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ARO15: Chert artefacts and structures during the final Mesolithic at Garvald Burn, Scottish Borders

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ARO15: Chert artefacts and structures during the final Mesolithic at Garvald Burn, Scottish Borders

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Contents

List of Figures

List of Figures *(continued)*

List of Plates

List of Plates *(continued)*

List of Tables

Abstract

In connection with the research of lithic scatters in southern Scotland[1], an early prehistoric site was discovered at Garvald Burn, near Dolphinton, in the Scottish Borders. The site is generally a palimpsest, from which mainly Late Mesolithic and Early Neolithic lithic artefacts were recovered, but it also yielded finds from other prehistoric periods. Although most of the site's 1,562 lithic finds are inextricably mixed, 587 mainly chert artefacts were identified as most likely relating to a single event in the Trench 4 Extension. These pieces formed a knapping floor, and they were associated with a hearth and a windbreak. The scatter possibly represents the production of microblades for scalene triangles, retooling activities, as well as activities involving the production and use of other tool forms, such as scrapers and a burin. A radiocarbon-date from a posthole within the windbreak suggests that the lithic artefacts and the features date to the latest part of the Late Mesolithic period (4350–4000 cal BC; AA-51538). This date is potentially significant, as it is one of the latest radiocarbon dates associated with scalene triangles in Scotland, and it may therefore indicate a compositional difference between Scottish and English lithic assemblages from this period, with the latter possibly being dominated by so-called 'rods' and/or 'quadrilaterals'.

The main focus of this publication is the 587-piece lithic assemblage from the Trench 4 Extension, which is characterised with special reference to raw-materials and typo-technological attributes. Also discussed are topics such as chronological issues, the associated features, raw material procurement and technological traditions in early prehistoric southern Scotland. The lithic finds from the site in general are presented as an Appendix.

Introduction

Aims and objectives

As part of the investigation of the Garvald Burn site in the Scottish Borders, a chronologically mixed lithic assemblage of 1,562 pieces was recovered. The site as a whole revealed almost no features, but in the Trench 4 Extension – a number of features were discovered, including a hearth and a windbreak. This area also yielded a lithic assemblage of 587 pieces, dominated by chert. The assemblage includes diagnostic typo-technological elements, which indicate a Late Mesolithic date, and radiocarbon-dating of a charcoal sample from posthole 404 within the windbreak supports this (4350–4000 cal BC; Table 4).

The general lithic assemblage from Garvald Burn is summarised in Table 7 in the Appendix, while the main part of the publication focuses on the detailed presentation and discussion of the assemblage and its context from the Trench 4 Extension. The assemblage is also compared with older and more recent discoveries of Mesolithic structures from Scotland and northern Britain. The features and lithic assemblage found in the Trench 4 Extension are the products of a complex prehistoric reality and a number of separate topics concerning the site and the assemblage formation are discussed, including raw material procurement in early prehistoric southern Scotland, and prehistoric industrial traditions in the region.

The evaluation of the lithic material is based upon a detailed catalogue of all the lithic finds from Garvald Burn, and the artefacts are referred to by their catalogue number (CAT no.). The finds are presently being allocated through the Treasure Trove system, whereas a copy of the catalogue was submitted to Historic Scotland and another lodged with the National Monuments Record, and in Edinburgh as part of the general site archive. All finds were examined to CIfA standards and guidance.

Project history

The investigation of the Garvald Burn site and its lithic assemblage began in the late 1990s when Barrowman carried out his PhD project *Surface Lithic Scatters as an Archaeological Resource in South and Central Scotland* (Barrowman 2000c). It was also known as The Scottish Lithic Scatters Project, of which it formed the southern section (Barrowman 2003; and Stuart 2003). As part of this project, funded by Historic Scotland from 1995 to 1998, numerous sites in the region were inspected and either exposed to surface collection or, more rarely, excavated. The aim of the project was to test the value of lithic scatters as a resource in south and central Scotland in

[1] As part of Chris Barrowman's PhD thesis

terms of their formation and research potential, and in addition to the production of Barrowman's dissertation, a database of lithic scatters was compiled.

Within southern Scotland, three sites were exposed to more detailed investigation: Firpark Wood (NGR: NT 026 465) in South Lanarkshire (commonly referred to as 'Weston'), Monksford (NGR: NT 587 324) in the Scottish Borders (commonly referred to as 'Dryburgh'), and Garvald Burn (Plate 1; NGR: NT 101 486), also in the Scottish Borders. Firpark Wood and Garvald Burn were fieldwalked and excavated, whereas Monksford was only subjected to detailed surface collection.

Plate 1: The location prior to excavation; view approximately towards WNW.

Firpark Wood (Ballin 2013a) forms a small part (238 lithic artefacts) of the larger Weston complex outside Biggar, which was exposed to repeated fieldwalking and excavation by the Biggar Archaeology Group (Ward 2006). Over the years, the complex as a whole has yielded thousands of lithic finds from most prehistoric periods, as well as pottery and objects in stone, although it may be dominated by later Mesolithic material[2]. Fieldwalking of two adjacent fields at Monksford resulted in the recovery of 423 lithic artefacts, mainly dating to the Late Mesolithic and Middle Neolithic periods (Ballin 2013b). However, it is thought that the finds from the two fields may represent a somewhat depleted sample of an original total, as the Dryburgh area has been investigated by numerous fieldwalkers and collectors over the past century. The Late Mesolithic and Middle Neolithic finds have also proved impossible to separate spatially. For these reasons, the authors agreed that the Barrowman assemblages from Firpark Wood and Monksford possess relatively low research value but the reports on the two sites and their assemblages have been made freely available on the Academia website as comparative material for the Garvald Burn report (https://independent.academia.edu/TorbenBjarkeBallin).

Although the Garvald Burn site (Barrowman 2000a and2000c) with its more numerous assemblage (1,562 pieces) mainly represents a palimpsest, indicating settlement throughout earlier prehistory (Early Mesolithic – Early Bronze Age, although clearly dominated by Late Mesolithic/Early Neolithic finds), the location does include one chronologically unmixed sub-assemblage, dating to the Late Mesolithic period. This assemblage was associated with a set of features, from which a late Mesolithic radiocarbon date was produced (4350-4000 cal BC; Table 4). After careful consideration and consultation with Historic Scotland, it was agreed that this assemblage and its context deserved more detailed scrutiny and publication.

The project was complicated by the fact that it was not possible to locate most documents relating to the three sites, especially those for Firpark Wood and Monksford, and some documents relating to Garvald Burn. Although some information dealing with the test pitting at the latter location in 1997 exists, the original plans and the note books covering the excavation of the trenches in 2000 are missing. All site information used in this publication is based on entries in CANMORE; Barrowman's thesis, which deals only with the test pitting (Barrowman 2000c); the original notebook relating to the test pitting; and the data structure report on the excavation of the site's trenches, which excludes the test pitting (Barrowman 2000a).

The assessment and characterisation of the three lithic assemblages, as well as this publication, were supported by a grant from Historic Scotland, for which the authors are very grateful.

The location

The Garvald Burn site (NGR: NT 101 486) is situated near Dolphinton, east of the South Medwin valley, which runs east/west from the Scottish Borders into South Lanarkshire, directly

[2] The full assemblage held by Biggar Archaeological Trust is presently being analysed by Dr Dene Wright, University of Glasgow, who will publish his findings at a later stage

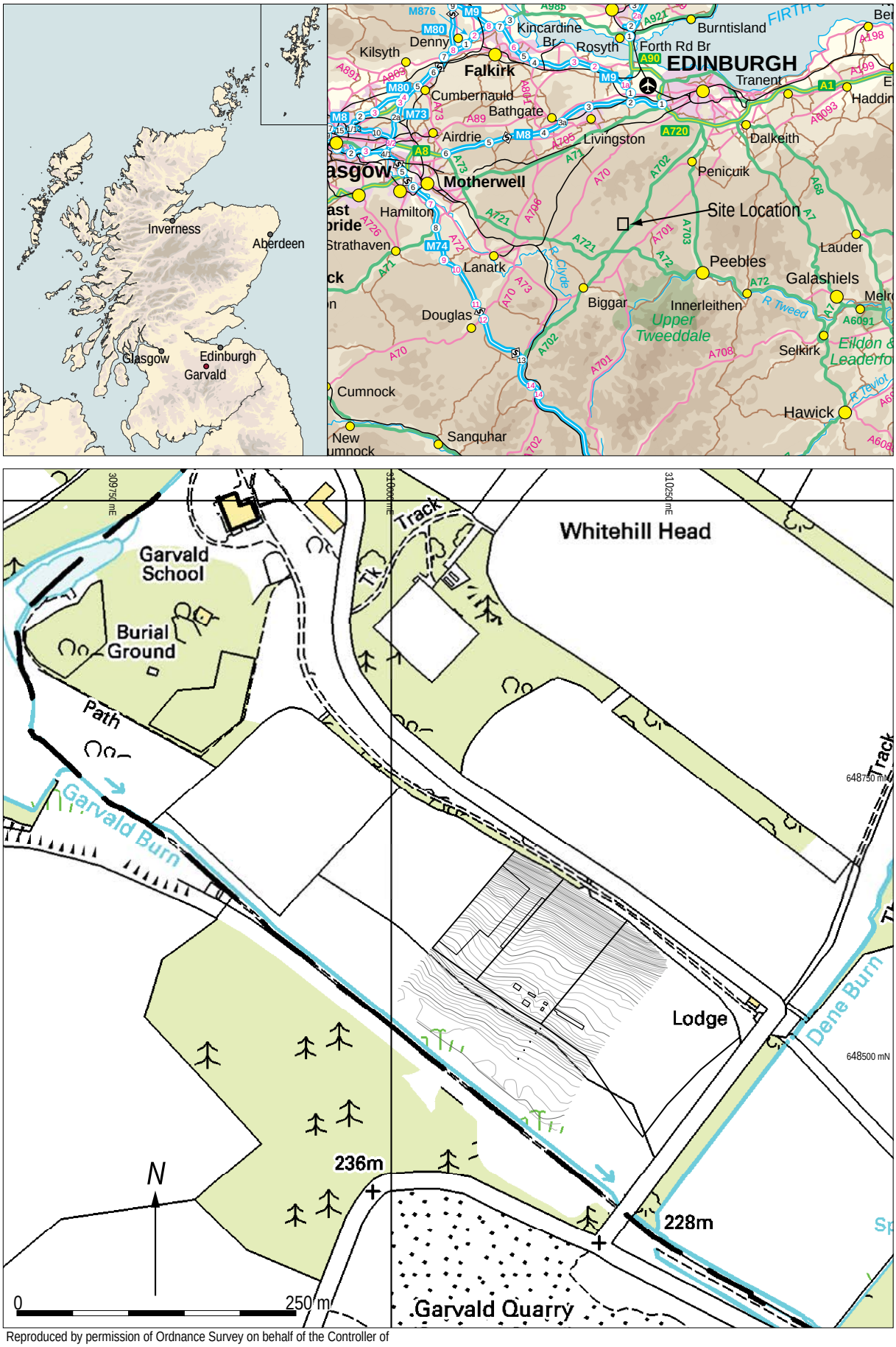

Figure 1: Location map.

south of the Pentland Hills (Figure 1).The Garvald Burn stream flows into the South Medwin river, which then becomes the Medwin, before joining the River Clyde.

The area around Garvald Burn was selected as one of several *foci* for the Scottish Lithic Scatters Project due to the region's general abundance of stray finds and lithic scatters[3], and the fact that this specific area was characterised by a distinct lack of fieldwork. During the late 1990s, Garvald Burn was north of an area being field walked by the Lanark and District Archaeological Society, and therefore fitted well with the general study of the prehistory of the Upper Clyde region.

The main Southern Uplands Fault runs from the south-west to the north-east, more or less straight through Dolphinton. To the south lie the hilly Southern Uplands composed mainly of Ordovician/Silurian greywacke with, *abundant* beds of radiolarian chert. The flatter landscape north of the fault line was formed during the Carboniferous period, and it contains limestone, coal, iron-ore and *some* chert. The South Medwin valley, which runs past the Garvald Burn site and also Dolphinton, was formed by glacial meltwater which deposited thick layers of sand and gravel, and amongst these sediments also occasional chert pebbles (Greig 1971).

A small stream named Garvald Burn lies at the foot of a slope running down from Whitehill Head, at the southern end of the Pentland Hills. From a marshy area at the foot of the slope, the field rises onto a flatter river terrace on which the archaeological site (Plate 1 and Figure 2) is located. It is thought that the Garvald Burn was a much larger river during post-glacial times (McMillan et al. 1981).

The contours suggest that, in prehistory, a small stream may have run through the field immediately south of the main concentration of finds. This likely (but now drained) stream is indicated in Figure 2, and it may have been an important factor in the setting up of camps during the Mesolithic and Neolithic.

[3] For an overview, see the Biggar Archaeology Group website: http://www.biggararchaeology.org.uk

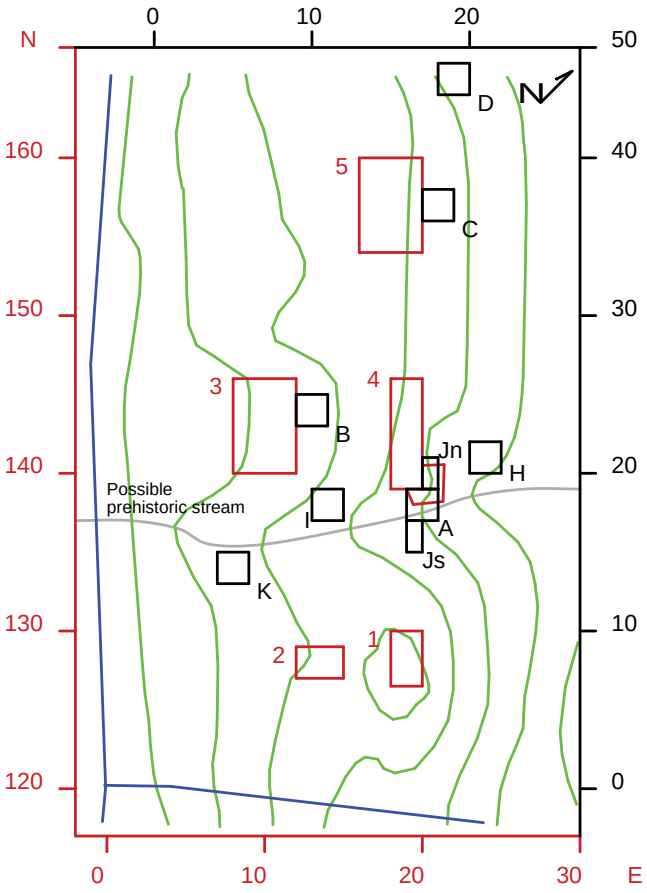

Figure 2: Test pits and trenches at Garvald Burn, as shown on the plan, the coordinate system was altered between test-pitting and trench excavation. Black: test pits and coordinate system used in connection with the test pitting; red: trenches and coordinate system used in connection with the trench excavations.

The site investigation *(Barrowman 2000a and 2000c)*

Fieldwork was carried out as a staged process, gradually defining areas of archaeological research potential. Initially, 16 fields near Dolphinton were walked, and although individual lithic finds were recovered from most, the present field on the northern side of Garvald Burn had the highest yield, and it was therefore selected for more detailed exploration.

Fieldwalking 1997

This field was walked in lines 20 m apart, and each find was flagged and bagged. Once the field had been noted as including a significant scatter of lithic material, it was walked again at 10 m intervals to locate potential concentrations of finds. Following the second walk-over, an even finer search was carried out across an area measuring 40 by 40 m, and the edges of the

concentration became apparent. Approximately 100 surface finds were surveyed into the grid to the nearest 100 mm, and as the lithic artefacts appeared to form smaller concentrations, it was decided to carry our geophysical analysis before defining the location of any future test pits. At this stage of the investigation, the presence of microliths and narrow blades indicated a mainly late Mesolithic date.

Geophysical survey 1997

The geophysical survey of the Garvald Burn area (see Sharpe 1997) included the application of both magnetic and electrical resistivity techniques. Some sub-surface anomalies were defined, but for the main part (as shown by the later test-pitting and trench excavation) they reflected the regional geological trend and the associated glacial drift. Some of the defined anomalies were thought to reflect past human activity, but some may have been modern, for example metallic detritus could have been confused with archaeological features like hearths and pits. The resistivity survey did not show any clear evidence of archaeological features.

Test-pitting 1997

Based on the results from both the fieldwalking and the geophysical survey, it was decided to place test pits over specific areas, rather than randomly. It was hoped that this would lead to the discovery of well-defined prehistoric settlement sites or camps. More specifically, test pits (TPs) were positioned over areas of dense lithic concentrations (TPs A, B, C and D); over blank areas between and out-with these concentrations (TPs E, F and G); and over areas with high numbers of geophysical anomalies (TPs H, I and K).

