PROJECT TITLE: Fragmentation, ash dispersal and sedimentation for hydromagmatic volcanic eruptions
DTP Research Theme(s): Solid Earth
Lead Institution: University of Bristol
Main Supervisor: Dr. Alison Rust, School of Earth Sciences, University of Bristol
Co-Supervisor: Prof. Katharine Cashman, School of Earth Sciences, University of Bristol
Co-Supervisor: Frances Becket, The Met Office
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Figure 1: Scanning electron microscopy images of ash particles from the Hverfjall Fires fissure eruption, Iceland (Liu et al, 2017)

Figure 2: Median grain size vs. distance from source for a selection of magmatic and hydromagmatic eruptions. Note that grain size is relatively constant for hydromagmatic deposits (Cashman and Rust, 2016)

Project Background
Of all volcanic hazards, dispersal of volcanic ash has the most far-reaching consequences. For the UK, the main impact is aviation disruption due to Icelandic eruptions as highlighted by the 2010 Eyjafjallajökull eruption. The Met Office is the authorised Volcanic Ash Advisory Centre responsible for forecasting ash over the northeast Atlantic, Iceland and the UK. In collaboration with the Met Office, the student will assess appropriate particle size distributions and aggregation schemes for modeling ash dispersal from hydromagmatic eruptions (i.e. eruptions where water interaction affects magma fragmentation and eruption dynamics).

The fall velocity, and consequently how far volcanic ash travels through the atmosphere, depends on the size, shape and density of the particles, and whether they fall as individual particles, particle aggregates or as larger-scale (en-masse) instabilities. All of these particle characteristics and processes are expected to differ for hydromagmatic vs. magmatic eruptions of the same magnitude and magma chemistry.

Project Aims and Methods
1. Compile published data and collect new data on the grain size, shape, density and componentry (i.e. proportions of types of particles; Fig. 1) as a function of distance from source in hydromagmatic fall deposits. Fieldwork will focus on deposits from Icelandic eruptions and one other region to be proposed by the student. Characterisation of samples will include laser particle size analysis, scanning electron microscopy, pycnometry, and laboratory measurements of terminal velocity.
2. Determine total grain size distributions (TGSD) for several hydromagmatic eruptions and develop a protocol for estimating TGSD for eruptions for which data are only available from sites over a limited spatial distribution (taking advantage of the relatively constant grain size distributions with distance of hydromagmatic deposits relative to magmatic deposits; Fig. 2).

3. Evaluate aggregation and en masse sedimentation by comparing model results to field data of both the mass per unit area and the grain size distribution of the deposits. An optional component of the project is to study these processes further through laboratory experiments.

4. Improve ash cloud forecasts for hydromagmatic eruptions and suggest default source parameters for modelling the dispersal of ash of common types of hydromagmatic eruptions.

**Candidate**

We anticipate that the student will have a geology background and an interest in developing modelling skills. Students with other physical sciences/engineering background with an interest in volcanology are also welcome.

**Training**

The research project-specific training will include field volcanology, laser particle size analysis, scanning electron microscopy, pycnometry and scaling of laboratory experiments. The student will also be taught how to run ash dispersion models with NAME through direct supervision with Dr. Beckett and through the NAME course regularly held in the Met Office college for training new users. The student will be introduced to programming languages, including Python, to run NAME and present their results.

**References / Reading List**


**Links**

School webpage - [http://www.bristol.ac.uk/earthsciences/courses/postgraduate/](http://www.bristol.ac.uk/earthsciences/courses/postgraduate/)

NERC GW4+ DTP Website: [http://nercgw4plus.ac.uk/](http://nercgw4plus.ac.uk/)

Bristol NERC GW4+ DTP Prospectus: [http://www.bristol.ac.uk/study/postgraduate/2017/doctoral/phd-great-western-four-dtp/](http://www.bristol.ac.uk/study/postgraduate/2017/doctoral/phd-great-western-four-dtp/)

**Application deadline:** 23.59 GMT, Sunday 7 January 2018

How to apply to the University of Bristol: [http://www.bristol.ac.uk/study/postgraduate/apply/](http://www.bristol.ac.uk/study/postgraduate/apply/)

**General Enquiries:**

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