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# Technological organization and sedentism in the Epipalaeolithic of Dakhleh Oasis, Egypt

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**Abstract**

At Dakhleh Oasis in south-central Egypt, a group of 'Epipalaeolithic' or 'Masara' sites featuring stone-built structures suggests a degree of sedentism that was unusual for the Eastern Sahara in early Holocene times. The paper investigates this apparent increased sedentism by focusing on the organization of lithic technology within the three Masara units defined in the oasis, including that with which the stone structures are associated. Information on three aspects of technological organization – the acquisition of raw material, core reduction sequences, and the portability of the resulting toolkits – when combined with evidence on other artifact categories and on site features and locations, points to a dramatic dichotomy within the Masara between small, highly mobile groups that ranged far beyond the oasis (Masara A), and a more sedentary element (Masara C), consisting of groups confined for at least part of the year to a particularly favoured locale in south-eastern Dakhleh.

**Résumé**

A l'oasis de Dakhleh, en Egypte Sud-Centrale, un groupe de sites Epipaléolithiques ou 'Masara' a livré des structures en pierre qui suggèrent un degré de sédentarisation peu courant pour l'Est du Sahara au début de l'Holocène. Cet article étudie l'accroissement apparent de la sédentarisation en se concentrant sur l'organisation de la technologie lithique au sein des trois unités 'Masara' définies dans l'oasis, y compris celle associée aux cercles de pierre. L'acquisition de la matière première, les séquences de réduction des nucleus, et le transport des outils qui en résultent sont des informations sur trois aspects de l'organisation technologique qui une fois combinées avec les données obtenues à partir d'autres catégories d'artefacts lithiques, de la configuration et de la situation du site, mettent en évidence une dichotomie très claire au sein du 'Masara' entre des groupes petits et très mobiles qui se déplacaient bien au delà du périmètre de l'oasis (Masara A) et un elément beaucoup plus sédentaire (Masara C) consistant en des groupes confinés pour au moins une partie de l'année dans un site particulièrement apprécié de la partie sud-est de Dakhleh.

## Introduction

With few exceptions, early Holocene archaeological sites of the Egyptian Western Desert and adjacent parts of the Nile Valley (Fig. 1) appear to be products of small, highly mobile groups. Such sites, variously labeled 'Epipalaeolithic', 'Terminal Palaeolithic', or 'Early Neolithic' (*e.g.* Vermeersch 1978; Wendorf *et al.* 1984), and dating from the tenth to the eighth millennia bp, tend to be small, ephemeral scatters of chipped stone and other artifacts, lacking features other than hearths. This is the case, for instance, with sites of three Early Neolithic entities in the Gebel Nabta and Bir Kiseiba areas of southern Egypt (Wendorf *et al.* 1984), contemporary sites on the Gilf el Kebir and at Abu Ballas to the west (Kuper 1981, 1988), and the Terminal Palaeolithic sites in Siwa Oasis (Hassan and Gross 1987:98 and elsewhere). Likewise, Qarunian sites at Fayyum Oasis appear to be camps of small groups of hunter-fishers (Wendorf and Schild 1976:317; Wenke *et al.* 1988:37), as does the site of Elkab in the Nile Valley north of Aswan (Vermeersch 1984). The pattern moreover extends far beyond the Western Desert of Egypt: throughout the Sahara, small, highly mobile groups seem to have been the norm in the early Holocene (Clark 1980:564; Holl 1989).

At the same time there is evidence for increased sedentism in a few favoured localities. In southern Egypt, some sites of the El Nabta entity feature pits, house foundations and deep wells, and have been interpreted as 'more or less permanent base villages' (Wendorf *et al.* 1984:422). Likewise in the Tadrart Acacus of south-western Libya, the presence of stone-built partitions in the rock shelter of Ti-n-Torha East suggests increasing sedentism in the latter half of the ninth millennium (Barich 1987:111 and elsewhere). To the south-west, at Adrar Bous 10 on the edge of the massif of Aïr, site size and quantities of locally made pottery may indicate a pattern of semi-sedentism at the end of the tenth millennium bp (Roset 1987:230).

In Dakhleh Oasis, south-central Egypt, recently discovered evidence also suggests some degree of sedentism in early Holocene times. A series of sites in the south-east corner of the oasis consists of clusters of stone structures which may be hut circles. These sites were discovered in the 1990 field season, and our knowledge of them is as yet limited. So far one site has been mapped but, save for one small test pit, not yet excavated. Consequently we have little information concerning features associated with these structures, or about site subsistence. In addition, dating evidence is still scarce.

Collections of chipped stone from one of these sites, however, differ in several respects from the lithics at early Holocene sites elsewhere in the oasis. These differences may reflect variations in mobility patterns within the oasis. This paper, then, investigates the degree of sedentism present in early Holocene Dakhleh, focusing particularly on the organization of lithic technology oasis-wide, and the light which this sheds on settlement systems in Epipalaeolithic or 'Masara'[1] Dakhleh.

If, as the presence of the stone structures suggests, there was a trend to greater sedentism in early Holocene Dakhleh, this in turn might reflect changes in subsistence patterns. This was a time when groups elsewhere in the Sahara, for instance at Nabta and at Ti-n-Torha, equipped with grinding stones and sometimes with pottery, exploited a wide variety of resources and may have begun producing food (Wendorf *et al.* 1984; Barich 1987). It is therefore important to determine the extent to which groups in Dakhleh, the largest oasis in

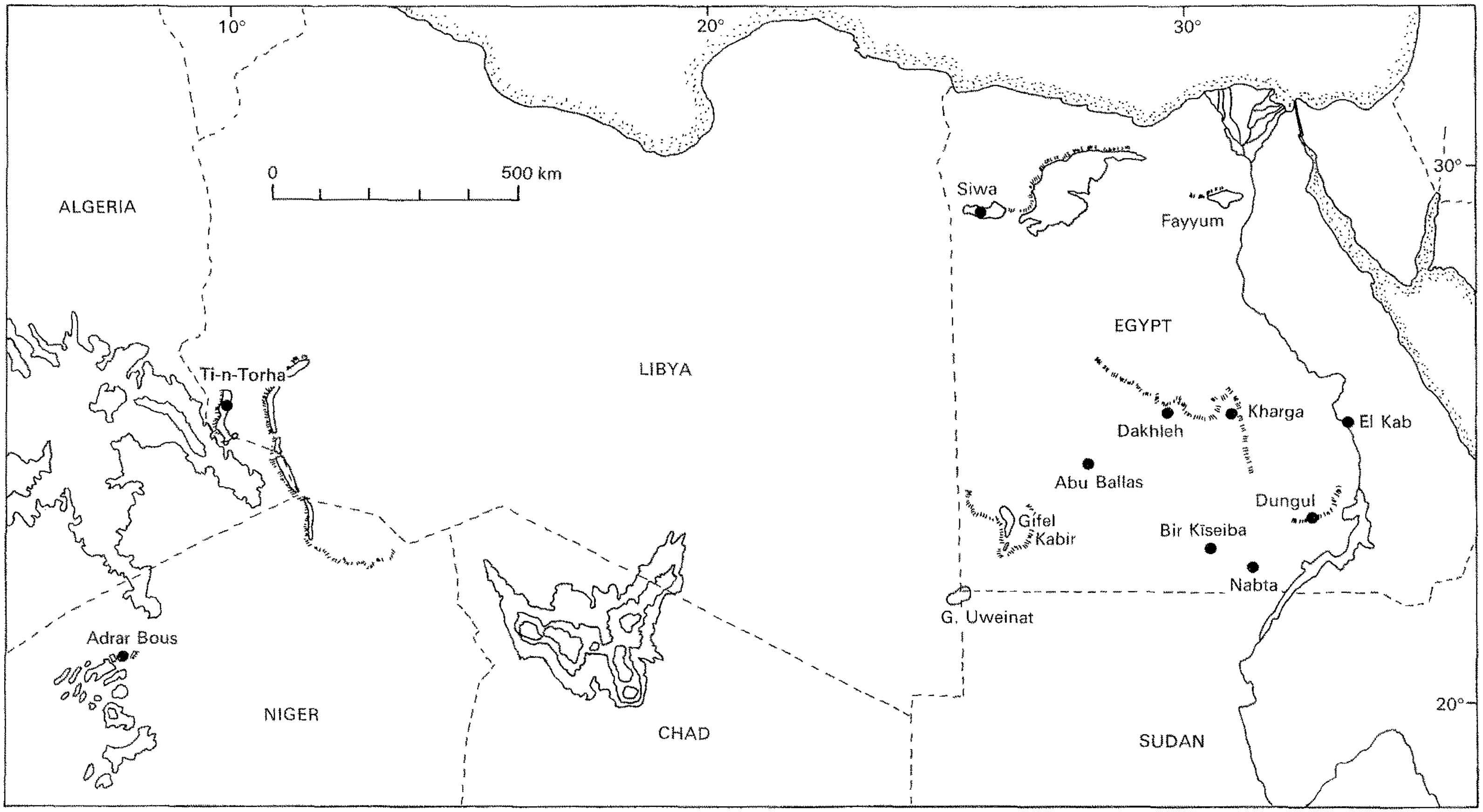



Figure 1 Map of North-east Africa showing location of sites mentioned in the text.

the Western Desert, participated in these changes. The answer could have important implications for, among other things, the current debate about the origin of agriculture and settled village life in the Nile Valley, and the role of the Western Desert in that transformation (Butzer 1976:10; Trigger 1983; Hassan 1986).

## Archaeological correlates of mobility patterns

In recent years the topics of settlement mobility among hunter-gatherer groups and of trends toward sedentism have received considerable attention in both the ethnographic and archaeological literature. The word 'sedentism' and its synonyms have been given various shades of meaning by archaeologists (*e.g.* Rafferty 1985; Hitchcock 1982:note 1). Rafferty (1985:115) would limit the term to settlement systems in which 'at least part of the population remains at the same locality throughout the entire year'. It seems unlikely, given the archaeological evidence and the postulated marked seasonality of the time (Neumann 1989; Hassan 1986) that any of the Dakhleh early Holocene sites would meet this criterion of year-round occupancy.

