AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Stephen C. Ruppel, F. Jerry Lucia, and James W. Jennings, The University of Texas at Austin, Austin, TX

Outcrop-Based Stratigraphic, Petrophysical, and Geostatistical Characterization and Modeling of a Carbonate Platform Reservoir Succession: Middle Permian, Permian Basin

Mature carbonate platform reservoirs commonly contain sizeable volumes of remaining oil. Critical to the development of improved methods for the recovery of this resource is the development of better techniques for reservoir characterization and modeling of interwell reservoir space.

We used high resolution stratigraphic and petrophysical data from reservoir-equivalent Lower Permian outcrops in the Sierra Diablo of West Texas as a basis for developing improved approaches to modeling reservoir architecture and petrophysical properties in the South Wasson Clear Fork reservoir in the Permian Basin. These outcrops, which provide more than 2 miles of continuous exposure, supplied critical information on reservoir architecture, including styles of cyclicity, vertical and lateral patterns of facies distribution, and continuity. We collected closely spaced porosity and permeability data along both vertical and horizontal traverses to define relationships between facies and petrophysics and to provide data pertinent to the spatial statistics of petrophysical properties in interwell reservoir space. Outcrop data proved crucial for the interpretation and modeling of subsurface wireline and core data. Cycle stratigraphic data provided a basis for defining reservoir architecture and for developing and applying a cycle-based correlation framework.

Integrated geostatistical analysis and modeling of outcrop and subsurface petrophysical data revealed two types of heterogeneity each having very different effects on fluid flow: a large scale stratigraphic component and a small-scale, poorly-correlated component. Modeling and simulation of these components produced a much more realistic match to historical waterflood performance suggesting that this approach is a significant improvement over previous reservoir modeling methodologies.