Understanding the Reservoir Architecture of Lower Fars Formation in North Kuwait through Seismic Reservoir Characterization

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ABSTRACT

The objective was to decipher the hydrocarbon potential of upper Miocene sandstone reservoirs for extensive field development using the seismic reservoir characterization. The two sandstone layers in the upper Miocene unit showed high complexity because of their lateral facies changes which needed to be investigated. The challenge is to discriminate between reservoir and non-reservoir facies using elastic properties and petrophysical properties. The use of modeled elastic logs was critical to achieve the lithological discrimination needed. Methodology was subdivided into two phases: The first phase was achieved by selecting appropriate wells and the existence of shear logs that cover the zone of interest. After that a series of histograms and cross plots were utilized to reach final conclusions on discrimination for lithology, porosity, and fluid. The second phase was carried out by estimating wavelets and generating pre-stack synthetic seismograms which were used for AVO analysis. Once appropriate low frequency model was built, the combination of P-impedance and S-impedance allowed us to differentiate between layer 1 and layer 2 packages, as well as, for the predictability of shales. A cross plot between P-impedance and porosity showed that as P-Impedance decreases porosity increases for layer 1 and layer 2. However, the inversion results were improved tremendously when the multi-attribute well interpolator model using seismic attributes was used as a background model compared to the low frequency model by using wells only. A better vertical and lateral resolution was achieved and we can see three pronounced events at the reservoir level which are analogous to the prospective zones in the neighboring areas. The salient point of this methodology is the use of multi attributes well interpolator as background low frequency model (LFM) that honour the trend observed in the seismic data as well as the well data. Inverted absolute impedances are in agreement with well impedances. Forward modelling validated the seismic interpretation and it was easier to interpret on the band-pass impedance volume than the actual seismic due to more continuity of the events and less noise content. Upper sandstone layer (F1A) shows promising and encouraging results based on our study and the porosity and net pay estimated showed that the areas with thicknesses greater than 12 ft. are highly prospective.