An undisturbed Early Mesolithic retooling station at Donich Park, Lochgoilhead, Argyll, Scotland – right-handed and left-handed knappers

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With a contribution by S. Ramsay (charcoal identification)

Abstract – This paper presents an Early Mesolithic (EM) lithic assemblage from Donich Park in Argyll, Scotland. At the present time, only a small number of Scottish EM assemblages are known, and they are all chronologically mixed to varying degrees. The Donich Park assemblage derives from a scatter measuring only 2.5 m across, and it is believed to represent a single visit to the site by a small hunting party, possibly including one right-handed and one left-handed knapper. The assemblage therefore represents a snapshot in time, and following detailed characterisation of the finds, particularly the microliths, the date and character of the site, as well as the possibility of further subdivision of the Scottish EM and the earliest part of the Late Mesolithic (LM) are discussed. The existence well into the Mesolithic period of the Doggerland land-bridge between Continental NW Europe and Scotland is essential to the discussion of the site's chronological issues, as well as to the general discussion of the chronology of the Scottish Mesolithic around the transition between the EM and LM periods. As no Scottish EM sites and assemblages have been radiocarbon-dated, the discussion of the period's chronology is based largely on typo-technological attributes and the comparison with contemporary Continental European material, first and foremost the sequence of well-dated and unmixed/only slightly mixed assemblages excavated in the Duvensee Moor in Schleswig-Holstein (northern Germany).

Key words – archaeology; Early Mesolithic period; Scottish Mesolithic chronology; NW Continental Mesolithic chronology; Doggerland; microliths; retooling; right-handedness/left-handedness;

Titel – Ein ungestörter frühmesolithischer Retooling-Fundplatz im Donich Park, Lochgoilhead, Argyll, Schottland – Über rechts- und linkshändige Steinschläger

Zusammenfassung – In diesem Aufsatz wird ein frühmesolithisches Steininventar aus dem Donich Park in Argyll (Schottland) vorgestellt. Momentan ist nur eine kleine Zahl solcher Inventare aus Schottland bekannt, die überdies durch mehr oder weniger intensive Vermischung chronologisch beeinträchtigt sind. Das Inventar vom Donich Park stammt von einer lediglich 2,5 m im Quadrat messenden Aretefaktverteilung und wird interpretiert als Hinterlassenschaft vom einmaligen Aufenthalt einer Gruppe von Jägern, bei der es möglicherweise einen rechts- und einen linkshändigen Steinschläger gab. Insofern repräsentiert das Artefaktensemble eine Momentaufnahme. Basierend auf einer eingehenden Darstellung der Funde, besonders der Mikrolithen, werden die Datierung und die Eigenschaft des Fundplatzes sowie die Möglichkeit einer weiteren Untergliederung des schottischen Frühmesolithikums (EM) und des frühesten Abschnitts des Spätmesolithikums (LM) diskutiert. Kernpunkt für die Diskussion der chronologischen Aspekte des Fundplatzes ist dabei der weit ins Mesolithikum reichende Nachweis der Existenz einer Landbrücke (Doggerland) zwischen Kontinental-Nordwest-Europa und Schottland. Dies gilt ebenfalls für die allgemeine Diskussion der Chronologie des schottischen Mesolithikums zum Zeitpunkt des Übergangs vom frühen zum späten Mesolithikum. Da keine schottischen frühmesolithischen Fundplätze und Artefaktensembles radiokarbondatiert sind, beruht die Diskussion der Mesolith-Chronologie weitgehend auf typo-technologischen Merkmalen und dem Vergleich mit zeitgleichem kontinentaleuropäischem Material. In allererster Linie ist das die Abfolge ausgegrabener, gut datierter und unvermischter/nur schwach vermischter Artefaktinventare vom Moorfundplatz Duvensee in Schleswig-Holstein.

Schlüsselwörter – Archäologie; Mesolithikum; Frühmesolithikum; schottische Mesolith-Chronologie; nordwesteuropäische kontinentale Mesolith-Chronologie; Doggerland; Mikrolithen; retooling; Rechts-/Linkshändigkeit;

Introduction

In 2008, archaeological evaluation was carried out on a parcel of land in advance of the construction of affordable housing and associated infrastructure at Donich Park, Lochgoilhead, Argyll, Scotland (centred on National Grid Reference NN 20146 01780) (**Fig. 1**). Due to the recovery of prehistoric features, lithics and pottery during the evaluation it was followed in 2010 by a controlled topsoil strip of all areas to be affected by the construction work and the full excavation of a series of features and contexts (Ellis, 2012).

The lithic assemblage recovered from Donich Park includes two highly valuable research collections, the first comprising an Early Mesolithic (EM) assemblage (9800–8400 cal BC) recovered from a small hunting camp/retooling station, and the second pitchstone artefacts from a small Early Neolithic (EN) pit cluster (Ballin, 2015a; 2017d). The present paper focuses on the site's EM component, and the EN features and finds will be published in a separate paper.

The EM collection is one of only a handful of Scottish assemblages likely to date from this period (**Table 1**). In addition, it represents, at present, the only small undisturbed single-occupation site from the Scottish EM; the most similar, although slightly younger published assemblage being Fife Ness in eastern Scotland (Wickham-Jones & Dalland, 1998). It is therefore essential that the Donich Park assemblage is presented and discussed in de-

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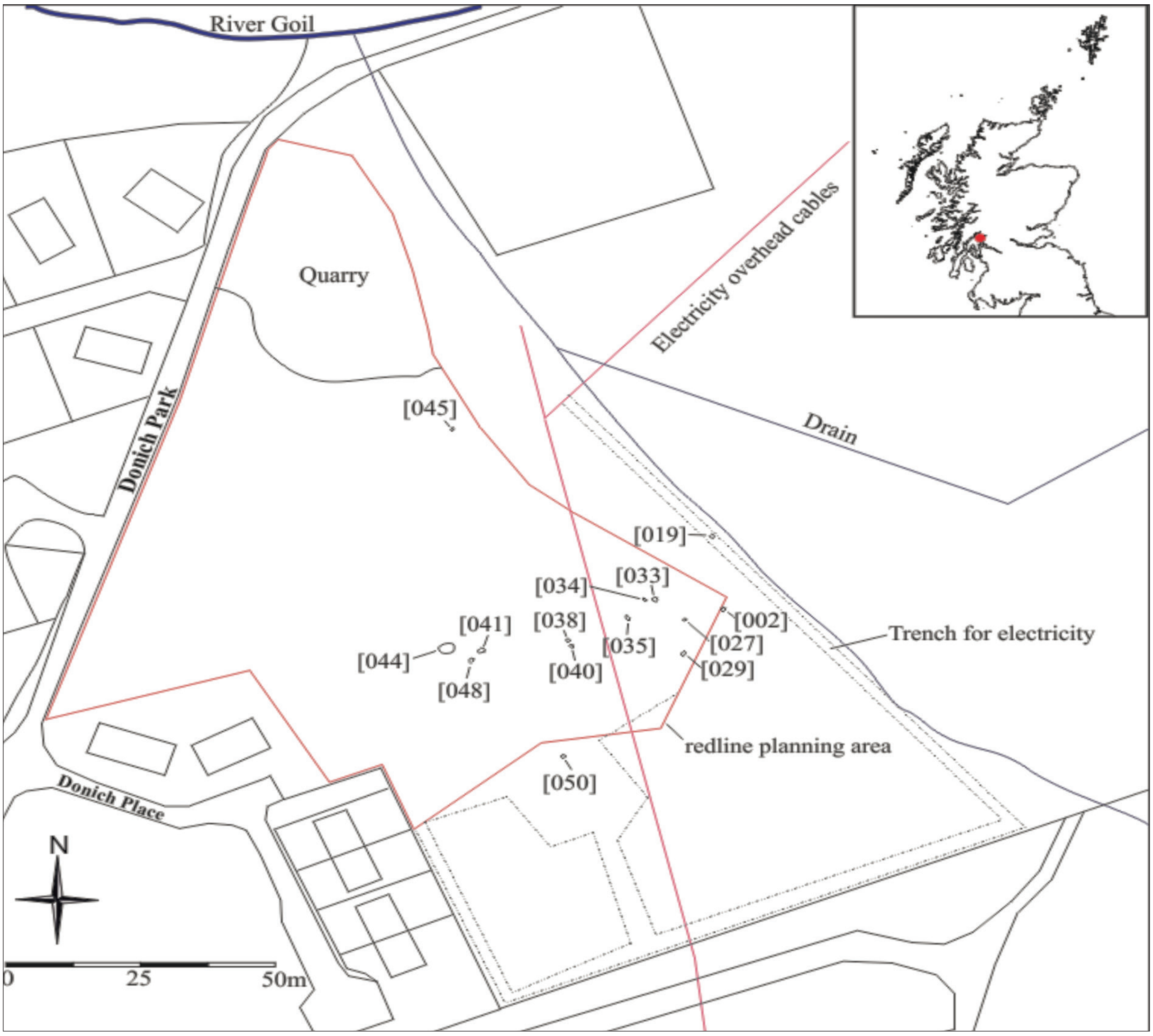

Fig. 1 Location plan of the features excavated at Donich Park.

tail, focusing on matters such as date, assemblage composition and site character.

There are only five known sites which date either entirely to the EM (including the hybrid EM/LM assemblage from Cramond; Saville, 2008), or which may allow the spatial separation on the site of EM and LM scatters (Glenbatrick Waterhole; Mercer, 1974) (Table 1). A further three sites are palimpsests with an EM component; five surface collections include EM material and some individual site assemblages may have limited EM admixtures, such as Firpark Wood (Weston Farm) in South Lanarkshire (Ballin, 2015b).

Although this material is numerically limited, it demonstrates that two of the four EM industries, the Horsham and Honey Hill industries, identified in southern Britain (characterised by different microlith spectra and discussed in Reynier, 2005) are not represented in Scotland and suggests that these industries may not be present north of Lincolnshire (Butler, 2005, 98; Waddington et al., 2017). Some mixed assemblages, like Nethermills Farm on the Dee (Ballin, 2017b), include some narrow obliquely blunted points and it is not possible yet to determine with absolute certainty whether EM Deepcar assemblages are present or absent in Scotland. However, at the moment all the EM assemblages and finds from Scotland seem to fit the material culture of the Star Carr group best (Reynier, 2005), although characterised by local features – blade-scrapers are present in the English Starr Carr group, where Scottish EM scrapers are almost entirely small oval flake scrapers.

Site	Area	EM component	Chronological status
Donich Park	Argyll	EM	Single visit
Cramond (hybrid)	Edinburgh	EM-LM transition	Probably single visit
Morton Site A	Fife	EM	Probably several visits
An Corran	Skye	Mostly EM, with LM admixture	Probably several visits
Glenbatrick Waterhole	Jura	EM half and LM half, spatially separated	Probably several visits
Nethermills Farm	Aberdeenshire	Palimpsest w EM component	
Lussa Bay	Jura	Palimpsest w EM component	
Lussa Wood	Jura	Palimpsest w EM component	
Shewalton Moor	Ayrshire	Multi-period surface collection w EM component	
Dryburgh Mains	Borders	Multi-period surface collection w EM component	
Tweed Valley	Borders	Multi-period surface collection w EM component	
Deeside	Aberdeenshire	Multi-period surface collections w EM component	
Tentsmuir Sands	Fife	Multi-period surface collection w EM component	
Various sites and areas		Limited EM admixture	

Table 1 Scottish sites and areas with EM components, and their chronological status.

