



Joint-PhD position

'Micromechanics of cemented granular materials'

Summary of the project

Micromechanics of sedimentary rocks and uncemented granular materials have been studied as different disciplines. This project recognises that these materials are related through cementation of grains and brings the two disciplines together via a careful, highly instrumented, experimental deformation programme where granular materials (e.g. sand) are cemented to create artificial rocks (e.g. sandstones). As cement binds the grains together it increases the strength of the rock. Grain-scale deformation, in both laboratory and field scales, have been previously associated with weakly cemented rock regions. Moreover, cement as a pore-filling mineral influences the porosity and permeability of the rock. However, the way in which the type and the degree of cementation may affect the porosity, the pore connectivity, the grain-scale deformation and finally the structural integrity of the rock remains largely unknown.

This PhD thesis will study the impact of cementation type and degree on the micro-processes induced during deformation of artificially cemented granular materials. This work will initially focus on sand grains, which have been collected from naturally deformed/undeformed regions of an outcrop at Orange, France. Grains of different mineralogy, various sizes and roundness may be used at a later stage. The types of cementation of the artificial rocks will involve bio-cement (e.g. bacteria), brine precipitation and Portland cement of different classes (industrial). Deformation experiments will be carried out coupled with combined pre-, syn- and post- deformation experimental methods (x-ray CT, ultrasonic measurements, ESEM). Further analysis of these measurements will involve tracking of grain kinematics, strain maps, as well as porosity and permeability calculations during the deformation processes.

Practical aspects of the project

This is a joint-PhD position between the Institute of Petroleum Engineering (IPE), Heriot-Watt University and Laboratory 3SR, University of Grenoble. The successful applicant will spend time in both Universities. She or he will work under the supervision of Dr E.M. Charalampidou and Dr H. Lewis (IPE) as well as Dr E. Andò and Prof. G. Viggiani (3SR). This work will be funded by an IPE scholarship, which covers the tuition fees in both Universities and offers a stipend at RCUK rates. The PhD is for 36-42 months.

Entry requirements

Applicants should be educated to at least a Good Honours degree in Geomechanics, Civil Engineering, Geoscience, Petroleum Engineering or relevant scientific subject and demonstrate good English language skills. Computer programming knowledge is an asset. Knowledge or experience in image processing, wave propagation, chemistry, or x-ray tomography is useful but not essential.

Applications

Interested candidates are invited to submit an online application form: <http://www.hw.ac.uk/student-life/how-to-apply/postgraduate.htm>, where they should upload a copy of their degree certificates and transcripts, a CV, two academic references and evidence of English language ability. Moreover, together with their online application, candidates are requested to email a statement of purpose to E.M. Charalampidou elma.charalampidou@pet.hw.ac.uk, copying H. Lewis helen.lewis@pet.hw.ac.uk, E. Andò edward.ando@3sr-grenoble.fr and G. Viggiani cino.viggiani@3sr-grenoble.fr. The **closing date** for the application is on the **15th of June 2015**. Should you have any further enquiries, please, contact E.M. Charalampidou.