

Guildford Fire Station

Excavation of a Late Upper Palaeolithic campsite in the valley of the River Wey, Surrey

by Nick Barton, Alison Roberts, Sonja Tomasso, Veerle Rots,
Elizabeth Stafford, Chris Hayden and Gerry Thacker

with contributions by

*Ben Attfield, Edward Biddulph, Lisa Brown, Simon Collcutt, John Cotter,
John Crowther, Mike Donnelly, Richard Macphail, Nathalie Marini, Rebecca
Nicholson, Mairead Rutherford, Jean-Luc Schwenninger and Tom S White*

Principal illustrators

Sophie Lamb, Gary Jones and Ian R Cartwright

Oxford Archaeology Monograph No. 37

2024

The publication of this volume was generously funded by Surrey County Council and Historic England

Designed by Oxford Archaeology Graphics Office

Edited by Chris Hayden

This book is part of a series of monographs which can be bought from all good bookshops and internet bookshops
For more information visit www.oxfordarchaeology.com

© 2024 Oxford Archaeology Ltd

Figure 1 Contains OS data © Crown Copyright (2019) and Arcworld data

Front cover – *Photograph of Refit Group 13*

Back cover – *The Late Upper Palaeolithic flint scatter under excavation*

ISBN 978-0-904220-92-6

Typeset by Production Line, Oxford

Printed in Great Britain by Short Run Press, Exter, England

Contents

List of Figures	vii
List of Tables.....	xv
Acknowledgements.....	xvii
Summary.....	xix
Résumé	xxi
Zusammenfassung.....	xxiii

Chapter 1 – Introduction

INTRODUCTION.....	1
SITE LOCATION, TOPOGRAPHY AND GEOLOGY	1
BACKGROUND TO THE EXCAVATION	1
ARCHAEOLOGICAL AND HISTORICAL BACKGROUND.....	6
STRUCTURE OF THE REPORT	7
SITE ARCHIVE	7
DIGITAL ARCHIVE.....	7

Chapter 2 – Methodology

INTRODUCTION.....	9
FIELDWORK METHODS.....	9
Sampling.....	12
POST-EXCAVATION ASSESSMENT AND ANALYSIS.....	12
The Late Upper Palaeolithic flint scatters	12
Scientific dating, geoarchaeology and palaeoenvironment.....	12
Flint	13
Flint functional analysis	13
Sediment analysis.....	14
POLLEN.....	14
CHARCOAL AND CHARRED PLANT REMAINS.....	14

Chapter 3 – Later prehistoric, Roman and more recent features and finds

INTRODUCTION.....	15
FEATURES	15
PREHISTORIC POTTERY.....	17
ROMAN POTTERY.....	18
POST-ROMAN POTTERY.....	18
CLAY TOBACCO PIPE.....	18
BUILDING MATERIALS.....	18

Chapter 4 – Stratigraphy, dating and sediment analysis

INTRODUCTION	19
The site and the geoarchaeological investigations.....	19
Site sedimentary sequences and chronology	21

OPTICALLY STIMULATED LUMINESCENCE DATING	25
CLAST LITHOLOGY	26
Introduction	26
Methods.....	26
Results	26
Comparative material and discussion.....	32
Conclusions	32
PARTICLE SIZE ANALYSIS	33
Introduction	33
Method	33
Results.....	34
MICROMORPHOLOGY, GEOCHEMISTRY AND MAGNETIC SUSCEPTIBILITY	34
Introduction	34
Methods.....	35
Results: bulk samples	36
Results: micromorphology	37
Discussion.....	44
 Chapter 5 – Artefact taphonomy	
INTRODUCTION	47
SIZE CLASS ANALYSIS	47
FABRIC ANALYSIS	49
Data and methods	49
Dip	50
Orientation	51
Fabric analysis.....	51
VERTICAL DISTRIBUTION OF THE FLINT.....	53
Depths of refits	55
Sorting by depth	55
REFIT ORIENTATIONS.....	56
Methods and data	57
Results.....	57
HORIZONTAL DISTRIBUTION OF THE FLINT	59
The distribution of the heat-affected flint.....	60
Hot spot analysis.....	60
Centroid diagrams.....	64
CONCLUSIONS	69
 Chapter 6 – The lithic assemblage	
INTRODUCTION	77
RAW MATERIAL.....	77
THE DEBITAGE ASSEMBLAGE.....	79
Classification	79
Cores and core rejuvenation pieces.....	79
Flakes, blades and bladelets.....	83
Debris (shatter/irregular waste)	87
Small debitage.....	87
STONE OBJECTS	87

Contents

THE RETOUCHE D TOOL ASSEMBLAGE	89
Typological classification	89
End-scrapers	89
Piercers/perforators	94
Burins	94
Burin spalls	100
Truncations	101
Notches and denticulates	101
Backed blade/lets and points	103
Rubbed end tools	105
Miscellaneous retouched blade/lets and flakes	105
POST-PALAEOLITHIC ARTEFACTS	111
REFITTING ANALYSIS	111
Introduction, methods and aims	111
Break and spall refits and individual tool lifecycles	112
Dorso-ventral refits and refitting groups	115
Catalogue of artefact refit groups	115
Site activities and discard patterns	148
Chapter 7 – Functional analysis	
INTRODUCTION	151
MATERIAL AND METHODS	151
Assemblage composition and sample selection	151
Analytical methods	151
Experiments	152
RESULTS	153
Preservation state of the material	153
Residue analysis	154
Use-wear analysis	154
Subsistence-related activities	154
Butchering activities	158
Manufacturing activities	158
CONCLUSION	169
Chapter 8 – Discussion: Guildford Fire Station and the Late Upper Palaeolithic	
INTRODUCTION	171
THE GEOLOGICAL CONTEXT OF THE FLINT SCATTER	171
THE PLACE OF GUILDFORD FIRE STATION IN THE LATE UPPER PALAEOLITHIC	173
The Guildford Fire Station Late Upper Palaeolithic site in its regional context	175
European affinities with the Guildford Fire Station site	176
SITE COMPLEXITY AND FUNCTION	179
FUTURE STUDIES	181
Bibliography	185
Index	193

