

**Ain Shams University
Faculty of Science
Geology Department



**HYDROGEOLOGIC AND HYDRODYNAMIC
ASSESSMENT OF NUBIA AQUIFER AND IMPACTS ON
OIL POTENTIALITY IN ALAMEIN AREA ,NORTH
WESTERN DESERT,EGYPT**

**Thesis Submitted for the Degree of Ph.D. in Geology
(Hydrogeology)**

**BY
Wael Ahmed Shukry**

(B. Sc. in Geology, Ain Shams University, 1984)

**(M. Sc. in Geology/Hydrogeology, Ain Shams University,
2009)**

To

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Cairo, Egypt, 2015

APPROVAL SHEET

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ABSTRACT

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The hydrocarbon occurrences in the Western Desert are closely linked with the tectonic, the stratigraphic history of the area and the hydrodynamic potential of the groundwater in the regional Nubia Sandstone Aquifer System in the Western Desert and in the local Nubia Sandstone Aquifer System in the Northern section of the Western Desert. The north of Western Desert province has a significant hydrocarbon potential as recent oil and gas discoveries.

The present work aims to identify the systems of flow dynamics and hydro-geochemistry of the groundwater, which encountered in the North Western Desert as well as geologic setting, the reservoir characteristics and formation processes. The hydrogeochemistry of the groundwater (formation water) represents one of the main topics aiming to understand the connate groundwater behavior in relation to oil, as the base for further investigations.

The flow systems and the hydrogeochemical regime of the groundwater in the Nubia Sandstone Aquifer in the regional and local systems in the Western Desert of Egypt have a great impacts on the generation, migration and accumulations processes of the hydrocarbons.

The development of oil traps in the North Western Desert depends mainly upon structures. They are highly controlled by the potential of the hydrodynamic conditions of the groundwater flow system in both the regional and local flow systems of the Nubia Sandstone Aquifer.

Flow trends of groundwater match with the trends of salinity variations. They flow from NE and NW towards the Qattara Depression. Opposite trends

were developed due to uplift structures and exerting discharge areas favorable for oil accumulation. The Qattara Depression represents the great discharge area in the North Western Desert of Egypt.

The aquifer framework of North Western Desert is classified into two main aquifer systems, the Post Nubia Aquifer System along the Mediterranean and assigned to Late Tertiary, Lower Miocene (Moghra Formation) and Quaternary the Nubia Sandstone Aquifer system which assigned to the Jurassic - Upper Cretaceous time (Khatatba, Alam El Bueib, Kharita and Bahariya Formations). The Nubia Sandstone Aquifer is built of multilayered system.

The hydrodynamic concept through the pressure –depth curves and cross sections in the North Western Desert along different reservoirs are investigated. The Middle and Lower Cretaceous Reservoirs (Bahariya, Kharita, Alamein and Alam El Bueib Formations) and Jurassic Reservoir (Khatatba Formation) are described. The potentiometric surfaces as based on groundwater heads are compiled. The hydraulic gradients of groundwater match with the trends of salinity variations.

Fourteen formation water samples were collected from three oil fields (Alamein, Yidema and Horus fields) they are collected from ten oil wells penetrating aquifers and different pay zones. They are selected to represent the hydrocarbon pay zones belonging to different geological times, and chemically analyzed. Variation of salinity and hydrogeochemical characteristics of the connate groundwater are investigated. They match the flow trends reflecting the hydrodynamic potentials in the Nubia Sandstone Aquifer System.

The salinity has a trend of increase northward forming a fresh /salt water boundary coinciding with the Qattara Depression. It divides the Western Desert into a northern area with salt water, low bacterial degradation and active oil generation and southern area with fresh water and high bacterial degradation with active water flushing and non-active oil generation. The permeability barrier between the Latitudes 29° and 30° N as a result of Jurassic orogeny is expected to prevent the fresh water flushing toward the North.

The groundwaters (formation water) in the multilayered Nubia Aquifer System in the North Western Desert have a marine water origin and act as active hydrodynamics zone. It reflects a favorable zone for hydrocarbon accumulation.

The hydrodynamic conditions of the Nubia Sandstone Aquifer System have great effect on the occurrence and distribution of oil accumulations in the North Western Desert. The oil possibilities in the North Western Desert and the best locations for oil potentiality exist around Abu Gharadig and Shushan- Matruh Basins.

LIST OF CONTENTS

LIST OF CONTENTS

Title	Page
CHAPTER (I)	1
INTRODUCTION	1
GENERAL OUT LINES	1
PROBLEM FORMULATION	1
SCOPE AND TARGETS	3
MATERIAL AND METHODS	3
REVIEW OF PREVIOUS WORKS	5
MANUSCRIPT OUTLINES	12
CHAPTER (II)	14
GEOLOGIC SETTING OF THE NORTH WESTERN DESERT OF EGYPT	14
GENERAL OUT LINES	14
1-LITHO-STRATIGRAPHIC SUCCESSION OF THE NORTH WESTERN DESERT	16
Nubia Sequence	21
1-Paleozoic clastic sequence	21
2-Mesozoic clastic sequence (Triassic-Cenomanian)	22
Post Nubia sequence	27
1-Tertiary Carbonate sequence (Turonian – Eocene)	27
2-Quaternary Clastic sequence (Oligocene – Recent)	30
2- STRUCTURAL FRAMWORK OF THE NORTH WESTERN DESERT	31
3- TECTONIC EVENTS OF THE NORTH WESTERN DESERT	33
4- SEDIMENTARY BASINS AND RESERVOIR FACIES DISTRIBUTION IN THE NORTH WESTERN DESERT	40
A) Northern Basins	
Matruh Basin	40

