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The archaeology of the first farmer-herders in Egypt : new insights into the Fayum Epipalaeolithic and Neolithic

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7. Lithic technological organisation and mobility in the Fayum Neolithic

7.1. Introduction

The Fayum Neolithic culture has been known not only for its earliest evidence of wheat/barley farming combined with sheep/goat herding in Egypt but also for its elaborate bifacially-retouched flint tools. Antiquarians and scholars have randomly collected Neolithic flint tools at many locations around Lake Qarun in the past hundred years, and nice-looking bifacially-retouched formal tools like axes, arrowheads, sickle blades and knives have tended to be selectively collected and published. As mentioned in Chapter 3, Caton-Thompson, who worked at many Neolithic sites on the northern shore of Lake Qarun, reported a predominance of bifacial tools in her Fayum Neolithic inventory (Caton-Thompson and Gardner 1934). However, other researchers have later undertaken excavations in Qasr el-Sagha as well as surface artefact collection at one site where Caton-Thompson worked, and revealed that she had neglected crude, less-retouched flake tools. Therefore, it became apparent that previously accepted images of the lithic tradition of the Fayum Neolithic were the result of selective collecting, and hence distorted. On the basis of the Qasr el-Sagha lithic assemblage, it has been estimated that 90 percent of the Fayum Neolithic flint tool assemblage must have been composed of flake tools, such as notches, denticulates and sidescrapers, and thus bifacially-retouched tools were quite minor components, even though they certainly existed at most Neolithic sites of the Fayum (Kozlowski and Ginter 1989: 172*ff*).

This revision of the image of the Fayum Neolithic tool assemblage gives rise to another important question about how such a variety of tools was actually made and used. Whereas great attention has been paid to the description of the tool classification in the Fayum Neolithic, toolmaking techniques in the Fayum Neolithic have been poorly studied. Not merely reconstructing the whole sequence of lithic reduction in terms of purely technical aspects but also understanding how this reduction sequence is closely associated with general subsistence and mobility strategies of prehistoric and ethnographic foragers have been popular as the studies of lithic technological organisation since the late 1970s (Binford 1979; Odell 2001: 62-69). This kind of study is definitely relevant to answer the questions as for how Neolithic subsistence activities such as wheat/barley farming and sheep/goat herding were integrated with the tradition of Epipalaeolithic hunting, gathering and fishing in the Fayum, and to what extent Fayum Neolithic people were mobile.

One remarkable thing in the lithic technology of the Fayum Neolithic, which is made clear in this study, is the exploitation of large flint cobbles. Whereas the Fayum Epipalaeolithic people preferred elongated flint pebbles which were readily available within their habitat and did not abundantly use large cobbles, the Neolithic people more abundantly used large cobbles which were not readily available around their lakeshore habitat. There is no doubt that these cobbles were transported to their habitat from distant source areas. Identifying the sources of these cobbles is a key to know the mobility range of Fayum Neolithic toolmakers and to understand the beginning of the lithic reduction sequence.

This study will focus on both unworked cobbles and lithic cores which were collected at selected Neolithic sites in the Fayum, and will discuss not only core reduction techniques and sequence but also raw material procurement and transport, while considering possible sources of raw materials. How the development of bifacial technology was realised in the Fayum Neolithic



Fig.7.1. Map of the sites studied in this chapter

will also be argued on the basis of this discussion. Based on the lack of evidence for substantial dwellings at any sites, previous scholars have been reluctant to say that Fayum Neolithic people were sedentary, but unexplored features of the Fayum Neolithic culture like the mobility range and strategy of Fayum inhabitants will be revealed by this study. It will help discuss how their subsistence activities and mobility changed or did not change in terms of alternations in their use of raw materials and tools.

7.2. Sites studied

In order to understand the spatial distribution of various lithic raw materials and reduction techniques, eight Neolithic sites on the northeastern shore of Lake Qarun were selected and investigated. They are 1) Kom K, 2) Site L, 3) Site E29H1, 4) Site XA, 5) Site X, 6) Locality 'Calcified Shrubs', 7) Kom W, and 8) the Site V Depression, from the east to the west (**Fig.7.1**). The first four sites are approximately 2 km distant from each other, and the distance between Site XA and Kom W is also approximately 2 km. Site X is approximately 500 m distant from Site XA. Locality 'Calcified Shrubs' is approximately 300 m distant from Kom W. The Site V Depression is approximately 150 m distant from Kom W. Among these sites, Kom K and Kom W are the largest Neolithic sites known in the Fayum. Although no substantial dwelling structure has been found, accumulations of cultural debris as well as many fireholes excavated by Caton-Thompson at these two sites suggest that these two sites were occupied for a considerable length of time. Indeed, the variety of lithic raw materials is particularly wider at Kom K and Kom W than that in other presumably temporary sites. The degree of preservation is different between the sites, and Kom K and Kom W are the most

severely disturbed by excavations. Therefore, it was difficult to apply the same method of surface material sampling to all these sites.

7.2.1. Kom K

Kom K (N29.58737° E30.87825° in the centre) is located to the northwest of the K Basin, and its elevation is approximately 20 m asl. Caton-Thompson's excavation at Kom K yielded a number of unifacially/bifacially-retouched, partly-retouched, or ground formal tools mainly made of flint, and they were neatly published. The unifacially/bifacially-retouched formal tools include 28 axes, ten sickle blades, seven concave-based arrowheads, one tanged arrowhead, four triangular arrowheads, one leaf-shaped spearhead, two knife blades, and some halberds. It is noted that a number of egg-shaped or oval quartz pebbles, most of which were battered at the extremities, were found on the surface and *in situ*. However, there is no detailed description of lithic debitage products in her report, and they were mentioned as village debris (Caton-Thompson and Gardner 1934: 38*ff*).

Presently, Kom K is a very low mound which has recently been ploughed heavily (**Fig.7.2**), and hence no trace of the trenches excavated by Caton-Thompson is visible. Nevertheless, there are dense scatters of hammer stones, lithic cores, debitage products, and pottery sherds in between ploughed tracks on top of the mound. This means that such objects were totally neglected and left there during Caton-Thompson's excavation. An important fact revealed by this situation is that some stages of lithic core reduction sequence actually took place on the site during the



Fig.7.2. Plough tracks on Kom K (looking west)

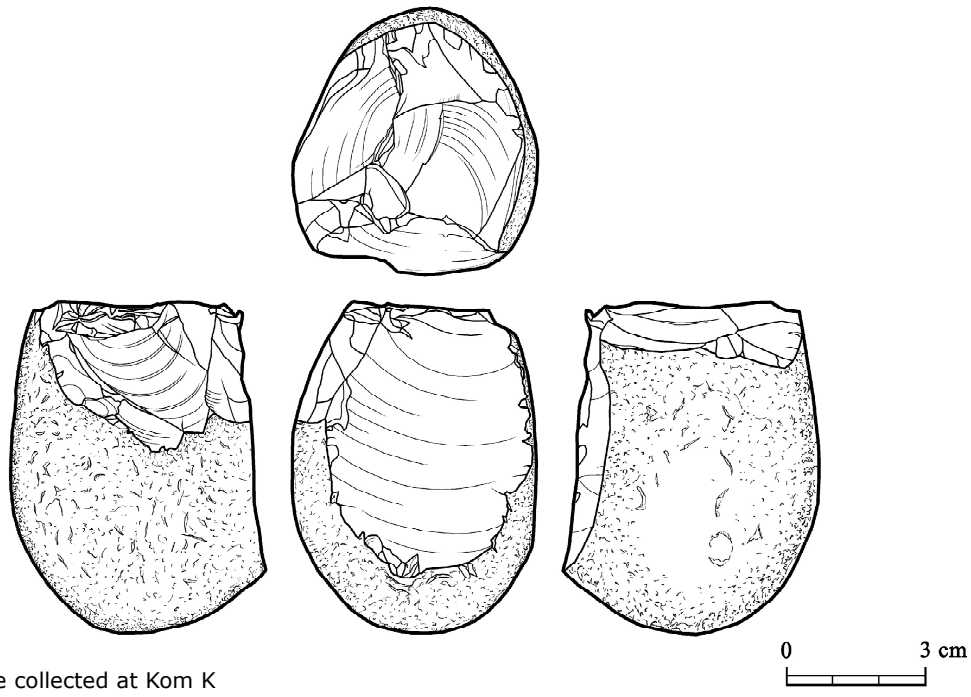


Fig.7.3. A core collected at Kom K

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	bifacial platform core, or, chopper	cortical/unfacetted	tertiary	50-75 %	9.1	7.5	3.6	D	brown/cream brown	dark brown
2	bifacial platform core, or, chopper	cortical/facetted	secondary	50-75 %	3.2	7.6	5.9	D	brown/cream brown	brown
3	single platform core	unfacetted	multiple	50-75 %	7.3	5.3	5.7	G	brown	dark brown
4	single platform core	cortical	tertiary	76-99 %	5.3	6.1	8.9	I	brown	brown
5	single platform core	unfacetted	multiple	50-75 %	4.7	10.8	7.0	I	brown	cream
6	single platform core	unfacetted	multiple	50-75 %	4.2	4.2	6.6	G	cream	brown.
7	single platform core	unfacetted	multiple	50-75 %	7.2	6.6	5.5	G	brown/cream brown	mottled brown
8	single platform core	cortical	secondary	76-99%	3.5	6.0	7.9	E	dark brown	dark brown
9	bifacial platform core, or, chopper	unfacetted	multiple	25-49%	3.5	8.6	7.3	D	brown/cream brown	brown
10	single platform core	unfacetted	tertiary	76-99%	7.0	8.4	2.2	A	light brown	brown
11	single platform core	cortical	tertiary	76-99%	3.5	8.8	8.4	K	light brown	light brown
12	single platform core	unfacetted	multiple	25-49%	7.0	8.5	6.4	L	grey	translucent grey
13	single platform core	cortical	secondary	50-75 %	6.8	6.6	4.4	L	grey	translucent grey
14	whole cobble	-	-	-	7.0	7.1	3.3	C	brown	-
	item	**use of circumference**	**percussion sequence**	**amount of cortex**	**L (cm)**	**W (cm)**	**T (cm)**	**cobble type**	**cortex colour**	**fresh part colour**
1	longitudinal hammer	at one end (fractures on both faces)	less than multiple	76-99%	6.6	5.3	3.4	E	dark brown	brown
2	longitudinal hammer	at one end (fractures on both faces)	less than multiple	76-99%	7.6	4.7	3.7	E	dark brown/cream brown	brown
3	longitudinal hammer	at one end (fractures on both faces)	less than multiple	50-75 %	7.7	6.4	3.9	E	brown	light brown
4	longitudinal hammer	one quarter of circumference	multiple	76-99%	7.1	6.8	3.8	F	brown	cream brown
5	transverse hammer	three quarter of circumference	multiple	76-99%	6.3	7.2	3.4	F	brown	light brown
6	transverse hammer	three quarter of circumference	multiple	50-75 %	6.1	8.3	5.3	F	dark brown	dark brown
7	longitudinal hammer	at one end	multiple	76-99%	6.2	4.4	2.8	N	translucent white/grey	translucent white
8	longitudinal hammer	at opposed ends	multiple	76-99%	6.6	4.5	2.6	N	translucent white/grey	white
9	longitudinal hammer	at opposed ends	multiple	76-99%	8.0	5.4	3.4	N	translucent white/grey	white

Table 7.1. Items collected at Kom K

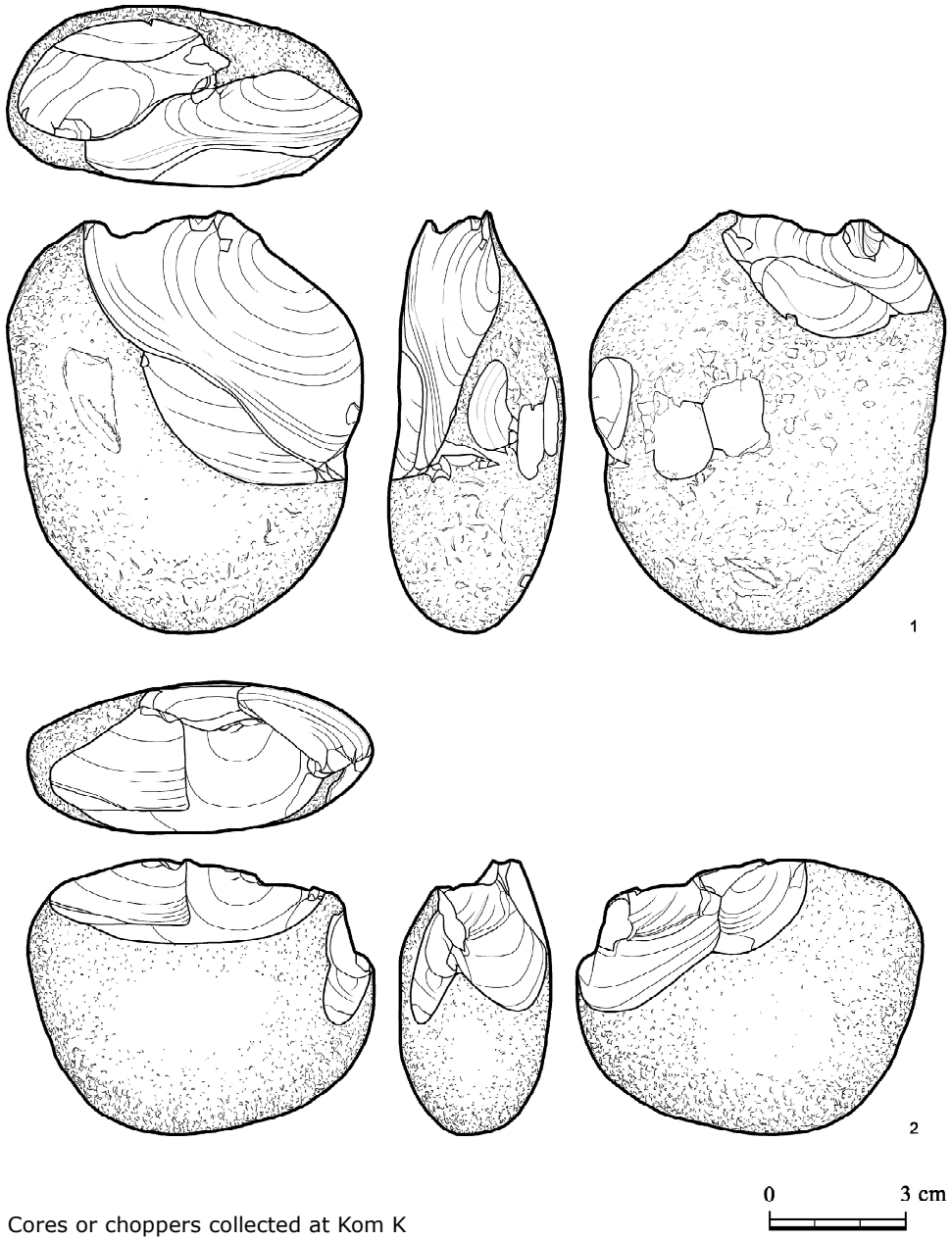


Fig.7.4. Cores or choppers collected at Kom K

Neolithic period. A surface collection of quite visible hammer stones and lithic cores was carried out in this artefact scatter in a grab sample manner (**Table 7.1** and **Fig.7.3** and **Fig.7.4**).

7.2.2. Site L

Site L is located on a slope overlooking the L Basin to its southeast. Small surface archaeological features like hearths and artefact concentrations distributed over a wide area on the slope were recognised and collectively designated as Site L by Caton-Thompson, but no detailed description of individual archaeological features was presented (Caton-Thompson and Gardner 1934: 73-74). One of such archaeological features dealt with here is located on a plain of approximately 20 m asl in



Fig.7.5. Scatter of cores at Site L (looking west)

the middle of Site L. The locality (N29.57819° E30.85024° in the centre) consists of a cluster of four stone-built hearths accompanied by a number of lithic artefacts and pottery sherds. The spatial extent of the hearth cluster surrounded by artefact scatters is 20 m wide. Therefore, it is assumed that this hearth cluster was a temporary field camp which may have been occupied several times. A concentration of large, oval lithic cores to the east of this hearth cluster was particularly remarkable (**Fig.7.5**), and hence all the lithic cores were collected (**Table 7.2** and **Fig.7.6**).

7.2.3. Site E29H1

Site E29H1 is located on the northeastern shore of the X Basin, and its elevation is approximately 10-13 m asl. The site has been recorded as an unnamed 'Fayum B Culture' site by Caton-Thompson (Caton-Thompson and Gardner 1934: Pl.CIX), and has been re-investigated later by Wendorf and Schild in more detail, and recognised as a huge Epipalaeolithic artefact cluster overlain by wide but sparse Neolithic artefact scatters (Wendorf and Schild 1976: 182*ff*). It has been known that most of the

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	half-split discoidal core	cortical	multiple	25-49%	8.0	5.8	2.5	D	brown	light brown
2	bifacial discoidal core	unfacetted	multiple	25-49%	9.8	6.8	3.4	D	dark brown	mottled brown
3	half-split bifacial discoidal core	unfacetted	multiple	25-49%	10.2	8.5	2.5	D	dark brown	mottled brown
4	half-split discoidal core	cortical	multiple	25-49%	12.3	6.8	4.0	J	dark brown	grey
5	bifacial platform core, or, chopper	unfacetted	multiple	50-75 %	3.5	8.4	8.5	D	dark brown	dark brown
6	single platform core	cortical	multiple	50-75 %	10.7	8.2	3.2	C	dark brown	brown
7	bifacial discoidal core	cortical/unfacetted	multiple	50-75 %	10.6	10.0	3.0	A	brown/cream brown	mottled brown
8	single platform core	unfacetted	secondary	25-49%	3.8	7.4	6.8	G	brown/cream brown	mottled brown
9	unused half-split discoidal core	cortical	primary	76-99%	9.6	7.0	2.3	D	dark brown	mottled brown
10	unused half-split discoidal core	cortical	primary	76-99%	11.0	8.1	2.1	D	brown/cream brown	mottled brown
11	whole cobble	-	-	76-99%	8.2	8.9	2.6	A	brown/cream brown	mottled brown
12	whole cobble	-	-	complete (100%)	10.1	8.1	2.6	C	dark brown	-

Table 7.2. Items collected at Site L

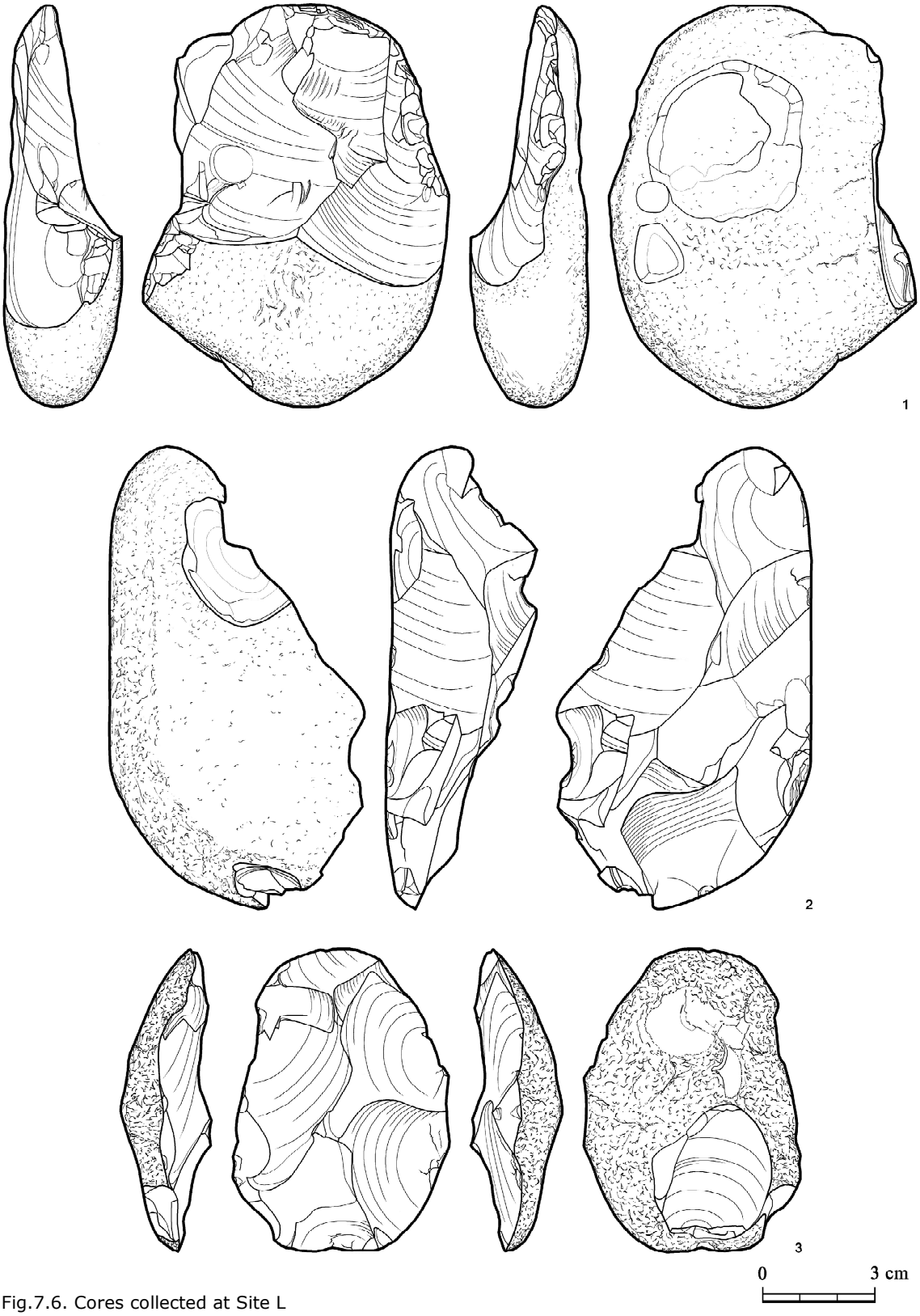


Fig.7.6. Cores collected at Site L

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	bifacial platform core, or, chopper	unfacetted	secondary	76-99%	13.9	11.1	3.7	B	brown	brown
2	single platform core	unfacetted	quarternary	50-75%	5.8	10.6	5.1	E	brown	mottled brown
3	single platform core	cortical/unfacetted	multiple	50-75%	4.2	15.2	7.0	J	brown	light brown
4	half-split single platform core	unfacetted	tertiary	50-75 %	4.0	9.8	6.2	H	brown	light brown
5	multiple platform core	unfacetted	multiple	0-24%	5.0	5.8	4.4	H	cream brown	dark brown
6	opposed platform core, or, chopper	cortical	tertiary	50-75%	2.5	7.8	11.0	A	brown	light brown
7	bifacial discoidal core	cortical	multiple	25-49%	9.9	10.2	2.2	A	brown/cream brown	brown
8	half-split bifacial discoidal core, or, chopper	unfacetted	multiple	25-49%	12.5	9.5	4.2	G	brown/cream brown	mottled brown

Table 7.3. Items collected at Site E29H1

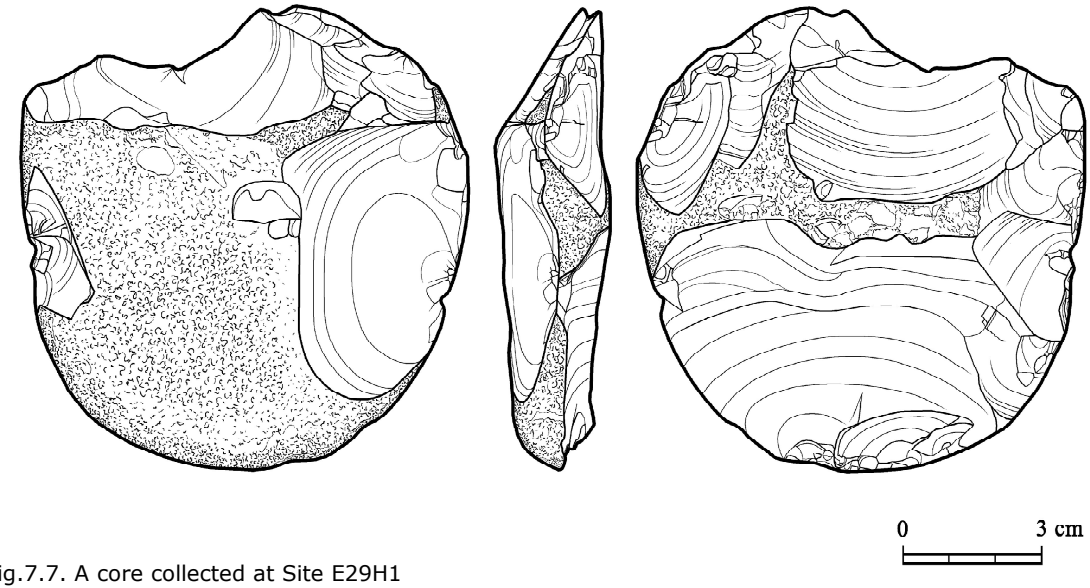


Fig.7.7. A core collected at Site E29H1

Epipalaeolithic lithic cores in the Fayum were made of rounded elongated pebbles of less than 5 cm long (Wendorf and Schild 1976: 311), and my investigation found that slightly larger pebbles of less than 7 cm long readily available in the surroundings were commonly used.

