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3D Seismic Imaging of Carbonate Reservoirs and Structures

3D image-processing techniques of stacked and migrated data incorporate all three dimensions, which when combined help to identify/highlight events of significance in the seismic data. The result is an attribute cube or volume that can be analysed and interpreted more objectively by the interpreter.

We have applied various 3-D image-processing techniques to produce filtered seismic reflectivity data and volume attributes to better visualise and delineate seismic facies, geometries and the structures of heterogeneous carbonate reservoirs. Image filtering techniques were applied to improve signal-to-noise ratios and to suppress random noise to obtain a better reflection definition. Combined volume dip and azimuth was calculated from the seismic cubes to detect subtle stratigraphic features such as low-angle progradation units and shoal-type mounded seismic facies in the Permian Khuff and Upper Cretaceous Natih E reservoirs. Semblance volumes were used to highlight reflection terminations and helped to distinguish between stratigraphic and structural features in Thamama B reservoirs. Texture was applied to 3-D attribute-generated volumes to extract different seismic facies and properties, which can be related to potential good reservoir zones in Malampaya and Malaysian fields. 3D visualisation tools were used to image both horizons and faults of a complex inverted structure of a deep Upper Cretaceous lacustrine carbonate reservoir in the Yacoraite Fm., NW Argentina.

Seismic facies and geometries interpreted from the attribute analyses, combined with interpretation of the original seismic and core/log data, allowed us to construct robust structural and depositional models of carbonate environments that were used as input for static reservoir models.