List of Figures

Chapter 1

1.1	Site location.	2
1.2	The topographical situation of the site.	3
1.3	The geological context of the site (bedrock and drift geology)	4
1.4	Areas of investigation	5
1.5	Excavation area with the Fire Station and training tower in the background	6

Chapter 2

2.1	Plan of the flint scatter and surroundings showing the excavation grid and the extent of the damage caused by the detonation of the mortar smoke round	10
2.2	Hand excavation of the flint scatter in 1m grid squares	11

Chapter 3

3.1	Plan of Iron Age, Roman, post-medieval and modern features	16
3.2	Sections of Iron Age, Roman, post-medieval and modern features	17
3.3	Roman pottery: 1020 Jar with everted rim in sandy reduced ware; 1001 Necked globular jar with cordoned shoulder and 'figure-7' rim in sandy reduced ware	18

Chapter 4

4.1	Test pit sample section 1010	20
4.2	Test pit sample section 1011	21
4.3	Summary of OSL date ranges	22
4.4	Section 1015 with kubienas 156 and 162 through the artefact bearing sand (G2c); the nodular flints of cobble layer G2b are visible in the foreground	23
4.5	Section 1016 with kubiena 167 through the artefact bearing sand (G2c)	23
4.6	Photographs of monoliths from test pit sample sections 1010 and 1011	24
4.7	Photographs of monoliths from sample grid squares	24
4.8	Particle size data	33
4.9	M113 (Context 1051b)	37
	1: Scan - relict iron-cemented locally translocated clay-enriched reddish soil-sediment, and pale loose sands where there has been iron and clay depletion (Dep) through soil leaching. Frame width is ~50mm.	
	2: Photomicrograph - <i>in situ</i> flint debitage within iron cemented sands at 270mm depth within thin section sample. Plane polarised light (PPL), frame width is ~4.62mm.	
	3: As 2, under oblique incident light (OIL); iron cementation provides orange to reddish colours.	
	4: Photomicrograph - <i>in situ</i> flint debitage within iron cemented sands at 245mm depth within thin section	
	5: As 4, under OIL.	
4.10	M113 (Context 1051b)	37
	6: Photomicrograph - iron cemented sands with iron-stained clayey pan from clayey alluvium inwash. PPL, frame width is ~4.62mm.	
	7: As 6, under OIL. Note orange and red iron cementation colours, which show preferential iron impregnation of clayey textural pedofeatures.	
	8: Photomicrograph - detail of clay and microlaminated clay void coatings and infills (from overbank fine alluviation). PPL, frame width is ~0.90mm.	
	9: As 8, under crossed polarised light (XPL); clay void coatings and infills show good orientation and associated birefringence despite obscuring secondary iron staining.	

4.11	M114 (Context 1051a)	40
	10: Photomicrograph - leaching boundary between leached loose sands and iron cemented sands with original clay void coatings and infills. PPL, frame height is ~4.62mm	
	11: As 10, under OIL, showing leached sands below original iron cemented soil-sediment.	
4.12	M115 (Context 1051a)	40
	12: Photomicrograph - brown clayey inwash affects burrows/biochannels. PPL, frame width is ~4.62mm.	
	13: As 12, under OIL; clay of likely recent overbank fine alluviation origin, is iron depleted.	
	14: Detail of probable alluvial clayey inwash in 12. PPL, frame width is ~0.90mm.	
	15: As 14, under XPL; clay inwash includes fine micas.	
4.13	M115 (Context 1051a)	40
	16: Photomicrograph - loose sands cemented by colourless gypsum (CaSO ₄). PPL, frame width is ~2.38mm.	
	17: As 16, under XPL; gypsum with typical low birefringence colours (first order greys)	
4.14	M116B (Contexts 1051a and underlying 1051b)	40
	18: Scan - showing approximate boundary between contexts 1051a and underlying 1051b. 1051b includes both relict patches of iron-cemented sands, and pale iron and clay depleted sediment (Dep). An embedded flint flake/debitage fragment is arrowed. Frame width is ~50mm	
	19: Photomicrograph (Context 1051b); iron cemented sediment includes flint flake/debitage fragment (see 18). This protects the original soil sediment below it from leaching effects. PPL, frame width is ~4.62mm.	
	20: Detail of 19, showing homogenised soil-sediment containing a very fine fragment of debitage below the long flake (F). PPL, frame width is ~2.38mm.	
	21: Detail of 20, under XPL. Some oriented clay coatings are just about visible.	
	22: As 21, under OIL. The 'sealed' soil-sediment occupation surface is strongly iron stained, with diminishing iron staining downwards.	
4.15	M116A (Context 1051a)	41
	23: Photomicrograph - vertically oriented probable reworked flint debitage material in leached and burrowed sands. PPL, frame width is ~4.62mm.	
	24: As 23, under OIL.	
4.16	M156 (Context 1076)	41
	25: Photomicrograph - small relict area of iron-cemented soil-sediment and flint gravel. PPL frame width is ~2.38mm.	
	26: Photomicrograph - leached sands containing fragment of weathering mortar/mortared-sands. PPL frame width is ~4.62mm.	
	27: As 26, under XPL; weathering micritic mortar present.	
	28: As 26, under OIL, with whitish grey calcitic matrix.	
4.17	M162 (Context 1076)	42
	29: Scan - iron and clay depleted loose sands (Dep) and relict patches of iron-cemented soil-sediment, and associated embedded flint flake (F). Frame width is ~50mm	
	30: Photomicrograph - flint flake (F) embedded in iron cemented sands (see 29 and 33). PPL, frame width is ~4.62mm.	
	31: As 30, under XPL; moderately poorly sorted sands.	
	32: As 30, under OIL, showing secondary iron cementation of sands and flint flake (see 33)	
	33: Detail of 30; flint flake (F) and contemporary sandy soil-sediment substrate. Clay inwash (arrowed coatings) record clayey alluviation prior to iron cementation. PPL, frame width is ~0.90mm.	
4.18	M167B (Context 1077b)	42
	34: Photomicrograph - relict area of iron cemented soil-sediment (Rss), which seems to embed a charcoal fragment (Ch); Later/more recent humic burrowed soil is also recorded (Hbs). PPL, frame width is ~4.62mm.	
	35: As 34, under OIL; orange coloured iron-cemented relict soil sediment (Rss) seems to embed this charcoal fragment (Ch) suggesting that it is contemporary with the Upper Palaeolithic occupation of these deposits.	

