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Effects of Compositional Variations, Texture and Burial History on Composition Driven Diagenesis

Composition driven diagenesis (CDD) is a recent hypothesis that suggests a substantial portion of reservoir sandstone diagenesis is a result of an intrinsic property, the differences between the mineralogy of reservoir units and adjacent lithologies. Initial compositional disequilibrium produces solute concentration gradients during burial that serve as the primary driving forces of diffusive mass-transfer that, over geologic time, can produce significant diagenetic alteration. The basic hypothesis has been tested using the reactive-transport computer model WRIS.TEQ. Preliminary studies have shown that normal compositional variations between adjacent units can produce variations in porosity of up to ±10% during burial. The predicted mass redistribution for these models is similar to that observed in the field.

The basic hypothesis of CDD is extended to further evaluate the effects of changing burial rates, and variations in mineralogy and grain sizes (thus the surface areas) within and between units. A series of simulations were performed to test each of these variations independently.

Simulations show that the effects of compositional variation between units remain the primary driving force of mass redistribution. Changing the rate of burial can produce significantly different paragenetic histories and final reservoir porosity, but with limited changes to the mineral assemblage. These results suggest that final clastic reservoir properties are most dominantly controlled by the depositing sediment composition and stratification. The results affirm the basic hypothesis of CDD, that the complexity of stratification and burial rate are the most important factors that determine the path of sediment diagenesis.