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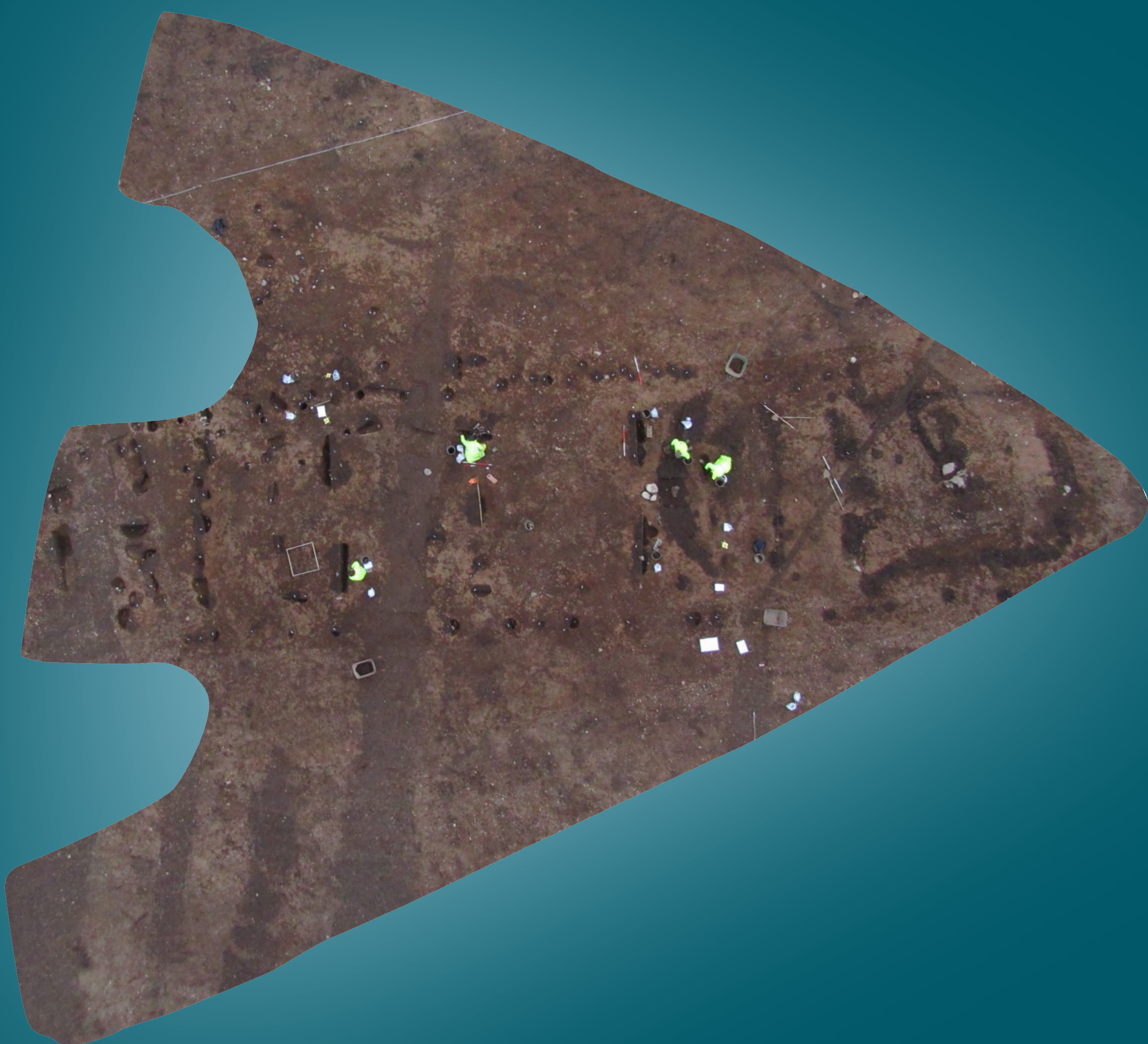

ARO60: Neolithic timber halls and a Bronze Age settlement with hoard at Carnoustie, Angus

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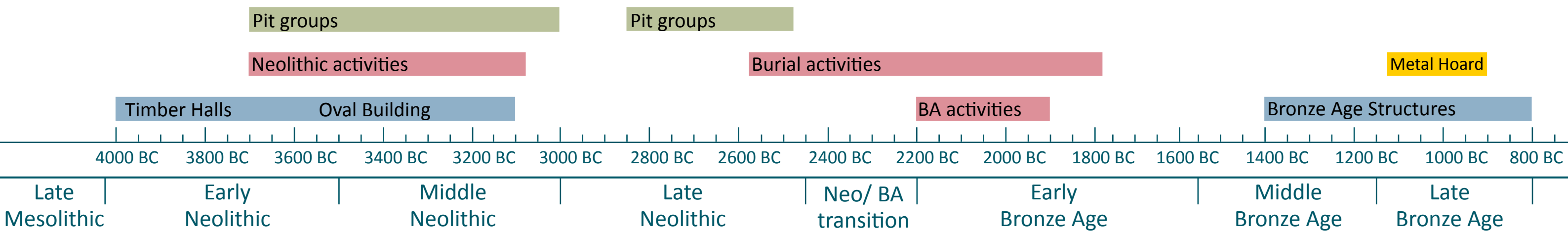

Summary

The Carnoustie excavation produced exceptional results. Traces of the longest early Neolithic timber hall in Scotland was discovered there beneath the topsoil alongside the remains of another large hall and which was replaced by a smaller hall. In addition, a rare and well-preserved late Bronze Age metalwork hoard of a sword, spearhead with gold decoration and a long pin were found wrapped in the remains of textile and sheep-skin and buried in a pit within the midst of a late Bronze Age settlement.

The first evidence of human activity on the site was organic and flint tool-making debris was left behind at temporary encampments by Mesolithic hunters and gatherers from the mid-seventh to the end of the fifth millennia BC.

This was followed near the beginning of the fourth millennium BC by the construction of the largest as-yet known timber hall of the early Neolithic in Scotland. This was a permanent structure built of oak with opposed doorways near one end of the building. Its large roof was supported by paired massive timber posts. Its walls were wattle and daub panels supported by posts that were partly protected by its over-hanging roof. This monumental building was planned and designed using marker pits for its layout and the divisions of space within it. Deposition of pitchstone and other stone artefacts in some of the postholes and pits for the building timbers represents the beliefs and rituals of the community that built it, perhaps one of the very first groups of farmers to colonise Scotland.

Built at roughly the same time was a smaller but companion timber hall. The timbers of the west wall of this building had to be reinforced and replaced but its large hearth with the remains of cereal grain and hazel nutshells suggested it had a more domestic function than the large hall. Both halls may have been used for seasonal festivities and community gatherings.

At some stage the large timber hall was replaced by a smaller hall built inside its footprint at the south-west end. Other contemporary timber halls in Scotland, when they had come to the end of their useful life, were burnt down, but at Carnoustie there was nothing to suggest this. The smaller hall was deliberately built and positioned so that it took on the beliefs and rituals of the larger hall.

For the first time there were also indications that people were using the spaces outside the hall, for short-lived visits to the site.

Later in the Neolithic, from c. 3500 to 3000 BC, people used the site for temporary shelters that they returned to time and time again. However, there were indications that some people also used the sites of the old halls for dwellings, such as the construction of a small oval building over part of the subsidiary hall. Another temporary dwelling of a hearth and postholes was also situated over part of the large timber hall. During this time fewer and fewer people returned to the site and at some stage the area was abandoned. A variety of factors could have been involved, including soil exhaustion from slash-and-burn agriculture and the lack of a woodland cover.

After this period of abandonment, the site was next occupied in the early Bronze Age from c. 2400 BC for a small number of isolated burials, the main evidence being the remains of pottery vessels associated with burial rituals. An early dated Beaker was discovered in a possible burial pit, and a burial with an urn had a barrow or mound of soil heaped over it with a shallow ditch around it in the north-eastern part of the site.

The erection of a permanent oval-shaped dwelling indicated the return of people in the middle and later Bronze Age to live and farm on the area. A single house with perhaps an ancillary building were replaced three or more times on new plots over the following centuries until around 800 BC. The later roundhouses each had a central ring of posts that held up their conical roofs and were enclosed within exterior walls comprised of wattle and daub panels.

The best preserved of these Bronze Age roundhouses was positioned over part of the foundations of the large timber hall. Like the other buildings it had an entrance facing south-east and during the course of its life it was used as a domestic dwelling, a workshop and also a byre. The overwintering and stalling of domestic livestock within the buildings of this period seem to have been a common occurrence. Behind this building, and between it and another larger roundhouse to its north, a hoard of precious metal objects was deliberately buried sometime between 1118 – 924 cal BC.

The objects include a bronze sword within its wooden scabbard, a bronze spearhead with a gold decorative band around its socket and a bronze sunflower-headed swan's neck pin. They were wrapped in woollen cloth and a sheepskin.

These, together with a shale bangle found in the roundhouse, indicate that its occupants were wealthy and had some status in the wider community. Hoards such as this are rare, but a similar collection of slightly later dated metalwork was found at Pyotdykes north of Dundee. The occurrence of these deliberate burials of late Bronze Age metalwork in the Tayside region and across Scotland indicates shared cultural practices and the wealth of some late Bronze Age farming communities.

A gap of around 1500 years followed the abandonment of this late Bronze Age settlement until Pictish farming activities are apparent during the early medieval period. Subsequent rig and furrow cultivation had a significant negative effect on the remains of the past. However, what did remain is an exceptional story of prehistoric timber buildings and a metalwork hoard.

Foreword

When Angus Council approved the development of two outdoor football pitches on land at Balmachie Road, Carnoustie, no one imagined the process would reveal one of the most remarkable and internationally significant archaeological discoveries in Scotland. The discovery of land rich in traces of past occupation provided evidence of Britain's largest Neolithic hall, a later Bronze Age settlement of roundhouses and, most surprisingly, a hoard of Bronze Age artefacts buried in haste and lost or forgotten.

The final publication report on the post-excavation analysis presented here, demonstrates the huge amount of work undertaken by GUARD Archaeology Ltd on behalf of Angus Council. The evaluation by Maureen Kilpatrick and subsequent excavation led by Alan Hunter Blair expertly identified previously unknown buried remains in this complex site. Off-site, a programme of analysis and conservation of the hoard has provided a unique insight into the creativity and craftsmanship of the period. Much appreciation goes to the GUARD team for their infectious excitement during engagement with the Carnoustie community. The provision of tours and presentations, work experience for two students who received Archaeology Scotland Heritage Hero Awards, the production of a popular booklet, the production of replica hoard items, and employment for a recently graduated archaeologist, have been of substantial benefit to the local community.

The work presented here confirms the extent of prehistoric features at the site, telling us about changes in settlement activity over time: the palaeo-environmental conditions, land use, economy and diet of the people on this site during the prehistoric period. Many current residents in the area may not have imagined life during this period of history, right on their doorstep! The wealth of discoveries at this site has provided an invaluable opportunity to learn more about how people in Angus lived in the Neolithic and Bronze Age.

The Bronze Age metal hoard discovered during the removal of topsoil is incredible and significant, both nationally and internationally, and provides a very rare example of the survival of late Bronze Age organic items. The wooden scabbard, sheepskin wrapper and woven textiles do not usually survive. The delicate gold decoration on the spearhead is one of only five examples of spearheads adorned with gold binding in the British Isles, and the survival of a pommel is also very rare.

The hoard gives us the indication that the owner would have been a wealthy and important member of the community and it is fitting that these wonderful artefacts represent a tangible link to Carnoustie's past.

Angus Council is delighted to have played its part in uncovering this fantastic link to our past and look forward to ANGUSalive's Museum Team securely and engagingly displaying the hoard, on loan from the National Museum of Scotland through an exhibition of the hoard at Carnoustie Library.

Margo Williamson

Chief Executive Angus Council

Angus Council
Comhairle Aonghais

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Part 1: The Background to the Project

By Warren Bailie, Alan Hunter Blair and Beverley Ballin Smith

Introduction

An archaeological excavation was carried out by GUARD Archaeology Ltd across an area of ground off David Moyes Road, on the edge of Carnoustie. This archaeological work was undertaken on behalf of Angus Council ahead of their construction of two football pitches on the site. The fieldwork was undertaken between 5 September 2016 and 17 February 2017 following a preliminary archaeological evaluation of the site by GUARD Archaeology in August 2016 when several groups of pits containing prehistoric pottery were unearthed (Kilpatrick 2016). The aim of the initial investigative fieldwork was to ascertain whether archaeological features survived beneath the topsoil. A total area amounting to 1.77 hectares was stripped of topsoil to determine the full extent of archaeological remains here. The work was agreed with the Aberdeenshire Council Archaeology Service acting as archaeological advisors to Angus Council and who had stipulated the necessity for an archaeological investigation.

Site location, topography and geology

The site chosen for the construction of two football pitches was situated to the immediate north of Carnoustie High School, on the northern outskirts of the town, and on the gently sloping area of a post-glacial raised beach (Figure 1.1). The 2.83 hectares site was centred on NGR: NO 5557 3521 at an elevation of between 28 and 32 m OD, which may once have had a commanding view across the coastline, now approximately 1.2 km away, and out to the North Sea. In earlier times this view was unobstructed except for native trees that probably grew there, but the expansion of Carnoustie northwards has reduced the impact of the landscape panorama from the site. The southern and western aspects of the site are also important as they provided uninterrupted maximum sunlight and daylight hours for activities situated there during prehistory. Prior to the development, the site was a green field site of open arable land, which was fallow at the time of the archaeological investigations.

From its northern boundary, which was relatively flat, the site sloped gently towards the southern limit of the development area. The whole south-western side of the site was a relatively steep natural bank that dropped to the level of Shanwell Road. The south-eastern side of the site was also a gentle slope to the present-day road level, but its edge had been cut back and truncated by the formation of David Moyes Road and modern housing to its east. Much of the land to the west, north and north-east of the site is currently used for arable farming, with Clayholes Farm lying just north of the development area.

The archaeological features were located towards and along the south-western and south-eastern portions of the site where there were open views across the landscape once woodland had been removed. In prehistory more distant boundaries to the site included the stream beds of the Lochty Burn flowing from the north-east, some 400 m away, and the Barry Burn (1.2-2 km away) that snaked around from the west to flow into the sea in the south.

The raised beach - the Main Postglacial Raised Beach - is a widely recognised geological feature extending from Stirling to Fraserburgh (Price 1983, 160), and was probably formed by an ice margin that retreated to the west (Cameron and Stephenson 1985, 140). At Carnoustie it comprises sandstone of the Scone Sandstone Formation (Devonian), formed 407 to 416 million

Figure 1.1: Location plan with contours.

years ago capped by fluvioglacial till in the north of the site, deposited during the last Ice Age (Quaternary) and raised marine deposits in the south (British Geological Survey Map Viewer 2025). During the archaeological fieldwork, the subsoil was observed as orange/brown sand and gravels with occasional larger stones and cobbles. These fluvioglacial till deposits, represent outwash deposits from the Highland glens (MacGregor 1996).

The site demonstrated its marine origin with a band of clay along its south-western side, and with sandy clay along its eastern boundary. The occasional occurrence of blocks of grey sandstone in the till was noted and these are likely to have derived from Lower Devonian outcrops along the coast northward or from the River Tay estuary (Cameron and Stevenson 1985, 18-21). Metamorphic quartzite cobbles were also found on the site probably derived from rivers coming down from the highland region, or were the result of glacial activity. In either case these cobbles were likely to have been deposited on the local beaches (ibid and pers. comm. Torben Ballin). They were an important resource that was used by the site's prehistoric peoples.

The soils that developed on the raised beach were sufficiently attractive for the earliest settlers on the site to use them for agricultural and settlement purposes, once clearings had been made in the native woodland (see PART 6). The modern-day land capability assessment for the soils to support arable agriculture in this part of Angus are Class 1 to 3.1, which are often considered to be *prime agricultural land*, and 'capable of being used to produce a wide range of crops. The climate is favourable, slopes are no greater than 7 degrees and the soils are at least 0.45 m deep and are imperfectly drained at worst' (James Hutton Institute).

The natural vegetation at the time of the initial prehistoric settlement was dominated by oak woodland with hazel and alder in wetter areas (Tipping 2003, 22, 23 and 25; see PARTS 4: *Archaeobotany* and 6: *Discussion*). However, the attributes of the site and the availability of nearby resources were extremely favourable for the development of settlement from the early Neolithic – during the first half of the fourth millennium BC.

Archaeological background

Prior to the investigation, there were no reports of archaeological discoveries within the boundaries of the development area. An archaeological evaluation had been undertaken by AOC Archaeology Group at the site of Carnoustie High School prior to the demolition of the old building and the construction of the new, but no prehistoric archaeological features were found there (Wilson 2006, 23).

There are, however, a number of known sites in the immediate vicinity, which have been investigated through archaeological evaluation and excavation over the last decade or so. The most relevant of these is the cropmark site at Clayholes (Angus Historic Environment Record (HER) - NO53NE0006), which lay immediately east of the development area (Figure 1.1). It was highlighted by aerial photography carried out by the RCAHMS (now Historic Environment Scotland) in 1983. The investigation of this area by CFA Archaeology in 2004 revealed use of the site in prehistory with 97 pits and part of a D-shaped enclosure. There were also agricultural features of medieval and post-medieval date (Suddaby and White 2004, 19; Suddaby and Anderson 2009).

Another area of similar cropmarks had been noted to the south-west of the Carnoustie site in the Shanwell area (NO53NW0029), which defines a wider area of interest around the Pitskelly scheduled monument (SM 6608). The cropmarks included hut circles with an adjacent rectilinear enclosure. Investigation by AOC Ltd of part of Upper Victoria, Pitskelly, in 2019 revealed a Neolithic pit, remains of probably Bronze Age roundhouses, a ring ditch, and an early Bronze Age cist cemetery with burials, and grave goods including copper alloy blades (NO53NW100). Further cropmarks of a probable prehistoric date are noted to the north, beyond Clayholes Farm (NO53NE0062). In addition to the areas of known cropmarks, other archaeological investigations have taken place to the south of Carnoustie High School (NO53NE0062) and at Woodlands (NO53NE0119), both of which revealed no significant archaeological features. A mid-nineteenth century cottage (NO53NE0103) was noted but no longer exists on the western periphery of the development.

The evidence from the cropmarks and known archaeological features in proximity to the site, and in the wider landscape, indicate that this area is rich in prehistoric activity. However, minor elements of medieval and post-medieval activity also survive as revealed in 2004 on adjacent land.

In 2017 and 2018, investigation immediately east of the site revealed a total of 23 archaeological features during evaluation and monitoring works (NO53NE0147). These included a mixture of postholes/stakeholes and pits, some possibly indicating a rectangular structure, and sherds from two Bronze Age vessels were recovered. The activity was dated to the middle Bronze Age and also to the late Bronze Age and early Iron Age.

Origins of the excavation

The positive results of the archaeological evaluation in advance of development of the two football pitches in 2016, led to the requirement for a larger scale excavation that began in autumn 2016. This work revealed an intensive area of prehistoric activity in the southern and eastern parts of the site. The archaeologists encountered many darker coloured features dug into the orangey/brown subsoil. These were predominantly pits, postholes and some deposits, many of which contained sherds of prehistoric pottery and lithic artefacts from the early Neolithic period and into the Bronze Age. During the controlled stripping of the topsoil, the extent of prehistoric archaeology was revealed, which expanded in every direction and up to and beyond the limits of the development area to the north, south, east and west (Figure 1.2).

Figure 1.2: Overall site plan with all features.

Aims and objectives

By Warren Bailie

Fieldwork aims

The main aim of the monitored topsoil strip and archaeological excavation was to establish the extent of the prehistoric features identified during the evaluation phase of the work and identify any other previously unknown buried remains within the development area, which were subsequently excavated and recorded. An archaeologically sterile buffer c. 10-20 m wide was required around the limit of any archaeological features uncovered, and those archaeological features uncovered within the stripped area prior to the development proceeding were to be excavated and recorded.

Post-excavation aims

A post-excavation research design was produced by GUARD Archaeology Ltd on behalf of Angus Council on completion of the fieldwork. This Research Design set out a programme of specialist analyses leading to the publication of the results, with archiving of the records of the investigative work and legal disposal of the finds through the Treasure Trove process. In addition to the specialists' analyses for the main excavation material (archaeological and palaeo-environmental) there was in addition a discovery of a deposit that contained Bronze Age metal work, including a sword, spear and other associated items (see *Part 6 The late Bronze Age metal hoard*). Due to the rare survival and sensitivity of these remains, in particular the surviving organic elements, an urgent post-excavation conservation programme was carried out by GUARD Archaeology for Angus Council in January 2017.

The main objective of the post-excavation strategy was to extract the fullest possible extent of information relating to the archaeological features and finds, and to publish the results in a suitable academic format. By this means a permanent record was created of the archaeological features and discoveries encountered during the investigations on the site, which is in the public domain.

Methodologies used

Fieldwork

A total area amounting to 1.77 hectares was stripped of its topsoil to establish the extent of archaeological features within the development area by determining an archaeologically sterile buffer. Topsoil was removed in spits to the first archaeological horizon, or failing that, to the natural subsoil. Archaeological features were cleaned by hand by archaeologists to determine their character and extent.

All of the archaeological features were half (50%) excavated as a minimum, in order to determine their significance, date and function, while occupation deposits and features containing finds were fully (100%) excavated. A single context recording system was employed to record all excavated features and their sections, by pro-forma sheets, drawings and photographs. All archaeological features were photographed, and recorded in plan and by section at scales of 1:20 and 1:10 respectively. They were also accurately surveyed using a sub-cm GPS and located within the National Grid. Overhead images were taken using a digital camera on a telescopic arm and kite camera.

The occupation layers within Structures 5, 10 and 12 were excavated in a grid of 1 m squares, and Kubiena tin samples were collected from within Structures 1, 7 and 10 for analysis of formation and depositional processes.

All archaeological finds were retrieved by hand by the on-site archaeologists but significant small finds were three dimensionally located prior to collection, bagging and labelling. Where large quantities of pottery, potentially representing parts of whole pots were uncovered, these were left in situ and lifted in a block of soil for more detailed and appropriate excavation. Significant in situ artefacts, such as the metalwork hoard were also lifted in a block of soil to facilitate excavation under laboratory conditions. Bulk soil samples were taken from all excavated fills of features and deposits for palaeo-environmental evidence, and animal bone was collected as bulk samples by context. All the finds were processed to MAP2 type standards and subject to appropriate specialist assessment. The conservation requirement of finds was also appraised to allow for specialist study.

Aberdeenshire Council Archaeology Service was the final arbitrator of significance regarding any findings and insisted on full excavation of particular features that would be destroyed by the development. All elements of the fieldwork and subsequent post-excavation work were undertaken in line with the standards and guidance of the Chartered Institute for Archaeologists of which GUARD Archaeology Ltd is a Registered Organisation. The backfilling of the stripped area was not undertaken after completion of the excavation.

Post-excavation

All artefacts required processing: cleaning, cataloguing, re-bagging and quantification of the specific assemblages. The environmental samples required varying degrees of processing dependant on the specialist analysis they were submitted to. The processing involved dry-sieving, wet-sieving, flotation, sub-sampling and preparation for transportation to the various specialists. During the environmental processing, the small finds that were not immediately apparent during excavation were recovered, and these were also processed and catalogued. The kubiena and bulk samples that were collected from features and deposits on site provided an opportunity for environmental analyses of the settlement and its wider landscape through the identification of diagnostic waste material (plant and animal species).

Carbonised samples from appropriate contexts were used for radiocarbon dating (AMS dates) in order to interpret the development, length of use, and demise of prehistoric settlement and related activities. The scientific analyses of all these remains and samples illustrate the activities and economy of the people who settled at the site, and form the latter sections of this volume.

Archives and finds disposal

On completion of all post-excavation analyses and the production of the publication manuscript, the fieldwork records were prepared to the required standard and submitted to the archive of the National Record of the Historic Environment, administered by Historic Environment Scotland. The artefacts have been reported to the Treasure Trove Unit, and been duly allocated and delivered to National Museums Scotland.

The main research questions of the project

The Scottish Archaeological Research Framework and the North-East Scotland Regional Archaeological Research Framework, along with the Aberdeenshire Council Archaeology Service were consulted in the preparation of the main research questions:

Do we have a good understanding of how taphonomic conditions and subsequent land use activities have affected the survival of artefacts and organic samples on this particular site, and how that affects the results of scientific analysis?

What does this site, and particular the Neolithic and Bronze Age settlement activity, contribute to our understanding of the overall pattern in north-east Scotland of settlement, land use and subsistence activity and how and why does it change?

Are there clearly defined patterns of settlement use on this site, and can they be attributed to distinct periods of prehistory or history?

'Craft activities, especially metalworking, and artefact deposition, should be researched in a wider context of house and landscape architecture…' (Downes 2012; ScARF 5.6, point 8), and how does the context of the Carnoustie hoard contribute to our understanding of artefact deposition in the context of house and landscape architecture?

Can radiocarbon dated samples suggest a chronology between and within structures, and demonstrate changes in settlement over time?

How has the local environment changed over time represented by the deposits sampled, and what changes can be directly related to human intervention and/or natural processes?

What do the various analyses of organic material tell us about the palaeo-environmental conditions, vegetation changes, land use, economy and diet of people on this site during the prehistoric period?

Can the scientific analyses of soils and other organic materials discriminate between specific areas of use in buildings, and between different phases of use?

Through the examination of the objects of material culture can we explain resource procurement, exploitation, and the wider influences that have affected style and design?

Can we sufficiently examine objects of the material culture to gain insight into their economic and social role in the activities and life on the site and in the region?

Can we identify objects or influences from outside the region that affected the activities at the settlements, and how important were those influences?

How does the Bronze Age weapon deposit relate to the settlement activity and other archaeological features, temporally and spatially?

Part 2: The Excavation Results

Alan Hunter Blair and Beverley Ballin Smith

The excavated site produced a complex pattern of activity in the form of pits and postholes across the whole area, but the main concentration was situated towards its south-eastern and southern boundaries. During the fieldwork and the writing of the data structure report, groups of features were identified as structures or groups of pits (Hunter Blair 2017). This initial patterning of features has changed slightly, as our understanding of the buildings and activities has developed after further analysis and investigation during the post-excavation programme.[1] There were clearly identified structures and discrete pit groups, with other areas of activities noted as pits external to buildings, lines of pits/postholes for possible field boundaries, possible burials from artefact analysis, and a large area, probably a field with some trees, which included deposits of refuse from the buildings.

On this site it was exceptionally difficult to distinguish a posthole from a pit, and a pit from a fire-pit, as size and shape were not always determining characteristics. In the following description, most of the fire-pits used for heating and cooking were vertical-walled pits, usually with flat bases. However, others displayed different forms, but the presence of heat-cracked stones or lenses of charcoal in their contents were characteristics that aided identification. Artefacts were often, but not exclusively, found in fire-pits or in larger pits or postholes.

The majority of other pits, which could have been for refuse or single use fire pits, had concave profiles and were often shallower than fire-pits, many had flecks of charcoal identified within them, but evidence of material culture was sparse or largely absent from their contents. Postholes varied widely in size and shape but generally tended to be smaller than pits, unless they were re-dug or received more than one post. Many were dug with vertical shafts and often had charcoal present, but others had wide almost V-shaped profiles, where only the last few millimetres of their bases survived.

The excavation produced a complexity of structures spanning predominantly the early Neolithic and into the later Bronze Age, with other intrusive elements. They are described in detail in the data structure report (forming part of the site archive) and here in chronological order after the brief description of the topsoil.

Topsoil and plough marks

Covering the whole site was a 0.3 m to 0.4 m thick layer of topsoil of sandy loam, mid-brown in colour that increased in depth to c. 1 m towards its sloping southern edge. This accumulation may be the product of natural soil creep and agricultural movement of the soil from the northern end of the site southwards, in spite of the gentle contours.

The orange/brown coloured subsoil of sand and gravel, with occasional stones and cobbles, and with bands of clay and sandy clay also present, is as described in Part 1: *The landscape setting*. Ceramic and rubble drains had been laid across site in recent times, but in the southern and eastern areas, where prehistoric activity was concentrated they cut through many archaeological features. Areas of disturbance, usually by drains and by animal borrowing, were noted in some of the structural remains, usually at important junctions of features.

1 The original name of the features has been kept to allow direct reference to the site archive, although for example, 'Structure' 7 is not a structure and 'Structures', 9, 10 and 12 are groups of pits.

Evidence of rig and furrow cultivation survived extending across the site, in a NW/SE direction most likely originating in the medieval period. The distance between the rigs was between 1 m and 3 m. Their surviving depth was between 50 mm to 190 mm, indicating the loss of height through modern ploughing.

Mesolithic traces

Although there were no features or artefacts specifically identified as Mesolithic, the evidence from the radiocarbon dates (Table 2.1) indicates that organic material from the late Mesolithic period was present on the site from as early as c. 6450 to as late as c.4000 BC. The material that was dated was charcoal, predominantly from alder wood with one sample of hazel wood (see PART 4: *Botanical remains*) and the dates range from the middle of the seventh millennium to the end of the fifth millennium BC.

The dated charcoal came from one pit (507) in Structure 8 and one in 'Structure' 12 (1088). A late Mesolithic date came from a deposit (7103) in Area C in the far north-western corner of the site. Another pit or posthole (5052) at the west end of the southern boundary of the site in Pit Group 16 produced a transitionary date range covering the late Mesolithic/early Neolithic.

The evidence suggests that residual charcoal from Mesolithic activities, possibly from camp fires, was relatively widespread. The interpretation of this material is that it became incorporated within the fills of later features through activities which disturbed the soil or subsoil.

Early Neolithic timber structures

Once the topsoil had been removed from sufficiently large enough areas, two long rectangular structures (Structures 8 and 13), were recognised preserved in the subsoil by the contrasting colours of their pits and postholes (Figure 2.1). However, a major problem with the identification of the timber structures, and of their surviving evidence, was the predominant shallowness of their features. Their pits and postholes were all generally less than 0.3 m in depth and usually averaged barely half of this. The postholes that survived are those that were deepest dug in prehistory, shallower ones and the tops of all features were ploughed away leaving only the bottom few centimetres of features. The picture presented from the field evidence is incomplete, sometimes hard to unravel and interpret, and in some cases it is barely visible.

Structures 8 and 8s

During the interrogation of plans, photographs and written evidence after the fieldwork, it became clear that the Structure 8 building was not as simple as it appeared in plan on the site, and its south-western portion was unusually populated with features that did not correspond with those in the rest of the building. A smaller structure (also Structure 8s) was identified as nestling within the outline of the larger building (Figure 2.2). In this description, the buildings are separated, but the relationship between them remains important.

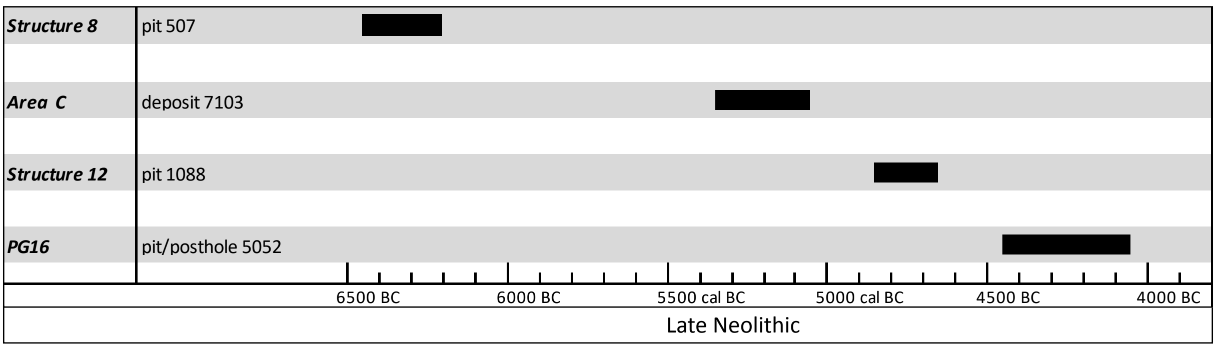

Table 2.1: Features with Mesolithic date ranges.

Figure 2.1: Location of early Neolithic structures.

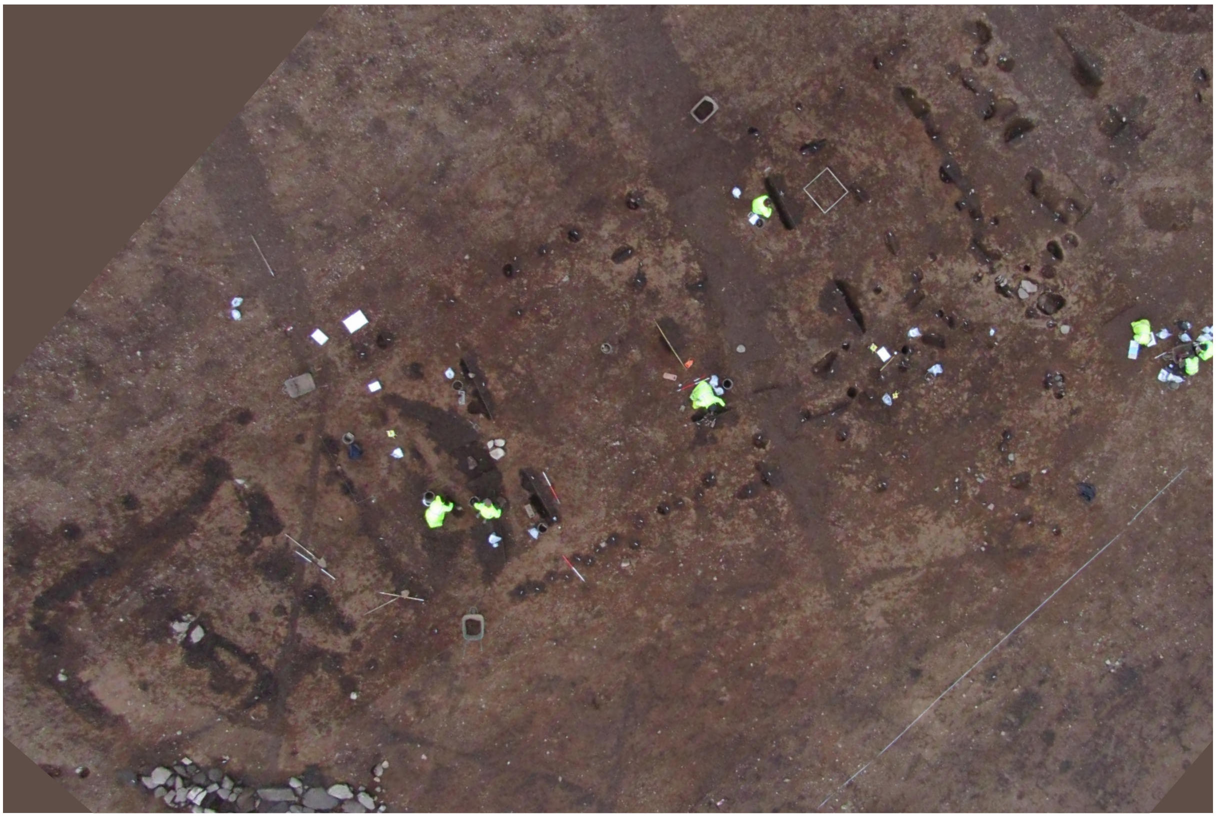

Figure 2.2: Structure 8 large hall, aerial view, with the smaller hall within its footprint to the left.

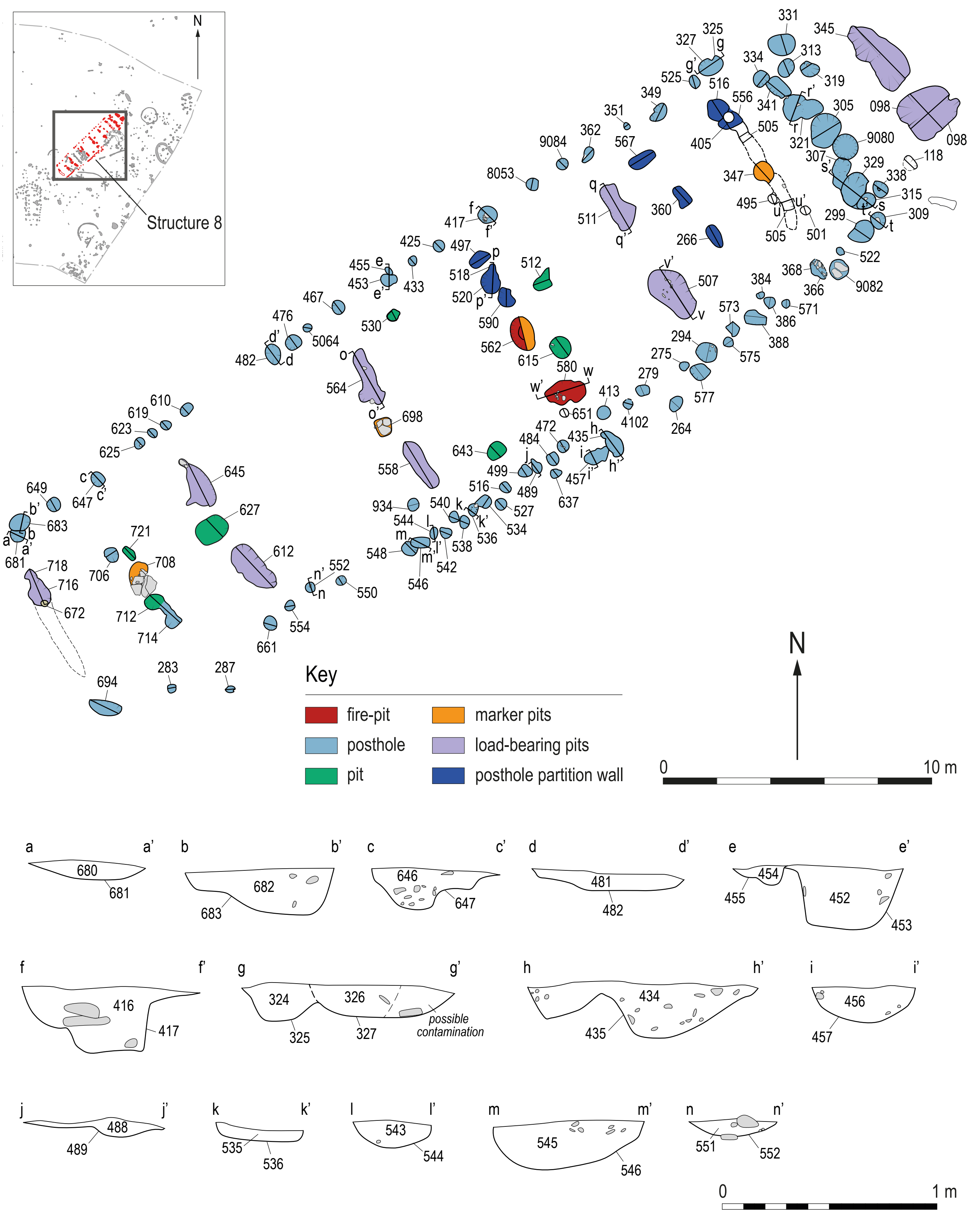

Figure 2.3: Structure 8 large timber hall with section drawings through postholes and pits of the long walls.

Structure 8 - the long timber hall

The large timber building was located towards the eastern side of the site along the 29.5 m OD contour and with a NE/SW orientation. It was the largest structure within the excavated area and its plan was rectangular with slightly rounded gables. It had an external length of 35.52 m and a general width of 9.35 m that narrowed to 7.7 m towards its south-west end. The building outline was defined by postholes forming its ends and its two long walls, and its internal space was sub-divided by rare massive postholes, and smaller ones, and also narrow channels marking perpendicular partitions placed between the longitudinal walls (Figure 2.3). It was heavily disturbed at its north-east end by a later building, Structure 5 (see below).

Internal divisions – partitions and roof supports

There were three sets of roof supports and three recognisable partitions within the building aligned between the long walls, comprising pits and narrow gullies, but not all appeared to be contemporary with the construction of the walls. Others may have been later sub-divisions or part of the smaller timber building constructed between its walls to the south-west. They are described from the north-east to the south-west (Figure 2.3).

Figure 2.4: Structure 8 central pit 347 in the middle of Partition 1 in the large timber hall.

The first - the *inner gable partition* was placed c. 1.8 m in front of the north-east gable wall and comprised a linear shallow channel (7.15 m long by 0.56 m wide and 0.27 m deep), with a post-setting at its north-western end, one in the middle (Figure 2.4) and one at the south-east end (complicated by the later inserted Structure 5, see below). However, there did not seem to be a passage through it. The end posts of the partition were positioned slightly away from the long walls and this mirrored the placement of the internal partition in front of the gable in Structure 13 (see below). Sherds of pottery and lithic artefacts were found in most of the partition fills.

The second possible *partition* was located 2.6 m further into the structure. Three oval postholes were situated 1.2 m apart, across the building. The largest was c.1 m long and up to 0.5 m wide: the other two were slightly smaller and all three were shallow. A fourth posthole towards the south-east may have been removed by a later building, as the partition may have had a central gap within it with two postholes to either side. This partition might have been a later division or a remodelling of the interior space of the building, or a later intrusion, given that the next set of timbers was load-bearing,

The first pair of roof supports (*Load-bearing pits 1*) comprised two large sub-oval pits located 1.5 m to the south-west of the previous internal division. The pits were positioned equidistant from the building walls with a gap of c. 2 m between them. Each was c. 2 m long and averaged c. 1.3 m in width. In contrast to the previously described partition postholes, these were substantially deeper at 0.56 m, indicating that they would have contained timbers large enough to support the roof. The fills of both pits were varied, with pale silty-sand, small stones, charcoal and lenses of redeposited subsoil. Both contained early Neolithic lithic artefacts and pottery sherds (Figure 2.5).

Located just north-east of the centre of the building and halfway between the first and second pair of roof supports, was the third internal *partition*. In the centre of building was a small deposit of sand and charcoal identified as the base of a hearth or fire-pit (562), which it is argued in Part 7: *Discussion* was part of the initial foundations of the building. To either side of it was inserted the partition. This feature comprised three postholes of 0.50 m to 0.87 m diameter towards the north-west wall of the building, with one smaller one near the south-east wall. A small additional posthole towards its north-west end may have indicated the requirement for an additional support there. Most of its postholes were less than 20 mm deep with one (590), closest to the centre of the building, being almost twice as deep at 0.35 m. The positioning of the partition relative to the fire-pit suggests that the partition was a later alteration within the internal space of the building. It in turn was later truncated by the insertion of another hearth (580) at its south-east end which was deep and contained fire-cracked stones in its fill.

The position of these two fire-pits in the centre of the building is significant. They were both c. 1.5 m long and c. 1 m wide and contained charcoal as well as stones. With the lack of occupation deposits and the shallow stratigraphy, these two features are the only ones that indicate use of the building.

Approximately 4 m further to the south-west, were another two large sub-rectangular pits positioned equidistantly from the building walls with a 2 m gap between them, identified as the second pair of roof supports (*Load-bearing pits 2*). The distance between the two sets of load-bearing timbers was c. 13 m. These pits were up to 2 m long by 0.66 m wide and their maximum depth was 0.43 m. As well as the presence of early Neolithic pottery sherds and lithic artefacts, both contained charcoal in their fills, but one had the addition of small stones. These pits were partners to the roof supports described above, with their significant location within the building, their size and depth, and the fact that they each could have contained a substantial load-bearing timber (Figure 2.5).

The identification of further partitions for this building has been complicated by the location of the smaller timber structure (Structure 8s) at its south-west end, but also by considerable animal burrowing. However, another pair of sub-rectangular pits was identified c. 9 m further to the south-west (*Load-bearing pits 3*). The length of these pits averaged c. 2 m, their width was up to 0.87 m and their depth was similar at 0.47 m.

Exterior construction

The north-western long wall of the structure comprised at least 23 postholes arranged in an approximately straight line. Their diameters measured on average 0.46 m and they were shallow, surviving only 0.13 m to 0.3 m deep (Figure 2.3). There was no regularity of posthole placement, as the features were anything from 0.19 m to 1.66 m apart, which probably indicates

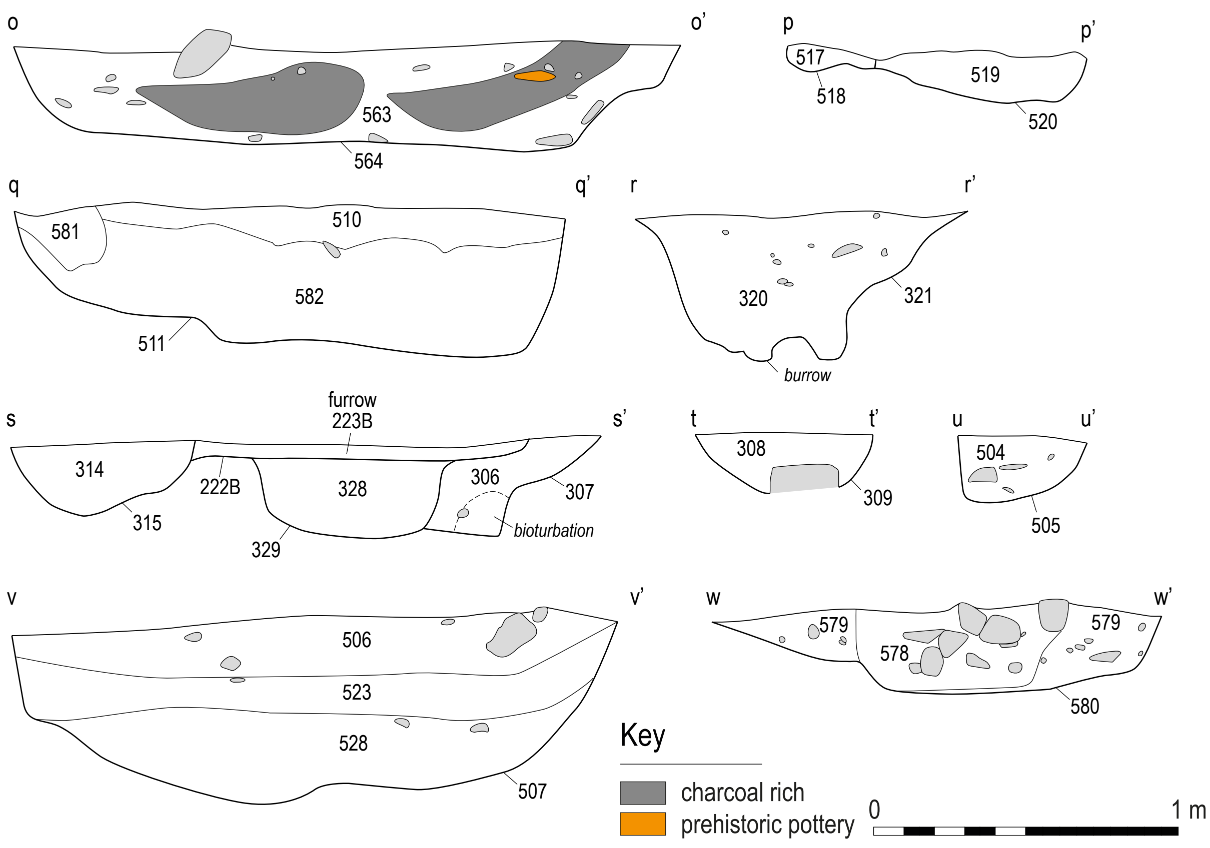

Figure 2.5: Structure 8 sections through loadbearing pits and other features.

renewal of posts and insertion of supports. These postholes were filled by dark grey/brown sandy-silt with some charcoal, and some of them had received stone packing such as (471) (Figure 2.6). A 3.35 m wide gap was noted in the wall towards its south-western end, possibly indicating a doorway, and it seemed to be matched in the south-east wall by a similar opening 2.38 m wide, but this area was complicated by the later insertion of the smaller Structure 8s timber building (Figure 2.7).

Figure 2.6: Structure 8 north-west wall posthole 417 in the large timber hall.

The south-east wall appeared much more complex than that of the north-west because of the greater number of postholes with a more irregular distribution along its alignment, and their varied diameters (from 0.33 m to 0.85 m) (Figure 2.3). Additional complications included the intrusion of a later building at its north-eastern end (Structure 5, see below), a number of closely positioned double postholes and pits in the middle due to repair or replacement, and a paucity of postholes towards the south-west end where the shallow depths of those that survived, in some cases only 90 mm, indicate that some had been lost to the plough (Figure 2.8). Sherds of early Neolithic pottery and lithic artefacts were found in some of the postholes, indicating contemporary activities in the middle section of the building, intrusive activities in the north-east and possibly contamination from later activities in the south-west.

Figure 2.7: Structure 8 west wall (to left) and internal features of the large timber hall, facing north.

Figure 2.8: Structure 8 east wall (to right) of the long timber hall, facing north.

The south-western gable end of the building was narrow and indistinct. Removal of evidence by ploughing, the presence of the small timber building (Structure 8s), and by the near intrusion of the later Structure 4, suggests that its original outline had been lost. It is doubtful that the walls of the building continued further, implying that the end of the small timber building marked the south-western gable of the longer structure. The deeper gable trench at this end of the building, although probably re-dug when the small building was inserted, suggested that further load-bearing pits had been positioned there (*Load-bearing pits 4*) (Figure 2.3).

The patterning of features at the north-east gable end of the building was not entirely clear, but they consisted of larger, deeper postholes than those of the walls, of 0.66 m to 1.35 m in diameter and up 0.66 m in depth (Figures 2.9). The intercutting of many of them indicated alteration to the building, or its disturbance by the insertion of the later Bronze Age roundhouse (Structure 5) to the east and activities associated with it. Some Bronze Age pottery and Neolithic lithic artefacts were found within the fills of a few of the postholes, perhaps suggesting changes in function after the life of the building or disturbance. Located c. 2 m beyond the north-east end of Structure 8, but parallel to it, were two large pits (345 and 098) in excess of 2 m by 1.4 m and over 0.4 m in depth (*Load-bearing pits 5*). A smaller posthole was part of this group (previously Pit Group 4) but it was positioned between the south-easternmost pit and the north-east corner of the gable. Although the north-western-most pit contained sherds of early Neolithic vessels, these features may have been intimately associated with the construction and stability of the building.

Figure 2.9: Structure 8 Pit 321 in the north gable of the large timber hall.

Figure 2.10: Structure 8 location of the marker pit with its artefacts between load-bearing pits 2.

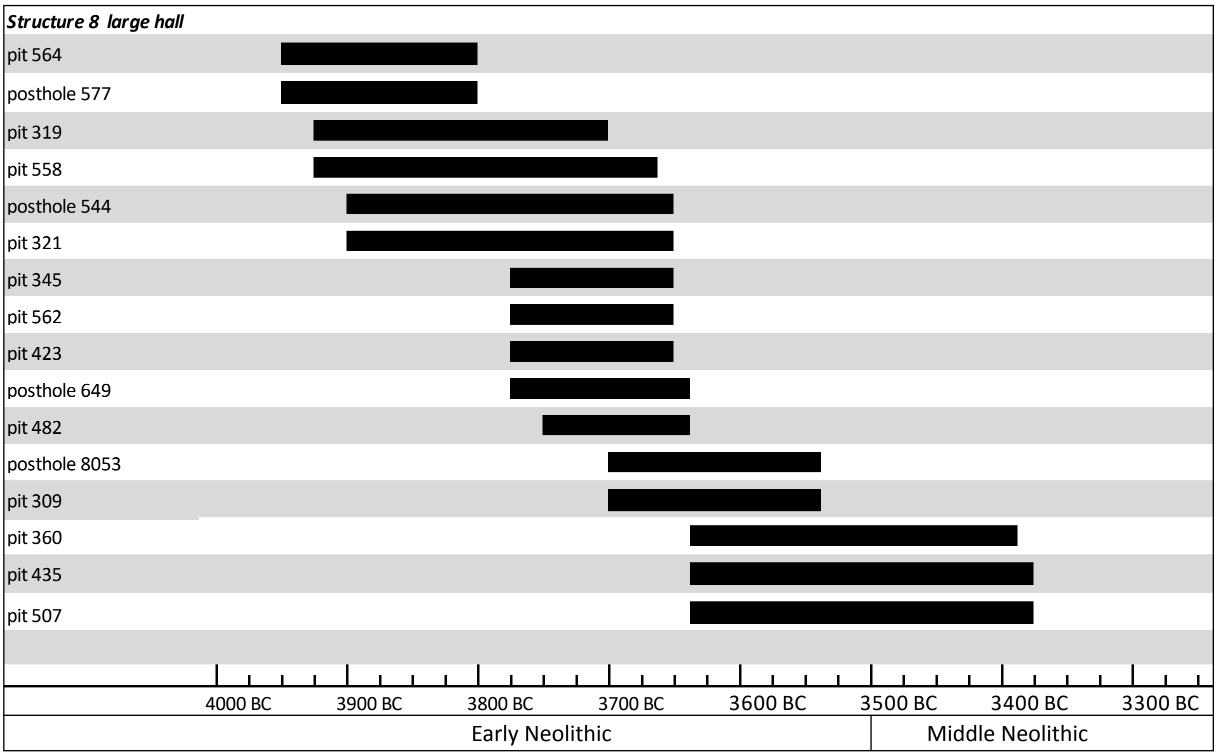

Table 2.2a: Radiocarbon dates from Structure 8.

Other internal features

Apart from the hearths described above and the occasional rare small posthole, which does not fit a pattern, there is only one other feature of significance, a shallow scoop or pit (698) positioned in the centre of the gap between the pits of the second pair of roof supporting timbers. This scoop contained two saddle querns SF 351 and SF 352 and a hone SF 377 (Figure 2.10). The external edge of the curved gable of the small timber building (see below) abutted the feature and its position is therefore significant to both structures. The stones were likely to have been a deliberate placement (see PART 7: *Discussion*).

Radiocarbon dates (Table 2.2a) from pits and postholes indicate the structure was most likely erected somewhere between 3957 and 3793 cal BC. It seems to have remained in used until the end of the early Neolithic, before 3500 BC[2]. The later radiocarbon dates from c. 3642 to 3376 cal. BC indicate middle Neolithic activities, within the building footprint.

2 ScARF - accepted end date for the early Neolithic and the beginning of the middle Neolithic.

Structure 8s - the small timber building

Exterior construction

This small timber structure was c. 14.25 m long by c. 6.5 m wide and was identified as occupying the space between the walls of the larger timber structure at its south-west end (Figure 2.11). The evidence points to this building being later than the large timber hall (Structure 8). The exact relationship between the two buildings is discussed below (see PART 3: *Radiocarbon dates* and PART 7: *Discussion*), but their stratigraphic connection is complex. The meeting point between the two structures encompasses a shallow pit (698) with its deposition of querns and a hone situated near the centre of the exterior arc of the north-east gable-end of the smaller building, and located in the gap between the second pair of load-bearing post-pits of the larger structure. The juxtaposition of these three features may have been intentional (Figure 2.12).

This building had rounded gable ends with straight walls along its south-west half, formed of linear construction trenches and postholes (Figure 2.13). The north-east gable of the structure was identified as a crescent-shaped gully that contained dark brown/black sandy-silt with some larger flat stones. It was 6.9 m long by 1.1 m wide but was shallow at only 0.12 m deep. A lithic artefact and early Neolithic pottery sherds were recovered from its fill along with a small concentration of hearth waste from the bottom of the feature.

Part of the south-west gable was also identified as a curvilinear gully with a flat base that was shorter and narrower than the north-east gable at 2.94 m long by 0.74 m wide. However, it was significantly deeper at 0.56 m (Figure 2.5). Its fill consisted of grey silty/gravelly sand with small stones, and both charcoal and lithic artefacts were present. The gable was extended to meet the north-west wall by two postholes. The largest

Figure 2.11: Structure 8s small hall (darker linear outlines from centre to bottom right) within the larger hall prior to excavation.

had a diameter of c. 0.7 m-0.8 m, but both were shallow, only 0.13 m deep or less. Evidence of the continuation of the gable by the placing of posts to join the south-east wall of the building has been lost.

The south-west half of the building had narrow construction trenches for its wall timbers. The south-east wall was shorter than its north-west partner and consisted of a trench 3.4 m long, 0.4 m wide and only 0.23 m deep with two features at its north-eastern end. One was a posthole that measured 1.5 m by 0.75 m and was 0.36 m deep. The other feature beside it may have been a shallow posthole or pit of dimensions 1.9 m by 1 m. This wall trench was disturbed by animal burrowing and by the insertion of a modern utility (Figure 2.13).

The partner north-west wall construction trench had survived as a more substantial feature. It was 6.58 m long, 0.68 m wide and 0.37 m deep. Its southern terminus was beside the two postholes at the north-west end of the south-west gable, and it ended in two large but shallow postholes 0.8 m in diameter at its north-eastern end. It was less disturbed than the south-east wall gully and two postholes survived that were located within it near its south-west terminus. A 0.80 m by 0.50 m posthole (674) dug at its north-east terminus may have been a contemporary or later feature.

The north-east ends of the two wall trenches with their postholes may imply that opposed entrances in the long walls of the building were located there. Any continuation of walling on either side of the building to the north-east gable is missing. Three small postholes (550, 552 and 554), with diameters less than 0.4 m and depths less than 0.13 m, lay slightly outside the alignment of the south-east wall to the north-east gable. They may have functioned as a porch for the doorway, or they may have been part of the east wall of the long timber hall. A single posthole (668) lying halfway between the end of the north-west wall and the end of the north-east gable, was of similar size to those to the south-east, and may have marked the continuation of walling in this part of the building (Figure 2.13).

Two additional postholes (635 and 934) lay north-east of the termini of the north-east gable gully. Both were c. 0.5 m in diameter and less than 0.25 m in depth. The similarity of size and location relative to the gable end of the building implies that they may have been additional supports for the walls or the roof of the structure.

Figure 2.12: Structure 8s relationship of the NE gable of the small timber hall with the marker pits and load-bearing pits of the larger hall, meeting at the marker pit (with the three white stones).

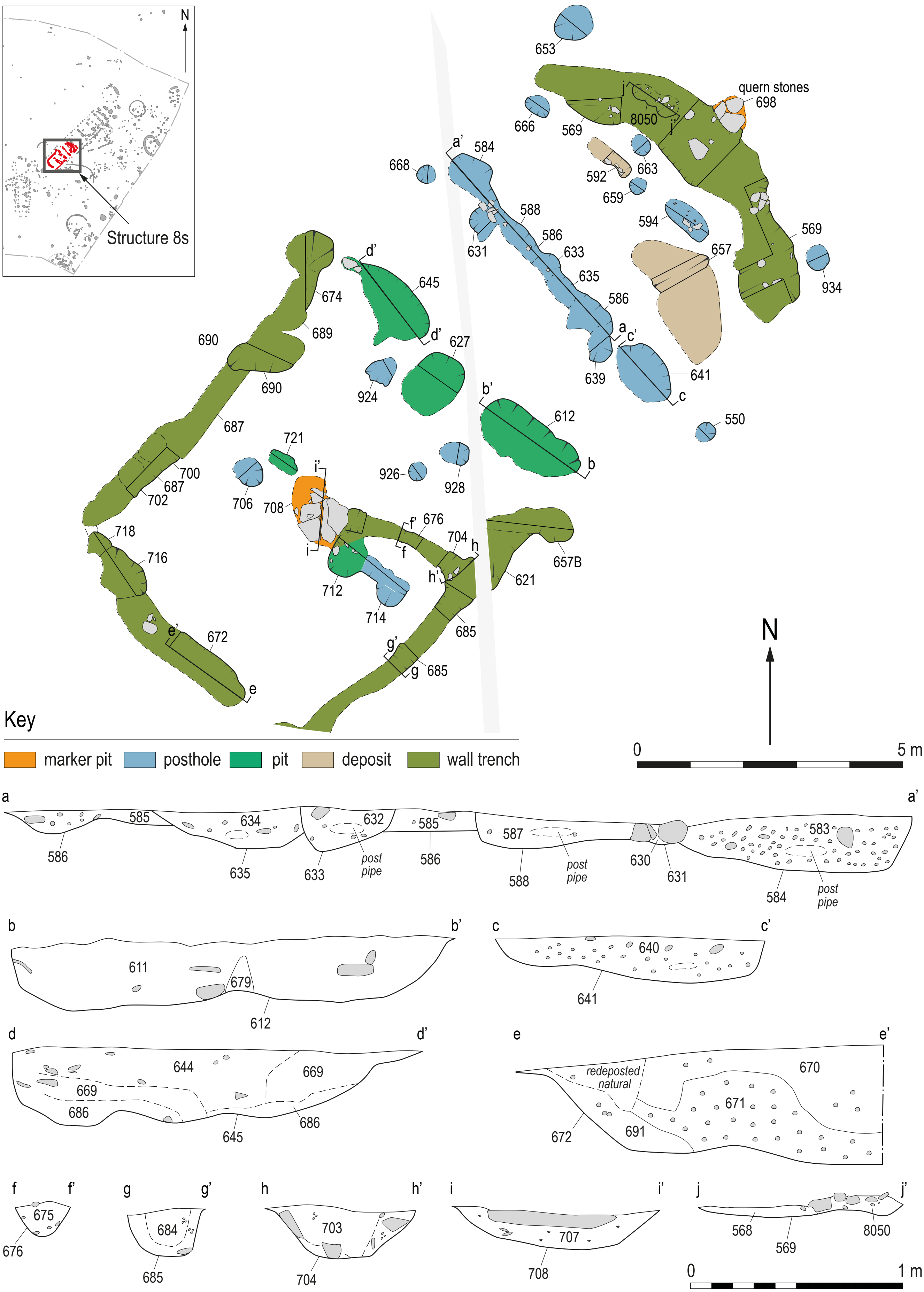

Figure 2.13: Structure 8s small hall with section drawings through features.

