

Cairo University
Faculty of Science
Geology Department

GEOLOGICAL AND
PALEOECOLOGICAL ASPECTS OF
THE MOGHRA FOSSIL MAMMALS,
NORTH WESTERN DESERT, EGYPT

Presented by
Mohamed Korany Ismail Abdel Gawad
(B. Sc. in Geology)

A Thesis submitted to
Faculty of Science

In Partial Fulfillment for the Requirements of
Master Degree of Science in Geology

To
Department of Geology,
Faculty of Science,
Cairo University

2011

Cairo University
Faculty of Science
Geology Department

GEOLOGICAL AND PALEOECOLOGICAL ASPECTS OF THE MOGHRA FOSSIL MAMMALS, NORTH WESTERN DESERT, EGYPT

Presented by
Mohamed Korany Ismail Abdel Gawad
(B. Sc. in Geology)

A Thesis submitted to
Faculty of Science
In Partial Fulfillment for the Requirements of Master Degree of Science in
Geology
To
Department of Geology,
Faculty of Science,
Cairo University

Supervisors
Prof. Mohamed Abdel- Hamid El Sharkawi
Professor of Mineralogy, Geology Department,
Faculty of Science, Cairo University.
Prof. Mohamed Abdel- Rahman Hamdan
Professor of Sedimentology, Geoarcheology and Quaternary geology,
Geology Department, Faculty of Science, Cairo University.
Dr. Ahmed Niazy El- Barkooky
Lecturer of Stratigraphy and Sedimentology, Geology Department,
Faculty of Science, Cairo University.

2011

APPROVAL SHEET FOR SUMISSION

Thesis Title
**GEOLOGICAL AND
PALEOECOLOGICAL ASPECTS OF
THE MOGHRA FOSSIL MAMMALS,
NORTH WESTERN DESERT, EGYPT**

Name of Candidate
Mohamed Korany Ismail Abdel Gawad

**This thesis has been approved for submission by the
supervisors:**

Prof. Mohamed Abdel- Hamid El Sharkawi
Professor of Mineralogy, Geology Department,
Faculty of Science, Cairo University.

Signature:

Prof. Mohamed Abdel- Rahman Hamdan
Professor of Sedimentology, Geoarcheology and
Quaternary geology, Geology Department,
Faculty of Science, Cairo University.

Signature:

Dr. Ahmed Niazy El- Barkooky
Lecturer of Stratigraphy and Sedimentology, Geology Department,
Faculty of Science, Cairo University.

Signature:

Prof. Adel A. A. Sehim

Chairman of Geology Department
Faculty of Science- Cairo University

أسماء الممتحنين

الممتحن الاول (الاجنبي) :

Dr. Gregg F. Gunnell

الممتحن الثاني (المصري) :

أ.د. عبد المحسن عثمان زيكو

الممتحن الثالث (المشرف) :

أ.د. محمد عبد الرحمن حمدان

م.د.د.

Acknowledgments

All praise and gratitude must be attributed to Allah; without his grace and help, the present thesis couldn't be achieved.

First of my thanks to Prof. Mohamed A. El-Sharkawi, Professor of Mineralogy, Geology Department, Faculty of Science, Cairo University, for his supervision and critical reading of the thesis and his valuable discussion and support.

I'm sincerely indebted to Prof. Mohamed A. Hamdan, Professor of sedimentology, Geoarcheology and Quaternary geology, Geology Department, Faculty of Science, Cairo University, for his wise supervision, and constant encouragement and beneficial suggestions in the field, and critical reading of the thesis.

My special pleasure is to acknowledge Dr. Ahmed N. El-Barkooky, Lecturer of Stratigraphy and Sedimentology, Geology Department, Faculty of Science, Cairo University, for his wise guidance, constant encouragement and beneficial suggestions in the field, his valuable discussion and support and critical reading of the thesis.

I wish to express my deep thanks and grateful to my uncle Prof. Gouda I. Abdel Gawad, Professor of Paleontology, Geology Department, Faculty of Science, Beni-Suef University, for his help, fatherly affection and critical reading of the thesis.

Many thanks for Wadi Moghira project which was funded by National Science Foundation, International Collaboration Grant (NSF award # 0403472 to E.R.M. and A.N.E-B), the Archie Fund of Wake Forest University (E.R.M) and Geology Department, Faculty of Science, Cairo University (A.N.E-B). Many thanks for Moghira Field Team work: Prof. Mohamed A. Hamdan, Dr. Ahmed N. El Barkooky, Dr. Ellen Miller, Dr. Gregg F. Gunnell, Dr. Mark Clementz, Louise Blundell, Courtney Nichols, Safiya M. A. Hassan, Ahmed H. Aboul Fottoh, Khamis Farhoud and the author.

