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## **Pottery of the Wadi Howar – traditions, transformations and their implications**

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### **Introduction**

Pottery is one of the most important sources of data for archaeological studies. Although mainly used for chronological and chorological classifications, it provides an abundance of information about many other aspects of prehistoric life. While often only treated as a functional item, the idea of its active role in the social web is today generally accepted. Thus the study of pottery sequences and their development should not only consider the environmental factors and ecological implications that encouraged the adoption of particular technologies. It is just as important to understand the social context in which the technological changes occurred. The role of pottery in cultural processes must therefore also be considered.

### **Case-study: The pottery of the Wadi Howar region<sup>1</sup>**

This paper presents an attempt to test the validity of using pottery to examine the background and processes of cultural change. The specific case study concerns the cultural transformations between the 6th and 2nd millennia BC in the Wadi Howar region, on the southern fringe of the Eastern Sahara (Fig. 1). Over the last 10,000 years, this part of the desert has been subject to considerable climatic and environmental changes, with increasing aridity spreading from north to south (e.g. Ritchie et al. 1985; Haynes 1987; Neumann 1989; Hoelzmann 2002). Due to its location and the fact that it was part of the

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<sup>1</sup> The Wadi Howar region is one of the main areas investigated during the former BOS project (Besiedlungsgeschichte der Ostsahara) and the recent special research project ACACIA (Arid Climate, Adaptation and Cultural Innovation in Africa) of the University of Cologne, both financed by the Deutsche Forschungsgemeinschaft. The archaeological sections are directed by Rudolph Kuper and Hans-Peter Wotzka (since 2002).

largest drainage system of the Eastern Sahara, this region enjoyed favourable environmental conditions over a long period of time (Pachur & Kröpelin 1987; Kröpelin 1993; Hoelzmann et al. 2001). The wadi, which links the Nile Valley with the Ennedi Mountains in the Chad, also allowed easy access to many areas. The Wadi Howar region must thus have been of significant importance from the early to late Holocene – as an area of settlement, as an ecological refuge when the desert expanded during the Holocene, and as a passage. As a result, the region was probably a crossroads of cultural influences.

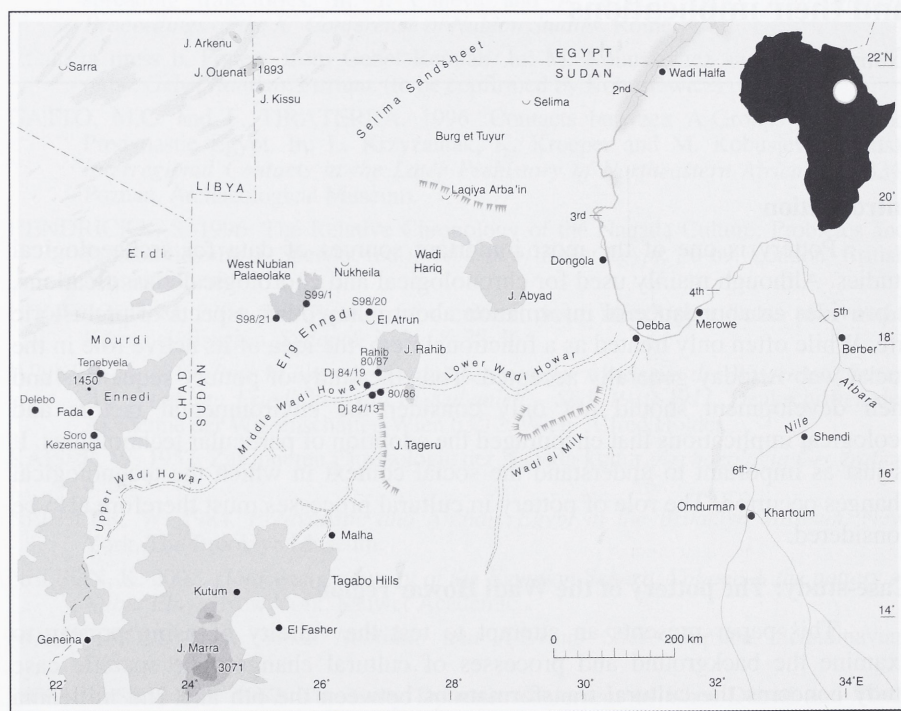


Fig. 1. The location of sites under investigation in Northwestern Sudan/Eastern Sahara and Northeastern Chad/Ennedi Mountains.

Pottery is by far the most characteristic type of artefact found in the Wadi Howar region. Upon it is based the chronological as well as the cultural classification of the 1800 known sites that have been discovered between 1995 and 2000 in the course of the ACACIA project of the University of Cologne (Fig. 2). At least two changes of pottery horizon can be observed in the region between the 6th and 2nd millennia. Each is linked with changes in the economic, social,

ritual and, probably, ideological spheres, against a background of increasing aridity (Keding 1998; in press; Keding & Vogelsang 2001). At the same time, clear shifts in the regional and supra-regional patterns of land-use and social networks emerge (Jesse 2004).







	Lower Wadi Howar n = 94		West Nubian Palaeolake Basin n = 301		Middle Wadi Howar n = 860		Djebel Tageru n = 263		Economy	BC
pottery	10%	50%	10%	50%	10%	50%	10%	50%		
 Handessi B			0,6%			19,0%		11,8%	keeper of sheep, goats and cattle	ca. 1500
 Handessi A			0,3%			18,3%		4,9%	keeper of goats and cattle	ca. 1800
 Halbmond- Leiterband				49,1%		17,6%		7,2%	cattle keeper	ca. 3000
 Leiterband		14,8%		11,3%		17,6%		18,3%	cattle keeper	
 Laqiya	8,5%			12,9%		4,6%		2,3%	hunter- gatherer, fisher	ca. 4500 ?
 Dotted Wavy-Line		27,7%		13,6%		1,7%		8,4%	hunter- gatherer, fisher	ca. 5000

Fig. 2. Archaeological sequences of the Wadi Howar region and adjacent research areas, based on survey data collected between 1995 and 2000. 'n' indicates the total number of sites in each area. Percentages indicate the proportion of sites with pottery of the different phases. Since sites where no pottery was found as well as sites that were reoccupied during different phases are included, the sum is never 100 %.

