

Structural characterization of segments of a Green River Formation oil shale core and the kerogen isolated from those segments

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A number of analyses have been completed on three one foot sections of a well-defined, well-controlled, fresh oil shale core taken from the Green River Formation in the Uinta Basin to characterize the chemical and geological nature of both the oil shale and the kerogen isolated from the oil shale. The first segment was at the peak organic content of the Mahogany zone; the second was also from the Mahogany zone but at a lower organic content; the third was of a similar organic content as the second, but from the upper R-6 zone. In addition, these same measurements were completed on the kerogen isolated from these segments. The analytical techniques that have been used to study the chemical structure include geological characterization (a visual analysis and X-ray fluorescence (XRF) elemental chemistry), solid-state ¹³C nuclear magnetic resonance (NMR), small and wide angle X-ray scattering (SAXS and WAXS), atomic pairwise distribution function (PDF) measurements, and mass spectrometry (MS). Each of these experimental techniques provides distinct information about the composition and/or structure of the sample. The XRF was used to provide the elemental analysis of the selected samples. The solid state ¹³C NMR data defines key organic structural features, including the average aromatic cluster size, the distribution of aliphatic structures, cross linking, and the aromatic substitution patterns. The SAXS and WAXS data were analyzed to provide information on the pore size distribution in the whole rock shale samples as well as in the powdered shale and kerogen. The PDF provides the atom-atom correlations in the samples as a function of distance, a reflection of the long-range order and the 3D structure. These experimental data were applied in two manners. First, the data were used to evaluate and modify an atomistic model of kerogen that is being developed. In addition, the data obtained are being analyzed to study the variation in the shale and the organic matter throughout the core. This talk will focus on the information about the structure obtained from these chemical and geological analyses.