Approval Sheet

"INTEGRATED SEISMIC REFLECTION AND WELL LOGGING INTERPRETATIONFOR SOLVING THE STRATIGRAPHIC AND STRUCTURAL PROBLEMSOF EL-OBAIYED AREA, NORTH WESTERN DESERT, EGYPT"

AHMED HAMDY HAFEEZ NAGATY

A Thesis Submitted to for partial fulfillment of the requirements for the degree of Master of Science in Geophysics

Geophysics Department, Faculty of Science

AinShams University

2014

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NOTE

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

Beside the research work materialized in this thesis, the Authorattend9 post-graduate courses for one academic year in the following Topics:

1. **Field Geophysics.**
2. **Numerical analysis and Computer Programming.**
3. **Elastic Wave Theory.**
4. **Seismic Data Acquisitions.**
5. **Seismic Data Processing.**
6. **Seismic Data Interpretation.**
7. **Earthquake and Engineering Seismology.**
8. **Deep Seismic Sounding and Earth's Structure.**
9. **English Language.**

He has successfullypassed the final examination for these courses, besides an advanced course in Computer and English language proficiency.

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Thanks God and thanks to all of you,

Ahmed Hamdy Hafeez

A proposal of M.SC. Thesis Entitled

"Integrated Seismic Reflection and well logging Interpretation for solving the stratigraphic and Structural problems of El-Obaiyed area, North Western Desert, Egypt"

By: Ahmed HamdyHafeezNagaty.

Plan of Work:

1- Interpreting the available 3D seismic reflection data in terms of structural elements of varying types and defining the reasons for low seismic resolution through the reservoir section.

2- Explaining the causes of fault orientation changes above and below Alam EL-BuiebFormation and the steep dip angle of the lower section faults of the reservoir section.

3- Analyzing the given well log data in terms of rock components and fluid fractions, and criticizing their facies changes and rock diagenesis.

4- Studying the reasons of change of the reservoir thickness of the Lower Safa and the comparable changes of reservoir quality (developed and undeveloped sands).

5- Delineating the causes of highly fractured carbonate rocks of Mediewer member, as well as the complete loss of fluids during drilling at these rock units.

6- Modeling the relationship among the tectonics standing behind the fore-mentioned stratigraphic and structural causatives, and the proved occurrences of oil and gas.

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ABSTRACT

El-Obaiyed gas and condensate field was discovered in 1992 and located in the northwestern part of the Western Desert in Egypt, some 65 km southwest of Matruh city. It produces from the Lower Safa Member of the Khatatba Formation (Middle Jurassic), which is the main reservoir in El-Obaiyed field and has helped to revitalize exploration in the northwestern part of the Western Desert of Egypt. The field is located on the western platform of the Matruh basin and has a complex stratigraphic and structural geology.Therefore, the main purpose of this thesis is to understandmore the structures and stratigraphy of this field by using seismic reflection data, well logging data and the available subsurface geological data.

The interpretation of the available seismic data and the mapping of the different levels: Top Khatatba Formation for the MiddleJurassic, top Alamein Formation for the Early Cretaceous and top AbuRoash Formation for the Late cretaceous, reflects that EL-Obaiyed field is characterized by gentle NE dip, small thickness of syn-rift sediments, small rate of tectonic subsidence and affected by three main structural trends: The first structural trend isthe NNE-SSW oriented faults, that dissected the deeper stratigraphic jurrasic and paleozoic units. theydivide EL-Obaiyed field into three NNE-SSW oriented rectangular blocks at the top of Khatatba level. These fault blocks are named: OBA NW block, Obaiyed block and Sharaif block. The second structural trend is the NW-SE oriented faults, that deformed the Upper Cretaceous rocks don't cut throw the deeper section and died out at Alam El-Buieb Formation.This rock unit acts as a ductile rock, can absorb the fault energy and doesn't allow the linear structures to propagate downwards. The third structural trend isthe NNE-SSW oriented anticlines, which affect the Upper Cretaceous sectionand lie exactly above the NNE-SSW oriented faults, that complicate the deeper stratigraphic units. These folds express their largest vertical closure in the Abu Roash Formation.They are asymmetrical anticlines representingthe fault propagation folds,that formed during the phase of positive structural inversion.

Well log analysis of the Lower Safa reservoir was performed to identify the hydrocarbon bearing zones and to study the reservoir properties, based on the data derived from 8 wells within EL- Obaiyed field, these are: OBA 3-1 st, OBA NW-2, OBA D1, OBA D3, OBAD13, OBA S-1, JB 16-3 st and JB 18-1 st. However, the main petrophysical parameters needed to evaluate the reservoir are its growth thickness, net sand thickness, porosity and hydrocarbon saturation.

