Modeling of Thermal Maturity History of Strata in the North Louisiana Salt Basin Area

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ABSTRACT

The study of the thermal maturity history of the North Louisiana Salt Basin area is based on the analysis of the burial history of the basin. Thermal maturity modeling was accomplished by using BasinMod 1D® software. Seventy-five core samples were analysed for total organic carbon content, organic matter type, thermal alteration index, and Rock-Eval pyrolysis. Modeling of present-day heat flow values, calculated from the corrected bottom hole temperatures, resulted in an average value of 52 mW/m^2 (1.25 Heat Flow Units, HFU). Examination of the paleoheat flow was performed for the basin based on the premise that its rifting evolution was from the Late Triassic to Middle Jurassic (210-170 Ma).

The results from thermal maturity modeling are in agreement with the geochemical data that indicate that Upper Jurassic Smackover lime mudstone served as an effective regional source rock throughout the basin, and that the Lower Cretaceous marine shales were effective local source rocks given the proper organic facies. The generation of hydrocarbons from the Smackover in the basin was initiated at 2,000 to 2,600 m (6,000 to 8,500 ft) during the Early Cretaceous and continued into the Early Tertiary. Initiation of oil expulsion from Smackover source rocks in the basin commenced during the Early Cretaceous and continued into the Late Cretaceous. Aqueous and petroleum inclusion homogenization temperatures were examined to estimate the maximum burial temperature and the timing of petroleum migration. Common bitumen was observed along the grain surfaces in the fluid inclusion samples, implying that the crude oils that migrated into the reservoirs were subjected to thermal cracking with depth of burial and time.