

## **On the relation between crustal deformation and seismicity during the 2012-2014 magmatic intrusions in El Hierro island.**

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The last volcanic eruption in the Canary Islands took place in 2011 less than 2 km offshore El Hierro island, after 3 months of measuring surface deformation (up to 5 cm) and locating more than 10 000 earthquakes. In the two years following the end of the submarine eruption on 5 March 2012, six deep magmatic intrusions were recorded beneath the island. Despite the short time duration of these intrusions, these events have been more energetic than the 2011 pre-eruptive intrusive event but none of them ended in a new eruption. These post-eruptive reactivations are some of the few examples in the world of well monitored magmatic intrusions related with monogenetic volcanism. In order to understand these processes we have analyzed the geodetic and seismic data with different techniques.

First, we did a joint hypocentral relocation of the six seismic swarms, including more than 6 300 events, to analyze the relative distribution of the earthquakes from different intrusions. The uncertainties of the earthquakes relocations was reduced to an average value of 300 m. New earthquakes' distribution shows the alignments of the different intrusions and a temporal migration of the events to larger depths. Moreover, we show the results of the ground deformation using GPS data from the network installed on the island (for each of the six intrusive events) and their inversion considering spherical models. In most of the intrusions the optimal source model was shallower and southern than the corresponding seismicity hypocenters. The intruded magma volume ranges from 0.02 to 0.13 km<sup>3</sup>. Finally, we also computed the b value from the Gutenberg Richter equation by means of a bootstrap method. The spatial and temporal evolution of the b value for the seismicity show a clear correlation with the temporal evolution of the crustal deformation.

The six magma intrusions can be grouped, depending on their location, in three pairs each one associated with each of the three active rifts of El Hierro island. Although all intrusions show similar magma supply rate (60–90 m<sup>3</sup>/s) we found particular characteristic for each the three groups of intrusions, including the relation between seismic energy and deformation or the ratio between seismic and geodetic moment. We discuss the compatibility or not of these results with the possible triaxial nature of the origin of El Hierro island.

As a conclusion, we have reviewed the historical seismic catalog and compared these post-eruptive intrusions with other possible magmatic intrusions in the Canary Islands. We found that a maximum of 50% of the volcanic unrests occurred in the Canary Islands in the last century ended in eruptions.