Sweet-spotting: Assessing Reservoir Geochemical Properties

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ABSTRACT

Sweet-spotting is a popular, but loosely applied term to describe areas or intervals of the best production in a given play or horizon. The intention is to convince oneself and investors that the best acreage has been acquired and is being exploited in the optimum manner. The identification of the best intervals for either oil or gas production requires a detailed and multi-disciplined approach, but the focus herein is on the best areas or intervals based on familiar and new geochemical parameters.

A fairway for unconventional resource system first requires the presence of a viable resource system in the proper petroleum window. Use of the phrases “oil window” or “gas window” is insufficient; more precise descriptions require discrimination of black oil from volatile oil, condensate from wet gas, and dry gas with estimates of gas-to-oil ratios (GOR). In condensate and wet gas plays, it is important to estimate yields of liquid petroleum associated with gas production. Advances in thermal maturity determination and correlation to characteristics of these windows reduce uncertainties.

For source rock intervals, while anoxia is an indication of the best interval for organic matter preservation, and hence organic richness, these intervals are also the most retentive, thereby interfering with production depending on petroleum composition. The highest TOC intervals are more efficient expellers of hydrocarbons, while retaining the least mobile petroleum, thereby affecting productivity. Composition is related to both source rock type and thermal maturity.

Determination of the oil potential and estimates of oil and water saturation as well as petroleum quality are key geochemical assessments. Further to thermal maturity assessments of petroleum type or phase, determination of petroleum composition, API gravity, GOR, and related pressures including saturation pressure, bubble point, and formation volume factors are helpful in advance of PVT analysis and resource assessments. These geochemical analyses, generally completed on rock and oil extracted from rock samples, provide a further step in sweet-spotting current and future petroleum production.