Humma Marrat Reservoir, Partitioned Neutral Zone (PNZ) Case Study – Part 1: Reservoir Geology and Stratigraphy

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The Jurassic-age, Humma Marrat carbonate reservoir is located largely within the PNZ. The reservoir was discovered in 1998 and produces from five wells. Additional delineation wells were drilled in 2005. The reservoir is a relatively simple anticline oriented N150E and may be open to the south towards the Jauf structure in Saudi Arabia.

The Marrat reservoir interval is divided into six units known informally as the Middle Marrat A, B, C, D and the Lower Marrat DL, and E zones. Porosity development occurs in shallowing upward para-sequences (inner ramp/inner shelf setting) and was controlled by depositional setting and dolomitization. The average porosity within productive intervals varies between 12-22%. Average permeability is 1-10 md. Based on limited PLT data, approximately 70-75% of the current oil production is from the more strongly dolomitzed E zone.

The structural setting of the western portion of the PNZ is dominated by the 250 mile long Humma-Fuwaris-Wafra-Burgan trend that extends from Saudi Arabia to Kuwait. The Marrat formation has been folded over deeper-seated horst blocks present in the Paleozoic or older basement. Multiple tectonic events reactivated the structure and resulted in folding and fracturing in the Marrat. Fractures, though uncommon in core or FMI data, are oriented N165E. Well test-derived permeability values that are higher than core values and indicate some fracturing, particularly in the A zone.

Thermally mature Paleozoic source rocks are stratigraphically adjacent to or beneath the Marrat formation. Though thermally immature in the PNZ, the source rock sequences are mature in the adjacent basinal areas. Lateral migration of hydrocarbons could come from the Arabian Gulf basin to the north and east or from the Dibdibah trough to the west.