

Chapter 11

The Aterian of the Oases of the Western Desert of Egypt: Adaptation to Changing Climatic Conditions?

A. L. Hawkins

Abstract The Aterian is well-represented in arid eastern North Africa, particularly in the Egyptian oases and other formerly watered areas. In this region, study of the Middle Stone Age (MSA), including the Aterian, has been hindered by the rarity of buried sites. However, work by a number of teams suggests that the Levallois-based industries associated with significantly higher moisture during Marine Isotope Stage 5 are not Aterian. The artifact inventory of Aterian differs from that of the earlier MSA industries, as does the distribution of sites on the landscape. Taking a technological viewpoint, I suggest that the Aterian represents an elaboration of earlier industries arising in response to changing climatic regimes.

Keywords Adaptation • Aterian • Climatic change • Dakhleh oasis • Kharga oasis • Lithic technology • Middle Stone Age

Introduction

The presence of Middle Stone Age (MSA)¹ material in the Western Desert of Egypt² has been attested since the early twentieth century (Winlock 1936). Caton-Thompson and Gardner's seminal study of the stone age material from Kharga Oasis (Caton-Thompson 1952) has proven to be an invaluable baseline for further work in the area by Simmons and Mandel (1986; Mandel and Simmons 2001), the Combined Prehistoric Expedition (Wendorf and Schild 1980; Wendorf et al. 1993a), the Dakhleh Oasis Project (DOP) (Churcher and Mills 1999; Churcher et al. 1999; Kleindienst 2003), the Kharga Oasis Prehistory Project (KOPP) (Smith et al. 2004, 2007), and the Czech Institute of Egyptology (Bárta et al. 2002; Svoboda 2004). Despite the considerable amount of research that has been undertaken in the Western Desert, a number of fundamental long-standing questions about the MSA, including the Aterian, of the Western Desert remain. Kleindienst (2001) has articulated some of these: can lithic assemblages be identified as Aterian if they lack tanged tools by using the presence or absence of other types or technological traits?; can temporal trends within the Aterian be identified?; did the Aterian evolve from an earlier MSA in North Africa or does it represent a population influx, perhaps from the south or from the Nile Valley?; what is the relation of the Aterian of the Western Desert of Egypt to that of the central Sahara and further west?; and, does the presence of tanged tools

¹ In this chapter I use the term Middle Stone Age (MSA) to refer to Pleistocene-aged Levallois-based units. The Aterian, using predominantly Levallois reduction, is therefore included in the MSA. See below for a discussion of the various units described for the MSA of the Eastern Sahara.

² In Egypt, the Nile Valley serves as a dividing line between the "Eastern Desert" and the "Western Desert." Archaeologists also employ the term "Eastern Sahara" to refer to the area that broadly overlaps with the "Western Desert," but is not confined to the borders of present-day Egypt.

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and bifacial foliates in the Aterian represent a fundamental change in behavior? To this we can also add: to what extent were the humans who produced earlier MSA and/or Aterian artifacts modern in their behavior?

In this chapter, I argue that, while the archaeological record from the Western Desert differs from that of the Maghreb, we can gain insights into the question of behavioral change by taking a regional approach and by comparing the Aterian with earlier MSA units. There are no stratified MSA sites in the Western Desert where the Aterian occurs in situ with other MSA material. In most cases, it is impossible to obtain chronometric dates on MSA archaeological materials. However, a number of recent publications help to clarify the chronology of changing climatic conditions of the Western Desert (Wendorf et al. 1993a; Churcher et al. 1999; Smith et al. 2004, 2007; Kieniewicz 2007; Kleindienst et al. 2008). By comparing the Aterian with earlier MSA units, we can move beyond description and chronology to address issues of behavioral change. Models for human behavior that consider different technological strategies and the desired design characteristics of tools may contribute to an understanding of the reasons for the lithic technology changes that are evident in the Aterian.

In this chapter, I focus on the archaeology of two of the important Western Desert oases, Dakhleh and Kharga, and the Bir Tarfawi region. I describe the oasis setting, including the geology, the chronology of climatic variation and MSA occupations, and the available fauna. The organization of technology approach that is employed to compare the different units is explained and is followed by a comparison of certain attributes of the Aterian with those of the earlier MSA. I conclude by considering the differences between the complexes and evidence for emergence of behavioral modernity.

The interpretation proposed in this chapter is, admittedly, based on a dataset with many limitations. Among the most important of these is the lack of secure dating for much of the material discussed. Further, I have chosen to focus on the MSA of Kharga and Dakhleh Oases and the Bir Tarfawi/Bir Sahara area because these are the materials with which I am most familiar. However, I argue that it is through proposing interpretations such as the one outlined here that we may be better able to focus future research on questions related to the behavior.

Oasis Database

The Western Desert Pleistocene archaeological record differs significantly from that of the Maghreb in that the majority of archaeological material is found in surface context (Kleindienst 1999). This is particularly true for the

Aterian; the only known locations with definite sub-surface Aterian artifacts are Mound-Spring KO6E at Kharga Oasis and silts at Bulaq Pass, which contain redeposited material (Caton-Thompson 1952; Hawkins et al. 2001). A positive aspect of this limitation is that archaeological sites are highly visible. Distributions are easily identified and samples can be collected in relatively short periods of time. It is also reasonably straightforward to determine the size of concentrations and the density of material, although it is necessary to consider the processes acting differentially upon surface assemblages. Raw material outcrops and geomorphic features associated with sites are also easily identified. Archaeological concentrations, however, should be considered time-averaged. Artifacts that have laid on the desert surface for over 40,000 years are frequently abraded and desert varnished. The degree of abrasion and varnish depends on the location of deposition in that objects lying on high elevation surfaces are subject to less abrasion.

Because this chapter presents an interpretation based in large part on material recovered from surface locations, a few cautionary notes are in order.

The comparative obtrusiveness of the different archaeological units must be considered. In some parts of the oases, there are large areas of gravel pavement composed of naturally fragmented chert and limestone, intermingled with artifacts. Surveyors decide to designate locations as “localities” based on considerations such as artifact density and the presence of diagnostic artifacts. Following Schiffer et al. (1978), obtrusiveness refers to the properties of artifacts, such as their colors, shapes, and sizes, while visibility refers to the relationship between an artifact and its background. While we have not tested this empirically, it is likely that Aterian sites, which include distinctive tanged tools and bifacial foliates, are more visible to surveyors than earlier MSA ones. Additionally, earlier MSA units are more difficult to assign to specific units because they lack distinctive tool types (cf. Caton-Thompson 1952).

Second, the cultural affiliation of some site types may be more easily identified than that of others; for example, tanged tools at former occupation areas make it easy to identify the sites as Aterian. However, the cultural affiliation of workshop localities is more difficult to ascertain and, in the absence of chronometric dates, any such attribution must be considered tentative. Isolated tanged tools can be identified and mapped, but the same is rarely true for isolated earlier MSA tools.

The possibility that surface sites may be “cumulative palimpsests” must be acknowledged. These are accumulations of material that represent activities on a number of occasions; most strictly defined, each occupation adds to the previous material and the patterning that once existed becomes increasingly blurred as a result of this addition and activities such as trampling (Bailey 2007). There is also the

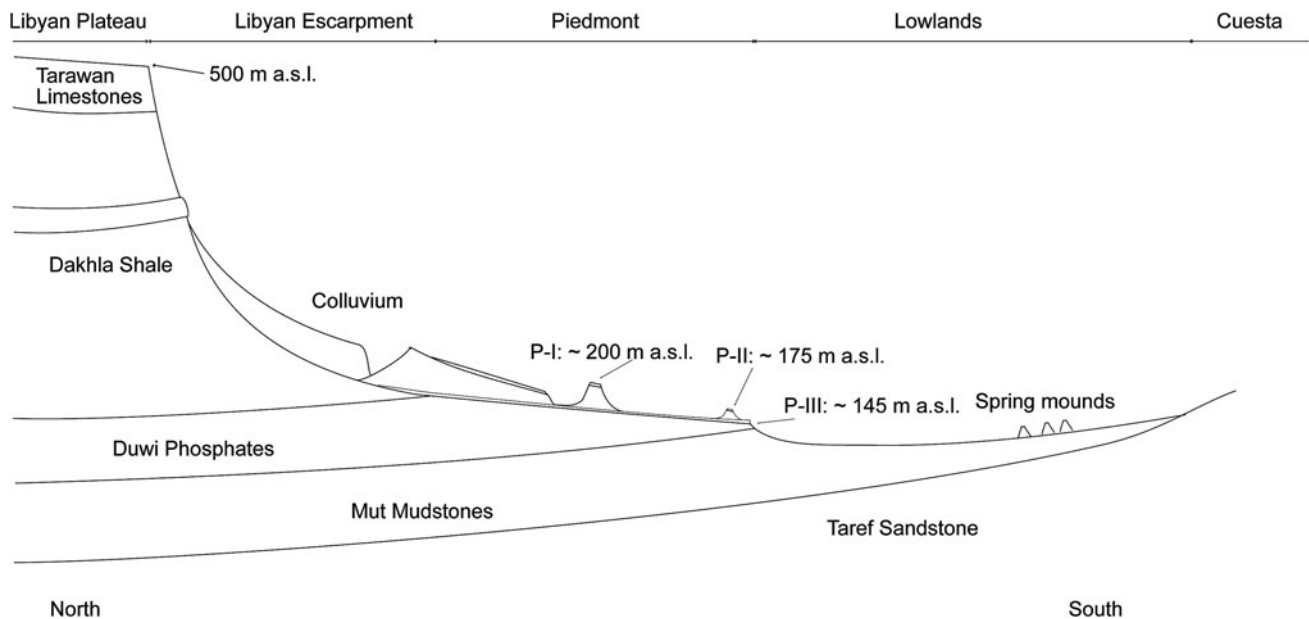


Fig. 11.1 Schematic section of Dakhleh Oasis showing the location of geomorphic zones described in the text. The P-I, -II, and -III surfaces represent three generations of pediment terraces mantled with gravels. After Kleindienst et al. (1999)

possibility that material from earlier uses of a site have been removed or reused. A relatively dense accumulation found close to a known resource location may represent a similar type of activity through time (i.e., lithic reduction or resource extraction).

