Making and Breaking Microliths: A Middle Mesolithic Site at Asfordby, Leicestershire

By LYNDEN P. COOPER *and* WAYNE JARVIS

APPENDIX S1. SOIL MICROMORPHOLOGY
(Richard Macphail & Wayne Jarvis)

TABLE S1: MESOLITHIC ASFORDBY; SOIL SAMPLES AND SOIL MICROMORPHOLOGY COUNTS

TP/ context	*Sample no.*	*Depth mm)*	*MFT*	*SMT*	*Voids*	*Coarse Ironstones*	*Small Round FeSt.*	*Charcoal*
TP 20								
302	M1A1	0–75	B2	2a(2b,2c)	35%	*	*	a(a-2)
303	M1A2	80–155	B1	2a,2c(2b)	30%		*	
304	M1B1	160–235	A2	2a,2b	20%(30%)		ff	a(a-1)
304-305	M1B2	235–300	A2/A1	1a,2a,2b/1a	35%	f/fff	f/ff	a*
TP 22								
306/307	M2A1	0–70	A2	2a,2b	25%	*	f	a
307	M2A2	70–130	A2	2a	30%	f	*	

TP/context	*Sample no.*	*Burned quartzite*	*Coarse quartzite*	*Textural intercal*	*Dusty clay*	*2ndary Fe*	*Thin burrows*	*Broad burrows*
TP 20								
302	M1A1			aaa	aaaa	aaaa	aaaa	aaaa
303	M1A2			aa	aaaa	aaaa	aaaa	aaaa
304	M1B1		a-1	aaaa	aaaa	aaa	aa	aaa
304-305	M1B2	(a–1?)	a-1	aaaaa	aaaaa	aaa	aa	aaa
TP 22								
306/307	M2A1		a-1	aaa	aaaaa	aaaa	aaaa	aaaa
307	M2A2	a–1	a-1	aaaa	aaa	aaaa	a	aaa

* - very few 0–5%, f – few 5–15%, ff – frequent 15–30%, fff – common 30–50%, ffff – dominant 50–70%, fffff – very dominant >70%

a – rare <2% (a*1%; a–1, single occurrence), aa – occasional 2–5%, aaa – many 5–10%, aaaa – abundant 10–20%, aaaaa – very abundant >20%

TABLE S2: MESOLITHIC ASFORDBY: SOIL MICROMORPHOLOGY DESCRIPTIONS, PRELIMINARY INTERPRETATIONS AND COMMENTS

Microfacies type (MFT)/Soil microfabric type (SMT)	*Sample No.*	*Depth (relative depth)* *Soil Micromorphology (SM)*	*Preliminary Interpretation and Comments*
		SM: heterogeneous; *Microstructure*: *Coarse Mineral*: C:F (Coarse:Fine limit at 10 μm), *Coarse Organic and Anthropogenic*: *Fine Fabric*: *Pedofeatures*:	***TP 20***
MFT B2/ SMT 2a(2b,2c)	**M1A1**	0–75 mm SM: essentially homogeneous SMT 2a, with poorly obvious 2c and traces of 2b; *Microstructure*: poorly formed coarse prismatic/massive, 35% voids, poorly accommodated planar voids, channels, vughs and chambers (3–12 mm); *Coarse Mineral*: as below, with very few coarse and fine ironstone nodules; *Coarse Organic and Anthropogenic*: rare examples of iron-impregnated charcoal (2–4 mm), and trace amounts of very fine charcoal; *Fine Fabric*: as below; *Pedofeatures*: *Textural*: many clayey textural intercalations and associated matrix void coatings, pans and infills, with abundant dusty void coatings (not affecting most planar voids and chambers); *Amorphous*: abundant impregnative iron forming thick channel hypocoatings and embedding soil and charcoal; *Fabric*: abundant thin and broad to very broad burrows. Sandy silt loam-clay loam, with burrows. Subrounded sharp edge iron nodules and example of strongly iron-impregnated charcoal (3+ mm). Trace amounts of fine charcoal. Homogeneous with very abundant dusty clay/impure clay void coatings, thin panning and very broad infills and textural/clayey intercalations.	302 Essentially homogeneous, thinly, broadly and very broadly burrowed fine sandy silt loam, with very few coarse and fine ironstone nodules. Rare examples of iron-impregnated charcoal (2–4 mm), and trace amounts of very fine charcoal, occur. There are abundant textural pedofeatures, including impure clay coatings, thin pans and clayey intercalations; most planar voids and chambers are unaffected by textural coatings. Abundant strong mottling and channel hypocoatings; rare examples of iron-impregnated charcoal. *Probably later prehistoric muddy ploughsoil colluvium, with included coarse wood charcoal becoming iron-impregnated during post-depositional period of waterlogging.*
MFT B1/ SMT 2a,2c	**M1A2**	80–155 mm SM: heterogeneous with SMT 2a and 2c (trace of SMT 2b); *Microstructure*: massive with weakly formed prisms and blocky structures, 30% voids, moderately accommodated planar voids, channels and vughs, including closed vughs; *Coarse Mineral*: C:F of SMT 2c=90:10, coarse silt dominated, as M1B2, very few fine gravel and very coarse sand size ironstone; *Coarse Organic and Anthropogenic*: trace of burned sand; *Fine Fabric*: SMT 2c: pale dusty brown (PPL), very low interference colours (close porphyric, stipple speckled b-fabric, XPL), very pale orange (OIL); *Pedofeatures*: *Textural*: occasional textural intercalations with abundant dusty clay void coatings, affecting closed vughs, fissures/planar voids, but not	303 Very finely burrowed sandy silt loam and silty soil, with also abundant broad burrowing. Occasional textural intercalations with abundant dusty clay void coatings affecting both intrapedal vughs and planar voids (not present in iron hypocoating affected channels). Abundant strongly formed iron mottling and channel hypocoatings (not dusty clay coated). *Colluvial soil sealing 'Mesolithic' levels, derived from bisequal soil upslope, presumably composed of aeolian silt over fine sandy silt loam river terrace drift. This colluvium has been partially semi-homogenised by burrowing mesofauna and soil structure formation, whilst also being affected by accumulating colluvium*

