Excavation of a Mesolithic Site at Windmill Hill, Nettlebed, Oxon.

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SUMMARY

Sample excavation at Windmill Hill, Nettlebed, Oxfordshire, produced a lithic assemblage of predominantly later Mesolithic date. Artefact class group representation and spatial patterning indicate that the assemblage was produced by a series of activities related to core preparation and reduction, and the manufacture, use and rejuvenation of tools during multiple reoccupations of the site by hunter-gatherers exploiting the surrounding area.

INTRODUCTION

During April 1994 Wessex Archaeology, on behalf of Thames Water Utilities, undertook the sample excavation of the site for a new water reservoir on Windmill Hill, Nettlebed, Oxfordshire. The proposed reservoir site, totalling 0.184 ha. in extent, had previously been subjected to an archaeological evaluation by Wessex Archaeology which revealed artefactual evidence for Mesolithic, earlier Neolithic, and post-medieval activity.[1] In response to these results, Wessex Archaeology, on behalf of Thames Water Utilities and in collaboration with the Archaeology Section of Oxfordshire County Council, prepared a project design detailing a programme of investigation for the site to ensure that an adequate record of the archaeological remains was made prior to their destruction by construction activities.

Excavation was carried out over two weeks and recovered an assemblage composed of over 6,000 lithic artefacts together with a number of post-medieval finds. A number of post-medieval features were also uncovered. No *in situ* Mesolithic occupation surfaces or features were found. With the completion of the post-excavation programme on the finds recovered from the site, this report has been prepared as the final stage of work required by the project design.

THE SITE

Nettlebed is a small village between Wallingford, to the north-west, and Henley-on-Thames to the south-east (Fig. 1). The village lies on a south-facing terrace within the heavily dissected and wooded southern end of the Chiltern Hills, at about 185 m. O.D. Windmill

[1] Wessex Archaeology, 'Nettlebed Reservoir, Nettlebed, Henley-on-Thames, Oxfordshire: Archaeological Evaluation' (unpublished Wessex Archaeology Client Report No. W663a 1994).

Hill (SU 7027 8722) is situated approximately 500 m. north-east of the centre of the village at about 210 m. O.D. Geologically it occurs on an outcrop of the Reading Beds with the soil being predominately a gleyic podzol of the Hornbeam 1 Association.[2] A water reservoir and pumping station lie on its summit with a number of isolated 19th-century houses occurring on its eastern and southern slopes. The northern and western slopes of the hill were extensively quarried for clay and sand in the 19th and early 20th centuries with the locations of the former pits surviving as visible hollows cut into the slope. A windmill with accompanying outbuildings was also situated on the summit during the period 1823–1912. The hill is currently largely covered by a mixed woodland with the summit being predominately pine and bramble undergrowth.

ARCHAEOLOGICAL BACKGROUND

Mesolithic activity was first recognized in the immediate vicinity of Windmill Hill during the earlier part of the 20th century. In 1913 quantities of lithic artefacts were collected from paths and a large sand pit on the west and south-west margins of the hill.[3] An apparently *in situ* 'working floor' lying at a depth of 0.3–0.9 m. below the surface was identified from a section along one of the faces of the pit. Some seventy artefacts, including blades and blade cores, microliths, and a number of other possible tools, were collected from this surface and evidence for the presence of at least one hearth noted. Subsequent work on this assemblage has indicated that it is probably of earlier Mesolithic date.[4]

Two other locations of Mesolithic artefacts are known for the west/south-western area at the base of the hill.[5] Artefacts recovered from these locations include blades and blade cores, scrapers, microliths, tranchet axes, and a number of other unspecified tools. No information is available regarding the date and context of these discoveries. A single tranchet axe was also found on or near the summit in 1954.

THE EXCAVATION

The project design prepared by Wessex Archaeology identified the site as possessing considerable potential for providing substantive data regarding the nature of Mesolithic settlement at Windmill Hill. Four objectives concerned with the character of the Mesolithic occupation at the site were set out:

1. to establish the relative date of the Mesolithic occupation and whether the occupation was of more than one phase
2. to determine the nature and location of the activities that took place
3. to identify the sources of lithic raw material represented by the artefacts in the assemblage, and
4. to compare and contrast the excavated lithic assemblage with other assemblages recorded for the local area

[2] M.G. Jarvis, R.H. Allen, S.J. Fordham, J. Hazelden, A.J. Moffat and R.G. Sturdy, *Soils and their use in South East England* (1984).

[3] A.E. Peake, 'A cave site at Nettlebed, S. Oxon.' *Proc. Prehist. Soc. E. Anglia*, 2 (1915), 71–80.

[4] R.M. Jacobi, 'Aspects of the Mesolithic Age in Great Britain,' in S.K. Kozlowski (ed.), *The Mesolithic in Europe* (1973), 237–65.

[5] J.J. Wymer, *Gazetter of Mesolithic Sites in England and Wales* (CBA Research Report 21, 1977), 223–8.

