CHAPTER II
SITE INVESTIGATION

CHAPTER (II)

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2.1- Introduction

Fayum depression is a roughly triangular region occupying about 1700 km^2. It is located in the Western Desert of Egypt, adjacent to the Nile Valley in the west, about 90 km southwest of Cairo. It lies between Latitudes 29° 15` and 29° 19` N and Longitudes 30° 33` and 30° 38` E (Fig. 2.1). The surface of the Fayum depression is generally sloping to the north western direction, it starts at 20 m above sea level at the eastern side and reaches -45 m below sea level where Qarun lake lying in the deepest part of the area. North to Qarun lake, the ground rises rapidly in a series of escarpments until it reaches the upper most escarpments (Qatrani scarp +350 m). It is marked by the presence of several major wadies such as Wadi El Rayan at the south western part, Wadi El-Hitan at the western side, Wadi Muweilh at the southern part, Wadi El-Batts along the eastern part and Wadi El Nazla along the western part. The meteorological data of this area indicate a typical hot desert climate. Long and dry hot summers characterize the climate of the area. The source of irrigation water is the surface water from the Nile, running along a canal called "Bahr Youssef" (Hammad et al. 1983). The area under investigation is located at the western part of Fayum depression (Latitude 29° 15¯ and 29° 19¯N. and Longitude 30° 33¯and 30° 38¯E.). Geomorphologically, it is considered as plateau divided by Wadi El Nazla, the buildings occur on the cliff of this plateau. (Fig. 2.2).

2.2- Geology and stratigraphic sequence

The sedimentary succession occurring at Wadi El Nazla-Roba area belongs to middle Eocene to late Eocene (Gehannam Formation), upper Eocene (Qarun Formation) and Quaternary deposits (Fig. 2.1).