		channels with iron hypocoatings; *Amorphous*: strongly formed abundant impregnative iron and channel hypocoatings; *Fabric*: abundant thin (mixing coarse silty iron-depleted SMT 2c) and broad burrows.	*above, which led to peds also being coated with dusty clay. Lastly, more recent rooting and waterlogging occurred.*
MFT A2/ SMT 2a,2b,2c	**M1B1**	160–235 mm SM: mainly homogeneous SMT 2a, with very few SMT 2b and 2c in thin 1mm size burrows; *Microstructure*: massive with fine prisms and angular blocky, intrapedal channels, vughs and closed vughs (20% voids), 35% voids generally with fissures/ planar voids; *Coarse Mineral*: as M1B2, with frequent rounded iron nodules (max 4 mm), eg of round quartzite (10 mm), very few flint (max 4 mm); *Coarse Organic and Anthropogenic*: occasional coarse burned (calcined) angular (fire-cracked'?) flint flakes (x2, max 21 mm); eg of 3.5 size wood charcoal; *Fine Fabric*: as SMT 2a; *Pedofeatures*: *Textural*: abundant textural intercalations (including along base of coarse flints – cf 'embedded grains') and dusty and microlaminated void coatings and partial infills (some fills microlaminated with occasional silt up to 1mm thick); SMT 2c – see M1B1; *Amorphous*: as below; *Fabric*: occasional thin and many broad burrows.	304 Fine gravely sandy silt loam containing examples of two coarse fire-cracked flints (max 21 mm) and charcoal (3.5 mm); a weathered flint (4 mm) and a quartzite gravel (10 mm) also occur. Abundant textural intercalations, dusty and microlaminated pedofeatures are present, with some infillings up to 1mm thick; burned flint occur as partial 'embedded grains'. Amorphous iron staining occurs as impregnations, marked impregnations of relict humic(?) soil and as thick (1 mm) channels hypocoatings. Many thin and broad burrows are present. *Mesolithic artefacts in colluvial soil-sediment that reflect biological activity and unstable surface soil conditions, presumably broadly contemporary with occupation; some textural pedofeatures including embedding of base of coarse burned flint into the soil matric (intercalations) may indicate trampling. (Some textural pedofeatures probably stem from 302 formation, although no obvious sorting has occurred)*
MFT A2/SMT 1a (2a, 2b) over MFT A1/SMT 1a	**M1B2**	235–300 mm SM: moderately heterogeneous with SMT 1a with very abundant textural pedofeatures and gravel-size ironstone and sharp-edge nodule content (305), becoming more bioworked upwards (304), and very few patches of SMT 2b and common 2a; *Microstructure*: massive with poorly formed prisms and angular blocky, 35% voids, poorly accommodated planar voids, with chambers, channels and open and closed vughs; *Coarse Mineral*: C:F (Coarse:Fine limit at 10 μm), 70:30 becoming 60:40 upwards, very poorly sorted with coarse silt, mainly fine and medium, with few rounded and subrounded sand-size quartz, quartzite and flint, with common angular ironstone and sharp edge nodules (max 12 mm) in 305; upwards few 2–3 mm size rounded ironstone in 304, eg concentration at 235–245 mm; silt rich burrow fills; *Coarse Organic and Anthropogenic*: trace amounts of very fine charcoal, rare (~×4) calcined angular flint (max 1.2 mm), and example of subrounded burned quartzite, with burned sand(?) in 304 and along the junction with 305; *Fine Fabric*: throughout 304 and 305, SMT 1a: finely dusty darkish brown (PPL), very low interference colours (close porphyric, stipple speckled b-	304 over 305 Massive sandy silt loam (with coarse silt, fine and medium sand) over coarse (max 12 mm) angular gravely loamy sand, with broad burrows throughout. Gravel-size ironstone and sharp-edge nodules decrease from common to few upwards, becoming smaller (2–3 mm) and rounded. Trace amounts of very fine charcoal, rubefied and calcined (burned) quartzite sand, flint (max 1.2 mm, ~×4) and 6 mm-size example of burned quartzite occur. Textural pedofeatures occur as very abundant matrix intercalations and associated closed vughs, and dusty clay void coatings; microlaminated void coatings also are present. Silt-rich burrow fills occur. Many iron impregnations were recorded, some impregnating very small amounts of possibly once-humic SMT 2a in burrowed soil in 304. Very broad burrows (max 4 mm) mix sand into loamy soil. *Junction between Last Late Glacial coarse angular gravelly river terrace drift/solifluction deposits and overlying fine gravelly sandy silt loam muddy 'Mesolithic' colluviation, containing traces of bioworked once-humic soil. Ephemeral surfaces were burrowed*

