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Stratigraphic Architecture of Cretaceous Platform Interior Carbonates: Impact on Flow Unit Geometry and Continuity

Platform interior carbonate deposits hold nearly 50% of the oil reserves in Oman but unfortunately the recovery efficiencies are relatively low. Proper understanding of the stratal geometries and definition of flow units within these carbonate systems is essential in order to improve production and the ultimate recovery from these rocks.

Carbonate platform interiors are often visualised as undifferentiated, extensive shallow-water areas, where carbonates accumulate by aggradation. As a result, subsurface models often assume a very simple “layer-cake” stratigraphy with laterally continuous flow units. However, a detailed seismostratigraphic study of the middle Cretaceous carbonates of the Natih Formation in Oman revealed an unexpected complex internal architecture.

The limestones of the Natih Formation form the interior part of an extensive carbonate platform that covered Oman during the Early Cretaceous. The formation consists of a number of repetitive sedimentary cycles ranging from several tens to 150 m in thickness, which are used to subdivide the formation into 7 members (“a' to “g”). Each cycle contains a thin shale unit at the base, followed by a thick deepening and shallowing-upward carbonate unit.

Within the Natih-e, which is one of the thicker members, seismic data and detailed well log correlations show the presence of clinoform complexes and intra-platform basins. Mapping of the clinoform belts and directions of progradation show that this laterally extensive carbonate member consists of a number of separate platforms (a few thousands up to 10,000 km2 wide), which merged by lateral accretion. Merging of the platforms was not always complete and in the intervening areas relict intra-platform basins developed (several hundreds up to 2,000 km2 wide) that were later filled with shales. The angles of the clinoforms vary from less than 0.5 up to 35 degrees and reflect the composition of the slope sediments.