



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكرو فيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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Impact of Cenozoic Structural Deformation on Hydrocarbon Preservation in South Alamein Block (northern Western Desert, Egypt)

*A Dissertation Submitted for
the Degree of Doctor of Philosophy in Science
(Geology)*

By

Mohamed AbdElhady Farag Hassan

(M.Sc. in Geology)

To

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

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AIN SHAMS UNIVERSITY



GEOLOGY DEPARTMENT
FACULTY OF SCIENCE

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To my father

– to whom I promised
to contribute
this dissertation
before he passed this
world, always in my
heart.

Your Son

ABSTRACT

Oil and gas reservoirs in the northern Western Desert have Mesozoic age and later phases of deformation during the Cenozoic affected some areas of the northern Western Desert and may have positive or negative impact on hydrocarbon preservation in these fields. This thesis deals with this issue in one of the hydrocarbon exploration areas in the northern Western Desert (South Alamein area) with detailed surface study of Cenozoic deformation at Gebel Qattamia area (northern Eastern Desert). 3D seismic and borehole data were used for subsurface study of the South Alamein area whereas the surface study of Gebel Qattamia area is based on detailed surface geological mapping of the exposed structures and study of the faults and the nature of their fault rock material.

The deep stratigraphic levels in the South Alamein area (Masajid to Abu Roash Formation) are dissected mainly by ENE-WSW and NW-SE oriented faults. These faults become discontinuous and less dominant at the top Khoman Formation. At the top Apollonia and top Dabaa Formations, NNW-SSE oriented normal faults are well developed and an E-W belt of left-stepped en echelon faults is obvious at the northernmost part of the area.

The main ENE-WSW oriented faults had normal slip during the early and late Cretaceous (till end of Coniacian) and were inverted in the Santonian and during the Paleocene, Eocene, and Oligocene times. The WNW-ESE oriented faults had continued normal slip from Jurassic to post-Oligocene times with largest slip during the Campanian- Maastrichtian.

Detailed surface geological mapping of Gebel Qattamia area indicates three main fault sets oriented NNW-SSE, WNW-ESE, and E-W. The E-W and WNW-ESE oriented faults form one en echelon fault belt in the

northern part of Gebel Qattamia area whereas the NNW-SSE oriented faults are the most dominant and form narrow linear grabens. Field measurements of fault damage zones indicate that they are dominated by fractures parallel to the faults in two conjugate sets. The width of the fault damage zones ranges from 15–20 meters (on each side of the fault) and the fault core material is mostly made up of breccia and/or gouge indicating deformation at shallow depth.

Comparison of the subsurface structures of the South Alamein area with those mapped at the surface at Gebel Qattamia area shows an identical structural pattern at the top Oligocene represented by NNW-SSE oriented narrow linear grabens abutted at the north by an E-W elongated belt of left-stepped en echelon normal faults. One of the narrow linear grabens in the South Alamein area is underlain by a 23 Ma basalt dike where the volcanic activity triggered the normal faulting. Rapid withdrawal of magma led to the formation of circular axial depressions at the top Apollonia Formation. The same subsurface structural features have also been identified at the surface in Gebel Qattamia.

The identical structural patterns in the South Alamein and Gebel Qattamia area indicates that the Cenozoic structures were formed at shallow structural levels and they do not reach the deep (Jurassic and Cretaceous) stratigraphic levels. For this reason, the Cenozoic deformation of the northern Western Desert does not have a negative effect on trap integrity at the deeper structural levels.

LIST OF CONTENTS

ACKNOWLEDGMENTS	i
DEDICATION	iii
ABSTRACT	iv
LIST OF CONTENTE	vi
LIST OF FIGURES	xii
LIST OF TABLES	xxi
LIST OF ENCLOSURES	xxi

