Regional Stratigraphy and Organic Richness of the Mississippian Meramec and Associated Strata, Anadarko Basin, Central Oklahoma

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ABSTRACT

The Mississippian Meramec Series and laterally equivalent units of the Caney and Sycamore formations of central and south-central Oklahoma vary considerably, but generally consist of a succession of interbedded quartz-rich calcareous siltstones, argillaceous siltstones, and organicrich mudstones that form premier unconventional reservoirs. Core, well-log, and outcrop data are integrated to develop a regional stratigraphic framework, characterize the depositional environment, and map the distribution of organic-rich facies.

The Meramec can be divided into seven sequence-stratigraphic zones that form shallowing upward cycles that are commonly capped by marine-flooding surfaces. The Sycamore is divided into 6 zones and was most likely deposited as turbidite flows with infrequent reworking by storm events. Surface to subsurface correlation reveals the uppermost Sycamore in the Arbuckle Mountains near Springer, Oklahoma, is correlative with the lowermost Meramec in Blaine County, and the upper Meramec is correlative with the “Ahloso Member” of the lower Caney Shale. The Meramec is a predominantly siliciclastic system believed to represent silt deposited in lower shoreface to offshore depositional environments variably within or below storm wave base and reworked by a variety of processes including tides, storms, and bottom currents. Three-dimensional shale volume and porosity models show the stratigraphic variability of petrophysical properties within the Meramec that are associated with transgressive zones that are richer in shale and exhibit higher porosity than regressive zones.

Δlog R-derived estimates of TOC show a basinward increase in TOC to the southeast.

TOC values north of the border between Canadian and Grady counties are typically <1 %, but TOC values to the south range from 0 to 8% with source-rock (TOC > 2%) thickness as high as 317 ft (97 m). High TOC corresponds to the early phases of the Laurentia-Gondwana plate collision that resulted in a rapidly-subsiding, restricted basin with anoxic bottom waters. Discrete source beds observed in the up-dip ramp setting correlate with flooding surfaces of the Meramec sequence-stratigraphic framework and most likely developed from upwelling nutrient-rich, anoxic waters.

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