

GEOPHYSICAL STUDIES TO EVALUATE THE DEEP GROUNDWATER AQUIFERS IN THE SOUTHWESTERN PART OF SINAI

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ABSTRACT

The study area lies in the southwestern part of Sinai Peninsula and is defined between Latitudes $27^{\circ} 45'$ and $28^{\circ} 45'$ N and Longitudes $33^{\circ} 10' 40''$ and $34^{\circ} 15'$ E.

The objective of this work is to make use of integrated geophysical data (aeromagnetic, deep seismic, well logging and geoelectrical resistivity sounding) to evaluate the characteristics of the deep and shallow formations as well as their vertical and horizontal extension in the study area in terms of groundwater potential. A special emphasis is given to the structural pattern affecting these formations and its impact on the groundwater occurrence.

To fulfill these tasks the available magnetic and deep seismic data were interpreted to delineate the subsurface structural pattern, while the wireline electrical well logging and geoelectrical well logging data were tools to study the characteristics of the groundwater aquifers. The geoelectrical resistivity sounding data were used to delineate the shallow formations and to detect groundwater occurrence within these formations.

The total intensity aeromagnetic field map has been qualitatively analyzed and quantitatively interpreted to delineate the structural elements at different depths using various methods of separations (Griffin's and Filtering techniques) and to estimate the average depths applying the spectral analysis.

The parameters of acquisition and processing of deep seismic data have been discussed in terms of velocity analysis and construction of velocity maps. The subsurface structural elements have been delineated by constructing

structure contour maps of Nubia, Lower Rudies, Upper Rudies, Kareem, Belayim and Zeit Formations.

Well logging data were used to determine the general characteristics of the water bearing formation in terms of shale volume, effective porosity, water saturation, and water salinity.

The geoelectrical resistivity sounding data have been quantitatively interpreted and the deduced geoelectrical parameters were used to delineate the near surface lithologic succession and the water bearing formations.

The statistical analysis of the tectonic trends inferred from the separation of the aeromagnetic data showed the presence of five tectonic trends. The Suez or Clysmic trend (N 30°- 40° W) is the major one while the Aqaba trend (N 5°- 15° E) is the minor one. In a decreasing order the Syrian Arc trend (N 30°- 50° E), Najd trend (N 40°- 60° W), Tethyan trend (E-W), East African trend (N-S) have also been detected.

The interpretation of velocity maps constructed for the top of the different formations (Nubia, Lower Rudies, Upper Rudies, Kareem, Belayim and Zeit Formations), revealed that the velocity values increase in the northeast, east and southwest part of the area and decrease towards the northwest and southeast directions.

The seismic velocity of each formation and their isochronous reflected data were used to construct structure contour maps in terms of depth. In addition, azimuth length distribution was carried out to enhance the structural interpretation. The thickness distribution of each formation has been presented in the form of isopach maps.

The structural pattern inferred from both magnetic and seismic interpretation was found to be more or less conformable to each other.

The interpretation of the well logging data revealed that the formations are moderately to highly porous and saturated with saline to highly saline water.

The results of geoelectrical resistivity sounding revealed that the lithologic succession consists of a number of layers that can be grouped in four main zones. The geoelectrical characteristics of the third and fourth zones suggest water saturation with downward increasing salinity. Locations for drilling water wells have been recommended.

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CONTENTS

S u b j e c t	Page
ABSTRACT	I
ACKNOWLEDGEMENTS	IV
CONTENTS	V
LIST OF TABLES	IX
LIST OF FIGURES	XI
LIST OF APPENDIX	XIII
INTRODUCTION	1
CHAPTER I	
PREVIOUS GEOMORPHOLOGICAL, GEOLOGICAL, GEOPHYSICAL AND HYDROGEOLOGICAL ASPECTS	5
I.1. Geomorphological Aspects	5
I.1.i. Basement Mountainous Unit	5
I.1.ii. Sedimentary Mountains Unit	5
I.1.iii. Alluvial Fans	6
I.1.iv. Terraces	6
I.1.v. Dry Wadis	8
I.1.vi. Playa Deposits	8
I.1.vii. Sand Dunes and Sand Sheets	8
I.1.viii. Sabkhas	9
I.2. Geological Aspects	9
I.2.i. Surface Geology	9
I.2.ii. Subsurface Geology	12
I.2.ii.i. Paleozoic	13
I.2.ii.ii. Mesozoic	15
I.2.ii.ii.i. Upper Cretaceous	15
I.2.ii.iii. Cenozoic	16
I.2.ii.iii.i. Tertiary-Quaternary	16
I.3. Structures	19
I.4. Hydrogeological Aspects	21
I.5. Geophysical Aspects	23
I.5.i. Gravity and Magnetic Studies	23
Aim of Study	26
CHAPTER II	
MAGNETIC STUDIES	
II.1. Reduction to the North Magnetic Pole Technique	30