For groups not fully sedentary, Binford (1980), using information on the present-day Nunamiut Eskimo and San Bushmen, models two kinds of subsistence-settlement system entailing contrasting types of mobility: 'residential' and 'logistic'. Foragers practise residential mobility by moving the entire social unit from one resource 'patch' to another. Collectors applying logistic mobility, in contrast, move resources to the group. They establish a base camp from which task forces travel to harvest resources and carry them back to the camp. Various types of site result from these two patterns: foragers produce base camps and 'locations'; collectors, in addition, produce field camps, stations for information gathering, and caches. The dichotomy between the two strategies is not complete: the same group could employ mixes of the two in different settings. In general, logistic strategies are more likely to be selected under conditions of marked seasonality, or during shifts toward economic intensification and agricultural production.

The portion of the archaeological record to receive most attention in inferring mobility patterns is the chipped stone assemblage, usually the most prominent class of archaeological remains on hunter-gatherer sites. There is a growing body of evidence, both ethnoarchaeological and archaeological (Binford 1979; Kelly 1983; Shott 1986), suggesting that lithic assemblages are structured not just by functional considerations – what the tools are used for – but by a number of other properties of the cultural system, including the constraints imposed by settlement mobility. If, in turn, the organization of lithic technology – how stone tools are manufactured, used, and discarded – is affected in defined ways by mobility patterns, the converse should also be true: the structure of chipped stone assemblages will reflect or shed light on prehistoric mobility patterns.

Several features of lithic technological organization may supply information on mobility patterns in early Holocene Dakhleh. Binford (1977, 1979) emphasizes the distinction between 'curated' and 'expedient' technologies. Curated tools are produced for future needs, designed for multiple uses, transported from site to site, maintained and recycled. Expedient tools are informal implements produced as needed, used on the spot, and discarded. Binford links curation with a logistic strategy, and predicts that curated tools will be discarded mostly in base camps. Problems have arisen, though, with the precise definition of tool curation (Chatters 1987:34). Moreover, some evidence suggests that curation may result more from raw material shortages than from mobility patterns (Bamforth 1986). A more useful perspective for the Dakhleh material might be that of Parry and Kelly (1987) who stress the advantages of 'formal' – as opposed to expedient – tools, which provide portability and flexibility for highly mobile groups who sometimes lack access to good raw material. Parry and Kelly detect cross-cultural correlations between expedient technology and increasing sedentism.

A concept related to curation as discussed above is that of 'embedded procurement'. Binford reports that Nunamiut groups do not make special trips for raw material; rather, 'procurement of raw materials is embedded in basic subsistence schedules' (Binford 1979:259). If this is generally the case with hunter-gatherer groups (see discussion, in Gould and Sagges 1985 and in Binford and Stone 1985, of what may be a different practice in Australia), it follows that the presence of, for example, exotic chert at a site will indicate something of the range of territory habitually used by a hunter-gatherer group (Chatters 1987:349; Morrow and Jefferies 1989:33). Further, differences between sites in the number of sources of exotic cherts represented might be a rough index of the relative mobility of the inhabitants of those sites.

Carrying costs constitute another constraint imposed by mobility on technology (Torrence 1983). Sheer numbers of tools and types of tools will be limited by transportation costs. As mobility increases, tools should become less diverse, more versatile, smaller, lighter, and more portable. Conversely, as mobility, and particularly frequency of moves, declines, tool size and diversity should increase, with tools becoming more specialized (Shott 1986:20 ff.).

Aside from the organizaton of lithic technology, other portions of the archaeological record will also indicate the degree of sedentism within a group. As with chipped stone, inventories of various classes of artifacts and features should increase as mobility declines. A site serving as a base camp for an extended period, as opposed to a residential camp or field camp, should yield evidence for a variety of activities and, occasionally, some specialized technologies (Chatters 1987:342). Heavy or immovable implements, pottery, dumps, and various storage facilities might be present. One would expect also more substantial houses, often rectangular, frequently showing some patterning in site layout (Rafferty 1985). Other measures of mobility, such as faunal evidence of predation patterns (Binford 1978; Chatters 1987), cannot be applied to the heavily deflated Dakhleh remains.

## The Masara cultural unit within Dakhleh Oasis

Dakhleh Oasis, at 25.5° N. and 29.0° E., is located half way across the Egyptian Western Desert, at roughly the latitude of Luxor. The oasis (Fig. 2) is a depression approximately 70 km long from east to west, by 20 km wide, divisible into three main zones north to south (Brookes 1989). Bounding it on the north and east is a 300 m high limestone-capped plateau. From the foot of the plateau, the piedmont zone slopes southward to the central lowland, lying less than 130 m above sea level, and featuring a discontinuous belt of cultivation fed by artesian wells (the only water available today in this hyperarid area). South again, the third zone, with fossil spring terraces and spring mounds, old playas, and a sandstone cuesta or ridge, slopes upward a total of about 30 m to the desert plain beyond.

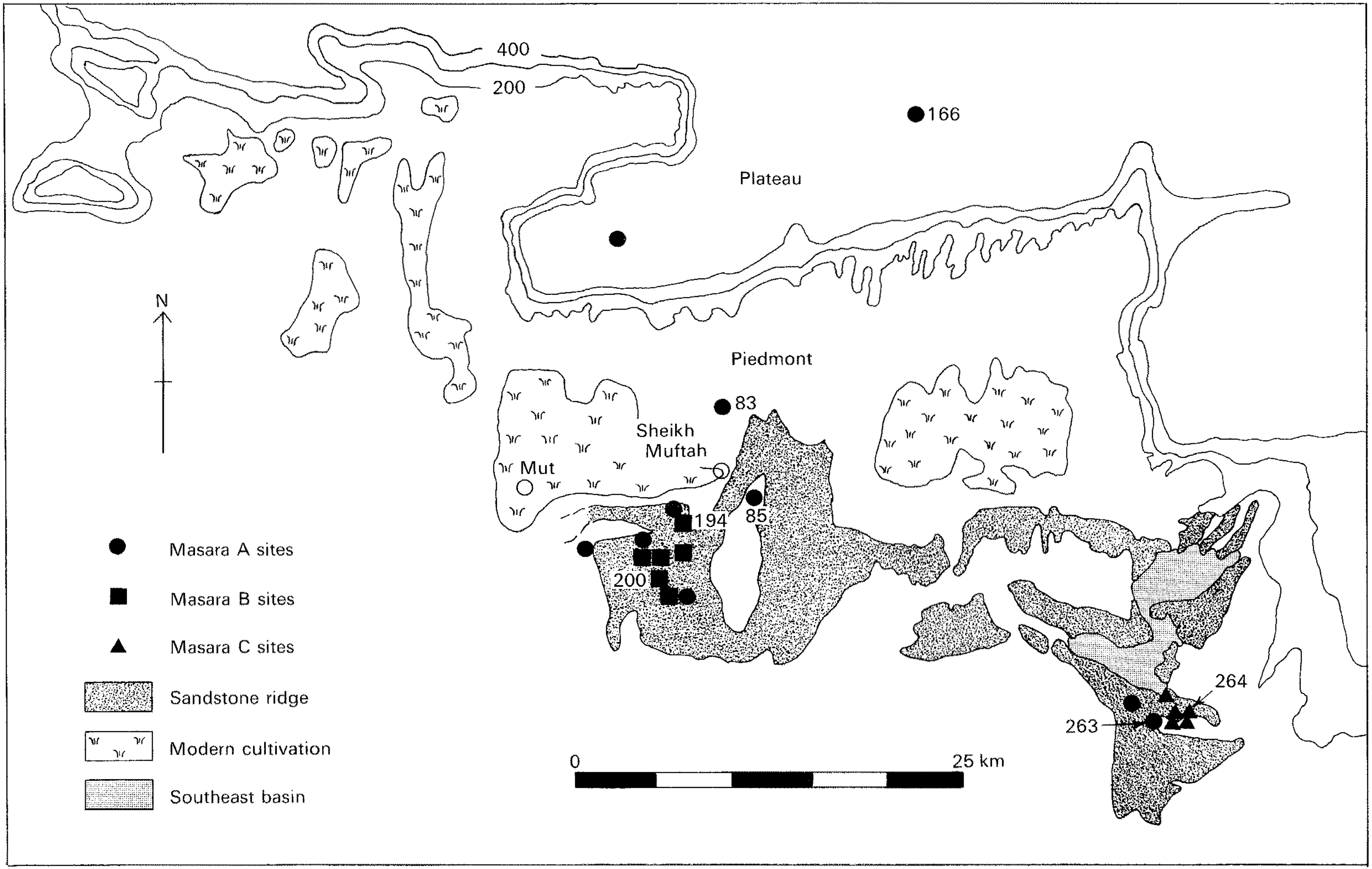



Figure 2 Masara sites in the eastern half of Dakhleh Oasis.

Early Holocene or Masara sites (Fig. 2) are largely confined to the margins of the oasis, at least in the eastern half of Dakhleh, the portion where the late prehistoric site survey of the larger Dakhleh Oasis Project (Mills 1984) has so far concentrated. Aside from a small quarry site in the piedmont zone, all recorded sites occur either atop the northern plateau, or around some of the sandstone ridges well to the south of modern cultivation.

The Dakhleh Epipalaeolithic or Masara cultural unit is divisible into three groups, Masara A, B, and C. The three can be distinguished on the basis of site location, site features, aspects of their lithic industries including choice of raw material and details of tool typology, and differences in other artifact classes. Chronometric and relative dating evidence, while still scarce, suggests that all three may be roughly contemporaneous.

## Masara site locations and site features

### *Masara C sites*

The sites with the stone structures, here labelled Masara C, are as yet confined to one of the sandstone ridges in the south-east corner of the oasis, over 15 km beyond the limit of modern cultivation. Here, in an area measuring 4.5 by 1.5 km, more than 20 Masara occurrences have been recorded. A few of these lack structures: they consist instead of surface scatters of lithics, small to fairly extensive in size, associated with muddy pans. The balance, some 15 sites, feature stone structures. Most sites are fairly small, ranging in size from two to about eight units, with each site nestled in a shallow hollow upon the ridge. Four of them are larger, consisting of a dozen or more structures each; the biggest, site 264 (29/450-G3-1), boasts roughly 20 units in an area 50 × 25 m (Fig. 3). All four large sites lie within 1.5 km of one another, on or adjacent to the ridge, but are spaced at least 600 m apart.

