Chapter 18

Lithic artefacts: Phase 6, the concentration south of Trench D and other more scattered pieces

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INTRODUCTION

This chapter presents the lithic collection from south of Trench D, and the various lithic artefacts that were more sparsely distributed throughout the rest of the Phase 6 clay. As discussed previously (Chapter 17; Table 17.1; Fig 17.1), the lithic collection from the Phase 6 clay was divided into three primary assemblages: 6.1, 6.2 and 6.3, for analysis based on their spatial clustering within the excavated area. The great majority of lithic material from the Phase 6 clay was contained within the concentration south of Trench D (Fig 18.1), and this material was designated as assemblage 6.1 (n=2010, including 139 natural pieces). The northern edge of this concentration is defined by the southern edge of Trench D, which was dug by machine before discovery of the concentration to its south, so it could be suggested that the sharp northern cut-off of this concentration is artificially created. A number of flints were recovered during machining of Trench D, and if as many had been found as were later discovered to its south, machining would have been halted in Trench D itself. Three Evaluation Trenches I, II and III were dug within Trench D, and these produced very few artefacts. Therefore, although it is probable that the machine excavation of Trench D has slightly enhanced the sharpness of the northern edge of the concentration later found to its south, it is still believed that this concentration had a well-defined northern boundary approximately where it appears to do so. The collection from the rest of the Phase 6 clay (excluding the assemblage associated with the elephant) was far more dispersed and far less numerous (Fig 18.1), and this material was designated as assemblage 6.2 (n=135, including 6 natural pieces). The material from around the elephant skeleton, discussed in the previous chapter (Chapter 17), was designated assemblage 6.3.

The remainder of this chapter follows the same broad structure as Chapter 17, although with some minor variations and changes of emphasis which reflect some important differences in the nature of the material from assemblages 6.1 and 6.2. After a brief review of the quantities and provenances of these assemblages (below), the following section considers their taphonomy and site formation processes, based on the combination of artefact condition, stratigraphy, spatial clustering, microdebitage sampling and refitting. The outcome of these analyses was that there is little benefit in stratigraphically sub-dividing either of the assemblages, and that a certain amount of more abraded lithic material within them should be excluded and analysed separately. This more abraded material does, however, represent important reworked evidence of an earlier phase of occupation.

Having established the most valid assemblages for analysis, technology, typology and the *chaîne opératoire* are looked at, including the evidence from refitted sequences of primary flaking and secondary flake modification. Finally, in the concluding section the evidence as a whole is considered in terms of how/

Table 18.1 Assemblage 6.1: lithic collection from Phase 6 grey clay south of Trench D

Phase	*Context*	*Natural pieces (n)*	*Chips (n)*	*Other artefacts (n)*	*Total (n)*	*Notes*
6	40036	-	-	2	2	Flints found on stripped surface of west bank of new road cutting during preliminary field evaluation in December 2003
	40078	-	-	2	2	Found in a slightly reddish-brown stained band, at northern side of concentration; discoloration not thought to be of any stratigraphic significance
	40100	119	110	1612	1841	-
6a	40039?	1	-	-	1	Contradictory provenance information in archive
	40039	19	5	140	164	Brown-stained bed at base of Phase 6 clay
Total		139	115	1756	2010	

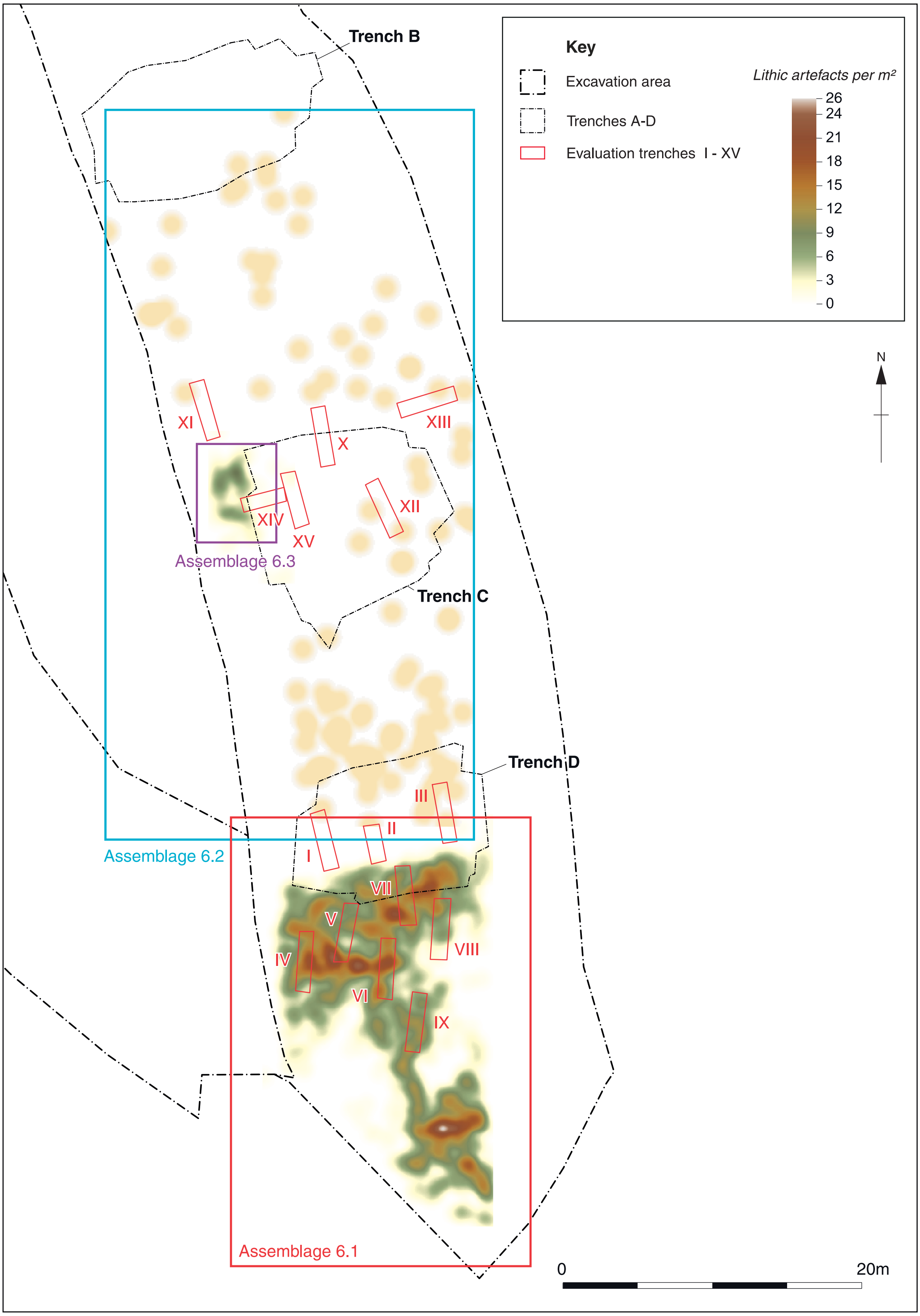


Figure 18.1 Assemblages 6.1 and 6.2: distribution of lithic finds (excluding natural pieces)

whether it provides any insights to hominin behaviour at the site and how it relates to the evidence from other sites in the Swanscombe area and further afield in south-east England. The extent to which it contributes to debate over the existence or otherwise of a Clactonian industrial tradition in south-east England in the earlier temperate part of the Hoxnian interglacial is also addressed.

PROVENANCE AND QUANTIFICATION

For assemblage 6.1 (Table 18.1), almost all of the constituent artefacts came from just two contexts. These were context 40100, the bottom 0.75m of the main body of the grey Phase 6 clay in the southern part of the site, and context 40039, the slightly sandy yellowish-brown stained clay-silt bed about 0.1-0.15m thick that underlay context 40100 in this part of the site. As discussed previously (Chapter 3), the Phase 6 clay in the area south of Trench D was being stripped by machine when flint artefacts began to be recognised in the lower part of the clay, at which point machine excavation ceased, and hand excavation began. The more northerly part of the area south of Trench D was trowelled and several evaluation trenches were also excavated with a combination of trowelling and careful mattocking. These methods probably led to a greater recovery of smaller chips <20mm long in the area where they were applied. In the central and southern parts of the area south of Trench D, excavation was carried out solely by mattocking, probably leading to a lesser recovery of smaller debitage. Therefore, aside from their specific inclusion in the microdebitage studies and their attempted use (rarely successfully) within the refitting programme, the chips were excluded from the quantitative analyses carried out. In general, smaller debitage of this size would not contain useful technological information for Lower/ Middle Palaeolithic flaking sequences, although all were examined as potential flake-flakes from tool manufacture, and if thought to be so, were included as such in the quantitative analyses.

Assemblage 6.2 (Table 18.2) was recovered from the thicker and stratigraphically more complex part of Phase 6, between Trenches B and D. The majority of artefacts (*c* 63%) came from contexts generally attributed to the main body of the Phase 6 clay (mostly from context 40100). However, a reasonable proportion (*c* 35%) was recovered from Phase 6a, from the bottom two contexts of the Phase 6 clay (contexts 40039 and 40103). In addition to these, a few (n=3) artefacts were recovered from the Phase 6b tufaceous channel-fill, context 40070. Most of the artefacts from assemblage 6.2 were recovered from careful monitoring of machine excavation, so many of them were slightly damaged by the process of discovery, and there is probably a bias in this assemblage against recovery of smaller artefacts. Nevertheless, the assemblage still includes 11 chips <20mm long.

TAPHONOMY AND SITE FORMATION

Almost all of the artefacts from assemblages 6.1 and 6.2 were in mint or very fresh condition. For assemblage 6.1, there were just 15 artefacts in slightly-moderately abraded condition and two artefacts in very abraded condition, ie less than 1% of the total assemblage was not in mint or fresh condition. The more abraded specimens must be intrusive into the assemblage, representing evidence of older phases of occupation reworked from the higher ground to the west of the site. Some of the slightly abraded specimens may belong with the main assemblage, but it was decided to exclude them as they contributed nothing additional to the analytical results, and it was preferred to base these wholly on the fresh material. For assemblage 6.2, there were only two artefacts not in mint or fresh condition (approximately 1.5% of the assemblage), both of them technologically undiagnostic debitage in slightly-moderately abraded condition, and these were likewise excluded from the more detailed quantitative analyses of the material.

The first objective of the lithic analysis was to consider whether there was any interpretive importance

Table 18.2 Assemblage 6.2: lithic collection from Phase 6 grey clay, excluding concentrations by elephant skeleton and south of Trench D

Phase	*Context*	*Natural pieces (n)*	*Chips (n)*	*Other artefacts (n)*	*Total (n)*
6	40158	-	-	1	1
	40100	-	8	54	62
	40099	-	-	1	1
	40078	3	-	11	14
	40069	-	-	4	4
	40068	-	-	2	2
6b	40144	1	-	-	1
	40070	-	-	3	3
6a	40103	-	-	5	5
	40039	2	3	37	42
Total		6	11	118	135

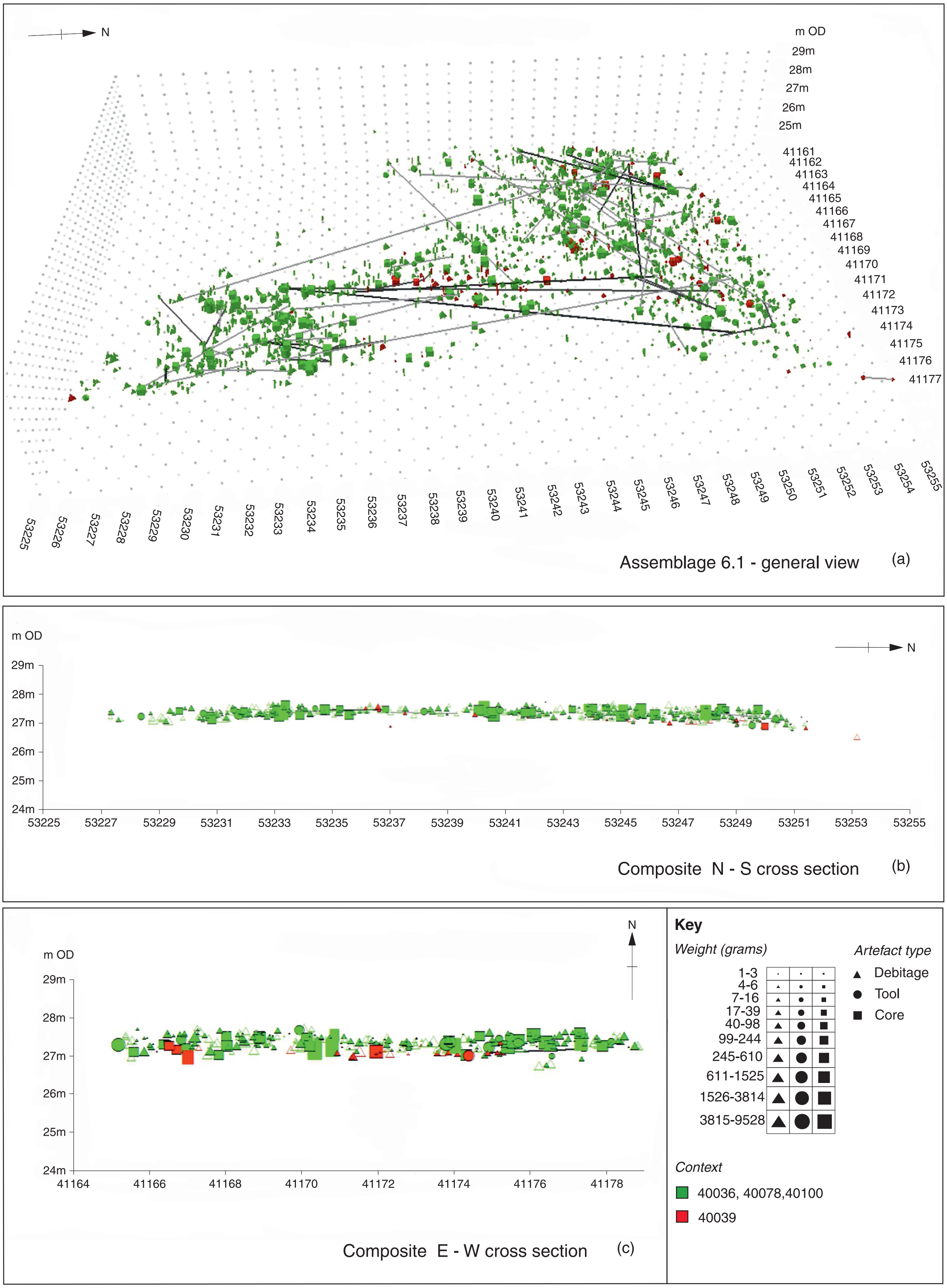


Figure 18.2 Assemblage 6.1: snapshots from 3-D GIS model, with refit connections: (a) general view; (b) conflated side-view (looking west); (c) conflated end view (looking north)

to the different stratigraphic horizons from which the artefacts were recovered, or whether the material would be better conflated for interpretive purposes. The same three approaches were adopted as for the investigation of the lithics from around the elephant skeleton. Firstly, an analogous 3-D GIS model was created for assemblage 6.1 with artefacts represented by different symbols for different technological categories, with the symbols sized according to their weight and colour-coded by context. This allowed initial investigation of the 3-D distribution of the artefacts, and of whether there was any immediate visual evidence of size-sorting, either laterally or vertically. Some snapshots from the model are illustrated here (Fig 18.2), showing the overall view of the concentration south of Trench D (assemblage 6.1), and cross-sections through the scatter. This is however a poor second to viewing the model for real, and as discussed previously, it is intended that the 3-D model is available for general investigation as part of the online resources accompanying this monograph.

The model showed that, within the area of lithic concentration, artefacts of all sizes were evenly distributed, both laterally and vertically. The slight increase in smaller debitage at its northern end is almost certainly due to the greater use of more careful hand-trowelling rather than a general attribute of the assemblage. It was also apparent that while there were distinct areas of greater artefact concentration (also see Fig. 18.1), these did not match the discrete concentrated clusters that would be expected from a palimpsest of undisturbed knapping activity, but were more homogenous. Therefore, although the lithic material was not looking like the result of undisturbed knapping activity, there was no sign that it was size-sorted within the sediment.

Secondly, a refitting study was carried out. All of the material from assemblage 6.1 (including the more abraded material, none of which was however found to refit) was laid out together. It was initially arranged to correspond with the on-site spatial clustering, and several weeks were spent attempting to fit it back together, in conjunction with the material from assemblages 6.2 and 6.3 (from near the elephant) since it was also hoped to use refitting evidence to link material from different parts of the site, and perhaps to investigate intra-site movement of artefacts in the event that it was found to represent a wider area of undisturbed activity. Refits were broken down into five main types:

B *in situ* ‘Break’; identified by unstained fresh joining surfaces, and almost zero distance between refitting pairs, for example for RG #35 and for RG #11, where Δ.43407 and Δ.43418 represent the eventual *in situ* detachment of a failed flake removal (see Fig. 18.14a).

J knapping break, ‘Join’; when a single flake has snapped during knapping, as distinct from subsequently in the ground or by deliberate breakage.

Jc ‘Complex join’; when a piece has been deliberately broken, or when a piece broken during knapping has undergone subsequent knapping.

R separate debitage ‘Removals’, but with scars from intervening removals that show them not to be directly consecutive.

Rc consecutive debitage ‘Removals’, so far as can be established.

Complementing this more descriptive classification of the refits, the last four types (that is apart from those thought to have been broken *in situ*) were also categorised into one of three groupings for taphonomic investigation. This was based on an interpretation of the likelihood that any piece of a refitting group would have been of any interest to a hominin, and therefore likely to have been moved by behaviour. Alternatively, whether it was regarded as likely to have been of minimal interest, and so any movement beyond the normal range of undisturbed material is likely to reflect sedimentary site formation processes. The three taphonomic groupings were:

1. ‘T’ – broken flakes and irregular waste, thought to have broken during knapping, and unlikely to have been used as tools, and therefore any movement/separation most likely to relate to sedimentary ‘Taphonomy’.
2. ‘T?’ – sequential flake removals, with no suspicion that either piece was likely to have been useful as a tool and affected by behavioural movement, therefore probably, although not definitely, any movement/separation relating to sedimentary ‘Taphonomy’.
3. ‘B/B?’ – sequential flake removals, with the possibility/expectation that either piece might have been moved by ‘Behaviour’. This category includes flakes that might have been removed with intervening hominid movement, for instance flakes from different stages of reduction of the same core and more than one flake-flake from the same flake-tool.

The refitting study was moderately successful, with 64 refitting groups found, including three from assemblage 6.2, and with 144 artefacts refitted in total, representing about 8% of the total fresh material from assemblages 6.1 and 6.2, excluding chips. Each refitting group was given a unique identifying number, RG #1-64, and the refits were tabulated as pairs of connecting artefacts (Table 18.3). Most of the refitting groups comprised just two artefacts, whether broken pieces or separate removals, but there were also a few groups with greater numbers of refitting pieces (Table 18.4). The greatest number of refitting pieces in a single group was 6, for RG #11, which was an intermittent sequence of five pieces of debitage fitted back to a core (discussed in more detail below). These results contrast with those from around the elephant where much longer reduction sequences were refitted, and almost 70% of the assemblage, including chips, was refitted (see Chapter 17). This immediately suggests a contrast between the level of disturbance of the material from assemblage 6.1

Table 18.3 Assemblages 6.1 and 6.2: collation of refits

Ref grp #	*Ref type*	*Taph-onomy grouping*	*Flint 1 of group (or pair within group)*				*Flint 2 of group (or pair within group)*				*XYZ distance - m*	*Vertical distance - m*	*Bearing from N (lighter from heavier)*
			Find ID - Δ	*Context*	*C1*	*C2*	*Find ID - Δ*	*Context*	*C1*	*C2*			
1	Rc	2	41329	40100	5	2	41211	40100	5	2	1.75	0.13	10.8
2	R	2	42145	40100	6	3	42436	40100	5	4	2.84	0.34	178.75
3	Rc	2	43178	40070	5	2	43062	40070	5	2	1.23	0.31	184.9
4	J	1	42544	40039	6	4	42572	40039	5	1	1.91	0.4	26.92
5	R	2	40812	40039	5	2	40813	40039	5	2	1.03	0.1	3.9
6	Rc	2	41747	40100	5	4	41934	40100	6	3	1.4	0.07	-86.65
6	R	2	41934	40100	6	3	41940	40100	5	2	2.17	0.22	163.52
6	R/Rc	2	41940	40100	5	2	41747	40100	5	4	2.96	0.29	136.98
7	Jc	3	41294	40100	5	1	41671	40100	5	4	1.77	0.24	-80.95
8	J	1	41345	40100	5	1	41517	40100	5	1	1.05	0.06	120.71
9	R	3	42470	40100	6	3	42468	40100	5	4	0.24	0.01	6
9	R	3	42468	40100	5	4	41371	40100	7	1	3.39	0.1	223
9	R	3	41371	40100	7	1	42470	40100	6	3	3.59	0.1	220.73
10	J	1	42682	40100	5	1	42689	40100	5	1	1.54	0.44	172.82
11	R/J	2	41993	40100	5	2	41855	40039	5	2	2.43	0.1	-86.04
11	R/J	2	43418	40100	7	1	41855	40039	5	2	15.87	0.29	3.96
11	R/J	2	43407	40100	5	2	41993	40100	5	2	16.13	0.24	12.67
12	J	1	41300	40100	5	2	41805	40100	5	2	1.62	0.21	56.24
13	R	2	41663	40100	7	1	42409	40100	5	2	2.42	0.19	232.26
14	J	1	41959	40100	5	1	42257	40100	5	1	1.67	0.01	119.85
15	J	1	42289	40100	5	1	43024	40100	5	1	2.09	0.3	264.53
16	J	1	40205	40100	5	1	40385	40100	5	1	1.08	0.08	229.46
17	R	3	42021	40100	5	2	42022	40100	7	1	1.17	0.04	105.62
18	R	3	40264	40100	6	3	42258	40100	5	2	2.69	0.24	119.29
19	J	1	42242	40100	5	2	42278	40100	5	2	0.49	0.01	140.3
20	R	2	42418	40100	5	2	42568	40100	5	2	4.09	0.14	57.66
21	R	2	41154	40100	5	2	41882	40100	5	2	11.4	0.66	51.68
22	J	1	40374	40100	5	2	42079	40100	5	1	2.75	0.14	26.55
23	R	2	41851	40100	5	2	41957	40100	5	2	1.84	0.24	-65.13
24	J	1	41779	40100	5	1	41891	40100	5	1	0.73	0	202.74
25	J	1	41516	40100	5	2	42946	40100	5	1	11.24	0.14	9.01
26	R	2	40300	40100	5	2	42353	40100	5	2	2.32	0.25	130.59
27	J	1	42594	40100	5	2	42812	40100	5	2	3.36	0.06	124.06
28	R	3	43182	40100	7	1	43217	40100	5	2	0.49	0.13	79.87
29	B	0	43081	40100	5	1	43082	40100	5	1	0.05	0.02	-45.49
30	R/J	3	43399	40100	7	1	43267	40100	7	1	0.57	0.02	-24.54
30	R	3	43198	40100	6	4	43267	40100	7	1	1.36	0.15	193.91
30	R/J	3	43267	40100	7	1	43262	40100	5	1	1.44	0.01	177.49
30	R/J	3	43262	40100	5	1	43399	40100	7	1	1.98	0.02	-8.7
31	R	2	43227	40100	5	1	43202	40100	5	2	0.24	0.19	201.74
31	R	1	43388	40100	7	1	43227	40100	5	1	1.62	0.17	26.86
32	R	2	43370	40100	5	2	43478	40100	5	2	1.5	0.05	175.63
33	J	1	43547	40100	5	1	43735	40100	5	1	1.6	0.01	88.73
36	R/B	0	43636	40100	5	2	43635	40100	5	2	0.02	0	128.54
36	R/B	2	43635	40100	5	2	43542	40100	5	2	0.49	0.21	88.19
37	J	1	42913	40039	5	1	40817	40039	5	1	0.49	0.05	-50.05
37	J	1	40817	40039	5	1	43051	40039	5	1	2.12	0.14	163.91
37	J	1	43051	40039	5	1	42913	40039	5	1	2.54	0.09	-22.26
38	J	1	43512	40100	5	1	43666	40100	5	1	2.3	0.24	-78.53
38	J	1	43666	40100	5	1	43609	40100	5	1	2.4	0.32	189.47
38	J	1	43609	40100	5	1	43512	40100	5	1	3.25	0.08	234.26
39	J	1	43411	40100	5	1	43398	40100	5	1	0.47	0.09	215.66
39	J	1	43570	40100	5	1	43411	40100	5	1	1.14	0.06	6.7
39	J	1	43398	40100	5	1	43570	40100	5	1	1.57	0.15	195.01
40	R	2	42783	40100	5	1	43523	40100	5	2	9.07	0.35	168.04
41	R	3	43111	40100	7	2	43307	40100	5	2	1.82	0.2	186.81
42	Jc	1	43476	40100	5	1	43734	40100	5	1	6.2	0.21	-41.98

Table 18.3 (continued)

Ref grp #	Ref type	Taphonomy grouping	Flint 1 of group (or pair within group)				Flint 2 of group (or pair within group)				XYZ distance - m	Vertical distance - m	Bearing from N (lighter from heavier)
			Find ID	Context	C1	C2	Find ID	Context	C1	C2			
43	R	2	41797	40100	5	1	43604	40100	5	2	19.12	0.33	158.06
44	J	1	41256	40100	5	1	42358	40100	5	1	4.99	0.12	61.22
45	J	1	43458	40100	5	1	43517	40100	5	1	0.97	0.15	20.08
46	Rc	3	42789	40100	5	2	43469	40100	7	1	8.72	0.21	-15.9
47	R	2	41155	40100	5	2	42170	40100	5	2	3.17	0.12	256.27
48	J	1	43327	40100	5	1	43328	40100	5	1	0.14	0.03	95.2
49	Rc	2	40616	40100	5	2	44018	40100	5	2	0.37	0.16	94.82
50	R	2	40274	40100	5	2	43584	40100	5	2	16.88	0.02	-10.7
51	Rc	2	41539	40100	5	2	42573	40039	5	2	5.37	0.06	231.12
52	R	2	40717	40100	5	2	40553	40100	5	2	6.12	0.16	-1.64
52	R	3	40553	40100	5	2	43102	40100	5	2	4.94	0.07	178.47
52	R	3	43102	40100	5	2	40717	40100	5	2	11.05	0.23	-1.59
53	J	1	42894	40100	5	1	43059	40100	5	1	2.37	0.05	-12.79
54	J	1	41282	40100	5	2	41480	40100	5	2	5.7	0.03	58.14
55	Rc	2	42467	40100	5	2	41938	40100	5	2	4.33	0.03	258.45
55	R/Rc	3	41938	40100	5	2	42619	40039	5	2	4.1	0.07	-61.93
55	R	3	42619	40039	5	2	42467	40100	5	2	7.93	0.11	-82.3
56	B	0	42457	40100	5	2	42458	40100	5	2	0.13	0.01	8.73
57	Rc	2	43594	40100	5	1	43697	40100	5	2	3.01	0.07	167.37
58	R	2	40468	40100	5	1	42624	40100	5	2	5.09	0.18	54.25
59	J	1	40203	40100	5	2	42465	40100	5	1	2.06	0.21	183.42
59	J	1	42465	40100	5	1	41554	40100	7	1	5.16	0.13	40.84
59	J	1	41554	40100	7	1	40203	40100	5	2	6.89	0.09	210.45
60	J	1	42090	40100	5	1	42723	40100	5	2	1.42	0.27	-5.86
61	R	3	40429	40100	7	1	42009	40100	5	2	7.24	0.01	-73.36
62	Jc	3	40618	40039	5	2	42972	40100	5	2	9.97	0.11	62.21
63	R	3	40425	40100	6	3	41537	40100	5	2	2.03	0.12	-55.94
64	J	1	41669	40100	5	1	42378	40100	5	1	3.57	0.06	-15

Table 18.4 Assemblages 6.1 and 6.2: refitting group sizes

Refitting group size (n pieces)	*Assemblage 6.1*	*Assemblage 6.2*	*Total*	*Refitting groups #*
2	49	3 (RGs: #1, #3 and #4)	52	All the rest
3	10	-	10	RGs: #6, #9, #31, #36-39, #52, #55 and #59
4	1	-	1	RG #30
5	-	-	-	-
6	1	-	1	RG #11
Total	61	3	64	

Table 18.5 Assemblage 6.1: distribution of refitting flints between 'upper' and 'lower' stratigraphic horizons
['Both-Upp.' represents the number of flints from upper contexts in refitting groups with flints from both upper and lower horizons; 'Both-Low.' represents the number of flints from lower horizons in the same groups]

Horizon	*All flints*		*Refitting flints*		*Refitting groups*	
	n	*%*	*n*	*%*	*n*	*%*
'Upper'	1602	92	120	87	55	90
Both-Upp.	-	-	9	6.5	4	6.5
Both-Low.	-	-	4	3		
'Lower'	139	8	5	3.5	2	3.5
Total	1741		138	7.9	61	

Table 18.6 Assemblage 6.2: refitting flints by phase and context

Horizon	*All flints*		*Refitting flints*		*Refitting groups*		
	n	*%*	*n*	*%*	*n*	*%*	*Context*
Phase 6	71	61.2	2	33.33	1	33.33	40100
Phase 6b	3	2.6	2	33.33	1	33.33	40070
Phase 6a	42	36.2	2	33.33	1	33.33	40039
Total	116		6	5.2	3		

with that by the elephant, which is thought to be essentially undisturbed.