These processes of change are not well understood. The appearance of new forms of material culture within a region can be explained by factors such as evolution, emulation, migration, exchange and innovation (CLARK 2001: 6-8). Equally, emulation can involve either the inception of unique local styles that reinterpret elements of neighbouring traditions, or the direct imitation of foreign styles. Foreign styles might also be brought into a region through intermarriage or migrant potters. Since the observed cultural transformations occur at the same time as drastic environmental changes, which probably went hand in hand with an increasing population density in the region as well as economic changes, they may well be connected with the economic intensification processes. In addition,

in both cases, it is assumed that at least the economic changes were mainly influenced by external impulses (2001). The first transformation, from hunter-gatherer-fishers to cattle-keepers, is thought to be the result of contact diffusion or the migration of people from the Nile Valley. The second transformation, from cattle-keepers to small-livestock herders of goats and sheep as well as cattle, is a clear adaptation to the increasing aridity and seems to have been strongly influenced by people from the northern and/or western areas. In other words, both changes are based on either emulation or the replacement of the former inhabitants by migrants into the area - which would produce similar artefact patterns.

Here, the numerous pottery finds in the Wadi Howar region are first examined with a view to determining their potential usefulness in revealing the cultural processes that underlie the observed changes. Do they help us determine in more detail such processes as emulation, migration or population replacement? This question is approached from four different angles:

1. a theoretical approach;
2. an analysis of the different types of pottery assemblage and their context in each horizon, with an emphasis on technological traits rather than decoration patterns;
3. an analysis of the formal variation in the pottery of each horizon in different areas;
4. a brief consideration of the decorative styles.

### **1. Theoretical approach: Material culture and style**

In order to isolate those attributes of pottery that reflect different aspects of social processes, certain assumptions are made about the role of material culture and its relationship to human behaviour as well as about the interpretation of stylistic variability. Anthropologists and archaeologists recognise a broad range of meanings and functions in material culture, which go beyond purely utilitarian purposes. They include the following points:

material culture "... reflects the choices ... (man) makes within an environment ... with which he interacts" (Schwarz 1979: 29);

material culture is meaningfully constituted (e.g. Hodder 1991);

material culture is dynamic and within its processes of change it is usually subject to reinterpretation (e.g. Johansen 1993: 9);

material culture "... does not passively reflect society - rather, it creates society ..." (Hodder 1991: 6; also e.g.: Shanks and Tilley 1987/1992: 146-155, 171; Gosden and Marshall 1999; Gell 1998).

Thus, material culture can be seen as an indirect reflection of human society. However, there is "... no direct, universal cross-cultural relationship between behaviour and material culture", because "frameworks of meaning intervene and these have to be interpreted by the archaeologist" (Hodder 1991: 14).

For archaeologists, one of the most important features of material culture is style. Renfrew and Bahn (1991/1996: 401) describe style as "... how you do something". They cite the art historian Ernst Gombrich, who defines style as "... any distinctive and therefore recognizable way in which an act is performed or an artifact made" (quoted from Renfrew and Bahn 1991/96: 401). Style is therefore less a matter of functional need than "... a form of social rather than individual practices offering a triple vision of the world in terms of habituated forms of social consciousness, principles of structural order..." (Shanks and Tilley 1987/1992: 155). Consequently, style is widely valued as a possible indicator of cultural affiliation or group membership.

Discussions that explore types and functions of style in archaeology are numerous. An early influential approach was the concept of *Kulturkreise* or Culture Areas (Kosinna 1911; Graebner 1911) at the beginning of the last century. More recent important approaches include Binford's "Cultural Style and Drift" hypothesis (1965), as well as concepts that focus on the social information transmitted by style. These may include information about social dominance (Shanks and Tilley 1987/1992), interaction (Plog 1980) or demarcation (e.g. Hodder 1982; Washburn 1989). Other approaches often emphasize information exchange by differentiation of style, with and without a message (Sackett 1977; Wobst 1977; Wiesner 1983, 1984, 1990).

However, based on ethno-archaeological studies, the different models indicate that stylistic variety is an unreliable indicator of group membership. Instead, stylistic expressions of social identity are heavily dependent on context and elude most attempts at generalisation (e.g. Appandurai 1986; Hodder 1991: 6; Thomas 1991).

One question raised here asks what kind of formal attributes of material culture can reflect what kind of processes, such as enculturation, communication, etc. Broad-based approaches to style are therefore of particular interest. These include distinctions between active and passive styles (Sackett 1977) and thus extend the range of stylistic attributes beyond those that convey conscious messages. They provide a strategy for the isolation of specific artefacts and attributes that reflect an enculturative background, i.e. traditions (Carr 1995b: 252).

Adopting Sackett's isochrestic model, Carr suggests in his synthesised broad-based "unified middle-range theory of artifact design" (1995a, b) that physical and contextual visibility could be an indicator for the differentiation of

the message potential of artefacts and attributes (for a detailed analysis based on Carr's theory see Clark 2001).

