
Porosity Evaluation in the Lower Eagle Ford Shale Formation, Atascosa County, South Texas

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ABSTRACT

The Eagle Ford Group represents a self-sourced petroleum system in South Texas; its sediments were interpreted as being deposited in a calm environment, thus promoting a homogeneous lithofacies. However, the occurrence of a relatively thin (20 ft thick), high porosity zone in the Lower Eagle Ford Formation located in central Atascosa County, Texas, calls for local peculiar depositional conditions and/or diagenetic transformations that enhanced reservoir properties. Using one full diameter core, thin sections, petrophysical logs, X-ray diffraction, and scanning electron microscopy, we aim to determine the accuracy of the density log readings in the high porosity zone. In particular, we intend to test if mineralogy, organic material or clay content may have influenced the density porosity readings, which average nearly 17%. Matrix density values from Dry & Dean Stark extracted conditions were used to determine true porosity at various sample points throughout the section. True porosity was calculated using the following formula: $\phi = (\rho_{\text{matrix}} - \rho_{\text{bulk}}) / (\rho_{\text{matrix}} - \rho_{\text{fluid}})$. The calculated true porosity values were compared to the density log values and display a negative mean offset of 4.5%, suggesting that the density tool provided overly optimistic readings compared to the calculated true porosity. On the other hand, the studied interval displays a substantial amount of quartz and kerogen, causing the matrix density to be lower (2.63 g/cc) than the limestone matrix (2.71 g/cc), on which the density tool was calibrated. The presence of light material is confirmed by scanning electron microscopy (SEM) and SEM Energy Dispersive Spectroscopy (SEM-EDS) imaging. Determining accurate porosity values in this zone is economically significant as several exploration and production companies target it for hydrocarbon extraction, whereas refining the influence of microfacies on the density tool will impact significantly oil and gas prospecting applied to other lithostratigraphic units.

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