The comparability of sites assigned to different times may be questioned. Surface sites dating to Marine Isotope Stage (MIS) 7 have undergone surface processes for a longer period of time than those assigned to MIS 3–4 (Kleindienst 2003).

Abrasion of artifacts in surface context precludes any form of use-wear analysis, and also makes retouch difficult to identify in some cases. Examination of the degree of reworking through use of edge angles is problematic, both because of the error inherent in measuring these on abraded artifacts, but also because the degree of abrasion varies between and within locations (Hawkins 2001; Kleindienst 2003). As such, tool functions are suggested based on form but these remain unverified hypotheses.

There is such a high density of material in surface context that surveyors sometimes selectively collect representative objects, such as cores, tools, and “specialized flakes”³ from concentrations. While this strategy is potentially useful for identifying a site’s cultural affiliation, it places limits on the behavioral interpretations that can be based on such material.

³ Kleindienst (2003) uses the term “specialized flake” to refer to flakes, points, and blades produced using Levallois, discoidal, and blade reduction. Similarly, “specialized cores” are Levallois, discoidal, and blade cores.

Generalized Geological and Climatic Background for the Oases

To understand strategies for using resources and to consider whether these changed, it is necessary to examine the distribution of archaeological artifacts in relation to former sources of lithic raw materials, water, and associated flora and fauna.

Geology and Geomorphology

The geology and geomorphology of Dakhleh and Kharga oases are not identical but the oases are broadly similar with respect to resources that would have been of interest to prehistoric human occupants. Both are structurally-controlled depressions bordering the Libyan plateau; the depression lies south of the plateau in Dakhleh Oasis, and west of the plateau in Kharga. The Dakhleh Oasis Project (DOP) archaeologists have used a broad geomorphic division of this oasis as a framework for understanding the locations of resources and archaeological localities (Kleindienst et al. 1999) (Fig. 11.1, Table 11.1).

The Libyan Plateau is not part of the DOP study area and has not been researched in depth at Dakhleh. Simmons and Mandel (1986) included the plateau in their research at Kharga Oasis, and interestingly, in their survey, the only Aterian sites that they located occurred on the plateau. The

Table 11.1 Summary of the geomorphic zones in Dakhleh and Kharga and the associated resources and archaeological technocomplexes

Geomorphic zone	Resources present	General age of surface or deposits	Associated technocomplexes
Libyan plateau	Wadis and pans	Holocene, Pleistocene	Earlier MSA, Aterian ^a
	Chert lag	Indeterminate	
Libyan escarpment	Tufa deposits	Pleistocene (see below for dates)	Earlier MSA (MIS 7 and 5) ^b
	Chert nodules	Indeterminate	Earlier MSA (MIS 5) ^c
Piedmont terraces	Chert/lookouts on P-I terraces	Indeterminate but significantly older than the P-II surface	Earlier MSA (MIS 7 and 5) ^d
	Chert/lookouts on P-II terraces	>200,000?	Earlier MSA (MIS 7 and 5) Aterian, ^d
	Chert on P-III terraces	<90,000–ca. 20,000	Aterian, Khargan ^d
Lowland	Springs	Pleistocene and Holocene	Earlier MSA, Aterian, Khargan ^e
	Lakes	Middle Pleistocene	Earlier MSA (MIS 7) ^f
	Lithic raw materials (chert in lag, small chert nodules, chalcedony, quartzite)	Indeterminate	Workshop concentrations associated have not been documented to date
Southern Cuesta	Quartzite	Indeterminate	Aterian, Khargan ^d

^a Mandel and Simmons (2001)

^b Caton-Thompson (1952); Smith et al. (2007); Kleindienst et al. (2008)

^c Smith et al. (2007)

^d Kleindienst et al. (1999); Kleindienst (1999)

^e Caton-Thompson (1952)

^f Churcher et al. (1999)

Tarawan limestone capping the plateau dates from the Paleocene to the Eocene. In both Dakhleh and Kharga, the plateau limestone is chert-bearing in some areas; chert lag is reported on the surface north of Dakhleh and east of Kharga (Kleindienst et al. 1999). The plateau at Kharga has wadis and pans that contained water in times of higher precipitation (Caton-Thompson 1952); the only well-documented basin with lacustrine sediments on the plateau in Dakhleh dates to the Holocene (Kleindienst et al. 1999), but this area in Dakhleh has not been well-explored.

In Dakhleh, the Libyan Escarpment runs approximately east–west on the northern edge and north–south on the eastern edge of the oasis (Fig. 11.2). In Kharga, the escarpment runs north–south. There is a drop of approximately 300 m from the plateau to the piedmont zone (Kleindienst et al. 1999). The morphology of the escarpment crest varies locally, and in some areas, steep limestone cliffs make access to the plateau impossible. In Kharga, the escarpment is mantled in tufa deposits (Caton-Thompson 1952), but in Dakhleh there is less evidence of tufa. Kleindienst et al. (1999) argue that, in Dakhleh, the escarpment reached its present form before 350 ka. At both Kharga and Dakhleh, the escarpment would be a place of interest to humans for several reasons: (1) at various times in the Pleistocene, springs issued from it; (2) the limestone capping the plateau is chert-bearing in places and chert nodules occur on the escarpment; (3) certain places on the

escarpment would have served as conduits for animal and human migration to eastern and northern locations; and (4) the escarpment provides a view of the surrounding landscape, including locations of springs and fauna.

The piedmont zone is composed of a series of complex alluvial fans that stretch from the escarpment into the lowland area (Kleindienst et al. 1999). It is argued that there were several periods of pediment formation and erosion and the resulting gravel terraces are differentially preserved at different elevations (Brooks 1986; Kleindienst et al. 1999). In Dakhleh, the earliest formed terraces (referred to as P-I) are the highest and are found mainly near the escarpment. Successive lower terraces (P-II and P-III) are more extensive, and extend well into the lowland oasis. The alluvial gravels of the piedmont zone were a significant source of lithic raw material for humans living in Dakhleh in the Pleistocene (Hawkins 2001; Kleindienst 2003). The presence of chert in the Tarawan limestone and in the piedmont gravels varies. In some areas, the remnants of the piedmont gravels stand high above the surrounding area, providing ancient occupants of the oases with good vantage points for observing locations of fauna and other resources.

Present-day springs and wells are found in the lowland oasis, where there is also ancient evidence for water. Mounds mark the locations of former springs in Dakhleh and Kharga, and in the oases, archaeological artifacts within the mound deposits attest to human use of the springs.

