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Holocene evolution of climate and environment, and stone "city" ruins in Northern Darfur, Sudan: is there a relationship?

Introduction

One paradigm of modern archaeological thinking is that cultural and environmental evolution are linked variables. Thus nomadism, with its low level of exploitation of natural resources prevails in marginal habitats, while sedentarism with its corollaries of demographic expansion, agriculture, animal husbandry *etc.*, requires a predictable environment with one outstanding limiting factor: a sufficient amount of precipitation.

Today the number of permanently inhabited villages in Darfur drops sharply north of 14°30′ *i.e.* north of a line drawn between the cities of Mellit and Kutum, where mean precipitation drops below 250 mm · y^{-1}. At the small township of Malha (situated north of 15°N), the long-ranging average is as low as 114 mm · y^{-1} (Ibrahim 1984) and agriculture is limited to a few depressions in humid valleys. North of Malha, only desert remains. Present-day as well as ancient stone-built villages of the Fur and related tribes are plentiful on the well-watered, terraced flanks of Jebel Marra where peak precipitations of 1,000 mm · y^{-1} occur (Wickens 1976). Run-off water from this massif, collection at its foot, permits the existence of modern cities such as El Fasher and Nyala.

We postulate that, for sizable human settlements of a permanent nature (*i.e.* in the present case, "cities" composed of circular stone huts) to have once extended north of Jebel Marra (including its southern extension, the Furung Hills) a sustained increase in precipitation must have occurred. By sustained we mean an increase lasting longer than the fluctuations of, say, decadal length which are typical of monsoonal climates. The remainder of this article is concerned with the probable origin of a number of ruined "cities" first discussed by Arkell (1951 -1952).

Materials and methods

A study was undertaken of the climatic history of the area of Meidob in Northern Darfur, Sudan (Nys 1986), by lifting a 9.25 m sediment core from the bed of the crater lake of Malha (Fig. 1). Biological, mineralogical, and radiological dating techniques were applied to successive layers of sediment at intervals of one to several centimeters (Mees *et al.* 1991; Mees and Stoops 1990). The field work took place in November 1985, in the framework of a Belgian-Sudanese

Fig. 1. Malha crater. The ruins of Malha city are encircled. Arrows indicate a solitary hut inside the crater, a long stone wall, and a concentration of tumuli.

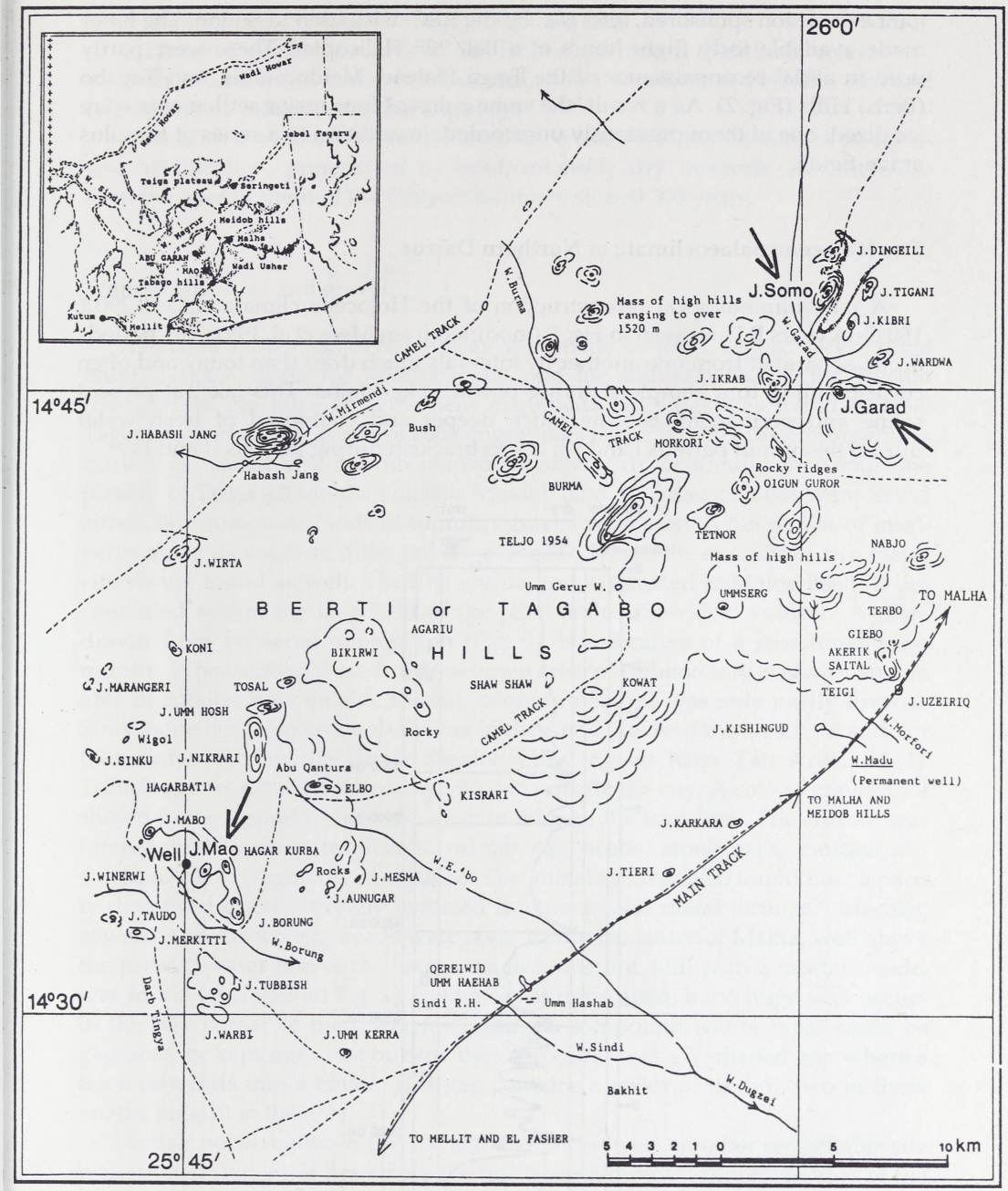


Fig. 2. Map of study area, indicating the situation of four stone-built cities.

