ENVIRONMENTAL CHANGE AND HUMAN CULTURE
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UNTIL THE SECOND MILLENNIUM B.C.
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Environmental change and the development of nomadism in the East-Central Sudan

This paper describes the transition to a nomadic pastoral adaptation in the Eastern Sudan during the early first millennium B.C. Palaeo-environmental reconstructions do not indicate any major ecological changes during this time of transition. Indeed, there is reason to believe the nomads inhabited landscape suitable for agriculture; a point which serves to cast doubt upon the popular notion that pastoral nomadism is strictly an adaptation to marginal lands. Data indicate that nomadism in the Southern Atbai may have come about not for ecological reasons, but as a result of macro-regional changes in the balance of political and economic power.

The analyses which follow are based on extensive surveys and excavations in the Southern Atbai (Fig. 1), in a study area between Khashm el Girba on the Atbara River and Kassala on the Gash River. Research in the Southern Atbai has been carried out by two separate teams: the Butana Archaeological Project (funded by the U.S. National Science Foundation), and the Italian Archaeological Mission in the Sudan Kassala (funded by the Italian Ministry of Foreign Affairs, Ministry of Education and National Research Council).

The Southern Atbai is today part of the easternmost Sahel. Receiving between 200 - 400 mm of rain *per annum*, it is classified as a low rainfall woodland savanna (Barbour 1964). Within this broad classification, the study area contains several different micro-ecological land use zones. These range from the prime agricultural lands of the inland Delta and lower reaches of the Gash River on the eastern boundary of the study area, to the steppe – a vast, open clay plain between the rivers which is today used as pastureland. On the western border of the study area, there are the badlands and narrow floodplains of the Atbara River valley.

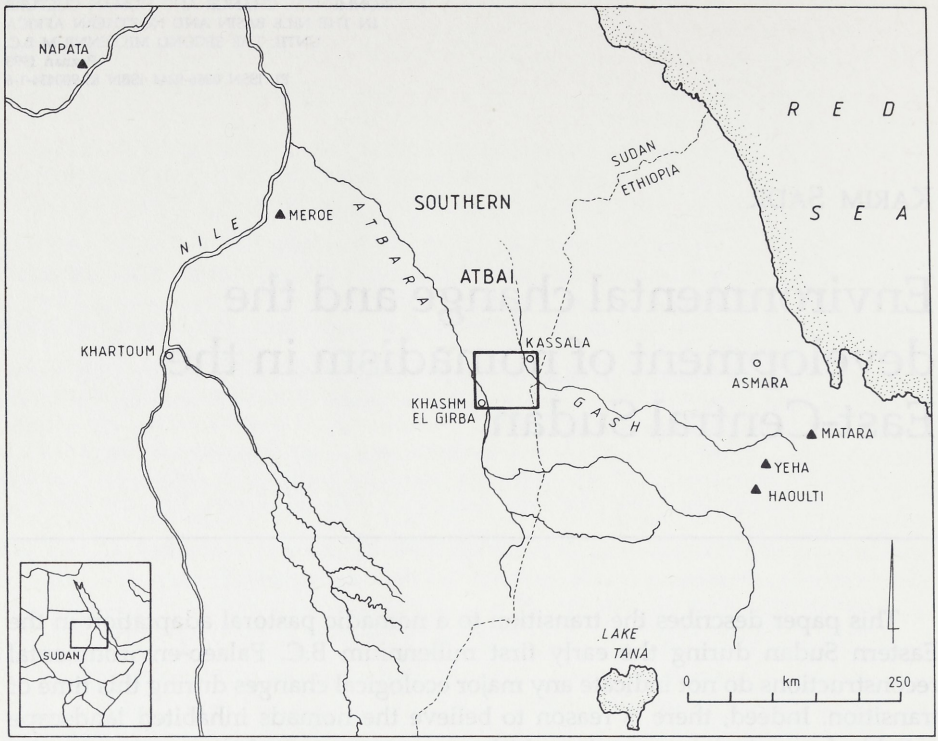

Fig. 1. The Eastern Sudan.

