Archaeological survey in the Blue Nile area, Central Sudan

Prospección arqueológica en el área del Nilo Azul, Sudán Central

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ABSTRACT

The results are presented of an intensive survey of the Wadi Soba-el-Hasib area east of Khartoum on the east bank of the Blue Nile and the exploration of the Blue Nile Basin upstream to Singa. The survey focused mainly on the Prehistoric sites, with the Mesolithic period (Early Khartoum) as the mostly represented with more than 80% of the discovered sites, the Neolithic sites (Shaheinab-Jebel Moya) making up most of the remainder 20%. Very few Palaeolithic sites were recorded. Late Neolithic sites of large size have been found for the first time in the Central Sudan, all of them located away from the Blue Nile in the Butana and Gezira plains. Site structure and formation processes, ceramic seriation and settlement patterns have been analysed applying statistical multivariate methods to the survey quantitative data. Some historical trends have been noticed. The first is the change from a Nile-wadi aquatic exploitation by small mobile groups towards demographic concentration of near-sedentary savanna hunting-herding populations. During the Late Neolithic period the groups adopted a mobile economy and their only archaeological record thereafter are the burial tumuli fields up to the Christian and Islamic periods.

KEY WORDS
Formation processes, Seriation, Settlement patterns, Khartoum Mesolithic-Neolithic, Holocene, Central Sudan

RESUMEN

Se presentan los resultados de una prospección intensiva del área de Wadi Soba-el-Hasib al este de Jartum en la orilla oriental del Nilo Azul y una exploración del Nilo Azul aguas arriba hasta Singa. El objetivo principal fueron los restos prehistóricos, con un 80% de yacimientos mesolíticos (Early Khartoum), siendo el resto neolítico (Shaheinab-Jebel Moya) junto a escasos restos paleolíticos. Por primera vez se han registrado yacimientos importantes del Neolítico Final en el Sudán Central, siempre en áreas lejanas al Nilo de la Butana y la Gezira. Se han aplicado métodos estadísticos multivariantes a los procesos de formación, seriación cerámica y modelos de asentamiento. Se advierte el paso primero de una explotación acuática por grupos móviles a una concentración demográfica de cazadores-pastores de sabana, que luego adoptan una economía móvil con túmulos funerarios como único resto arqueológico hasta la época moderna.

PALABRAS CLAVE
Procesos de formación, Seriación, Patrones de asentamiento, Mesolítico y Neolítico de Jartum, Holoceno, Sudán Central

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1. Introduction

Survey area and methodology (Figs. 1-6)

Five seasons of archaeological survey were carried out during the winters of 1990, 1992, 1993, 1994 and 2000. The autumn campaign of 1994 and those of 1996, 1997 and 1998 were dedicated to the excavation of several prehistoric sites (see general introduction for calendar details and Fernández, Jimeno, Menéndez 2003 for the results of the excavation work). We concentrated first on the Wadi Soba area that is immediately upstream from the area investigated in the 1989 season when a rescue excavation was made at the Early Neolithic site of Hag Yusuf (Fernández *et al.* 1989). After the agreement with the Sudan National Corporation for Antiquities and Museums (NCAM), our concession area was located between Khartoum North and the village of Eseilat on the Blue Nile eastern bank. The limits were, at west the meridian at Hag Yusuf (32º 7'), at north 15º 45', at east 32º 54', at south the Blue Nile and 15º 21' (Fig. 2). This area was investigated in the field campaigns of 1990 to 1998. For the 2000 field season we asked permission to examine a wider area in order to choose a new concession area for the next campaigns. The zone immediately east of the previous concession (the Wadi Rabob, Wadi el Hag and Wadi el Hasib areas) was extensively surveyed during two weeks (Fig. 2). Also a general exploration upstream the Blue Nile basin until the locality of Singa was made during one week in the same campaign (Fig. 19).

According to the 1: 100.000 map (sheet 360, Wad Hesona), the area of Wadi Rabob and Wadi el Hag is crossed by many small wadis, but we chose to name it only by these two (Rabob and el Hag) because most of the sites are situated in or near them. Moreover, they appear to be the more important wadis in the 1:250.000 map (sheet ND-36-C, El Kamlin). The landscape in all the survey areas is mostly flat, with many acacia trees and shrubs in the lower or more watered areas, being more abundant in the wadi bottoms (Figure 3). In a few zones there were still thick herbaceous patches left during the dry season (end of January, Figure 4). The entire region is spotted with artificial water reservoir (*hafir*), many of them probably of an ancient age (Sadr 1991: 111), while others are much bigger and have been made recently by machinery means (Figure 5). Besides the traditional Butana nomads that periodically come near the river, recent immigrants that work in Khartoum, and live in small mud brick buildings or, more frequently, temporary shanty houses (Figure 6) now occupy the whole region.

Our aim was to record all the archaeological evidence in the area from surface observations. Limited subsurface sondages were excavated only in very special cases. Thus, we tried to follow recent theoretical and methodological trends in archaeology that primarily emphasise the need for a large amount of data before any general inference about behavioural patterns in the past (socio-economic organisation, regional networks, demography, subsistence activities, etc.) can be made. At the same time, we hoped to improve our present knowledge of the rich archaeological heritage in Central Sudan, in order to make its preservation feasible in the near future.

Several research issues were addressed before the beginning of the fieldwork. Among these were the choice of an efficient survey methodology, the chronological control and the culture orientation of the survey. Initially, two simple survey strategies were observed: an intensive, all-embracing pedestrian inspection in elongated quadrats over the alluvial area, and several extensively inspected, narrow transects perpendicular to the river following by car the dry wadi beds and banks. The greater accuracy and efficiency of the random quadrats sampling technique, especially where the sites follow a random or regular distribution, has been established both in practical and theoretical terms (Plog 1976; see computer simulation in Fernández 1985a). However, it still needs confirmation in this area, where sites are very unevenly located and surveys have usually been conducted without sampling methods (Caneva and Marks 1992; Garcea and Sebastiani 1998). Shortly after starting the survey we realised that the intensive inspection of the alluvial plain was not yielding any results, since agricultural activity and house construction have largely transformed the area. Further from the Nile, the method of concentrating our efforts on the elevations, however small, of this very flat area, proved to be fruitful. The sites were mostly situated on these higher spots, being in some cases the remains of

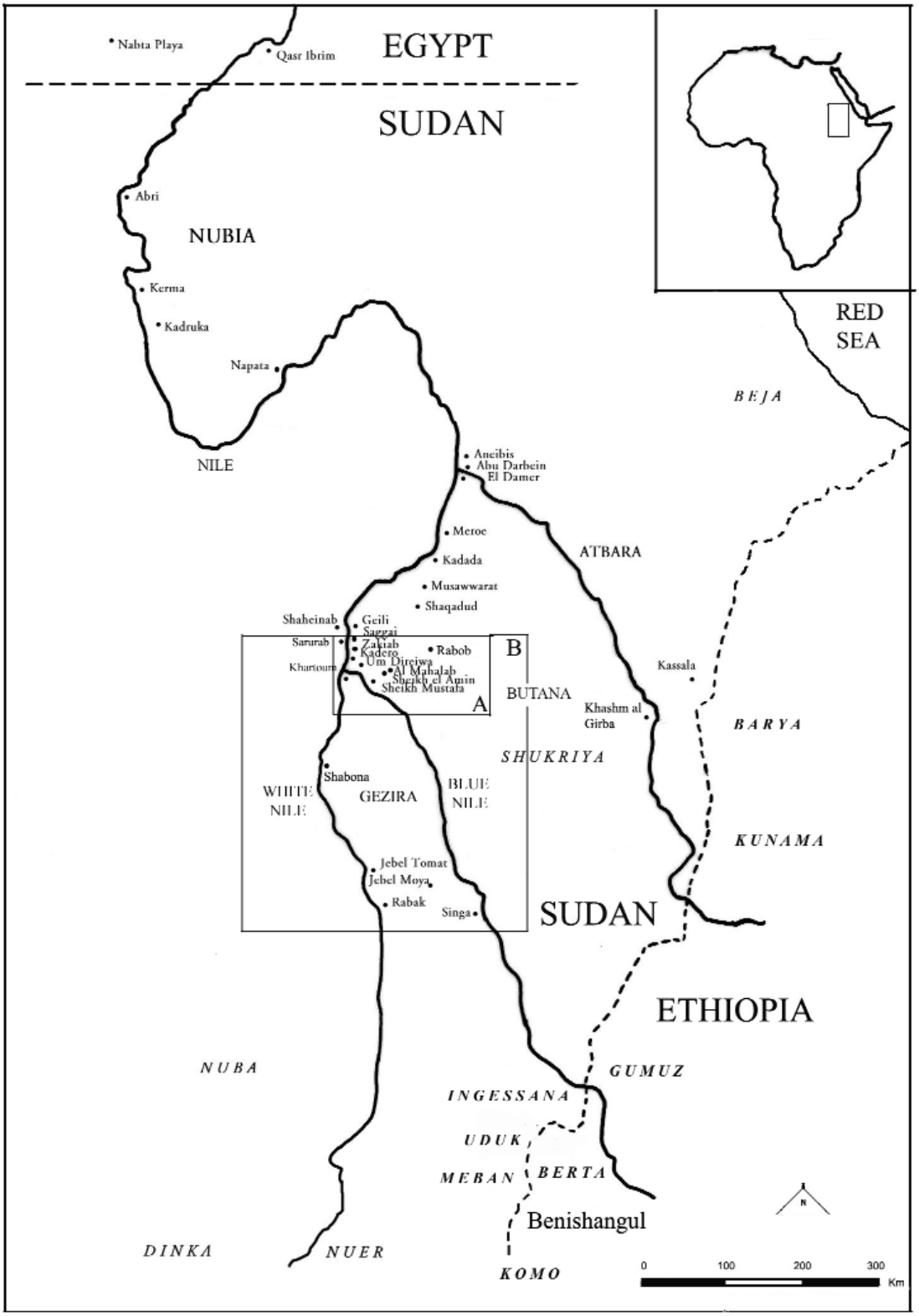

Figure 1.- Map of the Central and Northern Sudan with the general areas of research. Area A corresponds to figures 2 and 7 and area B to figure 19 in this paper. Archaeological sites (dots) and ethnic groups (italics) cited in the dossier are indicated.

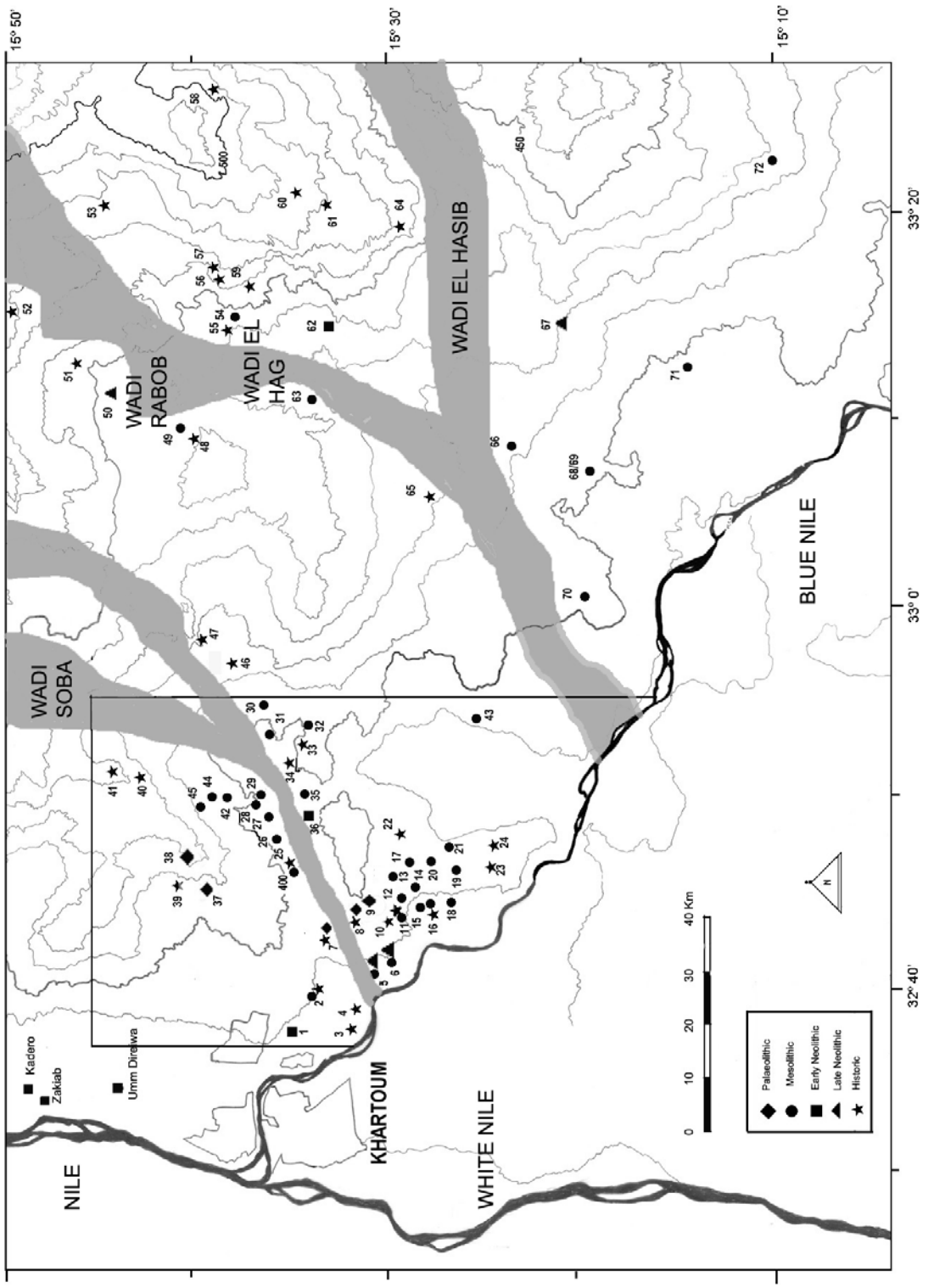

Figure 2.- The research area in the eastern bank of the Blue Nile southeast of Khartoum. The discovered sites in the intensive archaeological survey of the Wadi Soba area and in the archaeological exploration of the Wadi Rabob-el Hasib areas are shown. The square at left indicates the first concession area of the project. Site numbers correspond to table 1 and catalogue list in section 2.

Figure 3.- Acacia trees in Wadi Rabob area (January 2000).

ancient river terraces at the wadi banks and in others accumulations of cultural debris or both. Most, if not all the prehistoric sites were situated in the shores of the wadis or palaeochannels, and following those lines proved to be a productive method to find them. In this wider area, a car-survey was carried out, all sites being visible from at least 200-300 m away from the transect band limits (see Sadr 1991: 37 or Welsby 2001: 3 for a similar approach).

In order to establish a reasonable secure chronological control over the cultural sequence, cross-cultural information was used and statistical seriation techniques were applied (Doran and Hodson 1975: 267-84; Fernández 1985b) (see ceramic seriation in sections 6 and 7). This task was facilitated by the fact that multi-phase or stratified sites are rare in the area, and they are usually easy to identify since they conform to known patterns (e.g. Late Neolithic or Meroitic burials over earlier settlements; cf. Caneva 1988, 1993).

Figure 4.- Herbaceous landscape in Wadi Rabob area (January 2000).

Figure 5.- Artificial water reservoir (*hafir*) near Wad Hassuna (January 2000).

In the bigger sites there was the possibility of detecting a "horizontal" stratigraphy or general intrasite variability (e.g. it had been noticed during the digging of the Neolithic site of Hag Yusuf; Fernández *et al*. 1989: 266). After a first unsystematic collecting (grab sample) of surface finds in all the sites when discovered, in the main sites another technique was applied, by choosing differentiated, systematically sampled units (Redman and Watson 1970). All the artefacts were collected inside 1-meter diameter circles, these units being chosen according to a "systematic, stratified unaligned" sampling method that combines the advantages of both random and systematic sampling (Judge *et al*. 1975). Each unit was randomly selected inside every 30x30-m or 20x20-m square, depending on the entire site size, these squares covering the whole site surface extension (see Figures 10-13). The results of this intensive collection were

Figure 6.- Temporary camp in Wadi el Hasib area (January 2000).

different in some important aspects to the grab sample contents: many more plain sherds, lithic debris, and culturally insignificant finds were represented now. But, interestingly enough, the percentages of decorated pottery types were roughly similar in both collection methods, the general coincidence being observed in several sites. This conclusion seems to confirm previous statements advocating classical unsystematic collection methods (Sadr 1991: 38). Multivariate statistical analysis was carried out with the quantitative data from the systematic sampling. The results of this investigation, however, showed that in most cases the differences and the model could be ascribed to post-depositional deflation surface processes rather than to any kind of behavioural pattern (see surface micro-spatial analysis in section 6).

Our primary interest in the area focused mainly on the prehistoric remains - the Palaeolithic sequence; the transition between Mesolithic and Neolithic; the later Neolithic evidence. All the sites discovered in the survey including the historic remains were documented, and the records delivered in due course to the Sudan National Corporation for Antiquities and Museums for archiving and further study.

As in most archaeological surveys, site types in the area proved to be rather varied, and depending on the importance of the location, more or less data were gathered on the spot during the fieldwork (Ruiz and Fernández 1993). There is no general agreement on what are the minimal characteristics of a "site", and definitions include more than two (Anderson 1984), five (Warren 1982) or "several" artefacts spatially related to each other over the surface (Plog *et al*. 1978; Ammerman 1985). Very often it is hard to demarcate the difference between a site and the usual "background noise", i.e. the distribution of isolated artefacts all along the landscape (Gallant 1986). Quite a number of "non-sites" or "restricted activity sites" (Schofield 1991), probably the result of short-time human occupation of the area, have been recorded in the survey. For them only the co-ordinates and a short description of the finds are offered in the site catalogue. Proper or bigger sites with significant remains were measured along to approximately perpendicular axes and a short description of the surrounding area is presented in the catalogue together with the classification and counts of the archaeological materials observed. Finally, in some of the more important sites test-pit excavations were carried out and in three of the sites (nos. 13, 26 and 36) wider excavation works were undertaken and are described in a separate paper of this volume.

The name of each site in the gazetteer corresponds to the nearest geographical feature, recorded in the map. Two map types were used, the old 1:250.000 and the more recent 1:100.000 sheets. Very often we ascribed the same name to a group of sites, for instance the closest village, or had to assign the general name of the area (e.g. Wadi Soba) when there was not any single village or location nearby. In those cases and in order to avoid confusion, consecutive numbers have been added to the general name (e.g. Sheikh Mustafa-1, 2, 3, etc.). After Professor Hinkel's suggestion, we have followed the names and spelling of names of sites in accordance with the 1:250.000 maps and the Sudan Government Index Gazetteer of 1932 (Index Gazetteer 1932). Prof. Hinkel also most kindly corrected some of our 3' grid square assignments in the Archaeological Map of the Sudan (Hinkel 1977).

For the sake of simplicity and earlier and more common usage, we have employed the term "Mesolithic" for the cultural period also known as "Early Khartoum" (c. 9000-6000 bp in the Central Sudan; see section 6), and "Early Neolithic" for the period also known as "Shaheinab" (c. 6000-5000/4500 bp). Anthony J. Arkell first used all these terms in their seminal works of 1949 and 1953. We understand and appreciate, however, the reluctance to the use of these old and strongly European-related terms (e.g. Nur Eldaim Mohammed 1992; Magid in this volume). For the period called here "Late Neolithic" the alternative terms of "Kadada" or "Jebel Moya" have been occasionally applied. Usual acronyms for incised Wavy Line (WL), Dotted Wavy Line (DWL), Rocker impression (RK) and Alternately Pivoting Stamp (APS) decorated pottery are used throughout the volume. For the classification of pottery decoration types during the Mesolithic and Neolithic periods, we have followed Caneva 1983: 164-183; Caneva 1988: 83-110; Caneva and Marks 1990.

Geology and palaeoclimates (Figures 7-9)

The formations underlying the study area on the east bank of the Blue Nile between Khartoum and Wadi el Hasib in the northwestern corner of the Butana plain (Figures 2, 7) are the superficial deposits, the Nubian Sandstone Formation and the Basement Complex. The Umm Ruwaba or Gezira formation (Vail 1982: 59-60) is present only in a narrow band parallel to the Blue Nile that widens appreciably, up to 20 km, in the Wadi el Hasib zone. Further from the river the surface is mostly covered by quaternarian-stabilised dunes, dune fields (*Qoz*) and recent alluvium formed mainly by silt, silty sand and sand in the wadi beds (GRAS 1988). Away from the Blue Nile a gradation is noticeable from sand into loose sandy gravels with patches of clays. These gravels, usually composed of quartz fragments, mark the contact between the Butana clays and the Nubian sandstones (Vail 1982: 60). Abundant iron pisolites indicate a derivation from Nubian sandstone, cemented with iron in this area (El Boushi 1974: 22; Williams and Adamson 1980: 290). Ferruginuos horizons from that formation are more clearly exposed south and north of Wadi el Hasib. In the lower areas the clays are mixed with lateritic gravelly soil that shows mud cracks at the top; crystals of sodium chloride are seen close to the surface. The playa deposits formed by repeated evaporation, which extend from Sheikh Abu Qoron to Sheikh el Amin and northward untill Khartoum North, have been mined by local people since the beginning of the 20th century (El Boushi 1974).

In some areas near the Wadi Soba course and surrounding the beds of Wadi Rabob and Wadi el Hag and especially around Wadi el Hasib, undifferentiated Proterozoic metamorphic rocks from the Basement Complex are noticeable on surface (GRAS 1988). Singular rocky outcrops from the same period are visible both at north (Jebel Sileitat) and east (Jebel Qeili) of the study area. Also the Nubian Sandstone formation rocks can be seen on the surface at many places, (e.g. below the excavation levels in the lower areas of the Neolithic site no. 36, or in the Mesolithic site

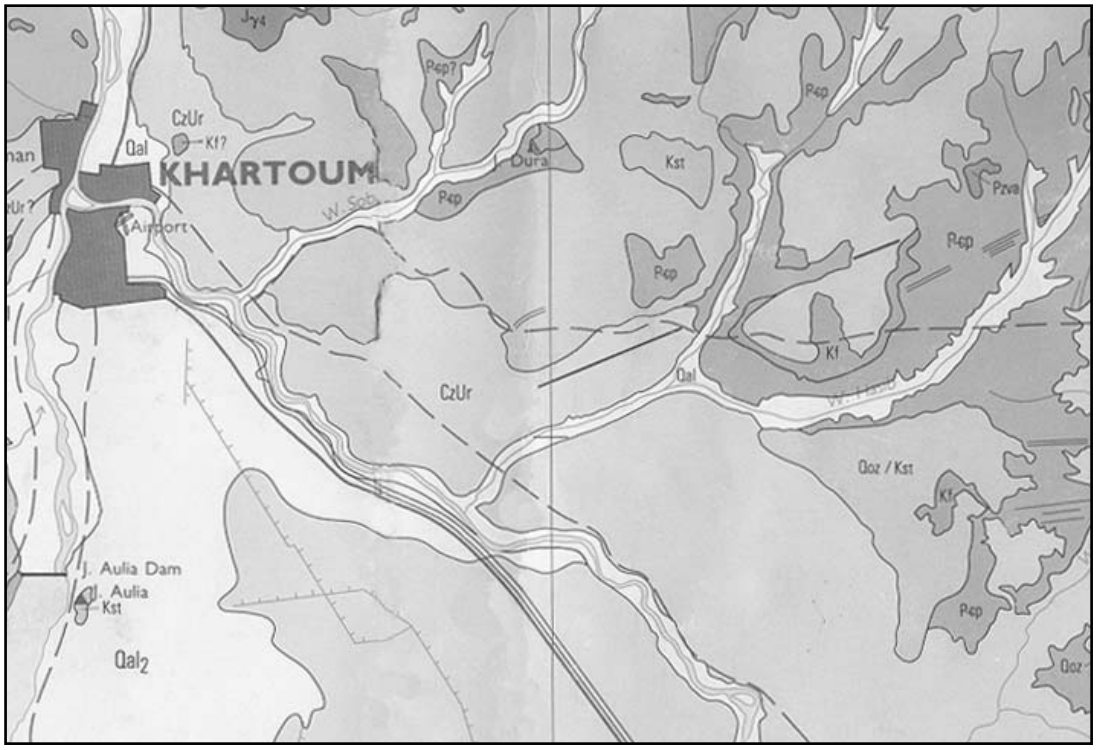

Figure 7.- Geological map of the research area (after GRAS 1988). Legend: Qal, recent alluvium. CzUr, Umm Ruwaba deposits (Cenozoic gravels, sands, silts and clays). Qoz, old, often stabilised dunes. Kst, undifferentiated fluviatile sandstones, siltstones and minor conglomerates of presumed Cretaceous age. Kf, ferruginous horizons in the Kst sequence. Pep, undifferentiated Proterozoic metamorphic rocks. Pzv, undifferentiated Paleozoic/Mesozoic volcanic rocks.

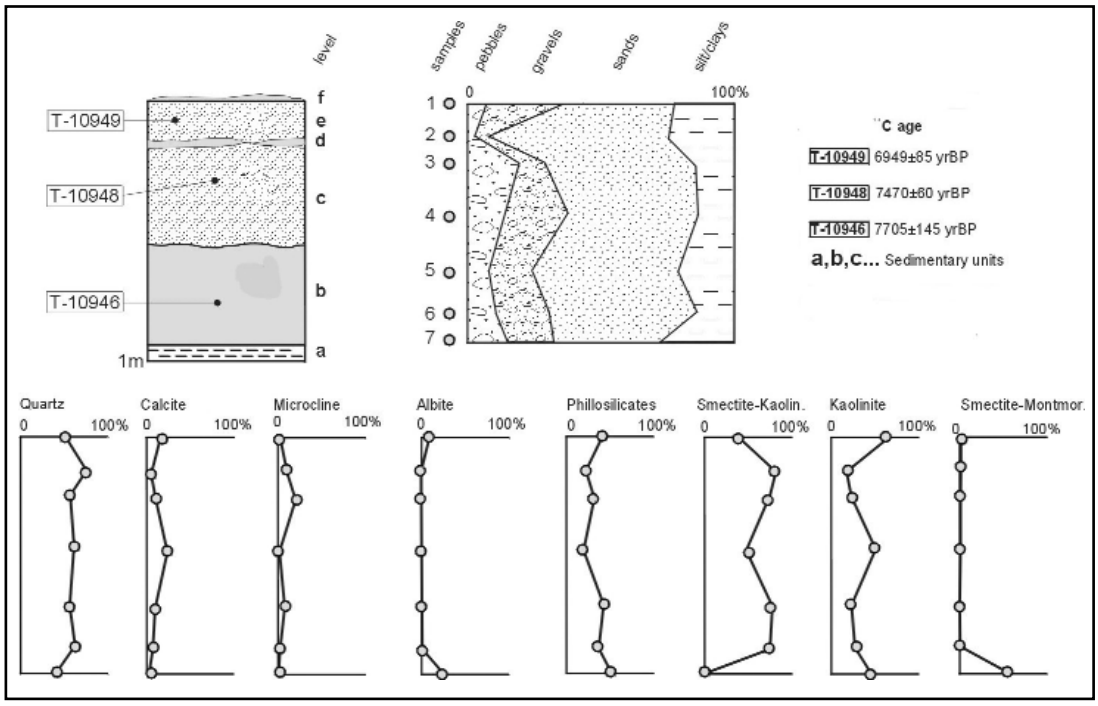

Figure 8.- Stratigraphic, sedimentological and geochemical profiles of the El Mahalab Mesolithic site.

no. 25), with some small outcrops such as Jebel Direr near Sheikh el Amin. A larger area of exposed sandstone is located immediately south of Wadi el Hasib. Quartz pebbles from this formation were intensively used for making microlithic implements in all the Mesolithic and Neolithic sites, and mudstone and sandstone rocks were flaked in the earlier, Palaeolithic periods to make bigger tools (sites nos. 7-9, 37, 38) (Vail 1982: 57-8).

A sedimentological and geochemical analysis was carried out on the soil samples from the test-square excavated in the Mesolithic site of El Mahalab during the 1993 field season (Figure 8). Contrary to the usual disturbed conditions in other sectors of this site and in most areas of the other sites excavated in the area, a clear stratigraphy was distinguished during the excavation. Six levels were recognised (see Figure 8), from top to bottom: level f of aeolian sands (present sand sheet); Level e of ochre sands similar to level c; level d of aeolian sands, archaeologically sterile; level c with ochre sands; level b with grey silty sands; natural level a of grey silts and marly-silts, corresponding to a flooding event of the Nile, archaeologically sterile (Umm Ruwaba formation). The levels e, c and b were radiocarbon dated as is shown in figure 8. Chronologically and stratigraphically, the three dates are correctly ordered.

The geochemical analysis (Figure 8; see Lario *et al*. 1997) indicate that the contents of calcite, kaolinite and microcline decrease from bottom to top. They also yielded high values of smectite-montmorillonite at the natural level a. A general trend towards aridity is consistent with these changes (Friedmand and Sanders 1978). During the early Holocene and up to 8000 bp, the entire area experienced humid conditions with frequent floods of the Nile river (level a of El Mahalab), and development of palustrine areas close to the present Blue Nile river bed (Wickens 1982: Fig. 6). A period of Nile aggradation with very high river floods has been recorded as well in Egypt between 10.000 and 7700 bp (Hassan 1998). Palaeochanels did also develop in the Gezira, west of the current Blue Nile bed (Adamson *et al*. 1982: Fig. 4). This feature has been described by different authors in the context of palaeoclimatic studies on the Eastern Sahara, Nile floods and/or lake level variations (Williams and Adamsom 1980; Hassan 1987; Haynes and Mead 1987; Haynes *et al*. 1989; Pachur and Hoelzmann 1991; Brewer 1992). All these studies recognise a stage of greater humidity at roughly the same period. A

similar fact has been observed in other African areas with similar climatic conditions (Lezine and Casanova 1989; Wengler and Vermet 1992; Gasse and Vancampo 1994). Between c. 7800 and 7000 bp, a drop in the flooding levels of the Nile indicates a reduction in humidity, which is in accordance with an episode of reduced sea surface temperature in the Eastern Mediterranean sea (Hassan 2002: 322). Nevertheless, the weather was still humid, as it has been recorded in the Western Egyptian desert (El Nabta-Al Jerar Maximum Humid Interphase between 8050 and 7300 bp, cf. Wendorf *et al*. 2001: 650). In the Central Sudan there were still some big seasonal floods, as suggested by the presence of *Pila sp*. in El Mahalab (see Chaix 2003: table 7), which has been described as being characteristic of areas with frequent floods (Tothill 1946; Adamson *et al*. 1982). Also the higher frequency of fish remains in the lower levels of Sheikh Mustafa, dated to around 7900 bp (see Chaix 2003: table 2) suggests the same scenario. This climatic phase is represented in level b of Al-Mahalab by high values of albite and smectite-montmorillonite at the bottom of the level and a progressive increase in microcline. At the same time a decrease of smectite-kaolinite is observed in the upper part and in level c (Figure 8). These trends and changes are characteristic of a reduction in humidity (Friedman and Sanders 1978).

This humidity decrease has been observed in the Northwest of Sudan by a still-stand in the lake levels at ca. 8000 bp, which followed a lake level rise between 8400 and 8000 bp (Haynes *et al*. 1989). Sites in eastern Africa, western Sahara, the Sahel and subequatorial Africa have also registered a relatively drier stage between 8000 and 7000 bp during a general period of humid conditions in the early to mid-Holocene (Gasse and Vancampo 1994). At c. 7500 bp the humidity appears to have been lower, with the reduction of fish remains in the upper levels of Sheikh Mustafa and the presence of *Limicolaria sp*. in the upper levels of El Mahalab (see Chaix 2003). *Limicolaria* is a land snail intolerant to floods and characteristic of Acacia-Tall Grass plains with more humid conditions than the present day (Tothill 1946; Williams and Adamson 1980; Adamson *et al*. 1992). In fact, Haynes and Mead (1987) found that most of the known species of *Limicolaria* live in forest or forest-savanna habitats and need almost 300 mm of annual rainfall. This presence confirms that *Limicolaria* was frequent in what is known as semi-desert scrub between ca. 8000 and 4500 bp as suggested by many authors (Tothill 1946; Arkell 1949a, 1953; Williams and Adamson 1980; Adamson *et al*. 1982). During the general trend towards aridity, some periods of a slight increase in humidity are detected with annual rainfall clearly higher than present day (Brewer 1992). In El Mahalab this is attested by the increase in calcite and kaolinite together with the decrease of smectite in level c (Figure 8), which indicates a leaching of the Ca coming from the weathering of feldspars due to an increase in humidity (Friedman and Sanders 1978). The availability of water is important in chemical weathering (Friedman *et al*. 1992). Under humid climatic conditions, albite, microcline and smectite weather into kaolinite and Na, K and Ca are respectively removed in solution; Na and K are mobilised readily during weathering, but Ca can precipitate as calcite (Garrels 1967; Garrels and McKenzie, 1967; Drever 1988).

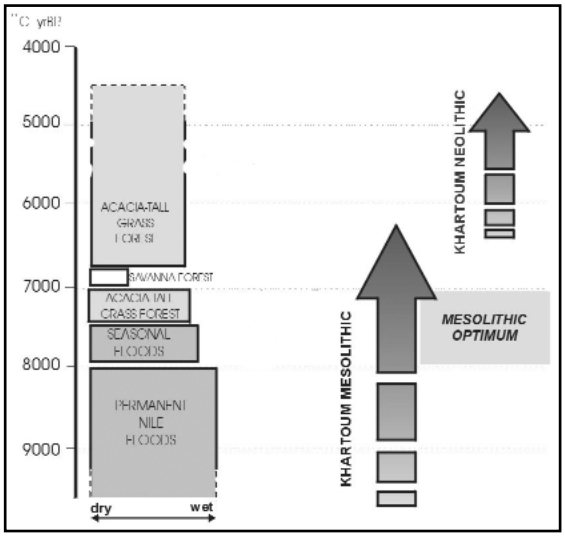

Figure 9.- Suggested environmental, climatic and cultural changes in the Blue Nile-Wadi Soba areas during the Early-Middle Holocene (after Lario *et al.* 1997).

The climatic changes proposed in the foregoing are consistent with the archaeological data presented in this volume. After a period of apparent depopulation of the area, indicated by the absence of Upper Palaeolithic sites, the abundance of Mesolithic sites on the Nile riverside and in the wadis suggest that the climatic conditions were optimum for these settlements.

