Society of Antiquaries of Scotland

SCOTTISH ARCHAEOLOGICAL INTERNET REPORTS

e-ISSN: 2056-7421

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How to cite:
Engl, R & Gooder, J 2021 ‘“A home by the sea”: the excavation of a robust Mesolithic house of the late 9th millennium BC at East Barns, East Lothian’, *Scottish Archaeological Internet Reports* 96. https://doi.org/10.9750/issn.2056-7421.2021.96

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‘A home by the sea’: the excavation of a robust Mesolithic house of the late 9th millennium BC at East Barns, East Lothian

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Funding
AOC Archaeology Group

e-ISSN: 2056-7421
DOI: https://doi.org/10.9750/issn.2056-7421.2021.96
Published by the Society of Antiquaries of Scotland.

Society of Antiquaries of Scotland
National Museums Scotland
Chambers Street
Edinburgh EH1 1JF
United Kingdom

www.socantscot.org
Registered Scottish charity no. SC010440

Managing editor: Adela Rauchova
Copy-editor: Helen Bleck
Production: Raspberry Creative Type, Edinburgh

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1. ABSTRACT

In 2001 excavation works undertaken in advance of quarrying at East Barns, East Lothian, revealed the substantial remains of a robust Mesolithic house structure, securely dated to the late 9th millennium BC. The house was situated within a large, natural hollow whose gradual infilling had effectively sealed the archaeological deposits. The house consisted of a sub-circular sunken floor with the remains of a west-facing entrance and two concentric angled post rings, suggesting episodes of replacement if not actual rebuilding. The remains of interior furniture were also recorded in the form of post holes, a platform, and three probable hearth features. A charred deposit of occupation debris rich in lithics sealed many of the structural features around the internal perimeter of the house. The distribution of this deposit appeared to reflect informal refuse toss/drop zones formed during the occupation of the structure and suggests some form of internal spatial organisation.

The house at East Barns joins an increasing group of substantial analogous sites related to Early Mesolithic activity in Scotland and northern England. These substantial house sites reflect increasing socio-economic, cultural and chronological complexity during the Mesolithic. As such the site allows provisional hypotheses to be formed about the scale and nature of Early Mesolithic social and economic adaptation around the North Sea Basin.

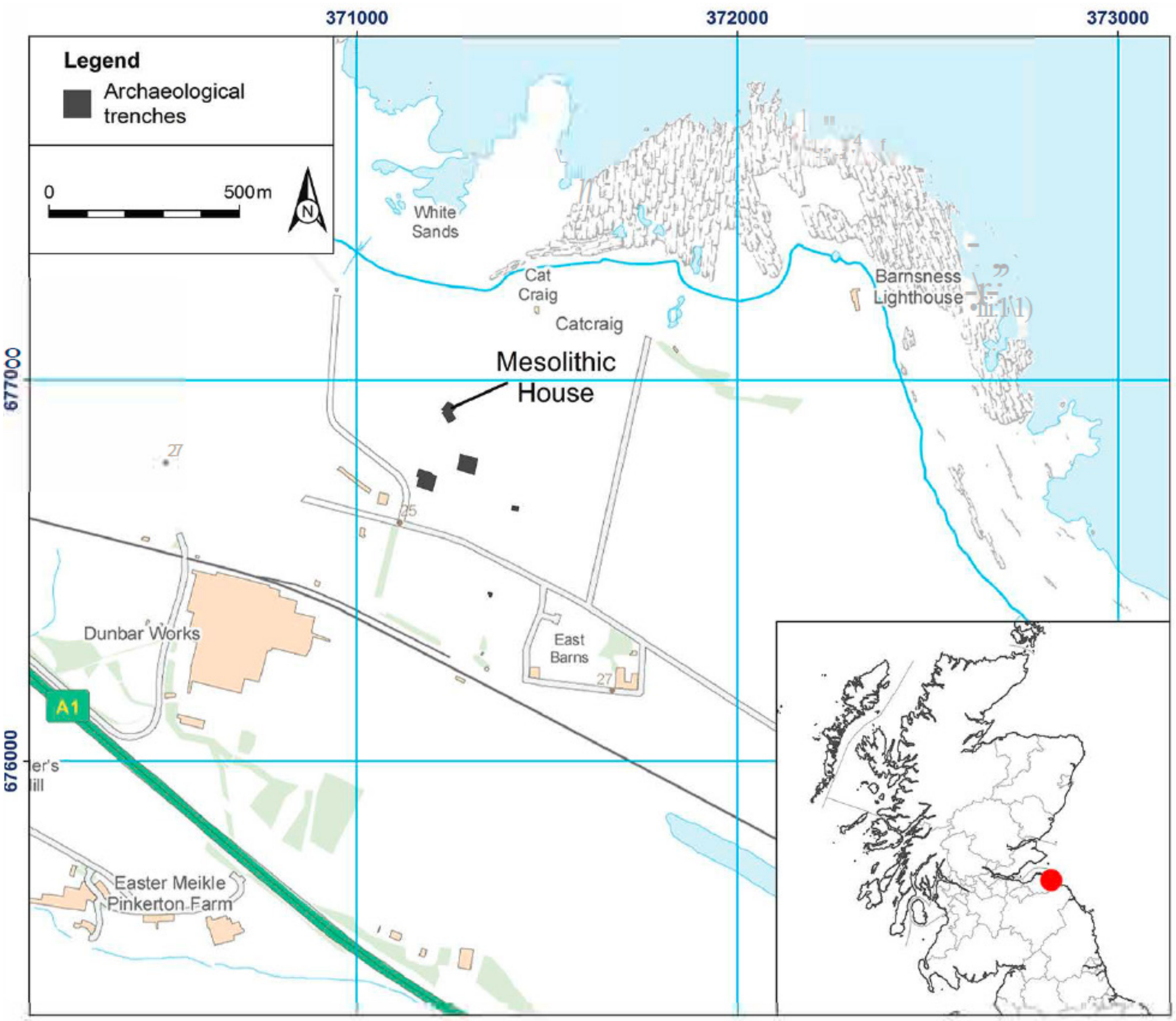
2. INTRODUCTION

The robust Mesolithic house was discovered and excavated in 2001 during an early phase of ongoing archaeological mitigation works carried out by AOC Archaeology Group in advance of limestone quarrying at East Barns, Dunbar, East Lothian (NGR NT 7121 7686, Illus 1). The works consisted of an extensive programme of geophysical survey, trial trenching, field-walking and test pitting over an area of 50 ha (Gooder 2001).

The site itself was located within a natural hollow and was revealed by a combination of geophysical survey and trial trenching (the evaluation trench cuts through the house – see Illus 2). A zone of archaeological material measuring 12m by 9m in extent was exposed revealing a suite of occupation horizons and cut features. The survival of this material appears to have been largely determined by its position within the hollow. Over time this had become gradually infilled with relatively homogeneous deposits of colluvium that acted as an effective buffer between the underlying anthropic deposits and the active plough-soil.

Substantial quantities of lithic material, including microliths and narrow-blade debitage, were retrieved alongside carbonised hazelnut shell. The immediate identification of the site as being of Mesolithic date enabled an effective methodology to be employed in its subsequent excavation (see Section 3, Excavation).

An interim paper on the site was published soon after the fieldwork was completed (Gooder 2007).



Illus 1 Location map. Excavation areas are shown as black squares

The current paper represents the full publication of the site following the implementation of a comprehensive post-excavation programme and concerns itself solely with the excavation of the robust Mesolithic house. The mitigation works also identified evidence for Neolithic and Bronze Age activity and Iron Age occupation (found in the other excavation areas shown on Illus 1), which will be dealt with in a forthcoming paper.

Specialist reports were commissioned on the lithic and coarse stone assemblages, the macroplant, charcoal and phytolith assemblages, and soil micromorphology. The major reports are reported in full here, but the minor reports on the macroplant, charcoal and phytolith assemblages are only alluded to where relevant and can be found in full within the site archive. Catalogue descriptions have been included for illustrated artefacts only, but full catalogues are also available in the archive.

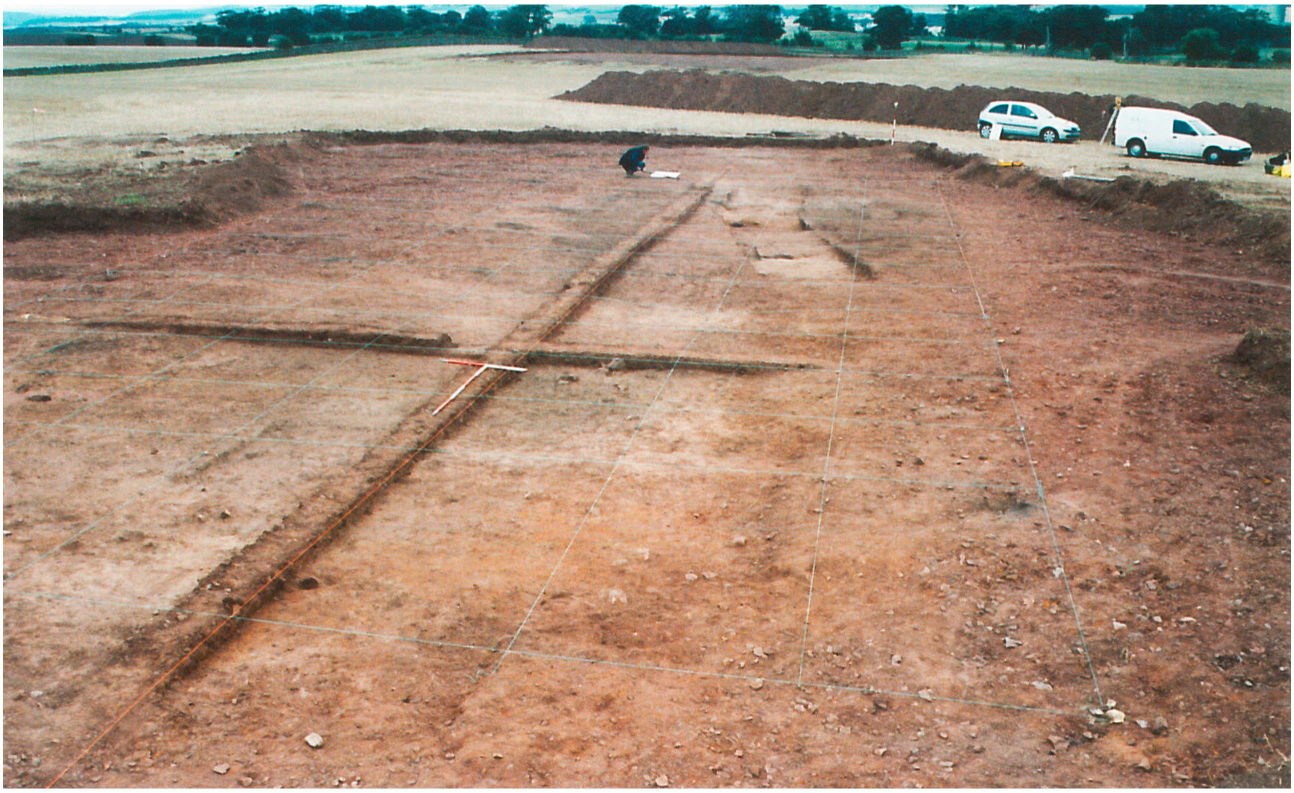
Fortuitously, the East Barns Mesolithic house was excavated almost in tandem with the similarly robust structure discovered at Howick, Northumberland (Waddington 2007, Waddington & Pedersen 2007). This allowed for an ongoing discussion between the excavators and led to a relatively standardised approach in relation to the excavated materials.

2.1 Location

The Mesolithic house was situated within the East Lothian coastal plain on undulating arable land formerly belonging to East Barns Farm (Illus 2). It was located to the immediate north of the old A1 (Skateraw Road) some 3 miles along the coast east of Dunbar. The site lay within the current land-take of Dunbar Quarry and cement works (Illus 1) and has been subject to intensive cereal/root crop rotation throughout the recent past.

2.2 Archaeological background

Despite the East Lothian coastal plain having a rich archaeological record of later prehistoric settlement (Cowley 2009), including the well-known and large-scale excavations undertaken at Broxmouth Hill Fort (Armit & McKenzie 2013) and Dryburn Bridge (Dunwell 2007), there is a dearth of evidence for Mesolithic activity. Disturbed lithic material of Mesolithic date was recorded at both Dryburn Bridge



Illus 2 The site prior to excavation, looking S. The hollow is just visible as a change in soil colour and texture and the grid has been laid out over it

(Dunwell 2007) and Torness (Mercer 1976). Similarly, narrow-blade material was identified approximately 600m to the east of the site during field-walking associated with the current project (Gooder 2001). The presence of such material suggests that Mesolithic settlement evidence is perhaps richer on this part of the coastal plain than is currently suggested by the existing archaeological record.

2.3 The environmental setting

The Mesolithic house structure at East Barns was inhabited during the late 9th millennium BC, a period of rapid climatic amelioration following the end of the Loch Lomond Stadial. By 8000 BC this event had led to a mean temperature rise one to two degrees above those of the present day (Atkinson et al 1987; Walker & Lowe 1997). This transition was remarkably rapid (Tipping 1994: 46) and is characterised by the spread of tree and shrub taxa including birch (*Betula* sp.), hazel (*Corylus avellana*), pine (*Pinus* sp.) and willow (*Salix* sp.). This colonisation appears to have occurred in southern and central Scotland by 8000 BC (Lowe 1994).

Despite a wealth of archaeological investigation, there is a general lack of palaeoenvironmental studies within East Lothian, and there are no published pollen-based regional vegetation reconstructions available for the county, probably because of the lack of suitable sedimentary deposits (Clarke 2002: 15).

Pollen records obtained from sites north of the Forth at Pickletillem, Fife (Whittington et al 1991a) and Black Loch, Fife (Whittington et al 1991b) show a hazel-dominant woodland cover established in eastern Scotland by the early 9th millennium BC. A palaeoenvironmental study undertaken in association with the excavation of the early 8th millennium BC robust Mesolithic house at Howick, Northumberland produced a pollen sequence which showed that mixed tree cover, including species such as hazel, pine and willow, had developed prior to the occupation of the house (Waddington et al 2007a: 202). The dominance of hazel is also seen at East Barns, where it forms 65% of the wood charcoal, oak forming a further 22.5% of the assemblage (Duffy 2002). Hazelnut shell was also recovered in significant quantities; indeed it was the only component of the macroplant assemblage from the Mesolithic deposits (Hall 2002: 17).

In its modern setting, the Mesolithic house at East Barns lies 20m above modern sea level and is located approximately 350m from the shoreline where the Firth of Forth meets the North Sea. In the late 9th millennium BC, the occupation of the site would have occurred during a period of falling relative sea level (Robinson 1993; Smith et al 2002). At Fife Ness, which occupies a comparable situation along the northern coast of the Forth, extrapolation has produced a range of +2m to –3.5m relative to modern sea level (Wickham-Jones & Dalland 1998). A similar sub-sea gradient would place the contemporary coastline somewhere between 350m and 550m to the north.

The Mesolithic house at East Barns then and now occupies a favourable position on the Lothian coastal plain. The site is close to the contemporary coastline, the uplands of the Lammermuir Hills and numerous out-flowing sources of fresh water. The house therefore seems to have occupied an optimum location for the exploitation of a diverse range of marine, riverine, estuarine and terrestrial resources.

2.4 Definitions

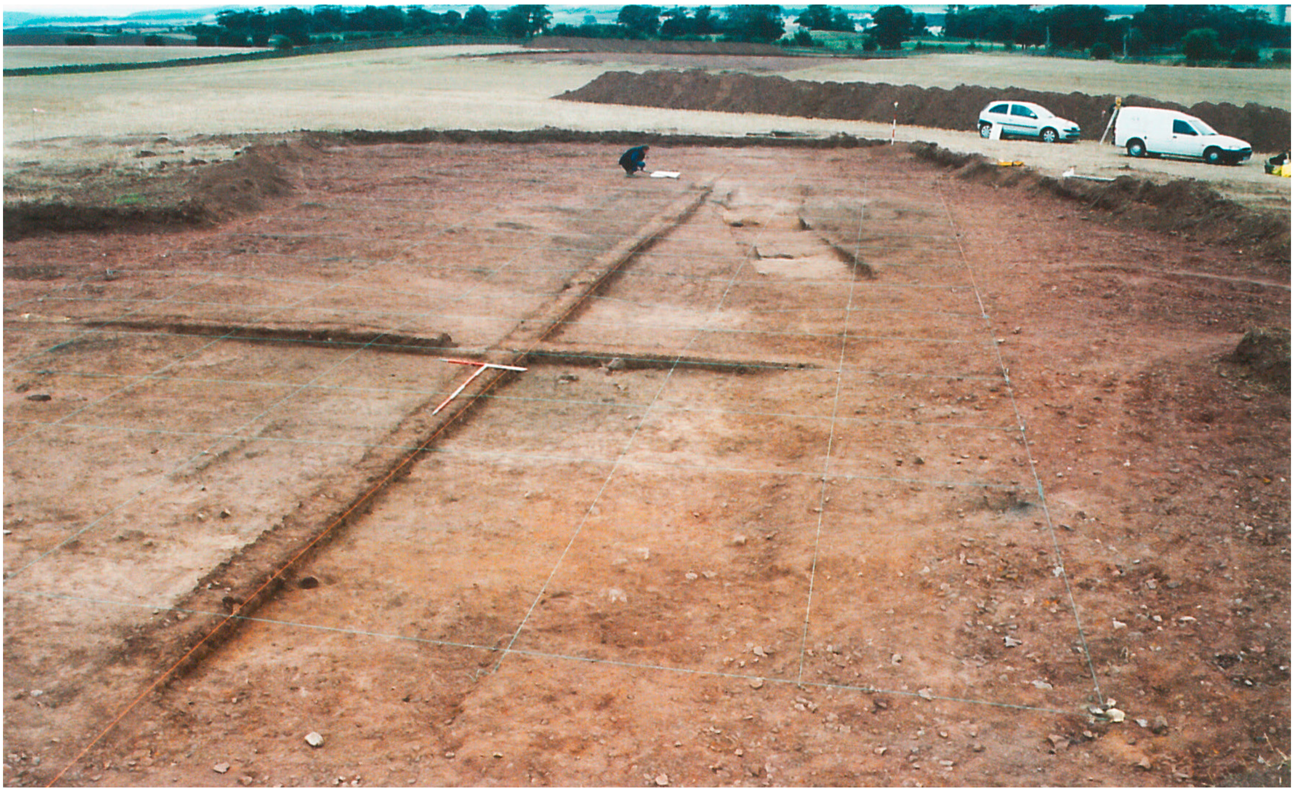
The term 'robust house' is used in this paper to describe the Mesolithic structure excavated at East Barns and is intended to denote a substantial construction associated with either long-term continuous occupation or perhaps recurrent but discontinuous use by a family-sized social unit. This is used to differentiate the dwelling from 'hut structure', which is used in reference to stationary but more provisional structures, built with more modest time investment (Fretheim 2017). The term 'house pit' is used to denote the below-ground archaeological feature that is part of the robust house rather than as a term for the house structure itself.

2.5 The dating of the robust house (Table 1)

A total of 11 AMS dates were obtained from structural features associated with the robust house (Illus 3). The dates were all derived from samples of charred hazelnut shell. Two of the dates were recovered from Hearth Feature 2677, seven from structural post holes (2505, 2593, 2660 and 2690), and two from

Table 1 The Mesolithic radiocarbon dates

Lab no.	Structure/feature	Context	Material	Species	uncal BP	Cal 1-sigma	Cal 2-sigma	$\delta^{13}C$ (‰)
SUERC-12060	2531	2531	charcoal	*Quercus* sp.	5970 ± 35	4903–4797	4949–4743	–25.2
SUERC-11041	2531	2531	charcoal	*Quercus* sp.	6005 ± 35	4939–4845	4991–4800	–26.5
AA-54961	2505	2506	nutshell	*Corylus avellana*	8830 ± 70	8185–7788	8229–7686	–24
AA-54962	2505	2506	nutshell	*Corylus avellana*	8835 ± 65	8186–7796	8226–7734	–24.3
SUERC-11054	2677	2678	nutshell	*Corylus avellana*	8865 ± 35	8198–9756	8218–7836	–24
SUERC-11042	2560	2555	nutshell	*Corylus avellana*	8870 ± 40	8201–7959	8224–7833	–25.3
SUERC-11050	2593	2601	nutshell	*Corylus avellana*	8895 ± 35	8207–7983	8229–7956	–21.5
SUERC-11055	2690	2691	nutshell	*Corylus avellana*	8920 ± 35	8228–7992	8241–7966	–25
SUERC-11051	2660	2661	nutshell	*Corylus avellana*	8935 ± 40	8241–7992	8252–7966	–21.5
SUERC-11053	2677	2678	nutshell	*Corylus avellana*	8940 ± 45	8245–7991	8261–7965	–23.5
SUERC-11043	2583	2571	nutshell	*Corylus avellana*	8970 ± 40	8274–8011	8281–7976	–25.1
AA-54960	2505	2506	nutshell	*Corylus avellana*	8985 ± 70	8286–7996	8307–7949	–23
SUERC-11052	2660	2661	nutshell	*Corylus avellana*	8990 ± 40	8279–8213	8290–7986	–22.6



Illus 3 Mesolithic and early Neolithic radiocarbon dates from East Barns

pits outside the house (2560 and 2583). A further two dates were obtained from occupation horizon deposits at the northern end of the hollow; these were derived from samples of oak charcoal.

The principal aim of the dating programme was to provide an absolute date for the house and to test the contemporaneity of the peripheral features. The lack of accumulated floor deposits occurring within the robust house at East Barns precluded the need for a more extensive dating regime.

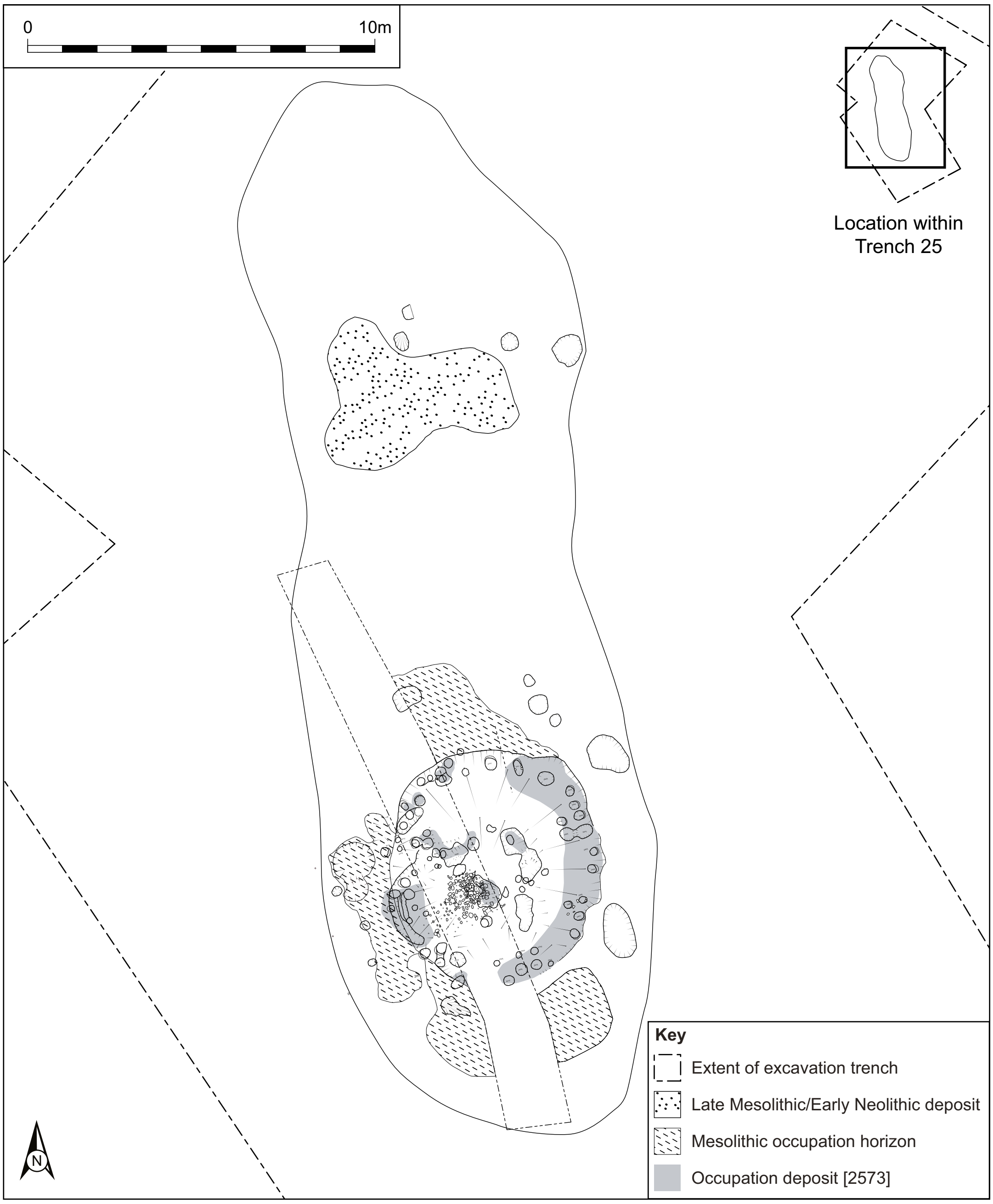
The samples directly associated with the robust house produced a tight cluster of dates restricted to the late 9th millennium BC, while the two samples obtained from the deposits at the north of the hollow were Late Mesolithic/Early Neolithic in date. Bayesian analysis of the dates from the house suggests that it was in use between 8278–8022 cal BC and 8200–7954 cal BC, and probably for a relatively short length of time of between 75 and 150 years (Donna Hawthorne pers comm).

3. THE EXCAVATION EVIDENCE: FEATURES AND DEPOSITS

3.1 Methodology

An area 1150m², centred on the hollow, was mechanically stripped of topsoil to the C-horizon or the first archaeological deposit encountered. All lower colluvial horizons and underlying anthropic deposits were subsequently excavated on a formal grid system (Illus 2). Individual grid squares (0.5m × 0.5m) were removed by spit or stratigraphic unit, thereby maximising data collection for artefacts and ecofacts.

A comprehensive sampling regime was employed during the excavation. Palaeoenvironmental and soil chemistry samples were retrieved from the full range of features and deposits associated with the house including occupation horizons, refuse deposits, the fills of features and lower colluvial horizons. The frequency and quantity of sample collection was determined by the significance of the context. In the case of features and horizons associated with the construction and occupation of the house, 50% of



Illus 4 The extent of the hollow

the deposit was retained. Elsewhere, the sampling of the infilling colluvial deposits was restricted to that of one grid square in eight. All spoil, other than that retained as samples, was processed on site with the use of a stationary 3mm wet-sieve in order to maximise artefact recovery.

3.2 The hollow

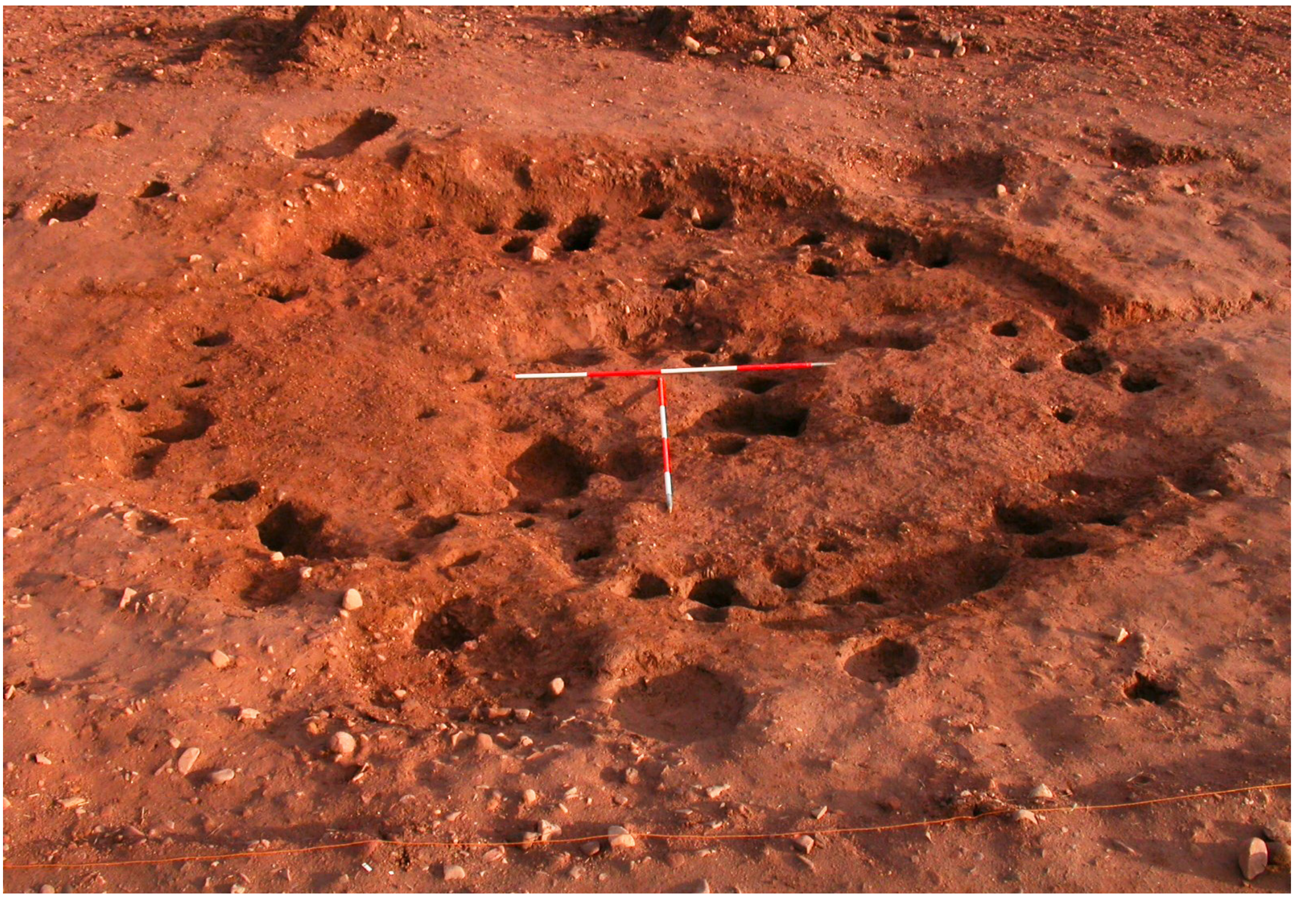
The removal of the topsoil by machine revealed the full extent of the hollow in which the robust house had been built (Illus 4). This natural ovoid-shaped feature lay within free-draining fluvio-glacial sands and gravels, and had been initially infilled with shallow colluvial deposits (Context 2544) representing an Early Holocene silting event (Ellis, Section 7 below). The hollow extended for a maximum of 31m north to south and by 9m east to west and was up to 0.5m deep.

The removal of the colluvial deposit (C2503) revealed two broad phases of underlying archaeological activity. In the north of the hollow lay a small group of Late Mesolithic and post-Mesolithic features including pits and a shallow occupation horizon (Illus 4). The Mesolithic occupation was concentrated within the southern portion of the hollow and consisted of the sub-circular house pit. Several contemporary occupation horizons and 13 pit and post hole features were also recorded around the immediate periphery of the house pit.

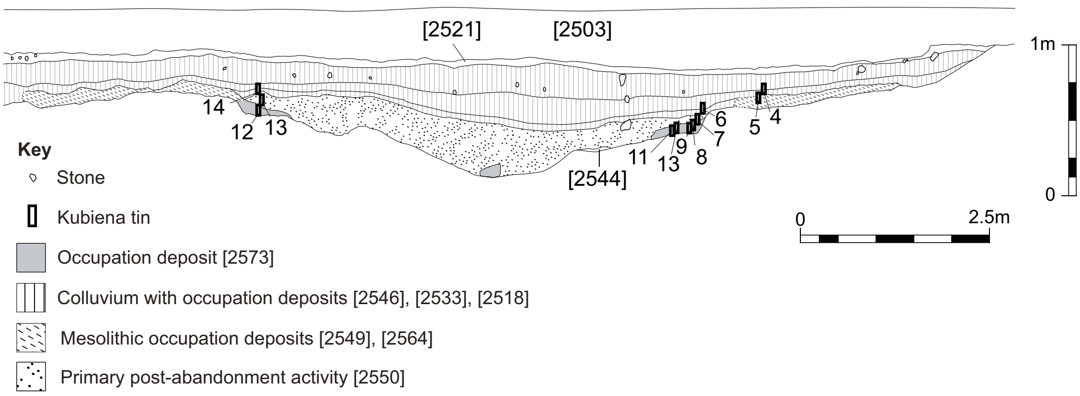
3.3 The robust house (Illus 5, 6 and 7)

3.3.1 The house pit

A large sub-circular pit which measured 6.8m north to south × 6.2m east to west, had been excavated into the sands and gravels, leaving a sharply defined and steeply sloping edge (Illus 5). This was especially visible along the northern and eastern perimeter, where it reached a maximum depth of 0.35m (Illus 6). The floor edge was less defined along the western



Illus 5 The Mesolithic house after excavation, looking E. The sharply defined E edge of the house pit is visible and in the foreground the cluster of postholes just outside an apparent hiatus in the post ring suggests the likely position of the entrance



Illus 6 W-facing section through the Mesolithic house (the vertical scale has been expanded to make the stratigraphy clearer)

perimeter, with the central portion in particular showing an apparent hiatus. Here the floor cut had been replaced with a worn, gentle gradient (Illus 7). A distinct realignment of the cut towards the interior of the hut was also visible along this section of the perimeter. This apparent hiatus, together with the attendant post hole/slot distribution, makes this the most likely position for a formally defined entrance (see below). At the southern end of the house pit a small segment of the perimeter had been truncated by the evaluation trench.

