


The Stratigraphy and Depositional Environments of the Late Jurassic Hanifa Formation along the Tuwaiq Escarpment, Saudi Arabia

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ABSTRACT

A sequence stratigraphic framework for the Hanifa Formation at its exposure in Central Arabia has never been established until now. Our study offers the first stratigraphic understanding of the Hanifa along the Tuwaiq Escarpment. It involved measuring 13 sections over a distance of 260 km and collecting 242 samples for petrographic analysis. Based on the gathered data, the Hanifa Formation has eight distinctive facies; 1) cross-bedded peloidal-skeletal grainstone, 2) cross-bedded skeletal-peloidal grainstone, 3) bioturbated foraminiferal wackestone/MDP, 4) oncolitic rudstone, 5) stromatoporoids-corals biostrome/bioherm, 6) peloidal/composite grains GDP/grainstone, 7) bioturbated spiculitic wackestone/MDP, and 8) thinly-bedded argillaceous limestone. Their vertical and lateral distribution along the exposure define their juxtaposition relationships that allowed the application of sequence stratigraphic concepts. By recognizing erosional surfaces, facies offset, and changes in facies proportions, five composite (third-order) sequences are interpreted for the Hanifa Formation. The correlation between the sequences across the study area shows only four sequences are preserved in the north where shallow-water deposits are well-developed. Facies trends within these sequences are further illustrated in a depositional model, which depicts the presence of a skeletal-peloidal shoal body that has never been documented at the Hanifa exposure. The model represents a ramp depositional setting under normal open marine conditions and is characterized by a high-energy shoreline. This study documents the first evidence of the Hanifa paleoshoreline. It also provides predictive tools and outcrop analogs for applications in hydrocarbon exploration and development. Furthermore, a basinal trend to the south of the study area is a potential site for unconventional plays.



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