Thermal Maturity of Upper Jurassic Source Rocks Based on Well Log and 1D Modeling Analyses, Northeastern Deepwater Gulf of Mexico: Preliminary Results

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ABSTRACT

The two Upper Jurassic source rocks in the northern deepwater Gulf of Mexico—Smackover, and uppermost Cotton Valley equivalents—have been penetrated by 28 wells with released logs. The upper Oxfordian Smackover source interval consists of thin interbeds of limestone and marls, ranging in thickness from 100 to 200 feet. Source interval consists of interbedded algal facies (type I kerogen) having total organic carbon (TOC) values of 1.5% by weight. This is the source interval that has been interpreted to have charged the underlying Norphlet sandstone in four announced discoveries.

The uppermost Jurassic Cotton Valley (upper Tithonian) is shale-rich, and contains type II kerogen. This source interval has a higher gamma-ray reading and slight increase in resistivity values compared to the underlying thick shale unit of the Cotton valley. The source unit varies in thickness from 50 to 100 feet.

The thermal maturity and potential of the two source rocks were evaluated using well log techniques and 1D thermal modeling. The upper Oxfordian limestone and marls of the Smackover did not indicate significant differences in the delta log resistivity (Δ log R) evaluation. In contrast, the upper Tithonian section shows good Δ log R separation, indicating high TOCs. The resistivity response for both source rocks is muted, indicating oil generation in the early oil window. The 1D modeling of Smackover indicates major generation and expulsion beginning ~10–6 Ma. For the shallower Cotton Valley source interval, only the MC (Mississippi Canyon) 392 well has begun expulsion window. The results of this study are highly preliminary, and substantial detailed work needs to be done.

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