LATE PREHISTORY OF THE NILE BASIN
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Early domestic cattle and scientific methodology

The Combined Prehistoric Expedition has worked for several years on problems of the Holocene settlement of the Eastern Sahara. The results of this work have been published in three monographs (Wendorf and Schild 1980; Wendorf *et al.* 1984; Banks 1984) and several articles. One of the conclusions to which our research has led us is that domestic cattle appeared very early in the Eastern Sahara. No formal paper was presented on this subject at the second Poznań conference, but there was, nevertheless, a very lively discussion of the topic and this paper is a response to some of the points raised there.

The possibility that there might have been very early domestic cattle in the Eastern Sahara was first raised in a rather tentative fashion in the preliminary publication of our data from the Nabta area (Wendorf and Schild 1980). Further research in the Desert since then has significantly strengthened the case for their presence (Wendorf *et al.* 1984). The new data are derived from a series of Holocene sites in the area of Bir Kiseiba (22°34′ N, 29°53′ E), some 200 km west of the Nile; there has also been a restudy specifically of the "large bovids" from the sites at Nabta. This new information has led to an expansion and clarification of our views, but is apparently completely unknown to our critics. We therefore feel it is worthwhile to restate our arguments and make more explicit the way in which we reached our conclusions.

Our method is that of "strong inference" (Platt 1964), involving the formulation of alternative hypotheses, the testing of these to exclude one or more of them and the adoption of what remains. This is based on the principle that "any conclusion that is not an exclusion is insecure" (Platt 1964: 347), or, to paraphrase Popper, that since another, later explanation may be as good or better, there is no such thing as proof and science advances only by disproofs.

The data with which we have to deal are derived from 23 early Holocene sites in the Eastern Sahara. We must begin by confessing that we have not formally tested the hypothesis that these "archaeological sites" do indeed represent the results of human activity, as our Lower Pleistocene colleagues would have done. If this assumption cannot be made for the Holocene, then we may discount as unfounded every paper presented at the entire symposium. The sites have yielded 29 cultural assemblages, which are grouped into Early Neolithic, Middle Neolithic and Late Neolithic, on the basis of dating and coincidental similarities in artefact types. The Early Neolithic is further subdivided into four consecutive stages, of which the first three were formerly called Terminal Palaeolithic (Wendorf and Schild 1980). Details of these groupings and of their numerous radiocarbon dates have been published elsewhere (Wendorf and Schild 1980; Wendorf *et al.* 1984) and need not be repeated here. Table 1 summarizes the groups, their chronological ranges and the frequency of large bovid bones associated with each cultural assemblage. Site E-77-1, which yielded some of the large bovid bones noted in the 1980 publication, is omitted

Table 1

Frequencies of large bovid bones and of all identifiable mammal bones in Eastern Saharan Neolithic sites

Region	Site	Large Bovid Bones	Identifiable Mammal Bones
Early Neolithic of El Adam type: 9500-9000 B.P.			
Nabta	E-77-7	2	6
Kiseiba	E-79-8	9	387
Kiseiba	E-80-4	9	50
Early Neolithic of El Kortein type: 8800-8500 B.P.			
Nabta	E-75-6, lower	1	138
Nabta	E-77-3	1	29
Kiseiba	E-80-1, Area A	0	0
Kiseiba	E-80-2	0	0
Early Neolithic of El Ghorab type: 8500-8200 B.P.			
Kharga	E-76-6	0	0
Dyke area	E-72-5	0	0
Nabta	E-77-6	0	0
Kiseiba	E-79-1	0	15
Kiseiba	E-79-3	0	7
Kiseiba	E-79-4, lower	1	130
Kiseiba	E-79-8, Area X	0	2
Early Neolithic of El Nabta type: 8200-7900 B.P.			
Nabta	E-75-6, upper	1	410
Kiseiba	E-79-4, upper	0	41
Kiseiba	E-79-5	0	24
Kiseiba	E-80-1, Areas C & D	2	60
Kiseiba	E-80-3	0	0
Middle Neolithic: 7700-6200 B.P.			
Nabta	E-75-8, lower	39	603
Nabta	E-77-5	1	63
Nabta	E-77-5A	0	0
Kiseiba	E-79-2	1	459
Kiseiba	E-79-6	3	100
Kiseiba	E-79-7	0	22
Late Neolithic: 6200-5000 B.P.			
Nabta	E-75-8, upper	20	143
Kiseiba	E-79-4, "Late Neol"	0	0
Kiseiba	E-79-5B	3	3
Kiseiba	E-79-9	0	0

