

CHAPTER 2

'I Hope Your Cattle Are Well' *Archaeological Evidence for Early Cattle-centred Behaviour in the Eastern Sahara of Sudan and Chad*

*Friederike Jesse, Birgit Keding, Tilman Lenssen-Erz and
Nadja Pöllath*

Introduction

'I hope your cattle are well' (*abere chemegi tuga chekug*) is the greeting phrase of pastoral Kalenjin in Kenya, and reflects their special relationship with cattle.¹ In many African societies cattle are not only of great economic importance but also play an important role in the social and ritual domains. They are prestige items and 'companions for life', often occupying central positions in ritual and mythology. The use of animals as a medium for complex symbolism is a widespread phenomenon, probably above all since 'natural species are chosen not because they are "good to eat" but because they are "good to think"' (Lévi-Strauss 1962: 89).

The importance of cattle in the various aspects of the herding way of life is not a recent occurrence but was already highly visible in ancient societies, as can be seen in a wide area in northern Africa stretching from the Nile Valley to the Atlantic.² Rather striking expressions of cattle-centred behaviour with obvious regional differentiations have been found in the Eastern Sahara of Sudan and Chad during archaeological research by the University of Cologne carried out over the last three decades (e.g., Kuper 1981, 1995; Keding 1997b, 1998; Lenssen-Erz and von Czerniewicz 2005; Jesse and Keding 2007; Keding et al. 2007; Lenssen-Erz 2007). The present chapter is based on these discoveries.

For societies in which cattle are the most important animals, not only in the economic but also in the other above mentioned domains, the term 'cattle complex' introduced by Melville Herskovits (1926) immediately comes to mind. Although not explicitly defined, Herskovits's 'cattle complex' was mainly based

on observations of eastern and southern African pastoralists among whom cattle were used in many fields of ritual, social and economic life. Despite controversial debates among cultural anthropologists (e.g., Mterwa 1982: 18–30; Mair 1985; Baxter 1996: 91–92; see also Comaroff and Comaroff 1990: 212), the concept is occasionally still used to describe cultural contexts where cattle are more than just a ‘walking larder’ (Clutton-Brock 1989) or provisions on the hoof.³ Here the more general term ‘cattle-centred behaviour’ will be used to describe a special form of pastoralism⁴ that developed in the southern Eastern Sahara during the middle and late Holocene. The main sources of evidence used here come from excavations, intensive surveys and rock-art studies. Numerous and well-preserved animal bones from archaeological sites permit detailed archaeozoological analysis. Prehistoric artefacts and, more importantly, archaeological features such as thousands of pits filled with cattle bones and/or pottery clearly suggest an importance of cattle beyond the economic sphere and help differentiate cultural entities. Complementary aspects of the social and ritual significance of cattle can be deduced from rock art. These sources are not evenly distributed in the area of research: Whereas rock art is abundant in the Ennedi Highlands of north-eastern Chad, archaeological features are much more numerous and better preserved in the Wadi Howar region of northern Sudan (see Figure 2.1). This discrepancy determines the following discussion, structured by aspects of archaeology and rock art.

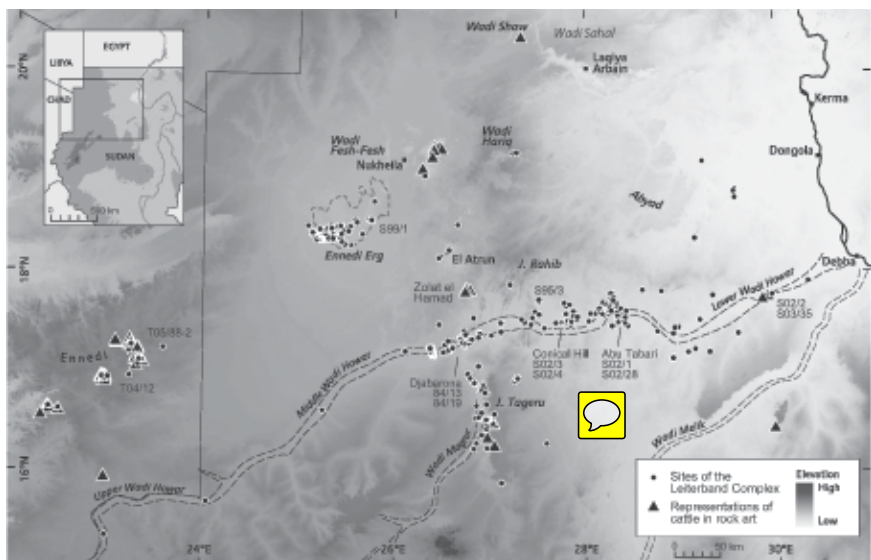


Figure 2.1: The study area in the Eastern Sahara of Sudan and Chad. Mapped are the sites of the Leiterband phase (fourth and third millennia BC) and representations of cattle in rock art. Sites discussed in the text are also indicated.

The Research Setting

The Eastern Sahara of Sudan and Chad is today hyper-arid. It features a multitude of different landscapes with wadi systems, highlands such as Jebel Rahib, Jebel Tageru and the Ennedi Highlands, and former lake and swamp regions such as Ennedi Erg and the West Nubian Palaeolake (cf. Pachur and Altmann 2006). The region's central axis is the Wadi Howar. Running from west to east over more than 1,050 kilometres, it connects the mountainous regions of Jebel Marra (Sudan), Borkou and the Ennedi Highlands (Chad) with the Nubian Nile Valley (Kröpelin 1993, 2007).

For the last 10,000 years, the Eastern Sahara has been subject to dramatic climate changes with humid and arid phases of varying intensity and regional impact. This is reflected in the Holocene cultural sequence of the southern Eastern Sahara (see Figure 2.2), which covers the last 7,000 years. Three cultural phases can be distinguished. They are characterised by different pottery styles, lithic tools and subsistence patterns. The economic sequence begins with a hunter-gatherer lifestyle, followed by a number of pastoral adaptations (for different scenarios, see Kuper and Riemer, this volume).

According to palaeoclimatic, archaeozoological, and (archaeo-)botanical studies, the area offered suitable ecological conditions for human occupation during the more humid periods of the early and middle Holocene.⁵ During this time, long sections of the Wadi Howar were marked by chains of large, deep fresh-

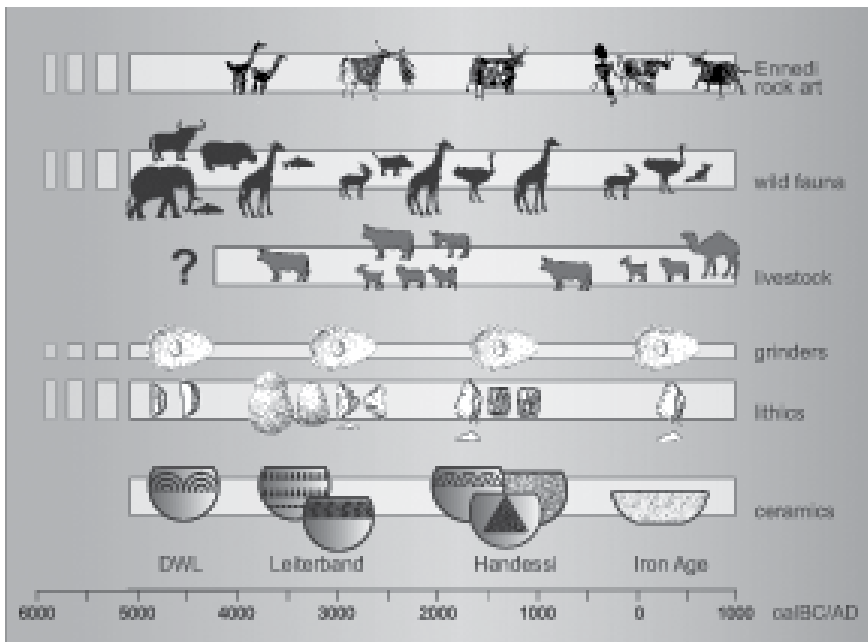


Figure 2.2: The Holocene cultural sequence of the Wadi Howar and Ennedi regions.

water lakes supporting a wide variety of fish species. Green bush and thorn savannah bordered the bodies of water, and offered good living conditions for various animal species. In the late Holocene (around 2500 BC) increasing aridity, progressing from north to south, finally reached the Wadi Howar. With the beginning of aridification, the ecological setting changed and resources became more and more patchy and unpredictable, forcing people to modify their ways of life. However, the Wadi Howar and the Ennedi Highlands, favoured by geographical position and hydrological conditions, remained refuges for humans and animals for hundreds, if not thousands, of years.

Cattle Pastoralism in the Wadi Howar Region: The Archaeological Evidence

Beginnings

The earliest evidence for domestic cattle in the Wadi Howar region (comprising Wadi Howar, the Jebel Tageru and the Ennedi Erg) are bones dated to the late fifth millennium BC (see Table 2.1 and Figure 2.3). These finds, ranging in date between circa 4200 and 4050 BC, come from three localities near Jebel Rahib and the Middle Wadi Howar. The prehistoric pastoral groups, of which different variants are present from the beginning, practised a sort of multi-resource pastoralism based on herding, plant-food collecting, and occasional fishing and hunting (Keding 1998; Kuper and Kröpelin 2006: 804, Fig. 1). Already the earliest pastoralists apparently chose to largely confine themselves in their ritual, social and economic life to a dominant, central element: cattle. Apparently various groups fostered cattle-first strategies of different character as a means to concisely symbolise and communicate regulative mechanisms of social, economic and ritual life.

Table 2.1: Radiocarbon dates for domestic cattle remains found in the Wadi Howar region and in the Ennedi Highlands (see Figure 2.3).

Region ¹	Site	Lab. no.	bp	cal BC ²	Material	δ ¹³ C	Remarks	Reference
MWH	84/19-3	KN-3417	5240±260	4060±280	bone	-11,9	cattle probable*	Keding 1997a: 34
MWH	84/19-3	KN-3522	4810±110	3570±130	bone	-11,9	cattle probable*	Keding 1997a: 34
MWH	84/25	KN-4669	4456±178	3160±230	ostrich eggshell	-9,95	cattle present	Jesse et al. 2007: Fig. 4
MWH	84/12-2	KN-3521	4420±130	3130±180	bone	-11,9	cattle present	Keding 1997a: 34
MWH	84/19-5	KN-3554	4410±120	3120±170	bone	-11,9	cattle probable*	Keding 1997a: 34
MWH	84/13-5	KN-3405	4210±200	2820±280	bone	-11,9	cattle	Keding 1997a: 34
MWH	84/13-3	KN-3408	4120±130	2680±170	bone	-11,9	cattle	Keding 1997a: 34

Table 2.1: *continued*

Region ¹	Site	Lab. no.	bp	cal BC ²	Material	δ ¹³ C	Remarks	Reference
MWH	80/86-6	KN-2940	3740±120	2170±180	bone	-11,9	cattle present	Keding 1997a: 34
MWH	84/13-5	KN-3416	3580±110	1950±160	bone	-11,9	cattle	Keding 1997a: 34
MWH	S96/5-2	KIA-12419	3335±300	1660±390	bone	–	cattle**	Jesse et al. 2007: Fig. 4
MWH	96/119	UtC-5941	3320±60	1610±80	bone	-10,0	cattle probable	Jesse et al. 2007: Fig. 4
MWH	84/1	KN-3523	3250±60	1540±70	bone	-11,9	cattle***	Jesse et al. 2007: Fig. 4
MWH	84/9	KN-3889	2690±130	840±180	bone	-11,6	cattle present	Jesse et al. 2007: Fig. 4
LWH	84/24-1	KN-3945	5760± 65	4610±80	bone	-14,2	cattle present	Jesse 2003: 325
LWH	95/3-1	UtC-5583	5400±50	4240±80	charcoal	-25,2	fireplace; cattle bones	Jesse 2003: 330
LWH	95/3-1	KIA-14900	5275±35	4120±80	charcoal	-27,91	fireplace; cattle bones	Jesse et al. 2007: Fig. 4
LWH	84/24-1	KN-3946	5000±150	3810±150	bone	-8,4	cattle present	Jesse 2003: 325
LWH	02/52-1	KIA-26358-IV-2	4760± 30	3570±50	bone	-4,40	cattle****	–
LWH	03/31	KIA-26360	4740±35	3520±100	bone	-12,38	cattle*****	Jesse et al. 2007: Fig. 4
LWH	02/52-1	KIA-26358-IV-1	4685± 35	3470±70	bone	-3,61	cattle****	–
LWH	02/52-1	KIA-26359-III-2	4645± 30	3450±50	bone	-1,30	cattle probable****	–
LWH	84/24-1	KN-3944	4600±250	3300±310	bone	-13,0	cattle present at site	Jesse 2003: 325
LWH	84/24-1	KN-3943	4600±150	3310±210	bone	-10,0	cattle present	Jesse 2003: 325
LWH	02/52-1	KIA-26359-III-1	4530± 25	3240±100	bone	-2,82	cattle probable****	–
LWH	02/28-1	KIA-26362	4450±180	3150±230	bone	-23,23	cattle*****	Jesse et al. 2007: Fig. 4
LWH	02/28, EF 462	KIA-24507-V	4110± 30	2720±100	bone	-2,24	cattle****	–
LWH	02/28, EF 462	KIA-24507-VI	4060± 45	2640±110	bone	-1,11	cattle****	–
LWH	K146	Hv-15588	3915±210	2410±300	bone	–	cattle	Kröpelin 1993: 212
LWH	02/4	KN-5561	3895±105	2370±150	bone	-10,14	cattle	Godhoff 2005: 17
LWH	03/13, EF 221	KIA-24508	2845± 25	1010±50	tooth	2,43	cattle****	–
Rahib	K154	Hv-15589	5350±275	4170±300	bone	–	cattle	Kröpelin 1993: 212
WH	?	Hv-14439	3540±180	1910±240	bone	–	cattle	Pachur 1999: 431