List of Figures

4.19	M384 (Context 1081)	43
	36: Scan - mainly loose leached sands, with relict iron cemented soil-sediments, including probable 'ped face' (arrows). 'Pea grit' is in the form of fine gravel size ironstone, chalk, brick (Br), weathered iron slag, charcoal slag (ChS) or 'cinder' and flint. Frame width is ~50mm.	
	37: Photomicrograph - 'pea grit' burrow fill, with humic soil (Bu) and inclusions of charcoal slag (ChS), and weathered vesicular iron slag (WFeS) and embedded burnt rock fragment (BR). PPL, frame width is ~4.62mm.	
	38: As 37, under OIL.	
	39: Photomicrograph - 'pea grit' fill, with charcoal slag (ChS), and fine gravel size quartzite (Qtz) and flints (F) including likely debitage material. PPL, frame width is ~4.62mm.	
	40: As 39, under XPL.	
	41: Photomicrograph - flint debitage example within sands. PPL, frame width is ~2.38mm.	
	42: As 41, under OIL.	
4.20	Monolith 430 and marked subsamples M430A and M430B	43
	43: Photograph - note vertical and subhorizontal leaching pattern. Such 'patterned ground' can be linked to frozen ground – here a possible short-lived permafrost-associated feature – frozen ground not allowing normal drainage.	
4.21	M430B (G2A; Context 1044; see Fig. 4.20)	43
	44: Scan - massive sands with vertical and sub - horizontal leaching features (L), and two likely flint debitage fragments (arrows). Frame width is ~50mm.	
	45: Photomicrograph piece of flint debitage at 120mm depth (upper arrow in 44). PPL, frame width is ~4.62mm.	
	46: As 45, under OIL, showing ferruginised fine fabric in original alluvial soil-sediment.	
4.22	M430A (G2b; Context 1043)	44
	47: Photomicrograph - remains of a flint core(?) in loose leached and burrowed sands. PPL, frame width is ~4.62mm	
	48: As 47, under OIL; note generally iron-depleted fine fabric.	
 Chapter 5		
5.1	Size class distribution of the flint (using maximum dimensions) for the whole scatter and the north-western and south-eastern concentrations.	48
5.2	Histogram of dip angles	50
5.3	Distribution of flint dipping at between 90° (in red) and 45° (in increasingly lighter shades)	50
5.4	Equal area rose diagram summarising the orientation of the flint	51
5.5	Stereonet summarising the orientation and dip of the flint at Guildford Fire Station	51
5.6	Benn diagram for the flint artefact fabric at Guildford Fire Station. Shaded areas representing post-depositional processes from Lenoble and Bertran 2004, fig. 16.	52
5.7	The depth of the flint projected onto an east-west aligned section	52
5.8	The depth of the flint projected onto a north-south aligned section	53
5.9	The depth of the flint, showing the mean (red) and median (blue) depths	53
5.10	Refits projected onto an east-west aligned section (the y axis (depth) has been exaggerated by a factor of 5 in relation to the x axis (easting))	54
5.11	Refits projected onto a north-south aligned section (the y axis (depth) has been exaggerated by a factor of 5 in relation to the x axis (northing))	54
5.12	Histogram summarising the difference in depth between all refitting pieces. The red line indicates the mean difference in depth; the blue line the median difference.	55
5.13	Cumulative frequency diagram showing the depth distribution of the flint by quintiles defined using the maximum dimensions of the flint (1 represents the smallest quintile; 5 the largest)	56
5.14	Refit orientations for Refit Group 1	57
5.15	Refit orientations for Refit Group 5	58
5.16	Refit orientations for Refit Group 9	58
5.17	Heatmap of all flint	58
5.18	Heatmap of heat-affected flint	59

