CHAPTER I

INTRODUCTION & PREVIOUS WORK

1- GENERALITIES:

A good knowledge of various aspects of the Mesozoic and Paleogene geology of Egypt is very important for global understanding of the structural evolution of the country. This is because Mesozoic tectonism in Sinai Peninsula was dominated by the action of forces differing from those were responsible for the formation of the Gulf of Suez rift. These features, which were generated during the Tertiary and started mainly at the end of the Paleogene, are often masking older structural trends which have been in part formed during the Mesozoic and particularly during the Cretaceous.

In order to determine such old structural trends of Mesozoic and Paleogene, it is important to study lateral and vertical variations in sedimentary facies in Cretaceous and Paleogene sequences. The study of sedimentary facies could help in understanding the effect of structures on the distributions of these facies. The best tools for these studies are to use stratigraphic, petrographic and paleontological data from field and laboratory observations.

2- GEOLOGICAL SETTING

The Sinai Peninsula is the Egyptian part that lies in the continent of Asia. It occupies the northeastern corner of Egypt, covering an area of 61, 000 sq. km. The peninsula is bounded by the Mediterranean Sea in the north, the Gulf of Suez and the Gulf of Aqaba in the west and east respectively. The Sinai Peninsula is situated between the African and Arabian plates.

The Sinai Peninsula was a broad shallow shelf situated on the southern passive margin of the Neo-Tethys, where a carbonate platform with siliciclastic intercalations was established (Kuss & Bachmann, 1996 and Bauer *et al.*, 2001). In the Mid and Late Cretaceous times, the main phase of compressive

tectonic activities is related to the Syrian Arc System that was initiated at the Late Cenomanian time (Bartov & Steinitz, 1977 and Kuss & Bachmann, 1996). Therefore, Sinai is believed to have remained tectonically rather quiet throughout the Cenomanian time (Kuss & Bachmann, 1996). According to Issawi *et al.* (1999), the trans- African seaway connecting the Tethys and the Gulf of Guinea initiated in the Early Cenomanian by a highstand sea level, started to close together with the Neotethys during the Turonian. Their exposures can be traced along the Tih to Egma Plateau, in the folded belt of northern Sinai, and along the Gulf of Suez and Gulf of Aqaba. Their distribution is controlled by two principal factors, namely global or local eustatic changes of sea level and tectonic deformation. Cretaceous strata have witnessed two main episodes of deformation. During the earlier phase (Late Cretaceous), NE-SW folds were formed in northern Sinai as a result of convergence between Africa and Eurasia and the closure of the Neotethys. This intraplate fold-belt is part of Krenkel's (1925) Syrian arc system that extended from Egypt to Syria, and that roughly coincides with the boundary between stable and unstable shelves in Egypt (Said, 1962). The fold-belt is bounded in the south, in central Sinai, by the Tih Plateau, where flat-lying Upper Cretaceous to Middle Eocene rocks are exposed. A narrow belt, termed the "hinge belt" by Shata (1956) or the "Central Sinai– Negev shear zone" (Bartov & Steinitz, 1977), and a narrow, gently folded belt separate the northern Sinai fold-belt from the Tih Plateau. This Late Cretaceous deformation phase was followed, during the Oligo- Miocene, by the opening of the Gulf of Suez and the initiation of the proto-Red Sea rift, as the Arabian plate began to separate from the African plate. During the later phase of deformation, the pre-existing rocks of Western Sinai were faulted by several NW- to NNW-oriented normal faults (Moustafa & Khalil, 1994 &1995).

The northern two-thirds of the Peninsula is occupied by a great northward draining limestone plateau as well as a thick sedimentary sequence which extends southwards until it terminates in a high Igma-Tih escarpment on

the northern flank of the Pre-Cambrian core. The sedimentary sequence of Sinai Peninsula ranges from Cambrian to Recent showing lateral and vertical lithofacies and biofacies variations throughout the Peninsula. The exposed Cretaceous rocks cover about 28% of the total area of Sinai and the stratigraphy of the exposed Cretaceous rocks in Sinai is still a matter of controversy. Several attempts on stratigraphic subdivision have been made by previous authors who were concerned either with a specific time interval in one particular area of Sinai, or in Sinai as a whole. Widely varying views, regarding the age of the different rock-units, have already been given and additional confusion has been created by the use of various formation nomenclatures.

