Abstract

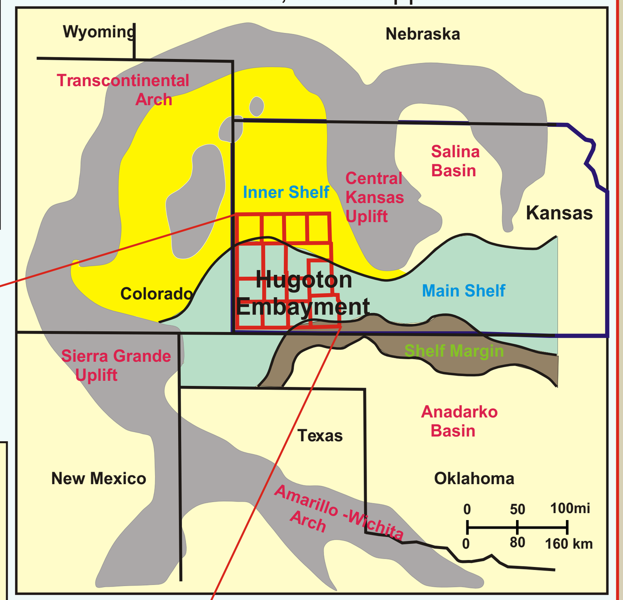
Mississippian St. Louis (Meramecian) oolitic grainstone shoals were widely deposited across North American, and are important petroleum reservoirs in the Midcontinent. To develop an improved understanding of the depositional controls on complex geometry and distribution of St. Louis oolitic grainstone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

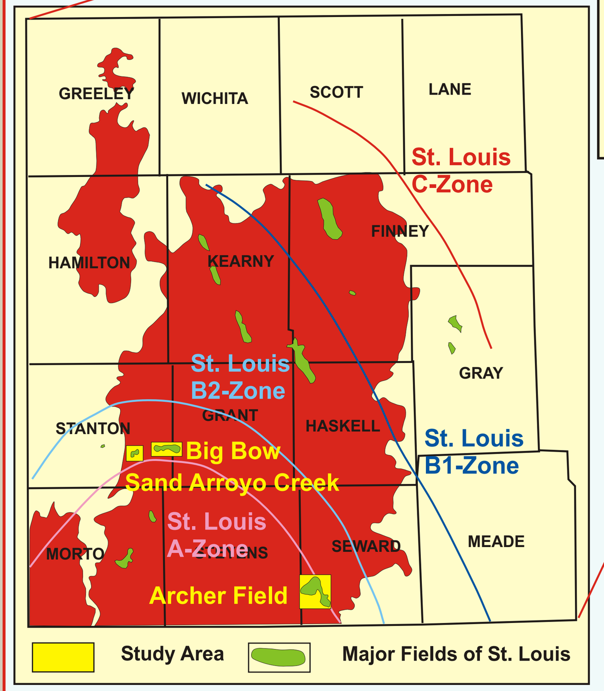
An improved geologic approach was used to model the sequence stratigraphic, lithofacies, and reservoir architectural framework of the St. Louis carbonate reservoir systems in three fields in Southwestern Kansas. Sequence stratigraphic surfaces were recognized from both cores and logs, and provided the basis of construct 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 (Kipling.xla) was used to calibrate core-scaled lithofacies to log-scaled petrofacies using suites of log curves (GR, resistivity, density and neutron porosity, and PE). Using the Kipling approach, log attributes from hundreds wells were used to predict lithofacies and petrofacies in wells without cores. The predicted results provides input for stochastic object-based modeling of the 3D geometry and connectivity of individual oolite lobes.

Improved quantitative lithofacies and petrofaices 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.

Paleogeography of North American During Late Mississippian (340 Ma)

