Mercury's Distribution in the Atmosphere, Soils and Plants of the Active Hydrothermal Area of Nisyros (Greece)

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Mercury and its compounds are highly toxic for humans and ecosystems. The dominant form of mercury in the atmosphere is gaseous elemental mercury (Hg0 ~98%), characterized by high stability (residence time 0.5-2 years), low solubility and high volatility. Volcanic and hydrothermal emissions are major natural sources of mercury to the atmosphere.

On June 2013 a multidisciplinary field trip was made on Nisyros island. There, real-time measurements of atmospheric Hg were carried out with a portable Zeeman atomic absorption spectrometer with high frequency modulation of light polarization (Lumex RA-915M). A multigas analyzer (manufactured by INGV-Palermo) was also used to measure in real-time the H_2O, CO_2 and H_2S concentrations in air. The two instruments were synchronized and set to high-frequency acquisition. These measurements were carried out along pre-determined paths at walking speed. The simultaneous acquisition of GPS signal provided the spatial coordinates for each concentration value. Atmospheric Hg concentrations in the atmosphere ranged from 30 to >7000 ng/m^3 within the Lakki caldera, with the highest concentrations close to active fumarolic vents. Background values, outside the Lakki caldera were <15 ng/m3. Furthermore, Hg values showed a good correlation with the other fumarolic gases (H_2O, CO_2 and H_2S) confirming its hydrothermal origin.

During the same field campain, 33 samples of top soils and 31 of endemic plants (Cistus creticus and salvifolius and Erica arborea and manipuliflora) were collected in the caldera area. Moreover, one sample of plant and soil was collected outside the caldera as local background, for comparison. All soil and plant samples were dried at 36o C and powdered avoiding metal contamination. Their Hg content were analyzed with Combustion Atomic Absorbance (CAA).

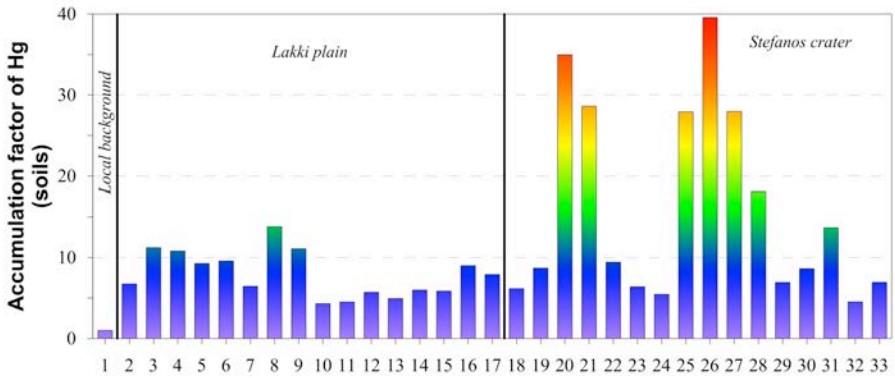

Figure 1. Enrichment of Hg in the soil samples. The values are normalized to the local background value.

The results showed good correlation of S - Hg in almost all the soil samples of Stefanos. Also, high enrichments of Hg are noticeable in the most active fumarolic areas, where the hydrothermal activity is more intense. The concentration in these sampling points varies from 15 to 45 times the concentration of the local background. Similar enrichments were also found in plants. From the comparison between Cistus sp. and Erica sp. we found a significantly higher enrichment and a better correlation with the soil Hg concentrations in the former respect to the latter, making Cistus sp. the most suitable plant for Hg biomonitoring studies at Nisyros.