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LATE PLEISTOCENE STRATIGRAPHY OF THE KOM OMBO PLAIN UPPER EGYPT : COMPARISON WITH OTHER RECENT STUDIES NEAR ESNA-EDFU

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I Introduction

In 1963-64 the writers spent 4 months of a 7-month field season in southern Egypt investigating the Quaternary record of the Kom Ombo Plain. The results have been published in full, together with full description of textural data, quartz-grain micromorphology, clay minerals, C^{14} dates, and an accompanying set of detailed maps (Butzer and Hansen, 1968). During subsequent years other teams carried out complementary studies further north, in the Edfu and Esna regions. Since the alternative stratigraphic and paleo-environmental interpretations appear to be difficult to reconcile, it seems to be of purpose to review the present status of information briefly. No systematic attempt is made here to discuss our Egyptian Nubian materials in relation to other parallel or supplementary investigations.

The Kom Ombo Plain is a large sedimentary basin, located east of the modern Nile, some 30 to 55 km north of Aswan. The northern and southern margins are formed by the Etbai Uplands, an erosional terrain of hills and upland plains formed in Nubian Sandstone and vevelled by a Mio-Pliocene planation

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surface. The eastern terminus of the Plain consists of downfaulted blocks of Paleocene Chalk amid a Pliocene infilling that coalasces (some 30 to 35 km away from the Nile) with another plain, the Atmur Nuqra, of unstudied bedrock geology and structure. The western periphery of the Plain is delimited by the massive alluvial accumulations of the Gallaba Gravel Plain, of early Pleistocene age. The actual demarcation of the Kom Ombo Plain is a result of a network of faults and other lines of deformation, modified by a set of Pleistocene fluvial platforms and alluvial terraces. Controversial, unpublished borings suggest that downwarping may have begun in late Cretaceous times, since the igneous and metamorphic basement was first struck at 850 m below sea level. However, Paleocene and Eocene strata are demonstrably faulted, whereas the Middle to Upper Pliocene beds were deposited into an existing graben. Consequently the primary tectonic deformation must be attributed to the Oligocene-Miocene transition (for details, see Butzer and Hansesn, 1968 : chap. 2).

II Late pleistocene nilotic stratigraphy of the Kom Ombo plain

The contemporary surficial deposits on the floor of the Kom Ombo Plain accumulated in late Pleistocene times, after a protracted period of dissection during which most of the early to middle Pleistocene deposits of the Nile and its major wadi tributaries were eroded. The resulting depositional plain comprises some 275 km2 of nilotic sediments and almost half that area again of coeval wadi alluvium. These nilotic and wadi sequences were first informally subdivided by Butzer and Hansen (1965, 1967) and subsequently given formal lithostratigraphic status, with full description of facies, stratigraphic details, and type sections (Butzer and Hansen, 1968 : chap. 3 and 1 : 100,000 roll map). The nilotic sequence is as follows (see Table 1) :

1) KOROSKO FORMATION

Subaqueous to fluvial marl, gravelly marl, and sandy gravel with stratigraphic thickness in excess of 15 m, primarily suballuvial, and attaining a floodplain elevation of at least 108 m. Abundant molluscan fauna, but lacking primary archeological contexts. Terminal beds ⩾ (greater than or equal to) a C^{14} date of 25,250 $^{+}1000/900$ B.C.[1] in Nubia.

(Footnote) 1). In deference to the convention used in Egyptian Pleistocene plublications during the last decade, all C^{14} dates are quoted in years B.C. with reference to the unadjusted, Libby half-life.

III Comparisons with the ESNA-EDFU nilotic stratigraphy

An element of confusion has been caused by Said *et al.* (1970) transferring the Sudanese nomenclature to the Esna-Edfu area of Upper Egypt (with an intervening hiatus of 350 km, thereby establishing a procedural precedent in stratigraphic nomenclature). Not surprisingly, the Sudanese units could not be adapted without modification. However, instead of defining new members, the original Sahaba Fm. of De Heinzelin was truncated, with the early and middle stages of the Sahaba relegated to a new, Deir el-Fakhuri Formation. To compound the problem of ever-increasing stratigraphic terms, the Sahaban concept was further and arbitrarily modified for Sudanese Nubia (Wendorf *et al.*, 1971), rendering existing correlations invalid.

