Nano to Macro-Porosity of Eagle Ford and Marcellus Shales: Characterization of Porosity Evolution

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Porosity measurements of hydrocarbon rich shales are key to determine the hydrocarbon quantity in a deposit and the effects of anthropogenic activities associated with gas production. Although there is much data obtained in the field by means of borehole measurements, there are limitations to the size and scale of the pores that can be quantified by current field-based methods. In order to quantify the extent to which these pores exist in hydrocarbon-bearing media relevant to unconventional gas extraction, methods have been developed to quantify pores with sizes ranging from the nano to macro-scale regimes with small angle neutron scattering approaches which include small and ultrasmall angle neutron scattering ((U)SANS) as well as imaging methods[1-3].

In this investigation, SANS was performed on hydrocarbon-bearing shale core samples from Eagle Ford of varying maturities and Marcellus Shale deposits to quantify the nature and range of pores observed in their native chemical states. Porosity evolution was probed with acid treatment as well as precipitation reactions for two common scale producing minerals, barite and calcite. Extractions of the organic phases were performed and the porosity remeasured to understand the role that organics of varying polarity play in determining the porosity of these shales. The results of this investigation will show relationships between pore size and hydrocarbon chain length, polarity, total organic carbon (TOC) and other parameters lending insight into solvent accessibility into pores of varying sizes.

[1] Anovitz *et al* (2008) *Geochim Cosmochim Acta*, **72**, A28. [2] Anovitz *et al* (2009) *Geochim Cosmochim Acta* **73**, 7303–7324. [3] Ruppert *et al* (2013) *Energy Fuels*, **27**, 772–779.