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The pattern of Neolithization in Dakhleh Oasis in the Eastern Sahara

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ABSTRACT

The Neolithic, characterized by V.G. Childe as a critical turning point in the human chronicle, entailed a major economic change, the domestication of plants and animals, plus accompanying changes in settlement patterns, technologies and ideology. Once fully developed in the Near East, it was spread to Europe and a few spots on the North African coast by colonists carrying the full 'Neolithic package'. But for most of North Africa, Neolithization consisted of indigenous groups choosing elements of the Neolithic package most appropriate to the local environment. In northeastern Africa, colonies with the full package may have been established at Merimde in the Nile Delta, and perhaps in the Fayum, but beyond that, the spread seems to have been by cultural diffusion. For the Egyptian Western Desert, the evidence from Dakhleh Oasis suggests that livestock, which arrived independently of the rest of the package, was the only element of the Near Eastern Neolithic to be accepted. Otherwise, the post-Pleistocene adaptation seems to have been an indigenous development, rooted in the local natural environment. This environment was basically a desert, better-watered in the early to mid-Holocene, but even then subject to short arid episodes. Subsistence consisted of hunting and intensively exploiting rich stands of wild African cereals such as sorghum, plus legumes and fruits. 'Neolithic' technologies were developed locally, independently of the Near East, to exploit these resources. Pottery with impressed decoration, for instance, appeared in the southern part of the desert at the beginning of the Holocene, and gradually moved northward into the Egyptian desert where it may have inspired a new undecorated pottery tradition. Bifacially-knapped implements like arrowheads and knives are different enough from their Near Eastern equivalents in form, dimensions and production sequences that they arguably were developed locally, starting in the early-Holocene. Dakhleh witnessed two episodes of increased sedentism, one in the early Holocene in response to an arid episode, the second in the mid-Holocene, under quite favourable rainfall conditions. These episodes transformed the original hunter–gatherer groups socially and ideologically to the point where they could readily accept livestock when it arrived, and started them on the road to increased social complexity. The onset of aridification ca. 7250 cal BP forced the oasis-dwellers out of their settled sites. The flocks and herds of the now-mobile groups remained, in the African pattern, a relatively minor element within a multi-resource pastoralism.

1. Introduction

In a volume investigating the Neolithization of the coastal and desert areas of North Africa, the early to mid-Holocene archaeological record of Dakhleh Oasis, Egypt, is potentially of great interest. Dakhleh is a desert entity located in the Eastern Sahara about 600 km south of the Mediterranean Sea, and some 700 km from the Near East, across what would have been, in the wetter part of the Holocene, an easily traversed desert.

The Near East was the setting for the Neolithic Revolution – the domestication of plants and animals and the accompanying technological changes and restructuring of human societies. Once established, the new way of life spread into Europe and the Mediterranean Basin. The process of Neolithization of the northern or European margin of the Mediterranean is now fairly well understood. It entails the establishment of colonies by farmers from the Near East, and the selective adoption of Neolithic traits by indigenous groups (Zeder, 2008; Moore, 2014). As for the southern or North African coast, Zeder described it as "essentially *terra incognita* for understanding the course of the Neolithic emergence" (Zeder, 2008, 11,603). Since 2008, relatively little has been added to our

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knowledge of developments along much of the coast or further inland (Barich, 2014).

Under these circumstances, the body of evidence concerning Neolithization within Dakhleh Oasis is pertinent. Dakhleh Oasis is a large entity ca. 70 × 20 km lying in the centre of the Egyptian Western Desert. Over 30 years of fieldwork by members of the Dakhleh Oasis Project (DOP) on the archaeology of the early to mid-Holocene has revealed a rich record concerning the origins and development of food producing cultures in the area. The evidence from Dakhleh Oasis is to some extent supplemented by that from Kharga, the large neighbouring oasis, where members of the Kharga Oasis Prehistoric Project (KOPP), an offshoot of the DOP, have since 2000 been investigating the Escarpment edge and the top of the Libyan Plateau that borders the oasis to the east.

In Dakhleh Oasis, hundreds of early to mid-Holocene sites were located on survey (McDonald, 1999). While most sites, as is typical in a desert environment, are highly deflated, some retain *in situ* deposits. Categories of information recovered include chipped stone collections, grinding equipment, small finds, pottery, remains of structures, animal bones, pollen and plant macrofossils, and samples for dozens of radiocarbon dates. This evidence can be brought to bear on the major questions concerning the timing and manner of the Neolithization of North Africa. Did the Neolithic, for instance, arrive as a package, perhaps borne by migrants from the Near East? Or did individual traits trickle in over time, to be selectively adopted by indigenous groups?

In brief, as explored below, the evidence from Dakhleh and Kharga Oases suggests the latter alternative. Local groups seem to have accepted very little from the Near East beyond animal domesticates. Other Neolithic traits – greater sedentism, pottery, the bifacial working of certain stone tools, seem to have evolved locally, independently of Near Eastern developments.

2. The Near Eastern Neolithic and its spread

2.1. Childe's Neolithic Revolution

Before focusing on developments in Dakhleh Oasis, some remarks on the Neolithic as such, and the nature of its spread across North Africa. In 1936, V.G. Childe coined the term 'Neolithic Revolution' for what he perceived as a pivotal point in the human chronicle, the transition to farming. There are generally thought to be several dimensions to the Neolithic Revolution, including changes in the economy, technology, settlement patterns, and ideology. At the centre of the revolution was food production – the domestication of plants and animals. New tools such as grinding equipment, polished stone hoes and axes, blade tools and pottery were needed to grow, process and store the new foods. A more settled lifestyle was both possible due to the secure resource base provided by domestic foods, and necessary, so that the new farmers could protect the growing crops and store and utilize the bulky harvest (Hitchcock, 1982; Marshall, 2006). Finally, an ideological shift was needed, in part to make aspects of the new economy, the concept of private property for instance, acceptable to the former hunter–foragers (Hodder, 1990; Barnard, 2007; Bowles and Choi, 2013).

While it is now clear that the Neolithic Revolution occurred, more or less independently, in many parts of the world (Fuller, 2010; Larson et al., 2014), arguably the earliest transition, and the one of concern here, occurred in the Near East starting around 12,000 years ago, at the end of the Pleistocene. The principal domesticates for this area were wheat, barley, various pulses and flax, plus sheep, goats, cattle and pigs.

While the picture sketched above of a Neolithic Revolution featuring newly-settled farmers with their 'package' of novel tools and plant and animal domesticates is still dominant in university courses, textbooks and so on (Barker, 2006, 328; Fuller, 2010; Finlayson and Makarewicz, 2013), advances in recent decades in fieldwork, dating techniques, archaeobiological approaches and genetic analyses have seriously eroded this scenario. Far from being a revolution with all elements appearing more or less simultaneously, the transition to agriculture seems to have been a complex and protracted process (Fig. 1). Full domestication of both plants and animals now appears to have taken thousands of years, with some species brought under control repeatedly, over a broad area of the Near East (Fuller, 2010; Zeder, 2011, S230). Similarly, some degree of sedentism can be found long before the Neolithic in the Late Pleistocene Natufian culture of the Levant (Bar-Yosef, 1998), while Early Neolithic (PPNA) sites, even those with elaborate architecture, do not qualify as year-round, sedentary villages (Finlayson et al., 2011; Asouti and Fuller, 2013). Zeder (2011, S231) estimates that a fully evolved, settled agricultural economy based primarily on domestic crops and animals took at least 4000 years to develop in the Near East (see also discussion in Finlayson et al., 2011).

2.2. Spread of the Near Eastern Neolithic

Once established, the farming way of life began to spread beyond Southwest Asia, notably into Europe and North Africa (Fig. 2). Two basic processes have been postulated for the agricultural dispersal westward, both initially suggested by Childe: migration (demic diffusion), and cultural diffusion.

For Europe, the predominant process for the spread of farming initially was migration or colonization by Near Eastern groups carrying the Neolithic package, that resulted in, for example, in the LBK (Linear Pottery Culture) found in much of Central Europe (Gronenborn, 2014). Beyond the LBK area however a complex picture is emerging of indigenous foraging groups adopting some components of the Neolithic package depending on the local environmental and cultural contexts (Barker, 2006, 379; Cummings, 2014). On the western fringes of the LBK culture, for instance, there were groups making their own style of pottery and remaining fairly mobile, but with a mixed economy involving hunter–gathering, pastoralism, and perhaps crop-growing (Gronenborn, 2014, 790).

As for the spread of farming to North Africa, the main routes would have been by land across the Sinai Peninsula, or by sea across the Mediterranean. In fact, recently published archaeological and genetic evidence indicates that the Mediterranean was a major thoroughfare for the spread westward of the Neolithic, the main agents being seafaring colonists from the Near East. The pattern seems to have been one of separate groups of 'leapfrogging' pioneers establishing farming communities in scattered coastal enclaves where conditions would have been especially favourable for agriculture (Zeder, 2008; Moore, 2014). In this fashion, the migrants reached the Atlantic on both the Spanish and Moroccan shores by the middle of the eighth millennium BP. At a key Moroccan site, Ifri Oudadane, Neolithic deposits starting ca. 7600 cal BP yield first lentils, then three types of wheat, barley, domestic ovicaprines and cattle, and the Cardial impressed ware carried across the Mediterranean by the migrating groups (Morales et al., 2013). Linstädter et al. (2012) model the subsequent Neolithization of the area: Epipalaeolithic hunter–gatherers at the inland site of Hassi Ouenzga for example suddenly begin making pottery in a style of their own, and over the next few hundred years, selectively adopt other Neolithic traits.

