

# بسم الله الرحمن الرحيم





# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار





# بعض الوثائق الأصلية تالفة





بالرسالة صفحات  
لم ترد بالأصل



B1 ✓ o y.

***EVALUATION OF GROUND AND SURFACE WATER  
IN TRIANGLE OF SHELA TEEN, ABU RAMAD,  
HALAIEB FOR DIFFERENT USES***

***A THESIS PRESENTED TO  
CHEMISTRY DEPARTMENT  
FACULTY OF SCIENCE  
CAIRO UNIVERSITY***

***BY***

***AMAL HOSNEY ESMAIL  
B.Sc. (Chemistry) 1986  
M.Sc. (Chemistry) 1993***

***FOR THE DEGREE OF  
Ph. D. OF SCIENCE  
(CHEMISTRY)***

***2001***

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ﴾

صَدَقَ اللَّهُ الْعَظِيمُ



## Approval Sheet for Submission

**Title of Ph. D. Thesis: EVALUATION OF GROUND AND SURFACE WATER  
IN TRIANGLE OF SHELAATEEN, ABU RAMAD,  
HALAIEB FOR DIFFERENT USES.**

**Name of the Candidate: AMAL HOSNEY ESMAIL.**

**The Thesis has been approved by Submission of Science, Cairo University**

**Supervision Committee:**

**Signature**

- 1- Prof. Dr. Yousry Moustafa Issa**  
*Professor of Analytical Chemistry  
Vice Dean for Postgraduate Studies  
Chemistry Department, Faculty of  
Science, Cairo University.*
- 2- Geologist: Ali Mahmoud Werwer**  
*Chairman and Managing Director  
General Company for Research  
and Ground Water (REGWA).*
- 3- Prof. Dr. Aida Lotfy El-Ansary**  
*Professor of Inorganic Chemistry  
Chemistry Department, Faculty of  
Science, Cairo University.*

**Prof. Dr. Sadek El-Said Ibrahim Abdou**  
**Chairman of Chemistry Department**  
**Faculty of Science, Cairo University**

## **Abstract**

**Name:** AMAL HOSNEY ESMAIL.

**Title of Ph. D. Thesis:** EVALUATION OF GROUND AND SURFACE WATER  
IN TRIANGLE OF SHELATEEN, ABU RAMAD,  
HALAIEB FOR DIFFERENT USES.

**Degree [Ph. D.] Faculty of Science, Cairo University, 2001.**

### **Abstract:**

Land reclamation projects represent one of Egypt strategic policies to meet over increasing in population. Some efforts have been directed to the Triangle of Halaieb, Shelateen and Abu Ramad (about 28 000 km<sup>2</sup>) at south east of Egypt for the establishment of agricultural communities in this critical area which will be considered as a good strategic issue. This study aims to study the potentiality of ground water and development plan at this triangle. The examined seventy ground water wells tapped the Quaternary, Basement, Miocene and Nubian Sand Stone Aquifers.

Chemical analyses and their related representations-which is considered as a pioneer research in this area-were used to answer many questions about the capability and suitability of these reservoirs for agricultural purposes and establishment of settlement in this concerned area.

**Key Words:** Halaieb, Shelateen, Abu Ramad, Abu Saafa, Ground Water, Water Type, Genesis, Evaluation, Agricultural usage, Drinking of live Stock and Poultry.