S u b j e c t	Page
II.2. Qualitative Interpretation	34
II.2.i. Description of RTP magnetic map	36
II.3. Quantitative Interpretation	37
II.3.i. Trend analysis	38
II.3.ii. Regional-Residual Separation	42
II.3.ii.i.Griffin's Technique (1949)	44
II.3.ii.ii.Filtering technique	55
II.3.iii. Depth Estimation Methods	67
II.3.iii.i. Peter's Slope Method (1949)	70
II.3.iii.ii. Straight Slope Method	70
II.3.iii.iii. Sokolov's Method (1949)	70
II.3.iv. Spectral analysis	74
CHAPTER III	78
SEISMIC STUDIES	
III.1. Introduction	78
III.2. Seismic data acquisition	78
III.3. Seismic processing	82
III.4. Interpretation of Seismic Data	85
III.4.i.Identification of Reflectors	85
III.4.ii.Picking and correlation of Reflectors	85
III.4.iii. Fault location detection	88
III.4.iv. Closing loops	88
III.4.v. The construction of maps	88
III.4.v.i. Geoseismic structure contour maps	88
III.4.v.i.i. Basement structure contour map	89
III.4.v.i.ii. Deep groundwater aquifer maps	90
III.4.v.i.ii.i. Nubia Formation	93
- Structure contour map of upper surface of Nubia Formation	93
- Isopach map of Nubia Formation	95
- Velocity map of Nubia Formation	98
III.4.v.i.ii.ii. Lower Rudeis Formation	100
- Structure contour map of upper surface of Lower Rudeis Formation	100
- Velocity map of Lower Rudeis Formation	103
III.4.v.i.ii. iii. Upper Rudeis Formation	103
- Structure contour map of upper surface of Upper Rudeis Formation	103

S u b j e c t	Page
- Isopach Map of Upper Surface of Upper Rudies Formation	106
- Velocity map of Upper Rudeis Formation	109
III.4.v.i.ii. iv. Kareem Formation	109
- Structure contour map of upper surface of Kareem Formation	109
- Isopach map of Kareem Formation	112
- Velocity map of Kareem Formation	112
III.4.v.i.ii. v. Belayim Formation	116
- Structure contour map of upper surface of Belayim Formation	116
- Isopach map of Belayim Formation	119
- Velocity map of Belayim Formation	119
III.4.v.i. vi. Zeit Formation	122
- Structural contour map of upper surface of Zeit Formation	122
- Velocity map of Zeit Formation	125
III.4.v.i.iii. Tectonic of the study area	125
 CHAPTER IV WELL LOGGING STUDIES	
IV.1. Introduction	129
IV.2. Log Data	129
IV.3. Measurements and Corrections	129
IV.3.i. Correction of Resistivity logs	130
IV.3.i.i. Corrections of Mud Resistivities	130
IV.3.i.ii. Corrections of Rock Resistivities	130
IV.3.ii. Correction of Porosity logs	136
IV.3.ii.i. Bulk Density (Pb) correction	136
IV.3.ii.ii. Neutron porosity (ϕ N) correction:	136
IV.4. Formation Evaluation Techniques:	139
IV.4.i. Determination of formation temperature (FT)	139
IV.4.ii. Determination of the formation water resistivity (Rw)	140
VI.4.iii. Determination of volume of shale content (Vsh)	140
IV.4.iv. Determination of formation porosity (ϕ)	143
IV.4.v. Determination of water saturation (Sw and Sxo)	146
IV.4.vi. Determination of water salinity	148

S u b j e c t	Page
CHAPTER V	
GEOELECTRICAL STUDIES	
V.1. Introduction	157
V.2. Field work	157
V.3. Interpretation of the results	159
V.4. Results	159
V.5. Hydrogeological aspects	166
- Maps of depth to water	168
- Maps of water table	168
- Isopach map of brackish water bearing zone	171
- Hand dug wells	171
- Drilled wells	171
- Discussion	178
SUMMARY AND CONCLUSIONS	181
REFERENCES	192
APPENDIX	213
ARABIC SUMMARY	i