joint expedition sponsored, *inter alia*, by the EEC delegation to Sudan. The latter made available forty flight hours of a Bell 205 Helicopter. These were partly used in aerial reconnaissance of the Teiga Plateau, Meidob Hills, and Tagabo (Berti) Hills (Fig. 2). As a result, the stone ruins of four major settlements were localized, one of them previously unrecorded, in addition to a series of tumulus grave-fields.

The Holocene palaeoclimate of Northern Darfur

A palaeolimnological reconstruction of the Holocene climate since 8,290 ± 150 C-14 years B.P. is given in Fig. 3 (modified from Mees *et al.* 1991). Six periods occur, separated from one another by intervals much drier than today and often corresponding to a complete drying out of Lake Malha. This lake, at present saline and permanent, became much deeper and composed of fresh water during the humid periods I and III. It was brackish during periods II and IV.

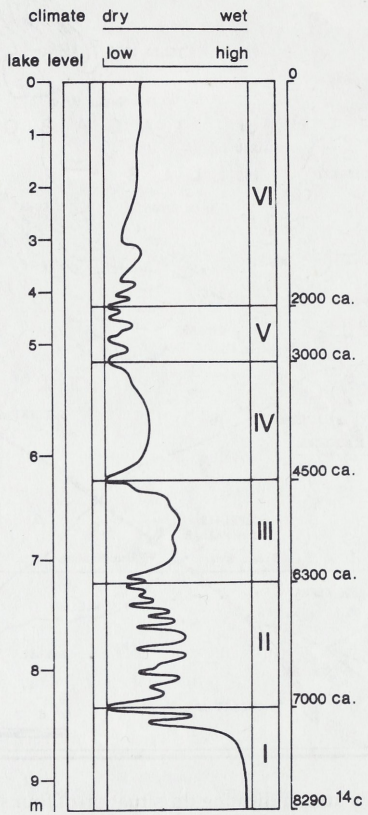


Fig. 3. Evolution of lake level since 8,290 C-14 years B.P. at Malha crater lake, reflecting climatic change throughout the Holocene. Major periods in Roman numerals, dates are approximate.

It is important to note that the region of the lake:

1. Has recovered since *ca.* 2,000 B.P. from a spell much drier than today;

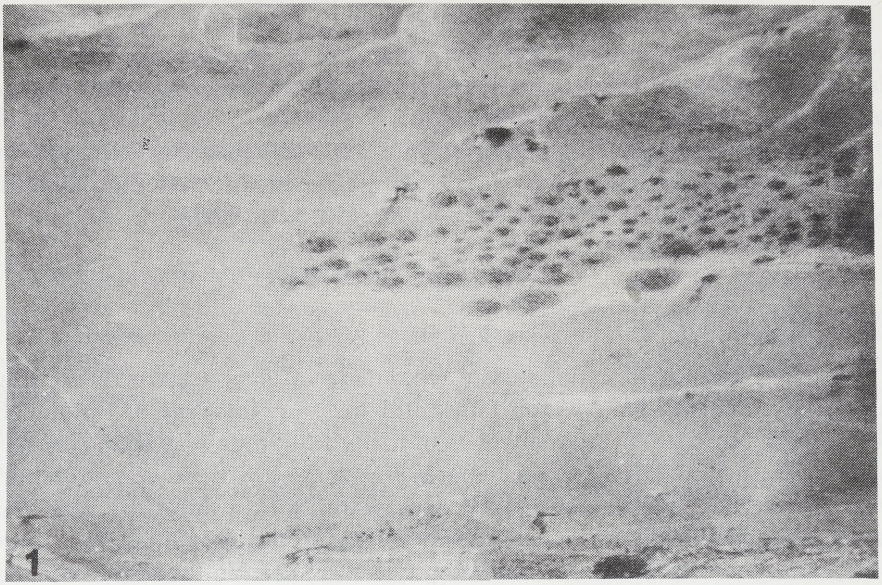
2. Shows no trend towards more aridity in the course of Period 6 (the last two thousand years), but rather contrary;

3. Has, on average, been much drier since 3,000 B.P. than before. A progressive aridification, punctuated by brief, intensely dry intervals, has therefore been the overall trend of the Holocene climate since 8,300 years.

