U-series and Sr Isotope Ratios in Soils from Basse-Terre Island, French Guadeloupe: Insights for Rapid Soil Formation in a Tropical Volcanic Setting

YVETTE PEREYRA[1*], LIN MA[1], PETER SAK[2], JEROME GAILLARDET[3], HEATHER BUSS[4], AND SUSAN BRANTLEY[5]

[1] Department of Geological Sciences, University of Texas at El Paso, El Paso, TX, USA (ypereyra@miners.utep.edu)
[2] Department of Earth Sciences, Dickinson College, Carlisle, PA, USA
[3] Institut de Physique du Globe de Paris, Paris, France
[4] School of Earth Sciences, University of Bristol, Bristol, UK
[5] Earth and Environmental Systems Institute, Pennsylvania State University, University Park, PA 16802, USA

Soils developed on tropical volcanic islands are highly depleted due to intensive chemical weathering, and mineral nutrients from exogenous inputs play an important role in sustaining soil fertility and productivity [1]. Sr and U-series isotopes are excellent tracers to identify the origin of atmospheric inputs into soils and to determine rates and timescales of soil formation [2, 3]. In this study, we analyzed major element concentrations, mineralogy, and Sr and U-series isotope ratios from three thick (8-12m), highly depleted soil profiles in Bras-David, Moustique Petit-Bourg, and Deshaies watersheds in Basse-Terre in French Guadeloupe to identify and quantify key soil formation processes. We also conducted Sr and U-series isotope analysis in sequential extraction fractions in soils to determine atmospheric input sources. Adjacent rivers were also studied for major element concentrations and U and Sr isotope ratios.

Results have shown a significant depletion of U, Sr, and major elements in the deep profile attributed to rapid chemical weathering. The upper soil profiles (3-4 m to the surface) all show addition of elements such as Ca, Mg, U, and Sr due to atmospheric dust. Sr and U-series isotope ratios of the top soils and sequential extraction fractions confirm that the sources of the dust are from the Saharan dessert, through long distance transport across the Atlantic Ocean [4]. Our study highlights that dusts and marine aerosols play important roles in element cycles and nutrient sources in the highly depleted surface soils of tropical oceanic islands.

[1] Clergue, *et al*. (2015) *Chem. Geol.,* **414**, 28-41. [2] Pett-Ridge *et al*. (2009) *Geochim. Chosmochim. Acta*, **73**, 25-43. [3] Derry & Chadwick (2007) *Elements,* **3**, 333-338. [4] Kumar *et al*. (2014) *Atm. Environ*., **82**, 130-143.