

Geomorphology of the Nagada Region Upper Egypt

by

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ABSTRACT

Detailed geomorphological study of the Nagada region, west of the Nile enables us to better understand the main landforms in this part of Upper Egypt.

Six geomorphic features are recognized including: the Thebaid plateau; the Plateau footslopes; the Pliocene and Quaternary terraces; the Nile flood plain, the drainage pattern and the Nile channel.

The study provided more data on the Pliocene - Quaternary terraces. These terraces are important because they host many predynastic sites.

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Introduction

The study area covers approximately 400 Km² of the western bank of the Nile valley, between Luxor and Qena (Fig. 1).

The main rock units in the area consist of sediments ranging in age from Tertiary to Quaternary (fig. 1). Eocene limestone (Thebes Formation) forms the top of the Thebaid Plateau. The limestone is underlain by Palaeocene Shales (Esna Shale). Quaternary outcrops lap up against the cliffs of the Thebaid plateau.

The purpose of this study is to classify the major landforms in area and to establish their chronology.

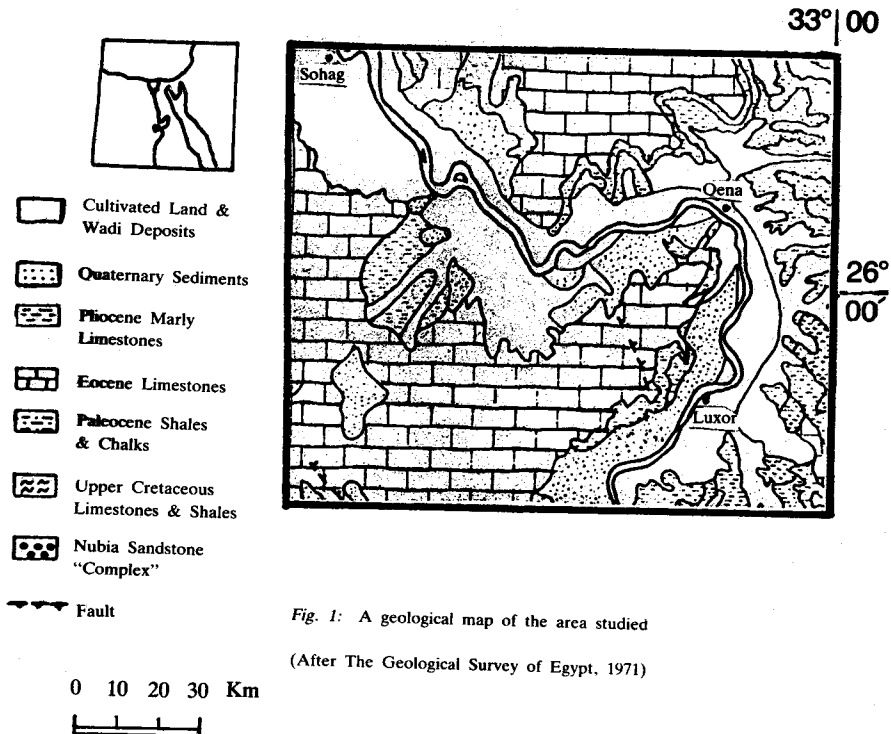


Fig. 1: A geological map of the area studied

(After The Geological Survey of Egypt, 1971)

A detailed geomorphological map (fig. 2) of the area (scale 1:50,000) was prepared based on field work and study of aerial photographs (geomorphological map of Nagada, Archaeological project, 1976, Smithsonian Institution, U.S.A.). This map revealed the presence of six main distinct geomorphological features which were differentiated on the basis of their form, relief and mode of origin. Following is a description of these geomorphic features:

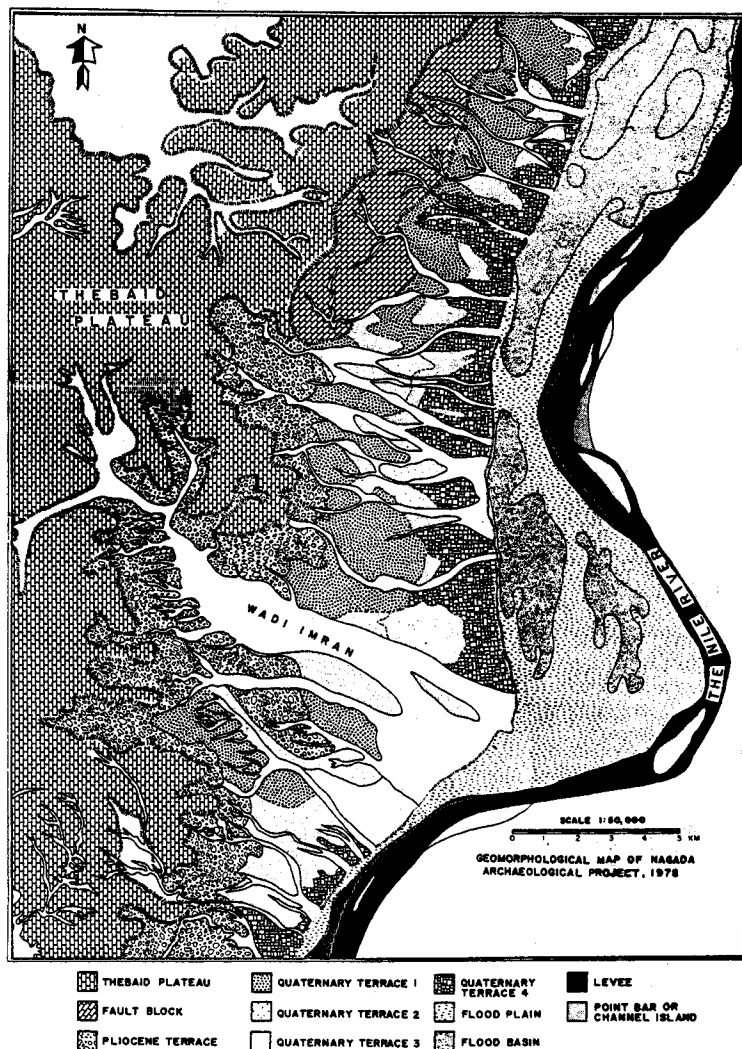


Fig. 2

1. The Thebaid Plateau

The Thebaid plateau forms the highest topographic feature in the studied area. The plateau ranges in elevation from 426 to 582 m above sea level. It occupies large portion of the western part of the region which is desiccated by large wadies. The surface of the plateau is made of hard, cherty limestone of the Thebes Formation. The plateau is cut by numerous faults and slumped fault blocks.

2. The Plateau Footslopes

The footslopes which fringe the Thebaid plateau to the east are partially covered by Pliocene-Quaternary terraces. The upper part of these slopes is characterized by steep erosional escarpments, while the lower part slopes gently towards the terraces. Slumped Eocene blocks, tauls and colluvial deposits cover the lower part of the terraces. According to their mode of origin, two types of footslopes can be recognized; fault-line scarp in the north and erosional escarpments to the south.

3. The Pliocene and Quaternary Terraces

A considerable portion of the studied area comprises both the Pliocene and Quaternary terraces (fig. 2). This unit is characterized by the presence of archaeological sites and occurrence of numerous drainage lines (wadies).

The terraces are characterized by low elevations with very smooth micro relief; interrupted by few rises (elevation ranges between 73 and 216 m above sea level. This landform is bordered to the west by the footslopes of the Thebaid plateau and to the east edge by the flood plain (cultivated land). The pliocene terraces are fill terraces (205-216 m above sea level) consisting mainly of brownish and greenish lacustrine calcareous silts and marls at the base. Several stages of downcutting created cut terraces at 180, 170 and 160 m above sea level.

The lower pleistocene terrace (Quaternary terrace 1) is 133-148 m above sea level. It consists of poorly sorted medium to coarse fluvial sand with red soil near the top. Quaternary terraces 2, 3 and 4 (middle Pleistocene-upper Pleistocene) are at 116-129 m, 106-112 m, and 84-100 m above sea level respectively. They consist of Nile silt of predominately Ethiopian origin, which in turn is overlain by a locally derived sheet of gravels.

4. The Nile Flood plain (cultivated land)

This unit fringes the Nile and extends more or less parallel to it. The flood plain consists of Holocene alluvial deposits of the Nile and attains a thickness of about 9.0 m at El-Ballas (Attia, 1954). This landform is formed mainly by aggradation processes. The width of the cultivated land in the studied area ranges between 0.5. and 5.4 km, with an average width of about 2.69 km. It possesses very low amplitudes of relief, which varies from 72 to 74 m above sea level. The unit is characterized by natural levees on the concave side of the channel meanders about 0.6 m above the flood plain.