Mapping of these parameters shows the thickness and quality variation of the reservoir: the NW and SW parts of the field were acted as paleo highs during the deposition times of the Lower Safa.So, the wells which drilled in this area didn't encounter the reservoir and drilled the Paleozoic section below Kabrit directly.

The thickness of the Lower Safa varies from 200m along the Eastern boundary faults, thinning to 0 in the south. Sandstone porosities of this very competent rock vary between 5 and 13%, with the bulk in the 9-11% range. Permeabilities range between 0.1 and 600 mD. The hydrocarbons are a condensate rich gas, with varying fluid properties (PVT, CGR, geochem) over the field due to a complex charge history. Hydrocarbon contacts also vary across the field. Initially the field was at dew point, but due to the recovery mechanism by depletion, pressures are well below this over a large part of the field.

The good matching between these Seismic data and the well log data, reveals a good story about the petroleum system of EL- Obaiyed field.

CHAPTER I

GEOLOGIC SETTING

I-1: INTRODUCTION

During the last decade, the Egyptian Western Desert has emerged as a major hydrocarbon province in North Africa. Much of the exploration success has resulted from the prospecting and exploration of the Jurassic hydrocarbon system and the associated reservoirs.

The Matruhbasin is one of the most important hydrocarbonproducing basins in the north Western Desert, because of its complex structures and stratigraphic setting, so it is very useful to understand the detailed relationships between fault networks and stratigraphy of the area for future development.

EL- Obaiyed field is one of the good gas and condensate producing fields in the Matruhbasin, which is discovered in 1992 by the well Obaiyed 2-2 well. The 3D seismic data played a very important role to explore and develop the field, especially when integrated with the well log data.

The Field is owned and operated by Bapetco, which is a joint venture between Shell and the EGPC. The field is located 65km southwest of Matruh City (Fig. 1.1).

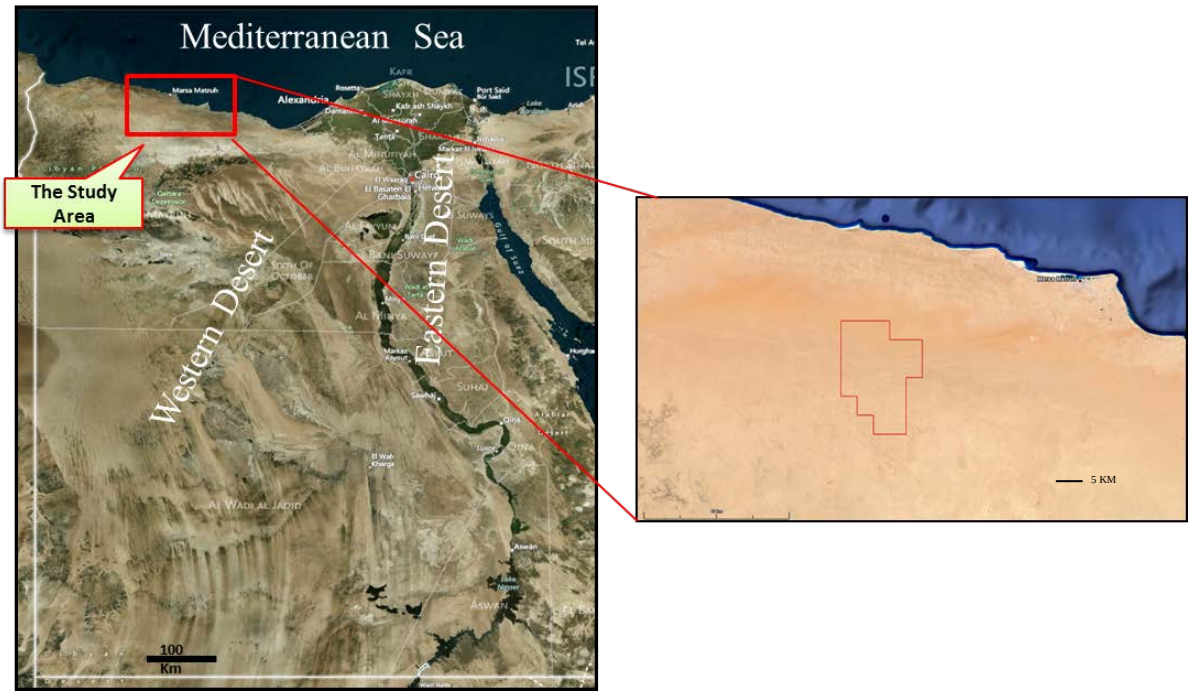

Fig. (1-1):The location of the study area.