During the surface collection of lithic artefacts in the hearth field of Site E29H1 Area D, a certain number of unusually large unworked/worked cobbles and large debitage products deriving from the cobbles were noticed. Their presence in an Epipalaeolithic assemblage looks quite odd in light of the predominance of elongated pebbles, and hence it is assumed that such unusually large cobbles were brought here by Neolithic people and were mixed up with Epipalaeolithic artefact scatters. Besides the surface collection square, several large cores of

apparently not the Epipalaeolithic were concentrated at the southwestern corner of the hearth field (E29.58383° E30.83260°), and all of them were collected (**Table 7.3** and **Fig.7.7**).

7.2.4. Site XA

Site XA (N29.58978° E30.81465° in the centre) is located on the terrace of a large meandering wadi running into the X Basin, and its elevation is approximately 15 m asl. This site has not been reported by previous visitors to the Fayum. The site is marked by several hillocks of less than two metres high, and the surface is covered by a crust of light yellow silty sediments which is broken into polygons. There are scatters of transparent gypsum crystals on and around this crust surface. These suggest that the site has been inundated in the past.

A dense concentration of lithic artefacts was observed on the crust surface around the hillocks (**Fig.7.8**). The number of unworked/worked cobbles as well as large and thick, primary or secondary flakes with wide unfacetted platforms, which must have been produced by hard hammer percussion, is enormous, while there are relatively few small chips/chunks which would be produced in later stages of the lithic reduction sequence. Apart from the obviously accidental occurrence of some Epipalaeolithic backed bladelets, few retouched tools of the Neolithic period were seen in this site. This situation suggests that initial core reduction took place here, but further reduction for tool making was done at other places. Or, this situation may simply be a result of taphonomic processes, by which small, thin, light-weight lithic artefacts may have been washed away by water. If the present situation of the site is to some extent the reflection of past reality, it may be argued that a number of cobbles were brought here and roughly knapped for making blanks for the ease of further transport. There are no other occupational features like hearths, scatters of pottery sherds, and clusters of animal bone fragments in the middle of this debitage product concentration, but such features are seen in the vicinity. This may suggest that this particular locality was a kind of flint knapping workshop.



Fig.7.8. Scatter of cores at Site XA (looking south)

All the lithic cores, debitage products, and supposedly hammers and anvils were collected on the surface in a 10 m x 10 m square while recording their spatial distribution. An attempt at refitting these debitage products was not at all successful. Therefore, it is assumed that this particular spot of debitage product concentration was occupied only for a little while but repeatedly. Only cores which are made on identifiable types of cobbles are listed (**Table 7.4**).

7.2.5. Site X

Site X (N29.58924° E30.80651° in the centre) is located in a shallow depression of approximately 150 m in diameter, which is surrounded on the north and west by sand dunes and hence looks like a cove. Its elevation is slightly below 15 m asl. The surface is covered by a crust of light yellow silty sediments which is broken into polygons, and there are scatters of transparent gypsum crystals on and around this crust surface. It was noticed that several intact lacustrine bivalves (*Aspatharia rubens*) of approximately 10 cm wide were embedded in the silty sediments. These suggest the presence of water for a considerable length of time in the past. The site was recognised by Caton-Thompson as a large surface site, and a number of Neolithic formal tools were collected by her. According to her report, amongst 111 unifacially/

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
50	fragmentary multiple platform core	unfacetted	multiple	25-49%	7.5	6.0	3.0	E	brown	brown
204	fragmentary single platform core	unfacetted	multiple	50-75%	2.3	5.2	7.2	G	brown	light brown
265	fragmentary discoidal core	unfacetted	multiple	50-75%	5.3	6.1	2.4	E	dark brown	brown
322	bifacial discoidal core, or, chopper	unfacetted	multiple	50-75%	7.8	7.0	2.8	E	brown	brown
379	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	3.2	8.6	8.4	C	dark brown	light brown
380	multiple platform core	cortical/unfacetted	multiple	50-75%	7.2	6.0	4.0	H	brown	mottled brown
391	bifacial discoidal core	unfacetted	multiple	50-75%	7.5	7.5	3.5	E	brown	brown
408	fragmentary multiple platform core	unfacetted	multiple	50-75%	3.3	5.3	5.3	G	brown	light brown
410	multiple platform core	unfacetted	multiple	25-49%	7.8	6.2	3.5	J	light brown	light brown
433	fragmentary multiple platform core	unfacetted	multiple	25-49%	5.2	4.5	2.4	E	brown	brown
434	fragmentary multiple platform core	unfacetted	multiple	25-49%	7.3	4.4	3.3	E	brown	mottled brown
444	single platform core	cortical	secondary	76-99%	6.1	3.1	5.6	J	brown	brown
466	multiple platform core	unfacetted	multiple	25-49%	6.2	5.7	2.6	H	brown	mottled brown
488	multiple platform core	unfacetted	multiple	50-75%	8.1	6.9	4.6	K	cream grey	cream
491	multiple platform core	cortical	multiple	50-75%	6.0	7.7	11.8	J	dark brown	dark brown
493	single platform core	unfacetted	tertiary	76-99%	6.8	12.5	5.5	D	brown	brown
497	multiple platform core	unfacetted	multiple	50-75%	4.5	5.8	3.9	H	brown/cream brown	brown
505	multiple platform core	unfacetted	multiple	50-75%	4.2	8.2	6.8	J	brown	brown
538	single platform core	unfacetted	multiple	25-49%	3.3	6.3	6.6	H	brown	mottled brown
540	multiple platform core	unfacetted	multiple	76-99%	4.0	8.2	6.5	G	brown/cream brown	brown
542	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	10.1	6.5	3.6	E	brown	brown
550	single platform core	unfacetted	multiple	50-75%	7.6	4.7	2.8	H	brown	light brown
576	bifacial platform core, or, chopper	unfacetted	multiple	76-99%	9.7	7.6	3.6	D	dark brown	dark brown
577	single platform core	unfacetted	multiple	50-75%	3.6	8.1	5.5	D	brown	light brown

Table 7.4. Items collected at Site XA

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	single platform core	unfacetted	multiple	24-49%	5.4	6.2	4.7	H	light brown	mottled brown
2	single platform core	unfacetted	tertiary	50-75%	5.5	5.3	4.2	G	brown/cream brown	translucent brown
3	multiple platform core	unfacetted	multiple	25-49%	8.3	6.0	3.9	D	brown	mottled brown
4	multiple platform core	unfacetted	multiple	25-49 %	9.4	7.6	4.6	E	brown	mottled brown
5	single platform core	unfacetted	multiple	50-75%	10.8	7.9	4.4	H	brown	brown
6	multiple platform core	unfacetted	multiple	25-49%	9.8	8.8	4.5	J	brown	mottled brown
7	bifacial platform core, or, chopper	cortical/unfacetted	secondary	76-99%	10.5	8.9	3.4	B	brown	mottled brown
8	bifacial platform core, or, chopper	unfacetted	multiple	76-99%	10.7	8.6	2.3	B	brown	brown
9	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	10.3	7.4	2.9	C	brown	brown
10	bifacial opposed platform core	cortical/unfacetted	multiple	76-99%	10.6	7.9	2.2	A	brown/cream brown	brown
11	bifacial opposed platform core	unfacetted	multiple	50-75%	9.4	7.6	2.8	B	light brown	mottled brown
12	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	9.9	9.5	2.7	B	brown	brown
13	half-split bifacial discoidal core	cortical/unfacetted	multiple	25-49%	8.6	6.5	2.9	E	brown	mottled brown
14	sidescraper made on half-split cobble	one side retouched from ventral to dorsal face	primary	76-99%	11.1	8.8	2.7	D	brown/cream brown	mottled brown
15	bifacial sidescraper made on flat cobble	two sides forming 90 degrees retouched from both faces	multiple	50-75%	8.8	7.9	2.3	C	brown	light brown
16	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	8.1	8.3	2.1	B	brown	mottled brown
17	bifacial platform core, or, chopper	unfacetted	primary	50-75%	10.1	7.4	4.0	D	brown/cream brown	brown
18	bifacial platform core, or, chopper	unfacetted	tertiary	50-75%	9.2	8.2	3.1	E	brown/cream brown	mottled brown
19	single platform core	unfacetted	secondary	50-75%	10.3	8.5	4.8	E	brown	light brown
20	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	3.0	9.9	6.4	A	brown	light brown
21	single platform core	cortical	multiple	76-99%	2.7	14.0	9.0	B	brown/cream brown	light brown
22	multiple platform core	unfacetted	multiple	25-49 %	8.6	9.5	6.5	J	brown/cream brown	brown
23	multiple platform core	unfacetted	multiple	1-24 %	4.3	10.4	7.8	L	grey	translucent light brown
24	longitudinal hammer?	at one end (fractures on both faces)	primary	50-75%	7.5	5.8	2.5	D	brown	light brown

Table 7.5. Items collected at Site X



Fig.7.9. Scatter of cores at Site X (looking south)



Fig.7.11. Scatter of unworked and worked cobbles at Locality Calcified Shrubs (looking southwest)

bifacially-retouched formal tools collected in Site X, there were eight axes, seven concave-based arrowheads, six triangular arrowheads, and 15 sickle blades (Caton-Thompson and Gardner 1934: 74-75). Although there are no structural remains at the site, the scatter of lithic artefacts and pottery sherds on and around the crust surface is still enormous (**Fig.7.9**), and in particular, a number of large lithic cores were quite noticeable in its northern half. A random collection of notable items was carried out (**Table 7.5** and **Fig.7.10**).

7.2.6. Locality 'Calcified Shrubs'

Approximately 300 m to the east of Kom W, there is a wide scatter of calcified plant roots (N29.58880° E30.79805° in the centre). It is 50 m long at most and approximately 200 m wide. Its elevation is slightly below 20 m asl. In contrast to its surroundings characterised by wind-blown fine-grained sand sheet and well-developed sand ripples, this dense scatter of calcified plant roots is quite visible. At many places in this calcified plant field, the bottom parts of the trunks still remain standing. A large number of unworked and worked cobbles and flakes deriving from the cobbles are scattered only on and around this calcified plant field (**Fig.7.11**). Many worked globular cobbles are undoubtedly single platform cores. Other flat and oval cobbles often have a worked edge at one end and look like choppers. Except for one presumably Neolithic bifacially-retouched knife, no formal tools were encountered.

There is no concrete clue to determine how old these calcified plant roots are and what species they are, but the scatters of choppers on and around this field may suggest that these plants are not common reeds or sedges but shrubs, and these tools were used for cutting the shrubs in the Neolithic period by the inhabitants of Kom W. Hundreds of fireholes excavated at Kom W by Caton-Thompson suggest the high demand of fuel at this site, and the pottery production on and around Kom W must also have required a stable supply of fuel. Therefore, sources of firewood in close proximity to Kom W must have been essential, and it is likely that this calcified plant field was one of the sources. Alternatively, considering that common reeds which thrive along the lakeshore and sheep/goat dung could also have been used as fuel, the primary aim of cutting wood may have been to obtain long branches for making arrow/spear shafts, bows, sickle handles and axe handles. Random collecting of quite visible lithic cores was carried out (**Table 7.6**).

7.2.7. Kom W

Kom W (N29.58894° E30.79248° in the centre) is located to the northeast of the Z Basin, and its elevation is approximately 22 m asl. Surface artefacts on this low mound and its vicinity have

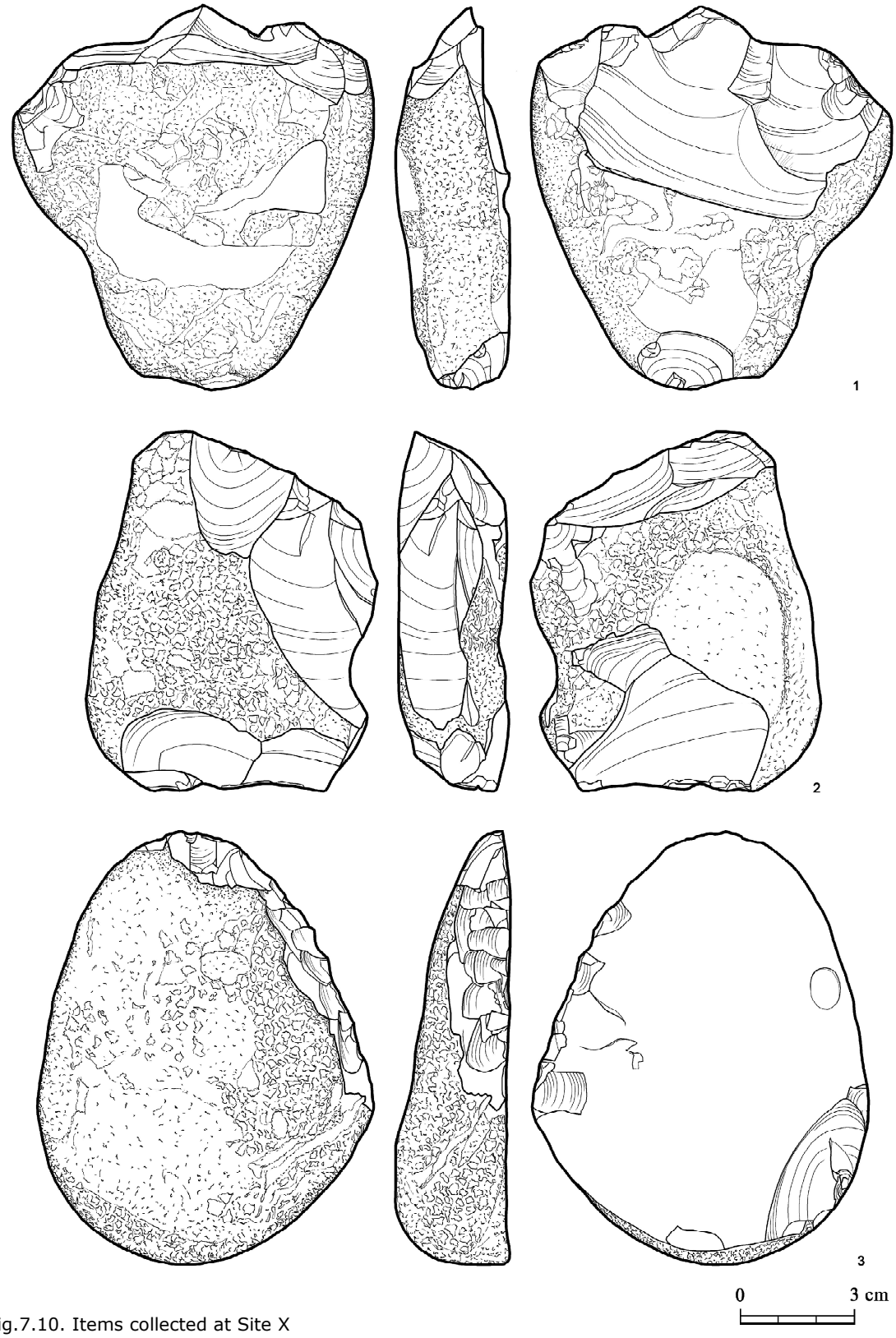


Fig.7.10. Items collected at Site X

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	discoidal core	cortical/unfacetted	multiple	50-75%	6.9	5.9	1.8	B	brown	brown
2	single platform core	unfacetted	multiple	50-75%	11.8	9.7	4.9	J	brown/cream brown	cream brown
3	single platform core	unfacetted	tertiary	50-75%	10.6	9.5	4.4	E	brown	mottled brown
4	single platform core	unfacetted	secondary	50-75%	11.2	8.5	4.3	E	brown/cream brown	mottled brown
5	single platform core	unfacetted	tertiary	50-75%	8.5	6.8	3.4	D	brown/cream brown	brown
6	single platform core	unfacetted	multiple	76-99%	8.1	6.4	4.1	G	brown	cream brown
7	ninety-degree core	unfacetted	multiple	76-99%	3.8	9.8	11.4	J	brown	mottled brown
8	single platform core, or, chopper	unfacetted	multiple	76-99%	2.9	7.4	10.4	B	brown/cream brown	mottled brown
9	bifacial platform core, or, chopper	unfacetted	multiple	50-75%	3.4	9.1	8.3	B	brown/cream brown	mottled brown
10	bifacial platform core, or, chopper	cortical/unfacetted	multiple	76-99%	2.9	11.1	8.2	B	brown/cream brown	cream brown
11	whole cobble	-	-	76-99%	11.7	7.6	2.4	B	brown	brown
12	single platform core	unfacetted	multiple	25-49 %	4.9	6.4	5.5	I	brown/cream brown	brown

Table 7.6. Items collected at Locality Calcified Shrubs

been known and plundered by antiquarians since the late 19th century. The first archaeological excavation by Caton-Thompson yielded a number of Neolithic lithic artefacts including unifacially/bifacially-retouched, partly-retouched or ground formal tools made of flint, limestone, basalt, and exotic stones. These findings were thoroughly described in her publication. Unifacially/bifacially-retouched formal tools include 75 axes, 17 concave-based arrowheads, six triangular arrowheads, one tanged arrowhead, and 31 sickle blades among others. Axes constitute more than 40 percent of all formal tools collected by her at Kom W. However, the presence of lithic debitage products was not mentioned in her report (Caton-Thompson and Gardner 1934: 22-31). It is also noted that she found 548 hammer stones, which were oval and spherical pebbles of flint, quartz and fossil wood and showed bruised areas, as well as a heap of 22 rounded flint cobbles and a quartz pebble which lay not far above bedrock (Caton-Thompson and Gardner 1934: 32).

Kom W is presently a huge excavation dump, and the traces of excavation trenches and backfills are still quite visible on the low mound (**Fig.7.12**). Each excavation trench has been



Fig.7.12. Caton-Thompson's excavation strips on Kom W (looking east)

designated by Caton-Thompson as 'Strip', and there are 20 strips, named Strip A to T from the east to the west. Since she collected only unifacially/bifacially-retouched and partly-retouched formal tools from her excavation trenches, while ignoring lithic cores and debitage products, an enormous amount of lithic cores and debitage products are still left on the site. A random surface collection of notable lithic cores was carried out between Strip D and Strip J (**Table 7.7** and **Fig.7.13**). This is the eastern half of Kom W.

According to Kozlowski and Ginter's study on Neolithic cores collected in the neighbourhood of Strip E, most cores are very small (approximately 3 cm long and 3 cm wide), and several small flakes were struck off from the cores. Thus, they concluded that the lithic industry at Kom W was principally flake-oriented (Kozlowski and Ginter 1989: 170-174). This conclusion must be partly true. However, a strange thing is that the flake tools which they collected are larger than the cores they collected, though some of their cores are not fragmentary, and hence there seems to be no direct relation between the flake tools and the cores. Some of the flake tools collected by them obviously derive from much larger cores, and indeed, many large unworked cobbles and worked cores are presently seen on Kom W.

More importantly, a puzzling thing is that the small cores which they collected and published (Kozlowski and Ginter 1989: fig.6) are similar to Epipalaeolithic cores which were described in Chapter 6. The presence of a small number of Epipalaeolithic tools at Kom W has been reported by Caton-Thompson (Caton-Thompson and Gardner 1934: 30-31), and hence, it is not surprising if Epipalaeolithic cores are present at Kom W. A number of small cores resembling

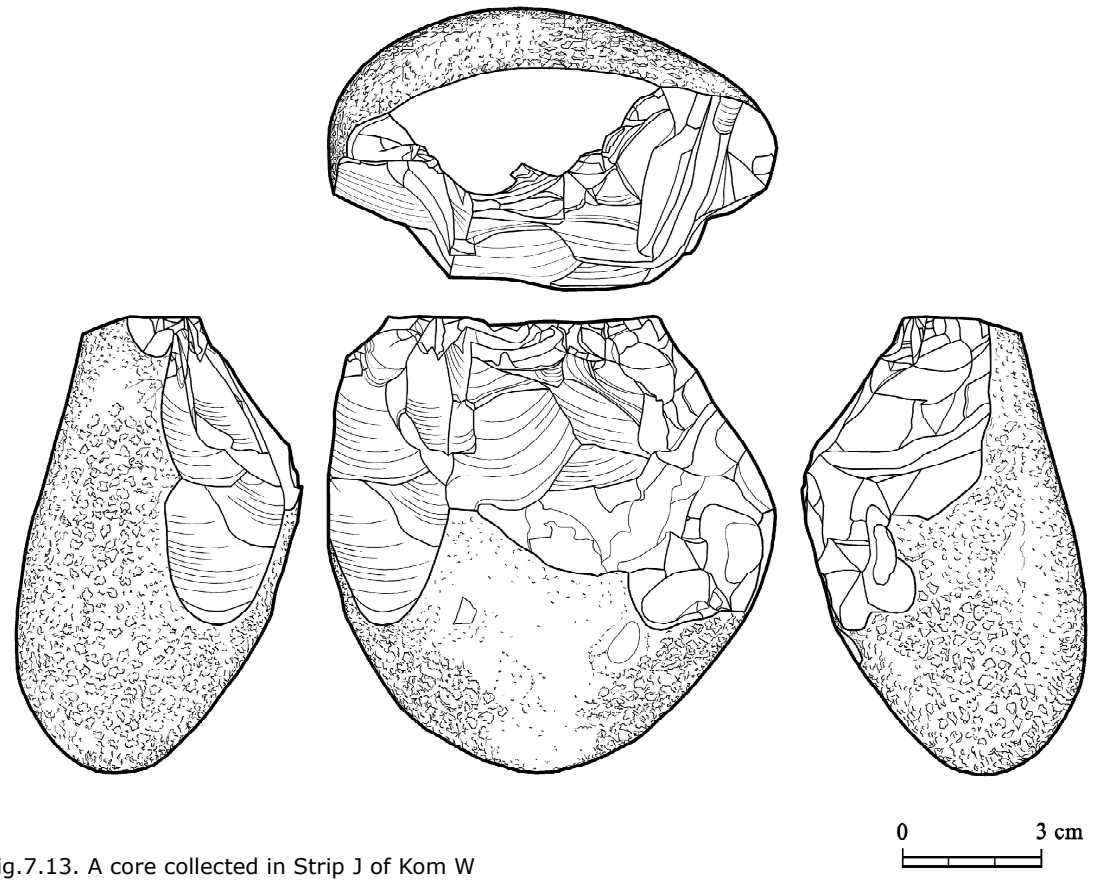


Fig.7.13. A core collected in Strip J of Kom W

	core type	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
D 1	single platform core	unfacetted	multiple	25-49%	4.1	8.6	6.9	D	brown	brown/cream brown
D 2	ninety-degree core	cortical/unfacetted	multiple	25-49%	6.7	4.5	3.7	H	brown	brown
D 3	discoidal core	cortical	multiple	76-99 %	5.7	4.1	4.2	G	brown/cream brown	translucent brown
D 4	fragment of multiple platform core	cortical/unfacetted	multiple	50-75%	3.2	6.5	4.2	E	brown	brown
D 5	multiple platform core	unfacetted	multiple	25-49%	2.7	4.2	3.1	G	brown	mottled brown
E 1	multiple platform core	unfacetted	multiple	25-49%	5.2	7.2	5.5	H	brown	mottled brown
E 2	bifacial platform core, or, chopper	unfacetted	multiple	76-99%	8.3	5.3	3.1	D	brown	mottled brown
E 3	multiple platform core	cortical/unfacetted	multiple	50-75%	7.2	3.6	5.0	E	brown	brown
E 4	opposed platform core	cortical/unfacetted	multiple	50-75%	5.6	10.0	8.6	J	brown	light brown
F 1	single platform core	cortical/unfacetted	quaternary	76-99 %,	9.6	6.6	3.0	C	brown	mottled brown
F 2	single platform core, or, chopper	unfacetted	tertiary	50-75%,	9.8	8.5	4.3	K	light brown	light brown
F 3	multiple platform core	unfacetted	multiple	none	7.0	5.2	2.0	-	unidentifiable	brown
F 4	multiple platform core	unfacetted	multiple	1-24 %	6.8	7.4	4.9	L	grey	translucent green
H 1	bifacial platform core, or, chopper	unfacetted	multiple	50-75 %	9.1	5.6	2.5	B	brown	brown
H 2	bifacial platform core	cortical/unfacetted	multiple	50-75 %	6.6	7.5	3.2	A	brown	light brown
H 3	single platform core	unfacetted	multiple	50-75 %	6.0	7.1	3.9	D	brown/cream brown	brown
H 4	single platform core	unfacetted/dihedral	secondary	76-99 %	9.2	5.4	4.8	I	brown	light brown
H 5	multiple platform core	unfacetted	multiple	1-24 %	6.1	6.5	4.0	L	grey	translucent cream brown
H 6	discoidal core	unfacetted	multiple	50-76 %	11.4	10.8	5.3	L	grey	translucent green
H 7	multiple platform core	cortical/unfacetted	quaternary	50-76 %	9.9	7.4	4.3	D	brown	brown
H 8	multiple platform core	unfacetted	multiple	25-49 %	5.6	6.5	6.0	L	grey	translucent green
H 9	single platform core	unfacetted	multiple	50-76 %	5.1	9.2	10.2	L	grey	translucent green
I 1	half-split bifacial discoidal core	cortical/unfacetted	secondary	76-99 %	8.8	8.9	2.7	D	brown	mottled brown
I 2	multiple platform core	cortical/unfacetted	multiple	50-75 %	8.2	6.2	3.0	C	brown	light brown