5.19	Contoured versions of the heatmaps in Figs 5.17 and 5.18	60
5.20	Density of flint in 0.1m wide rings, centred on the two main concentrations	61
5.21	Hot spot analysis of the maximum dimensions of the flint using a diameter of 0.3m. The size of the dots is proportional to the deviation from the overall mean.	62
5.22	Hot spot analysis of the maximum dimensions of the flint using a diameter of 0.9m. The size of the dots is proportional to the deviation from the overall mean.	62
5.23	Boxplots summarising the distribution of centroid distances for refit groups divided into concentrated groups, concentrated groups with outliers, and dispersed groups	63
5.24	Sets of refitting groups, classified by median and maximum centroid distances	64
5.25	Concentrated refitting group 9, showing the centroid diagram, a detailed plot of the group, and its location. The circles indicate the location of the two main concentrations of flint and the red points the group median centroid. (n=11)	66
5.26	Concentrated refitting group 7 (n=13)	67
5.27	Concentrated refitting group 3 (n=9)	68
5.28	Concentrated refitting group with outliers 1 (n=69)	69
5.29	Concentrated refitting group with outliers 4 (n=11)	70
5.30	Concentrated refitting group with outliers 5 (n=11)	71
5.31	Concentrated refitting group with outliers 8 (n=11)	72
5.32	Concentrated refitting group with outliers 14 (n=8)	73
5.33	Dispersed refitting group 2 (n=14)	74
5.34	Dispersed refitting group 10 (n=9)	75

Chapter 6

6.1	Overall distribution of all artefacts. Artefacts recovered from samples have been located randomly within their grid squares	78
6.2	Overall distribution of artefacts (A) over 20mm in length and (B) under 20mm in length	79
6.3	Distribution of artefacts retaining cortex on the dorsal surface	80
6.4	Overall distribution of heated/calcined material.	81
6.5	Distribution of cores and core manufacturing/modifying waste	82
6.6	Single platform blade core (c.945) and blade debitage with isolated <i>en éperon</i> -like platforms (c.921/c.989/c.988; c.295), linear platform (c.147), large plain platform (c.1709), and punctiform platform (c.4201)	84
6.7	Distribution of butt types for blades	86
6.8	Photograph of natural grooved stone (c.441)	88
6.9	Distribution of all retouched tools	90
6.10	End-scrapers (c.1625, c.1583, c.485, c.1761); double end-scrapers (c.2474); short end-scrapers (c.1272, c.1408)	91
6.11	Refitting blade end-scrapers (c.1315) and burin (c.1564). Refit Group 56	92
6.12	End-scrapers and burins with <i>rasante</i> retouch (c.2471, c.19, c.362, c.924/c.558/c.559).	93
6.13	Distribution of scrapers, unretouched refitting parts of scrapers, perforators and truncations	94
6.14	Micropiercers (c.991, c.1152), piercers (c.99/c.143, c.5421) and perforator (c.1428).	95
6.15	Burins. Dihedral burin on blade with <i>rasante</i> retouch (c.990/c.992); refitting burin on a break and unclassified burin (c.4691/c.2488); and dihedral burin on blade with <i>rasante</i> retouch and a refitting spall (c.1204/c.9277)	96
6.16	Burins. Dihedral burins with refitting spalls (c.142/c.1407, c.1910/c.3884); dihedral burin with refitting spall and part of original flake blank (c.596/c.6); burin on break (c.1166); burin on natural surface with refitting spall and part of original blade blank (c.1441/c.5875/c.1577).	97
6.17	Dihedral burins (c.1424, c.2451, c.365, c.2319, c.266/c.267).	98
6.18	Burins. Double burin (dihedral and on a break) with three refitting spalls and part of the original blade blank (c.319/c.524/c.692/c.2802/c.7007); two refitting burins (on a truncation and on a break) and a refitting retouched blade fragment (c.699/c.2313/c.7448); burin on a notch with a refitting spall (c.1557/c.4158); double burin (on a break and on a truncation) (c.459) with a refitting part of the blade blank (c.1242).	99
6.19	Distribution of burins, spalls and burin fragments	100
6.20	Truncations. Oblique distal truncation (c.453); straight truncations (c.45, c.1274, c.1245/c.2612)	101

