

Reservoir Facies of the Late Cambrian to Ordovician Formations Southwest of the Ghawar Field, Saudi Arabia

Mouathe Al-Essa¹, Nawaf Dossary¹, and Marco Vecoli¹

¹Geological Technical Services Division, Saudi Aramco, Dhahran, Saudi Arabia.

ABSTRACT

Lower Paleozoic, hydrocarbon bearing sandstones southwest of the Ghawar Field in Saudi Arabia, constitute promising clastic reservoirs. Sedimentological and biostratigraphical analyses of three such siliciclastic reservoirs have been conducted mainly based on subsurface cores and well log data. The aims of this study are to identify lithostratigraphic units from previously undescribed subsurface cores, to assess the stratigraphy, and to evaluate basin-scale reservoir potential within heterogeneous lithofacies associated with fair to good reservoir quality. The lithostratigraphic units comprise the fluvial to shoreface - dominated Saq, the shoreface - dominated Qasim, and the fluvio-marine, glacially - dominated Sarah formations. The Late Cambrian to Early Ordovician Saq Formation is subdivided into the Risha Member, characterized by amalgamated fining-up successions, deposited in a distributary channel setting, and the overlying Sajir Member, composed of mud-rich and bioturbated units deposited possibly in a shallow marine setting. By contrast, the Middle to Late Ordovician Qasim Formation is mainly characterized by a series of progradational shoreface-successions accumulated in a transgressive setting. The Qasim Formation is partially to completely eroded in this area due to advance and retreat of the Late Ordovician ice sheet. The overlying glaciogenic Sarah Formation was deposited as channel fills or outwash fans infilling erosional cuts into underlying sediments of the Qasim or Saq formations. Results of basin-scale architectural reconstructions show variable thicknesses of the aforementioned formations, with thicker units occurring in the central areas of the basin. Sedimentological and petrographic data have shown reservoir connectivity to be influenced by vertical and lateral heterogeneity.