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Imaging Basin-Floor Channel Systems of the Basal Brushy Canyon Fm with 3-D Seismic Attributes

Outcrop-based observations of stratigraphic geometries of the Permian Brushy Canyon Formation of West Texas provide valuable information that may be used in reservoir characterization programs of analog units. However outcrop-derived depositional models do not predict reservoir geometry or the distribution of physical properties in specific fields. Accordingly, there is a need to directly image pertinent physical properties, and we evaluated the use of attributes derived from 3-D seismic data for this purpose. Our data set consisted of a 41 km^2 3-D seismic volume, digital logs from 77 wells, and production data. The Basal Brushy Canyon in the study area was deposited on the basin floor, several 10s of km from the contemporaneous shelf break and slope. Log correlations allowed us to recognize that the field consists of a complex of vertically stacked channel/sheet elements, the location of which is strongly influenced by relief on the underlying Bone Spring Formation. Synthetic seismograms allowed major stratigraphic boundaries to be identified and mapped, although individual channel/sheet elements are below seismic resolution. We used a volume-based approach and 11 of the available wells for our seismic attribute study. This work allowed us to image the main, composite, channel trend, and also individual channel/sheet elements. Significantly: a) the neural network results (based on 11 wells) compare favourably with the results of the subsurface log correlations (based on 77 wells), b) the results of the attribute study make geologic sense, have a high statistical significance, and provide insights into depositional and diagenetic processes that may be used elsewhere, c) the results explain existing production trends, and d) the 3-D seismic-based results (e.g., porosity, structure) are in digital format and could be imported directly into reservoir simulators.