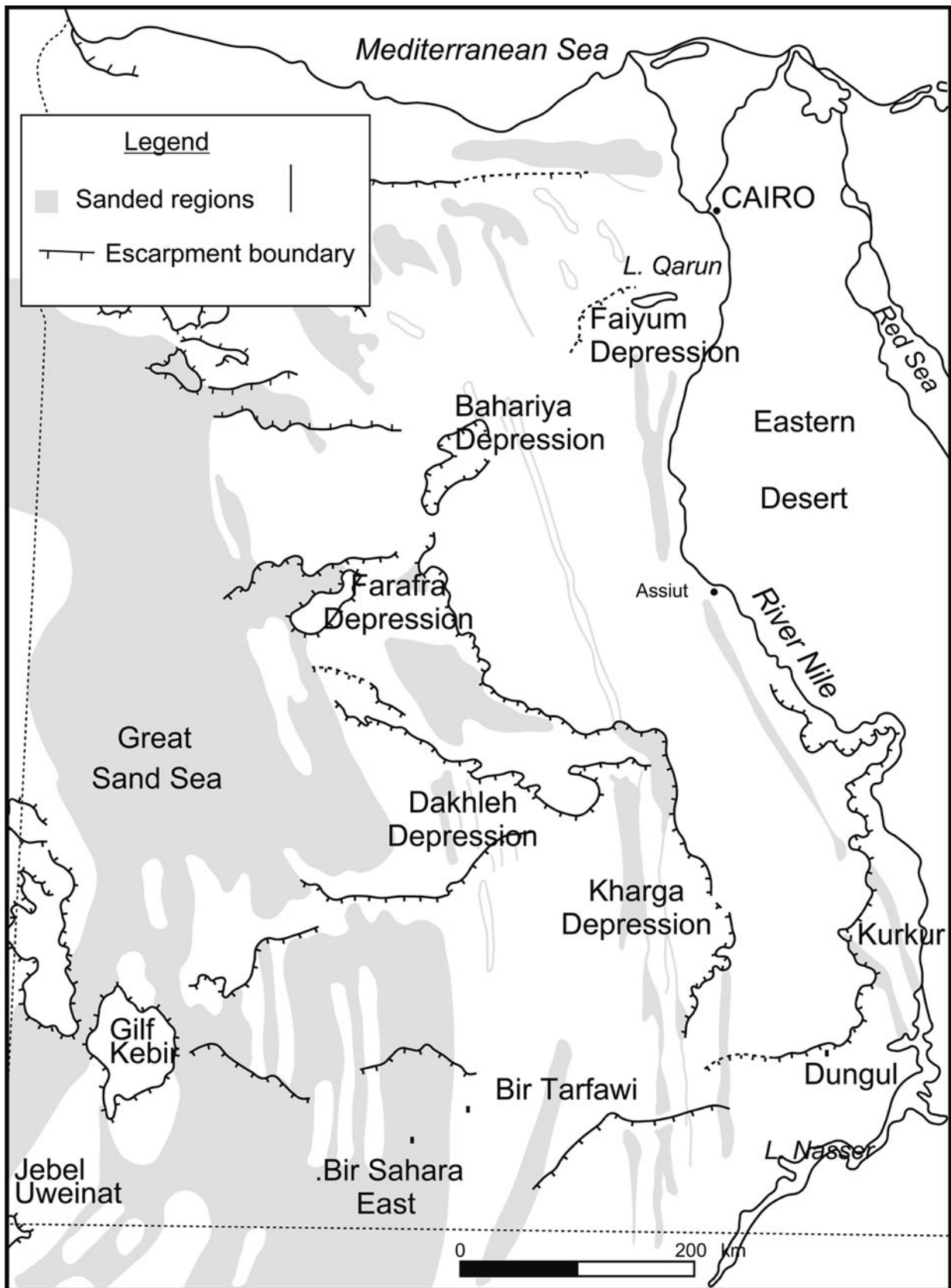


Fig. 11.2 The location of the Dakhleh and Kharga depressions and Bir Sahara and Bir Tarfawi. After Kleindienst

Spring mounds have been investigated in Kharga, where Caton-Thompson (1952) found Earlier Stone Age (ESA), MSA (including Aterian), and Neolithic artifacts in the deposits. At Dakhleh, Wendorf and Schild (1980) excavated a mound containing Terminal ESA artifacts and the DOP researchers investigated a mound with MSA artifacts that may be attributed to the Aterian (Hawkins 2001). At least three types of lithic raw materials occur in the lowland at Dakhleh: nodular chert that is found in nodules less than 10 cm in diameter, chalcedony, and ferruginous quartzite. While the presence of artifacts made from these raw materials attests to their use, no quarries or workshops of these materials are known. In addition, Tarawan chert fragments occur on the stone-paved surface or reg.

Lake sediments in the southern and eastern parts of the Dakhleh lowland overlay Nubian sandstone (Churcher et al. 1999; Kleindienst et al. 1999; Kieniewicz 2007). These are interbedded calcareous (CSS—Calcareous Silty Sediments) and ferruginous (FSS—Ferruginous Silty Sediments) deposits. Churcher et al. (1999) posit the existence of three large paleolakes that possibly date to the Middle Pleistocene. Earlier MSA concentrations occur in association with these lakes, and later MSA Khargan technocomplex material is found on the surface of CSS deposits (Kleindienst 1999).

The southern edge of Dakhleh Oasis is bordered in some areas by a sandstone ridge. There are large deflation basins in the sandstone, some with Pleistocene laminated sediments, but no association between artifacts and these sediments has yet been discovered (Churcher et al. 1999). Raw material available in this area includes quartzite. Although several expeditions have surveyed south of the oases, the extent of investigations by the DOP has been limited to the southern margins of present-day Dakhleh Oasis.

Chronology

Two aspects of the Pleistocene chronology of the Western Desert that should be considered are evidence for climatic changes and evidence for human occupation. Although there is an obvious connection between the two, it is necessary to consider them separately. Archaeological artifacts occur in association with tufa or water-laid deposits in Kharga (Caton-Thompson 1952), Bir Sahara and Bir Tarfawi (Wendorf et al. 1993a), and Dakhleh (Churcher et al. 1999). While some archaeological units are clearly associated with periods of relatively high humidity, this is not the case for all archaeological units.

Figure 11.3 summarizes some of the Middle and Late Pleistocene U-series dates that have been obtained by KOPP

and DOP researchers from tufas and a calcareous deposit at Kharga and Dakhleh (Kleindienst et al. 1999, 2008; Smith et al. 2004, 2007).⁴ Wendorf et al. (1993b), when summarizing the chronology of the lakes at Bir Sahara and Bir Tarfawi, assert that most of the lithic and bone accumulations at Bir Tarfawi can be assigned to 130 ka and later. It is noteworthy that between ca. 50 and 90 ka, there are very few chronometric dates on sediments indicative of higher humidity (Smith et al. 2007). There is one date for a calcareous deposit from Dakhleh at 40 ± 10 ka (Kleindienst et al. 1999), but this age is considered “rough.” At Kharga, a U-series determination of 49.8 ± 0.1 ka on tufa from Mata’na falls into MIS 3 and roughly correlates with a few other determinations from the Western Desert (Szabo et al. 1989; Sultan et al. 1997; Smith et al. 2004).

Archaeological Terminology

Archaeologists working in the Western Desert have used a plethora of terms to refer to Pleistocene-aged archaeological material. In this chapter, as noted above, the term “Middle Stone Age” (MSA) is preferred to the term “Middle Paleolithic” (see Kleindienst 2001, for a consideration of the use of African versus European-based terminology). As used here, the term MSA is an inclusive one that subsumes all Pleistocene-aged Levallois based units under discussion.

With respect to subdivisions within the MSA, researchers have generally followed one of two approaches—lumping or splitting. Among the splitters, one finds Caton-Thompson and Kleindienst. Caton-Thompson (1952) recognized a large number of archaeological units of different ages at Kharga, including the Lower and Upper Levalloisian, the Aterian, and the Khargan. Several other units (Acheulio-Levalloisian and Levalloisio-Khargan) are likely to have been from mixed deposits (Kleindienst et al. 2006, 2008). Similarly, Kleindienst (1999) describes several different units in Dakhleh, including a “large-sized” and “medium-sized” MSA, the Aterian, and the Khargan. To add to the complexity, researchers at Dakhleh assign “unit names” to the local manifestations of each technocomplex. For example, the Khargan at Dakhleh is referred to as the “Sheikh Mabrouk Unit” (Wiseman 1999), and the Aterian is referred to as the “Dakhleh Unit” (Kleindienst 1999). Kleindienst et al. (2006) also suggest new names for some of Caton-Thompson’s units from Kharga, but these are not employed here.

⁴ Infinite dates of >350 and >400 ka have been excluded.

