Decomposition of Organic Matter and Impact on Shale Resource Play Assessments

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High gas content in shale is dependent on the generation of products from both kerogen (primary cracking) and on the cracking of generated products retained in the source-reservoir system. To predict gas yields of these systems, a mass balance compositional model of organic matter decomposition was derived from a series of experimental data sets on low sulfur Type II marine shale (Toarcian Shale, Paris Basin). Additional data was collected on various shale-gas systems in North America and potential systems in Europe.

This new model demonstrates that primary cracking occurs under lower thermal stress than previously published, accounts for only small portion of the hydrocarbons generated, and gas yield is primarily due to the secondary cracking of the polar fractions. The new mass balance model accounts for primary cracking of kerogen (early gas and oil), secondary decomposition of polar compounds (main oil to main gas windows), and finally late gas generation from decomposition of refractory or restructured kerogen. These data may be utilized to assess the likelihood of commercial gas contents in shale resource plays

The implications for unconventional resource systems are (1) hydrocarbons are generated at lower thermal exposure than previously predicted, (2) secondary cracking of generated products occurs contemporaneously with their formation, (3) gas generation is continuous throughout the oil and gas windows from kerogen cracking with the principal yield from secondary cracking of polars, (4) maturation-induced changes in kerogen characteristics and rock matrix, (5) pressure and resistivity increase, and (6) carbon dioxide is generated throughout maturation and increases water acidity.