In assemblage 6.1, the refitting results were initially used to investigate the stratigraphic integrity between Phase 6 (context 40100) and Phase 6a (context 40039) (Table 18.5). There were 138 refitting flints in total, comprising nearly 8% of the total (fresh) assemblage, 92% of which came from context 40100, and 8% of which came from context 40039. Most of the refitting groups did not cross between these two contexts, which is statistically to be expected even if they have no stratigraphic significance. However, four of the refitting groups (RGs #11, #51, #55 and #62) included pieces from both contexts 40100 and 40039, leading to the conclusion that there was little stratigraphic integrity between the material from these two contexts. Therefore, all of the fresh condition material from Phases 6 and 6a south of Trench D was combined into a single assemblage (n=1854, including 113 chips) for subsequent analyses.

In assemblage 6.2 (Table 18.6), there were only three refitting groups of flints (RGs #1, #3 and #4), all of them comprising just two artefacts. The overall proportion of flints refitted was approximately 5%, which was broadly comparable to the figure from assemblage 6.1. The numbers of flints are too low for any meaningful statistical inferences, although each of these pairs represented a different stratigraphic phase, and none of the refitting pairs crossed any context boundary. The fresh material from this assemblage was likewise amalgamated (n=127, including 11 chips) to develop a quantitative technological and typological profile, since the material from the separate contexts would have been too low in number for meaningful comparisons, and there was not thought to have been any significant time depth between formation of the different contexts. It does, however, seem likely that the material from the different phases in this assemblage represents discrete parcels of material.

When the spatial connections between the refitting material were plotted (Fig. 18.2a; Fig. 18.3; Fig. 18.4) it can be seen not only that the overall quantities of refits are much lower than would be expected for undisturbed knapping debitage from the flake/core reduction sequences represented in the assemblage, but also that the clustering and distribution of the refitting material does not correspond with undisturbed material: for instance in contrast to four experimental scatters of the same flake/core technology (Fig. 18.5) and to the material by the elephant skeleton (Fig. 17.10). However, the overall quantity of refitting material is still quite significant, at approximately 8% of the total fresh assemblages, and suggests an only-slightly-spatially-disturbed accumulation of at least some material, and high stratigraphic integrity within the Phase 6 clay.

The data for refit direction and distance were then subject to further analyses, to try and identify any directional trends that might relate to site formation processes, and any residual behavioural information. All of the refitting material was analysed as pairs of connecting points. For groups of three, there were therefore usually three pairs of points, although in some instances (for example RG #31, Fig 18.7b) the sequence could be reduced to one removal, and then one break. Three statistics were calculated for each refitting pair: (1) their distance of separation in three dimensions XYZ, (2) their vertical separation regardless of spatial distance apart, and (3) the direction of the lighter piece from the heavier, as a bearing from North. These data are presented for each refitting pair in the collated refitting data table (Table 18.3). The directional data for each of the three different taphonomic refit groups are summarised on separate rose diagrams (Fig. 18.6). Three concentric circles represent increasing distance of separation, ranging from 'close' (< 2.5m, well within the typical spread range of undisturbed knapping remains), through 'medium' (2.5 – 7.5m, at the far end of the typical spread range of undisturbed knapping remains) and 'far' (>7.5m, well beyond the typical spread range of undisturbed knapping remains). Complementing the rose diagrams for each of the 3 taphonomic groupings are summary tables of the basic statistics 'Maximum value', the 3rd/4th quartile boundary 'Q3', the mean, the 1st/2nd quartile boundary 'Q1', minimum value and the population's sigma value 'SD' (Table 18.7).

It is immediately clear from the rose diagrams (Fig. 18.6) that the directions of refitting connections are essentially random for all three of the taphonomic groups of refit, and within each group for the different distance ranges. On the orthogonal plan-view of the refits from assemblage 6.1 (Fig. 18.3 – which also labels some of the longer refitting connections), there appears to be a slight predominance of longer north-south connections. However, this is a misleading illusion due to the lithic concentration being more extended north-south so there is an inevitable potential for more, and longer, refits in this direction. Also, three of the longer refitting connections (from RG #11 and RG #52) showing as darker lines in

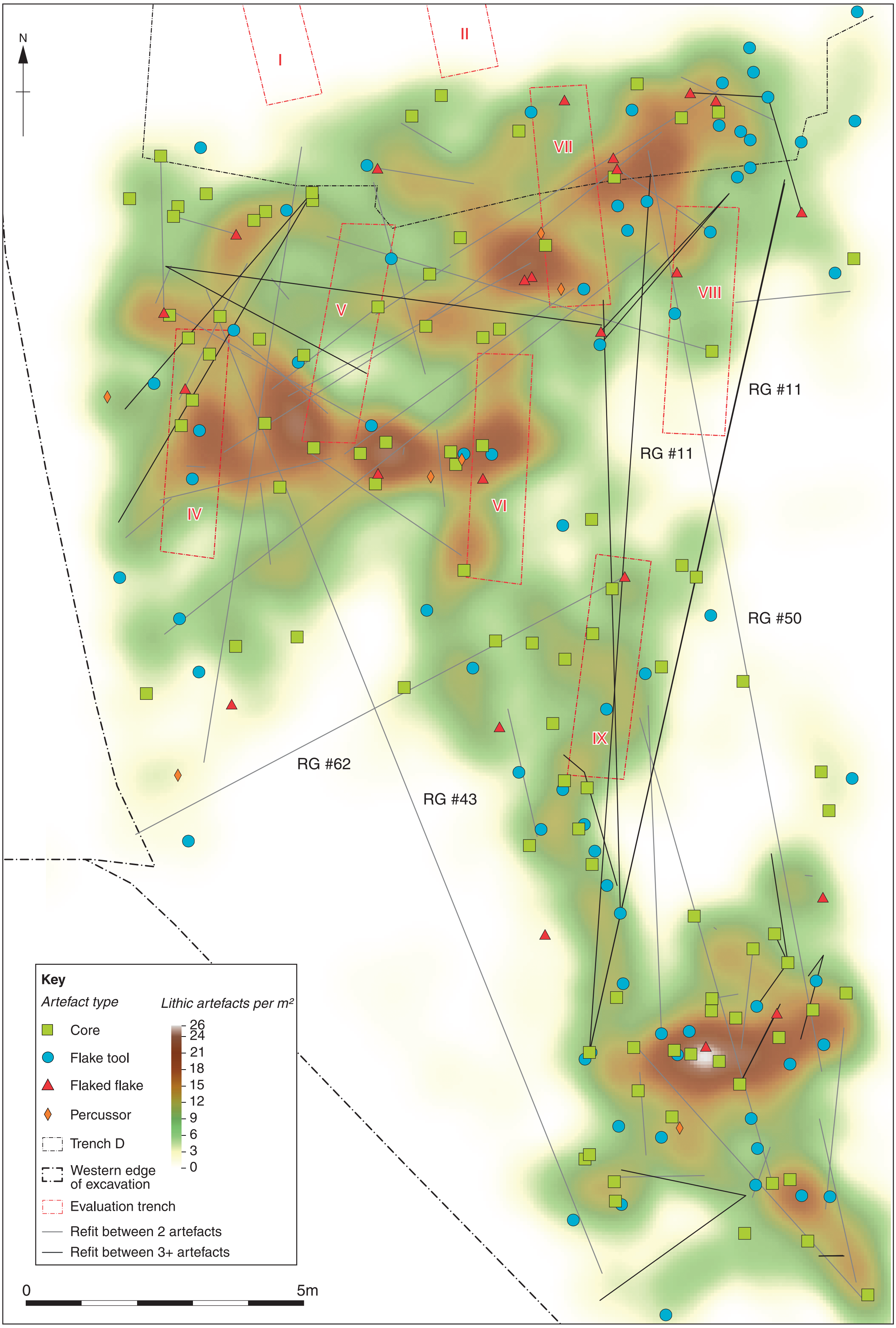


Figure 18.3 Assemblage 6.1: orthogonal view (from above) of refitting connections [lines linked to core or heaviest piece for groups where n>2]

Figure 18.4 Assemblage 6.2: orthogonal view (from above) of refitting connections [lines linked to core or heaviest piece for groups where n>2]

the north-south direction. There is certainly no trend for more 'behavioural' refits to be further apart than, or in different directions from, 'taphonomic' ones (Table 18.7). Aside from some higher outliers in the intermediate group 2 'T/T?' the majority of refits in all three groups occur with similar separations, between approximately 1m and 6m apart. The Q3 point is slightly lower for the presumed-more-taphonomic group 1, consisting of broken material, but this may be influenced by the intrusion of unrecognised material that broke *in situ* in the sediment, rather than being broken during knapping.

The most separated refit found was RG #43. This consisted of a small flake struck off a larger piece of irregular waste (Fig. 18.7a), with the irregular waste

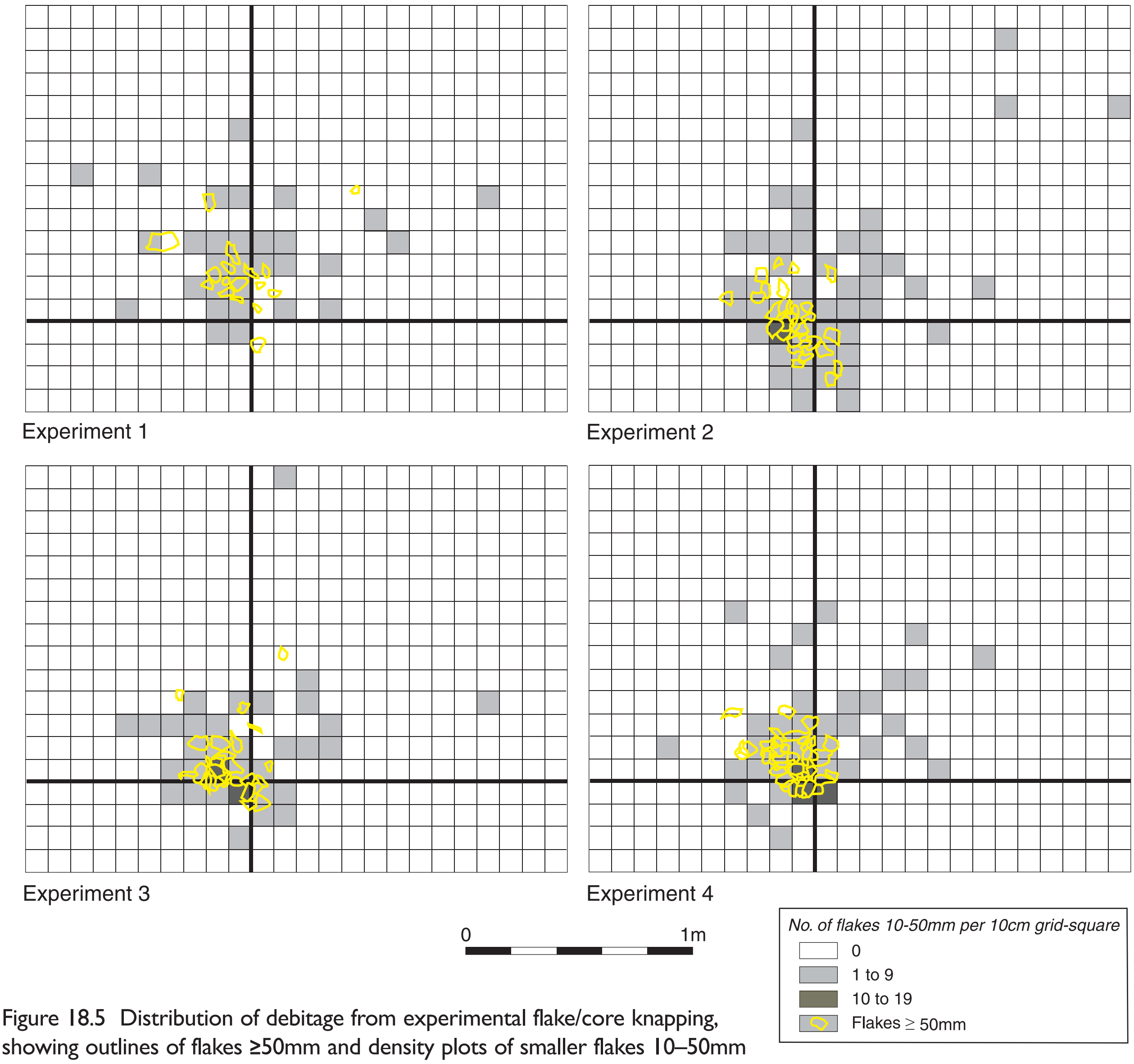
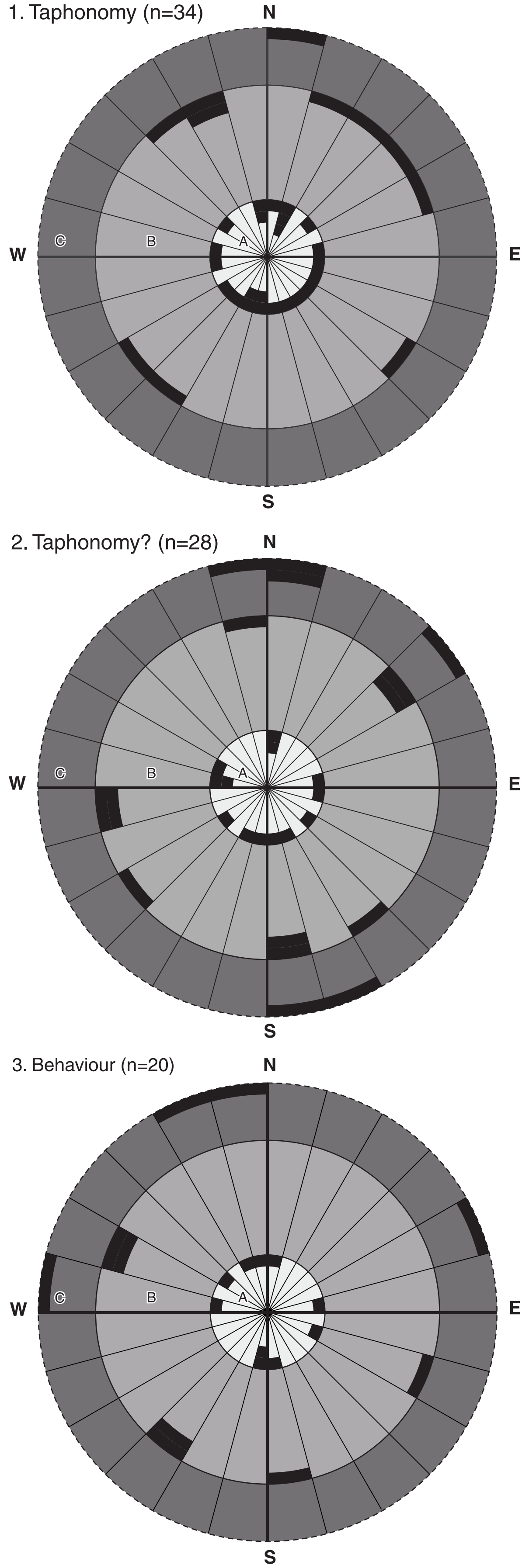


Figure 18.5 Distribution of debitage from experimental flake/core knapping, showing outlines of flakes ≥50mm and density plots of smaller flakes 10–50mm

Table 18.7 Assemblage 6.1: refitting separation summaries, by taphonomic group

	Taph. group 1 - T (n=34)		Taph. group 2 - T? (n=28)		Taph. group 3 - B/B? (n=20)		All Taph. groups (n=82)	
	Distance XYZ	*Vertical separation*	*Distance XYZ*	*Vertical separation*	*Disancet XYZ*	*Vertical separation*	*Distance XYZ*	*Vertical separation*
Max	11.24	0.44	19.12	0.66	11.05	0.24	19.12	0.66
Q3	3.12	0.20	5.56	0.26	5.51	0.16	4.79	0.21
Average	2.60	0.14	5.17	0.20	3.83	0.11	3.78	0.15
Q1	1.21	0.06	1.69	0.10	1.42	0.03	1.42	0.06
Min	0.14	0.00	0.24	0.02	0.24	0.01	0.14	0.00
SD (Pop)	2.24	0.11	5.43	0.13	3.27	0.08	4.00	0.12



found at the north-west corner of the main lithic concentration and the smaller flake found almost at the southern limit of the excavated area, almost 20m away (Fig. 18.3). Other notably separated refitting groups were RGs #11, #50 and #62 (Fig. 18.3; Fig. 18.7c,d,e). The first two of these were both attributed to the intermediate taphonomic group 2 'T?' and the third, which involved a flake-flake was in group 3 'B/B?', more likely to have been affected by hominin mobility. Group RG #11 was the longest sequence found, and represented a failed core with its last two small removals, and one earlier one (Fig. 18.7c; Fig. 18.18a). Unfortunately, the XYZ location of the early removal was lost, but the core was found in the southern part of the concentration and the two last failed removals approximately 15m to the north, about 2.5m from each other (Fig. 18.3).

Refitting group #50 was represented by two moderately small, quite nondescript flakes, one of which was found in the southern part of the concentration and the other almost 17m away towards its north-east corner. Refitting group #62 (Fig. 18.7e; Fig. 18.27b) was more interesting technologically. It comprised a large, long flake that had broken in two (during knapping presumably, judging by the absence of any sign of deliberate breakage). The broken distal end was then further knapped at one corner, by the break. The refitting pieces comprise the proximal end, and the flake-flake from the secondary working of the distal end; the worked piece is absent. The small flake-flake was found in the central part of the lithic concentration, and the larger proximal end some 10m away to the west.

An overall conclusion from the refitting work is that assemblages 6.1 and 6.2 do not represent wholly undisturbed knapping activity, in contrast to assemblage 6.3 from around the elephant. There is nonetheless a reasonably high degree of refitting, and the presence of quite numerous refits separated by less than 4m (n=58, roughly 70% of the total population of refit separations) suggests that at least some of the material is minimally disturbed. Finally, it is concluded that there is no evidence of trends of refit separation or direction that can be attributed to distinct sedimentary site formation processes or hominin behaviour and mobility.

The refitting work was complemented by an investigation of microdebitage quantities and distribution. As discussed previously (Chapter 17), experimental replication of similar flake/core knapping strategies applied to nodular flint raw material has provided a comparative data set for expected quantities of microdebitage in

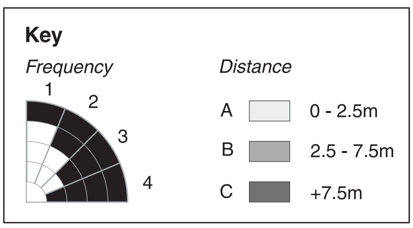


Figure 18.6 Rose diagrams showing distances and directions of refitting connections for the three taphonomic groups: (1) T - Taphonomy, (2) T? - Taphonomy? and (3) B/B? - Behaviour

relation to larger flakes and irregular waste. It is clear that, even when simple flake/core knapping strategies without deliberate platform preparation or fine surface-trimming are carried out, large quantities of microdebitage are produced. Furthermore, for undisturbed knapping scatters from single moderate reduction episodes (Fig. 17.5; Fig. 18.5), the microdebitage is concentrated in a tight cluster around the knapping point. Typically there are about 100 small flakes 10–50mm and over 250 chips in the size range 2.5–10mm within a circle of radius 0.5m, tailing off more than 1m from the central cluster. A sampling programme for microdebitage was therefore carried out in the area south of Trench D, in Evaluation Trenches IV, V and VII, and in the area of the *S kirchbergensis* rhino jaw (Group Δ.40843) just to the north of the main lithic concentration.

The programme is described in detail in the earlier chapter on excavation methods (Chapter 3). In summary, within each of the evaluation trenches, samples were taken in a vertical and horizontal grid of contiguous squares, normally 0.5 x 0.5m, as hand excavation progressed down in spits of 50mm thick.

