Assessment of Passive Margin Clastic Shelf Targets in the South Falkland Basin Through the Integrated Application of Geological, Geophysical and Rock-Physics Modeling

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ABSTRACT

The lower Cretaceous sediments of the South Falkland Basin comprise of a series of clastic sequences deposited along a passive margin that developed in response to the opening of the Weddell Sea during the early breakup of Gondwana. To date only three wells have targeted plays in the basin, two targeting the lower Cretaceous shelf sandstones. Acquisition of high quality 3D seismic data has provided excellent imaging of the lower Cretaceous stratigraphic architecture. Estimating information about reservoir properties from seismic data is a key challenge in exploration, appraisal and production of hydrocarbons. Well to seismic calibration is an essential component in understanding the relationship between a rocks elastic properties, and associated seismic response, with the rocks petrophysical properties. The Darwin well, drilled in 2012, successfully tested a tilted fault block structure that exhibited a DHI anomaly with excellent amplitude conformance to structure. The reservoir unit is comprised of thick Aptian aged, shallow marine sands. Good quality reservoir properties and moderate overburden provides an excellent acoustic contrast to bounding shale units. A high yield gas condensate contained within the reservoir unit further enhances rock unit contrasts. The well has provided excellent seismic calibration and has further added to the rock physics toolbox. Gas and gas condensate are easily separated from water wet reservoir, but the ease at which oil pay is identified is less certain and is generally controlled by the levels of gas saturation. The calibrated data has enhanced the interpretation and helped reduce risk. Well data and attributes derived from seismic inversion have been combined to derive petro-elastic models to produce local geologically constrained rock-physics diagnostic tools that can be used for lithology and fluid prediction. The combined application of stratal architecture, identified using 3D seismic, and rock physics modelling has helped identify a number of follow-up targets to the successful Darwin discovery. Given the sparse well data the South Falkland Basin would be classified as a frontier basin, but the geological setting combines a series of basin types — Atlantic-type, foredeep and thrust belt — that are globally proven to provide high exploration success rates. The Darwin well has proved that the play elements are in place. The calibrated seismic data suggests ongoing success in line with global analogues.