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Carbonate Response to Changing Base Level: Case Histories and Comparisons from the Permian of West Texas and the Jurassic of Saudi Arabia

The character of the late Permian shelf carbonate sediments of the Delaware Basin and the late Jurassic Arabian shelf reflect their tectonic setting, eustatic sea level position and rates of sediment accumulation. In both areas sedimentary fill has a widespread correlative cyclic character, confirming the uniformity of the controls on sediment accumulation. There is no doubt that in both regions accommodation of the sediment fill is the product of a combination continuous low frequency tectonic subsidence (with a few not unexpected local variations) punctuated by higher frequency eustatic signals caused by climatic variation driven by the orbital variations of Milankovitch. Local changes in rates of carbonate sedimentation can be related to water depth, nutrient and oxygen content, climate, clastic input and salinity. Many of the carbonate cycles of both regions are often incomplete, and deeper water carbonates alternate with shallow water ones with no accompanying carbonate fill from a tidal flat setting. These cycles are commonly marked by hardground development explainable as the product of ravinement in the photic zone with surprisingly little diagenetic evidence of subaerial exposure. The sequence stratigraphic framework suggests that deposition over thousands of years was interposed with much longer periods of exposure above sea level. We explain this paradox of long periods of exposure with little evidence of diagenesis by proposing that areas of high stand carbonate accumulation are protected from lowstand diagenesis by a lack of influxing freshwater and a consequent lack of karstification.