

(low gamma ray response) to spiky, transgressive carbonates (high gamma ray response). By tying the wells to the 3-D seismic with velocity surveys, the true geometry of the 144 m.y. terminal progradational ramp sequence is defined. Down dip from the terminal ramp margin of the underlying second-order HST, 2-3 basinally restricted reef cycles are recognized within older, larger down dip pinnacle reefs which were in a mid-slope position. These basinally restricted reef cycles record the initial floodback following the 144 m.y. relative sea-level drop and they have no equivalent ramp carbonate on the shelf, which may have been subaerially exposed.

Updip from the terminal ramp margin, above the 144 m.y. horizon, the second-order TST of SS2 (Haynesville/Cotton Valley lime carbonate shoal-pinnacle reef facies) consists of 4-5 regionally correlative third-order ramp sequences and 4-5 pinnacle reef cycles, each 50-150 ft thick, lasting 1 m.y. Pinnacle reef cycles are detached in plan view from the ramp cycles, yet linked in accommodation space and time. Ramp sequences systematically stack in a retrogradational or aggradational fashion, whereas individual pinnacle reefs progressively decrease in diameter as they aggraded vertically. Each ramp sequence consisted of an updip, proximal evaporite-red bed facies, a ramp-margin oolite shoal belt (traditional Haynesville reservoirs), and an outer ramp slope composed of muddy, argillaceous carbonate. During the second-order regional transgression (TST of SS2) older pinnacle reefs, over 1300 ft thick, grew in progressively deeper water and were eventually stranded down dip, passing updip to younger pinnacles, typically less than 300-500 ft thick, which grew in

successively more landward positions. Younger pinnacles are missing the earlier reef cycles, are not as tall, and are enriched in shallower-water facies as compared to their older, down dip counterparts.

Through high-resolution correlation of ramp sequences with reef cycles, guided by integrated seismic and well log control, updip oolite shoal regional porosity can be correlated directly with time-equivalent pinnacle reef reservoirs, casting light on porosity distribution as well as mechanisms for porosity development within the East Texas salt basin. The top of the Cotton Valley lime/Haynesville carbonate is a diachronous surface characterized by appreciable depositional topography, overlapped by the Bossier shale along a well-documented submarine condensed section. Little evidence exists for a relative sea-level drop at this surface.

A high-resolution sequence stratigraphic model which summarizes the Smackover-Buckner-Cotton Valley Lime/Haynesville (Lou-Ark) stratigraphy is presented in Figures 1 and 2. Figure 2 depicts the accommodation history over the temporal interval of concern. In this model, composite accommodation changes are

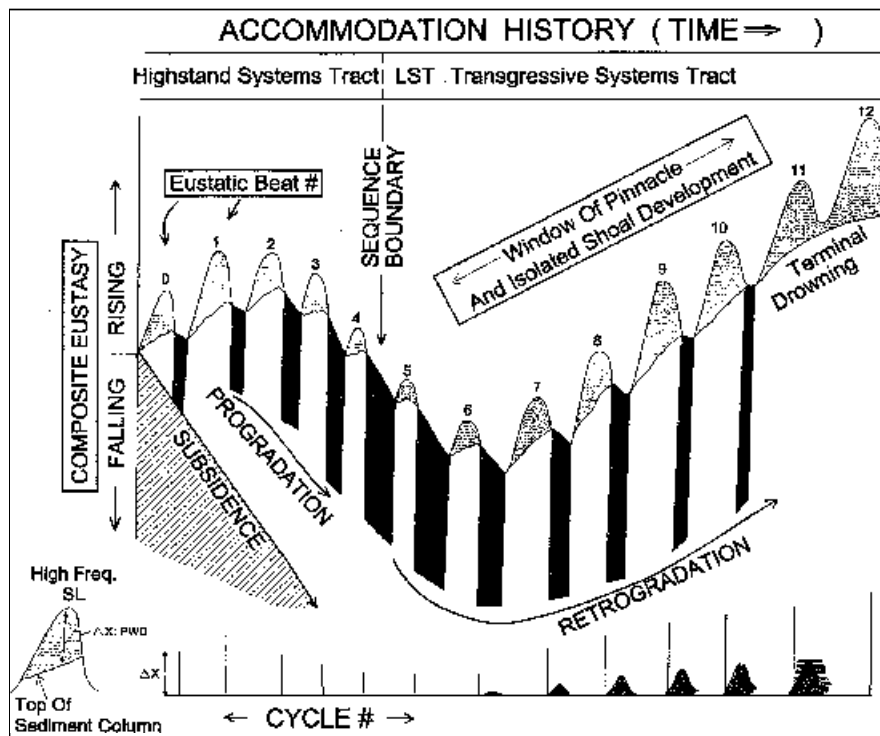


Figure 2: Composite accommodation model proposed for Lou-Ark stratigraphy.

produced by superimposing high-frequency 4th-3rd-order relative sea-level changes and lower frequency 2nd-order relative sea-level changes on background, regional tectonic, subsidence. The horizontal axis (Figure 2) represents time moving forward from left to right. The vertical axis depicts changes in sea level. The timing of second-order systems tracts are shown at the top of the diagram. Each high-frequency eustatic cycle (eustatic beat) is numbered from 0 to 12. As each beat floods the ramp top, sedimentation takes place (light gray stipple beneath the high-frequency sea-level curve

in Figure 2; "PWD" refers to paleo-water depth and delta X shows changes in PWD). During high-frequency submergence, the top of the sediment surface climbs from lower left to upper right in the diagram. When high-frequency sea level falls beneath the ramp top (times depicted by darker vertical shading), marine sedimentation ceases.

Due to the effects of composite eustasy, the proportion of marine submergence and concomitant sedimentation to exposure and non-deposition per high-frequency beat varies systematically as the beats migrate through the lower-frequency 2nd-order eustatic cycles. These systematic and sequential changes in accommodation space during eustatic beats result in a predictable stacking architecture of high-frequency stratigraphic cycles. Eustatic beats 0-4 are within the 2nd-order highstand systems tract, and each eustatic beat is capable of generating one stratigraphic cycle.

During the 2nd-order HST, accommodation is progressively declining and submergence-prone eustatic beats pass into exposure-prone eustatic beats. Thus, ramp cycles 1-4 thin upward and prograde laterally into the basin. Each ramp cycle has an updip evaporite