

Elastic Facies Prediction as a Tool to Quality Control Logs from Clastic Reservoirs in an Offshore Field of Saudi Arabia

Muhammad Ashfaq¹ and Omar H. Afif¹

¹Saudi Aramco, Dhahran, Saudi Arabia.

ABSTRACT

Predicting facies could be either an easy or a difficult task depending on the objective and the geological complexity of the area. Elastic facies are different from litho-facies and are commonly used to discriminate the reservoir rock from the non-reservoir rock using seismic inverted data. In this paper we present a workflow where elastic facies are defined using a basic set of logs and then used as a tool to quality control logs from wells which are either logged with very old tool vintages (prior to 1980) or the log data is severely affected by washouts. Log Quality Control (LQC) is a fundamental step for any rock physics or/and seismic inversion study. Only good quality log data ensures the success of any inversion study. The log QC becomes even more challenging when the log data is acquired using different tool vintages from different service companies. The proposed workflow is divided into two main parts. In the first part, the elastic facies are predicted from five key wells using Heterogeneous Rock Analysis technique (HRA) which uses the Principal Component Analysis to classify rocks. The key wells are selected based on the logging suite, the year of logging, the quality of log data, the reservoir coverage and the areal coverage representing the lithological variations within the reservoirs. The predicted facies are calibrated using different petrophysical properties well by well. Multi-well cross-plot techniques (e.g. V_p/V_s versus Acoustic Impedance color-coded by reservoirs properties, i.e. water saturation, porosity and volume of shale) are utilized to identify the clean hydrocarbon-bearing sands within the wells. The sweet-spots identified by the particular facies are then validated with formation test data from wells. In the second part, the HRA facies are used as a discriminating tool to benchmark the log readings for the log validation process. The mean and the mode log values for the Gamma Ray, the Density, the Neutron Porosity, the P- and S-sonic are established for each facies. These benchmark values are then used as guides to condition logs from nearby wells which are either logged with old tool vintages or the wireline data is severely affected by borehole washouts or gas kicks. This tool is also helpful to constraint the model to estimate shear and density logs over small missing intervals - although the proper rock physics model will be used to predict missing shear wave and/or density data in the second phase of this study.