Stephen C. Ruppel, Yong Joon Park, and F. Jerry Lucia

Applications of 3D Seismic to Development and Exploration of Carbonate Reservoirs: Permian Basin of West Texas

Bureau of Economic Geology
The John A. and Katherine G. Jackson School of Geosciences
The University of Texas at Austin
Austin, TX 78713-8924

3D geophysical data are a powerful tool for identifying and characterizing oil and gas reservoirs. However, successful application of 3D seismic technology in carbonate platform successions has lagged its use in clastic reservoirs. Here we present the results of an integrated study of outcrops, cores, wireline logs, and 3D geophysical data in a Permian (Guadalupian) platform carbonate reservoir on the Central Basin Platform of the Permian Basin which demonstrate the use of 3D seismic data both as a tool for identifying the structural controls on reservoir development and for defining the distribution of diagenetically developed reservoir porosity.

The South Cowden Grayburg reservoir resembles many Permian carbonate reservoirs in the Permian Basin in being composed of cyclic shallow marine platform carbonates. It differs from most, however, in that the most productive areas of the reservoir owe their high productivity to enhanced porosity and permeability development caused by anhydrite dissolution and diagenesis. Attribute analysis of 3D seismic data shows that the porosity created by this diagenesis can be mapped across the field using 3D data at a lateral resolution that exceeds that available from wireline logs.

3D seismic data also show that both the structural configuration of the field and the distribution of depositional facies are the result of accommodation patterns created by the deposition of a clastic-rich lowstand prograding wedge that built basinward from the terminal Clear Fork platform margin during late Leonardian (San Andres) sea level fall. Reconnaissance studies along the margin of the Central Basin Platform suggests that other Grayburg reservoirs may owe their development to lowstand wedges formed at this time.