Geophysical Research Abstracts
Vol. 16, EGU2014-9535, 2014
EGU General Assembly 2014

Preliminary results of trace elements mobility in soils and plants from the active hydrothermal area of Nisyros island (Greece)

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Trace elements, i.e. chemical constituents of rocks with concentration <1000 ppm, play a structural role in the organisms and use proteins as a carrier to their target site. Their toxicity depends on their concentration, speciation and reactions with other elements. In volcanic environments, significant amounts of trace elements discharged from gas emissions, contribute to produce air particulate. Nisyros Island is a stratovolcano located at the South Aegean active Volcanic Arc. Intense hydrothermal activity characterise the Lakki caldera. In particular, the fumaroles located in the craters of Stefanos, Kaminakia, Lofos Dome and the area comprising Phlegeton, Polyvotes Micros and Polyvotes Megalos discharge hydrothermal fluids rich in H_2O (91– 99%), SO_2 and H2S. Their temperatures are almost 100o C and H2S is highly abundant accounting for 8-26 % of the released dry gas phase.

On June 2013, during a multidisciplinary field trip on Nisyros island, 39 samples of top soils and 31 of endemic plants (Cistus Creticus and Salvifolius and Erica Arborea and Manipuliflora) were collected in the caldera area, with the aim to investigate the distribution of concentrations of trace elements related to the contribution of deep originated fluids. Moreover, one sample of plant and soil was collected outside the caldera as local background, for comparison. All the soil samples were powdered avoiding metal contamination and they were extracted twice, using HNO_3 + HCl for one extraction (closed microwave digestion) and ultrapure de- ionized water for the other one (leaching extraction). The leaves of plants were gently isolated, dried and powdered for acid microwave extraction (HNO_3 + H_2O_2). All the solutions were analysed for major and trace elements contents by using ionic chromatography (IC) and inductively plasma spectrometry (ICP-MS and ICP-OES).

The preliminary results showed high enrichment of many trace elements both in plant and soils respect to the local background, in particular for Tl, Rb, Zn, Mn, As, Pb, Se, Bi, Al. The highest concentrations were found both in soils and plants close to the most active fumarolic areas of Stefanos, Kaminakia and Polyvotes and also close to the Geothermal Drill (exploration well). Moreover, both soils and plants showed a good correlation between Cu-Zn, Cu-Pb, Bi-Pb, Ba-Sr, Bi-Tl, Ti-Al, Ni-Al, Tl-As, Te-Tl, Te-Se as well as REE's. From the comparison between Cistus sp. and Erica sp. we found a significant enrichment in the former respect to the latter, making Cistus sp. the most suitable plant for biomonitoring studies at Nisyros.