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Stratigraphic Architecture of an Icehouse, Epeiric Platform: Climatic and Eustatic Influences in the Pennsylvanian-Permian Succession of the Midcontinent

The Late Pennsylvanian to Early Permian succession of the North American Midcontinent (upper Wabaunsee, Admire, and lower Council Grove Groups in Kansas and Nebraska) records a hierarchy of high-frequency, high-amplitude stratigraphic cycles reflecting changes in both sea level and climate. Based on detailed outcrop and core study, 51 meter-scale cycles bounded by subaerial unconformities have been recognized. The lowstand systems tracts of these very thin depositional sequences are preserved as filled valleys in nearshore settings. The transgressive systems tracts, dominated by carbonate deposition in both nearshore and offshore settings, include peritidal evaporites, indicating relatively arid climatic conditions. The highstand systems tracts, dominated by siliciclastic deposition in both nearshore and offshore settings, include thin but persistent coals within deltaic coastal successions, indicating relatively humid climatic conditions. Paleosols at cycle boundaries record evolution from relatively humid to relatively arid conditions during subaerial exposure. The meter-scale cycles in the study interval can be correlated over the 300 km length of the outcrop belt and stack into 5 deepening-shallowing composite sequences, each bounded by previously unrecognized angular unconformities. This stratigraphic framework predicts the vertical succession of alternating carbonate and siliciclastic facies at the meter scale, which is a fundamental control on reservoir heterogeneity and continuity in this interval. In addition, it predicts the distribution and relative duration of stratigraphic gaps at the meter scale providing previously unavailable resolution for correlation on the platform. Cyclicity of this type may be a common trait of icehouse platforms that experienced high-frequency, high-amplitude changes in climate and sea level.