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Out of Dakhla: Cultural diversity and mobility between the Egyptian Oases and the Great Sand Sea during the Holocene humid phase.

Introduction

During the Early Holocene or Epipalaeolithic the flaked stone tools show great similarities throughout the entire Sahara. The Mid-Holocene period, approximately starting at 6400 BC (all dates are calibrated) and running until the beginning of the deterioration of the Eastern Sahara around 5000 BC, reflects a shift towards marked regional diversity that, following Close (1990: 176), might result from higher population density than during the Early Holocene. Regional diversity is of importance to define similarities between archaeological sites, and consequently scholars have stressed certain parallels as a result of contacts or influences between regions. For instance, influences of the "Saharo-Sudanese Neolithic" represented by ceramic decorative patterns of the Khartoum style have been reported from Dakhla (McDonald 1992; Hope 2002; Warfe 2003). A number of cultural traits of the oases region have in turn provoked some speculation about cultural affinities with the Nile Valley, Fayum or Merimde (McDonald 1991). In the north-western province McBurney has postulated a "Cyrenaican Neolithic" or "Neolithic of Libyco-Capsian Tradition" represented by pressure-flaking in the flint work, and the introduction of pottery at Haua Fteah (McBurney 1967). Tentatively he proposed a rather western influence from the Neolithic of Capsien tradition. Eiwanger's "south-western facies of Levantine Early Neolithic" (Eiwanger 1988: 53; 1994, 44) represented in layer I ("Urschicht") of Merimde Beni-salame (Eiwanger 1984) spread along the Mediterranean coast incorporating Merimde as well as the Cyrenaica (Eiwanger 1987: 86). In turn, he saw an African or Saharan tradition in Merimde from layer II upwards (1988: 53). Further hypotheses on contacts or influences across the

Western Desert could be listed here, but one may have a closer look into Hope's introduction (2002. 39) to the Dakhla traditions and influences where a great list already exists. It is not without irony, that they altogether suggest a hyper-active network throughout the inhospitable barren desert. The problem is that most of the contact or influence hypotheses do not illustrate the mechanisms of communication or distribution of cultural traits, and no attempts have been made to systematize the different facets of contact patterns (exceptions in Warfe 2003). Moreover, there is a lack of quantitative evidence that leads beyond simple parallels in artefact morphology.

The study of archaeological sites throughout the Western Desert of Egypt by the B.O.S. and ACACIA missions during the last two decades has revealed some data that could help to create a rather realistic scenario of the past contacts and divers cultural traditions, not least, as both projects followed a supra-regional approach.

The beginning at Regenfeld

It is quite clear that the "contacts" in the Western Desert of Egypt took place during the seasonal or episodic movements of the prehistoric dwellers before they returned to the wells, spring mounds and other permanent water resources during the dry season. It is also a basic assumption that the ecological conditions and the socio-economic fundament were faraway from an intensive exchange or trade system. In turn the oases and other favoured places obviously were meeting points where some exchange resulted from the population agglomeration during the dry episodes. The distribution across the deserts, however, results from the seasonal movements of hunter-gatherers or pastoralists.

The idea to study the different cultural influences and their mechanisms in the Western Desert was initiated by the archaeological work of ACACIA conducted west of Regenfeld in the southern Great Sand Sea (Fig. 1) during two campaigns in 1996 and 1997 (Riemer 2000; 2003a). The excavations and surface collections on the Regenfeld playa produced a small number of lithic assemblages from the Mid-Holocene wet phase which obviously indicated various individual cultural influences from different regions, and a high mobility of the prehistoric groups. Local raw materials for stone tool production are nearly absent in the area of Regenfeld, and much of what was found on the prehistoric sites was gathered outside. Libyan Desert Glass, quartzite and flint came from outcrops which are up to 250 km away from Regenfeld.

It was then noticed that the sites of Regenfeld may contain retouched stone tools which were not found in combination elsewhere in the Libyan or Western Desert. On the one hand, there are transversal arrow-heads which resemble the tradition of the Gilf Kebir (phase Gilf B) (Schön 1996; Linstädter &

Kröpelin 2004) and the sites of Mudpans (Mudpans A/B) (Kuper 1993; 1995). On the other hand, there are striking parallels with the lithic tool kit and the techniques of facial retouch as found in Dakhla Oasis (Bashendi A/B) (McDonald 1991; 1999) and on the Egyptian Limestone Plateau (Djara A/B) (Kindermann 2004).

The Southern Great Sand Sea, located between the more favoured Gilf Kebir Plateau in the southwest and the Oasis of Dakhla in the northeast, can be seen as the most arid core zone of the desert with only episodic precipitation and no availability of fossil groundwater during the Holocene wet phase. It is likely that human occupation of the desert region only took place after episodic rainfall when small ponds and playas held surface water. However, the less developed relief of the country limited the run-off, and enlarged basins were obviously rare. It is therefore likely that this desert area was a barrier zone between northern and southern Egypt, though it was penetrable during good years.

The region of Regenfeld situated in the centre of this desert area was definitely incorporated into the territory of various prehistoric groups who came from the southwest as well as from the northeast. The Regenfeld playa is a 600 m long playa basin where silty sediments agglomerated up to 6 or 7 m high. This basin was a pool which potentially could provide long lasting water stands over weeks or months. With regard to the many human occupation sites at this playa, the basin certainly profited from the enormous distances between the water pools across the Sand Sea creating an island-like character within the barren Sand Sea. During their episodic movements through the desert the hunter-gatherers of the Holocene wet phase distributed the various raw materials and tool types throughout the desert. It is plausible that years of intensive rainfall effected an extensive distribution over the entire Sand Sea while years of poorer rainfall only led to a population agglomeration in the vicinity of the oases. In turn, the properties of lithic traditions within an area can give an indication of the frequency of human occupations, and which tradition dominates within a region (Riemer in press).

This was the hypothesis when the project went into its next phase, and the research programme that was then performed for the following years should prove this hypothesis. As the Great Sand Sea is by far too large for a high resolution field survey, a transect between Regenfeld and Dakhla Oasis was selected to continue the work (Fig. 1). The primary objectives were to study the properties and proveniences of tool types and raw materials, and to analyse the production sequences for further details. The assumption was to find an increasing percentage of bifacially retouched tools and artefacts made of flint with decreasing distance to the oasis.

A reconnaissance survey in the southeastern Sand Sea east of Regenfeld revealed only a small number of sites, and none of them was large enough for

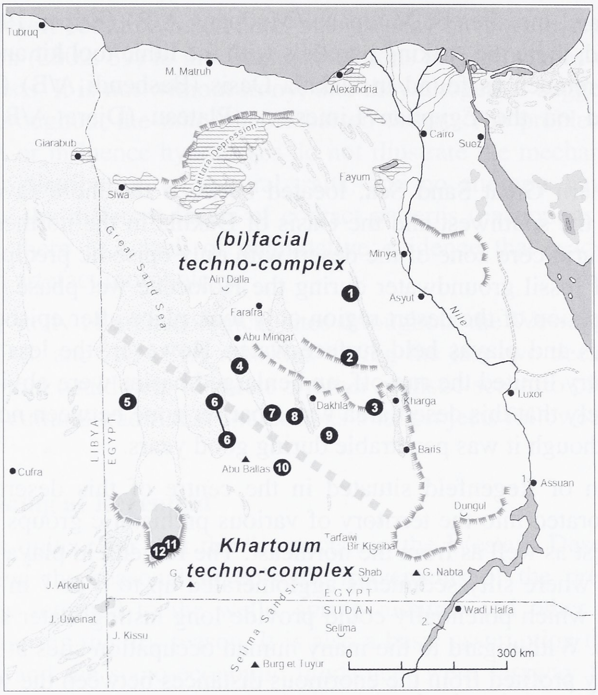


Fig. 1. Map of Egypt showing the Mid-Holocene techno-complexes, and the ACACIA/B.O.S. study areas mentioned in the text: 1 Djara; 2 Abu Gerara; 3 Abu Tartur; 4 Abu Minqar; 5 Glass Area; 6 Regenfeld; 7 Chufu; 8 Meri; 9 Eastpans; 10 Mudpans; 11 Wadi el-Bakht; 12 Wadi el-Akhdar.

Fig. 2. "Joint venture at Ladies Hill" (= Meri 99/36) in November 2000. From left to right, bottom: Lech Krzyżaniak, Ewa Kuciewicz; top: Heiko Riemer, Karin Kindermann, Andreas Pastoors, Eliza Jaroni, Michał Kobusiewicz.

further statistical examination. It was then, in the end of 2000, when a one-day joint-venture tour of ACACIA and DOP (Dakhleh Oasis Project) was organized to the rock art site of "Ladies Hill" (Fig. 2), a location that was registered in 1999 as "Meri 99/36". The team of the DOP petroglyphs unit headed by the late Lech Krzyżaniak visited the rock depictions while the other group discovered some Mid-Holocene surface sites, listed in the following as sites Meri 00/80, 00/81, and 00/82.

In 2002 an extended field survey was conducted in the area west of the Meri sites which was named "Chufu" after a Pharaonic site in its vicinity (Kuper and Förster 2003). While "Chufu" is a hilly country positioned close to the Great Sand Sea, the sites of "Meri", named after a Pharaonic inscription some kilometres away (Burkhard 1997), are located in a plain or gently undulating landscape. At least, the survey campaigns to Meri and Chufu yielded five large Mid-Holocene assemblages of which four have been recorded afterwards by surface collections and small excavations. The examination of two assemblages from Meri and Chufu has been finished until now, and a number of preliminary results can be presented here. Moreover, on site Chufu 02/14 the playa remains have been investigated in order to reconstruct the geomorphologic development of the playa basins.