List of Figures

6.21	Notches (c.1056, c.1069, c.1725) and denticulates (c.7, c.697/c.959)	102
6.22	Distribution of denticulates and notched pieces.	103
6.23	Backed blades, bladelets and points. Oblique points (c.2378, c.4200, c.694, c.5787, c.5032); curve-backed bi-point (c.308); curved backed point (c.7482, c.508); straight backed bladelet with oblique truncation (c.948); backed blade fragments (c.4322/c.4328, c.4062, c.4486); partially backed and truncated blade (c.4735); two refitting Krukowski microburins (c.1732, c.4743)	104
6.24	Photograph of curve backed bi-point (c.308)	105
6.25	Distribution of backed material.	106
6.26	Rubbed end tools (c.205, c.2555); blades with <i>rasante</i> retouch (c.1744, c.926), blade with fine lateral retouch (c.904/c.3121/c.529/c.541/c.4194/c.6492); blade with fine and denticulated retouch (c.28/c.2056/c.649)	107
6.27	Detail of rubbed end blade (c.2555)	108
6.28	Blade tools with <i>rasante</i> (scalar) retouch: dihedral burin (c.1204), end-scrapers (c.2471), <i>rasante</i> retouched blade (c.992, the proximal part of truncation burin c.990)	108
6.29	Distribution of retouched pieces	109
6.30	Distribution of edge-damaged pieces.	110
6.31	Photograph of Mesolithic axe fragment reused as a bladelet core (c.209), surface find	111
6.32	Overall distribution of all refitting artefacts	112
6.33	Distribution of all break refits	113
6.34	Distribution of all dorso-ventral refits	114
6.35	Photograph of Refit Group 01	116
6.36	Distribution of Refit Group 01	117
6.37	Photograph of Refit Group 02	117
6.38	Distribution of Refit Group 02	118
6.39	Photograph of Refit Group 03	118
6.40	Distribution of Refit Group 03	119
6.41	Photograph of Refit Group 04	119
6.42	Distribution of Refit Group 04	120
6.43	Photograph of Refit Group 05	120
6.44	Distribution of Refit Group 05	121
6.45	Photograph of Refit Group 06	122
6.46	Distribution of Refit Group 06	122
6.47	Photograph of Refit Group 07	123
6.48	Distribution of Refit Group 07	123
6.49:	Photograph of Refit Group 08	124
6.50:	Distribution of Refit Group 08	125
6.51	Photograph of Refit Group 09	126
6.52	Distribution of Refit Group 09	126
6.53	Photograph of Refit Group 10	126
6.54	Distribution of Refit Group 10	127
6.55	Photograph of Refit Group 11	127
6.56	Distribution of Refit Group 11	128
6.57	Photograph of Refit Group 12	128
6.58	Distribution of Refit Group 12	129
6.59	Photograph of Refit Group 13	129
6.60	Distribution of Refit Group 13	130
6.61	Photograph of Refit Group 14	131
6.62	Distribution of Refit Group 14	131
6.63	Photograph of Refit Group 15	132
6.64	Distribution of Refit Group 15	132
6.65	Photograph of Refit Group 16	133
6.66	Distribution of Refit Group 16	133
6.67	Photograph of Refit Group 17	134
6.68	Distribution of Refit Group 17	134
6.69	Photograph of Refit Group 18	134

6.70	Distribution of Refit Group 18	135
6.71	Photograph of Refit Group 19	136
6.72	Distribution of Refit Group 19	137
6.73	Photograph of Refit Group 20	137
6.74	Distribution of Refit Group 20	138
6.75	Photograph of Refit Group 25	139
6.76	Distribution of Refit Group 25	139
6.77	Photograph of Refit Group 28	140
6.78	Photograph of Refit Group 31	140
6.79	Photograph of Refit Group 37	141
6.80	Photograph of Refit Group 40	141
6.81	Photograph of Refit Group 41	142
6.82	Photograph of Refit Group 42	142
6.83	Photograph of Refit Group 43	143
6.84	Photograph of Refit Group 53	144
6.85	Photograph of Refit Group 55	144
6.86	Photograph of Refit Group 56	145
6.87	Photograph of Refit Group 67	146
6.88	Photograph of Refit Group 68	146
6.89	Photograph of Refit Group 75	147
6.90	Photograph of Refit Group 81	147
6.91	Photograph of Refit Group 83	148
6.92	Overall distribution of all other refit groups containing tools	149
6.93	Combined distribution of material from the remaining refit groups (not shown in other figures)	150

Chapter 7

7.1	Distribution of all objects included in the microwear analysis	152
7.2	Examples of altered pieces: a) patination; b) heat alteration; c) post-depositional gloss; d) mechanical alteration	153
7.3	Residues with taphonomic origin: a) iron oxide residues on the ventral proximal face of scraper c.924 (100×); b) plant tissue (algae) preserved on the ventral face of piece c.5105, photographed under DIC (200×)	154
7.4	Piercer c.99/143 with a) plant tissue and starch granules on the distal right edge of c.99. Photographed under neofluar light (1000×)	155
7.5	Backed blade c.4322/4328; a) detail of the distal bending fracture with a step-fissured termination on the ventral face (16×) and later removals from heat	156
7.6	Backed blade c.4062; a) macroscopic detail of the edge damage with step and fissured termination on the dorsal face (20×); b) ventral face of the left edge with the same edge damage (20×)	156
7.7	Backed blade c.4486; a) detail of the distal edge damage: distal and lateral bending fractures (20×); b) detail of the distal edge damage associated with MLITs (25×)	157
7.8	a) microscopic detail of rounding and rough polish on an experimental scraper used on dry hide (200×); b) microscopic detail of rounding and rough polish on scraper c.1583 (200×)	159
7.9	Double end-scraper c.2474 with a) detail of the proximal used edge; b) rounding, polish and striations from scraping hide (100×); c) light rounding and striations parallel to the cutting edge, ventral face (200×)	159
7.10	End-scraper on blade with <i>rasante</i> (scalar) retouch c.924 with a) macroscopic picture of the distal dorsal (10×) and b) ventral part of the tool with well-developed rounding that postdates the distal fracture (10×); c) microscopic detail of the rounded edge with polish and striations from scraping dry or moistened hide (20×); d) rounding cut by later removals from resharpening	160
7.11	End-scraper on blade with <i>rasante</i> (scalar) retouch c.2471 with a) rounding from use, distal end (200×) and b) scarring, proximal left edge (12.5×); c) microscopic detail of the lateral edge with rounding and polish (200×); d) microscopic detail of the lateral edge with striations (500×)	161

