NILE BASIN RESEARCH PROGRAMME

Terje Oestigaard (ed.)

Water, Culture and Identity:

Comparing Past and Present Traditions in the Nile Basin Region

UNIVERSITAS BERGENSIS

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Water, Culture and Identity:
Comparing Past and Present Traditions in the Nile Basin Region

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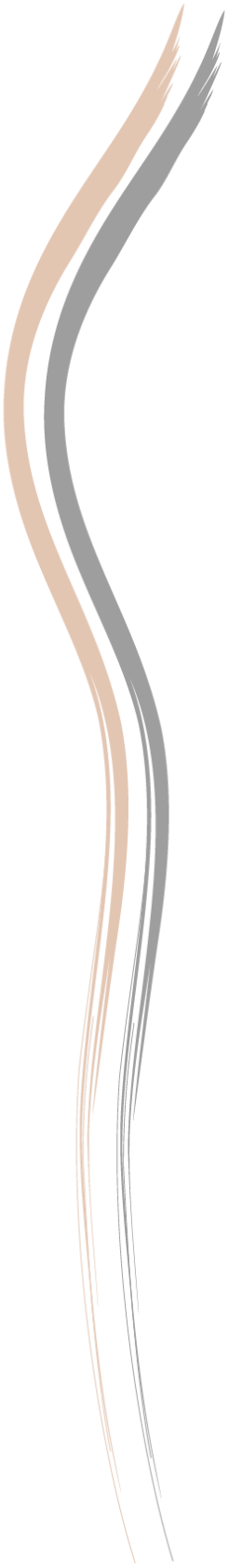

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Nile Basin Research Programme 2009

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Chapter 10

Neolithic Adaptations and Subsistence Economy in the Middle Nile Region, Sudan

Azhari Mustafa Sadig

Introduction

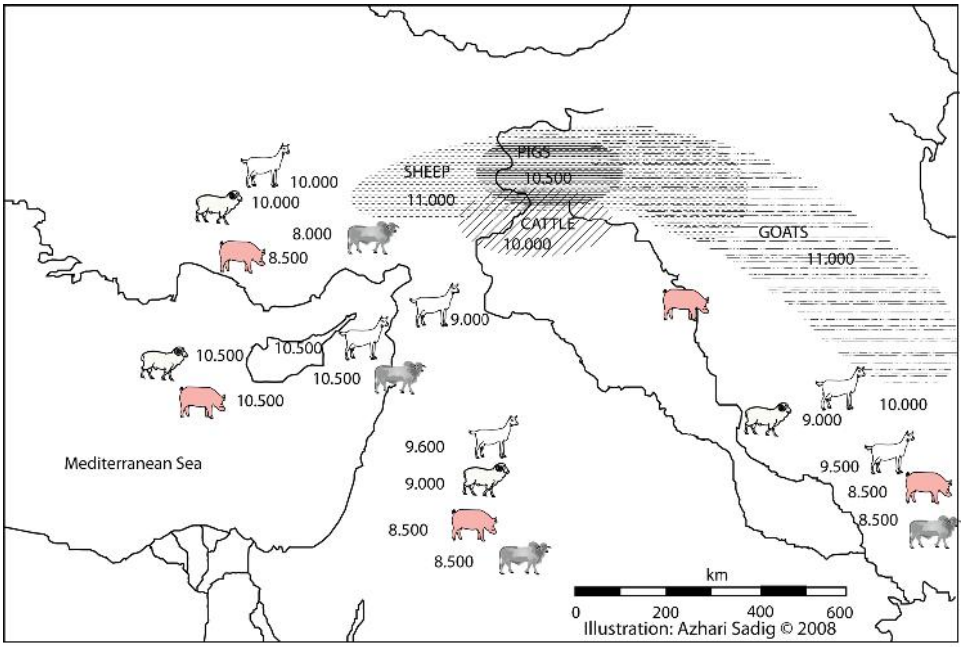
Many scholars have attributed animal domestication to humankind's ingenuity and assert that it occurred in a coordinated and premeditated fashion (Isaac 1962). Other researchers have argued that it was a natural consequence of the ecological and human demographic transitions which took place at the end of the last glaciation approximately 12,000 BP. These ideas include Childe's oasis or propinquity theory which contends that the encroaching desert in southwest Asia resulted in human and animal competing for water resources and that this ecological pressure fundamentally altered their interrelationship and eventually "led to animal domestication" (Childe 1952).

Binford (1972) took another approach to the origins of domestication and agriculture. His edge-zone hypothesis is based on culture as an adaptive device. He assumed that as human populations expanded in the Fertile Crescent, different groups impinged on each other, encouraging the development of new systems for more efficient resource-utilization, i.e. plant and animal domestication.

Although there is still no clear consensus concerning the precise changes in human behavior and ecology which gave rise to sedentary agriculture and animal husbandry, the evidence is overwhelming that the primary trigger was climatic. Recent evidence has confirmed that the 12 millennia since the end of the last glaciation have been the most stable.

Faunal remains and evidence of animal husbandry

First evidence: The oldest evidence for animal domestication appears in archaeological sites of the Natufian period, a Mesolithic culture of the Le-



Map 1. Map of south-west Asia, showing the earliest dates of domestic animals.

vant (c. 12,000-10,000 BP) (Isaac 1962; Meadow 1989). During this period a symbiotic relationship between humans and the wolf (*Canis lupus*) developed which gave rise to the domesticated dog (*Canis familiaris*). The earliest site where skeletal material from domesticated dogs has been recovered is at the Upper Paleolithic cave of Palegawra in present-day Iraq which dates to approximately 12,000 BP (Whitehouse 1983).

The next stage in the Neolithic transition was a marked change in the dominant food source of certain ancient Middle Eastern Neolithic cultures from a reliance on gazelle and deer to ovicaprids (sheep and goats). This can be detected as faunal shifts which occurred in the Middle East between 10,000-8,000 BP (Davis 1982). After this period sheep and goat remains became the most common faunal remains at the majority of ancient human settlements in southwest Asia.

The last of the major domesticated species in southwest Asia were cattle and pigs. This seems to have taken place during the 9th millennium BP in a number of ancient human settlements scattered across the Middle East and the Levant (Davis 1982) (Map 1).

In Africa, The first authenticated domesticated cattle appeared in the early Neolithic settlements of the Nile Valley about 6,800 BP, e.g. Fayum

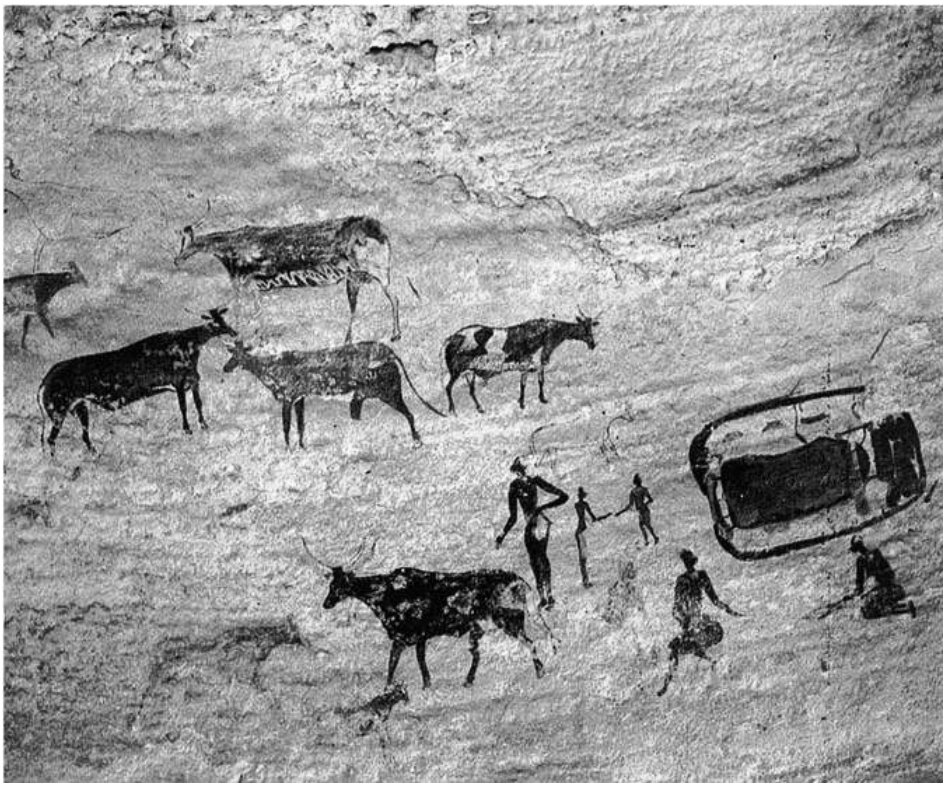


Plate 1. Rock painting of a pastoral scene, Tassili, southeast Algeria. Source: Phillipson 2005.

(Wendorf and Schild 1976). These longhorn cattle dispersed with Hamitic peoples; south through present-day Sudan, west along the northern coastal region, southwest into West Africa and also centrally through a much-reduced Saharan region. Cave art from the Tassili and Tibesti highlands indicate that at this time cattle were present in regions of the Sahara with practically no rainfall today (Plate 1).