		fabric, XPL), bright orange (OIL), trace of relict humic staining; in 304 SMT 1b: very dark brown/blackish brown (PPL), isotropic (close porphyric, undifferentiated b-fabric, XPL), reddish orange (OIL), probable relict iron-replaced organic staining; SMT 2a: as 1a, but dusty brown (PPL), moderate interference colours (close porphyric, stipple speckled b-fabric, XPL), pale orange (OIL), trace of relict humic staining *Pedofeatures*: *Textural*: 1) very abundant thick, dusty, poorly oriented clay and impure clay in voids associated with broad burrows, and 2) generally formed(?) microlaminated moderately oriented dark clay coatings (50–150 μm), especially in 305, with matrix intercalations (250 μm thick) and associated closed vughs throughout apart from burrowed areas; *Amorphous*: many moderately strongly formed iron impregnations, and thick channel hypocoatings; *Fabric*: many broad and very broad (4 mm) burrows especially in 304 (often sand filled).	*mixing fine (coarse sand-size) burned flint down-profile .*
			TP 22
MFT A2/ SMT 2a,2b	**M2A1**	0–70 mm SM: heterogeneous with dominant SMT 2a with frequent 2b; *Microstructure*: massive, 25% voids, fissures, channels and vughs and closed vughs; *Coarse Mineral*: as below, with very few coarse ironstone and few small rounded ironstone; eg of flint (5 mm) and quartzite (7 mm), *Coarse Organic and Anthropogenic*: rare burned sand-size flint and 2–2.5 mm size burned flint; traces of sharply angular sand size flint; rare charcoal, often embedded or stained with iron (max 1.5 mm), and often associated with SMT 2b; *Fine Fabric*: as in M1B2; *Pedofeatures*: *Textural*: many textural intercalations associated with elutriation and very abundant thick (250 μm) void fills, matrix material with fine charcoal sometimes (pans also); *Amorphous*: abundant nodular mottles and many iron staining of once-humic SMT 2b, concentrated in abundant thin to very broad (1–5 mm) burrows (*Fabric*). Massive sandy silt loam with burrows. Many diffuse and strongly formed iron nodules, and patches of moderately iron-depleted fine fabric. Rare sand-size angular calcined (burned) flint. Very abundant dusty clay to impure clay void coatings, and silty clay intercalations.	306/307 Massive sandy silt loam, with very few coarse ironstone and few small rounded ironstone; eg of flint (5 mm) and quartzite (7 mm). Rare burned sand-size flint and 2–2.5 mm size burned flint; traces of sharply angular sand size flint; rare charcoal, often embedded or stained with iron (max 1.5 mm), and often associated with once humic SMT 2b in burrows. Many textural intercalations associated with elutriation and very abundant thick (250 μm) void fills, matrix material with fine charcoal sometimes (pans also). Abundant nodular mottles and many iron staining of once-humic SMT 2b, concentrated in abundant thin to very broad (1–5 mm) burrows. Iron-depletion and much iron nodule formation. *Mesolithic occupation debris (combustion zone and flint working area) in probably trampled colluvium forming muddy soil-sediment in 'low' ground/hollow over sandy drift and impermeable clayey substrate of last late glacial origin.*
MFT A2/ SMT 2a	**M2A2**	70–130 mm SM: essentially homogeneous with SMT 2a; *Microstructure*: massive with weakly formed prisms, 30% voids, channels, vughs and poorly accommodated planar voids; *Coarse*	307 Massive and poorly prismatic sandy silt loam (coarse silt, fine and medium sand), with few coarse (8 mm) angular ironstone and pisolites and very few rounded fine