At Trench IV a total of 216 samples were taken from nine excavation spits (Fig. 18.9). At Trench V a total of 248 samples were taken from eight excavation spits (Fig. 18.10). At Trench VII a total of 312 samples were taken from nine excavation spits (Fig. 18.11) and at the rhino jaw, 24 samples were taken from a single excavation spit (Fig. 18.12). All of the samples were sieved, and any small sharp flint pieces thought to be microdebitage were sorted from the resulting residues. These were divided into one of three categories: (1) ≥ 20mm, (2) 4–20mm (ie did not go through a 4mm sieve-mesh), and (3) 2–4mm (ie went through 4mm sieve-mesh, but not a 2mm mesh). The results for each trench and the rhino jaw group are shown in the respective figures (Figs 18.9 – 18.12) and the quantitative data for each sampled area are also summarised (Table 18.8) with the total microdebitage

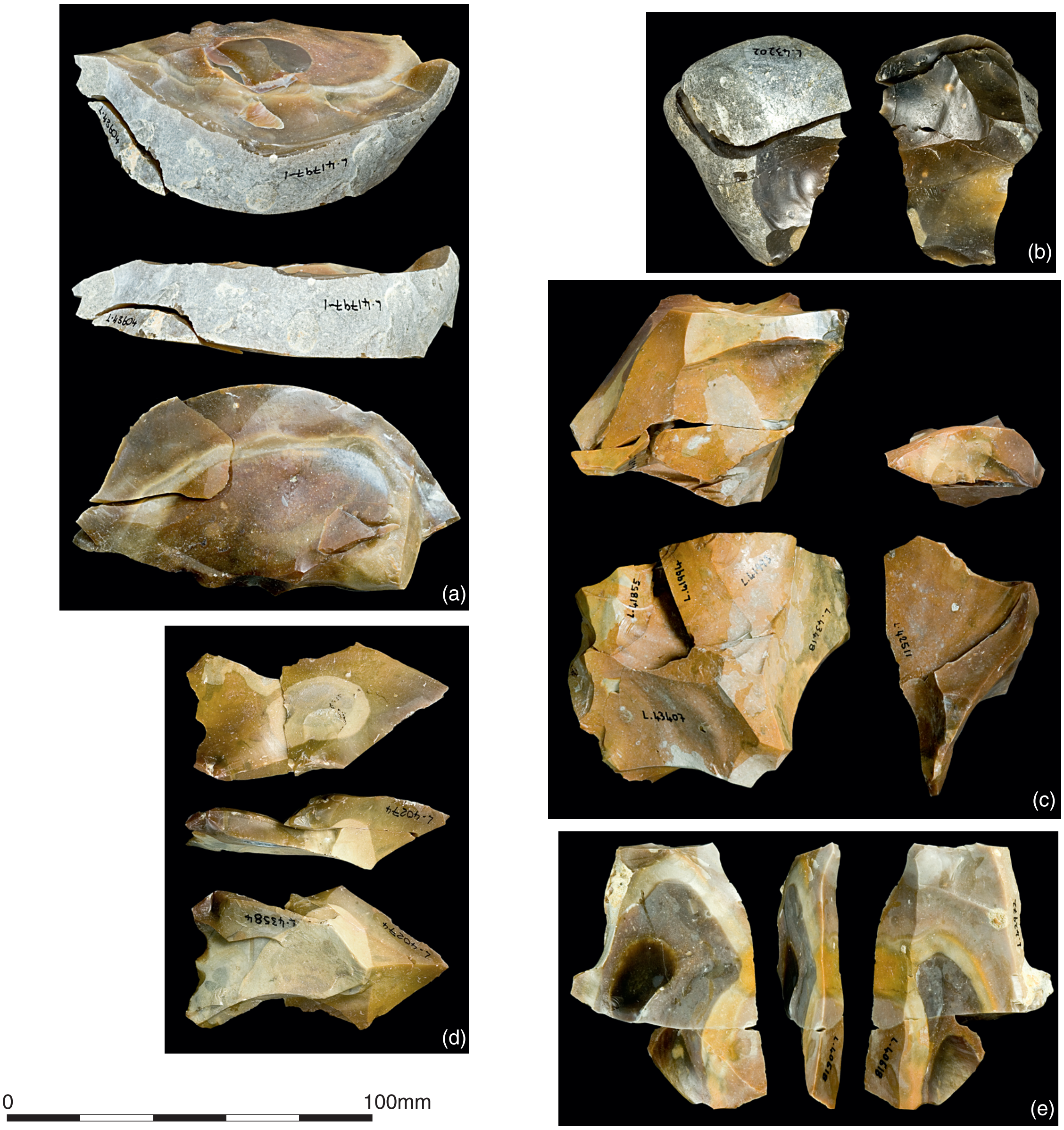


Figure 18.7 Photos of selected refitting groups: (a) RG #43; (b) RG #31; (c) RG #11; (d) RG #50; (e) RG #62

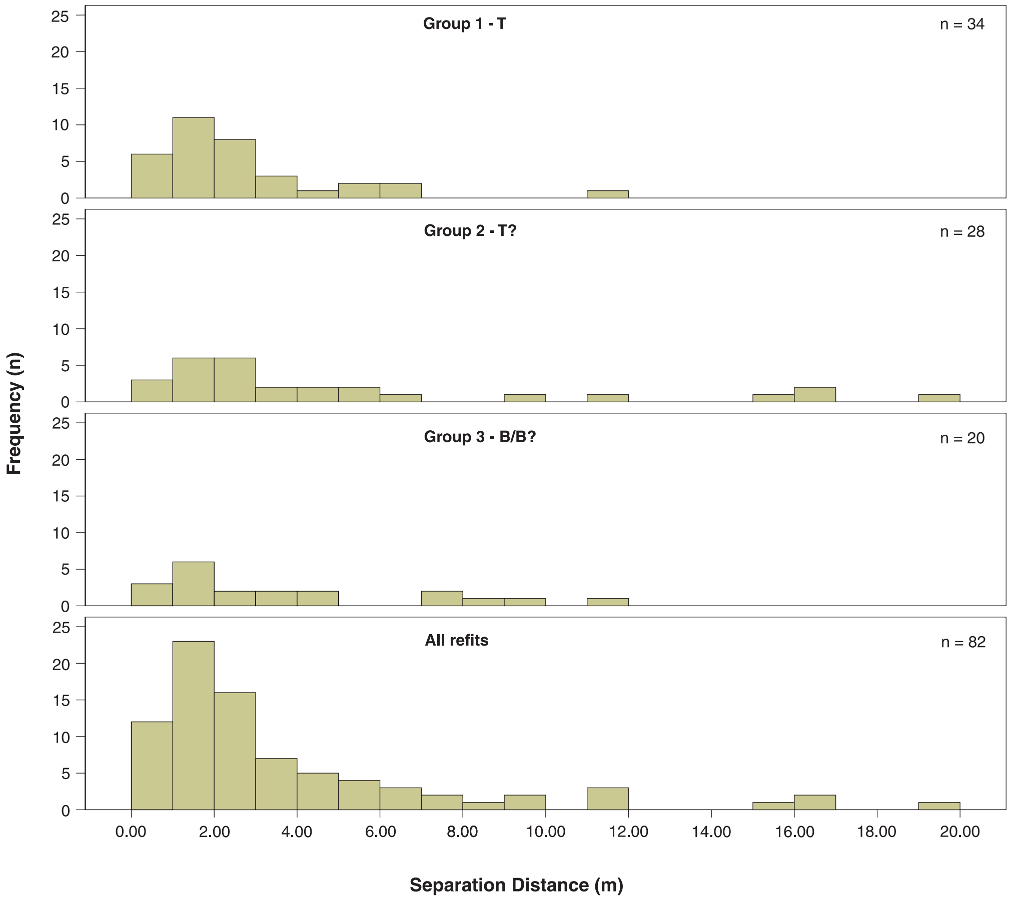


Figure 18.8 Histogram of refit separations

counts compared with the quantities of artefacts ≥ 20mm in the sampled areas.

Apart from those by the rhino jaw, these data present interesting and apparently contradictory results. At the rhino jaw, there is a sparse spread of all three artefact-size categories, with no sign that microdebitage is concentrated in a patch and associated with larger debitage so as to represent undisturbed knapping evidence. Although there are greater quantities of microdebitage than larger flakes, there are not as many as would be expected for undisturbed material. In conjunction with the absence of any refitting of the artefacts in the area of the rhino jaw microdebitage sampling, it seems evident that there is no association of undisturbed lithic evidence with the rhino jaw.

In Trenches IV, V and VII, the data are more complex. The sampling patterns allow investigation of both the spatial distribution of microdebitage, and a vertical profile through the sampled sequence in each trench. The same trends are visible in all three diagrams. Firstly, while there are some localised areas richer in microdebitage, for instance in the centre of Trench V, spit 3, these are never so densely concentrated as the experimental models for undisturbed knapping remains, and there are no instances of a rapid drop-off from a high concentration to a low concentration, as would be the case for an undisturbed scatter. Secondly, the microdebitage is quite evenly distributed through the sequence vertically. Thirdly, there seems to be no correspondence between the areas of concentration of the larger artefacts ≥ 20mm in size, and the areas with greater quantity of micro-debitage. And fourthly, there is no particular correspondence between areas richer in chip-size microdebitage (in other words 4–20mm) and areas richer in spalls (2–4mm). All of these factors indicate that, particularly in conjunction with the above-mentioned refitting results, that this area of the site cannot be regarded as containing undisturbed lithic remains.

Table 18.8 Assemblage 6.1, debitage and microdebitage quantitative comparisons: Trenches IV, V, VII and rhino jaw (group Δ.40843) compared to experimental data (Exp.)

Size-range	*Exp.*		*Tr IV*		*Tr V*		*Tr VII*		*Rhino jaw*	
	n	%	n	%	n	%	n	%	n	%
≥ 20mm	24	14	15	5	23	4	25	9	5	14
4–20mm	44	25	33	12	92	17	32	11	14	40
2–4mm	109	61	230	83	424	79	223	80	16	46

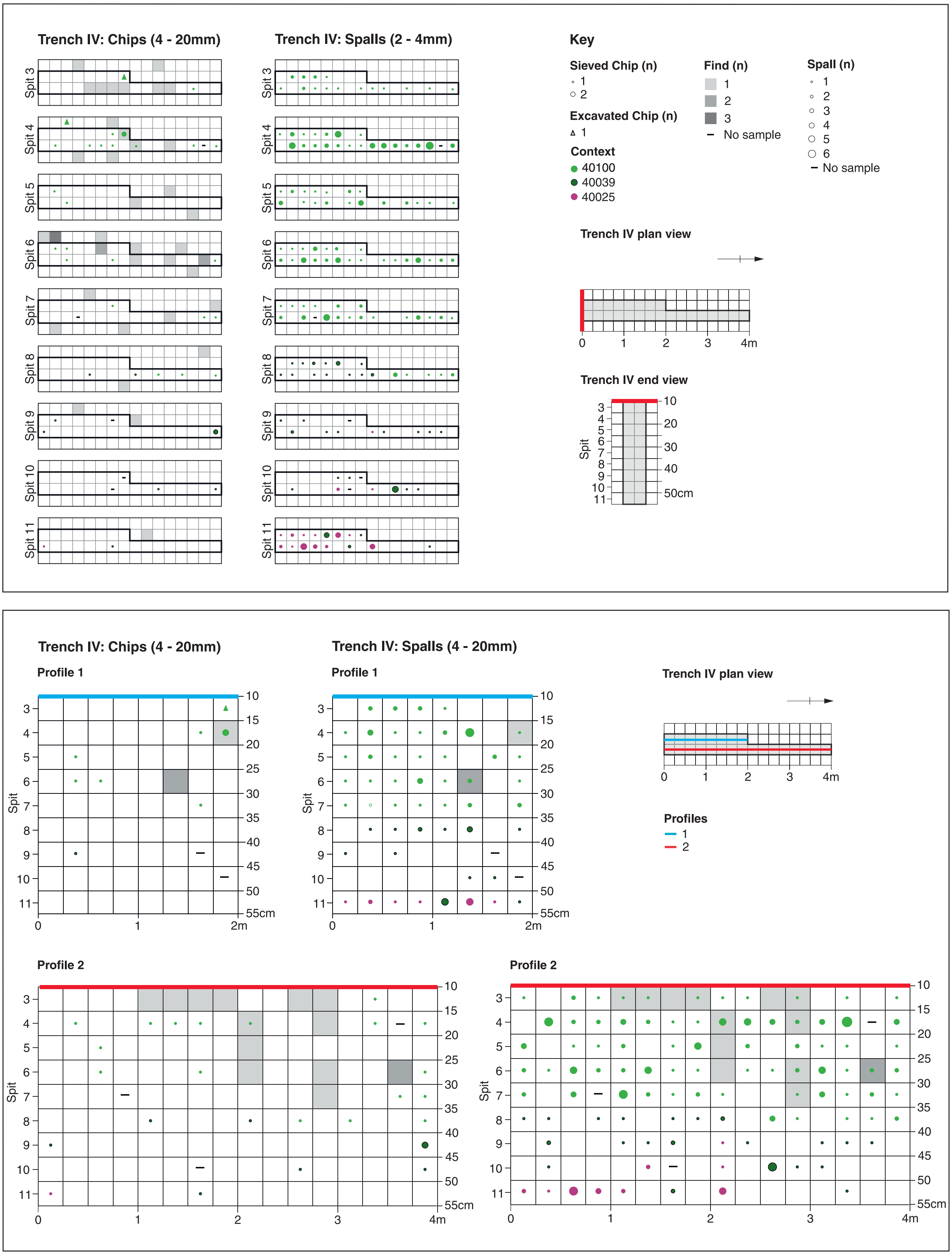


Figure 18.9 Microdebitage sampling and recovery, Trench IV

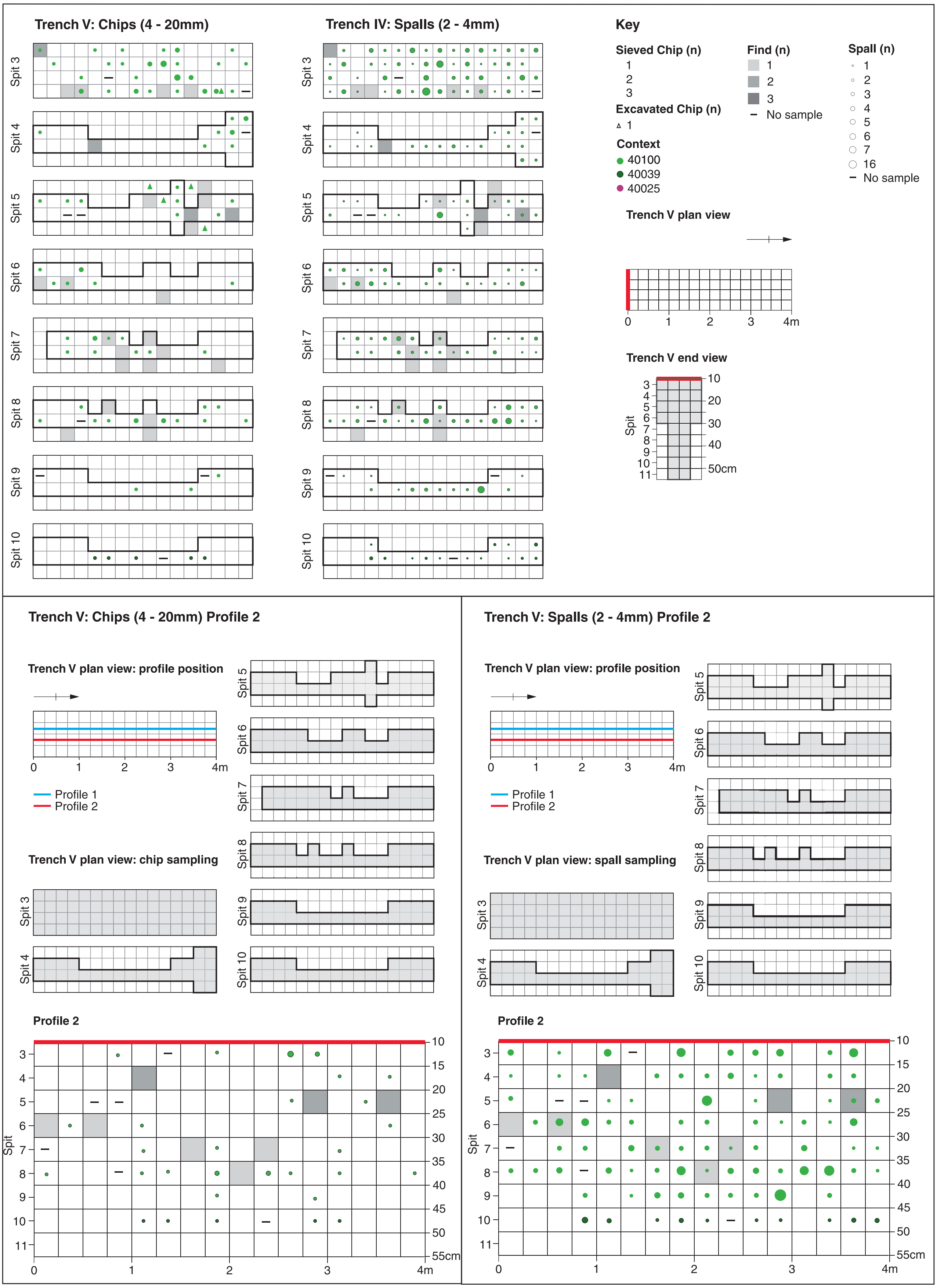


Figure 18.10 Microdebitage sampling and recovery, Trench V

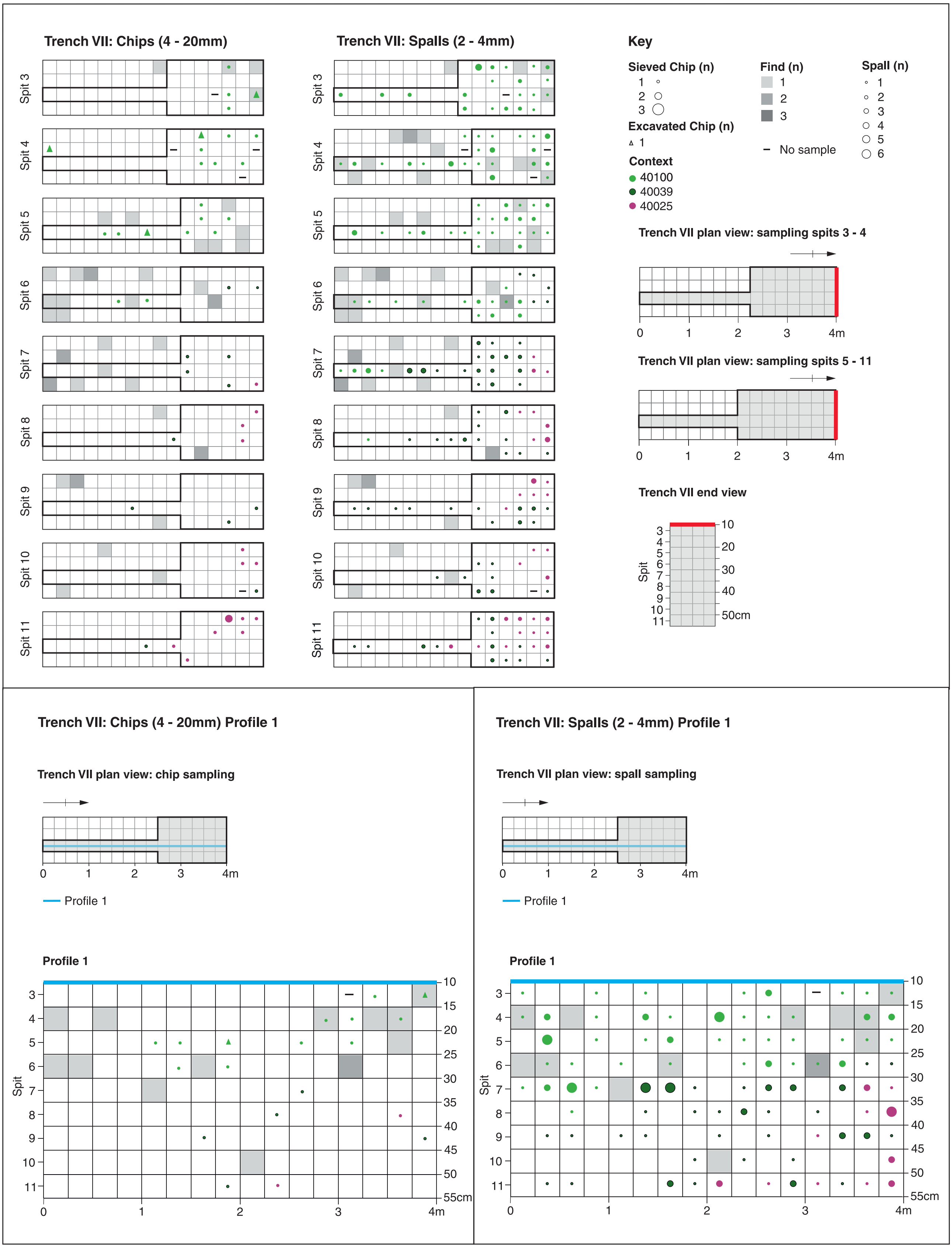


Figure 18.11 Microdebitage sampling and recovery, Trench VII

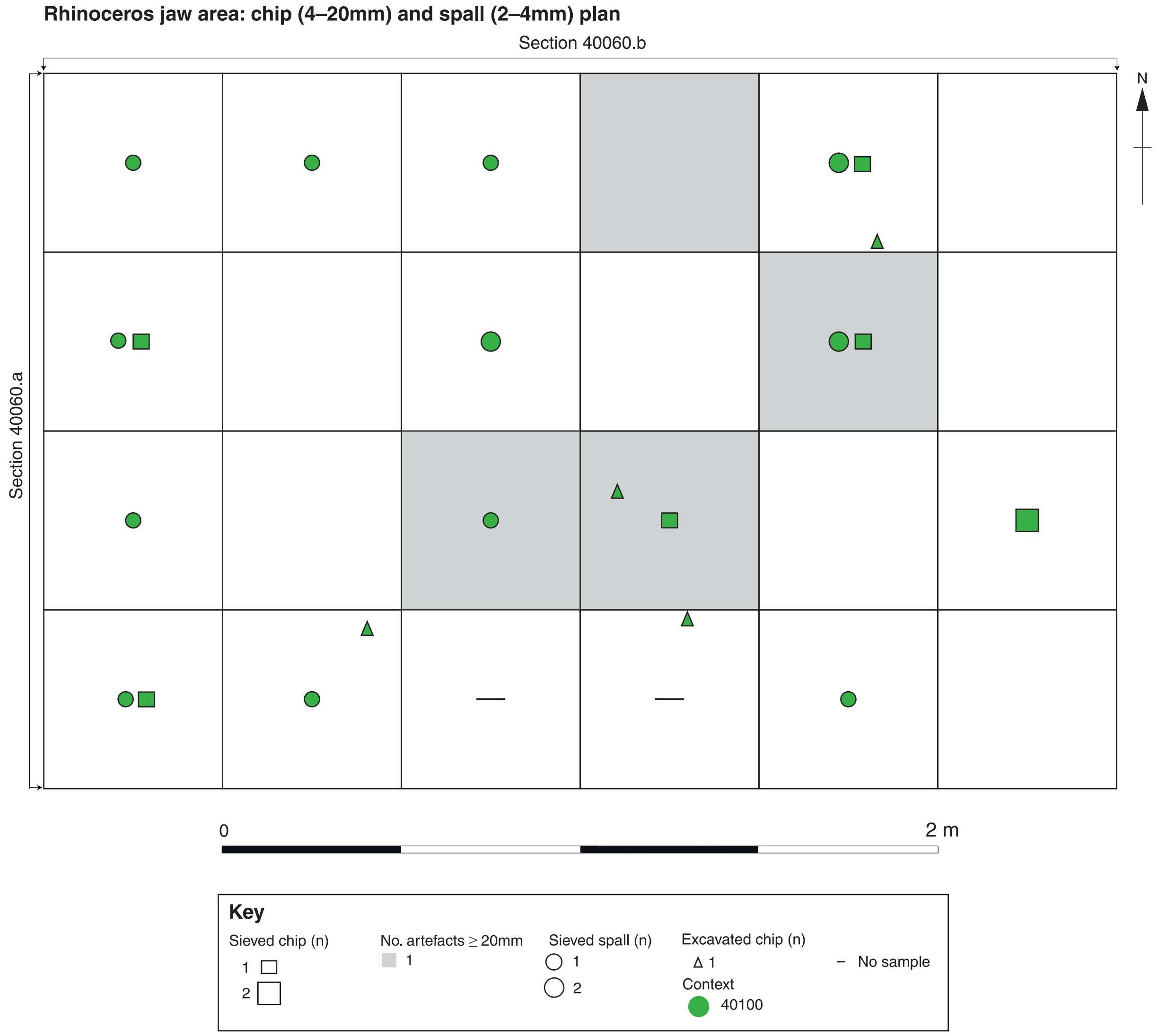


Figure 18.12 Microdebitage sampling and recovery, rhinoceros (*S. kirchbergensis*) jaw group Δ.40843

However, there are nonetheless high quantities of microdebitage (Table 18.8). In fact, when the total quantities of microdebitage are considered in relation to the number of larger lithic artefacts from the sampled volume of sediment, there are higher proportions of the smallest spall-size pieces than in the experimental models, typically approximately 80% versus 60%. Bearing in mind the proposed sedimentary depositional process for this deposit (see Chapter 4), which is one of clay-rich sheetwash from the west into a water-body of fluctuating level, periodically desiccating, it seems likely that knapping activity is taking place on the spot or the near vicinity. It is likely that the microdebitage is being dispersed and more evenly distributed by low-energy fluvial activity, perhaps with occasional slopewash episodes where sediment is mobilised *en masse*. These would carry with them, and slightly mix/disperse, larger artefacts from activity on the western slope and at the edge of the water-body, at the same time as rearranging and dispersing the microdebitage.

TECHNOLOGY, TYPOLOGY AND THE *CHAÎNE OPÉRATOIRE*

Introduction and raw material

The lithic artefact assemblage south of Trench D (assemblage 6.1) comprised 1871 artefacts, including 115 chips (see Table 18.1, Fig. 18.13a). That from the remainder of the Phase 6 clay (assemblage 6.2), except from around the elephant skeleton, comprised 129 artefacts with 11 of them chips (see Table 18.2; Fig. 18.13b). The raw material used was always flint, but other than this commonality, was extremely varied in every possible aspect: exterior condition, internal condition, texture, size, shape and colour, although this last property mostly reflects post-depositional burial history, rather than being a factor at the time of collection and knapping.

The great majority of the flint is nodular chalk flint with a very thin cortex, as is typical of much flint from the Upper Chalk of the Swanscombe area, which contains numerous seams with nodules of varying sizes, from small to huge. Some seams are almost tabular, or form as a network of connected nodules, which then break up on derivation into nodules with a solid central node and cylindrical projections. All these shape variants are present in assemblages 6.1 and 6.2. The cortical condition is never completely fresh and white, as if collected freshly derived from Chalk bedrock, but it is usually off-white or pale blueish/greyish white and slightly-moderately abraded, suggesting some degree of reworking before collection for knapping. Much of the material also has a smooth, weathered and well-abraded cortex, often darker blue-grey in colour, reflecting a greater degree of pre-collection exposure and reworking.

There is also a reasonably high incidence of frost-fracturing in the raw material, ranging from minor pot-lids and frost-fractures that would have had minimal effect on knapping potential, through to nodules/pieces that were so riven by frost-fractures that they were completely un-knappable. One of these (Δ.42777) was recovered, and fell into 59 pieces after excavation (Fig. 18.14c). After these were pieced back together, it was clear that at least one flake removal had been attempted, after which it was presumably abandoned as a lost cause; this piece was amongst those classified as a 'tested nodule'. The majority of the evidence of frost-fracture clearly pre-dates use for knapping, as many percussion fracture-planes are evidently influenced by pre-existing frost-fracture flaws. However, there is also some evidence of *in situ* temperature changes having had a post-knapping impact, for instance flake Δ.43751 has two small 'pot-lids' developed on its ventral surface, one of them developed from the point of percussion and found *in situ* in its hollow, and the other not recovered (Fig. 18.14b).