The structures themselves are not elaborate (Figs. 4, 5). Surface remains usually consist of a single tier of vertical stone slabs, although these may stand three or four slabs thick in places. A test excavation in one structure at site 264 showed it to be a pit 40–50 cm deep, with a probable hearth on its floor, the pit encircled by a layer of stone at ground level. Structures average 3–4 m in diameter, and are round, oval, or sometimes bilobed: they are interpreted as huts. Occasionally a smaller ring about 1 m in diameter occurs in a corner or the centre of a structure. What appear to be stone pavements are sometimes associated with the structures. One stony feature is much larger than the rest: lying in a corridor flanking the ridge, it is a ring measuring 47 × 37 m, open to the east.

Aside from the structures, Masara C sites of all sizes feature grinding equipment, both slabs and handstones. Grinding slabs, usually oval, can measure up to 75 × 35 cm. A total of eight handstones of various shapes and sizes, and seven grinding slabs or slab fragments, were scattered across site 264. Clusters of ostrich eggshell fragments and eggshell beads occur as well. At site 264, beads were made on-site, judging by the presence of fragments at various stages of manufacture. Scatters of fire-cracked rock and hearths capped with sandstone fragments are found also. At site 264, scatters of chipped stone tools and debitage occur among the structures, while on the slope of the basin just to the west is a scatter of tools, and another locality featuring both chert tools and knapped limestone.

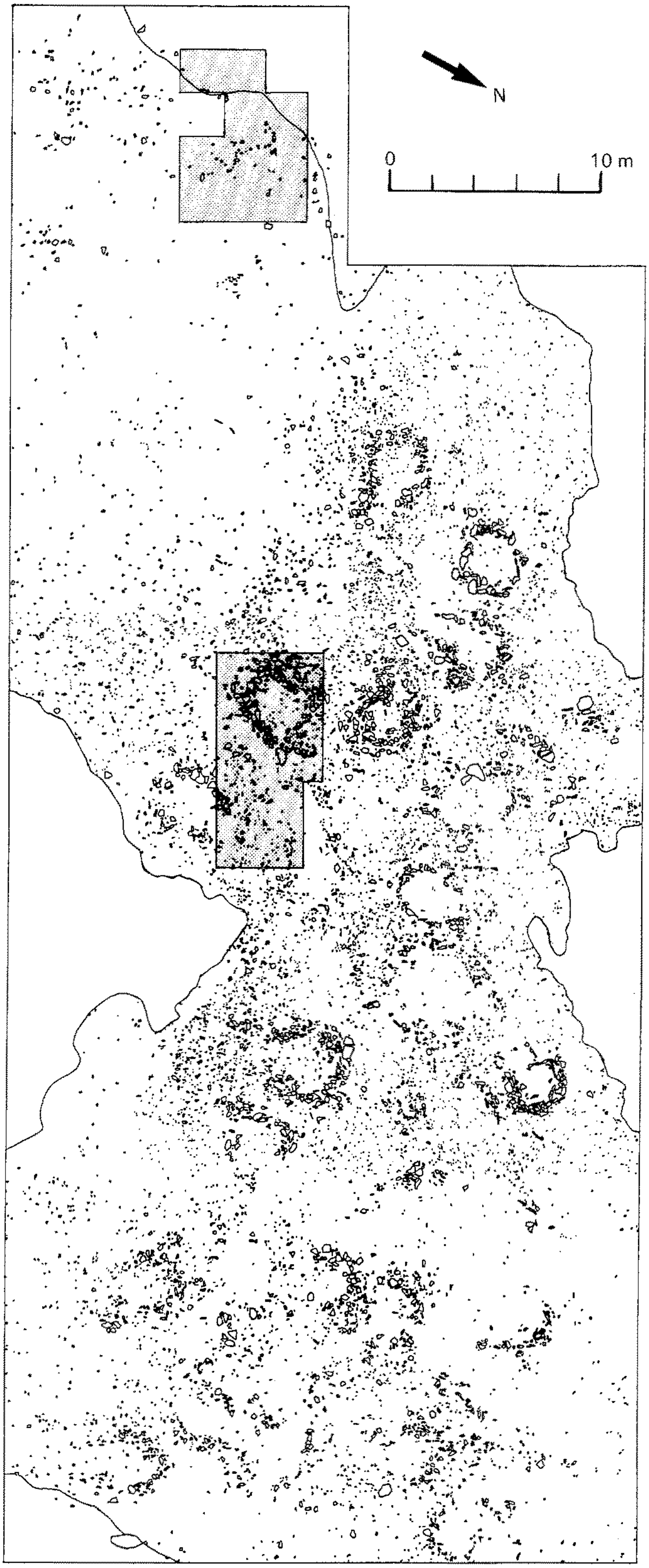



Figure 3 Plan of site 264. (Shaded areas were mapped and the artifacts collected.)

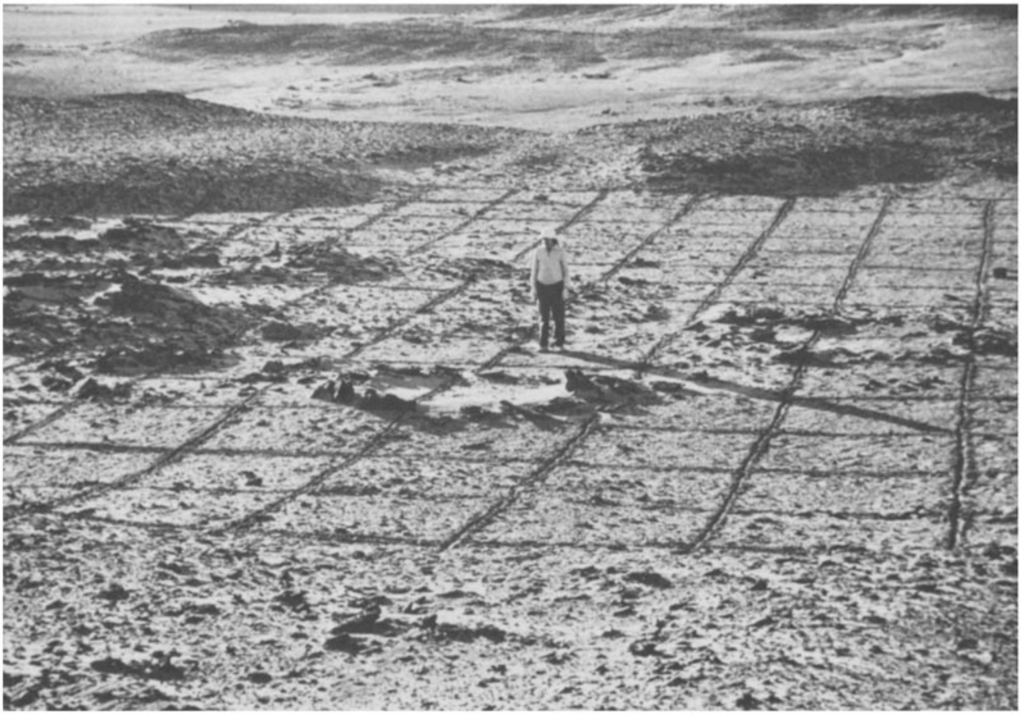


Figure 4 Masara C stone structures on the west half of site 264, from the north.

Figure 5 Close-up view of a stone structure on site 265 (29/450-G3-2), located about 600 m from site 264.

### *Masara B sites*

Masara B, like Masara C, seems localized. The six sites recorded to date are all confined to the northern portion of the sandstone ridge south-west of the modern village of Ezbet Sheikh Muftah in east-central Dakhleh, about 35 km west of the Masara C area noted above. Masara B sites are all deflated surface scatters occupying shallow basins and embayments within the cuesta. These basins sometimes also contain other Masara material, later prehistoric material, or debris from caravans that in later times crossed this area to and from the south.

Masara B sites are characterized by a heavy reliance on an unusual lithic raw material – chipped stone artifacts manufactured by members of earlier oasis cultures. This mostly 'Middle Stone Age' (MSA) material was systematically reworked by Masara B groups into a limited range of tool types constituting over 80% of some assemblages (McDonald in press b).

These sites are relatively impoverished in artifact classes other than chipped stone, and in features. They yield a few pounders and hammerstones and, occasionally, a grinding slab fragment. Because sites are deflated, no botanical evidence and virtually no faunal remains, other than sparse ostrich eggshell scatters, are recovered.

A typical Masara B site, no. 194 (30/420-D1-1), occupies a shallow basin *ca* 200 × 100 m. The densest part of the chipped stone scatter occupies 615 m$^2$. Within this area are a sandstone-capped hearth 1 m across, and a shallow hollow less than 2 m long and containing no trace of cultural material. There are also two short, enigmatic alignments of sandstone slabs, one, within the cluster, consisting of four slabs in a row, the other, just beyond, about 2 m long and forming an angle. Within the cluster is a thin scatter of eggshell. There are a few grinding slab figments 25 m to the north, and four hearths with Roman pottery lying 20–40 m to the south. There is also a small scatter of possible Masara A material 40 m to the south-west.

### *Masara A sites*

All other Masara sites, including some within the Sheikh Muftah sandstone ridge or on its perimeter, in the Masara C area to the south-east, or atop the northern plateau, are grouped as Masara A. There are also isolated blade-flaking stations on the high pediment gravel remnants of the piedmont zone (M. R. Kleindienst, pers. comm.). Masara A sites are characterized by blades knapped from fresh nodular chert which are then notched, denticulated, or modified into piercers (Fig. 4).

