The Geological Society

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North West Regional Group

Meeting

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GETTING GAS OUT OF SHALE: WHAT CAN EXPERIMENTS TELL US

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Despite recent decisions made by local governments natural gas from shale still presents a lower carbon alternative to coal for electricity generation and could provide the UK with a stable energy supply as we move toward a low carbon future. The examples from the US have shown that a strong regulatory frame work needs to be in place to make sure any shale gas exploration does not have a significant negative impact on the environment. Rock mechanics has a key role to play in helping get the most out of any shale gas play and in Manchester we are focusing on understanding (i) the controls on permeability in shales and (ii) the hydraulic fracture process used to increase gas extraction. We have measured the permeability of a number of different shales from the US, UK and Europe under reservoir pressures at both constant pore pressure and constant confining pressure. Resulting in an empirical relationship between permeability, confining pressure and pore pressure. It is found that some shales are more sensitive to pore pressure whilst others are more sensitive to confining pressure but the overall behaviour is consistent across all shales we have measured. We have modelled this behaviour using a simple effective medium approach which shows that the porosity must be bimodal with the majority of the pore volume in large pores but the transport being controlled by very narrow pore throats. This result is backed up by nitrogen adsorption measurements and careful 3D microstructural observations.

Horizontal drilling and hydraulic fracturing of shale reservoirs has allowed the exploitation of gas from shales but there still exists a considerable gap in our understanding of how shales respond during hydraulic fracture and how stimulation through hydraulic fracture can maximise productivity of gas from shale. Some specific questions that remain unanswered are: How and where do hydraulic fractures initiate? What is the geometry of hydraulic fractures created during stimulation and how do they propagate into the formation volume? How can the maximum volume of rock be stimulated during hydraulic fracturing? What mechanisms are effective at keeping a fracture open? We are trying to close these gaps through developing an in-situ rig to perform real time, 4D imaging of fracking using the Diamond-Manchester X-ray Imaging Beamline (DMB) at Diamond Light Source. This will provide not only the first qualitative observations of where fractures initiate, how they propagate, and whether they stay open or close, it will also allow quantification of many of these aspects. By simultaneously monitoring the fracture with acoustic tomography, calibrating that technique for shales.

Dr Julian Mecklenburgh is a lecturer in structural geology at Manchester University, and is the course leader for global tectonics, materials for drilling engineering as well as the field courses in Spain. Julian, since graduating in 1996 with a BSc in geology, has continued his career at Manchester University gaining his doctorate in 2000, and has been lecturer in structural geology at Manchester since 2011.

Venue: Williamson Lecture Theatre, Willamson Building, Manchester University, Oxford Road, Manchester.
http://documents.manchester.ac.uk/display.aspx?DocID=6507

Time: Prompt 6:30pm start, meeting in the foyer from 6pm on the 1st floor.

CPD: *These events may be considered for contributing to a recognised Continuing Professional Development (CPD) scheme as part of personal development. Delegates should check their individual scheme requirements.*

For further information contact the Group Secretary, Nik Reynolds at: geologicalsociety.northwest@gmail.com