Stone-built cities and graves

As stated earlier, an aerial survey was made of Jebel Tageru (West ridge only), Teiga Plateau, the Meidob Hills, and the southern half of the Tagabo (Berti) Hills. No trace of permanent man-made buildings was found in Jebel Tageru (where a rich group of rock engravings and a few frescoes representing cattle was visited in a canyon named Musawareid), or around the sandstone plateau of Teiga. Inside the volcanic Meidob land no traces of cities were found either, but numerous fields of tumulus graves were seen in the region of inselbergs along its western, dissected edge (Fig. 4). Where the remains of two major cities were found as well. The first and largest is situated at Malha itself. It lies concealed within the lava field of the Jebel Sodur (Sowidor) volcano. A plan, drawn from an aerial photograph (Fig. 5), is indicative of a structured community. When visited there is a downtown area, peripheral fortifications, and an area of smaller huts outside the city proper (this area was only partly drawn). Stray stone huts also occur elsewhere in the small oueds of the lava field and, for that matter, across the whole Meidob Hills (*e.g.* at Khor Tat: Arkell 1947). Tumuli graves are predominantly situated outside the city. A row of graves (not shown in the figure) fringes the western edge of the lava flow. The surface was littered with pottery fragments, ostrich egg beads, stone axes, mortars, arrowheads, and fragments of obsidian. One metal axe was also found near a partly destroyed grave, strongly oxidized fragments of a metal (bronze?) bracelet, cowries and ostrich egg beads were seen. Inside the crater of Malha, well above the present water line of the lake, a single stone hut, still with a mortar inside, was found (*cf.* arrow in Fig. 1). Malha city is not walled, but a huge wall occurs in the NW corner of the crater (delimiting a compound where cattle could be gathered, or kept out). Just outside the compound was a V-shaped gap where a track descends into a crater. This gap contains a series of tumuli, two of these are the biggest in the area.

Further north, between the 100 and 50 mm isohyets, another remarkable site was spotted (Fig. 6). It lies where the north-westernmost volcanic tongue of the Meidob Hills forms a triangular plateau, and is fringed by the bed of a meandering oued some 10 - 15 m below. The "open" site of this city is defended by three walls. There are few stone huts inside, but numerous large compounds occur. However, in the plain around the plateau stone remains of former villages



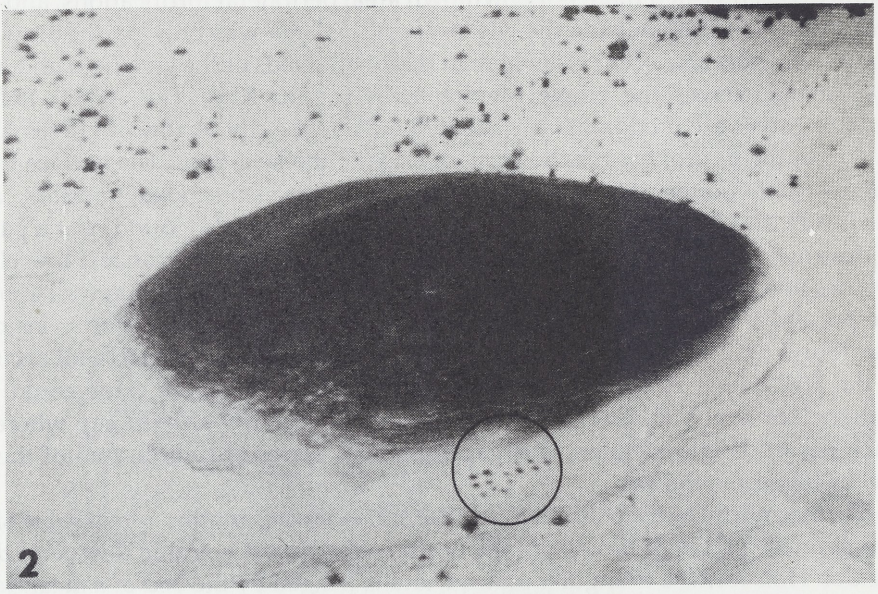


Fig. 4. Meidob land. Aerial views of fields of tumuli;

1: aerial view of major field of tumuli; 2: aerial view of group of tumuli at the foot of an inselberg, both situated along the western edge of the Meidob hills.

