SUMMARY AND CONCULSION

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This is a comparative study between the geochemical and geophysical data for evaluating the source rocks of Upper Cretaceous rock unites, Bahariya and Abu Roash Formations in the eastern part of the northern Western Desert of Egypt. The study area is delineated by latitudes 29 ° 30` and 29 ° 50` north and longitude 30 ° 20 ` and 31° 00 ` East . This study passes through several stages, the first is the study of the geologic setting of the area. Accordingly the investigated area slopes from the north to the south towards Qarun Lake and is covered mainly with Lower Miocene rocks "Moghra Formation" . This area is present in the unstable shelf zone of Egypt and divided into two main basins, the southern one, where the Paleocene-Eocene rocks " Apollonia Formation" attains its greatest thickness and the northern one, where the Upper Cretaceous rocks "Abu Roash and Khoman Formations" reaches their maximum thickness.

The second stage is the subsurface evaluation of the area through several steps, based on subsurface geologic and structural data. The thickness variations of Bahariya, Abu Roash, Khoman, Apollonia and Dabaa Formations are studied through the isopach maps. The thickness of Lower Bahariya Formation increases from the eastern to the western directions , but in case of Upper Bahariya Formation the thickness increases from the southwestern to the northern and western directions. In Abu Roash Formation, the thickness increases from the southeast and northwest toward the area around Qarun-DT well ; and in Khoman Formation, the thickness variation map indicates that, the thickness of this rock unit increases from the area around Gindi Deep-1X and

N.B.Q.-2X wells toward the northwestern and eastern directions . The variation in the thickness of this formation may be attributed to the subtopography of underlying Abu Roash Formation. The correlation charts through definite trends in the study area reveal mutual variations in the rock units thickness, reflecting the predominant tectonic activities at the close of the Mesozoic and the beginning of the Tertiary.

From the sand/shale ratio maps and lithofacies analysis, the Lower Bahariya Formation is mainly composed of argillaceous sandstone, but the Upper Bahariya Formation is graded from calcareous to argillaceous sandstone. In Abu Roash Formation, the lithofacies analysis indicates always from one member to the other. The Abu Roash "G" Member appears to consist mainly of shale and sandy shale rocks, while the Abu Roash "F" Member is mainly formed from limestone and graded to argillaceous limestone and calcareous shale i.e. its environment of deposition is graded from near shore to shallow marine. The Abu Roash "E" Member is build up of argillaceous sandstone, while in Abu Roash "D" Member the lithofacies analysis shows that, it is composed of shaly and argillaceous limestone , limestone , sandy limestone and calcareous sandstone. The Abu Roash "C" Member is constituted mainly of shale, calcareous shale and argillaceous limestone , the Abu Roash "B" Member is mainly composed of Limestone and argillaceous limestone, and the Abu Roash "A" Member consists mainly of calcareous sandstone , sandy limestone and argillaceous sandstone. Finally, as well as the Khoman Formation is composed of chalky limestone.

The study of the relief maps and structure contour maps of the Abu Roash and Khoman Formations, as well as the structural cross sections crossing the concerned area reflect that, the area is characterized by the presence of alternating horst and graben blocks, structural inversion and

normal faults of varying directions, NE-ENE and NW-SE. The presence of these structures may help in the development of structural traps in the study area.

The third stage is the source rock evaluation of the section started from the Bahariya Formation and ended by the Apollonia Formation. From the geochemical analysis of Qarun G-1X, Gindi Deep-1X, N.B.Q.-1X and N.B.Q.-2X core samples of the wells, through the determination of the total organic carbon (TOC) and rock eval pyrolysis, it is found that, the TOC of Bahariya Formation is ranged from fair to very good source rock. In Abu Roash "G, F, E and D" Members, it ranges from fair to good source rock and increases mainly around Qarun G-1X and N.B.Q.-1X wells. But, in Abu Roash "C, B and A" Members it ranges from poor to fair source rocks. The hydrocarbon potentiality of Khoman Formation is mainly poor in the studied wells, except in the N.B.Q.-1X well, where it reached to good source rock. In Apollonia Formation, the TOC is mainly poor to fair in N.B.Q.-1X well and ranged from fair to good in the other three wells. Rock eval pyrolysis results indicate that, the organic carbon of Bahariya Formation is mainly poor source rock. In case of Abu Roash " G and F" Members, the rock eval pyrolysis data reflect poor to good source rock . The other members of Abu Roash Formation in the studied wells are essentially poor source rocks. The difference between the TOC and rock eval pyrolysis results may result from the presence of reworked organic matter. The main type of organic matter identified from the kerogen study and from rock eval pyrolysis data reflects that the Bahariya Formation is mainly of type III. In Abu Roash "G, E, D, C, B and A" Members, the organic matter is mainly of type III with few samples of type II , as in Abu Roash "F" Member that is mainly of type II. Khoman Formation kerogen is mainly of type II and that of Apollonia Formation is of type I and II.

From the geophysical study, the total organic carbon (TOC) is calculated by using ***Passy et. al. (1990)*** overlay technique for four wells (two have both geochemical data in the form of (TOC) and the geophysical data in the form of sonic, neutron, density, resistivity, gamma and caliper logs and the others have only geophysical data). Sonic/resistivity, density/resistivity and neutron/resistivity logs were overlaid and used to calculate the TOC. The first method (sonic/resistivity overlay technique) give the most accurate and near-by data to the measured total organic carbon (TOC). These values are obtained with state of high level of organic maturity; but in reservoir parts, they give low values.

The study of the thermal maturation of the considered area was carried out through geochemical parameters, as the determination of vitrinite reflectance, T_{max} and production index (PI). The relation between vitrinite reflectance and depth is established. From the study of burial history curve of the evaluated wells, the time-temperature index (TTI) and time of oil generation (onset, peak and end) were calculated. Also, the study of thermal maturation indicators show that , the Bahariya Formation exceeds the mature stage and enters in the super mature stage. In Abu Roash Formation, it lies in the mature stage, while the Khoman Formation is present in the early mature stage in the eastern part of the study area and still immature in the remaining parts of the study area. From the study of burial history of the analyzed wells and through the defined times of oil generation, it is found that , the onset of oil generation of Bahariya Formation started during the Early Eocene in East Qarun well and during the Middle Eocene in the other wells, except in Qarun G-1X well, where it started during the Early Oligocene. The onset of oil generation of Abu Roash Formation ranging from the Middle Eocene in the southeastern part of the study area (around Qarun 3-1, N.B.Q.-1X, N.B.Q.-2X and Gindi Deep-1X) to the Early

Oligocene in Qarun-DT well and the Early Miocene in Qarun G-1X well. in case of Khoman Formation, it started in the Middle Eocene in both N.B.Q.-1X and Qarun 3-1 wells and started later in both Gindi Deep-1X and N.B.Q.-2X wells during the Early Miocene and did not start till now in the northeastern part of the study area (around Qarun G-1X, Qarun-DT and East Qarun wells)

Bahariya Formation is the only rock unit reached the end of oil generation in only four wells: during the Middle Eocene in Qarun 3-1 and N.B.Q.-1X and during Middle Miocene in Gindi Deep-1X and N.B.Q.-2X wells. So, the developed hydrocarbons are highly affected by the prevailing tectonics during and after the Cretaceous, so the probability of the presence of hydrocarbons may be low in the northwestern and western parts. Also, it is clear from the study of the effect of tectonics on the oil maturation give that, oil generation is developed mainly during the tectonic activity, where the temperature increases by the effect of rock movements and the short-lived heat occurrences emanated through the linear structural elements during tectonics.