شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

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HANAA ALY

Ain Shams University
Faculty of Science
Geophysics Department

"Reservoir Characterization Based on Seismic Inversion Techniques, at West Al Khilala Field, Onshore Nile Delta, Egypt"

A Thesis Submitted for a Partial Fulfillment for the Requirements
of the Master Degree of Science in Geophysics

By

Omar Mohammad Aly Ebrahim El-Gharabawy
(B.Sc. in Geophysics, Faculty of Science, Ain Shams University, 2017)

To
Geophysics Department, Faculty of Science,
Ain Shams University

Under The Supervision of

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Cairo-2021

Ain Shams University
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Approval Sheet

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Note

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

Head of Geophysics Department

Prof. Dr. Abdel-Khalek EL-Werr.

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ABSTRACT

The West Al-Khilala Field is a Messinian (Late Miocene) gas field located in Northwest El Mansoura concession, at the southern part of the Onshore Nile Delta, Egypt. The present study deals with a comprehensive interpretation for the seismic and well-log data and applying post-stack seismic inversion techniques, using the computer program of Petrel 2017.1, Hampson Russel and Tech Log 2015.1 softwares.

The available data for the current study is only 20 2-D seismic reflection lines and 4 wells including the open-hole logs and checkshot surveys, which are not sufficient to perform adequate study of the structural and stratigraphic features for the West Al-Khilala field. So, it is needed to resample the given 2-D seismic lines into a 3-D grid, using Petrel software.

Both seismic and well logs data were integrated, to exactly delineate the NW-SE Messinian Abu Madi gas-bearing channel. And also, to interpret the subsurface structural features; like NW-SE normal faults, with a down thrown side to the east.

Interpretation is also extended to the seismic attributes and post-stack seismic inversion techniques, which marked the high acoustic impedance (AI) zones. They represent very strong characteristic responses, that delineate reservoirs, especially gas-bearing sandstone reservoirs, like Abu Madi channel in this study It has low bulk densities and very low P-wave propagation velocities. So, it is a useful way to track this channel across West Al Khilala Field away from the well locations using the inverted acoustic impedance values.

The lateral variations of the petrophysical characteristics are represented in the form of iso-parametric maps (net-pay thickness, shale content, effective porosity, water saturation and hydrocarbon saturation). These petrophysical properties of Abu Madi Sandstone reflect the ability of this rock to store and produce hydrocarbon fluids. The effective porosity of Abu Madi Sandstone reservoir ranges between 9.1 and 19.8%, the shale/clay volume content ranges from 19.8 to 63.7%, and the hydrocarbon saturation ranges between 9 and 30.2%.

The obtained results of seismic attributes and seismic post-stack inversion results and the integration between them and well logs give an idea about the subsurface structural setting and the trend of Abu Madi gas-bearing sandstones channel and the locations of high acoustic impedance zones and also the high effective porosity and gas saturation values, which can be regarded as a gas charged reservoir.

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