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Early Pleistocene Deposits of the Nile Valley in Egyptian Nubia

During 1962-63 the writers spent 7 months on the Kom Ombo Plain and in Egyptian Nubia, working in association with a Yale University prehistoric expedition under direction of C. A. Reed. Responsible for the Pleistocene stratigraphy and geomorphology, the writers mapped the surficial geology and geomorphology of a 277 km long, 3 km wide stretch of the Nile Valley in Nubia at 1 : 10,000. Extensive mapping was also carried out of the Kom Ombo Plain and at Kurkur Oasis. This papers intended as an interim report on the older-Pleistocene deposits studied in Egyptian Nubia (see Butzer & Hansen, 1965). It accompanies a similar report on the late Pleistocene deposits of the same area (Butzer & Hansen, 1966).

Older Pediment Surfaces

The origins of the modern Nile Valley in Lower Nubia go back to the Pontian or even the Upper Miocene. Among the oldest, more distinctive geomorphic features are a number of broad pediment surfaces. The most extensive and pervasive of these is the Lower Nubian Pediplain. Varying in width to 50 km, this coalescing pediment plain extends in discontinuous fashion sub-parallel to the Nile from Kom Ombo, in Egypt, southward into Sudan. In the Kom Ombo-Aswan area this surface is generated westward to the limestone escarpment at an elevation of 190-210 m above sea-level. It relates to a former Nile base level at about 80-90 meters above present flood level.

From Aswan to Kurkur the Lower Nubian Pediplain is typically a quite featureless, barren undulating surface with local relief of less than 30 m. Slopes of less than 3 percent constitute over 90 percent of the area. Drainage is quite rudimentary with a distinctive lack of integration. Numerous closed depressions, of probable eolian origin, are encountered and large tracts have little or no surface

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expression of drainage. The region west of the Kom Ombo-Aswan area is quite lacking in bedrock residuals. However, to the south the number and size of such residual masses increases. Reddish yellow and brown colors dominate the landscape, reflecting the presence of considerable iron oxide. Ferruginization of the surface has taken place either in the form of a relatively thin patina or as a rind of ferro-magnesian precipitates. The presence of rock drawings in Nubia, with a quite fresh aspect, dating from *ca.* 3,000 years B.C., lends support to the notion that patination is occurring but slowly and that back-wearing of slopes is at a virtual standstill in this area today. The relict character of this landscape is further attested to by the paucity of debris on residual slopes and the almost complete lack of debris at the base of such slopes. Equally significant are the numerous fresh, wind-scoured, faceted bedrock surfaces found not only among the footslopes but wherever exposed bedrock is encountered.

In gross aspect the Lower Nubian Pediplain is generated across the crystalline Basement Complex with little change. There are differences in detail, such as a finer texture as well as linearities imparted by dikes, lithologic differences, and fault, but the general description holds. This major erosional surface appears to predate the Pliocene lagoonal deposits at Kom Ombo as well as the younger Pleistocene deposits of the Nile. Red paleosols occur on this surface but related surficial deposits are lacking. The evidence seems to indicate a Mio-Pliocene date for the responsible period of planation.

In Nubia younger pediments of considerable extent are encountered between approximately 150 and 190 m above sea-level. Particularly distinctive are those at 160-165 and 180-190 m above sea-level in southern Egyptian Nubia. All of these younger pediments have been subjected to ferruginization in varying degree. The assignment of chronological significance to these younger erosional features is hampered by subsequent faulting which has offset pediment segments in a rather random fashion. Further, although these pediments are frequently convergent with true fluvial platforms, often with associated gravel, it is not immediately clear that pediment and platform are contemporary.

The Autochthonous Nile Gravels and Related Wadi Deposits

Brief periods of deposition of coarse, rounded gravel interrupted the general downcutting by the Nile during the Pleistocene. The materials constituting these deposits are strictly of local origin, largely quartz, together with igneous and metamorphic components and local ferricrete sandstone at the mouths of the larger eastern wadis. No clear evidence of materials exotic to Egypt and northern Sudan is apparent, so that the designation *Autochthonous Nile Gravels* has been adopted.

Identification of several distinct stages has been made. Relative to modern Nile floodplain their elevations are + 50-55 m, + 48 m, + 52 m, + 32 m, and + 24 m. *In situ* fossils and human artifacts appear to be lacking in all of these terraces. Coupled with an apparent lack of marked variation in petrography, this situation necessitated the use of geomorphic criteria for terrace

correlation. Surface weathering by deep, red paleosols is characteristic of the + 50-55 m, + 48 m, and + 42 m gravels. Moderate rubefaction typifies the + 32 m and + 24 m gravels.