Since stratigraphic and chronometric comparisons between the Kom Ombo Plain and the Esna area are central to the purposes of this paper, a review is appropriate here. It must be stressed, however, that such correlations remain tentative since Said *et al.* (1970) and Wendorf *et al.* (1970a, 1970b, 1971) provide no more than a single non-schematic profile, offer the most rudimentary of lithologic descriptions, and desribe no type sections in either the Esna, Edfu or Dishna areas. Fortunately, sedimentological analyses now appear to be either underway or completed, so that a more exacting correlation may ultimately be possible.

1) DIBEIRA-JER FORMATION

The oldest defined entity in the Esna/Edfu region is the *Dibeira-Jer Formation* a massive nilotic silt whose terminal units are interbedded with dune sands and carry 7 C14 dates that range from 16,070 to 15,000 B.C. The eolian sands were formerly defined as the recessional Ballana Fm. by De Heinzelin (1968), although crucial textural data were never published (see reservations of Butzer and Hansen, 1968 : 291, 324) ; significantly, Wendorf *et al.* (1970a, 1970b, 1971) now accept the fact that these sands are no more than a facies. The implications for a dry climate in the Esna area find confirmation on the Kom Ombo Plain, where the contemporary Masmas Fm. shows next to no evidence of wadi activity (Butzer and Hansen, 1968 : 102f.). On the basis of our familiarity with what are presently labelled as Dibeira-Jer silts near Edfu (Sandford and Arkell, 1933 : 45f.) there can be little question that the main body of these sediments is closely comparable to and coeval with the Masmas Fm. The terminal eolian facies understandably find no parallel on the eastern bank of the Nile, although the earliest date of 15,050 ± 600 B.C. (Smith, 1968), form the Khor el-Sil channel (Channel A) of the Darau Member of Kom Ombo, suggests that the youngest eolian deposits may in fact be comtemporary with the base of the Darau Member.

TABLE 1

LATE PLEISTOCENE NILOTIC SEDIMENTARY UNITS AND KEY ARCHEOLOGICAL SITES OF THE NORTHERN KOM OMBO PLAIN

(In part, modified after Butzer and Hansen, 1968 : Smith, 1968 ; Vermeersch 1970

Litho-Stratigraphic Units		Major Archeological sites	
Arminna Member, Gebel Silsila Fm.	Suballuvial	(Represented by Epi-Paleolithic sites of El-Kab Fm., *Ca* 6400-5980 B.C. at Edfu)	
Darau Member, Gebel Silsila Fm.	Terminal High Floods (112 m), (*ca* 10,000 B.C.) not represented locally		
	Channel C Stage (97 m) (*ca* 10,000-11,000 B.C.)	? KS-IV	Late Paleolithic
	Channel B Stage (98-99 m) (*ca* 12,500-11,000 B.C.)	GS-2B-I, GS-1-XIII GS-2B-II, GS-1-III	Late Paleolithic
	Channel A Stage (100-102 m) (*ca.* 15,000-12,500 B.C.)	GS-2A complex, KS-II/III	Late Paleolithic
Masmas Fm. (Floodplain 110 m)	*ca* 22,000 - 16,000 B.C.	None	
Korosko Fm. (Floodplain 108 m)	Terminating *ca* 24,000 B.C.	None	

2) MASMAS FORMATION

Flood silts and some channel beds with a thickness of at least 23 m (probably in excess of 43 m), with maximum floodplain elevation of 110 m. Rare mammalian bone, diverse molluscan fauna, but lacking archeological inclusions. Terminal dates of 16,350 ± 310 and 15,150 ± 400 B.C., the last possibly too young.