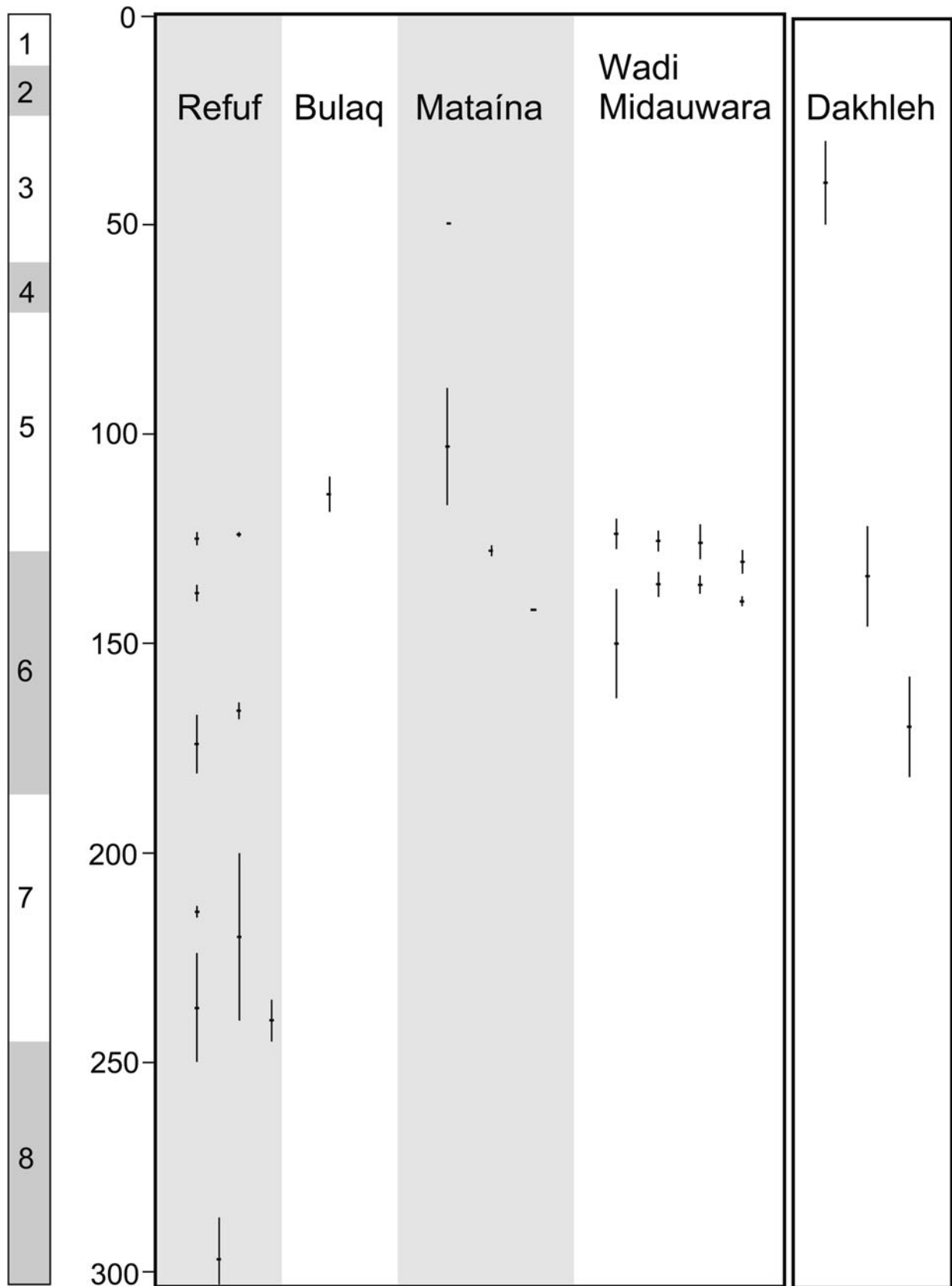


Fig. 11.3 U-series determinations on tufa and a calcareous deposit from Kharga and Dakhleh, based on published data in Smith et al. (2004, 2007) and Kleindienst et al. (1999, 2008)

Table 11.2 Framework for Pleistocene archaeological units from Dakhleh and Kharga Oasis

Estimated Age, Ka BP	Technocomplex	Characteristics (Caton-Thompson 1952; Kleindienst 2003)	Kharga Oasis localities	Dakhleh Oasis localities	Other Western Desert locations
30–50	Khargan Technocomplex	Cores reduction Small-sized Levallois Tools Scrapers	Bulaq solution pans	Sheik Mabruk Unit Localities (Wiseman 1999)	
MIS 3: > 50 < 100	Aterian Technocomplex	Cores reduction Levallois flake cores Nubian point cores Tools Range of scrapers Tanged points & other Tools Basally thinned tools Bifacial foliates	KO6E	Dakhleh Unit Localities (Hawkins 2001)	
MIS 5: ca. 120	Medium-sized MSA Upper Levalloisian	Core reduction Levallois flake cores Nubian point cores Tools Borers Basally thinned flakes	Refuf VII Mata'na G		Bir Tarfawi
MIS 7: ca. 220	Large-sized MSA Lower Levalloisian	Core reduction Levallois flake cores Nubian point cores Tools Endscrapers Little evidence of retouch Gifata points	Refuf IV Refuf VIII Refuf VI Mata'na F	Teneida Unit Localities (Hawkins and Kleindienst 2002, 2003) Gifata Unit Localities (Kleindienst 2003)	

Localities in bold are in situ within deposits. After Churcher et al. (1999) and Kleindienst (2003)

Other researchers (e.g., Hester and Hobler 1969; Mandel and Simmons 2001) recognize only a small number of units, and it is noteworthy that frequently no divisions are recognized in Levallois-based units that predate the Aterian. Members of the Combined Prehistoric Expedition have varied in their use of terms; they sometimes referred to the Levallois-based materials from Bir Tarfawi as Aterian (Schild and Wendorf 1975), and sometimes referred to it as Denticulate Aterian (Wendorf et al. 1987), but eventually they eschewed the use of labels in general (Wendorf et al. 1993a).

It is not my intention in this chapter to evaluate the validity of any of these divisions or terms, although I am conscious that the choices archaeologists make in combining or dividing archaeological entities ultimately have a bearing on behavioral interpretations. In this chapter, I put forward interpretations regarding adaptation, and for this reason I have chosen, as much as possible, to sidestep issues of terminology. In order to structure this analysis, I have chosen to use very broad climatic periods to group archaeological units. Furthermore, I have accepted the assignment of units to time periods as published by the original authors.⁵ Finally, where I do use unit names, I have

maintained those used by the original archaeologists, although I do not consider the MIS 5 MSA at Bir Tarfawi to be Aterian.

Table 11.2 provides a summary of the chronology, technocomplexes, characteristics of the stone tools from each technocomplex, and names of the localities from Dakhleh and Kharga. This is based on a framework proposed by Kleindienst (1999) and Churcher et al. (1999), which is a revision of Caton-Thompson's (1952) scheme.

Archaeological units that can be attributed to MIS 7 include the Lower Levalloisian at Kharga (Refuf Locus IV), the age of which has been confirmed by U-series dates overlying this locus (Kleindienst et al. 2008). Kleindienst (1999) considers the "large-sized" MSA at Dakhleh to be a "cognate to the Lower Levalloisian," but this remains undated. Two MIS 7 units, the Teneida Unit and the Gifata Unit, have recently been named at Dakhleh although neither is chronometrically dated (Kleindienst et al. 2006). The general characteristics of the MIS 7 MSA include use of

⁵ In some cases, the age of these units has been verified by chronometric dating (Wendorf et al. 1993a; Smith et al. 2007; Kleindienst et al. 2008), but in other cases they have not.

Levallois flake cores and Nubian point cores, production of end scrapers but few other retouched tools, and, according to Kleindienst (2003), production of an elongated biface referred to as a “Gifata point.”

Materials that are ascribed to MIS 5 include the Upper Levalloisian at Kharga, which is dated based on U-series determinations on tufa associated with Mata’na G and Refuf Locus VII (Smith et al. 2007; Kleindienst et al. 2008). The “medium-sized” MSA at Dakhleh is thought to be a “cognate of the Upper Levalloisian” (Kleindienst 1999). Most of the sub-surface archaeological remains from Bir Tarfawi are dated to MIS 5 (Wendorf et al. 1993b). The MIS 5 MSA is characterized by the continued use of Levallois flake cores and Nubian point cores and the addition of borers and basally thinned flakes to the tool repertoire.

The Aterian technocomplex is represented at both Dakhleh and Kharga, but remains undated. It is ascribed to MIS 3–4 based on its position on relatively younger geomorphic surfaces than the MSA units above, and based on the position of finds at Bir Tarfawi. The clearly pedunculated pieces from Bir Tarfawi are surface finds affected by aeolian processes. Wendorf and Schild (1993) attribute them to dry phases of the Green Lake. Wendorf et al. (1993b) suggest that the Green Lake phase of higher humidity, which is not well dated, ended before 60 ka. The MIS 3–4 Aterian assemblages are characterized by an expansion of formal tool types to include tanged points and other tools and finely produced bifacial foliates. One finds more examples of basally thinned tools and numerous scrapers. Cores include both Levallois flake cores and Nubian point cores.

The Khargan technocomplex may date to between 30 and 50 ka, based on its location on younger surfaces at Dakhleh Oasis (Churcher et al. 1999). Therefore, it is also ascribed to MIS 3. Although the Khargan does not form part of this analysis, its place and chronology is noted because Aterian technocomplex sites do not occur on the younger surface on which Khargan sites are found. It is therefore suggested that the Aterian in the Western Desert may pre-date 30–50 ka.

Fauna

Pleistocene-aged faunal assemblages from the Western Desert are few in number; Churcher et al. (1999) report on materials recovered from Dakhleh Oasis, and Gautier (1993), Van Neer (1993), and Kowalski (1993) describe the material from Bir Tarfawi and Bir Sahara. Churcher et al. (1999) place the Dakhleh material between 200 ka and greater than 300 ka, based on the “elevations and field relationships” of

the deposit in which the fauna are found. The fauna from Bir Tarfawi were recovered from several strata associated with different phases of the lake (Gautier 1993). Wendorf et al. (1993b) place them at ca. 130 ka and later, with the ages of the more recent phases not well-established.

The Middle Pleistocene fauna from Dakhleh suggests a “riverine gallery forest backed by savanna grasslands” to Churcher et al. (1999, p. 310). They draw a comparison between East Africa and Middle Pleistocene Dakhleh, indicating that a diverse array of resources would have been available in this environment. The presence of freshwater snails, in particular, is indicative of flowing freshwater (Churcher et al. 1999). Churcher et al. (1999) do not report any evidence of traces on the bone that could have resulted from hunting, scavenging, or butchering, and they do not elaborate on the association between clusters of lithic artifacts and faunal remains. This suggests that the faunal remains from Dakhleh should be treated, at this time, as paleontological rather than archaeological specimens. The reported hippopotamus, buffalo, antelope, gazelle, and zebra were at least available to humans using the oasis approximately 200 ka.