Apart from TP G (1 m^2), all test pits measured 2 by 2 m. Due to the presence of microliths and micro-waste, 25% of each m^2 was dry-sieved, and a smaller sample was bagged for wet-sieving in the laboratory. The test-pits were generally excavated one m^2 at a time, and in 100mm vertical spits. Almost 800 lithic artefacts were recovered in connection with the excavation of the test pits. As shown in Table 1, 587 lithic artefacts were recovered from TP A, and due to the yield of this test pit, 1 by 2 m test pits were excavated immediately north and south of it (TPs J North and J South). From these two additional test pits 45 and 69 lithic artefacts were retrieved, respectively, and a hearth was discovered at the bottom of TP J North (Figures 3 and 6). A possible hearth was discovered in TP I, but as it was only associated with 20 lithic artefacts, almost exclusively chips and waste flakes and no additional features, this location was given no further attention. Charcoal from this feature was later radiocarbon-dated to 4460-4160 cal BC; see Table 4).

Trench excavation 2000

Based on the combined results from fieldwalking, geophysical survey and the test-pit excavation, several trenches were defined (Figures 3 and Plate 2). Trenches 1 and 2 (both measured 2 by 3 m) were positioned over geophysical anomalies, but as shown in Table 11, neither location was associated with notable prehistoric activity (only 22 lithic pieces were recovered from the former and 24 from the latter). Trench 3 (4 by 6 m) was located immediately west of test-pit B, again with the main aim of investigating a geophysical anomaly. Despite the recovery of 400 lithic artefacts, no archaeological features were discovered, and the cause of the geophysical anomaly remains unexplained.

Plate 2: Excavated trench. Example of the site's stratigraphy: topsoil/plough soil and sand [SC1435757].

Trench 4 (2 by 7 m) was excavated in an attempt to re-find the hearth discovered in TP J North, and to investigate its surroundings. However, no prehistoric features were discovered in this trench, and fewer finds than expected were made. Subsequently, it was extended towards the south-east (Trench 4 Extension), adding a further c. 3.5 m^2 to Trench 4. The position of the original TP J North hearth was discovered, although it had been removed during the 1997 investigation. However, it was associated with a semi-circle of

post- and stake-holes, which probably represent a simple windbreak. In total, 117 lithic pieces were recovered from Trench 4 and Trench 4 Extension.

Trench 5 (4 by 6 m) was located immediately west of TP C, in association with a large concentration of surface lithic artefacts (123) but no prehistoric features were noticed. Trench 6 measured 3 by 27 m and was situated outside, and south of, the main surface scatter. It was excavated entirely by machine to test whether the raised plateau it was located on might have been the focus of prehistoric settlement, but only one lithic artefact was recovered.

Final test-pitting

Four test-pits (TPs 1-4) measuring 1 m^2 were each excavated in a NE/SW line at approximately 10 m intervals west of the main trenches (Barrowman 2000a). They were located in the marshy areas adjacent to the main scatter (Figure 1), and they were dug to create a profile through the peat deposits along the burn and to collect waterlogged environmental samples.

During their excavation, a number of different techniques were employed, with some areas being hand-trowelled spit by spit (varying between 50 mm and 100 mm spits), with artefacts recorded *in situ*, whereas other parts were investigated less meticulously and the finds only recorded by trench. All spoil from the trenches was dry-sieved, but 25% of the spoil was wet-sieved. The general principle was that the higher the find density, the more refined recovery techniques and recording procedures were applied.

In terms of recording the provenance of artefacts, the variation in excavation and recording methods across the site resulted in approximately half of all lithic finds having their location recorded by square metre, whereas the remainder were only recorded by their trench location. At the time, and in the context of PhD research, the variation of field approaches appeared sensible as it allowed the excavator to assess and discuss the differences of the chosen approaches. In hindsight this was unfortunate.

Due to the variation in excavation techniques and recording level, it has not been possible to carry out any detailed general analysis of site distribution patterns. In terms of the discussion of the late Mesolithic sub-assemblage and its associated features (Trench 4 Extension, TP A and TP J North) the finds from Trench 4 have been excluded, as it was not possible to spatially separate late Mesolithic finds from Neolithic ones (see Appendix). The lithic finds from TP J North were also excluded from analysis as the closeness of this test pit to Trench 4 with its later intrusion of Neolithic material, would make its inclusion dubious (one probably Early Neolithic pitchstone object was recovered from this test pit).

The focus of the discussion of the Late Mesolithic remains in this area is therefore the 587 lithic artefacts recovered from TP A, and the features revealed in connection with the excavation of TP J North and the Trench 4 Extension. This complex of contexts, features and excavation units is referred to below as Trench 4 Extension, unless it is relevant to be more specific.

Test pit A (TP A)

The only excavated part of the site which yielded substantial numbers of lithic artefacts (587), and did not include diagnostic finds from later prehistoric periods, is TP A (Figure 3). As indicated by Figure 4, the blade assemblage from TP A is heavily dominated by small microblades, which correspond roughly to the left peak in the curve produced by the blades of the full assemblage (the stippled curve in Figure 4; also see Figure 8). Two very small peaks to the right of the main summit of Figure 4 are probably blades produced during the initial core preparation as they have a considerably higher cortex ratio than the microblades. This is discussed in greater detail below (see dating section). For that reason, it was decided to carry out a case study on the finds from TP A, which - based on the microblades and supported by a radiocarbon date - are likely to date to the Late Mesolithic period.

It must be assumed that the excavation of TP A in 1997 left little to be found during the excavation of the Trench 4 Extension, with which it overlapped completely. Therefore the case study includes a discussion of the Trench 4/TP J North features and their relationship with the TP A lithic assemblage.

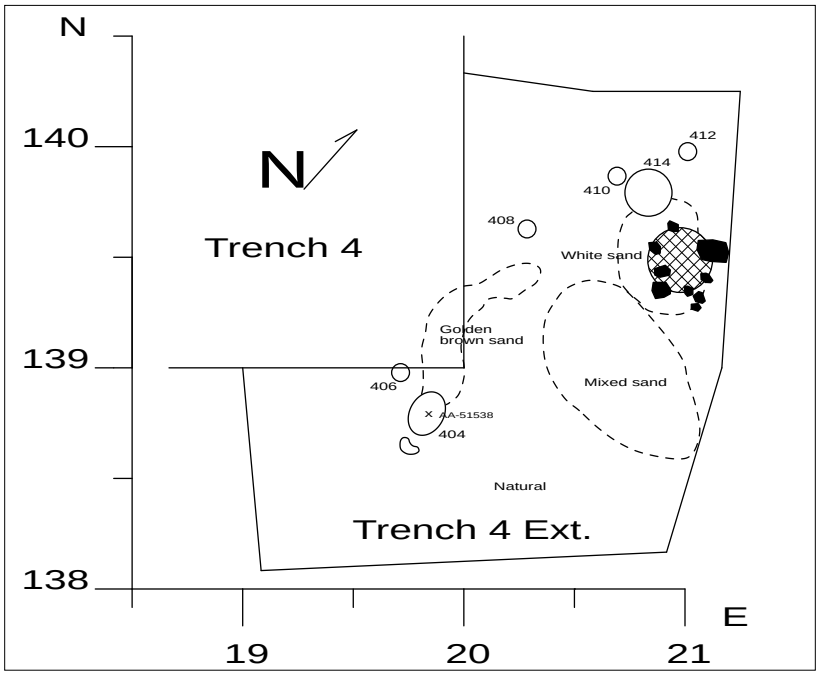

Figure 3: The Late Mesolithic features in Trench 4 Extension.

The late Mesolithic finds and features in Trench 4 extension

It was only possible to isolate one part of the assemblage, that from TP A (587 pieces), as representing a probably chronologically unmixed unit (see also dating section). These finds are associated with a hearth and an alignment of post- and stakeholes in Test Pit J North/ Trench 4 Extension (Figures 3 and 6; referred to collectively as Trench 4 Extension). The finds and features are dated by diagnostic implements (e.g. scalene triangles) and a radiocarbon-dated charcoal sample from posthole 404 (4350-4000 cal BC; Table 4), which together indicate that this part of the Garvald Burn site was the focus of a visit in the Late Mesolithic period. The typological composition of the TP A assemblage is shown in Table 1. The definitions of the main lithic categories are as follows:

Chips: All flakes and indeterminate pieces the greatest dimension (GD) of which is ≤ 10 mm.

Flakes: All lithic artefacts with one identifiable ventral (positive or convex) surface, GD > 10 mm and L < 2W (L = length; W = width).

Indeterminate pieces: Lithic artefacts which cannot be unequivocally identified as either flakes or cores. Generally the problem of identification is due to irregular breaks, frost-shattering or fire-crazing. *Chunks* are larger indeterminate pieces, and in, for example, the case of quartz, the problem of identification usually originates from a piece flaking along natural planes of weakness rather than flaking in the usual conchoidal way.

Blades and microblades: Flakes were L ≥ 2W. In the case of blades W > 8 mm, and in the case of microblades W ≤ 8 mm.

Cores: Artefacts with only dorsal (negative or concave) surfaces – if three or more flakes have been detached, the piece is a core, if fewer than three flakes have been detached, the piece is a split or flaked pebble.

Tools: Artefacts with secondary retouch (modification).

Debitage	
Chips	321
Flakes	155
Blades	17
Microblades	34
Indeterminate pieces	25
Crested pieces	8
Platform rejuvenation flakes	2
Total debitage	562
Cores	
Core rough-outs	1
Single-platform cores	3
Handle-cores	1
Cores w 2 platfs at an angle	1
Irregular cores	2
Core fragments	1
Total cores	9
Tools	
Scalene triangles	3
Frag. of microliths	2
Frag. of microlith or backed bladelet	2
Microburins	1
Short end-scraper	2
Burins	1
Denticulated pieces	1
Pieces w edge-retouch	4
Total tools	16
TOTAL	587

Table 1: Test Pit A. General artefact list.

Raw materials

The raw material composition of the artefacts from TP A is very similar to that of the full Garvald Burn assemblage (see Appendix). Where the full assemblage includes 96.7% chert, that from TP A includes 98% chert. Other raw materials present are flint (six pieces), chalcedony/agate (two pieces), quartz (one piece), and an uncertain chert/chalcedony-like raw material (three pieces). Raw materials usually associated with post-Mesolithic periods are absent from TP A, such as pitchstone (in southern Scotland generally associated with the Early Neolithic period (Ballin 2009; Ballin and Ward 2008), Cumbrian tuff (mainly associated with the Early Neolithic (Ritchie and Scott 1988, Bradley and Edmonds 1993), and Yorkshire flint (in this region generally associated with the Middle and Late Neolithic periods (Ballin 2011b).

The distribution of the chert (both vein- and pebble-based forms) also corresponds roughly to that of the general assemblage. The heavy dominance of the finds by tertiary pieces (only 8.3% of the chert is cortical) suggests that most of the chert is vein-based material (cf. Ballin and Ward 2013), whereas amongst the cortical material 58% has soft cortex and 42% abraded cortex, indicating that a notable proportion of chert was also obtained from pebble sources. A total of 21 pieces are burnt: 20 of the heat-exposed artefacts are chert and one piece is flint.

Apart from one core fragment in chalcedony (CAT 1445) and one piece with edge-retouch in an indeterminate raw material (CAT 121), all non-chert raw materials are debitage.

Debitage

The debitage (562 pieces) from TP A includes 321 chips, 155 flakes, 17 blades, 34 microblades, 25 indeterminate pieces, and 10 core preparation flakes (eight crested pieces and two platform rejuvenation flakes) (Table 1). The comparison in Table 2 between the composition of the debitage in TP A and that of the site as a whole shows two interesting trends: 1) chips are more common in TP A than across the site in general (57.1% against 38%), and 2) the blades of TP A tend to be microblades rather than broad blades (Figure 4), whereas the blades of the full Garvald Burn assemblage are evenly distributed across narrow and broad blades (see the two curves in Figure 8). Due to the considerably higher chip ratio in TP A than across the site in general (57.1% against 38%), the area's blade ratio is notably lower (9.1% against 13.7%).

	Garvald Burn (total)		Test Pit A	
	Quantity	Per cent	Quantity	Per cent
Chips	534	38.0	321	57.1
Flakes	541	38.5	155	27.6
Blades	100	7.1	17	3.0
Microblades	93	6.6	34	6.1
Indeterminate pieces	95	6.8	25	4.5
Crested pieces	31	2.2	8	1.4
Platform rejuvenation flakes	11	0.8	2	0.3
TOTAL	1,405	100.0	562	100.0

Table 2: Comparison between the composition of the site's debitage as a whole and the debitage from TP A.

The microblade:macroblade ratio of TP A (67:33) is reflected in Figure 4, where the microblades

form one undivided (bell-shaped) peak in the diagram's left side, whereas the broader blades form two discrete summits immediately to the right of the figure's dominant peak. The composition of the blades of the site in general is shown as a stippled line. The main peak of the TP A assemblage overlaps the left peak of the full assemblage and supports the suggestion (see Appendix) that the two peaks of the full assemblage (Figure 4's stippled curve) may represent a Late Mesolithic (left) and an Early Neolithic blade assemblage (right), respectively.

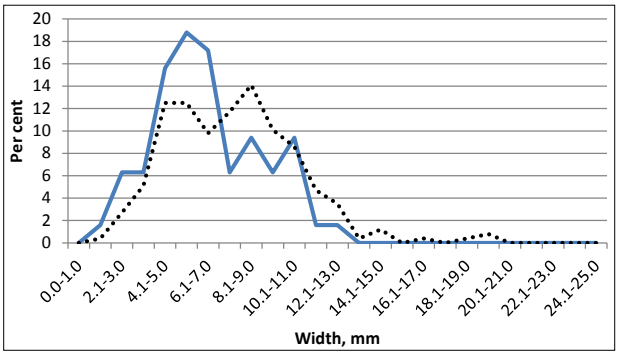

Figure 4: The width of all unmodified chert blades and microblades as well as blades/microblades with light edge-retouch from Test Pit A. The TP A blades are compared with the blades from the site as a whole (stippled line). To make the two samples of blades directly comparable, the vertical axis was redefined from quantity to percent.

The difference between the composition of the blade assemblage from TP A (16 intact pieces) and that of the site in general (67 intact pieces) is further demonstrated by the average dimensions of the two: the former being 16.8 by 6.3 by 2.7 mm and the latter 22.2 by 8.8 by 3.9 mm.

Table 3 shows how in this area flakes were produced by a combination of hard and soft percussion (ratio 47:53 respectively), whereas blades were manufactured almost exclusively by the application of soft percussion. This supports the suggestion made in connection with the presentation of the debitage of the full assemblage (see Appendix) that the blades are intentional tool blanks, whereas the flakes represent a combination of intentional tool blanks and waste from the preparation of the microblade cores.

Most of the eight crested pieces from TP A are fragmented specimens, three of which are clearly crested microblades and the remainder probably crested elongated flakes. One (CAT 46; 12 by 19 by 4 mm) of two platform rejuvenation flakes was identified as a core tablet from a regular conical or opposed-platform microblade core with a trimmed platform-edge and a faceted platform (Plate 3).

	Quantity			Per cent		
	Flakes	Blades/ micro-blades	Total	Flakes	Blades/ micro-blades	Total
Soft percussion	36	22	58	36.4	81.5	46.0
Hard percussion	32		32	32.3		25.4
Indeter-minate platform technique	18	4	22	18.2	14.8	17.5
Platform collapse	13		13	13.1		10.3
Bipolar technique		1	1		3.7	0.8
TOTAL	99	27	126	100.0	100.0	100.0

Table 3: The percussion techniques applied to produce TP A's technologically definable unmodified chert and flint flakes and blades/microblades.

Plate 3: Top row: crested pieces (CAT 48, 53, 437); bottom row: platform rejuvenation flake (CAT 46).

Cores

The TP A assemblage includes nine cores: one core rough-out (CAT 1443), three conical cores (CAT 1438, 1439, 1444), one handle-core (CAT 19), one core with two platforms at an angle (CAT

1441), two irregular cores (CAT 120, 1442), and one core fragment (CAT 1445).

The core rough-out (CAT 1443) is a well-shaped piece with two opposed crests and a regular apex. It measures 31 by 23 by 16 mm. A striking platform was prepared by removing a number of small flakes across the intended platform area, but the piece was probably discarded when tabular fragments broke off the front and rear faces of the rough-out.