5. The Nile channel

The river Nile defines the eastern limit of the study region, when it extends for about 63 km, oriented in a nearly NE-NW and NNE direction with a mean of 790 m (in Nagada - Khattara area).

The River channel in the area under investigation is characterized by Nile islands or point bars on the convex side of the Nile channel meanders. The bars show evidence of accretionary growth as well as direction, leading to the formation of the channel islands.

6. The Drainage Pattern

Drainage lines are clearly visible in the investigation area (fig. 3). This drainage pattern is mainly dendritic to subparallel, but irregular in the Pliocene-Quaternary terraces. Accordingly, this may indicate an old geomorphic feature; which was later rejuvenated. This view, which is strengthened by the relationship between the drainage pattern and the lithology of the underlying unit.

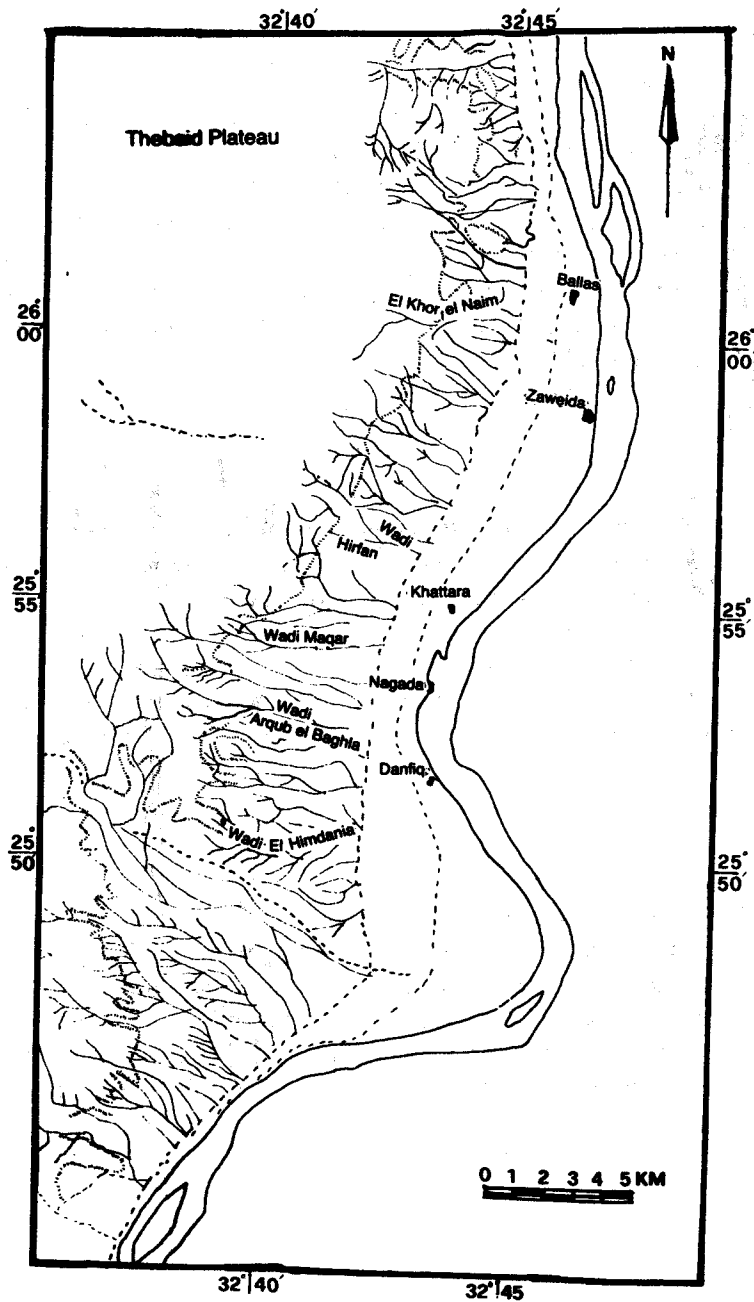


Fig. 3 Drainage map of Nagada region

It must be stated that the studied area is incorporated within the Sahara Arid Belt which is characterized by sporadic heavy rainfall of very short duration. All the drainage lines are of subsequent type. The drainage pattern in the area shows limited similarity to that cutting through the pediplain at the eastern side of the Nile, since the course of the drainage lines of the latter extends great distances from their watershed to the cultivated land and is relatively wider.

