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Pre-stack Seismic Inversion for Improved Reservoir Characterisation of KG Basin Deep Water Channel Sands – Case Study with Drilling Results

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Summary

A large-scale pre-stack seismic inversion project was carried out in one of the concessions in the Khrisha-Godavari Basin, Eastern Offshore India. The objective was to produce elastic and petrophysical property volumes from seismic data that could be used to optimally locate appraisal and development wells in the complicated Plio-Pleistocene deep water channel complexes. In addition a Bayesian probability analysis was conducted in order to predict the main litho-facies and their associated probabilities. Drilling results have confirmed the elastic properties, lithology classification and petrophysical properties derived from the pre-stack inversion of the seismic data. More wells are expected to be drilled and integrated to further fine tune the above relationship

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Introduction

A large-scale pre-stack seismic inversion project was carried out in one of the concessions in the Khrisha-Godavari Basin, Eastern Offshore India. The objective was to produce elastic and petrophysical property volumes from seismic data that could be used to optimally locate appraisal and development wells in the complicated Plio-Pleistocene deep water channel complexes. In addition a Bayesian probability analysis was conducted in order to predict the main litho-facies and their associated probabilities.

Theory and/or Method

Well-log data were used to build the probability density functions used in the lithology classification and also to derive suitable petro-elastic relationships for transforming the seismic elastic inversion products to petrophysical properties. Inversion of the seismic data consisted of two components: (a) second order AVO analysis to derive reflectivities for P-wave and S-wave impedance and density; and (b) post-stack inversion of the reflectivities to relative impedance volumes which are then combined with the appropriate low frequency models to produce absolute impedance and density cubes. The low frequency models are derived from horizon-constrained interpolation of the broad-band well impedances and density, with additional constraint provided by the pre-stack relative inversion attributes

Conclusions

The additional attributes derived from pre-stack inversion provide a significantly more confident classification of the main lithologies than would be possible using a single seismic attribute such as acoustic impedance. In addition quantitative estimates of petrophysical properties will provide useful information in the building of the reservoir models for production planning. Drilling results have confirmed the elastic properties, lithology classification and petrophysical properties derived from the pre-stack inversion of the seismic data. More wells are expected to be drilled and integrated to further fine tune the above relationship.

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