The + 50-55 m Stage

The oldest gravel terraces have their best expression as a striking "high" terrace in Wadi el-Allaqi, developed as a major wadi bed with tributary wadi ridges. Conspicuosly denuded by rill cutting, the gravels remain massive, attaining as much as 1.8 km in width. Near the Nile, at the intersection of the main gravel body with a tributary gravel ridge, the terrace elevation is 153 m. The crest elevation a little upstream, representing a higher substage, lies somewhat above 160 m. The projected floodplain elevation is about + 50 m.

In view of its impressive development in Wadi Allaqi, it is proposed that this + 50-55 m level be informally referred to as the *Allaqi stage*. Other exposures of similar terraces in Nubia are shown on Fig. 1. Almost certainly we are dealing with a terrace complex, representing two major substages.

At Kom Ombo, some 50 km north of Aswan, gravel terraces are encountered at elevations of about 142-143 m (+ 55 m) in Wadis Kharit and Shait. It is felt that these terraces probably are the stratigraphic equivalent of the Allaqi stage found further upstream in Nubia, although direct correlation is not yet possible and caution is advised.

The + 44-48 m Stage

At Dihmit, some 40 km of Aswan, an impressive gravel body is found to about 143 m elevation (+ 44 m), forming part of a + 44-48 stage. Just north of Khor Dihmit these gravels constitute a true Nile terrace. Identical gravels extend into the lower reaches of a tributary wadi, whose course runs parallel to the Nile. One kilometer up this wadi the gravels are 25 m thick and consist of crudely stratified and unsorted rounded quartz cobbles and coarse igneous pebbles in a matrix of semicemented, buff, coarse quartz sand. Interpretation of these gravels proceeds from the fact that the gradient of the underlying wadi floor is greater than the surface gradient of the gravels. This fact suggests that the gravels were either primarily deposited or redeposited by a Nile spillway about 1 km east of the present Nile channel.

Owing to its fine expression at Dihmit the name *Dihmit stage* is informally suggested for the + 44-48 m level. Well-developed fluvial platforms can be traced from south of Dihmit, at Kalabsha, to Kushtamna, just north of Dakka. In southern Nubia, a complex of gravels and fluvial benches between Tushka and Abu Simbel are very probably identical in age. Because the relative elevation of this stage drops from + 48 to + 44 m downstream, the gradient is a little steeper than that of the recent floodplain.

Possible stratigraphic equivalents appear in Wadis Shait and Kharit at Kom Ombo in elevations of 131-132 m (+ 45 m).