3.3.2 Post rings, entrances and post slots

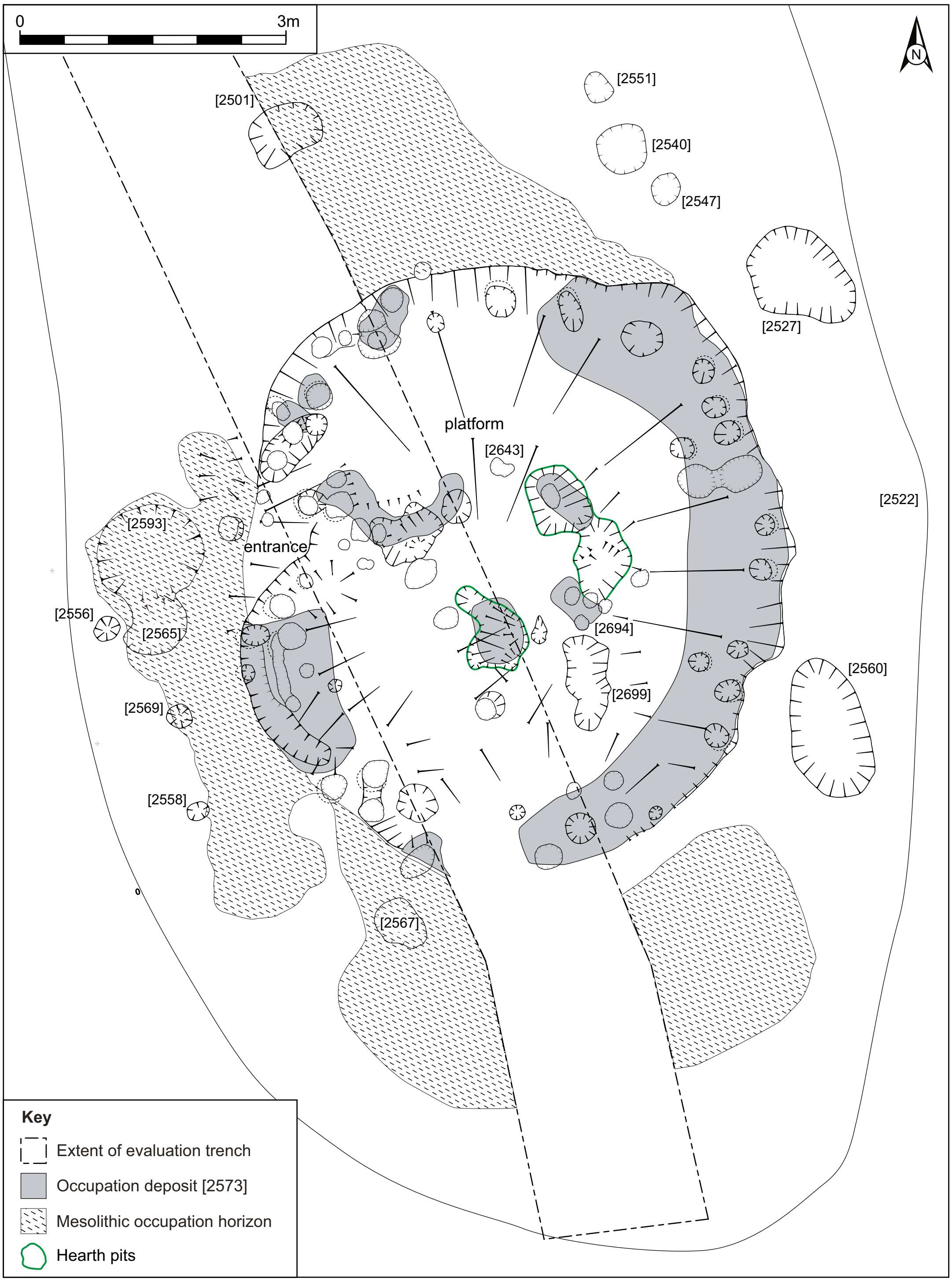
The excavation of the sunken floor revealed approximately 50 structural post holes. These features were arranged around the internal perimeter of the house pit forming two roughly concentric post rings (Illus 5). The outer post ring consisted of a near continuous line of post holes, while those along the inner post ring were more intermittently placed. The post holes varied widely in size, ranging from between 0.25m and 0.55m in diameter and up to 0.60m in depth. Upon excavation it became clear that the majority of the post holes associated with the post rings were angled inwards at approximately 6° towards the centre of the house (Illus 8). This would have created a steeply pitched roof. The area enclosed by the outer post ring would have provided a roughly circular living space some 28m^2 in area.

The post holes were filled with deposits of organic sandy silt containing charcoal, charred hazelnut shell and lithic material. The wood species represented in the charcoal suggests that hazel and oak posts were used; these had been occasionally packed in place by beach cobbles.

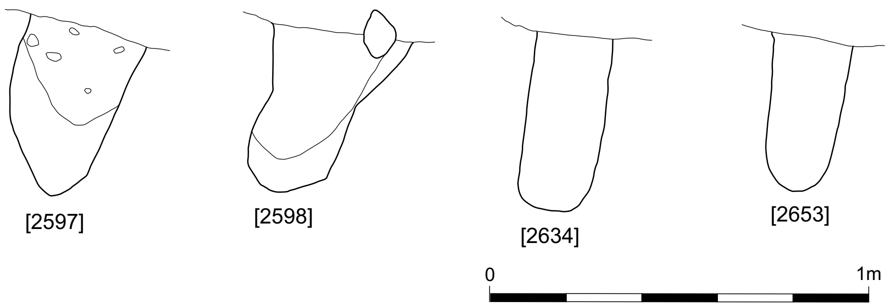
The majority of the larger post holes lay along the outer post ring. Given the generally smaller size and intermittent distribution of the post holes situated within the inner post ring, it is likely that these represent repairs or roof supports rather than representing a substantial rebuild of the structure. This is supported by their paired distribution and by the fact that several examples were intercut with those on the outer post ring (Illus 7). Two curvilinear post-slots were located on the south-western edge of the structure. The largest of these features (2659), appears to be a bedding trench and continues the line of the outer post ring along this side of the house.

The post rings were not continuous, and several hiatuses are apparent along the southern perimeter, one occurring within the area truncated during the evaluation. These gaps were initially identified as the possible entrance (Gooder 2007); however, there are two mitigating factors against this hypothesis. Firstly, both gaps were found to be sealed under the refuse deposit (2573) which appears to have built up during the occupation of the house (see below). It is likely that this deposit would have been eroded away during any use of the area as an entrance. Secondly, the gaps are associated with the vertically sloping cut of the house pit. Again, this shows little of the erosion likely to have been caused by repeated footfall.

A third hiatus within the post rings was observed along the western perimeter of the house. This



Illus 7 Plan of the Mesolithic house



Illus 8 Sections through selected postholes

gap was 1.5m across and coincided with both the terminated and realigned cut of the house pit, and with the gradual sloping of the ground surface into the interior of the house. This is consistent with the probable effects of erosion through footfall. The gap was flanked by a cluster of post holes including the 'door posts' (2592–2715), suggesting a formal entrance-way (Illus 5 and 7). The complex clustering of post holes associated with the entrance illustrates a degree of replacement and refurbishment. This is to be expected in an area of the house that would have been subject to the constant movement and interaction of its inhabitants over time.

3.3.3 The platform

A raised crescent-shaped platform lay within the northern and eastern perimeter of the house (Illus 7). The platform was most exaggerated to the north, where it lay approximately 0.30m above the ground surface occupied by the hearth pits clustered within the centre of the structure. It is likely that the platform was formed through the erosion of the ground surface surrounding the hearth pits by the constant movement of the inhabitants within this area.

3.3.4 The hearth pits and other internal furniture

Three large sub-triangular pits (2677, 2670 and 2680) were revealed clustered around the centre of the house. Chemical analysis (Inglis 2002: 8) revealed that all three pits provided a similar signature of high phosphate levels, and inclusions of charcoal and burnt bone; Pit (2677) also contained substantial lithic material. It is suggested here that these pits represent different phases of hearth use. Complex hearth arrangements appear to be a common structural component of such dwellings, occurring at both Echline Fields (Robertson et al 2013) and Howick (Waddington 2007: 43).

Unfortunately, the bone within the hearth pits was too fragmentary and poorly preserved to be identified to species. Phytolith analysis of the deposit in Pit 2677 suggested that the fuel used in the hearth consisted of hazel and oak, with smaller quantities of grass. The absence of cells associated with flowers or seeds suggests the fire was set in either early spring or late autumn (Madella 2002: 23). As with many of the internal features of the house, the hearth pits were partially covered by the refuse deposit (C2573). This is likely to have built up over the pits as they fell out of use and were replaced.

All three of the hearth pits appeared to be surrounded by a tripartite arrangement of post holes (Illus 7). These were slightly inclined towards the centre of the pits and it is conjectured that these features are the structural remains of a tripod set over the fire pit.

With the exception of probable Refuse Pit 2699 and Post Holes 2694 and 2643, no other interior furniture was observed (Illus 7).

The distribution of hearth pits and post holes also corresponds to the internal spread of the occupation deposit (C2573), and in effect defines a halo around the interior perimeter of the house, free of any occupation debris and internal furniture.

3.3.5 Occupation and post-occupation deposits

The occupation deposit (C2573) overlies many of the internal features of the house (Illus 6). This dark, organic material was especially concentrated along the eastern and south-western perimeters, where it reached a maximum depth of 0.13m (Illus

9). A more intermittent spread lay over the hearth pits and post holes described above. The deposit consisted of a mixture of sand and decomposed organic matter, including wood charcoal, charred hazelnut shell and ash. A large amount of lithic material was also present. The deposit was initially thought to be the remains of a turf wall (Gooder 2007), but this has subsequently been disproved by micromorphological analysis (Ellis, Section 7 below). The most likely explanation for its presence is that it represents an aggregation of domestic refuse that built up around the edges of the structure and over the interior furniture. It is conjectured that the deposit does not represent the actual living floor of the house; this would most likely have been a mixture of branch, bark or softer plant material (Grøn 2003: 695 – and see below). Rather, it is the probable remains of domestic refuse which has fallen through this flooring and been allowed to accumulate out of sight. The distribution of the deposit is telling, occurring as it does under the largely inaccessible eaves of the building and over internal pits and posts. Very little of the deposit was identified within the habitable areas of the structure. Instead, the material illustrates the presence of delineated activity areas that existed within the house (see Engl, Section 6 below). A similar deposit was recorded at the Echline Fields house site around the southern and northern edges of the structure. This was again thought to be the remains of turf walling (Robertson et al 2013: 81).

The absence of 'occupation floor' deposits such as those produced at both Echline Fields (Robertson et al 2013: 81) and Howick (Waddington 2007: 37) can possibly be explained by the shorter period of occupation represented at East Barns. The houses at both Howick and Echline Fields were occupied over a much longer timescale, and there is evidence of periodic reoccupation at both sites seen in the construction of new floor surfaces, most probably to repair the effects of erosion produced during former periods of occupation.

Illus 9 The house and hollow under excavation, looking N. The occupation deposit (2573) has been partially removed but its depth across the house is still visible

The occupation deposit was sealed in turn by a colluvial deposit of sandy silt (C2550). This completely infilled the house pit to a maximum depth of 0.30m (Illus 6). The silt was heavily bioturbated and contained a significant amount of charcoal and charred hazelnut shell. Narrow-blade lithic material was also present in substantial quantities. It is probable that this deposit represents material initially washed into the house area from surrounding occupation horizons now lost to the plough.

Overlying Deposit 2550 was a succession of mixed, bioturbated colluvial deposits (Contexts 2546, 2533, 2518) containing inclusions of worked lithics, rock fragments, burnt hazelnut shell fragments and charcoal. As with the underlying silt (C2550), it is probable that this anthropic material was incorporated into the colluvium through natural agency. The material may have been washed into the area of the house from remnant midden deposits surrounding the natural hollow. However, all three colluvial deposits are stratigraphically later than the occupation horizons surrounding the house. This makes it more likely that the anthropic material reflects continuing activity around the hollow, the debris of which gradually washed into the hollow throughout the Mesolithic.

3.3.6 Peripheral occupation horizons and cut features

Immediately surrounding the house to the north, south and west was a spread of occupation debris (Contexts 2561, 2564, 2549) (Illus 6 and 7) which consisted of compact sand, lithic material and charcoal flecks some 0.10m in depth. The lack of such an occupation deposit to the east of the house is explained by the limited extent of the hollow in this direction. It is likely that modern ploughing would therefore have removed any such in situ deposits, although several cut features containing Mesolithic material did survive on this side of the house (Illus 7).

These features consisted of a probable fire/cooking pit (2527), and two refuse pits (2560 and 2540), all of which produced a substantial amount of lithic material, charred hazelnut shell and fragments of burnt bone. Two post holes (2551 and 2547) were also recorded situated on either side of Pit 2540. To the north and east of the house, the occupation horizon sealed Refuse Pits 2501, 2593 and 2565 together with several smaller probable post hole features. All of the pit features produced a recurring assemblage of lithic material, charred hazelnut shell and fragments of burnt bone.

The masking of these features by the occupation horizon associated with the house reveals an initial phase of Mesolithic activity within the hollow. This activity may be associated with the very early life of the house which occurred before continued occupation could create more substantial horizons of cultural material.

4. THE LITHIC ASSEMBLAGE

4.1 Introduction

The excavations undertaken at East Barns produced a total of 30,142 lithic artefacts. The overwhelming majority of these were directly associated with the house and its surrounding deposits. The assemblage was retrieved by a combination of hand excavation and the on-site wet-sieving of all excavated deposits. This enabled a near 100% retrieval of artefacts to be undertaken. A more detailed description is given in the site methodology.

All material was catalogued using the typologies established during the excavations undertaken at Kinloch, Rhum (Wickham-Jones 1990) and the Southern Hebrides Mesolithic Project (SHMP) (Finlayson et al 2000). Information was also shared with the contemporary excavation at Howick, Northumberland (Pedersen 2007). This enabled a greater degree of standardisation to be employed for technical terms and descriptions.

4.2 Lithic raw materials

The lithic assemblage was dominated by flint (85%), with various supplementary materials such as cherts (8%), chalcedonies (1%) and quartz (5%) (Table 2).

This range of raw materials is common to Mesolithic sites along the east coast of Scotland such as Morton, Fife (Coles 1971), Cramond (Lawson 2001; Saville 2004) and Echline Fields (Robertson et al 2013). At East Barns the raw materials appear to be derived from the immediate locale. Here glacial tills overlie carboniferous sedimentary rocks of sandstones, shales, grits and limestones, materials rich in chalcedonic silicas (Bown & Shipley 1982).

Some caution must be applied in the identification of the raw materials recovered given the large percentage of fine fraction material present within the assemblage. It is notable that many of the cherts and chalcedonies are fine-grained and 'flint-like' in form. Therefore, a general macroscopic analysis of the material will likely provide potential for misidentification (Saville 2004: 213). Wickham-Jones & Hardy (2004: 20) have reported that this often happens where a wide variety of chalcedonic silicas occur within a single vicinity. At the excavation of the Mesolithic site of Camas Daraich on Skye (Wickham-Jones 2004c) this problem was alleviated by cataloguing all such material as generic chalcedonic silica. At East Barns most of the larger pieces were easily identifiable and as such a more precise identification was attempted in cataloguing the assemblage while recognising the probability for mistakes in the smaller fractions.

4.2.1 Flint

Flint dominates the assemblage (25,553 pieces/85%) and is generally fine-grained and of relatively good quality. Most of the flint appears to have been derived from small to medium sub-angular nodules with a smooth, hard cortex. Unlike sites such as Killellan Farm (Saville 2005: 99) where numerous such nodules were retrieved, only one intact example was recovered. Information on the types of flint nodules used at East Barns must therefore be gleaned by adding the 10 struck or tested pieces, together with inferences gathered from the 16 split nodules and the core types (see Section 4.4, Primary technology).

Due to the irregular shape and small size of the

Table 2 The lithic assemblage: raw materials

	Flint	Chert	Chalcedony	Quartz	Quartzite	Other
Debitage	24132	2333	303	1542	33	1
Pebbles	28	6	3	73	4	1
Cores	390	63	11	53	1	0
Retouched	288	37	11	4	0	0
Microliths	379	67	11	0	0	0
Scrapers	336	20	9	3	0	0
Totals	25553	2526	348	1675	38	2

nodules, many of the pieces show signs of cortication. Using the SHMP classificatory system for describing condition, this allowed 1,116/4% of the flint within the assemblage to be assessed. The majority of these pieces (956/85.6%) showed the presence of hard, smooth, water-rolled cortex, although occasional pieces were chalkier in appearance. These water-rolled artefacts were most probably obtained from the nearby shoreline. The remaining pieces (160/14.3%) had the pitted appearance characteristic of glacial flint obtained from local till deposits. Very few pieces were abraded, and this is probably a result of the site having escaped modern farming activity. Flaws were evident in many of the larger pieces in the form of voids, fossils and other impurities which often altered the shape of the nodule significantly and in the case of core pieces frequently led to their early abandonment (see Section 4.4, Primary technology).

The flint in its fresh state (7,373/29%) is generally pale to medium grey in colour. Smaller quantities of yellow, red, brown and translucent dark brown flint redolent of chalk-borne deposits are also present. Patination occurs in 4,501/18% of the pieces. This ranges from slight cream-coloured 'blooms' to a matt white. In some extreme cases this appears to have led to a loss of both weight and texture.

The flint is undoubtedly local in origin. Although mainland Scotland has an apparent lack of in situ flint deposits, flint pebbles have a widespread distribution around the coast. Significant chalk deposits are also known to underlie the North Sea (Gemmell & Kesel 1977: 66). Similarly, glacial till deposits containing flint, such as the Buchan gravels, are also known. The erosion of these sources by marine and glacial action (Piggott & Powell 1949: 160) has led to the creation of many such derived deposits along the length of the east coast, with a concentration known to exist in the East Barns locale (Wickham-Jones & Collins 1978). These flints are often characterised by their small size, grey and yellow colouration (Gemmell & Kesel 1977: 66) and common flaws and irregularities (Wickham-Jones 1986: 1).

It is likely that the majority of the assemblage is composed of material that was previously eroded into the sea from the local glacial till and then redistributed on the shoreline. The tendency for such till deposits to be mixed with other materials (Wickham-Jones 1986, 2) such as chert, chalcedony and quartz would support this origin given the noted similarities in their size and condition. A smaller proportion of the flint may also have been derived from submerged chalk deposits and from tills that are also now covered by the North Sea. Other sources of raw material would include locally available river cuts and exposures. The evaluation of the site area undertaken in 2001 also revealed raised beach deposits located to the south-east of the excavation area bordering the present-day dune system. However, these were probably not contemporary with the site. Numerous small and medium-sized flint nodules can still be obtained along the coastline at East Barns. These nodules probably represent the ongoing erosion of both submerged and coastal deposits.

Approximately 49% of the flint assemblage appears to have undergone some form of heat alteration such as a colour change, crazing and fracturing. There is the possibility that this percentage may be even higher. In experimental work on the heat treatment of flint undertaken at Kinloch, Rhum (Finlayson 1990a: 53) many intensely heated pieces were found not to display such visible evidence.

4.2.2 Chert

Chert is the most common of the supplementary raw materials used at East Barns (2,526/8%). The material assessed (182 pieces), showed that a slightly higher proportion of chert than flint appeared to have a pitted exterior surface (34.6%/63). This would suggest that a greater proportion of the chert was acquired directly from the local glacial tills. However, the majority was again most probably obtained from the shoreline. The 106 primary pieces suggest that in common with the other raw materials, initial decortication and reduction took place on site.

Chert occurs throughout Scotland and is particularly common in the Southern Uplands. This material not only forms a major component of inland Mesolithic assemblages across the Scottish Borders and south-west Scotland (Mulholland 1970; Affleck 1986; Finlayson 1990b; Saville 1994; Warren 2005) but also appears to dominate Mesolithic coastal assemblages along the Forth (Robertson et al 2013; Saville 2008; Engl 2012).

The majority of the chert within the assemblage can be described as being of 'Southern Uplands' type. This is often fine-grained and 'flint-like' and has a wide range of colour variations from a common blue-grey to grey-green, brown and dark purple (Ballin & Johnson 2005).

Chert, like flint and chalcedony, is a silicate found in calcareous sedimentary rocks and occurs in stratified or nodular forms. Like flint, the distribution, colour and form of chert is affected by post-diagenetic factors and fine-grained cherts such as the Southern Uplands type can be found in all carboniferous limestones (Hind 1998: 1). Nearby Chapel Point has been recorded as a prominent source of small dark grey chert lenticules found in limestone (Wickham-Jones & Collins 1978: 14). Numerous small nodules of chert were observed both on the present-day shoreline and within the till deposits encountered during the archaeological works at East Barns. There is evidence in southern Scotland that cherts were obtained from both primary and derived sources (Saville 1994: 59), with several quarry sites being identified within the region (Warren 2007: 146).

As with the flint, the chert assemblage is affected by the presence of numerous flaws and inclusions. Fifty-one pieces were identified as heat affected. The burning of the chert resulted in the discoloration of the pieces together with an increased friability. As with flint, experiments in the burning of chert have generally shown an absence of discoloration. However, it may be that such a change occurs some time after the initial burning (Ballin & Johnson 2005: 63).

4.3 Quartz and quartzites

Quartz accounted for 5.5% (1,675 pieces) of the total assemblage, with a small amount of quartzite (0.03%/38) also present. The quartz can be characterised by a light grey translucence, a fine grain, and a generally good conchoidal fracture. Out of the total of 1,675 pieces only 178 (10.6 %) were friable and coarse grained. The quartzite pieces on the other hand are medium grey to pale brown in colour and are generally of a quite coarse grain. Where an outer skin was present both materials appeared water-rolled. This was visible on 34.6% (580 pieces) of the material. Like many of the other raw materials present at East Barns, the quartz/quartzite was obtained locally, either from the shoreline or raised beach deposits, or from nearby riverine sources. Quartz nodules are today fairly common, both within the till and on the shoreline.

Quartz is found as a common supplement to flint on a wide range of prehistoric sites throughout Scotland, with an understandable preference for finer quality material. Wickham-Jones (1986: 30) states that quartz was generally used only where other, more easily worked, materials were not available. This hierarchy of materials appears not to have been as prevalent or as rigid at East Barns. Here, the high quality of the quartz, combined with its ready availability and the general small size of nodules of all material types made its collection and subsequent use attractive.

4.3.1 Chalcedony

Only 348 (1.1%) pieces of chalcedony were recovered. This is probably a slight underestimation given the problems in identification explained above. As with the flint and chert, the chalcedony occurred in nodular form, with evidence of water-rolled skin present on 14% (50 pieces) of the material. Pitted pieces accounted for 11% (38 pieces). This is slightly higher than the flint and chert and may indicate a greater exploitation of this material from within the glacial till.

The chalcedony appears in a variety of colours and forms. The majority appear homogeneous and fine-grained. They are largely pale grey in colour with a distinct waxy lustre. Other types include pink and banded agates and jasper.

4.3.2 Other materials

Two other raw materials were present within the assemblage. These consisted of a small piece of silicified limestone and a fragment of fossil wood. Both are known supplementary materials on Mesolithic sites.

4.4 Primary technology (Table 3)

4.4.1 Introduction

The assemblage contains numerous cores and debitage classes relating to artefact manufacture.

Table 3 The lithic assemblage: character of debitage

	Flint	Chert	Chalcedony	Quartz	Quartzite	Other	Total
Flakes	7050	973	147	384	23	0	8577
Regular	2181	374	62	130	6	0	2753
Irregular	4583	551	80	240	17	0	5471
Primary	650	87	20	66	0	0	823
Secondary	1576	105	26	92	2	0	1801
Tertiary	4537	734	95	212	21	1	5600
Bipolar	13	1	0	7	0	0	21
Fragments	262	43	5	5	0	0	315
Spalls	12	2	0	1	0	0	15
Rejuvenation flakes	249	42	9	2	0	0	302
Blades	1175	151	27	0	0	0	1354
Primary	5	0	0	0	0	0	5
Secondary	185	12	3	0	0	0	200
Tertiary	985	139	24	0	0	0	1149
Small fraction	14433	765	80	713	0	1	15992
Primary	64	4	0	27	0	0	95
Secondary	227	10	9	15	0	0	261
Tertiary	14142	751	71	671	0	1	15636
Chunks	1215	398	40	324	10	0	1987
Fragments	9	3	0	120	0	0	132
Cores	390	64	11	52	1	0	518
Platform	337	51	10	21	1	0	421
Bipolar	42	7	1	30	0	0	80
Amorphous	11	5	0	1	0	0	17
Pebbles	2	3	3	9	1	1	19
Tested pebbles	10	0	0	21	0	0	31
Split pebbles	16	3	0	43	3	0	65

This material reflects the initial stages of the *chaîne opératoire* at East Barns. A number of analyses were undertaken in order to obtain a more detailed picture of the assemblage and its character. These analyses were based on those undertaken in the SHMP (Finlayson et al 2000). As a significant percentage of the assemblage was recovered from redeposited contexts infilling the area of the house it was decided to target the in situ occupation deposits both within and immediately surrounding the structure in order to produce as uncontaminated a sample as possible. The analyses focus on the core, blade/flake and fine fraction categories.

4.4.2 Pebbles, split pebbles and tested pieces

As mentioned within the Raw materials section (4.2 above), a variety of unmodified and tested pebble artefacts were recovered. These included 28 made on flint, six on chert, three on chalcedony and 73 on quartz (Table 3). The nodules were of a generally small size and largely water-worn.

A mean size of 39.4mm × 32.7mm × 21.2mm was calculated for the 12 whole and tested nodules. This is at the threshold for undertaking successful platform core knapping (Marshall 2000). It is probable that the platform cores found within the assemblage would have utilised a range of larger nodules than is represented here (see below), as they often display a range of dimensions that exceeds those of the pebbles. A search of the present shoreline found pebbles that ranged from very small to hand-sized examples, and this is probably representative of the range of flint nodules exploited at East Barns during the Mesolithic. It is likely that the nodules recovered from the assemblage were gathered during general collections of raw materials, possibly as part of the daily round, in which selection criteria such as size were low. These pieces were then later examined and tested before being discarded as unsuitable for further working.

Sixteen split flint pebbles were also retrieved; these pieces represent the opening of rounded pebbles/nodules on an anvil using a direct hard-hammer technique (see below). The mean length of 33.4mm given by these pieces appears to reinforce the general small size of the flint available within the locale. However, the subsequent lack of reduction suggests that these too were abandoned due to lack of size.

Those pieces made on chert and chalcedonies were also generally small in size. These pieces gave a mean weight of 9.2g and a mean size of 24.7mm × 21.2mm × 14.4mm and 24.7mm × 18.1mm × 16mm respectively. These sizes compare favourably with nodules recovered from the plough-soil within the vicinity.

A far greater proportion of quartz pebbles (0.02%/9), tested pieces (0.07%/21) and split pebbles (0.14%/43) were recovered from the assemblage than from the other raw materials. This undoubtedly reflects the prevalence of this material within the local till soils. In addition, a single pebble and three split pebbles of quartzite were also recovered. The quartz and quartzite exhibited a far greater size and weight range. However, the mean recorded size and weight was only slightly larger than those of the other raw materials. The quartz pebbles produced a mean size of 39.5mm × 33.9mm × 25.4mm.

The high proportion of split pebbles reflects the use of bipolar knapping as the favoured technique for working this material.

4.4.3 Cores (Tables 4a, 4b and 4c)

A total of 518 cores and core fragments were recovered. These occurred in all of the main raw materials (Table 2), with those in flint being the most numerous (*n* 390), followed by chert (*n* 63), quartz (*n* 53) and chalcedony (*n* 11). A single quartzite example was also retrieved.

Blade, flake and non-specific platform cores dominate the flint, chert and chalcedony components, followed by smaller numbers of bipolar and amorphous flake types. This is reversed in quartz, where the more intractable nature of the material means that the bipolar technique is more frequently utilised (Table 3).

The general characteristics of each core were recorded including dimensions, weight, number of platforms and extent of working. This information is summarised in Tables 4a, 4b, 4c and 5.

As the material from the infilling of the structure was possibly contaminated with material from other periods, a more detailed technological analysis was restricted to the 96 cores recovered from the in situ Mesolithic occupation horizons (Contexts 2549, 2561, 2564 and 2573) surrounding the structure. The attributes, stages and dimensions of this sample

Table 4a Platform core types

Material	Platform type							
	Single	Opposed	Multi (3)	Multi (4)	Multi (5)	Fragment	Carinated	Totals
Flint	196	73	30	6	1	19	11	336
Chert	36	7	4	2	0	2	0	51
Chalcedony	5	5	0	0	0	0	0	10
Quartz	20	1	0	0	0	0	0	21
Quartzite	0	0	0	0	0	1	0	1

Table 4b Median core dimensions

Material	Core type		
	Platform	Bipolar	Amorphous
Flint	23.93/21.4/15.51	23.3/13.47/9.61	23.3/21.5/16.9
Chert	25.0/23.61/19.5	26.9/14.7/9.95	30.9/28.86/21.74
Chalcedony	26.96/25.11/16.6	0	0
Quartz	24.4/27.9/21.4	20.8/13.2/7.9	0

Table 4c Median core weights

Material	Core type		
	Platform	Bipolar	Amorphous
Flint (*n*)	9.54	3.66	10.74
Chert (*n*)	17.09	4.01	30.22
Chalcedony (*n*)	23.84	13.90	0.00
Quartz (*n*)	26.70	4.75	178.44(1)

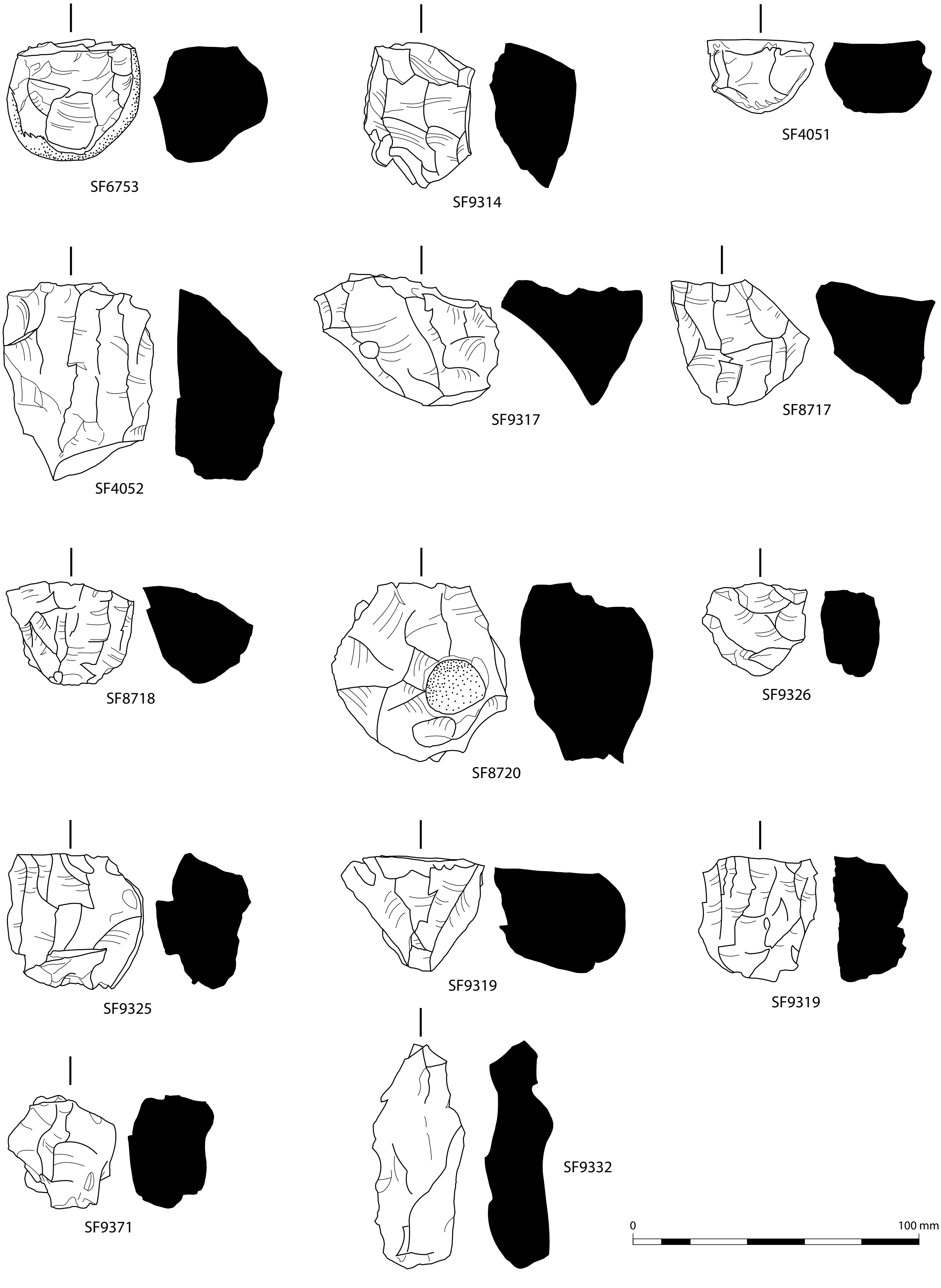
are given in Tables 6a–6e. This sample was also taken in order to maximise evidence for spatial patterning. A selection of core types is illustrated in Illus 10.

The distribution of core types is described and discussed in Section 4.6 below, Spatial analysis and material distributions.

General character

Most of the cores are assumed to have been produced on split or quartered nodules opened through the use of a hard hammer and anvil. Nevertheless, there are examples of platform cores also utilising the flat inner surface of thick primary flakes.

Single platform cores dominate in all raw materials with the exception of chalcedony (Table 4a). Flint provided 196 single platform cores, and a further 73 dual platforms. The majority of these were opposed in form. Multi-stage cores account for 37 pieces, including 30 triple-stage, six four-stage cores and a single five-stage example. This is repeated to a lesser degree in chert, where four triple-stage and two four-stage cores were recorded in a total of 49 whole examples. Chalcedony provided 10 complete cores, equally split between single and dual platform types. Finally, quartz presented 20 single platform cores and one dual platform example.



Illus 10 Platform cores and bipolar cores (SF 9371 and SF 9332) (flint unless otherwise indicated)

Bipolar worked cores were the second most numerous core type (Table 3), producing 42 examples in flint and 30 in quartz. Others were also made on chert (*n* 7) and chalcedony (*n* 1). The majority of these cores show the characteristic signatures of this reduction technique, including scalar flake removals from both ends of the nodule and crushed impact scars (Illus 10 – SF 9371). The cores included classic thin residual types (Illus 10 – SF 9332) with scalar scars and less regular, unifacial and bifacial examples. It is likely that the majority of the bipolar cores made on both flint and chert were the result of a deliberate decision to further extend the productivity of platform cores (see below).

Many platform cores exhibit signs of damage consistent with reduction on an anvil. This damage did not seem to produce any sizeable flakes, and this suggests that these are possibly residual marks in many cases, derived from an initial opening or striking of the nodule on an anvil.

Seventeen amorphous cores are recorded within the assemblage, 11 on flint, five on chert and a single example on quartz. Amorphous cores reflect an *ad hoc* and uncontrolled knapping strategy designed to produce flakes from any suitably sized pieces.

The general dimensions and weights of all 516 cores within the assemblage were recorded. This illustrated that those platform cores made of flint were the smallest in both dimensions and weight (Tables 4a and 4b) and were therefore likely to have been the most heavily worked. This was illustrated by work on the core sample derived from the in situ occupation deposits discussed below. Chert cores were next in size, followed by chalcedony and quartz. Amorphous cores in all materials were the largest, again reflecting the *ad hoc* nature of their reduction.

Bipolar worked cores were the smallest by weight. However, their mean lengths were consistent with those given by both the platform cores in both flint and chert. This perhaps illustrates that these pieces were initially platform cores, whose utility was extended by the subsequent use of the bipolar technique. Bipolar reduction would provide flakes from both ends of the core but would leave the length of the piece relatively unaltered. Three platform examples (two in flint and one in chert), showed visible evidence of being reworked by the bipolar technique. The smallest bipolar examples in both weight and dimensions were made on quartz. This suggests that bipolar reduction was the primary reduction technique used to work this material at East Barns.

The percentage of worked platform area (Table 5) shows a similar pattern of usage. This again shows flint as being the most intensively worked material, with 87 out of 269 examples revealing a worked platform of over 75%. The 37 flint cores with a completely worked platform include 11 very small carinated examples. The majority (*n* 148) were worked at around 50% with a further 34 worked at 25% and under.

