High Resolution Reservoir Correlation – an Integrated Approach with Sequence Stratigraphy, Geochemical and Biostratigraphical Studies of the Permo-Triassic Transition within the Khuff (Dalan/Kangan) Formation

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The Khuff Formation (Dalan/Kangan) is one of the most important reservoir formations in the Middle East Gulf region and contains some of the world's biggest gas reserves. The Upper Khuff formation can be simply subdivided into four major reservoir units from K4 to K1 (from base up), with the K4 and K3 generally regarded as Permian, whilst the K2 and K1 considered Triassic. However the precise nature of the K3 – K2 reservoir transition, and thus the Permo-Triassic boundary, has always been problematic with many interpretations being put forward. Among the different proposed scenarios, some models suggest a major sequence boundary at the top of the K3 (Top Permian), and a significant stratigraphic time gap between the Permian and the Triassic. Other models suggest no major sequence boundary at the top of the Permian and a continuous transgression with no major sedimentation break. These different models have a major impact on the correlation strategy of the K2 reservoir interval at both reservoir and Gulf scale. In order to resolve these issues a detailed multidisciplinary study has been launched on a large Gulf-scale database (subsurface and outcrop) examining the details of the Permo-Triassic boundary and the K3 – K2 reservoir transition. This study integrates at high resolution: (1) sedimentology, (2) sequence stratigraphy, (3) geochemistry, (4) biostratigraphy, and (5) wireline log interpretations. The implication of the results were tested on the correlation of the K3 and K2 reservoirs between a number of fields in the Gulf. The resulting models reconcile the sedimentological, stratigraphic, palaeoecological, geochemical and petrophysical data for this K3 – K2 transition. Moreover the study illustrates that over-relying on a single discipline (e.g. sequence stratigraphy or biostratigraphy) no matter how "convincing" the data may appear, can lead to miscorrelation of reservoir units.