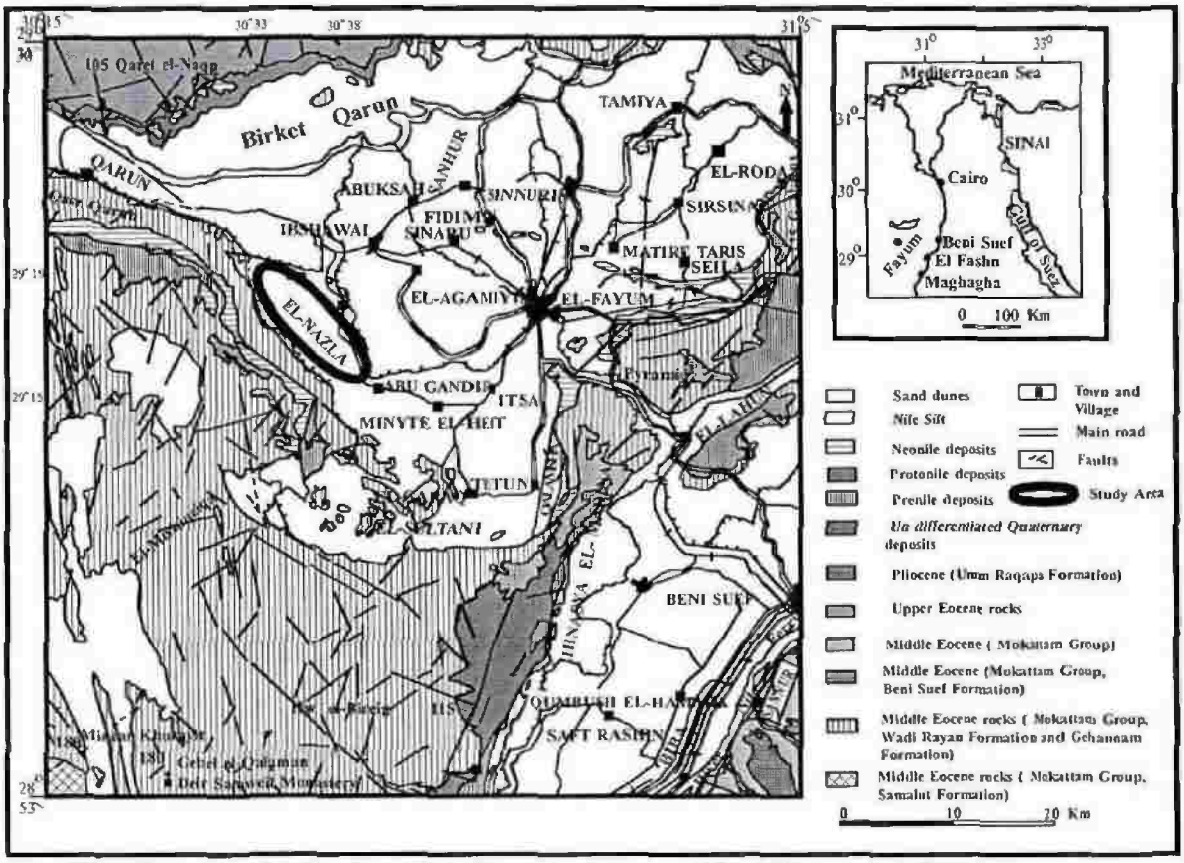

Fig. 2.1: Geological map of the study area after Conoco, 1987.

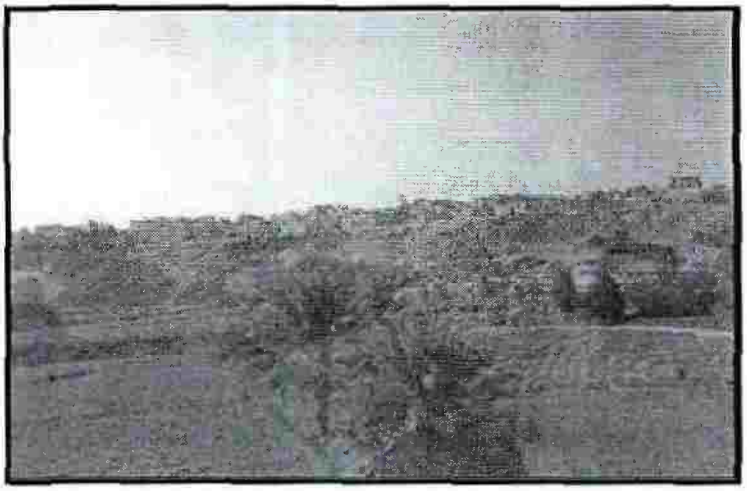

Fig. 2.2: Panoramic view showing building and infrastructure above the cliff of the area under investigation (Wadi El Nazla).

Generally, the most common rock types in the studied area belong to middle to late Eocene and Quaternary ages. Three cross sections were selected in the studied area to show the relation between petrological and

engineering properties for the rocks and their weathering products outcropping in the studied area (Fig. 2.3). These rocks represented by yellowish white argillaceous limestone, yellowish white stratified shale with gypsum (Gehannam Formation) and dark grey cultivated land (Quaternary deposits (Fig. 2.4 section A). In section B (Fig. 2.5), it represented by yellowish grey argillaceous limestone, egg yellowish to yellowish grey shale with gypsum, yellowish white massive marly limestone and grayish white stratified shale (Gehannam Formation) and dark grey shale (Quaternary deposits). Unconformity surface of sand occurs between Gehannam formations and Quaternary deposits attains the maximum thickness of about 1.5 m. (Fig. 2.5). Section C (Fig. 2.6) attains thickness about 31 m. Thickness of rock mass increases upwards to the north (Figs. 2.3, 2.4, 2.5 and 2.6).

