

Unlocking Hidden Potential: A Case Study of Carbonate Field B's Transformation Through Step-Out Drilling

Ahmed Al Aرامي¹

¹Occidental of Oman

Abstract

Carbonate Field B, situated just 5 kilometers southeast of the primary Carbonate Field A, has undergone a remarkable transformation that exemplifies the potential for advancing small and aging oil fields. Discovered in April 2005 during the drilling of X-1P well, the initial understanding of this reservoir was limited to its structural characteristics as a compartmentalized Upper Shuaiba Unit carbonate reservoir. Its estimated initial oil in place (STOIP) was small. However, the story of Carbonate Field B took a dramatic turn in 2022, driven by a regional geological reevaluation and innovative well interventions.

This abstract showcases how a simple step-out pilot hole, X-2P well, coupled with advanced logging, geological integration, and reservoir characterization, elevated the Carbonate Field B from small to substantial. By looking beyond the structural constraints, we identified a Western fault block, which increased the estimated STOIP by a factor of ten, signaling a remarkable growth in reserves.

One of the key factors in this transformation was the implementation of 3D seismic fault detection through Machine Learning algorithms. It helped in identifying the Upper Shuaiba Unit potential in the Western fault block, which was confirmed by the successful placement of the step-out pilot hole. Through the deployment of special logging techniques, such as the Wireline triple combo with Petromac rollers and sidewall core sampling, Oxy was able to gain invaluable insights into the reservoir's properties. These insights revealed the Upper Shuaiba Unit rock's high permeability and its vuggy, grainstone nature. Thin sections and Mercury Injection Capillary Pressure (MICP) analysis confirmed these findings, substantiating the reservoir's potential.

Furthermore, the use of LWD Image logs in horizontal wells revealed the extensive reach of the patchy vuggy system, coupled with the identification of fracture features. This detailed reservoir understanding allowed Oxy to develop an accurate 3D static model and deploy geo-steering tools, facilitating the optimal placement of wells in the challenging, patchy reservoir.

The implementation of an extensive Field Development Plan (FDP) that incorporated 3D static modeling and simulation, along with drilling and logging of high-inclination wells (exceeding 70 degrees), accelerated the development of the reservoir. In particular, the X-2P well was instrumental in extending the Upper Shuaiba reservoir into an adjacent compartment.

Carbonate Field B's development journey serves as a beacon of success in rejuvenating older fields and enhancing their reserves. By pushing the boundaries of traditional structural paradigms and embracing innovative geological techniques, the Carbonate Field B exemplifies the potential for converting small and declining fields into fields with significant promise.