**Supervision Committee:**

**Signature**

**1-Prof. Dr. Yousry Moustafa Issa**

**2-Geologist: Ali Mahmoud Werwer**

**3-Prof. Dr. Aida Lotfy El-Ansary**

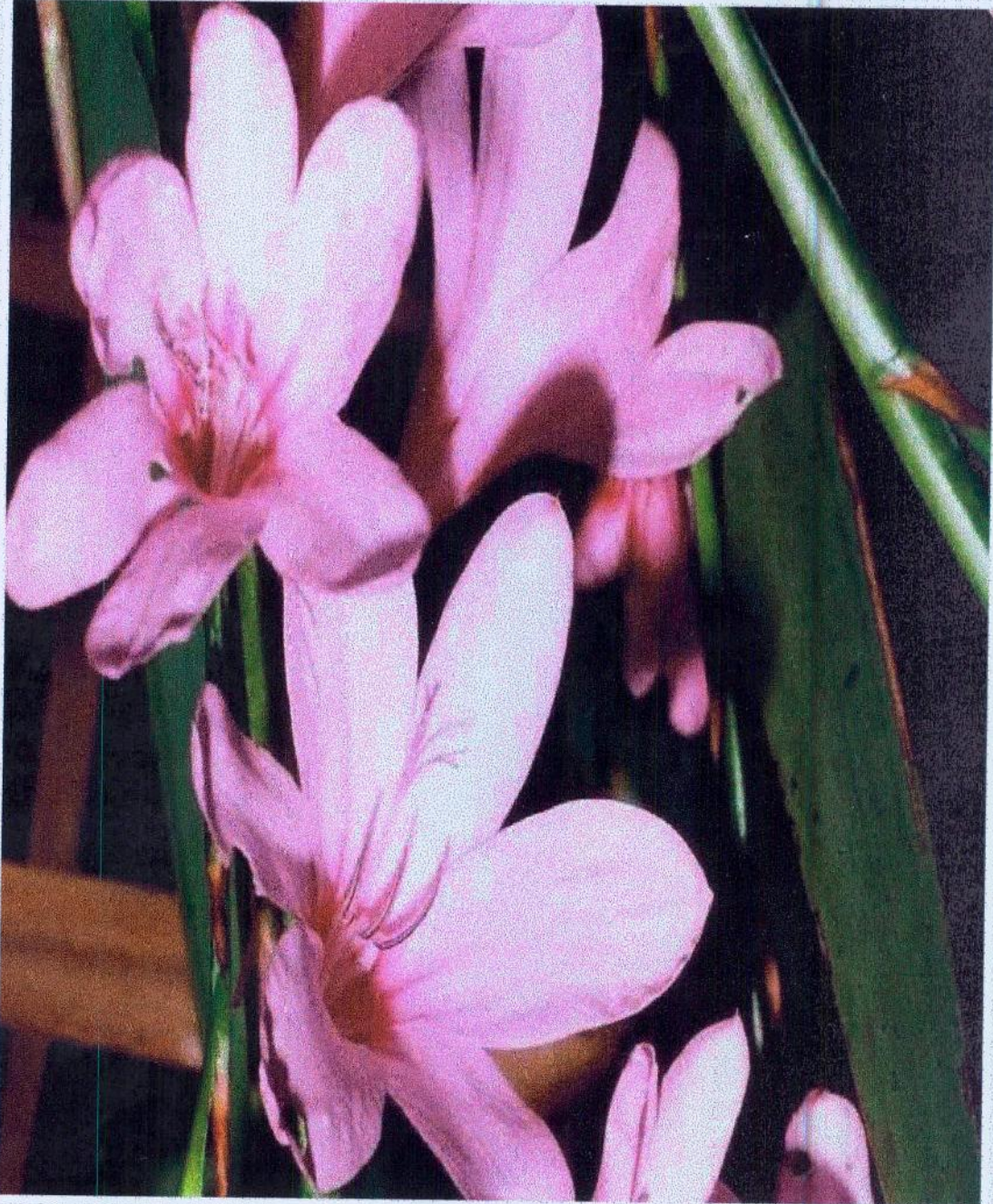
**Prof. Dr. Sadek El-Said Ibrahim Abdou**  
*Chairman of Chemistry Department*  
*Faculty of Science, Cairo University*

## Acknowledgement

*The author wishes to express her deep thanks, appreciation and sincere gratitude to Dr. Y. M. Issa, Professor of Analytical Chemistry, Vice Dean for Postgraduate Studies, Chemistry Department, Faculty of Science, Cairo University; Geologist A. M. Werwer, Chairman and Managing Director, General Company for Research and Ground Water (REGWA); Dr. A. L. El-Ansary Professor of Inorganic Chemistry, Chemistry Department, Faculty of Science, Cairo University for suggesting the problem, valuable guidance, helpful comments, kind interest and fruitful discussion throughout the present work.*

*Many thanks also to Dr. Kh. A. Guindy Assis. Prof. of hydrogeochemistry Hydrology Department, Desert Research Institute, for the kind help and encouragement.*

# *To My Family*



## CONTENTS

|                                              | <i>Page</i> |
|----------------------------------------------|-------------|
| List of Figures                              |             |
| List of Tables                               |             |
| Aim of The Works.....                        | 1           |
| <b>CHAPTER I: Introduction</b>               |             |
| 1.1. General Outline.....                    | 1           |
| 1.2. Location .....                          | 1           |
| 1.3. Previous Work.....                      | 3           |
| 1.4. Climatic Conditions.....                | 4           |
| 1.4.1. Air Temperature.....                  | 4           |
| 1.4.2. Rain Fall.....                        | 4           |
| 1.4.3. Relative Humidity.....                | 4           |
| 1.4.4. Evaporation.....                      | 5           |
| 1.4.5. Airidity Coefficients.....            | 5           |
| 1.5. Regional Geological Setting.....        | 5           |
| 1.5.1. Stratigraphy .....                    | 5           |
| 1.6. Hydrogeology.....                       | 5           |
| 1.6.1. Hydrogeological Setting .....         | 7           |
| 1.6.1. The Quaternary Aquifer System.....    | 7           |
| 1.6.2. Miocene .....                         | 7           |
| 1.6.3. The Nubian Sand Stone Aquifer.....    | 7           |
| 1.6.4. The Precambrian Aquifer System.....   | 8           |
| 1.7. Ground Water flow.....                  | 8           |
| <b>CHAPTER II: Experimental</b>              |             |
| II.1. In The Field.....                      | 10          |
| II.2. In The Laboratory.....                 | 10          |
| II.2.a. Sampling Procedures.....             | 11          |
| II.2.b. Preparation of Solutions.....        | 11          |
| II.2.b.1. Standard Solutions .....           | 11          |
| II.2.b.2. Reagent Solutions .....            | 12          |
| II.2.b.3. Ammoniacal Buffers Solutions ..... | 13          |