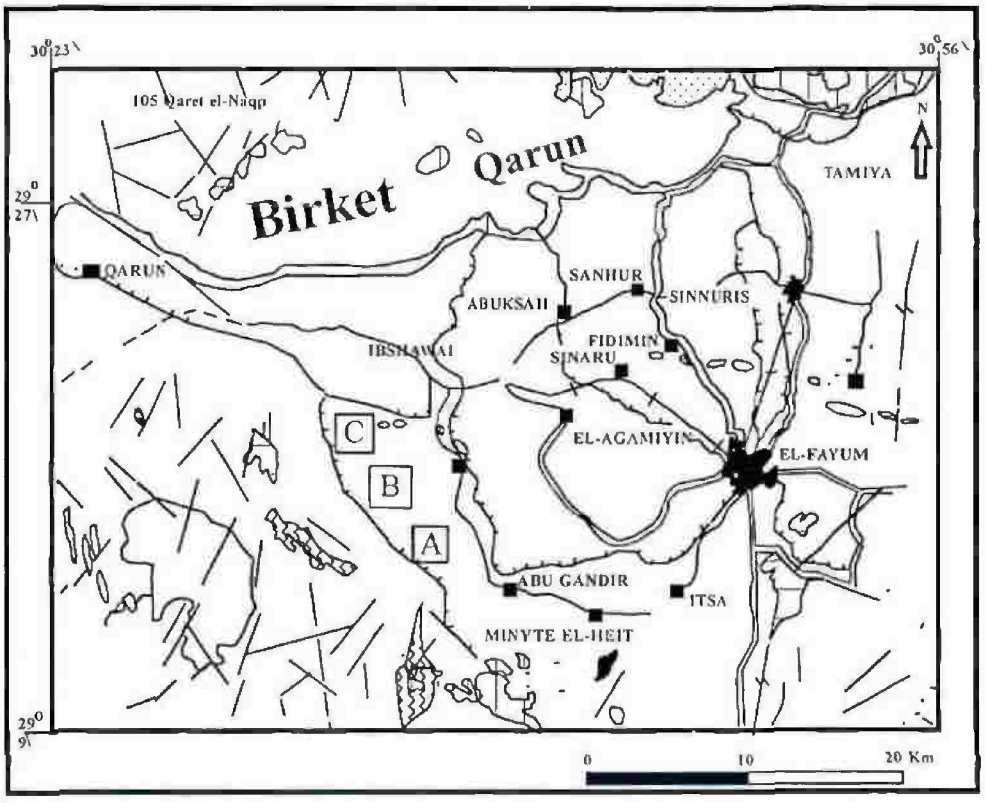

Fig. 2.3: The studied cross sections of El Nazla-Roba area (A, B and C), stratigraphic sequences of the area under study are given in Figs. 2.4, 2.5 and 2.6.