With the combined logistical support of both projects, the entire study area was surveyed by vehicle. For sampling purposes, the landscape from the Atbara to the Gash River was divided into eight ecologically specific sectors, which cover the various grades of agricultural lands, as well as the various types of pasturelands in the marginal zones. It was planned that each of the eight sectors should be surveyed if not completely, then at least more or less evenly. In the end, however, although all sectors were covered, unpredictable shortages of time and gasoline caused the extent of coverage to vary from one sector to the next (Table 1). Additional factors, such as urban development, intensive cultivation, and severe erosion imposed their own limitations on the survey of paricular sectors. By 1984, when surveys were terminated, over 650 sq. km of terrain had been covered: a figure which amounts to some 44% of the designated study area.

Within these 650 sq. km, 233 sites were recovered. Over 80% of these were surface collected for artefacts and another 15 (6%) were excavated by the members of the two projects. The materials recovered from excavations and surface collections allowed the reconstruction of a cultural sequence spanning some ten millennia, from about 8,000 B.C. to the late 18th century A.D. (Fig. 2). The

Table 1

The Southern Atbai survey.

Sector	Area (sq. km)	Coverage (sq. km)	Coverage (%)
Atbara	135	43	33.3
Abu Shosh	115	35	30.4
Hagiz	115	97	84.3
Qaradah	136	43	33.0
Malawiya	212	115	54.2
Sharab	280	135	48.2
Dilulayeb	349	166	47.2
Kassala	140	20	14.2
Total	1482	654	44.4

details of this sequence have already been published elsewhere (Fattovich, Marks and Mohammed-Ali 1984; Marks, Mohammed-Ali and Fattovich 1986). Here, we focus upon a small part of it: the period of transition from the Late Kassala to the Taka Phase during the early first millennium B.C. Analyses have shown that in this transition adaptative strategies changed from a sedentary mixed economy to a specialized nomadic pastoral one. This change in adaptation can be documented in several different aspects of the archaeological remains, including faunal, artefactual and settlement patterns.

Foremost, it is the faunal and macro-botanical remains which herald the shift to a strictly pastoral adaptation. Evidence from three excavated sites suggest that subsistence during the Late Kassala Phase was based on agriculture, pastoralism, hunting, and perhaps gathering, as well. Actual seeds of sorghum and their imprints in clay have been found in a Late Kassala Phase context (Costantini *et al.* 1983). Domestic animals including cattle, goat and sheep are among the most frequently recovered faunal remains (Peters 1986). In addition, some gazelle and giraffe bones have also been found (Peters 1986). In contrast, faunal remains are extremely rare on the mostly surface sites of the Taka Phase. The few bones which have so far been recovered predominantly belong to domesticated cattle (Peters 1986). No floral remains have yet been found in a Taka Phase context.

This apparent shift to more intense pastoral production is also reflected in the distribution of grinding stones. These artefacts are abundant on all Late Kassala Phase sites, but absent on the majority of Taka Phase sites (Sadr 1988). This suggest that the processing of plant foods was not an important part of the Taka Phase subsistence activities. Increased reliance on pastoralism during the Taka Phase apparently went hand in hand with a decreased reliance on agricultural production.

The change in focus of subsistence strategy towards more pastoralism was paralleled by a shift to a more mobile way of life, as is indicated by changes in settlement patterns. Of these, the most dramatic is a change from long term to ephemeral occupation of settlements.

In an evenly deflating landscape, such as obtains in the Southern Atbai, gross differences in surface artefact densities among different sites can reflect diffe-