Of the total 390 flint cores, 80 were in a fresh condition with 107 showing some signs of patination and a further 116 appearing heat affected. A further 72 had significant cortex present showing a smooth, rolled appearance.

*Core sample (**n** 95)*

Of the 95 cores recovered from the in situ Mesolithic occupation deposits, 81 were made on flint with a further nine on chert, three on chalcedony and two on quartz (Table 6a). Blade platform types predominate (*n* 38), with the majority being either

Table 5 Platform cores as percentile of worked platform

Material	Platform type			
% area worked	25%	50%	75%	100%
Flint	34	148	50	37
Chert	6	20	10	7
Chalcedony	3	4	0	3
Quartz	4	11	2	3
Quartzite	0	0	0	0

Table 6a Selected occupation deposits: core attributes

Probable reasons for abandonment	Flint	Chert	Chalcedony	Quartz
Indeterminate	2	0	0	0
Size	46	3	3	2
Flaws	7	2	0	0
Overshot	1	0	0	0
Stepping/hinging	17	4	0	0
Angle	1	0	0	0
Stepping/hinging and angle	7	0	0	0
Cortex type				
None	27	1	0	2
Smooth/chalky	4	0	0	0
Smooth/hard	37	6	2	0
Pitted	9	2	0	0
Battered	4	0	1	0
Estimate of pebble size				
Indeterminate	34	1	0	0
Small	44	7	2	2
Medium	3	1	1	0
Large	0	0	0	0
Angularity/sphericity				
Indeterminate	43	1	0	2
Angular (nodular)	13	7	1	0
Sub-angular	17	1	2	0
Sub-rounded	6	0	0	0
Rounded	2	0	0	0
% of platform area				
< or *c.* 25%	17	2	1	2
< or *c.* 50%	36	6	2	0
< or *c.* 75%	20	1	0	0
< or *c.* 100%	8	0	0	0

Table 6b Selected occupation deposits: core stage attributes

Type	Flint	Chert	Chalcedony	Quartz
Bipolar	10	0	0	2
Blade platform	35	2	1	0
Flake platform	16	3	2	0
Non-specific platform	19	4	0	0
Amorphous	1	1	0	0
Platform type				
Unprepared	16	0	0	2
Simple preparation	65	9	3	0
Complex preparation	0	0	0	0
Lost	0	0	0	0
Predominant removal				
Indeterminate	13	1	0	0
Flake	21	4	2	2
Blade	35	1	1	0
Mixed	12	3	0	0
Negative bulb				
Not present	27	2	2	0
Marked	44	4	1	0
Diffuse	10	3	0	0
Flake/blade scar dimensions				
Mean length	21.81	17.11	17.36	0
Standard deviation length				
Maximum length	39.7	26.5	20.2	0
Minimum length	5.6	7.5	15.5	0
Mode length				
Mean width	9.69	9.82	9.13	0
Standard deviation width				
Maximum width	19.8	16.3	12.2	0
Minimum width	3	5.3	4.2	0

Table 6c Selected occupation deposits: platform type by stage

	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Bipolar	0	15	0	0	0	0
Blade platform	14	1	14	6	3	0
Flake platform	8	0	9	3	0	1
Non-specific platform	5	0	13	5	1	0
Amorphous	0	2	0	0	0	0

Table 6d Selected occupation deposits: bipolar core dimensions

	Bipolar			
	Length	Width	Thickness	Weight
Mean	23.15	13.25	8.3	2.92
St. Dev.				
Max.	40	18.5	12.4	5.47
Min.	17.2	7.7	4.2	1.18

single stage (*n* 14) or dual stage (*n* 14). A further nine are recorded as multi-stage pieces (Table 6c). The blade platform cores range in form from classic conical examples to more simple types with limited removals. Non-specific platforms (NSP) (*n* 24) and flake platforms (*n* 21) follow. The majority of NSP cores are double (*n* 13) or multi-stage (*n* 6). Only five of this core type was single-stage. NSP cores therefore would appear to represent a strategy employed to extend the utility of the core through a change in emphasis from blade production to the less restrictive creation of serviceable flakes. Flake platform cores provide eight single stages, nine opposed and four multi-stage examples, one of which has five stages. Twelve bipolar cores and two amorphous flake cores were also recorded all on flint, with the exception of two bipolar cores made on quartz and one amorphous core on chert. It is suggested that bipolar reduction was used to both extend core utility in flint and to more successfully utilise the more intractable quartz component of the assemblage.

As with the data garnered from the general core assemblage (Table 5), the majority of the sample had a worked platform area of approximately 50% (*n* 44). A further 21 were worked around 75% and eight were completely worked. Twenty-two cores were worked at 25% and less (Table 6a). This suggests that cores were often not worked to exhaustion but may have been abandoned for a variety of other reasons, such as internal flaws.

The evidence from the core sample would suggest that the majority of the parent nodules were relatively small in size (*n* 55). Bipolar cores were the smallest of the core types, given that the majority of these represent the final stage of platform worked cores (Table 4a). Of the platform types, single-stage cores had both the smallest average dimensions and weight followed by opposed and multi-stage types (Table 4b). Though the differences are not great, it would suggest that the larger of the collected nodules were the most intensively worked. Nevertheless, only five cores were judged as coming from medium-sized nodules and the average size of the raw material appeared generally small.

The suggested shape of these nodules was angular (nodular) (*n* 21) or sub-angular (*n* 20) with only six sub-rounded and two rounded. Forty-six pieces were recorded as indeterminate (Table 6a).

Sixty-five of the cores had visible cortex (Illus 10 – SF 6753), unsurprising given the general size and proposed angularity of the parent nodules. The

Table 6e Selected occupation deposits: platform core dimensions

	Single				Opposed				Multi			
	Length	Width	Thickness	Weight	Length	Width	Thickness	Weight	Length	Width	Thickness	Weight
Mean	24.8	20.77	16.61	10.51	28	22.63	18.21	17.18	26.49	22.71	18.73	13.05?
St. Dev.												
Max.	40.2	30.4	27.8	42.04	46.2	58.8	39.2	125.2	33.5	28.5	32.3	23.74
Min.	6	8	8.2	1.8	20.3	8.7	10.7	4.44	16.4	16.5	14	5.18

cortex was smooth, hard and water-rolled on 45 examples. Four presented a similarly smooth yet soft and chalky cortex. A further 11 had the pitted cortex characteristic of a nodular, glacial origin. Five were battered in appearance (see Section 4.2, Lithic raw materials).

The apparent small size of the raw material was probably a major restriction to reduction. In estimating the most probable reason for the abandonment of the cores, size was the most frequent, accounting for 54 of the pieces (Table 6a). This was followed by stepping/hinging (*n* 21), inherent flaws within the material (*n* 9) and stepping/hinging and angle (*n* 7). A single core was overshot. In two examples the cause was considered indeterminate.

Preparation of the core platforms appears to have been restricted to the simple trimming of the platform edge in order to remove spurs and overhangs caused by previous removals (Table 6b). Platforms are largely restricted to the utilisation of a flat surface produced through the initial splitting or flaking of a nodule. This was noted on 77 of the cores, with a further 18 relying simply on the cortical surface of the nodule itself.

The most frequent removal is that of blades (*n* 37) followed by flakes (*n* 29) and then mixed blades/flakes (*n* 15). A further 14 are indeterminate. It is noted that both regular and more scalar type flake removals are present especially on those cores with more than a single stage. These scalar type removals may reflect the working of the core on an anvil.

Negative bulbs present on the cores are largely marked (*n* 49), with only 13 being recognised as diffuse.

The average measurable length of removals is 21.81mm for flint blade/flake scars. Both chert and chalcedony are smaller, at 17.00mm and 17.36mm respectively.

Nodules, split nodules and tested pieces

The evidence from the pebble, core and blank analyses undertaken at East Barns suggests that the assemblage is derived from the working of relatively small, locally available, nodular raw materials. The reduction of these materials is visibly hierarchical in form. Flint is the most numerous and most intensively worked raw material, followed by chert, quartz and chalcedony.

The pebbles and tested pieces recovered from the excavation are not numerous and can be defined by their small size. In many cases the given dimensions are smaller than those of the cores within the assemblage and suggest that these pieces represent material initially brought onto site and later rejected as either too small or flawed for further reduction.

Core reduction

The high frequency and technological attributes of both cores and core-related debitage suggest that the primary reduction of all raw materials was undertaken on site through a variety of techniques, with the majority worked from platforms. Most of these platforms consisted of the flat surfaces created by the splitting of nodules with the implied use of an anvil.

Though the platform working of cores is dominant in all materials with the exception of quartz, there is distinct variability within the primary technology of the assemblage. This is illustrated by the significant presence of the bipolar technique and more amorphous flake core types. It is probable that the relationship between the identified range of reduction strategies is more complicated than is suggested in this report. A high degree of flexibility was probably employed, in order to maximise the productivity of the small nodular material.

The bipolar technique was used to extend the productive life of both the flint and chert cores and appears to have often been the final recognisable stage of core reduction. Although quartz is also capable of producing platform cores, it was more often worked through the bipolar technique. This technique is often used in connection with the working of more intractable raw materials.

Core rejuvenation

A variety of rejuvenation strategies were employed in order to maintain both core face and platform utility. These included platform rejuvenation flakes struck from the side, core-trimming flakes and core-trimming flakes which also removed the existing platform. The latter two examples were struck to remove stacked steps which occurred at the platform edge or core face as a result of inherent flaws within the raw material or knapping errors.

The presence of platform rejuvenation and core-trimming flakes confirms the importance of platform reduction within the assemblage and emphasises that the size of the nodules did not inhibit the rejuvenation of the cores. It suggests that perhaps larger nodules were exploited than is immediately apparent from either the cores or pebbles recovered from the excavation.

Core stages

The number of stages produced by the analysis of the core sample obtained from the selected Mesolithic occupation deposits shows that a significant proportion of the cores were intensively worked. Single stage flint cores were the smallest of the platform types in both dimensions and weight, suggesting that initially larger and higher quality pieces were more intensively worked.

Platform area

The intensity of reduction was also visible in the amount of work to which the perimeter of the core had been subjected. At East Barns a study of the overall number of platform cores of all raw materials within the assemblage showed the majority were worked at around 50% (53.50%), with 18.1% worked at 75% and 14.6% being completely worked. These figures are replicated in the sample taken from the Mesolithic occupation deposits and suggest that the cores at East Barns were fairly intensively worked.

Core abandonment

The core sub-sample from the Mesolithic occupation deposits showed size was the most common reason for core abandonment, followed by technical problems such as stepping, hinging and angle and internal flaws. In experimental work undertaken by master flint knapper John Lord on beach pebbles from the SHMP (Mithen et al 2000: 531) size was shown to be the main reason for the abandonment of blade cores derived from a beach pebble source.

4.4.4 Chunks

Chunks account for 6.6% (*n* 1,987) of the assemblage. The majority of these are made on flint (*n* 1,215) with smaller numbers of chert (*n* 398), quartz (*n* 324), chalcedony (*n* 40) and quartzite (*n*

10). 41.54 % (*n* 806) of the chunks showed evidence of burning with a further 226 showing some degree of patination.

4.4.5 Fragments

A total of 132 fragments were recovered, nine of flint, 120 of quartz and three of chert. These differ from the chunk category in form because they have a particularly 'orange segment' appearance. This is often coupled with signs of percussion impact. It is probable that these pieces represent waste material from bipolar reduction.

4.4.6 Flakes (Table 3)

Flakes account for 28.45% of the assemblage: 23% (*n* 7,050) are flint, 3.2% (*n* 973) chert, 0.49% (*n* 147) chalcedony, 1.3% (*n* 383) quartz and 0.1% (*n* 23) quartzite; 9.9% (*n* 852) of the flake total are primary removals with 21.6% (*n* 1,854) secondary and 68.3% (*n* 5,854) tertiary. Of the flint flakes, 1,832 were patinated and 2,672 burnt.

Regular flakes account for 32.1% (*n* 2,752) of the flake total, with irregular examples at 63.8% (*n* 5,471).

Edge damage commensurate with use-wear is considered to have affected 152 flakes. A sample of these flakes from the occupation deposits was submitted for use-wear analysis (see Section 5, Lithic microwear analysis). It is recognised that some edge damage may also be the result of post-depositional factors such as trample.

Twenty-two bipolar/scalar flakes were recognised within the assemblage. These pieces have the characteristic opposed crushed striking platforms and percussion features associated with this technique. Given the presence of other debitage classes with bipolar characteristics such as cores, 'orange segment' fragments and split pebbles within the assemblage, it is likely that these flakes represent only a small fraction of the true total.

A total of 316 flake fragments were recorded which have neither recognisable proximal nor distal ends.

Fifteen spalls were also recognised. As with the bipolar flakes, the identification of these pieces was restricted to those examples with an easily recognisable form.

Rejuvenation strategies

A total of 302 (1% of the assemblage) rejuvenation flakes were recovered during the excavation. Of these 138 (45.7%) were retrieved from the infilling deposits of the house. The majority were made on flint, although they occur in all four of the main raw materials (Table 3). A number of rejuvenation flakes have been modified, and appear in the catalogue under various categories.

The majority of the flakes (*n* 243) appear to have been removed in order to eliminate stacked steps, flaws, uneven platform surfaces and overhangs from the existing platform area. Most are fairly regular in form and have been struck from the side at a 90° angle to the platform edge. In all cases these appear to have been struck from simple, flat surface platforms and with the exception of two examples which also remove opposing platforms, appear unidirectional. No true crested blades were identified within the assemblage.

Fifty-seven rejuvenation flakes appeared to trim or remove the core face. The majority of these were designed to remove step fractures and spurs. However, some do appear deliberately overshot, possibly in order to re-shape the core face. This number is undoubtedly on the low side as there is some degree of difficulty in isolating such flakes from more general removals.

4.4.7 Blades (Table 3)

The term 'blade' adheres rigidly to the description given in the 1999 edition of the *Technology and terminology of knapped stone* (Inizan et al 1999: 71). The overall lamellar index for the assemblage is 15.8%.

Blades account for 4.5% of the assemblage: 3.9% are flint, with 0.5% chert and 0.1% chalcedony; 3.8% are tertiary with 0.7% secondary and only five considered primary removals.

1.5% of the blades are patinated, with 0.6% burnt or heat affected, 2.3% considered fresh, 0.02% pitted and 0.13% rolled.

0.3% were considered edge damaged as a likely result of use or post-depositional trample. As with the flakes, a sample was submitted for use-wear analysis (see Section 5, Lithic microwear analysis).

4.4.8 Flake/blade technological analysis (Tables 7a–d)

Table 7a Selected occupation deposits: flake/blade sample

Context	2573		2561		2564		2549		Total	Total	
	Flake	Blade	Flake	Blade	Flake	Blade	Flake	Blade		Flake	Blade
Complete	53	18	15	1	77	11	17	10	202	162	40
Prox absent	6	1	0	0	17	6	7	4	41	30	11
Distal absent	8	1	1	1	22	6	4	1	44	35	9
Prox fragment	2	0	0	0	1	0	0	0	3	3	0
Distal fragment	0	1	1	0	5	0	2	0	9	8	1
Medial fragment	7	2	3	0	14	2	10	2	40	34	6
Truncated width	11	0	0	0	22	1	5	0	39	38	1

A technological analysis was conducted on a sample of 378 pieces (*n* 310 flakes and 68 blades) retrieved from randomly selected quadrate squares within the in situ Mesolithic occupation deposits surrounding the house (Contexts 2549, 2561, 2564 and 2573). These quadrates were associated with the same deposits that produced both the core and fine fraction analyses. The profile of the sample pieces is given by context in Table 7.

Fragmentary pieces account for 46.6% of the sample. These are almost equally divided between absent distal and proximal ends (*n* 44 and 41 respectively), medial fragments (*n* 40) and pieces with truncated widths (*n* 39).

The sample comprised 94.2% flint, with 4.8% chert and relatively insignificant numbers of quartz, chalcedony and quartzite. Of the combined sample, 33.6% showed signs of burning. The lamellar index for the sample as a whole is 19.10. By context the index is as follows: Context 2549 = 37.7, Context 2561 = 10, Context 2564 = 16.45 and Context 2573 = 26.4.

The sample produced 202 complete pieces, the dimensions and technological attributes of which are given in Tables 7b–c.

118 of the pieces were tertiary, with cortex located in small numbers on both proximal and distal ends (Table 7b). The lateralisation of cortex is also restricted in number, with left-hand side (LHS) (*n* 14) cortical pieces slightly outnumbering right-hand side (RHS) (*n* 6). Pieces with cortex visible in combination are the second most numerous category (*n* 50).

Diffuse bulbs of percussion (*n* 115) are the most common bulb type within the sample, followed by pronounced examples (*n* 69).

46.5% of the platforms are simply prepared, with cortical platforms accounting for 11.9 % and crushed platforms 28%. 11.9% were absent or indeterminate with three appearing faceted.

Jagged/irregular distal terminations are the most frequently occurring, with 33% with abrupt next at 27%, feathered 13.9% (*n* 28), hinge 13.4 (*n* 27) and plunging 11.4 (*n* 23) terminations follow in relatively similar amounts.

With the exception of numerical differences, the composition and character of the four contexts represented in the sample show only slight differences in the attribute profile. Contexts 2564 and 2573

Table 7b Selected occupation deposits: technological attributes of complete flake and blade sample

Context		2573		2561		2564		2549			Total	
		Flake	Blade	Flake	Blade	Flake	Blade	Flake	Blade	Total	Flake	Blade
Location of cortex												
	absent	65	14	6	1	7	10	8	7	118	86	32
	prox	4	1	1	0	2	0	0	0	8	7	1
	distal	3	1	0	0	2	0	0	0	6	5	1
	lat left	2	1	0	0	9	0	0	2	14	11	3
	lat right	2	1	0	0	3	0	0	0	6	5	1
	combination	13	0	6	0	20	1	9	1	50	48	2
Bulb type												
	absent	8	0	2	0	7	0	1	0	18	18	0
	pronounced	19	6	5	1	23	3	8	4	69	55	14
	diffuse	25	12	8	0	48	8	8	6	115	89	26
Platform type												
	absent/indeterminate	12	5	2	0	4	0	0	1	24	18	6
	cortical	6	1	3	0	11	0	2	1	24	22	2
	simple	27	4	8	0	35	6	10	4	94	80	14
	faceted	0	0	0	0	1	0	1	1	3	2	1
	crushed	9	8	2	1	26	5	4	2	57	41	16
Distal termination												
0	absent	2	0	0	0	1	0	0	0	3	3	0
1	abrupt	11	10	3	0	18	5	3	4	54	35	19
2	hinge	5	0	2	1	14	2	2	1	27	23	4
3	plunging	7	2	1	0	11	2	0	0	23	19	4
4	feathered	7	4	3	0	8	1	4	1	28	22	6
5	jagged/irregular	22	2	6	0	25	2	7	3	67	60	7

Table 7c Selected occupation deposits: complete flake dimensions

	Length	Width	Thickness
Mean	18.34	12.64	3.71
St. Dev.			
Max.	48	35	14
Min.	9	5	1

Table 7d Selected occupation deposits: complete blade dimensions

	Length	Width	Thickness
Mean	22.6	9.16	2.74
St. Dev.			
Max.	51	23	6
Min.	13	4	1

provide 77.8% of the sample and suggest more intensive areas of working/dumping. Context 2573 has 39% of all tertiary material, with Context 2564 having a slightly greater proportion of cortical material. Blades are fairly equally distributed across Contexts 2564, 2573 and 2549, with the latter having a particularly high lamellar index (37.7).

4.4.9 Fine fraction

Fine fraction debitage accounts for 53% of the chipped stone assemblage. Again, most of the material is made on flint (*n* 14,433), with smaller amounts of chert (*n* 765), quartz (*n* 713) and chalcedony (*n* 80).

The majority of the fine fraction consists of tertiary material (97.8%), with 261 secondary and 95 primary pieces.

A sample of the fine fraction debitage was taken from the same quadrate squares as used for the technological analysis of the flake and blade sample. This produced a total of 584 pieces.

4.4.10 Technological analysis (Tables 8a and 8b)

Of the 584 pieces retrieved from the technological sample, 568 were of flint. Very small numbers of chert (*n* 9) and quartz (*n* 7) were also present. Flakes dominate, constituting 94% of the sample. Of these, 85% are tertiary, with 11.6% secondary and 3.4% primary. 54.6% are complete, with 30.6% fragmentary and 14.9% indeterminate. The condition of the fine fraction debitage is predominantly burnt or heat affected (62.7%), with 29.7% appearing fresh and 7.4% patinated. Only one piece was judged rolled.

4.4.11 Blades and flakes (Tables 7a–d)

Despite having an overall lamellar index of only 15.8%, which is well under the total of 20% proposed by Bordes & Gaussen (1970) for the definition of a blade technology, the assemblage at East Barns can be comfortably characterised as a 'narrow blade' industry. This approach, in which the quantity of blades in the assemblage is compared to that of flakes, has been criticised as rather mechanical by Ballin (2014: 16). It must therefore be reiterated that the blades within the assemblage were identified by a strict set of criteria and that the study of both blanks and flake scars suggests that a significant proportion of the regular flake assemblage was relatively narrow and bladelike in form. It is also apparent that within the study of the selected in situ Mesolithic occupation deposits, the indices of two contexts (2549 and 2573) both showed a high ratio of blades to flakes (37.7 and 26.4) as well as a matching predominance of platform blade cores.

Table 8a Selected occupation deposits: fine fraction attributes

Blank		Flint	Chert	Quartz
	Flake	535	9	5
	Chunk	33	0	2
Cortex				
	Primary	18	0	2
	Secondary	68	0	0
	Tertiary	482	9	5
Condition				
	Burnt	366	0	0
	Fresh	165	9	0
	Patinated	36	0	7
	Rolled	1	0	0
Fragmentation				
	Complete	308	4	6
	Fragment	176	2	1
	Indeterminate	84	3	0

Table 8b Selected occupation deposits: fine fraction by context

Context	2573		2561		2564	2549
Quadrant	G10	G12	B6	A9	F6	D15
Total	54	89	21	69	220	141

The lamellar index was originally created to analyse material from areas rich in high-quality chalk flint. Therefore the small nodular material characteristic of East Barns and most other Mesolithic sites in northern Britain may be seen to have imposed some constraints on the traditional views of blade production (Finlay et al 2000). That blade manufacture was an important focus of the Mesolithic reduction sequence undertaken at East Barns is not in doubt, given the general make-up of the assemblage. However, the high number of flake cores, varied scraper types and other tool forms intentionally created on flakes suggest blade manufacture was not always the primary objective. It is felt important therefore that the blade/flake ratio is used in conjunction with analyses that assess the frequency of blade platform cores within an assemblage to determine the dominance of blade technology.

Blade and flake dimensions

The dimensions of both the flake and blade blanks suggest that flakes are on average wider and thicker than blades, though the mean length is relatively similar. The blank sizes also display a very similar range of maximum and minimum dimensions, reinforcing this observation.

The mean dimensions of the flake/blade scars occurring in the core sub-sample (Table 6b) are very similar to those taken from the blank analysis, suggesting that the creation of relatively long, narrow regular blanks was the primary manufacturing purpose within the assemblage. This regularity would also seem to reflect a high degree of skill being employed in the knapping carried out at the site.

Blade and flake fragmentation

Of the 584 pieces retrieved from the technological sample, 30.6% were recorded as fragmentary, with 14.9% indeterminate. No clear pattern emerges as the categories consisting of absent proximal and distal ends, medial fragments and pieces with truncated widths all have similar proportions (Tables 7c–d). The latter are thought to be related to bipolar reduction (Finlayson et al 2000: 563). Given that the pieces occur in both probable dump and working deposits situated around the exterior of the structure (see Section 4.6, Spatial analysis and material distributions), it is likely that a proportion are the result of trample and other post-depositional factors.

Reduction techniques

The bulb types present on the complete blades and flakes recovered from the in situ occupation deposits were categorised as pronounced or diffuse in order to help determine the dominant percussion technique used within the assemblage. There are 115 pieces with diffuse bulbs followed by 69 with pronounced bulbs. The greater number of diffuse bulbs is present in both flakes and blades although the ratio is greater in the former.

Diffuse bulb types are often seen as indicative of direct soft-hammer percussion, and pronounced bulbs are usually associated with hard-hammer techniques. However, Zetterlund (1990) has queried this relationship, arguing that attributes often thought characteristic of technique may be affected by a range of other factors such as skill, platform size, angle of impact and raw material quality. At Kinloch Farm, Rhum, it was concluded that soft percussion was used, and that this produced a range of attributes normally associated with hard percussion (ibid: 66).

The presence of only three probably accidentally faceted platforms within the sample indicates that careful preparation of the core platform prior to blank removal was not a major consideration of the knappers of East Barns. Within the studied sub-sample, 25.7% were identified as simple and narrow. A further 15.6% appeared crushed or collapsed. Narrow platforms suggest that the platform was struck directly and close to the edge, a technique which when slightly misdirected results in a high number of crushed examples. Crushed platforms are a common phenomenon when direct soft percussion is used (Zetterlund 1990: 71). The application of direct soft-hammer percussion is also supported by the high number of marked scars on the core sample.

With regard to blank terminations, jagged/irregular, abrupt and hinge distal terminations together account for 73.4% of the sample. This perhaps is a result of the use of small flawed material combined with occasionally poorly controlled direct soft-hammer percussion.

The bipolar flakes and debitage are probably under-represented within the catalogue, given the large amount of recognised cores. Many of the short thick flakes present within the assemblage are probably the result of bipolar application.

The evidence from East Barns would seem to support a similar conclusion to that reached at Kinloch Farm. Direct soft-hammer technique using a variety of differing percussors appears to have been the dominant method of producing blade/flake blanks. However, the significant quantity of bipolar-related material would suggest that a hard-hammer technique was also important. It is therefore likely that a variety of techniques and percussor types were utilised in the creation of the assemblage.

4.5 Secondary technology

4.5.1 Introduction

Modified pieces form 3.8% of the total assemblage, with microliths and scrapers predominating (Table 9). Pieces made on flint dominate, accounting for 86.2% of the total. Chert provided 10.5%, followed by chalcedony with 2.7% and quartz at 0.6%.

28.6% of the pieces show signs of patination and 20.4% appear burnt or heat affected to variable degrees. The dimensions and weight of each individual piece were recorded in the main catalogue alongside a brief description. Samples of each artefact category are illustrated in Illus 11–14.

4.5.2 Microliths

A total of 407 identifiable and 50 fragmentary geometric, backed and obliquely blunted narrow-blade microliths were recovered (Table 10). The complete pieces recovered from the in situ Mesolithic occupation deposits were subjected to a

Table 9 Secondary technology

	Material				Total
Type	Flint	Chert	Chalcedony	Quartz	
Microliths	332	64	11	0	407
Microlithic fragments	47	3	0	0	50
Scrapers	309	19	8	3	339
Scraper fragments	15	0	1	0	16
Scraper rejuvenation flakes	12	1	0	0	13
Microburins	45	4	1	2	52
Notch and snaps	40	3	1	0	44
Notched pieces	43	7	1	1	52
Lamelles a cran	2	0	0	0	2
Denticulates	22	0	3	0	25
Possible burins	15	5	0	0	20
Points	27	5	3	1	36
Retouched pieces	94	12	2	0	108
Knives	2	1	0	0	3
Total	1005	124	31	7	1165

Table 10 Microliths

Type	Material			Total
	Flint	Chert	Chalcedony	
Scalene triangle	150	35	4	189
Double-backed scalene	12	4	2	18
Triangle	14	2	0	16
Crescent	29	3	0	32
Fine point	31	9	4	44
Leaf point	10	0	0	10
Oblique truncation	43	5	0	48
Truncation	2	0	0	2
Backed bladelet	28	3	1	32
Double-backed blade	8	1	0	9
Trapezoid	0	1	0	1
Irregular	5	1	0	6
Fragmentary	47	3	0	50
Total	379	67	11	457

Table 11 Microliths: dimensions and attributes of complete examples

Scalene triangles	Flint (*n* = 140)			Chert (*n* = 34)			Chalcedony (*n* = 2)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	16.11	5.4	2.14	15.7	5.2	2.2	13.4	4.9	1.9
Max.	33.5	9.6	1	24.4	6.8	3.1	13.7	5.2	2.7
Min.	8.6	3.8	5	11.7	3.8	1.3	13.2	4.5	2.2
Double-backed scalenes	Flint (*n* = 11)			Chert (*n* = 4)			Chalcedony (*n* = 2)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	19.3	6.6	2.4	18.9	6	2.1	18.3	6	2.7
Max.	23.5	15.8	4.3	24.7	7.8	2.4	21.6	7.3	2.7
Min.	16.2	4.4	1.7	13.6	4.1	2.1	15	4.7	2.7
Triangles	Flint (*n* = 14)			Chert (*n* = 2)			Chalcedony (*n* = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	13.1	5.2	1.8	13.3	5.6	2.1	0	0	0
Max.	18.8	6.3	2.5	15	6.5	2.2	0	0	0
Min.	10	3.7	1	11.7	4.8	2	0	0	0
Crescents	Flint (*n* = 27)			Chert (*n* = 3)			Chalcedony (*n* = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	15.8	5	2.2	19.1	9.85	3	0	0	0
Max.	24.2	7.3	4	22.5	12.5	4	0	0	0
Min.	9.8	3.2	1	16.3	7.2	2	0	0	0
Double-backed crescents	Flint (*n* = 2)			Chert (*n* = 0)			Chalcedony (*n* = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	14	5.1	1.8	0	0	0	0	0	0
Max.	16.7	5.7	2	0	0	0	0	0	0
Min.	11.3	4.5	1.6	0	0	0	0	0	0

Table 11 *cont*

Fine point	Flint (n = 32)			Chert (n = 9)			Chalcedony (n = 4)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	14.4	5.42	2	15.6	5.3	2.2	14.1	5.35	1.7
Max.	20.5	8	4	23.4	6.6	2.6	16.3	7.5	1.8
Min.	7.5	3.3	1.3	11	3.7	1.6	12.5	3.2	1.3
Leaf point	Flint (n = 10)			Chert (n = 0)			Chalcedony n = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	18.1	5.6	2	0	0	0	0	0	0
Max.	28.5	8.3	2.9	0	0	0	0	0	0
Min.	14.1	4.8	1.3	0	0	0	0	0	0
Oblique truncations	Flint (n = 37)			Chert (n = 5)			Chalcedony (n = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	16.2	6.1	2.2	17.7	6.3	2.1	0	0	0
Max.	22.7	9	8	22.4	7.2	2.8	0	0	0
Min.	9.3	4.2	1	12.7	5.3	1.3	0	0	0
Backed blade	Flint (n = 28)			Chert (n = 0)			Chalcedony (n = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	15.3	5.3	2	0	0	0	0	0	0
Max.	25.5	8	3.3	0	0	0	0	0	0
Min.	10.2	3.3	1.1	0	0	0	0	0	0
Double-backed blades	Flint (n = 8)			Chert (n = 0)			Chalcedony (n = 0)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	14.8	5.8	2.4	0	0	0	0	0	0
Max.	19	7.6	3.2	0	0	0	0	0	0
Min.	10	4.2	1.2	0	0	0	0	0	0

more detailed typological analysis. The dimensions and attributes derived from this sample are presented in Table 11.

Scalene triangles and double-backed scalene triangles (n 207)

Scalene triangles predominate and account for 46.7% of the total number of microliths within the assemblage. The majority are made on flint, with 39 on chert and six on chalcedony. 29.3% are patinated, with 16.6% burnt or heat affected. Of the 207 recovered pieces, eight are fragmentary, yet complete enough to be unequivocally recognised as scalene in character. Only the dimensions of complete pieces are given in Table 11.

The scalene triangles are characterised by a generally small size and narrow shape. Four examples (Illus 11) are extremely thin and elongated in form. Those scalene pieces made on flint are the largest in size followed by those made on chert and chalcedony. This is in contrast to the dimensions provided by the other microlith categories in which the chert is narrowly larger (Table 10). However, it must be noted these were dimensions taken from much smaller proportions of chert microliths. A mean length of 16.11mm was taken for the flint pieces compared with 15.7mm for the chert and 13.4mm for the chalcedony pieces. The mean widths and thicknesses gave a similar progression (Table 11). A large variation in size was noted in the samples of both flint and chert. The former provided a maximum/minimum length of 33.5mm/8.6mm. Although not as marked within the chert sample the disparity was still sizeable, with the maximum/minimum length being 24.4mm/11.7mm.

Eighteen have blunt, microlithic retouch applied to the opposite long edge of the piece and are described here as double-backed (Illus 11 – SF 7774). This retouch either extends along the complete length of the edge or is confined to the angle of the two longest edges (Illus 11 – SF 1229). The double-backed examples were larger than the regular scalenes in all three raw materials in which they were made, yet followed the same hierarchical size progression. However, the mean, maximum and minimum dimensions are consistently closer together and display few of the size disparities recognised in the regular scalene pieces (Table 11).

Oblique truncations (n 48) (Illus 12 – SF 1168)

Obliquely truncated microliths provided the next most numerous type, accounting for 10.5% of the microlithic assemblage. Flint provided 43 pieces, with five occurring on chert. Five were fragmentary yet considered complete enough for confident categorisation. Patination was present on 16 examples and eight were burnt.

All the pieces appeared to have been made on bladelets blunted by microlithic retouch along the left or right lateral edge. The pieces are generally quite small, with those made on chert being slightly larger than those on flint (Table 11).

These pieces can be more correctly described as obliquely truncated points as the retouch generally truncates the bladelet to a fine, sharp point.