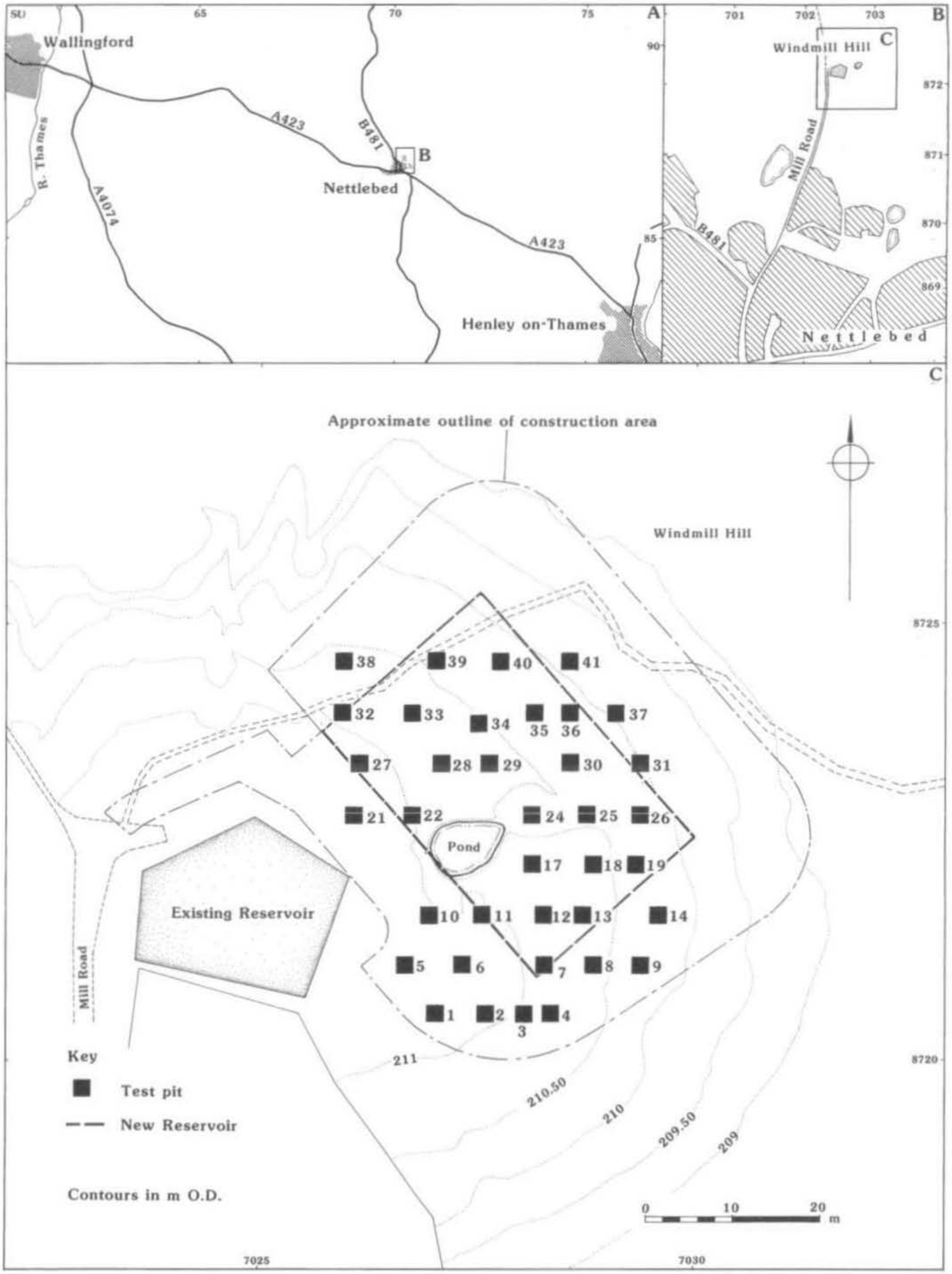

Fig. 1. Windmill Hill, Nettlebed: site location.

All four of these objectives require representative data concerning lithic assemblage composition and the distribution of artefact type classes across the area of the site. A small team size and restrictions on the time available for fieldwork required the use of a systematic unaligned sampling strategy designed to meet these data requirements as described by Cochran.[6] An initial sample of forty 2 sq.-m. testpits, representing 8.7% of the site's area, was selected as the maximum number of units that could be excavated by a small team within the two week period allowed for fieldwork. The test-pits were plotted on a 1:400 map prior to fieldwork using a north–south baseline which intersected an O.S. Triangulation point located within the site. Eight transects were established with a variable number of testpits located along each. The spacing of transects and number of testpits per transect were established according to the methods outlined by Kish[7] and Cochran.[8]

A total of thirty-seven testpits out of the planned number of forty were set out across the site. The density of trees and understory vegetation in places did not allow for the placement of three testpits. In addition, when it was discovered that one testpit was situated in the middle of a small stagnant pond, an additional testpit was assigned to the eighth transect and given the number 41. The 37 testpits gave a total coverage of 148 sq. m. or an 8% sample of the site. The distribution of the testpits across the site is shown in Figure 1.

The majority of the testpits were hand-excavated by spits into the top 0.05–0.15 m. of the subsoil, with 15% of their fill dry-sieved through a 5 mm. mesh to increase the recovery of small artefacts. Artefacts recovered were bagged by testpit and context, and the deposits recorded using Wessex Archaeology's *pro forma* recording system. Six testpits contained features of post-medieval or modern date and were only partially excavated. These features included cobbled surfaces (testpits 17, 18, and 25), wall foundations (testpit 17) and a possible wall slot (testpit 6). Most are likely to be the remains of outbuildings and yards or paths associated with the former windmill. All features were assigned context numbers, planned, photographed and recorded but not excavated. Descriptions of the individual features are available in archive. Table 1 summarizes the number and categories of artefacts recovered from individual testpits.

Stratigraphy

No *in situ* deposits of prehistoric date were identified in any of the testpits. In undisturbed areas two natural soil horizons were identified exhibiting features characteristic of a gleyed podzol. The characteristics of these two soil horizons can be summarized as follows (Fig. 2):

0–0.25 m. – A1 Horizon: very dark greyish brown, slightly stony, clay loam or sandy clay loam. The horizon is heavily disturbed by tree roots with the upper 0.05 m consisting of loose humic leaf mould.

0.25–0.45+ m. – A2 Horizon: mottled yellowish brown, slightly stony, clay loam or sandy clay loam. Numerous roots and root casts occur in this horizon.

Artefacts were distributed vertically throughout the A1 horizon with a greater number concentrated in a 0.05–0.10 m. zone at the interface between the two horizons. Processes responsible for the formation of this zone remain only partially understood but appear to be largely related to sorting actions produced by the lateral movement of roots along the boundary between the two horizons.[9] In the A2 horizon below artefacts occurred primarily in root casts with lithic pieces often oriented vertically within them. Post-medieval and modern artefacts occur in both soil horizons with those recovered from root casts being predominately very small fragments of pottery.

[6] W.G. Cochran, *Sampling Techniques* (1977), 205–6.

[7] L. Kish, 'Selection of the sample', in L. Festinger and L. Katz (eds.), *Research Methods in the Behavioural Sciences* (1953), 61–107.

[8] Cochran, op. cit.

[9] S. Limbrey, *Soil Science and Archaeology* (1975); W.R. Wood and D.L. Johnson, 'A survey of disturbance processes in archaeological site formation' in M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory*, 1 (1978), 314–81.

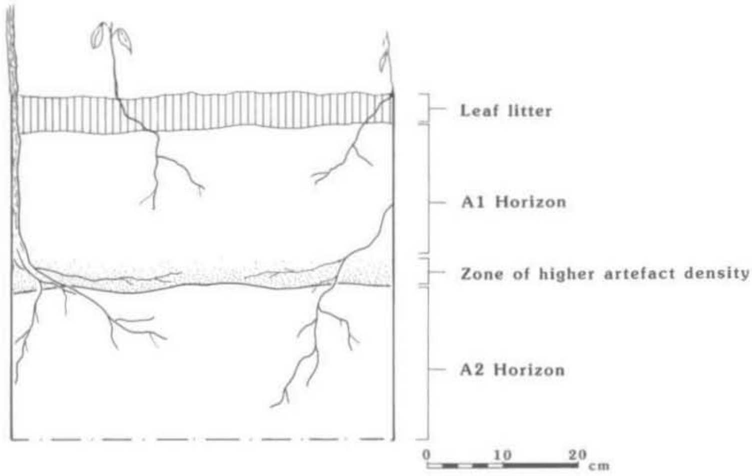

Fig. 2. Windmill Hill, Nettlebed: schematic profile of the natural stratigraphy at the site.

THE LITHIC ASSEMBLAGE

The excavation produced a largely homogeneous Mesolithic lithic assemblage composed of 6,359 artefacts. Frequency data for this assemblage was generated by subdividing the artefacts into a number of type classes. Attribute or 'metric' data were obtained by means of a systematic random sample[10] with sampling fractions of 20% each for complete unretouched flakes and blades (flakes n = 432, blades n = 188), and 25% for complete cores (n = 27). Proportional allocation methods were employed in artefact selection to ensure that a representative proportion of the pieces from each context was examined. The remaining type classes in the assemblage were not described metrically. Selected artefacts from the assemblage are illustrated in Figure 3. Full details of the statistical methods employed and the results are in archive.

Condition

Patination ranges from a light waxy film to a greyish white and was simply recorded as being either present or absent on individual pieces. In total, 4,463 artefacts (70.18%) exhibit some degree of patination with 1,896 (29.82%) unpatinated. The majority of artefacts in the assemblage are in an excellent state of preservation with only 752 pieces (11.82%) exhibiting identifiable traces of post-depositional edge damage or breakage. Most of this damage is excavation-induced and consists of isolated trowel nicks and impact fractures produced by mattocks and shovels. There is no clear indication of systematic intentional breakage.

Raw Material

A total of 6,351 pieces in the assemblage (99.87%) are flint and only eight chert (0.13%). Three local sources for the flint occur within 1 km. of the site; Upper Chalk, clay-with-flints, and Reading Beds. Cortical condition and flint colour indicate that all three raw material sources are present within the assemblage in fairly even numbers.

[10] R. Torrence, 'Chipping away at some misconceptions about sampling lithic assemblages', in J.F. Cherry, C. Gamble and S. Shennan (eds.), *Sampling in Contemporary British Archaeology* (BAR 1978), 373–98.