Table 7.7. Items collected at Kom W

	core type	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
I 3	multiple platform core	unfacetted	multiple	1-24 %	8.8	7.5	4.9	L	green	translucent light green
I 4	multiple platform core	unfacetted	multiple	none	9.1	5.1	3.0	L	green	translucent green
I 5	multiple platform core	unfacetted	multiple	25-49 %	4.5	5.5	5.0	H	cream	brown
I 6	single platform core	unfacetted	multiple	50-75 %	4.1	4.2	7.8	J	cream brown	mottled brown
I 7	single platform core	unfacetted	quaternary	50-75 %	3.5	4.5	6.8	J	brown	mottled brown
I 8	opposed platform core	cortical/unfacetted	multiple	25-49 %	4.2	3.1	1.9	-	brown/cream brown	light brown
I 9	single platform core	cortical/unfacetted	multiple	25-49 %	2.8	3.3	3.2	-	brown/cream brown	light brown
I 10	multiple platform core	cortical/unfacetted	multiple	25-49 %	3.4	3.4	2.9	-	brown	brown
I 11	multiple platform core	unfacetted	multiple	25-49 %	3.7	3.8	3.0	-	brown	brown
I 12	multiple platform core	cortical/unfacetted	multiple	25-49 %	3.1	3.9	2.2	-	brown	translucent green
I 13	multiple platform core	unfacetted	multiple	1-24 %	3.1	3.0	3.8	-	brown	mottled brown
I 14	multiple platform core	unfacetted	multiple	1-24 %	2.1	2.4	2.7	-	calcareous white	brown
I 15	multiple platform core	unfacetted	multiple	1-24 %	2.2	2.7	2.1	-	calcareous white	light brown
J 1	multiple platform core	unfacetted	multiple	1-24 %	3.9	3.7	2.6	-	brown	cream brown
J 2	single platform core	unfacetted	tertiary	50-75 %	5.4	4.4	3.5	J	dark brown	brown
J 3	single platform core	cortical	multiple	76-99 %	4.0	5.8	8.8	I	brown/cream brown	brown
J 4	multiple platform core	unfacetted	multiple	50-75 %	7.5	5.5	3.5	D	brown/cream brown	brown
J 5	single platform core	unfacetted	multiple	76-99 %	9.4	9.8	5.4	D	brown/cream brown	mottled brown
J 6	multiple platform core	unfacetted	multiple	1-24 %	4.9	6.0	4.4	L	cream	grey
J 7	multiple platform core	unfacetted	multiple	1-24 %	3.5	7.0	3.3	L	grey	grey
J 8	multiple platform core	unfacetted	multiple	25-49 %	2.9	3.7	3.5	-	brown	light brown
J 9	ninety degree core	unfacetted	multiple	25-49 %	3.3	2.8	3.1	-	brown	mottled brown
J 10	single platform core	unfacetted	multiple	25-49 %	2.6	3.4	2.6	-	brown/cream brown	green

Table 7.7. Items collected at Kom W (continued)



Fig.7.14. Small cores on pebbles and cobble fragments collected in Strip J of Kom W

those collected by Kozlowski and Ginter could easily be collected by me on the Strips (**Fig.7.14**). The cores can be divided into those made on flint pebbles and those made on fragments of rounded or subangular large cobbles. Both of them exhibit the same platform preparation and flaking patterns as those of the cores collected by me at Epipalaeolithic sites in the X Basin and Z Basin. However, considering the abundance of similar examples of cores at the Predynastic site of Maadi (Rizkana and Seeher 1988: pls.1 and 2), it is probable that such cores did actually exist in the Neolithic. Nevertheless, it must be kept in mind that some of the small cores at Kom W may be dated to the Epipalaeolithic. In other words, it must be supposed that Kozlowski and Ginter's collection of cores was a mixture of Epipalaeolithic and Neolithic ones, but was misrepresented as merely Neolithic.

7.2.8. The Site V Depression

The Site V Depression (N29.58354° E30.79358° in the centre) is located approximately 150 m to the south of Kom W, and its elevation is between 15 m and 20 m asl. The area is a large, oval-shaped, shallow depression of approximately 500 m north-south and 300 m east-west. The surface of this depression is covered by white calcareous clay sediments and scatters of transparent gypsum crystals. Beneath the clay surface, there is a thin layer of dark grey fine-grained sand. A number of lacustrine snails of approximately 2 cm long are scattered on this surface, and also many lacustrine bivalves (*Aspatharia rubens*) of more than 10 cm wide remain intact and embedded in these sediments. This suggests that this depression had been filled with water permanently in certain periods of time. Caton-Thompson speculated that this



Fig.7.15. Scatter of worked cobbles at the Site V Depression (looking northwest)

depression with marginal loams had been used as an agricultural field by the inhabitants of Kom W (Caton-Thompson and Gardner 1934: 75).

Although there are no clear structural remains like hearths, scatters of lithic artefacts and pottery sherds are seen on and around this depression. Particularly dense scatters of artefacts are seen on slightly higher mounds to the west. The surface of these higher mounds is also covered by silty sediments and tiny fragments of indurated calcium carbonate, but no lacustrine snail and bivalve are seen. This may mean that inundations of the mounds were not long enough for lacustrine snails and bivalves to inhabit them and to grow up. As for the dense scatters of artefacts on the mounds, the pottery sherds are undoubtedly dated to the Neolithic, and except for some apparently Old Kingdom knives, most lithic artefacts seem to be dated to the Neolithic. A concentration of flint cobbles was seen in these artefact scatters (**Fig.7.15**), and all the cobbles were collected (**Table 7.8** and **Fig.7.16**).

7.3. Identifying and distinguishing Neolithic cobbles and lithic cores from Epipalaeolithic and Old Kingdom examples

Before discussing unworked and worked rocks used by Neolithic people in detail, one problem which the sites studied bore must be solved. Overlapping occupations of the same sites by people from different periods are quite natural,

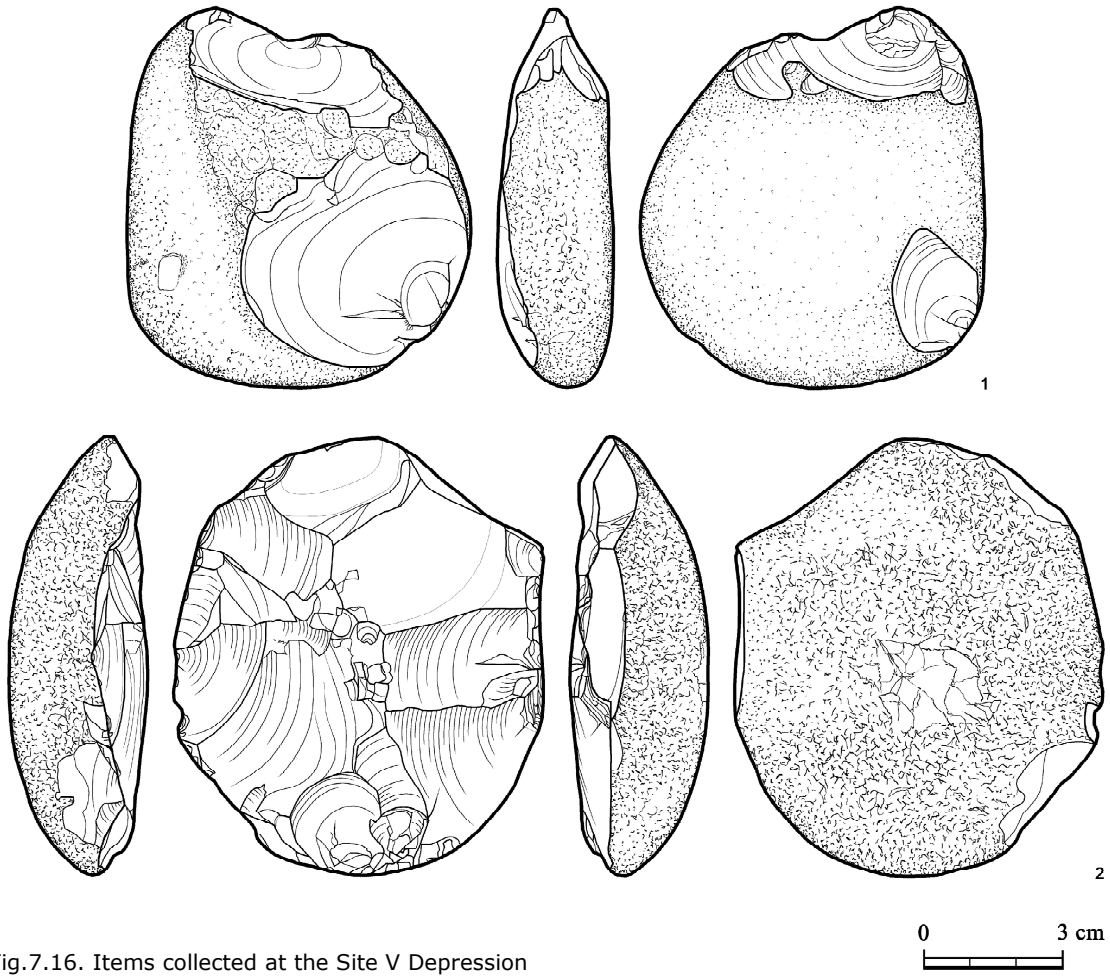


Fig.7.16. Items collected at the Site V Depression

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	bifacial discoidal core	cortical	multiple	50-75 %	9.7	9.3	2.1	A	brown/cream brown	brown
2	bifacial discoidal core	cortical	multiple	25-49 %	9.3	9.1	2.3	A	brown/cream brown	mottled brown
3	bifacial platform core, or, chopper	cortical/unfacetted	secondary	50-75 %	8.3	7.3	2.2	A	brown/cream brown	brown
4	discoidal core	cortical	multiple	50-75 %	9.2	7.4	2.1	B	brown	brown
5	bifacial discoidal core	cortical/unfacetted	multiple	25-49 %	8.1	6.5	2.2	A	brown	brown
6	half-split bifacial discoidal core	cortical/unfacetted	multiple	25-49 %	9.2	7.7	1.6	D	brown/cream brown	brown
7	half-split discoidal core	cortical/unfacetted	multiple	25-49 %	9.3	7.7	2.7	D	brown/cream brown	brown
8	endscraper made on half-split cobble	cortical	primary	76-99%	10.3	6.6	2.3	D	brown/cream brown	mottled brown
9	sidescraper made on half-split discoidal core	cortical/unfacetted	multiple	25-49 %	9.8	6.4	2.1	I	brown	brown
10	half-split discoidal core	cortical	multiple	25-49 %	10.6	6.0	2.5	J	brown	light brown
11	single platform core	cortical	multiple	50-75 %	6.8	8.5	2.8	D	brown	light brown

Table 7.8. Items collected at the Site V Depression

and have actually been observed at many sites in the Fayum. As long as one is dealing with artefacts collected on the surface, there is always a problem of the mixing up of artefacts from different periods and the misunderstanding of a mixed assemblage as an undisturbed single assemblage of one specific period. Caton-Thompson could recognise some diagnostic Predynastic and Old Kingdom formal tools found among Neolithic formal tools on the surface of Kom K and Kom W based on her knowledge (Caton-Thompson and Gardner 1934: 23-24, 38). Similar careful examination of surface artefacts has to be done for the studied sites.

It was not difficult for me to distinguish the Neolithic lithic cores from the Epipalaeolithic cores, because uncontaminated collections of Fayum Epipalaeolithic cores are at my disposal for reference. Not only at Kom W but also at other sites studied like Site L, Site XA and the Site V Depression, the presence of a very small number of Epipalaeolithic cores and tools was recognised, and these were carefully eliminated from this study.

Moreover, through my survey, it was concluded that the area near Site L and particularly the area around Kom W had been occupied during the Old Kingdom as well, and a number of odd lithic cores were found. Hence, it was suspected that Old Kingdom people not only brought flint cobbles there by themselves, but also reused flint cobbles left by Neolithic people. Therefore, distinguishing Neolithic cobbles and lithic cores from Old Kingdom examples was the first step.

For this purpose, unworked and worked cobbles at gypsum quarrying workshops in Umm es-Sawan (N29.71340° E30.87966° at a workshop in the middle), which is located 14 km to the north of Kom K, were referred to. Umm es-Sawan is known for extensive outcrops of gypsum, and it was exploited exclusively in the Old Kingdom period. When Caton-



Fig.7.17. Scatter of cobbles around the gypsum quarrying workshop A in Umm es-Sawan (looking north)



Fig.7.18. Scatter of cobbles on the flint chipping floor in Umm es-Sawan (looking southeast)

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	single platform core	unfacetted	primary	50-75 %	10.2	9.7	6.1	J	brown	light brown
2	conical chunk	cortical	primary	76-99%	9.7	7.8	6.1	J	brown/cream brown	mottled brown
3	multiple platform core	cortical/unfacetted	multiple	50-75 %	5.5	7.8	9.9	H	brown/cream brown	dark brown/ dark grey
4	hemispherical chunk	cortical	secondary	50-75 %	9.4	7.8	4.8	H	brown/cream brown	mottled brown
5	single platform core	unfacetted	multiple	25-49 %	5.0	6.9	5.3	H	brown	light brown
6	single platform core	unfacetted	primary	50-75 %	7.2	7.2	5.6	H	brown/cream brown	brown
7	single platform core	unfacetted	multiple	50-75 %	7.8	6.9	7.2	I	brown/cream brown	cream brown
8	single platform core	unfacetted	multiple	25-49 %	6.0	8.4	7.9	J	brown	brown
9	single platform core	cortical	primary	76-99%	5.0	8.4	11.8	J	mottled brown	mottled brown
10	single platform core	cortical	multiple	76-99%	4.9	10.0	5.5	E	mottled brown	mottled brown
11	single platform core	unfacetted	primary	76-99%	5.5	10.4	8.6	J	brown	cream brown
12	single platform core	cortical	multiple	76-99%	5.3	9.2	6.7	J	light brown	mottled brown
13	ninety-degree core	cortical	secondary	76-99%	3.0	9.3	7.2	C	brown	brown
14	chopper	cortical	multiple	76-99%	2.8	9.8	9.2	A	light brown	light brown
15	chopper	cortical	multiple	76-99%	3.1	9.5	10.1	C	brown	mottled brown
16	chopper	cortical	quarternary	76-99%	2.5	12.5	10.3	C	brown	brown

Table 7.9. Items collected on the flint chipping floor in Umm es-Sawan

Thompson visited and studied the gypsum quarrying workshops there, she found near the workshops the flint chipping floor, where a large amount of unworked and worked flint cobbles were scattered. Since flint cobbles do not naturally occur in this terrain, it was obvious that they had been brought there by Old Kingdom workers as raw materials for toolmaking (Caton-Thompson and Gardner 1934: 104, pl.LVIII and pl.LXIII-3). This flint chipping floor still exists (**Fig.7.17** and **Fig.7.18**). Worked cobbles were collected there for a comparative study (**Table 7.9**).

It is probable that the original sources of cobbles visited by Neolithic and Old Kingdom people were the same. However, it was realised through the observation of the Umm es-Sawan specimens that the cobbles chosen and the knapping techniques employed by Old Kingdom people are apparently different from those by Neolithic people. The general characteristics of the unworked and worked cobbles of the Old Kingdom are; 1) the preference for weathered/abraded, globular/egg-shaped or irregularly-shaped/subangular flint cobbles, which are identical to the cobble types H and J described below, but are much larger and heavier than Neolithic specimens, 2) splitting the cobble



Fig.7.19. An Old Kingdom single platform core collected on the flint chipping floor in Umm es-Sawan



Fig.7.20. An Old Kingdom chopper collected on the flint chipping floor in Umm es-Sawan

around the half part of the body by a very hard, poorly-controlled blow as is indicated by peculiar ripples on the scar, and obtaining conical or hemispherical pieces which were utilised as single platform cores by using the scar as a striking platform (**Fig.7.19**), and 3) making choppers by striking repeatedly one end of oval and flat cobbles, which are identical to the cobble types A and C described below, from one face only without preparing an unfacetted platform (**Fig.7.20**). As a result, one face of the cutting edge of the chopper remains cortical. Based on these characteristics, suspicious worked cobbles collected at the Neolithic sites studied could carefully be eliminated. It was revealed that problematic cobble collections from Site L, Locality 'Calcified Shrubs' and Kom W certainly included some presumably Old Kingdom worked cobbles, whereas the other sites did not.

A remaining problem is the possible presence of Predynastic people in the sites studied. According to Caton-Thompson's publication and my field observations, a very small number of formal retouched blades of the Predynastic period seem to be present at Kom K, Site E29H1 and the Site V Depression. However, it is not certain whether tool making took place at these sites in the Predynastic period, due to the paucity of reliable references for Predynastic lithic cores except for those from Maadi (Rizkana and Seeher 1998). It can only be said that the lack of flint cores or nodules for the production of large blades, which are the hallmarks of Predynastic lithic artefacts, and the raw materials of the long blades which are apparently different from any types of flint cobbles found in the sites studied, may suggest that Predynastic blade production was probably not undertaken there. On the other hand, it is known that bifacially-retouched arrowheads and knives which flourished in the Neolithic did persist into the Predynastic period, though few in number. Therefore, it is difficult to exclude completely the possibility of the occurrence of Predynastic tool making.

7.4. The description of the rock types collected at Neolithic sites

It was recognised through the surface collection that a variety of rock types in different forms were used in the Neolithic sites. Almost all of them do not naturally occur in the lakeshore habitats of the Neolithic period, and hence it is certain that they were transported from elsewhere. Since Kom W yielded the highest variety of rock types and the other sites lack some or many of the various types, the following description of rock types relies mainly on those from Kom W. Flint is the commonest raw material, and many different forms of flint were recognised. They were classified on the basis of shape, surface weathering and abrasion.

A) rounded and weathered, flat flint cobbles
The surface is rough due to weathering, and is covered by clefts. The circumference is well-rounded. The shape is not always oval, but there are triangular and rectangular varieties. It is very flat and thin. The cortex has a dark brown to brown colour, but some parts are faded into cream brown.

B) rounded and abraded, flat flint cobbles
These cobbles are different from the cobbles mentioned just above in terms of the degree of surface abrasion. There is little or no surface undulation, and it is abraded. The circumference is well-rounded. The shape is not always oval but there are triangular and rectangular varieties. It is very flat and thin. The colour of the surface is generally dark brown to brown.

C) rounded and polished, flat flint cobbles
These cobbles are different from the cobbles mentioned just above in terms of the degree of surface abrasion. There is definitely no surface undulation, and it is naturally polished. The circumference is well-rounded. The shape is not always oval but there are triangular and rectangular varieties. It is very flat and thin. The colour of the surface is generally dark brown to brown.

D) rounded and weathered, oval and flat flint cobbles
The surface is rough due to weathering, and is covered by clefts. The circumference is well-rounded. The shape is oval and flat. The colour of the cortex is generally dark brown to brown, but some parts are faded into cream brown.

E) rounded and abraded, oval and flat flint cobbles
Undulated but not porous surface is abraded. The circumference is well-rounded. The shape is oval and flat. The colour of the cortex is generally dark brown to brown.

F) rounded and polished, oval and flat flint cobbles
Due to a considerable degree of abrasion, the surface undulation is almost gone, and the surface looks smooth, and it is naturally polished. The circumference is well-rounded. The shape is oval and flat. The colour of the cortex is generally dark brown to brown.

G) rounded and weathered, globular or egg-shaped flint cobbles
The surface is rough due to weathering and is covered by clefts. The circumference is well-rounded. The colour of the cortex is generally dark brown to brown, but some parts are faded into cream brown.

H) rounded and abraded, globular or egg-shaped flint cobbles
Due to abrasion, the surface is undulated but not porous. The circumference is well-rounded. The colour of the cortex is generally dark brown to brown, but there are examples which have a white to cream calcareous cortex.

I) rounded and weathered, irregularly-shaped or subangular flint cobbles
The surface is rough due to weathering, and is covered by clefts. The circumference is well-rounded, but the entire shape is irregular and subangular. The colour of the cortex is generally dark brown to brown, but some parts are faded into cream brown.

J) rounded and abraded, irregularly-shaped or subangular flint cobbles
Due to abrasion, the surface is undulated but not porous. The circumference is well-rounded, but the entire shape is irregular and subangular. The colour of the cortex is generally dark brown to brown.

K) rough, porous and abraded, irregularly-shaped flint cobbles
The surface is quite rough and porous, and it is abraded. The entire shape is irregular. The colour of the cortex is generally dark brown to brown, but there are lighter varieties.

L) rough and porous, angular translucent chert nodules
This nodule looks similar to that described above, but it is more angular, and its surface is very rough and porous like lava. Its colour is apparently different from that of common flint described above, and is translucent brown to grey. Since the size of collected fragmentary samples is various, it is difficult to imagine the original size of the nodule before reduction.

M) rough and porous flint/sandstone hexahedrons/balls
The entire surface is very rough and exhibits traces of repetitive percussion which resemble those seen on the circumferences of hammer stones. The entire shape is hexahedron to ball. In many examples, there is no clear trace of use, but some examples from Kom K and Kom W have a small part of surface abrasion, suggesting that they were used as rubbers.

N) quartz cobbles
The entire surface is very smooth, and the circumference is well-rounded. The shape is flat and oval, and the colour is white to translucent white. Quartz cobbles are often found scattered not only at the sites studied mentioned above but also at other Neolithic surface sites surveyed by me. Many examples have traces of repetitive percussion and resultant fractures on several parts of their circumference, suggesting that they were used as hammers. This kind of quartz cobble use has been recognised by Caton-Thompson (Caton-Thompson and Gardner 1934: 87). There is no evidence for other kind of use.

O) limestone nodules and cobbles
There are two distinct kinds of limestone. One is pale and coarse-grained and bears many fossil shells. Another is white and fine-grained, and bears no visible inclusions. The first kind of limestone is too coarse and too fragile to be used for manufacturing, and indeed, it was observed through my survey that they had often been used without modification for making hearths at Neolithic surface sites in the L Basin, X Basin and Z Basin. The second kind of limestone is fine enough for manufacturing. One example of a limestone cobble (approximately 8 cm in length, 4 cm in width, and 3 cm in thickness) collected at Kom K is grooved longitudinally against the longer axis, suggesting that it was used as a weight. It was often observed during the survey that fine-grained limestone slabs were used as querns, judging from a shallow depression on them. It is also likely that some fine-grained limestone slabs seen at Site E29H1 and Site XA were used as anvils for flint knapping.

Water/wind-eroded pale limestone slabs and fragments are scattered on extensive linear outcrops of limestone beds on the northern shore of the L Basin and Z Basin, and also on around the 0-10 m asl contour line more than 2 km away from the present lakeshore. Fine-grained limestone blocks must have been exploited at scarps which are sparsely seen at higher elevations to the north.

P) sandstone nodules and cobbles
There are two distinct kinds of sandstone. One is fine-grained, and cream to white. Another is coarse-grained, and has a dark grey to black colour. It was often observed during my survey that slabs and blocks of the fine-grained one had been used as querns, judging from a shallow depression on the slabs and blocks. It is likely that some fine-grained slabs seen at Site E29H1 and Site XA were used as anvils for flint

knapping. It was also observed through my survey that sandstone cobbles of slightly larger than fist size had often been used without modification for making hearths at Neolithic surface sites in the L Basin, X Basin and Z Basin. But it is noticeable that these hearths rarely consist of sandstone cobbles only. In most cases, the majority of hearth stones are pale and coarse-grained limestone cobbles, and sandstone cobbles are only minor components. Those sandstone cobbles often have a flat face, and therefore, it is probable that they had actually been used as rubbers. Similar supposedly querns and rubbers made on coarse-grained sandstone were also seen during my survey.

