
Carbonate Reservoir Characterization Using the Cementation Factor: A Case Study of Little Cedar Creek Field, Onshore Alabama

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ABSTRACT

Facies characterization can be utilized to locate reservoir rocks. However, it alone cannot predict permeability and reservoir performance due to the complexity of pore type variation. In this paper, cementation factor “m” in Archie's law is used to quantify the pore type variation in a microbial carbonate formation in onshore Alabama. From log and core analysis, we find that the dominant pores are: micropores ($1 < m < 1.9$), intercrystalline and intergranular pores ($1.9 < m < 2.1$), and vuggy pores ($2.1 < m < 3$). The cementation factor deviation log is then introduced to assist in locating high permeability zones. The results show that the deviation in m agrees with the velocity deviation, both of which display a similar trend with permeability. Considering the similar impact of pore structure on resistivity and sonic velocity, m is further applied to estimate shear wave velocity and predict the amplitude versus offset (AVO) responses of reservoirs. The results show that rocks dominated by vuggy, moldic/intragranular, or microporosity display distinctive AVO features, and that fluid detection in carbonate rocks using conventional AVO classification is challenging.

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