Paleogeography of Southwest Kansas St. Louis, Mississippian

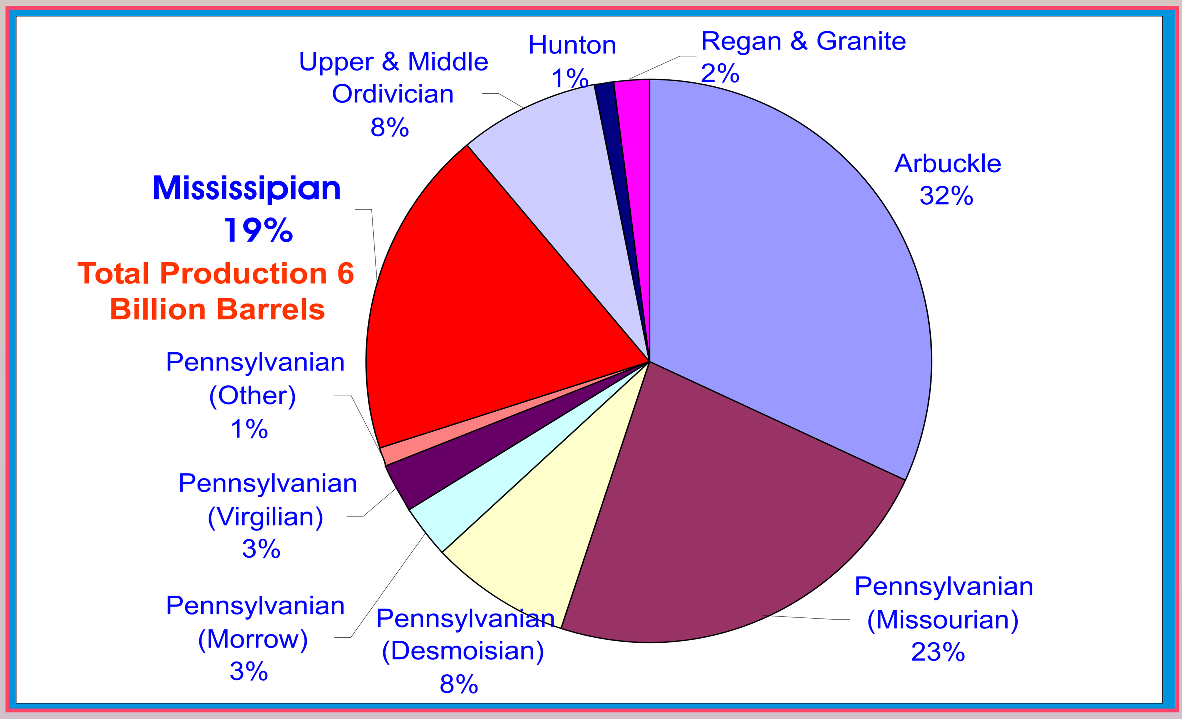




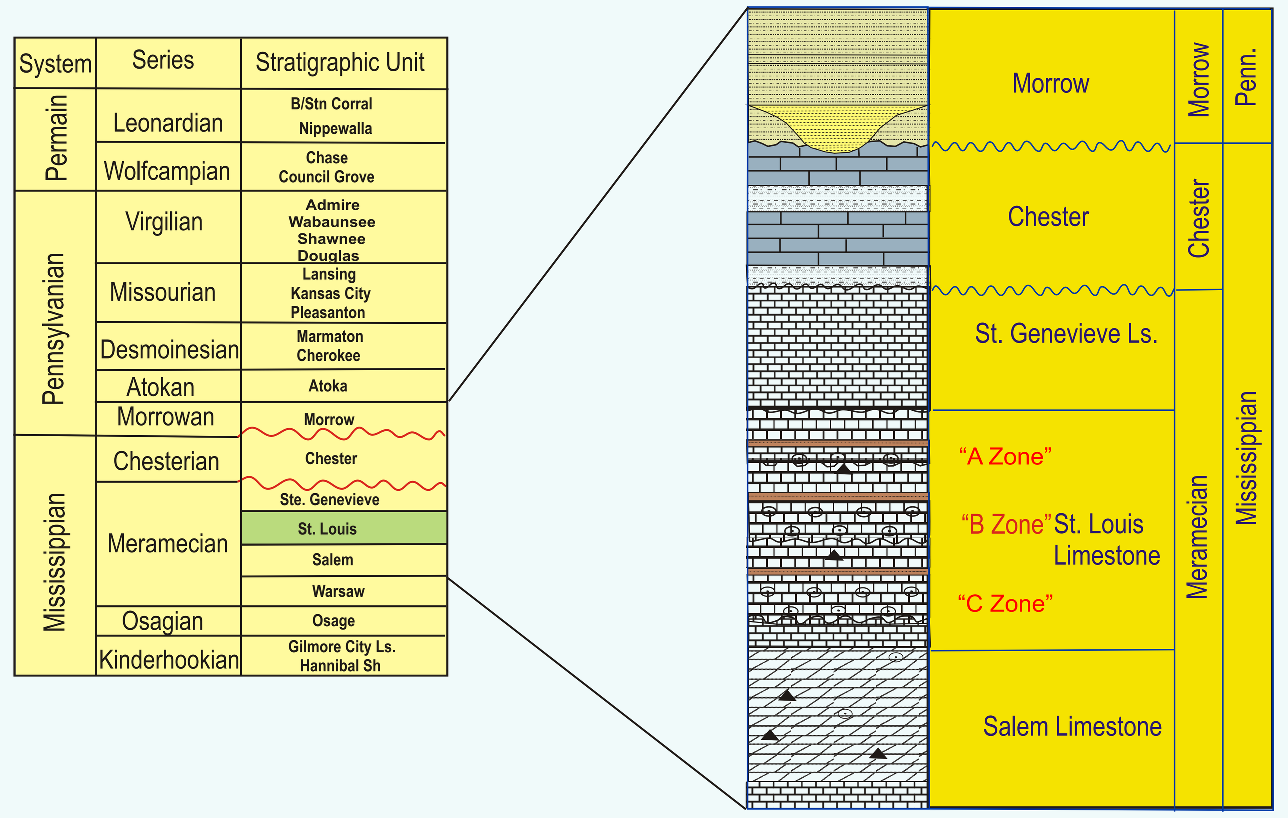
Major Mississippian St. Louis Fields Southwest Kansas

