

Evaluating the Untapped Potential of Jurassic Marrat Reservoirs in Western Part of Kuwait Bay

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Kuwait Arch, extending from Greater Burgan in South to Bahrah in North has proven commercial hydrocarbon potential. The Arch plunges in North towards Bahrah and beyond, the fields in Greater Burgan as well as Bahrah are prolific producers from Marrat reservoirs of Jurassic age. Kuwait Bay part of Kuwait Arch, located in between these fields is relatively less explored and the proven commerciality in the vicinity makes it an ideal candidate for increased exploratory efforts. The Bay area was covered with vintage 2D seismic, realizing the potential of the area a new 3D seismic was acquired and processed. Based on the new 3D seismic and the nearby wells a comprehensive prospect evaluation has been carried out.

The G&G assessment comprising paleo-depositional and modern tectonic framework has resulted in the identification of a number of anticlinal structures at Jurassic Marrat level. Most of these structures are manifested by independent 4-way closures within the major trends bounded by faults. The dominant NNE-SSW and NW-SE trending faults appear to have potential of compartmentalizing the broader structures. Marrat formation in Kuwait is broadly subdivided into three units Lower, Middle and Upper Marrat. Hydrocarbon potential is proven from all the three units of Marrat, however Middle Marrat is more prolific. Middle Marrat unit is understood to have got deposited in shallow open marine platform to moderately deeper in an intra-shelf. Based on the integration and detailed interpretation of log, core, and seismic data Al-Eidan, A.J et al., 2010 have inferred a depositional model incorporating sabkha, tidal flats, lagoon, backshoal, shoal, shoreface inner shelf, outer shelf, and slope/basin. Middle Marrat unit broadly is subdivided into subunits based on the sequences with fining upward cycle followed by a coarsening upward cycle, bearing three different reservoirs MM1, MM2 and MM3 within the sub units. All these reservoirs have proven hydrocarbon potential. The reservoir quality of Middle Marrat is mostly matrix controlled and the thickness and facies related porosity are key factors to contribute towards the prospectivity of Middle Marrat reservoirs.

Time converted PSDM volume was utilized for post stack inversion to decipher better reservoir sections. A detailed pre-stack inversion was carried out to better understand the lithology and porosity. The inverted seismic data was duly calibrated with good number of drilled well data. Detailed log-based formation evaluation, comprising rock typing, and porosity, permeability and saturation estimations were carried out. Reservoir quality assessment based on, seismic inversion and gross depositional environment indicates that the younger units, MM1 and MM2, have very good reservoir properties. MM1 unit is well developed in the Northern part compared to the Southern part of the Kuwait Bay whereas MM2 unit exhibits the reverse trend. This evaluation has

brought out a major Jurassic exploratory area in the Bay area and successful exploration can result in significant reserve accretion.