Better Subsalt Imaging Integrating 3-D Seismic and Full Tensor Gradient Data: Gemini Field Case Study

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Full tensor gravity gradiometry data acquired by Bell Geospace has been used to make important revisions to a complex 3-D geologic model of the productive subsalt Gemini field. The initial model, developed from 3-D seismic data, suggested that the pay horizons were truncated against the base of allochthonous salt. This interpretation was tested by calculating gravity and gradient data for the model and comparing the results to the Bell gradiometry data. The differences between the simulated and measured data were used to reinterpret the 3-D seismic data and modify the geologic model until the differences were significantly reduced. The full tensor gradient data aided this process by highlighting salt edges and indicating layers of incorrect density and thicknesses within the model. The revised model reinterpreted the pay horizons as a broad anticline lying below the salt. The gradiometry data also supported the conclusion that the original seismic data had incorrectly imaged the base of salt too high in some areas by as much as 1,250 feet. This could be caused by possible velocity errors in converting the 3-D time migrated data to depth or to the limitation of the seismic data to properly image the base of salt. This study proves that 3-D gradiometry data provides an important independent constraint for successfully interpreting seismic data, particularly in areas of poorly imaged seismic reflectors caused by overlying structural and stratigraphic complications.