

**A STUDY OF CERTAIN MINERALS AS A
CRITERIA OF SOIL FORMATION**

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Thesis

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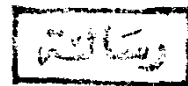
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To the Faculty of Agriculture,

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A P P R O V A L S H E E T

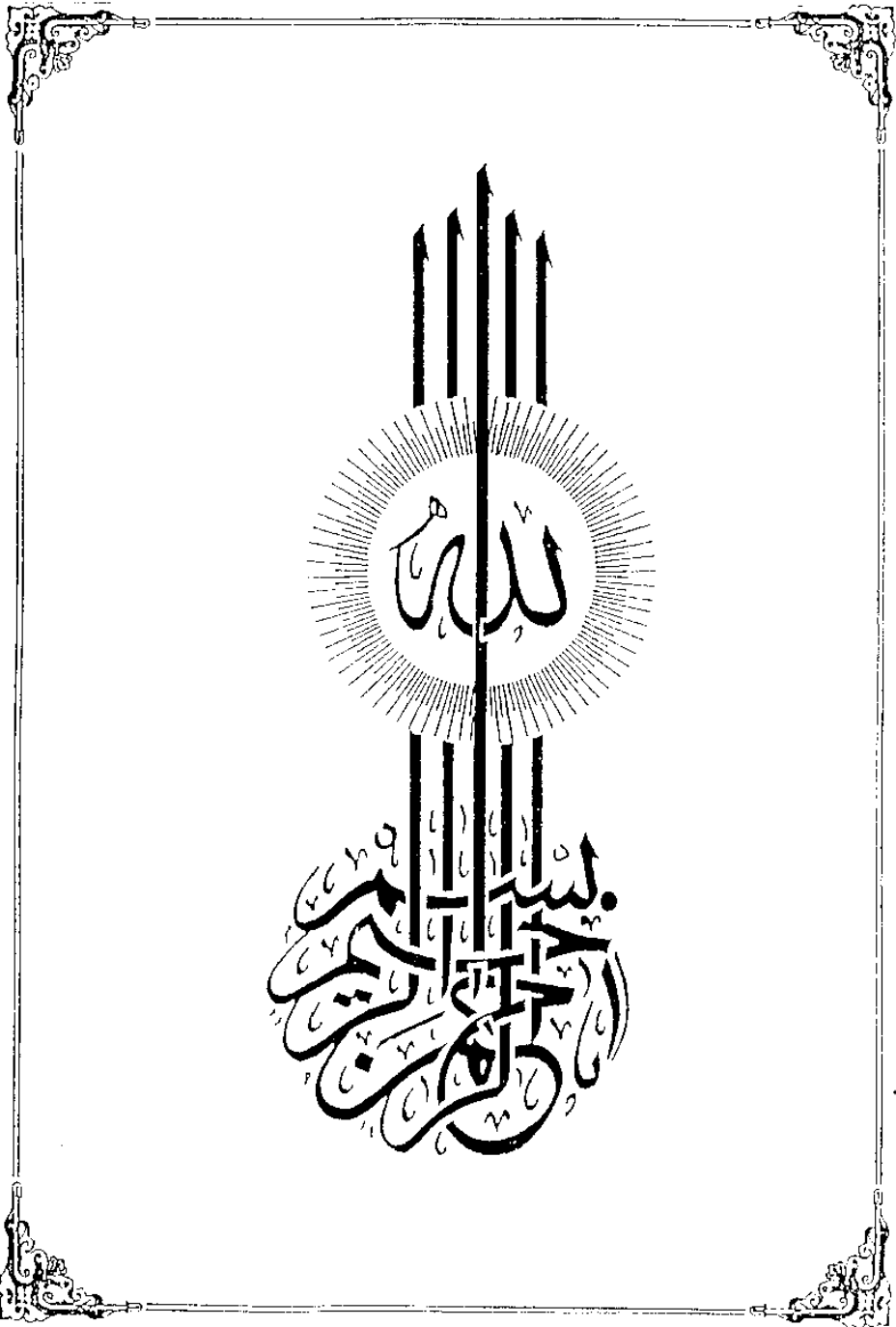
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A C K N O W L E D G M E N T