Four single-platform cores were recovered from TP A, three of which are conical pieces (Plate 4), whereas one is a handle-core (Plate 5). The three conical cores are regular specimens, but they differ somewhat in terms of size and shape. CAT 1438 and 1439 are both fairly small, with average length:width measurements of 22 by 19 mm, but where the former is thin (Th = 10 mm), the other is thick (Th = 23 mm). CAT 1444 is the remains of a considerably larger (although equally regular) core which lost its apex, and it measures 27 by 33 by 21 mm. They all have plain, trimmed platforms. The collection's solitary handle-core (CAT 19) measures 26 by 48 by 51 mm. The platform is notably elongated (the defining feature of a handle-core), and it has a trimmed, plain platform at one end. The flaking-fronts of the four single-platform cores are all characterised by regular, parallel microblade scars.

Plate 4: Single-platform (conical) cores (CAT 1444, 1439, 1438).

CAT 1441 is a core with two platforms at an angle (Plate 6). It is relatively flat and based on a small hard-percussion flake (29 by 26 by 17 mm). It has one main flaking-front, and although the surviving flake-scars are all from the detachment of flakes, the perpendicular platforms are both carefully trimmed and highly regular, and this core is probably the exhausted remains of a microblade core.

Plate 5: Single-platform core (handle-core) (CAT 19).

Plate 6: Core with two platforms at an angle (CAT 1441) and an irregular core (CAT 1442). The differently orientated platforms are commonly associated with different faces.

The two irregular cores differ somewhat in terms of shape, size, and regularity, and they may represent different operational approaches. CAT 1442 (Plate 6) is relatively small (22 by 23 by 13 mm), but fairly regular, and the character of its flake scars suggests that this may be an exhausted and redefined microblade core. One face seems to have been reduced from opposed directions, whereas the other face was reduced from a perpendicular direction. All platform-edges display careful trimming. CAT 120, on the other hand, is a flat tabular piece (35 by 32 by 12 mm), from which small flakes were removed in a random manner by striking suitable edges.

A small (GD = 30 mm) core fragment (CAT 1445) was also recovered from the test pit.

Tools

The TP A assemblage includes 16 tools: five scalene triangles (CAT 246, 301, 1567, 1572, 1577), two fragments of microliths or backed bladelets (CAT 1574, 1775), one microburin (CAT 1570), two short end-scrapers (CAT 1440, 1461), one burin (CAT 3), one denticulated piece (CAT 119), and four pieces with edge-retouch (CAT 13, 29, 121, 359). All TP A tools are in chert.

The eight microliths and microlith-related pieces are all very narrow implements, measuring between 3.8 mm and 6.6 mm (Plate 7). Four of the five scalene triangles (CAT 246, 1567, 1572, 1577) are fragmented pieces, and they were identified as damaged scalene triangles by the angled retouch of one lateral side. Two of these pieces (CAT 1567, 1572) have their shortest retouched side at the distal end, whereas two (CAT 246, 1577) are too small (GD = 5.2-11 mm) and damaged to allow their orientation to be determined. CAT 301 is intact and it has an oblique truncation, which runs straight through the blank's bulbar area. In this case, microburin technique was clearly not applied. CAT 1572 has retouch along all three sides, CAT 1567 along the two shortest sides, whereas CAT 301 only has retouch at the proximal end. CAT 246 and 1577 are too small and fragmented for more detailed characterisation.

Plate 7: Top row: scalene triangles (CAT 1572, 1567); bottom row: proximal microburin (CAT 1570).

The two fragments of microliths or backed bladelets (CAT 1574, 1575) are distal and medial fragments of microblade blanks with blunting retouch along their left lateral side (for a distinction between the 'fragments of microliths' and 'fragments of microliths or backed bladelets', see Appendix). Their width varies between 3.8 mm and 6.6 mm. CAT 1570 is a microburin which snapped in a lateral notch. The notch was formed in the right hand side proximal end of a small, regular microblade (55 by 6.1 by 1.6 mm).

The two short end-scrapers are both expedient pieces (Plate 8). CAT 1461 is a small scraper (29 by 21 by 17 mm), which is based on an abandoned, fairly crude conical core. It has a convex, steep scraper-edge at the apex, and this working-edge displays notable use-wear from processing hard materials, such as wood, bone or antler (Juel Jensen 1988, 67). CAT 1440 is slightly larger (34 by 28 by 13 mm), and it is based on a flake, the ventral face of which was obstructed by the presence of several, closely spaced fault planes. The dorsal face is characterised by parallel scars of narrow blades, which were detached from opposed platforms. A convex, steep working-edge was formed at one corner.

Plate 8: Short end-scrapers: CAT 1440 on a flake and CAT 1461 on a small abandoned core.

Only one burin was recovered from TP A: the angle-burin CAT 3 (Plates 9 and 10). It is a blade-based piece, measuring 29.1 x 9.8 x 6.1 mm. Its distal burin-edge was formed by detaching a series of narrow, parallel spalls, using the scar of a previously detached flake as a striking platform. CAT 119 was defined as a denticulate. It has three

protruding teeth, formed by the detachment of a series of adjacent single-removal chips or flakes. It is based on a relatively large indeterminate piece (GD = 42 mm), and it is uncertain whether it is a tool or a fragment of an unsystematically worked core.

Four pieces with various forms of edge-retouch are based on three flakes and one indeterminate blade (CAT 13), and they may have served a variety of functions. The greatest dimension of these pieces varies between 17 and 37 mm.

Plates 9 and 10. Plate 9: Burin, dorsal view (CAT 3); Plate 10: burin, right lateral view, close-up of burin facets.

Technological summary

As demonstrated by the blade width (Figure 4) and the spatial distribution of the artefacts (Figure 6), the assemblage from TP A probably represents a single lithic industry, and most likely, a single knapping event. The microliths, among other things (see dating section below), indicate that this industry/event is datable to the Late Mesolithic period.

The TP A lithic industry is characterised by the almost exclusive use of grey chert (98%), which was procured mainly from local veins, supplemented by chert from pebble sources. Where the full assemblage from Garvald Burn was defined by the manufacture of roughly equal numbers of microblades and narrow broad blades (see Appendix), this sub-assemblage focuses on narrow blade production (average. dimensions 16.8 by 6.3 by 2.7 mm). The lithic material from TP A also includes a small number of broader blades (Figure 4), but the character of these pieces indicates that they may, for the most part, be blades from the preparation of cores rather than actual intended tool blanks. Only 6% of the microblades are cortical and 24% of the macroblades are cortical (compared to 6% and 10% for the full assemblage). Blanks from the earliest stages of the reduction process generally tend to be somewhat larger than pieces from the later stages, as early-stage cores are larger than later-stage cores (see dating section).

The analysis of the blanks from the full assemblage from Garvald Burn (Table 2) suggested that the blades are intentional tool blanks, whereas the flakes may represent waste from core preparation as well as intentional blanks. This is reflected in the different percussion techniques used to detach the two types of debitage, with the flakes having been produced by a combination of hard and soft percussion, whereas the blades are principally produced by the application of soft percussion. However, where the full assemblage, constituting a mixture of predominantly Late Mesolithic and Early Neolithic material, including small numbers of blades produced by the use of hard percussion (hard:soft ratio 11:89), the blades from the Late Mesolithic TP A assemblage include no hard percussion pieces at all. This industry exclusively applied soft percussion for the manufacture of microblades.

This is further supported by the cores of the sub-assemblage, which are mainly single-platform microblade cores, and several of its 'lower rank' cores (e.g. CAT 1441 and 1442) are identifiable as exhausted microblade cores. The two short end-scrapers (CAT 1461 and 1440) are probably also recycled microblade cores. The assemblage from TP A includes no bipolar cores.

The recovery of eight crested pieces and two core tablets, in conjunction with attribute analysis of TP A's cores, shows how the microblade cores of this industry were prepared by initial cresting and trimming/abrasion, followed by adjustment of the cores by platform rejuvenation during the reduction process. The evidence suggests that at this location, the probably solitary knapper (see artefact distribution, below), followed an operational schema similar (or identical) to the one suggested in the Appendix for the Garvald Burn Late Mesolithic and Early Neolithic industries in general (Table 8).

Features, find distribution and activities

As mentioned in the introduction, a number of features were discovered in connection with the investigation of TP J North and Trench 4 Extension. These features have been combined to form Figure 3. As shown in this illustration, the features include two main elements: a hearth in the northern part of Trench 4 Extension (excavated as part of TP J North in 1997), and a curvilinear structure, or parts of a structure, running diagonally through the area, from north to south, immediately west of the hearth (excavated as part of Trench 4 Extension in 2000). The latter includes posthole 404 (towards the south) and posthole 414 (towards the north), as well as stakeholes 406, 408, 410, and 412 along the curved line joining the postholes.

A carbon sample was extracted from posthole 404 and later radiocarbon dated to 4350-4000 cal BC (Table 4), or the Late Mesolithic period. A sample of soil,charcoal and ash was extracted from the hearth area, but it no longer exists and direct dating of the hearth is therefore not possible. However, botanical analysis of this sample (Miller and Ramsay 2002, 14) identified charcoal of oak, willow, birch and hazel nutshell, thus confirming the feature's function as a hearth.

Structural evidence from Scottish Mesolithic sites was discussed by Wickham-Jones (2004), but since the publication of her paper more structural evidence has been provided through new excavations or publication of older excavation reports (e.g. Gooder 2007; Murray *et al.* 2009; Ballin forthcoming a). Although Mesolithic structures and features are occasionally discovered in connection with fieldwork, they are by no means common, and when they are discovered, they are frequently poorly preserved. In general, structural remains and features from Scottish Mesolithic sites can be grouped as: 1) hearths; 2) shelters; 3) pits and pit alignments; 4) general occupational deposits; 5) middens; and 6) others (partly after Wickham-Jones 2004, table 12.1).

The Mesolithic hearths from Scotland are generally simple structures. Frequently, they are only patches of ash or burnt subsoil, occasionally associated with a few scattered stones (e.g. Camas Daraich, Skye; Wickham-Jones and Hardy 2004, illus 15), but commonly (for example in connection with short-term settlement) fire-setting did not leave any trace on the site, and the position of a domestic hearth must be deduced on the basis of concentrations of fire-crazed lithic artefacts (a so-called 'latent structure' Cziesla 1990, 257). The central hearth from the Mesolithic house at Howick in Northumberland (Waddington 2007, 43) was slightly more complex than most, due to repeated use, but it was essentially also simply a burnt patch associated with hearth pits cut into the older burnt deposits, or constructed around the central soot and charcoal patch.

The hearth from Trench 4 Extension was also a relatively simple structure, consisting of mottled, slightly clayey deposits of ash and charcoal, and associated with some burnt stones of sandstone, which may have been structural elements. It measured c. 0.3 m across and was roughly circular. Due to recent ploughing, the feature only survived to a depth of a few centimetres, and the western edge of it was cut through by a plough furrow, introducing plough soil into its fill.

Plate 11: The row of post-/stake-holes approximately from the north-east (2000). The hearth, which was removed during the 1997 investigation, was located near the big stone left of the row of post-/stake-holes.

The area's two postholes and four stakeholes form a curvilinear feature (Plate 11). The postholes (404, 414) were positioned roughly 1.75 m from each other, and they were half-sectioned. The four stakeholes (406, 408, 410, 412), which stretched from posthole to posthole, were fully excavated.

Posthole 404 measured 0.2 by 0.15 by 0.15 m (Figure 5), and its fill consisted of brown silty-sand with occasional stones. The second posthole (414) measured 0.22 by 0.23 by 0.2 m. and was filled with grey/white sand with orange flecks and occasional pieces of charcoal. Both features had vertical sides and rounded bases. The

stakeholes were of roughly equal size and shape. Stakehole 406 measured 60 by 70 by 150 mm; it was a vertical pipe with a slightly rounded base. Stakehole 408 measured 60 by 60 by 90 mm and also had straight sides and a rounded bottom, but it was angled at 45 degrees, in such a way that it would have pointed towards and over the hearth. The third stakehole (410) measured 80 by 70 by 70 mm, and it was vertical with a large stone in its base. Stakehole 412 measured 60 by 80 by 170 mm, with vertical sides and a flat base.

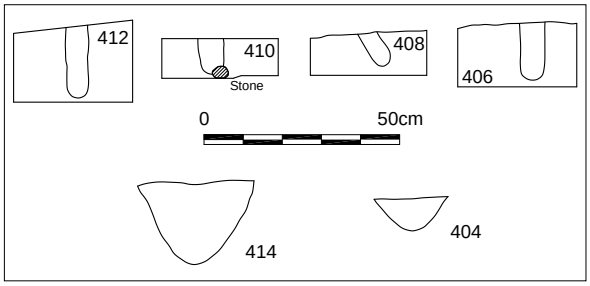

Figure 5: Stakeholes 406, 408, 410 and 412 and Postholes 404 and 414. The stakeholes were sectioned in the field, whereas the postholes were emptied.

The line of post- and stakeholes were interpreted as the remains of a windbreak (Barrowman 2000b), corresponding to the curvilinear line of similar features running through Fife Ness, which was dated to an earlier phase of the Scottish Late Mesolithic (7750-7080 cal BC; AA-25202-15) (Wickham-Jones and Dalland 1998). It cannot be ruled out entirely that the row of post- and stakeholes represent a segment of a wall of a prehistoric house like those known from, for example, East Barns, East Lothian (Gooder 2007), and Howick, Northumberland (Waddington 2007), but in these examples the hearths of the Mesolithic houses are central, and not positioned near the wall. The likelyhood of the Garvald Burn curved line not being the surviving remains of a house is reinforced by the evidence from the distribution of the lithic artefacts.

Figure 6 shows the distribution of lithic finds in Trench 4 Extension, and they are clearly concentrated in two square metres in the original TP A (E19–20/N138). The fact that only 69 lithic pieces were recovered from TP J North, suggests that the find density dropped sharply either side of those two squares. This may indicate that a traditional fan-shaped knapping floor was located in this area (cf. Ballin 2013c). Primary knapping at this spot is supported by the fact that most of these pieces are minuscule chips, representing the knapping floor's drop zone (cf. Binford 1983, 183).

The information from the grid squares regarding the find density and general composition of this sub-assemblage shows that the square closest to the hearth (E20/N138) was the richest in terms of finds, as well as in terms of burnt pieces and small core preparation flakes. No cores were found in this square. In contrast, heavier debris is located further away from E20/N138 and the hearth, with most cores (six pieces) deriving from E20/N137. The general distribution is mirrored by the distribution of the 16 implements of this sub-assemblage, where most were found in E20/N138 (six microlithic pieces and four other tools), and only two tools from each of the other three squares (the other two microlithic pieces were retrieved from E19/N138).

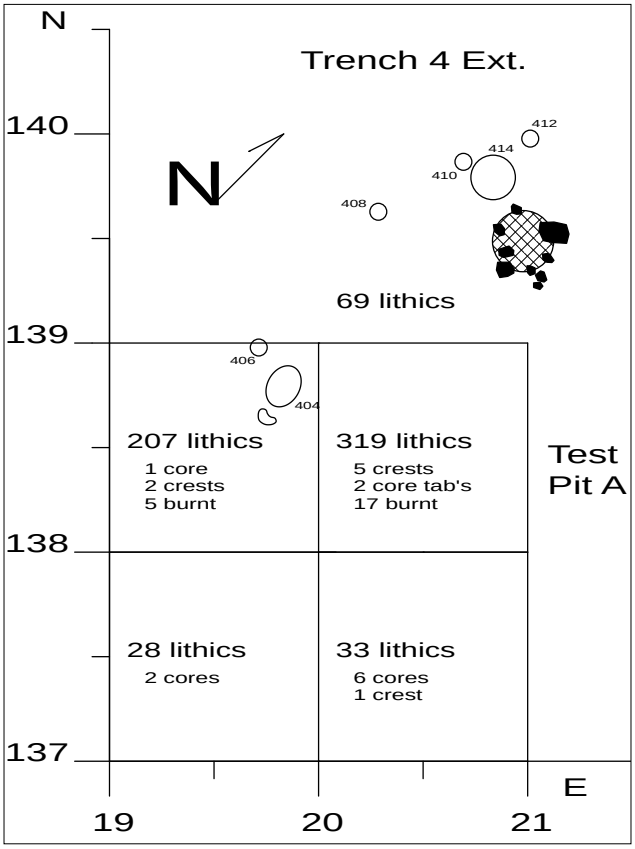

Figure 6: The distribution of lithic artefacts in TP A in relation to the features in Trench 4 Extension. The numbers above and below TP A indicate the number of lithic artefacts found throughout TP J North and South (see Table 11).

The most likely interpretation of the distribution of finds and features from Trench 4 Extension is that at some stage in the later part of the Late Mesolithic period, a small group of hunter-gatherers stayed for at short period of time at

Garvald Burn. The contours of the landscape (Figure 2) suggest that a small stream may have run past Trench 4 Extension, immediately south of the location, and this may have been a key factor influencing them to settle at this specific spot in the landscape.

