UNDERSTANDING STRUCTURE AND MOLECULAR COMPOSITION OF KEROGEN IN MARCELLUS SHALE MATURITY SERIES

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ABSTRACT

Organic-rich black shales have become a vital component of the US energy portfolio. Kerogen, the largest reservoir of organic carbon on earth, is a high molecular weight macromolecule that serves as starting material for the oil and gas in these shales. Despite its importance, kerogen remains to be one of the least studied components because of tedious kerogen isolation procedure and lack of effective analytical instruments to directly analyze kerogen in the past. It has been noted that shales with a similar amount and type of kerogen and similar reservoir parameters such as maturation produce different amount of hydrocarbons. These heterogeneities highlight the need to better understand the variability in composition and structure of kerogen and its structural evolution on maturation. Understanding these variabilities will enable us to unravel the mechanism of hydrocarbon (HC) generation, and to identify sweet spots for hydrocarbon production. This study utilizes isolated kerogen from Marcellus shale cores of different maturity from a natural maturity series. Direct kerogen analytical techniques such as 13C solid state NMR (Nuclear magnetic resonance), XPS (X-ray photoelectron spectroscopy), and ATR-FTIR (Attenuated total reflection-Fourier transform infrared spectroscopy) will be employed to determine the distribution of different functional group and their association with the aliphatic and aromatic fraction of the kerogen. The results of direct kerogen analysis on Marcellus maturity series will be further utilized to understand the carbon chains/functional groups contributing HC generation potential, and effect of kerogen structure on HC release and retention.

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