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CONTENTS

	Page
INTRODUCTION...	1
1. PHYSICOGRAPIHC FEATURES ...	2
1.1. General ...	3
1.2. Location ...	4
1.3. Climate ...	5
1.4. Geology ...	8
1.5. Geomorphology..	10
1.6. Natural vegetation. ...	16
3. MATERIAL AND METHODS...	18
3.1. Sampling...	18
3.2. Particle size Distribution Analysis ...	19
3.3 Mineral Analyses ...	20
3.3.1. Particle size segregation...	20
3.3.2. Mineralogy of the sand fraction. ...	21
3.3.3. Mineralogical analyses of the clay fraction ((2 u) ...	22
3.3.4. Electron microscope analyses ...	23
3.4. Chemical analyses..	23
3.5. Thin Section Techniques ...	24

4. SUMMARY AND DISCUSSION...	57
4.1. Macromorphological Features of the Selected Profiles ...	57
4.1.1. Western Mediterranean Coast...	57
4.1.2. The Fayoum depression ...	41
4.2. Mineralogical Composition of the Soils...	53
4.2.1. Sand fraction ...	53
4.2.1.1. The heavy minerals ...	53
4.2.1.2. Light minerals...	59
4.2.2. Profile uniformity ...	60
4.2.3. Mineralogical analyses of the fine fractions (< 2 μ) ...	76
4.2.3.1. X-ray techniques. ...	76
4.2.4. Electron micrography..	83
4.3. Micromorphological Studies...	85
4.3.1. Micromorphology of Burg el Arab Soils. ...	89
4.3.2. Micromorphology of the soils of Fayoum	101
5. PEDOGENIC PROCESS AND SOIL FORMATION OF THE STUDIED AREAS ...	119
6. SUMMARY AND CONCLUSIONS..	117
7. REFERENCES...	139

I. INTRODUCTION

Egypt is divided from the geomorphological point of view, into distinct regions namely; the Nile Delta, the Nile Valley, the Eastern Desert, the Western Desert and Sinai peninsula.

The aforementioned regions differ in their respect to the geological formations and the surface rocks contributive to soil formation. It is, therefore, expected that the soils formed vary greatly from one region to the other according to the variations in parent materials and local conditions. The Delta and the Nile Delta basin are occupied by the alluvial sediments transported over the past decades by the Nile water.

The Eastern desert is occupied by igneous and sedimentary formations. The western desert, which is more to our concern, is occupied by old geological formations, mainly limestones belonging to the Cretaceous and sandstones belonging to the Tertiary.

The northern part of the Western desert is occupied by highly calcareous formations derived of the Miocene rocks forming the Libyan Plateau.

The great area of the southern Western desert, are occupied by formation , mainly geological, dominated by sandstone or limestone, belonging to the Pleistocene period.

For the aim of the current investigation two different areas including the most geomorphological features characterizing the soils of Egypt were chosen. The undertaken studies were, therefore, limited to each region and described in connection with the geology and the geomorphology of the area. No correlation or coordination between soils of one area and those of the other were attempted.

This work deals with the mineralogy of sand and clay fractions as related to soil development and formation in the two different regions namely; the Mediterranean coastal region and the interference zone between Nile valley and Western desert where Fayoum depression is located.

The former is characterized by highly calcareous formations, mostly belonging to Miocene, Pleistocene and Recent. While the latter has been affected by alluvial and lacustrine deposition of Oligocene, late Pliocene, and Recent. Also macro and micro-morphological studies as well as fabric analyses of representative profiles from the two regions were included.

1. GEOGRAPHIC FEATURES

1.1. General.

The United Arab Republic forms the north-eastern corner of Africa and occupies almost one thirtieth of the total area of the Africa continent. It is bounded to the north by the Mediterranean sea, to the south by the Republic of Sudan, to the west by Libyan Arab Republic and to the east by Palestine and the Red sea. Egypt lies for the most part in the temperate zone, with less than a quarter of its area south the tropic of Cancer. The whole country forms a part of the Great Desert belt, and like all other lands lying within this belt is characterized by a warm and almost rainless climate.

