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Some implications of Late Palaeolithic cereal exploitation at Wadi Kubbaniya (Upper Egypt)

The recent discovery of several grains of barley in a Late Palaeolithic site, dating between 17,000 and 18,000 B.P.,[1] at Wadi Kubbaniya near Aswan, Egypt, is perhaps known to all of you (Wendorf, *et al.*, 1979) (Fig. 1). As you will hear later in this symposium, a grain and inflorescence fragment of einkorn wheat have also been identified from this site. These discoveries have challenged some of our previous assumptions about when intensive utilization of cereals began, where the first steps toward food production occurred, and the social and economic consequences of this development. It is understandable, therefore, that these discoveries are disturbing to many of us, long accustomed to the belief that food production was a post-Pleistocene phenomenon which began in the Near East and spread from there to Africa and Europe. It is fair to say that a healthy degree of skepticism greated the initial announcement of the Kubbaniya discoveries. It was felt that there must be some mistake: the grains must have been accidentally intruded into the site, or else the site must not be dated correctly, or the grains have been incorrectly identified.

The discovery, however, should come as no surprise to those who are familiar with recent work on the prehistory of the Nile Valley in Egypt and northern Sudan. In the mid-1960s several sites in this general area were reported to contain numerous grinding stones, and one of these sites yielded pollen from a large, unidentified cereal-type grass and wheat rust spores. The same site also produced several lithic pieces with lustrous edges, presumably from use as sickles. The sites with grinding stones occurred as far south as the Second Cataract, and northward to Kom Ombo. Several radiocarbon dates placed these sites with grinding stones between 14,500 and 13,000 B.P. (Butzer and Hansen, 1968; Wendorf, 1968).

Farther north, near Isna, Egypt, other sites with grinding stones and lustrous edged pieces (sickles) were found and dated between 12,600 and 12,000 B.P. (Wen-

[1] It is obvious that these dates need to be confirmed by individual dating of the original cereal grains.

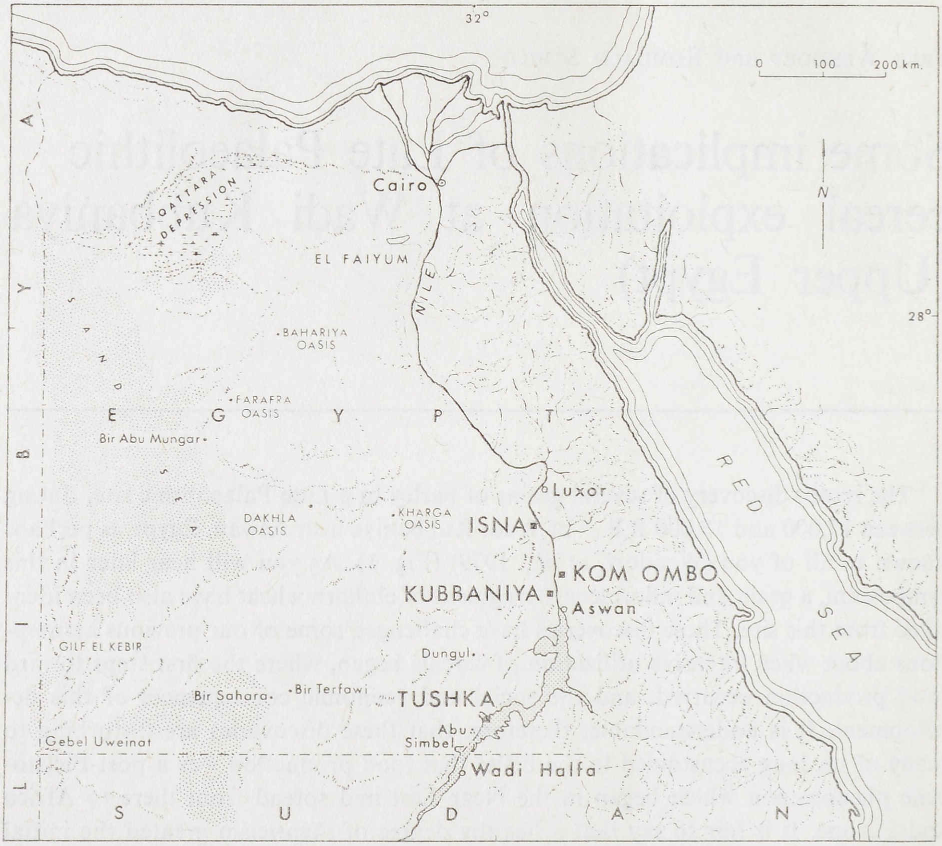

FIG. 1. Map of Egypt showing location of Kubbaniya and other localities discussed in text