Some Masara A sites, notably those on the Masara C ridge, are associated with muddy pans. Site 166 on the plateau on the other hand, is associated with an early Holocene lake (I. A. Brookes, pers. comm., 1990). Site 83 (31/420/G4/1), the only Masara occurrence recorded in the piedmont zone, served as a quarry site (McDonald 1982:123). Here nodules of a distinctive honey-coloured coarse-grained chert or quartzite were used to produce blades which turn up in small numbers of other Masara A sites. All oasis-floor sites are virtually completely deflated.

Masara A sites consist of scatters of chipped stone and sometimes a little grinding equipment associated, usually, with a hearth. They range in size from site 224 (30/405-N3-1), a single, sparse scatter about 5 m across, on the desert floor west of the Sheikh Muftah ridge, to site 263 (29/450-F3-1), consisting of many separate scatters covering an area at least 800 × 200 m around a large muddy pan about 1.5 km west of the stone structures of site 264. Typical in some ways is site 85 (31/420-H10-1), east of the Sheikh Muftah ridge, where several small chipped stone scatters cover an area *ca* 150 × 95 m. Within that area as well are a few stone-capped hearths, a pair of grinding slab fragments, a possible handstone fragment, and sparse ostrich eggshell.

## The organization of lithic technology

To examine the organization of lithic technology in so far as it reflects mobility patterns within the Masara groups, the focus here is on three topics: the procurement of raw materials, lithic manufacturing patterns, and portability of tool-kits.

There are small controlled chipped stone collections available for each of the three Masara groups. For Masara C, lithic samples were collected from two areas on site 264 (Fig. 3). One is from 40 m$^2$ within the limestone knapping and work area on the basin slope just west of the structures. The other comes from a 46 m$^2$ area within the hut cluster that includes the structure with the test pit, and a littered area in front of it to the east. In the former area the material was mapped and collected, but the soil was not screened. In the latter, the 10–15 cm thick surface layer down to sterile soil was screened. Masara B collections come from two sites, 194 and 200 (30/420-C5-1). On site 194, collections are from two blocks of 10 × 9 m and 10 × 6 m within the 615 m$^2$ densest part of the site. On site 200, collection 2 is the total pick-up from a knapping scatter *ca* 5 × 4 m, while collection 4 comes from an area of 44 m$^2$ within a larger surface scatter. No screening was done for the Masara B material. The Masara A collections are from site 85. Collection 1 is the total pick-up of an 80 m$^2$ scatter of chipped stone around a hearth, while collection 2 is a knapping debris dump *ca* 0.7 m in diameter, located 10 m from the collection 1 scatter. Both areas were screened.

### *Masara lithic raw materials*

Table 1 lists the lithic raw materials found in the controlled samples from sites 85, 194, 200, and 264, and from two other Masara A sites, 166 atop the plateau, and 242, a small site beside a pan west of site 264. The principal raw materials used on these early Holocene sites are chert, quartzite, limestone, and worn chert artifacts produced by earlier inhabitants (listed as 'double-patinated' in Tab. 1).

Both chert and quartzite can be found in spots on the oasis floor (Kleindienst in press). Both occur in some localities in the piedmont zone as nodules, as at site 83, or as geodes – unusually large nodules or balls up to 30 cm across. Some of these geodes are found, whole or worked, on sites south of the cultivation. Outcrops of good-quality quartzite can be found south of the cultivation as well; there is for example a Neolithic quartzite workshop on one of the ridges east of Sheikh Muftah (McDonald 1983:163). However, the only fresh chert in this southern zone comes in the form of small, rough nodules, rarely more than 5 or 6 cm across, that erode out of spring terraces and from shales of the Mût Formation (Kleindienst in press).

Table 1 Lithic raw material types in assemblages from six Masara sites.

| **Masara:**<br>**Sites:** | **A**<br>**166** | <br>**85** | <br>**242** | **B**<br>**200** | <br>**194** | **C**<br>**264** |
|---|---|---|---|---|---|---|
| Nodular cherts | | | | | | |
| a Grey | × | × | × | | | |
| b Grey-brown | | | | × | | × |
| c Porcelanous | × | | | | | |
| d Lt yellow, wine veins | × | | | | | |
| e Mustard | × | | | | | |
| f Yellow-grey | | × | | | | |
| g Yellow-brown | | | × | | | |
| h Whitish | | × | | | | |
| Chert, heavy spalled or tabular | × | | × | | | |
| Yellow-brown tabular | × | × | | | | |
| Site 83 chert or quartzite | | × | | × | × | |
| Double-patinated | × | × | × | × | × | × |
| Grey chert(?) – layered | | | | | × | |
| Quartzite | | × | × | × | × | × |
| Ferrug. sandstone – black | × | × | × | | × | |
| Ferrug. sandstone – grey | × | | | | | |
| Limestone | × | | | | | × |
| Petrified wood | × | | × | | × | |
| Quartz pebble | × | × | | | | |
| Chalcedony – yellow-grey | | × | × | | | |
| Chalcedony – orange | | × | | | | |
| Jasper(?) | | | | | | × |
| **Total** | **12** | **11** | **8** | **4** | **6** | **5** |

The chert used for the large Masara A blades is a fine-grained nodular material that comes mostly from the limestone of the plateau. Most of it is grey, but of various shades, and it is sometimes mottled or banded. Cherts of different shades or variegations may each come from a separate source; one source yielding exclusively a light grey banded chert, for example, is located on the plateau above the west end of the oasis. Some cherts of colours other than grey, probably each from a separate source (labeled c–g in Tab. 1), also occur. Chert c, for instance, is a creamy translucent material identical to the 'porcelanous' chert used at an earlier time for handaxes in Khârga oasis to the east of Dakhleh (M. Kleindienst, pers. comm.; Caton-Thompson 1952). Chert e is a mustard-coloured material with brown dots.

The knapped limestone originates on the plateau rather than the oasis floor, where the bedrock is sandstone, but it does sprinkle portions of the piedmont near the plateau. In addition, portions of the plain just north of the Masara C ridge are littered with grapefruit-sized limestone cobbles, probably derived from the escarpment to the east.

The MSA artifacts reworked by Masara groups are widely available on the bare surfaces of both the oasis and the plateau. They form a thin litter across the Masara B ridge, with a scatter occurring, for instance, in one corner of the site 194 basin. Some of these artifacts, moreover, may have been relatively fresh when collected. About one quarter of Masara B reused lithics may have come from fossil spring-mounds, as they bear the distinctive patina acquired in the iron-rich deposits of these features. A cluster of such spring-mounds occurs just to the north-east of the Masara B ridge, in an embayment south of Sheikh Muftah. Fresh Levallois flakes and bifaces similar to those used in the Masara industry continue to erode out of those mounds today.

Of the other raw materials used, ferruginous sandstone is widely available throughout the oasis, while petrified wood and chalcedony occur in a few locations, the latter sometimes in geode form. Tabular chert probably comes from the plateau, although no sources have been found yet in the vicinity of Dakhleh.

As demonstrated in Table 1, knappers on both Masara B and Masara C sites used a limited range of raw materials, up to six on the former, five on the latter. Most of these types, moreover, would be readily available in the oasis southern zone, in the vicinity of their respective sites. Masara A sites, in contrast, feature a greater variety of lithic raw materials. Even on small oasis-floor sites, several of those types, while often constituting a minor element within their assemblages, could be classed as exotic, drawn probably from a number of sources atop the plateau or beyond it.

### *Lithic manufacture on Masara sites*

Information concerning Masara chipped stone manufacturing patterns can be gleaned from Table 2, showing the composition of assemblages on the four sampled sites, and from Table 3, which supplies ratios based on information in Table 2. Variations in these data between sites may reflect differences in mobility patterns within the three units, Masara A, B, and C.

#### Masara A patterns

All Masara sites have low ratios of tools to debitage and cores to debitage, although all fall within the range for Saharan Epipalaeolithic sites (Holl 1989:334). The ratio of tools to debitage on Masara A site 85 is particularly low, especially when collections 1 and 2 are combined (on the assumption that the collection 2 dump comes from the collection 1 scatter). This low figure reflects the abundance and variety of debitage within the scatter, including cores and core fragments, blades and flakes, fragments, chips and hammerstones – and it attests to the importance at site 85 of knapping, and particularly of blade and bladelet production through standardized core reduction.

This information, combined with that on raw material sources and site location, suggests an embedded procurement pattern for the group(s) at site 85, and by extension, at other Masara A sites with similar knapping patterns. The good quality chert being knapped at site 85 could not have come from the vicinity of the site; in fact, as noted above, the likely source is the plateau, or else the high pediment gravels where isolated flaking stations have been noted. Yet at site 85, as at other Masara A sites, whatever their location, masses of blades and flakes were being produced. The raw material must have been imported in the form of nodules or at most rough core preforms, to judge by the number of primary flakes (28% of flakes and 7% of blades bear more than 50% cortex). It would appear that these groups collected good raw material from various sources encountered on their normal

Table 2 Masara A (site 85), Masara B (sites 194 and 200), Masara C (site 264) collections: major artifact categories.

