AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Stephen C. Ruppel, The University of Texas at Austin, Austin, TX

Patterns of Porosity Evolution in Permian Waning-Icehouse Carbonate Platform Successions

Porosity development and evolution in carbonate platform successions is the result of the interaction of depositional energy, accommodation, eustasy, climate, and diagenesis. Because these same factors control the development and character of stratigraphic sequences, porosity patterns should display characteristic patterns within such sequences. Outcrop and subsurface studies of the distribution and style of porosity and permeability development in Lower Permian carbonate platform successions in the Permian Basin suggest that this is the case.

In Clear Fork Group (Leonardian) carbonate sequences, which were deposited under semi-arid, waning icehouse conditions, porosity development is directly related to accommodation and thus to position within sequences. In low accommodation, early TST and late HST deposits in fully aggraded successions, porosity is primarily developed in cycle-capping, tidal flat deposits that have undergone early diagenesis. These porous caps are commonly laterally continuous but largely impermeable because of the dominance of fenestral pores. In relatively high accommodation, late TST to early HST deposits, rocks are dominantly subtidal and porosity is characteristically a function of facies distribution. Subject to diagenetic overprint, porosity is usually best developed at high energy, grain-rich cycle tops that can also display good lateral continuity. Permeability is higher in these subtidal rocks because of the dominance of interparticle pores. Porosity, permeability, and continuity in grain-poor, typically non-capping, subtidal facies is generally lower.

An understanding of the sequence stratigraphic setting of such platform successions thus provides a critical insight into not only expected styles of porosity evolution, but more importantly into patterns of associated permeability distribution.