dorf and Schild, 1976: 69 - 75). A nearby fossil pond yielded grains of a cereal--type pollen, indentified as barley. The cereal-type pollen occurred sporadically throughout the pollen profile, and suddenly became numerous (10 - 15% of the total pollen) near the top of the sequence, roughly contemporary with the Late Palaeolithic occupation.

These discoveries had shown that ground grain was intensively used in the Nile Valley in southern Egypt, and that there were reasonable grounds to believe that these utilized grains included barley, and perhaps other Mediterranean cereals. The recent finds at Kubbaniya, therefore, should be seen as entirely consistent with previous data from the Nile Valley. The new finds merely extend our knowledge of the grain-using complex backwards in time some 3,000 to 3,500 years, and provide specific information on the identities of the grains utilized. Instead of being surprising, the Kubbaniya finds should be seen as entirely expected.

The question of wheather the cereals recovered were somehow accidentally intruded into the sediments at Kubbaniya can best be discussed by considering first, the geomorphic setting in which the sites occur; second, the stratigraphy of the site; and third, the nature of the remains.

Around 20,000 years ago the desert adjacent to Wadi Kubbaniya was hyper-arid, deflation scoured the landscape, and the Nile was confined to a narrow channel. Shortly thereafter, before 18,000 years ago, the river began to aggrade, and during periods of high water the floodplain extended up the dry wadi bed a distance of more than 3 km. as a large embayment. The bed of the floodplain was about 95 m. above sea level. Vegetation, sustained by these floodwaters, grew along the edge of the floodplain, and began to trap some of the sand which was moving into the wadi, driven down the scarp along the sides of the wadi by strong northerly winds. Thus began a complex process of simultaneous dune and silt accumulation which continued until, finally, the dune completely blocked the mouth of the wadi and a pond formed by seepage behind the dune. The maximum height of the dune barrier is not known, but the highest trace of the seepage pond is 17 m. (112 m. above sea level) above the lowest sand/silt sediments, and the dune barrier presumably stood somewhat higher (Fig. 2).

Almost immediately after the sand/silt accumulation began, the dunes adjacent to the wadi were occupied by Late Palaeolithic groups, no doubt drawn there by the opportunity to take the fish which had been carried into the dunes by the flood and then trapped in the swales and low areas as the flood receded. These first Late Palaeolithic occupants at Wadi Kubbaniya also brought with them a fully developed grain-using technology, including numerous crude but adequate milling stones and handstones, but no sickles, so far as is presently known. Except for the grinding stones, the lithic assemblages are entirely consistent with other Late Palaeolithic complexes in the Nile Valley of comparable age.

Most of these dune sites have evidence of multiple occupations, often separated by thin lenses of aeolean sand. In addition to the lithics, the dune sites yielded numerous faunal remains, mostly fish, but also wild cattle, hartebeest, gazelle, hippo, and numerous bones of ducks and geese, of species which today are winter visitors to Egypt. These avian remains suggest that the dune sites were occupied during the winter months. If the Nile flood occurred then as today, in late August and September, the sites also must have been occupied during the early fall as well, when fishing would have been the most productive.

Besides the dune settlements, there is evidence that the same Late Palaeolithic people were using the adjacent floodplain. These floodplain sites differ from those in the dunes in several important features. First of all, there are no traces of grinding stones; secondly, they yielded few remains of fish; thirdly, there were no winter birds; and fourthly, gazelle were more important than hartebeest in the faunal remains. These sites are seen as dry season camps, and during this period it seems that processing of cereals was not an important economic activity.

