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Diffuse Hg^0 emission from the summit cone of Teide volcano, Tenerife, Canary Islands

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Volcanoes are the major natural source of vapour Hg emission to the atmosphere since magma degassing is the main source of Hg^0 in volcano-geothermal systems. Fumarole and hot springs geochemical monitoring can be used to detect the rise of magma. Here we outline the use of diffuse Hg^0 emission as a geochemical tool to improve Teide volcano monitoring program. Teide volcano (3,717 m a.s.l.) is located in the central part of Tenerife island, at the intersection of three major volcanic rift-zones. Low temperature fumaroles (81-85^{0}C) are present at the summit cone (0,5 km^2), where significant amounts of diffuse CO_2 degassing occurs, about 75-100 Td^{-1}. Diffuse Hg^0 degassing surveys were carried out during the summer of 2000 and 2004. These surveys were performed by means of 105-120 sampling site observations well distributed through the summit cone. Hg^0 efflux at each sampling site was estimated multiplying soil CO_2 efflux times the Hg^0/CO_2 weight ratio in the soil gas. During the 2004 survey soil gas for Hg^0 and CO_2 analysis were collected at 40 cm depth by mean of a metallic probe and inside an accumulation chamber. Soil Hg^0 concentration was measured in situ using Jerome 431-X portable analyser, and soil CO_2 concentration was measured at the lab by microGC. Soil CO_2 efflux measurements were performed by a portable NDIR sensor according to the accumulation chamber method. Observed Hg^0 efflux data ranged from non detectable values to 3,05 and 3,07 mg m^{-2} d^{-1} for the 2000 and 2004 surveys, respectively, collecting soil gas at 40 cm depth. Observed Hg^0 efflux data, after collecting soil gas by means of an accumulation chamber, ranged from non-detectable values to 2,42 mg m^{-2} d^{-1} for the 2004

survey. Most of the study area showed background values of Hg^0 efflux, about 0,6 mg m^{-2} d^{-1} for 2000 and 2004 for both methodologies. Peak values of Hg^0 efflux (> 1,2 mg m^{-2} d^{-1}) were mainly observed inside the summit crater of Teide volcano where fumarolic activity is more intense. The total diffuse Hg^0 output from the summit cone of Teide volcano was estimated about 6,4 and 19 g d^{-1} for the 2000 and 2004 surveys, respectively, after following the same procedure. In the case of the soil gas collected from an accumulation chamber, the total diffuse Hg output was estimated about 9,3 g d^{-1} for the 2004 survey. These results suggest that an average value for diffuse Hg^0 emission from the summit cone of Teide is about 10 g d^{-1} or 3.650 g y^{-1}. The volcanogenic Hg flux from passively degassing volcanoes is about 30 Mg Hg y^{-1} (Varekamp and Buseck, 1986); therefore, the diffuse Hg^0 emission summit cone of Teide volcano just account for a 0,00000001% of the global volcanogenic Hg flux from passively degassing volcanoes.

Varekamp and Buseck, 1986. Global mercury flux from volcanic and geothermal sources, Applied Geochemistry, 1, 65-73