Geophysical Research Abstracts
Vol. 19, EGU2017-6809, 2017
EGU General Assembly 2017

Observed changes of the diffuse H_2 emission at the summit cone of Teide volcano (Tenerife, Canary Islands): a geochemical evidence of processes operating deep in the magmatic system

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Hydrogen 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 (Giggenbach 1987; Chiodini and Marini 1998). Because of its chemical and physical characteristics such as low weight and low solubility in groundwater and hydrothermal fluids, H_2 moves rapidly within the crust and escapes easily to the atmosphere. These characteristics make H_2a potentially excellent tracer of processes operating deep in magmatic systems. Most of the diffuse degassing studies on active volcanic-hydrothermal systems is primarily focused on CO_2, the second major component of volcanic gases. Unfortunately however, few studies of surface H_2efflux measurements at active volcanoes have been performed to evaluate diffuse H_2 emission rates from active volcanic systems. Here, we report a time series on diffuse H_2 emission rates from surveys carried out in yearly basis at the summit cone of Teide volcano, where most obvious geothermal features at Tenerife occurs, during the 2006-2016 period. Thousands of samples of volcanic gases from the surface environment, at 40 cm depth, have been collected during this 2006-2016 period to estimate surface H_2 efflux values from 150 observation sites selected to cover the 0.5 Km^2 area of the summit cone Teide volcano. Most of the surveys showed diffuse H_2 emission rate values lower than 40 kg·d-1 from the summit cone of Teide volcano. On the contrary, an increasing trend of diffuse H_2 emission rate from 35 $\pm$ 7 to 122 $\pm$ 36 kg·d^{-1} was observed during the 2006 to 2009 period. This increase trend of diffuse H_2 emission rate was detected before a raise of seismic activity in and around Tenerife from November 2009 to June 2011, with about 1176 seismic events recorded by Spanish-IGN in 2010 (Pérez and Schmincke, 2016). The observed increased trend of diffuse H_2 emission occurs simultaneously with an increase trend of diffuse CO_2 emission at the summit cone of Teide volcano during the 2005-2009 period (Pérez et al., 2013) suggesting the ascent of deep-reservoir (CO_2-H_2-rich) gas bubbles. These geochemical observations seem to be clear evidences of changes of processes operating deep in the magmatic system of Tenerife.

Chiodini and Marini 1998, Geochim. Cosmochim. Acta,

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