LIST OF TABLES

No.	Title	Page
1	Classification of quaternary deposits after Jica (1999)	22
2	Trend analysis parameters detected from the RTP magnetic map of the area	40
3	Trend analysis parameters detected from residual magnetic map of the area (R = 1.5 km).	51
4	Trend analysis parameters detected from residual magnetic map of the area (R = 3 km).	51
5	Trend analysis parameters detected from residual magnetic map of the area (R = 3.5km).	52
6	Trend analysis parameters detected from residual magnetic map of the area (R = 4 km).	52
7	Trend analysis parameters detected from residual (High pass) magnetic map with 2.7 Unit.	63
8	Trend analysis parameters detected from residual (High Pass) magnetic map with 4 Unit.	63
9	Trend analysis parameters detected from residual (High Pass) magnetic map with 5.3 Unit.	64
10	Trend analysis parameters detected from residual (High Pass) magnetic map with 8 Unit.	64
11	Depths and Formations of drilled wells in the study area.	68
12	Results of depth estimation methods	72
13	Results of spectral analysis	75
14	Seismic data acquisition	83
15	Processing of parameters of seismic cross sections	84
16	Trend analysis parameters detected from the basement map inferred from seismic data	92
17	Trend analysis parameters detected from the top of Nubia Formation map inferred from seismic data	96
18	Trend analysis detected from the top of Lower Rudeis Formation map inferred from seismic data	102
19	Trend analysis parameters detected from the top of Upper Rudies Formation map inferred from seismic data	107
20	Trend analysis parameters detected from the top of Kareem Formation map inferred from seismic data	113
21	Trend analysis parameters detected from the top of Belayim Formation map inferred from seismic data	118
22	Trend analysis parameters detected from the top of Zeit Formation map inferred from seismic data	124

23	Summary of available well logging data	133
24	Summary of lithology of Formations in wells	134
25	Summary of petrophysical parameters of Nubia Formation	149
26	Summary of petrophysical parameters of Lower Rudeis Formation	149
27	Summary of petrophysical parameters of Upper Rudeis Formation	149
28	Summary of petrophysical parameters of Kareem Formation	150
29	Summary of petrophysical parameters of Belayim Formation	150
30	Summary of petrophysical parameters of Zeit Formation	150
31	Summary of relationship between shale content and velocity values of available wells	154
32	Interpreted results of the vertical electrical sounding stations	161
33	Depth to water, depth to interface, water level and layer thickness	167
34	Design and safety yield of water wells	177

LIST OF FIGURES

No.	Title	Page
1	Location map of the study area	2
2	Geomorphological map of the study area	7
3	Surface geology map of the study area	11
4	Complete stratigraphic sequence of the study area	14
5	Structural pattern of the southern part of El-Qaa plain	20
6	Basement tectonic map after Mashref and El-Qattan (1989)	25
7	Total field aeromagnetic map of the study area	29
8	Reduction to the magnetic pole (RTP) map	31
9	Rose diagram of RTP map	40
10	Residual magnetic map of radius (1-5 km)	47
11	Residual magnetic map of radius (3 km)	48
12	Residual magnetic map of radius (3.5 km)	49
13	Residual magnetic map of radius (4 km)	50
14	Rose diagram of Residual maps	53
15	Magnetic map with 2-7 residual filter (High pass) map	59
16	Magnetic map with 4 residual filter (High pass) map	60
17	Magnetic map with 5.3 residual filter (High pass) map	61
18	Magnetic map with 8 residual filter (High pass) map	62
19	Rose diagram of high pass maps (a,b,c and d) at 2.7,4,5.3,8 units	65
20	Location map of the drilled wells in the study area.	69
21	Depth estimation methods	71
22	RTP map showing locations of depth estimation profiles using traditional methods	73
23	RTP map showing locations of depth estimation profiles using spectral analysis	76
24	Spectral analysis results along magnetic profiles 2,29 using Treitel method	77
25	Shot point location map of the study area	79
26	Time-depth curve (well velocity) survey of El-Qaa-1 well	80
27	Time-depth curve (well velocity) survey of Isla-1	81
28	Seismic section (Qs 156-80)	86
29	Seismic section (Q5-172-80)	87
30	Structure contour map of basement relief inferred from seismic data	91
31	Rose diagram of basement relief map inferred from seismic data	92
32	Structure contour map of top of Nubia Formation	94
33	Rose diagram of upper surface of Nubia Formation	96
34	Isopach map of Nubia Formation	97