from the table, since it is a mixed Early and Middle Neolithic site. It is obvious from Table 1 that although large bovid bones are very rare, they occur in every faunal assemblage with a significant number of identifiable mammal bones. The collection from the upper layers of E-79-4, with 41 identifiable mammal bones, is the largest not to contain large bovids.

Since large bovid bones are so rare, it can be hypothesised that they might be intrusive into the sites. There are three taphonomic classes of intrusive faunal remains: geological, penecontemporaneous and recent (Gautier 1984). The bovid bones are not fossilised and so are not geological intrusives. There are not large bovids in the Eastern Sahara today and have not been for several millennia, so they cannot be recent intrusives. If intrusive, the bovid bones must be penecontemporaneous with the sites. This would imply that there were large bovids in the Eastern Sahara during the early Holocene, dying at random across the landscape, and that we have found the remains of those which chanced to die in archaeological sites. As far as surface remains are concerned, the most cursory visit to the Eastern Sahara shows that there is not a random scatter of large bovid bones across the surface of the desert; they occur only in archaeological sites. It is more difficult to determine the overall subsurface distribution of large bovid bones, but the hundreds of square metres of stratigraphic trenches excavated away from the sites have never yielded such bones, suggesting that the subsurface large bovid bones also occur only in archaeological sites. The correlation between sites and large bovid bones is almost perfect (imperfect only because not all sites yielded bovid bones) and we may reject the hypothesis of intrusion. The large bovid bones are in true archaeological association with the sites.

Large bovids occurring in Holocene contexts in northeastern Africa may be giant buffalo (*Pelorovis antiquus*, formerly *Homoioceras antiquus*), African buffalo (*Syncerus caffer*), wild cattle (*Bos primigenius*) or domestic cattle (*B. primigenius* f. *taurus*). The identification with giant buffalo may be rejected on both osteometric and morphological grounds (Gautier 1984). African buffalo falls within the same size-range as cattle and the avocational palaeontologist might have difficulty in distinguishing between the two. The entire collection has been carefully re-examined to verify that this is not a problem and, morphologically, the bones are very unlikely to belong to *Syncerus* (Gautier 1984). Metrically and morphologically, the large bovid bones can be assigned to cattle.

We therefore have cattle bones in true association with archaeological sites in the Eastern Sahara from about 9,500 to about 5,000 B.P. The crucial question is whether these are the bones of wild cattle or of domestic cattle. It has been suggested that the earlier cattle, at least, were wild on the basis of their size, although size alone is a very treacherous criterion to use as an indicator of domestication. Change in size may result not only from genetic isolation, but also from environmental change or stress. European wild cattle were smaller in the Holocene than in the Pleistocene (Bökönyi 1974: 99; Lasota-Moskalewska 1980: 121) without being any whit less wild, and there are several well-documented instances of both reduction and increase in size of domestic cattle during and after the European Neolithic (*op. cit.*). It is, in any case, very unlikely that there was a complete barrier to interbreeding between wild and domestic cattle during Neolithic times anywhere, and interbreeding seems actually to have been encouraged in, for example, the Globular Amphorae culture, where domestic cattle were fully as large as their wild relatives (Lasota-Moskalewska 1977). Size, then, is ambiguous. The samples from the Neolithic of the Eastern Sahara fall overall within the size-ranges of larger domestic cattle and of smaller wild cattle (Gautier 1984). This could actually be taken to support their domestic status, since the environmental conditions were so difficult (see below) that any wild cattle would have undergone a significant reduction in size, purely as a response to stress. In the end, however, the samples are so limited as to be inconclusive.