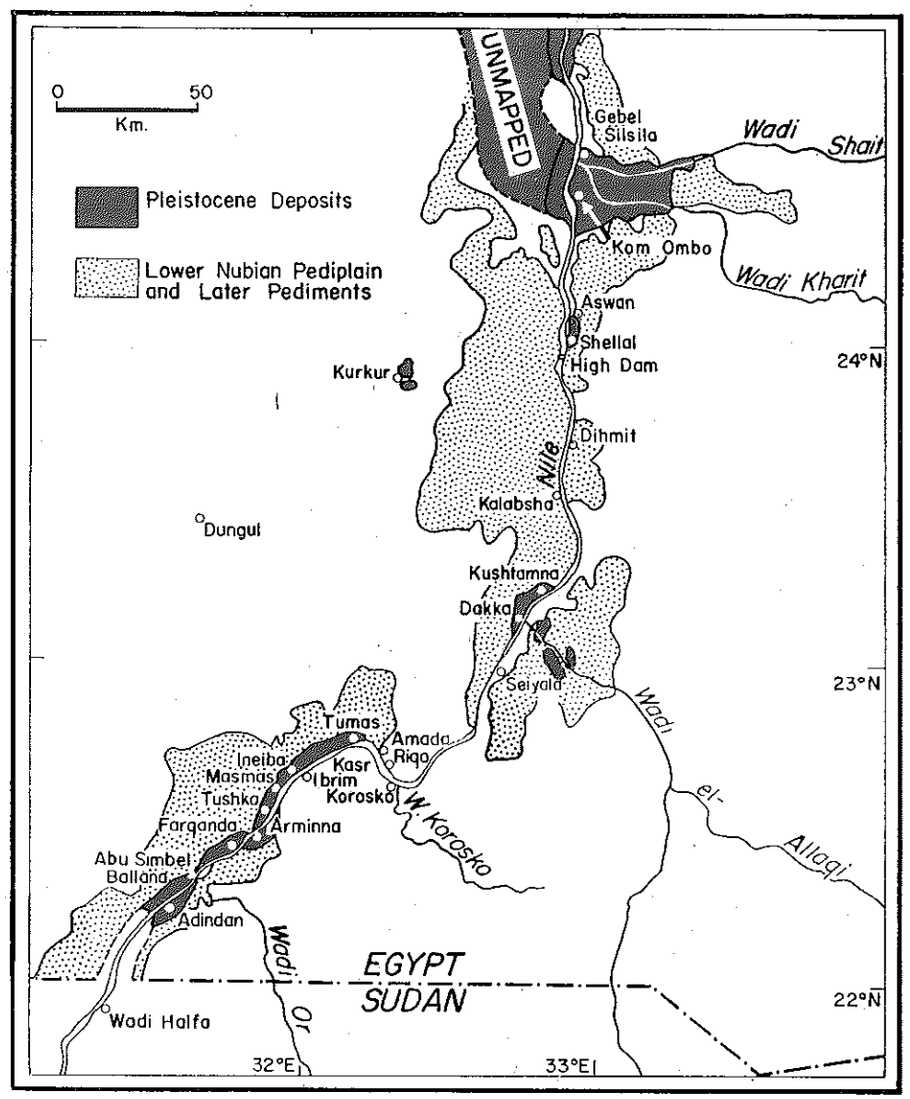

FIG. 1. – Southern Egypt, showing the extent of Pleistocene deposits (as mapped or field checked by the writers) and the Lower Nubian Pediplain.

THE + 42 M STAGE

Adindan, a few kilometers north of the Sudanese border, is the site of the best development of the + 42 m terrace. On the west bank this stage is preserved at 163 m elevation (+ 42 m) as several major patches of Nile gravels on both sides of the valley and with gravel ridges of two major wadi tributaries on the west bank. The Nile gravels attain a thickness of at least 7 m, averaging about 3 m.