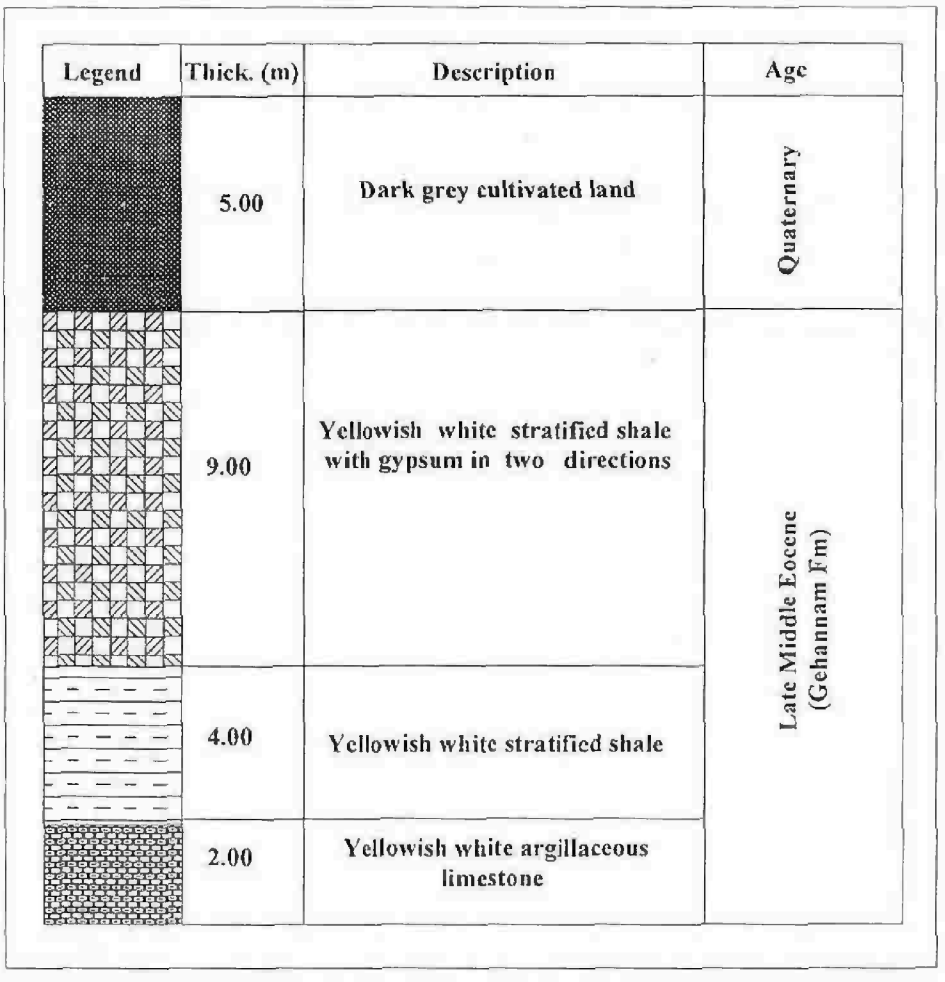

Fig. 2.4: Stratigraphic succession of Roba area (section A).

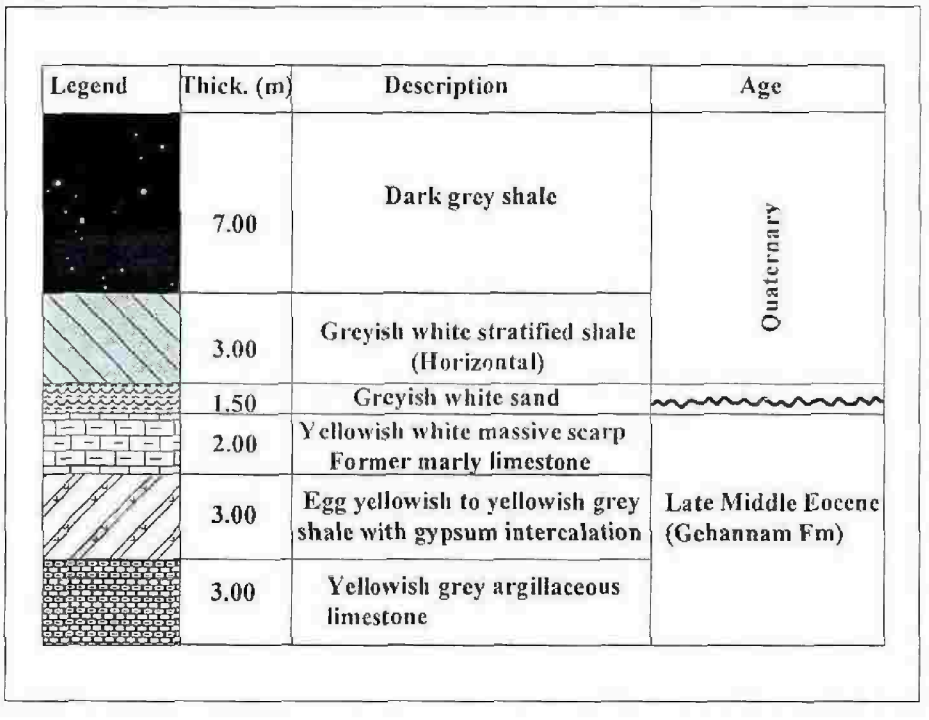

Fig. 2.5: Stratigraphic succession of Roba area (section B).

