Red Fork Sandstone of Oklahoma: Depositional History, Sequence Stratigraphy and Reservoir Distribution

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The Middle Pennsylvanian Red Fork Sandstone formed as a result of progradation across eastern Kansas and most of Oklahoma. It is one of several transgressive-regressive sequences (cyclothems) developed within the Desmoinesian "Cherokee" Group. Sea-level changes together with varying subsidence were dominant factors controlling the general stratigraphic (correlative) characteristics of the Red Fork interval. Progradation was episodic with sand deposition in the more active part of the basin during lower sea-level stands and valley-fill deposition in the more stable areas during sea-level rises.

The Red Fork was correlated, subdivided and mapped using data from more than 27,000 wells. Maps of Red Fork sand trends reveal a fluvial-deltaic complex covering most of Oklahoma. The Red Fork consists primarily of undifferentiated alluvial-valley and plain (fluvial) bodies in the northernmost part of Oklahoma, fluvial-deltaic bodies in most of the remaining parts of shelf area and off-shelf submarine-fan and slope-basinal floor complexes within the deeper part of the Anadarko Basin. The basinal facies can also be interpreted as low-stand deltaic deposits.

The Red Fork appears to represent one Vail-type third-order sequence. It can be divided into at least three parasequences which for the purpose of this study are called upper, middle and lower. Each parasequence represents a transgressive-regressive episode often separated by thin regional limestones or shale markers. Correlation of these parasequences is relatively easy from the lower shelf to the basin, and more difficult on the upper shelf.

The provenance for the Red Fork was most likely an extensive drainage system to the north and northeast of Oklahoma. This drainage system probably extended as far as the Canadian Shield or even Greenland and appears to be subparallel to the Midcontinent Rift. A secondary source for the Red Fork was the Wichita-Amarillo Mountains in the south.

Much of the oil and gas has been trapped in stratigraphic traps, and a significant amount of oil is in channel sandstones and trends at high angles to the structural grain. The Cherokita-Wakita Trend, South Thomas Field, East Clinton Field and Strong City Field represent excellent examples of facies and reservoir development controlled by facies distribution and related diagenesis.