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## Outcrop Study Combined with 3-D Petrel Modeling of a Khuff Reservoir Analog: Insights into "Layer-Cake" Stratigraphy

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In the framework of a joint ENI E&P – University research consortium, Triassic Muschelkalk carbonates in the South-German Basin were studied as an analog to the “layer-cake” type Khuff reservoir system in the Middle East. Similar to the Khuff, Muschelkalk carbonates were deposited in an epicontinental, very gently inclined carbonate ramp; reservoir facies consist of skeletal and oolitic carbonate grainstones, and are organised in a pronounced hierarchy of cycles. A pilot study focussed on a paleogeographically and stratigraphically selected portion of the Muschelkalk. Previous outcrop sedimentology and correlation suggested simple layer-cake stratal patterns. However, high resolution 3-D modelling of sedimentary body geometries and spatial distribution using Petrel imposed new correlation strategies between vertical outcrop sections (pseudo-wells) and provided new insights: the apparent layer-cake stratigraphy turned out be a “pseudo-layer-cake”. While the boundaries of sedimentary cycles remain continuous over many tens of kilometres, the carbonate grainstone reservoir bodies within the cycles show various stratal architectures. In particular, considerable differences between the geometries of the sedimentary bodies during progradation and retrogradation could be demonstrated. This “pseudo-layer-cake model” might be crucial in defining typical subseismic reservoir heterogeneities of epeiric carbonate systems: continuous seismic reflectors represent major cycles (time lines), while e.g. subtle offlapping geometries of smaller-scale cycles are likely “hidden” between the reflectors, but fundamental for the assessment of the fluid flow continuity inside the reservoir itself.

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