Although there was an indigenous African aurochs, *Bos primigenius opisthonomous*, it is widely accepted that this subspecies was not domesticated independently (fig. 1) (Epstein 1971; Epstein and Mason 1984; Payne 1991).

There has been some speculation in the literature however, that this native African aurochs actually formed or contributed to the early domesticated populations on the continent (for reviews see Grigson 1991; Wendorf and Schild 1994).

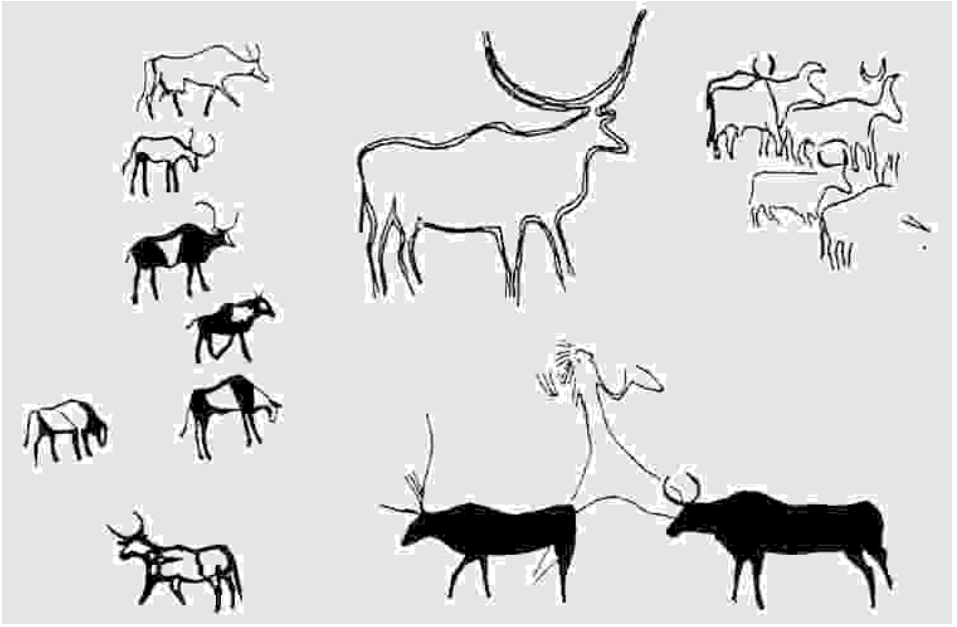


Fig. 1. Rock paintings from Tassili n'Ajjer in southwest Algeria showing putative domesticated cattle and a human figure, possibly a herder (Reproduced from Grigson, 1991).

African Evidence: In Africa, the question of the food production is one of the most important problems facing the prehistoric archaeologists. This problem is generally concerning the origin of domestic species of plants and animals and the role played by the Africa late prehistoric populations in their domestication or introduction of them.

There are two schools of thought that applied their models in the study of early food production in Northeast Africa. The first believes that the area received knowledge of plant cultivation and animal husbandry from South-West Asia before they spread to the rest of the continent. The Nile Valley and, occasionally, the Horn and Ethiopia were suggested as possible routes for the diffusion of these ideas. Mohammed-Ali (1984: 65-66) summarized both opinions. For the former, the evidences are as follows:

a) The occurrence in South-West Asia of settlements with evidence of food production predating those from Africa.

b) The oldest domestic plants and animals (wheat, sheep and goat) recovered from Northeast African sites (Fayum, Merimde, Shaheinab etc.)

pointed to a South-West Asian origin, since no local wild ancestors of theirs had been identified.

c) Farming in temperate African zones was believed to predate that of tropical Africa.

d) Until recently no settlements with evidence of food production contemporary to, or earlier than, the earlier settlements of the Nile had been discovered in Africa.

The second school supported indigenous African domestication of sub-tropical plant and animals, independent of, and contemporary with, the South-West Asian complex. This was also due to a number of factors (Mohammed-Ali 1984: 65-66):

a) There was increasing evidence supported by radiocarbon dates that in Africa there was a stage of intensive plant exploitation (a necessary prerequisite, it was agreed, for food production) as early as, or even earlier than, equivalent intensive exploitation in South-West Asia.

b) Recent botanical work has confirmed that present-day African domesticated tropical cereals (Sorghum, Pennisetum, etc) were indigenous to Africa, and that their wild forms were unknown to South-West Asia.

c) There was sufficient evidence, supported by radiocarbon dates, that at least two of the so-called "Neolithic" innovations (pottery and ground stone tools) were known in the Sahara prior to their introduction into Northeast Africa.

d) Wild cattle (Bos primigenius) were found widespread in North Africa and the possibility of a local domestication could not, therefore, be ruled out.

Without detailed discussion of the evidence of these two schools, it is obvious that either domestic animals or plants were introduced to Sudan from outside or there was indigenous domestication in the Sudan.

In regard to the second argument, it has always been thought that the major domestic animals (i.e. sheep and goat) could not have been domesticated locally because no wild ancestors of these species are known to have existed in the area in pre-Neolithic times.

It is thought that these species were introduced to the Sudan from the north, namely from Egyptian Nile Valley and the Sahara, where they are known to have occurred at an earlier date than the Neolithic of the Sudan; then they are thought to have been only developed by the Sudanese food-gatherers (Krzyżaniak 1978: 169-170). This argument rejects part of

the evidence of the first school, which pointed out that in Africa no early settlements with evidence of food production have been discovered. The last argument could be modified by saying that if the domestic species were introduced from South-West Asia, they must occur firstly in the Nile before the rest of the continent.

Archaeological and botanical evidence

Of the three major domesticated ruminant species in Africa, only cattle had a wild ancestor present on the continent during the period of time when domesticated livestock first appeared in the archaeological record (Epstein 1971). A number of scholars have presented archaeological evidence that cattle were domesticated independently in northern Africa (Carter and Clark 1976; Gautier 1984a; 1987a; 1987b; Grigson 1991; Wendorf and Schild 1994).

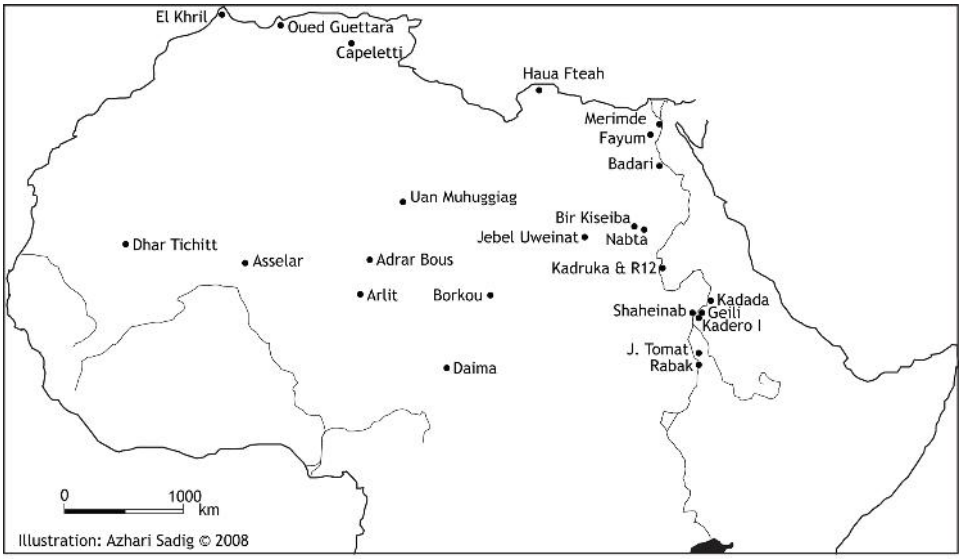
The oldest securely identified remains of domesticated cattle in Africa were discovered in North Africa in Capéletti in Algeria and these gave radiocarbon dates of 6,530±250 BP (Clutton-Brock 1989).

Another site, which revealed putative domesticates, was Adrar Bous in northern Niger and these remains were dated to 5,760±500 BP (Carter and Clark 1976). However, these later sites are within a timeframe which would allow them to be derived from domesticated stock originating in the Middle East (Map 2).

The northern region of Africa has undergone major climatic changes since the end of the Pleistocene epoch (Maley 1977; Street-Perrott and Perrott 1993). Three major wet phases have occurred in North African during the last 10,000 years, the first between 10,000 and 8,000 BP, the second during the period between 7,500 and 6,500 BP and the most recent between 6,000 and 5,500 BP.

The ecological conditions during these periods were very different from the arid environment present over most of northern Africa today. Lake Chad is the lone remnant of a series of permanent standing lakes which were scattered across the Sahara 9,000 years ago. Lake Chad was, at one time larger in area than the Caspian Sea and is referred to as MegaChad during the period 10,000-8,000 BP (Grove 1993).

The tsetse zone extended about 500 km further north than its present boundary, almost reaching the 18th parallel (Smith. 1992a). Most of the present-day desert was grassland and the mammalin fauna was similar



Map 2. Location of principal sites with rock art and/or evidence for early cultivation or herding.