The study area of "Meri"

The landscape in which the sites of Meri are positioned is a rather plain or gently undulating sand sheet interrupted by small inselbergs and escarpments up to 20 m high, and patches of sandstone gravel. The altitude is more than 300 m a.s.l., and groundwater of the Nubian Aquifer are out of reach in this area. The sites in question are situated east of a 10-15 m high escarpment that stretches from north-northeast to south-southwest (Fig. 3). A number of rocks and small sandstone cones are scattered in front of the small escarpment. A shallow basin with a recent playa deposit with soft mud curls on the surface and dry vegetation form the place where the archaeological sites have been discovered. A more detailed examination of the basin indicated that older and more extended playa sediments were present but in large parts covered by wind blown sand. Between the 2 m and 4 m elevation lines, test excavations yielded reddish "playa sand" consisting of reworked or mixed-up playa silts. This probably marks the shoreline area of the old episodic lake. The position of most of the artefact material at the 2 m contour line is another good indicator for the highest water level that occurred here.

Three clusters of surface artefacts were found and subsequently recorded as three individual assemblages (00/80, 00/81, and 00/82). Meri 00/80 and 00/81 were situated at the former playa basin. On both sites the surface is covered by a

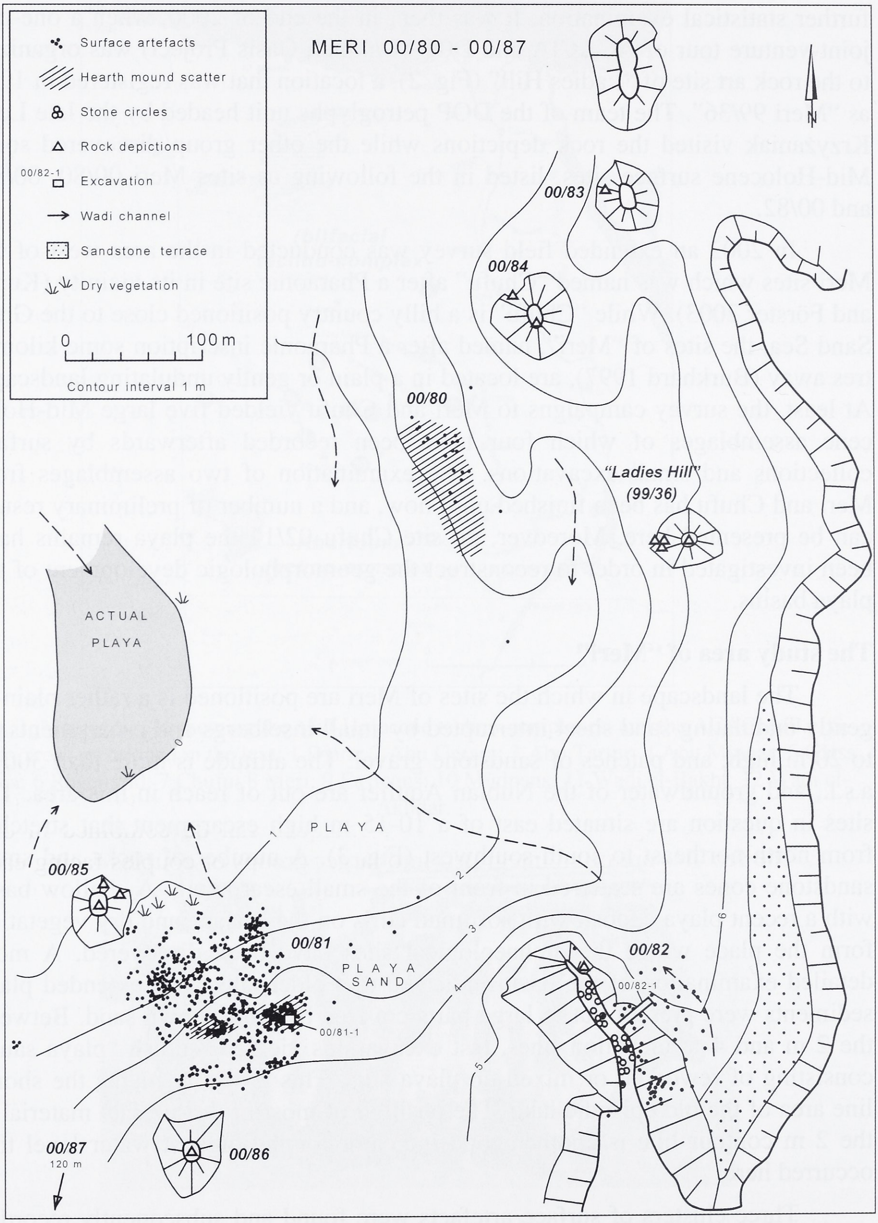


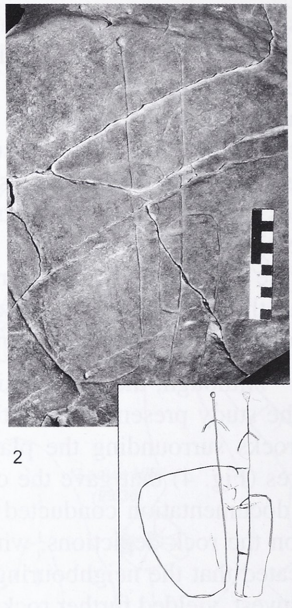
Fig. 3. Meri 00/80, 00/81, 00/82 and connected sites: site map.

dense scatter of grinding implements, knapping debitage and hearth stones. While on 00/80 and 00/82 only a small number of retouched tools and grinders were found, the area of 00/81 yielded the mass of the tool assemblage. 00/82 is situated on the east flank of a 15 m high spur of rock that juts out to the north-west into the basin. The top surface of the spur of rock, that measures approximately 100 m in length and less than 10 m in width, is covered by about 20 stone circles. Though stone artefacts within the stone structures were rare, the small collection that was made here, as well as a ^{14}C-date places the spur of rock "city" into the same period as the surface clusters down slope. It was therefore decided to put the three assemblages together into one that accounts 53 retouched tools, 27 cores, and 121 upper and lower grinders at least.

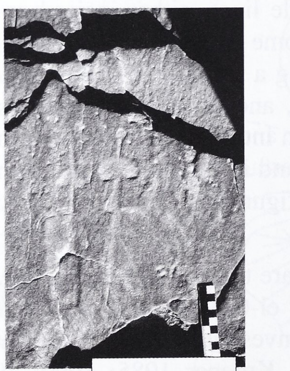
Although, the surface sites yielded an assemblage that is of great interest for the study presented here, the most impressive features are the depictions on the rocks surrounding the playa (Fig. 3). Among them are many women-like figures (Fig. 4) that gave the central hill (=Meri 99/36) the name "Ladies Hill". The documentation conducted in 2000 concentrated on 99/36. A survey carried out on the rock depictions, which were investigated by Bettina Patrick in 2002, indicated that the neighbouring hills, two in the north of 99/36, and three to the southwest, yielded further rock depictions which were briefly recorded, and listed as sites 00/83 to 00/87. Again, women-like depictions could be observed at many of the sites. The techniques in which they were carried out include pecking, incising, and grinding (Fig. 4). While the arms and the upper-bodies of the females are worked as single lines, either incised or pecked, the opulent lower part of the bodies, and in some cases the breasts, are outlined and often facially ground or pecked resembling a sunk relief. The manner in which the techniques are used can differ greatly, and different techniques can be combined in one figure. The females are often integrated into larger groups or couples facing each other. Other petroglyphs found in proximity to the female depictions are giraffes and a great variety of non-figurative elements and symbol-like objects, such as crosses and rows of lines.

The closest parallels are to be found among the rock depictions at Tineida village and along the Darb el-Ghubari east of Dakhla Oasis first recorded by Winkler (1938; 1939), and investigated by the DOP since the 1980s (Krzyżaniak 1987; 1990; Krzyżaniak & Kroeper 1985; 1990; 1991). Winkler's "pregnant women" (1939: 27) are obviously identical to what was found at the Ladies Hill, but they have not been found elsewhere until now (though Červíček 1992-93 associates Badarian/Naqada figurines). Although the females might point to a close connection of the desert dwellers of the Ladies Hill with Dakhla Oasis, it can not be made certain that the depictions and the camp sites around the Ladies Hill are contemporaneous. For the prehistoric time Winkler has suggested a two-

4-1. Meri 99/36 "Ladies Hill", panel C (outlined and fully pecked).



4-2. Meri 00/85, panel J (incised).



4-3. Meri 00/87, panel B: (incised and partially polished).

Fig. 4. 1-3:Rock depictions of women-like figures.

phased relative chronology including the "Earliest Hunters" followed by the "Early Oasis Dwellers". However, absolute dating of rock art and its relation to other artefact classes is notoriously difficult. Winkler's "Early Oasis Dwellers" among which the female depictions have been subsumed can hardly be connected to the ceramic and lithic-based chronological sequence. Although the "Early Oasis Dwellers" have roughly been connected to the Sheikh Muftah phase (Krzyżaniak 1990), a somewhat earlier date can not be excluded.

The study area of "Chufu"

The area of Chufu is situated close to the eastern dune trains of the southern Great Sand Sea, with an east-west extension of approximately 30 km. Within this area the landscape is hilly with myriads of inselbergs ranging from small rocks to large hills up to 50 m high. The predominating north-south wind is channelled between the hills and ridges resulting in heavily wind-blasted surfaces and deep, longish blown-out basins. These pans are often several meters deep with steep sides. Their width normally does not exceed more than 100 m while their length can go up to several hundred meters (Fig. 5). A number of larger basins show Holocene stillwater sediments (playa sediments) intermitted by aeolian sand and weathered shale. The actual situation, however, displays a high amount of deflation up to several meters since the Mid-Holocene, and playa deposits are still reduced to remnants at the edges of the pans and adjacent hills.

At many playa basins artefact scatters have been found which date to the Holocene humid period. As in many other parts of the Western Desert, the basins created favourable living conditions after a rainfall when surface water ran-off and formed rain ponds in the basins for weeks or months. From a large amount of sites discovered during field surveys, three sites have been studied in detail, namely Chufu 02/14, 02/15, and 02/17. The investigations conducted at these sites comprised complete surface collections of selected areas, as well as a number of test excavations. As the study of Mid-Holocene assemblages was the primary subject, the Early Holocene or Epipalaeolithic surface clusters have not yet been recorded on these sites. To date the Mid-Holocene assemblage of site 02/15 has fully been examined; regarding the other assemblages, some preliminary conclusions can be presented.