The curve of the gable was situated at the centre of the pit (698) that contained two saddle querns and a hone, described above. Its relationship and significance to the buildings and its purpose is discussed further below (See PART 7: *Discussion*).

Internal features

Starting at the north-east end of the building an arrangement of three evenly spaced, elongated oval-shaped but shallow pits were positioned immediately south-west of the north-eastern gable gully and aligned parallel to it. They measured between 0.64 m to 1.6 m in length, 0.26 m to 0.4 m in width, surviving no deeper than 0.21 m. The smallest was positioned near the western terminus of the gable, but the other two pits were situated more centrally within its arc. Possibly associated with the two central pits were two small off-set postholes: one dug between the pits (659), and the other between the middle pit and the gable itself. A Neolithic polished stone axe SF 8017 was recovered from the fill of the middle pit (592), and sherds of early Neolithic pottery came from the south-easternmost pit (594). The deposition of the axe within the building at this particular location is further discussed below (see PART 7: *Discussion*). Situated to the immediate south of the south-easternmost pit of this alignment was a thin deposit of dark silt roughly 1 m by 2 m in area. This is most likely the only surviving evidence of occupational material in the building.

Located c.3.5 m to the south-west from the north-east gable gully, was the base of another irregularly shaped linear feature. It appeared to span the width of the building, from the north-west wall to the south-east, with a length of c. 6 m and width of c. 0.3 m. It was dug to receive five or more closely positioned wooden posts or planks erected in postholes that were more linear than circular. The line of posts extended beyond the gully to the south-east by one other larger posthole (641); the whole arrangement may have formed a wooden partition. The two largest and longest postholes, both over 1 m in length and 0.60 m to 0.86 m in width were at either end of the partition. Sherds of Neolithic pottery and a lithic artefact were found in some of the postholes, along with evidence of charred wood from the posts.

In the middle of the building were two large oval pits, (also described in the long timber hall as its third pair of roof supports). They were the largest pits in this building and the deepest features at 0.47 m, except for the south-west gable gully. Their central location in the structure is significant as they probably continued to function as pits for load-bearing posts for supporting the roof of this smaller building. The south-easternmost pit (612) appeared to have had a later use as a possible fire-pit, or received backfilling material from a nearby hearth, as it contained heat-cracked stones, Neolithic pottery and a lithic artefact. Its partner pit (645) had also various fills. In the c. 2 m gap between this pair of features was another smaller pit (627), 0.94 m in diameter. It had vertical walls, a flat base and was filled with dark silty sand, some charcoal and stones, which included some lithic artefacts. Although not proven, its central location indicates that at some time it may have been used for a roof supporting timber, or as a fire-pit. A small pit or posthole was dug to the immediate north-west of the feature, and may have had close association with it. Two smaller pits/postholes were located c. 1.2 m away to the south.

The final internal features that survived of this structure are confined to its south-western half. They are dominated by a large irregular pit (708) c. 1 m by 1.5 m, which was rich in charcoal and silt and capped by four large cracked flat stones, identified as a possible fire-pit with a hearth stone (Figure 2.14). It was positioned halfway between the walls of the structure and halfway between the south-west gable and the pit between the large load-bearing pits. Lying beside it to the south-east was a smaller pit (712), possibly another fire-pit. In the eastern angle between the two, and running towards the south-eastern wall of the structure where there was another pit (704) with charcoal, lithic artefacts and Neolithic pottery sherds, was a shallow, narrow and irregularly shaped gully (676) (Figure 2.15). It cut both pits and was possibly the remains of an animal burrow. A second, shorter and shallow gully (714) extended south-east from the smaller fire-pit, and it too could have been the remains of another burrow.

Figure 2.14: Structure 8s small, with its stone-capped marker pit 708.

Figure 2.15: Structure 8s small, pit 704.

North-west of the larger fire-pit were two adjacent postholes. The largest (706) measured 0.72 m by 0.58 m, and both were less than 0.18 m deep and both could have had functions relating to the fire-pit. Some sherds of Neolithic pottery and the occasional lithic artefact were found amongst these features in the lower half of the structure, but no occupation deposits survived (Figure 2.16).

The radiocarbon dates for the small timber building (Table 2.2b) show some overlap with those from the large timber hall, but generally are slightly later and with longer time periods. It is quite possible that the samples chosen for radiocarbon dating from this building incorporate material from the larger hall, due to the close relationship of the two. The dating of this building is discussed further in PART 3: *Radiocarbon dates.*

Figure 2.16: Relationship of the Structure 8 (yellow) and Structure 8s (red) timber halls, from the SW.

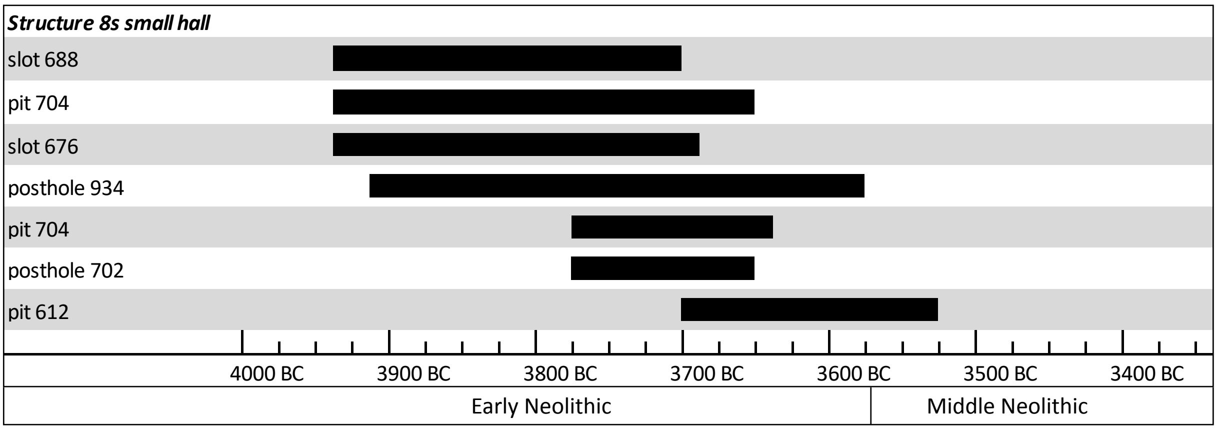

Table 2.2b: Radiocarbon dates from Structure 8s.

Structure 13

This wooden building was situated some 11 m south-west of the Structure 8 large timber hall. Its rectangular outline was clearly noticeable during excavation from the number of pits and postholes visible in the subsoil. It was aligned north/south, had rounded gables, measured 19.75 m in length by 8.55 m in width, and is identified as another long timber hall (Figures 2.17 and 2.18). Understanding the pattern of the surviving features was not easy as there were additional pits and postholes at the building's north end, and also at its north-west extent where they seemed to form a curved addition to the building. Further analysis identified a smaller oval building (Structure 13n) aligned perpendicular (east/west) over it, and early to middle Neolithic in date, paralleled by a similar structure at Garthdee Road, Aberdeenshire (Murray and Murray 2014, illus 33). These smaller structures were predominantly oriented east/west. Also clouding the picture of the long timber hall were pits/postholes from the porch of the adjacent Bronze Age roundhouse, Structure 14. The west side and southern features of Structure 13 were notably reduced in depth compared to those on the east and to the north, it is therefore possible that many features of this building have been lost due to taphonomic conditions, and the picture that survives is skewed.

The timber hall

The north gable and the east external wall of the north/south aligned timber hall are clearly identified by a number of similar sized, circular or sub-circular postholes that varied in diameter from 0.50 m to 0.72 m. Their depths also differed significantly from 0.11 m to 0.46 m, but became shallower towards the gables and in the centre of the building (Figure 2.19). The pairing of some postholes, plus extra ones, from the middle of the wall to the northern gable indicates replacement of timbers, the addition of extra supports, or the confusion of evidence from later structures. The data from the southern half of the building suggests the postholes were positioned c. 1 metre apart. However, postholes were sparse at the southern gable indicating the loss of evidence by the almost 2 m wide gap between them. Dark brown sand with occasional charcoal flecks and angular stones filled the postholes.

The west wall of the structure is perceived to be a row of up to seven elongated oval pits/postholes which averaged c. 1.4 m in length by c. 0.57 m in width and were dug to receive posts, occasionally double posts (Figures 2.18 and 2.19). Generally, the pits were spaced between 0.7 m to 1.46 m apart but they survived only as shallow features 0.22 m deep. Charcoal and some lithic artefacts and sherds of Neolithic pottery were found in their dark silty fills. At least four smaller postholes were associated with the pits suggesting additional reinforcement of the west wall.

A row of sub-circular postholes spaced roughly 1.2 m apart were aligned north/south and were positioned parallel to the west wall, but c. 0.8 m east of it. These postholes probably housed single smaller posts for supporting either the west wall or the roof in the middle part of the building.

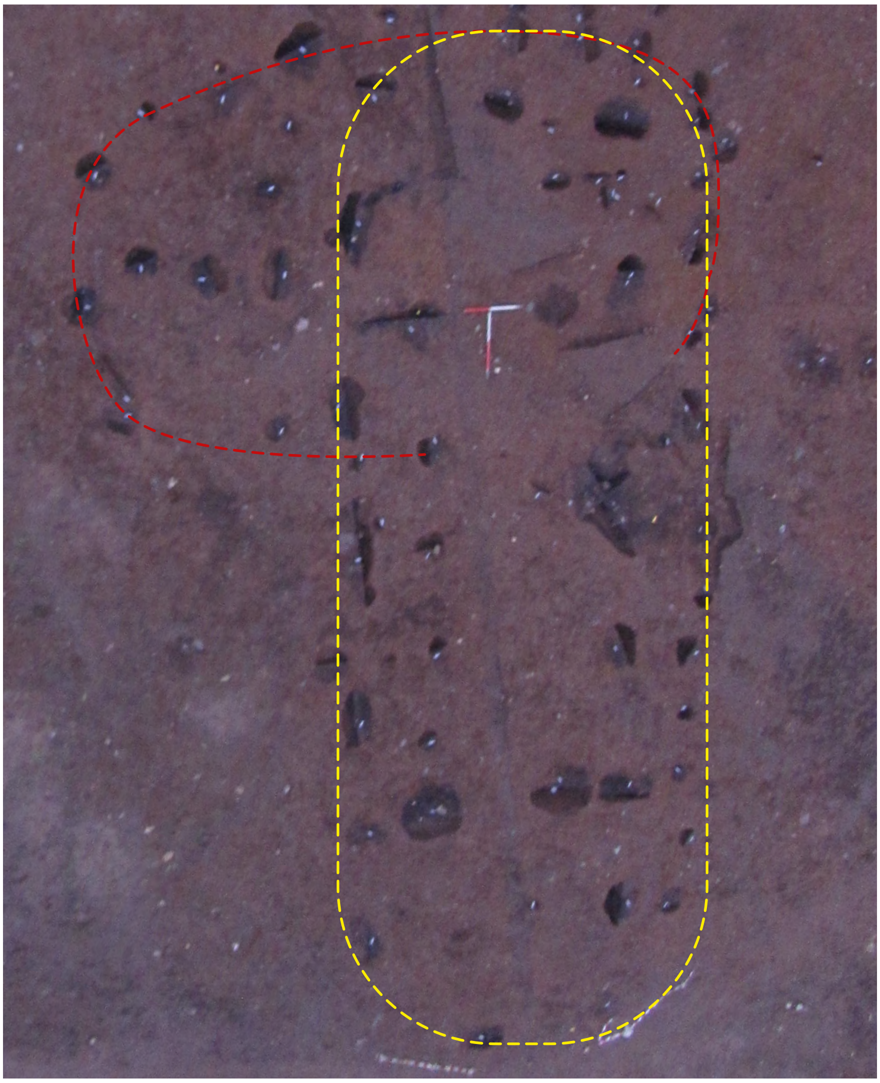

Figure 2.17: Structures 13 (yellow) and 13n (red), aerial view.

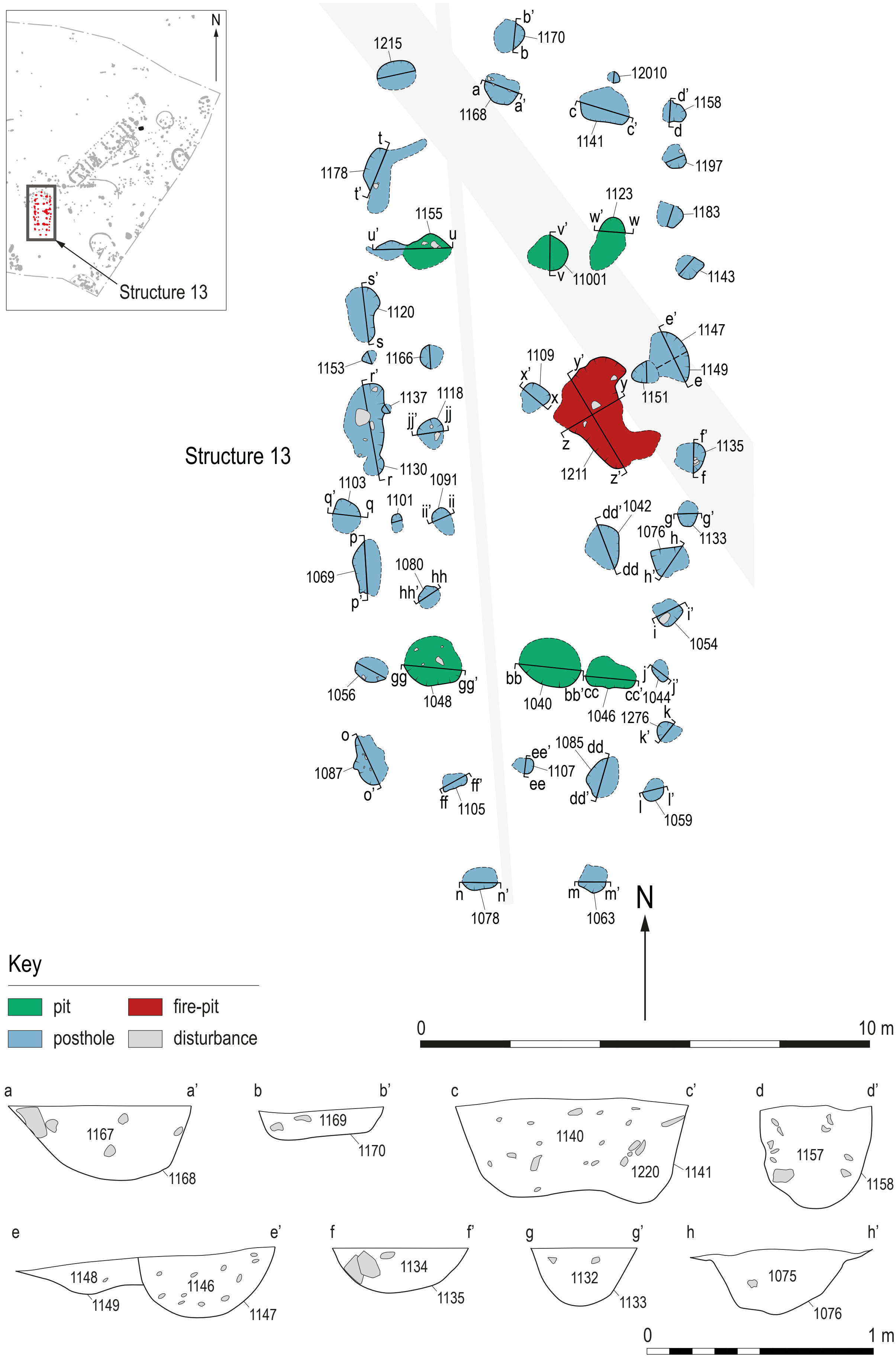

Figure 2.18: Structure 13 large timber hall plan with section drawings through the wall postholes and pits.

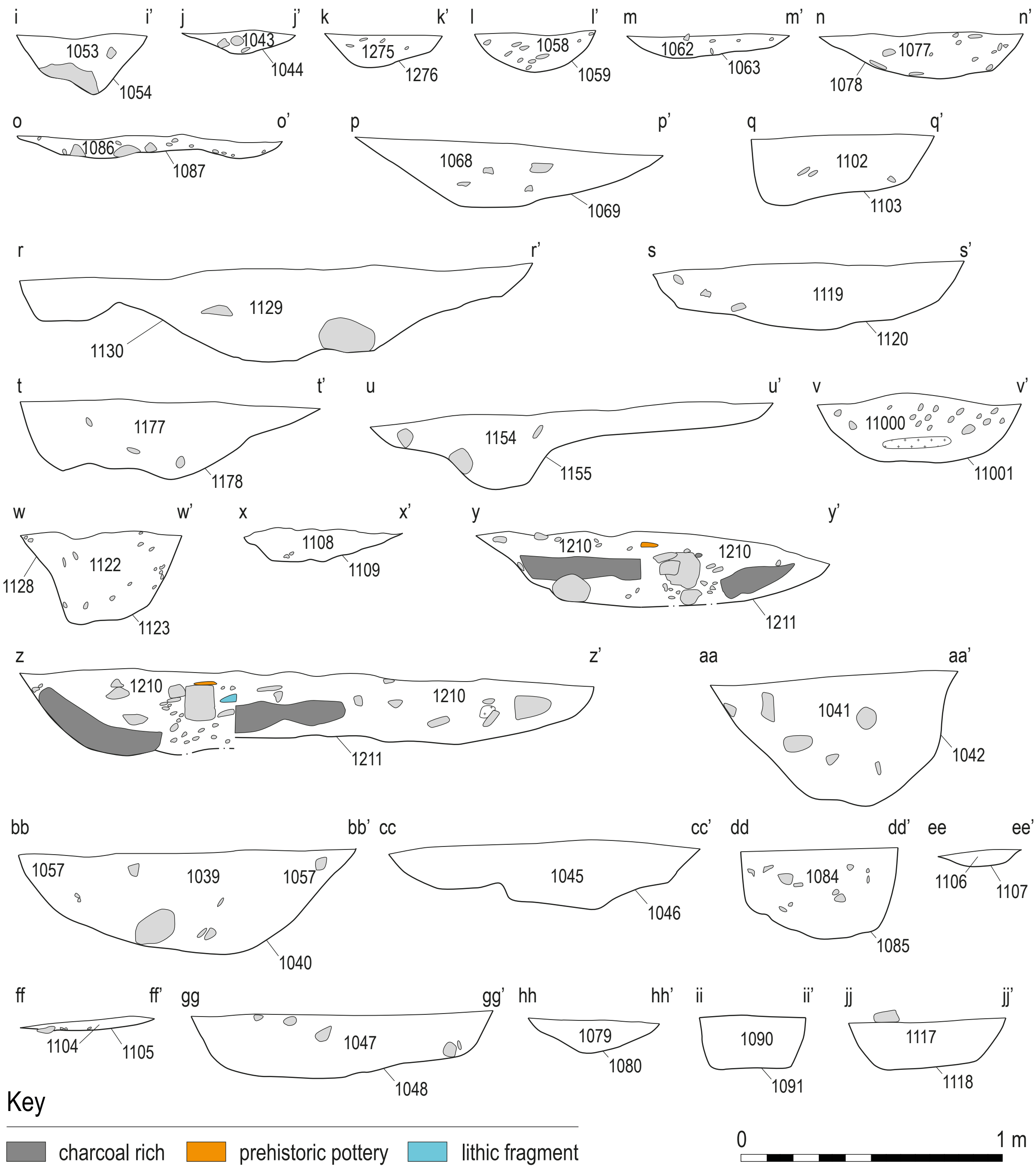

Figure 2.19: Structure 13 section drawings through loadbearing pits and gable postholes, hearth, internal pits, west wall supporting postholes and inner gable partition postholes.

Other internal features included possible partitions and a fire-pit (Figure 2.19). The latter (1211), which measured 2.3 m by 1.99 m, was 0.33 m deep and was situated close to the east wall but in the centre of the length of the building. The fire-pit contained ash and charcoal as well as lithic artefacts and a later early Neolithic pottery vessel V69, which was recovered from near the top of the fill of the pit during the excavation. A posthole (1109), situated to the immediate west of the fire-pit, which lay in the centre of the building, contained a Beaker vessel (V70) from the late Neolithic/early Bronze Age. The occurrence of this vessel in this place suggests that it is evidence of a burial or deposition inserted into the foundations of the building (see PART 5: Pottery).

Two substantial east/west aligned partitions were identified dividing the building into three parts (Figure 2.18). There was a large central area with the fire-pit, and two smaller areas on either side of it towards each gable. The northern one comprised three pits/postholes (1155, 11001 and 1123) lying between the walls and with one pit abutting the west wall. There was a c. 2 m wide gap between the west pit and the two postholes to the east that were positioned more closely together. The southern partition, again of three pits (1048, 1040 and 1046) was similarly arranged, suggesting that passage was possible through each partition, but it was not central to the building's axis.

Towards the southern end of the building, two small postholes and a pit in a roughly east/west alignment suggest that another less substantial partition was erected to divide that area into two in front of the gable (Figure 2.19). The evidence for a matching east/west inner gable partition dividing the northern area into two unequal parts was suggested by the alignment of three pits lying close to the north gable.

The only other feature of note in the middle part of the building was a pit (1042) which was dug due south of the fire-pit, and contained sherds of Neolithic pottery and lithic artefacts.

During excavation, the large west wall pits (1155 and 1178) were noted to have been enlarged by burrowing animals, and further bioturbation as well as construction of the oval building on top may have distorted the surviving structural evidence of this building.

Its earliest radiocarbon date (Table 2.3) suggest the hall is a contemporary or near contemporary building to the Structure 8 large timber hall, but with later alterations and with subsequent middle Neolithic activities.

Structure 13n - the oval timber building

The pits and postholes at the north end of the large timber building, with the extension of features to the west, suggest that there was a later east/west aligned oval building, possibly of middle Neolithic date (Table 2.3) overlying it at right-angles (Figures 2.17 and 2.20).

The structure was positioned with its rounded gables ends to the east and west. It was approximately 13 m in length and c. 8 m in width. The west end and the southern wall of the structure were marked by eight postholes and a pit, with an approximately 1 m gap between each. A disparity in their position was noted in the continuation of the south wall eastwards, where a larger 2 m gap between postholes, possibly a doorway, was recorded. However, continuing the evidence to the east and north through the pits and postholes of the earlier timber hall is difficult and haphazard (Figure 2.20). The east wall of the oval building with its double, and in at least one case, triple postholes indicates a reuse of part of the footprint of the gable of the earlier structure. There is a slight indication of a curve in the posthole alignments here, which suggests that some of them may in fact belong to the oval building. The north wall is largely unclear because of the alignment of the curved gable to the hall, and postholes identified as forming the ends of the porch to Structure 14. There is possibly one posthole in the west wall of the earlier hall and one or two in its east wall which could belong to the oval structure, but this is simply guesswork.

On safer ground is the identification of interior features, including two fire-pits at the west end of the oval building. Pit (1251) is identified as

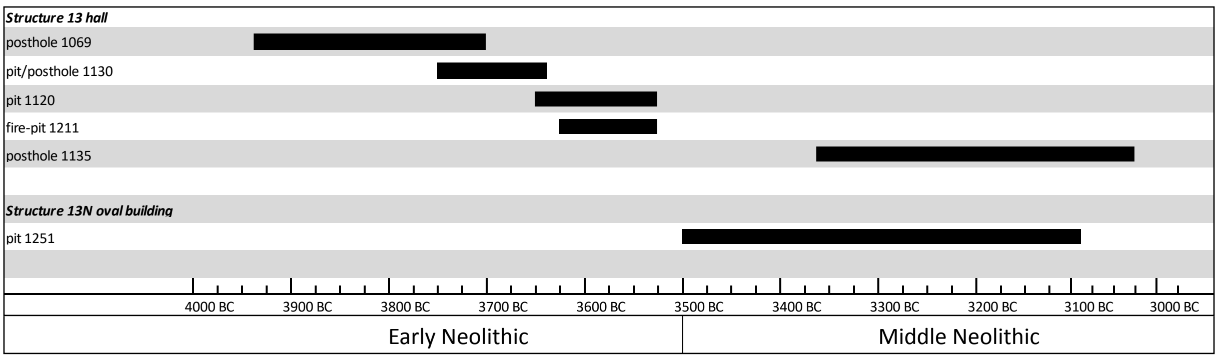

Table 2.3: Radiocarbon dates from Structure 13 and Structure 13n.

a definite fire-pit and pit (1249) is an adjacent similar feature (Figure 2.20). Both produced charcoal, sherds of pottery and lithic artefacts in their fills. East of the hearths is a north/south row of four postholes, possibly forming a partition, with the southernmost posthole positioned in the south wall of the building.

Other features considered belonging to the oval structure are six small circular to linear postholes situated towards the east. Four form a tight group and two lie a little beyond them. These shallow features, less than 0.13 m in depth, range from 0.24 m to 0.56 m in length and 0.19 m to 0.32 m in width, appear to be an anomaly within the larger building and therefore might belong to the oval structure. Some lithic artefacts were found in the fill of one of them.

The interpretation of the features of Structure 13, the rectangular timber hall located south-west of the largest hall, Structure 8, includes the addition of a later timber oval structure inserted over the top east/west to north/south, which indicates a significant reorganisation of settlement. This is discussed further below (see PART 7: *Discussion*).

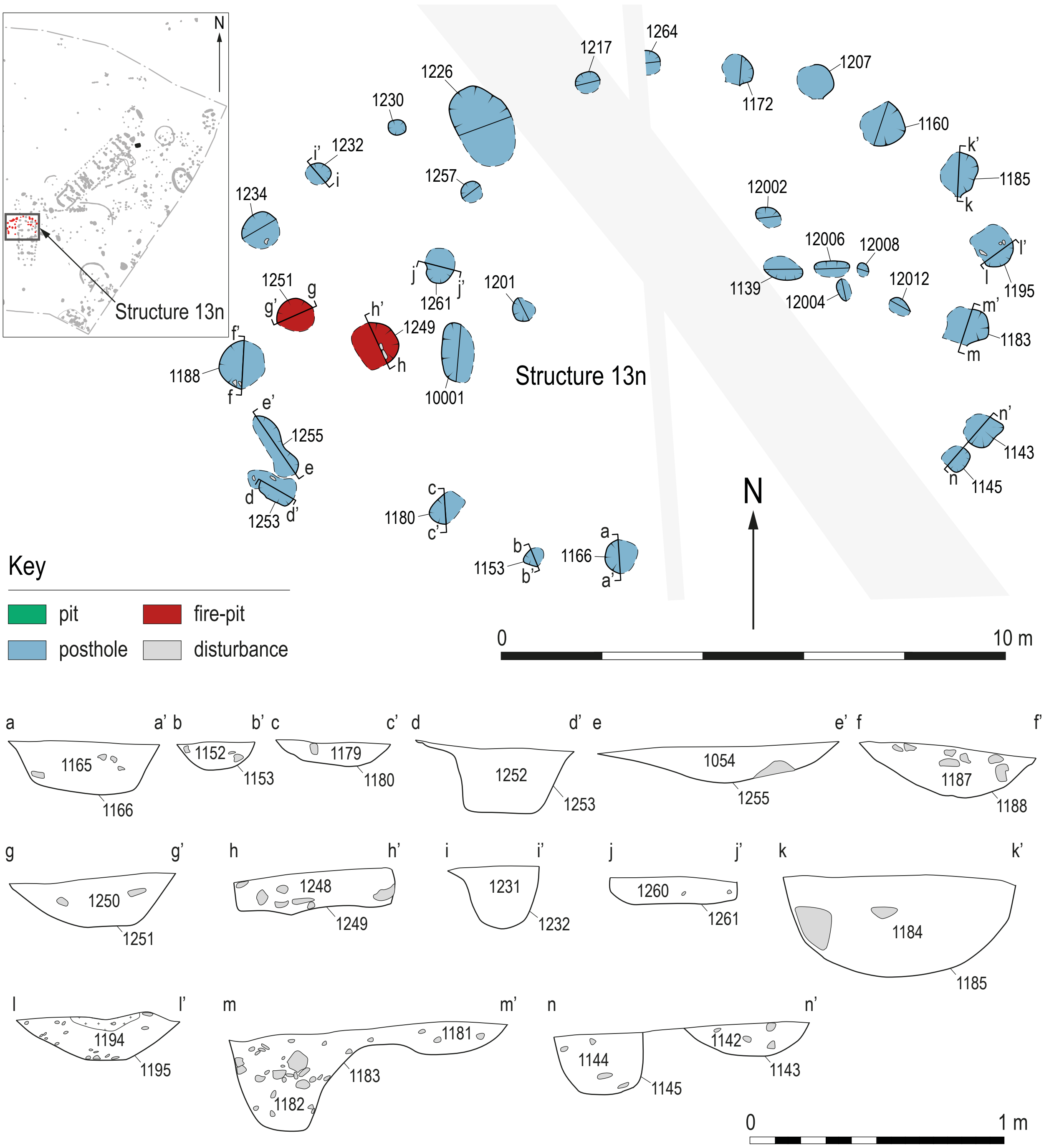

Figure 2.20: Structure 13n oval structure plan and sections drawings through wall postholes and internal features.

The radiocarbon dates (Table 2.3) from the large and smaller buildings of Structure 13 indicate that they are both Neolithic in date, with certainly the larger structure being early Neolithic with evidence of later use, including that of an inserted probable Beaker burial. The single radiocarbon dated from the smaller oval Structure 13n indicates it is later than the larger hall, and most likely middle Neolithic in date. Pottery from it, although rather fragmented and burnt suggests vessels later in date than the early Neolithic.

Groups of pits and other areas of early Neolithic date

There were clusters of pits and postholes situated between the large timber buildings and the south-eastern boundary of the site that share similar material culture with them. These groups of features represent outdoor activities that seem to be centred on fire-pits, where many of the features indicate repeated use, and certainly prolonged use of the same area. It cannot be assumed that all the features are contemporary, or that they are contemporary with the halls, but they tell us a little about activities that took place when the smallest building (Structure 8s) was possibly still used, and afterwards. Some of these groups of pits and postholes have been disturbed by later buildings and activities, most prominently from the Bronze Age (see below), and it is also apparent that more recent features and activities have intruded into the area and truncated the earlier patterns of activity. The evidence of activities external to the timber buildings is layered, complex, incomplete, and not fully understood.

North-east of the north-eastern end of the long timber hall - Structure 8, was a small group of five or six features *Pit Group 2* (Figures 2.21), within which were two large fire-pits (146 and 159). The larger (146) measured c. 0.92 m in diameter (Figure 2.22) but the smaller was more rectangular. In addition, they were each accompanied by a posthole (203 and 157), both less than 0.50 m in diameter. A small isolated posthole lay to the east, with another large but elongated pit (194) situated to the south-west measuring 0.85 m by 1.42 m.

The largest of the fire-pits was 0.27 m deep, but all the rest of the features were shallow, and most had fragments of charcoal in their fills. The two fire-pits had the addition of cracked, burnt stones as well as lithic artefacts and sherds of early Neolithic pottery (V10, V11 and V12). Sherds of V12 were also found in one of the smaller pits. The distribution of sherds suggests the use of the pits was contemporary (Table 2.4).

A separate, and somewhat larger but shallower pit is included here even though it was situated c. 7 m to the south. It also probably functioned as a fire-pit and had abundant charcoal in its fill. No additional features or artefacts were associated with it.

Between the latter pit and those described above were six evenly spaced postholes and a larger pit that formed a NW/SE aligned linear boundary with a right-angled bend at its north-west end. Lying a little to the north was another discrete alignment of three postholes. These are probably the remains of post-medieval or modern field boundaries.

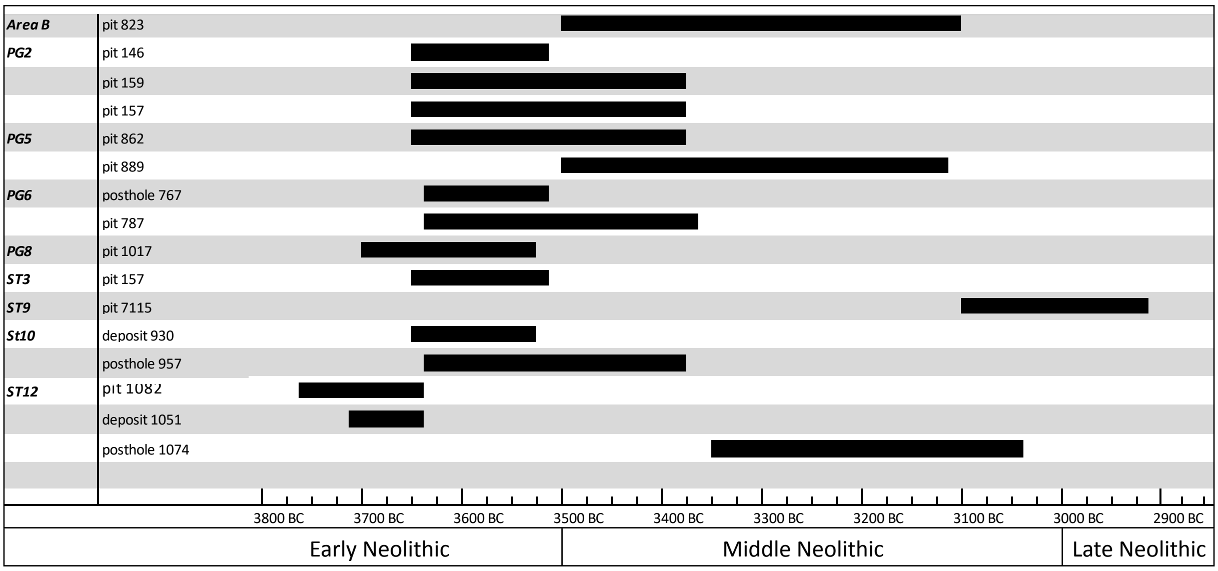

Table 2.4: Radiocarbon dates from features external to the timber halls.

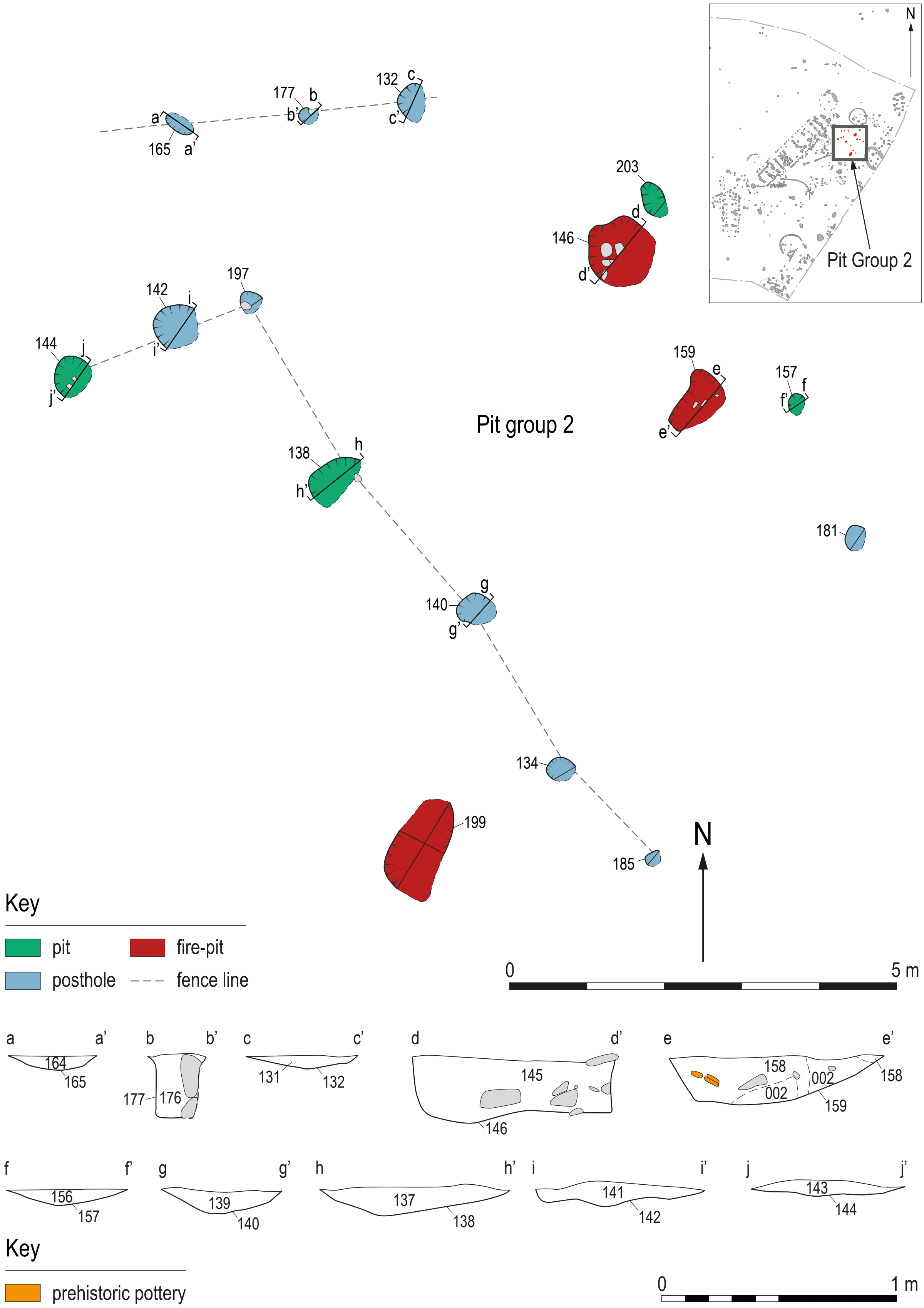

Figure 2.21: Pit Group 2 plan and section drawings through features.

Figure 2.22: Pit Group 2 section through pit 146.

South of the features just described and situated east of the middle of the Structure 8 large timber hall were a large number of pits and postholes identified as '*Structure' 9* and *Pit Group 5*. The main activity identified in the centre of the group of features of '*Structure' 9* was an area of sandy-clay (900), burnt red by high temperature burning, covering an area of c. 2 m by 3 m, with a mixed charcoal layer extending beyond it (Figure 2.23). The upper part of (900) was subjected to archaeomagnetic dating (see Part 3: *Archaeomagnetic studies*) which produced a date range of the early Neolithic of 3800 – 3555 BC and of the middle Bronze Age to early Iron Age of 1545 – 600 BC.

Deposit (900) overlay two large pits: pit (7115) was almost 0.90 m in diameter and was filled with charcoal-rich material (901). This was dated to the late Neolithic 3090 – 2904 cal BC (UBA-39359). A second similarly-size pit (7117) was positioned next to it that contained only mottled sand (Figure 2.24). The charcoal-rich pit filling produced a middle to late Neolithic radiocarbon time frame of the end of the fourth and the beginning of the third millennium BC (Table 2.4). This was one of the largest areas of burning located on the site and suggests the site of a bonfire or a possibly kiln for the firing of pottery. A small posthole was located to its immediate west, but it could be a later feature as it intruded into the charcoal deposit, and another posthole was located to the east.

A few metres to the north of the possible kiln, was a larger fire-pit (849) that measured 1 m by 2 m by 0.53 m. It too contained charcoal but had been recut. A posthole and two other pits were situated to its north and east. Another smaller fire-pit was situated to the west of the kiln with associated postholes and a pit but some of these features had been disturbed by animal burrowing. South of the kiln were a number of postholes, possibly forming two slightly random but closely positioned NW/SE alignments. East of these were two pits, but several of these features were also disturbed by burrowing animals. Some lithic artefacts and middle Neolithic pottery were found in the fills of some of the postholes and a pit. The excavators considered that the group of features formed a structure. However, it is more likely that the postholes denoted the position of temporary windbreaks around the kiln and the hearths.

Following the features southwards was a largely elongated group of pits and postholes running parallel with the long timber hall (*Pit Group 5,* Figures 2.23). South-west of the above described burnt area, with its postholes and pits were possibly three fire-pits, three postholes and three adjacent pits. The fire-pits all contained sherds of early and middle Neolithic pottery. Hazel nutshells were found in the fill of (815), and a sandstone whetstone SF 444 came from (889).

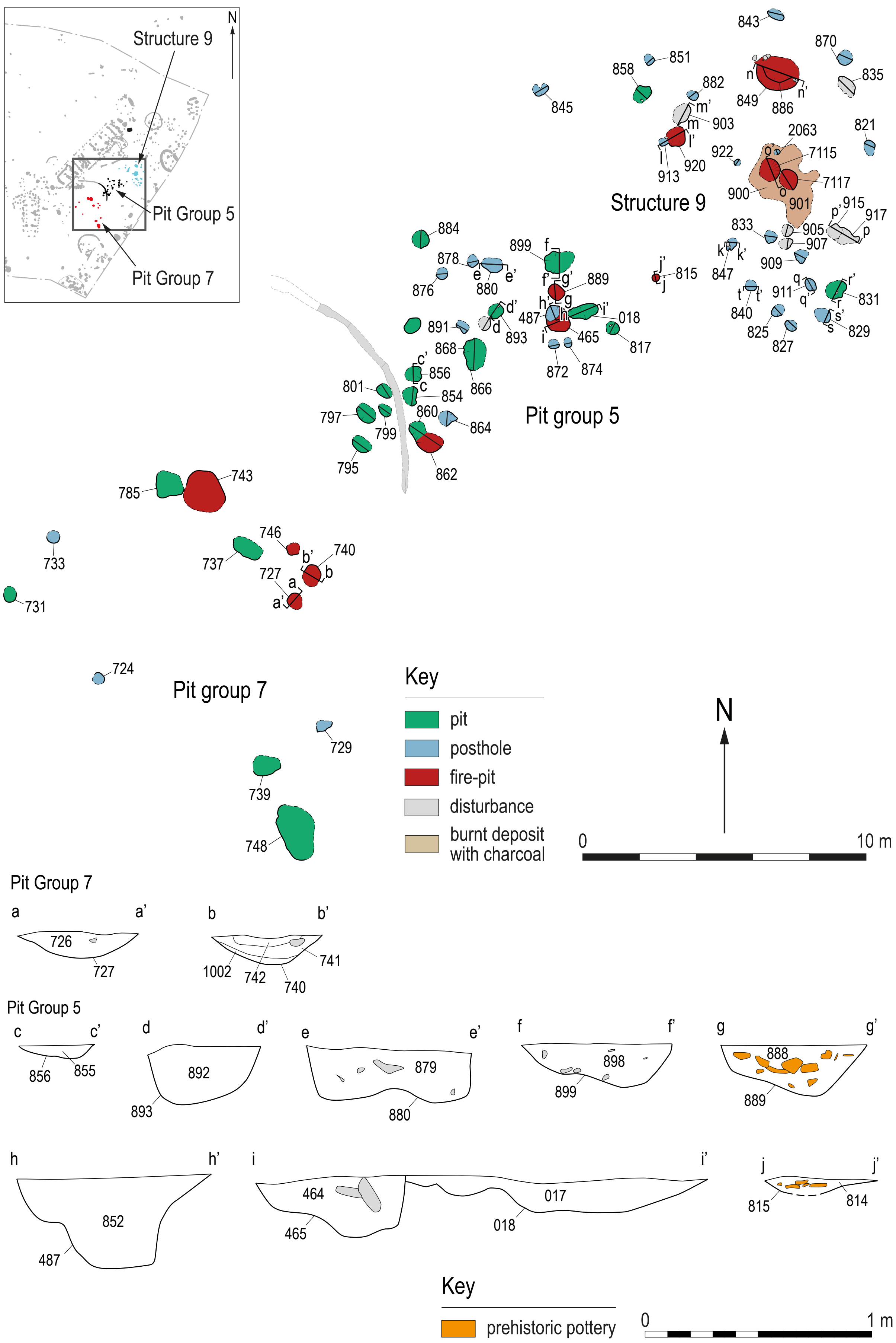

Figure 2.23: 'Structure' 9 plan, with plans and section drawings of Pit Groups 5 and 7.

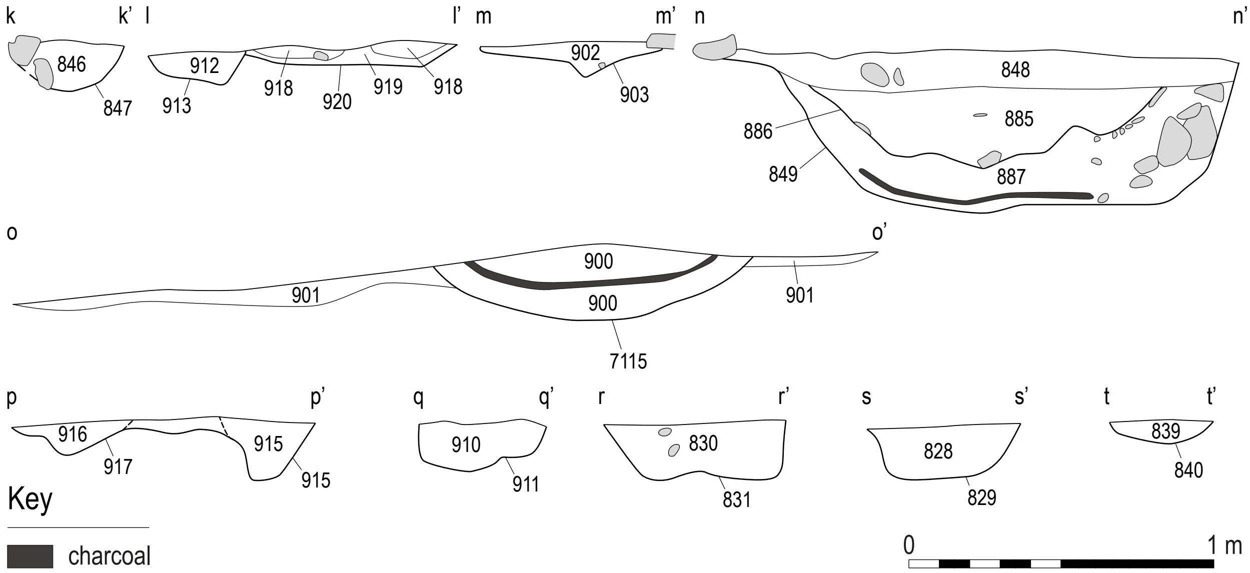

Figure 2.24: 'Structure' 9 section drawings.

To the west were several postholes and pits, and their distribution continued to the south-west, where another fire-pit (862) also containing pottery and lithic artefacts, was situated together with a posthole and adjacent pits. One of these pits (795) also had lithic artefacts in its fill but several of these features had been again disturbed by animal burrowing and the digging of a later curved structure.

Further west by the south-west gable of Structure 8 was a group (*Pit Group 18*, Figure 2.25) of seven pits with charcoal, but only two contained lithic artefacts, and seven postholes that possibly formed a boundary or fence alignment. Another posthole to the west had a flat stone in its base. The additional feature, a large fire-pit with an early medieval date, is discussed further below.

South-east of the latter group was another collection of features (*Pit Group 9*), which given their similarity to later structures, is discussed with the Bronze Age features (below). To their east was another widespread but small group of pits (*Pit Group 7*, Figure 2.23) that continued Neolithic activities to the south-west. A group of three fire-pits that individually was no larger than 0.50 m in diameter, each contained noticeable charcoal and sherds of two early Neolithic pottery vessels (V37 and V38). One of the fire-pits also had fragments of hazel nutshells in its fill. A larger pit (743) to the north-west returned a late Bronze Age date range.

East of this last group (*Area B*) besides the eastern edge of the excavated area, were a few isolated features that comprised two postholes, three pits and one large fire-pit measuring over 1 m in diameter (Figure 2.26). The latter contained cracked burnt stones, sherds of undiagnostic pottery, and lithic artefacts. This feature had been cut through by the laying of a post-medieval or modern drain, and most of the other pits and postholes had been disturbed by animal burrowing.

Immediately south-west of the previous group, and along the south-east boundary of the excavated area were two large fire-pits with a group of pits, postholes and four other smaller fire-pits situated between them (*Pit Group 6,* Figures 2.26). The largest fire-pit (754) to the south, measured 3 m by 3 m and contained frequent charcoal, but it was shallow, surviving only to a depth of 0.11 m. The northern fire-pit (791) was a little smaller at c. 2 m by 1.5 m, but attained a depth of 0.4 m. It too contained charcoal, as well as lithic artefacts and sherds from at least four early Neolithic pottery vessels (V31, V34-36). There was a close connection between the use of these fire-pits and the smaller ones lying between, as sherds from one vessel (V34) were found in three fire-pits, and sherds from another (V32) were found in two. The largest fire-pit to the south contained no material culture.

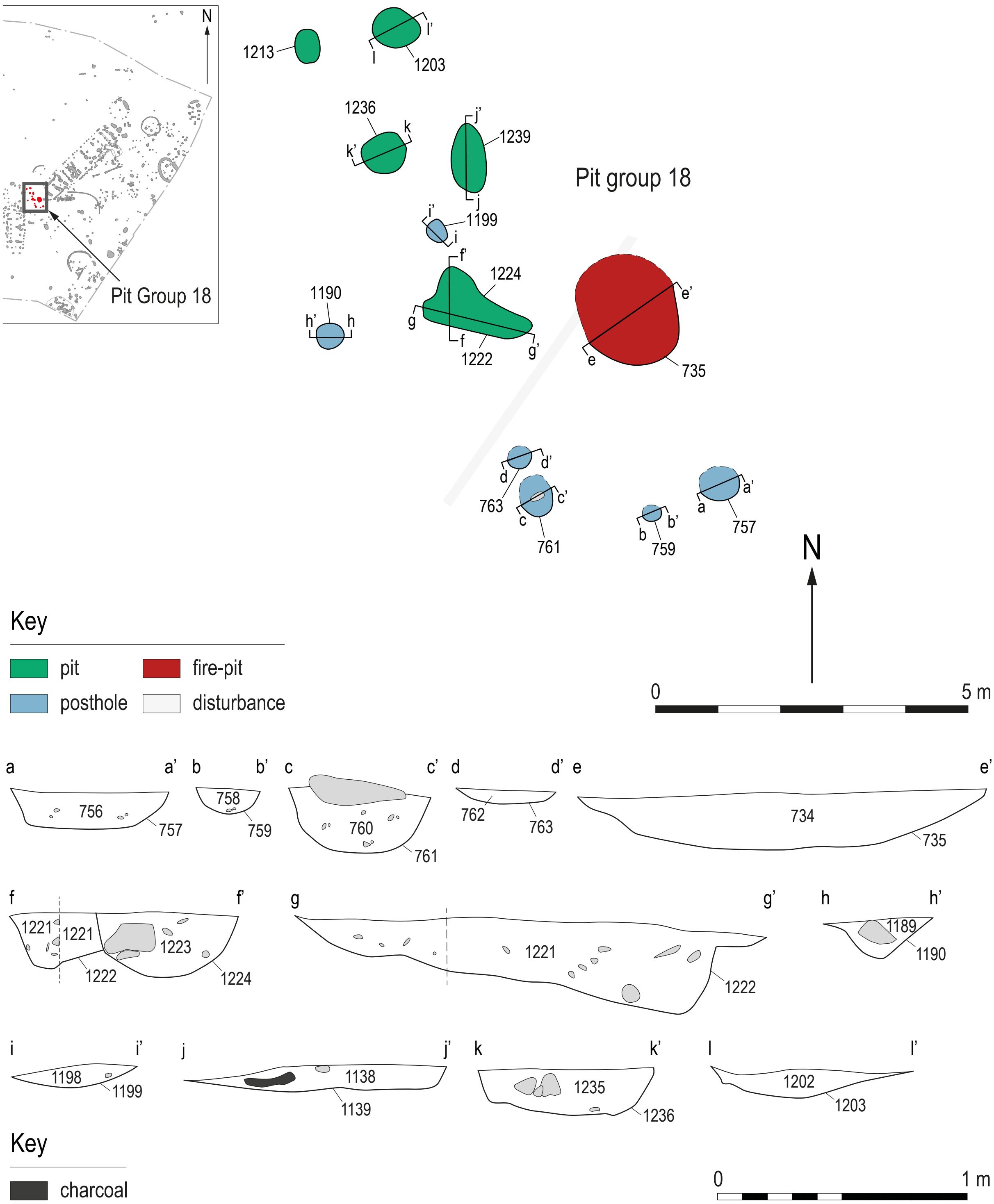

Figure 2.25: Pit Group 18 plan and section drawings.

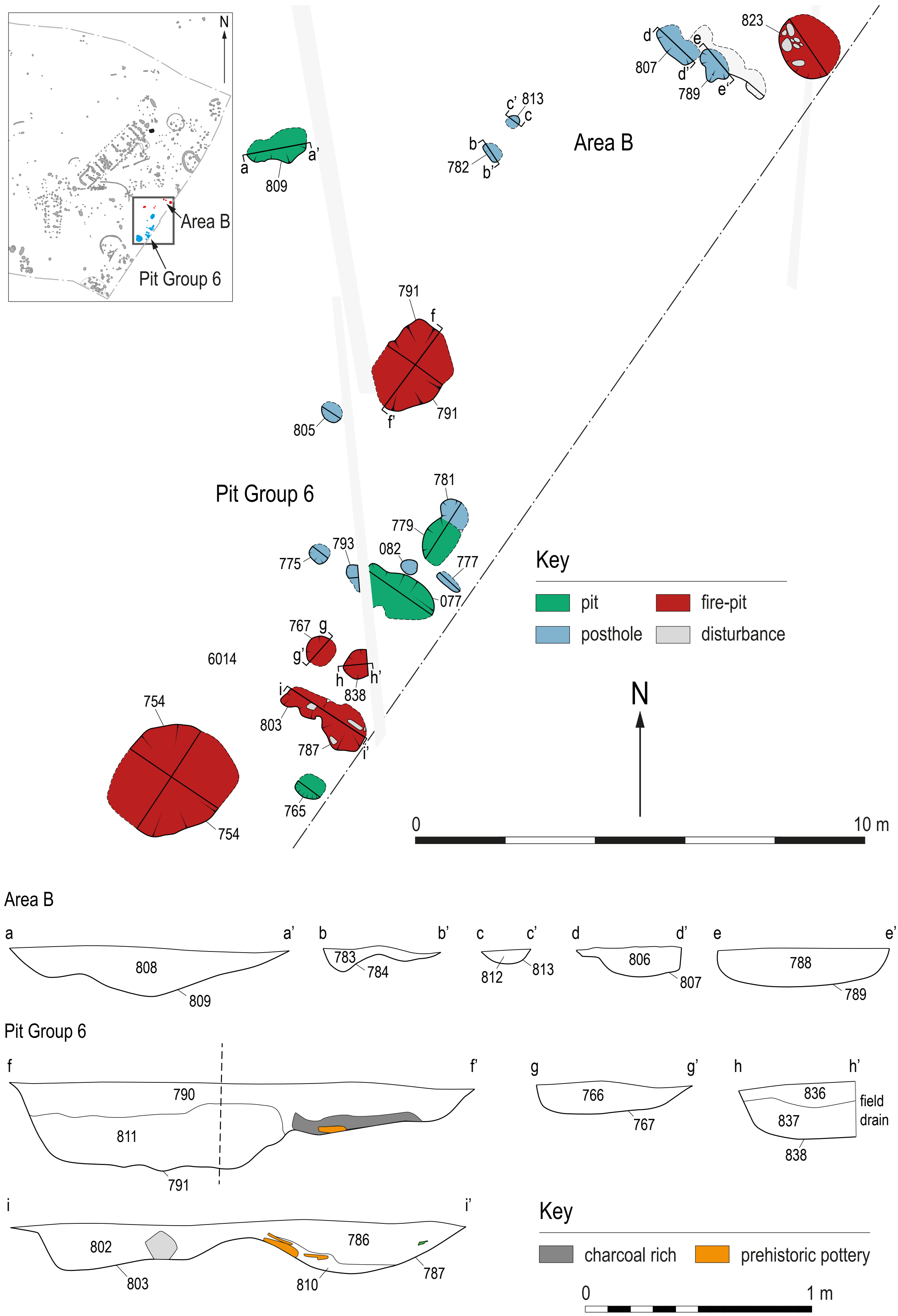

Figure 2.26: Area B and Pit Group 6 plans and section drawings.

‘Structure’ 10 with Pit Group 8 and ‘Structure’ 12

These two possible ‘structures’ and a pit group lying between them form a group of activities in the south-east corner of the site. It was not possible to determine with any certainty whether large timber structures had been present in this area from further investigation.

‘Structure’ 10, a group of features, was located on the eastern boundary of the site but their extent had been cut away to the east by the construction of the modern road. A shallow destruction or floor layer (930) comprising charcoal and silty-sand marked the limits of the occupation in a large curve to the north-west, which covered an area of at least 45 m^2. It overlay all the postholes and pits and two areas of occupation material that had survived in shallow undulations or pockets in the subsoil (Figure 2.27).

The postholes of this group measured from 0.26 m to 0.78 m in diameter and were up to 0.28 m in depth. However, many were much shallower than this, with depths as little as 40 mm registered. Posthole (942) on the north-eastern edge of the structure was an irregular U-shape, (946) was V-shaped, and others were flatter in form (Figure 2.27). In general, the postholes were filled with dark-brown silty-sand containing flecks or concentrations of charcoal, which was similar to all pits and postholes in this area of the site. Large and small postholes formed what appeared to be an arc of features in the west, with a few smaller postholes to their east – suggesting to the excavators the outline of a wall of a timber structure. Two other postholes lay to the south-west and south-east, and a large 0.90 m by 0.80 m diameter but shallow posthole (967), lay further to the north-west. Its fill contained both lithic artefacts and early Neolithic pottery (V42 and V44) could suggest it was a pit that had a secondary function. Another posthole at the surviving southern end of arc of features had a diameter of 0.90 m. It seemed to have been re-dug or contained a much larger timber than the others. However, its depth was only 80 mm.

Two other features were fire-pits. Context (963), lying in the middle of the arc of postholes and close to a surviving patch of occupation deposits, was a sizable fire-pit measuring 1.10 m by 0.80 m, with charcoal in its fill. The function of a small posthole (1038) recorded beneath the occupation deposit may have been related to the fire-pit. The other feature (939), lying to the north, was slightly smaller than the former but may have been a second fire-pit. It contained lithic artefacts and possibly Bronze Age pottery.

A final feature on the south-western edge of the pit group was an elongated fire-pit (969) that measured 2.3 m by 0.6 m by 0.35 m that contained both early Neolithic pottery and lithic artefacts. Its location on the periphery of the group could suggest it is possibly a later feature. It was not distinguished from the other features by its fill, but given the depth of topsoil in this area it might have been disturbed or enlarged by animal burrowing.

A few metres to the south-west were three separate postholes, smaller than 0.45 m in diameter and with depths of less than 0.13 m, with a group of eight pits to their immediate south, covering an area of c. 5.4 m2. This area was called *Pit group 8* but its location between ‘Structures’ 10 and 12 and its close proximity to the latter, suggests some association (Figure 2.28). The pits were irregular in shape, with the central pit (1017) identified as a possibly a fire-pit, as it was the most circular at 1.27 m in diameter, and contained some early Neolithic pottery, V39 and V40. It also provided a radiocarbon date of the middle of the fourth century BC of 3692 – 3530 cal BC (UBA-39318) (Table 2.4, Figure 2.28). Three other elongated pits, with flat bases and vertical sides surrounded it to the west and south, but only one had charcoal in its fill and their interpretation as additional fire-pits is uncertain. The dimensions of the other pits in the group varied in length from 0.80 m to 1.54 m and in width from 0.44 m to 0.91 m. The deepest attained a depth of 0.34 m. Additional sherds of undiagnostic pottery were found in two of the postholes and a lithic artefact came from a pit immediately south of the fire-pit.