Q) conglomerate nodules and cobbles
Grains of this rock are much coarser than those of sandstone. The shape of this specimen is flat and oval to hexahedron/ball. Traces of use are hardly seen in most examples collected and observed in the field.

R) basalt nodules and cobbles
Basalt seems quite homogeneous, and no difference is seen between specimens collected or observed at different places in the field. Querns and rubbers made on basalt were rarely seen during my survey. Other kinds of basalt use were not found.

It has been argued that basalt was abundantly available in Gebel Qatrani, approximately 8 km to the northwest of Qasr el-Sagha, and indeed, this Gebel Qatrani basalt is known to have been intensively quarried in the Old Kingdom period. However, basalt occurs naturally on top of sandstone escarpments not only in Gebel Qatrani but also along the entire northern fringe of the Fayum Depression, and hence it is reasonable to think that Neolithic people did not necessarily go to exploit the Gebel Qatrani basalt, but rather procured basalt from sources closer to their habitat.

S) elongated petrified wood fragments
There are various shapes and sizes of this raw material. The largest examples are quite angular or tabular, and they tend to be broken longitudinally along old 'fibres' into elongated fragments. Most of such fragments are subrounded. The colour is light brown to dark grey.

T) hexagonal petrified wood cobbles
As described above, petrified wood naturally occurs in angular and tabular forms, but this specimen is hexagonal in shape. In many examples, there is no clear trace of use, but some examples from Kom K and Kom W have a small part of surface abrasion, suggesting that they were used as rubbers. One or two faces of some other examples from Kom W have one or two grooves which are parallel to old 'fibres', suggesting that they were used as sharpeners.

7.5. Remarks on the various uses of cobbles and core reduction techniques

A number of unworked flint cobbles seen at the sites studied suggest that flint cobbles were usually brought to habitation sites without decortification for reducing carrying weight and/or for insuring quality. The presence of primary and secondary cortical flakes at habitation sites and task locations means that the decortification of flint cobbles was done at habitation sites and task locations, and not at source areas. This may suggest that the cobble collectors were quite sure of the quality of cobbles procured at specific sources, and that the sources are not very far from the habitation sites, because transporting heavy cobbles must have been a big burden.

Removing low-utility portions of resources prior to their transport back to the residential base is known as field processing in the central place foraging models of human behavioural ecology, and lithic raw materials can also be field-processed (Metcalfe and Barlow 1992: 352). It has been argued that when the travel distance between a residential base and a source of lithic raw materials is long, reduction of the materials would proceed further at the source than when the travel distance is short, in order to reduce carrying weight. However, it is difficult to predict precisely the travel distance at which field processing becomes an optimal solution to

carry the heavy load efficiently, without the estimates of load capacities and processing costs and the calculation of the low/high-utility parts of the raw materials. Actually, no ethnographic and experimental data exist on optimal load size for a single lithic raw material procurement event by an individual (Beck *et al*. 2002: 489-490). Therefore, what the lack of decortification of flint cobbles at source areas in the Fayum case really implies is not certain, without examining the manner of cobble use in more detail.

7.5.1. Cobble shapes

In general, there are four distinct shapes of flint cobbles for core reduction. The first is a flat cobble of circular or irregular shape. The second is an oval and flat cobble of 7-12 cm in length, 6-10 cm in width, and 3-5 cm in thickness. The third is a globular or egg-shaped cobble of 5-6 cm in diameter and 7-8 cm in height. The fourth is an irregularly-shaped or subangular cobble. The surface of these four shapes of cobbles is rounded, weathered or abraded. The shape and size of the cobble and the extent of surface weathering and abrasion must depend on the extent to which the cobble has suffered from water rolling, sandblasting and chemical action. In other words, the differences are related to which geological deposits they derived from.

7.5.2. Core reduction techniques

Different techniques were employed for the four distinct shapes of flint cobbles mentioned above. Five different kinds of core reduction techniques were used for the flat cobbles and the oval and flat cobbles (**Fig.7.21**). The first kind of core reduction technique is to strike one end of a cobble from one face repeatedly without making a platform, thereby obtaining several cortical flakes (**Fig.7.6**-1: Site L-6). The resultant core can be called a single platform core. The second kind of core reduction technique is to strike the cobble at one end along the shorter axis, in order to create a flat platform. Then, flakes were taken off continuously by striking the edges of the platform (**Fig.7.13**: Kom W- J5). The resultant core can also be called a single platform core.

The third kind of core reduction technique is to strike one end of a cobble from both faces repeatedly, thereby obtaining several cortical flakes. One or more flake scars made on one end of one face were used as platforms for obtaining flakes from the reverse face (**Fig.7.4**-1: Kom K-1**, Fig.7.4**-2: Kom K-2**, Fig.7.10**-1: Site X-12, and **Fig.7.16**-1: the Site V Depression-3). The resultant platform can be called a 'bifacial platform'. It is also highly probable that some or many of 'bifacial platform cores' were actually made as choppers. Cores or choppers of the same size have been reported as abundant at sites QS VIA/79, QS VI/79, QS V/79, QS VII H/80 and an unnamed surface site in Qasr el-Sagha (Caneva 1970: Fig.2; Dagnan-Ginter *et al*. 1984: Fig.35; Ginter *et al*. 1980: Figs. 24, 26, 27 and 28), and they are collectively dated to the Middle Kingdom. One noticeable characteristic of the Middle Kingdom cores or choppers is that they rarely have the 'bifacial platform'. This is the same characteristic as that of the Old Kingdom specimens from Umm es-Sawan described earlier. Bifacial platform cores or choppers similar to the Fayum examples are seen in the Predynastic assemblage at Maadi (Rizkana and Seeher 1988: pl.9-1). Therefore, it can be said that a 'bifacial platform' is definitely a characteristic of the Neolithic-Predynastic cores or choppers.

The fourth kind of core reduction technique is to strike one or more ends of a cobble from both faces, thereby obtaining a number of cortical flakes. Platforms are not necessarily made (**Fig.7.7**: Site E29H1-7 and **Fig.7.10**-2: Site X-11). The resultant cores can be called either bifacial opposed platform cores, bifacial multiple platform cores, or bifacial discoidal cores. No blade cores are formed from these cobbles.

The fifth and the most unique core reduction technique is to wedge the cobble along the long axis, producing two discoids, and then, non-cortical flakes were taken off continuously from the edges of the dorsal face to the ventral face of a discoid, while rotating it (**Fig.7.6**-3: Site L-1). This can be called a 'half-split unifacial

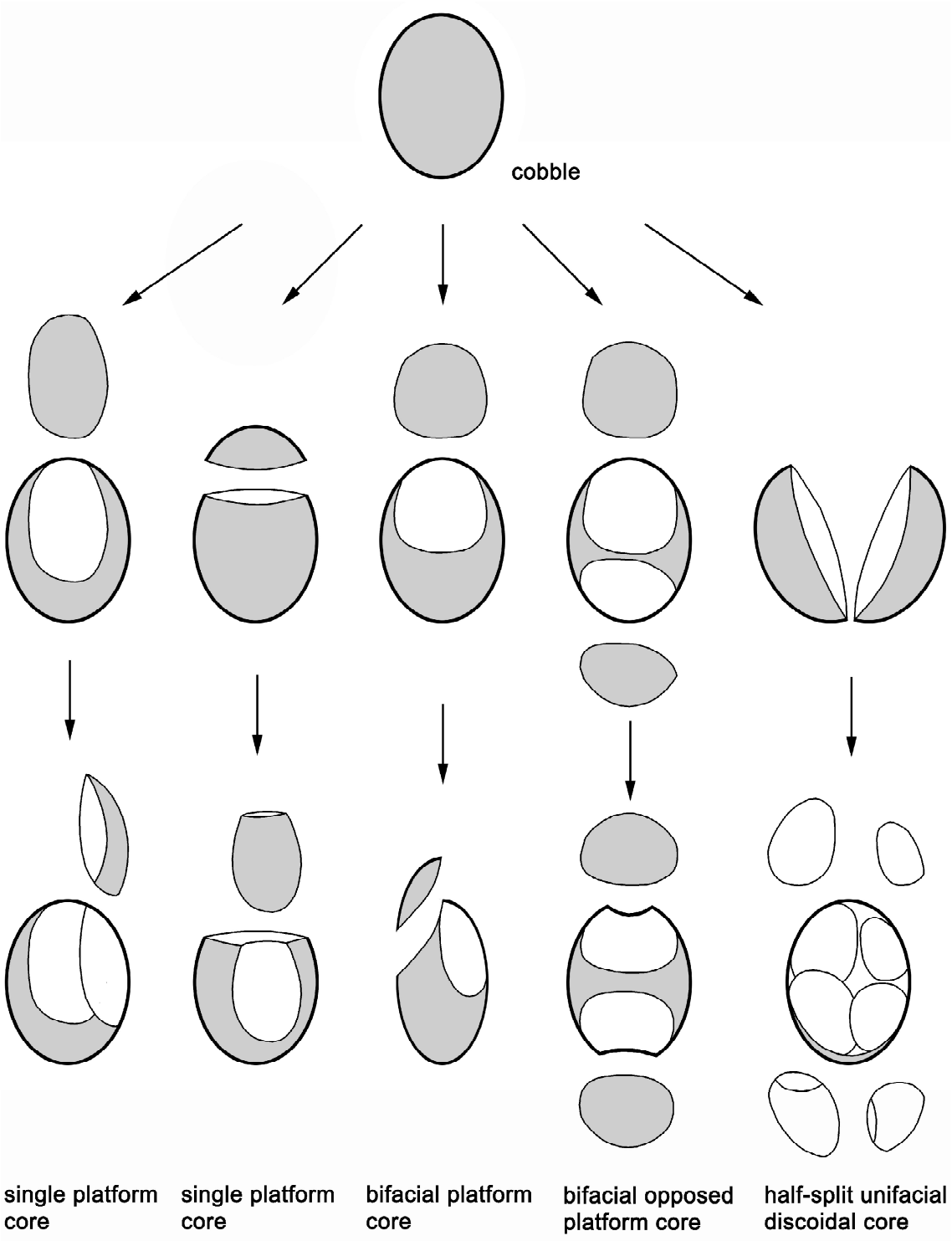


Fig.7.21. Core reduction techniques employed in the Fayum Neolithic

discoidal core'. And when the discoid is thick enough, cortical flakes were also taken off continuously from the edges of the ventral face to the dorsal face. The resultant core can be called a 'half-split bifacial discoidal core'. It is not sure how this splitting of oval and flat cobbles was done. However, traces of a hard blow such as an unusually large compression bulb on one end and a bad fracture on the opposite end of unused discoids from Site L (**Fig.7.22**: Site L-9 and **Fig.7.23**: Site L-10) and of a discoidal core from the Site V Depression (**Fig.7.16**-2: the Site V Depression-7) suggest that both the bipolar percussion technique, by which a straight blow wedges a cobble rested on a hard anvil, and the split cone technique, by which a very hard blow at right angles splits a cobble rested on a yielding surface like sand or a padded leg (Whittaker 1994: 113*ff*), were employed.

These five different core reduction techniques were employed for the globular or egg-shaped cobbles and the irregularly-shaped or subangular cobbles as well. However, it seems that the first technique by which one end of a cobble is struck in order to create a flat platform and to take off flakes while striking the edges of the platform (**Fig.7.3**: Kom K-3) and the fifth technique by which cobbles were split into two pieces in order to flake the ventral face of the pieces (**Fig.7.6**-2: Site L-4 and **Fig.7.24**: the Site V Depression-10) are the most suitable for the globular or egg-shaped cobbles and the irregularly-shaped or subangular cobbles which have no good striking platforms for initial flaking in a natural state.

7.5.3. Flakes

As for flakes struck off from these cores, the size of flakes is already determined by the size of cores, and hence the flakes cannot be larger than 9-12 cm in length and 7-10 cm in width. Except for flakes from unifacial discoidal cores, most flakes from the other cores are primary flakes, because the cores are not exhaustively reduced. How these primary flakes were actually used is another interesting topic, which will be discussed later in more detail.

7.5.4. Hammers

It was often observed that one end or opposed ends of oval quartz cobbles of approximately 6-



Fig.7.22. An unused discoid collected at Site L (half-split along the long axis of a cobble)



Fig.7.23. An unused discoid collected at Site L (half-split along the short axis of a cobble)



Fig.7.24. A half-split discoidal core collected at the Site V Depression



Fig.7.25. A quartz hammer collected at Kom K



Fig.7.26. A flint hammer collected at Kom K

8 cm long and 4-5 cm wide had numerous percussion marks and fractures, indicating that they were used as hammers (**Fig.7.25**: Kom K-7). Similar examples of quartz cobble hammers have been found at the Neolithic site of Merimde Beni Salama (Eiwanger 1992: pl.105-IV.1225, III.188 and OF.87). Since quartz cobbles are relatively light and brittle, it is assumed that they were not used for hard percussion practised in the early stages of a knapping sequence.

Flint cobbles of the same size and the same shape or more circular shape were also used as hammers, judging from numerous percussion marks on one end or opposed ends of the cobbles (**Fig.7.26**: Kom K-4) or in a ring on the circumference of the cobbles (**Fig.7.27**: Kom K-6) as well as large fractures on one end of the cobbles (**Fig.7.28**: Kom K-1). Similar examples of flint cobble hammers have been reported at the Neolithic sites of Merimde Beni Salama (Eiwanger 1992: pl.105-IV.1226) and El Omari (Debono and Mortensen 1990: pl.32-2 and 3)



Fig.7.27. A flint hammer collected at Kom K



Fig.7.28. A flint hammer collected at Kom K

and at the Predynastic site of Maadi (Rizkana and Seeher 1998: pl.11-1), and there is no doubt that the Fayum cobbles were also used as hard hammers. Several samples from Kom K show that the type E (rounded and abraded, oval and flat flint cobbles) and type F (rounded and polished, oval and flat flint cobbles) of approximately 6-8 cm long and 5-7 cm wide are usually used as hammers. This is reasonable, given the ease of holding by hand.

A curious thing is that elongated petrified wood fragments seem to have been used as soft hammers. Such a use had already been guessed by Caton-Thompson at the Old Kingdom gypsum quarrying workshops in Umm es-Sawan. Near these workshops, there was a flint knapping ground, and roughly-knapped flint cobbles which were no doubt used for quarrying



Fig.7.29. Petrified wood hammers collected at Site XA (above) and Site X (below)

gypsum were accompanied by splintered petrified wood (Caton-Thompson and Gardner 1934: 104). During my survey, elongated and slightly pointed fragments of petrified wood of hand-held size and length were often found with lithic cores and debitage products not only at the Neolithic surface sites studied but also at many other localities not intensively studied (**Fig.7.29**). These petrified wood fragments could have been used as a soft hammer (billet) or pressure flaker, though it seems difficult to use them as indirect percussion punches because experimental use demonstrates that they easily shatter. It is possible that animal horn and bone were used as soft hammers, but such examples have never been reported at Neolithic sites in Egypt. There is no example of the use of a petrified wood nodule as a lithic core in the Fayum Neolithic sites. Petrified wood does not naturally occur at lower elevations close to the lakeshore, and therefore, it is certain that they were brought from elsewhere.

7.5.5. Wasteful and thorough uses of flint cobbles

It seems that many flint cobbles were abandoned after a small number of flakes were obtained. In some cases, this is obviously because of the failure of knapping such as hinged termination of flake scars and obtuse platform angle, but it is not certain whether this could also be because of other problems such as the bad knapping quality of the cobbles. In many cases, cobbles and prepared cores were discarded even though they were still in good shape and large enough to provide more flakes of a certain size. Therefore, it gives the impression that Neolithic people used flint cobbles in a rather wasteful manner. Unless cobbles were abundant and readily available, people would have had to make the most of scarce cobbles by various economising behaviours (Odell 1996), and the cobbles must have been more carefully selected at the sources and the core reduction must have been more exhaustive. This Fayum Neolithic case may suggest that flint cobbles were so abundant and so readily available that toolmakers tended to waste the material. In other words, this may indicate that people did not mind wasting raw materials and were sure of procuring more materials again without trouble. Flint cobbles may have been procured through regular trips to specific source locations and stockpiled at habitation sites. Or, the lithic cores which seem to be wastefully discarded should be regarded as de facto refuse rather than primary refuse (Schiffer 1976: 33), and may actually have been stockpiled at the sites for future reuse.

On the other hand, there are small fragmentary cores which seem to have been used thoroughly. Because of different sampling methods, such small fragmentary cores were collected only at Site L, Site XA and Kom W.

The fragmentary cores apparently derive from rounded or subangular large cobbles, and the fragments could probably be obtained by shattering the cobbles. Several flat faces of the fragments which form an angle of less than 90 degrees were used as striking platforms in an unpatterned manner, whereas some cortical parts were left untouched. This fragmentary cobble use stands in strong contrast to the seemingly wasteful use of whole cobbles mentioned above. It is probable that the use of fragments of cobbles as cores was the last resort to utilise large cores which were already used partly but were of no more use due to dull platform angle and bad flake scars caused by previous flaking. This manner of cobble fragment production and use has been argued as a kind of economising behaviour under conditions where lithic raw materials are scarce (Odell 1996). However, the situation at Site L, Site XA and Kom W in terms of the availability of lithic raw materials does not seem to have been very difficult. Therefore, it is more likely that shattering of cobbles has habitually been done in an expedient manner for obtaining small non-cortical flakes at these sites.

7.5.6. Enigmatic stone balls

Lastly, as for the rough and porous flint/sandstone balls collected at Kom K and Kom W (**Fig.7.30**), since there are few visible traces of wear, it is not certain how they were used. Some balls were broken into two pieces, but these hemispherical pieces do not seem to have been used as lithic cores. Therefore, one possible use of these enigmatic objects is that the balls were thrown by hand or by using a sling at game animal for hunting. Such balls cannot kill the animal instantly by one throw, but it can immobilise or weaken the animals, which are afterwards killed with spears and clubs. This kind of stone ball use was already suggested by



Fig.7.30. Enigmatic stone balls collected at Kom K

Caton-Thompson (Caton-Thompson and Gardner 1934: 39), and has recently been argued in the Neolithic and later periods in the Near East (Mazurowski 1994). It is significant to consider this possibility, since this gives an insight into the development of an unprecedented hunting tactic in the Fayum Neolithic.

7.5.7. Differences in the use of cobbles and the core reduction techniques between the sites studied

As mentioned earlier, due to the different preservation of the sites studied, the sampling method and the number of samples were not consistent. Therefore, any statistical analysis of flint cobble assemblages is quite difficult. Nevertheless, the collected data give some tentative ideas about the similarities and differences of flint cobble assemblages between sites.

It seems that apart from the extent of surface weathering, flat flint cobbles (types A, B and C) and oval and flat flint cobble (types D, E and F) are the most prevalent cobbles in the studied sites. It may be said that the cobbles of this size and shape were the most versatile cobbles and were the easiest to transport and handle.

As for the general size of cobbles, it is difficult to find any significant differences between sites, partly because of the sampling bias. Both large and small cobbles are unevenly distributed, and it does not seem that either are concentrated at specific sites. Therefore, it is hard to determine whether there is an increase or decrease of cobble size according to the distance between source areas and the sites, as has been negatively discussed in the Early Ceramic sites in the Egyptian Western Desert (Close 1999). This may perhaps suggest that this entire Neolithic habitat in the northeast of Lake Qarun belonged to one technological organisation based on some distribution centres, and that the procurement and distribution of cobbles were logistically organised.

The general absence of unifacial/bifacial discoidal cores made on the A, B and C types of cobbles at Kom K, Site XA, Site X and Kom W exhibits a striking contrast to their presence at Site L, Site E29H1, Locality 'Calcified Shrubs' and the Site V Depression. Considering that Site L, Site E29H1, Locality 'Calcified Shrubs' and the Site V Depression look like field camps or locations for subsistence activities, it is presumed that this core reduction technique employed for flat cobbles was related to the immediate need for fresh thin flakes at task locations. It seems that half-split unifacial/bifacial discoidal cores made on the D, E, G, H, I, and J types of cobbles are substitutes for discoidal cores made on flat cobbles mentioned above, but it is not certain whether half-wedging of cobbles was usually done upon arrival at task locations. The complete lack of half-wedging techniques at Kom K, Site XA and Locality 'Calcified Shrubs' does not necessarily mean that half-wedging of cobbles were never done there, but may be that half-split cobbles were rarely left there. This possibility may support the assumption that they were related to the immediate need for fresh thin flakes at task locations for specific subsistence activities. As described below, given the fact that half-split cobbles were sometimes partly retouched and transformed into large scrapers, it may be said that half-split cobbles were quite versatile raw materials comparable to unworked flat cobbles of the A, B and C types.

Kom K and Kom W are remarkable in terms of the presence of the type F (rounded and polished, oval and flat flint cobbles). These cobbles have not been seen at the other sites studied. Even at Kom K, these cobbles seem to have been used almost exclusively as hard hammers. This may perhaps reflect a unique preference of toolmakers at Kom K. Kom K and Kom W are also remarkable in terms of the presence of the type L (rough and porous, angular translucent chert nodules). These nodules have not been seen at the other sites studied.

In summary, these observed differences in the use of cobbles and the core reduction techniques between the sites studied may reflect the different functions of the sites or different durations of

occupation. It seems probable that Kom K, Site XA and Kom W were residential bases and logistical centres for subsistence activities, and that Site L, Site E29H1, Site X, Locality 'Calcified Shrubs' and the Site V Depression were field camps or locations occupied or visited temporarily for some specific tasks. This topic will be discussed later in more detail.

7.6. Sources of lithic raw materials in the Fayum Depression and its vicinity

Although several scholars have discussed the possible sources of flint used by Neolithic toolmakers in the Fayum and its vicinity, no one has pinpointed exact locations. Citing Beadnell's suggestion, Caton-Thompson considered that the flint used by Neolithic people might have derived from outside the Fayum Depression in nodular or tabular form: one type from the Middle Eocene limestone to the south like that observed in Wadi Rayan and another type from the Cretaceous limestone to the north of Abu Roash. As for the possibility of the use of local materials, she mentioned the material available at Gebel Qatrani (Caton-Thompson and Gardner 1934: 87).

Considering the huge amount of cobbles found at Neolithic sites, it is unlikely that all of them came from such distant places as Abu Roash, which is located more than 100 km to the north of the Fayum. It seems more likely that the major source was much closer to the Fayum Neolithic habitats. The rocky terrain of Qasr el-Sagha and Gebel Qatrani, which are approximately 15-20 km to the northwest of Kom W, has been argued by several scholars as a possible source. However, my visit to this terrain revealed that on the limestone escarpments above Qasr el-Sagha, there is no surface scatter of large flint cobbles like those described at length (**Fig.7.31**). Since Gebel Qatrani is a sandstone plateau and does not yield tabular or nodular flint, it is not clear where at Gebel Qatrani Caton-Thompson found flint sources. No flint cobble is scattered at Gebel Qatrani, and only small pebbles which are not suitable for tool making are sparsely scattered (**Fig.7.32**). Therefore, the sources of flint cobbles must be sought somewhere else. In search of flint sources within the Fayum Depression, some explorations were carried out (**Fig.7.33**).

7.6.1. The northern fringe of the Fayum Depression

The northern fringe of the Fayum Depression is approximately 22 km to the north of the present lakeshore and is higher than 100 m asl. It is dominated by a sandstone plateau capped by a thin layer of basalt, and there is no natural outcrop of flint. Some outcrops of quartzitic sandstone, which was commonly used for tool making in southern Egypt in prehistory, were observed in this area, but this material has never been used for tool making in the prehistory of



Fig.7.31. Escarpments above Qasr el-Sagha (looking southeast)



Fig.7.32. Gebel Qatrani (looking northwest)

the Fayum. Some scatters of rough and porous, angular translucent chert nodules found only at Kom K and Kom W are seen in this area. Their size and shape are quite similar to those found at these sites, and it is probable that this place is one of the sources of this peculiar raw material.

