DEPOSITION AND DIAGENESIS OF A PETTET RESERVOIR AT LISBON FIELD, CLAIBORNE PARISH, LOUISIANA

James P. Ford[1] and Wayne M. Ahr[1]

ABSTRACT

Rocks of the Pettet Zone at Lisbon Field consist of three shoaling upwards oolite cycles that were deposited over a paleotopographic high as dip trending, lenticular sand bodies.

The lower 5 feet of the ooid shoals consist of superficial ooid packstones and grainstones. These rocks are succeeded vertically by "regular" ooid packstones and grainstones. Adjacent to the shoals are marine rocks consisting of intraclast, ooid, bivalve packstones and oyster wackestones and packstones. The open marine shelf downdip from the shoals and the marine lagoon updip from the shoals were blanketed by skeletal mudstones and wackestones.

Shoal deposition is interpreted to have started during periods of relative sea-level rise. The basal two oolites are capped with unconformities that marked sea-level retreats. During these retreats, the topographically high shoal areas were partially exposed as islands, and silty shales were deposited as laterally equivalent facies in a quiescent marine environment.

Diagenetic alteration began in the marine environment and continued into the subsurface. Marine diagenesis includes mainly micritization of grains in the oolites. Later, vadose and freshwater diagenesis occurred during the periods of exposure. Aragonitic allochems were selectively dissolved, and magnesian calcites were altered to low magnesium calcite. Lime mud underwent aggradational neomorphism, and columnar to blocky calcite rim cements were precipitated in the lower portions of the leached, sand buildups.

Selective dissolution of aragonite produced abundant moldic porosity in the superficial ooid packstones and grainstones where the majority of the ooid nuclei were composed of mollusk fragments. In contrast, many ooid corticies around the moldic voids were preserved, suggesting that the corticies were of a different mineralogy—probably Mg-calcite.

Compaction and attendant brittle fracture are common in the moldic superficial ooid facies, but microstylolitic grain contacts mark the more resistive regular ooid facies. Stylolitization is common in clay rich facies adjacent to the shoals. Virtually all of the diagenetic and primary porosity was partially filled by coarse calcite cement at this time.

Subsequently, minor replacement and cementation by saddle dolomite and anhydrite occurred along with late dissolution. These features are most common in the lower two oolitic zones, and they characterize the deeper subsurface environment. The late dissolution event enlarged much of the porosity that had been partially occluded by the pore-filling calcite mosaic spar. Late leaching has significantly enhanced reservoir porosity.

The reservoir at Lisbon Field consists primarily of facies selective, diagenetic porosity. Exploration and development in similar situations will require careful petrographic study combined with conventional stratigraphic mapping.

[1]Texas A & M University, College Station, Texas