Petroleum System Evolution in the Conecuh Embayment, Southwest Alabama, U.S. Gulf Coast

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Analyses of hydrocarbon maturation trends in Smackover reservoirs of southwest Alabama indicate that crude oils in updip reservoirs of the Conecuh Embayment are anomalously mature for their present temperature-depth regimes. It is inferred that these mature oils equilibrated to depth-temperature conditions in deeper reservoirs downdip, and subsequently re-migrated to their present positions. Burial history reconstructions, regional structure, and reservoir distributions support a model in which these mature oils leaked from the Jay-Flomaton-Big Escambia Creek field complex during Tertiary time, migrated through the Norphlet Formation, and accumulated in updip Smackover and Haynesville traps associated with basement knobs.

Geochemical evidence suggests that hydrocarbon leakage from the Jay-Flomaton-Big Escambia Creek complex may have been triggered by an influx of very mature gas-condensates with high non-hydrocarbon gas contents from failed reservoirs still farther downdip. This scenario has potential implications for 1) predicting potential migration pathways and preferred areas of crude oil accumulation in the updip portion of the Conecuh Embayment, and 2) re-interpreting organic-inorganic burial diagenetic reactions in Norphlet Formation reservoirs of offshore Mobile Bay.

Synchronous Dynamic Stratigraphic and Structural Influences on Hydrocarbon Maturation Migration in Louisiana

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Mixed age Mesozoic and Cenozoic hydrocarbons in many Louisiana oil and gas reservoirs result from the dynamic process of upward vertical migration of hydrocarbons from deeper, older source rocks and/or reservoirs. Increasing levels of thermal maturation are achieved from the passage of such source/reservoir zones as basin sedimentary loading progresses. The entire process of generation migration mixing may be repeated through several cycles. This generally results in a vertical progression of younger and younger reservoirs holding some thermally up graded admixtures of older, and sometimes even more mature, hydrocarbons than those capable of being derived from nearby lateral or subjacent source beds.

Integrated spatial temporal mapping is helpful in predicting the probable location of the following: (1) hydrocarbon generating paleo geothermal conditions, (2) paleo geopressure zones, and (3) zones of tectonism. Such maps and cross sections assist in identifying former or present potential hydrocarbon source zones, the location of probable microfracturing that may have assisted in the initial expulsion and migration processes, and major regional vertical migration conduits.

Simulation of the generation migration mixing process is illustrated for specific Louisiana Cretaceous and Tertiary reservoirs.