As the accumulation of the sand and silt continued in the wadi, these earlier

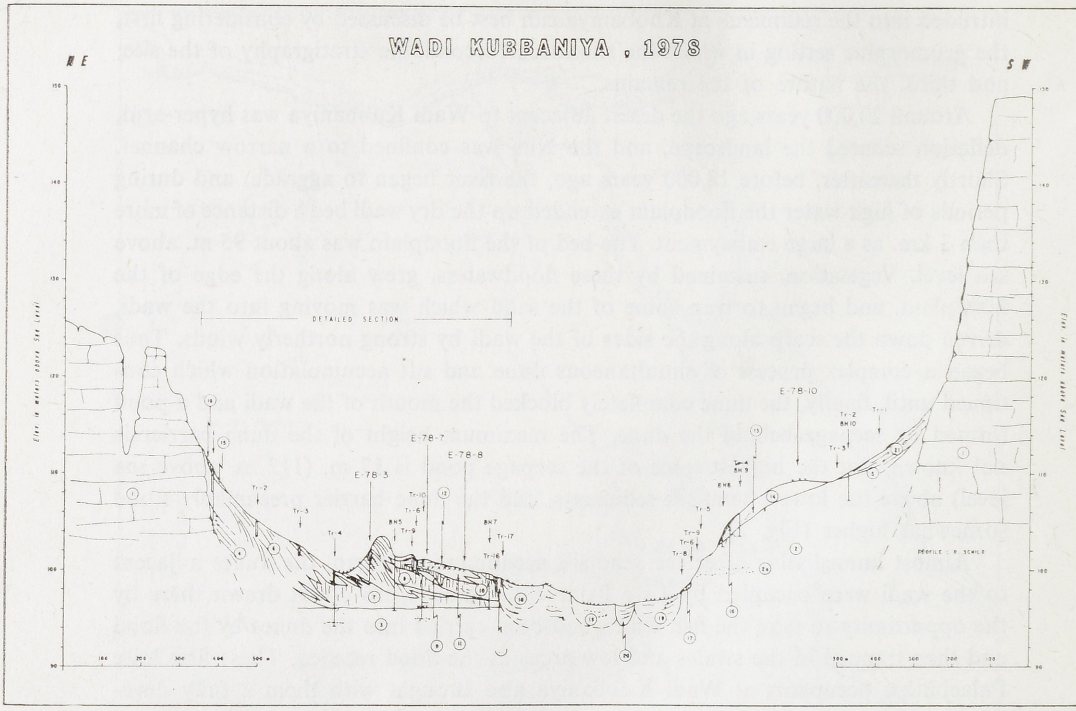

FIG. 2. Transect across Wadi Kubbaniya

1: Nubian sandstone; *2* and *3*: Cemented wadi sand and gravels; *4*: Sandy slope wash; *5*: "Old" slope wash, contains pebbles unit 2: *6*: Dune, very deflated, shows foreset beds and slopes interfingering with silt, and lenses of cultural materials; *7* and *8*: Silt and sandy silt; *9*: Coarse aeolean sand; *10*: Lower vertisol clay; *11*: Cemented silty sand with dense cultural material *12*: Upper vertisol clay; *13*: Casts of plant roots; *14*: Remnant of dune formed in later phase of dune accumulation; *15*: Diatomaceous pond silt with snail breccia; *16*: Brown silt; 17 - 20: Wadi sands and gravels; *21*: Loose slope wash

Late Palaeolithic occupations (both the dune and floodplain sites yielded several radiocarbon dates between 18,240 and 16,960 years ago) were buried beneath 10 to 15 m. of accumulated sand and silt. The dune barrier, with its enclosed archaeological remains, stood as a huge block, over 2 km. thick at its base and 20 m. or more high, extending across the entire wadi, blocking the mouth. Around 12,000 years ago large lake formed behind the barrier, fed by seepage from the higher Nile floods. There is no evidence of wadi discharge into the lake, indicating that local rains were extremely rare. Final Palaeolithic groups occasionally camped around the ponds.

Shortly after 12,000 years ago the level of the Nile fell to an elevation below the modern floodplain, but the huge sand/silt barrier at the mouth of Wadi Kubbaniya probably continued to block the wadi until the Early Holocene, when the adjacent desert began to receive rainfall and the runoff down Wadi Kubbaniya cut through the barrier, leaving remnants on both sides of the wadi. Modern deflation continues to erode the sand and silt remnants, and has exposed parts of the earlier Late Palaeolithic settlements near their base. The lenses of silt and sand, and enclosed occupation horizons, are clearly preserved at the sites, until recently protected by the thick overburden of the dune barrier (Fig. 3).

