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Three-Dimensional Clastic Reservoir Modeling: An Integrated Approach for Sand Bodies Delineation in a Highly Faulted Early Cretaceous Strata

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ABSTRACT

The study area located in the northwestern part of the Muglad Basin, Sudan. The exploration results showed occurrence of accumulations of hydrocarbon in the study area. The fluvio-deltaic sandstone rock within the Early Cretaceous strata (Au Gabra Formation) represents the primary reservoir. The facies together with the complex fault systems and stratigraphic architecture create a complex reservoir geometry. The objective of this study is to establish a three dimensional geostatistical model for the lithofacies, facies associations, and porosity. The lithofacies classification shown thee lithofacies (sand, shaly-sand, and shale). The porosity show consistency with the lithofacies distribution. During this study we concentrate on two depositional systems (braided delta and lacustrine systems). Four sub-environment were interpreted in the braided delta; those are fluvial dominated delta plain, delta plain, delta front, and prodelta. Four zones from top model (zone-1) to bottom model (zone-4) were produced in the horizons modeling process with thicknesses of 103 m, 147m, 179m, and 134 respectively. These zones were generated based on the sequence stratigraphic framework. Layering were performed for all zones with different number of sub-layers based on the range of sand bodies' thickness. A total of 563 layers characterizing Sequence-E (3rd order sequence) of Abu Gabra Formation were created the fine grid model. The total grid cell number is 7,972,643. In zone-1 and 2, the sand facies are dominated and porosity relatively high (delta plain). In zone-3, the sand facies and porosity decreases downward where shaly facies of delta front are dominated. In zone-4, the proportion of the lacustrine mud is high and this is due to the depositional setting of prodelta. These models were provided better understanding of the structural and facies configuration in the study area. The generated models could use as a predictive tool for reservoir quality distribution laterally and temporally.