The palustrine areas were replaced by Acacia forest, as is evidenced by the appearance of *Limicoria*. Mesolithic settlements are widespread along the wadi areas and the Blue Nile riverside, after approximately 8000 bp. The earliest radiocarbon date in our sites is 7930 ± 50 bp (Sheikh Mustafa-1, see later). This spreading of settlements develops under the optimum climatic conditions that we propose to call the "Mesolithic Optimum" (Figure 9). Only the lower areas, for instance the playa deposits south of Sheikh el Amin, are devoid of sites, probably due to repeated floodings. In the South-western Egyptian desert a relative humid phase is also detected at approximately the same time, the El Nabta/Al Jerar Humid Interphase, c. 8050-7300 bp (Schild and Wendorf 2001). A probable maximum in human occupation of the area is suggested by the concentration of radiocarbon dates around 8000 bp (Nicoll 2001: Fig. 2).

Between 7400 and 6900 bp, the presence of an aeolian sandy deposit in level d of El Mahalab seems to indicate a short arid period. Haynes *et al*. (1989) registered an arid phase in Selima at 7000 bp marked by a fall in the lake levels and increased salinity. This arid stage has also been identified in studies from eastern Sahara and in records of lake levels and floods of the Nile (Hassan 1987; Brewer 1992). It probably corresponds to the Post Al Jerar Arid Phase (7300-7100 bp or 7250-7200 bp, maximum or minimum duration), a major period of aridity registered in the Nabta/Kiseiba area of the Egyptian Sahara (Schild and Wendorf 2001: 22; Wendorf *et al*. 2001: 650). The apparently short duration of this stage in our area, inferred from the thin sand deposit of level d at El Mahalab, seems to agree with the Egyptian data (cf. Wendorf and Schild 2003) rather than with the evidence from other zones (Central Sahara, Mediterranean sea surface temperatures) advocating a longer arid phase, from 7800 to 7000 bp (Hassan 2002: 322).

After this short arid phase, the area regained the humid conditions as it is marked in El Mahalab by an increase in kaolinite and calcite in level e (Figure 8). This phase could correspond to the "Middle Neolithic" humid interphase recorded from 7100 to 6600 bp in the South-western Egyptian desert, the time when cattle and sheep/goat spread to the Central Sahara (Wendorf *et al*. 2001: 662-4; Schild and Wendorf 2001). Even though we have no additional information from our sites, other authors suggest that this wet phase, with short arid intervals (c. 6600-6550 bp, 5800-5500 bp in Nabta Playa, cf. Schild and Wendorf 2002: 24-6), lasted until ca. 4500-4000 bp in western Nubia (Sudan). Faunal data from the site of Sheikh el Amin (warthog more abundant than before, see Chaix 2003: table 12), dated to 5500-4600 bp, suggest that the Butana plain had at least seasonal humid conditions. The presence at Sheikh el Amin of a seed-impression on pottery of the perennial herb *Carex sp*. (see Magid 2003), a plant typical of moist regions (e.g. Equatoria in Southern Sudan), together with *Celtis* and *Sorghum*, also hints at humid conditions during the Early Neolithic period. The present arid and hyperarid conditions started at about 4500 bp time in Western Nubia and some centuries earlier in the north (Haynes and Mead 1987; Pachur and Hoelzmann 1991; Hassan 2002: 323).

To sum up, prior to 8000 bp the area experienced humid conditions that promoted the occurrence of floods in the Nile, with development of marshy areas close to the present Blue Nile riverbed. This probably made the area inappropriate for human establishment. After c. 8000 bp a reduction in humidity is recorded from a drop in the flooding levels of the Nile. The development of Acacia-Tall Grass forest both in the wadis and in areas over 390 m high (i.e. those areas not affected by Nile floods) during this time, created optimum conditions for the spread of a Mesolithic population (*Mesolithic Optimum*) (Figure 9).

A dry phase between 7400 and 6900 bp has been recognised, not only in this area but also in Northern Sudan and South-western Egypt, from sedimentological, flooding and lake level data. The prevalence of conditions more humid than the present day, without reaching the former flooding levels, at c. 7000 bp, allowed the development of Acacia forest and highly vegetated areas close to the Nile, probably favouring the spreading and arrival of Neolithic pastoral populations to the Middle Nile. These conditions appear to continue until ca.4500-4000 bp, when the present arid to hyperarid conditions commenced.

2. Gazetteer of sites (Table 1)

Nº	Name	Arch. Map Sudan	Geographical Coordinates	Periods
1	Hag Yusuf	ND-36-B/11-R	15º 35' 7'' N / 32º 37' 30'' E	Early Neolithic
2	Umm Dom-1	ND-36-B/11-S	15º 34' 5'' N / 32º 40' 55'' E	Mesolithic/Historic
3	Umm Dom-2	ND-36-B/11-W	15º 31' 40'' N / 32º 38' 10'' E	Historic
4	Umm Dom-3	ND-36-B/11-X	15º 31' 15'' N / 32º 38' 45'' E	Historic
5	Soba-1	ND-36-B/11-X	15º 30' 41'' N / 32º 41' 33'' E	Mesolithic/Late Neolithic
6	Soba-2	ND-36-B/11-Y-1	15º 30' 24'' N / 32º 42' 3'' E	Mesolithic/Late Neolithic
7	Umm 'Ushush	ND-36-B/11-Y-2	15º 32' 15'' N / 32º 42' 39'' E	Middle Palaeolithic
8	Sambra-1	ND-36-B/11-Y-3	15º 30' 14'' N / 32º 43' 44'' E	Middle Palaeolithic/Historic
9	Sambra-2	ND-36-B/11-Y-4	15º 30' 44'' N / 32º 43' 46'' E	Middle Palaeolithic
10	Sambra-3	ND-36-B/11-Y-5	15º 30' 44'' N / 32º 43' 46'' E	Historic
11	Sambra-4	ND-36-B/17-E-1	15º 29' 44'' N / 32º 43' 39'' E	Mesolithic/Historic
12	Sambra-5	ND-36-B/17-E-2	15º 29' 38'' N / 32º 44' 32'' E	Mesolithic
13	Sheikh Mustafa-1	ND-36-B/18-A-1	15º 29'' 27'' N / 32º 45' 55'' E	Mesolithic
14	Sheikh Mustafa-2	ND-36-B/18-A-2	15º 29' 1'' N / 32º 45' 26'' E	Mesolithic
15	Sheikh Mustafa-3	ND-36-B/18-A-3	15º 28' 42'' N / 32º 45' 30'' E	Mesolithic?
16	Sheikh Mustafa-4	ND-36-B/18-A-4	15º 28' 8'' N / 32º 45' 5'' E	Mesolithic/Meroitic
17	Sheikh Mustafa-5	ND-36-B/18-A-5	15º 29' 0'' N / 32º 46' 41'' E	Mesolithic
18	Sheikh Mustafa-6	ND-36-B/18-A-6	15º 27' 33'' N / 32º 45' 17'' E	Mesolithic
19	Karnus-1	ND-36-B/18-A-7	15º 27' 43'' N / 32º 47' 22'' E	Mesolithic
20	Karnus-2	ND-36-B/18-A-8	15º 27' 23'' N / 32º 46' 44'' E	Mesolithic
21	Karnus-3	ND-36-B/18-A-9	15º 27' 17'' N / 32º 47' 51'' E	Mesolithic
22	Bakrab	ND-36-B/18-B-1	15º 27' 43'' N / 32º 48' 37'' E	Historic
23	Hudeiba, El –1	ND-36-B/18-F-1	15º 25' 11'' N / 32º 46' 33'' E	Historic
24	Hudeiba, El –2	ND-36-B/18-F-2	15º 25' 5'' N / 32º 46' 45'' E	Historic
25	Arrehana	ND-36-B/12-P-1	15º 35' 28'' N / 32º 45' 56'' E	Mesolithic/Historic
26	Mahalab, El	ND-36-B/12-L-1	15º 36' 12'' N / 32º 48' 24'' E	Mesolithic
27	Umm Maishera	ND-36-B/12-L-2	15º 36' 28'' N / 32º 49' 29'' E	Mesolithic
28	Wadi Soba area –1	ND-36-B/12-L-3	15º 36' 56'' N / 32º 50' 2'' E	Mesolithic
29	Wadi Soba area –2	ND-36-B/12-L-4	15º 36' 49'' N / 32º 50' 10'' E	Mesolithic
30	Wadi Soba area –3	ND-36-B/12-N-1	15º 36' 25'' N / 32º 55' 14'' E	Mesolithic
31	Wadi Soba area –4	ND-36-B/12-R-1	15º 35' 50'' N / 32º 53' 25'' E	Mesolithic
32	Wadi Soba area –5	ND-36-B/12-R-2	15º 34' 10'' N / 32º 53' 18'' E	Mesolithic
33	Wadi Soba area –6	ND-36-B/12-R-3	15º 34' 35'' N / 32º 53' 18'' E	Historic
34	Wadi Soba area –7	ND-36-B/12-R-4	15º 34' 59'' N / 32º 51' 59'' E	Historic
35	Wadi Soba area –8	ND-36-B/12-Q-1	15º 35' 3'' N / 32º 50' 5'' E	Mesolithic
36	Sheikh el Amin	ND-36-B/12-Q-2	15º 34' 46'' N / 32º 49' 39'' E	Early Neolithic/Mesolithic
37	Galla el Haddadia –1	ND-36-B/12-K-1	15º 38' 49'' N / 32º 45' 43'' E	Palaeolithic
38	Galla el Haddadia –2	ND-36-B/12-F-1	15º 39' 28'' N / 32º 47' 2'' E	Palaeolithic
39	Galla el Haddadia –3	ND-36-B/12-F-2	15º 40' 37'' N / 32º 45' 52'' E	Historic
40	Galla el Haddadia- 4	ND-36-B/12-C-1	15º 42' 3'' N / 32º 51' 12'' E	Historic
41	Ibrahim al Kabbashi, J.	ND-36-B/12-C-2	15º 44' 53'' N / 32º 51' 40'' E	Historic
42	Magarbah	ND-36-B/12-M-1	15º 37' 42'' N / 32º 51' 13'' E	Mesolithic
43	Akod	ND-36-B/18-I-1	15º 25' 3'' N / 32º 54' 49'' E	Mesolithic
44	Wadi Soba area –9	ND-36-B/12-M-1	15º 38' 41'' N / 32º 51' 11'' E	Mesolithic
45	Wadi Soba area –10	ND-36-B/12-G-1	15º 39' 55'' N / 32º 50' 5'' E	Mesolithic
46	Wadi Abu Dibiera area –1	ND-36-B/12-O-1	15º 38' 54'' N / 32º 57' 6'' E	Historic
47	Wadi Abu Dibiera area –2	ND-36-B/12-J-1	15º 40' 1'' N / 32º 58' 57'' E	Prehistoric
48	Wadi Rabob area –1	ND-36-C/07-I-1	15º 40' 17'' N / 33º 9' 15'' E	Historic
49	Wadi Rabob area –2	ND-36-C/07-I-2	15º 41' 29'' N / 33º 9' 27'' E	Mesolithic
50	Rabob	ND-36-C/07-D-1	15º 43' 9'' N / 33º 10' 43'' E	Late Neolithic

.../...

51	Wadi Rabob area – 3	ND-36-C/01-X-1	15º 46' 3'' N / 33º 11' 18'' E	Historic
52	Dururba, J.	ND-36-C/02-P-1	15º 50' 32'' N / 33º 15' 33'' E	Historic
53	Wad Hassuna area	ND-36-C/02-W-1	15º 46' 7'' N / 33º 22' 52'' E	Historic
54	Salamat Wad Nail-1	ND-36-C/08-K-1	15º 38' 12'' N / 33º 15' 46'' E	Mesolithic?
55	Salamat Wad Nail-2	ND-36-C/08-K-2	15º 38' 17'' N / 33º 16' 50'' E	Historic
56	Wadi El Hag area –1	ND-36-C/08-L-1	15º 38' 22'' N / 33º 18' 10'' E	Historic
57	Wadi El Hag area –2	ND-36-C/08-L-2	15º 38' 40'' N / 33º 18' 35'' E	Historic
58	Wadi El Hag area –3	ND-36-C/08-J-1	15º 39' 1'' N / 33º 27' 20'' E	Historic
59	Wadi El Hag area –4	ND-36-C/08-K-2	15º 37'' 36'' N / 33º 17' 43'' E	Historic
60	Hafir Umm Dam	ND-36-C/08-R-1	15º 35' 12'' N / 33º 22' 24'' E	Historic
61	Hafir Umm Mohhar	ND-36-C/08-R-2	15º 33' 2'' N / 33º 22' 20'' E	Historic
62	Bir el Lahamda	ND-36-C/08-P-1	15º 33' 43'' N / 33º 16' 56'' E	Early Neolithic
63	Hafir Umm Gana	ND-36-C/07-S-1	15º 34' 21'' N / 33º 11' 10'' E	Mesolithic
64	Hafir Quseima	ND-36-C/14-C-1	15º 29' 59'' N / 33º 21' 40'' E	Historic
65	Hafir Umm Sinait	ND-36-C/13-B-1	15º 28' 2'' N / 33º 5' 12'' E	Historic
66	Alwan	ND-36-C/13-N-1	15º 23' 44'' N / 33º 9' 43'' E	Mesolithic
67	Wad el Amin	ND-36-C/14-K-1	15º 21' 52'' N / 33º 15' 27'' E	Late Neolithic
68	Khalifa Ahmed, el –1	ND-36-C/13-R-1	15º 20' 0'' N / 33º 7' 20'' E	Mesolithic?
69	Khalifa Ahmed, el –2	ND-36-C/13-R-2	15º 20' 21'' N / 33º 7' 45'' E	Mesolithic?
70	Lahamda, El	ND-36-C/13-P-1	15º 19' 43'' N / 33º 1' 55'' E	Mesolithic
71	Farig Er Rizgab	ND-36-C/19-E-1	15º 14' 13'' N / 33º 13' 52'' E	Mesolithic
72	Hafir Umm Hijlija	ND-36-C/20-I-1	15º 11' 14'' N / 33º 24' 43'' E	Mesolithic?
73	Hantub	ND-36-G/15-F-1	14º 26' 22'' N / 33º 32' 59' E	Historic
74	Kordogeili-1	ND-36-G/15-Q-1	14º 20' 47'' N / 33º 34' 56'' E	Historic
75	Kordogeili-2	ND-36-G/15-L-1	14º 21' 56'' N / 33º 33' 48'' E	Historic
76	Sherif Ya'qub-1	ND-36-G/15-Y-1	14º 15' 53'' N / 33º 42' 39'' E	Historic
77	Sherif Ya'qub-2	ND-36-G/15-Y-2	14º 15' 13'' N / 33º 42' 58'' E	Historic
78	Sheikh Ahmed-1	ND-36-G/23-N-1	14º 06' 42'' N/ 34º 11' 38'' E	Historic?
79	Sheikh Ahmed-2	ND-36-G/23-N-2	14º 06' 56'' N / 34º 11' 39'' E	Historic
80	Ugheilif, J. el	ND-36-L/01-G-1	13º 56' 53'' N / 34º 33' 10'' E	Prehistoric/Historic?
81	Denabo, J. –1	ND-36-H/19-U-1	14º 00' 11'' N / 34º 32' 47'' E	Rock Art
82	Denabo, J. –2	ND-36-H/19-U-2	14º 00' 11'' N / 34º 32' 47'' E	Historic
83	Umm Sunt	ND-36-G/15-Q-1	14º 19' 14'' N / 33º 35' 11'' E	Historic
84	Karaba, El	ND-36-K/15-S-1	13º 18' 29'' N / 33º 40' 18'' E	Prehistoric (Palaeolithic?)
85	Eneikliba-1	ND-36-K/15-Y-1	13º 16' 26'' N / 33º 43' 10'' E	Mesolithic
86	Eneikliba-2	ND-36-K/22-B-1	13º 13' 30'' N / 33º 48' 07'' E	Mesolithic
87	Kabaro, El Qoz –1	ND-36-G/07-J-1	14º 41' 55'' N / 33º 12' 37'' E	Mesolithic
88	Kabaro, El Qoz –2	ND-36-G/07-J-2	14º 41' 36'' N / 33º 12' 26'' E	Late Neolithic
89	Bakhit, El Qoz	ND-36-G/07-J-3	14º 41' 53'' N / 33º 13' 05'' E	Late Neolithic
90	Wad Sheneina	ND-36-G/01-Q-1	14º 50' 50'' N / 33º 04' 03'' E	Mesolithic/Late Neolithic
91	Humeira	ND-36-G/19-H-1	14º 09' 36'' N / 33º 08' 12'' E	Historic
92	Umm Daqal	ND-36-F/24-O-1	14º 06' 50'' N / 32º 58' 41'' E	Mesolithic
93	Bashaqra Gharb	ND-36-C/19-B-1	15º 12' 29'' N / 33º 04' 23'' E	Early Neolithic
94	Qeili, J.	ND-36-C/10-U-25/26	15º 30' 9'' N / 33º 46' 15'' E	Late Neolithic/Historic
95	Moya, J.	ND-36-K/14-B-1	13º 29' 19'' N / 33º 19' 05'' E	Late Neolithic/Historic

Table 1.- The list of discovered (1-86, 91-3) or revisited (87-90, 94-5) sites in the survey.

Survey in the Wadi Soba area (1990-1994) (Figure 2)

A GPS receiver (Global Positioning System; Trimble Transpack II model) was used to locate the sites, with an error of ± 100 m. Co-ordinates are given in two formats: geographical (degrees, minutes and seconds) and UTM system (Universal Transverse Mercator projection, zone 36). The latter is intended to use with the modern 1:100.000 maps. The Archaeological Map of the Sudan references (ASN; Hinkel 1977: 21-31) are also indicated. Dimensions of sites are approximate and rounded to the next 10-m unit. The 1975 edition of the sheet no. 359 of the

1:100.000 Map of Sudan (Khartoum sheet), where all the sites listed in this section are situated, apparently has an error: all the longitudinal UTM co-ordinates (horizontally in the map) are displaced 5000 units (5 km) to the West.

1.- **Hag Yusuf.** 15º 35' 7'' N / 32º 37' 30'' E (E 0459807 / N 1723118). Early Neolithic (Shaheinab). The artefacts are distributed over an area of 300 x 150 m. The site was discovered by A.J. Arkell in 1942 (Arkell 1953: 108, Fig. 57), and excavated by the Spanish team in January 1989 (Fernández *et al*. 1989).

2.- **Umm Dom-1.** 15º 34' 5'' N / 32º 40' 55'' E (E 0465897 / N 1721230). Mesolithic / Historic. Several small mound formations (*kôms* 1.5-2 m over the plain) near the road from Khartoum to Soba; partially destroyed by big holes of a modern quarry. The sherds are of two kinds: prehistoric (2 WL or DWL, eroded; 9 with rocker impression decoration) and historic, probably Christian (rough or black burnished without decoration).

3.- **Umm Dom-2.** 15º 31' 40'' N / 32º 38' 10'' E (E 0460975 / N 1716783). Historic. Two *kôms*, 120 x 90 m; 30 x 20 m; about 1.5 m high. Abundant red bricks; some wall alignments with white plaster on the bricks were recorded, together with very few sherds of wheel-made red fabric.

4.- **Umm Dom-3.** 15º 31' 15'' N / 32º 38' 45'' E (E 0462016 / N 1715985). Historic. A *kôm* of approximately circular shape, 35 m in diameter, 2 m high. Abundant red bricks and wheel-made sherds. An irrigation canal crossed through the site in 1992.

5.- **Soba-1.** 15º 30' 41'' N / 32º 41' 33'' E (E 0467020 / N 1714933). Mesolithic / Late Neolithic. Scattered sherds in an area of about 20 x 30 m, made of two fabrics, with and without mineral temper. The first type is decorated with rocker impressions (Figure 43: 9) and WL (Figure 42: 17); the second is decorated with incised triangles and comb impressed lines (Late Neolithic) (Menéndez *et al*. 1994: Fig. 3: 16-27). Some fragmented grinders, one tapering cylindrical rubber and two flakes in sandstone were also collected.

6.- **Soba-2.** 15º 30' 24'' N / 32º 42' 3'' E (E 0467916 / N 1714416) (ND-36-B/11-Y-1). Mesolithic / Late Neolithic. Scattered sherds in about 20 x 20 m, as in the previous site. Mesolithic sherds include DWL and rocker (highly eroded); late Neolithic sherds have incised triangles and impressed-incised combined decoration.

7.- **Umm 'Ushush.** 15º 32' 15'' N / 32º 42' 39'' E (E 0469005 / N 1717819) (ND-36-B/11-Y-2). Middle Palaeolithic? / Historic. Five tumuli, c. 15-20 m in diameter. Two of them had a plundering hole in its central part, but no artefacts were conspicuous. In the nearby some retouched mudstone flakes were collected (see section 5 and Figures 39-40).

8.- **Sambra-1.** 15º 30' 14'' N / 32º 43' 44'' E (E 0470299 / N 1715943) (ND-36-B/11-Y-3). Middle Palaeolithic? / Historic. Several small tumuli of about 4-6 m in diameter, made of heaps of black sandstone blocks. Scattered in the nearby, some mudstone retouched flakes were recorded near natural mudstone outcrops (see section 5 and Figures 39-40).

9.- **Sambra-2.** 15º 30' 44'' N / 32º 43' 46'' E (E 0470983 / N 1715020) (ND-36-B/11-Y-4). Middle Palaeolithic? Scattered retouched flakes over an area of rocky outcrops (black Nubian sandstone and fine yellow mudstone) (see section 5 and Figures 39-40).

10.- **Sambra-3.** 15º 30' 44'' N / 32º 43' 46'' E (E 0471019 / N 1713453) (ND-36-B/11-Y-5). Historic. A field of 12 tumuli near the modern Islamic cemetery of Sambra, immediately at the south of the village. Several fragments of grinding stones were also collected.

11.- **Sambra-4.** 15º 29' 44'' N / 32º 43' 39'' E (E 0470772 / N 1713177) (ND-36-B/17-E-1). Mesolithic / Historic. At about 200 m south of the village, scattered artefacts over a flat area (130 x 120 m) with several small *kôms*, probable tumuli. Sherds of the WL (2), DWL (1) (Figure 43: 18), rocker (13) and alternately pivoting stamp impression (5) types, lunates in white quartz, sandstone flakes, sandstone stone rings and grinding stones were found.

12.- **Sambra-5.** 15º 29' 38'' N / 32º 44' 32'' E (E 0472356 / N 1713003) (ND-36-B/17-E-2). Mesolithic. A few scattered sherds in a small area (50 x 50 m) inside a modern *hafir*. WL (2) (Figure 42: 13), rocker (2) and alternately pivoting stamp impressed (4) sherd types; also a Late Neolithic incised sherd was recorded.

13.- **Sheikh Mustafa-1.** 15º 29'' 27'' N / 32º 45' 55'' E (E 0474823 / N 1712650) (ND-36-B/18-A-1). Mesolithic. At about 200 m south of the village, a high concentration of artefacts in a wide area (80 x 100 m) (Figure 10): WL and

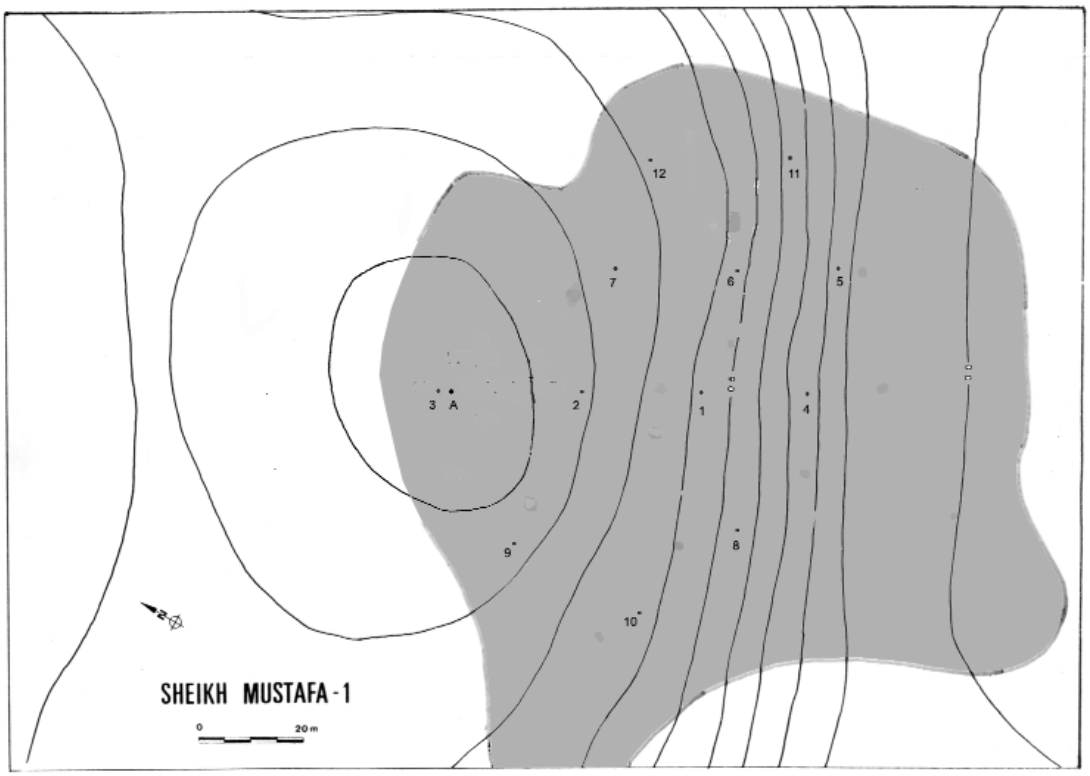

Figure 10.- Topographical map of the Sheikh Mustafa-1 Mesolithic site (no. 13). Dots indicate the surface systematic sampling units (see section 6) and squares the initial test-pit. Darker area marks the surface artefact distribution; contour lines every 10 cm.

rocker sherds, a wide variety of microlithic types in white quartz (lunates, backed blades and bladelets, perforators, etc.), big flakes in sandstone, stone rings. The sherds were classified in WL (11) (Figure 42: 12), rocker, mostly spaced zigzags (15), and alternately pivoting stamp (7) types (grab sample), and in WL (9), rocker (14) and alternately pivoting stamp (1) types (systematic sampling) (see sections 1 and 6). A squared meter test-pit was excavated in January 1993. Down to 35 cm deep, two archaeological levels were apparent in this part of the site. The upper had a loose, sandier earth of clear colour and the lower was characterised by darker, compacted and less sandy sediment. Some kind of chronological pattern could be distinguished, since the upper part yielded mostly rocker sherds (43) with only one WL sherd, while the lower produced 23 sherds of the WL type. (See a more detailed account of the excavations at the site in 1993-1996 in Fernández, Jimeno and Menéndez, this volume).

14.- **Sheikh Mustafa-2.** 15º 29' 1'' N / 32º 45' 26'' E (E 0473958 / N 1711852) (ND-36-B/18-A-2). Mesolithic. A high concentration of artefacts were found in a wide area (150 x 140 m): WL (1 sherd), DWL (9), rocker (24) sherds, plenty of small flakes with some lunates in white quartz, a few big flakes of sandstone, grinding stones, stone rings. The systematic sampling only yielded 10 rocker impressed sherds. A squared meter test excavation was made in January 1993. The archaeological level was only 10 cm deep and the sediment was mixed with sand and apparently disturbed; a few sherds with rocker (11) and DWL (1) decoration were recovered from the test-pit.

15.- **Sheikh Mustafa-3.** 15º 28' 42'' N / 32º 45' 30'' E (E 0474085 / N 1711271) (ND-36-B/18-A-3). Mesolithic? A few sherds (6), all very eroded with rocker impressed decoration were collected around a modern quarry hole.

16.- **Sheikh Mustafa-4.** 15º 28' 8'' N / 32º 45' 5'' E (E 0473330 / N 1710240) (ND-36-B/18-A-4). Mesolithic / Meroitic. A high concentration of artefacts in a wide flat area (120 x 100 m), besides a modern irrigation canal. WL (10 sherds in the grab sample, 3 in the systemat-

ic collection, see sections 1 and 6) (Figure 42: 10), DWL (17 and 1) (Figure 43: 8, 10, 11, 13, 16, 19), rocker (18 and 17) (Figure 43: 4) and alternately pivoting stamp (10 and 0) pottery sherds were collected. Microliths of white quartz (lunates, perforator, small flakes) and bigger flakes of sandstone; grinding stones and stone rings (Figure 41: 5); a bone bead and a biconical lip plug in fine red sandstone (Figure 41: 9) were collected. The canal destroyed one or several Meroitic graves in the vicinity; human bones and pottery (hand-made, burnished, comb-impressed) were observed in the slopes of the canal earthwork. A test-excavation of one square meter was carried out in January 1993. Only one superficial level, less than 10 cm thick, was recorded with mixed Meroitic and Mesolithic materials (9 WL and 7 Rocker sherds were collected in the dig).

17.- **Sheikh Mustafa-5.** 15º 29' 0'' N / 32º 46' 41'' E (E 0476199 / N 1711825) (ND-36-B / 8-A-5). Mesolithic. A few scattered artefacts over a small elevation: DWL (2) and rocker impressed (7) sherds, a lunate and some grinding stones.

18.- **Sheikh Mustafa-6 (Khalifa Ali Farm**). 15º 27' 33'' N / 32º 45' 17'' E (E 0479196 / N 4474610) (ND-36-B/18-A-6). Mesolithic. Scattered artefacts over a wide area (110 x 90 m): WL (4), DWL (2) (Figure 43: 12) and rocker (35) sherds; grinding stones and stone ring; flakes and lunate in white quartz; flakes in sandstone. A stratigraphic section of the site could be studied cleaning the wall of a big hole made by recent quarrying work in the site. The archaeological sediment was 40-50 cm thick, formed of loose sandy soil with many yellow sand pockets and only a few cultural remains (some animal bones, plain sherd and stone grinder).

19.- **Karnus-1**. 15º 27' 43'' N / 32º 47' 22'' E (E 0477415 / N 1709461) (ND-36-B/18-A-7). Mesolithic. In the 1:100.000 map (sheet 388, Al Mased) the place is wrongly marked as Hillat al Hufra, which is situated 4 km towards the river. There are two big Mesolithic sites in a flat acacia-spotted area (150 x 100 m; 170 x 100 m), separated by a small area without artefacts of about 200 m long. Both sites have a very high concentration of artefacts, with similar types: WL and rocker pottery sherds, lunates, backed blades and flakes in white quartz, some flakes in sandstone, grinding stones and stone rings, a polished palette, and a bead in ivory (Figure 41:

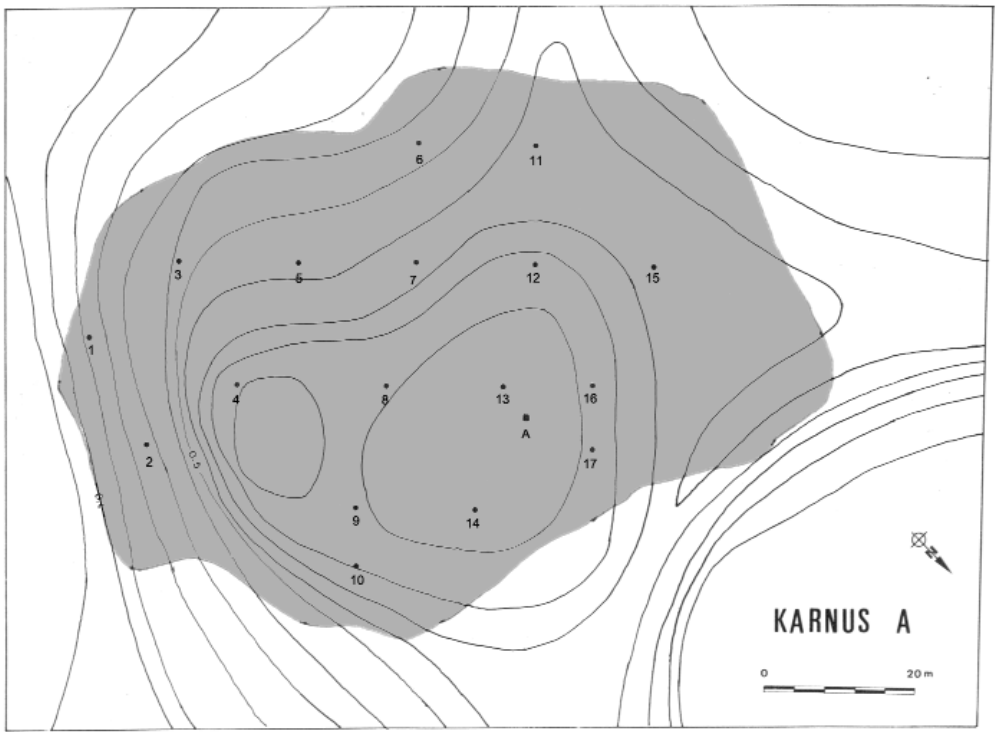

Figure 11.- Topographical map of the Karnus-1A Mesolithic site (no. 19A). Dots indicate the surface systematic sampling units (see section 6) and square the initial test-pit. Darker area marks the surface artefact distribution; contour lines every 10 cm.

10). In the first of the sites (Karnus-1A, Figure 11), the pottery collected on surface was classified as WL (20 sherds) (Figure 42: 4, 5, 11), rocker impression (10) (Figure 43: 3), and alternately pivoting stamp impression types (1) after the first unsystematic (grab) sampling. WL (51), rocker (18) and alternately pivoting stamp (2) were found using a systematic stratified sampling in equidistant units (see sections 1 and 6). In Karnus-1B the sherds belonged to WL (41) (Figure 42: 1-3, 8, 9, 14) and rocker (8) (Figure 43: 2, 6) types in the first sampling, and to WL (15) and rocker (3) types in the systematic collection. The differences of type percentages produced by the two different sampling methods were not statistically significant (t-test) (see section 6, table 3). One square meter test-pit was excavated in the central part of Karnus-1A in January 1993. The archaeological remains were concentrated in the first 5-10 cm bellow the surface and directly over the natural muddy sediment. The excavation yielded 13 potsherds with WL decoration, 11 rocker and 45 plain, together with undifferentiated lithics made in quartz and some animal bones. Another test-pit was dug in Karnus-1B in January 1993. Here the archaeological remains were found in a sediment 35-cm deep, yielding 15 WL, 1 rocker and 8 plain sherds, 9 fragments of stone grinder and some lithics, including 4 Nubian sandstone flakes. The sediment was composed of gravel earth with yellow sand pockets inside. Two organic samples (of wood and peat) were collected for radiocarbon analysis from the lower part of the sediment. The wood was dated to 230 $\pm$ 90 bp (T-10951, Trondheim laboratory) and the peat to 555 $\pm$ 85 bp (T-10952), thus clearly pointing at recent perturbations having affected the site.