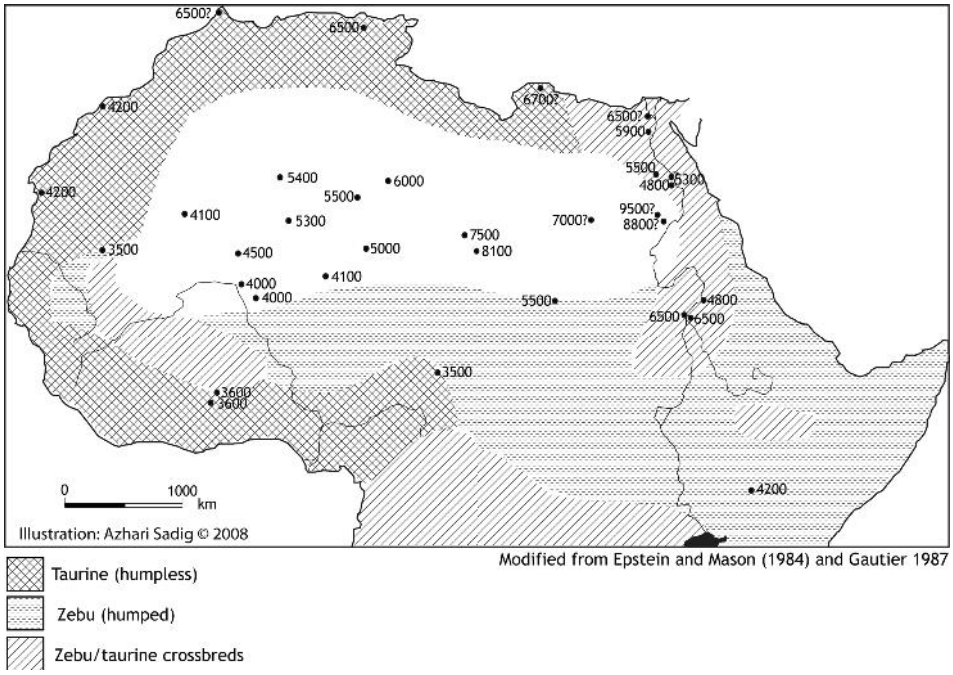
to the present fauna in East Africa. Elephants, giraffes, hippos, rhinoceros and wildebeest were only some of the large mammals which existed in the region at this time. Human populations were taking advantages of these resources and rock engravings, paintings and cultural debris are found in areas with less than 20 mm of rainfall today.

Smith (1992b) has argued that the ecological change between wet phases, particularly after the first Holocene wet phase may have been the environmental stress responsible for the domestication of cattle.

Human populations living in increasingly arid regions may have started to interact with cattle in such a way as to bring them partly under their control and this may have eventually led to full-scale domestication. A primary motive for such an event would have been to ensure the availability of adequate supplies of animal fat, a vital commodity for humans living in desert conditions, and cattle provide relatively large amounts of this substance (Speth and Speilmann 1983).

Cattle

Cattle were the earliest domesticates in Africa (Map 3). Starting in the 1980s, Wendorf, Gautier, and their associates argued for the presence of



Map 3. Approximate distributions of the various types of domesticated cattle found in north of equator Africa and the earliest dated of their occurrence.

domestic cattle in the tenth millennium BP in sites from the Bir Kiseiba area of the Egyptian Western Desert (Close 1990; Gautier 1984b; Wendorf and Schild 1998; Wendorf et al. 1987). These dates would make African cattle domestication an independent and older event than in Southwest Asia. Gautier and van Neer (1982) further proposed that large bovid bone fragments from the Ti-n-Torha East Cave in Libya (8490–7920 BP) could also be of domestic cattle. Recent studies suggest that they were probably domesticated from North African populations of wild *Bos primigenius* by hunter-gatherers of the eastern Sahara 10,000–8000 BP. Their origins are still controversial, and the evidence is sparse and not highly diagnostic, but Gautier (1980; 1987a; 1987b; 2001) and Wendorf (Close and Wendorf 1992; Wendorf et al. 1984; 2001; Wendorf and Schild 1980) argue for domestic cattle in the eastern Sahara at Bir Kiseiba c. 9500 BP, and Nabta Playa c. 8840 BP. These dates would make African cattle domestication an independent and older event than in Southwest Asia. Cave paintings dating to 6,754 BP have been found at Tassili n'Ajjer in southwest Alge-

Site name	Country	^{14}C yrs. BP	Dom. Cattle	Dome. Caprines	Sources
Merimda-Benisalama	Egypt	5830±60 5440+75	x	x	Driesch and Boessneck. 1985
Fayum A	Egypt	5860+115	x	x	Wendorf and Schild. 1976
Nabta/E-75-8	Egypt	7120±150 6240±70	??	-	Wendorf and Schild. 1980
Kharga/E-76-7, E-76-8	Egypt	7890±65 5450±80	??	-	Wendorf and Schild. 1980
Bir Kiseiba	Egypt	9000±100 8150±70 8740+95 8740170	??		Close, ed. 1984
Gilf el Kebir	Egypt	6980±80	x	-	Gautier. 1980
Shaqadud	Sudan	7500 3500	x	x	Peters. 1992
el Kadada	Sudan	4790±110 4630±80 4830±50 4730180 4840±70 5170±110	x	x	Gautier. 1986
Es-Sour	Sudan	5296±48 5330±54 5180148	x	x	Sadig 2005a, Sadig 2008b
Khashm el Girba	Sudan	5000 2000	x	x	Peters. 1992
Kadero I	Sudan	5630±70	x	x	Gautier. 1984a
El Zakiab	Sudan	5350±90 5660±80	x	x	Tigani el-Mahi. 1988
Um Direiwa	Sudan	4950±850 5600±110 6010190	x	x	Tigani el Mahi. 1988
El Nofalab	Sudan	52901100 5520±130	x	x	Tigani el-Mahi. 1988
Laqiya	Sudan	3500 4000	x	x	Van Neer and Uerpmann. 1989
Wadi Howar	Sudan	5200 5000 3000	x	x	Van Neer and Uerpmann. 1989

Table 1. Dates for early cattle and caprines in the Nile Valley and adjacent areas.

Site	*Bos Primigenius f. taurus*	Source
Shaheinab	00%	Arkell. 1953
Zakiab	33.46% / 75.77% per class	Tigani el-Mahi. 1982
Umm Direiwa 1	33.54% / 43.98% per class	Tigani el-Mahi. 1982
Shaheinab	6.96% / 50.00% per class	Tigani el Mahi. 1982
Nofalab	11.43% / 33.33% per class	Tigani el-Mahi. 1982
Kadero I	74.45%	Krzyżaniak. 1978

(F: frequent—more than 100)

Table 2. Cattle percentages from Central Sudan sites.

ria which depicts pastoralists and herds of humpless cattle (Smith 1992b). Cattle are present to the west at Enneri Bardagu´e in the Tibesti by c. 7400 BP and in the Acacus by c. 7400–6700 BP (Garcea 1995; Gautier 1987a).

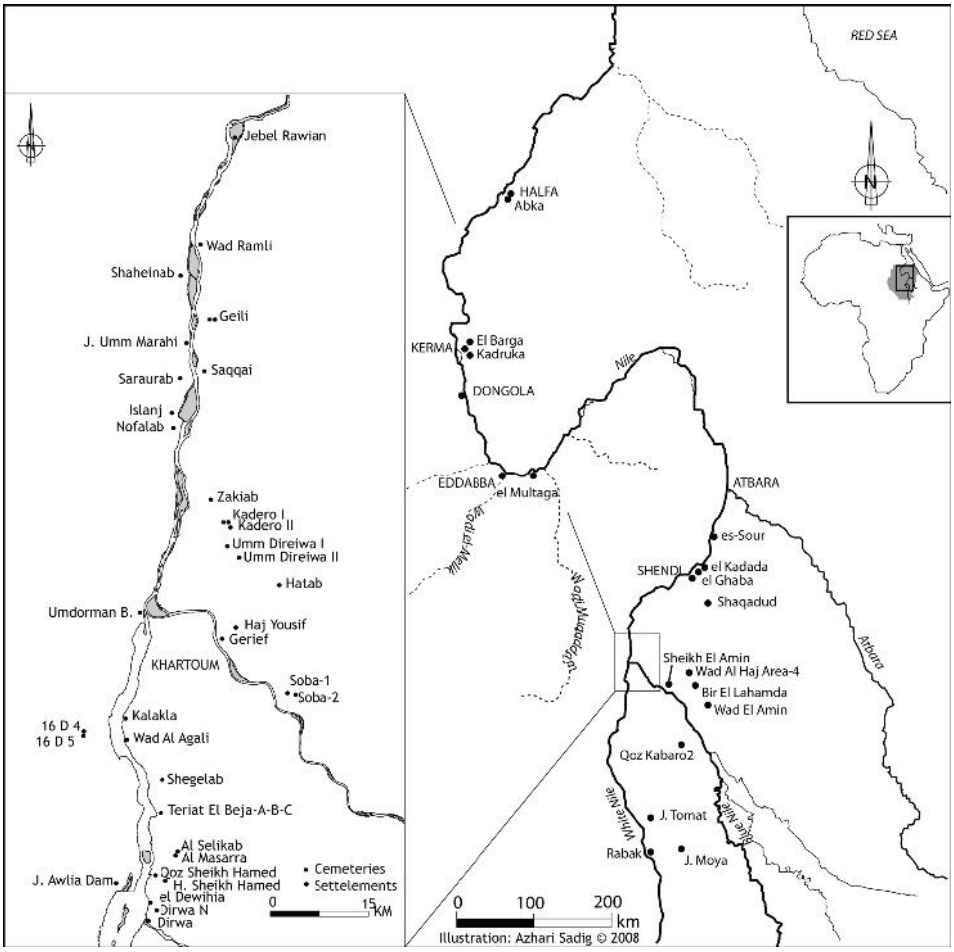
The wet climatic phase between 10,000 and 8,000 BP may have incorporated local cattle domestication and sites in Nabta Playa and Bir Kiseiba in the eastern Sahara have yielded putative Bos bones dated as far back as the 10th millennium BP (Gautier 1984a; 1987a, 1987b). Gautier

and his collaborators have argued that these cattle were domesticated because the ecology and climate of this area during this period would not have been capable of sustaining wild cattle populations. Evidence was also uncovered of shallow watering holes of about 1.7 meters in depth which could have been used to provide water for domestic stock (Wendorf and Schild 1994). A reinterpretation of the ecological and anthropological evidence led Smith (1992a) to argue against this interpretation and until more evidence is forthcoming from these sites, the question remains in the balance. Until unambiguous evidence of the domestication process such as faunal shifts or clear size diminution is discovered, it is unlikely that archaeology can resolve the issue whether cattle were domesticated independently in Africa.