Table 2.1: *continued*

Region ¹	Site	Lab. no.	bp	cal BC ²	Material	δ ¹³ C	Remarks	Reference
J. Tageru	western edge	Hv-15568	3665±250	2090±330	bone	–	cattle	Pachur 1999: 431
Laqiya	82/38-2	KN-3014	4350±320	2980±420	bone	–	cattle	Cziesla 1986: 144
Ennedi Erg	99/1-3	KIA-12420	5080±30	3880±60	charcoal	-22,63	pit with cattle bones among other contents	Holst 2003: 207
Ennedi Erg	99/1-7	KIA-12421	4875±30	3670±30	charcoal	-21,03	pit with cattle bones among other contents	Holst 2003: 207
West Nubian Palaeolake	–	–	3733±81	2150±120	bone	–	cattle*****	Pachur and Wünnemann 1996: 27
Wadi Hariq	9777-1	KN-5447	3785±40	2220±70	charcoal	-25,0	cattle present at site	Jesse et al. 2004: 132, Tab. 2
Wadi Hariq	9777-1	KN-5327	3675±40	2060±70	charcoal	-25,28	cattle present at site	Jesse et al. 2004: 132, Tab. 2
Wadi Hariq	01/4-1	KIA-17508	3430±25	1740±30	charcoal	-19,97	cattle present at site*****	Jesse et al. 2004: 132, Tab. 2
Wadi Hariq	01/1-1	KIA-17543	3385±25	1690±40	faeces	-25,9	cattle present at site	Jesse et al. 2004: 132, Tab. 2
Wadi Hariq	01/1-1	KIA-17510	3355±25	1650±40	charcoal	-25,23	cattle present at site	Jesse et al. 2004: 132, Tab. 2
Ennedi	T 05/88-2	Poz-16595	2480 ± 30	630 ± 100	bone	–	cattle (carbonate fraction)	Keding et al. 2007: 38

1 LWH – Lower Wadi Howar; MWH – Middle Wadi Howar; WH – Wadi Howar.

2 Calibrations by CalPal (Version March 2007), using the IntCal04 calibration data set.

* Cattle bones largely dominate the faunal remains from Djabarona 84/19, including those from the pits excavated in trenches 3 and 5.

** The collagen fraction (0.06 mg C) was dated to 3340 +300 / –290 bp (d13C = –21.90 ± 0.05); the bone rest fraction (0.06 mg C) was dated to 3170 +300 / –290 bp (d13C = –23.17 ± 0.25) (letter by P.M. Grootes, 15-11-2001).

*** The bones for the radiocarbon sample were taken in square 12/21b-14, from a context with cattle bones (written communication W. Van Neer, 2006).

**** Apatite fraction; the sample was solubilised by hydrochloric acid HCl (letter by M. Hüls, 7-7-2009).

***** The collagen fraction (0.12 mg C) was dated to 9670 +360 / -340 bp (d13C = –26.23 ± 0.77); the bone rest fraction (1.0 mg C) was dated to 4740 ± 35 bp (d13C = –12.38 ± 0.18). The age of the collagen fraction is much too old and indicates sample contamination. The age of the bone rest fraction is in good accordance with archaeological expectation, but the date cannot be regarded as reliable (letter by P.M. Grootes, 26-07-2005).

***** The collagen fraction (0.10 mg) was dated to 10230 +450 / -430 bp ($d_{13}C = -27.67 \pm 0.39$); the bone rest fraction (0.14 mg C) was dated to 4450 ± 180 bp ($d_{13}C = -23.23 \pm 0.72$). The age of the collagen fraction is unreliable and indicates contamination; the age of the bone rest fraction appears more probable archaeologically, but the date cannot be regarded as reliable (letter by P.M. Grootes, 26-07-2005).

***** “Three dates of *Bos taurus* (identified by Boessneck, München) averaged 3733 ± 81 yr BP” (Pachur and Wünnemann 1996: 27).

***** The sample yielded two rather different results: 3430 ± 25 bp (fulvic acids, 2.2 mg C) and 1610 ± 35 bp (humic acids, 0.6 mg C). Interpretation is difficult but the age of the fulvic acids seems to be a better indication of the true site age (written communication P.M. Grootes, 10-11-2004).

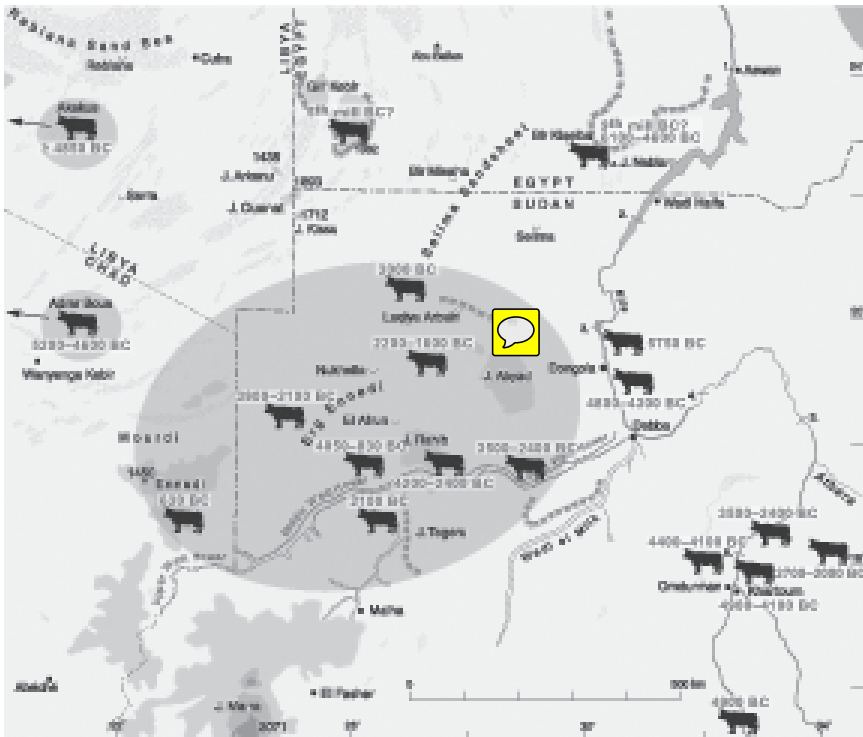


Figure 2.3: The appearance of domestic cattle in north-eastern Africa as indicated by the available radiocarbon evidence (see Table 2.1).

At that time, around 4200 BC, cattle herding was already well-established in northern Africa. At least from the seventh millennium BC onwards, cattle and small livestock are known from a number of sites (Gautier 1987, 2001; Blench and MacDonald 2000; Hassan 2002; Marshall and Hildebrand 2002; Garcea 2004; Kuper and Riemer, this volume). Compared to other regions of the world, the earliest pathways to food production in Africa are distinctive. Cattle occurred before crops and the first food producers were thus, depending on the region,

either pastro-foragers or mobile herders, but not sedentary farmers (Marshall and Hildebrand 2002). The reasons for the shift to food-producing economies are not yet fully understood. Various ideas have been presented, including the notion of animal herding as a reaction to enduring subsistence crises, for instance in the Libyan Tadrart Acacus (Holl 1998: 84) or as a possibility to display wealth and social status (Garcea 2004: 125). Marshall and Hildebrand favour the improved predictability of food as a key argument: 'Domestication is linked to broad social or ecological processes, proximate contexts, in which predictability becomes crucial, and manipulation practices meant to restore or enhance predictable access and scheduled consumption' (Marshall and Hildebrand 2002: 105). Even if the exact origins of the pastoral economy in the Wadi Howar region have not as yet been elucidated, different scenarios are conceivable: the displacement of local foraging groups by foreign cattle herders; the assimilation of local hunter-gatherers by foreign herders; or the diffusion or adoption of cattle herding by local groups through contact with cattle keepers elsewhere.

Since the archaeological record of the Wadi Howar region shows no indications of displacement, the diffusion or adoption of cattle herding seem to be most probable (Keding 2006). In contrast to the northern areas of the Eastern Sahara, there is no evidence for a precedence of pastro-foraging (see Kuper and Riemer, this volume); instead, the earliest regional herding was tantamount to fully developed pastoralism. The available data suggest two potential areas of origin (see Figure 2.3). The first, and more probable (Keding 1997a), is the Nile Valley, where cattle remains are known from the beginning of the fifth millennium BC, or even earlier, at Rabak, Esh Shaheinab and Kadero, as well as in the Dongola Reach;⁶ during the middle Holocene pastoralism with large and small livestock was practised in the Nile Valley, with cattle always dominant among domesticates (Gautier 1989). The other possible source area is the Central Sahara, where cattle herding was present from around 5000 BC, for example, at Adrar Bous (Niger) and in the Tadrart Acacus (e.g., Marshall and Hildebrand 2002: 110, fig. 2.2; Gifford-Gonzalez 2008).⁷

In the Wadi Howar region different pastoral adaptations existed at the time of the beginning of pastoralism, that is, around 4000 BC: In the area west of Jebel Rahib, at sites of the Leiterband Complex such as Djabarona 84/19 and Ennedi Erg S 99/1, cattle largely dominate the faunal spectrum of the excavated areas (Günther 1995: 46; Keding 1997a; Berke 2001). The sites are characterised by concentrations of animal bones and/or pottery, which turned out to be remains of former pits (see below). By contrast, prehistoric groups in the Lower Wadi Howar based their livelihood on cattle pastoralism, but also used the mosaic of different habitats around the sites for fishing and hunting; their sites are devoid of pits.

Examples of this form of multi-resource pastoralism have been documented at the Conical Hill S 95/3 site where undecorated pottery and a few sherds of pottery of Leiterband type (Keding 1997b: 36) were found with cattle bones and a few bones of both goat and wild game.⁸ Another example comes from the large open air site S 02/1 in the Abu Tabari region, dated to around 3800 BC (Jesse 2006:

45–46). Domestic mammals (predominantly cattle) constitute 53 per cent of the faunal assemblage. Wild mammals (gazelle, antelope, warthog, elephant) make up 15 per cent of the faunal remains, and 32 per cent are constituted by a variety of aquatic species (Pöllath and Peters 2007: 65). Cattle were the most important source of food besides aquatic resources and, judging from the large amounts of grinding material, probably wild plants, whereas hunting played a minor role in subsistence. That cattle also played a role beyond the purely economic sphere might be reflected in their representation as small figurines made of clay. One complete piece of a probable representation of a cow with a length of 4.9 cm and several fragments of legs or horns has been found (Jesse 2006: 45–46).

The Lower Wadi Howar sites suggest contacts with Neolithic sites in the middle Nile Valley indicated by similar ceramics and by the size and robustness of the cattle bones. The proximity to the Nile Valley and the possibility of exchanging livestock and ideas certainly best explain this regional development of cattle-centred behaviour contrasting with the Leiterband Complex further west.

Pastoral Climax: The Leiterband Complex

In the Middle Wadi Howar, the Jebel Tageru and the Ennedi Erg, a distinctive and rather remarkable form of pastoralism, the Leiterband Complex, existed from the regional beginnings of pastoralism, around 4000 BC, and prospered during the fourth and third millennia BC. It may be regarded as the most expressive occurrence of cattle-centred behaviour in the southern Eastern Sahara.

More than 800 Leiterband sites are presently known. They are mainly distributed west of Jebel Rahib, in the region stretching from the Middle Wadi Howar to the Ennedi Highlands (see Figure 2.1) (Jesse and Keding 2007; Keding 1997a: 204–16). From the beginning of the Leiterband Complex, the Middle Wadi Howar emerged as the most important centre of occupation due to its favourable ecological conditions. In the Ennedi Erg to the north-west, wide plains and the shores of the Nubian Palaeolake offered good pasture and water (Hoelzmann et al. 2001). The highlands, Jebel Tageru to the south, and Ennedi to the west, in particular their forelands, were also integrated in transhumant cycles as were parts of the Lower Wadi Howar (Keding 2004; Jesse and Keding 2007; Keding et al. 2007).

FEATURES

Most sites may be classified as camps of different sizes and functions; burials are rare (Jesse and Keding 2002). The settlement pattern of the Leiterband Complex is characterised by a high proportion of (semi-)permanent medium-sized camps (circa 70 per cent), numerous small sites (15 per cent), which are mainly interpreted as stock posts, and very large sites (circa 15 per cent). Sites of the first and second categories are located in different topographic positions, but are linked to a large extent to water sources for watering livestock. In contrast, most

large camps are prominently situated on elevations such as dunes, with a wide view over pasture and land. They may be subdivided into at least two categories: first, settlements with a wide variability of artefacts such as pottery sherds, lithic artefacts and grinding material; second, sites featuring countless (eroded) pits filled with pottery and cattle bones, which probably played a role in the social-ritual sphere.