Strangely, there is little evidence of seafaring colonists anywhere else on the admittedly somewhat poorly explored North African coast between Egypt and Morocco. The evidence, reviewed by Barich (2014), seems to be of individual hunter–gatherer groups

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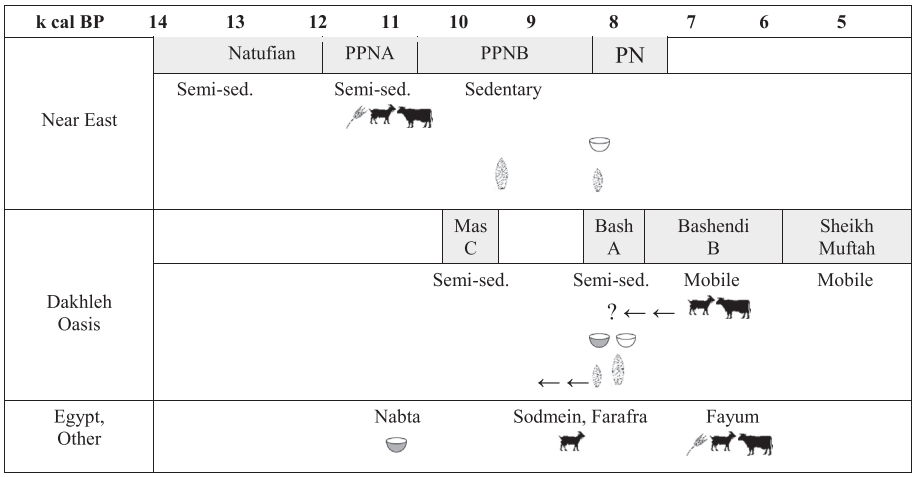

Fig. 1. Chart showing the first appearance of certain Neolithic traits in the Near East, in Dakhleh Oasis, and elsewhere in Egypt. Traits include degrees of sedentism, plant and animal domesticates, impressed (solid colour) and undecorated pottery, and large and small arrowheads.

across this far-flung area adopting certain Neolithic traits depending on local environmental conditions, often long after the Neolithic package had reached Morocco. Thus in the relatively well-watered Jebel Gharbi area of Northwest Libya, while organic remains are scarce, site locations, pottery, lithic technology, hearths (*steinplätze*) and hut foundations, plus the fact that goats are already present at nearby Haua Fteah, all suggest some food production by local groups after ca. 6700 cal BP (Barich, 2014).

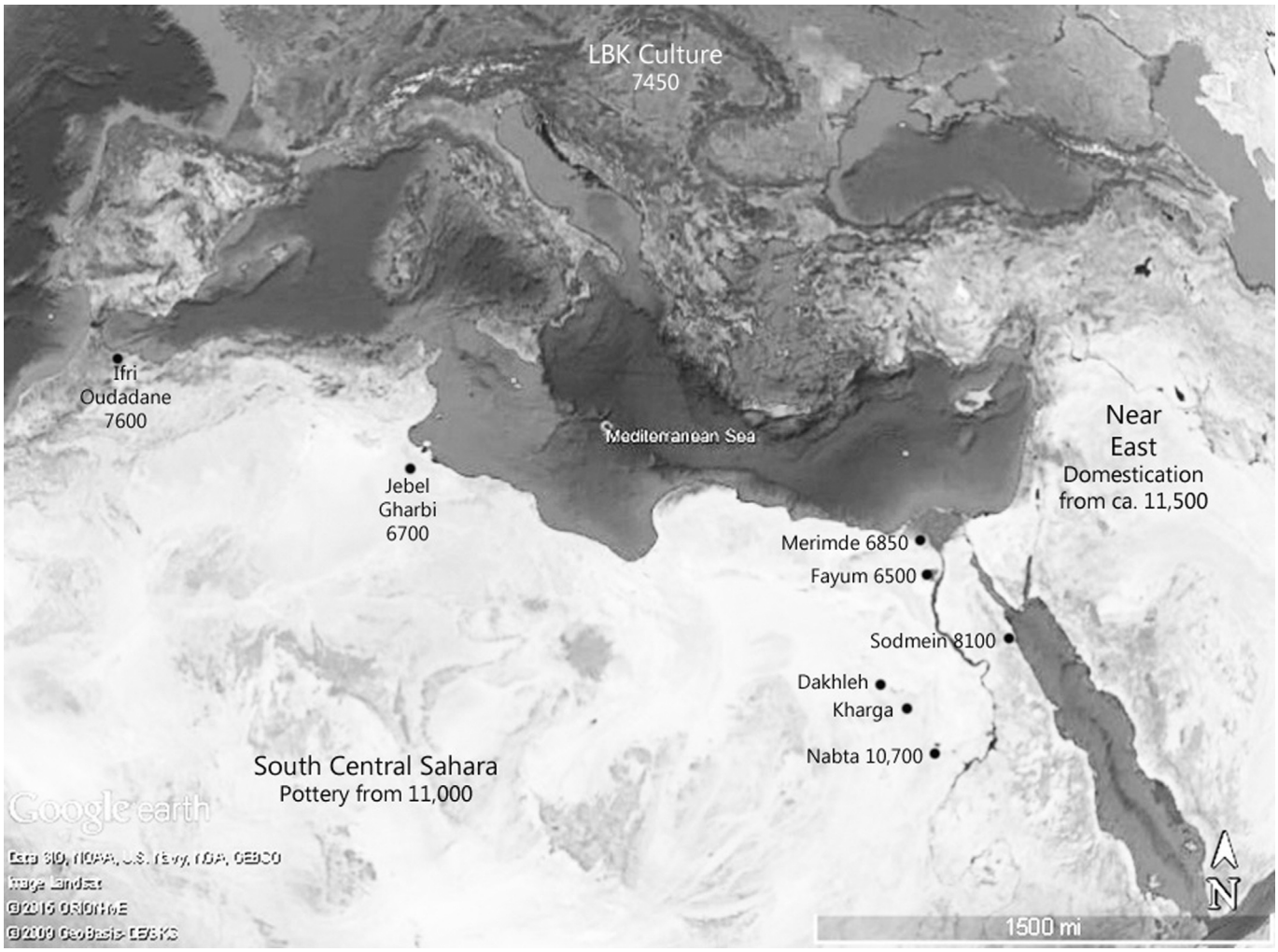

Fig. 2. Map of lands around the Mediterranean Sea showing some of the sites mentioned in the text and the dates (cal BP) of the appearance of certain Neolithic traits. Image credit: Google Earth Pro.

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3. Neolithization of Northeastern Africa

Towards the east end of the Mediterranean basin, closer to the Near East, Neolithic traits seem to appear later still. In the Fayum Oasis, just west of the Nile (Fig. 3), much of the Neolithic package – sheep, goat, pig and a few cattle, emmer wheat and barley, and much pottery, but with little evidence of permanent structures, is found at the stratified sites of Kom K and Kom W, dated ca. 6500–6200 cal BP (Wendrich et al., 2010; Phillipps et al., 2012; Linseele et al., 2014). There is also some limited evidence for earlier animal domesticates in the Fayum: sheep at Qasr El-Sagha XI/81 dated 7350 cal BP, and sheep, goat and cattle at IX/8 at 7150 cal BP (Linseele et al., 2014, 9).

The earliest Neolithic site in the Nile Valley, Merimde Beni Salama in the Western Delta, has both plant and animal domesticates starting from its lowest level, Level I or the *Urschicht* (Midant-Reynes, 2000). This ephemeral occupation, while poorly dated, is estimated to fall ca. 6850–6650 cal. BP. Levels II–V, with more solid architecture, date ca. 6550–6100 cal BP (Linseele et al., 2014). Domesticates reach Upper Egypt a little later. The Badarian site of Mahgar Dendera 2, essentially a fishing camp with livestock, is dated 6350–6200 cal BP (Hendrickx et al., 2001).

As to the mode of transmission of the Neolithic to this Northeastern corner of Africa, the excavator of Merimde, Eiwanger (1984), citing a wide range of traits shared with the Levant, argues that migrants from the Near East were responsible for Merimde Level I. Concerning the Fayum, present-day researchers seem undecided as to how the Neolithic arrived. Phillipps et al. (2012, 74) suggest either an 'inland transfer' of the socio-economy from the Delta, or an outright colony. Shirai (2010) addresses the problem in part by comparing aspects of the Fayum Neolithic material culture with that of the Levant. Fayum pottery might resemble early Levantine (Yarmukian) pottery in forms and sizes, but not in surface treatment or decoration (Shirai, 2010, 312). There are some parallels in farming tools, notably in coarsely-serrated bifacial sickle blades similar to those of the Levantine Lodian culture (ca. 7850–7500 cal BP), and bifacial axes with polished working edges. He also equates small bifacial projectile points from the Fayum with three small points from the Pottery Neolithic in the Levant. Despite these parallels, Shirai (2010, 338 *et passim*) favours primarily

