

SP3

## Multi-Scale Reservoir Characterization of Tight Gas Sand: A Case Study from the Paleozoic Glaciogenic Sarah Formation, Rub' Al-Khali Basin, Saudi Arabia

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### Summary

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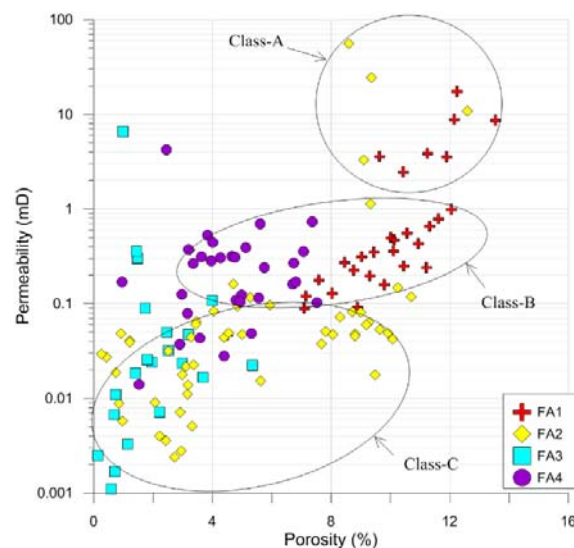
This study integrates core description, thin section, X-ray diffraction, Scanning Electron Microscopy, porosity and permeability measurements to characterize the Late Ordovician Sarah Formation in Rub' Al-Khali Basin, Saudi Arabia. Core samples retrieved from six exploratory wells drilled in this basin were used for this study. The Formation is one of the Palaeozoic siliciclastic sequences targeted for unconventional tight gas in the Kingdom of Saudi Arabia. However, the heterogeneity within the Formation's lithofacies, depositional environments and deep burial were revealed as major challenges for gas exploration and development activities, particularly, in the studied basin.

## Abstract

This study integrates core description, thin section, X-ray diffraction, Scanning Electron Microscopy, porosity and permeability measurements to characterize the Late Ordovician Sarah Formation in Rub' Al-Khali Basin, Saudi Arabia. Core samples retrieved from six exploratory wells drilled in this basin were used for this study. The Formation is one of the Palaeozoic siliciclastic sequences targeted for unconventional tight gas in the Kingdom of Saudi Arabia. However, the heterogeneity within the Formation's lithofacies, depositional environments and deep burial were revealed as major challenges for gas exploration and development activities, particularly, in the studied basin.

On the basis of depositional environments, the identified lithofacies are grouped into four lithofacies associations (FA) including nearshore (FA1), glaciolacustrine delta (FA2), subglacial tillites (FA3) and glaciofluvial outwash lithofacies (FA4). Based on reservoir quality, the cores were classified into three classes (Figure 1) including high (A), moderate (B) and poor (C) reservoir qualities. The class-A is associated with fractured lithofacies and it is predominantly composed of quartz. This class, observed in several lithofacies of FA1 and FA2, is characterized by permeability values that are greater than 1 millidarcy (mD). The class-B is also dominated by quartz and it is characterized by heterogeneous lithofacies with permeability values ranging from 0.1 to 1 mD. It is recognized in most of the lithofacies belonging to the FA1 and FA4. The class-C, mainly represented by FA2 and FA3 lithofacies, is characterized by lithofacies and mineralogical heterogeneities with permeability values that are less than 0.1 mD. Grains compaction, cementation and matrix contents are the main factors reducing the reservoir quality of this class.

Recognizing the reservoir characteristics of the Sarah Formation is essential for understanding and predicting its reservoir quality. This leads to better tight gas reservoir assessment in the future of gas exploration and development of the formation in the Rub' Al-Khali Basin, Saudi Arabia.



**Figure 1** High (A), moderate (B), and poor (C) reservoir qualities of the studied cores. Note that FA1 stands for nearshore, FA2 for glaciolacustrine delta, FA3 for subglacial tillites, and FA4 for glaciofluvial outwash lithofacies.