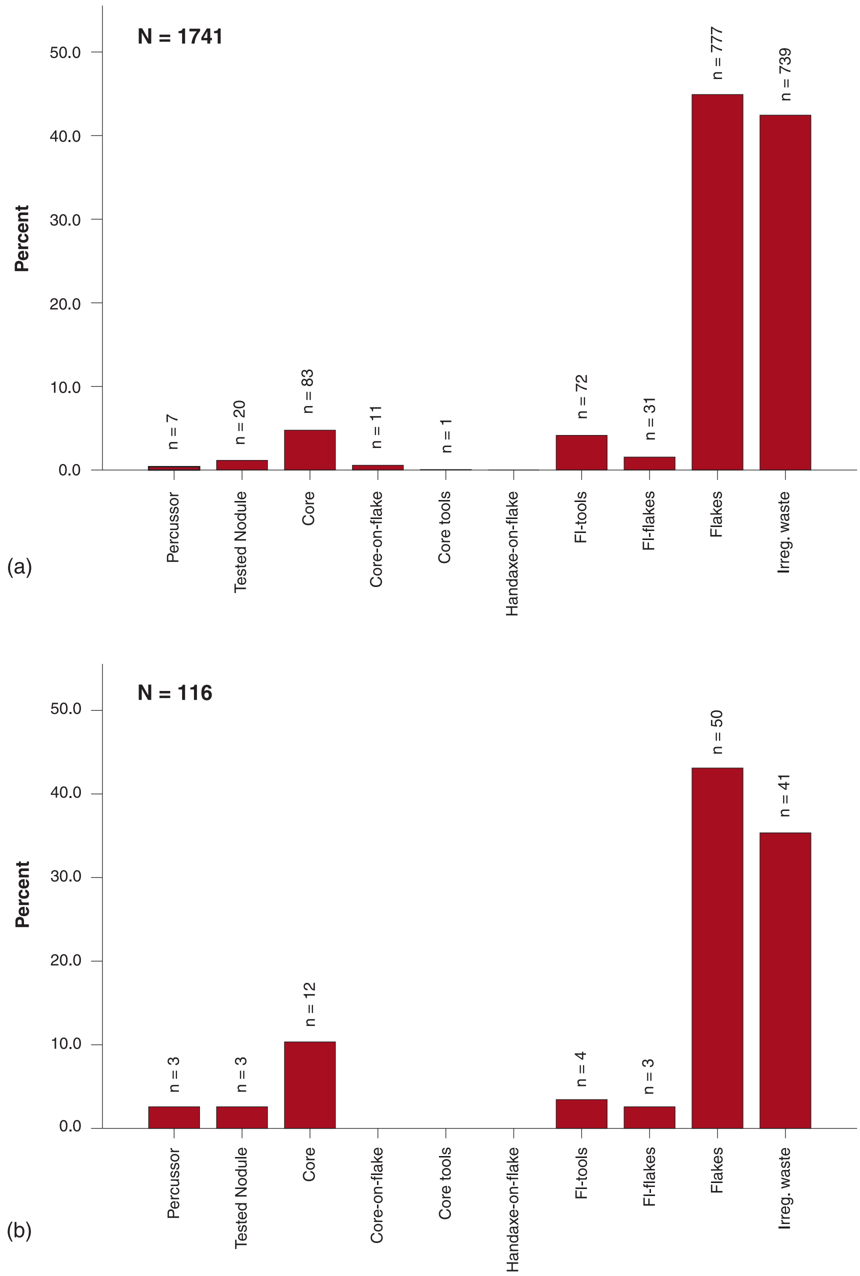


Figure 18.13 Histograms of technological categorisation: (a) assemblage 6.1; (b) assemblage 6.2

Figure 18.14 Photos of selected artefacts: (a) *in situ* break, Δ.43407=43418, RG #11; (b) *in situ* break, Δ.44017=43497, RG #35; (c) pot-lids on ventral surface, flake Δ.43751, RG #34; (d) shattered tested nodule, Δ.42777; (e) percussor, Δ.42644; (f) core-tool, Δ.42377

In addition to the nodular chalk flint, there is a reasonable quantity (approximately 2-5%) of Bullhead Bed flint, with its distinctive dark green cortex and sub-cortical orange-stained band, the cortex typically being moderately abraded. There is also some use of well-rounded Tertiary pebbles/cobbles as raw material for knapping. These are clearly recognisable from their well-rounded, chatter-marked and heavily abraded exteriors, normally stained dark grey, brown or pale ochre. Their interior flint is always coarse with very poor flaking properties and prone to break up on knapping, so it is hard to imagine that this was a very desirable raw material. Nonetheless, it was knapped, although the only artefacts found were a few pieces of debitage and irregular waste, so there is no evidence that it was ever successfully incorporated into a *chaîne opératoire* for tool manufacture and use.

It seems likely that the raw material was all very locally available. The Phase 6 clay sediments included a fair number of sizeable natural flint clasts, 145 of which were collected as finds in assemblages 6.1 and 6.2, and these are included in the site archive. Many more natural pieces were not recovered, but it is worth noting anecdotally that they were most common in the area south of Trench D, and included reasonably numerous very well-rounded derived Tertiary cobbles up to about 100–120mm long. Whether the concentration of natural clasts precisely matched the spatial clustering of the artefact distribution is, however, uncertain.

Test pit investigations in the area to the west of the site (Chapter 4) have confirmed the presence there, albeit a puzzling and difficult-to-explain presence, of chalk-rich sediments rich in flint nodules on what would have been slightly higher ground to the west of the site. These are presumed to equate broadly with Phase 3 of the site sequence, and thus to have formed flint-rich valley-side deposits that would have extended down to the water-body at the floor of the valley. They would have provided a ready source of flint raw material for hominins in the vicinity during Phases 4, 5 and 6. The evidence of abrasion and frost-fracturing in the raw material confirms its reworking and exposure to the elements, and considering the dating of the site to the earlier Hoxnian interglacial, it seems likely that the flint raw material had been exposed to the cold of the preceding Anglian glaciation. The presence of derived Tertiary material suggests input not only from chalk-rich sediments on the lower slopes, but also from Tertiary deposits that would have been higher up the slope to the west of the site, capping the now-quarried Swanscombe Hill (Fig. 2.3).

Technological summary and knapping methods

The breakdown of assemblages 6.1 and 6.2 into the main technological categories used in this analysis is given below (Table 18.9; Table 18.10), and the results for both assemblages are also summarised as bar-charts (Fig. 18.13). Assemblage 6.1 included 17 abraded artefacts, mostly in the category 'slightly-moderately abraded', but two of them were 'well-abraded'. The latter group included one medium-size technologically undiagnostic waste-flake, together with a hard-to-interpret bifacially flaked artefact (Δ.42862) that seems to be a broken part of a biface that has suffered a deep plunging flake transversely across it, which has then been further flaked. This artefact and the equally well-abraded flake are clearly intrusive into the assemblage and must represent derived evidence of earlier hominin occupation in the region, probably pre-Anglian. The former group are all technologically undiagnostic waste debitage comprising a mixture of small-medium flakes and irregular waste. They may also represent pre-Anglian evidence that has been subject to less severe reworking, or they may represent earlier Hoxnian activity on the valley side above the site that has then been transported down into the site area by slopewash, to mingle with relatively undisturbed evidence of activity at the foot of the slope.

Assemblage 6.2 has just two abraded artefacts, both in slightly-moderately abraded condition. One of them is a small piece of irregular waste. The other is a large but technologically undiagnostic waste flake (Δ.40352) with no cortex, several dorsal scars and a long sharp edge with visible scaling all along it. This was interpreted as natural damage, rather than use-wear, although this was possibly wrong, and the artefact could alternatively be interpreted

Table 18.9 Assemblage 6.1: technological categories, excluding natural pieces

	5 - Percussor	*10 - Tested nodule*	*20 - Core*	*30 - Core-on-flake*	*40 - Core-tools*	*50 - Handaxe-on-flake*	*60s - Fl-tools*	*80 - Fl-flakes*	*90 - Flakes*	*100 - Irreg. waste*	*110 - Chips*	*Sub-total (n)*
Fresh material	7	20	83	11	1	-	72	31	777	739	113	1854
% - inc chips	0.4	1.1	4.5	0.6	0.1	-	3.9	1.7	41.9	39.9	6.1	
% - excl chips	0.4	1.1	4.8	0.6	0.1	-	4.1	1.8	44.6	42.4		1741
Abraded material	-	-	-	-	1	-	-	-	8	6	2	17
% - inc chips	-	-	-	-	5.9	-	-	-	47.1	35.3	11.8	
% - excl chips	-	-	-	-	6.7	-	-	-	53.3	40.0		15

Table 18.10 Assemblage 6.2: technological categories, excluding natural pieces

	5 - Percussor	*10 - Tested nodule*	*20 - Core*	*30 - Core-on-flake*	*40 - Core-tools*	*50 - Handaxe-on-flake*	*60s - Fl-tools*	*80 - Fl-flakes*	*90 - Flakes*	*100 - Irreg. waste*	*110 - Chips*	*Sub-total (n)*
Fresh material (n)	3	3	12	-	-	-	4	3	5	41	11	127
% - inc chips	2.3	2.3	9.0	-	-	-	3.0	2.3	37.6	30.8	8.3	
% - excl chips	2.5	2.5	9.8	-	-	-	3.3	2.5	41.0	33.6		116
Abraded material (r)	-	-	-	-	-	-	-	-	1	1	-	2
% - inc chips	-	-	-	-	-	-	-	-	50.0	50.0	-	
% - excl chips	-	-	-	-	-	-	-	-	50.0	50.0	-	2

Table 18.11 Assemblages 6.1-6.2: percussors

Assemblage	*Find ID*	*Whl*	*WtG*	*Notes*
6.1	Δ.40719	1	211	Abraded flint pebble with patch of fresher battering at one end
	Δ.41235	1	395	Heavy battering at one end
	Δ.41622	1	292	Small nodular lump with one protrusion showing numerous impact marks
	Δ.42555	1	646	Localised impact marks at one end, but possibly natural rather than percussion
	Δ.42644	1	344	Definitely a percussor; clear, localised impact marks (Fig. 18.14e)
	Δ.42935	1	259	Localised impact marks suggesting use as percussor, but also damaged by mattock when found
	Δ.43060	1	221	Small core remnant with numerous flake removals and patch of localised battering on rounded cortical protrusion, suggesting additional use as a percussor (Fig. 18.20b)
	Δ.43442	1	559	Lump of irregular waste with localised batter-marks that suggest use as a percussor rather than attempted flake removal
6.2	Δ.40394	1	152	Fractured Tertiary pebble, poss. impacts from percussion?
	Δ.42544	0	227	Possibly broken during use, refits with irregular waste Δ.42572
	Δ.42571	0	82	Broken piece; heavily battered, possibly two phases of use

as a heavily utilised flake-tool. As with assemblage 6.1, these abraded elements probably represent intrusive evidence of pre-Anglian or earlier Hoxnian hominin activity on the high ground to the west of the site, introduced to the site sequence by slopewash from the west.

For the fresh assemblages, it is immediately clear (Fig. 18.13) that, despite assemblage 6.1 being 15x larger than assemblage 6.2, the relative proportions of different categories of artefact are virtually identical. The only difference is the slightly increased number of pieces identified as 'percussor' in assemblage 6.2, which is easily explained as a disproportionate statistical influence of a chance variation in a small assemblage. The majority of both assemblages 6.1 and 6.2 was formed of flakes (approximately 40–45%) and irregular waste (approximately 35-40%), with the relative quantity of flakes slightly higher in assemblage 6.1. This probably reflects the increased recovery of smaller, thinner flakes in the area south of Trench D due to the increased use of hand excavation. Cores constitute a higher proportion of assemblage 6.2 than 6.1 (about 10% versus 5%), and this likewise probably reflects the increased recovery of smaller debitage by hand excavation in the area south of Trench D. Tested nodules are a very small element of both assemblages (about 1–2%). There is just one example of an artefact classifiable as a core-tool rather than a core, in assemblage 6.1; this is discussed in more detail below, but suffice it to say that it is not bifacially worked and could not be classified as even the most proto of proto-handaxes.

The rest of both assemblages consists of flake-tools (about 3–4%), that is flakes and irregular waste that have been subject to secondary working (when not interpreted as cores) and flake-flakes caused by this secondary working (about 1-2%). The latter are probably under-represented since they are not always clearly identifiable, and were only classified as such when there was clear evidence that they had been struck on a pre-existing flake removal. All these elements are discussed in more detail below.

The whole assemblage seems to have been created by hard-hammer percussion. Most flakes have typical hard-hammer diagnostic features such as circular ring-cracks indicating the point of percussion, the absence of a lip between the point of percussion and the ventral surface,

Table 18.12 Assemblages 6.1 and 6.2: core statistics (all cores)

Assemblage	*Statistic*	*ML*	*DSC*	*WtG*	*Notes*
6.1 (n=83)	Max	146	24	901	Includes 12 cores classified as 'broken'; excluding these makes negligible difference to the figures, and it is often problematic to establish that a core was broken after its last removal; nonetheless, comparative data for whole cores are provided in Fig. 18.15
	Q4/Q3	83.5	8	224.5	
	Mean	73.85	7.01	177.73	
	Q2/Q1	62	5	79	
	Min	42	1	31	
	Sd (pop)	19.65	3.84	154.49	
6.2 (n=12)	Max	275	20	6350	Includes one very large core, Δ.42916 (Fig. 18.16)
	Q4/Q3	95	9	397.75	
	Mean	111.55	7.5	1143.67	
	Q2/Q1	77	4.75	245	
	Min	62	1	62	
	Sd (pop)	64.20	4.77	1991.66	

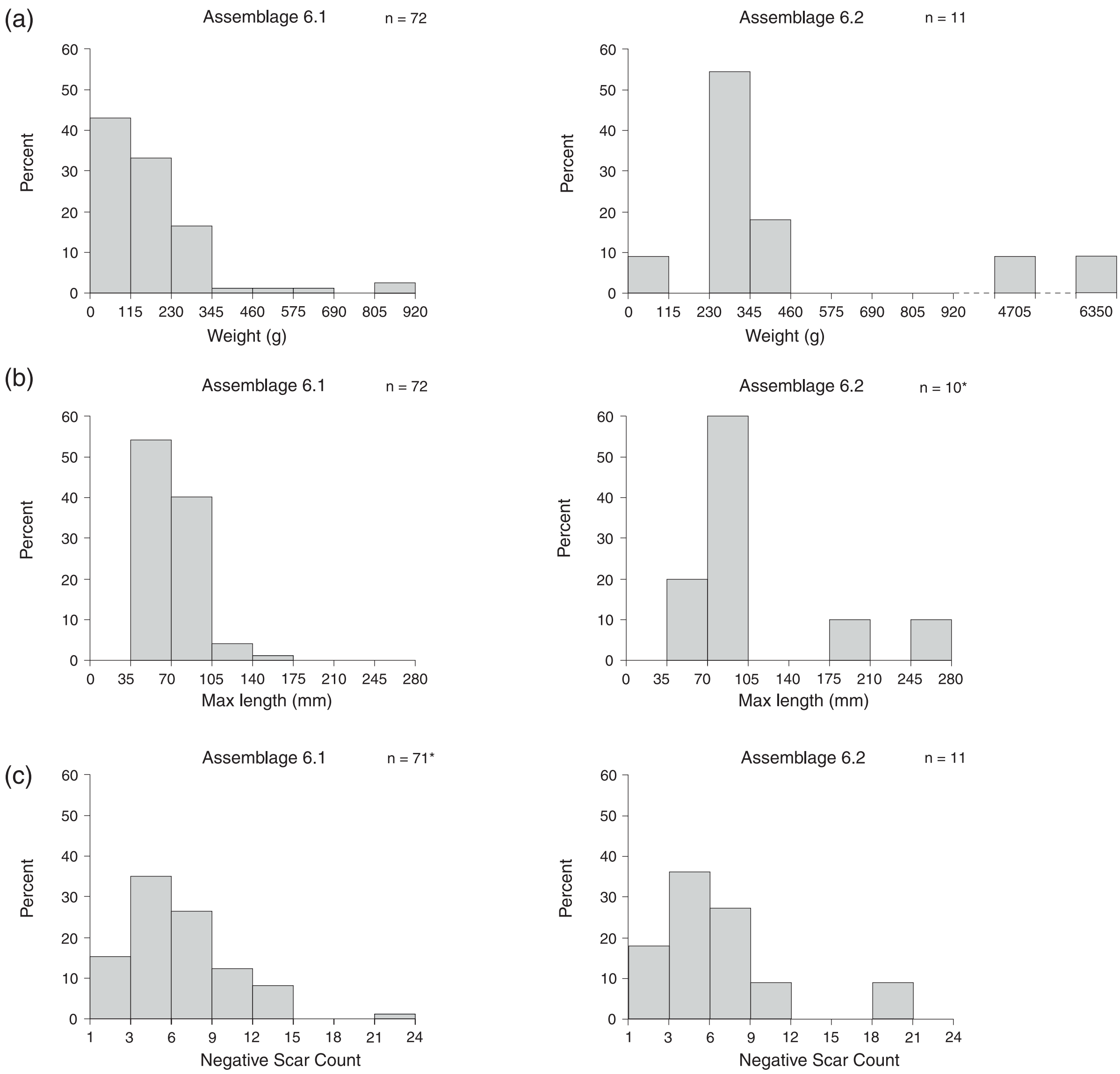


Figure 18.15 Histograms of core size and reduction attributes (unbroken cores only) from assemblages 6.1 and 6.2: (a) weight; (b) maximum length; and (c) negative scar count [* missing one measurement of negative scar count from Ass. 6.1 and one measurement of max. length from Ass. 6.2]

and a higher incidence of visible conchoidal rippling on the ventral bulb of percussion. The last probably reflecting the harsher vibrations introduced by a hard-hammer blow than a soft-hammer one.

In addition to this indirect evidence of percussor type, a number of flint pieces were found with localised patches of battering suggesting their use as hard-hammer percussors, including one (Δ.43060) that also served as a core (Table 18.11; see also Fig. 18.20b, below). On some of these, it was hard to distinguish natural battering from hominin percussion, but on others there was very clear and localised fresh battering clearly indicating use as a percussor (Δ.42644, Fig. 18.14d). The average weight of the more complete percussors was a little under 350g, which corresponds well with the preference of modern knappers in some recent experiments (pers. observation).

A core-tool, cores and flaking strategies

Out of all the material comprising (the fresh elements of) assemblages 6.1 and 6.2, there was just one artefact classifiable as a core-tool. There was not one single example of a handaxe on a flake and there was not one single piece of debitage suggestive of bifacial thinning and/or shaping. The 'core-tool' (Δ.42377) was a cylindrical flint nodule about 120–150mm long, weighing 520g (Fig. 18.14e). One end was diagonally truncated by a natural frost-fracture, and this frost-fracture had been used as the platform for removal of a flake to form a transverse sharp

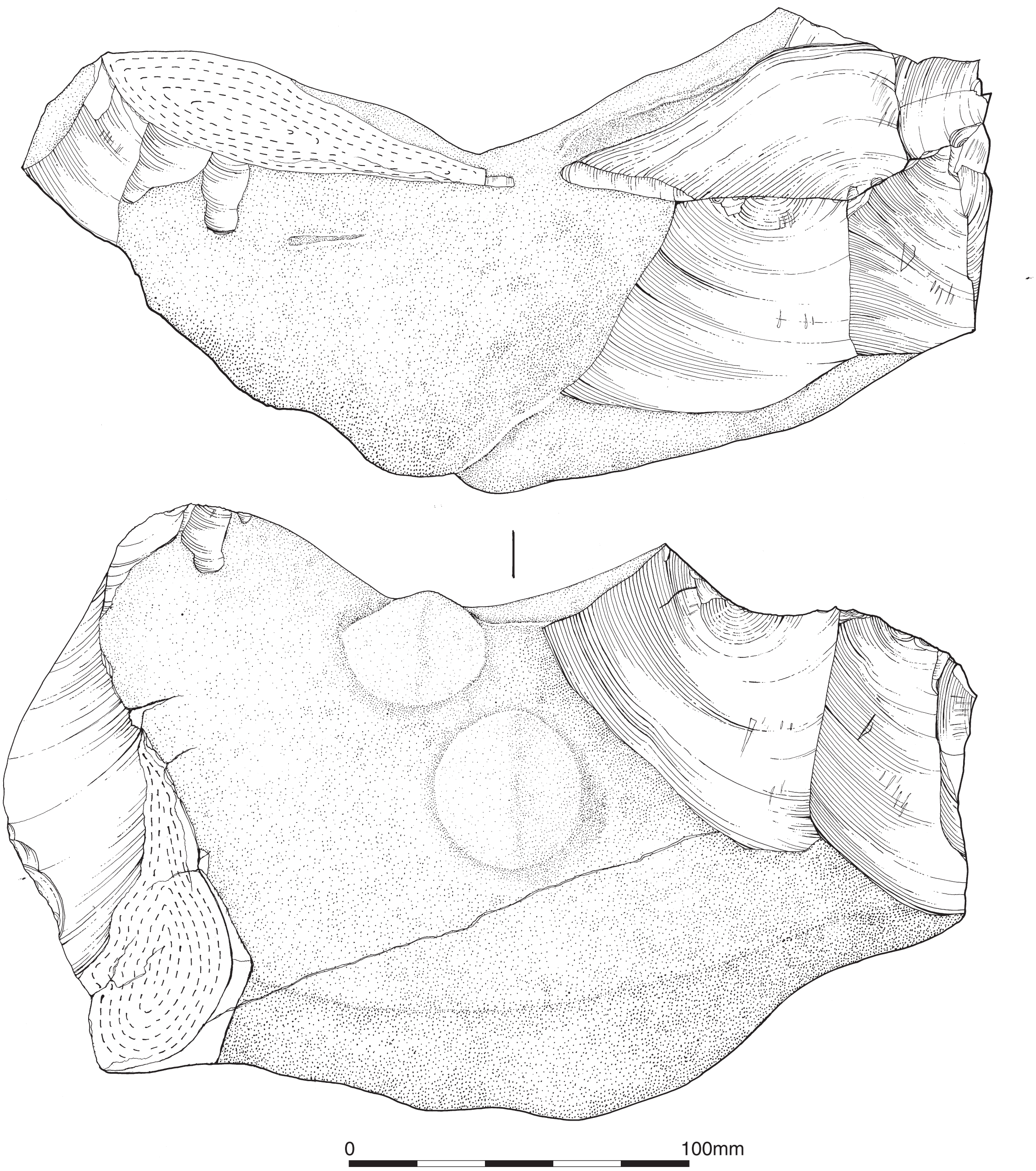


Figure 18.16 Assemblage 6.2: core Δ.42916 [ill. B. McNee]

edge across the end of the nodule. This edge had some small, invasive chips on it, which look like macro use-wear rather than natural abrasion. There is no hint of bifacial working. So one thing that is clear about the site is that there is no evidence of bifacial tool manufacturing in any of the Phase 6 assemblages 6.1, 6.2 or 6.3, aside from the single, very abraded intrusion discussed above.

As well as nodules from which only single small removals were made, classified here as 'tested nodules', there were 83 cores in assemblage 6.1, and 12 in assemblage 6.2. The basic size statistics of the cores from these assemblages are given (Table 18.12). It can be seen that they occur in a wide range of sizes from about 40mm to 275mm long, weighing from about 30g to 6350g and with widely varying intensities of reduction with from 1–24 countable negative flake scars. The few instances of cores with single flake scars were, incidentally, distinguished from 'tested nodules' due to their small size, the higher quality flint (tested nodules were often interpreted as abandoned due to frost-fracturing or being an awkward shape to knap) and the relatively large size of the flake removed compared to the core. Apart from one huge core (Δ.42916) which somewhat skewed the statistics, the sizes and degree of reduction of cores were broadly similar in both assemblages 6.1 and 6.2. Histograms were prepared showing the distributions of these three size variables (Fig. 18.15a–c). The collection of cores from assemblage 6.1 is probably more representative as it is substantially larger, and was recovered by hand-excavation, and so is less biased towards larger specimens. It shows that most cores were abandoned at quite a small size (between approximately 30 and 100mm maximum length and weighing less than 200g). It also shows that most cores had quite low dorsal scar counts, predominantly in the range 4–6, although this is an unreliable indication of the actual number of flakes produced, as many of the earlier removals would not leave scars that remained visible at the end of the reduction sequence.

All the cores seemed to result from simply structured approaches to producing series of flakes of varying sizes. A representative selection of 15 cores was chosen for illustration (Figs 18.16–18.21), including three with refitting flakes: RGs #11, #30 and #59. Some cores were abandoned after removal of several, or sometimes very few, large flakes (for example core Δ.42916 – Fig. 18.16) and others were quite intensively worked and showed the removal of many small-medium flakes (Fig. 18.20). In terms of the knapping strategies adopted, it is a moot point whether the *post hoc* modern imposition of concepts such as 'approaches' and 'strategies' is valid, or whether it is more appropriate to describe the reduction sequence carried out as neutrally as possible and observe groupings and repetitions without any suggestion that these reflect deliberately applied strategies. The approach taken here is that it is not thought that there was any intention to create a core in a final shape, so the repeated occurrence of similarly shaped cores must be the unintentional outcome of repeated approaches to reduction. Also, that it is possible to describe the sequence of reduction without casting it as a pre-conceived strategy, and then have a subsequent discussion of whether it is possible to cross into the territory of considering the repetition of any particular reduction pathways as deliberately conceived strategic approaches.