These (eroded) pits are the most striking and widespread type of feature of the Leiterband Complex, appearing at about 50 per cent of the sites presently known. They are found at sites of all sizes and in comparable quantities, but probably had different functions. There are three different categories of pits, all apparently of the same age: First, pits containing (nearly) complete vessels, which seem to have fallen apart *in situ*; the latter probably deposited upside down for future use – for example, site Ennedi Erg S 99/1. Second, rubbish pits filled with butchered remains of cattle – for example, Ennedi Erg S 99/1–3 (Berke 2001: 245) – and/or discarded stone artefacts (Keding 1997a: 222–23), pottery and sometimes fragments of grinding tools. Third, pits featuring cattle bones apparently intentionally buried. Such features underline an important ritual rank of cattle. Due to erosion, the original contents of the pits, consisting mainly of pottery and cattle bones, now form dense, compacted concentrations of finds on the surface (see Figure 2.4). Beneath some of these round accumulations, measuring about one metre in diameter, the remains of steep-walled pits are preserved, up to two metres deep, filled with a fine-grained grey sediment mixed with cattle bones, sometimes almost whole cattle skeletons or large parts of cattle, and an abundance of nearly complete pottery vessels. Though the main



Figure 2.4: Djabarona 84/13 in the Middle Wadi Howar, a large site with numerous concentrations of bone and/or pottery.

components of these are uniform, their composition appear to be non-standardised. Thus, numbers of pots and animals vary, occasionally bones are burnt, sometimes (fragments of) grinding tools are included, and, in rare cases, some bones of wild game are also found.

Eight extremely large sites in the Middle Wadi Howar and the western foreland of Jebel Tageru are characterised by dozens, hundreds, or even more, pit remnants of the last mentioned type. The most impressive example is Djabarona 84/13 (Figure 2.4), with more than 1,000 pits, representing a chronological sequence of at least 800 years (Keding 1997a, 1998). Generally, these sites cover several hectares, being situated on dunes or slight elevations and covered by a dense artefact scatter of all types of finds (see above). Some, for instance Djabarona 84/13 (Keding 1997a: 29–30, fig. 4) are spatially subdivided into areas with or without pits. In no case were above-ground pit covers or markers observed.

MATERIAL CULTURE

Typical Leiterband finds include pottery, large numbers of bones, numerous grinding tools, stone artefacts, axes, and ostrich eggshell beads (Figure 2.5) (Keding 1997a).

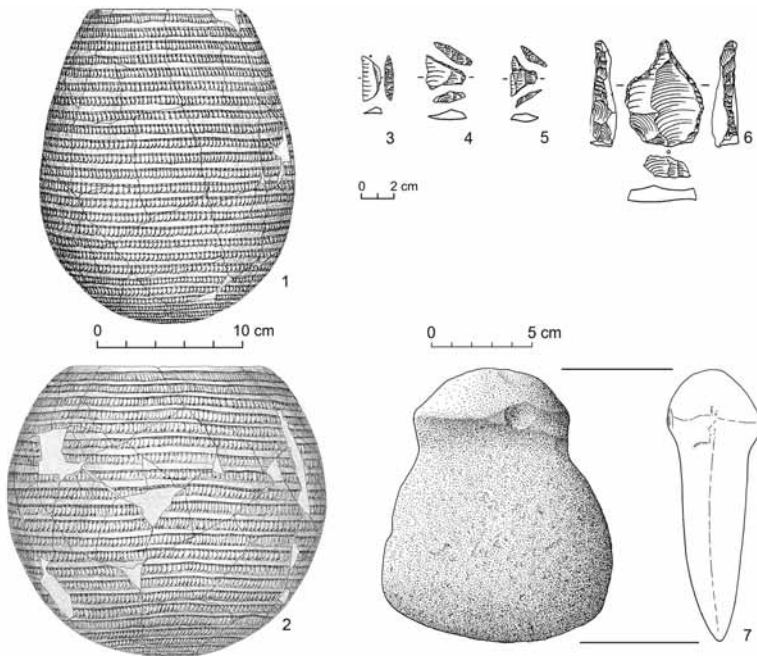


Figure 2.5: Material culture of the Leiterband phase. 1–2: Leiterband pottery; 3: segment; 4–5: transverse microliths; 6: borer; 7: axe of Darfur type.

The pottery vessels (Figures 2.5.1 and 2.5.2) consist mainly of well-made, neck-less pots of different sizes and shapes. Many are decorated over the entire exterior with rocker stamp impressions, among which the 'Leiterband Decoration' is the most prominent pattern. According to the find contexts, pottery was used in the domestic as well as in the ritual spheres. While the early stages of Leiterband decorations reveal supra-regional connections with the east, especially with the Khartoum Neolithic (or Shaheinab Culture) of the Sudanese Nile Valley, dated to the fifth millennium BC, the later phases largely coincide with the pottery of Hohou type found in the Ennedi Highlands to the west of the Wadi Howar (Keding 1997a: 166–181; 1998: 5–9; Keding et al. 2007).

The stone artefacts (Figures 2.5.3 to 2.5.6) are characterised by a microlithic industry and are dominated, depending on site function, by a wide variety of transverse microliths, mega-segments, thumbnail scrapers and borers (Keding 1997a: 369, pl. 77; Holst 2003). Besides the use of local quartz for artefacts, tools are mainly made from often non-local chalcedony (e.g., Keding 1997a: 200, fig. 81). According to ethnographic sources, there is no typical herder's tool kit (Cribb 1991: 69), but some of the implements are certainly connected with the exploitation of cattle. Thumbnail scrapers might indicate the processing of (cattle) leather (e.g., Schön 2002: 316), and mega-segments, with their large cutting edge, the butchering of animals.⁹ The transverse microliths were possibly used to pierce the veins of domestic animals to extract blood (Keding 1997a: 199–201). The 'bleeding' of cattle by means of comparable tools is still a widespread practice among cattle keepers in East Africa, where blood is a nutritional supplement (e.g., Dahl and Hjort 1976: 172).

Axes of the Darfur type (Figure 2.5.7) suggest the importance of wood working, though their function as prestige items cannot be excluded (e.g. Keding 1997a: 366, pl. 74). Their distribution indicates north–south exchange cycles and, more dominant, east–west orientated networks.

Grinding tools, probably used for plant processing, are numerous. While lower grinding stones may take the form of flat slabs or basins, most of the upper grinders are characterised by an oval outline and section.

In total, the preserved Leiterband material culture is characterised by three significant traits: Firstly, by its relative homogeneity over a period of nearly two thousand years. This may be related to the apparent significance of material goods, especially pottery and its decoration, as potential media of identity.¹⁰ Secondly, Leiterband material culture lacks definite prestige items or signs of (nascent) social complexity (e.g., Cribb 1991). Such items are neither found at habitation sites in the Wadi Howar or Ennedi regions, in ritual or cultic features such as graves (Jesse and Keding 2002), nor at the extraordinary sites featuring hundreds of pits. Cattle probably fulfilled the role of a status symbol, just as they are regarded as the sole expression of wealth in many recent societies (e.g., Herskovits 1926: 264). Thirdly, Leiterband material culture occurs in massive accumulations of artefacts, especially at medium sized to large sites, which include numerous breakable (such as pots) and/or heavy items (such as grinding

tools). This indicates the restricted mobility of a large part of the pastoral society and repeated, planned use of the specific locations (see Cribb 1991: 75–80).

SUBSISTENCE

The Leiterband Complex is associated with people who practised a developed food-producing economy mainly based on cattle. Most sites yielded well-preserved cattle bones usually amounting to more than 90 per cent of the faunal inventories of excavated sites (Van Neer and Uerpmann 1989: 332, table 5; Jesse et al. 2007: 46, fig. 1). Nevertheless, the role of cattle in subsistence is difficult to determine unambiguously. According to the different uses of domestic animals, pastoralists can be divided into ‘meat only’ and ‘meat plus milk’ livestock keepers. Today, cattle herders’ subsistence in comparably dry environments is essentially based on milk products at least during some time of the year (e.g., Dyson-Hudson and Dyson-Hudson 1970; Dahl and Hjort 1976: 141–81). Usually beef is only consumed in the context of social, ceremonial or ritual events, and thus does not play an important role as an energy source (e.g., Dahl and Hjort 1976: 142; Smith 1980: 474; compilation of literature in Keding 1997a: 232–235). On such occasions, cattle are slaughtered and their meat is distributed within the community. Nowadays, such events are often periodic and mainly take place during the dry season (e.g., Dahl and Hjort 1976: 162).

Milking and the processing of milk are difficult to trace in the archaeological record. One important indicator, namely culling patterns of livestock, did not produce clear results for the Wadi Howar assemblages. Their mixture of juvenile, sub-adult and adult animals, with an explicit dominance of young animals, indicate a meat economy (Van Neer, pers. comm. 2003; see also Davis 1987: 157–158).¹¹ However, since the bones come generally from sites and pits that are interpreted as ritual, rather than settlement sites with consumption refuse, the underlying criteria for slaughtering cattle might not reflect economic patterns. In sum, clear archaeological evidence for milking and milk processing is missing, but rock art and linguistic results suggest the use of milk in this region at least since the third millennium BC (Bechhaus-Gerst and Keding 2007).

Other faunal remains indicate some small stock keeping, fishing and, on a smaller scale, hunting. The bones of wild fauna are mainly gazelles (*Gazella dorcas*, *G. dama*) and a few hares, but also giraffe, elephant and hippopotamus (Van Neer and Uerpmann 1989; Berke 2001). Fishing was mainly restricted to species capable of surviving short periods of adverse living conditions, such as Tilapiini and Clariidae (Van Neer 1989: 62–66). Hunting and fishing probably only contributed on a small scale to daily food consumption and other requirements. However, the ideological value of both strategies might have been much more significant.

However, ethnographic studies of present-day societies shows that even specialised cattle pastoralists rely substantially on plant food (e.g., Johnson 2002). Botanical remains are rare at Leiterband sites, and derive mostly from charcoal.

The known species list therefore comprises mainly trees, such as *Acacia nilotica*, *Ziziphus* sp., cf. *Grewia tenax* and *Capparidaceae* (Neumann 1989: 140). They all yield fruits and/or seeds, which were also consumed in the Old Egyptian Kingdom, and today are mainly prepared by livestock keepers into different kinds of porridge (e.g., Tubiana and Tubiana 1977; Germer 1985; von Maydell 1990). Impressions of Paniceae grass seeds were found in pottery sherds at sites Ennedi Erg S 98/24 and Jebel Tageru S 98/6.¹² Wild grass seeds were abundant in the region (Neumann 2005: 266) and are still used today by pastoralists either for their own nourishment or for that of their animals. Numerous grinding stones prove an intensive exploitation of wild plants by Leiterband groups.

MOBILITY PATTERNS

The Leiterband societies reveal different mobility levels and group structures during an annual subsistence cycle. Shifting centres of occupation and an obvious variability in site sizes reflect large and small scale mobility, seasonal uses of diverse sub-regions as well as environmental changes in the long term.

Within the territory of the Leiterband cattle keepers, the Middle Wadi Howar and, to a lesser extent, the Ennedi Erg were focal points characterised by medium-sized to large dry season camps, used by sedentary or at least semi-sedentary segments of a pastoral society. The limited distribution of the extremely large sites with their abundance of pits underlines the role of the Middle Wadi Howar, the Ennedi Erg and the Jebel Tageru as the core area of the Leiterband Complex.

The high share of (probably) semi-permanently or permanently occupied sites (around 75 per cent) attests to a low degree of mobility for a large segment of the pastoral society. Furthermore, the furnishing of sites with 'site fixtures' or 'site furnitures' (Binford 1980; Cribb 1991: 68) such as grinding tools, very large vessels, as well as features such as pits, which are all recorded at least for more than half of the sites, indicate planned repeated access of special locations and thus fixed subsistence cycles. In consideration of the environmental features of the areas and some slightly pronounced regional cultural expressions of the Leiterband Complex, east–west as well as north–south transhumance cycles with distances of 180 to 220 kilometres are conceivable.

THE IDEOLOGICAL ROLE OF CATTLE

Cattle seem to have not only played an essential part in the diet but also a key role in the ideological or ritual sphere, as is shown by the extremely large sites with countless pits in the Middle Wadi Howar and Jebel Tageru. The accumulation of finds and features, as well as their special appearance and the time depth, suggest an interpretation in terms of regularly frequented sites which might have been associated with mythological or historical events remembered by a group (see Tilley 1994: 18).

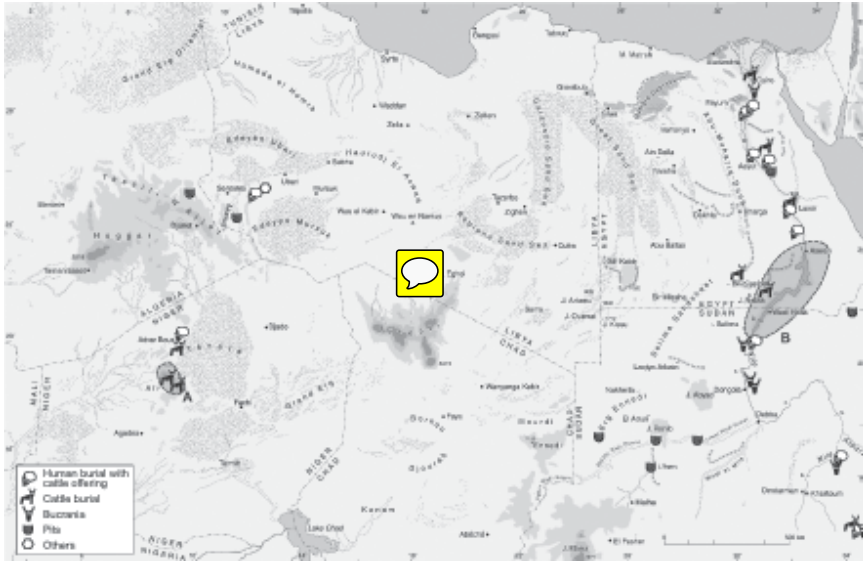



Figure 2.6: aspects of cattle cults in northern Africa. Note cattle burials are frequent in regions A and B. A – Talak–Timersoi region; B – A-Group and C-Group region. Based on Keding (1997a), Paris (1997), Applegate, Achilles and Duncan (2001) and di Lernia (2006).