TABLE 1. TOTAL NUMBER OF ARTEFACTS RECOVERED BY TESTPIT

Test Pit	*Burnt Flint* no	*Burnt Flint* wt	*CBM* no	*CBM* wt	*Clay Pipe* no	*Clay Pipe* wt	*Lithics* no	*Lithics* wt	*Glass* no	*Glass* wt	*Pottery* no	*Pottery* wt	*Slag* no	*Slag* wt	*Slate* no	*Slate* wt	*Metal*
1	82	658	–	–	–	–	395	3582	1	4	3	28	1	29	–	–	1
2	63	346	–	–	–	–	341	1875	–	–	–	–	–	–	–	–	5
3	6	32	–	–	–	–	346	3380	–	–	–	–	–	–	–	–	2
4	267	1967	12	273	2	4	754	4822	8	32	23	138	2	66	–	–	6
5	171	1164	53	739	5	16	776	5040	18	119	47	278	1	6	4	28	19
6	37	246	8	560	–	–	460	3728	1	17	7	144	–	–	–	–	9
7	127	1006	–	–	–	–	204	1851	–	–	1	1	–	–	–	–	1 Cu
8	47	263	–	–	–	–	202	1367	–	–	–	–	–	–	–	–	–
9	1	22	–	–	–	–	91	1882	–	–	–	–	–	–	–	–	4
10	41	353	–	–	–	–	60	1924	–	–	–	–	–	–	–	–	–
11	43	280	–	–	–	–	129	1960	1	10	–	–	–	–	–	–	–
12	181	1181	61	421	3	11	544	3323	4	5	107	504	–	–	2	1	11
13	124	1293	2	55	2	7	337	2897	3	35	23	200	–	–	–	–	5
14	8	207	1	98	1	2	192	2360	7	24	29	538	–	–	–	–	4: 2 Cu; 2 Pb
17	1	22	–	–	–	–	23	163	–	–	3	62	–	–	–	–	2
18	–	–	–	–	–	–	5	182	–	–	6	64	–	–	–	–	3
19	17	133	–	–	–	–	94	1499	–	–	–	–	–	–	–	–	–
21	16	209	–	–	–	–	171	1647	–	–	–	–	–	–	–	–	1
22	53	469	9	186	2	6	261	2185	–	–	27	218	–	–	–	–	1
24	114	595	182	2693	3	4	127	922	11	24	48	218	4	244	5	5	14
25	1	1	–	–	–	–	–	–	3	3	10	13	–	–	–	–	10
26	6	28	–	–	–	–	8	77	–	–	–	–	–	–	–	–	–
27	58	321	75	1311	4	6	96	414	3	15	28	146	2	63	3	8	19
28	4	74	4	190	1	4	81	592	2	3	9	109	–	–	1	15	8
29	8	137	2	206	–	–	16	303	1	1	9	138	–	–	–	–	2
30	5	129	–	–	–	–	19	236	–	–	–	–	–	–	–	–	–
31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
32	9	177	–	–	–	–	50	353	1	7	4	23	–	–	–	–	3: 1 Pb
33	5	247	–	–	–	–	49	937	–	–	–	–	–	–	–	–	–
34	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
35	18	149	7	273	–	–	100	841	3	5	15	186	–	–	–	–	3
36	101	1665	3	77	1	1	61	1419	–	–	4	18	–	–	–	–	2
37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
38	–	–	–	–	–	–	9	72	–	–	–	–	–	–	–	–	10
39	22	301	2	142	–	–	63	1538	4	68	8	58	–	–	–	–	–
40	26	454	17	511	5	10	117	1549	5	14	21	102	1	88	–	–	2
41	115	457	113	1691	6	17	161	1784	6	17	44	263	–	–	–	–	18: 1 Cu
TOTAL	1777	14586	551	9426	36	91	6359	56704	82	403	476	3449	11	496	15	106	173 Fe; 4 Cu; 3 Pb

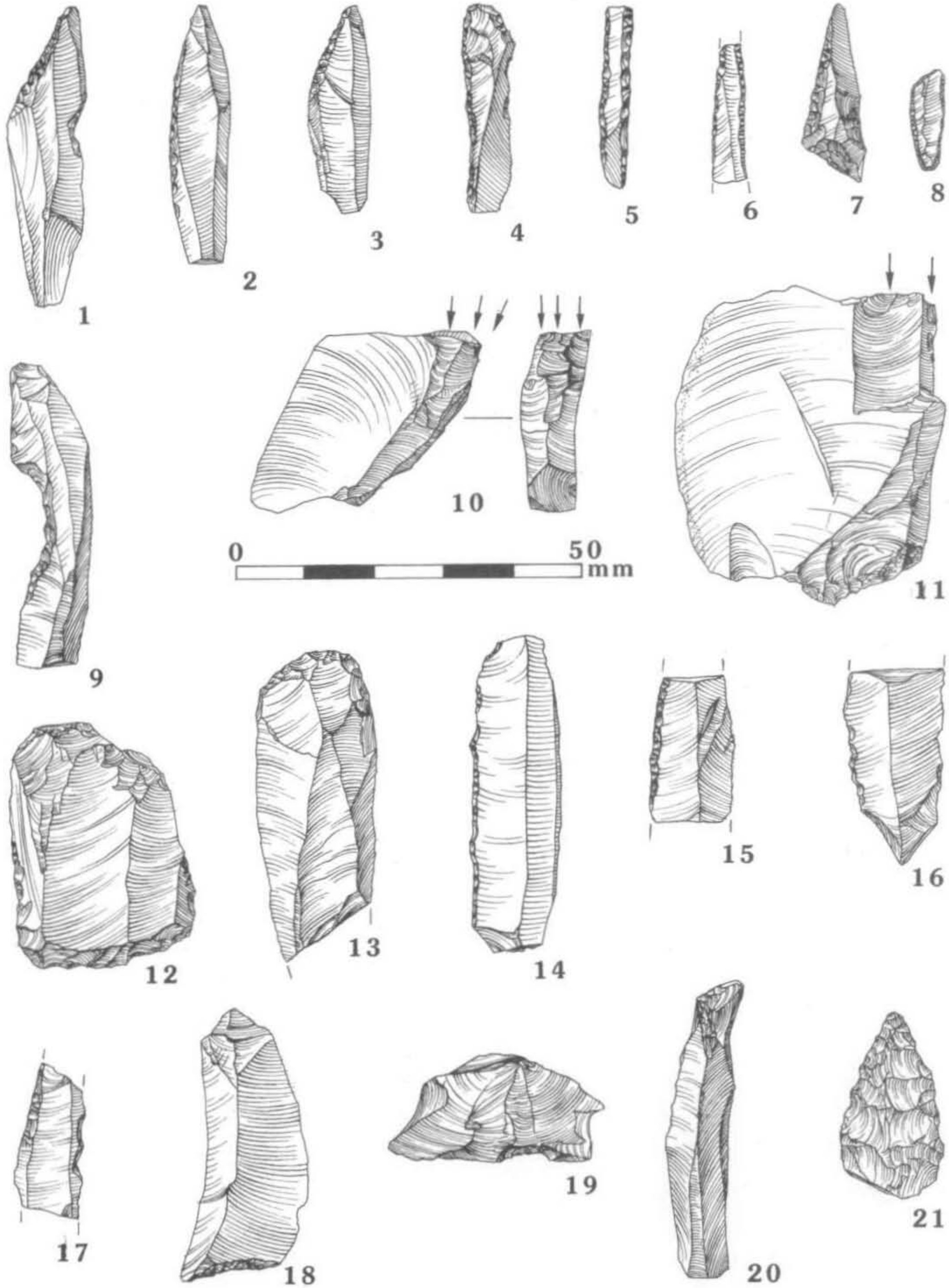

Fig. 3. Windmill Hill, Nettlebed: selected artefacts recovered by the excavations: 1–8 microliths; 9 unfinished microlith; 10–11 burins; 12–13 scrapers; 14–15 backed blades; 16–17 denticulates; 18 truncation; 19 notch; 20 piercer; 21 leaf-shaped arrowhead.

