Integrating Well and Seismic Data for Facies Prediction: A Case Study

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ABSTRACT

Summary: The objective of this study was to work collaboratively with KOC's Exploration Studies and Prospect Evaluation teams to identify sweet spots within the Ratawi formation using a newly-developed probabilistic supervised facies prediction methodology. It introduces an innovative and complementary new workflow to expand the traditional uses of seismic data for seismic characterization of the elastic properties of the reservoir. Democratic Neural Network Association: The principle of DNNA is to take information from 3D seismic data (prestack/poststack/attribute) jointly with rock type at wells. Hard training data extracted from wells is used to train a first set of neural networks. Soft data taken away from wells is used to stabilize the neural network training through a voting system. This combination of hard and soft data is used as a final set for training the final combination of neural networks. Case Study: Facies Prediction within the Ratawi Limestone Formation The Ratawi Formation overlies the Minagish Formation and underlies the Zubair Formation. It is informally divided into a lower Ratawi Limestone Member and an upper Ratawi Shale Member having a sharp contact in between. The thickness of Ratawi Formation is nearly uniform and varies from 600 to 700 feet. The Ratawi Limestone member was deposited on a low-gradient carbonate ramp and consists mostly of limestone with minor, localized calcareous claystone and thin, argillaceous dolostone layers. Well log information is the main source of information for determining lithology and fluid content. Therefore, a key step in lithology and fluid prediction is to run a precise and careful analysis of the well data. Final facies logs were determined through the calibration of rock-typing lithology and fluid estimation from a series of available logs, common to all selected wells for the project. The input seismic data consisted of 15 angle stacks at 2 degrees increments (0-30 degrees), generated from conditioned Offset Vector Tile pre-stack data. A DNNA probabilistic model captures the detailed facies group description at the well location to build a consistent probabilistic model at the prospect scale. Volume interpretation and geobody extraction was then performed on the facies attribute to extract multi-Z surfaces corresponding to the facies associated with hydrocarbon overprint. Bodies intersected by wells are consistent with the observation made along the wellbore.