Triangles (Illus 12 – SF 6694)

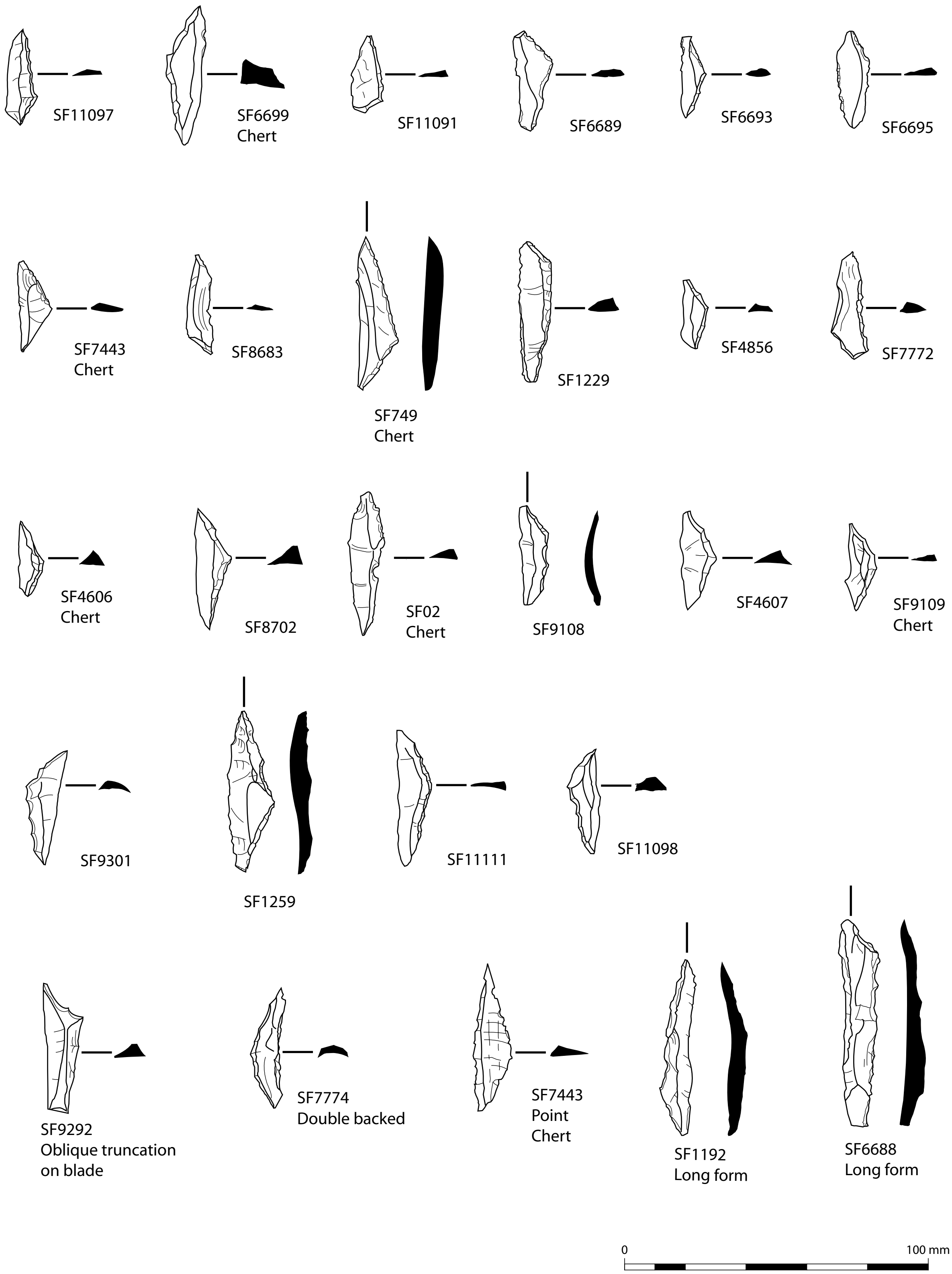
Fourteen flint and two chert microliths were identified as isosceles triangles having two equal retouched sides. They appear to be the smallest of the microlith categories with a size range ranging from 10mm to 18.8mm in length and a width ranging from 3.7mm to 6.5mm (Table 11).

Fine points (Illus 12 – SF 7767 and SF 6704)

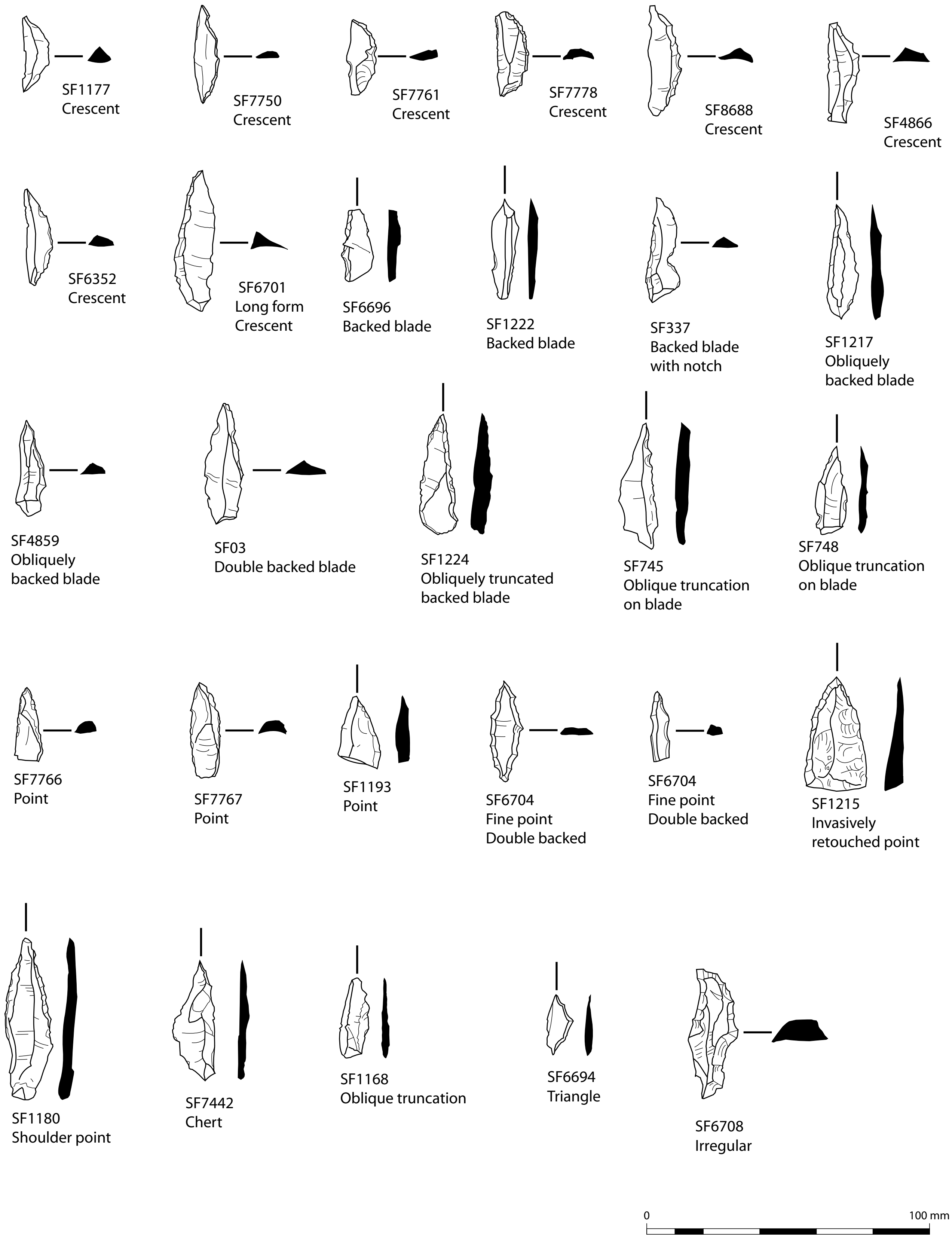
Fine-point microliths are the third most numerous of the complete microlith sub-categories, accounting for 9.9% (*n* 44) of the total. Thirty-one are made on flint with a further nine occurring on chert and four on chalcedony. Those made on chert appear slightly larger than those on flint, with the smallest being made on chalcedony (Table 11). All the pieces are characterised by having fine microlithic retouch applied along both lateral edges, converging into a point. This is often very 'needle-like' in form.

Leaf points

The leaf points form a less numerous microlithic point category, with only 10 recognised examples, all occurring on flint. In general they are slightly larger than the fine-point form with a mean length/width of 18.1mm/5.6mm (Table 11). With the exception of SF 1215 and SF 1180 (Illus 12), which have double-sided retouch, the pieces are retouched along one side, which converges with the un-retouched edge to form a point (eg Illus 12 – SF 1193). The retouched edge tends to be slightly curved in form.



Illus 11 Microliths – scalene (flint unless otherwise indicated)



Illus 12 Microliths (flint unless otherwise indicated)

Backed bladelets (Illus 12 – SF 6696, SF 1222, SF 337, SF 1217, SF 4859, SF 03, SF 1224, SF 745, SF 748)
Thirty-two backed bladelets were recovered, all made on flint. All the pieces are characterised by having microlithic retouch along one lateral edge. This is mostly straight and oblique but some slightly curved and more irregular forms are present. The mean length/width of the artefacts is 15.3mm/5.3mm.

Double-backed bladelets
As with the scalene and crescent categories, a double-backed form of bladelet is present with retouch applied along both lateral edges. Nine of these were retrieved at East Barns, eight made on flint, one on chert. The double-backed variant appears to be of similar size to the regular backed bladelet form, with a mean length/width of 14.8mm/5.8mm.

Crescent/double-backed cresents (Illus 12 – SF 1177, SF 7750, SF 7761, SF 7778, SF 8688, SF 4866 and SF 6352)
Thirty-two crescent-shaped microliths were recovered, of which 29 occurred on flint and three on chert. Crescents are microliths defined by the application of retouch that creates a crescentic shaped lateral edge. At East Barns two double-backed pieces were also retrieved. These pieces also have retouch applied along the straight lateral edge of the microlith. The crescent microliths are generally of small size, with maximum/minimum dimensions ranging from 24.2mm/9.8mm in length to 12.5mm/3.2mm in width.

Trapezoid/truncations/irregular microliths
A single chert trapezoidal microlith was identified along with two microlithic truncations and five irregular pieces, all made on flint. The irregular microliths are a range of forms that do not appear in the classificatory systems used by either the SHMP or at Kinloch Farm. These pieces tend to have irregular shapes and retouch (Illus 12 – SF 6708).

Fragmentary microliths
Fifty microliths were classified as being fragmentary, ie the piece was not considered complete enough to place it within one of the other typological categories. A closer examination revealed that the majority of these pieces were probably scalenes.

Table 12 Scraper types

	Flint	Chert	Chalcedony	Quartz	Total
Short convex	67	2	1	2	72
Short thick convex	2	0	0	0	2
Wide convex	49	4	1	0	54
Long convex	1	2	0	0	3
Concave	11	3	0	0	14
Disc	8	0	0	0	8
Angled	64	4	2	0	70
Sub-angled	43	2	0	0	45
Denticulate	7	0	0	0	7
Straight	32	1	1	1	35
Irregular	29	1	3	0	33
Fragment	16	0	1	0	17
Scraper edge rejuvenation flake	6	1	0	0	7
Possible scraper	1	0	0	0	1
Totals	336	20	9	3	368

4.5.3 Scrapers

After microliths, scrapers form the next most numerous category of modified artefact recovered at East Barns. 368 pieces (1.2%) were identified and placed within the 14 typological categories shown in Table 12. These include fragmentary pieces (*n* 17) and scraper edge rejuvenation flakes (*n* 7). 115 pieces showed signs of burning or being heat affected. A further 99 showed visible degrees of patination. It has been noted that little in-depth work has been done on scraper technology from assemblages with secure Mesolithic contexts; therefore, the classification of the scrapers from East Barns closely follows that outlined within the SHMP (Finlayson et al 2000: 68–9). This is in order to aid intra-site comparison with other recently published Mesolithic assemblages and to provide a building block for further study.

Scraper morphology is recognised as highly variable and difficult to place chronologically with any great accuracy (Finlayson et al 2000: 583). Although the majority of the scrapers associated with the occupation of the house fit happily into existing Mesolithic classifications such as that of Wickham-Jones & McCartan (1990), it must be noted that many of the types presented here and in other Mesolithic assemblages are also to be found in later prehistoric deposits. Given that a number of dated later Mesolithic and Neolithic deposits were excavated both cutting Mesolithic deposits within the area of the house (C2574) and as deposits within its immediate vicinity (Contexts 2582, 2562 and 2531), a number of scrapers from the assemblage may be of later date. Similarly, the colluvial deposits of the hollow infilling the house, such as C2518 and C2533, may also contain scrapers of a later chronological date.

Although the scrapers may have come from a variety of chronological deposits, it would appear that the majority were fashioned on retouched flakes, with many retaining cortex showing that scraper manufacture was relatively simple and utilitarian. Primary or secondary flakes were often chosen, probably on grounds of thickness and functionality. The seven scraper rejuvenation flakes present show that some curation was also practised.

Scrapers occurred in all four of the major raw materials, with flint providing 336, chert 20, chalcedony nine and quartz three.

A sample of each category is illustrated in Illus 13 and a short description is given below.

Short convex

The most numerous of the scraper categories, short convex forms, were found in all four of the main raw materials, with 67 occurring on flint, two on chert, one on chalcedony and two on quartz. These scrapers have a single convex scraper edge less than 10mm thick. All but two have the working edge situated at the distal end.

This scraper category was morphologically very varied and ranged from simple end-scraper types on primary flakes to very small invasively flaked ‘micro’ scraper types. These latter pieces must have been too small to adequately work with the fingers and it is likely that they were hafted. Four examples were identified as made on core rejuvenation flakes while one occurred on a platform core fragment and one on a chunk. Four pieces showed a marked narrowing of the piece away from the working edge (Illus 13 – SF 6654). This may also have been employed in order to facilitate hafting.

Wide convex (Illus 13 – SF 6655)

These scrapers have a scraping edge situated along the longest lateral edge and can also be termed convex side-scrapers. Of the 54 pieces, 49 are on flint with four on chert and one on chalcedony.

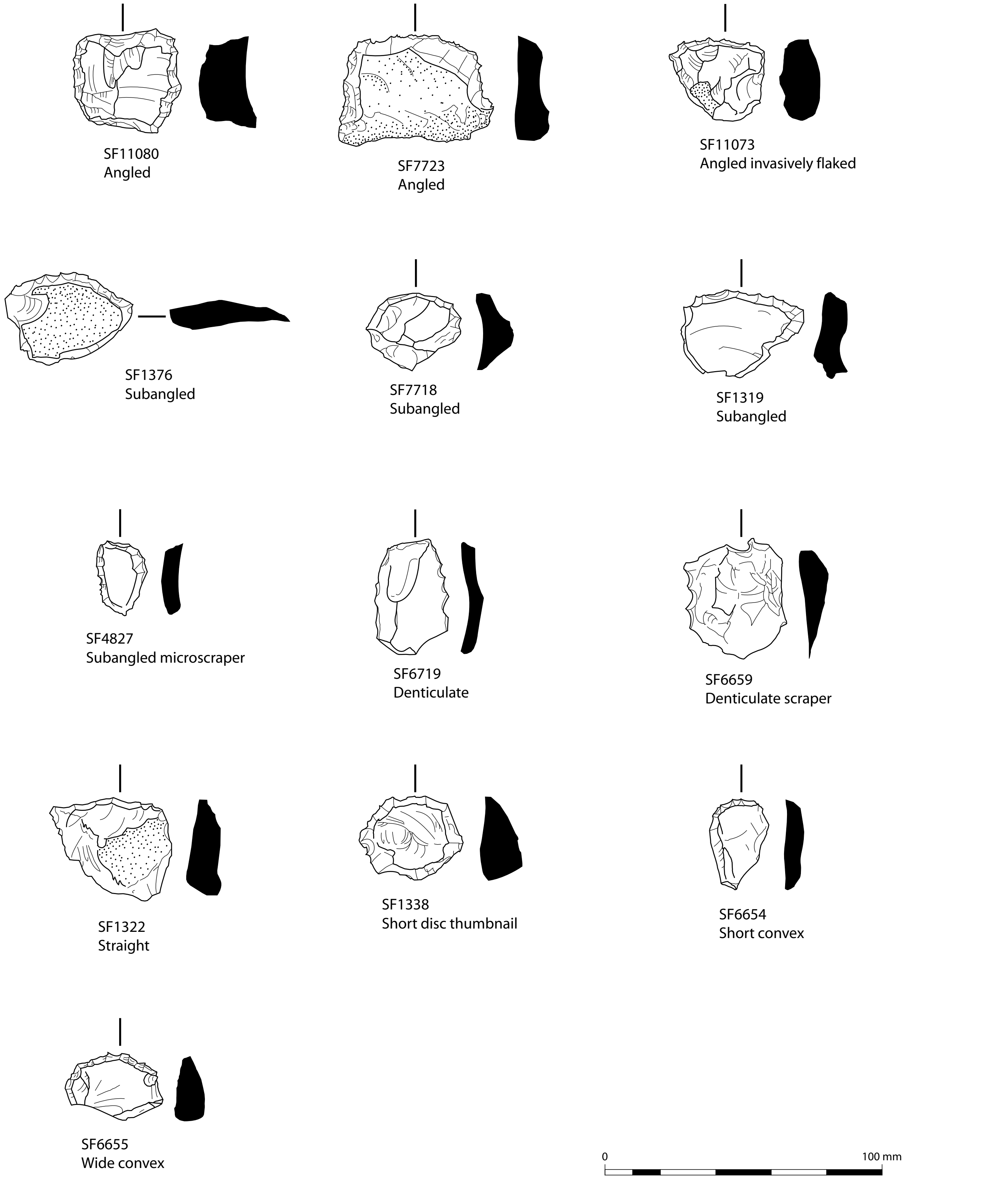
Wide convex scrapers are much less varied in form than the short convex type, with the majority made on flakes. A single piece was identified on a bipolar core remnant.

Long convex and short thick convex

There were three and two pieces respectively in these categories. All are made on flint. The latter has a convex scraping edge more than 10mm thick while the former is a short convex scraper but twice as long as wide. All are made on flakes.

Concave

Fourteen concave scrapers were recovered, 11 on flint and three on chert. Concave scrapers have a working edge that is concave or hollow in profile. All had the working edge on the distal end of the



Illus 13 Scrapers (all flint)

piece. In one example the working edge had been worked transversely.

Disc
Eight pieces were identified as disc scrapers, all of flint. These pieces had retouch applied around the entire circumference of the flake. All are generally small in size.

Angled
Seventy pieces were identified as being angled. All have more than one scraping edge meeting with sharp corners. Sixty-four are made on flint with four on chert and two on chalcedony. Most of the pieces are made on the distal end of flakes. One example is invasively flaked (Illus 13 – SF 1338).

Sub-angled
Forty-five scrapers are sub-angled and have more than one working edge meeting with rounded corners (Illus 13 – SF 1319 and SF 1376). Forty-three are made on flint, with two on chert. The sub-angled category contains a number of small, almost micro-sized examples, with one example which appears to have a chamfered proximal end, possibly for hafting within a stick (Illus 13 SF 4827). All but one sub-angled scraper is worked at the distal end.

Denticulate
Seven pieces on flint are denticulated, ie the working edge has multiple small notches, creating a saw effect (Illus 13 – SF 6719 and SF 6659). The majority appear worked along the distal end of flakes.

Straight
The 35 scrapers in this category had a continuous scraping edge that is neither convex nor concave (Illus 13 – SF 1322). Thirty-two were on flint with single pieces on chert, chalcedony and quartz. The majority are retouched across the distal end or along the right-hand lateral edge of flakes. However, five have retouch applied along both lateral edges and two are on blades. A single piece is made on a chunk.

Irregular
The 33 pieces in this category were complete scrapers with retouch that could not be fitted into the other categories. Twenty-nine were on flint, with three on chalcedony and a single piece on chert. These pieces are morphologically varied, with many appearing to combine categories. The majority are made on flakes, with the exception of two fashioned on blades and one on a platform rejuvenation flake.

Fragmentary
Seventeen scraper fragments were identified, 16 of which were on flint and a single piece on chalcedony.

Scraper rejuvenation flakes
Seven pieces were identified, six on flint and one on chert. Like the majority of the platform rejuvenation flakes, these pieces were created by side blows to the working edge.

4.5.4 Microburins

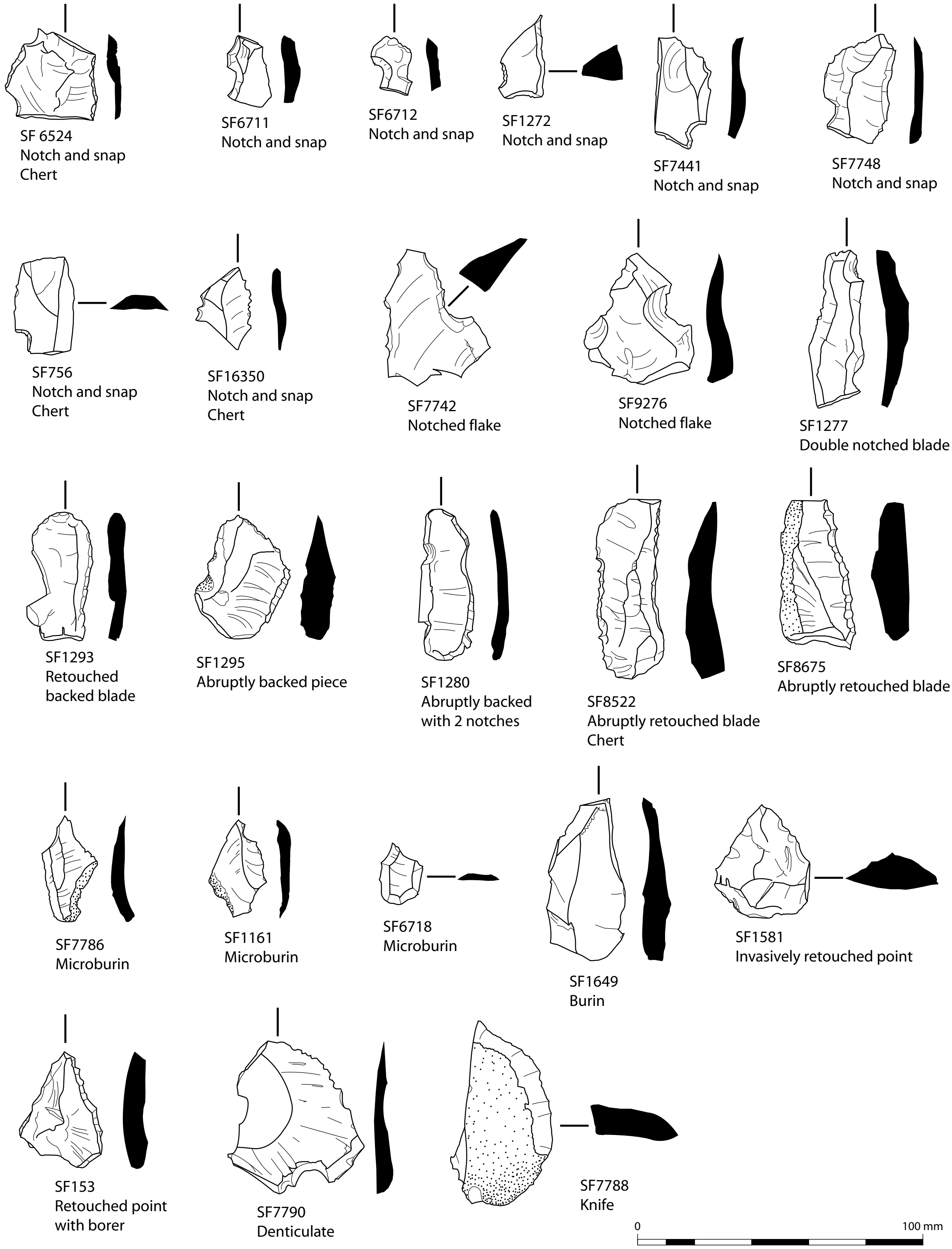
Fifty-two microburins were identified within the assemblage (Illus 14 – SF 7786, SF 6718 and SF 1161). Forty-five were made on flint with four on chert, one on chalcedony and two on quartz. The latter are problematic and though both display a notch and recognisable burin facet, these may be accidental.

Microburins are recognised as the snapped ends of bladelets and are usually seen as a waste product of microlith manufacture. In particular this category is linked with the manufacture of scalene triangles (Wickham-Jones & McCartan 1990: 100).

The microburins range widely in size with maximum/minimum dimensions of 23mm/8.7mm in length and 18.8mm/4mm in width. Of the 52 pieces, 33 were notched on the right-hand side, with 19 notched on the left.

4.5.5 Notch-and-snaps (Illus 14 – SF 6524, SF 6711, SF 6712, SF 1272, SF 7441, SF 7748, SF 756 and SF 16350)

Although closely related to microburins, the 44 notched pieces provided a snap truncation rather than a burin facet. Of these, 40 were made on flint, one on chert and three on chalcedony. In size they were similar to the microburins, with a max/min length of 28mm/8.4mm and a width of 16.1mm/4.5mm. Notched pieces with simple snap truncations may be evidence of failed attempts at microlith production through the microburin technique (Saville 2005: 113).



Illus 14 Other tools (flint unless otherwise indicated)

4.5.6 *Lamelles a cran*

Only two *Lamelles a cran* were positively identified, both made on flint. *Lamelles a cran* are a possible long form of microburin and are another category assumed to be linked to the production of scalene microliths (Wickham-Jones & McCartan 1990: 100). However, given the predominance of scalene triangles within the modified assemblage at East Barns together with the relative abundance of other associated classes such as microburins, notch-and-snaps and notched pieces, the scarcity of *Lamelles a cran* is noticeable.

Both pieces are proximal with retouched notching extending along the right-hand side and left-hand side. In size the *Lamelles a cran* are at the upper end of the microburin scale, with a mean length of 18.7mm and a width of 12.35mm.

4.5.7 Notched pieces

Fifty-two pieces were characterised as notched. Forty-three were of flint, seven of chert and one each on chalcedony and quartz. These pieces occur on both flakes (*n* 32) (Illus 14 – SF 7742) and blades/bladelets (*n* 20) (Illus 14 – SF 1280) with three made on flake fragments. There is some difficulty in deciding which are functional or technological in form without a comprehensive programme of microwear being conducted. Nevertheless, given the relative abundance of microburins/notch-and-snaps a significant number are thought to be related to microlith production.

Three pieces are double-notched (Illus 14 – SF 1277). A single example occurs on a platform rejuvenation flake.

4.5.8 Denticulates

Twenty-four denticulated flakes and blades/bladelets were identified. These pieces are characterised by multiple small notches or flake removals creating a serrated edge (Illus 14 – SF 7790). All were made on flint with the exception of three occurring on chalcedony. All but four occurred as flakes.

4.5.9 Points

A total of 33 pieces were classified as points. Twenty-four were made on flint, with five on chert, three on chalcedony and one on quartz. Seven showed degrees of patination and three were burnt. Both blades/bladelets and flakes had been modified by the application of retouch in order to produce a sharp working point. This modification varies in character from that of notches applied to create a sharp '*bec*' (Illus 14 – SF 153) to that of fine semi-abrupt retouch converging along lateral edges (Illus 14 – SF 1281). Several appear to take the form of possible combination tools or reworked pieces from other categories. The size of this category is just as varied, with lengths ranging from 7.8mm to 28.5mm and widths from 7mm to 22.7mm.

The uses of such tools would probably be as varied as their size and morphology. The larger and coarser of the pieces may have served as gravers, while other domestic tool types such as piercers, borers and awls are all undoubtedly represented. A few of the finer examples may even have served as projectile points.

4.5.10 Edge retouched pieces

Edge retouched pieces other than those described in the categories above account for 9.3% (*n* 108) of the modified assemblage. All had retouch regular enough to be identified as being deliberately modified.

The edge retouched pieces occurred on both flakes (Illus 14 – SF 1295) and blades (Illus 14 – SF 1293 and SF 1280), with larger blanks being favoured for the latter. A small range of other pieces such as chunks and platform rejuvenation flakes were also modified.

Twenty-five of the pieces were patinated, with a further 12 being burnt or heat affected. Flint again dominated, producing 95 pieces; 11 were made on chert and two on chalcedony. The retouch is regular and is largely restricted to the lateral edges, although proximal and distal examples are present.

The category was divided into five further sub-categories: thin-backed retouch, thick-backed retouch, abrupt, truncations and retouched.

Thin-backed pieces

Thirty-three pieces showed fine regular edge retouch. Twenty-one of the pieces were on recognisable flakes or flake fragments, two were on blades, one was made on a chunk and one on a side-struck platform rejuvenation flake. Five of the flake pieces were fragmentary. In all but two examples the retouch was fairly abrupt. The two others have semi-acute retouch applied to a lateral edge and therefore can possibly be viewed as simple knives.

Three of the pieces were retouched along the right-hand side, with 10 along the left. Two were retouched across the distal end of the piece and two were also worked across the proximal end. Two pieces had retouch applied to both lateral edges. SF 40 had fine abrupt retouch applied to the left lateral edge, whereas the right-hand side appears to have a slight concave scraping edge. It would appear that in most of the pieces edge trimming served to back the piece for easier handling or hafting.

The complete thin-backed flakes gave a max/min length range of 6.8mm/49.6mm and a width range of 6.2mm/27.7mm. The two blades were large examples with lengths of 32mm and 26.8mm and widths of 10mm and 12.2mm respectively.

Abruptly retouched pieces

These are similar in morphology to the thin-backed examples, although the retouch is larger and blunter. Thirty-eight pieces were identified, with four made on chert and the remainder on flint. Recognisable flakes account for nine of the blanks used, with nine blades. Ten of the pieces were fragmentary. Retouch occurred on all edges, with lateral modification of the left-hand side being the most common. Three of the blades were retouched along both lateral edges (Illus 14 – SF 8522). Two pieces had blunting retouch along a single edge with presumed occasional use-wear.

The complete abruptly retouched flakes gave a max/min length range of 28.2mm/12.2mm and a width range of 13.2mm/6.4mm. The blades were relatively large examples, with lengths ranging from 35.7mm to 13.4mm and widths of 10.8mm and 19.2mm respectively.

Thick-backed pieces

Four pieces were catalogued as thick-backed. All were made on flint. Three were flakes, with a single piece made on a blade. All four were characterised as thicker pieces with steep, abrupt and less regular retouch. The pieces have a max/min length of 34.8mm/13.4mm and a width of 10.3mm/7mm. It is possible that these pieces represent small fabricators.

Truncations

Nineteen pieces were catalogued as truncations. Unlike the SHMP typology, this study has avoided terming them as 'microlithic truncations' because the retouch truncating the piece varies significantly. However, it seems probable that some are indeed related to microlith manufacture. Sixteen are made on flint, with the remainder on chert. Nine pieces are made on blades, of which two are fragmentary. The remaining 11 are on flakes only, one of which is fragmentary. Thirteen of the artefacts have been obliquely truncated, with four truncated across the distal and two across the proximal end. A single piece truncates a denticulated flake and another truncates a blade with fine regular retouch. A single piece has a small notch underlying the truncation; this piece may represent a failed attempt at microlith manufacture.

The size of the pieces varies considerably, with max/min length of 30.6mm/11.3mm and a width of 19.4mm/5.7mm.

Other retouched pieces

This category includes five pieces all made on flint. These pieces do not fit easily into any of the other modified categories due to morphology. In the main these pieces exhibit retouch that differs significantly from the other modified pieces within the assemblage, and it is possible that some are related to later prehistoric activity.

4.5.11 Possible burins

Twenty possible burin-struck blanks (Illus 14 – SF 1649) were identified, 15 made on flint and five on chert. It is likely that many of these pieces are the result of proximal spalling occurring during removal.

4.6 Spatial analysis and material distributions

4.6.1 Introduction

Unlike the majority of Mesolithic sites, the excavation at East Barns produced coherent structural remains with considerable in situ deposits. The site area itself was contained within a natural hollow, a situation which appears to have encouraged the build-up of overlying and infilling layers of colluvial silt. These deposits effectively sealed the underlying archaeology and have therefore protected it from the erosional nature of modern farming practices.

The East Barns house also appears to have been restricted to a single main construction phase, unlike, for example, the Mesolithic house excavated at Howick (Waddington 2007). However, the presence of numerous conjoined and closely spaced post holes would suggest efforts at probable repair, if not reconstruction. In situ occupation deposits were identified both within and outwith the house in the form of an intermittent refuse deposit, occupation horizons and pit fills.

In order to gain any meaningful insights from intra-site artefact distributions, it was necessary to disregard any re-deposited lithic material and focus solely on those artefacts contained within the in situ occupation deposits and features. All modified tool and debitage categories retrieved from these deposits with the exception of the pit fills were plotted (Illus 15–19).

All artefactual material retrieved during the excavation was recorded using a strictly controlled grid system (see Section 3.1, Methodology). The material was recovered through both hand excavation and the on-site wet-sieving of all excavated deposits. This method enabled large amounts of material to be quickly processed and for the material to be both spatially and temporally identified with a fair degree of accuracy.

4.6.2 General material distribution

The vast majority of artefacts were recovered from deposits directly associated with the house. These included the occupation horizons immediately surrounding the house (Contexts 2549, 2561, 2564 and 2567) and the intermittent refuse deposit found within the interior of the structure itself (C2573). In situ lithic material was also recovered from both external and internal pit features. Nevertheless, a large proportion of the assemblage was retrieved from the infilling colluvial deposits. These were almost certainly incorporated into the house, either by being washed in from the surrounding occupation horizons or by being deliberately dumped within the hollow once the structure had passed out of use.

Twelve pits and post holes excavated within the immediate vicinity of the house provided a further 956 lithics. These included 28 modified tool types (microliths, scrapers and retouched). Seven of the pits are located within the occupation horizons lying to the north and west of the structure. A small cluster of four pit features was located to the immediate north-east and a single large pit was positioned to the east. It is likely that the majority of these features represent waste pits. As such, the lithic material they contain is of limited value in determining on-site spatial patterning and has therefore been omitted from the more detailed distributions given below.

Five internal pits and deposits were excavated within the central area of the structure. These included Hearth Feature 2677, from which 157 lithics were retrieved, and included a scraper, three scalene triangle microliths, a fine point and a backed blade. The pits produced 335 lithic artefacts. A further three scalenes, a scraper and two other microliths were found within the other pit fills.

A stratigraphically visible fall-off in the total amounts of lithic material retrieved from the deposits is apparent. The in situ deposits consisting of the activity floors and the house detritus produced a total of 4,562 artefacts. The infilling deposit (C2550) which immediately overlay the structural elements of the house and the detritus deposits produced even more, with a total of 6,380. This deposit was considered the primary infill of the house after abandonment, which may explain the large number of lithics. The four sequentially overlying infills of colluvium then produced a rapid fall-off in numbers: C2546 = 2,663, C2533 = 2,575, C2518 = 996 and C2521 = 48. A similar stratigraphic fall-off in numbers was identified within the Mesolithic structure excavated at Echline Fields (Robertson et al 2013: 111). Interestingly, the topsoil overlying the immediate vicinity of the East Barns house produced negligible numbers of lithic material. This suggests that all activity areas associated with the structure were confined to the extent of the hollow and remained relatively intact.

4.6.3 Temporal distinctions

No strong temporal distinctions can be observed from the distribution of the majority of the lithic material associated with the structure. A broadly similar mix of debitage and Mesolithic artefact categories was found in all of the associated stratified deposits. However, later activity was observed within the area of the structure in the form of the two large flint knives recovered from Neolithic deposits and the colluvial layer (C2533) lying immediately above.

Neolithic activity was also noted at the northern end of the hollow, where several pits produced Neolithic dates and associated pottery. A later Mesolithic activity floor (C2531) dating to 4800–5000 cal BC was revealed to the immediate south of these features. This floor produced a relatively low number of lithics (*n* 109) and included no microlithic artefacts or other modified tool categories. Core types were restricted to four platform examples. Quartz was the dominant raw material within this context, accounting for over 80% of the recovered lithics.

Interestingly, there were no broad-blade microlithic types present in the assemblage. Few Mesolithic sites have a complete absence of this material (Wickham-Jones pers comm). Some broad-blade material was present at Howick outside the main structure, but at East Barns lithic material was almost solely confined within the hollow. A test pitting survey undertaken as part of the initial evaluation revealed a surprisingly thin scatter of largely narrow-blade lithic material. It is therefore likely that the homogeneous narrow-blade assemblage associated with the house was created in relative isolation within a sparsely populated landscape with little chance of admixture with earlier material. This gives weight to the notion of the inhabitants of East Barns representing a pioneer population associated with a secondary colonisation of Britain.

4.6.4 Spatial analysis

Debitage

All five plotted debitage categories (cores, blades, flakes, rejuvenation flakes and fine fraction) gave very similar distributions (Illus 16–19). Given the overall nature of the assemblage, all three of the recognised occupation horizons directly associated with the structure produced significant material in relatively proportional quantities. These proportions were also replicated within the refuse deposit (C2573).