Nodules available from these sources vary in size and can exceed 1200 g. in weight, and shape, ranging from irregular to round or cylindrical. Core and other debitage characteristics indicate that a wide variety of nodule sizes and shapes were selected for tool production from these different sources including small to medium sized cylindrical nodules.

The chert in the assemblage is of non-local origin and is distinguished by a very dark grey/greyish brown colour and a grainy texture. All eight artefacts in the assemblage are non-cortical. The source of this raw material is unknown.

Assemblage Composition

Table 2 presents the major artefact class groups for the assemblage. Manufacturing and rejuvenation debitage class groups make up 97.28% (n = 6,194) and show assemblage composition to be dominated by various 'waste' types generated by core preparation and reduction activities in blank production, and the manufacture and rejuvenation of retouched tools. Retouched and utilised tool classes make up respectively 2.26% (n = 144) and 0.33% (n = 21) of the assemblage, reflecting characteristics of lithic assemblages in southern England generally.

TABLE 2. ASSEMBLAGE COMPOSITION

	Complete	Fragment	Burnt	Total	%
Unretouched Flake	2121	764	448	3333	52.41
Unretouched Blade	944	1209	223	2376	37.36
Flake Core	47	8	6	61	0.96
Blade Core	59	11	6	76	1.19
Core Trimming Debris	194		18	212	3.33
Core Rejuvenation Flake	28	3	2	33	0.52
Microburin	12			12	0.19
Unfinished Microlith	2			2	0.03
Burin Spall	4			4	0.06
Axe/Adze Sharpening Flake	2	1		3	0.05
Other Tool Sharpening Flake	1			1	0.01
Microdebitage	81			81	1.27
Retouched Tool	91	49	4	144	2.26
Utilized Tool	18	3		21	0.33
TOTAL	3604	2048	707	6359	

Cores

A total of 137 complete, fragmentary, and burnt cores was recovered from the site. Flake cores comprise 45.53% (n = 61) of the total and are predominately prepared platform types: single platform (n = 18) and multiple platform (n = 27). The remainder are sixteen unclassifiable cores possessing flake scars. Blade cores make up 54.47% (n = 76) of the total and comprise single platform (n = 33) and bipolar platform (n = 36) cores, and cores with two or more platforms at 45°–90° angles to each other (n = 5). Two unclassifiable cores possessing blade scars make up the remainder. Approximately 47.54% (n = 29) of the flake cores and 51.31% (n = 39) of the blade cores possess one or more blade or flake scars and indicate that the majority were utilized for the production of both flakes and blades throughout the reduction sequence. Three cores also possess evidence of secondary utilization; two as hammerstones (1 flake, 1 blade) and one as a burin/piercer (flake). Table 3 summarizes the core types identified for the assemblage along with their general condition.

The sample of cores drawn from the assemblage (n = 27) for more detailed analysis consists of twelve flake or flake and blade cores (44.44%) and fifteen blade or blade and flake cores (55.55%) and closely reflects their relative frequencies within the assemblage recovered as a whole. Sample statistics together with their standard errors for the variables total number of scars, maximum length, maximum width, and weight are presented in Table 4. Cores in the sample were classified according to platform characteristics into six types and described according to surviving cortex and scar type (Table 5).

TABLE 3. CORE TYPES

	Complete	Fragment	Burnt	Total	%
Flake Core					
Single Platform	11	7		18	29.51
Multiple Platform	25		2	27	44.26
Unclassifiable	11	1	4	16	26.33
Total	47	8	6	61	
Blade Core					
Single Platform	21	9	3	33	43.42
Bipolar Platform	33		3	36	47.32
Other*	4	1		5	6.58
Unclassifiable	1	1		2	2.63
Total	59	11	6	76	
OVERALL TOTAL	106	19	12	137	

* Cores with two or more platforms at 45°–90° angles to each other

TABLE 4. CORE SAMPLE STATISTICS

	Total Number of scars	Length	Width	Weight
Sample Size	27	27	27	27
Mean	11.07	55.67	43.41	108.30
Median	11	56	43	93.10
Variance	9.99	200.77	139.71	11,406.30
Standard Deviation	3.16	14.17	11.82	106.80
Standard Error	0.61	2.73	2.27	20.55
Minimum	6	31	28	28.40
Maximum	18	99	78	501.70
Range	12	68	50	473.30

TABLE 5. CORE SAMPLE TYPES

	Cortex					Characteristics				Scar Type			
	0	10%	25%	50%	75%	$\bar{x}$ length	$\bar{x}$ width	$\bar{x}$ weight	$\bar{x}$ scar	flake	blade	flake & blade	Total
Single Platform		2	2	1	2	51.74	42.86	80.36	9.14	2	2	3	7
Bipolar Platform	4	3		3	1	54.36	38.78	69.83	11.73	1	1	9	11
Multiple Single Platform		1	1			70.50	54.50	227.45	11.50			2	2
Single Joint Platform			1			80.00	65.00	501.00	10.00	1			1
Multiple Joint Platform		2	2			52.25	44.00	102.10	13.50			4	4
Combined Platform*			1	1		56.50	48.00	114.30	9.50	1		1	2
TOTAL	4	8	7	5	3					5	3	19	27

* Cores possessing both single and joint platforms

In general, Table 5 indicates that cores with less cortex possess a greater mean number of scars and are narrower than those with a greater proportion of surviving cortex. Single platform cores seem to have been discarded at different stages in the reduction process whilst the use of multiple platforms appears to have occurred largely during secondary decortication stages of core reduction. Bipolar cores appear to reflect the production of blades and/or flake blades during tertiary reduction sequences and the use of cylindrical nodules as raw material. Overall, the majority of the cores in the assemblage were in all likelihood utilized for the production of both flakes and blades with their morphology largely conditioned by the final sequence of blank removals.

Core Shatter/Trimming Debris

A total of 212 pieces occur in the assemblage that are identifiable as shatter or trimming debris produced by core shaping and initial reduction. They include both cortical and non-cortical pieces of variable shape and, in general, possess large bulbs of percussion and thick, often cortical, platforms, indicating that they were largely detached from the nodule by direct percussion with a hard hammer (e.g. hammerstone).

Core Rejuvenation Flakes

Some thirty-three core renewal pieces, removed in order to rejuvenate stepped, battered, or otherwise flawed, striking platforms, were identified (Table 2). Three types occur:

(1) core tablet (n = 13): the removal of the entire platform of the core;
(2) core face/platform (n = 9): the removal of a portion of the platform and part of the core face; and
(3) core edge (n = 11): the removal of a blade-shaped piece with the old platform edge as its central ridge.

Flakes and Blades

Unretouched flakes comprise 52.41% (n = 3,333) of the assemblage and consist of 2,121 complete artefacts, 764 fragments, and 448 burnt pieces. Burnt flakes, fragments, and flake fragments are not further discussed.

For complete flakes, four distinctive shapes occur in the assemblage; narrow (27.80%; n = 579), proportional (51.63%; n = 1095), squat (20.46%; n = 434), and irregular (0.61%; n = 13).

