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

Martin K. Dubois[1], Alan P. Byrnes[1], Geoffrey C. Bohling[1], Shane C. Seals[2], John H. Doveton[1] (1) Kansas Geological Survey, University of Kansas, Lawrence, KS (2) Pioneer Natural Resources USA, Inc, Irving, TX

Statistically-Based Lithofacies Predictions for 3-D Reservoir Modeling: An Example from the Panoma (Council Grove) Field, Hugoton Embayment, Southwest Kansas

The Panoma (Council Grove) Field in southwest Kansas lies stratigraphically subjacent to the more prolific Hugoton (Chase) Field, and has recovered 2.8 TCF of gas from approximately 2,600 wells across 1.7 million acres since its discovery in the early 1960's. Field-wide upscaling of lithofacies distribution for reservoir characterization has proven problematic in large heterogeneous reservoirs like the Panoma Field, but prediction tools, neural networks and the Excel add-in Kipling.xla, a nonparametric discriminant analysis tool, provide solutions to the facies prediction dilemma.

Panoma produces gas from the upper seven fourth-order sequences of the Permian Council Grove Group containing 50% nonmarine siliciclastics and 50% marine carbonates and siliciclastics. Lithofacies controlled petrophysical properties dictate gas saturations and discrimination of lithofacies reduces standard error in permeability prediction in marine carbonate facies by a factor of twelve. Nonmarine siliciclastic facies error was reduced by a factor of three. At low gas column heights, lithofacies discrimination can result in predicted saturation differences of 20-40% while differences at high gas column heights, near ''irreducible'', are less than 10%.

Both a neural network and Kipling.xla were ''trained'' on data from eight wells including half-foot digital wireline log data and descriptions of two thousand feet of core utilizing a digital rock classification scheme. Both models were then used to predict lithofacies in non-cored wells based on their log attributes. Techniques employed in this study could be applied to other large and complex reservoirs where accurate representations of lithofacies heterogeneity in the 3-D volume are key to realistic reservoir analysis.