The fauna from Bir Tarfawi is interpreted as indicative of a Sudano-Sahelian dry savannah, with some variation through time (Gautier 1993). The presence of small gazelles and the decrease in the representation of large animals in the upper parts of the sequence suggests increasingly dry conditions closer to the present (Gautier 1993). During the Grey Lake 1 phase, a number of large mammals would have been present in the region, including rhinoceros, giraffe, buffalo, and camel. Gautier (1993) is equivocal about how they were obtained or used by humans, if they were at all, but he does indicate that they likely died at Bir Tarfawi and were not carried there by people. In contrast, he does assert that gazelles were hunted seasonally (Gautier 1993).

There is no clear association between any faunal assemblage in the Western Desert and the Aterian, nor is there any faunal assemblage that can be ascribed to the period subsequent to the Tarfawi Lakes and before the Holocene. A single equid metacarpal shaft found in the spring deposits at Location 80 is attributed to the Aterian by Churcher et al. (1999), but no unequivocally Aterian artifacts were discovered in this location (Hawkins 2001).

An “Organization of Technology” Framework for Examining the Western Desert MSA

Study of the Aterian in much of northern Africa was initiated and has been subsequently carried out largely within a theoretical framework developed for use on European materials (Hawkins 2001; Kleindienst 2001). While there has been

discussion of the relationship between the Aterian and the Mousterian (e.g., Bordes 1975–1976; Wengler 1994), and subdivisions within the Aterian (e.g., Caton-Thompson 1946; Ferring 1975), studies of the Aterian have generally not applied theoretical frameworks developed mainly by North American lithic analysts to try to investigate human behavior and behavioral changes, particularly among mobile foragers (e.g., Bamforth 1986; Bleed 1986; Shott 1986; Dibble 1987). To contribute to our understanding of the origins of modern behavior in northern Africa, it is important that research is framed in terms of understanding adaptation and changes to it, rather than by seeking the presence or absence of markers of modernity such as those suggested by Mellars (1989) and elaborated on in many subsequent publications (see McBrearty and Brooks 2000). Indicators of modernity, such as improved hunting ability, production of bone and antler tools, use of ochre, fishing, and production of items used for personal adornment, are impossible to apply in a region with poor archaeological preservation, and where most archaeological material is found in surface context. Other traits that may indicate modern behavior, such as production of blades and standardization of tools, are best considered contextually in terms of adaptation, mobility, raw material availability, and other requirements.

Nelson (1991, p. 57) describes the organization of technology approach as one focused on “the selection and integration of strategies for making, using, transporting and discarding tools and materials needed for their manufacture.” Several key behavioral variables have been the focus of analysis, although Nelson cautions that to understand the dynamics of the past, it is best to employ several levels of analysis. At a general level, the concept of technological strategy can be considered a set of adaptive behaviors that people use to cope with variation in the availability of resources and human constraints on accessing them.

Resources differ in their availability in space and time, varying along a continuum of distribution from even to clumped. Exploitation of resources may involve careful scheduling and may require interception at specific locations. Technological strategies are methods or behaviors that address challenges such as these (Nelson 1991). Different technological strategies result in a range of tool design characteristics. Variable characteristics include reliability, maintainability, and transportability (Nelson 1991). Technological strategies also have outcomes with respect to the distribution of different types of sites on the landscape (Nelson 1991). While the distribution of Aterian sites at Dakhleh is reasonably well-known (Hawkins 2001), representative comparative databases for the earlier MSA are not available. Therefore, this comparison will focus on examining design characteristics of stone tools and the technological strategies of curation and expediency.

Technological Strategies: Curation and Expediency

People employ technological strategies to extract resources from the environment, in particular, to balance competing requirements of the timing and location of resource-gathering activities. Three strategies, which are not mutually exclusive, are curation, expediency, and opportunism (Nelson 1991).

Curation involves advance energy investment in tools and toolkits, which may be manifested in, for example, fashioning, reworking, storing, or transporting of toolkits or parts thereof. Curation is a strategy that enables people to cope with the occurrence of raw materials and resources to be exploited in different locations. It helps overcome problems related to short-term availability of resources.

The concept of curation has been the subject of much debate, owing to a lack of clarity in its introduction into the archaeological literature (Binford 1973). Shott (1996, p. 267) argues that it should be defined as “the degree or utility extracted, expressed as a relationship between how much utility a tool starts with—its maximum utility—and how much of that utility is realized before discard.” In this chapter, I follow Nelson’s (1991, p. 62) broader concept of curation as “a strategy of caring for tools and toolkits than can include advanced manufacture, transport, reshaping, and caching or storage... a critical variable differentiating curation from expediency is preparation of raw materials in anticipation of inadequate conditions ... for preparation at the time and place of use.”

Expedient strategies are employed when raw materials are available at the location of need, which may be used on multiple occasions, and there is no time stress involved in preparing them for use. According to Nelson (1991), use of expedient strategies depends upon resource extraction where raw materials are present, either naturally or through caching, lack of time stress to prepare tools for use, and use of a resource extraction site on multiple occasions. Curated and expedient strategies both involve anticipation of raw material needs in the future. While people who employ curation strategies anticipate future need within a narrow time frame, those who use expedient strategies expect that both time and raw materials for tool preparation will be available at the location of resource exploitation. Use of different technological strategies will result in different assemblage composition and artifact forms (Nelson 1991).

In contrast to curation and expediency, opportunistic strategies are employed in unanticipated conditions. When a hunter, collector, or scavenger is confronted with an unanticipated opportunity for resource exploitation and finds a technological solution that allows for exploitation of that resource, such a strategy is considered opportunistic (Nelson 1991). A crucial difference between opportunism

and expediency, as defined by Nelson, is that expediency is a planned strategy, while opportunism is not.

Kuhn (1992) addressed the issue of whether it is possible to apply frameworks that imply planning to premodern humans. He points out that other animals engage in behaviors that could be considered “planned” (Kuhn 1992), but that humans and premodern humans relied upon tools and, therefore, by necessity engaged in planning behavior. Rather than considering whether or not there is evidence for planning, Kuhn argues that it is more instructive to consider the conditions for planning and how these may have differed over time, between groups, and according to other variables. He distinguishes broadly between provisioning of places and provisioning of people. The latter entails the concept of “personal gear,” described by Binford (1979) as the tools individuals always carry with them in general anticipation of need. These tools are curated, in that they are prepared and cared for in advance, and that their design characteristics include portability and maintainability (Kuhn 1992). People provision places by carrying raw materials, tools, and partially prepared materials to locations where they anticipate a future need. The transport of materials to a location in anticipation of future use is a type of curation, however, the later use of these at the location is likely to be expedient.

In the following sections, I will consider how the differences and similarities in the nature of recovered material of different ages may relate to technological organization. I will first examine concentrations that are found near raw material outcrops and I will follow this by comparing concentrations located near former sources of water and further from raw materials. Finally, I will consider what can be learned from the characteristics of the tools themselves.

Technological Strategies Near Raw Material Outcrops

Although there are several types of lithic raw material available at Dakhleh and Kharga, the preferred material is chert, specifically chert derived from Tarawan formation limestone (Hawkins and Kleindienst 2002). A number of localities in the escarpment and piedmont zones at Dakhleh and Kharga record where people took advantage of raw material outcrops. The MIS 7 MSA is represented by published descriptions of material from the Kharga Lower Levalloisian sites (Caton-Thompson 1952) and the Dakhleh Gifata Unit (Kleindienst 2003). The MIS 5 MSA is represented by the Kharga Upper Levalloisian material (Caton-Thompson 1952) and possibly surface material from a workshop at Wadi Midauwara (Smith et al. 2007). Aterian material comes from several P-II surfaces in Dakhleh (Hawkins 2001). While the Aterian localities are undated, tanged tools, basally thinned flakes, and/or bifacial foliates

of the same degree of abrasion and patina as flaking debris were recovered from these locations (Hawkins 2001).

Springs issued from the scarp during MIS 5 and 7, and based on plant casts in tufa, it was vegetated and would have been attractive to fauna (Smith et al. 2007). Thus, the escarpment localities may have served as *both* resource extraction and lithic raw material procurement areas. To interpret the nature of the activities carried out on the scarp, it is worthwhile to consider what type of remains would be expected from the different technological strategies.

Resource extraction may have been opportunistic (*sensu* Nelson 1991), in which case we would expect to find nearly all of the remains of complete reduction sequences in small scatters. Resource extraction in this area may also have been based on an expedient strategy in which humans knew that both raw materials and resources were present. In this case, at raw material outcrops, we may anticipate finding little more than a few cortical flakes that may have been removed to examine the quality of the nodule. At resource extraction locations, we would expect to find most of the elements of complete or nearly complete reduction sequences, similar to the remains resulting from opportunistic behavior. However, if people consciously or unconsciously provisioned places for future anticipated use, the concentrations of artifacts would be higher than in locations of chance, opportunistic resource extraction. Further, as locations are reused, the materials found there may be re-sharpened or reworked, so cores may be smaller, more non-cortical flakes will be present, and larger numbers of retouched tools will be found. Finally, it is possible that resource extraction on the scarp took place within a system in which tools were curated (i.e., tools were brought to the site as personal gear). In this case, one would expect to find raw material outcrops with evidence of flake preparation for use as tools and possibly objects that are non-local in origin having been exchanged at the knapping site. In a technological strategy focusing on provisioning of people as opposed to places, resource extraction sites would have less evidence for on-site knapping.

