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Green Canyon Block 205: Geophysical Analysis of a Deepwater Gulf of Mexico Discovery

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Abstract

Chevron U.S.A. and Exxon are currently evaluating development plans for a large discovery in the Green Canyon Block 205 Unit. The field consists of Lower Pleistocene and Upper Pliocene turbidite reservoirs deposited along a fault–bounded salt–cored anticline. The reservoirs vary from massive, blocky sands to laminated sand–shale sequences. Seismic amplitude anomalies are associated with reservoirs containing hydrocarbons and 2–D seismic data has been used to define their areal extent.

Because deepwater operation costs are extremely high, detailed reservoir characterization is critical to making sound economic development decisions. Stratigraphic variations in the reservoir facies are complex and difficult to delineate seismically. In addition, vertical seismic resolution and tuning effects also complicate the seismic response. Delineation drilling within the field area indicates various facies have overlapping seismic amplitude characteristics. The primary problem is distinguishing between oil–filled laminated sands and massive wet sands which have similar stacked seismic amplitudes.

Checkshot, stacking and migration velocities differ in the study area and suggest that these deepwater, shale-dominated sequences are anisotropic in nature. The initial 3–D seismic volume was migrated with velocities similar to the stacking velocities and 5% faster than the checkshot functions which resulted in under–migration of the seismic data and poor synthetic well ties. Remigration of the 3–D data using the prestack 3–D migration velocity analyses with velocities 10% faster than the checkshot surveys, enhanced the seismic imaging and established strong well ties necessary for reservoir characterization.

Amplitude versus offset modeling suggests that certain facies not distinguishable strictly from stacked seismic amplitudes may be delineated by AVO techniques. AVO modeling suggests that massive oil sands can be distinguished from laminated oil sands based on a distinct increase in amplitude with offset. Preliminary modeling suggests that gas sands should not exhibit a strong AVO increase. Chevron is currently evaluating 2–D versus 3–D AVO imaging in this area to help predict lateral reservoir characteristics. Comparisons of 2–D and 3–D AVO seismic data show distinct differences which can be attributed to 2–D fresnel zone effects where changes in stratigraphy and seismic amplitude occur perpendicular to the shooting direction. Where this occurs, 3–D imaging is needed to correctly estimate stratigraphy from AVO analysis.

Biographical Sketch

Bernard Regel

Bernard Regel is a Staff Geophysicist with Chevron USA working in the Special Project Group Team concerned with evaluation and development of Green Canyon Block 205. He worked for Gulf Oil from 1979 until the Gulf/Chevron merger in 1985 and has been with Chevron since. He attended Bowling Green State University and received a B.S. in Geology in 1976 and a M.S. in Geophysics in 1979.