Insights into Early Reservoir Development of the Upper Cretaceous Eagle Ford Group and Pepper Shale from Observations of the USGS Gulf Coast #1 West Woodway Low-R_o Research Core in McLennan County, Central Texas

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ABSTRACT

To understand reservoir diagenesis and pore-network development in unconventional reservoirs, early (shallow burial and low R_o) processes affecting the host rock must be documented before later (deeper burial and higher R_o) processes can be analyzed. For the Eagle Ford and underlying Pepper Shales in East Texas, the USGS Gulf Coast #1 West Woodway research core (present-day depth 150 to 400 ft) can be used to document early mineral and organic-matter diagenetic processes. Burial history suggests the core was buried between 2000 and 4000 ft and measured R_o is 0.30% to 0.31%.

Eagle Ford and Pepper Shales were deposited on the drowned Lower Cretaceous paleoshelf below storm-wave base. Most biota lived in the shallow-water column including coccolithophores and planktic foraminifers. The Pepper Shale is a noncalcareous argillaceous mudstone and the Eagle Ford is a chalky marl to a chalky argillaceous mudstone. Elevated TOC (1.56 to 7.00 wt. %) suggests anaerobic conditions.

Several observations can be made relative to low-temperature (<130°F) diagenesis. Extensive compaction occurred during early stages of diagenesis. Clay platelets were aligned and bent around more rigid grains. Authigenic calcite, pyrite, and kaolinite precipitated within foraminifer chambers and occluded the minor amount of macropores present. Some ductile kerogen was deformed during compacted against rigid grains, however some kerogen still retained its original particulate shape. Organic matter shows

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both original inherited pores related to marine algal material and thermal maturation pores related to thermal stress.

The pore network is composed of (1) interparticle pores predominantly preserved between clay platelets and between coccolith elements within the matrix, (2) intraparticle pores within clay platelets, foraminifer chambers, coccolith spines, and pyrite framboids, (3) inherited OM pores in composite granular OM particles. Other OM pores appear to be spongy pores that are commonly associated with thermal maturation.