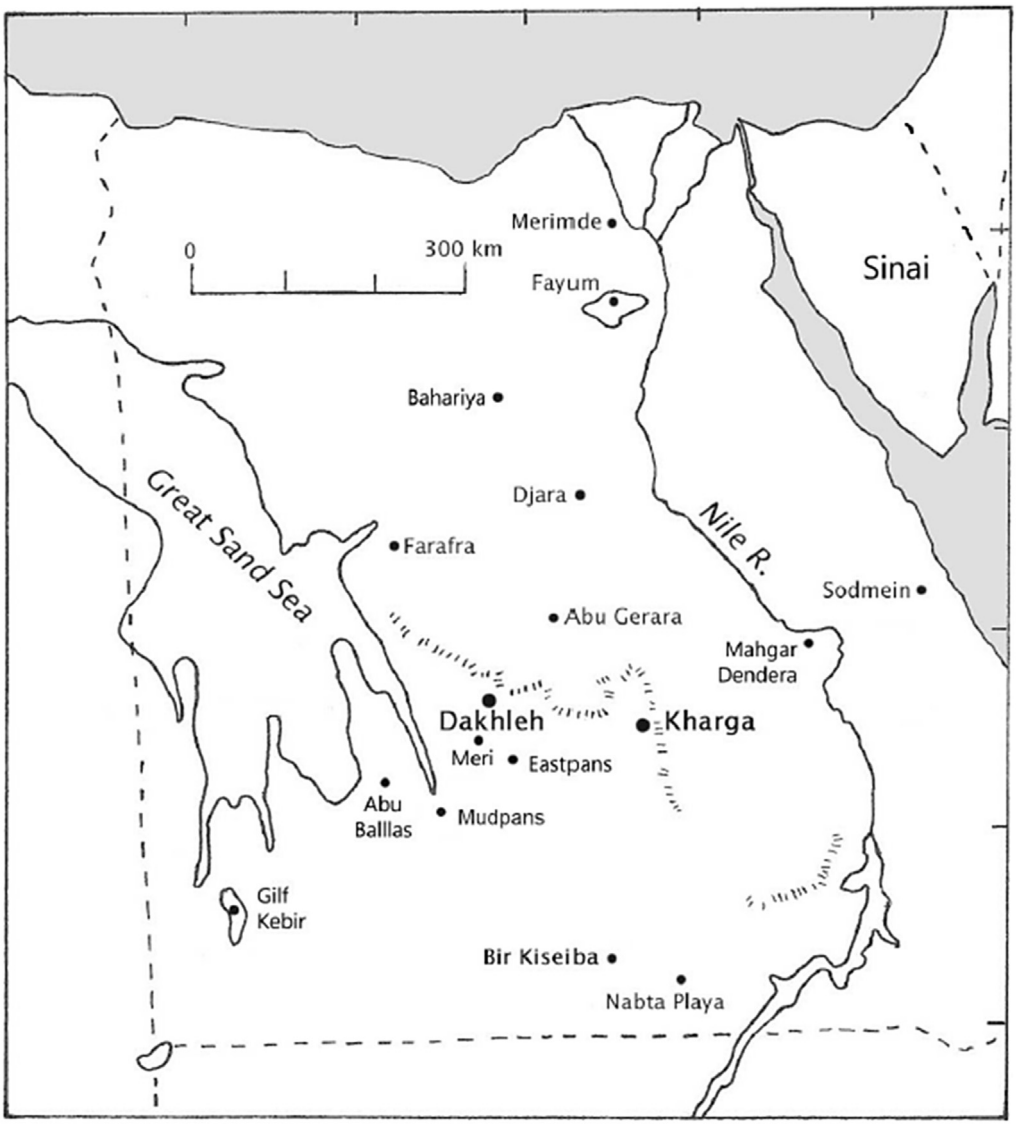

Fig. 3. Map of Egypt showing some of the sites mentioned in the text.

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diffusion rather than colonization to explain the arrival of the Neolithic. While there is a chronological gap between the Fayum Epipalaeolithic and the Neolithic, and a change in lithic technological organization, there is considerable continuity as well, suggesting that local groups adopted various aspects of the Neolithic.

The Neolithic packages found in the Fayum and Merimde in the seventh millennium are not the earliest examples of food production in Northeast Africa. As mentioned, animal domesticates appear in the Fayum starting ca. 7350 cal BP. They occur even earlier in the Eastern and Western Deserts of Egypt. At Sodmein Cave on the Red Sea Coast, goat bones and dung are present as early as 8100 cal BP (Vermeersch et al., 1996; Vermeersch, 2008). In the southern part of the Western Desert at Nabta Playa, remains of sheep/goat and cattle are present in the Middle Neolithic Ru'at El Ghanam period, which begins ca. 8000 cal BP (Wendorf and Schild, 2001). At Farafra Oasis, goat dated ca. 8100 cal BP was found *in situ* in the Hidden Valley village (Barich, 2014, 25).

Summing up this evidence from the Fayum and Merimde on the one hand, and the Egyptian deserts on the other, Linseele et al. (2014) suggest that there were two major episodes in which domesticates were introduced from the Near East. The earlier one, starting by the end of the ninth millennium, involved only livestock – ovicaprines and probably cattle – with the most likely route running from the Sinai across the Gulf of Suez or the Red Sea to sites like Sodmein Cave and the nearby Tree Shelter (Vermeersch, 2008). As for the agents involved in the transfer, Vermeersch (2008, 95) suggests 'wandering herders' from the Near East. There is however little evidence that they carried with them much of the material culture of the Levant. The relevant horizon at the Tree Shelter, AH3, is aceramic, while the expedient flake-based lithic assemblage is essentially African, not Levantine (Vermeersch, 2008, 37, 95). The herders seem to have quickly crossed the Nile, appearing in a few spots such as Nabta Playa and Farafra, and later perhaps, the Fayum. Generally, the bones of domesticates are rare, with game animals still dominating the assemblages (Linseele et al., 2014).

4. Neolithization in Dakhleh Oasis: introduction and environmental background

The remainder of this paper is a detailed look at how these general trends in the Neolithization of North Africa are played out in large oases in the central part of the Egyptian Western Desert (Fig. 4). To some extent, the pattern in Dakhleh Oasis could be considered typical of post-Pleistocene developments in Northeastern Africa in general, away from the relatively well-watered coastal strip and the Nile Valley.

I argue here that goats and cattle are virtually the only Neolithic elements from the Near East that were accepted by the oasis dwellers. Otherwise, all early and mid-Holocene cultural developments, whether 'Neolithic' or not, originated locally, or at least within Northeastern Africa. Thus, while herd animals were accepted, the Near Eastern crop complex, adapted to a winter rainfall regime, never penetrated the Western Desert which, even in the mid-Holocene, received its rainfall predominantly in the summer (see below). Instead, local groups intensively exploited wild stands of African cereals such as sorghum. Concerning settlement, in Dakhleh as well as Kharga Oasis, there was a pattern of increased sedentism long before the arrival of domesticates, while groups became *more* mobile once livestock was introduced. As for material culture, some traits including ceramics and the bifacial working of lithics, often cited as imports from the Near East, are arguably of local, African origin. These issues are discussed in the next two sections, sections 5 and 6. Section 5 examines the question of increased sedentism in Dakhleh in the early and mid-Holocene, the accompanying subsistence patterns, and the effects the reduced mobility may have had on hunter–gatherer ideology. Section 6 addresses the issue of whether certain ceramic and lithic artifact categories were local in origin or imported from the Near East as part of the Neolithic package. First though, a brief summary of the post-Pleistocene environmental background for the Egyptian Western Desert.

The Egyptian Western Desert today is hyperarid, uninhabitable except for a half-dozen oases including Dakhleh and Kharga, all supported by groundwater accessed through deep artesian springs or wells. In the early to mid-Holocene however, the Eastern Sahara generally was more humid than today, due to the rapid northward shift of the African monsoon belt ca. 10,400 cal BP (Kuper and Kröpelin, 2006). As a result, the oases as well as many localities in what is now the barren desert were occupied by hunter–gatherer groups. In Dakhleh Oasis, the earliest radiocarbon dates fall around 10,100 cal BP (McDonald, 2001). In the mid-Holocene, the Mediterranean rainfall belt expanded southward, bringing winter rains to supplement the summer monsoons in much of the Western Desert. The humid period persisted until ca. 7250 cal BP. Thereafter, with the monsoon belt in retreat, aridification continued until full desert conditions were reached ca. 5500 cal BP. Geological and archaeological evidence amassed by the Combined Prehistoric Expedition, mostly in the southern part of the Western Desert, indicates that the early to mid-Holocene humid period was interrupted by several brief, dry episodes (Hassan, 1988, Fig. 2; 2002, Fig. 2.2; Wendorf and Schild, 2001).

5. Increased sedentism in Dakhleh in the early and mid-Holocene

Three cultural units have been defined within the Dakhleh Late Prehistoric record: the *Masara* or Epipalaeolithic, dated ca. 10,100–8450 cal BP, the Neolithic *Bashendi*, subdivided into Bashendi A (ca. 8370–7600 cal BP), and Bashendi B (7350–5750 cal BP), and the *Sheikh Muftah*, which may have spanned over 1500 years, extending into Old Kingdom times ca. 4100 cal BP.

5.1. The early Holocene Masara C

The Masara Unit is divisible into two main groups, A and C, on the basis of both artifact inventory and site type, Masara C being the more sedentary (McDonald, 2003). Masara C existed during a portion of the entire Masara timespan, from ca. 9900 to 9500 cal BP. Masara C sites are largely confined to a spot in southeastern Dakhleh, well beyond the extant oasis (Fig. 4). Most of the 20 recorded localities feature apparent structures, the largest sites consisting of 14–20 units each. Structures are rings of stone, typically round or oval, a few crescent-shaped, and generally two to four meters in diameter. Most are semisubterranean, and pits and storage bins are present. Various lines of evidence including the structures themselves, the expedient use of local lithic raw materials, a diverse and specialized lithic toolkit (Fig. 5), and evidence for a number of other activities, all suggest a somewhat sedentary population (McDonald, 1991). Heavy grinding equipment is present, including both slabs and handstones, but no pottery has been found.

There is no evidence of food production at these sites. They appear rather to be the base camps of 'collector' groups (Binford, 1980, 1990) focusing on a broad spectrum of local resources. Faunal remains (Churcher et al., 2008) range from hartebeest, gazelle and hare, to ostrich and smaller (wading?) birds, to tortoise, lizard and toad. Palaeobotanical evidence (Thanheiser, 2011) including Sahelian elements amongst the trees and shrubs, and sedges and other marshland plants, suggest a fairly wet environment locally. As the period 9820–9520 cal BP seems to have been a

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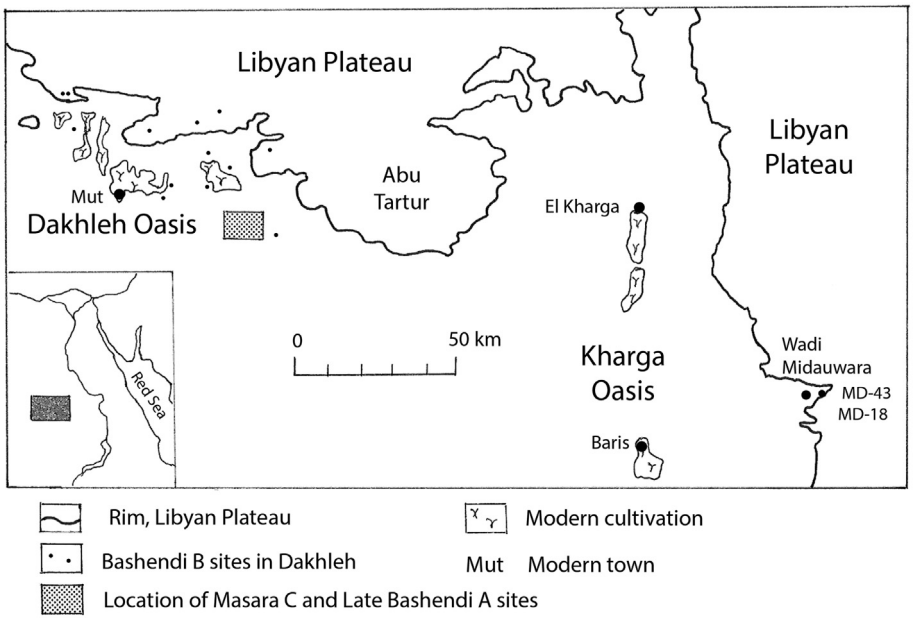

Fig. 4. Map of Dakhleh and Kharga Oases showing the location of some of the archaeological sites mentioned in the text.

markedly arid one in the Western Desert in general (Wendorf and Schild, 2001: 649; Hassan, 2002), it appears that Masara C groups were pushed into settling in what may have been a small well-watered refuge within an otherwise suddenly reconstituted desert (McDonald, 2009).

