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New data on the Holocene occupation of the Wadi Howar region (Eastern Sahara/Sudan)

Introduction

Today, the Eastern Sahara in Egypt and Sudan is one of the most arid regions of the world. In contrast, numerous sedimentological, botanical, faunal and archaeological investigations demonstrate that the environment was favourable for human occupation in prehistoric times. The Wadi Howar is one of the most impressive witnesses of the dramatic climatic changes during the last 12,000 years. Located on the southern margin of the Eastern Sahara, the wadi is a former tributary of the Nile (Fig. 1). During the Early Holocene, the over 1200 km long river connected the mountainous region of the eastern Chad with the Nile Valley which it joined opposite Old Dongola (Meissner and Schmitz 1983; Pachur and Kröpelin 1987). During the Middle and Late Holocene the river was gradually transformed into a chain of freshwater lakes fed by local rainfall (Kröpelin 1993). Hundreds of prehistoric sites along the wadi banks indicate the former favourable ecological situation (Neumann 1989) in this region and its significance as a settlement area and link between the Nile Valley and the Chad in earlier periods.

Since 1995, the Wadi Howar region has been one of the main research areas of the Collaborative Research Centre ACACIA (Arid Climate, Adaptation and Cultural Innovation in Africa) (SFB 389, Kultur- und Landschaftswandel im ariden Afrika) of the University of Cologne. The main emphasis of the project is on the relationship between environmental change and the inhabitants' way of life during the period of increasing aridity in the Holocene. This includes the analysis of climatic change, the impact of man on his surroundings and his reaction to changing ecological conditions. Between 1995 and 1997, the research focused primarily on the classification of the prehistoric groups which occupied this region and on improving the pottery chronology of the area. Consequently,

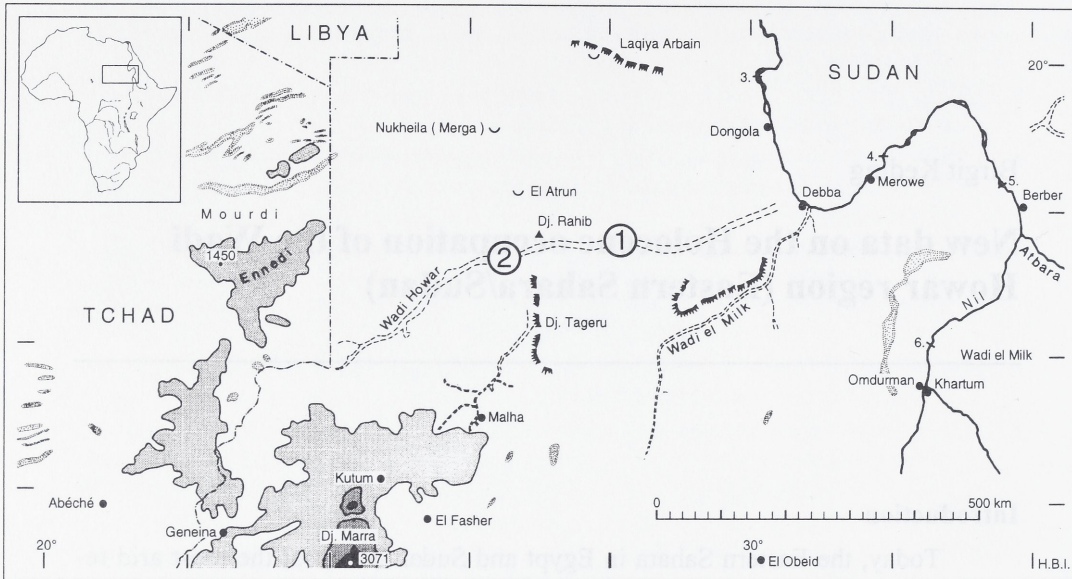


Fig. 1. Map of North-western Sudan: 1 - Lower Wadi Howar, 2 - Middle Wadi Howar.

the archaeological sites, their finds and settlement structures, information on the economy and ecological conditions as well as their gradual modification were recorded. At the same time, research focused on the location of sites with a clear pottery stratigraphy.

Based on the results of the former B.O.S. Project in the 80s (Kuper 1981, 1986, 1988, 1995, Richter 1989; Keding 1993, 1997a, 1997b, 1998) headed by Rudolph Kuper, the fieldwork concentrated on two sections of the wadi course: the Lower and the Middle Wadi Howar. These two areas are separated by a 10,000-year-old dune barrier south of Djebel Rahib and are very different, both in their topography and their archaeological situation.

