



Integration of Sedimentology, Petrophysics and Statistics for Characterizing the Reservoir Heterogeneity of the Late Ordovician Sarah Formation, Central Saudi Arabia

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The first glaciogenic event in the Arabian Peninsula is represented by the Late Ordovician Sarah Formation. Sarah Formation is outcropping in areas of central and northern Arabia bordering the Arabian Shield, while it occupies several sub-basinal areas in the subsurface. The glacio-fluvial Sarah Formation is considered as an important tight gas reservoir target. This study uses the outcrop analog of the Sarah Formation to characterize the reservoir heterogeneity of the paleovalleys based on sedimentological, petrophysical, and statistical approaches. Facies types and architectural elements were identified within several paleovalleys of the Sarah Formation. The study indicated variability in texture, composition, sandstone type, facies, geometry and architecture at outcrop scale. Outcrop relationships also showed vertical and lateral facies change with other Paleozoic formations. The integration of field and laboratory data helped identifying the heterogeneity within Sarah paleovalleys. The reservoir quality trends in the Sarah Formation show variations that might be due to the controls of facies, depositional environments, and paleogeography. Three measures of heterogeneity were applied on the petrophysical data for various paleovalleys of the Sarah Formation. Those measures are: the coefficient of variation, Dykstra-Parsons, and Lorenz coefficients. The coefficient of variation values indicate extremely heterogeneous distribution. Dykstra-Parsons coefficient values suggest very to extremely heterogeneous reservoirs. Lorenz coefficients show good correlation with Dykstra-Parsons coefficient for Sarah paleovalleys. The studied heterogeneity measures indicate that Sarah paleovalleys represent very to extremely heterogeneous reservoirs.