20.- **Karnus-2.** 15º 27' 23'' N / 32º 46' 44'' E (E 0476285 / N 1708844) (ND-36-B/18-A-8). Mesolithic. A few artefacts scattered over a small elevation: WL (2) and alternately pivoting stamp (2) sherds, grinding stone, stone ring, quartz lunate and flake.

21.- **Karnus-3.** 15º 27' 17'' N / 32º 47' 51'' E (E 0478285 / N 1708652) (ND-36-B/18-A-9). Mesolithic. Near a small obelisk commemorating a battle in 1884, a few artefacts scattered over a small elevation (100 x 40 m): WL (1) and rocker (5) sherds, lunates and flakes in white quartz and a stone ring.

22.- **Bakrab**. 15º 27' 43'' N / 32º 48' 37'' E (E 0479650 / N 1709456) (ND-36-B/18-B-1). Historic. Two wide tumuli in the outskirts of the village.

23.- **El Hudeiba-1.** 15º 25' 11'' N / 32º 46' 33'' E (E 0475953 / N 1704783) (ND-36-B/18-F-1). Historic. The remains of an abandoned village. High concentration of sherds from big roughly burnished vessels with impressed and incised decoration.

24.- **El Hudeiba-2.** 15º 25' 5'' N / 32º 46' 45'' E (E 0476304 / N 1704604) (ND-36-B/18-F-2). Historic. The same features as in the previous site.

25.- **Arrehana**. 15º 35' 28'' N / 32º 45' 56'' E (E 0474871 / N 1723748) (ND-36-B/12-P-1). Mesolithic / Historic. The Mesolithic remains, very scanty, are scattered over a small, elongated elevation (100 x 60 m) (Figure 12). At the western end of the elevation there are ten rounded tumuli (c. 7-15 m in diameter). The Mesolithic artefacts were classified as lunates, perforators, blades and bladelets, backed blades and small flakes, all of them of white quartz, some big flakes of sandstone, sandstone grinding stones (2) and stone rings (2). During several visits to the site, only seven pottery sherds were found on the surface (six without or unidentified decoration and one of the alternately pivoting stamp type). As pottery finds are rare, we classified this site as "epipalaeolithic" in a previous publication, just after the discovery and first survey of the site in 1990 (Menéndez *et al*. 1994: 15). Even though part of the lithic assemblage may be comparable to the later Pleistocene sites of the Upper Atbara region (Elamin 1987; Marks *et al*. 1987), we currently favour the idea of this being just another Mesolithic site, maybe a reflection of a shorter occupation than in the rest of the settlements. This interpretation is supported by the fact that no other sites with microlithic technology and without or little pottery were found in the survey, and also by the results of a test excavation carried out in January 1993. The archaeological deposit was concentrated in the first 5 cm, immediately over a local outcrop of Nubian sandstone. The archaeological material recovered consisted of 2 WL and 1 rocker sherds, 6 grinder fragments, and 90 lithic items including one lunate, all in white quartz.

26.- **El Mahalab.** 15º 36' 12'' N / 32º 48' 24'' E (E 0479280 / N 1725095) (ND-36-B/12-L-1). Mesolithic. Over a small elevation (c. 120 x 110

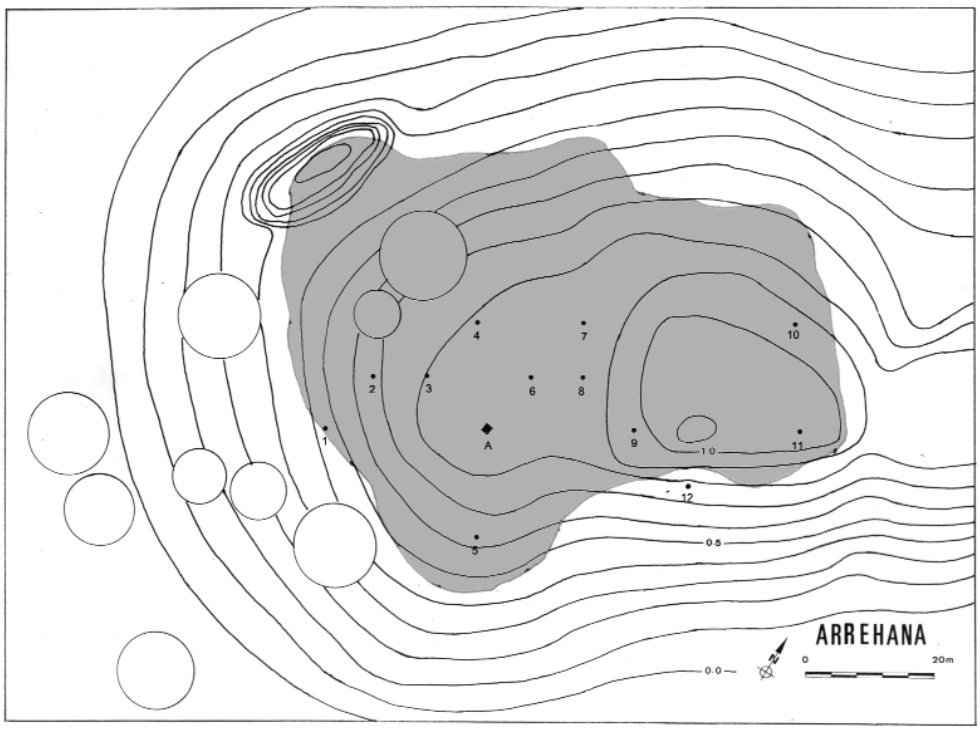

Figure 12.- Topographical map of the Arrehana Mesolithic site (no. 25). Circles indicate historic tumuli. Dots indicate the surface systematic sampling units (see section 6) and square the initial test-pit. Darker area marks the surface artefact distribution; contour lines every 10 cm.

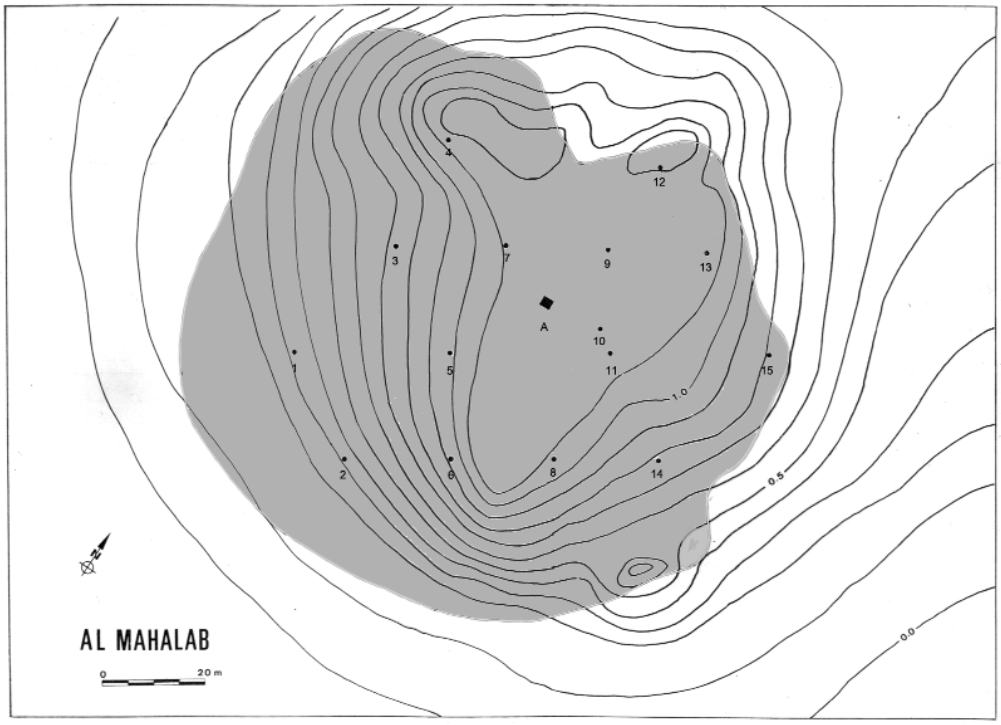

Figure 13.- Topographical map of the El Mahalab Mesolithic site (no. 26). Dots indicate the surface systematic sampling units (see section 6) and square the initial test-pit. Darker area marks the surface artefact distribution; contour lines every 10 cm.

m in size, 1.50 m over the plain; Figure 13) there is a relatively large concentration of artefacts: WL (17 in the grab sample, 4 in the systematic sample) (Figure 42: 7, 18), rocker (9, 1) and alternately pivoting stamp (10, 0) (Figure 42: 19, 19) sherds, lunates, perforators, backed blades, debitage in white quartz, some flakes and one blade of sandstone, two stone rings and a fragmented polished bone. Faunal remains were also abundant on the surface. Sherds seem to be more concentrated while lithic tools appear scattered over a wider area. A test-excavation was made in February 1993 at the central area of the site that produced WL (40), Rocker (28), DWL (9) and Alternately Pivoting Stamp sherds (15). (See section 1 and report on the 1993-1996 excavations at the site in Fernández, Jimeno and Menéndez, this volume).

27.- **Umm Maishera.** 15º 36' 28'' N / 32º 49' 29'' E (E 0481219 / N 1725585) (ND-36-B/12-L-2). Mesolithic. Over a small elevation, 150 x 120 m in size with three smaller *kôms* inside, there is a relatively dense concentration of artefacts: WL (10) (Figure 42: 6), rocker (15) and alternately pivoting stamp (3) (Figure 42: 16) sherds, lunates, perforators, backed blades and flakes in white quartz, and two stone rings. A squared meter test-pit was dug in January 1993. The archaeological level as limited to the first 25 cm of sediment over a fossil sand dune. The excavation produced 5 WL and 9 rocker impressed sherds.

28.- **Wadi Soba area-1.** 15º 36' 56'' N / 32º 50' 2'' E (E 0482199 / N 1726445) (ND-36-B/12-L-3). Mesolithic. A few lunates in white quartz, some very eroded sherds and one stone ring were scattered over a small area.

29.- **Wadi Soba area-2.** 15º 36' 49'' N / 32º 50' 10'' E (E 0482443 / N 1726229) (ND-36-B/12-L-4). Mesolithic. Over a wide area (200 x 150 m), sloping towards the bottom of the wadi, there are lithic tools (lunates, blades and backed blades, flakes in white quartz, bigger flakes in sandstone) and pottery sherds (8 DWL, 5 rocker -Fig. 43: 1- and 1 alternately pivoting stamp sherds were collected). The lithic items appear concentrated in three smaller areas with plenty of debitage (workshops?). A closer examination of the site in February 1993 showed that the cultural remains are only on the surface, with no sub-soil deposit. Two WL sherds were collected on the occasion.

30.- **Wadi Soba area-3.** 15º 36' 25'' N / 32º 55' 14'' E (E 0491492 / N 1725484) (ND-36-B/12-N-1). Mesolithic. Over a rounded elevation (1 m high) there is an area (80 x 70 m), very disturbed by animal burrowing, with eroded sherds (5 WL, 7 rocker -Fig. 43: 5- and 3 alternately pivoting stamp sherds were selected), and a higher density of lithic tools: lunates, flakes and truncated blade of white quartz, some flakes of sandstone. A test-pit in February 1993 revealed that all the remains are on the surface and that there is no archaeological deposit; two DWL sherds were collected.

31.- **Wadi Soba area-4.** 15º 35' 50'' N / 32º 53' 25'' E (E 0488246 / N 1724407) (ND-36-B/12-R-1). Mesolithic. Several concentrations of artefacts scattered over a wide flat area (130 x 100; 100 x 100 m): WL (8), rocker (16) and alternately pivoting stamp (6) (Figure 42: 20) sherds, lunates, backed blades, retouched blades and flakes, grinding stones and stone rings.

32.- **Wadi Soba area-5.** 15º 34' 10'' N / 32º 53' 18'' E (E 0488033 / N 1721337) (ND-36-B/12-R-2). Mesolithic. A few artefacts scattered in a small area: DWL sherds and a lunate in quartz.

33.- **Wadi Soba area-6.** 15º 34' 35'' N / 32º 53' 18'' E (E 0488034 / N 1722109) (ND-36-B/12-R-3). Historic. An area of modern quarrying with big heaps of earth and plenty of sherds.

34.- **Wadi Soba area-7.** 15º 34' 59'' N / 32º 51' 59'' E (E 0485678 / N 1722844) (ND-36-B/12-R-4). Historic. An area of small *kôms* with modern pottery; probably an abandoned village.

35.- **Wadi Soba area-8.** 15º 35' 3'' N / 32º 50' 5'' E (E 0482283 / N 1722844) (ND-36-B/12-Q-1). Mesolithic. Over a slightly elevated area (200 x 80 m), WL (4), DWL (2), rocker (10) (Figure 43: 7) and alternately pivoting stamp (4) (Figure 42: 15) sherds, lunates, blades, bladelets and flakes of white quartz, grinding stones and one stone ring (Figure 41: 6) were sampled. One Neolithic sherd was also collected. A test-pit in February 1993 yielded not any archaeological deposit under the surface remains.

36.- **Sheikh el Amin.** 15º 34' 46'' N / 32º 49' 39'' E (E 0481511 / N 1722448) (ND-36-B/12-Q-2). Early Neolithic / Mesolithic. First of two Early Neolithic sites recorded by our team in the wadi areas far from the Nile (the other is no. 62, Bir El Lahamda). Eleven *kôms* in a very wide

area (250 x 240 m), covered with sherds (rocker impressed, incised, black topped, incised and impressed rims, etc.) with very few lithics (only some unretouched flakes were recorded on the surface) and grinding stones. For more detail see the report on the 1993 and 1997-98 excavations at the site in Fernández, Jimeno and Menéndez 2003. In the northwestern corner of the site (location E 0481310 / N 1722568), we collected some DWL sherds, microlithic tools and debris, some grinder stones and stone circles from a previous Mesolithic occupation of the same area.

37.- **Galla el Haddadia-1.** 15º 38' 49'' N / 32º 45' 43'' E (E 0474491 / N 1729921) (ND-36-B/12-K-1). Palaeolithic. In a small area (50 x 20 m) at the western slope of an elongated elevation, we gathered some flakes in ferrous dark sandstone. The flakes are of a special and rather uniform type: short and wide, the distal end bigger than the platform and perpendicular to the striking direction, usually not retouched (Figure 39: 1-3, 5). The site probably corresponds to a temporary workshop of Middle (?) Palaeolithic chronology. Several other find spots were recorded in the nearby, usually with a few flakes of the same or similar type.

38.- **Galla el Haddadia-2.** 15º 39' 28'' N / 32º 47' 2'' E (E 0476841 / N 1731117) (ND-36-B/12-F-1). Palaeolithic. A few big flakes in white sandstone (Figure 39: 8). A probable workshop, seemingly predating site no. 37.

39.- **Galla el Haddadia-3.** 15º 40' 37'' N / 32º 45' 52'' E (E 0474759 / N 1733242) (ND-36-B/12-F-2). Historic. A tumulus arranged in dark sandstone blocks, on the top of an elevation.

40.- **Galla el Haddadia-4.** 15º 42' 3'' N / 32º 51' 12'' E (E 0484290 / N 1735873) (ND-36-B/12-C-1). Historic. Two small tumuli were observed over an elevation.

41.- **Jebel Ibrahim al Kabbashi.** 15º 44' 53'' N / 32º 51' 40'' E (E 0485127 / N 1741099) (ND-36-B/12-C-2). Historic. Three tumuli, made with dark sandstone blocks, are on the top of the Jebel; there are several other tumuli at the eastern side of the elevation.

42.- **Magarbah.** 15º 37' 42'' N / 32º 51' 13'' E (E 048442 / N 1727761) (ND-36-B/12-M-1). Mesolithic. A few WL, DWL and rocker pottery sherds and a dense concentration of lithic remains were observed on a flat area. A group of Islamic graves marked by small earth heaps in the same area prevented us from testing the site in February 1993. An intensive surface collection over one square meter produced 231 flakes (84 primary, 62 secondary, 84 tertiary), 6 amorphous cores, 2 bladelets, 5 lunates and 1 burin.

43.- **Akod.** 15º 25' 3'' N / 32º 54' 49'' E (E 0490886 / N 1704440) (ND-36-B/18-I-1). Mesolithic. A small scatter of artefacts, with a few eroded sherds, mostly of the WL type, microlithic waste in white quartz.

44.- **Wadi Soba area-9**. 15º 38' 41'' N / 32º 51' 11'' E (E 0484405 / N 1729577) (ND-36-B/12-M-1). Mesolithic. A few sherds of DWL and specially rocker type, microlithic artefacts in white quartz and some flakes in Nubian sandstone were collected.

45.- **Wadi Soba area-10.** 15º 39' 55'' N / 32º 50' 5'' E (E 0482442 / N 1731852) (ND-36-B/12-G-1). Mesolithic. A relatively dense concentration of microliths, WL and rocker sherds and stone grinders. Sherds and grinders had been washed down by erosion to the lower, small gully areas inside the site.

Survey in the Wadi Rabob, Wadi el Hag and Wadi el Hasib areas (2000) (Figure 2)

Two weeks were spent in January-February 2000 carrying out an initial extensive survey of the areas east and southeast of our previous survey area in Wadi Soba. The region is crossed by an intricate network of wadis extending from West to East between Wadi Soba and the village of Wad Hassuna (modern spelling Hesona) in the western corner of the Butana steppe. A car survey was made in this predominantly flat area (Figure 14) along the wadi banks where most of the prehistoric sites are found, in a pattern similar to that previously observed at Wadi Soba. The location of the sites was obtained by means of a GPS receiver (Global Positioning System; Garmin GPS 12), with an error of ± 30 m.

46.- **Wadi Abu Dibiera area-1.** 15º 38' 54'' N / 32º 57' 6'' E (E 0494680 / N 1729974) (ND-36-B/12-O-1). Historic. 10-12 tumuli are besides a jebel and a few more on the top of it. They are enclosed by a stone circle and are very probably Islamic (many have a clearly oval shape oriented in the NW-SE direction). Some small elongated graves also enclosed with stones and with the same orientation were seen in the nearby of the tumuli. The grave of a Sheikh, marked by two flags and with metal and plastic containers

Figure 14.- A general view of Wadi Rabob area from the top of Jebel Dururba (site no. 52).

on it, was located on the highest point of the jebel. In the south-east lower extension of the jebel some flakes, one retouched blade in white quartz and a grinder fragment were found on the surface.

47.- **Wadi Abu Dibiera area-2.** 15º 40' 1'' N / 32º 58' 57'' E (E 0498130 / N 1732122) (ND-36-B/12-J-1). Prehistoric. Several concentrations of lithic tools on the top of a low hill, possibly the remains of temporary hunting watching points of Mesolithic or Neolithic age. Small flakes, debitage and several end scrapers and one lunate, all in white quartz, were found. One of the spots was just some meters above a small water pond, clearly conspicuous in the dry season by way of a circular patch of grass.

48.- **Wadi Rabob area-1.** 15º 40' 17'' N / 33º 9' 15'' E (E 0516522 / N 1732619) (ND-36-C/7-I-1). Historic. Several tumuli, with black stones on them, probably Islamic.

49.- **Wadi Rabob area-2.** 15º 41' 29'' N / 33º 9' 27'' E (E 0516877 / N 1734829) (ND-36-C/7-I-2). Mesolithic. Recorded artefacts include sherds decorated with WL (20), DWL (4), rocker impression of packed zigzag (14), rocker impression of spaced zigzag (2), two stone rings (one squared), four sandstone grinders, flakes, blades, bladelets, cores and five lunates, one end scraper and some *Pila* shells.

50.- **Rabob.** 15º 43' 9'' N / 33º 10' 43'' E (E 0519143 / N 1737906) (ND-36-C/7-D-1). Late Neolithic. Near the village of Rabob. It is the biggest site found during the survey. The surface remains extend over an area of about 600 x 500 m, with 8 small elevations divided by shallow erosion gullies. The sediments are part of an old terrace of Lower Proterozoic age with metamorphic material, around 1 meter high over the surrounding flat acacia and shrub areas (Figure 15), these being small lateral branches of Wadi Rabob. On the surface there were plenty of flakes, blades and broken white quartz pebbles, but the percentage of retouched tools was lower than it is usual in Mesolithic and even Neolithic sites. An outstanding fact is the great abundance of perforated sandstone disks, not paralleled in other sites of the area, and the variety of their shapes: round, square, oval, etc. (Figure 41: 1, 2, 8); also a polished porphyry mace-head was found (Figure 51: 4). Had it not been for the pottery decoration types, which clearly assign the site to a Late Neolithic, post-Shaheinab, phase, we had ascribed the site to the previous, Early Khartoum Mesolithic phase where stones rings do belong. The finding of a polished disk mace-head and the small size of some of these stone rings suggest a functional use to make stone-headed clubs comparable to those used recently in the Nuba mountains (Arkell 1949a: 63-4). Also polished axes and adzes in green stone, together with sandstone cylindrical and conical rubbers were very abundant (Figures 16, 50). Two beads, in ostrich shell and green stone, were found on the surface.

Two square meter test-pits were excavated in different parts of the site, to examine its archaeological potential and sediment thickness. Most of archaeological material was found within the top sediment (10-20 cm), the deeper being with very scanty remains. In the test-pit A we found a hole and burrowing tunnel of a big den that had

Figure 15.- The site of Rabob (no. 50). The terrace elevation can be seen with a darker colour in the background (photo by Alfredo González-Ruibal).

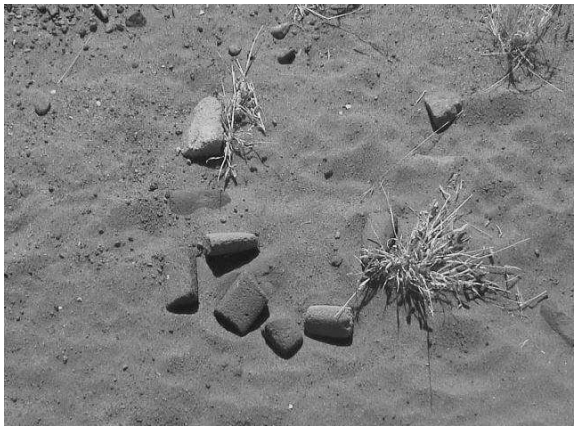

Figure 16.- A group of stone grinders and rubbers on the sandy surface of the Rabob site (no. 50).

disturbed completely the layers in that area. It has been observed that there is a complete absence of animal bones, but a few Nile oyster shells were found in the pits. A shell sample from the test-pit B was radiocarbon analyzed (using the AMS technique) and produced a date of 4670 ± 50 bp (Ua-19741, Uppsala laboratory). The archaeological material consists mainly of pottery. A total of 490 sherds were recovered and classified, as shown in the table below:

Pottery Decoration Type	**N**	**%**
Rocker impression packed zigzag	37	7.5
Rocker impression spaced zigzag	99	20.3
Rocker impression plain edge	3	0.6
Alternately pivoting stamp	29	5.9
Simple zoned impression	28	5.7
Incision, fine	2	0.04
Incision, rough (scraped)	17	3.5
Ripple ware	10	2
Black topped	1	0.02
Impressed thick rims	9	1.8
Incised thick rims	22	4.5
Plain sherds	233	47.8
Total	490	100

The high frequency of rocker impressed sherds and the black topped decoration are typical features of the pottery from the Shaheinab phase. But the high percentage of plain sherds, simple zoned impressed and scraped surface sherds (very scarce in Shaheinab sites), and the presence of slightly thickened rims with incised and impressed decoration, strongly suggest that the site belongs to the final stages of the Shaheinab Neolithic or the beginning of the following phase, which for this area can be called Jebel Moya phase (see section 7 and Figures 51: 5, 8; 52: 1, 6, 9; 53: 6, 11, 13, 18, 24; 54: 23-24). A large number of flakes and blades of white quartz were also recovered from the surface and in the excavation of the site, with only a few retouched tools present (three lunates, two end scrapers and one truncated blade).

51.- **Wadi Rabob area-3.** 15º 46' 3'' N / 33º 11' 18'' E (E 0520177 / N 1743251) (ND-36-C/1-X-1). Historic. A wide elevation with pottery sherds, most probably Christian (Balfour-Paul 1952: 212, Figs. 12-3; Welsby and Daniels 1991: 213-5), of partly burnished surface, some of them black and other red slipped, with incised and occasionally impressed decoration in a horizontal band near the rim (Figure 17).

52.- **Jebel Dururba.** 15º 50' 32'' N / 33º 15' 33'' E (E 0527757 / N 1751524) (ND-36-C/2-P-1). Historic. A group of accumulations of big stones, with rounded shape (burial mounds or animal traps? cf. Binford 1983: Fig. 73) were

Figure 17.- Christian incised and impressed pottery sherds from site no. 51.

Figure 18.- Burial mound in the Wad Hassuna area (site no. 53).

recorded in the flat areas on the top of the Jebel (see view from the top in Figure 14).

53.- **Wad Hassuna area**. 15º 46' 7'' N / 33º 22' 52'' E (E 0540830 / N 1743404) (ND-36-C/2-W-1). Historic. At least 11 or 12 small tumuli, probably Islamic since some of them show an elongated shape roughly following the North-South direction (Figure 18). About 4-5 m in diameter and less than 1 m in elevation, surrounded and topped by volcanic stones. Over an elevation immediately at north-east some flakes and a rough scraper in white quartz were collected.

54.- **Salamat Wad Nail-1.** 15º 38' 12'' N / 33º 15' 46'' E (E 0528167 / N 1728787) (ND-36-C/8-K-1). Mesolithic? A small group of flakes and blades in white quartz, a lunate and a broken mortar were seen on surface.

55.- **Salamat Wad Nail-2.** 15º 38' 17'' N / 33º 16' 50'' E (E 0530078 / N 1728940) (ND-36-C/8-K-2). Historic. A deserted village, with sherds of burnished and rough surface types without decoration, around the remains of mud house floors; one complete polished stone axe (Fig. 51: 9).

56.- **Wadi el Hag area-1**. 15º 38' 22'' N / 33º 18' 10'' E (E 0532457 / N 1729100) (ND-36-C/8-L-1). Historic. Two isolated tumuli, of oval shape (c. 8 x 5 m in size) surrounded by stones, and NE-SW orientation.

57.- **Wadi el Hag area-2.** 15º 38' 40'' N / 33º 18' 35'' E (E 0533457 / N 1729655) (ND-36-C/8-L-2). Historic. A group of 9 tumuli, the biggest one 13 m in diameter. Unlike in the previous site, these mounds have not stones in the periphery, and some of them could have been plundered.

58.- **Wadi el Hag area-3.** 15º 39' 1'' N / 33º 27' 20'' E (E 0548833 / N 1730325) (ND-36-C/8-J-1). Historic. A field of tumuli similar to no. 57, 60 and 61, with about 60 rounded burial mounds in total.

59.- **Wadi el Hag area-4.** 15º 37'' 36'' N / 33º 17' 43'' E (E 0531655 / N 1727686) (ND-36-C/8-K-1). Historic. A group of 10-12 tumuli of rounded and oval shape peripherally marked by circles of black stones. Some small Muslim graves between the mounds and in the vicinity strongly suggest that all the remains are of that chronology.

60.- **Hafir Umm Dam.** 15º 35' 12'' N / 33º 22' 24'' E (E 0540038 / N 1723275) (ND-36-C/8-R-1). Historic. About eleven tumuli of the same type than at the bigger site no. 61.

61.- **Hafir Umm Mohhar.** 15º 33' 2'' N / 33º 22' 20'' E (E 0539920 / N 1719277) (ND-36-C/8-R-2). Historic. More than 90 big circular tumuli ranging in dimension between 5 and 10 m in diameter, around 1 m in elevation. All of them are covered with small white and rosey quartz pebbles from the ancient terrace (but the same condition applies to all the surface around them and in the whole site). The small and sandy particles were probably washed out by the rain from the top of the mounds leaving only the pebbles on them. None of the mounds show any signs of disturbance, and not archaeological material was found on and around them, with the exception of some lunates, scraper, flakes and lithic cores that were collected around but most probably do not come from the tumuli. The absence of archaeological remains and of disturbance poses some difficulties to determine the type of site and its chronology. However, an Islamic grave also covered by a round tumulus of small pebbles was recorded at Saggai 1 north of Khartoum (Caneva 1983: 14-5).

62.- **Bir el Lahamda.** 15º 33' 43'' N / 33º 16' 56'' E (E 0530270 / N 1720525) (ND-36-C/8-P-1). Early Neolithic. A very big site (500 x 300 m) of the Shaheinab phase. Unfortunately, this important site (an Early Neolithic settlement 40 km from the main river) could not be more intensively investigated since it was discovered the last day of the survey. Besides the pottery sherds sample, also two fragments of stone rings (Figure 41: 7), three rubbers, one fragmented polished axe, two lunates, flakes, blades and some cores were observed. The pottery sherds

were classified as in the following table (see Figures 52: 6; 53: 3):

Pottery Decoration Type	**N**	**%**
Rocker impression packed zigzag	26	26
Rocker impression spaced zigzag	52	52
Alternately pivoting stamp	3	3
Dotted wavy line	1	1
Simple zoned impression	2	2
Impressed thick rims	3	3
Incised thick rims	1	1
Scraped surface	3	3
Plain sherds	9	9
Total	100	100

63.- **Hafir Umm Gana.** 15º 34' 21'' N / 33º 11' 10'' E (E 0519969 / N 1721678) (ND-36-C/7-S-1). Mesolithic. Situated over the elevation of an ancient terrace covered with white quartz pebbles, it is a small site with sherds decorated with wavy line (4), rocker impression with packed zigzag (3), rocker spaced zigzag (1), dotted wavy line? (1), and plain without decoration (1). Several stone rings (two round, one squared, Figure 41: 3-4), 12 lunates of white quartz, flakes, blades, one backed bladelet and quartz and agate lithic cores were also recorded.

64.- **Hafir Quseima.** 15º 29' 59'' N / 33º 21' 40'' E (E 0538744 / N 1713655) (ND-36-C/14-C-1). Historic. Recently abandoned Islamic village, situated near an Islamic cemetery with many flags over the graves.

65.- **Hafir Umm Sinait.** 15º 28' 2'' N / 33º 5' 12'' E (E 0509306 / N 1710026) (ND-36-C/13-B-1). Historic. The remains of a recently abandoned Islamic village.

66.- **Alwan.** 15º 23' 44'' N / 33º 9' 43'' E (E 0517382 / N 1702107) (ND-36-C/13-N-1). Mesolithic. Situated over a small elevation on an ancient terrace of Wadi el Hasib. A surface collection was recorded, consisting of sherds with wavy line decoration (8), dotted wavy line (1), rocker impression packed (3), rocker impression spaced (2), two lunates, one scraper, flakes, blades and cores (in quartz and agate), two broken stone mortars and several *Pila* shells.

67.- **Wad el Amin.** 15º 21' 52'' N / 33º 15' 27'' E (E 0527643 / N 1698673) (ND-36-C/14-K-1). Late Neolithic. Located over an ancient terrace and near a *hafir* and a modern Muslim cemetery (with small individual graves and bigger tumuli), there is a dense concentration of surface remains extending over an area of about 70 x 110 m. The sherds were classified according to decoration as follows (see Figures 52: 1, 2, 7; 53: 5; 54: 1, 2, 10, 12, 15, 17; 55: 13, 14):

Pottery Decoration Type	**N**	**%**
Rocker impression packed zigzag	10	11
Rocker impression spaced zigzag	9	10
Simple zoned impression	60	66
Incised thick rims	2	2
Impressed thick rims	10	11
Total	91	100

The abundance of simple impression and decorated thick rims and the scarcity of rocker impression, suggest a younger chronology for this site than for Rabob (no. 50; see seriation in section 7 and Figure 56). Several sandstone rubbers, cylindrical (4) and conical (4), one square perforated sandstone disk, a curved adze of green stone and two fragmented axes were also collected (Figure 51: 8).

68.- **Al Khalifa Ahmed-1.** 15º 20' 0'' N / 33º 7' 20'' E (E 0513129 / N 1695255) (ND-36-C/13-R-1). Mesolithic? Over the flat eroded remains of an ancient terrace of the wadi, we found two small lithic assemblages with cores, flakes and blades of white quartz, including three retouched lunates, and a small spherical mortar.

69.- **Al Khalifa Ahmed-2.** 15º 20' 21'' N / 33º 7' 45'' E (E 0513868 / N 1695867) (ND-36-C/13-R-2). Mesolithic? Very near the previous site, a small sample of flakes and blades of white quartz was recorded.

70.- **El Lahamda.** 15º 19' 43'' N / 33º 1' 55'' E (E 0503438 / N 1694693) (ND-36-C/13-P-1). Mesolithic. Situated over a *kôm* in the alluvial plain at 6 km from the Nile. Some Muslim graves, already partially eroded, had been dug in the same place. A sample of artefacts was analysed: sherds with wavy line decoration (27), dotted wavy line (3), rocker impression with packed zigzag (20) and spaced zigzag (2), incision (1), several flakes and blades in agate, quartz cores, three fragmented mortars.

71.- **Farig Er Rizgab** (after local informants) or **Farig Al Galahig** (after the 1:100.000 map). 15º 14' 13'' N / 33º 13' 52'' E (E 0524823 / N

1684569) (ND-36-C/19-E-1). Mesolithic. A slightly elevated mound over the flat alluvial plain that goes parallel to the Nile south-west of the Wadi el Hasib mouth. Largely destroyed site, where a group of 14 pottery sherds decorated with rocker impression (packed or zigzag one cannot say, since they are very much eroded, but the fabric is unmistakably of the Early Khartoum type), together with a white quartz lunate, several blades, core and spheroid mortar were observed.

72.- **Hafir Umm Hijlija.** 15º 11' 14" N / 33º 24' 43" E (E 0544259 / N 1679098) (ND-36-C/20-I-1). Mesolithic? Over a small elevation in the wide flat plain there were several broken mortars and two lunates of white quartz.

