When Should We Use Seismic Inversion Results for Porosity Prediction? A Case Study from Dhulaima and Lekhwair-East Fields

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Constrained sparse spike inversion (CSSI) is often used for reservoir characterisation. The accuracy of the prediction is dependant on seismic data quality, strength of porosity-impedance relationship and consistency of the bounding lithology. In this case study, we focus on the impact of porosity-impedance relationship and variability in bounding lithology.

The Dhulaima and Lekhweir-East fields have proven oil reserves in the Creataceous carbonate Shuaiba formation. The largest accumulations are found in the Lower Shuaiba unit. Smaller amounts of oil are found in the Upper Shuaiba unit.

The seismic data quality of the two fields was comparable and sufficient well coverage existed. Therefore, CSSI was run on both fields with the aim of delineating the good reservoir zones and predicting porosities where possible. Petrophysical analysis of the well data showed an acoustically homogeneous layer over both fields bounding the Upper Shuaiba units. The analysis also showed that the porosity-impedance relationship is stronger within the lower Shuaiba unit. The thickness of the lower Shuaiba unit was also found to be consistently above the tuning thickness over the two fields. This together with an acoustically more consistent Upper Shuaiba unit bounding the lower Shuaiba over the Dhulaima field allowed for porosity prediction to be made in this layer from the inverted seismic data. On the other hand, the variability in the bounding Upper Shuaiba over the Lekhwair-East did not allow porosity prediction over this field. Porosity predictions of the Upper Shuaiba layer itself were not attempted due to a weak porosity-impedance relation.