

## **The eruption and deposition of hot, crystal laden slurries: a study of crystal-rich ignimbrites**

Supervisors: Dr. David Brown and Dr. Fiona Meade

Crystal-rich ignimbrites are common products of 'super-eruptions' and examples such as the Fish Canyon Tuff are up to 5000 km<sup>3</sup> in volume. These ignimbrites, often referred to as 'monotonous intermediates', are typically massive, of dacitic composition, chemically homogeneous, and contain up to 50% crystals. They are thought to represent voluminous eruptions of crystal mushes from large magma reservoirs in the upper crust. The crystal-rich ignimbrites are typically accompanied by crystal-poor rhyolitic ignimbrites that represent eruptions of interstitial melt extracted from these crystal mushes. Together, these ignimbrites provide considerable insight to the behaviour of magma in the upper crust and the generation and eruption of evolved melts.

However, newly identified crystal-rich ignimbrites from the British-Irish Palaeogene Igneous Province (BIPIP) display unique textures and chemistries, which cannot be reconciled with existing eruption models. Although of considerably smaller volume than the monotonous intermediates, ignimbrites from Ardnamurchan, Arran and Skye show significantly higher crystal populations (up to 70%) and larger crystal sizes (up to 10 cm). Locally, these ignimbrites are stratified and chemically heterogeneous. This project aims to explain the magmatic history of these samples and their behaviour during eruption and deposition.

Detailed field mapping and logging will be undertaken in order to examine and document the physical volcanology of the ignimbrites, with particular focus on subtle changes in stratigraphy. A range of petrographic and chemical analyses (optical and scanning electron microscopy, cathodoluminescence, X-ray fluorescence, microprobe, and crystal isotope stratigraphy) will also be undertaken to describe and interpret textures in the ignimbrites, in particular the crystals. These techniques will be used to develop models of the magma chambers and crystal mushes that fed these eruptions. Samples will also be analysed using image analysis software and microCT, which will allow 3D geometries of the deposits to be reconstructed. These data, aligned with the field observations will allow models of the deposition of the crystal-rich ignimbrites to be developed.

The student will receive training in:

- 1) mapping and logging of ignimbrites using a rigorous lithofacies approach
- 2) analytical techniques: optical microscopy, SEM, CL, XRF, microprobe, CIS
- 3) image analysis and microCT

The successful candidate will have a strong, demonstrable interest in igneous petrology, in particular physical volcanology and geochemistry. The student must be able to drive, have a good level of physical fitness, and experience of working in mountainous terrain.

**About us:** In Glasgow, the student will join the Graduate Schools of the School of Geographical and Earth Sciences (up to 20 new PhD students starting in autumn 2011) and the broader College of Science and Engineering; both of these have thriving post-graduate research communities. The Glasgow Earth Systems Research Group (ESRG) is a vibrant research group that has weekly meetings and one or two research 'away-days' annually. ESRG is supported by state-of-the-art laboratories on the Glasgow campus and at the Scottish Universities Environmental Research Centre in Glasgow's southern suburbs.

### **Application procedure and deadlines**

To be considered for PhD studentships to be held in the School of Geographical and Earth Sciences (GES), suitably qualified candidates should apply via the website of the College of Science and Engineering (<http://www.gla.ac.uk/colleges/scienceengineering/graduateschool/prospectivestudents/essentialinformation/>). Closing dates for University and research council funded studentships will be in early in the new year, as stated on the GES studentships page: <http://www.gla.ac.uk/schools/ges/research/postgraduate/>.

Non- English speakers must meet the University's English language requirements. Candidates for NERC studentships should also meet the NERC's requirements for both academic qualifications and residential eligibility. For more information go to <http://www.nerc.ac.uk/funding/application/studentships> and please note that *non-UK European Union citizens will be awarded fees only by NERC.*

For informal enquiries about the research projects please contact the relevant supervisors. Information on the GES graduate school and the application process can be obtained from Mrs Jean McPartland, the assistant to head of the School ([Jean.McPartland@glasgow.ac.uk](mailto:Jean.McPartland@glasgow.ac.uk)).