	Mineral: as M1B2, with few angular ironstone (max 8 mm) and eg of pisolite, and very few small nodules, eg of 5 mm size quartzite gravel; *Coarse Organic and Anthropogenic*: eg of 2 mm size burned quartzite; *Fine Fabric*: as SMT 2a; *Pedofeatures*: *Textural*: abundant textural intercalations and associated elutriated matrix, and 250 μm-thick matrix coatings, and many finer dusty clay void coatings; *Amorphous*: strongly formed abundant impregnative iron and channel hypocoatings; *Fabric*: rare thin, many broad and very broad burrows (eg of broad once-mammilated excrement?).	gravel; eg, of 5 mm-size quartzite gravel. An example of a 2 mm size burned quartzite was also noted. Abundant textural intercalations and associated elutriated matrix, and 250 μm-thick matrix coatings, and many finer dusty clay void coatings; strongly formed abundant impregnative iron mottles and void hypocoatings. Thin, broad and very broad burrowing recorded. *Mixed muddy 'Mesolithic' and relict late glacial drift colluvium.*

APPENDIX S3: MICROWEAR STUDY
(Adrian A. Evans)

TABLE S3. MEAN RIDGE WIDTH MEASUREMENT OF SELECTED PIECES

Artefact no.	*MRW(μm)*
6537	2.4
5048	2.18
1876	3.518
5015	3.04
1923	3.22
3811	3.18
1897	<1
5047	1.94

TABLE S4: RESULTS OF MICROWEAR STUDY

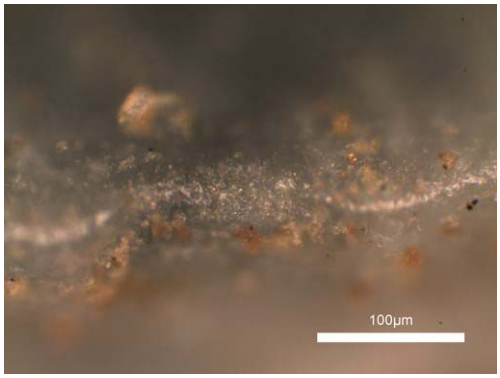
Artefact no.	*Code*	*Contact material*	*Description*	*Basic type*	*Sub-type*
228	UU	Unknown	unknown	Microlith	L
659	XX	Unused	unused - hafted end?	Microlith	PB
964	UU	Unknown	unknown - hafted end?	Microlith	PIBR
965	UU	Unknown	unknown	Microlith	PIBR
966	M1U	Meat	meat (cutting)	Microlith	T
967	UI	Impact	imact (projectile	Microlith	SS
968	M1P	Meat	meat cutting	Microlith	ST
969	UU	Unknown	unknown	Microlith	PIBR
970	UI	Impact	unknown	Microlith	PIBR
971	M1P	Meat	meat cutting	Microlith	ST
972	UU	Unknown	unknown	Microlith	L
973	UU	Unknown	unknown	Microlith	IT
974	UU	Unknown	unknown	Microlith	PB
975	UI	Impact	impact (implied)	Microlith	ST
976	M1P	Meat	meat cutting	Microlith	ST
977	R0M	Bone/Wood	hard (wood or bone)	Microlith	PB
978	UU	Unknown	unknown	Microlith	PB
979	H1R	Hide	hide piercing	Microlith	L
980	UI	Impact	impact	Microlith	PB
981	UU	Unknown	unknown - hafted end?	Microlith	OTP?
982	Y0P	Soft	soft cutting (plant or dry hide)	Microlith	OTP?
983	M1P	Meat	meat cutting	Microlith	L
984	UU	Unknown		Core tablet	
986	XX	Unused	unused	Burin	
992	H1S	Dry Hide	dry hide scraping	Scraper	
998	UI	Impact	impact	Microlith	TP
1051	M1P	Meat	meat cutting	Microlith	unclass
1179	UU	Unknown	unknown - hafting wear?	Microlith	OTP
1203	H1S	Dry Hide	dry hide scraping	Scraper	