The westernmost playa 02/14 was selected for a more detailed geomorphological analysis related to the archaeological study of the connected site. It can be seen as characteristic for the other playas. The playa depression of 02/14 extends about 300 m in north-south direction and about 200 m in east-west direction (Fig. 5). The centre of the basin is about 5-6 m below the surrounding surface indicating traces of advanced deflation (Fig. 6). Playa remains at a foot slope of the central hill (hill 3) partially overrun by slope rubble rises more than

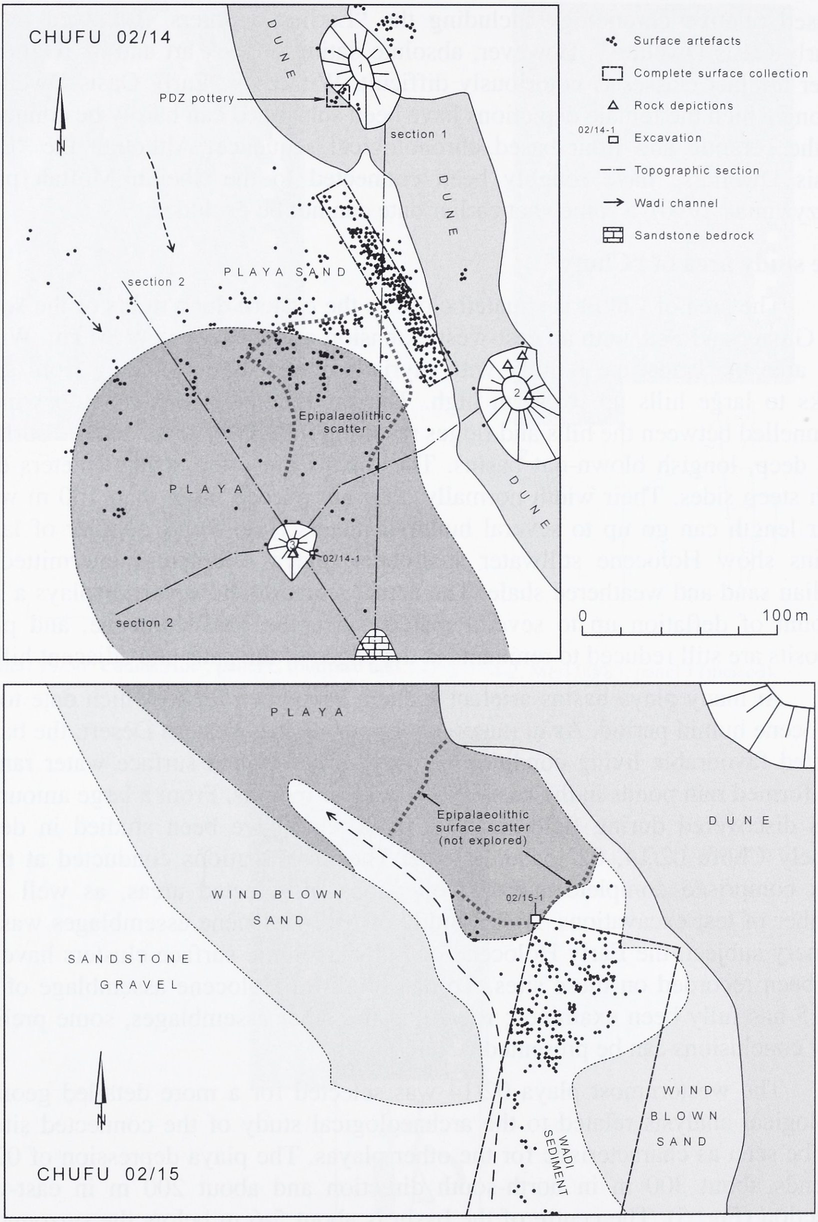


Fig. 5. Chufu 02/14 and 02/15: site maps.

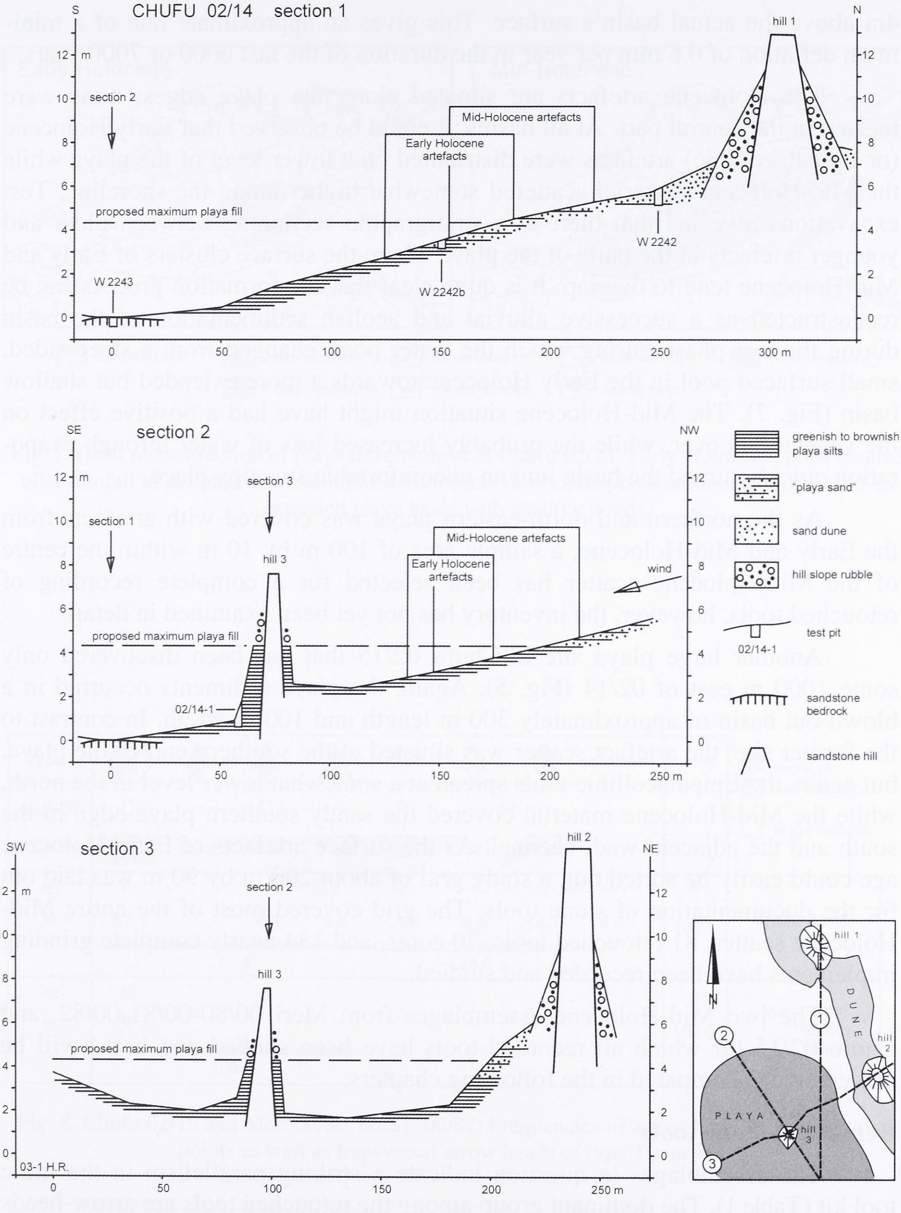


Fig. 6. Chufu 02/14: topo-sequence of the playa basin recorded along three sections.

4m above the actual basin's surface. This gives an approximate rate of a minimum deflation of 0.6 mm per year in the duration of the last 6000 or 7000 years.

The Holocene artefacts are situated along the playa edges; none were located in the central part. At all basins, it could be observed that Early Holocene (or Epipalaeolithic) artefacts were distributed on a lower level of the playa while the Mid-Holocene material scattered somewhat higher along the shoreline. Test excavations revealed that there is a stratigraphic sectioning between older and younger artefacts in the parts of the playa where the surface clusters of Early and Mid-Holocene tend to overlap. It is quite clear that the formation process can be reconstructed as a successive alluvial and aeolian sedimentation of the basin during the wet phase during which the water pond changed from a steep-sided, small surfaced pool in the Early Holocene towards a more extended but shallow basin (Fig. 7). The Mid-Holocene situation might have had a positive effect on the vegetation cover, while the probably increased loss of water through evaporation quickly turned the basin into an uncomfortable swampy place.

As the northern and north-eastern playa was covered with artefacts from the Early and Mid-Holocene, a sample area of 100 m by 10 m within the centre of the Mid-Holocene scatter has been selected for a complete recording of retouched tools, however, the inventory has not yet been examined in detail.

Another large playa site is Chufu 02/15 that has been discovered only some 1000 m east of 02/14 (Fig. 5). Again, the playa sediments occurred in a blown-out basin of approximately 300 m length and 100 m width. In contrast to the former site, the artefact scatter was situated at the southern end of the playa, but again, the Epipalaeolithic tools spread at a somewhat lower level in the north, while the Mid-Holocene material covered the sandy southern playa edge in the south and the adjacent wadi channel. As the surface artefacts of Early Holocene age could easily be sorted out, a study grid of about 200 m by 90 m was laid out for the documentation of stone tools. The grid covered most of the entire Mid-Holocene scatter. 81 retouched tools, 70 cores, and 134 nearly complete grinding implements have been recorded and studied.

The two Mid-Holocene assemblages from Meri 00/80-00/81-00/82, and Chufu 02/15 for which all recorded tools have been studied and listed will be presented and compared in the following chapters.

Retouched stone tools

The assemblages in question indicate a striking parallelism in the lithic tool kit (Table 1). The dominant group among the retouched tools are arrow-heads that range from 19-24%. Among them, bifacially retouched, leave-shaped and stemmed pieces dominate while laterally retouched, stemmed points are rare (Fig. 8; Fig. 9.1-8). Only one transversal arrow-head was found on site 02/15 (Fig. 9.5).