Regional Setting

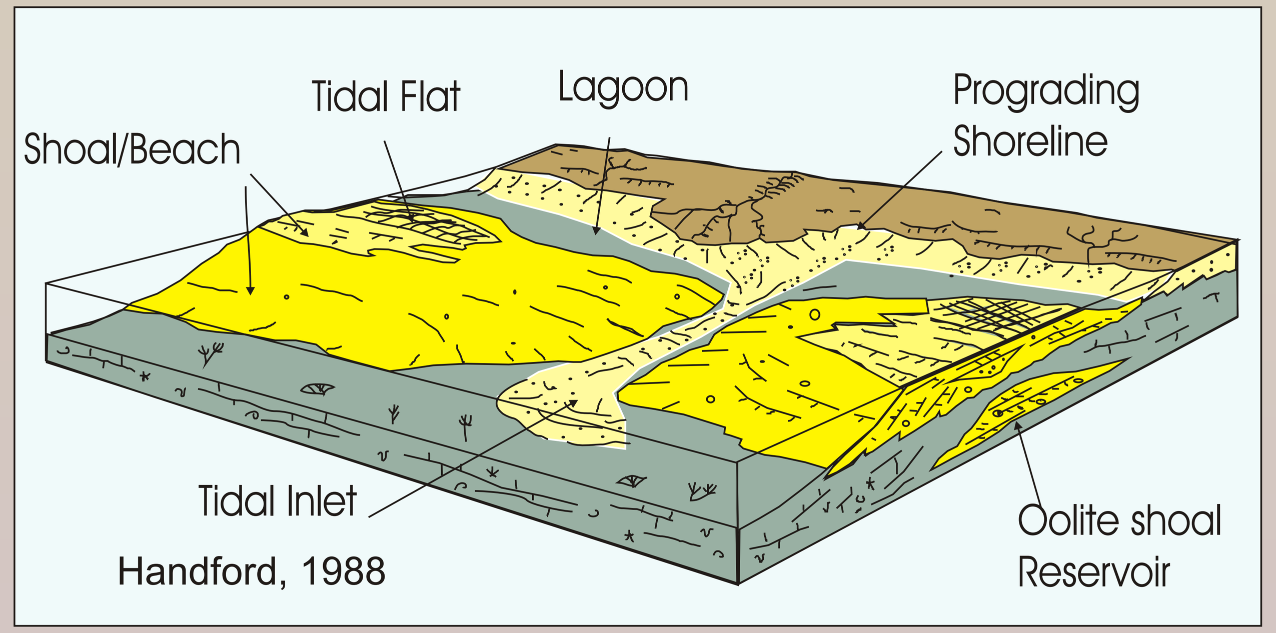
The Study Area is located in the Hugoton Embayment, which is flanked to the west and southwest by the Las Animas Arch and Sierra Grande uplift, and to the northeast by the Central Kansas uplift. The Mississippian sections dips gently from the north and thickens southward, reaching a thickness of more than 1,700 feet and merging with the deeper Anadarko Basin.