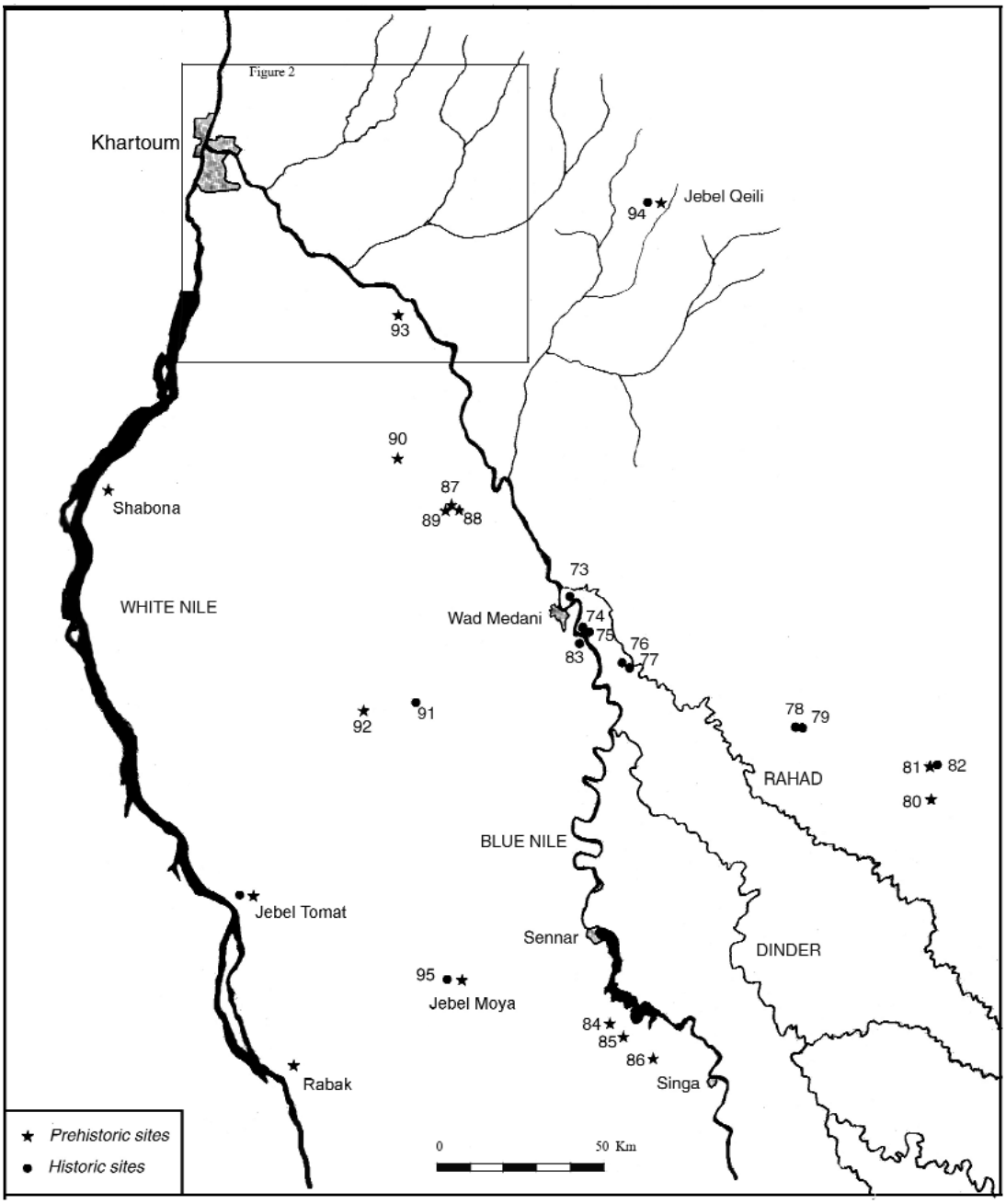

Figure 19.- The area explored in the winter of 2000, with the discovered or revisited sites. Site numbers correspond to table 1 and the catalogue list in section 2.

Exploration between Wad Medani, Gedaref and Singa (2000) (Figure 19)

The whole area is very flat, which in principle would make the discovering of archaeological sites on the landscape an easy task. Yet, as André Vila already observed in his survey of a part of it in 1974 (Vila 1979: 121-134), intensive cultivation activities have heavily disturbed and most probably destroyed many ancient sites. Starting from our base in Wad Medani (Figure 20), we made a very general exploration of the area during one week in February 2000. We tried to locate some of the Gezira sites previously discovered in the 1940's by Paul Balfour-Paul (1952), and in other areas we simply asked to people in the villages. Our aim was to get a general idea of the archaeological "thing" in the area, what type of sites and how they are preserved, and if any trace had been left of the Mesolithic and Neolithic occupation in the region. The objective was also to identify the nature of the archaeological features present and to make use of these when looking for related sites across the border into Ethiopia during the following seasons.

73.- **Hantub**. 14º 26' 22'' N / 33º 32' 59' E (E 0559257 / N 1596417) (ND-36-G/15-F-1). Historic. Situated near the village of Hantub on the southern side of the road to Gedaref after crossing the Blue Nile Medani bridge. Over the inundated terraces near the river, are the remains of old mud houses in squared shape, together with some sherds of the Islamic period (Figure 21). Most of them come from flat-based bowls decorated with geometric incision arranged in horizontal bands near the border, such as it was typical in the Funj period (Arkell 1934: 104; Crawford and Addison 1951: pl. 31).

Figure 20.- The Blue Nile at Wad Medani.

Figure 21.- Pottery sherds from the Funj period (site no. 73).

74.- **Kordogeili-1**. 14º 20' 47'' N / 33º 34' 56'' E (E 0562786 / N 1586131) (ND-36-G/15-Q-1). Historic. Very close to the course of the Blue Nile, there is a *kôm* of red bricks belonging to the Christian period, the probable remains of a church. One of the bricks had a graffito with two Greek letters (lambda and other unidentifiable); also some sherds with rough relief decoration were recorded.

75.- **Kordogeili-2**. 14º 21' 56'' N / 33º 33' 48'' E (E 0560744 / N 1588249) (ND-36-G/15-L-1). Historic. Very near the previous spot, a small cemetery of Christian (?) chronology. At least one of the graves was disturbed by erosion, and human bones and a group of flat, cylindrical ostrich egg beads were scattered in the nearby. Some brown burnished, undecorated sherds were observed in the area.

76.- **Sherif Ya'qub-1**. 14º 15' 53'' N / 33º 42' 39'' E (E 0576683 / N 1577139) (ND-36-G/15-Y-1). Historic. A big Islamic site, situated near the Rahad river in front of the modern village of Sherif Ya'qub. The site consists of small elevations being the remains of ancient houses, with many rough, incised pottery sherds and stone mortars.

77.- **Sherif Ya'qub-2**. 14º 15' 13'' N / 33º 42' 58'' E (E 0577256 / N 1575912) (ND-36-G/15-Y-2). Historic. Near the previous spot besides the Rahad river. Besides a modern Islamic cemetery, with the grave of a Sheikh surrounded by stones and a circle of small tree trunks, there are the remains of an ancient Islamic cemetery, with abundant remains of fossilised human bones but no visible archaeological remains.

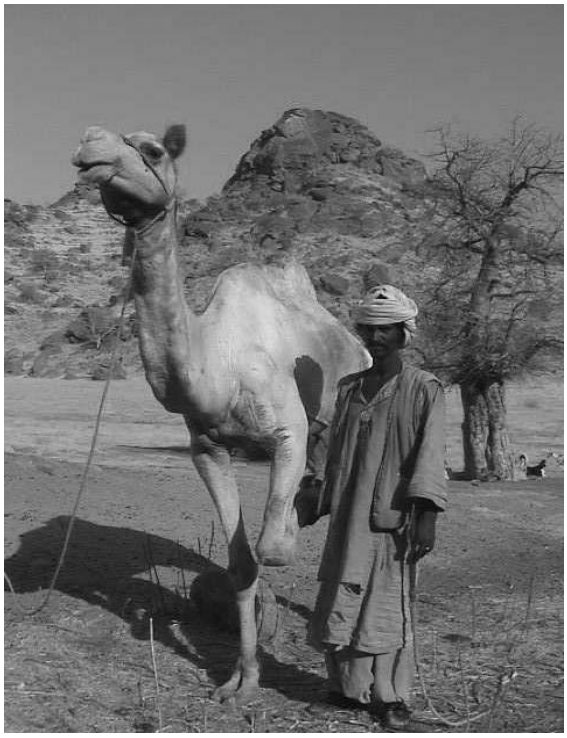

Figure 22.- Shukriya nomad at the Jebel el Ugheilif well (site no. 80).

78.- **Sheikh Ahmed-1**. 14º 06' 42'' N/ 34º 11' 38'' E (E 0628883 / N 1560422) (ND-36-G/23-N-1). Historic? In one of the interior wadis of the Qalat Arang Hill range in the Fau area, near the village of Sheikh Ahmed, we observed visually that a circle made of big stones was erected in the middle of the slope of the rocky Jebel Husaan. However, none of our informants could tell us anything about it.

79.- **Sheikh Ahmed-2**. 14º 06' 56'' N / 34º 11' 39'' E (E 0628914 / N 1560852) (ND-36-G/23-N-2). Historic. Near the previous spot and the mouth of the wadi shortly before the connecting point to the road to Gedaref. A deserted village of recent, Islamic chronology with rough sherds of incised decoration and stone mortars. The remains of an ancient floor were visible, made of big stones with an overall squared shape.

80.- **Jebel El Ugheilif**. 13º 56' 53'' N / 34º 33' 10'' E (E 0667754 / N 1542551) (ND-36-L/1-G-1). Prehistoric/ Historic? Leaving the Gedaref asphalted road in the service area of Jebel Migreh and following a track to the South, there are several jebels (rocky inselbergs) with natural wells and springs, used today by Shukriya nomads (Figure 22). The first spot we visited was Jebel El Ugheilif, where there are some big rocks that were hollowed in several places (Figure 23) to make mortars (?) of the same type that are found in Jebel Qeili and many other sites of the Butana steppe (*Napflöcher*, cf. Hintze 1959). Only some undecorated sherds (with a Mesolithic-like fabric) and some flakes near the holes were observed. Very probably nomad groups come since long ago to the site for the sake of its water.

81.- **Jebel Denabo-1**. 14º 00' 11'' N / 34º 32' 47'' E (E 0667025 / N 1548628) (ND-36-H/19-U-1). Rock art. On the eastern flank of Jebel Denabo there is an ancient well still in use by Shukriya groups (three girls were bringing up water at that moment, Figure 24). Besides the well it is a big rock with a flat eastern face engraved with representations of animals that appear walking to the right in several rows. Horses, camels, cows, donkeys and probably goats and dog are easily identified in the panel (Figu-

Figure 23.- "Pan-holes" (*Napflöcher*) in the rocks at Jebel el Ugheilif (site no. 80).

Figure 24.- Shukriya girls at the Jebel Denabo well (site no. 81).

Figure 25.- The engraved panel at Jebel Denabo-1 (site no. 81).

res 25-27). Three horsemen, with a flock of goats at their right, head the group. Then follow two or three cows and three camels with a horseman guarding the right side. Finally three more cows and two or three donkeys (and a dog?) close the herd. The length of the engraved panel is of 155 cm. The animals represented, the technique (pecking) and the very schematic style suggest a recent chronology for these representations (see very similar engravings from Somalia in Bachechi 1998: Fig. 3).

82.- **Jebel Denabo-2**. 14º 00' 11'' N / 34º 32' 47'' E (E 0667028 / N 1548631) (ND-36-H/19-U-2). Historic. Near the previous spot, at the northern side of the Jebel, there are the remains of a deserted Islamic village with a small cemetery in the nearby, many scattered sherds of the Funj type (like in site no. 73), mortars, an iron axe, etc.

83.- **Umm Sunt**. 14º 19' 14'' N / 33º 35' 11'' E (E 0563248 / N 1583277) (ND-36-G/15-Q-1). Historic. In the outskirts of the village of Umm Sunt, very close to the riverbank, there are the rests of a big deserted Islamic village, with many pottery sherds of Funj type, glass beads and broken glass bottles, fragments of China ware, and human bones from a near cemetery. We asked the local villagers about the post-Meroitic cemetery investigated by Balfour Paul (1952: 207-9; see an assessment of the materials from a more recent excavation in Edwards 1991:49-52), and were informed that river floods and recent buildings have destroyed the site

84.- **El Karaba**. 13º 18' 29'' N / 33º 40' 18'' E (E 0572759 / N 1471318) (ND-36-K/15-S-1). Prehistoric (Palaeolithic?). Near the village of El Karaba, on the bank of a dry riverbed that flows from the Gezira into the Blue Nile, at the east side of the asphalted road from Sennar to Singa. Several lithic tools were observed scattered on the surface between the riverbed and the modern cultivation fields: flakes in quartz, agate and

Figure 26.- Detail of the central part of the engravings from Jebel Denabo-1 (site no. 81).

Figure 27.- Detail of the engraved horsemen from Jebel Denabo-1 (site no. 81).

rhyolite, and one big side scraper in white quartz.

85.- **Eneikliba-1**. 13º 16' 26'' N / 33º 43' 10'' E (E 0577939 / N 1467557) (ND-36-K/15-Y-1). Mesolithic. Near Eneikliba village at the west side of the road to Singa, there are several deep and wide quarry holes on a *Qoz* area. On one of the first mounds (earthworks) coming from the road, some Mesolithic artefacts were recorded: 69 pottery sherds, plain or with weathered decoration, 8 with rocker impression (packed zigzag), 6 plain rim sherds (all of them with the rough surface and mineral temper typical of the Early Khartoum horizon), two lunates (of white quartz and agate), flakes, blades and bladelets, cores and mortars.

86.- **Eneikliba-2**. 13º 13' 30'' N / 33º 48' 07'' E (E 0586900 / N 1462180) (ND-36-K/22-B-1). Mesolithic. Near Eneikliba Station at the west side of the road to Singa. A few, much eroded pottery sherds with typical Mesolithic fabric, flakes, cores and mortars were recorded on the surface of an area of quarry canals besides the road.

Exploration of the Qoz areas in the Northern Gezira (2000) (Figure 19)

During a two days survey we tried to locate the sites discovered by H.G. Balfour Paul in the 1940's, belonging to what he called the "Goz Culture". Travelling along the Gezira canals and intensive cultivation fields, with the help of local guides, we found some of the previously known sites (no. 87-90) and discovered a few new ones (no. 91-93). Later on we applied at the National Museum in Khartoum to examine the material collected in the old survey (see section 3).

87.- **Qoz Kabaro-1**. 14º 41' 55'' N / 33º 12' 37'' E (E 0522648 / N 1625021) (ND-36-G/7-J-1). Mesolithic. Situated besides several rubbish heaps of the village of Qoz Kabaro, after the villager's information. The position of this village and that of Qoz Bakhit (no. 89) seem to be reversed in the 1:250.000 map and Balfour Paul article (1952: map 1). A local informant had recently reported the site to the National Corporation for Antiquities and Museums in Khartoum, but it turned out to be the same spot excavated and published by H.G. Balfour Paul (1952: 203-6). There were scattered materials from different periods, and the basement of a house made of mud brick was visible in a trench recently dug at one elevation of the site. The great majority of the observed pottery sherds, however, belong to the Mesolithic period. Thus, Balfour Paul was not right in defining the "Goz Culture" (or Qoz) in this and other close sites of the *Qoz* area as a mixture of the Early Khartoum and Jebel Moya groups. Only one of the sherds recorded by our team in the site was ascribed to the Late Neolithic period (a rim with simple impression and incision). The rest were classified as Wavy Line (10 sherds), Dotted Wavy Line (1) (Figure 43: 14), Rocker impression packed (7), Rocker Impression spaced (2), and a combination of Rocker Impression and Wavy Line (1). (See section 3 and Figs. 33-36 for the cemetery excavated near this site by Balfour Paul).

88.- **Qoz Kabaro-2**. 14º 41' 36'' N / 33º 12' 26'' E (E 0522317 / N 1624440) (ND-36-G/7-J-2). Late Neolithic. Very close to the previous spot, at both sides of the asphalted road that crosses the Gezira from East to West in this area. Modern quarrying has disturbed the site. There are also mixed materials from different periods, and around ten pottery sherds recorded are probably of Christian chronology (similar to the site no. 51), but the majority belong to the Late Neolithic phase. They were classified in simple zoned impression of parallel lines (2 sherds), parallel bands (3) (Figure 54: 5) and triangular designs (4), rocker impression of packed zigzag (7) and scraped surfaces (2). Three lunates in white quartz were also observed.

89.- **Qoz Bakhit**. 14º 41' 53'' N / 33º 13' 05'' E (E 0523482 / N 1624963) (ND-36-G/7-J-3). Late Neolithic. About one km east from the previous site, near a small village and small tent camp of northern immigrants called Qoz Bakhit. This place name was told to us by the villagers at the spot; the name is in the Balfour Paul article and the 1:250.000 map but not in the recent 1:100.000 map. In the latter map the nearest place is Abu Juweli, which reminds the place name Abu Gueili, located at the same zone in Balfour Paul's publication (1952: map 1). When we asked for this site, however, we were informed that there was not any archaeological site there. The Qoz Bakhit site is c. 200 x 200 m in extension of surface artefacts dispersion. Several stone rings were seen but not retouched

lithic tools were found. The pottery sherds were classified as in the following table:

Pottery Decoration Type	**N**	**%**
Rocker impression packed zigzag	5	5.6
Rocker impression spaced zigzag	6	6.7
Alternately pivoting stamp, fine dots	1	1.1
Simple zoned impression	45	50.6
Incision	10	11.2
Incised thick rims	5	5.6
Impressed thick rims	4	4.5
Scraped inner surface	11	12.3
Relief decoration with white plaster	1	1.1
Pottery disk support	1	1.1
Total	89	99.8

The sherds with simple impression were classified according to the decorative designs, in triangular designs (25 sherds), chess pattern (9), parallel bands (9), circular (1) (Figures 52: 4; 53: 10; 54: 9, 14, 19, 20, 21, 22; 55: 5, 9, 10) and one possible animal representation (Fig. 53: 7).

90.- **Wad Sheneina**. 14º 50' 50'' N / 33º 04' 03'' E (E 0507268 / N 1641449) (ND-36-G/1-Q-1). Mesolithic / Late Neolithic / Historic. Near the village of Qoz Wad Sheneina. Over an elongated *kôm* that clearly rises around 2 meters over the flat Gezira plain (an ancient fossilised sand dune, see Figure 28), about 200 m long (in a NNE-SSW direction) and 50/60 m wide, there is a prehistoric site in the central and northern parts, with some Islamic remains at the southern end. Almost all the surface was covered with *Pila* and *Limicolaria* shells. This elevated area was occupied for a long period of time covering different cultural periods, since the pottery sherds belong to the Mesolithic, Late Neolithic, Meroitic (?), Christian and Islamic times. Also a lot of human bones were conspicuous on the surface. The documented artefacts include one partially perforated stone disk, flakes, blades, a core of agate, two lunates and one end scraper of white quartz. The pottery of the historic periods consists of several incised and impressed sherds and an almost complete bowl with holes in its bottom (salt strainer? see Figure 33: 1). Most of the pottery sherds are of the Mesolithic (Early Khartoum) type (see two DWL examples in Figure 43: 15, 17), and may be classified according to the following types:

Pottery Decoration Type	**N**	**%**
Wavy Line	11	11.6
Wavy Line + Rocker impression packed	2	2.1
Dotted Wavy Line	26	27.4
Rocker impression packed zigzag	38	40
Rocker impression spaced zigzag	5	5.3
Rocker impression plain zigzag	1	1
Alternately pivoting stamp, dashes	12	12.6
Total	95	100

The pottery sherds of Late Neolithic chronology were mostly decorated with simple zoned impressions, these being of triangular designs (3 sherds), parallel bands (2) or parallel bands forming triangles (1), and with incision (1) and scraping (2) (Figures 53: 11; 54: 7, 16, 25, 26). The cord impressed sherd of Figure 55: 22, with vegetal tempered fabric, is the only one of this kind found in the survey, an seems to belong to the "Naima ware" of the close site of Shabona (Clark 1989: 405), also known in the Khartoum Chest Hospital site (Arkell 1949: 88, Fig. 77: 3). The incised sherd of Figure 55: 2, with vegetal temper fabric, is also different to any other found in the survey.

91.- **Humeira.** 14º 09' 36'' N / 33º 08' 12'' E (E 0514755 / N 1565447) (ND-36-G/19-H-1). Historic. Near Managil town in the big *Qoz* area at the middle of the Gezira area, there are the remains of a small deserted Islamic village.

92.- **Umm Daqal**. 14º 06' 50'' N / 32º 58' 41'' E (E 0497641 / N 1560347) (ND-36-F/24-0-1). Mesolithic. East of the big *Qoz* area in the middle of the Gezira, there are a few remains of a Mesolithic site, heavily disturbed. Only four

Figure 28.- The site of Wad Sheneina in the Gezira plain (site no. 90).

pottery sherds undecorated but with typical Early Khartoum fabric, together with three lunates in white quartz, a retouched natural flat stone, flakes, blades, and blade and flake cores were seen on surface.

93.- **Bashaqra Gharb**. 15º 12' 29'' N / 33º 04' 23'' E (E 0507855 / N 1681362) (ND-36-C/19-B-1). Early Neolithic. Near the village of Bashaqra Gharb, on the road from Medani to Khartoum. We visited this site to check a recent report of local informants to the NCAM. The site extends only over a small *kôm* of around 20 x 20 m but we were unable to check its total size since it is located among the houses of the village. It seems of Early Neolithic chronology (Shaheinab phase) but with some features of the Late Neolithic period (simple impression and fine incised decoration). The pottery sherds were classified as follows (Figures 52: 3, 9; 53: 2, 4, 8; 54: 3):

Pottery Decoration Type	**N**	**%**
Rocker impression packed zigzag	6	15.4
Rocker impression spaced zigzag	17	43.5
Alternately pivoting stamp, fine dots	2	5.1
Simple zoned impression	9	23.1
Ripple ware	1	2.6
Rough incision	3	7.7
Fine incision	1	2.6
Total	39	100

Other sites

94.- **Jebel Qeili.** 15º 30' 9'' N / 33º 46' 15'' E (E 0582704 /N 1713919) (ND-36-C/10-U-25-26). Late Neolithic/Historic. During our survey

Figure 29.- Jebel Qeili from the West (site no. 94).

Figure 30.- Engravings of giraffes and other animals on the western side of Jebel Qeili (site no. 94).

in January 2000 we visited the well known site of Jebel Qeili in the Butana (Crowfoot 1920; Hintze 1959) (Figure 29). A total of 20 pottery sherds were examined in the flat areas around the small rock with the Meroitic engraving and on the top of the rocky mountain. According to their decoration, they were classified as follows: incision (6) (Figure 55: 1), simple zone impressed with triangular designs (3) or short parallel lines (3) (Figure 54: 23), ripple (1) and without decoration (7). Even if the site was probably visited by pastoral nomad groups during a long time, this kind of pottery strongly resembles the types of the Late Neolithic phase to which many of the sites described in this report belong. Some pictures were taken of the Prehistoric engravings at the site (Figures 30-31).

95.- **Jebel Moya**. 13º 29' 19'' N / 33º 19' 05'' E (ND-36-K/14-B-1). In February 2000 we paid a short visit to this well known site of the south-

Figure 31.- Engravings of bovids on the top area of Jebel Qeili (site no. 94).

ern Gezira, excavated by the Henry Wellcome expedition in 1910-1914 (Addison 1949) (Figure 32). A collection of sherds was made from the surface and especially from the Wellcome large excavation heaps. Most of them seem to belong to the Late Neolithic phase. After a study of the decoration on location, they were classified as rocker impression (18 sherds: packed 16, spaced 1, dotted wavy line 1), alternately pivoting stamp of triangles (1), simple zoned impression (14 sherds: short parallel lines 3, short lines forming angles 1, zigzag 1, triangular designs 4, horizontal band designs 3, undefined 2) (Figure 54: 4) and incision (17 sherds parallel 6, zigzag 2, angular designs 1, empty losanges 1, incision filled losanges 3, incision filled horizontal bands 4) (Figure 55: 3-4, 6-8). A lot of thick decorated rims composed the sample, 60 sherds decorated with incision (23, mostly oblique parallel lines or cross-hatching patterns) (Figure 55: 11, 19, 21), impression (17, usually comb impressions forming oblique parallel lines or cross-hatching patterns) (Figure 55: 15-17), combining both decoration types (18, usually incised parallel lines and impressed round dots) (Figure 55: 12, 18, 20) or plain (2). Apparently at least, the part of the sample most probably belonging to the Late Neolithic phase includes a bigger proportion of incised sherds and less zoned simple impressed sherds than in other inspected sites of the same period (Rabob, Wad el Amin, Qoz Kabaro, Qoz Bakhit, etc.).

3. Archaeological material from the 1940's excavations in the Blue Nile area

Once the survey was completed during the 2000 field season, the Sudan National Museum granted us permission to examine the old material from the Balfour Paul (1952) excavations in different areas of the Blue Nile. New drawings and photographs were made of the most representative artefacts form these sites, in order to compare them with the archaeological material obtained in our surveys and excavations in the northern Blue Nile area. Significantly, the greater part of the prehistoric material analysed corresponds to the Late Neolithic phase, which had been detected in a number of sites during our last campaign.

We examined the complete pots from the excavated burials at the cemetery of the Qoz Kabaro site, stored in the Museum. In the original publication (Balfour Paul 1952: 203-4) there are some indications about the location of this cemetery, with "apparently innumerable burials", in a flat area immediately south of the village, but we could not find its remains in the area. The pots from the graves kept in the Museum seem to belong to the Late Neolithic period, since some of them strongly recall those from the graves at the Kadada and Kadruka cemeteries (Reinold 2002: Figs. 1, 3, 10). Two small impressed hemispheric bowls from the old excavations (no. GK 1/8 and 1/9, Balfour-Paul 1952: 203-4, Fig. 2), had been transferred to El Obeid Museum. According to the excavation report, both vessels were in the same burial, one inside the other and both in turn inside the bigger black vessel from our Figure 34: 1. This kind of hemispherical bowls, often decorated with simple impressed zoned motifs (mostly forming triangles), appear in the Late Neolithic cemeteries (J. Reinold, pers. com.). The aforementioned black vessel also recalls one from the chapel C5 at Kerma, combining incision, impression and white paint, dated in the Middle Kerma period, c. 2050-1750 BC (Privati 2000: Fig 131: 4). According to the Museum files, the vessel from Figure 33: 4 had been put in the tomb with a complete perforated ostrich egg inside.

Figure 32.- Remains of the "House of boulders" made during the Henry Wellcome excavations at Jebel Moya in 1910-1914 (cf. Addison 1949: plate xiv).

The remaining vessels and others not published in the original paper were examined and drawings and photographs are shown in Figures 33, 34 and 36. A sample of zeolite lip plugs from the same site is shown in Figure 35.

Pottery sherds and other material of the Balfour Paul survey from other sites were also

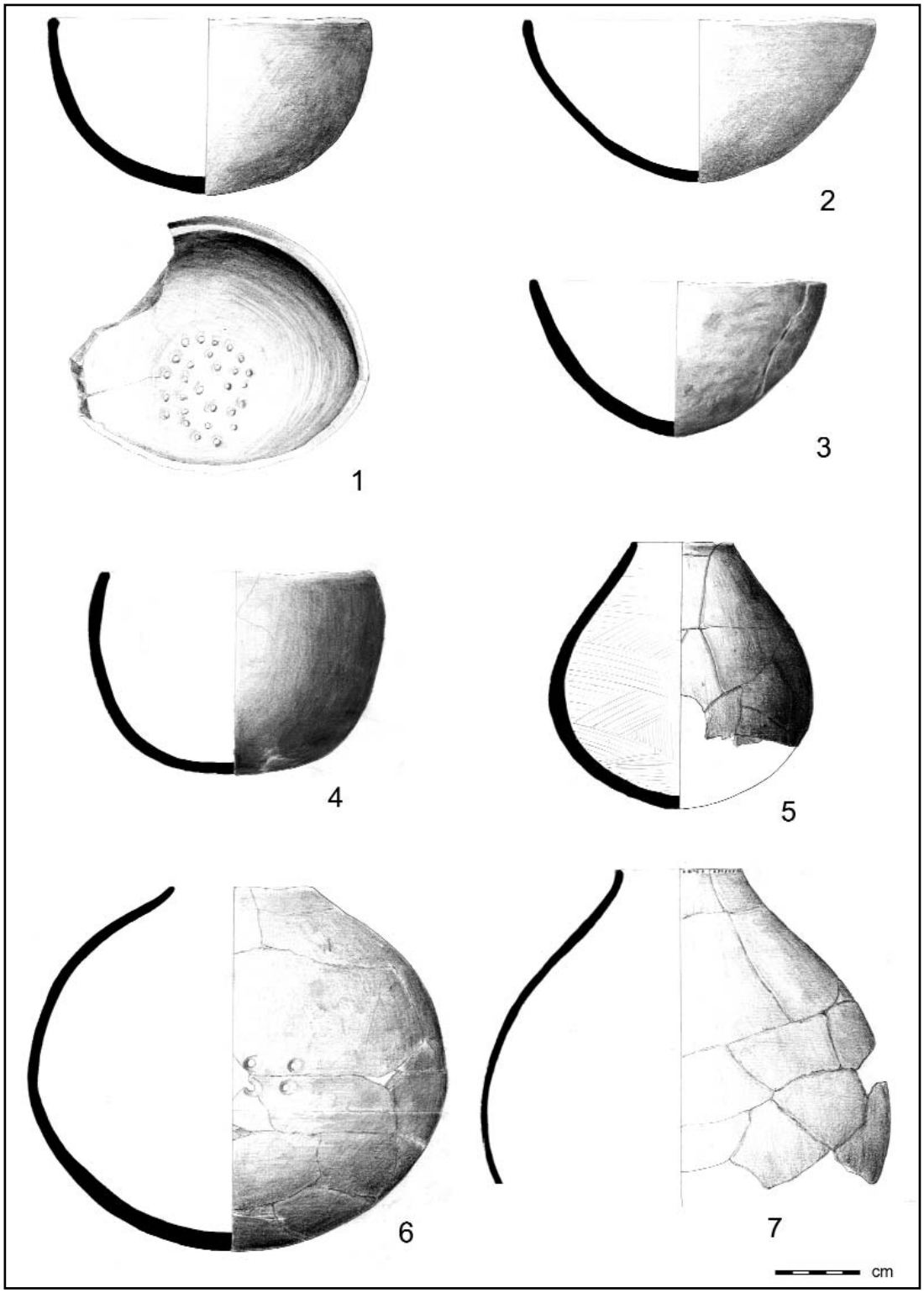

Figure 33.- Pottery vessels from our survey of the site at Wad Sheneina, site no. 90 (1) and from the Qoz Kabaro cemetery (sites no. 87-8) excavated by H.G. Balfour Paul (1952) and stored in the Sudan National Museum. No. 2, 3, 4, 6 and 7 have external scraped surfaces, and no. 5 internal and external scraped surfaces. Museum labels: 2 (9441), 3 (9439), 4 (9443 GK 1/11), 5 (9445 GK 1/5), 6 (9490), 7 (9477 55-G).

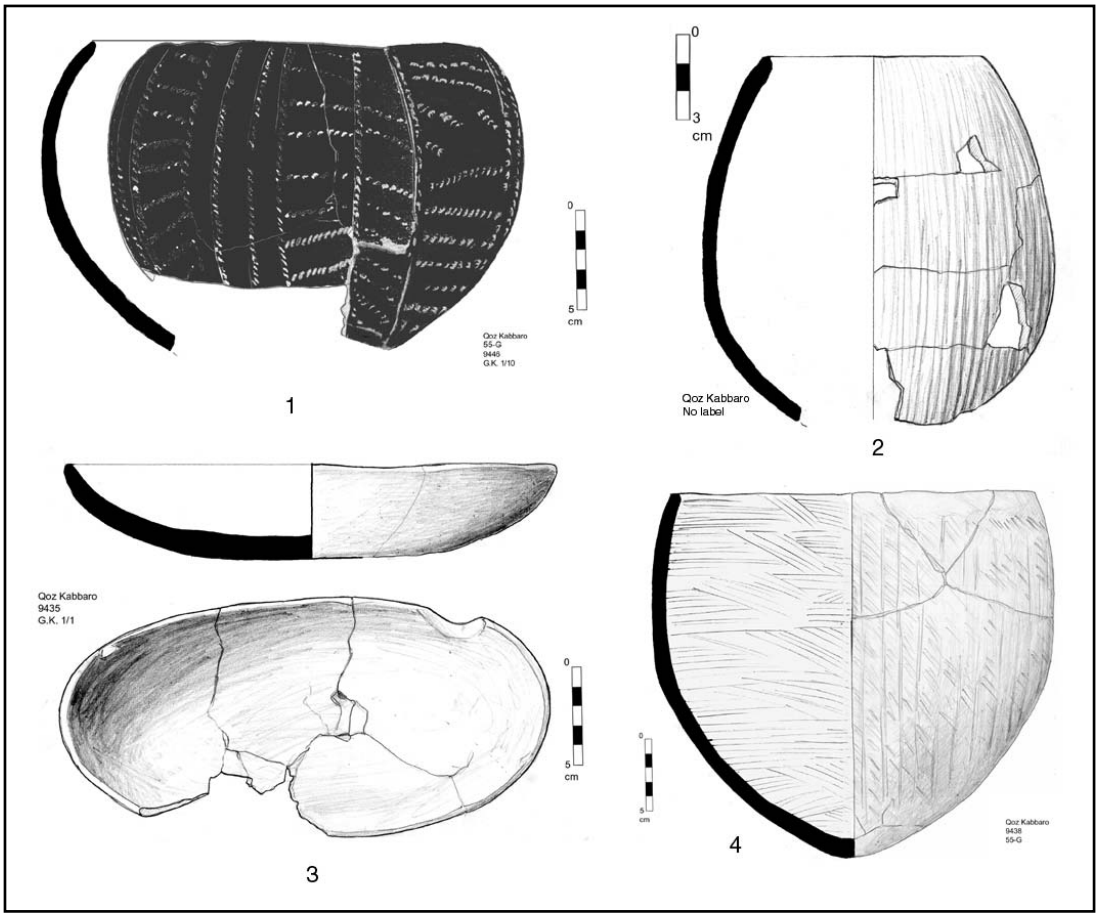

Figure 34.- Pottery vessels from the Qoz Kabaro cemetery (sites no. 87-8) excavated by H.G. Balfour Paul (1952) and stored in the Sudan National Museum. Decoration by simple impression (1), ripple surface (2) and scraped outer and inner surface (4). Nos. 1 and 2 seem to correspond to no. GK 1/10 and 1/12 in Balfour Paul 1952, Fig. 2. Museum labels: 1 (9446 GK 1/10), 2 (no label), 3 (9435 GK 1/1), 4(9438 55-G).

analysed. The site of Abu Miriam in the West Butana (Figures 37-38) is characterized by the abundance of pottery with simple impression decoration and scraped inner surfaces, and also with thick impressed rims that ascribe this site to a Late Neolithic chronology, with strong relations with the Jebel Moya site (Addison 1949).