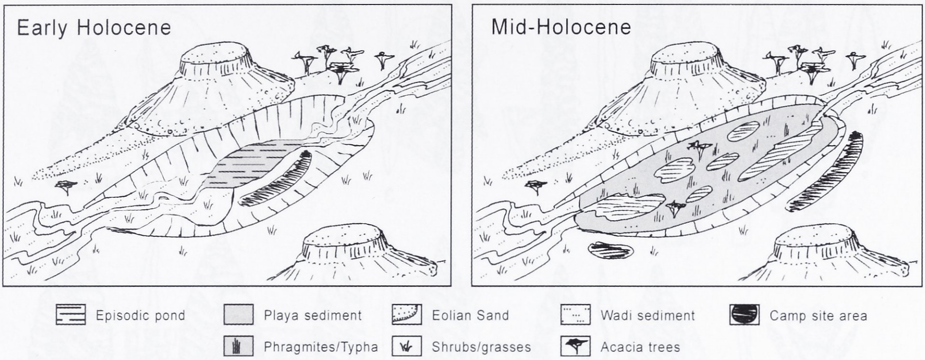


Fig. 7. Draft reconstruction of playa development at Chufu 02/14. Early Holocene: pond created after rainfall in deflated depression; Mid-Holocene: developed playa sedimentation created an extended playa basin with shallow ponds.

Type								unknown	total	
HUGOT	C	D			F	H				
ACACIA	5-8/15-18 101-108	65-68	60-64	51-58	283	231-248	201-216			
no.	12		1	2	1	1	3	1	21	Chufu 02/15
%	57.1		4.8	9.5	4.8	4.8	14.3	4.8	100.1	
	71.4				28.6					
no.	10								21	Meri 00/80 00/81 00/82
%	100.0								100.0	
	100.0									

facial or flat retouch

edge retouch

Fig. 8. Chufu 02/15 and Meri 00/80, 00/81, 00/82: Frequencies of arrow-head types (including points as well as transversal arrow heads of type Tixier 89).

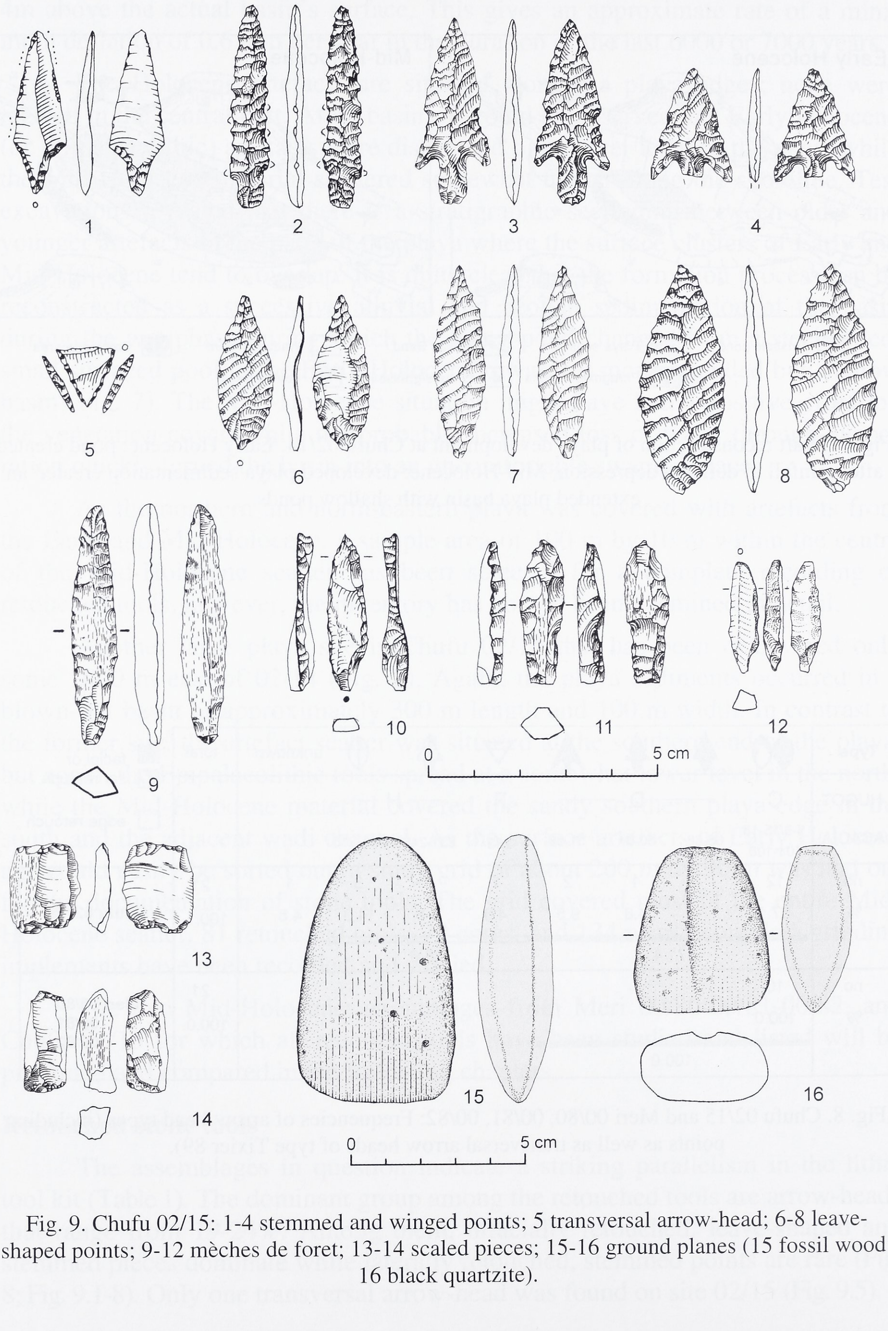


Fig. 9. Chufu 02/15: 1-4 stemmed and winged points; 5 transversal arrow-head; 6-8 leave-shaped points; 9-12 mèches de foret; 13-14 scaled pieces; 15-16 ground planes (15 fossil wood; 16 black quartzite).

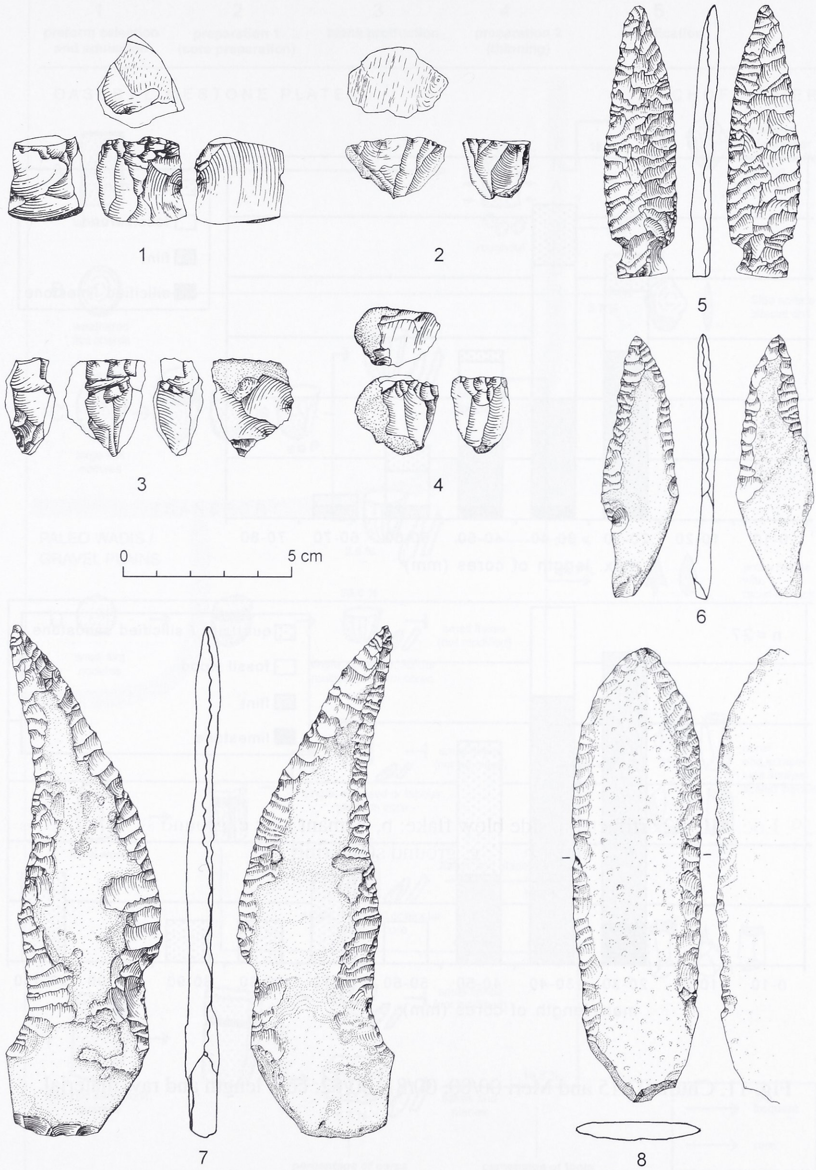


Fig. 10. Chufu 02/15: 1-4 cores (1, 4 flint; 2-3 fossil wood); 5-8 knives (5-7 flint; 8 black quartzitic sandstone).

