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Continuous in-situ measurements of gases (H_2, H_2S, CH_4, N_2, O_2, Ar, He, and CO_2) at the fumarole "Soffionissimo" (Solfatara volcano, southern Italy)

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From November 29th to December 1st 2006, a gas monitoring experiment was carried out at the Solfatara volcano (Pozzuoli, Italy). The primary objectives were to prove that monitoring is possible with the experimental set-up described below, and to compare the new data obtained with those from earlier continuos gas monitoring carried out in November 2001.

Temperature measurements and gas extraction were done at the fumarole "Soffionissimo" very close to the "Bocca Grande". The temperature measurements were performed with a temperature probe (K-type thermocouple), which was let about 30 cm into the fumarole. For better comparison of temperature and gas data, the gas tube was directly connected with the temperature probe. After having adjusted a continuous gas flow with a diaphragm pump and a needle valve, the gas was piped through a 10 m Teflon© tube for more than 40 hours. The gas phase primary consists of water gas, which was condensed in a trap, installed in a refrigerator. The amount of water in the trap was determined regulary every 3-4 hours.

At the beginning of the monitoring experiment, the Teflon© tube was heated in order to avoid condensation of the water in the tube before getting trapped. Although the tube was not heated for the whole time of the experiment, it turns out that the

amount of water, condensed in the water trap per hour, and does not significantly change when the tube was not heated. Hence, the amount of water, condensing in the tube before getting trapped, seems negligible. The remaining, almost water-free gas phase was finally dried over Fe wool in a filter, and then continuously analysed with a quadrupole mass spectrometer (Balzers Omnistar ®) for the following components: H_2, H_2S, CH_4, N_2, O_2, Ar, He, and CO_2. To make sure that the final drying process does not influence the gas composition in particular for H_2 and H_2S, a comparison measurement was done without the filter, which only revealed somewhat higher water content. During the second half of the monitoring, additionally CO_2 gas concentration measurements were performed using a laser spectrometer based on a semiconductor laser source emitting around 2 μm connected on-line with the gas line. Gas samples were taken from the gas line for laboratory gas-chromatographic analysis and noble gas analyses.

Although data processing is still ongoing, the residual (=water-free) average gas composition can be preliminary described as follows: CO2 $>$97 vol%, H2S $\sim$0.16 vol%, H2 $\sim$0.15 vol%, N2 $<$2 vol%,

O2 $<$0.5 vol%, Ar $<$0.02 vol%, CH4 $\sim$0.05 vol%, He $<$20ppmv.

O2 and most of the N2 and Ar are due to atmospheric contamination of the system. Besides the varying air contribution, the gas composition shows no significant variations over time within the analytical uncertainties of the experiment.