These lenses of silt, sand, and occupation horizons are still evident at Site E-78-4, which yielded the carbonized remains of barley and einkorn wheat. On Fig. 4 may be seen a map of the site showing the distribution of artifacts and the two areas worked. One of the studied areas was only surface collected, but at the second area,

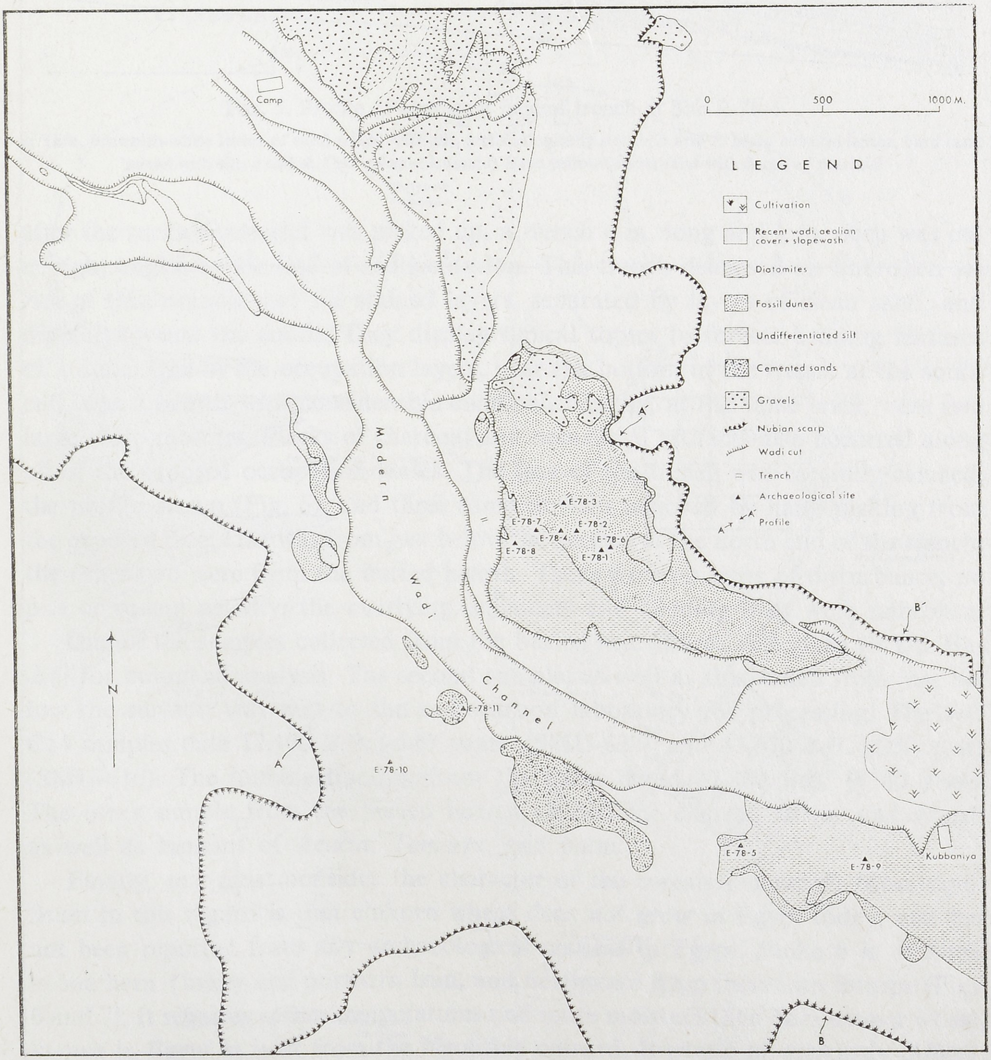

FIG. 3. Map of Wadi Kubbaniya showing location of the sites investigated and the extent of the major geologic units. The Nile river is off the right edge of the map

