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**Early Diagenesis and Compaction of Carbonates and Implications to Reservoir Limestone Properties: A Basin.RTM Simulation of the Florida Carbonate Platform**

Petrographic and permeability analyses of Floridan platform carbonates indicate that permeability loss occurs predominantly by mechanical compaction in mudstones, wackestones, and tidal laminites, whereas pore-filling cementation preferentially affects packstones and grainstones. Basin.RTM simulations were performed to characterize these permeability-reduction mechanisms. Of particular interest are interactions between RTM (Reaction-Transport-Mechanical) processes and the timing of permeability reduction. Basin.RTM's dynamic rheologic model simulates evolving sediment viscosities as functions of sediment composition and texture. The model includes kinetic water-rock interactions, pressure solution, mass-transfer and texture dynamics, and it regenerates a sediment's compaction and alteration history.

We modeled 11 bioclastic facies in three 40 my old peritidal cycles totaling 20 m in thickness, with more generalized over-and under-lying sediments. Burial and thermal histories were that of the Floridan carbonate platform. Seven carbonate phases (dolomite and 3 polymorphs each of calcite and aragonite) were used to characterize the sediments. Simulations included influx of sea-and fresh-water of varying duration and quantity.

Results indicate early disappearance of aragonites, rapid early compaction of fine-grained sediments, slower compaction of coarser-grained sediments, cementation of pores with low-Mg calcites, and low-Mg calcite replacement of high-Mg calcites. Calcite cementation and replacements depend strongly on fluid flux rates. The simulations indicate that significant compaction and cementation occur within the first 6 my of the burial history (i.e., to < 350 ft of burial); the ensuing 34 my produce less porosity and permeability alteration. This is consistent with petrographic results that suggest limestone reservoir potential is determined early in a sediment's burial history.