The majority of cores were recovered from the occupation horizons situated to the immediate north (C2535–2549) and south (C2564) of the house (Illus 16). A relative absence of cores from the activity area to the west of the house (C2561) was observed. This relatively discrete clustering of material suggests that the northern and southern areas were the probable focus for reduction on site. Smaller clusters of cores were also found within the house itself. These were recorded within the refuse deposit (C2573).

Microliths and microburins

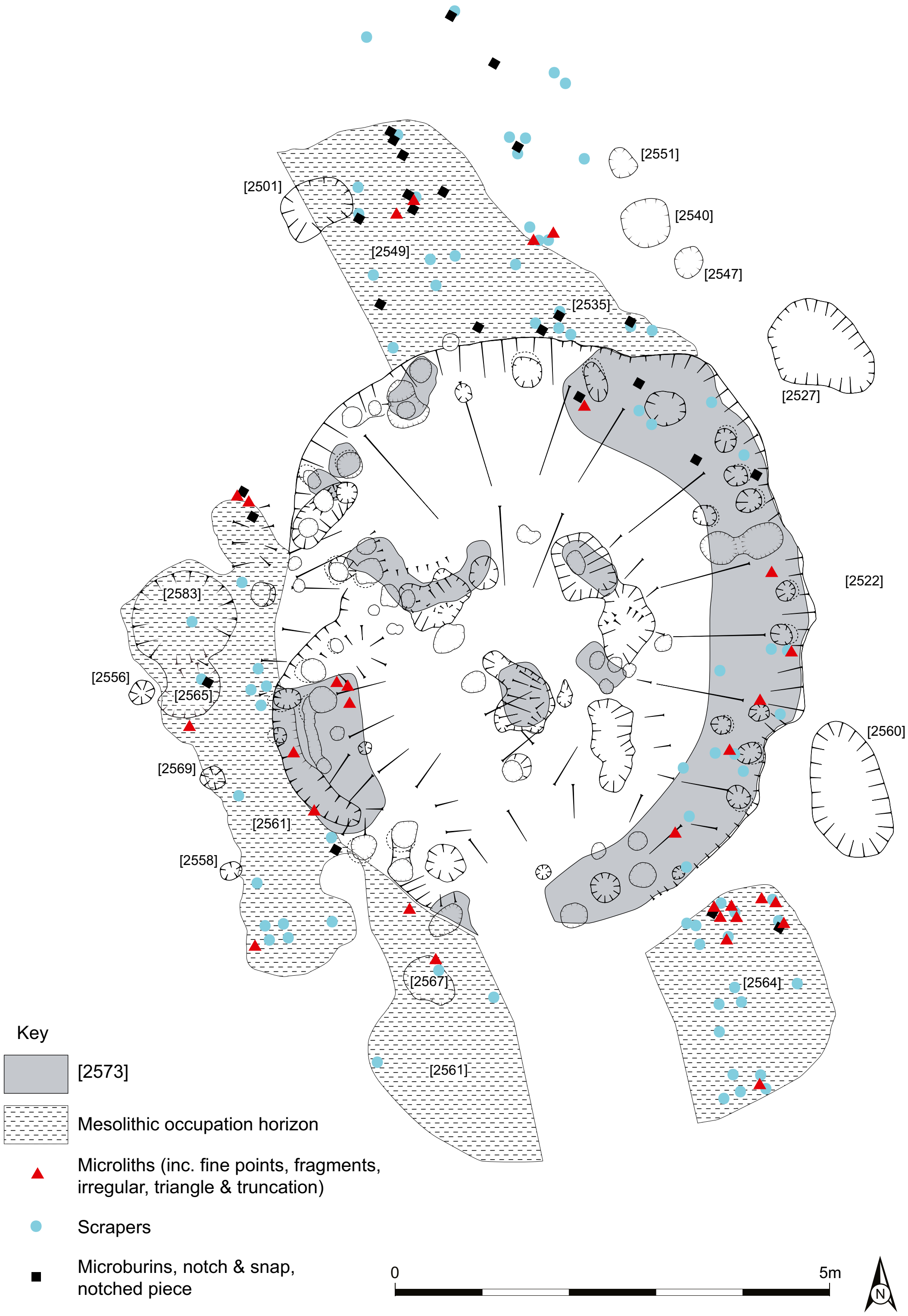
The distribution of microliths corresponds closely with the majority of the other categories recorded within the in situ deposits (Illus 15). A tight cluster of varied forms occurred in the northern part of Occupation Horizon 2064. This is repeated within Horizon 2549, although in a more diffuse manner. Scalene triangles are present in all of the activity areas.

However, they only appear to dominate the westernmost horizon (C2561). Within the structure itself microliths are again found in respectable numbers, mostly in the form of scalenes. They are largely restricted to the eastern lenticular part of Refuse Deposit 2573. Ten microliths, including six scalene triangles, were recovered from the hearth (C2677) and other deposits located within the centre of the house.

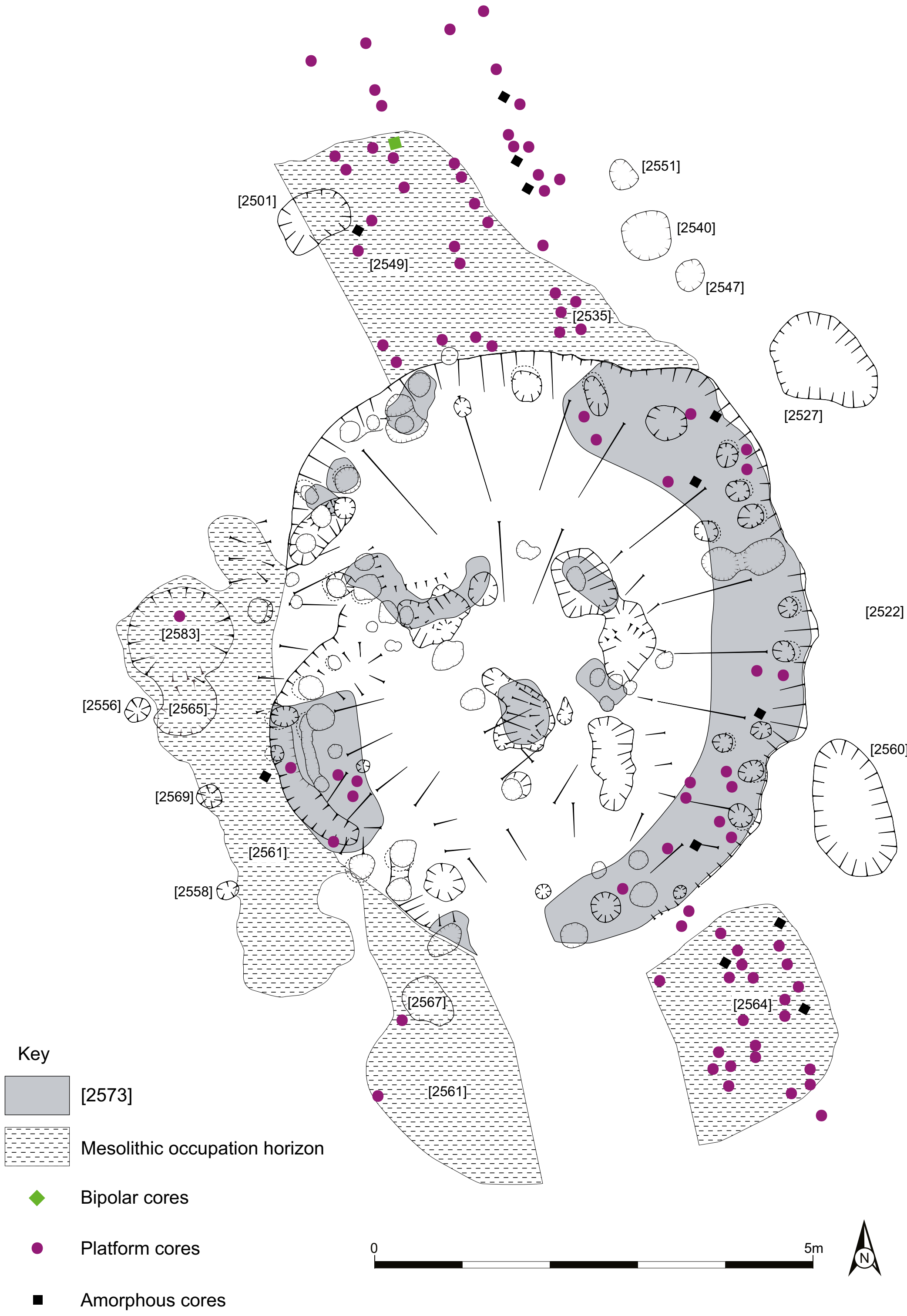
Microburins and associated pieces were largely confined to the northern occupation horizon (C2535–2549), with occasional examples occurring within the other external horizon deposits. These artefacts appeared to be absent from within the structure itself, with the exception of four pieces recovered from the north-east corner of the house again occurring within Refuse Deposit 2573.

Scrapers

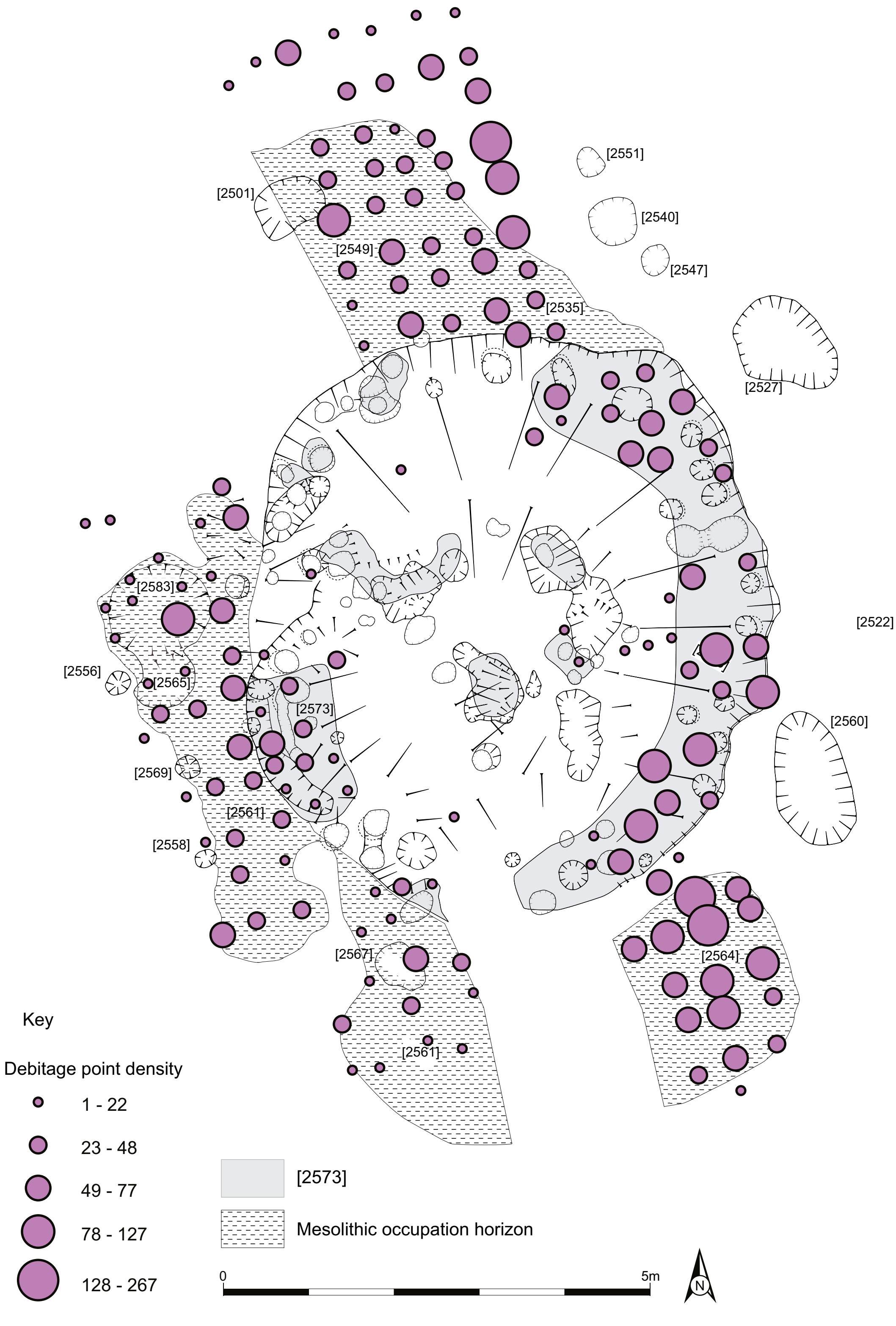
Scrapers were well distributed throughout the external occupation horizons (Illus 15). These tools were again recovered from the interior of the house, with two clusters located in the north-east and south-east. These were again found within the refuse deposit (C2573) located along the eastern perimeter of the structure. Two scrapers were also retrieved from the refuse deposit located within the centre of the house.



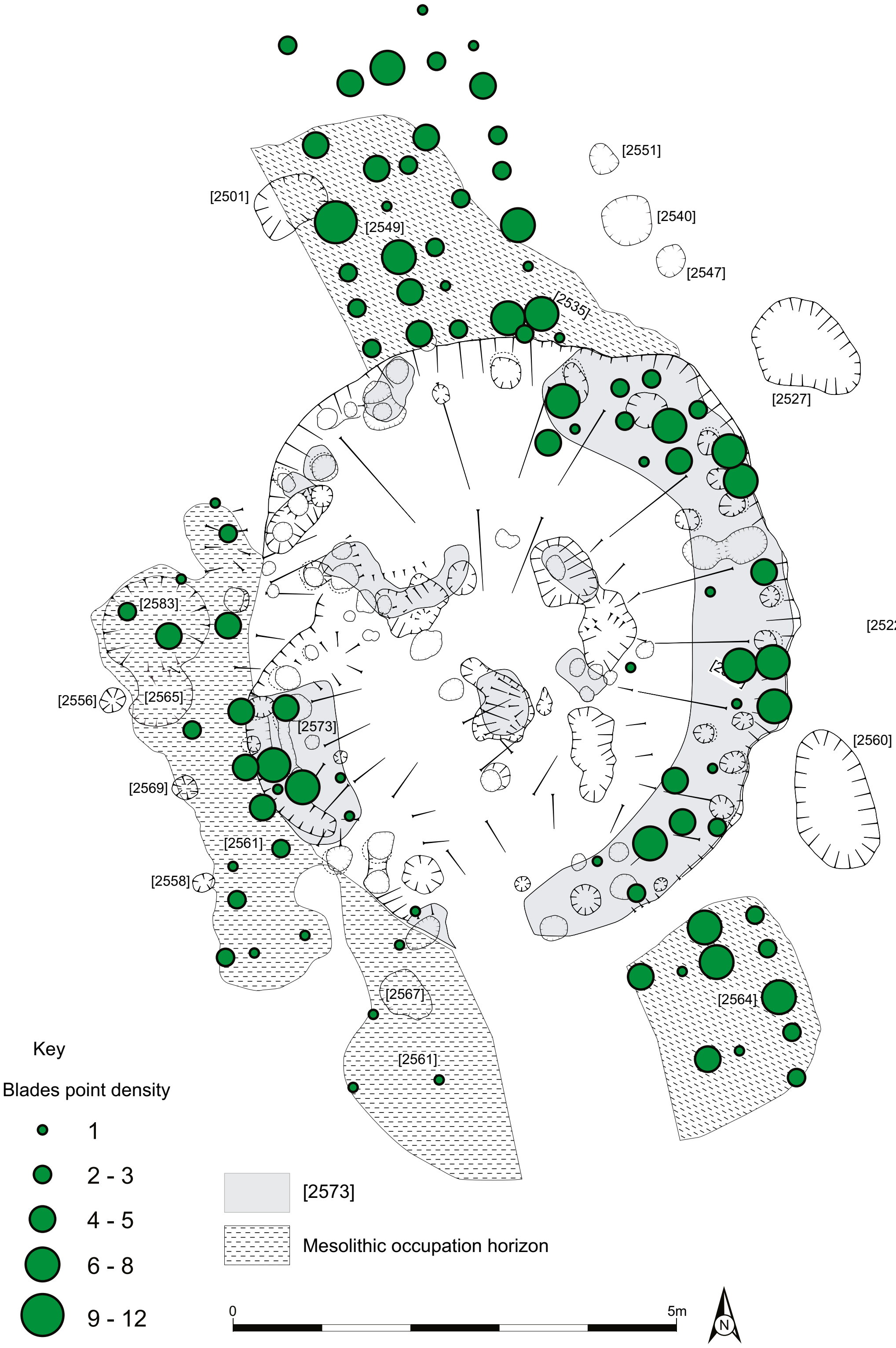
Illus 15 Distribution of modified lithic tools



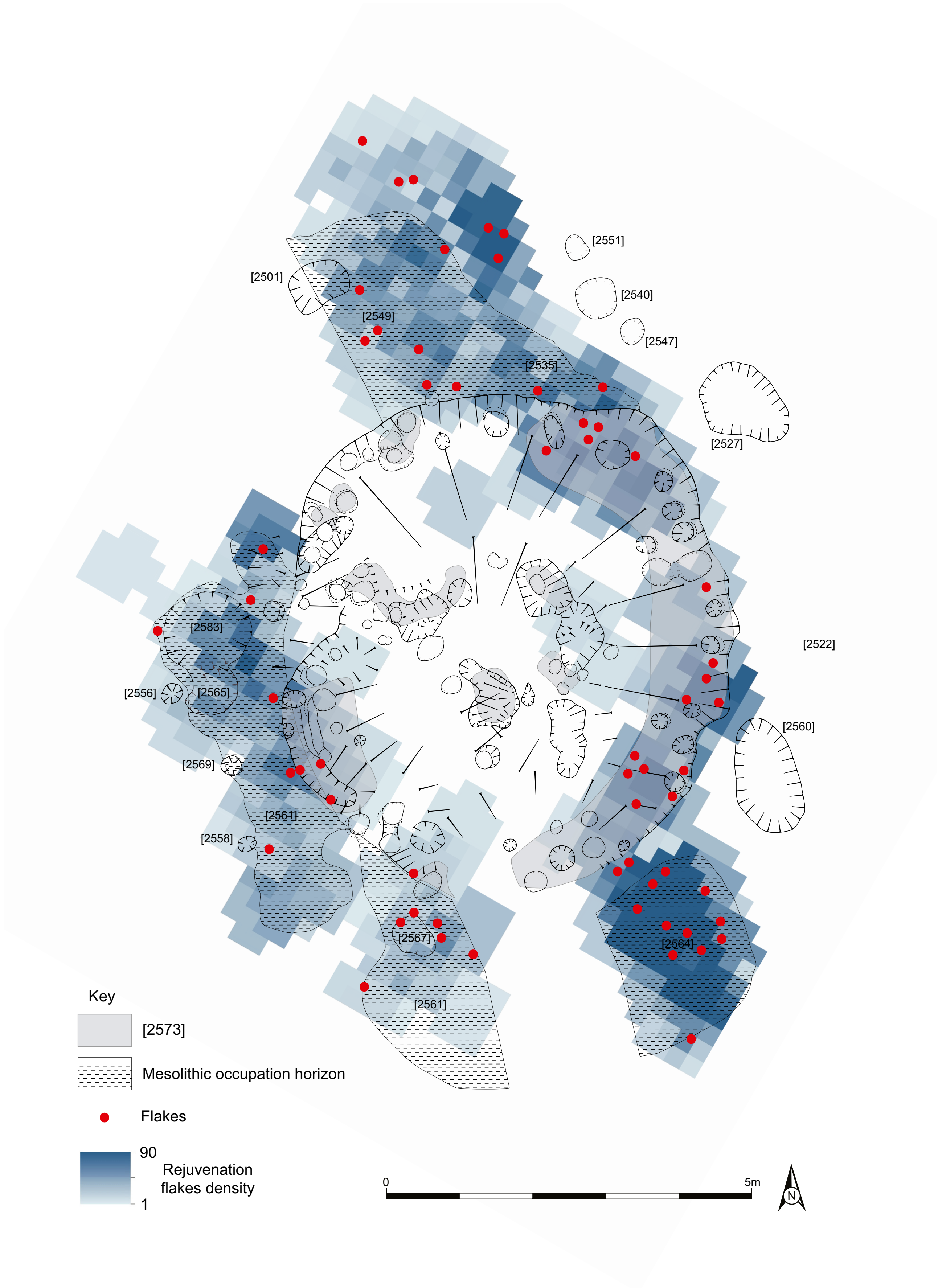
Illus 16 Distribution of core types



Illus 17 Distribution of debitage



Illus 18 Distribution of blades



Illus 19 Distribution of flakes and rejuvenation flakes

Other tool categories
These artefacts included points, retouched pieces, denticulates and knives. As with the other modified tool categories, their distribution appears to be largely restricted to the occupation horizons to the north and south-east of the structure. A small cluster of points is located within the southern half of C2564, with a cluster of retouched pieces occupying the northern part of the context. Retouched pieces are also fairly numerous within the northern horizon (C2549), together with a single knife and denticulate.

Within the house itself, the refuse deposit located along the eastern perimeter contains several points, retouched pieces and denticulates. The latter category appears largely confined to the southern half.

4.6.5 Summary and discussion

Illus 15 to 19 clearly show that the majority of the in situ lithic material including both modified and debitage classes was concentrated within the external occupation horizons and from within the refuse deposit within the interior of the house. This deposit also had a lithic-rich presence within the south-west corner of the house and occurred intermittently both within the central interior and north-west perimeter. The deposits and features associated with and surrounding the hearths also provided a substantial amount of lithic artefacts, again including both modified material and debitage.

Cores, blades, flakes, fine fraction and rejuvenation flakes have almost identical plotted distributions. All five categories exist in significant quantities both within the occupation horizons to the north and south of the house and from within the refuse deposit along the eastern and south-western interior perimeter. On the eastern perimeter a small yet significant gap is apparent within the distribution of the debitage (Illus 17). The presence of numerous cores and other debitage within the refuse deposits and fills of the interior suggests that blade/flake production was also occurring within the house itself. This activity was also noted within the structure excavated at Mount Sandel (Woodman 1985: 141).

The distribution of the debitage within the house most probably represents the waste from three working zones immediately surrounding the central hearth pits to the north-east, south-east and south-west (Illus 17) of the interior. Interestingly, cores of all types are largely absent from the west of the house. Core reduction was therefore apparently restricted to the north-eastern and south-eastern parts of the house and its associated external occupation horizons.

The distribution of scrapers and miscellaneous tool categories forms an interesting accompaniment to that of the debitage. Several large, diffuse clusters of scrapers are visible within the external occupation horizons, showing that these were the primary areas of usage. However, scrapers also appear in significant numbers within the house. These appear restricted to two separate clusters, one in the north-east and one in the south-east of the refuse deposit. This appears to be replicated by the general distribution of the miscellaneous tool categories. The distribution of these artefacts implies that domestic tasks such as the scraping of hides etc also took place within the house in addition to general tool manufacture and curation (Illus 15).

The distribution of microliths also appears to follow the pattern observed in the categories above. Numerous examples were recovered from the external occupation horizons and the internal refuse deposits as well as from the waste pits both inside and outside the house. It would appear from the distribution plots that scalene triangles are the most numerous categories found within the refuse deposit. This distribution is especially marked in the north-east of the house, where other categories are almost entirely absent. The scalenes and indeed most of the other microlith categories appear to occur in tight clusters. This suggests evidence of tool maintenance occurring within specific and possibly demarcated areas within the house.

Microburins and associated categories are almost totally absent within the house, with the exception of several notched pieces found in the north-east corner. These artefacts appear largely restricted to the occupation horizon situated immediately north of the house, with occasional examples occurring within the other areas. Given that these artefacts are associated with microlith manufacture and that numerous microliths were recovered from the interior of the house, it would be sensible to conclude that the majority of microlith manufacture was conducted outwith the house.

The in situ lithic material recovered from the house displays a primarily annular distribution directly related to the build-up of Refuse Deposit 2573 (see Section 4.7, Discussion). This deposit was formed by the remains of domestic refuse and lithic manufacture/maintenance which had fallen through the soft plant flooring of the house and been allowed to accumulate out of sight. It is likely that the distribution of lithic material therefore represents 'conversational' patterns of disposal (Binford 1978; Woodman 1985: 141). Such a refuse deposit would likely aggregate around the seated positions of the inhabitants around a central hearth. It is also likely to accumulate within the rear recesses of the structure as waste is tossed behind the seated individual away from the active areas of the house. This would account for both the high amount of general waste and the variety of tool categories recovered from this deposit. This method of disposal, though far from an ideal form of housekeeping in a modern sense, would leave the majority of the house free from debris. The lithic material recovered from in and around the hearth pits suggests that material was also thrown into the fire pits from people facing it. This pattern of disposal is also seen at Echline Fields (Robertson et al 2013: 93) and at Howick (Pedersen 2007). At the former, concentrations of lithic material were recovered not only from the fills of internal pits and post holes associated with the primary occupation but also from around the central hearth feature.

During the primary occupation phase at Howick, a similar complex of formal tool types and debitage was observed, forming three clusters around a prominent central hearth. Although these were not associated with a refuse deposit, their general distribution within the house was also thought to reflect discrete activity areas. As at East Barns, the distribution of cores mirrored that of blades and other debitage. This was also repeated within the modified tool categories such as microliths and scrapers.

The lack of lithic material found in the north-west interior of the East Barns house possibly implies a separation of activities occurring within the house. This area is occupied by the platform and appears to have avoided the signs of erosion associated with repeated movement and footfall present within the southern half of the structure. It is therefore highly likely that the north-western part of the house was used for sleeping quarters or other less utilitarian activities.

In summary, the spatial analysis has revealed that the majority of lithics retrieved from the in situ deposits within the house reflect the gradual accumulation of waste material directly derived from both the direct manufacture of blades and flakes and from other activities such as the maintenance and utilisation of tools. These accumulations of material reflect an annular pattern of disposal from three discrete working areas located to the north-east, south-east and south-west of the central hearth.

To the immediate north, south and west of the house lay several occupation horizons in which similar distributions of lithic material to those found within the house were in evidence. This suggests that a similar set of activities were also practised outside the house.

4.7 Discussion

The excavation of the Mesolithic house at East Barns produced a significant lithic assemblage obtained largely from a series of spatially limited, well-defined and securely dated contexts relating to a late 9th millennium BC occupation.

A key factor in the examination of this material was the study of its 'sister' assemblage at Howick, Northumberland (Pedersen 2007). The author makes no apologies for focusing on this site for many direct comparisons, given the geographical proximity and the similar natures of the sites. The two sites were investigated almost in tandem, which allowed for information to be shared and terms and descriptions standardised.

The material produced at East Barns can be characterised as a narrow-blade/scalene triangle-dominated assemblage. As such, it appears to fit into the small but growing group of sites associated with early dates relating to the 8–9th millennium BC (Saville 2004: 207). In addition to the assemblages associated with house structures at Howick (Waddington 2007), Low Hauxley (Pedersen 2016), Mount Sandel (Woodman 1985) and Echline Fields (Robertson et al 2013), one can add the small-scale excavations at Cramond, Edinburgh (8400 cal BC) (Saville 2008; Engl 2012; Lawson et al forthcoming).

The increasing number of narrow-blade

microlithic assemblages associated with early dates has obvious ramifications with regard to the traditionally prevailing model (Jacobi 1976) of an Early Mesolithic characterised by broad-blade industries and a narrow-blade industry denoting the later Mesolithic. Saville (2008: 213) has already questioned the relevance of this model for interpreting lithic assemblages within the 9th millennium of northern Britain. The reassessment for the emergence of narrow-blade technology within the north-east of the British Isles has begun to take a more formal shape through the work of Waddington (2007; et al 2007b; 2014) and Waddington & Bonsall (2016), whose hypothesis on a population diaspora initiated by the inundation of the North Sea Basin includes narrow-blade technology as part of a spreading culture complex first emerging in south-east Scotland and north-east England. This would appear at this current time to be well supported by the existing evidence as more early, narrow-blade-associated house sites such as East Barns and Echline Fields join the archaeological record.

As with the aforementioned assemblages, the East Barns material is characterised by the localised procurement of abundant and good quality lithic raw materials. This appears to have been an essential part of subsistence activities practised throughout the Early Mesolithic. Mesolithic populations in Scotland are known to have used a wide range of lithic raw materials, usually but not exclusively as a supplement to flint (Finlayson 1990a; Saville 1994). The dominance of flint (85%) within the assemblage is slightly less than at other settlement sites of the period such as Mount Sandel in Northern Ireland (99%) (Woodman 1985), Newton, Islay (99.9%) (McCullagh 1989), Howick, Northumberland (98.9%) (Waddington 2007) and Echline Fields, on the Firth of Forth. At Echline Fields good-quality chert was the dominant raw material (Robertson et al 2013: 107). This may reflect issues of local availability, combined with the relatively good quality and utility of the supplementary materials, which allowed the knappers of East Barns to produce modified tool types in chert, chalcedony and quartz. These materials were also obtained from the same local sources as the flint and it seems unlikely that Mesolithic collectors would ignore the presence of such serviceable materials in a concerted search for flint, as this would have had undoubted cost/benefit implications. This may explain in part why supplementary raw materials are usually present within flint-dominated assemblages of the northern British Mesolithic.

Nevertheless, a Mesolithic preference for flint as a working material can be seen in its ubiquity on Mesolithic sites, even where the material is locally scarce (Saville 2004: 185). Flint is present within the lithic assemblages of areas such as central Dumfries and Galloway (Finlayson 1990a) and the Upper Tweed Valley (Warren 2005), where good quality chert forms the mainstay of many assemblages. On the Hebridean Isle of Rhum flint actually dominates the Mesolithic assemblages even though no local flint is presently known from the island's beaches and good-quality bloodstone and chalcedonies are readily available (Finlayson 2004; Wickham-Jones 1990).

Flint would therefore appear to head a hierarchy of utilised raw materials within the Mesolithic. These materials produce the highest frequencies of microliths and blades, followed by chert, which produces a higher frequency of flakes, then chunks, with finally quartz not producing conventional blades (Finlayson 2004: 223). This appears to be well illustrated by the evidence from East Barns. However, although flint produced the most blades and microliths in number, both chert and chalcedony produced a slightly higher percentage of these artefacts compared with the total proportions of each material present within the assemblage. This again can probably be explained by the generally high quality and small nodule size of all raw materials found within the area.

As already mentioned, the exploitation of flint and other raw materials in the Mesolithic of northern Britain was undertaken on a local and perhaps regional level. The Southern Uplands chert present at East Barns is the major component of Mesolithic assemblages across Dumfries and Galloway, the Forth Valley and the Upper Tweed Valley, where it was possibly mined in the Mesolithic (Warren 2003). Flint occurs to a lesser degree, though it appears intensively used within these assemblages (Finlayson 1990a). This flint is presumably derived from coastal deposits such as those found at East Barns. Finlayson's model (Finlayson 1990a; 2004: 224) of differentiating lithic economies through the proportions of raw materials and the assumed high value ascribed to those such as flint, can be applied with regard to coastal flint-rich sites such as East Barns and Howick and inland areas such as the Tweed Valley, where chert dominates. Finlayson implies that where flint is embedded into the site economy as a 'local material within the mobile round', a steady fall-off in such a round would account for a lower proportion of flint on sites furthest away from the source of the high-value raw material. This in turn would lead to generally higher visible rates of curation (Finlayson 2004: 224). The presence of such a mobile round in the vicinity of East Barns is still to be recognised due to a current lack of fieldwork within the surrounding area.

With the high value placed on flint, it is probable that the presence of a reliable source of this material was a primary concern within the Mesolithic economy. This would have been a major draw in attracting people to inhabit sites such as East Barns.

The range, quantity and types of raw material encountered on the site are typical of many of the more substantial and stratified Mesolithic coastal sites excavated in northern Britain. It is notable for the general quality of its supplementary raw materials which, though smaller than flint in number, were evidently obtained from the same sources and were of sufficient quality to produce a similar range of artefacts such as conventional blade blanks and retouched tools.

The assemblage at East Barns shows the hierarchical on-site reduction of a variety of local nodular raw materials. These were worked in a variety of ways, with platform reduction being the most important. A significant bipolar presence was also registered. This technique appears to have been used to work less tractable materials such as quartz, and extend the productivity of the higher quality flint and cherts. Cores of all types were worked fairly intensively, with numerous multi-stage examples.

Blade cores were the predominant platform type, which, coupled with the information gleaned from the blank sample, suggests that blade manufacture was an important if not primary focus of manufacture undertaken on site. This was also recognised at both Howick and Echline Fields.

Cores were heavily maintained, and a range of rejuvenation flakes were produced, maintaining the platform and core face. The majority of cores appear to have been abandoned due to size constraints. Other factors influencing abandonment, such as technical problems and naturally occurring flaws within the material itself, were also observed.

Knapping involved the creation of simple platforms on opened nodule surfaces. In many cases the angle of the unopened nodule was considered sufficient to support direct knapping on the cortical surface itself. Platforms were maintained by the simple trimming of the edge to remove lips and other irregularities.

A direct soft-hammer technique appears to have been the main form of reduction employed within the assemblage. The bulbs of percussion were a mix of diffuse and pronounced types, with the former in the majority. Other indicators of the direct application of soft-hammer technique are present in the high number of narrow and crushed blade/flake platforms.

As with the assemblages at Howick and Echline Fields, all stages of the *chaîne opératoire* were present at East Barns. However, significant differences between the assemblages are apparent. The East Barns assemblage revealed evidence for production, use, curation and discard. This was recovered from both external occupation horizons and internal refuse deposits. At Howick, external horizons were absent, with primary reduction thought to occur close to the area of collection. It is thought that the debitage recovered from the internal deposits at Howick resulted almost solely from tool curation and replacement (Waddington 2007: 54). At Echline Fields, lithic material was also recovered from deposits within the excavated structure but was restricted externally to pit fills.

It is possible that such inter-site differences may be the result of differing taphonomic processes. In contrast with both Howick and Echline Fields, the position of the East Barns site within a natural hollow led to the formation of a protective covering of colluvium. This in turn protected the in situ deposits from the erosional effects of modern farming practices.

At East Barns the distribution of lithic material both internally and externally was relatively consistent. A similar set of activities, including core reduction, appeared to be practised both internally and externally. An annular pattern of disposal was observed within the house, obtained from three discrete working areas located to the north-east, south-east and south-west of the central hearth pits. This distribution pattern around a central hearth is replicated to a certain degree in the primary occupation phase at Howick.

The assemblage at East Barns produced a wide range of formal tool and microlith types with a high incidence of scalene triangles, microburin/notched bladelets and scrapers. These tools were used in a range of activities, including hide working, butchering, tool/ornament manufacturing and tool maintenance. The range of microliths in particular was very similar to that produced at Howick. At East Barns microliths accounted for 1.52% of the assemblage compared with 2.1% at Howick and 3.8% at Echline Fields. Though this initially appears rather low, the combination of a protected site and intensive artefact recovery has obviously helped reduce the relative percentage in comparison to the other sites, where much of the production evidence has been removed.

