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Sequence Stratigraphy and Reservoir Heterogeneity Related to the Mishrif Formation, Rumaila Field, Southern Iraq

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SUMMARY

The Upper Cretaceous Mishrif Formation of southern Iraq is part of a large shallow carbonate platform system developed on the Arabian plate. The carbonates are of a high economic importance since they provide the host of large hydrocarbon accumulations of the giant oil fields of southern Iraq. A series of sedimentological, diagenesis, chemo-, and biostratigraphic studies were performed and integrated in a sequence stratigraphic framework. Furthermore, first interpretation results from a 3D seismic analysis suggest lateral heterogeneities of these carbonates.

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The Mishrif carbonates over Rumaila developed on a shallow platform developed over southern Iraq with ramp-type morphologies. The Mishrif was divided into 5 third-order sequences overlaying the Rumaila Formation. The lower 3 sequences comprise the mB reservoir unit and are separated from the upper 2 sequences which form the mA by a major sequence boundary. The lower part Mishrif Formation is composed of a rudist/echinoderm shoal complex developed on top of deeper water mudstones and wackestones of the Rumaila Formation. The shoal deposits are composed of wackestones to packstones coarsening upward to echinoderm/rudist grainstones and form in places subtle progrades. The grainstones are overlain by lagoonal carbonates composed of gastropod wackestones/packstones with benthic foraminifer fining upward to lagoonal mudstones with dissolution pipes and in places karst features. These carbonates are interpreted as deposited on a broad lagoon in the lee of the platform margin. Two major platform-interior shoal trends interrupt the succession. The top of the mB is capped by several exposure surfaces in the proximal part of the platform and hardgrounds to the south.

After exposure of the platform, nodular mudstones containing planktonic foraminiferas were deposited suggesting flooding. Shallow platform carbonates with benthic foraminiferas and subsequently coral build-up established in the north of the field and are in parts overlain by tidal flat and lacustrine carbonates. To the south these pass into bioturbated and organic-rich laminated mudstones deposited in a deeper water intra-platform basin. A well-developed soil horizon in the north of the field with associated karst features marks the end of carbonate deposition of the Mishrif and marks a major regional sequence boundary.

Establishing a detailed sequence stratigraphic and depositional framework are important in understand the distribution of reservoir facies and the sweep efficiency in the reservoir. In addition, dynamic data combined with sedimentological and diagenesis analysis helped to understand where high-perm zones in the reservoir. Finally the preliminary interpretation of the 3D seismic provided new insight into the distribution of depositional elements such as tidal channels and deltas and the orientation of the main facies belts.