One rule of this theory is that the higher the physical and contextual visibility of an attribute and the artefact, the greater its message potential (Clark 2001: 12). Ethno-archaeological studies show that high visibility attributes involve the active and sometimes conscious manipulation of goods to negotiate social relationships (active style). They are more likely to be emulated or imitated and are often encoded in decorative parameters. In contrast, "...attributes with low physical and contextual visibility can be assumed to have little message potential" (passive style) (Clark 2001: 12). They are automatic and largely unconscious, reflect a thoroughly internalised understanding of a shared craft tradition that is passed from generation to generation<sup>2</sup> and constitute "the way things should be done". As a result, they are very stable since less likely to be imitated or emulated and functional needs constrain the range of acceptable variation. These attributes are often encoded in the technological style of a community.

Generally speaking, "stylistic similarities (...) merely reflect a shared settlement history and a common enculturative background. (...) Stylistic differences are interpreted as the result of a stylistic or cultural drift between non-interacting groups (Binford 1965; Braun 1995)" (Carr 1995b: 195-198, 213, in Clark 2001: 12). Consequently, the documentation of chronological changes in ceramic attributes with different physical and contextual visibility is essential for the identification of major socio-cultural transition points in the Wadi Howar development sequence.

Three provisional assumptions structure the following study. The first is that the patterns of formal variation in the technological attributes of pottery constitute "technological styles" and represent deeply embedded cultural traditions. The second is that, for a given range of utilitarian goods circulating in restricted networks, these technological styles reflect the cultural affiliations of the producers. The third is that decoration parameters can be the result of conscious manipulations and may, therefore, reflect intentional messages about group affinity. For the cultural changes considered here, this means: in the case of migration,

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<sup>2</sup> Some general patterns of the learning and transmission of crafts from generation to generation in recent traditional societies are pointed out by Arnold (1989). Pottery making is learned by imitation and practice rather than by direct teaching. Learning thus involves a series of complex motor-habit patterns of pottery production, combined with a cognitive knowledge of raw materials and knowledge of processes like fabrication and firing. These motor habits are unconscious; they are "... culturally patterned but habitually used activity patterns that cause particular muscles to be strengthened" (:180). They require repetition over a long period in order to be effectively utilised. Decoration patterns are derived less from motor-habit patterns than from cognitive knowledge, and are thus more easily modified than the basic motor habits involved in vessel production.

changes in both the technological as well as the decoration styles are to be expected; in the case of emulation, a change in decoration can be expected while a change in the technological style would only occur if it is accompanied by clear functional advantages.

## 2. The Pottery sequence of the Wadi Howar region

The assemblages studied have a chronological span from the 6th to the 2nd millennium BC, starting with the Dotted Wavy-Line and partly contemporary Laqiya phase, then the Leiterband-/Halbmondleiterband phase and, finally, the Handessi A and B horizons (Fig. 2, 3) (Keding 1998). A critical problem in this dating is the lack of clear sequences. The prehistoric settlements are usually severely eroded surface sites where a clear association of datable material and pottery is not always available. The analysis is therefore based on a few, better preserved reference sites for each horizon where some excavation has been done.

The “operational sequence” (Lemonnier 1986) of ceramic manufacture involves multiple steps, each of which poses problems that can be resolved in numerous ways, depending on the choices made by the potter. The typological classification of ceramics in the ACACIA analysis covers the main steps and is based on visual inspection.

*Dotted Wavy-Line and Laqiya pottery (Fig. 3.1; Tab. 1, left row)*

Dotted Wavy-Line pottery and the somewhat younger Laqiya pottery characterise the oldest pottery horizon known so far (Jesse 2003). They are most often found as small to medium fragments on settlement sites.

The brown ware is usually heavily tempered with coarse grains of sand as well as angular quartz, which was probably crushed. Occasionally, micaceous particles are also included in the paste, and plant impressions are sometimes found on the surface. The vessels were formed using the coil-and-scrape technique; both the outer and inner surfaces are generally burnished. The range of vessel forms comprises mainly pots and bowls but also includes dishes. Rim shapes are simple, while the bottoms are characterised by round as well as pointed forms. The pots are usually decorated from rim to bottom in the rocker-stamp technique using toothed implements. The different Dotted Wavy-Line and zig-zag patterns are arranged in closely packed horizontal bands.

*Leiterband pottery (Fig. 3.2; Tab. 1, middle row)*

The red-ochre Leiterband pottery and its variant, the Halbmondleiterband pottery, are generally well preserved (Keding 1997). They are often found in eroded pits, where the pots had been placed in a nearly complete state together with cattle bones (Keding 1997: 204-240). In many cases a ritual context seems probable.

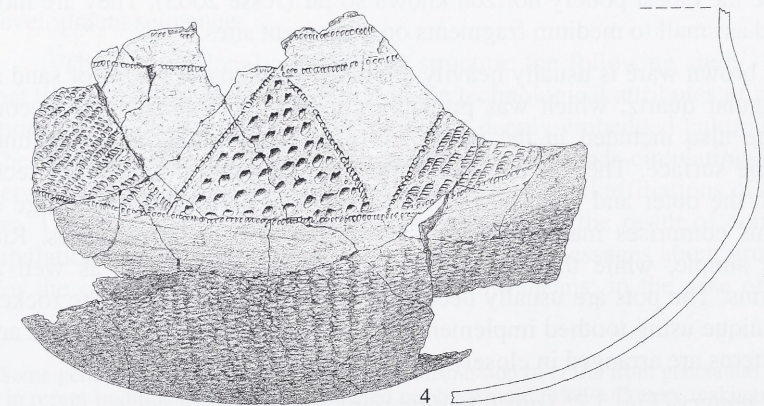
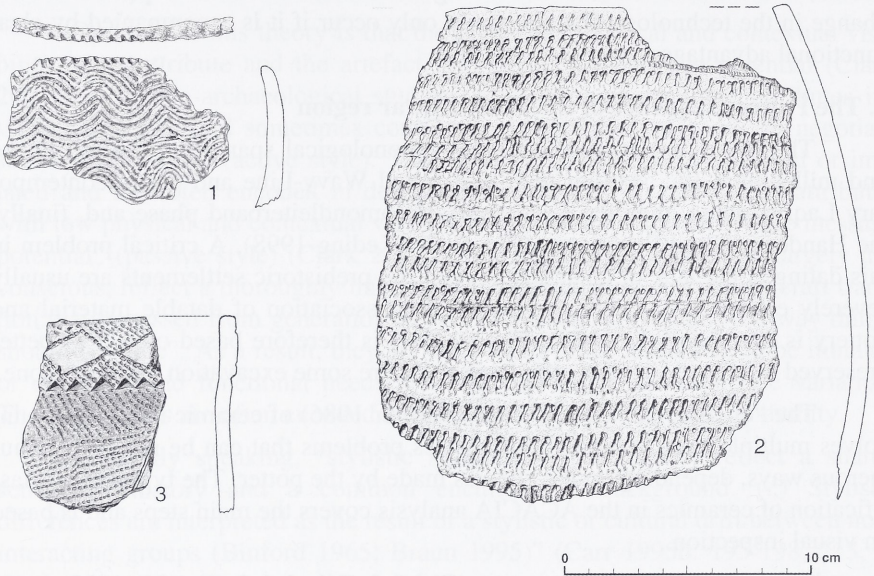


