Reservoir Quality Assessment of the Lower Acacus and Tannezuft Formations in the NC4 Block, Ghadames Basin, Libya

Mohamed Imsalem[1], Adewale Amosu[1], Matthew Wehner[2], Anne Raymond[1], and Yuefeng Sun[1]

[1]Department of Geology and Geophysics, Texas A&M University, MS 3148, College Station, Texas 77843

[2]University Lands, 825 Town and Country Ln., Ste. 1100, Houston, Texas 77024

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ABSTRACT

The Ghadames Basin located in northwest Libya contains important oil and gas producing reservoirs. It is a polycyclic intracratonic basin composed of many superimposed basins laid on top of one another, influenced by multiple tectonic events, which has resulted in the development of regional unconformities and fault structures. Upper Ordovician sandstone belonging to the Memouniat Formation lies at the base of the section in the Ghadames Basin. The Early Silurian marine transgressive Tannezuft shale, produced by eustatic sea-level rise, overlies the Memouniat Formation. At the top of the section, the Lower Acacus Formation consists of northeastward prograding sandstones and shales of Middle and Late Silurian age, deposited by a fluviodeltaic system. Reservoir facies in these formations are affected by diagenetic iron-oxides (from meteoric water) and pore-filling clay (kaolinite/illite) cements. In this study, we make use of integrated data from 18 wells in the NC4 block of the Ghadames Basin, including well log data, core samples, and thin section photomicrographs. We correlate the well logs using facies identification as well as palynological markers which identified from specific intervals and an index palynomorphs fossils of marine and terrestrial taxa containing acritarchs, chitinozoans, scolecodonts, prasinophytes, embryophytic spores, and cryptospores. Various marker species were identified from the stratigraphic interested depth intervals, allowing for succinct age determination and improve stratigraphic correlation throughout the three wells studied and examined detailed structural and stratigraphic variation within the block. Multi-mineral composition analysis enables us to estimate the volume of quartz, calcite, anhydrite, kaolinite, and other clay minerals. We successfully map out the variation in several components such as kaolinite, illite, and lithified sediments within the Akakus and Tannezuft formations. We demonstrate that low lithification correlates with small volumes of kaolinite and illite. When coupled with extensive fracturing, this leads to a better reservoir quality.

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