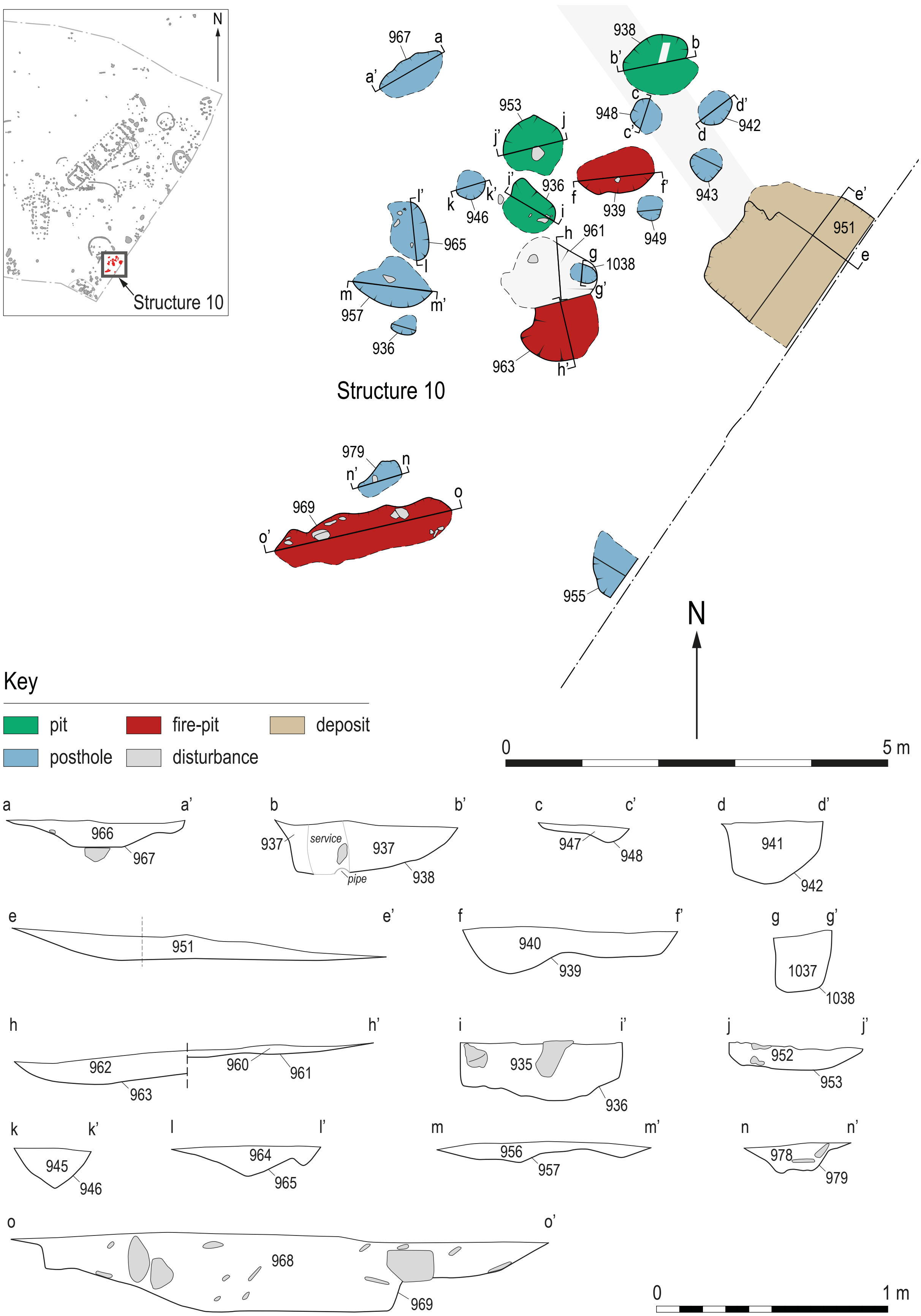

Figure 2.27: 'Structure' 10 plan and section drawings.

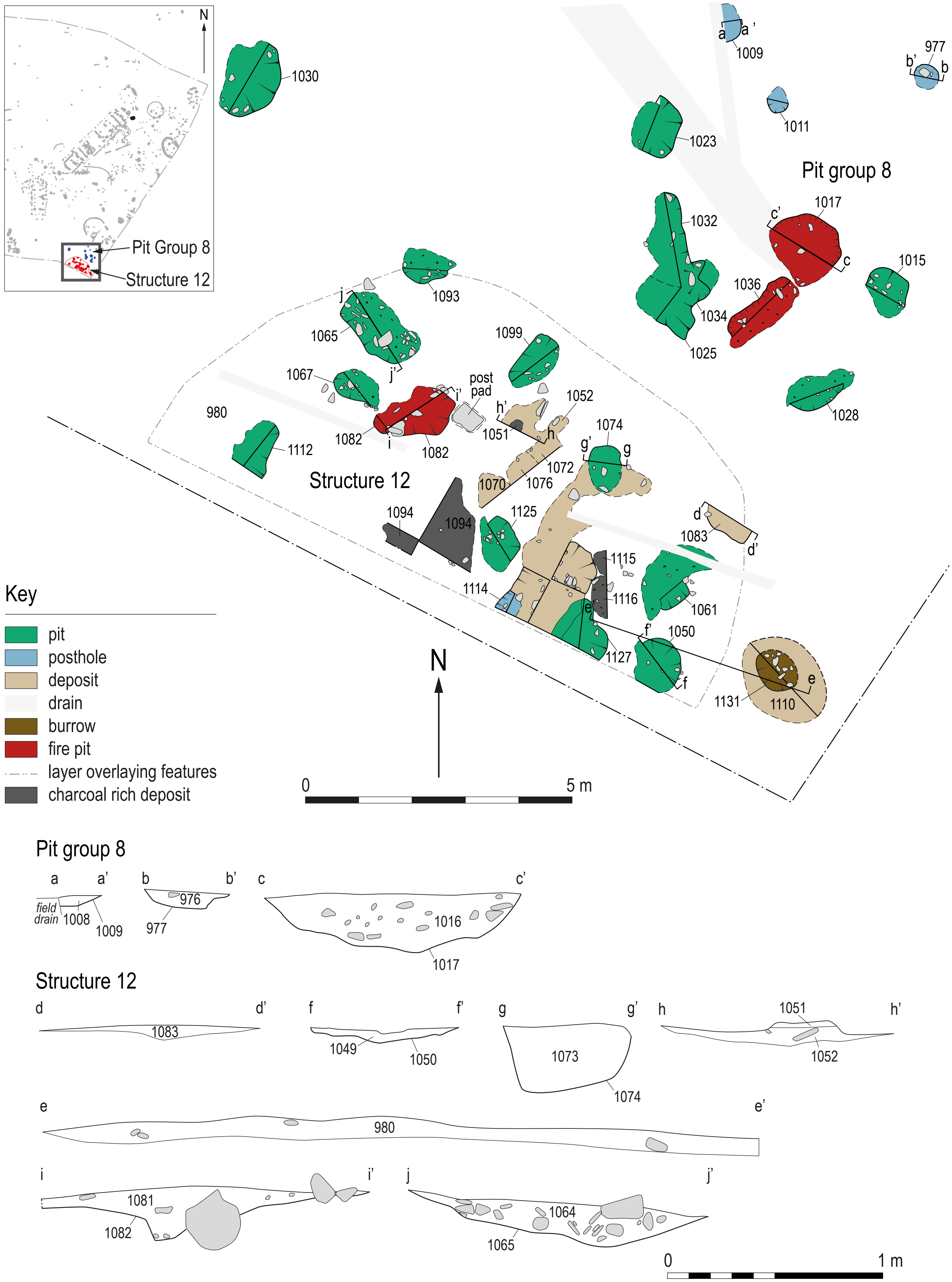

Figure 2.28: Pit Group 8 and 'Structure' 12 plans and section drawings.

A larger group of pits and deposits exposed in an area of 13.2 m by 5.3 m, *'Structure' 12,* was located immediately to the south-west of Pit Group 8 described above (Figure 2.28). Their close proximity suggests a stratigraphic or temporal relationship. Like the features forming 'Structure' 10, an extensive dark silty destruction or occupation layer with stones and flecks of charcoal covered features lying beneath it. This material had continued beyond the trench edge to the south and contained sherds of pottery from numerous vessels, lithic artefacts and fragments of animal bone

Below the destruction layer, a number of shallow occupation deposits with charcoal were visible in the centre and towards the eastern side of a group of pits and possible postholes. Most of these features had fills that were rich in charcoal. A pit (1082), together with what was described as an adjacent post-pad, a horizontal stone, may have been a fire-pit. It contained some larger stone within its fill and sherds of early Neolithic pottery (V57). Other finds of pottery and lithic artefacts came from occupation deposits and one possible posthole (1074). It was particularly difficult to distinguish between pits and postholes in this area due to the intrusion of a recent ceramic drain and truncation of the subsoil. As far as can be determined, no other postholes were positively identified in this area that indicated the presence of a timber structure.

The radiocarbon dates (Table 2.4) for features discussed here indicate that there was a long timescale of use during the latter part of the early Neolithic with some overlap of date ranges. The middle to later Neolithic date from 'Structure 12' suggests a possible later intrusion.

Groups of pits along the south-west edge of the site

Eight groups of features lying in fairly close proximity were identified running along a roughly level contour between 28 m and 29 m OD on the south-western edge of the excavated area. A total of 16 radiocarbon dates were returned from these features (see Table 2.5). They are predominantly early to middle Neolithic in date range with some later Neolithic activity, and evidence of early Bronze Age use of the area. These groups are described from east to west.

Pit Group 10 was the easternmost of these groups and it comprised a relatively tightly positioned cluster of 13 pits with two postholes and a shallow deposit (Figure 2.29). Four fire-pits were situated in the centre of the group forming an almost north/south arrangement, with the largest and shallowest to the north (3010). The latter contained lithic artefacts and sherds from pottery vessels, one of which was early Neolithic in date (V67). The most interesting of the fire-pits was the southernmost (2007), which was more than twice as deep at 0.74 m than its neighbours. It contained large stones with animal bone and late Neolithic/early Bronze Age pottery (V58) within its six alternating layers of sand and silt, indicating the many occasions it had been used.

East of this fire-pit was a 2 m by 2.5 m deposit of silty sand (11002) containing charcoal and sherds of possibly middle Neolithic pottery (V65) beneath which were two more fire-pits, another pit and a posthole. Situated immediately west of the line of fire-pits was a second posthole, and to the immediate north of them was a rectangular deposit of silty sand with charcoal (Figure 2.30).

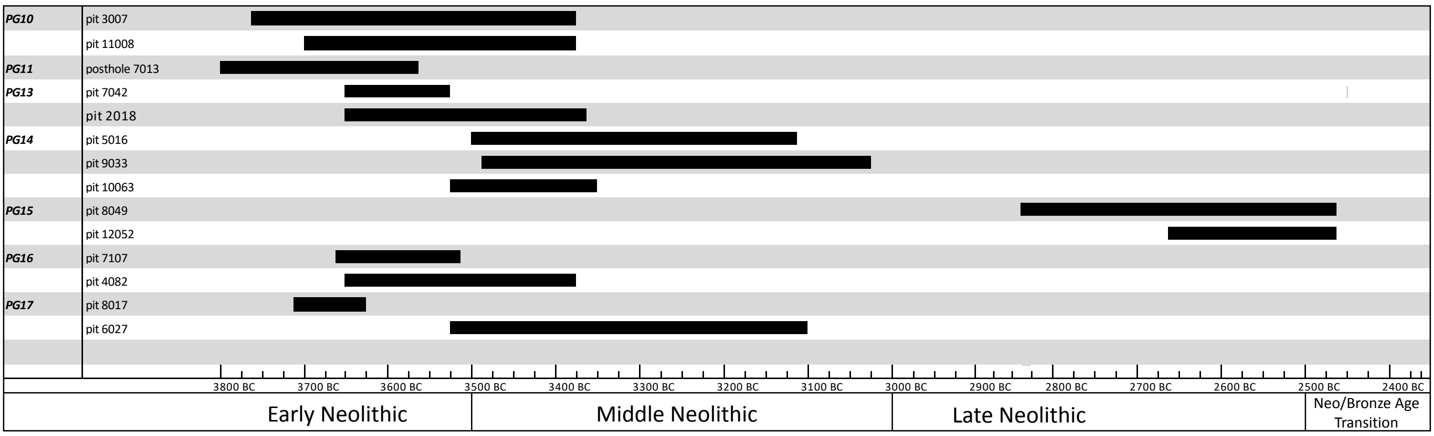

Table 2.5: Radiocarbon dates from Pit Groups along the southern edge of the site.

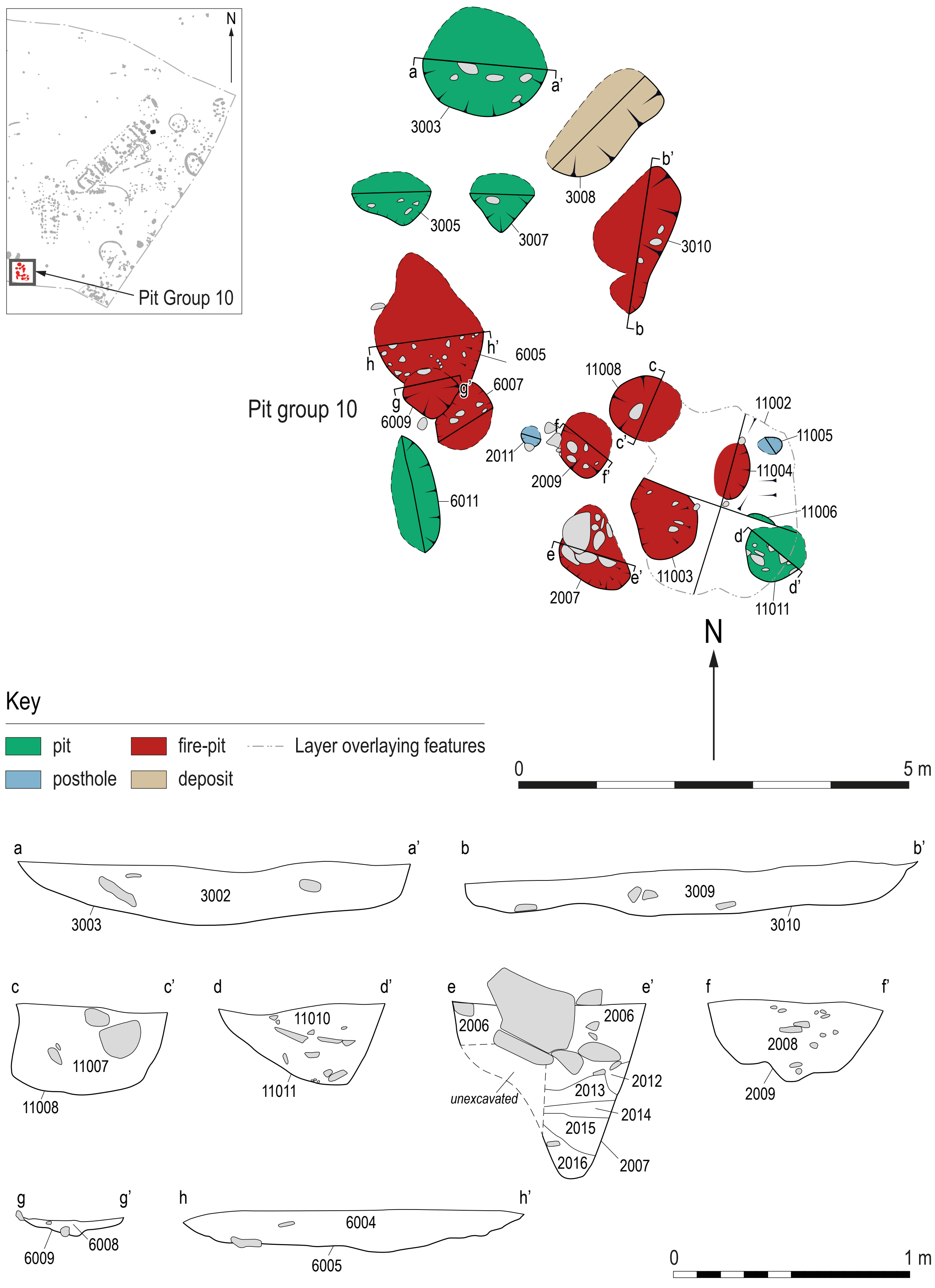

Figure 2.29: Pit Group 10 plan and section drawings.

Figure 2.30: Pit Group 10 during excavation.

Six other pits of various sizes were dug to the west of the features already described. Early Neolithic pottery sherds (V59) were found in the northernmost (3003) and a range of sherds from several Neolithic vessels (V61-63) plus lithic artefacts were found in the middle pit (6005), the largest of this group measuring almost 1.5 m by 2 m in extent. The activities represented in this group spanned the early Neolithic through to the early Bronze Age.

Located to the west of the previous group and in contrast to it, was a collection of features identified as *Pit Group 11* that comprised a widely dispersed and loose group of shallow pits and postholes with two deposits (Figure 2.31). The deposits of brown sand and silty sand survived towards the immediate north and west of a possible fire-pit with an adjoining pit. The fire-pit (7013) had with gently sloping shallow sides, and was barely 0.12 m deep. It measured 0.82 m by 0.72 m in diameter and produced an early Neolithic radiocarbon date from charcoal in its fill (see Table 2.5). No artefacts were found there or in any other elements of this group. The remaining features were situated some distance from the fire-pit: two postholes and a pit to the east, a pit with fire-cracked stones to the west that had suffered plough damage, two possible postholes to the north-west (one disturbed by animal burrowing), and one posthole and one large pit to their west. The latter (4005) could have been a possible fire-pit, but this is uncertain.

Further to the west was *Pit Group 12,* a more discrete group of pits and two postholes (Figures 2.31) dominated by a 0.35 m deep, elongated oval fire-pit (3016) almost 6 m in length and 2.3 m in width, filled with sandy silt, small stones, with some charcoal, Bronze Age pottery (V118) and lithic artefacts, overlying a lower layer which was rich in charcoal. The base of the pit was reddened due to burning. It produced a radiocarbon date from the early Bronze Age of 2114 – 1778 cal BC (UBA-39331) (Table 2.7), and it was archaeomagnetically dated with a wide range of dates from 5000 BC to 1645 AD (see Part 3: *Archaeomagnetic studies*). The eastern end of this massive pit was bordered to the north and south by a pair of postholes, and three other pits/ postholes abutted or lay close to its middle and west end (Figure 2.32). Two of them contained charcoal and the third (9029), unidentified sherds of pottery.

To the north were two larger pits, both in excess of 2 m by 2 m. One (9013) was a fire-pit, the other a possible fire-pit, with a possible smaller fire-pit, another pit and a posthole situated towards the west. The smaller fire-pit (9010) contained significant quantities of charcoal and stones cracked through heating confirming its function, and lithic artefacts were found in the westernmost posthole (9008).

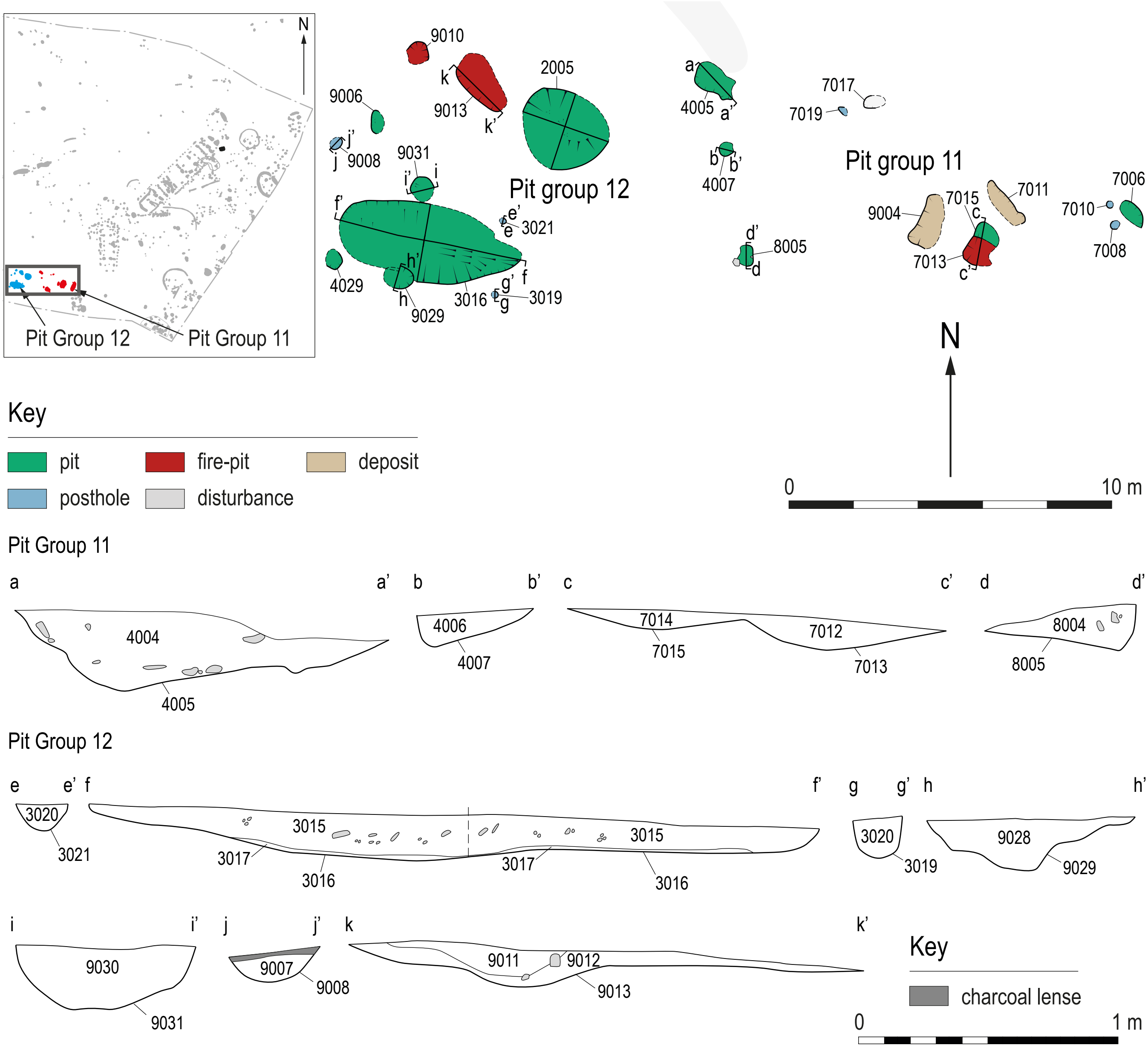

Figure 2.31: Pit Groups 11 and 12 plans and section drawings.

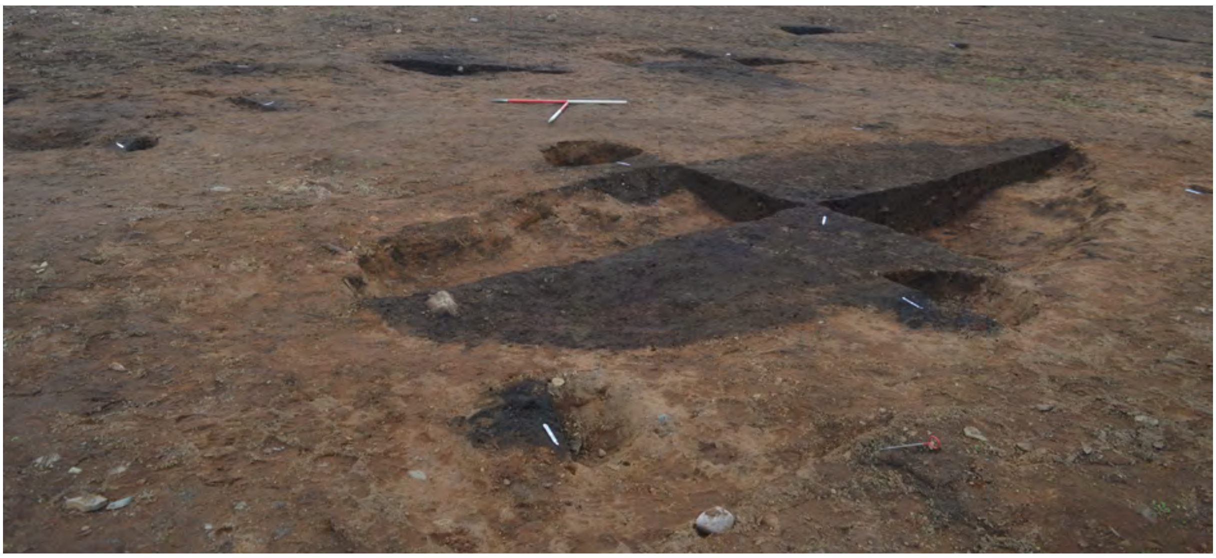

Figure 2.32: Pit Group 12 during excavation.

The next pit group to the west *Pit Group 13*, comprised three postholes, and two pits with a small fire-pit arranged north/south, with a second cluster of three fire-pits, three pits, and three postholes aligned along the contour, with an additional fire-pit situated at a distance towards Pit Group 12 (Figure 2.32). Of the east/west aligned cluster, the easternmost pit (6015) was the largest at c. 2 m by 1 m, and contained a range of pottery sherds (V126, V127, V130, V132 and V134) from the early, middle and later Neolithic. It also contained lithic artefacts, and one of the postholes was positioned close to its east end. The middle fire-pit (2018) also contained middle Neolithic pottery (V133) and produced an early to middle Neolithic radiocarbon date of 3640 – 3378 cal BC (UBA-39329) (Table 2.5). This fire-pit together with its neighbour to the west also appeared to a have a posthole each to their south. The pit alignment continued westwards with the positioning close by of a fire-pit that seemed to have been disturbed by a gully, possibly an animal burrow, followed by two further pits or fire-pits, one of which (4032), contained lithic artefacts and sherds of early Neolithic pottery (V131) lying below its three sandy fills that included charcoal.

Most of the features to the north were concealed below a layer of brown sandy silt that contained prehistoric pottery sherds (Figure 2.34). A small fire-pit (7042), which produced an early Neolithic radiocarbon date, contained middle Neolithic pottery (V128) and fragments of an early Bronze Age urn (V129).

The close association of pits and postholes with fire-pits is noted again in the next grouping - *Pit Group 14*. Activities were centred on five or six fire-pits arranged in a tight cluster with other pits and postholes to their immediate west and south (Figures 2.33). Two small pits, one with lithic artefacts, and three postholes were situated between the main features and the previous pit group. The use of this particular area suggests repeated visits over a long period of time (Figure 2.35).

The south-easternmost fire-pit (10032/10037) was the largest of this cluster. It measured 1.77 m by 1.45 m and was the deepest feature of the group at 0.34 m. Its story was complicated by the insertion of another fire-pit (10036) within it, with both containing fire-cracked stones, fragments of burnt animal bone, sherds of Bronze Age pottery (V123 and V124), as well as lithic artefacts. A posthole was also inserted at its west end. Samples from a fire-pit (9033) to the north and one (5016) to the west both returned middle Neolithic radiocarbon dates 3489 – 3026 cal BC (UBA-39349) and 3508 – 3113 cal BC (UBA-39333) respectively (Table 2.5). However, lying between these two was a double fire-pit (4045) in a figure of eight shape, which produced early Neolithic pottery (V125) and lithic artefacts. Immediately north of the latter, fragments of a Bronze Age vessel (V121) were found in yet another, smaller fire-pit.

Seven postholes, with an additional two to the north-east, could have housed securing posts for a windbreak(s) in a curve around the fire-pits. The postholes seemed to form two, almost parallel alignments suggesting repositioning or replacement of the structure.

The next group, *Pit Group 17* to the west, almost mirrored the close proximity of fire-pits and other pits as in the previous pit group, but without postholes (Figures 2.36). Three fire-pits with a possible fourth were arranged close together and formed the centre of this group. The largest (6027) measured 1.4 m in length, but they were all c. 1 m wide, and none was deeper than 0.25 m. The south-western fire-pit (6027) produced a middle Neolithic radiocarbon date range of 3520 – 3111 cal BC (UBA-39337). The south-eastern one (8017) produced an early Neolithic radiocarbon date of 3702 – 3636 cal BC (UBA-39345) (Table 2.5), and the north-eastern fire-pit (8019) contained sherds of an early Neolithic vessel (V120). Most of the fire-pit fills contained stones, as did the surrounding pits (Figure 2.37). Charcoal was found in the contents of most of the features and lithic artefacts were found in two.

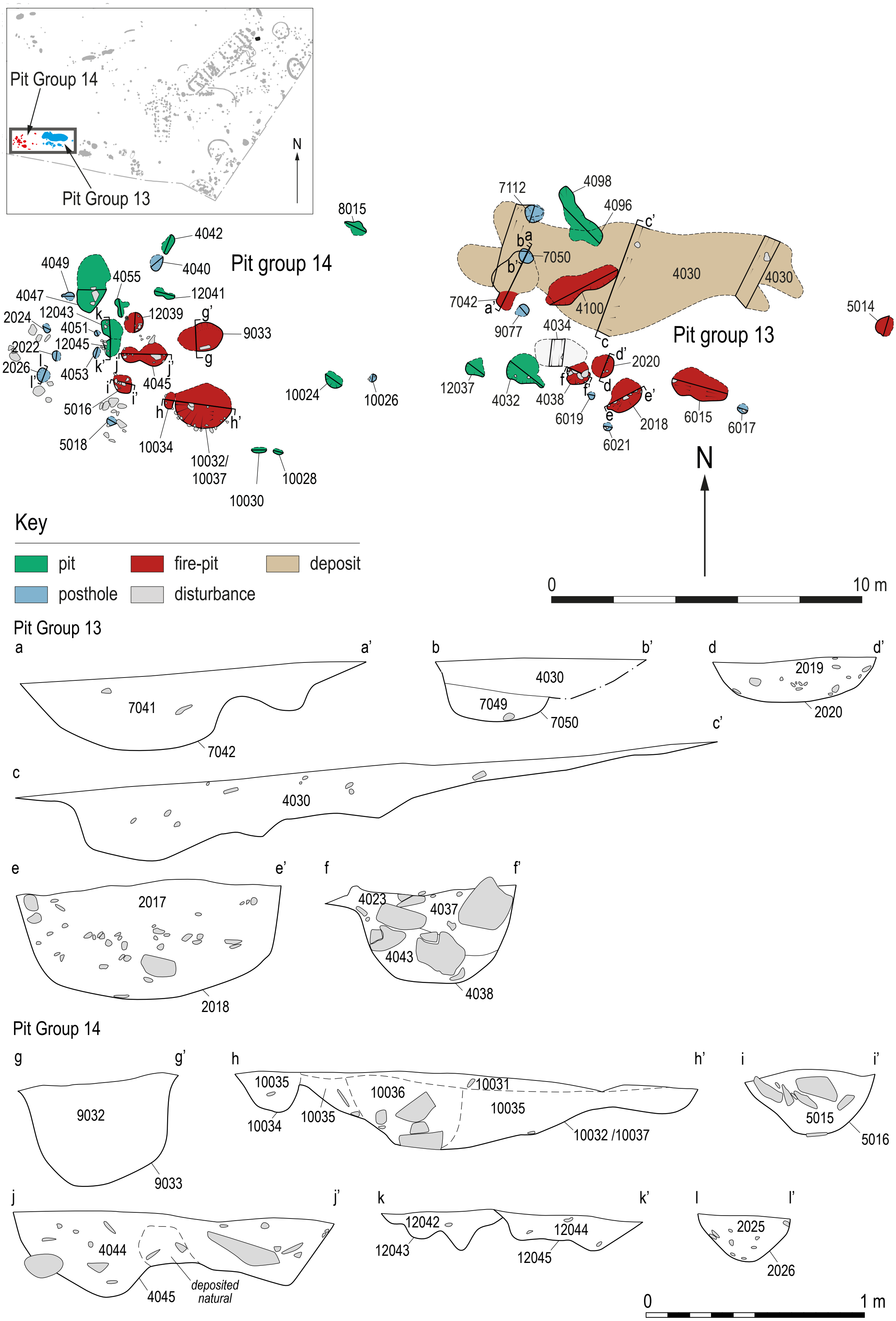

Figure 2.33: Pit Groups 13 and 14 plans and section drawings.

Figure 2.34: Pit Group 13 during excavation.

Figure 2.35: Pit Group 14 during excavation.

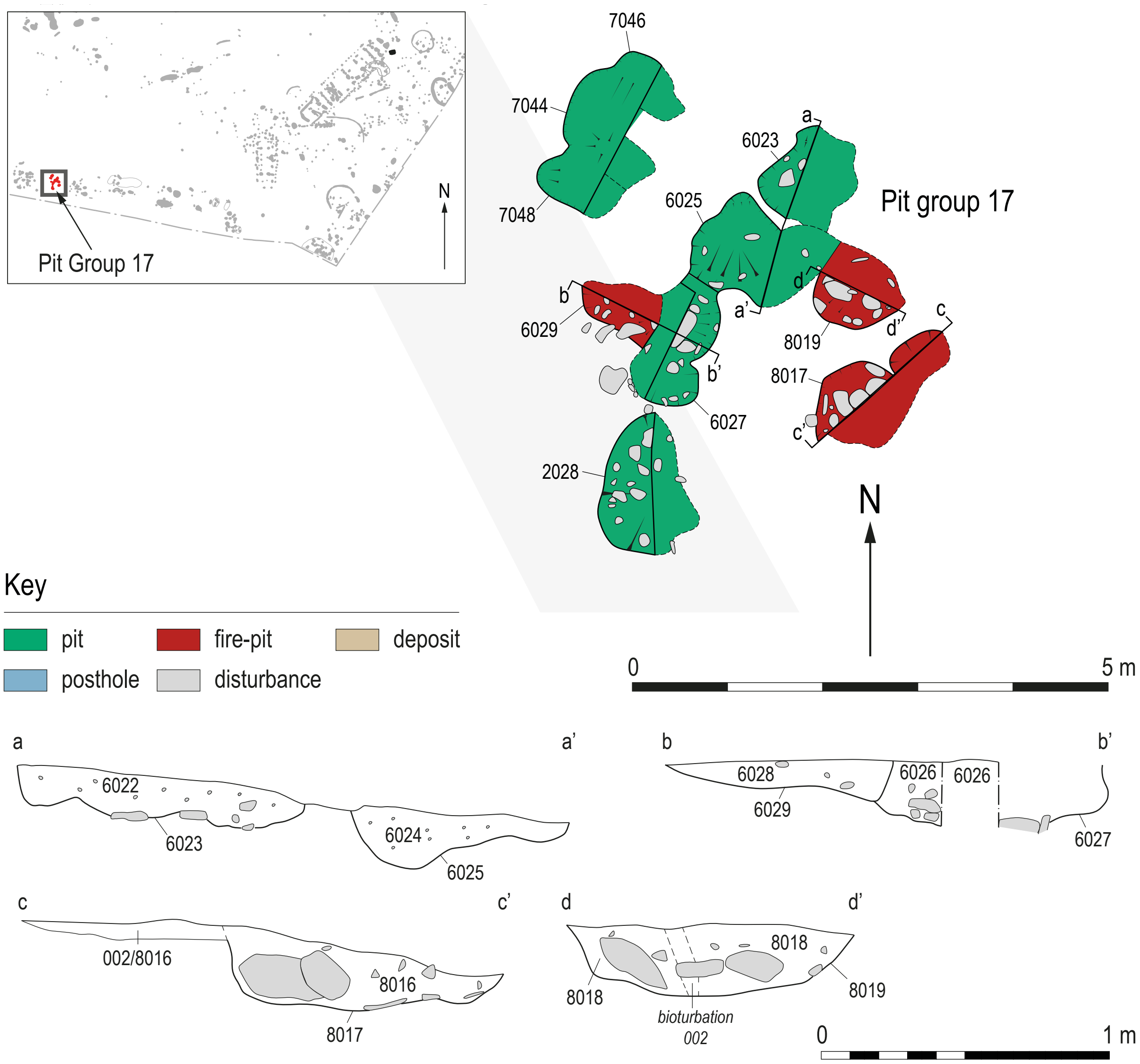

Figure 2.36: Pit Group 17 plan and section drawings.

Figure 2.37: Pit Group 17 during excavation.

The next group to the west, *Pit Group 15,* was a larger group of c. 20 pits, at least five of them were identified as fire-pits, one large feature comprised three pits, and in addition there were four or five postholes. All the features seemed randomly arranged but individual fire-pits appeared to be accompanied by pits and in one example by a posthole (Figures 2.38 and 2.39).

The pits in the north-western part of the group were covered by a deposit of brown-grey sandy silt including charcoal flecks, charred hazel nutshells and sherds of Neolithic pottery. Some of this material also comprised the upper fills of the triple pit (10058/10060/10065). This feature situated towards the north-east corner of the group also contained sherds of early Neolithic and Neolithic pottery. Its three pits were all c. 1 m in diameter, but no deeper than 0.33 m (Figure 2.39). Situated immediately south-east of the latter, was a shallow, small fire-pit (11063), which also contained early Neolithic pottery (V141 and V142) and returned a middle Neolithic radiocarbon date of 3517 – 3353 cal BC (UBA-39353). Three pits to the south-west, two of which (8049 and 8043) could be fire-pits contained early, middle and late Neolithic pottery, emphasising the reuse of pits, their clearing out and also backfilling, and the mixing of material cultural remains from different periods. Pit 8049 was dated to the late Neolithic 2839 – 2473 cal BC (UBA-39347) (Table 2.5)

In the south-eastern corner of this group was a fire-pit (5022), slightly smaller than 1 m in diameter, which produced lithic artefacts and early Neolithic pottery. Some 5 m to the west was a fire-pit (12052) that measured 1.5 m by 0. 87 m and was the deepest feature of this group attaining a depth of 0.54 m. It contained charcoal, fire-cracked stones, undated pottery sherds and returned a late Neolithic/early Bronze Age radiocarbon date range of 2835 – 2474 cal BC (UBA-39356) (Table 2.5). The excavation record indicates that it might have been marked by a post situated within the pit at its east end. A small posthole to its immediate north was also present.

To the north-west, on the west side of the group was an irregularly shaped pit (2053) that measured 1.8 m in length, 1.5 m in width and was 0.33 m deep. It contained sherds of Neolithic pottery and lithic artefacts. To its north-east were two small pits or postholes. Further pits lay to the north, some of which contained lithic artefacts, and one at least may have functioned as another fire-pit.

Figure 2.38: Pit Group 15 as excavated.

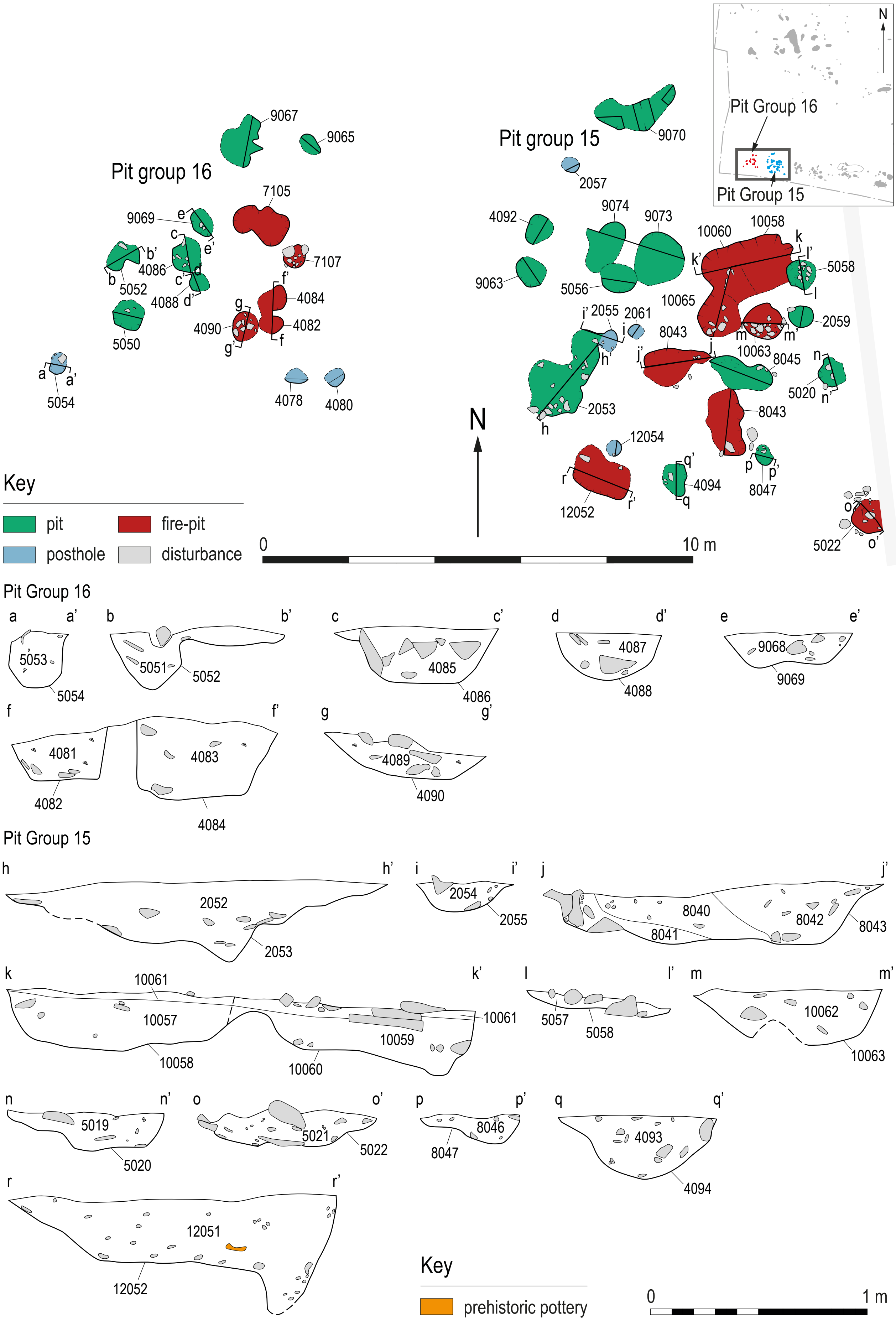

Figure 2.39: Pit Groups 15 and 16 plans and section drawings.

The last group of (15) pits recorded along the southern boundary of the site lay furthest west were *Pit Group 16*. Fire-pits formed a rough circle with pits to the north and west with a line of three postholes to the south. The fire-pits were aligned roughly north/south with the largest (7105) to the north (Figures 2.39). The easternmost (7107) was the most interesting, and although it was slightly smaller than 1 m in diameter, it contained two fills, and attained a depth of 0.44 m, the deepest pit of the group. Charcoal from it was radiocarbon dated to the early Neolithic, 3659 – 3523 cal BC (UBA-39343) (Table 2.5), but its contents of sherds of pottery, some of which it shared with its northern neighbour, were early Neolithic and early Bronze Age in date. This paradox indicates that the fire-pit was in use later than indicated by its radiocarbon date, and also that it was reused.

Early Neolithic pottery (V143) was also found in three adjoining fire-pits (4082, 4084 and 4090) along with lithic artefacts. Further sherds of similarly dated pottery (V143) were found in a possible fire-pit (4086) to the north-west. The western-most pit (5052) contained lithic artefacts and produced a late Mesolithic radiocarbon date of 4442 – 4048 cal BC (UBA-39334) (Table 2.1). A thin deposit of charcoal-rich material lay to the north of the pit group and this may have been material raked out from one of the fire-pits.

The date ranges and material cultural evidence from this pit group and others indicates the complexities and problems of interpretation of their use and their longevity. The evidence points to that fact that people returned to this area for activities which involved the digging, use and backfilling of pits, sometimes several times, possibly the marking of specific fire-pits with posts, and the digging of other pits whose function cannot often be ascertained.

Land in use beyond the buildings – the outland[3]

The large extent of ground to the north and west of the Neolithic timber structures to the site boundaries was devoid of recognisable buildings and amounted to c. two-thirds of the topsoil stripped area. From the number of pits, postholes, deposits and the occasional gully that survived, it was clear that the area had been used intermittently for activities, some of which were found more frequently closer to the buildings. The deposition or spreading of organic waste materials, with the addition of broken pottery, appeared to be widespread, but whether this was a deliberate form of manuring or fertilising with debris from the buildings, thus creating an enhanced soil for cultivation, is uncertain. These activities took place from the early Neolithic in particular, presumably for agricultural purposes and continued to almost the present day, as seen in the remnants of rig and furrow cultivation, which has removed parts of many features, or indeed whole features, and disturbed others. Alignments of postholes of unknown date suggest boundaries to fields, and one early Bronze Age burial in Area G, where an early Bronze Age decorated Beaker (V152) was found, suggests that ritual activities also took place there.

Across this large area, groups of features or deposits were identified. These included Area G immediately north-west of the buildings and ‘Structure’ 7 in the north-west corner. Surrounding the latter were Pit Groups 22 through to 25 along with Areas C, D and E with H to the south-east. Around Area G was Pit Groups 19 to 21 with Area I to the south and Pit Groups 26 to 28 to the north (Figures 2.40 - 2.47).

Where features from these areas add to our understanding of the use of the cultivable land to the north-west and the buildings to the east and south, they are described below. There are a total of 10 radiocarbon dates from this area (Table 2.6 and 2.7).

3 Outlying land = outland. This word has been chosen because words such as out-break, out-tilling, out-field, out-back and back-land have all specific meanings derived from old Norse land and settlement descriptions, or old Scots, none of which is suitable in this context.

Area G

Immediately north-west of Structure 8, at a distance of 6.5 m from it, was a short, curved and undated gully (12016) that measured 5.35 m long by up to 0.43 wide. It was exceedingly shallow at only 80 mm deep and it contained no finds, only charcoal. Whether it was the remains of a structure, such as an enclosure or building, is not known. Close by were a pit and a possible posthole. Other features in the middle part of this area include a possible posthole, three pits and two possible isolated fire-pits. One of the latter (7021) to the north-east contained sherds of unidentified pottery but returned an early Neolithic radiocarbon date of 3645 – 3521 cal BC (UBA-39339) (Tables 2.6 and 2.7).

In the north-western arm of the site, two possible pits and two postholes formed a linear arrangement, possibly a fence, and charcoal was found in some of their fills. To their east was a circular fire-pit (7065) c. 1.40 m in diameter containing fire-cracked stones, and considerable fragments of an early Neolithic pottery vessel (V151) (Figure 2.40).

There were two other postholes in the area, one pit, and a fire-pit (10039) with lumps of charcoal, which returned an early Neolithic date of 3960 – 3796 cal BC (UBA-39352). However, the most interesting feature was a burial pit (8023), c. 1.8 m long by 1.6 m wide, which survived to a depth of 0.34 m (Figure 2.40). The walls of the pit were straight and the base was roughly flat. Although no bone fragments were present in the pit, lithic artefacts were found in its backfill as well as fragments of an All Over Corded Beaker (V152), dated to the late Neolithic/early Bronze Age (see below and Table 2.7).

Areas around Area G predominantly contained pits and postholes - Pit Groups 19 to 21, 26 to 28 and Area I. None of the features in *Pit Group 26* to the immediate north produced material cultural evidence, except one posthole, 0.46 m deep that had two fills, in which undated sherds of prehistoric pottery was found (Figure 2.41) To its south was a group of four small pits and to its north-west were five pits of various sizes, well-spaced out, with a posthole between two of them. Some of these pits were plough damaged. To their west were two almost adjoining shallow fire-pits with charcoal. The largest of these measured c. 1 m by 0.73 m. Some 20 metres to the east was another small group of three pits, two with charcoal, and two postholes in *Pit Group 27*. To the south east, the features closest to the settlement area, were linear in their arrangement and formed *Pit Group 28* (Figure 2.41). This group comprised four possible postholes tightly positioned in a row in the west, which were aligned directly with three other pit/postholes some 12 m to the east, also in a row, and with another posthole some 3 m further east. Four pits, two with charcoal in their fills, were located south of the posthole alignment, with a small fire-pit to the south-east (9017) that contained fire-cracked stone. North of the posthole alignment and towards its west was a large irregular pit (8011) measuring 1.6 m by 1.5 m and 0.25 m in depth. A smaller, shallower

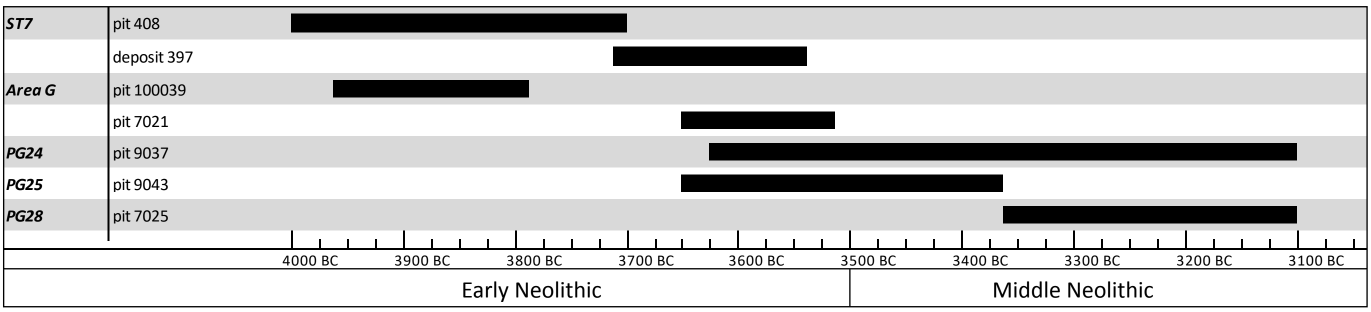

Table 2.6: Radiocarbon dates of features to the north-west.

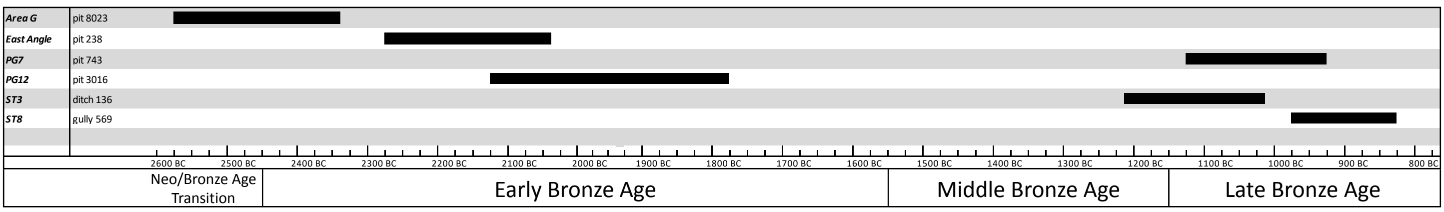

Table 2.7: Radiocarbon dates of burials and other isolated features.

pit was situated south of it and the posthole alignment. Neither of these two pits contained charcoal nor other dateable evidence.

In the extreme north-east corner of the excavated area in *Area 0 and East Angle* were three isolated pits and a deposit of black silty sand, gravel and charcoal. The westernmost of the pits (238) produced an early Bronze Age date (Table 2.7).

South of the western arm of Area G in the middle part of the excavated area were three groups of pits and one isolated pit. The northernmost group, *Pit Group 21*, produced a long line of 16 pits and five postholes roughly aligned NE/SW, with an isolated posthole to the north (Figure 2.42 and 2.43). Situated in the middle of these features were two c. 5 m long shallow and irregularly shaped gullies. There seemed to be no recognisable relationship between them and any of the nearby features. A pit (12031) located to the north-east of the westernmost gully produced an early Medieval radiocarbon date of the late first century AD (Table 3.1). Towards the north-east extent of this group of pits was a linear gully (8013), with charcoal that measured 4.76 m in length and c. 0.5 m in width. It too returned a late first century AD date range, indicating activities in this part of the site at that time. Two additional pits with charcoal in their fills were located in the far north-east corner of this area.

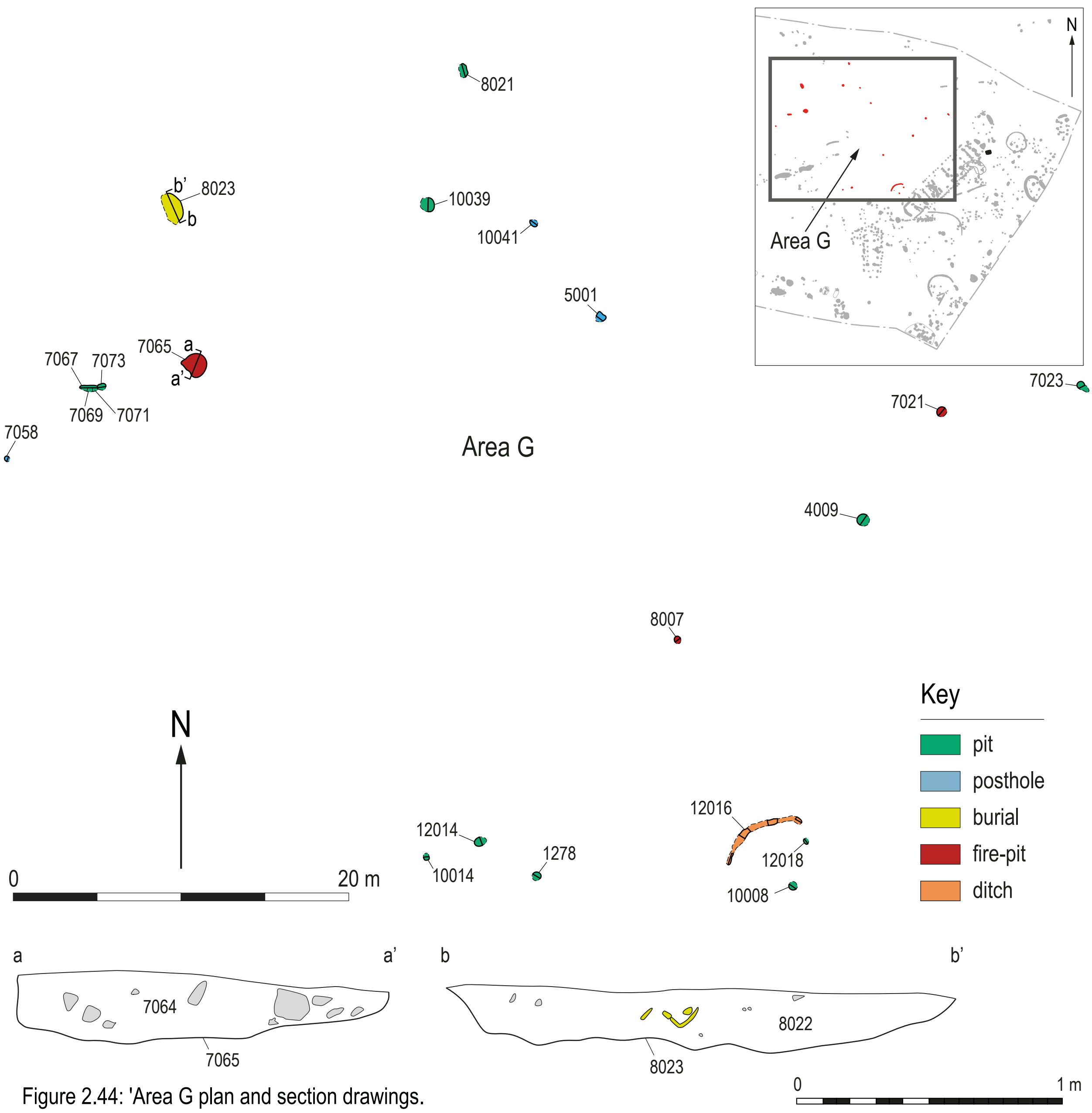

Figure 2.44: 'Area G plan and section drawings.

Figure 2.40: 'Area G plan and section drawings.

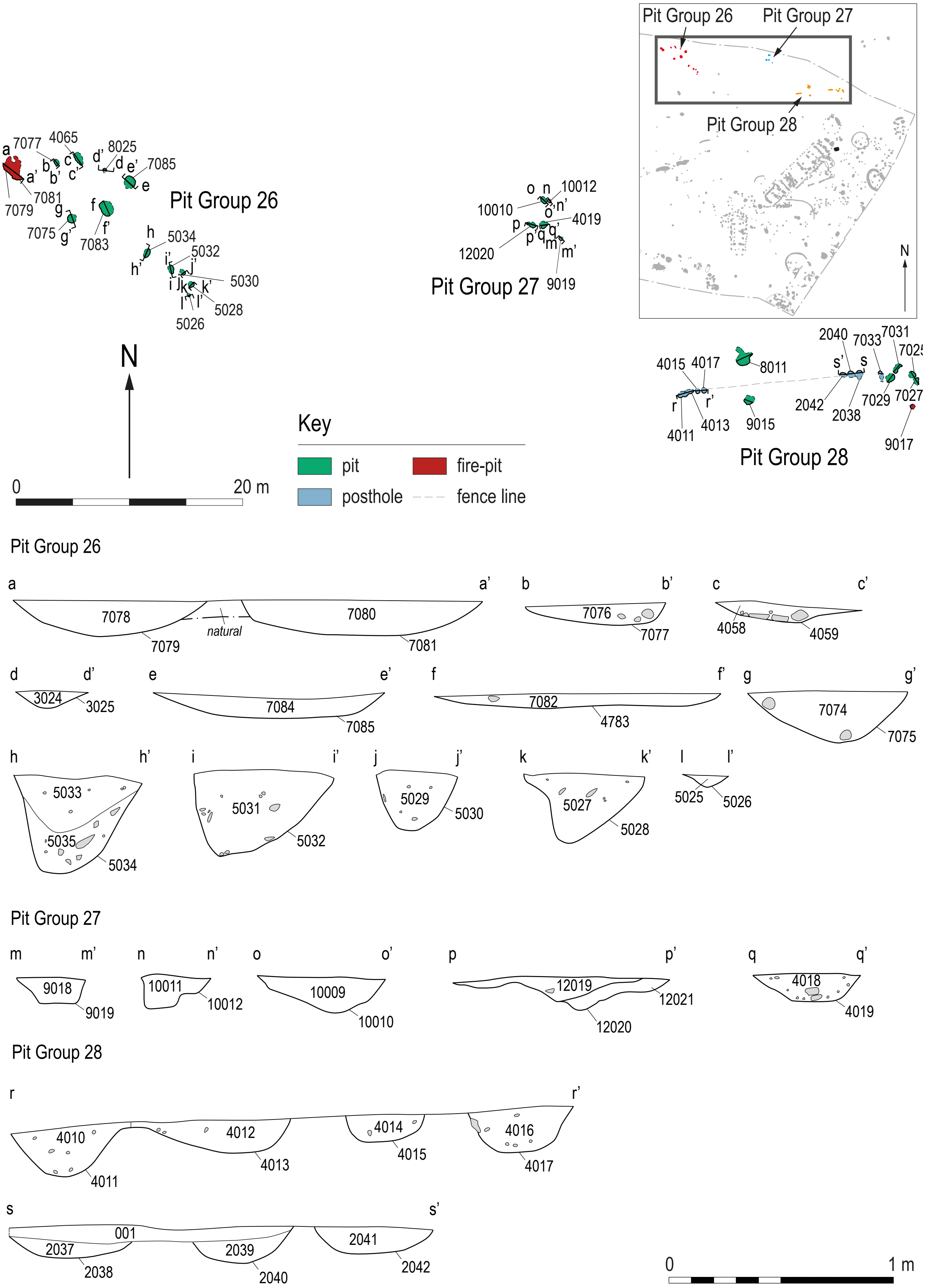

Figure 2.41: 'Plans of Pit Groups 26-28 with section drawings.