Scalene triangle microliths dominated, accounting for 46.7% of the total number of microliths. Scalenes were also the dominant form at the house sites of Howick and Mount Sandel. Surprisingly, these artefacts were almost absent at Echline Fields, being supplanted by crescent forms. However, the high number of unrecognised broken microliths present at this site may again have skewed the data set.

Microburins, notched bladelets and notch-and-snap artefacts are linked with the manufacture of scalene triangles and other microlith categories (Wickham-Jones & McCartan 1990: 100; Saville 2005: 113). The 148 pieces recovered at East Barns would suggest that the production of microliths was an important undertaking. The relative scarcity of such artefacts at Howick and Echline Fields is again most probably due to the absence of in situ working areas surviving at these sites.

In the study of the Howick assemblage, Waddington has identified a tentative 'signature' for lithic assemblages obtained from Mesolithic settlement sites (Waddington 2007: 55) based on five characteristics. These consist of a wide range of tool and microlith types, an absence or low incidence of microburins, a disproportionately large number of formal tool types compared to primary and secondary debitage, and finally a large proportion of tools broken before discard. The East Barns assemblage displays a similar signature, albeit with the presence of numerous microburins and a lower number of formal tool types. As previously explained, factors of site morphology and taphonomy are again the most obvious explanation for these discrepancies rather than absolute differences.

Due to the fortuitous nature of its location and the subsequent survival of its external working areas, East Barns probably presents a more complete assemblage than any of its contemporaries. The presence of large numbers of primary and secondary debitage therefore makes East Barns a link between the substantial house sites of the 9th millennium and the later large knapping sites such as Kinloch, Rhum (Wickham-Jones 1990: 99) where significant structural evidence survives but without the robust nature of those sites on the Forth littoral.

5. LITHIC MICROWEAR ANALYSIS (WRITTEN 2009)

Randolph E Donahue and Adrian A Evans

5.1 Introduction

The objectives of the proposed lithic microwear study were:

- To identify lithic artefact use and its relationship to tool types
- To identify the diversity of activities (as identified by microwear analysis on the tools) and their spatial locations across the site
- To examine the implications of activities at the site regarding the duration and season of occupation and hunter-gatherer mobility strategies
- To improve understanding of site formation processes including post-depositional disturbance and modification.

5.2 Method

A sample of 291 lithic artefacts, including 192 retouched tools and cores of various types, 82 unmodified blades and bladelets, and 14 unmodified flakes, was taken for wear analysis (Appendix 1). Although not a simple random sample, the only selection criterion was that the tools should appear to be in reasonable condition to retain evidence of wear. Other than that, all retouched tools unboxed for consideration had an equal chance of being selected. In addition to the tool forms, a small sample of unmodified blades and flakes were selected for analysis. All artefacts were gently washed in water with a soft nylon brush to remove adhering sediment, and then photographed. This was followed by bathing the artefacts in 10% HCl for 10 minutes, rinsing them in water, then bathing them in water for a further 10 minutes. They were then patted dry with a clean, lint-free towel. Ethanol and acetone were used where necessary to remove finger grease from artefacts during microscopic examination.

All artefacts were viewed principally at 200× magnification with an Olympus KL-BH2-UMA metallurgical microscope with incident-light and long working-distance objectives. Microscopic characteristics of edge fracture scars, striations, pitting and surface polishing were recorded and analysed to interpret tool use, resharpening, recycling and hafting (following Donahue 1994: 2002; Burroni et al 2002). In addition to use-wear features found on the edges of the tools, microscopic characteristics of ridge rounding, plastic deformation, thermal alteration (micro-cracking, potlidding and crazing) edge fracture scars, striations, pitting and surface polishing that resulted from post-depositional modification were recorded. The roundedness of ridges, caused by post-depositional movement of artefacts or sediments, and by chemical dissolution, was measured following Burroni et al (2002) and Donahue (2002). These data provided the means to evaluate further use-wear

Table 13 Microwear analysis: association between artefact use and artefact type

	Artefact use (material)				
Artefact type	Impact	Meat	Hide	Bone/antler	Total
Burin	0	0	0	2	2
End scraper	0	0	28	1	29
Truncation	0	0	1	0	1
Piercer	0	0	1	0	1
Microlith	32	1	1	0	34
Backed tool	0	1	0	0	1
Unmodified blade	0	4	1	0	5
Total	32	6	32	3	73
	43.8%	8.2%	43.8%	4.1%	100.0%

interpretations and to improve understanding of the variability of post-depositional modifications within and between contexts.

5.3 Results

Of the 291 lithic artefacts studied, 73 showed evidence of how they were used. The remaining artefacts were too badly affected by post-depositional processes to permit interpretation with an adequately high degree of confidence. Of tool uses, 32 of the artefacts showed evidence for hide working, 32 were used as points or barbs on projectiles. Six artefacts were identified as having been used for cutting meat or meat and some hide, and three artefacts were used to work the hard organic materials of either bone or antler (Table 13). The low frequency of meat cutting is viewed as a direct result of the impact of post-depositional processes; wear features resulting from meat cutting are very superficial and tend to be the first kind of wear to be eliminated or modified beyond identification from such processes. Wear produced by the cutting of silica-rich herbaceous plant fibre survives such processes very well, so the lack of artefacts with such wear is indicative that silica-rich plant fibre was not being worked, at least not with the flaked stone tools. That there is no evidence for wood working is surprising, as there are almost always a few such tools at British Mesolithic sites. It is suggested that this results from sampling error, which is further supported by the lack of notches and denticulates in the sample. The frequency of bone/antler working tools is about what would be expected.

5.4 Discussion

5.4.1 Tool type and tool use

Microwear analysis often leads to the identification of associations between tool types and tool uses in site assemblages (eg Donahue 1988). At East Barns such associations also exist. The fronts of end scrapers were consistently used for scraping hide (Table 14), with 28 of 29 indicating use on hide. The one exception noted was interpreted as having been used for scraping bone. This predominance of scraping hide with the fronts of end scrapers is typical of Stone Age sites dating from the Upper Palaeolithic to the Neolithic (Donahue 1988; 2002).

Another tool form found in other studies to be associated with a particular use is the microlith. Of the 34 microliths and microlith fragments with identifiable use, 32 microliths appear to have been used as armatures (points and barbs) on projectile weapons, like arrows, or on equipment like leisters (a pronged fishing spear). They tend to display evidence of impact damage at their tip (eg invasive scars, burinations, long striations parallel to the microlith axis and initiated near the tip) and, importantly, virtually no other evidence of use. Thus, while a microlith used as a knife might show some tip damage, it will have a variety of other wear features. Of the remaining two microliths with use-wear traces, one was used for the cutting of meat, and one was used for the piercing (drilling motion) of hide, similar to that of the piercer that also appears to have been used for drilling holes in hide.

Table 14 Microwear analysis: association between artefact use and spatial context

		Use				
		Impact	Meat	Hide	Bone/antler	Total
Context	2549	7	5	9	3	24
	2553	2	0	0	0	2
	2561	6	1	7	0	14
	2564	9	0	11	0	20
	2573	8	0	5	0	13
Total		32	6	32	3	73

Table 15 Microwear analysis: tool use percentile distributions for a sample of Mesolithic sites in Britain (Lismore Fields is a mixed Mesolithic and Neolithic site and North Park Farm may have some Neolithic artefacts in its assemblage)

	Sites			
Use	East Barns	North Park Farm	B&Q	Lismore Fields
Meat/butchering	8.2%	19.1%	0.0%	41.4%
Hide working	43.8%	38.3%	53.3%	28.6%
Herbaceous plant	0.0%	4.3%	3.3%	17.1%
Soft material	0.0%	0.0%	10.0%	0.0%
Wood working	0.0%	2.1%	0.0%	0.0%
Bone/antler	4.1%	2.1%	3.3%	10.0%
Hard material	0.0%	0.0%	6.7%	0.0%
Impact (projectile)	43.8%	34.0%	23.3%	2.8%
Per cent total	99.9%	99.9%	99.9%	99.9%
Total count	73	47	30	70

5.4.2 Diversity and location of activities

The 73 artefacts with identifiable use-wear come from five contexts. There is substantial consistency in artefact use across these contexts, except for the prevalence of meat cutting evident in C2549 (Table 14). This may reflect more on the amount of post-depositional modification than tool use in the different contexts, since wear from meat is the most susceptible to post-depositional modification. However, since bone and antler working is only found in C2549, it does suggest that this context is somewhat unique with regard to activities. Armatures seem to be discarded or replaced in all contexts, and hide scraping also seems well distributed, being found in four contexts. Hide piercing as opposed to hide scraping occurs in C2561 and C2564 (one tool in each context).

5.4.3 Post-depositional modification

The degree of post-depositional modification was studied as part of the preliminary analysis of this assemblage and was undertaken on only a small sample of material from various contexts. This preliminary report can be found in the site archive.

5.4.4 Comparison with similar sites

Microwear analysis has been applied to numerous Mesolithic assemblages in Britain, but rarely have large samples been studied with equivalent techniques which would permit statistical comparison. Furthermore, such ancient sites undergo quite different kinds of amounts of post-depositional modification, which will affect the distributional frequencies of tool uses. As a result, a side-by-side comparison is not really meaningful. One British Mesolithic site that has undergone lithic microwear analysis is the B&Q site excavated by MoLAS (Donahue 2002). The size of the Mesolithic locality ‘B’ displayed evidence of more activities than what is observed at East Barns (Table 15). Lismore Fields, located in the Peak District National Park near Buxton and better known for its Neolithic component, provides a large Mesolithic sample, but one that includes the Neolithic component as well (Donahue nd). The high percentage of plant cutting at Lismore Fields reflects this Neolithic contribution to the assemblage and impacts on the percentage of tools used as armatures for projectiles. Another Mesolithic site, of substantial size and quantity of material is North Park Farm in Surrey. Extensive excavations by the Surrey Archaeological Unit revealed large areas of artefact clusters. A large sample of artefacts was analysed for wear, but only 47 (less than 10%) had identifiable use-wear. This site also had a diverse set of activities represented (Donahue & Evans 2013).

5.4.5 Conclusion

The site of East Barns has undergone some post-depositional modification, even though this may principally be the result of trampling during its occupation. This modification, however, may have seriously affected the frequency distributions of activities indicated at the site, so generalisations dependent on relative tool frequencies need to be considered cautiously. The microwear analysis of the East Barns assemblage indicates that a relatively small range of activities was performed at the site. These include hide working, butchering, tool/ornament manufacturing, and the maintenance of weapons. It would seem that this site was repeatedly visited but may have had a fairly specialised role in the subsistence-settlement system or that it was occupied during a season when only a few activities were performed, and which required use of flaked stone tools. Male- and female-associated activities are well represented, so there is good reason to assume that one or more family units are represented at the site.

6. COARSE STONE

Rob Engl

6.1 Introduction

The excavation at East Barns produced a small assemblage of 21 coarse stone artefacts, all but one of which was associated with stratified deposits. Fourteen of these pieces were categorised as bevel-ended pebble tools. The remainder of the assemblage consisted of two hammer-stones, a knapping stone, an anvil, a burnisher and an anvil or knocking stone. An un-worked packing stone of quartzite was also included due to the nature of the raw material and its context.

The artefacts were grouped according to general characteristics such as morphology, use-wear and probable function. A detailed description of each individual artefact is given in the category sections given below.

6.2 Raw materials

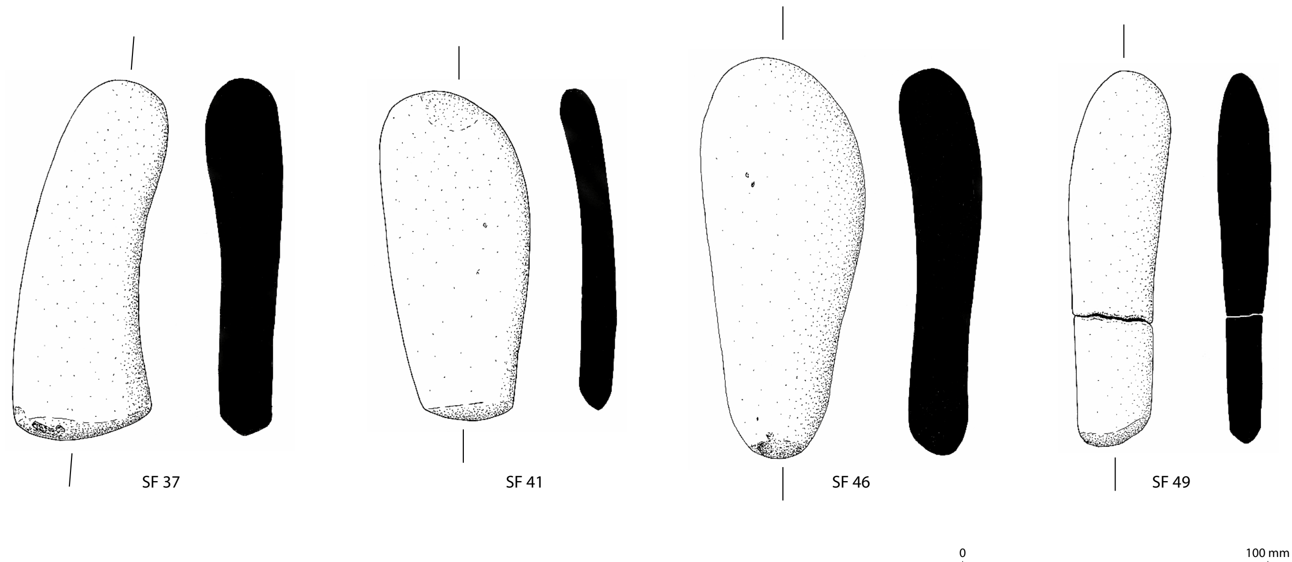
The site is situated within till deposits overlying a solid geology of carboniferous sedimentary rocks (Bown & Shipley 1982). All the artefacts are made on locally derived cobbles of water-worn sandstone, quartzite and fine-grained sedimentary rocks. These were brought onto the site from the shoreline or nearby riverine sources.

6.3 Bevel-ended pebbles

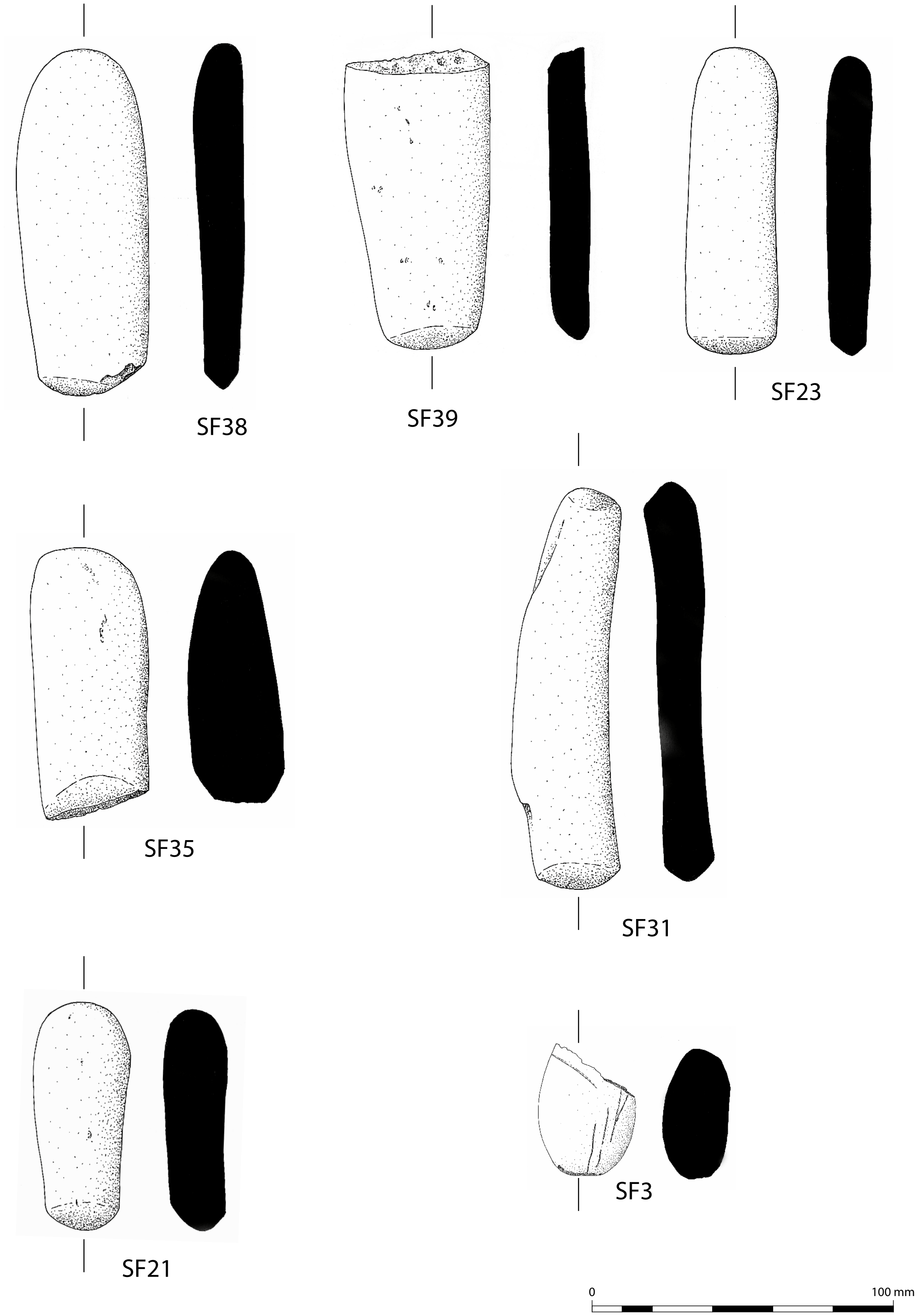
The excavation recovered 14 bevel-ended stone tools, all of which are made on elongated, water-worn pebbles of sandstone and fine-grained sedimentary rock. Nine of the pieces were complete and five were fragmentary. The size of the complete pieces varies but all are at least twice as long as they are wide. A selection of the tools is illustrated in Illus 20 and 21.

All of the pieces show evidence of use occurring in the form of a bevel, probably formed through a grinding or rubbing action of a rounded end of the cobble. In 11 of the pieces the bevel is bifacial in character, with the remainder unifacial. Only one example has bevelling at both ends of the cobble. SF 38 has a bevel that shows surface damage in the form of pitting and flake scars (Illus 21). On all pieces the bevel is generally pronounced, with the exception of SF 44, on which only a lightly formed area of wear is visible.

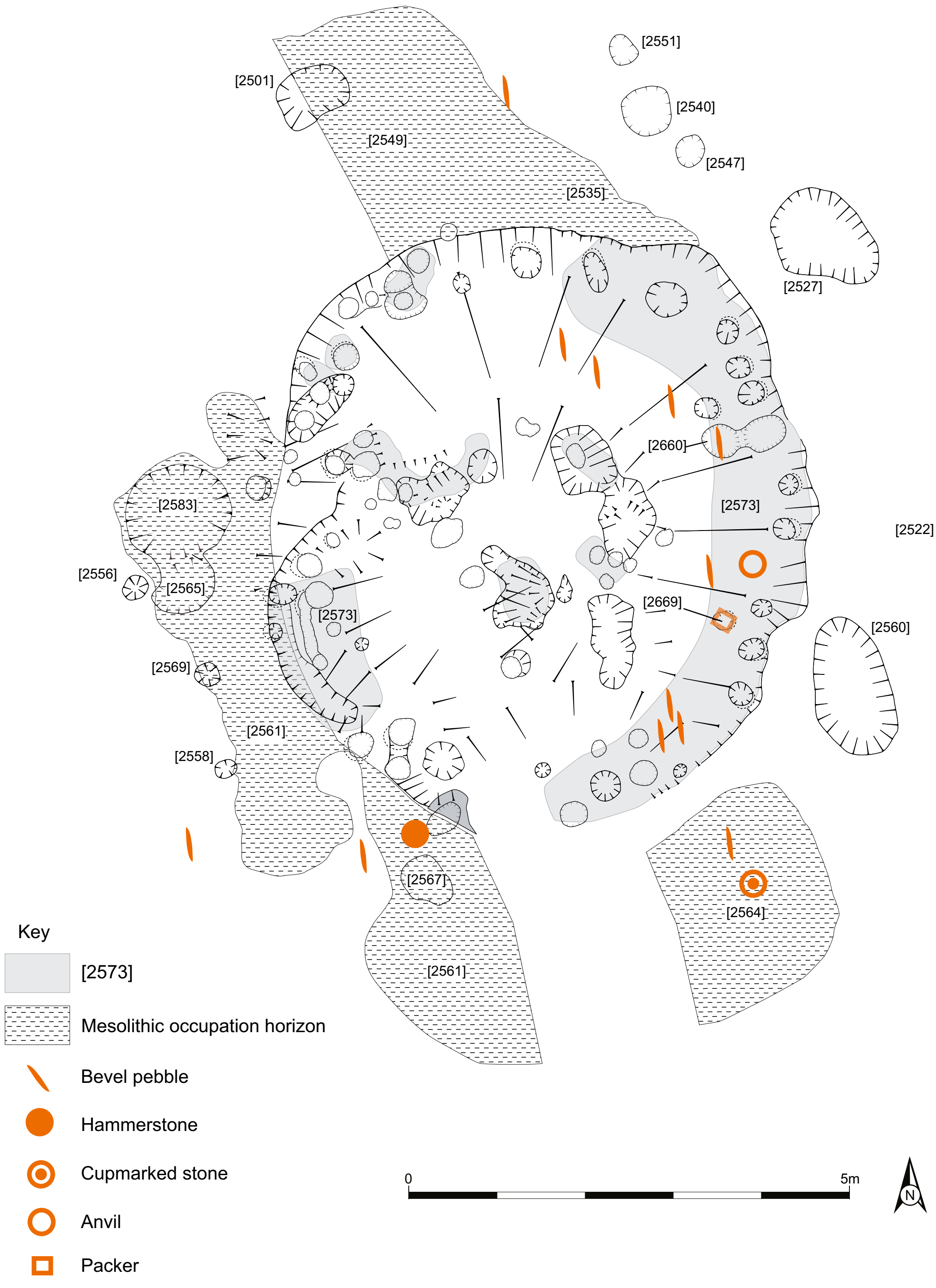
It is not clear whether the fragmentary pieces were broken during use or became fractured after abandonment. However, the fragmentation pattern is similar to those occurring in other Mesolithic assemblages and from experimental examples broken during use (Barlow & Mithen 2000: 517).



Illus 20 Bevel-ended pebbles



Illus 21 Bevel-ended pebbles and coarse stone tools (SF 03 and SF 21)



Illus 22 Distribution of coarse stone tools

6.3.1 Distribution (Illus 22)

All of the bevel-ended tools were recovered from stratified contexts associated with the prehistoric occupation of the hollow (2522).

Six of the artefacts were directly associated with the Mesolithic house. These included two pieces identified as packing stones recovered from within post hole features (SF 41 and 31). Four pieces were also retrieved from occupation layers both within and surrounding the house structure. Three of these pieces (SF 37, 38, 39) were retrieved from the in situ deposit (2573) located within the interior of the house. A solitary piece (SF 32) was also recovered from the exterior activity area to the immediate south-west of the house.

Eight bevel-ended tools were also associated with the colluvium infilling the hollow. Four pieces were found within contexts directly overlying the house structure. A further three examples were recovered from along the inner north-eastern edge (SF 47, 48, 49) and one at the south-eastern edge (SF 44). These pieces represent material from the surrounding occupation areas washed or deliberately deposited into the structure after its abandonment. Three pieces were also recovered from areas close to the structure. SF 21 was found bordering the occupation deposit (2535), and two (SF 46 and 23) were retrieved from the south-west. A single example (SF 36) was recorded away from the immediate environs of the structure. This piece was recovered from the colluvium infilling the north of the hollow and lying close to the radiocarbon-dated Late Mesolithic deposit (2531).

Catalogue of illustrated artefacts (dimensions in mm; weight in g)

▸ **SF 21 (2533) E15 SE Bevel-ended tool (76.2 × 33.6 × 22.7) 89.18g. Complete.**

Bifacial bevel on narrow end of small elongated sandstone pebble. (Illus 21)

▸ **SF 23 (2534) B7 NW Bevel-ended tool (101.6 × 33 × 14.7) 95.8g. Complete.**

Bifacial bevel on wider end of sub-rectangular sandstone pebble. (Illus 21)

▸ **SF 31 (2561) Bevel-ended tool (133.8 × 35 × 15.7) 143.5g. Complete.**

Double ended with one end bifacial and one unifacial, on elongated oval pebble of fine-grained sedimentary rock. (Illus 21)

▸ **SF 37 (2573) E8 SE Bevel-ended tool (122.2 × 45.6 × 24.8) 125g. Complete.**

Bifacial bevel on single end of elongated, oval pebble of sedimentary rock. (Illus 20)

▸ **SF 38 (2573) E8 SE Bevel-ended tool (114.6 × 44.6 × 18) 165.9g. Complete.**

Bifacial bevel with some pitting on elongated oval pebble of fine-grained sedimentary rock. (Illus 21)

▸ **SF 39 (2573) E8 SE Bevel-ended tool (96.3 × 50.6 × 16.7) 125g. Fragment.**

Bifacial bevel on single end of elongated, oval sandstone pebble. (Illus 21)

▸ **SF 41 (2628) Bevel-ended tool (109.8 × 47.1x 12.8) 120.9g. Complete.**

Bifacial bevel on narrow end of flat, elongated sandstone pebble. (Illus 20)

▸ **SF 46 (2553) Z8 SE Bevel-ended tool (130.6 × 53.5 × 27.3) 292.6g. Complete.**

Unifacial bevel on single end of elongated, flat, sandstone pebble. (Illus 20)

▸ **SF 49 (2550) E12 NE Bevel-ended tool (123.4 × 31.6 × 17.7) 88.04g. Fragment**

Bifacial bevel on narrow end of flat, elongated sandstone pebble. (Illus 20)

6.4 Other coarse stone

Six other tool types make up the remainder of the coarse stone assemblage. These consist of a small knapping stone (SF 3), two cobble hammer-stones (SF 43), a burnisher (SF 35), an anvil (SF 25), a large packing stone and an anvil/knocking stone (SF 42) (Illus 21 and 22). This latter piece is made on a large roughly oval, flat surfaced cobble of fine-grained sedimentary rock. It has a circular, roughly pecked indentation with peck marks also scattered across the surface. It is likely that this piece represents an anvil used for the initial reduction of lithic material or perhaps even for the cracking of hazelnuts or other hard-shelled foodstuffs.

The small knapping stone (SF 3) is made on a small water-worn quartz pebble with dense percussion wear on one end. This artefact is much smaller than the hammer-stones so it is likely that this artefact would be used for more precise tasks, such as tool production or modification requiring more general control and dexterity.

6.4.1 Distribution (Illus 22)

Of the seven pieces of coarse stone tools, three were associated with the infilling deposit (C2550). The knapping stone SF 3 was also associated with a deposit (C2521) infilling the house structure. The quartzite packing stone was retrieved from structural Post Hole 2669. The anvil/knocking stone SF 42 was recovered from the occupation deposit (C2564) located to the immediate south-west of the structure.

Catalogue of illustrated artefacts (dimensions in mm; weight in g)

▸ **SF 3 (2521) Knapping stone (39 × 30.5 × 26.4) 49.9g. Complete.**

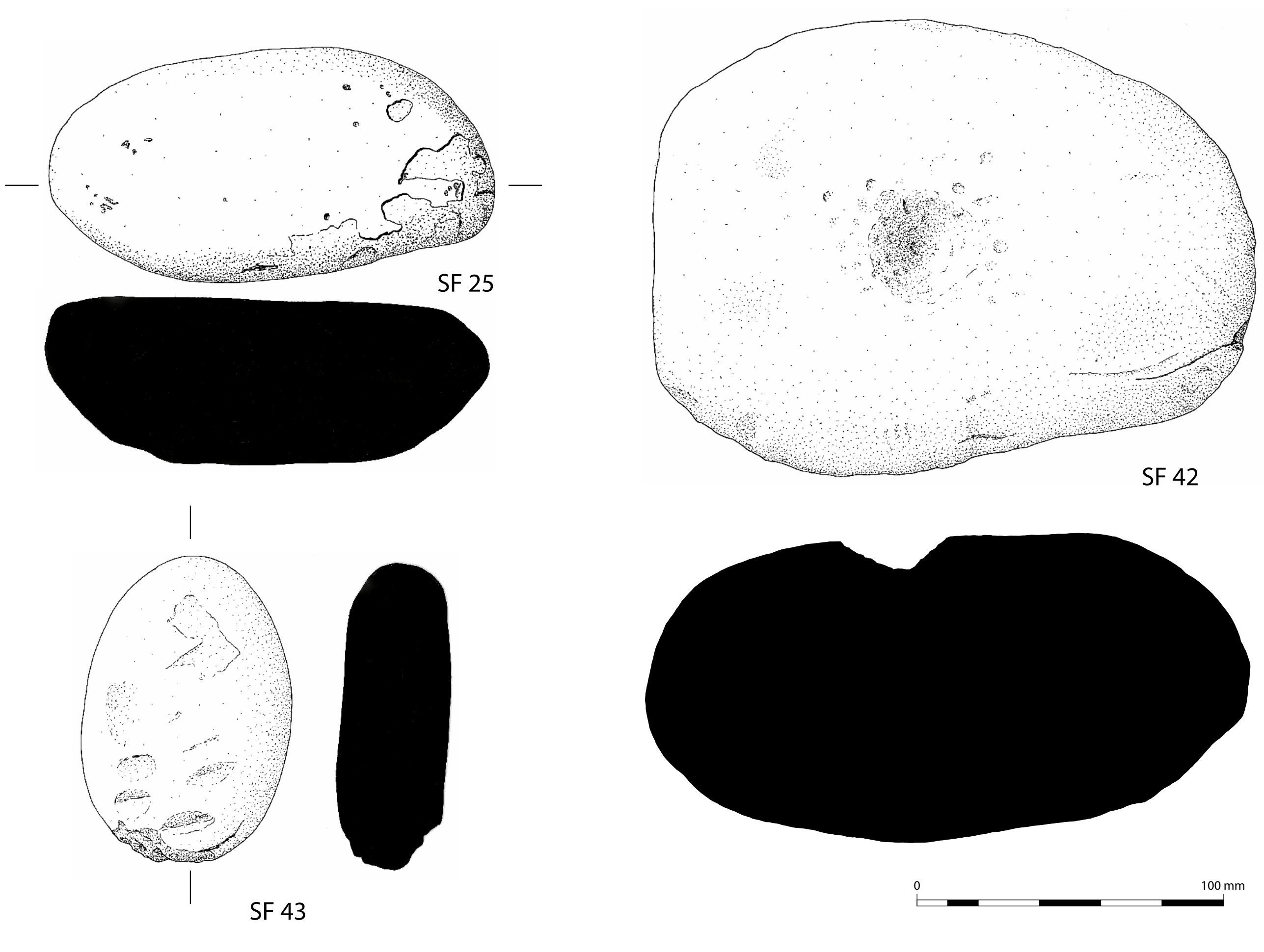
Small hammerstone on water-worn quartz pebble. One end has severe percussion wear. (Illus 21)

▸ **SF 25 (2550) G9 NW Anvil (88.7 × 45.2 × 31.4) 163.2g. Complete.**

Rounded sandstone cobble with flattish faces. Centralised wear on one face in the form of pecking. (Illus 23)

▸ **SF 35 (2550) Burnisher (145.1 × 74.8 × 52) 900.6g. Complete.**

Fine-grained sedimentary cobble with single smoothed area on one face. Wear extends slightly onto one edge. (Illus 21)



Illus 23 Other coarse stone tools

▸ **SF 42 (2564) Anvil or knocking stone (190 × 140 × 85). Complete.**

Large cobble of fine-grained sedimentary rock with centrally placed pecked circular indentation measuring 38.6 × 38.6. The indentation has a depth of 13.2 mm. Peckmarks are also scattered across the surface. (Illus 23)

▸ **SF 43 (2550) B7 NE Hammerstone (100.4 × 68.5 × 36.2). 303.6g. Complete.**

Cobble of foliated sandstone with severe damage along one edge. (Illus 23)

6.5 Discussion

Coarse stone artefacts form an important though often ignored source of evidence for reconstructing Mesolithic culture. Though often small in number, a recurring range of tools is associated with both microlithic and non-microlithic Mesolithic sites. The bevel-ended cobble tools, hammer-stones and anvils present at East Barns therefore form a recognisable set of artefacts that have parallels in assemblages throughout northern Britain. Together with the assemblage at Howick (Waddington 2007), East Barns provides a well-stratified source of information away from the heavily studied sites of the Atlantic seaboard.

Bevel-ended stone tools form the mainstay of the coarse stone assemblages of both East Barns and Howick. Such tools made on stone, antler and bone are found throughout Britain, Ireland and Brittany (Warren 2005: 100). The early dates coming from these two sites mean that bevel-ended tools are now known throughout the Mesolithic period of Scotland and beyond.

Within the Mesolithic, these tools have a primary association with coastal midden and Obanian cave sites (Anderson 1898; Bishop 1914; Coles 1971; Mellars 1987; Saville 2004: 191). Examples of bone and antler tools are almost solely restricted to midden sites where conditions of preservation are favourable, whereas quantities made on stone have been found on narrow-blade microlithic sites such as East Barns, Kinloch Farm, Rhum (Clarke 1990: 120), Howick (Waddington 2007) and Camas Daraich (Clarke 2004: 46).

A coastal or near-coastal location appears to link all of the assemblages in which bevel-ended tools are found. David & Walker (2004: 323) have stated that these artefacts are a product of rocky coastlines, particularly along the Atlantic seaboard. The sites of Howick and East Barns now lie close to the shoreline, but whether they were of a similar rocky appearance during the site's occupation is open to conjecture.

The apparent restriction of bevel-ended tools to coastal or near-coastal sites would initially suggest a role in exploiting a particular set of marine resources. Bevel-ended tools of all materials were originally interpreted as limpet hammers (Grieve 1885: 57) or limpet scoops (Bishop 1914: 95). Although this interpretation has been heavily criticised (Finlayson 1995), experimental work has shown that bevel-ended cobble tools could successfully be used to remove limpets (Barlow & Mithen 2000; Birch 2009), with the action producing similar abrasion and breakage patterns to those identified within the assemblages at East Barns, Howick and other Mesolithic sites.

Other proposed functions have included flint knapping (Breuil 1922: 267–71; Saville 2004: 191), while the experiments on bone bevel-ended tools undertaken at Sand as part of the Scotland's First Settlers Project (Birch 2009: 293) proved that these tools could undertake a variety of other functions, including plant processing, bark removal and hide working.

The latter was also proposed by Foxon (1991), Finlayson (1995; 1998) and Griffiths & Bonsall (2001) on stone bevel-ended tools. The possible use in hide working was first addressed by Anderson (1895: 222), who thought that the more common smaller bevel-edged tools found in middens were likely used for the dressing of hides. Jacobi (1980: 189) has in turn associated bevel-edged tools with the dressing of seal skins, an attractive theory given the general locations in which these artefacts are found.

Finlayson (1995: 262) argues that the identification of these artefacts as limpet scoops ignores the lack of shell midden associations found away from the west coast. This is very much the case at sites such as East Barns, Howick and Kinloch Farm, where bevel-ended tools were not found in close association with sources of shellfish, the likelihood being that the sites were situated some distance from the Mesolithic coastline during their occupation.