The enormous amount of bones indicates that cattle played an important role in these special, probably ritual, social activities (Keding 1997a, 1998). Starting at around 5500 BC in different places in the Sahara, cattle cults, or the use of cattle in activities which seem to have had a ritual background, became a widespread phenomenon in North Africa (Figure 2.6).¹³ Since the fourth millennium BC these features are known from a wide belt, stretching from Ancient Egypt and the Nubian area to the western Sahara (e.g., Ghoneim 1977: 196–216; Ferhat, Striedter and Tauveron 1996; Keding 1997a: 224–27; Paris 1997; Wendorf and Schild 2001: 668; di Lernia 2006). Apparently they took a variety of regional cultural expressions. Some represent without doubt cattle burials, occasionally even forming cemeteries, such as reported for the Bisharin Beja in eastern Sudan (Murray 1926). They are partially designated by above ground markers and/or are equipped with grave goods, such as Adrar Bous Site 1 (Paris 1997). Other cattle features are associated with human burials, for example, at Chin Tafidet in Niger (ibid.: 115). According to their find context, these cattle features are interpreted as sacrifices, burials of ‘holy animals’ or as offerings in human graves (e.g., Behrens 1963; Gratien 1985). Of special interest is the site of Mankhor in Algeria, dated to the second half of the fifth millennium BC. Here a necropolis of more than thirty cattle burials in pits was studied. All cattle had been buried at a young age, their bones having been placed in anatomical order or piled up in quarters (Ferhat, Striedter and Tauveron 1996; Ferhat 2003: 79). The presence of pits with cattle remains at Mankhor is a good analogue of the cattle features of the Leiterband Complex.

At present, no conclusive interpretation of the Leiterband pits is possible. However, ethnographic sources suggest a wide range of possible reasons for sacrificing cattle. Here only three feasible interpretations will be mentioned. The first conceives cattle sacrifices as offerings for deceased humans due to their economic or prestige value and/or emotional links between the deceased and special animals. This hypothesis is supported by the occurrence of pits filled with cattle bones together with human inhumations at Ennedi Erg S 98/I31. However, in general, human graves are nearly unknown in the Leiterband Complex. Thus, it is conceivable that sacrifices of cattle were part of ritual mortuary practices accompanying archaeologically invisible human burials. The dead may have been buried elsewhere, or the mortuary practices may have left no surviving traces of the deceased (Jesse and Keding 2002).

A second line of interpretation sees cattle sacrifices as a reaction to poor conditions in the natural or social environment. Today, in traditional societies, imbalances or changes in climate and/or natural environment are often attributed to the spiritual, moral, social or political sphere (e.g., De Garine and Koppert 1988; De Waal 1989; Shipton 1990: 361). Rituals and sacrifices are often a means of coping. In their analyses of behaviour patterns among recent pastoralists, Dahl and Hjort state:

apart from slaughter for  cases of emergency, the most frequent type of slaughter is ... for ceremonial purposes. These may relate to life-cycle ceremonies, yearly thanksgiving or prayer for rain, etc. It should be remembered that such sacrificial feasts do not involve the destruction of the sacrificed animal, but rather public ceremonies with communal and communal sharing of food ... [and] many such feasts, such as appeasements for better times, occur during famines when milk production is low. (Dahl and Hjort 1976: 162)

In this vein, di Lernia (2006: 60) suggests prehistoric features displaying traces of 'ritual' slaughtering of cattle in the Eastern and Central Sahara to be partial relics of rainmaking ceremonies in areas characterised by drying environments. Since the period of the Leiterband Complex (4000 to 2200 BC) is characterised by a decrease of rainfall and biomass, the exceptional sites with hundreds of cattle pits would fit well in this scenario.

Last but not least, the prominent pit sites also reveal traits of 'competitive feasting' locations. During such social events, individuals, clans, or groups try to increase their prestige and strengthen their rank, power or authority by squandering luxury goods. Valuables are withdrawn from economic cycles without direct equivalents. Archaeological indicators might be 'architectural elements, food refuse, suites of serving vessels, and symbols or motifs associated with those vessels' (Arnold 2000: 29). Extensive slaughtering of cattle and the deposition of pottery vessels in great quantity might have been the pertinent media during the Leiterband phase.

In sum, it must remain a matter of speculation whether the Leiterband pits filled with cattle bones bear any relationship to ancient cults practised in other

North African regions. However, regardless of their former actual use, these pits and sites document the enormous significance beyond the subsistence level that cattle must have had during the Leiterband phase.

Beyond the Leiterband Complex

The Leiterband Complex, with its main centre in the Middle Wadi Howar, had an influence on developments in neighbouring areas. This becomes obvious in the Lower Wadi Howar. Whereas at the beginning of the fourth millennium BC cattle only played a dominant role in areas to the west of Jebel Rahib, by the late fourth millennium BC cattle were also significant to the east of Jebel Rahib. Cattle bones on sites in the region of Conical Hill and Abu Tabari make up between 95 per cent and nearly 100 per cent of the identifiable faunal assemblages.¹⁴ Pits have also been found on sites up to the region of Abu Tabari (see Figure 2.1), even if they are here not so much characterised by a predominance of concentrations of pottery and/or bones on the surface. The large site Abu Tabari S 02/28, dating to around 3000 BC, is the best studied example. The ceramics found at this site display a variety of design styles, including incised herringbone patterns and Leiterband decorations (Jesse 2006). The pits here are explained by the disposal of the bones after butchering and consumption, but in some cases also with ritual practices with different forms of expression. In one pit, for example, the remains of at least five cattle were found and many bones were burnt. This bone assemblage might either be the result of a single event, say a big feast, or of refuse collected over some time and buried in one event. In other pits, pottery sherds, numerous ostrich eggshell beads, animal bones and human remains were found mixed together. Cattle were so important that they were even buried in graves like humans as is best indicated by the complete skeleton of a sub-adult cow carefully laid down on its right-hand side at Abu Tabari S 02/28–24. The animal was orientated along a north–south axis, with the head to the north. No burial pit was recognisable (Jesse 2006: 48).

Increasing aridity during the fourth millennium BC and corresponding changes in the ecosystem in the Lower Wadi Howar (Pöllath and Peters 2007: 65) probably stimulated the growing importance of cattle in economic and social life, and therefore led to the adoption of features such as pits previously known only west of Jebel Rahib in the Leiterband Complex. The recurrence of cattle and the appearance of elements of cattle cults, such as cattle burials, can then be seen as a social response to environmental changes (di Lernia 2006). However, the sites of the late fourth and third millennium BC in the Lower Wadi Howar cannot simply be incorporated into the Leiterband Complex as they show originality reflected especially in the different pottery styles present. Besides Leiterband patterns, incised herringbone patterns are present which clearly indicates strong contact with the A-Group and pre-Kerma culture in the Nubian Nile Valley around the third and second Cataracts (Keding 2000: 92; Jesse 2006: 49). Affiliation with the Nile Valley is also reflected in the archaeozoological record:

The cattle bones found in the Lower Wadi Howar overlap in size with those of the Egyptian and Sudanese Nile Valley (cf. Pöllath and Peters 2005; Jesse et al. 2007), indicating the exchange of livestock and/or the adoption of efficient strategies of husbandry as they had been developed, for example, in Egypt since the Old Kingdom (Laudien 2000: 102–8). The obvious mixture of different cultural traits in the Lower Wadi Howar led to the development of local forms of cattle-centred behaviour at the periphery of the Leiterband Complex.

The Finale

At the end of the third millennium BC a cultural break becomes visible in the Wadi Howar region, triggered by the consequences of climatic change (see Figure 2.2). This settlement phase, the Handessi Horizon, mainly dates to the second millennium BC and is marked by pottery with geometric decorations (Francke 1986a, 1986b; Keding 1998: 10–11; Jesse 2007; Jesse and Keding 2007). In contrast to the preceding Leiterband Complex, a broader territory of the southern Eastern Sahara is exploited by the Handessi groups, including the Wadi Howar region and the Ennedi Highlands, but also areas more to the north such as Wadi Hariq and the Laqiya region (Jesse 2007; Jesse and Keding 2007: 42). In the Wadi Howar region, the limiting influence of aridification restricted settlement as well as herding, gathering and hunting activities to some favourable areas such as the Middle Wadi Howar and the Jebel Tageru. Probably as a reaction to the decreasing availability of usable land, a broader spectrum of resources was exploited. This included the addition of goats and sheep on a larger scale to livestock herds, as well as more intensive gathering and hunting. Cattle were still very important in subsistence (Jesse et al. 2007: 46, fig. 2.1). However, compared to the preceding Leiterband phase, their role changed. This is borne out by a new site layout, now lacking pits filled with cattle bones and pottery. In the Wadi Howar region there are no traces to define the ideological value of cattle during this period, but already the presence of cattle in the light of the arid environment may indicate the high esteem in which cattle were still held. It definitely indicates the pastoral skills of the Handessi groups in managing the constraints of marginal environments, for example, by digging wells or the adjustment of their transhumant cycles to benefit from the effects of the rainy season in areas outside the Nile Valley (Jesse 2007). On the other hand, in the Nubian Nile Valley, sites of C-Group and Kerma Culture affiliation feature ample evidence of the high value of cattle, such as hundreds of bucrania found in burial contexts and countless small clay figurines of cattle (Chaix and Grant 1992; Bonnet 1996: 58–59; Kuper and Riemer, this volume, fig. 1.2). The ideological importance of cattle is also manifest in the rock art of the Ennedi Highlands.

From about 1100 BC onwards, permanent use of the Wadi Howar region was no longer possible, but there are spots (such as watering troughs around wells) which still indicate its importance as a thoroughfare and even a habitat for pastoralists.

Pastoral Rock Art

Pastoral livelihood is a material condition defined by the characteristics elaborated above, but which cannot exist without adequate cognitive, ideological and social concomitants. These evanescent elements find expression, for instance, in the treatment of dead cattle, but are more tangibly reflected in rock art, thus providing clues for a deeper understanding of pastoralists' attitudes towards their livestock. If we postulate that the early herders already had cattle cults or a kind of 'infatuation' (Robertshaw 1990: 208) with their beasts, then a sophisticated communication medium such as rock art would mirror such an intimate coupling of economic organisation and epistemic structures.

For the region in question, the southern Eastern Sahara, two heterogeneous bodies of art will be considered here: the rock engravings of the Wadi Howar region and the paintings and engravings of the Ennedi Highlands (see Figure 2.1).¹⁵ Both main research areas are subdivided into disconnected sub-regions, all of which have their own particular landscape setting.

The Wadi Howar Region

The richest rock-art site of the Wadi Howar region is Zolat el Hamad, located some 30 kilometres north of the Middle Wadi Howar (Figure 2.1). It comprises a roughly round array of numerous rocky hills with a maximum diameter of six kilometres. The region's rock art was first discovered by Newbold (1924, 1928), who made hasty records, as did the Frobenius expedition of 1933, so that no systematic documentation exists (Rhotert 1952: 79). After visits by research teams from Cologne University in 2003–2005, more rock art was reported (Kröpelin 2004), almost exclusively engravings. The bulk of the motifs show domestic cattle, with giraffes being the second most frequent motif (roughly a third of the number of cattle depictions), followed by ostriches (just above a tenth of the cattle motifs). Game animals representative of a more humid climate (elephants and rhinoceroses) are very rare, and it is a peculiarity of Zolat el Hamad that camels are missing entirely. The same situation seems to prevail in the rock art of the nearest oasis, Nukheila, about 120 kilometres to the north-north-west (Newbold 1928: 279).

Another hilly region loosely linked to the Middle Wadi Howar, though located 100 kilometres south, is Jebel Tageru. While no systematic records of this mountain's rock art are available, preliminary reports and photographs indicate that the engravings are very similar to those of Zolat el Hamad (*ibid.*: 277).¹⁶ It appears that here the focus on cattle is even stronger since very few giraffe depictions are to be found and none of other game animals. It is surprising that here, too, depictions of camels seem to be absent.

In the Lower Wadi Howar, roughly 100 kilometres west of the Nile, rock engravings were found mainly on flat or slightly erect outcrops on the banks of the wadi (Kröpelin 2004; Jesse 2005). Three large sites (Figure 2.1) were detected

in an 8.5 kilometres stretch along the wadi. Though relatively near to each other, the three sites are of rather different character as regards the motifs to be found there. While the record of engravings in the Lower Wadi Howar may as yet be incomplete, it seems to be rather certain that, in contrast to Zolat el Hamad and Jebel Tageru, there is no clear dominance of cattle in the art. At site S 03/35 (Jesse 2005), where giraffes are the most frequent representational motif, cattle are engraved on a vertical wall in a way that they can be seen at a distance in the wadi.

In line with the familiar problem that rock art is difficult to date precisely, here the chronological aspects can only be dealt with in a sweeping sense, linking the art to general knowledge about climate development and archaeological sequences. However, at the central site in the Lower Wadi Howar, S 02/2, a radiocarbon date was obtained on charcoal from the sediment covering an engraved giraffe. These were dated to no later than about 1200 to 1300 BC (ibid.: 33).

