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Subduction process and diffuse CO_2 degassing rates along Central America volcanic arc

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Central American arc volcanism is the result of the subduction of the Cocos under the Caribbean plate and shows a strong geochemical zoning along its volcanic chain. These geochemical spatial variations arise from changes in the mantle and the crust, changes in the strength of the slab signal and changes in the type of slab signal, primarily the extent of the hemipelagic sediment component (Carr et al., 2003). Here we report diffuse CO_2 degassing rate data from El Salvador, Nicaragua, and Costa Rica volcanoes as an additional geochemical tool to evaluate the C cycling through subduction zones. Diffuse CO_2 emission surveys at Central American volcanoes have been carried during the last 5 years by an international research team: ITER (Spain), UES (El Salvador), INETER (Nicaragua), UCR (Costa Rica), ICE (Costa Rica) and OU (USA). Firstly this research activity on diffuse CO_2 emission in Central America were conducted for the purpose of volcanic surveillance research, but additional scientific insights came out from these studies performed at 7 Central American volcanic systems: Santa Ana-Izalco-Coatepeque, San Salvador (El Salvador), Cerro Negro, Masaya (Nicaragua), Miravalles, Poás and Irazú (Costa Rica). Each diffuse degassing survey had implied to perform hundreds of soil CO_2 flux measurements in and around each volcanic system. Soil CO_2 efflux measurements were performed by means of a portable NDIR sensor and according to the accumulation chamber method. Soil CO_2 efflux ranged from negligible (< 0,5 g m^{-2} d^{-1}) to average maximum val-

ues of 292 g m^{-2} d^{-1} for Santa Ana-Izalco-Coatepeque, 780 g m^{-2} d^{-1} for San Salvador, 26.000 g m^{-2} d^{-1} for Cerro Negro, 35.000 g m^{-2} d^{-1} for Masaya, 24.153 g m^{-2} d^{-1} for Miravalles, 2.600 g m^{-2} d^{-1} for Poás and 316 g m^{-2} d^{-1} for Irazú volcanic systems. Background mean value of soil CO_2 flux for all these volcanic systems ranged from 1 to 10 g m^{-2} d^{-1}; therefore, a significant amount of deep CO_2 is released from these volcanoes to the atmosphere through the surface environment. A very clear regional spatial variation of diffuse CO_2 degassing rate is observed for the Central America volcanic arc, and the highest soil CO_2 flux values were measured at Nicaraguan volcanoes. Lower peak values of soil CO_2 flux measurements than those detected for Nicaraguan volcanoes were observed in Costa Rica and El Salvador volcanic systems. This geochemical observation is consistent with an enhanced input of slab-derived C to magma sources in Nicaragua as it has also been described by other geochemical signatures such as (L+S)/M ratios (where L, M, and S represent the fraction of CO_2 derived from limestone and/or marine carbonate, the mantle, and the sedimentary organic sources, respectively (Shaw et al., 2003).

Carr, Feigenson, Patino and Walker, 2003. Volcanic and Geochemistry in Central America: Process and Problems, Geophysical Monograph, 138, 153-179 Shaw Hilton, Fischer, Walker, Alvarado, 2003. Earth and Planetary Science Letters, 214, 499-513.