Though named after the characteristic wear created by their use, one must keep in mind that the natural rounded edge of the cobble tool was the desired working edge. This edge is common to water-worn cobbles of all shapes and sizes and would in most cases be more than capable of removing shellfish. Therefore, the need for a dedicated, elongated cobble tool is hard to justify.

The distributions of these artefacts at East Barns suggest a close association with tasks undertaken in and around the house. Three were found in the internal detritus deposit (2573), while another two examples were re-used as post hole packing stones. This suggests that the pieces may have been used in domestic tasks within the house itself. Those recovered from in and around the outer occupation deposits may reflect direct use in these areas or may represent dumped material from the inside of the structure. The artefacts from the infilling colluvium may also represent material washed or thrown into the house area after abandonment.

The elongated shape and presence of a bevel are unifying morphological factors when discussing these artefacts in all materials, and imply a common function. Warren (2005: 100) however, notes that the physical properties of bevel-ended tools, whether made on stone, bone or antler, are very different and that whatever use(s) these tools were put to, the choice of material was deliberate, perhaps reflecting differing functions.

The deliberate choice of materials may also be reflected in the general size range of these implements. The mean dimensions of the complete tools recovered from East Barns were compared with samples from the near-coastal narrow-blade microlithic sites of Howick, Kinloch and Staosnaig. These were then compared with the samples given in Finlayson (1995: 262), which included mixed stone and bone tools recovered from five largely non-microlithic (with the exception of Morton) coastal midden and cave sites (Table 16).

A large discrepancy in size was observed, with those stone tools recorded from the near-coastal microlithic sites being almost twice as long as those examples obtained from the coastal cave and midden samples. While this may be a result of geological circumstance, it could represent a deliberate selection of material. This in turn may reflect the possibility of functional differences. It is therefore possible that smaller bevel-ended tools of both bone and stone were used to exploit marine resources and as such were abandoned near their place of use in coastal caves and middens. The larger pieces, made on stone, were possibly used in base camp activities such as the dressing of hides or flint-working at sites situated some distance from the foreshore.

This deliberate choice of materials may also have a chronological aspect. The four occupation sites associated with narrow-blade microliths all produced relatively early radiocarbon dates. These ranged from *c* 7800 cal BC (Howick) and *c* 8000 cal BC (East Barns and Kinloch Farm) to 7000 cal BC at Staosnaig. With the exception of Morton, which is associated with a broad-blade microlithic industry, coastal midden and cave sites produced a uniformly later Mesolithic range of dates.

Unlike the other sites mentioned above, Morton is considered to represent repeated low-level

Table 16 Coarse stone: metrical comparison of bevel-ended pieces (mean values)

	Number studied	Length	Width	Thickness
East Barns	9	111.3	40.4	20
Kinloch Farm	9	99	40.4	20.1
Staosnaig	9	112.5	19.2	12.2
Carding Mill Bay	?	45.3	13.5	7.3
MacArthur's Cave	?	54.7	15.9	8.8
Cnoc Sligeach	?	58.7	18.4	11
Morton	?	60.7	18.6	8.9
Cnoc Reach	?	67.4	16.2	11.6

transitory occupation by small numbers of people. The bevel-ended tools recovered from the midden at this site are not considered morphologically similar to those from the west coast (Finlayson 1995: 262), and no bevel-ended stone cobble tools were excavated. This is reversed at both Howick and East Barns. It is presumed that such bone tools are absent on these sites due to a simple lack of survival. This is a problem common to many non-midden sites in Scotland.

Stone bevel-ended tools do not occur on all Mesolithic occupation sites with structural evidence. At Mount Sandel, Northern Ireland (Woodman 1985) and the Mesolithic structures excavated at Echline Fields (Robertson et al 2013), no examples of bevel-ended cobble tools were recovered from the excavations of the structures. This was also the case at Newton, Islay (McCullagh 1989), where the excavation of a large hollow, thought to be the base of a Mesolithic structure, produced no coarse stone tools. While recognising the possibility that artefacts of this type were overlooked during excavation, it is likely that these locations represent sites such as processing or long-term hunting camps where the range of activities did not require the use of certain tools.

Of the other tool categories present at East Barns, parallels can be drawn with many other Mesolithic and later prehistoric sites. As Saville notes, 'few coarse stone tools are reliably diagnostic, being a continuing facet of tool use in Scotland well into the first millennium AD' (Saville 2003; 2005: 191). Fortunately, East Barns saw a close association between these tools and both Mesolithic cultural material, and dated deposits.

The hammer-stones, anvil and knapping stone are most obviously associated with the on-site reduction of lithic material. The stone with the pecked hollow recovered from the occupation deposit (2564) is similar in form to the hollowed stone from Fife Ness (Wickham-Jones & Dalland 1998, illus 9). No specific function was assigned to this artefact, although the possibility of use as an anvil was noted. The artefact from East Barns differs in that it is larger and the hollow is deeper and formed by pitting. Scattered elements of pitting are also visible across the face of the piece. This would suggest intensive use as an anvil for lithic reduction.

Despite the presence of later prehistoric material at East Barns, the coarse stone artefacts can confidently be associated with activities undertaken in and around the Mesolithic house. As is often the case, a more precise picture of the roles these tools played in Mesolithic life is difficult to assess. The presence of hammer-stones and anvils in association with large quantities of lithic material would support a primary role in lithic reduction. However, as with many types of coarse stone tools, their use in a variety of other activities, such as food processing, cannot be discounted. Similarly, in view of the still-conflicting experimental evidence for the use of bevelled pebbles, their use as general purpose tools remains the most plausible hypothesis. At East Barns, both artefact distribution and site location suggest a use in hide dressing, knapping or other camp-based activities.

The small coarse stone assemblage at East Barns provides a valuable, stratified source of evidence for Mesolithic culture on the east coast of Scotland.

7. SOIL MICROMORPHOLOGY

Clare Ellis

7.1 Introduction

Eleven kubiena samples were taken in stratigraphic succession from the west section across the Mesolithic house (Illus 6) and one further sample from an internal hearth. These samples were subject to full analysis (see site archive), the summary results of which are given below.

A series of broad research questions were formulated regarding the nature of the occupation on the site, the type of structure present and the function of these. Specifically, the objectives were to:

- determine the nature of the basal deposit (C2544), Samples 12, 11 and 9 – formation hypothesis is that the natural silt was excavated to form a sunken floor
- determine the sedimentary characteristics and mode of formation of Deposit 2573, Samples 11, 12, 9 and 8 – formation hypothesis is that this deposit is the burnt remains of some form of organic walling/covering to the house superstructure
- determine the sedimentary characteristics, mode of formation and mode of deposition of Deposit 2550, Samples 7, 6, 5, 4, 12, 13 and 14 – formation hypothesis is that these deposits are colluvial in origin
- determine the sedimentary characteristics and mode of formation of the fill of Deposit 2677, Sample 2678B – formation hypothesis is that this deposit is the remnants of an internal hearth.

7.2 Results and discussion

7.2.1 General characteristics

The basal, natural semi-disturbed sediment was a silt while all the archaeological contexts ranged from fine to coarse, poorly to moderately sorted sands. The microstructure of nearly all the contexts was generally complex, with a major element of each the result of post-depositional bioturbation and infiltration/compaction. All the matrices, except that of Sample 2678B were brown to dark reddish brown in colour, with high levels of amorphous organic matter and extensive masking of the fine mineral and clay content by iron oxides (various types). The matrix of Sample 2678B was black, being dominated by disseminated charcoal.

The mineralogy of all the sample contexts is very similar, being derived from drift deposits with a mixed lithology including sedimentary rocks (sandstones, siltstones, cementstones/limestones, cherts), metamorphic rocks (quartzites) and igneous rocks (mainly basic volcanics). All the rock fragments are well rounded and range in size from coarse sand to gravel, set within silt to coarse sand.

Amorphous organic matter occurred within the matrix material of all the sampled contexts, with the highest content occurring in Samples 4, 5 and 2678B. Wood charcoal was very rare and charred hazelnut shells were few in occurrence. All the larger charcoal fragments had been rounded by physical attrition, presumably caused by the reworking of the deposits and ingestion of smaller fragments by soil biota, but it is possible that there may have been some aeolian erosion of these immediately after the abandonment of the structure. Disseminated charcoal occurs within the matrix of all of the contexts but is particularly concentrated in C2573 and the various elements of C2550. Surprisingly, biogenic silica is extremely rare in all the contexts.

All the contexts have been subject to post-depositional bioturbation, which has totally or partially destroyed the original sediment fabric; the lower fills tend to exhibit less physical disturbance than the upper ones. In addition, all the contexts have been affected by translocation, where rainwater has penetrated the deposits, carrying with it locally eroded clay and soluble iron resulting in limpid and occasionally dusty clay coatings/infillings in nearly all the contexts and are particularly associated with roots, soil biota channels and densities of organic matter. The crescentic shape of many of the infillings is a good indication of sedimentation relating to gravity (Courty et al 1989). The clay and silt translocation was probably caused by seasonal disturbance of the soil surface through cultivation. However, the completeness of many of these coatings indicates that these were formed after most of the bioturbation had occurred and are therefore likely to be a consequence of recent land-use history rather than ancient cultivation.

7.2.2 Basal Deposit 2544

Basal Deposit 2544 comprises a compact, fine sand with a silt matrix, much of which is masked by iron oxides; the prevalence of iron oxide is thought to be largely inherited from the nearby Old Red Sandstone bedrock, although the sediments may have been subject to limited and seasonal rubefaction (Courty et al 1989). This unit has been subject to episodes of wetting and drying, which has resulted in the gradual accumulation of iron oxides but also accounts for the slight alteration and compaction of the fabric. The boundary between this unit and the overlying destruction deposit (C2573) is indistinct and this seems largely due to post-depositional bioturbation. Although it cannot be stated categorically that the basal fine sand was partially removed and remodelled prior to the construction of the Mesolithic house, the cumulative micromorpological evidence, comprising an irregular line of rounded rock fragments, a horizontal line of voids and a dramatic colour change in the matrix, does intimate a deliberate cut. Furthermore, the physical disturbance of Deposit 2544 by soil biota and the presence of amorphous organic matter, including minuscule charcoal fragments, would probably not have been so pronounced if the sediment had not been disturbed during house construction. Compaction of the deposit has occurred post-depositionally; a component of the compaction is likely to be a consequence of pore-water movement but it is also likely to be the result of trampling within the house.

7.2.3 Occupation Deposit 2573

Around the edge of the house was an overlying deposit (C2573). This comprises a poorly sorted medium sand which has been much disturbed by post-depositional bioturbation and the later effects of pore-water movement and illuviation; the latter may be a consequence of more recent cultivation, although there are many broken clay coatings in one sample. However, traces of the original fabric appear to survive in Sample 12, in which many of the rock fragments, mineral grains and hazelnut shell exhibited a dip of approximately 35° in one direction. This preferred orientation could have been brought about if the deposit accumulated on a slope, for example, or if the material was gradually dumped up against a barrier or into a hollow. This unit has a silt matrix which is largely masked by iron oxides and amorphous organic matter. It is unclear whether all the amorphous organic matter is charred because it is extremely decomposed and also masked from view by iron oxide impregnation. Given the depth of burial of this deposit and the undisturbed nature of the majority of clay coatings it is probable that much of the bioturbation took place prior to its burial, although some was observed during excavation.

Disseminated charcoal occurs frequently within this silt, and because of its density and even distribution is interpreted as the remnants of ash. The source of the charcoal cannot be positively identified, but is likely to be a combination of hazelnut shell and highly weathered wood charcoal; the general lack of biogenic silica, which is often the only surviving portion of ash, is a strong indication that grasses were not utilised. The few to frequent larger fragments of charcoal are predominantly burnt hazelnut shell, with a minority appearing to be wood charcoal. There is no micromorphological evidence for burnt turf, burnt soil clasts, burnt mud or a mud/grass type mixture, which could be expected to survive in some form if this destruction layer was the remnants of a turf wall or a 'wattle and daub' type wall construction. One minute piece of possible peat and one small fragment of clay were observed, but these had not been burnt. There are two plausible explanations for the occurrence of burnt hazelnut shells in this deposit. The first is that the lack of wood charcoal, relatively high mineral content of the deposits, frequent disseminated charcoal and extremely decomposed nature of the organic matter is indicative of the remnants of ash midden (domestic refuse) in which burnt hazelnut was an everyday addition. The second is that the unit is the collapsed burnt remnants of the house, ie a destruction horizon, in which post-depositional pore-water movement has all but destroyed the soft wood charcoal, leaving only minuscule particles within the matrix. However, the harder hazelnut shell had a greater survival ratio, its presence in the deposit perhaps explained if these were stored in bags suspended from the wooden superstructure of the house. It is also plausible that the deposit is actually comprised of domestic refuse piled immediately on the exterior of the house structure which was subsequently destroyed by fire.

7.2.4 House infill Deposit 2550

The centre of the house hollow is infilled by a silty sand (C2550) with a large grit-sized component; the unit has been subject to intensive bioturbation, which has imparted a granular fabric. The organic content is similar to, but of less density than, that observed in Deposit 2573, with burnt hazelnut shell accounting for the larger charcoal fraction and frequent disseminated charcoal dispersed within the matrix. The large rock fragments (0.5cm to 1.5cm) show no preferred orientation and mirror the unstructured nature of the finer material; consequently, it is not possible to identify the mode of deposition of this unit. However, the relatively high proportion of anthropic material is unlikely to be derived solely from the underlying deposit, rather it probably formed an integral part of the deposit prior to deposition. Interestingly, all the clay coatings in this context had been disturbed and fragmented but are not so in the overlying deposits, indicative perhaps of an earlier phase of post-depositional bioturbation.

7.2.5 Colluvial deposits

Overlying Deposit 2573 was the primary post-abandonment deposit (C2550), which comprised silt with a mixed lithology of rock fragments, burnt hazelnut fragments and charcoal; these were interpreted in the field as colluvial deposits. In thin section the individual contexts identified during excavation were not readily distinguishable. These deposits have been subject to pedogenic processes, including extensive bioturbation that has largely reworked their original fabrics, imparting a channel to granular microstructure; the degree of bioturbation increases towards the top of the unit. Unfortunately, the intensity of bioturbation has prevented distinguishing the mode of formation of these deposits. Like Deposit 2573, these layers have been subject to post-depositional illuviation, resulting in the accumulation of clay coatings rich in iron oxides. In addition, pore-water movement resulted in probable replacement of a small bone fragment by microquartz. The similarity in composition between Deposit 2573 and the overlying deposits fosters two possible explanations. Firstly, the charcoal and hazelnut shell were gradually incorporated by the activities of soil biota after the deposits had entered into the extended hollow, or secondly, the deposits already contained these anthropic elements, the latter having been incorporated from some form of remnant midden material located outwith, but very local to the house. The latter explanation is the preferred one, especially as Samples 5 and 4, located on the southern side of the house, exhibited zones partially rich in charred hazelnut shells and disseminated charcoal, which appears identical in nature to Deposit 2573.

7.2.6 Burnt Deposit 2678

Feature 2677 was an irregular scoop with a coarse sand to fine gravel fill (Deposit 2678) rich in charcoal dominating the upper two thirds of the slide. The lower third of the slide appears to be the remnants of substrate (compacted floor?) directly upon which a fire was burnt. Despite its disseminated nature, the high charcoal content of the matrix distinguishes it from all the other deposits from East Barns which have been subject to micromorphological examination. This disseminated charcoal cannot be identified to a specific source, although the clear lack of biogenic silica may indicate that the major source was wood as opposed to peat or turf. The larger surviving charcoal fragments all comprise hazelnut shell, which has been affected by the activities of soil biota, as have all the smaller organic components of the deposit. Biological activity was concentrated in the upper two thirds of the slide, presumably because of the higher organic content of the ash. The survival of charcoal and a few fragments of burnt bone are interpreted as the remnants of a low-temperature fire, such as would be used for cooking and grilling. The presence of charred hazelnut shell may be explained by either their deliberate roasting or perhaps spent shells were discarded in the domestic fire. The concentration of clay coatings in the upper portion of the slide is indicative of post-depositional weathering in ash rich in potassium, because the latter encourages local clay movement (Courty et al 1989: 113).

7.3 Summary conclusions

1. The basal silt is natural in origin (presumably fluvial/glacial), although it has

been mixed with elements of the overlying contexts by the activities of soil biota.

2. The basal silt appears to have been deliberately truncated prior to the accumulation of the overlying contexts.
3. The formation processes of Deposit 2573 are unclear, although its composition (including poorly to moderately sorted sand-sized mineral matter, amorphous organic matter, disseminated charcoal, rare wood charcoal and a few charred hazelnut shells) is indicative of domestic refuse, rather than being solely derived from the construction timbers and any roofing material.
4. There is no micromorphological evidence in the samples of Deposit 2573 for a turf or wattle and daub type wall.
5. The house infill Deposit 2550 is very similar in composition to Deposit 2573, and elements of its composition are thought to be derived from domestic refuse. Unfortunately, extensive bioturbation prevents identification of its mode of deposition.
6. The overlying deposit (2550) is interpreted as in situ patches and spreads of mixed midden and natural material, the former so similar in character to Deposit 2573 that it is assumed to be derived from much earlier deposits associated with the occupation of the main structure.
7. The fill of an internal scoop (Deposit 2677) is interpreted as in situ mixed ash from low-temperature burning such as would be necessary for cooking.

8. DISCUSSION

8.1 House construction

Due to the findings of both research- and developer-led projects, the early years of the 21st century have seen a rapid expansion in evidence for Early Mesolithic settlement in Scotland and northern England. The house at East Barns is broadly contemporary with a number of recently investigated sites. With the exception of the more ephemeral camp sites of Fife Ness, near Balcomie, Fife (7400–7600 BC) (Wickham-Jones & Dalland 1998) and Cramond, Edinburgh (8630–8210 cal BC) (Saville 2008; Lawson et al forthcoming), these appear in the main to be robust house structures constructed during the turn of the 8th millennium BC and situated within ecologically rich and diverse locations.

Sites such as East Barns, Howick (8000 cal BC) (Waddington 2007), Echline Fields (8300 cal BC) (Robertson et al 2013) and Cass ny Hawin II, Isle of Man (8200–7950 cal BC) (Brown forthcoming) join other established house sites within the record such as Mount Sandel (Woodman 1985) in suggesting the existence of a hitherto unrecognised complexity within the Mesolithic settlement record of the western North Sea Basin.

These excavations have revealed a remarkably consistent set of structural features. The houses are generally between 4m and 6m in diameter and display a subcircular, sunken house pit, often edged with inwardly angled post holes and containing a complex arrangement of centrally positioned hearths. Such house sites are not solely confined to the British Isles but are a frequent component of the Mesolithic settlement record across the breadth of the North Sea Basin (Larsson 2017; Grøn & Sorenson 1995; Grøn 2003; Hesjedal et al 1996). The 26.6m^2 interior living space revealed at East Barns compares favourably with that of the earliest construction phase at Howick (Waddington 2007) and also with Mount Sandel at 30m^2 and Echline Fields at 20.91m^2.

East Barns displayed a west-facing post-built entrance, a construction feature which appears to be replicated at both Echline Fields (Robertson et al 2013: 129) and Cass Ny Hawin II (Brown forthcoming).

The complexity of Mesolithic settlement is becoming more apparent, with the increasing variety of structural remains appearing within the recent archaeological record across the British Isles. These structural remains have a wide chronological and physical range and include both fairly substantial circular post ring sites such as Castlandhill, Fife (Robertson et al 2013), Star Carr (Conneller et al 2012: 1,004), Lunt Meadows, near Crosby, Merseyside (Liverpool Landscapes 2012), Dunragit, Dumfries & Galloway (Bailie & Mooney 2014) and Greenan, Ayr (Engl forthcoming), together with more ephemeral sites where defined structures are often not immediately apparent.

Other less definitive structural evidence has recently been bracketed under the general term ‘shelter’ (Mithen & Wicks 2018: 85) in order to interpret chronologically and structurally disparate sites with differing feature sets, such as the groups of stake-holes, post holes and pits represented at Cramond, Edinburgh (Lawson et al forthcoming), Morton, Fife (Coles 1971), Fife Ness, Fife (Wickham-Jones & Dalland 1998), Bolsay Farm, Isle of Islay (Mithen et al 1992) and Standingstones, Aberdeenshire (van Wessel 2019), and structures largely defined by constrained artefact concentrations such as at Caochanan Ruadha in the southern Cairngorms (Warren et al 2018).

Mithen & Wicks (2018: 85) included a number of sites containing possible ‘house’ pits and post rings within their ‘shelter’ category. These include Low Hauxley, Northumberland (Waddington & Bonsall 2016) and Cass ny Hawin I (Woodman 1987) as well as Newton, Islay (McCullagh 1989), Staosnaig, Colonsay (Mithen et al 2000) and Lilliehill Bridge, Ayrshire (MacGregor & Donnelly 2001), identified in a previous review of the data set of Mesolithic structures in Scotland (Wickham-Jones 2004a). These sites were not interpreted as unequivocal evidence for house structures, probably because of a combination of partial excavation, differential preservation and the presence of a complex palimpsest of features obscuring phasing and interpretation.

At Newton, Islay (McCullagh 1989), a sunken, sub-rectangular area *c* 5m × 4m and 0.35m deep and containing angled post holes was suggested as a dwelling. At Staosnaig on Colonsay a 4.5m diameter sub-circular pit was interpreted as the base of a hut, albeit with an absence of post holes (Mithen et al 2000). This was also the case at Lilliehill Bridge, Ayrshire, where a series of large sub-circular scoops were interpreted as structures (or one structure with frequent rebuilds) ranging from 6m × 4m to 4m × 2m (MacGregor & Donnelly 2001). The majority of these possible 'pit house' sites appear to date to the 7th millennium BC and may suggest the partial survival of the building techniques observed in the robust pit house sites of the late 9th and early 8th millennium BC into the later Mesolithic.

Despite the growing evidence for a variety of structural settlement types within the British Mesolithic it should be noted that all of the later examples differ markedly in their structural form from the substantial, robust, pit-built structures represented at East Barns, Howick and Echline Fields. These sites on current evidence appear to form a temporally and geographically coherent grouping clustered around the early 8th millennium BC.

8.2 Occupation deposits

The presence of pit houses is replicated elsewhere around the North Sea Basin. Dwelling pits are seen as one of the most persistent indicators of house sites throughout the South Scandinavian Mesolithic (Grøn 2003: 692) and occur in both Maglemosian and later Ertebølle cultural horizons. They are often recognised by the presence of lenticular-shaped spreads of cultural material (ibid) containing large quantities of lithics. At the early Ertobølle site of Bredasten in Sweden, the lenticular spread was formed inside the wall ditch of the dwelling (Larsson 1986). These spreads of material have been interpreted as the remains of cultural debris that has formed beneath the living floor of the house during its occupation (Grøn 2003: 695). This interpretation has been applied to the lenticular spreads of similar material seen at East Barns. Ellis (Section 7, above) has suggested that the spreads of such material at East Barns may derive from a destruction event associated with the house but this appears unlikely given the large quantities of lithic material contained within the deposit and the uneven distribution of the spreads within and surrounding the house.

Despite the sealed nature of the archaeological deposits, no evidence for the actual living floors was recorded at East Barns. In southern Scandinavia, floors of bark, branch and twig have been recorded on both submerged and peat bog sites (Grøn 2003: 686), and we might envisage similar floors of soft plant material at East Barns, through which occupation debris filtered onto the base of the dwelling pit.

The absence of substantial structural floor deposits at East Barns can possibly be explained in terms of length of occupation. At both Echline Fields and Howick multiple floor surfaces, clear phases of construction and a wide dating span were interpreted as reflecting the reoccupation of the houses after periodic rebuilds or abandonments (Robertson et al 2013: 81, Waddington 2007: 37). There is no clear evidence at East Barns for large-scale reconstruction (only minimal refurbishment in the replacement of some post holes – see above). Indeed, the areas of erosion present within the East Barns house suggest a single period of use, albeit on an intermittent or seasonal basis. This is supported by the closely clustered radiocarbon dates which reveal a possible period of occupation ranging between 75 and 150 years in duration.

8.3 Household activities

The sealed nature of the archaeological deposits and the relatively simple stratigraphy excavated at East Barns allowed for a meaningful interpretation of material distributions to be made as these were free from the 'mixing' effects produced on more open sites, where a complex palimpsest of features and cultural horizons are often in evidence. The distribution of the lithic material suggests that a similar range of activities was being undertaken both within the structure itself and in the areas immediately outside the house. These activities probably included a variety of tasks including primary manufacture, butchery, hide working, and tool/ornament maintenance and manufacture (see Section 5, Lithic microwear analysis). Within the interior of the house these activities appeared to be focused and organised around the central hearths.

What is perhaps most important about the distribution of artefacts, refuse deposits and internal furniture is that this provides clear evidence for deliberate spatial organisation, implying that there were socially defined areas within the East Barns house where certain activities could and could not take place. The absence of lithics, and the relative lack of deposits on the platform around the inner northern perimeter of the house, suggest that this area may have been isolated from the main area of social and domestic activities centred on the hearths and not subject to the same pressures of movement and subsequent erosion. Such platforms associated with a similar absence of lithic material are a common component of Mesolithic sites in southern Scandinavia (Grøn 2003: 695–6).

Although used over a much shorter period than either of the structures found at Howick or Echline Fields, the East Barns house did see inter-generational occupation; it was constructed with a degree of permanence in mind and it is likely that the appearance of the house remained relatively constant throughout its lifespan. As argued for Howick, this points to a level of residential stability, or perhaps an increasing sedentism which was probably determined by the economic cycle of its inhabitants and which reflected their physical attachment to a landscape rich in a diverse and stable set of resources (Waddington et al 2007a: 197).

A key similarity in all of the robust house sites in the British Isles is their ecotonal setting within the Mesolithic landscape though it is noted that this can also be applied to many more ephemeral sites. At East Barns as at Howick the site appears to have occupied an optimum location in terms of economic advantage, with ready access to marine, estuarine, riverine and terrestrial resources. This choice of location was perhaps only constrained by the need to maintain social relations with the wider Mesolithic inhabitants of the locale.

Unfortunately, with the exception of lithic material, timber and hazelnuts, the variety of these resources is not particularly visible within the site record. A small quantity of burnt bone was retrieved from the site, but a combination of relatively hostile preservation conditions and the corroded nature of the remains produced only two positive identifications: those of a medium-sized bird and those of a seal (*phocidae*) (Bailey 2002: 23–4). Seal was also recovered at Howick. Despite the lack of identifiable animal remains it is likely that a coastal adaptation based on the hunting of marine mammals was also practised at East Barns.

The lack of palaeoenvironmental data is not particularly helpful in determining if the occupation of East Barns occurred on a seasonal or more year-round basis. At Howick, the most likely scenario saw the house used on a seasonal basis, possibly over the autumn and winter (Waddington et al 2007: 198).

Seal and bird bones were also recovered at Howick, along with those of wild boar (*Sus scrofa*), fox (*Vulpes vulpes*) and probable dog (*Canis familiaris*). At Echline Fields a wider inventory of taxa was identified, including wild boar, canids and possible auroch (*Bos primigenius*), roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*) (Robertson et al 2013: 101–2).

Other sites with midden material located around the Forth have also provided a variety of information. At Morton, Fife, mammal remains included hedgehog (*Erinaceus europaeus*), wild boar, red and roe deer and aurochs (Coles 1971). Whereas the Late Mesolithic shell midden sites of the Forth Valley have produced red deer in addition to large quantities of oyster (Lacaille 1954).

Surprisingly, given the coastal location enjoyed at East Barns, no marine shell was recovered. However, it is possible that this food source was processed closer to the coast and such midden evidence has either been removed or lies under the Forth. Marine shell was not found at Echline Fields either (Robertson et al 2013), though at Howick dog-whelk, periwinkle and limpet amongst others were recovered from the site, albeit with the majority obtained from unstratified sources.

Despite the varied but ephemeral quality of the organic evidence it is clear that the house sites of the Forth littoral would have had access to a wide variety of faunal and plant resources taken from marine, terrestrial and estuarine environments.

8.4 East Barns in the Mesolithic world

As argued above, the location of robust house sites such as East Barns can be intimately linked to the availability of reliable and predictable resources such as food, building materials and lithic material. These 'pull factors' (Lillie 2015: 45–64) will have contributed to the viability of residential permanence and this 'permanence' would then likely result in the emergence of substantial house structures as populations spent increasing amounts of productive time within a fixed locale. The robust construction evident at East Barns implies just such an exhibition of permanence. The ethnographic literature suggests that Mesolithic populations are likely to have operated on a number of spatial scales, with settlement activities ranging from base camp aggregation to more seasonal and resource-specific temporary camps. This spatial scale may have been reduced at sites such as East Barns, where the relative ease of resource procurement may have fostered a cultural adaptation involving longer periods of extended occupation or perhaps the regular reoccupation of a known location. Ethnographic observations (Fretheim et al 2016) of hunter-gatherer groups in the Beagle Channel area of South America show that sunken hut structures located in preferential foraging areas were often intermittently occupied, with reoccupation involving only minor repairs to the structure.

Whichever occupation pattern was employed at East Barns, the house would appear to meet all of the requirements for the definition of a 'home' within the archaeological record of the Mesolithic. The house was set within a suitable and productive economic location, it was large and substantial enough to house a family unit, it was occupied, possibly seasonally for a lengthy duration and it is associated with a varied artefact assemblage which would cover a less specialised and wider-ranging series of activities.

Although the necessity of hearth features within house structures may seem obvious, hearths or fire pits may also have had an important role within the social ordering of the Early Mesolithic. Numerous ethnographic examples (Spikins et al 2010: 186; Lavrillier 2010: 221) reinforce not only the practical, but also the social and cosmological importance of fire to varied hunter-gatherer communities. The presence of at least three hearth features with associated furniture at East Barns suggests that the fireplace was central to the occupation of the house. As Marshall (1976: 84–6) states 'the fire is the nuclear family's home, its gathering place, its rightful place to be'.

Feelings of attachment to place and tenure are therefore likely to develop and increase with each subsequent occupation and use of the 'home'. Substantial and long-lasting structures such as East Barns would therefore serve not only as dwellings but perhaps as historical, visual and symbolic monuments expressing ownership and exclusivity with regard to the exploitation of the resources in the vicinity. Monumentality within the Scottish Mesolithic has been argued for by Pollard (1996), who has suggested that the Oronsay shell middens acted as cultural markers, though this has been recently challenged by Finlay et al (2019).

The long occupation sequences recorded at robust house sites such as Howick and Echline Fields appear to support Tilley's assertion (1994) that certain localities were revisited by Mesolithic populations over significant timescales (Lillie 2015: 37–51). This gives rise to the notion of 'persistent places' (Barton et al 1995: 81–2; Jacques & Phillips 2014: 7). The siting of these places would not only be influenced by utilitarian concerns such as resource procurement, subsistence and settlement strategies but also by social, personal, cosmological and historical factors (Mithen 2019: 131) that place the East Barns site within a likely enculturated Mesolithic landscape possibly as initial territorial markers, ceremonial centres or both (ibid: 105).

At East Barns, the area of the hollow in which the house was placed appears to have been subject to repeated activity throughout the Mesolithic and into the Neolithic and Bronze Age. At the northern end of the hollow two Late Mesolithic dates represent activity some 3,000 years after the abandonment of the house itself.

The construction of robust house structures in association with large narrow-blade lithic industries has been proposed as a specific cultural response to the inundation of the North Sea Plain at the turn of the 8th millennium BC (Waddington et al 2007a; 2015; Waddington & Bonsall 2016; Waddington & Passmore 2012). The excavation at East Barns joins an emerging suite of early, robust Mesolithic house sites including Howick and Echline Fields, in providing strong support for this 'colonising' hypothesis. The sites are relatively uniform in nature, with a similar suite of structural features, economies and locations focused on the coast. The sites are clustered both temporally (8400–7800 cal BC) and geographically (north-east England and south-east Scotland), giving credence to what Waddington sees as a population move westwards from Doggerland along the then shoreline towards the north-east coast of Britain (Waddington & Bonsall 2016:

277). These populations then quickly spread throughout the northern part of the British Isles. While archaeological evidence for other types of substantial hut structures is present within the later Mesolithic, none appear to be directly comparable to the earlier pit house sites dating to the turn of the 8th millennium BC.

The majority of recent Mesolithic 'house' site discoveries (East Barns, Echline Fields, Dunragit, Cas Ny Hawin II and Greenan) have occurred as a result of developer-funded fieldwork undertaken within areas not traditionally subject to such pressures. Mesolithic settlement sites in general have been thought to be relatively unpredictable in both form and location (Wickham-Jones 2004b: 12). However, patterns are emerging in the discovery of sites with a recurring set of structural features, set in similar ecotonal locations and associated with large narrow-blade lithic assemblages, thus producing the beginnings of a consistent framework for the Mesolithic settlement record of the British Isles. These patterns should provide stimulus to future research into this aspect of Mesolithic archaeology in the 21st century.

The excavation at East Barns provided the first unequivocal evidence for robust construction in Mesolithic Scotland (Gooder 2007). An increasing number of such structures are now steadily making their way into the archaeological record, but East Barns remains an important and influential site due to its wealth of structural information, large stratified cultural assemblages and early date. With this publication it now takes its place alongside its 'sister site' of Howick in revealing the emerging complexity of Early Mesolithic settlement around the North Sea Basin.

9. APPENDIX 1: LIST OF ARTEFACTS STUDIED FOR MICROWEAR

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
3	2561	A10 NE	f	Scraper angled	Endscraper	Front	Fresh hide	Scraping	H2S	Fresh hide scraping. Not very evident; could be natural.
9	2561	A8 SW	f	Scraper angled	Endscraper	Circular	Dry hide	Scraping	H1S	Evident only on convex localities of front.
10	2561	A11 NW	f	Scraper angled invasively flaked	Endscraper	Front	Dry hide	Scraping	H1S	
11	2561	Z8 SE	f	Microlith fine point	Microlith	Microlith	Undet.	Impact	U0I	Burinations at tip and opposite end fractured.
13	2561	Z10 NW	f	Microlith scalene	Microlith	Microlith	Dry hide	Piercing	H1S	Wear extends about 4mm from tip.
14	2561	B12 NW	f	Scraper sub-angled	Endscraper	Front	Dry hide	Scraping	H1S	Greasy dry hide?
16	2561	A11 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Invasive fracture scars at tip.
18	2561	A11 SE	f	Scraper angled	Endscraper	Front	Dry hide	Scraping	H1S	Opposite front is very similar with perhaps a little less rounding.
21	2561	A9 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Burination at tip and crushing at opposite end.
24	2561	B7 NE	f	Microlith backed blade	Microlith	Microlith	Undet.	Impact	U0I	Burination at tip.
26	2561	A12 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	
30	2561	B6 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	
40	2561	C7 SE	f	Unmodified	Blade	Blade	Fresh hide	Mixed	H2M	Edge shows mild to moderate rounding with hide-like wear. Striations are mixed.
83	2561	A10 SW	f	Unmodified	Blade	Lateral edges	Meat	Cutting	M2P	
100	2553	A9 SE	I(C)	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Impact scar at tip

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
105	2553	Z8 SE	f	Microlith fine point double backed	Microlith	Microlith	Undet.	Impact	U0I	Tiny burinations at tip.
108	2573	F13 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Invasive fracture scar at tip.
111	2573	B10 NW	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Invasive fracture scar.
114	2573	F8 SW	c	Microlith trapezoid	Microlith	Microlith	Undet.	Impact	U0I	
118	2573	G12 NE	c	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Poor quality; both tips broken.
120	2573	G12 NW	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Impact scarring and burinations at tip.
122	2573	G12 SW	c	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Burinations at both ends.
123	2573	F13 SW	f	Microlith obliquely truncated blade	Microlith	Microlith	Undet.	Impact	U0I	Burinations on tip.
124	2573	B9 NW	f	Microlith crescent	Microlith	Microlith	Undet.	Impact	U0I	Invasive fracture scar at tip.
131	2573	G9 NE	f	Scraper angled	Endscraper	Front	Hide	Scraping	H0S	Fresh or greasy dry hide.
133	2573	F8 NE	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	Opposite front is less clear.
134	2573	F8 NW	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	Mild, but definitely matt characteristics.
136	2573	F12 NW	f	Scraper angled	Endscraper	Front	Dry hide	Scraping	H1S	
139	2573	G12 NE	f	Scraper irregular	Endscraper	Front	Dry hide	Scraping	H1S	
148	2549	E17 SE	c	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Burinations at tip although poor quality material.
149	2549	E15 NE	c	Microlith double-backed blade	Microlith	Microlith	Undet.		U0I	Some damage at tip.
155	2549	E13 NE	f	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Tip has impact scarring and burination.

