Laboratory modelling of concentrated particle suspensions: application to geological processes.

A fully-funded PhD studentship at the University of Strathclyde

Many geological processes involve the deformation of particles suspended in or surrounded by fluids. Examples include fault gouge, crystal rich magma, and fluidised soils. If we understand the mechanics of these processes then textures preserved in the rock record could potentially be used to infer conditions during their formation. For instance, clast distributions in an injected fault gouge could be used to infer the deformation conditions during fault slip, or variation of crystal fractions in lava could be used to infer conditions and dynamics of historical volcanic eruptions.

This project uses novel experiments originally developed for food and suspension engineering to examine the mechanics and force response of particle suspensions, to help us to interpret the textures preserved in rocks. Preliminary work has shown that 'model' concentrated suspensions under stress display behaviour similar to geological phenomena, including slip planes in shear (*cf* fault rocks), solid-fluid separation (*cf* erupting magma), and anomalously low friction in shear (*cf* measurements from earthquake deformation). With the model suspensions we can directly vary key physical parameters including particle size distributions, volume fractions and particle interactions. The experimental system also enables quantitative study of response to stress throughout the bulk of the material, by *in situ* optical microscopy, imaging and particle tracking. Finally we can vary stress conditions, from squeezing to vibration to shear, to emulate a wide range of geological conditions.

The PhD will involve fieldwork and analysis to collect and characterise textures in geological samples. Image analysis will be used to provide statistical data to compare grain textures in rocks with those from the experiments. Comparison of particle distributions/interactions and stress conditions in the experiments, with deformation patterns in geological samples, will enable knowledge-based inference of the geological conditions that lead to different observed textures and features.

The PhD student will be supervised by Prof. Zoe Shipton, a geologist in the department of Civil and Environmental Engineering, and Dr Mark Haw from Chemical and Process Engineering, who developed the novel experimental setup. We will collaborate with Dr Davie Brown from the School of Geographical and Earth Sciences at the University of Glasgow. Applications are welcome from students with first or upper second-class degrees in the areas of civil or environmental engineering; geology; geosciences; or equivalent field of study. The studentship covers home (UK or EU) tuition fees, and a standard stipend of £13,800 per year for 42 months. Contact Zoe.Shipton@strath.ac.uk for further information

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