

Diffuse CO₂ And 222Rn Degassing From Faial Volcano System, Azores

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The island of Faial is the nearest of the central Azorean islands to the Mid-Atlantic Ridge. The main morphological feature of the island is a 2-km-wide summit caldera (Caldeira) in the summit of a complex large andesitic-to-trachytic stratovolcano. The formation of the caldera was followed by construction of fissure-fed basaltic lava fields and small volcanoes that form a peninsula extending to the west. The WNW-ESE Pedro Miguel graben is the most relevant tectonic structure observed in the island, being composed by two families of faults dipping NE and SW, respectively. Two historical eruptions have occurred at the island, being the most recent the Capelinhos eruption in 1957-58. This eruption created a new island that soon merged with the western peninsula.

With the aim of estimating the total CO₂ emission rate at the entire island during an inter-eruptive period and to delineate the relation between soil diffuse degassing and the main volcano-tectonic structures, soil CO₂ afflux and 222Rn activity were measured at 432 homogeneously-spaced sampling sites. Spatial distribution maps of both parameters were constructed by means of sequential Gaussian Simulation (sGs). Diffuse CO₂ emission values ranged between non detectable values to 270 g m⁻² d⁻¹, with an average value of 19 g m⁻² d⁻¹. Highest soil CO₂ efflux values were measured at the East side of the island and at the North flank of the Caldeira. The total CO₂ emission rate estimated for the entire island was 3,418 ± 71 t d⁻¹. In the case of 222Rn, it ranged between non detectable to 49 kBq m³, with an average value of 4 kBq m³. Anomalous high 222Rn activity values were observed along the East and South of the island, and at the Pedro Miguel graben. These data indicate a deeper source for the gas emission at Pedro Miguel graben. These data correspond to the first study of surface gas geochemistry conducted on the island of Faial and will serve as a basis for future studies of volcano monitoring.