The University of Oxford Department of Earth Sciences

EARTHSCIENCES

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Age and development of Santorini volcano, Greece

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Overview

Santorini is a large caldera volcano in the Aegean Sea, where it forms a part of the South Aegean Volcanic Arc. While the age and evolution of the volcano over the past 360,000 years is well known from detailed studies of caldera-wall exposures and marine tephra, the older history of this system is poorly known.

This project will build on new opportunities that arise from an ocean-drilling expedition to the Santorini volcanic field (IODP 398; scheduled for Dec 2022-Jan 2023) and will focus on reconstructing the age and eruption history of the Santorini volcanic field prior to the establishment of the 'modern' volcano at ca. 360 ka.

https://santoriniofficialguides.com/portfolio-item/impressive-santorini-oia/

Aerial view of the island group of Santorini, looking East, showing the locations of Peristeria (P) and Akrotiri (A), two of the older centres of volcanism.

Methodology

This research project will focus on the study of the older products of Santorini volcano: both those exposed above sea-level on Santorini (including Peristeria volcano, and the Akrotiri Peninsula), complemented by drill-core samples.

Fieldwork on Santorini will focus on establishing the relationships between the older volcanic units (from field mapping, with follow up petrological and geochemical work on selected samples). Selected samples of major and well-characterised units would be the focus of radiometric dating (by ^{40}Ar-^{39}Ar techniques), which would be carried out at the Scottish Universities Environmental Research Centre, SUERC.

Age-dating and geochemical results from the sub-aerial sequences will be integrated with new data derived from the IODP drilling project, augmented by volcanological, petrological and dating work on selected core samples. This will give new insights into the age and development of the Santorini volcanic system.

Timeline

Year 1: The student will join the diverse cohort of students from Oxford's Doctoral Training Partnership in Environmental Research (DTP; https://www.environmental-research.ox.ac.uk/) and will spend the first six months engaged in training (run by the DTP); reading and reviewing the wider literature, and preparing a detailed research proposal.

Preliminary work would include exploratory investigations of previously-collected samples, the results of which would help to inform planning for a fieldwork and sampling campaign on Santorini towards the end of year 1.

Years 2 and 3: A major element of the project will be to carry out radiometric (^{40}Ar-^{39}Ar) dating on suitable minerals from well-characterised samples, in order to determine the timing of volcanism during the early development of the volcanic field. This will require careful preparatory laboratory work, both for sample characterisation, mineral separation and isotope analysis. This will require an application to the UK National Environmental Isotope Facility (NEIF) for access to the Argon-dating facilities at the Scottish Universities Environment Research Centre (SUERC).

During Years 2 and 3, the student would work closely with members of the IODP 398 science team, in order to access and work on new core material that might reveal the early volcanic history of Santorini. This work will complement parallel studies by other colleagues on the volcanic and rifting histories of the Christiana-Santorini-Kolombos region.

Year 4: The concluding stages of the work will include the integration of multiple data sources in order to develop a time-stratigraphic framework for the early stages in the development of the Santorini volcanic field. The work may address leading questions – for example, how, when and why activity at Santorini became dominated by sub-aerial explosive eruptions.

The student will write up the results of the ongoing work as the research progresses; will present these results at workshops, meetings and conferences and in peer-reviewed publications.

They will submit a thesis documenting their research during their 4th year of study.

Training & Skills

Funding for the studentship will be sought from Oxford's NERC doctoral training partnership in Environmental Research (DTP). The DTP provides a detailed programme of training in research and wider skills (including coding, computing, networking and presentation) over the first six months of the project, and continuing support for the full 4-year duration of the project. Additional training directly relevant to the project will be provided in the field (Santorini), and in the laboratories, as required. There will be ample opportunities for presenting research posters and talks, for writing scientific papers, and for engaging with ongoing research that will arise from the IODP activities, throughout the course of the work.

The student will benefit from the strong research environment in volcanology, petrology and geochemistry in Oxford; and from the breadth of expertise in their supervisory team, all of whom are involved in the preparations for IODP 398. They will also benefit from the modern laboratory, computing and library facilities in Oxford, Keele and SUERC, including access to rock preparation and mineral separation labs, scanning electron microscopes, an electron microprobe and Ar-dating facilities. There will be opportunities to participate in field trip and class demonstrating: at the moment both Oxford and Keele run volcanology field classes.

References & Further Reading

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Further Information

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