List of Figures

7.12	Short end-scrapers c.1408; a) microscopic detail of the polish on the scraper-head (100x)	161
7.13	a) Blade with <i>rasante</i> (scalar) retouch c.992 with stepped retouch, left lateral edge, dorsal face (10x); b) end-scrapers on blade with <i>rasante</i> (scalar) retouch c.2471 with stepped retouch (1) cut by subsequent removals from use (2), left lateral edge, dorsal face (12.5x); c) truncation burin on blade with <i>rasante</i> (scalar) retouch c.19, dorsal face, right edge, bending-initiated scar with a hinge termination (12.5x); d) experimental tool with stepped retouch and subsequent removals from cutting and sawing bone (11.2x)	162
7.14	a) Blade with <i>rasante</i> (scalar) retouch c.926 (10x); b) detail of the lateral retouch/notch cut through by a later fracture (20x); c) truncation burin on blade with <i>rasante</i> (scalar) retouch 990 (8x); d) detail of the lateral retouched edge/notch cut through by a later fracture (16x)	163
7.15	a) microscopic detail of rounding, friction and rough polish on blade with <i>rasante</i> (scalar) retouch c.992 (200x); b) detail of the same wear patterns on an experimental tool used for cutting and shaving dry hide (200x)	163
7.16	Truncation burin on blade with <i>rasante</i> (scalar) retouch c.19 with a) microscopic detail of the polish on the right lateral edge, mesial part of the tool (200x); b) rounding, right lateral edge (200x); c) rounding and striation on the lateral left edge of the tool (200x); d) striation and light developed polish on the lateral left edge of the tool (200x)	164
7.17	Dihedral burin on blade with <i>rasante</i> (scalar) retouch c.2451 with a) detail of the distal edge damage at the tip (8x)	164
7.18	Double burin on blade with <i>rasante</i> (scalar) retouch c.319 with a) detail of the distal edge damage at the tip with polish, from use on antler or bone (200x); b) macroscopic detail of the burin tip (25.0x); c) macroscopic detail of the proximal left part of the burin with scarring related to use, cut by the transversal fracture (10.0x); d) microscopic detail of the left lateral edge with a wood-like polish (200x)	166
7.19	Rubbed end blade c.2555 with a) macroscopic picture of the sturdy distal part of the blade (12.5x); b) microscopic detail of the used edge with intense rounding and striations (100x)	166 167
7.20	Oblique backed point c.5032 with a) rounding on the ventral surface of the tip (200x)	167
7.21	Piercer c.5421 with a) microscopic detail of the used edge with friction polish (500x)	168
 Chapter 8		
8.1	Topographic relief map of south-eastern England and north-eastern France showing key sites mentioned in the text	172
8.2	Late Glacial climate and archaeology	173
8.3	Curve-backed bi-points: Guildford Fire Station (c.308; 41mm); Wey Manor Farm (#52; 67mm)	175

List of Tables

Chapter 4

4.1	Summary of geoarchaeological analyses	19
4.2	Summary of stratigraphic units	22
4.3	Summary of OSL dating results.	25
4.4	Angularity /roundness categories. These are based on verbal descriptions by Schneiderhöhn (1954, in Pryor 1971) of the categories devised by Powers (1953). Simplified from Fisher and Bridgland (1986).	26
4.5	Clast lithology analysis	26
4.6	Angularity /roundness analysis and comparative data	27
4.7	Comparative data from the Ebbsfleet Valley, Lower Thames and other British Pleistocene sites.	28
4.8	Particle size analysis	33
4.9	Samples analysed for micromorphology, geochemistry and magnetic susceptibility	34
4.10	Geochemical and magnetic susceptibility data	35
4.11	Phosphate fractionation data for samples related to thin sections	36
4.12	Soil micromorphology and counts	38

Chapter 5

5.1	The average, minimum and maximum dimensions of the flint in each quintile, classified according to their maximum dimensions	55
5.2	Refit orientation statistics	56
5.3	Refit groups: summary statistics for centroid distances	65

Chapter 6

6.1	Assemblage composition (artefact class by number and percentage; 323 natural and later prehistoric objects have not been included in the analysis).	81
6.2	Cores, core rejuvenators, and crested pieces (none burnt)	81
6.3	Flakes, blades, and bladelets (unretouched): qualitative attributes. Sample size (n=) indicates the number of objects for which the attribute could be recorded.	85
6.4	Composition of small debitage assemblage.	87
6.5	Retouched tools, including retouched tool debitage	89
6.6	Burin typology	96
6.7	Burin spalls	101
6.8	Backed tools and fragments	105

Chapter 7

7.1	The sample selected for functional analysis	151
7.2	Summary of functional interpretations for the retouched and unretouched blades and bladelets. The confidence level (CL) of each interpretation is scored on a scale of 1 (low certainty) to 4 (certain)	155
7.3	Summary of the functional interpretations for the analysed burins. The confidence level (CL) of each interpretation is scored on a scale of 1 (low certainty) to 4 (certain)	165
7.4	Summary of the functional interpretations with the worked materials and activities.	168

Chapter 8

8.1	Main characteristics of British Creswellian and Federmesser assemblages (from Barton <i>et al.</i> 2003; 2009; Barton and Roberts 1996).	174
8.2	Guildford Fire Station and Wey Manor Farm (data from Jones 2013 and pers. obs.).	176
8.3	Development of Magdalenian to Federmesser / Azilian (After Valentin <i>et al.</i> 2006 with additions from Naudinot <i>et al.</i> 2019; Coudret and Fagnart 2015; Fagnart pers. comm. and Mevel pers. comm.)	178

Acknowledgements

We are very grateful to Surrey County Council for funding the excavation and to Surrey County Council and Historic England for funding the post-excavation analysis and publication. We are also grateful to Jonathan Mullis of Jacobs who commissioned the work on behalf of Surrey County Council.