While there, the hunter-gatherers constructed a small hearth, and a windbreak immediately next to the fireplace. Approximately 1.5 m south of the hearth, one person reduced a number of chert blocks and pebbles, intending to manufacture a series of microblades. This work resulted in the production of a knapping fan, probably measuring 1-1.5 m across and centred on square E20/N138. The microblades were most likely intended to become blanks of new microliths, in connection with retooling activities (Keeley 1982). Some waste flakes and abandoned cores were transformed into a number of expedient tool forms.

The distribution of the different artefact types indicates that primary and secondary production, as well as tool-use, took place at the very same spot. This is suggested by the fact that 1) most knapping debris, including preparation flakes, was recovered from square E20/138; 2) discarded ?damaged microliths (possibly discarded in connection with retooling) were also generally found in this square; and 3) the heavily used scraper CAT 1461, as well as burin CAT 3, were also abandoned in E20/N138. The fact that the cores were generally recovered from the three squares around E20/N138 is consistent with a situation where the knapper was sitting facing the hearth, and where he 'tossed' these pieces out of the central area in connection with 'preventive maintenance' – that is, they formed a 'backwards toss zone' (Binford 1983, 189).

It cannot be ruled out that the area was visited by a slightly larger social group, that included more than one knapper, and that one or more similar knapping floors, as well as specialized activity areas, may exist in unexcavated areas immediately ENE of the scatter, on the other side of the hearth.

Dating

Integrity of the assemblage and the features

As the Trench 4 Extension finds and features represent a small part of the considerably larger Garvald Burn (palimpsest) site and assemblage, it is important to discuss the chronological integrity of this material. The likelihood of the lithic artefacts having been produced during a short stay at Trench 4 Extension is supported by several factors: 1) the typological homogeneity of the finds; 2) the technologically well-defined operational schema (production of very narrow microblades by the exclusive use of soft percussion); and 3) the spatial distribution of the lithic remains. The tight spatial distribution of the chert artefacts, the heavy dominance of the concentration by chips, as well as the recovery of some microblades and tools, clearly define this scatter as a typical knapping floor with associated retooling activities (replacement of damaged microliths with new ones), and to a lesser degree general activities associated with other tool forms (cf. Binford 1983; Ballin 2013c). The distribution patterns indicate that this knapping floor was produced by a single knapper.

It would have been interesting to attempt to test the chronological integrity of this assemblage by the application of lithic refitting (cf. Cziesla 1990; Ballin 2000), but a number of factors prevented this: 1) the microlithic character of the 587-piece assemblage would have made this a very time-consuming and expensive exercise; 2) due to the many internal fault planes and brittleness of the chert, 'perfect' refits would probably have been rare, as minuscule angular bits would have broken off in connection with the general disintegration of parent pieces and blanks; and 3) it is possible that some pieces may have been removed from the knapping floor to activity zones in unexcavated peripheral parts of the original prehistoric settlement site, for example on the other side of the hearth.

As no lithic material was recovered from the radiocarbon-dated posthole (Context 404), the suggested contemporaneity of the assemblage and features hinges only on logical reasoning. If the post- and stakeholes represent a windbreak, this structure would have sheltered the hearth, as well as the knapper from the prevailing westerly winds. In the original data structure report, Barrowman (2000a, 26) pointed out that stakehole 408 sloped at a 45 degree angle in such a way that a stake would have pointed towards and over the fire, and it is possible that this stake may have had a function in relation to the

fireplace and the cooking of food. The position/distance of the knapping floor in relation to the hearth also corresponds roughly to what is commonly known about the spatial layout of open-air hunter-gatherer sites (e.g. Binford 1983; Stapert 1992; Ballin 2013c).

The raw materials and typo-technological attributes of the area

The finds from TP A are datable by a number of elements, such as raw material preferences and typo-technological attributes (Tables 1, 7 and 11), and one well-contexted radiocarbon date (Table 4).

The almost exclusive reliance on chert (98%) is a general characteristic of Late Mesolithic and Early Neolithic assemblages in southern Scotland, as is the production of narrow microblade blanks from prepared microblade cores. However, at this location microblades seem to have been manufactured with the specific aim of producing diminutive microliths, probably for insertion into composite tools, such as slotted bone points. Microliths are generally perceived as a diagnostic form indicating a Mesolithic date (Butler 2005, 88). The site's solitary burin (CAT 3) also supports a Mesolithic date (e.g. Ballin and Ward 2013, 20). Scalene triangles, such as the five specimens recovered from the present location, are generally seen as one of the key diagnostic features of the Late Mesolithic period, a date supported by the area's solitary radiocarbon-date (Table 4, and see discussion below).

Radiocarbon dates

The present lithic assemblage is also dated by its association with a windbreak (above). From one (404) of the postholes of this light structure a charcoal sample was secured (AA-51538), and radiocarbon analysis of this sample provided a date from the final part of the Late Mesolithic period.

Eight radiocarbon samples from the Garvald Burn site were dated: one from TP I (AA-51537), one from TP 3 in the lower marshy parts of the site (OxA-10280), three from Trench 4 (AA-51540-3), two from Trench 4 Extension (AA-51538, OxA-10449), and one from Trench 5 (AA-51539) (Table 4).

Several of the dates are from broad contexts (e.g. 'charcoal in sand'), and as such they only indicate that the site was visited during the Late Mesolithic, Early Neolithic, and Middle Neolithic periods (Figure 7), which corresponds well with the raw material and typo-technological evidence recovered from the full site, suggesting that Garvald Burn was visited during these periods (see Appendix).

As shown in Table 4, two radiocarbon dates were secured from Trench 4 Extension, AA-51538 and OxA-10449, but the latter is based on charcoal recovered outside TP A, on the border between Trench 4 proper and the Trench 4 Extension (Barrowman 2000a, Fig. 7). It suggests a visit to the trench extension in the Early Neolithic period, which tallies with other Early Neolithic dates from Trench 4 proper (Table 4; Figure 7). Furthermore, the charcoal on which date OxA-10449 is based was recovered from 'sand' without any further contextual information and it is therefore of little value in terms of dating specific sub-sets of artefacts or features.

In terms of dating the present sub-assemblage and its associated features, the only relevant radiocarbon-date is AA-51538 (4350-4000 cal BC; Table 4). The date is based on a piece of willow (*Salix*) charcoal from the fill of posthole 404 in the structure interpreted as a windbreak. It contained no artefacts, and it does not appear to have been redug at any time. AA-51538 therefore suggests a date for the scatter towards the end of the Late Mesolithic period.

Radiocarbon date AA-51538 and the scalene triangles of TP A

The association of Scottish scalene triangles with a very late Late Mesolithic radiocarbon date is potentially important. Studies of the British Late Mesolithic in general suggests that, towards the Mesolithic-Neolithic transition, the composition of microlith assemblages changed, with the inclusion of higher numbers of so-called 'rods' and 'quadri-laterals' at the expense of scalene triangles (e.g. Myers 1989, Fig. 9.4; Spikins 2002; French *et al.* 2007). However, such very late Mesolithic assemblages are still relatively rare, and it is uncertain whether the microlithic repertoire of this period entirely excluded scalene triangles (see for example Bishop 2008).

However, even if the latest Mesolithic assemblages in middle and southern England are characterised mainly by 'rods' and 'quadri-laterals', the question is whether this typo-chronological framework has validity north of the Anglo-Scottish border? Although assemblages dating to the very latest part of the Scottish Late Mesolithic are admittedly rare (Saville 2004; Finlay *et al.* 2004), '*there is no indication thus far of any specifically 'Late' or 'Terminal' Mesolithic element in the form of rod-dominated microlithic assemblages [...] among the Scottish finds*' (Saville 2004, 205).

Although several Early Mesolithic assemblages are known from Scotland, these all appear to belong typologically (Reynier 2005) to what is usually referred to as the Star Carr group, and at present no typical assemblages of Deepcar or Horsham type are known. It is possible that the Scottish Late Mesolithic period may also be typologically simpler than its English counterpart, with assemblages from the entire period being defined primarily by different mixtures/ratios of scalene triangles, crescents and edge-blunted pieces (e.g. Ballin forthcoming a).

Lab code	BP	±	Cal BC (68.2%)	Cal BC (95.4%)	Period	Loc.	Comments
AA-51539	5995	60	4950-4780	5040-4720		Tr. 5	Charcoal in sand
AA-51537	5465	55	4360-4240	4460-4160	LM	TP I	C900; burnt sand/ash
AA-51538	5370	75	4330-4040	4350-4000		Tr. 4 ext.	C403; fill of posthole 404
OxA-10280	5000	45	3910-3700	3950-3660		TP 3	Waterlogged peat
AA-51541	4950	60	3780-3650	3940-3630	EN	Tr. 4	Charcoal in sand
OxA-10449	4865	40	3700-3630	3720-3530		Tr. 4 ext.	Charcoal in sand
AA-51540	4855	60	3710-3530	3780-3510		Tr. 4	Charcoal in sand
AA-51542	4470	55	3340-3030	3360-2920	MN	Tr. 4	Charcoal in sand

Table 4: Radiocarbon dates.

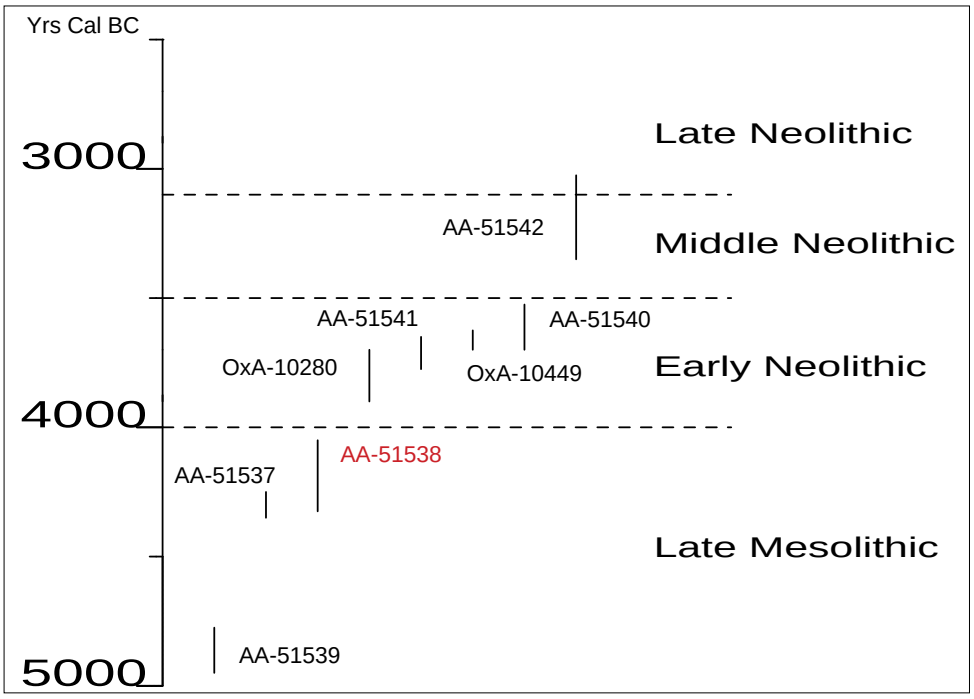

Figure 7: The distribution of radiocarbon dates across periods. The date relating to the present scatter has been highlighted.

Summary and discussion – site and assemblage formation

As mentioned above, the site of Trench 4 Extension, as well as its small Late Mesolithic lithic assemblage, are both probably the products of a long list of factors. One of the main ones, in terms of site formation, is the fact that the settlers were hunter-gatherers, and a site was selected as the focus of a visit on the basis of how that location would fit into a particular social group's mobile economic strategy. General concerns would have been where prey could be encountered, vegetable matter gathered, and which sites would offer good fishing.

The location of river courses and small streams was of utmost importance, as these topographic features offered means of transport, fishing grounds, as well as drinking water for animals and people. As mentioned in the introduction, the Garvald Burn may have been a considerably larger watercourse in Mesolithic times, with some logistic relevance, and a small stream may have run through the field immediately next to the site, offering freshwater for drinking. The fact that these topographic features may have been of equal importance to people throughout prehistory – it should be borne in mind that hunting, fishing and gathering also took place in post Mesolithic times – explains why palimpsests formed at sites like Garvald Burn.

The specific layout of the camp in the Trench 4 Extension, including its general size and features, indicates that the social group settling at this location may have been a numerically small one. A small domestic hearth was identified (compare for example with the more substantial one at Howick; Waddington 2007), associated with a relatively 'flimsy' structure thought to be an expedient windbreak radiocarbon-dated to 4350-4000 cal BC(AA-51538), or the end of the Late Mesolithic period. Sheltered by this structure, and immediately next to the hearth, a relatively dense knapping floor was identified, associated with primary production, retooling and other tool use. The expedient character of the features, as well as the numerically small size of the lithic assemblage and its composition, suggests that this may have been a transit camp for a small group of people, possibly even for small task group consisting of one or two hunters.

The composition of the assemblage is consistent with this scenario, with the primary debris indicating the production of microblade blanks for the production of microliths; discarded microliths suggest retooling activities; and the scrapers (one of which was clearly used to process hard materials) and the burin may have been used in connection with the production or repair of implements in wood, bone or antler, such as for example slotted bone points for the microliths, arrowshafts, etc.

In the greater picture, the assemblage is the product of a particular technological tradition and its raw material procurement strategy (both discussed above). but these issues need to be dealt with in slightly greater detail to allow all relevant aspects to be covered.

The term 'technological tradition', or techno-complex, generally refers to the visible output of a complex set of inter-related elements, such as raw material preferences, preferred tool blanks, preferred percussion technique, and a usually well-defined operational schema. These elements are themselves products of, *inter alia*, climate change and subsequent changes to topography, vegetation, and fauna, causing changes to economical strategies; local raw material availability; and the evolution of culture forms.

Techno-complex	Period	Raw material	Target blanks	Percussion technique
1	UP/Early Mesolithic	Exotic and local flint/ chert	Broad blades	Soft
2	Late Mesolithic	Chert/ some local flint	Microblades	Soft
	Early Neolithic	Chert/ some local flint	Microblades /broad blades	Soft
3	Middle Neolithic	Mainly exotic grey flint/some chert	Broad blades	Hard (Levallois-like)
	Late Neolithic	Mainly exotic dark-brown flint/some chert	Broad blades	Hard (Levallois-like)
4	Early Bronze Age	Exotic and local flint/ chert	Flakes	Hard

Table 5: Chronological subdivision of early prehistoric southern Scotland (techno-complexes); based on lithic raw material preferences, preferred blanks, and percussion techniques.

The four techno-complexes suggested in Table 5 therefore represent more than simply specific technological approaches and products; they also represent different forms of economic strategies and human social organisation. Simply put, Techno-complexes (TC) 1-4 represent a development in Scotland from what is frequently called (in popular terms) 'reindeer hunters', through 'hunters of the forest', to early and more complex farmers. Following the evolutionary sequence of Service (1971), TC1 represents band society; TC2 more complex band society and early tribal society; TC3 more complex forms of tribal society and 'budding chiefdoms'; whereas TC4, Bronze Age society, is at the social level usually associated with chiefdoms (cf. Ballin 2009, 57-62).

The different techno-complexes and types of society represented in early prehistoric southern Scotland are associated with different forms of raw material procurement, probably mostly due to their different economical strategies and levels of mobility, and the level of social complexity (egalitarian-hierarchical) (ibid., 57-62, Table 18; also Saville and Wickham-Jones 2012; Brophy and Sheridan 2012):

TC1 represents late Upper Palaeolithic and Early Mesolithic hunter-gatherers, associated with hunting prey on the north-west European plains and the earliest open forests of that area. Their society was egalitarian and their economical strategy required them to be highly mobile. Immediately after the deglaciation of the region, they relied to a large extent on lithic raw materials which were brought into the region, and they slowly adapted to local raw materials.

TC2 represents the Late Mesolithic hunter-gatherers of the now denser forests as well as the first farmers. The society of the former was egalitarian and the economical strategy slightly less mobile than during TC1, and that of the latter was a fairly egalitarian Big Man type of society representing the first sedentary economies. Both groups relied largely on local raw materials, and after the Mesolithic-Neolithic transition an extensive and complex exchange network was constructed to allow the distribution across northern Britain of lithic raw materials which may have been imbued with not only functional but also symbolic properties (Arran pitchstone, Antrim flint, Great Langdale tuff).

