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Towards the development of rapid screening techniques for shale gas core properties

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Shale gas has been produced for many years in the U.S.A. and forms around 8% of total their natural gas production. Recent testing for gas on the Fylde Coast in Lancashire UK suggests there are potentially large reserves which could be exploited. The increasing significance of shale gas has lead to the need for deeper understanding of shale behaviour. There are many factors which govern whether a particular shale will become a shale gas resource and these include:

i) Organic matter abundance, type and thermal maturity;
ii) Porosity–permeability relationships and pore size distribution;
iii) Brittleness and its relationship to mineralogy and rock fabric.

Measurements of these properties require sophisticated and time consuming laboratory techniques (Josh et al 2012), whereas rapid screening techniques could provide timely results which could improve the efficiency and cost effectiveness of exploration. In this study, techniques which are portable and provide rapid on-site measurements (X-ray Fluorescence (XRF) and Infra-red (IR) spectroscopy) have been calibrated against standard laboratory techniques (Rock-Eval 6 analyser-Vinci Technologies) and Powder whole-rock XRD analysis was carried out using a PANalytical X'Pert Pro series diffractometer equipped with a cobalt-target tube, X'Celerator detector and operated at 45kV and 40mA, to predict properties of potential shale gas material from core material from the Bowland shale Roosecote, south Cumbria. Preliminary work showed that, amongst various mineralogical and organic matter properties of the core, regression models could be used so that the total organic carbon content could be predicted from the IR spectra with a 95 percentile confidence prediction error of 0.6% organic carbon, the free hydrocarbons could be predicted with a 95 percentile confidence prediction error of 0.6 mgHC/g rock, the bound hydrocarbons could be predicted with a 95 percentile confidence prediction error of 2.4 mgHC/g rock, mica content with a 95 percentile confidence prediction error of 14% and quartz content with a 95 percentile confidence prediction error of 14% .

References
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