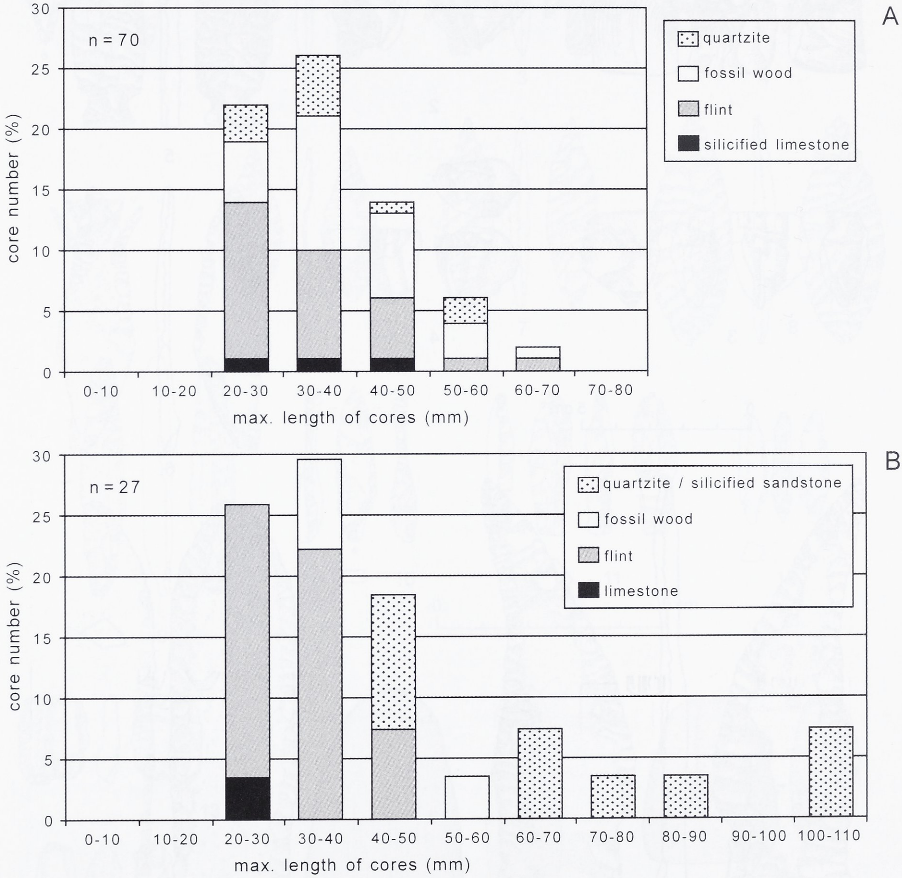


Fig. 11. Chufu 02/15 and Meri 00/80, 00/81, 00/82: core length and raw material.

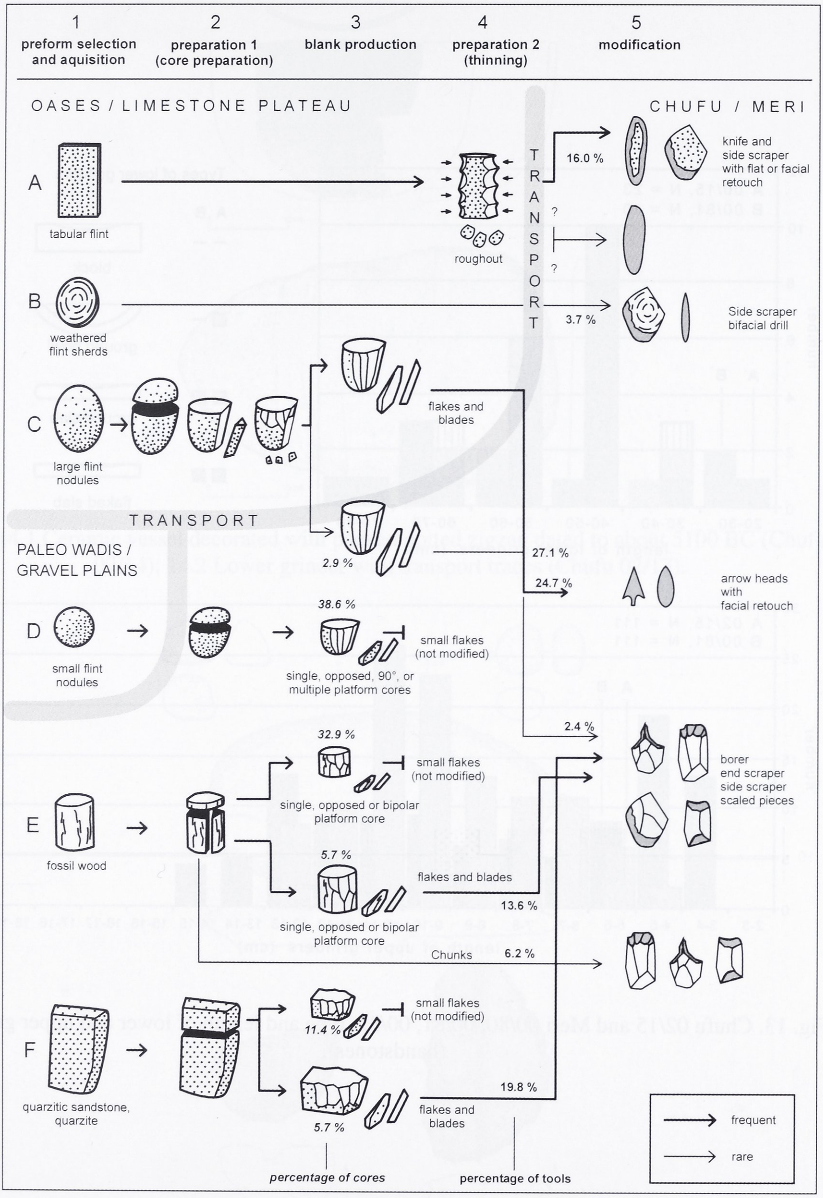
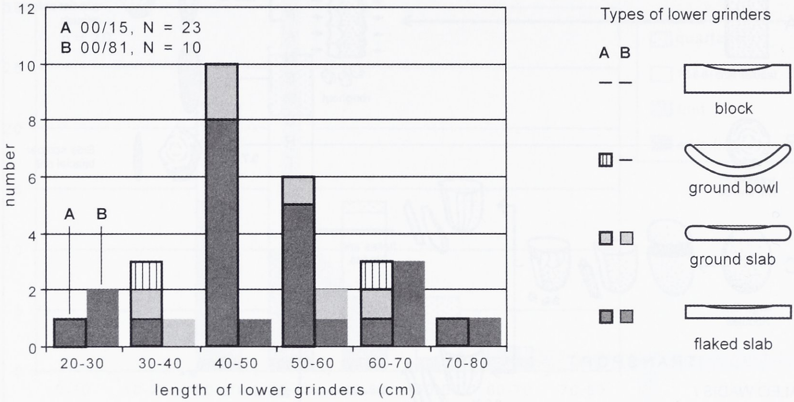


Fig. 12. Generalized reduction sequence (*chaîne opératoire*) for the Chufu/Meri area. Percentages on cores and tools are based on the assemblage of Chufu 02/15-surface (small cores < 5 cm).



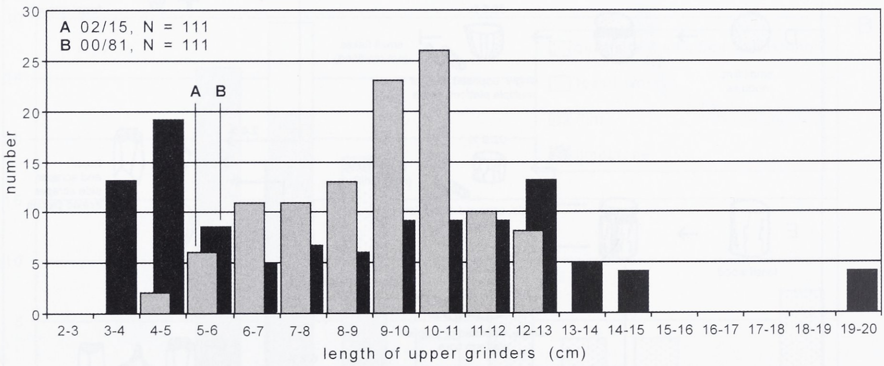


Fig. 13. Chufu 02/15 and Meri 00/80, 00/81, 00/82: type and length of lower and upper grinders (handstones).

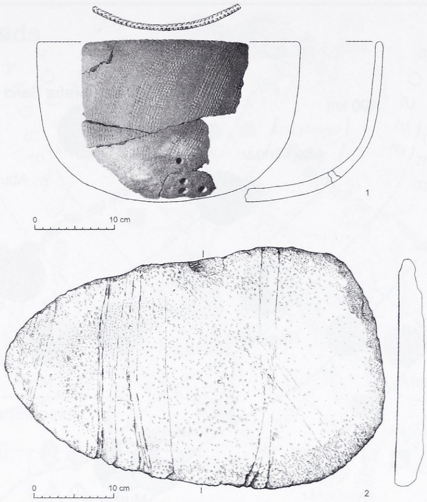


Fig. 14.1 Ceramic vessel decorated with packed dotted zigzag dated to about 5100 BC (Chufu 02/14); 14.2 Lower grinder with transport traces (Chufu 02/17).

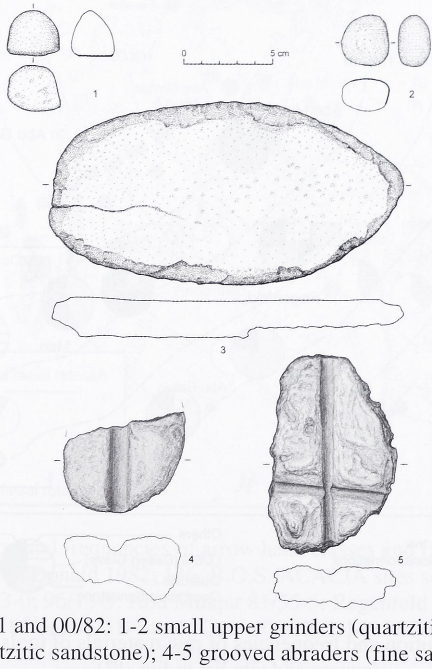


Fig. 15. Meri 00/81 and 00/82: 1-2 small upper grinders (quartzitic sandstone); 3 palette (quartzitic sandstone); 4-5 grooved abraders (fine sandstone).