|                                                                        | <i>Page</i> |
|------------------------------------------------------------------------|-------------|
| II.2.b.4. Indicators .....                                             | 13          |
| II.3. Solid Reagents .....                                             | 14          |
| II.4. Working Procedures .....                                         | 14          |
| II.4.a. Water Temperature .....                                        | 14          |
| II.4.b. Electrical Conductivity .....                                  | 14          |
| II.4.c. pH value Measurements.....                                     | 14          |
| II.4.d. Total dissolved solids, TDS .....                              | 15          |
| II.4.e. Determination of Carbonates and Bicarbonate .....              | 15          |
| II.4.f. Determination of Chloride .....                                | 15          |
| II.4.g. Determination of Sulphate .....                                | 15          |
| II.4.h. Major and Trace Elements Determinations .....                  | 16          |
| II.4.h.1. Flame Photometric Determination of Sodium and Potassium..... | 16          |
| II.4.h.2. Compleximetric Determination of Calcium and Magnesium.....   | 16          |
| II.4.h.3. Spectrophotometric Determination of Iron.....                | 16          |
| II.4.h.4. Spectrophotometric Determination of Boron.....               | 17          |
| II.4.h.5. Spectrophotometric Determination of Silica.....              | 17          |
| II.4.h.6. Atomic Absorption Determination of Trace Elements.....       | 17          |
| II.4.h.7. Standard Solutions for Atomic Absorption Spectrometry.....   | 18          |
| 1. Aluminum.....                                                       | 18          |
| 2. Manganese.....                                                      | 18          |
| 3. Cadmium .....                                                       | 18          |
| 4. Lead .....                                                          | 18          |
| 5. Selenium .....                                                      | 18          |
| 6. Zinc .....                                                          | 18          |

### **CHAPTER III: Results and Discussions**

|                                                                                 |    |
|---------------------------------------------------------------------------------|----|
| III. Ground Water Quality of Triangle of Halaieb, Shelateen and Abu Ramad ..... | 19 |
| III.1. The General Chemical Characters of Ground Water .....                    | 24 |
| III.1.1. Total Dissolved Solids.....                                            | 25 |
| III.1.1.1. The Dug Wells in Quaternary Aquifer.....                             | 25 |
| III.1.1.1.a. Wadi Hoddien (Quaternary Aquifer).....                             | 26 |
| III.1.1.1.b. Delta Wadi Kraff.....                                              | 26 |

|                                                                                                                | <i>Page</i> |
|----------------------------------------------------------------------------------------------------------------|-------------|
| III.1.1.1.c. Wadi Sermatay .....                                                                               | 27          |
| III.1.1.2. The Dug Well in Miocene Aquifer .....                                                               | 27          |
| III.1.1.3. The Dug and Drilled Wells in Nubian Sand stone Aquifer .....                                        | 27          |
| III.1.1.3.a. Wadi Hoddien .....                                                                                | 27          |
| III.1.1.4. The Dug Wells in Basement Aquifer .....                                                             | 30          |
| III.1.1.4.a. Wadi Rahba.....                                                                                   | 33          |
| III.1.1.4.b. Wadi Hoddien.....                                                                                 | 34          |
| III.1.1.4.c. Wadi Abb.....                                                                                     | 35          |
| III.1.1.4.d. Wadi Kraff.....                                                                                   | 35          |
| III.1.1.4.e. Wadi Aquamattra (Albaa Mountain).....                                                             | 36          |
| III.1.1.4.f. Wadi Osear.....                                                                                   | 36          |
| III.1.1.4.g. Wadi Bebway.....                                                                                  | 36          |
| III.1.1.4.h. Wadi Meseh.....                                                                                   | 36          |
| III.1.1.4.i. Wadi Akoan.....                                                                                   | 37          |
| III.1.2. The Ionic Distribution and Water Type.....                                                            | 37          |
| III.1.2.1. The Dug Wells in Quaternary Aquifer.....                                                            | 37          |
| III.1.2.1.a. Wadi Hoddien.....                                                                                 | 37          |
| III.1.2.1.b. Wadi Kraff .....                                                                                  | 44          |
| III.1.2.1.c. Wadi Sermatay.....                                                                                | 46          |
| III.1.2.2. Ionic Distribution and Water Type of Water for Miocene Aquifer .....                                | 49          |
| III.1.2.3. Ionic Distribution and Water Type in Dug and Deep Wells in<br>Nubian Sand Stone (Wadi Hoddien)..... | 51          |
| III.1.2.4. The Ionic Distribution and Type of Water for basement Aquifer .....                                 | 62          |
| III.1.2.4.a. Wadi Rahba .....                                                                                  | 62          |
| III.1.2.4.b. The Ionic Distribution and Water Type in Wadi Hoddien.....                                        | 68          |
| III.1.2.4.c. The Ionic Distribution and Water Type in Wadi Abb.....                                            | 76          |
| III.1.2.4.d. The Ionic Distribution and Water Type in Wadi Kraff.....                                          | 76          |
| III.1.2.4.e. The Ionic Distribution and Water Type in Wadi Aquamattra.....                                     | 79          |
| III.1.2.4.f. The Ionic Distribution and Water Type in Wadi Osear.....                                          | 82          |
| III.1.2.4.g. The Ionic Distribution and Water Type in Wadi Bebway.....                                         | 84          |
| III.1.2.4.h. The Ionic Distribution and Water Type in Wadi Meseh.....                                          | 85          |
| III.1.2.4.i. The Ionic Distribution and Water Type in Wadi Akoan.....                                          | 86          |
| III.1.3. Ground Water Genesis or Origin .....                                                                  | 89          |