In the desert wadis which stretch north-south and connect the rocky fringe of the Fayum Depression to the lakeshore, a survey was carried out to see whether flint cobbles and artefacts are scattered along the wadis. Scatters of flint pebbles were actually seen on wadi levees and banks, but again, they are too small to be used for tool making. A number of Middle Palaeolithic, Epipalaeolithic and Neolithic lithic artefacts were collected during this survey, but they are made of flint cobbles which are not seen in these wadis. Therefore, it is concluded that the rocky terrain on the northern fringe of the Fayum Depression is not the source of flint cobbles, even though basalt and sandstone blocks could probably have been exploited there by prehistoric people.

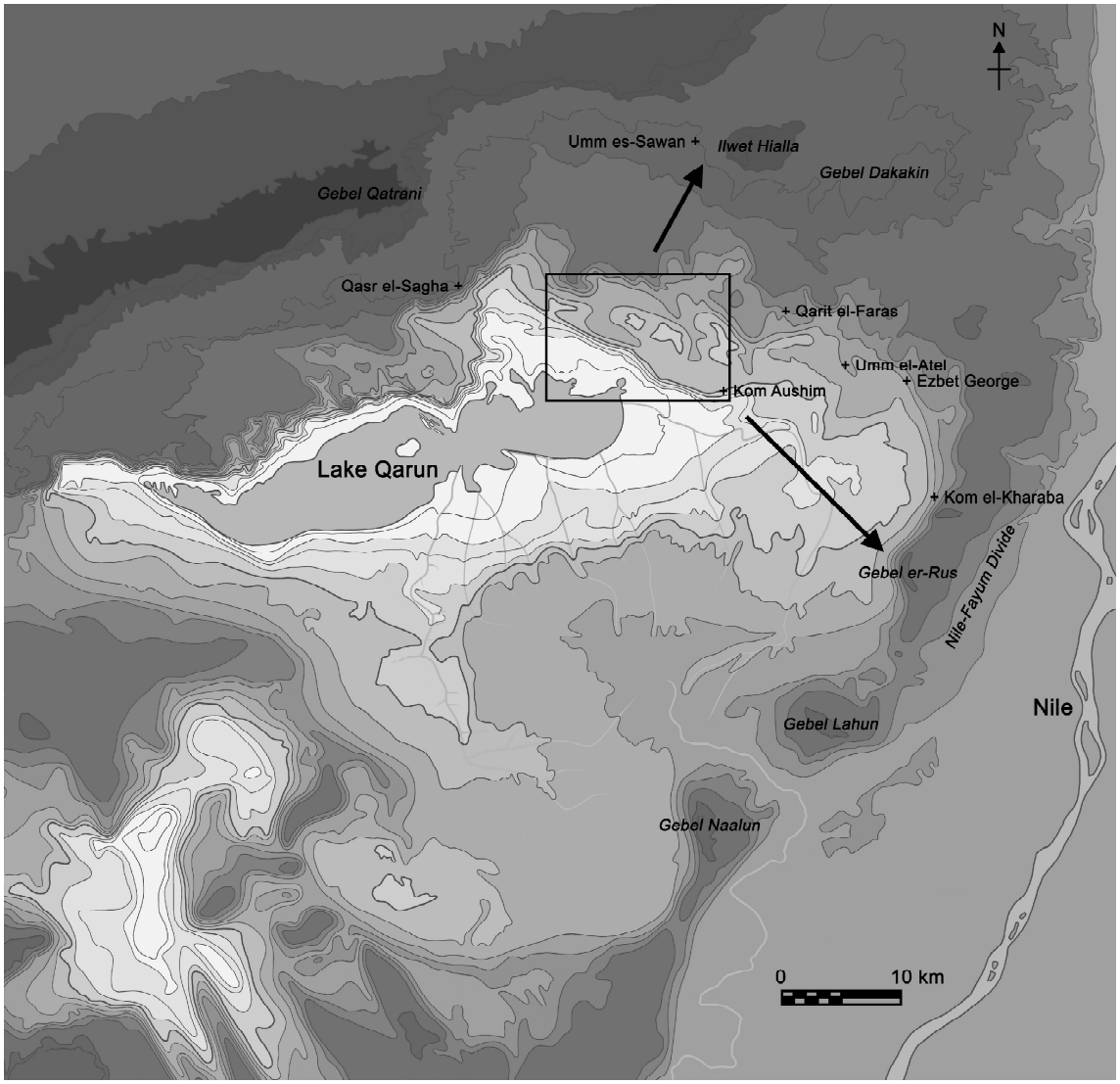


Fig.7.33. Locations of possible sources of lithic raw materials in the Fayum



Fig.7.34. Limestone outcrop near the present lakeshore (looking south)

7.6.2. Rocky terrains close to the present lakeshore

The rocky terrains around the 10-15 m asl contour line close to the present lakeshore is formed of Upper Eocene limestone of the Qasr el-Sagha Formation. There are a number of linear outcrops of limestone bedrock which stretch northwest-southeast and mark ancient shorelines. This flat limestone bed extends southwards and is gradually replaced by sandstone beds of the Birket Qarun Formation. They gently fall, and form steep cliffs at some places. The sandstone beds are replaced by another limestone bed, which reaches the present lakeshore (**Fig.7.34**). These successive limestone and sandstone beds do not contain flint layers, and no flint cobbles are scattered in these terrains.

In summary, there is no possible source of flint cobbles to the north, south, and northwest of the major Fayum Neolithic habitation sites within the Fayum Depression. Therefore, remaining areas to be explored are to the east and the northeast of the Fayum.

7.6.3. The Nile-Fayum Divide

The nearest potential source of flint cobbles is the area between Lake Qarun and the Nile Valley, or, the Nile Valley itself. This area, which is called the Nile-Fayum Divide, has not been sufficiently investigated by Caton-Thompson, because of trouble with another archaeological mission regarding the research area concession. Therefore, it is no wonder that she overlooked this area as a potential source of flint cobbles in the Neolithic period. However, when she investigated Old Kingdom gypsum quarrying workshops at Umm es-Sawan, she discovered a flint knapping ground on which thousands of unworked flint cobbles and cobble hand-picks were scattered. The cobbles were trimmed down to a rough point by careless free flaking, though a rounded butt of the cortex were retained, and the points were undoubtedly used for quarrying gypsum. She was amazed by the fact that there was no flint of comparable size in the surroundings and concluded that those cobbles must have been transported from elsewhere by Old Kingdom quarry workers. She guessed that the sources of those flint cobbles might be to the north, or might be the Quaternary deposit at Gebel er-Rus on the Nile-Fayum Divide to the southeast (Caton-Thompson and Gardner 1934: 104; 129). Strangely, she did not mention the possibility that Gebel er-Rus was visited by Neolithic people, but it is not surprising if Gebel er-Rus was one source of flint cobbles in the Neolithic period.

Sandford and Arkell (1929) investigated the Nile-Fayum Divide and made a detailed geological map. They located the extent of Middle-Upper Eocene limestone escarpments and Pleistocene gravel beaches containing Middle and Late Palaeolithic artefacts eroded out and washed by the wave action of the Pleistocene lake, which was much larger than the Neolithic Moeris Lake. Such Pleistocene gravel beaches are located within my survey area to the north of the lake around the contour line of approximately 30-40 m asl, but the gravels consist of rolled pebbles and subangular fragments of flint, which are much smaller than the flint cobbles under consideration, and hence they are obviously not the source areas of the cobbles.

More substantial information about the possible sources of flint cobbles has been provided not only by Sandford and Arkell but

also by Little, who mapped many locations of Pliocene/Plio-Pleistocene gravel deposits in the Nile-Fayum Divide (Sandford and Arkell 1929: 11-27 and folding map; Little 1936: pl.IX). The Pliocene/Plio-Pleistocene gravel deposits have been found on top of high escarpments at many places in the region between the Fayum and the south of Cairo, and have been known to contain well-rounded flint cobbles of fist-size (Mori and Iryu 2001: 78-81). The contents of the Pliocene/Plio-Pleistocene deposits in the Nile-Fayum Divide must be the same. Sandford and Arkell did not mention the exact size and characteristics of flint cobbles seen in the Pliocene/Plio-Pleistocene deposits in the Nile-Fayum Divide and instead preferred to use the term 'gravels' when they described the contents of the deposits. When one sees the photographs in their publication, their Pliocene/Plio-Pleistocene 'gravels' seem to be larger than clastic Pleistocene beach gravels. However, according to Cagle (1994), who has investigated some of Plio-Pleistocene deposits around the Fayum, only a few of them contained flint cobbles adequate for tool making, though he did not mention exactly where they were. It seems that he did collect good samples of flint cobbles near Gebel Dakakin, which is approximately 25 km to the northeast of Kom K and is beside the modern Cairo-Fayum Road No.22.

Based on the assumption that the Pliocene/Plio-Pleistocene deposits in the Nile-Fayum Divide provide some types of large flint cobbles described earlier and that Neolithic people visited some of these Pliocene/Plio-Pleistocene deposits on high escarpments, a survey was carried out at 1) Kom el-Kharaba (the ancient Philadelphia of the 3rd century BC to the 3rd century AD), which is approximately 27 km to the southeast of Kom K, 2) Fag el-Gamous and Seila, which are located on Gebel er-Rus and are approximately 28 km to the southeast of Kom K and approximately 7 km to the southwest of Kom el-Kharaba, and 3) Gebel Lahun, which is approximately 14 km to the southwest of Gebel er-Rus. There was no time to visit Gebel Naalun, which is the highest plateau in the Nile-Fayum Divide and is located approximately 2 km to the southwest of Gebel Lahun across the Hawara Channel.

As is known from unpublished Fayum lithic collections presently housed in the Egyptian Museum in Cairo, stray Neolithic tools like bifacially-retouched concave-based arrowheads and knife blades have been collected by de Prorok and Caton-Thompson at such sites as Kom Aushim (the ancient Karanis of the 3rd century BC to the 5th century AD), Qarit el-Faras, and Umm el-Atel (the ancient Bacchias of the 3rd century BC to the 4th century AD), all of which are approximately 10-20 km to the east of the present lake but were actually located on the northern shore of the Neolithic Moeris Lake. It has also been reported that there were Neolithic artefact scatters and hearths at Ezbet George, which is supposed to be around the northeast corner of the Neolithic Moeris Lake and is located between Umm el-Atel and Kom el-Kharaba (Caton-Thompson *et al*. 1937). All of them can be indirect evidence for the movement of Neolithic people between the Fayum Depression and the Nile Valley.

The site of Kom el-Kharaba (N29.44145° E31.09347° in the approximate centre) is located on plain desert, and the southeastern end of the site is marked by a high plateau which stretches east-west along Darb Gerzeh (**Fig.7.35**) and is dated to the Pliocene. Rounded and weathered flint cobbles of larger than fist size are sparsely scattered on and around the plateau of approximately 100 m asl at the highest point (**Fig.7.36**). Unexpectedly, a number of seemingly Neolithic, but more likely, Predynastic partly-retouched and bifacially-retouched spearheads and blades were collected on one of the plateau, which is approximately 60 m asl. However, the raw material of some of the tools and the flint cobbles collected are not similar to those which are commonly seen in the Neolithic sites in the northeast of Lake Qarun, in terms of shape, colour and surface weathering. Therefore, even though it is probable that Neolithic people passed by Kom el-Kharaba, it must be said that Kom el-Kharaba is not the major source area of the flint cobbles used by Neolithic people.

Gebel er-Rus (N29.39869° E31.04626° in the



Fig.7.35. Kom el-Kharaba (looking southeast)



Fig.7.37. Gebel er-Rus (looking north)



Fig.7.36. A high plateau near Kom el-Kharaba (looking southwest)



Fig.7.38. Scatter of cobbles at lower elevations of Gebel er-Rus (looking east)

approximate centre) is marked by the third highest plateau in the Nile-Fayum Divide (**Fig.7.37**), and flint cobbles of various sizes and shapes are widely scattered on and around the plateau. The plateau is sandstone of the Upper Eocene Birket Qarun Formation, overlying a limestone bed of the Middle Eocene Gehannam Formation. The flint cobble deposits are dated to the Pliocene. The cobbles at lower elevations are very dirty and muddy (**Fig.7.38**), and hence, at first glance, they do not look similar to those which are commonly seen in the Neolithic sites in the northeast of Lake Qarun, in terms of colour and surface weathering. However, once they are cleaned, they exhibit a remarkable similarity to some types of cobbles which have been used by Neolithic people in the northeast of Lake Qarun. The cobbles collected at lower elevations of Gebel er-Rus, which are approximately 50 m asl, include the type B (rounded and abraded, flat flint cobbles), type C (rounded and polished, flat flint cobbles), type D (rounded and weathered, oval and flat flint cobbles), type I (rounded and weathered, irregularly-shaped or subangular flint cobbles), and type N (quartz cobbles) (**Table 7.10**). Specimens of the types B, D and I are actually knapped in the manner quite similar to those have been repeatedly observed on Neolithic cores in the northeast of Lake Qarun.

Only the highest point of the plateau of Gebel er-Rus, on which the Pyramid of Seila, a step pyramid of the Old Kingdom is located (N29.38239° E31.05152° in the centre), is dated to the Plio-Pleistocene. Flint cobbles of various sizes and shapes are quite extensively scattered there (**Fig.7.39**). The composition of various flint

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	bifacial platform core, or, chopper	unfacetted	multiple	50-75 %	9.7	11.3	3.0	B	brown/cream brown	brown
2	whole cobble	-	-	76-99%	11.8	8.7	2.4	C	mottled brown	light brown
3	discoidal core	cortical	tertiary	50-75 %	10.2	9.4	4.0	D	cream brown	mottled brown
4	single platform core	unfacetted	quaternary	76-99%	2.7	6.8	6.5	D	dark brown	brown
5	single platform core	unfacetted	primary	76-99%	4.0	8.7	11.9	I	mottled brown/ cream brown	mottled brown
6	whole cobble	-	-	complete (100%)	6.9	6.2	3.9	D	brown/cream brown	-
7	whole cobble	-	-	complete (100%)	9.4	8.1	3.3	D	brown	-
8	whole cobble	-	-	complete (100%)	6.2	4.5	2.1	N	translucent white	-
9	whole cobble	-	-	complete (100%)	7.1	4.5	2.0	N	translucent white	-

Table 7.10. Items collected at lower elevations of Gebel er-Rus

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	bifacial discoidal core	cortical	tertiary	50-75 %	8.9	10.1	1.6	A	brown	mottled brown
2	bifacial discoidal core	cortical	multiple	50-75 %	10.4	10.8	2.1	B	brown	mottled brown
3	single platform core, or, chopper	cortical	multiple	76-99%	3.1	9.1	8.4	C	brown	light brown
4	whole cobble	-	-	76-99%	11.8	7.7	11.5	A	brown/cream brown	brown
5	whole cobble	-	-	complete (100%)	10.2	9.5	2.6	A	brown/cream brown	-
6	whole cobble	-	-	complete (100%)	10.8	8.4	3.0	B	brown	-
7	whole cobble	-	-	complete (100%)	9.3	6.6	2.2	C	brown	-
8	whole cobble	-	-	complete (100%)	9.1	6.4	3.1	D	dark brown	-
9	single platform core	-	multiple	50-75 %	10.9	9.2	6.1	J	brown	brown
10	whole cobble	-	-	complete (100%)	7.3	4.6	2.2	N	translucent white	-
11	whole cobble	-	-	76-99%	10.0	9.4	3.0	A	cream brown	brown

Table 7.11. Items collected at higher elevations of Gebel er-Rus



Fig.7.39. Scatter of cobbles at higher elevations of Gebel er-Rus (looking west)



Fig.7.40. Scatter of cobbles on Gebel Lahun (looking southeast)

cobbles in this Plio-Pleistocene deposit resembles that in the Pliocene deposit at the base of Gebel er-Rus. The cobbles collected at higher elevations of Gebel er-Rus, which is approximately 100 m asl, include the type A (rounded and weathered, flat flint cobbles), type B (rounded and abraded, flat flint cobbles), type C (rounded and polished, flat flint cobbles), type D (rounded and weathered, oval and flat flint cobbles), type J (rounded and abraded, irregularly-shaped or subangular flint cobbles), and type N (quartz cobbles) (**Table 7.11**). Specimens of the types A, B, C and J are actually knapped in a manner quite similar to what has been observed on Neolithic cores in the northeast of Lake Qarun.

Gebel Lahun (N29.27099° E30.98967° in the approximate centre) is marked by the second highest plateau in the Nile-Fayum Divide, and flint cobbles of various sizes and shapes are quite extensively scattered on the plateau (**Fig.7.40**). The plateau is sandstone of the Upper Eocene Birket Qarun Formation, overlying a limestone bed of the Middle Eocene Gehannam Formation. The flint cobble deposits are dated to the Pliocene. The cobbles collected at higher elevations of Gebel Lahun, which is approximately 140 m asl, include the type A (rounded and weathered, flat flint cobbles), type B (rounded and abraded, flat flint cobbles), type C (rounded and polished, flat flint cobbles), type D (rounded and weathered, oval and flat flint cobbles), type G (rounded and weathered, globular or egg-shaped flint cobbles), type H (rounded and abraded, globular or egg-shaped flint cobble), type J (rounded and abraded, irregularly-shaped or subangular flint cobbles), and type N (quartz cobbles) (**Table 7.12**). Specimens of the types A, B, D and H are knapped in a manner similar to what has been observed on Neolithic cores in the northeast of Lake Qarun.



Fig.7.41. Ilwet Hialla (looking northeast)

Therefore, it can be concluded that these Pliocene/Plio-Pleistocene deposits on the plateaus of Gebel er-Rus and Gebel Lahun are the sources of flint cobbles and quartz cobbles used by Neolithic people.

	core type	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	single platform core, or side scraper	unfacetted	quarternary	25-49 %	1.9	8.6	5.7	D	brown	mottled brown
2	bifacial discoidal core	cortical	multiple	25-49 %	7.9	6.8	2.1	A	brown	brown
3	discoidal scraper	unfacetted	multiple	25-49 %	8.8	6.6	1.2	A	brown	mottled brown
4	end scraper	cortical	multiple	50-75 %	8.4	8.2	2.4	A	brown	brown
5	bifacial platform core, or chopper	unfacetted	multiple	50-75 %	9.4	8.6	2.6	A	brown	brown
6	bifacial platform core, or chopper	unfacetted	quarternary	50-75 %	11.6	8.3	2.9	A	brown	brown
7	side scraper	unfacetted	multiple	25-49 %	11.8	9.2	3.2	B	brown	brown
8	single platform core, or chopper	cortical	multiple	50-75 %	12.8	8.2	3.9	D	brown	brown
9	single platform core, or chopper	cortical	tertiary	76-99%	16.0	8.5	2.0	C	brown	brown
10	single platform core	unfacetted	quarternary	50-75 %	3.8	8.6	4.0	J	brown	brown
11	single platform core, or natural break	cortical	tertiary	50-75 %	4.2	10.1	4.3	D	brown	brown
12	single platform core	unfacetted	tertiary	50-75 %	6.7	8.1	5.4	H	brown	brown
13	single platform core, or natural break	unfacetted	quarternary	50-75 %	5.8	12.1	5.7	H	brown	brown
14	whole cobble	-	-	complete (100%)	9.4	5.8	4.2	G	brown	brown
15	whole cobble	-	-	complete (100%)	9.9	8.5	1.6	C	brown	brown
16	whole cobble	-	-	complete (100%)	8.3	7.7	2.1	A	brown	brown
17	whole cobble	-	-	50-75 %	8.1	7.8	2.1	A	brown	mottled brown
18	quartz cobble	-	-	complete (100%)	8.5	4.9	3.0	N	cream	-
19	quartz cobble	-	-	complete (100%)	6.0	3.6	2.7	N	cream	-

Table 7.12. Items collected at Gebel Lahun

7.6.4. Ilwet Hialla and Umm es-Sawan

In addition, another survey was carried out at Ilwet Hialla and its vicinity, approximately 14 km to the northeast of Kom K. Ilwet Hialla is a sandstone plateau of the Oligocene Gebel Qatrani Formation which marks the northeastern boundary of the Fayum Depression and stretches east-west (**Fig.7.41**). It is above 200 m asl, and forms steep cliffs. The surface on top of this plateau is covered by scatters of petrified wood fragments and coarse-grained black sandstone slabs as well as flint pebbles of elongated or irregular shape. However, a few kilometres farther to the northeast of the plateau and close to the modern Cairo-Fayum Road No.22, the

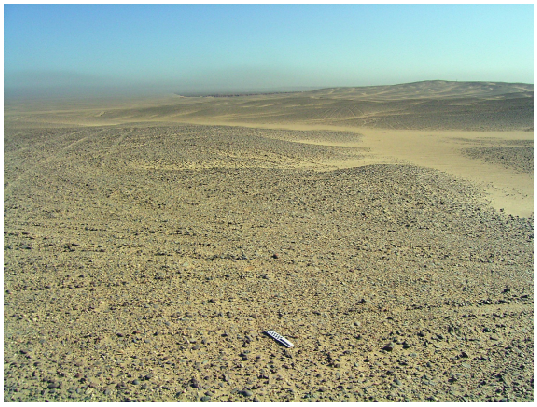


Fig.7.42. Scatter of cobbles on Ilwet Hialla Northeast (looking northeast)



Fig.7.43. Scatter of cobbles in the south of Ilwet Hialla (looking north)

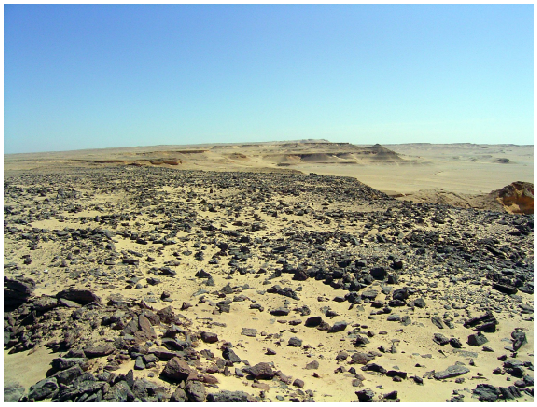


Fig.7.44. Scatter of sandstone slabs and cobbles on top of Umm es-Sawan (looking east)

landscape is more hilly, and the surface is covered by extensive scatters of flint cobbles of various sizes and shapes (**Fig.7.42**), which are similar to those found in Pliocene deposits in Gebel er-Rus. These high elevations (N29.74523° E30.97495° in the approximate centre) can be understood as western extensions or patches of the Pliocene deposits of Gebel Dakakin.

The cobbles collected at high elevations to the northeast of Ilwet Hialla, which are approximately 205 m asl, include the type B (rounded and abraded, flat flint cobbles), type C (rounded and polished, flat flint cobbles), type D (rounded and weathered, oval and flat flint cobbles), type E (rounded and abraded, oval and flat flint cobbles), type F (rounded and polished, oval and flat flint cobbles), type G (rounded and weathered, globular or egg-shaped flint cobbles), type H (rounded and abraded, globular or egg-shaped flint cobble), type J (rounded and abraded, irregularly-shaped or subangular flint cobbles), type K (rough, porous and abraded, irregularly-shaped flint cobbles), and type N (quartz cobbles) (**Table 7.13**). Whereas quartz cobbles seen at these high elevations are much smaller than those commonly used by Neolithic people and hence are not usable as hammers, other flint cobbles listed are quite similar to those which are seen in Neolithic sites to the northeast of Lake Qarun, in terms of size, shape, colour and surface weathering. Specimens of the types B, D, E and F are actually knapped in the manner similar to those which were observed on Neolithic cores to the northeast of Lake Qarun. Therefore, it is highly probable that this area was also visited by Neolithic cobble collectors.