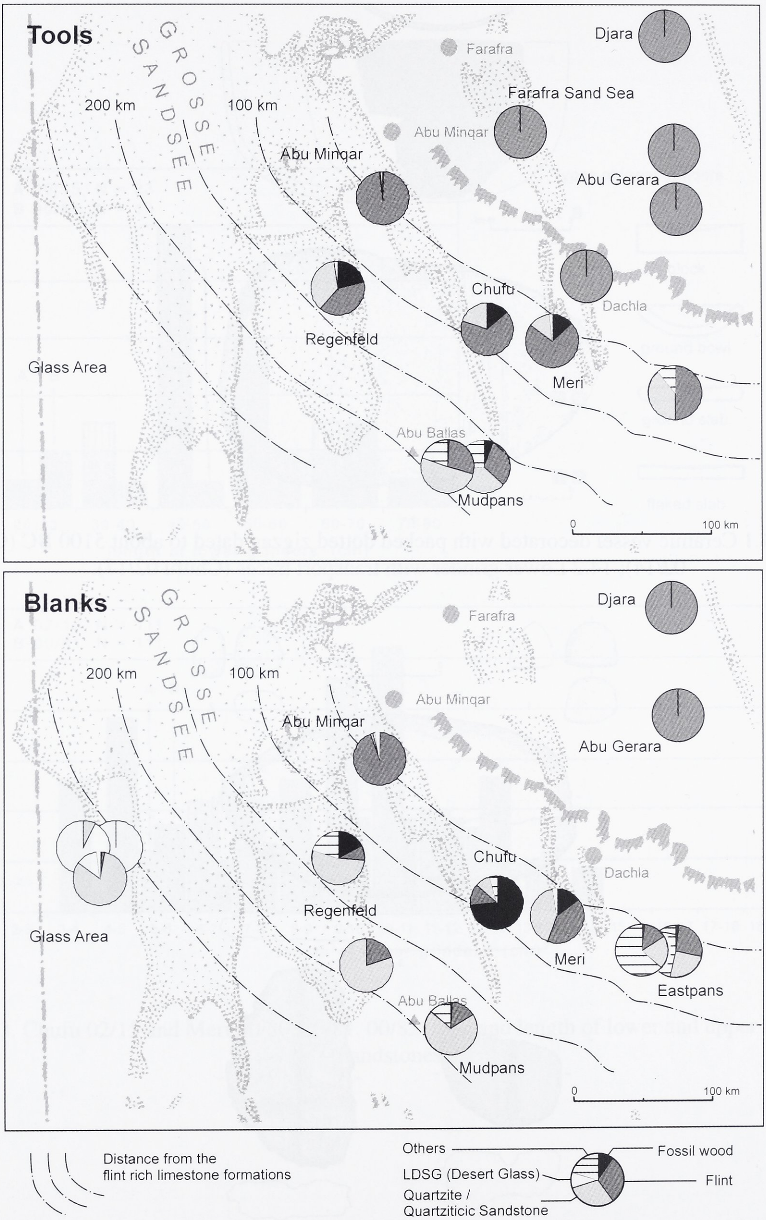


Fig. 16. Distribution and frequencies of raw materials of tools and blanks (source and site list in Fig. 17).

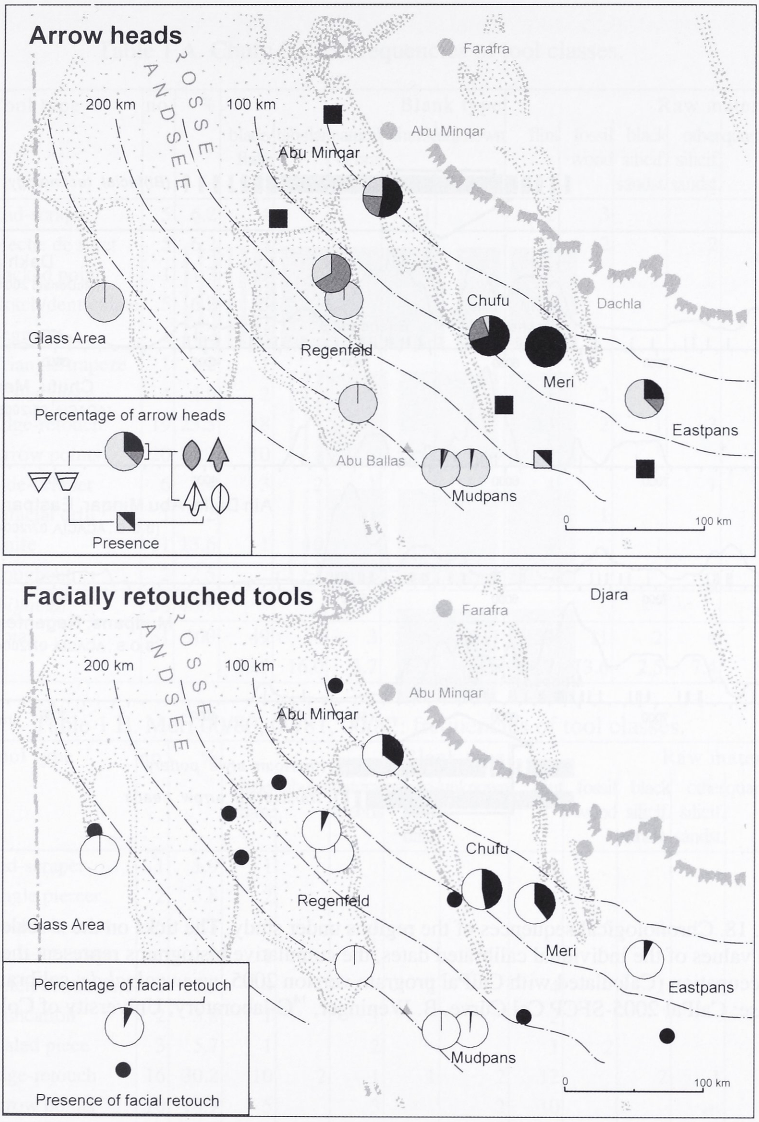


Fig. 17. Distribution and frequencies of arrow head classes and facially retouched tools. (source: Dakhla after McDonald 1982, 136; B.O.S./ACACIA sites southwest of Dakhla: Glass Area 81/61-1+2; 96/13-0; 96/13-3; Abu Minqar 81/55-5; Regenfeld 96/19-Cl. 1; 96/1-3-West; 96/15-3+4; Mudpans 85/56; 85/51-1 to 4; Chufu 02/15-0; Meri 00/80-0 to 00/82-0; Eastpans 95/1-1; 95/1-2).

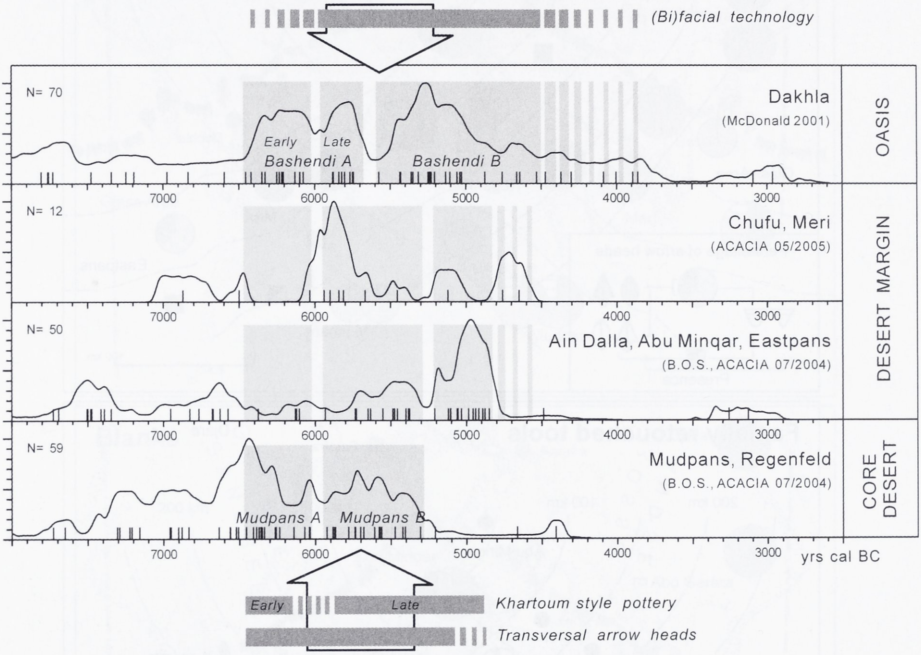


Fig. 18. Chronological sequences of the regions under study. The ticks on the x-scale are the mean values of the individual calibrated dates, the cumulative histograms represent the intensity of occupation (Calculated with CalPal program version 2005, *www.calpal.de*; calibration data base: CalPal 2005-SFCP Cal Curve, B. Weninger, ^{14}C-laboratory, University of Cologne).

Table 1 A. Chufu 02/15: frequencies of tool classes.

Tixier type	Tool type	no.	%	Blank type					Raw material				
				blade/ flake	tabular	natural debris	chunk	unknown	flint	fossil wood	black silicif. sandst.	other silicif. sandst.	quartzite
1-11	End-scraper	5	6.2	4			1		2	3			
16	Meche de foret	5	6.2	3			2		1	2		2	
45	Backed point	1	1.2	1					1				
73-79	Notch/denticulate	5	6.2	5					5				
82	Segment	1	1.2	1					1				
89-93	Triangle/trapeze	1	1.2	1					1				
104	Scaled piece	4	4.9	2			2		1	3			
105	Edge-retouch	19	23.5	18		1			13	2	1	3	
	Arrow points	20	24.7	10				10	19				1
	Side-scraper	6	7.4	3	2	1			4			1	1
	Bifacial drill	1	1.2			1				1			
	Knife	11	13.6	1	10				4		1		6
	Roughout	2	2.5		1			1	2				
	(bi)facial	*38*	*46.9*										
	Total	81	100	49	13	3	5	11	54	11	2	6	8
	%			60.5	16.0	3.7	6.2	13.6	66.7	13.6	2.5	7.4	9.9

Table 1 B. Meri 00/80, 00/81, 00/82: frequencies of tool classes.