| | Site 85 | | | | Site 194 | | | | Site 200 | | | | Site 264 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coll. 1 | | Coll. 2 | | Coll. 2 | | Coll. 1 | | Coll. 2 | | Coll. 4 | | Coll. 1 | | Coll. 2 | | Coll. 3 | |
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % | n | % |
| Tools | 37 | 4.0 | 12 | 0.9 | 65 | 15.3 | 47 | 18.1 | 20 | 6.2 | 11 | 4.0 | 4 | 0.6 | 47 | 22.8 | 142 | 10.0 |
| Cores | 21 | 2.3 | 6 | 0.5 | 15 | 3.5 | 6 | 2.3 | 9 | 2.8 | 13 | 4.8 | 3 | 0.5 | 7 | 3.4 | 9 | 0.6 |
| Core fragments | 34 | 3.7 | 16 | 1.2 | 23 | 5.4 | 9 | 3.5 | 25 | 7.7 | 20 | 7.3 | 5 | 0.8 | 2 | 1.0 | 5 | 0.4 |
| Spalls | – | | – | | 20 | 4.7 | 38 | 14.7 | 19 | 5.8 | 3 | 1.1 | – | | – | | – | |
| Blades | 364 | 39.9 | 171 | 12.4 | 51 | 12.0 | 44 | 17.0 | 66 | 20.3 | 59 | 21.6 | N.A. | | N.A. | | 296 | 20.8 |
| Blade sections | 70 | 7.7 | 98 | 7.1 | 22 | 5.2 | 16 | 6.2 | 18 | 5.5 | 30 | 11.0 | N.A. | | N.A. | | N.A. | |
| Flakes | 223 | 24.4 | 150 | 10.9 | 113 | 26.6 | 67 | 25.8 | 119 | 36.6 | 106 | 38.8 | 203 | 33.8 | 111 | 53.9 | 415 | 29.1 |
| Chips | 94 | 10.3 | 495 | 36.6 | N.A. | | N.A. | | N.A. | | N.A. | | 128 | 21.3 | 17 | 8.3 | 294 | 20.6 |
| Fragments | 58 | 6.4 | 426 | 31.0 | 62 | 14.6 | 18 | 6.9 | 49 | 15.1 | 31 | 11.4 | 257 | 42.8 | 19 | 9.2 | 265 | 18.6 |
| Unmodified MSA | 12 | 1.3 | – | | 54 | 12.7 | 14 | 5.4 | – | | – | | – | | 3 | 1.5 | – | |
| **Total** | **913** | | **1374** | | **425** | | **259** | | **325** | | **273** | | **600** | | **206** | | **1426** | |

Table 3 Masara A (site 85), Masara B (sites 194 and 200), Masara C (site 264) collections: technological ratios.

| | Site 85 | | Site 194 | | Site 200 | | Site 264 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coll. 1 | Coll. 2 | Coll. 2 | Coll. 1 | Coll. 2 | Coll. 4 | Coll. 1 | Coll. 2 | Coll. 3 |
| Tools/waste | 0.043 | 0.009 | 0.188 | 0.228 | 0.068 | 0.044 | 0.007 | 0.303 | 0.111 |
| Cores/waste | 0.025 | 0.004 | 0.043 | 0.029 | 0.030 | 0.052 | 0.005 | 0.046 | 0.007 |
| Blades/flakes | 1.632 | 1.14 | 0.451 | 0.657 | 0.555 | 0.557 | N.A. | N.A. | 0.713 |

rounds, producing some tools on the spot – there are cores and blades left at quarry site 83, for example – but carrying most of it with them for use in tool making as needed where no suitable local chert was available. For a mobile group, blade production is an efficient way to utilize a given weight of raw material, whether the goal is a simple cutting edge or microlithic elements for a composite tool (Parry and Kelly 1986; Clark 1986:260); it is better moreover to transport a core preform than a bundle of blades that could be chipped or broken *en route*.

## Masara C patterns

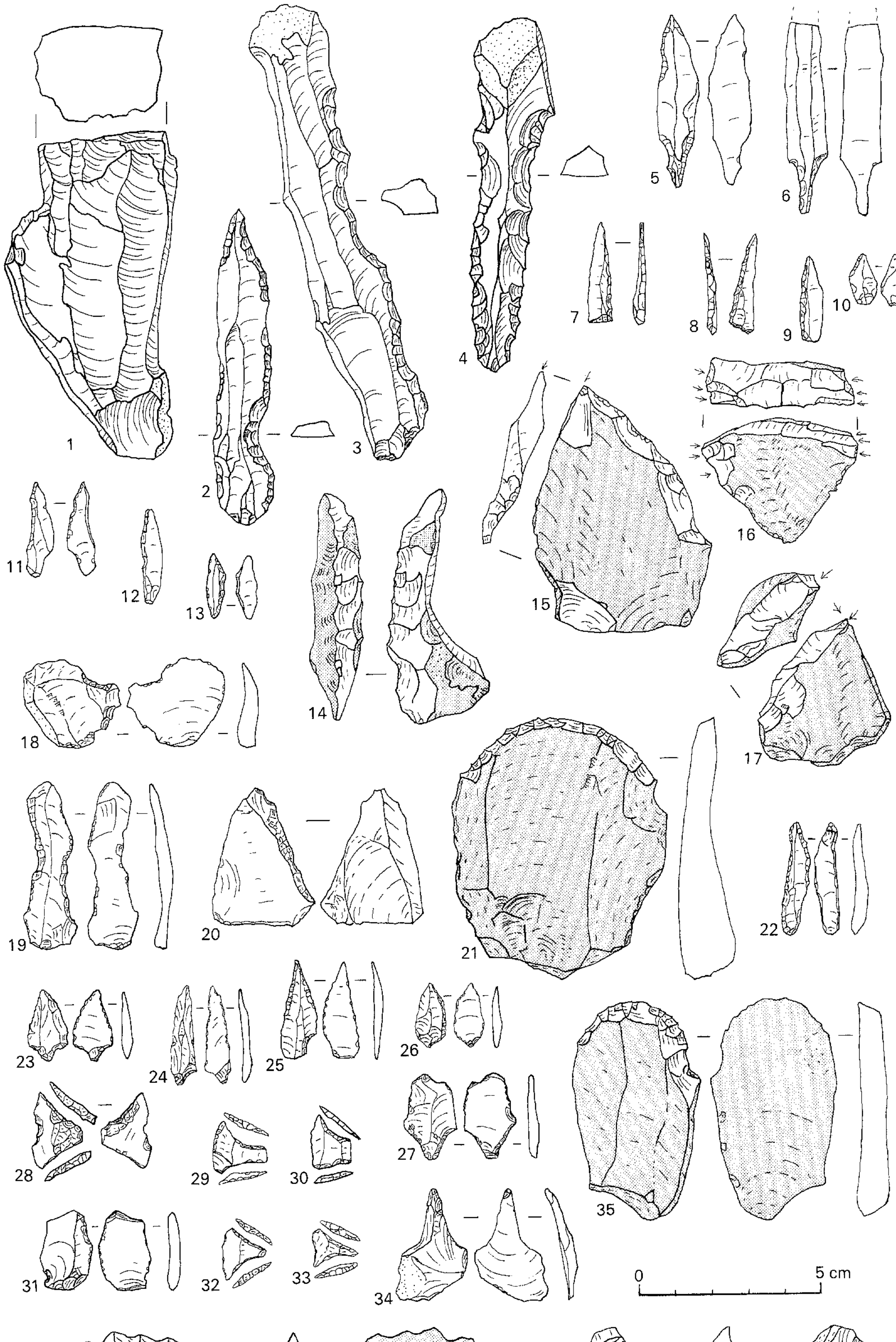
The organization of tool production at Masara C sites contrasts in several respects with the Masara A pattern of eclectic raw material acquisition and the apparent emphasis on portability. For this study of manufacturing patterns, the site 264 collection from the work area west of the huts is split in Tables 2 and 3 into two components, one of limestone (Collection 1), the other of chert and quartzite (Collection 2). Site 264 Collection 3 is from within the cluster of structures (Fig. 3).

The limestone assemblage seems an excellent example of an expedient technology (Parry and Kelly, 1986). The raw material abounds near the site. The tools to debitage and cores to debitage ratios are both unusually low. Core reduction is unstandardized, resulting in a wide variety of often quite large flakes, and few artifacts that can confidently be identified as either cores or core fragments. Likewise there seem to be few formal tools: suitable flakes were apparently selected and then used with little modification (Fig. 6: 20, a possible burin, may constitute an exception). Tools probably had a short use-life due to the relative softness of the material. The full sequence of manufacture, use and discard seems to have occurred on the spot. Limestone knapping is most concentrated in this western work area, but in fact limestone debitage and at least 50 cobbles or cores of the material are scattered elsewhere across the site and attest to the importance of the limestone component of the lithic industry in the site economy as a whole.

The components composed predominantly of chert in both the western work area and around the structure yield relatively high tool to debitage ratios. The blade to flake ratio from the hut area, on the other hand, is considerably lower than that for site 85. The blades from site 264 are in general shorter than those that characterize Masara A, and seem to be made on a different grade of raw material. This is reflected in the relative sizes of exhausted cores from the two units: those from site 85 average 55.9 mm in length and range from 78 to 43 mm, while those from site 264 average 35.7 mm, ranging from 45.5 to 23 mm (compare also Fig. 6: 1 and 37). At present then it appears that the site 264 group was not exploiting the large nodules from plateau or pediment gravel chert sources, but using instead a grey-brown nodular material from much closer to home.

The people at site 264 did use some large tools; in fact formal tools from site 264 are larger on average than those from site 85 (see below). For the larger items in the tool-kit, though, they tended to rely, like the Masara B groups, not on freshly knapped blanks, but on worn MSA artifacts. Seventeen of twenty scrapers in the site 264 collection, for example, as well as some of the piercers and a large saw, are made on the worn material (Fig. 6: 21, 35, 36).

The source of these ancient artifacts is problematic: the Masara C ridge, unlike most of


1
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5 cm

the sandstone ridges in the southern zone, is today bare of this material. Either the Masara C groups collected it all (double patinated tools and some unworked worn flakes and fragments are a prominent part of the assemblages of most Masara C sites), or they had to go elsewhere in the southern zone for their blanks. All of the reworked chert from site 264 is worn surface material; none seems to have come from spring-mounds.

### Masara B patterns

Masara B collections resemble those from site 264 in their relatively high tool to debitage ratio, while the blade to flake ratio is even lower than that of Masara C (Tab. 3). The Masara B collections differ from both A and C in that the majority of tools and much of the debitage is double-patinated – bearing the zones of lighter desert varnish and fresher retouch scars characteristic of old stone artifacts subsequently reworked. In the collections from site 194, all but 11 of 112 tools (and 8 of 21 cores) are double-patinated, as are 50% of the flakes from collection 2. The cores that are made on fresh stone resemble those of site 264 rather than site 85 in size and raw material.