Table 11.3 shows the types of materials that were recovered from different MSA localities near lithic raw material outcrops. The samples from the *in situ* sites at Kharga are all very small and it is impossible to know whether the numbers of artifacts published by Caton-Thompson (1952) represent the total number of pieces at these aggregates. Recent observations of sections at localities at Refuf and Mata’na suggest that these scatters are relatively small and can be contrasted with the dense concentrations of knapping material found on the P-II remnants in Dakhleh and at Midauwara 10.

The samples of MIS 7 MSA (Lower Levalloisian) materials are the smallest. Despite the small size, the lack of

Table 11.3 Types of lithic material recovered from lithic raw material exploitation sites on or near raw material outcrops

		Primary and secondary flakes	Initial or failed cores	Struck cores	Core trimming flakes	Failed Levallois flakes	Edge modified tools	Levallois flakes	Exhausted tools parts
MIS 7—	Refuf IVa	X	X	X	?				
Lower Levalloisian	Refuf IVb	X	X	X	?		X		
	Refuf VIII		X	X	X		X		
	Refuf VI		X	X			X	X	
MIS 5—	Mata'na G	X	X	X	X	X	X	X	X
Upper Levalloisian	Midauwara 10	X	X	X	X	X	X	X	
MIS 3?—	L. 216 TP	X	X	X	X	X	X	X	X
Aterian	L. 342	X	X	X	X	X	X	X	X
	L. 216 BC	X	X	X	X	X	X	X	X

Compiled from data in Caton-Thompson (1952), Hawkins (2001) and fieldnotes

complete reduction sequences suggests that these do not represent opportunistic use of resources. In some cases, primary and secondary flakes are lacking, suggesting that debris represents material removed from partially prepared cores. At other sites, Levallois flakes are lacking, suggesting that they were transported elsewhere. Edge modified tools are present at most MIS 7 MSA sites, possibly indicating that these locations were used for resource extraction or maintenance activities.

The MIS 7 MSA from Dakhleh is represented by the Gifata Unit, which is found dispersed on a P-II surface near the base of the escarpment. According to Kleindienst (2003, p. 10), “the aggregates appear to represent highly dispersed clusters,” but she also notes that a conjoining flake and core were found on this surface less than 2 m apart. The high proportion of primary cortical flakes suggests to Kleindienst that these were workshop locations. The density of material is low, ranging from 0.02 to 0.12 artifacts per m². While the different site situations make it difficult to compare the Kharga and Dakhleh materials, it is noteworthy that the artifact concentrations are small in both locations. The Gifata materials may be most similar to the Refuf IVa and IVb concentrations in which cores and core preparations materials are present, suggesting workshops and preparation of flakes for use as personal gear.

The MIS 5 MSA (Upper Levalloisian) material from Mata'na G is found in a similar context to the clusters of MIS 7 MSA Refuf material but the sample is larger and a wider range of lithic material is represented. Some of the increased diversity may be explained by the greater sample size. Table 11.4 shows that, in addition to flaking debris, retouched tools were recovered. These may have been made for use at this location, but thinning of the base suggests hafting, and potential exchange of tool parts at this location.

Thus, the Mata'na G materials may be interpreted as evidence that both provisioning of place and provisioning of people were part of the technological strategies of MIS 5 MSA humans here.

Midauwara 10 is located on a tufa sheet on the escarpment at Kharga where chert outcrops naturally (Smith et al. 2007). The archaeological site consists of clusters of flaking debris, including initial and struck cores, primary flakes, failed Levallois flakes, and some edge retouched tools. The only good example of a formed tool can be attributed to more recent manufacture, based on abrasion and patina (Smith et al. 2007). The tufa surface on which the artifacts lie has been dated to 124.8 ± 4.0 ka, representing a minimum age for this outcrop. The lack of formed tool parts suggests that this location was not used for retooling. The number of edge retouched tools is low, and the cores indicate production of flakes and points, which would have been produced for transport elsewhere.

The Aterian locations differ from all of the others in that they would not have been located near water; lying on isolated remnants of the P-II surface, they would, however, have provided good vantage points for viewing the surrounding oasis. These localities show the range of knapped material, including many examples of both failed flakes and points, and of exhausted tools. This suggests that one of the main knapping activities here was production of flakes and points for transport away from the knapping location.

There seems to be evidence for the use of special locations to produce flakes and possibly cores throughout the MSA, but in the MIS 7 MSA, these locations appear to be small and may represent use on only a few occasions. Later in time, such locations appear to have been used repeatedly. During MIS 5 and 7, the escarpment likely served as a location for procuring both stone and other

Table 11.4 Comparison of the distribution of cores, flakes and flaking debris and tools from localities near lake deposits (L. 211 and BT 14 A) and on the southern oasis margin (L. 130)

	MIS 7 MSA		MIS 5 MSA		Aterian	
	Dakhleh L. 211		Bir Tarfawi 14 A		Dakhleh L. 130	
	N	%	N	%	N	%
Cores and core fragments	32	15	48	2	45–57	5–6
Flakes, broken flakes and debris	158	74	1535	80	783–819	91–86
Retouched tools	24	11	340	18	37–71	4–7

Collections from all three locations were systematically carried out (Kleindienst 2003; Wendorf and Schild 1993; Hawkins 2001)

The totals from L. 130 are given as a range with the first number indicating the number of objects collected in a grid collection and the second number indicating the total number of objects collected. Selective collection of tools and cores occurred before the grid collection, depressing the numbers of tools and cores in the grid. The selective collection, however, extended beyond the area of the grid

resources; the Aterian is much better known from locations within the oasis and has not been found in association with tufa deposits on the scarp. This suggests that during Aterian times, people made less use of the scarp and more use of central oasis locations. Within the central oasis, there appears to be more intensive use of the same places.

Technological Strategies at Resource Exploitation Locations Near Former Bodies of Water

A second context in which MSA sites are located in the Western Desert is near former water bodies and some distance from raw material outcrops. Again, it is useful to consider how different technological strategies might be reflected in stone tool assemblages. These locations may be places of opportunistic behavior, in which case we would expect to find complete reduction sequences of raw materials that are found in the immediate area. More likely, these places were locations of planned use at some level. If places were provisioned with raw materials, we would expect to find a range of materials, including cores. At least some of these would likely be highly reduced as they are used and reused on subsequent visits. It is also possible that some of the cores may bear cortex or be only partially reduced. In addition, assemblages would include flaking debris and tools used on site for resource extraction or maintenance. If people employed a strategy of provisioning people, one would expect to find two types of sites, remains of camps at which tool maintenance activities were conducted (Binford 1979) and locations of resource extraction. The latter site type is likely to be represented by isolated tools or fragments, or small scatters of tools. The former would likely include some cores and flaking debris, because cores may have formed part of the personal gear. If this were the case, one would anticipate that most of the discarded cores would be highly reduced as they would be removed from the

personal gear because they would no longer be useful. Binford (1979) asserts that people are not likely to embark on resource extraction excursions without preparing personal gear in advance.

The difference between a strategy in which people were provisioned with artifacts and one in which places were provisioned with raw materials may be difficult to observe archaeologically, particularly when there are no accompanying ecofacts that may be used to interpret site function.

In eastern Dakhleh, MIS 7 MSA (Teneida Unit) localities (Churcher et al. 1999; Kleindienst 2003) are found associated with lake deposits.⁶ Kleindienst (2003) contends that, although much of this material occurs in surface context, its condition indicates that it has eroded out of deposits recently, and, therefore, that it is representative of MIS 7 MSA material and is not mixed with later material. Locality 211 will be used to exemplify the Teneida Unit.⁷ The MIS 5 MSA will be exemplified by the Bir Tarfawi 14 Area A (BT 14 A), the material described by Wendorf and Schild (1993). It is also associated with lake deposits. Given the association with lake environments, it is possible that the Dakhleh L. 211 and Bir Tarfawi locations were used for extraction of resources such as animal carcasses and aquatic plants or that such activities were carried out nearby.

⁶ Kleindienst (2003, p. 32) notes that “the only chronometric determinations available for the Teneida Palaeobasin are Ar/Ar determinations on lagged Dakhleh Glass ... the isochron age limiting the age of some pre-existing surface of the Lake Teneida Formation onto which the glass was deposited is $122,000 \pm 40,000$ (Schwarz et al. 2008).” Churcher et al. (1999, p. 305) assert that the deposit from which the faunal remains derive “dates broadly to the later middle Pleistocene.” Some of the earlier MSA material from the Teneida Palaeobasin is found in situ in the same deposit, some is found in surface context. Kleindienst (2003, p. 26) indicates that the Teneida unit material is “probably within the older Middle Stone Age time range.”

⁷ Material from L. 211 was selected for examination because “all artefacts seen were collected” (Kleindienst 2003, p. 32), making the assemblage generally comparable with the grid collection from 130 and the excavated material from BT 14 A.

