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THEME 3

Characterization of the crustal structure of Timanfaya volcanic area (Lanzarote, Spain) through gravity study.

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The eruption that took place in Lanzarote between the years of 1730 and 1736 was one of the most important volcanic events occurred in the Canarian Archipelago over the last 500 years. This eruption affected a quarter of Lanzarote and gave rise to the now known as Timanfaya volcanoes. In the 19th century, there were other eruptions during which several new volcanoes emerged, occurring the last event in 1824. Actually, this volcanic area is known as Timanfaya National Park Timanfaya which occupies a surface of 51.07 km² in the southwest of the island.

The Timanfaya National Park is a restricted area and only a small zone can be visited. So, the use of prospective techniques which help to know its subsurface structure is very difficult. Until now, some regional study through gravity, magnetism and seismic have been undertaken to model the deeper crustal structure of Lanzarote Island.

It is firmly established that the gravity modelling plays an important role in helping us to understand volcanic structures. We present here a study of the near subsurface structures of the volcanic area of Timanfaya by the analysis and interpretation of high-resolution gravity data obtained over areas which had not been measured until now. This new data allows us to model the anomaly sources related with the volcanic activity occurred in Timanfaya.

We have achieved two gravity surveys with a precision about 13 μ Gal. The new Bouguer gravity anomaly map show the minimum values over the Timanfaya and Rajada volcanoes, while a smaller minimum occurs at the eastern area of the Park. These lows show interesting alignments, which can be associated to a fracture system corresponding to structural stress and also correlate with the Timanfaya eruption. Moreover, there is a clear regional tendency NE-SE which mask other local features of the field. Then, we apply first several analysis techniques in order to achieve a previous qualitative interpretation of the data. Fitting a polynomial surface, the regional component of the gravity field is identified and removed. This residual map is interpreted to obtain information about shallower crustal structures. Moreover, first vertical derivative of the Bouguer gravity dataset is also studied. Secondly, we carry out a structural study of the subsurface by means of gravity inversion, looking for information about lateral changes in mass distribution. We use a 3-D approach based on a genetic algorithm upon a prismatic partition of the subsoil volume, and adopting a priori values of density contrast (positive and negative). The calculated model of crustal anomalous masses shows correlation with several volcanic and tectonic structures and the outcome is consistent with the results of previous geophysical and volcanological studies.

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