The scanty rainfall in Egypt accounts for the fact that the greatest part of Egypt consists of barren and desolate desert. It is only through the river Nile that a regular and voluminous supply of water, coming of the high lands lying further south, is secured. This water is channelled by artificial canals over a narrow strip of alluvial land on both sides of the river, the Fayoum Depression and the Delta expanse. These tracts of fertile land which cover less than 3 percent of the total area of Egypt, are over populated.

The Nile valley and the Delta, the Western desert, the Eastern desert and the Sinai Peninsula. More individuals were included to these main units, Ball (1939) such as : The Fayoum depression, the Suez canal zone, and the islands in the Red sea.

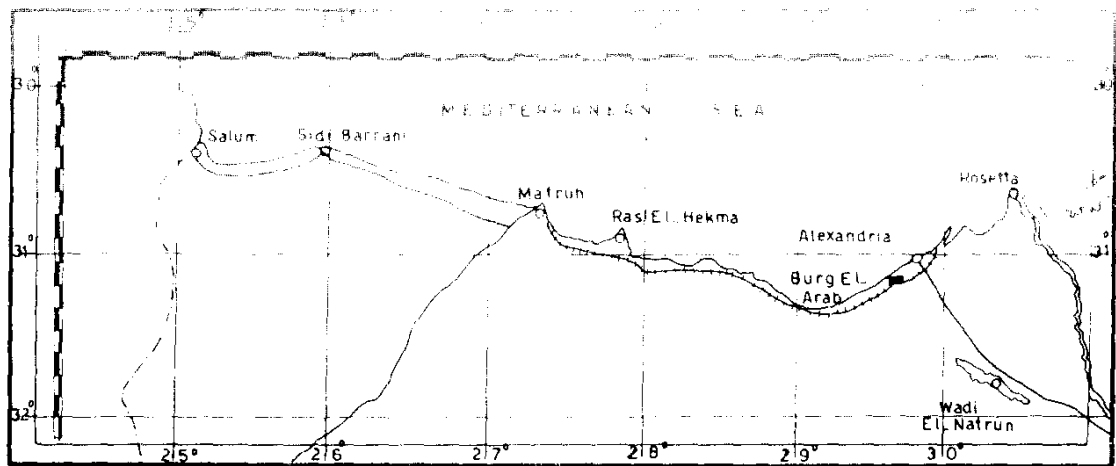
The Nile valley and the Delta, the Western desert, the Eastern desert and the Sinai Peninsula. More individuals were included to these main units, Ball (1939) such as : The Fayoum depression, the Suez canal zone, and the islands in the Red sea.

The Western desert are further subdivided into two main subregions Bahna, (1970): The Mediterranean coastal littoral, which stretches from Alexandria to the boarder of Lybia and the desert plateau including the depressions in which the Oasis are situated.

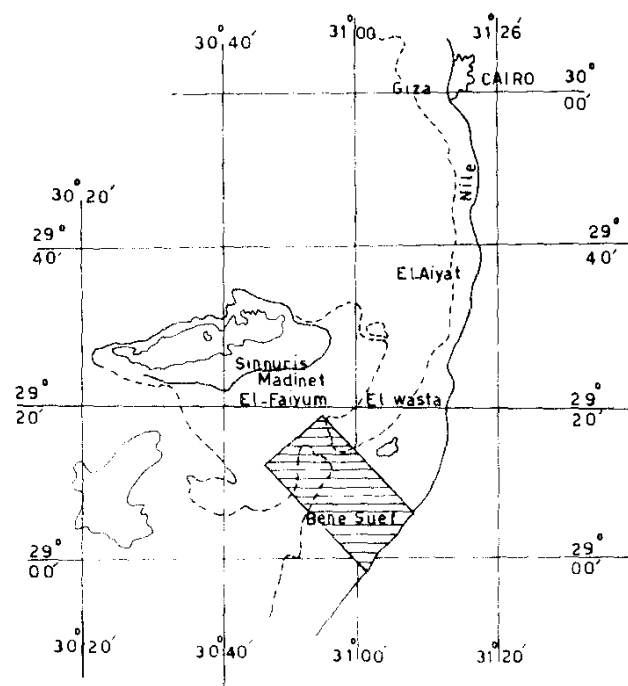
2.2. Location.

The soils selected for the present study are located along the Western Mediterranean coastal littoral; and the Fayoum depression.