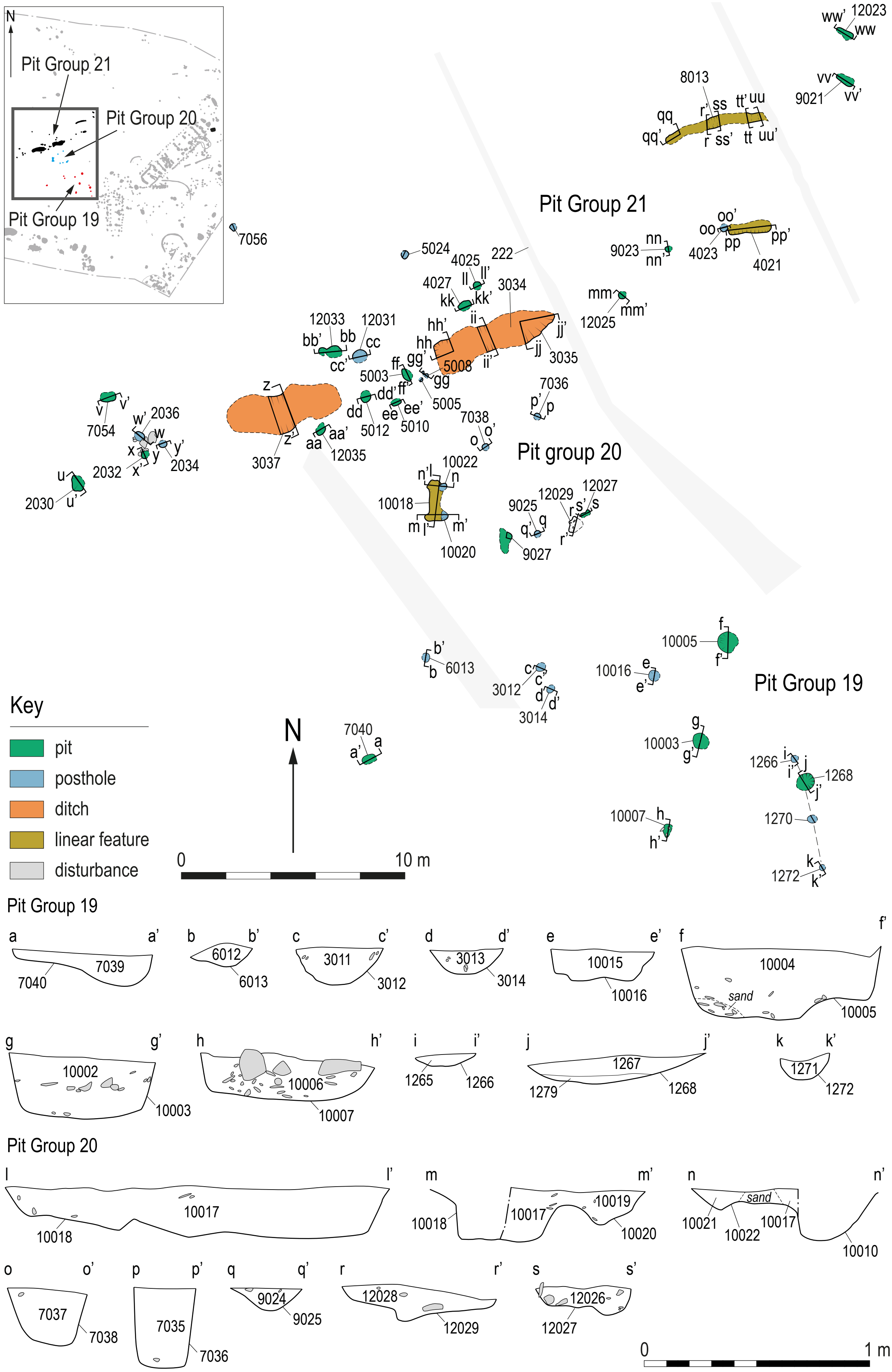

Figure 2.42: 'Plan of Pit Groups 19-21 and Pit Group 19 section drawings.

Features continued southward where there was a discrete area (*Pit Group 20*) of four pits, two of which had been disturbed by animal burrowing or a field drain, and two possible postholes north of them (Figure 2.43). To the west was an unusual feature of an almost rectangular, steep-sided gully or pit (10018) aligned north/south. It measured 1.8 m in length by 0.48 m in width by 0.24 m in depth and expanded slightly to the west at its ends. Lying at either end on the eastern side of the feature were two possible postholes. It did not contain dateable or artefactual evidence to aid its interpretation.

Additional features further to the south in *Pit Group 19* included five pits and three postholes, with three postholes and a pit forming a linear arrangement to the east, possibly part of a fence line (Figure 2.43). The northernmost pit of the group was possibly a fire-pit, and it contained lithic artefacts. An isolated pit in *Area I* was identified to the south and close to the pit groups along the southern edge of the site.

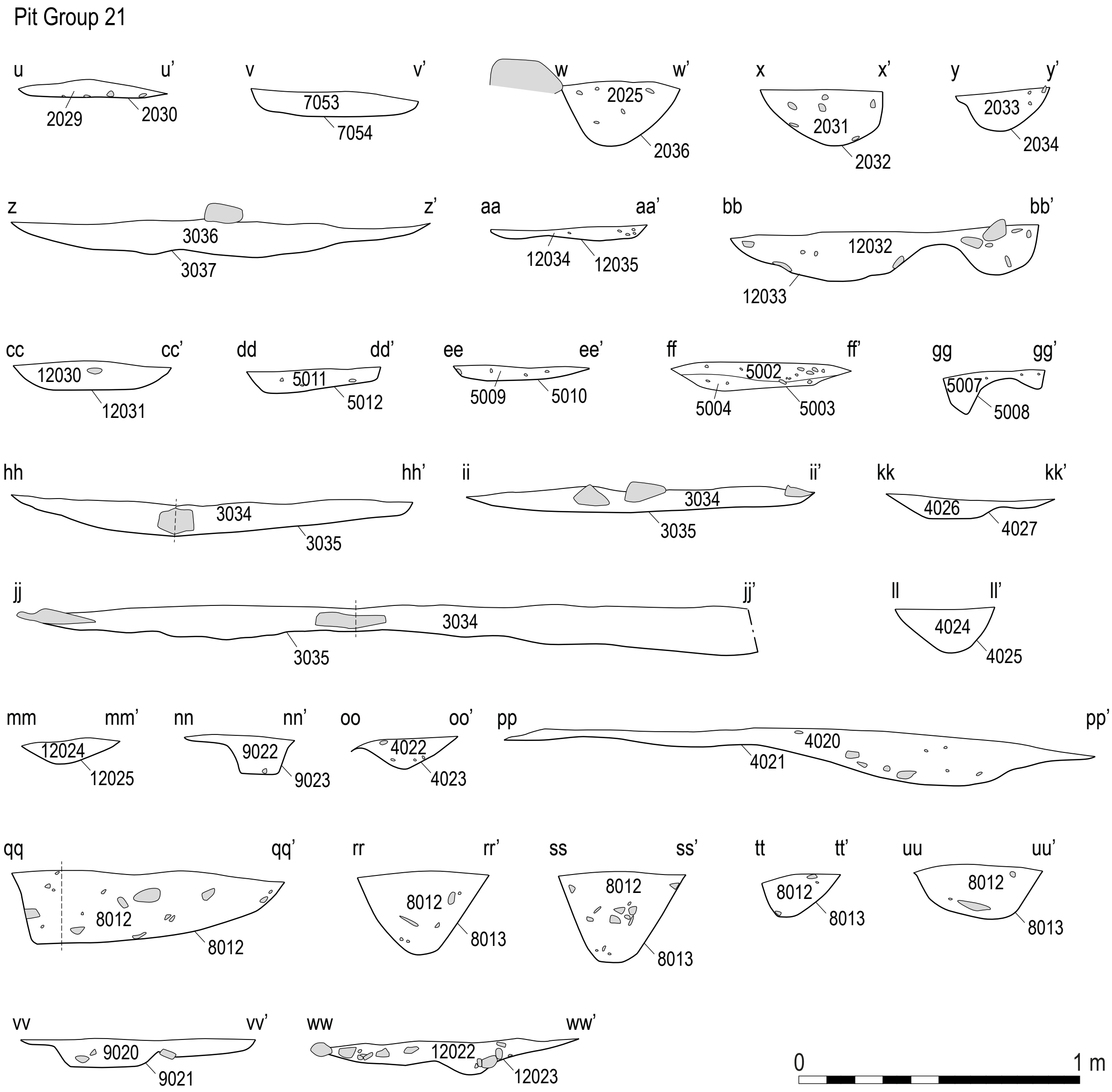

Figure 2.43: Pit Group 21 section drawings.

'Structure' 7

This area in the north-west corner of the excavated area was originally thought to include a wooden structure, but none was identified there. However, there were considerable expanses of enhanced organic deposits that resembled discarded human or animal waste materials. The upper layer covered an area c. 279 m^2, and although the lower layer was less extensive, both were c. 100-130 mm thick. The areas covered by these deposits were excavated in 1 m^2 grid squares (Figures 2.44 and 2.45). Sherds of prehistoric pottery were numerous and lithic artefacts were also present. A radiocarbon date from the lower deposit (397) produced an early Neolithic time range (Table 2.6). The identified pottery from these deposits is also early Neolithic in date.

Features beneath these deposits in its southern part included a 4.5 m long gully (410), and one c. 2.3 m long, both of which were less than 0.18 m deep but could have functioned as drainage ditches. There were also two pits and a 2.5 m long fire-pit (408) that was c. 1 m wide. Organic material inside the pit produced an early Neolithic radiocarbon date of 3943 – 3711 cal BC (UBA-39287) (Table 2.6) and pottery of the same period, included two lugs or proto-handles (V147 and V149).

Four postholes situated to the north in *Area E* suggest an angled alignment, possibly a field boundary of unknown date. In addition, there was a pit which produced sherds of pottery of unknown date. To the north-east was *Pit Group 24*, near the excavation boundary with a widespread group of four pits, each with evidence of charcoal in their fills (Figure 2.45 and 2.46). A sample from one of them (9037) produced an early to middle Neolithic radiocarbon date of 3623 – 3112 cal BC (UBA-39350) (Table 2.6). A 2.3 m long gully or fragmentary ditch lay south-west of the pits. It was aligned NE/SW and had charcoal in its backfill.

Figure 2.44: Aerial view of 'Structure' 7.

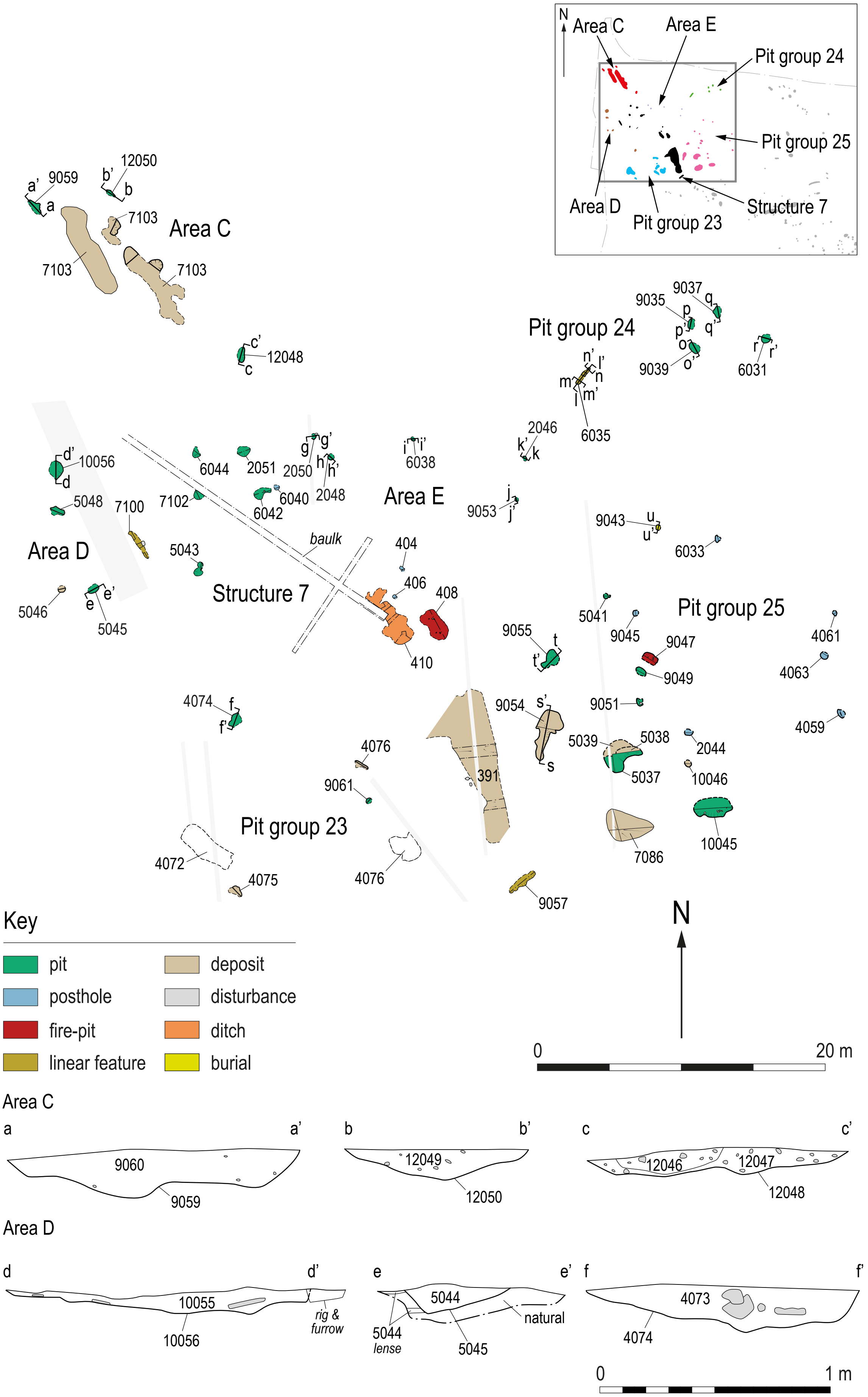

Figure 2.45: 'Plans of 'Structure' 7, Pit Groups 23-25 and Areas C, D and E.

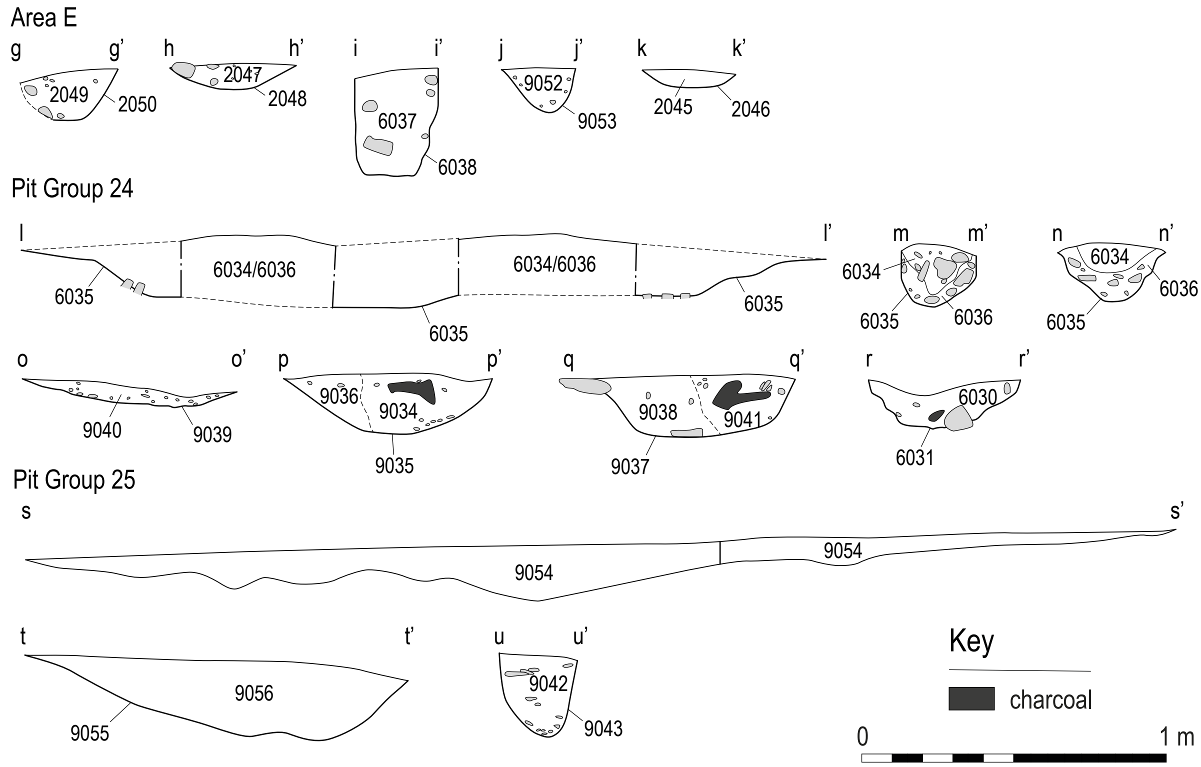

Figure 2.46: 'Structure' 7 section drawings.

In the north-western portion of *'Structure 7',* in further deposits of organic debris were a posthole, another short, shallow gully 2.4 m long, and five pits. One of the latter had some charcoal and another was disturbed by animal burrowing. None of these features contained material cultural evidence, or was dated (Figure 2.45). Additional organic layers were identified in the north-west corner of the excavated area (*Area C*) as long, linear deposits with a pit surviving close to each of their north-west ends, and a single pit was identified to their south. Radiocarbon dating of the organic deposits (7103) produced a late Mesolithic date of possibly from a camp in the area of 5307 – 5071 cal BC (UBA-39342) (Table 2.1).

To the south and west of the main organic deposits, additional evidence of use of the outland was noted in *Area D*. This included a few pits and two fire-pits, one of which produced fire-cracked stones and lumps of charcoal (Figure 2.45). Smaller patches of organic deposits were noted further south and east in *Pit Group 23*, where some produced a few lithic artefacts and a single pit was located between them. This area was partly truncated by rig and furrow cultivation and also by tile and rubble field drains.

To the east in *Pit Group 25* were four additional deposits of organic material. Associated with two of them were pits that had been dug through the deposits. Eight additional pits, with a larger one to the south with charcoal, three postholes, one possible fire-pit with charcoal, and one definite fire-pit with fire-cracked stone and charcoal, were recorded in the vicinity (Figure 2.45 and 2.46). The latter fire-pit and another pit were situated close together. In the north of this group, a pit (8043) with charcoal produced lithic artefacts, sherds of an early Neolithic pottery bowl (V119) and a radiocarbon date suggesting the pit was in use from the early Neolithic into the middle Neolithic with a date range of 3642 – 3374 cal BC (UBA-39351) (Table 2.6).

The features of *Pit Group 22* situated beyond the southernmost extent of 'Structure' 7 were randomly distributed, with five pits and two postholes to the west, one pit to the south (*Area H*), two postholes to the north-east, and four postholes and two pits to the north centre of the group (Figure 2.47). Towards the east and south-east were three pits with charcoal and one pit with burnt bone fragments that lay to either side of a large fire-pit (356). This feature contained charcoal and was densely packed with a large number of stones, many of them fire-cracked. The pit measured 1.9 m long by 1.8 m wide and was 0.33 m deep.

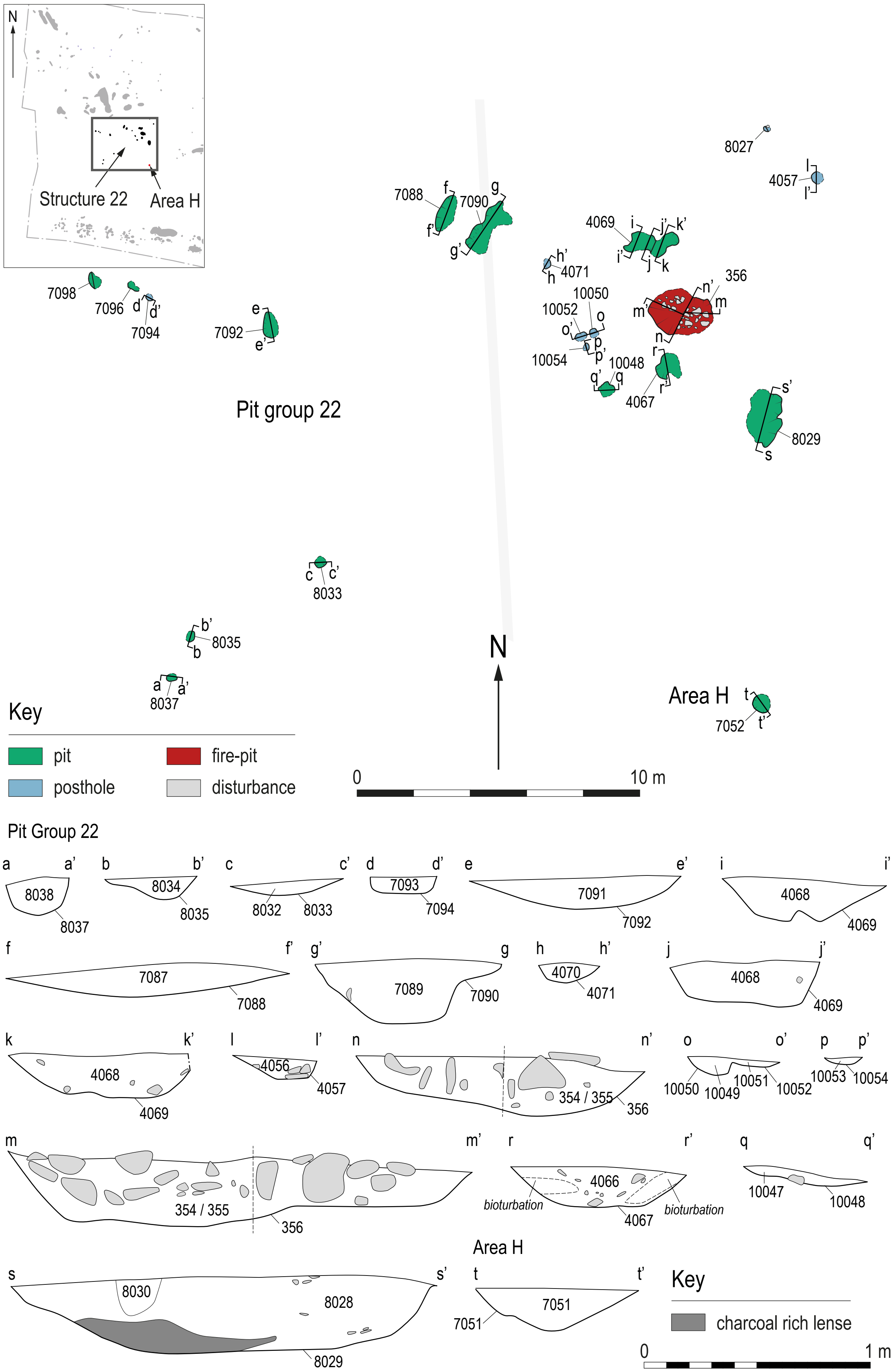

Figure 2.47: 'Plan of Areas H with Pit Group 22.

Evidence of the Bronze Age

Bronze Age activity defined by the type of structures, the occasional pottery vessel, the late Bronze Age metal hoard and radiocarbon dates, was more restricted across the excavated area than that of the Neolithic (Figure 2.48), and in several cases it was identified as insertions into earlier structures. Most of the evidence was limited to the north-east corner of the site and along its southern border, with occasional evidence elsewhere.

Burials and other isolated features

Burials

A number of features, some within structures suggest that burials had taken place in parts of the excavated area during the early Bronze Age. The recognition of pottery from that period that was deposited in pits, adds to the understanding of activities taking place on the site.

One of the most complete early Bronze Age vessels V152 was an All-Over Corded Beaker found in a large oval-shaped pit (8023) in *Area G* (Figure 2.43). The pit, which measured 1.8 m in length and was almost 1.2 m wide, had vertical walls and survived a little over 0.3 m in depth. Its isolated location, to the north and west of the Bronze Age structures, suggests it was probably a burial but none of its contents, except for the pot, survived. A radiocarbon date from charcoal from the pit provided a date of 2571 – 2348 cal BC (UBA-39346) and indicates that the date of deposition of the Beaker took place at the transition of the end of the Neolithic with the beginning of the Bronze Age (Table 2.7).

Vessel 70 comprised a few sherds of another All-Over Corded Beaker that were found in a shallow, round pit (1109) in the centre of *Structure 13*. Most of the pit had been ploughed away along with the greater part of the pot and with other evidence for a burial, such as cremated bone.

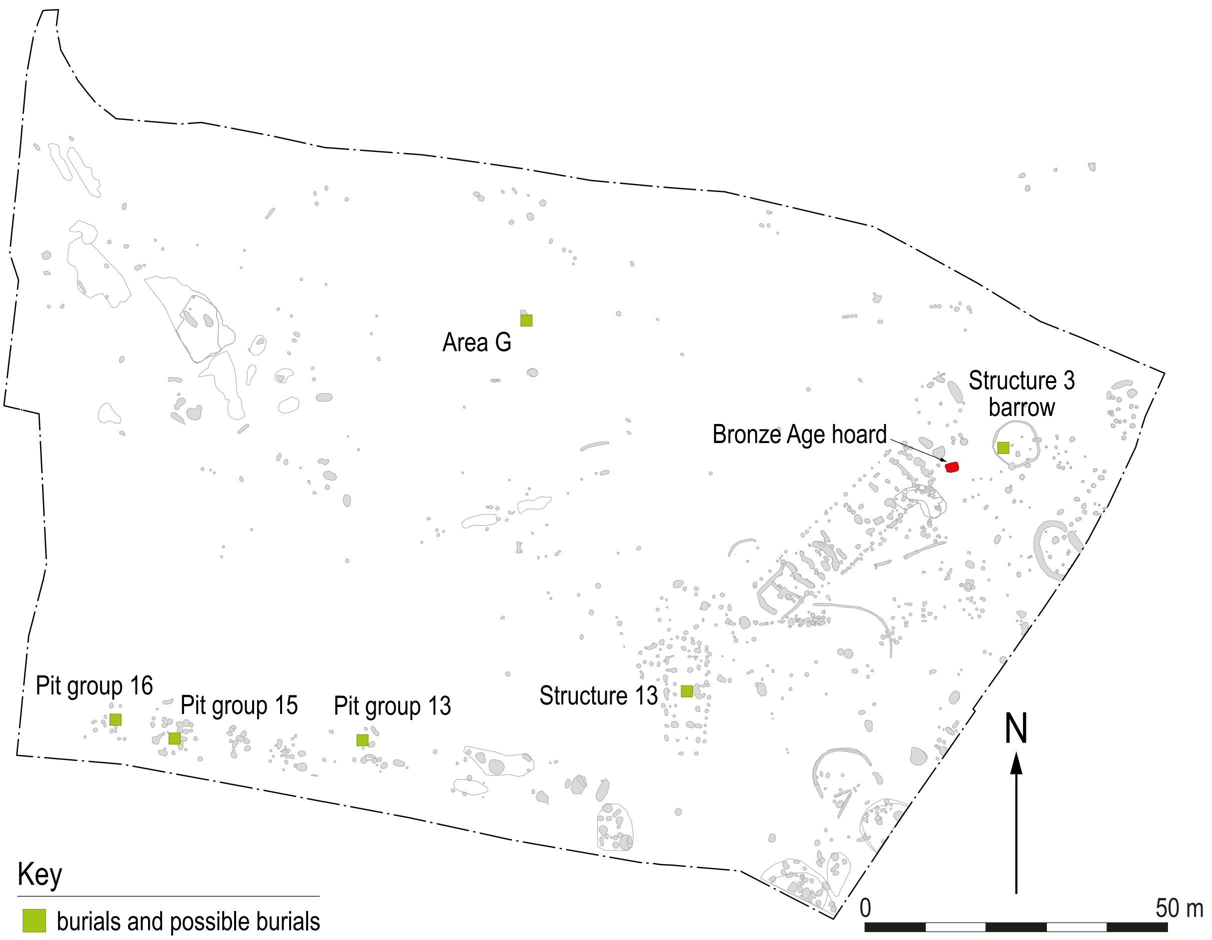

Figure 2.48: Simplified enlarged view of location of structures with burials and hoard.

A small sherd of Beaker pottery with cord impressions (V137) was also found within one of the fire-pits (8049) of *Pit Group 15*, suggesting that this pit, which also contained middle/late Neolithic pottery, was used late in the late Neolithic/early Bronze Age. The radiocarbon date from charcoal from the feature returned a late Neolithic date range of 2839 – 2473 cal BC (UBA-39347) (Table 2.5).

The western part of *Pit Group 13* was also possibly the site of another early Bronze Age burial where an urn (V129) was placed in a large oval pit (7042) over 1 m long by 1 m in width. The walls of the pit, which survived less than 0.3 m deep, were vertical and it would appear that the pot was inverted when it was placed there. It too was lifted in a block of soil during the excavation due to its fragility, in order for it to be analysed later. Parts of its decorated rim survived, but its base had been lost when it was disturbed by ploughing. During the truncation of the pit, the pot had been overturned and part of its rim and side had collapsed inwards. It contained fragments of burnt bone. A radiocarbon date from the fill of the pit returned an early Neolithic radiocarbon date range of 3644 – 3524 cal BC (UBA-39341) indicating the incorporation of earlier material into the grave with the backfilling material (Table 2.5).

Structure 3 barrow and its burial

Located to the west of Pit Group 3 in the north-eastern part of the site, was a roughly circular area enclosed by an annular ditch (136) c. 7.5 m in diameter and averaging 0.5 m in width, which had been badly disturbed by rig and furrow cultivation (Figure 2.49). Samples from the ditch fill returned a radiocarbon date of 1207 – 1017 cal BC (UBA-39266), the middle to late Bronze Age (Table 2.7).

Within the enclosed area was a burial pit positioned in the south-west close to the ditch edge. A badly damaged Bronze Age urn (V19) was found within the small, shallow and straight-walled flat-bottomed pit (193) measuring c. 0.3 m diameter at its base. The pit was just large enough to receive the pot in an upright position as part of a cremation burial (Figure 2.50). However, the vessel was badly damaged by agricultural activities, as both the rim and base of the vessel were missing.

Associated with the enclosure were three internal postholes and two internal and two external pits paired both sides of the ditch in its south and east segments. In addition, there was an internal fire-pit (153) with a second (182) that lay beneath the southern portion of the ditch. The latter fire-pit had a charcoal-rich fill which included burnt hazel nutshell fragments and numerous sherds of a possible Bronze Age vessel (V4), but it is earlier than the ditch and presumably the burial (V19). The fire-pit (153) within the enclosed area contained fire-cracked stones and charcoal and returned an early Neolithic radiocarbon date range of 3646 – 3520 cal BC (UBA-39268) (Table 2.4). The backfilling of the fire-pit had most likely disturbed earlier contexts to return the early date. How many of the features in the area are intimately associated with the cremation, burial and the ditch is conjecture, but the larger fire-pit could be considered for the siting of the cremation pyre.

It is highly likely that the burial was the focus for the surrounding ditch, even though it was not central to it, and together they suggest that a barrow or mound of earth had been erected over the grave. The ditch defined the extent of the mound and also provided the earth and subsoil to create it.

During the excavation of the pit by the archaeologists, the remains of the vessel were lifted in a block of soil to be subsequently excavated under laboratory conditions. Unfortunately, the contents of the urn, a cremation burial, were no longer present, having been destroyed when the grave was truncated in the past.

Other features

A Bronze Age vessel (V118) was found in the upper fill of the largest pit (3016) in *Pit Group 12*, which produced an early Bronze Age radiocarbon date of 2114 – 1778 cal BC (UBA-39331), (Table 2.7; Figure 2.32). The date and the pot suggest domestic rather than ritual activity associated with this area of the excavated site. The remains of three Bronze Age pots (V121, V123 and V124) were associated with two fire-pits (12039 and 10032/10037) in *Pit Group 14* (Figure 2.34). The sherds of pottery suggest some domestic use of this area, with a possible wind screen from the evidence of the postholes in the vicinity of the fire pits.

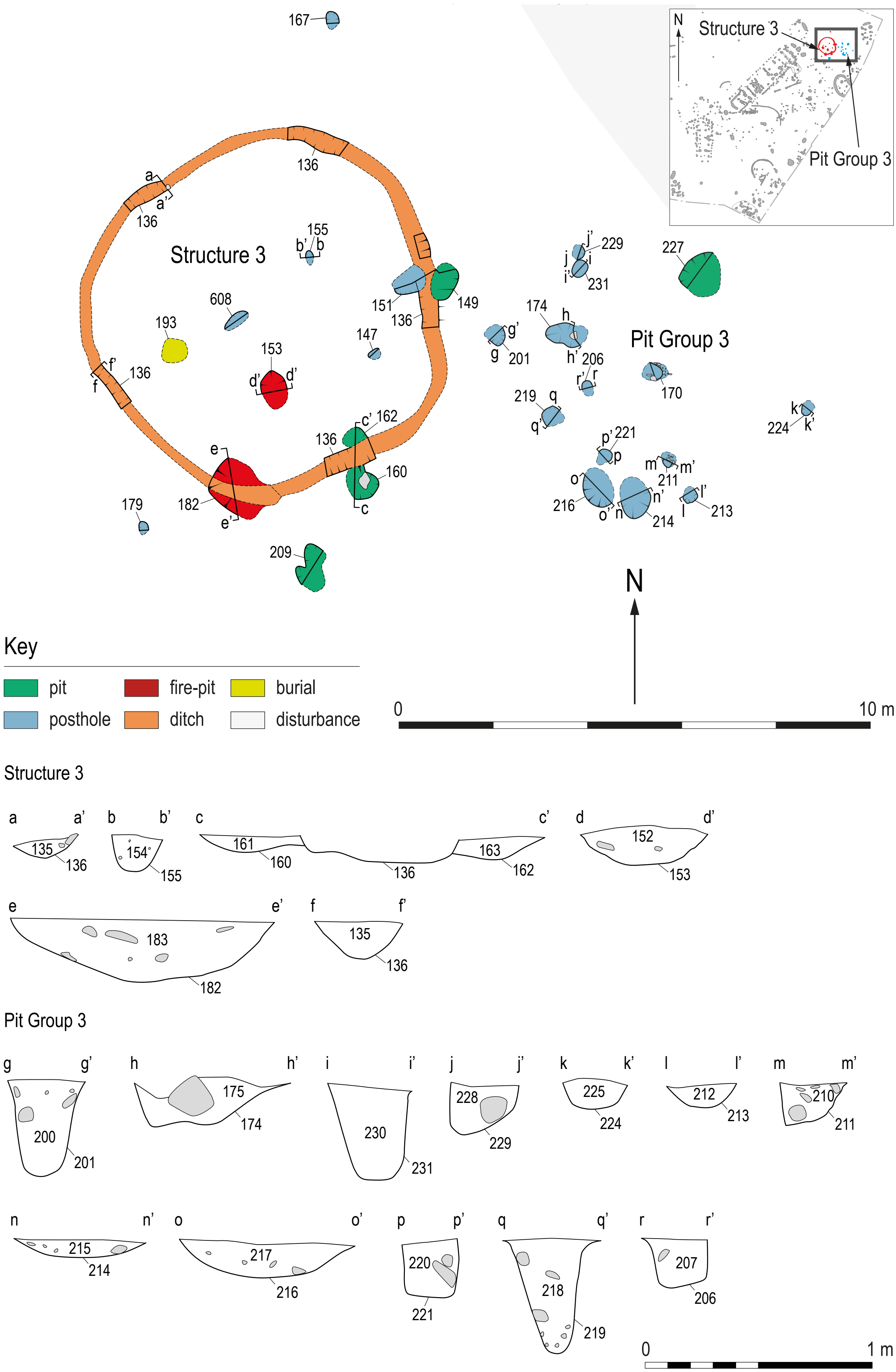

Figure 2.49: Structure 3 and Pit Group 3 plans with section drawings.

Figure 2.50: Structure 3 aerial view.

The sherds of a large and heavy early Bronze Age vessel (V144), possibly an urn, but more likely a domestic cooking vessel, was found in two adjacent pits (7105 and 7107) within *Pit Group 16* (Figure 2.39). Both pits had been used several times, and indicate the later activities in an area previously used in the early Neolithic (see Table 2.5).

As mentioned previously, the fill of a large pit (743) in *Pit Group 7* situated between the early Neolithic timber halls also returned a late Bronze Age date range (Table 2.7). It had no cultural material associated with it, other than some lithic artefacts, but it was an anomaly in an area of otherwise early Neolithic activity. Likewise, an isolated pit (238) in the *Area O/East Angle* produced an early Bronze Age date range, and part of the fill of the northern gable curved trench (569) to the Structure 8 small timber hall returned a late Bronze Age date (Table 2.7).

Houses - oval and round

A number of structures were identified in the north-east part of the excavation which differed markedly in shape and architectural detail from those of the early Neolithic (Figures 2.48 and 2.51). Most of these buildings are round or oval in design, and built of wooden posts that supported the roof. Walls are likely to have been of wattle and daub construction, protected by the steep roofs of the buildings. Other buildings are defined by drainage gullies or small ditches.

Structure 1

This oval-shaped building was cut through by the south-eastern boundary of the excavated area and by the recent road that was made for housing and the nearby high school. The most recognisable feature of this structure was its c. 1 m broad ditch or gully (004) with a maximum depth of c. 0.30 m (Figures 2.52 and 2.53). The ditch encircled the remains of a building c. 7.4 m long by 5.4 m wide, with a seemingly narrow break for the doorway situated to the north-east. Although no postholes were located in the sandy fill of the gully, a number were found within the enclosed area. Four or five of them closely followed the inside perimeter of the ditch, although one had been disturbed by animal

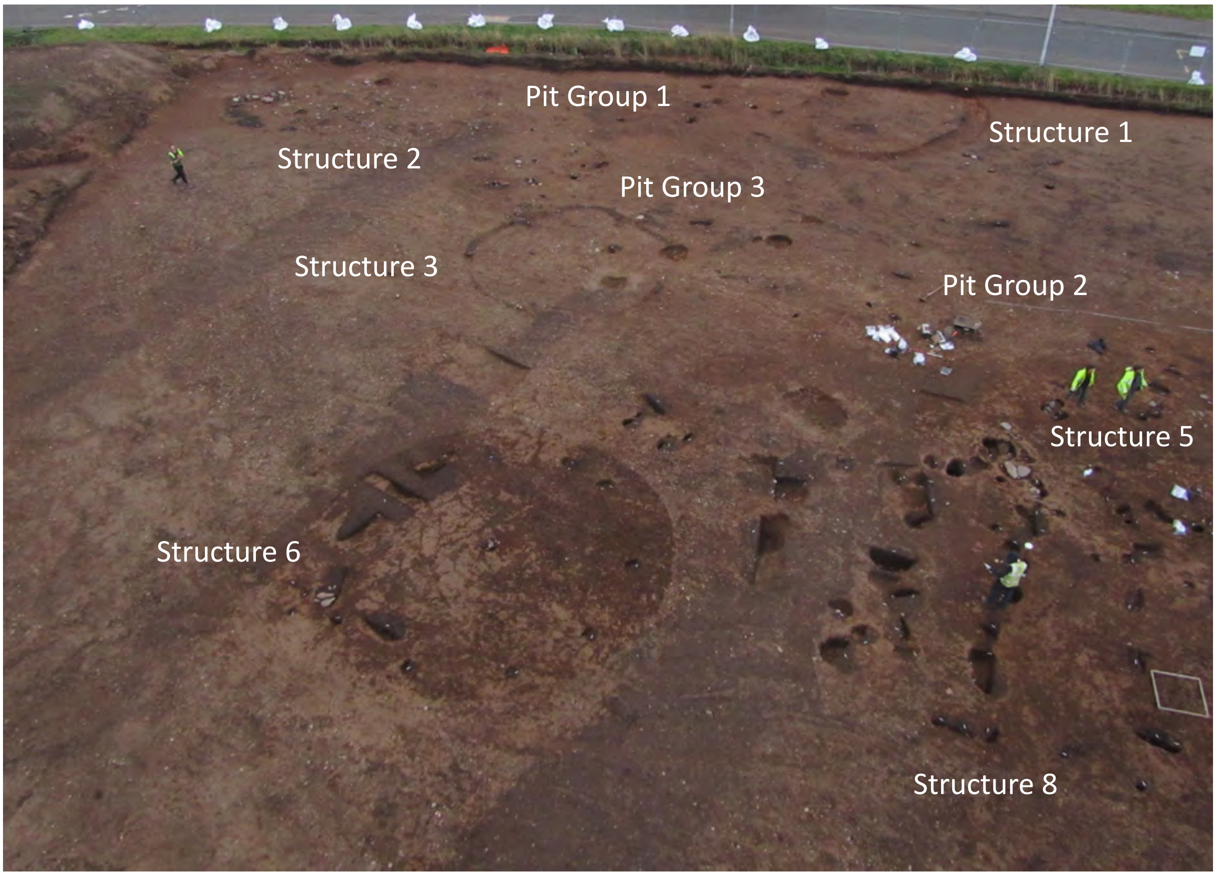

Figure 2.51: Aerial view of Sts 1, 2, 3, 5, 6 and parts of 8 with Pit Groups 1, 2 and 3.

burrowing. Five postholes were positioned in a square in the centre of the building, with each side measuring c. 3.75 m (Figure 2.52). The extra posthole recorded in the north-east corner of this arrangement suggests the corner post may have needed support or was replaced by another. The posts would have been the main load-bearing timbers for the roof of the building and their postholes averaged c. 0.30 m in diameter by c. 0.12 m in depth. Occasional charcoal flecks were found within them.

Other features within the structure included a small posthole between the western arc of the walls and the central square of posts. A fire-pit (069) was situated in the north-western part of the building and to the north of the central roof timbers, with a small posthole to one side of it. It had two sandy fills within it: the lower one was paler than the dark upper fill, which contained charcoal. A shallow pit or area of wear (010) just inside the building from the doorway was noted that possibly contained occupation deposits. Sherds of late Bronze Age pottery (V1), were found in the fire-pit, with fragments of the same pot and another vessel (V2) found in the sandy fill of the ditch. Lithic artefacts and animal bone fragments were also found in the ditch fill. Two radiocarbon dates from the filling of the ditch returned late Bronze Age dates of 1046 – 916 cal BC (UBA-39260) and 920 – 818 cal BC (UBA-39261) (Table 2.8).

Outside the entrance to the structure was a posthole (042) and beyond it a double posthole (245) suggesting a porch or a windbreak extending to the north-east (Figure 2.54). However, this is made more complex due to the proximity of the oval structure identified as *Pit Group 1*, where the posthole (245) was recut and packed with stone, possibly as a support to the latter building. A sample from the fill of this feature produced a radiocarbon date of the early Bronze Age, 2138 – 1972 cal BC (UBA-39276) (Table 3.1). Close to the external circumference of the ditch and to the south-east of the doorway were two postholes some distance apart. On the external western side of the ditch was a group of three small postholes, together these suggest that the walls of the building may have required extra support.

On the west side of the building and continuing southwards to the boundary of the excavated area (*Area A*) were a small group of two pits and three postholes, with a deposit of occupation material, three postholes with charcoal and a packing stone, and a large pit to the south. A few sherds of burnt and undated pottery were found in the pit and none of the features were dated.

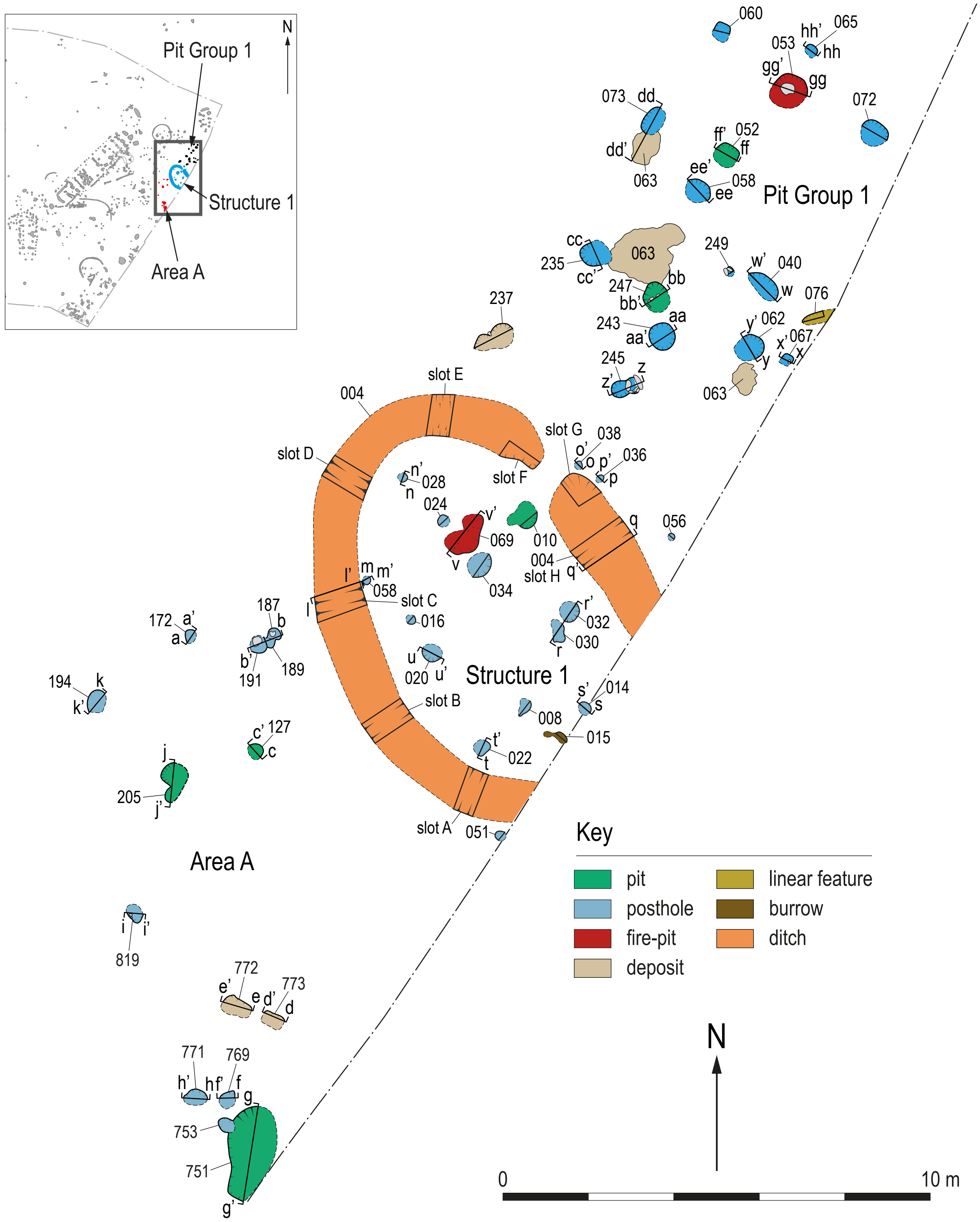

Figure 2.52: Plans of Structure 1, Area A and Pit Group 1.

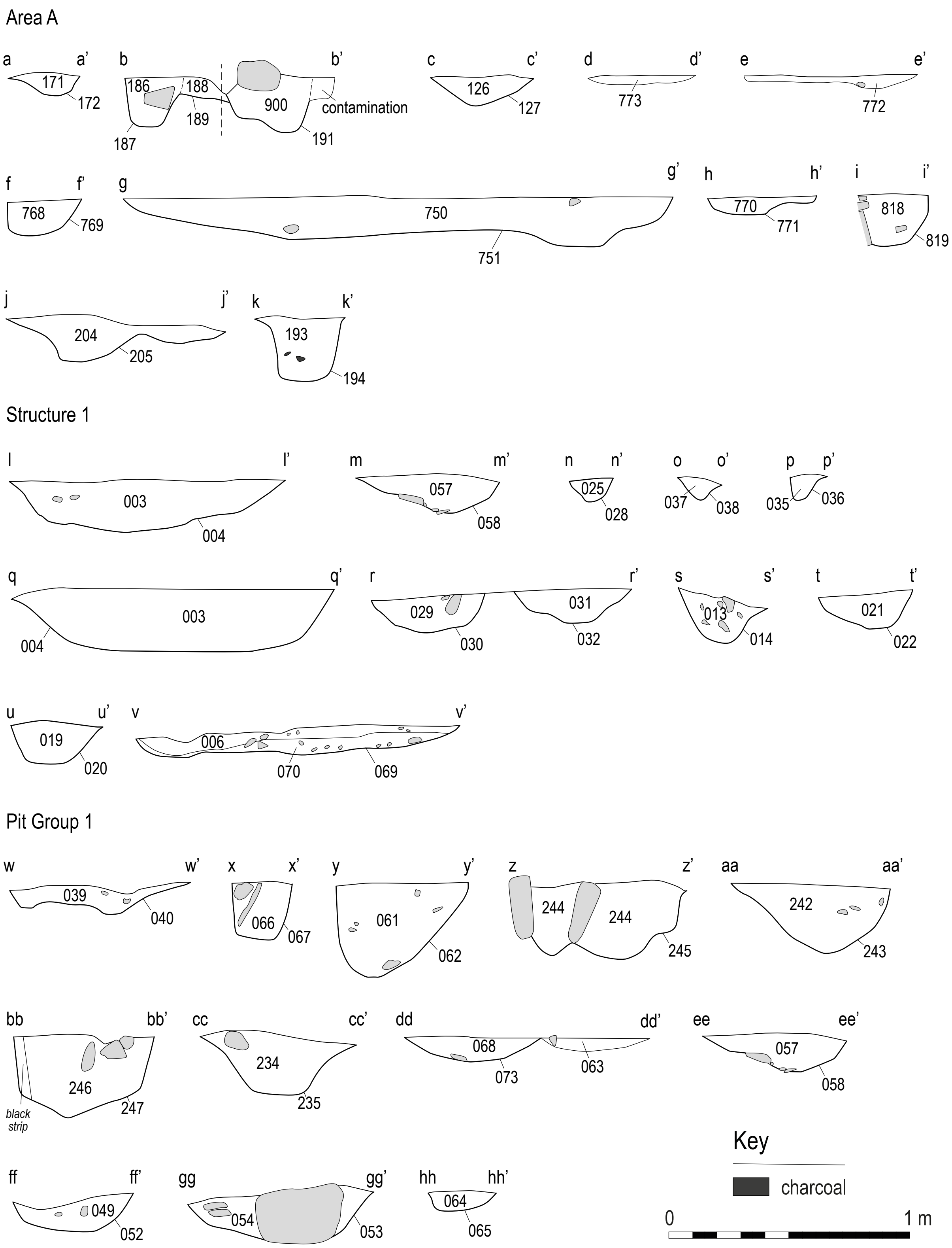

Figure 2.53: Section drawings of Structure 1, Area A and Pit Group 1.

Figure 2.54: Structure 1 aerial view.

Structure 2

The outline of Structure 2 located in the north-east corner of the site is not as clearly understood as Structure 1 (Figures 2.55 and 2.56). The most prominent feature of this north/south aligned building is the two parts of a segmented ditch in the northern part of it. The ditch was up to 1 m wide but shallow. The fill of the large northern section (084) returned two radiocarbon dates of 1192 – 998 cal BC (UBA-39265) and 1084 – 912 cal BC (UBA-39264) (Table 2.8) indicating the building was in use at the end of the middle Bronze Age and into the late Bronze Age.

The building was constructed of load-bearing posts placed roughly in a rectangle to hold up its roof. Evidence of the west side of the structure indicated that it originally comprised a 5 m long row of three internal postholes. One posthole was positioned to the north near the western arm of the segmented ditch, one in the centre and a single posthole lay to the south. However, the centre post was replaced or repositioned as two other postholes were placed beside it. A parallel, but slightly shorter row of four equally spaced postholes was positioned on the east side of the building. The eastern alignment curved slightly as the width at the southern end of the

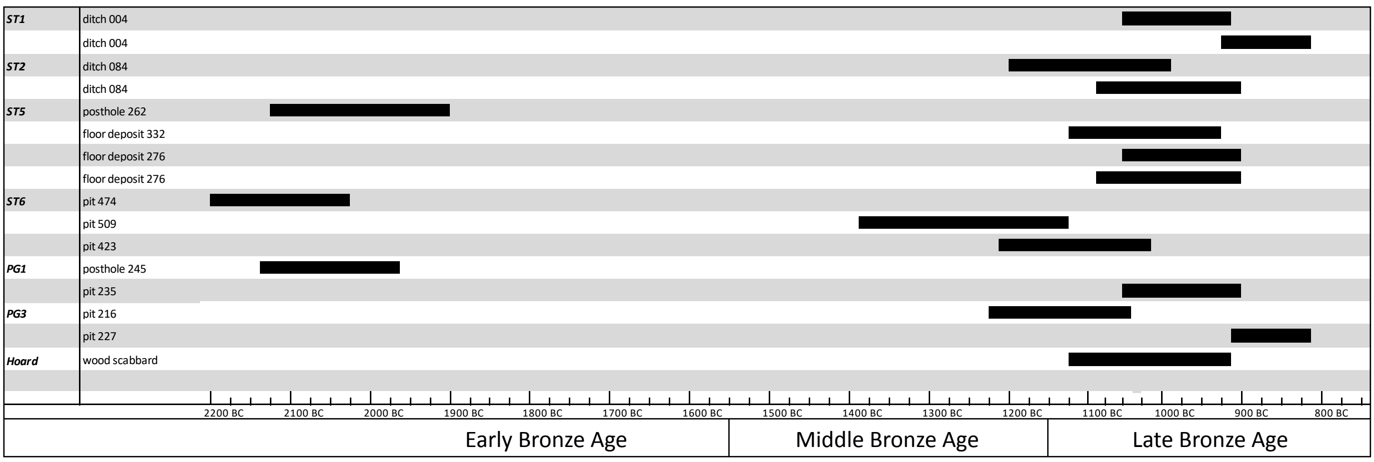

Table 2.8: Radiocarbon dates for Bronze Age structures on the site.

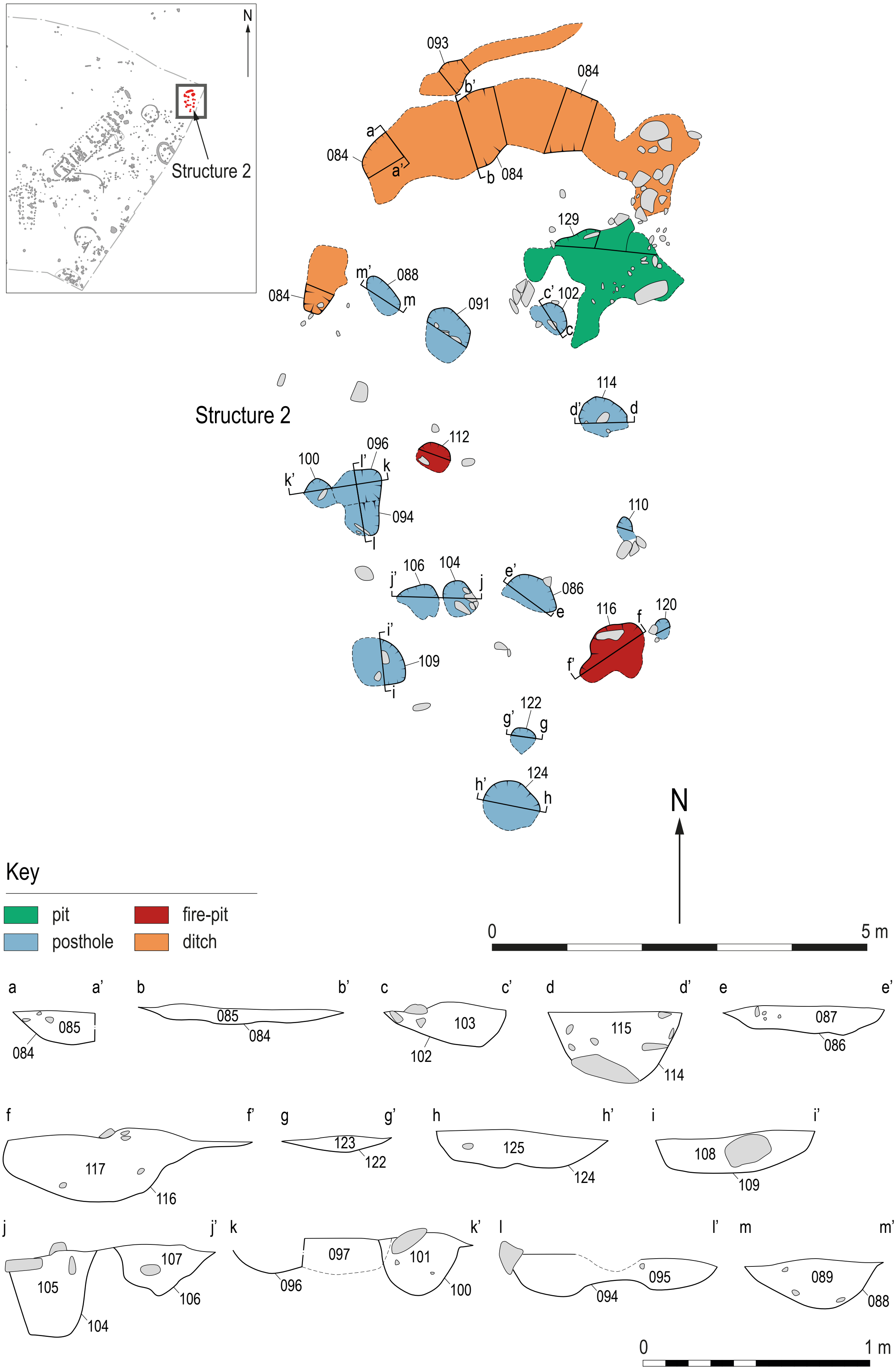

Figure 2.55: Structure 2 plan and section drawings.

building measured c. 3.3 m to accommodate a 1 m diameter fire-pit (116), but the width between the two rows of posts in the north was only 2.5 m. Two postholes to the south indicate that the end of the internal space was possibly curved, and required extra support, but a further posthole that may have continued the alignment to the east was possibly lost near the trench edge. The implication of this arrangement of posts is that the building within the segmented ditch was roughly sub-rectangular in shape and could have measured c. 8 m by c. 5 m internally. The identification of an additional posthole (091) with a packing stone, miss-aligned between the northern ends of post rows, suggests some alteration. Almost all the fills of the postholes contained charcoal (Figure 2.55).

Within the internal space at the southern end of the building was a short alignment of three postholes, indicating a partition placed partially across the width of the structure divided it in two unequal parts, with a fire-pit in each. The southern fire-pit (116) contained fire-cracked stones, and large sandstone slabs indicative of a hearth area. Sherds of middle to late Neolithic pottery were found within the fire-pit indicating disturbance of earlier contexts in that area. A smaller fire-pit (112) north of the partition, but in the middle of the structure, also contained sherds of the same vessel (V3).

A large irregularly shaped pit (129) in the north-east part of the building had two fills, both with charcoal indicating it could also have been a fire-pit. Its location may have dictated the positioning of the northern post of the east post alignment. The locations of the posts, the identification of supporting or replaced timbers to the west and south, and the insertion of a partition suggest that the internal arrangement of this building was altered during its lifetime.

Figure 2.56: Structure 2 aerial view.

Pit Group 1

The remains of another oval structure similar to Structure 2, but without the segmented ditch were recorded between Structures 1 and 2 (Figures 2.52 and 2.53). Towards the south-east there was a short length of a possible ditch that continued below the edge of the excavation area to the east that may have marked the edge of the building. No other sections of ditch were located in association with the building.

The structure comprised features aligned NE/SW: an arc of three postholes at its north-eastern extent was matched by a similar arc of three postholes at its south-western end, with a single posthole between the arcs in the north-west. A corresponding posthole to the south-east is missing and it may have lain just beyond the edge of the excavation area. The arrangement of postholes indicates a building that measured c. 6.5 m in length by 4.5 m wide internally. A stone-lined double posthole (245) was situated a little over 1 m south of the southernmost post of the building, suggesting an external support, but this feature could have also formed part of a porch arrangement to *Structure 1* to the immediate south.

Internal features to this structure included two small postholes (249 and 067) that may indicate a partition. An interior posthole (058) was also identified in the centre of the building but positioned near the north-west posts. There were also two fire-pits situated at the northern end of the building, almost midway between the northern arc of posts and the interior posthole (Figure 2.52). The most northerly of the fire-pits (503) had a hearth stone positioned centrally within it. Between the latter and the southern fire-pit (052), were the remains of shallow floor deposits.

The material cultural remains found in the fire-pits and postholes indicated pottery (V5, V6 and V7), dated to the late Bronze Age. Sherds from the same vessel were found in a number of the features. However, the radiocarbon dates (see Table 2.8) are varied. A sample from the southernmost posthole (245) (see also Structure 1), produced an early Bronze Age date, with a posthole (235) situated to the north-west producing a late Bronze Age date. Charcoal from the most northerly fire-pit (053) produced an early to middle Neolithic date range indicating disturbance of earlier deposits, and an Iron Age date of the middle to late first century AD came from another of the southern postholes (062), where later material or animal activity had intruded into earlier deposits (Table 2.9).

Pit Group 3

North-west of Pit Group 1 and close to Structure 3 (described above) was a roughly circular arrangement of pits and postholes that defined another building, which measured c. 5 m by 5 m (Figures 2.49). The structure appeared to have been constructed of two circles of post. The outer circle is incomplete but comprised six postholes, with the one to the north-west having another posthole positioned beside it, indicating the location of a supporting post or a replacement timber. The southernmost post-pits/postholes were larger than the others and although they were positioned close together, one could have been a replacement.