Artefact no.	*Code*	*Contact material*	*Description*	*Basic type*	*Sub-type*
1210	UU	Unknown	unknown	Microlith	OTP?
1317	UU	Unknown	unknown	Microlith	OTP
1346	UU	Unknown	unknown	Microlith	PB
1361	UU	Unknown	unknown	Microlith	CB
1548	UU	Unknown	unknown	Microlith	OTP
1550	UU	Unknown	unknown - hafted end?	Microlith	PB
1613	UI	Impact	impact (implied)	Microlith	PB
1613	UI	Impact	impact (implied)	Microlith	PB
1648	XX	Unused	unused - hafted end?	Microlith	PIBR
1674	nd	ND		Retouched	
1874	UU	Unknown		Flake	
1876	H1P	Dry Hide	dry hide cutting	Flake	
1897	UU	Unknown		Flake	
1899	UU	Unknown	unknown	Microlith	OTP
1908	UU	Unknown	unknown	Microlith	L
1911	UU	Unknown		Flake	
1922	XX	Unused	unused	Microlith	OTP
1923	MP	Meat	meat cutting	Flake	
1945	H0S	Fresh Hide	fresh hide scraping	Scraper	
2037	UI	Impact	impact	Microlith	R
2060	UI	Impact	impact	Microlith	L
2062	UU	Unknown	unknown - hafted end?	Microlith	PIBR
2079	nd	ND		Scraper	
2083	H1S	Dry Hide	dry hide scraping	Scraper	
2103	Y0R	Soft	soft piercing	Microlith	MT
2177	UI	Impact	impact	Microlith	Lu
2182	UI	Impact	impact	Microlith	SS
2241	Y0R	Soft	soft piercing	Microlith	MT
2421	UU	Unknown	unknown	Microlith	ST
2464	UU	Unknown	unknown	Microlith	OTP
2490	nd	ND		Microlith	OTP?
2518	UU	Unknown	unknown	Microlith	PIBR
2558	UI	Impact	impact	Microlith	PB
2632	RM	Wood	wood working	Retouched blade	
2692	PM	Plant	plant? Mixed cutting	Microlith	OTP?
2811	UU	Unknown	unknown	Microlith	OTP
2828	UU	Unknown	unknown - hafted end?	Microlith	ST
2891	H0S	Fresh Hide	fresh hide scraping	Scraper	
2903	UU	Unknown	unknown	Microlith	PB
3074	UU	Unknown	unknown	Microlith	L
3150	UU	Unknown		Scraper	
3325	UU	Unknown	unknown	Microlith	PIBR
3537	UI	Impact	impact	Microlith	CB
3542	H1S	Dry Hide	dry hide scraping	Scraper	
3544	HR/S	Hide	hide piercing/cutting	Burin	
3668	UU	Unknown	unknown - hafted end?	Microlith	
3714	XX	Unused	unused	Burin	
3811	UU	Unknown		Blade	
4094	H0S	Fresh Hide	fresh hide scraping	Scraper	
4328	UU	Unknown		Scraper	
4398	XX	Unused	unused	Axe	
5015	RS	Bone/Wood	wood or antler working	Bladelet	
5027	UU	Unknown	unknown	Microlith	CB
5047	UU	Unknown		Chip	
5048	UU	Unknown		Bladelet	
5061	UU	Unknown		Burin	

