

Reservoir Heterogeneity of the Early Cretaceous Yamama Carbonate Formation: Impact of Depositional Facies and Diagenetic Processes in Southern Iraq

Authors : Abbas Mohammed, Felicitász Velledits

Abstract : Evaluating carbonate rocks is crucial for the petroleum industry as they often serve as major hydrocarbon reservoirs, where understanding their depositional and diagenetic characteristics directly influences exploration, production, and field development plans. The Early Cretaceous Yamama carbonates Formation in southern Iraq exhibits significant reservoir heterogeneity, influenced by its depositional facies and diagenetic processes. Detailed sedimentological investigations of drill cores and well logs have identified 14 distinct facies/microfacies within both reservoir and non-reservoir units, deposited in a shallow carbonate ramp setting. Among these, grain-supported facies such as intertidal peloidal oncoidal grain/rudstones, backshoal pelletal pack/grainstones, Lithocodium-Bacinella float/boundstones, shoal ooidal-peloidal grainstones, cortoidal-peloidal grainstones, and skeletal rudstones facies of the foreshoal display favorable reservoir quality due to preserved interparticle porosity (reaches 25%) at depths greater than 4000 m. This preservation is attributed to early diagenetic circumgranular calcite cementation and limited scattered equant and syntaxial calcite overgrowths, which protected the grains from physical compaction. In contrast, mud-supported facies such as lagoonal skeletal mud/wackestones, skeletal cortoids wacke/packstones, skeletal dasyclads wacke/packstone, middle-ramp bioturbated dolomitic wackestones, skeletal foraminiferal mud/wackestones, and outer-ramp spiculitic skeletal mud-wackestones exhibit reduced reservoir quality due to a combination of fine-grain texture, physical and chemical compaction, and substantial amounts of equant calcite cement. This cement fills interparticle and moldic pores, significantly reducing porosity and permeability in these facies. Diagenetic alterations influence the spatial variability of reservoir properties, adding complexity to hydrocarbon exploration and production in the region. Reservoir heterogeneity of the formation is attributed to depositional facies, which control the texture of the sediments, and to various types of diagenetic alterations. These findings provide valuable insights for optimizing hydrocarbon exploration and development strategies within carbonate reservoirs of the Mesopotamian Basin. Special attention should be directed to the Lithocodium-Bacinella facies build-ups and the shoal barriers grain-supported facies.

Keywords : depositional facies, grain-supported limestones, lithocodium-bacinella, reservoir heterogeneity, yamama formation

Conference Title : ICGGS 2025 : International Conference on Geology, Geotechnology and Seismology

Conference Location : Toronto, Canada

Conference Dates : June 19-20, 2025