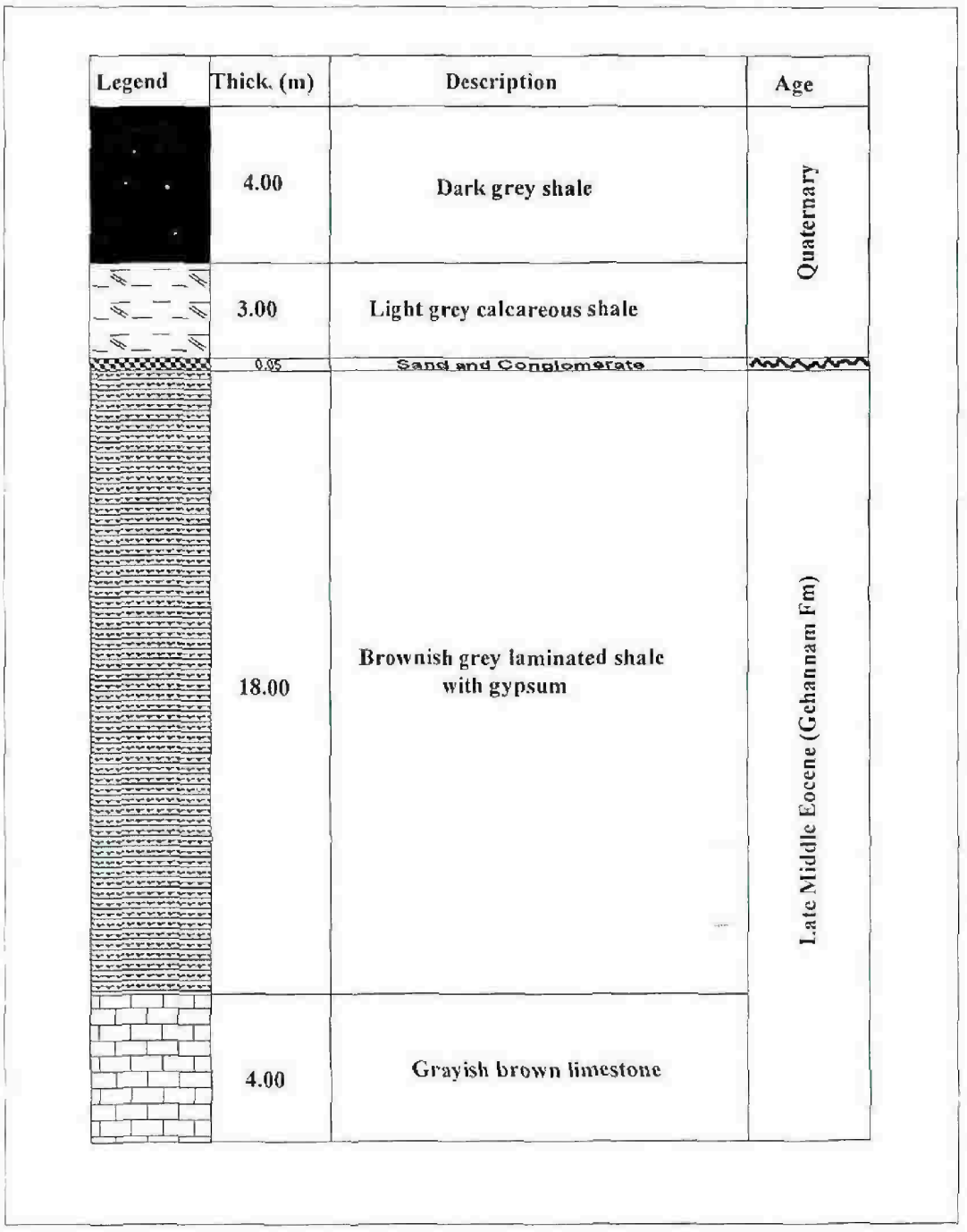

Fig 2.6: Stratigraphic succession of Nazla area (section C).