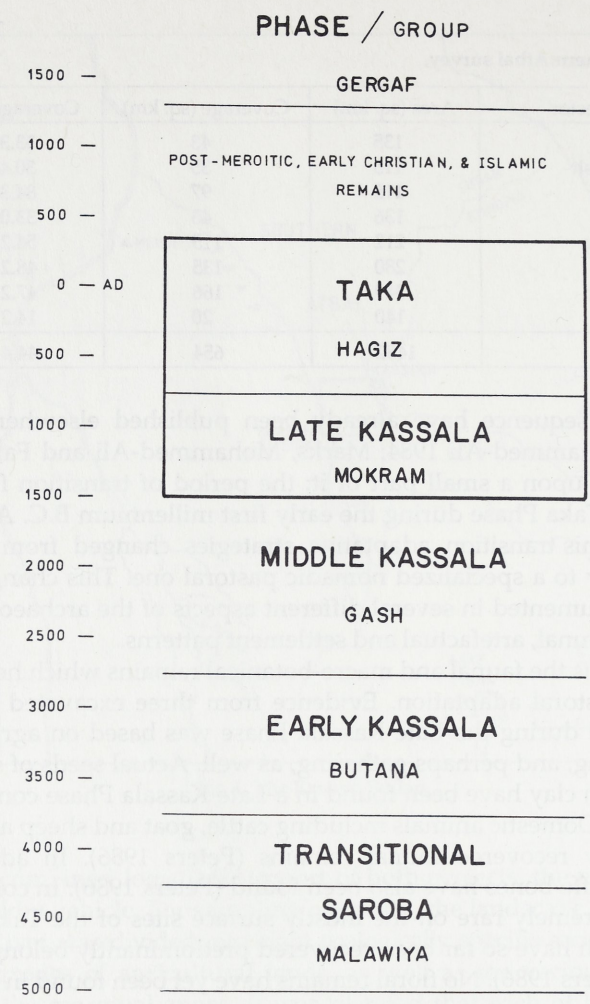

Fig. 2. The Southern Atbai cultural sequence.

rences in the duration of occupations at the sites: the longer the occupation, the more material will be left behind. In this light, a comparison of Late Kassala and Taka Phase sites by surface artefact densities (Table 2) suggests that there was a change to more ephemeral occupations after the early first millennium B.C.

Two high density sites – with over a 100 sherds per surface square meter, and over 35 cm of *in situ* deposit, interpreted as settlements with very long durations of occupations – are associated with the Late Kassala Phase, while none are known from the Taka Phase. Likewise, medium density sites – with 25 - 100 sherds per square meter, and 5 - 10 cm of *in situ* materials, suggesting a relatively long duration of occupation – are common in the Late Kassala Phase, but extremely rare in the Taka Phase. In contrast, low density sites – those with less

than 25 sherds per square meter and no depth of deposits, interpreted as very short term occupation – make up 90% of the Taka Phase settlements. This predominance of short term occupations, suggests that the population of the Southern Atbai during the Taka Phase was considerably more mobile than that of the Late Kassala Phase.

Table 2

Sites by density.

Site	Late Kassala Phase		Taka Phase	
Density	*n*	%	*n*	%
High	2	2.6	0	0.0
Medium	40	53.3	8	10.0
Low	33	44.0	72	90.0
Total	75	99.9	80	100.0