We are very grateful, in particular, to Nick Truckle, Tony Howe and Susan Hanford (Surrey County Council) and Helen Keeley and Jenni Butterworth (Historic England) for the considerable help they have provided in the completion of this report. We would also like to thank Historic England's scientific advisor, Jane Corcoran, for her help, and the anonymous reviewer for their helpful comments.

All of the fieldwork and the post-excavation assessment were managed by Gerry Thacker. We would like to thank Leigh Allen, Rebecca Nicholson, Nicola Scott, Matt Bradley, Anne Dodd and Leo Webley for managing the finds, the environmental evidence, the archive, the survey data and the post-excavation analysis. We would particularly like to

thank Gary Jones for his work on the spatial analysis of the site and Mairead Rutherford for her work assessing the pollen. The project is the result of the work of a large team and we would also like to thank the following people for their work on the site, the finds, environmental samples, survey data and archive: James Archer, Ben Attfield, Thomas Booth, Ian Cook, Sharon Cook, Geraldine Crann, Mark Dodd, Mike Donnelly, Matthew Fenn, Jonathan Gill, Victoria Green, Leo Heatley, Christof Heistermann, Victoria Hughes, Michael McLean, Tony Mears, William Mills, Kev Moon, Richard Palmer, Conan Parsons, Nik Petek, Emily Plunkett, Susan Rawlings, Joanne Robinson, Alice Rose, Mairead Rutherford, Victoria Skipper, Lee Sparks, Ashley Strutt, Nicholas Taylor and Jennifer Thurstan. Thanks are due to Christof Heistermann and Charles Rousseaux for translating the summaries, and we are also very grateful to Martin Street, Jean-Pierre Fagnart and Paule Coudret for their expert help with the translations.

Summary

Excavations carried out prior to the construction of a new fire station and housing in Guildford, Surrey, revealed a well-preserved, *in situ* Late Upper Palaeolithic flint scatter. Both techno-typological analysis of the flint and Optically Stimulated Luminescence dates suggest that the scatter dates from the first half of the Late Glacial (Windermere) interstadial (*c* 14–15 KBP). The assemblage is generally comparable to that of Wey Manor Farm, Surrey, which lies 15km downstream from Guildford Fire Station. The two sites differ slightly in the typology of their backed tool forms but otherwise share many features in common including the presence of curve-backed bi-points. The finds from Guildford Fire Station raise interesting questions, examined in this volume, concerning its relationship with the Creswellian assemblages further north in Britain and Azilian/Federmeßer traditions on the near continent.

Geoarchaeological analyses suggest that the site lay on cold-climate fluvial sandy gravels deposited in braided stream systems prior to the onset of the Late Glacial (Windermere) interstadial. The flint scatter itself lay within the upper part of a deposit of fine-grained sands, probably deposited by seasonal floods. Deposition of the upper sands appears to have been contemporaneous with the period of occupation of the site. During drier periods, weath-

ering and ephemeral soil formation occurred on the surface of the sands.

Analysis of the lithic assemblage shows that it is homogeneous and that apart from initial extraction and nodule testing all stages of flint manufacture are represented. A suite of analyses examining the taphonomy of the artefacts all suggest that the flint has not suffered from significant post-depositional disturbance and was largely *in situ*. Two main concentrations of knapping are represented, 3–4m apart. The main focus of the knapping was the production of blade blanks, some of which appear to have been removed from the site. The retouched tool assemblage shows that other limited activities also took place on the site, and that this occurred outside the main knapping foci. Refitting of retouched tools reveals the lifecycle of use and discard of burins and other artefacts on the site. Additional confirmation of tool use and function comes from trace wear analyses which indicate the presence of projectiles and the processing of animal and plant materials. The site seems to represent a relatively short occupation during which flint knapping, retooling of hunting equipment, and small-scale craft activities took place. An unusual aspect of this assemblage, recognised during refitting, is the presence of products made by a novice amongst the flint debris left by more experienced flintknappers.

Résumé

Les fouilles archéologiques menées préalablement à la construction d'une nouvelle caserne de pompiers et de logements à Guildford, Surrey, ont révélé une occupation archéologique bien préservée attribuable au Paléolithique final. L'analyse typo-technologique du matériel ainsi que les datations par la méthode de l'OSL permettent de la rapporter à la première moitié du Tardiglaciaire weischélien (Windermere, 14000–15000 AP). L'industrie est globalement comparable à celle du gisement de Wey Manor Farm, Surrey, situé à 15 km en aval de Guildford. Les deux sites diffèrent légèrement par la typologie des pièces à dos, mais partagent de nombreux traits communs, notamment la présence de bipointes à dos courbe. L'identité culturelle de l'industrie de Guildford Fire Station pose la question de sa relation avec les assemblages du Creswellien britannique, dont les gisements sont situés plus au nord, et ceux de la tradition des groupes à Federmesser (Azilien) du proche continent.

Les analyses géoarchéologiques montrent à la base de la séquence des graviers fluviatiles sableux pléni-glaciaires, déposés dans un système de chenaux en tresses antérieur au début du Tardiglaciaire (Windermere). L'industrie lithique, quant à elle, repose à la partie supérieure d'un dépôt de sables fins (silts), probablement mis en place lors de crues saisonnières. Cette formation semble avoir été contemporaine de la période d'occupation du site. Ultérieurement, la partie supérieure des sables a été affectée par une faible pédogénèse.

