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Continuous in-situ measurements of gases at Solfatara, Pisciarelli - Phelgrean Field and Tor Caldara - Latium (Italy): A new experimental approach.

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In late 2006, a new gas monitoring research initiative has started with two gas monitoring experiments carried out from November 29 to December 1 at the Solfatara volcano (Pozzuoli) and from December 19 to 20 at Tor Caldara (Lazio). Gas monitoring was repeated a year later in Solfatara from May 13 to 18, again at the fumarole “Soffionissimo” very close to the “Bocca Grande”, furthermore at a fumarole field located about 1 km south-est from Solfatara volcano named “Pisciarelli”. The primary goal of the experiments was to prove that monitoring is possible with the set-up described below, and to compare the new data obtained at Solfatara with those from a previous continuous gas monitoring experiment carried out in November 2001 and the complete literature record of discrete gas monitoring at the sites investigated.

At Solfatara and Pisciarelli, a continuous gas flow was adjusted with a diaphragm pump and a needle valve, and the gas piped through a 10 m Teflon© tube. Gas temperature was measured in the fumarole with a K-type thermocouple. The released gas phase primary consists of water gas, which was gravimetrically determined in regular intervals after being trapped in a refrigerator. In contrast to the gas discharge at Solfatara, the gas at Tor Caldara is discharged at the bottom of a pool. The gas bubbles

were collected in a funnel, which was placed at the bottom of the pool, and let into a gas tube. Hence, the gas was not actively pumped, furthermore the water content was not quantified.

For all experiments, the remaining, almost water-free gas phase was continuously analysed with a quadrupole mass spectrometer for the following components: H_2, H_2S, CH_4, N_2, O_2, Ar, He, and CO_2. The gas line was also connected to a tuneable diode laser spectrometer for CO_2 concentration measurements. Off-line gas samples were taken for laboratory gas-chromatographic and noble gas analysis.

Due to the experimental set-up, the gas phase generally shows a small and varying contribution of atmospheric gases (O_2, N_2,Ar). The air-free calculated gas composition is dominated by CO_2($>$97 vol% Solfatara and Pisciarelli; 93 vol% Tor Caldara), followed by H_2S, H_2, CH_4, and He. There are, however, clear differences in the gas composition of the two investigated fumaroles at Solfatara and Pisciarelli in good agreement with the available gas composition in literature. Beside this, no significant variations over the time of investigation were observed within the analytical uncertainties of the experiment confirming the possibility to use this continuous gas monitoring set up for long term monitoring.