Dune habitats of the Lower Wadi Howar

The Lower Wadi Howar comprising the 400 km long section west of Djebel Rahib is, today, an uninhabited, featureless 5 to 15 km wide valley with no vegetation and no pronounced embankments. The density of prehistoric sites is less evident than in other areas of the Wadi Howar region. However, the large

dimensions of the nearly 100 recorded sites and the abundant finds indicate an intensive occupation in the Early and Middle Holocene. Two kinds of sites are characteristic: sites in the plains and dune habitats.

The majority of the 44 sites in the plains currently known are located at the foot of the eastern Djebel Rahib. They are situated between dune habitats and appear to be merely surface sites. They cover several square kilometres and are marked by a more or less dense scatter of finds, consisting mainly of stone artefacts with almost no pottery finds.

In contrast to these less specific surface sites, the dune habitats are characteristic features in the landscape of the lower course of the wadi. They are located on the northern wadi banks east of Djebel Rahib and 200 km downstream. The settlements are situated on fossil dunes which had been consolidated around 7000 BC during the climatic maximum (Besler, pers. comm.). Aquatous sediments at their base attest a swampy environment which still existed around 2500 BC, however periodically (Besler, pers. comm.). The surfaces of the dunes are characterized by a dense scatter of pottery, stone artefacts, bones and grinding stones as well as features like burials and different types of stone structures. The large quantity of finds points to long-term or at least repeated stays on these sites. The compact eroded layers of occupational refuse still protect the deeper cultural layers and stabilize the location and form of the dunes. In addition to the 7 dune sites already found during the last two seasons, 43 more sites were discovered.

Surveys of the dune habitats show that the stone artefacts were made of a wide range of raw material which seems to have been mainly supplied by local outcrops. The pottery spectrum is relatively uniform and gives a first hint of the occupational sequence: Dotted Wavy-Line and pottery with zigzag decorations are very common, and there are also small quantities of Leiterband ceramics. In contrast, Laqiya and herringbone pottery only occur in isolated cases.

Up until 1995, the single known stratigraphic sequence in the Wadi Howar was discovered at the dune site Conical Hill 84/24 (Gabriel et al., 1985; Richter 1989: Fig. 2). We therefore expected to find additional cultural sequence on other settlement dunes. Four dune habitats in three different areas between Conical Hill and Abu Tabari were chosen for six test excavations. Due to the instability of the sediment and the large quantities of finds, they were kept small in size. Three of the test excavations yielded stratigraphic sequences up to a depth of at least 1 m.

Pottery sequences

Abu Tabari S95/2, situated 250 km west of the Nile Valley, is the most easterly dune habitat known so far. With a diameter of 750 m and a height of 20 m, this site is the largest of a complex of four dune settlements. Its surface is characterized by a large amount of artefacts with well preserved pottery. Two test

trenches were dug. The first, S95/2-1, covered 6 square metres and was situated on the eastern slope. The surface yielded particularly well-preserved pottery. However, the cultural layer turned out to be only 0.5 m deep and rather disturbed. In contrast, the second test-trench, S95/2-2, was positioned in the centre of the dune plateau and yielded archaeological deposits to a depth of 1.10 m. A total of 458 pottery sherds, representing 392 vessels, were recorded. 275 sherds of 217 vessels were decorated. They provided a pottery sequence beginning with Dotted Wavy-Line pottery, then ceramics with dotted zigzag and double-pronged ornaments, followed by pottery with herringbone, plain zigzag and Leiterband patterns as well as a large quantity of undecorated sherds (Fig. 2; Fig 3). While most of these pottery types are well known and widespread in the Wadi Howar and neighbouring areas, the herringbone decorated ware was registered for the first time in this region (Fig. 4). This pottery is reddish, well-burnished, inorganic tempered and decorated with herringbone, geometric or zigzag patterns. Its technology, form and decoration reveal a general resemblance to pottery of the Nubian Pre-Kerma or A-Group of the Nubian Nile Valley.

A third excavation on this dune site, Abu Tabari S95/2-3, yielded this pottery type in an undisturbed burial. The grave of a young female was discovered on the southern slope of the dune settlement. The deceased was buried in a strongly contracted position lying on her right side, along a north-south axis with her head to the north. Two complete globular herringbone patterned pots, one inside the other, had been deposited close to her pelvis. A shell, a small axe, seven stone artefacts, a small lump of ochre, fish bones and a burnt cattle bones were placed on and around the skeleton. Like the pottery, the grave itself - in particular the position and orientation of the skeleton - shows some similarities with A-Group and Pre-Kerma graves of the Nubian Nile Valley (Nordström 1972: 130). Unfortunately, radiocarbon samples from the skeleton did not yield a date.