35	Velocity map of Nubia Formation	99
36	Structure contour map of top of lower Rudies Formation	101
37	Rose diagram of upper surface of lower Rudies Formation	102
38	Velocity map of lower Rudies Formation	104
39	Structure contour map of top of up Rudies Formation	105
40	Rose diagram of upper Rudies Formation	107
41	Isopach map of upper Rudies Formation	108
42	Velocity map of upper Rudies Formation	111
43	Structure contour map of top of Kareem Formation	110
44	Rose diagram of Kareem Formation	113
45	Isopach map of Kareem Formation	114
46	Velocity of Kareem Formation	115
47	Structure contour map of top of Belayim Formation	117
48	Rose diagram of Belayim Formation	118
49	Isopach map of Belayim Formation	120
50	Velocity map of Belayim Formation	121
51	Structure contour map of top of Zeit Formation	123
52	Rose diagram of Zeit Formation	124
53	Velocity of map of Zeit Formation	126
54	Well location map	132
55	Velocity –V shale relationship along Isla-1 well	154
56	Velocity –V shale relationship along Abu-Raya-2 well	155
57	Velocity –V shale relationship along Safariat-1 well	155
58	Velocity –V shale relationship along Ashiera-1 well	156
59	Velocity –V shale relationship along El-Qaa-1 well	156
60	Location map of the study area, location of VES sections, the gas electrical cross-sections in El-Gebiel area	158
61	Geoelectrical cross-section A-A' (El-Gebiel area)	163
62	Geoelectrical cross-section R-R' (El-Gebiel area)	163
63	Geological cross-section C-C' (El-Gebiel area)	164
64	Geological cross-section D-D' (El-Gebiel area)	164
65	Geological cross-section E-E' (El-Gebiel area)	165
66	Geological cross-section F-F' (El-Gebiel area)	165
67	Depth to water map from the ground surface	169
68	Depth to interface between brackish and saline water from the ground surface	170
69	Water table map	172
70	Water level of the interface between the brackish and saline water	173
71	Isopach map of brackish water Formation layer.	174

LIST OF APPENDIX

No.	Title	Page
1	Input data of Nubia Formation at well Sabil-1	213
2	Input data of Nubia Formation at well Islal-1	214
3	Input data of Nubia Formation at well El-Qaa-1	214
4	Input data of Lower Rudies Formation at well Sabil-1	215
5	Input data of Lower Rudies Formation at well Isla-1	216
6	Input data of Lower Rudies Formation at well El-Qaa-1	217
7	Input data of Lower Rudies Formation at well Safariat-1	218
8	Input data of Lower Rudies Formation at well Ashiera-1	219
9	Input data of Lower Rudies Formation at well Abu-Raya-2	220
10	Input data of Upper Rudies Formation at well Isla-1	222
11	Input data of Upper Rudies Formation at well Abu-Raya-2	223
12	Input data of Upper Rudies Formation at well El-Qaa-1	224
13	Input data of Upper Rudies Formation at well Safariat-1	225
14	Input data of Upper Rudies Formation at well Ashiera-1	227
15	Input data of Kareem Formation at well Isla-1	228
16	Input data of Kareem Formation at well Abu-Raya-2	229
17	Input data of Kareem Formation at well El-Qaa-1	230
18	Input data of Kareem Formation at well Safariat-1	231
19	Input data of Kareem Formation at well Ashiera-1	232
20	Input data of Belayim Formation at well Isla-1	232
21	Input data of Belayim Formation at well Abu-Raya-2	233
22	Input data of Belayim Formation at well El-Qaa-1	234
23	Input data of Belayim Formation at well Safariat-1	235
24	Input data of Belayim Formation at well Ashiera-1	235
25	Input data of Zeit Formation at well Isla-1	236
26	Input data of Zeit Formation at well Abu-Raya-2	237
27	Input data of Zeit Formation at well Safariat-1	238
28	Input data of Zeit Formation at well Ashiera-1	239
29	Output data of Nubia Formation at well Sabil-1	239
30	Output data of Nubia Formation at well Isla-1	240
31	Output data of Nubia Formation at well Abu-Raya-2	240
32	Output data of Lower Rudies Formation at well Sabil-1	241
33	Output data of Lower Rudies Formation at well Isla-1	241
34	Output data of Lower Rudies Formation at well El-Qaa-1	242
35	Output data of Lower Rudies Formation at well Asheira-1	242
36	Output data of Lower Rudies Formation at well Safariat-1	243
37	Output data of Lower Rudies Formation at well Abu Raya-2	243

38	Output data of Upper Rudies Formation at well Isla-1	244
39	Output data of Upper Rudies Formation at well Abu Raya-2	244
40	Output data of Upper Rudies Formation at well El Qaa-1	245
41	Output data of Upper Rudies Formation at well Safariat-1	246
42	Output data of Upper Rudies Formation at well Ashiera-1	246
43	Output data of Kareem Formation at well Isla-1	246
44	Output data of Kareem Formation at well Abu Raya-2	247
45	Output data of Kareem Formation at well El Qaa-1	247
46	Output data of Kareem Formation at well Safariat-1	248
47	Output data of Kareem Formation at well Ashiera-1	248
48	Output data of Belayim Formation at well Isla-1	248
49	Output data of Belayim Formation at well Abu Raya-2	249
50	Output data of Belayim Formation at well El Qaa-1	249
51	Output data of Belayim Formation at well Safariat-1	249
52	Output data of Belayim Formation at well Ashiera-1	250
53	Output data of Zeit Formation at well Isla-1	250
54	Output data of Zeit Formation at well Abu Raya-2	250
55	Output data of Zeit Formation at well El Qaa-1	251
56	Output data of Zeit Formation at well Safariat-1	251