Exploration Insights for Miocene Exploration in Bahrah, Kuwait

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Abstract

The Middle Miocene sandstones are long established, prolific oil reservoir in northern Kuwait. These sandstones are characterized by multiple pay intervals (F0, F1 and F2 sands with average porosity of around 30%) which are characterized by multiple pay intervals separated by intervening shaly seals. The oils are severely biodegraded and have secondary charge from deeper source rock. The accumulations are characterized by highly mature oil sourced from Upper Jurassic marine, sapropelic kerogen deposited under anoxic conditions. These source rocks are in middle - late maturity windows in the northern parts of Kuwait. The exploration and development of these shallow reservoirs is challenging due to complex entrapment and poor seismic imaging. To formulate exploration strategy in the Bahrah, these issues were addressed by innovative workflows integrating the data from surface geology, drilling, well logs, geochemistry, seismic and gravity. The pattern of oil accumulations in the area defy the simple structural entrapment. The accumulations are confined to the spatial limits of an anomalous zone / geobody partially extending over Bahrah High. The seismic amplitude attribute analysis clearly brings out the spatial limits of this geobody. The discontinuity attributes like fault likelihood indicate presence of sub-seismic faults within the identified geobody. These discontinuities at the reservoir level and the underlying seal may be proxy for sub-seismic faults that may affect the integrity of seals acting as barrier to facilitate upward migration of hydrocarbons from deeper levels. Also, surface geological features representing manifestation of deep fluids migrated to near-surface and surface levels are restricted to the confines of geobody. The geobody overlies a zone characterized by high degree of tectonism at Jurassic level and probably represents a zone where underlying Rus and other seals are breached by faults facilitating multiphase migration from underlying Jurassic source and remigration from Cretaceous pools. The exploration insights gained from the study can be utilized in generating exploration concepts for the Middle Miocene reservoirs in frontier areas.