The burin is by far the most common class of tool in the double-patinated assemblages of Masara B, ranging from 64% to 80% of all tools in the four collections (Fig. 6: 15–17). At the thicker end of the scale, burins grade into core scrapers and cores. Thick-sectioned Levallois flakes are the preferred blanks, although cores, bifaces, and even an Aterian point were chosen as well. Each was systematically reduced to produce a chunky, thick-sectioned burin, together with a series of spalls corresponding to the various stages of burin production (Fig. 6: 14, McDonald in press b). The distinctive technology used to produce these burins is not unique to Dakhleh. A range of burin spalls similar to those of Masara B occurs, for example, on Epipalaeolithic sites of the Maghreb (Tixier 1963:29–32), but the Maghreb burins are made mostly on freshly knapped blades.

Aside from burins, worn artifacts were used to produce a few notches, denticulates, retouched pieces and piercers. The production system for these tools was simple: suitable blanks were collected from the surface or nearby spring-mounds and, except for the piercers, which required more elaborate shape modification, tools were completed using some edge trimming.

Finally, the Masara B sites resemble the work area of site 264 in that it appears that tools, particularly the burins, were both made and used on the spot. Quantities of spalls from all stages of manufacture were recovered, and the burins themselves are heavily damaged. Macroscopic wear traces[2] occur fairly consistently on the burin face just below the bevel, and on one or both corners. While there is as yet little indication what the burins

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Figure 6 Masara chipped stone artifacts. (Shaded areas represent old surfaces of double-patinated artifacts.)
1–10, Masara A, various sites. 1, core; 2–4, various blade tools; 5, 6, Ounan points; 7, 8, triangles (site 95); 9, straight-backed bladelet (site 45); 10, microburin.
11–17, Masara B, sites 194 and 200. 11, shouldered bladelet; 12, straight-backed bladelet; 13, lunate; 14, spall; 15–17, burins.
18–37, Masara C, all from site 264. 18, 19, notches; 20, burin? in limestone; 21, 35, end scrapers; 36, denticulated end scraper; 22, drill bit; 34, piercer; 23–27, Ounan-Harif points; 28–30, trapezes; 32, 33, triangles; 31, microburin; 37, core.

were used for, the wear patterns suggest a graving rather than a scraping mode of use (White 1982).

### *Tool-kits on Masara sites*

The end products of the manufacturing process, the collections of formal tools,[3] may imply different mobility patterns within the three Masara groups. As mentioned above, carrying cost considerations dictate that tool-kits of mobile groups should be less diverse and more versatile, with tools that are smaller, lighter, and more portable, than are those of more sedentary groups.

The term 'diversity' denotes the number of distinct tool types or classes in an assemblage. For Epipalaeolithic assemblages, Holl (1989:tab. 3) uses eight categories, based loosely on Tixier's (1963) typology for the Maghreb: scrapers, borers, burins, backed pieces, denticulates, truncations, microliths, and diverse. Following this scheme, site 264 (Masara C) yielded tools in all eight classes, the two Masara B sites in six classes, and site 85 in five. The disparity between Masara C and the other two units seems far more pronounced if tool types rather than classes are considered: following the Tixier scheme, there are 33 types in the combined collections from site 264, 15 types in collections from the two Masara B sites, and 13 from Masara A (Tab. 4). The relatively small size particularly of the sample from site 85, however, may invalidate any conclusions about relative diversity between these units (McCartney and Glass 1990).

The term 'versatility' is used for '... the number of tasks to which tool classes can be applied. It may vary across tool classes, and values can be calculated by class or in the aggregate for complete technological inventories' (Shott 1986:19). Tool versatility is in fact a difficult thing to measure with any confidence, particularly in the absence of microwear analysis. Holl, however, has devised a 'classification of elementary task applications based on types of physical motions such as hammering, chopping, knapping, cutting, scraping, sawing, etc.... ' (Holl 1989:336 and tab. 8). Under that scheme, the collections from site 264 score eleven, the highest figure for the three units. Masara B and A collections, however, score nine each even though they are smaller (in the case of the site-85 collection) and apparently less diverse. Some of the Masara A tools, moreover, appear to have been designed with versatility in mind: composite blade tools such as piercer-denticulates, for example, or piercers with several notches (Fig. 6: 2).

As for the relative sizes in relation to 'portability' of tools among Masara units, there is some question as to the relevance of size, at least for Masara A. Evidence cited above suggests that chert may have been transported principally in the form of nodules or core preforms rather than blades or completed tools. In so far as tools were carried between sites, one would theoretically expect this to emphasize the more elaborately worked and maintained of the formal tools (Binford 1977).

Possibly the best single measure for comparing relative sizes of tools between units, the average weight per tool in each collection, is not yet available. Instead, a calculation was made of the average volume (l × w × t) of tools, excluding microliths, in Masara and A collections. By this rough measure, tools from Masara C site 264, at 134.4 $mm^3$, are very slightly larger than those from site 85 (129.1 $mm^3$).

In summary, there is not a great deal of variation bearing on the question of sedentism

Table 4 Masara A (site 85), Masara B (sites 194 and 200), Masara C (site 264) collections: distribution of retouched tool types, following type-list of J. Tixier (1963).

| Site | 85 | | 194 | | 200 | | 264 | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| 1. End scraper on flake | – | | – | | – | | 7 | 3.7 |
| 4. Core-like end scraper | – | | 16 | 14.3 | 1 | 3.2 | 1 | 0.5 |
| 5. Denticulated end scraper | – | | – | | – | | 6 | 3.1 |
| 6. Nosed or shouldered end scraper | – | | – | | – | | 2 | 1.0 |
| 8. Single end scraper on blade | – | | – | | – | | 4 | 2.1 |
| 12. Single piercer | – | | 2 | 1.8 | – | | 18 | 9.4 |
| 13. Piercer on backed bladelet | – | | – | | – | | 1 | 0.5 |
| 16. Drill bit | – | | – | | – | | 5 | 2.6 |
| 17. Dihedral burin | – | | 52 | 46.4 | 13 | 41.9 | 2 | 1.0 |
| 19. Burin on a break | – | | 10 | 8.9 | 2 | 6.5 | – | |
| 20. Multiple dihedral burin | – | | 13 | 11.6 | 2 | 6.5 | – | |
| 45. Pointed straight-backed bladelet | 7 | 14.3 | – | | 2 | 6.5 | 1 | 0.5 |
| 51. Pointed st.-backed bladelet, retouched base | 1 | 2.0 | – | | – | | – | |
| 56. Curved-back bladelet | 2 | 4.1 | – | | – | | – | |
| 64. Shouldered bladelet | – | | – | | 3 | 9.7 | – | |
| 66. Fragment of backed bladelet | 18 | 36.7 | – | | 1 | 3.2 | 3 | 1.6 |
| 67. Obtuse-ended backed bladelet | 1 | 2.0 | – | | – | | – | |
| 72. Fragment of bladelet, Ouchtata retouch | – | | – | | – | | 1 | 0.5 |
| 74. Notched flake | – | | 4 | 3.6 | 1 | 3.2 | 17 | 8.9 |
| 75. Denticulated flake | – | | 3 | 2.7 | 1 | 3.2 | 11 | 5.8 |
| 76. Notched blade or bladelet | 3 | 6.1 | 4 | 3.6 | – | | 9 | 4.7 |
| 77. Denticulated blade or bladelet | 1 | 2.0 | – | | – | | 5 | 2.6 |
| 78. Saw | – | | – | | – | | 2 | 1.0 |
| 79. Notched or denticulated, continuous retouch | – | | 2 | 1.8 | – | | – | |
| 80. Truncated piece | 1 | 2.0 | – | | – | | 3 | 1.6 |
| 82. Segment | – | | – | | 3 | 9.7 | 1 | 0.5 |
| 83. Isosceles triangle | – | | – | | – | | 1 | 0.5 |
| 85. Trapeze rectangle | – | | – | | – | | 1 | 0.5 |
| 86. Trapeze, one side concave | – | | – | | – | | 5 | 2.6 |
| 87. Trapeze, two sides concave | – | | – | | – | | 1 | 0.5 |
| 89. Isoceles or equilateral triangle | – | | – | | – | | 2 | 1.0 |
| 90. Scalene triangle | 1 | 2.0 | – | | – | | 1 | 0.5 |
| 91. Triangle, one side concave | – | | – | | – | | 2 | 1.0 |
| 92. Triangle, two sides concave | – | | – | | – | | 1 | 0.5 |
| 95. Elongated scalene triangle, v. short side | 5 | 10.2 | – | | – | | – | |
| 101. Blade or bladelet, trihedral point | – | | 1 | 0.9 | – | | – | |
| 102. Microburin | 1 | 2.0 | 1 | 0.9 | 1 | 3.2 | 14 | 7.3 |
| 105. Piece with continuous retouch | 7 | 14.3 | 4 | 3.6 | 1 | 3.2 | 30 | 15.7 |
| 107. Ounan point | – | | – | | – | | 23 | 12.0 |
| 108. Bou-Saâda point | – | | – | | – | | 1 | 0.5 |
| 111. Tongued piece | – | | – | | – | | 1 | 0.5 |
| 112. Miscellaneous | 1 | 2.0 | – | | – | | 9 | 4.7 |
| **Total** | **49** | | **112** | | **31** | | **191** | |

detectable on present evidence among the tool-kits of the Masara units. Figures on both versatility and tool size are, for reasons touched upon above, somewhat ambiguous in this regard. So too are those on tool diversity. The fact, however, that the Masara C tool-kit appears to contain roughly twice as many types as those of Masara A and B may be an indication of greater sedentism in this unit.

### Dating and climate

Before the other archaeological evidence on sedentism can be assessed, the question of dating the Masara units must be addressed.

While the most complete sequence available in southern Egypt, that from Nabta and Kiseiba, shows the Epipalaeolithic or Early Neolithic to span the period approximately 9800–7900 bp (Wendorf *et al.* 1984), sparse dating evidence from Dakhleh suggests that the Masara unit may fall roughly within the middle third of this range. Eight radiocarbon dates, six of which have already been published (Brookes 1989), are now available (Tab. 5). All are on eggshell collected from surface scatters. None is calibrated, while only two, the Masara C dates, have been adjusted for isotopic fractionation. For internal consistency, and to make these dates more comparable with other sets from the Western Desert (*e.g.* Wendorf *et al.* 1984; Hassan 1986; Kuper 1989), the Masara A and B dates have, in the third column of Table 5, been adjusted by adding a constant factor of 350 years.[4] In addition to these eight, two new dates from site 166 fall within the range of those shown here (I. A. Brookes, pers. comm.). Taken at face value, these dates suggest a rough contemporanieity among the three subunits, with Masara B actually bracketing A and C.

