



Gas emission and composition measurements at two Andean volcanoes – Copahue and Peteroa

Nicole Bobrowski (1,2), Jonas Kuhn (1), Maria Clara Lamberti (3), Mariano Augusto (3), Sebastian Garcia (4), Gabriela Velasquez (5), Claudia Bucarey (5), Oscar Valderrama (5), Lukas Tirpitz (1), Ulrich Platt (1,2)

(1) Heidelberg, IUP, Heidelberg, Germany (nbobrows@iup.uni-heidelberg.de), (2) Max Planck Institut for Chemistry, Mainz, Germany, (3) Universidad de Buenos Aires, Argentina, (4) Servicio Geologico Minero Argentino, (5) Observatorio Volcanologico de los Andes del Sur, Chile

Copahue (37.856°S, 71.159°W, 2997 m a.s.l.) and Peteroa (35.240°S, 70.570°W, 3603 m a.s.l.) are active strato-volcanos, both located at the border between Argentina and Chile. Copahue volcano is situated on the rim of the large, about 2 Ma old Cavihue caldera. The eastern currently active summit crater hosts a cold melt water lake, a hyperacidic lake and a spattering mud pool (observation March 2018). The crater is surrounded by walls of phreatic debris and glacier ice. Peteroa volcano is part of the NNE-oriented Planchón-Peteroa-Azufre Volcanic Complex. The about 5 km wide caldera at the Peteroa summit is partially covered by glaciers and consists of four craters hosting acidic lakes and one scoria cinder cone. The activity of both volcanos is characterized by phreatic and phreatomagmatic eruptions.

During February-March 2018, new emission flux and gas composition measurements at Peteroa and Copahue were undertaken. We performed measurements of SO₂ fluxes with a scanning DOAS instrument. The SO₂ flux at Peteroa was 188(±28) tSO₂/d and the SO₂ flux at Copahue was determined to 1294 ± 377 tSO₂/d. Both values are similar to earlier reported SO₂ fluxes on Peteroa and Copahue, respectively.

Simultaneously to the SO₂ fluxes, we determined CO₂/SO₂ ratio inside the plumes with a PITSA instrument by measuring at the crater rim of crater 4, the only significantly degassing crater at Peteroa as well as on the crater rim of Copahue. The CO₂/SO₂ ratio for Peteroa on all three measurement days varied only slightly between 1,44 and 1,81 meaning that the CO₂ flux of Peteroa plume was about 300(±72) tCO₂/d.

At Copahue, the CO₂/SO₂ ratio lies between around 1 and 60. The large scatter in the CO₂/SO₂ ratio of Copahue's plume most likely originates from mixing of emissions from the closely located sources. We assign the lowest values of the CO₂/SO₂ ratio (CO₂/SO₂ = 1) to the plume from the spattering mud pool, which has therefore a CO₂ flux of 1294 ± 377 tCO₂/d. This is however only a lower limit to the CO₂ flux of Copahue since the CO₂ emissions from e.g. the bubbling lake (where most of the SO₂ might be scrubbed and therefore cannot be used for tracing plume CO₂) are not taken into account.

In addition, we evaluated the DOAS spectra for halogen species. We could not detect any BrO or OCIO above our column density detection limits of 2e13 molec cm⁻², corresponding to 57 ppt and 8 ppt for Copahue and Peteroa, respectively.

Furthermore, a comparison between soil and plume emission was carried out for the first time at Peteroa. This comparison leads to the result that the major emission of CO₂ is focused on a "point source" – the lake inside crater 4. With the current data available from Peteroa, only about 2 % of the total calculated CO₂ output are degassed by diffusive soil degassing in the crater region. Certainly, further studies in the surroundings are still necessary to assure no missing emission source on the flank of the volcano.