**Ain Shams University**
**Faculty of Science**
**Geophysics Department**

# Hydrocarbon Reservoir Modeling of Taurt Field, Ras El-Barr Concession, Nile Delta, Egypt.

A Thesis Submitted In Partial Fulfillment of The Requirements For The Master Degree of Science In Applied Geophysics

**BY**

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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.

Head of Geophysics Department

Prof. Dr. Salah Abdel Wahab

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## Dedication

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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; Taurt Field is located in the Ras El-Barr concession approximately 72Km from offshore in the East Nile Delta area at a fault block to the northeast of Ha'py Field and northwest of the Denise Field in 108 m water depth. Taurt Field discovered with the drilling of Taurt-1 well in March 2004 and then Taurt-2 appraisal well in June 2004 by British Petroleum Company (Bb).

Taurt is the first subsea-to-shore gas field development in BP's portfolio and the first subsea well production for BP Egypt. Taurt consists of five Pleistocene sand reservoir units in Mit Ghamr Formation called S10, S20, S30, S40 and S50.The recent study is focus on evaluation of S10, S20 and S30 reservoir units. Down holes fluid samples have been collected from the exploration and the appraisal wells, which indicate that the reservoir fluids are considered dry gas.

This study includes petrophysical evaluation of five wells (T-01, T-02, T-03 and it's side track T-03-ST-01, T-04 and T-05) distributed in Taurt Field and 3D seismic data interpretation of Pleistocene sand reservoir units in Mit Ghamr Formation.

Well logging analysis for reservoir units led to the following observations; The reservoir units in Mit Ghamr Formation are deposited in sand bar shape in shallow marine depositional environment. S20 unit represents the main reservoir within Taurt Field because it contains maximum gas saturation.

The analysis of MDT pressure data is concerned mainly with locating the different fluid contacts, vertical connection between sand levels in sand reservoir units and determining the pressure gradients of the gas-bearing zones. Very close pressure regimes are detected for most of the investigated gas zones throughout the study area.

The constructed litho-saturation cross plots reflect the vertical variation of the petrophysical characteristics and iso-parametric maps verify the lateral variation of petrophysical properties.

3D seismic interpretation was carried out on Top and Base of S10, S20 and S30 reservoir units. Different types of mapping of the reservoir units clarify the presence of four way dip closures for S10, S20 units, two way dip closure for S30 unit and thickness variation for each unit. These closures dissected by a series of normal faults in NW-SE, NW-SW and E-W directions.

Different types of seismic attributes (RMS, Max negative amplitude, trace envelope, variance, spectral decomposition and geo-body extraction) clarify the locations of high amplitudes "bright spots" which reflect the reservoir presence, faults pattern, lateral and vertical extension of sand reservoir units.

The results from well logging analysis and 3D seismic data interpretation were collected together to build-up the 3D static reservoir modeling. Static model is a representative tool by which the facies, petrophysical properties and structure can be imagined. Also fluid contact model give general idea about hydrocarbon volume in place. Such static model can support the detection of suitable places for hydrocarbon potential.

Mit Ghamr reservoir static model shows a combined trap with thickness variation. The thickness increases in south direction bounded by syn-depositional growth normal fault. This reservoir is subdivided into three units S10, S20 and S30 composed of sand and shale intercalations. Higher effective porosity and saturation values were noticed for the sand, while lower values are found for the shale.

From the volumetric calculations, it is clear that the southern closure at S20 unit holds the highest volumes of hydrocarbons (726bcf), while the central closure of S30 unit hold less volumes (47bcf).

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**Keywords:** Taurt Field, Well logging, Seismic attributes, Static model and Volumetric calculations.

# List of Content

# List of Figures