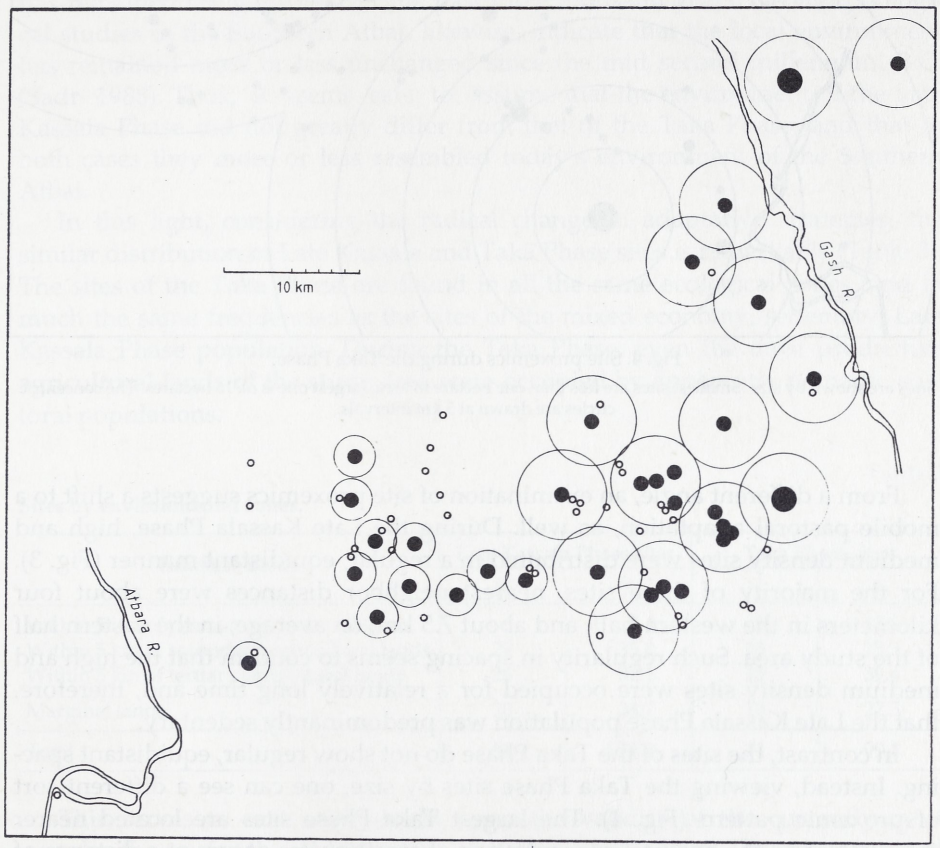

Fig. 3. Site proxemics during the Late Kassala Phase;
Sites are shown by surface artefact density: large filled circles = high artefact densities; medium filled circles = medium densities; small filled circles = low densities.

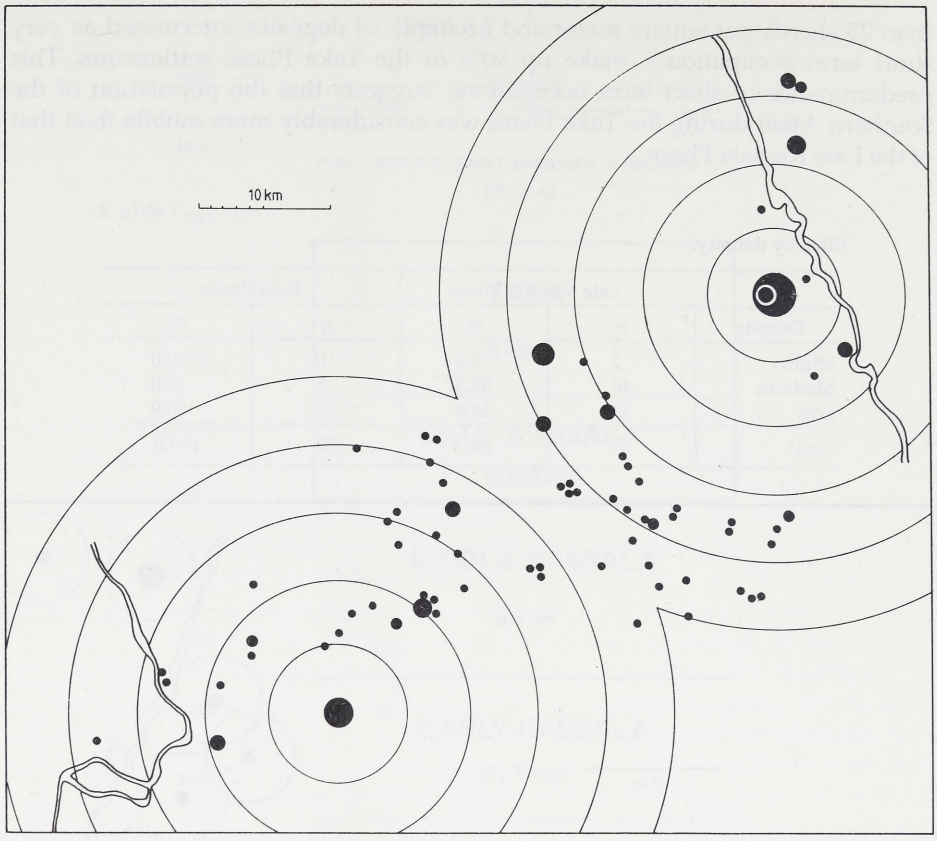

Fig. 4. Site proxemics during the Taka Phase;
Sites are shown by size. Smallest sites are less than one hectare in area, largest one is *ca.* 16 hectares. The concentric circles are drawn at 5 km intervals.