The critical argument, and the one which seems to be least understood, is the ecological one. All of the faunal assemblages are dominated by small dorcas gazelle (*Gazella dorcas*) and hare (*Lepus capensis*), with, usually, minor quantities of the larger dama gazelle (*G. dama*). In the absence of cattle, this would indicate an environment with a very low carrying capacity, restricting the ruminants to gazelles. This is in accord with the sedimentological and pedological studies, which also show an arid environment. Except for two fragments of oryx or addax from the Middle Neolithic of E-75-8, there are no remains of animals intermediate in size between the gazelles and the cattle. Large bovids are known from other parts of the Sahara at this and earlier periods, but in every case are associated with a full spectrum of animals of other sizes: the giant buffalo in the Middle Palaeolithic of Bir Tarfawi, for example, occurs with white rhinoceros, wild camel, warthog and large and medium-sized antelopes, as well as gazelles (Gautier 1980). What is known of the ecology of modern arid and semi-arid environments suggests that a fauna composed of gazelles, hare and cattle, with nothing in between, would be surprising at the very least. The carrying capacity of the Eastern Sahara in the Early Holocene was simply unsuitable for herds of wild cattle.

There is also the problem of water. Gazelle can survive for extended periods on only the moisture they obtain from green vegetation. Hares are not quite so desert-adapted, but can obtain sufficient moisture from dew. Cattle need actually to drink water at least every other day. There was no permanent, standing water in the Holocene Sahara (although there had been during the period of the Middle Palaeolithic), only ephemeral playa lakes. These filled during the rainy season but stood dry for much of the year, at which time the only way to obtain water was to dig wells for it. We know the human occupants of the area dug wells but such behaviour has not yet been demonstrated for *Bos* sp. We may therefore reject the hypothesis that cattle were an integral part of the natural, wild fauna of the Eastern Sahara in the Early Holocene.

We know that wild cattle were numerous in the lush environment of the Nile

Valley at this time, and it can be hypothesised that each year the Nilotic cattle ranged westward into the Desert of their own accord, to graze on the new grass after the summer rains, and returned to the Valley before the dry season. This might be possible for Nabta (100 km west of the Nile), but is extremely unlikely for Bir Kiseiba (200 km west of the Nile), and, again, makes very little ecological sense. In the Valley, the wild cattle are accompanied, as expected, by the full range of animals of other sizes (Gautier 1976; 1978). If the cattle went far out into the Desert, why did the medium-sized animals not do likewise? This is a particularly pertinent question for the hartebeest, which was quite common in the Valley, which is much better adapted to aridity than the cattle, but which was absent from the Eastern Sahara. We may, again, reject the hypothesis that the animals in the Desert were wild cattle coming from the Nile Valley.

We are left with the hypothesis that the cattle bones, found in true archaeological association with Eastern Saharan sites of the 10th to 6th millennia B.P., are those of animals that were to some extent domesticated. The process of biological domestication may still have been at an early stage, which would accord with the rather large size of the animals, but there seems to have been very effective human control of their movements. This is simply a working hypothesis and has not been "proved". Nothing is proved in the natural sciences; the theory of gravity has been a useful and reliable predictor of future events for several centuries, but it remains unproven. If another, later hypothesis should be as good or better, then we may reject the hypothesis of domestic cattle. For the moment, however, it seems to be our closest approximation to what was actually happening in the Eastern Sahara during the Early Holocene.

