Geological Characterization of Lower Al Bashair Reservoir in Blocks 3 and 4, Oman

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ABSTRACT

The Late Cambrian Al Bashair Formation of Haima Supergroup is distributed over north-central Oman subsurface. The extension of this formation is exposed at surface in a relatively small area named Qarn Mahatta Humaid, in the north of Huqf region. This formation was previously considered a seal for the underlying reservoirs of Haima Supergroup. However, recent explorations show successful and commercial production from the sandstone intervals of this formation in blocks 3 and 4 of Oman. This project aims to investigate reservoir potentiality and quality distribution of the Lower Al Bashair in the blocks 3 and 4. This study is based on (i) a detail description of two conventional cores for lithofacies determination and depositional environment interpretation, (ii) textural and compositional analysis on thirty-three thin-sections collected from various lithofacies for diagenetic alterations distribution and their subsequent impact on reservoir quality evolution, (iii) the analysis of thirteen wells using Petrel and Techlog Schlumnerger's software were used to identify lithology, detailed petrophysical interpretation, clarify the lateral and vertical continuity via correlation and calculation of thickness map of reservoir units. It has been found that this formation is comprised of packages of very fine sandstone, coarse siltstone interbedding with claystone and infrequently oolitic grainstone. The presence of hummocky cross stratification and wave ripples indicate that Al Bashair was deposited in storm dominated shallow marine system. Preliminary investigation of thin sections under optical microscope has shown that mechanical and chemical compaction together with various types of cementation played major roles in porosity deterioration. Carbonate cement e.g. dolomite cement and anhydrate cement are significantly resulted in porosity reduction. The porosity enhancement is attributed mainly to partial dissolution of dolomite cement and thus intergranular development of secondary porosity. Correlation of well log data revealed that the reservoir units of formation are laterally continuous over the three studied fields. Petrophysical analysis of those reservoir units demonstrated that the average calculated porosity is between 7 and 10%, permeability 20 mD and oil saturation between 40 and 70%. The integration of well logs and core data increased our understanding of Al Bashair depositional environment and diagenesis, reservoir quality, distribution and continuity.