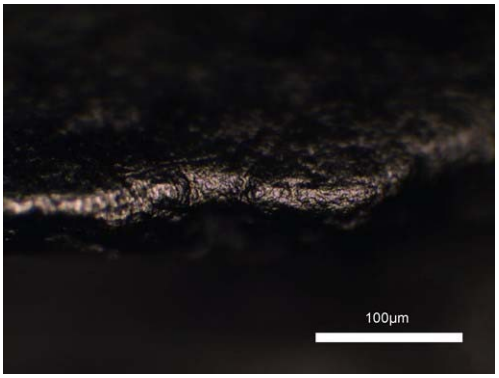
Artefact no.	*Code*	*Contact material*	*Description*	*Basic type*	*Sub-type*
5130	UU	Unknown	unknown	Microlith	PB
5184	UU	Unknown	unknown	Microlith	L
5318	UI	Impact	impact	Microlith	L
5324	XX	Unused	unused	Microlith	OTP
5519	UU	Unknown	unknown	Scraper	
5567	UU	Unknown	unknown	Burin	
5597	RR	Bone/Wood	hard (wood or bone) piercing	Microlith	MT
5713	UI	Impact	impact	Microlith	PB
5726	UU	Unknown	unknown	Microlith	MT
5785	UU	Unknown	unknown	Microlith	OTP?
5794	UU	Unknown	unknown	Microlith	SS
5844	UU	Unknown	unknown	Microlith	PIBR
5956	UU	Unknown	unknown	Burin	
5975	UU	Unknown	unknown	Microlith	OTP?
6219	UU	Unknown	unknown	Microlith	PB
6288	UU	Unknown	unknown	Microlith	PIBR
6321	UU	Unknown	unknown	Microlith	MT
6359	UU	Unknown	unknown	Microlith	MT
6421	UU	Unknown	unknown	Microlith	PB
6502	UU	Unknown	unknown	Microlith	OTP
6531	UU	Unknown	unknown	Microlith	PIBR
6537	MP	Meat	meat cutting	Bladelet	
6606	XX	Unused	unused	Burin	
6652	XX	Unused		Scraper	
6731	UU	Unknown	unknown	Microlith	ST
6764	HS	Hide	hide scraping	Scraper	
6864	UU	Unknown	unknown	Microlith	SS
6940	UU	Unknown	unknown	Microlith	PIBR
7058	MP	Meat	meat cutting	Microlith	L
7066	uu	Unknown		Scraper	
7239	UU	Unknown	unknown	Microlith	CB
7459	UU	Unknown		Burin	
7706	UU	Unknown	unknown	Microlith	L
7732	UU	Unknown	unknown	Microlith	R
7803	UU	Unknown	unknown	Microlith	L
7846	UU	Unknown		Microlith	OTP
7865	UU	Unknown		Microlith	OTP?
7903	UU	Unknown		Microlith	L
7935	UU	Unknown		Microlith	PB
7957	UU	Unknown	unknown	Microlith	SS
7986	UU	Unknown		Microlith	OTP
8281	RM	Strike	strike a light	Pick	
8320	UU	Unknown	unknown	Microlith	PIBR
8400	UU	Unknown		Burin spall	
8402	UU	Unknown	unknown	Microlith	OTP?
8426	UU	Unknown		Scraper	
8429	UU	Unknown	unknown - hafted end?	Microlith	OTP
8430	UU	Unknown	unknown	Microlith	PB
8431	UU	Unknown		Microlith	Lu
8432	UI	Impact		Microlith	CB
8433	UU	Unknown		Microlith	OTP
8434	UU	Unknown		Microlith	PIBR
8435	UU	Unknown	unknown	Microlith	CB
8436	UU	Unknown	unknown	Microlith	PB
8437	Y0R	Soft		Microlith	OTP?

Artefact no.	*Code*	*Contact material*	*Description*	*Basic type*	*Sub-type*
8438	UU	Unknown		Microlith	MT
8439	UI	Impact		Microlith	PB
8440	UU	Unknown		Microlith	PB
8441	UU	Unknown		Microlith	OTP?
8442	UU	Unknown		Microlith	OTP?
8443	nd	ND		Microlith	PB
8444	nd	ND		Microlith	OTP?
8445	nd	ND		Microlith	L

Microlith sub-types: obliquely truncated point (otp); convex backed (cb); lanceolate (l); partially backed (pb); point with inverse basal retouch (pibr); rhomboid (r); isoscele triangle (is); trapezium (t); scale triangle (st); small scalene (ss); micro-triangle (mt); tanged point (tp); lunate (lu)



a.



b.

Fig. S1.
Edge of scraper 992 shown as original (a) and, by way of replica, same part of edge (b)

APPENDIX S3. RESIDUE ON MICROLITH 1550
(Rhea Brettell And Carl Heron)

We report on the analysis of a sample of a putative adhesive adhering to a flint microlith fragment originating from the Middle Mesolithic site. The sample consisted of an irregularly shaped brown residue, *c.* 6 × 1.5 mm in size, situated on the dorsal surface of the microlith and extending from the medial portion towards the distal end. The microlith had been packaged in a plastic bag within a plastic container.