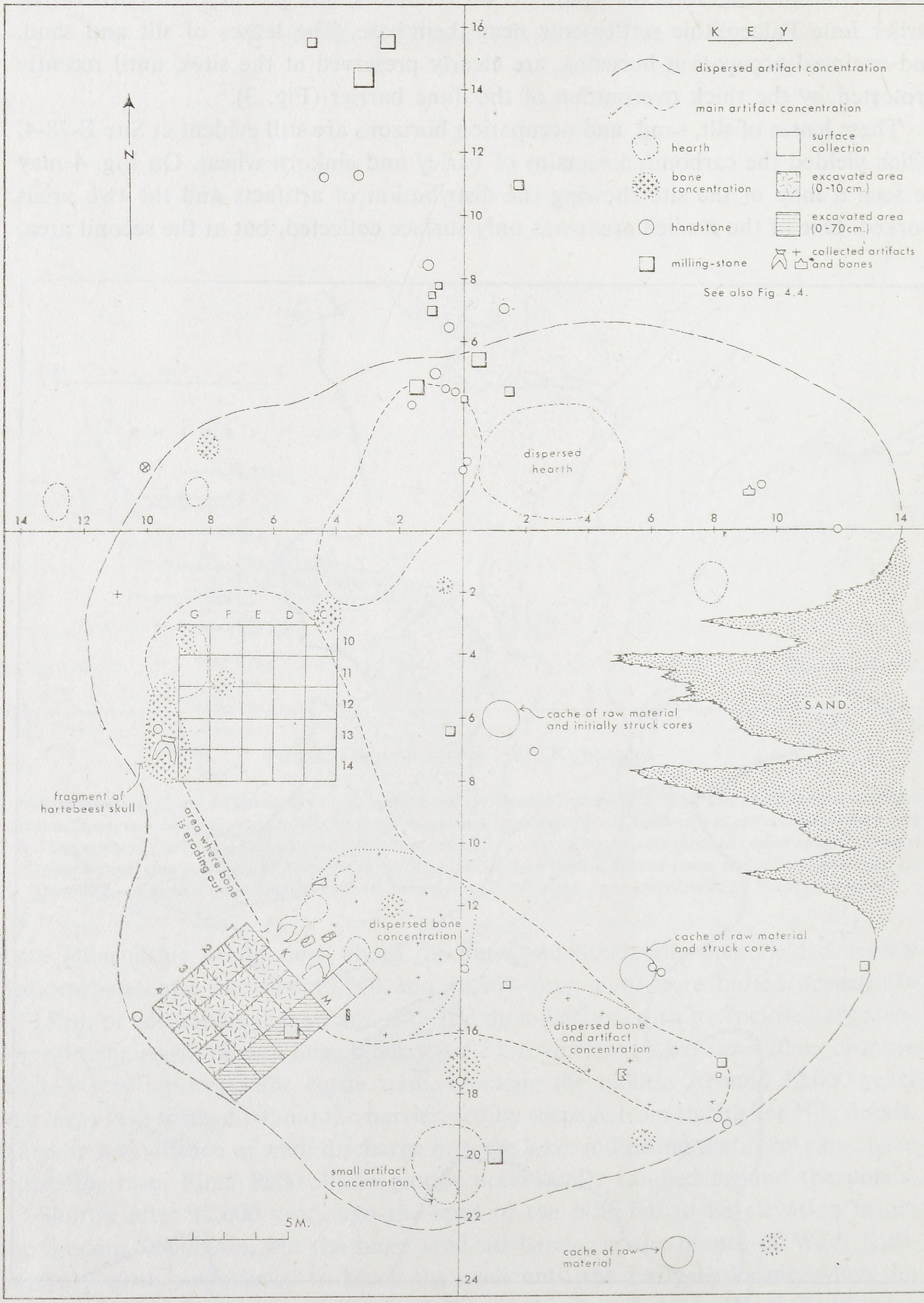

FIG. 4. Map of Site E-78-4 showing areas collected and tested

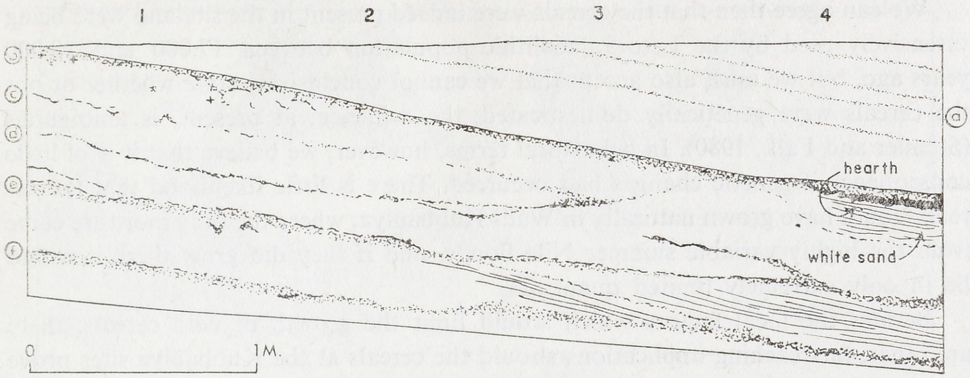

FIG. 5. Profile of southeast face of trench at Site E-78-4

a: Thin, brownish-white lenses of sand mixed with silt, archaeologically sterile; *b* and *e*: Main cultural lenses, hard sand mixed with silt; *c* and *d*: Thin cultural lenses; *f*: Hard yellow-brown sand with flecks of charcoal

after the surface material was picked up, a trench 4 m. long and 1 m. deep was cut at right angles to the line of sedimentation. This trench disclosed an unbroken series of thin organic and silt stained layers, separated by layers of clean sand, and dipping toward the south. They display typical topset to foreset bedding features of a dune. One of the occupation layers, near the bottom of the trench at the south end, was a hearth with considerable charcoal. Nearby, at the same level, were two large, deep mortars. Flecks of charcoal and occasional artifacts also occurred along all of the exposed occupation lenses. The face of the trench was carefully cleaned, the profile drawn (Fig. 5), and three samples were removed by hand picking from the exposed face. One was from just below the surface at the north end of the trench; the other two were from the buried hearth. There were no signs of disturbance, no pits or rodent activity; the overlying sediments and bedding lines were unbroken.

One of the samples collected from the buried hearth area was given to Dr. Hadidi for botanical analysis. The second sample, as well as that taken from just below the surface, was sent to the radiocarbon laboratory for processing. The two C14 samples date 17,100 B.P. ± 540 years (SMU-623) and 17,670 B.P. ± 250 years (SMU-616). The humate fraction from the latter dated 17,380 B.P. ± 340 years. The other sample from the buried hearth yielded the charred barley and wheat, as well as remains of *Acacia*, *Tamarix*, and palm.