This structure also had a partial inner circle of postholes that surrounded a posthole (170) positioned centrally in the building. The three southernmost postholes of the inner ring were located equidistant from each other and formed an arc parallel with the outer ring of posts. Another two postholes were dug into the south-

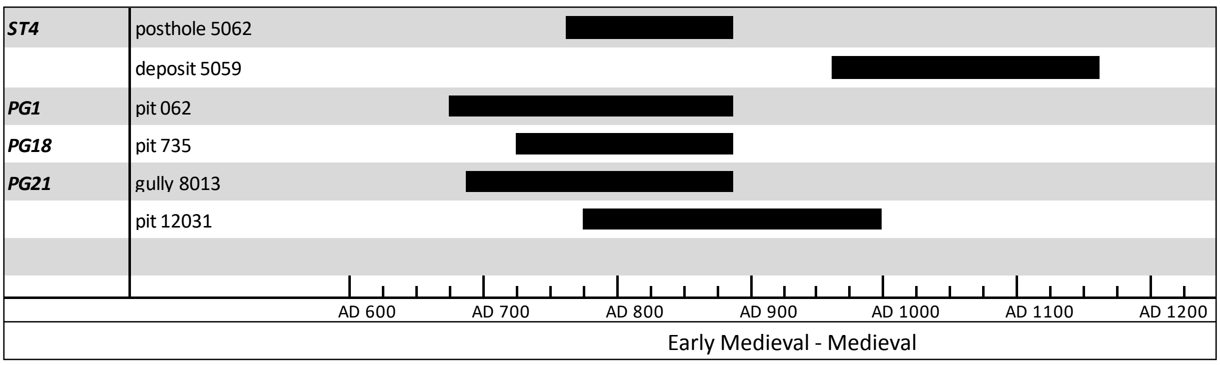

Table 2.9: Latest radiocarbon dates from the site.

west quadrant of the structure. One possibly continued the inner ring of posts northward but it was positioned further into the interior of the enclosed space. The other was smaller and was situated between the post in the centre of the structure and the north-west end of the inner ring of posts.

A large pit (227), less than 1 m in diameter, was located close to the outer post ring in the north-east quadrant of the structure. Its function was not confirmed as a fire-pit but it contained sherds of a possible late Bronze Age vessel (V9) and returned a late Bronze Age radiocarbon date (Table 2.8).

Fragments of a second vessel (V8) were located in the fills of the pit/posthole (216) to the south and the nearby posthole (221) of the inner ring of posts. Charcoal from both these features produced radiocarbon dates. The fill of the inner ring posthole (221) returned an early Neolithic date range (Table 3.1). The pit/posthole (216) immediately to the south of it produced a late Bronze Age date of 1222 – 1044 cal BC (UBA-39271) suggesting the building was a later construction (Table 2.8).

Structure 5

This structure overlay the north-eastern corner of Structure 8, the early Neolithic long timber hall, but its form is difficult to entangle from that of the earlier building because of the reuse of postholes and insertion of other features. In keeping with some of the other Bronze Age buildings, it was circular in shape, c. 9.5 m in diameter, and had an entrance to the south-east (Figure 2.57 and 2.58).

The building was built of timbers placed in postholes with packing stones, with the circular form of the structure best understood from the survival of features in its southern half, where larger postholes framed the entrance with corresponding posts forming a porch. One (262) provided an early Bronze Age radiocarbon date of 2118 – 1914 cal BC (UBA-39277). The curve of the building to the west was identified from the regularity of postholes positioned c. 2 m apart. The northern half of the structure was identified from the extent of its occupation deposits as the number of postholes in that area was exceptionally large (Figure 2.57).

The southern half of the building contained an internal continuation of the entrance, with three postholes to either side of it indicating perhaps an inner door, and also an inner ring of posts. The latter was situated c. 1 m from the outer posts, and was paired with them. Additional postholes found in the building may be due to changes of the internal arrangements and of the renewal of posts. Between the inner and outer post rings and tucked close to the left of the entrance was a large fire-pit (080) with charcoal and cobbles in its fill. Another fire-pit (294) was located to the west, close to the inner ring of posts but within the central enclosed area.

The northern half of the structure contained a lower (332) and an upper deposit (276) of dark brown silty-sand, which together survived to a combined depth of 0.28 m, and masked some of the building, with another deposit (388) in the south-western lobe of deposits. A curvilinear gully was also located beneath the south-eastern lobe of deposits and was filled by them. Three radiocarbon dates from these deposits provided evidence for the use of the building during the later Bronze Age between 1118 – 931 cal BC (UBA-39283), 1084 – 906 cal BC (UBA-39279) and 1082 – 9065 cal BC (UBA-39278) (Table 2.8).

These floor deposits were the best-preserved occupation deposits of the excavated area, and due to their rare survival they were subject to a 0.5 m² gridded excavation (Figure 2.59). The deposits contained a number of sherds of early Neolithic pottery (disturbed from earlier contexts) and Bronze Age pottery (V113 and 114), with lithic artefacts, a stone spindle whorl, five quartzite cobble tools and a fragment of a cannel coal bracelet found within the deposits or within fills of pits associated with them (see Part 5).

Pits and other groups of postholes associated with the occupation deposits are difficult to interpret (Figure 2.57). Two possible fire-pits (9082 and 364) were identified near the northern edge of the occupation deposits suggest the building was in use either side of the end of the second and beginning of the first millennium BC, during the late Bronze Age.

Located equidistantly between the rear of this structure and the porch of Structure 8 was the burial place of the metal hoard (described below).

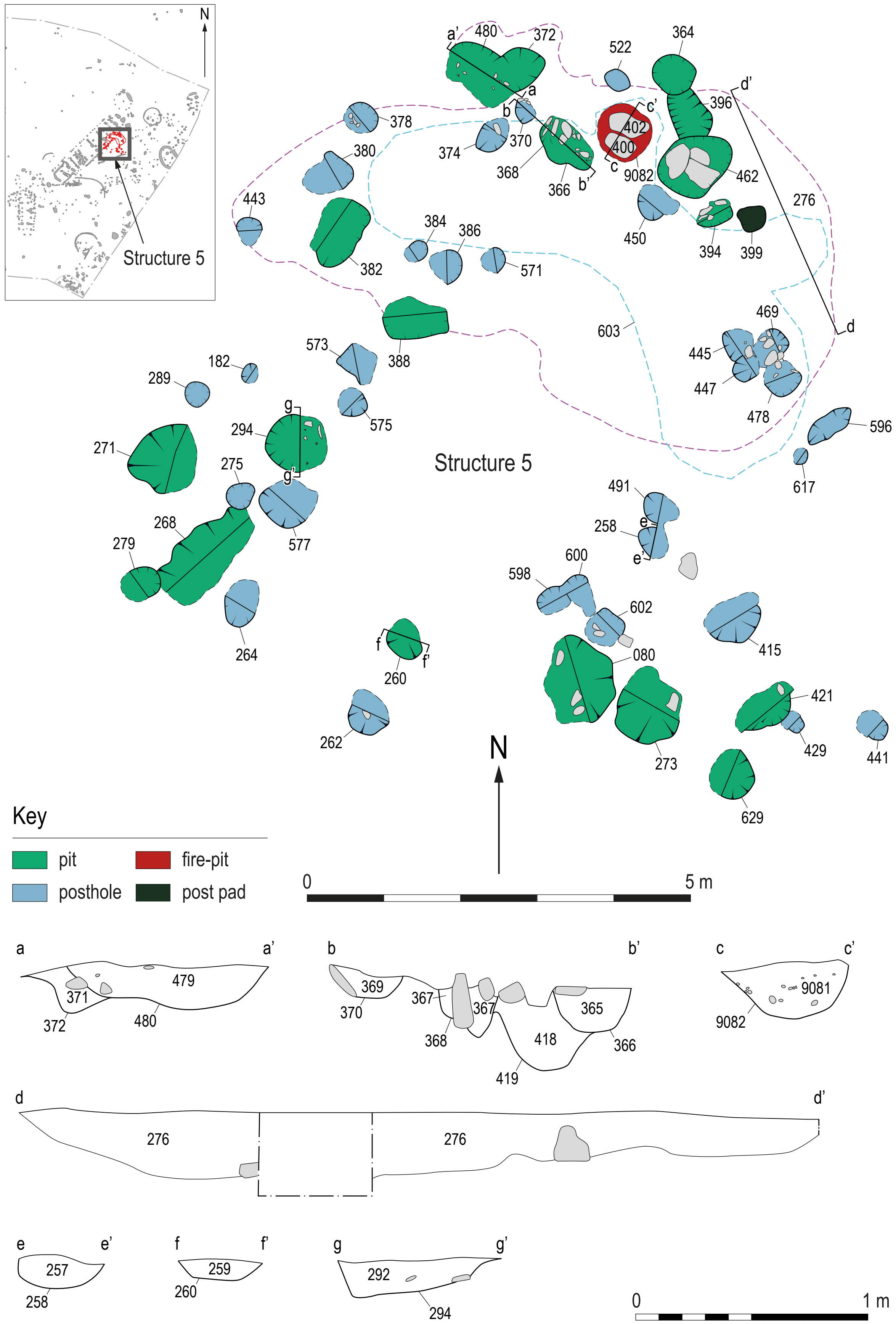

Figure 2.57: Structure 5 plan and section drawings.

Figure 2.58: Structure 5, outlined, aerial view.

Figure 2.59: Structure 5 gridded for excavation and scientific analysis. Looking west.

Structure 6

Located north of Structure 5 and north-west of Structure 3 was a 7.8 m diameter circular building, clearly defined by nine surviving postholes (Figure 2.51). Each of the postholes averaged c. 0.45 m in diameter and they were positioned roughly 2 m apart. An entrance was identified in the south-east portion of the structure between postholes (317 and 323), which had c. 1 m gap between them. Continuing the alignment of the entrance externally were two further postholes of Pit Group 4 situated c. 2 m to the south-east that formed a porch, with a posthole and a pit terminated the ends of it (Figures 2.60 and 2.61).

Within the area enclosed by the posts was a centrally positioned fire-pit (509), with three additional postholes, two large pits to its north, and an internal elongated pit (423) to the north-east (Figure 2.60). The latter was over 4 m long, approximately 1.5 m wide, and up to 0.3 m deep. It contained groups of fire-cracked stones in its fill, along with sherds of probably early Bronze Age pottery (V13) and lithic artefacts. Charcoal from the pit produced a middle Bronze Age date range of 1207 – 1016 cal BC (UBA-39289). Sherds from the same vessel (V13) were also found in the fill of the pit (474) to the north-west. Charcoal from this pit was dated to the early Bronze Age, 2203 – 2037 cal BC (UBA-39291) indicating that its backfilling material included earlier dated artefacts.

The fire-pit (509) in the middle of the building contained fire-cracked stones and charcoal fragments, and was dated to the end of the middle and the beginning of the later Bronze Age 1379 – 1130 cal BC (UBA-39293). The radiocarbon dates (Table 2.8) suggest that the structure is probably middle to later Bronze Age in date, and it was probably constructed over the top of earlier pits in the north.

Approximately 4 m south of the porch to this building was the burial place of the later Bronze Age metalwork hoard (see below).

Structure 14

This circular building was located to the immediate north of the early Neolithic timber hall, Structure 13. Eight postholes, most with packing stones, formed its outer ring of posts and five, possibly six postholes created an inner ring (Figure 2.62). The entrance to the structure was in the south-east of its circumference where two larger postholes (1174 and 1176) with packing stones marked its position. Two similar sized postholes (1205 and 1164), located in the north part of *Structure 13* may have formed part of the entrance structure. The diameter of the building was roughly 7.5 m.

A large pit (1291), with some burnt lithic artefacts, and one other smaller pit (1241) with burnt bone, disturbed the post rings in the north. A fire-pit was positioned between the inner and outer ring of posts in the eastern side of the structure. Charcoal and burnt bone was found it its two fills but it contained no evidence of material culture. The structure was not dated but it is possibly of a similar date to Structures 5 and 6.

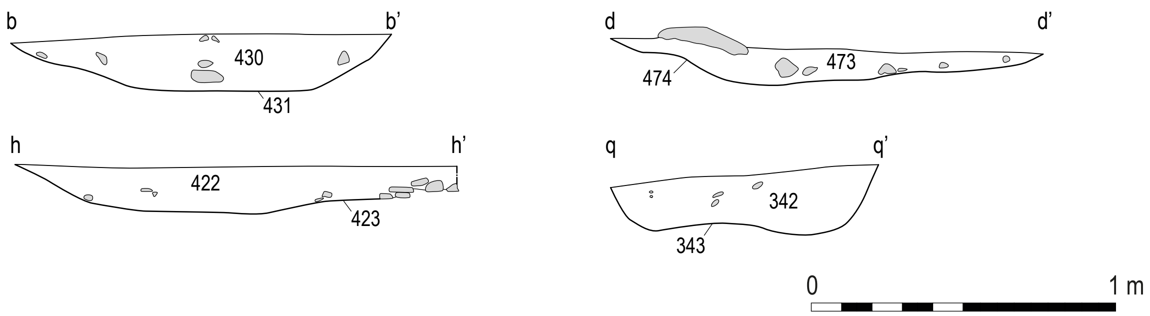

Figure 2.60: Pit section drawings of Structure 6.

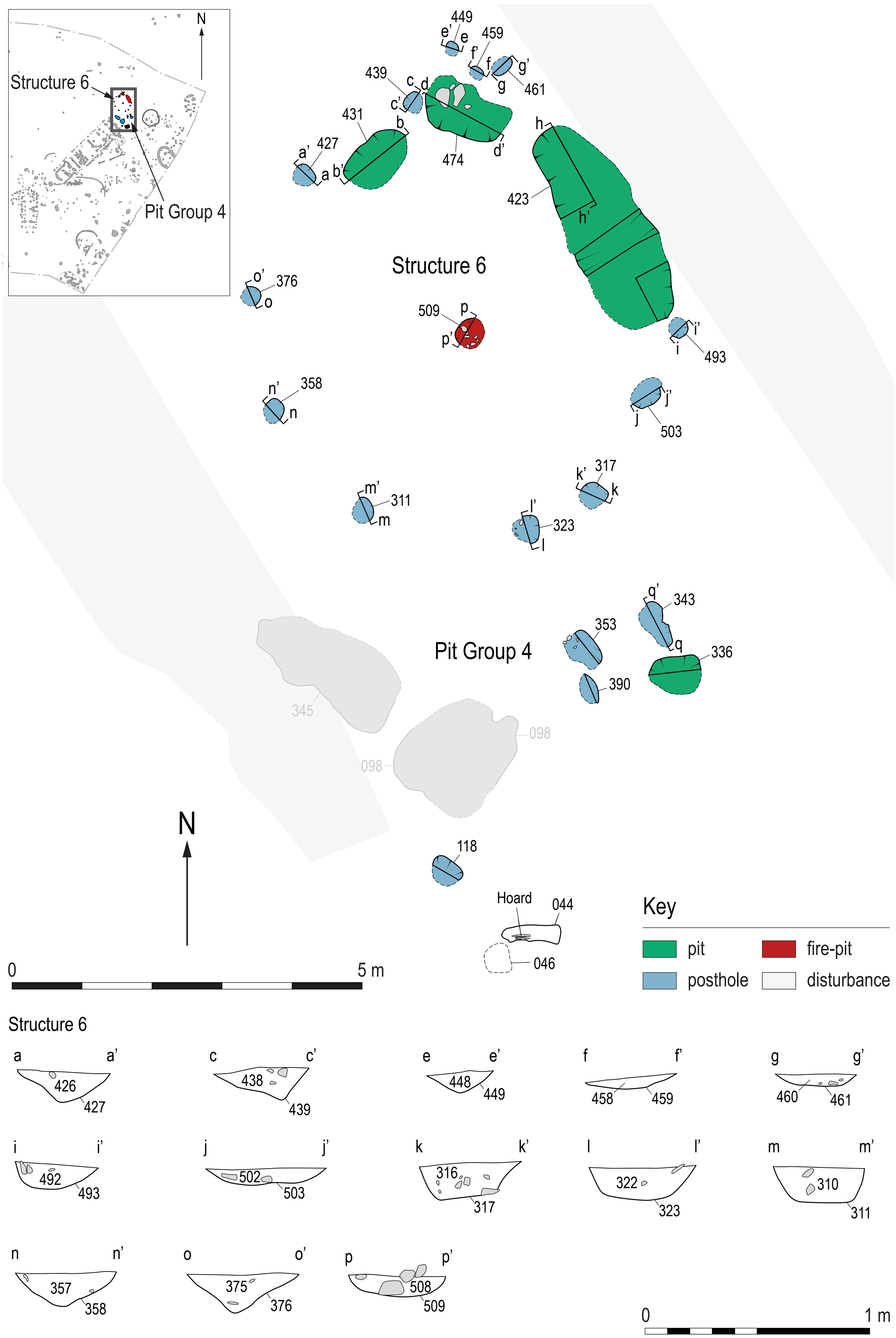

Figure 2.61: Structure 6 plan and section drawings with plan of Pit Group 4.

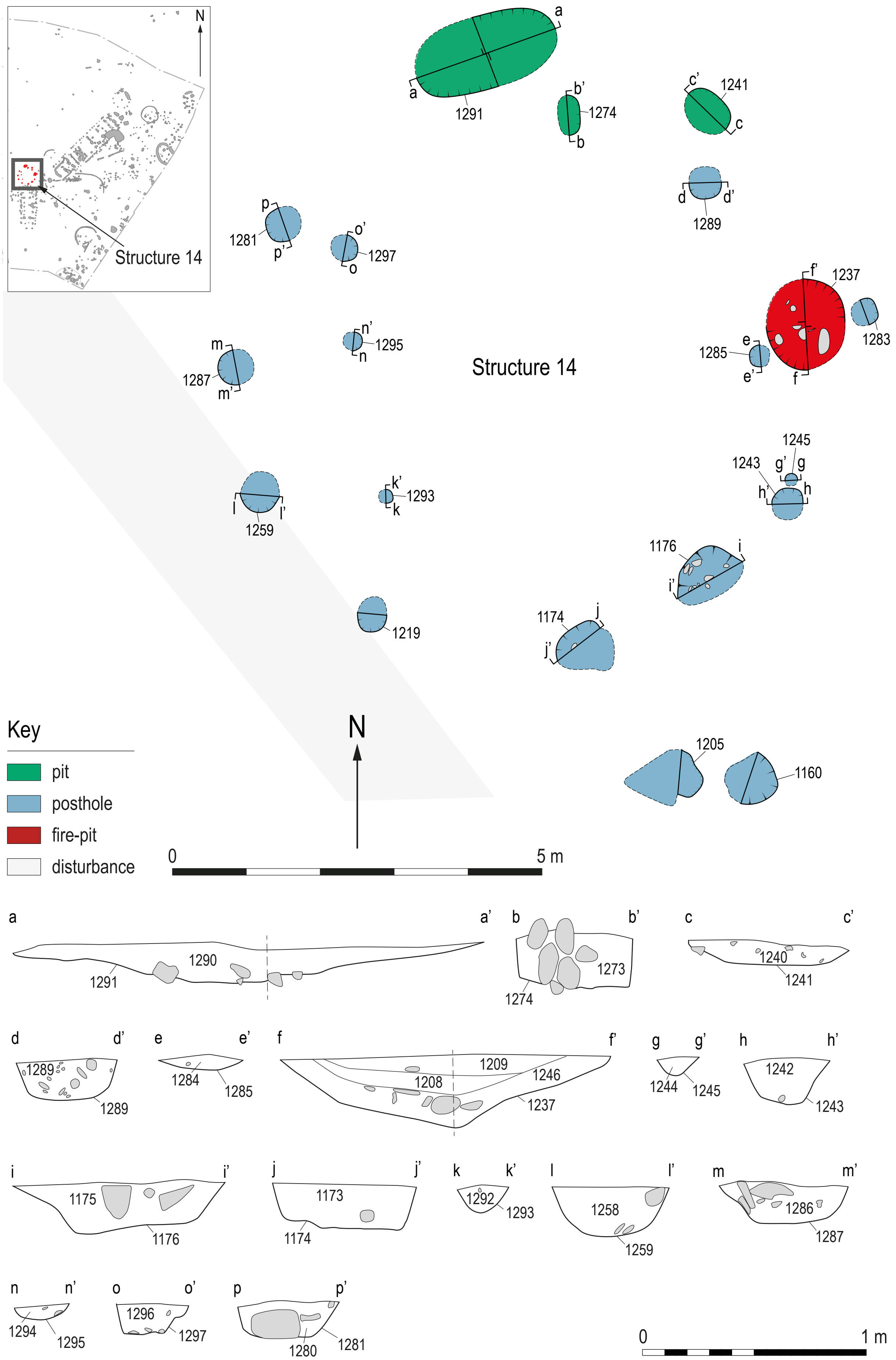

Figure 2.62: Structure 14 plan and section drawings.

Pit Group 9

This group of postholes and a pit was located south-east of Structure 14 and appeared to be the partial remains of another circular or oval-shaped building a little over 6 m in diameter (Figure 2.63). Much of the west side of the possible structure had been removed by a modern service trench, but the six postholes of the northern and eastern arcs of it survived, and two outlying postholes to the south could have been part of its entrance. The internal area marked by the postholes contained another posthole with two pits positioned west of its centre, and another pit or posthole in the north-east interior segment. These features could be the remains of one or more fire-pits as charcoal was present, but no cultural material was identified.

The features of this group were shallow from barely 60 mm to 0.2 m but given the patterning of postholes, it has been identified as a likely Bronze Age structure. It was not dated.

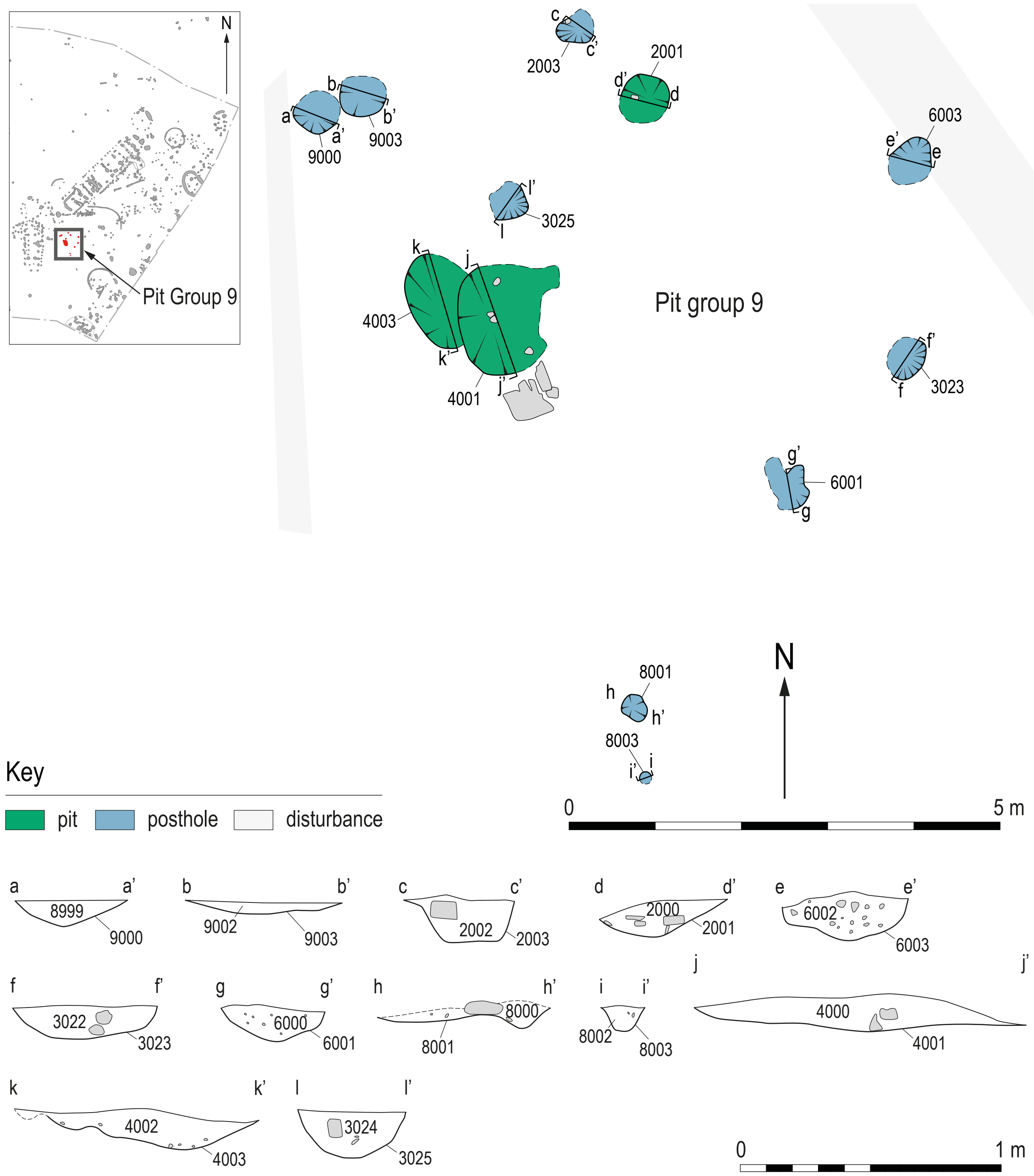

Figure 2.63: Pit Group 9 plan and section drawings.

The Bronze Age hoard

Located a few metres south of Structure 6 (Figures 2.48 and 2.61) and to the immediate north-east of Structure 8 and Structure 5, was a shallow hollow or pit in the subsoil that contained a Bronze Age metal hoard (Figure 2.64). It was discovered during the removal of topsoil from the area and comprised a bronze spearhead with gold decoration, a bronze sword with a lead pommel and wooden scabbard fittings, and a swan's neck disc-headed bronze pin. The pit with its contents was lifted as an intact block and excavation under laboratory conditions (see PART 6). Its single radiocarbon date of 1118 – 924 cal BC (SUERC-75019, GU45283) places it firmly in the late Bronze Age (Table 2.8).

Later structures

The remaining structures from the excavated site are those that overlay the pattern of Neolithic and Bronze Age settlement and activities, or where a medieval radiocarbon date hints at events for which there is little other evidence (Figure 2.65).

Structure 4

To the south of the south-east corner of Structure 8, was a linear depression, c. 38 m deep, aligned east/west filled with irregularly shaped boulders, considered during the excavation to be a platform, located beneath a charcoal-rich deposit (Figure 2.66). The stones were laid in the base of the pit, which was almost 9 m long and 2 m wide

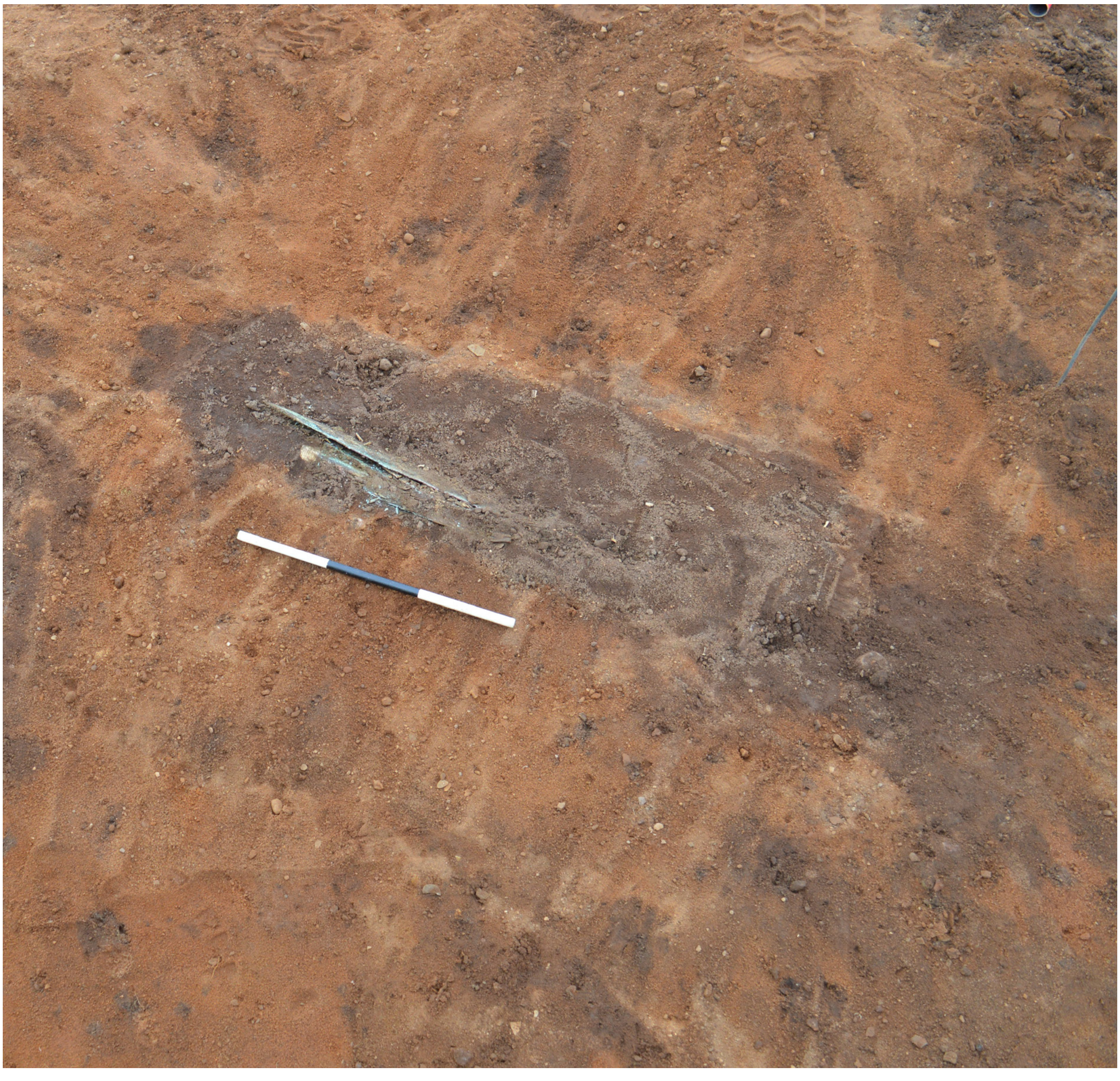

Figure 2.64: The finding of the hoard prior to lifting.

with a sandy matrix between them. Charcoal from this matrix (5059) produced a radiocarbon date of 972 – 1155 cal AD (UBA-39335), the late first millennium/early second millennium AD, an early medieval date (Table 2.9). Smaller stones were noted in the pit infill at its west end, but this may have been the result of plough disturbance, and a large fragment of a rotary quern (SF 89) was noted lying 2 m to the north of the structure, possibly dislodged from the stony infill (Figure 2.67).

The pit was bordered on its north edge by three equally spaced postholes, and it had a pit at either end. The west pit had two fills and contained a lithic artefact, presumably a stray find, in its uppermost fill. The fill of the east pit (5062) returned a radiocarbon date of 769 – 888 cal AD (UBA-39336), the late first millennium AD (early medieval). Two additional postholes and two pits were also observed continuing the alignment of the stone-filled feature to the west. They ended just to the east of a large pit (735 in *Pit group 18*) that was over 1.6 m in diameter. It was fairly shallow but had been used as a fire-pit as the sand within it was burnt. Charcoal from this pit was radiocarbon dated and closely matched the late first millennium AD, suggesting it was possibly a contemporary feature (Table 2.9).

After removal of stone from the feature two further pits were recorded at either end of the structure. The western-most one contained some burnt bone and charcoal was recorded in the pit to the east. It is possible that these two pits are prehistoric rather than early medieval, given their location close to Structure 8, and may not be related to the activities of the structure.

North-east of the structure was a curvilinear ditch in *Area N*, which was 17 m long with a maximum width of c. 0. 60 m. It was shallow at only 0.18 m deep and was filled with sand and small stones. Its form suggests it could have been a field boundary. This feature was not dated. Further

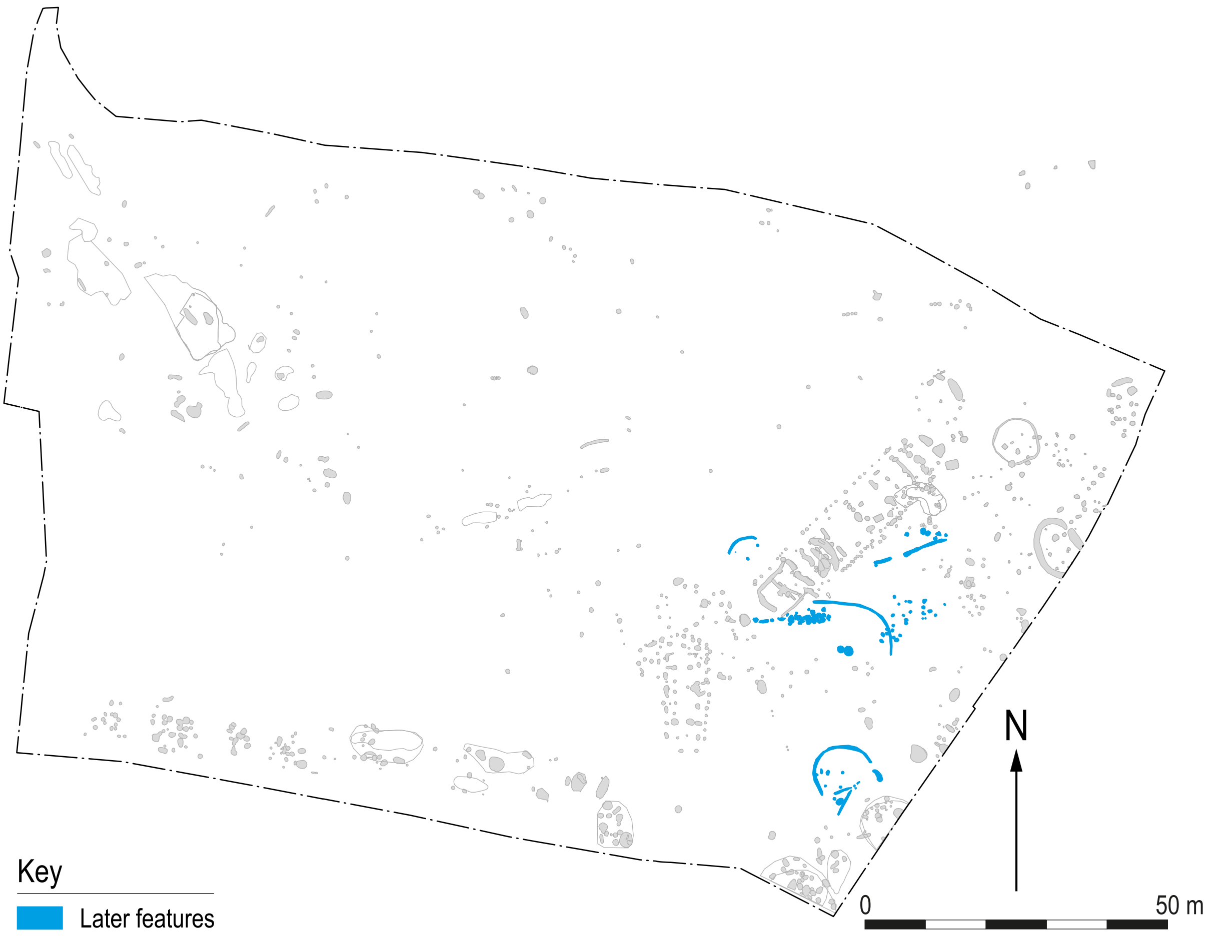

Figure 2.65: Simplified enlarged view of location of later structures.

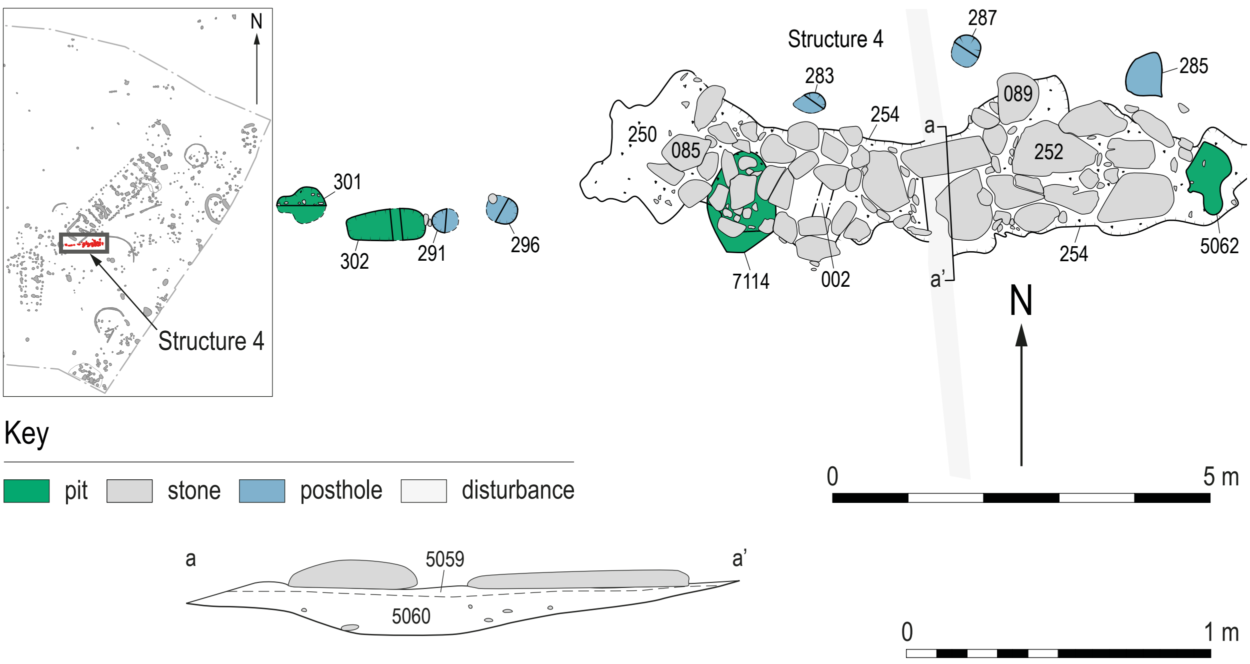

Figure 2.66: Detailed plan of Structure 4 with section drawing.

Figure 2.67: Structure 4 during excavation.

to the north-east in *Area J* were three surviving lengths of another linear ditch which was half the width of the former. It was badly disturbed by rig and furrow ploughing, and given its orientation, seems to have been most probably a different age of field boundary than the latter. Again, this feature was undated. A partial curved ditch, in the southern part of *Area G*, to the north-west of Structure 4, is also undated, but most likely indicative of early medieval agricultural activities.

A further area of later activity was *Structure 11* (Figures 2.68) located near the south-east corner of the excavated area. The main element of it was a semi-circular shaped ditch, segmented into three, with breaks in its circuit to the north-west and north-east, possibly for entrances into its semi-enclosed space. The ditch as excavated measured over 16 m in length and it had a width of over 0.5 m. Two additional lengths of straight ditch were noted that converged at an angle towards the middle of the southern extent of the semi-circular ditch. These ditches were 4.5 m and 2.5 m in length and half the width of the latter, and very shallow. It is not known whether these features are contemporary or were dug at different times.

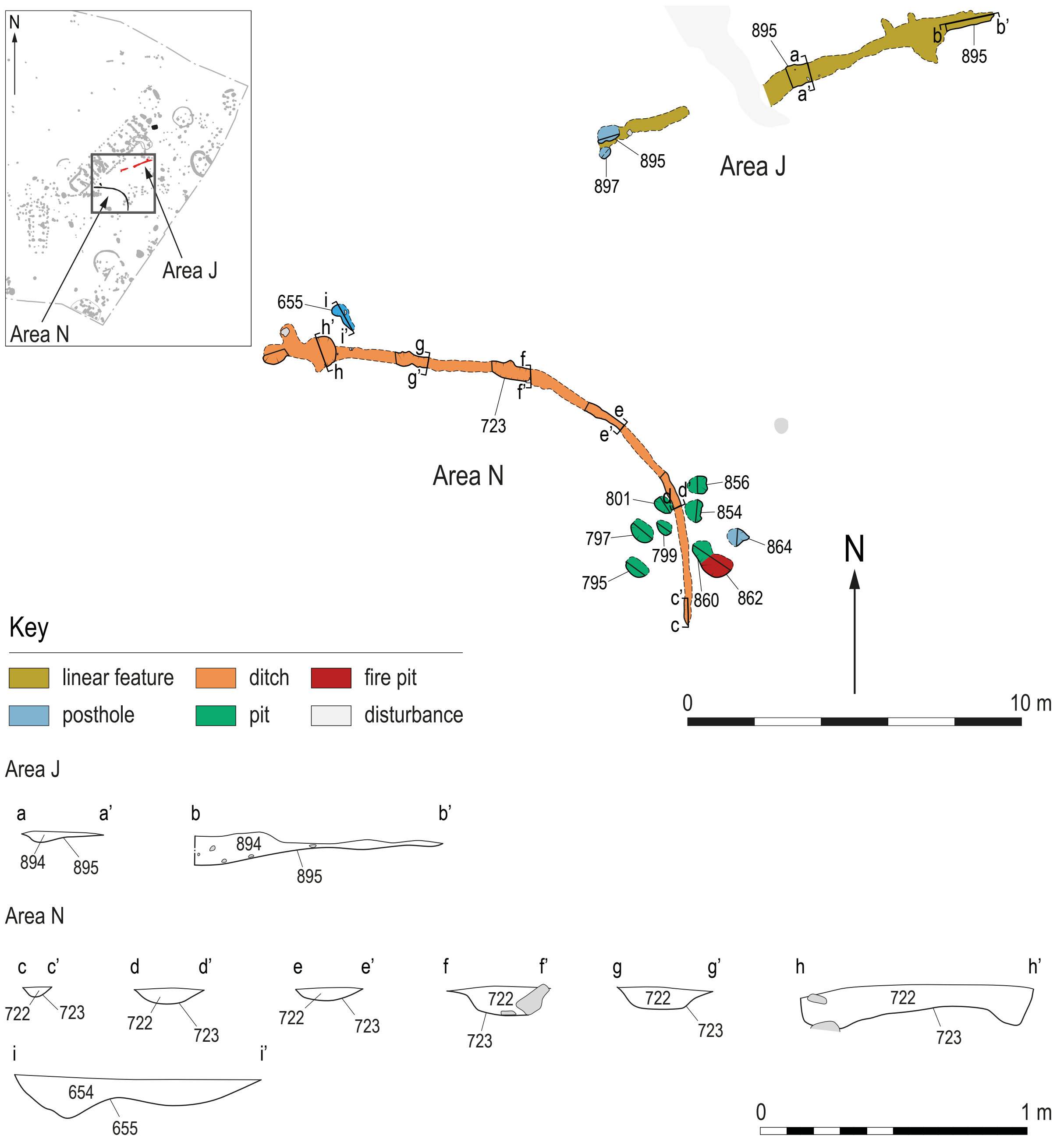

Figure 2.68: Areas J and N plans and section drawings.

Associated with the ditches and lying between them were six postholes, possibly related to fences, and four pits some of which contained charcoal, and a small charcoal-rich deposit. The southernmost pit (1013) lying between the arms of the straight ditches contained modern material possibly as a result of animal burrowing. Occasional residual lithic artefacts were found in some of the features. Although none of the features of this group were dated, it seems likely that the ditches were late, possibly early medieval, but some of the features within them could have been prehistoric.

In addition to the structures, there were three radiocarbon dates (Table 2.9) which suggested early medieval activities on the excavated area. A short length of ditch (8013) in *Pit Group 21* produced a later first millennium AD date of 693 – 879 cal AD (UBA-39344), and a pit/posthole (12031) in the same general area, where fence lines and later activities occurred produced a slightly later radiocarbon date of 779 – 991 cal AD (UBA-39355) but of the same period. These two dates (Table 2.9) relate well with those from *Structure 4,* and may reflect general agricultural activities during that time. One other sample that produced a radiocarbon date from the latter half of the first millennium AD came from a pit (062) in the *Pit Group 1* building, a focus of late Bronze Age activity. An explanation of this later date from this building is that animal burrowing may be the cause, as the pit was on the very edge of the excavated area.

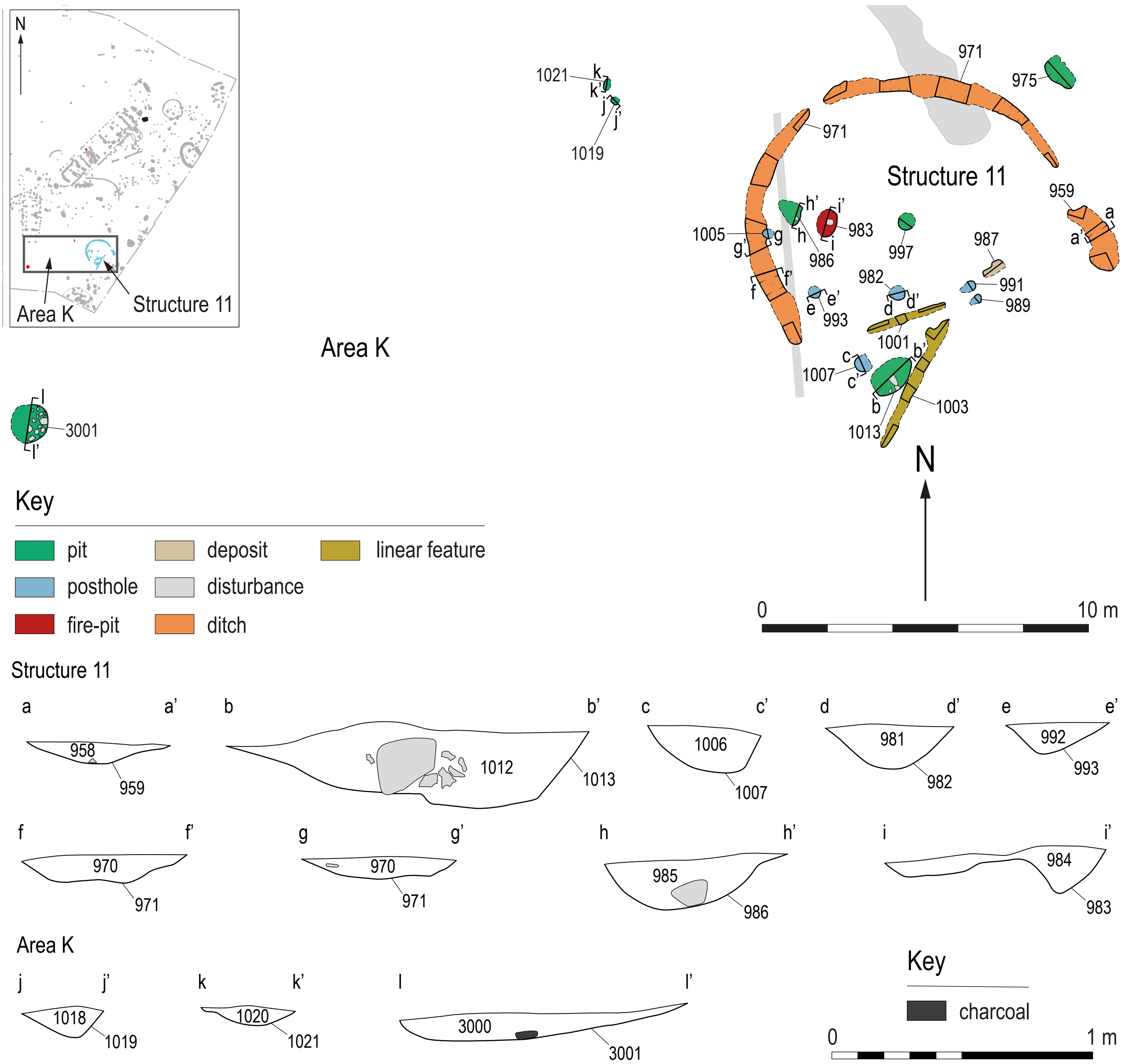

Figure 2.68: Structure 11 and Area K plans and section drawings.

Part 3: Dating

The radiocarbon dates

By Beverley Ballin Smith

Factors influencing sampling and the dates

Collecting samples for radiocarbon dating from Carnoustie was dependent on a number of factors: the depth of the feature, the interpretation of what sort of feature it was, its location, the relationship and distance of that feature to others, and whether there was other cultural material associated with its backfill or deposits.

The structures prioritised for absolute dating were first and foremost the two large timber halls followed by other structures, each recognisable from their outline or their pattern of features, with also a selection of samples from the outland deposits and features. However, not all structures provided samples for dating due to the lack of charcoal in their features or because those features that survived were very shallow.

Several other factors affected the sampling, including animal burrowing. The latter was recognised especially in the eastern and southern parts of the excavated areas where the topsoil was deeper due to soil movement from the higher parts of the site to the lower. There was also a more widespread disturbance of deposits by ploughing, especially by rig and furrow cultivation and more recent agricultural activities, but also by the digging and laying of drains, and the construction of field boundaries in the form of fence posts.

It may not have been as apparent during the excavation as it was during the post-excavation, but there had been very extensive rebuilding or alteration, redigging, clearing out and reuse of earlier features by later activities, which was unexpectedly widespread. To some extent these activities have also affected sampling but more importantly the radiocarbon returns.

Another important influence on the sampling of charcoal, especially from the structures, is the accepted method of using AMS single samples from short-lived tree species such as alder, willow, birch and hazel for dating. The fact that 90% of all the charcoal from Structure 8 was oak, with 94% oak charcoal from the exterior postholes (see Archaeobotany, below), suggests that the timber halls were generally constructed of long-lived oak, none of which was dated. Alder charcoal was the most commonly chosen species for dating, but it accounted for only 7% of the charcoal identified from the structure. The other shorter lived tree species accounted for less than 1% of the charcoal from the same structure.

It is important to note that we do not have any radiocarbon dates from a confirmed structural timber (oak) from any of the early Neolithic buildings. This may not matter, as using oak for dating would have introduced a number of uncertainties. However, and with hindsight, a parallel set of samples using oak for dating could have altered or refined our understanding of the construction, alteration and demise of these buildings. The questions remain as to what was the origin of the short-lived tree charcoal that has been dated? Does it simply reflect activities in and around the buildings? Was this timber used internally for repairs, later partitions, or was it debris from fuel? In short, does it accurately date the buildings?

The dates

The 101 radiocarbon dates are presented in Table 3.1 and in Table 3.2[1] where they are sequenced

1. All presented at 95% confidence

chronologically[2]. In PART 2: The excavation results, the radiocarbon dates were displayed for each structure, or block of features relating to their location on the site, so that their specific dates and activities could be compared and viewed more easily.

The late Mesolithic dates, ranging from 6451 - 4078 cal BC, reflect a background of earlier activity from the north, west and southern extremities of the site, and also beneath Structure 8. The charcoal may represent woodland clearance or it may be hearth waste from campfires.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39260	001	Alnus cf glutinosa from 003 fill of ditch 004	2827 ± 24	1009 – 970 cal BC 961 – 934 cal BC	1046 – 916 cal BC	Structure 1
UBA-39261	006	Alnus cf glutinosa from 003 fill of ditch 004	2729 ± 26	3699 – 3656 cal BC	920 – 818 cal BC	Structure 1
UBA-39262	031	Corylus cf avellana from 054 fill of pit 053	4679 ± 27	3515 – 3494 cal BC 3466 – 3410 cal BC 3405 – 3398 cal BC 3384 – 3375 cal BC	3621 – 3608 cal BC 3522 – 3482 cal BC 3477 – 3370 cal BC	Pit group 1
UBA-39263	034	Betula sp from 061 fill of pit 062	1228 ± 36	cal AD 716 – 743 cal AD 766 – 779 cal AD 789 – 869	cal AD 688 – 885	Pit group 1
UBA-39264	047	Corylus cf avellana from 085 fill of ditch 084	2835 ± 28	1020 – 969 cal BC 963 – 932 cal BC	1084 – 1064 cal BC 1058 – 912 cal BC	Structure 2
UBA-39265	049	Alnus cf glutinosa from 085 fill of ditch 084	2891 ± 26	1113 – 1028 cal BC	1192 – 1168 cal BC 1165 – 1144 cal BC 1134 – 998 cal BC	Structure 2
UBA-39266	076	Corylus cf avellana from 135 fill of ditch 136	2913 ± 26	1188 – 1181 cal BC 1157 –1146 cal BC 1128 – 1049 cal BC	1207 – 1201 cal BC 1196 –1141 cal BC 1134 – 1017 cal BC	Structure 3
UBA-39267	087	Alnus cf glutinosa from 145 fill of pit 146	4783 ± 28	3636 – 3629 cal BC 3548 – 3531 cal BC	3641 – 3618 cal BC 3611 – 3521 cal BC	Pit group 2
UBA-39268	089	Alnus cf glutinosa from 152 fill of pit 153	4791 ± 33	3639 – 3628 cal BC 3584 – 3531 cal BC	3646 – 3520 cal BC	Structure 3
UBA-39269	091	Alnus cf glutinosa from 156 fill of pit 157	4745 ± 31	3632 – 3559 cal BC 3537 – 3518 cal BC 3392 – 3389 cal BC	3635 – 3504 cal BC 3428 – 3381 cal BC	Pit group 2
UBA-39270	096	Alnus cf glutinosa from 158 fill of pit 159	4769 ± 32	3634 – 3625 cal BC 3599 – 3549 cal BC 3544 – 3525 cal BC	3640 – 3515 cal BC 3421 – 3418 cal BC 3412 – 3404 cal BC 3399 – 3384 cal BC	Pit group 2
UBA-39271	121	Alnus cf glutinosa from 217 fill of pit 216	2935 ± 27	1208 – 1110 cal BC 1097 – 1092 cal BC	1222 – 1044 cal BC	Pit group 3
UBA-39272	124	Betula sp from 220 fill of pit 221	4909 ± 29	3699 – 3656 cal BC	3762 – 3741 cal BC 3733 – 3725 cal BC 3715 – 3642 cal BC	Pit group 3
UBA-39273	127	Betula sp from 226 fill of pit 227	2723 ± 26	895 – 836 cal BC	914 – 816 cal BC	Pit group 3
UBA-39274	132	Alnus cf glutinosa from 234 fill of pit 235	2814 ± 28	1000 – 929 cal BC	1043 – 903 cal BC	Pit group 1
UBA-39275	136	Alnus cf glutinosa from 239 fill of pit 238	3750 ± 27	2203 – 2134 cal BC 1075 – 1065 cal BC 1057 – 905 cal BC	2278 – 2251 cal BC 2229 – 2221 cal BC 2211 – 2119 cal BC 2096 – 2040 cal BC	Area O East Angle?

Table 3.1: The radiocarbon dates.