Comparable results were obtained from a test excavation on the plateau of the dune settlement S97/1, located 300 km to the west of the Nile Valley. This site, one of a group of four dune habitats, measures approx. 540 by 350 m. The cultural layers were 0.95 m thick and yielded pottery fragments from 862 vessels in an excavated area of only 2 square metres. Even though the stratigraphic sequence of this dune seemed to have been partially disturbed, Dotted Wavy-Line pottery and ceramics with dotted zigzag motifs dominated in the lower levels, whereas herringbone and Leiterband pottery as well as undecorated sherds were found in the upper layers (Fig. 5). Unlike the sequence in the dune further east, Abu Tabari S95/2, some fragments of Laqiya pottery were found, thus fitting chronologically in the early occupation phase.

The pottery sequence is slightly different in the most westerly occurrence of dune habitats, a few kilometres east of Djebel Rahib in the region of Conical

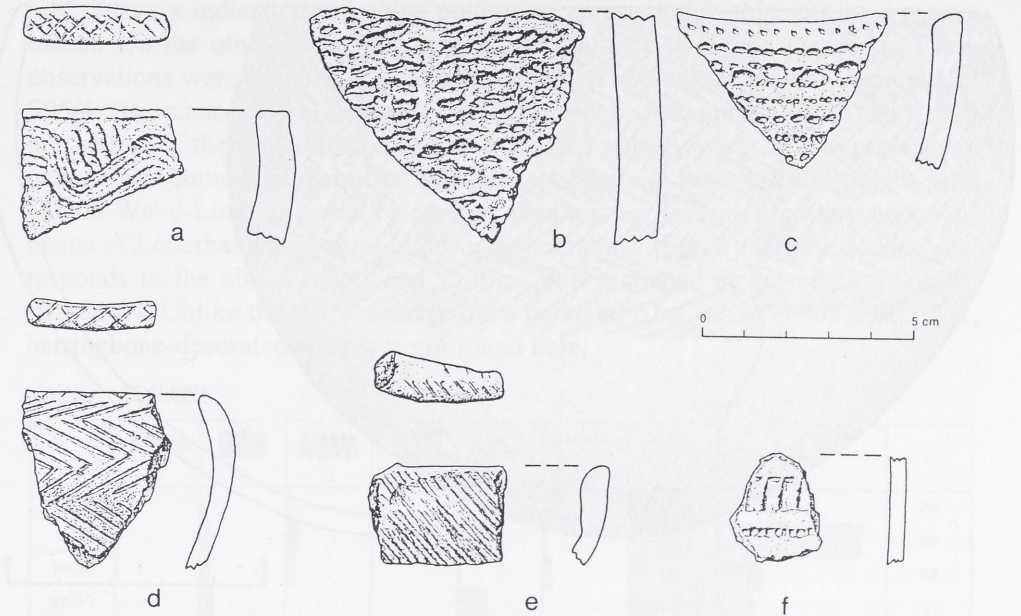


Fig. 2. Lower Wadi Howar, Abu Tabari S95/2-2: **a** Dotted Wavy-Line, **b** Dotted zigzag (flexible (?) implement), **c** Dotted zigzag (rigid implement), **d** herringbone, **e** plain zigzag, **f** Leiterband.

Abu Tabari S 95/2-2

Deco- ration cm	a	b	c	d	e	f	g	h	n
0-2									34
2-10									67
10-20									80
20-30									57
30-40									67
40-60									50
60-70									22
70-80									14
80-90									2
90-100									1
n	23	68	39	36	15	30	6	175	392

Fig. 3. Lower Wadi Howar, Abu Tabari S95/2-2: pottery sequence: **a** Dotted Wavy-Line, **b** Dotted zigzag (flexible (?) implement), **c** Dotted zigzag (rigid implement), **d** double pronged motifs, **e** herringbone and geometric motifs, **f** plain zigzag, **g** Leiterband, **h** undecorated.

Hill. Surveys indicate that Laqiya pottery is represented in this area to a greater extent. On the other hand, there are no herringbone-patterned ceramics. These observations were confirmed by a test excavation at the dune habitat Conical Hill S95/4. Its archaeological deposit was 1.20 m thick. A 2 square metre test trench on the top of the dune yielded sherds from 323 pottery vessels. The pottery sequence was somewhat disturbed but, here too, a series emerges that begins with Dotted Wavy-Line, followed by Laqiya, then zigzag decorated pottery and fragments of Leiterband as well as undecorated ceramics (Fig. 6). This sequence corresponds to the above mentioned stratigraphic sequence at the nearby Conical Hill 84/24. Unlike the more easterly dune habitats, Abu Tabari S95/2 and S97/1, herringbone-decorated ware was not found here.