Considering the exceedingly low number of EM sites and EM diagnostic pieces known from Scotland, it is important that as much evidence dating to this period as possible is made publically available. The assemblage from Donich Park is of great value in this context, as it probably represents a brief visit to the location, an over-night stay or just a few days, by a small family group or a couple of hunters. Although we still have no radiocarbon dates from the Scottish EM, it may be possible to suggest a chronological sequence within the EM and during the earliest part of the following LM period on the basis of microlith form and size, where the EM is characterised mainly by obliquely blunted points and isoseles triangles and the LM by scalene triangles, crescents and edge-blunted pieces, and with broad-blade assemblages generally being earlier than narrow ones, and with the blades probably gradually growing smaller and narrower towards the EM/LM transition. A similar, and well-dated, trend is known from Scandinavia and the Continent (Andersen, 1983, 140; Ballin, 2004).

The inclusion in the Cramond assemblage of isosceles as well as scalene triangles, and the use of very narrow blades for microliths (Saville, 2008, Fig. 4), indicates that this assemblage dates to the transition between the EM and LM. The fact that the Donich Park microliths and blades are fairly narrow – for example compared to the microliths from An Corran – may suggest a late date for this assemblage within the EM period. This is discussed further below.

The main aims of this paper are therefore to:

- Present a chonologically undisturbed and representative lithic assemblage from an EM single-occupation site – Donich Park in Argyll;
- Characterize the lithic finds from this site, particularly the microliths and the blades, in detail to allow typo-technological comparison with other assemblages from the EM and early LM periods;
- Discuss the date of the EM assemblage from Donich Park and the possibility of further subdivision of the the Scottish EM period and the earliest part of the LM;
- Discuss the character of the site and the activities which took place there.

The Site and its Excavation

The site was subject to an archaeological evaluation followed by a controlled topsoil strip (**Fig. 1**). In summary, there were seven pits, one possible disturbed cobble cist, a couple of possible tree boles and a small deposit of charcoal associated with buried soils; where possible, all these features and deposits were fully excavated. Prior to excavation, the site had been grazed by sheep. The area contained a large sub-oval mound located to the west of the central burn and a large quarry on the edge of the development area. The topsoil comprised grey brown silty sand. The drift geology comprised coarse matrix-supported gravel, peaty gravels and peaty silts.

*Early Mesolithic deposits (**Fig. 2**)*

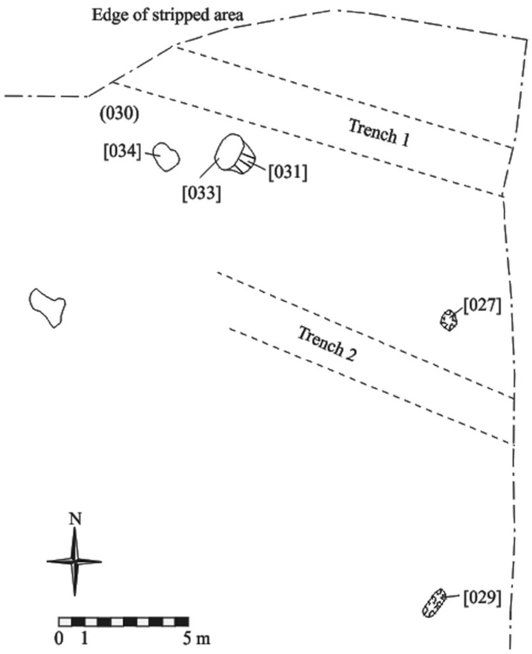

Fig. 2 Plan showing the relative location of the EM features and contexts (also see **Fig. 1**).

A small area of black silty dissolved charcoal with small stones and cobbles (Context 033) was located on the north-east side of the development area. The deposit was up to 0.10 m deep but much of the silty charcoal deposit had clearly washed down between the underlying natural cobbles (**Figs. 3 and 4**). On the east side of Context 033 was a yellowish brown silt with grit (Context 031) within which the majority of the struck flint (debitage, cores, and microliths) was recovered. This was capped on the east side by a pale bright brown silt (Context 032) from which a few struck flakes were recovered and to the west and north by the remnants of ploughsoil (Context 030), where some struck flints were also recovered. Below, Context 030 on the north side of Context 033 and also partially underneath Context 033, was a thin layer of light brown sandy silt with occasional pebbles and a few flakes of flint (Context 036). Unfortunately, weather conditions were bad at the time of excavation of these features, with the site becoming flooded by torrential rain (**Fig. 3**). However, despite the weather a notable assemblage (357 lithics) with diagnostic EM microliths similar to those from for example Morton Site A in Fife and An Corran on Skye (Coles, 1971; Saville, 2004; Saville et al., 2012) was associated with the above deposits. The site is interpreted as the location of a small knapping floor which was around 2.5 m in diameter.

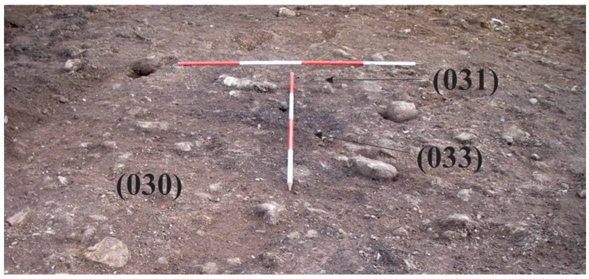

Fig. 3 Area of black silt and charcoal (Context 033) and surrounding deposits including residue ploughsoil (Context 030) and silt with grit (Context 031), looking east, pre-excavation.

Early Neolithic features and spreads
In addition, eight EN pits (Contexts 002, 027, 029, 038, 040, 041, 048, 050) and a cobble cist or large posthole (Context 019) were fully excavated. These features were mainly located west and south-east of the EM features, and they will be characterised in detail and discussed in a separate paper.

Fig. 4 Half section of Context 033, looking north.

In total, five radiocarbon-dates were obtained (**Table 2**), but they either relate to the EN pits or to LM visits to the site which were so brief that no lithic material was produced or left (see dating section).

The Early Mesolithic Assemblage

Raw materials
The Mesolithic assemblage from Donich Park includes three raw materials: flint (80 %), quartz (17 %) and pitchstone (3 %). The flint is generally fine-grained material with few impurities, but some pieces contain more fossils than others,

Context	Feature	Lab code	Species	Radiocarbon Age BP	Calibrated Date 95.4%
44	Tree bole	SUERC-44908 (GU29792)	Corylus	6969+/-33	5918-5752 cal BC
33	Charcoal rich deposit	SUERC-44905 (GU29789)	Corylus	6270+/-33	5323-5207 cal BC
20	Fill of pit	SUERC-44904 (GU29788)	Corylus	4862+/-33	3709-3631 cal BC
37	Fill of pit	SUERC-44906 (GU29790)	Corylus (nutshell)	4809+/-33	3606-3522 cal BC
43	Lower fill of pit	SUERC-44907 (GU29791)	Corylus (nutshell)	4714+/-33	3466-3375 cal BC

Table 2 Radiocarbon dates from Donich Park.

and a small number of pieces belong to a coarser-grained, more impure variety with a higher content of chalcedony. Most pieces are covered by a thin layer of cortication (sensu Shepherd, 1972), making it very difficult to assess colours and patterning, but uncorticated pieces seem to be mostly cream or grey and either unpatterned or mottled. The outer cortex of the site's primary and secondary flints is smooth and abraded, indicating that this raw material was collected from a pebble source, most likely the nearby shores of the Atlantic Ocean (cf. Harding et al., 2004).

The quartz is fine-grained white milky-quartz with few impurities and good flaking properties. The only impurities are small specks of mica. Few pieces are cortical, and the cortex of those pieces is generally smooth and abraded. As in the case of the flint, this indicates collection from secondary deposits, probably the local shores (Ballin, 2008).

The pitchstone is fine-grained volcanic glass of the obsidian family, with excellent flaking properties. The high quality of the raw material suggests procurement through exchange with contemporary groups on the Isle of Arran (Ballin, 2009; Ballin & Faithfull, 2009). The pitchstone object associated with the EM scatter (CAT 7) is generally very finely porphyritic, indicating procurement from sources in eastern (the Corriegills/Monamore area) or western Arran (the Tormore area), and its light-green colour suggests that it has been exposed to fire (cf. Ballin, 2009, Plates 9–13). This piece was recovered from the ploughsoil (Context 030) above the EM scatter and probably represents EN intrusion (Ballin, 2015a; 2017d).

General composition of the assemblage

Table 3 shows the composition of the lithic assemblage from the Mesolithic concentration (described above). A solitary piece of pitchstone from the ploughsoil covering the Mesolithic concentration is thought to represent a later EN intrusion (cf. Ballin, 2009; 2017d), with the Mesolithic assemblage generally consisting of flint and quartz (relative composition c. 83 : 17). In total, 78 % of the assemblage is debitage, whereas 2 % is cores and 20 % tools.

Key definitions

The definitions of the main lithic categories are as follows:

- *Chips:* All flakes and indeterminate pieces the greatest dimension (GD) of which is ≤ 10 mm.
- *Flakes:* All lithic artefacts with one identifiable ventral (positive or convex) surface, GD > 10 mm and L < 2 W (L = length; W = width).
- *Indeterminate pieces:* Lithic artefacts which cannot be unequivocally identified as either flakes or cores. Generally the problem of identification is due to irregular breaks, frost-shattering or fire-crazing. Chunks are larger indeterminate pieces, and in, for example, the case of quartz, the problem of identification usually originates from a piece flaking along natural planes of weakness rather than flaking in the usual conchoidal way.
- *Blades and microblades:* Flakes where L ≥ 2 W. In the case of blades W > 8 mm, in the case of microblades W ≤ 8 mm.
- *Cores:* Artefacts with only dorsal (negative or concave) surfaces – if three or more flakes have been detached, the piece is a core, if fewer than three flakes have been detached, the piece is a split or flaked pebble.
- *Tools:* Artefacts with secondary retouch (modification).

	Flint	Quartz	Pitch-stone	Total
Debitage				
Chips	85	18		103
Flakes	58	34		92
Blades	23	3		26
Microblades	45	2	1	48
Indeterminate pieces	1	1		2
Platform rejuvenation flakes	3			3
Crested pieces	6			6
Total debitage	221	58	1	280
Cores				
Single-platform cores	2			2
Opposed-platform cores	1			1
Irregular cores	1			1
Bipolar cores	2			2
Total cores	6			6
Tools				
Obliquely blunted points	32			32
Isosceles triangles	12			12
Frags of microliths	2			2
Microburins	4			4
Frags of microliths or backed bladelets	6			6
Backed bladelets	1			1
Truncated flakes & bladelets	2			2
Drill bits (meches de foret)	1			1
Short end-scrapers		2		2
Atypical scrapers	1			1
Burins	2			2
Notched pieces	2			2
Pieces w edge-retouch	4			4
Total tools	69	2		71
TOTAL	296	60	1	357

Table 3 General artefact list – Mesolithic finds (Contexts 030–033, 036).