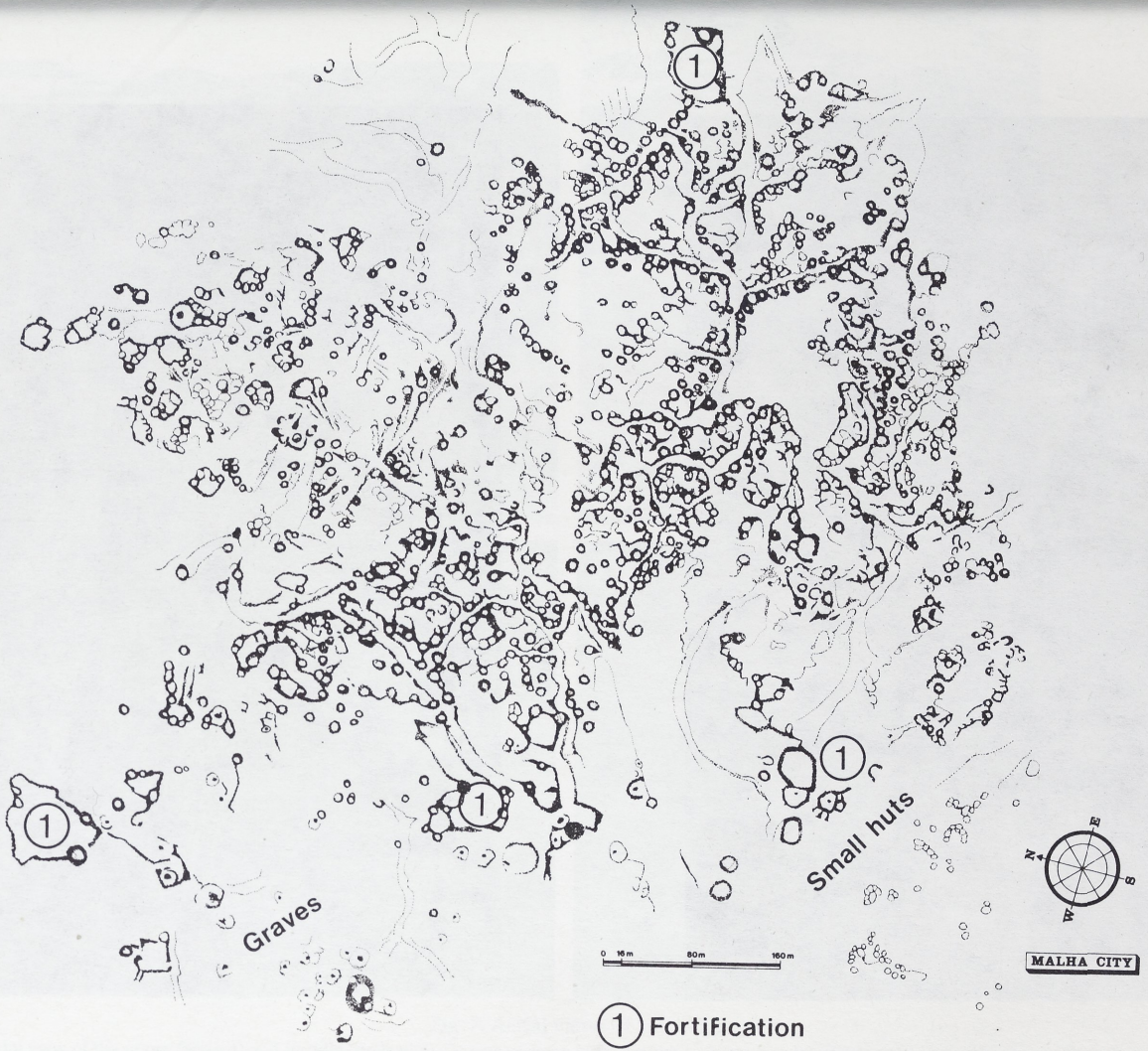
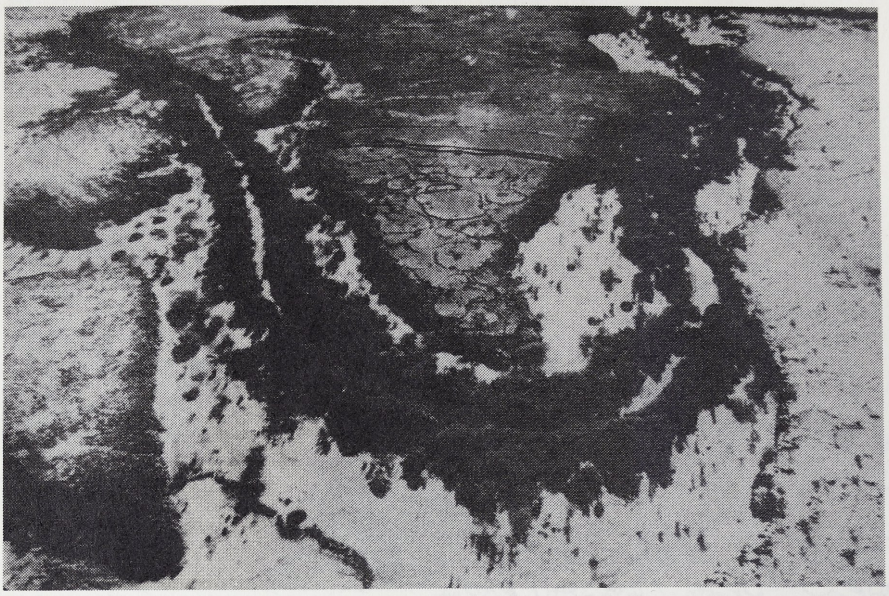


Fig. 5. Plan of Malha city.



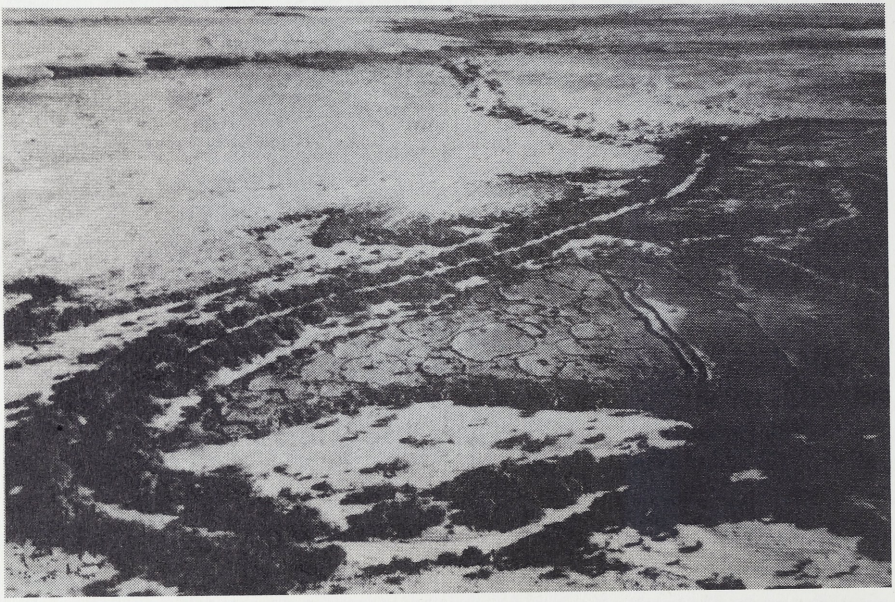


Fig. 6. Two aerial views of Seringeti.