Genetic analysis probably represents the most promising avenue of research to substantiate claims for an African domestication. These could be improved dramatically if breeds of cattle were examined from the areas known to have given rise to domesticated cattle in the Middle East. These populations could then be compared to both African and European.

New DNA evidence has shown that African cattle have been separate from those of Southwest Asia for at least 25,000 years. Scientists at the Africa-based International Livestock Research Institute, confirmed through DNA analyses that indigenous African cattle were domesticated from local strains of wild ox long before the introduction of cattle from Asia and the Near East (Hanotte 2002). Domestication, they believe, took place along the border area between modern-day Egypt and Sudan. The new research shows that cattle are an integral part of the African landscape, possessing longstanding adaptation to African savannas. Many wildlife conservationists believe that cattle are an alien species, but the new research provides evidence of their local origins. This strong evidence has confirmed that there was a separate center of cattle domestication in Africa.

The results presented in former pages indicate that the domesticated animals in Sudanese Neolithic sites (Map 4) were introduced from outside. There is no evidence, until now, which could support the process of a local domestication in the Sudan. Krzyżaniak summarized this by saying "we should, however, continue the research for such information, in particular for information concerning the domestication of the wild cattle (aurochs)" (Krzyżaniak 1992: 267-273). As regards the wild cattle, it is thought that this animal lived and was hunted on the middle Atbara River in the cool

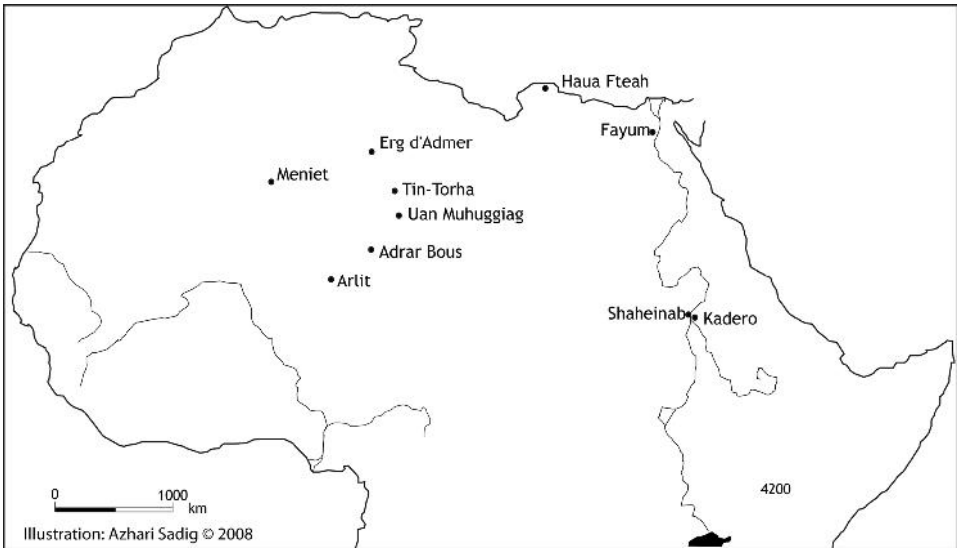


Map 4. Neolithic sites in the Middle Nile Region.

and arid times of the Terminal Paleolithic, around 10,230 ± 270 BP (Marks 1987:88). Wild cattle remains were also recovered from the lowest level of Site 440, a Middle Paleolithic settlement estimated to date c. 80,000 years old on geological grounds as described by Shiner (Shiner 1968; El Amin 1981). Also wild cattle were recovered from almost every site assigned to the Khormusan Industry, a late Middle Paleolithic complex dated at between 65,000 and 50,000 years old (Marks 1968). In spite of the importance of this evidence, the question is how to determine if the Sudanese hunter-gatherers tried to domesticate that animal.

Sheep and goat

Unlike cattle, the wild ancestors of sheep and goats are believed to be indigenous to the mountains of South-West Asia. These undoubtedly were introduced to the Sudan from outside. The earliest evidence of domestic sheep and goat in Africa appears after 7700 BP (Map 5). Their bones have been found at the Haua Fteah in Cyrenaica c. 6800 BP and the Fayum c. 6400 BP. All this coincided with the opening up of a grassland niche in the Sahara which was increasingly occupied by pastoral people - e.g Tin-Torha (Libya) from 7400 and 5300 BP, Uan Muhuggiag (Acacus Mountains, Libya) c. 6000 BP, Adrar Bous (Ténéré Desert, Niger) c. 5800 BP, Meniet (Hoggar Mountains, Algeria) c. 5400 BP, Erg d'Admer (Algeria) c. 5400 BP, and Arlit (Niger) c. 5200 BP (Smith 1992a). They almost certainly come from western Asia (Gautier 1984a), because there are no wild ancestors for sheep and goat in Africa. Close (2002) argues that sheep and goat came to Africa via the southern Sinai before Near Eastern crop complex, which is thought (Wetterstrom 1993) to have entered the continent through the Nile Valley. These same animals, as well as cattle, are found in many Neolithic sites in Sudan with dates going back to about 6000 BP (Tigani el-Mahi 1982).



Map 5. Earliest dated occurrences of domestic sheep and goat in Africa north of equator.

Faunal percentages	*Ovis ammon f. aries*/ *Capra* (sheep) / *Aegagrus f. hircus* (goat)	Source
Zakiab	2.90% / 16.30% per class	Tigani el-Mahi. 1982
Umm Direiwa I	7.28% / 9.54% per class	Tigani el Mahi. 1982
Shaheinab	0.22% / 1.56% per class	Tigani el-Mahi. 1982
Nofalab	10.48 % / 30.56% per class	Tigani el-Mahi. 1982
Kadero I	22.10%	Krzyżaniak. 1978

(F: frequent=more than 100)

Table 3. Sheep and goat percentages from Central Sudan sites.

The beginning of pastoralism

Pastoralism is a mode of subsistence consisting of the rearing of livestock (usually cattle, sheep or goats) and a process of constant movement between two or more different areas of pasture. In some cases, pastoralism is adopted as only one part of an agriculturally-based, semi-sedentary culture, while in other more extreme cases a wholly nomadic lifestyle is adopted (Shaw and Jameson 1999: 459). With the evidence available, it is most likely to say that the Neolithic people of Central Sudan were Pastoralists. Their subsistence consists mainly of herding cattle and there are many evidences that they move to different areas for pasture. However, this term is so confusing. This confusion may arise from imprecise application of the term "pastoralist" to any person or community possessing domestic animals, irrespective of the importance which these animals may have had in the overall life-style of the people concerned (Phillipson 2005). In his book (African Archaeology), Phillipson (2005) used the term "herder" to designate someone who owns or controls domestic livestock. However, the term pastoralism pertains more to the Neolithic herders of Central Sudan and Upper Nubia. It includes animal husbandry: the care, tending and use of animals such as goats, cattle, sheep, and so forth (see: Lees and Bates 1974). It may have a mobile aspect, moving the herds in search of fresh pasture and water. Social organization and all other aspects of pastoralism are evident in both areas.

One of the important problems concerning the domestication of animals is the kind of human action by which these domesticates were introduced to the Sudan Nile Valley. More traditionally oriented theories hold the opinion that the occurrence of the Neolithic domestic animals in the Sudan was the result of the influx of the pastoral populations from the Middle Holocene Sahara. These pastoralists are thought to have trekked

with their herds southwards, along the Nile, bringing with them the pastoral technology (Hassan 1986: 98-99, Clark 1980: 568; 577). Wendorf argued that the first domestication or human control of cattle occurred in the Nile Valley, possibly in the area between Tushka in Egypt and Dongola in Sudan, and between 12,000 and 10,000 radio carbon years ago (Wendorf Pers. Comm. 2003).

The only evidence to support this is at Tushka where they were using cattle skulls (wild) as head markers on burials, between 14,500 and 12,500 years ago. He further argued that from there the cattle herders moved into the desert when the summer rains intensified around 10,000 years ago, and they probably came because the wild grasses that grew after these rains were good for pasture.