Four main pathways of reduction were observed in the core collection, as well as numerous short episodes of single platform or alternate flaking, and removal of flakes from randomly migrating platforms in what seemed an

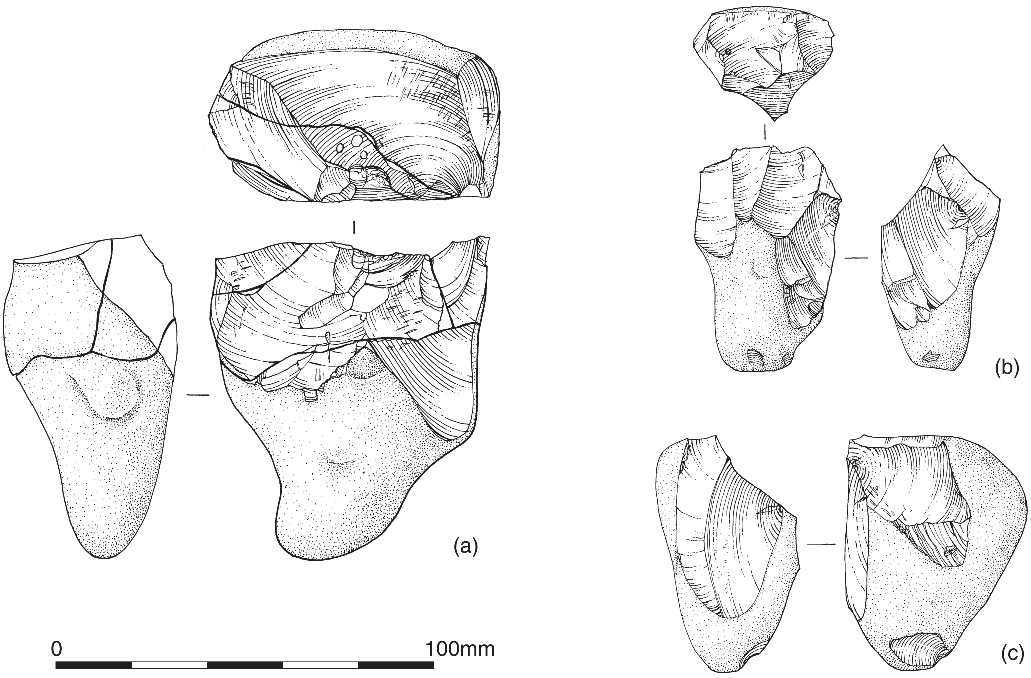


Figure 18.17 Assemblage 6.1 cores, alternately flaked around part of nodule: (a) RG #59, Δ.40203=Δ.41554=Δ.42465; (b) Δ.42775; (c) Δ.43713 [ill. B. McNee]

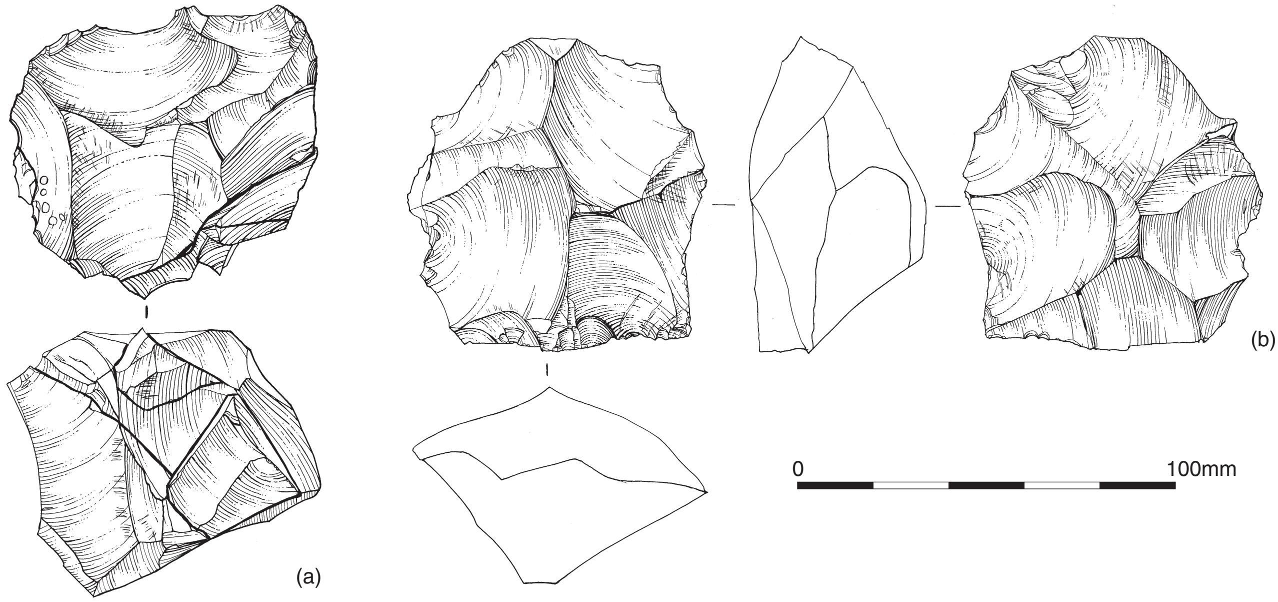


Figure 18.18 Assemblage 6.1, bi/uni-pyramidal cores: (a) RG #11, Δ.43418=Δ.43407, Δ.41993=Δ.41994, Δ.41855; (b) Δ.43718 [ill. B. McNee]

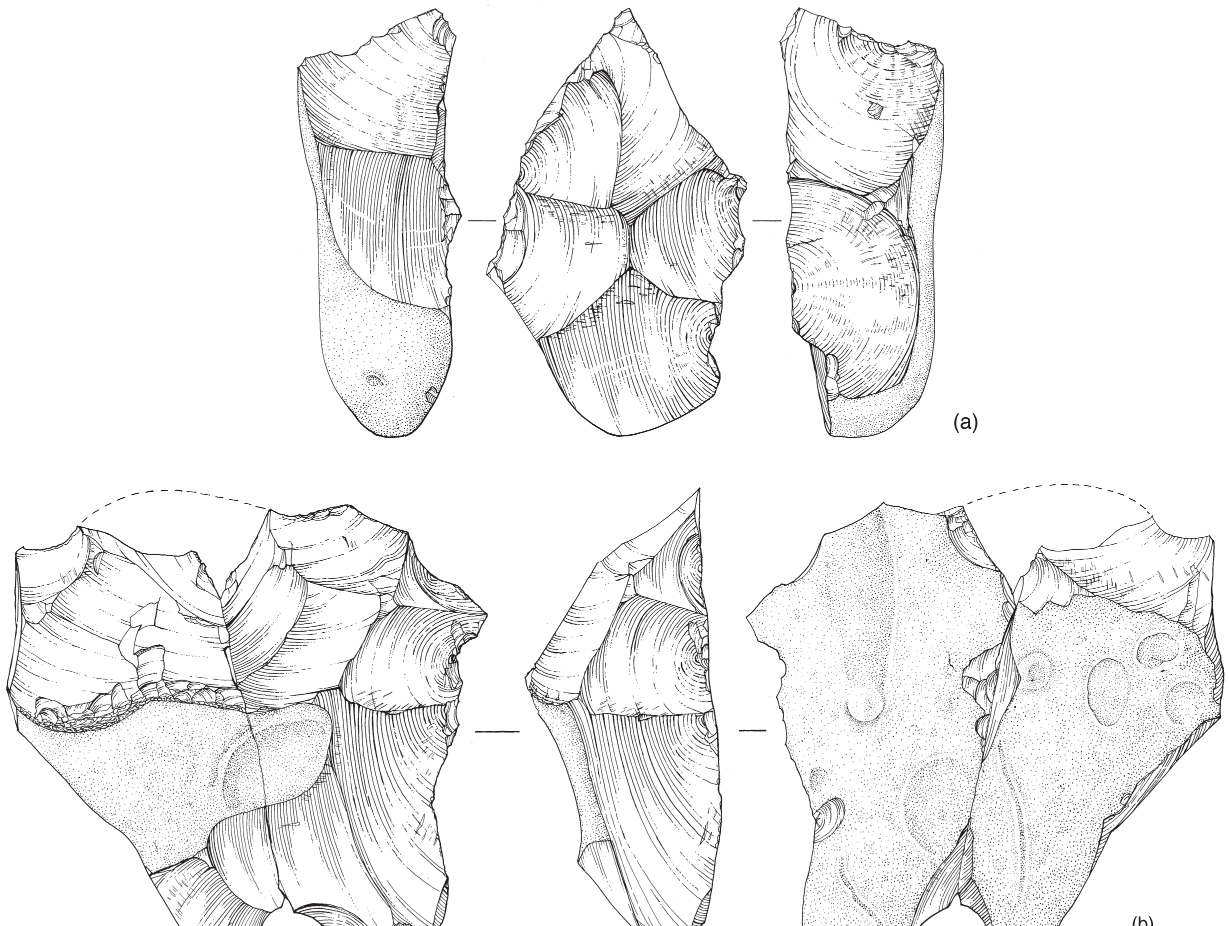


Figure 18.19 Assemblage 6.1, unifacial/single platform cores: (a) Δ.43309; (b) Δ.42437 [ill. B. McNee]

entirely *ad hoc* manner. Firstly, several cores were alternately flaked at one end, with this pattern of flaking sometimes ceasing after only a few removals, and sometimes continuing further around a nodule (Fig. 18.16 – Δ.42916; Fig. 18.17 – Δ.42775, Δ.43713 and RG #59, although this latter sequence is interrupted by breakage of the core).

Another regular occurring pattern of reduction (also represented in the main core Δ.40871 of refitting Group C from around the elephant skeleton) was for some flakes to be removed from a flatter 'top' surface, but for this 'top' surface to be mostly used as a striking platform for flakes that were struck around most of its perimeter, resulting in a uni-pyramidal end-form of the core (Fig. 18.18b – Δ.43718). There were also instances of repeated flaking from just one platform all around a core (Fig. 18.19b – Δ.42437), or conversely for most of the flakes to come from one flat surface of a core, and only a few from around the perimeter (Fig. 18.19a – Δ.43309). A variation on this was for the distinction between 'top' surface and main flaking direction to be less clear-cut, and for pseudo-bifacial alternate flaking to proceed around the perimeter of a core, leaving a pseudo-bifacial or bi-pyramidal form (Fig. 18.18a – RG#11; Fig. 18.20d,

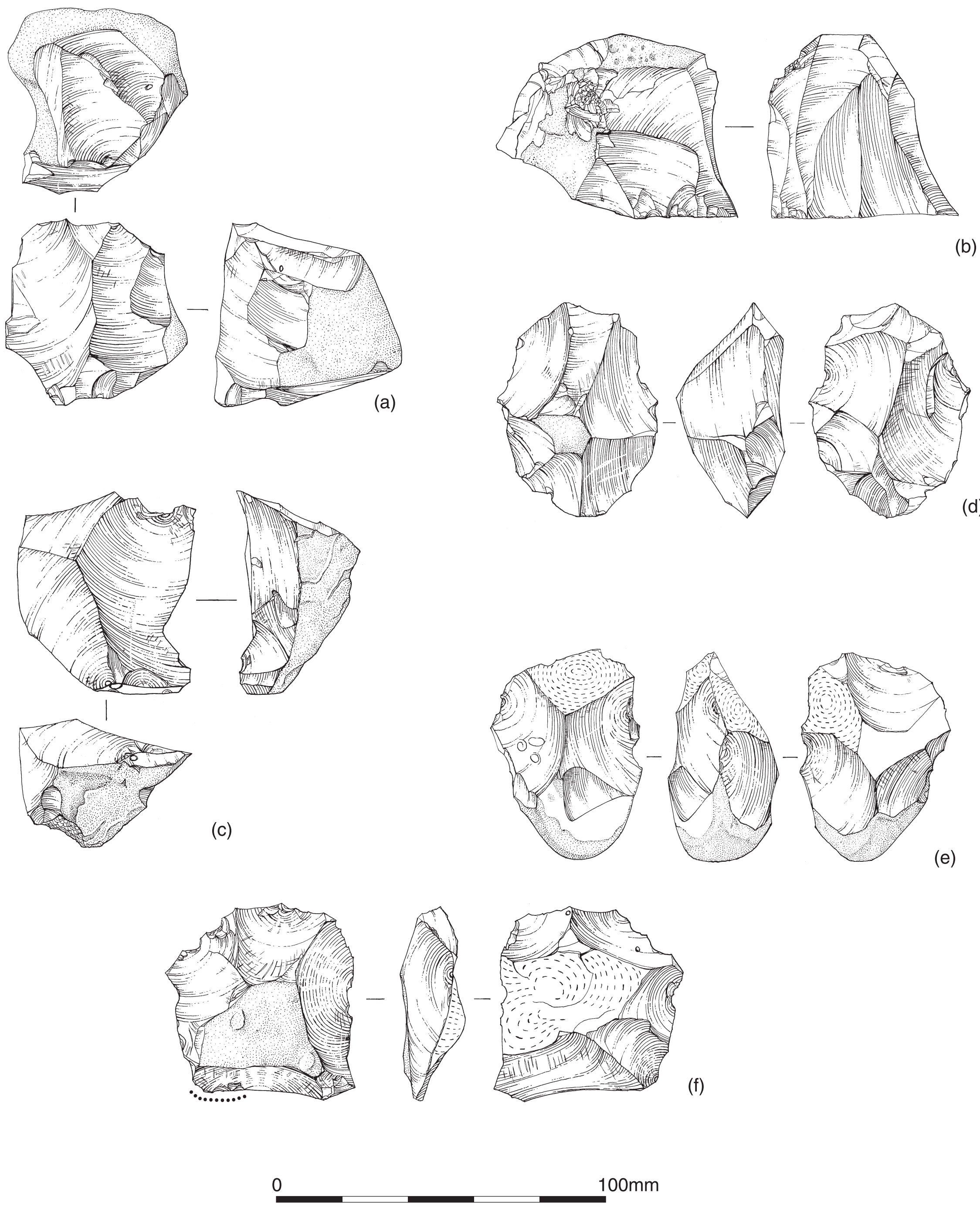


Figure 18.20 Assemblage 6.1, small globular cores (a)–(c) and pseudo-bifacial forms (d)–(f): (a) Δ.42801; (b) Δ.43060, with marks from use as percussor; (c) Δ.43235, on flake; (d) Δ.40742; (e) Δ.40835; (f) Δ.42628, on irregular waste, with faint macro use-wear shown as dots [ill. B. McNee]

e, f – Δ.40742, Δ.40835 and Δ.42628), with very sinuous edges and no indication of thinning/straightening the edge as a bifacial cutting edge, although one of these illustrated cores was quite thin (Δ.42628), and had signs of possible macro use-wear on one of its sharp edges, leading to ambiguity over whether it should be regarded as a core or a flake-tool.

There were quite a few small lumps with no apparent structure to the reduction pathway, which had been flaked via a combination of new and alternating platforms, two of which are shown here, the latter of which also has batter-marks suggesting it was also used as a percussor (Fig 18.20a, b – Δ.42801; Δ.43060).

Several of the cores (n=11, in assemblage 6.1) were made on large flakes or pieces of irregular waste (see for example Fig. 18.20c, f – Δ.43235, Δ.42628). As discussed below, one of the problems in interpretation was to try and distinguish between chunky flake-tools and small cores on flakes or waste debitage. This was an impossible task, although it was attempted since some of the single and double-notched flakes seemed so clearly to be deliberately made tools that it seemed negligent to exclude them from consideration as such. This, however, had the knock-on effect of having to force inappropriate categorical boundaries on other material. Aside from the possibility that some of these smaller cores are purposeless juvenile knapping, their interpretation as cores presumes that some quite small flakes were useful for certain light duty tasks.

The following section considers the reduction pathways applied further, based on the small number of slightly longer refitted flaking sequences found.

Refitted reduction sequences

In contrast to the material from around the elephant, there were no long refitted reduction sequences that demonstrated significantly more detailed pathways of flake reduction than could be observed in the cores themselves. The most informative sequences were RG #11 (Fig. 18.18a; Table 18.13), RG #30 (Fig. 18.21a, b; Table 18.14) and RG #52 (Fig. 18.21c; Table 18.15; Table 18.16), which provided slightly more information on sequences of core position, and exemplify some of the variety of approaches.

RG #11: (Δ.43418 = Δ.43407; Δ.41993 = Δ.41994; Δ.42511; Δ.41855)

In the first of these, RG #11, also considered above purely as a core, there were six constituent pieces (Fig. 18.22). However, these only represent three removals and the core, since the core is formed of two pieces (Δ.43407 = Δ.43418) that were almost certainly broken *in situ* when frost-action and sediment heaving exacerbated the pre-existing fracture-plane of a failed flake removal. Likewise, one of the three removals is formed of two joining pieces thought to have broken *in situ* (Δ.41993 = Δ.41994). The other two flakes completing

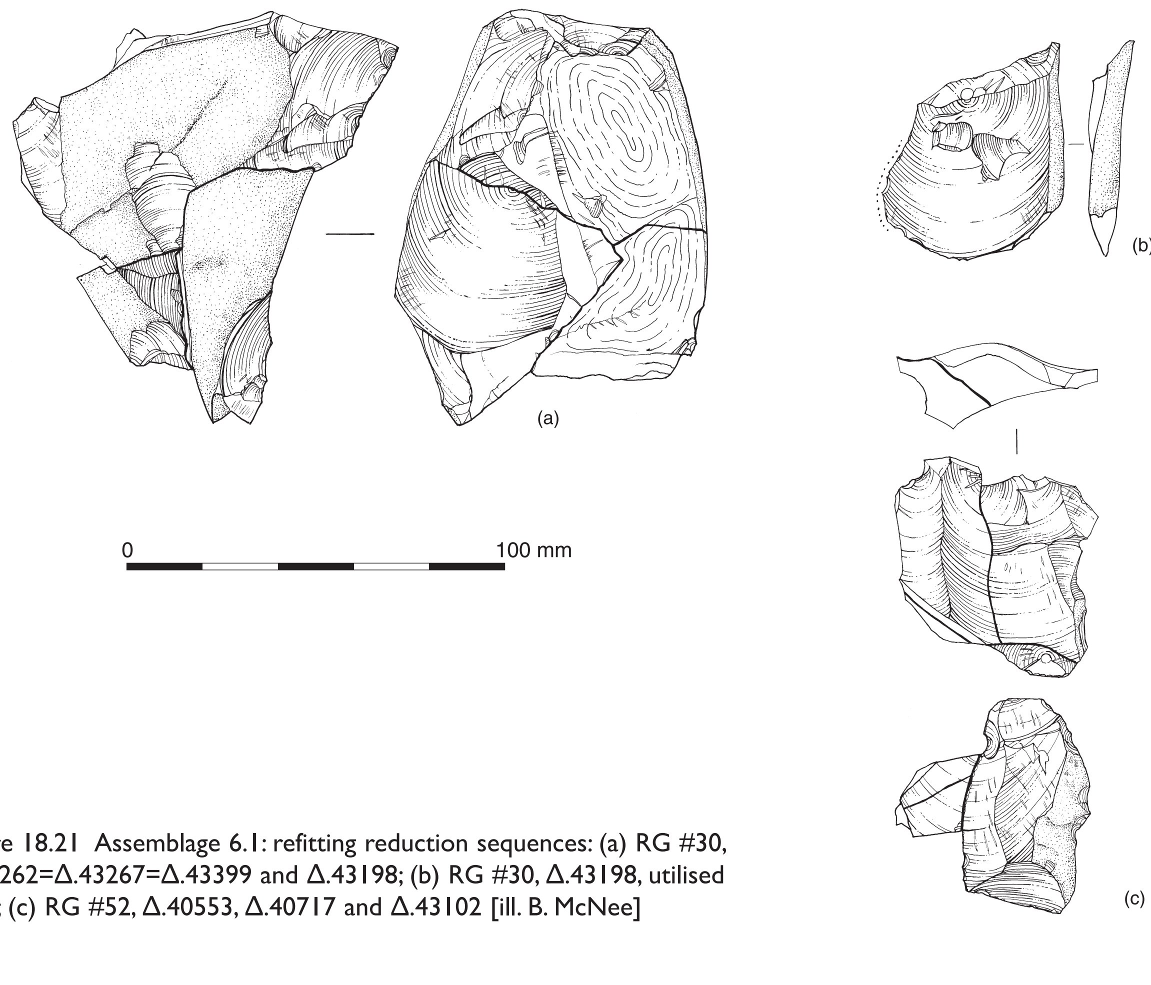


Figure 18.21 Assemblage 6.1: refitting reduction sequences: (a) RG #30, Δ.43262=Δ.43267=Δ.43399 and Δ.43198; (b) RG #30, Δ.43198, utilised flake; (c) RG #52, Δ.40553, Δ.40717 and Δ.43102 [ill. B. McNee]

the refitting group are Δ.42511 (not illustrated) and Δ.41855 (illustrated attached to the core).

When considered as a core, this was a good example of a core with a bi-pyramidal end-form resulting from pseudo-bifacial alternate flaking around its perimeter. The overall strategy of flaking represented in the core is very clear, at least as represented in the surviving evidence of its negative scars and refitting removals. There are also clear signs of the failures that led to its abandonment. The earliest flake in the sequence is Δ.42511 (which unfortunately lacks XYZ spatial provenance). This flake has approximately 10 dorsal scars indicating previous flaking. At least one of these appears to have been from a very sizeable flake that ended in a step fracture, part of the ridge from which is preserved on the dorsal surface of Δ.42511 and the other part on the

Table 18.13 Assemblage 6.1, RG#11 'bi-pyramidal core': reduction *chaîne opératoire*

Event order #	*Core/platform positioning*	*Flake removal*	*Comments*
-	General alternate platform flaking around perimeter of core	△n+⇩	At least ten flakes missing from the early sequence, probably many more; most of them with a tendency towards hinge terminations
1	New platform, scar of one of the earlier removals	▲42511⇩	Flake struck from perimeter of core, towards centre of one pyramidal face
2	New platform, alternate (▲42511 scar) – core turned upside down	△a ⇩	Squat flake with hinge termination
3	Same platform, (*c* 15mm clockwise)	△b ⇩	Another, even squatter flake with step termination
4	Same platform, (*c* 5mm anti-clockwise)	▲41993=▲41994=△c⇩	Another, even more squat flake with step termination; breaks with Siret fracture, one side of which is missing
5	Same platform, (*c* 5mm clockwise)	▲41855⇩	Small flake with hinge termination; fails to clear steps on core surface resulting from events #2–4
6	New platform, alternate (▲41855 scar) – core turned upside down again	△d ⇩	Small flake (*c* 50mm long) that travels across what was previously the top surface of the core, guided by the left ridge of the earlier removal ▲42511
7	New platform, opposite side of core's median perimeter	△e⇩	Another small flake that also successfully crosses the core surface
8	Same platform, (*c* 30mm clockwise)	△f⇩	Squat flake that ends with a hinge termination
9?	New platform – core turned upside down again	▲43407 (failed), ■ 43418	There are several percussion points on the platform, one of which has caused initiation of a fracture plane towards the centre of the core; [this event could alternatively have happened between events #5 and 6]; ▲43407 was not detached at the time, but it was later split off by frost action that extended the fracture plane, probably during burial

△ - missing debitage from refitted sequence; ▲ - debitage present in reduction sequence; ■ - core left at end of sequence

Table 18.14 Assemblage 6.1: refitting group RG#30

Find ID	*ML*	*MW*	*MT*	*WtG*	*Notes*
Δ.43262	-	-	-	101	Irregular waste - no flake removals ≥20mm
Δ.43267	72	56	27	77	Core - one flake removal (Δ.43198)
Δ.43399	97	68	50	381	Core - scars from several flake removals, but all of them small and/or failed with hinge/step terminations, and affected by internal flaws that persist within the piece
Δ.43198	44	43	11	31	Utilised flake - has use macro-wear on sharp edge

Table 18.15 Assemblage 6.1: refitting group RG#52, basic statistics

Find ID	*%Cx*	*DSC*	*ML*	*MW*	*MT*	*WtG*	*Notes*
Δ.40553	1	7	52	53	15	41	Flake
Δ.40717	0	5	46	25	10	13	Flake
Δ.43102	3	3	54	33	17	27	Utilised flake? Has faint micro-chipping and one larger mini-notch along its sharp edge

Table 18.16 Assemblage 6.1, RG#52 'migrating platform' *chaîne opératoire*

Event order #	*Core/platform positioning*	*Flake removal*	*Comments*
-	General migrating platform flaking, from two platforms opposed to each other	△n+⇩	At least three flakes missing from the early sequence, probably many more
1	New platform, migrated round *c* 180° from previous removal	▲43102⇩	Flake has cortex down right-hand side, and scars from three previous removals,
2	New platform, migrated round *c* 90° from previous removal	△a⇩	Small but quite solid flake *c* 45 x 25mm crosses full length of core surface
3	Same platform, (*c* 15mm clockwise)	▲40717⇩	Smaller flake that also crosses full length of core surface
4	Same platform, (*c* 10mm anticlockwise)	△b ⇩	Short, squat flake *c* 15 x 25mm that only travels a short distance, with slight hinge at end
5	Same platform, (directly behind)	▲40553⇩	Small-medium flake that thickens towards distal end, crossing full length of what would have been quite a small core

△ - missing debitage from refitted sequence; ▲ - debitage present in reduction sequence

core. There is no remnant of cortex on the core or on any of its refitting flakes, and it was clearly of much more substantial size when its knapping commenced. It retains scars of some 20 removals and could have produced considerably more, although the evidence of this is not preserved. The result is a roughly bi-pyramidal core with a sinuous median perimeter from which flakes were struck off one or other of the two pyramidal faces, depending which way up the core was held.

After removal of Δ.42511, the core was turned upside down and the scar from this removal was used as an alternate platform for two consecutive flakes off the opposite face, events #2-3, Δa and Δb (neither recovered). These two flakes were followed by two further removals struck from the same platform, events #4-5, Δ.41993 = Δ.41994 = Δc and Δ.41855. All four flakes were short and squat, with hinge/step terminations and failed to travel along the surface of the core. Although one has to be wary in ascribing success or failure to prehistoric knappers, this is unlikely to have been thought a satisfactory outcome. It is only in much later prehistory, such as the Neolithic or Bronze Age that flake-production strategies for arrowhead blanks seem to deliberately aim at producing squat flakes with hinge terminations.

After event #5, there is a slight ambiguity in the remainder of the reduction sequence. It is possible that the event shown as #9? in the tabular summary (Table 18.13) was interspersed between events #5 and #6, in which case it would have been a clockwise migration around the perimeter of the core, and a failed attempt to detach a substantial flake from the same face of the core as was being flaked by events #2-5 and would have removed the surface blockage caused by the hinge/step fracturing. As it is, it is guessed as slightly more likely, considering the predominance of alternate platform flaking, that the core was turned over after event #5 and the scar of flake Δ.41855 was used as an alternate platform for the removal of flake Δd (event #6). After this, the following two flakes (Δe and Δf, events #7-8) were struck from the same face, but from the opposite side of the median perimeter of the core. None of these three flakes were recovered; Δd and Δe were successful in crossing the core surface, but Δf finished in a steep hinge termination, leaving a protruding step on this core-surface too.

