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Thomas C. Wynn[1], J. Fred Read[1] (1) Virginia Tech, Blacksburg, VA

High-resolution Sequence Stratigraphic Model for Transition from Greenhouse to Ice-House Conditions of a Carboniferous Ramp, West Virginia, USA

The 50 to 500m thick mixed carbonate-siliciclastic Mississippian Greenbrier Group of West Virginia which formed on the Appalachian foreland provides an outcrop and subsurface analog to better understand Mississippian reservoir stacking patterns and the stratigraphic signatures of global greenhouse to icehouse conditions. We are generating a high-resolution sequence stratigraphic framework for the Greenbrier Group throughout the subsurface in West Virginia, using well data. A series of detailed regional cross-sections and isopachs of time slices are being prepared to better understand the transition from greenhouse to global ice-house conditions and what effect this had on reservoir development. Thickness trends strongly reflect tectonically induced basinal subsidence. The ramp margin in the vicinity of the basinal hinge line separates the relatively stable up-dip sections from the faster subsiding basin and localized high-energy grainstone trends, as did subtle tectonic highs. Subsidence rates in the up-dip and downdip areas differ by an order of magnitude, yet the eustatic signal, was the dominant cause of the 3rd order sequences and component 4th order sequences and can be traced into the Illinois Basin. The extremely complex sequence stratigraphy on the platform, suggests a complex history of relative sea level change. This complex sea-level history has caused the rapid lateral facies heterogeneity on the platform. Three-D mapping of the sequence stratigraphic time slices showing the thickness variation and distribution of environmentally sensitive facies is the only way to track the complex influence of tectonics and eustasy and their effects on the stacking patterns of reservoirs on the platforms.