A New Approach to Differentiate Organic Facies Through Maturity Pathways, Spraberry and Wolfcamp Formations, Midland Basin.

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Geochemical assessment is a key component to proper unconventional resource appraisal and development. Established methods of assessing organic content and quality have been in place for more than 40 years and have been successfully utilized in present day exploration. Too often, assessment cut-offs just using TOC, Tmax, and S1/TOC can be insufficient to predict viability of an unconventional target. One such assessment is the relationship between source maturity, source type, and hydrocarbon produced. Typical maturity pathways involve relationships between hydrogen indices (HI) and Tmax. However, including the oxygen index (OI) in relationship with the HI can illustrate different maturity pathways that are governed by changing source type.

The role of organic mixing is a lesser studied phenomenon, at least within the Permian Basin. The recurring assumption is that the organic types in the Wolfcamp and Spraberry are predominantly marine sourced and oil-prone in conversion characteristics. However, thorough investigation of the data presented here reveals that the picture is much murkier than this simple assumption implies. During the Wolfcampian and Leonardian Series of the Lower Permian the Permian Basin was transitioning from a tropical to an arid climate. This set the stage for a complex organic depositional environment as compared to a global “hot house”, temperate climate during the Devonian and Cretaceous; times that reflected “textbook” marine, oil-prone source characteristics. Transitional climate can exhibit variability in water chemistry, biomass source, and depositional dynamics thereby forcing quick changes in organic deposition.

Delineating source mixing can lead to better assessments of unconventional potential

when it is coupled with other study; such as textural analysis and pore/pore throat typing. Also, delineating source mixing necessitates consistent and reliable TOC/Pyrolysis methods that will result in data with a high degree of accuracy and precision. Most analysis conducted is as-received to capture the S1 peak for in-place hydrocarbon assessments; however non-extracted samples tend to have higher ambiguity in Tmax, S2, and S3 measurements. All data that we will present will be on an extracted basis and combed meticulously for precision and accuracy to remove this ambiguity. The data is averaged for each target interval for each well and then plotted using Tmax and ((HI-OI) x 100). The result is groups of geochemical signatures that relate relatively well to a production indicators in the vicinity. We are not proposing this to be a leading indicator of highly productive areas, but it can be considered another tool in the toolbox to delineate sweet-spots within a basin of interest.

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