A special thanks for Dr. Ellen Miller, Ass. Professor of Anthropology, Wake Forest University, U.S.A. for her expert assistance during the field work and identification of Early Miocene vertebrate, constructive guidance and critical reading of the vertebrate part.

Many thanks for Dr. R. L. Ciochon for photographing the vertebrate specimens, Dr. W. Sanders for training the author the preparation of the mold and cast in laboratory, Dr. G. F. Gunnell for helps in identification of some vertebrate specimens and Mr. J. Craft for his help and preparation of the Anthracotherse skull.

My special thanks to Prof. Adel A. Sehim, Head of the Geology Department, Faculty of Science, Cairo University, for his encouragement and support.

And also extend to Prof. El-Sayed A. Youssef, Former head of the Geology Department, Faculty of Science, Cairo University, for his encouragement and support.

Many of my thanks and grateful to my colleagues Dr. Nahla Shallaby, Dr. Sameh Tahoun, Miss Safya M. Ali, Mr. Amir M. Hassan, Mr. Moataz M. Adel, Mr. Ahmed H. Aboul fottoh and Mr. Ahmed Zakaria for their logistical help in both graphic presentation, laboratory and field work and for their kind support.

Mohamed K. Abdel-Gawad

2011

Dedication

I would like to dedicate this thesis to my father Prof. Korany Ismail Abdel-Gawad, my mother Prof. Rafee Ibrahim El Zanaty and my sister Dr. Fatma Korany Ismail, and my lovely dedication to my lovely wife Dr. Marwa Aly El Chaghabey and my little lovely daughter Hafsa.

Mohamed K. Abdel-Gawad

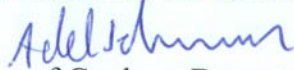
2011

Note

The candidate has been passed the pre-master courses in Geology (Sedimentary rocks and sedimentology) in 12/2005. The courses include:

- 1) Clastic sedimentary rocks
- 2) Non-Clastic sedimentary rocks
- 3) Sedimentation
- 4) Primary sedimentary structures
- 5) Stratigraphy
- 6) Geochemistry of sedimentary rocks
- 7) Diagenesis
- 8) Tectonics and sedimentation
- 9) Evaporites
- 10) Statistics
- 11) German language

Prof. Adel A. A. Sehim



Chairman of Geology Department
Faculty of Science- Cairo University

ABSTRACT

Student Name: Mohamed Korany Ismail Abdel Gawad

Title of the thesis: **Geological and paleoecological aspects of the Moghra fossil mammals, north Western Desert, Egypt**

Degree: Master in Sedimentary rocks and sedimentation

This thesis deals with geological and paleoecological aspects of the Early Miocene fossils mammals of Moghra Depression, North Western Desert, Egypt. The vertebrate assemblage is represented by mixture of marine, fresh water and terrestrial types such as shark, rays, turtles and crocodiles. The mammal's assemblage represented as follows Sirenia as marine mammal, fresh water mammal such as Artiodactyla (Anthracotheriidae) and the terrestrial ones such as Artiodactyla (Suidae, Sanitheriidae, Ruminantia), Perissodactyla, Proboscidea, Carnivora, Creodont and Primate. Ichnofossil assemblages in the studied area are represented by *Ophiomorpha*, *Thalassinoides* and Root system of Mangrove. Petrified wood may be found in situ in the bed or found in great numbers on some levels as Petrified Forest and Lag deposits which contain coprolites. Taphonomic aspects suggest that the fossil location might not be always the site of a natural death assemblage. The sedimentary facies and faunal content of the Moghra Formation reveal tide dominated estuary depositional environment.

Keywords: Moghra Formation, Early Miocene, mammals, *Ophiomorpha*, *Thalassinoides*, coprolites, Taphonomic aspects, and tide dominated estuary.

Supervisors:

Signature:

1- Prof. Mohamed Abdel- Hamid El Sharkawy

2- Prof. Mohamed Abdel- Rahman Hamdan

3- Dr. Ahmed Niazy El- Barkooky

Prof. Dr. Adel Abdel Aziz Sehim

Chairman of Geology Department
Faculty of Science- Cairo University

Abdel Gawad, M. K.

Abstract

Abstract

The present thesis deals with geological and paleoenvironmental aspects of the Early Miocene fossils mammals of Moghra Depression, North Western Desert, Egypt. The fossil content in the study area includes both invertebrate and vertebrate remains as well as trace fossils.

