
"Layer-cake" Gas Reservoirs in Triassic Carbonates of the Netherlands: Understanding an Analog for the Khuff of Arabia

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Muschelkalk dolomites are currently producing gas in the Dutch De Wijk field. This study aims to evaluate the depositional factors controlling the development of this particular type of "layer-cake" reservoir, which shows many similarities to the Khuff on the Arabian Platform, including (super)giant fields in Saudi Arabia and Qatar: 1) Geotectonic and climatic setting: characterized by overall low subsidence, very low but extensive depositional gradient and very low accommodation potential developed during a phase with semi-arid climate and high frequency, low amplitude sea level changes. 2) Depositional processes and model: mud-dominated carbonates were deposited on an extensive storm-dominated epeiric carbonate ramp. Higher energy mid ramp environments include thin, shoreline-detached and patchily developed carbonate sheet sands. Depositional units show very subtle lateral facies transitions and are laterally continuous for at least many tens to hundreds of kilometres. 3) Reservoir facies: The best reservoir facies is recognised in distal inner ramp laminated dolo-mudstones (permeability up to 32 mD). The reservoir quality of dolo-mudstones decreases markedly in landward and seaward direction from the inner ramp. 4) Sequence stratigraphy and reservoir architecture: the aggradational stacking of relatively thin (decimetre- to metre-thick) reservoirs can be explained by a four-fold hierarchy of depositional cycles. This leads to the "layer-cake" seismic pattern commonly recognized in epeiric settings. However, very low-angle depositional shingles are inferred on the subseismic scale. 5) Paleogeography and reservoir distribution: Patches of reservoir facies are frequently located above paleohighs. Their lateral extent may be detected with seismic data. These insights may aid reservoir prediction and characterisation during exploration and development of the Khuff in the Middle East.
