P09 Mercury emissions in volcanic gases from Mt. Etna, Italy.

Salvatore Giammanco[1], *Jo e Kotnik[2], Vesna Fajon[2]*
[1]*Istituto Nazionale di Geofisica e Vulcanologia, CATANIA, Italy*
[2]*Jo ef Stefan Institute, LJUBLJANA, Slovenia*

Mercury is a global pollutant that can be found in different forms and different ecosystems. Special attention has recently been devoted to mercury due to its high chemical reactivity, its global spreading, its biogeochemical cycling, its transformations in the environment, its ability for biomagnification and its high toxicity. Beside anthropogenic sources, mercury can also be of natural origin. Among natural Hg sources, volcanoes can be important. Volcanic gas emissions may be rich in elemental gaseous mercury (Hg^0), reactive gaseous mercury (Hg^{II}) and other mercury forms. Mt. Etna (Sicily, Italy) is one of the most active volcanoes in the world and one of the largest contributors of magmatic volatiles to the environment; consequently, we tried to estimate its contribution to regional and global Hg budgets and tested the eligibility of Hg as a tool for volcano monitoring. Mercury concentrations have been measured on Mt. Etna during several campaigns carried out between 2004 and 2007 in fumaroles, mofettes and diffuse degassing areas, as well as in the air inside and across the volcanic plume. In addition, Hg fluxes have been measured by flux chamber technique. Mercury concentrations measured in air below the volcanic plume in November 2004 ranged between 4 and 30 ng m^{-3} at low altitude, and between 65 and 132 ng m^{-3} close to the summit craters. A profile of Hg in the air below the volcanic plume carried out on helicopter on November 2006 showed Hg concentrations up to 60 ng m-3. Hg contents in fumarole gases reached 64,200 ng m^{-3}, and soil gas Hg showed temporal variations that reached the highest values (up to 240 ng m^{-3}) in fall 2005. The highest Hg fluxes were measured in bubbling gas from mud volcanoes at the SW foot of Etna, reaching 1300 ng m^{-2} h^{-1}. Mercury contents were found highly correlated both with water/mud temperature at mud volcanoes and with concurrent soil CO_2 effluxes. In the latter case, hydrothermal gases showed higher values and a higher correlation than "cold"gases. Our results, therefore, look promising for the use of mercury in geochemical monitoring of volcanic activity.

P10 Combined monitoring of CO2 efflux, 222-Rn and 220-Rn in soil gas on Mt. Etna: a new geochemical tool for volcano surveillance.

Salvatore Giammanco, *Marco Neri, Salvatore Consoli, Manuela Lopez, Francesco Calvagna*
Istituto Nazionale di Geofisica e Vulcanologia, CATANIA, Italy

Since 2002, measurements of ^{222}Rn, ^{220}Rn activity and of CO_2 efflux in soil and fumaroles were carried out at several locations on Mt. Etna volcano. An empirical relationship links the $^{222}Rn/^{220}Rn$ ratio to the CO_2 efflux: deep sources of gas are characterized by high ^{222}Rn activity and high CO_2 efflux, whereas shallow sources are indicated by high 220Rn activity and relatively low CO_2 efflux. This relationship is more constraining on the type and depth of the gas source than using the $^{222}Rn/^{220}Rn$ ratio alone.

Since June 2006, periodical measurements of these parameters were carried out in 10 sites located over a surface of about 7 km^2 on the east flank of Mt. Etna (Zafferana village). The chosen area is characterized by anomalous diffuse degassing produced by fault-driven leakage of volatiles from a magma source whose depth is inferred at about 4-7 km below the surface. The sampling frequency varied between once a month to once every ten days. We studied the temporal variation of the ratio between CO_2 efflux and ($^{222}Rn/^{220}Rn$), that we define as a Soil Gas Disequilibrium Index (SGDI). Increases of this parameter occurred just before and during the 2006 eruptive period (July to December 2006), and at the onset of the March-May 2007 sequence of summit paroxysmal episodes. Furthermore, a slow increasing trend preceded by a few months the August-September 2007 summit activity of Etna, culminated with the September 4th 2007 paroxysmal episode. Remarkable spike-like increases not associated with eruptions occurred on January 10th, 2007, correlated with anomalous increases in volcanic tremor, and on June 20th, 2007, linked with marked short-lived anomalies both in the ground deformation and in the gravimetric signals recorded by the INGV-Catania monitoring networks. The last increase in this geochemical index was recorded in late March 2008, correlated with a marked increase both in the volcanic tremor and in the plume SO_2 flux. This index looks very promising as a new tool for volcano monitoring, as it seem very sensitive to volcanic unrest.