

Main Petrophysical Challenges Unforeseen in the Red Sea

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ABSTRACT

The actual extensive Red Sea exploratory campaign, including both offshore shallow and deep-water wells that Saudi Aramco has embarked upon in the past few years has posed new challenges on reservoir description and formation evaluation. The understanding of this complex stratigraphy within an active rift basin and its petroleum system is of critical relevance for future exploration successes. In that sense, the main objectives of this paper are to describe and assess the Early to Middle Miocene tectono-stratigraphic mega-sequences (Adaffa, Al Wajh, Burqan Formations and Maqna Group) and the associated petroleum system (reservoir, seal and source rocks), while minimizing the geological uncertainties as a whole. Furthermore, understanding the geologic basement upon which these mega-sequences were deposited and its structural deformation, is critical as it is the framework that controls the syn-rift sedimentary deposition and trapping mechanism. Due to the very complex lithological combinations encountered in the various formations that include siliciclastics, carbonates, volcanics, highly mobile salt deposition as well as pre-rift and basement rocks, it is necessary to describe each of these geological units to the highest degree of achievable details to define their provenance, maturity, fluid content and role in the hydrocarbon accumulation scheme. The ultimate goal is to combine all potential measurements acquired at the various stages of drilling such as neutron spectroscopy logs, image & dip data, minor faults spotted from exhaustive structural interpretation of sub-seismic events at high resolution (multi-offset VSP), and a combination of mineralogical assemblages from recovered cores, comprising the multifaceted and unique lithology that defines the Adaffa through Burqan Formations and the Maqna Group. We will show in this work that collecting and integrating critical data during each of the drilling phases of several wildcat wells greatly assisted the asset team in optimizing well trajectories for the deeper sections and also the following perforations, thus ultimately achieving the asset primary exploratory objectives while broadening our understanding of this vast new frontier area, where considerable efforts and capital still need to be invested in the future.