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FACULTY OF SCIENCE
GEOPHYSICS DEPARTMENT

SEISMIC STRUCTURAL AND STRATIGRAPHIC INTERPRETAION AND THEIR APPLICATIONS IN THE HYDROCARBON ENTRAPMENT POTENTIAL AT WEST MATROUH BASIN-WESTERN DESERT-EGYPT

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ABSTRACT

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The migration of oil has been a little understood phenomenon. Oil migration processes probably depend only on the tectonic events which have occurred since the decomposition of Kerogen. The migration of the generated oil drops starts from the basins to the ridges and positive features laterally, diagonally or vertically. The migration paths depend primarily on interconnected pore channels and secondarily on open fault system. The oil migration paths of the area under study were determined by a qualitative measure depending on the relative pressure gradient in the area.

The main purpose of this study is the applications of seismic reservoir interpretation and formation evaluation interpretation for hydrocarbon potentialities. Hydrocarbon potentialities in the study area need a complete knowledge of some elements sharing in the requirements of hydrocarbon occurrences. These elements are represented by suitable stratigraphic sequence, adequate transformation cycle and proper entrapping style. In addition to coordination between these elements and the different petrophysical parameters that were derived from the formation evaluation interpretation is also required.

The study area West Matrouh Basin lies in the northern part of the Western Desert of Egypt. It is found between

latitudes 30° 30′ & 30° 54′ N and longitudes 26° 30′ & 27° 00′ E. Seismic techniques have been used in this area to clarify the structural settings of Abu Roash and Bahariya formations. Also, comprehensive stress analysis has been carried out on the top of Abu Roash and Bahariya formations.

The study went through the interpretation of all available seismic data in order to construct both seismic time and depth structural contour maps to delineate the subsurface structural configuration on the top of Abu Roash and Bahriya formations and to define the structural trends of faults dissecting both formation tops.

The structural contour maps which were constructed from seismic data interpretation indicated that the study area is characterized by fault elements of NW-SE trend which is the major trend in the area. It is suggested that this trend of faults is parallel to dextral strike slip fault movement. On the map under discussion, the E-W fault system is the second predominant trend. It is easily tracked in the middle and western parts of the area.

The tectonic maps constructed from the relative mass distribution maps at three depth levels illustrate that the study area (West Matrouh Basin) is characterized by a complex structural pattern. This pattern reflects the intensive stresses that were affecting the study area in successive episodes. But unfortunately, the defined structures deduced don't show any variation with depth which did not support the study as much as

was expected. This may be due to the fact that potential methods are very regional in there nature and less accurate to be used in this study.

A comprehensive formation evaluation was carried out for the Bahariya Formation section encountered in seven wells in the study area.

The hydrocarbon potentiality of the study area was evaluated through vertical and horizontal distribution of hydrocarbon occurrence. The vertical distribution was presented and discussed through the litho-saturation cross plots where the lateral distribution of was discussed through a number of porosity and saturation maps of the Bahariya Formation. The seven plots show the main lithology of the Bahariya Formation. It is composed mainly of sandstone and shale.

The lateral distribution of hydrocarbon occurrences was discussed through a number of porosity and saturation maps of the Bahariya Formation such as the total and effective porosity porosity, water saturation map, hydrocarbon saturation maps (movable or residual).

The possible structural configuration in the area under study that was deduced from the vector map exhibits complicated fault patterns dissecting the formation tops. This fault pattern is characterized by a number of trends, the first trend is NW-SE which is the major trend dissecting the area, it lies between 270°-320°. In the second place the E-W fault trend appears on the map which is very common in the Western

Desert. The fault trend lies almost between 250°-290°. The third common trend is the N-S; it lies between 340°- 0° degrees. These three trends are clearly represented on the resulted stress vector map on the top of Bahriya Formation.

Pressure gradient map was constructed within Bahariya Formation showing several higher and lower anomalies. Migration or flow paths are oriented perpendicular to the isopotential surfaces or isopressure gradient surfaces pointing toward the regions of lowest potential or lowest pressure gradient. Such migration paths are indicated by black arrows orienting outward or inward through four proposed prospects.

The arrows refer to the direction of oil migration from the central part of the area outwards to the northern and southern parts. Such movement is from the higher-pressure zones to the lower-pressure ones where such hydrocarbons finally accumulated. This result supports our theory about the hydrocarbon entrapment conditions of the north Western Desert reservoirs to be hydrodynamic not hydrostatic.

Key words: Stress Analysis, Hydrocarbon Entrapment Potentials, Gravity, Seismic, Pressure Gradient, Matrouh Basin, Bahariya Formation.

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