In Kharga, high above the oasis floor in the Midauwara embayment under the rim of the Libyan Plateau (Fig. 4), there seems to have been a similar episode of increased sedentism roughly contemporary with Masada C. Site MD-43, for instance, boasted about 20 slab structures, and a lithic toolkit similar to that of Masada C (McDonald, 2009). Interestingly, Masara C-like assemblages have been recorded on the oasis floor in Southern Kharga, but on what appear to be open-air sites without slab structures (Briois and Midant-Reynes, 2010: 46).

5.2. The Late Bashendi A unit

In Dakhleh Oasis, the next major episode of increased sedentism is associated with the Late Bashendi A in the mid-Holocene, ca. 8000–7600 cal BP. Occupation is again in the same area of SE Dakhleh, but conditions seem considerably more humid, with perhaps a bimodal (winter–summer) rainfall pattern (Goodfriend, 1991; Neumann, 1993; Arz et al., 2003). The number, variety and size of at least some sites increased dramatically. The largest, in fact the largest site recorded anywhere in Northeastern Africa for this time, is Loc. 270, with 200 slab structures (Fig. 6). Structures come in a variety of shapes and sizes, and appear to form clusters, perhaps reflecting social groupings (McDonald, 2008). Excavation suggests a somewhat complex life history for the site which, according to a suite of radiocarbon dates, could have spanned 900 years (McDonald, 2008, Table 2). Other sites with structures in the vicinity of 270 include a pair of much smaller, probable special purpose sites, Locs 306 and 307, and Loc. 269, a large stone ring measuring 48 × 35 m (McDonald, 2009).

Late Bashendi A chipped stone assemblages, basically flake-based, feature numerous bifacial arrowheads, small and large, as well as larger knife- and foliate-shaped bifaces (Fig. 7). Other artifact categories include ostrich eggshell beads, labrets (Fig. 7m), grinding slabs and handstones, and a little pottery, both undecorated and Khartoum-style impressed ware (Hope 2002; Warfe, 2008; Fig. 8). Grinding equipment, both slabs and handstones, is common.

Organic remains recovered so far from Bashendi A suggest an intensive focus on strictly wild resources. Faunal remains are of game animals such as gazelle, a large bovid, a small carnivore, and three sizes of bird including ostrich (Churcher et al., 2008). As for plants, the dicots and sedges that dominated Masara C samples are still present, but grasses are now the dominant group, found in virtually every sample. *Sorghum bicolor* ssp. *arundinaceum* (a wild sorghum) is important, while *Panicum turgidum* (a millet) and small quantities of other millets are present as well (Thanheiser, 2011).

Despite the lack of evidence in the faunal collection, it seems likely that herding was practised in the Late Bashendi A. Domesticates, both cattle and sheep/goat, were, as noted above, present by now elsewhere in the Western Desert – at Nabta Playa, at Farafra Oasis, possibly at Djara to the NE of Dakhleh (Wendorf and Schild, 2001; Kindermann, 2010; Barich, 2014, 25; Linseele et al., 2014, 13). The site layout at Loc. 270, and the presence in Late Bashendi A toolkits of implements elsewhere associated with pastoral groups, items such as scrapers on side blow flakes (Fig. 7a) and tranchets or planes, argue for the presence of herds or flocks (McDonald, 2009). Loc. 269, the large stone ring, could have served as an animal kraal, although other functions are also possible.

On the Escarpment above Kharga Oasis, at Wadi el-Midauwara, several slab structure sites contemporaneous with Late Bashendi A have been recorded. The largest of the Midauwara sites, MD-18, features 64 structures of mid-Holocene age. Again, no mid-Holocene slab structure sites have been recorded on the oasis floor (Briois and Midant-Reynes, 2010: 46).

The two large oases of the Central Western Desert seem unique in the area, given the presence in both the early and mid-Holocene of slab structure sites. In Nabta Playa to the south there is evidence of increased sedentism, but not slab structures, by the early mid-Holocene. In the El Nabta/Al Jerar phase (ca. 8900–8150 cal BP), large sites like E-75-6 are occupied for most of the year. They feature wells and bell-shaped storage pits, but the 'huts' are oval basins up to 30 cm deep with a superstructure probably built of

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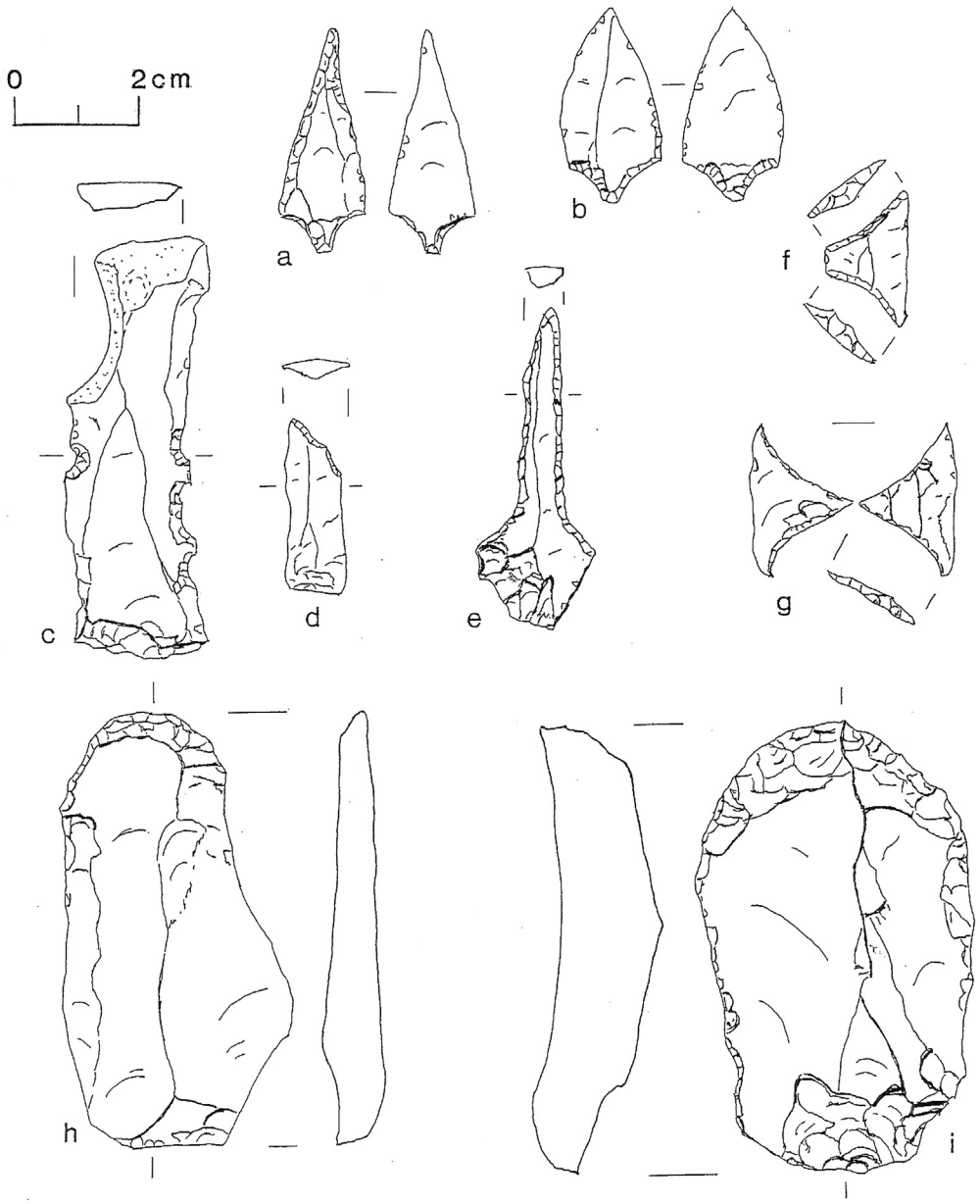

Fig. 5. Masara C chipped stone tools (from McDonald, 2003, Fig. 5).

sticks. Slab structure sites do appear by Late Bashendi A times further north in the desert, around Abu Ballas to the southwest of Dakhleh (Kuper, 1993) and at Meri to the west of the oasis (Riemer, 2006). In the Farafra Depression to the northwest, two 'villages' have been investigated, one in Hidden Valley, with at least 10 slab structures, the other in the Sheikh el-Obeiyid area, with 25 structures (Barich and Lucarini, 2008; Hamdan and Lucarini, 2013). These sites were occupied by 7750, or as early as 8100 cal BP (Hamdan and Lucarini, 2013; Barich, 2014, 25), by people exploiting wild animals and plants, notably sorghum, and herding goats.