Conical Hill S 95/4

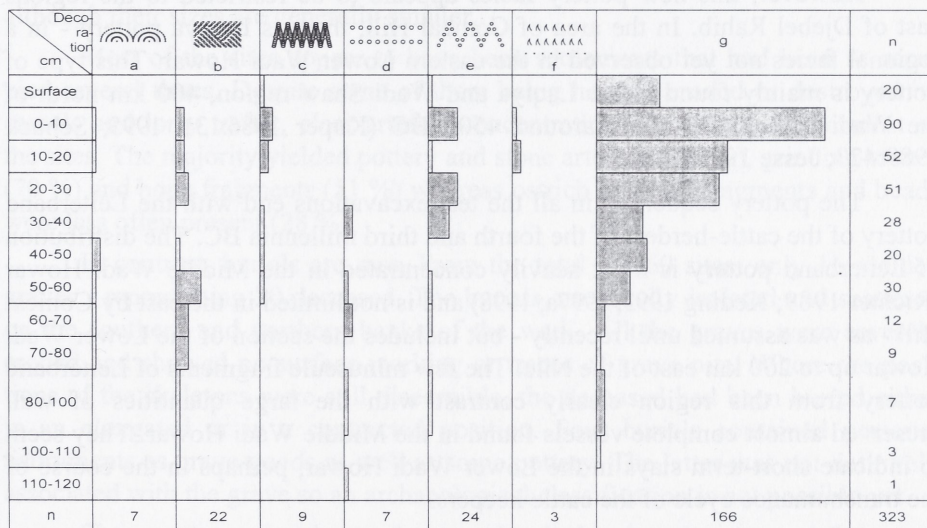


Fig. 6. Lower Wadi Howar, Conical Hill S95/4: pottery sequence. **a** Dotted Wavy-Line, **b** Laqiya, **c** Dotted zigzag (flexible (?) implement), **d** double pronged motifs, **e** Dotted zigzag (rigid implement), **f** Leiterband, **g** undecorated.

To recapitulate: Although the information from the survey and small-sized text excavations is limited, the dune settlements are currently the only available source of stratified data and they do hint at a broader picture of the chronology and distribution of the different pottery types in the Lower Wadi Howar region. Judging from the finds at the settlement dunes, the Lower Wadi Howar was mainly occupied - and exploited - from the Dotted Wavy-Line phase until the Leiterband phase, between 5000 and 3000 BC (Fig. 9).

While on most of the dune habitats the earliest signs of occupation are

numerous well-preserved fragments of Dotted Wavy-Line pottery, the later pottery in the stratigraphic sequences appears to reflect two different regional developments in the western and eastern regions of the Lower Wadi Howar.

The archaeological deposits of the Abu Tabari region, 200 - 325 km west of the Nile Valley, yielded a pottery type previously unknown in the Wadi Howar, probably belonging to an occupation phase between the earliest Dotted Wavy-Line and the last Leiterband pottery horizons. This newly discovered pottery, often observed on the surface of burial-like structures, is characterized by a high-quality surface treatment and herringbone, geometric and dotted zigzag decorations. Both finds and features could point to cultural links with the Nubian Pre-Kerma or A-Group.

However, this new pottery facies appears to be restricted to the regions east of Djebel Rahib. In the area of Conical Hill, there is Laqiya pottery - in a regional facies not yet observed in the eastern Lower Wadi Howar. This type of pottery is mainly found in the Laqiya and Wadi Shaw region, 400 km north of the Wadi Howar and dates around 4500 BC (Kuper 1986:131, 1995; Schuck 1989:423; Jesse 1998).

The pottery sequences in all the test excavations end with the Leiterband pottery of the cattle-herders of the fourth and third millennia BC. The distribution of Leiterband pottery is most heavily concentrated in the Middle Wadi Howar (Richter 1989; Keding 1993, 1997a; 1998) and is not limited in the east by Conical Hill - as was assumed until recently - but includes the section of the Lower Wadi Howar up to 200 km east of the Nile. The few minuscule fragments of Leiterband pottery from this region clearly contrast with the large quantities of well preserved almost complete vessels found in the Middle Wadi Howar. They seem to indicate short-term stays in the Lower Wadi Howar, perhaps in the course of the transhumance cycle of the cattle keepers.