Like other useful hypotheses, this not only answers questions but also raises them. If the cattle were in the Desert as domestic animals, where were they domesticated? Further, since our evidence suggests that the desert was not occupied year-round before about 8,200 B.P., where did the early cattleherders take their herds during the dry season? Smith has suggested elsewhere (1984: 323) that the cattle were domesticated from local wild stock. Since there were no local wild stock we may discount this suggestion. The process of domestication must at least have begun in an area where wild cattle occurred naturally; that is, an area where water was more readily and permanently available. Such an area could also have served as a refuge during the dry season in the desert. In the Early Holocene, there were two such regions adjacent to the Eastern Sahara: western Sudan and the Nile Valley to the East.

If, as seems most likely, the Early Holocene wet periods in the Eastern Sahara resulted from a northward shift of the summer monsoon belt, then northern Sudan received more rainfall than did southern Egypt, and wild cattle may have occurred naturally across the modern Sahel. It can be hypothesised that they were domesticated there, and that in the Eastern Sahara we have the northern section of a North-

-South pattern of transhumance. The prehistory of western Sudan remains largely unknown. However, preliminary survey work in the area of Merga, in northern Darfur, has shown that while there are Early Holocene sites, they differ markedly from contemporary sites in Egypt in both lithics and ceramics, and their faunas do not include cattle. This lack may be due to the lower quality of forage in the higher--rainfall zone. Under modern Sahelian conditions and particularly in sandy soils, vegetation which grows where water, rather than nitrogen is the limiting factor (less than 300 mm of rain *per annum*) is richer in protein, leading to the curious situation that at the end of the dry season there is more good forage in the northern Sahel than in the southern Sahel or Savannah (Breman and de Wit 1983). This might explain why there was early Neolithic cattle-herding in southern Egypt, which corresponded to the modern northern Sohel, but not in northern Sudan, which was more like the modern southernSahel. In any case, it see msunlikely that the Early Holocene pastoralists of the Eastern Sahara either came from, or returned to, the South.

The method of strong inference leads us to suppose that the first cattle-pastoralists came from the Nile Valley. The latitudes of Bir Kiseiba and Nabta suggests specifically, the area between the First and Second Cataracts, which, unfortunately, now lies beneath Lake Nasser. A few Early Holocene sites are known from this part of the Valley (Schild *et al.* 1968), and resemble the Desert occurrences in lithic technology and typology, and in a shared preference for Egyptian flint; they also yielded many cattle bones. However, recent re-examination of the Nilotic cattle bones (Gautier 1984) has shown that the cattle were larger than those in the Desert and fall within the size-range of wild cattle, *Bos primigenius.* This apparently contradictory situation is not, in fact, at variance with a Nilotic origin for the Saharan domestic cattle. Cattle bones are extremely rare in the Saharan sites (Table 1), indicating that they were not kept primarily for meat, but rather for products such as milk and blood, as are the cattle of many East African pastoralists to this day. Such a restricted use of the domestic animals would be maintained during the dry seasons in the Nile Valley – it would make no sense to slaughter them – while the Nilotic wild cattle could be hunted for meat. This leads to the curious situation where the camp-sites of cattle-pastoralists apparently contain the bones only of wild cattle. The bones of occasional domestic animals that died (or were killed) in the Valley are statistically lost among the much larger wild population. This implies that the domestic cattle are archaeologically invisible not only in the dry season sites of established pastoralists, but also in those sites occupied when domestication was first beginning. We may recognise the early Saharan cattle as domestic on ecological ground, but are quite unable to recognise the first domestic cattle in the Nile Valley.

In short, the data which are currently available permit us to exclude many hypotheses, but not the one that there were domestic cattle in the Eastern Sahara by the 10th millennium B.P. We suppose that these were cattle first domesticated at an earlier, but unguessable, date in the Nile Valley. It is unfortunate that our critics were aware only of our initial and tentative suggestions and not of the additional research and many more data that have further supported them. It is doubly unfortunate that they were unaware of the scientific rigour by which we arrived at our conclusions. We hope that this exposition will be helpful to them.

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