TC3 represents Middle and Late Neolithic established farming communities, and in Ballin (2011a, 65) it is suggested that the type of society characterising these periods is best described as 'budding chiefdoms' in a developing prestige economy (also Clarke et al. 1985). Where for example Arran pitchstone may largely have been exchanged in relatively small amounts and very much for its symbolic properties, flint from north-east England ('Yorkshire flint') was now imported into southern Scotland to almost cover the total lithic needs of South Lanarkshire, the Scottish Borders, and the Lothian counties. Although Yorkshire flint in prehistoric southern Scotland is likely to have been perceived as exotic, this massive exchange would have required a much more complex exchange network, and the imported lithic raw material must almost have reached a status of 'trade goods', although the exchange would still have been kinship-based.

TC4 represents Early Bronze Age established farming communities socially organised as chiefdoms. The beginning of the period is characterised by a relatively high level of raw material exchange (Yorkshire flint), but, with the increasing use of metal, lithic raw materials gradually became less important, lithic exchange decreased with local raw materials becoming more important, and lithic technology became less sophisticated.

Essentially, this complex of factors determined the composition of the assemblage from Trench 4 Extension, its technological approach, and its almost complete reliance on local raw materials – that is, chert.

Within Late Mesolithic southern Scotland, the composition of assemblages – chert contra flint, and vein chert contra pebble chert – varied somewhat, depending on a given site's specific location. Chert was abundantly available throughout the region, but there are no indications of chert having been associated with any symbolic values, or that it was exchanged outside the immediate social territory. In Late Mesolithic southern Scotland, the same seems to have been the case regarding the procurement of coastal flint, which was exchanged along the

rivers, but only to provide raw material for groups living relatively near the coasts. Where flint was readily available, it was favoured at the expense of chert, due to its ability to form sharp, strong and durable working-edges.

This resulted in a procurement strategy, with flint dominating along the eastern and western seaboards, but with chert dominating the central parts of southern Scotland, where flint, in logistical terms, became too expensive. On the coast, e.g. Low Clone and Barsalloch in Dumfries and Galloway (Cormack 1970; Cormack and Coles 1968), Late Mesolithic groups almost exclusively exploited flint; in the interior e.g. Glentaggart and Climpy in South Lanarkshire (Ballin and Johnson 2005; Duncan 2000), chert was used equally exclusively; and at the mid-point, such as at Starr and Smittons in the interior parts of East Ayrshire and Dumfries and Galloway; (Finlayson 1990), chert and flint were used in roughly equal measures. The chert:flint ratios of Starr and Smittons are 52:48 and 73:25, respectively (ibid., 46-47). Shewalton Moor, which is a coastal Late Mesolithic site in North Ayrshire, was dominated almost entirely by flint, but with some use of raw materials (jasper and chalcedony) from local volcanic rock formations (Lacaille 1930, 45). The assemblage from Garvald Burn, which is located approximately 80-100 km from the eastern and western shores, and roughly 30 km from the Firth of Forth (but with no rivers connecting the site with any coastal flint deposits there), is almost exclusively composed of chert.

The fact that in southern Scotland chert occurs in two forms, vein chert and pebble chert, was briefly touched upon in the raw material section (also see Appendix). Veins of radiolarian chert is most commonly found in the Southern Uplands, but it is also present in rock formations north and south of this area, up to the Highland Boundary Fault, and well into Northumberland and Cumbria. Pebble chert may be found throughout the region, in riverine deposits or screes, having eroded out of any of the above primary formations.

It is not always obvious why a specific Late Mesolithic chert assemblage is composed the way it is, in terms of its components of vein and pebble chert. However, as chert does not appear to have been imbued with evident symbolic values, any choice as to whether to give preference to one or the other form of chert must have been based on mainly economical/logistical reasoning, that is, how much time and effort is needed for the procurement of vein chert contra pebble chert. The assemblage from Meldon Bridge in the Scottish Borders is dominated by pebble chert, which was readily available in the local boulder clay (Ballin 1999); at Firpark Wood (Weston) in South Lanarkshire the Mesolithic settlers relied almost entirely on vein chert (Ballin 2013a), probably due to the proximity of rich outcrops of primary chert, which was clearly mined during this period (Warren 2007; Ballin and Ward 2013); and at Monksford (Dryburgh) in the Scottish Borders, pebble chert as well as vein chert was used, probably due to the vicinity of the River Tweed with its pebble deposits (Ballin 2013b). The composition of Garvald Burn is not unlike that of Monksford, and in this case the pebble chert may have been procured from the banks of the then probably river-sized Garvald Burn (McMillan *et al.* 1981).

However, the economics (and other *rationale*) of Late Mesolithic raw material procurement clearly needs more attention in the future, focusing on assemblage composition, local geology (availability), and topography (logistics). This would be a worthy topic for further reseach, and it should include more newly excavated, but as yet unpublished, assemblages. Site formation in general would be another interesting topic to pursue in the context of a thesis or dissertation, allowing greater understanding to be achieved of the formation processes responsible for Late Mesolithic sites like Garvald Burn in general (palimpsest) and more specifically the Trench 4 Extension (single-occupation site), including their lithic assemblages.

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Appendix: The full Garvald Burn assemblage

The raw material composition of the full assemblage – raw material types, sources and condition

As shown in Table 7, the full assemblage is dominated by chert (1,508 pieces or 96.7%), with other raw materials making up 3.3%. With 21 pieces, or 1.3%, flint is the collection's most common non-chert raw material. The other raw materials exploited at Garvald Burn are variants of the chalcedony family (chalcedony, agate, jasper), quartz, pitchstone, and a raw material belonging to the jet family (either jet *sensu stricto* or cannel coal).

Being a crypto-crystalline form of quartz, chert is closely related to flint. Both are composed of silicon dioxide (SiO_2), but where flint (according to British consensus) derives mainly from Upper Cretaceous chalk (e.g. Pellant 1992, 246), Scottish chert is primarily associated with older formations (Greig 1971, 12-19, 59; Wickham-Jones and Collins 1978; Cameron and Stephenson 1985, 26; Armstrong et al. 1999; Owen et al. 1999; Paterson and Ward 2013). In Scotland, chert is found throughout the country, but it is particularly common in the Southern Uplands zone where it dominates many inland assemblages (e.g. Callander 1927; Mulholland 1970; Finlayson 1990; Saville 2004, 2008; Ballin and Johnson 2005).

Though banding does occur, most of the chert from Garvald Burn is plain radiolarian chert, which formed in deep tropical oceans, when tiny silica-rich shells of plankton called *Radiolaria* settled on the sea floor. The collection's chert has a fairly homogeneous appearance, with 87% of the chert artefacts belonging to a grey/dark-grey/black continuum; the grey pieces usually have a faint bluish or greenish hue. A total of 0.2% of the finds are in more vivid colours (red and green), whereas other colour varieties may indicate secondary effects.

It appears that the colour beige, for example, is mostly associated with layers near the margins of the chert bedding planes, just below the powdery cortex of the pieces. Those pieces were probably procured from strata near the surface of the chert outcrop where these layers were affected by their surrounding environment. At Garvald Burn, beige pieces and pieces with beige outer layers account for almost 8% of the assemblage. Artefacts with slight, or more pronounced, fire-crazing are frequently associated with some form of discolouration. Those colours are usually varieties of grey with a faint green hue (2.5%), but it is thought that some pale grey pieces (0.6%) may also represent discolouration through exposure to fire.

Table 6 shows that the flakes include almost twice as many cortical pieces as the blades and microblades, indicating that the latter pieces were produced after more careful core preparation than the flakes, or that some of the flakes may be waste from the decortication of blade and microblade cores. The fact that the chert assemblage includes relatively few cortical pieces (15%) suggests that probably most of the chert was procured from vein sources (cf. Ballin and Ward 2013), but the fact that 53% of all cortical pieces have soft cortex, with 47% having abraded cortex, indicates that notable amounts of chert were also procured from pebble sources.

	Quantity			Per cent		
	Flakes	Blades/ micro-blades	Total	Flakes	Blades/ micro-blades	Total
Primary pieces	12	-	12	2.0	-	1.4
Secondary pieces	92	24	116	15.5	9.3	13.6
Tertiary pieces	491	234	725	82.5	90.7	85.0
TOTAL	595	258	853	100.0	100.0	100.0

Table 6: Reduction sequence of all unmodified and modified flakes and blades/microblades (almost exclusively chert).

The local chert is generally riddled with fissures and fault-planes, which affect the flaking properties of this resource negatively. It is thought that the notable reliance in prehistoric southern Scotland on chert is due to its abundance rather than its specific flaking properties, which are poor. Basically, if a nodule, core, blank or tool broke during production or modification, suitable replacement blocks or pebbles were readily at hand.

The fault-planes in the rock are commonly coated with a thin layer of small particles, which gives them a rough appearance, akin to cortex. However, where cortical surfaces are usually uneven and either powdery (from vein sources) or abraded (from pebble sources), the coated fault-planes are generally level, and they tend to run parallel to similar planes, forming the tabular blanks known from most southern Scottish chert assemblages (e.g. Davidson et al. 1949; Ballin and Johnson 2005; Saville 2008). Table 6's many tertiary pieces include numerous tabular specimens with coated fault-planes.

The 21 pieces of flint include 11 yellow/red/orange pieces, five grey pieces, two dark-brown pieces and four burnt and discoloured pieces; the flint is generally fine-grained and vitreous. The former group makes up about two-thirds of the non-discoloured flint, and this type of flint is usually associated with the Mesolithic period and the region's east-coast, although most flint in this part of Scotland tends to be in one of several shades of grey (assemblages inspected by Ballin in National Museums Scotland). The site's vitreous dark-brown and light-grey flint belongs to types of flint usually associated with the importation of flint from Yorkshire into Scotland during the Middle and Late Neolithic periods (Ballin 2011b, Fig. 3). The solitary Levallois-like core (CAT 1478), for example, is in light-grey Yorkshire flint.

In Scotland, minority raw materials such as chalcedony (plain, usually bluish-grey), agate (chalcedony with concentric bands, frequently pink), and jasper (red chalcedony) are usually associated with volcanic rock forms, and in Scottish prehistory they were probably largely collected as erratics in the general landscape or from beachs or river beds (Pellant 1992, 88). Quartz (ibid. 86) occurs in all main rock forms (igneous, sedimentary and metamorphic), and may have been procured locally as erratics or from pebble sources.

The pitchstone artefacts are mostly dark-green to black, and they are generally aphyric (Plate 12). They were almost certainly imported from the Isle of Arran, and the fact that they are aphyric indicates procurement from the Corriegills/Monamore area on the island's east-coast (Ballin 2009; Ballin and Faithfull 2009).

Three pieces (CAT 844, 1177, 1206) were defined as belonging to the jet family. Jet, cannel coal, lignite, and torbanite were all used in British prehistory to make jewellery and ornaments, but it is not possible to distinguish between smaller pieces of these materials without the application of FTIR analysis (Fourier Transform Infrared Spectroscopy) (Watts and Pollard 1998). If the pieces are in fact jet, they probably represent importation from north-east England (Whitby), whereas other jet-like materials are known from Scotland, such as Torbane Hill, near Bathgate (Paterson and Ward 2013, 39), and Brora in Sutherland (Shepherd 1985, 204).

Six small flakes in red/cream colours were defined as 'uncertain raw material', as it was not possible to determine whether they are chert or chalcedony. In addition, the raw material of a bifacial arrowhead (CAT 1561) was also defined as 'uncertain', as its weathered surface did not allow its raw material to be determined. However, due to its relatively dull surface the implement is unlikely to be chert, and Cumbrian tuff is probably the most likely option. Cumbrian tuff, from the Great Langdale area in the Lake District, was generally imported into southern Scotland from the beginning of the Early Neolithic period onwards (Ritchie and Scott 1988; Bradley and Edmonds 1993).

Plate 12: Pitchstone artefacts. 1: flake (CAT 1512); 2: microblade (CAT 1371); 3: distal blade fragment (CAT 663).

The typo-technological composion of the full assemblage

General overview

From the investigations at Garvald Burn, 1,562 lithic artefacts were recovered. They are listed in Table 7. In total, 90% of the assemblage is debitage, whereas 4% is cores and 6% tools.

Debitage

During the archaeological investigation of Garvald Burn, a total of 1,405 pieces of debitage were recovered (Table 7): 534 chips (38%), 541 flakes (38.5%), 100 blades (7.1%), 93 microblades (6.6%), 95 indeterminate pieces (6.8%), and 42 core preparation flakes (31 crested pieces and 11 platform rejuvenation flakes) (3%). Most of the debitage (96.9%) is chert, supplemented by a variety of other raw materials.

The high number of chips suggests that primary production took place at the location. As the assemblage in general is thought to be dominated by Late Mesolithic and Early Neolithic material (see dating section), the blade ratio of 13.7% is unexpectedly low. However, this is largely a reflection of the chert's poor flaking properties, which resulted in the production of much fine debris, automatically lowering the ratios of other debitage categories. Generally, relatively low blade ratios should be expected from artefact assemblages based on Southern Uplands chert, as indicated by the early prehistoric chert collection from Glentaggart, South Lanarkshire (blade ratio 15%; Ballin and Johnson 2005), which dates to the Late Mesolithic period[4].

A total of 301 intact flakes measure on average 16.7 by 13.9 by 4.7 mm, whereas 67 intact blades and microblades have average dimensions of 22.2 by 8.8 by 3.9 mm. This defines the flakes as small and slightly elongated, whereas the blades are small and short. However, as suggested by Figure 8, the blades form two numerically equal metric classes – a group of exceedingly narrow microblades (with a peak at width 4-5 mm) and a group of broader microblades/narrow blades (with a main peak at 8-9 mm).

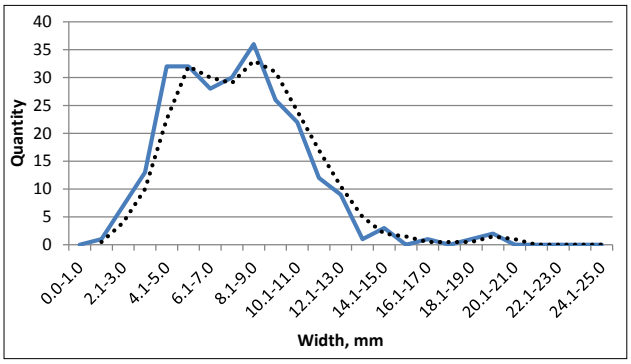

Figure 8: The width of all unmodified chert blades and microblades as well as blades/microblades with light edge-retouch. The curve is based on 67 pieces, and it was thought that the curve's minor fluctuations could have been caused by this (in statistical terms) relatively low number. A 'moving average trend line' (the stippled line) was inserted as a test, and as the trend line is almost identical to the main curve, the curve's double-peaked character must be assumed to be a reality.

Generally, a curve illustrating blade width (based on blades representing one technological tradition and deposited within a relatively short space of time) would be approximately bell-shaped (Ballin forthcoming b), and the double-peaked nature of Figure 8 probably indicates that the assemblage represents a minimum of two visits to the site. Diagnostic types and radiocarbon dates indicate that the site may mainly have been visited during the Late Mesolithic and Early Neolithic periods, and as the curve produced to describe the blades from Trench 4 Extension (Figure 4) overlaps Figure 8's left peak, it is suggested that the two peaks in the diagram probably represent visits to the site during the Late Mesolithic (left) and Early Neolithic (right) periods (also compare these results with the microblades and blades from the Early Neolithic sites Garthdee Road in Aberdeen and Auchategan in Argyll, Ballin 2006; Ballin forthcoming c).

The flakes were manufactured by a combination of hard and soft percussion (hard:soft ratio c. 53:47) and the blades/microblades largely by soft percussion (hard:soft ratio c. 11:89). This probably indicates that the flakes represent a mixture of waste from core preparation as well as intentional tool blanks, whereas the blades and microblades probably generally represent intentional tool blanks. Bipolar products are almost absent in this assemblage, which may be due to chert generally being too brittle for the successful use of this robust approach (Ballin and Johnson 2005, 65).

[4] One of the authors (TB) has discussed the interpretational value of blade ratios on a number of occasions (e.g. Saville et al. 2012, 23), and, contra Bordes and Gaussen (1970) who suggest that a blade ratio of 20 per cent is required to classify an assemblage as the product of a blade industry, he proposes that the classification of an industry as a flake or blade industry should not be based entirely on a ratio. Instead, the key point ought to be whether it could be argued that blades are intentional products of that industry or not (that is, a fuller understanding of the industry's operationa l schema is required), whatever the collection's blade ratio. The regularity of the Garvald Burn blades and blade blanks (i.e. their parallel lateral sides and dorsal arrises) clearly define them as intentional (i.e. non-random) blades, and thereby the assemblage as the product of an industry/-ies focusing on specialised blade production, despite its blade ratio of only 13.7%.