The view that the fauna from the Neolithic site of Shaheinab near Khartoum (fifth to fourth millennium BC) had 98% wild animals (Bate 1953) has been challenged by Peters (1986) who has restudied the surviving material and concluded that the large bovids which comprise a large proportion of the assemblage were probably domestic cattle. A similar situation was found by Gautier (1984b) at Kadero I nearby, dated to about 4200 BC.

With reference to some evidences proving that the first domesticated animals appeared at the Sudanese section of the Nile River at c. 6000 BP (c. 4900 BC), Krzyżaniak suggested that it is difficult to connect this with the climatic deterioration in the Sahara, because there were other evidences indicating that the climatic deterioration was before 5750 BP (Krzyżaniak 1992: 267-273). As an alternative, he suggested "the acquisition of domestic animals by the Sudanese food-gatherers resulted from a functioning long-distance exchange network" (Krzyżaniak 1992: 269). Such networks, if there were any, could have existed in the Nile already before the Neolithic times. Caneva agreed with Krzyżaniak that there were earlier contacts between the Nile and the Sahara since the Mesolithic period which could have allowed the diffusion of domestic animals and the pastoral economy in the Sudanese regions (Caneva 1993: 89). Elsewhere, Caneva and Marks stressed on what they called "the Saharan cultural elements" which occurred outside the Nile in some sites like Shaqadud (Caneva and Marks 1992). Such elements include mainly some techniques of decoration at Shaqadud as well as some technological aspects, which did not occur in the Neolithic sites along the Nile Valley. This argument involved also that

common cultural features were shared by people inhabiting the regions between the Nile and the Ennedi/Tibesti mountains, as well as to the east of the Nile Valley, since the seventh millennium BC (Caneva and Marks 1992: 23-24). The problem is that these elements did not occur in the Neolithic sites along the Nile Valley before Shaqadud. In fact these contacts should have reached the Nile first before they reached Shaqadud, bearing in mind that Shaqadud's dates are not earlier than those of the Nile sites (Mohammed-Ali. Pers. Comm., see also El Amin and Khabir 1987).

It is obvious from the above hypotheses, which agreed that the livestock were introduced from outside, that there are two arguments concerning the origin of the domestic animals in the Sudan. The first suggests that the first domestic animals were introduced from the north, i.e. from Egypt, while the second suggests that earlier contacts preceding the Neolithic period between the Nile and the Sahara resulted in the expansion of the pastoral economy in the Nile.

Chronology and relations between Sudanese and Saharan areas (Paris 2000; Smith 1992a) suggest that domestic stock were introduced from the Sahara as it became drier (Haaland 1992; Hassan 1997). Cattle, sheep, and goats appear by the sixth millennium BP (Gautier 1984b; 1984c). Local assemblages of lithics and ceramics show continuity (Caneva 1987, 1988; Haaland 1995; Marks and Mohammed-Ali 1991), indicating that any movement of Saharans into the region was small-scale, and culture contact was more important than migration to socioeconomic change.

Entry of Saharans may have been eased by prior social links with the Sudan, indicated by trade and common ceramic styles. Compared to the original Saharan herding environments, the Sudanese Nile offered more dependable, productive resources. This area also posed no particular problems for cattle, as it lies within their wild range. Like earlier local hunter-gatherers, pastoralists used large, semi-permanent camps near the Nile, as at Shaheinab and Geili (Caneva 1988; Haaland 1995; Krzyżaniak 1991). Domestic animals are the dominant large mammals at many sites, such as Kadero I c. 5000–4000 BP, but were added to a wide range of wild animals used by earlier hunter-gatherers (Gautier 1984c; Haaland 1992). Unlike Saharan pastoralists, herders in this better-watered landscape are thought to have used plants more intensively than their hunter-gatherer predecessors.

Site structure and increased use of grindstones at Kadero 1, Um Di-

reiwa and Zakiab indicate to Haaland (1992) that, as early as 5000 BP, pastoral groups were cultivating sorghum that was morphologically wild (Stemler 1990).

Social differentiation appeared among Sudanese herders by the sixth millennium BP. Clusters of especially rich graves of men, women, and children at Kadero I argue for differences in wealth (Krzyżaniak 1991), but there is no evidence for social stratification. Pastoral intensification and a decrease in wild animal use are also evident at some sites in the Middle Nile after 5300 BP. Despite these developments, the spread of herding was patchy: at Shaqadud, east of the Nile, subsistence focused on wild resources as late as 4000 BP (Marks and Mohammed-Ali 1991; Peters 1991).

The evidences of animal husbandry in Nubia provide a rather varied picture. It is difficult to reconstruct the economic aspects of the Khartoum Variant groups, given the rarity of faunal remains. No animal domestication is evidenced, and the remains are primarily of fish and fresh-water mollusks, particularly *Aetheria elliptica*, indicating that these people were still very much directly dependent on riverine resources. The frequent occurrence of grinding stones and ostrich eggs at these sites serves to indicate both the exploitation of local wild plants and the hunting of the ostrich.

Evidence of hunting is very clear in the material of Abkan sites in Lower Nubia. Although the economic subsistence is not represented in the archaeological remains of Abkan sites, one of the largest and best known finds of Nubian prehistoric art was at Abka, closely associated with occupation remains at the Qadan and Abkan industries of the Final Stone Age and the Neolithic. Curiously, in view of the presumed subsistence activity of the people who lived at Abka, there are no representations of fish, although one semi-abstract design might be a fish trap (Myers 1958: Pl. xxxiv). Although Perkins (1965) considered that the fauna from the Abkan site ASG-G-25 at Wadi Halfa was wild, his "large bovids" may very well also have been domestic cattle (Grigson 1991: 133). The collection from this site contains catfish, Nile perch, ostrich eggshell, Egyptian goose (*Alopochen aegyptiacus*), hare, gazelle, large bovid and wild ass. Domestic goat (Capra hircus) seems to be represented by a single distal epiphysis found in the upper layer of the site and may be Terminal Abkan or intrusive (Grigson 1991: 222).

Another Abkan faunal assemblage was described briefly by Carlson (1966: 53-62) and includes fish, hare, gazelle and remains of a large bovid which could have been domestic cattle at least for part of them (fig. 2).

Fig. 2. Graffiti of domesticated cattle with male and female human figures from the Faras site in Sudan. These drawings were found on pottery dated to the 5th millennium BP (Reproduced from Grigson 1991).

Hence our scanty knowledge does not permit an unquestionable affirmation that the Abkans already were practicing animal husbandry though it seems that they may have combined gathering and hunting with pastoral activities.

The faunal remains recovered from the graves at site R12 near Kerma indicate that domestic livestock was most important, but collecting and hunting were not minor activities as shown by the large amount of hippopotamus teeth, gazelle bones and bivalves (Pöllath 2008: 77). The graves contained a wide variety of faunal remains including different animal products, eggshell, mollusk shells, bones and teeth, worked into ornaments, and other tools. Cattle were certainly most important as is demonstrated by the large amount of tools made from cattle bones and by the burcania that were a sign of wealth, power and influence. The lambs buried with the deceased indicate that sheep also played a vital role in burial customs.

Botanical remains and evidence of cultivation

Before food production, Mesolithic people of Central Sudan made intensive use of wild plants. Early Khartoum people c. 9000-6000BP lived in large settlements, fished, hunted, and used *Celtis integrifolia, Echinocloa colona, Panicum tugidum, Salix sunbserrata, Setaria* sp., *Sorghum* sp., and *Ziziphus* sp. Plant impressions in pottery suggest that wild cereals were key dietary elements (Arkell 1949; Haaland 1987a). The exploitation of the domesticated plants during the subsequent Neolithic period remains hypothetical. Plant remains were limited to the imprints of grains found on potsherds excavated from several Neolithic sites along the Nile. Most of these imprints have been identified as wild sorghum (*Sorghum verticiliflo-*

rum), while very few as the wild ancestors of millet (*Pennisetum vidacum*) (Magid: 1989).

Morphological data: In Sudan the area between 15 and 20º North latitude roughly corresponds to Harlan's bicolor zone where the first domestication of sorghum is believed to have occurred (Harlan 1971: 128-135). This area included the Qoz of Kordofan, the area around Khartoum and Atbara. In addition, the Jebel Marra region in western Sudan is another likely area which may yield direct evidence of domestication of millet. The last point is based on the fact that this region is one of the most conspicuous areas of interaction among wild, weedy and cultivated races of pearl millet (Harlan 1971: 471). The origins of crop sorghums, in the form of the primitive race bicolor, have generally been assigned to the sub-Saharan thorn savanna belt, from Nigeria to the Sudan, from *arundinaceum* (Harlan 1971: 471), although an Ethiopian origin has also been suggested (Doggett and Prasada 1995: 173).

Macrobotanical remains and plant impressions in pottery suggest that Shaheinab people used *Acacia sp., Celtis integrifolia, Elaeis guineensis, Hyphenaena thebacia, Ziziphus* sp., possible wild or domestic *Citrullus* sp., other Cucurbitaceae, and *Nymphaea*; grasses include *panicoids*, *Setaria* sp., *Sorghum verticilliflorum*, and wild S. *bicolor* ssp. *arundinaceum*. Morphological data indicate that sorghum was wild (Arkell 1953, Haaland 1987a).

