

Sandstone Outcrop Analogue of the Late Triassic Minjur Formation Reservoirs in Central and Southern Saudi Arabia

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ABSTRACT

Subsurface settings have many limitations regarding reservoir properties and quality. In this context, sedimentary outcrops are frequently used to give better insight about reservoir quality prediction. The Late Triassic Minjur Formation represents one of the most prolific Mesozoic reservoirs in Saudi Arabia. Outcrops of Minjur Formation are widely distributed along the flank of Arabian Platform in Central Saudi Arabia. Fluvial, deltaic, and shallow marine sandstones represent the pay zones of Minjur Formation in Saudi Arabia. This study targeted the sandstone lithofacies of Minjur Formation outcrop and reservoirs in Central and Southern Saudi Arabia. The objectives of study are: 1. Detailed investigation of the reservoir properties of different outcrop sandstone lithofacies. 2. Constructing outcrop-reservoir correlations regarding reservoir quality of Minjur Formation. Field and petrographic analyses revealed five sandstone lithofacies, classified based on depositional texture and sorting; those lithofacies are: i) clean to ferruginous-cemented, moderately to well sorted coarse-grained sandstone, ii) trough cross-bedded, well sorted medium-grained sandstone iii) massive, muddy, well sorted coarse-grained sandstone, iv) planar cross-bedded, clean to clay-cemented, moderately sorted medium-grained sandstone, and v) clean to clay-cemented, moderately to well sorted fine-grained sandstone. Sandstone reservoir quality is mainly influenced by grain size, sorting, and cementation. The Permeability of sandstone lithofacies is directly proportional and controlled by its porosity. The results obtained from outcrop were compared with equivalent Minjur Formation reservoirs in both of Central Saudi Arabia and Rub' Al-Khali Basin in Southern Saudi Arabia. Petrographic analyses showed dominance of intergranular porosity in both of outcrop and reservoir settings. An acceptable outcrop-reservoir correlation was observed with well-data from Rub' Al-Khali Basin, where overburden compaction showed a minor effect on reservoir quality. Better correlation was observed in Central Saudi Arabia, characterized by higher porosity and permeability. Considering the slight diagenetic effect in sandstone lithofacies, and proximity between the outcrop and reservoir are important factors for good correlation and prediction. Therefore, it is critical to get a detailed discrimination by taking depositional and diagenetic settings and environments into consideration.