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Unraveling the Nukhul Reservoir in the Arta Field, Egypt

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Summary

The Arta Field is a Miocene-age, onshore producing asset within the West Gharib Concession in the Eastern Desert of Egypt. West of the Gulf of Suez, the field lays within a rotated fault block and is comprised of two pools, the tight Nukhul Pool and the underlying conventional Red Bed Pool. TransGlobe Energy Corporation (TGL) acquired the Concession in 2007, and has drilled 44 wells into the Nukhul Pool and 24 wells into the Red Bed Pool since acquisition. The Nukhul Pool produces from a tight mixed siliciclastic-carbonate reservoir that has high lateral variability and the reservoir quality ranges from poor to moderate. The Nukhul has been developed with vertical and deviated wells which require stimulation in order to achieve economic flow rates. The underlying Red Bed Pool represents a more conventional reservoir and produces from thick conglomeratic and sandstone packages, with moderate to high porosities and high permeabilities. The Nukhul Pool represents a large STOOIP and requires an unconventional approach in order to optimize the hydrocarbon recovery. This talk will be focused on the Nukhul Pool and steps that TGL is taking to optimize the Pool and increase the overall recovery factor.

As a tight conventional reservoir, the wells in the Nukhul Pool had a variety of performance outcomes that did not meet TGL's predictions, both positively and negatively. The key driver in embarking on the 3-D characterization of the Arta Field and in particular, the Nukhul reservoir, was to further understand the factors controlling production. There was significant disconnect between the interpretation of the logs in new wells and the well performance observed over time. The technical foundation of the Arta Field was lagging behind the development scenarios, as the quality and lateral variability within the reservoir and non-reservoir units was difficult to recognize in logs and did not point to any major underlying trends.

TransGlobe's approach focused on decoding the depositional environment and developing a conceptual framework to be used as a guide when populating the geocellular model. An advanced core study was completed in 2018, and aimed to refine the depositional model and catalog the principal facies of both reservoir and non-reservoir types. Key learnings included a refined understanding and strengthened facies identification in the petrophysical analyses, an explanation for the disconnect between clastic depositional style seen in core and the high quantity of calcite and dolomite identified in the logs, as well as a gained understanding of the clay content and distribution amongst facies. By unraveling the core facies, we were able to translate these into petrofacies to be modeled throughout the field. Integrating the key learnings from the advanced core study, FMI facies interpretation, and the final petrophysical analyses, a conceptual geologic model was built which guided the facies modeling and supported the petrophysical modeling thereafter.

The 3-D Arta Nukhul geomodel has provided better insight into the link between well logs, log analysis, and well performance in the Nukhul field. TransGlobe is using this as a platform to plan, budget, and evaluate future development strategies that can be evaluated both technically and

economically. To date, the model has been used for dynamic simulation, and history matching, that resulted in a significant increase in the field STOOIP and could result in significant reserve adds for TGL. The static and dynamic models have also been used to identify infill drilling opportunities, and as direct input for a horizontal well and multi-stage stimulation study to maximize economic recovery. TransGlobe is utilizing learnings from unconventional reservoirs in North America and applying these to our tight conventional assets in Egypt.

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