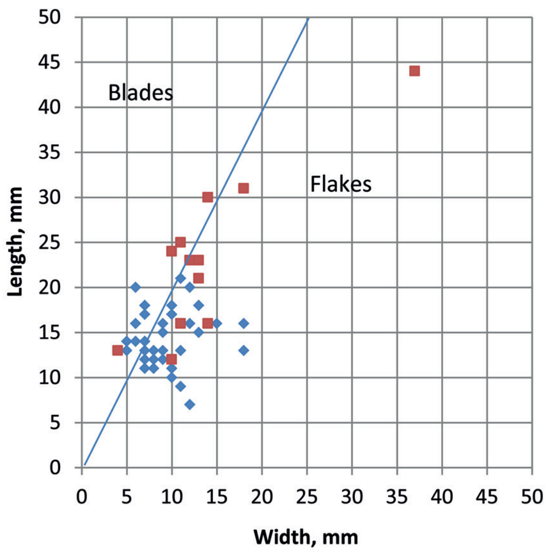

Fig. 5 Intact unmodified flakes and blades/microblades. Blue: flint; red: quartz. The solid line indicates the distinction between the standard flake and blade definitions (above).

Debitage

The debitage from the Mesolithic scatter includes 103 chips, 92 flakes, 26 blades, 48 microblades, two indeterminate piece, and nine preparation flakes. Fig. 5 shows the dimensions (length : width) of all intact flakes and blades/microblades.

The flint flakes have average dimensions of 14 x 11 x 3 mm, whereas the quartz flakes measure 23 x 17 x 8 mm. The flint blades/microblades measure on average 16 x 8 x 2 mm, whereas the quartz blades/microblades measure 21 x 9 x 5 mm. In general, the quartz blanks are approximately one-and-a-half times longer, but almost three times thicker, than the flint blanks.

Fig. 6 is highly informative and shows the following:

1. The approximately bell-shaped – or statistically 'normal' – distribution of the flint blades' widths indicates that the Mesolithic assemblage is fairly undisturbed and probably represents material deposited almost entirely during a single visit to the site, or at least material deposited within a very limited time-frame.
2. Two fragmented 'outsider' flint blades at widths 14 mm and 21 mm are so far outside the general size distribution that they may represent the only and very limited admixture of non-Mesolithic material or they may be blades from the first blade series of a core. As the second 'dent' in the bell-shape (at width 9mm) corresponds to the average width of the site's microliths (**Fig. 6**), it is possible that it may have been formed by the knapper(s) selecting blades with a preferred width for their microliths. It should, however, be borne in mind that the microlith population is (in statistical terms) relatively small (**Table 1**), and that both 'dents', including the one at 6 mm, may represent random statistical fluctuations as indicated by **Fig. 6**'s more regular 'moving average trendline' (stippled line).

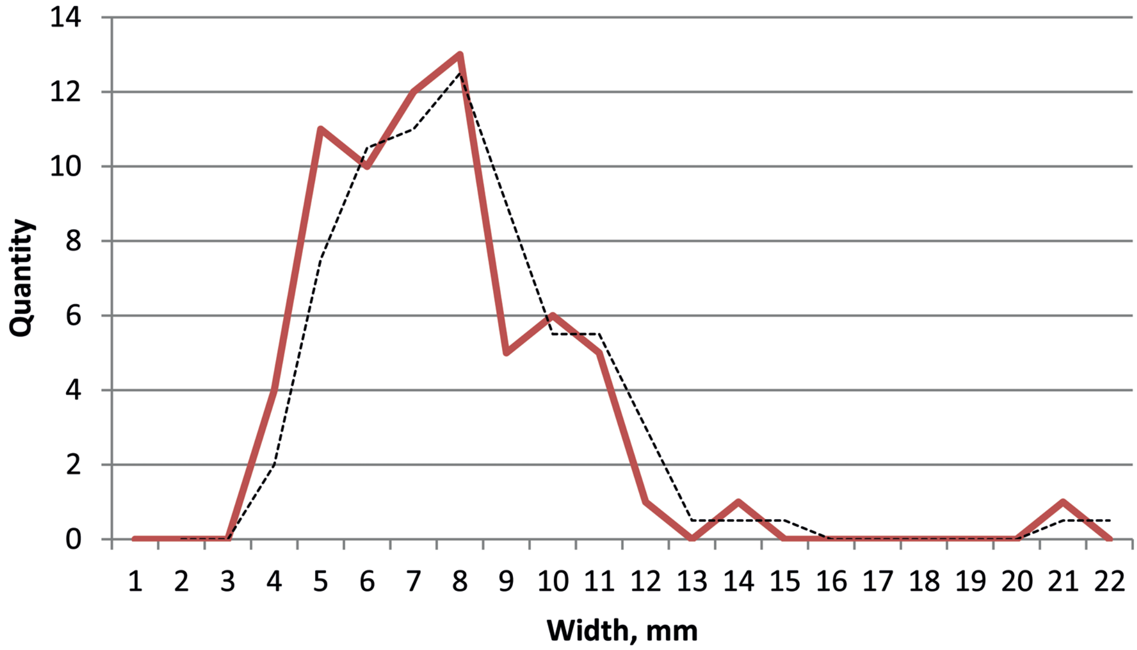

Fig. 6 The width of all intact and fragmented unmodified flint blades and microblades (stippled line: 'moving average trendline') (n=69).

It is difficult to assess the applied percussion techniques as so few blades and microblades survive intact – in total, 14 unmodified blades/microblades are complete, whereas 69 intact and fragmented specimens were available for the discussion of blade width. However, it is possible to assess a number of blade attributes which combined indicate the applied techniques. As shown by for example Madsen (1992), Sørensen (2006) and Damlien (2015), it is possible to distinguish between direct and indirect techniques, as well as techniques involving a large variety of hard, medium and soft percussors in stone, wood and antler. In this paper, percussion technique is assessed with reference to Sørensen (2006).

Although most of the collection's flint blades/microblades are fragmented to varying degrees, it is obvious that these blanks are generally very small (average width c. 8 mm); the platform remnants are generally either punctiform or small/narrow; bulbs are either absent or discrete, and the pieces tend to have discrete lips; and some microblades and microliths indicate that the blanks frequently had parallel dorsal arrises and had been struck from fluted cores, despite the fact that the surviving cores are heavily exhausted and somewhat irregular.

Comparing the Donich Park flint microblades and microliths with the Early Mesolithic (Maglemosian) assemblages presented by Sørensen (2006), the majority of the Donich Park pieces fit those from the Danish Maglemosian sites Ulkestrup I and II best. These microblades were produced by the application of Sørensen's Schema 4 (ibid., 59): 'The blade core is supported against the ground and held by the feet. The core front is thoroughly prepared by a soft hammerstone or an antler punch. A curved punch is placed c. 2 mm from the edge at a 90° angle. The punch is then hit with a wooden billet and the blade is detached'.

A small number of the larger flint blades have pronounced bulbs, indicating the use of direct hard technique, and some have crushed terminals, suggesting that they were manufactured by the application of bipolar technique (Ballin, 1999). The former were probably detached during the initial reduction of the flint cores, and the latter towards the end of the reduction process.

In terms of the flakes' and blades' position in the reduction sequence, the flint debitage and the quartz debitage have approximately the same low degree of cortex-cover – 13 % flint blanks with cortex against 12 % quartz blanks – showing that the cores were extensively decorticated (**Table 4**).

	Quantity			Per cent		
	Flint	Quartz	Total	Flint	Quartz	Total
Primary pieces	4	1	5	2	2	2
Secondary pieces	21	4	25	11	10	11
Tertiary pieces	171	36	207	87	88	87
TOTAL	196	41	237	100	100	100

Table 4 Reduction sequence of all unmodified and modified flakes and blades/microblades in flint and quartz.

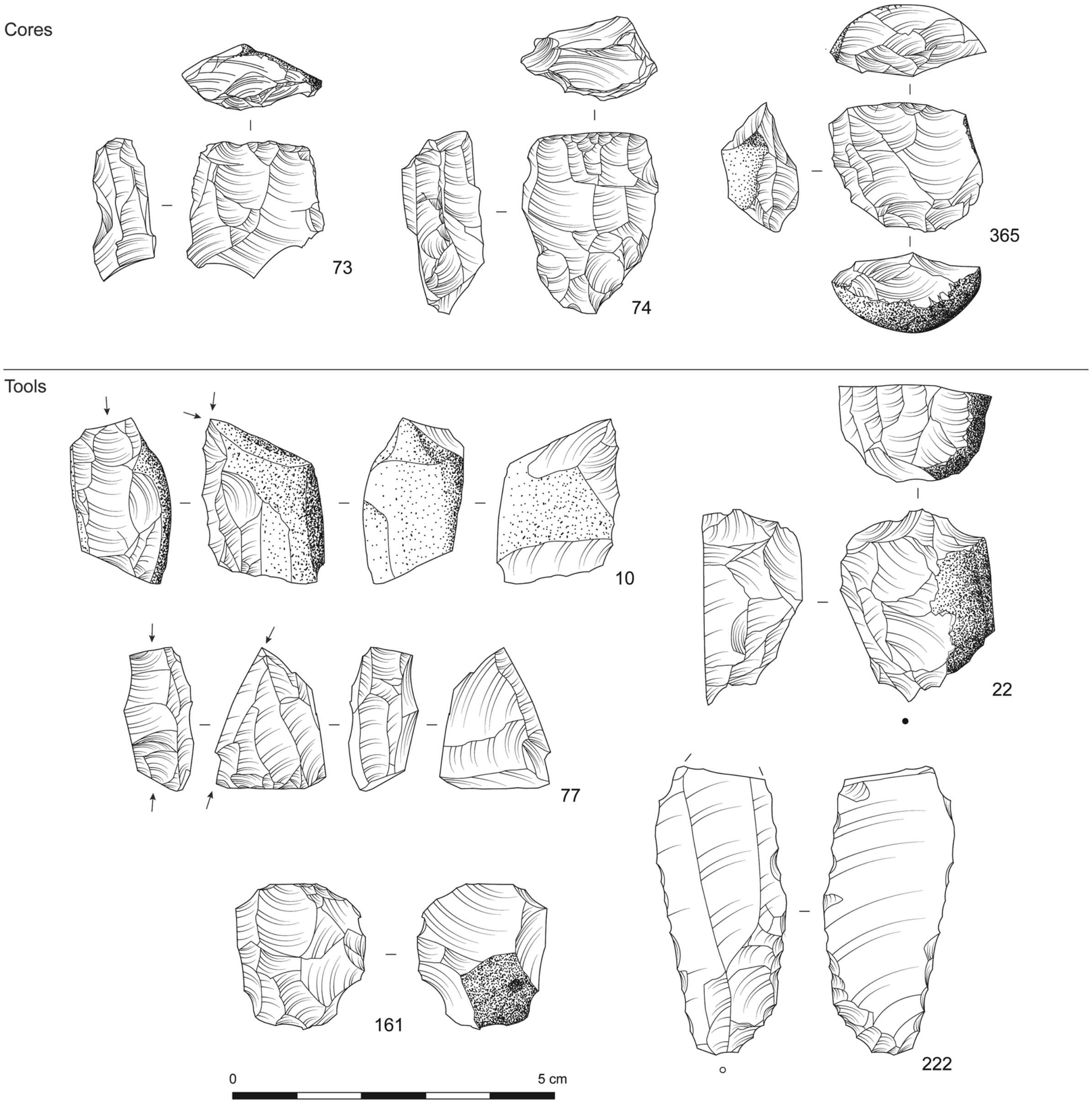

Fig. 7 Cores and larger tools, including burins (CAT 10, 77), scrapers (CAT 161, 22) and a scale-flaked blade from the area outside the EM scatter (CAT 222) (drawn by Leeanne Whitelaw).