Fig. 3.1. Dotted Wavy-Line pottery fragment (Site S98/20);  
Fig. 3.2. Leiterband pottery fragment (Site S99/1); Handessi A pottery fragment (Site S96/2);  
Handessi B pottery fragment (Site S96/119).



Tab. 1. Characteristics of Dotted Wavy-Line and Laqiya pottery, Leiterband and Halbmondleiterband pottery, Handessi A and Handessi B pottery.

Pottery horizon	Dotted Wavy-Line/Laqiya	Leiterband	Handessi A	Handessi B
BC	~ 5000/ 4500	~ 3000	~ 1800	~ 1500
Subsistence	Hunter-gatherer-fishers	Cattle-keepers	Keepers of sheep, goats and cattle	Keepers of sheep, goats and cattle
<i>Technological attributes</i>				
Temper composition	mineral	mineral	organic and/or mineral	organic and/or mineral
" quantity	heavy			light
" quality	coarse			fine
Manufacturing technique	coiling	coiling	pinching/drawing	pinching/drawing
Surface treatment, outside	burnished or smoothed	burnished or smoothed	mat impression and/or burnished	mat impression and/or burnished
Colour, outside	brown	red-brown	brown, grey	brown
" , inside	brown	red	brown	black
Fracture, zones and their colours	brown/brown/brown	red/grey/red	black/black/black	black/black/black
Firing atmosphere	reducing	oxidising	reducing	reducing
<i>Forms</i>				
Vessel	pots, bowls	pots	necked pots, pots, bowls, dishes	necked pots, pots, bowls, dishes
Rim	simple	simple	simple	simple
Base	round or pointed	round	round	round or flattened
<i>Decoration</i>				
Position	rim/wall/bottom	rim/wall/bottom	rim/(wall/bottom)	rim/ inner rim/ neck/wall/bottom
Technique	rocker-stamp	rocker-stamp, incision (mainly rim)	comb, single and mat impression, incision	comb, single and mat impression, incision
<i>Arrangement</i>				
horizontal bands	repeated and linked	repeated and linked	pronounced single bands	pronounced single bands
geometric	-	very rare	frequent	frequent
decorated vessel zones	rim/wall/bottom	rim – wall/bottom	rim – wall/bottom	rim – inner rim – neck – wall/bottom

Leiterband pottery is always tempered with sand and about 30% of the shards also contain crushed quartz particles. Shaping was done in the coil-and-scraper technique; the red-brown surfaces are burnished and smoothed, sometimes with visible stroke marks. The limited range of vessel forms is dominated by various sizes of round-bottomed spherical and bag-shaped pots with no neck restriction. Only the outer surface of the vessels is decorated, either completely or just from rim to belly, with horizontal bands running parallel to the rim. The 110 different body decorations are almost exclusively impressed in the rocker-stamping technique using various combs and spatulas (Keding 1997: Fig. 37). Typical decorations on the pottery from Djabarona 84/13 site are different kinds of zig-zag pattern, “contraposed triangles“, Leiterband patterns and Halbmondleiterband patterns. In this horizon, undecorated vessels also appear for the first time (Jesse in press). These may indicate the beginning of a differentiation between purely utilitarian household ware and decorated vessels for more public use.

*Handessi pottery*<sup>3</sup> (Fig. 3.3, 3.4; Tab.1, right row)

Pottery of the Handessi Horizons comprises at least two facies, each with different attributes as far as technology, form and decoration are concerned, which have yet to be fully differentiated (Keding 1998: 10-11; Jesse this vol.; Lange this vol.). In general, this type of pottery is not well preserved in the Wadi Howar. It is usually found in small fragments on settlement sites. However, some nearly complete vessels of the later “Handessi B” horizon were found beside burials and seem to represent offerings.

Characteristic of the earlier “Handessi A” (Fig. 3.3) pottery are a grey-brown surface, a mineral temper which also contains some organic matter, spherical vessel shapes with only rarely a curved profile, as well as both incised and impressed decorations (Keding 1998: 10; Prill 2000). The incised decorations frequently include cross patterns, while the impressed decorations consist, in particular, of single triangular impressions and parallel comb impressions that often form geometric patterns.

