



Geochemical monitoring of Cumbre Vieja volcano (Canary Islands) by summer diffuse CO₂ degassing surveys

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La Palma Island is the north-westernmost and one of the youngest of the Canarian Archipelago. In the last 123ka, volcanic activity has taken place exclusively at Cumbre Vieja volcano which is located at the southern part of the island. Cumbre Vieja is characterized by a main north-south rift zone 20km long and 1950m in elevation covering an area of 220km² with volcanic vents located northwest and northeast. Cumbre Vieja is the most active basaltic volcano in the Canaries with 7 historical eruptions, being Teneguía (1971) the most recent one. The most relevant volcanic activity episodes occurred since Teneguía eruption, are two intense seismic swarms occurred beneath Cumbre Vieja on 7-9 and 13-14 of October 2017. Since visible volcanic gas emissions do not occur at the surface of Cumbre Vieja, the geochemical surveillance program has been focused mainly on diffuse degassing studies. In the last 18 years diffuse CO₂ emission surveys have been yearly performed in summer periods to minimize the influence of meteorological variations. Measurements have been performed following the accumulation chamber method in about 600 sites and spatial distribution maps have been constructed following the sequential Gaussian simulation (sGs) procedure to quantify the diffuse CO₂ emission. Herein we summarize the diffuse CO₂ emission time series during this period and describe the results obtained in the last 2019 survey. The soil CO₂ efflux values measured in 2019 survey ranged from non-detectable to 72.7gm⁻²d⁻¹. Diffuse CO₂ output was estimated in 1,064 ± 35td⁻¹, a value within the background +1s range (1,254 td⁻¹) (Padrón et al., 2015, Bull. Volcanol. 77:28). In the period 2001-2017, the diffuse CO₂ output released to the atmosphere from Cumbre Vieja volcano ranged between 320 to 1,544td⁻¹. Enhanced endogenous contributions of deep seated CO₂ might have been responsible for the higher CO₂ emission values measured in 2011 and 2013. After the October 2017 seismic swarms, diffuse CO₂ output showed an increasing trend from 788 to 3,251td⁻¹ in March 2018, to decrease gradually until 852td⁻¹ in September of that same year, and begin to gradually increase again to 2,371td⁻¹ in November 2018. These changes were possibly caused by an upward magma

migration. Our results demonstrate that periodic surveys of diffuse CO₂ emission are extremely important for the detection of early warning signals of future volcanic unrest episodes at Cumbre Vieja.