The site of Abu Zumein in the West Butana (where far less material was collected) has cultural features similar to those of Abu Miriam. The Qoz Wad Nureim site (not referred in Balfour Paul 1952) is also culturally similar to Jebel Moya, though some Mesolithic material was collected here. Two other sites in the Gezira, Goz Abu Khadra y Qoz Shikeira (the latter not mentioned in Balfour Paul 1952), were classified as Mesolithic on the basis of the few pottery types collected in them (WL and rocker decoration).

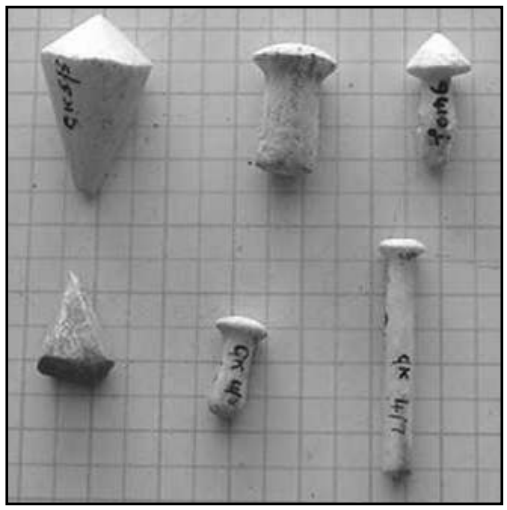

Figure 35.- Zeolite lip plugs from Qoz Kabaro stored in the Sudan National Museum (see Balfour Paul 1952, Fig 8); scale divisions of 5 mm.

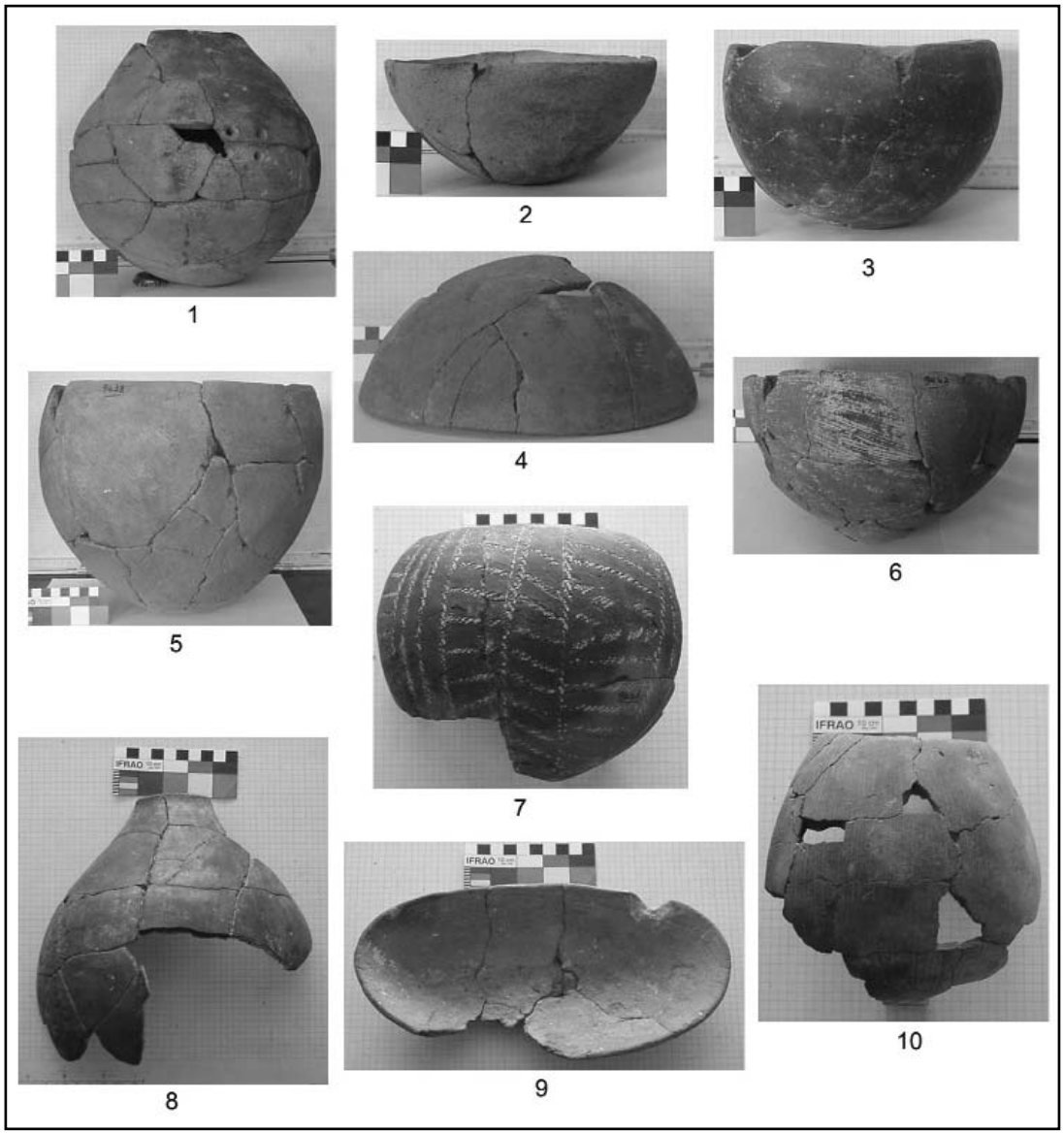

Figure 36.- Photographs of the pottery vessels from the Late Neolithic site of Goz Kabaro, excavated by H.G. Balfour Paul (1952) and stored in the Sudan National Museum. Museum labels: 1 (9490), 2 (9439), 3 (9443 GK 1/11), 4 (9441), 5 (9438 55-G), 6 (9442, GK 1/3), 7 (9446 GK 1/10), 8 (9477 55-G), 9 (9435 GK 1/1), 10 (no label).

4. Radiocarbon chronology

A total of 14 radiocarbon dates were processed from five of the sites investigated in the project. They are presented in table 2. Most of them come from Mesolithic and Neolithic sites. The samples from Sheikh Mustafa-1 were all of charcoal since not a single shell was found in the site. Because of their small size most of them were analysed by the Accelerator Mass Spectrometer (AMS) method. The samples from Karnus-2 were of wood and pet, both of them producing recent dates probably because of the site disturbance. One further charcoal sample from the same site had not enough radiocarbon to be analysed by the conventional method and was rejected. Two other samples of bone from sites no. 13 and 18 had no collagen left in them and could not be dated. The rest of the samples were of landsnail (*Limicolaria sp.*) or fresh water molluscs shells (*Pila*, *Lanistes* and Nile oysters).

Even if the number of dates is small, the results for the Mesolithic (no. 13, 26) and Neolithic (no. 36, 50) sites are generally consistent

Figure 37.- Zoned simple impressed pottery from Abu Miriam (West Butana).

Figure 38.- Zoned simple impressed and incised pottery from Abu Miriam (West Butana).

with the previous chronological information on both periods (Hassan 1986). In Sheikh Mustafa-1 there are, however, two dates that are younger than 6000 bp and thus fall outside what is considered the Mesolithic time span (c. 9000-6000 bp). This deviation could be attributed to recent contamination, and very probably this is the case also with the dating of 6295 bp, too young when compared with the rest of the site results. The other dates (7930-7600 bp) are in agreement with the early position of this site in the ceramic seriation (see section 6). The three dates from El Mahalab (spanning from 7705 to 6940 bp) are consistent both internally, since they appear stratigraphically ordered, and externally when compared to the Sheikh Mustafa site, which seems to be slightly earlier on the basis of its cultural contents.

The dates for the Neolithic sites are few but consistent with cross-cultural chronological information. The earliest dating from Sheikh el Amin is located at the middle of the time span for the Shaheinab Early Neolithic phase (c. 6000-5000 bp). The same happens with the date from Rabob (4670 bp), in the middle of the fifth

Site (no)	Square	Deep	Sample	Method	Lab ref.	Date bp	Cal. B.C.
Sheikh Mustafa-1 (13)	G-10	50 cm	charcoal	Conventional	T-11920	6295 ± 215	5480-4990
Sheikh Mustafa-1 (13)	G-3	50 cm	charcoal	AMS (alkali extract)	GrA-9836	5790 ± 50	4720-4550
Sheikh Mustafa-1 (13)	G-3	50 cm	charcoal	AMS	GrA-10527	5520 ± 70	4460-4250
Sheikh Mustafa-1 (13)	G-9	48 cm	charcoal	AMS (alkali extract)	GrA-10530	7600 ± 80	6590-6260
Sheikh Mustafa-1 (13)	E-15	54 cm	charcoal	AMS	GrA-9834	7930 ± 50	7030-6690
Sheikh Mustafa-1 (13)	H-11	39 cm	charcoal	AMS	GrA-10529	7720 ± 110	6660-6430
El Mahalab (26)	test	17 cm	shell	Conventional	T-10949	6940 ± 85	5900-5720
El Mahalab (26)	test	53 cm	shell	Conventional	T-10948	7470 ± 60	6400-6250
El Mahalab (26)	test	128 cm	shell	Conventional	T-10946	7705 ± 145	6750-6390
Karnus-1B (19-1B)	test	35 cm	wood	Conventional	T-10951	230 ± 90	1510-1950 ad
Karnus-1B (19-1B)	test	30 cm	peat	Conventional	T-10952	555 ± 85	1300-1440 ad
S. el Amin (36)	test	60 cm	shell	Conventional	T-10950	5555 ± 60	4460-4340
S. el Amin (36)	J/B5	55 cm	shell	AMS	Ua-20415	4590 ± 45	3500-3120
Rabob (50)	test	40 cm	shell	AMS	Ua-19741	4670 ± 50	3520-3360

Table 2.- Radiocarbon dates from the excavated sites. Laboratories are Trondheim (T), Groningen (Gr) and Uppsala (U). Calibration has been made using the program OxCal 3.8, Bronk Ramsey 2002 (date ranges are given with 68.2% of probability).

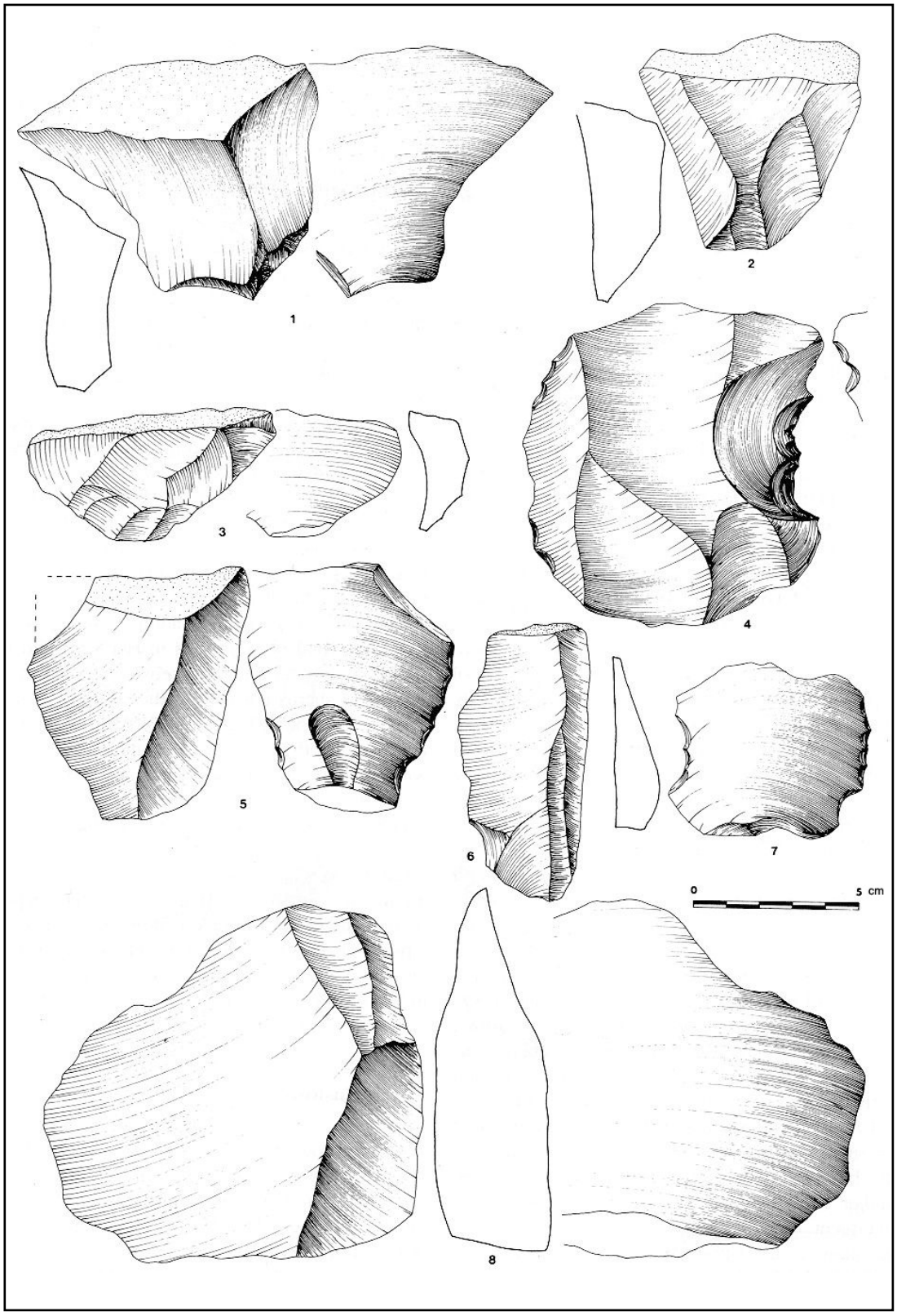

Figure 39.- Early and/or Middle Palaeolithic flakes and tools from the sites of Galla el Haddadia (sites nos. 37-38).

millennium bp and thus being consistent with its cultural features that are parallel to the Late Neolithic phase in Eastern Sudan (Kassala phase) and the Gezira (Jebel Moya). Only the second date from Sheikh el Amin (4590 bp) seems to contradict the model, being apparently too recent. Nevertheless, it comes from a sample excavated in what seems to be the youngest area of the site, and moreover this difference does not appear too serious when having a so small group of dates.

5. The Palaeolithic sites

A total of five Palaeolithic sites were recorded in the survey. Three of them are near the alluvial plain, close to the villages of Umm 'Ushush (site no. 7) and Sambra (8 and 9), and the other two were located far from the Nile, in a semi-desert area known as Galla el Haddadia (site no. 37-38). Even though they have a Palaeolithic look, the scanty findings from site no. 84 (El Karaba) do not allow us to include it safely in the sample of earlier sites. The sites are frequently located on the western slopes of small elevations, usually the remains of ancient river terraces. The concentrations are fairly small, the maximum dimension being usually less than one hundred meters and the artefact densities on surface generally low. No structural feature, faunal remains or stratigraphical preserved conditions could be discerned on the surface of the sites.

At Galla el Haddadia, at about 12 km from the Nile, two sites were recorded that probably belong to the Early or Middle Palaeolithic. At both places the most abundant find is a special type of flake, short and wide, the distal end (often with cortex) being characteristically wider than the platform and perpendicular to the striking direction (Figure 39: 1-3, 5). The only indication of tool making is the presence of uneven denticulate or notch retouching on about a third of the flakes, but this could have been caused by natural action (Figure 39: 4-5, 7). The raw material is dark Nubian sandstone in site no. 37 and in one group of flakes of site no. 38. A second group of flakes (bigger, with no retouch and more intensively eroded, thus suggesting an earlier dating; Figure 39: 8) is made up of lighter coloured sandstone. Some flakes have a Levallois aspect but not prepared cores were found (most of them are natural sandstone tablets). A few facetted striking-platforms were recognised, though most of them are flat with obtuse angle. Neither bifaces nor cleavers have been found (as in the nearby Acheulian site of Khor Abu Anga, cf. Arkell 1949b, or in the area of Jebel Baroka

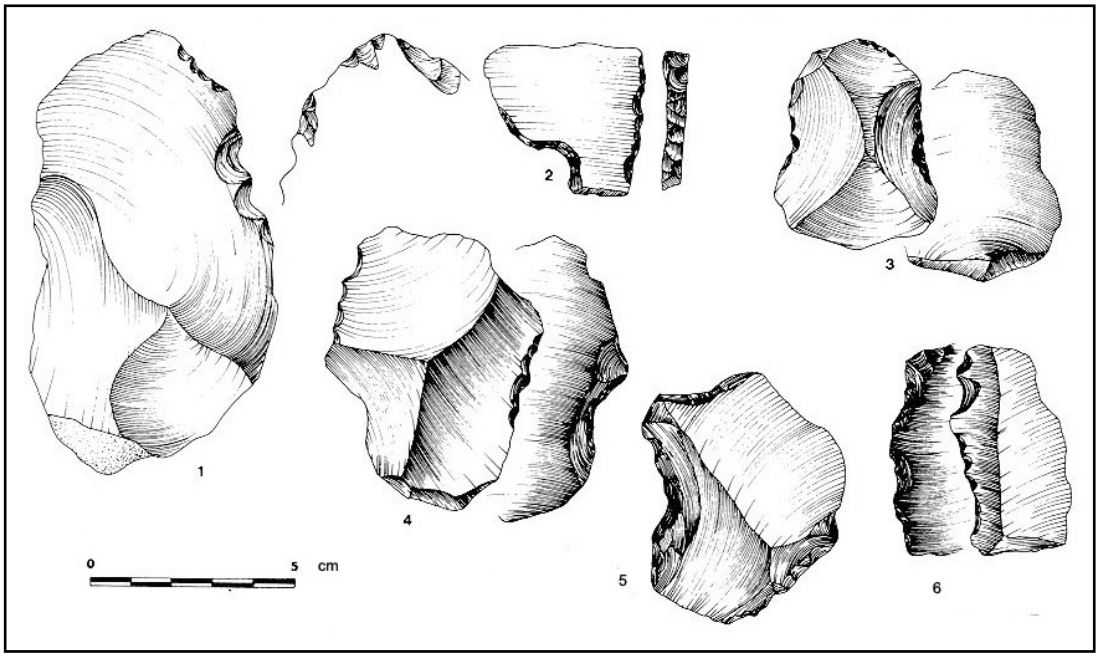

Figure 40.- Middle Palaeolithic denticulates (1, 3, 6) and notches (2, 4, 5) from Umm 'Ushush and Sambra (sites nos. 7-9).

southwest of Omdurman, cf. Usai and Salvatori 2002). The general uncharacteristic aspect of the industry (probably because of both sites being lithic workshops?) makes its cultural and chronological attribution unfeasible.

The three sites near Umm 'Ushush and Sambra exhibit Middle Palaeolithic features. The industry is made of yellow mudstone from local outcrops, and consists of denticulates (48 %), notches (22 %) and a few side scrapers (7 %) (Figure 40); some flakes are of thermal origin but many others are human-made and come from atypical Levallois cores. The assemblages include some "Upper Palaeolithic" tools: simple and nosed end-scrapers, raclette and "sur fracture" burin. Even though the sites and collected surface samples are very small, both the overall character of the technology and the tool percentages strongly remind us of the Denticulate Mousterian of Lower Nubia (Marks 1968: 205-15), as yet unrecorded in the Central Sudan.

6. The Mesolithic sites

Introduction

This is the most frequent type-site in the area - 36 sites discovered in the survey of Wadi Soba, Rabob, el Hag and el Hasib areas. This abundance is typical of the Khartoum area and seems to justify the frequent use of the label "Early Khartoum" to name this period in the Central Sudan (Arkell 1949a), that roughly covers the time span between c. 9300 and 6000 years bp. Other three Mesolithic sites were re-corded in our exploration of the Gedaref-Singa areas (nos. 80, 85, 86) and three more in the central Gezira area (nos. 87, 90, 92). This "archaeological culture" forms a part of the great "technocomplex" (Clarke 1978) of Early Holocene Saharan cultures that was called "Aqualithic" by J.E.G. Sutton (1974, 1977), "Neolithique Saharo-Soudanais" by the French school in Northern Africa (Camps 1974), Epipalaeolithic with pottery (Barich 1987), Pre-pastoral period (Garcea 1993) or, more frequently and simply, Mesolithic (Arkell 1949a; Caneva 1983). Recently, the denomination of "Khartoum Horizon-Style" (Hays 1971: 134) has been proposed and used again (Jesse 2000: 69; Mohammed-Ali, Khabir 2003: 82). The features of the cultural complex seem to be in agreement with the early and later usage of the French term "Mésolithique" since the work of M. Reboux in 1873 or J. de Morgan in 1909. It was designed to include all the (European) industries that are different to and chronologically fall between the last Palaeolithic and the first Neolithic cultures (Orliac 1988). The "aqualithic" Saharan-Sahelian cultures existed after or shortly before the end of the Palaeolithic in Northern Africa (Iberomaurusian-Capsian industries) and the Nile valley (Qarunian-Elkabian-Shamarkian-Arkinian), even if they occupied a larger geographical area that was inhabited until that moment. They were also clearly previous to the Neolithic phase, which begun during the 7th millennium bp with the spread of domestic cattle in the Sahara and Nile

The most conspicuous artefacts that define this period are the pottery, stone grinders, stone rings and microlithic tools. Examples of Mesolithic pottery sherds and Mesolithic and Neolithic stone rings and other types recovered from the sites discovered during the survey can be seen in Figures 41 to 43.

An analysis of the pottery sherds recovered from the Mesolithic sites with magnifying glass shows that the fabric is very homogeneous. Only mineral temper is seen, composed of quartz grains (white and brown colour), usually less than 1 mm in size, yet there are some sherds that have grains of bigger size, up to 5 mm in some cases. Other temper material include black grains (basalt?), mica and in one case from El Mahalab possibly crushed shell (mollusc shells are very abundant at the site). In some of the sherds crushed pottery seems to have been also added. The wall thickness of the sherds varies between 5 and 10 mm for the WL, Rocker and DWL sherds, and between 5 and 7 mm for the alternately pivoting stamp sherds (APS). The APS sherds have small size temper and a better surface treatment, sometimes approaching the burnishing quality.

The DWL sherds from site 16, supposedly one of the youngest Mesolithic sites in the survey (see later, Seriation), show some special features. Contrary to the usual external aspect of most Mesolithic sherds, the surface appear in most cases very well smoothed (Figure 43: 8, 10, 11, 16). Temper grains are smaller than usual. One sherd from this site has the rare combination of WL and DWL techniques near the rim (Fig. 43: 10). The DWL sherds from the sites in the

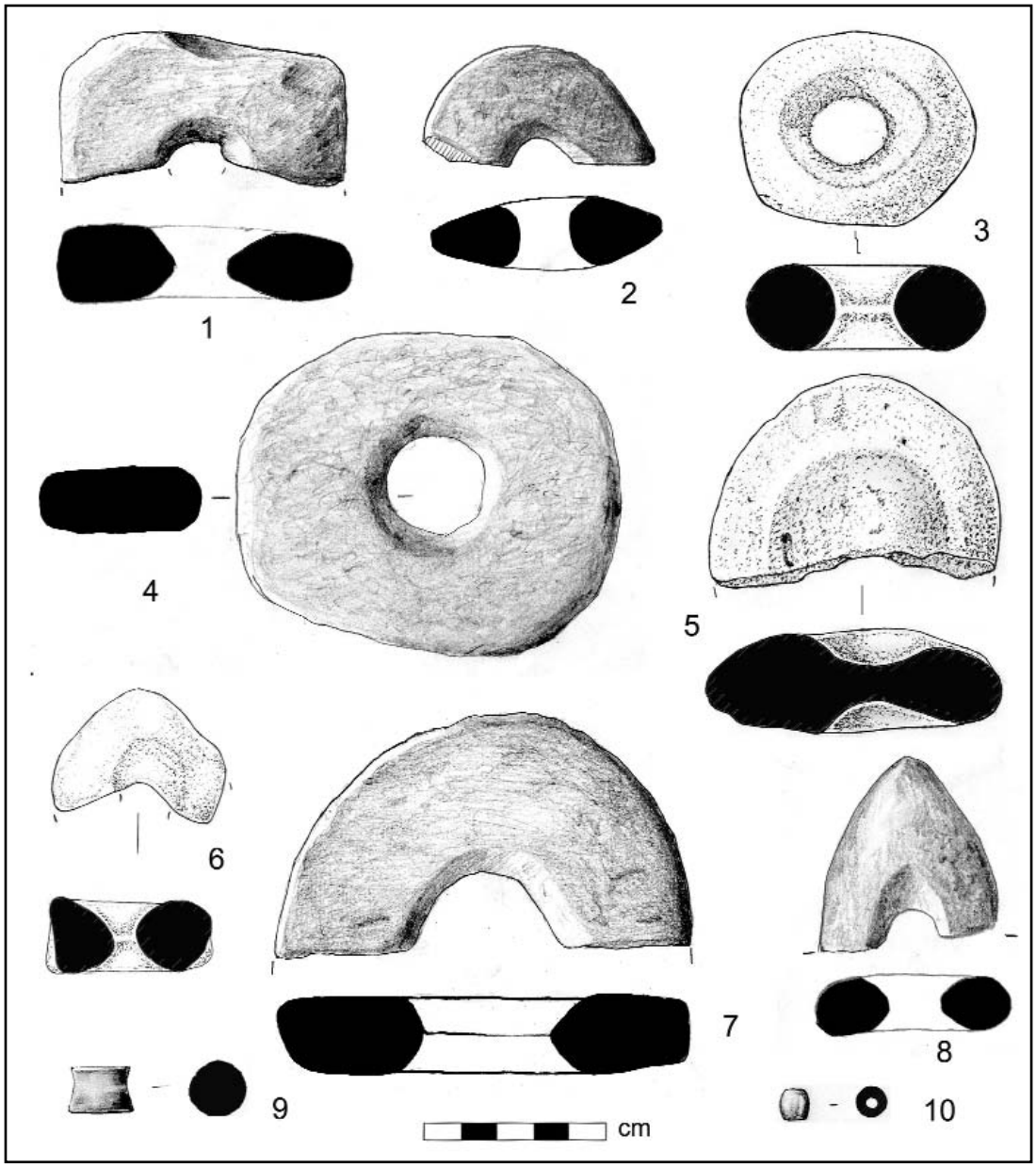

Figure 41.- Mesolithic and Neolithic sandstone rings and other finds from the survey. Nos. 1, 2 and 8 from Rabob (site no. 50, Late Neolithic), nos. 3-4 from Hafir Umm Gana (63, Mesolithic), no. 5 from Sheikh Mustafa-4 (no. 16, Mesolithic), no. 6 from Wadi Soba area-8 (no. 35, Mesolithic), no. 7 from Bir Al el Lahamda (no. 62, Early Neolithic). No. 9 is a lip plug in fine red sandstone from Sheikh Mustafa-4 (no. 16, Mesolithic), no. 10 is an ivory bead from Karnus-1A (no. 19-A, Mesolithic).

Gezira area (sites no. 87 and 90) also exhibit unusual characteristics (Figure 43: 14, 15, 17). Besides the normal mineral temper, two of the sherds (14, 15) have also vegetal temper, a very rare feature in the Prehistoric pottery from our survey area. Also the decoration technique looks different, roughly made and less deeply impressed than in the other sherds. This pottery probably belongs to the later phases of the Mesolithic period, when Wavy Line decoration was absent or scarce, as it is the case in these sites.

A total of 27 Mesolithic sites were discovered in the survey of the Wadi Soba area and 9 in the Wadi Rabob-el Hag-el Hasib areas, which are farther from the Nile. In two of the Mesolithic sites (nos. 13 and 26) our team undertook archae-

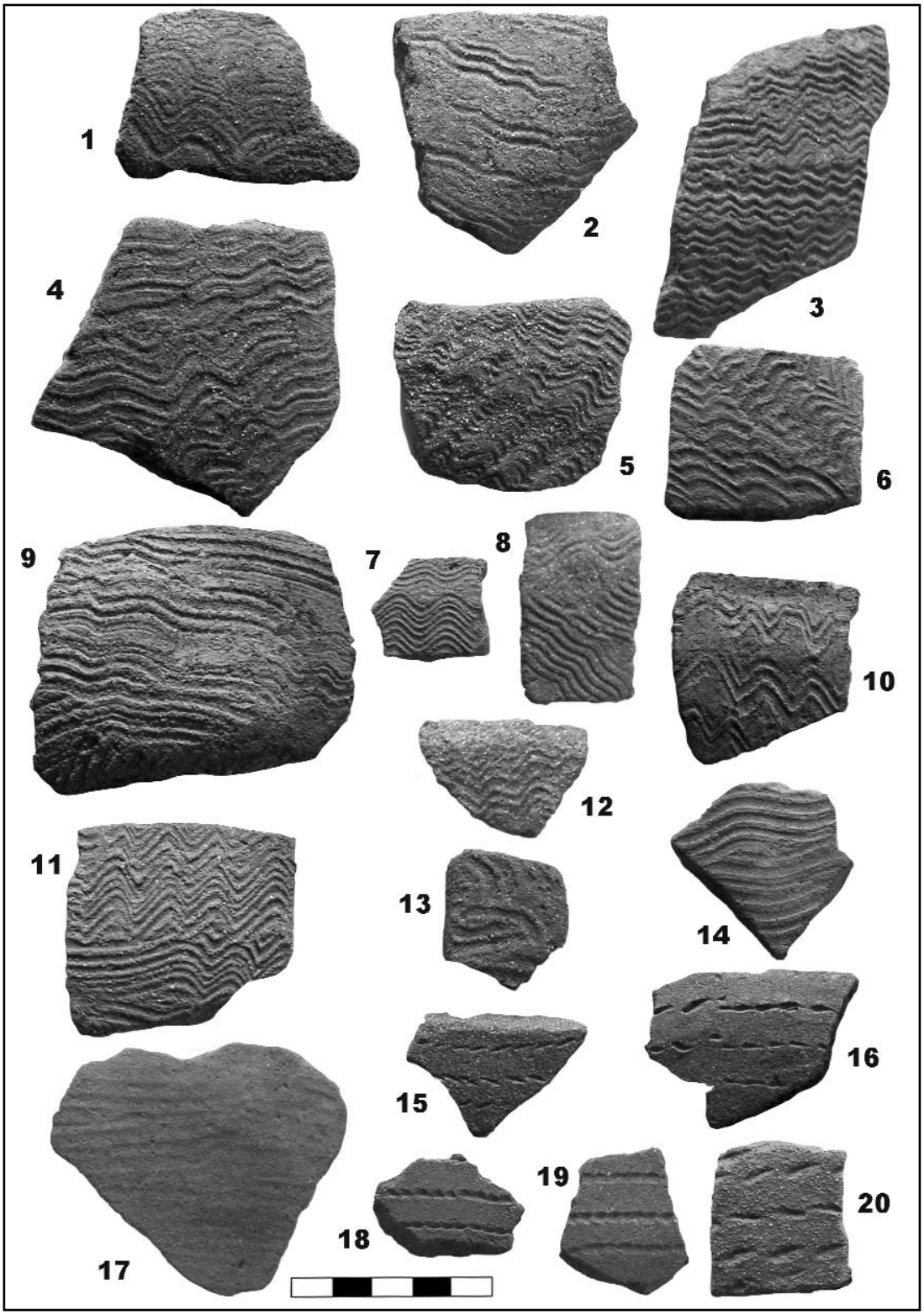

Figure 42.- Wavy Line (1-14, 17) and Alternately Pivoting Stamp (15-16, 18-20) pottery sherds from the survey. Nos. 17 (site no. 5), 13 (no. 12), 12 (no. 13), 10 (no. 16), 4, 5, 11 (19-A), 1, 2, 3, 8, 9, 14 (no. 19-B), 7, 18, 19 (no. 26), 6, 16 (no. 27), 20 (no. 31), 15 (no. 35). Scale in cm.

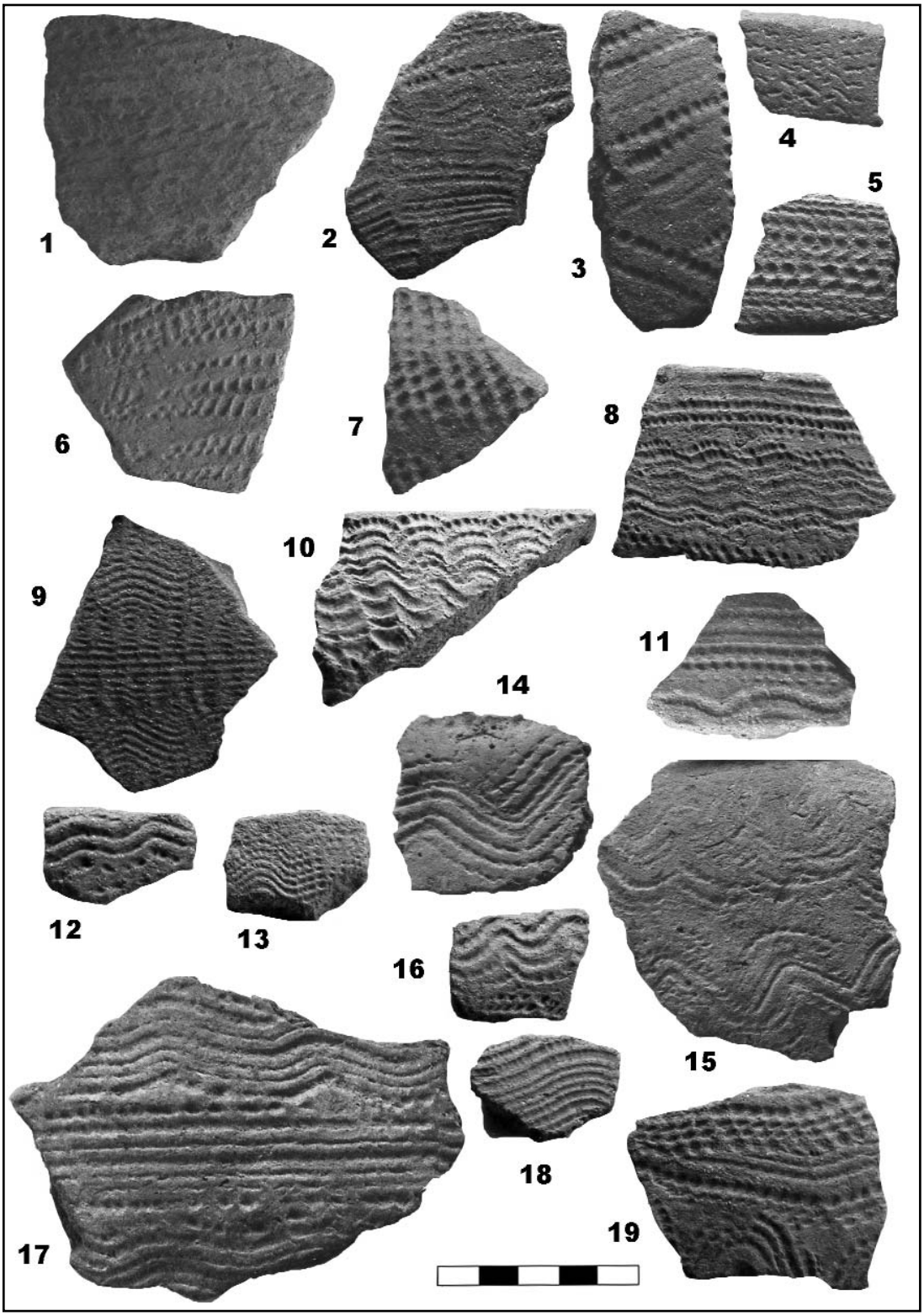

Figure 43.- Rocker (1-7) and Dotted Wavy Line (8-19) pottery sherds from the survey. Nos. 9 (site no. 5), 18 (no. 11), 4, 8, 10, 11 13, 16, 19 (no. 16), 12 (no. 18), 3 (no. 19-A), 2, 6 (no. 19-B), 1 (no. 29), 5 (no. 30), 7 (no. 35), 14 (no. 87), 15, 17 (no. 90). Scale in cm.

ological work during several field seasons (see Fernández, Jimeno and Menéndez 2003).