Shushan Basin	40
Natron Basin	41
Alamein Basin (Dahab-Mireir)	42
B) Southern Basins	45
Abu Gharadig Basin	46
Ghazalat Basin	46
El Gindi Basin	50
(II) Reservoir facies distribution	51
a) Bahariya Sandstone Formation (Upper Cretaceous):	54
B) Kharita Sandstone Formation (Early Cretaceous)	55
c) Alamein Dolomite Formation (Early Cretaceous)	55
d) Alam El Bueib Sand Formation (Early Cretaceous)	57
e) Khatatba Sand Formation (Jurassic Age)	59
5-STRATIGRAPHIC AND GENETIC CLASSIFICATION	61
CHAPTER (III)	61
GROUNDWATER FLOW AND HYDROGEOCHEMICAL SYSTEMS IN THE POST NUBIA AND NUBIA SANDSTONE AQUIFER SYSTEMS IN THE NORTH WESTERN DESERT OF EGYPT	61
General Outlines	63
1- REGIONAL FLOW SYSTEMS IN THE NORTH WESTERN DESERT	69
2- LOCAL FLOW SYSTEM IN THE NORTH WESTERN DESERT	71
Post Nubia Miocene Aquifer System-Local groundwater flow system	76
Nubia Aquifer System-Local flow systems	77
Local groundwater flow system for Upper Cretaceous -Bahariya Formation Aquifer system	83
Local groundwater flow system for Lower Cretaceous Aquifer (Alam El Bueib Formation)	
Local groundwater flow system for Jurassic Aquifer	

	87
3-HYDRODYNAMIC CONDITIONS AND YDROGEOCHEMICAL	91
CHARACTRSTIC IN THE NORTH WESTERN DESERT	
SALINITY VARIATIONS AND FLOW TRENDS	91
Groundwater Salinity trends for Upper Cretaceous Aquifer (Bahariya Formation)	92
Groundwater salinity trends for Lower Cretaceous Aquifer (Alam El Bueib Formation)	96
Groundwater Salinity trends for Jurassic Aquifer (Kharita Formation)	102
4. HYDROGEOCHEMICAL SYSTEMS OF FORMATION WATER	107
4.1 GEOCHEMICAL ANALYSIS OF FORMATION WATERS IN THE	
NORTH WESTERN DESERT	107
The salinity and total dissolved solids (T.D.S)	113
Major ions concentrations	118
HCO ₃ ⁻ concentration of the formation groundwaters	119
The groundwater resistivity and specific gravity	119
The Aquifer oil gravity variations of the groundwaters	119
The groundwater alkalinity (pH)	121
Water chemical type	123
Hydrochemical Parameters of the groundwater	125
Hypothetical Salt Combination	128
Hydrochemical Classification	130
Depth Related Change	137
Conclusion –Hydrogeochemical characteristics	140
5- INVESTIGATED HYDRODYNAMIC CONDITIONS IN THE	
NUBIA SANDSTONE AND POST NUBIA AQUIFERS IN THE	
NORTH WESTERN DESERT	142

Nubia Sandstone Aquifer Hydrodynamic conditions	142
Nubia Sandstone Aquifer System Hydrodynamic Conditions and Relationship	143
Nubia Sandstone Aquifer Hydrochemical Character	144
Post Nubia Sandstone Aquifer System Hydrodynamic Conditions and Relationship	149

CHAPTER (IV)

MIGRATION AND ACCUMULATION OF HYDROCARBONS IN THE NORTH WESTERN DESERT OF EGYPT	150
General Outlines	150
4.1 HYDRODYNAMIC PROCESSES OF MIGRATION AND CONDITIONS	151
Organic Richness	151
Kerogen Type	153
Thermal Maturity	153
Hydrocarbon Migration Pathways In The North Western Desert	156
4.2HYDRODYNAMIC CONDITIONS FOR ACCUMULATIONS PRESSURE VARIATIONS AND FLOW SYSTEMS OF THE OIL PAY ZONES IN THE NORTHERN WESTERN DESERT	160
Source of formation pressure data	161
Nature of fluids	162
Trap concept	162
Pressure gradient	162
Application	166
Pressure-gradient model along Upper Cretaceous (Bahariya Formation) reservoir	166
Pressure-gradient model along Lower Cretaceous (Alam El Bueib) Reservoir	172
Pressure-gradient model along Jurassic Reservoir	

Entrapment under Hydrodynamic Conditions	174
Fresh water Salt water under Hydrodynamic Conditions	176
Gas Oil and Water System under Hydrodynamic Condition	176
Hydrodynamic Conditions and Processes of Alamein Basin	176
Hydrocarbon for Accumulations and Entrapment	178
Hydrodynamic Conditions and Processes of North Bahariya area	178
Hydrocarbon Accumulations and Entrapment	181
Hydrodynamic Conditions and Processes of Abu Gharadig Basin	181
Hydrocarbon for Accumulations and Entrapment	184
4.3 IMPLICATIONS FOR PETROLEUM EXPLORATION IN	184
NORTH WESTERN DESERT	188
 SUMMARY AND CONCLUSION	 200
REFERENCES	208