بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة /صفاء محمود عبد الشافى

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لايوجد

Note

The present thesis is submitted to Faculty of Science, Ain Shams University in partial fulfillment for the requirements of the Ph.D. degree of Science in Geophysics

Beside the research work materialized in this thesis, the candidate has attended ten post-graduate courses for one year in the following topics:

1. Geophysical field measurements
2. Numerical analysis and computer programming
3. Elastic wave theory.
4. Seismic data acquisition
5. Seismic data processing
6. Seismic data interpretation
7. Seismology
8. Engineering seismology
9. Deep seismic sounding
10. Structure of the earth

He successfully passed the final examinations in these courses.in fulfillment of the language requirement of the degree, he also passed the final examination of a course in the English language.

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AIN SHAMS UNIVERSITY

FACULTY OF SCIENCE

GEOPHYSICS DEPARTMENT

SEISMO-PETROPHYSICAL STUDIES OF APOLLONIA RESERVOIR, RAZZAK FIELD, ALAMEIN BASIN, WESTERN DESERT, EGYPT

ATHESIS

Submitted for the partial fulfillment for the requirements

of the Ph.D. degree in Geophysics

BY

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To

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ACKNOLEDGMENTS

I would like to thanks Allah, who created me and gave me knowledge and health.

I would like to express my appreciation to Professor Dr. Ahmed Sayed Ahmed Abu El-Ata, professor of geophysics, faculty of science, Ain Shams University on his unflagging efforts to improve readability, assistance with writing, theoretical aspects of the seismic structure and stratigraphic analysis, and his suggestions concerning the content were of great help. In addition, his encouragement, commitment to accuracy, does not pass unnoticed.

I have learned a great deal from him about how to express the concepts in a clear and logical manner, and made a major contribution refining this work, so he deserves special thanks.

I am very grateful to Dr. Amir Maher Lala Professor of geophysics, Faculty of Science, Ain Shams University for his excellent guidance and support

I am very Thankful to Dr Nahla Abd El Moktader Assistant Professor of geophysics, EPRI for her support.

I am grateful to my father Mr. Mohamed Metwalli, to his support and inducement me to complete their scientific research excellence. I express explicitly my appreciation to a special person, my spouse Mrs. Rania, who alternatively threatened me with dire consequences to make me complete this research. Without her affectionate support, completion of this work would not have been possible.

I would like to express my gratitude to the Egyptian General Petroleum Corporation (EGPC) and Khalda Petroleum Company (KPC) for their approval and permission to use the seismic and wells data for this study.

ABSTRACT

The area of study is located in Razzak oil field, the Early Cretaceous Alamein basin, the northern part of the Western Desert of Egypt. In the present study, integration occurred between geologic and log data of five wells (ERZK-110X, ERZK-15X, ERZK-100X, ERZK-77X, and ERZK-180X) wells, as well as geophysical data represented by 30 seismic sections, to study the structural setting, stratigraphic features and petrophysical parameters of the Apollonia, Abu Roash G, Baharyia, Alamein and AEB-1 Formations, using Schlumberger petrel 2015 and Tech log 2015.1 software.

The evaluation of the seismic attributes and seismic reflection characteristics analysis of Razzak Field was undertaken by subdividing the evaluated rock units of the study area into four seismo-facies units of varying parameters from top to bottom. These units are comparable to the Apollonia and Khoman Formations; Abu Roash Formation; Baharyia Formation and Alamein Formation.

The seismo-facies of unit 1 of the Apollonia and Khoman Formations reveals parallel to sub-parallel layering, with a thickness increased gradually northwards, the lithologic distribution shows limestone with minor clay intercalations, with a facies varied from middle neritic, graded to outer neritic. Unit 2 of the Abu Roash G Formation , exhibits divergent layering, with a thickness increased gradually northwards and eastwards, the lithologic distribution, reflects the predominance of carbonate and sandstone occur, with minor portion and laterally graded into shale, with littoral facies, graded to inner and middle neritic facies. Unit 3 of the Baharyia Formation reveals chaotic and oblique layering, with a time thickness increases towards the northeastern and southwestern parts, the lithologic distribution illustrates sand and shale, with minor limestone streaks, and facies varied from continental to inner-middle neritic. Unit 4 of the Alamein Formation shows variation from parallel-subparallel orientation to oblique and chaotic features with thickness increased northwards and eastwards, the lithologic distribution

