Preservation of Reservoir Quality by Chlorite Coats in Deep Tuscaloosa Sandstones, Central Louisiana, U.S.A.

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ABSTRACT

Thick, continuous chlorite coats on detrital grains in some Upper Cretaceous Tuscaloosa sandstones preserve porosity by inhibiting quartz cementation, but sandstones with discontinuous, incomplete chlorite coats are extensively cemented by quartz. The percentage of chlorite-coat coverage on detrital grains was quantified and compared to porosity and permeability to determine what completeness of grain coatings is necessary to reduce quartz cementation and preserve reservoir quality in hot (>275°F [>135°C]), deeply buried (>14,000 ft [>4.3 km]) Tuscaloosa sandstones in central Louisiana.

Petrographic analysis of 141 samples from central Louisiana documented composition, diagenesis, and reservoir quality in fluvial and deltaic Tuscaloosa sandstones having the same provenance. Most sandstones are sublitharenites, with an average composition of 86% quartz, 1% feldspar, and 13% rock fragments ($Q_{86}F_1R_{13}$); average grain size is upper fine grained (2.44 phi [0.184 mm]). Porosity, permeability, and chlorite-cement volume all have bimodal distributions. Twelve samples with a wide range of porosity and permeability were selected for quantification of chlorite grain-coat coverage on detrital quartz grains, measuring 50 grains per sample. Chlorite-coat coverage ranges from 29 to 95%, and chlorite-cement volume in these samples covaries from 2.5 to 10%. Significant correlations exist between chlorite-coat coverage and volume of chlorite cement, quartz cement, porosity, and permeability. Tuscaloosa sandstones with ≥80% chlorite-coat coverage (≥8% chlorite-cement volume) retain high porosity (20–29%) and permeability (10–1249 md) at temperatures of 275° to 420°F (135° to 215°C) by inhibiting quartz cementation. An estimated 25% of the Tuscaloosa sandstones in central Louisiana contain such extensive chlorite-coat coverage. Grain size and volcanic-rock-fragment content are the most important factors in determining chlorite-coat growth and reservoir quality in Tuscaloosa sandstones in central Louisiana.

Reservoir quality in Tuscaloosa sandstones is also influenced by the presence of carbonate concretions that completely occlude porosity within the cemented zones. The presence of thick, continuous chlorite coats did not inhibit later precipitation of carbonate cement. The concretions, which have an average measured thickness of 0.8 ft (0.23 m), degrade reservoir quality in 5% of the total thickness of the Tuscaloosa sand-

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