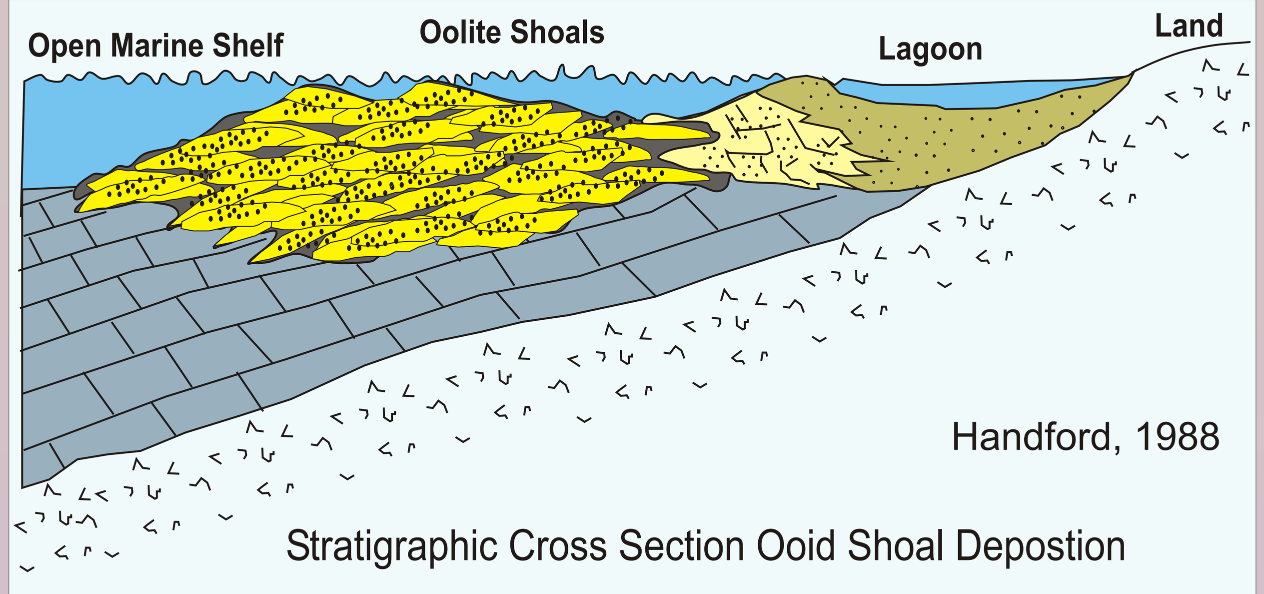
Southwest Kansas Stratigraphy



The St. Louis Formation comprises approximately 200 feet of the Mississippian section in the Hugoton Embayment. This formation thickens southward and is erosionally truncated across the Las Animas Arch and Central Kansas uplift. The St. Louis Formation consists of skeletal and oolitic limestone, peloidal limestone, dolomite and anhydrite. Oil are produced from three producing zones (A, B, C zone) formed of skeletal oolitic limestone.

