Volatile plume derived elements in groundwater of Mt. Etna volcano.

M. LIOTTA[1*], W. D'ALESSANDRO[1], S. BELLOMO[1] AND L. BRUSCA[1]

[1]Istituto Nazionale di Geofisica e Vulcanologia - Sezione di Palermo, Via Ugo La Malfa, 153 - 90146 Palermo – Italy (*correspondence: marcello.liotta@ingv.it)

At Mt. Etna the presence of a persistent volcanic plume provides large amount of volcanogenic elements to the bulk deposition along its flanks. The volcanic plume consists of solid particles, acidic droplets and gaseous species. After H_2O and CO_2, S, Cl and F represent the most abundant volatile elements emitted as gaseous species from the craters. On the other hand, minor amount of I and Br are also discharged. During rain events acidic gases interact rapidly with droplets lowering the pH of rain. This process favors the dissolution and dissociation of the most acidic gases. Under these conditions the weathering of volcanic rocks starts when acidic bulk deposition interacts with outcropping rocks and ashes. The weathering processes are further promoted by diffuse CO_2 emissions that usually characterize aquifer hosted in active volcanic edifices. The chemical composition of groundwater at Mt. Etna has been investigated in order to define to what extent the persistent plume affects the chemical composition of circulating waters. The content of dissolved elements derives from the bulk deposition at the recharge areas as well as from the weathering of volcanics rocks during infiltration and transport of groundwater. The content of chlorine and bromine dissolved in groundwater mainly derives from the interaction between the plume and rainfall while total alkalinity can be totally ascribed to the dissociation of carbonic acid. The relative contribution of plume derived elements/weathering and CO_2 driven weathering has been computed for several elements. Sulfur usually reflects the bulk deposition, fluorine undergoes processes that decrease the pristine concentration of the bulk deposition and iodine, in spite of its complex geochemical behavior, often reflects the plume composition. In addition, anomalous concentration of Se and B have been recognized in the most plume-influenced sites thus confirming their high volatility.

Due to the huge fluxes of emitted gases, Mt. Etna volcano impacts the geochemical cycles of volatile elements at a larger scale.