	Chert	Flint	Quartz	Chalcedony family	Pitchstone	Jet family	Uncertain	Total
Debitage								
Chips	525	6	2	1				534
Flakes	515	8	7	1	3	2	5	541
Blades	98	2						100
Microblades	91				2			93
Indeterminate pieces	91		2	1		1		95
Crested pieces	31							31
Platform rejuvenation flakes	11							11
Total debitage	1,362	16	11	3	5	3	5	1,405
Cores								
Split/flaked pebbles	4							4
Core rough-outs	2							2
Single-platform (conical) cores	24							24
Handle-cores	1							1
Opposed-platform cores	7							7
Cores w 2 platfs at an angle	2							2
Levallois-like cores		1						1
Other discoidal cores	2							2
Irregular cores	14							14
Core fragments	3			1				4
Bipolar cores	3							3
Total cores	62	1		1				64
Tools								
Microlith preforms	1							1
Scalene triangles	12	1		1				14
Crescents	1							1
Edge-blunted pieces	1							1
Backed bladelet	3							3
Truncated bladelets	3							3
Frag. of microliths	1							1
Frag. of microlith/backed bladelet	9							9
Microburins	2							2
Barbed and tanged arrowheads		1						1
Bifacial arrowheads							1	1
Short end-scraper	10							10
Double-scrapers	1							1
Side-scrapers	1							1
Burins	3							3
Piercers	1							1
Mèche de foret	2							2
Backed knives	1							1
Truncated pieces	2							2
Notched pieces	1							1
Denticulated pieces	2							2
Pieces w edge-retouch	27	1		1	1		1	31
Pieces/frags with invasive retouch		1						1
Total tools	84	4		2	1		2	93
TOTAL	1,508	21	11	6	6	3	7	1,562

Table 7: General artefact list: lithic artefacts. A total of 44 natural pebbles, seven wood samples, three charcoal samples, and one piece of glazed stoneware were excluded from this list.

The lithic artefacts from Garvald Burn also include a number of core preparation flakes (Table 7), namely 31 crested pieces and 11 platform rejuvenation flakes (Plate 13). Approximately two-thirds of the crested pieces are blades or microblades, with the remainder being flakes. Thirteen intact specimens measure on average 22.5 by 11.7 by 5.6 mm. Seven of the 11 core tablets are intact, and they have average dimensions of 18 by 19 by 6 mm.

Plate 13: Top row: crested pieces (CAT 1551, 616, 909, 1253); bottom row: platform rejuvenation flakes (CAT 1518, 1592, 1227).

Cores

In total, 64 cores were recovered during the investigations at Garvald Burn. They include the following types: four split/flaked pebbles, two core rough-outs, 24 conical cores, one handle-core, seven opposed-platform cores, two cores with two platforms at an angle, one Levallois-like core, two plain discoidal cores, 14 irregular cores, four core fragments, and three bipolar cores. Sixty-two cores are in chert, one is in flint (CAT 1478), with one (CAT 393) being in chalcedony. In the descriptions below, pieces are chert if not specifically stated that they are based on other raw materials.

Split/flaked pebbles and core rough-outs: The category of split/flaked pebbles includes four nodules which were 'tested' by the prehistoric knappers, either by the application of bipolar technique or by free-hand percussion. They have greatest dimensions of 24-57 mm. In most cases, the presence of high numbers of internal fault planes resulted in uncontrolled flaking/splitting of the pieces and they were subsequently discarded. Two core rough-outs measure on average 32 by 24 by 17 mm, and they are defined by attempts at equipping suitable nodules with one or more striking-platforms and/or crests. They were discarded when tabular fragments broke off the front and rear faces of the pieces.

Single-platform cores: Usually, single-platform cores are subdivided into two formal categories: conical cores and handle-cores (e.g. Ballin 1996, Figs 1.3-4). Conical cores are roughly 'bullet-shaped' cores with a round/oval or short platform at one end of the long axis and a pointed apex at the other, whereas handle-cores have their flaking-front at one end of an elongated platform (or a flaking-front at either end of an elongated platform) and an opposed keel rather than a pointed apex. From Garvald Burn, only one handle core was recovered (CAT 19), whereas 24 conical cores were retrieved.

The 24 conical cores are all fairly small microblade-cores. A total of 21 intact cores have average dimensions of 25 by 20 by 15 mm, with the greatest dimension of the pieces varying between 14 mm and 42 mm. Most conical cores from Garvald Burn are elongated specimens, with five pieces being relatively squat (Figures 9 and 10, and Plate 14). Seven of the conical cores are untrimmed, with most having trimmed platform-edges. Apart from one piece with a cortical platform (CAT 77), and one faceted platform (CAT 1482), all platforms are plain.

Although many conical cores were abandoned due to having been completely spent, probably an equal number had knapping failures. Many cores were discarded when an overshot blade/flake removed a large part of the core's apex, or cores were discarded due to the formation of deep hinge or step fractures which ruined the flaking-front and prevented further controlled reduction.

The assemblage only includes one handle-core (CAT 19). It measures 26 by 29 by 51 mm, and it has a trimmed, plain platform.

Dual-platform cores: Two different types of dual-platform cores were recovered from the site: opposed-platform cores (seven pieces)

and cores with two platforms at an angle (two pieces). Their dimensions are shown in Figures 9 and 10. The opposed platform cores (Plate 14) tend to be slightly elongated and cylindrical with average dimensions of 24 by 17 by 11 mm and Length:Width = 1.4, whereas cores with two platforms at an angle (Plate 15) are more cubic with average dimensions of 27 by 24 by 17 mm and Length:Width= 1.1.

Figures 9 and 10: The length:width of all intact cores.

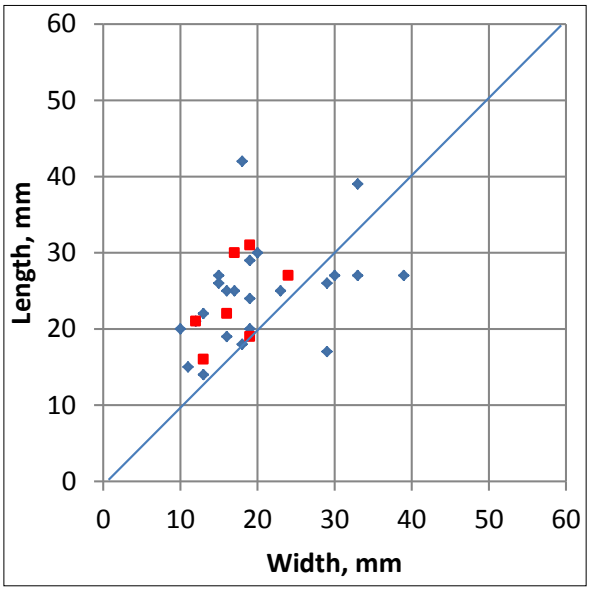

Figure 9: single-platform and opposed-platform cores (blue=single-platform cores; red=opposed-platform cores);

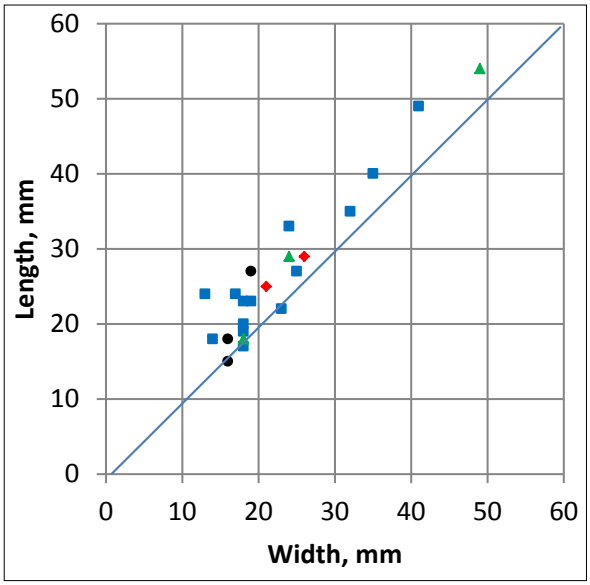

Figure 10: all other cores (blue=irregular cores; red=cores with 2 platforms at an angle; green=discoidal cores; black=bipolar cores). A line has been inserted, indicating Length:Width = 1:1.

Plate 14: Top row: single-platform (conical) cores (CAT 1447, 1492, 1497); bottom row: opposed-platform cores (CAT 1455, 1449).

Plate 15: 1: core with two platforms at an angle (CAT 1448); 2-3: irregular cores (CAT 1472, 1473); 4) bipolar core (CAT 1463).

Although these two core types are formally related by having two striking platforms, they also differ on key points. Like the conical cores and handle-cores, the opposed-platform cores focused on the production of blades and microblades, and they generally have trimmed, plain platforms. Cores with two platforms at an angle, on the other hand, share attributes with irregular cores, such as their cubic shape, focus on flake production as well as blade/microblade production, and less meticulous preparation (in this case, only one of the two cores has a trimmed platform). The two types of dual-platform cores are clearly positioned at different levels in the

site's lithic operational schema (see technology section).

Discoidal cores: Three discoidal cores were recovered from Garvald Burn, two of which are fairly simple pieces, whereas one (CAT 1478; Plate 16) represents a more sophisticated approach. CAT 1478 is the burnt fragment of a small, entirely exhausted Levallois-like core (18 by 18 by 8mm) (Ballin 2011a; Suddaby and Ballin 2011). It is in grey Yorkshire flint, and it has a cortical lower face, opposed by a flat flaking-front. The flaking-front is heavily pitted by exposure to fire. At one end of this face, the piece has a trimmed faceted platform, and along one of its lateral sides, a short segment of a crest survives. The two simpler discoidal cores (CAT 1325, 1493) are plain chert flake cores with greatest dimensions between 54 mm and 29 mm.

Plate 16: Small burnt, partially disintegrated Levallois-like core (CAT 1478). The trimmed platform-edge is down, and a short stretch of surviving crest is seen along the left lateral edge.

Irregular cores: The assemblage includes 14 irregular (multi-directional) cores. Their surfaces are generally characterised by flake scars, and with average dimensions of 27 by 23 by 14 mm. They are as cubic as the cores with two platforms at an angle discussed above (Plate 15).

Core fragments: This category includes fragments of platform-cores in chert (three pieces), as well as in chalcedony (one piece). Their greatest dimensions vary between 13 mm and 41 mm.

Bipolar cores: The finds from Garvald Burn include three bipolar cores, two of which (CAT 1451, 1471) are exceedingly small (average dimensions of 17 by 16 by 5 mm), whereas one (CAT 1463; Plate 15) is somewhat larger (27 by 19 by 8 mm). The three pieces are standard bipolar cores with pointed-oval cross-sections, and typical crushed terminals rather than actual platforms.

Tools

The assemblage includes 93 tools, namely 35 microliths and microlith-related pieces, two arrowheads, 12 scrapers, three burins, three piercers (including two *mèches de forets*), one backed knife, two truncated pieces, one notched piece, two denticulates, 31 pieces with simple edge-retouch, and one piece with invasive retouch. One scalene triangle (CAT 1589) and one barbed-and-tanged arrowhead (CAT 1564) are in flint, and one scalene triangle (CAT 1596) is in chalcedony; all other implements are in chert.

Microliths and 'microlith-related pieces': This category (35 pieces) embraces a number of formal types, including one microlith preform, 14 scalene triangles, one crescent, one edge-blunted piece, three backed bladelets, three truncated bladelets, 10 fragments, and two microburins. In the archaeological literature, the term microlith is defined in a number of different ways, adding some confusion to the discussion of the category and – first and foremost – its dating. In the present report, 'microlith' is defined as in previous reports on early prehistoric assemblages (e.g. Ballin forthcoming a; b):

Microliths are small lithic implements manufactured to form part of composite tools, either as tips or as edges/barbs, and which conform to a restricted number of well-known forms, which have had their (usually) proximal ends removed (Clark 1934, 55). This definition secures the microlith as a diagnostic (pre Neolithic) type. Below, microliths sensu stricto *(i.e. pieces which have had their usually proximal ends removed) and backed or truncated microblades (with surviving proximal ends) are treated as a group, as these types are thought to have had the same general function.*

Most members of this category are defined by their blanks and dimensions as narrow-blade pieces, whereas one microlith preform (CAT 1523) and one microburin (CAT 1569) are based on broader blades. One scalene triangle is in chalcedony.

Microlith preforms: CAT 1523 (17.4 by 8.6 by 2.1 mm) was defined as a microlith preform (Plate 17). It has had the proximal end removed by microburin technique, forming an oblique truncation. However, when it was attempted to remove the distal end in a similar manner – possibly to create an isosceles triangle – the piece broke in an irregular fashion, and the piece was subsequently abandoned.

Plate 17: 1: microlith preform (CAT 1523); 2-5: scalene triangles (CAT 1586, 1598, 1571, 1584); 6: crescent (CAT 1606); 7: edge-blunted piece (CAT 1591); 8: distal microburin (CAT 1531); 9: backed bladelet (CAT 1607); 10: truncated bladelet (CAT 1588).

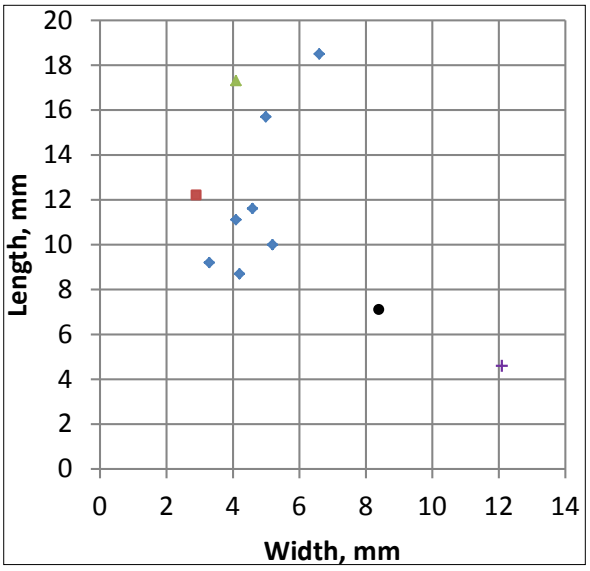

Figure 11: The main dimensions of selected (intact) microliths and microlith-related pieces: blue: scalene triangles; red: crescents; green: edge-blunted pieces; purple: backed bladelets; black: truncated bladelets.

Scalene triangles: Seven of the 14 scalene triangles are intact and they measure on average 12.1 by 4.7 by 2 mm, varying in length between 8.7 mm and 18.5 mm (Figure 11, Plate 17). The pieces vary considerably in terms of orientation, that is, whether the base is proximal or distal, and whether the shortest (retouched) legs are turned towards the left or right. The concave delineation of the shortest side of CAT 1571 and 1598 suggests that these two pieces may have been produced by the application of microburin technique (the concavity representing the original microburin notch), but several pieces appear to have had their proximal ends removed by simple oblique retouch through or around the bulbar area.

Other microliths: The assemblage includes one crescentic microlith (CAT 1606; Plate 17), which is a small regular piece (12.2 by 2.9 by 2 mm) with a convex retouch along its right lateral side, supplemented by fine straight retouch along its left side. Only one edge-blunted piece was recovered, namely CAT 1591 (Plate 17). This piece (17.3 by 4.1 by 2.6 mm) has straight modification along its right lateral side, whereas the opposed unmodified side is less regular. It is uncertain whether the crescent and the edge-blunted pieces were manufactured by the application of microburin technique.

Backed and truncated bladelets: With one lateral side blunted, the three backed bladelets (Plate 17) are probably functionally related to the edge-blunted microliths. The category's three members (CAT 1585, 1590, 1607) all have retouch along the right lateral side. The only intact piece (CAT 1607) measures 12.1 by 4.6 by 2.2 mm, and the width of the three pieces vary between 4.1 mm and 6.6 mm (Plate 6).

Like the backed bladelets, the three truncated bladelets (Plate 17) were not exposed to modification by microburin technique. The only intact piece (CAT 1588) measures 8.4 by 7.1 by 1.8 mm, and the width of the three pieces vary between 6.9 mm and 7.3 mm. Two truncated microblades (CAT 950, 1588) have oblique truncations, whereas one has a straight truncation (CAT 1582).

Fragments of microliths and microlith-related implements: These edge-blunted fragments were subdivided into two groups, namely 1) fragments of microliths, and 2) fragments of microliths or backed bladelets. Proximal fragments which have clearly had their bulbar ends removed, but which could not be formally defined as belonging to one or the other specific microlith type, were referred to the former category, whereas medial and distal fragments, which would not allow the character of their proximal ends to be defined,

were referred to the latter category. Only one piece (CAT 1595) was defined as a fragment of a microlith, and nine pieces as fragments of microliths or backed bladelets. The width of these fragmented implements varies between 2.7 mm and 6.6 mm.