Finally, one must consider the character of the cereals recovered. Most significant in this regard is that einkorn wheat does not grow in Egypt today, and has not been reported from any archaeological context in Egypt. Einkorn is at home in southern Turkey and northern Iran, and northward from there into Europe (Figs. 6 and 7). It requires cooler temperatures and more moisture than does emmer wheat, known in Egypt at least from the Neolithic onward. It would be extremely difficult to account for the presence of the einkorn at Wadi Kubbaniya by deriving it from a later settlement.

We can agree then that the cereals were indeed present in the site and were being intensively used by the Late Palaeolithic population between 17,000 and 18,000 years ago, but we must also accept that we cannot conclusively state whether or not the cereals were genetically domesticated; the evidence, at present, is ambiguous (Stemler and Falk, 1980). In behavioral terms, however, we believe that it is of little consequence if genetic changes had occurred. There is little likelihood that the cereals would have grown naturally in Wadi Kubbaniya, where the only moisture came from the highly variable summer Nile floods, and if they did grow there it would be in only extremely limited quantities.

Besides the local factors which would limit the growth of wild cereals, there are other, far-reaching implications should the cereals at the Kubbaniya sites prove to be wild. If wild wheat and barley were growing along the Nile in southernmost Egypt 18,000 years ago, they were sustained by the moisture from the Nile floods. Local rainfall was insignificant; it was certainly no more than today, and probably less. If the cereals present at Kubbaniya were indeed wild, then they must have been present along the entire Nile, northward to the Mediterranean, and more sig-gnificantly, there is no reason why they should not have been present as far south as Ethiopia. There is no evident barrier which would confine wild cereals sustained by Nile floods to southern Egypt. In fact, between the Mediterranean and the Ethiopian highlands, southern Egypt is the least favorable region for the growth of cereals. This hypothetical distribution of cereals in the Late Pleistocene is markedly different from most currently accepted reconstructions of cereal distributions for that period. Before we reject it, however, perhaps we should recall the earlier suggestion by Vavilov (1926) that Ethiopia was the locale where wheat and barley were first domesticated.