It is suggested here that the final event (#9?) of the core's life was then turning it over again, and making another attempt to remove a flake from the opposite face. There are several percussion marks on the surface of the core (Fig. 18.18a), one of which has initiated a fracture plane towards its centre, but which has failed to remove a flake. This fracture plane has subsequently become extended due to *in situ* frost-fracturing (Fig. 18.14a), leading to recovery of part of the core with the proximal end of the failed flake as a separate find (Δ.43407) from the main part of the core (Δ.43418). It is, however, also possible that this (proposed final) event was interspersed between events #5 and #6, and that the failure of this side of the core instigated its inversion. The sequence of events #6-8 then represented the end-game of its reduction and the failure of the other face with the hinge termination resulting from flake Δf was the final event of the sequence.

Despite the surface failures that have apparently led to its abandonment, it would have been possible to continue flaking the core, removing flakes of size approximately 40–50 x 20–30mm. These would have had quite uneven edges, however, and would have had messy dorsal surfaces with various ridges and bumps caused by old step-fractures and steep ridges from scar intersections. This perhaps presents a useful indication of the size and type of flake that were, on at least one occasion, regarded as not worth bothering with.

RG #30: (Δ.43262 = Δ.43267 = Δ.43399; Δ.43198)

The four flints comprising this refitting group were all found reasonably close together (within an area of about 2.5 x 1m) in the southern part of the concentration south of Trench D (Fig. 18.22). The group exemplifies a completely different approach to flake production than nicer cores and longer sequences such as RG #11. In this group, a nodule that has been heavily affected by internal frost-fracturing has been broken into irregular

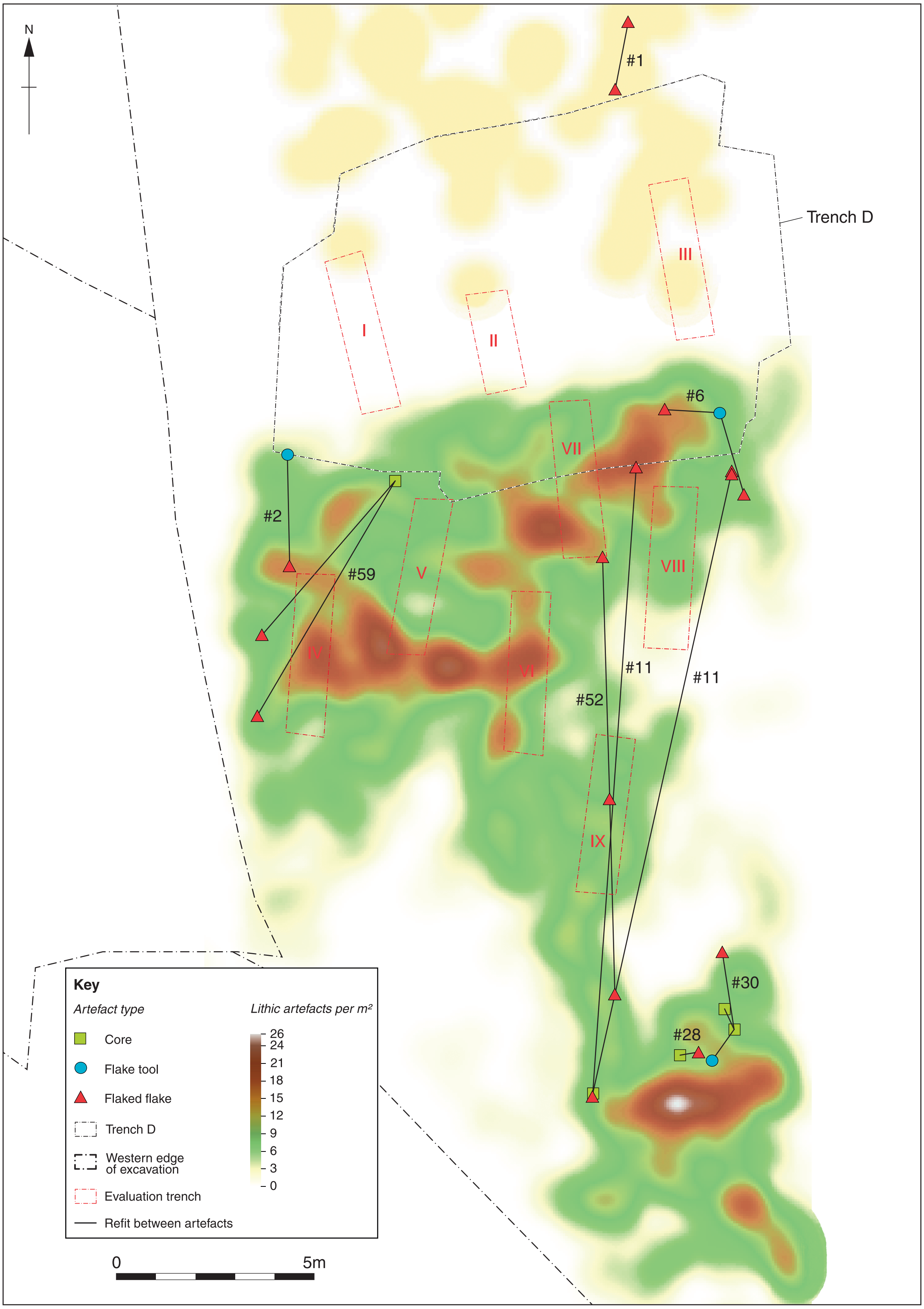


Figure 18.22 Spatial distribution of selected refitting groups and key artefacts: RG #1, RG #2, RG #6, RG #11, RG #28, RG #30, RG #52, RG #59

waste pieces, and then at least two of these waste pieces have served as cores for the attempted removal of flakes.

The group comprises three pieces of irregular waste (Table 18.14) that join together, and appear to have broken apart simultaneously along internal frost-fracture planes of the parent nodule (Fig. 18.21a). The pieces combine to form one end of a much larger flint nodule, the rest of which was not recovered. A number of flake removals were attempted from the largest piece (Δ.43399, weighing about 380g) but all were unsuccessful due to the persistence within the piece of internal flaws caused by frost-fracturing. One of the two smaller pieces (Δ.43267, weighing about 80g) was, however, used as a core for the removal of a single flake (Δ.43198) which was recovered only approximately 1.5m away. This flake (Fig. 18.21b) had a blunt cortical side opposed by a straight convex sharp edge, and this edge had slight chipping and nibbling suggesting use macro-wear. As a whole, this refitting group reflects a much more expedient technological approach, with the production of a flake for immediate use, followed by its prompt abandonment.

RG #52: (Δ.40553; Δ.40717; Δ.43102)

This refitting group comprises three separate small-medium flake removals from what would probably have been a small globular core (Fig. 18.21c; Table 18.15; Table 18.16). They were found quite widely separated (Fig. 18.22), with Δ.40717 in the north part of the concentration south of Trench D, Δ.43102 in the southern part and Δ.40553 approximately halfway between the other two.

The first removal of the surviving sequence was Δ.43102, which bears the scars of at least three previous removals, the last of which crosses its distal end struck from an opposing direction. After this, the core is rotated through about 90° and a flake (event #2, flake ra) struck off, which was not recovered. This was followed by removal from the same platform, with clockwise striking point migration of approximately 15mm, of another flake that was recovered (event #3, Δ.40717). Then, from the same platform, another small flake was struck and this too was not recovered (event #4, rb). Finally, still from the same platform, a further flake was struck (event #5, Δ.40553). The core was not found in the excavated collection, although a careful search was made.

The distribution of the artefacts along their north-south connecting line does not match their removal order. The first removal (Δ.43102) is the most southerly of the pieces, then the second removal (Δ.40717) is the most northerly, and the final removal (Δ.40553) was found roughly halfway between. Considering the evidence of artefact dispersal thought to be by non-hominin sedimentary processes, these separations can not be reliably interpreted as reflecting intra-site movement, although this remains a possibility. This sequence, in contrast to RG #11 (discussed above) demonstrates that core reduction was often continued when the maximum potential length of any flakes produced would be around 50mm, so although flakes this small may not have been desirable, they were often produced. Whether or not this reflects a mindless engagement with lithic material – if it doesn't move, knap it – or whether it reflects a more considered and thoughtful engagement whereby it was actively decided to produce flakes of a certain size, remains a conundrum for wider consideration in the interpretation of lithic material culture of this era. It is also of course possible that the missing so-called 'core' would be better regarded as a tool, and that these flakes should be viewed as secondary waste from tool production, rather than potential tools or blanks; this issue is considered further below.

Secondary flake modifications and flake-tools

A significant technological element of the assemblage was the quantity of flakes and small pieces of irregular waste that were subject to the removal of further, secondary flake-flakes. It is accepted that there is an unknowable grey and subjective area in attempting to distinguish secondary modifications aimed at creating flake-tools, from secondary flaking of larger debitage pieces where the flake-flake product is not waste, but the desired end-product in its own right. Distinctions have been attempted here based on the size and shape of the piece subject to secondary working, the size of the secondary flake-flakes (beneath about 30mm they were not regarded as having been desirable end-products in their own right), the distribution and outcome of the secondary flaking and whether the flaked piece looked to have any viability as a tool in terms of its handling and cutting potential, or for some other potential use. Nonetheless, there remained a residual rump of ambiguous pieces, some of which are presented below.

It is postulated here that the majority of secondary working was aimed at transforming debitage into tools, mostly more useful cutting tools. The secondary working often produced a sharp concave notch that would have formed an ideal tool for cutting through substances such as animal skin, much like the hook on the end of a present-day box-knife. Conversely, the secondary working on a minority of pieces seems to have been aimed at deliberately smoothing and blunting an irregular edge opposed to a naturally straight and sharp edge. It is suggested here that, rather than being construed as a 'scraper' which would be the immediate interpretation of many lithic analysts, focusing on the secondary working, these pieces represent the creation of comfortably blunt handling facets, to facilitate use of the opposing sharp edge of the piece as a 'knife' for cutting. Finally, quite a few pieces of debitage that are unaffected by secondary flaking show localised areas of micro-chipping and damage on otherwise pristine sharp edges; these are interpreted here as macro use-wear, and these pieces are classified as 'utilised flakes'.

It is also necessary to recognise that, while an interpretive assumption has been made that many secondarily worked pieces should be construed as 'tools', and these are grouped below into 'types' according to the nature and distribution of secondary working, this is not the same as asserting that these tool-types were intentionally formed and conceived as distinct groups by their prehistoric makers. Rather, it is suggested that most tools should be understood purely as a flexible and plastic combination of handle and a working edge, usually for cutting, with the working edge usually formed by a secondarily flaked notch. The beauty of flint as a raw material for this technological approach is that it is highly flexible; most flakes can receive a notch, and any flake in use (whether notched or not) can be rejuvenated with replacement or additional notches if the immediate needs change, or if a particular cutting edge becomes damaged. One of the features of both the notched tools and the flake-flakes, discussed in more detail below, is that they often show signs of macro use-wear on what would have been a cutting edge; so it seems clear that individual cutting tools had a biography of use and transformation, perhaps progressing from un-notched through single-notched to multiple-notched forms, with an accompanying legacy of flake-flake debitage. Whether the timescale of this life-cycle should be thought of in terms of a short period such as a few hours, a longer period of punctuated abandonment and reclamation, or a combination of the two is another factor to be considered and integrated into an understanding of the lithic *chaîne opératoire*.

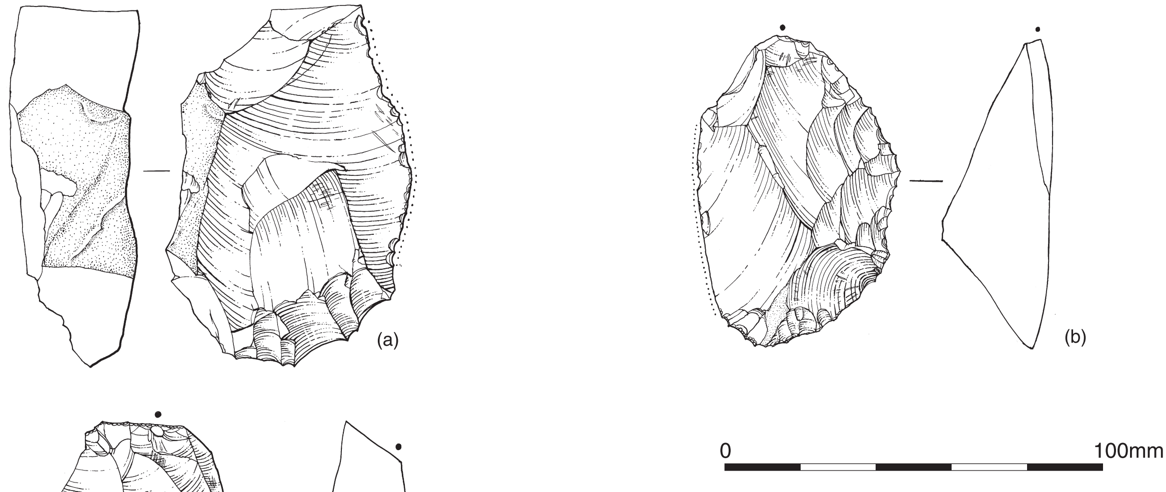
As shown in the earlier tabular summaries (Table 18.9 and Table 18.10) there were 76 pieces identified as flake-tools in assemblages 6.1 and 6.2, 34 pieces identified as flake-flakes from secondary working and eleven pieces identified as cores-on-flakes. In the remainder of this section a representative selection of these finds is presented, highlighting certain types of end-product and patterns of secondary working that seem to regularly recur, and also presenting some refitting evidence of secondary debitage modification. Five main groupings of flake-tools were identified, all of them variations on notched and un-notched cutting tools (Table 18.17). The quantities of each of these groups are given for

Table 18.17 Technological categories of secondarily modified pieces, subsidiary types for flake-tools and cross-references to figures

Technological category	*Tool-type*	*Analysis code*	*Description*	*Figure/s*
Flake-tool	Utilised flake	61	Use-damaged, evidence of macro use-wear but no secondary flaking	Fig. 18.21a Fig. 18.23
	Flake-knife	62	Blunting/backing retouch opposite/beside natural cutting edge, which can show macro-wear, to facilitate handling and use	Fig. 18.23a,b
	Single notch	63	Clear single notch, can be backed by natural cortical handle or blunting/backing retouch	Fig. 18.24
	Double/linear notch	64	Two or more notches, aligned on one edge to form crude denticulate	Fig. 18.25
	Multiple notch	65	Two or more notches, scattered around; for instance orthogonal to each other, or on different sides of the same flake	Fig. 18.26
	Miscellaneous other	66	Any other secondary working that does not fit into the other categories, often when broken	-
Core-on-flake	-	30	Debitage used as a core	Fig. 18.20c
Flake-flake	-	80	Debitage from flaking a flake	Fig. 18.27
Ambiguous worked pieces	Cores? Flake-tools?	-	Solid pieces of debitage or irregular waste, with small-medium secondary removals	Fig. 18.28

Table 18.18 Assemblages 6.1 and 6.2: flake-tools, flake-flakes and cores-on-flakes

	61 - Utilised flakes	*62 - Knives*	*63 - Single notches*	*64 - Double/linear notches*	*65 - Multiple notches*	*66- Misc flake-tools*	*60s - All Fl-tools*	*80 - Fl-flakes*	*30 - Cores-on-flakes*
Ass 6.1	15	5	17	17	8	10	72	31	11
Ass 6.2	2	-	2	-	-	-	4	3	-
Ass 6.1 & 6.2	17	5	19	17	8	10	76	34	11



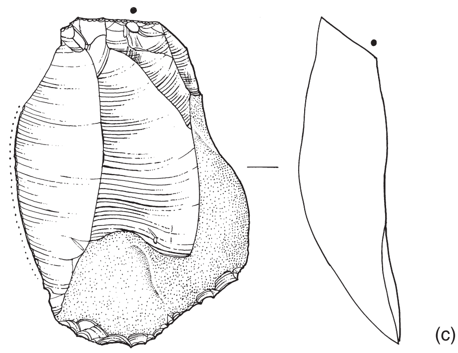


Figure 18.23 Flake-tools 'knives' (a)–(b) and utilised flake (c): (a) Ass. 6.1, Δ.42000; (b) Ass. 6.1, Δ.42505; (c) Ass. 6.2, Δ.42070 [ill. B. McNee]

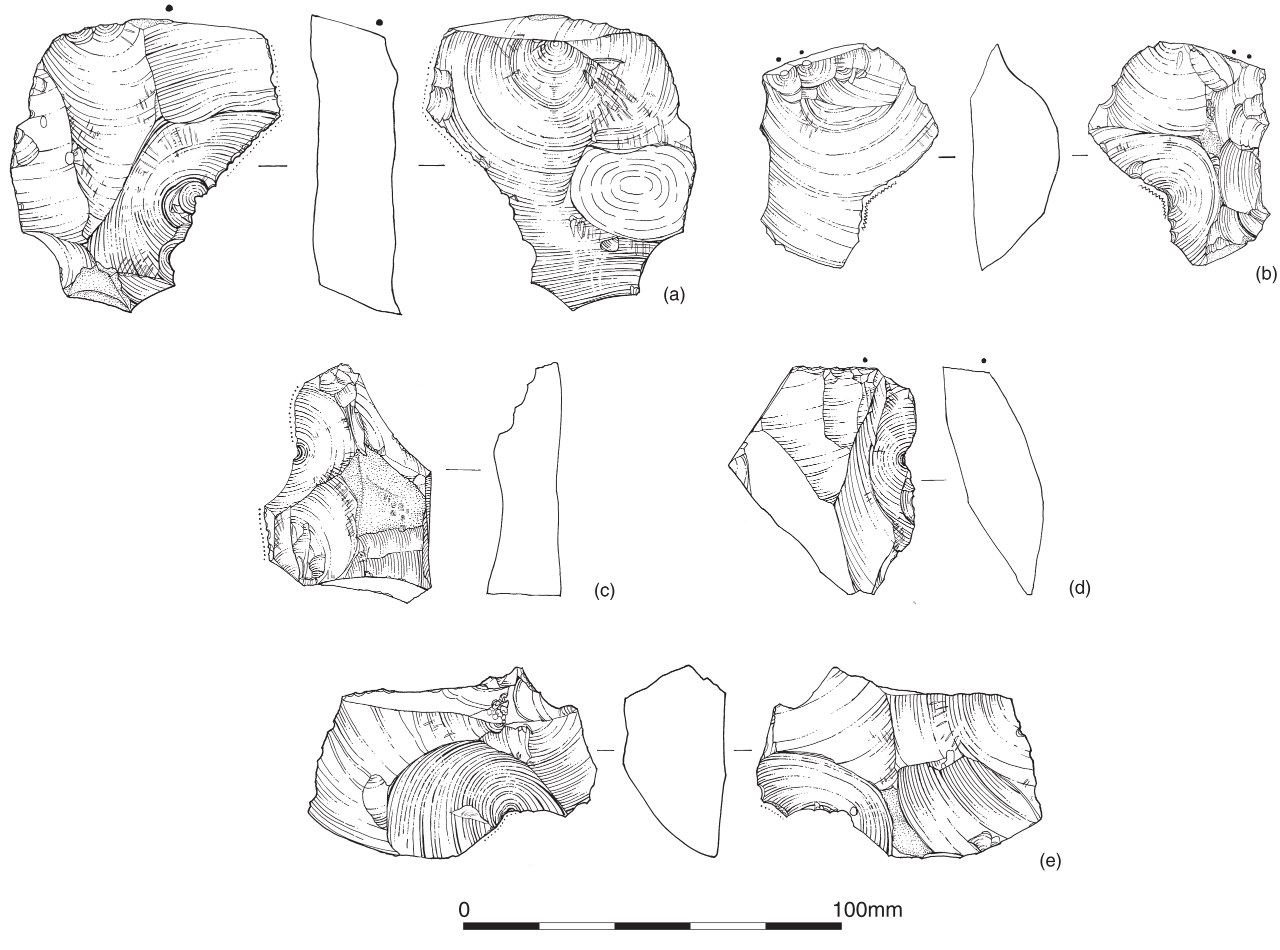


Figure 18.24 Flake-tools, single notches: (a) Ass. 6.2, Δ.40211; (b) Ass. 6.1, Δ.41577; (c) Ass. 6.1, Δ.42805; (d) Ass. 6.1, Δ.42842; (e) Ass. 6.1, Δ.43809 [ill. B. McNee]

assemblages 6.1 and 6.2, together with the quantities of flake-flakes and cores-on-flakes (Table 18.18). Various investigations were made exploring the spatial distribution of flake-tools and other technological categories within assemblages 6.1 and 6.2. Although there were some minor variations in relative proportions of different categories in different parts of the site, as is statistically inevitable, the overall impression was of remarkable homogeneity, so the remainder of this section focuses on their technological and typological characteristics without consideration of their spatial distribution.

Three of the pieces identified as utilised flakes are illustrated, RG #30 Δ.43198 (Fig. 18.21b), RG #52, Δ.43102 (Fig. 18.21c) and Δ.42070 (Fig. 18.23c). Clearly there is some difficulty in the reliable differentiation of macro use-wear from incidental damage to delicate sharp flake edges, whether during knapping, burial or post-depositionally *in situ*. However, several pieces had localised damage that had a slightly more invasive and regular character than the isolated and evenly distributed small chips that were regarded as incidental natural damage. Much use may have left no visible trace, and it is suspected that many flakes classified as waste debitage may in fact have been used. Two of the five tools classified as 'flake-knives' are illustrated (Δ.42000 and Δ.42505, Fig. 18.23a, b). Both of these seem particularly clear examples of instances where secondary retouch has been applied, not to form a working part of the tool, but to facilitate handling and use of the unworked sharp edge of the tool for cutting. For Δ.42000 there is a natural blunt cortical facet down one side of quite a large flake, opposed by a regular slightly convex sharp edge. The distal end of the flake seems to have been lightly trimmed to follow the convexity of the cutting edge, and clear it for use. Furthermore, there is marked 'nibbling' along this edge that seems a very clear example of macro use-wear. For Δ.42505, secondary working has formed a convex blunt face opposing a regular slightly convex sharp edge, which has occasional small invasive chips suggestive of macro-use wear. It seems highly likely that this working was aimed at facilitating handling of the tool with use of the sharp edge for cutting, rather than for use of the opposite blunt face as a scraping facet. If the latter was the mode of use, then

Table 18.19 Assemblage 6.1: quantitative comparison and size statistics for flake-tools and debitage (only whole pieces included)

	61 - Utilised flakes	*62 - Knives*	*63 - Single notches*	*64 - Double/linear notches*	*65 - Multiple notches*	*66- Misc flake-tools*	*60s - All Fl-tools*	*90 - Flakes*
(n=)	7	4	12	8	2	235	566	
Max L - Max	115	80	95	112.00	60.00	40.00	115.00	125
- Q4/Q3	90.5	66.5	63.25	74.5	55.75	35.25	70	51
- Mean	74.57	59.75	59.25	62.88	51.50	30.50	61.11	40.44
- Q2/Q1	56.5	49.75	51.25	46.25	47.25	25.75	47	28
- Min	50	46	24	29	43	2121	12	
- SD pop	23.80	13.05	19.17	25.01	8.50	9.50	22.54	16.64
Max W - Max	56	65	77	53.00	45.00	47.00	77.00	132
- Q4/Q3	52	56	48.25	46.25	43.5	38.75	48.5	41
- Mean	44.71	43.75	45.92	40.63	42.00	30.50	43.11	33.35
- Q2/Q1	39.5	30.25	40.25	35.5	40.5	22.25	37	23
- Min	28	25	31	26	39	1414	10	
- SD pop	9.45	16.02	11.12	9.03	3.00	16.50	11.75	14.54
Max T - Max	38	32	36	47.00	26.00	16.00	47.00	75
- Q4/Q3	28.5	20	26.25	24.75	25	13.75	26	17
- Mean	21.86	18.50	22.67	22.50	24.00	11.50	21.43	12.97
- Q2/Q1	15	14	19	15.75	23	9.25	16	8
- Min	7	11	13	11	22	77	2	
- SD pop	10.15	8.02	6.07	10.45	2.00	4.50	8.65	7.43
Weight g - Max	170	115	263	276.00	48.00	39.00	276.00	543
- Q4/Q3	119	79.75	80.75	81.25	47.25	30.5	81.5	34
- Mean	81.14	54.75	74.25	80.13	46.50	22.00	70.17	28.27
- Q2/Q1	43	18.5	43	29	45.75	13.5	29.5	7
- Min	11	17	18	11	45	55	2	
- SD pop	54.04	40.34	63.20	80.46	1.50	17.00	62.29	42.04

the tool would have been very awkward to handle, with the sharp cutting edge pressing right into the hand.

Five of the 20 pieces identified as single notches are illustrated (Fig. 18.24). Of these five, four have visible use macro-wear on part of the sharp edge created by the notch. Although prevalence of this property was not formally quantified, it was commonly found on notched tools, whether single, double or multiple. The notches are usually, although not always, placed at one side or other of a flake towards its distal end. As one of the more numerous categories of flake tool, the size statistics are worth considering (Table 18.19; see also Figs 18.31–32, below). These show that the average size of single-notch flake tools (and indeed, of all flake-tools) in their present state after secondary flaking, is approximately 60 x 45 x 22mm, with an average weight of roughly 75g. This is significantly larger than the average size of unworked flakes. It therefore perhaps gives an indication of the size of flake blank that was regarded as preferred for tool-use.