Surface micro-spatial analysis

In the larger Mesolithic sites, the surface analysis has provided certain micro-spatial information concerning different functional activities and/or post-depositional perturbation processes. Preliminary test-excavations made it possible to select sites with sufficient depth of deposit for large-scale excavation. In the same way, the quantitative surface collections and test-pit data were analysed statistically, obtaining a tentative chronological seriation for the most important sites that could cover the whole Mesolithic period in the area (see next section).

In the 1992 campaign, a significant sample of materials was collected from each site when it was discovered, using a non-systematic way (grab sampling): six people walking over the entire site for about 15-30 minutes and picking up the most interesting finds. In the 1993 campaign a systematic strategy for collecting surface materials was adopted in the biggest sites, sampling one-metre diameter circles at almost regular 20-metre intervals (see section 1 for general methodology and Figures 10-13 for actual site samplings). All the surface artefacts collected from these circles were classified according to their types and counted on the spot.

Out of the 36 Mesolithic sites discovered, 20 had a quite low density of surface artefacts, so they were not analysed after they had been discovered. The site of Magarbah (no. 42), apparently important, could not be analysed due to the presence of several Islamic tombs at one end of the *kôm* formed by the site. Twelve sites in the Soba and Wadi Soba areas were investigated in greater depth during the 1993 field season, of which ten were test-excavated using 1x1 m test-pits (nos. 13, 14, 16, 19A, 19B, 25, 16, 27, 30, 35). In two other sites (nos. 18 and 28) this was not necessary because industrial quarrying work being carried out in the places allowed us to examine the sediments without excavation. Data

Site no.	Sampling system	WL	RK	DWL	APS	r	Sig.
13	Grab sample	11	15	0	7	0.920	0.080
13	Systematic sample	9	14	0	1	0.996	0.004
13	Test-pit	24	43	0	0	0.891	0.109
14	Grab sample	1	24	9	0	0.932	0.068
14	Systematic sample	0	10	0	0	0.996	0.004
14	Test-pit	0	11	1	0	0.960	0.040
16	Grab sample	10	18	17	10	0.621	0.379
16	Systematic sample	3	17	1	0	0.555	0.455
16	Test-pit	9	7	0	0	-0.065	0.935
19-1	Grab sample	20	10	0	1	0.988	0.012
19-1	Systematic sample	51	18	0	2	0.881	0.119
19-1	Test-pit	13	11	0	0	0.943	0.057
19-2	Grab sample	41	8	0	0	1.000	0.000
19-2	Systematic sample	15	3	0	0	0.991	0.009
19-2	Test-pit	15	1	0	0	0.992	0.008
26	Grab sample	17	9	0	10	0.827	0.173
26	Systematic sample	4	1	0	0	0.929	0.071
26	Test-pit	40	28	9	15	0.883	0.117
27	Grab sample	10	15	0	3	0.981	0.019
27	Test-pit	5	9	0	0		

Table 3.- Frequencies of sherds with different decoration types recovered from the Mesolithic sites, using unsystematic (grab) and systematic surface sampling, and test-pit excavation methods. Pearson's correlation coefficients r (between first and second systems, second and third, and third and first when applicable), and their statistical significance are also given.

from the test-pits, however, reduced the number to only two sites deserving wider excavation work, Sheikh Mustafa-1 (no. 13) and El Mahalab (26). The rest display a similar pattern of erosion: the original archaeological mound has been partially or totally dismantled, scattering the materials horizontally over an area considerably larger than the original site (see Fernández, Jimeno and Menéndez 2003: Fig. 11).

A comparison was made of the frequencies of the general pottery decoration types coming from non-systematic and systematic surface sampling and the test-pit excavations in seven sites (Table 3). Surprisingly enough, the three methods produced a very similar general picture for six of the sites, with very high correlation coefficients between them (e.g in Sheikh Mustafa-1, no. 13, r = .92, .996, .891). However, differences exist for the less frequent types (i.e. DWL and APS), whose percentages obviously oscillate to a greater extent because they are less likely to be included in the sample and are thus more dependent on the random character of the sampling techniques. The APS type presents the additional problem of being hard to distinguish from other types of Rocker decoration, especially in the small and/or eroded sherds.

The most striking case occurred in El Mahalab (no. 26), where no DWL fragments were collected from the surface, but test-digging produced about 10%. This fact was probably a reflection of different degrees of erosion: this is one of the less deflated sites, with a deposit depth of nearly one metre, and thus the surface is less an accurate image of the buried deposit than in the other sites. But even in this site the correlation of systematic surface sampling, non-systematic surface sampling and test-pit data is fairly high (r = .827, .929, .883) as in the other sites, always near or above .9 with the exception of no. 16. Here the correlation is much lower and statistically not significant, a case perhaps to be explained by the disturbance of the original disposition of the remains in the site due to subsequent tumuli construction in the historical period and a modern irrigation canal.

More important than that, the main objective of the systematic surface sampling was to check the existence of some kind of spatial model of the remains in relation with possible areas of functional activity in the Mesolithic settlements. The quantitative data from the units sampled in

Sampling unit no.	CO	F1	F2	F3	TT	BL	GR	PO
1	8	32	45	50	8	4	2	20
2	9	52	82	153	15	0	1	9
3	0	33	31	33	13	1	1	11
4	6	34	29	23	1	1	6	15
5	4	46	33	40	3	2	4	21
6	21	76	58	104	7	1	6	48
7	7	30	14	29	4	2	5	15
8	10	62	37	104	7	0	5	46
9	7	35	19	72	2	0	2	4
10	11	34	21	37	0	1	3	29
11	10	17	14	10	0	1	6	12
12	12	17	25	31	0	2	4	14

Table 4.- Artefact type frequencies in the systematic surface sampling units at the Mesolithic site of Sheikh Mustafa-1 (no. 13; see their position on the site in Figure 10). Legend: CO, cores, F1-F2-F2, primary, secondary and tertiary flakes, TT, formal lithic tools, BL, bladelets, GR, stone grinders, PO, pottery.

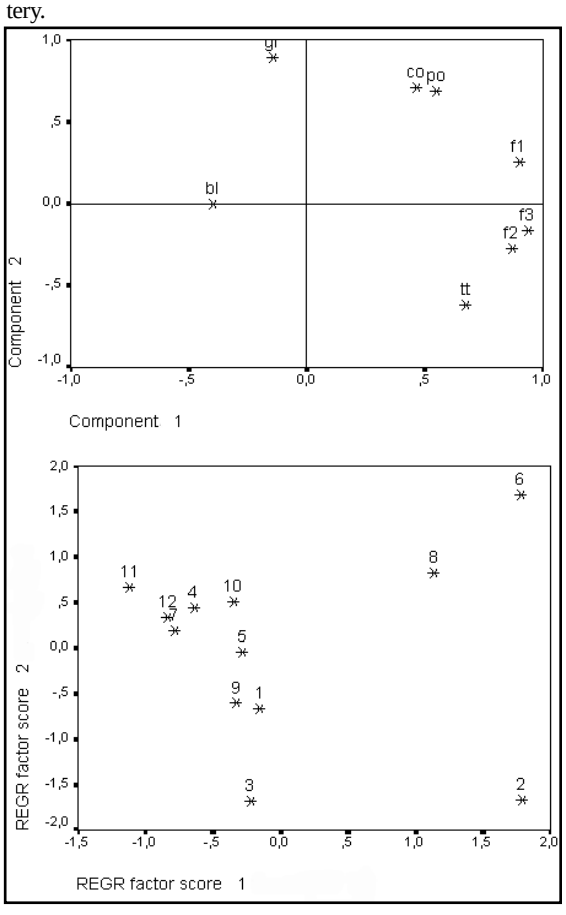

Figure 44.- Principal Component Analysis of the surface distribution data in systematic sampling units at the Mesolithic site of Sheikh Mustafa-1 (table 4). Plotted variables in the first diagram follow the legend of table 4. Plotted in the second diagram are the 12 surface sampling units (SPSS program).

each site were processed using statistical multivariate methods (Principal Component Analysis), with interesting results. If the surface materials had been mixed in a random fashion, either as a result of deflation or because this was their original arrangement as a result of successive changes and overlaying of different activities at the settlement ('palimpsest effect'), it would be natural to expect an equally random result within each site or different models from one site to another. But, in six of the seven analysed sites -all except, significantly, no. 16- the result was very similar: the lithic flakes and tools appear spatially opposed to grinders (and sometimes also to pottery); i.e. the areas with more tools have fewer grinders, and vice versa. As one example, see table 4 and Figures 10 and 44 for the data and results at the Sheikh Mustafa-1 site, no. 13.

This statistical result suggests the possibility that functional areas originally existed in the settlements and, more important, that the traces of this differentiation have been preserved until today, at least in part, despite the heavy deflation and post-depositional disturbance of the area that has led to consistently pessimistic opinions in this respect (e.g. Arkell 1949a: 4-5; Caneva 1983: 18; Reinold 1986: 121; Haaland 1992a: 22; Welsby 2001: 569). Such functional areas, which would obviously have to be confirmed by large-scale excavation, could correspond to female (gathering) and male (hunting-fishing) activities, as the contemporary ethnographic data suggest and has been proposed for the various types (riverside/savannah) of Neolithic settlements (Haaland 1987a: 211-3).

Another possible cause for the observed spatial dichotomy could be just post-depositional. In most of the analysed sites the diagram plots show how mortars and sometimes pottery tend to appear in bigger quantities over the peripheral or lower part of the sites, while the lithic items are more frequent in the central, which is usually the upper area. Thus, the "size-effect" (Baker 1978) could have been influencing the distribution, making wider objects to sink by the effect of wind and rain action, and letting the thinner artefacts in the upper and flatter areas. This fact has been detected in many sites, and interpreted as another "cautionary tale" against archaeological inferences based on surface findings (Fernández and Lorrio 1986: 189). It was practically observed during the survey in some of the Mesolithic sites, especially in site no. 45 during the 1994 field season.

Multivariate analysis has also shown a recurrent spatial association of retouched tools (lunates, backed bladelets, scrapers, etc.) and the much more abundant unretouched flakes (especially secondary and tertiary flakes). This fact suggests that flakes should sometimes be considered true tools even when they were not retouched (Caneva and Zarattini 1983: 211).

Ceramic seriation

On the basis of quantitative surface data (percentages of pottery decoration types), retrieved from surface sampling we tried another type of statistical analysis: chronological seriation of the sites using a model of gradual variation of pottery types and applying the statistical multivariate analysis model known as Multidimensional Scaling (Kendall 1971; Doran, Hodson 1975: 267-84; Fernández 1985b; see a recent application to African archaeology in Usman 2003). The input data from the most representative sites is shown in table 5.

SITE No.	WL	DWL	RK	APS	Total
11 (Sambra-4)	9.5	4.5	59.1	23.8	21
13 (S. Mustafa-1)	67.8	0.4	31.2	0.6	4595*
14 (S. Mustafa-2)	2.9	26.5	70.6	0	34
16 (S. Mustafa-4)	18.2	30.9	32.7	18.2	55
18 (S. Mustafa-6)	9.7	4.9	85.4	0	41
19-A (Karnus-1A)	64.5	0	32.2	3.2	31
19-B (Karnus-1B)	83.7	0	16.3	0	49
26 (El Mahalab)	37.2	2.0	56.5	4.3	3276*
27 (Umm Maishera)	35.7	0	53.6	10.7	28
29 (Wadi Soba-2)	0	57.1	35.7	7.1	14
30 (Wadi Soba-3)	33.3	0	46.7	20	15
31 (Wadi Soba-4)	26.7	0	53.3	20	30
35 (Wadi Soba-8)	20	10	50	20	20
49 (Wadi Rabob-2)	50	10	40	0	40
66 (Ulwan)	60	6.7	33.3	0	15
70 (El Lahamda)	51.9	5.8	42.3	0	52

Table 5.- Pottery decoration percentages in the surface samples from the Mesolithic sites. Legend: WL: Wavy line; DWL: Dotted wavy line; RK: Rocker; APS: Alternately pivoting stamp. (*) In the sites nos. 13 and 26 survey data have been replaced by the frequencies obtained in the excavation (see Fernández, Jimeno and Menéndez 2003).

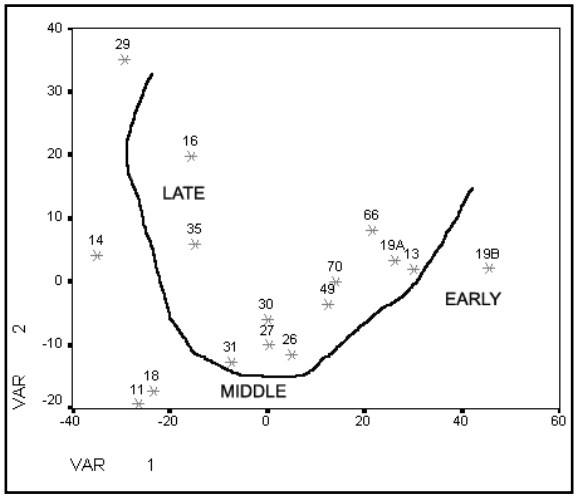

Figure 45.- Diagram plot on the first two axis of the multidimensional scaling of the 16 sites with 4 variables of table 5.

After analysing the data with a Multidimensional Scaling program (MDSCAL, with ATD program, *Analyse d'un tableau de distances*, cf. Foucart 1982), the following ordering of sites is retrieved from the diagram in Figure 45. The "horse-shoe" shape indicated by the curved line is expected for chronological studies of archaeological material (Cowgill 1972). Projecting the sites on that line an order is obtained with the most gradual variation of decoration percentages: 19-B, 13, 19-A, 66, 70, 49, 26, 27, 30, 31, 11, 18, 35, 14, 16, 29. The diagram with the variation of the percentages in the ordered sites is shown in Figure 46.

As it is shown in Figure 46, there is a fairly gradual variation for the WL type, which decreases at an almost constant rate (the clearest model). The RK type increases at the same time yet more irregularly, APS pottery follows a more random model (but this type presents some identification problems, see above), while the DWL type tends to appear and increase at the end of the ordering. The only exceptions to the DWL model are the three sites discovered in the Rabob and Hasib areas (nos. 49, 66 and 70), which despite having a large amount of WL pottery, present a small but significant quantity of DWL. This difference is probably due to their different location, and possibly hints at the known fact that the variation patterns are not universal but depend upon the specific areas where people lived in the past.

This chronological ordering is obviously tentative and has to be confirmed by means of any other relative dating method or by radiocarbon dating of some of the sites. Only two Mesolithic sites have been radiocarbon dated, Sheikh Mustafa-1 and El Mahalab (nos. 13 & 26). Both are situated in a relative position that is roughly in accordance with their radiological dating: Sheikh Mustafa-1 between 7900 and 7600 bp, and El Mahalab between 7700 an 6900 bp (see table 2). (See Fernández, Jimeno and Menéndez 2003 for a detailed analysis of the pottery variation between both sites.) Unfortunately, we could not get a bigger sample of radiocarbon dates spanning the whole period covered by the seriated sites, which would contribute to a better checking of the proposed ordering.

However, further support for our hypothesis may be obtained from more traditional archaeological methods to get relative chronologies. Thus, there is a coincidence of our model and what is known from the excavation of the Mesolithic site of Saggai 1, where there is also a clear model of WL decreasing and RK increasing through time (Caneva 1983: 187-8). The same pattern was deduced in the only multi-stratified

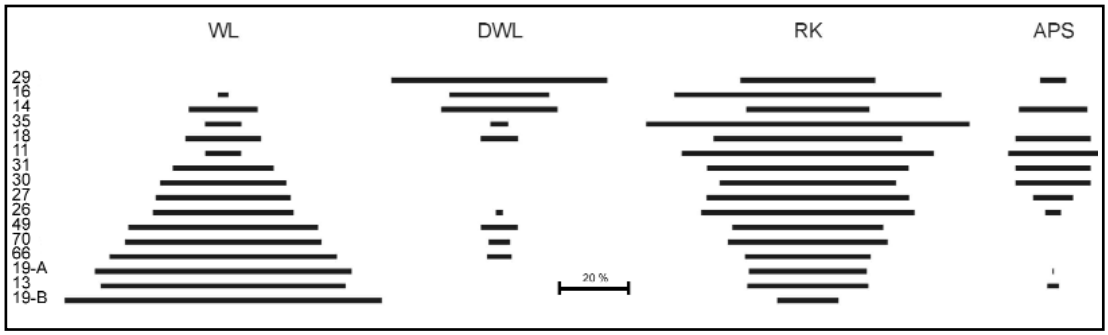

Figure 46.- Percentage variation of pottery decoration types in the Mesolithic sites from the Wadi Soba, Rabob and el Hasib survey, according to data in table 5 and diagram of Figure 45. The order is supposedly chronological, the earlier sites being at the lower and the younger at the upper part.

site excavated in central Sudan for this period, the Shaqadud cave (Caneva and Marks 1990). The division of the deep deposit at Shaqadud into artificial levels displays a pattern of gradual variation of the pottery decorations from bottom to top, which allowed its arbitrary division into four phases: the first with predominant WL and RK pottery, the second with predominant APS and RK, the third with predominant RK and DWL, and the fourth with different decorative types that date to the following, Neolithic period (Ibid.: 21, Fig. 2). The models only differ in both the greater preponderance of WL type -a specifically Nilotic decoration (Ibid.: 22)- and the earlier appearance of DWL in our sites.

Also the pattern detected at our sites looks very much like the model deduced from an analysis of the Mesolithic sites surveyed in the east bank of the Main Nile north of Khartoum (Saggai-Geili area) by the Italian project from Rome University (Caneva 1983, 1988; Garcea 1991). In order to compare the two areas using a similar method, we attempted a statistical seriation of the northern sites. The data on percentages of different decoration types in the sites were taken from Caneva (1983: 168) and Garcea (1991: 62-6), and are presented in table 6. After applying an MDSCAL program to these data we obtained a better-ordered list of SL-KH-SU-US-EA-AI-QA-KL-KU-ET, whose decoration types variation is seen in Figure 47.

Although the frequencies of WL in the northern sites are lower than in the Soba sites, it is easily observed that the same model of decreasing WL, increasing RK and, to a lesser extent, DWL is present here. Radiocarbon dates for the sites also confirm the chronological ordering:

SITE	WL	DWL	RK	APS	Total
Umm Singid (US)	28.9	0.6	57.6	12.9	349
Qala'a (QA)	9.7	2.4	87.8	0	41
El Ahamda (EA)	27.8	0	72.2	0	18
El Temeyim (ET)	1.9	0	98.1	0	411
Awlad el Iman (AI)	11.9	7.4	80.0	0	67
Kabashi-upper (KU)	0	8.1	91.9	0	111
Kabashi-lower (KL)	4	4.7	91.3	0	150
Kabashi Haitah (KH)	49.9	6.6	40.8	2.7	561
Saggai-upper (SU)	25.9	1.3	70.6	2.2	228 (1c)
Saggai-lower (SL)	77.0	0.9	20.3	1.8	217(5b)

Table 6.- Pottery decoration percentages in the Mesolithic sites investigated by the Italian team north of Khartoum (after Caneva 1983 and Garcea 1991).

SL (7410 ± 100), KH (7470 ± 90 bp), US (7240 ± 90), SU (7230 ± 100), AI (7750 ± 90), QA (6620 ± 90), KU (6150 ± 80) (Caneva 1988: 399-400). There is only one reversion of the sequence at Awlad el Iman (AI), easily explicable by the contamination and random problems of the method (Long and Rippeteau 1974; Fernández 1984a; see later for another possible explanation).

As to the variation in the WL amounts, among the northern sites only the lower levels of Saggai and Kabbashi Haitab have similar percentages to the Blue Nile sites, over 50% (Caneva 1983: 187; Garcea 1991: 66). Significantly, they also show very close radiocarbon dates (7450 ± 90 bp in Kabbashi Haitab and 7410 ± 100 for Saggai Lower) (Caneva 1988: 28). In principle, it could be assumed that our Karnus and Sheikh Mustafa-1 sites (13, 19-A, 19-B), with WL frequencies over 60%, are earlier than Saggai 1 and Kabbashi Haitab, and perhaps contemporary with

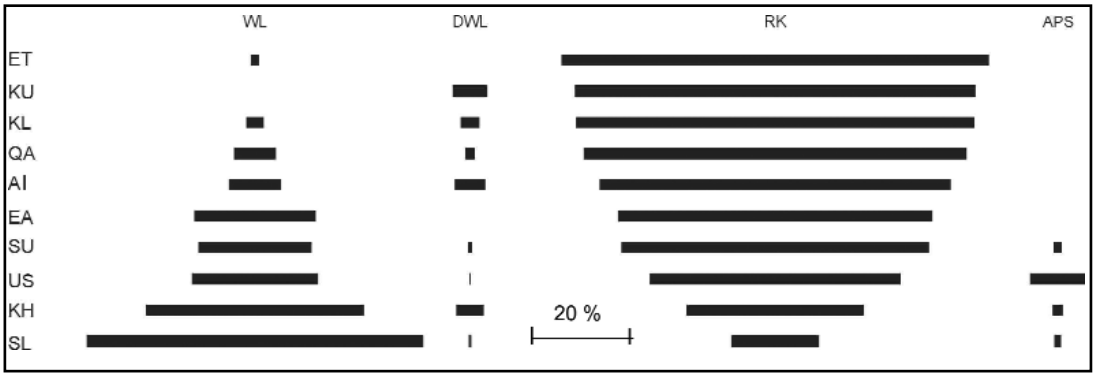

Figure 47.- Percentage variation of pottery decoration types in the Mesolithic sites from the Saggai-Geili region north of Khartoum, according to data in table 6. The order is presumably chronological, the earlier sites being at the lower and the younger at the upper part.

the Khartoum Hospital site, where the WL type is about 70% (Mohammed-Ali 1982: 76, 1985: 437).

The phase 2 at Shaqadud, with its high percentages of APS, appears to be underrepresented in the sites on the Main Nile. This presence occurs only in Umm Singid, with 13 % of APS (Garcea 1991: 62), and Sarurab 1, with 17% (Mohammed-Ali 1985: 438), both sites being younger than Kabbashi Haitab but widely separated in time (Umm Singid: 7240 ± 90, Caneva 1988: 28; Sarurab 1: 6407 ± 80, Mohammed-Ali 1982: 173). A different situation is seen on the sites at the Blue Nile reported here, where relatively high percentages of APS occur in a considerable number of sites, approaching 20 % and even 30 % in some sites (table 5). The position of these sites in the seriation ordering, approximately in the middle of the sequence after the group defined by WL and before the sites with more DWL (Figure 46), also corresponds with the recorded pattern at Shaqadud.

As regards Shaqadud phase 3, which is characterised by the extinction of WL and the appearance of DWL, the situation is less clear. In our seriation this type appears in the seemingly younger sites, in contrast with the WL pottery (Figure 46). The same is true for the sites on the Main Nile (Caneva 1988; Garcea 1991): Kabbashi's upper level, dated at a quite later date (6150 ± 80), has no WL, and its lower level has very little WL. El Qala'a also has a small frequency of WL and is also dated at a later period (6620 ± 90) (Figure 47).

DWL types, however, also appear in some ancient sites, as in the case of El Mahalab (no. 26), Kabbashi Haitab (near 7 %) as it has been already mentioned, and in Awlad el Iman, where, despite the existence of very little WL, a radiocarbon dating yielded a very early date (7750 ± 90) (although this site could have been disturbed, cf. Garcea 1991: 54). Also the Khartoum Chest Hospital must be mentioned in this group, with 7 % of DWL (Mohammed-Ali 1982: 76-7, 1985: 437) and very probably of an early date, as we saw previously. Perhaps also Sarurab 2 belongs to this group, with two surprisingly early dates (9370-9339 ± 110) and where the presence of DWL is mentioned, although in the dated levels only the WL type is referred (Khabir 1987: 378). The only site in our survey that correctly fits in the "DWL phase" (i.e. without WL) is no. 29, possibly a lithic workshop near the wadi riverbed.

The Mesolithic sites near Atbara, also in Central Sudan but further north from the Blue Nile area (Haaland 1987b, 1992a; Magid 1989; Haaland and Magid 1995), show a model that resembles and at the same time differs from the Khartoum area model. The sequence in the three excavated sites, Abu Darbein, el Damer and Aneibis, also shows a chronological model of decreasing WL (from 12 % to almost nil), increasing RK (from 48 % to 84 %), and increasing but not so clearly, in the case of DWL (15 - 5 - 34 - 14 %) (Haaland 1995: 113). As this area is far from the core of Central Sudan, the Khartoum area where WL pottery possibly originated and where its earliest dates are known, the abundance of this type is much lower. This great concentration of WL pottery type in Central Sudan contrasts with its almost total absence in the Saharan areas far from the Nile, its previous identification in those regions having been recently corrected in most cases as being actually DWL (Caneva and Marks 1990: 22; Garcea 1998).

At the same time, the presence of DWL in the Atbara sites at an early date (Abu Darbein between 7700 and 8640 bp; Aneibis area 4, where a 34 % of DWL was recorded, between 7470 and 8090 bp; cf. Haaland and Magid 1995: 49-50), is in accordance with the very early presence of the type in the Saharan areas. As it is well known, DWL, together with RK, is the earliest decoration type found at the "Mesolithic" sites in most of the Saharan region far from the Nile, with dates earlier than 9000 bp in some cases (e.g. Roset 1987 for Niger, cf. Garcea 1993 for a comprehensive review).

The presence of some early DWL pottery on the Nile makes the river data more similar to the Saharan model. This presence has been taken as evidence of contacts with Saharan hunter-gatherers that were pushed towards the Nile by the expanding first pastoralists, which eventually brought the pastoral economy to the river populations (Caneva 1988: 368-9, 2002: 232). But in this theory the contacts took place at a later date in the Mesolithic sequence, the DWL being "only rarely and atypically attested in the Nile Valley before about 6500 years ago" (Caneva 1991: 265). It seems that the irregular presence of DWL in the Blue Nile sites, but specially its abundance in the Atbara region, suggest the real

possibility that those contacts already existed from an earlier phase of the Mesolithic period.

Settlement patterns (Figure 48)

An analysis of the distribution of Mesolithic settlements first reveals their abundance and great variation in site extension. The phenomenon of alternating large and small sites is also found on the Main Nile (Caneva 1988: 337-43) and can be possibly explained by longer or shorter periods of occupation. As these sites are situated in similar areas, it is unlikely that they were subjected to different degrees of erosion.

In contrast to the pattern on the northern Main Nile, where sites seem to follow lines parallel and near the river, in the Blue Nile area an entire system of settlements exists at both banks of the Wadi Soba course for at least 25 kilometres inland (sites 42-45), and almost 50 km in Wadi Rabob and Wadi el Hag areas (sites 49, 54). The depths of archaeological deposits at the sites vary, and in many there is virtually no deposit at all, the material being concentrated over the surface sand sheet due to deflation processes. Nevertheless, archaeological sediments in the subsoil have been conserved partially intact in some sites: 60 cm in depth (no. 14), 30 cm (13), 25 cm (16), 25 cm (27), 15 cm (19-1) and 35 cm (19-2) (values from test-excavations). The spatial distribution itself is different, with the Wadi sites being farther apart (2.9 km on average) than those on the main river (1.6 km).

The seriation seen in the previous section suggests the existence of contemporary sites on the Wadi and on the river, and the analysis of the cultural remains provides some indications of functional differences between the settlements in the two areas. In the first place, a multivariate analysis (Principal Component and Correspondence Analysis) of the total frequencies of the various artefact types found on the surface systematic sampling and in the test-pits excavated at seven sites (nos. 13, 14, 16, 19-A, 19-B, 25, 26, see table 7) suggests a separation between the Wadi and river sites (Figure 49).

The two sites in the Wadi, Arrehana and El Mahalab (no. 25 and 26), appear clearly separat-

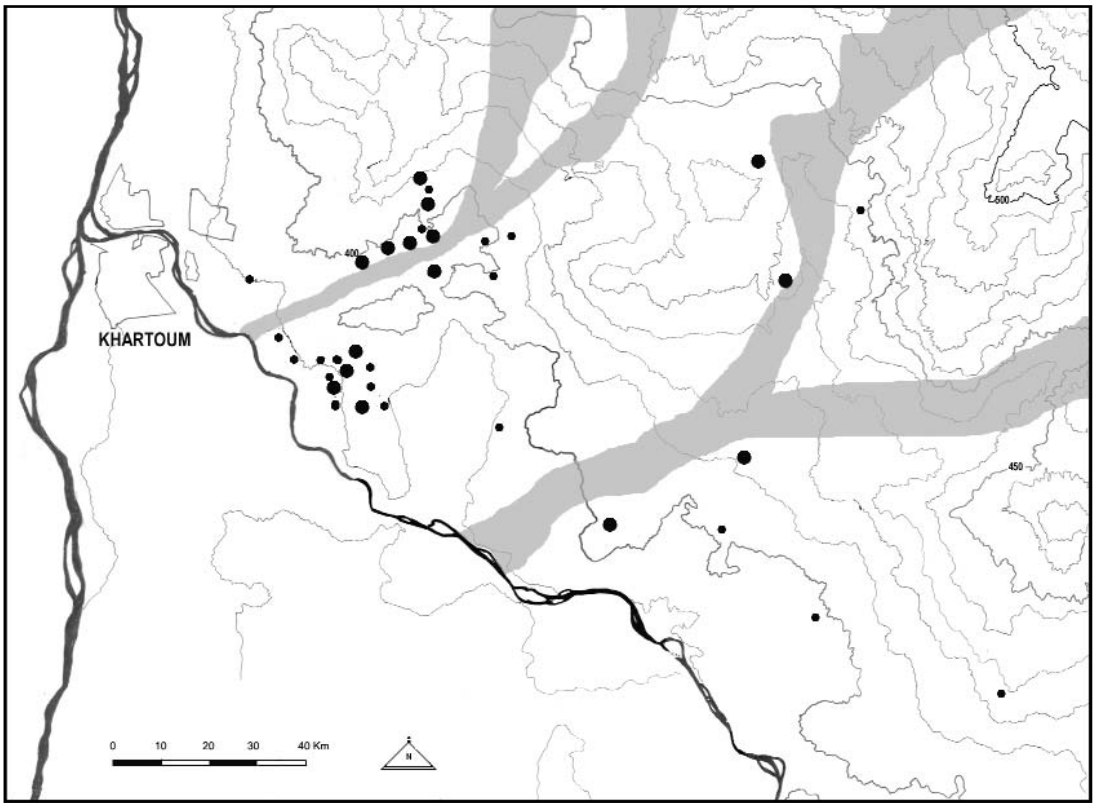

Figure 48.- Distribution of Mesolithic sites in the Wadi Soba-Rabob-el Hag-el Hasib area; bigger and smaller dots indicate larger and smaller sites.

Site (No.)	F1	F2	F3	BL	CO	LU	ES	DE	TU	NO	BP	TR	BU	RF	NQ	GR	PO
Karnus-1 (19-A)	402	314	473	12	84	20	00	00	00	01	00	00	00	00	02	39	129
Karnus-1 (19-B)	477	435	378	26	136	28	00	03	01	01	11	01	00	03	15	79	320
El Mahalab (26)	214	217	339	17	44	08	04	02	08	05	04	00	00	07	11	15	41
S.Mustafa-1 (13)	468	408	686	20	105	28	00	01	01	02	14	00	02	02	15	45	244
S.Mustafa-4 (16)	200	132	106	07	34	08	00	00	01	00	04	02	00	01	04	22	70
S.Mustafa-2 (14)	291	277	320	03	91	15	01	00	03	01	01	02	00	02	01	46	138
Arrehana (25)	68	68	62	06	20	04	01	04	02	02	02	00	03	12	03	03	04

Table 7.- Cultural type frequencies in the systematic surface survey and test-pits at seven Mesolithic sites of the Wadi Soba area. Legend: F1, F2, F3: primary, secondary and tertiary flakes. BL: bladelets. CO: cores. LU: lunates. ES: end scrapers. DE: denticulates. TU: truncations. NO: notches. BP: backed points. TR: triangles. BU: burins. RF: retouched flakes. NQ: non-quartz flakes. GR: stone grinders and rings. PO: pottery sherds.

ed at the upper left corner in the sites plot on the two first principal components. They have fewer grinders and pottery than the river sites, for example in Arrehana only four decorated sherds were found. In the case of lithic tools there is a greater variety at the Wadi sites, with a larger proportion of retouched flakes, end scrapers, notches, denticulates, burins and truncations. Furthermore, the Nile sites have more pottery and grinders, and a proportionately greater number of points, lunates, cores and unretouched flakes. Even the river sites can be divided in two groups according to the analysis output. In the younger sites, especially nos. 14 and 16, there are more grinders, pottery and lunates than in the earlier ones (13 and 19-1B), that appear in the plot closer to earlier types as backed points. As regards the lithic tools, the whole model could also be interpreted as specifically chronological, the sites in the Wadi appearing in general more ancient than the river ones. This difference could be attributed to the climatic deterioration that took place towards the end of the Mesolithic period, with arid intervals at c. 7300-7100, 6600-6550 bp (see section 1). In the chronological ordering of Figures 45-46, though the Wadi and river sites are intermingled along the sequence, four of the last six sites (11-18-16-14) are situated near the Blue Nile river.

