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The Fangaia mud pool, Solfatara (Campi Flegrei, Italy): the effect of scrubbing on CO_2 and H_2S degassing

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Recent studies have demonstrated degassing of acid species (HCl, SO_2, H_2S) from the surfaces of peak-activity crater lakes. We here consider the Fangaia as a "mini-crater lake" (20 m x 25 m max), being a steam-heated mud pool (sulfate content near 2000 mg/L, pH 1.5). Hence, understanding degassing from the Fangaia can provide insights into the diffuse degassing regime for the Solfatara crater area. In June 2017, we conducted the first MultiGAS measurements by moving a fishing cane approx. 10 cm above the surface of the mud pool, pumping the gas through a syringe at 1.5 L/min to the CO_2 NDIR and H_2S EZ3H electrochemical sensors (0-10 $\%$ and 0-200 ppm detection limits, respectively). The measurement procedure (approx. 50 minutes) is filmed with a GOPro camera, covering the view of the entire area with a fish-eye lens. The exact location of the measuring points (syringe) is consequently deduced using the open-source graphical software ImageJ and MTRackJ, within a reference frame established in the field by clearly visible cones, needed to correct for the perspective angle of the GOPro pictures. Images are extracted from the GOPro time lapse with a frequency of 5 seconds, afterwards synchronized with the frequency of data acquisition of the MultiGAS (2 Hz). The bathymetry of Fangaia is obtained upon direct measurements of the lake depth (61 points, max depth 1.25 +/- 0.05 m), and elaborated graphically as above. This methodology is simple, but efficient. Maps for CO_2 (321 to 75,824 ppm) and H_2S (9 to 224 ppm) concentrations for the Fangaia mud pool show highest concentrations above strongly bubbling areas, and lowest concentrations above diffuse degassing areas. Nevertheless, CO_2/H_2S ratios are lowest above bubbling degassing areas, and highest above the deepest areas of the Fangaia. These observations strongly suggest H_2S scrubbing when gas flushes through a thicker water layer, whereas CO_2 will pass without being affected due to the high acidity of the water. Quantifying and time-framing this degassing process is a challenge for ongoing research, through experimental setups and mass balance approaches after repeated field campaigns. These first findings are promising as they reflect the fast dynamics of the Fangaia mud pool, a "window" into the hydrothermal system underlying the emblematic Solfatara crater.