AIN SHAMS UNIVERSITY
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Seismic and Well Logging Data Interpretation for Reservoir Properties Estimation at Beni Suef Oil Field, Egypt.

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A THISIS
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تفسير البيانات السيزمية و تسجيلات الأبار لتعيين خواص الخزان لحقل بترول بنى سويف، مصر

رسالة مقدمة من

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على درجة الماجستير في العلوم
في الجيوفيزياء

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Note

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

Beside the research work materialized in this thesis, the candidate has attended ten post-graduate courses for one year in the following topics:

1- Geophysical field measurements.
2- Numerical analysis and computer programming.
3- Elastic wave theory.
4- Seismic data acquisition.
5- Seismic data processing.
6- Seismic data interpretation.
7- Seismology.
8- Engineering seismology.
9- Deep seismic sounding.
10- Structure of the earth.

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

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ABSTRACT

The present work was devoted to evaluate the reservoir properties for Beni Suef Oil Field. Beni Suef Oil Field is located in the Western Desert, and covers the western part of Beni suef Basin. It is restricted between latitude 29 º 00' N and 29 º 87' N and longitudes 30º 30' E and 32º00' E. The seismic interpretation, well log analysis and formation pressure evaluation are used to define the subsurface geological structure and the petrophysical properties favoring for the oil accumulation of the hydrocarbon materials and they are also used to determine reservoir driving mechanisms and fluid migration paths that control the behavior of fluids within reservoir.

Such work was conducted through several steps, started by reviewing the geologic setting of the study area to shed lights on the subsurface geology, subsurface stratigraphy, and tectonics.

Seismic interpretation performed in the study area for twenty-eight seismic lines in both strike and dip directions to identify the subsurface structure for the tops of Formations of interest (Abu Roash, Bahariya and Kharita Formations). Close investigation of these sections show that the area is affected by a group of normal faults with different trends and throws. These faults form together horsts and grabens structures.

The well logging analysis carried out for six wells in the study area by using a petrophysics computer program (TechLog 2011) developed by Schlumberger. The procedure includes the determination of water resistivity by using Pickett crossplots, Rwa and SP methods.. The volume of shale (Vsh) is calculated by using GR log as a single indicator and Neutron-Density log as a double indicator. Also, the corrected porosity was calculated by: Sonic, Density and Neutron logs. Formation pore pressure calculated by

several methods: pre-drilling method using seismic velocities, during drilling method using d-exponent and after-drilling method using well logs data.

As the formation pore pressure estimation is very important for drilling and reservoir engineers and if it predicted or calculated well it will help in avoiding many problems like well kicks, lost circulation, blowouts, stuck pipe, excessive costs and borehole instability. In this work we do not have measured RFT data so we used several methods for calculating the formation pore pressure: 1) before drilling using seismic velocities, 2) during drilling using drilling and mud parameters, and 3) after drilling using nearby well logs data.

The pre-drilling methods which are used for predicting the pore pressure are: the equivalent depth method, Eaton method and modified Eaton method. All these methods require knowledge of the interval velocities that were calculated from the available root mean square velocities. Also, the available drilling parameters (rate of penetration (ROP), weight on bit (WOB), rotary speed (N), bit diameter (d_b), Formation fluid density and mud density) used for calculating the formation pore pressure during drilling. Also, we used the nearby measured well logs as porosity logs for calculating the formation pore pressure.

Pore pressure gradient maps constructed for Abu Roash and Bahariya Formations that exhibits the locations of both higher and lower pressure gradients to predict the possible horizontal fluid flow (migration paths) for the proposal of new prospects. Finally, it is possible to calculate and recommend the required heavier mud weight to drill.

TABLE OF CONTENTS

Subject	Page
Acknowledgments	i
Abstract	ii
List of Figures	iv
List of tables	iv
Chapter One: Introduction	1
1.1. Location of the study Area	1
1.2. Previous Exploration Works	1
1.3. Aim and Objectives	3
1.4. Available Data	3
1.5. Methodology and Techniques	4
Chapter Two: Regional Geologic Setting	6
2.1. Introduction	6
2.2. Subsurface Stratigraphy	6
2.2.1. Pre-Cambrian	8
2.2.2. Cretaceous	8
2.2.2.1. Lower Cretaceous	8
2.2.2.1.1. Kharita Formation (Albian)	10
2.2.2.2. Upper Cretaceous	10
2.2.2.2.1. Bahariya Formation (Cenomanian)	10
2.2.2.2.2. Abu Roash Formation (Cenomanian- Turonian)	11
2.2.2.2.3. Khoman Formation (Campanian- Maastrictian)	11
2.2.3. Tertiary	11
2.2.3.1. Apollonia Formation (Eocene)	11
2.2.3.2. Dabaa Formation (Oligocene)	12