Surface sites in the Middle Wadi Howar

The environmental setting and archaeological situation are very different in the Middle Wadi Howar, the region west of Djebel Rahib. Here, the Wadi Howar is a shallow 8 to 11 km wide depression with a certain amount of vegetation, still used by some camel nomads from the south. Hundreds of sites cluster along the banks and bed of the wadi. However, in contrast to the Lower Wadi Howar, there are no dune habitats here and the prehistoric sites consist mainly of surface assemblages with no deeper archaeological deposit.

The first two seasons of fieldwork in the Middle Wadi Howar focused on recording the archaeological groups and their pottery facies, the density and position of sites and the economic exploitation of the area through time (Keding 1997b, 1998, in press). The research began with detailed surveys and was contin-

ued with excavations. However, most of the test trenches have not yet been fully analysed. Consequently, only preliminary results of the surveys can be presented here. Three 3 km wide and c. 12 km long transects in an approx. 40 km long section of the wadi with their eastern limits 0.5 km west of the Ku Wad' Lau Lau were surveyed on foot. The transects were 15 km apart. They were positioned across the wadi and included c. 2 km of the southern and northern banks. Within this area of 9 by 12 km, a total of 860 archaeological sites were discovered and their position, size, finds and features were recorded (Fig. 7). The analysis of these data produced the following summarized results.

In the areas of the transects, both the wadi banks and the wadi bed are covered with a scatter of sites with the density increasing from east to west. Compared with the Lower Wadi Howar, the number of sites is extremely high, although their sizes are generally smaller.

Most of the sites appear to have been settlements that had been re-occupied several times. Despite some of them being heavily eroded or destroyed by camels and lorry traffic, clear artefact concentrations are preserved on most of the sites. The majority yielded pottery and stone artefacts (98 %), grinding-stones (70 %) and bone fragments (51 %) whereas ostrich eggshell fragments and beads were less often present (28 %).

In contrast, burials are rare. From the total of 860 sites, only 16 yielded graves - representing 20 deceased. The burials are usually isolated and scattered on the southern and northern banks of the wadi. All the graves were severely eroded and showed no surface marking or traces of grave pits. Where the positions of the skeletons were still discernible, the deceased had been buried either in an elongated or in a contracted position. Four burials contained personal adornments as grave goods as well as some pottery. The latter was not definitely associated with the grave so an archaeological classification is not possible yet.

Since pottery was observed on nearly all the sites, it was used for a preliminary cultural and chronological classification. At least six pottery types can be differentiated (Fig. 9). Judging from radiocarbon dates as well as from supra-regional stylistic comparisons of the pottery with dated find inventories beyond the Wadi Howar, the sequence covers a period between 5000 and 1500 BC.

The earliest is Dotted Wavy-Line pottery, which was present on 1.7 % of the sites. This pottery is mostly heavily quartz-tempered with globular pots decorated from rim to base with various Dotted Wavy-Line patterns (Jesse 1998, this volume). It fits into the known "Khartoum Horizon Style" (Hays 1971) and its distribution is known from the Sudanese Nile Valley to the Atlantic coast. The few radiocarbon dates place the Dotted Wavy-Line inventories in the Wadi Howar region mainly between 5000 and 4000 BC.

