Tailored QI workflows applied to prospect evaluation in the South Falkland Basin.

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Robust prospect appraisal is essential for ensuring successful well outcomes. This becomes even more important in remote areas where exploration and exploitation costs are high. Here we address the challenge of determining lithology and fluid properties in the Darwin field, located in the South Falkland basin. The Darwin structure comprises two adjacent tilted fault blocks: Darwin East, which contains the discovery well 61/17-1, and Darwin West, which remains untested. The reservoir encountered in the Darwin discovery well is interpreted to be an early Cretaceous shallow marine sandstone comprising predominantly quartz, but with some feldspar, lithic fragments and clays. Net pay in the discovery well was determined as 67.8m, with porosity up to 30%, averaging 22% and an average permeability of 337 mD. The sand unit extends across the two fault blocks and is clearly represented on 3D seismic by amplitude conformance to structure and a class 3 AVO response. Fluid samples recovered from the well confirmed the presence of a high yield gas condensate (148 to 152 stb/MMscf). Current management assessment indicates the Darwin field has a prospective liquid recoverable resource in excess of 360 MMBO. The goal of the study presented here is to assess the potential of the untested Darwin West prospect by applying carefully designed quantitative interpretation workflows that utilize RSI's innovative Multi-Attribute Rotation Scheme (MARS).

When the goal of a study is to constrain lithology and fluid properties, a carefully designed workflow, tailored to the geology and question at hand is required. A common way to understand the relationship between seismic attributes and petrophysical properties is by the use of rock physics templates or simply by cross-plotting well log derived elastic attributes against a color-coded petrophysical property. Both ways graphically illustrate the relationship between the elastic and petrophysical domains, which can be used to estimate reservoir properties from seismic inversion attributes. However, the attribute domain in which these methods are applied is chosen subjectively and may not be optimized for the problem of interest.

In contrast, the multi-attribute rotation scheme (MARS) is a methodology that uses a global search algorithm to estimate a mathematical expression that optimizes the sensitivity of input attributes to output target properties (Alvarez et al., 2015). This methodology uses measured and/or rock physics-modelled well log information as an input, to estimate a well log-derived transform between several elastic attributes and the target petrophysical properties. This optimized transform can then be applied to seismically-derived elastic attributes to predict the spatial distribution of petrophysical reservoir properties for reservoir characterization and delineation, and to estimate secondary variables in geostatistical workflows for static model generation and reserve estimation.

For this case study, MARS was used to estimate a lithology and fluid saturation volumes in both the Darwin East and West fault blocks (Alvarez et al. 2016). By applying the MARS methodology, customized transforms were found from the well-log data to estimate reservoir properties from seismically derived elastic attributes. Figures 1a and 1b show a comparison between the actual and predicted Sw and Vclay logs upscaled to seismic resolution, showing an excellent match. Finally, the resultant transform was applied to seismically-derived volumes of elastic attributes to obtain volumes of Sw and Vclay. A cross-section of the resultant petrophysical volume through the calibration well together with its Sw and Vclay curves are shown in Figure 1c. In this figure it is possible to see a good match between the seismic and well-log derived petrophysical properties in Darwin East. Results suggest that the Darwin West prospect has similar properties to Darwin East in terms of reservoir quality and content. The resulting reservoir property volumes (Sw and Vclay) can further enhance the characterization of the heterogeneity of the reservoir, and can be applied during static model generation, reserve estimation, and to optimize the exploration, appraisal, and exploitation plan in the area.

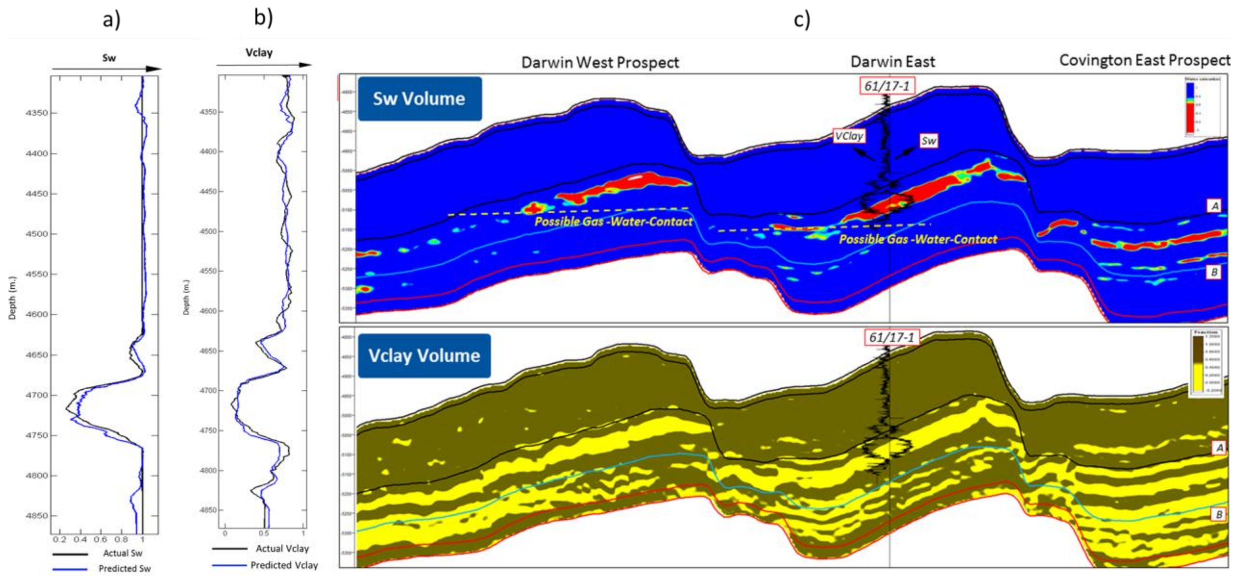

Figure 2. *a) Comparison between the actual and predicted Sw logs upscaled to seismic resolution. b) Comparison between the actual and predicted Vclay logs, upscaled to seismic resolution. c) Cross section along the resultant Sw volume along wells 61/17-1 together with the Sw and Vclay logs. Notice the good match between the seismic and well-log-derived Sw and Vclay.*

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References

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