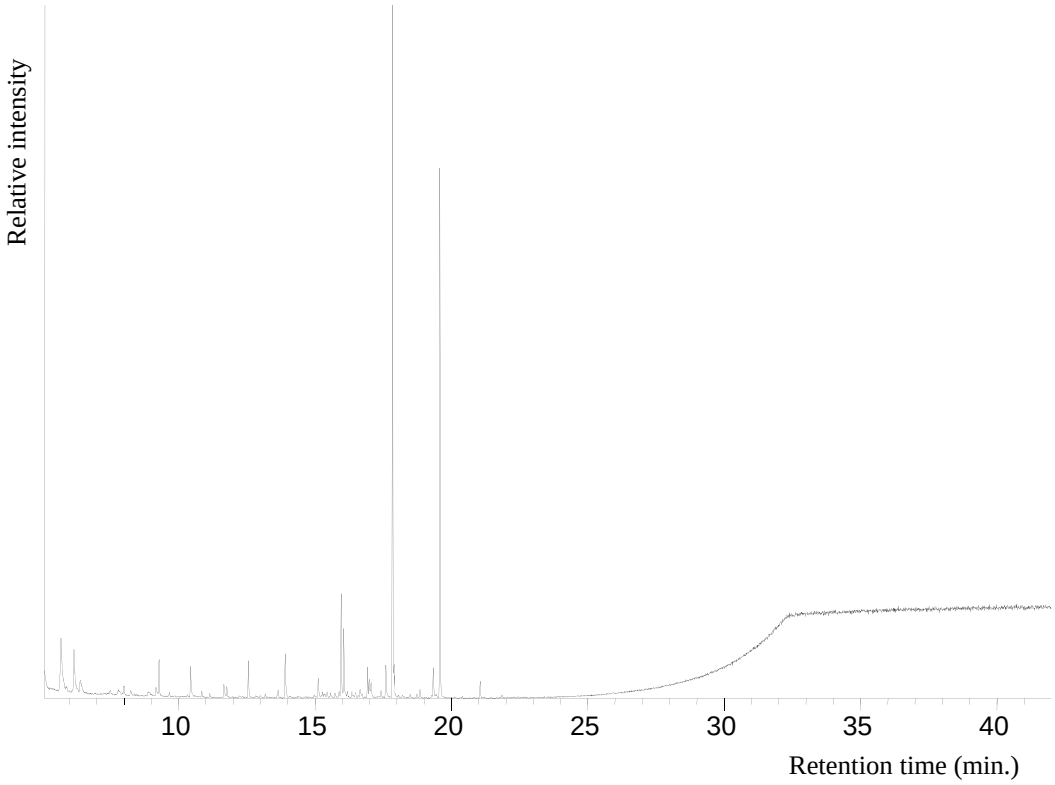
Sample preparation

The microlith was photographed (Fig S2) and the appearance of the adhering residue recorded (as above). Ensuring that a portion of the residue remained for future analysis, a sub-sample was removed with an unused, disposable scalpel and dissolved in ~2 ml chloroform:methanol (2:1 v/v) with the aid of sonication. The sample gave a pale orange, almost clear solution with some undissolved material remaining in the base of the vial. The solvent extract was transferred to a clean glass vial and the volume reduced to ~0.5 ml under a stream of nitrogen gas with gentle heat on a warm hotplate (*c.* 40°C). The extract was left overnight to evaporate to dryness. An aliquot of *N,O*-bis(trimethylsilyl)trifluoroacetamide with 1% TMCS (trimethylchlorosilane) (*Pierce*) was added to derivatise the sub-sample. Any excess reagent was removed under a stream of nitrogen gas. Ten drops of DCM were used to re-dilute the derivatized extract for analysis by GC-MS. Disposable screw topped glass vials were used throughout to minimise the possibility of cross-contamination and all glass and metal wares were triple-cleaned with dichloromethane (DCM) prior to use.