Characteristic of the later thin-walled “Handessi B” (Fig. 3.4) pottery are a fine to medium-grained sand and organic temper and, usually, a mat-impressed or burnished outer surface and a burnished or smoothed inner surface (Günther 1995; Keding 1998: 11; Jesse this vol.; Lange this vol.). There is a wide range of vessel shapes, including different types and sizes of pots, dishes and curved-profile vessels. 60% of the pottery is decorated. Decoration on the inside of the

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<sup>3</sup> “Handessi pottery” is the new term for the previous provisional expression “geometric pottery” (e.g. Keding 1998). “Handessi A” pottery corresponds to “fine geometric” ware, “Handessi B” to “coarse geometric” ware (see Jesse this vol.).

rim is noticeably more frequent. The most important techniques are incision and impression, with a predominance of geometric patterns and mat impressions. However, zig-zag patterns produced in the rocker-stamp technique are also known.

#### *General trends in the pottery sequence of the Wadi Howar region*

Notable trends in technology, form and decoration as well in the find context are evident in the assemblages. Although the technology of the early ceramic horizon is already mature, subsequent developments demonstrate a gradual evolution towards improved and more complicated manufacturing technologies as well as an increased complexity in decoration parameters.

There is a gradual development from a heavier, coarser tempered and more thick-walled ware to fine-grain tempered and thin-walled pottery. Additional technological improvements are indicated by the vessel forms: while the earlier horizons are characterised by very limited spectra, dominated by vessel forms with “simple contours”, the later assemblages have a wide range of forms that also includes vessels with technologically more complex composite contours. The same trend can be observed in the decoration parameters: the range of decoration techniques, patterns and arrangements as well as an ever more pronounced structure of the decoration system reveal increasing variety and complexity.

Nevertheless, certain portions of the sequence clearly underwent rapid stylistic changes, whereas other portions were much more stable. The most rapid and striking changes are evident in temper composition, manufacturing and firing techniques, vessel shapes and decorations. These points of discontinuity in the stylistic sequence seem to lack any transitional character and are concentrated in the Handessi horizons. In contrast, the assemblages of the Dotted Wavy-Line/Laqiya horizon and the Leiterband horizon reveal much more gradual changes rather than drastic transformations.

### **3. Regional trends in the pottery sequence**

In order to study the formal variation of the pottery within each horizon, the assemblages have to be examined on a more regional level. If Carr’s model is valid, technological attributes and decoration features should provide qualitatively differentiated information, both chronologically and spatially.

Included in the analysis are sites from the Middle Wadi Howar, the West Nubian Palaeolake Basin – both research areas of the ACACIA project – and the Ennedi Mountains (Fig. 1). Assemblages from the last area were excavated in the 1950s by Gerard Bailloud on behalf of the Musée de l’Homme in Paris (Bailloud

1969; 1997)<sup>4</sup>. In the 1990s, I had an opportunity to compare Bailloud's material with the finds from the Wadi Howar region<sup>5</sup>.

The three areas had very different environments during the early and middle Holocene. The Middle Wadi Howar, a 400 km long section of the now dry water course to the west of Djebel Rahib, was a chain of lakes (Pachur and Kröpelin 1987; Kröpelin 1993). The West Nubian Palaeolake Basin, situated to the west, was a plain with the large West Nubian Palaeolake and some smaller lakes (Pachur and Hoelzmann 1991; Pachur 1997; Hoelzmann et al. 2001). In contrast, the Ennedi Mountains were characterised by narrow valleys and small natural ponds (Bailloud 1969; 1997). All three areas show traces of intensive occupation. However, while the people in the Wadi Howar area and the West Nubian Palaeolake Basin usually lived on dunes at the edge of the lakes, in the Ennedi Mountains there are long occupational sequences in abris and caves. The most prominent example so far is Delebo (Bailloud 1969). This site has a stratigraphic sequence with 5 layers spanning several pottery horizons, beginning with Wavy-Line and ending with Hohou, which corresponds to the Leiterband pottery. Unfortunately, there are no layers with geometric-patterned pottery. Consequently, this part of the present analysis is limited to the earlier pottery horizons<sup>6</sup>.

#### *The technological complex*

A comparison of the technological styles of the different assemblages from these three areas is of special importance. They are all situated in a region that was a cultural crossroads for eastern and western influences. However - on a regional level - the cultural assignment of the West Nubian Palaeolake Basin is of particular importance. Was this area a foreland used by people from the mountainous region to the west, or a hinterland used by groups from the Wadi Howar, or does it represent a unique and separate technological tradition?

#### *The Dotted Wavy-Line horizon and the Leiterband horizon*

Several patterns emerge when the Dotted Wavy-Line horizon and the Leiterband horizon are subdivided by region (Tab. 2; 3). Firstly, the technological

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<sup>4</sup> In 2003, the ACACIA project also started to do fieldwork in the Ennedi Mountains (Lenssen-Erz & von Czerniewicz 2005), with the participation of the author since 2004 (Keding in press b).

<sup>5</sup> I thank the DAAD (Deutscher Akademischer Ausstauschdienst e.V.) and the MSH (Maison des Sciences de l'Homme) for the grant that enabled this study. I also thank the Musée de l'Homme in Paris and, especially, Prof. de Lumley, Dr. M. Perpère and Prof. G. Bailloud for permission to analyse the Ennedi material in 1994.

<sup>6</sup> ACACIA project excavations of three sites in the Ennedi Mountains, in 2003 and 2004, revealed stratigraphic sequences but these did not include geometric-pattern pottery. However, surface finds included pottery with geometric decorations, which were dated in the second millennium BC (Keding in pressb).

Tab. 2. Dotted Wavy-Line pottery: regional characteristics.