The Ennedi Highlands

The highlands of the Ennedi seem to have been a favourable landscape over long periods of the Holocene, not only in the early periods but even today.¹⁷ Located in the Sahara–Sahel transition zone (Andigüe, Bonnaventure and Adoum 2006: 13), the Ennedi Highlands are sparsely settled. The western foothills differ from the rest of the highlands not only in terms of hydrology, ecology and topography, but also as regards rock-art styles and motifs. Therefore different developments seem to have unfolded despite the close vicinity of the regions, which are echoed in patterns of use even today. Large herds of sheep and goats and even occasional horses can be seen in the vicinity of Archei (approximately 16°50' north of the Equator), a sight unseen in the inner parts of the highlands at the same or even more southerly latitudes. On the south-western outskirts of the Ennedi, near Bechikele (16°30'), one can encounter the northernmost cattle herds of Chad (cf. Clanet, Lemoalle and Dara 2006: 35). On the other hand, camels are omnipresent.

Though archaeological sites with stone artefacts and more or less well-preserved pottery are numerous in the Ennedi Highlands, their potential for reconstructing subsistence patterns or the ideological role of cattle is very restricted.¹⁸ Classifiable faunal remains are limited to one cattle jaw, which was found in a disturbed archaeological context at site Mornou T 05/88–2 and has been dated to around 630 BC (Table 2.1).

The range of the mainly painted rock-art motifs, which is as narrow in the Ennedi as it is in the Wadi Howar (cf. Sauvet et al. 2006), is focused on cattle (and later also camels) in such a way that it does not seem to reproduce the true quantitative relations of domestic animals. Sheep and goats, the bones of which have been found in the Wadi Howar region (Van Neer and Uerpmann 1989; Berke 2001), and which are still present in the Ennedi today, are conspicuously absent from engravings in both regions, although they do appear in the paintings of earlier periods. Their absence from the engravings seems to be linked to a symbolic incongruence, for instance a taboo, of ovicaprids with engraving tech-

niques, or it may indicate that painters were different from engravers in the value they accorded sheep and goats.

Judging from the distribution of cattle motifs in rock art, seemingly the entire Ennedi Highlands once used to be cattle-herder terrain, where people at any given time appear to have followed rather uniform subsistence patterns (Keding et al. 2007). Nevertheless, rock art is far from being homogeneous, certain sub-regional peculiarities indicating lively synchronic and diachronic cultural dynamics (ibid.: 28–32).

The Development of Ennedi Pastoral Art

There is a general trend in the pastoral art of the Ennedi by which, after their introduction into the region, cattle become more and more ‘independent’ of people, until they are no longer represented as an aid for work but as an indicator of wealth and status. Another way of expressing the significance of cattle was opened to the pastoralists through their immersion into the symbolism of livestock. This provided them with an expressive repertoire which allows the articulation of, among other things, identities in a cattle idiom

The pastoralist’s occupation with cattle, as expressed in art, underwent a development which mirrors an obviously narrowing focus – or maybe a growing infatuation – parallel to the ongoing climatic degradation. There are no hard data by which the beginning of so-called ‘Bovidien’ or pastoral art production in the Ennedi can be determined exactly, but general archaeological data indicate a more or less intense use of the highlands from the introduction of domestic stock in the fourth millennium BC (Figure 2.2).¹⁹

During this period, a remarkable rise in the number of archaeological camp sites is noticeable (Keding et al. 2007: 36, 39–40). These are mostly characterised by Hohou pottery (Bailloud 1969), which corresponds to the Leiterband ceramics used by cattle pastoralists in the Wadi Howar region (Keding 1997a; 1998: 9, fig. 4).²⁰ One radiocarbon date places Hohou ceramics at around 3000 BC (Bailloud 1969: 40). Thus the Ennedi Highlands were probably incorporated into a pastoral system that seems to have originated, or had its main base, about 300 kilometres to the east, in the area of the Leiterband Complex. In contrast to the Wadi Howar region, pits and bones were not registered in the Ennedi Highlands, the latter due to erosion.

For the art of the earliest Bovine Period, or Bovidien Ancien, Bailloud (1997: 26) observed that human figures were captured in lively action which generally goes together with a lateral view. They are mainly monochrome and do not seem to be highly standardised stylistically. Depictions of cattle are also largely monochrome and without patterning, so that there is no explicit individualisation of cattle. Activities imply attending on cattle, for instance in a milking scene from site T 04/12 in the Shekitiye region (Figure 2.7.1); images of cattle wearing what may be taken to be a harness (Figure 2.7.2) or pulling a rack (Figure 2.7.3) also fall in this period and seem to indicate that the symbolism of domestic stock

implied, certainly among other things, pragmatic aspects of pastoral life, and that metaphorism to some extent anchored in everyday human–stock interaction.

Later the motifs become bichrome as well as polychrome. Human figures, for example, are frequently depicted in two or more colours, and feature elaborate details of clothing and ornament. While in the western foothills humans are still shown in distinct activities, in the central highlands the lateral aspect is replaced by a static frontal aspect unsuited to rendering distinct activities. Accordingly, depictions of humans interacting with their stock are no longer produced. The cattle begin to stand by themselves, symbolising their significance through their mere presence. At the same time they become individualised through the depiction of distinctive patterns of the coat. This feature is echoed in the work of contemporary pastoral groups, where the individuality of cattle is not only expressed by a multitude of terms applied to patterns of the coat, horns and other features (e.g., Haberland 1983; Galaty 1990; Eckl 2000; Smith 2005),²¹ but also by individual names (Haberland 1983: 185).

The process of individualising cattle continued while aridity reached its peak and the Neolithic gave way to the Iron Age. The latter is well represented by numerous archaeological sites. The first use of iron is dated to around AD 400 but could have been earlier (Keding et al. 2007: 37–38, 40–42). Although evidence for iron use and technology is rare, sites with typical Iron Age ceramics, known



Figure 2.7: Rock art from the southern Ennedi Highlands, presumably from early herding periods, showing scenes of pastoral cattle use. 1: a person milking a cow (length of cow, 9 cm); 2: a person attending to a cattle wearing a harness (height of human, 19 cm); 3: a cow pulling a rack. Tracings from photographs by T. Lenssen-Erz.

as 'Djoki' pottery, are numerous (Bailloud 1969). This homogeneous pottery follows an entirely new concept. It includes high percentages of undecorated red-slipped sherds with thick, blackened rims (Keding, Lenssen-Erz and Pastoors 2007: 38, fig. 8). The few decorations include shallow geometric incisions under the slip and mat impressions on the body and bottom (Keding et al. 2007: 39, fig. 9). While connections to the east (Wadi Howar and the Nile Valley) are rare, some painted sherds may reflect western influence. This is also indicated by iron artefacts, including various types of awls and bead, as well as arrow-, lance- and spearheads (Keding et al. 2007: 40, fig. 10) which were probably traded in from the west as prestige items. Although finds of metal points are extremely rare, numerous representations of them in rock art suggest the high social value of metal, itself probably a sign of prestige. In rock art, metal points are frequently associated with depictions of cattle accompanied by static sentinel-like figures of the 'Libyan warrior' type (e.g., Muzzolini 2001), equipped with lance and shield (see Figure 2.8) and often with rich head decorations. They are widespread in the inner highlands, also being an indication of western relationships since, for instance, these figures abound in the engravings of the Aïr mountains of Niger (Dupuy 1998). The shields are often decorated in ways recalling the unrealistic patterns of cattle markings (cf. Smith 2004: 46). Andrew Smith (2005: 14) describes South African pastoral Zulu warriors using cow-hide shields of a particular colour for each regiment. Another link of cattle hide pattern and group identity is reported for the Ethiopian Bodi, where each clan is identified with a specific hide pattern and deceased elders are buried in the hide of a cow with this pattern (*ibid.*). A similar association between clans and hide patterns can be seen among pastoral Herero of Namibia (Eckl 2000: 425–28). As for the Iron Age pastoral groups of the Ennedi Highlands, it may be concluded that when the climate had turned entirely arid they manifested their affiliation and identity through a symbolism closely linked to their cattle, and which they advertised in part through the designs on their shields.

Another aspect of cattle centrism is addressed by the rather frequent depiction of cows with their calves. Often the painters made an effort to mark certain calves as being the obvious direct offspring of particular cows by giving both very similar coat patterns (Figure 2.9). This shows a concern with the descent and genealogy of cattle, which is also known from modern cattle pastoralists (e.g., Galaty 1990: 227; Eckl 2000: 424; Smith 2005: 14). Moreover, it seems to focus on reproduction, which in the context of cattle herding is tantamount to an emphasis on the growth of wealth and reputation. In accordance with the practices of many modern pastoral groups, cattle in the Ennedi Highlands were probably a means to advertise status and wealth, and through rock art this material as well as symbolic capital became meta-symbolic capital – that is to say that when living cattle were of symbolic value beyond their economic worth, then art provided an option to add a higher level of symbolism: if cattle were symbolic capital, among other things, then rock art allowed to save it in an even more abstract symbolic form. This may be an indication for the motivation for this

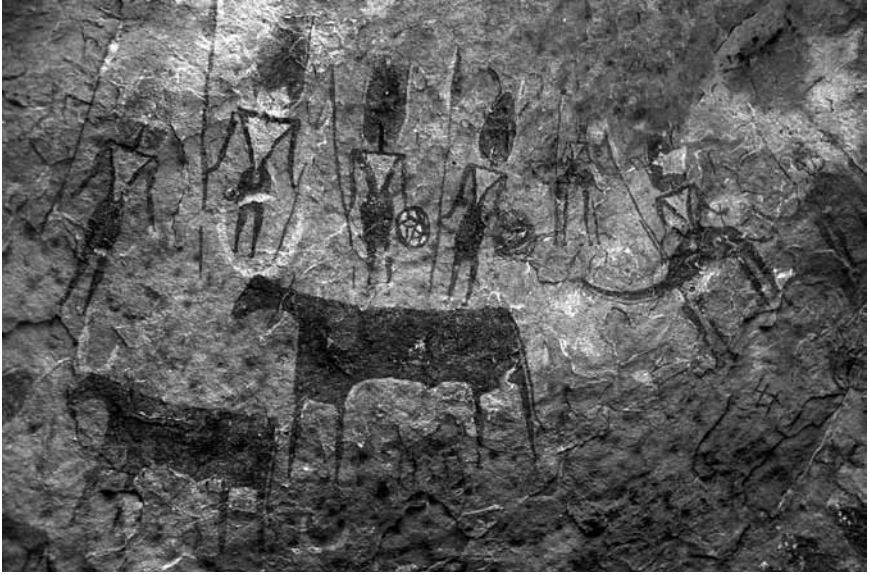


Figure 2.8: Men presenting shields and lances with iron tips: three males are mounted on camels, juxtaposed with domestic cattle. Site T 03/26, southern central Ennedi (height of leftmost man, 40 cm). Photograph by T. Lenssen-Erz.



Figure 2.9: A cow with her calf, the pattern of the coat showing indisputably that the calf is her offspring. Site T 05/501, north-eastern Ennedi (length of cow, 22 cm). Photograph by A. Pastoors.

particular rock art: It provided the means to petrify, as it were, once and forever the value cattle had for the owner. Moreover, in the periods under investigation, climatic development had gradually depleted the carrying capacity of the land and the usable space for pastoral economies, and therefore the tendency towards a manifestation of distinct identities and group affiliations would have increased.

According to archaeological evidence, the Early Iron Age in the Ennedi Highlands probably began in the second century AD when the horse and camel may have added other options for pastoralist livelihoods, as is suggested by some depictions of camels juxtaposed with cattle in the inner highlands (Figure 2.8). But, unlike camels, horses seem to be entirely incompatible with cattle: there are almost no joint depictions. Horses display a uniform pattern of use, being largely ridden by armed people in a ‘flying gallop’ (74 per cent). Maybe they stand for a specific ‘class’ or ‘caste’ not involved in the ordinary working processes of the pastoralist environment. Brass (2007) suggests an emergence of elites in Saharan pastoral societies at a time even before the Ennedi was colonised by pastoralists. His argument is mainly founded on cattle and human burials under tumuli in the Acacus Mountains of Libya and the Egyptian Nabta Playa region, but he also draws on depictions of ‘prominent individuals’ in the rock art of the Libyan Mesak Settafet and Tassili n’Ajjer in Algeria (*ibid.*: 17).



Figure 2.10: An engraved, almost life-size cow (120 cm long) with deep grooves resulting from intense grinding on the navel, udder, neck, tail tuft and lower hind legs. Site T 05/560, north-eastern Ennedi. Photograph by T. Lenssen-Erz.

A final remark should be made about the difference between paintings and engravings. Typically, engravings are on flat rocks or on vertical walls. Unlike paintings, they are usually not found at inhabited sites, their location seeming to be determined by landscape properties rather than qualities linked to everyday livelihoods. Moreover, since they comprise no scenes and contain only a few depictions of humans, and exhibit many non-representational motifs, the whole context of engravings removes them from everyday life and from the experiences and causalities of the conscious, material world in comparison to paintings. This may be the reason why the 'infatuation' of veritable cattle centrism seems to be more comprehensively detectable in paintings than in engravings. With its narrative and metaphoric potential, painted art may be more open to the intricacy of 'cattle-first strategies' with their all-embracing influence on everyday life. Engravings, by contrast, with their largely symbolic function, lack the anchoring in the empirical, mundane sphere, and generally seem to be linked to a 'higher' sphere of a more abstract religiousness. This may be corroborated by large engravings of cattle, where the navel and in some instances also the udder or other body parts have been rubbed so intensively that deep hollows have been formed (Figure 2.10), which sometimes also show clear traces of red pigment. This bears witness to a particularly intense, probably repeated and ritual interaction with the finished pictures, being related to a special meaning of the animal which is not found among paintings.