2. Using ScARF period divisions

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39276	137	Corylus cf avellana from 244 fill of posthole 245	3672 ± 25	2076 – 2073 cal BC 2070 – 2064 cal BC	2138 – 1972 cal BC	Pit group 1
UBA-39277	145	Alnus cf glutinosa from 261 fill of posthole 262	3627 ± 25	2023 – 1954 cal BC	2118 – 2097 cal BC 2039 – 1914 cal BC	Structure 5
UBA-39278	157	Corylus cf avellana from 276 occupation layer	2829 ± 30	1014 – 930 cal BC	1082 – 1078 cal BC 1075 – 1065 cal BC 1057 – 905 cal BC	Structure 5
UBA-39279	170	Betula sp from 276 occupation layer	2831 ± 30	1016 – 967 cal BC 956 – 930 cal BC	1084 – 1064 cal BC 1058 – 906 cal BC	Structure 5
UBA-39280	176	Salix sp from 308 fill of pit 309	4836 ± 32	3655 – 3633 cal BC 3556 – 3539 cal BC	3694 – 3678 cal BC 3671 – 3628 cal BC 3586 – 3530 cal BC	Structure 8
UBA-39281	181	Corylus cf avellana from 318 fill of pit 319	4994 ± 27	3745 – 3713 cal BC	3929 – 3877 cal BC 3804 – 3703 cal BC	Structure 8
UBA-39282	9054	Alnus cf glutinosa from 320 fill of pit 321	4959 ± 36	3778 – 3696 cal BC	3893 – 3883 cal BC 3799 – 3653 cal BC	Structure 8
UBA-39283	222	Betula sp from 332 occupation layer	2862 ± 29	1106 –1105 cal BC 1083 – 1064 cal BC 1058 – 979 cal BC	1118 – 968 cal BC 963 – 931 cal BC	Structure 5
UBA-39284	195	Betula sp from 344 fill of pit 345	4935 ± 28	3758 – 3752 cal BC 3750 – 3744 cal BC 3713 – 3658 cal BC	3771 – 3654 cal BC	Structure 8
UBA-39285	200	Corylus cf avellana from 359 fill of pit 360	4776 ± 31	3635 – 3627 cal BC 3590 – 3528 cal BC	3642 – 3517 cal BC 3395 – 3386 cal BC	Structure 8
UBA-39286	221	Alnus cf glutinosa from 397 occupation layer	4879 ± 33	3694 – 3678 cal BC 3668 – 3641 cal BC	3712 – 3634cal BC 3551 – 3542 cal BC	Structure 7
UBA-39287	217	Alnus cf glutinosa from 407 fill of pit 408	5023 ± 32	3936 – 3872 cal BC 3810 – 3765 cal BC 3722 – 3718 cal BC	3943 – 3855 cal BC 3846 – 3830 cal BC 3824 – 3711 cal BC	Structure 7
UBA-39288	332	Alnus cf glutinosa from 412 fill of pit 423	4920 ± 27	3705 – 3659 cal BC	3763 – 3724 cal BC 3715 – 3648 cal BC	Structure 8
UBA-39289	277	Corylus cf avellana from 422 fill of gully 423	2912 ± 26	1188–1182 cal BC 1157–1146 cal BC 1128 – 1048 cal BC	1207 –1201 cal BC 1196–1141 cal BC 1134 – 1016 cal BC	Structure 6
UBA-39290	242	Alnus cf glutinosa from 434 fill of pit 435	4755 ± 44	3635 – 3548 cal BC 3544 – 3519 cal BC	3641 – 3498 cal BC 3448 – 3445 cal BC 3438 – 3377 cal BC	Structure 8
UBA-39291	262	Alnus cf glutinosa from 473 fill of pit 474	3733 ± 25	2197 –2167 cal BC 2150 – 2131 cal BC 2085 – 2051 cal BC	2203 – 2113 cal BC 2102 – 2037 cal BC	Structure 6
UBA-39292	271	Alnus cf glutinosa from 481 fill of pit 482	4877 ± 34	3694 – 3678 cal BC 3668 – 3641cal BC	3747 – 3746 cal BC 3712 – 3633 cal BC 3554 – 3540 cal BC	Structure 8
UBA-39293	293	Salix sp from 508 fill of pit 509	3008 ± 25	1283 – 1212 cal BC	1379 – 1345 cal BC 1304 – 1189 cal BC 1180 – 1160 cal BC 1144 – 1130 cal BC	Structure 6
UBA-39294	309	Alnus cf glutinosa from 528 base of pit 507	7517 ± 33	6432 – 6382 cal BC	6451 – 6351 cal BC 6308 – 6263 cal BC	Structure 8

Table 3.1 (continued): The radiocarbon dates.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39295	7060	Alnus cf glutinosa from 528 base of pit 507	4747 ± 49	3634 – 3551 cal BC 3542 – 3515 cal BC 3422 – 3419 cal BC 3409 – 3405 cal BC 3398 – 3384 cal BC	3639 – 3497 cal BC 3458 – 3376 cal BC	Structure 8
UBA-39296	352	From context 543 fill of posthole 544	4958 ± 37	3779 – 3695 cal BC	3894 – 3882 cal BC 3799 – 3652 cal BC	Structure 8
UBA-39297	4055	Alnus cf glutinosa from 557 fill of pit 558	4981 ± 34	3787 – 3709 cal BC	3929 – 3877 cal BC 3804 – 3691 cal BC 3685 – 3662 cal BC	Structure 8
UBA-39298	306	Corylus cf avellana from 560 fill of pit 562	4925 ± 31	3711– 3654 cal BC	3768 – 3649 cal BC	Structure 8
UBA-39299	320	Alnus cf glutinosa from 563 fill of pit 564	5075 ± 30	3948 – 3926 cal BC 3917 – 3916 cal BC 3877 – 3804 cal BC	3957 – 3797 cal BC	Structure 8
UBA-39300	307	Alnus cf glutinosa from 568 fill of gully 569	2757 ± 24	923 – 891 cal BC 879 – 846 cal BC	974 – 955 cal BC 942 – 832 cal BC	Structure 8
UBA-39301	319	Alnus cf glutinosa from 576 fill of posthole 577	5069 ± 32	3944 – 3913 cal BC 3878 – 3803 cal BC	3956 – 3793 cal BC	Structure 8
UBA-39302	367	Alnus cf glutinosa from 611 fill of pit 612	4823 ± 34	3651 – 3631 cal BC 3577 – 3574 cal BC 3564 – 3536 cal BC	3692 – 3685 cal BC 3663 – 3623 cal BC 3603 – 3524 cal BC	Structure 8s
UBA-39303	379	Alnus cf glutinosa from 648 fill of posthole 649	4894 ± 34	3695 – 3650 cal BC	3761 – 3741 cal BC 3732 – 3725 cal BC 3715 – 3637 cal BC	Structure 8
UBA-39304	4066	Alnus cf glutinosa from 675 fill of slot 676	5003 ± 28	3893 – 3883 cal BC 3799 – 3757 cal BC 3754 – 3749cal BC 3745 – 3713 cal BC	3937 – 3872 cal BC 3811 – 3705 cal BC	Structure 8s
UBA-39305	401	Alnus cf glutinosa from 687 fill of slot 688	5016 ± 27	3927 – 3877 cal BC 3804 – 3763 cal BC 3723 – 3716 cal BC	3941 – 3857 cal BC 3816 – 3709 cal BC	Structure 8s
UBA-39306	405	Salix sp from 701 fill of posthole 702	4940 ± 27	3760 – 3742 cal BC 3714 – 3661 cal BC	3773 – 3655 cal BC	Structure 8s
UBA-39307	417	Alnus cf glutinosa from 703 fill of pit 704	4913 ± 42	3712 – 3646 cal BC	3775 – 3640 cal BC	Structure 8s
UBA-39308	4063	Alnus cf glutinosa from 703 fill of pit 704	4960 ± 58	3790 – 3662 cal BC	3941 – 3857 cal BC 3816 – 3642 cal BC	Structure 8s
UBA-39309	427	Corylus cf avellana from 734 fill of pit 735	1206 ± 22	cal AD 773 – 779 cal AD 789 – 831 cal AD 836 – 867	cal AD 727 – 737 cal AD 768 – 887	Pit group 18
UBA-39310	12038	Alnus cf glutinosa from 744 fill of pit 743	2860 ± 26	1075 – 1065 cal BC 1057 – 976 cal BC	1115 – 970 cal BC 961 – 934 cal BC	Pit group 7
UBA-39311	8040	Salix sp from 766 fill of posthole 767	4788 ± 29	3637 – 3629 cal BC 3582 – 3532 cal BC	3643 – 3619 cal BC 3610 – 3521 cal BC	Pit group 6
UBA-39312	482	Alnus cf glutinosa from 822 fill of pit 823	4563 ± 36	3369 – 3329 cal BC 3216 – 3181 cal BC 3158 – 3124 cal BC	3491 – 3469 cal BC 3373 – 3308 cal BC 3302 – 3282 cal BC 3276 – 3265 cal BC 3240 – 3104 cal BC	Area B
UBA-39313	501	Alnus cf glutinosa from 861 fill of pit 862	4764 ± 26	3633 – 3624 cal BC 3601 – 3554 cal BC 3540 – 3524 cal BC	3638 – 3517 cal BC 3395 – 3386 cal BC	Pit group 5

Table 3.1 (continued): The radiocarbon dates.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39314	519	Corylus cf avellana from 888 fill of pit 889	4587 ± 33	3492 – 3469 cal BC 3374 – 3338 cal BC 3206 – 3195 cal BC 3147 – 3144 cal BC	3499 – 3432 cal BC 3379 – 3325 cal BC 3231 – 3225 cal BC 3219 – 3173 cal BC 3161 – 3118 cal BC	Pit group 5
UBA-39315	533	Alnus cf glutinosa from 930 occupation deposit	4802 ± 28	3640 – 34631 cal BC 3578 – 3572 cal BC 3569 – 3535 cal BC	3648 – 3624 cal BC 3601 – 3525 cal BC	Structure 10
UBA-39316	534	Alnus cf glutinosa from 933 fill of posthole 934	4983 ± 27	3779 – 3712 cal BC	3911 – 3879 cal BC 3802 – 3695 cal BC 3676 – 3672 cal BC	Structure 8s
UBA-39317	547	Alnus cf glutinosa from 956 fill of posthole 957	4737 ± 26	3631 – 3578 cal BC 3573 – 3567 cal BC 3536 – 3516 cal BC 3397 – 3385 cal BC	3634 – 3552 cal BC 3541 – 3501 cal BC 3430 – 3380 cal BC	Structure 10
UBA-39318	8038	Alnus cf glutinosa from 1016 fill of pit 1017	4833 ± 28	3652 – 3633 cal BC 3554 – 3540 cal BC	3692 – 3684 cal BC 3663 – 3628 cal BC 3585 – 3530 cal BC	Pit group 8
UBA-39319	610	Corylus cf avellana from 1051 deposit	4884 ± 28	3694– 3679 cal BC 3667 – 3644 cal BC	3704 – 3640 cal BC	Structure 12
UBA-39320	618	Alnus cf glutinosa from 1068 fill of posthole 1069	5006 ± 28	3903 – 3899 cal BC 3895 – 3880 cal BC 3800 – 3758 cal BC 3752 – 3750 cal BC 3744 – 3713 cal BC	3938 – 3868 cal BC 3813 – 3706 cal BC	Structure 13
UBA-39321	626	Alnus cf glutinosa from 1073 fill of posthole 1074	4483 ± 27	3329 – 3262 cal BC 3252 – 3216 cal BC 3180 – 3158 cal BC 3123 – 3099 cal BC	3341 – 3089 cal BC 3047 – 3036 cal BC	Structure 12
UBA-39322	628	Alnus cf glutinosa from 1081 fill of pit 1082	4888 ± 32	3695 – 3677 cal BC 3671 – 3646 cal BC	3757 – 3754 cal BC 3749 – 3744 cal BC 3713 – 3636 cal BC	Structure 12
UBA-39323	633	Corylus cf avellana from 1088 deposit	5896 ± 37	4796 – 4721 cal BC	4844 – 4692 cal BC	Structure 12
UBA-39324	706	Corylus cf avellana from 1119 fill of posthole 1120	4817 ± 27	3647 – 3631 cal BC 3561 – 3536 cal BC	3653 – 3627 cal BC 3590 – 3528 cal BC	Structure 13
UBA-39325	4076	Betula sp from 1129 fill of trench/ gully 1130	4906 ± 27	3696 – 3655 cal BC	3758 – 3743 cal BC 3714 – 3641 cal BC	Structure 13
UBA-39326	709	Corylus cf avellana from 1134 fill of posthole 1135	4511 ± 46	3245 – 3312 cal BC 3294 – 3286 cal BC 3274 – 3265 cal BC 3238 – 3108 cal BC	3362 – 3089 cal BC 3053 – 3033 cal BC	Structure 13
UBA-39327	4080	Alnus cf glutinosa from 1210 fill of pit 1211	4708 ± 33	3625 – 3600 cal BC 3525 – 3498 cal BC 3435 – 3378 cal BC	3631 – 3577 cal BC 3574 – 3565 cal BC 3536 – 3491 cal BC 3469 – 3373 cal BC	Structure 13
UBA-39328	770	Alnus cf glutinosa from 1250 fill of pit 1251	4551 ± 49	3367 – 3321 cal BC 3272 – 3268 cal BC 3235 – 3170 cal BC 3164 – 3114 cal BC	3494 – 3466 cal BC 3375 – 3093 cal BC	Structure 13n
UBA-39329	4098	Salix sp from 2017 fill of pit 2018	4755 ± 42	3634 – 3550 cal BC 3543 – 3519 cal BC	3640 – 3498 cal BC 3435 – 3378 cal BC	Pit group 13
UBA-39330	3003	Corylus cf avellana from 3006 fill of pit 3007	4837 ± 52	3693 – 3681 cal BC 3665 – 3629 cal BC 3582 – 3532 cal BC	3757 – 3753 cal BC 3750 – 3744 cal BC 3713 – 3516 cal BC 3397 – 3385 cal BC	Pit group 10

Table 3.1 (continued): The radiocarbon dates.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39331	3009	Alnus cf glutinosa from 3017 fill of pit 3016	3587 ± 40	2012 – 1999 cal BC 1978 – 1891 cal BC	2114 – 2100 cal BC 2037 – 1873 cal BC 1844 – 1814 cal BC 1800 – 1778 cal BC	Pit group 12
UBA-39332	4041	Alnus cf glutinosa from 4081 fill of pit 4082	4795 ± 40	3641 – 3627 cal BC 3589 – 3528 cal BC	3654 – 3515 cal BC 3410 – 3405 cal BC 3398 – 3384 cal BC	Pit group 16
UBA-39333	5007	Alnus cf glutinosa from 5015 fill of pit 5016	4591 ± 37	3495 – 3464 cal BC 3375 – 3338 cal BC 3207 – 3194 cal BC 3148 – 3141 cal BC	3508 – 3426 cal BC 3382 – 3320 cal BC 3272 – 3269 cal BC 3235 – 3169 cal BC 3164 – 3113 cal BC	Pit group 14
UBA-39334	5017	Alnus cf glutinosa from 5051 fill of posthole 5052	5445 ± 49	4344 – 4310 cal BC 4305 – 4260 cal BC	4442 – 4423 cal BC 4372 – 4227 cal BC 4201 – 4168 cal BC 4126 – 4120 cal BC 4093 – 4078 cal BC	Pit group 16/ Structure 15
UBA-39335	5032	Corylus cf avellana from 5059 fill of structure	1001 ± 42	cal AD 988 – 1045 cal AD 1095 – 1120 cal AD 1042 – 1146	cal AD 972 – 1155	Structure 4
UBA-39336	5033	Betula sp from 5061 fill of posthole 5062	1201 ± 21	cal AD 774 – 779 cal AD 789 – 831 cal AD 836 – 868	cal AD 769 – 888	Structure 4
UBA-39337	6013	Corylus avellana nutshell from 6026 fill of pit 6027	4606 ± 47	3501 – 3430 cal BC 3380 – 3339 cal BC 3205 – 3196 cal BC	3520 – 3319 cal BC 3292 – 3290 cal BC 3272 – 3268 cal BC 3236 – 3168 cal BC 3165 – 3111 cal BC	Pit group 17
UBA-39338	7006	Alnus cf glutinosa from 7012 fill of posthole 7013	4968 ± 27	3770 – 3708 cal BC	3797 – 3691 cal BC 3685 – 3662 cal BC	Pit group 11
UBA-39339	7011	Alnus cf glutinosa from 7020 fill of pit 7021	4790 ± 31	3638 – 3629 cal BC 3583 – 3532 cal BC	3645 – 3618 cal BC 3611 – 3521 cal BC	Area G
UBA-39340	7013	Alnus cf glutinosa from 7024 fill of pit 7025	4519 ± 29	3638 – 3631 cal BC 3578 – 3572 cal BC 3569 – 3535 cal BC	3355 – 3263 cal BC 3244 – 3101 cal BC	Pit group 28
UBA-39341	7021	Corylus cf avellana from 7041 fill of pit 7042	4796 ± 26	3350 – 3322 cal BC 3272 – 3269 cal BC 3235 – 3171 cal BC 3163 – 3116 cal BC	3644 – 3624 cal BC 3602 – 3524 cal BC	Pit group 13
UBA-39342	7051	Alnus cf glutinosa from 7103 deposit	6239 ± 35	5302 – 5207 cal BC 5143 – 5140 cal BC 5090 – 5083 cal BC	5307 – 5201 cal BC 5174 – 5071 cal BC	Area C
UBA-39343	7054	Corylus cf avellana from 7108 lower fill of pit 7107	4817 ± 34	3648 – 3631 cal BC 3578 – 3572 cal BC 3568 – 3535 cal BC	3659 – 3621 cal BC 3606 – 3523 cal BC	Pit group 16
UBA-39344	8006	Betula sp from 8012 fill of curved feature 8013	1229 ± 21	cal AD 718 – 742 cal AD 766 – 778 cal AD 791 – 807 cal AD 811 – 826 cal AD 840 – 863	cal AD 693 – 746 cal AD 763 – 782 cal AD 786 – 879	Pit group 21
UBA-39345	8010	Alnus cf glutinosa from 8016 fill of pit 8017	4867 ± 27	3692 – 3684 cal BC 3663 – 3369 cal BC	3702 – 3636 cal BC	Pit group 17

Table 3.1 (continued): The radiocarbon dates.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma (95.4% probability)	Structure
UBA-39346	8013	Alnus cf glutinosa from 8022 fill of pit 8023	3961 ± 30	2565 – 2532 cal BC 2496 – 2459 cal BC	2571 – 2513 cal BC 2504 – 2431 cal BC 2425 – 2400 cal BC 2381 – 2348 cal BC	Area G
UBA-39347	8028	Corylus cf avellana from 8048 fill of pit 8049	4049 ± 36	2624 – 2558 cal BC 2536 – 2491 cal BC	2839 – 2814 cal BC 2676 – 2473 cal BC	Pit group 15
UBA-39348	8039	Corylus cf avellana from 8052 fill of posthole 8053	4864 ± 33	3693 – 3681 cal BC 3665 – 3637 cal BC	3707 – 3632 cal BC 3557 – 3538 cal BC	Structure 8
UBA-39349	9017	Corylus cf avellana from 9032 fill of pit 9033	4527 ± 58	3356 – 3311 cal BC 3295 – 3286 cal BC 3275 – 3265 cal BC 3239 – 3106 cal BC	3489 – 3471 cal BC 3372 – 3081 cal BC 3069 – 3026 cal BC	Pit group 14
UBA-39350	9023	Corylus cf avellana from 9041 fill of pit 9037	4613 ± 51	3512 – 3424 cal BC 3383 – 3340 cal BC 3202 – 3199 cal BC	3623 – 3603 cal BC 3523 – 3319 cal BC 3291 – 3290 cal BC 3272 – 3268 cal BC 3236 – 3169 cal BC 3164 – 3112 cal BC	Pit group 24
UBA-39351	9024	Alnus cf glutinosa from 9042 fill of pit 9043	4746 ± 59	3634 – 3551 cal BC 3542 – 3514 cal BC 3422 – 3514 cal BC 3399 – 3384 cal BC	3642 – 3492 cal BC 3468 – 3374 cal BC	Pit group 25
UBA-39352	10021	Alnus cf glutinosa from 10038 fill of pit 10039	5079 ± 34	3951 – 3926 cal BC 3917 – 3916 cal BC 3877 – 3804 cal BC	3960 – 3796 cal BC	Area G
UBA-39353	2029	Alnus cf glutinosa from 10062 fill of pit 10063	4635 ± 36	3498 – 3436 cal BC 3378 – 3364 cal BC	3517 – 3394 cal BC 3387 – 3353 cal BC	Pit group 15
UBA-39354	8042	Alnus cf glutinosa from 11007 fill of pit 11008	4808 ± 45	3647– 3628 cal BC 3588 – 3529 cal BC	3694 – 3679 cal BC 3666 – 3515 cal BC 3422 – 3418 cal BC 3413 – 3404 cal BC 3399 – 3384 cal BC	Pit group 10
UBA-39355	12019	Betula sp from 12030 fill of pit 12031	1124 ± 27	cal AD 892 – 906 cal AD 915 – 968	cal AD 779 – 789 cal AD 829 – 839 cal AD 866 – 991	Pit group 21
UBA-39356	12034	Alnus cf glutinosa from 12051 fill of pit 12052	4046 ± 34	2620 – 2562 cal BC 2535 – 2492 cal BC	2835 – 2817 cal BC 2665 – 2474 cal BC	Pit group 15
UBA-39357	421	Corylus avellana nutshell from 722 fill of curved feature 723	4888 ± 30	3694 – 3677 cal BC 3670 – 3646 cal BC	3709 – 3638 cal BC	Structure 4/8
UBA-39358	449	Alnus cf glutinosa from 786 fill of pit 787	4689 ± 48	3619 – 3610 cal BC 3521 – 3492 cal BC 3468 – 3374 cal BC	3631 – 3577 cal BC 3574 – 3566 cal BC 3536 – 3366 cal BC	Pit group 6
UBA-39359	780	Alnus cf glutinosa from 901 near hearth 900	4367 ± 36	3014 – 2920 cal BC	3090 – 3046 cal BC 3035 – 2904 cal BC	Structure 9
SUERC-75019 (GU45283)	?	Sample of the hazel wood scabbard from the BA sword	2855 ± 33	1071 – 940 cal BC	1118 – 924 cal BC	Hoard

Table 3.1 (continued): The radiocarbon dates.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
UBA-39294	309	Alnus cf glutinosa from 528 base of pit 507	7517 ± 33	6432 – 6382 cal BC	6451 – 6351 cal BC 6308 – 6263 cal BC	Structure 8	Mesolithic
UBA-39342	7051	Alnus cf glutinosa from 7103 deposit	6239 ± 35	5302 – 5207 cal BC 5143 – 5140 cal BC 5090 – 5083 cal BC	5307 – 5201 cal BC 5174 – 5071 cal BC	Area C	Late Mesolithic
UBA-39323	633	Corylus cf avellana from 1088 deposit	5896 ± 37	4796 – 4721 cal BC	4844 – 4692 cal BC	Structure 12	Late Mesolithic
UBA-39334	5017	Alnus cf glutinosa from 5051 fill of posthole 5052	5445 ± 49	4344 – 4310 cal BC 4305 – 4260 cal BC	4442 – 4423 cal BC 4372 – 4227 cal BC 4201 – 4168 cal BC 4126 – 4120 cal BC 4093 – 4078 cal BC	Pit group 16	Late Mesolithic/ early Neolithic
UBA-39352	10021	Alnus cf glutinosa from 10038 fill of pit 10039	5079 ± 34	3951 – 3926 cal BC 3917 – 3916 cal BC 3877 – 3804 cal BC	3960 – 3796 cal BC	Area G	EN
UBA-39299	320	Alnus cf glutinosa from 563 fill of pit 564	5075 ± 30	3948 – 3926 cal BC 3917 – 3916 cal BC 3877 – 3804 cal BC	3957 – 3797 cal BC	Structure 8	EN
UBA-39301	319	Alnus cf glutinosa from 576 fill of posthole 577	5069 ± 32	3944 – 3913 cal BC 3878 – 3803 cal BC	3956 – 3793 cal BC	Structure 8	EN
UBA-39287	217	Alnus cf glutinosa from 407 fill of pit 408	5023 ± 32	3936 – 3872 cal BC 3810 – 3765 cal BC 3722 – 3718 cal BC	3943 – 3855 cal BC 3846 – 3830 cal BC 3824 – 3711 cal BC	Structure 7	EN
UBA-39305	401	Alnus cf glutinosa from 687 fill of slot 688	5016 ± 27	3927 – 3877 cal BC 3804 – 3763 cal BC 3723 – 3716 cal BC	3941 – 3857 cal BC 3816 – 3709 cal BC	Structure 8s	EN
UBA-39308	4063	Alnus cf glutinosa from 703 fill of pit 704	4960 ± 58	3790 – 3662 cal BC	3941 – 3857 cal BC 3816 – 3642 cal BC	Structure 8s	EN
UBA-39320	618	Alnus cf glutinosa from 1068 fill of posthole 1069	5006 ± 28	3903 – 3899 cal BC 3895 – 3880 cal BC 3800 – 3758 cal BC 3752 – 3750 cal BC 3744 – 3713 cal BC	3938 – 3868 cal BC 3813 – 3706 cal BC	Structure 13	EN
UBA-39304	4066	Alnus cf glutinosa from 675 fill of slot 676	5003 ± 28	3893 – 3883 cal BC 3799 – 3757 cal BC 3754 – 3749cal BC 3745 – 3713 cal BC	3937 – 3872 cal BC 3811 – 3705 cal BC	Structure 8s	EN
UBA-39281	181	Corylus cf avellana from 318 fill of pit 319	4994 ± 27	3745 – 3713 cal BC	3929 – 3877 cal BC 3804 – 3703 cal BC	Structure 8	EN
UBA-39297	4055	Alnus cf glutinosa from 557 fill of pit 558	4981 ± 34	3779 – 3712 cal BC	3929 – 3877 cal BC 3804 – 3691 cal BC 3685 – 3662 cal BC	Structure 8	EN
UBA-39316	534	Alnus cf glutinosa from 933 fill of posthole 934	4983 ± 27	3787 – 3709 cal BC	3911 – 3879 cal BC 3802 – 3695 cal BC 3676 – 3672 cal BC	Structure 8s	EN
UBA-39296	352	From context 543 fill of posthole 544	4958 ± 37	3779 – 3695 cal BC	3894 – 3882 cal BC 3799 – 3652 cal BC	Structure 8	EN
UBA-39282	9054	Alnus cf glutinosa from 320 fill of pit 321	4959 ± 36	3778 – 3696 cal BC	3893 – 3883 cal BC 3799 – 3653 cal BC	Structure 8	EN
UBA-39338	7006	Alnus cf glutinosa from 7012 fill of posthole 7013	4968 ± 27	3770 – 3708 cal BC	3797 – 3691 cal BC 3685 – 3662 cal BC	Pit group 11	EN

Table 3.2: The radiocarbon dates by period.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
UBA-39307	417	Alnus cf glutinosa from 703 fill of pit 704	4913 ± 42	3712 – 3646 cal BC	3775 – 3640 cal BC	Structure 8s	EN
UBA-39306	405	Salix sp from 701 fill of posthole 702	4940 ± 27	3760 – 3742 cal BC 3714 – 3661 cal BC	3773 – 3655 cal BC	Structure 8s	EN
UBA-39284	195	Betula sp from 344 fill of pit 345	4935 ± 28	3758 – 3752 cal BC 3750 – 3744 cal BC 3713 – 3658 cal BC	3771 – 3654 cal BC	Structure 8	EN
UBA-39298	306	Corylus cf avellana from 560 fill of pit 562	4925 ± 31	3711– 3654 cal BC	3768 – 3649 cal BC	Structure 8	EN
UBA-39288	332	Alnus cf glutinosa from 412 fill of pit 423	4920 ± 27	3705 – 3659 cal BC	3763 – 3724 cal BC 3715 – 3648 cal BC	Structure 8	EN
UBA-39272	124	Betula sp from 220 fill of pit 221	4909 ± 29	3699 – 3656 cal BC	3762 – 3741 cal BC 3733 – 3725 cal BC 3715 – 3642 cal BC	Pit group 3	EN
UBA-39303	379	Alnus cf glutinosa from 648 fill of posthole 649	4894 ± 34	3695 – 3650 cal BC	3761 – 3741 cal BC 3732 – 3725 cal BC 3715 – 3637 cal BC	Structure 8	EN
UBA-39325	4076	Betula sp from 1129 fill of trench/ gully 1130	4906 ± 27	3696 – 3655 cal BC	3758 – 3743 cal BC 3714 – 3641 cal BC	Structure 13	EN
UBA-39322	628	Alnus cf glutinosa from 1081 fill of pit 1082	4888 ± 32	3695 – 3677 cal BC 3671 – 3646 cal BC	3757 – 3754 cal BC 3749 – 3744 cal BC 3713 – 3636 cal BC	Structure 12	EN
UBA-39330	3003	Corylus cf avellana from 3006 fill of pit 3007	4837 ± 52	3693 – 3681 cal BC 3665 – 3629 cal BC 3582 – 3532 cal BC	3757 – 3753 cal BC 3750 – 3744 cal BC 3713 – 3516 cal BC 3397 – 3385 cal BC	Pit group 10	EN/MN
UBA-39292	271	Alnus cf glutinosa from 481 fill of pit 482	4877 ± 34	3694 – 3678 cal BC 3668 – 3641cal BC	3747 – 3746 cal BC 3712 – 3633 cal BC 3554 – 3540 cal BC	Structure 8	EN
UBA-39286	221	Alnus cf glutinosa from 397 occupation layer	4879 ± 33	3694 – 3678 cal BC 3668 – 3641 cal BC	3712 – 3634cal BC 3551 – 3542 cal BC	Structure 7	EN
UBA-39357	421	Corylus avellana nutshell from 722 fill of curved feature 723	4888 ± 30	3694 – 3677 cal BC 3670 – 3646 cal BC	3709 – 3638 cal BC	Structure 4/8	EN
UBA-39348	8039	Corylus cf avellana from 8052 fill of posthole 8053	4864 ± 33	3693 – 3681 cal BC 3665 – 3637 cal BC	3707 – 3632 cal BC 3557 – 3538 cal BC	Structure 8	EN
UBA-39319	610	Corylus cf avellana from 1051 deposit	4884 ± 28	3694– 3679 cal BC 3667 – 3644 cal BC	3704 – 3640 cal BC	Structure 12	EN
UBA-39345	8010	Alnus cf glutinosa from 8016 fill of pit 8017	4867 ± 27	3692 – 3684 cal BC 3663 – 3369 cal BC	3702 – 3636 cal BC	Pit group 17	EN
UBA-39354	8042	Alnus cf glutinosa from 11007 fill of pit 11008	4808 ± 45	3647– 3628 cal BC 3588 – 3529 cal BC	3694 – 3679 cal BC 3666 – 3515 cal BC 3422 – 3418 cal BC 3413 – 3404 cal BC 3399 – 3384 cal BC	Pit group 10	EN/MN
UBA-39280	176	Salix sp from 308 fill of pit 309	4836 ± 32	3655 – 3633 cal BC 3556 – 3539 cal BC	3694 – 3678 cal BC 3671 – 3628 cal BC 3586 – 3530 cal BC	Structure 8	EN
UBA-39302	367	Alnus cf glutinosa from 611 fill of pit 612	4823 ± 34	3651 – 3631 cal BC 3577 – 3574 cal BC 3564 – 3536 cal BC	3692 – 3685 cal BC 3663 – 3623 cal BC 3603 – 3524 cal BC	Structure 8s	EN

Table 3.2 (continued): The radiocarbon dates by period.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
UBA-39318	8038	Alnus cf glutinosa from 1016 fill of pit 1017	4833 ± 28	3652 – 3633 cal BC 3554 – 3540 cal BC	3692 – 3684 cal BC 3663 – 3628 cal BC 3585 – 3530 cal BC	Pit group 8	EN
UBA-39343	7054	Corylus cf avellana from 7108 lower fill of pit 7107	4817 ± 34	3648 – 3631 cal BC 3578 – 3572 cal BC 3568 – 3535 cal BC	3659 – 3621 cal BC 3606 – 3523 cal BC	Pit group 16	EN
UBA-39332	4041	Alnus cf glutinosa from 4081 fill of pit 4082	4795 ± 40	3641 – 3627 cal BC 3589 – 3528 cal BC	3654 – 3515 cal BC 3410 – 3405 cal BC 3398 – 3384 cal BC	Pit group 16	EN/MN
UBA-39324	706	Corylus cf avellana from 1119 fill of posthole 1120	4817 ± 27	3647 – 3631 cal BC 3561 – 3536 cal BC	3653 – 3627 cal BC 3590 – 3528 cal BC	Structure 13	EN
UBA-39315	533	Alnus cf glutinosa from 930 occupation deposit	4802 ± 28	3640 – 34631 cal BC 3578 – 3572 cal BC 3569 – 3535 cal BC	3648 – 3624 cal BC 3601 – 3525 cal BC	Structure 10	EN
UBA-39268	089	Alnus cf glutinosa from 152 fill of pit 153	4791 ± 33	3639 – 3628 cal BC 3584 – 3531 cal BC	3646 – 3520 cal BC	Structure 3	EN
UBA-39339	7011	Alnus cf glutinosa from 7020 fill of pit 7021	4790 ± 31	3638 – 3629 cal BC 3583 – 3532 cal BC	3645 – 3618 cal BC 3611 – 3521 cal BC	Area G	EN
UBA-39341	7021	Corylus cf avellana from 7041 fill of pit 7042	4796 ± 26	3350 – 3322 cal BC 3272 – 3269 cal BC 3235 – 3171 cal BC 3163 – 3116 cal BC	3644 – 3624 cal BC 3602 – 3524 cal BC	Pit group 13	EN
UBA-39311	8040	Salix sp from 766 fill of posthole 767	4788 ± 29	3637 – 3629 cal BC 3582 – 3532 cal BC	3643 – 3619 cal BC 3610 – 3521 cal BC	Pit group 6	EN
UBA-39285	200	Corylus cf avellana from 359 fill of pit 360	4776 ± 31	3635 – 3627 cal BC 3590 – 3528 cal BC	3642 – 3517 cal BC 3395 – 3386 cal BC	Structure 8	EN/MN
UBA-39351	9024	Alnus cf glutinosa from 9042 fill of pit 9043	4746 ± 59	3634 – 3551 cal BC 3542 – 3514 cal BC 3422 – 3514 cal BC 3399 – 3384 cal BC	3642 – 3492 cal BC 3468 – 3374 cal BC	Pit group 25	EN/MN
UBA-39267	087	Alnus cf glutinosa from 145 fill of pit 146	4783 ± 28	3636 – 3629 cal BC 3548 – 3531 cal BC	3641 – 3618 cal BC 3611 – 3521 cal BC	Pit group 2	EN
UBA-39290	242	Alnus cf glutinosa from 434 fill of pit 435	4755 ± 44	3635 – 3548 cal BC 3544 – 3519 cal BC	3641 – 3498 cal BC 3448 – 3445 cal BC 3438 – 3377 cal BC	Structure 8	EN/MN
UBA-39270	096	Alnus cf glutinosa from 158 fill of pit 159	4769 ± 32	3634 – 3625 cal BC 3599 – 3549 cal BC 3544 – 3525 cal BC	3640 – 3515 cal BC 3421 – 3418 cal BC 3412 – 3404 cal BC 3399 – 3384 cal BC	Pit group 2	EN/MN
UBA-39329	4098	Salix sp from 2017 fill of pit 2018	4755 ± 42	3634 – 3550 cal BC 3543 – 3519 cal BC	3640 – 3498 cal BC 3435 – 3378 cal BC	Pit group 13	EN/MN
UBA-39295	7060	Alnus cf glutinosa from 528 base of pit 507	4747 ± 49	3634 – 3551 cal BC 3542 – 3515 cal BC 3422 – 3419 cal BC 3409 – 3405 cal BC 3398 – 3384 cal BC	3639 – 3497 cal BC 3458 – 3376 cal BC	Structure 8	EN/MN
UBA-39313	501	Alnus cf glutinosa from 861 fill of pit 862	4764 ± 26	3633 – 3624 cal BC 3601 – 3554 cal BC 3540 – 3524 cal BC	3638 – 3517 cal BC 3395 – 3386 cal BC	Pit group 5	EN/MN
UBA-39269	091	Alnus cf glutinosa from 156 fill of pit 157	4745 ± 31	3632 – 3559 cal BC 3537 – 3518 cal BC 3392 – 3389 cal BC	3635 – 3504 cal BC 3428 – 3381 cal BC	Pit group 2	EN/MN

Table 3.2 (continued): The radiocarbon dates by period.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
UBA-39317	547	Alnus cf glutinosa from 956 fill of posthole 957	4737 ± 26	3631 – 3578 cal BC 3573 – 3567 cal BC 3536 – 3516 cal BC 3397 – 3385 cal BC	3634 – 3552 cal BC 3541 – 3501 cal BC 3430 – 3380 cal BC	Structure 10	EN/MN
UBA-39358	449	Alnus cf glutinosa from 786 fill of pit 787	4689 ± 48	3619 – 3610 cal BC 3521 – 3492 cal BC 3468 – 3374 cal BC	3631 – 3577 cal BC 3574 – 3566 cal BC 3536 – 3366 cal BC	Pit group 6	EN/MN
UBA-39327	4080	Alnus cf glutinosa from 1210 fill of pit 1211	4708 ± 33	3625 – 3600 cal BC 3525 – 3498 cal BC 3435 – 3378 cal BC	3631 – 3577 cal BC 3574 – 3565 cal BC 3536 – 3491 cal BC 3469 – 3373 cal BC	Structure 13	EN/MN
UBA-39350	9023	Corylus cf avellana from 9041 fill of pit 9037	4613 ± 51	3512 – 3424 cal BC 3383 – 3340 cal BC 3202 – 3199 cal BC	3623 – 3603 cal BC 3523 – 3319 cal BC 3291 – 3290 cal BC 3272 – 3268 cal BC 3236 – 3169 cal BC 3164 – 3112 cal BC	Pit group 24	EN/MN
UBA-39262	031	Corylus cf avellana from 054 fill of pit 053	4679 ± 27	3515 – 3494 cal BC 3466 – 3410 cal BC 3405 – 3398 cal BC 3384 – 3375 cal BC	3621 – 3608 cal BC 3522 – 3482 cal BC 3477 – 3370 cal BC	Pit group 1	EN/MN
UBA-39337	6013	Corylus avellana nutshell from 6026 fill of pit 6027	4606 ± 47	3501 – 3430 cal BC 3380 – 3339 cal BC 3205 – 3196 cal BC	3520 – 3319 cal BC 3292 – 3290 cal BC 3272 – 3268 cal BC 3236 – 3168 cal BC 3165 – 3111 cal BC	Pit group 17	MN
UBA-39353	2029	Alnus cf glutinosa from 10062 fill of pit 10063	4635 ± 36	3498 – 3436 cal BC 3378 – 3364 cal BC	3517 – 3394 cal BC 3387 – 3353 cal BC	Pit group 15	MN
UBA-39333	5007	Alnus cf glutinosa from 5015 fill of pit 5016	4591 ± 37	3495 – 3464 cal BC 3375 – 3338 cal BC 3207 – 3194 cal BC 3148 – 3141 cal BC	3508 – 3426 cal BC 3382 – 3320 cal BC 3272 – 3269 cal BC 3235 – 3169 cal BC 3164 – 3113 cal BC	Pit group 14	MN
UBA-39314	519	Corylus cf avellana from 888 fill of pit 889	4587 ± 33	3492 – 3469 cal BC 3374 – 3338 cal BC 3206 – 3195 cal BC 3147 – 3144 cal BC	3499 – 3432 cal BC 3379 – 3325 cal BC 3231 – 3225 cal BC 3219 – 3173 cal BC 3161 – 3118 cal BC	Pit group 5	MN
UBA-39328	770	Alnus cf glutinosa from 1250 fill of pit 1251	4551 ± 49	3367 – 3321 cal BC 3272 – 3268 cal BC 3235 – 3170 cal BC 3164 – 3114 cal BC	3494 – 3466 cal BC 3375 – 3093 cal BC	Structure 13n	MN
UBA-39312	482	Alnus cf glutinosa from 822 fill of pit 823	4563 ± 36	3369 – 3329 cal BC 3216 – 3181 cal BC 3158 – 3124 cal BC	3491 – 3469 cal BC 3373 – 3308 cal BC 3302 – 3282 cal BC 3276 – 3265 cal BC 3240 – 3104 cal BC	Area B	EN/MN
UBA-39349	9017	Corylus cf avellana from 9032 fill of pit 9033	4527 ± 58	3356 – 3311 cal BC 3295 – 3286 cal BC 3275 – 3265 cal BC 3239 – 3106 cal BC	3489 – 3471 cal BC 3372 – 3081 cal BC 3069 – 3026 cal BC	Pit group 14	MN
UBA-39326	709	Corylus cf avellana from 1134 fill of posthole 1135	4511 ± 46	3245 – 3312 cal BC 3294 – 3286 cal BC 3274 – 3265 cal BC 3238 – 3108 cal BC	3362 – 3089 cal BC 3053 – 3033 cal BC	Structure 13	MN
UBA-39340	7013	Alnus cf glutinosa from 7024 fill of pit 7025	4519 ± 29	3638 – 3631 cal BC 3578 – 3572 cal BC 3569 – 3535 cal BC	3355 – 3263 cal BC 3244 – 3101 cal BC	Pit group 28	MN

Table 3.2 (continued): The radiocarbon dates by period.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
UBA-39321	626	Alnus cf glutinosa from 1073 fill of posthole 1074	4483 ± 27	3329 – 3262 cal BC 3252 – 3216 cal BC 3180 – 3158 cal BC 3123 – 3099 cal BC	3341 – 3089 cal BC 3047 – 3036 cal BC	Structure 12	MN
UBA-39359	780	Alnus cf glutinosa from 901 near hearth 900	4367 ± 36	3014 – 2920 cal BC	3090 – 3046 cal BC 3035 – 2904 cal BC	Structure 9	MN/LN
UBA-39347	8028	Corylus cf avellana from 8048 fill of pit 8049	4049 ± 36	2624 – 2558 cal BC 2536 – 2491 cal BC	2839 – 2814 cal BC 2676 – 2473 cal BC	Pit group 15	LN
UBA-39356	12034	Alnus cf glutinosa from 12051 fill of pit 12052	4046 ± 34	2620 – 2562 cal BC 2535 – 2492 cal BC	2835 – 2817 cal BC 2665 – 2474 cal BC	Pit group 15	LN
UBA-39346	8013	Alnus cf glutinosa from 8022 fill of pit 8023	3961 ± 30	2565 – 2532 cal BC 2496 – 2459 cal BC	2571 – 2513 cal BC 2504 – 2431 cal BC 2425 – 2400 cal BC 2381 – 2348 cal BC	Area G	LN/EBA
UBA-39275	136	Alnus cf glutinosa from 239 fill of pit 238	3750 ± 27	2203 – 2134 cal BC 1075 – 1065 cal BC 1057 – 905 cal BC	2278 – 2251 cal BC 2229 – 2221 cal BC 2211 – 2119 cal BC 2096 – 2040 cal BC	East Angle?	EBA
UBA-39291	262	Alnus cf glutinosa from 473 fill of pit 474	3733 ± 25	2197 –2167 cal BC 2150 – 2131 cal BC 2085 – 2051 cal BC	2203 – 2113 cal BC 2102 – 2037 cal BC	Structure 6	EBA
UBA-39276	137	Corylus cf avellana from 244 fill of posthole 245	3672 ± 25	2076 – 2073 cal BC 2070 – 2064 cal BC	2138 – 1972 cal BC	Pit group 1	EBA
UBA-39277	145	Alnus cf glutinosa from 261 fill of posthole 262	3627 ± 25	2023 – 1954 cal BC	2118 – 2097 cal BC 2039 – 1914 cal BC	Structure 5	EBA
UBA-39331	3009	Alnus cf glutinosa from 3017 fill of pit 3016	3587 ± 40	2012 – 1999 cal BC 1978 – 1891 cal BC	2114 – 2100 cal BC 2037 – 1873 cal BC 1844 – 1814 cal BC 1800 – 1778 cal BC	Pit group 12	EBA
UBA-39293	293	Salix sp from 508 fill of pit 509	3008 ± 25	1283 – 1212 cal BC	1379 – 1345 cal BC 1304 – 1189 cal BC 1180 – 1160 cal BC 1144 – 1130 cal BC	Structure 6	MBA
UBA-39271	121	Alnus cf glutinosa from 217 fill of pit 216	2935 ± 27	1208 – 1110 cal BC 1097 – 1092 cal BC	1222 – 1044 cal BC	Pit group 3	MBA/LBA
UBA-39289	277	Corylus cf avellana from 422 fill of gully 423	2912 ± 26	1188–1182 cal BC 1157–1146 cal BC 1128 – 1048 cal BC	1207 –1201 cal BC 1196–1141 cal BC 1134 – 1016 cal BC	Structure 6	MBA/LBA
UBA-39266	076	Corylus cf avellana from 135 fill of ditch 136	2913 ± 26	1188 – 1181 cal BC 1157 –1146 cal BC 1128 – 1049 cal BC	1207 – 1201 cal BC 1196 –1141 cal BC 1134 – 1017 cal BC	Structure 3	M/LBA
UBA-39265	049	Alnus cf glutinosa from 085 fill of ditch 084	2891 ± 26	1113 – 1028 cal BC	1192 – 1168 cal BC 1165 – 1144 cal BC 1134 – 998 cal BC	Structure 2	LBA
UBA-39283	222	Betula sp from 332 occupation layer	2862 ± 29	1106 –1105 cal BC 1083 – 1064 cal BC 1058 – 979 cal BC	1118 – 968 cal BC 963 – 931 cal BC	Structure 5	LBA

Table 3.2 (continued): The radiocarbon dates by period.

Lab Code	Sample Nr	Context	Radiocarbon Age BP	Dates at 1 sigma (68.3% probability)	Dates at 2 sigma	Structure	Period
SUERC-75019 (GU45283)	?	Sample of the hazel wood scabbard from the BA sword	2855 ± 33	1071 – 940 cal BC	1118 – 924 cal BC	Hoard by Pit group 4	LBA
UBA-39310	12038	Alnus cf glutinosa from 744 fill of pit 743	2860 ± 26	1075 – 1065 cal BC 1057 – 976 cal BC	1115 – 970 cal BC 961 – 934 cal BC	Pit group 7	LBA
UBA-39264	047	Corylus cf avellana from 085 fill of ditch 084	2835 ± 28	1020 – 969 cal BC 963 – 932 cal BC	1084 – 1064 cal BC 1058 – 912 cal BC	Structure 2	LBA
UBA-39279	170	Betula sp from 276 occupation layer	2831 ± 30	1016 – 967 cal BC 956 – 930 cal BC	1084 – 1064 cal BC 1058 – 906 cal BC	Structure 5	LBA
UBA-39278	157	Corylus cf avellana from 276 occupation layer	2829 ± 30	1014 – 930 cal BC	1082 – 1078 cal BC 1075 – 1065 cal BC 1057 – 905 cal BC	Structure 5	LBA
UBA-39260	001	Alnus cf glutinosa from 003 fill of ditch 004	2827 ± 24	1009 – 970 cal BC 961 – 934 cal BC	1046 – 916 cal BC	Structure 1	LBA
UBA-39274	132	Alnus cf glutinosa from 234 fill of pit 235	2814 ± 28	1000 – 929 cal BC	1043 – 903 cal BC	Pit group 1	LBA
UBA-39300	307	Alnus cf glutinosa from 568 fill of gully 569	2757 ± 24	923 – 891 cal BC 879 – 846 cal BC	974 – 955 cal BC 942 – 832 cal BC	Structure 8	LBA
UBA-39273	127	Betula sp from 226 fill of pit 227	2723 ± 26	895 – 836 cal BC	914 – 816 cal BC	Pit group 3	LBA/EIA
UBA-39261	006	Alnus cf glutinosa from 003 fill of ditch 004	2729 ± 26	3699 – 3656 cal BC	920 – 818 cal BC	Structure 1	LBA/EIA
UBA-39263	034	Betula sp from 061 fill of pit 062	1228 ± 36	cal AD 718 – 742 cal AD 766 – 778 cal AD 791 – 807 cal AD 811 – 826 cal AD 840 – 863	cal AD 688 – 885	Pit group 1	early Medieval
UBA-39344	8006	Betula sp from 8012 fill of curved feature 8013	1229 ± 21	cal AD 716 – 743 cal AD 766 – 779 cal AD 789 – 869	cal AD 693 – 746 cal AD 763 – 782 cal AD 786 – 879	Pit group 21	early Medieval
UBA-39309	427	Corylus cf avellana from 734 fill of pit 735	1206 ± 22	cal AD 773 – 779 cal AD 789 – 831 cal AD 836 – 867	cal AD 727 – 737 cal AD 768 – 887	Pit group 18	early Medieval
UBA-39336	5033	Betula sp from 5061 fill of posthole 5062	1201 ± 21	cal AD 774 – 779 cal AD 789 – 831 cal AD 836 – 868	cal AD 769 – 888	Structure 4	early Medieval
UBA-39355	12019	Betula sp from 12030 fill of pit 12031	1124 ± 27	cal AD 892 – 906 cal AD 915 – 968	cal AD 779 – 789 cal AD 829 – 839 cal AD 866 – 991	Pit group 21	early Medieval
UBA-39335	5032	Corylus cf avellana from 5059 fill of structure	1001 ± 42	cal AD 988 – 1045 cal AD 1095 – 1120 cal AD 1042 – 1146	cal AD 972- 1155	Structure 4	early Medieval

Table 3.2 (continued): The radiocarbon dates by period.

Structure 8 - the large timber hall and Structure 8s - the smaller building

The dates from the timber halls provide a series of events that are difficult to interpret. It is obvious from UBA-39294 (6451 – 6263 cal BC) that some Mesolithic material was disturbed when Structure 8 was constructed, or was incorporated into backfilling material, and that late Bronze Age activities (UBA-39300, 974 – 832 cal BC) took place within its footprint long after the building's demise. One of the major questions posed, was the exact relationship of the small timber building (Structure 8s) to the large timber hall (Structure 8) and whether it was earlier or later than the timber hall. This could not be determined through the interrogation of contexts, plans or cultural material alone.

The radiocarbon date ranges from these two structures overlap considerably, but two from the large timber hall are the earliest and relate to the construction of the building. The fill of a posthole (564) for a load-bearing timber has a date range of 3957 – 3797 cal BC (UBA-39299), and a posthole (577) in the east wall produced contemporary dates of 3956 – 3793 cal BC (UBA-39301) from its fill, suggesting that the timber hall was built within a roughly 160 year time period. Other closely related dates but with longer timeframes include 3929 – 3703 cal BC (UBA-39281) from the fill of pit (319) in the north gable and 3929 – 3662 cal BC (UBA-39297) from the fill of pit (558) in the pair of load bearing pits (No 3) that suggest later repairs or replacement timbers. Two other dates 3894 – 3652 cal BC (UBA-39296) the fill of posthole (544) in the east wall and 3893 – 3653 cal BC (UBA-39282) the fill of pit (321) in the north gable, again suggest ongoing maintenance of the building. However, there were no radiocarbon dates from floor levels or hearths due to the lack of surviving occupation deposits.

The smaller timber building (Structure 8s) was constructed within the footprint of the larger hall, a relationship that is important and is discussed further (see PART 7: Discussion). Its earliest radiocarbon dates are fairly contemporary in range with those from the large hall including 3941 – 3709 cal BC (UBA-39305); 3941 – 3642 cal BC (UBA-39308); 3937 – 3705 cal BC (UBA-39304) and 3911 – 3672 cal BC (UBA-39316). The features that are dated are the fill of the building's north-west wall gully, an internal pit by the south-east wall slot, an adjoining gully for a possible partition by its south-east wall, and a support for its north-east gable. Although there is some overlap with the construction of the large timber hall around 3940 to 3870 cal BC, the main period of activity appears to be from just after 3820 to c. 3700 cal BC perhaps continuing to as late as 3627 cal BC.

The reuse of older timbers or the inclusion of charcoal from the larger building into the fills of features of the smaller structure, might explain these date ranges. It also infers that the large timber hall was not necessarily occupied for a long duration, and the small hall was constructed later in the south-western third of its footprint. It would seem entirely implausible that a smaller building would be constructed within an already existing structure, but the close association of radiocarbon dates and physical links between the structures questions our understanding of the events that occurred, and the origin of the charcoal from those features that were dated.

The next radiocarbon dates in the sequence suggest that there could have been a refurbishment of the small hall between 3773 and 3640 cal BC to possibly as late as 3524 cal BC. They are UBA-39307 (3775 – 3640 cal BC) from a fill of the same pit that produced UBA-39308, and UBA-39306 (3773 – 3655 cal BC) from the fill of a posthole in its north-western wall slot and UBA-39302 (3692 – 3524 cal BC), from the fill of a slot relating to an internal division. The latter is the latest date from Structure 8s.

Contemporary or slightly later radiocarbon dates to the refurbishment of the small timber hall came from within the footprint of the larger hall (Structure 8), suggesting a number of different activities took place there. These are UBA-39303 (3761–3637 cal BC) and UBA-39292 (3747–3540 cal BC), both fills of postholes connected with the southern part of the alignment of the north-west wall of the former timber hall. The structural alterations of the smaller timber building may have necessitated additional support, or caused disturbance to postholes from the earlier hall. There was also UBA-39284 (3771 – 3654 cal BC) from the fill of a large pit, in the area of the former hall's north-east gable; UBA-39298 (3768

– 3694) from hearth (562); UBA-39288 (3763 – 3648 cal BC) from a nearby posthole; and UBA-39348 (3707 – 3538 cal BC), which was also associated with the hearth (562). The date ranges from these features are from 3771 cal BC to 3633 cal BC to possibly as late as 3538 cal BC, and may indicate a temporary reoccupation of part of the building footprint.

The remaining radiocarbon dates for Structure 8 were all from the footprint of the large timber hall. They include UBA-39280 (3694 – 3530 cal BC) in the north-east corner of what was the north-east gable, with UBA-39285 (3642 – 3386 cal BC), UBA-39290 (3641 – 3377 cal BC) and UBA-39295 (3639 – 3376 cal BC) the fills of pits. These dates take the story of the use of this building's footprint to the end of the early Neolithic and into the middle Neolithic, a period spanning a time frame of 3694 cal BC, to as late as 3376 cal BC. These dates suggest intermittent use of the site by short-lived, temporary disturbances.

Structure 13 – the timber hall and the oval building

The archaeobotanical evidence from this structure produced only five samples for radiocarbon dates for the timber hall and one from the oval building at its north end, as the truncation of deposits was largely responsible for the paucity of suitable samples. As with the Structure 8 large timber hall, this building had also been constructed mainly of oak (c. 73%) with 24% alder, 2% hazel and a small amount of birch. Charcoal from short-lived tree species was again used for radiocarbon dating.

The constructional time frame suggested for the Structure 13 timber hall of 3938 – 3706 cal BC (UBA-39320) came from a sample from the fill of a large posthole or pit forming the west wall of the building. This suggests it is slightly later in date than the Structure 8 large timber hall. Two other dates UBA-39325 (3758 – 3641 cal BC) and UBA-39324 (3653 – 3528 cal BC) suggest either a much a later rebuilding or replacement of parts of the west wall, on perhaps two occasions, or intrusive activities on the site, such as those associated with the later use of the small timber hall (Structure 8s). It is argued that both large timber halls could have been in use at the same time for at least part of their existence, but thereafter the picture is uncertain.

A large fire-pit in the centre of the structure but besides its east wall, returned a date range spanning the end of the early Neolithic and into the middle Neolithic 3631 – 3373 cal BC (UBA-39327), suggesting that activities continued in and around this feature, but most likely at a time when the building was no longer standing. A posthole beside the hearth, but located in the footprint of the east wall of the timber hall, also returned a middle Neolithic date of 3362 – 3033 cal BC (UBA-39326). From so little evidence it is difficult to postulate a history of the building with any certainty but possible alterations to it, and certainly a later use of the site, can be demonstrated by these dates.

The remaining date of 3494 – 3093 cal BC (UBA-39328), from a fire-pit in the west end of the oval building (Structure 13n) that was constructed over the northern end of the large timber hall, clearly suggests that the structure was in use sometime during the middle Neolithic period,

Other Neolithic dates

The remaining early Neolithic dates have come from Pit Groups 2 and 5, 'Structures' 10, 12 and Pit Group 8, and along the south-west boundary of the site, in particular Pit Groups 10, 11, 13, 16 and 17 with a scattering of features across the outland area. In general, the features of these areas are not exclusively early Neolithic and none have produced dates as early as the construction and early use of Structures 8 and 13. Their dates seem to represent outdoor activities around fire-pits and other pits, with little evidence of any permanent structural evidence. The earliest of these activities appeared to be centred in the west and south corner of the excavated area, with the fill of a posthole (7013) in Pit Group 11 providing a date range of 3797 – 3662 cal BC (UBA-39338), samples from the fill of pit (1082) in 'Structure' 12 returned dates of 3757 – 3636 cal BC (UBA-39322), and 3704 – 3640 cal BC (UBA-39319) came from a deposit (1051). They appear to have occurred at the time of alterations to both Structure 13 and the Structure 8s small hall. Another sample from a fill of a pit (8017) in Pit Group 17 further to the west indicated some overlap in activities with a date range of 3702 – 3636 cal BC (UBA-39345).

Further activities in these areas were noted, but with longer time frames extending into the middle Neolithic, such as those from the fill of pit (3007) in Pit Group 10 of 3757 – 3385 cal BC (UBA-39330) and 3694 – 3384 cal BC (UBA-39354) from the fill of pit (11008). These latter date ranges are typical of examples from Pit Groups 2, 5, 8, 13 and 16 and 'Structures' 10 and 12, which span the latter part of the early Neolithic to the end of the middle Neolithic, just before 3000 BC.

The end use of the Structure 8 large timber hall was marked by the occurrence of activities (see above) that also indicated a middle Neolithic time frame. This also occurred in Structure 13, where middle Neolithic dates seem to be related to the construction and use of the oval building (Structure 13n) overlying the footprint of the timber hall (above). Elsewhere, among the features of 'Structure' 12 in the south-east corner of the site, UBA-39321 (3341 – 3036 cal BC) indicates a middle Neolithic date range connected to a posthole. Other middle Neolithic radiocarbon dates are associated with activities external to the location of the early Neolithic timber halls, and also between them and the eastern border of the site. As well as Pit Groups 2 and 5, they also include Pit Group 6, 'Structure' 9, and Area B. Although none of them can be confirmed as being associated with permanent structures, other cultural material such as pottery vessels are confirmation of activities during this period.

The south-western edge of the site, Pit Groups 10, 13 to 17, also indicated a focus of activity during the middle Neolithic perhaps of temporary camps or intermittent use rather than permanent settlement, but accompanied by pottery of the same date range. A few other middle Neolithic dates were from isolated features in the north of the outland area.

Evidence of later occupation of the site and of radiocarbon dates of the later Neolithic were rare and restricted to the fills of two pits in Pit Group 15 in the south-west UBA-39347 (2839 – 2473 cal BC) and UBA-39356 (2835 – 2474 cal BC), with a single middle to late Neolithic date from the fill of a hearth in the south-east in 'Structure' 9, UBA-39359 (3090 – 2904 cal BC), and a late Neolithic/early Bronze Age date from a pit in the outland, UBA-39346 2571 – 2348 cal BC). None of these dates seem to be associated with material culture of the period, perhaps indicating movement of people through the landscape with short visits to the site.

The Bronze Age dates

Six radiocarbon dates from the fills of pits and postholes scattered across the site returned early Bronze Age date ranges. Several of them also contained contemporary pottery. The most interesting of these dates was UBA-39346 (2571 – 2348 cal BC) from a cremation burial in Area G of the outland. The pit contained lithic artefacts and an All-over Corded Beaker (V152). Other dates with vessels were UBA-39291 (2203 – 2037 cal BC) from Structure 6 (V13), UBA-39276 (2138 – 1972 cal BC) from Pit Group 1 (V7) and UBA-39331 (2114–1778 cal BC) from Pit Group 12 (V118). However, there is no way of knowing whether all these vessels and the date ranges were contemporary because of the small number of sherds and in some cases their lack of diagnostic attributes.

The other radiocarbon dates from this period were mainly from structures and related pit groups but the events are not easy to understand. The earliest of the Bronze Age buildings was Structure 6. Its earliest date UBA-39291 (2203 – 2037 cal BC) is early Bronze Age and appears to predate the building as the following two dates from Structure 6 were from the middle Bronze Age UBA-39293 (1379 – 1130 cal BC) and into the later Bronze Age, UBA-39289 (1207 – 1016 cal BC). The former was from the fill of a pit and the latter from the fill of a gully within the building. The dates appear to overlap and probably indicate use of the structure.

The next events in the sequence concerned Structure 3, UBA-39266 (1207 – 1017 cal BC) and its adjoining Pit Group 3, UBA-39271 (1222 – 1044 cal BC) and UBA-39273 (914 – 816 cal BC). The dates spanned the middle to later Bronze Ages and were from the ditch fill of the structure and the fills of two pits, suggesting some occupation and use of the pits to its east. Structure 3 and Structure 6 may have been in use at roughly the same time at the end of the middle Bronze Age and into the later Bronze Age.

The next two buildings, Structure 5, a roundhouse and Structure 2, an oval building, appear also to be contemporary. Six radiocarbon dates were produced from samples from the buildings, but Structure 5 was slightly problematic as it overlay the remains of the long timber hall (Structure 8), and produced an early Bronze

Age date, UBA-39277 (2118 – 1914 cal BC) which relates to earlier activities on the site. Of the two, Structure 2 produced the earliest late Bronze Age radiocarbon date, UBA-39265 (1192 – 998 cal BC) from its segmented ditch fill, but the second date from the same feature, UBA-39264 (1084 – 912 cal BC) and the three dates from the occupation layers of Structure 5, UBA-39283 (1118 – 931 cal BC), UBA-39279 (1084 – 906 cal BC) and UBA-39278 (1082 – 905 cal BC) indicate the contemporary use of the buildings. The single date from the wooden scabbard from the metal hoard SUERC-75019 (1118 – 924 cal BC) demonstrates that the hoard was very closely linked to the date range of activities within the Structure 5 roundhouse.

The last three dates from buildings of this period were from Structure 1, an oval building and Pit Group 1, potentially another oval structure. Two dates, UBA-39260 (1046 – 916 cal BC) and UBA-39274 (1043 – 903 cal BC), one from the fill of the building ditch, the other from a pit, indicate contemporary use of the structures. There was also a slightly later date from Structure 1, UBA-39261 (920 – 818 cal BC) perhaps indicating a longer occupation of the building, or its reuse. Other dates, UBA-39300 (974 – 832 cal BC) from the fill of a gully and UBA-39310 (1115 – 934 cal BC) from the fill of a pit appear to indicate isolated late Bronze Age activities on the site. Two other areas of the site were considered Bronze Age in date, the Structure 14 roundhouse in particular, and possibly also Pit Group 9. The former did not produce carbonised material for dating and the latter produced only an early Neolithic date.

The latest dates from the site

The final six radiocarbon dates from the excavation, were from the early medieval period into the Medieval period. Of these, UBA-39263 (688 – 885 cal AD) seems to be an intrusion of a pit into Pit Group 1. Three others appear to be related to use of the outland, possibly from agricultural activities. UBA-39344 (693 – 879 cal AD) was from the fill of a fragment of a curved ditch near the prehistoric settlement, and UBA-39309 (727 – 887 cal AD) and UBA-39355 (779 – 991 cal AD) were from the fills of later pits. The two remaining dates were from Structure 4. One was a posthole, UBA-39336 (769 – 888 cal AD and the other the lining and fill of the feature, UBA-39335 (972 – 1155 cal AD). Even though the two dates were from the same feature, the fill of the posthole was much earlier, suggesting incorporation of earlier material into its backfill.

Conclusions

The radiocarbon dates for the site covered a period of over 5000 years from the late Mesolithic and early Neolithic to the Medieval period. The majority of the dates concerned the structures and activities associated with the two large early Neolithic timber halls and a smaller wooden building that succeeded them in time. Although the dates provide rough time-spans for these buildings there is not the clarity of events, such as use, alteration and destruction or removal, due to shallow stratigraphy, later reuse, mixing of contexts and intrusion. In some cases the paucity of dates from structures is a hindrance to understanding events and there is a certain amount of guess work to fill in the gaps. Irrespective of these issues, the early Neolithic is clearly very important and activities of this period were wide-ranging across the site. The middle Neolithic indicated probably short lived settlement, and the later Neolithic demonstrated a significant change in use of the site to one of sparse and intermittent settlement, suggesting people had largely moved elsewhere.

During the early Bronze Age, radiocarbon dates and pottery vessels indicate isolated parts of the site were used for burials (see PART 5: The pottery), but not necessarily for habitation. The subsequent evidence for more settled use of the site, with permanent structures occurred towards the end of the middle Bronze Age and into the later Bronze Age period. Although there were relatively few radiocarbon dates for this period considering the number of possible structures involved, they indicate a settlement of at least one or two buildings at any one time, with nearby external activities. It is possible that buildings were replaced by successive generations moving and building anew two or three times. Where the undated Structure 14 fits into the sequence is another question. It is close to the size of Structures 5 and 6, which may imply that it too is part of the late Bronze Age settlement pattern.

The later dates from the site were few and relate to sporadic and widespread activities most likely relating to agricultural practices. The final medieval date was from an enigmatic stone filled feature.

Archaeomagnetic studies of two fired features from Carnoustie

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Summary

This report describes the archaeomagnetic investigation of two archaeologically fired features from the prehistoric site at Carnoustie, Angus. The first feature sampled was a circular hearth (900) that not structurally defined, but in which 40 samples were collected from across the fired horizon (CAR1). The second was an area of heat affected natural subsoil (002) at the base of a quarter sectioned pit (3016) where 30 samples were collected (CAR2). The samples were assigned the lab reference numbers AM326 and AM327 respectively.

The purpose of this archaeomagnetic study pertained to PhD research to improve the archaeomagnetic dating method for the Neolithic, and as such was not intended to provide an archaeomagnetic date. However, an attempt to calibrate the archaeomagnetic direction with the current archaeomagnetic calibration curve was carried out.

The majority of measured samples showed they were carrying a remanence from the last time context was fired. The average magnetic direction recorded by the features returned several possible age ranges when calibrated against the current British reference curve (Batt et al. 2017) at 95% confidence:

CAR1: 3800 – 3555 BC and 1545 – 600 BC[3]

CAR2: 5000 – 4800 BC, 4520 – 4500 BC, 4045 – 3385 BC, 2700 BC – AD 185, AD 280 – 1100, and AD 1480 – 1645.

Archaeomagnetic ID:	AM326
Feature	Hearth
Location – Latitude:	56.507
Location – Longitude:	-2.723
Magnetic deviation:	-2.2
Number of samples (taken/used in mean)	40/29
AF demagnetisation applied:	2.5 – 100mT
Distortion correction applied:	N/A
Declination (at Site and deviation applied):	32.2°
Inclination (at Site):	73.2°
Alpha-95 (α95):	2.4°
Date range (95% confidence)	3800 – 3555 BC and
	1545 – 600 BC
Archaeological date range:	Neolithic – Iron Age
Archaeomagnetic ID:	AM327
Feature	Heat affected natural
Location – Latitude:	56.507
Location – Longitude:	-2.723
Magnetic deviation:	-2.2
Number of samples (taken/used in mean)	30/19
AF demagnetisation applied:	5 – 40mT
Distortion correction applied:	N/A
Declination (at Site and deviation applied):	8.7°
Inclination (at Site):	69.7°
Alpha-95 (α95):	4.7°
Date range (95% confidence)	5000 – 4800 BC
	4520 – 4500 BC
	4045 – 3385 BC
	2700 BC – AD 185
	AD 280 – 1100
	AD 1480 – 1645
Archaeological date range:	Neolithic – Iron Age

Table 3.3: Summary of archaeomagnetic data.