Dotted Wavy-Line ~ 5000/4500 BC Hunter-gatherer-fishers Site	Region:	Region:		Region:
	Ennedi Mountains	Westnubian Palaeolake Basin		Middle Wadi Howar/Rahib
	Delebo	S98/20	S98/21	80/87
Analyzed by	B. Keding	B. Keding	B. Keding	F. Jesse
<i>Technological attributes</i>				
<i>Temper composition</i>	mineral	mineral and <b>organic</b>	mineral and <b>organic</b>	mineral
" quantity	<b>moderate</b>	heavy	heavy	heavy
" quality	fine to <b>coarse</b>	fine to <b>coarse</b>	fine to <b>coarse</b>	fine to <b>middle</b>
<i>Manufacturing technique</i>	coiling	coiling	coiling	coiling
<i>Surface treatment, outside</i>	<b>smoothed</b> or burnished	<b>smoothed</b> or burnished	<b>burnished</b> or smoothed	<b>burnished</b> or smoothed
<i>Colour, outside</i>	brown	ochre or brown	brown	red-brown
" , inside	brown	grey or brown	brown	red-brown
<i>Fracture, colour(s) and number of zones</i>	grey <b>1 zone</b>	black / grey <b>2 zones</b>	brown / black <b>2 zones</b>	black-grey <b>1 zone</b>
<i>Firing atmosphere</i>	reducing	reducing	reducing	reducing
<i>Forms</i>				
<i>Vessel</i>	Pots, bowls, dishes	pots, bowls, dishes	pots, bowls, dishes	pots, bowls
<i>Rim</i>	simple	simple	simple	simple
<i>Base</i>	round, <b>flattened</b> or pointed	round or <b>pointed</b>	round, <b>pointed</b> or flattened	round, (flattened, pointed)
<i>Decoration</i>				
<i>Technique, rim</i>	rocker-stamp	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression
<i>Technique, wall</i>	rocker-stamp	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression (?)	rocker-stamp
<i>Patterns, rim and wall</i>	Incised Wavy-Line; Dotted Wavy-Line; <b>Orogowdé</b>	Dotted Wavy-Line; <b>Laqiya</b>	Dotted Wavy-Line; <b>Laqiya</b>	Dotted Wavy-Line; <b>Laqiya</b>
<i>Arrangement</i>	horizontal bands, repeated and linked	horizontal bands, repeated and linked	horizontal bands, repeated and linked	horizontal bands, repeated and linked

Tab. 3. Leiterband pottery: regional characteristics.

Dotted Wavy-Line ~ 5000/4500 BC Hunter-gatherer-fishers Site	Region:	Region:		Region:
	Ennedi Mountains	Westnubian Palaeolake Basin		Middle Wadi Howar/Rahib
	Delebo	S98/20	S98/21	80/87
Analyzed by	B. Keding	B. Keding	B. Keding	F. Jesse
<i>Technological attributes</i>				
<i>Temper composition</i>	mineral	mineral and <b>organic</b>	mineral and <b>organic</b>	mineral
" quantity	<b>moderate</b>	heavy	heavy	heavy
" quality	fine to <b>coarse</b>	fine to <b>coarse</b>	fine to <b>coarse</b>	fine to <b>middle</b>
<i>Manufacturing technique</i>	coiling	coiling	coiling	coiling
<i>Surface treatment, outside</i>	<b>smoothed</b> or burnished	<b>smoothed</b> or burnished	<b>burnished</b> or smoothed	<b>burnished</b> or smoothed
<i>Colour, outside</i>	brown	ochre or brown	brown	red-brown
" , inside	brown	grey or brown	brown	red-brown
<i>Fracture, colour(s) and number of zones</i>	grey <b>1 zone</b>	black / grey <b>2 zones</b>	brown / black <b>2 zones</b>	black-grey <b>1 zone</b>
<i>Firing atmosphere</i>	reducing	reducing	reducing	reducing
<i>Forms</i>				
<i>Vessel</i>	Pots, bowls, dishes	pots, bowls, dishes	pots, bowls, dishes	pots, bowls
<i>Rim</i>	simple	simple	simple	simple
<i>Base</i>	round, <b>flattened</b> or pointed	round or <b>pointed</b>	round, <b>pointed</b> or flattened	round, (flattened, pointed)
<i>Decoration</i>				
<i>Technique, rim</i>	rocker-stamp	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression
<i>Technique, wall</i>	rocker-stamp	rocker-stamp, simple comb impression (?)	rocker-stamp, simple comb impression (?)	rocker-stamp
<i>Patterns, rim and wall</i>	Incised Wavy-Line; Dotted Wavy-Line; <b>Orogowdé</b>	Dotted Wavy-Line; <b>Laqiya</b>	Dotted Wavy-Line; <b>Laqiya</b>	Dotted Wavy-Line; <b>Laqiya</b>
<i>Arrangement</i>	horizontal bands, repeated and linked	horizontal bands, repeated and linked	horizontal bands, repeated and linked	horizontal bands, repeated and linked

styles within each horizon vary considerably. Secondly, an examination of the temper, firing technique and surface treatment suggests spatially discrete manufacturing traditions. This is the case for both the Dotted Wavy-Line and the Leiterband horizons. Thirdly, though the attributes vary widely, the technological traditions that structured ceramic production seem remarkably similar in their spatial structure over time.

#### *Temper material*

A closer look at the composition of the temper in the Dotted Wavy-Line and Leiterband pottery reveals a spectrum that includes sand, crushed quartz and organic materials as the main components. At the same time, the compositions in the different regional assemblages indicate three distinct patterns. The Dotted Wavy-Line pottery assemblages from the Middle Wadi Howar and the Ennedi Mountains are generally similar, with a dominance of sand and crushed quartz. The assemblages from the West Nubian Palaeolake Basin, on the other hand, are clearly different: crushed quartz is almost totally absent and up to 60% of the vessels have an organic temper. The same threefold pattern is visible in the Leiterband horizon: again, the pottery from the Middle Wadi Howar and the Ennedi Mountains shows the same general trend with a dominance of sand and crushed quartz, whereby the amount of crushed quartz is considerably higher in the latter region. In contrast, pottery from Site S99/1 in the West Nubian Palaeolake Basin is heavily tempered with organic material.