Tixier type	Tool type	no.	%	Blank type					Raw material				
				blade/ flake	tabular	natural debris	palaeo-lithic flake	unknown	flint	fossil wood	black silicif. sandst.	other silicif. sandst.	quartzite
1-11	End-scraper	1	1.9	1					1				
12	Single piercer	2	3.8	2					1				1
16	Meche de foret	6	11.3	5		1				5	1		
66	Backed bladelet	1	1.9	1					1				
73-79	Notch/denticulate	6	11.3	4			2		4		1		1
80	Truncation	2	3.8	1		1			2				
104	Scaled piece	3	5.7	1		2			1	2			
105	Edge-retouch	16	30.2	10	2	1	1	2	12		2	1	1
	Arrow points	10	18.9	5		3		2	10				
	Side-scraper	1	1.9		1				1				
	Knife	4	7.5		1				4				
	Roughout	1	1.9		1				1				
	(bi)facial	*21*	*39.6*										
	Total	53	100.1	30	8	8	3	4	38	7	4	1	3
	%			56.6	15.1	15.1	5.7	7.5	71.7	13.2	7.5	1.9	5.7

Knives range from about 8 to 14% and make up another important tool group (Fig. 10.5-8). In both inventories, mèches de foret (Fig. 9.9-12), notches/denticulates, and to some extent splintered or scaled pieces (Fig. 9.13-14) are frequent tool types. Only end-scrapers show significant differences between both assemblages, as they amount to about 6% on site 02/15, while the sites of Meri have only 2%.

More than two thirds of the tools in both assemblages are made out of flint (synonymous for flint *and* chert) (Table 1). Among the flints, two or three varieties can be listed as very frequent: (1) a soft, opaque grey flint with dusky weathered surfaces (to be found in form of large nodules or weathered pieces in the wadi terraces of the Limestone Plateau escarpment at Dakhla, or on the Plateau itself); (2) a reddish to brownish nodular flint with brown scarred cortex (the nodules are very small and might have been collected from Wadi gravels in front of the Plateau escarpment); (3) a brownish to yellowish caramel flint which is of better quality for flint knapping than the varieties previously mentioned (the caramel flint was predominantly found in geological formations that crop out at the Plateau escarpment east and north of Kharga and along the Abu Gerara escarpment). Less frequent is the so-called "silicified limestone". This is, in fact, a glossy nodular flint (non-reactive to hydrochloric acid) of opaque white colour. Outcrops of this flint have only been found in the Farafra Sand Sea.

Chufu and Meri are situated within the Nubian sandstone formations, and it is quite clear that all flint varieties are from non-local resources that were exploited elsewhere on the limestone.

Fossil wood which was used for the tool production within proportions of 13-14% is a local or sub-local resource that can be collected within a day's walk nearly anywhere southwest of Dakhla and in the Great Sand Sea. Quartzite and sub-metamorphic sandstone (here paraphrased as "quartzitic sandstone") has a total account of 15-20%. Theoretically it can be found anywhere on the sandstone formations, however, outcrops of quartzite and high quality metamorphic sandstone are rare in the region. However, a number of large quartzite cores found on the sites of Chufu and Meri may point to the presence of unknown outcrops not far from the sites.

At first glance, the analysis of the raw material of the cores presents a picture that seems to be in good accordance with the tool analysis (Fig. 11): Flint is the most important source, followed by fossil wood and quartzite/quartzitic sandstone. It is, however, somewhat surprising that most cores are to be found in the size classes of 20-40 mm length (Fig. 11). These small cores (Fig. 10.1-4) are not well-exhausted, as one might expect, but often show only a single knapping platform and/or a high percentage of cortex. The cortical cores are predominantly made out of the small nodules of the red-brown flint variety mentioned above, which are too small for tool production. In turn, many tools collected on the sites of Chufu and Meri consist of flint varieties that have not been flaked on the sites. This provides quite a good argument that most retouched tools were produced outside of Chufu and Meri, possibly in Dakhla or on the Limestone Plateau (Fig. 12). To prove this reconstruction of the production sequences, the debitage as found within two excavation squares on Chufu 02/15 and Meri 00/81 has been examined. Although, the percentages of raw materials vary to some extent in the excavations, the flint varieties which were used for the tools could not be found among the production waste. As there is nearly no tool that is small enough to be struck off from these nodules, the only explanation that can be offered is that the flakes have been produced in order to get small sharp tools without the need of any edge retouchment.

About 20-30% of the tools were made out of tabular flint or flint sherds that were naturally produced by thermal and salt weathering. This implies a production strategy that concentrates on the selection of useful natural blanks on the flint outcrops. Therefore a blank production was not needed, and the flint knapper could immediately start shaping and thinning the natural blank in order to create the working edges. This kind of *chaîne opératoire* is most characteristic for the "(bi)facial techno-complex" on the Egyptian Limestone Plateau for which the sites of Djara and Abu Gerara can be listed (Kindermann 2003).

It was often not necessary to thin tabular flint, as the pre-forms were thin enough. Knives were predominantly made out of tabular flint, and this explains why most knives do not have a complete facial retouchment – which would appear as a result of thinning –, but only a flat working of the edges (Fig. 10.6-8). Another distinctive relationship between form and function can be observed for the splintered pieces. They were often made out of massive chunks either naturally or artificially formed (Fig. 9.13-14).

The spectrum of flaked tools indicates an impressive parallelism to the oases and the Limestone Plateau region, though there are some minor differences. While on the Plateau and in Dakhla side-blow flakes and flaked planes are common for the Mid-Holocene since the Late Bashendi A/Bashendi B and Djara B phases, they are absent in the Chufu/Meri area, and we do not have a plausible explanation for this phenomenon yet. As planes probably were used for cutting and processing wood, this could be an indication for rather sparse wood resources in Chufu and Meri. However, this is questionable, since two ground planes or axes were found at Chufu 02/15 (Fig. 9.15-16).

In conclusion, the schematic reconstruction of the production sequences (Fig. 12) lists the major lithic strategies performed. It is clear that many primary procedures for tool production did not take place on the sites of Chufu and Meri, but elsewhere; and also that there is a high amount of small cores used for the production of small unmodified flakes. Raw material procurement, tool tradition and the general strategies that become visible in the *chaîne opératoire* clearly point to frequent contacts with the oases and the plateau region to the north and northeast. In fact the Chufu/Meri area can be linked to the "(bi)facial techno-complex" for which sites on the Egyptian Limestone Plateau (Kindermann 2003; 2004; Riemer 2003b) and in the oases of Dakhla (McDonald 1999; 2002), Farafra (Barich & Hassan 1988; Barich & Lucarini 2002), south of Abu Minqar (Klees 1989), and Kharga (Caton-Thompson 1952) can be listed.

Grinding stones

The grinding equipment is a very dominant group of tools on all large sites of the Mid-Holocene, which probably was used to process wild cereals. Unfortunately, most of the lower grinders are fragmented, and often hundreds of tiny pieces of grinding slabs occur on the sites. For instance, the surface scatter of site Meri 00/81 revealed 372 small fragments of lower grinders while only 10 lower grinders were preserved in a way that allowed to measure or reconstruct the length and to evaluate the shape (As a standard formula to reconstruct size and shape, more than 50% of a grinding stone must be available).

In the assemblages of Chufu and Meri grinding stones are numerous (Fig. 13). Listing only the complete or reconstructed grinders, the sites yielded 33 lower grinders and 222 handstones. The lower grinders were made on relatively thin slabs with flaked or polished edges, or made as fine polished bowls out of sandstone blocks. One lower grinder from 02/17 has rope marks and abrasions on it which indicate that it was obviously tied for transport (Fig. 14.2). Immobile block grinders were not used on the sites.

The high amount of grinders from the Mid-Holocene sites points to the intensive utilisation of wild cereals. It is possible to suggest that after rainfall there was a dense grass vegetation on the sandy substrate along the neighboured dune trains, which then was exploited by the prehistoric people.

There is a number of smaller grinders which can be described as palettes (Fig. 15.3). On the site of Meri 00/81 they are very frequent. The corresponding handstones are made of quartzitic sandstone or of natural quartz pebbles (Fig. 15.1-2). The bimodal distribution of the size classes on site Meri 00/81 (Fig. 13) may indicate that grinders and palettes were individual functional classes. It is most likely that the palettes were not used for the preparation of cereals, but to powder colour sediments. The shale and sandstone formations in the area provide intensive colour pigments in red and yellow.

As a special type of tool, grooved abraders have been found in a small number on the sites of Chufu and Meri (Fig. 15.4-5). They were made out of a fine-grained sandstone, probably in order to polish arrow shafts or ostrich egg shell beads.

Pottery

As implied by the assemblage of 02/15, the people who occupied the Chufu area used the tool kit of the northern oases and the Limestone Plateau. They obviously entered the oases of Dakhla during the dry season while they were in the Chufu area after rainfall. Only little evidence occurs in the Chufu area which points to a southern influence; for instance, transversal arrow-heads are very rare.

Considering this, it was expected to find some pottery in Chufu which would resemble the wares of the Late Bashendi A or Bashendi B cultural units of Dakhla Oasis. Unfortunately, pottery is nearly absent on the sites of the Chufu area, with a small number of exceptions. Many potsherds found show traces of advanced wind-abrasion, and are difficult to determine. However, two well preserved pots were found on site 02/14 buried among the rubble of a hill slope. The outer surfaces show a packed dotted zigzag pattern characteristic for the Khartoum style (Fig. 14.1). It is known from a number of sites that the northern extent of Khartoum style pottery reached Mudpans and Eastpans, Dakhla Oasis, and Abu Tartur (Hope 2002; Warfe 2003; Riemer & Jesse in press). The mentioned desert sites yielded the dotted zigzag pattern that was found in stratigrapic connection to radiocarbon dates around 6500-6300 BC. In Dakhla this pottery decoration falls into the Bashendi A unit, that might be parallel with our dates. The dating is, however, a crucial point, as the pots of Chufu are tempered with plant material while the pottery mentioned above yielded a mineral temper. Plant temper combined with packed dotted zigzag was found in the Glass Area at the western border of the Great Sand Sea, but the ^{14}C-dates fall into a period between 5400-4900 BC. A ^{14}C-date recently made on the tempering agent of one of the Chufu sherds yielded an age around 5100 BC (Tab. 2), and it seems that the plant temper marks a younger horizon of Khartoum style tradition into Egypt (Riemer & Jesse in press).

