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Sequence Stratigraphy of the Arab-A and B in a Giant Carbonate Field, and its Impact on Reservoir Quality

Yousef Mousa[1], Abdullah A. Neyazi[1], and Khalaf O. Altemimi[1]

[1]Saudi Aramco

ABSTRACT

A sequence stratigraphic framework is a necessity with the on-going development of a major carbonate field for the Arab Formation. Previous work relied on correlations using porosity logs and only a general interpretation of the lithology using Gamma Ray logs. Applying the principles of sequence stratigraphy provides a better understanding of the impact of facies distribution on porosity for both reservoirs and explains the added thickness in carbonates in the southern area and identifies potential for further development in the North.

Twenty-six wells were described, capturing all aspects of the core including lithology, rock textures, grain types, sedimentary structures, major fossil types, and porosity types. A total of 10 lithofacies were identified for the Arab-A and B Members. These lithofacies are as follows (from distal to proximal): (1) Intraclast-Brecciated Floatstone/Rudstone, (2) Peloid dominated Packstone/Grainstone, (3) Gastropod-Oolitic Floatstone/Rudstone, (4) Oolitic Grainstone, (5) Peloid-Skeletal GDP/Grainstone, (6) Thaumatoporella-Clypeina-Pellet dominated Wackestone, (7) Thrombolite-Pellet dominated Wackestone/Packstone, (8) Planar-Crinkly algal laminated Wackestone/Mudstone, (9) Stromatolite Dominated Wackestone, and (10) Anhydrite. These lithofacies show deposition to have taken place on a shallow, partially restricted carbonate platform.

Six High Frequency Sequences (HFS) were identified based on facies distribution and vertical stacking relationship (using Walther's law), four in the Arab-B Member, and two in the Arab-A Member and were mapped. Several cross sections generated across the field illustrated the importance of understanding what influence the Rimthan Arch had on the relationship between carbonates and evaporates, especially in the southern area of the field, where good circulation and accommodation space enhanced reservoir quality. Restricted conditions to the north allowed additional evaporates to be deposited, and possibly the development of additional stringers within the evaporites.