Lithofacies and Depositional Environments of the Late Ordovician Sarah Formation in the Subsurface of Rub' Al-Khali Basin, Saudi Arabia

Abdullah Alqubalee[1], Osman Abdullatif[1], Lameed Babalola[2], and Mohammed Makkawi[1]

[1]Geoscines Department, College of Petroleum Engineering and Geosciences, KFUPM
[2]Center for Integrative Petroleum Research, College of Petroleum Engineering and Geosciences, KFUPM

ABSTRACT

The Late Ordovician Sarah Formation is considered as a potential tight gas sand reservoir in the Rub' Al-Khali Basin, Saudi Arabia. Exploration work carried out on the formation in the basin revealed challenges that related to lithofacies, paleoenvironments, paleogeography and deep burial. This study investigates the lithofacies and depositional environments of the Sarah Formation from core samples retrieved from six exploratory wells in the Rub Al-Khali Basin. We conducted detailed sedimentologic core description and petrographic analysis and defined four lithofacies associations including massive bioturbated sandstone, grayish massive sandstone, diamictites, and partially deformed, graded to massive sandstones. The lithofacies associations were interpreted as a nearshore lake, glaciolacustrine delta, subglacial tillites, and glaciofluvial outwash environments, respectively. The glaciofluvial lithofacies characterized by deformed and massive sandstones overlain by channel bars sediments occurred at the western margin of a basin while the massive bioturbated sandstone of the nearshore environment occurred at the eastern margin of the basin. The glaciolacustrine delta front and the subglacial tillites lithofacies were recognized close to the basin center. The former is characterized by massive and deformed sandstones while the latter contains massive matrix-supported, stratified matrix-supported, massive clast-supported, and massive sandy matrix-supported diamictites. Those different types of the diamictites were formed during periods of glacial advance while the glaciofluvial and the glaciolacustrine lithofacies were deposited during the glacial retreat. The lithofacies depositional heterogeneity is expected to impact reservoir quality and architecture of the Sarah reservoir. Understanding this heterogeneity within integrated lithofacies depositional models would help to identify sweet spots and to provide leads to enhance exploration and development of the Sarah Formation.