Stratigraphic Architecture and Production Potential of the Mississippian Osagean Series of North-Central Oklahoma

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To understand the production potential of Mississippian Osagean strata of north-central Oklahoma, it is necessary to understand the environment of deposition, the stratigraphic architecture, and subsequent diagenesis. To achieve an understanding of these facets, a detailed subsurface correlation and evaluation of over 6000 electric logs was conducted. The study area was approximately 7000 square miles and included all or parts of Grant, Kay, Osage, Garfield, Noble, Alfalfa and Woods Counties, Oklahoma.

The Mississippian Osagean carbonates are areally persistent and were deposited largely as regressive sequences on a shelf edge margin setting. This resulted in a series of progradational wedges that are characterized by being distinct and correlatable units. These wedges are present from the northern edge of the study area, at the Kansas-Oklahoma border, southward to the southern extent of the study area in the central parts of Garfield and Noble Counties, Oklahoma. These wedges are interformational units that probably comprise the Osagean Reeds Spring Formation.

It is interpreted that occasional periods of lowered sea level elevations likely exposed Osagean rocks allowing diagenetic alteration to occur which developed largely lower secondary porosity zones within the wedges. A sequence bounding unconformity ensued at the top of the Reeds Spring Formation and was responsible for the subaerial exposure and additional meteoric alteration of the Osagean aged strata where development of high porosity zones at or near the unconformity surface occurred.

Transgressive Meramecian and Chesterian seas deposited a series of shales, cherty limestones and siltstones that were subsequently uplifted and eroded during post-Mississippian pre-Pennsylvanian time. Subsequent deposition of Pennsylvanian aged deposits preserved the subcrop pattern mapped today.

Matrix porosity and permeability for the Reeds Spring Formation is very low, often in the 2-5 percent range with areas that may approach 10 percent locally. Some of the higher porosity intervals remain consistent in their stratigraphic position and are mappable units within specific wedges. Fracturing is the primary permeability mechanism and may add as much as several porosity percent to the net porosity for volumetric oil in place calculations.