Characterization of Porosity Systems Based on Diagenetic Models and its Effect on Petrophysical Analysis in Permian Carbonates

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ABSTRACT

Diagenesis can create and destroy pore structures in carbonate rocks. Thus, it is important to understand porosity evolution in carbonate reservoirs to accurately predict water and hydrocarbon saturation. The Happy Spraberry Field is located on the eastern shelf of the Midland Basin within Garza county about 50 miles southeast of Lubbock, Texas. The field produces hydrocarbons from the Lower Clear Fork Formation, which is predominantly a packstone/grainstone reservoir. This study focuses on incorporating a diagenetic history of productive reservoir rock and determining its effect on porosity systems to improve petrophysical analysis. This project aims to examine pore geometries using imaging analysis software to assess the implication of pore structure on petrophysical analysis. Furthermore, stable isotope analysis of ^{13}C and ^{18}O will be performed to aid in understanding diagenetic conditions which will provide more certainty in developing a diagenetic history. Incorporating a diagenetic model along with stable isotope and petrographic analysis will allow us to establish a better understanding of how to calculate saturation in this type of reservoir. Some preliminary analysis of the reservoir has been performed such as core descriptions, limited petrographical work from different core material, and x-ray diffraction (XRD) from a fair amount of samples from the field. In limited thin section analysis, crinoids, brachiopods, and bryozoans are common skeletal grains along with non-skeletal ooid grains reworked from the platform margin. The main mineralogy is low-magnesium calcite with varying percentages of dolomite, as well as minor amounts of quartz and clays.

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