



Analysis of volcano-related seismicity around Fogo and Brava, Cape Verde, by (multi-)array techniques

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The Cape Verde archipelago is believed to originate from a mantle plume, underlying an almost stationary tectonic plate. Fogo and Brava are located in the south-western part of the archipelago, about 18 km apart from each other and belong to the younger islands. Only Fogo experienced eruptions since the settlement in the 15th century. This volcano has an eruption interval of about 20 years, the last eruption took place from November 2014 to February 2015.

Previous studies, using seismic stations distributed on the islands, have indicated relatively high seismic activity in the vicinity of Brava. Based on these findings, a possible link of the plumbing system of Fogo to a magmatic source near Brava has been proposed. More recently, a “seismic crisis” on Brava led to the evacuation of a village during August 2016.

In our study we aim to investigate the magmatic plumbing system of Fogo and to characterize the seismic activity of this region. As the majority of the seismic events are located offshore, we decided to use multi-array techniques to perform the investigations. Furthermore, many volcano-related seismic signals lack a clear onset of phases, such that array methods may be more suitable to locate their origin.

In October 2015 we first deployed a seismic array on Fogo. The circular array consists of 10 seismic stations with an aperture of 700m. Additionally, we set up three broadband-stations across the island in January 2016. Since January 2017 we operate three similar arrays, two on Fogo and one on Brava, complemented by seven single short-period stations on both islands.

To localize earthquakes, we apply a time-domain array analysis, combined with a distance estimation from travel-time differences between S- and P-wave arrivals. With this method, 276 earthquakes were located beneath and around Brava from January to December 2016. 25 of the events occurred during the “seismic crisis” on Brava from Aug. 1-2, 2016. The seismicity beneath Brava remained at a high level in the following months. The temporal evolution of these earthquakes, as well as their locations and magnitudes will be presented.

Additionally we recorded a swarm of subcrustal earthquakes beneath Fogo. We analyzed 13 events of this cluster located beneath the southern part of Fogo at a depth of about 40 km. Results from our P-wave receiver-function analysis show that the Moho discontinuity is located at a depth of about 11 km. This indicates that the deep earthquakes occur well within the upper mantle. We ascribe the earthquakes to a possible magma related origin, which in turn questions the hypothesis of a link between the magma supply systems of Fogo and Brava.