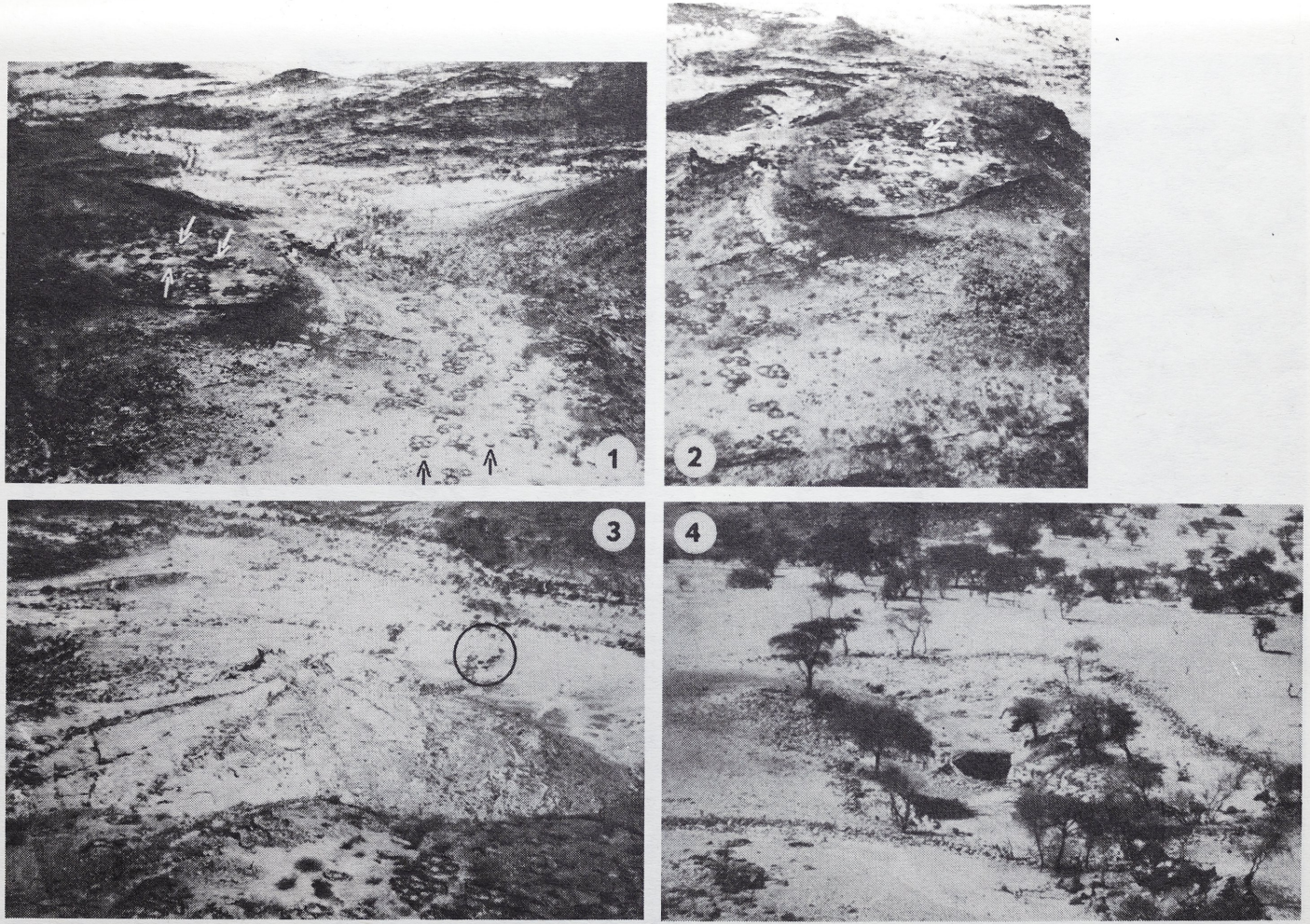


Fig. 7. Aerial views of Mao city;
1 - 2: aerial view of the upper (walled) and middle levels with clusters of stone huts. Arrows indicate circular, flat-topped graves; 3: view of the valley at the foot of Mao. Large well encircled; 4: well situated in a (dug-out?) depression and encircled by a wall.

Fig. 8. Two graves at Mao.