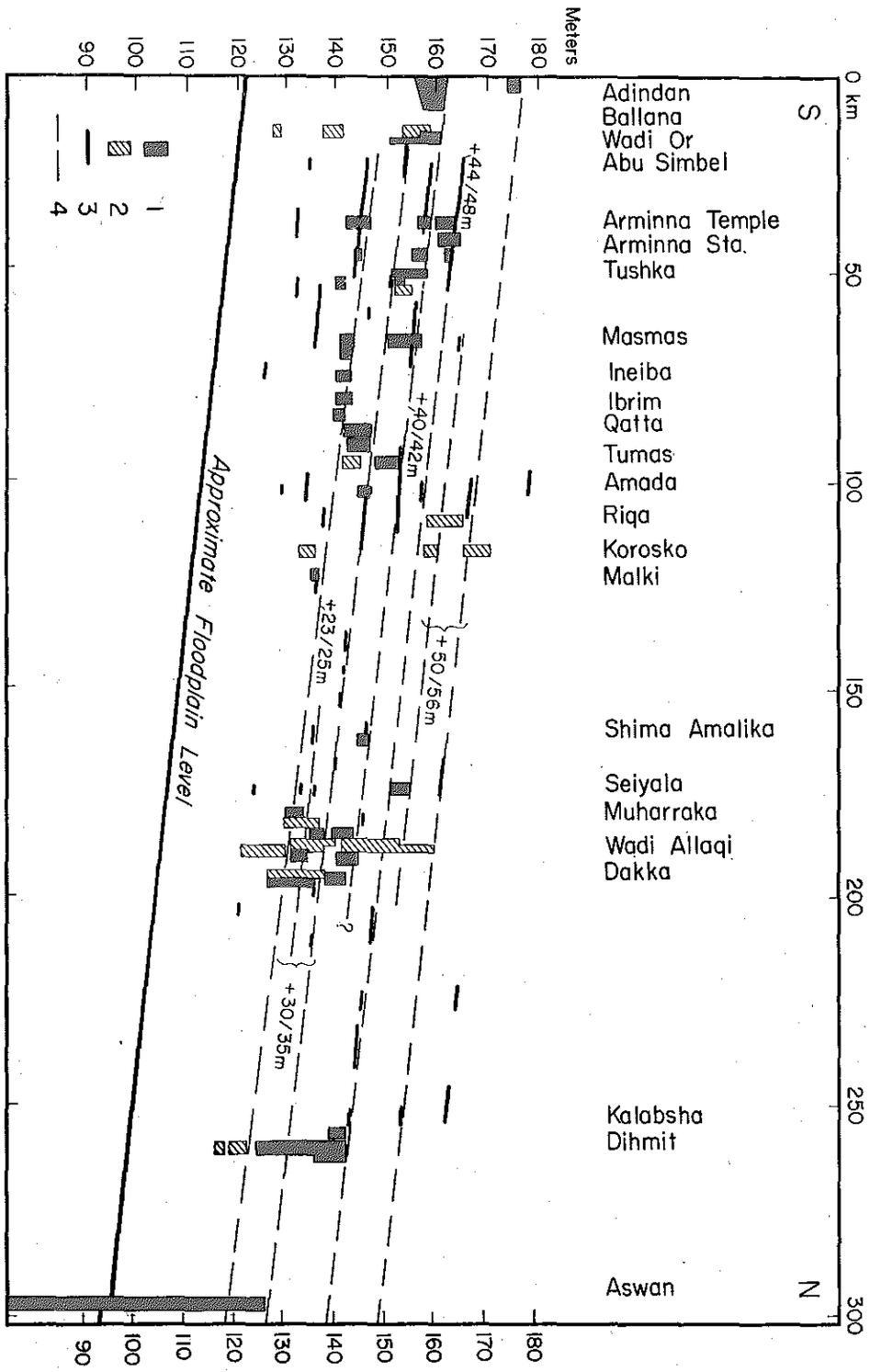

Fig. 2. – Autochthonous Nile gravels and wadi deposits in Egyptian Nubia.
1 Nile gravels, indicating maximum elevation and thickness recorded — 2 Wadi gravels
3 Fluvial platforms — 4 Reconstructed Pleistocene floodplain levels.

They are deposited on an ironstone-capped bedrock surface that rises laterally at less than 1% to at least 168 m, forming part of an older platform or pediment. The gravels are unconsolidated and show deep rubefaction with a relict soil of red, secondarily calcified medium to coarse sandy silt as matrix to the coarse gravel. On the east bank at Adindan this same terrace is found fringing the Nile at 163 m (+ 42 m). Total floodplain width at Adindan during this stage was 3.2-3.6 km compared with just half that distance today. The terrace on the east bank continues downstream to a point opposite Ballana where it appears as a narrow, dissected ridge averaging 50 m wide and 4 m thick.

In view of the excellent exposures of this + 42 m level at Adindan it is proposed that it be informally designated as the *Adindan stage*. Contemporary gravels are well developed opposite the Abu Simbel Temples, south of Ineiba, at Tumas and again near Dakka, where two substages may be represented.

The + 32 m Stage

Dakka is the site of the best development of the next youngest stage. Gravels are subcontinuously preserved for some 4 km, reaching a maximum thickness of over 5 m and a maximum width of 400-500 m. Highest local elevation is 136 m (+ 30 m). These gravels consist of stratified, rounded, more or less flattish, coarse to cobble gravel of dark igneous rocks and quartz set in a matrix of light brown, calcareous rocks and quartz set in a matrix of light brown, calcareous, silty coarse sand. A distinct soil profile is lacking but this may be attributed to stripping during the Late Pleistocene. On the east bank at Dakka there are two conspicuous gravel ridges, at + 130 m and 138 m elevations (+ 32), pertaining to the same stage. In the same area a striking platform is cut across tilted Nubian sandstone strata at 136 m elevation.

Size and intensity of development of this stage at Dakka leads to the suggestion that this be informally called the *Dakka stage*. A series of Nile and wadi terraces with some related fluvial benches in the Tumas area and again between Tushka and Abu Simbel are equivalents of the Dakka stage further south. The massive gravel fill of the abandoned Nile arm followed by the railroad from Shellal to Aswan is also contemporary. A number of fluvial benches, stripped gravels and lower-lying deposits suggests the existence of a younger substage a few meters lower.

Wadi terraces at *ca.* 122 m (+ 35 m) in Wadis Kharit and Shait together with Nile gravels at *ca.* 121 m (+ 34 m) near the Nile between Darau and Gebel Silsila, on the Kom Ombo Plain, seem to represent the stratigraphic equivalent at Kom Ombo.

The + 24 m Stage

In lower Wadi Korosko a fragmentarily-preserved wadi terrace rises some 15 m above the wadi floor at the confluences of the north and south branches, with a detached but contemporary alluvial cone. Included in these deposits are

derived blocks of ferruginized conglomerate from a higher (+ 55 m?) terrace. The base is comprised mainly of foreset beds, with dips of 30-48%, of semi-cemented, subrounded to rounded, coarse to cobble gravel. These beds grade upward into topset beds, with dips of 3-5%, of somewhat finer medium to cobble gravel and coarse sands with dispersed pebbles. The base of this alluvial cone is intensely rubefied, while the upper and external parts of the cone are ferricreted in addition. Projecting the gradient of the deposit to the Nile, the computed elevation is *ca.* 236 m (+ 24 m).

