Transition from Paleosols in the Cenomanian Woodbine Group to Carbonates in the Coniacian Lower Austin Chalk in East Texas Field: An Example of a Compressed Transgressive Succession from Subaerial Processes to Deepwater Deposition

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ABSTRACT

Cores in East Texas Field and adjacent areas in the East Texas Basin illustrate significant lithologic and facies variability above and below a regional, angular unconformity at the base of the Austin Chalk. Paleosols in the Woodbine Group below the unconformity record long-lived periods (at least 6 million years [Myr]) of subaerial exposure of delta-plain environments. The Woodbine sedimentary fabric below the unconformity is significantly modified by insect burrows and root traces, as well as by diagenetic clays. These paleosols throughout East Texas Field and adjacent areas suggest that subaerial environments in the Woodbine Group were more regionally extensive and persistent through time than previously documented.

Regional inundation and marine reworking of the Woodbine Group is represented by a basal (1 to 3 ft [0.3 to 0.9 m]) section of upward-fining, mixed clastics and carbonates with rip-up clasts, shell debris, and marine trace fossils. This basal section is overlain by deeper water (shelf), low-permeability chalk deposits that form a regional seal over the Woodbine succession. Over a span of less than 3 ft (<0.9 m) of preserved stratigraphy, Lower Austin Chalk strata display a change from a subaerial exposed system to one containing marine sediments deposited at 300 ft (91.5 m) depths or deeper. When relative sea level started to rise over the exposed Woodbine floodplain, the initial depositional environment was a shallow-marine system, with remnants of shallower water fauna (oysters and echinoderms), detrital chert and phosphate, and abundant reworked silt and sand from the Woodbine Group. However, original shallow-water sediments were subsequently reworked into deeper water (shelf) sediments. As transgression continued, Austin Chalk marine depositional environments became

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deeper and biota became exclusively deepwater in origin, with coccolithophore fragments, planktic foraminifers, and inoceramid clams. This stratigraphic section is an excellent example of deeper water sediments deposited over a subaerial exposure surface during a regionally extensive sea-level rise coupled with decreased accommodation during progressive rise of the tectonically active Sabine Uplift. This resulted in little evidence of intervening shallower water depositional processes.

Results from this study have implications for future exploration and development for oil and gas in the Woodbine Group in the East Texas Basin. Woodbine sandstones of shallow-marine origin may exist between the Woodbine paleosol succession and the base-of-Austin-Chalk unconformity where greater accommodation may have occurred in areas away from the Sabine Uplift. In addition, complex sedimentary fabrics and fine-grained, silty mudstones and clays in Woodbine paleosols may contribute locally to the main seal (base-of-Austin Chalk unconformity) in East Texas Field and adjacent areas in the East Texas Basin.

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