

## Diagnosing pre-eruption processes at a mafic volcano in southern Chile

### Supervisory Team

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### Overview

What controls the location, composition and eruptive style of primitive mafic volcanoes in the Southern Volcanic Zone of Chile? In places, these magmas erupt in monogenetic cone-fields; in others, they build stratovolcanoes. Current models suggest that the magmas feeding cones erupt rapidly from depth; while magmas that supply the larger edifices have a more protracted evolution at shallower depths. The difference between the two scenarios is often ascribed to the balance between the regional stress field (tectonics), and magma supply rate.

This project will focus on the young mafic volcano of Hornopirén, southern Chile. This is a small arc-front volcano, located in an extensional graben. The volcano has erupted both lava flows and scoria during the Holocene, and may have been active as recently as the early 19<sup>th</sup> century. The aim of the project is to use field, petrological and geochemical tools to investigate the origin, evolution and eruption history of this little known volcano, and to use these new data to understand the regional controls on mafic volcanism in the Southern Volcanic Zone, and elsewhere.



*View of the flanks and summit of Hornopirén volcano, southern Chile*

### Methodology

This project will involve literature review and synthesis, field work in a young volcanic terrain and analysis and interpretation of digital elevation models. The main focus will be the petrological characterisation and geochemical analysis of suites of rock, mineral, glass and melt inclusion samples. The aim will be to develop an eruption stratigraphy for Hornopirén, and to place this within the regional volcanic history. Focussed work on individual eruption deposits will be used to determine the conditions under which the magmas evolved, and to place constraints on the chemical and physical processes that led up to eruption. This project will be carried out in close collaboration with the Chilean Geological Survey (SERNAGEOMIN), and will feed into their ongoing programmes of work on volcanic hazards.

### Timeline

**Year 1:** A student funded by the Doctoral Training Partnership will spend the first 3 months undertaking cohort-based training (in maths, coding and other research skills). After this, the student would be expected to complete a thorough and literature review, and use this to develop a research plan. Preliminary petrological and geochemical work will be carried out on scoria samples that we already have in hand, and this will help both to generate some preliminary data, and to refine the objectives for fieldwork.

**Years 2, 3 and 4:** We anticipate that there will be one main field season, carried out in close conjunction with SERNAGEOMIN, most likely early in Year 2. Work following on from this will develop according to which samples look most promising; and which research questions look to be the most exciting or tractable. We expect that the student

will write up papers for publication, and give presentations at both UK (VMSG) and international conferences as their work progresses. There will be ample opportunities to present and discuss your work in Oxford, both at weekly 'volcano lunch' meetings, and as a part of the formal stages of graduate student progression.

A significant component of the research will be to synthesise the data from Hornopirén, and by comparing it to data from other systems to test existing models and develop new hypotheses about the origins of small mafic volcanoes in subduction-zone settings.

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## Training & Skills

The supervisory team (Pyle, Mather, Amigo) has considerable expertise of working on the petrology, geochemistry and eruptive histories of young volcanoes. They have all worked in southern Chile. This collaboration will provide an exciting opportunity for a student to carry out new and fundamental research on a young volcano, and to feed their results directly into the Chilean national programme on volcanic hazards, led by Dr Amigo.

Core training in research and skills will be provided through Oxford's Doctoral Training Partnership in Environmental Research. Training in work in volcanic terrains will be provided in the field, by the supervisory team and collaborators; and full training in the processing and analysis of samples and data will be provided as needed. The project will involve international fieldwork, and may require periods of analytical work at facilities outside Oxford. Knowledge of Spanish and an ability to drive would be helpful for fieldwork.

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## References & Further Reading

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## Further Information

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