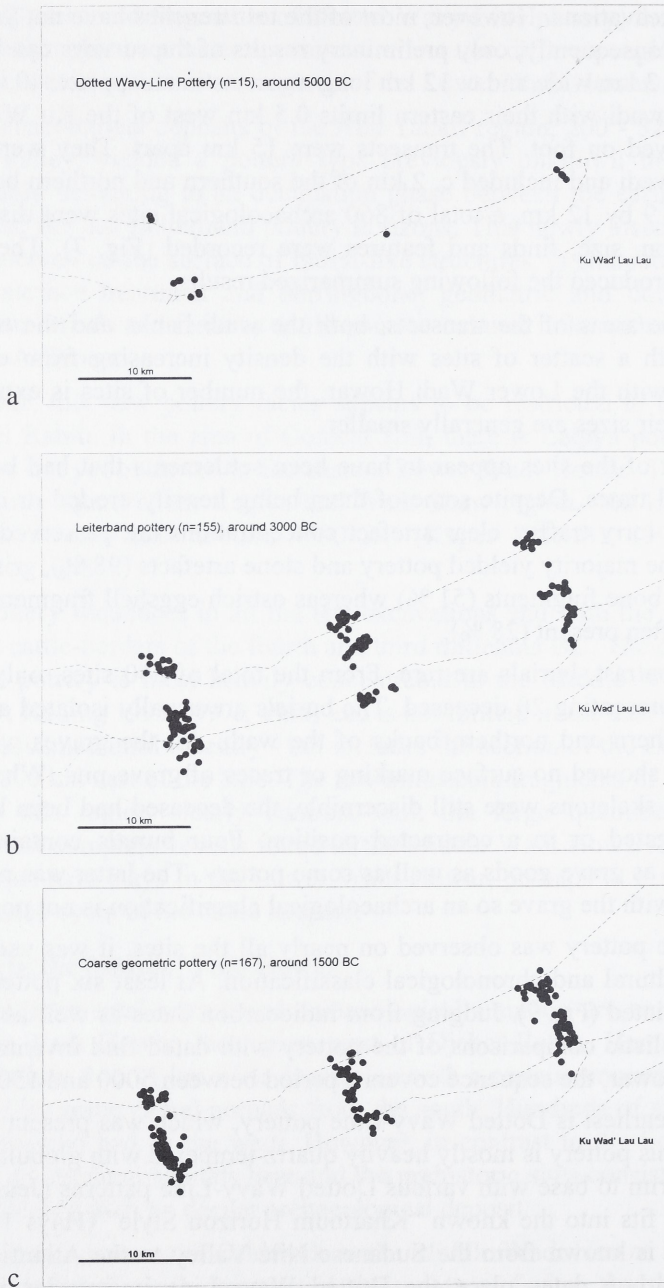


Fig. 7. Middle Wadi Howar: site distribution with different pottery types.

The succeeding, and partly contemporaneous, Laqiya pottery was found on 4.8 % of the sites. The quartz-tempered pots are mainly decorated with criss-cross and rockerstamp patterns which cover the whole vessel. It is mainly concentrated in the Wadi Howar, Wadi Shaw and Laqiya area (Kuper 1986:131, 1995:133; Schuck 1989:423, fig. 2:10, 11; Jesse 1998), indicating north-south rather than east-west connections. Judging from the associated bones and other finds, these two earliest pottery types in the Wadi Howar were probably used by hunter-gatherer groups.

Leiterband and Halbmond-Leiterband pottery both appear on 18.0 % of the recorded sites. These two facies of the same ceramic complex, probably with slightly different chronological positions, are characterized by neckless pots decorated over their entire surface with banded rockerstamp patterns which run parallel to the rim. While the earlier Leiterband motifs are formed of straight impressions (Keding 1993: fig. 3:2-5; 4:4) the later Halbmond-Leiterband decorations were impressed using rounded implements (Keding 1997a, 1998: Pl. 2). Nearly complete vessels of Leiterband pottery are often found in eroded pits in association with well preserved cattle-bones, mainly dated between the fourth and the third millennium BC. Since the early phase of the Leiterband sequence shows a strong resemblance with the pottery of the Khartoum Shaheinab of the Sudanese Nile Valley (cf. Arkell 1953; Caneva 1988), a common origin is assumed (Keding 1997a, 1998: fig. 3a). However, the Halbmond-Leiterband of the later phase can only be linked to pottery of the Chad area (Bailloud 1969) and indicates an increasing regionalization and western orientation of the cattle herders then inhabiting the Wadi Howar region (Keding 1998: fig. 3c)

Fine geometric pottery, recorded on 18.7% of the sites, and coarse geometric pottery, recorded on 19.4% of the sites, represent the last ceramic phases (Keding 1998:10f.). They each have different decorations, vessel-forms and temper and are denoted here - provisionally - as "fine geometric" and "coarse geometric" ceramics. Analyses of the sites excavated at Djabarona S96/2, S96/3, S96/119 and S96/120 will form the base for detailed descriptions of the inventories.