Table 11.5 Percentage breakdown of tool types recovered from MSA localities found near former water sources. Compiled from Kleindienst (2003), Wendorf and Schild (1993) and Hawkins (2001)

	MIS 7	MIS 5	MIS 3–4
Locality	211	BT 14A	130
N	17	263	63
Retouched points	6	8	24
Retouched scrapers	76	27	13
Burins	0	1	0
Bifacial foliates	0	2	2
Basally thinned tools	0	0	14
Tanged tools	0	3	3
Tanged points	0	1	3
Edge modified tools (notches and denticulates)	18	58	41

Finally, Locality 130 is an Aterian concentration in south-eastern Dakhleh. The presence of ancient and modern wellheads near it suggests that this site was also located near a former water source, but it is difficult to infer its exact use (Hawkins 2001).

All three of these MSA occurrences are found some distance from outcrops of raw material. The MIS 7 MSA (Teneida Unit) localities are at least 6 km from sources of Tarawan chert (Hawkins and Kleindienst 2002), Tarfawi is approximately 3 km east of sources of quartzitic sandstone used by MIS 5 MSA inhabitants of BT 14 A (Wendorf et al. 1993b), and the Aterian L. 130 is between 5 and 10 km from Tarawan chert sources (Hawkins and Kleindienst 2002).

Table 11.4 compares the proportion of different artifact types from the three locations. At all three places, in which a range of material, including cores, flaking debris, and tools, is represented, we find evidence for knapping of stone that has been carried in from some distance. The question under consideration is whether the stone was brought to the location for use at that specific place or whether it was brought there in the course of normal travel and was further prepared there for use at some other nearby location.

Two pieces of evidence suggest that the three locations likely record some form of habitual behavior. It is unlikely that the amount of material records use on a single occasion, particularly for BT 14A. At the other two locations, a range of raw materials is present, suggesting procurement from different areas (Hawkins and Kleindienst 2002).

The proportion of cores at the Bir Tarfawi location is quite low, despite Wendorf and Schild's (1993, p. 268) assertion that "[a] major activity at almost all of the sites adjacent to lakes was the final preparation and initial exploitation of partially prepared Levallois cores." If cores were only initially exploited, we may infer that they formed part of the personal gear and were transported away from this location.

Data on the sizes of cores is unfortunately lacking for L. 211 but at another MIS 7 MSA (Teneida Unit) locality (L. 374), mean length of 7 "specialized cores" is 54 mm. This does not differ greatly from the 55 mm mean length of 23 Levallois cores from the Aterian L.130. Although the sample sizes are very small, this may suggest that cores were abandoned mainly when they were too small to be of further use. Cores abandoned at Aterian workshop locations are significantly larger (Hawkins 2001). Abandonment of exhausted cores is more likely to occur in a pattern of provisioning of people than of place. Future research should consider the degree to which these concentrations include cortical flakes and the range of sizes of abandoned cores.

The suite of tools may also help to determine the nature of the technological strategies employed at different locations. Table 11.5 shows a summary of the types of tools found at the three localities. Terminology and analysis methods employed by different researchers vary, and summarization doubtlessly simplifies the complexity of the tool assemblages. However, two things are noteworthy. First, scrapers outnumber points at both of the earlier MSA sites, while points outnumber scrapers at the Aterian site. Second, a large number of the tools from BT 14 A are tools such as denticulates and notches.

These differences suggest that a different suite of resources was exploited during the earlier MSA than during the Aterian. It is possible that all of these locations served essentially as occupation locations or camps in which tools were repaired and/or resources that had been brought to the location were used. The difference in the tool assemblages suggests a greater emphasis on tools used as part of mobile personal gear in the Aterian and greater use of tools employed on-site in the earlier MSA.

Finally, although comparison is not possible because published accounts of the earlier MSA do not include tallies

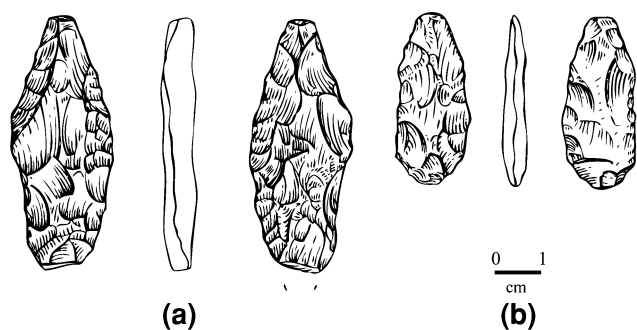


Fig. 11.4 Bifacial foliates recovered from L. 325, an Aterian surface locality at Dakhleh Oasis

of broken tools, at L. 130, 34% of tools collected were broken, suggesting that a major activity in this area was retooling.

During all three of the periods concerned, people appear to have exploited resources associated with bodies of water. It would appear that they revisited the same locations, bringing stone from several kilometers away with them. The fact that these locations were subject to revisits suggests that they provided humans with something attractive, which may have been water, the resources associated, and/or stone materials brought on previous occasions. Without further analysis, it appears that the differences among the three types of sites lie mainly in the nature of the associated tools, with the Aterian site having greater evidence for tools likely to be used away from the site.

Tool Design

Technological strategies will also affect design characteristics of tools. Requirements of tools needed for exploiting mainly non-mobile resources available at predictable times will be quite different from the requirements of tools needed for exploiting mobile resources available for only a short time, or at an unpredictable time. Several variables of tool design include reliability, maintainability, flexibility, versatility, and transportability (Nelson 1991).

Reliably designed tools function when they are needed, and are therefore considered appropriate for both encounter hunting of game that occurs in unpredictable locations and for hunting of game available in short time frames (i.e., migratory species) (Bleed 1986). To ensure that the tool functions when needed, it is over-designed (Bleed 1986). Examples of reliable design outcomes are secure fittings, standardized replacement parts, and redundancy (Nelson 1991).

Maintainable designs can work easily under different circumstances. One design strategy that allows for this is

flexibility in that tools can be reformed to meet different needs. A second strategy that also results in maintainability is termed “versatility.” In this case, tools are maintained in a generalized form to allow for use in multiple tasks.

The repertoire of formed tools assigned to the MIS 7 MSA is very small. Caton-Thompson (1952, p. 28) describes retouch in the Lower Levalloisian as follows, “retouch, if any, which is exceptional apart from very rare end-scrapers ... is intermittent and nibbling.” The list of formed tools assigned to the Gifata Unit includes “side-scrapers, core axes, ventrally-thinned flakes, and a distinctive type of bifacial point” (Kleindienst 2003, p. 25). This point type, which is termed a “Gifata point,” is long (ca. 14 cm), narrow (ca. 5 cm), and bifacially worked, frequently with a cortical butt (Kleindienst 2003). These have been discovered in surface context associated with the L. 187 workshop material; the presence of such points on younger surfaces is attributed to redeposition (Kleindienst 2003). Attribution of these tools to the MIS 7 MSA requires confirmation by recovery of similar tools from dated deposits.

A somewhat expanded suite of tools is assigned to the MIS 5 MSA. At Kharga, Caton-Thompson (1952) notes that retouch is more invasive and includes basal thinning. The formed tools from Bir Tarfawi include a number of scrapers, Mousterian points (including some with ventral retouch at the tip), and basally-thinned or truncated pieces (Wendorf et al. 1993a). Although they also describe tanged tools, these are either found in surface context (Wendorf and Schild 1993) or they are unlikely to be true tangs, being made on the distal end of flakes (Wendorf and Schild 1993). Similarly, the tools described as bifacial foliates do not closely resemble the thin points typical of the Aterian (compare Wendorf et al. 1993a, with Hawkins 2001, and Caton-Thompson 1952).

Clearly the Aterian is marked by a number of changes in tool technology, including production of small bifacial foliates (Fig. 11.4). It is difficult to imagine that the main function of these was not as points. Tanged tools include points, scrapers, burins, and borers (Fig. 11.5). There is a continuation and perhaps expansion of the use of basal thinning, and both pointed tools and flakes are thinned (Fig. 11.6).

Examined in terms of tool design, it seems clear that there is an increased concern with hafting through time. The Gifata point, if it can be attributed to the MIS 7, was likely hafted, as were the basally thinned pieces of the Upper Levalloisian at Kharga. However, the Aterian bifacial foliates, basally thinned tools, and tanged tools are all designed to be placed within handles. A significant portion of these tools made for hafting are points (Fig. 11.4a), which we can only surmise were used in hunting. I interpret this change as indicative of greater concern with reliability of tools.

