ABSTRACT

The present study deals with Ras Fanar reefs as one of the most popular reefs in the Middle East and North Africa. It focuses on the petrographic, reservoir properties and petrophysical evaluation of the subsurface oil-bearing Middle Miocene "Nullipore" carbonate sequence in Ras Fanar Field. This sequence (400 ft-980 ft thick) consists of dolomitic limestone rich in algal fragments. It is unconformably overlies the Lower Eocene Thebes Formation and underlies the Middle to Upper Miocene South Gharib Formation.

Wireline log suites of nine wells (KK84-1, KK84-11, KK84-12, KK84-4A, KK84-8, RF-A2, RF-A3, RF-B2 and RF-B3) in Ras Fanar Field were studied and evaluated, as well as conventional and special core analyses of some wells. In addition, about 20 thin sections were prepared from the core samples and microscopically examined. Different logging and mapping software such as Geology Office, ELANPlus, Reservoir Summation and Surfer 7.0 were used for correlation between different zones, achieving the final interpretation and constructing the different distribution maps.

Complete quantitative petrophysical analysis was preformed over Nullipore carbonate rocks and many petrophysical parameters were deduced; like, uranium volume (Vu), porosities (go_t and oti_eff), fluid saturations (S_w, 5_{xo}, S_g, and Sh), lithology volumes ($V_{L.s}$, V_{D01} ...etc) and pay cut-offs. Besides, many qualitative relationships and crossplots were constructed.

The integration between log and core data in terms of lithology, porosity and permeability indicates that the Nullipore rocks are dolomitic limestones affected by different diagenetic processes. The relations between these diagenetic processes have been studied using the capillary pressure curves performed on some core samples. The

mercury injection tests were also used to identify the Nullipore pore throat sizes. Moreover, a field-wide porosity-permeability relationship has been derived from routine core analysis. This has been applied to log derived porosity to obtain log derived permeability in uncored reservoir sections. Also Nullipore reservoir zonation was carried out by the combined study of wireline log suites with coralline algae and special core analysis. Such study reveals that the "Nullipore" sequence consists of 3 electro-lithofacies zones (zone I, II and III).

Porosity, water and hydrocarbon saturation distribution maps have been constructed for each zone. These maps revealed that there are two lobes (A and B lobes) of high porosity and hydrocarbon saturation, however B lobe was found to be better in reservoir quality than A lobe. Porosity and water saturation cut-offs (14 % and 64 %, respectively) have been calculated to define the net effective reservoir rock and the net bay thickness.

In general, the obtained results in this work indicate that the reservoir quality parameters (porosity, permeability and fluid saturation) of Nullipore rocks are better understood both qualitatively and quantitatively by integrating well logging, core analysis and geological data.