Some typical traits of the "fine geometric" pottery are a brown surface colour, mixed sand and fibre temper, mainly neckless vessel forms and decorations that include criss-cross incisions, impressed triangles and comb impressions which form geometric patterns (Keding 1998: Pl. 5). At first glance, the "coarse geometric" pottery appears to be very similar but clear differences are the reddish-brown surface colour, the nearly pure fibre temper, the broader spectrum of vessel forms including large pots with pronounced necks, and decoration on the inside of the rim (Fig. 8). Initial comparisons indicate that the "fine geometric" pottery tends toward connections with the Wadi Shaw area to the north (Francke

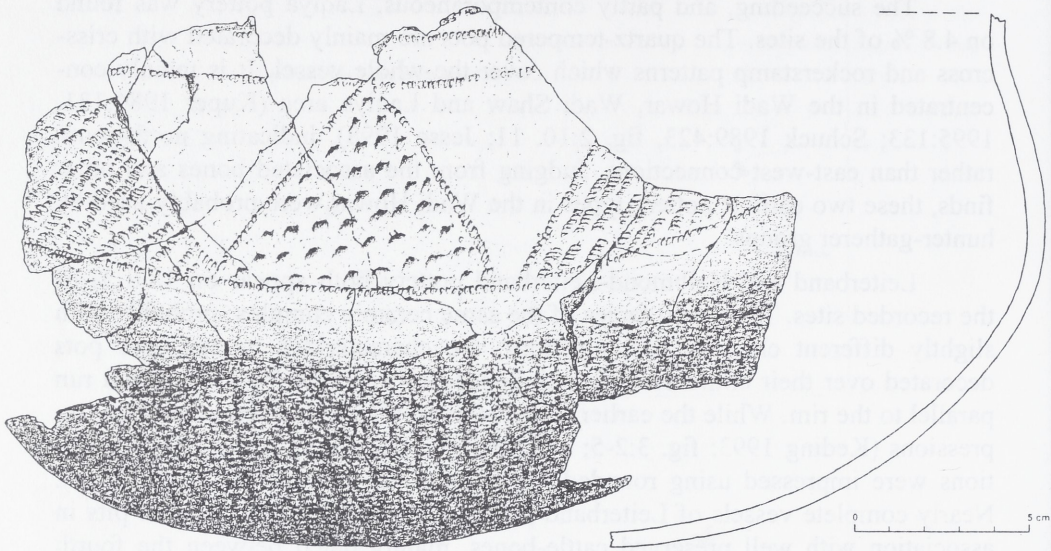


Fig. 8. Middle Wadi Howar, Djabarona S96/3-1: "coarse geometric" pottery.

1986), whereas the "coarse geometric" ware shows a general resemblance to material from more western areas such as the Ennedi Mountains. Both inventories are associated with animal bones, small livestock as well as cattle. The few radiocarbon dates place them mainly between 1500 and 2000 BC. Moreover, at 15 % of the sites, several so far unknown pottery types have been recorded - often represented by just a single sherd.

The pottery sequence of the Middle Wadi Howar corresponds, in its early phases, to the stratigraphic series of the settlement dunes in the western area of the Lower Wadi Howar. However, unlike the Lower Wadi Howar with its principal occupation period between the Dotted Wavy-Line horizon and the Leiterband complex, the Middle Wadi Howar was mainly occupied in the later phases (Fig. 9). During the Leiterband phase, the centre of settlement shifted from the lower course of the wadi to the apparently more favourable area in the middle section. As a result, the Lower Wadi Howar was abandoned, whereas the occupation of the Middle Wadi Howar continued. The final occupation phase has "fine geometric" and "coarse geometric" pottery in addition to Halbmond-Leiterband pottery.

Substantial transformations in the economy (Fig. 9) and the settlement pattern (Fig. 7) took place during the occupation of the Middle Wadi Howar. This can probably be interpreted, at least in part, as a result of the increasing aridity. The various pottery phases are associated with different subsistence strategies. While the processes of change could not be determined - this will only be achieved by excavations - the survey results demonstrate a sequence from hunting-fishing-gathering in the Dotted Wavy-Line phase, to cattle-herding in the Leiterband phase and, finally, additional small livestock keeping - goats and sheep - in the phases with geometric pottery (Van Neer and Uerpmann 1989:331ff., 335; Berke in press.).