Another site providing evidence of domestic plants is the Shaqadud site. On the basis of the botanical evidence from Shaqadud Cave, it appears that two distinct but complementary strategies of plant exploitation were used (Magid 1991: 196). The evidence for fruits of *Zizyphus* (Nabag) and *Grewia* indicates seasonal collection of these wild plants. The second strategy is apparent in the presence of domestic *Pennisetum*. The proportionately small numbers of *Pennisetum* remains might indicate that it played a relatively small role in the overall diet (Magid 1991: 196).

Large quantities of carbonized *Sorghum bicolor* (L.) Moench grains, spikelets and inflorescence fragments sorted from about 2 foot^3 of charred material have been found in a storage pit at Jebel et Tomat (13° 36'N, 32° 34'E), and small amounts of carbonized sorghum found in eleven levels of the midden excavated there, suggest that sorghum was the staple grain of people who inhabited the site. The date of 245 ± 60 AD (UCLA 1874M) was obtained from a concentration of carbonized plant remains in the floor of the pit, which was dug into the dark clay loam on which the midden rests probably at about the same time as the accumulation of the middle

or beginning of the upper unit of the midden. The remains of wickerwork matting and many fragments of thick stalks of cereal grass suggest that the pit may have been a silo lined with stalks and mats (Clark and Stemler 1975: 588-91). If so, it is not dissimilar to the pits made today in the area for storing grain.

Archaeological evidence: Sorghum certainly has a history of early dates within Africa that have been discounted following more detailed examination. Cultivated sorghum presents one of the more perplexing problems in African agrarian history. It is found in archaeological sites in Korea and India millennia before confirmed archaeological finds in Africa (Blench 2003: 276). The evidence for the sorghum in Asian sites clearly has implications for the antiquity of its cultivation and domestication in Africa. Dorian Fuller's recent re-analysis of claims for domesticated cereals in India, confirmed the presence of pearly millet, sorghum and two legumes (cowpeas and hyacinth beans) by the mid-second millennium BC (Fuller 2006). Finger millet is present from around 1000 BC. This is one such case where focusing solely on morphological domestication is too limiting a strategy for understanding the origins of domesticated sorghum. It is now well established that sorghum at least will not undergo the morphological changes that identify it as domesticated if harvested by stripping the grain from the stalks or beating it into baskets. Sorghum impressions (all morphologically wild in status) are plentiful on early Holocene potsherds in Nubia; grindstones are numerous and settlements occur in alluvial settings with heavy clay soils, contexts well suited for growing sorghum, whether for food or beer. Wasylikowa and Dahlberg (1999: 11-32) show that the carbonized sorghum grains found at Nabta Playa in southern Egypt from c. 8000 BP are exclusively wild.

Material from Neolithic sites of Kadero I, Zakiab and Um Direiwa shows that the inhabitants were probably cultivating wild sorghum. The discoveries at these sites include several imprints of sorghum in potsherds and an extremely large number of grindstones (Haaland 1981a: 196-197). The dates obtained from the site of Zakiab range between 5350 ± 90 BP to 5660 ± 80 BP. Three radiocarbon dates were also obtained from the site of Kadero I; the oldest of these is 5700 ± 100 BP and the youngest is 5030 ± 70 BP, as well as four radiocarbon dates from the site of Um Direiwa I; the oldest of these is 5600 ± 110 BP and the youngest is 4950 ± 80 BP (Haaland 1981a: 55).

Plate 2. Fragments of some of the broken grinders recovered from the Um Direwa site during excavation. Source: Haaland 1995.

These dates provide the earliest evidence of exploited wild sorghum in Sudan. In addition to these, one impression of *sorghum verticilliflorum* on a potsherd was also recovered from the Neolithic site of Shaheinab (Magid 1982: 97-98). Several dates were obtained from this site (Arkell 1953, Haaland 1981a, 1981b, 1987a); all these are more or less contemporary to those obtained from the sites of Zakiab, Kadero I, and Um Direiwa I. Stemler (1990), who identified the plant remains from these sites, pointed out that the sorghum imprints are not morphologically different from those of wild grain, the only exception being one impression from Um Direiwa that bears some resemblance to domestic sorghum (Stemler 1990: 87-98). Stemler's main argument is that "the type of sorghum looks like wild sorghum", but "there is a possibility that it was a primitive domesticate very similar to the wild" (Stemler 1990: 96).

As regards to the other evidence of cultivation, the many numbers of grindstones on the Neolithic sites could not be used as a direct evidence of cultivation, although their frequency may point to a greater reliance

on plant food (Plate 2). On the other hand, there is a clear decrease of the other indirect evidence such as the tools that may have been used as sickles. The only tools that were discovered and that may have been used as sickles are lunates and backed tools (Wendorf 1968: 943).

In the case of the Neolithic sites in the environ of Khartoum, Haaland suggested that these microlithic tools were not used as sickles because of their very low frequency (Haaland 1987a: 76). In another place she used some evidences to argue that the early Neolithic populations have cultivated sorghum (Haaland 1981a: 213-215). This hypothesis is based on various arguments:

1. The large dimensions of the early Neolithic base settlements could have accommodated large populations,

2. High frequencies of grindstones used for the processing of grain occur in these settlements,

3. The use of lithic gouges which are thought to have been used as blades of hoes in tilling the soil.

She also used a botanical argument when she states that the simple sweeping off the ground of the grains of sorghum - cultivated or not - cannot lead to domestication unless a harvesting tool (knife, sickle) is used (Stemler 1980: 514-516, 521). In his discussion of this hypothesis, Krzyżaniak stated that: "It is however, difficult to accept this hypothesis on the basis of the archaeological ground mentioned above before testing its arguments. Firstly, we still know very little about the actual dimensions of the early Neolithic settlements at any one time when they were functioning. Second, observation made at Shaheinab and Kadero I point to a possibility that a considerable part - perhaps the majority - of grindstones found at the sites were used to perform some function other than crushing or milling grain. Thirdly, as regards the function of the gouges, their use can only be hoped to be determined by use-wear analysis; traditionally they are thought to have been used in wood-working" (Krzyżaniak 1992: 269-270). Unfortunately, our present understanding of the early development of seed-crop agriculture in the Sudan depends largely on such indirect evidence. The artifacts, which have been usually used for inferring early food production, are such items as grinding stones, sickles, pottery and ground stone axes (Frankenberger 1979:21). However, it is important to reiterate that a certain degree of caution should be exercised when such material is being considered as diagnostic signs of food production in the Sudanese Nile Valley. Such artifacts have been found in non-agricultural

contexts as well. Taking this into account, the finding of such pieces of evidence is of some value in filling many of the gaps left by exiguous records of direct evidence.

Indirect evidence: Some of the earliest finds of the indirect archaeological evidence for plant domestication in the Sudan has been found in the Early Khartoum sites. The radiocarbon dates for these sites demonstrate that pottery manufacture was much earlier in this region than in the Egyptian Nile Valley (Plate 3). The un-burnished wavy line decoration characteristic of the Early Khartoum sites has also been found in sites in Ennedi in Chad as well as at Amekni in the Hoggar region of Algeria (Arkell 1972: 222). These Sahara sites register dates between 5230 and 6100 BC (Arkell 1972: 222). Clark postulates that the wide distribution of this pottery gives a strong indication that an exchange of knowledge as well as trade goods was occurring all across North Africa, and that "a knowledge of plant cultivation as well as domestication of animals could equally have been diffused to the limits of the Savanna at this time" (Clark 1970: 201).

Magid (1989: 123-129), summarized the association of pottery with the exploitation of food-plants in the following points:

1. The introduction of pottery probably demarcated the beginning of a new adaptation in which already known, potential food-plants were now exploited, for instance the beginning of utilizing seeds and grains of cereals. Pottery might have provided the basic requirement for cooking these seeds and grains before serving them as food.

2. Pottery containers would also provide means of storage for the durable food-plants, e.g. seeds, berries, fruits and nuts to be used during periods of need or when they were not available in nature.

Another area of the Sudan, which provides indirect evidence of domestication of plants, comprises the Butana and the Atabai plains east of the Nile Valley in the Eastern Sudan (Mohammed-Ali 1985: 26). Neolithic sites have been located in this area as well as the latter, contemporary with the last half of what has been designated the Kassala phase, wherein occurred a group of over fifty sites termed "Jebel Mokram". This phase has been generally dated to around 2nd millennium BC and is characterized by seasonal occupations of nomadic groups who moved into the Butana and the Atbai (Mohammed-Ali 1985: 26, Fattovich et al. 1984: 182). In addition to domestic cattle, some of the potsherds recovered from these sites contain amounts of macrobotanical materials. Some of these were identified as domestic sorghum (Fattovich et al. 1984: 182).

