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Geochemical monitoring of the Tenerife North–South Rift Zone (NSRZ) volcano (Canary Islands) by means of diffuse CO_2 degassing surveys

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Tenerife (2,034 km^2), the largest and one of the most active islands of the Canarian volcanic archipelago, has registered four volcanic eruptions in the last 300 years. One of the main volcano-structural and geomorphological features of Tenerife is the triple junction-shaped rift system, as a result of inflation produced by the concentration of emission vents and dykes at 120^o one to another. These rift zones, oriented NW-SE (NWRZ), NE-SW (NERZ) and a more scattered area on the south (NSRZ), are characterized mainly by effusive activity of basaltic lavas forming spatter and cinder cones. The NSRZ comprises 139 monogenetic cones representing the most common eruptive activity occurred on the island during the last 1My (Dóniz et al., 2008). The main structural characteristic of the NSRZ is the apparent absence of a distinct ridge and a fan shaped distribution of these monogenetic cones. Since no visible degassing (fumaroles, etc.) at Tenerife NSRZ surface occurs, a geochemical monitoring program at Tenerife NSRZ was established mainly consisting on performing diffuse CO_2 emission surveys to evaluate the temporal and spatial variations of soil CO_2 efflux values and the diffuse CO_2 emission rate. Six diffuse CO_2 degassing surveys have been carried out at NSRZ of Tenerife since 2002 covering an area of 325 km^2, the last one in the summer period of 2017. Measurements of soil CO_2 efflux were performed in situ by means of a portable non-dispersive infrared sensor following the accumulation chamber method (Parkinson, 1981) at about selected 600 sampling sites to obtain a homogeneous distribution after taking into consideration the local geology, structure and accessibility. During 2017 survey, soil CO_2 efflux values ranged from non-detectable to 15.2 $g \cdot m^{-2} \cdot d^{-1}$. Statistical-graphical analysis of the 2017 data show two different geochemical populations; background (B) and peak (P) represented by 98.9% and 1.1% of the total data, respectively. The geometric means of the B and P populations are 1.4 and 11.2 $g \cdot m^{-2} \cdot d^{-1}$, respectively. Most of the area showed B values while the P values were observed as multiple isolated anomalies in the study area. To estimate the diffuse CO_2 emission in tons per day released from Tenerife NSRZ for the 2017 survey, about 100 sGs simulations were performed. The estimated 2017 diffuse CO_2 output released to atmosphere by the NSRZ of Tenerife was 571 ± 18 $t \cdot d^{-1}$. This value is very similar to the previous one in 2016 (524 $t \cdot d^{-1}$) and falls within the estimated background range (152 - 788 $t \cdot d^{-1}$) observed for Tenerife NSRZ volcano during the period 2002-2017, although is still higher than background value (338 $t \cdot d^{-1}$). Monitoring the diffuse CO_2 emission contributes to detect early warning signals in the activity of the Tenerife North-South Rift-Zone volcanic system.

Reference:

Dóniz et al., 2008. J. Volcanol. Geotherm. Res. 173,185.