Complete unretouched flakes were divided into primary (dorsal surface wholly cortical), secondary (dorsal surface partially cortical), and tertiary (dorsal surface non-cortical) class groups to determine the relative occurrences of flakes produced at different stages during the process of core reduction. Primary flakes account for 5.56% of the total (n = 118), secondary 36.59% (n = 776) and tertiary 57.85% (n = 1,227). Primary flakes are characterised by thick, often cortical platforms and pronounced bulbs of percussion, indicating that they were probably removed by direct percussion. Platform and bulbar characteristics for secondary and tertiary flakes are more variable and reflect their detachment from the core by both direct and indirect percussion techniques but can be described, in general, as possessing relatively narrow platforms and less pronounced bulbs of percussion. Ratios calculated for the three class groups show the frequency of secondary flakes in the assemblage to be six and a half times greater than primary flakes with the frequency of tertiary flakes around 1.6 times greater than that for secondary flakes. Tertiary flakes, when compared to primary and secondary flakes combined (n = 894), are only around 1.4 more common indicating that 42% of the flake component in the assemblage are by-products of decortication stages of core reduction; an observation confirmed by t-test.[11]

[11] Two t-tests for the differences between proportions (Blalock 1979, 232–4) were carried out between secondary and tertiary flake and blade class groups. Results of these tests indicate that there are significant differences between the proportions of secondary and tertiary flakes and blades in the assemblage. Secondary flakes occur in greater proportions than secondary blades (t = 6.20, sig. at the .01 level) and confirm that a substantial proportion of the flakes in the assemblage represent by-products of decortication stages in core reduction. Tertiary blades, on the other hand, occur in greater proportions than tertiary flakes (t = 13.31, sig. at the .01 level) and indicate that the majority of the blades in the assemblage were produced during tertiary stages of core reduction.

The sample of flakes drawn from the assemblage (n = 432) consists of 18 primary (4.2%), 191 secondary (44.2%), and 223 tertiary (51.6%) flakes. Sample statistics together with their standard errors for the variables platform thickness, platform angle, length, width, and length/width ratio are presented in Table 6. Frequency distributions for flake length and width suggest a continuous gradation in size from larger to smaller pieces. Product-moment correlations[12] indicate that much of the variation in flake characteristics can be accounted for by the mechanical interdependence of attributes produced by different stages of core reduction (Table 7). Platform thickness is positively correlated with length and width, and negatively correlated with platform angle and the length/width ratio. The positive correlations indicate platform thickness to be largely dependent on piece size with the negative correlations appearing to reflect the change from direct to soft hammer/indirect percussion during core reduction and the association of thick platforms with squat flakes. Platform angle is positively correlated with the length/width ratio and indicates that platform angles increase as flakes become more blade-like during secondary and tertiary core reduction stages. Length and width, unsurprisingly, are highly correlated, increases in the length/width ratio being accompanied by decreases in width and vice versa.

Unretouched blades comprise 37.36% (n = 2,376) of the assemblage and consist of 944 complete artefacts, 1,209 fragments and 223 burnt pieces. Again, burnt blades and blade fragments are excluded from further analysis.

Primary blades account for 0.74% (n = 7) of the total, secondary 25.42% (n = 240) and tertiary 73.83% (n = 697). Primary blades are not deliberate blanks of predetermined shape but rather incidental by-products of core reduction produced by the removal of nodule edges. They are characterized by largely cortical platforms of variable thickness, with or without pronounced bulbs of percussion, and were probably removed by direct and indirect percussion techniques not only during initial core shaping but also at other stages in the reduction process to renew shape and platform attributes or to provide a new platform. Platform and bulbar characteristics for secondary and tertiary blades are dominated by narrow platforms and more diffuse and/or smaller bulbs of percussion, indicating that they were largely removed by soft hammer/indirect percussion techniques. Ratios calculated for the true blades (secondary and tertiary pieces) show tertiary blades to be almost three times more

TABLE 6. FLAKE SAMPLE STATISTICS

	Platform Thickness	Platform Angle	Length	Width	L/W
Sample size	432	347	432	432	432
Mean	4.10	67.57	35.85	31.15	1.23
Median	3	70	35	29	1.20
Variance	8.83	128.91	150.95	155.67	0.14
Standard Deviation	2.97	11.35	12.29	12.48	0.38
Standard Error	0.14	0.61	0.59	0.60	0.02
Minimum	1	6	8	8	0.24
Maximum	17	88	94	86	3
Range	16	82	86	78	2.76

All measurements in millimetres

TABLE 7. CORRELATION MATRIX FOR UNRETOUCHED FLAKES

	Platform Thickness	Platform Angle	Length	Width	L/W
Platform Thickness	–				
Platform Angle	–0.27*	–			
Length	0.35*	0.08	–		
Width	0.50*	–0.13	0.55*	–	
L/W	–0.23*	0.24*	0.33*	–0.53*	–

Values starred significant at the .05 level

[12] H.M. Blalock, *Social Statistics* (1979), 396–410.

TABLE 8. BLADE SAMPLE STATISTICS

	Platform Thickness	Platform Angle	Length	Width	L/W
Sample size	188	90	188	188	188
Mean	1.92	75.52	45.72	14.49	3.30
Median	2	76	43	13.50	3.24
Variance	1.57	61.98	203.18	25.74	0.60
Standard Deviation	1.25	7.87	14.25	5.07	0.77
Standard Error	0.09	0.83	1.04	0.37	0.06
Minimum	1	52	18	5	1.65
Maximum	6	86	109	29	6.60
Range	5	34	91	24	4.95

All measurements in millimetres

TABLE 9. CORRELATION MATRIX FOR UNRETOUCHED BLADES

	Platform Thickness	Platform Angle	Length	Width	L/W
Platform Thickness	–				
Platform Angle	–0.23	–			
Length	0.29*	–0.15	–		
Width	0.40*	–0.23	0.71*	–	
L/W	–0.17	0.15	0.11	–0.57*	–

Values starred significant at the .05 level

common than secondary blades and indicate that the blade component in the assemblage is largely the by-product of tertiary stages of core reduction; an observation again confirmed by t-test.[13]

The sample of blades drawn from the assemblage (n = 188) consists of 49 secondary (26.1%), and 139 tertiary (73.0%) blades and closely approximates their relative frequencies within the assemblage as a whole. Sample statistics together with their standard errors for the variables platform thickness, platform angle, length, width, and length/width ratio are presented in Table 8. Product moment correlations (Table 9) lead to similar conclusions regarding blade attributes as for flakes. However, unlike the flake component, platform angle on blades is *negatively* correlated with width and indicates that increases in platform angle are accompanied by decreases in blade width as the core becomes smaller during blank production.

Tool Manufacturing and Rejuvenation Debris

A total of twenty-two pieces are identifiable as debris produced during the manufacture or use of tools. They comprise twelve microburins and two unsnapped microlith preforms (small notched blades). No subdivision of microburin attributes was attempted. The rejuvenation debris consists of four burin spalls, two complete and one fragmentary axe-sharpening flakes, and a single example of a probable scraper-sharpening flake.

Microdebitage

Some eighty-one pieces classifiable as microdebitage or 'chips' were recovered by the sieving programme. These pieces are all less than 1.0 cm. in size and include various spalls, facets, small flakes, and nondescript shatter produced during core reduction and by the manufacture, use, and rejuvenation of tools.

[13] op. cit. note 12.

Tools

Retouched and utilized tool forms comprise 2.59% (n = 165) of the assemblage and consist of 109 complete artefacts, forty-nine fragments and seven burnt pieces. Table 10 summarizes the tools identified by type class together with their general condition.

Microliths: Microliths comprise 25.15% (n = 42) of the retouched component. Microlith type classes represented are: obliquely blunted points (twenty-two complete, five fragments), straight-backed pieces or rods (five complete, three fragments, one burnt), triangle/subtriangle (one complete), and one complete and four fragments which are unclassifiable.