|                                                                                                                          | <i>Page</i> |
|--------------------------------------------------------------------------------------------------------------------------|-------------|
| III.1.3.a. The Trilinear Analysis Diagram .....                                                                          | 89          |
| III.1.3.b. Suline's Diagram (1948) .....                                                                                 | 90          |
| III.1.3.c. Hydrochemical Ratios .....                                                                                    | 91          |
| III.1.3.a.1. Groundwater Genesis or Origin (Piper Diagram) in Dug Wells in Quaternary<br>Aquifer .....                   | 92          |
| III.1.3.a.1.a. Wadi Hoddien (Quaternary Aquifer).....                                                                    | 92          |
| III.1.3.b.1. Groundwater Genesis or Origin (Suline's Diagram) .....                                                      | 93          |
| III.1.3.b.1.a. Wadi Hoddien (Quaternary Aquifer) .....                                                                   | 93          |
| III.1.3.c.1.a. Hydrochemical Coefficients of Wadi Hoddien .....                                                          | 95          |
| III.1.3.a.1.b. Groundwater Genesis or Origin (Piper Diagram) of Wadi Kraff (Quaternary<br>Aquifer) .....                 | 95          |
| III.1.3.b.1.b. Suline's Diagram in Wadi Kraff .....                                                                      | 95          |
| III.1.3.c.1.b. Hydrochemical Coefficients of Wadi Kraff (Quaternary Aquifer) .....                                       | 96          |
| III.1.3.a.1.c. Groundwater Genesis or Origin (Piper Diagram) of Wadi<br>Sermatay (Quaternary Aquifer) .....              | 96          |
| III.1.3.b.1.c. Suline's Diagram in Wadi Sermatay .....                                                                   | 96          |
| III.1.3.c.1.c. Hydrochemical Coefficients of Wadi Sermatay (Quaternary Aquifer) .....                                    | 99          |
| III.1.3.a.2. Groundwater Genesis or Origin (Piper Diagram) of (Miocene Aquifer).....                                     | 99          |
| III.1.3.b.2. Suline's Diagram in Dug Wells in Miocene Aquifer .....                                                      | 99          |
| III.1.3.c.2. Hydrochemical Coefficients of Miocene Aquifer .....                                                         | 99          |
| III.1.3.a.3. Groundwater Genesis or Origin (Piper Diagram) of Dug and Deep Wells in<br>(Nubian Sand Stone Aquifer) ..... | 100         |
| III.1.3.b.3. Suline's Diagram in Dug Wells and Deep Wells in (Nubian Sand Stone<br>Aquifer) .....                        | 100         |
| III.1.3.c.3. Hydrochemical Coefficients of Nubian Sand Stone Aquifer (Wadi<br>Hoddien) .....                             | 103         |
| III.1.3.a.4. Groundwater Genesis or Origin (Piper Diagram) of Dug Wells in<br>(Basement Aquifer) .....                   | 103         |
| III.1.3.a.4.a. Wadi Rahba (Basement Aquifer) .....                                                                       | 103         |
| III.1.3.b.3.a. Suline's Diagram in Wadi Rahba (Basement Aquifer) .....                                                   | 104         |
| III.1.3.c.3.a. Hydrochemical Coefficients of Dug Wells in Basement Aquifer (Wadi<br>Rahba) .....                         | 104         |