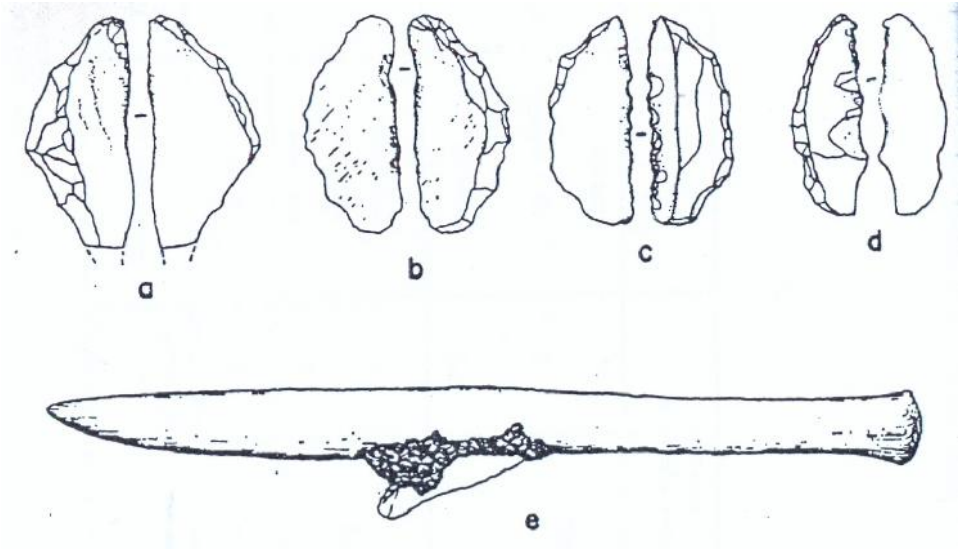


Fig. 3. Suggested method of hafting of lunate-sickle from Toshka (Source: Wendorf and Schild. 1976. 277).

Another indirect evidence of food production is the use of lithic tools associated with plant activities. These contain luntaes, sickle-blades, grinders, rubbers and stone. It has been suggested that hafted lunates dated to c. 12000 BP were used as sickles (Wendorf 1968: 943, Wendorf and Schild 1976: 276-277) (fig. 3), and according to Honegger (2008: 172) there are two main groups of lunates; the large lunates which "must have been sickle or plant knife elements" and "the smaller ones "which are identified as arrowheads" (figs. 4a and 4b).

According to Magid (1989: 135) the interpretation suggested by Wendorf as to how the lunates were hafted and what function they performed is not applicable in the case of the lunates which were recovered from Central Sudan for the following reasons:

1. Scientific examination of the lunates under microscope did not show any visible traces of sickle-gloss on them that would indicate that they were probably used as tools to cut food-plants.

2. The tools are too small to have been used as sickles if they had been hafted.

3. It is evident that there was a noticeable decrease both in the number and size of lunates from the period of Early Khartoum to those of the

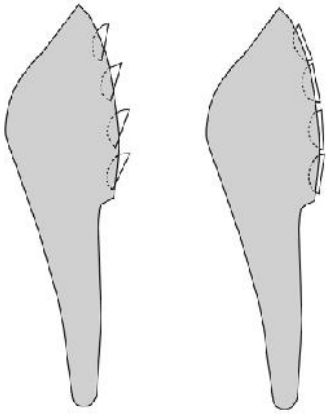
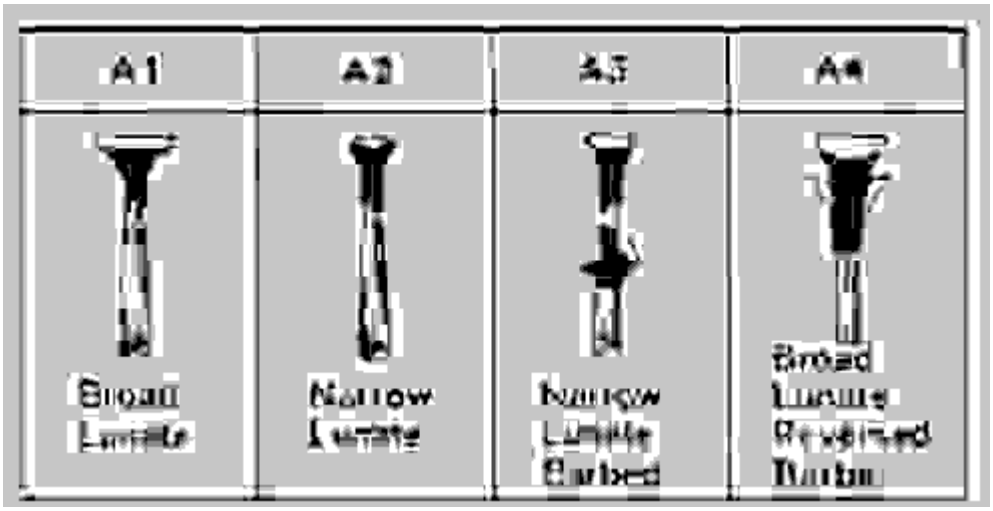


Fig. 4a (left). Proposition of reconstitution of sickles with two different insertion methods for the microliths, in accordance with the observations made at Kadruka (Source: Reinold 1994) and at Kerma.

Fig. 4b (below). Outline representing lunates hafted as arrowheads or barbs, the way they were found at Naga Ed-Der, 2320-1760 BC (Source: Clark et al. 1974, fig. 9, p. 362).



Shaheinab. Thus if lunates were used for the exploitation of food-plants, they would have also increased in number over time.

Other artifacts played an important role in the food production process. For example, the extremely numerous grinders found in the Neolithic sites indicate an increased importance of vegetal foods such as sorghum and perhaps the beginning of their cultivation (Haaland 1981a: 215, Magid. 1989: 149). Evidence of grinders was recovered from late sites such as Jebel Tomat. The earliest evidence of domesticated cereals, namely *Sorghum bicolor* (L.) Moench from the Central Sudan, was found at this site. It is most likely that grinders were used during this late period more than at

Plate 3. Rimsherd from a large vessel, probably used for storage, from Aneibis, Atbara Region. Source: Haaland 1995.

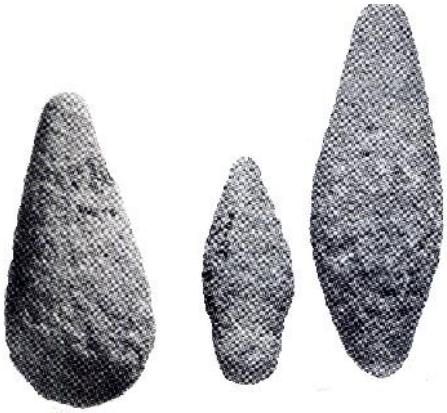


Plate 4. Sandstone Rubbers from Shaheinab site (Source: Arkell 1953).

any time before for grinding food-plants (Magid 1989: 149).

According to Magid (1989: 177), the only tool which might be directly related to cultivation activities is the sandstone rubbers which are believed to have been used for shaping and polishing wooden and bone artifacts (Plate 4). As stated previously, at present there is to my knowledge no direct archaeological evidence for plant domestication in the Sudan during the Neolithic period. This seems quite strange considering the fact that this area was probably one of the places where the first attempts at domestication took place in Africa (Vavilov 1951, Harlan 1971).

Other subsistence economies

The archaeological materials from the Neolithic sites in the Middle Nile show that fishing, shellfish collecting, hunting and plant gathering were important subsistence activities.

Fish remains represent a major aquatic resource exploited by the Neolithic people. Six Nile fish genera, all represented in today's Nile, were identified by Tigani el-Mahi at Zakiab, Um Dereiwa, Shaheinab and Nofalab (1982: 59-78). Among these six genera, four are presented at all the sites, namely *Tilapia, Lates, Synodontis* and *Clarias*.

The remains of bone harpoons, spears and fish hooks suggest one method by which fish were caught. Tigani el-Mahi (1982) has argued that other methods were used for fishing. These included traps, baskets and poison. Unfortunately, we do not find any direct evidence for the use of the last three methods. In his study of fish remains in Mesolithic sites in the Atbara region, Peters (1991) suggests that nets were used, although no remains of these have been found. Some disk-shaped pottery artifacts that are frequently recovered on all Mesolithic sites in that region might have been net sinkers (Haaland 1995: 159).

The importance of the aquatic resources was further indicated by the very numerous shell remains found. At Shaheinab fifteen species of shellfish were identified (Arkell 1953: 11). These include *Ampullaria wernei, Lanistes carinatus, Melanoides tuberculata, viviparus unicolor, Cleopatra bulimoides*, seven species of bivalves and three species of land-snails.

At Shaheinab, 32 mammalian species have been identified and of these, buffalo, giraffe and hippopotamus were the most plentifully represented among the wild animals (Bate 1953: 11). The swamp-loving animals (reed rat, water mongoose and Nile Lechwe) were absent. Antelope had noticeably decreased. Mammalian remains are also abundant on the other Meolithic sites in the Middle Nile and show that a wide range of animals was hunted. The hunting is also practiced in Butana sites. The faunal materials from Shaqadud certainly attest to hunting. Most of the animals hunted during the Neolithic were still being hunted, although the larger antelopes are not found and hare makes an appearance. Small antelopes were hunted, as were giraffes; a large part of one was found in the middle cave deposits (Marks et al. 1985: 275).

Macrobotanical remains suggest that the only remains found were seeds of hackberry tree (*Celtis integrifolia*). This type of seed was found

on many Neolithic sites in Central Sudan. The inner seeds were left, and probably the outer parts of the berries were eaten (Haaland 1987a: 181). Neolithic people also used *Acacia* sp., *Elaeis guineensis, Hyphenaena thebacia, Ziziphus* sp., possible wild or domestic *Citrullus sp*., other *Cucurbitaceae*, and *Nymphaea*; grasses include *panicoids, Setaria sp., Sorghum verticilliflorum*, and wild *S. bicolor ssp. arundinaceum*.