2.3. Regional tectonic setting 12

2.4. Regional Structure Setting 17

Chapter Three: Seismic Data Interpretation 19

3.1. Introduction 19

3.2. Available Seismic Data in the Study Area 20

3.3. Seismic Data Interpretation 22

3.3.1. Seismic Data Interpretation Technique 22

3.3.2. Seismic Data Interpretation Output 24

3.3.2.1. Interpretation of seismic sections 24

3.3.2.2. Interpretation of seismic maps 31

3.3.2.2.1. Time structure maps on the tops of the interested formations 33

3.3.2.2.2. Average velocity maps on the tops of the interested formations 37

3.3.2.2.3. Depth structural contour maps on tops of the interested formations 49

Chapter Four: Well Logging Analysis 58

4.1. Introduction 58

4.2. Well log process and interpretation 59

4.2.1. Present Study 59

4.3. Procedures of Reservoir Evaluation 59

4.3.1. Shale Volume Determination Methods (Vsh) 60

4.3.1.1. Single- Curve Indicators 60

4.3.1.2. Double- Curve Indicators 61

4.3.2. Present Study 62

4.4. Formation Porosity Determination Methods (ϕ) 62

4.4.1. Density Log (Φ_D) 62

4.4.2. Neutron Log (Φ_N) 63

4.4.3. Sonic Log (Φ_S) 64

4.4.4. Determination of effective porosity 66
4.4.5. Present Study 66
4.5. Evaluation of Water Resistivity (RW) 67
4.5.1. Present Study 69
4.6. Determination of Fluid Saturation 73
4.6.1. Determination of Water Saturation in Uninvaded Zone (Sw) 73
4.6.1.1. Archie's Model 73
4.6.1.2. Indonesia Model 73
4.6.2. Determination of Water Saturation in Flushed Zone (Sxo) 74
4.6.2.1. Archie's Model 74
4.6.2.2. Indonesia Model 74
4.6.3. Determination of Hydrocarbon Saturation 75
4.7. Lithology Determination and Interpretation 76
4.7.1. Neutron –Density Crossplot 76
4.7.2. M-N Crossplot 84
4.7.3. Litho-saturation Crossplots 92
4.8. Horizontal Distribution of Petrophysical Parameters 123
4.8.1. Horizontal Distribution Maps for Abu Roash Member (A) 123
4.8.2. Horizontal Distribution Maps for Bahariya Formation 130
4.8.3. Horizontal Distribution Maps for Kharita Formation 137
Chapter Five: Formation Pressure Evaluation 145
5.1.Introduction 145
5.1.1.Basic Terminology 146
5.1.2. Overpressure Generating Mechanisms 145
5.1.3. Abnormal Pore Pressure Criteria 154
5.2. Research Methodology 155

5.2.1. Overpressure estimation methods 155
5.2.1.1. Overpressure Estimation before Drilling Using Seismic Velocities 155
5.2.1.1.1. Equivalent depth method 155
5.2.1.1.2. Bowers' Method 156
5.2.1.1.3. Eaton Method 157
5.2.1.2. Overpressure Estimation while Drilling Using d-exponent method 161
5.2.1.2.1. Jorden and Shirley model 162
5.2.1.2.2. Rehm and McClendon 162
5.2.1.2.3. Rehm and McClendon correlation 164
5.2.1.2.4. Zamora correlation 164
5.2.1.2.5. Eaton correlation 165
5.2.1.3. Pore pressure prediction from porosity method 166
5.3. Results and Interpretation 171
5.3.1. Results of Pore Pressure Prediction from Well Logs (Porosity Logs) 171
5.3.2. Results of Pore Pressure Prediction While Drilling 177
5.3.3. Results of Pore Pressure Prediction Pre-Drilling Using Seismic Velocities 180
Summary and Conclusion 197
Appendix (A) 204
Reference 216
Arabic Summary 223

List of Figures

Figure No.	Figure Caption	Page No.
1-1	Location map of Beni Suef Basin	2
2-1	The General Stratigraphic column of North Western Desert	7
2-2	The stratigraphic column of the Beni Suef Basin	9
2-3	Western Desert basinal and high areas	13
2-4	Arabo Nubian Shield Craton Elements Map(EGPC,1992)	15
2-5	Main geotectonic cycles in the Western Desert of Egypt (After EGPC, 1992)	16
2-6	North Western Desert Regional Structure Map	18
3-1	Shot point location map of the study area	21
3-2	Interpreted seismic section (CROSSLINE-2470)	26
3-3	Interpreted seismic section (CROSSLINE-2295)	27
3-4	Interpreted seismic section (INLINE-10335)	33
3-5	Interpreted seismic section (INLINE-10155)	30
3-6	Time structural contour map on the top of Abu Roash Member (A)	34
3-7	Time structural contour map on the top of Bahariya Formation	35
3-8	Time structural contour map on the top of Kharita Formation	36
3-9	The drift between T-D curves from well data and seismic data	39
3-10	The drift between average and rms velocities curves with depth	40
3-11	Velocity drift map on the top of Abu Roash Formation	41
3-12	Velocity drift map on the top of Bahariya Formation	41
3-13	Velocity drift map on the top of Kharita Formation	42
3-14	Heterogeneity Factor map on the top of Abu Roash Formation	44
3-15	Heterogeneity Factor map on the top of Bahariya Formation	44
3-16	Heterogeneity Factor map on the top of Kharita Formation	45
3-17	3D view for the calculated average velocity	46
3-18	Average velocity map on the top of Abu Roash Member (A)	47
3-19	Average velocity map on the top of Bahariya Formation	48