بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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Ain Shams University
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Geophysics Department

"3D Modeling of Depositional Basin and Evaluation of the Extended Reservoirs in South Abu Gharadig and Alam El Shawish East oil Fields, Northern Western Desert, Egypt"

A Thesis Submitted

In Partial Fulfillment of the Requirements for

the Degree of Master of Science in Geophysics

By

Nihal Mohamed Ali Abdel Gawad

B.Sc. of Geophysics-2009

To

Geophysics Department
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Approval Sheet

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Note:

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

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

1. Geophysical Field Measurements.
2. Advanced well Logging.
3. Elastic Wave Theory.
4. Physical Properties of Rock.
5. Formation Evaluation.
6. Subsurface Geology.
7. Geophysical Prospecting.
8. Sedimentary Basin Analysis.
9. Numerical Analysis.
10. Bascal programming
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Abstract

"3D Modeling of Depositional Basin and Evaluation of the Extended Reservoirs in South Abu Gharadig (SAG) and Alam El Shawish East (AES-E) oil Fields, Northern Western Desert, Egypt"

The study area is a part of Abu El Gharadig basin, and is about 753.6 sq.Km divided by the development leases boundary into two parts, 495 sq.Km, in WD-30 development lease and 258.6 sq.Km, in AES-E development leases.

The perimeter of the area about 11 km to the Northeast, Abu El Gharadig field (AG field) is located which is the first oil and gas discovery, in Abu El Gharadig Basin (AG Basin), in the Western Desert of Egypt. It was discovered in 1969 and produced from the reservoirs of Lower Cenomanian Bahariya (BAH) Formation; Middle Cenomanian Abu Roach-G (ARG), Upper Cenomanian to Lower Turonian Abu Roash-E (ARE); and Middle Turonian Abu Roach-C (ARC) Member, Turonian Abu Roash-D (ARD) and Kharita Formation.

The structural mapping of the Middle to Upper Cretaceous intervals, using the converted, 2D seismic lines to 3D seismic cube and borehole data of about 8 wells, has been achieved to describe and understand the present-day three-way dip closure of SAG/AES-E extended field, and by means of 13 interpreted framework horizons from the deepest mappable horizon (estimated Top Early Jurassic), to the shallowest horizon (Oligocene time Top Dabaa) and creating isopach maps and 2D restoration showed the evolution of this part of AG basin, by extensional events in the NW-SE direction that started in Early Jurassic time, then the extension rotation towards NE-SW direction in Early Cretaceous

time, that continued during the deposition of Kharita Formation up to Khoman-B Member, then the extension events are followed by the compressional pulses of the Syrian Arch event, after the deposition of the Santonian Khoman-B Member, that continued to the Early Tertiary and resulted in the inversion of the deep seated rift structure and evolve the NW-SE faulted structure of SAG/AES-E Field.

The surgical mapping of the reservoir intervals and the extracted attributes reveal the facies distribution across the area and show the entry points of the fairways of the clastic reservoirs of Abu Roash-C, E, G, Upper Bahariya and Lower Bahariya, which are the main reservoir intervals in SAG/AES-E, and provide illustration about the confined paths of these system from the entry point from the southeast direction towards the rift basin to the West- Northwest and Northwest directions where the fairways becomes unconfined and lobate or forms basin floor fan.

The results of the geophysical study and the analysis of the pressure data give evidences of the possible connectivity of the reservoirs explored in SAG and AES-E and consider them as on straddle field across the common boundary that separate the development leases, this gives opportunity to clarify the concept of unitizing the production from a straddle field as per the petroleum agreement. This unitization process mainly aims to save the country benefits in the extended fields, preventing disputes between the leases owners and regulate the process of splitting the volumetric between the development leases that shares the straddle fields.

The petrophysical evaluation of well log data, from 8 wells in the study area, is carried out to quantify the parameters of Upper Cretaceous reservoirs of Abu

Roash and Bahariya formations in South Abu El Gharadig (SAG) and Alam EL Shawish-East (AES-E) fields. Moreover, the well logs have been prepared to be used for the quantitative reservoir characterization from seismic data by seismic inversion that requires high quality acoustic logs (compressional sonic log) and density logs.

The calculated pay parameters for all the reservoirs are ranged as PHIT of 17-25 %, N/G of 8-25 % and Sw of 10-30%. The original hydrocarbon pore volume (OHPV), is calculated to assign the calculated volumetric to reservoir condition, as it proved presence of the gas cap in the reservoirs like the AR.E Member and as wet gas reservoirs in the Bahariya Formation, where the production from any of these reservoirs may cause fluid phase change across the field.

The total calculated OHPV in WD-30 lease is about 319.5 mmbbls and about 35.4 mmbbls in AES-E development leases and by considering the field as one unit and splitting the extended reservoirs between the development leases proportionally with the percentile of the reservoirs extent in each lease, WD-30 development lease will hold 276.4 mmbbls, while the AES-E will hold 35.4 mmbbls.

The unitization process concluded that, the WD-30 license has 88.5% share of the reserves in all the reservoirs pass across the field, while AES-E area 3 and 4 includes 11.5% from the reserves in the extended reservoirs. The equity share of the unit field represents the rights and liabilities of each licensee on the SAG/AES-E field.

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