Modelling the Mental Maps of Ennedi Cattle Pastoralists

Based on the analyses carried out in the Ennedi Highlands, where rock art was recorded comprehensively in relation to landscape properties, some general hypotheses as to the difference between engravings and paintings can be set forth, thus giving meaning to their parallel existence in the pastoral landscape and linking them to different mental maps. These concepts seem to have become increasingly distinct from the Neolithic to the Iron Age, without suggesting clear chronological thresholds or any cogent climatic causality. The dichotomy of representing the significance of cattle at the interface with the landscape may be summarised as in Table 2.2.

These hypotheses corroborate the findings from other disciplines and reach out beyond the Ennedi case study: although there are no paintings in the Wadi Howar, the characterisation of the relationship between landscape and engravings applies there, too. Zolat el Hamad is a peculiar landscape feature marked with engravings, and in the Lower Wadi Howar (S 03/35) depictions of cattle were made in such a way that they attain a signalling effect over a considerable distance. Obviously, groups living in the wider area shared very similar economic strategies and a cattle-centred ideology but were clearly distinct in other cultural traits even though their territorial units may have partly overlapped.²² With this trend towards regionalisation, expressed in different conceptualisations of landscape (that is, the mental maps of painters and engravers), with the rather narrow

Table 2.2: Two ways of representing the significance of cattle in pastoral rock art.

Pastoral rock art – engravings	Pastoral rock art – paintings
<p>Sites</p> <ul style="list-style-type: none"> • sign posts (few traces of habitation) • motifs with signal character (long-range visibility) • landscape-related properties narrowly patterned 	<p>Sites</p> <ul style="list-style-type: none"> • paintings usually at inhabited sites • paintings normally inside shelters • landscape-related properties variant
<p>Art sample</p> <ul style="list-style-type: none"> • 773 figures at 54 sites • 14.3 figures per site • thin scatter of sites over landscape • some areas without engravings 	<p>Art sample</p> <ul style="list-style-type: none"> • 5795 figures at 104 sites • 55.7 figures per site • clear local concentrations • evenly distributed over highlands
<p>Main motif</p> <ul style="list-style-type: none"> • cattle are the first vehicle to transport notions of the extraordinary • engraved cattle are offerings to the landscape, not being referential to humans and their mundane actions • engravers had a relatively moderate ‘infatuation’ with cattle • they neglect goats and sheep in the art • this may indicate that the pastoral means of production were not suited per se to express meaning 	<p>Main motif</p> <ul style="list-style-type: none"> • the symbolic capital constituted by cattle was ‘saved’ in the landscape • the landscape formed the stage on which to advertise one’s ‘infatuation’ with cattle • paintings of cattle were self-referential, apparently having served to transcribe the value and meaning of cattle onto the landscape • this perpetuated the dominance of cattle in, and its intertwining with, everyday life
<p>Hypothesis: ‘passive’ approach to landscape</p> <ul style="list-style-type: none"> • the entire landscape is charged symbolically • marked spots define the sacred landscape, beyond the everyday human life-world • places of symbolic significance were always there, even before art • configurations of the landscape were of importance in their own right, irrespective of the use made of them • the pre-existent significance of places was made visible by engravings 	<p>Hypothesis: ‘active’ approach to landscape</p> <ul style="list-style-type: none"> • the landscape is marked in the context of its mundane and ritual use • art sites are places of everyday routines (notwithstanding the existence of specialised ritual sites) • people appropriated the landscape through use in the context of their normal livelihood • when choosing a site they had no particular configuration and symbolism of the landscape in mind • first criterion of choice was a site’s suitability for dwelling purposes • at a chosen site paintings completed the appropriation of the place by ritual means

demarcation of spatial entities by the exclusiveness of certain motifs in special areas and also with different idioms to communicate within and through the landscape (paintings versus engravings), it seems plausible that these groups may also have spoken different languages. While the ecological conditions seem to have imposed a narrow choice of economic strategies, it was perhaps the growing scarcity of resources which favoured a parallel development of cultural multi-locality and distancing.

Conclusion

Cattle-centred societies, based on multi-resource pastoralism, had already developed in the fifth millennium BC in the Eastern Sahara of Sudan and Chad and can be traced through to the beginning of the Iron Age in the first half of the first millennium AD. Cattle were seen as capital, not only in an economic but also in an ideological and social sense. Cattle, providing milk and meat, assured people's livelihood and served as a means of exchange, but their incorporation in rituals also allowed societies to cope both physically and mentally with vulnerable conditions such as climate change. Various cattle-first strategies developed as a means to concisely condense and communicate regulative mechanisms of social, economic and ritual life. Especially during the second half of the Holocene, this strong relationship seems to have counterbalanced for a long time the criticality of ecological conditions that deteriorated to a state where animals better adapted to arid ecotopes could possibly have yielded a more resilient source of subsistence. But what at first appears like an unsustainable strategy may have been an efficient feedback loop. The cognitive fixation on cattle might have tolerated no alternative. Through this focus the whole potential of all possibilities to keep cattle was creatively exploited. This allowed herding under conditions that from a strictly ecological perspective would seem completely unsuited. However, comparable attitudes can still be found, for example, among the BaSotho of Lesotho, where Ferguson (1985: 651–52) has pertinently documented a pastoralist's cattle strategy in the face of severe drought.

All sets of data investigated in this study – that is, artefacts, bones, and rock art – allow a consensual interpretation pointing towards a fixation with cattle, distributed over various landscapes and habitats of the southern Eastern Sahara. A variety of pastoral adaptations were present in different areas, such as the Ennedi Highlands or the Wadi Howar region, and also through time.

However, a set of characteristics of cattle-centred behaviour can be established, including some or all of the following features:

- cattle bones clearly dominate the faunal remains;
- pits filled with cattle bones and often with broken pottery; occasionally even large parts of still articulated or entire carcasses were deposited in these pits; these pits indicate various uses of cattle in secular and ritual contexts;
- large sites with hundreds of such pits, showing the interlinked special meaning people imposed on localities and animals; in some cases this particular significance, likely of a ritual and certainly of a social character, lasted over several centuries;
- less frequent features include: individual cattle burials; small cattle figurines of clay; bones from outstandingly large beasts;
- pastoral strategies of herd management such as the recurrence of different breeds or the installation of watering troughs;

- in the rock art, cattle depictions are predominant;
- the individualisation of cows in representations, with special efforts put into the production of cattle pictures and occasional tactile interaction with finished pictures;
- a passive role for humans in painted scenes involving cattle is characteristic of Iron Age rock art;
- in general, the fixation on cattle is maintained for a considerable period of time, even when climatic conditions deteriorate to a state where the herding of more resilient species (sheep, goats, camels) would seem to have been less risky and these species could be expected to gain in symbolic significance.

Cattle-centred behaviour functioned for rather a long time in the southern Eastern Sahara: ubiquitous during the Leiterband Phase (4000 to 2200 BC), it was more strongly focused on the Ennedi Highlands in the ensuing periods up to the beginning of the Iron Age in the first half of the first millennium AD.

The value of cattle is rooted in times long before their domestication, as indicated by evidence of final Pleistocene sites in Egypt and Algeria. For instance, at site 8905 in the Tushka area of Egypt, the skulls (or parts thereof) of wild cattle (*Bos primigenius*) were found associated with human burials, dated to between around 16000 and 12000 BC (Wendorf 1968: 872–73; Wendorf and Schild 2001: 657). At Columnata in Algeria, the horncores of five or six wild cattle were found in a stone setting associated with a human burial of Ibéromaurusian date (about 12000 BC) (Hachi and Roubet 2003: 17).

In the late middle Holocene, finds of cattle integrate sites of the southern Eastern Sahara into a large northern African pastoral sphere. Since their first appearance, cattle were of outstanding importance in the way of life of the prehistoric groups of this area. This was not restricted to subsistence but also included ritual aspects, as manifested in different forms in the archaeological record (see Figure 2.6). Despite cattle being a widespread phenomenon throughout northern Africa, regional differences become obvious.²³

This general trend towards regionalisation becomes especially apparent when taking a look at phenomena with a high potential to communicate symbolic meanings, such as pottery styles and rock art. There are overarching divisions in the research area based on chronological and environmental features (most pronounced: the Ennedi Highlands versus Wadi Howar) that still allow for small-scale cultural expressions within these sub-divisions. In the rock art of the Ennedi and the Lower Wadi Howar there are regional specialisations which seem to circumscribe territorial entities no larger than a few dozen square kilometres. On the other hand, there are large supra-regional phenomena, such as the distribution of certain decorative patterns of pottery and types of lithic artefact. Obviously, lithic artefacts and pottery operated as expressions of identity on a different level than rock art. Pastoralism as the dominant form of subsistence could be the uniting but also the dividing factor for this. While on a broad scale

the value and use of cattle was shared, from another perspective the ideological process of individualising cattle may have been coupled with the phenomenon in the social environment where identities, too, showed a tendency towards small-scale entities. Occasional social events and meetings between different pastoral groups could explain the far-flung spread of certain traits, whereas a more or less constant neighbourhood as well as competition for scarce resources may have advanced the need to advertise distinct identities. As a consequence, people sharing the same landscape and the same pastoral subsistence strategy may have developed different intensities of cattle-centred behaviour.

An archaeological study that provides evidence for cattle-centred behaviours over a vast landscape and over many centuries can neither elucidate the psychological aspect of the fascination with cattle, nor the extent of the cognitive effort to explain, order and understand the world. But the early appearance of such behaviours and their occurrence in the present may indicate that even emotional factors constitute a form of cultural capital that strengthens resilience under precarious ecological conditions and secures survival despite strong environmental and cultural changes. These changes may be of minor importance if only 'the cattle are well'.

Notes

Between 1980 and 1993, field research was carried out by a team from the University of Cologne as part of the *Besiedlungsgeschichte der Ostsahara* (BOS) project. Since 1995, research has continued for twelve years under the aegis of the ACACIA (Arid Climate, Adaptation and Cultural Innovation in Africa) collaborative research centre. Both projects owe their funding to the Deutsche Forschungsgemeinschaft. We would like to thank our archaeological and geological counterparts in Sudan and Chad, the National Corporation for Antiquities and Museums (NCAM) and the Geological Research Authority (GRAS), both in Khartoum, and the Centre National d'Appui à la Recherche (CNAR) in N'Djamena for their fruitful cooperation during this time. For useful critical comments on earlier drafts of this chapter we would like to thank Heiko Riemer, Michael Bollig and Hans-Peter Wotzka.

1. We are grateful to E. Ndiema (personal communication) for bringing this greeting phrase to our attention.
2. For the ritual aspect of cattle, see, e.g., Keding (1997a: 224–27), Paris (1997, 2000), Applegate, Achilles and Duncan (2001) and di Lernia (2006).
3. For an archaeological perspective on this matter, see, e.g., Wendorf and Schild (2001: 657, 671–73).
4. In the anthropological literature there is a wide range of definitions of pastoralism, the lowest common denominator being an economic dependence on the herding of domesticated animals (Johnson 2002: 152). Along the two axes of mobility and subsistence strategies it is possible to distinguish various forms of pastoralism (cf. Sadr 1991: 4; Johnson 2002: 166).
5. For palaeoclimatic studies, see Pachur and Kröpelin (1987), Kröpelin (1993), Hoelzmann et al. (2001), Kuper and Kröpelin (2006), Pachur and Altmann (2006) and Kröpelin et al. (2008); for archaeozoological studies, see Van Neer (1989), Van Neer and Uerpman

