

## **Lower Lekhwair Play in North Oman: A New Play Concept of an Entire Carbonate – Carbonate Reservoir and Seal**

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### **ABSTRACT**

Despite a long legacy of exploration in Oman, the PDO concession continues to deliver new plays by challenging the old dogmas. Traditionally, the exploration activities for the lower part of the Cretaceous Lekhwair Formation were excluded due to lack of robust understanding of the petroleum prospectivity. Poor understanding of reservoir quality and continuity with distribution & efficiency of seal were the main reason for not targeting the lower Lekhwair Formation. In recent years, selected exploration wells within the Northern central part of PDO's concession were planned for deepening to test the presence of 5-8m thick pay. A detailed integrated study was carried out to evaluate the play potential using all subsurface data over the area of interest. These data are mainly from vertical wells which have logs over the play, cores, side well core samples covering the lower part of the Lekhwair Formation's potential reservoir and seal pairs. Considering the broad understanding of the Cretaceous stratigraphy in Oman, the studied intervals are interpreted to have formed in the distal part of a lagoon, close to a carbonate platform margin. This is supported by the occurrence of high-energy deposits of peloidal packstones, reworked Lithocodium-/Bacinella floatstones and grainstones that might represent wash-over fans during storm events, where the grain-rich sediments were probably transported from the foreshore to backshore. The interpretation of the lower Lekhwair depositional setting was also investigated using seismic data, which suggests that the associated reservoir facies are indeed related to storm reworking, episodically influenced by falls in relative sea level. Therefore, it is possible to explain that the occurrence and development of the Lower Lekhwair reservoir is linked on-lapping, related to storm events. The new results and understanding of the Lower Lekhwair depositional setting were used to construct reservoir and seal segment maps, together with fault juxtaposition model, in order to generate a play concept in the study area, targeting low-relief structures associated with possible wider stratigraphic traps. Following this model, the PDO Exploration planned and drilled a dedicated vertical pilot hole and 1500m long horizontal well, which proved reservoir continuity and uniformity (in thickness and quality) across a low relief structure, carbonate seal efficiency, faults juxtaposition sealing and recovery at commercial rates from this new reservoir.