L'analyse de l'assemblage lithique montre un ensemble homogène. À l'exception de l'acquisition de la matière première et du test initial des blocs, toutes les étapes de la chaîne opératoire de production lithique sont représentées. L'ensemble des analyses taphonomiques et plus particulièrement des tests de fabrication montrent que le site est bien en place et n'a pas subi de perturbations post-dépositionnelles. Les vestiges se présentent sous la forme de deux concentrations principales, distantes de 3 à 4 m. L'objectif principal du débitage est orienté vers la production de supports laminaires, dont certains ont fait l'objet d'emports hors du site. D'autres activités, situées en dehors des zones principales de débitage, sont attestées par la présence des supports transformés en outils. Les remontages effectués révèlent un cycle d'utilisation et de rejet, notamment pour les burins. L'analyse tracéologique met en évidence la présence de pointes de projectiles et d'outils dévolus au traitement des matières animales et végétales. Le gisement de Guildford représente une occupation relativement courte dans le temps, où la taille du silex est associée à des activités domestiques et cynégétiques comme le réarmement des armatures de chasse. Autre spécificité du site, les remontages montrent la présence de produits taillés par des débutants à partir d'éléments lithiques rejetés par des tailleurs plus expérimentés.

Zusammenfassung

Bei Ausgrabungen in Vorfeld des Baus einer neuen Feuerwache und eines Wohngebietes in Guildford, Surrey, wurde eine in situ gut erhaltene Feuersteinkonzentration aus dem späten Jungpaläolithikum frei gelegt. Sowohl die technologisch-typologische Analyse des Feuerstein-Inventars als auch die OSL-Datierungen deuten darauf hin, dass die Fundstelle aus der ersten Hälfte des spätglazialen (Windermere) Interstadials (ca 14–15 KBP) stammt. Das Fundinventar ist im Wesentlichen mit dem der 15km flussab gelegenen Fundstelle von Wey Manor Farm, Surrey, vergleichbar. Die beiden Fundstellen unterscheiden sich geringfügig bezüglich der Typologie der rückengestumpften Geräteformen, weisen ansonsten aber zahlreiche Gemeinsamkeiten auf, einschließlich des Vorkommens von „bipointe“-Rückenspitzen. Im vorliegenden Band werden die interessanten Fragen untersucht, die von den Funden der Feuerwache Guildford bezüglich ihres Verhältnisses zu den Inventaren des weiter nördlich in Großbritannien auftretenden Creswellien und denen der Azilien / Federmesser-Traditionen auf dem nahen europäischen Festland aufgeworfen werden.

Geoarchäologische Analysen deuten darauf hin, dass die Fundstelle auf kaltzeitlichen fluviatilen sandigen Kiesen lag, die vor dem Beginn des spätglazialen (Windermere) Interstadials in einem verzweigten Flusssystem abgelagert worden waren. Die Feuersteinkonzentration selbst lag im oberen Teil einer Schicht von feinkörnigen Sanden, die wahrscheinlich von jahreszeitlich wiederkehrenden Hochwässern abgelagert worden war. Die Sedimentation der oberen Sande scheint zeitgleich mit der Aufsuchung des Ortes erfolgt zu sein. Während trockener Phasen, führte die Verwitterung der sandigen Oberfläche zu einer ephemeren Bodenbildung.

Die Analyse des lithischen Fundinventars zeigt, dass es in sich homogen ist und bis auf die ursprüngliche Bergung und Prüfung der Feuersteinknollen alle Stufen der Feuersteinbearbeitung aufweist. Eine Reihe von Analysen zur Taphonomie der Artefakte deuten alle darauf hin, dass die Feuersteinkonzentration nach ihrer Niederlegung keine wesentlichen Störungen mehr erlitten hat und sich weitgehend in situ befand. Zwei Hauptkonzentrationen innerhalb des Schlagplatzes liegen 3–4m voneinander entfernt. Schwerpunkt der Feuersteinbearbeitung war die Herstellung von Klingen, die zum Teil von der Fundstelle entfernt wurden. Das Inventar der retuschierten Steingeräte zeigt, dass in begrenztem Umfang auch noch andere Tätigkeiten am Fundort stattfanden, und dass diese abseits der Hauptzentren der Feuersteinbearbeitung erfolgten.

Das Zusammenpassen von retuschierten Werkzeugen verdeutlicht den Lebenszyklus von Stacheln und anderen Artefakten am Fundort, von der Verwendung bis zur Entsorgung. Eine zusätzliche Bestätigung für den Verwendungszweck und die Funktion von Werkzeugen lieferte die Gebrauchsspurenanalyse, die das Vorhandensein von Projektilen und die Bearbeitung von tierischen und pflanzlichen Materialien belegt. Der Fundplatz scheint einen vergleichsweise kurzen Aufenthalt zu repräsentieren, während dessen die Bearbeitung von Feuerstein, die Instandsetzung von Jagdwaffen und in geringerem Umfang weitere handwerkliche Aktivitäten erfolgten. Eine Besonderheit, die beim Zusammenpassen der Feuersteinartefakte festgestellt wurde, ist der Nachweis von Erzeugnissen, die von einem Anfänger hergestellt worden waren, vermischt mit dem von erfahreneren Feuersteinschlägern hinterlassenen Abschlagmaterial.