represents dolomitic limestone, with minor streaks of limestone, and a facies varied from middle neritic to outer neritic and bathyal facies. Finally, the results are integrated to build up a seismo-stratigraphic model in the evaluated area of the north Western Desert of Egypt. The seismic interpretation involves the construction of structure contour maps. In terms of time and depth, on the tops of Apollonia, Abu Roash G, Baharyia and Alamein Formations. These maps show three structural closures, due to folding, that are dissected by NW-SE faults. The analysis of relevant structural and stratigraphic seismic attributes, such as; root-mean-square amplitude, local structural dip, variance, iso-frequency component, sweetness and acoustic impedance average energy applied on the reservoir tops, to enhance the visibility of faults, structural interpretation and the physical parameters of the subsurface related to lithology and stratigraphy for reservoir characterization. Finally, the results obtained are used, to construct a seismic structural model with, the integration of the obtained seismic stratigraphic model, that lead to building a geologic model of the north Western Desert of Egypt.

Petrophysical iso-parametric maps illustrate the reservoir characterizations (net-pay thickness, net-gross thickness, volume of shale, effective porosity, water and hydrocarbon saturation, and give better drilling results at the middle part of the area, while the productivity fades toward the northeastern and southern direction. and southwards. Facies and effective porosity modeling are established, to calculate the reserves most accurately and rapidly. Results confirmed that, the Baharyia sandstone Abu Roash G and Apollonia reservoirs have good petrophysical properties. Finally, after integrating the constructed facies model and effective porosity petrophysical model, a petrophysical geologic model is established for the study area of the north Western Desert illustrates a uniform changes representing stratigraphic features and abrupt changes of the structural setting affecting the area. The stratigraphic facies model of the Baharyia Formation for the sand channels oriented in N-S to NE-SW directions and were, deposited in a lagoonal mud setting affected by tides in a marine environment shows different facies settings.

Petroleum system of the study area shows, that mature organic-rich rocks with excellent potential to generate mainly oil are present in the Middle Jurassic Khatatba Formation, which entered the late mature stage of oil and gas generation window at vitrinite reflectance measurements between 1.0-1.3 Ro% during the Late Cretaceous. Meanwhile, good to fair source rocks of Alam El-Bueib and Abu Roash-G Member, within the early to mid and mature stages of oil generation window (with vitrinite reflectance measurements 0.5 and 1.0 Ro%), developed at a time varying from Late Cretaceous to late Eocene.

Shales in the Abu Roash E and G Members reached the oil window in the Late Paleocene-Early Eocene after, the formation of structural traps, which occurred during the Late Cretaceous at Abu Gharadig. Shales in the underlying Baharyia and Betty Formations reached the oil window before the traps were formed. However, continued burial caused these formations to reach the wet-gas zone in the Late Miocene-Pliocene. Therefore, shales in the Abu Roash Formation E and G Members are considered to be the source rock for liquid hydrocarbons at Alamein Basin. The Jurassic Ras Qattara and Khatatba Formations are important oil and gas source. Vitrinite reflectance data shows that the Ras Qattara and Khatatba sediments have reached the mature to late mature stages for hydrocarbon generation, consistent with Rock-Eval pyrolysis Tmax values. Based on these data, the Jurassic sequences have attained sufficient burial depth and thermal maturity for significant hydrocarbon generation. Maturation modeling proved, that hydrocarbon migration takes only the vertical direction through the fault surfaces.

The conclusions of study work prevailed that, the most significant reservoir rocks are in the Cretaceous age, the main structure traps related to the compressional stresses that took place in Early Cretaceous and the fault framework shows, two main trends. The first trend related to Jurassic rifting (NNE-SSW) is of Late Paleozoic rifting and the second trend (NW-SE) is of Tertiary tectonics. The depositional environment of Apollonia Formation varied from middle neritic, graded to outer neritic, Abu Roash G Formation, exhibits littoral facies, graded to

inner and middle neritic facies, Baharyia Formation shows facies varied from continental to inner-middle neritic and Alamein Formation illustrates facies varied from middle neritic to outer neritic and bathyal facies.

The petrophysical parameters of the studied formations exhibits, good results expect the permeability values of Apollonia Formation which need special drilling operation in order to increase the productivity of such Formation. Iso-parametric maps reveal that, the southwestern and middle parts of the studied are the most significant parts for oil accumulation and existence.

Hydrocarbons which charged the study area must have migrated vertically form mature Jurassic source rocks while, the entire Cretaceous section would be immature to expel oil.

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