Sr and Nd constraints on geochemical processes in highly weathered volcanic catchment, Guadeloupe (FWI)

CELINE DESSERT[1]*, CLEMENTINE CLERGUE[1], ALAIN ROUSTEAU[2] AND MARC BENEDETTI[1]

[1]Institut de Physique du Globe de Paris, Université Paris-Diderot, France (*dessert@ipgp.fr)

[2] Dynamique des Ecosystèmes Caraïbes, Université des Antilles, France

In this study, we analysed major and trace element concentrations and Sr, Nd isotopic compositions in the surface reservoirs (soils, rocks, plants, stream and rain waters) of a small forested andesitic watershed located in the tropical rain forest of Guadeloupe (OBSERA critical zone observatory – CNRS-IPGP). Sr and its isotopes have been shown to be proxies for cation nutrient cycling in the atmosphere-soil-plant system [1]. Previous studies have also shown that deposition of Saharan dusts occurs in the Carribean and can strongly influenced nutrient cycle and Sr isotopic signature [2]. Nd isotopes analyses of soil samples provide independent evidence for the presence of exogenous dust in the regolith.

Our results show that the $^{87}Sr/^{86}Sr$ ratio of unweathered andesite is 0.704. Most of soil samples Sr isotopes ratios (between 0.7086 and 0.7155) are intermediate between rainfall (0.709) and Saharan dust (0,718) endmembers. Sr isotopes ratios of soil solution (0,710) and of plants (0,710) show that exchangeable pool of Sr is dominated by sea salts and dust leaching.

Nd isotopes in the soil displays εNd values between -8,39 and 2.71 [3]. The very negative values are different from values characteristic for andesite (4.8), implying that an exogenous source (-13.5) contributes to Nd budget in the soil.

All our results reveal the significant contribution of atmospheric deposition to soil composition and confirms previous study done in Puerto Rico [2]. In this tropical Caribbean context, with very thick and cation poor soil, Saharan minerals have strong impact on soil genesis. Because of thick saprolite layer, vegetation is isolated from primary minerals and those atmospheric inputs constitute a significant nutrient supply for vegetation growth.

[1] Capo et al. (1998) Geoderma 82, 197-225; [2] Pett-Ridge et al. (2009) GCA 73, 25-43; [3] Clergue et al. (2015) Chem. Geol. 414, 28-41.