3. BCE and CE have been changed to BC and AD respectively.

Site and context details

The author collected all archaeomagnetic samples from the features between the 6th and 7th February 2017 for the purposes of PhD research. A total of 40 samples were collected from hearth (900) (CAR1, AM326) and a further 30 samples were collected from an area of heat affected natural (002) at the base of pit (3016) (CAR2, AM327). All samples were individually orientated using a North-seeking compass. This archaeomagnetic study investigates whether a date of last heating can be ascertained for these archaeological features despite the poor reconstruction of the calibration curve for this archaeological time period.

The centre of Structure 9 contained an area of heat reddened sandy clay (900) which overlay a charcoal-rich deposit (901) both contained within pit (7115), which clearly represented a hearth-like feature measuring 0.40 m in diameter (Figure 3.1). The second feature sampled was the heat reddened natural sand and gravel (002) at the base of the largest pit (3016) of Pit Group 12 measuring 0.90 m by 0.45m as exposed (Figure 3.2). Sampling was carried out by inserting sample tubes.

Analysis

All sample preparation and analysis were carried out at the Archaeomagnetic Dating Research Laboratory at the University of Bradford. The tube samples were consolidated using a solution of sodium silicate (approximately 1:1). The direction and strength of the natural remnant magnetisation (NRM) of the samples were measured using a Molspin fluxgate spinner magnetometer. This allows a first pass analysis of the scatter in the data and is a good indicator of how homogenously well-fired the context is. The stereographic projections in Figure 3.3 shows a good clustering of the NRM directions for CAR1 (α95 = 2.6°), however CAR2 has a much more scattered set of archaeomagnetic directions (α95 = 6.0°) shown in Figure 3.4. This larger scatter could be due to incomplete firing of the material or a viscous overprint masking the true archaeomagnetic signal.

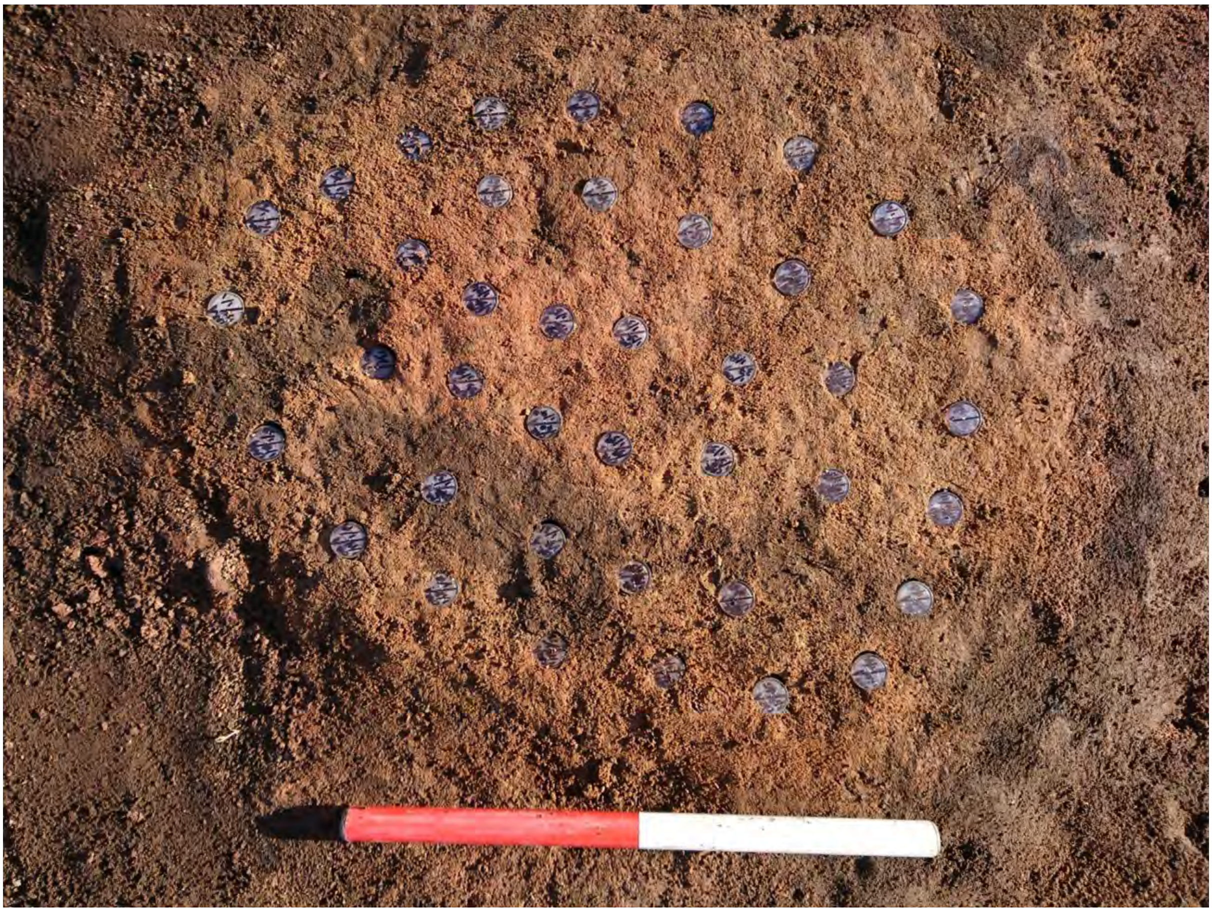


Figure 3.1: Hearth-like feature (900) sampled (CAR1). © Samuel Harris.

Figure 3.2: Heat-affected natural sand sampled at the base of pit (3016) (CAR2). © Samuel Harris.

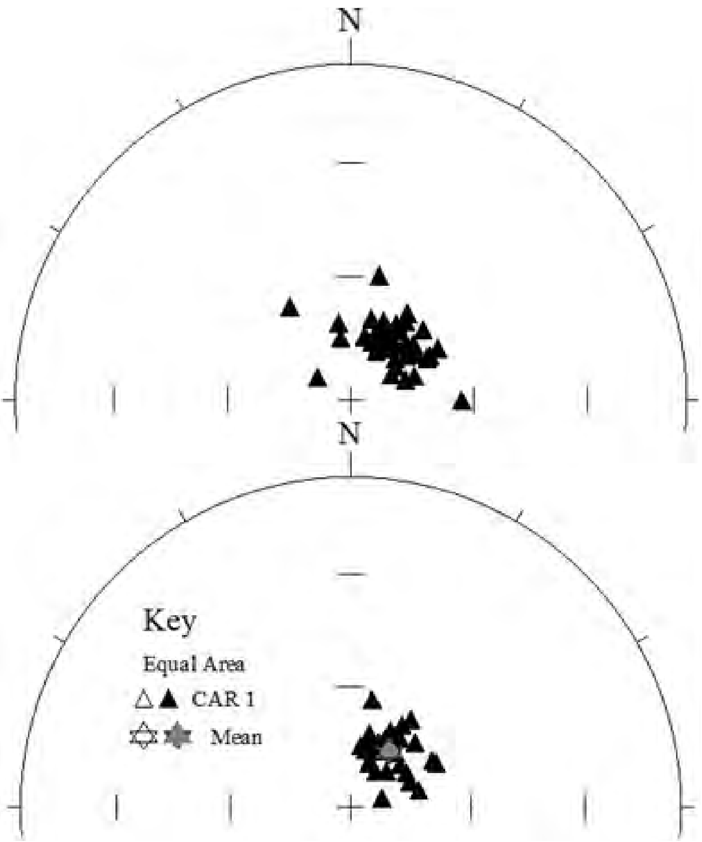


Figure 3.3: Stereographic projection of the NRM directions and ChRM directions for AM 326.

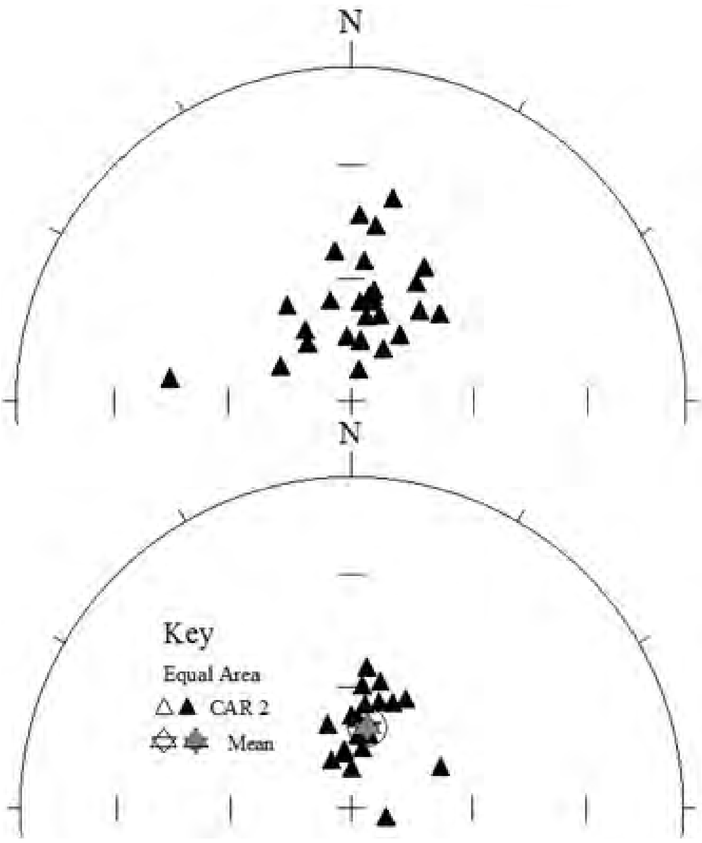


Figure 3.4: Representative demagnetisation behaviour for AM326 for samples 2 and 20, note the two distinct behaviours.

CAR1

The methodology was altered for this sample set to satisfy a research query during the course of the PhD research. All of the samples underwent what would usually be the pilot study with stepwise alternating field (AF) demagnetisation in 13 steps progressively from 2.5mT to 100mT. All the samples showed a range of mineralogical properties present with MDF values ranging from 4.3 – 22.8mT and a large range of 2.5 – 30.7% for the total NRM remaining after 100mT suggesting a mix of magnetic minerals present. The demagnetisation behaviours were generally grouped into two sets (Figure 3.5). The first group were represented by the quintessential behaviour required for archaeomagnetic studies, a single stable component which heads to the origin. The second group showed less stable behaviour exhibited by the removal of a primary component in fields up to ~10mT followed by the inability of the demagnetisation method to remove the remaining NRM. This first component could be due to the exposure of the fired material to weathering processes. The analysis of the demagnetisation data showed that some samples responded better to the AF treatment than others; the higher fields were unable to take the component through to the origin in approximately fifteen of the samples. This could be due to the presence of haematite. However, in some cases a single stable component was easily isolated which went to the origin after removal of a small viscous overprint.

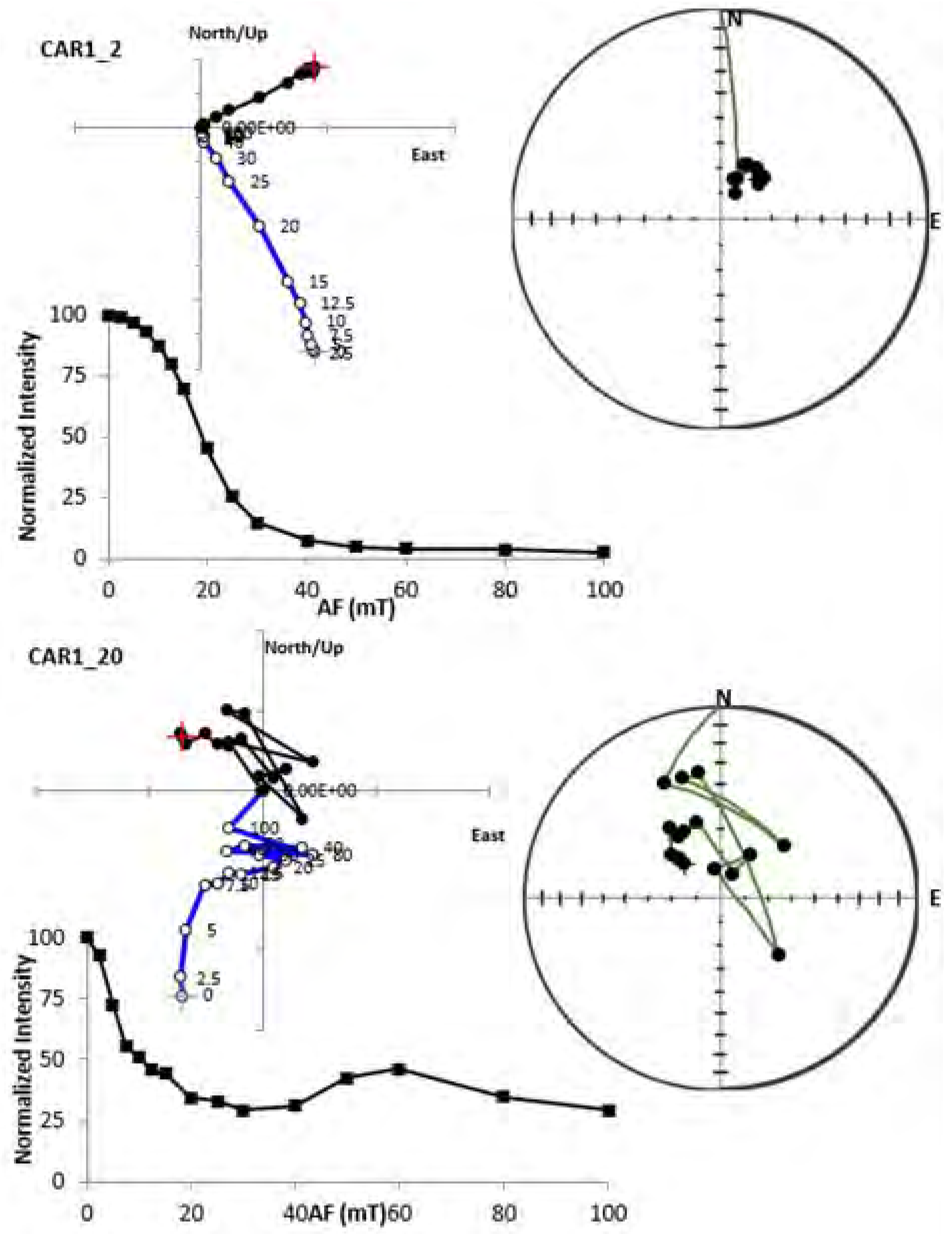


Figure 3.5: Stereographic projection of the NRM directions and ChRM directions for AM 327.

CAR2

In order to ascertain whether the variation in the NRMs was due to a VRM, samples /5, /10, /15/ 20, /25 and /30 were subjected to the pilot demagnetisation procedure. The behaviour of the pilot samples was quite erratic (Figure 3.6), four of the six samples showed MAD angles ranging from 5.6° – 14.9° and evidence of unstable behaviour. The MDF values ranged from 9.6 – 17.6mT and the percentage of the NRM remaining after 100mT varied from 5.8 – 23.9% suggesting a range of rock magnetic behaviour. The pilot study showed that only one component was present after removal of the overprint in the majority of samples, the Characteristic Remanent Magnetization (ChRM), evident by a straight line on the Zijderveld plot (Figure 3.6). To isolate the ChRM (define the straight line), all remaining samples (except 10% preserved for future analysis) were bulk demagnetised in six demagnetisation steps from 5 – 40mT.

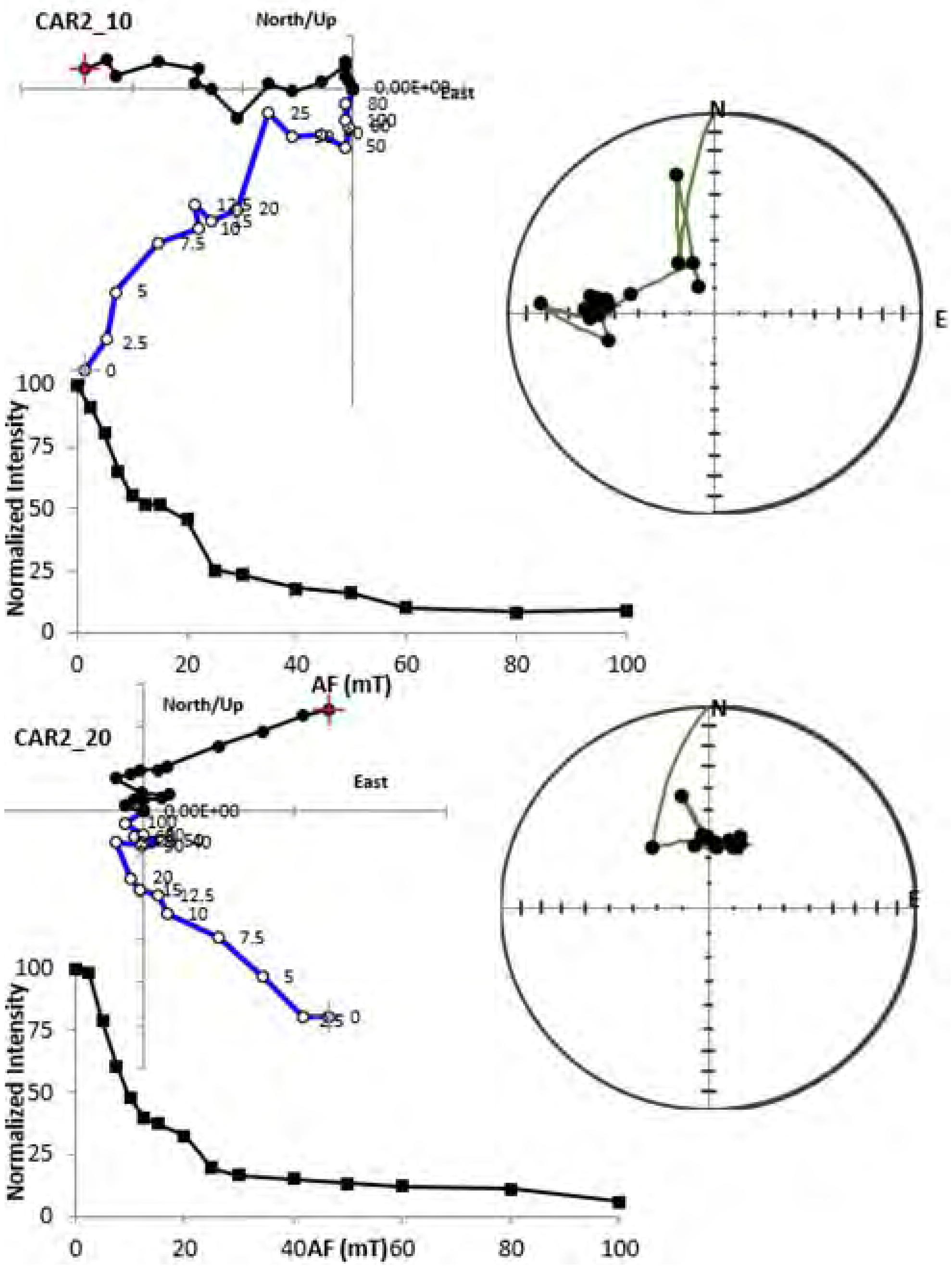


Figure 3.6: Representative demagnetisation behaviour for AM327 for samples 10 and 20, note the two distinct behaviours.

All the ChRM results (and NRM data) are summarised in Tables 3.4 and 3.5 showing quite a large change between NRM and ChRM directions for CAR2 (a reflection of the viscous overprint). The characteristic remanent magnetisation (ChRM) for each sample was determined using principal component analysis (PCA) (Kirschvink 1980) as employed in Sagnotti's (2013) DAIE spreadsheet which allows the calculation of the maximum angular deviation (MAD) to quantify the deviation from the sum of the vectors; this is a useful parameter in quality control. The PCA of all the sample data showed that it was possible to identify a ChRM for all samples. The sample set

	NRM				ChRM		
Sample	Dec	Inc	Intensity	a.f field (mT)	Dec	Inc	MAD
1	22.8	71.3	579.666	5 - 100	31.5	69.2	1.8
2	46	65.6	3565.478	5 – 100	44.9	67.6	1.1
3	51.2	73.2	1078.168	5 – 100	27.2	68.8	1.5
4	350.7	71.2	152.749	5 – 100	343	64.2	5.3
5	39	72.9	164.302	2.5 – 30	12	76.3	5.5
6	25.2	74.8	363.726	5 – 100	19.1	74.5	1.8
7	90.5	63.1	307.614	10 – 100	93.6	62.7	8.9
8	69.7	73.6	354.994	5 – 30	66.6	74.2	1.6
9	70	76	1845.287	12.5 – 100	75.8	72.8	1.4
10	61.3	69	1780.838	7.5 – 100	62.4	66.2	4.6
11	32.6	69.4	661.918	5 – 30	26.4	71.3	1.1
12	47	75.3	1615.862	5 – 100	45.1	77.6	1.7
13	44.4	71	268.025	2.5 – 20	17.2	73.6	3.9
14	23	74.9	1228.137	2.5 – 100	8.9	74.7	2.9
15	35.2	66.9	1038.099	7.5 – 25	34.2	63.6	1
16	28.5	73.4	1028.057	2.5 – 100	23.2	72.7	2.5
17	22.6	69.4	616.185	2.5 – 100	31.9	66	3
18	27.4	76.7	374.89	2.5 – 100	21.5	77.4	2.9
19	33.9	75	649.244	12.5 – 100	35.8	69.2	1.8
20	326.7	62.9	133.244	2.5 – 25	324.9	63.6	10.1
21	350.4	74.8	138.448	2.5 – 100	13.8	75.4	3.4
22	11.9	74.3	109.86	2.5 – 100	14.2	71.4	2.8
23	26	74.7	104.49	5 – 100	27.6	73.7	1.4
24	19.7	75.3	160.592	5 – 100	22.4	78.2	1.9
25	31	68.5	199.242	2.5 – 100	22.2	72.8	7
26	48.3	69.8	145.969	2.5 – 100	48.8	74	2.3
27	29.9	74.9	133.071	2.5 – 25	30.6	75.8	11.4
28	53.5	76.6	209.292	2.5 – 30	43	84.8	6.3
29	37.1	73.4	334.291	2.5 – 100	40.6	79.5	6.9
30	21.3	72.7	206.321	5 – 40	34.4	79.3	3.5
31	12.8	58.9	212.62	2.5 – 25	3.2	55.4	4
32	303.4	80.3	129.788	12.5 – 50	355.1	77.3	17.2
33	14.1	69.8	178.366	5 – 100	14	74.6	2.6
34	35.9	69.6	137.209	5 – 30	39.6	72.6	1.2
35	20.2	73.5	118.644	5 – 30	21.3	75.2	2.4
36	58.6	78.6	223.694	5 - 100	74	82.1	2.8
37	33.1	64.9	159.946	2.5 – 20	11.1	62.7	4.2
38	60.6	68	279.353	7.5 – 100	60	66.8	3.5
39	54.4	70.8	289.117	2.5 – 100	57.7	73.8	2.8
40	59.4	65.5	79.216	5 – 40	86	68.1	6.9
ChRM Mean: Dec = 32.2° Incl = 73.2° α95 = 2.4° k = 124.79							

Table 3.4: Details of the archaeomagnetic analysis of the NRM and ChRM for CAR1. A.f. field denotes the ranges the PCA was applied to. Corrected mean for the ChRM.

CAR1 showed MAD angles above 5.0° for 25% of the sample set which was far higher than any of the other samples sets from the PhD. These were all removed along with sample CAR1/31 which did not pass the outlier discordancy analysis as outlined by McFadden (1982). Interestingly, the Fisher-based mean for the remaining 29 samples showed little difference from the NRM mean. The sample set CAR2 showed the isolation of the ChRMs from the bulk sample data was much more successful; seven samples had MAD angles above 5.0° and were subsequently removed. The outlier discordancy analysis identified one sample which was also removed from the calculation of the mean. This showed much less scatter then the NRM data.

Archaeomagnetic dating

The mean of the directional results was calculated based on Fisher statistics (1953). The archaeomagnetic direction was relocated to the location of the calibration curve (ϕ = 52.43° N, λ = 1.62° W) using the conversion via pole method as outlined by Noel and Batt (1990) during the calibration process. Fisher based means are summarised in Table 3.6. The corrected mean direction was then compared to the calibration dataset for the UK, ARCHUK.1 (Batt et al. 2017) using the updated online dating tool developed by Pavón-Carrasco and colleagues (pers comm.) ArchaeoPyDating. The details of the calibrated age ranges produced using these calibration

Sample	NRM			a.f field (mT)	ChRM		
	Dec	Inc	Intensity		Dec	Inc	MAD
1	8.7	74.9	18.15	7.5 – 30	351.4	76.4	5
2	7.9	45.8	7.089	7.5 – 30	6.2	54.6	2.3
3	296.7	70.8	4.237	7.5 – 30	3.6	71	6.6
5	11.6	37.8	4.414	5 – 100	26.5	40.2	5.6
6	28.9	56.6	8.183	7.5 – 30	12.6	57.8	5
7	323.3	72.3	12.632	5 – 30	291	66.2	4.9
8	356.1	74	16.715	5 – 30	103.1	81.3	3.8
9	326.4	61.8	7.524	7.5 – 30	323	74.8	6
10	277.4	44.5	6.935	5 – 100	273.1	42	8.9
11	11.7	65	7.346	7.5 – 30	337.5	77.3	4.7
12	2.6	43.3	4.495	0 – 30	26.2	59.8	4.6
13	5.4	55.1	10.225	5 – 30	3.7	67.6	2.5
15	18.5	67.8	5.167	5 – 30	0.1	80.1	4.5
16	31.4	75	9.764	5 – 30	10.1	75	3.4
17	327.3	69.3	14.978	5 – 100	344	68.5	2.3
18	348.4	64.8	21.342		4.9	59.5	4.4
19	13.1	81.9	35.707	5 – 30	353	75.6	4
20	9.6	64	10.958	5 – 100	14.4	62.8	4.6
21	11.7	62.2	11.339	5 – 30	65.3	65.8	4.5
22	353.8	52.6	3.939	5 – 30	13.1	71.2	3.5
23	36.4	69.9	2.091		358.2	72.2	11.4
25	36.9	62.1	5.471		23.9	56.7	8.4
26	12	63.7	9.06	5 – 30	7.4	64	5
27	45.2	59.4	20.632		4.9	71.9	3.9
28	10.3	68.9	7.357		21.2	62	3.6
29	5.1	65.6	18.874	7.5 – 100	359.8	67	1.5
30	28.6	52.2	8.273	5 – 30	26.8	53.1	14.9
ChRM Mean: Dec = 8.7° Incl = 69.7° α95 = 4.7° k = 52.80							

Table 3.5: Details of the archaeomagnetic analysis of the NRM and ChRM for CAR2. A.f. field denotes the ranges the PCA was applied to. Corrected mean for the ChRM.

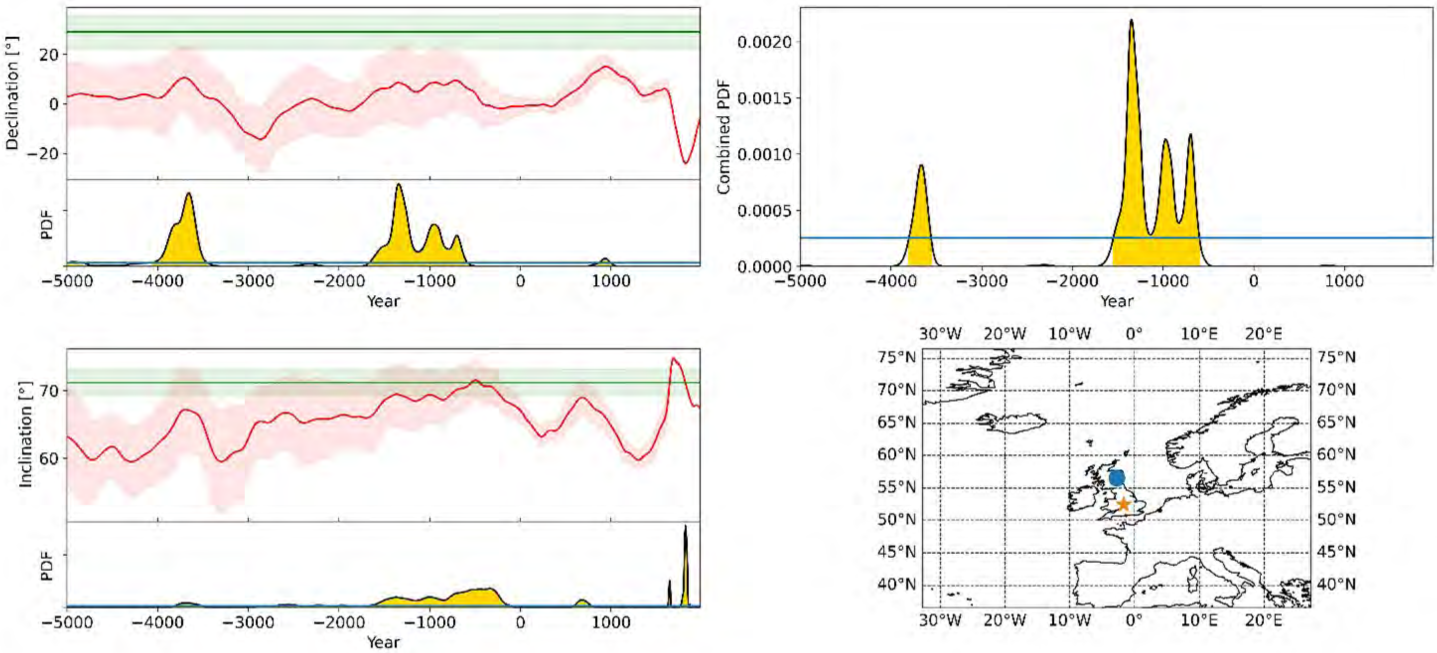
curves can be found in Figures 3.7 and 3.8. It is important to note that these possible age ranges relate to the last time the feature was heated above c. 400°C, and therefore potentially date to the end of the phase of activity within the structure/feature. The calibration dates for the sample sets can be quoted at the 95% confidence interval:

CAR1: 3800 – 3555 BC and 1545 – 600 BC

CAR2: 5000 – 4800 BC, 4520 – 4500 BC, 4045 – 3385 BC, 2700 BC – AD 185, AD 280 – 1100, and AD 1480 – 1645.

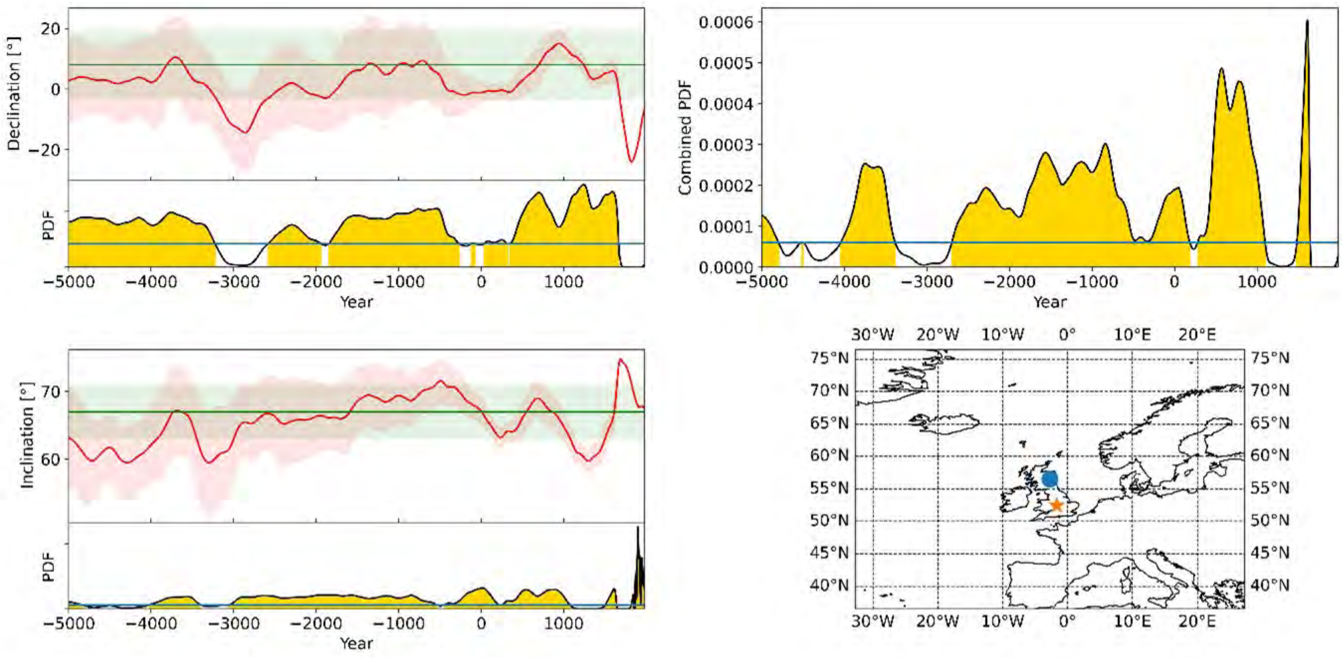
	Dec	Inc	Alpha-95 (α95)	Precision parameter (k)
CAR1 NRM value corrected at Site	33.7	73.2	2.6	77.4
CAR1 ChRM Value corrected at Site	33.2	73.2	2.4	124.79
CAR2 NRM value corrected at Site	1.6	65.4	6	22.48
CAR2 ChRM Value corrected at Site	8.7	69.7	4.7	52.8

Table 3.6: Summary of the mean magnetic vectors for AM 326 and AM 327.



Site: CAR1
Reference Curve: Great Britain (directional)
Between t = 5000 BC and 1980 AD
Dating results: 3800 BC – 3555 BC; 1545 BC – 600 BC;

Figure 3.7: Probability density for AM 326 produced by the online archaeomagnetic dating tool ArchaeoPyDating. Right hand side shows master secular variation curves for the observation site (red bold curves with red error bands) of the declination and inclination with the archaeomagnetic directions (green line) and associated error (green band) with associated individual probability density functions at 95% probability threshold. Right hand side shows the combined probability density marked with the green line of 95% probability and a map of site location (blue) and calibration curve location (yellow).



Site: CAR2
Reference Curve: Great Britain (directional)
Between t = 5000 BC and 1980 AD
Dating results: 5000 BC – 4800 BC; 4520 BC – 4500 BC; 4045 BC – 3385 BC;
2700 BC – 185 AD; 280 AD – 1100 AD; 1480 AD – 1645 AD;

Figure 3.8: Probability density for AM 327 produced by the online archaeomagnetic dating tool ArchaeoPyDating. Right hand side shows master secular variation curves for the observation site (red bold curves with red error bands) of the declination and inclination with the archaeomagnetic directions (green line) and associated error (green band) with associated individual probability density functions at 95% probability threshold. Right hand side shows the combined probability density marked with the green line of 95% probability and a map of site location (blue) and calibration curve location (yellow).

Discussion and Conclusion

The samples from Carnoustie had poor clustering in the initial magnetic directions for CAR2 however after full analysis the data was able to provide a reasonable archaeomagnetic direction. The full archaeomagnetic study of this material showed that there was a viscous overprint masking the true archaeomagnetic direction and once all the samples had undergone demagnetisation to remove this the majority of samples contained a single stable component and had been fired to sufficiently high enough temperatures. The first sampled set, CAR1 was clearly well fired as this provided a good archaeomagnetic direction with a small cone of confidence defined by the alpha-95 value. This allowed the magnetic minerals present to realign to the ambient geomagnetic field when they cooled from the last firing event.

The archaeomagnetic dating of these features suggests that they were last utilised between the following date ranges:

CAR1: 3800 – 3555 BC and 1545 – 600 BC

CAR2: 5000 – 4800 BC, 4520 – 4500 BC, 4045 – 3385 BC, 2700 BC – AD 185, AD 280 – 1100, and AD 1480 – 1645.

Multiple date ranges are possible due to the behaviour of the Earth's geomagnetic field which is known to have been in the same position more than once in the past. This calibration should also note that the aim of taking these samples was not to obtain an archaeomagnetic date. The more recent archaeomagnetic dates can be rejected on the basis of the archaeological evidence that this is a prehistoric site.

Part 4: Environmental Evidence

Introduction

By Beverley Ballin Smith

The taphonomic conditions at Carnoustie severely affected the survival of the organic record to such an extent that surviving materials were very limited. Compared to other excavated Scottish early Neolithic timber halls the botanical remains were less in quantity but the number of species present allows comparison with halls such as Balfarg and Warren Field, both in Aberdeenshire. Sufficient charcoal survived to provide a reasonable narrative of exploitation of the local environment, but what is not known is what happened to the Carnoustie timber halls at the end of their use. The majority of the other excavated halls seem to have been deliberately burnt down, but there is no evidence to suggest this happened here. The charred ends of the large timber posts at Carnoustie are also not present, and neither are the tops of postholes to indicate whether timbers were burnt in situ. The shallow remains of pits and postholes are a stark contrast to many of the other timber halls with their deep postholes and their clear stratigraphy. Our understanding of the use of organic resources used for the roofs of the timber buildings at Carnoustie is very limited and the floors of buildings with the potential for organic debris had simply dissipated.

Ramsay in the Archaeobotany section discusses tree species utilised at the site and wild plant resources gathered from the local area, such as hazel nuts. She also identified cereal grains, evidence of the production of crops as part of the subsistence economy of the site during its prehistoric occupation. The harvesting of plant material or cereal crops was also confirmed by the presence of flint 'sickles' (plano-convex and scale-flaked knives) from early Neolithic contexts (see PART 5 Lithic assemblage). Although the cultivation of slash and burn plots was part of the subsistence economy, human survival during these times must have equally relied on the exploitation of the local landscape and probably marine resources. Even with the results of other scientific analyses in this section, it has not been possible to expand on the effects that early Neolithic agriculture had on the landscape and the local environment. The evidence has not survived to demonstrate the changes the opening up of new plots for cereal growing had on the extent of natural forest and woodland cover, and therefore the availability of other local wild food resources.

In comparison with the archaeobotanical samples, the remains of wild fauna (mammals, birds, fish and marine shellfish) are entirely absent from the archaeological record, and therefore the role they played in the economy of the site, which could have been significant, cannot be evaluated. In the middle Neolithic, a pottery vessel was decorated by what is likely to have been a bone implement from a small bird. Its carcass provided a suitable bone for a specific domestic use, but it is uncertain whether that bird was a food species.

Smith in the Animal bone section has confirmed the presence of cattle on the site, but their status is unknown as was their value to society. No other domestic species were identified from the rare surviving samples of calcined bone from pits and fire-pits, and all the remains could be later in date than the early Neolithic. The paucity of animal bone also explains the complete absence of antler and other bone artefacts from the site, which would have provided information on organic-material tools used there. The occurrence of a solitary arrowhead indicates bows and arrows for hunting or defence, but information from use-wear analysis of the worn edges of flint tools yielded additional information. These tools were apparently used for a variety of occupations, which included the processing of soft and hard wood, hard bone or antler, butchering animals, cutting meat, and scraping fresh hides (see PART 5 Use-wear analysis). The analysis of microscopic use-wear provides a significant addition to our understanding of the life and work of people during the early Neolithic, and the resources used, which otherwise have been lost from the archaeological record.

There is also indirect evidence of the presence of sheep from the early and late Bronze Age. The decoration of Beaker vessels by the use of twisted wool cords in the early Bronze Age indicates that sheep formed part of the economy of that time. A skin of a wild sheep has been identified as used for wrapping around the spearhead of the metal hoard (see PART 6 The late Bronze Age metal hoard). Wool from domestic sheep was also found in microscopic quantities from two types of woven textiles or cloths that were used to wrap and protect items of the hoard (ibid). It is also interesting that a stone spindle whorl came from deposits inside the Structure 5 roundhouse, close to where the hoard was buried. The spindle whorl is indicative of the presence of wool-bearing sheep, the processing of a fleece and the use of yarn for textile production on a loom. The base of pottery vessel V144 had impressions of what appears to be woven (wool fabric) on which it was placed during its manufacture. By connecting the limited evidence, a slightly more convincing picture of domestic life and perhaps shepherding can be made.

Through a combination of prehistoric, medieval and modern ploughing, organic evidence has disappeared from the site, and this situation was made worse by the effects of soil movement and waterlogging (see Soil micromorphology). The effects of heavier rain at certain times in the past combined with water run-off may have produced pools along the southern and eastern extremities of the site. The Multi-element analysis of the Structure 5 roundhouse revealed an added dimension to our understanding of that building. At some stage during its life parts of it were used as a byre or for the stalling of domestic animals. Which animals they were and how they fitted into the economy of the settlement and the agricultural annual cycle is open to speculation.

From these tantalising and often tiny pieces of evidence, small indications of domestic and agricultural life at the site during parts of the Neolithic, especially the early Neolithic, and also during the early and late Bronze Ages, can be made. They are examined further in PART 7 Discussion.

Archaeobotany

By Susan Ramsay

Summary

The excavations revealed a large number of archaeological structures and groups of pits, which largely date to the Neolithic and Bronze Age. Two Neolithic timber halls were almost certainly constructed from oak but there is little evidence for any hazel wattle-work in the structures. Naked barley and emmer wheat were being consumed, together with hazelnuts and apples. There was little evidence for burnt structural remains from the other buildings and their carbonised assemblages were probably the remains of scattered hearth waste from domestic occupation. Structure 4 shows a very different carbonised assemblage with heather type twigs dominating, perhaps representing roofing or flooring material. Large quantities of heather stems were also identified from Pit group 18 along with a few grains of oats and flax seed. These finds and the subsequent AMS radiocarbon dates indicate that Pit group 18 and Structure 4 were early medieval in date.

Introduction and methodology

The following account details the processing, analysis and interpretation of carbonised botanical remains recovered from samples taken during the excavations.

Sample Processing

A programme of bulk sampling was undertaken in order to examine the carbonised archaeobotanical remains from the excavation. In total, 184 bulk samples were analysed for the presence of botanical remains. They were processed by flotation, using standard methods, and sieves of mesh diameter 1 mm and 500 µm for flots and 2 mm and 4 mm for retents from flotation.

Macrofossil Analysis

Dried flots and sorted retents were examined using a binocular microscope at variable magnifications of x4 - x45. For each sample, estimation of the total volume of carbonised material >4 mm was made and all charcoal >4 mm was identified unless this proved impractical, in which case a known percentage of the charcoal was identified and this percentage is noted in the results tables. All carbonised cereals, seeds and other plant macrofossil remains were also removed and identified.

The testa characteristics of small seeds and the internal anatomical features of problematic charcoal fragments were further identified at x200 magnification using the reflected light of a metallurgical microscope. Reference was made to Schweingruber (1990) and Cappers et al. (2006) to aid identifications. Vascular plant nomenclature follows Stace (1997) except for cereals, which conform to the genetic classification of Zohary and Hopf (2000).

Results

Results are discussed chronologically beginning with the two Neolithic structures, other Neolithic structures and their related pit groups, then the south-west pit groups, the out-field area, followed by the Bronze Age structures and related features, and lastly the early Medieval structures.

The pits and deposits were separated into 28 groups based simply on their close relationship and these groups of features are not necessarily contemporaneous in date, and have been further refined during the post-excavation analysis into chronological units. The full results tables are also presented. AMS radiocarbon dates from material selected from significant samples have been incorporated into this report and are stated after the associated context number, at the 2 sigma (95.4%) level of confidence

Early Neolithic

Structure 8 - the large timber hall

This structure comprised a long rectangular timber hall, but within its footprint at its south-west end was a smaller building with rounded gable ends (Structure 8s).

Structure 8 was a large rectangular building, over 35 m in length and 9 m in width, located towards the eastern end of the site. The outline of the structure was largely defined by postholes, and there were numerous internal subdivisions some formed by postholes and some by small gullies.

The carbonised remains from some of the postholes forming the exterior walls of the structure are shown in Table 4.1. Oak was by far the commonest charcoal type present, particularly in postholes (305 and 321), the latter dated 3893 – 3653 cal BC (UBA-39282), (413) 3763 – 3648 cal BC (UBA-39288), (435) 3641 – 3377 cal BC (UBA-39290) and (577) 3956 – 3793 cal BC (UBA-39301). This may suggest that the building was formed from large oak posts. However, it isn't clear if this charcoal represents the remains of posts burnt in situ because more charcoal might have been expected, or it may suggest some burning of the structure. It is also possible that the oak posts were charred on the outside to harden them and prevent decay prior to being erected in the postholes. Alder charcoal was also present in many of the posthole fills, but at a much lower concentration than oak. This, together with fragments of hazel nutshell and very occasional cereal grains (barley and possibly wheat) suggests that scattered hearth waste may have trickled down into some of the posthole fills. Although large amounts of oak charcoal normally suggests the remains of structural material, there is a possibility that the oak charcoal was simply the remains of fuel. Fill (308) of posthole (309) dated to 3694 – 3530 cal BC (UBA-39280), contained more or less equal quantities of alder, oak and willow charcoal, together with a large number of hazel nutshell fragments. This posthole forms the north-east corner of the structure and so it may have had hearth material deposited within it during construction of the building.

A group of pits at the north-east end of Structure 8 appears to form its gable wall support (previously identified as Pit Group 4). One of these pits, (319), was analysed for botanical remains (Table 4.1). Its fill (318), dated to 3929 – -3703 cal BC (UBA-39281) comprised oak charcoal, with a small amount of hazel and hazel nutshell and would be in keeping with the carbonised assemblages recovered from the fills of the exterior postholes of Structure 8. Pit (345), fill (344) dated 3771 – 3654 cal BC (UBA-39284)

	Area	Structure 8 large timber hall exterior pit/postholes					
	Context	304	308	318	320	344*	412
	Sample	175	176	181	9054	194, 195	231, 232
	Description	Basal fill of pit/ posthole (305)	Fill of pit/ posthole (309)	Fill of pit (319)	Fill of pit/ posthole (321)	Fill of pit (345)	Fill of post-hole (413)
Volume of charcoal >4 mm		50ml	20ml	5ml	120ml	25ml	50ml
% charcoal >4mm ID		100%	100%	100%	100%	100%	100%
Charcoal							
Alnus cf glutinosa	alder	-	12 (0.62g)	-	8 (0.38g)	4 (0.09g)	18 (1.07g)
Betula spp	birch	-	-	-	-	2 (0.06g)	-
Corylus cf avellana	hazel	-	-	1 (0.02g)	-	-	-
Ericales	heather type	-	-	-	-	-	-
Quercus spp	oak	428 (9.54g)	25 (0.82g)	46 (0.54g)	740 (25.18g)	218 (4.96g)	466 (8.89g)
Salix spp	willow	-	6 (0.49g)	-	-	-	-
Indet charcoal	indet charcoal	-	10 (0.48g)	-	-	-	-
Indet cinder	indet cinder	-	-	-	-	-	-
Carbonised cereals						-	
Hordeum vulgare var nudum	naked barley	-	-	-	1	-	-
Hordeum vulgare sl	barley	-	-	-	-	-	1
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-
cf Triticum spp	cf wheat	-	-	-	-	-	-
Cereal indet	indet cereal	-	-	-	-	-	2
Carbonised seeds etc							
Corylus avellana nutshell	hazel nutshell	-	102 (1.27g)	1 (0.06g)	1 (0.01g)	1 (0.01g)	4 (0.04g)
cf Malus sylvestris	cf apple	-	-	-	-	-	-

	Area	Structure 8 large timber hall exterior pit/postholes					
	Context	434	481	543	576	648	8052
	Sample	242, 9052	271	352	319, 4090	379	8039
	Description	Fill of double post-hole (435)	Fill of post-hole (482)	Fill of post-hole (544)	Fill of post-hole (577)	Fill of post-hole (649)	Fill of post-hole (8053)
Volume of charcoal >4 mm		30ml	5ml	5ml	55ml	5ml	10ml
% charcoal >4mm ID		100%	100%	100%	100%	100%	100%
Charcoal							
Alnus cf glutinosa	alder	13 (0.42g)	5 (0.18g)	1 (0.04g)	1 (0.04g)	1 (0.02g)	-
Betula spp	birch	-	-	-	-	-	-
Corylus cf avellana	hazel	-	-	-	-	-	1 (0.02g)
Ericales	heather type	2 (0.04g)	-	-	-	-	-
Quercus spp	oak	494 (7.33g)	-	70 (0.55g)	461 (13.85g)	15 (0.19g)	99 (0.99g)
Salix spp	willow	-	-	-	-	-	-
Indet charcoal	indet charcoal	-	-	-	-	-	-
Indet cinder	indet cinder	-	-	-	-	5 (0.10g)	-
Carbonised cereals							
Hordeum vulgare var nudum	naked barley	-	-	-	-	-	-
Hordeum vulgare sl	barley	-	-	-	-	-	-
cf Hordeum vulgare sl	cf barley	1	-	-	-	-	-
cf Triticum spp	cf wheat	1	-	-	-	-	-
Cereal indet	indet cereal	-	-	-	-	-	-
Carbonised seeds etc							
Corylus avellana nutshell	hazel nutshell	5 (0.07g)	38 (0.57g)	-	5 (0.11g)	-	-
cf Malus sylvestris	cf apple	-	-	-	-	-	-

* pit external to gable

Table 4.1: Botanical remains from Structure 8 large timber hall exterior pit/postholes.

(Table 4.1) also lying just beyond the north-east gable may have housed a structural support for the end wall of the building and also produced large quantities of oak charcoal together with traces of alder, birch and hazel nutshell.

Additional AMS dates of 3747 – 3540 cal BC (UBA-39292) from fill (481) of exterior posthole (482), 3894 – 3652 cal BC (UBA-39296) from fill (543) of posthole (544), 3707 – 3538 cal BC (UBA-39348), from fill (8052) of posthole (8053), and 3761 – 3637 cal BC (UBA-39303) from fill (648) from posthole (649) all support an early Neolithic date for this structure.

There were numerous postholes and pits within the interior of the structure and these often seemed to be aligned perpendicular to the walls of the building, perhaps subdividing it into smaller rooms or spaces. The charcoal assemblages from these interior features (Table 4.2) were very similar to those recorded from the exterior postholes. Oak was the main charcoal type present, with small amounts of alder, birch and hazel also recorded. Hazel nutshell fragments were also found in the majority of these fills but generally at trace levels and there was no indication of deliberate deposition of these food plant remains into the posthole fills. In addition,

	Area	Structure 8 large timber hall Interior pits, postholes and trenches										
	Context	359	504	506	523	528	557	560	563	578	613	691
	Sample	200	284, 294	296, 7058	297, 7059	309, 7060	4055	306	320, 9053	311, 9051	345	5039
	Description	Fill of pit (360)	Fill of linear trench (505)	Upper fill of pit (507)	Secondary fill in pit (507)	Charcoal rich fill at base of pit (507)	Fill of pit (558)	Basal fill of pit (562)	Fill of pit (564)	Core fill of pit (580)	Fill of pit (615)	Charcoal lens below fill (670) in trench (672)
Volume of charcoal >4 mm		10ml	7.5ml	7.5ml	15ml	30ml	25ml	<2.5ml	40ml	20ml	5ml	<2.5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal												
Alnus cf glutinosa	alder	14 (0.41g)	-	1 (0.04g)	-	6 (0.33g)	5 (0.32g)		36 (2.60g)	-	-	-
Betula spp	birch	-	-	-	3 (0.34g)	-	-		1 (0.04g)	-	-	-
Corylus cf avellana	hazel	3 (0.15g)	-	-	-	-	-	1 (0.02g)	2 (0.03g)	-	-	-
Quercus spp	oak	31 (0.51g)	63 (0.98g)	133 (1.69g)	126 (2.15g)	401 (4.42g)	318 (7.99g)	4 (0.05g)	337 (7.39g)	297 (5.45g)	41 (0.70g)	-
Carbonised cereals												
Hordeum vulgare sl	barley	2	-	-	-	-	-	-	3	-	-	-
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	1	-	-	-	-	-
Triticum dicoccum	emmer wheat	-	-	-	-	-	3	-	2	-	-	-
Triticum spp	wheat	-	-	-	-	-	-	-	6	-	-	-
cf Triticum spp	cf wheat	-	-	-	-	-	1	-	2	-	-	-
Cereal indet	indet cereal	-	-	-	-	-	2	-	12	-	-	-
Carbonised seeds etc												
Corylus avellana nutshell	hazel nutshell	5 (0.08g)	1 (0.01g)	38 (0.72g)	15 (0.23g)	1 (0.06g)	6 (0.09g)	-	34 (0.57g)	10 (0.15g)	-	-
Malus sylvestris	apple	-	-	-	-	-	-	-	1	-	-	-
Rumex spp	docks	-	-	-	13	-	-	-	-	-	-	-

Table 4.2: Botanical remains from Structure 8 large timber hall Interior pits, postholes and trenches.

carbonised cereal grains were recorded from pits (360) 3642 – -3386 cal BC (UBA-39303), (558) 3929 – -3662 cal BC (UBA-39297) and (564) 3957 – 3797 cal BC (UBA-39299). Barley and wheat, including emmer wheat, were identified from these interior features. Pit (564), which produced the largest number of cereal grains (25 grains), also contained a single carbonised apple pip. A further early Neolithic AMS radiocarbon date of 3768-3649 cal BC (UBA-39298) from the fill (560) of pit (562) was obtained. The basal fill (528) of pit (507) produced two AMS radiocarbon dates: 3639 – 3376 cal BC (UBA-39295) and 6451 – 6263 cal BC (UBA-39294). This suggests that redeposition of earlier occupation debris had occurred within this pit.

Structure 8s - the small timber hall *(Table 4.3)*

A smaller timber hall was identified positioned within the walls of the large timber hall and towards its south-western end. A posthole (704) near the south-east wall of this structure contained oak charcoal but it could have been damaged by the construction of Structure 4. Two possible apple pips were identified from fill (703) dated 3775 – 3640 cal BC (UBA-393070); 3941 – -3642 cal BC (UBA-39305) of posthole (704), within an assemblage dominated by oak charcoal but with cereals grains, hazel nutshell and alder charcoal also present. Apple pips are very rare in Scottish prehistoric archaeological deposits and will be considered further in the Discussion section of this report. Carbonised cereal grains were recorded from pit (612) 3692 – 3524 cal BC (UBA-39302), forming a possible internal partition to the structure.

Further early Neolithic AMS radiocarbon dates were obtained: 3773 – 3655 cal BC (UBA-39306) from the fill (701) of posthole (702) located in the north-west wall trench and 3911 – 3672 cal BC (UBA-39316) from fill (933) of posthole (934) lying beside the curved north-east gable of the building.

	Area	Structure 8s small timber hall					
	Context	553	568	593	611	634	675
	Sample	358	307, 4061	330	367, 4064	4060	386, 390, 4066
	Description	Fill of post-hole (554)	Fill of crescent shaped gully (569)	Fill of post-hole (594)	Fill of pit (612)	Fill of post-hole (635)	Fill of slot trench (676)
Volume of charcoal >4 mm		<2.5ml	2.5ml	5ml	7.5ml	10ml	12.5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%
Charcoal							
Alnus cf glutinosa	alder	-	3 (0.09g)	-	4 (0.15g)	-	13 (0.39g)
Betula spp	birch	-		-	-	-	
Corylus cf avellana	hazel	-	1 (0.07g)	-	-	-	2 (0.14g)
Ericales	heather type	-	1 (0.02g)	-	-	-	-
Quercus spp	oak	9 (0.04g)	1 (0.02g)	25 (0.54g)	81 (1.96g)	156 (2.11g)	42 (0.78g)
Salix spp	willow	-	-	-	-	-	2 (0.09g)
Indet charcoal	indet charcoal	-	3 (0.10g)	-	-	-	-
Indet cinder	indet cinder	-		-	-	-	
Carbonised cereals							
Hordeum vulgare var nudum	naked barley	-		-	-	-	
Hordeum vulgare sl	barley	-		-	3	-	
cf Hordeum vulgare sl	cf barley	-					
Triticum dicoccum	emmer wheat		1				-
cf Triticum spp	cf wheat	-		-	2	-	
Cereal indet	indet cereal	-	1				1
Carbonised seeds etc							
Corylus avellana nutshell	hazel nutshell	-	-	-	4 (0.03g)	-	23 (0.24g)
cf Malus sylvestris	cf apple	-	-	-	-	-	-

Table 4.3: Botanical remains from Structure 8s small timber hall.

	Area						
	Context	684	687	701	703	933	8050
	Sample	415	401	405	417, 4063	534	8033, 8034
	Description	Fill of slot trench (685)	Fill of linear slot trench (688)	Fill of post-hole (702)	Fill of posthole (704)	Fill of post-hole (934)	Deposit beneath (568) in gully (569)
Volume of charcoal >4 mm		5ml	5ml	5ml	50ml	10ml	20ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%
Charcoal							
Alnus cf glutinosa	alder	1 (0.04g)	8 (0.18g)	5 (0.19g)	28 (1.28g)	1 (0.02g)	20 (0.53g)
Betula spp	birch	-		-	1 (0.09g)	-	
Corylus cf avellana	hazel	-	-	-	-	-	-
Ericales	heather type	-	-	-	-	-	-
Quercus spp	oak	44 (1.30g)	47 (0.56g)	14 (0.44g)	317 (9.96g)	88 (0.92g)	231 (6.20g)
Salix spp	willow	-	-	-	-	-	-
Indet charcoal	indet charcoal	-	-	-	-	-	-
Indet cinder	indet cinder	-		-	-	-	
Carbonised cereals							
Hordeum vulgare var nudum	naked barley	-		-	-	-	
Hordeum vulgare sl	barley	-		-	1	-	
cf Hordeum vulgare sl	cf barley	-			1		
Triticum dicoccum	emmer wheat		-				-
cf Triticum spp	cf wheat	-		-	-	-	
Cereal indet	indet cereal	-	-		9		-
Carbonised seeds etc							
Corylus avellana nutshell	hazel nutshell	-	-	-	1 (0.08g)	6 (0.08g)	4 (0.13g)
cf Malus sylvestris	cf apple	-	-	-	2	-	

Table 4.3 (continued): Botanical remains from Structure 8s small timber hall.

Within the interior of the structure were a range of slots and gullies, for timber partitions. Again, the main charcoal type recorded was oak, with much smaller amounts of alder, hazel, heather type and willow also present. The fill (687) of gully (688) produced an AMS radiocarbon date of 3941 – 3709 cal BC (UBA-39305) and fill (675) of slot (676) produced a date of 3937 – 3705 cal BC (UBA-39304). The fill (568) of the crescent shaped gully (569) of the north-east gable produced a diverse range of charcoal types, together with a single grain of wheat and fragments of hazel nutshell, suggesting hearth waste. However, below (568) was a charcoal rich deposit (8050) that had a very different assemblage with large quantities of oak charcoal, present. This suggests two distinct phases of use.

Structure 13 - the large timber hall *(Table 4.4)*

Structure 13 also comprised two structures: a rectangular timber post-built structure, located to the south-west of Structure 8, with a smaller oval building (Structure 13n) identified overlying it at its north end.

The larger building was considerably smaller in size than Structure 8, being almost 20 m in length and just over 7.5 m in width. The external walls were delineated by two parallel rows of pits. Four of these pits were analysed for the presence of carbonised botanical remains: Pits (1069/1068) 3938 – 3706 cal BC (UBA-39320), (1120/1119) 3653 – 3528 cal BC (UBA-39324), (1130/1129) and (1135/1134) 3362 – 3033 cal BC (UBA-39326). The carbonised assemblages from these fills were dominated by oak charcoal with small amounts of alder, birch, hazel or willow charcoal also identified. More importantly, all these fills contained carbonised cereal grains, with 170 grains recorded from fill (1119) and 71 grains from fill (1129) dated to 3758 – 3641 cal BC (UBA-39325). The cereal assemblages were dominated by barley (Figure 4.1a), with some of the grains further identifiable as the naked variety (Figure 4.1b). Wheat was also present in smaller amounts, with some grains further identifiable as emmer wheat (Figure 4.1c). A significant proportion of the cereal grains were very poorly preserved (Figure 4.1d), which may suggest several periods of burning, such as in the base of a hearth, or burning at a high temperature. The fill (1134) of posthole (1135) also contained large quantities of carbonised hazel nutshell (Figure 4.2), which may suggest deliberate deposition rather than just trickle down from scattered hearth waste.

