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Impact of Sedimentology and Diagenesis on Petrophysical Properties of Miocene Dam Formation. Outcrop Approach – Al – Lidam Area, Eastern Saudi Arabia

Moaz A.Salih[1], Osman Abdullatif[1], Khalid Al-Ramadan[1], Dave L. Cantrell[2], Lameed Babalola[2], Mazin A. Bashri[1]

[1]Earth Sciences, King Fahd University of Petroleum &Minerals, Dhahran, SAUDI ARABIA
[2]Saudi Aramco, Dhahran, SAUDI ARABIA

ABSTRACT

Outcrop studies proved to be powerful tools in hydrocarbon exploration due to their ability to integrate different scales of observation and measurements and overcome limitations that are associated with subsurface data. Stratigraphic equivalents of the Miocene Dam Formation occur as hydrocarbon reservoir intervals in the Arabian Plate. Detailed characterization of the Miocene Dam Formation indicates that the petrophysical properties are controlled by depositional and diagenetic processes. The study revealed that the Miocene Dam Formation in Al-Lidam area, eastern Saudi Arabia is composed of a mixed siliciclastic-carbonate successions that were deposited, during Miocene (Burdigalian) times, in a closed embayment under supra-tidal, inter-tidal and shallow sub-tidal conditions. Thin-sections and SEM images has shown that the diagenesis started by marine micritization by micro-organisms, especially cyanobacteria. Following micritization, grain dissolution by meteoric water led to initiation of moldic, shelter, vug, and intra-particle porosity that resulted in secondary porosity enhancement. Moreover, meteoric water got more saturated with respect to calcium carbonate that led to precipitation of pendant, meniscus, and equant calcite cement in vadose and phreatic environments. Dolomitization were also noticed from SEM and XRD analysis as one of the porosity enhancing processes. Meteoric dissolution was the main porosity enhancing process, while the equant calcite cement was the main porosity occluding process. The paragenesis study provides a predictive porosity distribution model within a high-resolution sequence stratigraphy framework and its associated diagenetic events. This model could provide better understanding of porosity evolution and valuable guide for subsurface exploration and development.