The southern edge of Ilwet Hialla is severely disturbed by a modern military base, which seems to have been abandoned many years ago, but nevertheless, scatters of flint cobbles are still visible on the surface. The area to the south of the Ilwet Hialla plateau is dominated by Upper Eocene limestone, and the flat surface of the lowest area is covered by extensive scatters of fossil shells which derive from the limestone bed. In contrast, parts of this area are quite undulated, which seem to be caused by water/wind erosion, and the surface is covered by fragments of petrified wood, limestone slabs, black and white

	item	platform preparation	knapping sequence	amount of cortex	L (cm)	W (cm)	T (cm)	cobble type	cortex colour	fresh part colour
1	whole cobble	-	-	76-99%	11.3	7.9	1.6	B	brown	light brown
2	bifacial discoidal core	cortical	multiple	25-49 %	8.4	6.7	2.1	B	brown	light brown
3	single platform core	unfacetted	multiple	50-75 %	3.1	7.4	9.3	B	brown/cream brown	light brown
4	whole cobble	-	-	complete (100%)	9.1	7.5	2.7	C	brown	-
5	single platform core	cortical	multiple	50-75 %	3.8	8.8	8.0	E	brown	mottled brown
6	half-split opposed platform core	unfacetted	multiple	25-49 %	8.5	6.1	2.7	E	brown	light brown
7	whole cobble	-	-	50-75 %	8.1	6.9	3.0	E	brown	light brown
8	whole cobble	-	-	76-99%	8.2	6.9	3.8	E	brown	light brown
9	multiple platform core	unfacetted	tertiary	76-99%	9.9	7.3	4.2	E	brown/cream brown	brown
10	whole cobble	-	-	76-99%	9.1	6.5	4.2	E	brown	brown
11	single platform core	cortical	primary	76-99%	9.0	6.7	3.6	F	brown	mottled brown
12	multiple platform core	cortical/unfacetted	multiple	50-75 %	10.8	8.4	5.2	G	brown	brown
13	single platform core	unfacetted	multiple	50-75 %	6.5	4.7	3.7	J	brown/cream brown	brown
14	bifacial platform core	unfacetted	multiple	50-75 %	8.7	6.0	4.6	J	brown/cream brown	light brown
15	whole cobble	-	-	complete (100%)	8.3	5.5	3.8	J	dark brown	-
16	single platform core	unfacetted	multiple	76-99%	10.7	8.1	3.9	J	brown	mottled brown
17	whole cobble	-	-	complete (100%)	13.7	8.1	6.6	J	brown	-
18	whole cobble	-	-	complete (100%)	11.4	7.6	4.6	K	brown	-

Table 7.13. Items collected at Ilwet Hialla Northeast

sandstone slabs, chert cobbles and flint pebbles (**Fig.7.41**). One peninsular high elevation is covered by an enormous amount of fine-grained black sandstone blocks. According to a geological map (**Fig.3.2**), there are several patches of Pliocene deposits in this area, and indeed, some wadi-like traces of surface water flow, which come downslope from the plateau (**Fig.7.43**), contain oval or irregularly-shaped flint cobbles and flint balls, both of which are characterised by a calcareous cortex. These types of flint cobbles have not been seen in the Neolithic sites studied, but flint balls are similar to those found at Kom K and Kom W in terms of size and shape, and hence it is probable that this area (N29.69149° E30.91022° in the approximate centre) was a source of such flint balls. It seems that more patches of Pliocene deposits are distributed in this geologically complex area.

The northwestern extension of Ilwet Hialla is covered by remarkably extensive scatters of large petrified wood nodules and their fragments, fine-grained black sandstone slabs and cobbles, and conglomerate slabs and cobbles (**Fig.7.44**). The downslope of the western end of this Oligocene plateau is Umm es-Sawan, and its gypsum deposits are quite visible on rock walls and on the surface of the plain in the south. Considering that Umm es-Sawan must have been visited by Old Kingdom gypsum quarry workers via a wadi which runs from around the X Basin and that an Epipalaeolithic locality was found on the wadi bank approximately 1 km to the southwest of Umm es-Sawan, it is not surprising if the Neolithic people who inhabited the lakeshore visited Umm es-Sawan and its vicinity for exploiting these rock materials.

7.6.5. Summary

Although one would tend to assume that different types of flint cobbles must have derived from different source areas, it was revealed through visits to some Pliocene/Plio-Pleistocene deposits to the east and northeast of the Neolithic habitats of the Fayum, that flint cobbles included in these deposits are definitely not homogeneous but are quite various in terms of size, shape, colour and surface weathering. Thus, it seems to have been possible for Neolithic cobble collectors to procure easily more than several types of cobbles at one source area. These source areas actually have more types of cobbles which were not used by Neolithic people. This means that Neolithic people did not collect cobbles randomly but rather chose cobbles suitable for their needs. Moreover, it is likely that Neolithic cobble collectors checked the quality of cobbles at the source areas by knapping cobbles by way of trial once or twice, but that such trial cobbles with poor fractures and internal cracks were discarded there immediately, and whole cobbles collected nearby were taken away.

7.7. Lithic raw material procurement and its embeddedness in mobility and subsistence strategies

The question arises as to how Neolithic inhabitants of the northern shore of the lake organised lithic raw material procurement trips to such distant source areas as Gebel er-Rus and Ilwet Hialla. This question is related to another important question as to how the Fayum Neolithic people integrated lithic raw material procurement into their general mobility and subsistence strategies on a daily, seasonal, and yearly basis. It has been argued on the basis of ethnoarchaeological studies that lithic raw material procurement was normally embedded in routine movement for subsistence activities and that special trips for lithic raw materials were very rarely organised (Binford 1979: 259). If this argument was the case with the Fayum Neolithic people, they must have had economic reasons for visiting the area between the lake and the Nile Valley or the Nile Valley itself, other than lithic raw material procurement. Therefore, it is useful to start first by considering the basic mobility and subsistence strategies of the Fayum Neolithic people.

It is assumed in terms of human behavioural ecology that the people adopted central place foraging, and attempted to maximise the foraging return rate through monitoring and exploiting several resource patches, by means of logistical trips as well as occasional residential moves (Kaplan and Hill 1992). Given the dense accumulations of flint cobbles at some large sites and the supposedly low sedentariness of site occupations observed on the Fayum Neolithic lakeshore, two possibilities on a yearly basis must be examined, while following the well-debated dichotomy of foragers' residential mobility and collectors' logistical mobility. Furthermore, the possibility of territorial mobility which encompasses cyclical movement of people among a series of territories on a long-term basis must also be taken into account (Binford 1980; 1982; Kelly 1992).

7.7.1. Residential mobility

The first possibility is that Fayum Neolithic people are classified as foragers who move their residential bases seasonally, and that the entire population regularly moved to the Nile Valley in seasons of bad harvests of plants and fish and poor hunting of terrestrial mammals due to low or high lake water, and then returned to the Fayum while collecting flint cobbles on their way after the lake water came back to a moderate level. Alternatively, this move might occur on a long-term basis, and thus people moved out in lean years, and eventually returned to a previously occupied place. This manner of move may probably explain how the accumulation of flint cobbles at some Neolithic sites in the Fayum was made possible by the efforts of many people who transported a large number of heavy flint cobbles at one time. It also explains why Neolithic sites in the Fayum do not show clear evidence for fully sedentary occupations.

A problem in this possible mobility strategy is that a stable supply of flint cobbles throughout a year would be difficult, and there would always be a risk of the depletion of flint cobbles at residential bases for unexpected reasons before new materials become available by the next return residential move. The accumulation of cobbles at some sites and the supposedly wasteful manner of cobble use mentioned earlier do not seem to reflect such a risky situation. In addition, another problem is the feasibility of the residential mobility strategy in relation to socioeconomic factors like territoriality and lean season/year economy. This mobility strategy is a possible option only in the case that the fluctuations in resource availability differ between adjacent or distant regions, and that the region which one group of people want to move into is not occupied by another group. Otherwise, staying at the present location and stabilising food supply by increasing diet breadth and storing food are inevitable options (Kelly 1991).

In the case of the Fayum and the Nile Valley, the variety and seasonality of available wild food resources in both regions must have been the same. Essential resources in the Fayum such as fish and waterfowl were quite seasonal, and this was also the case in the Nile Valley (Hassan 1984b). There are some data about the seasonality of subsistence activities in the Fayum Neolithic (Brewer 1989a; 1989b). The most popular fish caught by Fayum Neolithic people was clariid catfish. Clariid catfish inhabit shallow water all the year around, but according to the study of the growth pattern of fish spines, Fayum people caught the fish most intensively when the lake level was rising in late summer, and when the lake level was lowering in late spring. Late summer is the spawning season of clariid catfish, and they are highly aggregated. Therefore, people could catch them abundantly. In late spring, clariid catfish must have been trapped in residual shallow pools of receding water, and people could catch them easily. Migratory waterfowl come to the Fayum in winter, and thus waterfowl hunting was basically a winter activity. The fluctuation of resource availability in the Fayum and the Nile Valley must have been almost identical, because both regions are fed by the same, sole water source, namely, the Nile. Even if spring water at particular locations in the desert and some rain water in winter were available, the success of subsistence activities in both regions was ultimately dependent on the Nile water. The Fayum resources may have been more vulnerable to droughts, because the water level of the lake has been subject to the annual influx of Nile floodwater through the Hawara Channel in the Nile-Fayum Divide and the water supply to the lake might be cut off during particularly low floods (Hassan 1986b: 494). Therefore, a residential move from the Fayum to the Nile Valley could have been an option to mitigate food resource shortages caused by the failure of annual Nile floods.

However, it is doubtful that the Nile Valley was an entirely uninhabited area where 'refugees' from the Fayum came in to exploit wild food resources freely, though there are no demographic data for these regions in this period. The original inhabitants of the Nile Valley must have claimed the ownership of particular resource-rich locations, and the outsiders would

not have been allowed to exploit the resources without socioeconomic relations. Ethnographic studies have shown that hunter-gatherers maintain a network of kin ties across wide regions and use a variety of mechanisms to reinforce reciprocity between particular partners in different geographic locations and to allow mutual territorial access in order to buffer temporal local resource scarcity (Cashdan 1992: 248 and 259*ff*). Even if there were peaceful, risk-sharing ties between the Fayum and Nile Valley inhabitants, given the general parallelism of resource fluctuations in both regions, it is likely that the Nile Valley inhabitants tended to try to limit the access which the Fayum inhabitants wanted to essential food resources, especially as population increased in both regions. This must have encouraged or forced the Fayum inhabitants to stay within the Fayum and to look for other solutions to survive occasional lean periods. It has been argued that the Fayum people resided in the Fayum for most if not all of the year, because wild food resources were almost constantly available even though they were seasonal (Wetterstrom 1993: 209-210), but this could also be because the Fayum people had no freedom to exploit wild food resources in the Nile Valley. In fact, wheat/barley farming and grain storage started in the Fayum in the Neolithic period, and this is a more reasonable solution in the face of seasonal resource shortages and restricted residential moves.

7.7.2. Logistical mobility

The second possibility is that the Fayum inhabitants are classified as collectors who do not move their residential bases frequently, and that extra resource procurement was logistically organised by dispatching small task groups from residential bases on the lakeshores in the Fayum in the direction of the Nile Valley routinely and perhaps frequently. The logistical mobility strategy may have ensured a stable supply of flint cobbles no matter where the residential base was moved. However, from a viewpoint of human behavioural ecology, it must be explained if the cost of taking long distance trips for lithic raw materials really met the benefit of making flint tool-using activities more efficient, thereby achieving a high return rate (Kelly 2000: 69-72). Therefore, embedding lithic raw material procurement in other routine movements for subsistence activities could be an optimal solution to reduce opportunity costs. The question is whether this was feasible in the Fayum situation.

When Fayum Neolithic people collected some types of flint cobbles from the nearest Plio-Pleistocene deposits on top of Ilwet Hialla and Gebel Dakakin, they had to walk a distance of 15-20 km from their habitat on the northern shore of the Neolithic Moeris Lake, and to walk back the same distance. When they collected flint cobbles from the Plio-Pleistocene deposits at places like Gebel er-Rus in the Nile-Fayum Divide, then they had to walk a distance of 30-40 km from their habitat, and to walk back the same distance. Since it has been known in ethnography that a 20-30 km round trip was the maximum distance that hunter-gatherers could walk comfortably in a day in a variety of habitats (Kelly 1995: 133), it may have been possible for Neolithic cobble collectors to leave at dawn for Ilwet Hialla and Gebel Dakakin and to come back before dusk. On the other hand, there is little doubt that the Neolithic cobble collectors walking to Gebel er-Rus from the habitat on the northern shore had to stay overnight somewhere between the Fayum and the Nile Valley during their trips. Thus it seems unreasonable that during resource-rich years/seasons some task groups took trips to the Nile Valley in order to exploit similar wild food resources, and then came back to the Fayum while collecting flint cobbles on their way in addition to carrying a heavy load of food items. Therefore, it may be more likely that lithic raw material procurement was embedded in animal herding trips.

In spite of numerous bones of sheep and goats found at Fayum Neolithic sites (Brewer 1989b: table 4; Gautier 1976b: table I-7; von den Driesch 1986: table 1; Wenke *et al*. 1988: table 1), there is no information about how these newly-introduced domestic animals were actually tended by Fayum Neolithic people.

However, it is logically assumed that the people must have kept sheep and goats away from farming plots which were supposed to be near the lakeshore residential bases, particularly while crops were growing. If people often took pastoral grazing trips, they may have had a good reason to visit hilly and gravelly terrains of the Fayum Depression like Qasr el-Sagha and Gebel Qatrani as well as the Nile-Fayum Divide. Since these gravelly terrains are not good places for foraging and flint cobbles are almost inexhaustible, these gravelly terrains would have been beyond the territorial claims of any other group of people, and the cobble collectors would have had no difficulty in accessing the sources, and they could collect flint cobbles there and could even carry the cobbles on the backs of sheep and goats.

The use of sheep and goats for carrying things has not been known in ethnographic records, but the use of cattle for transporting heavy rocks to task locations for expedient toolmaking has been suggested at Early Ceramic sites in the Western Desert of Egypt (Close 1996a). Hence, it is possible that flint cobbles were transported on the backs of sheep and goats, and that cattle were used in the same manner in the Fayum Neolithic. This practice may probably explain how a large amount of flint cobbles could easily be transported long distances by herdsmen. This may also have been the case with the procurement of basalt blocks and petrified wood nodules in the rocky terrains 12-20 km to the north and northwest of the Neolithic lakeshore.

Another probable optimal lithic raw material procurement may be embedded in boat/raft fishing in the lake. According to the reconstruction of lake level fluctuations in prehistory (Wendorf and Schild 1976: 222-226), Gebel er-Rus abutted the eastern shore of the Neolithic Moeris Lake (**Fig.3.4**). The use of boats/rafts by people in this period has not been substantiated by archaeological evidence, but it has been argued that the appearance and dramatic increase in number of deep water fish in the faunal assemblages of Early Holocene sites in the Nile Valley might suggest the beginning of deep water fishing on boats/rafts in the Nile (Van Neer 1989: 54-55; 2004: 257). In the case of the Fayum, the presence of a certain number of deep water fish like Nile perch in both Epipalaeolithic and Neolithic faunal assemblages has been revealed, and it has been suggested that deep water fish might have been caught by netting or angling in the open, deeper water of the lake (Brewer 1989b: 113). However, most of the Nile perch found through recent excavations at Kom K and Kom W are not large-sized adults that surely inhabit the deeper waters of the lake but are juveniles that can inhabit shallow water (Wim Van Neer, personal communication 2007). Therefore, it is unlikely that the inhabitants of Kom K and Kom W practised deep water fishing with the aid of boats/rafts. However, this does not necessarily mean that boats/rafts were never used at all in the Fayum Neolithic. It is still possible that they were used by the inhabitants of other locations in the Fayum to enable occasional deep water fishing during trips on the water from the northern shore to Gebel er-Rus on the eastern shore, and this must have made the transport of procured flint cobbles much easier.

If lithic raw materials were really collected by herdsmen or fishermen and not by the toolmakers themselves, it is possible to assume that the cost of obtaining raw materials was virtually zero for the toolmakers and hence the use of the raw materials by the toolmakers tended to be expedient and even wasteful. Such division of labour in the sequence of core reduction is worth considering, especially when the costs and benefits are supposed to be important determinants of which materials are chosen and which techniques are employed.

The next question as to how frequently or at what time the Fayum Neolithic people moved between the Fayum Depression and the Nile Valley for lithic raw material procurement is a key to consider further their basic mobility and subsistence strategies. Considering the dense accumulations of flint cobbles at some sites, it is unlikely that trips for lithic raw material procurement were planned and carried out during emergencies or at times when the raw materials became scarce or depleted at the

residential bases, but more likely that procurement occurred frequently, regardless of the abundance of materials at residential bases, as exemplified by ethnographic records (Gould and Saggers 1985: 120). This situation in the Fayum may support the above-mentioned assumption that lithic raw material procurement might be embedded in routine animal herding or boat/raft fishing trips.

7.7.3. Eclectic mobility

In terms of the possible embeddedness of lithic raw material procurement in the basic mobility and subsistence strategies, it is argued that flint cobble procurement could have normally been achieved by small task groups, through logistical trips from residential bases. A problem with this possibility is that there is no evidence for substantial dwellings at large sites like Kom K and Kom W, which are supposed to be residential bases. Hence it is not certain whether the Neolithic people really maintained any central place while adopting a logistical mobility strategy in a strict sense, as expected in the central place foraging model. Since the geographic stability of the sites is obvious even though they may not have been occupied throughout the year due to inundation or desiccation, it is presumed that the Neolithic people adopted an eclectic mobility strategy depending on the fluctuating situation, instead of choosing one from the two extreme strategies and sticking to it.

It is probable that the Fayum Neolithic people maintained several residential bases on the lakeshore and moved between them, or repeatedly aggregated and dispersed within the Fayum Depression. During certain seasons or years, people stayed at a particular residential base, and from there, they organised logistical trips for foraging and herding, depending on necessity. When the essential resources within an easy walking radius of the residential base were depleted and/or the residential base became less comfortable due to the accumulation of trash or due to changing conditions of wind, sunlight and shade, people decided to move their residential base to other resource-rich locations or more comfortable locations, and continued similar logistical trips for additional resources. The people could return to the original place when the essential resources became available again or the living condition became better again.

7.7.4. Non-embedded lithic raw material procurement

It has so far been argued that lithic raw material procurement was embedded in general mobility and subsistence strategies. But it may be worthwhile to consider lithic raw material procurement in terms of a lack of such embeddedness, because the wide variety of lithic raw materials may have derived from more than the several sources which were accessible by routine herding trips, and because there are actually examples of, and arguments about, lithic raw material procurement being disembedded from regular subsistence activities. Contrary to the optimal foraging model, it has been argued that optimal exploitation of food resources and lithic raw materials at specific sites might co-occur but that this would not always be the case for other sites, and in many cases, procuring lithic raw materials would involve a significant extra expenditure in time and effort, and would create scheduling conflicts (Hayden 1989: 9).

Ethnographic studies have shown that people make special efforts to visit distant places for obtaining lithic raw materials which are known to have superior technical properties, and avail themselves of any edibles along the way (Andrefsky 1994: 23; Gould and Saggers 1985: 120). In such cases, people clearly state that their primary aim is to procure lithic raw materials even though they do other things on their way. This means that other activities were embedded in lithic raw material procuring trips. Since such ethnographic records come from people who are no longer in the habit of making and using stone tools, it is not certain that special trips for lithic raw materials were common among prehistoric people whose primary material for toolmaking was stone. Nevertheless, it must be taken into account that lithic raw material procurement

could be carried out in the same manner as foraging trips for food resources, apart from the general mobility and subsistence patterns. In other words, it may be assumed that lithic raw material procurement was made possible by the toolmakers' primary concern with, and accessibility to, source areas, and not induced by their pre-existing mobility/settlement and subsistence patterns (Andrefsky 1994; Bamforth 1986). Therefore, even in the Fayum Neolithic, it can be said that people may have organised small task groups and took long distance trips especially for procuring lithic raw materials, or that pastoral grazing may have habitually been embedded in the lithic raw material procurement trips and herdsmen intentionally took the herds of sheep and goats close to lithic raw material sources.

Moreover, lithic raw material procurement is not necessarily embedded in purely subsistence-oriented activities, but can be embedded in other non-foraging activities. It has been known in ethnography that foragers make information-acquiring or monitoring trips specifically to determine the location of resources or resource patches and when and where to move camp in the near future, and travel very long distances (Kaplan and Hill 1992: 186-187; Kelly 1995: 97-98). Furthermore, it has been recorded in ethnography that people regularly visit their families and relatives in remote areas in order to maintain close ties and to find mates, and also travel to exotic locations of symbolic or religious importance regularly or occasionally, in order to maintain links with important locations (Gould and Saggers 1985; MacDonald and Hewlett 1999; Whallon 2006). It is possible that lithic raw material procurement may have habitually been embedded in these kinds of mobility. Such a manner of lithic raw material procurement must also be taken into account in the Fayum Neolithic.

Lastly, although this is beyond the argument on mobility strategies, it must be mentioned that Fayum Neolithic lithic raw materials could have been obtained through long distance exchange as well. Since exotic materials like Red Sea shells, Mediterranean Sea shells and Nubian diorite did actually begin to come into the Fayum in the Neolithic period (Caton-Thompson and Gardner 1934: 87-88), it is certain that long distance exchange networks existed in this period. It would be no great surprise if some types of lithic raw materials were also obtained from distant regions through exchange.

7.8. Mobility pattern and lithic raw material economy

How flint cobbles were distributed from place to place within the Fayum is a key to understand the mobility pattern and lithic raw material economy of the Fayum Neolithic people. Remarkably dense concentrations of a wide variety of unworked/worked cobbles at Kom K, Site XA and Kom W, and concentrations of less various unworked/worked cobbles at Site L, Site E29H1, Site X, Locality 'Calcified Shrubs' and the Site V Depression may possibly imply that the cobbles were first brought to large residential bases and stockpiled there, and then, several cobbles were selectively transported to other small, temporary field camps or locations without reduction, and tools were made at the task locations according to arising needs.

This presumed logistical manner of cobble transportation seems to contradict the well-debated idea of curated technology. This states that special-purpose tools are made at residential bases in advance of going to achieve expected tasks at distant specific sites in an environment where lithic raw materials are not readily available, and then the tools can be repaired and recycled at the task locations if necessary (*e.g.*, Bamforth 1986; Binford 1979; Odell 1996). Moreover, such cobble transportation seems to be inconsistent with the argument regarding the concept of mobile toolkits, which defines that optimising the utility of artefacts relative to their weight is the single most important consideration in making up assemblages of artefacts which mobile people forage around with, and that it is most rational to remove unusable parts of cobbles and to reduce the cobbles to tool blanks of portable small size and light weight prior to departure (Kuhn 1994: 436*ff*; Shott 1986).

However, if curation is more generally defined as the preparation of raw materials in anticipation of inadequate conditions (materials, time, or facilities) for tool-using activities at the time and place of use, or, as the mitigation of the incongruity between availability of tools or raw materials and the location of tool-using activities (Nelson 1990: 63), then, the logistical manner of cobble transportation in the Fayum Neolithic habitat may be called a kind of curatorial behaviour. It can be said that transported and stockpiled cobbles facilitated not only making tools expediently but also making elaborate tools in anticipation of future needs, namely, in a curatorial manner, according to different conditions.

One reason for such lithic raw material transportation in the Fayum may be that the tasks at the sites like Site L, Site E29H1, Site X and the Site V Depression did not entail desperate stalking but rather ambushing, watching or waiting. Therefore, the task performers could afford to sit down and to spend time making tools from cobbles according to needs, without being bothered by an idea that time should be invested in toolmaking in advance of arriving at the task locations, in order to maximise food procuring time (Torrence 1983). It is presumed that their subsistence activities were not under time-stress, and that the availability of food resources was more or less predictable. Such activities must be a combination of more promising and predictable fishing and wild plant harvesting and less predictable game hunting and waterfowl hunting on an encounter basis and trap hunting on a fortuitous basis. Another reason for cobble transportation may be that the unique functional properties of whole cobbles as tools were highly appreciated. Large cobbles with thick edges can be very useful and efficient for a variety of heavy-duty tasks, for which smaller flake tools are entirely inadequate and inefficient (Kuhn 1994; Morrow 1996). The task performers must have found it more economical and flexible to transport unworked cobbles rather than tool blanks and/or finished tools and to leave them at the task locations, no matter how burdensome the transportation of heavy cobbles was. This behaviour suggests long occupation or regular reuse of the sites in order to take advantage of the stockpile.

It is difficult to interpret the enormous accumulation of unworked/worked flint cobbles at Site XA with little clear evidence of tool-using activities. This site is located close to a large meandering wadi which runs from the north, and there may have been some strategic reasons for stockpiling cobbles there. Considering that the meandering wadi runs in the direction of Ilwet Hialla via Umm es-Sawan, it is likely that the accumulation of flint cobbles at Site XA was left by the people who returned from trips to the flint source area. It is assumed that the site may have functioned as a cache of lithic raw materials for those who passed by for foraging. As has been argued on the basis of ethnoarchaeological studies (Binford 1979), logistical operations for foraging trips are supported by a wide-ranging caching strategy ensuring the dispersion in the habitat of goods and materials which might be needed later. When people dropped in at the lithic raw material caches during foraging trips, it may have been most optimal for them to pick up at least one or two cobbles in addition to smaller and lighter tool blanks and/or finished tools, thereby realising the versatility and lightweight of overall mobile toolkits for any contingent event.

7.9. Expedient toolmaking and curation

How flakes obtained from the cores described earlier were actually used is not easy to demonstrate due to the paucity of collected samples. Nevertheless, tools collected along with cores at the sites studied and their vicinities provide some ideas about how flakes were dealt with by toolmakers at task locations.

