Velocity Model Building to Improve Subsalt Imaging of 2D Seismic Data in the Green Canyon and Walker Ridge Area of the US Gulf of Mexico

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ABSTRACT

Exploration success in the deepwater U.S. Gulf of Mexico (GOM) since the early 2000's is a testament to steady improvement in geophysical imaging of hydrocarbon reservoirs in subsalt sedimentary sections. Better subsalt imaging has reduced the risk of expensive, deepwater, subsalt wells. The goal of our study is to integrate well data 2D and 3D seismic data to build a new and more accurate, velocity model for the Green Canyon and Walker Ridge areas of the north-central US GOM. Inputs into our new velocity model include: (1) interval velocities (Vint) extracted from 16,000 km long 2D seismic lines; (2) Vint extracted from 6180.5 km² of 3D seismic data that overlaps the 2D seismic lines; and (3) Vint from 42 wells. The velocity model from the 3D seismic data was created assuming a constant salt velocity of 4480 m/s. For the well control, three different types of well data were used to populate the velocity model: (1) seven checkshot surveys; (2) thirty sonic logs and synthetic velocities calculated from mudlogs; and (3) five VSP surveys. Comparison of the original velocity model using Vint from the 2D seismic data with the new velocity model built for this study shows that greater detail for the geometry of the salt bodies is achieved using the new velocity model. This improved resolution is related to the higher accuracy of Vint from the 3D seismic data and from borehole Vint that better represent both the velocity variations within salt bodies relate to changing evaporite compositions within the salt canopy and sedimentary inclusions and the occurrence of Cenozoic limestone documented in a few wells in the salt canopy. The final step is using the improved velocity model to depth migrate the 2D seismic data which we use to illustrate previously unrecognized features in the subsalt, sedimentary section.

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