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Spatial and temporal variations of diffuse CO_2 degassing at the N-S volcanic rift-zone of Tenerife (Canary Islands, Spain) during 2002-2015 period

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Tenerife is the largest of the Canary Islands and, together with Gran Canaria Island, is the only one with a central volcanic complex that started to grow at about 3.5 Ma. Nowadays the central complex is formed by Las Cañadas caldera, a volcanic depression measuring 16×9 km that resulted from multiple vertical collapses and was partially filled by post-caldera volcanic products. Up to 297 mafic monogenetic cones have been recognized on Tenerife, and they represent the most common eruptive activity occurring on the island during the last 1 Ma (Dóniz et al., 2008). Most of the monogenetic cones are aligned following a triple junction-shaped rift system, as result of inflation produced by the concentration of emission vents and dykes in bands at 120^o to one another as a result of minimum stress fracturing of the crust by a mantle upwelling. The main structural characteristic of the southern volcanic rift (N-S) of the island is an apparent absence of a distinct ridge, and a fan shaped distribution of monogenetic cones. Four main volcanic successions in the southern volcanic rift zone of Tenerife, temporally separated by longer periods (∼70 – 250 ka) without volcanic activity, have been identified (Kröchert and Buchner, 2008). Since there are currently no visible gas emissions at the N-S rift, diffuse degassing surveys have become an important geochemical tool for the surveillance of this volcanic system. We report here the last results of diffuse CO_2 efflux survey at the N-S rift of Tenerife, performed using the accumulation chamber method in the summer period of 2015. The objectives of the surveys were: (i) to constrain the total CO_2 output from the studied area and (ii) to evaluate occasional CO_2 efflux surveys as a volcanic surveillance tool for the N-S rift of Tenerife. Soil CO_2 efflux values ranged from non-detectable up to 31.7 g m^{-2} d^{-1}. A spatial distribution map, constructed following the sequential Gaussian simulation (sGs) procedure, did not show an apparent relation between higher diffuse CO_2 emission values and the main N-S axis of the rift. The total CO_2 output released to the atmosphere in a diffuse way has been estimated at 707 t d^{-1}, which represents a value three times higher than the average of the three studies conducted previously. This observed increase suggests the occurrence of an episodic enhanced magmatic (endogenous) contribution. This also confirms the need of periodic diffuse emission surveys in the area as a powerful volcanic surveillance tool, mainly in volcanic systems where visible gas emanations are absent.

References:

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

Kröchert and Buchner, 2008. Geol. Mag. 146, 161.