Scrapers: Scrapers make up a further 22.75 % (n = 38) of the assemblage's retouched component and comprise thirty-four endscrapers, two double endscrapers, and two side scrapers. Eight of the endscrapers are broken and three burnt. Steep overhanging retouch is present on four examples with six fragments exhibiting identifiable pressure snaps characteristic of breakage during utilization. Some twenty-five endscrapers occur on flakes, six on blades and one on an unmodified natural thermal flake. The four double end/side scrapers occur on flakes.

Burins: Seven burins or gravers occur in the assemblage, two dihedral burins, and five angle burins. Multiple spall removals are present on four pieces (two dihedral, two angle). Five burins are on flakes and one on a blade. The blank for the remaining burin is largely indeterminate.

Notches: Five retouched artefacts can be described as notched pieces. The five pieces are complete and represent examples of the single notch type class. No double notch types were identified for the assemblage. All five occur on flakes.

Microdenticulates: Microdenticulates comprise seven complete pieces and six fragments with very fine serrations and/or alternating dorsal-ventral utilization scars along their lateral edges. All examples of this type class occur on blades.

Denticulates: The denticulates consist of one complete piece and eight fragments with a series of contiguous notches. All nine occur on blades.

Piercers: Piercers comprise ten complete pieces and one fragment. Nine of the piercers occur on blades, one on a flake and one on a piece of core shatter. Seven artefacts (six complete, one fragment) possess retouch/utilization scars on their distal ends, one on its proximal end, one on its left lateral, and one on the pointed end of a curving snap on a blade segment. Retouch/utilization scars occur on a pointed end of the piece of core shatter.

Truncations: Two complete and two fragmentary truncations occur in the assemblage. The four pieces represent examples of the oblique type class with three possessing retouch on their distal ends (two complete, one fragment) and one on its proximal end. All examples occur on blades.

TABLE 10. RETOUCHED AND UTILIZED TOOLS

	Complete	Fragment	Burnt	Total
Microliths	29	12	1	42
Scrapers	27	8	3	38
Burins	7			7
Notches	5			5
Microdenticulates	7	6		13
Denticulates	1	8		9
Piercers	10	1		11
Truncations	2	2		4
Backed Pieces	1	4		5
Drill Bits		3		3
Marginal Retouched Pieces	2	3		5
Diverse		2		2
TOTAL	91	49	4	144
UTILIZED	18	3	21	

Backed Pieces: Backed pieces comprise four fragments on blades and one complete example on a flake.

Drill Bits: Three blade fragments are tentatively classified as drill bits. Two are small distal fragments with unifacial retouch leading to a point along their lateral edges. The third is a larger piece with a similar pattern of unifacial retouch along the length of one of its laterals and exhibiting a pressure snap at its proximal end.

Marginal Retouched Pieces: Two complete artefacts and three fragments can be described as possessing recognizable but undiagnostic marginal retouch. Three pieces (two complete, one fragment) appear to be retouched along one lateral and two bilaterally. Four are on blades and one on a flake.

Diverse: Two artefacts are included in this category. One is an unclassifiable distal blade fragment with unifacial retouch extending along the medial-proximal edges of both laterals and exhibiting a snap at its proximal end. The second is a fragment of a bifacial leaf-shaped arrowhead.

Utilized: Twenty-one pieces exhibit patterns of edge damage attributable to use. Lateral utilisation scars occur on thirteen and distal utilization scars on seven. Fourteen utilized pieces occur on flakes, five on blades, and one on a piece of core shatter.

Hammerstones: One complete and two fragmentary hammerstones together with two hammerstone flakes were also recovered from the site. The complete and fragmentary hammerstones are unmodified irregularly-shaped nodules. One of the hammerstone flakes is burnt. All exhibit traces of battering on their surfaces.

Relative Date

Technologically the assemblage is predominantly Mesolithic in character and includes deliberate blades of varying size, single, bipolar blade or blade and flake cores, core rejuvenation flakes, and a range of other debitage class groups. Retouched tool forms in the assemblage include microliths, burins, scrapers, and a number of other type classes. The relative chronological position of the assemblage within the Mesolithic can be determined on typological grounds by the presence of straight-backed pieces or rods and the small geometric triangle/subtriangle. These types are characteristic elements of later Mesolithic industries post-dating 6500bc[14] and indicate that the assemblage largely dates from within this period. The recovery of a single leaf-shaped arrowhead, and another in the evaluation, indicates that earlier Neolithic activity also occurred at the site. The absence of any additional tool types assignable to this period would seem to suggest that these two artefacts represent intrusive elements within a predominantly Mesolithic assemblage and that the Neolithic activity at the site was relatively ephemeral in character with only a minimal contribution to assemblage composition.

NON-LITHIC ARTEFACTS, BY L.N. MEPHAM

Burnt Flint

Burnt flint was not evenly spread between the testpits, but clustered at a number of points within the area sampled (Table 1). While not intrinsically datable, the fact that burnt flint tends to occur in the testpits together with lithic artefacts would suggest that the majority of it is of similar date.

Pottery

The majority of the pottery recovered was of post-medieval or modern date, including glazed red earthenwares, salt-glazed stonewares, and fine white wares, with a combined date range of 18th–20th century. Six sherds were

[14] Jacobi op. cit.; P. Mellars, 'The Palaeolithic and Mesolithic', in C. Renfrew (ed.), *British Prehistory* (1974), 41–99; M.W. Pitts and R.M. Jacobi, 'Some aspects of change in flake stone industries of the Mesolithic and Neolithic in southern Britain', *J. Archaeol. Sci.* 6 (1979), 163–77.

identified as of medieval date, comprising single unglazed sandy body sherds and two partially glazed sandy sherds. In the absence of clearly diagnostic material, these sherds are not closely datable within the medieval period, although a broad date range of 13th–14th century would seem likely.

Other Finds

All other finds collected on site were of post-medieval or modern date. These included ceramic building materials, clay pipe stems, window and bottle glass, slag or cinder, roofing slate, iron nails, and other metal objects. Some of the ceramic building materials showed signs of vitrification resulting from burning. Post-medieval material was not evenly spread between the testpits, but clustered at several points within the area sampled (Table 1).

SPATIAL PATTERNING

The spatial analysis of the lithic artefact distributions recovered from the testpits is orientated towards the discovery of clusters of associated artefact class groups which co-occur spatially. Its purpose was to determine whether any activity areas have survived at the site and, if so, how they relate to site function.

Methods

There are a number of quantitative techniques that can be applied to the analysis of artefact distributions.[15] The process of pattern recognition employed in the analysis involved two main steps:

1. the identification of associational patterns for artefact class groups on the basis of Kendall's tau-b statistic; and
2. the spatial delineation of clusters of associated artefact class groups utilizing contour mapping of joint artefact densities per unit volume.

Tau-b values were obtained from the SPSSPC subprogram CROSSTABS statistic option, with contour mapping carried out utilizing the GRID subprogram of the SURFER graphics package. Full details of the pattern recognition procedure have been presented elsewhere[16] and the reader is referred to these for a discussion of the statistical tests and assumptions behind their use. Artefacts from the two soil horizons in the testpits were pooled together and treated as a single spatial unit.