There are nine preparation flakes, including three platform rejuvenation flakes (CAT 15, 75, 76) and six crested pieces (CAT 78, 79, 130, 162–164). The former are generally squat flakes, and none is a complete core tablet. They all represent between half and one-third of a full platform and they all display an arc of trimmed platform-edge at the proximal end. They measure on average 13 x 17 x 4 mm. The crested pieces are all either microblades or narrow macroblades and they have full or partial, slightly wavy crests produced by detaching small chips to one side of the dorsal ridge. Only two more robust pieces are intact, and they measure on average 20 x 10 x 4 mm.

Only one piece from the Mesolithic concentration shows signs of exposure to fire, namely the pitchstone microblade fragment (CAT 7), which was recovered from the covering ploughsoil and therefore probably represents later intrusion (also see Ballin, 2015a; 2017d on radiocarbon-dated Early Neolithic pits with pitchstone).

Cores

A total of six flint cores were recovered from the Mesolithic scatter: two single-platform cores (CAT 73–74), one opposed-platform core (CAT 365), two irregular cores (CAT 9, 205), and one bipolar core (CAT 8). Three of them are illustrated in **Fig. 7**.

CAT 74 is an intact single-platform core with a flat conical shape (29 x 21 x 12 mm). At one end, it has a broad, plain platform with a neatly trimmed platform-edge towards the core's main flaking-front. Along its right lateral side, towards the core's pointed apex, it has the remains of an old crest, whereas attempts were made to correct the left lateral side by producing a new crest. At least two flakes were detached from CAT 74's 'back-side' by applying force to the core's apex, but it is uncertain whether this indicates that the core had an 'earlier life' as an opposed-platform core, or that it was supported on an anvil.

CAT 73 is a broken single-platform core, which has lost its apex. Like CAT 74 it is a fairly flat piece, with the surviving fragment measuring 22 x 20 x 9 mm. It has a broad, plain platform with a neatly trimmed platform-edge towards the core's main flaking-front, and approximately two-thirds of its 'back-side' is cortical.

CAT 365 is a small, broad opposed-platform core (20 x 22 x 12 mm) with a fully cortical, domed 'back-side' and one main flaking-front. The flaking-front has had a small number of squat flakes detached from its two opposed platforms. One platform is plain and trimmed, whereas the other is faceted and trimmed.

CAT 205 is an irregular core, defined by having been reduced from three directions. One flaking-front was reduced mainly from one end, and the opposed flaking-front mainly from the opposite end. Finally, a third platform was created by trimming one of the original opposed-platform core's lateral sides. The platform-edges are generally neatly trimmed, and the core's main platform is plain. This relatively flat specimen measures 31 x 26 x 13 mm.

CAT 9 is also an irregular core, but in this case the core was reduced from four directions. Like the above cores, this core is also fairly flat (30 x 22 x 7 mm). Although the core's number of platforms define the piece as an irregular core, it is technically a double opposed-platform core, with each face having been reduced from opposed directions; the reduction axis of one face runs along the core's long axis, whereas that of the opposed face is orientated perpendicularly to the axis of the first face. One platform-edge still has surviving neat trimming.

CAT 8 is a small (25 x 15 x 8 mm) bipolar core with two reduced faces and one reduction axis (i.e. one set of opposed terminals).

Tools

In summary the assemblage includes 71 tools, namely 32 obliquely blunted points, 12 isosceles triangles, two fragments of microliths, six fragments of microliths or backed bladelets, three 'microlith-related implements', four microburins, one piercer, three scrapers, two burins, two pieces with retouched notches, and four pieces with simple edge-retouch. Apart from two quartz scrapers, all tools are of flint.

Microliths and 'microlith-related pieces': This category embraces 59 pieces (listed above). In the present paper, 'microlith' is defined as: *"Microliths are small lithic artefacts manufactured to form part of composite tools, either as tips or as edges/barbs, and which conform to a restricted number of well-known forms, which have had their (usually) proximal ends removed. This definition secures the microlith as a diagnostic (Mesolithic) type. Below, microliths sensu stricto (i.e. pieces which have had their usually proximal ends removed; Clark 1934, 55) and backed or truncated microblades are treated as a group ('microlith-related pieces'), as these types are thought to have had the same general function"* (e.g. Ballin et al., 2018, 33).

The main attributes of the site's obliquely blunted points, isosceles triangles and microburins are shown in **Table 5**. Generally, only the two shortest legs of the triangular microliths were modified (apart from CAT 86, which also has very fine retouch of its longest side) and only the remains

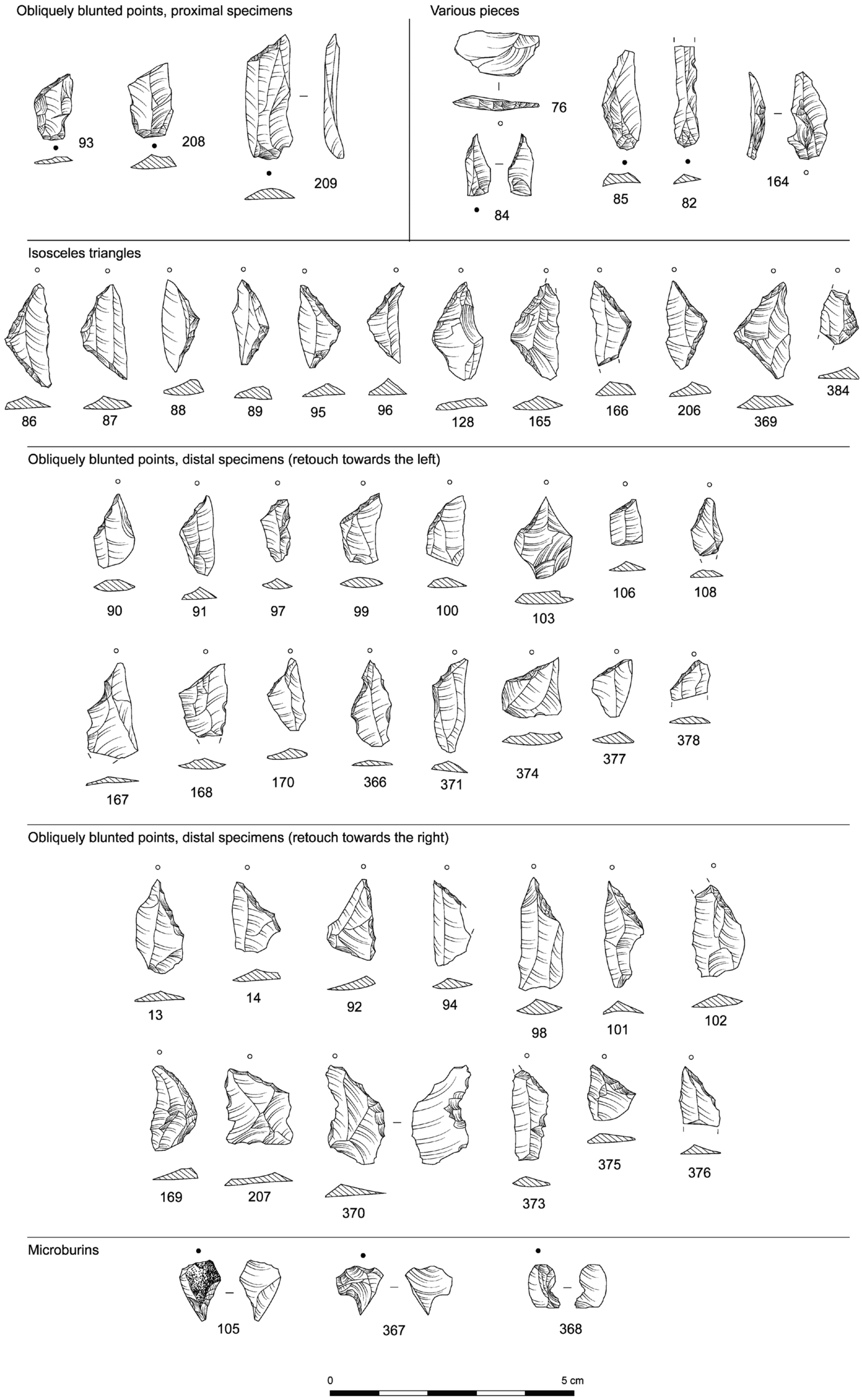

Fig. 8 A selection of microliths, microburins and other small objects (drawn by Leeanne Whitelaw).

	Average length	Average width	Average thickness	Left modif.	Right modif.	Proximal specimens	Medial specimens	Distal specimens
Obl. blunted points	15.5	8.7	2.1	16	16	3	0	29
Isosceles triangles	17.6	8.4	2.6	6	6	0	9	3
Microburins	9.4	8.2	2.6	2	2	4	0	0

Table 5 Main attributes of the site's microliths and microburins; all measurements are in millimetres.

of the original microburin notch and the oblique break facet of the obliquely blunted points were modified. Obliquely blunted point CAT 209 is a fairly long (length 25.3 mm) proximal variant and it was considered whether to classify the piece as a truncated piece or knife rather than a microlith. However, as shown in **Fig. 8**, it is only fractionally longer than the longest distal forms of obliquely blunted points, and it was subsequently decided to include it amongst the site's microliths.

As indicated in **Table 5** and **Fig. 9**, the recovered obliquely blunted points tend to be slightly shorter and thinner than the isosceles triangles. This is probably largely due to the fact that most of the isosceles triangles are based on medial blade segments, whereas most of the obliquely blunted points are based on distal blade segments. The smaller average width of the isosceles triangles is due to the more extensive lateral modification of these pieces prior to the formation of the triangles' two short legs, and the original blade segments probably had roughly the same width as the obliquely blunted points, that is, c. 9 mm (see discussion of blade width above, and **Fig. 6**). Although most of the isosceles triangles are medial segments, three (CAT 96, 128, 165) are based on distal segments; those three pieces have a more expedient appearance than the regular medial-segment triangles.