Faunal remains from the Neolithic sites in Lower Nubia include those of wild animals and fish. Although no direct evidence of food production has been obtained from the two cultures, the dominance of small sites in Khartoum Variant, both along the river and as far as at least 20 km west of the Nile, has been interpreted as evidence of a pastoral economy. Evidence of hunting is very clear in the material of Abkan and Khartoum Variant sites. Although the economic subsistence is not represented in the archaeological remains of Abkan sites, it seems that the Abkan people were essentially exploiting the river valley, judging from the remains of mollusks and fish (*lates niloticus, Clarias)*. Land-based creatures, such as the gazelle, the ostrich and the goose (*Alopochen aegyptiacus*), are also represented among the faunal remains. Finally, the metatarsal bones of domestic goat may possibly be linked with the Abkan stratum at site AS-6-G-25, excavated by the Scandinavian Joint Expedition (Nordström 1972).

The Neolithic people of Upper Nubia had a mixed subsistence economy including animal husbandry, hunting and gathering. Major faunal resources for subsistence needs were probably available within the region. As discussed before, the R12 faunal assemblage reveals an increase in exploitation of domestic animals, especially cattle. The faunal profiles seem to suggest that hunting wild animals, including some very large game such as elephants, appears to have been a significant activity in the community, though, it is difficult to say whether elephants were present in the vicinity of R12 during the Neolithic. The finds from this cemetery are exclusively ivory objects and are not helpful in solving this question. The evidence of wild animals shows that the Nile Valley inhabitants exploited the aquatic resources and went on hunting trips, exploiting the River Nile itself as well as the riparian forest zone and the adjacent semi-desert (Pöllath 2008: 73).

Conclusion

The Neolithic culture of the Middle Nile Rasin was distributed through the Central and Northern regions in the fifth millennium BC. Several cultural traits mark the social and economical development in the Neolithic period. Burial practices indicate the presence of social hierarchies. Regional cultures became more extensively distributed, and finally, the Late Neolithic cultures of this region became increasingly complex, forming the foundation for the development of the Bronze Age societies (A-Group, C-Groups and Kerma civilization).

The wide excavations on the Neolithic sites have greatly increased our knowledge of the cultural development of the Neolithic period, together with the results of the previous work in Nubia and Central Sudan. However, many more questions concerning the Neolithic development remain unanswered. We know little about agricultural activities, land use, and community organization. We lack information on the origins of the Neolithic of Central Sudan. Caneva argued that "the chronological gap which seemed to separate the Khartoum Mesolithic from the Shaheinab Neolithic is now consistently filled by the dotted wavy line cultures" (1993: 89-90). Focusing the research on this problem ought to bring us closer to explaining to what degree the older, local cultural base contributed to the development of the Neolithic culture of Central Sudan and what the main factors were that contributed to the development of the Neolithic societies in this whole area.

Social differentiation appeared among Sudanese herders by the 6th millennium BP. Clusters of especially rich graves of men, women, and children at Kadero I argue for differences in wealth, but there is no evidence for social stratification. Pastoral intensification and a decrease in wild animal use are also evident at some sites in the Middle Nile after 5300 BP. Despite these developments, the spread of herding was patchy: at Shaqadud, east of the Nile, subsistence focused on wild resources as late as 4000 BP.

However, whatever this social organization might have been, it should have left some material manifestations of its structure. The increasing importance of domesticated animals, for example, would be associated with the emergence of more individualized rights and responsibilities in economic management and this would have led to increased differentiation within such communities.

It seems that, in spite of many excavated sites, evidence for the social organization of the people of the Neolithic in Central Sudan will be limited to that derived from burial information. Although the hypothetical social classes reflected in the graves were not observed in the settlements, currently available evidence seems to indicate that the burial grounds at el Kadada and Kadero I clearly illustrate the process of increasing concentration of goods and power by a social "elite" toward the end of the Neolithic.

It is clear that the social structure in the Central Sudan during the Neolithic period exhibited more or less inseparable economic and settlement patterns which are in turn witness to developmental stages extending from the Early Neolithic to the complex picture of the Late Neolithic.

The archaeological and morphological evidences of Neolithic subsistence show that the people practiced multi-resources during that period. There is evidence for food production based on animal husbandry around 6000 BP. It seems that all riverine settlements of the Middle Nile region during the 6th and 5th millenniums BC were occupied by populations following basically similar mixed economy strategies (fig. 5), which consist of the following (based on Krzyżaniak 1984: 314):

1. Riverbank Adaptation: subsistence based on fishing, collecting and hunting, supplemented by small-scale animal husbandry (possibly only of the ovicaprids). The Khartoum Variant sites suggest fairly stable, long term occupation by a relatively sedentary population. Although only bones of fish and some mollusks have been found associated with the riverside sites, the presence of many formal tools in the lithic industry suggests a mixed economic adaptation, albeit perhaps one without any domesticated plants or animals. The Abkan can also be reasonably identified as a mixed economy population. The Abkan adaptation seems to have focused on fishing supplemented by hunting and gathering. Large numbers of fish remains are associated with Abkan sites. Also, a variety of hunted animals, including gazelle, large bovids and geese as well as grinding stones are found on most sites. As in the Khartoum Variant case, the Abkan mixed adaptation may not have included use of domesticated plants and animals.

2. Valley Plain Adaptation: subsistence based on large-scale animal husbandry (mainly cattle) of pastoral character combined with the intensive, and perhaps already with elements of specialization, collecting of seeds of wild tropical cereals, other grasses, tree fruits, mollusks and some hunting. The evidence from Kerma and Dongola areas allows iden-

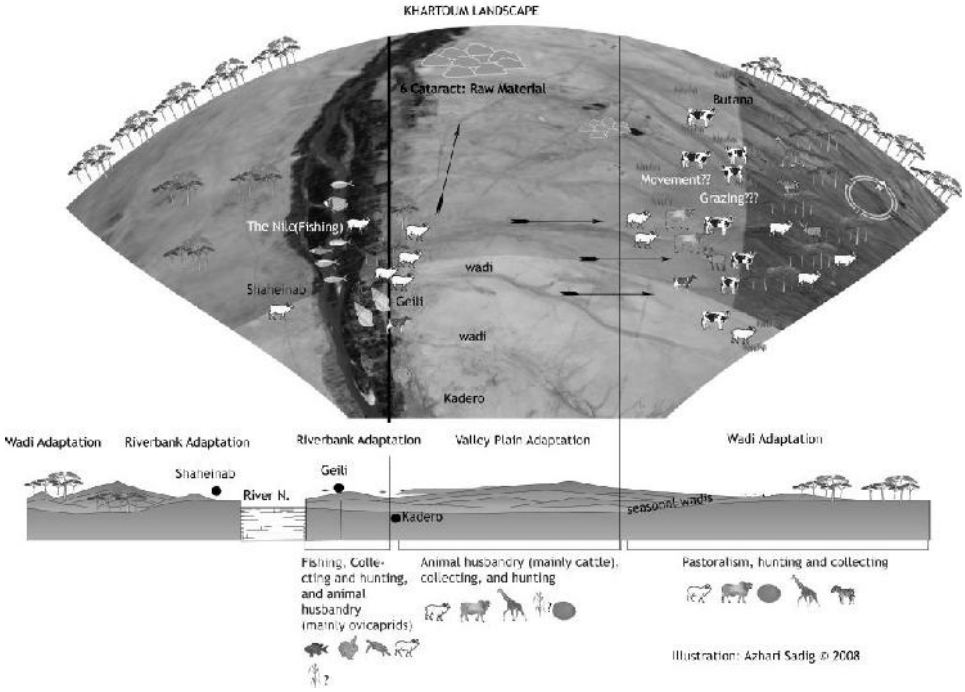


Fig. 5. Hypothetical illustration of the economic strategies of the Neolithic communities in the Khartoum Nile environment.

tification of such adaptation. Faunal remains from Kadruka and Multaga sites represent a sedentary or semi-sedentary mixed economy population, similar to that of Central Sudan. The remains from the Neolithic sites in Central Sudan represent a sedentary or semi-sedentary mixed economy population, which in some cases included cultivation of domesticated? plants and herding of domesticated animals. Haaland has argued that the processes of cultivation started at an early date and constituted the selection pressures which finally led to the evolution of domesticated sorghum (Haaland 1987a). She also mentioned that the material from the Neolithic sites such as Kedaro I, Um Direiwa and Zakiab shows that the inhabitants were probably cultivating wild sorghum (*S. verticilliflorum*) (Haaland 1992: 50). As far as archaeological and morphological evidence are concern, cultivation is much less certain, indicating human utilization of wild varieties of sorghum rather than clearly domesticated sorghum.

3. Wadi Adaptation: subsistence based probably on pastoralism, hunting and collecting. This feature could be observed in the sites of Shaqadud (50 km from the River Nile bank), Sheikh el Amin (18 km), Wad el Amin (25 km), Bir el Lahamda (40 km) and Wadi Rabob (58 km). According to their location with respect to the Nile, the settlements had a different socio-economic orientation: dry season camps in the alluvial plain or Butana plain, exploiting the aquatic resources (in the case of last four sites), base sites occupied all-year round in the alluvial plain or Butana and orientated to cultivation, and herding camps in the Butana savanna during the rainy season (Haaland 1987b: 216).

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