From a different angle, an examination of site proxemics suggests a shift to a mobile pastoral adaptation, as well. During the Late Kassala Phase, high and medium density sites were distributed in a regular, equidistant manner (Fig. 3). For the majority of these sites, nearest neighbor distances were about four kilometers in the western half, and about 7.5 km, on average, in the eastern half of the study area. Such regularity in spacing seems to confirm that the high and medium density sites were occupied for a relatively long time and, therefore, that the Late Kassala Phase population was predominantly sedentary.

In contrast, the sites of the Taka Phase do not show regular, equidistant spacing. Instead, viewing the Taka Phase sites by size, one can see a different sort of proxemic pattern (Fig. 4). The largest Taka Phase sites are located nearer the rivers, and the heaviest concentration of smaller sites occurs at a distance of 15 - 20 km from the largest ones. This pattern is especially clear in the eastern half of the study area but can also be vaguely discerned in the west.

Assuming that this pattern is not simply an artefact of incomplete survey coverage, it is interesting to note that it recalls a basic herding rule among modern Sudanese pastoralists. Herds taken out beyond half a day's walk from the main settlements – a half a day's walk for a herd being 15 - 20 km – have to be sheltered overnight, and thus herding camps must be set up (Evans-Pritchard 1927; Holy 1974). It is tempting to interpret the high concentration of the smaller Taka Phase sites, at just that distance from the largest ones, as a conglomeration of such temporary herding camps.

Overall then, the transition from sedentary mixed economy to nomadic pastoral adaptations in the Southern Atbai can be seen in several aspects of the data including faunal and artefactual remains, as well as settlement patterns. Surprisingly, however, one of the aspects of the data which does not reflect this transition is the distribution of sites by ecological zones.

Palaeoenvironmental reconstructions by Warren (1970) and Wickens (1982) from the Western and Central Sudan indicate that the climate of the Eastern Sahel has remained fairly stable over the past three thousand years. Geomorphological studies in the Southern Atbai, likewise, indicate that the local environment has remained more or less unchanged since the mid second millennium B.C. (Sadr 1988). Thus, it seems safe to assume that the environment of the Late Kassala Phase did not greatly differ from that of the Taka Phase, and that in both cases they more or less resembled today's environment of the Southern Atbai.

In this light, considering the radical change in adaptative strategies, the similar distribution of Late Kassala and Taka Phase sites is remarkable (Table 3). The sites of the Taka Phase are found in all the same ecological zones, and in much the same frequencies as the sites of the mixed economy, sedentary, Late Kassala Phase population. During the Taka Phase, even the most productive agricultural lands of the study area were occupied by apparently nomadic pastoral populations.

Table 3

Sites by environmental zones.

Land use zones	Late Kassala Phase sites		Taka Phase sites	
	N	%	*N*	%
Within 5 km of primary agricultural lands	6	7.4	9	12.6
Within 5 km of secondary agricultural lands	29	35.8	18	25.3
Within 5 km of tertiary agricultural lands	26	32.1	28	39.4
Marginal lands	20	24.7	16	22.5
Total	81	100.0	71	99.8

This serves to cast some doubt upon the validity of the currently most popular theory for the development of pastoral nomadism. The proponents of the ecological theory (Coon 1943; Lattimore 1967; Service 1975; Khazanov 1984) have long argued that pastoral nomadism was adopted by populations, who, as

a result of environmental change and/or population pressure, had lost access to agricultural lands. Since they had no arable lands to cultivate, so the argument goes, the population turned to pastoral production, and since pastoralism in a marginal environment requires seasonal migrations, so the populations became nomadic.

