Facies and Paleogeography of Early Devonian Strata in Eastern Saudi Arabia: Insights from Recently Cored Wells

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Abstract

This study summarizes the result of recent geological characterization of the Early Devonian from the subsurface of Eastern Saudi Arabia. This study was initiated to incorporate cored well data from the past few years to a pre-existent conceptual model. Since the previous studies, an additional 30 cored wells have been analyzed. Cores were described in detail using an in-house lithofacies scheme. The described cored footage represents approximately 38% of the gross Devonian in the subsurface. The overall characteristics and associations of sub-foot scale lithofacies aided in identifying sedimentary processes and depositional environments. Palynological analysis and core gamma ray acquisition were undertaken to establish stratigraphy, as well as calibrate and integrate the core-based interpretation with wireline and image logs where applicable. Overall, the Formation in question is represented by a variety of facies reflecting paralic depositional environments that were subdivided into lower, middle and upper parts. This include wave-dominated shoreface in the lower part, tidal bars, estuarine channels as well as lagoon, marsh and bayhead deltas in the middle part, tidal and fluvial channels in the upper part. The muddy to silty lagoonal facies are spatially associated with marsh deposits. Washover fans and barrier deposits can be interpreted locally. Bayhead deltas appear to be associated with lagoonal deposits. Facies distribution and stratigraphic trends were utilized to create a paleogeographic map and establish a sequence stratigraphic framework of the study area. The data from recently cored wells has shed new light on heterogeneity and spatial variation of depositional environments. The proposed facies scheme and depositional environments have significantly improved the conceptual geological model. Furthermore, it has largely refined the previous work.