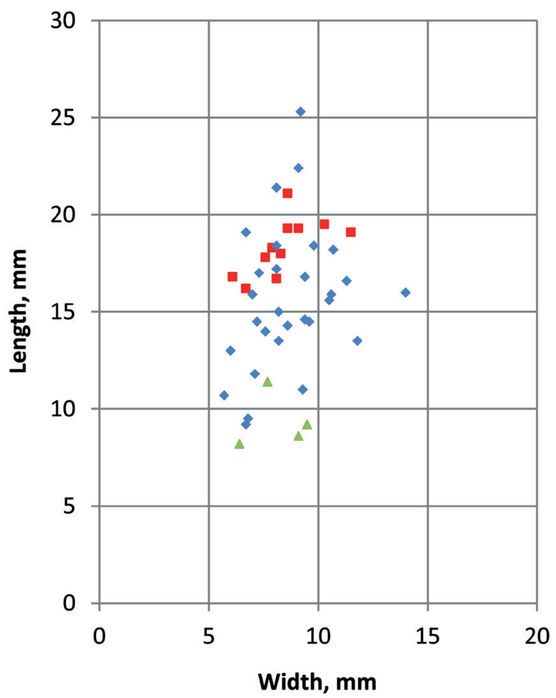

Fig. 9 Length : width (mm) of all microliths. Blue: obliquely blunted points; red: isosceles triangles; green: microburins.

As indicated by finds from other north-western European Mesolithic sites, such as Ulkestrup Lyng Hut I (Andersen, 1982, Fig. 34), the Sværdborg II hut (Brinch Petersen, 1971, Fig. 17), and Broxbourne (Warren et al., 1934, Fig. 4), microliths from small single-occupation sites are frequently orientated in the same way. However, the microliths from Donich Park, that is, the obliquely blunted points as well as the isosceles triangles, are evenly distributed across pieces with the longest lateral side orientated towards the left and pieces with this side towards the right, and the four microburins are also evenly distributed across left and right variants. This point is discussed further below.

Due to the extensive modification of the microliths' tips (in the case of the triangles, also their bases), it was very difficult to assess how the microliths were manufactured. However, in some cases the oblique edges of the microliths were less extensively retouched, allowing this question to be addressed (**Fig. 8**). The blank for triangular microlith CAT 166, for example, was clearly made by simply snapping the parent blade in two places and neither end displays a microburin facet. Nonetheless, most of the microliths are thought to have been produced by the application of microburin technique (**Fig. 10**):

1. although many oblique tips are approximately straight, several are somewhat concave, prob-

ably due to the extensive modification of a microburin notch (e.g. CAT 13, 89, 98, 168, 170);
2. several pieces display remnants of the actual microburin notch (e.g. CAT 14, 88, 167, 374);
3. a small number of pieces display surviving microburin facets (e.g. CAT 101, 167, 366, 371, 374, 381).

Jointly, these attributes suggest that the microliths recovered from Donich Park were manufactured as shown in **Fig. 10**. As the site's blades/microblades are generally relatively short (**Fig. 5**), with L : W ratios just above 2, it is quite likely that most segmented blades only produced a single microlith (contra INIZAN ET AL., 1992, Fig. 24.10).

croburin facet (and in the case of CAT 105 even a small bulb-of-percussion, a so-called 'demicone'), showing how the piece was struck to create this facet (cf. Inizan et al., 1992, Fig. 24.1–3). CAT 105 has slight use-wear along the longest lateral side, suggesting that it may have been used as an ad hoc obliquely blunted point. CAT 366 and 371 have very fine retouch along the edges of the oblique facet, for which reason these pieces were classified as obliquely blunted points rather than microburins.

Two microblade fragments (CAT 372, 382) with greatest dimensions of 5–16 mm were defined as fragments of microliths (and not backed

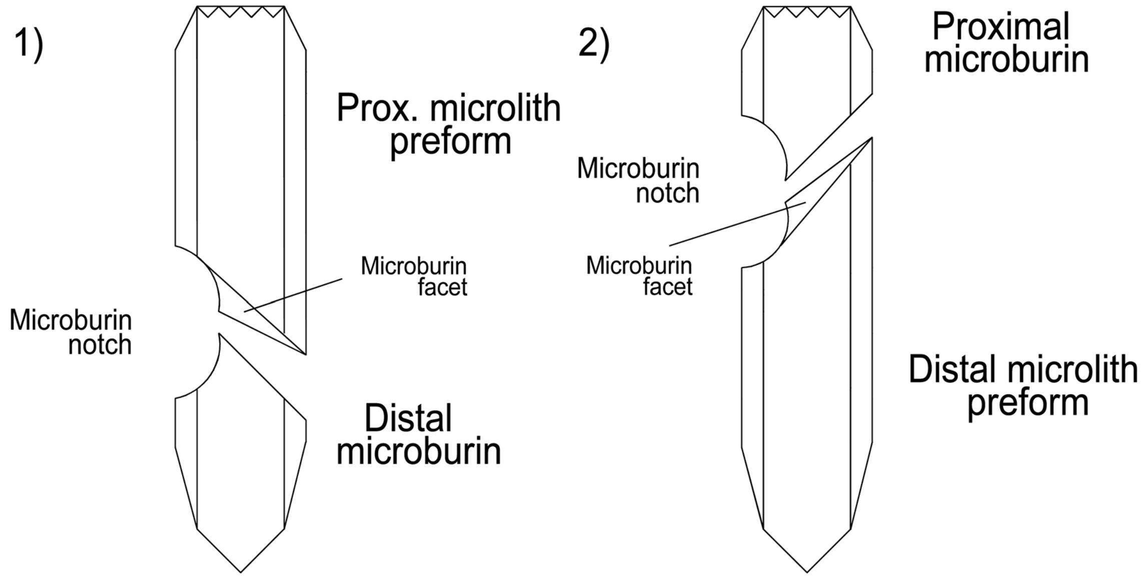

Fig. 10 Microburin technique applied at Donich Park in connection with the production of the site's most common microliths, the obliquely blunted points (orientation according to MARTINGELL & SAVILLE, 1988): (1) Removal of the distal end to produce a proximal variant (three pieces); and (2) removal of the proximal end to produce a distal variant (29 pieces).

Only four microburins (compared to the significantly higher number of microliths) were retrieved, namely CAT 105, 107, 367, 368; they are all proximal microburins, with the microburins being evenly distributed across variants with the notch in the left or right lateral side. They measure on average 9.4 x 8.2 x 2.6 mm. CAT 107 and CAT 367 represent an unsuccessful attempt to produce a microlith and snapped straight across the blade, rather than producing an oblique microburin facet. The remaining two pieces, on the other hand, are textbook examples of microburins, displaying the remains of a microburin notch, an approximately oblique fracture, and a typical mi-

bladelets), as they both have a surviving oblique retouch at the proximal end, which must have been deliberately removed (cf. microlith definition above). Both implements are missing their distal ends. Six medial or lateral blade/microblade fragments (CAT 83, 104, 379-81, 383) with greatest dimensions of 4–18 mm, and with fine lateral retouch, may be fragments of either microliths or backed bladelets. All microliths had their CAT numbers written on their ventral faces, and it was unsuccessfully attempted to refit the microliths with potentially complementary pieces.

Three other 'microlith-related pieces', a backed bladelet (CAT 85), a truncated bladelet (CAT 210), and a small truncated flake (CAT 385), were also recovered. They are all intact and have surviving platform remnants at their proximal ends. CAT 85 measures 19.7 x 7.5 x 3.3 mm and it has fine steep blunting retouch along its left lateral side, proximal half. CAT 210 measures 17.5 x 6.7 x 2.1 mm, and it has a finely retouched oblique truncation at its distal end. CAT 385 is a small flake (12.3 x 8.6 x 2.1 mm) with a slightly oblique distal truncation, the right side of which is fully blunted. This produces an angle with the truncation, giving the piece a sub-triangular shape. The general shape of this piece indicates that it may have been used as an ad hoc microlith.

Four isosceles triangles (CAT 128, 165, 210, 384), eight obliquely blunted points (CAT 93, 100–102, 370, 373, 375–376) and the backed bladelet (CAT 85), or a total of 13 'microlith-related pieces' (22 % of the category), have fine use-wear along their longest lateral side, indicating that they may have been replaced at the site rather than manufactured there.

Piercers: The assemblage includes a solitary piercer, namely a small drill bit, or meche de foret (Jacobi, 1980). It measures 12 x 5 x 2 mm, and it is based on a diminutive microblade. It has a distal piercer tip formed by propeller retouch, that is, one lateral side is formed by retouch from the ventral face and the other lateral side by retouch from the dorsal face.

Scrapers: Three scrapers were recovered from the site, one of which is of flint (CAT 161, **Fig. 7**), whereas the other two are of quartz (CAT 22, **Fig. 7**; CAT 123). The two quartz scrapers – the collection's only non-flint implements – are short end-scrapers, with CAT 22 (30 x 23 x 15 mm) being slightly larger than CAT 123 (14 x 14 x 6 mm). The latter falls into the size category of 'button scrapers'. Where the microliths are based on soft percussion microblades and blades, these implements are based on hard percussion flakes. They both have a convex, steep working-edge at the distal end. CAT 161 is an atypical scraper based on a flat discoidal core (23 x 21 x 9 mm). Several protruding points have been rubbed to transform these points into convex, steep scraper-edges.

Burins: Two small burins are based on a pebble (CAT 10) and a recycled flat conical microblade core (CAT 77) (both illustrated in **Fig. 7**). CAT 10 measures 28 x 19 x 14 mm, and a dihedral burin-edge was formed at the corner of one end. CAT 77 measures 22 x 18 x 10 mm, and two burin-edges were formed at opposed ends of one lateral side. At the implement's platform-end, a working-edge was created by a burin-blow to the striking platform, whereas a dihedral working-edge was created at the opposite end by two perpendicular blows.

Notched pieces: Two almost intact microblades (CAT 81, 82) with a diminutive lateral notch in one side measure on average 19 x 7 x 2 mm. The notch of the former is rather simple and may have been formed by prehistoric trampling across the camp site, whereas that of the latter is more well-executed and may have been formed with the intention of breaking the piece to create a microlith (microburin technique).

Retouched pieces: Four fragments of flakes and blades (CAT 11, 12, 80, 129) display various forms of lateral modification. They differ considerably in shape and size with a greatest dimension of 8–26 mm. This tool group probably includes fragments of artefacts with different functions.

Technological summary

This technological summary is based on information presented in the raw material, debitage, core and tool sections above.

With 45 % of the flakes and blades from the Mesolithic scatter being blades and microblades, this assemblage clearly represents a blade industry. The blades are dominated by microblades – 48 microblades against 26 broadblades – with the average dimensions of the intact flint and quartz blades being 18 x 8 x 3 mm. However, as shown in Figs. 9 and 13 and Table 5, blades with an average width of c. 9 mm were selected for microliths, suggesting that the original average size of the site's blades (prior to the modification of selected pieces) may have been slightly larger than indicated by the average size of the surviving unmodified pieces.

The assemblage includes material of flint and quartz, and it is thought that both raw materials were procured from local pebble sources, probably the nearby beach. The sizes of the artefacts indicates that flint may have been procured in the form of fairly small pebbles (the largest flint artefact measures 40 mm), whereas the quartz may have been procured in the form of slightly larger pebbles/cobbles (the largest quartz artefact measures 44 mm).