- (1989), Berke (2001), Peters and Pöllath (2004) and Pöllath and Peters (2007); for (archaeo-)botanical studies, see Neumann (1989) and Nussbaum, Kröpelin and Darius (2007). For the subdivision of the Holocene, see Kuper and Kröpelin (2006).
6. Recent research in the Kerma Basin has provided evidence for domestic cattle at least from the early sixth millennium bc. At El-Barga, a Neolithic grave had been covered by the skull of a domestic cow for which two radiocarbon dates clustering around 5750 bc are available. A sondage at a site about 5 kilometres from El-Barga yielded bones of domestic cattle in association with fragments of ostrich eggshell and shells which gave radiocarbon dates of around 7000 bc (Honegger 2005: 247). At Rabak, south of Khartoum, bones of domestic cattle were found in level six of the excavation. A shell sample found in the same level was dated to 4980 ± 140 bc. However, the fauna found at the site shows a heavy emphasis on fishing, with some hunting of various animal species (El-Mahi and Haaland 1984: 30).
 7. The radiocarbon date of 6310 ± 170 BC (7455 ± 180 BP; Hv-2775) on a bone sample found at Enneri Bardagué in the Tibesti mountains (Chad), often mentioned in reviews of early African cattle husbandry (e.g., Marshall and Hildebrand 2002: 110, fig. 2.2) is not considered here because the dated animal bone was not identified (Gabriel 2002: 387). Besides cattle, the site yielded remains of elephant, giraffe, buffalo (Bubalus), antelope, gazelle, sheep and ostrich (Gabriel 1977: 52). A review of the radiocarbon dates associated with early domestic cattle in Africa seems necessary since uncritical acceptance of dubious contexts is frequent.
 8. Gazelle (*Gazella dorcas*), addax (*Addax nasomaculatus*) and hare (*Lepus capensis*) were identified by Hubert Berke, University of Cologne.
 9. In a refuse pit at Ennedi Erg S99/1, cattle bones bearing butchering marks were even found in association with mega-segments (Berke 2001: 245).
 10. For studies of recent pastoral societies in relation to this matter, see Cribb (1991: 82) and Hodder (1982).
 11. We are also grateful to W. Van Neer (personal communication) on this matter.
 12. B. Zach (personal communication).
 13. For instance, at Nabta Playa in the Egyptian Western Desert (Applegate, Achilles and Duncan 2001: 486–87; Wendorf and Schild 2001: 668) and at Adrar Bous Site 1 in Niger (Paris 1997: 115). For a review, see di Lernia (2006).
 14. At site Conical Hill S02/3, cattle bones make up nearly 100 per cent, whereas at site Conical Hill S02/4, small livestock herding is also attested, sheep and goat representing 1.4 per cent of the faunal remains (Godhoff 2005: 25–26). Among the faunal remains of site Abu Tabari S02/28, cattle are largely dominant, accounting for about 95 per cent of the identified bones. Fishing and hunting only played a minor role (Pöllath and Peters 2007: 65).
 15. Both regions have undergone intensive research by ACACIA projects, but, more importantly, the Ennedi represents a core area of prehistoric art production in the Eastern Sahara.
 16. Reports and photographs include Newbold (1924, 1928); the information contained there has been supplemented as a result of the Cologne University BOS and ACACIA projects.
 17. Pachur and Altmann (2006: 564) have reconstructed an annual precipitation rate of 400 to 700 mm for the period around 7000 bc.
 18. Research into the archaeology and rock art of the region has covered four more or less representative regions along a west–east transect (Lenssen-Erz and von Czerniewicz 2005;




- Keding et al. 2007) where archaeological sites, paintings and engravings can be found in different relative quantities.
19. For a discussion of so-called 'Bovidien' art in the Ennedi Highlands, see Heckendorf (2008).
 20. Due to research history, the two terms 'Leiterband' and 'Hohou' are used for the same type of pottery, the former in the Wadi Howar region and the latter in the Ennedi (Keding 1998).
 21. See also Coote (1994: 250) for further references on this matter.
 22. Compare the regionalisation which Bailloud (1997) grasped by recognising eight, mainly locality-bound, styles of the Bovine period within a very restricted area of about 70 by 60 kilometres.
 23. This view is supported by linguistic evidence which not only indicates a linguistic fragmentation in the area but also contacts between east and west: see, e.g., Blench (1999) and Dimmendaal (2007).

References

- Andigüe, J., S. Bonnaventure and A. Adoum. 2006. 'Climat', in *Atlas du Tchad*. Paris: Les Éditions J.A., pp.12–13.
- Applegate, A., G. Achilles and S. Duncan. 2001. 'The North Tumuli of the Nabta Late Neolithic Ceremonial Complex', in F. Wendorf et al. (eds), *Holocene Settlement of the Egyptian Sahara: The Archaeology of Nabta Playa*, New York: Kluwer Academic/Plenum, pp.468–88.
- Arnold, J.E. 2000. 'Revisiting Power, Labour Rights, and Kinship: Archaeology and Social Theory', in M.B. Schiffer (ed.), *Social Theory in Archaeology*. Salt Lake City: University of Utah Press, pp.14–30.
- Bailloud, G. 1969. 'L'Évolution des Styles Céramiques en Ennedi (République du Tchad)', in *Mémoires I, Actes du Premier Colloque International d'Archéologie Africaine, Fort Lamy (Rép. du Tchad) 1966*. Fort Lamy: Institut National Tchadien pour les Sciences Humaines, pp.31–45.
- . 1997. *Art Rupestre en Ennedi*. Saint-Maur: Éditions Sédia.
- Baxter, P.T.W. 1996. 'Cattle Complex', in A. Barnard and J. Spencer (eds), *Encyclopedia of Social and Cultural Anthropology*. London: Routledge, pp.91–92.
- Bechhaus-Gerst, M., and B. Keding. 2007. 'Meat or Milk? Archaeological and Linguistic Evidence for the Peridynastic Use of Cattle in the Eastern Sahara', *SUGIA* 18: 17–35.
- Behrens, H. 1963. 'Neolithisch-frühmetallzeitliche Tierskelettfunde aus dem Niltal und ihre Religionsgeschichtliche Bedeutung', *Zeitschrift für Ägyptische Sprache* 88: 75–83.
- Berke, H. 2001. 'Gunsträume und Grenzbereiche: Archäozoologische Beobachtungen in der Libyschen Wüste, Sudan und Ägypten', in B. Gehlen, M. Heinen and A. Tillman (eds), *Zeit-Räume: Gedenkschrift für Wolfgang Taute*. Bonn: Habelt, pp.237–56.
- Binford, L.R. 1980. 'Willow Smoke and Dogs' Tails: Hunter-gatherer Settlement Systems and Archaeological Site Formation', *American Antiquity* 45: 4–20.
- Blench, R. 1999. 'The Westward Wanderings of Cushitic Pastoralists. Explorations in the Prehistory of Central Africa', in C. Baroin and J. Boutrais (eds), *L'Homme et l'Animal dans le Bassin du Lac Tchad*. Paris: Éditions IRD, pp.39–80.
- Blench, R.M. and K.C. MacDonald (eds). 2000. *The Origins and Development of African Livestock: Archaeology, Genetics, Linguistics and Ethnography*. London: University College London Press.

- Bonnet, C. 1996. 'C-Gruppe', in D. Wildung (ed.), *Die Pharaonen des Goldlandes: Antike Königreiche im Sudan*. Mannheim: Reiss-Museum, pp.51–70.
- Brass, M. 2007. 'Reconsidering the Emergence of Social Complexity in Early Saharan Pastoral Societies, 5000–2500 BC', *Sahara* 18: 7–22.
- Chaix, L., and A. Grant. 1992. 'Cattle in Ancient Nubia', *Anthropozoologica* 16: 61–66.
- Clanet, J.-C., J. Lemoalle and L. Dara. 2006. 'Elevage et Pêche', in *Atlas du Tchad*. Paris: Les Éditions J.A., pp.34–37.
- Clutton-Brock, J. (ed.). 1989. *The Walking Larder: Patterns of Domestication, Pastoralism, and Predation*. London: Unwin Hyman.
- Comaroff, J.L., and J. Comaroff. 1990. 'Goodly Beasts, Bestly Goods: Cattle and Commodities in a South African Context', *American Ethnologist* 17(2): 195–216.
- Coote, J. 1994. "'Marvels of Everyday Vision": The Anthropology of Aesthetics and the Cattle-keeping Nilotes', in J. Coote and A. Shelton (eds), *Anthropology, Art and Aesthetics*. Oxford: Clarendon Press, pp.245–73.
- Crioll, J. 1991. *Nomads in Archaeology*. Cambridge: Cambridge University Press.
- Dahl, G., and A. Hjort. 1976. 'Having Herds: Pastoral Herd Growth and Household Economy', *Stockholm Studies in Social Anthropology* 2. Stockholm: University of Stockholm.
- Davis, S.J.M. 1987. *The Archaeology of Animals*. New Haven, CT: Yale University Press.
- De Garine, I., and G.J.A. Koppert. 1988. 'Coping with Seasonal Fluctuations in Food Supply among Savanna Populations: The Massa and Mussey of Chad and Cameroon', in I. De Garine and G.A. Harrison (eds), *Coping with Uncertainty in Food Supply*. Oxford: Clarendon Press, pp.210–59.
- De Waal, A. 1989. *Famine that Kills: Darfur, Sudan, 1984–1985*. Oxford: Oxford University Press.
- di Lernia, S. 2006. 'Building Monuments, Creating Identity: Cattle Cult as a Social Response to Rapid Environmental Changes in the Holocene Sahara', *Quaternary International* 151: 50–62.
- Dimmendaal, G. 2007. 'The Wadi Howar Diaspora: Linking Linguistic Diffusion to Palaeoclimatological and Archaeological Findings', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.148–49.
- Dupuy, C. 1998. 'Réflexions sur l'Identité des Guerriers Représentés dans les Gravures Rupestres de l'Adrar des Iforas et de l'Aïr', *Sahara* 10: 31–54.
- Dyson-Hudson, R., and N. Dyson-Hudson. 1970. 'The Food Production System of a Semi-nomadic Society: The Karimojong, Uganda', in P.F. McLoughlin (ed.), *African Food Production Systems: Cases and Theory*. Baltimore, MD: Johns Hopkins University Press, pp.91–123.
- Eckl, A.E. 2000. 'Language, Culture and Environment: The Conceptualization of Herero Cattle Terms', in M. Bollig and J.-B. Gewalt (eds), *People, Cattle and Land: Transformations of a Pastoral Society in Southwestern Africa*. Cologne: Rüdiger Köppe, pp.401–31.
- El-Mahi, A.T., and R. Haaland. 1984. 'Archaeological Research in the Area of Rabak and Atbara, Sudan, 1983–84', *Nyame Akuma* 24/25: 28–32.
- Ferguson, J. 1985. 'The Bovine Mystique: Power, Property and Livestock in Rural Lesotho', *Man* 20(4): 647–74.
- Ferhat, N. 2003. 'Mankhor : Une Nécropole de Bovidés au Tassili N'ajjer (Sahara Algérien)', *Dossiers d'Archéologie* 282: 79.

- Frhat, N., K.-H. Striedter and M. Tauveron. 1996. 'Un Cimetière de Boeufs dans le Sahara Central: La Nécropole de Mankhor', in G. Aumassip (ed.), *La Préhistoire de l'Afrique de l'Ouest*. Saint-Maur: Éditions Sépia, pp.103–7.
- Francke, U. 1986a. 'Camp 49 Re-examined', in M. Krause (ed.), *Nubische Studien*. Mainz: Philipp von Zabern, pp.137–42.
- 1986b. 'Untersuchungen zur Keramik des Dritten und Zweiten Jahrtausends v. Chr. aus dem Wadi Shaw, Nord-Sudan', MA dissertation. Cologne: University of Cologne.
- Gabriel, B. 1977. *Zum Ökologischen Wandel im Neolithikum der Östlichen Zentralsahara*. Berlin: Institut für Physische Geographie der Freien Universität Berlin.
- 2002. 'Alter und Ursprung des Rinderhirtennomadismus in Afrika', *Erdkunde* 56: 385–400.
- Galaty, J.G. 1990. 'Cattle and Cognition: Aspects of Maasai Practical Reasoning', in J. Clutton-Brock (ed), *The Walking Larder: Patterns of Domestication, Pastoralism, and Predation*. London: Unwyn Hyman, pp.215–30.
- Garcea, E.A.A. 2004. 'An Alternative Way Towards Food Production: The Perspective from the Libyan Sahara', *Journal of World Prehistory* 18: 107–53.
- Gautier, A. 1987. 'Prehistoric Men and Cattle in North Africa: A Dearth of Data and a Surfeit of Models', in A.E. Close (ed.), *Prehistory of Arid North Africa*. Dallas, TX: Southern Methodist University Press, pp.163–87.
- 1989. 'A General Review of the Known Prehistoric Fauna of the Central Sudanese Nile Valley', in L. Krzyżaniak and M. Kobusiewicz (eds), *Late Prehistory of the Nile Basin and the Sahara*. Poznań: Poznań Archaeological Museum, pp.353–57.
- 2001. 'The Early to Late Neolithic Archaeofaunas from Nabta and Bir Kiseiba', in F. Wendorf et al. (eds), *Holocene Settlement of the Egyptian Sahara: The Archaeology of Nabta Playa I*. New York: Kluwer Academic Press, pp.609–35.
- Germer, R. 1985. *Flora des Pharaonischen Ägypten*. Mainz: Philipp von Zabern.
- Ghoneim, W. 1977. *Die Ökonomische Bedeutung des Rindes im Alten Ägypten*. Bonn: Habelt.
- Gifford-Gonzalez, D. (ed.). 2008. *Adrar Bous: Archaeology of a Central Saharan Granitic Ring Complex in Niger*. Tervuren: Royal Museum for Central Africa.
- Godhoff, H.F. 2005. 'Von den Ufern des Nils zu den Weiden der Wüste. Interkulturelle Beziehungen im 4. und 3. Jahrtausend v.Chr. am Beispiel des Fundplatzes Conical Hill 02/4 im Unteren Wadi Howar/Sudan', MA dissertation. Cologne : University of Cologne.
- Gratien, B. 1985. *Sai, I: La Nécropole Kerma*. Paris: Centre National de la Recherche Scientifique.
- Günther, S. 1995. 'Djabarona 84/19: Keramik und Befunde des Vierten bis Zweiten Jahrtausends v. Chr. aus dem Wadi Howar (Nord-Sudan)', MA dissertation. Cologne: University of Cologne.
- Haberland, E. 1983. 'Mensch-Tier-Beziehungen: das Beispiel der Nordostafrikanischen Hirten', in H. Müller-Karpe (ed.), *Zur Frühen Mensch-Tier-Symbiose*. München: C.H. Beck, pp.175–89.
- Hachi, S., and C. Roubet. 2003. 'Les Inhumations en Nécropoles de l'Homme de Mechta-Afalou', *Dossiers d'Archéologie* 282: 16–21.
- Hassan, F.A. (ed.). 2002. *Droughts, Food and Culture: Ecological Change and Food Security in Africa's Later Prehistory*. New York: Kluwer Academic/Plenum.
- Heckendorf, R. 2008. *'Bubalin' und 'Bovidien' in Südmarokko*. Wiesbaden: Reichert.
- Herskovits, M.J. 1926. 'The Cattle Complex in East Africa.' *American Anthropologist* 28: 633–64.