Discussion

Geomorphology has become a very important tool in the resolution of some geology-related problems in archaeology, especially for catchment analysis of archaeological sites (Vita-Finzi and Higgs, 1970) and for evaluating the effect of geological processes on the density and distribution of artifacts in the given site (Kirkby, 1976).

Geomorphology is also useful in evaluating ancient landscape for settlement location. This approach has been developed by Hassan (1979 a), who named it **geoekistic** analysis and applied it to the Nagada Khattara area; Hierakonpolis, Egypt and Ras El-Naqb area, Jordan. Furthermore, Butzer (1971) established a general classification of the archeological sites on the basis of their geomorphological settings.

In the present work, the chronological characteristics of the studied area have been elucidated through the following aspects:

A. The Geomorphological Processes and the Resulting Landforms in the Nagada Region:

In the studied area the exogenic processes are significant. The exogenic processes which are acting in Nagada region as inferred from field evidence are degradation and aggradation processes. The main degradation processes include, physical and chemical weathering; gully erosion; rock gliding; rock and debris fall, and soil creep. The aggradation processes on the other hand result mainly in the accumulation of alluvium and colluvium deposits.

The physical disintegration of rocks is mainly due to insolation weathering; moisture swelling; chemical alteration; and mechanical collapse.

Insolation weathering is inferred from the presence of boulder cleavage, which is thought to be the result of the effect of fluctuations of temperature and the

differences in the specific heat coefficients of the rocks. Moisture swelling appears to characterize the Esna Shale in the studied area. The repetitive absorption and loss of moisture by the shale and marl results in volume changes, which lead to physical disintegration. Chemical alteration of the clay minerals of the Esna Shales has the same effects.

Mechanical collapse characterizes free face sites, where the weathered material fall in their dry state. This occurs in the Thebaid plateau face. Block fields have developed as a result of rockfalls, debris falls and debris slides from the free faces and the upper slopes of the plateau. Clear evidence of landslides processes is seen in the western Thebaid plateau, where jointed Eocene limestone outcrops. Rocks slides and debris slides are probably due to the lubrication, caused by groundwater level, and the two main joint set in the Eocene outcrops.

The effects of aggradational processes on the other hand are represented mainly by the extensive footslopes are built up of colluvium deposits, which were derived from the upper slopes by mass movements and runoff processes. The flood plains are made up of deep alluvium deposits, which were mainly laid down by the river Nile.

B. Chronology of landforms in Nagada - Kattara region:

In the late Paleocene time, shallow water conditions in the area under investigation, where the deposition of shales, marls and limestones continued until the end of the Paleocene (Esna Shale). By the beginning of the Eocene time, the area was submerged again beneath a deep sea, in which the thick limestone (Thebes Formation) was deposited. This period of deposition was followed by uplift, which was responsible for the formation of the Eocene Thebaid Plateau. Stability followed this uplift and active denudation resulted in the Paleocene-Eocene outcrops.

The history of the Pliocene-Quaternary has been discussed by several workers. According to Said (1975) the temperature of the Pliocene period was probably about the same as the one today, though during the Pliocene, arid climate was interrupted by a short period of considerable moisture and pluvial conditions (the Arman Pluvial). The Pleistocene climate probably fluctuated widely. Relatively cool, moist intervals or pluvials alternated with relatively long, warm, semiarid or arid intervals. Said also pointed out, that the most common pluvial intervals till the end of the Paleonile/Neonile are the Idfu Pluvial and

the Abbasia Pluvial. There are also other moist intervals recorded in the Pleistocene during the deposition of Deir Fakhur, sediments and Dishna Playa (Said, et, al 1970, Wendorf, et, al 1970 and Issawi, et, al 1973).

Butzer (1971) has noted maximum pluvial conditions in southern Egypt as shown by the presence of the Wadi Floor Conglomerate (ca 60,000 B.P.?) which probably correspond to the early Wurm in Europe.

The Holocene was also a time of fluctuating climate, where the Nile valley was characterized by several moist intervals (Butzer and Hansen, 1968). Singari sediments provide evidence for a period of accelerated Wadi activity which terminated about 6000 B.C., indicating a period of greater local rainfall. Moreover, a little later, ca 5000 B.C., a red paleosol has been formed at Kom Ombo, which indicates a mat of vegetation and more frequent, gentle rains.

