Syn-rift Stratigraphy And Sedimentary Evolution Of The Midyan Basin: From Geological Observations To Forward Stratigraphic Modeling

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Abstract

**Objectives/Scope:** The northwestern onshore basins of Saudi Arabia (Midyan, Umm Luj, Jeddah, and Yanbu) formed during the rifting of the Red Sea, have the potential to store major CO2 emissions along Saudi Arabia’s west coast. This study aims to evaluate the stratigraphy and sedimentology of the Midyan Basin, in order to gain insights into the reservoir heterogeneity and its implications for CO2 storage in the syn-rift formations of the northwestern onshore basins.

**Methods, Procedures, Process:** We used a multidisciplinary approach to analyze the basin, combining geology, seismic interpretation, and stratigraphic modeling. First, the structure and stratigraphy of the basin are analyzed based on a literature review, outcrop study, and seismic interpretation. Integrating all of the geological data and interpretations we produced a conceptual tectonic-sedimentary geological model. Then, the conceptual model was used to perform a Forward Stratigraphic Model (FSM) of the syn-rift and transitional units of the Midyan Basin using DionisosFlow Software.

**Results, Observations, Conclusions:** The stratigraphy, depositional environments, and lithologic distribution of the syn-rift formations are reproduced by the FSM in 3D and are calibrated with geological observations and seismic data, although uncertainties are present and associated with several input parameters (e.g., sediment sources, diffusion coefficient, lithology, sea level fluctuations). The results suggest that the Midyan Basin is mainly filled by a thick syn-rift marine Burqan Formation, deposited during the rift climax, overlying a relatively thin early syn-rift continental Al Wajh Formation. The Burqan Formation, which has good reservoir potential, may have an adequate degree of reservoir heterogeneity making it suitable for CO2 disposal in the basin.

**Novel/Additive Information:** The study successfully demonstrates the feasibility of using Forward Stratigraphic Modeling to characterize the reservoir formations and their potential for CO2 storage in data-poor basins.