High-resolution imaging and modelling of the magma plumbing system at the Santorini volcano

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Santorini: A major caldera-forming eruption at Santorini in around 1600 BC has been linked to the demise of the Minoan civilization. Santorini is currently in a dome-forming phase [Nomikou et al., 2014], with the last eruption occurring in 1939-1941. A seismic crisis accompanied by inflation in 2011-2012 showed that a large eruptible volume of magma has accumulated in a shallow chamber [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014]. Santorini is currently in a dome-forming phase [Nomikou et al., 2014], with the last eruption occurring in 1939-1941. A seismic crisis accompanied by inflation in 2011-2012 showed that a large eruptible volume of magma has accumulated in a shallow chamber [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014] and that Santorini remains one of the most hazardous volcanoes in Europe [Parks et al., 2014].

Seismic tomography: FWI involves finding a velocity model that is able to match the full seismic wavefield wiggle-for-wiggle. The method involves iteratively updating an initial starting model using a linearized local inversion. The principal advantage of FWI is the recovered velocity models have a high spatial resolution. In the figure below, the starting model (left) has been obtained using conventional industry methods, and the FWI velocity model (centre) has been obtained by inverting the low-frequency (4-7 Hz) refracted wavefield. The faults in the FWI velocity model correlate well with the migrated seismic data (right).

Project: The overall aim of the project is to use 3D FWI to obtain fine-scale models of P-wave velocity and other physical properties such as anisotropy, attenuation and S-wave velocity, which will provide constraints on the size, shape, melt content and composition of magma batches and mush zones, as well as locate individual layers of fluids and/or melt. These results will be integrated with other available data such as ground deformation, geochemical and petrological information, and used to steer numerical models of melt intrusion, using a thermo-mechanical model that includes melt segregation [Solano et al., 2012].

We are looking for geologists, geophysicists, physicists, computer scientists, applied mathematicians, engineers and others with a numerical background and an interest in imaging the Earth. Some previous experience with active source seismic data would be an advantage. The PhD project is funded by the Leverhulme Trust.

Details about how to apply: [http://www.imperial.ac.uk/earth-science/prosp-students/phd-opportunities/](http://www.imperial.ac.uk/earth-science/prosp-students/phd-opportunities/)

CLOSING DATE FOR APPLICATIONS is 31 January 2017.

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References


Nomikou, P., et al. (2014), The emergence and growth of a submarine volcano: The Kameni islands,
Santorini (Greece), GeoResJ, 1, 8-18.