Results

Nineteen artefact class groups were identified and used in the analysis. Tau-b values for the artefact class groups are listed in matrix form in Table 11 with those significant at the 99% level starred. One immediate observation is the large number of significant associations among the artefact groups. Some 67.25% (n = 115) of the pairwise associations are statistically significant with a number of functionally unrelated artefacts spatially associated. The nineteen individual artefact class groups exhibit variable patterns of association but the arrangement of the tau-b values in Table 11 suggests five possible overlapping sets of pairwise associations:

[15] C. Carr, 'The nature of organisation of intrasite archaeological records and spatial analytic approaches to their investigation', in M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory*, 7 (1984) 103–222; H.J. Heitata (ed.), *Intrasite Spatial Analysis* (1984); H.P. Blankholm, *Intrasite Spatial Analysis in Theory and Practice* (1991).

[16] H.J. Hietala and D.S. Stevens, 'Spatial analysis: multiple procedures in pattern recognition', *American Antiquity*, 42.4 (1977), 539–59; W.A. Boismier, 'Human Behaviour and Spatial Analysis: A Preliminary Study' (Unpublished M.A. Thesis, Department of Archaeology, University of Southampton, 1981); idem, 'An analysis of worked flint artefact concentrations from Maidenhead Thicket, Maidenhead, Berkshire', in I. Barnes, W.A. Boismier, R.M.J. Cleal, A.P. Fitzpatrick, and M.R. Roberts, *Early Settlement in Berkshire: Mesolithic to Roman Occupation Sites in the Thames and Kennet Valleys* (Wessex Archaeology Report No. 6, 1995), 52–64.

Group 1: Flake and blade cores, core trimming debris, core rejuvenation flakes, and primary, secondary and tertiary unretouched pieces.
Group 2: Microlith manufacturing debris, burin spalls, microliths, and scrapers.
Group 3: Burin spalls, axe sharpening flakes, burins, and notches.
Group 4: Microlith manufacturing debris, burin spalls, notches, microdenticulates, denticulates, and piercers.
Group 5: Microliths, scrapers, piercers, other retouch, and utilized.

These sets of artefact class group associations suggest that a number of functionally related artefacts co-occur spatially in the testpits across the site. Contour mapping of their joint density distributions shown in Figure 4, however, reveals a high degree of spatial correspondence between the artefact groups identified from the matrix. The different groups all exhibit considerable overlap in their distributional patterns with identifiable concentrations tending to co-occur at the same testpit locations in the south of the site. Such patterns reveal the site to be composed of a series of overlapping artefact distributions and document that no discrete activity areas have survived. Assemblage condition indicates that the processes largely responsible for this pattern were those related to multiple reoccupations of the location by later Mesolithic hunter-gatherers. These processes include the shifting of activity locations between occupations and changes in site function, which would have produced a build-up of different types of debris across the site and resulted in a merging of activity area boundaries. The relative contribution to pattern formation of post-depositional disturbances associated with the windmill and the woodland are only partially understood, but appear, with the exception of root sorting actions, to have been relatively minimal.

TABLE 11. MATRIX OF TAU-B VALUES

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
01	–																		
02	.33*	–																	
03	.46*	.41*	–																
04	.35*	.40*	.40*	–															
05	.45*	.34*	.59*	.33*	–														
06	.52*	.39*	.67*	.51*	.61*	–													
07	.55*	.34*	.66*	.45*	.64*	.76*	–												
08	.32	.24	.56*	.37*	.63*	.49*	.51*	–											
09	.37*	.05	–.03	.46*	.39*	.40*	.39*	.55*	–										
10	.08	–.03	.39*	.11	.05	.19	.22	.10	.28	–									
11	.46*	.21	.43*	.48*	.48*	.58*	.62*	.38*	.43*	.09	–								
12	.50*	.44*	.55*	.57*	.51*	.56*	.53*	.40*	.37*	.06	.54*	–							
13	.14	.04	.04	.12	.17	.17	.19	.17	.36*	.35*	.24	.0	–						
14	.41*	.24	.39*	.28	.37*	.44*	.46*	.54*	.46*	.46*	.29	.30	.26	–					
15	.60*	.25	.43*	.25	.35*	.46*	.50*	.41*	.39*	.20	.33*	.39*	.08	.59*	–				
16	.38*	.30	.41*	.23	.39*	.36*	.43*	.42*	.50*	.19	.40*	.28	.26	.32	.25	–			
17	.44*	.31	.55*	.36*	.43*	.47*	.48*	.73*	.49*	.08	.36*	.46*	.09	.49*	.51*	.31	–		
18	.36*	.45*	.44*	.28	.43*	.43*	.51*	.24	.06	–.20	.45*	.33*	.17	.14	.24	.47*	.23	–	
19	.55*	.37*	.63*	.57*	.46*	.46*	.63*	.52*	.48*	.04	.50*	.55*	.12	.56*	.46*	.56*	.55*	.46*	–

Values starred significant at the .01 level

Key to Table 11, artefact class groups used in the spatial analysis

01	Flake core	11	Microlith
02	Blade core	12	Scraper
03	Core trimming debris	13	Burin
04	Core rejuvenation flake	14	Notch
05	Primary unretouched flakes and blades	15	Microdenticulate
06	Secondary unretouched flakes and blades	16	Denticulate
07	Tertiary unretouched flakes and blades	17	Piercers
08	Microlith manufacturing debris	18	Other retouch
09	Burin spall	19	Utilized
10	Axe/adze sharpening flake		