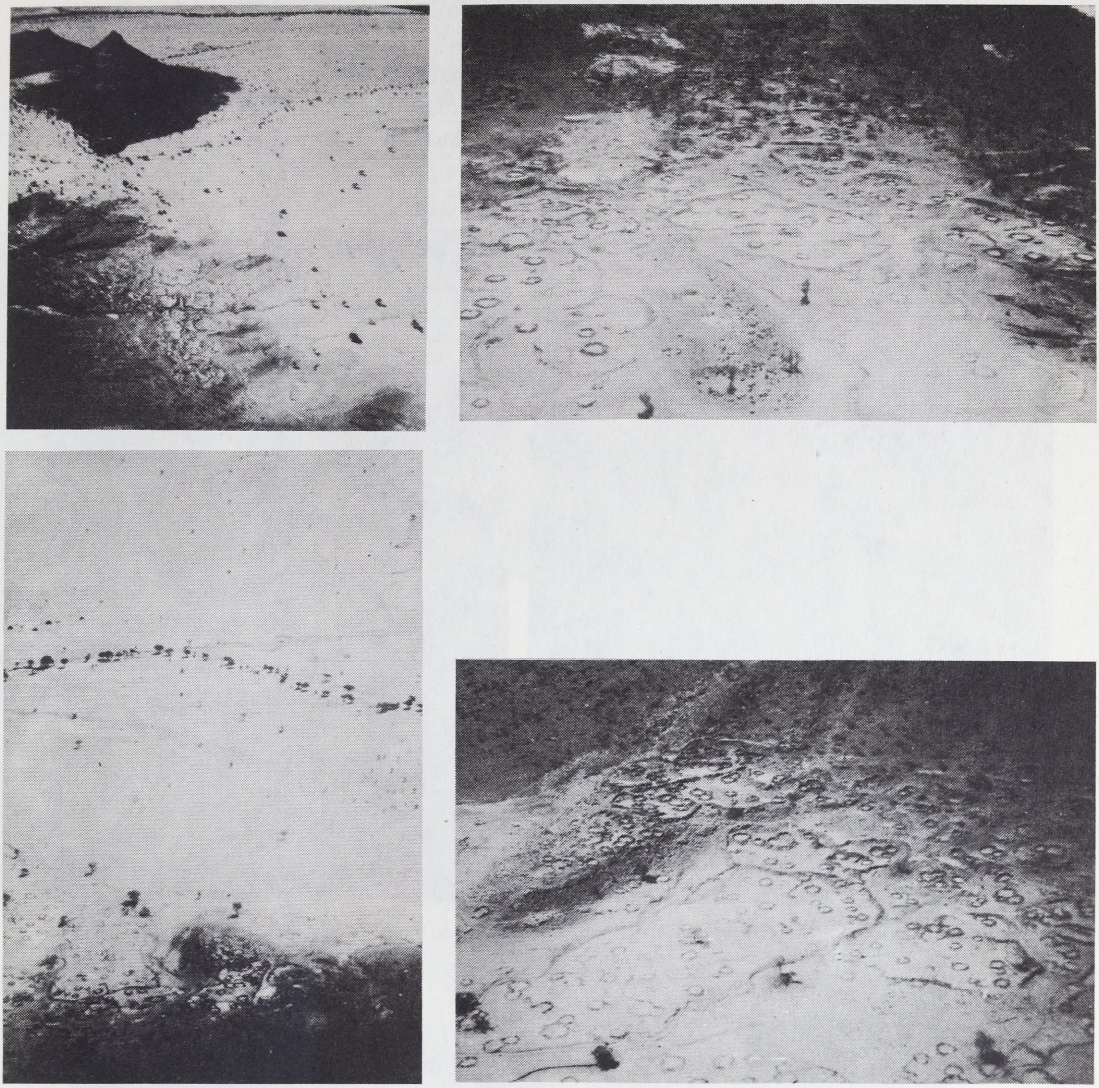


Fig. 9. Abu Garan. Various views of the site.

abound, and there is ample evidence for metal working and agriculture (contours of former agricultural plots – now buried under sand, could be identified from the air). The name given to this site by the Meidobi is Seringeti. Arkell (1951 - 1952) calls it Kerkera.

In the Tagabo Hills, two further "cities" were identified. The southernmost of the two is situated on an (artificially flattened?) hilltop (Fig. 7 - 8), and is walled. Stone huts, either solitary or in conglomerates also occur at two lower

levels: one halfway the slope to the sandy valley of an oued (Wadi Mao? Wadi Borung?), and one on the floor of that valley, where a huge well is situated in the deepest part of a dug-out excavations. That depression, several meters deep, may originally have been a hafir or a similar type of water collector. The site probably corresponds to the "red city of Mao", mentioned but not visited by Arkell (1951 - 1952).

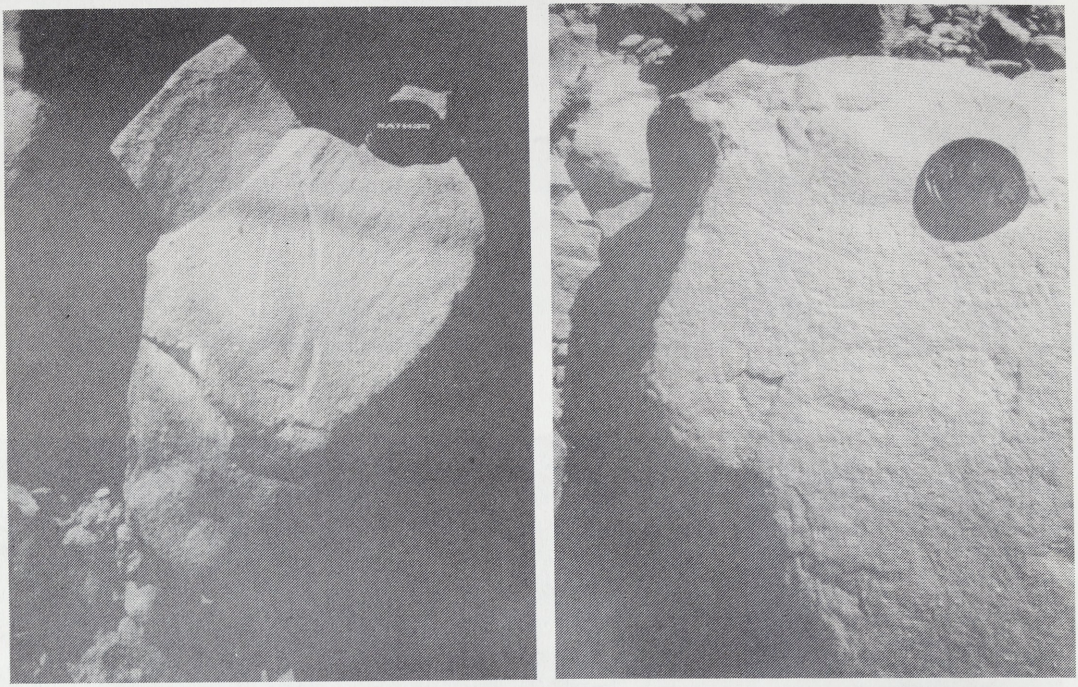


Fig. 10. Scratch-markings on rocks inside the ruins of Abu Garan.