As discussed in the debitage section (above), the flint from the Mesolithic scatter was generally worked by the application of indirect soft percussion, probably pressure-technique, with some crude flakes and decortication flakes having been produced by hard percussion and bipolar technique. Compared with the Early Mesolithic (Maglemosian) examples presented in Sørensen (2006), the majority of the Donich Park pieces fit those from the Danish Maglemosian sites Ulkestrup I and II best. These microblades were produced by the application of Sørensen's Schema 4 (ibid., 59), where the flint core is supported against the ground; the platform-edge is thoroughly prepared by a soft hammerstone or an antler punch; and the blade is then detached by hitting a curved punch with an antler billet.

The quartz, on the other hand, was mainly worked by the application of hard percussion (42 %) and bipolar technique (38 %). The flint assemblage shows that flint blades and microblades were struck from carefully shaped conical, sub-conical and opposed-platform cores. These cores were prepared by decortication and cresting; the edges of the mostly plain platforms' edges were neatly trimmed and between blade series the platforms were occasionally rejuvenated by detaching partial core tablets, which left some surviving platforms with faceted surfaces. Blades and microblades were mainly detached from one face of the cores, resulting in the cores becoming rather flat before they were finally discarded. No quartz cores were recovered and apart from some crude trimming of the platform-edges, no quartz flakes or blades show signs of core preparation or rejuvenation.

Dating

The small homogeneous flint and quartz assemblage from Contexts 030–036 comes across as a coherent chronological unit and its composition in conjunction with the small horizontal extent of the assemblage suggests that it may have been deposited within a relatively short span of time. Most likely, these finds represent a single brief visit to the site.

The lithic collection includes several diagnostic elements, largely in the form of typo-technological attributes. The main chronological indicator is the presence of specific microlith forms, such as broad obliquely blunted points, isosceles triangles, and their complementary microburins. These forms are generally associated with the EM period (9800–8400 cal BC; Ballin, 2017c; Saville, 2008), with the Scottish LM being associated mainly with scalene triangles and related narrow forms. Isosceles triangles and obliquely blunted points dominate the contemporary microlith assemblages from An Corran on Skye (Saville et al., 2012) and Morton Site A in Fife (Coles, 1971; Saville, 2004), and the lithic finds from Glenbatrick Waterhole G1 and Lussa Bay on Jura also include substantial numbers of these microlith types (Mercer, 1970; 1974; Saville, 2004). In addition, a notable EM sub-assemblage was identified in connection with the presentation and discussion of the mainly LM finds from Nethermills Farm in Aberdeenshire (Ballin, 2017b).

The presence of burins is also important, although in Scotland these pieces are known from the entire Late Upper Palaeolithic and Mesolithic period (c. 12700–4000 cal BC; Ballin 2017c). However, where Mesolithic sites (such as Donich Park) may yield a relatively low number of burins, if any, Scottish Upper Palaeolithic sites frequently yield higher numbers (e.g. Howburn Farm in South Lanarkshire – 40 pieces; Ballin et al., 2017a; 2018). Also, Scottish Mesolithic burins are generally rather plain, where Upper Palaeolithic specimens tend to be more complex and include burins on truncated ends (ibid.).

Other diagnostic types include one small drill bit or meche de foret (Jacobi, 1980). They are characteristic of the Mesolithic period at large. Small, relatively simple thumbnail or button-shaped scrapers are also typical of this period.

Traditionally, the Scottish Mesolithic period is subdivided into two parts, namely the EM (9800–8400 cal BC) and the LM (8400–4000 cal

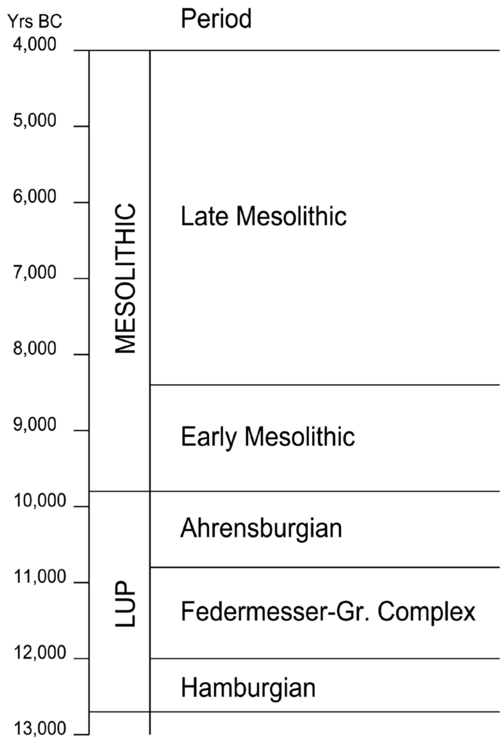

Fig. 11 The Scottish Late Upper Palaeolithic / Mesolithic sequence (Saville & Wickham-Jones, 2012).

BC) (**Fig. 11**) and generally defined by differences in microlith forms and (within each region) average blade size. The average size of the blades produced at Donich Park, prior to the selection of blades for microlith production, is c. 8–9 mm. This defines the site's blades as somewhat broader than those produced during the LM (the average width of flint and quartz blades and microblades from a recent excavation of a LM site at Shieldaig, Wester Ross, is 6 mm; Ballin, 2012; also see Saville, 2004, Fig. 10.2). This result supports an assemblage date to the earlier part of the Mesolithic period.

However, when the subdivision of the Scottish Mesolithic is compared with that of for example southern Scandinavia (e.g. Vang Petersen, 1993, 10), two Mesolithic phases against 12 (**Fig. 12**), it is obvious that it must be possible to subdivide the two Scottish Mesolithic phases into further meaningful sub-phases on the basis of typological and technological differences. Analyses of Mesolithic lithic assemblages from Denmark (e.g. Andersen, 1983, 140) and southern Norway (Ballin, 2004, 420-422) have shown that the average widths of blades and microliths of assemblages are diagnostic and it is quite possible that the dimensions of the blades and microliths from Donich Park define this collection as being rather late within the EM period (that is, closer in time to the LM with its narrow blades and microliths).

As shown in **Fig. 13**, the microliths from Donich Park are quite small compared to, for example, those from An Corran (Saville et al., 2012). Unfortunately, the radiocarbon dates from An Corran are not very helpful, with all dates post-dating the generally accepted end-date of the Scottish EM (Saville, 2004, Table 10.2; Saville, 2008). Furthermore, whether the size differences shown in **Fig. 13** truly represents earlier and later dates within the EM period – An Corran earliest / Donich Park later – or whether these differences may represent differences in terms of available lithic raw materials at the two locations – e.g. large blocks of baked mudstone vs. small pebbles of flint – will have to be decided by future comparison of the Donich Park assemblage with finds from new well-dated EM single-occupation (i.e. not chronologically mixed) sites.

However, it is important to note that the radiocarbon-dated assemblage from Cramond near Edin-

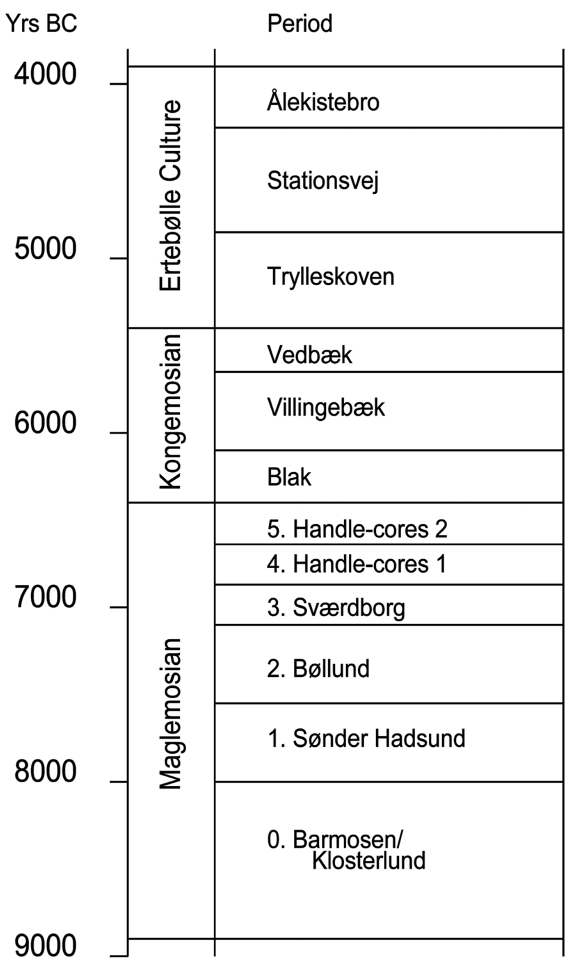

Fig. 12 The Mesolithic sequence of Southern Scandinavia. The Mesolithic period according to Becker (1951). The Middle and Late Mesolithic phases mainly according to Vang Petersen (1984).

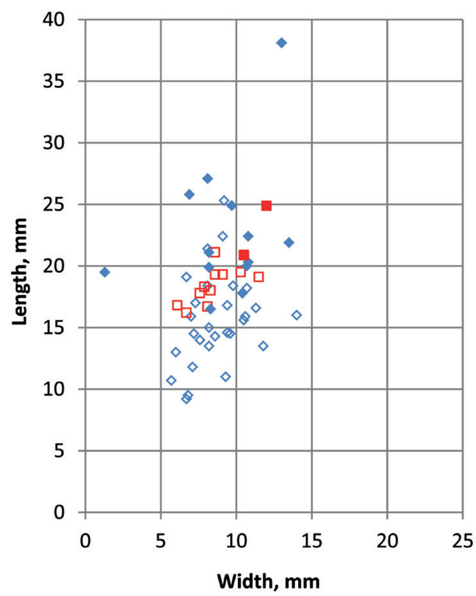

Fig. 13 Comparison between the dimensions of the microliths from Donich Park and those from An Corran. Open symbols: Donich Park; closed symbols: An Corran. Diamonds: obliquely blunted points; squares: isosceles triangles.

