Hydrodynamics—Implications for Future Exploration in the Wilcox Play?

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ABSTRACT

Hydrodynamically active reservoirs have been recognized in various parts of the world. The majority of these are considered to be gravity-driven, whereby fluid flow is driven by hydraulic head. More recently, drainage-driven hydrodynamic reservoirs have been recognized, where fluid flow is driven from high pressure to low pressure, and is typically found in laterally extensive reservoirs, e.g., the Wilcox Play.

The lateral drainage of pressure in reservoirs leads to a pressure gradient from higher pressured shales above, and below, into the reservoir, leading to a focus of fluids, including hydrocarbons, within the reservoir. Within a laterally extensive reservoir fill and spill updip is likely to dominate the trapping of hydrocarbons, which is typically assisted by hydrodynamic flow as the aquifer will drain updip. Hence, secondary migration along extensive sands is a highly effective carrier system, with little/no potential for vertical migration of hydrocarbons since there are higher pressures above and below. Hydrocarbon column heights can extend above the limits imposed by capillary entry pressures on account of the higher water pressures in the sealing rocks relative to the aquifer pressures in the sands.

Such reservoirs are present in the Miocene of the Gulf of Mexico and evidence of this includes the Mad Dog Field where fluid contacts do not conform to structural closure but show a tilt in the direction of fluid flow/overpressure variation. Furthermore, based on a regional geopressure study conducted a few years back, data are presented that indicate the deeper Lower Tertiary Wilcox play is hydrodynamically active by combining direct pressure data interpretation with the geological depositional model. The implications of hydrodynamics in the Wilcox play leads to new exploration opportunities and may affect future development plans of existing fields.

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