#### *Surface treatment*

The surface treatment reveals a similar picture. During the Dotted Wavy-Line period, the dominant attributes in all three areas are the same - smoothing and burnishing - even if there are proportional differences. However, while the pottery from the Middle Wadi Howar and the Ennedi Mountains is very homogeneous, the pottery from Site S98/21 in the Paleolake Basin is much more diverse. In the Leiterband horizon, the treatment of the outer surface shows a less clear picture: burnished surfaces generally dominate but the degree of care taken varies, with the assemblages from the Ennedi Mountains showing the greatest tendency towards higher quality.

#### *Colour of the fractures*

A third attribute worthy of mention is the colour of the fractures. Even if this is influenced by variable conditions, it does provide information about methods, which are also a feature of tradition. In the Dotted Wavy-Line horizon, in all three areas, the pottery fractures are usually not zoned but rather a monochrome grey or black indicating firing in a reducing atmosphere. However, while grey clearly dominates in the pottery from the Middle Wadi Howar and the Ennedi Mountains, in the case of the West Nubian Palaeolake Basin both the

inner and outer edges of the fractures show a wider range of colours. During the Leiterband phase, the structure and colour of the fractures point to the use of several methods with different firing conditions – a reducing atmosphere in the Ennedi Mountains and West Nubian Palaeolake Basin, but oxidising conditions in the Middle Wadi Howar. While the pottery from the last area is characterised by fractures with three colour zones - red outer zones and a grey to black core, the fractures in assemblages from the Ennedi Mountains and the West Nubian Palaeolake Basin are usually monochrome grey or black.

To sum up: On a regional level, the technological styles indicate at least three different expressions within each horizon, which are typical for the different areas – the Middle Wadi Howar, the Palaeolake Basin and the Ennedi Mountains. These might represent different traditions. While the technological features analysed are not always constant over time (e.g. the composition of the temper material in the Dotted Wavy-Line and the Leiterband pottery), the three different technological styles remained stable in their spatial structure for several thousands of years.

#### *The Handessi horizons*

The study of the technological styles in the Handessi A and B horizons is restricted to assemblages from the Middle Wadi Howar. There are no sites with this type of pottery in either the West Nubian Palaeolake Basin or the Ennedi Mountains (Tab. 1).

An overview of attribute variability in the Handessi horizons is very informative. Two aspects are particularly intriguing. Firstly, the variety of technological styles in Handessi A and B seems to be much greater than in the previous pottery horizons. However, this could be the result of evolving functions for both sites and pots. For example, the temper composition is clearly dominated by sand and organic material, but in varying proportions, quantities and qualities throughout both horizons. The treatment of both inner and outer surfaces is particularly varied in the Handessi A horizon: coarse burnish or burnish with visible stroke marks dominate but smoothed surfaces are also found. The outer-surface treatment in the Handessi B assemblages seems to be more narrowly defined. Firing techniques are not uniform: fractures show single as well as two-zoned colours and the inner surface is sometimes smudged. There is a similar diversity in the decoration parameters: techniques as well as patterns show a much wider range than in the older assemblages. Secondly, the technological styles of both Handessi horizons show significant differences in nearly all their attributes when compared with the earlier horizons. This is true of the temper, the manufacturing technique, the main outer-surface treatment, the firing technology and some pottery shapes as well as the decoration parameters. Thus, a clear break emerges in the basic concept of the pottery: this applies to



both the technological features and the decoration style as well as, probably, practical and social functions.

*What do these trends mean?*

If the above-mentioned assumptions are correct – that technological attributes yield information about traditions and reflect the introduction of inventions and the existence of “production centres” – the following conclusions can be drawn from the examination of the technological complex:

So far, the investigation reveals an archaeological record that reflects a separate evolution in each area studied as well as the influence of various neighbouring traditions at different times.

Entrenched social boundaries seem to have been established already in the Dotted Wavy-Line period. Assemblages from the Ennedi Mountains and the Wadi Howar, in particular, seem to be clearly defined. In contrast, the assemblages from the West Nubian Palaeolake Basin are more diverse; they share some traits with both the western and south-eastern assemblages but are also characterised by some important technological differences. This combination shows that this area had its own distinct technological style.

With the transition to the Leiterband horizon the picture of separate regional traditions does not change. Despite the transition to a cattle-herding economy, which must have involved changes in the organisation of labour, mobility and ideas regarding land use and ownership, the social boundaries reflected in the technological differences remain remarkably stable in all three areas and only gradually become more pronounced as time passes. On a general level, these boundaries are reflected in a more careful pottery manufacture in the Ennedi Mountains and a rather negligent finishing of the ceramics in the West Nubian Palaeolake Basin. In detail, they are demonstrated by technological attributes like temper and firing techniques. Functional differences related to micro-differences in subsistence practices between the plain and the mountains may have generated a demand for different vessel forms in each region. These findings do not negate the arguments for direct contacts with cattle herders or partial emulation. Principally, however, they support a model of in-situ development of the populations in the Wadi Howar region during the transition process from Dotted Wavy-Line to Leiterband pottery rather than a model of population replacement.

With the emergence of the Handessi horizons, technologically different ceramic traditions became established in the Wadi Howar region. The earlier discrete social affiliations vanished – probably due to the increasing aridity as well as a population shift. Even if some of the new technological attributes can be interpreted as technical improvements, distinguishing techniques in manufacture, temper, and surface treatment as well as in vessel forms hold the key to a differ-

entiation between the earlier and later horizons. All the decorative parameters - technique, pattern and arrangement - can be added to this list. What emerges from a comparative analysis of the Handessi horizons is a picture of increasing diversity due to the implementation of a set of already known but seldom used technologies. This pattern suggests an immigration of people, probably from the north. As shown by Friederike Jesse and Matthias Lange for the Wadi Hariq 400 km to the north east and the Wadi Shaw (both in this volume), similar pottery to the Handessi A horizon existed already in these areas (Jesse et al. 2004). At the same time, groups with different types of geometric-patterned pottery become archaeologically visible in the Ennedi Mountains (Bailloud 1969).