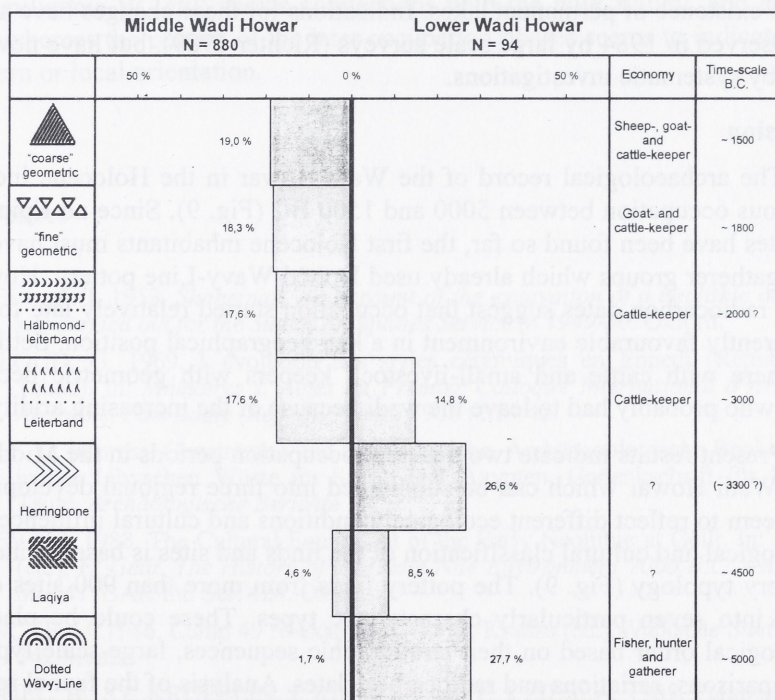


Fig. 9. Occupation periods in the Lower and Middle Wadi Howar.

At the same time, remarkable changes can be observed in the settlement patterns as far as site density, location and size are concerned - probably signs of an increasing aridity. In the earliest Holocene occupation period, characterized by inventories with Dotted Wavy-Line and Laqiya pottery, the site density was extremely low and settlements or just single finds are mainly found on the wadi banks (Fig. 7a). During the later phases, the occupation centres gradually shifted towards the wadi bed. In the Leiterband and Halbmond-Leiterband phases, a

clear increase in the number of sites becomes apparent (Fig. 7b). The sometimes very large sites, often characterized by pits filled with pottery and cattle bones, are distributed on the wadi banks as well as in the wadi bed. Permanent or temporary lakes, which obviously still existed at that time, appear on the distribution maps as zones without sites. During the final settlement phases, characterized by the inventories with the geometric decorated pottery of the cattle and small livestock keepers, the site density remained stable. However, the sites became smaller and the occupation centres were in the wadi bed (Fig. 7c). A map of the site distribution shows such a dense scatter of sites in the wadi depression indicating that there are no longer any white areas left which could point to the possible existence of permanent lakes. Indications for these changes have already been observed in 1984 by large scale surveys (Richter 1989), but have now been proved by systematic investigations.

Conclusion

The archaeological record of the Wadi Howar in the Holocene indicates continuous occupation between 5000 and 1500 BC (Fig. 9). Since no Epipalaeolithic sites have been found so far, the first Holocene inhabitants must have been hunter-gatherer groups which already used Dotted Wavy-Line pottery. However, the few radiocarbon dates suggest that occupation started relatively late for such an apparently favourable environment in a key geographical position. Settlement ended here with cattle and small-livestock keepers with geometric decorated pottery who probably had to leave the wadi because of the increasing aridity.

Present results indicate two different occupation periods in the Middle and Lower Wadi Howar which can be subdivided into three regional developments. These seem to reflect different ecological conditions and cultural influences. The chronological and cultural classification of the finds and sites is based principally on pottery typology (Fig. 9). The pottery finds from more than 900 sites can be divided into seven particularly characteristic types. These could be placed in chronological order based on their stratigraphic sequences, large-scale typological comparisons, seriations and radiocarbon dates. Analysis of the faunal remains allowed a preliminary determination of the associated economic development and documented repeated changes in the economic base. Occupation began with a foraging way of life in a well-watered environment. During the fourth millennium BC, at the latest, it continued with a phase of intensive cattle keeping. Later, small livestock was added and - at the end of the development sequence - hunting became more important.

The archaeological evidence from the areas to the east and west of Djebel Rahib and its adjacent dune barrier seems to reflect different cultural and environmental developments in the Lower and Middle Wadi Howar. This is reflected

in the regional patterns of settlement as well as in their long-range contacts. While Dotted Wavy-Line pottery is still found in both areas with an occupation centre in the Lower Wadi Howar, the predominant ceramics of the younger phases show different facies and a shift of the occupation centre to the Middle Wadi Howar. The Lower Wadi Howar seems to have been abandoned by the third millennium BC, whereas the occupation of the Middle Wadi Howar continued to the second millennium BC. At the same time, an increasing regionalization of the archaeological finds can be observed. The Dotted Wavy-Line pottery is part of the Early Khartoum horizon, spreading in the southern Sahara from the Nile Valley to the Atlantic. The Leiterband complex of the fourth and third millennia BC still shows connections with the Nile Valley, and later with Mali, whereas the pottery of the later occupation phases seems to indicate a more northern or local orientation.

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