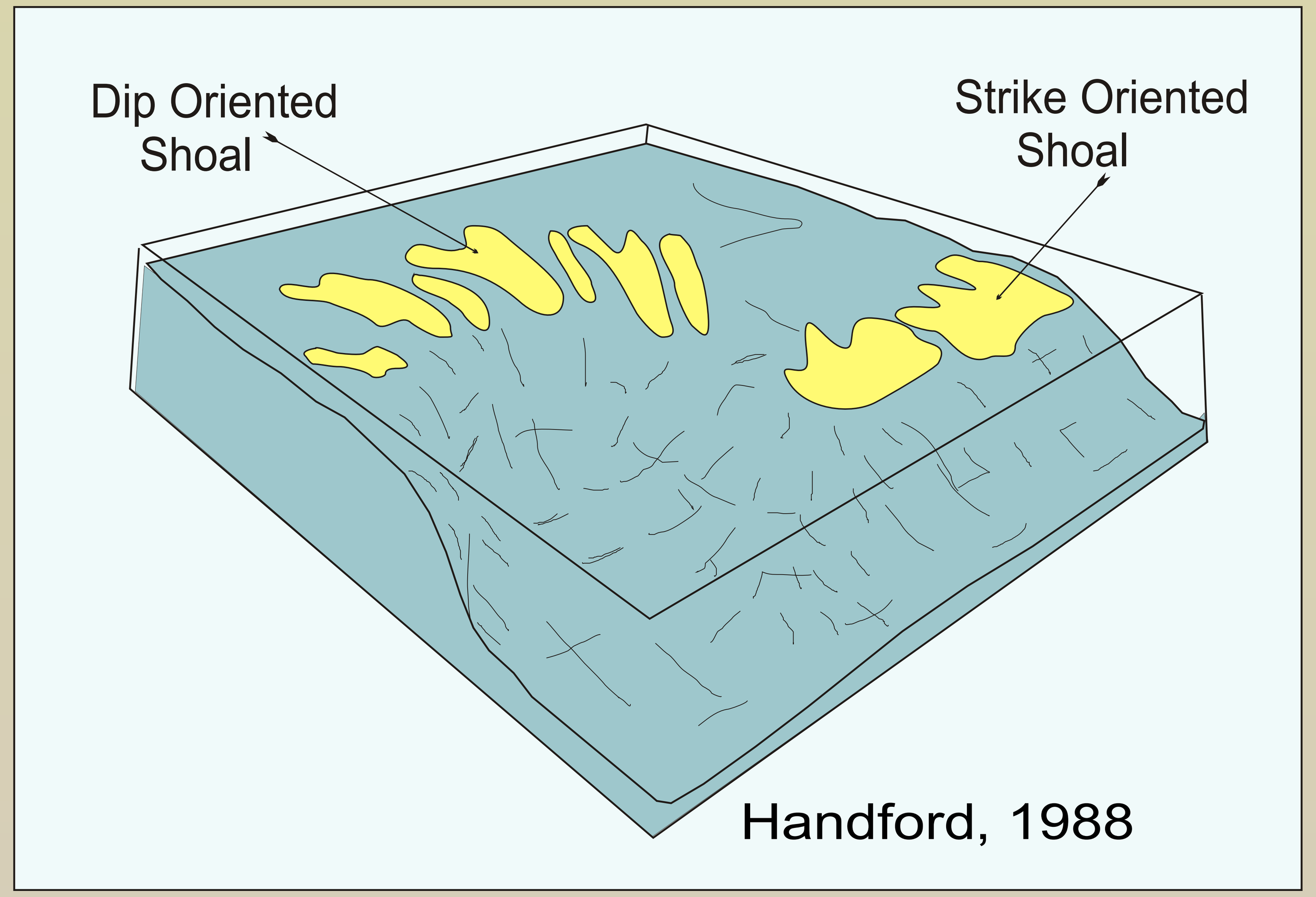


Schematic Illustration of depositional environment of Mississippian Oolite shoals