Microburins: Microburins are the waste products from the production of microliths by microburin technique (Inizan et al. 1992, Fig. 24.10). The assemblage includes two microburins, one of which (CAT 1570) is proximal, and one (CAT 1531; Plate 17) distal. The two pieces differ considerably in terms of size. CAT 1531 (14.1 by 9.2 by 2.7 mm) is probably the waste product from the production of an Early Mesolithic broad-blade microlith, whereas CAT 1570 (5.5 by 6.1 by 1.6 mm) may represent the production of a Late Mesolithic narrow-blade microlith.

Arrowheads: CAT 1564 (Plate 18) is an almost intact barbed-and-tanged arrowhead in fine-grained orange flint (typical Scottish east-coast flint). It is a relatively short piece, and it has lost one of its barbs (19.0 by 15.6 by 3.2 mm). It belongs to Green's type Sutton B (Green 1980, 50), and it has a squared-off tang and rounded barbs.

Plate 18: 1: tip of bifacial (leaf-shaped?) arrowhead in ?Cumbrian tuff (CAT 1561); 2: barbed-and-tanged arrowhead (CAT 1564); 3: fragment of bifacial implement (arrowhead or knife) in ?Yorkshire flint.

CAT 1561 (Plate 18) is the tip fragment of a bifacial arrowhead (14.8 by 11.2 by 2.7 mm), and although its formal type cannot be determined with certainty, its relatively acutely pointed tip suggests that it may have been a leaf-shaped point rather than a barbed-and-tanged one. It is uncertain which raw material it was based on, but Cumbrian tuff is probably the most likely option.

Scrapers: In total, 12 scrapers were retrieved from Garvald Burn. They include 10 short end-scrapers, one double-scraper, and one side-scraper (Figure 12), which are mostly based on robust, cortical flake blanks. Three are based on abandoned cores (CAT 1087, 1461, 1494). In general, the Garvald Burn scrapers are expedient pieces based on whatever blank was suitable, and with a scraper-edge on whatever edge or corner was appropriate .

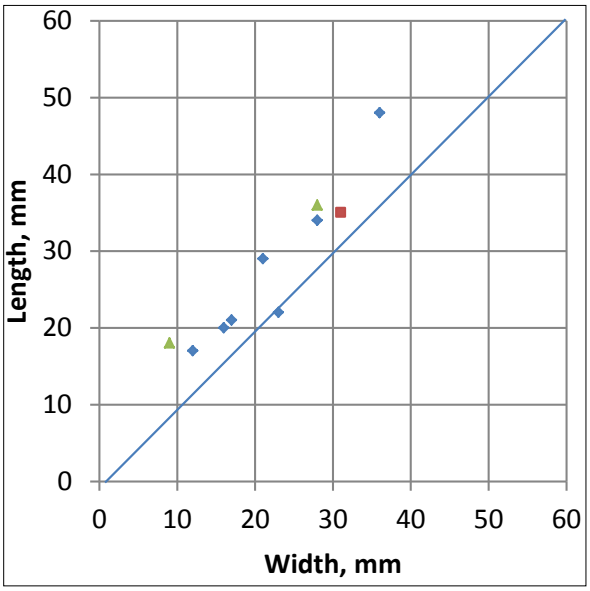

Figure 12: The Length:Width of all intact scrapers: short end-scrapers (blue diamonds); double-scrapers (red squares); and side-scrapers (green triangles). The inserted line indicates Length:Width 1:1, and shows how the site's scrapers are generally fairly short and squat.

The short end-scrapers (Plate 19) include the only relatively regular scraper, namely CAT 1527. This piece is a small flake (22 by 23 by 10 mm) with soft vein cortex, and it has a convex, steep working-edge at the distal end. The remaining end-scrapers have more or less convex, steep scraper-edges, some of which are uneven to denticulated. The intact end-scrapers vary in size between GDs of 20 mm and 48 mm. Only one double-scraper (CAT 1118; Plate 19) was retrieved at Garvald Burn, measuring 35 by 31 by 13 mm. It is an indeterminate piece with a straight, steep working-edge at either end, supplemented by coarse lateral blunting along one lateral side. The solitary side-scraper (CAT 1087; Plate 19) is a bipolar core (18 by 9 by 6 mm) with a straight, steep working-edge along one lateral side.

Burins: Three burins (CAT 3, 601, 1134) were recovered from the site. CAT 3 is based on an indeterminate blade, CAT 1134 on a distal flake fragment, and CAT 601 (Plate 20) on an indeterminate piece. They are all angle-burins,

where a small number of burin spalls were detached either by striking a natural fault-plane, or by striking a surface formed by the removal of small flakes. The burins have greatest dimensions of 22-29 mm.

Plate 19: Top row: short end-scrapers (CAT 1481, 1005, 1527); bottom row: double-scraper (CAT 1118) and side-scraper on abandoned bipolar core (CAT 1087).

Plate 20: 1: burin (CAT 601); 2: piercer (CAT 1173); 3-4: meches de forets (CAT 1569, 1603); 5: backed knife (CAT 1231); 6: piece with oblique truncation (CAT 837).

Piercers: The site's three piercers include one large 'traditional' piercer (CAT 1173; Plate 20), and two small drill tips or *mèches de foret* (CAT 1569, 1603; Plate 20). *Mèches de foret* used to be functionally associated with the microliths (frequently referred to as 'needle points'; e.g. Finlayson et al. 1996, Table 16.2), but Jacobi's (1980) research into the type and its use-wear indicated that these pieces are actually small piercers or drill bits.

CAT 1173 is a crude piercer on an indeterminate platform-flake (26 by 21 by 10 mm), and it has an approximately right-angled tip at the distal end. Both *mèches de foret* are based on microblades. CAT 1603 is a very narrow piece, which has lost its proximal end (10.9 by 2.5 by 2.3 mm). It has steep retouch along both lateral sides which meet at the distal end to form an acutely pointed tip. CAT 1569 belongs to a particular scalene-shaped sub-type of drill bits, but their robust and frequently abraded tips define them as drill bits rather than scalene triangles (cf. Ballin forthcoming a).

Backed knives: The assemblage includes one backed knife (CAT 1231; 24 by 12 by 6 mm). This piece (Plate 20) is based on a small hard percussion flake, and it has convex backing of the entire left lateral side. Slight use-wear indicates that the opposite, slightly concave side functioned as the knife's cutting-edge.

Truncated pieces: This heterogeneous category includes two pieces: CAT 668 and CAT 837. It is thought that both pieces may have been used as small expedient knives. The former is a relatively irregular, indeterminate blade (22 by 9.1 by 3.8 mm) with a straight distal truncation, whereas the latter (Plate 20) is a small indeterminate flake (18 by 9.1 by 3 mm) with a very short oblique distal truncation.

Notched and denticulated pieces: Only one notched piece was recovered (CAT 1546). It is the proximal fragment of an indeterminate platform-flake (16 by 12 by 3 mm), with a small retouched notch (chord c. 7 mm) in its left lateral side. The notch may have been formed to facilitate hafting. Two pieces (CAT 119, 1525) were defined as denticulates. They both have two to three protruding teeth, formed by the detachment of a series of adjacent single-removal chips or flakes. They are based on relatively large (GD 38-42 mm) chunks, and it is uncertain whether they are actually tools or fragments of unsystematically worked cores.

Fragments with invasive retouch: CAT 1540 (Plate 18) is a medial flake fragment in grey (Yorkshire?) flint (12 by 23 by 4 mm). It has semi-invasive bifacial retouch along its left lateral side, but it is not possible to determine the shape and type of the original tool. The piece is burnt.

Pieces with edge-retouch: Thirty-one lithic

artefacts display various forms of lateral modification. Twenty-seven are chert, one is flint (CAT 1563), one agate (CAT 673), one pitchstone (CAT 1512), whereas one (CAT 367) raw material is uncertain. Twenty-three are based on flakes, whereas five are based on broad blades or microblades, two are modified indeterminate pieces, and one is a small chip. These pieces differ considerably in shape and size (greatest dimension 8-54 mm), and it is thought that this tool group includes artefacts, or fragments of artefacts, with different functions.

Technological summary

This technological summary is based on the information presented in the raw material, debitage (tool blanks), core and tool sections above. Although the collection's blade ratio is relatively low (13.7%), there is no doubt that the present assemblage represents one or more blade industries (that is, industries producing *intentional* blades; see debitage section). The double-peaked character of the curve describing the width of the site's macro- and microblades indicates that the lithic artefacts may represent two main industries (one predominantly producing microblades, and one microblades and narrow macroblades), and the heavy dominance of chert (96.7%) over other raw materials suggests that both industries belong to the Late Mesolithic – Early Neolithic techno-complex. Diagnostic elements (see dating section) indicate that one of the industries of this techno-complex may be Late Mesolithic and the other Early Neolithic, although individual finds are datable to earlier as well as later periods. The focus of the present section is the LM/EN chert industries responsible for most of the lithic artefacts recovered at Garvald Burn.

Detailed analysis of the chert's cortex suggests that the Garvald Burn settlers may have procured this raw material from two different sources: most of the chert appears to have been obtained by quarrying primary sources (such as at Burnetland Hill, Scottish Borders west; Ballin and Ward 2013), and the remainder by collection from secondary pebble sources (such as at Meldon Bridge, Scottish Borders east; Ballin 1999).

As mentioned in the debitage section, the finds include roughly equal numbers of macroblades (100 pieces) and microblades (93 pieces). The intact blades have average dimensions of 22.2 by 8.8 by 0.9 mm, but the groups of blades represented by the two peaks in Figure 8 centre around blade widths 4-5 mm and 8-9 mm.

The flakes have average dimensions of 16.7 by 13.9 by 4.7 mm, and probably represent waste from core preparation as well as intentional tool blanks, whereas the blades are thought to largely represent intentional tool blanks ('target blanks'). This difference is reflected in the percussion techniques employed to detach the two types of debitage (Table 3), where flakes were detached by a combination of hard and soft percussion (hard:soft ratio 53:47), blades were almost exclusively detached by the application of soft percussion (hard:soft ratio 11:89). This difference in status (partly waste and mainly 'target blanks') is also reflected in the different cortical ratios of the two debitage groups (Table 6) – the fact that the blades' cortical ratio (c. one-tenth) is only half that of the flakes' cortical ratio (c. one-fifth) suggests that the blades were produced after considerably more careful core preparation (e.g. decortication) than the flakes.

As explained in the debitage section, the soft percussion flakes may be failed blades which simply turned out slightly shorter than intended (for example due to the presence of internal fault planes), and the hard percussion blades probably represent flakes which incidentally turned out longer than intended.

The collection from Garvald Burn includes a varied assortment of cores. However, they do not generally represent different reduction methods but, to a degree, stages within the same operational schema. Based on preparation forms and blank types produced (flake-, blade-, and microblade-scars on the cores), it is possible to suggest a generalized operational schema for the site's blade/microblade production (Table 8).

1	Procurement of chert, from primary and, to a lesser extent, secondary sources;
2	Core preparation (decortication, cresting, and platform-edge trimming);
3	Production of first blade or microblade series (conical or opposed-platform cores);
4	Core adjustment (detachment of core tablets; formation of new crests; renewed trimming);
5	Production of second, etc. blade or microblade series (conical or opposed-platform cores);
6	Production of mainly flakes from cores w two platforms at an angle and irregular cores;
7	Final abandonment of core.

Table 8: Operational schema covering the Late Mesolithic/ Early Neolithic industries at Garvald Burn.

However, the fact that some of the cores with two platforms at an angle and the irregular cores are quite large, resulting in larger average dimensions than those of the single- and opposed-platform cores (Table 9), indicates that these cores do not *only* represent the later stages of blade production, but that some of them represent a separate and parallel operational schema, aimed at the production of robust flake blanks from larger and cruder cores, characterised by less meticulous preparation.

	Average		
	Length	Width	Thickness
Core rough-outs	32	24	17
Single-platform cores	25	20	15
Opposed-platform cores	24	17	11
Cores w 2 platfs at angle	27	24	17
Irregular cores	27	23	14

Table 9: The average dimensions of the site's main core types.

This operational schema, focusing on flake production, would probably involve less careful decortication (cf. Table 6), less careful cresting (if any – cf. the average dimensions of the site's crested pieces: 22.5 by 11.7 by 5.6 mm) and trimming. The size of the platform rejuvenation flakes (average dimensions 18 by 19 by 6 mm) indicates that they are probably mainly associated with the collection's microblade cores, and the production of intentional flake blanks would most likely have been characterised by immediate redefinition of worn cores into cores of lower rank, rather than attempts at rejuvenating them. The following schema was probably followed: crude single-platform core ⇒ core with two platforms at an angle (dual-platform core) ⇒ irregular core (three or more platforms).

The recovery of 31 crested pieces indicates that, in connection with the production of blades, core rough-outs with one or two crests (guide ridges) were prepared, and the proximal attributes of the blades suggest that this was followed by neat trimming/abrasion of the core platforms, removing all irregularities.

Once blade production had commenced, the platform-edges would probably have been trimmed/abraded on a regular basis to remove all salient points, such as the 'spurs' between the scars of recently removed blanks. On occasion, the Garvald Burn knappers would have needed to adjust the platforms in a more robust manner, and partial or complete core tablets would be detached. This process is evidenced by the retrieval of 11 platform rejuvenation flakes. The only form of core preparation identified in connection with the flake cores is platform-edge trimming.

Only eight flakes and three cores (CAT 1451, 1463, 1471) have been defined as representing bipolar (hammer-and-anvil) technique. The almost complete absence of this approach to exhaust chert platform cores, may be due to a combination of reasons, such as: 1) chert with acceptable flaking properties was available in such abundance that bipolar technique was not needed to economize raw material; and 2) as bipolar material is generally quite rare within the area covered by the southern Scottish chert industries (see for example the assemblage from Cramond, Edinburgh; Saville 2008), chert may simply have been considered too brittle for bipolar technique to be a relevant (controllable) approach.

Although almost the entire assemblage from Garvald Burn is thought to represent the Late Mesolithic/Early Neolithic chert techno-complex of southern Scotland, a small number of other technological traditions are also represented amongst the finds. Diagnostic types indicate the likely presence, albeit in small numbers, of Early Mesolithic, later Neolithic, as well as Early Bronze Age pieces (see dating section), but only the later Neolithic component includes finds which inform on technological approach. Although very small (18 by 18 by 8 mm) and burnt, CAT 1478 is a small Levallois-like core, and as such it has the typical slightly domed broad flaking-front, a faceted

platform, as well as the remains of one lateral crest (Ballin 2011a; Suddaby and Ballin 2011). The grey flint, on which it is based, was probably imported from the greater Yorkshire area (Ballin 2011b).

Dating

The lithic finds from Garvald Burn include several diagnostic elements, such as raw material preferences, technological approaches as well as core and tool typology.

Raw materials: Within southern Scotland and the Central Belt, chert was the preferred raw material through most of earlier prehistory. In Scandinavia, it has been shown how the earliest post-glacial settlers continued to exploit the raw materials they were used to for centuries after the colonization of recently deglaciated areas, and only slowly adapted to the raw materials available in the newly colonized areas (e,g, Bruen Olsen 1992, Fig. 55). This situation is mirrored in Scotland, where the first post-glacial settlers at Howburn, South Lanarkshire (representing the Hamburgian material culture; Ballin et al. 2010; Ballin et al. forthcoming), predominantly used flint brought from north-east England.

It is uncertain how long this initial flint-dominated period lasted, but by the beginning of the Mesolithic the hunter-gatherers now populating Scotland appear to have adapted to local raw materials, with the Early Mesolithic settlers at An Corran, Skye, predominantly exploiting the local baked mudstone (Saville et al. 2012, Table 3), and contemporary groups at Morton in Fife using a large variety of raw materials, with approximately half being flint and the other half chalcedony and related local materials from '*the Lower Old Red Sandstone lavas*' (Coles 1971, Table III).

At present, no Early Mesolithic assemblages from southern Scotland have been examined and published, but the assemblage from Cramond, Edinburgh (Saville 2008) shows how, by the Early/Late Mesolithic transition (8690-8230 cal BC; OxA-10143-45, 10178-80), local chert had clearly become the preferred raw material in this region. The assemblage from Daer Reservoir 1 (which is not published and still requires specialist analysis) seems to be a near contemporary of Cramond (8550-7950 cal BC; AA-30354), and it is unusual in the sense that it is composed mainly of flint, siltstone and other raw materials, rather than radiolarian chert, despite the fact that the site is located in the Southern Uplands (Paterson and Ward 2013, 7).

The assemblage from Glentaggart, South Lanarkshire (Ballin and Johnson 2005) from the later part of the Mesolithic period is also entirely dominated by Southern Uplands chert, as are Early Neolithic assemblages recovered by Biggar Archaeology Group (e.g. Nether Hangingshaw, South Lanarkshire, Ward 2005). By the beginning of the Middle Neolithic, through the Late Neolithic, and into the Early Bronze Age, sites from the Scottish Borders, South Lanarkshire and the Lothians are generally heavily dominated by flint imported from north-east England (see the discussion of the assemblages from sites near Overhowden Henge, Scottish Borders, Ballin 2011b).