The geologic description of each formation (Fig. 2.1) is discussed as follows:

2.2.1- Gehannam Formation"Ravin beds"(Late-middle Eocene)

The term "Ravine beds" was first introduced by Beadnell (1905) to describe a sequence of middle Eocene sediments underlying the alluvium

deposits at the deep water channels or ravines within the Fayum province. The type locality of this Formation is at Qaret Gehannam, where it measures 70 m thick. Said (1962) used the term Gehannam Formation to describe Beadnell's "Ravine beds". It overlies the Wadi El Rayan Formation and underlies the Birket Qarun Formation (Beadnell, 1905 and Said, 1962). Recently, Strougo (1992) mentioned that the Gehannam Formation overlies the Gharaq Formation and underlies Birket Qarun Formation at the area between Wadi El Rayan in the south and Lake Qarun in the north. More recently, Abd El-Gaied and Abd El-Aziz (2007) and Abd El-Aziz and Abd El-Gaied (2007) assigned the Gehannam Formation as late middle Eocene.

Gehannam Formation in the study area measures 15 m thick at Roba area (Section A), 8 m thick at Roba area (Section B) while it attains about 22 m thick at El Nazla area (Section C) (Figs. 2.4, 2.5 and 2.6). It mainly composed of repeated cycles of argillaceous limestone, marl, limestone and stratified shale with gypsum intercalation, cracked shale, jointed shale and marly limestone (Figs. 2.3, 2.4 and 2.5).

2.2.2- Qarun Formation (Upper Eocene)

The term "Birket Qarun Series" was first introduced by Beadnell (1905) to describe a 50 m tkick of Nummulites, Operculina bearing beds which form the northern escarpment immediately overlooking the lake Qarun. Said (1962) replaced the term "Series" by the term "Formation". The Birket Qarun Formation is exposed at the northern, southeastern and western portions of the Fayum province. It overlies the Gehannam Formation and underlies the Qasr El Sagha Formation and it composed of sandstones and shale with minor bands of limestone (Beadnell, 1905 and Said, 1962). In the present study the Birket Qarun Formation is exposed at Nazzaza area at the opposite side east Wadi El Nazla, (Fig. 2.7).

