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Chemostratigraphy of Glacial Paleo-Valleys Sarah Formation, North West Saudi Arabia: An Integrated Approach to use the geochemical signature as a proxy for stratigraphic correlations and reservoir quality prediction

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The Glacial paleo valleys of Sarah Formation are consisting an important reservoir targets for tight gas sands in several basinal areas in Saudi Arabia. Previous exploration work indicated challenges and difficulty of accurate characterization and correlation of the reservoir due to the heterogeneity as a result of complexity of facies among the various fluvial, glacial and marine environments of Sarah Formation in the subsurface. Outcrop analogs could be used to fill the gap associated with the large inter-well spacing within the fields scale. An excellently exposed outcropping the Late-Ordovician Sarah Formation in the northwestern Saudi Arabia provide good analog for the glacial paleo-channels. This allow examining and evaluating sedimentary heterogeneity which have an important impact on reservoir quality.
During the course of this study, we tested the hypothesis that elemental chemistry varies with the lithofacies and could be used for reservoir quality prediction. This study examines the major oxides, trace and rare earth elements for Sarah Formation outcrops in the northwestern Saudi Arabia. Elemental chemostratigraphy were integrated with the lithofacies, petrographic analysis, and petrophysical properties. By using particular geochemical elements, vertical profiles, binary, and ternary diagrams were generated and it show differentiating between different lithofacies and flow units within Sarah Formation thus supports the established layering.
This study helps to tackle some of challenges related to reservoir heterogeneity and allow to examine different scale of sedimentary heterogeneity from micro-scale, meso-scale, macro-scale to mega-scale at the outcrop belt.
The integrated geological and geochemical approach add uniqueness to this study in describing and characterizing the glacial paleo valleys sandstone reservoirs and predicting their geological heterogeneity at different outcrop scales. The geochemical signature successfully used as a proxy for reservoir quality prediction. The outcomes of this project might help in correlating complex lithofacies and could be used for stratigraphic correlations in the subsurface within Sarah Formation in the nearby basins.