The Western Mediterranean coastal littoral extends from Alexandria to El Mallum, to the west in a distance of about 500 km. Burg el Arab, located at about 50 km. west of Alexandria- is selected to represent the coastal zone, Fig. (1A).



Fig(1A)KEY MAP OF THE BURG EL ARAB AREA



Fig(1B)KEY MAP OF LE FAIYUM AREA

0 10 50km

The Fayoum depression, on the other hand, is situated in the Western desert at about 10 km. west of the Nile valley, south west of Gairo. The selected area extends from lake garun on the west to the Nile Valley on the east, Fig. (1B).

2.3. Climate.

The climate of the coastal zone of the U.A.R. is generally characterized by a short rainy season from October to March and a long dry summer from April to September. It is identified as arid Mediterranean with the following characteristics;

mean annual temperature of about 19°C.

annual precipitation at an average of 140 mm.

relative humidity at about 56%.

wind velocity of about 18 Km./h.

Burg el Arab

As to Burg el Arab area, the same conditions prevail with some local variations as outlined in Table (1).

The Fayoum governorate

The climate of the Fayoum area is generally characterized by extreme dryness. Rainfall rates are exceedingly small

Monthly weather data (El Fayoum area)

Month	air temp. mean °C	soil temp. mean °C	relative humidity mean	evaporation mm./day
January	13.5	16.8	76	6.4
February	15.1	17.2	75	7.4
March	17.1	20.6	74	7.6
April	18.2	23.9	72	7.5
May	20.6	26.4	74	6.9
June	23.8	29.6	77	6.8
July	25.8	31.5	81	6.9
August	26.5	32.0	80	7.4
September	25.1	30.9	77	8.2
October	23.1	28.2	45	8.1
November	19.3	24.4	75	6.8
December	16.6	18.6	74	6.4

Table 2

Monthly weather data (El Fayoum area)

1931-1950	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature °C												
daily max.	20.6	22.0	24.9	29.4	33.7	35.7	36.6	36.2	33.3	31.3	26.9	22.1
daily min.	6.2	7.2	9.7	12.2	17.3	19.6	21.2	21.4	19.1	17.1	12.3	8.1
of day	11.0	13.3	16.2	20.2	25.0	27.1	28.2	25.6	19.0	13.2	10.0	7.4
mm (mm.)	1.0	1.0	2.0	1.0	1.0	-	-	-	-	1.1	1.1	1.0
relative humidity	68	62	58	50	43	40	51	56	62	64	66	70

1950-51 season. The annual rainfall was 10.5 mm. The weather conditions which were registered by the meteorological station located at the southern shore of Lake Maryut.

Correlation between climatic features and soil properties have been studied by many scientists, Dokutcheav (1900), Lang (1920), Demartonne (1925), Mayer (1926), and Emberger (1939). Applying their formulae to define the prevailing climate, the following indices are obtained, Table (3).

Table 3
Definition of Prevailing Climate

Definition	Burg el Arab	The Maryut
Dokutcheav value $\frac{P}{E}$	1.93	2.5
Lang's rainfactor modified by Emberger	6.50	1.2
1/S quotient (Mayer)	9.60	13.3
Degree of aridity	35.09	45.5

Values shown in Table 3 for both Burg el Arab and Maryut area are very low indicating extreme aridity.

4. Geology

Burg el Arab area.

The western Mediterranean coast is occupied essentially by sedimentary rocks belonging to the Quaternary and Tertiary formations, Shukry and Philp (1953), Shata (1957), Said (1962) and El Shazly (1964). In Burg el Arab area the surface is occupied by lime and clay facies belonging to the Neogene, Eocene limestone and loamy deposits belonging to the Pleistocene and Holocene. The Neogene deposits are widely distributed in the table-land area (part of the Marmarican monocline).

The substrata in the coastal plain are mostly calcareous from Pliocene and Pleistocene formations and covered by various types of recent deposits, mostly loams and stones brought in by runoff, white calcareous sand of marine or littoral origin, and calciferous or siliceous clays deposited in the lagoons.

Ridges and dunes composed of Eocene limestone are generally found along the edge of the coastal plain. These are either in the course of consolidation, or fully consolidated. Some of the dune formations are of mixed type, with loose sand accumulations covering an old dune in which the