Poster Presentation

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Diagenesis and kerogen release in oil- and gas-bearing shales

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The microstructure of pore space in sedimentary rocks and its evolution during reaction with pore- or fracture-contained fluids is a critically important factor controlling fluid flow properties in geological formations, including the migration and retention of water, gases and hydrocarbons. The size, distribution and connectivity of these confined geometries (pores, fractures, grain boundaries), collectively dictate how fluids of various chemistries migrate into and through these micro- and nano-environments, wet, and ultimately react with the solid surfaces. In order to interpret the time-temperature-pressure-fluid flow history of any geological system, the physical and chemical “fingerprints” of this evolution preserved in the rock must be fully explored over widely different length scales from the nanoscale to the macroscale. We are experimentally investigating these reaction-controlled changes in rock microstructure by conducting in-situ heating experiments on samples of the Garfield oil shale. Oil shale, an organic-rich fine-grained sedimentary rock, contains significant amounts of kerogen (a solid mixture of organic chemical compounds) from which liquid hydrocarbons can be extracted. Pyrolysis (heating shale in the absence of oxygen) converts the kerogen in the oil shale to shale oil (synthetic crude oil) and oil shale gas and a solid residue. Through SANS, we clearly observe these kerogen and oxidation release at lower temperatures followed by pore structure reordering and finally enlargement at higher temperatures. These results are compared with preliminary results tracking the natural diagenesis of the commercially-important Eagle Ford shale formations across the oil/gas boundary.

Keywords: neutron scattering, fossil fuels, porous materials