A Soil Pit with a View: Understanding Pedogenesis on San Cristóbal, Galápagos

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Due to varying ages of the islands in the Galápagos archipelago and a precipitation gradient that results from the regional climatic setting, the Galápagos are an ideal location to understand soil formation processes in the tropics. This study on the island of San Cristóbal, one of the oldest islands in the archipelago upon which a climosequence is found, seeks to test how the volume of precipitation and mean soil moisture content affect the degree of weathering. We hypothesize that the degree of weathering differs across the climate zones, with low chemical indices of weathering (CIW) and more parent material minerals found in the low elevation, dry zones and high CIW and few parent material minerals in the high elevation, humid zones.

To test these hypotheses, we excavated soil pits at four elevations and collected surface soils at a wide range of elevations. Soil pits were described and sampled until we encountered bedrock or saprolite. We determined the particle size distribution on oven-dried samples and ran X-ray diffraction analysis on the different size fractions (fine sand, silt, and clay). Clay samples were treated with ethylene glycol and formamide to better identify clay minerals. Preliminary results suggest that the high elevation sites' sand- and silt-sized particles are composed of ilmenite, iron oxides, and hematite and the clay-sized particles are dominated by interstratified clays and gibbsite. There is also a large amount of amorphous material, probably allophane, in the soils at the high elevation sites. Middle elevations have less amorphous material than do the high- and low-elevation sites. The low-elevation sites' sand- and silt-sized particles are dominated by aluminosilicates rather than iron species. Using gamma spectroscopy, we measured the daughter products of U- and Th-decay, and then selected samples to undergo bulk digestion for alpha spectroscopy for Po, U, and Th. Data from gamma spectroscopy will help understand sources of minerals within the soil. Understanding the modes and rates of weathering on San Cristóbal provides context for vadose zone hydrological studies and will be helpful in creating land use rehabilitation standards.