Orbitally Driven Sequence Development of Permo-Triassic Upper Khuff Carbonates in Saudi Arabia

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Abstract

Upper Khuff Formation cores from wells were logged to form a sequence stratigraphic framework. The lithofacies include: paleosol breccias, subaqueous-and supratidal anhydrite, tidal flat laminites, lagoonal mudstone, ooid-peloid grainstone, and subtidal fore-shoal open marine mudstone. Third order sequences include the Late Permian Changhsingian Khuff, and the Early Triassic Induan Khuff sequences, which were correlated with global sea-level cycles. Seven high frequency sequences (HFSs) make up the Changhsingian interval and comprise five (~400 k.y.) sequences. Eight HFSs in the Early Triassic Khuff comprise four (~400 k.y.) sequences. Component parasequences are dominantly precession in the Changhsingian and lower Induan intervals and obliquity in the upper Induan section. Across the Permo-Triassic boundary, the mass extinction is marked by a major decrease in biotic groups followed by development of subtidal thrombolites, and increased microbial presence due to decreased bioskeletonization. Progradation direction trends in HFSs were due to subtle interplay between the local structural elements and regional paleoslope. Thin anhydrites in the Changhsingian Khuff occur near the base of the unit. Thick anhydrites in the Triassic Khuff HFSs include both transgressive and highstand deposits. The study provides a better understanding of the controls on porosity preservation associated with anhydrite plugging in the oolitic facies, associated with distance or proximity to evaporitic salinas and tidal flats.