5.3. The Bashendi B unit (7350–5750 cal BP)

In Dakhleh Oasis, the Bashendi A episode of increased sedentism ended by the mid eighth millennium cal BP as aridification began with the southward shift of the monsoon rains. The Bashendi B phase, which appears after what may be a short gap, is the product of mobile herder–foragers. The settlement pattern changes dramatically as the slab-built settlement sites are abandoned. Localities now are typically open-air sites consisting of clusters of hearth mounds and associated cultural debris. Sites occur as before on the oasis southeastern margin, but also down slope in the oasis Central Lowlands, and atop the Plateau to the north (Fig. 4). Beyond the oasis itself, Bashendi B groups ranged during the rainy season onto the Abu Muhariq Plateau to the northeast of the oasis (Riemer, 2010: 597), and as far as 100 km to the southwest, to such sites as Meri and Chufu (Riemer, 2006). Elsewhere in the Western Desert, Bashendi B-like groups have been recorded in Farafra Oasis (Barich and Lucarini, 2008; Barich et al., 2012) and in Nabta Playa to the south, where similar mobile herder groups date to the Late and Final Neolithic phases (Wendorf and Schild, 2001). Distant from any oasis, the core area of the desert, lacking any permanent surface water, remained the domain of pure hunter–gatherers (Riemer,

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Fig. 6. Dakhleh Site 270 showing outlines of structures. Shaded: higher ground (from McDonald, 2009, Fig. 12).

2009). By 7250–6850 cal BP, these areas were completely abandoned due to dryness.

Bashendi B toolkits retain the small bifacial arrowheads and the knives, and add tranchets or planes, scrapers on side blow flakes, and scaled pieces on quartz pebbles (Fig. 9). A rich ground stone industry includes small polished axes or celts, small palettes, toggles, and beads carved in amazonite, carnelian and limestone. Pendants and bracelets are fashioned from shell. Bashendi B pottery typically has a fine quartz- and shale-tempered fabric; vessels are small and thin-walled, with simple shapes. Some are black-topped, but decoration otherwise is rare (Hope, 2002). Faunal remains include cattle and goat, as well as game animals including gazelle and hartebeest. Few botanical remains were recovered, but large grinding slabs and handstones and possible sickle elements suggest the continued exploitation of plant foods. Kuper and Riemer (2013) characterize this adaptation as 'multi-resource pastoralism'.

5.4. The Sheikh Muftah unit (ca. 5600–4100 cal BP)

If Bashendi B groups exploited the oasis and the desert beyond, the succeeding Sheikh Muftah Unit seems more oasis-oriented, with sites located down slope, closer to the centre of the oasis (McDonald et al., 2001; McDonald, 2002). But while sites are littered with heavy implements fashioned in tabular chert, and with more and larger pots than before, groups do not seem sedentary. The 70 plus sites feature hearth mounds and fire pits, but virtually no structures. Moreover, they are not strictly confined to the oasis. The ACACIA group have recorded a number of Sheikh Muftah sites in their surveys to the north and west of Dakhleh (Riemer, 2011). El Kharafish 02/5, located atop the Plateau some 30 km north of Dakhleh, served repeatedly at the end of the winter rainy season as a base camp for a hunter–herder group coming from Dakhleh.

The Sheikh Muftah people of Dakhleh were primarily pastoralists, keeping cattle and goats. The cattle, to judge from the maturity

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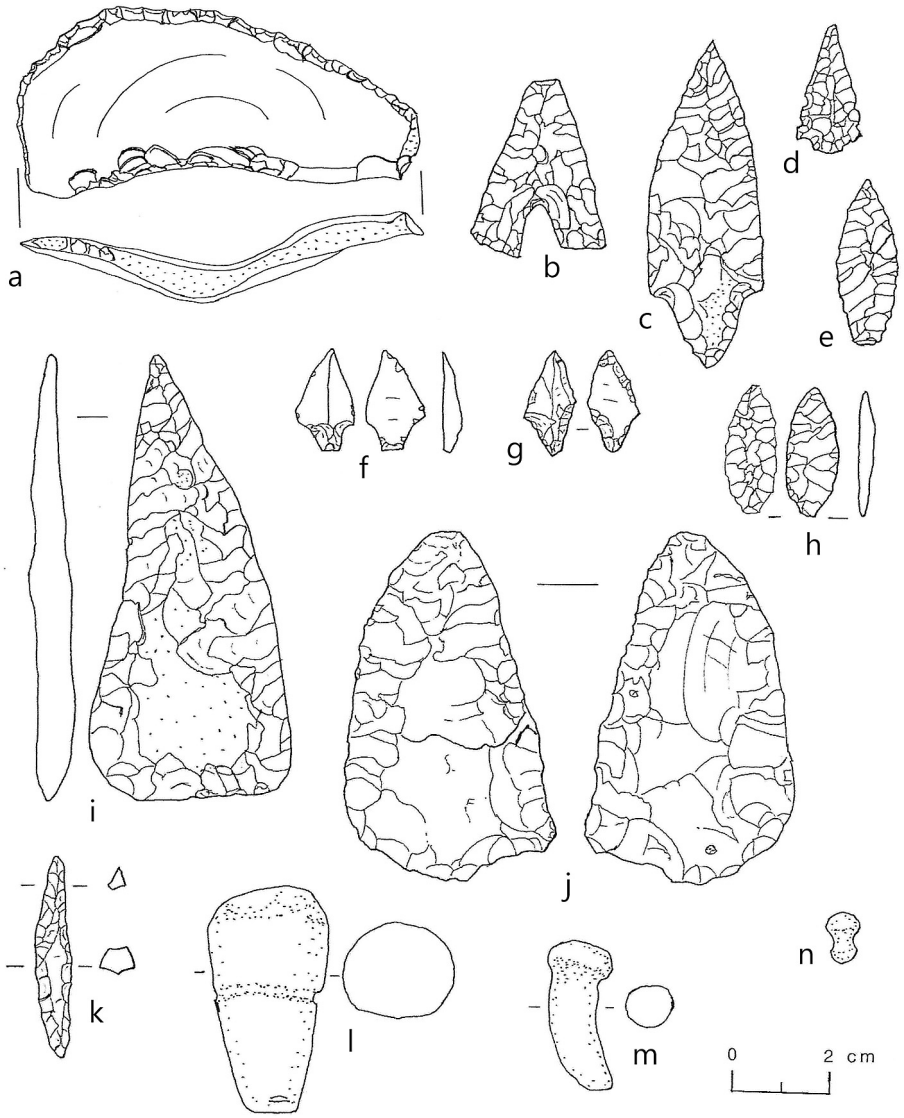

Fig. 7. Bashendi A artifacts: a, Late Bashendi A scraper on side blow flake; b, c, large bifacial arrowheads; d, Helwan point; e–h, small tanged and leaf-shaped points; i, knife; j, bifacial item; k. drill; l–n, items carved in barite.

of most specimens, were exploited for milk and perhaps blood and/or transport, as well as meat. Wild ass or donkey bones were recovered from a number of sites, and the animal appears to have been domesticated by late Sheikh Muftah times (Churcher and Kleindienst, 2006; Churcher et al., 2008). Hunting continued, with prey including gazelle, hartebeest, Cape buffalo, zebra, pig and hare (Churcher et al., 2008). Little is known about the exploitation of plants for food. The Sheikh Muftah unit persisted in Dakhleh to overlap with colonists who arrived from the Nile Valley in Old Kingdom times, ca. 4100 BP.

5.5. Adjustments in ideology and social organization with increased sedentism

Finally, early to mid-Holocene groups in Dakhleh and Kharga Oases, with their long history of increased sedentism, may have undergone important changes in social relations and ideology, leaving them more receptive then 'pure' hunter–gatherers to the concept of animal herding, which is a delayed return system entailing ideas of ownership (Woodburn, 1988; Bowles and Choi, 2013; McDonald, 2013). Firstly, Masara C groups display a clear territorial commitment to their spot in Southeastern Dakhleh, which seems to have persisted for centuries. Generalized reciprocity within the larger area, entailing as it does open access to resources for everyone (Benz, 2010), would be compromised. Within individual sites, if storage was practised, the tradition of communal sharing might have been eroded. Furthermore, pit structures themselves generally represent more than just shelters (Goring-Morris and Belfer-Cohen, 2003). The numbers of huts on the bigger Masara C sites suggest groups somewhat larger than most hunter–gatherer bands, and ones settled for a longer period than normal. The resulting scalar stress (Johnson, 1982) would require new social mechanisms to manage conflicts and to stabilize the group (Goring-Morris and Belfer-Cohen, 2003; Bar-Yosef, 2010; Benz, 2010; Gebel, 2010; Watkins, 2010).

By the mid-Holocene, site 270 had a semi-sedentary population of probably several hundred, while nearby lay a variety of other sites, large and small, with or without structures, and apparently occupied at different seasons of the year. Within Loc. 270 there is evidence, in certain details of site structure and in the presence of

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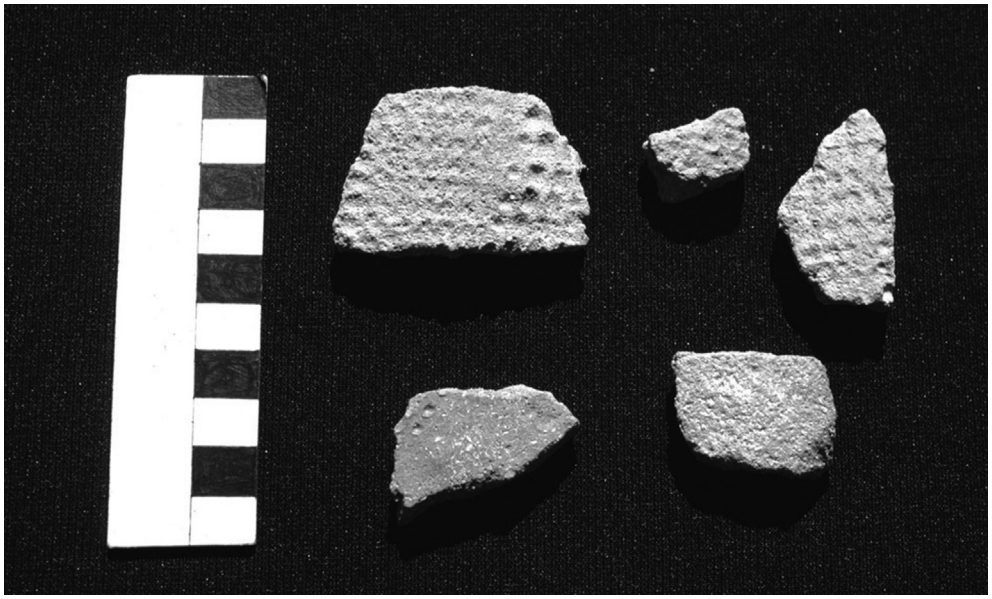

Fig. 8. Sherds of impressed pottery from a Late Bashendi A site.

prestige technologies (Hayden, 1998), such as labrets and perhaps the pottery, for the emergence of socioeconomic differentiation (McDonald, 2008, 2009; Fig. 7). Under these circumstances, when domestic ovicaprines became available in the Western Desert ca. 8000–7850 cal BP, there was arguably no major ideological barrier to their acceptance.