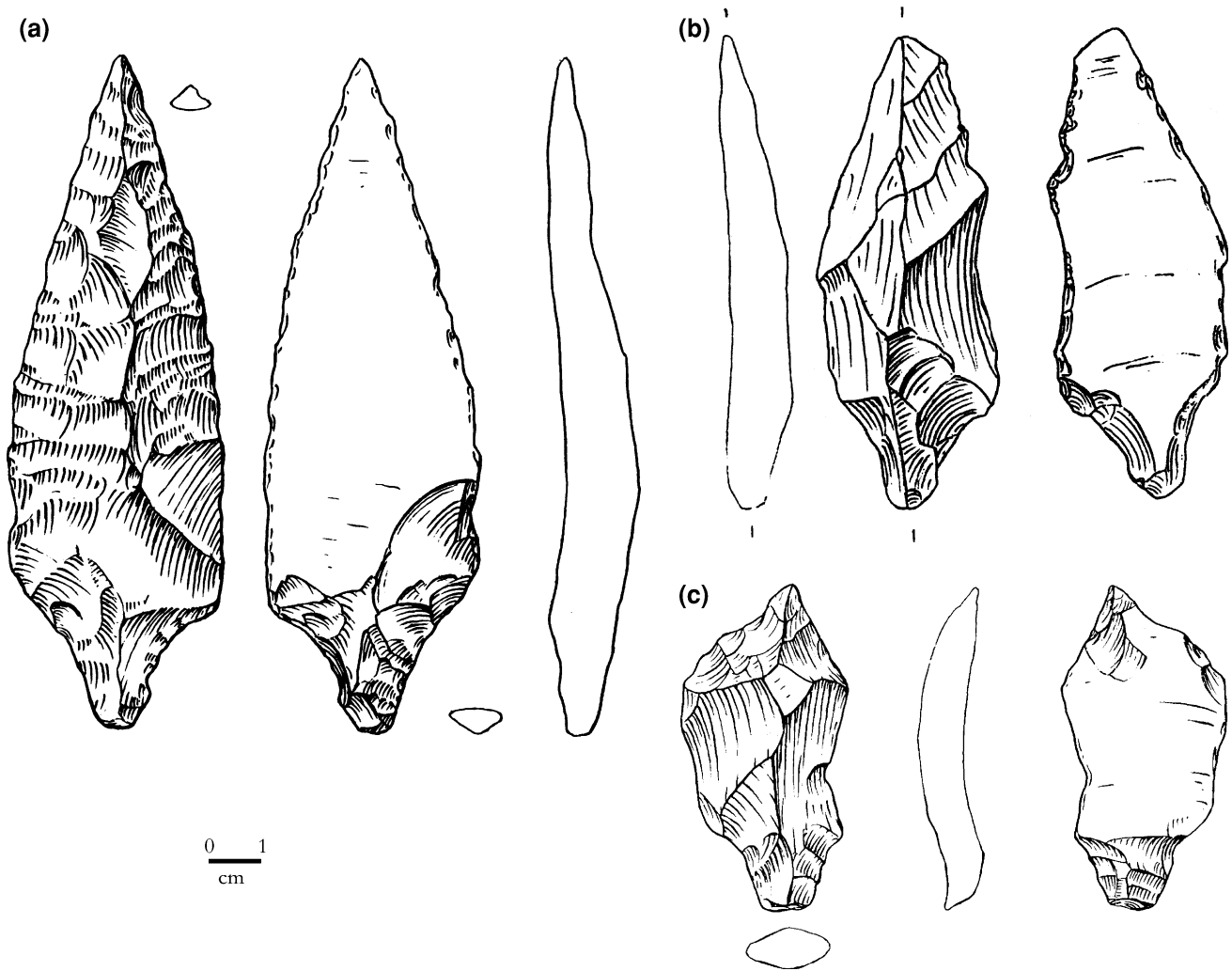


Fig. 11.5 Tanged tools recovered from Aterian surface localities at Dakhleh Oasis: **a** tanged point from L. 328, **b** tanged flake from L. 283, and **c** tanged borer from L. 130

The wide range of tools that are designed for hafting, both tanged and basally thinned, is also worth considering. These tools are frequently asymmetrical and are often unretouched above the tang or basally thinned area (Fig. 11.4b). At Dakhleh, the tang was designed around a major arête on the dorsal face of the flake; the flint knapper appears to have been concerned with producing a tool with a maximally strong tang, rather than with producing a symmetrical tool. In terms of design, this can be interpreted as concern with reliability of the haft; the hafted tool should not break in the handle when in use. The range and high number of tools that are not retouched above the tang may indicate concern with maintainability, obtained through using a flexible design. Tools may be used for cutting in their unretouched form, but they may also be further modified to produce scrapers, borers, and possibly points.

Conclusions

The database from the Western Desert demonstrates the following:

1. There were periods of higher precipitation at a number of times in the Pleistocene and these resulted in the presence of lakes in Dakhleh, Bir Tarfawi, and probably also Kharga.
2. Human use of the oases and the Bir Tarfawi area during these periods is well attested.
3. Numerous archaeological localities in the Western Desert have been dated to MIS 5–7 but true tanged tools have not been recovered from any of these; they are not considered to be Aterian.

As discussed above, there are many limitations to the available database for the Western Desert. In this chapter, I propose an explanation for some of the differences that

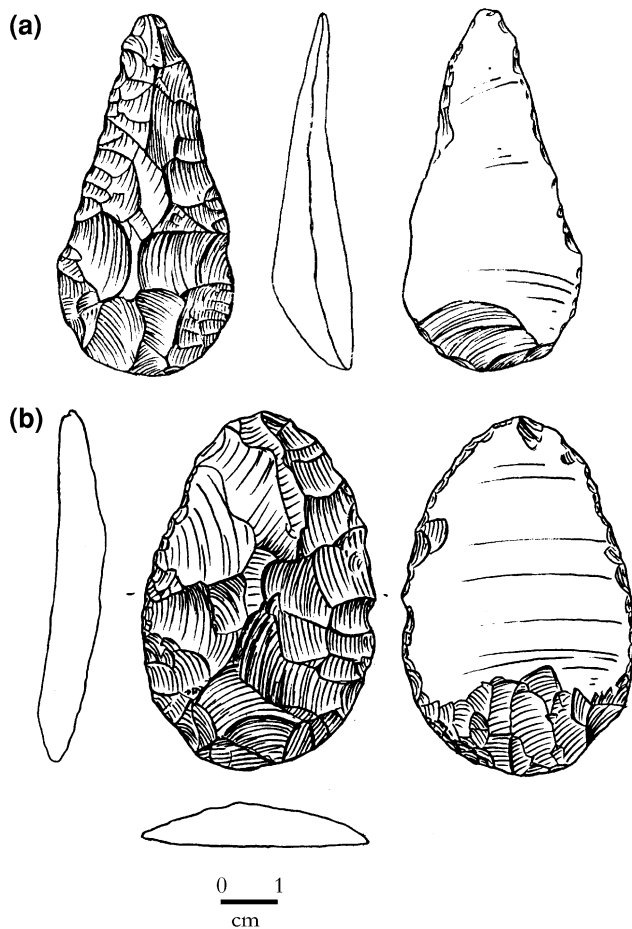


Fig. 11.6 Basally thinned tools from Aterian surface localities at Dakhleh Oasis: **a** pointed tool from L. 325, **b** basally thinned flake from L. 319

have been observed between earlier MSA units and the Aterian. I have attempted, as much as possible, to use comparable samples for this analysis, however, this has not always been possible and it is my hope that future research will focus on direct comparison of the earlier MSA and the Aterian.

The model that is proposed here suggests that the differences among the MSA units attributed to MIS 7–3 are ones of degree rather than kind. However, the change from the MIS 5 MSA to the Aterian is more pronounced than earlier changes. The differences can be explained reasonably well by a model in which different technological strategies were adopted. These are solutions to problems, or adaptations. Ample evidence points to relatively humid periods during MIS 7 and 5, while the evidence for higher precipitation and spring activity during MIS 3–4 exists but is much more ephemeral. I suggest that, in more humid periods, humans living in the Western Desert would have encountered adequate non-mobile resources in their environment for survival. They may have also pursued game, as

is suggested by both Gautier (1993) and the Gifata points at Dakhleh. However, the archaeological record suggests that this was a comparatively minor contributor to subsistence.

We may anticipate that different resources would have been available in drier periods. Aquatic vegetation and/or carcasses that could be scavenged at lakeshore settings were likely fewer and the escarpment would not have been an attractive location from a subsistence perspective. The exploitation of fauna may have required careful scheduling if, for example, people exploited migratory species such as some species of gazelle. Alternatively, if the hunting strategy was mainly through encounter because locations of game were less predictable, there would also be a need for reliable tools.

Desiccation and the decrease in available resources may have resulted in increased human mobility and focused human activity on a few known locations of resource exploitation. The high number of point cores at the Aterian workshop locations, and the relatively high density of material suggest reuse on many occasions, with the primary focus of lithic reduction being the production of flakes and points for transport, rather than the production of tools for use at the site (Hawkins 2001). Further, higher mobility may have made a focus on personal gear as opposed to provisioned places advantageous.

To what extent were the Aterians who used the Western Desert behaviorally modern? The lithic reduction strategies employed during the Aterian are largely a continuation of those used by earlier groups. The basal thinning of tools to aid in hafting also occurs first in the MIS 5 MSA. If Kleindienst's (2003) attribution of the Gifata points is correct, production of foliates also occurs earlier than the Aterian. Repeated use of workshop locations such as at Midauwara 10 occurs first in MIS 5, but is in greater evidence in the Aterian. Using sites near water as base camps or possible resource extraction locations appears to occur from MIS 7 though MIS 3/4, but the nature of the tools discarded at these locations changes.

Based on the evidence from lithics and the distribution of sites, at this time it is only possible to say that the Aterian represents an elaboration on behavior and technology that occur earlier, and that this elaboration is likely related to changes in subsistence, probably arising in part from climatic changes. At the same time, it must be remembered that this analysis is based largely on surface material, and that many of the indicators of modern behavior—if they existed—would not have survived several tens of thousands of years on the desert surface.

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