Thus we see that the Kubbaniya cereals pose enormous problems, whether wild or domestic. In some respects, the complications are less severe if they are domestic, but this requires that the process of planting, harvesting, and storage (at least of seed stock) began earlier than we previously believed.

Regardless of the eventual resolution of this question, we are left with the conclusion that the first known Late Palaeolithic occupants in this portion of the Nile Valley already possessed, when first seen, an economy which placed considerable emphasis on cereals as an integral portion of their diet. We do not know if these first Late Palaeolithic cereal users were recent migrants into the Kubbaniya area, or developed locally. There is no archaeological record anywhere in Egypt or northern Sudan which can be placed in the interval from the latest Middle Palaeolithic, dated at more than 35,000 years ago, and the Kubbaniya sites.

It is interesting to note, however, that the Kubbaniya lithic complex has few resemblances to any of the known industries in the Levant, but there are close parallels with the Ibero-Maurusian of Cyrenaica and the Maghreb, where the earliest occurrences are comparable in age with the Kubbaniya finds. A generally North African origin for these complexes would seem to be indicated.

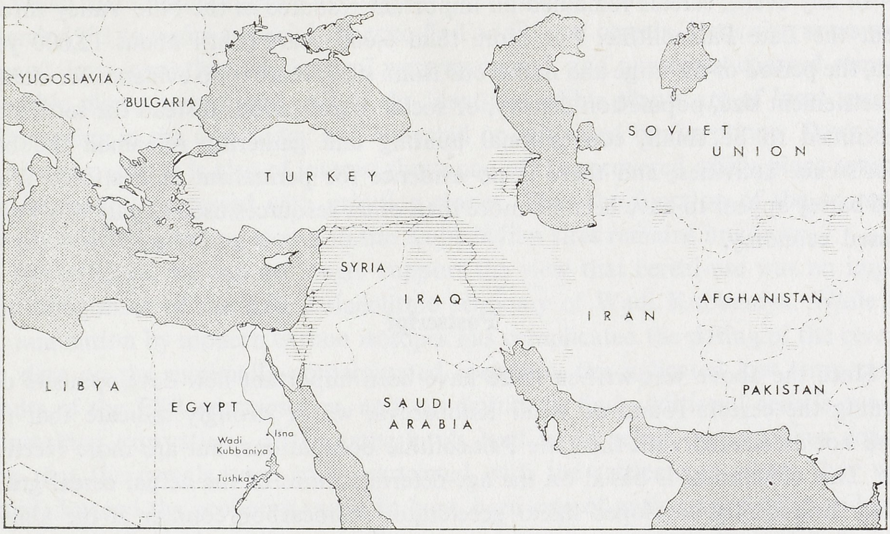

FIG. 6. Map showing known modern distribution of wild barley (after Harlan and Zohary, 1966 Fig. 1)

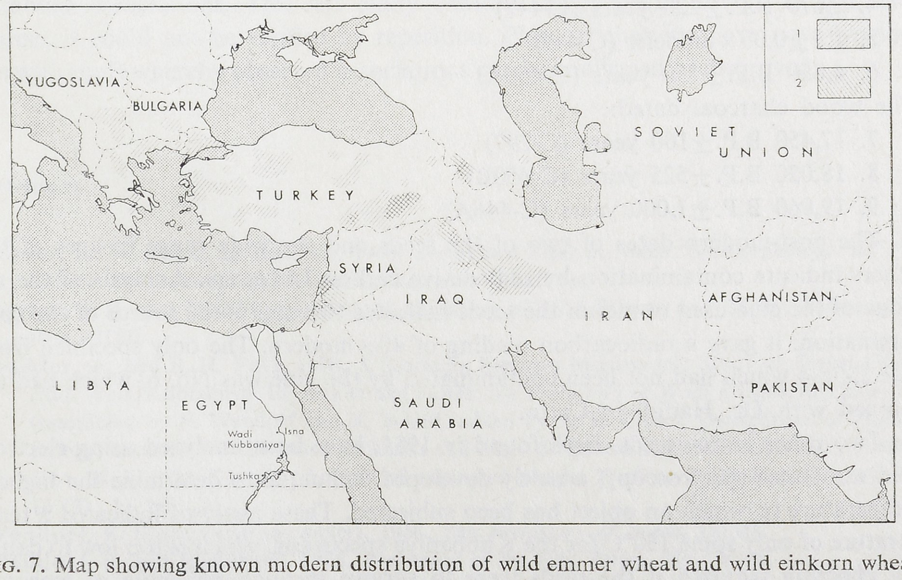

FIG. 7. Map showing known modern distribution of wild emmer wheat and wild einkorn wheat. Note the more northerly distribution of einkorn wheat (after Harlan and Zohary, 1966, Figs. 3 and 4)

