

Microfacies Variability of the Basinal Bowland Shale, United Kingdom

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ABSTRACT

Characterization of the properties of shales is an essential process in the estimation of gas and oil resource potential. Important shale gas and oil resources are believed to exist in Western Europe and especially in the UK. In particular, the Bowland Basin, situated next to Blackpool in Lancashire, UK, is promising due to the presence of a carboniferous sequence of organic-rich shale interbedded with clastic and carbonate sediments. However, the microstructure, mineralogical textures and geological processes of Bowland shale are still poorly understood and characterized. In this study, we perform a multi-scale and petrologic characterization of the different facies of Bowland Shale in the Preese Hall-1 borehole, a significant and recent exploration borehole in Lancashire, UK. Characterization techniques used include multi-scale optical and scanning electron microscopy, X-ray diffraction and total organic carbon analysis. Since the microstructural understanding of Bowland Shale Formation is currently low, our aim is to determine the variability of rock facies, from the centimeter to the micrometre scale. Based upon the analysis of 11 samples from different depths in the Preese Hall-1 borehole, there is a high variability of microfacies, organic-matter particles and fractures. For the majority of samples, the high TOC (>2 wt%), low clay content (<20wt%), high proportion of quartz (>50wt%) and the presence of a multi-scale fracture network, support increasing interest in the Bowland shale as a potentially exploitable oil and gas resource. Moreover, the microtextural observations performed in this study highlight preliminary evidence of fluid passage or circulation in Bowland shale sequence and temperature reactions during burial.