7.9.1. Uses of half-split discoids

The largest flake which could be obtained from a cobble is a half-split discoid. Interesting examples from Site X and the Site V Depression show that a half-split cortical discoid could be shaped into a sidescraper or endscraper by

retouching one long or short margin of the discoid continuously from the ventral to dorsal face (**Fig.7.10**-3: Site X-14 and **Fig.7.45**: the Site V Depression-8). It is not certain whether this way of use was common. It is probable that half-split discoids were normally used as unifacial/ bifacial discoidal cores to obtain non-cortical flakes. However, one example from the Site V Depression shows that a half-split unifacial discoidal core was shaped into a sidescraper by retouching one long convex margin of the discoid continuously from the already exhausted ventral face to the dorsal face (**Fig.7.46**: the Site V Depression-9). In other words, an exhausted half-split unifacial discoidal core was recycled as a sidescraper.

Half-split unifacial discoidal cores were collected not only at the sites studied but also in an isolated situation. These discoids are already knapped from the margin of the dorsal face to the ventral face in their entire circumference to an exhaustive extent and became thin (**Fig.7.47** and **Fig.7.48**). Therefore, they look like unifacial axes or scrapers. However, since there is no clear trace of such uses on the edges of the discoids, it can be considered that they were actually cores, and that they were discarded there because of exhaustion. These examples seem to suggest that people on the move did not always bring whole cobbles but took half-split cobbles probably for reducing weight, and obtained non-cortical flakes from the discoids when necessity arose.

7.9.2. Uses of primary flakes

The size of flakes obtained from any kinds of cores used in the Fayum Neolithic is already determined by the size of cores, and hence the flakes cannot be larger than 9-12 cm in length and 7-10 cm in width. Actually, many of the previously collected and published Fayum Neolithic bifacial tools like arrowheads and sickle blades are shorter than this size. Except for flakes from unifacial discoidal cores, most flakes from the other cores are primary flakes, because many cores are not reduced to an exhaustive extent. Primary flakes obtained from flat cobbles are naturally flat, and hence are suitable for making straight tools.

How these primary flakes were actually utilised is a key to understand tool making in the Fayum Neolithic. The tools made on primary flakes have been classified by Caton-Thompson as 'pebble-backed knives and scrapers' (Caton-Thompson and Gardner 1934: 21, pl.XLI). It has also been observed that even relatively small bifacially-retouched tools in the Fayum Neolithic still retained cortex in the middle of the dorsal face (Shirai *in press*). This means that these tools were made on primary flakes, and that primary flakes were absolutely not waste products but rather the most favoured pieces for making tools. A number of interesting examples of the various uses of flakes and the various stages of tool making were collected at the Site V Depression. They will be used for a discussion about expedient and curated tool making.

The first examples are the simplest uses of primary flakes as denticulates and sidescrapers with partial retouch at an acute angle of less than 45 degrees. In the case of a denticulate (**Fig.7.49**-1) and a sidescraper (**Fig.7.49**-2), one long margin of an oval or elongated primary flake was continuously retouched from the ventral to dorsal face, thereby making a slightly convex cutting edge. There is no retouch on the ventral face. In the case of an endscraper (**Fig.7.49**-3), one long margin and one short margin of a rectangular or trapezoidal primary flake was continuously retouched from the ventral to dorsal face, thereby making a cutting edge which forms a corner at an angle of approximately 90 degrees. There is no retouch on the ventral face. Primary flakes could be shaped into denticulates in a different way. One denticulate (**Fig.7.50**-1) shows that one long margin of an elongated primary flake was continuously retouched from the dorsal to ventral face at an obtuse angle of more than 45 degrees, thereby making a denticulated cutting edge. There is no retouch on the dorsal face. In the case of denticulates, flake scars on either the dorsal face or the ventral face tend to be wider and longer, suggesting the use of a hard hammer, whereas in the case of scrapers, flake scars on the dorsal face tend to be narrower and shorter, suggesting the use of a



Fig.7.45. Endscraper made on a half-split discoid collected at the Site V Depression



Fig.7.46. Sidescraper made on a half-split unifacial discoidal core collected at the Site V Depression



Fig.7.47. A half-split unifacial discoidal core collected 500 m to the northeast of Kom W



Fig.7.48. A half-split unifacial discoidal core collected 500 m to the northeast of Kom W

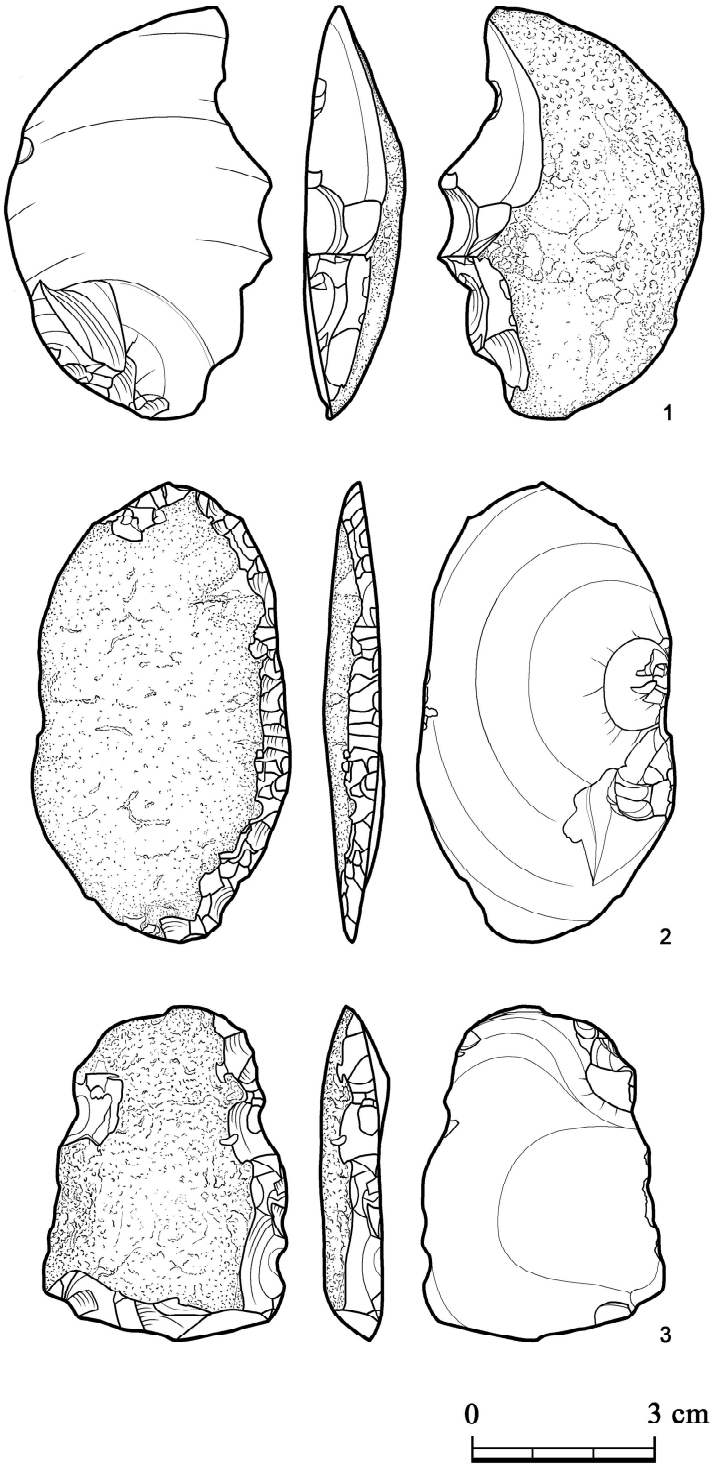


Fig.7.49. Tools collected at the Site V Depression

soft hammer. In these cases, there would be no considerable difference in time and energy expended for retouching, and this seem to be literally expedient tool making.

The second example (**Fig.7.50**-2) is an advanced version of the denticulates or scrapers made on a primary flake described above. The primary flake with retouch on one convex margin of the dorsal face was turned over, and then another convex margin of the primary flake was retouched continuously from the dorsal to ventral face. As a result, the entire circumference of a leaf-shaped flake is retouched either from the ventral to dorsal face or from the dorsal to ventral face.

The third example (**Fig.7.50**-3) is different from the second example described above in terms of the treatment of the ventral face. The ventral face of a primary flake was continuously knapped from the circumference of the dorsal face, while rotating the flake in the same manner as that of a discoidal core. Then, one longer convex margin of the flake was continuously retouched from the ventral to the dorsal face, but more than 90 % of cortex remains on the dorsal face. The resultant tool can be called a unifacial denticulate or scraper. However, a strange thing is that the thorough removal of flakes from the ventral face is absolutely unnecessary work for creating one cutting edge on one long margin of the primary flake. Therefore, it is probable that the toolmaker recycled discoidal cores and trimmed them into denticulates or scrapers, or that these items were still in the middle of the production of bifacially-retouched, leaf-shaped tools, even though they may have actually been used.

The fourth example (**Fig.7.51**-1) is different from the third example described above in terms of the treatment of the dorsal face. The dorsal face of a primary flake was continuously knapped from the circumference of the ventral face, while rotating the flake in the same manner as that of a discoidal core, and the cortex was mostly removed by large scars which covered the dorsal face. And then, one long margin of the flake was minimally retouched from the dorsal to ventral face, and the ventral face was left almost unretouched. The resultant tool can also be called a unifacial denticulate or scraper. But again, the thorough removal of cortex from the dorsal face looks absolutely unnecessary for creating one cutting edge on one long margin or two cutting edges on two long margins of the primary flake. Therefore, it is highly likely that these items were still in the middle of the production of bifacially-retouched, leaf-shaped tools, even though they may have actually been used.

The third and fourth examples strongly suggest that making bifacially-retouched tools was not necessarily an undisturbed, straightforward process which was immediately fulfilled in a given moment for specific purposes, but instead was a gradual process, and must be regarded as a part of a long reduction sequence. In other words, these examples demonstrate that the border between supposedly expedient, partly-retouched tools and supposedly curated, bifacially-retouched tools is not always clear, and there are a number of 'transitional' tools between them. Such 'transitional' tools could be used and abandoned before the completion of the final elaborate form. It may be said that seemingly 'finished' bifacial tools are merely contingent end products of a long reduction sequence, and that they could become different from those originally designed in the mind of toolmakers. This observation is consistent with an argument regarding a re-definition of curation as a continuous variable and a property of individual tools, and not of entire tool assemblages (Shott 1996).

It can be said that most bifacially-retouched tools were actually made by removing cortex on the dorsal face of unifacial denticulates or scrapers in the third example as much as possible, while rotating the unifacial items in the same manner as that of a discoidal core. The resultant bifacial items can be finally shaped into axes (**Fig.7.51**-2), knives, and leaf-shaped, triangular, or concave-based arrowheads. As mentioned earlier, well-debated ideas of curated technology have referred to special-purpose tools which were made at residential bases in advance of going to achieve expected tasks at distant

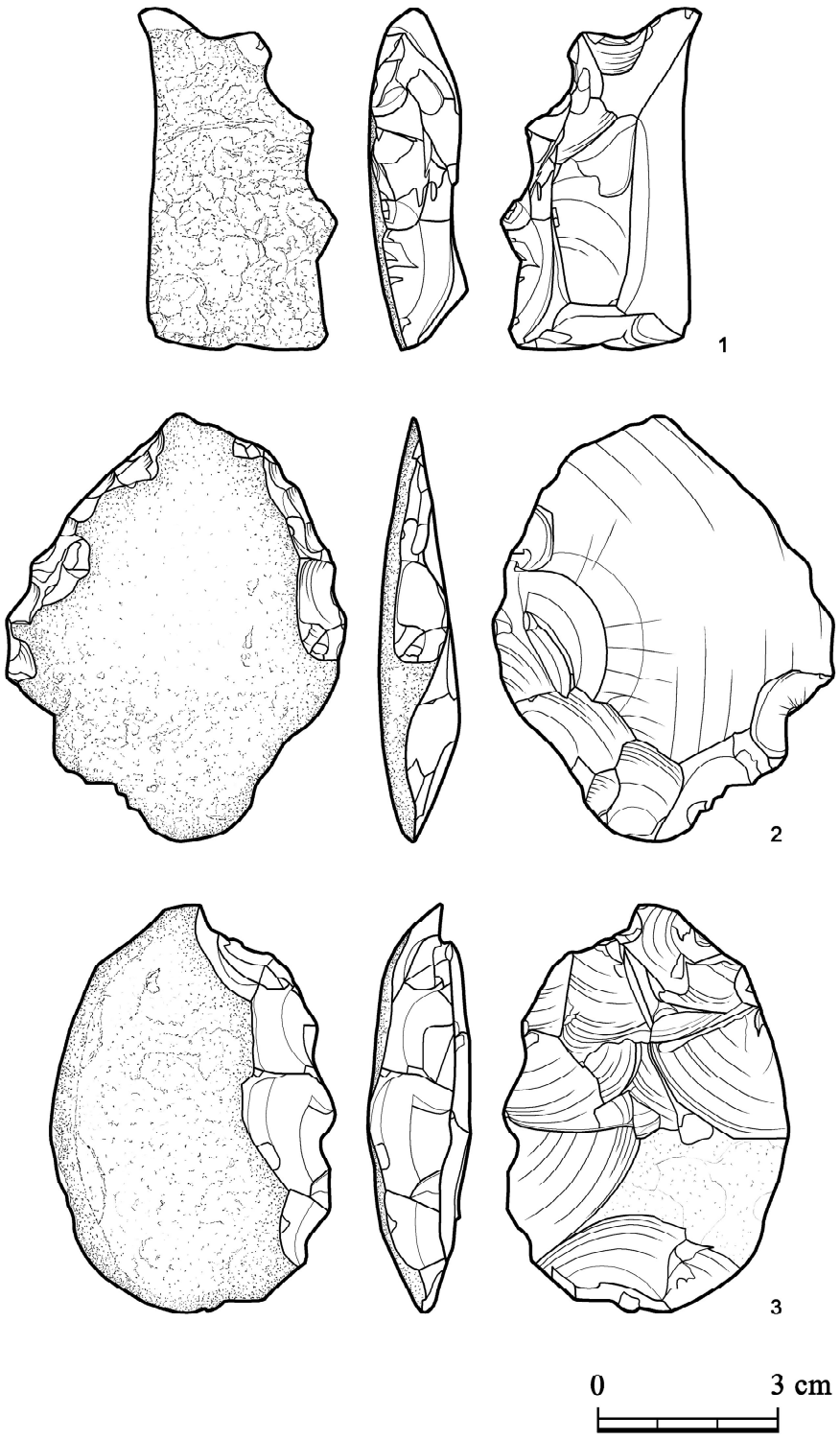


Fig.7.50. Tools collected at the Site V Depression

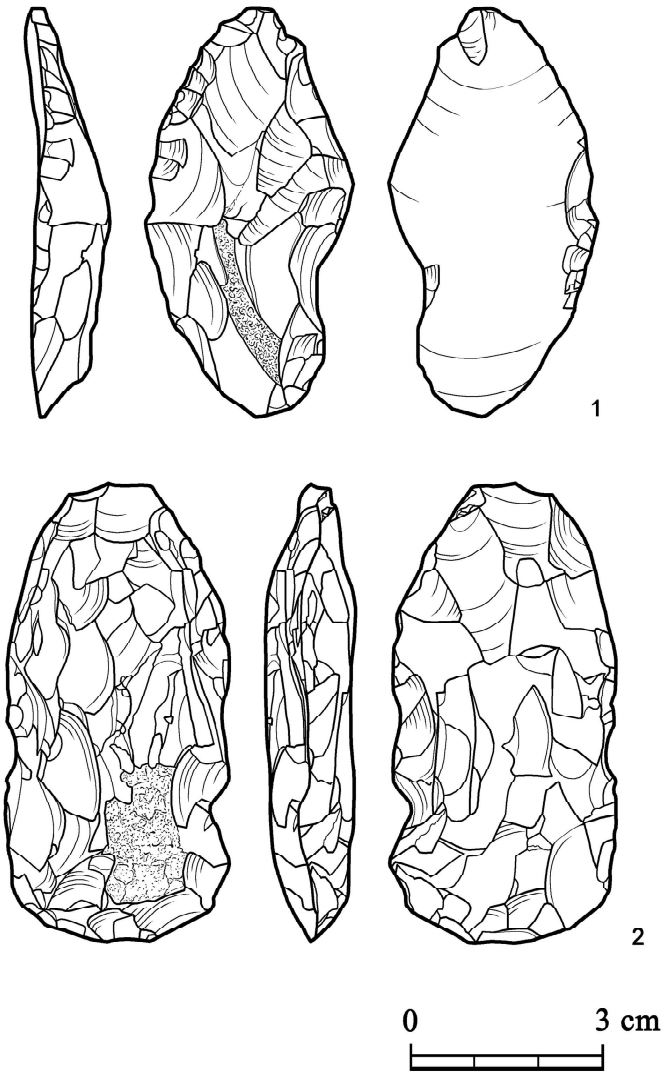


Fig.7.51. Tools collected at the Site V Depression

specific sites and were repaired or recycled there. However, the manner of tool making observed at the Site V Depression suggests that bifacially-retouched tools were actually being made at task locations. Moreover, it is probable that the making of bifacially-retouched tools was initiated at task locations presumably under a relaxed condition, because if the toolmakers had been under severe time-stress when they had been engaged in food procuring and processing, they should have finished making tools in advance of arriving at the site. As has been discussed, it appears that the major food procuring activities of the Fayum Neolithic people did not entail desperate stalking but rather ambushing, watching or waiting. Therefore, it is quite possible that they made or initiated to make formal tools not only for immediate needs but also for future needs, in order to relieve boredom while ambushing, watching or waiting.

It must be stressed that primary flakes were not the sole materials used for making tools which could eventually develop into elaborate bifacial ones, but this popularity of primary flakes in the Fayum Neolithic must be the reason for not only the transportation of whole cobbles

without decortification from source areas to habitation sites and from the habitation sites to task locations, but also the discard of cobbles in the early stages of core reduction.

7.9.3. Uses of other cortical flakes

Another unique types of flakes which were probably often used for making formal thin tools are the oval flakes which have curved cortical parts on the margin but have no cortex on the dorsal face (**Fig.7.52**-1 and **Fig.7.52**-2). These curved cortical parts on the margin of the flakes are apparently parts of the circumference of a discoidal core, because the cortical parts form an angle of approximately 90 degrees against both the ventral and dorsal faces. Hence it can be understood that these flakes were obtained from the ventral face of a discoidal core made on a half-split cobble, or a bifacial discoidal core made on a flat cobble by striking the cortical margin of the discoid. In the case of the first example (**Fig.7.52**-1), a striking platform and a percussion bulb on the proximal end and a hinged or stepped distal end of the flake seem to have been taken off, and consequently, a flat and nearly rectangular flake with cortex on the short lateral margins is formed. Then, this flake is rotated at an angle of 90 degrees, and one cortical lateral margin becomes the basal part of an elongated flake, and the long lateral margins can be retouched. The final form of the elongated flake can be a projectile point or a knife. In the case of the second example (**Fig.7.52**-2), a cortical part remains on one lateral margin, and another lateral margin is thoroughly retouched from both faces.

The tools made on these types of flakes have already been classified by Caton-Thompson as 'pebble-butted points and knives' and 'pebble-backed knives and scrapers', and have been recognised as the largest and most various tool classes (Caton-Thompson and Gardner 1934: 21, pl.XLI). It is likely that flat flakes without percussion bulbs on the ventral face and ridges of flake scars on the dorsal face were favoured by makers of pebble-butted points and knives, because removing them in the process of bifacial thinning is sometimes difficult. An example of pebble-backed knife made on this type of flake (**Fig.7.52**-2) shows that the toolmaker made a special effort to remove a percussion bulb at the proximal end of the ventral face, even though such an effort seems to be unnecessary, because the feathered distal end of the flake has a long, sharp cutting edge, and hence it can be used as a pebble-backed knife without additional retouch. Instead of removing a percussion bulb on the cortical proximal end of an oval flake, the ventral face is repeatedly flaked from the cortical margin of the dorsal face, thereby a percussion bulb was removed, and the flake was made thinner. Then, the distal end of the dorsal face was flaked from the ventral face, whereby a cutting edge was made. Therefore, these examples of the preparation of cortical flakes are definitely not that of expedient tool making, but must be regarded as a kind of curated technology.

The generally known prevalence of pebble-backed/butted tools in the Fayum Neolithic tool assemblage and the reconstructed sequence of bifacial tool making may suggest that the size, shape and thickness of primary flakes obtained from flat cores and flakes with marginal cortex obtained from discoidal cores were the easiest for Neolithic toolmakers to handle. In other words, these facts may reflect the cultural preference of the Fayum Neolithic toolmakers, because in other cultures, non-cortical flakes and blades are the most preferred raw materials for making formal tools, and primary flakes and other cortical flakes are waste products.

7.9.4. Uses of non-cortical flakes

The last but the commonest and hardest-to-define type of flakes which could have been used for tool making in the Fayum Neolithic were all kind of flakes other than the flakes described above. At Site XA, where all lithic artefacts were collected in a 10 m x 10 m square, flakes and chunks of various sizes and shapes with various extent of cortex were produced (**Tables 7.14**, **7.15** and **7.16**), though they are generally characterised by an unfacetted platform and hard hammer percussion bulb. It is difficult to

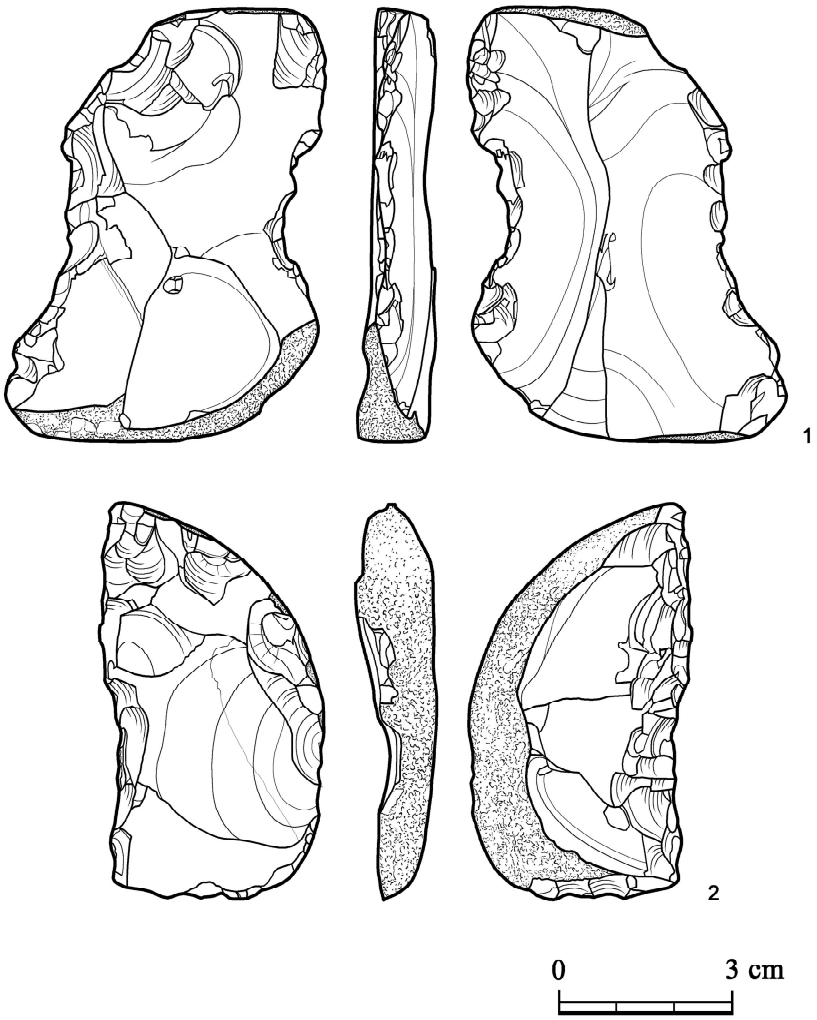


Fig.7.52. Tools collected at the Site V Depression

interpret the abundance of large and thick flakes of various extent of cortex, which would be usable for further reduction, left unused at Site XA. It may suggest that cobble knappers had an intention to produce such flakes in large number for use, but it is also possible that those flakes are actually waste products and hence left unused.

