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Carbonate Reservoir Bodies: Geometry, Poroperm and Stratigraphic Architecture of "Shoals" in Epeiric Outcrop Analogs (Muschelkalk, German Basin)

The purpose of this outcrop analog study was a detailed analysis of the architecture, high resolution sequence stratigraphy and petrophysics of shelly-oolitic reservoir bodies on a shallow carbonate ramp. The Muschelkalk represents excellent outcrop analogs for epeiric carbonate systems in the Middle East (e.g. Khuff, Hanifa, Arab reservoirs). Meter-scale transgressive-regressive units build fundamental cycles. Their stacking composes larger-scale regressive and transgressive cycles with the following general patterns: 1. Within the larger-scale regressive hemi-cycles grainstones and thus reservoir thickness and extension increase upwards. Individual reservoir bodies are up to 18 km x 8 km in extend and up to 2 m thick. 2. Reservoir quality also increases during the large-scale regression. The best reservoirs have Phi=15 % and k=82 mD in average. Two factors control the evolution of carbonate shoal-complexes with reservoir potential: A) Cyclicity, controlled by hierarchical eustatic oscillations. The best and most voluminous reservoir facies are developed during peak regression, whereby porosity is enhanced by meteoric leaching. B) Regional differential subsidence of basement blocks. Subtle paleotectonic uplift or low subsidence causes preferred accumulation of shoals on local paleohighs compared to the surroundings with higher subsidence rate. The predictive patterns and quantitative data deduced from these outcrop analog are designed for use in building static reservoir models.