# Neo-Proterozoic Hydrocarbon Reservoir: A Case Study from the Khufai Formation, Nafun Group, Block 50, Sultanate of Oman

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## Abstract

The Khufai Formation is the oldest carbonate platform dominated by dolomitic strata containing microbial carbonates. The potential hydrocarbon reservoirs associated with these carbonates are of low porosity and permeability. This study is an endeavor to characterize the Khufai reservoir, Block 50, Oman, by assessing the sediments geologically and petrophysically.

A sedimentology study to characterize the depositional facies is followed by diagenetic assessment of the Khufai sediments. This is complemented by fracture analysis study that provides an input on the structural styles/deformation. Evaluation of conventional core analysis data and wireline logs (inc. borehole images, Sonic & 3D sonic Imaging) lays out the basis for petrophysical analysis and integration.

The sedimentary facies analysis provides valuable insights into the depositional environments. Coated grains, microbial laminates/stromatolite along with peloids and other skeletal grains constitute the textural attributes dominating the pervasively dolomitized packstone to boundstone fabrics. These textural assemblages, allochem content along with their stacking pattern highlights a tidal flat/intertidal depositional characteristic. The hydrodynamic variations/sea level fluctuations defines the vertical and lateral heterogeneities and places the sediments in a regressive trend in terms of the sequence stratigraphic framework.

Distribution of the reservoir properties depends on the primary depositional texture and diagenesis. In the Khufai, alteration of the sediment textures via diagenesis plays an important role in determining the reservoir quality. Dolomitization and silicification as key porosity degrading phase, whereas dissolution plays a positive role by creating secondary pore volume. Fractures have a marginal impact in enhancing the reservoir properties. The reservoir properties of doloboundstones, the connectivity of the fenestral pores in particular are largely enhanced by fracturing.

The understanding derived from the integration of the various geological and petrophysical parameters serves as an effective tool, which can be extrapolated to offset wells for reservoir architecture prediction. Additionally, a comparative assessment of the subsurface and outcrop data from available published studies in the adjacent areas is undertaken to gain an understanding of the geobodies thus improving their predictability.