Petrophysical data analysis using MATLAB tools for the middle Miocene sediments in the Gulf of Suez, Egypt

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Middle Miocene sediments are the most important productive oil zone in the Sidri Member within Belayim oil field. The Belayim oil field is one of well-known oil fields in Egypt, which is located on the eastern side of the Gulf of Suez. The Sidri Member consists of shales, sandstones and limestone with net pay thickness ranges from 5 to 60 m. The oil saturated sandstone layers are coarse grained and poorly sorted, which are classified into sub-litharenite, lithic arkose and arkose microfacies with several diagenetic features. This study measured and collected petrophysical data from the sandstone core samples and well logging of drilling sites to evaluate oil potentiality and reservoir characteristics of the Sidri Member. The collected petrophysical data are porosity, permeability, water and oil saturation, resistivity and grain and bulk density. MATLAB tools were used to analyze the extensive dataset, quantify the correlation trends and visualize the spatial distribution. The porosity values range from 2% to 30%, which show very good positive correlation with horizontal permeability (0 to 1,300 md). The porosity as well as type and radius of pore throats present important relationship with permeability and fluid saturation. The petrophysical characteristics of the Sidri sandstones are controlled by the depositional texture, clay-rich matrix and diagenetic features. This study distinguished poorly, fairly, good to excellent reservoir intervals in the Sidri Member. The best quality reservoir potentiality is recorded in the well sorted sand layers with little clay matrix in the lower part of the Sidri Member. The petrophysical characteristics are high porosity (20% to 30%), high permeability (140 to 1250 md), high oil saturation (20% to 78%), low water saturation (13% to 36%), moderate to high resistivity and relatively low grain density. The hydrocarbon production rates reported from the Sidri reservoirs are greatly correlated with the petrophysical characteristics described in this study.