V31F-0158 Seismic Tomography Reveals a Shared Lower-Crustal Magma Source for Proximal Santorini and Kolumbo Volcanoes

Wednesday, 13 December 2023

08:30 - 12:50

Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Santorini volcano in the South Aegean Volcanic Arc has a detailed history of ongoing volcanic and seismic activity, making it a prime location for studying magma storage and transport at arc volcanoes. The shallow magmatic system (<5 km depth) is well constrained by geophysical studies, but the deeper crustal structure is not. Located 15 km NE of Santorini, the Kolumbo seamount is also an active edifice, with consistently more seismicity and hydrothermal venting than Santorini. Geochemical studies indicate that Santorini and Kolumbo are fed by separate mantle and crustal magma sources, but prior seismic studies suggest otherwise (Dimitriadis et al, 2010; McVey et al, 2020). This study addresses the nature of lower-crustal magma structure beneath arc volcanoes and whether evolved volcanoes and nearby vents are connected through their plumbing. Tomographic inversion of P-wave Moho reflection (PmP) and turning P-wave (Pg) traveltimes is used to create 3-D models of Moho depth and P-wave velocity (Vp) down to depths of ~25 km. The PROTEUS experiment provides an exceptionally dense and large aperture traveltime dataset from an amphibious array of ~150

seismometers and ~14,000 active marine sources. The data are ~33,000 manually picked PmP arrivals and ~256,000 Pg arrivals from existing studies. Results show a low Vp anomaly extending from the Moho to the surface. This anomaly starts at the base of the crust under the NW Santorini caldera and extends up to the east. It is most pronounced at 10-15 km depth, where it is offset from both Santorini and Kolumbo. Limited resolution prevents imaging of a connection between this mid-crustal anomaly and the known shallow magma storage region under the Santorini caldera. A high-velocity core beneath Santorini is not found, a feature interpreted at other volcanoes as a cooled intrusive complex. Because no additional low Vp anomalies are found in the lower crust, we infer that a common mantle source and mid-crustal plumbing system is actively feeding both Santorini and Kolumbo. The spatial offset and elongated nature of magma storage implies a complex relationship between evolving magmatic structures and tectonics.

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