Close to the north rim of the Tagabo Hills, a fourth and previously unrecorded city was discovered. From the dry floor of an oued (the Wadi Garad?), it runs up the steep slopes of a mountain to an altitude of more than 100 meters. Here, individual stone huts are carved out from the rock. A surface search revealed the usual pot sherds, stone implements, and strange markings on the rocks (Figs. 9 - 10). In a nearby rock shelter, primitive paintings represent human and camels, but it is not clear whether these are associated with the ruins (Fig. 11). The city is not walled, and there are no wells close to it. The local nomads call it Abu Garan (or Garad), and apply that same name to the mountain and to the oued. In northward direction, the Oued Garan joins the Wadi Magrur, which becomes indistinct in front of Jebel Tageru, but probably joins (or at least joined) the Wadi Howar.

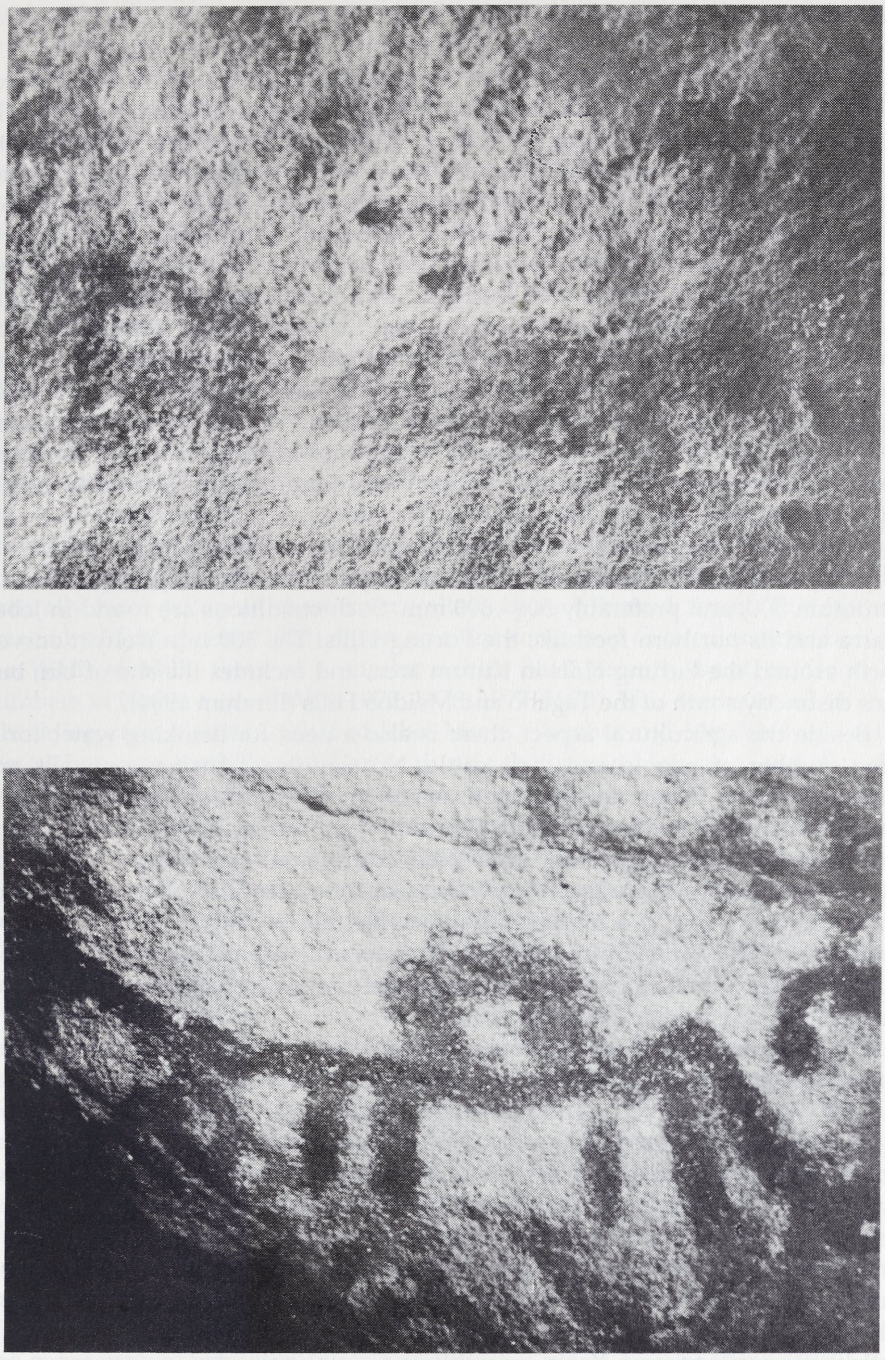


Fig. 11. Red ochre paintings, a human figure and a camel, in a rock shelter near Abu Garan.

Discussion

The history of Darfur, particularly the period after 1200 A.D. was discussed in an authorative way by Arkell (1951 - 1952). He assigns all desert stone-built cities of Jebel Marra, of Tagabo, and of Meidob to "medieval" and "post-medieval" periods. Explicitly included are the great town of Uri near Kutum, the "red-city" of Mao, Malha, and Kerkera (=Seringeti). From the sources examined by Arkell, there can be little doubt about his conclusions as far as Uri, and perhaps even Mao go, but we have serious problems to follow him for the sites of Abu Garan, Malha, and Seringeti. The former two had a capacity of about 6,000 inhabitants. The third, including the surrounding villages, was of the same order of magnitude. While the structure of Mao, with paved streets, hewn blocks of sandstone, circular graves with flat top, and an upper level separated from the lower levels by a wall indicates a peculiar form of social stratification, hence, perhaps a "recent" origin, such is not the case for the three northern cities. These, among other things, share a uniform, undiversified building style, and tumulus graves.