3) GEBEL SILSILA FORMATION, DARAU MEMBER

Channel beds with some flood silts, considerably more than 14 m in cumulative thickness. Locally subdivided into 3 "channel stages", with median floodplain elevations of 100 - 102 m (*ca.* 15,000 - 12,500 B.C., 4 C^{14} dates), 98-99 m (*ca.* 12,500 - 11,000 B.C., 10 C^{14} dates, see also Smith, 1968) and 97 m (*ca.* 10,500 B.C. 1 C^{14} date). A final, high flood phase occurred ca. 10,000 B.C. (3 C^{14} dates). Younger members of the Gebel Silsila Formation, recognized in Egyptian Nubia, are not represented on the Kom Ombo Plain, being suballuvial north of Aswan and the Kalabsha Gorge (see Vermeersch, 1970).

This sequence is replicated in (with additional units and details) and mapped at 1 : 41,500 for Egyptian Nubia (Butzer and Hansen, 1968 : chap. 6 and roll maps). It can be compared, in part, with the lithostratigraphic units of De Heinzelin (De Heinzelin and Paepe, 1965 ; De Heinzelin, 1967, 1968) defined for Sudanese Nubia, whereby the Masmas Fm. is approximately equivalent to the Dibeira-Jer (ex-Khor Musa) Fm. of De Heinzelin, the Darau Member to De Heinzelin's Sahaba Fm. However, since De Heinzelin mentions no textural, heavy mineral, nor clay mineral analyses, a number of discrepancies regarding eolian facies, possible paleosols, and other details cannot be resolved. The stratigraphic resolution of De Heinzelin's earlier deposits does not permit possible Sudanese correlations with the Korosko Fm. Thus, De Heinzelin (1968) insisted that the Dibeira-Jer Fm. Included the earliest nilotic deposits, basing himself solely on pebble lithology. To the contrary, Butzer and Hansen (1968 : 95,148ff., 271, 329, 455ff., Appendices B and D) were able to show conclusively that the heavy and clay minerals of the Korosko Fm, militated for a part -- Ethiopian and specifically nilotic origin. Butzer and Hansen (1968 : 78f., 264, 453ff.) further argued that summer flood components of Ethiopian origin probably reached back well into mid-Pleistocene times or earlier, a viewpoint now finding additional confirmation (Said *et. al.*, 1970 ; Fekri Hassan, pers. comm.).

2) DEIR EL-FAKHURI FORMATION

The *Deir el-Fakhuri Formation* currently refers to a series of poorly dated pond deposits, with diatoms, from intradunal swales well west of the Nile floodplain, where terminal units may include wadi wash. The two available dates are 14,880 and 10,740 B.C., the latter considered too young, the former obtrained from below the actual sediments in question (Wendorf *et al.*, 1971). Although contemporary deposits of the Eastern Desert wadis record a moister, local climate (in the form of the Malki Member of the Ineiba Formation (Butzer and Hansen, 1968 : 116ff.), with a basal date of 15,450 ± 300 B.C. and a terminal date of 10,070 - 205 B.C.) the paleoclimatic evidence form the Esna area is inconclusive : (i) the non-calcic, humic, "mediterranean" type soil (Said *et al.*, 1970 : 54 ; Wendorf *et al.*, 1971 : 63) remains to be described in even basic terms ; (ii) the diatom-rich ponds do not prove "cooler summer temperatures" (Said *et al.*, 1970 : 56), but can be adequately explained by lateral seepage from the Nile-controlled water-table, even during the low-water season (cf. modern lagoons and swales west of Dairut, e.g. Butzer, 1959c). Comparable pond deposits near Ballana Police Post in Egyptian Nubia are included as facies within the Darau Member by Butzer and Hansen (1968 : 29f. and Fig. 6-10).

3) SAHABA FORMATION

The truncated *Sahaba Formation* is associated with C^{14} dates of 11,430 and 10,550 B.C., the latter recording a widespread brush fire that provides a provocative marker horizon along the former floodplain from Esna to Dishna (Romuald Schild, pers. comm.). An approximate temporal correlation with Channels B and C of the Darau Member is suggested, inferring that the Deir el-Fakhuri unit probably coincides with Channel A.

