Integrated Petrological Characterization of Missourian Series Sandstones, Anadarko Basin: Examples from 2 Hogshooter Wells, Texas & Oklahoma

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ABSTRACT

Diagenesis can either destroy, preserve or create reservoir rocks in the subsurface. The Hogshooter Sandstone of the western Anadarko Basin (Wheeler County, Texas and Beckham County, Oklahoma) is an example of a very unique combination of source minerology and diagenetic processes involving high availability of carbonate and clays. This unique combination of phenomenon have not been extensively described in the literature as most available studies on Pennsylvanian sandstone petrology in the Midcontinent are limited to the eastern and central portions of the region. In this presentation we will expand our prior work on the Desmoinesian Granite Wash interval in the Western Anadarko Basin (Seyedolali et al., 2015, AAPG, Denver) into the Missourian Hogshooter Sandstone in roughly the same area. The goal is to not only to add to the general knowledge of the factors affecting Pennsylvanian sandstone reservoirs in the western Midcontinent but to define the risks that limit the extent of good to excellent reservoir occurrence.

To resolve these diagenetic relationships we performed quantitative point count, size analyses and constructed a paragenetic schema based upon petrographic, FESEM, fluid inclusion and computer image analyses of 50 thin sections across the Hogshooter in 2 cores. The results highlight carbonate as a major pore-occluding diagenetic mineral followed by quartz while in some zones, pore coating chlorite is a major contributor to porosity preservation and has created micro-porosity associated with dissolution of isolated feldspars and portions of recycled rock fragment grains. The relative location and timing of deposition appear to be the controlling factors – early deposition and closeness to source contribute a larger amount of this grain coating material and more feldspar to dissolve whereas a larger distance from the source (later deposition) deposits have fewer clays, clay coatings and feldspar.

The initial (primary) controls on reservoir quality (RQ) for Hogshooter samples are the amount and distribution of detrital clays, average grain size and grain sorting. The earliest diagenesis (mechanical compaction) is greatly influenced by these factors. The amount of early mechanical compaction set the stage for secondary controls on the RQ of these samples. These secondary controls are the result of chemical diagenesis, which include chlorite cementation, calcite cementation and alteration/replacement of matrix and grains. The initial RQ would have been best in those samples with the least amount of pore-filling detrital clay and least amount of compaction (highest IGV). Pervasive cementation by chlorite or calcite basically inverts the RQ of these samples, by most available macro pore space being filled with chlorite or calcite. Calcite cement was much more effective at reducing RQ than the detrital clay. To summarize, those samples which were initially the best RQ of this sample set (due to low detrital clay content) were changed into the worst RQ due to calcite cementation.