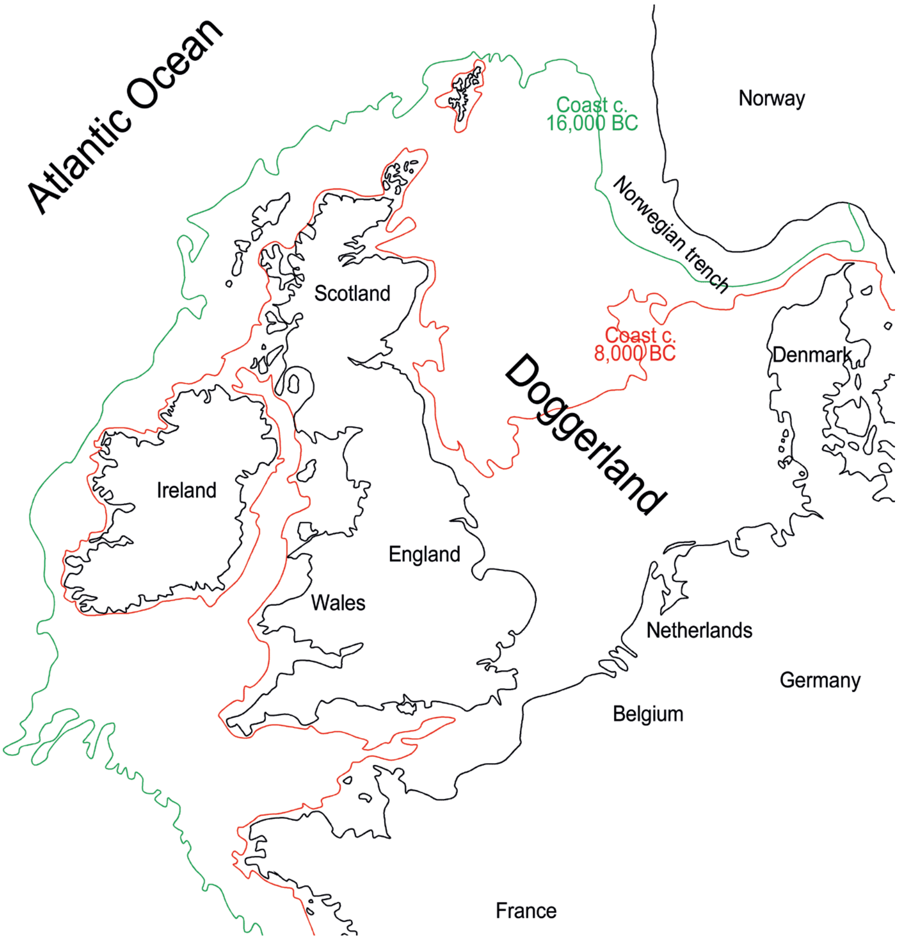

Fig. 14 Map of Doggerland based on Spinney (2012). A number of other interpretations of Doggerland's shape and size exist (e.g., Brooks et al., 2011; Grøn, 2005; Pettitt, 2008; Sturt et al., 2013; Weber, 2012). Reproduced from Ballin (2016).

burgh – six dates spanning the period 8600–8300 cal BC; OxA-10143–10145, 10178–10180 – which was defined by Saville (2008) to be an early narrow-blade assemblage with a typical LM spectrum of microliths, is actually a hybrid EM/LM assemblage as it includes several narrow isosceles triangles as well as fully developed scalene triangles (based on measurements of the microliths' short sides). The redefinition of some of the Cramond microliths from scalene to isosceles triangles does not alter the status of this assemblage and it is still as useful as before as an indicator of when the Scottish EM developed into the LM as defined by the replacement of one set of microlith forms with another. However, it does support the suggestion of Donich Park, with its relatively narrow blades and microliths, probably being late within the EM period.

Two Mesolithic radiocarbon-dates were obtained from Donich Park, but none of the dated material is directly associated with the clearly EM material from scatter 030–036 with its broad obliquely blunted points and isosceles triangles **(Table 2**). Charcoal (corylus) from Context 033 returned a date of 5323–5081 cal BC (SUERC-44905), or the second half of the LM (**Table 2**). This date is only slightly later than a date derived from the charcoal fill of a probable tree bole (Context 044) c. 35 m west of Context 033 of 5975–5762 cal BC (SUERC-44908) and it is very likely that the charcoal of Context 033 is also derived from the ash of a much later forest fire. Given the dearth of LM material from the site it is possible that the forest fires were started by natural forces rather than by man.

Currenty the only way to date the Donich Park assemblage more precisely is by comparison with similar, but radiocarbon-dated, microlith assemblages from other parts of north-west Europe. But unfortunately, no typical Scottish EM assemblages have been radiocarbon-dated, with the hybrid assemblage (narrow isosceles

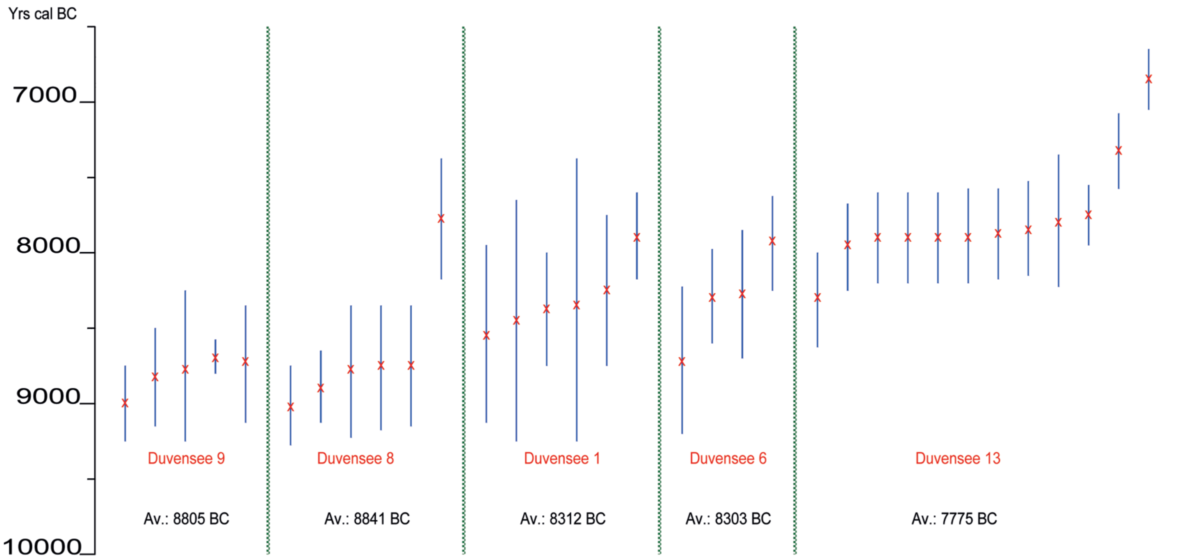

Fig. 15a Early and early Late Mesolithic microlith assemblages from Duvensee Moor in Schleswig-Holstein (Duvensee 9, 8, 1, 6 and 13) – the radiocarbon-dates. They were sequenced by Bokelman (1999, Fig. 7) on the basis of the lithic material and analysis of the sites' context and stratigraphy. The dates, which were kindly provided by S. Hartz, Curator at Schloss Gottorff, Schleswig-Holstein, have been calibrated by the authors by applying the OxCal 4.3 software (Bronk Ramsey, 2019).

and scalene triangles) from Cramond suggesting a date for the Scottish EM/LM transition of c. 8400 cal BC. In contrast to the English/Welsh EM, most – if not all – Scottish microlith assemblages appear be of Star Carr type.

As at this time Britain was still connected with the European continent across Doggerland (**Fig. 14**; Sturt et al., 2013; Ballin, 2016), northwest European microlith sequences may be useful as comparative material. The best material for our purpose is arguably that from Duvensee Moor in Schleswig-Holstein, where a sequence of radiocarbon-dated microlith assemblages from small settlement sites has been constructed (**Fig. 15a-b**).

The Continental (Denmark, southernmost Sweden and northern Germany) Maglemosian techno-complex (8900–6400 cal BC; Ballin, 2016) has been sub-divided into several phases on the basis of formal and technological attributes (e.g. Brinch Petersen, 1966; Skaarup, 1979; Vang Petersen, 1993; Sørensen, 2006), where a first stage is characterized by the presence of obliquely blunted points and no other microlith forms; a second phase by obliquely blunted points and isosceles triangles; a third phase by broad and short scalene triangles; a

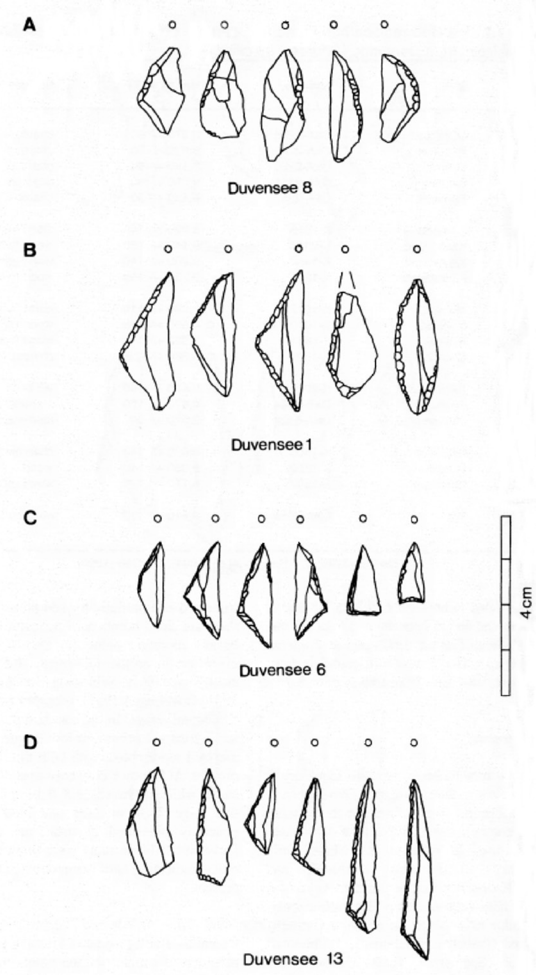

Fig. 15b Early and early Late Mesolithic microlith assemblages from Duvensee Moor in Schleswig-Holstein (Duvensee 9, 8, 1, 6 and 13) – the most common microlith forms. The microlith illustrations were provided by M. Reynier, London Higher.

fourth phase by narrow and long scalene triangles; and towards the end of the Maglemosian, narrow trapezoids which were later transformed into the broad trapezoids of the Kongemosian. Parts of this sequence is shown in **Fig. 15a-b**, where Duvensee 8 and 9 are characterized by obliquely blunted points only, Duvensee 1 by obliquely blunted points and isosceles triangles, Duvensee 6 by isosceles and broad/short scalene triangles, and Duvensee 13 by narrow/long scalene triangles.

In Scotland, no EM assemblages dominated entirely by obliquely blunted points have been found, but given the small number of presently known Scottish EM sites and assemblages, this 'absence of evidence' is most certainly not 'evidence of absence'. Most of the Scottish assemblages from this period appear to be of Duvensee 1 type, suggesting a date for these assemblages after 8800 cal BC (Duvensee 8 and 9), but probably before 8300 cal BC (Duvensee 6). Daer Reservoir 1 in South Lanarkshire (inspected by one of the authors [TBB]), which is characterized by the presence of broad/short scalene triangles and which is an assemblage of Duvensee 6 type, was dated to 8333–7962 cal BC (AA-30354), or c. 8150 cal BC (Ward, 2000; 2002). Duvensee 13, which is an archetypal LM assemblage, was dated to 7775 cal BC, mirrored by the date of the formally related assemblage from Daer Reservoir 2 (7255–6654 cal BC; AA-30355). The fact that the microliths from Donich Park are based on fairly narrow broadblades and microblades suggests that these microliths may only be slightly older than the hybrid (isosceles/scalene triangles) narrowblade assemblage from Cramond (c. 8400 cal BC).

