بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الالكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات
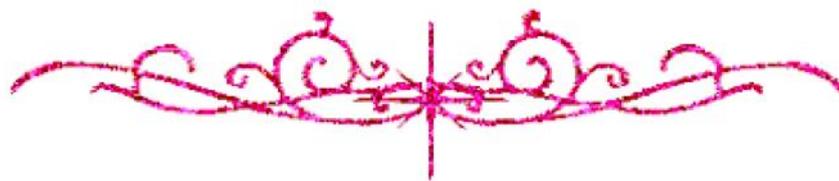
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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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لم ترد بالأصل

Ain Shams University
Faculty of Science
Geology Department

A Study of Reservoir Characteristics of Bahariya Formation, Aghar-4 Oil Field, Alamein Basin, Western Desert, Egypt.

Thesis submitted for a partial fulfillment of the requirements of master degree in Science in Geology.

By

MAHMOUD ISMAIL MOHAMED MOHAMED

(B. Sc. in Geology-Chemistry-Faculty of Science-Cairo University, 2008)

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.   To

Geology Department

Faculty of Science، Ain Shams University

Cairo-2020

NOTE

The present thesis is submitted to Geology Department, Faculty of Science, Ain Shams University in partial fulfillment of the requirement for the degree of Master in Science in Geology.

Beside the research work materialized in this thesis, the candidate has successfully passed the final examinations of the Premaster courses in Cairo University and Complementary courses in Ain Shams University covering the following topics:

Cairo University
1. Petroleum Provinces of Egypt.
2. Structural and Stratigraphic Control of Hydrocarbon.
3. Advanced Resevoir Studies.
4. Petroleum Geology.
5. Petroleum Well Logging.
6. Source Rocks Evaluation.
7. Petroleum Basin Analysis.
8. Petroleum Geochemistry.

Complementary
9. Geostatistics.
10. Sedimentry Rocks.

In fulfillment of the language requirement of the degree, the candidate also passed the final examination of a course in Deutsch Language.

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Approval Sheet

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Supervisors   **Approved**

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Qualifications

Name: MAHMOUD ISMAIL MOHAMED MOHAMED

Scientific Degree: Master in Science in Geology

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Dedication

This work is dedicated

To Allah and I hope to accept it from me

ACKNOWLEDGEMENTS

Abstract

The Upper Cretaceous Bahariya Formation is one of the most significant hydrocarbon reservoirs in the Western Desert over the years. However, the thinly bedded sequence of sandstones and shales makes the reservoir characterization still a challenge.

This study aims to clarify the sedimentological and petrophysical characteristics of the Early Cenomanian Bahariya Formation in Aghar-4 Oilfield Western Desert, Egypt. These characteristics will be used to overcome the petrophysical challenges in reservoir evaluation of the studied field.

The used materials were Sedimentological logs and samples obtained from five cores of Aghar 4-1 well, in addition well log data of four wells penetrating Bahariya Formation in the studied oilfield.

The petrographical analyses of the 38 selected samples from the various lithofacies at three reservoir levels of Bahariya Formation allowed their classification into 16 clastic rock types and 7 carbonate rock types. Based on the classification system of Dott (1964), the subfeldspathic wacke and glauconitic subfeldspathic arenites are the main recognized clastic rock types in the studied reservoir. The carbonate rock types were classified by Dunham (1962) into sandy wackestone rock types. The results of XRD analysis of the bulk samples indicated that quartz is the main mineral with subordinate amounts of plagioclase and K- feldspars. The clay fraction XRD analysis indicated that the recorded clay minerals are smectite, kaolinite, and illite. Smectite is the most abundant clay mineral with percentages reached up to 71 %. In addition, the petrographical analyses revealed that the studied sedimentary succession was affected by several diagenetic processes, which have influenced porosity and permeability and may have influenced the present day reservoir quality.

The recognized facies associations were deposited in the tidal flat, tidally influenced channel, shoreface, inner shelf siliclatics, restricted inner shelf carbonate, mid to outer shelf and outer shelf. The results point to a transgressive trend where marginal marine environment was gradually deepening up to offshore transition to offshore marine environments.

In general, the lithofacies types are arranged in a distinct pattern, which may be attributed to seven deepening cycles. All over the core tidal flat deposits, occasionally mixed with fore-shore sandstones, are followed upward by inner-shelf siliciclastics. These siliciclastics locally replaced by inner-shelf carbonates. Two flooding surfaces were described represented by glauconite-rich sandstones to siltstones. Tidal channel deposits are mainly represented by lag deposit of reworked facies. The overall depositional setting of the cored successions for the Bahariya Formation has been interpreted as tidally-influenced estuarine- nearshore / shallow subtidal depositional setting.

A petrophyscial evaluation has been generated for four wells penetrating Bahariya Formation by using all available logs and core data. A volume of shale cut-off of 0.5 v/v was used for discrimination of shales and sands, more over the resulted net sand was calibrated with available core which have better vertical resolution.

Porosity was calculated using the density based model with average matrix density of 2.66 g/cc and apparent fluid density of 1 g/cc. The results showed that, the porosity ranges from 18 to 25 %. A comparison study of water saturation was carried out using two different saturation models (Archie, and LRP Techlog model).

Archie's interpretation model was applied successfully to estimate water saturation in clean formations. However, in shaly sand formation, this model yields inaccurate water saturation estimates (overestimate) due to shale

or clay effects. So LRP model is more optimistic for the study due to its lower average water saturation value.

The results revealed that the average water saturation values of the upper part of the Upper Bahariya are 67% using the Archie model and 49% using the LRP model, and that of the lower part of the Upper Bahariya are 57% using Archie model and 44% using LRP model, the upper part of the Lower Bahariya are 50% using Archie model and 35% using LRP model and the lower part of the Lower Bahariya. Those of clean water bearing zone are 83% using Archie model and 92% using LRP model.

A POR-PERM transform have been created using the available routine core air-permeability measurements in Aghar 4-1 well. The permeability values range from 1 mD reached up to 2636 mD.

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