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
157	2549	E15 NW	f	Microlith backed blade	Microlith	Microlith	Undet.	Impact	U0I	Snap with invasive termination suggests impact damge; could be from other causes, however.
159	2549	D14 NW	c	Microlith backed blade	Microlith	Microlith	Undet.	Impact	U0I	Impact scar at tip
162	2549	E14 SE	f	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Tip is fractured.
163	2549	F15 SW	f	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Invasive scar at tip.
164	2549	F15 SW	f	Microlith fragment	Microlith	Microlith	Meat	Cutting	M1P	Substantial wear along edge except at tip (snapped fragment) and at base for 5mm. Cutting edge here is retouched/backed.
165	2549	F16 NW	f	Scraper angled retouch along lhs and distal end	Endscraper	Front and left lateral	Fresh hide	Scraping	H2S	Limited evidence. Appears more as remnant location.
166	2549	F13 NW	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	Only one edge (distal) shows clear use.
167	2549	D15 NW	f	Scraper short convex on primary flake	Endscraper	Front	Hide	Scraping	H0S	
168	2549	D17 NE	f	Scraper short convex very small	Endscraper	Front	Fresh hide	Scraping	H2S	Fresh hide scraping. Invasive fracture scars on ventral surface at prox. end of lateral edges may reflect hafting.
175	2549	F14 SW	f	Scraper sub-angled retouched on rhs and distal end	Endscraper	Front	Hide	Scraping	H0S	Hide scraping. Appears to be greasy dry hide or PDM.
178	2549	E14 NW	f	Scraper wide convex	Endscraper	Front	Bone	Scraping	B2S	

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
179	2549	D16 SW	f	Scraper wide convex	Endscraper	Front	Fresh hide	Scraping	H1S	Material is rough, which makes it look somewhat like greasy dry hide.
180	2549	E14 SE	c	Fine fraction	Endscraper	Front	Hide	Scraping	H0S	Hide scraping. Greasy dry hide?
186	2549	E17 SE	f	Burin lhs distal end	Burin	Bit	Hard/ bone?	Graving	B1S	The left lateral edge appears to have been used to work antler or butchery (bone contact). Prefer (B1M).
188	2549	D14 SE	f	Burin struck flake distal end lhs	Burin	Left lateral	Bone/ antler	Scraping	B1S	Remainder of tool is undet.
195	2549	E15 NW	c	Flake	Backed and truncated blade	Partially backed and truncated blade	Meat	Cutting	M2P	
196	2549	D17 SE	f	Blade with edge damage along both lateral edges and carinated thick distal end with removal of several very small bladelets. Rhs prox end appears to have been narrowed by application of reg abrupt retouch on dorsal face	Endscraper	Front	Dry hide	Scraping	H1S	Good example.
218	2549	D14 NE	c	Flake		Right and left lateral	Meat/ hide	Cutting	M1P	Both lateral edges.
221	2549	E16 SE	c	Fine fraction	Blade	Lateral edges	Meat	Cutting	M2P	Wear has greasy appearance with mild rounding.

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
225	2549	E15 NE	f	Blade edge damage along both laterals	Blade	Lateral edges	Meat & hide	Cutting	M1P	
236	2549	E17 SE	f	Blade	Truncation	Truncation (proximal) or front	Dry hide	Scraping	H1S	Lateral edges used for cutting meat (M1P). Truncated edge is slightly convex. Near left edge, but not at corner, is a smooth polish that looks similar to bone, but is more likely 'glass' polish that sits atop rounding from hide.
244	2564	E5 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Heavily patinated but burinated at one end.
245	2564	E5 NE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Impact scar and burination at tip.
248	2564	F7 SW	f	Scalene microlith	Microlith	Microlith	Undet.	Impact	U0I	Fragment.
249	2564	F7 SW	f	Scalene microlith	Microlith	Microlith	Undet.	Impact	U0I	Impact scar at tip.
250	2564	F7 SW	f	Microlith obliquely truncated blade	Microlith	Microlith	Undet.	Impact	U0I	Badly thermally altered, but tip has burination.
257	2564	F5 NE	f	Microlith double-backed scalene	Microlith	Microlith	Undet.	Oblique	Y1O	Striations and scars tend to be oblique to edge.
259	2564	F6 NE	f	Microlith crescent	Microlith	Microlith	Undet.	Impact	U0I	Invasive scar at tip.
260	2564	E6 NE	f	Microlith scalene triangle	Microlith	Microlith	Undet.	Impact	U0I	Some damage at tip and opposite end.
261	2564	F6 SE	f	Flake	Microlith	Microlith	Undet.	Impact	U0I	Edge shows a limited amount of rounding. Tip is fractured and there is a burination scar; both with unworn arrises. Impact fractures are evident on opposite end as well.

Artefact	Context	Grid sq.	Material	Catalogue type	Tool type	Edge	Material	Action	Use	Comments
262	2564	E6 SE	f	Microlith scalene	Microlith	Microlith	Undet.	Impact	U0I	Burination at tip and snap with bending termination at opposite end.
265	2564	F7 SW	f	Scraper sub-angled	Endscraper	Front	Dry hide	Scraping	H1S	
266	2564	F7 SW	f	Scraper angled	Endscraper	Front	Dry hide	Scraping	H1S	Dry hide scraping.
269	2564	E6 NE	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	Unused stone surface is rough.
272	2564	E5 SE	f	Scraper irregular	Endscraper	Front	Dry hide	Scraping	H1S	
273	2564	E5 SE	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	
275	2564	E6 SE	f	Scraper angled	Endscraper	Front	Dry hide	Scraping	H1S	Opposite edge is severely TA.
276	2564	F6 SE	c	Flake	Endscraper	Front	Dry hide	Scraping	H1S	Wear seen under patina.
277	2564	F7 SE	f	Scraper short convex	Endscraper	Front	Dry hide	Scraping	H1S	Wear seen below patina.
279	2564	F6 SW	f	Scraper short convex on core trimming flake	Endscraper	Front	Dry hide	Scraping	H1S	
280	2564	F6 NE	f	Scraper sub-angled	Endscraper	Front	Dry hide	Scraping	H1S	
284	2564	F5 NW	c	Point double notches forming bec	Piercer		Hide piercing	Piercing	H1S	Hide piercing. Opposite edge similar; dorsal ridge only mildly rounded.

10. ACKNOWLEDGEMENTS

The excavation at East Barns and the subsequent post-excavation programme were fully funded by Lafarge Cement, and ably managed for them by John Hernon. The excavation staff consisted of Martin Cook, Ralph Troup, Alan Hunter-Blair and Joe Sommerville. The post-excavation programme was managed by Ciara Clarke and Anne Crone. All illustrations were prepared by Gemma Hudson (copyright resides with AOC Archaeology Group). Special thanks are due to Anne Crone for her editing and for her dogged determination in getting this to publication. This paper has benefited from the comments and criticisms of the referees and the authors are grateful for their input.

11. REFERENCES

Affleck, T L 1986 'Excavations at Starr, Loch Doon 1985', *Glasgow Archaeology Society Bulletin* 22: 14–21.

Anderson, J 1895 'Notice of a cave recently discovered at Oban, containing human remains, and a refuse-heap of shells and bones of animals, and stone and bone implements', *Proc Soc Antiq Scot* 29: 211–30.

Anderson, J 1898 'Notes on the contents of a small cave or rockshelter at Druimvargie, Oban; and of three shell mounds in Oronsay', *Proc Soc Antiq Scot* 32: 298–313.

Armit, I & McKenzie J 2013 *An Inherited Place: Broxmouth Hillfort and the South-East Scottish Iron Age*. Edinburgh: Society of Antiquaries of Scotland.

Atkinson, T C, Briffa, K D & Coope, G R 1987 'Seasonal temperatures in Britain during the past 22,000 years, reconstructed using beetle remains', *Nature* 325: 587–92.

Bailey, G 2002 'Burnt animal bone assessment', *in* 'North-East Quarry, Dunbar 2002: post-excavation research design'. AOC Archaeology Group unpublished client report: 1–48.

Bailie, W and Mooney, K 2014 'Discovering the heart of Prehistoric Galloway', *Archaeology Scotland* 20.

Ballin, T B 2014 'The mainly Late Mesolithic flint and bloodstone assemblage from Shieldaig, Wester Ross, Highland – local flint and exotic bloodstone'. Available at www.academia.edu. Accessed 23 November2015.

Ballin, T B & Johnson, M 2005 'Glentaggart, South Lanarkshire – discussion of a Scottish chert assemblage and its associated technology', *Lithics: The Journal of the Lithic Studies Society* 26: 57–86.

Barlow, C & Mithen, S 2000 'The experimental use of elongated pebble tools', *in* Mithen, S (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–98*. Vol 2: *Archaeological Fieldwork on Colonsay, Computer Modelling, Experimental Archaeology and Final Interpretations*, 513–21. Cambridge: McDonald Institute Monographs.

Barton, R N E, Berridge, P J, Walker, M J C & Bevins, R E 1995 'Persistent places in the Mesolithic landscape: an example from the Black Mountain uplands of South Wales', *Proceedings of the Prehistoric Society* 1: 81–116.

Binford, L R 1978 *Nunamiut Archaeology*. New York: Academic Press

Birch, S 2009 'The production and use of bone bevel-ended tools', *in* Hardy, K & Wickham-Jones, C (eds) 'Mesolithic and later sites around the Inner Sound, Scotland: the work of the Scotland's First Settlers Project 1998–2004', *Scottish Archaeological Internet Reports* 31. https://doi.org/10.5284/1017938

Bishop, A H 1914 'An Oransay shell-mound – a Scottish Pre-Neolithic site', *Proc Soc Antiq Scot* 48: 52–108.

Bordes, F & Gaussen, J 1970 'Un fonde de tente Magdalenian pres de Mussidan (Dordogne)', *Frühe Menscheit und Umwelt* 1: 313–29.

Bown, C J & Shipley, B M 1982 *South-east Scotland: Soil and land capability for agriculture*. Aberdeen: The Macaulay Institute for Soil Research.

Breuil, H 1922 'Observations on the pre-Neolithic industries of Scotland', *Proc Soc Antiq Scot* 56: 261–81.

Brown, F forthcoming *Excavations at Ronaldsway Airport, Malew, Isle of Man*. Lancaster: Oxford Archaeology North.

Burroni, D B, Donahue, R E, Pollard, A M & Mussi, M 2002 'The surface alteration features of flint artefacts as a record of environmental processes', *Journal of Archaeological Science* 29: 1,277–87.

Clarke, A 1990 'Coarse stone tools', *in* Wickham-Jones, C R (ed.) *Rhum: Mesolithic and later sites at Kinloch, Excavations 1984–86*, 117–26. Society of Antiquaries of Scotland Monograph Series 7. Edinburgh: Society of Antiquaries of Scotland.

Clarke, A 2004 'Coarse stone tools', *in* Wickham-Jones, C R & Hardy, K (eds) 'Camas Daraich: A Mesolithic site at the Point of Sleat, Skye', *Scottish Archaeological Internet Report* 12: 46.

Clarke, C 2002 'Pollen assessment and paleo-environmental background survey', *in* 'North-East Quarry, Dunbar 2002: post-excavation research design'. AOC Archaeology Group unpublished client report.

Conneller, C, Milner, N, Tayler, B & Tayler, M 2012 'Substantial settlement in the European

Early Mesolithic: new research at Star Carr', *Antiquity* 86: 1,004–20.

Coles, J M 1971 'The early settlement of Scotland: excavations at Morton, Fife', *Proceedings of the Prehistoric Society* 37.2: 284–366.

Courty, M A, Goldberg, P & Macphail, R 1989 *Soils and micromorphology in archaeology*. Cambridge: Cambridge University Press.

Cowley, D C 2009 'The Traprain environs in a regional perspective', *in* Haselgrove, C (ed.) *The Traprain Law Environs Project, Fieldwork and Excavations 2000–2004*, 205–24 Edinburgh: Society of Antiquaries of Scotland.

David, A & Walker, E A 2004 'Wales during the Mesolithic period', *in* Saville, A (ed.) *Mesolithic Scotland and its Neighbours*, 185–220. Edinburgh: Society of Antiquaries of Scotland.

Donahue, R E 1988 'Microwear analysis and site function: Paglicci Cave, Level 4a', *World Archaeology* 19: 357–75.

Donahue, R E 1994 'The current state of lithic microwear research', *in* Ashton, N & David, A (eds) *Stories in Stone*, 156–68. Oxford: Lithic Studies Society.

Donahue, R E 2002 'Microwear analysis', *in* Sidell, J, Cotton, J, Rayner, L & Wheeler, L *The Prehistory and Topography of Southwark and Lambeth*, 81–8. MoLAS Monograph 14. London: Museum of London.

Donahue, R E (nd) 'Lithic microwear analysis of the Lismore Fields, Buxton Site', unpublished report prepared for Trent & Peak Archaeological Unit.

Donahue, R E & Evans, A A 2013 'Lithic microwear analysis', *in* Jones, P *A Mesolithic 'persistent place' at North Park Farm, Bletchingley, Surrey*, 80–4. SpoilHeap Monograph 8. Woking: SpoilHeap Publications.

Duffy, A 2002 'Charcoal analysis', in *North-East Quarry, Dunbar 2002: post-excavation research design*. AOC Archaeology Group unpublished client report.

Dunwell, A 2007 'Cist burials and an Iron Age settlement at Dryburn Bridge, Innerwick, East Lothian', *Scottish Archaeology Internet Reports* 24.

Engl, R P 2012 'Lithics', *in* Gooder, J *Cramond Roman Fort*. AOC Archaeology Group unpublished client report.

Engl, R P forthcoming 'Greenan, Ayr: The excavation of a multi-period archaeological landscape'.

Finlay, N, Finlayson, B & Mithen, S 2000 'The secondary technology: its character and inter-site variability', *in* Mithen, S (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–98*. Vol 2: *Archaeological Fieldwork on Colonsay, Computer Modelling, Experimental Archaeology and Final Interpretations*, 571–87. Cambridge: McDonald Institute Monographs.

Finlay, N, Ceron-Carrasco, R, Housley, R, Huggett, J, Graham Jardine, W, Ramsay, S, Smith, C, Wright, D, Augley, J & Wright, P J 2019 'Calling Time on Oronsay: Revising Settlement Models Around the Mesolithic-Neolithic Transition in Western Scotland. New Evidence from Port Lobh, Colonsay', *Proceedings of the Prehistoric Society* 85: 83–114.

Finlayson B 1990a 'The examination of surface alteration', *in* Wickham-Jones, C R (ed.) *Rhum: Mesolithic and later sites at Kinloch, Excavations 1984–86,* 53–4. Society of Antiquaries of Scotland Monograph Series 7. Edinburgh: Society of Antiquaries of Scotland.

Finlayson, B 1990b 'Lithic exploitation during the Mesolithic in Scotland', *Scottish Archaeological Review* 7: 41–57.

Finlayson, B 1995 'Complexity in the Mesolithic of the Western Scottish seaboard', *in* Fischer, A (ed.) *Man and Sea in the Mesolithic: Coastal Settlement Above and Below Present Sea Level,* 261–4. Oxbow Monograph 53. Oxford: Oxbow Books.

Finlayson, B 1998 *Wild Harvesters: The First People in Scotland*. Edinburgh: Canongate Books and Historic Scotland.

Finlayson, B 2004 'The use of stone tools in Mesolithic Scotland: function, value, decision-making and landscapes', *in* Saville, A (ed.) *Mesolithic Scotland and its Neighbours*, 221–8. Edinburgh: Society of Antiquaries of Scotland.

Finlayson, B, Finlay, N & Mithen, S 2000 'The cataloguing and analysis of the lithic assemblages', *in* Mithen, S (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–1998.* Vol 1: *Project Development, Palaeoenvironmental Studies and Archaeological Fieldwork on Islay*, 61–72. Cambridge: McDonald Institute Monographs.

Foxon, A D 1991 'Bone, antler, tooth and horn technology and utilisation in prehistoric Scotland', unpublished PhD thesis, University of Glasgow.

Fretheim, S E 2017 'Mesolithic dwellings – an empirical approach to past trends and present interpretations in Norway'. PhD thesis, Norwegian University of Science and Technology, Trondheim.

Fretheim, S E, Piana, E L, Bjerck, H B & Zangrando, A F J 2016 'Home by the sea – exploring traditions of dwelling reoccupations and settlement stability among marine foragers in Norway and Tierra del Fuego', *in* Bjerck, H B, Breivik, H M, Fretheim, S E, Pena, E L, Skar, B, Tivoli, A M & Zangrando, A F J (eds) *Marine Ventures. Archaeological Perspectives on Human–Sea Relations*, 175–92. Proceedings from the Marine Ventures International Symposium in Trondheim 2013. Sheffield: Equinox.

Gemmell, A M D & Kesel, R H 1977 'Developments in the study of the Buchan flint deposits', *Scottish Archaeological Forum* 9. Edinburgh: Edinburgh University Press.

Grieve, S 1885 *The Great Auk or Garefowl: Its History, Archaeology and Remains*. London: Thomas C Jack.

Gooder, J 2001 'BCI North-East Quarry, Dunbar, East Lothian (Dunbar Parish), evaluation, geophysical survey, field-walking', *Discovery & Excavation in Scotland* 32, 31–2.

Gooder, J 2007 'Excavation of a Mesolithic house at East Barns, East Lothian, Scotland: an interim view', *in* Waddington, C & Pederson, K (eds) *Mesolithic Studies in the North Sea Basin and Beyond: Proceedings of a Conference held in Newcastle in 2003*, 49–59. Oxford: Oxbow Books.

Griffiths, J & Bonsall, C 2001 'Experimental determination of the function of antler and bone "bevel-ended tools" from prehistoric shell middens in western Scotland', *in* Choyke, A M & Bartosiewicz, L (eds) *Crafting Bone: Skeletal Technologies Through Time and Space*, 207–20. British Archaeological Reports (International Series 937). Oxford: Archaeopress.

Grøn, O 2003 'Mesolithic dwelling places in south Scandinavia: their definition and social interpretation', *Antiquity* 77 (298): 685–708.

Grøn, O & Skaarup J 1995 'Excavation of a Mesolithic dwelling in a submerged landscape', preliminary report, *NewsWarp* 17: 28–31.

Grøn, O & Sorensen, S A 1995 'Aggemose: an inland site from the Early Kongemose culture on Langeland', *Journal of Danish Archaeology* 11: 7–18.

Hall, A 2002 'Macroplant and insect assessment', in *North-East Quarry, Dunbar 2002: post-excavation research design*. AOC Archaeology Group unpublished client report.

Hesjedal, A, Damm, C, Olsen, B & Storli, I 1996 *Arkeologi pa Slettnes. Dokumentasjon av 11,000 ars bosetning*, Tromsø: Tromsø Museums Skrifter XXVI.

Hind, D 1998 'Chert use in the Mesolithic of Northern England', Assemblage 4, University of Sheffield, www.assemblage.group.shef.ac.uk/4/4hind.html. Accessed 10/02/2021.

Inglis, R 2002 'Soil chemistry analysis', *in* 'North-East Quarry, Dunbar 2002: post-excavation research design'. AOC Archaeology Group unpublished client report.

Inizan, M L, Reduron-Ballinger, M, Roche, H & Tixier, J 1999 *Technology and terminology of knapped stone: Prehistoire de la Pierre Taillee, Tome 5*, trans. J. Feblot-Augustins, Nanterre: CREP.

Jacobi, R M 1976 'Britain inside and outside Mesolithic Europe', *Proceedings of the Prehistoric Society* 42: 67–84.

Jacobi, R M 1980 'The Early Holocene settlements of Wales', *in* Taylor, J A (ed), *Culture and Environment in Prehistoric Wales*, 131–206. Oxford: British Archaeological Reports (British Series 76).

Jacques, D & Phillips, T 2014 'Mesolithic settlement near Stonehenge: excavations at Blick Mead, Vespasian's Camp, Amesbury', *Wiltshire Archaeological & Natural History Magazine* 107: 7–27.

Lacaille A D 1954 *The Stone Age in Scotland*. London: Oxford University Press (for the Wellcome Historical Medical Museum, New Series, no. 6.).

Larsson, M 1986 Bredasten. *An Early Ertobölle Site with a Dwelling Structure in South Scania*. Lunds: Meddelande fran Lunds Universitets Historiska Museum.

Larsson, M 2017 *Life and Death in the Mesolithic of Sweden*. Oxford: Oxbow Books.

Lavrillier, A 2010 'The creation and persistence of cultural landscapes among the Siberian Evenkis: two conceptions of sacred space', *in* Jordan, P (ed.) *Landscape and Culture in Northern Eurasia,* 215–31. London: Taylor & Francis.

Lawson, J 2001 'Cramond, Edinburgh', *Discovery and Excavation in Scotland*, New Series 2: 124.

Lawson, J, Saville A & Engl, R P forthcoming 'Scotland's first settlers? Evidence for an Early Mesolithic site at Cramond, Edinburgh'.

Lillie, M 2015 *Hunters, Fishers and Foragers in Wales: Towards a Social Narrative of Mesolithic lifeways.* Oxford: Oxbow Books.

Lowe, J, J. 1994 'Isolating the climatic factors in early- and mid-Holocene paleaobotanical records from Scotland', *in* Chambers, F M (ed.) *Climate Change and Human Impact on the Landscape*, 66–82. London: Chapman & Hall.

MacGregor, G & Donnelly, M 2001 'A Mesolithic scatter from Littlehill Bridge, Girvan, Ayrshire', *Scottish Archaeological Journal* 23: 1–14.

Madella, M 2002 'Phytolith assessment', *in* 'North-East Quarry, Dunbar 2002: post-excavation research design'. AOC Archaeology Group unpublished client report.

Marshall, G 2000 'The distribution and character of flint beach pebbles on Islay as a source for Mesolithic chipped stone artefact production', *in* Mithen, S (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–98*. Vol 1: *Project Development, Palaeoenvironmental Studies and Archaeological Fieldwork on Islay,* 79–90. Cambridge: McDonald Institute Monographs.

Marshall, L 1976 *The !Kung of Nyae Nyae*, Cambridge MA: Harvard University Press.

McCullagh, R 1989 'Excavation at Newton, Islay', *Glasgow Archaeological Journal* 15: 23–51.

Mercer, R 1976 'The archaeological survey of a coastal area of East Lothian at Torness, Innerwick', *Transactions of East Lothian Antiquarian and Field Naturalists Society* 15: 1–16.

Mellars, P A 1987 *Excavations on Oronsay: Prehistoric Human Ecology on a Small Island.* Edinburgh: Edinburgh University Press.

Mithen, S 2019 'Mesolithic fireplaces and the enculturation of Early Holocene landscapes in Britain, with a case study from western Scotland', *Proceedings of the Prehistoric Society* 85: 131–59.

Mithen, S & Wicks, K 2018 'The Interpretation of Mesolithic structures in Britain: New Evidence from Criet Dubh, Isle of Mull, & Alternative Approaches to Chronological Analysis for Inferring Occupation Tempos & Settlement Patterns', *Proceedings of the Prehistoric Society* 84: 77–110.

Mithen, S, Finlayson, B, Finlay, N and Lake, M 1992 'Excavations at Bolsay Farm, a Mesolithic settlement on Islay', *Cambridge Archaeological Journal* 2.2, 242–53.

Mithen, S, Finlay, N, Carruthurs, W, Mason, S, Hather, J & Carter, S 2000 'Occupation and activity at Staosnaig', *in* Mithen, S (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–98*. Vol 2: *Archaeological Fieldwork on Colonsay, Computer Modelling, Experimental Archaeology and Final Interpretations*. Cambridge: McDonald Institute Monographs.

Mulholland, H 1970 'The microlithic industries of the Tweed Valley', *Transactions of the Dumfriesshire & Galloway Natural History & Antiquarian Society* 47: 81–110.

Pedersen, K 2007 'Stratigraphic and spatial distribution', *in* Waddington, C (ed.) *Mesolithic Settlement in the North Sea Basin: A Case Study from Howick, North-east England*. Oxford: Oxbow Books.

Pedersen, K 2016 'Chipped Stone Tools', *in* Waddington, C & Bonsall, C (eds) *Archaeology and Environment on the North Sea Littoral: A Case Study from Low Hauxley*. Bakewell: Northumberland Wildlife Trust and Archaeological Research Services Ltd.

Piggott, S & Powell, T G E 1949 'The excavation of three Neolithic chambered tombs in Galloway 1949', *Proc Soc Antiq Scot* 83: 103–61.

Pollard, T 1996 'Time & tide: coastal environments, cosmology and ritual practice', *in* Pollard, T & Morrison, A (eds) *The Prehistory of Scotland*, 198–213. Edinburgh: Edinburgh University Press.

Robertson, A, Lochrie, J & Timpany, S 2013 'Built to last: Mesolithic and Neolithic settlement at two sites beside the Forth Estuary, Scotland', *Proc Soc Antiq Scot* 143: 78–136.

Robinson, M 1993 'Microfossil analyses and radiocarbon dating of depositional sequences related to Holocene sea-level changes in the Forth valley, Scotland', *Transactions of the Royal Society of Edinburgh: Earth Sciences* 84: 1–60.

Saville, A 1994 'Exploitation of lithic resources for stone tools in earlier prehistoric Scotland', *in* Ashton, N & David, A (eds) *Stories in Stone*, 57–70. Lithic Studies Society Occasional Paper No. 4. London: Lithic Studies Society.

Saville, A 2003 'Lithic resource exploitation for artefacts in prehistoric and early historic Scotland', *in* Stollner, T, Korlin, G, Steffans, G & Cierny, J (eds), *Mesolithic on the Move: Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*, 340–50. Oxford: Oxbow Books.

Saville, A 2004 'The material culture of Mesolithic Scotland', *in* Saville, A (ed.) *Mesolithic Scotland and its Neighbours*, 185–220. Edinburgh: Society of Antiquaries of Scotland.

Saville, A 2005 'Struck lithic artefacts', *in* Ritchie, A (ed.) *Killellan Farm, Ardnave, Islay – Excavations of a Prehistoric to Early Medieval Site by Colin Burgess and Others 1954–76*. Edinburgh: Society of Antiquaries of Scotland.

Saville, A 2008 'The beginning of the later Mesolithic in Scotland', *in* Sulgostowska, Z & Tomaszewski, A J (eds) *Man–millennia–environment* (Studies in Honour of Romuald Schild). Warsaw: Institute of Archaeology and Ethnology, Polish Academy of Sciences.

Smith, D E, Firth, C R & Cullingford, R L 2002 'Relative sea-level trends during the early–middle Holocene along the eastern coast of mainland Scotland, UK', *Boreas* 31: 185–202.

Spikins, P, Kelly, R & Manzi, L 2010 '"When the last fires were put out": ethnographic analogy and the symbolic use of fire in the Palaeolithic and Mesolithic', *Quaderni di Thule, XXXII Convegno Internazionale di Americanistica*: 183–92.

Tilley, C 1994 *A Phenomenology of Landscape: Places, Paths and Monuments.* Oxford: Berg.

Tipping, R 1994 'The form and fate of Scotland's woodlands', *Proc Soc Antiq Scot* 124: 1–54.

Van Wessel, J 2019 'Standing Stones, an upland camp', *in* Dingwall, K, Ginnever, M, Tipping, R, van Wessel, J & Wilson, D (eds) *The Land was Forever: 15,000 Years in North-East Scotland: Excavations on the Aberdeen Western Peripheral Route/Balmedie-Tipperty,* 204–23. Oxford: Oxbow Books.

Waddington, C (ed.) 2007 *Mesolithic Settlement in the North Sea Basin: A Case Study from Howick, North-east England*. Oxford: Oxbow Books.

Waddington, C 2014 *Rescued from the Sea. An Archaeologist's Tale*. Bakewell: Archaeological Research Services Ltd and Northumberland Wildlife Trust.

Waddington, C 2015 'Mesolithic re-colonisation of Britain following the drowning of North Sea landscapes', *in* Ashton, N & Harris, C (eds) *No Stone Unturned: Papers in Honour of Roger Jacobi*, 221–32. London: Lithic Studies Society.

Waddington, C & Bonsall, C 2016 *Archaeology and Environment on the North Sea Littoral: a case study from Low Hauxley*. Bakewell: Archaeological Research Services Ltd and Northumberland Wildlife Trust.

Waddington, C & Passmore, D G, 2012 'Hunter-gatherer-fishers *c*. 13400–3900 BC', *in* Passmore, D G & Waddington, C (eds) *Archaeology and Environment in Northumberland*, 112–40. Till-Tweed Studies, Vol 2. Oxford: Oxbow Books and English Heritage.

Waddington, C & Pedersen, K (eds) 2007 *Mesolithic studies in the North Sea Basin and Beyond.* Proceedings of a Conference held at Newcastle in 2007. Oxford: Oxbow Books.

Waddington, C, Bailey, G & Milner, N, 2007a 'Howick: discussion and interpretation', *in* Waddington, C (ed.) *Mesolithic Settlement in the North Sea Basin: A Case Study from Howick, North-east England*, 189–202. Oxford: Oxbow Books

Waddington, C, Bailey, G, Bayliss, A & Milner, N 2007b 'Howick in its North Sea context', *in* Waddington, C (ed.) *Mesolithic Settlement in the North Sea Basin: A Case Study from Howick, North-east England*, 203–24. Oxford: Oxbow Books.

Walker, M J C & Lowe, J J 1997 'Vegetation and climate in Scotland, 13,000 to 7,000 Radiocarbon Years Ago', *in* Gordon, J E (ed.) *Reflections on the Ice Age in Scotland*, 105–15. Glasgow: Scottish Natural Heritage.

Warren, G 2003 'Chert quarries at Kilrubie Hill, Eddleston Valley', *Peeblesshire Archaeological*

Society Internet Reports 2003–2005. https://peeblesarchsoc.org.uk/Reports/Kilrubie_Hill_Chert_Quarries.pdf. Accessed 26 March 2021.

Warren, G 2005 *Mesolithic Lives in Scotland*. Stroud: Tempus.

Warren, G 2007 'An archaeology of the Mesolithic in eastern Scotland: deconstructing culture, constructing identity', *in* Waddington, C & Pedersen, K (eds) *Mesolithic Studies in the North Sea Basin and Beyond*, 137–50. Oxford: Oxbow Books.

Warren, G, Fraser, S, Clarke, A, Driscoll, K, Mitchell, W, Noble, G, Paterson, D, Shulting, R, Tipping, R, Verbaas, A, Wilson, C & Wickham-Jones, C R 2018 'Little house in the mountains? A small Mesolithic structure from the Cairngorm Mountains, Scotland', *Journal of Archaeological Science: Reports* 18: 936–45.

Whittington, G, Edwards, K J & Caseldine, C J 1991a 'Late and post-glacial pollen analytical and environmental data from a near coastal site in north-east Fife, Scotland', *Review of Palaeobotany and Palynology* 68: 65–85.

Whittington, G, Edwards, K J & Cundill, P R, 1991b 'Late and post-glacial vegetational change at Black loch, Fife, eastern Scotland', *New Phytologist* 118: 147–66.

Wickham-Jones, C R 1986 'The procurement and use of stone for flaked tools in prehistoric Scotland', *Proc Soc Antiq Scot* 116: 1–10.

Wickham-Jones, C R 1990 *Rhum: Mesolithic and later sites at Kinloch, Excavations 1984–86*. Society of Antiquaries of Scotland Monograph Series 7. Edinburgh: Society of Antiquaries of Scotland.

Wickham-Jones, C R 2004a 'Structural evidence in the Scottish Mesolithic', *in* Saville, A (ed.) *Mesolithic Scotland and its Neighbour,* 229–42. Edinburgh: Society of Antiquaries of Scotland.

Wickham-Jones, C R 2004b 'The Mesolithic in Scotland: Action Archaeology for the Twenty-First Century', *Before Farming* 1: 1–18.

Wickham-Jones, C R 2004c 'Flaked lithics', *in* Wickham-Jones, C R & Hardy, K (eds) 'Camas Daraich: A Mesolithic site at the Point of Sleat, Skye', *Scottish Archaeological Internet Reports* 12: 19–37. https://doi.org/10.5284/1017938

Wickham-Jones, C R & Collins, G H 1978 'The sources of flint and chert in northern Britain', *Proc Soc Antiq Scot* 109: 7–21.

Wickham-Jones, C R & Dalland, M 1998 'A small Mesolithic site at Craighead Golf Course, Fife Ness, Crail, Scotland', *Tayside and Fife Archaeological Journal* 4: 1–19.

Wickham-Jones, C R & Hardy, K 2004 'Camas Daraich: A Mesolithic site at the Point of Sleat, Skye', *Scottish Archaeological Internet Reports* 12. https://doi.org/10.5284/1017938

Wickham-Jones, C R & McCartan S 1990 'The lithic assemblage: secondary technology', *in* Wickham-Jones, C R, *Rhum: Mesolithic and later sites at Kinloch, excavations 1984–86*, 87–101. Society of Antiquaries of Scotland Monograph Series 7. Edinburgh: Society of Antiquaries of Scotland.

Woodman, P C 1985 *Excavations at Mount Sandel, 1973–77: County Londonderry* (No. 2). Belfast: HMSO.

Woodman, P 1987 'Excavations at Cass ny Hawin, a Manx Mesolithic Site, and the position of the Manx Microlithic industries', *Proceedings of the Prehistoric Society* 53: 1–22.

Zetterlund, P 1990 'The lithic assemblage: primary technology', *in* Wickham-Jones, C R 1990 *Rhum: Mesolithic and later sites at Kinloch, excavations 1984–86*, 64–86. Society of Antiquaries of Scotland Monograph Series 7. Edinburgh: Society of Antiquaries of Scotland.

Website

Liverpool Landscapes 2012 'Lunt Meadows, Sefton'. Liverpool Museums. www.liverpoolmuseums.org.uk/mol/archaeology/projects/lunt-meadows/. Accessed 8 November 2020.