3- LOCATION OF THE STUDY AREA:

The area under investigation is located in west Central Sinai, about 35km east of Suez tunnel covering an area of about 1000 sq. km. The area is situated between latitudes 29° 57' N and 30° 15' N and longitudes 32° 52' E and 33° 10' E and surrounded by Sadr El Heitan- El Hassana road to the East, El Giddi pass and Gebel Um Khesheib to the North (Fig.1). The area studied includes Gebel Um Horeiba, Gebel Heitan, Gebel Um Bausal, Gebel Hamraa, Gebel El Hamra, Gebel Mitla, Gebel Abu Hyman, Gebel Alaqa, Gebel At Tuwal, Gebel Um Khesheib and Gebel El Giddi (Fig. 2). A thick sedimentary sequence is well represented and exposed ranging in age from Late Jurassic (Masajid Formation) to Early Eocene time (Thebes and Minia Formations that form escarpments above the Upper Cretaceous rocks). Tectonically, the area under investigation (Mitla Pass and its environs) is related to the tectonics of the Syrian arc system that extend through the northern part of Sinai and forms a series of fold belts such as Gebel Halal, Gebel Maghara, Gebel Yelleg, Gebel Minsherah and from the study area, Gebel Um Horeiba, Gebel Um Bausal, Gebel Hamraa, Gebel El Hamra and Gebel El Giddi anticlines.