In the settlements near the river, grinders were probably associated with vegetal processing (Magid 1989: 144-53; Haaland 1987a: 78-83), and pottery was related to the preparation of vegetables and fish (Caneva 1983: 263; Haaland 1992b: 48). The analysis of vegetal impressions on the pottery sherds from Sheikh Mustafa-1 and El Mahalab (see Magid 2003: table 1) suggests that food-plants exploitation was an important economic activity at both settlements. The activity included gathering of immediately eaten edible fruits and harvesting of plants that required processing and preparation before being served as food (e.g. seeds/grains of wild cereals and grasses). In the extensive excavations at Sheikh Mustafa-1 site near the Nile (see Fernández, Jimeno and Menéndez 2003) we

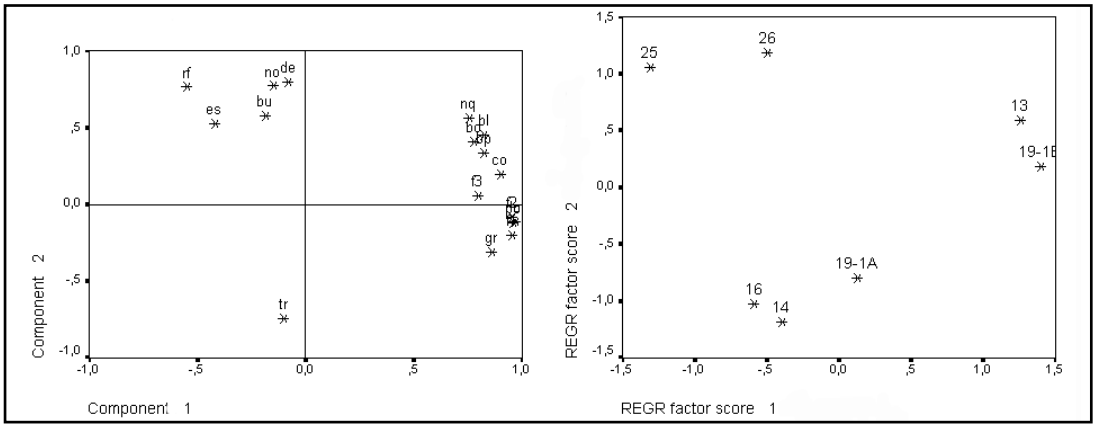

Figure 49.- Principal Component Analysis of surface type frequencies for the seven Mesolithic sites of table 7 (SPSS program).

recorded quite a big number of curved backed points in quartz that have been interpreted in Palaeolithic and Mesolithic sites elsewhere as fish hooks, and a few possible "net-sinkers" made out of pottery sherds (cf. Haaland 1992b: Fig 3) that could have been used to fish in the Nile waters. This could have been made using boats in deep waters (Peters 1991), so that fishing would have been possible throughout the year and not just during the wet season. Evidence of fishing is attested by the faunal analysis of the bone remains in the Sheikh Mustafa-1 and El Mahalab sites, yet in the former site the activity took place only in the low waters during the dry season (see Chaix 2003: tables 2 & 6).

Points and lunates (Haaland 1987a: 73-6; Magid 1989: 135-42) provide some indication of hunting. All this suggests a broad-spectrum subsistence economy, which is also suggested by the faunal data and has been attested for other sites close to the Nile, such as Saggai 1 (Caneva 1983: 265). In contrast, the Wadi sites offer a different image of functional especialization, perhaps exclusively hunting (some of the lithic tools most abundant there -end scrapers, denticulates- are associated with skin treatment; Haaland 1987a: 69-73), carried out during the rainy season (Clark 1984: 116). The abundance of mammal bones and scarcity of fish bones in El Mahalab (see Chaix 2003: table 2), is in accordance with the foregoing interpretation.

Both in the wadi and the main river there are sites of big and small size (Figure 48). The sites with significant surface remains were measured along to approximately perpendicular axes (see gazetteer and table 8), and the site size was computed by multiplying the two measures. In Figure 50 a fairly even distribution is observed for the number of sites with different sizes. The most abundant size category is between 12.500 and 17.500 m^2, with 7 sites. The bigger settlement is no. 29 in the Wadi Soba area, with 3 hectares of surface artefact distribution. This variation could be due to differences in the post-depositional disturbances affecting the sites, but these could not be very dissimilar in the different zones of the same area. Furthermore, the size diversities may be considered roughly proportional to the human group size (Hassan 1981) or to the duration of the settlement occupation. Both variables have worked simultaneously, because of their shared relationship to the climatic conditions of the area. Possibly in much the same way that the Nuer populations used to move over the country when they were studied by Evans-Pritchard (1940), in a geographical and climatic setting in Southern Sudan like the one that we can infer for the Central Sudan between 8000 and 7000 year ago, so the Mesolithic populations could have split their groups during the dry season and move from one to another area to optimise the exploitation of diminishing water resources. Applying this

Site no.	Area (m^2)
11	15600
12	2500
13	15600
14	21000
16	12000
18	9900
19-A	15000
19-B	17000
21	4000
25	5600
26	13200
27	18000
29	30000
30	5600
31	13000
35	16000
90	10000

Table 8.- Areas of surface artefact distribution at the main Mesolithic sites.

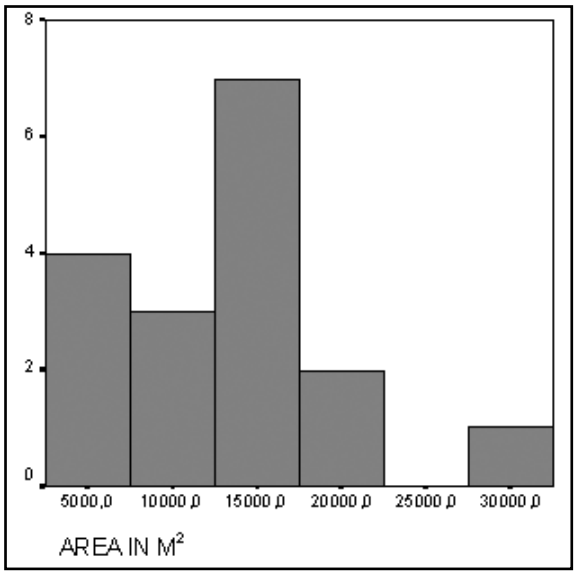

Figure 50.- Histogram for the sizes of 17 Mesolithic sites in the Blue Nile region.

model, the remains of the smaller sites would have been deposited during the dry season (*camps*), while the bigger ones would have been formed at the end of that same period when the water resorts were concentrated on a few places. The larger settlements could similarly correspond to the rainy season (*villages*), when people had to concentrate on the elevated places to avoid floods inundating most of the plains. Even though the economic system during the Mesolithic period was very different to the Nuer system based on animal herding, both societies had a strong fishing component and the Mesolithic hunters would have looked for green prairies to found their prey, just like the Nuer were in search of good pasture for their herds.

One fact supporting the previous model is that the smaller sites, including those not represented in Figure 50 since their surface distribution area was not measured during the survey, are more abundant near the Blue Nile than in the wadi area (Figure 48). Those small sites are nos. 2, 12, 15, 17, 20, 21, 43, 70, 68, 69, 71, 72 in the river area, while in the wadi area we found only three sites of the same kind, nos. 28, 32, 54. The smaller settlements near the river could correspond to the camps of the beginning of the dry season, the bigger ones in the same area to the bigger camps at the end of the same season, and the bigger ones in the wadis could have been the villages used during the flooding season when the alluvial plain near the Blue Nile was wholly inundated.

7. The Neolithic sites

Introduction

The occupation model is radically different during the following, Neolithic period. In agreement with the results of the survey along the main Nile (Caneva 1988), the number of sites in the Blue Nile also decreases abruptly, more so than one would expect due to the shorter duration of the Neolithic period. Interestingly, the percentages of sites belonging to the different periods during the Holocene -Mesolithic, Early and Late Neolithic- that we found in our survey are very similar to those of the Main Nile investigation (Caneva 1988: 334) (Table 9). Apart from the probable demographic contraction that that decrease suggests, the distribution of sites is also different. The population moved away from the main river, and the bigger sites of this period (Sheikh el Amin for the Early Neolithic and Rabob for the Late Neolithic period) are situated many kilometres far inland in Wadi Soba and Wadi Rabob. Along the Nile watercourse where the majority of settlements had been previously concentrated, only two small and much eroded sites were found in our survey (Hag Yusuf and Soba). Their position at the mouth of Wadi Soba, an area where there are very few Mesolithic sites known, suggests that the wadi probably was almost dry during the Neolithic or flowed at a lower level than in earlier times.

SURVEY	Mesolithic	Early Neolithic	Late Neolithic
Main Nile	81.5 %	11.1 %	7.4 %
Blue Nile	82.5 %	7.5 %	10.0 %

Table 9.- Percentages of sites discovered for each cultural period in the Main Nile north of Khartoum and in the Blue Nile south-east of Khartoum.

This decrease in the number of sites is not paralleled in other areas along the Nile. In the Dongola Reach, the survey made by the French Unit (Reinold 2001: 5) recorded 7 Mesolithic sites (17.5 %) and 33 Neolithic sites (82.5 %): the percentages show a model, which is just the opposite of the Khartoum pattern. A similar image was obtained in the survey made by the Sudan Archaeological Research Society immediately south of the French concession, to the point that no Mesolithic wavy line neither dotted wavy line pottery was found (Welsby 2001: 569).

A total of seven Neolithic sites were discovered in the Wadi Soba, Rabob, el Hag and el Hasib areas. Three are related to the Early Neolithic period (Shaheinab phase): nos. 1, 36, 62. The other four belong to the Late Neolithic horizon: nos. 5, 6, 50, 67. Another Early Neolithic or, better, transitional site (no. 93) and two Late Neolithic sites (nos. 88, 89) were also recorded in the Gezira area west of the Blue Nile. Large scale excavations were undertaken in the biggest Early Neolithic discovered, Sheikh el Amin (no. 36, see Fernández, Jimeno and Menéndez 2003), and test-pits were also excavated in Rabob (no. 50, see description of results in section 2), which is the biggest Late Neolithic site recorded in the survey. As no spatial analysis of surface finds was undertaken at any of these sites, only the results on the ceramic seriation and settlement patterns will be presented here.

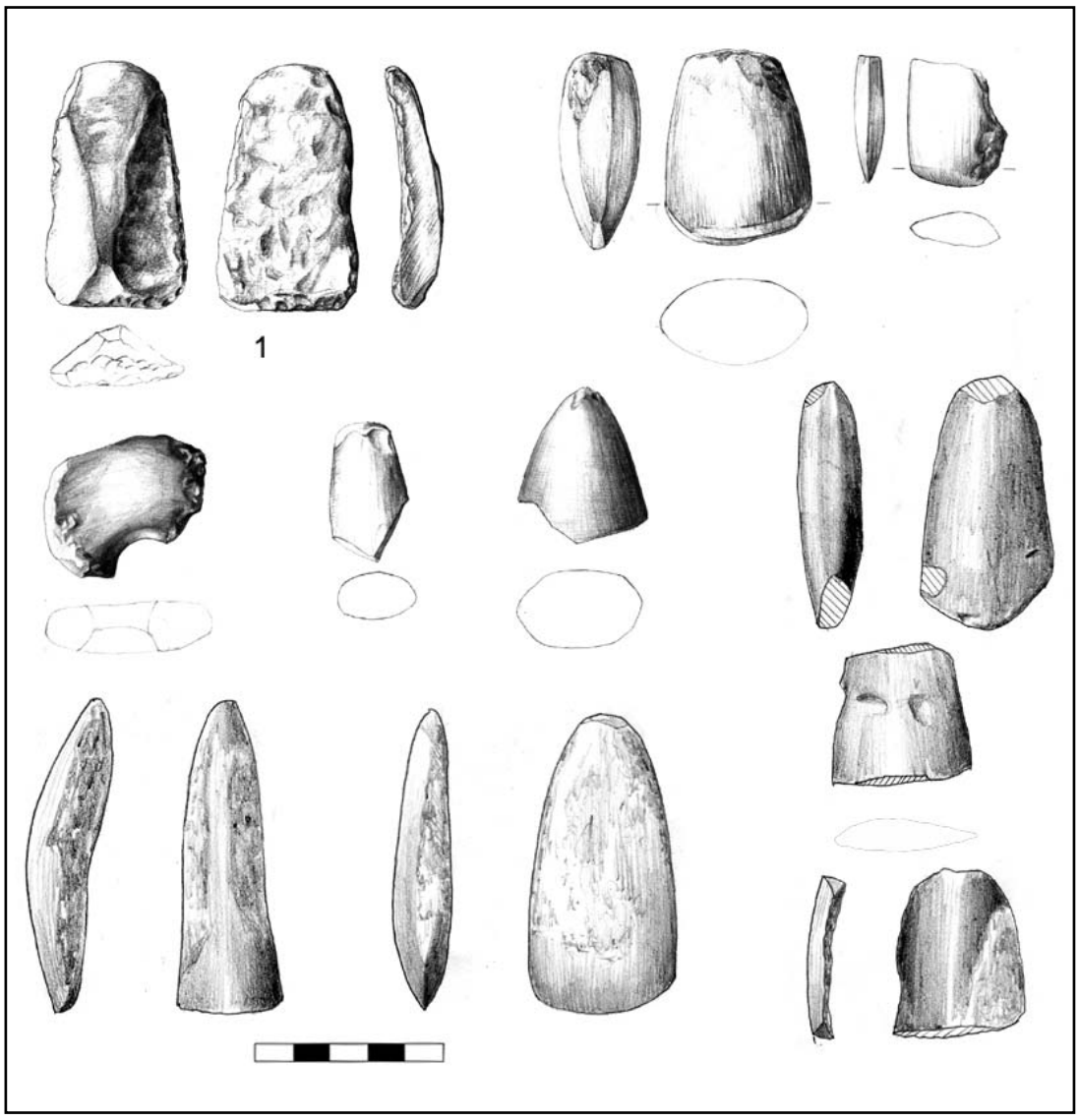

Figure 51.- Neolithic polished axes, celts and rubbers in green stone and mace-head in porphyry (4) from the survey. All from site no. 50 (Rabob) except no. 8 (site no. 67, Wad el Amin) and no. 9 (site no. 55, Salamat Wad Nail). Scale in cm.

As to the finds, a selection of polished lithic implements from the surveyed Neolithic sites can be seen in Figure 51. Some of the stone rings represented in Figure 41 also come from Early and Late Neolithic sites. One of the biggest rings found in the survey (Fig. 41: 7) was found on the site no. 62, Bir El Lahamda, dated to the Early Neolithic phase. These kind of big stone rings probably were used as weights for digging sticks in plant gathering activities (see Magid 2003). The function of the three small perforated stones from the Late Neolithic site of Rabob (Fig. 41: 1, 2, 8) is harder to ascertain, but some of their non-functional shapes (squared, oval) point to their possible use as stone-headed clubs as recently used in the Nuba mountains (Arkell 1949a: 63). They are also probably connected to the Predynastic and Shaheinab Neolithic disk mace-heads (Ibid.: 64), such as the broken one found on the surface of the same site (Figure 51: 4). The presence of stone rings in Early Neolithic and especially in Late Neolithic sites is a very singular fact, since these pieces have been considered characteristic of the earlier, Mesolithic period. But the record has not been made here for the first time, since they were also found in one of the few Late Neolithic sites known so far, El Kenger (Caneva and Gautier 1994: 76).

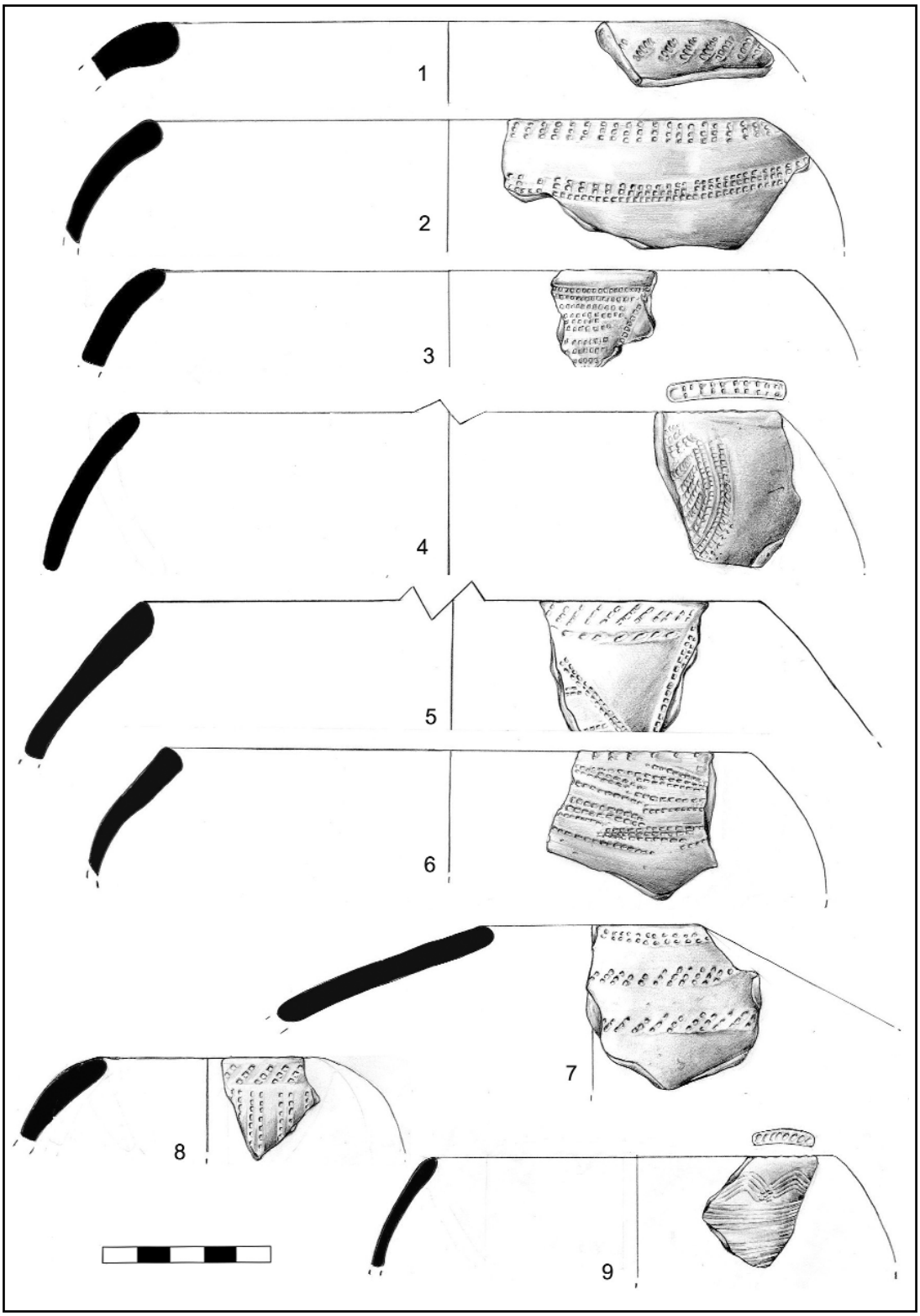

Figure 52.- Simple zoned impressed and incised (9) sherds from Early and Late Neolithic sites in the survey: Rabob, site no. 50 (5,8), Bir El Lahamda, no. 62 (6), Wad el Amin, no. 67 (1, 2, 7), Qoz Bakhit, no. 89 (4), Bashaqra Gharb, no. 93 (3, 9). Scale in cm.

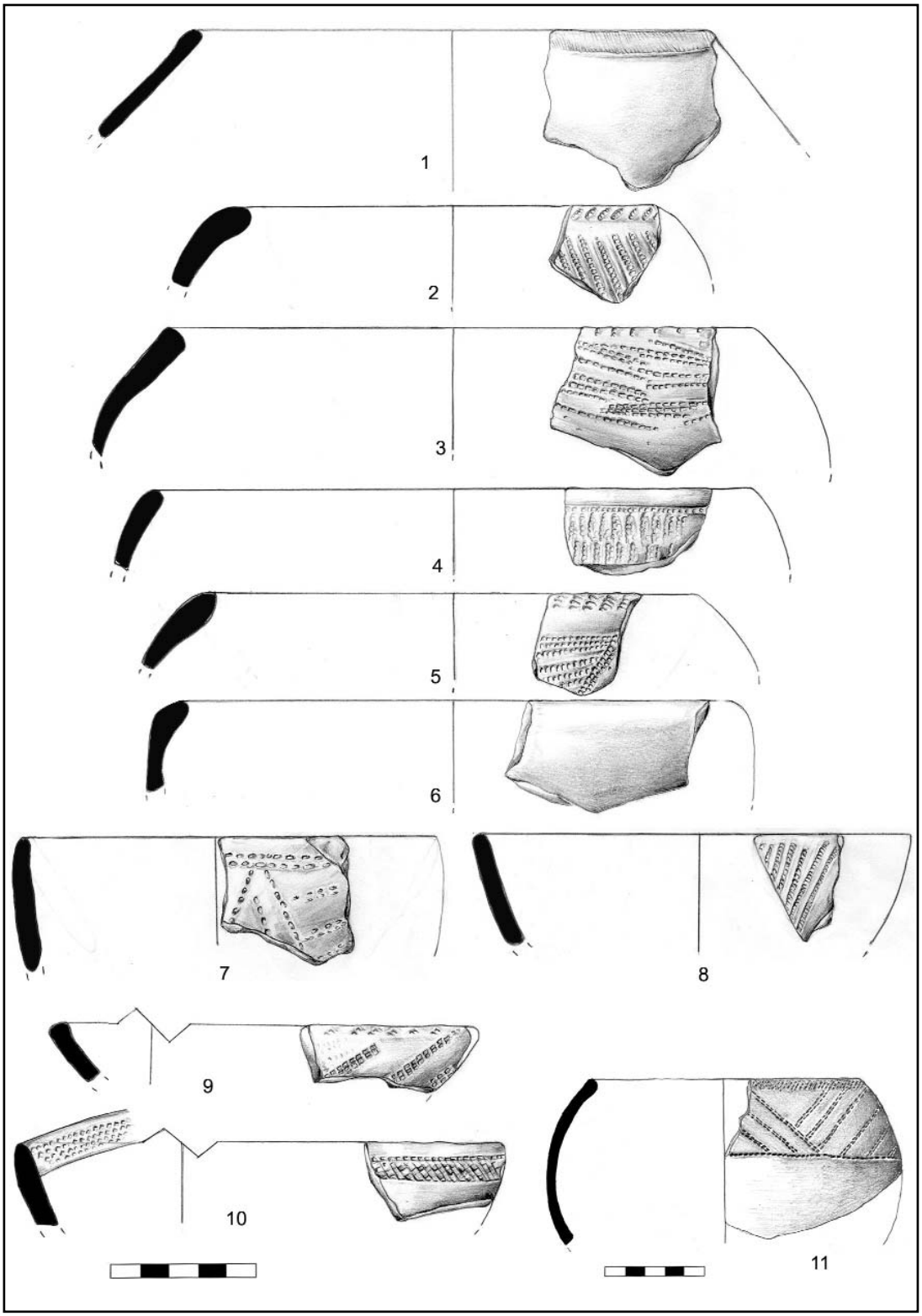

Figure 53.- Simple zoned impressed, incised (1) and plain (6) sherds from Early and Late Neolithic sites in the survey: Rabob, site no. 50 (1, 6, 9), Bir El Lahamda, no. 62 (3), Wad el Amin, no. 67 (5), Qoz Bakhit, no. 89 (7, 10), Wad Sheneina, no. 90 (11), Bashaqra Gharb, no. 93 (2, 4, 8). Scale in cm.

The pottery recorded from the Neolithic sites belongs to two groups. One is the well-known Shaheinab pottery from Early Neolithic sites, which include polished surface vessels with different decoration types. These are the rocker impression or alternately pivoting stamp comb impression covering most or all the outer surface; concentric incised lines also in all the vessel exterior; black topped with dark triangles on the rims; ripple undulated surfaces, etc. (Arkell 1953: 68-77; Chlodnicki 1984; 1987; Reinold 2002). Sherds with those decoration types were found during the survey at all the mentioned Neolithic sites, and their respective abundance is indicated in the sites gazetteer. As a much larger number of sherds from that period, however, came to light in the excavation of the Sheikh el Amin site (see Fernández, Jimeno and Menéndez 2003), we will not treat them in detail here.

The second group of pottery sherds, though present in small numbers in the Early Neolithic sites, is considered typical of the Late Neolithic ones. The decoration techniques that were predominant in this period are zoned simple impression and incision. Simple impression appears now for the first time in the Sudanese cultural history and because of its originality and abundance it deserves some comments here. In Figures 52 (1-8) and 53 (2-5, 7-11) the drawings of the most representative rim sherds with this decoration found in the survey are presented. Figure 54 (nos. 1-24) shows examples of the different decoration patterns made with this technique. The sherds come from sites both in the Western Butana and in the Gezira, yet they seem to be more abundant in the former area. The great majority of the vessel forms are simple globular restricted forms (Figures 52-53), with a few examples of open unrestricted bowls (Fig. 53: 7-10). The outer surfaces are very well smoothed almost approaching the burnishing in some cases, while the inner are smoothed or sometimes scraped. The fabric is of a good quality, harder than in the Mesolithic and even the Early Neolithic times. Temper is mostly of mineral nature, including the same elements (quartz and some mica), yet not so abundant and of smaller size, than in the Mesolithic pottery in this report, with some vegetal temper added.

The decoration types are varied, as few motifs are repeated in the recovered sherds. In Figure 54 examples are shown of triangular designs (Fig. 54: 1-4), curvilinear (5-7), rectangular with oblique lines inside parallel ones (8-10), crossing lines (11), parallel or angular double or triple lines (12-18; no. 16 is the same as in Figure 53: 11), short parallel lines (19-20), oblique lines inside parallel incised ones (21-22), irregular impressions of a short (23) or longer comb (24). The same motifs can be seen in the drawn sherd-rims of Figures 52 and 53 with some cases of complex designs as Fig. 52: 5 or 53: 7.

Since little material has been published so far, comparing this pottery type with other wares known from Central Sudan is not easy task. Some cases of linear, triangular and rectangular designs have been presented from El Kenger East (Caneva and Gautier 1994: pl. V; Caneva 1988: 336) and Geili (Ibid.: 103). Parallels also exist with the pottery of the Gash Group of the Southern Atbai area in the Eastern Butana, with frequent scraped surfaces and simple impression patterns near the rims (Sadr 1990: Fig. 5; Sadr 1991: Figs. 3.11). Yet the survey did not yield significant amounts of cross-hatching incised pottery such as that of the Atbai Mokram Group (Ibid.: Fig. 3: 14), which has been recently recorded in some tumuli of the northern Khartoum province (dated to 3220 bp) and could be the result of an influence or migration from the Pan-Grave people of Northern and/or Eastern Sudan (Caneva 2002).

The closest similarities of our pottery is to be found south of the research area, especially in the well known site of Jebel Moya (Addison 1949), whose earlier levels have been dated to 4200 $\pm$ 80 bp (Clark and Stemler 1975: 589). This site is characterised by the abundance of simple impressed pottery, many of whose sherds bear decoration patterns similar to ours (Addison 1949: pls. 95-97). The Late Neolithic sites of Rabak and Jebel Tomat in the Gezira area also yielded some pottery of the same kind (Haaland 1987a: 45-7, 56). Another type of pottery embellishment that seems to be distinctive of this period in our area and more southern zones is the impression and/or incision of thick rims from big vessels, such as they have been recovered at Jebel Moya (Addison 1949: pl. 89: A.4, A.10, pl. 90: H.10, H.11, pl. 91: J.5, K.4, K.5, L.13, M.1, M.2). A few sherds of this kind were recorded in our survey, for instance in Wad el Amin (no. 67; Fig. 55: 13, 14) in the Blue Nile area, or Qoz Bakhit in the Gezira (nos. 89; Fig. 55: 10). They

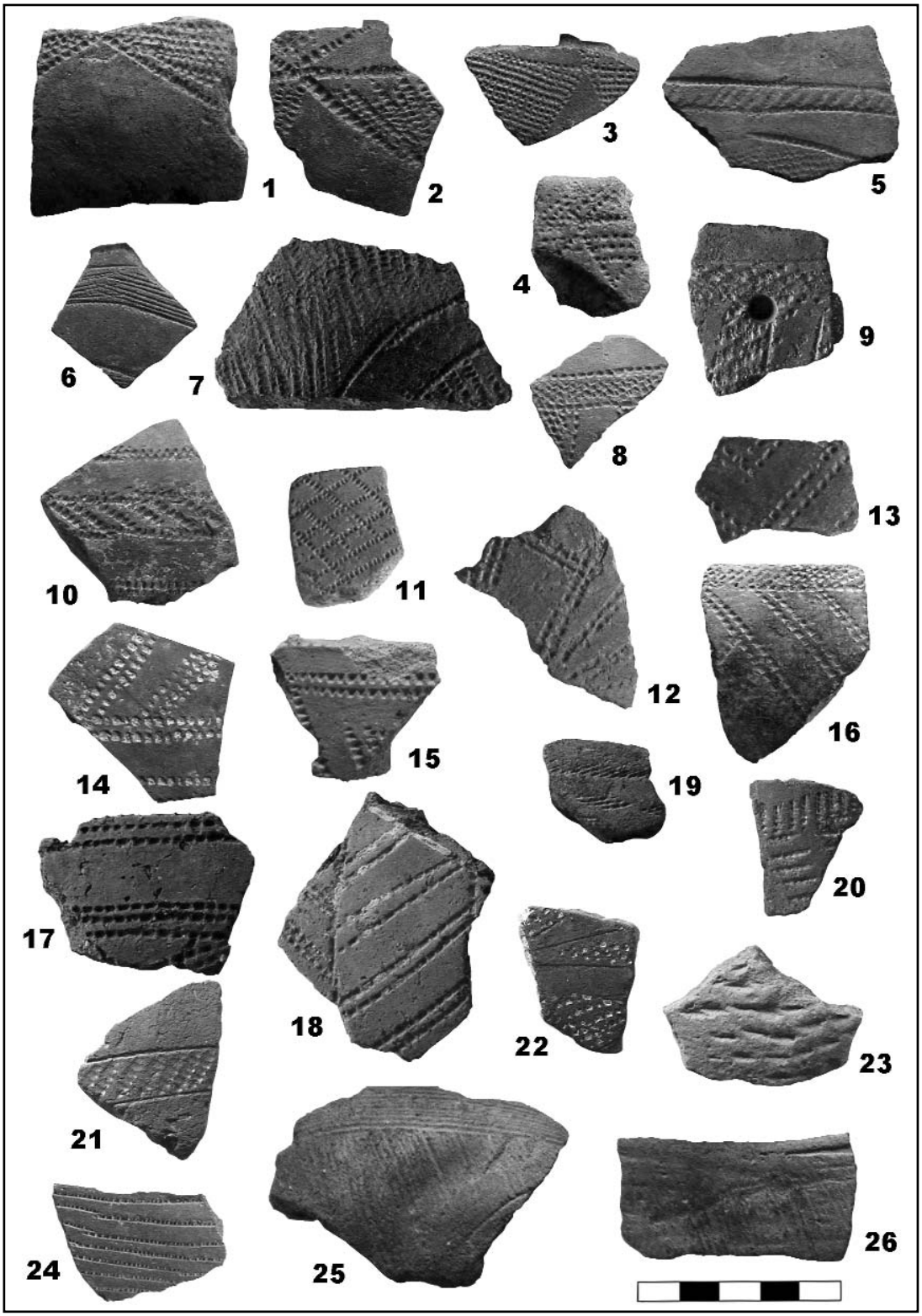

Figure 54.- Simple impressed (1-24) and scraped (25-26) pottery sherds from the survey. Nos. 6, 11, 13, 18, 24 (site no. 50), 1, 2, 10, 12, 15, 17 (no. 67), 8 (no. 71), 5 (no. 88), 9, 14, 19, 20, 21, 22 (no. 89), 7, 16, 25, 26 (no. 90), 3 (no. 93), 23 (no. 94, Jebel Qeili), 4 (no. 95, Jebel Moya). Scale in cm.

are outstandingly similar to those that we photographed from the site of Jebel Moya itself (Fig. 55: 11-12, 15-21). This type of decorated rims is different to that characteristic of earlier Neolithic sites, sometimes also thickened but typically much finer in size and with decoration

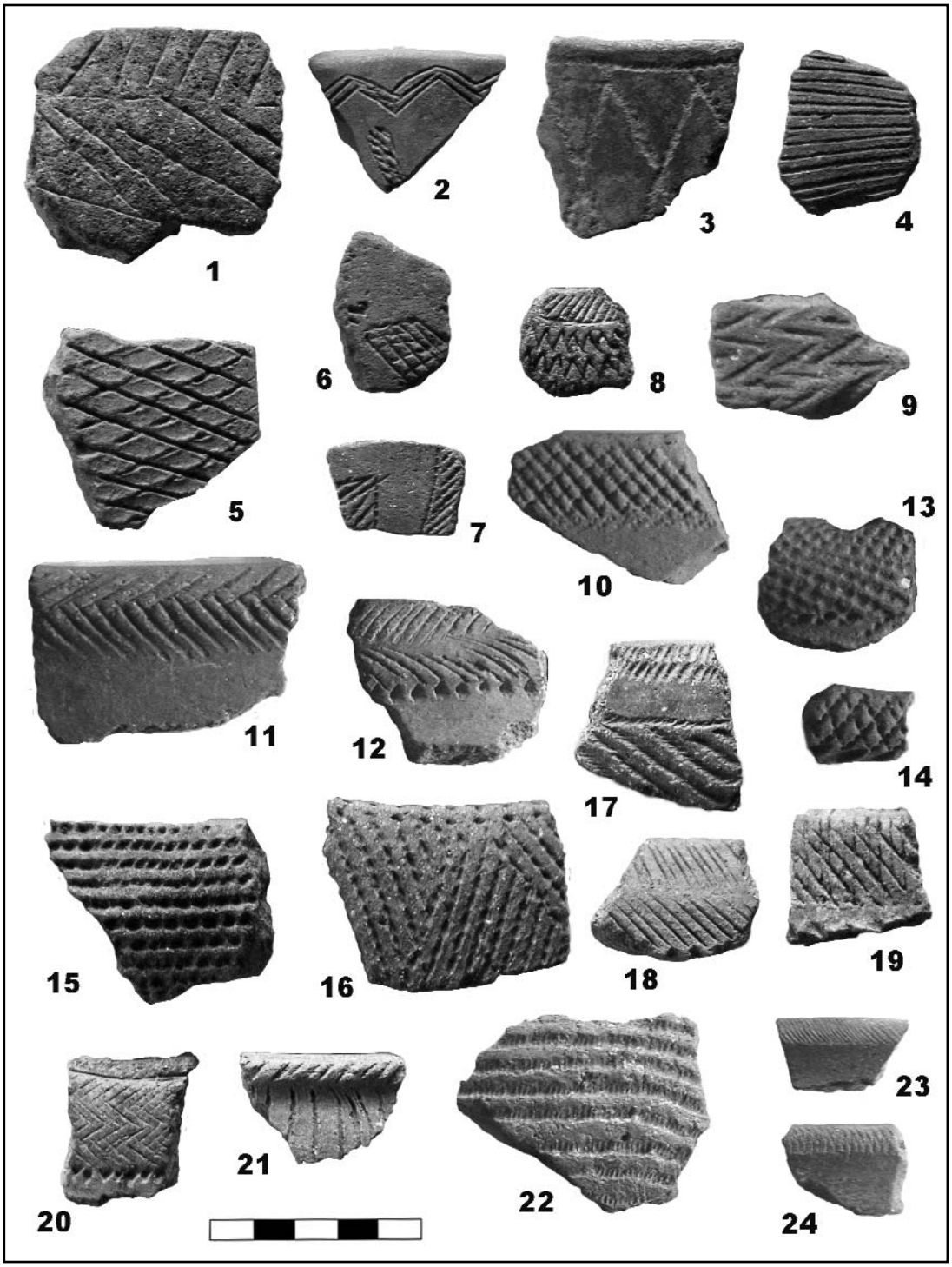

Figure 55.- Incised pottery sherds (1-9), thick decorated rims (10-21, 23-24) and corded sherd (22). Nos. 23, 24 (site no. 50), 13, 14 (no. 67), 5, 9, 10 (no. 89), 2, 22 (no. 90), 1 (no. 94, Jebel Qeili), 3, 4, 6, 7, 8, 11, 12, 15-21 (no. 95, Jebel Moya). Scale in cm.

of plain rocker or minute incised lines (Fig. 53: 1; Fig. 55: 23-4).