By Bashendi B times, a marked increase in types of prestige technologies arguably suggests that these newly mobile herder–foragers went further than their Late Bashendi A predecessors along the road toward social differentiation or inequality (see discussion in McDonald, 2008). Examples of such technologies are items in exotic raw materials, or involving high production costs, and often visually striking, including for example beads in semi-precious stone, bracelets or pendants made of marine shell, and palettes, toggles, and small ground stone axes (Fig. 9). Several of these items mark the 'mobile elites' that MacDonald (1998) detects in the pastoral groups that would scatter southwestward across the Sahara and Sahel in the waning stages of the humid period and ultimately crystallize into 'medium-level complex societies' such as Kerma to the south, or Dhar Tichitt to the west.

6. Mid-Holocene material culture traits: Near Eastern imports?

Several elements of material culture found in the mid-Holocene Western Desert are thought to have been introduced from the Near East either individually or as part of a Neolithic package. Traits cited include pottery, specifically undecorated pottery (Kuper, 2002) and bifacial lithic technology (Kuper, 2002; Vermeersch, 2008, 95; Kuper and Riemer, 2013, 37). Individual items listed by Shirai (2010) include bifacial axes with polished working edges, bifacial sickle blades, and three small points from the Levantine Pottery Neolithic.

6.1. Pottery

Two hallmarks of the Neolithic, grinding equipment and pottery, appeared in Northern Africa long before the advent of food production. Grinding equipment, both milling-stones and handstones, occur at Wadi Kubbaniya in the Nile Valley near Aswan ca. 18,000 years ago (Banks, 1980). At Nabta, grinding equipment is found throughout the sequence starting ca. 10,700 cal BP. In Dakhleh, Masara C sites yield both grinding slabs and handstones, and these continue in use in the oasis through the mid-Holocene.

Similarly, pottery is found widespread in Northern Africa from early in the eleventh millennium cal BP, long before well-made pottery was produced in the Near East (Close, 1995; Twist, 2007, 32). Early impressed ware is found in three areas, the South Central Sahara, Central Sudan running southward from Khartoum, and the Eastern Sahara, initially at Nabta Playa and Bir Kiseiba, starting about 10,700 cal BP (Figs. 1 and 2). It would take millennia for this 'Wavy-Line' or 'Khartoum-related' pottery to spread from Nabta northward in the Western Desert. It is found at Mudpans and Eastpans, up to 150 km south of Dakhleh, ca. 8450–8200 cal BP (Riemer and Jesse, 2006), and, as mentioned, it reaches Dakhleh in Late Bashendi A times, ca. 8000 cal BP (Fig. 8). In Dakhleh this pottery, with its coarse sand or quartz fabric, appears to be an import from the south (Warfe, 2008, 240). Similar pottery (undated) occurs on Loc. MD-18 in Wadi el-Midauwara above Kharga Oasis (Warfe, 2008, 257) and on the Abu Tartur Plateau between Kharga and Dakhleh oases, dated ca. 8400 cal BP (Riemer and Schönfeld. 2006). On the Kharga Oasis floor, impressed ware is found on small 'Terminal Epipalaeolithic' campsites dated to the ninth millennium (Briois and Midant-Reynes, 2010).

In addition to the Khartoum-related impressed ware, Late Bashendi A sites, as mentioned above, also yield undecorated pottery, and it continues in use throughout the Bashendi B. It is this undecorated material which some suggest may have originated in the Near East. Briefly, undecorated vessels are fine-tempered; surfaces are plain or burnished, and the rim occasionally incised. In Dakhleh, vessels are small and thin-walled, and either open or slightly restricted in shape. Fabrics indicate they were made locally in the oasis (Warfe, 2008).

While undecorated pottery was first noted by Close (1995), R. Kuper, based on the survey work of the Besiedlungsgeschichte der Ost-Sahara (B.O.S.) and the later ACACIA projects, was able to define an undecorated pottery tradition confined initially to the central part of the Egyptian Western Desert, starting ca.8450 cal BP (Kuper, 1995, 2002). He reported undecorated ware from the Mudpans area south of Dakhleh, and from sites in the Great Sand Sea to the west, while his earliest date, from the Gilf Kebir in the

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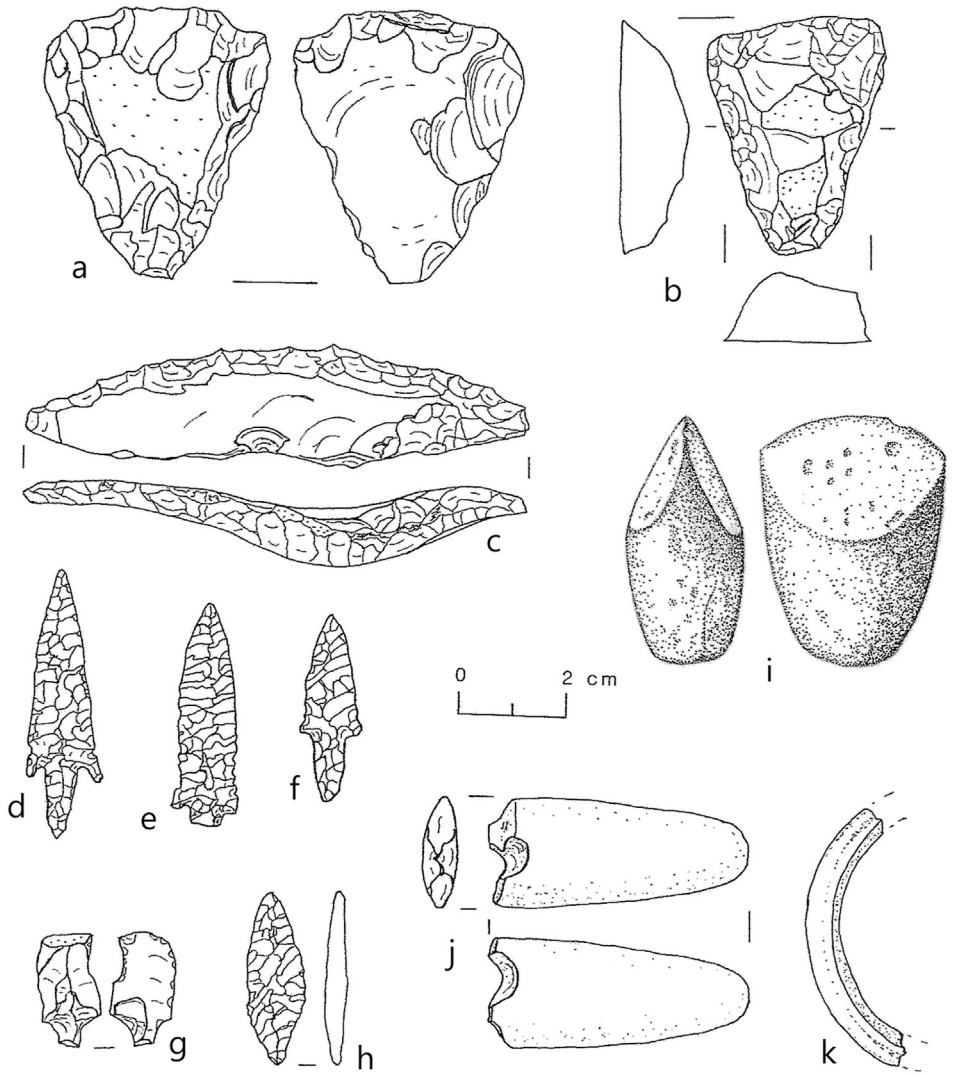

Fig. 9. Bashendi B artifacts: a, b, planes or tranchets; c, scraper on side blow flake; d–h, arrowheads; i, ground stone axe; j, toggle fragment; k, shell bracelet fragment.

southwest, falls ca. 8550 cal BP. Further north, undecorated ware is reported from the Abu Gerara area to the northeast of Dakhleh starting ca. 7550 cal BP, while a very few sherds were found further north again at Djara (Riemer, 2003; Riemer and Schönfeld, 2010). Generally, this pottery seems rare to absent to the north of Dakhleh. None has been reported from Seton Hill north of Djara, or from Bahariya Oasis, or Sitra (Hassan, 1979; Cziesla, 1993; Gehlen et al., 2002). In Farafra, the slab structure villages mentioned above seem to be aceramic, but a few undecorated sherds "characterised by rough paste with vegetal temper and thin walls …" (Hamdan and Lucarini, 2013, 164) are associated with a 'Middle Holocene' phase dated ca. 7220 cal BP.

Concerning the origin of the undecorated pottery tradition of the Egyptian Western Desert, Kuper (1995, 135; 2002, 5) suggests that it could have developed out of, or been inspired by, the Khartoum-related pottery, or it could have originated in the Near East. Of the two, he appears to favour a Near Eastern origin, suggesting it may have been introduced to the Eastern Sahara together with ovicaprines and the bifacial flint technology (Kuper, 2002, 10).