Another reasonably common group of secondarily-worked notched tools was double/linear notches, of which there were 16 in total, of which five are illustrated (Fig. 18.25). One of the illustrated specimens (Δ.42973 – Fig. 18.25d) is quite large (maximum length 88mm; weight 115g) and has two notches side-by-side opposing a cortical ridge, so it seems pretty clear that the notches were the functional part of the tool, although there is also some apparent abrasion at the proximal end, possibly minor trimming of a sharp edge to facilitate handling, rather than use-wear. Another one (Δ.43276 – Fig. 18.25e) likewise has two notches in a row, but here they are on a thicker flake with an opposing sharp edge so it is much less clear which bit of the artefact was the working part, if indeed just one part of it was, rather than different edges being used as appropriate to specific tasks. Δ.43716 (Fig. 18.25f) is quite similar to Δ.42973, although a little smaller.

In contrast to the other illustrated specimens, Δ.42866 (Fig. 18.25c) is substantially smaller, although its maximum length of 41mm and weight of 14g are by no means the smallest in this flake-tool category. One of the enduring mysteries of Lower/Middle Palaeolithic flint artefacts is the regular occurrence of tiny versions of lithic tool forms. Since lithic artefacts are virtually indestructible once formed, and since there must have been a stage of juvenile knapping experimentation and learning that would have contributed to the archaeological record, it is not entirely fanciful to suggest that some, or most, of these might relate to juvenile flint-knapping, emulating surrounding adult practices.

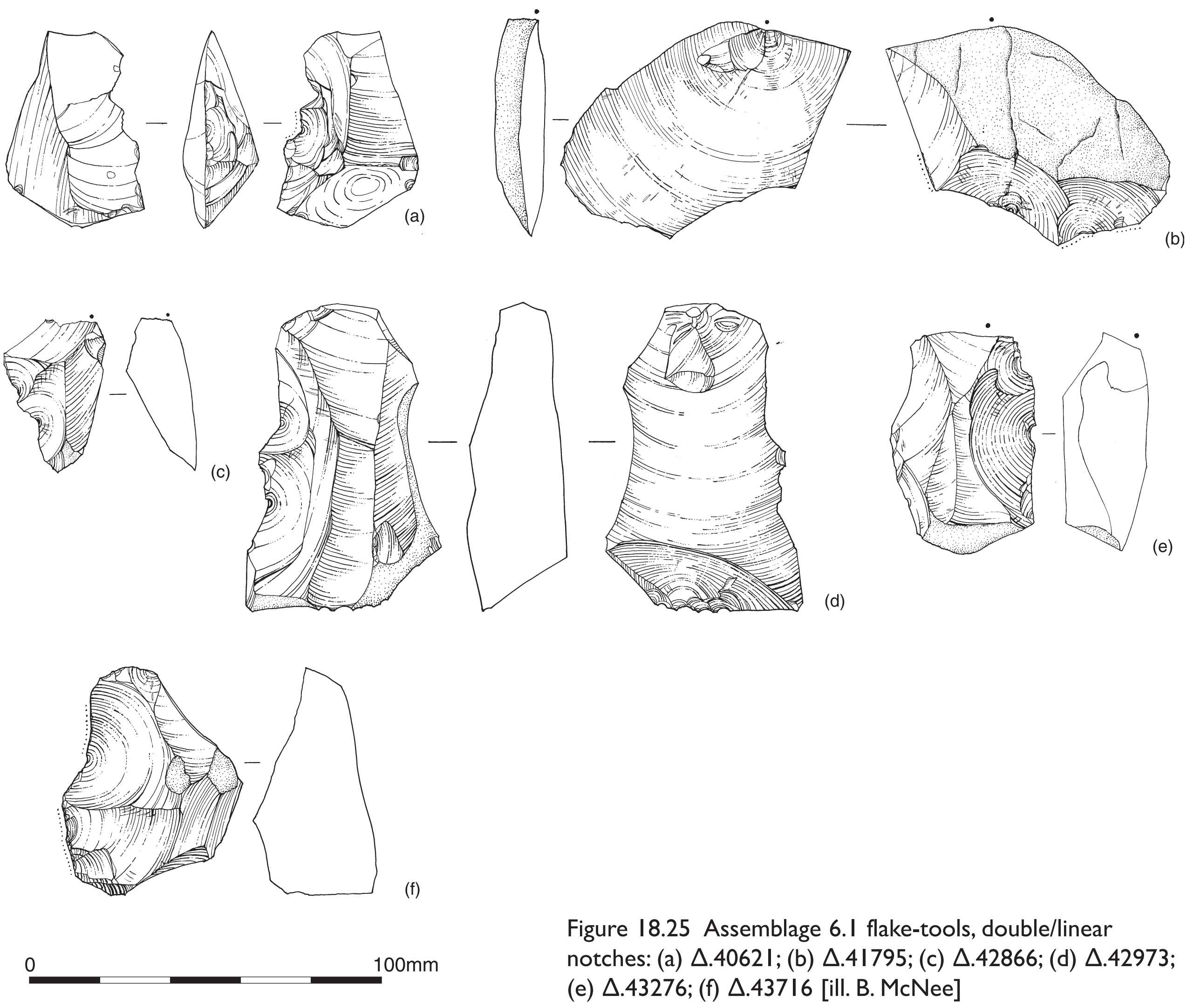


Figure 18.25 Assemblage 6.1 flake-tools, double/linear notches: (a) Δ.40621; (b) Δ.41795; (c) Δ.42866; (d) Δ.42973; (e) Δ.43276; (f) Δ.43716 [ill. B. McNee]

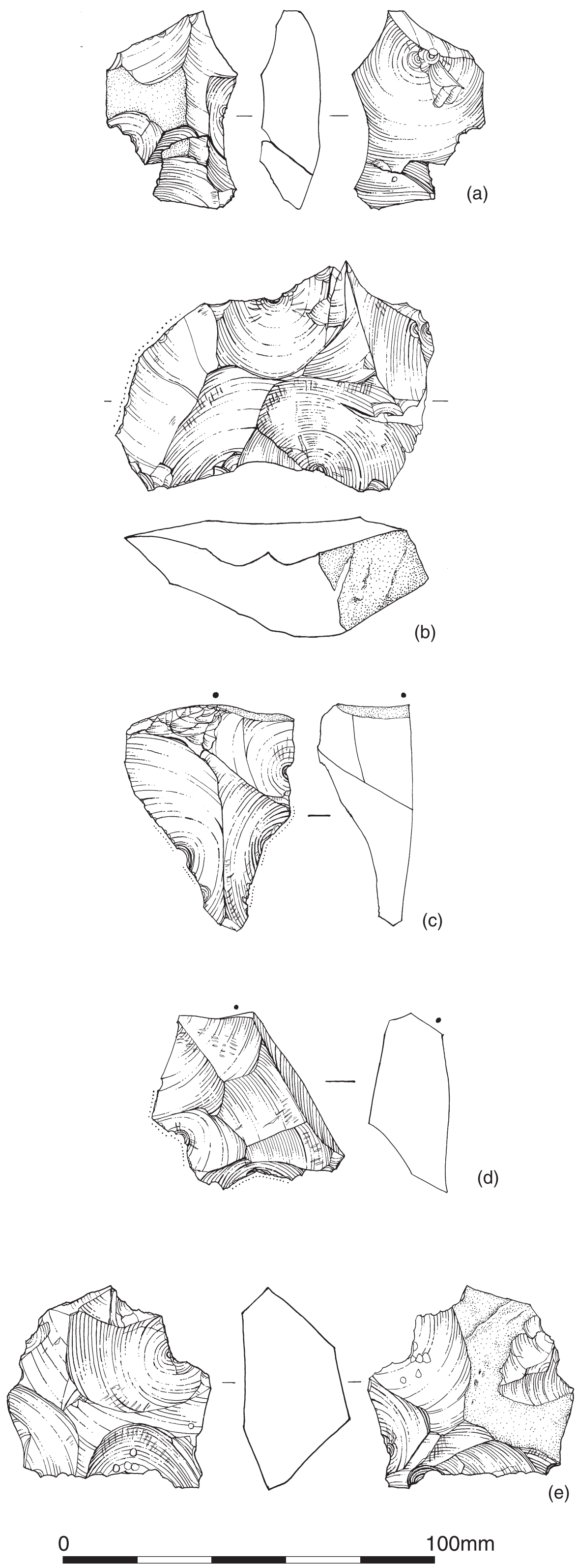


Figure 18.26 Assemblage 6.1 flake-tools, multiple notches: (a) RG #63 - Δ.40425-Δ.41537; (b) Δ.42824; (c) Δ.42873; (d) Δ.42967; (e) Δ.43473 [ill. B. McNee]

Finally, the fifth illustrated artefact in this group is Δ.40621 (Fig. 18.25a), which, rather than having two large notches in a row, has three smaller ones to create a coarsely denticulated edge opposite a reasonably sharp edge. It is not immediately clear how this piece should be understood in terms of its likely mode of use and handling, but there is micro-chipping in two places: within the middle notch, and on the end of one of the end notches, that perhaps reflects macro use-wear.

There were only eight multiple-notched tools that were whole and could not be attributed to one of the other notched-tool categories, five of which are illustrated (Fig. 18.26), including one refitting group with both the parent tool and the secondary flake: RG #63 (Fig. 18.26a). On one of these (Δ.42824, which was one of the larger flake-tools recovered, with a maximum length of 85mm and weighing 120g; Fig. 18.26b), there are three medium-size secondary flakes that have removed the proximal and distal ends of what was once a substantial flake, leaving one sharp edge on what has become the putative working end of the tool, but on what was originally one of the flake's sides. This sharp edge has tiny chipping indicative of macro use-wear, so conceptually this tool could equally have been categorised as a 'flake-knife'. The other tools with multiple notches are less easy to make a sense of. The notches on the larger tools (Δ.42873 – Fig. 18.26c; Δ.42967 – Fig. 18.26d; and Δ.43473 – Fig. 18.26e) would all have had sharp edges that were potentially useful for cutting, although none of these pieces seem especially convenient to handle. The slightly chaotic and repeated ring-cracks from failed percussion blows on Δ.43473 again bring to mind juvenile emulation of adult behaviour, perhaps applied to a discarded tool.

Finally, piece Δ.40425 (Fig. 18.26a) is the proximal end of a flake that is now reduced to a maximum length of 35mm and weighs only 20g. It has had a radial series of notches flaked around its distal end, all struck on the ventral surface. One of these secondary flake-flakes (Δ.41537) was recovered, only about 2m away, both artefacts being found towards the northern edge of the lithic concentration south of Trench D. Again, it is hard to suggest a mode of use and handling for this small piece of flint, although it was clearly deliberately flaked to leave it in its current form. The recovery of both pieces in such proximity suggests a minimum of disturbance, although there were other secondary removals both preceding and subsequent to the one recovered, that were not found in the excavated assemblage. They may have been missed due to their small size, or they perhaps have been lost during machining of Trench D, a short distance to the north. It seems very unlikely that the missing flake-flakes, which would have been about 10mm long, were selected for use elsewhere. It is also unlikely that the last (missing) two flake-flakes of the reduction sequence were knapped elsewhere, before the tool was moved back and abandoned at the exact spot of the earlier (recovered) flake-flake.

Most of the miscellaneous flake-tools were either broken, and therefore uncertainly classifiable to any of the other forms, or had minor secondary working in odd places that could not be easily construed as blunting/backing or as a notch. Some of them were in the category of ambiguous knapped pieces for which it could not be decided whether they should be categorised as a core or a flake-tool, and one of these (Δ.40611) is illustrated and discussed further below (Fig. 18.28e).

The inevitable technological counterpart of the high incidence of working of parent flakes was the production of secondary flake-flakes, a representative selection of which is illustrated here including two that refit to each other (Fig. 18.27). There is a clear imbalance in the assemblage between the proven quantities of notches from secondary working (a minimum of approximately 75) and the recovered quantity of flake-flakes (n=31). However, this almost certainly does not reflect organisational structure of the lithic production. Rather, it probably reflects that firstly, the secondary flake-flake products are small, and therefore their recovery is likely to have been less than complete, and secondly, rarely clearly identifiable as distinct from normal flakes. Of the four flake-flakes that were found to refit to parent debitage: RG #6, Δ.41940 and Δ.41746 (Fig. 18.28b); RG #2, Δ.42436 (Fig. 18.28a); and RG #63, Δ.41537 (Fig. 18.26a), all were originally classified as conventional flakes prior to their refitting, after which the original records were revised. This suggests that flake-flakes are almost certainly under-represented in the overall results of the technological analysis. Consequently, the average dimensions of conventional flake products are probably slightly larger than indicated in the summary table and figures (Table 18.19; see also Figs 18.31-32, below), since the data undoubtedly includes measurements from a number of flake-flakes, which would generally be smaller than normal flakes.

Several of the flake-flakes show signs of macro use-wear (eg. Δ.42319, Fig. 18.27f) and/or previous flake-flake removals, emphasising that secondary working is carried out in conjunction with, and as part of an ongoing process of, tool-use. Another (Δ.43252, Fig. 18.27h) shows heavy use-wear on an unmodified flake-edge, lending credence to a model of a life-history of cutting tools involving a progressive transformation from unmodified utilised flakes to single notches, and then perhaps further on to double and multiple notches.

Two refitting flake-flakes were found that were of particular interest, shown here (Fig. 18.27a, RG #1 – Δ.41329 and Δ.41211). These were found only about 1.75m away from each other, just to the north of Trench D (Fig. 18.22), and only about 2m away from the

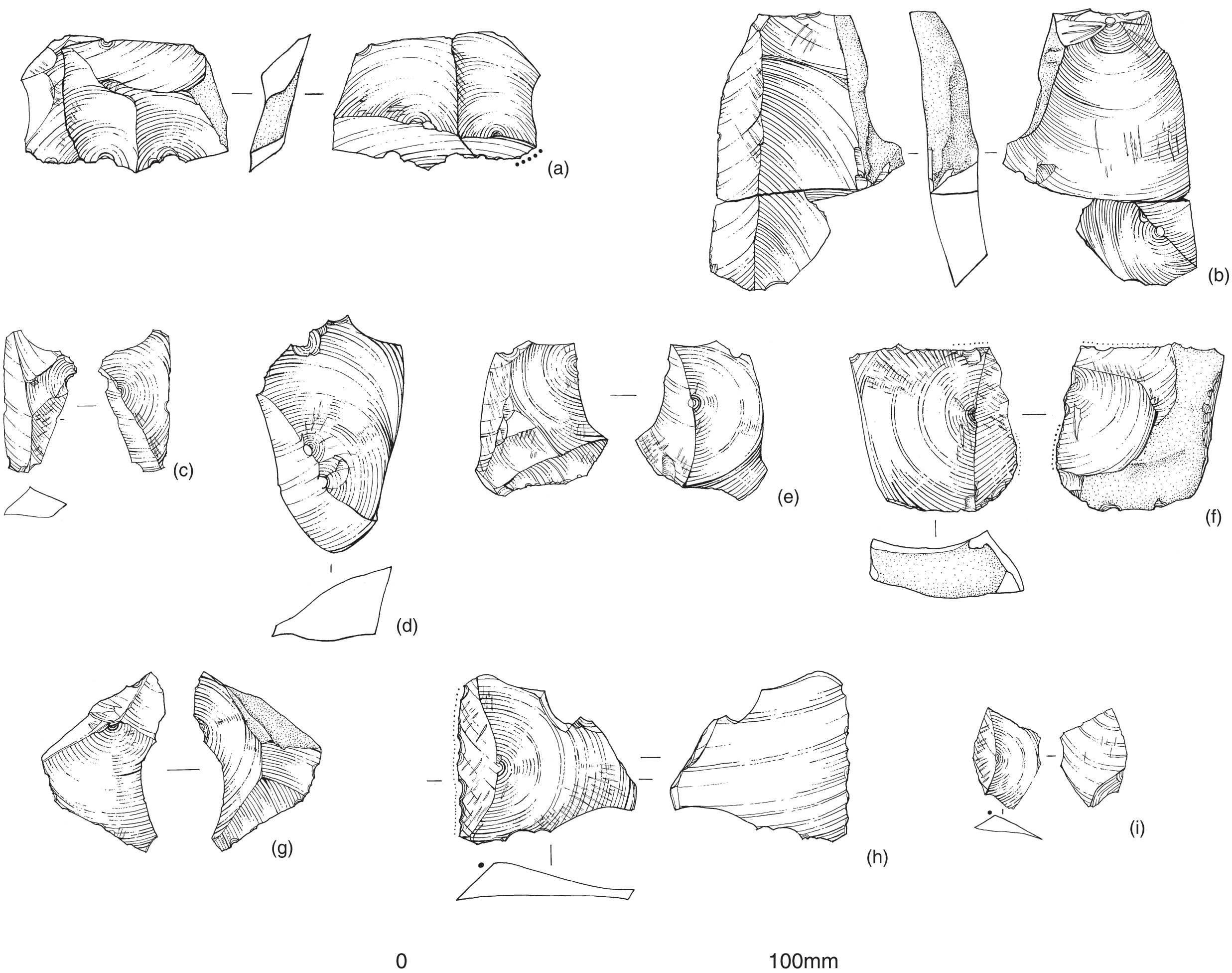


Figure 18.27 Assemblages 6.1 (b)–(i) and 6.2 (a), secondary flake-flakes: (a) RG #1 – Δ.41329-Δ.41211; (b) RG #62 – Δ.40618-Δ.42972; (c) Δ.40486; (d) Δ.40502; (e) Δ.41676; (f) Δ.42319; (g) Δ.43203; (h) Δ.43252; (i) Δ.43347 [ill. B. McNee]

S kirchbergensis rhino jaw (Group Δ.40843 – see Chapter 7). There is however no reliable basis for associating these finds with the rhino jaw, as there is a general sparse distribution of lithics in this area, without any apparent focus on the area where the jaw was found. Besides from the fact that they refit and were found close together, suggesting a minimum of disturbance, and that they therefore represent activity carried out at the site, these flake-flakes exemplify the proposed progressive re-sharpening tool-use model. When refitted, they retain as dorsal scars the evidence of two earlier flake-flake removals, with signs of macro use-wear. They also perhaps provide a hint that the linear double notch might not just be a progression of more intensive resharpening from a single notch, but might in fact be a deliberately conceived type, with the previous double linear notch re-sharpened to a new linear double notch as a single event.

The final group of secondarily worked flakes to consider is the ambiguous forms that could not be reasonably categorised as either cores or flake-tools with any confidence. A selection of these is shown (Fig. 18.28), including three refitting groups (RG #2, RG #6 and RG #28 – Fig. 18.22) where both the secondary flakes and the parent pieces were recovered to aid in their attempted classification. In RG #2 for instance (Fig. 18.28a), the parent piece (Δ.42145) was originally a very large flake, and has been subject to the removal of numerous chunky flake-flakes, just one of which (Δ.42436) was recovered, a little less than 3m away, not the last secondary flake incidentally, two later removals were not found. The parent piece was classified as a 'core-on-flake' when first analysed, but closer examination revealed some possible macro use-wear on one sharp protrusion, so this should perhaps be reconsidered as a 'flake-knife', with the large secondary

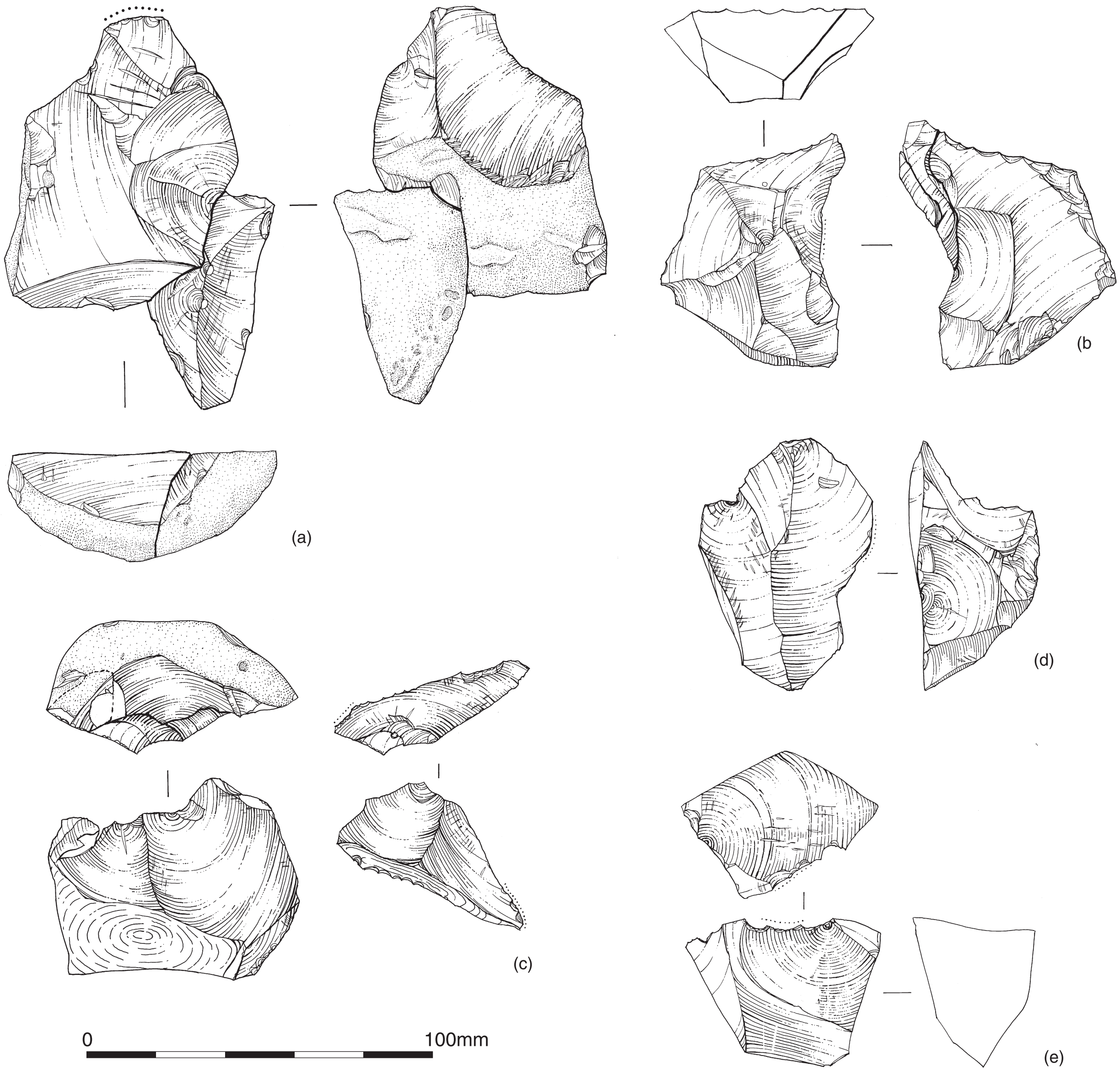


Figure 18.28 Assemblage 6.1, chunky secondarily worked flakes that are ambiguous as to whether 'core-on-flake' or 'flake-tool': (a) RG #2 – Δ.42145–Δ.42436; (b) RG #6 – Δ.41934–Δ.441747-Δ.41940; (c) RG #28 – Δ.43182–Δ.43217; (d) Δ.40517; (e) Δ.40611 [ill. B. McNee]

flakes merely removed to make it fit the hand more comfortably.

Pieces Δ.40517 (Fig. 18.28d), Δ.40611 (Fig. 18.28e) and Δ.41934, from RG #6 (Fig. 18.28b), were all classified as flake-tools in the original analysis and this remains a reasonable possibility, although they do not exhibit the obvious functionality and handling convenience of the majority of the other flake-tools. It is hard to imagine that the refitting flake-flakes of RG #6 (Δ.41940 and Δ.41747) would have had much useful functionality, particularly the former, which was 23mm long and weighed 5g. The latter, which was slightly larger (28mm long and weighing 10g), did however have one sharp edge approximately 30mm long which showed some tiny denticulations, the negative scars from which were stained pale grey, in contrast to the deep red staining of the rest of the piece. These scars did not appear, however, to be from damage during excavation. They may represent *in situ* post-depositional damage or they may perhaps represent macro use-wear reflecting use of this small piece as a cutting tool subsequent to its removal from the parent piece. The position of these denticulated chips means, incidentally, that it is not possible that they were formed while attached to the parent piece.

One final point to make about the flake-tools found, is the anecdotal observation that there is a disproportionate focus for secondary flaking on flakes from the slightly coarser opaque interior of flint nodules. Many flint nodules have translucent glossier flint nearer their outside cortex, but a progressively coarser and more opaque texture deeper into their interior. These pieces are now often stained on a gamut from pale greenish-yellow through to deep ochre following their prolonged burial, probably associated with a greater capacity to absorb minerals or moisture. It seems that the Palaeolithic knappers at the site actively preferred for flake-tools the slightly tougher opaque flint that most would today regard as less satisfactory. This is contra modern preference, whereby it is generally assumed that more glossy, translucent flint is of higher quality and would be preferred, for instance proposed as a universal pan-cultural law of lithic technology by Rhys Jones (Jones and White 1988). It may have been less slippery to hold, perhaps, or it may have maintained a tougher edge with better cutting properties for longer than the brittle, ostensibly sharper edge from more glossy and translucent flint.

The chaîne opératoire *and organisation of production*

Unlike the lithic concentration around the elephant (Chapter 17), where the refitting confirmed that the assemblage was essentially undisturbed and long refitting reduction sequences therefore directly represented the *chaîne opératoire* and the organisation of production, assemblages 6.1 and 6.2 seem to have been more disturbed. They do not contain long refitting sequences representing activity that was happening at or near the site. However, when compared with representative datasets for complete experimental flaking sequences (Fig. 18.29a; Fig. 18.30a) – using the data from Wenban-Smith's (1996) Clactonian experiments, which involved reduction of three nodular flint cores, with each sequence producing *c* 50 flakes – the assemblage of refitting flakes (n=56) corresponded well with the datasets for dorsal scar counts and percentage cortex (Fig. 18.29b; Fig. 18.30b), two of the variables shown (ibid.) to correlate best with reduction order, with correlation coefficients of 0.41 and -0.37 respectively, both significant at the 1 in a 1000 level. Since these attributes correlate so well with reduction order, it is suggested that the refitting flake assemblage, although of small size and consisting of numerous short sequences, nonetheless matches an overall pattern of evenly balanced flake production at the site, without a bias towards either early or late stages of core reduction.