Ceramic seriation

As the field work progressed, it became clear to us that the pottery sherds recovered from the surface at the different Neolithic sites did not present a two-phase model (Early-Late) with a clear-cut separation, but instead a gradual variation of decoration categories. These ranged from the typical Early Neolithic types (especially rocker impression) to those which are characteristic of the final phases, especially simple impression and incision (Figures 52-55). This turn from one to another so a different decoration technique is really striking. The first technique is based on impressions on the fresh clay of the vessels using a system of continuous pivoting of the (usually denticulated) comb between one and the following impression. This means alternative turning of the comb a bit around its two ends, the final result being zigzag lines, more or less packed against each other (the "packed" or "spaced" zigzag types of Caneva 1988: 83), that usually cover all the outer space of the vessel. The second technique is radically different: the comb has to be completely lifted from the surface between one impression and the next one. This results in a pattern of more detached lines, this effect being usually reinforced by letting a surface area free from decoration (a choice not so easy to apply, and actually very seldom chosen, with the first technique) (Figures 52-54).

As shown on table 10, a ceramic seriation was made with the percentages of sherds with different decoration types found in eight surveyed and/or excavated sites: Hag Yusuf (no. 1), Sheikh el Amin (36), Rabob (50), Bir el Lahamda (62), Wad el Amin (67), Qoz Kabaro (88), Qoz Bakhit (89) and Bashaqra Garb (93). The first five sites are located at the east bank of the Blue Nile river, in the areas of Khartoum, Wadi Soba, Wadi Rabob and Wadi Hasib. The last three are found on the west bank in the Gezira region. The scarcity of data obliges us to overrule one of the principles of archaeological seriation, which prescribes that sites must come from the same cultural region (Rouse 1967: 178-9).

Following the same method than in the Mesolithic sites (see section 6), a multivariate analysis using a MDSCAL program for PC computer (ATD, Foucart 1982) yields a "better" ordering of sites according to a model of gradual variation of decoration percentages between the sites. The order is Bir el Lahamda, Hag Yusuf, Sheikh el Amin, Rabob, Bashaqra Garb, Qoz Kabaro, Qoz Bakhit, Wad el Amin. The small number of sites to be ordered and the presence of only two quantitatively important types (RK and SIMP) would permit to carry out the analysis manually, simply ordering by decreasing RK and increasing SIMP, or vice versa. The model of gradual variation is shown in Figure 56.

A constant decrease in the rocker impression technique is recorded in the model, what is presumably chronological. Contrary to that pattern is the also continuous increase in the other technique of making impressed patterns namely the simple impression. Alternatively pivoting stamp, a technique very similar and with the same principle of the rocker impression, also decreases

SITE	RK	SIMP	APS	INC	BT	RIP	DWL	TOTAL
1 (Hag Yusuf)	79.6	0.3	12.8	6.9	0.4	0	0	1833*
36 (S. el Amin)	74.8	0	1.7	22.4	0.2	0	0.8	28830*
50 (Rabob)	61.5	12.4	12.8	8.4	0.4	4.4	0	226
62 (Bir el Lahamda)	89.6	2.3	3.4	3.4	0	0	1.1	90
67 (Wad el Amin)	24	75.9	0	0	0	0	0	79
88 (Qoz Kabaro)	38.9	50	0	11.1	0	0	0	18
89 (Qoz Bakhit)	16.4	67.1	1.5	14.9	0	0	0	67
93 (Bashaqra Garb)	59	23.1	5.1	10.3	0	2.6	0	39

Table 10.- Percentages of pottery decoration types in the surface or excavated samples from Neolithic sites. Legend: RK: Rocker impression (including packed and spaced zigzag, even and unevenly serrated edge, and plainedge types; variation of these subtypes seems erratic in the seriation); SIMP: Simple impression; APS: Alternatively Pivoting Stamp; INC: Incision; BT: Black Topped; RIP: Ripple ware; DWL: Dotted Wavy Line. (*) Data from excavation has been taken for sites nos. 1 and 36.

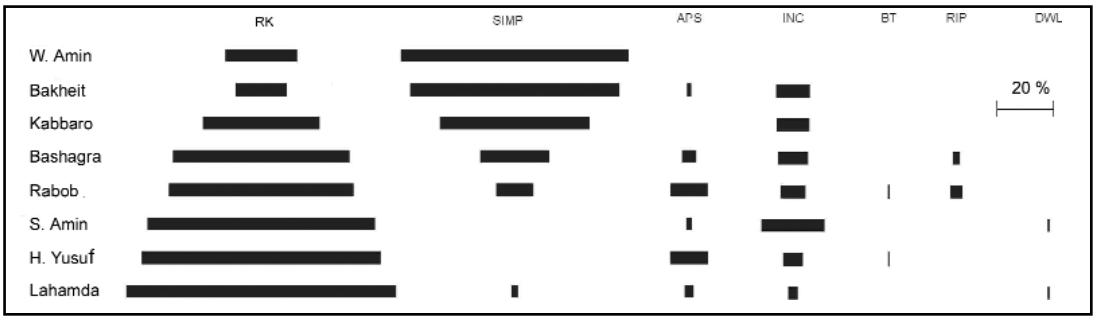

Figure 56.- Seriation of pottery decoration types percentages in the Neolithic sites surveyed in the Blue Nile area, according to data in table 10. The order is presumably chronological, the earlier sites being at the lower and the younger at the upper part.

with the passing of time. Incision, a cultural mark for Late Neolithic times, increases yet with a not so clear pattern. The less frequent decoration types, such as black topped and ripple undulated surface, do not show a distinct model, probably due to their small numbers. Dotted wavy line sherds only occur at the beginning of the sequence, which is in accordance with their cultural provenance from Mesolithic times. The results of the seriation analysis indicate that the border between both phases is indistinguishable or either does not exist. Considerations of a different kind, such as the settlement analysis that comes in the next section below, could make it easier to understand the behavioural and social changes that took place in the Sudanese Sahel during the Middle Holocene.

A related model of increase in simple impression decoration was also detected in the two Neolithic sites excavated by the Italian team in El Kenger, North of Khartoum. El Kenger Middle had 12.5 % of sherds with this kind of decoration and was radiocarbon dated to 5620 ± 80 bp (level 3 of sounding 1, another date from a surface shell gave a younger, if questionable, date: 5080 ± 70 bp). El Kenger East had 65.6 % of simple impressed sherds and was dated to 5290 ± 80 bp (Caneva and Gautier 1994: 68, 70). Other evidence for pottery variation in the Wadi el Kenger sites does not match our model, however. For instance the incised sherds decrease instead of increasing over time as in the case of the Blue Nile sites. Only the APS technique, much more abundant, shows a decreasing pattern as in our sites. The radiocarbon dates are also unexpectedly early when interpreted in terms of the high frequency of simple impression patterns, as the excavators clearly admit in the publication (Ibidem: 72).

Only three samples were successfully radiocarbon-dated from the Neolithic sites of our survey (another two from Hag Yusuf were not useful for they came from a more recent Christian context, cf. Fernández *et al*. 1989: 264). One shell sample from sector B of Sheikh el Amin yielded a date of 5555 ± 60 bp (T-10950, Trondheim laboratory), and a Nile oyster shell from the site of Rabob produced a date of 4670 ± 50 bp (Ua-19741 at Uppsala laboratory using AMS technique). Hence the order of the two sites in the seriation seems to be correct, if only too much separated in time (885 years) for being so close in the seriation (see Figure 56). Another oyster shell sample from Sheikh el Amin was later analysed using the AMS method at Uppsala laboratory. It came from the open area excavation in sector J, probably the only part of the site that could be considered of a younger date than the rest, all of it very homogeneous. The date (4590 ± 45 bp; Ua-20415) is, however, surprisingly young when compared with that from sector B of the same site. Its proximity to the Rabob date, however, is in accordance with the similarity of pottery type frequencies at both sites.

During the fieldwork we made a cultural classification of the sites on the basis of the pottery types observed on the surface. With one single exception, this preliminary labelling was not changed and so it appears in the gazetteer of section 2 of this paper. Curiously enough, we classified as "Early Neolithic (Shaheinab)" the first three sites of the seriated list (Lahamda, Hag Yusuf, S. Amin) and the fifth one (Bashagra), and we put the "Late Neolithic" label to the fourth (Rabob) and the last three sites (Kabaro, Bakhit, W. Amin). A probable explanation for the "error" in the two wrongly classified sites is a purely subjective one. Rabob was the first important

site with significant amounts of simple impression pottery that we found (and it is a very unique kind of site in the Central Sudan indeed), so we tended to ascribe to it rapidly the new label of "Late Neolithic". Bashagra was just the last site, Neolithic or of any other kind, that we discovered during the survey.

A similar shift from rocker to simple impression zoned decoration in pottery seems to have occurred in the Eastern Sudan area, marking the transition between the Saroba and Kassala cultural phases (Fattovich *et al*. 1984: Figs. 3, 5; Fattovich 1990: 13-4). Another feature in the pottery of the Blue Nile Late Neolithic sites is also related to the Eastern Sudan, namely the decoration of surfaces by rough wide scraping or combing. Scraped decoration is the most characteristic technique of the Atbai ceramic tradition in the Gash-Atbara area during the last five millennia bc (Fattovich *et al*. 1984: 177-8; Fattovich 1990: 10-1; Sadr 1990: 69-70), and is present in some of the Blue Nile sites: Bir Lahamda (3 %), Rabob (3.5 %), Kabaro (11.1 %) and Bakhit (12.3 %). Simple impression appeared in Eastern Sudan around the middle of the VI millennium bp (Fattovich *et al*. 1984: 179). In the Central Sudan it may be dated, as it is inferable from the aforementioned data, between the middle of the VI and the middle of the V millennium bp. Thus the first region could be suggested as a probable origin for this gradual technological change, irrespective of its possible linguistic or ethnic implications (the coming of Cuchitic specialised pastoralists to the Khartoum area; Haaland 1987a: 229-30, 1991, 1992b). The much longer chronological duration of the rocker impression technique in the Southern Sudan (Mack and Robertshaw 1982) and in the "prenilotic" areas of Western Ethiopia, as it has been evidenced in our own survey at Benishangul from 2001 to 2003, could also indicate some kind of long term relationship of this decoration with Nilo-Saharan populations. This association perhaps begun in the Mesolithic or "Aqualithic" period as J.E.G. Sutton (1974, 1977) first proposed it.

The sites discovered or re-examined in our survey come to fill the supposed population gap in this area during the last millennia bc. Also the materials from two sites surveyed in the West Butana area by Balfour-Paul (1952) and reanalysed in the Khartoum National Museum, Abu Miriam and Abu Zumein, show close similarities with Eastern Sudan and with the Jebel Moya Late Neolithic cultural assemblage (see section 3). All these sites are situated in-between and thus serve to connect culturally the settlements of the Eastern Butana with others known in the Southern Gezira such as Jebel Moya, Jebel Tomat or Rabak. As we have seen, thick rims with impressed and, more frequently, incised decoration are abundant in Jebel Moya (Addison 1949: pl. 91-3; Balfour-Paul 1952: Fig. 5). They have often been interpreted as a "fossil guide" for the Late Neolithic in the Gezira area, such as in the sites of Rabak and Jebel Tomat (Haaland 1987a: 45-7, Fig. 14, 1987b: 57, Fig. 8).

The relations between Eastern Sudan and the Gezira in Late Neolithic times had been suggested by several authors (Clark 1973; Clark and Stemmler 1975; Haaland 1987a), but the cultural aspects defining this phase were unknown in the Central Nile valley proper (Caneva 1991: 264, 2002). The radiocarbon date from Rabob (4670 $\pm$ 50 bp) falls within the Late Neolithic chronology previously assumed for the site and also parallels known dates from Eastern Sudan and the Gezira. It is one of the first radiocarbon dates in the fifth millennium bp for occupation sites in Central Sudan, the other dates corresponding to cemetery sites such as El Kadada (Hassan 1986: table 1). A very close date, 4490 $\pm$ 100 bp, was obtained for the upper, Late Neolithic part of the occupation midden of Rabak (Haaland 1987b: 57; Magid 1989: 49-51).

So far plenty of sites of the previous phases (Mesolithic and Early Neolithic) had been found, but very few were of the period that forms the transition between the Neolithic agro-pastoral phase (Shaheinab, c. 6000-5000 bp) and the beginning of the Meroitic period shortly after 3000 bp. The only sites known are the earlier phases of Jebel Moya (Addison 1949; Gerharz 1994) -with the exception of a few sherds that could even be earlier (Caneva 1991)-, Jebel Tomat (Clark and Stemmler 1975) and Rabak (Haaland 1987a, b; Magid 1989). All these sites are located in the middle of the Gezira or at the White Nile bank but none of them in the Blue Nile valley. As to the Khartoum region, only the few findings of the El Kenger in the main Nile valley (Caneva 1988: 335-6; Caneva and Gautier 1994) could be ascribed to this phase.

Settlement patterns (Figure 57)

The remains found on the surface of the site of Sheikh el Amin cover an area of c. 60.000 square metres. The results of extensive excavations carried out during the 1997 and 1998 campaigns (see Fernández, Jimeno and Menéndez 2003) have confirmed that the real extension of the site is approximately that large. The site is thus one of the biggest known prehistoric settlements in Central Sudan. The other two big Neolithic sites in our survey have even larger surface remains: no. 50, Rabob (c. 300.000 m^2) and no. 62, Bir El Lahamda (c. 150.000 m^2). It is possible, however, that the archaeological sub-soil deposits do not correspond to that wide distribution. The test-pits in the Rabob site did not reveal significant stratigraphic levels, and in Lahamda the observation was made that the pottery distribution was smaller in size than the whole surface covered by the lithic remains. For the Mesolithic sites, data from the excavations in no. 19-1, Karnus and no. 13, Sheikh Mustafa (see Fernández, Jimeno and Menéndez 2003) show that the surface artefact distribution do not correspond to the underground remains. However, other sites, for instance El Mahalab (Ibid.), seem to have been less affected by deflation and post-depositional disturbance. Anyway, we can safely assume that a general relationship exists between the artefact distribution on the surface of each site (Table 11) and the relative importance of the settlement in the past. Site size can be correlated with the number of its inhabitants (population nucleation or dispersal), and artefact density with the duration of occupation at each site (Sadr 1988: 392-3). An overall com-

Site no.	Size (m^2)
1	45000
36	60000
50	300000
62	150000
67	7700
89	40000
90	10000

Table 11.- Areas of surface artefact distribution at the main Neolithic sites.

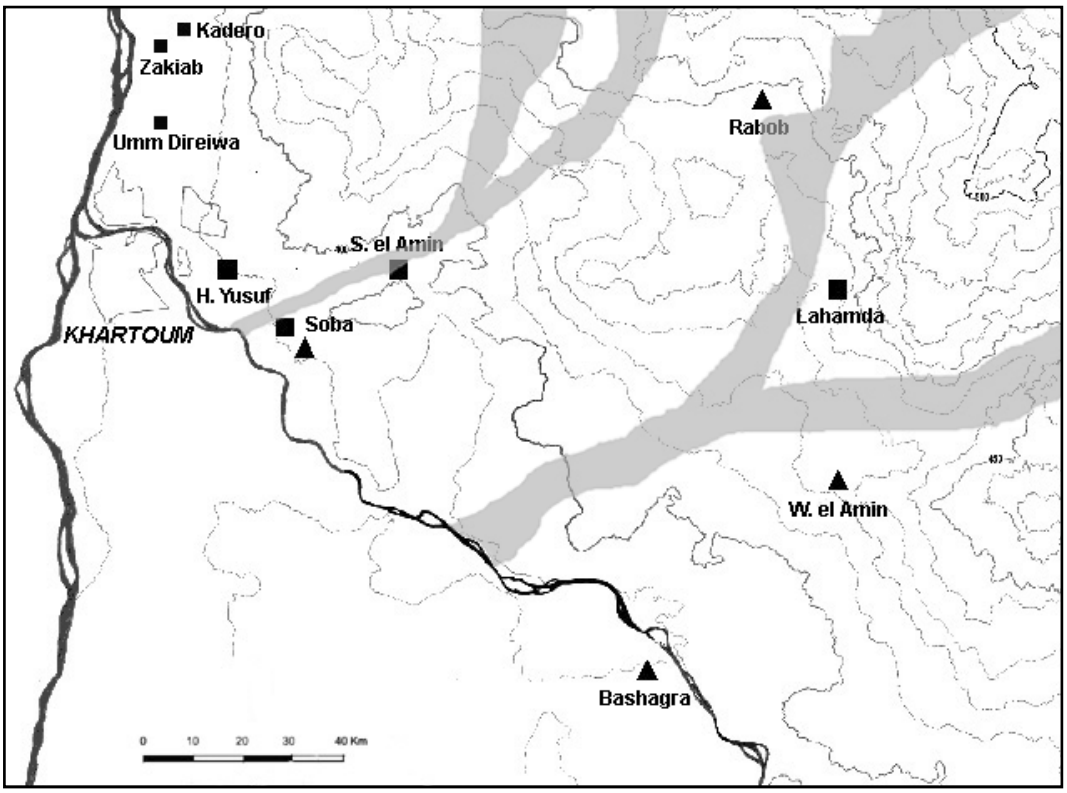

Figure 57.- Distribution of Early (squares) and Late (triangles) Neolithic sites in the Wadi Soba-el Hasib area, including the site of Bashaqra Garb in the Gezira West of the Blue Nile (no. 93) and the previously known sites in the Main Nile east bank.

parison of the surface areas for the best-preserved sites in the two periods shows a significant and large increase in site size for the Neolithic settlements. The mean area size for the Mesolithic sites is 13.176 m^2 (N= 17), while for the Neolithic sites it is 87.529 m^2 (N= 7).

Another feature of the Neolithic sites in the Eastern bank of the Blue Nile is their general location in areas that are farther apart from the current course of the Blue Nile than the Mesolithic sites. With the exception of Hag Yusuf and the two small sites of Soba, all the Neolithic sites discovered in the Soba-Rabob-Hasib areas are at more than 18 km from the Nile: Sheikh el Amin (18 km), Wad el Amin (25 km), Bir el Lahamda (40 km), Wadi Rabob (58 km).

This model of Neolithic occupation inferred from the survey, with fewer but larger sites and farther inland sites than in the earlier Mesolithic period, can be compared to that proposed previously by L. Krzyzaniak (1978) and expanded by R. Haaland (1987a, b). According to their location with respect to the Nile, the settlements had a different socio-economic orientation: dry season camps in the alluvial plain, exploiting the aquatic resources (male and female activities), base sites occupied all-year round in the alluvial plain and orientated to cultivation (female activity), and herding camps (male activity) in the Butana savanna during the rainy season (Haaland 1987b: 216).

The four previously mentioned sites might have been large permanent settlements (base sites) near the wadi beds in the Butana plain -the same could be said of Qoz Kabaro and Qoz Bakhit in the Gezira plain-, probably occupied throughout the year and mainly used for cultivating crops or gathering wild plants. The sites nearer the main watercourse, like Hag Yusuf and Soba on the east bank, or Bashagra on the West Bank, much smaller in size, could have been temporary dry season settlements, used for fishing and herding in the dry season. From the site seriation (Fig. 56) the inference is possible that the later type was more abundant at the beginning of the period (Early Neolithic) and that the former is typical of the Late Neolithic times. This hypothesis is in accordance with the presence of only Early Neolithic sites in the proximity of the Main Nile course, such as the well-known settlements of Kadero, Umm Direiwa, Zakiab, Geili, etc.

Also a comparison of the spatial distribution of the Neolithic sites of our survey (Fig. 57) and those previously known north of Khartoum at both sides of the Main Nile, on which the model referred to is based (e.g. Haaland 1987a: 37; Caneva 1988: 21; Magid 1989: 12) shows important differences. In the Main Nile all the sites are located in a narrow band parallel to the Nile: the maximum distances that set them apart is less than 10 km from the present Nile course, as in the case of Umm Direiwa I and II. It could be said that our big sites in the Butana, both of early and late chronology, are too far apart from the main river to be complementary seasonal settlements in the hinterland for the same human groups in the river. Equally important, they do not fulfil the criteria set for seasonal herding camps (Haaland 1987a: 30, 207-13). These sites are much bigger than could be expected for a mobile camp, and the faunal remains do not indicate husbandry especialization. In the only extensively excavated site, Sheikh el Amin, domestic animals amount to only 13.1 % of the faunal remains analyzed (see Chaix 2003: table 12). With the exception of Esh Shaheinab, this percentage is outstandingly low if compared with other sites in the region, (e.g. Geili 24 %; Nofalab 62.1 %, Kadada 64.5 %, Kadero 88.3 %, Za-kiab 87 %) (Gautier 1986, 1988; Tigani el Mahi 1988; Peters 1992). The two small test-pits dug in the Late Neolithic Rabob (no. 50), did not yield any mammalian faunal remains.

If the general chronology and cultural aspect are taken into consideration, there is reason to suggest that Sheikh el Amin and Bir el Lahamda are similar to the large Early Neolithic sites near the main Nile such as Geili and Kadero. But they are located in a different ecological setting, namely the Butana savanna. Most of our sites, both Early and Late Neolithic, are located on the banks of the wadis, which were probably not completely dried out during the rainy season. Further inside the Butana there are seemingly not many settlements from this period. The German survey in the fifties discovered only two "Neolithic" sites, most probably Early and Late Mesolithic, in all the Butana area investigated (Hintze 1959: 177-8, 192). But being near the water did not mean that the fishing activities were important as the scanty fish remains found in Sheikh el Amin show (one single fragment of Nile perch; cf. Chaix 2003: table 12). Compared

with the fish remains in the nearby Mesolithic site of El Mahalab, where they amount to 13.7 % (Ibidem), a substantial reduction in the aquatic economic orientation seems to have taken place during the Neolithic period in this area.

These sites in the Western Butana were occupied by mostly hunting and gathering groups with domestic livestock as a subsidiary food source: around 87 % of the bones found in Sheikh el Amin correspond to wild savanna species (Chaix 2003: table 14). A parallel situation is known to have occurred with other inland groups, as it has been recorded in the Northern area (Shaqadud cave) and in the Eastern Butana and Southern Atbai region (Khashm Al Girba-Kassala areas). The population of Shaqadud had a hunting-gathering economy during the first occupation in the eight millennium bp and it is only in the fourth millennium bp when a small percentage of domestic animal remains (2.7 %) is recorded (Peters 1991b: 229). In the Southern Atbai region, evidence of food-production does not appear until the later half of the Butana Group (c. 6000-4500 bp), being fully established only in the following Gash Group (c. 4500-3500) (Fattovich 1990: 14; Sadr 1991: 40-1; Geraads 1986). It seems that the introduction of the herding economy was a gradual diffusion process from the Nile towards the Eastern Sahel.

The big area of the Neolithic sites discovered in our survey still awaits explanation. The dramatic size increase of the settlements, true "villages" of the savanna, imply a great demographic concentration that was previously unknown in the area, and will not be seen again until modern times. Several authors have insisted on the humid conditions of the Central Sudan area during the second half of the Holocene, with a slow diminution of precipitation until present day conditions were reached about 3000 bp (Wickens 1982). The good conditions would have favoured the exploitation of the resources of the thorn savanna, during the rainy season if not on a permanent basis as in the Gash area, where very big settlements have also been recorded at about the same time (Fattovich 1990: 14). The abundance of edible wild plant impressions in the Sheikh el Amin pottery is another indication of an intense exploitation of food resources in the area (see Magid 2003: table 1). Possibly because of the contracting water resources, and contrary to the Mesolithic period when wadi flooding was more intense, now the groups tended to concentrate in bigger settlements. This nucleation process could also be explained by social reasons, since as it is clearly shown in the Kadero settlement and cemetery, the groups exhibit now for the first time evidence of emerging social division and complexity, probably related to the livestock ownership (see Fernández 2003b).

The finding of Late Neolithic sites in areas where they were previously unknown (Khartoum region, Blue Nile basin) widens considerably our knowledge of this period. Moreover, the larger sites (Wadi Rabob, Wad el Amin, Qoz Bakhit) suggest a more intense occupation of the area than was previously thought. Some interesting hypothesis advanced on the question (Haaland 1987a, b, 1992b) insinuate that the economic way of life changed to a fully pastoral system in the transition from Early to Late Neolithic phases. A new population, a nomad people that only occasionally visited the river areas (as in El Kenger, Soba or Bashagra), initiated the new economy. This change could be related to the introduction of the Afro-asiatic languages in the area replacing the previous Nilo-Saharan ones that correspond to the previous "aquatic" populations (Sutton 1974, 1977).

Contrary to this, our data suggest that the pastoral element is not yet decisive in the later Neolithic times. Moreover, there was not any significant cultural interruption during the whole Neolithic period. As we have previously seen, pottery decoration patterns show a continuous variation, gradually replacing one technique of impression with another. Nonetheless, the significance of this slow change was surely important, for the rocker technique had been used in the Nile and all along the Saharan area during many millennia. In the following archaeologically "visible" cultural period, when the Meroitic culture was being formed in the first millennium bc, the hand-made black pottery tradition that connects with the Late Neolithic times was decorated using mostly incision and simple impression techniques. Rocker technique, though still present, was very rare (see for example the vessels from Jebel Moya, Addison 1949: plates 89-93, from Geili, Caneva 1988: 202-6, Meroe and Kadada, Lenoble 1995, or the large collection from the Early Meroitic cemetery of Amir Abdallah in Northern Sudan, Fernández 1984b: 75-7, 1985c: 372-425).

The transition to the Meroitic kingdom in the area poses a different problem, since not one single site is known from the time extending between approximately 4000 and 2500 bp. After our data, the Neolithic sites become very large and then suddenly disappear. The better example of this process is the Late Neolithic site at Rabob (no. 50). Unlike many Mesolithic sites, which are small in size and probably correspond to short time occupations, the Rabob site is quite big and presumably a larger human group produced its remains. Another possibility is that a small or medium size group camped on the same place periodically. This model would correspond to a nomadic group that approached the vicinity of the Blue Nile or the wadi, choosing the same favourable place in every seasonal visit. Since the midden shifted every year, it produced an even and thin spread of artefacts on a large surface ("sheet midden"). On the contrary, the Early Neolithic site of Sheikh el Amin (no. 36), which is also fairly large, has much deeper sediments concentrated in separate *kôms* with areas in between almost devoid of archaeological deposit (see report on the excavation in this volume). This would correspond to a more sedentary group living on the same spot year after year. As the midden location never changed this would result in higher concentration of artefacts in the waste areas and lower densities in the habitation cleared areas (see Sadr 1991: 20-3, for this model of archaeological record formation). This transition from a sedentary to a more nomadic way of life, inferable from the changes between both archaeological sites, is in accordance with previous theories about the economic trends in the Central Sudanese Neolithic (Krzyzaniak 1978; Haaland 1987a, 1987b; Caneva 1988). The chronology of the sites (5550-4670 bp) is also consistent with the period when that change is supposed to have occurred.

The shift to a progressively mobile economy was probably due to environmental (more arid climate) or social (problems of group organisation and division) reasons, or both. The human groups at this period became archaeologically invisible and at the end of the time gap most of them were already fully nomadic, just about the same time that the fully pastoral Hagiz Group occurred in the Atbai region at the eastern side of the Butana (Sadr 1991: 111). Only some funerary mounds, very difficult to distinguish from those made in the historical period (see next section), seem to correspond to this "post-Neolithic" period. Recent excavations have shed some light on the "ghosts" of the Khartoum province, represented by tumuli -some of them true cenotaphs, i.e. empty tombs probably erected as a memorial for people dead and buried elsewhere. Some of the burials produced incised pottery reminiscent of the pan-grave and Mokran groups of Northern and Eastern Sudan (Caneva 2002).

8. The Historical sites

All along the field survey we found tumuli fields that can be ascribed to the historical period, from the Meroitic times onwards. Even though we were working near the north-eastern corner of the Butana plain, which was called in the antiquity the "island of Meroe", only a few remains could be asigned that chronology (a part of site no. 16), together with the well known engravings of Jebel Qeili, located in an area that fell outside of our main survey area (Crowfoot 1920; Hintze 1959: 189-192). This absence was also detected in the 1957-1958 Berlin Humboldt University survey, whose inspection only detected Meroitic sites in the Western part very near the Nile river and particularly along the fertile wadis where important settlements such as Musawwarat es Sufra and Naqa were erected. In this sense, the "Meroitic culture, like the Egyptian, was a culture of the Nile Valley" (Hintze 1959: 196). Other outposts in the hinterland, not very far from the river, were interpreted as fortifications (Ibid.), since they exerted some degree of control over the desert pastoralist nomads when they annually came near the river to the edge of the more densely settled area (Adams 1977: 330). Throughout the Meroitic period those nomads wandered and exploited the grasslands of the Butana, and the temple/*hafir* complexes at Musawwarat and Naga were their contact points with the sedentary agricultural population established near the river (Bradley 1986; Sadr 1991: 115). Those association of the artificial water ponds (*hafir*) with nomadic groups probably begun earlier, since at Shaqadud the cave overlooks a partly man-made water pool that could have been used by people in the site before c. 3500 bp (Sadr 1991: 111).

Tumuli ascribed to a nomadic population which yielded pottery of Late Neolithic affilia-

tion (rocker and simple impression, incision), tentatively dated around 4000 bp, were excavated near Meroe at Jebel Makbor, some kilometres away from the Nile course (Lenoble 1987). Together with the aforementioned Khartoum region tumuli, this site is the earliest known of a long series of funerary mounds that lasted for millennia in this area, and were the only type of archaeological feature until the Christian era. This did not only happen in the hinterland and more remote East Butana zones, but also near the Nile. The survey around Geili and Saggai did not found any Meroitic settlement remains, only graves that were interpreted, on the basis of paleodietary analysis of their bones, as belonging to a nomad population that came near the river to bury their dead (Caneva 1988: 335). The surface inspection of some of the burial grounds reveals that many tumuli fields could have been erected during several periods, and their cultural attribution is unfeasible unless some excavation work is done (Lenoble 1987: 238).

Some of the groups of burial mounds found in our survey are probably of Islamic chronology (site nos. 46, 48, 53, 56, 59). Their mounds are small, made of earth and oval in shape, surrounded by a stone circle. They follow a N-S or NW-SE orientation and sometimes have smaller stone-circled tombs with the same layout and orientation, or sheikhs graves marked with flags, in between or nearby the mounds. The stone accumulations over some granitic outcrops or smaller elevations (site nos. 39, 40, 41, 52) could belong to the same period. Normal cemeteries without visible mounds were recorded in site no. 75 (besides the remains of a Christian church) and no. 77 (Islamic).

Another type of burial mound ground is represented by sites nos. 10, 11, 22, 25, 57, 58, 60 and 61. The first four sites are in the Wadi Soba area and in some cases the tumuli cover part of a Mesolithic site. Even if there were no signs of plundering neither culturally idiosyncratic items on surface allowing attribution, the similar cases recorded in the Geili area (Caneva 1988) suggest a Meroitic chronology for those cases. The other four mound grounds, recorded in the area in between Wadi Rabob and Wadi el Hasib, are of a different type. The tumuli are more numerous, e.g. up to 90 mounds in site no. 61, all of them are of an almost perfect circular shape and are covered by white quartz pebbles. Using a simple exclusion argument, these graves could belong to the Christian era.

As regards the settlement sites, we found the remains of three brick buildings that probably correspond to Christian churches (nos. 3, 4 and 74). The first two are very near the medieval town of Soba and the third had one of the bricks incised with letters of the Greek alphabet. Three other settlement sites were abandoned during the Christian period (nos. 23, 24, 51) since the pottery found on the surface was of the type defined as "incised" in the recent Soba excavations (Welsby and Daniels 1991: Figs. 122-33).

The settlement sites that can be attributed to the Islamic period are of two types. In some of them (nos. 73, 76, 79, 82, 83, 91?) we found incised decoration with geometric designs that is known to belong to the Funj period (Crawford and Addison 1951: 59-60, pl. 32-3; Chataway 1930: Fig. 6; Arkell 1934). All these sites are situated south of Wad Medani in the Rahad and Blue Nile valleys, that is very near the core of the Funj Kingdom of Sennar (Crawford 1951; Kleppe 1997), and thus were probably abandoned before the end of the kingdom at the beginning of the XIX century. The second type seems to be more recent, because the sites appear to have been abandoned not long ago (nos. 34, 64, 65). The common pottery found on them has a very hard fabric, usually with a black and red section because of uneven firing, the outer surface being very rough and without any kind of decoration. Isolated sherds of this kind were frequently found on the surface during the survey, including in the prehistoric sites discovered and investigated during this research project.

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