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Seismic Stratigraphy, Reservoir Characterization, and 3-D Visualization of Seismic Attributes of Carbonate Facies and Karst in the San Andres Formation, Vacuum Field, Lea County, New Mexico

Mature carbonate reservoirs of the Permian San Andres in the Delaware Basin have low recovery efficiencies due to compartmentalization by reservoir scale heterogeneity. The San Andres was deposited on a shallow, open to restricted marine shelf. Seaward progradation of individual shallowing upward cycles and lateral facies shifts created heterogeneity on a reservoir scale. The most productive reservoir rocks are the oolitic, peloidal packstones and grainstones found in the middle ramp to outer ramp. Permeability barriers include tight anhydrite cemented wackstones and mudstones of the peritidal through ramp facies, and anhydrite cemented karst features associated with exposure surfaces.

Breaks in sedimentation and differences in deposition give rise to different stratal patterns which expressed in 3-D seismic data permit correlation between carbonate facies and seismic attributes in the San Andres Formation, Vacuum Field, Lea County, New Mexico. Information on stratigraphy and lithology gained from time slices and flattened horizons using seismic attributes of amplitude, spectral decomposition, coherence, and phase reversal allows better delineation of subtle features and changes of features. Through a combination of 3-D visualization techniques and seismic attribute analysis, a correlation between specific attributes and stratigraphic features responsible for reservoir compartmentalization can be established. While seismic provides an image of structure and geomorphology between wells, it has only limited vertical resolution. Furthermore, the amplitude and phase of the seismic can only be tied to lithology through logs and cores. Core, wireline logs, sidewall core data, and production data provides the "ground truth" for calibrating multiple seismic attributes.