The rest of assemblage 6.1, although not refitting and not representing undisturbed knapping remains from on-the-spot activity, is nonetheless thought to represent evidence of minimally disturbed activity in the near vicinity. Consequently some quantitative analyses were also carried out on this much larger quantity of material in an attempt to investigate the *chaîne opératoire* and the spatial organisation of production. Some of these are necessarily crude, since they are vulnerable to uncertainties. These are, firstly, the influence of the high degree of frost-fracturing and the possibly misleading quantitative effects of the high proportion of irregular waste consequently produced. Secondly, the extent of the invisibility of early flakes from cores with longer sequences of reduction, where the scars of early flake removals were not retained on the eventual core.

Nonetheless a simple comparison was carried out to investigate how the quantity of debitage in assemblage 6.1 compared with the overall number of scars on the cores from the assemblage. Added to the scars from tested nodules, which were all allocated a provisional count of one scar since this data was not recorded when analysed, the combined total of debitage scars represented in the cores is 618. This is based on the total dorsal scar count: 20 from tested nodules, 568 from cores and 30 from cores-on-flakes. The total number of pieces of debitage represented by the flakes and flake-tools is 749, counting only whole debitage and proximal pieces: 694 from flakes, and 55 from flake-tools. However, it needs to be remembered that cores-on-flakes are themselves pieces of debitage, so a further ten pieces need to be added to the debitage total, bringing it to nearly 760. Considering that there is likely to be some invisibility of flake scars from early in reduction, and that the quantity of debitage probably includes quite a few flake-flakes, these quantities look broadly comparable. This suggests that the pattern of flake production correspond with locally obtained raw material that was exploited on the spot. It is assumed for this analysis that debitage from the cores-on-flakes would have been more likely to have been categorised as 'flakes' rather than 'flake-flakes' when originally recorded.

A slightly more detailed quantitative analysis was also carried out on the flake assemblage, comparing the dorsal percentage of cortex and the number of dorsal scars with complete experimental sequences of flake production using what was thought to be a similar *ad hoc* knapping approach utilising the data from Wenban-Smith's (1996) Clactonian experiments. This analysis (Fig. 18.29; Fig. 18.30) established that, to a slightly lesser degree than the refitting flake data, there was still a good correspondence between the profile for the complete set of experimental data and the archaeological data. The most significant area of comparison is between the experimental data and the large hand-excavated dataset of assemblage 6.1. The main points of contrast are the much lower proportion of flakes with less than 10% cortex in the excavated assemblage (about 34% versus about 54%), and the more equal numbers of flakes with two rather than one dorsal scars (24%:22% versus 29%:16%), although the total proportion of flakes with either one or two dorsal scars is virtually identical. In general these data seem to likewise suggest that all stages of reduction are represented pretty equally in the excavated collection. The relative lack of flakes with minimal cortex probably reflects the relatively high incidence of much shorter reduction sequences in the archaeological assemblage (see Fig. 18.15), compared to the experimental dataset which was based on three long reduction sequences, of approximately 50 flakes each.

These analyses do not necessarily indicate an expedient lithic technological *chaîne opératoire*, with raw material

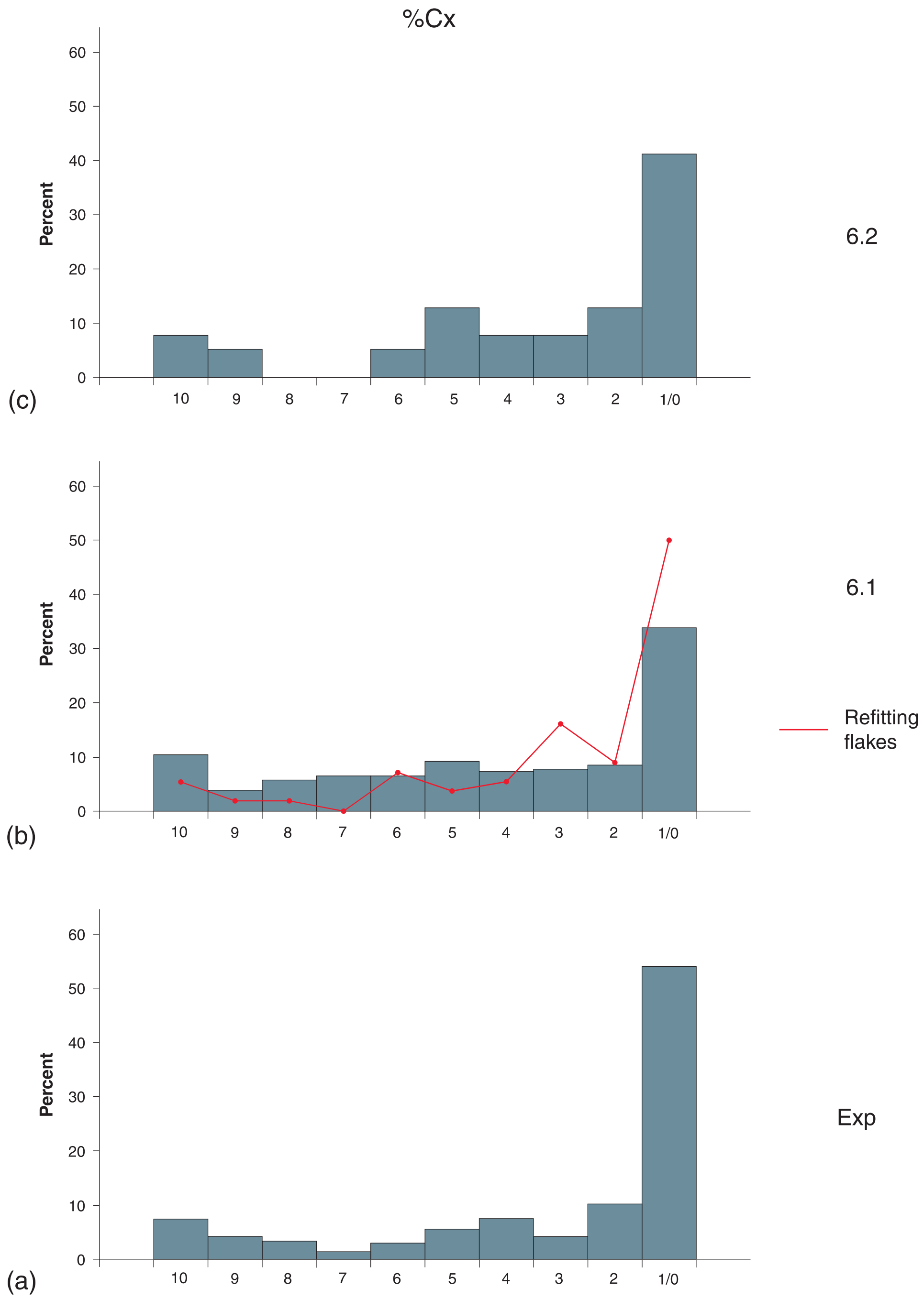


Figure 18.29 Histogram of percentage dorsal cortex (Cx%) on whole debitage: (a) comparative experimental data for complete reduction sequence; (b) assemblage 6.1 with line for refitting flakes; (c) assemblage 6.2

locally obtained, reduction carried out on the spot, and certain flake products immediately subject to secondary flaking to form notched cutting tools that are then used, with resharpening if needed, and discarded on the spot. This is because they are based on an assemblage of flakes that are mostly all from different individual reduction sequences. It therefore remains uncertain whether the missing parts of individual sequences are merely due to sampling and post-depositional mixing, or whether there was temporal separation and/or spatial mobility associated with the progression of individual *chaîne opératoires*. There is clear evidence of some behavioural mobility in the least disturbed, refitting element of the assemblage. This includes evidence of tool rejuvenation, but no tool (RG #1) and many flake-sequences without their core (Table 18.3), although their temporal/spatial extensions are unknown. However, the balanced profile of the assemblage indicates a lack of pattern in the organisation of production around the local landscape, with all stages seeming equally likely to occur in the area represented by the excavated assemblage, which is also an area rich in the raw material used. There is therefore certainly no indication of a preferential export of flake-blanks or part-worked cores as might be expected if the raw material source was exploited in a more logistically organised way, for instance as with the handaxe-manufacturing locale at Red Barns, Hampshire (Wenban-Smith *et al.* 2000; Wenban-Smith 2004b), where the marked predominance of distinctive handaxe-manufacturing debitage clearly indicates a pattern of the manufacture and export of handaxes at the site (ibid.)

DISCUSSION

This section recapitulates the main conclusions of the preceding analyses and investigations of the lithic material in assemblages 6.1 and 6.2, and considers them

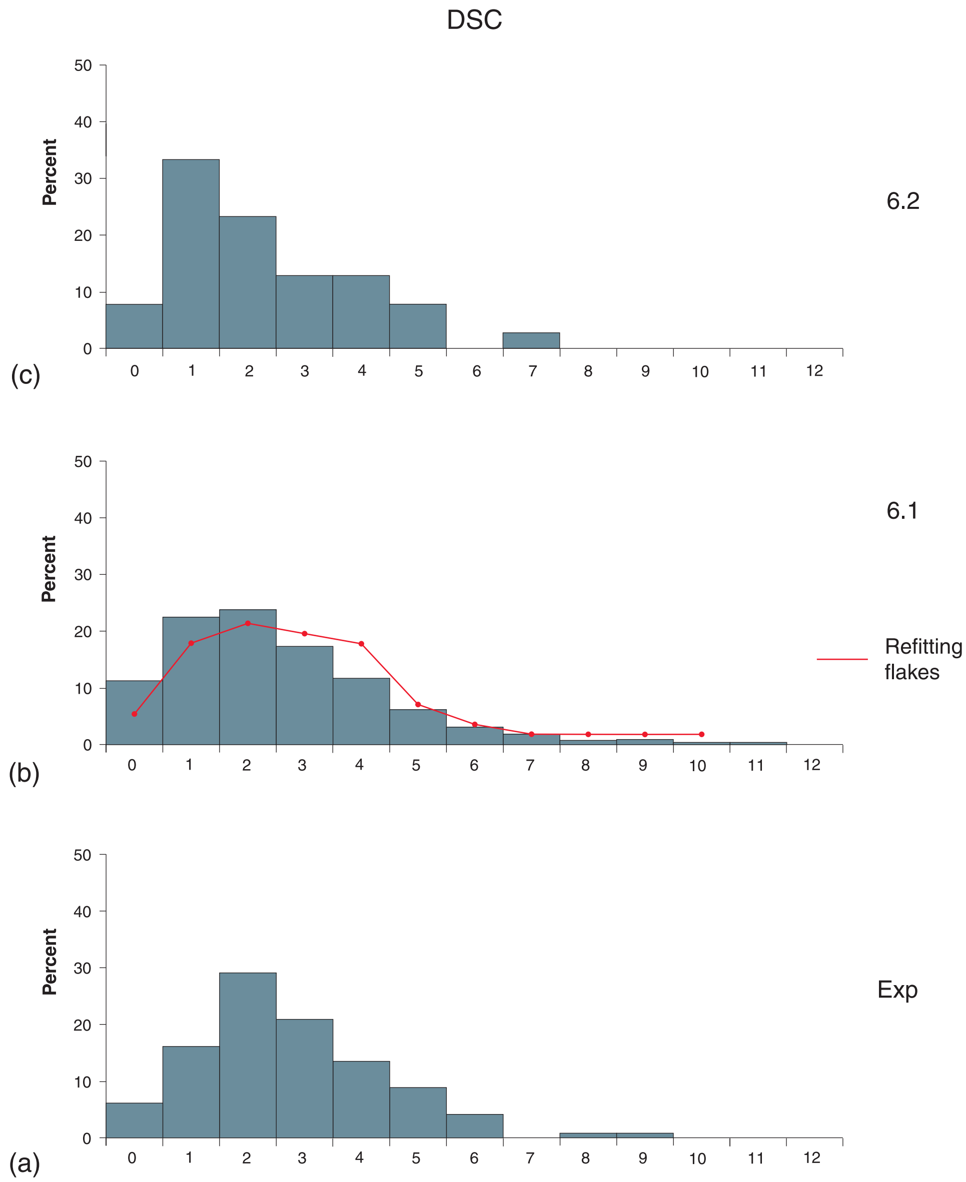


Figure 18.30 Histogram of dorsal scar count DSC on whole debitage: (a) comparative experimental data for complete reduction sequence; (b) assemblage 6.1 with line for refitting flakes; (c) assemblage 6.2

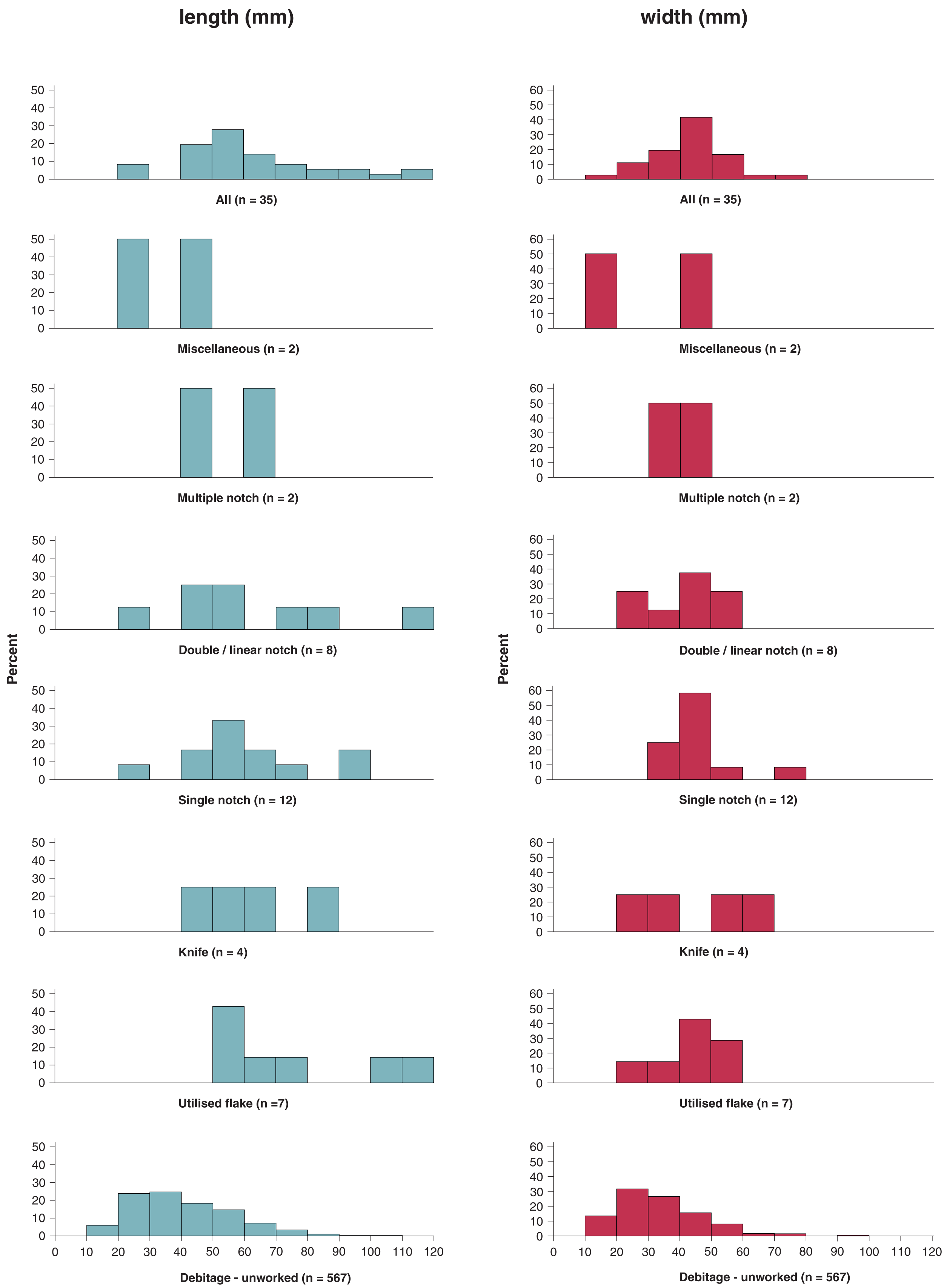


Figure 18.31 Histograms of length and width distributions for flakes and flake-tools from Assemblage 6.1 (whole artefacts only)

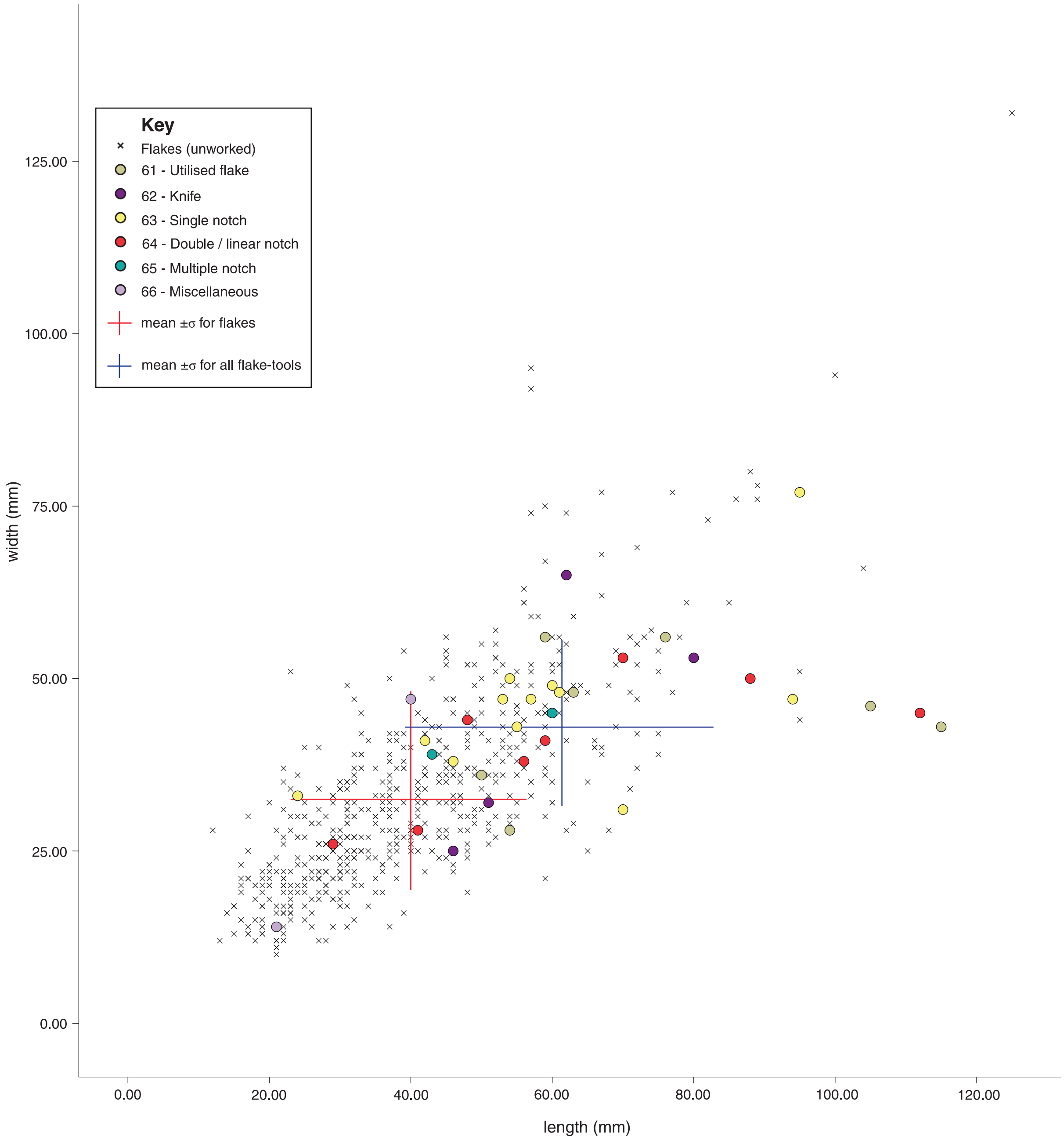


Figure 18.32 Bivariate scatterplot of length versus width for flakes and flake-tools from assemblage 6.1 (whole artefacts only)

in the wider contexts of the Lower/Middle Palaeolithic of (a) the Swanscombe area and (b) south-east England.

Site formation and integrity

The refitting and microdebitage studies have firmly established that assemblages 6.1 and 6.2, here focusing on the parts of them that were in mint or fresh condition, do not consist of entirely undisturbed lithic remains. However, nor do they seem to represent a particularly mixed collection. The great majority are in mint condition, and there is a reasonable amount of refitting material, with about 5% of the artefacts from assemblage 6.2 and about 8% of those from assemblage 6.1 refitting. Although there is quite a homogenous mixture of material of different sizes, shapes and technological categories in the areas where lithic material is present, the overall distribution of lithic material south of Trench D is strongly clustered (see Fig. 18.1; Fig. 18.3). There are patches of high lithic concentration occurring next to patches with virtually no lithic remains. Furthermore, of the refits that were found, many of them represent technological refits (such as flaking sequences, and secondary flaking) that were found only a short distance apart, suggesting a minimum of disturbance. It is suggested here that assemblages 6.1 and 6.2 represent a complementary combination of two contrasting site formation processes. The majority of the material is thought to represent the remains of knapping activity that was taking place in the close vicinity, to the west of the water-body that would have been present, over perhaps many hundreds of years. It has probably become slightly conflated by removal of fine-grained clay sediments by sheetwash processes, and fed en masse into the water-body at the foot of the slope, as minor fans or tongues of sediment with rich concentrations of artefacts. Superimposed upon the landscape of this process, are the undisturbed remains of occasional bouts of activity that have become incorporated with minimal disturbance. It is therefore postulated that the lithic material represents a combination of slightly disturbed material from activity over a reasonable period of time, in the local area and a little upslope to the west, with almost entirely undisturbed material from activity over the same period of time but at the site itself. One might expect the proposed mass movement to have caused more abrasion to many of the artefacts, but their concentration seems to have been too low for this to have happened; hardly any were found in touching distance of each other, apart from those thought to have broken *in situ*.

Organisation of production and the chaîne opératoire

Various methods were applied to investigate the *chaîne opératoire* and the organisation of production. The direct evidence of refitting was rather unsatisfactory, as no complete sequences of reduction were recovered. Those that were found did not, however, provide direct evidence that any pieces of raw material were collected, worked and abandoned at the spot, in contrast to the evidence from around the elephant skeleton (see Chapter 17). However, when the assemblage was considered as a whole, all avenues of analysis seemed to suggest that this was nonetheless the case. The overall quantities of debitage and negative scars on cores broadly matched each other. The characteristics of the flake assemblage that are most closely linked to stage of reduction (percentage of cortex, and dorsal scar count) broadly corresponded with comparative experimental material representing complete sequences of production, from flaking similar nodular flint cores from start to finish. Likewise, the presence in the assemblages of fairly numerous (about 4%) secondarily worked flakes, mostly interpreted as flake-tools, together with secondary flake-flakes from their working (including some refitting examples, see Figs 18.26 – 18.28) indicate that this technological aspect was also being carried out at the site, or in its near vicinity. Some of the refitting evidence did, however, indicate that the technological *chaîne opératoire* was not wholly expedient, but that there were at least some occasions where, for instance, a flake-tool was re-sharpened, and then exported for use elsewhere (RG #1, Fig 18.27a). The refitting evidence and, in particular, the presence of macro use-wear both in the notches of notched flake-tools and in the secondary flake-flakes from their rejuvenation, also suggests that these notched flake tools were not used and abandoned immediately after being made. Rather it seems that they went through a cycle of use and maintenance before their discard. It is uncertain how extended this cycle might have been temporally and spatially, and gaining further insight into this should be a key priority for improving understanding of the behaviour and cognitive capabilities of these hominins.

In general, in conjunction with the presumed slightly-transported mode of site formation for the majority of the lithic material, the lithic evidence seems to represent the time-averaged accumulation of a palimpsest of activity on the west side of the water-body, or periodically desiccated plain. This would have been present at the foot of the slope up to the west. There is no spatial structure to the flint knapping/use activity within the excavated area, nor evidence of a spatial organisation to different stages of the technological *chaîne opératoire*. It seems that over the (probably reasonably substantial) period of time represented by the lithic remains, the same overall *chaîne opératoire* has been enacted in slightly different places, depending upon where resources were encountered. This means that a snapshot of one place (such as represented by the excavation) provides a balanced representation of the full *chaîne opératoire* without necessarily containing all the elements of the same individual *chaîne opératoires*. However this apparent lack might reflect the slight lack of integrity of the lithic material, rather reflecting the organisational structure of hominin behaviour.

Finally, the flaking methods and the types of flake-tool represented closely match the characteristics of the lithic assemblages from a number of other horizons at other sites from the same period – ie the early part of MIS 11, the early temperate stage of the Hoxnian interglacial) – identified as 'Clactonian', in particular from (a) the Lower Loam and Lower Gravel at nearby Barnfield Pit (Conway *et al.* 1996), (b) unit 5 (pale grey silt) at Barnham (Ashton *et al.* 1998) and (c) the marl/gravel at the golf course excavation at Clacton-on-Sea (Wymer 1985: 264-284). However, what is of particular importance about the collection represented by assemblages 6.1 and 6.2 is (a) that so much of the material found exhibits such technological and typological consistency and (b) that although some of this material is thought to be entirely undisturbed, the majority of it is thought to be slightly time and space averaged, and therefore represents a sample of stable and consistent material cultural practice from a community of hominins through a sustained time period. There is not one shaped/thinned bifacially-edged tool, let alone one that could be dignified by the term 'handaxe', and nor is there any instance of distinctive debitage from handaxe manufacture. The excavated material from Phase 6 at Southfleet Road, particularly assemblage 6.1, therefore provides the most substantial assemblage, and one with the most suitable taphonomic history, to represent and validate the Clactonian as an early MIS 11 industrial tradition in Britain. This is considered further in the concluding chapter (Chapter 22), in conjunction with the lithic material from Phases 7 and 8 of the site's sequence, discussed in the following chapters (Chapters 19 and 20).