Chemical composition of volcanic gases emitted during the 2014-15 Fogo eruption, Cape Verde

Pedro A. Hernández (1,2), Gladys V. Melián (1,2), Samara Dionis (2), José Barrancos (1,2), Germán Padilla (1,2), Eleazar Padrón (1,2), Sónia Silva (3,4), Paulo Fernandes (3), Nadir Cardoso (3,4), Nemesio M. Pérez (1,2), Fátima Rodríguez (2), Maria Asensio-Ramos (2), David Calvo (2), Helio Semedo (5), Vera Alfama (3,4,6)

(1) Environmental Research Division, ITER, 38611 Granadilla de Abona, Tenerife, Canary Islands, SPAIN (phdez@iter.es), (2) Instituto Volcánológico de Canarias (INVOLCAN), 38400 Puerto de la Cruz, Tenerife, Canary Islands, SPAIN, (3) Observatório Vulcanológico de Cabo Verde (OVCV), Universidade de Cabo Verde (UniCV), Campus do Palmarejo, 279 Praia, Santiago Island, CAPE VERDE, (4) Departamento de Ciência e Tecnologia, Universidade de Cabo Verde (UniCV), Campus do Palmarejo, 279 Praia, Santiago Island, CAPE VERDE, (5) Serviço Nacional de Protecção Civil (SNPC), ex Aeroporto Francisco Mendes, Praia, Santiago Island, CAPE VERDE, (6) Centro de Vulcanologia e Avaliação de Riscos Geológicos (CVARG), Universidade dos Açores, 9500-321 Ponta Delgada, Açores, PORTUGAL

Pico do Fogo volcano (2,800 m) is the youngest and most active volcano of the Cape Verde archipelago and is located in Fogo Island. In November 23, 2014, a new volcanic eruption occurred at the west flank of Pico do Fogo, near the site of the 1995 eruption. From November 28, 2014, daily SO₂ ground-based plume measurements have been performed by ITER/INVOLCAN/UNICV/OVCV/SNPC research team, representing the first SO₂ plume measurements ever performed during an eruption of this volcano. Measurements were carried out with a miniature ultraviolet (UV) spectrometer miniDOAS to estimate the SO₂ emission from the volcanic plume. On November 30th by combining mini-DOAS and a portable multi-sensor gas (Shinohara et al., 2005), we were able to quantify the SO₂, H₂S, H₂, CO₂ and H₂O emission rates from the plume. Multi-sensor gas measurements were performed about 1 km distance from the eruptive vent. Average SO₂ emission rate calculated from 4 traverses on November 30, 2014, was 117 kg s⁻¹ (10,118 t d⁻¹). Combining this value with the estimated average CO₂/SO₂, SO₂/H₂S, and H₂S/H₂ and H₂O/SO₂ mass ratios (1.06, 178, 568 and 2.40, respectively), we calculated the CO₂, H₂S, H₂ and H₂O plume emissions: 124 kg s⁻¹ (10,688 t d⁻¹), 0.7 kg s⁻¹ (57 t d⁻¹), 0.2 kg s⁻¹ (18 t d⁻¹), and 281 kg s⁻¹ (24,245 t d⁻¹), respectively. Plume gas composition obtained in November 30 indicated average CO₂/SO₂, CO₂/H₂O and SO₂/H₂S molar ratios of 1.5, 0.3 and 7.5, respectively. These values were remarkably different from those molar ratios measured at the fumarole discharges from summit crater previously to the eruption onset, and representative of the ascent of magma to the surface and the injection of SO₂-rich hot magmatic gases in the H₂S-rich hydrothermal system of Pico do Fogo volcano as was observed through the increase on the SO₂/ H₂S and decrease on the CO₂/SO₂ measured molar plume ratios. Based on the measured chemical composition of the plume, the apparent equilibrium temperature (AET) was estimated following the method reported by Ohba et al., 1994 in 1,265°C, value typical of basaltic magmas.