The Challenges and Capabilities of Simultaneous Pre-Stack Inversion and Reservoir Characterization – a Case Study from the Western Timor Sea

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Abstract

The Vulcan sub-basin is situated in the Western Timor Sea on the Australian Continental shelf. The basin is a northeast-southwest trending intra-cratonic rift, which developed in response to the Late Jurassic – Early Cretaceous break-up of the Australian northwest continental margin. The main targets are Middle Jurassic to Late Triassic gas-bearing marine reservoirs and proven Late Jurassic oil-bearing sands of the Vulcan Formation. A rock physics feasibility study revealed that a combination of elastic properties, such as P-impedance and Vp/Vs, could be used to predict the reservoir sand distribution in the target area. On the other hand, fluid replacement modeling (FRM) showed that varying pore fluid types had little effect on the seismic amplitude responses, and probably attributed to the relatively stiff reservoir rock type.

The results of the QI study provided good quality seismic inversion products and lithology cubes, which enabled sand delineation at the reservoir level. The key contributors were a combination of (1) improved seismic input data quality, being in this case achieved through the use of broadband seismic acquisition technology, (2) careful preparation of input gathers and well log information, (3) detailed low-frequency model building, and (4) utilization of a methodical multi-stack deterministic seismic inversion workflow. The results of the study demonstrate how quantitative interpretation (QI) successfully can improve confidence in reservoir mapping, in an area of complex geology and challenging seismic data quality.