WHAT'S NEW IN CARBONATE DIAGENESIS: WHAT WE THOUGHT WE KNEW AND WHERE WE'RE GOING

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Porosity prediction remains a fundamental challenge in carbonate reservoir work – one in which we still must learn what rules apply for making predictions with accuracy. Most researchers have been fed a steady diet of freshwater vadose, freshwater phreatic, mixing zone, and marine diagenesis at low temperature. The simplistic views of these systems have commonly held that if you get one of these salinity realms, then you get a particular diagenetic product in the rock - whether it is dissolution, cementation, or replacement. The idea that predictable salinity realms should lead to a predictable diagenetic record has been pervasive, but the rock record and modern systems tell another story that should lead us to rethink this model.

It is clear that many variables must be included in models of low-temperature meteoric systems, including fluid flow, pCO_2, degassing near the water table, mixing at the water table, microbially controlled chemistry, and rates related to unstable minerals. Much porosity and calcite cement forms in environments other than low-temperature meteoric systems, and has been ascribed inappropriately to meteoric waters. It also has become apparent that seawater can no longer be treated as a constant. Its composition has varied enough over time to yield different diagenetic reactions than modern systems. Work on mixing zones has made great progress, and is more complex than expected. Finally, those searching for reservoir porosity in carbonates may have underestimated the importance of reflux, hydrothermal systems, microbial controls on water chemistry, and direct microbial controls on nucleation and precipitation.