



## **On the origin of the 2017 seismovolcanic activity in La Palma**

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During the last centuries, La Palma has been one of the most active volcanic island of the Canarian Archipelago, with 7 eruptions in the last 600 years. Most of the eruptions were preceded by seismic swarms which lasted from days to weeks and were felt by the population of the island. However, the last eruption occurred in 1971 and the instrumental records of the pre-eruptive seismicity were very scarce.

On October 2017, the IGN seismic network detected the first volcano-tectonic swarm beneath the island. More than 300 earthquakes were detected by manual picking but, due to the low amplitude of the seismic signals, only 110 events could be located. Seismicity was located under the South part of the island (Cumbre Vieja) where all historical eruptions occurred. Depths of the earthquakes vary between 15-22 km and epicenters are located along a wide area of 10 km. Magnitudes  $m_{BLG}$  range from 1.0 to 2.7. The volcanic swarm lasted only 10 days. We have found a slightly high  $b$  value of the Gutenberg-Richter law which may indicate the presence of gas or liquid surrounding the seismicity and could point as a magma intrusion as the origin of the swarm. A deep analysis of La Palma's seismicity during the previous 4 years shows a very low background seismicity with less than 10 earthquakes detected per year.

During the unrest, no deformation was detected in any of the 5 GPS stations deployed in the island, neither in the InSAR results using Sentinel-1 images. This is consistent with the low magnitudes that would suggest a small magma volume associated to the intrusion. In this sense, we worked on solving the direct problem by considering different volumes of synthetic intrusions at 15-22 km depth and computing the expected deformation and thus obtained a threshold detection for that with a volume change of  $0.01\text{km}^3$  at the depth of the seismicity the expected deformation would be of only few mm, so it would be difficult to detect.

Furthermore, discrete measurements of physicochemical parameters, dissolved gases and chemical composition of groundwater have been accomplished in the island since the end of 2013. On October 2017, two permanent Radon/Thoron detectors were installed. Geochemical parameters monitored before, during and after the unrest did not show significant changes directly related to the seismic events.