



Applying fractal dimensions and energy-budget analysis to characterize fracturing processes during magma migration and eruption: 2011-2012 El Hierro (Canary Islands) submarine eruption

Carmen López (1), Joan Martí (2), Rafael Abella (1), and Marta Tarraga (2)

(1) Instituto Geográfico Nacional, C/Alfonso XII, 3, 28014 Madrid, Spain (clmoreno@fomento.es), (2) Institute of Earth Sciences Jaume Almera, Lluís Solé Sabaris s/n, 08020 Barcelona, Spain

The impossibility of observing magma migration inside the crust obliges us to rely on geophysical data and mathematical modelling to interpret precursors and to forecast volcanic eruptions. Of the geophysical signals that may be recorded before and during an eruption, deformation and seismicity are two of the most relevant as they are directly related to its dynamic. The final phase of the unrest episode that preceded the 2011–2012 eruption on El Hierro (Canary Islands) was characterized by local and accelerated deformation and seismic energy release indicating an increasing fracturing and a migration of the magma. Application of time varying fractal analysis to the seismic data and the characterization of the seismicity pattern and the strain and the stress rates allow us to identify different stages in the source mechanism and to infer the geometry of the path used by the magma and associated fluids to reach the Earth's surface. The results obtained illustrate the relevance of such studies to understanding volcanic unrest and the causes that govern the initiation of volcanic eruptions.