The argument for a Near Eastern origin for the undecorated ware seems weakened by the known dating and distribution of the ceramic-bearing sites, as the earliest sites are found in the south and southwest, and none are recorded in the northern third of the Western Desert, closest to access routes from the Near East (Fig. 3). Warfe (2008, 259 ff.) is inclined to reject the suggestion of a Near Eastern origin, for the same reason that Shirai did concerning early pottery in the Fayum (Shirai, 2010, 313; see above). While the earliest well-developed Near Eastern pottery, from the Yarmukian culture starting ca. 8250 cal BP (Twist, 2007), is mostly undecorated and some of it is burnished, many of its characteristic traits such as loop-handled jars, trays, chalices, and red-painted and incised decoration, are absent in the Western Desert.

The alternative is an African origin for the undecorated pottery, and it is suggestive that the earliest examples come from sites that also yield Khartoum-related pottery. Again though, there are significant differences between the two traditions, notably in the absence of decoration in the one, and the fact that Khartoum-related vessels tend to be much larger and more numerous than the undecorated ones, designed arguably for food storage and preparation (Haaland, 1992). As for the undecorated pottery, the rarity, small size, careful construction and lack of decoration suggests a very different function for these vessels, possibly in the social or symbolic realm (Close, 1995; Warfe, 2008).

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6.2. Bifacial lithic technology

Bifacially knapped items such as knives, axes and arrowheads are a prominent feature on many mid-Holocene sites in the Eastern Sahara. The roots of this technology are thought by some to lie in the Near East, where a similar range of bifacial tool types was produced throughout the PPNA and PPNB, starting ca. 11,700 cal BP. There is however a very long tradition of bifacial working in Africa, from the Acheulian through such industries as the Lupemban, Still Bay and, in the Late Pleistocene, the Aterian of North Africa. There seems though to be a break in the tradition in the early Holocene with the Epipalaeolithic and its focus on blades, bladelets and geometric microliths (Vermeersch, 2008, 95). Bifacial working would then be reintroduced from the Near East in the mid-Holocene with other Neolithic traits.

I have argued elsewhere (McDonald, 2013, in press) that, based in part on evidence from Dakhleh Oasis, the Northeast African mid-Holocene bifacial tradition is largely of local origin, not part of a package of imports from the Near East. Timing is one issue: the three imports cited by Kuper for instance, ovicarprines, pottery and bifacial working, seem to appear in Africa separately. At Sodmein on the Red Sea coast for example, goats were introduced ca. 7350 cal BP (Vermeersch, 2008, 95; Linseele et al., 2014, 14). Bifacial working, on the other hand, is thought to have arrived earlier, in archaeological horizon 4 (AH4), ca. 8550 cal BP or perhaps earlier still, in the Epipalaeolithic AH5 (ca. 9000–8550 cal BP) (Vermeersch, 2008, 61, 90, 95). Pottery, for its part, does not appear at the Tree Shelter site until much later: AH3 (7650–5650 cal BP) is aceramic (Vermeersch, 2008, 37). There is a similar timing issue in Dakhleh Oasis, where bifacial items are present from the start of Bashendi A ca. 8370 cal BP, while livestock first appears in Late Bashendi A, ca. 8000 cal BP, or perhaps only in Bashendi B.

Concerning bifacial implements, most of the discussion focuses on projectile points and their possible origin in the Near East. The relevant Near Eastern corpus (Fig. 10) includes three large (<100–150 mm long) points from the Levantine PPNB, the Jericho, Byblos and Amuq points. The first two have tangs, while the Amuq points are oval or leaf-shaped (Gopher, 1994, 36 ff.). Harparsa, Nizzaniam and Herzliya are small versions of the Jericho, Byblos and Amuq points respectively (Gopher, 1994, 41; Fig. 10) that appear somewhat later, ca. 8350 cal BP (Gopher, 1994). Relevant also is the Helwan (Fig. 10), an earlier small bifacial point (in the Levant ca. 11,500–9650 cal BP). It is the three small Pottery Neolithic points that are most often cited as ancestral to the Northeast African corpus of arrowheads (Gopher, 1994, 224; Kuper and Kröpelin, 2006; Shirai, 2010, 317).

In Dakhleh, Bashendi A projectile points can be divided into four groups on the basis of size and morphology, each group with a somewhat different history of development. They include 1) small (l. < 40 mm) bifacial stemmed and leaf-shaped points similar to some of the small points of the Levant; 2) large projectile points including stemmed and leaf shaped, but also the distinctive hollow-based point; 3) Helwan points and 4) microlithic elements (transversals and segments or crescents) and small triangular-shaped points, dubbed by Riemer (2007) the *Southern Microlithic Complex*. Most of the points in these groups arguably are local, Northeast African inventions.

Of the four groups, the Helwan point probably did originate in the Levant (Shirai, 2010), although it disappeared in the Near East (see above) long before farming may have been introduced to North Africa. The 20 Dakhleh examples, confined to Early Bashendi A sites, are similar but not exact copies of the Levantine ones (Fig. 7d; Fig. 10). The microlithic elements (# 4), on the other hand, are not bifacially worked, plus they have no connection with the Near East, having originated in the Nubian sandstone country of Southwestern Egypt (Riemer, 2007). The more contentious claims concern Group 1, the small bifacial points, and Group 2, the large points.

Concerning the small bifacial points, the two groups, Levantine and northeast African, are roughly contemporaneous, both appearing ca. 8370 cal. BP. Of the three small points of the Levant, the most distinctive in shape is the Haparsa. It has pointed, often downturned barbs, a long oval–elliptical or triangular tang, and often concave sides or laterals (Gopher, 1994, 213 and Fig. 5.60; Fig. 10). Points of this shape do occur in the Fayum Oasis (Shirai, 2010, Fig. 8.7), but seem absent beyond it in the Western Desert. None have been recorded in Dakhleh. The other two Levantine points, tanged and leaf-shaped, are of a much more common form. In fact both forms can be found world-wide, virtually wherever arrows are used.

Both tanged and leaf-shaped points are common on Bashendi A sites (Fig. 7), but they may have developed locally over time. Both types are found in Dakhleh as early as Masara times. The typical Masara C point is the Harif, a simple tanged implement with a little basal retouch (Fig. 5a, b). However, Loc. 265, dated somewhat later than the other Masara C sites (McDonald, 2003, Table 3), yielded tanged and leaf-shaped points, some with bifacial edge retouch (Fig. 11). Two similar points were recovered from Loc. 268, another late Masara C site (McDonald, 2007, Fig. 3: 03). The interval between the Masara unit and Bashendi A is poorly documented in Dakhleh, but two sites, Locs 219 and 006, both with narrow bipoints and tanged items, may help to fill the gap.

Dakhleh Group 2, the large projectile points, likewise seem to have originated locally. Up to 70 mm long, weighing from ca. 3 to 10 g, and usually carefully bifacially retouched, they come in a greater range of shapes than the small ones: stemmed, with or without wings, leaf-shaped or bipointed, hollow-based, and rhomboid-shaded (Fig. 7b, c; Riemer, 2007, Fig. 8). The hollow-based point, an elongated triangle with short, square-ended barbs and a shallow basal hollow or concavity, is clearly a North African invention (e.g. Hugot, 1957). There is simply nothing resembling it in the early or mid-Holocene record for the Levant. The case for the other large point forms, the bipointed and the tanged, is not so clear-cut, and they have been equated with some of the large Levantine forms, specifically the Amuq, Byblos and Jericho points (e.g. Gopher, 1994, 224). The Saharan points, though, appear to have originated locally: they are arguably products of a very different knapping tradition, and seem to have been designed to serve a different purpose than the Levantine points (McDonald, 2013, in press).

Briefly, the Levantine large points are products of a distinctive technocomplex dubbed by Kozlowski (1999) the *Big Arrowhead Industries* (BAI). The BAI entailed a complex system of raw material supply and exploitation to produce a highly specialized “naviform” core designed to yield long, broad, straight-profiled blades, some of them used to fashion the large projectile points. The Eastern Sahara large points in contrast are fashioned on tabular flint. The production sequence for tabular flint is very simple (Kindermann, 2010, 82–96; Lucarini, 2014, 268–272). No core preparation is necessary: one simply chooses an already flattish fragment of roughly the size, shape and thickness required, modifies the edge to produce the tang or whatever, and further thins the implement as needed, using flat surface retouch.

If the large points from the two regions are products of different production sequences, the finished implements also are of different dimensions and morphology, suggesting they might be designed for different purposes. The average length/width ratio for Amuq, Byblos and Jericho points for example is a very laminar 3.5–4.5 (Gopher, 1994, Figs. 4.6, 4.7 and 4.8; Fig. 10). The North African points in comparison are shorter and wider: the length/width ratio

