Impacts of Seismic Anisotropy and Subsalt Velocity Updates in Imaging, Deepwater Gulf of Mexico

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Seismic anisotropy refers to seismic waves traveling with different velocity at different propagation angle, usually in consolidated, shale-prone areas such as in Gulf of Mexico and West Africa. Conventional isotropic (velocity independent of angle) pre-stack depth migration often produces mis-positioned and distorted images in these areas. Instead of using a single migration velocity parameter as in the isotropic depth migration, the anisotropic pre-stack depth migration uses the vertical (or normal) velocity and the anisotropic parameters (often referred to as delta and epsilon) estimated from seismic data with well controls. The anisotropic migration with the anisotropic velocity models significantly improves the accuracy of positioning and the interpretability of subsalt events around and below the salt bodies.

Another challenge in the Deepwater, Gulf of Mexico, is the velocity model update in the areas of subsalt and with low signal/noise ratio. Conventional approach in these areas is to use pre-stack depth migration scans with different subsalt velocity functions. These multiple migrations are expensive and often prohibitive for common use. The pre-stack depth migration implemented with the delay-imaging-time (DIT) scan allows a single migration with multiple-volume outputs. Each of these DIT volumes is obtained by applying a delay time imaging condition at subsurface locations. The subsalt velocity can be updated with the DIT semblance or stacks. This DIT-scan migration provides an efficient and affordable process to update the subsalt velocity model.

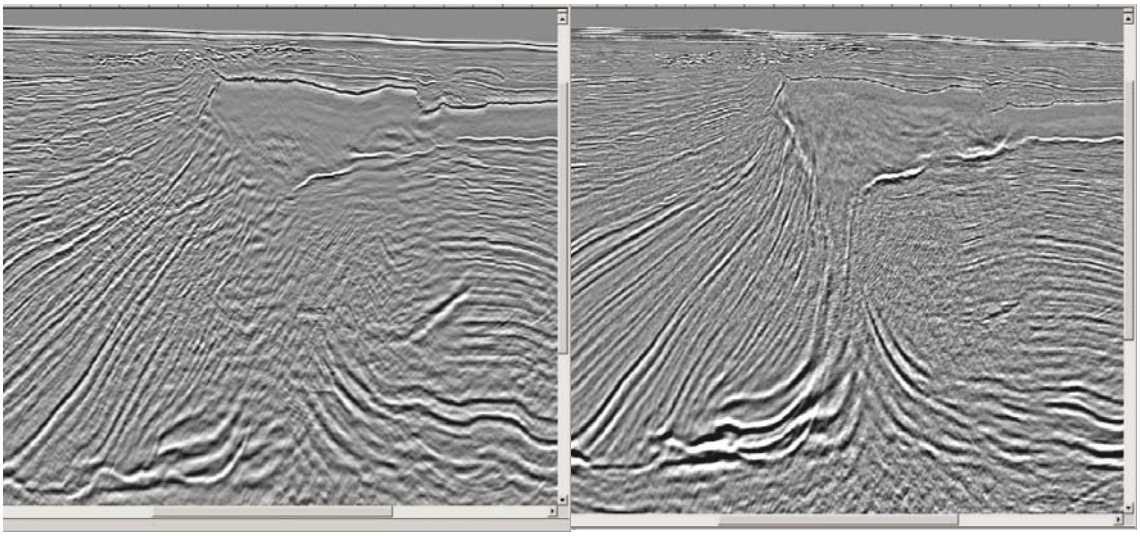

Figure 1. Image improvement before (left) and after (right) new depth processing (anisotropy and tomography).

This paper was invited by the workshop organizer and was not reviewed by the Technical Program Committee.