### **The decoration complex**

Finally, a brief consideration of decoration styles: according to Carr's model, these often signal interaction between groups. They thus reflect different social affiliations rather than technological styles. I will not go into great detail here but simply mention the distribution of the decorations, which reveals a somewhat different picture to that drawn by the distribution of technological styles. It also demonstrates important chronological changes.

#### *The Dotted Wavy-Line and Laqiya horizon (Fig. 4)*

In the Dotted Wavy-Line horizon, assemblages from the Wadi Howar region and the West Nubian Palaeolake Basin are decorated with Dotted Wavy-Lines and their typically associated decorations, as well as with Laqiya patterns (Jesse 2002; 2003). Both types appear on technologically equivalent shards. Laqiya patterns are typical of a more regional pottery facies with its centre in the Laqiya area, 400 km to the north (Schuck 1989), and a distribution from the Selima Sandsheet in the north to Djebel Tageru to the south (Jesse 2002). The regular association of Dotted Wavy-Line and Laqiya decorations clearly demonstrates a relationship between the people of the two regions. In contrast, there is no pottery with the Laqiya pattern in the Ennedi Mountains (Bailloud 1969). Instead, the assemblages have a new type of Wavy-Line pattern – the Orogowdé pattern. This decorative element seems to be merely an addition to the older inventory, but it is found on a particularly fine type of ware. Thus, at the time of the Dotted Wavy-Line Horizon, the Ennedi Mountains marked a cultural or “social” boundary, which divided the Dotted Wavy-Line Horizon into an eastern and a western decoration facies (for details of the differences in the design style see Jesse 2002).

#### *The Leiterband horizon (Fig. 5)*

The distribution pattern changes with the transition to a cattle-keeping economy. During the Leiterband period, all three areas share the same pottery



Fig. 4. Dotted Wavy-Line and Laqiya patterned pottery: distribution of decoration (continuous line) and regional technological traits (discontinuous line).



Fig. 5. Leiterband- and Halbmondleiterband patterned pottery: distribution of decoration (continuous line) and regional technological traits (discontinuous line).

decorations, although in slightly different regional and chronological forms. During this period, the Ennedi Mountains seem to have been a “cultural bridge” between East and West Africa: Leiterband patterns extend from the Wadi Howar in the east as far as Mali (Commelin 1983, Pl. LIV, 3-7) to the west (overview Keding 1997, Fig 74). Further to the east as well as to both the north and the south, however, only single finds of Darfur axes indicate the possibility of some kind of exchange.



Fig. 6. Geometric-patterned pottery: distribution of decoration (continuous line).

*The Handessi horizons (Fig. 6)*

With the emergence of the Handessi horizons, groups with geometric-patterned pottery appeared in the Wadi Howar (Keding 1998; Jesse this volume), the Ennedi Mountains (Bailloud 1969), the Wadi Hariq (Jesse this vol.; Lange this vol.) as well as in the Wadi Shaw (Francke 1986), but there are more distinctly regional facies than in the earlier horizons. This increasingly “conscious” differentiation in the pottery might be interpreted as a sign of a growing demarcation of land and resources (Hodder 1982). This development could be the result of a decline in resources due to the increasing aridity and also be linked with growing population pressure due to immigration. At the same time, social proc-

esses such as a gradual “closure” of the societies (Lourandos 1997) due to increasing stratification must also be taken into account.

#### 4. Summary and conclusion

*To recapitulate:*

Technological styles – as probable indicators of cultural affiliations among producers – demonstrate a strong regional imprint from the beginning of pottery production in the Wadi Howar region and adjacent areas. They indicate shared traditions in the sense of inherited suggestions and limitations. However, these local social units or “production” systems were not autonomous. This is underlined by the distribution patterns of the decoration styles.

Decoration styles - as probable indicators of cultural networks – cover a much larger area, uniting the different local technological styles in the regions studied. The similarities between decoration patterns indicate a shared set of ideas about the appropriate way to decorate pots. They may well also suggest shared ideas concerning ideology and/or “identity” and/or possible alliances.

The distribution areas of the technological and the decoration styles are not identical. Moreover, the boundaries between both styles are not equally emphasised in each area and indicate different degrees of stability. In addition, the production units seem to remain stable for a long period, while the larger networks show pronounced changes over time. This last point seems to prove the validity of Carr’s model.

The most drastic changes in the pottery and in the economy do not appear simultaneously, although points of discontinuity in the stylistic sequence do correspond to economic changes. For example, the adoption of a food-producing way of life - a step which is usually seen by archaeologists as an essential demarcation line in cultural “development” - is less dramatically reflected in the pottery than the later transition to increased small-livestock keeping, which would theoretically be just a logical adaptation to the drier environment. This may be evidence of different processes of cultural change. While it could be inferred from these findings that the transformation from hunting and gathering to cattle-keeping was largely an emulation process, the second change to small-livestock keeping would seem to have coincided with the immigration of new people.

As indicated by the last two of the above-mentioned processes, the Wadi Howar region was indeed a crossroads of cultural influences. However, the study also shows that this region cannot be viewed as a passive recipient of influences from the Nile Valley and the northeast throughout the course of its prehistory. A more appropriate model is one in which the resident population exhibited a whole range of responses to increasing aridity and demographic shifts within the

basin. These responses included emulation, the adoption of new technologies from other regions, the integration of immigrants and - at least at the end of the occupation sequence - migration.

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