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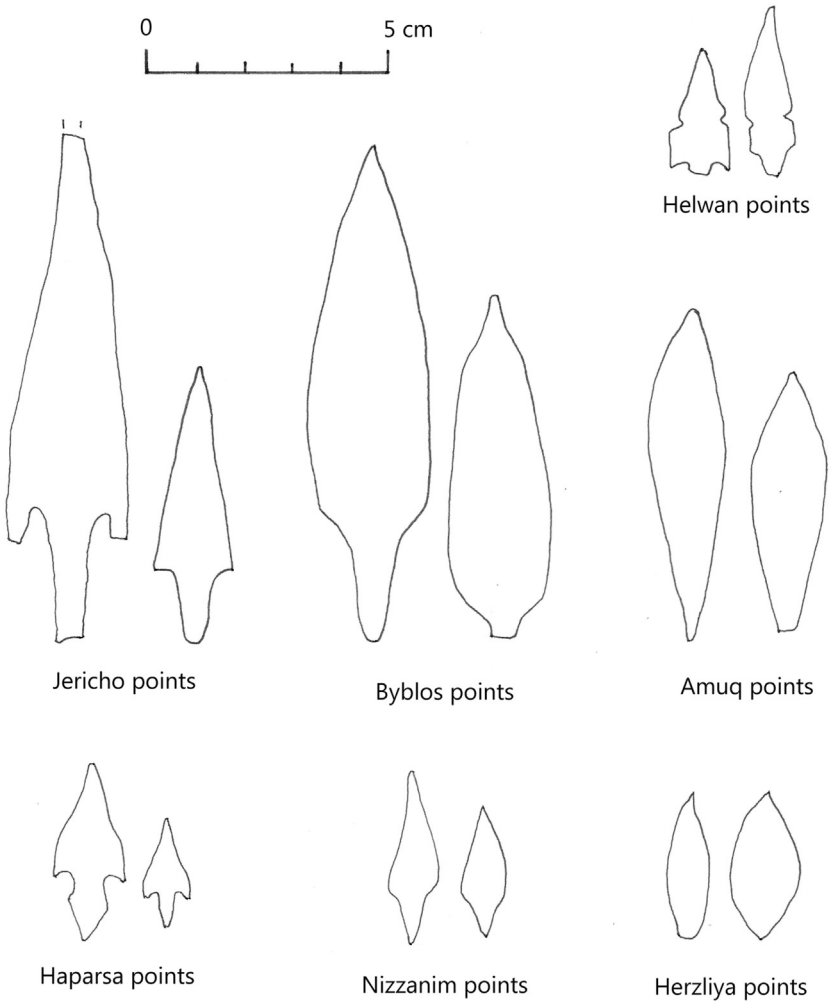

Fig. 10. Outline drawings of Near Eastern Neolithic large and small arrowheads and the Helwan point.

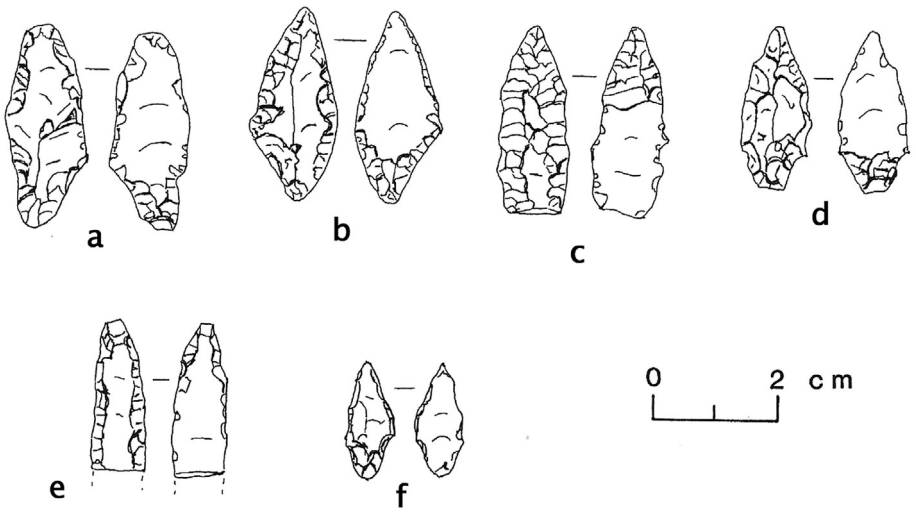

Fig. 11. Small arrowheads with bifacial knapping from late Masara C site 265.

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for 26 points from Dakhleh averages 1.8. Likewise, the two groups have quite different tip cross-sectional areas (TCSA), a measurement which can be used to sort out different functional classes of lithic weapon armatures (Hughes, 1998; Shea, 2006; McDonald, in press). Briefly, most of the large points from the Levant probably served as arrowheads; those from Dakhleh may have been used to tip throwing or thrusting spears (McDonald, in press).

Aside from the points, other bifacial items on mid-Holocene sites in Dakhleh Oasis are probably also of local origin. Bifacial knives appear in some parts of the Western Desert only ca. 7950–7850 cal BP or later (Kindermann, 2010, 207 and Table 6; Lucarini, 2012), suggesting they may have been introduced with livestock. In Dakhleh however, knives are recorded on four Early A sites, with dates averaging around 8350 cal BP. Some support for the early dates comes from site 02/15 at Chufu, west of Dakhleh Oasis, a site with several knives and dates of ca. 8800 and 8000 cal BP (Riemer, 2006, Fig. 10 and Table 2). Other items cited by Shirai (2010) as likely imports from the Near East are bifacial axes with polished working edges, and bifacial sickle blades, both of which are found in the Fayum. Neither however, seems to have penetrated much beyond the Fayum. The only examples of bifacial sickles reported from the Western Desert are from campsites at Abu Gerara, between the Nile Valley and Dakhleh (Riemer, 2003, 2010) and Seton Hill, to the southwest of the Fayum (Kindermann, 2010). As for axes, the only types recorded in the Western Desert to date are fully-flaked versions, most of them with tranchet scars (Armant axes) and small fully polished axes, many of them from Bashendi B contexts in Kharga and Dakhleh (Fig. 9i). Both may be local, North African inventions (Holmes, 1990; McDonald, 2013).

7. Discussion and conclusions

It now appears that the 'Neolithic Revolution', even in the Near East, was a complex, protracted process, with the major components – plant and animal domesticates, new technologies, sedentism and ideological developments, fully in place only after several millennia. The subsequent spread of the Neolithic did entail the establishment of colonies in Europe and along the Mediterranean coast by Near Easterners carrying the full Neolithic package. But in both cases, beyond the colonies themselves, Neolithization seems to have been carried out by indigenous groups of hunter–gatherers choosing elements of the Neolithic package most appropriate for the local natural and cultural environment, and who then gradually moved towards a settled agricultural economy.

In Northeastern Africa beyond the Nile Valley and the wetter coastal strip, the connection with the Near Eastern Neolithic seems more tenuous (see also Lucarini, 2013). Near Eastern animal domesticates were accepted and incorporated into the local economy, but apparently very little else. This is not to say that the two areas, the Near East and the Western Desert, were completely isolated from one another. They lie in fairly close proximity, with few physical barriers between them especially during the African Humid Period, so that ideas and items of material culture, such as the Helwan point, could easily have been exchanged. Indeed a growing body of human genetic evidence has been interpreted as showing that Neolithic migrants from the Near East carried pastoralism into Egypt and across North Africa (*e.g.* Arredi et al. 2004; Cruciani et al. 2010). However, genetic dating, and particularly Y-chromosomal dating, can be somewhat inaccurate (*e.g.* Arredi et al. 2004, Table 2) such that the events reflected in this record could fall anywhere within the early to mid-Holocene, or even beyond it (see discussion in McDonald, 2013). Certainly, the archaeological record reviewed here suggests that Near Eastern migrants likely made it as far as the Nile Valley at Merimde, and possibly to the Fayum, but probably little further. The Near Eastern animal domesticates that reached Dakhleh were probably passed along by the hunter–forager groups that left hundreds of campsites dated ca. 8000–7200 cal BP at places like Djara and Abu Gerara on the Limestone Plateau between the Nile River and the Western Desert oases (Riemer and Kindermann, 2008; Kindermann, 2010; McDonald, 2013).

The imported livestock aside, the Eastern Sahara arguably was developing its own version of the Neolithic, or perhaps more accurately, a 'post-Pleistocene adaptation' in parallel with that of the Near East, an adaptation uniquely suited to the local, rather different, natural environment. Even in the relatively humid early Holocene, the Eastern Sahara was a semiarid environment supporting a somewhat restricted list of game animals, but one that included species such as the Dorcas gazelle and hares that can withstand intense exploitation. Vegetation included wild cereals such as sorghum and millets, and wild legumes and fruits, plants which, even under today's arid conditions, can yield rich harvests for desert dwellers (Smith, 1980; Wasylikowa et al., 1997; Barakat and Fahmy, 1999). 'Neolithic' technologies such as pottery, grinding equipment, storage facilities and improved hunting gear, were developed locally, in Africa, the better to exploit these rich resources.

For much of the early Holocene, hunter–gatherer groups so equipped flourished in the oases and beside playas, but also out in the now barren desert. There were, however, short arid episodes within the early Holocene, and in one of those, Masara C groups adapted by settling in what appears to have been a well-watered refuge in southeastern Dakhleh Oasis. In the mid-Holocene for a time, under a favourable bimodal rainfall regime, a large, fairly complex settlement system flourished in the same area in southeastern Dakhleh. Game animals such as gazelle and rich stands of wild cereals were intensively exploited, and livestock may already have been present. Some classes of artifact such as labrets, perhaps the pottery, and some of the finer arrowheads, seem designed for more than purely utilitarian purposes, and may have played a role in an increasingly complex social scene. Eventually, with aridification, groups in southeastern Dakhleh had to abandon their settlements to become mobile multi-resource pastoralists, based in the oasis, but ranging well beyond it in the wetter season. Groups of this sort also ranged westward across the Sahara, marking their passage with rock art, *Steinplätze* or fireplaces, and tumuli (Gifford-Gonzalez 2005; Linseele, 2010). Eventually, they were forced southward by continued aridification into the Sahel and beyond. Only there would the first African domestic crop, pearl millet, appear, by about 4450 cal BP, in the Tilemsi Valley, Mali (Manning et al., 2011).

In summary, it could be argued that Dakhleh Oasis, and perhaps the Western Desert in general, participated only minimally in the Near Eastern derived Neolithization. Rather than searching for parallels with the nearby Near East, it might be more productive to view the area as an African entity subject to essentially African environmental conditions. From this perspective, the early to mid-Holocene archaeological record of Dakhleh and Kharga Oases reviewed here appears remarkably similar to, indeed an early example of, what Marshall and Weissbrod (2011: S408) characterize as a distinctive African pathway towards food production:

> "Animals were domesticated before plants, herding populations became more mobile than their forager ancestors, the subsistence system was characterized by a few morphologically wild domesticates (*e.g.*, the donkey), a wide range of wild resources in ecodiverse combinations continued in use, and mosaics of hunter-gatherers and herders occupied varied regions. Pastoralism developed early in the arid topics, whereas the beginning of farming based on domesticated plants was late."

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