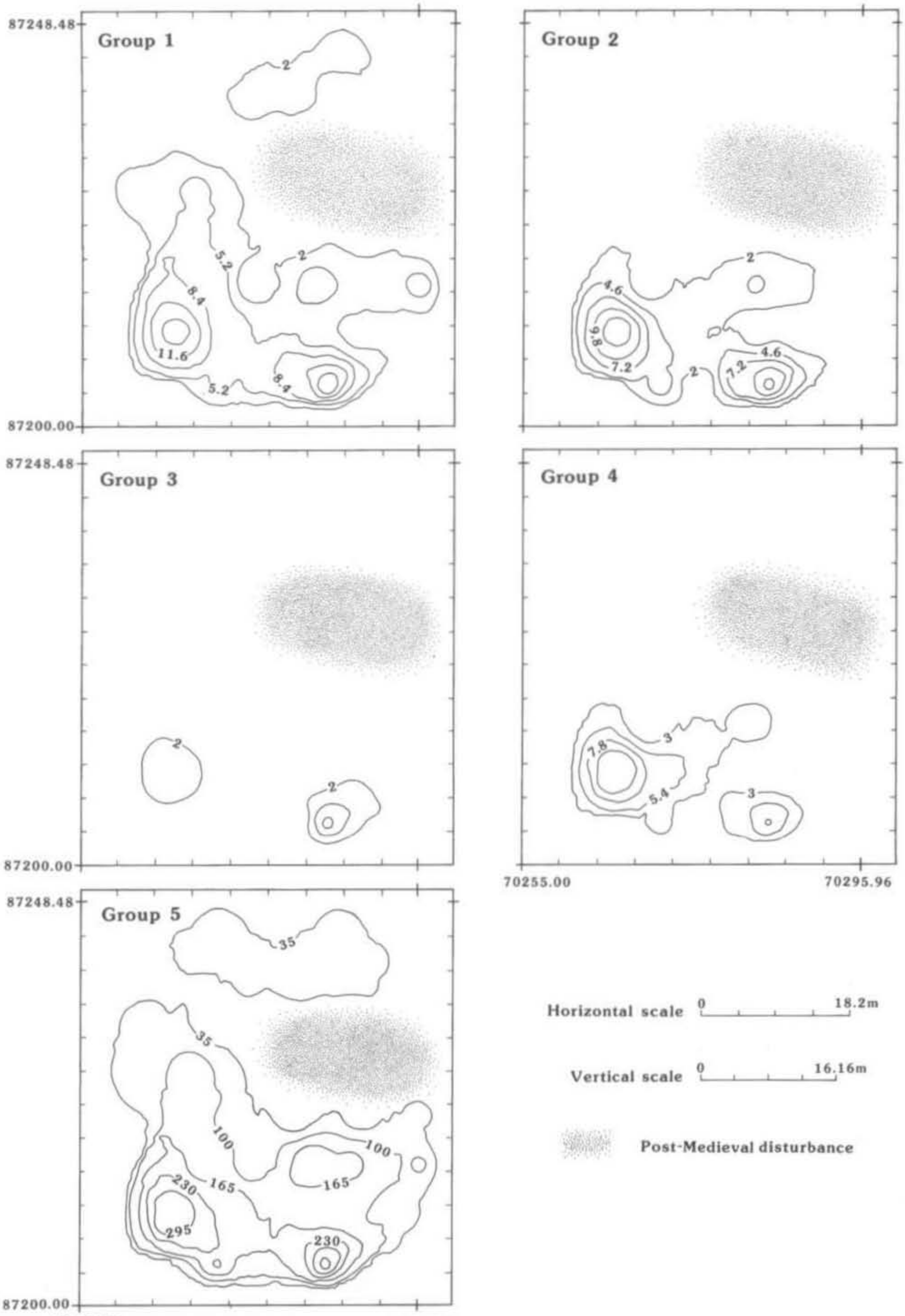

Fig. 4. Windmill Hill, Nettlebed: density distributions for the five groups of pairwise artefact associations.

DISCUSSION

In attempting to identify site function, a useful starting point is the functional classification of Mesolithic lithic assemblages proposed by Mellars.[17] In this classification the relative percentages of a set of 'essential' tool and waste product type classes (microliths, scrapers, burins, saws, axes, cores, and microburins) were used to define three different types of assemblages related to site function:

Type A: microlith-dominated assemblages;
Type B: balanced assemblages; and
Type C: scraper-dominated assemblages.

Type A assemblages were considered characteristic of temporary residential camps associated with subsistence activities related to hunting; Type B with their lower percentages of microlithics and higher percentages of scrapers and other 'essential' tools as reflecting both hunting and domestic activities associated with seasonal, often winter, residential locations; and Type C assemblages as definitive of specialized limited activity locations where intensive skin processing occurred.

The percentages of essential tools recovered by the excavation are within the range of those identified as belonging to the Type B Balanced Assemblage class group (microliths: 42.42%; scrapers: 38.38%; burins: 7.0%; saws: 9.09%; axes/axe sharpening flakes: 3.0%; cores: 13.88%; microburins: 33.33%) and apparently suggests that the site functioned primarily as a seasonal residential location. Such patterns in assemblage composition, however, can also be produced by small task groups engaged in a variety of subsistence activities, repeatedly occupying the same location. Ethnoarchaeological studies[18] indicate that, as the frequency of reoccupation increases, artefacts from different occupations become mixed and form a palimpsest assemblage, with the patterns of association between artefact class groups across the site reflecting an accumulation of unrelated debris from different occupation episodes rather than any meaningful patterning which may be interpreted behaviourally in relation to site structure.

Results of the spatial analysis revealed the site to be composed of a series of overlapping artefact distributions with no identifiable discrete activity areas within the area sampled. The groups of associated artefacts identified from the matrix of tau-b values all exhibit substantial overlap in their distributional patterns across the site with their concentrations tending to co-occur at the same testpit locations. Such patterns are indicative of multiple reoccupations and their masking effects on spatial patterning, and strongly suggest that the assemblage recovered from the site represents a palimpsest composed of artefacts from a number of different occupation episodes. Identification of site function thus becomes more difficult as artefact class group representation indicates that the assemblage was produced by a series of activities related to core preparation and reduction, tool manufacture, and the use and rejuvenation of a variety of tools in the working of bone, antler, or wood, and the processing of skins. Available data is unable to resolve how assemblage composition may relate to occupational episodes and different site functions. Further analysis of the assemblage is required before the question of site function can be resolved.

Palaeoecological data summarized by Simmons et al[19] indicate that the environment of the

[17] P. Mellars, 'Settlement patterns and industrial variability in the British Mesolithic', in G. de G. Sieveking, I.H. Longworth and K.E. Wilson (eds.), *Problems in Economic and Social Archaeology* (1976), 375–99.

[18] L.R. Binford, 'The archaeology of place', *J. Anthropological Archaeol.* 1 (1982), 5–31.

[19] I. Simmons, G.W. Dimbleby and C. Grigson, 'The Mesolithic', in I. Simmons and M. Tooley (eds.), *The Environment in British Prehistory* (1981), 82–124.

later Mesolithic was relatively stable with much of the landscape of southern England covered by mixed deciduous forest and dominated by a relatively warm and oceanic climate. Animals in temperate forests are generally solitary or aggregated in small groups and well dispersed throughout an area within a series of limited home ranges. To exploit such resources efficiently, hunter-gatherers generally disperse into a number of small subsistence task groups over a large area. Changes in settlement and land use documented by a number of studies[20] all show that later Mesolithic sites are more numerous and widespread in their distribution than those from the earlier Mesolithic and suggest a more systematic exploitation and management of habitat diversity by small task groups operating away from residential locations.

The site on Windmill Hill is of interest regionally as it forms part of a larger distribution of broadly contemporaneous findspots of Mesolithic artefacts known for the area.[21] Immediately to the north and west at the base of the hill, three locations were recorded in the early 20th century from areas of mineral extraction, including an *in situ* working floor of apparently earlier Mesolithic date.[22] Within a radius of 7–8 km. a further eight findspots of Mesolithic material are known for the surrounding parishes. Assemblage characteristics for these findspots are highly variable in their quality and do not allow for meaningful quantitative characterizations or comparisons to be made. Patterns of presence–absence occurring in the artefact class groups from them, however, suggest that they may have functioned as limited activity locations related to subsistence and other resource procurement activities. Although the assemblage recovered from the site is relatively uninformative regarding site function, the location of the site on a hilltop and adjacent to the boundary between two major soil associations, indicates that it also probably functioned as some form of limited activity location related to subsistence strategies, where the procurement and reduction of lithic raw material was imbedded within other site activities.

Whether the remaining findspots for the area actually represent later Mesolithic limited activity sites or were in fact some other type of settlement cannot be ascertained with the data presently available. What can be ascertained is that the site on Windmill Hill, together with these findspot locations, functioned as part of the specialized settlement and land-use strategies carried out by Mesolithic hunter-gatherers within the area. Further fieldwork and research should assist in clarifying the chronological ambiguities and the range of functional variability occurring in assemblage and site characteristics for the artefact concentrations dating from this period.

ACKNOWLEDGEMENTS

The project has been entirely funded by Thames Water Utilities and particular thanks are due to Mr M.R.L. Hall, Archaeologist, Ms Juliet Roper, Conservation and Heritage Scientist, and Surinda Chana, Project Manager. The collaborative role of the Archaeology Section of Oxfordshire County Council, and especially Mr Hugh Coddington, Deputy County Archaeologist, is also acknowledged. The project was managed for Wessex Archaeology by Roland Smith and directed by W.A. Boismier, with the assistance of Kate Atherton, Phil Davies, Sue Hucks, Mick Rawlings, Steve Smailes and Jez Taylor. The illustrations were undertaken by Linda Coleman and Julian Cross.

[20] Jacobi op. cit.; Mellars op. cit.; P. Mellars and S.C. Reinhardt, 'Patterns of Mesolithic land-use in southern England: a geological perspective', in P. Mellars (ed.), *The Early Postglacial Settlement of Northern Europe* (1978), 243–93.

[21] Wymer op. cit.

[22] Peake op. cit.; Jacobi op. cit. 242.