

Paleoenvironment, Tectono and Sequence Stratigraphy, and Hydrocarbon Potential of Abu Gabra Formation, Muglad Basin, Sudan

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Abstract

The Muglad basin, is the largest one of a series of NW trending Cretaceous to Tertiary aged continental rift basins in interior Sudan. Three-rift cycles affected the Basin and influenced its structural, stratigraphic, and hydrocarbon potential. These rift cycles were documented and dated as Early Cretaceous, Late Cretaceous, and Paleogene in age. The first rift cycle is the most important for basin development and deposition of the source rocks. Revealing the future hydrocarbon potential in Muglad Basin, is dependent on understanding the interaction of the different rift cycles and their influence on the petroleum system elements especially charge and seal in the later rift stages. This study of the paleoenvironment, tectono & sequence stratigraphy, and hydrocarbon Potential of Abu Gabra Formation is based on core cuttings, well logs, and seismic data. Conceptual depositional models were constructed and interpreted based on facies interpretation. The first rift cycle consists of Abu Gabra Formation (active rifting phase) overlain by Bentiu Formation (sag phase). During the first rift phase, the basin was characterized by close drainage system linking a series of lakes. This allow for accumulation of organic rich lacustrine shales. This thick shale is interbedded with fine-grained sands and silts. Abu Gabra shales are the primary source rock in Muglad Basin and the intervening interbedded sands are the main reservoir in the NW Muglad Basin. This interval is prolific and yielded hydrocarbon that have been migrated upward as well as self-sourced sandy intervals in the Abu Gabra. This rift phase is conducive to conventional structural and stratigraphic entrapment and based on recent drilling, it has potential for unconventional resource exploration. At the early rift cycle, the system began with a wide fluvial deposition that was abruptly overlain by deep lacustrine which was overlain by shallowing upward fluvio-deltaic environments. The distribution of these facies vary from one place to another within the lacustrine system as the geometry of the basin developed asymmetrically through time. Seismically, the sedimentary record of the syn-rift stage could be differentiated. Seismic, well data and the stratigraphic record confirm this period of tectonic activities. The syn-rift sediments of Abu Gabra Formation kept pace with thick skin faulting and slid with the basement complex forming wedge shapes. The results of this study is useful in constraining and correlating rocks of complicated strata in this area as well as in other areas with similar conditions. Play-based exploration to map hydrocarbon fairways, plays segmentation and incorporation of field-size distribution and yet-to-find hydrocarbon determination is useful in exploration activities prioritization and assessment the hydrocarbon potential of the basin.