Geophysical Research Abstracts
Vol. 21, EGU2019-9940-2, 2019
EGU General Assembly 2019

Soil He and H2 emissions at Furnas Volcano, São Miguel Island, Azores

Eleazar Padrón (1,2,3), Mar Alonso (1,2), Cecilia Morales (1), Gladys V. Melián (1,2,3), María Asensio-Ramos (1), Pedro A. Hernández (1,2,3), Catarina Silva (4,5), Fátima Viveiros (4), Nemesio M. Pérez (1,2,3)

(1) Instituto Volcanológico de Canarias (INVOLCAN), 38600 Granadilla de Abona, Tenerife, Canary Islands, Spain (nperez@iter.es), (2) Instituto Tecnológico y de Energías Renovables (ITER), 38600 Granadilla de Abona, Tenerife, Canary Islands, Spain, (3) Agencia Insular de la Energía de Tenerife (AIET), 38600 Granadilla de Abona, Tenerife, Canary Islands, Spain, (4) Instituto de Vulcanologia e Avaliação de Riscos (IVAR), University of the Azores, Rua Mãe de Deus, Ponta Delgada 9501-801, Portugal, (5) Centro de Informação e Vigilância Sismovulcânica dos Açores (CIVISA), Rua Mãe de Deus, Ponta Delgada 9501-801, Portugal.

Furnas Volcano, a stratovolcano with maximum height about 800 m a.s.l, occupies the east-central part of São Miguel Island, Azores archipelago (Portugal) and has experienced 17 trachytic eruptions during the last 5,000 years, including 10 eruptions within the inner caldera, being the last one subplinian with the formation of a tuff ring and dome. Main fumarolic fields are located in the northern shore of Lagoa das Furnas and in Furnas village area, and seem to be mostly associated with the WNW-ESE and NW-SE tectonic structures that cross the volcano edifice. However, non-visible (diffuse) emission is currently the main emission mechanism of volcanic gases at the scale of the entire volcano (Viveiros et al., 2010; Pedone et al., 2015; Andrade et al., 2016). In this work, we present the first study of He and H2 emissions, with the aim to provide additional insights of the degassing regime of Furnas Volcano. H2 and He are highly mobile and/or non-reactive gases that offer important advantages for the detection of vertical permeability structures, because their interaction with the surrounding rocks or fluids during the ascent toward the surface is minimum. He has unique characteristics as a geochemical tracer: it is chemically inert and radioactively stable, non-biogenic, highly mobile, and relatively insoluble in water. H2 is one of the most abundant trace species in volcano-hydrothermal systems and is a key participant in many redox reactions occurring in the hydrothermal reservoir gas. In May 2018, 272 sampling sites were selected covering homogenously the soils of Furnas caldera. At each sampling site soil gas samples were taken at 40 cm depth and analyzed later in the laboratory for the He and H2 content. To estimate the He and H2 emission rates at each sampling point, the diffusive component was estimated following the Fick's law and the convective emission component model was estimated following the Darcy's law. Diffuse He and H2ranged from non-detected values and 15 and 985 mg m-2 d-1, respectively. The spatial distribution maps, constructed averaging results of the 100 simulations following the sequential Gaussian simulation algorithm, He and H2 degassing anomalies mainly located at those areas with surface geothermal manifestations. The He and H2 emission rates were estimated 1.3 kg•d-1 and 36 kg•d-1, respectively. The multi-gas evaluation of these silent, invisible soil emission rates and their ratios may be an important tool for the volcanic surveillance program of Furnas Volcano, since soil degassing is the biggest volcanic gas emission contributor during the actual quiescent state of the volcano.

References:
Andrade et al., 2016. J. Volcanol. Geotherm. Res. 315:51–64.
Pedone et al., 2015. Earth, Planets and Space 67:174.
Viveiros et al., 2010. J. Geophys. Res. 115, B12208.