1: Einkorn wheat *2*: Emmer wheat

In any event, cereals remained an important resource in the Nile Valley throughout the Late Palaeolithic. For more than 6,000 years (until about 12,000 years ago, the period of the large and numerous Isnan sites) there is no evidence for changes in settlement size, population density, or social organization. Instead the settlements continued to be small, conventional hunting and gathering remained the basic subsistence activities, and there is no evidence for permanent habitations. Wheat and barley appear to have been no more than other resources used as part of a broad-based economy.

Postscript

Since the above was written there have been important new developments concerning the cereals found at Wadi Kubbaniya, which strongly indicate that they were not associated with the Late Palaeolithic occupations, but are more recent in age. This conclusion is based on the age-determinations of the actual cereal grains, using the recently developed linear accelerator radiocarbon counter at the University of Arizona in Tucson.

Four of the grains found in 1978, and two others found in 1981 were dated, together with three pieces of wood charcoal. The cereals dated as follows:

1. 820 B.P. $\pm$500 years (C-299)
2. 1,090 B.P. $\pm$500 years (C-298)
3. $2.4 \pm 0.05 \times$ modern (C-448A)
4. 2,670 B.P. $\pm$220 years (C-447)
5. $1.3 \pm 0.05 \times$ modern (C-449)
6. 4,850 B.P. $\pm$150 years (C-450A)

The wood charcoal dated:

7. 17,450 B.P. $\pm$100 years (C-297)
8. 18,020 B.P. $\pm$525 years (C-450B)
9. 19,060 B.P. $\pm$1,000 years (C-446A)

The post-modern dates of two of the seeds and the wide range in ages of the others indicate contamination by radioactive carbon-14 tracers. Analysis of the residue of the glue used to mount the seeds indicates that this is the source of the contamination: it gave a radiocarbon reading of $40 \times$ modern. The only specimen from Site E-78-4 which had not been contaminated by the glue was No. 6, which had remained with Dr. Hadidi in Cairo.

Two other barley seeds, both found in 1981, have been analyzed using electron spin resonance spectroscopy, a newly developed technique to determine the highest temperature to which an object has been subjected. These analyses indicated a temperature of only some 150°C for the Kubbaniya specimens, which is too low to cause the charring required if the seeds were to survive through millennia of seasonal flooding. The fact that they had not been charred suggested that these two barley seeds were not truly associated with the Late Palaeolithic site where we found them.

When these results became available we returned to Wadi Kubbaniya in January--March 1983 to make a special effort to find additional cereals. Extensive areas were opened, large quantities of charcoal were recovered, and numerous charred remains of edible plants were found. All of the identified edible plants are of local species, still growing in the area today and collected or cultivated by Egyptians. There were no more cereals. It is also of interest that none of the recovered edible plant remains can be readily processed with grinding stones. Thus the function of the scores of heavily utilized grinding stones in the Kubbanyian sites remains unknown.

Nevertheless, we can no longer support the view that cereal-use was an important component of the Late Palaeolithic economy of Wadi Kubbaniya. While the contamination by modern carbon isotopes has complicated the dating of the cereals, the date on the minimally contaminated specimen, the indicated low temperature results of the ESR spectroscopy, and our failure to find additional cereals even in painstaking excavations of the same levels lead us to reject our previous conclusion that the cereals were truly associated with the settlements where they were found. Instead the economy seems to have been one of gathering, fishing and hunting.

This experience has provided us with a vivid illustration of the difficulties inherent in determining associations in archaeological sites, particularly where small, fragile specimens are concerned. It is also an excellent example of the continuing contributions of the physical and chemical sciences to archaeology. Archaeologists in the past have had to rely entirely on visual observations during excavation to establish associations. This left many obvious opportunities for error and, even worse, it could not be verified by repetition. Physical chemists have now provided us with tools whereby observed associations can be confirmed or disproved.

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