

“Shales” as Unconventional Gas and Oil Reservoirs – how useful are Conventional geochemical measurements and concepts?

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Geochemical measurements and protocols being used today in the assessment of “Shales” as Unconventional Reservoirs, rather than Conventional Source Rocks, are essentially unchanged since the invention of Rock-Eval screening pyrolysis over 30 years ago. How well do these techniques address the understanding of petroleum storage in “Shale” reservoirs?

This talk will address the question under the following themes:

1) A model for petroleum storage in organic rich rocks

What chemical and physical changes happen when the kerogen in a source rock “matures”? What is the difference between expulsion and primary migration, and why does it matter? How do capillary pressures help place limits on petroleum saturations in the inorganic matrix of “shales”? How does this help us to evaluate “Shales” geochemically and petrophysically?

2) Oil in the Gas window

Our concepts of “Oil” and “Gas” windows are calibrated empirically against the occurrence of Conventional Resources which have been expelled and have migrated out of the source bed. What remains in the source bed – the potential Unconventional Resource – can be quite different in composition to the fluid expelled and migrated.

3) Kinetics of gas generation at high thermal stresses

The Rock-Eval experimental technique was developed in the “Era of Oil Exploration”; and was never designed to assess the total (gas) potential of source rocks. Plots of Hydrogen Index vs. elemental Hydrogen / Carbon ratio show positive intercepts with H/C around 0.6 at HI = 0. In other words, significant generative potential remains in samples which by conventional analysis would be regarded as “spent”. Similarly, significant hydrogen remains in coals even at the anthracite rank. Therefore no published model today allows a description of the late “Gas Window”; all terminate gas generation too early.