The character of the Donich Park Early Mesolithic settlement

In Scotland, broad obliquely blunted points and isosceles triangles have been discovered as admixtures of many surface collections, such as those from Dryburgh Mains (Scottish Borders; Callander, 1927; Mulholland, 1970), Shewalton Moor (North Ayrshire; Lacaille, 1930) and Deeside locations (Aberdeenshire; Patterson & Lacaille, 1936), but some excavated Scottish assemblages also include notable EM elements (e.g. Lussa Bay and Glenbatrick Waterhole G1 on Jura; Mercer, 1970; 1974; Saville, 2004), and some assemblages were deposited mostly during the EM (An Corran on Skye and Morton Site A in Fife, both with some later intrusion; Coles, 1971; Saville, 2004; Saville et al., 2012). Although the assemblages from An Corran and Morton Site A appear to date mostly to the EM, their vertical and horizontal distribution patterns indicate that they may represent repeated visits to those sites during the period. In comparison with all the above assemblages, the EM assemblage from Donich Park stands out, as its recovery within a concentration measuring only c. 2.5 m across suggests that the finds were deposited during a single brief visit to the location.

Compared to Scotland's other two mainly EM assemblages, An Corran and Morton Site A, the Donich Park assemblage differs slightly in terms of composition (**Table 6**). The microliths from An Corran are dominated by obliquely blunted points, where those from Donich Park and Morton Site A include notable proportions of isosceles triangles (Donich Park: 27 % of isosceles triangles + obliquely blunted points); selections of microliths from An Corran and Morton Site A are shown in Saville (2004). The microlith : microburin ratio varies considerably from site to site, with An Corran having a ratio of 67 : 33, Morton Site A 82 : 18, and Donich Park 93 : 07.

The relative composition of the three tool collections (**Table 6**) shows that the EM assemblage from Donich Park includes a substantially higher proportion of microliths (77 %) than the other two assemblages (18–22 %). Apart from 'various retouched pieces' – which should probably be perceived as a 'mixed bag' of tools and tool fragments with different functions – at Donich Park non-microlithic pieces (piercers, scrapers, burins) make up 2–4 % each. In contrast, An Corran includes 14 % scrapers, whereas Morton Site A includes 41 % scrapers. Piercers are relatively rare in all three assemblages (1-7 %) and as mentioned above, burins are usually also low in numbers in Scottish Mesolithic assemblages (cf. Saville 2004, 189). The many 'burins' from Morton Site A are mostly pieces with various 'burin-like' fractures, but not burins as the type is defined today (cf. Inizan et al., 1992, Figs. 27-31). The above figures relating to the assemblage from Morton are from Coles' original publication (1971), and it would be helpful if the lithic finds from Morton could be re-examined and re-interpreted.

Based on stratigraphy, horizontal layout and assemblage composition, it is thought that these three EM assemblages represent different sets of activities, where An Corran and Morton Site A probably represent repeated and/or longer-duration visits to the locations, combined with a more broad-spectred activity pattern, whereas Donich Park may represent a single brief visit to the site, with activities concentrating on the replacement of worn microliths with new ones. It is suggested that Donich Park may be

	Quantity			Per cent		
	An Corran	Morton A	Donich Park	An Corran	Morton A	Donich Park
Microliths	32	226	55	22	18	77
Microburins	17	49	4	11	4	6
Piercers	10	7	1	7	1	2
Scrapers	20	518	3	14	41	4
Burins		226	2		18	3
Various retouch	68	229	6	46	18	8
TOTAL	147	1255	71	100	100	100

Table 6 The tool composition of the EM assemblages from An Corran, Morton Site A, and Donich Park.

the remains of a small hunting camp/'retooling station' (Keeley, 1982), based on the following factors: firstly, the assemblage includes many microliths which were clearly produced by microburin technique (at least 13 pieces), but only a small number of microburins were recovered (four pieces); and secondly, a total of 13 microliths have macroscopic use-wear along one edge.

The microliths recovered at Donich Park were mainly manufactured by the application of microburin technique. The low microlith : microburin ratio at Donich Park (93 : 07 compared to An Corran's 67 : 33) therefore suggests that many (but not all) of Donich Park's microliths may have been produced at a nearby base camp and brought to the site, say, in a small pouch. This interpretation is further supported by the collection's low blade and core ratios (**Table 3**).

The isosceles triangles and obliquely blunted points from Donich Park are roughly evenly distributed across variants with the retouch orientated towards the left and right sides. As Mesolithic microlith production may have been carried out in the form of fast 'conveyor-belt production' – 'grab microblade, make notch, hit/break microblade, quickly rub frontal burin-facet, put completed microlith aside, grab next microblade, etc.' – microlith production was probably very much affected by the individual knapper's personal motoric habits such as left- or right-handedness (Blankholm, 1990). This resulted in the microliths of the individual knapper usually being orientated towards one particular side and microliths from small single-occupation sites are frequently, in terms of orientation, of one type, such as those from Ulkestrup Lyng Hut I (Andersen, 1982, 25 Fig. 34), the Sværdborg II hut (Brinch Petersen, 1971, Fig. 17) and Broxbourne (Warren et al., 1934, Fig. 4). In contrast, the proportion of left and right variant microliths from large Mesolithic palimpsest sites, like for example Nethermills Farm in Aberdeenshire (Ballin, 2017b) commonly include c. 80–85 % pieces orientated towards the left and c. 15–20 % orientated towards the right, corresponding to the proportions of left-handed and right-handed individuals in a statistically normal human population (Mastin, 2012). It is therefore suggested, given the small scale of the Donich Park assemblage, that the microliths may represent two different sets of motoric habits and thereby at least two individuals.

Although the lithic collection from Fife Ness, East of Scotland (Wickham-Jones & Dalland, 1998), is technically a LM assemblage (7400–7600 cal BC; Wickham-Jones & Dalland, 1998), the site's undisturbed nature, the recent date of its excavation, as well as the small size of the concentration and the numerically small size of the assemblage make comparison with Donich Park highly relevant. Like Donich Park, the Fife Ness Mesolithic concentration measured approximately 2.5 m across. With 1,518 pieces (entirely flint), the assemblage is somewhat larger than that of Donich Park (357 pieces), although still a fairly small one – Kinloch on Rhum, for example, yielded almost 140,000 worked lithics (Wickham-Jones, 1990, 57). The occupied area, in conjunction with the numerically small size of the assemblage, indicates a relatively short stay at Fife Ness, but the presence of actual features (small pits and post- or stake-holes), possibly indicating a flimsy shelter or subsistence-related activities, suggests a visit to the site of slightly longer duration than that at Donich Park, where no negative EM features were recorded. It may also be important in this respect that 32 % of the flint recovered at Fife Ness was burnt, whereas none of the flints from Donich Park was affected by exposure to fire.

Following the artefact definitions used in the present paper, the Fife Ness assemblage (Wickham-Jones & Dalland, 1998, Table 3) includes 1,448 pieces of debitage (chunks, debitage flakes, regular flakes and blades), of which 74 are unmodified blades. This results in a blade ratio of only 5 %, but the presence of proper parallel-sided blades and blade/microblade tools shows that blade production clearly took place at Fife Ness. Only nine cores were recovered (a core ratio of only 0.6 %), suggesting that some cores may have been removed from the site. The composition of the tool assemblages from these two short-duration camps, Fife Ness and Donich Park, is shown in **Table 7**.

The tools from Fife Ness include a high proportion of microliths (57 %), although relatively fewer than those found at Donich Park (77 %). The larger EM assemblages from An Corran and Morton Site A only include c. 20 % microliths each. The only other formal tools found at Fife Ness are scrapers (18 %), with informal tools (simple retouched pieces) amounting to 21 %. In terms of scrapers present, Fife Ness corresponds roughly to An Corran (14 %), whereas Morton Site A yielded many more (41 %). In general terms, the assemblages from Fife Ness and Donich Park are quite similar, with high numbers of microliths, and both assemblages probably represent short-duration hunting camps, although the visit to Fife Ness may have lasted slightly longer than that at Donich Park, and the activities at Donich Park were more specialized – microlith production/retooling rather than subsistence-related activities.

The microliths from Fife Ness are heavily dominated by a single formal type, namely crescents (20 of 22 'proper' microliths, i.e. pieces which have had their usually proximal end removed). The publication's artefact illustrations (Wickham-Jones & Dalland, 1998, Fig. 8) indicate that most of these were orientated the same way (the longest lateral side turned towards the right), which, as mentioned above, is a common attribute of microlith assemblages from short-duration camps.

	Quantity		Per cent	
	Fife Ness	Donich Park	Fife Ness	Donich Park
Microliths	32	55	57	77
Microburins	2	4	4	6
Piercers		1		2
Scrapers	10	3	18	4
Burins		2		3
Various retouch	12	6	21	8
TOTAL	56	51	100	100

Table 7 The tool composition of the two short-duration camps, Fife Ness and Donich Park.

Conclusion and Future Perspectives

The EM assemblage from Donich park is one of a small number of Scottish assemblages from this period. In addition, it represents, at present, the only small undisturbed single-occupation site from the Scottish EM, and fascinatingly it appears to have been created by perhaps two knappers, one right-handed and the other left-handed who, shortly before 8400 cal BC, camped briefly at the head of the loch mainly to replace damaged microliths (**Fig. 16**). It is thought that most of the new microliths inserted into slotted arrowshaft were produced elsewhere and brought to the site, but that some of the new microliths may have been manufactured at Donich Park, as indicated by production waste. The damaged microliths were discarded and left at the location.

It has been possible to define the Mesolithic element of the assemblage as relating to a small short-term hunting camp/retooling station, which sets Donich Park apart from other known sites from the EM/early LM period, which are generally thought to represent camps of slightly longer duration (e.g. Fife Ness) or sites visited on more than one occasion (e.g. An Corran and Morton Site A), and with more broad-spectred activity patterns. To expand our understanding of the yearly cycle of the highly mobile Mesolithic hunter-gatherers in Scotland – compare for example with Binford's account of the yearly cycle of the Alaskan Nunamiut (Binford, 1983) – it is necessary to find and analyse more sites and assemblages from this period. This requires an input of new fieldwork as well as further re-examination of old museum collections in the hope that more unmixed assemblages from this period may be made available for research. Hopefully new fieldwork will eventually provide material for radiocarbon analysis and precise dating of assemblages like the one from the Donich Park site.

Fieldwork is presently being carried out along the Dee in Aberdeenshire, and one of the aims of this project is to locate undisturbed Late Upper Palaeolithic and Mesolithic scatters (Caroline Wickham-Jones, pers. comm.). The Grieve Collection – cared for by Aberdeen City Museum and collected by Dr Grieve during the 1970s – suggests that material from these periods is indeed present along the Dee (Ballin, 2018). It is also essential that three sites excavated by Biggar Archaeology Group in southern Scotland (Daer Reservoir 1–3) are catalogued, analysed and discussed, as Daer Reservoir 1 and 3 date to the earliest part of the Scottish LM period, with Daer Reservoir 2 pro-

Fig. 16 The Donich Park retooling station; an artist's impression by Alan Braby.

viding comparative material from the middle of the LM. Sites 1 and 3 have been radiocarbon-dated, and the date of Site 1 (c. 8150 cal BC) suggests that it is only slightly later than Cramond (c. 8400 cal BC). Together, Cramond and Daer Reservoir 1 represent the period where isosceles triangles were gradually transformed into broad scalene triangles, and they are probably both only slightly later than Donich Park. Daer Reservoir 1 may represent a new phase within the Scottish LM (broad scalene triangles), corresponding to for example Duvensee 6 in Schleswig-Holstein, Germany.

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