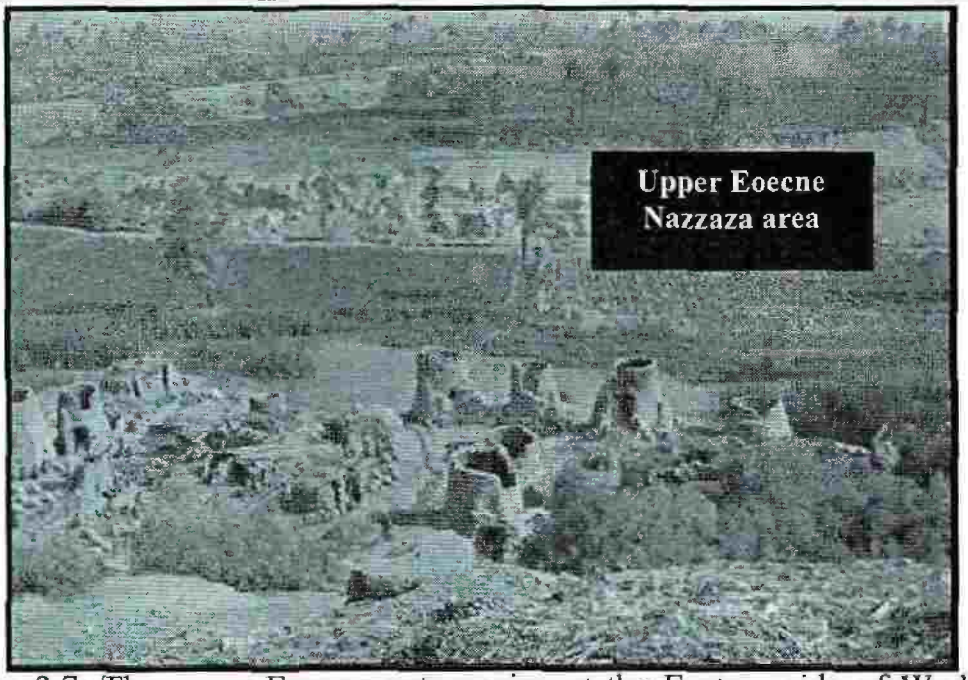

Fig. 2.7: The upper Eocene outcropping at the Eastern side of Wadi El Nazla, shale of Quran Formation exhibits two sets of joints and overlained by Quaternary deposits. Fawakhirs are observed at the western side of the area.

2.2.3 Quaternary Deposits

Some of the last studies on Quaternary deposits at Fayum depression can be summarized in the following:

Beadnell (1905) considered the Quaternary sediments to have been deposited in fresh water lake fed by the Nile that must have followed then at a higher level, and these deposits are composed of gravels, sands mixed with pebbles.

Hammad et al., (1983) stated that the Pleistocene deposits mainly of Fluvio-Lacustrine origin constitute.

El-Anbaawy (1989) described the Quaternary (Pleistocene) deposits in form of Lacustrine sandy mudstone, cross-bedded, fine-grained sandstone and diatomaceous clays with silt intercalation.

Pre-Holocene Quaternary sediments west of Qasr El Basc were described by Issawi and McCauley, 1993 as sands, gravels, limestone pebbles, silt and clay.

In this study the Quaternary deposits are measured 5 m thick at Roba area (Section A) and 10 m thick at Roba area (Section B), while it attains 7 m thick at El Nazla area (Section C) (Figs. 2.4, 2.5 and 2.6). It mainly composed of greyish-white to light-grey calcareous shale and dark grey shale (cultivated land) showing columnar and stratified features.

Generally the area under investigation shows clear lateral variation in the thickness of both Gehannam Formation and Quaternary deposits where the Quaternary deposits thickness ranges from 5m to 10m and late middle Eocene (Gehannam Formation) thickness shows maximum of 22m at the north.

2.3 Rock mass/weathering products characteristics

Lithologically as discussed above, the rock units in the studied area are classified into: late to middle Eocene (Gehannam Formation) and upper Eocene (Qarun Formation) covered by Quaternary deposits and cultivated lands (Fig. 2.8), Qarun Formation is observed at Nazzaza area at the opposites side east Wadi El Nazla. (Fig. 2.7).

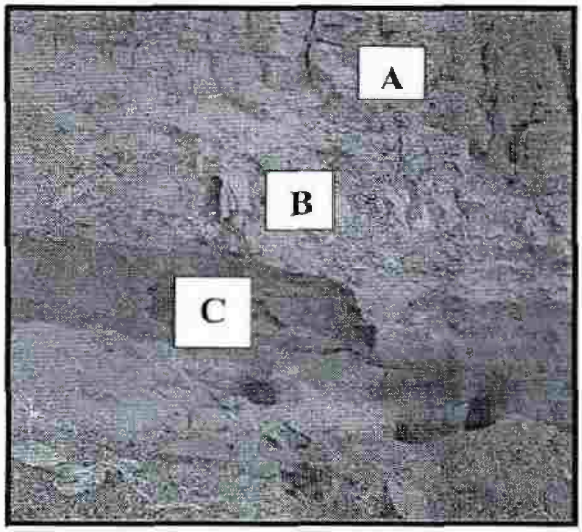

Fig. 2.8: Clear contact between shale of middle Eocene and two types of Quaternary shale deposits
A- Columnar Quaternary shale
B- Horizontal Quaternary shale
C- Middle Eocene shale

Large parts of the study area are built on steep slopes, at the northern part of the area under investigation (Fig. 2.2) (El Nazla section, C) (Roba sections, A and B). The base materials of the area under study are suffered from instability, for example settlement as well as slope failure due to the induced of swelling and shrinkage by wetting or drying out of water (Figs. 2.9 and 2.10). So that the engineering behaviour of rock type of clayey rich materials and their weathering products at different water contents are examined in this study.