- Hodder, I. 1982. *Symbols in Action: Ethnoarchaeological Studies of Material Culture*. Cambridge: Cambridge University Press.
- Hoelzmann, P., et al. 2001. 'Environmental Change and Archaeology: Lake Evolution and Human Occupation in the Eastern Sahara during the Holocene', *Palaeogeography, Palaeoclimatology, Palaeoecology* 169: 193–217.
- Holl, A. 1998. 'The Dawn of African Pastoralisms: An Introductory Note', *Journal of Anthropological Archaeology* 17: 81–96.
- Holst, D. 2003. 'Das Steininventar des Fundplatzes S 99/1 (NW-Sudan). Rohmaterialversorgung und Artefaktproduktion bei Neolithischen Pastoralnomaden', *Archäologische Information* 26(1): 207–13.
-  egger, M. 2005. 'Kerma et les Débuts du Néolithique Africain', *Genava* N.S. 53: 239–49.
-  F. 2005. 'Rock Art in Lower Wadi Howar, Northwest Sudan', *Sahara* 16: 27–38.
- _____. 2006. 'Cattle, Sherds and Mighty Walls – The Wadi Howar from Neolithic to Kushite Times', *Sudan and Nubia* 10: 43–54.
- _____. 2007. 'Pastoral Groups in the Southern Libyan Desert: The Handessi Horizon (c. 2400–1100 BC)', in K. Kroeper, M. Chlodnicki and M. Kobusiewicz (eds), *Archaeology of Early Northeastern Africa*. Poznań: Poznań Archaeological Museum, pp.987–1004.
- Jesse, F., and B. Keding. 2002. 'Death in the Desert: Burials in the Wadi Howar Region (Eastern Sahara)', in Jennerstr. 8. (eds), *Tides of the Desert/Gezeiten der Wüste*. Cologne: Heinrich-Barth-Institut, pp.277–93.
- _____. 2007. 'Holocene Settlement Dynamics in the Wadi Howar Region (Northern Sudan) and the Ennedi Mountains (Chad)', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.42–43.
-  F., B. Keding, N. Pöllath, M. Bechhaus-Gerst and T. Lenssen-Erz (2007) 'Cattle Herding in the Southern Libyan Desert', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Environmental Change and Human Adaptation in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.44–47.
- Johnson, A.L. 2002. 'Cross-cultural Analysis of Pastoral Adaptations and Organizational States: A Preliminary Study', *Cross-Cultural Research* 36: 151–80.
- Keding, B. 1997a. *Djabarona 84/13. Untersuchungen zur Besiedlungsgeschichte des Wadi Howar Anhand der Keramik des 3. und 2. Jahrtausends v. Chr. Africa Praehistorica 9*. Köln: Heinrich-Barth-Institut.
- _____. 1997b. 'Prehistoric Investigations in the Wadi Howar Region: A Preliminary Report on the 1995/96 Season', *Kush*: 33–46.
- _____. 1998. 'The Yellow Nile: New Data on Settlement and the Environment in the Sudanese Eastern Sahara', *Sudan and Nubia* 2: 2–12.
- _____. 2000. 'New Data on the Holocene Occupation of the Wadi Howar Region (Eastern Sahara/Sudan)', in L. Krzyżaniak, K. Kroeper and M. Kobusiewicz (eds), *Recent Research into the Stone Age of Northeastern Africa*. Poznań: Poznań Archaeological Museum, pp.89–104.
- _____. 2004. 'The Yellow Nile: Settlement Shifts in the Wadi Howar Region (Sudanese Eastern Sahara) and Adjacent Areas from between the Sixth to the First Millennium BC', in T. Kendall (ed.), *Nubian Studies 1998: Proceedings of the Ninth Conference of the International Society of Nubian Studies*. Boston: Department of African-American Studies, Northeastern University, pp.95–108.
- _____. 2006. 'Pottery of the Wadi Howar – Traditions, Transformations and Their Cultural Implications', in K. Kroeper, M. Chlodnicki and M. Kobusiewicz (eds), *Archaeology*

- of Early Northeastern Africa. In *Memoriam of Lech Krzyżaniak*. Poznań: Poznań Archaeological Museum, pp.235–59.
- Keenan, B., T. Lenssen-Erz and A. Pastoors. 2007. 'Pictures and Pots from Pastoralists. Investigations into the Prehistory of the Ennedi Highlands in NE Chad', *Sahara* 18: 23–46.
- Kröpelin, S. 1993. *Zur Rekonstruktion der Spätquartären Umwelt am unteren Wadi Howar (Südöstliche Sahara/NW-Sudan)*. *Berliner Geographische Abhandlungen* 54. Berlin: Institut für Physische Geographie der Freien Universität Berlin.
- . 2004. 'New Petroglyph Sites in the Southern Libyan Desert (Sudan-Chad)', *Sahara* 15: 111–17.
- . 2007. 'The Wadi Howar', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.38–39.
- Kröpelin, S., et al. 2008. 'Climate Driven Ecosystem Succession in the Sahara: The Past 6000 Years', *Science* 320: 765–68.
- Kuper, R. 1981. 'Untersuchungen zur Besiedlungsgeschichte der östlichen Sahara: Vorbericht über die Expedition 1980', *Beiträge zur Allgemeinen und Vergleichenden Archäologie* 3: 215–75.
- . 1995. 'Prehistoric Research in the Southern Libyan Desert: A Brief Account and Some Conclusions of the B.O.S. Project', *Cahiers de recherche de l'Institut de Papyrologie et Egyptologie de Lille* 17(1): 123–40.
- Kuper, R. and S. Kröpelin. 2006. 'Climate-controlled Holocene Occupation in the Sahara: Motor of Africa's Evolution', *Science* 313: 803–7.
- Laudien, A. 2000. 'Osteometrische Untersuchungen zum Altägyptischen Langhornrind', PhD dissertation. Munich: Ludwig-Maximilians-Universität.
- Lenssen-Erz, T. 2007. 'Rock Art in African Highlands. Ennedi Highlands, Chad: Artists and Herders in a Lifeworld on the Margins', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.48–51.
- Lenssen-Erz, T., and M. von Czerniewicz. 2005. 'Résultats Préliminaires des Recherches Archéologiques dans l'Ennedi', *Revue Scientifique du Tchad* 7(2): 5–18.
- Lévi-Strauss, C. 1962. *Totemism*. Boston: Beacon Press.
- Mair, L. 1985. 'The Cattle Complex', *Man* 20(4): 743.
- Marshall, F., and E. Hildebrand. 2002. 'Cattle Before Crops: The Beginnings of Food Production in Africa', *Journal of World Prehistory* 16: 99–143.
- Mtsetwa, J. 1982. *Man and Cattle in Africa: A Study of Social Change in Pastoral Societies in Botswana*. Saarbrücken: Breitenbach.
- Murray, G.W. 1926. 'Graves of Oxen in the Eastern Desert of Egypt', *Journal of Egyptian Archaeology* 12(3/4): 248–49.
- Muzzolini, A. 2001. 'Saharan Africa', in D.S. Whitley (ed.), *Handbook of Rock Art Research*. Walnut Creek, CA: Altamira Press, pp.605–36.
- Neumann, K. 1989. 'Zur Vegetationsgeschichte der Ostsahara im Holozän: Holzkohlen aus Prähistorischen Fundstellen (mit einem Exkurs über die Holzkohlen von Fachi-Dogonbulo/Niger)', in R. Kuper (ed.), *Forschungen zur Umweltgeschichte der Ostsahara*. Cologne: Heinrich-Barth-Institut, pp.13–181.
- . 2005. 'The Romance of Farming: Plant Cultivation and Domestication in Africa', in A. Brower Stahl (ed.), *African Archaeology. A Critical Introduction*. Malden: Blackwell, pp.249–75.

- Newbold, D. 1924. 'A Desert Odyssey of a Thousand Miles', *Sudan Notes and Records* 7: 43–92.
- . 1928. 'Rock-pictures and Archaeology in the Libyan Desert', *Antiquity* 2: 261–91.
- Nussbaum, S., S. Kröpelin and F. Darius. 2007. 'The Flora and Vegetation of Wadi Howar', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa*. Cologne: Heinrich-Barth-Institut, pp.40–41.
- Pachur, H.-J. and N. Altmann. 2006. *Die Ostsahara im Spätquartär. Ökosystemwandel im Größten Hyperariden Raum der Erde*. Berlin/Heidelberg: Springer.
- Pachur, H.-J. and S. Kröpelin. 1987. 'Wadi Howar: Paleoclimatic Evidence from an Extinct River System in the Southeastern Sahara', *Science* 237: 298–300.
- . 1997. 'Les Inhumations de Bos au Sahara Méridional au Néolithique', *Archaeozoologia* 9: 113–22.
- . 2000. 'African Livestock Remains from Saharan Mortuary Contexts', in F.A. Hassan (ed.), *Droughts, Food and Culture. Ecological Change and Food Security in Africa's Later Prehistory*. New York: Kluwer Academic/Plenum, pp.111–26.
- Peters, J. and N. Pöllath. 2004. 'Holocene Faunas of the Eastern Sahara: Zoogeographical and Palaeoecological Aspects', in R.C.G. Lauwerier and I. Plug (eds), *The Future from the Past: Archaeozoology in Wildlife Conservation and Heritage Management. Proceedings of the 9th Conference of the International Council of Archaeozoology, Durham 2002*. Oxford: Oxbow Books, pp.34–50.
- Pöllath, N. and J. Peters. 2005. 'On the Possible Use of the LSI Scaling Technique for Stature Analysis in Cattle', *Revue de Paléobiologie*, Vol. Spéc. 10: 225–35.
- . 2007. 'Holocene Climatic Change, Human Adaptation and Landscape Degradation in Arid Africa as Evidenced by the Faunal Record', in O. Bubenzer, A. Bolten and F. Darius (eds), *Atlas of Cultural and Environmental Change in Arid Africa, Africa Praehistorica 21*. Köln: Heinrich-Barth-Institut, pp.64–7
- Rhotert, H. 1952. *Libysche Felsbilder*. Darmstadt: L.C. Wittich.
- Robertshaw, P. 1990. 'The Development of Pastoralism in East Africa', in J. Clutton-Brock (ed.), *The Walking Larder: Patterns of Domestication, Pastoralism, and Predation*. London: Unwyn Hyman, pp.207–14.
- Sadr, K. 1991. *The Development of Nomadism in Ancient Northeast Africa*. Philadelphia: University of Philadelphia Press.
- Sauvet, G., et. al. 2006. 'La Structure Iconographique d'un Art Rupestre : Est-elle une Clef pour Son Interprétation?' *Zephyrus* 59: 97–110.
- Schön, W. 2002. 'Survey before GPS: Some Remarks on Archaeological Sites on the Northern Bank of the Middle Wadi Howar (Sudan)', in Jennerstrasse 8 (eds), *Tides of the Desert/ Gezeiten der Wüste*. Cologne: Heinrich-Barth-Institut, pp.313–9.
- Shipton, P. 1990. 'African Famines and Food Security: Anthropological Perspectives', *Annual Review of Anthropology* 19: 353–94.
- Smith, A.B. 2004. 'A Prehistory of Modern Saharan Pastoralists', *Sahara* 15: 43–58.
- . 2005. *African Herders. Emergence of Pastoral Traditions*. Walnut Creek: Altamira Press.
- Smith, S.E. 1980. 'The Environmental Adaptation of Nomads in the West African Sahel: A Key to Understanding Prehistoric Pastoralists', in M.A.J. Williams and H. Faure (eds), *The Sahara and the Nile: Quarternary Environments and Prehistoric Occupation in Northern Africa*. Rotterdam: Balkema, pp.467–87.
- Tilley, C. 1994. *A Phenomenology of Landscape*. Oxford/Providence: Berg.

- Tubiana, M.-J. and J. Tubiana. 1977. *The Zagbawa from an Ecological Perspective*. Rotterdam: A. A. Balkema.
- Van Neer, W. 1989. 'Holocene Fish Remains from the Sahara', *Sahara* 2: 61–68.
- Van Neer, W. and H.-P. Uerpmann. 1989. 'Palaeoecological Significance of the Holocene Faunal Remains of the B.O.S.-Missions', in R. Kuper (ed.), *Forschungen zur Umweltgeschichte der Ostsahara. Africa Praehistorica 2*. Köln: Heinrich-Barth-Institut, pp.307–41.
- von Maydell, H.-J. 1990. *Trees and Shrubs of the Sabel: Their Characteristics and Uses*. Weikersheim: Markgraf.
- Wendorf, F. 1968. 'Late Palaeolithic Sites in Egyptian Nubia', in F. Wendorf (ed.), *The Prehistory of Nubia*. Vol. 2. Dallas: Fort Burgwin Research Center and Southern Methodist University Press, pp.791–953.
- Wendorf, F. and R. Schild. 2001. 'Conclusions', in F. Wendorf, R. Schild and Associates (eds), *Holocene Settlement of the Egyptian Sahara. Vol. 1 The Archaeology of Nabta Playa*. New York: Kluwer Academic/Plenum, pp.648–75.