The transition to nomadism in the Southern Atbai, however, does not fit this interpretation. Certain sectors of the Southern Atbai cannot, by any stretch of the imagination, be called agriculturally marginal. Even today, with Northeast African climates practically at their driest since the late Pleistocene (Muzzolini 1982) simple rainfall agriculture can support large sedentary populations in parts of the study area. During the Taka Phase these parts of the study area must have had the same agricultural potential. Even though, for several centuries, the Taka Phase nomads were the sole occupants of these fertile sectors, there is no evidence to suggest that they settled down to exploit the agricultural potential of the region. Thus, environmental change and lack of access to agricultural lands does not seem to have been a decisive factor in the transition to pastoral nomadism in the Southern Atbai.

But then, what was the decisive factor? A hint of an answer is provided by a cross correlation of historic events in the Eastern Sahel, which suggest that nomadism in the Southern Atbai may have developed in response to changes in the macro-regional balance of political and economic power.

If one steps back and observes diachronic developments at a scale covering all of the Central Sudan and Northern Ethiopia some suggestive patterns emerge. At the time of the Late Kassala Phase, that is before *ca.* 750 B.C., the Central Sudanese Nile Valley was apparently all but depopulated (Marks *et al.* 1985): in the stretch of the Nile from south of Khartoum to the north of the Atbara confluence, no sites have yet been found which date between *ca.* 1,500 - 800 B.C. To the east, in the Northern Ethiopian highlands, from the period between 1,500 - 500 B.C., only a few poor assemblages are known from the Godebra Rockshelter (Phillipson 1977) and in Begemder province near Lake Tana (Dombrowski 1972). These suggest a relatively low level of cultural complexity in that region.

If the poverty of archaeological remains in these neighboring regions is not simply an artefact of the amount of research carried out (a point which can be more easily argued in the Central Sudanese rather than Northern Ethiopian context) it can be said that during the late second and early first millennium B.C. the two regions neighboring the Southern Atbai were culturally, economically and politically peripheral zones. In contrast, at that time the Southern Atbai was something of a cultural and economic center. As the research of the Butana Archaeological Project and the Italian Archaeological Mission has shown, during the Late Kassala Phase a large sedentary population inhabited this region. Elsewhere, it has been shown that the Late Kassala Phase inhabitants of the Southern Atbai had contact with the cultures of the Nubian Desert, and imported exotic stones from the Red Sea Hills. Indeed, Fattovich (1985) has suggested that Southern Atbai of the second millennium B.C. may even have been

a province of the Land of Punt, an important trading partner of Pharaonic Egypt. Thus, a political/economic map of this part of the Eastern Sahel during the time of the Late Kassala Phase would show the heartland in the Southern Atbai, flanked by the hinterland regions of the Central Sudan and Northern Ethiopia.

At the beginning of the Taka Phase, however, this center/periphery arrangement completely reversed itself. First, around 800 B.C., the Kushitic Kingdom established one of the major centers at Meroe in the Central Sudanese Nile Valley (Bradley 1984). Indeed, around 500 B.C., Meroe became the capital of the Meroitic Kingdom, and later established strong political and economic links with Ptolemaic and Roman Egypt (Shinnie 1967). At about the same time, in the Northern Ethiopian highlands of the mid-first millennium B.C., the Pre-Axumite Kingdoms established their centers at places such as Yeha, and Matara (Fattovich 1984; Anfray 1968). These Northern Ethiopian Kingdoms apparently had strong links to the Arabian cultures of that time. By the first few centuries A.D. the contacts of the succeeding Axumite Kingdom extended as far as India and Ceylon (Kobishchanov 1979).

While the Central Sudan and Northern Ethiopia were being elevated to political and commercial heartlands, the Southern Atbai – as the forgoing discussion has indicated – became a peripheral zone, sparsely inhabited by the nomads of the Taka Phase. Given the lack of significant environmental change during the early first millennium B.C., it cannot be argued that ecological factors turned the Southern Atbai into a peripheral region. On the contrary, the macro-regional sequence suggests that it was a realignment of the politico-economic axes which led to the reversals in the fortunes of the Southern Atbai. Nomadism apparently arose in the Southern Atbai when that region became politically peripheral, not when it became ecologically marginal. Thus, in this case, nomadism appears to have been an adaptation to the cultural, rather than the natural environment.

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