A successfully refitted core made on a flat and oval cobble, which was collected at Site L, shows that after a large primary flake was obtained from one flat face of the cobble and was taken away, the flake scar was used as a striking platform and three quarters of the circumference of the cobble were knapped off by hard blows, whereby several thick cortical flakes were produced (**Fig.7.53**). These thick cortical flakes were left unused, and instead, two thick non-cortical flakes were knapped off from the resultant cubic core and were taken away. It is not certain how such non-cortical flakes were utilised. But no matter how wasteful this manner of knapping is, obtaining such non-cortical flakes may also be the reason why cobbles at Site XA were knapped so roughly to produce numerous unused thick cortical flakes.

	n	%
primary chunk	4	0.76
chip/chunk	64	12.14
primary flake	44	8.35
flake from single platform core	217	41.18
flake from opposed platform core	15	2.85
flake from ninety-degree core	7	1.33
flake from multiple platform core	89	16.89
flake from discoidal core	13	2.47
unidentifiable flake	29	5.50
primary blade/bladelet	5	0.95
blade/bladelet from single platform core	31	5.88
blade/bladelet from opposed platform core	3	0.57
blade/bladelet from ninety-degree core	1	0.19
blade/bladelet from multiple platform core	2	0.38
unidentifiable blade/bladelet	3	0.57
total	527	100.00

Table 7.14. Debitage products collected in a collection square at Site XA

	n	mean (cm)	st.dev
length	40	3.23	1.36
width	40	2.93	1.30
thickness	40	0.89	0.50

Table 7.15. Metrical data of measured primary flakes collected in a collection square at Site XA

	n	mean (cm)	st.dev
length	376	3.25	1.37
width	376	2.81	1.30
thickness	376	0.86	0.49

Table 7.16. Metrical data of measured debitage products other than primary flakes collected in a collection square at Site XA

7.9.5. The progressive manner of making bifacially-retouched tools

The co-existence of a number of cobbles, debitage products, finished bifacial tools and broken bifacial tools at Kom K and Kom W, as revealed by Caton-Thompson's excavations and my research, can certainly fit the concept of curation. One could assume that the inhabitants of Kom K and Kom W transported flint cobbles from distant sources, and stockpiled them, making formal tools in anticipation of special tasks at distant sites. Upon return from those tasks, they resharpened and recycled broken tools as well as complete ones. On the other hand, one previous study at Kom W demonstrated that the majority of Neolithic tools were expediently-made, informal flake tools such as notches, denticulates and scrapers, and that bifacially-retouched formal tools were quite minor components of the assemblage (Kozlowski and Ginter 1989: 170*ff*). The manner of tool making observed at the Site V Depression also suggests that expedient tool making and curated tool making could always co-exist sequentially according to need and spare time, and that originally expedient tools could develop into highly-curated elaborate tools.

There is no doubt that making bifacial tools is more labour-intensive and time-consuming than making partly-retouched flake tools. When a toolmaker decides to make a flint tool, he/she has a choice among various kinds of tools and ways to make tools. Which is chosen may depend on how much time it takes to make the tool and on the expected return from using the tool. In terms of human behavioural ecology, given the invested labour and time, it is not cost-effective if bifacial tools do not ensure higher returns or more efficient tool-using activities. Therefore, it has been argued that tool makers/users had to make a decision whether to spend less time getting raw material and making tools and to forage with the less effective, short-lived flake tools, or, to spend more time getting raw materials and making elaborate tools which would enable more efficient foraging and hence maximise returns. If a resource could be obtained or processed with a simple flake tool just as easily as with a bifacial tool, then flake tool production would probably be chosen over bifacial tool production, especially if raw materials suitable for bifacial tools were not readily available. One benefit of making bifacial tools would be that they could be used for a longer period of time (Kelly 2000: 70-72). But the progressive manner of bifacial tool making as described above can also average the cost of procuring raw material. Considering that the border between expedient tools and highly-curated elaborate tools is ambiguous, arguments



Fig.7.53. A refitted single platform core collected at Site L

such as which sites were more or less 'intensively' or 'sedentarily' occupied, on the basis of the presence or absence of supposedly expedient and curated tool assemblages, may not be significant.

7.9.6. Expedient toolmaking reconsidered

Another question is what the abundant fragmentary cores and informal flake tools observed at Kom W imply, in terms of expedient and curated tool making and the costs and benefits of technologies. It is probable that people at residential bases had less time to spare for meticulous tool making than those who got bored at field camps or watching locations, and that the people at residential bases had fewer opportunities of being required to respond to unanticipated needs. Therefore, it is likely that they tended to be satisfied with minimal technological preparation of tools for an expected range of household and communal tasks, but instead they had to take care of other things.

If an enormous amount of large and small debitage products, which were produced by knapping whole cobbles, were left scattered on the floor of household and communal areas in residential bases, razor-sharp edges of the debitage products would have been dangerous to barefoot residents and particularly for young children, who tend to pick up small things and to take them into their mouths. When people stayed at one residential base continuously, collective dumping of debitage products as well as other food refuse must have been really necessary and inevitable, in order to keep the living floor safe and tidy (Hardy-Smith and Edwards 2004). It is reasonable to think that even if tool making was performed at residential bases, debitage products would have been collected immediately and dumped away from the major household area of the residential bases, or deeply buried beneath the surface of the living floor, as has been observed at Epipalaeolithic sites in the X Basin and Z Basin.

Alternatively, it is plausible that reduction of whole cobbles, which would produce a large amount of debitage products at one time, was principally avoided at household areas of residential bases, and that recycling already exhausted cores collected from debitage middens in dumping area or workshop area by shattering was the common way of making tools. Fragmentary cores and informal tools at Kom W may reflect such economising behaviour. As has been suggested in a discussion about the definition of expediency (Bousman 1993: 69-70; Nelson 1991: 64-65), expedient tool making at presumably residential bases must be viewed as a planned response to expected tasks with least technological effort, and is different from

opportunistic tool making as an unplanned technological response to unanticipated tasks.

7.10. Development of bifacial technology in terms of design theory and behavioural ecology

A remarkable feature of the lithic technology of the Fayum Neolithic is the emergence of bifacially-retouched, formal tools. A number of beautifully-shaped arrowheads, knife blades, sickle blades and axes found at Kom K and Kom W by Caton-Thompson were made by bifacial technology. One major reason for the emergence of bifacial tools in the Neolithic would be that good quality large cobbles, which provided fine-grained durable flakes, became available. This causality has not yet been substantiated by meticulous lithic refitting studies, but is assumed on the basis of the coincidence of unprecedented cobbles and bifacial tools in Neolithic sites and the possible reduction sequence demonstrated so far, as well as the fact that bifacial tools of longer than the average cobble size are rare.

A question arises as to whether the needs of bifacial formal tools required toolmakers to look for good quality large cobbles, or the discovery of good quality large cobbles enabled toolmakers to think about developing elaborate bifacial tools. It is true that raw material procurement and the organisation of technology are mutually co-dependent (Odell 2001: 67), and thus, this way of questioning may lead to a chicken-and-egg argument. However, according to the principles of design theory, a tool must exist to solve a given problem, and tool design is a means of creating or adapting the tool form to meet functional needs within the context of given environmental, technological, social and economic conditions. Different kinds of constraints operate in the development of solutions for each problem, and elimination of one constraint may enable a new design (Hayden 1998: 3*ff*; Hayden *et al*. 1996). Therefore, it is significant to consider tool design and technological organisation by analysing each tool type in its own terms, identifying the constraints and design strategies represented by each, and combining them, and then to reach a better understanding of the entire assemblage.

7.10.1. Arrowheads and knives

Given the faunal data showing that both Epipalaeolithic and Neolithic Fayum people exploited the same species of fish and waterfowl in similar relative abundance, while using similar strategies during the same time of year (Brewer 1989a; 1989b), it is difficult to think that Neolithic people were particularly eager to increase the yield of fishing and fowling grounds or to improve the efficiency of fishing and fowling by technological innovation. However, most Fayum Neolithic arrowheads and knives made by bifacial technology are relatively large and heavy (**Fig.7.54** and **Fig.7.55**), and thus are apparently not suitable for fishing and fowling, but more suitable for large game hunting and butchering. Therefore, it must be assumed that these tools were first and foremost invented according to arising needs for hunting large animals that were dangerous but could provide a large amount of meat. Indeed, two bifacially-retouched, concave-based arrowheads have been found among the bones of a hippopotamus and an alleged elephant respectively (Caton-Thompson and Gardner 1934, 72 and 84). These findings clearly indicate at what kinds of target animals such arrowheads were shot. It has also been revealed that animals like hippopotamus and crocodile are less commonly found in Epipalaeolithic assemblages but are found more in the assemblages of the Neolithic and later periods in the Fayum (Gautier 1976b: table I-7; Wenke *et al*. 1988: table 1). These facts suggest that new hunting weapons and butchering tools were invented especially for such large, aggressive and thick-skinned animals.

The appearance of enigmatic flint balls at Kom K and Kom W in the Neolithic period, as discussed earlier, may be put into this context and can be argued as a part of a new tactic for hunting dangerous animals. Namely, Fayum Neolithic hunters threw flint balls at these animals and immobilised them, and then

delivered the fatal spear shot. In other words, it may be said that a new adaptive strategy for hunting previously less-exploited animals required reliable tool systems in which tools were specially designed to accomplish risky tasks at the time of use without failure in predictable situations, at the expense of multifunctionality or maintainability, which are the optimal design alternatives for tool systems needed in unpredictable situations (Bettinger 2001; Bleed 1986; Torrence 1989).

The reliable tool systems would be realised through taking mainly material, technological, and socioeconomic constraints into consideration. As already discussed, regular access to the sources of large flint cobbles which have better flaking quality and provide better and longer cutting edges was somehow made possible in the Fayum Neolithic, and this eliminated at least a material constraint on the development of elaborate tools of a certain size. It can be argued that elaborate, adaptive tools emerged as a consequence of the elimination of this constraint, but after a long evolutionary process in which many attempts of technological innovation were made and one of many, more or less equally acceptable solutions was selected according to variable circumstances (Fitzhugh 2001).

It is apparent that large and robust knives made by bifacial technology are more useful for butchering thick-skinned large animals than tiny bladelets, and the resharpening potential of bifacial knives under intensive use conditions must also have been highly appreciated. In contrast, the value of large bifacial arrowheads is not as apparent as bifacial knives. According to experimental studies, although bifacial technology, and pressure flaking in particular, can make a sharp, thin, formal projectile tip, it is not robust and fractures easily during manufacture and use (Whittaker 1994: 161-166). It has also been argued that projectile points would have rarely been designed with durability in mind because projectile points of any size and shape tend to break so easily under any use conditions that durability beyond a few shots or throws is not an achievable goal (Cheshier and Kelly 2006). Moreover, the possibility of reusing bifacially-retouched projectile points, with or without modification, is not much higher than that of reusing unretouched flake projectile points (Odell and Cowan 1986: 205*ff*).



Fig.7.54. Concave-based arrowhead and hollow-based arrowhead collected at Camp II



Fig.7.55. Knife blades collected at Site LX

Therefore, the relative merits of a bifacial spearhead must be evaluated by whether it can make a fatal wound on a target animal by the first shot. Another experimental study has demonstrated that bifacially-retouched thin projectile points penetrated more deeply into animal bodies than informal flake points did, and are less likely to bounce off a target animal especially if hafted onto shafts (Odell and Cowan 1986: 203 and 208-209). It is probable that compared with microlithic or flake equivalents, large bifacial arrowheads proved their better killing power and higher reliability when they were used for hippopotamus and crocodile, and thus were selected for.

The costs of procuring good quality flint cobbles from distant source areas and making reliable, specialised tools for hunting and butchering hippopotamus and crocodile are certainly very high. However, according to a prediction of optimal foraging models that foragers employing costly technology need to exploit resources whose return rates are high (Bousman 1993: 64), it is presumed that the benefits of obtaining a large amount of meat from these animals met these costs. It can be said that the development of reliable tool systems in the Fayum Neolithic, as shown by elaborate bifacial arrowheads and knives, suggests the addition of a high cost and high return exploitation or resource maximisation strategy in predictable resource patches to the low cost and low-to-high return exploitation or time minimisation strategy of the preceding Epipalaeolithic period. Or, if the procurement of cobbles was not so costly due to its embeddedness in herding or fishing trips taken by non-toolmakers, the development of elaborate bifacial arrowheads and knives should better be regarded as a part of a risk minimisation strategy.

7.10.2. Axes, gouges, and planes

The development of reliable tool systems would also be the case with bifacially-retouched and ground axes, gouges and planes (**Fig.7.56**). These new tools, which first appeared in the Neolithic period, could not be realised without cobbles of fist size, and hence, getting access to the sources of large cobbles was essential. It must be better to assume that arising needs for new activities in the Neolithic period like tilling soil, and cutting, whittling, and carving wood required specialised toolkits, and that those bifacially-retouched and ground tools proved not only their advantage compared with microlithic tools or flake tools but also their cost-effectiveness in terms of their resharpening possibility under intensive use conditions.

The coincidence of the emergence of bifacially-retouched and ground tools with an increasing wood-cutting requirement has been reported elsewhere (Hayden 1989: 14-15), and this may also be the case in the Fayum Neolithic. Considering that most of the Fayum Neolithic bifacial tools are not hand-held tools and cannot be used without being hafted, the development of various bifacial tools would not have been realised without the extra costs of getting wood branches and making shafts and handles, which are generally more time-consuming and labour-intensive than making hafted stone tools (Keeley 1982: 800). Therefore, it is quite likely that bifacially-retouched gouges and planes were preferred due to their high resharpening possibilities under intensive use conditions. Furthermore, the beginning of pottery production in the Fayum Neolithic period must also have required a large amount of firewood for firing pottery vessels in bonfire, and this may have led to the invention of handy wood-cutting tools.

However, as mentioned, there seem to have been choppers made of cobbles in the Fayum Neolithic. The scatter of many choppers found around calcified plants in Locality 'Calcified Shrubs' suggests that they were used for cutting wood very roughly. It is assumed that they were made under relaxed conditions which did not necessitate frequent resharpening and that they were used expediently, because making and resharpening choppers by hard hammer percussion is the least labour-intensive but is wasteful of raw materials, and tends to create progressively steeper edge angles with every resharpening, thereby preventing effective continued use (Hayden 1989: 11*ff*). Therefore,

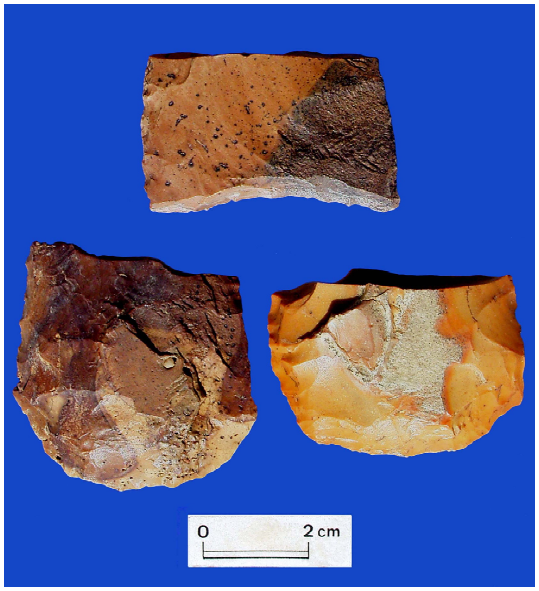


Fig.7.56. Gauge, axe and plane collected 500 m to the north of Kom W



Fig.7.57. Sickle blades collected at the Upper K Pits (left) and in Wadi A (right)

it may be said that the choice of curated and expedient technologies in the Fayum Neolithic was not always dependent on available raw materials but was subject to use conditions. Since such choppers have been found around the concentrations of large animal bone fragments at surface sites of supposedly Neolithic date around Kom W, it may be said that the choppers were also used for breaking hard bones.

7.10.3. Sickle blades

On the other hand, it is difficult to explain why Neolithic sickle blades were also made by bifacial technology. In the Fayum Neolithic culture as well as other contemporary Neolithic cultures in Lower Egypt, both faces of elongated and often pointed sickle blades were finely retouched, and one lateral margin of the blades was usually serrated. Bilaterally-serrated bifacial sickle blades are extremely rare (Caton-Thompson and Gardner 1934: 21) (**Fig.7.57**). A well-preserved sickle found in a Neolithic granary pit in the Fayum shows that three blades, which are 4.7 cm long due to being snapped short, 7.8 cm long, and 8.2 cm long respectively, are inserted in line into a centrally-placed longitudinal groove on a slightly curved wooden shaft of 51 cm long and are held in position by resin (Caton-Thompson and Gardner 1934: 45, pls.XXVIII and XXX). This way of use means that the blades were expendable and were replaced by new ones when their cutting edges became worn and dull.

It has been argued on the basis of experiments and ethnographic observations, that sickle harvesting was the most productive when wheat and barley grew very densely in hard soil and when they were at the green or half-green stage of maturity, whereas hand harvesting like picking or stripping seed heads without tools could be as efficient as sickle harvesting, when wheat and barley grew sparsely in sandy soil, and when they were at the half-green or ripe stage of maturity (Anderson 1999; Simms and Russell 1997). Therefore, the use of a long sickle in the Fayum Neolithic suggests quite intensified harvesting for high productivity as well as low cutting on the stems to obtain a long straw. It must be assumed that the cost of making such bifacially-retouched sickle blades as described above met the benefits of increasing productivity of harvesting tasks at the expense of efficiency.

Given that threshing and milling harvested grains to render them edible are also time-consuming and labour-intensive tasks, which require suitable facilities or tools, it must also be assumed that making sickle blades would have been optimised in relation to the costs of processing harvested grains against the benefits of obtaining sufficient nutrition.

From this cost-benefit perspective, relevant questions are why the entire surface of sickle blades had to be finely retouched before one cutting edge was serrated, and why the distal end of sickle blades had to be pointed. Retouching the entire surface seems to be an unnecessary effort, because the most important element of a sickle blade is a sharp and long cutting edge. One serrated cutting edge of a simple blade without further bifacial thinning or retouching sufficiently meets the functional need to cut siliceous plants, as exemplified by Levantine Neolithic sickle blades (Quintero *et al*. 1997). It seems that the pointed distal end of a sickle blade has no utility, because this part is covered by the wooden shaft and does not contact the materials being cut.

One possible explanation about these bifacial sickle blades is that such blades could be wedged into the groove of a wooden shaft more easily and be fitted better to a slightly-curved shaft. In terms of the aims and effects of hafting, the advantage of wedged hafts is that the attachment of blades to its handle is speedy and simple, and hence the replacement of blades is also easy. Better fitting of bifacially-retouched tools to a pre-existing haft has been emphasised as the reason why the tools are shaped in such a manner (Keeley 1982: 801; Kelly 1988: 718-719, 721*ff*). But the disadvantage is that such hafts allow movement of blades in the haft, which increases breakage and lowers the precision of work (Keeley 1982: 799). However, as mentioned, one example of the Fayum sickle shows that blades were actually held in position by resin. Therefore, unless this mastic haft example is exceptional, and unless the use of resin was uncommon in the Fayum Neolithic, it does not seem that bifacial retouching and a pointed distal end were intended to increase fitness to the shaft considerably without being assisted by mastic.

Another possible explanation is that bifacially-retouched sickle blades were intended to double the possibility of serrating cutting edges, by using two lateral margins of a blade one after another. However, bilaterally-serrated bifacial sickle blades are extremely rare in the Fayum Neolithic, and thus it seems likely that such a manner of blade use was not habitually intended, but rather was expediently attempted. Given that sickle blades were held firmly in a groove of a wooden shaft by resin, it is quite unlikely that blades were frequently replaced by new ones during a sickle-using task at the location of their use, because blade replacement requires a fire to melt resin, and this is complicated and time-consuming work (Keeley 1982: 799-800). As mentioned in Chapter 5, sickle blades have been found most abundantly at Kom W by Caton-Thompson, whereas they have been found elsewhere in isolation during my survey. As is often the case with hafted tools discussed in a study of the distributional effects of hafting (Keeley 1982: 802*ff*), tools may be resharpened or replaced when it is convenient to do so rather than when it is necessary. It can be said that worn sickle blades in the Fayum Neolithic were more frequently discarded and replaced at residential bases than they were at use locations, and that worn sickle blades were rarely resharpened to an exhaustive extent. Therefore, the high possibility of resharpening and recycling is apparently not a good explanation for the bifacial sickle blades in the Fayum Neolithic.

A further possible explanation about the seemingly unreasonable bifacial sickle blades is that those sickle blades were actually secondary products, and that other bifacial items like arrowheads and knives were habitually recycled and transformed into sickle blades, by making one lateral margin serrated. It is not easy to substantiate this explanation by demonstrating the reduction sequence or life history of a bifacial item, but it is significant to keep this possibility in mind, for shedding further light on the curatorial behaviour of Neolithic people. A unilaterally-serrated, concave-based sickle blade

found in Merimde Beni Salama (Eiwanger 1992: pl.B-E) may be considered as an example for transforming a concave-based spearhead into a sickle blade.

7.11. Development of a unique technological organisation in the Fayum Neolithic

It has been argued that the mobility frequency and magnitude of foragers significantly affected the size and diversity of their technological inventory (Shott 1986). It has also been discussed that bifacial tools might be associated with frequent long-distance mobility in the environment, where good lithic raw materials were not always available, because bifacial tools were superior in terms not only of portability but also of maintainability that refers to the possibility of resharpening and recycling (Bleed 1986; Kelly 1988). However, there is no simple relationship between curated/expedient technology and residential/logistical mobility, and the Fayum Neolithic case seems to suggest that the organisation of bifacial technology was actually associated with a logistical type of mobility, supported by a caching or stockpiling strategy, in generally predictable resource patches. Given the lack of flint cobbles and the richness of food resources in the Neolithic habitat of the Fayum, it is understandable that Neolithic people developed bifacial technology with a basically logistical mobility strategy. Even though no substantial dwellings were found, it is considered on the basis of such lithic raw material use that the Fayum people have principally maintained residential bases in several essential resource locations at water margins and have procured additional resources from remote places by sending task persons routinely rather than moving the residential bases to those places. It is probable that routine visit to lithic raw material sources was embedded in pastoral grazing trip.

Another remarkable feature of the lithic technology of the Fayum Neolithic is the great reliance on locally-unavailable flint cobbles. In the Fayum Epipalaeolithic period, the toolkit included formal backed bladelets and arrowheads as well as informal flake tools like scrapers, notches and denticulates, and they were made not only on flakes obtained from elongated flint pebbles, which were abundantly available within an easy walking radius of their habitat, but also on flakes obtained from large flint cobbles, which were not locally available but must have been procured from distant sources. The division between formal tools and informal tools does not seem to derive from different raw materials, but the size difference of tools is certainly affected by the different size of raw materials, and large tools could not be made on locally-available pebbles.

In the Neolithic period, by contrast, it seems that toolmakers stopped relying heavily on locally-available elongated flint pebbles, but started to use locally-unavailable flint cobbles even for making small expedient tools, which could otherwise be made easily on locally-available flint pebbles. One previous study at Kom W has found that the majority of Neolithic tools were actually informal flake tools such as notches, denticulates and scrapers, and that bifacially-retouched formal tools were quite minor components of the assemblage (Kozlowski and Ginter 1989: 170*ff*). According to my observation at Kom W, those informal tools are apparently made on flakes from large cobbles and not on flakes from elongated pebbles. Therefore, it may be concluded that a new demand for large lithic raw materials required for new subsistence activities in the Neolithic period triggered more intensive exploitation of locally-unavailable large flint cobbles, and that this gradually affected the entire Neolithic technological organisation, and eventually led to the great reliance on large flint cobbles. In other words, it can be said that the Fayum Neolithic lithic technological organisation on the whole is characterised by its inclination toward a high cost and high return resource exploitation strategy, departed from a previous low cost, time minimising resource exploitation strategy.

7.12. Concluding remarks

It must be stressed that the Neolithic lithic artefacts studied record patterns in prehistoric human behaviour as they are manifested over large areas and long spans of time, and hence reflect the cumulative results of decisions made and actions taken by many generations of people. These patterns may not necessarily represent the ways which individual cobble collectors and toolmakers took in order to meet immediate needs in one particular situation during the Neolithic period. Moreover, the contemporaneity of the sites studied, which should be measured ideally in decades at least, is not adequately substantiated. Nevertheless, this study could illustrate that the lithic technological organisation in the Neolithic period was significantly different from that in the preceding Epipalaeolithic period, and that it represented a unique adaptation to the Fayum environment. Although the lack of substantial dwelling remains at any sites studied is puzzling, other circumstantial evidence strongly suggests that Fayum Neolithic people decreased residential moves by groups but increased logistical foraging moves by individuals considerably. The success of a farming-herding lifeway in the Fayum Neolithic was probably not possible without the decrease of residential moves, but was not realised without a supply of external resources enabled by the increase of logistical moves by individuals.