This situation is reflected in the assemblage from Garvald Burn, where general Mesolithic (e.g. burins: CAT 3, 601, 1134), possibly Early Mesolithic (one potential isosceles triangle preform: CAT 1523; one broad microburin: CAT 1531), and Late Mesolithic lithic artefacts (scalene triangles and various other narrow microliths and microlith-related implements, as well as two *mèches de foret*) are all in chert. Almost all blades and microblades (representing both peaks in Figure 8 and therefore probably Late Mesolithic as well as Early Neolithic settlement) are also in chert.

As noted by Ballin (2009; 2015), pitchstone was mainly imported into the area during the Early Neolithic period, as indicated by radiocarbon-dated finds of pitchstone microblades from pits (Figure 13). The definition of pitchstone microblades as mainly representing Early Neolithic settlement in central and southern Scotland is also supported strongly by the finds from Auchategan in Argyll, where they were found with Carinated Pottery, Northern Irish leaf-shaped points, and Cumbrian tuff artefacts (Brophy and Sheridan 2012, 75). At Garvald Burn, six pitchstone artefacts were recovered, two of which are microblades.

A small number of flint artefacts are assumed to represent importation from the Yorkshire area, including four grey pieces (CAT 957, 976, 1079, 1478) and two dark-brown pieces (CAT 1084,

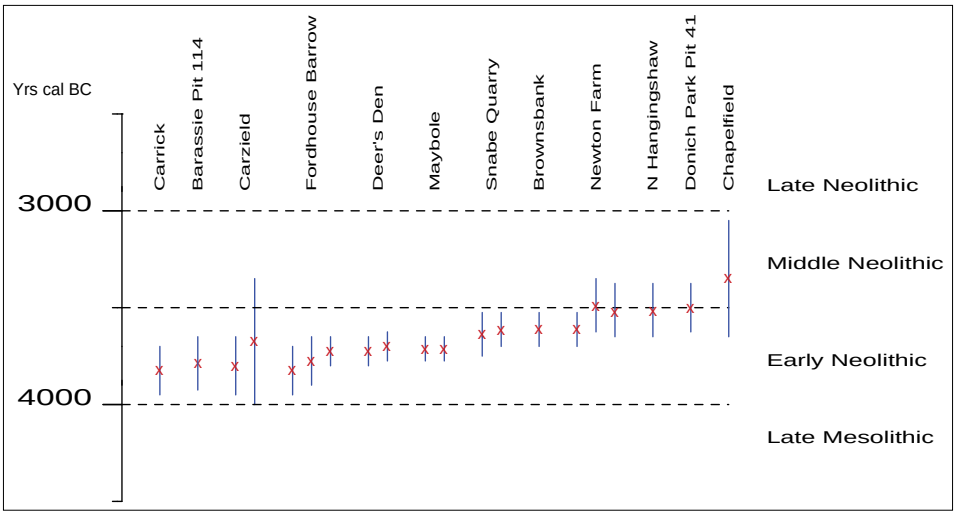

Figure 13: Radiocarbon-dated pitchstone artefacts from pits (cal BC).

1355). A slightly discoloured artefact with semi-invasive retouch (CAT 1540) was probably also originally grey, and may belong to this group. As mentioned above, Yorkshire flint was generally imported into southern Scotland during the Middle and Late Neolithic periods, and the fact that CAT 1478 is a small exhausted Levallois-like core supports this date. The fact that only seven pieces are in Yorkshire flint, and bearing in mind that in the eastern parts of southern Scotland Middle and Late Neolithic assemblages tend to be almost entirely in Yorkshire flint (Ballin 2011b), indicates that the site was only visited briefly during the later Neolithic.

Two flakes and one indeterminate piece (CAT 844, 1177, 1206) are made in jet or jet-like materials. If the material is jet, it may have been imported from the area around Whitby in north-east England, whereas cannel coal/lignite is known from several locations in Scotland. These materials were commonly used in the later Neolithic and Early Bronze Age periods (Shepherd 1985, 213).

The fragment of a bifacial arrowhead (most likely a leaf-shaped point) may be in Cumbrian tuff, but the weathered character of this piece prevents certain identification of the raw material. Cumbrian tuff was mostly used for axeheads (Bradley and Edmonds 1993), although damaged axeheads were frequently broken up, and the resulting flakes recycled in the form of smaller tools. This raw material was imported into Scotland from the Early Neolithic period onwards, but the use of Cumbrian tuff after the Early Neolithic is not yet certain. It is generally perceived as forming part of an Early Neolithic 'cultural package' including Carinated Pottery and Arran pitchstone, as demonstrated at Carzield in Dumfriesshire (Maynard 1993; Ballin 2015), where Carinated Pottery, Cumbrian tuff, and Arran pitchstone were found together in a radiocarbon-dated pit (Figure 13).

Technological approach: The various early prehistoric assemblages known from southern Scotland suggests the chrono-technological subdivision of the region shown in Table 10. A number of chronological type sites are mentioned in the raw material, debitage, core and technology sections.

As approximately 97% of the assemblage is chert, it is almost certain that the bulk of the finds from Garvald Burn represents Table 10's Techno-complex 2. This complex focused on the exploitation of local chert and the production of microblades and narrow broad blades by the application of soft percussion. The operational schema followed during this period included the meticulous preparation of specialized microblade cores by decortication, cresting, platform-edge trimming/abrasion and, when necessary, platform rejuvenation (see technology section). The cores were mainly conical single-platform cores, although handle-cores and opposed-platform cores were also used in connection with the manufacture of microblades and narrow broad blades.

Techno-complex	Period	Raw material	Target blanks	Percussion technique
1	UP/Early Mesolithic	Exotic and local flint/chert	Broad blades	Soft
2	Late Mesolithic	Chert/some local flint	Microblades	Soft
	Early Neolithic	Chert/some local flint	Microblades/ broad blades	Soft
3	Middle Neolithic	Mainly exotic grey flint/some chert	Broad blades	Hard (Levallois-like)
	Late Neolithic	Mainly exotic dark-brown flint/ some chert	Broad blades	Hard (Levallois-like)
4	Early Bronze Age	Exotic and local flint/chert	Flakes	Hard

Table 10: Chronological subdivision of early prehistoric southern Scotland; based on lithic raw material preferences, preferred blanks, and percussion techniques.

Although Scandinavian handle-cores are highly diagnostic (mainly dating to the Middle Mesolithic; Sørensen 2006), Scottish handle-cores are apparently only diagnostic in the broadest sense of the word. They occur on some Late Mesolithic sites (e.g. Monksford, Dryburgh, Scottish Borders, Ballin 2013b), but are absent, or almost absent, on other Late Mesolithic sites (e.g. Garvald Burn). They are mostly absent from Scottish Early Neolithic sites, but were recovered in relatively large numbers from Early Neolithic Garthdee Road in Aberdeen (Ballin forthcoming c). Most likely, the use of handle-cores in Scotland was largely a matter of the shape and size of the available lithic nodules and blocks available in the local area. However, the question as to whether some people in early prehistoric Scotland chose to use handle-cores and others not, should be investigated further.

The collection's blades are generally either microblades or narrow broad blades, with average dimensions of 22.2 by 8.8 by 0.9 mm. Blades this delicate are usually associated with the Late Mesolithic period, but as demonstrated by, for example, the pitchstone blades from Auchategan in Argyll (Ballin 2006), Early Neolithic blades are also frequently quite narrow. The average width of the blades from Auchategan is 9.6 mm (6-15 mm wide). On this basis, the width of the Garvald Burn blades only allows a date of Late Mesolithic to Early Neolithic to be suggested.

However, as shown in Figure 8, the blades from Garvald Burn form two almost numerically equal groups, one with an average width of 4-5 mm and one with an average width of 8-9 mm. Although it is uncertain how the average width of the blade in assemblages fluctuates through the Late Mesolithic period, it is likely that the narrowest group of blades represent settlement at Garvald Burn at some stage during the Late Mesolithic period, and the latter (broader) group at some stage during the Early Neolithic period. A Late Mesolithic presence at the location has been proven through the recovery of narrow microliths (see discussion of the finds from TP A, above) and an Early Neolithic presence through imported pitchstone artefacts (also above).

CAT 1478 is a small, totally exhausted Levallois-like core, which suggests that the site was visited, probably briefly, during the Middle or Late Neolithic periods. Levallois-like cores have been discussed on a number of occasions (Ballin 2011a; Suddaby and Ballin 2011). It is generally thought, that this core type/approach was adopted as Levallois-like cores allowed the production of broad flakes (for transverse arrowheads) and slender blades (for different types of cutting implements) from one and the same core type. The use of this approach in Scotland probably also necessitated the importation of flint from primary sources, as the local pebble flint was only available as small nodules, which would not allow the production of the desired larger flint tool forms (cf. Ballin 2011a).

Core and tool typology: The assemblage includes several more-or-less diagnostic types, such as a number of core forms, microliths, arrowheads, and burins. These artefact categories basically support the views on site chronology expressed above. Although small conical and opposed-platform cores are traditionally attributed to the Mesolithic, both core forms may be encountered in Early Neolithic contexts as well, as they are associated with the production of a particular form of blanks – soft percussion microblades and narrow broad blades (e.g. Auchategan in Argyll and Garthdee Road in Aberdeenshire; Ballin 2006; forthcoming c).

One small Levallois-like core (CAT 1478) in grey flint is datable to the Middle or Late Neolithic period (Ballin 2011a; 2011b; Suddaby and Ballin 2011).The fact that it is based on *grey* Yorkshire flint suggests that it is more likely to date to the Middle Neolithic than to the Late Neolithic. Yorkshire flint imported into Scotland in the Middle Neolithic tends to be dominated by grey pieces, whereas that imported in the Late Neolithic tends to be dominated by dark-brown pieces (Ballin 2011b).

Microliths *sensu stricto*, as defined in the tool section above, are clearly datable to the Mesolithic period, with the different microlith forms dating to different segments of this period. A broad microlith preform like CAT 1523 (which probably represents an attempt at producing an isosceles triangle) and a broad microburin like CAT 1531 (which is most like the waste product from the production of an isosceles triangle or a large obliquely blunted point – cf. the pieces from Donich Park in Argyll; Ballin forthcoming b) indicate that the site may have been visited briefly in the Early Mesolithic, that is, pre c. 8500 cal BC (Saville 2008). At the present time, Scottish microliths from the Early Mesolithic generally seem to conform to the microlith spectrum characterising the period's Star Carr group, including mainly broad isosceles triangles and relatively short, mostly squat obliquely blunted points (Reynier 2005).

The Late Mesolithic period is generally associated with narrow microliths like scalene triangles, crescents, and edge-blunted pieces, as well as narrow microlith-related pieces, such as backed and truncated bladelets. However, where narrow microliths are exclusively diagnostic of the Late Mesolithic period (e.g. Cramond, Fife Ness, Nethermills Farm, and Camas Daraich; Saville 2008; Wickham-Jones and Dalland 1998; Ballin forthcoming a; Wickham-Jones and Hardy 2004), backed bladelets may also be found in Early Neolithic contexts (Ballin 2006). The recovery of 12 narrow microliths from Garvald Burn suggests that Late Mesolithic material may dominate the lithic finds, probably supplemented by a notable sub-assemblage of Early Neolithic material (as suggested by the pitchstone artefacts).

The *mèche de foret* used to be considered a form of microlith (needle points), but it was functionally redefined as part of Jacobi's (1980) research into microlith typology and is now considered a form of piercer (drill bit). However, it is still equally diagnostic, and the two pieces from Garvald Burn most likely date to the Late Mesolithic period. This suggestion is supported by the scalene outline of CAT 1569 (cf. Ballin forthcoming a).

Burins have traditionally been perceived as a Mesolithic type, but analysis of pre-Neolithic assemblages has shown that, although they occur in Mesolithic contexts, they are considerably more common in Upper Palaeolithic contexts (e.g. Ballin et al. 2010; forthcoming). The site's three burins (CAT 3, 601, 1134) are therefore only indicative of one or more visits to the site in pre-Neolithic times. However, given the other available evidence (raw material, microliths, *mèches de foret*), they are more likely to be Mesolithic than not.

Two fragmented arrowheads were recovered from the location. One (CAT 1564) is identifiable as a Sutton B barbed-and-tanged arrowhead, and as such datable to the Early Bronze Age period in general (Green 1980, 129), whereas the other one (CAT 1561) is less typologically certain. It may be the tip of a leaf-shaped arrowhead, and as such it is datable to the Early Neolithic period (Green 1980, 82). This is further supported by the fact that it may be based on Cumbrian tuff.

One piece with semi-invasive retouch (CAT 1540) is based on flint, and although the piece has been exposed to fire, it is almost certain that the raw material is grey Yorkshire flint. The colour of the piece suggests that it dates to the Middle Neolithic rather than the Late Neolithic (see above). In general, invasive retouch was in use from the beginning of the Early Neolithic period (Butler 2005, 119), and it disappeared before the beginning of the later Bronze Age (Clark 1936, 47).

General distribution

A total of 83 lithic artefacts were recovered during the initial fieldwalking, whereas 789 pieces were found during the test pitting, and 687 during the excavation of the trenches. The only trenches from which significant numbers of lithic artefacts were recovered are Trenches 3 (400 pieces), 4 (117 pieces) and 5 (123 pieces).

	Test Pits										Trenches						Sur-face	Un-strat.	Total
	A	B	C	D	G	H	I	Js	Jn	K	1	2	3	4	5	6			
Debitage																			
Chips	321	1	1	12		3	10	20	18	1	2	2	84	15	36		8		534
Flakes	155	6	6	10		4	6	9	32		5	12	166	57	39		32	2	541
Blades	17			1		2	2	4	6		2	1	31	13	11		10		100
Microblades	34		2	4		1		5	3		3	1	22	5	11		2		93
Indeterminate pieces	25				1	2	2	2	4		4	5	27	6	6		11		95
Crested pieces	8			1		1		1			1		13	3	3				31
Platform rejuvenation flakes	2												6		1		2		11
Total debitage	562	7	9	28	1	13	20	41	63	1	17	21	349	99	107		65	2	1,405
Cores																			
Split/flaked pebbles				1							1	1					1		4
Core rough-outs	1												1						2
Single-platform cores	3							2					12	3	1		3		24
Handle-cores	1																		1
Opposed-platform cores			2			1							3	1					7
Cores w 2 platfs at an angle	1					1													2
Levallois-like cores													1						1
Other discoidal cores													1	1					2
Irregular cores	2											1	6		2		3		14
Core fragments	1			1									1	1					4
Bipolar cores								1							1		1		3
Total cores	9		2	2		2		3			1	2	25	6	4		8		64
Tools																			
Microlith preforms																	1		1
Scalene triangles	3							1				1	3	2	1		1		12
Crescents															1				1
Edge-blunted pieces													1						1
Backed bladelet													1	1	1				3
Truncated bladelets											1		1	1					3
Frag. of microliths	2														1				3
Frag. of microlith or backed bladelet	2	1							1				2	1	2				9
Microburins	1																1		2
Barbed and tanged arrowheads															1				1
Bifacial arrowheads														1					1
Short end-scraper	2								1				3	1		1	2		10
Double-scrapers													1						1
Side-scrapers													1						1
Burins	1			1									1						3
Piercers													1						1
Meche de foret									1						1				2
Backed knives													1						1
Truncated pieces									1									1	2
Notched pieces														1					1
Denticulated pieces	1																1		2
Pieces w edge-retouch	4								2		3		10	4	5		3		31
Pieces/frags with invasive retouch																	1		1
Total tools	16	1		1				1	6		4	1	26	12	13	1	10	1	93
TOTAL	587	8	11	32	1	15	20	45	69	1	22	24	400	117	123	1	83	3	1,562
Of which pitchstone									1		2				2			1	6
Of which jet													3						3
Of which Yorkshire flint													5		1		1		7

Table 11: The distribution of lithic artefacts across all test pits and trenches.

The *Early Mesolithic* microlith preform was recovered during fieldwalking, well north of the site's main lithic scatter (E58/N236); *Late Mesolithic* diagnostic pieces were recovered throughout the site; *Early Neolithic* pieces (pitchstone and bifacial arrowhead CAT 1561) were retrieved from Trenches 2, 4 and 5 as well as TP J north; *Middle/Late Neolithic* artefacts (grey/dark-brown Yorkshire flint and Levallois-like core CAT 1478) were found in Trenches 3 and 5; and artefacts datable to the Middle/Late Neolithic or Early Bronze Age periods (jet and barbed-and-tanged arrowhead CAT 1564) were found in Trenches 3 and 5.

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