Notwithstanding, the two Chufu pots decorated in dotted zigzag pattern clearly indicate a southern influence in Chufu, while undecorated wares representing the typical Dakhla pottery tradition have only been discovered in a very small number.

Subsistence

At date, only wild animals are indicated for the sites of Chufu and Meri, but further excavations and determinations of bones have to be expected. It is still an open question whether domesticated animals were introduced into the region. A first step towards pastoralism is evidenced for the Late Bashendi A unit in Dakhla Oasis as well as for Eastpans, some 100 km south of Dakhla, at about 5000 BC. The latter gives reason to suggest that pastoral nomads (which in fact combined hunting, gathering and herding as a multi-resource management) penetrated the desert in the vicinity of the oases. In contrast, bones of domesticated animals were not observed in the assemblages of Mudpans and Regenfeld, and it was suggested that the herds were not able to cover the enormous distances between the water pools in that area (Riemer 2005). On the other hand, the areas of Chufu and Meri are between 80 and 100 km away from Dakhla; therefore, they lie in the range of the herders' territories, such as the sites of Eastpans.

Conclusions on spatial distribution and chronology

During the study of the Mid-Holocene assemblages recorded in the area of Regenfeld, situated in the centre of the southern Great Sand Sea some 250 km away from Dakhla Oasis, a small proportion of facially retouched tools have been registered, as well as a certain amount of non-local flint, both of which point to contacts with the oases region and the Egyptian Limestone Plateau behind of the oases (Fig. 16-17). Raw materials and artefacts must have been distributed during the seasonal or episodic movements of the desert dwellers, as exchange processes probably played only a minor role in the desert.

The ongoing field work in the areas of Chufu and Meri has provided large Mid-Holocene prehistoric sites between the Great Sand Sea and Dakhla Oasis. As expected due to the hypothesis developed on the basis of the Regenfeld analysis, the lithics found on the two sites of Chufu and Meri indicate a predominant influence from the Dakhla and Limestone Plateau area, respectively. Among the tool types are stemmed and leave-shaped points, knives, and side-scrapers, which are so characteristic for the sites of Dakhla, Abu Gerara, Djara etc. The facial/bifacial technique is the most prominent modification type for many tool types found on the sites, and places the area, some 100 km southwest of Dakhla, within the "(bi)facial techno-complex". A more detailed picture was drawn by the study of the lithic production sequences. They principally are the same as on the Limestone Plateau, however, the availability of high quality flint on the plateau and the absence of flint on the Nubian Sandstone southwest of Dakhla results in an effective decrease of larger flint cores and primary products on the sites of Chufu and Meri.

As was outlined above, it is apparent that the prehistoric dwellers of Chufu and Meri came from the northeast, most likely from Dakhla Oasis. However, it can not be denied that there is also some intrusion from another influence that clearly points to the south or southwest. The most important argument is the pottery of Chufu 02/14, decorated with the packed dotted zigzag motif, that can be connected to the rocker stamp technique of the Khartoum style pottery in Sudan and southern Egypt. Local pottery of the Dakhla tradition is surprisingly rare on the sites of Chufu and Meri. The presence or absence of pottery does not consequently correlate with lithic traditions elsewhere, as the difference between Farafra or Djara, on the one hand (nearly without pottery), and Dakhla or Abu Gerara, on the other hand (many potsherds) illustrate (cf. Lucarini 2002; Kindermann 2004; Hope 2002; Riemer 2003 a). However these regions belong to the "(bi)facial complex". We do not yet know why some prehistoric groups in Egypt tended to use pottery, and others did not. This might be explained by different subsistence strategies (presence or absence of pastoral elements?) and/or the diverging distances which had to be covered without water, but we do not have any certain evidence about this as yet.

Looking at the tool types, the transversal arrow-head is the only type that can securely be connected to a southern and southwestern influence, as this kind of arrow-head is characteristic on sites in the Gilf Kebir, at Mudpans, and elsewhere in the southwest (Fig. 17). Although the transversal arrow-head is not absent on the sites of Chufu (Fig. 9.5), stemmed and leave-shaped points are clearly dominant. This may illustrate that groups from the south only rarely came into the Dakhla region as a consequence of the enormous distances which had to be covered without groundwater resources, while the groups from Dakhla regularly visited the desert in the vicinity. It would not be surprising if climatic influences also played a role within these overlapping traditions, as the border zone between winter and summer rains has most likely to be located in the area between Mudpans and Dakhla. While the archaeobotanical record at Mudpans points to a summer rain domination (Neumann 1989), Dakhla might be oriented to the winter rain zone, or at least lies within a transition zone with overlapping summer and winter rains. Sites and artefacts that have been found deep in the desert, such as at Mudpans and Regenfeld, probably represent the rounds through the desert enabled by summer rain. Whereas the Chufu/Meri-area can be allocated to a desert margin close to Dakhla Oasis that profited from both, summer and winter rains, or that could have been occupied during the drier years when Regenfeld was outside the range of macro-movement of the prehistoric groups.

The study of the chronological development indicates another difference between the areas in question. The ^{14}C-dates used for the this comparison are figured as calibrated cumulative curves using the CalPal program (Fig. 18). They comprise 70 dates from Dakhla Oasis (McDonald 2001), 59 dates from Mudpans and Regenfeld representing the faraway core desert, and a total of 62 dates from areas close to the oases region ("desert margin"), among them 12 dates from the Chufu and Meri areas (Table 2). The graphs listed in order of the areas mentioned suggest a shifting of the final depopulation ("exodus event") when the

Table 2. ^{14}C dates from the study areas of Chufu and Meri.

Lab.	site	feature	mat.[1]	^{14}C-yrs BP	age cal BC[2]
KIA-18416	Chufu 01/01-4	upper playa	Ch	6960 +/- 35	5840 +/- 60
KIA-18414	Chufu 02/14-1	camp fire	Ch	7000 +/- 35	5900 +/- 60
KIA-21540	Chufu 02/14	surface	CPT	6165 +/- 50	5120 +/- 80
KIA-18413	Chufu 02/15-1	camp fire	Ch	7955 +/- 55	6870 +/- 120
KIA-18412	Chufu 02/15-2	hearth mound	Ch	7160 +/- 35	6030 +/- 30
KN-5492	Chufu 02/17-2	hearth mound	Ch	5800 +/- 40	4650 +/- 50
KN-5491	Chufu 02/17-3	fire place	Ch	5880 +/- 40	4760 +/- 40
KIA-21545	Chufu 02/17-4	knapping place	Ch	7640 +/- 35	6500 +/- 50
Poz-8628	Meri 00/81-1	camp fire	Ch	6920 +/- 50	5810 +/- 60
KN-5476	Meri 00/82-1	ash slope, bottom	Ch	6755 +/- 50	5670 +/- 40
KN-5594	Meri 00/82-1	ash slope, top	Ch	6875 +/- 45	5770 +/- 50
Poz-8586	Meri 00/82-2	stone circle	OES	7050 +/- 40	5940 +/- 50

[1] abbreviations used for material: Ch = charcoal; OES = ostrich egg shell; CPT = charred plant temper (Packed dotted zizzag potsherd).

[2] calculated by 2-D Dispersion Calibration Program CalPal, Version 06/2005 (calibration data base: CalPal 2005-SFCP Cal Curve) by B. Weninger, ^{14}C Laboratory, University of Cologne.

occupational history of the desert areas stopped as a consequence of the drying trend at the end of the Holocene humid phase. The drop off in dates from the areas in the core desert about 5300 BC can be seen as the earliest climatic signal for the onset of the Eastern Sahara deterioration trend (Gehlen et al. 2002; Bubenzer & Riemer in press). The curve calculated for Dakhla Oasis illustrates a decrease of the dates about 300 years later, as well as a low-levelled continuation during the following millennia. The areas of the desert margins at Chufu, Meri, southwest of Ain Dalla and Abu Minqar, as well as at Eastpans south of Dakhla surprisingly neither follow the curves of Mudpans and Regenfeld nor that of Dakhla. Here, the final occupation phase took place around 5000 BC. This observation is important in the face of the fact that the deterioration of the Eastern Sahara was rather a continuous trend than a rapid fall off. It is quite logical that differences in the carrying capacities of the various areas, and the growing risks with increase in distance from the oasis must have led to a diversified occupational history.

Having outlined the study of the Chufu and Meri sites that yielded detailed insight into the spatial diversity of archaeological traditions, a provisional map of the spatial distribution of archaeological traditions in Egypt's Western Desert during the Mid-Holocene humid phase can be drawn. Two different techno-complexes can be separated on the basis of the flaked lithic material, and to some extent on the pottery as well. A transition zone, where both traditions in material culture are to be found, can be explained as being the result of overlapping territories. Throughout the Great Sand Sea, both traditions are well-separated as a consequence of the enormous desert distances that had to be covered during the seasonal movement (Fig. 1). At Nabta Playa and Bir Kiseiba, both traditions can be observed in close proximity (Wendorf et al. 2001). Sites that can be linked to the northern bifacial techno-complex have been found predominantly atop the Limestone Plateau north of Nabta/Kiseiba, while the sites around the large playa basins can be assigned to one of the two traditions, or at least indicate assemblages composed of both.

It is quite interesting to see that there is rather a north-south gradient that separates the cultural traditions than a west-east change in material diversity, alike the one which has been subsumed among the model of the Sahara-Sudan-Neolithic vs. the Neolithic of Capsien tradition across the western and parts of the central Sahara. And again, there are some arguments which point to the climatic gradient between the northern and the southern Sahara, primarily the differences in the summer-winter rain distribution (Vernet 1995), that might have been the basic motor behind the cultural spread.

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