The vertebrate assemblage is represented by mixture of marine, fresh water and terrestrial types such as shark, rays, turtles and crocodiles. The mammals assemblage represented seven orders, 16 families, 25 genera and 24 species as follows Sirenia as marine mammal , fresh water mammal such as Artiodactyla (Anthracotheriidae, ancestor of hippopotamus) and the terrestrial ones such as Artiodactyla (Suidae, Suidae, Suidae (pig), Ruminantia (deer and giraffe)), Perissodactyla (the rhinoceroses and their relatives), Proboscidea (the largest land mammals, elephants), Carnivora (Flesh eating mammals, wolves and cats), Creodont (Hyaena) and Primate (omnivorous and herbivorous mammals, lemur, monkey and apes).

The trace fossils are important paleoenvironmental aspects. Ichnofossil assemblages in the studied area are represented by *Ophiomorpha* which indicates intertidal zone and *Thalassinoides* indicating subtidal environments, Root system of Mangrove is mainly characteristic of the beaches and tidelands in the Tropics (especially the Eastern Hemisphere) that best grows in brackish water (most commonly in salt water), Petrified wood may be found in situ in the bed with less silicification or found in great numbers on some levels as Petrified Forest and Lag deposits which contain coprolites (fecal pellets of the vertebrates).

Taphonomic aspects have been considered in this work. Most of the fossilized remains of the mammals are teeth, jaws with or without teeth, and sometimes skull and broken bones. The fragmented and disarticulated nature of the fossils suggests that the fossil location might not be always the site of

a natural death assemblage. The concentration of teeth and denser bones could be the result of sorting by transport processes.

The sedimentary facies and faunal content of the Moghra Formation reveal tide dominated estuary depositional environment.

Contents

Subject	Page
Chapter 1: Introduction	1
1.1 Location of the study area	1
1.2 Aim of study	3
1.2.1 Geomorphology of the Qattara Depression	3
1.2.2 Geomorphology of the Moghra Depression	5
1.3 Methodology	8
1.4 Previous work	10
1.4.1. The stratigraphy of the study area	10
1.4.2. The vertebrate (especially mammals)	18
Chapter 2: Stratigraphy	23
2.1 Stratigraphy of the study area	23
2.2 Depositional environment	54
Chapter 3: Paleoenvironmental Indicators	59
3.1 Geological signatures	59
3.1.1 <i>Ophiomorpha</i> burrows	59
3.1.2 <i>Thalassinoides</i> burrows	60
3.1.3 <i>Teredolites clavatus</i>	61
3.1.4 Coprolites	61
3.1.5 Root system Mangrove	63
3.1.6 Petrified wood	64
3.1.7 Lag deposits	64
3.2 Vertebrate signatures	66
Chapter 4: Moghra mammals	78
4.1 Mammals in Wadi Moghra	78
4.1.1 Order: Artiodactyla	80

4.1.1.1 Suborder: Suiforms	82
4.1.1.1. A) Family: Suidae	82
4.1.1.1. B) Family: Sanitheriidae	84
4.1.1.1. C) Family: Anthracotheriidae	87
4.1.1.2 Suborder: Ruminantia	91
4.1.1.2. A) Family: Palaeomerycidae	93
4.1.1.2 B) Family: Sivatheriidae	95
4.1.1.2 C) Family: Tragulidae (chevrotains and mouse deer)	96
4.1.2 Order: Perissodactyla	98
Family: Rhinocerotidae	99
4.1.3 Order: Proboscidea	101
4.1.3.1 Suborder Elephantiformes	103
Family Gomphotheriidae	103
4.1.3.2 Suborder Mammutoidea	106
Family Mammutidae	106
4.1.3.3 Suborder: Deinotherioidea:	107
Family Deinotheriidae	107
4.1.4 Order: Carnivora	109
4.1.5 Order: Creodonta	115
Family: Hyaenodontidae	116
Subfamily: Hyainailourinae	116
4.1.6 Order: Primates	120
4.1.6.1 Superfamily Cercopithecoidea	120
Family Victoriapithecidae	120
4.1.6.2 Superfamily Hominoidea	124
4.1.7 Order: Sirenia	124
4.2 Relation between Moghra and other Miocene sites	126

4.3 Paleobiogeography of the Early Miocene	127
Chapter 5: Taphonomy	140
5.1 General definitions	140
5.2 Moghra Case	144
Chapter 6: Summary and conclusions	149
References	152
Arabic Summary	