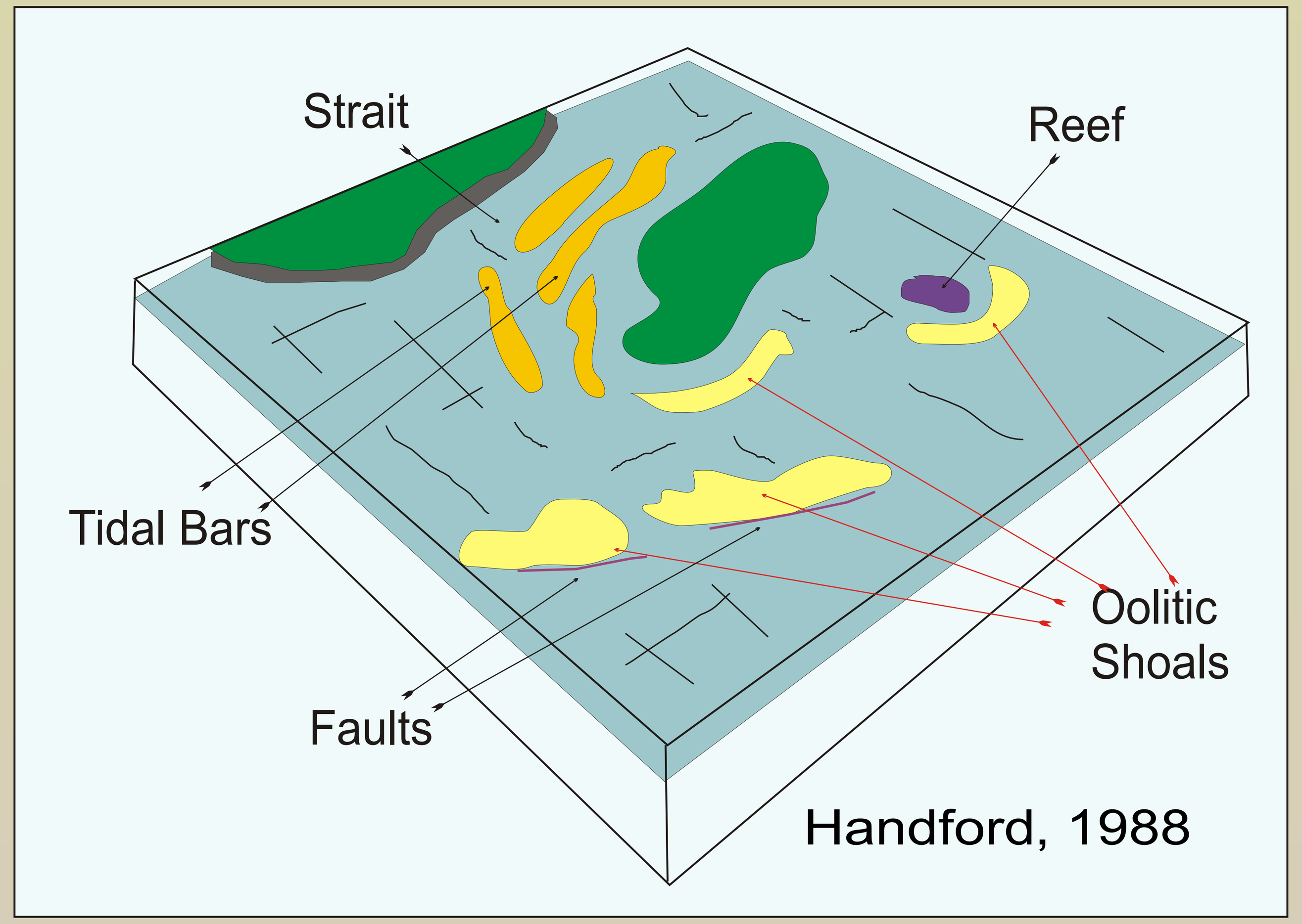


Stratigraphic Cross Section Ooid Shoal Depostion

Rimmed Shelf Area

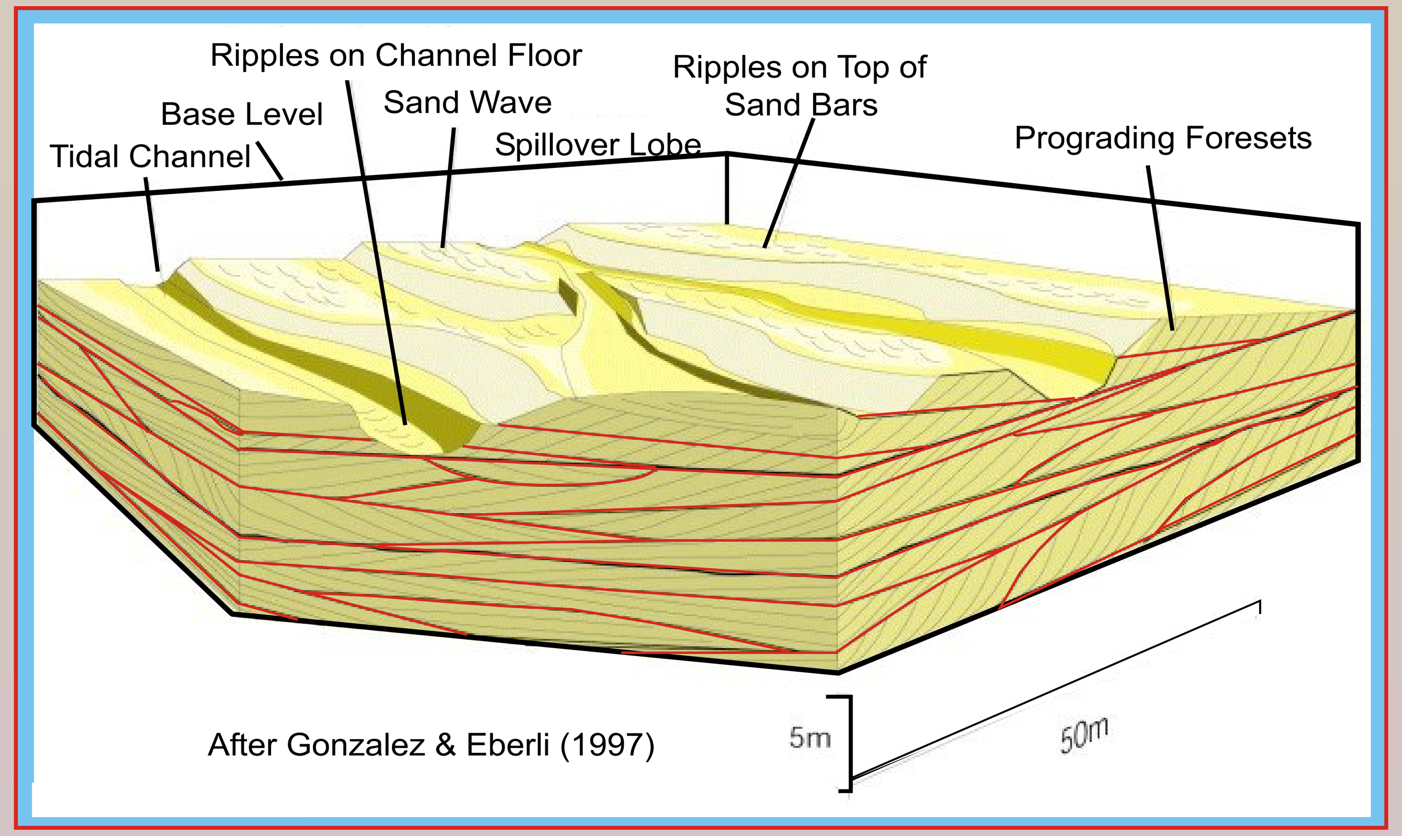


Shelf Deposition



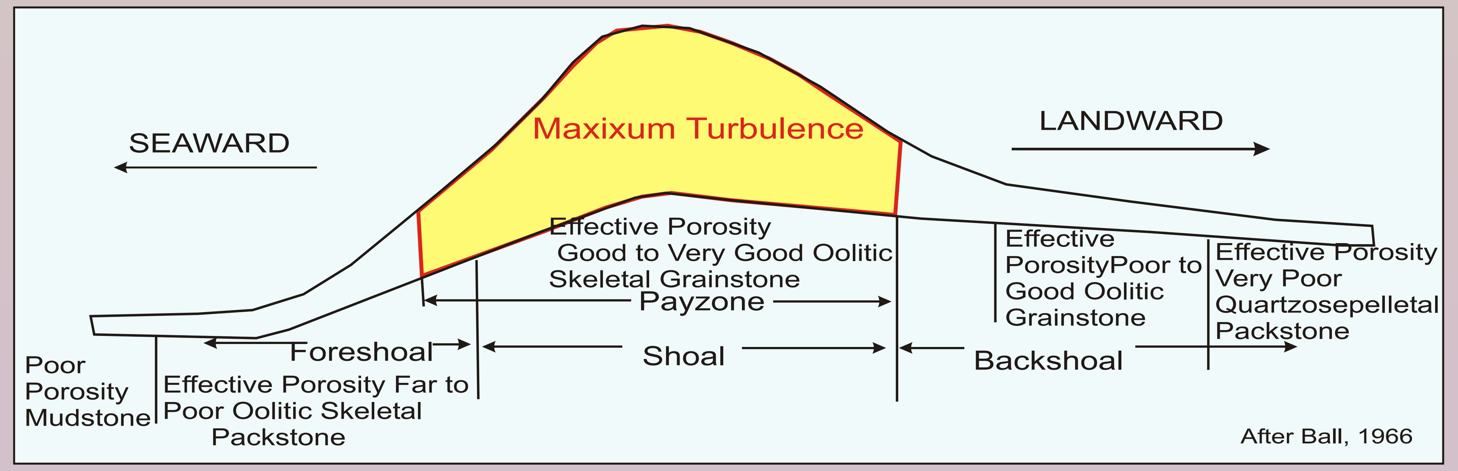
Many St. Louis oolite shoals have been deposited as linear-ramp, barrier-type shoals trending southwest of, and parallel to, a norhtwest-southeast shoreline flanking the Central Kansas Uplift. Other St. Louis oolite shoals have been interpreted as platform shoals that have local variations of deposition on sea-floor highs and near islands.

Internal Conceptual Model



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 current. Oolite shoals can amalgamate and form an oolite shoal complex.

Transverse View of An Oolitic Shoal



Complexity of Oolite Shoals