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New insights into the magmatic system southeast of El Hierro from high-resolution 2D seismic data

Kai-Frederik Lenz[1], Felix Gross[1,2], Andreas Klügel[3], Rachel Barrett[1], Philipp Held[1], Katja Lindhorst[1], Paul Wintersteller[3,4], and Sebastian Krastel[1]

[1]Institute of Geosciences, Christian-Albrechts-Universität zu Kiel, Kiel, Germany
[2]Center for Ocean and Society Kiel, Christian-Albrechts-Universität zu Kiel, Kiel, Germany
[3]Institute of Geosciences, University of Bremen, Bremen, Germany
[4]MARUM - Center for Marine Environmental Sciences, Bremen, Germany

A new high-resolution seismic dataset is used to investigate the distribution and influence of different phases of magmatic activity in the southeast of El Hierro, Canary Islands. The Canary Archipelago off NW-Africa has largely been formed over the past 20 Myr, but older volcanic edifices exist. One of those older edifices is Henry Seamount, an extinct 126 Ma volcano located 40 km southeast of El Hierro, the youngest (1.1 Ma) and westernmost of the Canary Islands. Hence, the area southeast of El Hierro is influenced by both older and younger magmatic activity. We also found evidence for comparatively young volcanic activity at Henry Seamount, probably contemporaneous to El Hierro. Therefore, a complex magmatic system is assumed to have resulted in the different phases of magmatic activity.

A detailed high-resolution 2D seismic reflection dataset was collected in an area between El Hierro and Henry Seamount during RV Meteor expedition M146 in 2018 to image the expressions of this magmatic system in the upper sub-surface. Several acoustic blanking zones were discovered and identified as the most prominent features in this seismic dataset. We classify these blanking zones into three different types. Type 1 blanking zones are related to volcanic edifices, which crop out at the seafloor and cut through all imaged sedimentary units. Type 2 blanking zones are characterised by upward bending of adjacent reflectors and are most likely caused by hydrothermal doming resulting from saucer-shaped sill intrusions. Type 3 blanking zones cut clearly through adjacent reflectors, and are probably related to fluids or gases that were mobilized by the sill intrusions. The type 1 and 2 blanking zones cluster in the central part of the working area, whereas the blanking zones of type 3 are located on the outskirts. This specific distribution and the occurrence of the varying blanking zone types are combined to make a conceptual model of this complex magmatic system. Our model takes sill intrusions, hydrothermal doming, as well as volcanic out-crops and mobilized fluids into account. Therefore, this study provides new insights into the magmatic evolution of the youngest Canary Island, which can help to achieve a better understanding of the whole system.