Chapter I		page
I	INTRODUCTION	1
1.1	Location of the Study Areas	3
1.2	Objectives of the Study	4
1.3	Used Data and Work Methodology	5
1.4	Hydrocarbon Exploration History of the Northern Western Desert	6
1.5	Exploration History of the South Alamein Concession Area	12
1.6	Previous Studies on the Northern Western Desert	14
1.7	Previous Studies on the Northern Eastern Desert	22
Chapter II		
II	STRATIGRAPHY	26
2.1	Stratigraphy of the study area of the northern Western Desert	26
2.1.1	PALEOZOIC	28
2.1.2	BAHREIN FORMATION	28
2.1.3	WADI NATRUN FORMATION	29
2.1.4	KHATATBA FORMATION	30
2.1.5	MASAJID FORMATION	31
2.1.6	ALAM EL BUEIB FORMATION	32
2.1.7	ALAMEIN DOLOMITE	33
2.1.8	KHARITA FORMATION	34
2.1.9	BAHARIYA FORMATION	35
2.1.10	ABU ROASH FORMATION	37
I.	ABU ROASH 'G' MEMBER	39
II.	ABU ROASH 'F' MEMBER	40
III.	ABU ROASH 'E' MEMBER	41

IV.	ABU ROASH 'D' MEMBER	42
V.	ABU ROASH 'C' MEMBER	43
VI.	ABU ROASH 'B' MEMBER	44
VII.	ABU ROASH 'A' MEMBER	45
2.1.11	KHOMAN FORMATION	46
2.1.12	APOLLONIA FORMATION	48
2.1.13	DABAA FORMATION	49
2.1.14	MOGHRA FORMATION	50
2.1.15	RECENT TO POST-MIOCENE DEPOSITS	51
2.2	Stratigraphy of the study area of the Cairo-Suez District	52
2.2.1	Middle Eocene Rocks	52
i.	UNIT E1	52
ii.	UNIT E2	54
2.2.2	Upper Eocene Rocks (Unit U)	54
2.2.3	Oligocene Rocks	55

Chapter III

III	STRUCTURAL SETTING OF THE SOUTH ALAMEIN AREA	57
3.1	Structure of the Mapped Horizons	58
3.1.1	Top Jurassic Structures	60
3.1.2	Top Alamein Dolomite Structures	62
3.1.3	Top Bahariya Structures	62
3.1.4	Top Abu Roash Structures	65
3.1.5	Top Khoman Structures	65
3.1.6	Top Apollonia Structures	68
3.1.7	Top Dabaa Structures	68
3.2	Nature of Slip on the Main Faults of the South Alamein Area	71
3.2.1	Slip on the ENE-WSW oriented Faults	71
3.2.2	Slip on the WNW-ESE oriented Faults	78
Table 3.1	Summary of the expansion ratio of the different mapped rock units due to normal displacement on the WNW-ESE oriented F2 Fault in the South Alamein area	82
3.3	Deformation History of the ENE-WSW and NE-SW Oriented Faults in Northern Egypt	86
3.4	Deformation History of the WNW-ESE Oriented Faults in other Areas of Egypt	90

Chapter IV

IV	STRUCTURAL SETTING OF THE GEBEL QATTAMIA AREA	93
4.1	NNW-SSE Oriented Faults	98
Table 4.1	Data of the mapped faults of Gebel Qattamia area	98
4.1.1	F4 and F5 Faults	103
4.1.2	F6 Fault	111
4.1.3	F9 Fault	111
4.1.4	F15 Fault	117
4.1.5	F34, F40 and F42 Faults	125
4.1.6	F47 Fault	132
4.2	WNW-ESE Oriented Faults	132
4.2.1	F22, F38, F37, and F36 Faults	137
4.2.2	F100 Fault	145
4.3	Gebel Qattamia En Echelon Fault Belt	145
4.3.1	F44 Fault	144
4.3.2	F53 Fault	151
4.3.3	F63 Fault	151
4.3.4	F33 Fault	157
4.4	Other E-W to ENE-WSW oriented Faults	157
4.5	Reverse Faults	157
4.5.1	F68 Fault	163
4.5.2	F107 Fault	163
4.6	N-S Faults	163
4.6.1	F31 Fault	163
4.6.2	F76 and F79 Faults	168
4.6.3	F101 and F106 Faults	168

Chapter V

V	FAULT DAMAGE ZONES	170
5.1	Introduction	170
5.2	Field measurements of Fault Damage	172
5.3	Fault Damage Zones of the Gebel El Qattamia Area	173
5.3.1	NNW-SSE Oriented Faults	174
5.3.2	WNW-ESE Oriented Faults	190