

Proximal to Distal Expression of Carbonate - Mudrock Rhythmites of the Lower Permian Lueders Limestone, Texas: Record of High-Frequency Climate Change on the Eastern Shelf, Midland Basin

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The Lower Permian Lueders Limestone represents the maximum marine onlap of the Upper Wolfcampian - Leonardian supersequence on the Eastern Shelf of the Midland Basin. Meter scale, carbonate - mudrock couplets, or rhythmites, are the fundamental stratal motif of the Lueders in both distal, shallow platform locations of north-central Texas and in proximal coastal settings at the highstand lapout of far north Texas. Differential stacking of these rhythmites defines parasequence sets and systems tracts of the Lueders, therefore interpreting the nature of these mixed lithology rhythmites is critical for understanding the sequence stratigraphy of the Lueders and has important implications for climate dynamics of the Midland Basin Permian.

Distal rhythmites are dominated by thin to thick - bedded limestones with thin to very thin - bedded fissile to platy mudstone interbeds. Limestones are mollusk - dominated grainstone and packstone with pervasive bioturbation. Mudstones are carbonaceous and contain a generally sparse fauna, although vertebrate material and ostracodes can be common.

Proximal rhythmites are dominated by medium to thick - bedded mudstones with thin to very thin - bedded carbonates. Mudstones are gray to black, blocky to fissile with variable amounts of plant foliage and debris. Scour surfaces mantled with lag debris overlain by laminated mudrock are regularly encountered in these intervals. The associated carbonate beds are generally peloidal mudstone to wackestone with skeletal packstones. Cryptalgal laminites and laminite - clast conglomerates can be common. Fauna include vertebrates, ostracodes, serpulids, and rare mollusks.

The rhythmites appear to define discrete intervals of carbonate - dominated or mudstone - dominated deposition across the platform, here interpreted as wet-dry climate cycles. Reduced runoff during the dry phase allowed development of peri-tidal carbonates on the northern shoreline with down dip deposition of open platform bioturbated skeletal limestones. During the wet phase brackish to freshwater bays, estuaries, and low-net fluvial-tidal channels and flats replaced the peri-tidal carbonates of the north coast while down dip carbonaceous mudstones replace the open marine limestones. These thin carbonaceous mudstones (with comparatively low Th:U ratios) imply development of a freshwater plume beyond detrital input strong enough to shut down carbonate production on the platform.