

Anisotropic Depth Imaging of Lorien Discovery in Deepwater Northern Gulf of Mexico

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The Lorien discovery in the Green Canyon Area of deepwater Gulf of Mexico is defined by a seismic amplitude anomaly on the northern edge of a salt-floored mini-basin. The elongate, west-to-east trending reservoir is in close proximity to salt and present day structural dip is in excess of forty-five degrees. Anisotropic velocity model building (VMB) and prestack depth migration (PSDM) were employed to accurately position the narrow target and ensure optimal well placement. Depth prognoses using the PSDM were correct to within ~1% at TD of the well (60m at 5200m TVDSS). Maximum travel time errors of 1-2% at target depth were confirmed by velocity survey.

Using target images from anisotropic Kirchhoff PSDM with turning rays, anisotropic parameters were estimated by incorporating well data from several locations. VMB was performed using tomographic techniques. The amplitude anomaly moved laterally up to 400 m after anisotropic depth imaging compared to its location in an existing prestack time-migrated volume. Synthetic tests indicate that such lateral error in positioning of dipping reflectors is expected if anisotropy is ignored during VMB. These observations, when considered in the context of the successful test of the prospect, indicate that the target could have been missed if the interpretation and well planning decisions were made without the benefits of anisotropic imaging. With the very high costs of drilling in deepwater environments, there is a high value in the use of such advanced technology to accurately image targets, and thus reduce risk.