Fig. S2.
Microlith fragment with adhering residue

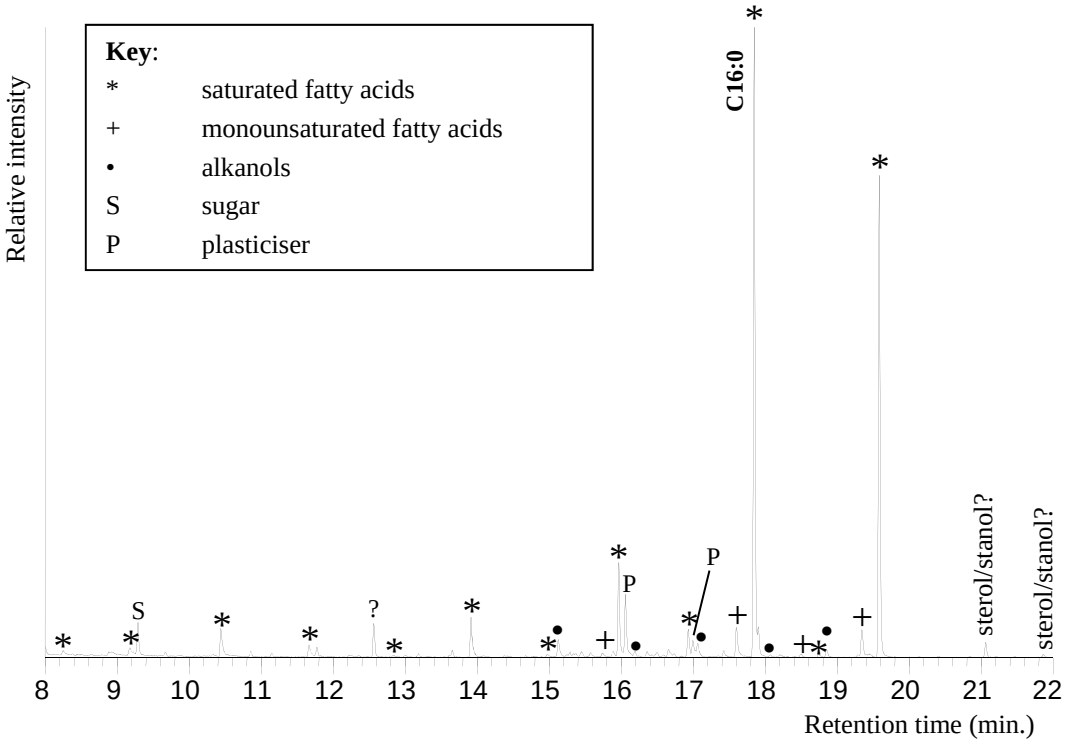
GC-MS analysis

The analysis was carried out by combined gas chromatography-mass spectrometry (GC-MS) using an Agilent 7890A GC system, fitted with a 15 m × 0.25 mm, 0.25 μm DB-5MS UI 5% phenyl methyl siloxane phase fused silica column (Agilent), connected to a 5975C inert XL triple axis mass selective detector. The splitless injector and interface were maintained at 300°C and 280°C respectively and the carrier gas, helium, at constant flow. The temperature of the oven was programmed to rise from 50°C (isothermal for 2 min.) to 350°C (isothermal for 10 min.) at a gradient of 10°C per minute. The column was directly inserted into the ion source where electron impact (EI) spectra were obtained at 70 eV with full scan from *m/z* 50 to 800 amu.



Total ion chromatogram: organic residue from microlith

Fig. S3.
Gas chromatogram of the BSTFA derivatised extract



Partial mass chromatogram: organic residue from microlith XA124

Fig. S4
Partial gas chromatogram (8–22 minutes) of the BSTFA derivatised extract

Results and Discussion

The results are presented as a total ion mass chromatogram of the TMS derivatized solvent extract of the organic residue sampled from the microlith showing each separated component as a discrete peak (Fig. S3). A partial mass chromatogram of the peaks eluting between 8 and 22 minutes is also provided in which the identified compounds have been labelled (the * symbol denotes saturated fatty acids; + monounsaturated fatty acids; • alkanols; Fig. S4). All assignments have been made through mass spectral interpretations based on the molecular mass and established fragmentation patterns of simple and complex lipids and their relative retention times.

The residue did not contain any biomarkers consistent with the presence of a tar, pitch or similar adhesive (Aveling & Heron 1998; Regert 2004; Urem-Kotsou *et al.* 2002). Instead it provided evidence for a range of saturated fatty acids ($C_{8:0}$ to $C_{18:0}$), a number monounsaturated fatty acids ($C_{14:1}$; $C_{16:1}$; $C_{17:1}$ and $C_{18:1}$), alkanols (C_{14} to C_{18}) and traces of sterols and/or stanols. The dominant compound, eluting at 17.8 minutes, was found to be hexadecanoic acid ($C_{16:0}$). This combination of components is generally considered to be indicative of the presence of an animal fat or vegetable oil, with a prevalence of $C_{16:0}$ more often associated with the latter (Charters *et al*. 1993; Condamin *et al.* 1976; Evershed 2008). However, due to taphonomic processes, which can substantially alter the composition of fatty materials (Morgan *et al.* 1973), the limited range of fatty acids that comprise most fats and oils (Hilditch & Williams 1964) and the degraded nature of the sample, this residue cannot be reliably linked to a specific source. The phthalate plasticisers (P) are modern contaminants, probably from the plastic storage bag.

Conclusion

Plant and animal tissues contain complex mixtures of fatty acids and these can often be present within the burial environment. The relatively low abundances and degraded nature of many of the components in the residue from the microlith cannot be conclusively associated with any specific source or definitely related to an archaeological cause. The images show a blackened deposit possibly solidified from a liquid. This would be consistent with heating and would lend support to the deposit having a cultural origin. Previous studies of hafting materials from Mesolithic sites have confirmed the widespread use of birch bark tar as an adhesive. This cannot be confirmed in this case. Further analysis could be undertaken using compound specific techniques but the condition of the residue would be likely to preclude effective results.

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