Comparative evidence from the Eastern Sahara seems generally to support these dates, although the Dakhleh dates appear on the whole somewhat older than those on analogous material elsewhere. For Masara A, the best parallels in the Combined Prehistoric Expedition (CPE) sequence are with the third or El Ghorab entity. El Ghorab shares with Masara A (Tab. 4; Fig. 6: 1–10) a formal blade core technology, the use of the microburin

Table 5 Radiocarbon dates for Masara sites in Dakhleh Oasis. All are on eggshell; none are calibrated. Masara C dates adjusted for isotopic fractionation. All other dates adjusted by adding a constant factor of 350 years.

| Lab . no. | Age bp | Adjusted age bp | Site |
|---|---|---|---|
| **Masara A** | | | |
| Beta–23684 | 8720±100 | 9070±100 | 85 |
| Beta–23694 | 8650±150 | 9000±150 | 75 (30/420–C2–1) |
| Beta–17022 | 8270±160 | 8620±160 | 166 |
| **Masara B** | | | |
| Beta–23693 | 8830±110 | 9180±110 | 194 |
| Beta–23687 | 8110±110 | 8460±110 | 200 |
| **Masara A or B** | | | |
| Beta–23696 | 8630±130 | 8980±130 | 197 (30/420–E3–1) |
| **Masara C** | | | |
| Gd–5720 | — | 8730±70 | 264 |
| Gd–5718 | — | 8650±80 | 262 (29/450–H3–1) |

technique, and many tool types such as elongated scalene triangles with short sides, pointed straight-backed bladelets, and notched and denticulated blades (Wendorf *et al.* 1984). In addition, Ounan points occur on several Masara A sites (Fig. 6: 5,6). For Masara B (Tab. 4; Fig. 6: 11–17), the best parallels seem to be with the El Nabta phase. Sites of this entity yield a higher proportion of burins than usual on Epipalaeolithic sites (7 to 30% of tools), and share with Masara B such types as pointed straight-backed bladelets and shouldered bladelets. Dating of El Ghorab is not firmly established, but it is thought to range from 8500 to 8200 bp, while El Nabta is listed as 8100 to 7900 bp (Wendorf *et al.* 1984:412 ff.).

As for Masara C, its closest parallels in the CPE sequence are with the El Kortein entity, tentatively dated 8800 to 8500 bp (Wendorf *et al.* 1984:411). Masara C (Tab. 4; Fig. 6: 18–37) shares with El Kortein an emphasis on end scrapers, perforators and notches, concave-sided trapezes and triangles, and many Ounan-Harif points (see Wendorf and Schild 1980:110 for the distinction between Ounan points, found widely across the Sahara, and the Ounan-Harif points of the Western Desert). As for Masara C's most distinctive feature, its stone structures, there are few dated parallels elsewhere in the Sahara. One 'slab-lined' structure has been reported for an El Kortain site near Nabta (Wendorf and Schild 1980:108), while the 'permanent base villages' mentioned in the introduction belong to the El Nabta phase, dated *ca* 8100 to 7900 bp. Likewise the stone-block structures of Ti-n-Torha rock shelter date between 8640 and 7990 bp (Barich 1987:102).

As to climate, the ninth millennium seems to have been a relatively humid period in the eastern Sahara, but with a dry phase occurring *ca* 8800–8600 bp (Hassan 1986: tab. 1; Banks 1984: fig. III:3). Even at the height of the early Holocene wet phase, however, the desert around Dakhleh, lying as it does within the hyperarid core of the eastern Sahara, would not have received much rainfall (Haynes 1987; Peters 1988), although the oasis itself would probably have been better favoured, thanks in part to large, more-or-less perennial artesian springs.

## Archaeological evidence for sedentism in Masara C

The archaeological evidence *in toto* suggests an unusual degree of sedentism within Masara C compared with the other Masara units at Dakhleh Oasis, and with Epipalaeolithic sites elsewhere in the Sahara.

Aside from the stone structures themselves, the best evidence bearing on the question of sedentism in early Holocene Dakhleh comes from observations on the organization of lithic technology: the acquisition of raw material including source location and procurement patterns; core reduction sequences whether standardized or expedient; and the relative portability of the resulting tool-kit. In each, the main dichotomy lies between Masara A and Masara C, with Masara B falling between the two.

Of the three, Masara A seems, on the basis of technological organization, the most mobile. Masara A sites in the oasis feature a wide variety of raw material, little of it local, each type arguably from a different source. Some of these sources may have lain a considerable distance from Dakhleh. If the 'porcelanous' chert (see above) was in fact a product of the Khârga region, it would have been transported a minimum of 100 km to Dakhleh. The tabular chert likewise may have been carried a considerable distance. The evidence that lithic manufacturing sequences occur routinely on sites well away from chert sources, suggests an embedded procurement pattern rather than trade or direct procurement of raw material through special trips (Morrow and Jefferies 1989). This in turn implies that Masara A groups habitually used a fairly extensive range beyond the oasis. The tool-kit produced by Masara A knappers seems to have been somewhat lighter, less diverse, and perhaps more versatile than that of Masara C groups. A significant portion of the portability required by a mobile group may have been achieved, however, through their reliance on blades and bladelets produced by means of a standardized core reduction technique.

In comparison with Masara A, Masara C seems a much more sedentary unit. Most of the Masara C raw materials are from the oasis floor rather than further afield. Indeed, one significant component of the industry, the limestone cobbles, would have been available within 1.0 km of any of the Masara C sites. The other major elements, the MSA artifacts, the fresh chert and the quartzite, may all likewise have come from the zone south of the cultivation.

The limestone assemblage of site 264, as mentioned above, exemplifies an expedient core technology. Parry and Kelly (1987) examined ethnographic accounts of unstandardized core reduction worldwide, and studied the adoption of this technology within various cultures in prehistoric North America and elsewhere. They conclude that while there are instances of mobile Holocene hunter-gatherers using expedient tools, generally the adoption of expedient core technology correlates with a shift towards sedentism (Parry and Kelly 1987:297). They explain that the portability built into the formalized tools of mobile groups comes at a cost – such items are relatively difficult and costly to make, use, and maintain. The unretouched flake tools produced through an expedient technology, in contrast, require little time or effort to make, while supplying the necessary cutting edges, though they can be wasteful of raw material. This waste is not a serious problem, however, either for sedentary groups living near sources of raw material or for those who can stockpile it where needed.

Much of the lithic industry at site 264 seems then to fit this pattern and suggests a degree of sedentism for Masara C. The contrast was not complete, of course. Most of the chert and quartzite tools, whether or not they were made on blades, were products of a standardized core reduction technology. This technology, however, is never fully replaced among settled stone-working peoples elsewhere in the world; with sedentism, there is simply a shift in emphasis towards the expedient. The other major component of the Masara C tool-kit, the double-patinated items, like the limestone, required little effort beyond procuring suitable ancient blanks. For the scrapers, for instance, just a little retouching was needed either to produce or to resharpen the working edge.

The Masara B industry, like that of Masara C, is based predominantly on locally available raw material, principally the MSA artifacts scattered across the sandstone ridge or eroding out of the spring-mounds adjacent to it. The technology is simple but efficient, geared to produce the required tool – usually a sturdy dihedral burin. A standardized core reduction technology is employed as well for bladelets and other useful blanks. The tool-kit produced on these sites is roughly as varied as that on the Masara A site 85, and much less diverse than that of site 264. Implications of these data for understanding the nature of the occupation on Masara B sites will be discussed below.

Aside from the organization of lithic technology, some other portions of the archaeological record also point to increased sedentism on Masara C sites. There is evidence for a greater variety of activities at site 264 than at sites of the other units. Ostrich eggshell beads, for example, were being made on site. So too were arrowheads, to judge by the presence of several half-finished ones amongst the score or more in the collection from around the hut (Fig. 6: 25, 27). Large, heavy grinding slabs and handstones litter Masara C sites, but are rare to absent on oasis-floor sites of the other two units. There is little information on features associated with the huts, except for the occasional stone pavement, and the possible storage bins (or graves?) within some structures.

The stone structure clusters themselves are, of course, a clear point of difference between Masara C and the other sites, and provide the best evidence for increased sedentism within that unit. The Masara C structures are not elaborate – hardly the substantial, often rectangular, houses found in some fully sedentary prehistoric communities (Rafferty 1985; Flannery 1972). Nor is there anything that could be identified as a ceremonial structure on any of these sites. As for community planning, another possible correlate of sedentism (Rafferty 1985:130 ff.), most of the structures at site 264, especially those at the east end of the site, are so badly disassembled that patterning is difficult to detect. The five structures at the west end of the site are, however, clearly arranged in a semicircle.

If the hut circle clusters are unique within early Holocene Dakhleh, they are unusual as well within a much wider North African context. As noted above, there is little evidence for sedentism within the early Holocene anywhere in the Sahara. Clusters of stone-built structures are occasionally found, but most of these are poorly dated. Thus stone circles at Karkur Idriss in the Gebel Uweinat are labelled simply 'Neolithic' (Van Noten 1978: fig. 216). Likewise 'slab structures' in Dungul Oasis west of the Nile in southern Egypt yield little dating material, but are assigned to the early- to mid-Holocene Libyan culture on the basis of distributional data and their lack of pottery (Hester and Hobler 1969:56).