Fig. 2.9: Showing water drainage in the study area which affects the cliff stability (section A).

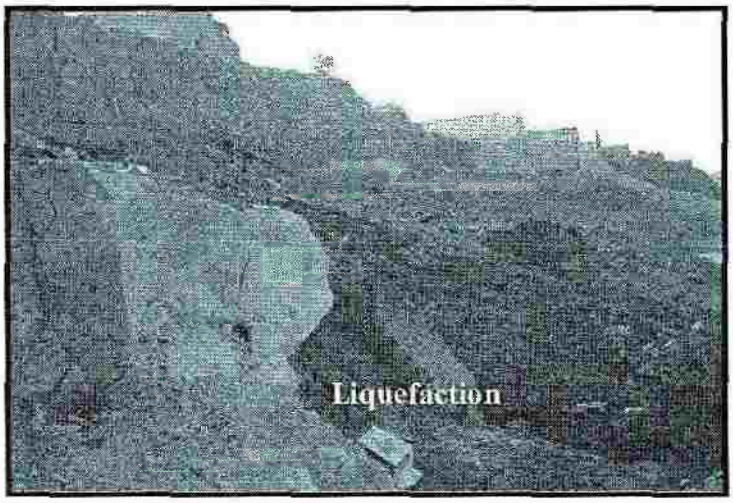

Fig. 2.10: Showing sewage water causing liquefaction of the Quaternary deposits, minor fault is also observed.

The susceptibility of a slope to failure is dependent on many factors including the slope gradient, the geotechnical properties of the material involved, the presence of discontinuities (joints, fractures and faults), the amount of water entering a slope which is a function of the vegetation cover, drainage, soil type, rock structure and weathering process (Yalcin, 2007) (Figs. 2.9, 2.10, 2.11, 2.12 and 2.13).

Fig. 2.11: The effect of weathering in Gehannam Formation (Rock fall, Roba) section A.

Fig. 2.12: Three set of joints in argillaceous shale of Eocene; minor joints are also observed (section C).

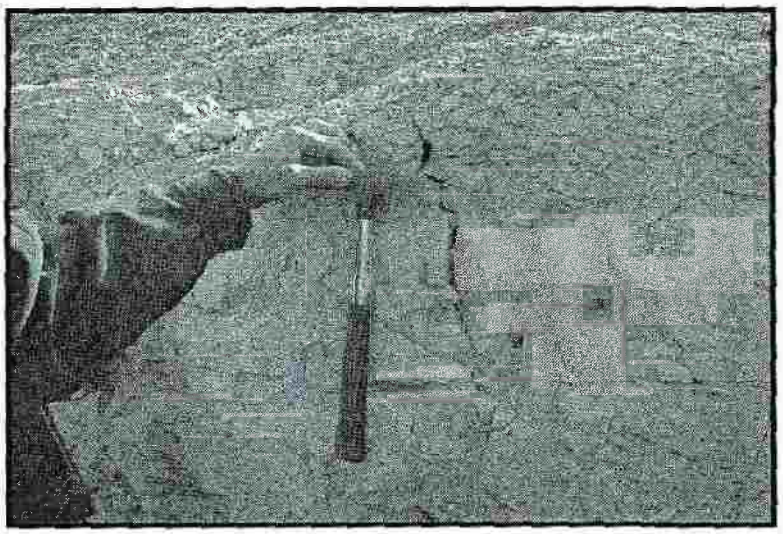

Fig. 2.13: Fractures filling by gypsum minerals in the middle Eocene shale (Roba area section A).