In the Quaternary period, a radical modification of all the pre-existing landforms took place and most of the present topographic details of the area have been produced during the Pleistocene and the recent period. The extensive footslopes of the area, which are mantled by colluvial deposits in some parts of the investigated area, were probably developed during the Pleistocene period, while the extensive flood plains and the areas of gully dissection are probably very recent landforms. The Nile course might have attained its present course during the termination of the Pleistocene period.

C. Landforms and their importance to archeologic investigation in the studied area:

Due to the fact that some of the important predynastic sites in the studied area occur on the Pliocene-Quaternary sediments, it was necessary to throw light on the morphology of the landforms of these sediments.

The Quaternary sediments in the present area seem to form a group of marginal terraces, bordering the modern Nile flood plain. This situation is similar to the one described in the area between Esna and Tahta in the Nile Valley, where Yehia (1973) considered the Quaternary sand and gravel as a series of marginal terraces which border the cultivable lands of the present-day flood plain.

Shahin (1970) constructed a morphological map of Wadi Hilal, south of Esna, upper Egypt, where he recognized six surface terrace remnants. These included the "summit surface" and terrace 1, which are erosional features, developed on different rock types (on the Dakhia Shale and Phosphate Formation as well as the Nubia Formation). The flat surface of terrace 2 is well developed on the variegated Shale rock unit. A series of three well-developed gravel terraces are represented by terrace 3, terrace 4 and terrace 5 above the present flood plain of the Nile.

In Kom-Ombo plain, Upper Egypt, Butzer and Hansen (1968) studied the geomorphology of the area and divided the Kom-Ombo plain into six geomorphic zones, where four of them have been formed during the Quaternary. These are the Gallaba gravel plain, the "High" gravel terraces, the "Middle" gravel terraces and finally the "Low" gravel terraces. The absolute elevations, as well as their relative elevations to the modern flood plain, are shown in Table 1.

At Hierakonpolis, north of Idfu, Hassan (in press) studied the geomorphology and established the presence in this area of a cut-terrace at an elevation of 125 m above sea level, a lower cut-terrace at elevation 110-114 m above sea level and low fill terrace at elevation 87 to 92 m above sea level.

The Pleiocene terraces of the Nagada-Khattara region with its several stages of down-cutting, which may have extended to the basal Pleistocene, may be equivalent to terrace 1 and terrace 2 at wadi Hilal of Shahin (1970). Also the lower Pleistocene terrace at Nagada-Khattara area may correspond to the Gallaba gravel plain of the Kom-Ombo plain, taking into consideration that both of them are cut-in fill terraces.

Moreover, the Middle and Upper Pleistocene terraces of the Nagada-Khattara region may correspond to HI-I, HI-II, MT and LT-I gravel terraces of Kom-Ombo plain (Butzer and Hanson, 1968). Also they may correspond to terrace 3 and terrace 4 at Wadi Hilal.

At Hierakonpolis, the higher and the lower cut terraces, which are present at elevations 125 m and 110 to 114 m above sea level respectively, may correspond with the lower stages of Middle and Upper Pleistocene terrace of the present area, as well as with HT-II and MT at Kom-Ombo.

Table 1.

Absolute elevations and relative elevations to the modern floodplain of the Pliocene and Pleistocene terraces at Nagada-Khattara region and some adjacent areas.

	<i>Nagada-Khattara region (The present work)</i>	<i>Wadi Hilal (South of Isna) (Shahin 1970)</i>	<i>Kom Ombo (Butzer and Hansen 1968)</i>
The elevation of the modern floodplain	73 - 74	80	90 - 89
Age	QT4 84 - 100 (11 - 27)	T5 83 - 90 (3 - 10)	LT ₂ 112 - 114 (15)
Middle and Upper Pleistocene	QT3 106 - 112 (33 - 39)	T4 90 - 120 (10 - 40)	LT ₁ 116 - 118 (22)
	QT2 116 - 129 (43 - 56)		MT 121 - 125 (34)
Lower Pleistocene	OT1 138 - 148 (65 - 75)	T3 120 - 150 (40 - 70)	HT II 129 - 133 (40 - 43)
			HT I 140 - 144 (51 - 54)
Basal Pleistocene		T2 150 - 180 (70 - 100)	Gallaba Stage 150 - 163 (60 - 74)
Pliocene	Cut T 180 - 170 - 160 (107) (97) (87)		
	fill T 205 - 216 (132 - 143)	T1 180 - 210 (100 - 130)	

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