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New Insights about the Lithostratigraphy of the Early Syn-Rift Sequence, Red Sea, Saudi Arabia

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ABSTRACT

A complex structural and stratigraphic history evolved in the Red Sea with rift initiation in an intra-continental setting. In the Oligocene-Early Miocene an extensional regime initiated which resulted in anti-clockwise rotation of the Arabian Plate away from Africa in a N55°-65°E direction. This extensional regime switched to a left-lateral transtensional setting during Late Miocene resulting in a N10°-15°E movement along the Aqaba Fault Zone. Variable lithostratigraphic architectures were recently recorded in the onshore and offshore of the Red Sea, Saudi Arabia in addition to what was previously described by Hughes et al, 2005. Along with this an integrated borehole data and seismic study was utilized to characterize this Early synrift sequence and tectonostratigraphic history. The Early Synrift sequence is described in a wedge-shaped architecture which unconformably overlies the Cretaceous and the Precambrian crystalline basement and unconformably underlies a transgressional sequence which consists of marine mudstones, sandstone, carbonates and evaporites of the Maqna Group. An Early Miocene succession in the subsurface is called the Wajh-Burqan and is a retrogradional clastic sediment which filling half-graben sub-basins bounded by rift shoulder faults. This is a major stratigraphic development across the rift margin faults with internal erosional surfaces in uplifted footwall blocks. The Al Wajh Formation is the first undisputed stratigraphic evidence of rifting in the Red Sea. It is poorly age-constrained and the succession mainly consists of fluvial conglomerates and sandstones. Overlying the Al Wajh is a better age-controlled succession of the Burqan Formation and is characterized by gradually fining upwards marine shales which changes distally into shelf carbonates. Deep-marine turbidite sandstones occur within these shales. These facies changes are related to fault block rotations and subsidence-induced transgressions primarily controlled by the rifting tectonics. The sand fairways controlled by these fault systems impacted the distribution of potential hydrocarbon reservoirs.