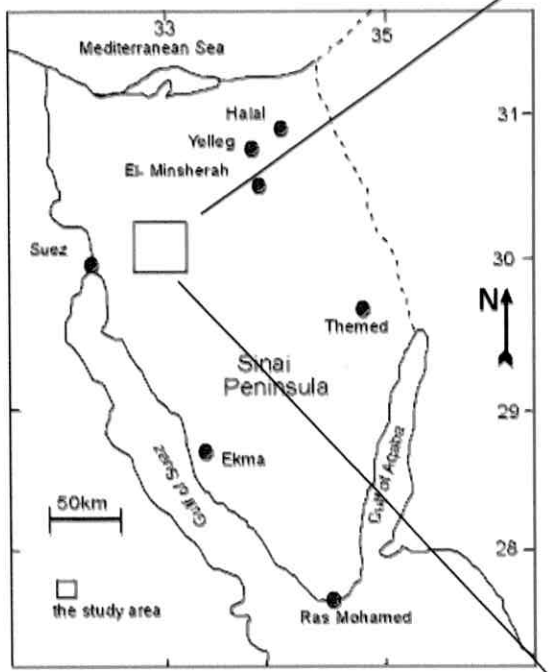

Fig. (1): Location map of the study area

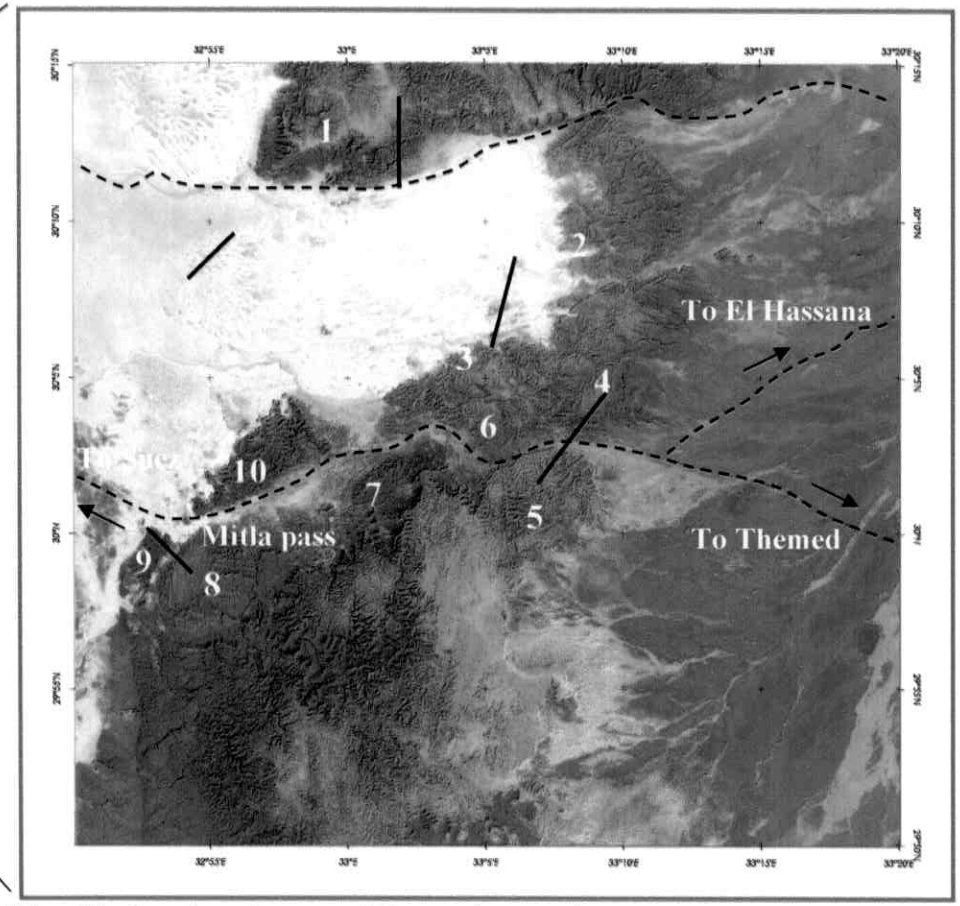

Fig. (2): Land sat image of the study area (1- G. Um Khesheib, 2- G. El Giddi, 3- G. At Tuwal, 4- G. Um Horeiba, 5- G. Heitan, 6- G. Um Bausal, 7- G. El Hamraa, 8- G. El Hamra, 9- G. Alaqa and 10- Gebel Abu Hyman). The studied sections (/)

4- SCOPE OF THE PRESENT WORK:

This work aims to achieve the followings:-

- Recognition of the different lithostratigraphic units and specifying the different lithofacies exposed at the area studied.

- Specifying the field relation between the different rock units.

- Studying the different microfacies for each rock unit covering the area.

- Discussion of the diagenetic processes and the different depositional environments of the different rock units exposed in the area studied.

- Deducing the geologic history of the area in the light of the global tectonic events.

5- METHODOLOGY:

To achieve the above objectives, the following investigations have been performed:-

1- Several field trips were performed during seasons 2009 – 2010 to measure several stratigraphic sections representing the entire studied rock units, where about 850 rock samples were collected to cover all possible rock varieties.

2- The mega-invertebrate fossils have been carefully identified and used in biostratigraphic zonation.

3- About 380 thin sections were prepared for petrographical studies to investigate the different lithofacies and the diagenetic processes that affected on them. These studies were carried to be a complement

with the biostratigraphic zonation and field observation on the distribution of the different rock units to recognize the sedimentary cycles and related them to the tectonic phases.

6- SUBDIVISION OF THE THESIS:

The thesis thus represents the result of the above mentioned studies undertaken on the Mesozoic-Paleogene exposures of the sections studied from the area and includes the following parts:

1- A discussion of previous literature on the Jurassic-Eocene of west Central Sinai and its environs with special reference to the stratigraphic problems.

2- A discussion of the stratigraphy of the area, including lithostratigraphic subdivisions and their relation to time stratigraphic units and biostratigraphic subdivisions. This chapter is intended to provide a good understanding of the different stratigraphic discussion on the rock sequence studied from the area.

3- Studying the different microfacies that represent the different rock varieties of the area studied.

4- A discussion of the diagenetic processes affecting on the different sediments as well as the paleoenvironmental evolution of the different rock units studied in the area. This discussion is intended to help in deciphering bathymetric changes that occurred in the Jurassic- Eocene seas that occupied the area during these times.

5- At the end a summary for the main results obtained during the progress of this work is given and the main conclusions shortly discussed.