Korosko being the type site for this stage, it i ssuggested that the term *Korosko stage* be used for this level. Contemporary deposits are preserved in Wadi el-Allaqi and Khor Dihmit and probable Nile equivalents are recorded between Tushka and Abu Simbel. At Kom Ombo the stratigraphic equivalent ma y possibly be sought in terraces at 111 to 113 m (+ 26 m) in Wadis Kharit an Shait.

A number of altimetrically lower wadi gravels and fluvial benches occur in southern Nubia. Although probably younger than the Korosko stage, they are too fragmentarily preserved and incoherent to permit any stratigraphic assessment.

As suggested earlier, the above terrace correlations are based on indirect evidence such as relative geomorphic significance, degree and character of surface erosion, and depth of weathering together with the direct evidence of simple altimetric correlation. Without clear-cut and definitive stratigraphic criteria the correlations presented here, on a regional basis, are admittedly not established beyond a doubt. However, for those reaches Adindan to Ballana, Farqanda to Tumas, and Wadi el-Allaqi to Dakka the authors have no reservations concerning the internal validity of correlations and differentiation. Furthermore, the entire scheme seems reasonable, consistent and very probable for Egyptian Nubia as a whole. With respect to Kom Ombo, here too, the internal correlation is of the same order of validity as further south but the dangers of long distance correlation, particularly across the contemporary barrier of the Aswan cataracts, are many. Therefore, the correlations made between the terraces in Nubia and those at Kom Ombo are offered only tentatively.

The Question of Pleistocene Tectonics

The tectonic character of the Kom Ombo Plain has long been recognized, and Yallouze and Knetsch (1954) have shown the general existence of linear structures dominating the drainage patterns of the Eastern Desert sedimentaries north of Aswan. Tectonic deformations are also evident in Nubia. Many of the Nile Valley pediments are bounded by fault zones of limited vertical displacement, related to gentle flexures and linear structures within the Nubian Sandstone. These features were in part transmitted from joint patterns and fracture lines in the underlying Basement Complex, in part caused by the revival of fractures along old lines of weakness during the Alpine orogeny.

The dimensions of vertical displacements evident in Egyptian Nubia are very modest and seldom exceed 10 meters. There is little evidence for major vertical

faults or horizontal tearfaults in the Nubian Sandstone. And above all, such deformations as are visible predate the Autochthonous Nile Gravels. Deposits of the Adindan stage were observed to cross minor fracture zones without disturbance.

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ZUSAMMENFASSUNG

Auf Grund intensiver Geländeuntersuchungen im südlichen Ägypten 1962-63 kann ein Schema alt- bis mittelpleistozäner Nil- und Wadiaufschotterungen entworfen werden. Solche grobklastische Ablagerungen bestehen aus örtlichem Material, ohne Zwischenschaltungen von Schwebesedimenten, die dem Blauen oder Weissen Nil zugeschrieben werden könnten. Diese Schotter sind jünger als eine Mio-Pliozäne Rumpffläche in etwa 200 Meter Höhe. Ebenso sind die spätpleistozänen nilotischen Ablagerungen — etwa dem Zeitabschnitt Würm bis Mittelholozän entsprechend — deutlich jünger. Obwohl die älteren Schotterterrassen auf Grund geomorphologischer Indizien und der Paläoböden stratigraphisch eingeordnet werden, können sie nicht mit ausserägyptischen Zeiteinheiten korreliert werden.

RIASSUNTO

Denudazione e incisione sono state le caratteristiche principali dell'evoluzione pleistocenica della Valle del Nilo nell'Egitto meridionale. Tra gli elementi più caratteristici degli aspetti del suolo in questa fase erosiva sono una pianura pedemontana estesa intorno alla

quota di 200-210 m, i più recenti pedimenti a quote inferiori e le masse residue associate con queste superfici.

Un temporaneo accumulo di ciottolami interruppe almeno cinque volte nel corso del Pleistocene inferiore e medio la tendenza essenzialmente incisiva del Nilo. Questi ammassi di ciottolami, tranne che negli uadi, sono in genere poco profondi, sono fortemente denudati e composti di elementi di origine locale. La sedimentazione di materiale grossolano si può spiegare solo con un aumento del potere di trasporto del fiume. Diversi periodi di formazione di suolo determinarono il costituirsi di un mantello, soggetto sia alla deflazione che alla denudazione durante periodi intermittenti di aridità quasi totale. Sia i ciottolami che le terre rosse fanno pensare a periodi di clima più umido o eventualmente semiarido. In mancanza di materiale databile con precisione sembra impossibile ricostruire la cronologia esatta di questi periodi pluviali precedenti al Pleistocene superiore.