

A Spatial Investigation of Metal and Mineral Associations in the Marcellus Shale

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In this study, Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) was used to map the elemental compositions of core and outcrop samples of the Marcellus Shale collected from western NY and PA. 2-D image maps produced from ToF-SIMS analysis were analyzed by ImageJ, a computer-based program that integrates hardware and software for managing, analyzing and displaying data. Six shale samples were analyzed and total organic content (TOC) varied between 3.13 wt% and 8.55 wt%. Uranium concentrations ranged from 8.7 ppm to 53.4 ppm. Chromium concentrations ranged from 53 ppm to 120 ppm. Preliminary results indicate that chromium (Cr⁺) is negatively correlated to the hydrocarbons present within the samples with correlation coefficients ranging from -0.06 to -0.25. Uranium was analyzed as UH⁺, U⁺ and UO⁻. UH⁺ and U⁺ both show a negative or minimal correlation with the hydrocarbons present within the sample. Positive correlation coefficients ranged from 0 to 0.22 and negative correlation coefficients ranged from -0.01 to -0.1. UO⁻ also shows minimal correlation with the hydrocarbons present within the sample. Positive correlation coefficients ranged from 0.02 to 0.23.