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Integration of Core and Wire-Line Logs to Generate a High Resolution Sequence Stratigraphic Framework for the Permo-Triassic Khuff A, B & C Carbonate Reservoirs, Ghawar Field, Saudi Arabia

Over 15,000 feet (5000 meters) of core and wire line log data in 200 closely spaced (cored and un-cored) wells are the basis for mapping high resolution (fourth order?) sequences, their TST, HST, and component cycle-sets, in the major Khuff A, B, and C carbonate reservoirs in central and southern Ghawar, Saudi Arabia. The Khuff Formation overlies Permo-Carboniferous siliciclastics, is overlain by Triassic fine siliciclastics, and the Khuff Formation at Ghawar Field contains three of the largest non-associated gas reservoirs in Saudi Arabia.

The Khuff C carbonates hold within it two, reservoir bearing high resolution sequences; whereas the Khuff A and B Carbonates are each made up of one reservoir bearing, high resolution sequence. Khuff C, B, and A (in stratigraphical order) formed during longer term transgressive phases of lower (3rd/2nd) order sequences, where sub-tidal, high-energy, and open marine facies, overprinted by early diagenetic features formed high porosity reservoir compartments. Non-reservoir anhydritic/dolomitic carbonate coastal successions formed thick, non-reservoir intervals between Khuff C & B, and Khuff B & A, during longer-term (3rd/2nd) order HST (?), overprinted by extreme inland climatic aridity, coincident with the assemblage of the super-continent Pangea.

Glacio-eustatically driven, regionally mappable, high-resolution sequences controlled the vertical partitioning of reservoir facies within Khuff C, B, and A carbonates. The active Ghawar structure during the Permian lead to lateral partitioning of these facies from proximal on the crest to distal on the flanks. Furthermore, subtle highs and saddles along the crest accentuated lateral partitioning of the reservoir. Reservoir facies formed during the late TST and HST of each high resolution sequence.