4) DISHNA FORMATION

A *Dishna Formation* may possibly be represented in the Esna area by a "recessional beach" with a date of 9610 B.C. (Wendorf *et al.*, 1971). By contrast, the youngest, non-functional nilotic deposits at Kom Ombo are exceptionally high flood silts with C^{14} dates of 10,050 ± 120, 10,070 ± 205, and 9770 ± 195 B.C. (Butzer and Hansen, 1968 : 115f.). Thus the Dishna "beach" may represent a point-bar deposit of a downcutting Nile.

IV Interrelationships of the nilotic and wadi record on the Kom Ombo plain

Despite the obvious significance of the nilotic stratigraphy of Upper Egypt, e.g. for comparing Saharan and East African climates (see Butzer, Isaac *et al.*, 1972), the local wadis reflect far more closely on regional environmental parameters. This data, which complements Table 1 above, can be summarized from Butzer and Hansen (1968 : chap. 3) :

(1) Dissection by Nile (to below modern floodplain, vertical differential at least 12 m) and wadis (over 10 m cutting in fill). Lower Nile floods and limited wadi activity.

(2) Alluviation of Korosko Formation by Nile and wadis (prior to 24,000 B.C.). Greater Nile velocity. Valley margin :

Facies III : Marl. Limited wadi activity.

Facies II : Gravelly marl. Some wadi activity.

Facies I : Sandy gravel. Accelerated wadi activity.

(3) Dissection by Nile (to below modern floodplain ; vertical differential at least 19 m, possibly over 40 m) and wadis (well over 5 m). Lower Nile floods and limited wadi activity.

(4) Alluviation of Masmas Formation by Nile (*ca* 22,000 - 16,000 B.C.). Flood regime similar to that of today ; minimal wadi activity in general, interrupted by at least six periods of limited wadi flow.

(5) Development of hydromorphic paleosol on floodplain (a vertisol of Mazaquert type).

(6) Dissection by Nile (to below modern floodplain, vertical differential at least 20 m) and wadis. Lower Nile floods and limited wadi activity.

(7a) Alluviation of Gebel Silsila Formation, Darau Member, by Nile, (*ca* 15,000-10,000 B.C.). Influx of exotic gravel in bed load ; greater Nile competence.

(7b) Alluviation of Malki Member, Ineiba Formation, by major wadis (thickness over 9 m). Contemporary with phase (7a). Accelerated wadi activity in Red Sea Hills ; some local rains recorded by basal gravel stratum.

(8) Brief stage of sporadic or periodic Nile floods of exceptionally great

amplitude *ca* 10,000 B.C.. Formation of Mazaquert paleosol on Malki deposits and secondary gypsum impregnation of Masmas silts.

(9) Dissection by Nile (amplitude uncertain) and wadis (vertical differential at least 12 m). Limited wadi activity.

(10) Alluviation of Sinqari Member, Ineiba Formation, by major wadis (thickness over 11 m). Accelerated wadi activity in Red Sea Hills and greater local rains, with abundant wadi activity *ca* 9500 - 6500 B.C.

(11) Biochemical weathering with formation of red paleosol. Frequent, gentle rains and greater vegetation. A period of minor dissection separates phases (10) and (11).

(12) Dissection of wadi fill (total cutting since phase 10 exceeds 6 m). Limited wadi activity.

(13) Alluviation of Shaturma Formation by wadis :

Member II. 2.5 m thickness. Some winter rains, no organic vestiges. *ca* 1000 - 1200 A.D.

Dissection (about 1.5 m).

Member I. 3 m thickness, grading into colluvial screes, suggesting heavy, torrential rains. Fourth millennium B.C. First alluviation of modern Nile floodplain probably contemporary.

(14) Dissection of fill in minor wadis (vertical differential 2 to 3 m) and clay accumulation in Red Sea Hills wadis. In general, very limited wadi activity

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