Abstract

Mississippian St. Louis (Meramecian) oolitic grainstone shoals were widely deposited across North America, and are important petroleum reservoirs in the Midcontinent. To develop an improved understanding of the depositional controls on complex geometry and distribution of St. Louis oolitic grainstone reservoirs, the external geometry and spatial continuity of individual selected oolite shoals were studied.

An improved geologic approach was used to model the sequence stratigraphic, lithofacies, and reservoir architecture framework of the St. Louis carbonate reservoir systems in three fields in Southwestern Kansas. Sequence stratigraphic surfaces were recognized from both cores and logs, and provided the basis for constructing a sequence stratigraphic framework to constrain further reservoir analysis. Lithofacies were described and classified using cores for approximately 15 available wells. A neural network analysis tool (Kipkit-4) was used to calibrate core-scaled lithofacies to log-scaled petrofacies using suites of log curves (GR, resistivity, density and neutron porosity, and PEC). Using the Kipkit approach, log attributes from hundreds of wells were used to predict lithofacies and petrofacies in wells without cores. The predicted results provide input for stochastic object-based modeling of the 3D geometry and connectivity of individual oolite lobes.

Improved quantitative lithofacies and petrofacies models for St. Louis carbonate reservoir systems can improve our understanding of key factors that control the facies distribution, and the production of hydrocarbons within carbonate shoals.

Many St. Louis oolite shoals have been deposited as linear-ramp, barrier-type shoals trending southwest of, and parallel to, a northwest-southeast shoreline flanking the Central Kansas Uplift. Other St. Louis oolite shoals have been interpreted as platform shoals that have local variations of deposition on sea-floor highs and near islands. Oolite shoals are tabular shape elongated bodies with thickness from 1 to 10's of meters, width from hundreds of meters to several kilometers and length from several to tens of kilometers. The boundaries of depositional sets (red lines in left figure) indicate progradation due to longshore currents. The smaller scale cross-beds are the internal structures of sandwaves created by the tidal currents. Oolite shoals can amalgamate and form an oolite shoal complex.