For cities of this size to evolve, rainfed agriculture with a low probability of crop failure would be necessary, and this requires an annual precipitation of minimum 300, and preferably 500 - 600 mm. Such conditions are found in Jebel Marra and its northern foothills, the Furung Hills. The 300 mm isohyet curves north around the Furung Hills in Kutum area, and includes the site of Uri, but runs distinctly south of the Tagabo and Meidob Hills (Ibrahim 1984).

Beside the agricultural aspect, there is also a need for drinking water for a large number of people and their cattle. No significant springs or wells are found near Abu Garan and Seringeti, while at Malha fresh water occurs in a number of springs inside the crater. This supply, however, is not even sufficient for the present population of the area. When, during our stay there, the pump of the government borehole broke down, a rush for water from the crater began. The springs ran dry in a matter of days, while the Ph values of the water extracted from the wells around the lake rose to over 9.0 and the water became saline, as lake water rather than groundwater was being drained towards the wells.

Our climate curve does not argue for a substantial increase in precipitation during the 1st and 2nd millennia A.D. Arguments in favor of such an amelioration by Nicholson (1981) were derived from Browne's (1799) writings, but are equivocal. Ameliorations, if any, may have occurred over periods of decadal length, but there is no evidence from the core that in historical times places like Malha ever received a precipitation of 300 mm $\cdot$ y^{-1} except in single wet years. Yet, the concentration of sizable towns (assuming these were inhabited simultaneously) in the Meidob and Tagabo Hills suggests the population which may have been sedentary, and a multiple of the present 2 - 3 inhabitants per square kilometer. A study of recent sedimentation rates in Lake Malha, derived from Pb dating (Richardson and Yates, unpublished data) provided no evidence for changes in sedimentation rates over the past two centuries, except since the

1930s. This, however, reflects the demographic explosion of the present time, and measures todays' man-made desertification.

The question remains how far back in time the origin of the towns should be situated. If they are older than the 2nd millennium A.D., they should also antidate the extremely dry period of 3,000 - 2,000 B.P. Periods I - IV, on the other hand, are acceptable candidates. In particular, period I seems attractive, since it was not only the most humid of all, but was felt as far north as Wadi Howar (Kuper 1988). This would push their roots back to pre-Meroitic times. Is such remote date possible? The present Meidobi have no traditions that link them with the cities, which they uniformly call "Abganaan". They trace their homeland back to the Dongola area of the Nile. This indicates that it was feasible to travel between the Nile and Darfur along the Wadi Howar–Wadi Magrur and the Wadi el Milk. However, this trip is still quite a normal one to-day, especially during the cool season. What is impossible here today, and has remained so for a few millennia, is the establishment of truly permanent settlements. Conversely, in the humid spells of the Middle Holocene (periods I - IV of Fig. 3), corresponding to a precipitation of 400 - 600 mm $\cdot$ y^{-1}, the rivers mentioned were running either permanently, or intermittently but in a predictable way. Sedentary people later retreating to the Nile Valley and Darfur would naturally have occupied these river valleys in such humid times. This is confirmed by McMichael's (1918) report on ruins composed of circular stone huts in the Wadi el Milk. Sites of a similar nature have recently been recorded in numbers in Nubia as well (Vila 1975; 1976; 1977; 1978). This seems to tell us that a building style similar to that of Jebel Marra, Tagabo, and Meidob was widespread between the Nile and Darfur during the humid Holocene, and that the towns in Wadi el Milk, Meidob, and most of Tagabo were deserted during the droughts of 3,000 - 2,000 B.P. but others continued to be inhabited, and were further elaborated upon as the "Tora" style, further south. In fact, the modern Fur villages on Jebel Marra are still constructed in much the same manner, in contrast to the *zaribas* of the Meidob and Berti tribes.

The Mid-Holocene ease of exchanges between the Nile and Darfur is also supported by the biogeographic argument. We analyzed the relict aquatic fauna of the surface waters of Meidob (the springs in Malha crater, the springs of Sjachacha, and the guelta of Sereif). There is today a complete absence of fish here, although fish were present as far north as Wadi Howar some 4,000 years ago (Kuper 1988). This reflects the effect of the severe dry spell of 3,000 - 2,000 B.P. The subsequent wetter period was not wet enough to permit fish to recolonize the area. Quite interestingly, among the extant invertebrate relicts, two Asiatic elements occur (the dragon-flies *Orthetrum sabina* and *Orthetrum taeniolatum*). These reached northern Darfur having first descended the Nile, while now dry wadis were still active. Needing much less water than fish for their larvae to develop, they may have survived where fish perished. On Jebel Marra fish are still plentiful (Bailey-Watts and Rogers 1970), indicating that the droughts never had a devastating impact on that area. The Jebel Marra aquatic fauna is still rich and largely Afrotropical. Its flora (Wickens 1976) has a similar composition: few

palaearctic and oriental elements, but a wealth of tropical savannah and rainforest species. All these data support the strongly increased, though northwardly declining, humid climates of the Early and Middle Holocene. With the advent of the extremely arid interval of 3,000 - 2,000 B.P., much human culture and animal and plant life was wiped out between the Wadi Howar and the Tagabo Hills, but not on Jebel Marra and only in part of the Furung Hills. The historical climate improvement was not sufficient to permit a complete restoration, even in the Meidob Hills.

Conclusions and recommendations

In order to resolve the apparent paradox between the network of stone sites of the Meidob and Tagabo Hills, the presumed early 2nd millennium A.D. age of these sites, and the climatic circumstances which argue against this recent origin, the founding of the towns should be pushed back in time to the Middle Holocene. If this could be confirmed, it would suggest a very early, common origin for the later Meroitic culture of the Nile Valley, and the Tora culture of Darfur. Proper excavations and dating will be necessary to test this hypothesis.

Acknowledgements

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