PROJECT TITLE: Neotectonic Insights into Arc Magmatic Systems

University of Bristol Theme: Net Zero and Climate Change
Research Group(s): Geophysics, Volcanology
Lead Supervisor: Dr Sam Wimpenny (University of Bristol, School of Earth Sciences)
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Co-Supervisor: Dr Carlos Benavente (INGEMMET, Peru)
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Funder: University of Bristol Scholarship

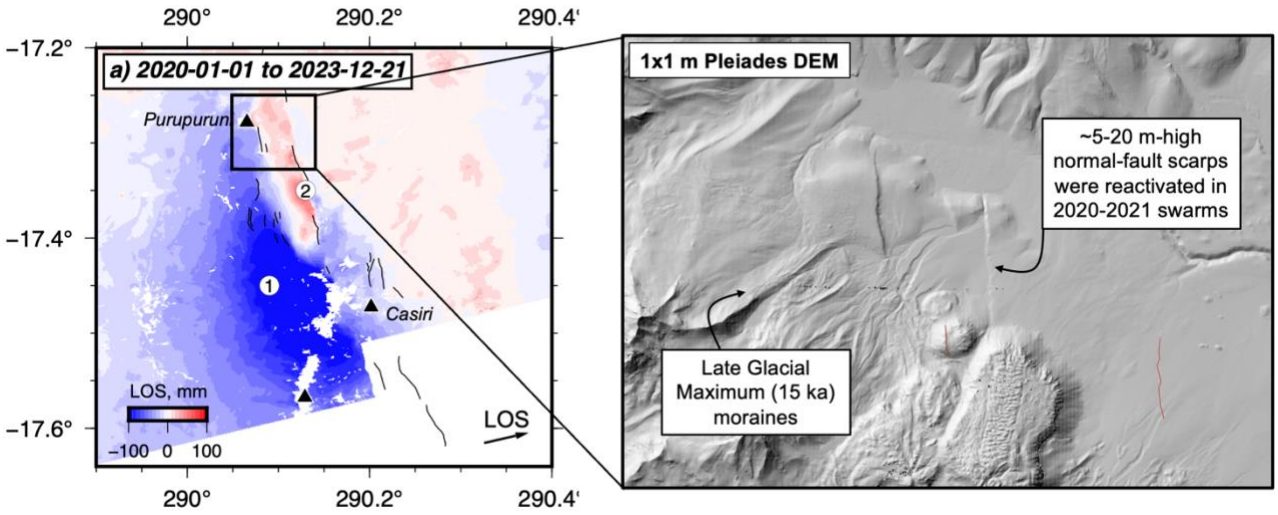

Figure 1: (left) InSAR time-series measurements of deformation in southern Peru showing evidence that fault slip [point 2] is contemporaneous with magmatic inflation and dyke injection [point 1]. (right) Hillshade showing fault scarps that have been repeatedly reactivated, presumably due to multiple episodes of intrusive magmatism.

Project Background

The vertical movement of magma into the shallow crust leads to slip on overlying fault systems (Fig. 1). Therefore, geomorphological and paleoseismological methods for reconstructing the timing and rate of slip on fault systems through time can provide a novel – but underutilised – proxy for the longevity and evolution of shallow-crustal magma reservoirs, complementing the petrological record.

The significance of understanding the longevity of magma reservoirs lies in its link with critical metals. Epithermal porphyry ores containing critical metals form as a result of long-term (1-2 Myr) degassing of silicic magma beneath volcanic arcs [1]. Why some magma reservoirs can be long-lived and develop economic ore bodies remains unclear – studying the longevity and spatio-temporal evolution of volcano-tectonic fault systems in active arcs can help address this question.

Project Aims and Methods

In this project, you will examine the spatio-temporal evolution of volcano-tectonic faulting within the south Peruvian volcanic arc and relate this to the history of shallow intrusive magmatism. The methodologies you choose will depend on your skillset, and you will be encouraged to shape the project based on your interests and emergent research directions.

Some potential lines of study include: (1) conducting a field-based analysis of the spatio-temporal evolution of fault slip around two active volcanic systems using a combination of paleoseismic trenching, Quaternary geomorphological analyses and geological analysis of volcanic rocks, (2)

developing a physical model for the relationship between shallow magma reservoir size and shape and surface fault slip based on contemporary examples of volcanic unrest, and (3) linking the timing of recent earthquakes on shallow fault systems with the timing of past eruptive activity.

Candidate

This project would suit a student with a background in Geology or Geophysics to MSc/MSci level and an interest in both volcanism and tectonics. Experience planning and conducting geological fieldwork is desirable.

Project partners

You will be supervised by a team with expertise in both tectonics and volcanology based in Bristol and the Instituto Geologico, Minero y Metalurgico (INGEMMET) in Peru. The candidate will be a member of the UK Centre for the Observation and Modelling of Earthquakes, Volcanoes and Tectonics (COMET) and will have access to training and student-centred events they organise.

Training

The candidate will receive training in methods used for reconstructing the history and kinematics of fault slip, including paleoseismic trenching, geomorphological analysis, satellite remote-sensing and field-based neotectonics. Further training in modelling volcanic and tectonic deformation will be provided by the supervisors if the project requires.

Background reading and references

MacQueen, P., et al., 2020. Volcano-tectonic interactions at Sabancaya volcano, Peru: Eruptions, magmatic inflation, moderate earthquakes, and fault creep. Journal of Geophysical Research: Solid Earth, 125(5), p.e2019JB019281.

Benavente, C., Wimpenny, S., Rosell, L., Robert, X., Palomino, A., Audin, L., Aguirre, E. and García, B., 2021. Paleoseismic evidence of an Mw 7 pre-Hispanic earthquake in the Peruvian forearc. Tectonics, 40(6), p.e2020TC006479.

Useful links

https://www.bristol.ac.uk/earthsciences/postgraduate/
https://www.bristol.ac.uk/science-engineering/postgraduate-research/pgr-scholarships/
https://www.bristol.ac.uk/directory/visas/student-visa/apply/money

Eligibility

UK and International students are eligible for University of Bristol Postgraduate Research Scholarships. These are funded for 4 years and cover university fees, living expenses at the UKRI standard rate, and an allowance towards research expenses. Scholarships do not cover visa or NHS surcharge costs. See links above for details.

Application

During application select "**University of Bristol Scholarship**" for funding source and "**Geology (PhD)**" for programme. If you are applying this specific project upload this PDF as the "research statement". All studentships must have a September 2026 start date.