There are, however, more securely dated early Holocene communities in the Nabta and Bir Kiseiba areas to the south-west of Dungul. Site E-75-6 at Nabta features hearths, wells, pits, and 'house foundations' – shallow basins – aligned in two rows (Wendorf *et al.* 1984:136), while at E-79-4 in the Kiseiba area, similar basins are arranged in an arc (Wendorf *et al.* 1984:136). Actual stone-built or 'slab-lined' houses occur in that area as well, but usually singly or in small groups (*e.g.* Wendorf and Schild 1980:108, 144). At Ti-n-Torha East in south-western Libya, as mentioned above, there are stone-built partitions of early Holocene age within the rock shelter (Barich 1987:111). Large clusters of stone-built structures such as those of Masara C are, however, not known elsewhere in the Sahara for the early Holocene.

## Implications for settlement systems within early Holocene Dakhleh

Data on the organization of lithic technology, combined with that on other artifact categories, on features, and on site locations, can be used to reconstruct something of the settlement systems of the groups in question. The information from early Holocene Dakhleh suggests that each of the three Masara units represents a different kind of component within its settlement system.

*Masara A*

In Masara A, dramatic differences in size and density can mask the essential similarity and apparent functional equivalence of most sites. The basic unit consists of a relatively small scatter of knapping debris with a limited range of stone tools and occasionally a grinding stone, all clustered around a hearth. The larger, denser sites, such as site 263 in south-east Dakhleh or those atop the plateau, appear to consist of several or many such units, probably reflecting repeated occupations of favoured locales.

These sites, following Binford's (1980) scheme, appear to be residential bases within a fairly mobile foraging strategy. This strategy probably also took Masara A groups far out into the deserts beyond Dakhleh, as suggested by the variety of exotic raw materials in the lithic tool-kit.[5] Within the oasis, the small, ephemeral nature of individual sites indicates that each stay was relatively short. The evidence for repeated occupations on the larger sites, however, suggests a certain 'tethering' (Binford 1980:9) to particularly rich locations.

For Masara A groups, procurement of lithic raw materials was embedded within the basic subsistence schedule, while the actual knapping occurred largely at the base camps rather than at the source. The emphasis was on a formalized blade core technology resulting in a standardized tool-kit of relatively small, potentially portable artifacts.

This pattern is certainly not confined to Dakhleh and its environs. As mentioned above, the el Ghorab entity in southern Egypt consists of sites similar to those of Masara A, with similar tool-kits. El Ghorab sites are distributed widely across the Western Desert and beyond (Wendorf *et al.* 1984:413). Besides the Nabta and Kiseiba areas, they occur in Khârga Oasis, in the Dyke area south of Dakhleh, and even in the Nile Valley at Elkab. Similar sites are found far to the west in the Maghreb amongst such Capsian groupings as the Chacal, the Aïi Aachena, and the Sétif Facies (Wendorf *et al.* 1984:413). Indeed the technological and settlement patterns on Masara A sites conform closely to those recently defined for most Terminal Palaeolithic and Epipalaeolithic sites across the entire Sahara (Holl 1989:339).

*Masara C*

The Masara C hut circle sites stand in sharp contrast to this apparent Sahara-wide early Holocene pattern. There is considerable evidence for increased sedentism: the hut structures themselves, possible storage bins, the emphasis on an expedient lithic technology, and evidence for a variety of other activities apparent, for instance, in the diverse lithic tool-kit, abundant grinding equipment, and the manufacture of beads. Although excavation may change the picture, these sites do not appear to be fully sedentary in the sense of being occupied year-round, perhaps over a period of years: the structures seem too flimsy, the sites themselves not sufficiently cluttered. Moreover, a study of 'pit structures' (structures with floors lower than the ground surface) in both the ethnographic and archaeological records worldwide, suggests all are associated with, minimally, a biseasonal settlement pattern (Gilman 1987).

The Masara C structures may have been fairly long-term base camps within a collector or logistic system (Binford 1980). A site such as 264 seems to fit this picture. It appears to have served for a period of time (a season? longer? repeatedly for part of the year?) as a hub of activities. Resource collection and perhaps some processing occurred elsewhere. Much of the preparation for such activities, however, such as the manufacture of arrowheads, some of the processing evidenced by the grinding stones and elements of the chipped stone toolkit such as scrapers and piercers, as well as the consumption of resources, took place on site (*cf.* Chatters 1987:340).

Two further questions about Masara C concern what it was that attracted this unusual degree of sedentism to this spot, and where else Masara groups went on their annual round, assuming they were not permanently in their 'base camps' on and around site 264.

Sedimentological studies are of little help in trying to account for the presence of Masara C stone structure sites, since virtually all early Holocene deposits have been scoured away in this part of Dakhleh (I. A. Brookes, pers. comm., 1990). At least a partial answer is suggested, however, by the topography of the area. The Masara C ridge forms the southern boundary of a unit called the South-east Basin, which was an important focus of settlement in mid-Holocene times (McDonald, in press a; see also Fig. 2). The South-east Basin, at *ca* 145 m above sea level, seems to have been well-watered during the Holocene humid periods. It lies at the southern terminus of a major wadi system in which, even today, the occasional green bush can be found.

In the early Holocene, as mentioned above, the area was a magnet also for Masara A groups; site 263, *ca* 1.5 km west of 264, is by far the largest and richest Masara A site recorded on the oasis floor. In mid-Holocene times, the South-east Basin was sprinkled with sites of the 'Bashendi', a Neolithic cultural unit, as well as sites of Old Kingdom date. One cluster of Bashendi sites at the west end of the basin covers an area *ca* 3 × 2 km, and has yielded radiocarbon dates spanning a millennium (McDonald 1990). A small ridge at the east side of the basin features clusters of hut circles belonging to the Bashendi unit, including one site consisting of over 150 structures. Arguably the conditions that made the area such a focus of settlement in mid-Holocene times may also have stimulated an unusual degree of sedentism in the early Holocene.

There may also have been an additional environmental factor at work promoting sedentism in the earlier period. It may be no coincidence that the two Masara C dates available so far fall within the 8800–8600 bp dry phase that interrupts the early Holocene humid period.

Where else Masara C groups might have gone on a postulated annual round is not clear. A pattern of seasonal aggregation in the oasis by groups otherwise dispersed well out in the desert has been suggested for the later Bashendi unit (McDonald 1985). That pattern seems less likely for Masara C, however. The fact that most chipped stone raw materials are from oasis sources, and the absence of the sort of exotic items that litter Bashendi sites, suggest a much tighter focus on the oasis than found with either Masara A or Bashendi groups. A pattern of short trips into the desert in the wettest part of the year is one possibility. There may moreover have once been Masara sites closer to the centre of the oasis, that have since been obliterated by later settlements or cultivation. Another possibility is that a settlement system extended eastward toward Khârga Oasis, along the foot of the plateau, with sites located in a few favoured locales similar to that around the ridge with the Masara C sites.

### *Masara B*

The Masara B sites south of Sheikh Muftah probably constitute a different type of component within their settlement system than either the Masara A or Masara C sites. With their restricted assemblages, they do not appear to be either residential or logistical base camps. Neither do they qualify as 'locations', which, by definition, are places occupied briefly, perhaps for only a few hours, for some extractive task. Masara B sites were primarily places where burins were manufactured from local materials and then used. They might, following Binford's (1980) model, be classed as 'field camps'. Field camps are temporary centres where groups from a base camp might spend several days performing some special task. The fragmentary alignments of stone, sparse grinding equipment, and the restricted range lithics (aside from the burins), seem consistent with the picture of a field camp.

These task forces then would have come from home bases elsewhere. There is so far no firm evidence linking Masara B with either of the other units, and dating evidence is inconclusive. Theoretically, though, these home bases would more likely be relatively settled sites of the Masara C type, rather than the small temporary foragers' camps of Masara A. Masara B does share some traits with Masara C:

- similar site locations, in that both groups chose shallow basins upon their respective sandstone ridges;
- alignments of sandstone slabs, though fragmentary ones in the case of Masara B; and
- the same focus on MSA blanks for making specific tool types, albeit different types, burins and scrapers respectively, for the two units.

## Concluding remarks

Dakhleh Oasis conforms to a Sahara-wide pattern of the early Holocene in the Masara A unit, which consists of sites of small mobile groups who regularly ranged far beyond the oasis. In Dakhleh there was, in addition, a far more sedentary element, consisting of groups confined for at least part of the year to a particularly favoured locale in the south-east corner of the oasis. The evidence for this unusual degree of sedentism comprises site locations, structures and a few features, and data on the organization of lithic technology. The many questions that remain concerning the exact nature of these Masara C sites can be addressed only through more fieldwork aimed at recovering data on structures and features, subsistence, seasonality, and frequency of occupation at site 264 and on some of the smaller hut-clusters, and through further survey transects radiating from the Masara C area, particularly to the south and east. The evidence to date on increased sedentism suggests we can also expect to find changes in subsistence strategies on Masara C sites, perhaps in the direction of food production.

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### Endnotes

1 Named after Ma'asara, a village about 6 km north-west of the localities where the unit was first defined. The term Masara is applied to all early Holocene sites within Dakhleh. These, while quite varied, feature such 'Terminal Palaeolithic' or 'Epipalaeolithic' traits as backed bladelets, geometric microliths, the use of the microburin technique, and/or an emphasis on blade production.

2 No microscopic wear studies have been conducted to date on these surface collections.

3 An equally important end product – utilized pieces as opposed to those showing deliberate, patterned trimming or shaping – is more difficult to define in this regard, especially in the absence of use wear studies, and is not included in this analysis. In Table 1, utilized pieces are included in the counts for their respective blank categories – flakes, blades, etc.

4 The figure 350 is based on two sets of data. Eight early Holocene dates on eggshell, reported by Wendorf *et al.* (1984:409 ff.), when recalculated using a fractionation standard of −25 (the standard used for the Masara C dates), averaged 355.7 years older than the raw dates. Furthermore, on pairs of dates from two sites of the Bashendi cultural unit in Dakhleh, where each pair consists of a date on charcoal and one on eggshell, both from the same hearth, the average difference between the eggshell and charcoal dates was 330 years (McDonald 1990:tab. 1).

5 Gabriel (1987) has found campsites scattered across the deserts of southern Egypt and westward in the Sahara, which were occupied during the more humid episodes of the early to mid-Holocene. The earliest of these desert sites date to the ninth millennium bp and may pertain to groups like Masara A.

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