شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

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

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Geophysics Department

Quantitative Interpretation of Well Logging and Seismic Data for Reservoir Characterization, Ha'py Field, Ras El Bar Concession, Nile Delta, Egypt.

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

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Note

The present thesis is submitted to the Faculty of Science, Ain Shams University in partial fulfillment of the requirements of the Master degree of Science in Geophysics. Besides the research work materialized in this thesis, the candidate has attended six post-graduate courses for one year in the following subjects:

1. Geophysical Field Measurements.
2. Numerical Analysis and Computer Programming.
3. Petrophysical Properties of Rocks and Advanced Well Logging.
4. Formation Evaluation and Reservoir Evaluation.
5. Subsurface Geology and Geophysical Prospecting.
6. Sedimentary Basin Analysis and Fluid Dynamics.

The candidate has successfully passed the final examinations of these courses. In fulfillment of the language requirement of the degree, the candidate also passed the final examination of a course in the English language.

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Abstract

The offshore Nile Delta is one of the most promising areas for gas exploration and production in Egypt and the Middle East where proven reservoirs within Nile Delta cone vary in age from Oligocene to Pleistocene. The area of study is Hapy Field which lies in Ras El Barr concession approximately 40 km from offshore eastern Nile Delta in 80 m of water. It is the largest field yet discovered in the Pliocene trend.

The gas reserves of Hapy Field are contained in sandstone reservoir units within the Pliocene Kafr El-Sheikh Formation. The main purpose of this study is to delineate the lateral and vertical extension of the sand reservoir units, discriminate between the gas-bearing sandstone, brine sandstone and shale, distinguish between Base and Base Gas of the main sand unit of A20 and estimate the gas reserve of the A20 reservoir unit.

This study includes petrophysical evaluation of six wells (H-1, H-2-ST-2, H-4, H-7, H-7-ST and H-8) distributed in Hapy Field and interpreting seismic data for A20 reservoir unit.

Well logging analysis led to the following observations; the main sand unit of A20 exists in all wells with optimum thickness, effective porosity and hydrocarbon saturation values. The A20 sand unit is deposited in sand bar shape in shallow marine depositional environment. In addition to A22, A24 and A30 sand members existing in few wells with optimum reservoir properties.

Analysis of MDT pressure data shows that, the gas-bearing sand members of H-1 well are isolated while those of H-8 well are vertically connected. The analysis of the multi-well pressure depth plot shows that, there is no horizontal connectivity between the sand units of H-1 and H-8 wells due to producing from two sand bars isolated by a geological barrier (permeability barrier of shales).

Seismic interpretation was performed on Top, Base gas and Base of A20 reservoir. Time and depth maps show that, A20 reservoir is trapped in a tilted fault block between two major listric growth faults with NE-SW and NW-SE trends down-throwing toward the north. A20 sand is also dissected by two minor faults trending WNW-ESE which splay from the major NE-SW fault.

Various types of seismic attributes (3D amplitude auto-tracking, spectral decomposition, RGB color blending and geobody extraction) show the lateral and vertical extension of the gas-bearing sand units and illustrate that, the gas-bearing sand bars are trending toward the west. The gas reserve of A20 reservoir was estimated using the volumetric method, utilizing the average values of the petrophysical evaluation results, reservoir engineering

parameters and the area of the geobody extracted from the RGB color blending, yielding 2.527 TCF of gas.

Rock physics analysis was performed by cross-plotting seismic elastic properties and petrophysical properties to effectively discriminate between gas-bearing sandstone, brine sandstone and shales. It's noticed that, Poisson's impedance is the most efficient attribute to discriminate between different lithologies and fluid content.

Model-based inversion was found to be the most accurate poststack inversion method yielding inverted P-impedance. Then reservoir properties volumes (shale volume, effective porosity and hydrocarbon saturation) were derived from the inverted P-impedance and predicted using PNN. It's noticed that, prediction using PNN gives more accurate results. Then horizon slices were created through the inverted P-impedance and these reservoir properties volumes to clearly discriminate between gas-bearing sandstone, brine sandstone and shale.

Keywords: Hapy Field, Well logging, Seismic attributes, Gas reserve, Rock physics, Model-based inversion and PNN.

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