A large fire-pit (1211/1210) 3631 – 3373 cal BC (UBA-39327), was located in the middle of the structure, towards its east side. Prehistoric pottery and lithic artefacts were recovered from its fill. The charcoal assemblage contained large quantities of oak charcoal, with smaller quantities of alder also recorded. In addition there were over 180 carbonised cereal grains, the majority of which were unidentifiable but naked barley and possible wheat were identified. Although large amounts of oak were present in the fill it may provide evidence for the use of oak, in conjunction with alder, as the main wood types used for fuelling hearths. The presence of naked barley in this pit, together with the finds of this cereal type in the exterior postholes provides further evidence for an early-middle Neolithic date for this structure, since naked barley is rarely recorded after the end of the Neolithic in Scotland.

	Structure	Structure 13 timber hall					Structure 13n oval building
	Context	1068	1119	1129	1134	1210	1250
	Sample	618	706	4076	709	766, 767, 4080	770
	Description	Fill of post-hole (1069)	Fill of post-hole (1120)	Fill of post-hole slot trench (1130)	Fill of post-hole (1135)	Fill of pit (1211)	Fill of pit (1251)
Volume of charcoal >4 mm		5ml	2.5ml	10ml	40ml	45ml	20ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%
Charcoal							
Alnus cf glutinosa	alder	1 (0.04g)	-	-	52 (2.11g)	17 (0.65g)	73 (2.81g)
Betula spp	birch	-	-	2 (0.07g)	-	-	-
Corylus cf avellana	hazel	-	-	-	9 (0.41g)	-	2 (0.06g)
Quercus spp	oak	46 (1.70g)	44 (0.52g)	92 (2.06g)	47 (4.32g)	323 (8.74g)	-
Salix spp	willow	-	-	-	3 (0.15g)	-	-
Carbonised cereals							
Hordeum vulgare var nudum	naked barley	4	23	4	-	28	-
Hordeum vulgare sl	barley	8	29	22	3	41	4
Triticum dicoccum	emmer wheat	-	6	7	-	-	-
Triticum spp	wheat	-	4	5	-	-	3
cf Triticum spp	cf wheat	-	-	-	-	3	-
Cereal indet	indet cereal	12	108	33	3	111	20
Carbonised seeds etc							
Corylus avellana nutshell	hazel nutshell	-	1 (0.03g)	1 (0.02g)	369 (5.31g)	2 (0.04g)	22 (0.83g)

Table 4.4: Botantical remains from Structure 13 timber hall and Structure 13n.

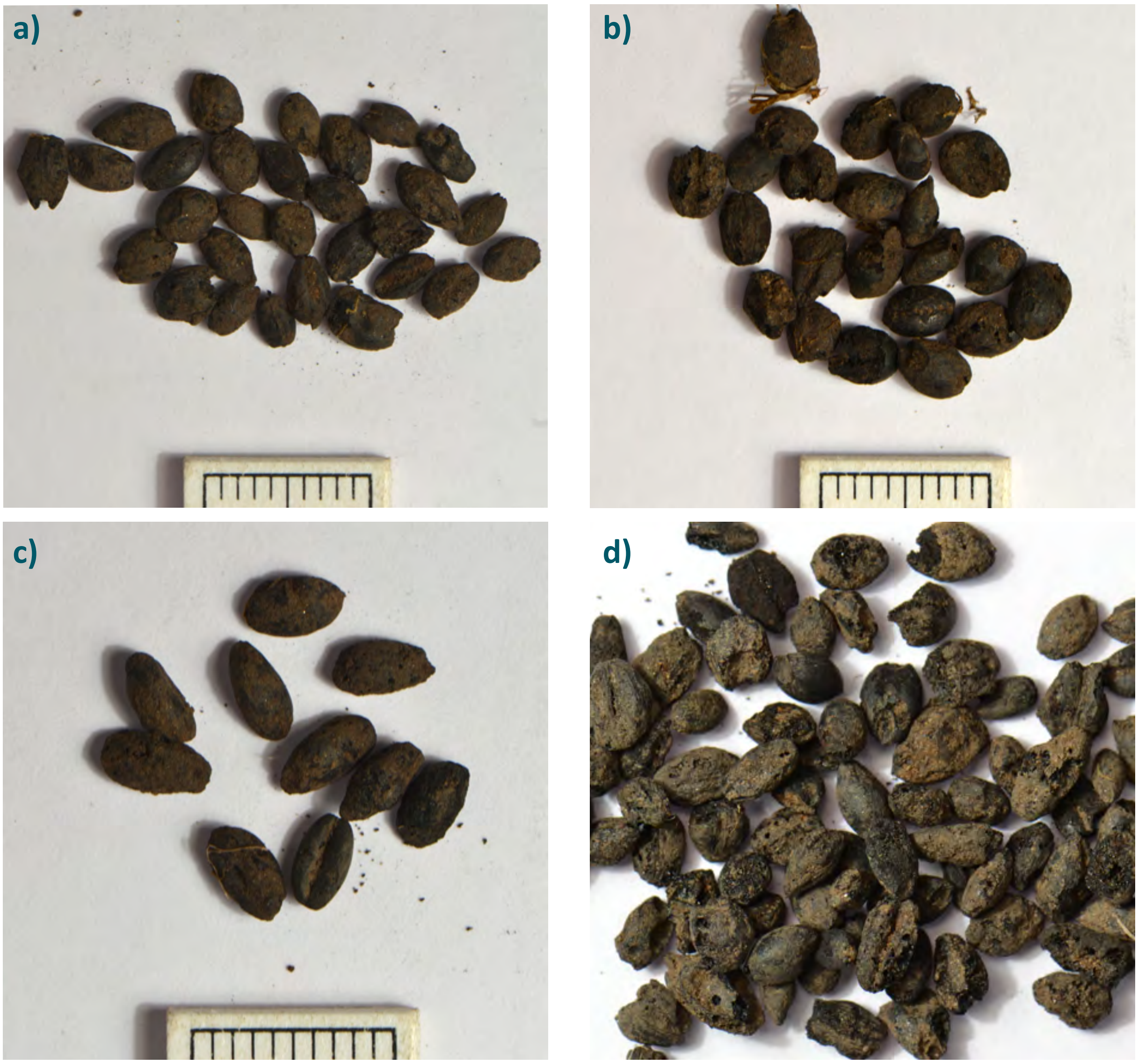


Figure 4.1: a) barley grains, b) naked barley, c) wheat, d) unidentfied cereal grains.

Figure 4.2: Carbonised hazel nutshells.

Structure 13n - the small oval building

A group of 14 pits at the north end of the long timber hall formed a semi-circle overlying the north-west end of Structure 13. Other pits to the immediate east suggest this was a smaller oval-shaped building. Only the fill (1250) 3494 – 3093 cal BC (UBA-39314) of fire-pit (1251) was examined and this produced a carbonised assemblage dominated by alder with only a small amount of hazel also present (Table 4.4). Unusually, oak was entirely absent. Carbonised cereal grains and some hazel nutshell were also recorded and so it would appear this deposit represents the remains of hearth waste. Lithic artefacts and pottery vessels were also found in the fill of the fire-pit.

Other Neolithic pits and postholes

'Structure' 9 *(Table 4.5)*

Structure 9 consisted of a group of 26 postholes and pits that encircled a large pit (849). To the south of this pit was an area of reddened sandy clay (900) 3090 – 2904 cal BC (UBA-39359) that overlay a charcoal-rich deposit (901) both of which lay within pit (7115). Although deposit (901) was described as 'charcoal-rich' in the field, only traces of alder and oak charcoal together with a few fragments of carbonised hazel nutshell were identified from this context.

The fill of pit (823) 3491 – 3104 cal BC (UBA-39312) in Area B to the south of Structure 9 comprised a significant amount of alder charcoal but nothing else.

'Structure' 10 *(Table 4.5)*

Structure 10 was located in the south-east corner of the site. Occupation layer (930) 3648 – ll3525 cal BC (UBA-39315) had a carbonised assemblage dominated by oak charcoal, with traces of alder and several cereal grains with both emmer wheat and naked barley identifiable.

The fill (956) 3634 – 3380 cal BC (UBA-39317) of posthole (957) was also examined and produced a mixed assemblage of alder, heather type, oak and willow charcoal together with a single grain of emmer wheat and a few fragments of hazel nutshell. This appears to be the remains of scattered hearth waste.

'Structure' 12 *(Table 4.5)*

Structure 12 was located in the south-east corner of the site and comprised an occupation layer (980) that contained small amounts of alder, birch, heather type and willow, a few grains of barley and wheat and a single fragment of hazel nutshell. A single possible flax seed, a dock seed and a few seeds of corn spurrey were also noted. The presence of these seeds may indicate the remains of crop weeds.

Below occupation layer (980) were a number of charcoal deposits including layer (1088) 4844 – 4692 cal BC (UBA-39323), which contained oak, alder and hazel charcoal with a few fragments of hazel nutshell. Lying between these deposits was a group of 15 postholes. Three of these (1052, 1074 and 1082) were examined for the presence of carbonised remains. All contained charcoal but the assemblages were different. Fill (1051) 3704 –83640 cal BC (UBA-39319) of posthole (1052) contained alder and oak charcoal, whilst fill (1073) 3341 – 3036 cal BC (UBA-39321) of (1074) was dominated by alder charcoal, with small amounts of birch and oak also present. Fill (181) of posthole/pit (1082) 3757 – 3636 cal BC (UBA-39322) was dominated by oak charcoal, with alder and hazel also present, together with a few carbonised cereal grains. These fills appear to represent different burning events rather than general background scatter from domestic habitation and the AMS radiocarbon dates suggest that these postholes were not contemporaneous.

Pit Group 2 *(Table 4.5)*

Pit Group 2 was a group of 16 pits and postholes located to the east of Structure 8. Pit (146), fill (145) 3641 – 3521 cal BC (UBA-39267) contained fire cracked stones and fragments of prehistoric pottery but did not produce a large volume of charcoal, but small amounts of alder, hazel, oak and a single fragment of hazel nutshell were present. Pit (159), fill (158) 3640 – 3384 cal BC (UBA-39270), also contained fire cracked stones but again, little evidence for charcoal, with only small amounts of alder and indeterminate charcoal with some fragments of hazel nutshell. Although these pits contained fire cracked stone, which may suggest hearth pits, the quantities of charcoal involved did not correspond with this

	Structure	'Structure' 9		'Structure' 10		'Structure' 12				
	Context	822	901	930	956	980	1051	1073	1081	1088
	Sample	482	780	533, 534	547	574	610	626	628	631, 633
	Description	Fill of pit (823)	Charcoal rich layer surrounding hearth (900)	Occupation layer overlying PHs & pits	Fill of post-hole (957)	Occupation layer	Charcoal rich layer surrounded by (1052)	Fill of post-hole (1074)	Fill of pit (1082)	Charcoal rich deposit
Volume of charcoal >4 mm		10ml	<2.5ml	7.5ml	2.5ml	2.5ml	5ml	20ml	55ml	5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	58 (2.72g)	1 (0.04g)	2 (0.06g)	4 (0.64g)	5 (0.05g)	-	32 (2.92g)	6 (0.23g)	4 (0.12g)
Betula spp	birch	-	-	-	-	1 (0.02g)	-	1 (0.08g)	-	-
Corylus cf avellana	hazel	-	-	-	-	-	9 (0.56g)	-	2 (0.03g)	1 (0.03g)
Ericales	heather type	-	-	-	1 (0.02g)	1 (0.02g)	-	-	-	-
Quercus spp	oak	-	1 (0.04g)	55 (1.22g)	1 (0.02g)	8 (0.06g)	3 (0.04g)	-	52 (0.67g)	20 (0.18g)
cf Quercus spp	cf oak									
Salix spp	willow	-	-	-	1 (0.07g)	-	-	2 (0.08g)	-	-
Ulex / Cytisus	gorse/ broom									
Indet charcoal	indet charcoal	-	-	-	-	-	-	-	-	-
Carbonised cereals										
Hordeum vulgare var nudum	naked barley	-	-	2	-	-	-	-	-	-
Hordeum vulgare sl	barley	-	-	-	-	2	-	-	-	-
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	-	1	-
Triticum dicoccum	emmer wheat	-	-	6	1	-	-	-	-	-
Triticum spp	wheat	-	-	5	-	4	-	-	-	-
cf Triticum spp	cf wheat	-	-	-	-	-	-	-	1	-
Cereal indet	indet cereal	-	1	4	-	6	-	-	9	-
Carbonised seeds etc										
Corylus avellana nutshell	hazel nutshell	-	10 (0.06g)	-	3 (0.03g)	1 (0.02g)	-	2 (0.03g)	4 (0.02g)	3 (0.02g)
cf Linum spp	cf flax	-	-	-	-	1	-	-	-	-
Rumex spp	docks	-	-	-	-	1	-	-	-	-
Spergula arvensis	corn spurrey	-	-	-	-	4	-	-	-	-

Table 4.5: Botantical remains from features external to the timber halls.

	Structure	Pit Group 2			Pit Group 5			Pit Group 6		Pit Group 8
	Context	145	156	158	814	861	888	766	786	1016
	Sample	087	091	096	473	501	519	445, 8040	449	592, 8038
	Description	Fill of pit (146)	Fill of pit (157)	Fill of pit (159)	Fill of pit (815)	Fill of pit (862)	Fill of pit (889)	Fill of pit (767)	Fill of pit (787)	Fill of pit cut (1017)
Volume of charcoal >4 mm		5ml	2.5ml	2.5ml	15ml	10ml	60ml	95ml	100ml	5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	14 (0.67g)	2 (0.09g)	6 (0.12g)	32 (1.54g)	23 (0.57g)	132 (5.04g)	138 (5.70g)	43 (2.34g)	29 (0.92g)
Betula spp	birch	-	-	-	-	10 (0.18g)	-	-	1 (0.05g)	-
Corylus cf avellana	hazel	1 (0.07g)	-	-	1 (0.04g)	5 (0.24g)	10 (0.72g)	-	11 (0.72g)	2 (0.06g)
Ericales	heather type	-	-	-	-	-	-	-	-	-
Quercus spp	oak	2 (0.03g)	3 (0.04g)	-	-	6 (0.15g)	-	124 (6.72g)	342 (19.88g)	3 (0.05g)
cf Quercus spp	cf oak	-	-	-	-	-	-	-	-	-
Salix spp	willow	-	-	-	11 (0.83g)	1 (0.03g)	4 (0.22g)	15 (1.33g)	-	-
Ulex / Cytisus	gorse/ broom	-	-	-	-	-	-	-	1 (0.03g)	-
Indet charcoal	indet charcoal	-	-	3 (0.07g)	-	-	-	-	-	-
Carbonised cereals										
Hordeum vulgare var nudum	naked barley	-	-	-	-	-	-	2	2	-
Hordeum vulgare sl	barley	-	-	-	-	2	-	4	-	2
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	-	-	-
Triticum dicoccum	emmer wheat	-	-	-	-	-	-	-	4	-
Triticum spp	wheat	-	-	-	-	-	-	6	4	2
cf Triticum spp	cf wheat	-	-	-	-	-	-	-	-	1
Cereal indet	indet cereal	-	-	-	-	-	4	5	7	4
Carbonised seeds etc										
Corylus avellana nutshell	hazel nutshell	1 (0.02g)	-	18 (0.16g)	149 (3.23g)	42 (0.69g)	1162 (15.45g)	461 (8.60g)	9 (0.12g)	2 (0.04g)
cf Linum spp	cf flax	-	-	-	-	-	-	-	-	-
Rumex spp	docks	-	-	-	-	-	-	-	-	-
Spergula arvensis	corn spurrey	-	-	-	-	-	-	-	-	-

Table 4.5 (continued): Botantical remains from features external to the timber halls.

interpretation unless the pits were cleaned out frequently. A further pit (157), fill (156) 3635 – 3381 cal BC (UBA-39324), contained only small amounts of alder and oak charcoal with no other carbonised remains identified.

Pit Group 5 *(Table 4.5)*

Pit Group 5 was a group of 28 pits and postholes located to the south of Structure 8. Pits (815/814) and (889/888) dated 3499 – 3118 cal BC (UBA-39314) contained very similar carbonised assemblages, with significant amounts of alder charcoal, with smaller amounts of hazel and willow also present. However, the most notable constituents of the assemblages were very large quantities of hazel nutshell, with over 1,000 fragments, weighing over 15 g from pit (889) alone. Such large amounts of hazel nutshell tend to be found in earlier prehistoric features, and this is confirmed by the radiocarbon date from fill (888) of 3499 – 3118 cal BC (UBA-39314). The third pit examined from this group was (862/861) dated 3638 – 3386 cal BC (UBA-39313) which also contained alder, hazel and willow charcoal but with the addition of oak and birch together with a couple of carbonised barley grains and fragments of hazel nutshell, but not in the concentrations recovered from the other two pits examined in this group.

Pit Group 6 *(Table 4.5)*

Pit Group 6 was a group of 13 postholes and pits located to the north-east of Structure 10. The fill (786) 3631 – 3366 cal BC (UBA-39327) of pit (787) contained very large quantities of oak charcoal, lesser amounts of alder charcoal and traces of birch, hazel and gorse type also present. In addition there were cereal grains including naked barley and emmer wheat and small amounts of carbonised cereal grains. This cereal assemblage is what might be expected from a Neolithic site and may represent domestic hearth or midden waste. The other pit (767/766) examined from this group dated 3643 – 3521 cal BC (UBA-39311), also contained significant amounts of alder and oak charcoal, but with the only other charcoal type present being willow. This pit also contained a cereal assemblage that contained naked barley and wheat, although it was not possible to further identify the wheat to emmer. The fill (767) differed from fill (787) in that it also contained large amounts of carbonised hazel nutshell with > 450 fragments, weighing >8 grams, recovered from this fill.

Pit Group 7

Pit Group 7 was a widely spaced group of 12 pits and postholes possibly of different periods located to the south-east of Pit Group 5. It is discussed further in Bronze Age burials, below.

Pit Group 8 *(Table 4.5)*

Pit Group 8 was a group of 11 pits and postholes located between 'Structures' 10 and 12. The fill (1016) of pit (1017) dated 3692 – 3530 cal BC (UBA-39302) contained small amounts of alder, hazel and oak charcoal, a few grains of barley and wheat and traces of hazel nutshell.

SW Pit Groups

The pits that were not directly associated with structures were allocated to one of 28 pit groups across the site. However, this does not mean that all the pits in the same group were necessarily contemporaneous.

Pit Group 10 *(Table 4.6)*

Pit Group 10 was a group of 16 pits, postholes and a shallow deposit to the SSW of Structure 13. Pits (11003, 11004 and 11011) contained a similar fill (11002) that included fragments of burnt bone. The charcoal assemblage contained small amounts of alder, hazel, willow and possibly elm with a few poorly preserved cereals grains but a large number of hazel nutshell fragments. Pit (11008/11007) also produced large numbers of hazel nutshell but also a larger number of cereal grains, some of which were identifiable as naked barley and emmer wheat dated to 3694 – 3384 cal BC (UBA-39354). The two other pit fills examined were (3006/3007) dated to 3757 – 3385 cal BC (UBA-39322) and (6004/6005), which both produced small amounts of charcoal, a few cereals (emmer and naked barley were identifiable) and significant numbers of hazel nutshell fragments. The similarities in the carbonised assemblages from the pit fills recorded for this grouping does suggest that these pits were contemporaneous and this is supported by the radiocarbon dates.

Pit Group 12 *(Table 4.6)*

Pit Group 12 was a group of 12 pits and postholes that lay to the west of Pit Group 11. The largest pit (3016) contained prehistoric pottery and a lithic artefact and had heat reddened sand at the base. The fill (3017) dated to 2114 – 1778 cal BC (UBA-39331) contained very large quantities of alder charcoal with some birch also present. However, the most notable finds were significant numbers of cereal grains with 386 carbonised grains recovered from this fill. Over a third of these grains were identifiable as naked barley, with a further third less well preserved but still recognisably barley, but the remaining third of the grains were too poorly preserved to be identifiable to type. In addition, a number of carbonised weed seeds were also identified. These could be crop weeds but are, perhaps, more likely to be from the vegetation growing in the vicinity of the pit. The presence of naked barley is in keeping with the early Bronze Age date for this feature.

	Area	Pit Group 10				Pit Group 12
	Context	3006	6004	11002	11007	3017
	Sample	3003	6002	11001	8042, 11002	3009
	Description	Fill of pit (3007)	Fill of possible pit (6005)	Fill overlying pits (11003) & (11004)	Fill of pit (11008)	Basal fill of pit (3016)
Volume of charcoal >4 mm		5ml	10ml	10ml	20ml	500ml
% charcoal >4 mm ID		100%	100%	100%	100%	20%
Charcoal						133 (20.78g)
Alnus cf glutinosa	alder	-	-	5 (0.12g)	25 (1.56g)	14 (1.63g)
Betula spp	birch	-	-	-	-	-
Corylus cf avellana	hazel	4 (0.08g)	-	1 (0.05g)	2 (0.04g)	-
Ericales	heather type	-	-	-	-	-
Quercus spp	oak	7 (0.14g)	-	-	2 (0.04g)	-
cf Quercus spp	cf oak	-	1 (0.32g)	-	-	-
Salix spp	willow	-	-	2 (0.10g)	1 (0.10g)	-
cf Ulmus spp	cf elm	-	-	(0.12g)	-	-
Indet charcoal	indet charcoal	-	-	-	-	-
Carbonised cereals						
cf Avena spp	cf oats	-	-	1	-	-
Hordeum vulgare var nudum	naked barley	-	-	-	1	152
Hordeum vulgare sl	barley	-	1	-	2	124
cf Hordeum vulgare sl	cf barley	-	-	-	2	-
Triticum dicoccum	emmer wheat	1	5	-	2	-
Triticum spp	wheat	1	-	-	10	-
cf Triticum spp	cf wheat	-	-	1	2	-
Cereal indet	indet cereal	5	10	6	6	112
Carbonised seeds etc						
Aphanes arvensis	parsley piert	-	-	1	-	11
Carex spp	sedge	-	-	-	-	3
Chenopodium album	fathen	-	-	-	-	3
Chenopodium rubrum	red goosefoot	-	-	-	-	-
Corylus avellana nutshell	hazel nutshell	45 (0.82g)	249 (3.08g)	115 (1.65g)	197 (2.88g)	-
Isolepis setacea	bristle club-rush	-	-	-	-	1
Lamiaceae	dead nettle family	-	-	-	-	1
cf Linum spp	flax	-	-	-	-	-
Persicaria maculosa	redshank	-	-	-	-	29

Table 4.6: Botantical remains from Pit Groups 10-12.

	Area	Pit Group 13					Pit Group 14			
	Context	2017	6014	7012	7041	12019	4044	4046	5015	9032
	Sample	2008, 4098	6007	7006	7021	12013	4020	4021	5007	9017
	Description	Fill of pit (2018)	Fill of pit (6015)	Fill of pit (7013)	Fill of pit contained full vessel (7042)	Fill of pit (12020)	Fill of possible cooking pit (4045)	Fill of small pit (4047)	Fill of possible pit (5016)	Fill of pit (9033)
Volume of charcoal >4 mm		12.5ml	5ml	<2.5ml	15ml	10ml	5ml	<2.5ml	5ml	15ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	4 (0.24g)	1 (0.04g)	2 (0.07g)	-	-	14 (0.44g)	-	9 (0.17g)	4 (0.23g)
Betula spp	birch	-	-	-	-	-	-	-	2 (0.04g)	1 (0.03g)
Corylus cf avellana	hazel	3 (0.07g)	-	-	25 (4.04g)	-	-	-	6 (0.20g)	11 (1.07g)
Ericales	heather type	-	-	-	-	-	-	-	-	-
Quercus spp	oak	-	126 (1.47g)	-	2 (0.07g)	46 (1.13g)	5 (0.15g)	4 (0.05g)	7 (0.23g)	34 (1.21g)
cf Quercus spp	cf oak	-	-	-	-	-	-	-	-	-
Salix spp	willow	15 (1.48g)	-	-	-	-	-	-	-	7 (0.21g)
cf Ulmus spp	cf elm	-	-	-	-	-	-	-	-	-
Indet charcoal	indet charcoal	-	-	-	-	-	-	-	-	3 (0.32g)
Carbonised cereals										
cf Avena spp	cf oats	-	-	-	-	-	-	-	-	-
Hordeum vulgare var nudum	naked barley	-	-	-	-	-	-	-	-	-
Hordeum vulgare sl	barley	1	-	-	-	-	-	-	-	-
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	-	-	-
Triticum dicoccum	emmer wheat	-	-	-	-	-	-	-	-	-
Triticum spp	wheat	4	-	-	-	-	-	-	1	-
cf Triticum spp	cf wheat	-	-	-	2	-	-	-	-	-
Cereal indet	indet cereal	9	-	-	3	-	-	-	2	-
Carbonised seeds etc										
Aphanes arvensis	parsley piert	-	-	-	-	-	-	-	-	-
Carex spp	sedge	-	-	-	-	-	-	-	-	-
Chenopodium album	fathen	-	-	-	-	-	-	-	-	-
Chenopodium rubrum	red goosefoot	-	-	-	-	-	-	-	-	-
Corylus avellana nutshell	hazel nutshell	141 (1.48g)	-	-	205 (2.20g)	-	2 (0.06g)	4 (0.03g)	24 (0.19g)	5 (0.03g)
Isolepis setacea	bristle club-rush	-	-	-	-	-	-	-	-	-
Lamiaceae	dead nettle family	-	-	-	-	-	-	-	-	-
cf Linum spp	flax	-	-	-	-	-	-	-	-	-
Persicaria maculosa	redshank	-	-	-	-	-	-	-	-	-

Table 4.6 (continued): Botantical remains from Pit Groups 13-14.

Pit Group 13 *(Table 4.6)*

Pit Group 13 comprised a group of 17 pits and postholes located to the west of Pit Group 12. Pit (7042), fill (7041) dated 3644 – 3524 cal BC (UBA-39341), contained a seemingly complete prehistoric pot together with large fragments of hazel charcoal, traces of oak charcoal, and over 200 fragments of hazel nutshell. This was one of the few features on the site that contained large amount of hazel charcoal meaning that this pit may contain the remains of a wattle structure or object. Large quantities of hazel nutshell were also recorded from the fill (2017) of pit 2018 dated to 3640 – 3378 cal BC (UBA-39329). This fill also contained cereals, both barley and wheat, together with alder, hazel and willow charcoal.

The fills (6014 and 12019) of pits (6015 and 1202) respectively, both produced significant quantities of oak charcoal but no cereals or nutshell. These may be the remains of structural features. The fill (7012) 3797 – 3662 cal BC (UBA-39338) of pit 7013 contained only traces of alder charcoal and so adds little to the interpretation of this pit group.

Pit Group 14 *(Table 4.6)*

Pit Group 14 comprised a group of 22 pits and postholes located to the west of Pit Group 13. Pit (4045) had a figure of eight shape and contained fragments of prehistoric pot and lithic artefacts. However, it only produced small amounts of alder and oak charcoal with a couple of fragments of hazel nutshell and so probably was not a cooking pit as was suggested in the DSR. The fill (4046) of pit (4047) only contained traces of oak charcoal and hazel nutshell.

Pits (5016/5015) 3508 – 3113 cal BC (UBA-39333) and (9033/9032) 3489 – 3026 cal BC (UBA-39349) both contained diverse charcoal assemblages, with a few fragments of hazel nutshell, and fill (5015) also contained a few cereal grains. These fills were probably the remains of scattered or dumped hearth waste.

Pit Group 15 *(Table 4.7)*

Pit Group 15 lay to the west of Pit Group 17 and comprised 25 pits and postholes. The pit fills generally contained alder and hazel charcoal, with small amounts of other types occasionally present such as oak, willow, birch and rowan type. In addition, all the fills contained small amounts of hazel nutshell, apart from fill (10064) of pit (10065) which produced 166 fragments of nutshell weighing over 3 g. A few carbonised cereal grains, including a possible bread wheat were also identified and a few fragments of what may be burnt dung were recovered from fill (10064). These fills are consistent with scattered hearth/midden waste. An AMS radiocarbon date of 3517 – 3353 cal BC (UBA-39353) was obtained from fill (10062) of pit (10063), a date of 2835 – 2474 cal BC (UBA-39356) from fill (12051) of pit (12052) and a date of 2839 – 2473 cal BC (UBA-39347) from the fill (8048) of pit (8049).

Pit Group 16 *(Table 4.7)*

Pit Group 16 lay to the west of Pit Group 15 and comprised a group of 14 pits and possible postholes and a deposit of charcoal-rich material. The pit fills (4081) 3654 – 3384 cal BC (UBA-39332), (4087), (5051) (4442 – 4078 cal BC (UBA-39334), (7106) and (7108) 3659 – 3523 cal BC (UBA-39343) in this group contained small amounts of charcoal with each containing one or more of alder, hazel and oak types. A few cereal grains and significant numbers of hazel nutshell fragments were also recovered from fills (4081 and 7108). The concentrations of carbonised remains recorded from these features were relatively low and so probably represents background domestic scatter from hearths or middens.

Pit Group 17 *(Table 4.7)*

Pit Group 17 lay between Pit Group 14 and Pit Group 15 and comprised a group of 10 pits. Fill (6026) dated 3520 – 3111 cal BC (UBA-39337) of pit (6027) and (8018) of pit (8019) both contained significant numbers of hazel nutshell fragments, with a few barley grains and poorly preserved indeterminate cereal grains. No charcoal was recovered from (6026) but the fill (8018) contained small amounts of alder and hazel charcoal. These pits appear to contain waste associated with food processing.

A further possible cooking pit (8017) (also Table 4.7) had a fill (8016) dated to 3702 – 3636 cal BC (UBA-39345) that produced a very much smaller quantity of charcoal, with only traces of alder present. Cereals and significant numbers of hazel nutshell fragments were also recorded but the lack of charcoal suggests that this material may have been dumped rather than being burnt in situ.

	Area	Pit Group 15							
	Context	8048	9071	10057	10059	10061	10062	10064	12051
	Sample	8028, 8029	9044	10032	10033, 10036	10031	2029	10037	12033, 12034
	Description	Fill of pit (8049)	Fill of pit (9070)	Fill of pit (10058)	Fill of pit (10060)	Layer over pits (10058, 60, 65)	Fill of pit (10063)	Fill of pit (10065)	Fill of pit (12052)
Volume of charcoal >4 mm		7.5ml	<2.5ml	<2.5ml	2.5ml	5ml	5ml	25ml	25ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	10 (0.18g)	-	-	11 (0.46g)	2 (0.04g)	4 (0.07g)	2 (0.10g)	68 (4.64g)
Betula spp	birch	-	-	-	-	1 (0.02g)	-	-	-
Corylus cf avellana	hazel	11 (0.44g)	-	-	1 (0.09g)	3 (0.14g)	-	47 (2.88g)	8 (0.71g)
Maloideae	rowan type	-	-	-	-	-	-	5 (0.45g)	-
Quercus spp	oak	-	15 (0.15g)	-	3 (0.02g)	-	-	2 (0.05g)	-
Salix spp	willow	-	-	-	-	1 (0.01g)	-	-	-
Indet charcoal	indet charcoal	-	-	-	-	-	-	-	-
Indet cinder	indet cinder	-	-	-	-	-	-	-	-
Carbonised cereals									
Hordeum vulgare sl	barley	-	-	-	-	-	-	1	-
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	-	-
Triticum cf aestivum	cf bread wheat	-	-	-	-	-	-	1	-
Triticum spp	wheat	-	-	-	-	-	-	2	-
cf Triticum spp	cf wheat	-	-	-	-	1	-	-	-
Cereal indet	indet cereal	-	-	2	-	-	-	2	-
Carbonised seeds etc									
Corylus avellana nutshell	hazel nutshell	14 (0.15g)	2 (0.02g)	34 (0.29g)	126 (1.47g)	34 (0.99g)	101 (0.99g)	166 (3.03g)	8 (0.09g)
Misc									
Burnt dung?	burnt dung?	-	-	-	-	-	-	3 (0.20g)	-

Table 4.7: Botantical remains from Pit Group 15.

	Area	Pit Group 16					Pit Group 17		
	Context	4081	4087	5051	7106	7108	6026	8018	8016
	Sample	4041	4044	5027	7053	7054	6013	8011	8010
	Description	Fill of possible fire pit (4082)	Fill of pit (4088)	Fill of possible post-hole (5052)	Upper fill of possible fire pit (7107)	Lower fill of pit (7107)	Fill of pit (6027)	Fill of cooking pit (8019)	Fill of possible cooking pit (8017)
Volume of charcoal >4 mm		5ml	2.5ml	<2.5ml	5ml	5ml	5ml	5ml	5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	5 (0.12g)	-	1 (0.04g)	10 (0.40g)	-	-	10 (0.30g)	4 (0.04g)
Betula spp	birch	-	-	-	-	-	-	-	-
Corylus cf avellana	hazel	1 (0.03g)	5 (0.51g)	-	4 (0.20g)	8 (0.28g)	-	10 (0.39g)	-
Maloideae	rowan type	-	-	-	-	-	-	-	-
Quercus spp	oak	-	-	2 (0.04g)	2 (0.07g)	-	-	-	-
Salix spp	willow						-	-	-
Indet charcoal	indet charcoal	-	-	-	-	1 (0.04g)	-	-	-
Indet cinder	indet cinder	-	-	-	-	-	-	-	11 (0.02g)
Carbonised cereals									
Hordeum vulgare sl	barley	1	-	-	-	1	3	13	4
cf Hordeum vulgare sl	cf barley	-	-	-	-	-	-	-	3
Triticum cf aestivum	cf bread wheat	-	-	-	-	-	-	-	-
Triticum spp	wheat	-	-	-	-	1	-	-	-
cf Triticum spp	cf wheat	-	-	-	-	-	-	-	-
Cereal indet	indet cereal	-	-	-	-	3	5	62	16
Carbonised seeds etc									
Corylus avellana nutshell	hazel nutshell	62 (0.75g)	-	-	20 (0.31g)	37 (0.63g)	152 (1.72g)	126 (1.23g)	95 (1.00g)
Misc									
Burnt dung?	burnt dung?	-	-	-	-	-	-	-	-

Table 4.7 (continued): Botantical remains from Pit Groups 16-17.

The Outland

'Structure' 7 *(Table 4.8)*

'Structure' 7 was located in the north-west corner of the site. It was defined by a layer (392) that contained a mixed charcoal assemblage of oak, alder, birch and hazel together with a couple of fragments of hazel nutshell. Below this layer was an earlier layer (397) dated 3712 – 3542 cal BC (UBA-39286) but this only contained small amounts of oak and alder charcoal plus a single possible carbonised grain of wheat. Neither of these layers shows significant amounts of domestic hearth or midden material, although they did contain numerous finds of prehistoric pottery and lithics.

Below these layers were the remains of some postholes, a large pit (408), and two gullies (410) and (7100). The fill (407) of the pit (408), contained significant amounts of oak charcoal with a small amount of hazel also present and was dated to 3943 – 3711 cal BC (UBA-39287). There was no evidence for cereals or other food remains in the pit. However, this assemblage does suggest that oak wood was being used as fuel as well as for construction timbers.

To the north-east of Structure 7 lay pit (10056), its fill (10055) produced significant amounts of alder charcoal with traces of oak and hazel nutshell also recorded. Pit (12048), fill (12047), also lay to the north of Structure 7 but produced only a trace of oak charcoal. A large deposit (7103) dated to 5307 – 5071 cal BC (UBA-39342) also lay to the north of Structure 7 but it produced only traces of alder and birch charcoal.

	Structure	'Structure' 7						Area G		Area O
	Context	392	397	407	7103	10055	12047	7020	10038	239
	Sample	208, 209, 8020	212, 221, 8021	217	7051	10030	12028	7011	10021	136
	Description	Occupation layer	Basal occupation layer	Fill of pit (408)	Large fill (7103), north of 'Structure' 7	Fill of pit (10056)	Basal fill of pit (12048)	Fill of cooking pit (7021)	Fill of pit (10039)	Fill of pit (238)
Volume of charcoal >4 mm		12.5ml	10ml	15ml	<2.5ml	15ml	<<2.5ml	30ml	100ml	<2.5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	4 (0.20g)	9 (0.28g)	4 (0.18g)	1 (0.03g)	15 (3.89g)	-	41 (3.94g)	1 (0.07g)	1 (0.05g)
Betula spp	birch	1 (0.03g)	-	-	1 (0.01g)	-	-	5 (0.31g)	-	-
Corylus cf avellana	hazel	1 (0.06g)	-	-	-	-	-	6 (0.19g)	-	-
Quercus spp	oak	54 (0.62g)	30 (0.49g)	53 (2.73g)	-	1 (0.08g)	3 (0.04g)	7 (0.39g)	502 (21.94g)	4 (0.06g)
Salix spp	willow	-	-	-	-	-	-	2 (0.16g)	-	-
Indet charcoal	indet charcoal	9 (0.64g)	1 (0.03g)	6 (0.71g)	-	12 (2.09g)	-	4 (0.31g)	-	-
Carbonised cereals										
Hordeum vulgare var nudum	naked barley	-	-	-	-	-	-	2	-	-
Hordeum vulgare sl	barley	-	-	-	-	-	-	4	-	-
cf Triticum spp	cf wheat	-	1	-	-	-	-	-	-	-
Carbonised seeds etc										
Corylus avellana nutshell	hazel nutshell	2 (0.09g)	-	-	-	1 (0.04g)	-	21 (0.22g)	-	-

Table 4.8: Botantical remains from the outland.

Area G *(Table 4.8)*

The fill (10038) of pit (10039) Area G produced over 500 fragments of oak charcoal weighing almost 22 grams which were dated 3960 – 3796 cal BC (UBA-39352). This may represent the remains of burnt structural material rather than just the remains of hearth waste.

Pit (7021) had been identified as a cooking pit. The fill (7020) dated 3645 – 3521 cal BC (UBA-39339) contained a large amount of charcoal with alder, birch, hazel, oak and willow all represented, together with a few barley grains (including the naked variety) and fragments of hazel nutshell. This assemblage would be consistent with a cooking pit dating to the early Neolithic.

Area O/East Angle *(Table 4.8)*

A number of isolated pits that could not be allocated to any of the pit groups were also examined for the presence of carbonised remains. The fill (239) 2278 – 2040 cal BC (UBA-392750 of pit (238) contained only traces of alder and oak charcoal and so was similar to many of the pit fills recovered from the site.

Pit Group 18 *(Table 4.9)*

Pit Group 18 was situated immediately south-west of Structure 8 and directly west of Structure 4 and comprised nine pits including postholes. The fill (734) 727 – 887 cal AD (UBA-39309) of pit (735) had a diverse charcoal assemblage dominated by heather type stems but with birch, hazel, holly, Scots pine and oak also present. A few grains of oats and barley were also identified along with a range of weed seeds, including corn spurrey, and a single seed of cultivated flax. This assemblage was very different from the rest of the pit groups and the presence of oats and flax is in keeping with the early medieval date for this feature. It is notable that features from Structure 4 also produced significant numbers of heather stems and so it may be that these two feature groupings were related.

Pit Group 20 *(Table 4.9)*

Pit Group 20 was located to the north of Pit Group 18 and comprised nine pits. The fill (9024) of pit (9025) produced only small amounts of indeterminate charcoal and a single indeterminate cereal grain and so nothing further can be said about this pit group.

Pit Group 21 *(Table 4.9)*

Pit group 21 lay to the north of Pit Group 20 and comprised 22 pits surrounding two gullies. Towards the east end of the pit group were two gullies (8013 and 4021). The fill (8012) of gully (8013), dated to 693 – 879 cal AD (UBA-39344), contained small amounts of alder, birch, heather type and oak charcoal with a single fragment of hazel nutshell. Fill (8012) also produced prehistoric pottery but the AMS date suggests this pottery must be redeposited. The fill (12030) of pit (12031) dated 779 – 991 cal AD (UBA-39355) produced small amounts of birch, hazel and heather type charcoal with a few grains of oats and barley also identified. The presence of oats is in accordance with the AMS date from the charcoal in this feature.

Pit Group 22 *(Table 4.9)*

Pit Group 22 was located to the north-west of Pit Group 21 and comprised 13 pits arranged around a large pit (356). The fill (355) of pit (356) produced only traces of oak and heather type charcoal but the amounts recorded are not sufficient to confirm that this feature was an oven as suggested in the DSR.

Pit Group 23 *(Table 4.9)*

Pit Group 23 was located to the north-west of Pit Group 22 and comprised a number of amorphous deposits and a single pit. Deposit (4076) produced oak charcoal but not in sufficient quantities to suggest that a structure had been destroyed by fire. This may just be the remains of hearth waste.

Pit Group 24 *(Table 4.9)*

Pit Group 24 was located to the north-east of Structure 7 and comprised a group of 13 widely spaced pits, postholes and four deposits. Prehistoric pottery and lithics were recovered from the fill (9042) of pit (9043) dated 3642 – 3374 cal BC (UBA-39351) but only small amounts of alder and oak charcoal were recorded. Prehistoric pottery was also recorded in deposit (9054) and oak charcoal was recorded from it as well. The fill (9046) of pit (9047) produced only small amounts of heather type and oak charcoal.

	Area	Pit Group 18	Pit Group 20	Pit Group 21		Pit Group 22	Pit Group 23	Pit Group 24		
	Context	734	9024	8012	12030	355	4076	9042	9046	9054
	Sample	427	9013	8006	12019	206	4037	9024	9026	9031
	Description	Fill of pit (735)	Fill of pit (9025)	Fill of curvilinear (8013)	Fill of pit (12031)	Fill of oven pit (356)	Possible occupation layer	Fill of pit (9043)	Fill of pit (9047)	Spread, possible occ layer
Volume of charcoal >4 mm		100ml	<<2.5ml	2.5ml	5ml	<2.5ml	10ml	2.5ml	5ml	5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%	100%
Charcoal										
Alnus cf glutinosa	alder	-	-	3 (0.02g)	-	-	-	6 (0.15g)	-	-
Betula spp	birch	7 (0.54g)	-	4 (0.06g)	12 (0.25g)	-	-	-	-	-
Corylus cf avellana	hazel	6 (0.19g)	-	-	2 (0.02g)	-	-	-	-	-
Ericales	heather type	636 (18.67g)	-	6 (0.02g)	21 (0.18g)	1 (0.05g)	-	-	10 (0.55g)	-
Ilex aquifolium	holly	1 (0.18g)	-	-	-	-	-	-	-	-
Pinus sylvestris type	Scots pine type	3 (0.32g)	-	-	-	-	-	-	-	-
Quercus spp	oak	1 (0.05g)	-	5 (0.06g)	-	1 (0.02g)	24 (2.27g)	2 (0.02g)	7 (0.13g)	65 (0.74g)
Indet cinder	indet cinder	-	7 (0.14g)	-	-	-	-	-	-	-
Carbonised cereals										
Avena spp	oats	3	-	-	2	-	-	-	-	-
Hordeum vulgare var nudum	naked barley	-				-	-	-	-	-
Hordeum vulgare sl	barley	2	-	-	3	-	-	-	-	-
Triticum dicoccum	emmer wheat	-	-	-	-	-	-	-	-	-
Triticum spp	wheat	-	-	-	-	-	-	-	-	-
Cereal indet	indet cereal	3	1	-	4	-	-	-	-	-
Carbonised seeds etc										
Ajuga reptans	bugle	1	-	-	-	-	-	-	-	-
Calluna vulgaris seed capsule	heather seed capsule	4	-	-	-	-	-	-	-	-
Carex spp	sedge	4	-	-	-	-	-	-	-	-
Corylus avellana nutshell	hazel nutshell	1 (0.04g)	-	1 (0.01g)	-	-	-	-	-	-
Lamiaceae	dead nettle family	1	-	-	-	-	-	-	-	-
Linum usitatissimum	cultivated flax	1	-	-	-	-	-	-	-	-
Persicaria maculosa	redshank	3	-	-	-	-	-	-	-	-
Poaceae (small)	grass	2	-	-	-	-	-	-	-	-
Rumex spp	docks	1	-	-	-	-	-	-	-	-
Spergula arvensis	corn spurry	1	-	-	-	-	-	-	-	-

Table 4.9: Botantical remains from additional pit groups from the outland.

Pit Group 25 *(Table 4.9)*

Pit Group 25 was located to the north of the site, north-east of Structure 7 and comprised a series of four postholes and pits that formed an arc with a gully to the south-west of the pits. The fill (9041) of pit (9037) dated 3623 – 3112 cal BC (UBA-39350), produced >400 fragments of oak charcoal weighing >23 grams, suggesting that this may be the remains of a structure burnt in situ.

Pit Group 26 *(Table 4.9)*

Pit Group 26 was located at the north of the site, some distance to the east of Pit Group 25. Fire cracked stones were found in the fill (7064) of pit (7065). This fill also contained a significant amount of charcoal, with alder, oak, birch and hazel present together with fragments of hazel nutshell and 84 cereal grains. Naked barley and emmer wheat were both identified from the cereal assemblage. These finds suggest food processing or hearth waste, probably dating to the Neolithic or early Bronze Age. The fills (7066) of pit (7067) and (8022) of pit 8023 dated to 2571 – 2348 cal BC (UBA-39346) produced only small amounts of charcoal.

	Area	Pit Group 25	Pit Group 26			Pit Group 28
	Context	9041	7064	7066	8022	7024
	Sample	9023	7049	7031	8013	7013
	Description	Charcoal rich fill of pit (9037)	Fill of large pit (7065).	Fill of pit (7067)	Fill of pit (8023)	Fill of pit (7025)
Volume of charcoal >4 mm		80ml	30ml	<2.5ml	5ml	5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%
Charcoal						
Alnus cf glutinosa	alder	-	86 (2.95g)	-	8 (0.18g)	10 (0.78g)
Betula spp	birch	-	4 (0.13g)	-	-	1 (0.02g)
Corylus cf avellana	hazel	-	21 (0.53g)	-	-	-
Ericales	heather type	-	-	-	-	-
Ilex aquifolium	holly	-	-	-	-	-
Pinus sylvestris type	Scots pine type	-	-	-	-	-
Quercus spp	oak	422 (23.27g)	28 (1.84g)	5 (0.04g)	14 (0.98g)	-
Indet cinder	indet cinder	-	-	-	-	-
Carbonised cereals						
Avena spp	oats	-	-	-	-	-
Hordeum vulgare var nudum	naked barley	-	10	-	-	-
Hordeum vulgare sl	barley	-	12	-	-	-
Triticum dicoccum	emmer wheat	-	5	-	-	-
Triticum spp	wheat	-	3	-	-	-
Cereal indet	indet cereal	-	54	-	-	-
Carbonised seeds etc						
Ajuga reptans	bugle	-	-	-	-	-
Calluna vulgaris seed capsule	heather seed capsule	-	-	-	-	-
Carex spp	sedge	-	1	-	-	-
Corylus avellana nutshell	hazel nutshell	3 (0.09g)	51 (0.50g)	3 (0.02g)	-	-
Lamiaceae	dead nettle family	-	-	-	-	-
Linum usitatissimum	cultivated flax	-	-	-	-	-
Persicaria maculosa	redshank	-	-	-	-	-
Poaceae (small)	grass	-	-	-	-	-
Rumex spp	docks	-	-	-	-	-
Spergula arvensis	corn spurry	-	-	-	-	-

Table 4.9 (continued): Botanical remains from additional pit groups from the outland.

Pit Group 28 *(Table 4.9)*

Pit Group 28 was located in the north-east corner of the site and comprised a line of 11 postholes, with a further four pits to the north and south of the alignment. The fill (7024) dated 3355 – 3101 cal BC (UBA-39340) of pit (7025) produced only small amounts of alder and birch charcoal, which was probably scattered hearth waste rather than evidence for structural material.

Bronze Age burials

Structure 3 *(Table 4.10)*

Structure 3 was located in the north-east of the site and comprised a sub-circular ditch (136) that enclosed a number of pits and postholes. The fill (135) dated 1207 – 1017 cal BC (UBA-39266) of the ring ditch (136) produced only small amounts of alder, birch, hazel and heather type charcoal together with a single fragment of hazel nutshell. This assemblage is consistent with scattered domestic hearth waste. The fill (152) dated 3646 – 3520 cal BC (UBA-39268) of pit (153) within the area enclosed by the ditch contained heat cracked stones and a charcoal assemblage of alder, birch, hazel and oak, with some hazel nutshell. This assemblage would be consistent with the use of the pit as a domestic fire-pit but it was clearly much earlier in date than the rest of the structure. A further pit (193) contained part of the sides and base of a large early Bonze Age urn but the fill (192) did not produce any carbonised remains.

Pit Group 7 *(Table 4.10)*

The fill (744) of pit (743) a burial pit dated to 1115 – 934 cal BC (UBA-39310), produced a very diverse charcoal assemblage but the quantities involved were relatively small. Charcoal of alder, birch, hazel, heather type and oak were recorded together with a cereal grain, traces of hazel nutshell and a possible flax seed.

Bronze Age structures

Structure 1 *(Table 4.11)*

Structure 1 was located in the north-east of the site and appeared to be a timber post structure that was delineated by a ring ditch (004). The fill (003) dated to 1046 – 916 cal BC (UBA-39260) and 920 – 818 cal BC (UBA-39261) of this ditch produced prehistoric pottery and lithic artefacts. The carbonised assemblage was very diverse but the quantities of charcoal recovered were not large. Oak, alder, birch, hazel and willow charcoal were all represented with small amounts of carbonised cereal grain (including barley) and traces of hazel nutshell. This assemblage is consistent with hearth waste but the small quantities involved do not suggest deliberate dumping, but accidental scatter from a nearby hearth. The ring ditch enclosed a series of 13 postholes and a hearth towards the north-west end of the structure. However, the upper fill (006) of this hearth pit (069) did not contain any identifiable carbonised remains. A further pit (205/204) produced small amounts of oak charcoal with a single grain of naked barley and a possible grain of wheat.

	Area	Structure 3			Pit Group 7
	Context	135	152	192	744
	Sample	076	089	109	432, 12038
	Description	Fill of ring groove (136)	Fill of pit (153)	Fill of pot in pit (193)	Fill of pit (743)
Volume of charcoal >4 mm		2.5ml	5ml	-	2.5ml
% charcoal >4 mm ID		100%	100%	-	100%
Charcoal					
Alnus cf glutinosa	alder	1 (0.04g)	18 (1.00g)	-	10 (0.17g)
Betula spp	birch	1 (0.02g)	2 (0.11g)	-	7 (0.08g)
Corylus cf avellana	hazel	2 (0.07g)	1 (0.03g)	-	1 (0.05g)
Ericales	heather type	1 (0.01g)	-	-	2 (0.04g)
Quercus spp	oak	-	3 (0.05g)	-	1 (0.02g)
Carbonised cereals					
Cereal indet	indet cereal	-	-	-	1
Carbonised seeds etc					
Corylus avellana nutshell	hazel nutshell	1 (0.02g)	22 (0.37g)	-	2 (0.02g)
cf Linum spp	flax	-	-	-	1

Table 4.10: Botantical remains from Bronze Age burials.

Structure 2 *(Table 4.11)*

Structure 2 was located in the north-east of the site and comprised a timber post structure that was delineated by a segmented gully (084). The northernmost section of the gully produced a large amount of carbonised material, with large fragments of charcoal present. The fill (084) dated to 1084 – 912 cal BC (UBA-39264) and 1192 – 998 cal BC (UBA-39265) of gully (085) produced a very diverse charcoal assemblage dominated by alder, birch and hazel, but with smaller amounts of oak and willow also present. There were also numerous indeterminate carbonised small twigs in the samples but only two indeterminate cereal grains and no hazel nutshell. This assemblage is consistent with general domestic hearth waste that has been dumped into the gully.

Structure 5 and the hoard *(Table 4.11)*

Structure 5 overlay the north-east corner of Structure 8. An upper occupation layer (276) dated 1082 – 905 cal BC (UBA-39278) and 1084 – 906 cal BC (UBA-39279) produced a loom weight, lithic artefacts and pottery fragments. The charcoal assemblage was very diverse with alder birch, hazel, heather type, oak and cf elm all present together with a few cereal grains, one of which was identifiable as naked barley. This assemblage is consistent with domestic hearth waste. Below occupation layer (276) was an earlier occupation layer (332) dated to 1118 – 931 cal BC (UBA-39283) but this only contained small amounts of birch, heather type and oak charcoal with no evidence for cereals.

The occupation layers overlay evidence for a timber post-built structure. The fill (261) of posthole (262) dated 2118 – 1914 cal BC (UBA-39277) produced significant amounts of alder charcoal with birch, cherry type and oak also present in small quantities. As before, this assemblage is more consistent with hearth waste or midden material than evidence for a post burnt in situ.

The Bronze Age hoard was found to the east of Structure 5. The wooden scabbard from the sword within the hoard provided an AMS radiocarbon date of 1118 – 924 cal BC (SUERC-75019, GU45283). The fill (046) of a posthole (045) near the hoard produced only a trace of oak charcoal and a couple of carbonised barley grains and so provides little additional information about the hoard or its environs.

Structure 6 *(Table 4.11)*

Structure 6 lay directly north of Structure 8 and comprised a timber post-built roundhouse, with 10 postholes visible together with a short gully (423) that formed the north-east section of the structure. The fill (422) of the gully dated to 1207 – 1016 cal BC (UBA-39289) produced charcoal of alder, birch, hazel, and oak with a trace of hazel nutshell, which is consistent with domestic hearth waste. However, a possible hearth (509/508) dated to 1379 – 1130 cal BC (UBA-39293) produced only small amounts of cherry type and willow charcoal together with a few cereal grains. These carbonised assemblages appear to represent very different episodes of burning. Two large pits were located towards the north edge of the structure. The fill (473) of pit (474) dated 2203 – 2037 cal BC (UBA-39291) produced only traces of alder, birch and oak charcoal, with a single fragment of hazel nutshell. This is a similar assemblage to that seen in the fill of gully (423) and these carbonised assemblages may be representative of general domestic hearth scatter across the structure.

Structure 14 *(Table 4.11)*

Structure 14 was located directly north of Structure 13 and was formed from 12 postholes with a large oval pit (1241) at its north end. Although the fill (1240) of pit (1241) produced burnt lithics and flecks of burnt bone it only contained a single tiny fragment of heather type charcoal.

Pit Group 1 *(Table 4.11)*

Pit Group 1 was a group of 14 pits located to the north of Structure 1. The most significant pit (053) had a fill (054) dated 3621-3370 cal BC (UBA-39262) that contained large amounts of alder and hazel charcoal, with small amounts of heather type, willow and oak charcoal and numerous fragments of hazel nutshell also present. The other dated pits that were examined from this grouping (062/061) 688-885 cal AD (UBA-39263), (235/234) 1043-903 cal BC (UBA-39274) and (245/244) 2138 – 1972 cal BC (UBA-39276) produced only traces of charcoal but with oak present in all fills. The AMS dates indicate that the pits within this group were not contemporaneous.

	Structure	Structure 1			Structure 2	Structure 5			Hoard
	Context	003	006	204	085	261	276	332	045
	Sample	001-008	037	116	047, 049	145	157, 170	222	026
	Description	Fill of ditch segment (004)	Upper fill of hearth pit (069)	Fill of pit (205)	Fill of ditch segment (084)	Fill of post-hole (262)	Occupation layer	Occupation layer	Fill of posthole (046) nr hoard
Volume of charcoal >4 mm		10ml	-	2.5ml	450ml	25ml	5ml	5ml	<2.5ml
% charcoal >4 mm ID		100%	-	100%	50%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	3 (0.11g)	-	-	67 (22.55g)	55 (3.94g)	5 (0.24g)	-	-
Betula spp	birch	3 (0.08g)	-	-	60 (17.26g)	16 (0.81g)	10 (0.51g)	1 (0.03g)	-
Corylus cf avellana	hazel	1 (0.03g)	-	-	117 (5.98g)	-	2 (0.07g)	-	-
Ericales	heather type	-				-	1 (0.02g)	5 (0.04g)	
Prunoideae	cherry type	-				1 (0.02g)	-	-	-
Quercus spp	oak	20 (0.30g)	-	14 (0.24g)	5 (0.30g)	1 (0.02g)	1 (0.02g)	6 (0.06g)	4 (0.04g)
Salix spp	willow	1 (0.01g)	-	-	16 (0.49g)	-	-	-	-
cf Ulmus spp	cf elm	-				-	1 (0.06g)	-	-
Indet charcoal	indet charcoal	-				-	-	-	
Indet small twigs	indet small twigs	-	-	-	48 (0.72g)	-	-	-	-
Indet rhizome	indet rhizome	2 (0.18g)	-	-	-	-	-	-	-
Carbonised cereals									
Hordeum vulgare var nudum	naked barley	-	-	1	-	-	1	-	-
Hordeum vulgare sl	barley	2	-	-	-	-	3	-	2
Triticum spp	wheat	-	-	-	-	-	-	-	-
cf Triticum spp	cf wheat	-	-	1	-	-	-	-	-
Cereal indet	indet cereal	7	-	-	2	-	1	-	-
Carbonised seeds etc									
Carex spp	sedge	-	-	-	2	-	-	-	-
Corylus avellana nutshell	hazel nutshell	4 (0.03g)	-	-	-	-	-	-	-
Euphorbia helioscopia	sun spurge	-	-	-	1	-	-	-	-
Polygonum aviculare sl	common knotgrass	-	-	-	-	-	-	-	-
Misc									
cf Fucoid seaweed	cf seaweed	-	-	-	-	-	-	-	-

Table 4.11: Botanical remains from Bronze Age structures and pit groups.

	Structure	Structure 6			Structure 14	Pit group 1			
	Context	422	473	508	1240	054	061	234	244
	Sample	252, 277, 278	262	293	763	031	034	132	137
	Description	Fill of gully (423)	Fill of pit (474)	Pit filled by (508). Possible hearth	Fill of pit (1241)	Fill of pit (053)	Fill of pit (062)	Fill of pit (235)	Fill of post-hole (245)
Volume of charcoal >4 mm		15ml	2.5ml	2.5ml	<2.5ml	30ml	<2.5ml	<2.5ml	2.5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%	100%	100%	100%
Charcoal									
Alnus cf glutinosa	alder	10 (0.23g)	6 (0.10g)	-	-	54 (2.72g)	-	1 (0.02g)	-
Betula spp	birch	7 (0.80g)	2 (0.03g)	-	-	-	1 (0.03g)	-	-
Corylus cf avellana	hazel	4 (0.16g)	-	-	-	34 (2.16g)	-	-	1 (0.02g)
Ericales	heather type	-	-	-	1 (0.01g)	10 (0.52g)	-	-	-
Prunoideae	cherry type	-	-	6 (0.19g)	-	-	-	-	-
Quercus spp	oak	5 (0.18g)	1 (0.02g)	-	-	1 (0.03g)	2 (0.02g)	3 (0.05g)	4 (0.08g)
Salix spp	willow	-	-	1 (0.09g)	-	1 (0.12g)	-	-	-
cf Ulmus spp	cf elm	-	-	-	-	-	-	-	-
Indet charcoal	indet charcoal	1 (0.02g)	-	-	-	-	-	-	-
Indet small twigs	indet small twigs	-	-	-	-	-	-	-	-
Indet rhizome	indet rhizome	-	-	-	-	-	-	-	-
Carbonised cereals									
Hordeum vulgare var nudum	naked barley	-	-	-	-	-	-	-	-
Hordeum vulgare sl	barley	-	-	-	-	-	-	-	-
Triticum spp	wheat	-	-	1	-	-	-	-	-
cf Triticum spp	cf wheat	-	-	-	-	-	-	-	-
Cereal indet	indet cereal	-	-	2	-	-	-	-	-
Carbonised seeds etc									
Carex spp	sedge	-	-	-	-	-	-	-	-
Corylus avellana nutshell	hazel nutshell	1 (0.01g)	1 (0.03g)	-	-	46 (0.85g)	-	-	2 (0.01g)
Euphorbia helioscopia	sun spurge	-	-	-	-	-	-	-	-
Polygonum aviculare sl	common knotgrass	-	-	-	-	-	-	-	-
Misc									
cf Fucoid seaweed	cf seaweed	-	-	-	-	-	-	-	-

Table 4.11 (continued): Botanical remains from Bronze Age structures and pit groups.

	Structure	Pit group 3			Pit group 9
	Context	217	220	226	4000
	Sample	121	124	127	4000
	Description	Fill of pit (216)	Fill of pit cut (221)	Fill of pit (227)	Fill of pit (4001)
Volume of charcoal >4 mm		<2.5ml	<2.5ml	5ml	<2.5ml
% charcoal >4 mm ID		100%	100%	100%	100%
Charcoal					
Alnus cf glutinosa	alder	2 (0.09g)	-	-	-
Betula spp	birch	-	1 (0.03g)	15 (0.44g)	-
Corylus cf avellana	hazel	-	-	-	-
Ericales	heather type	-	-	10 (0.15g)	-
Prunoideae	cherry type	-	-	-	-
Quercus spp	oak	1 (0.01g)	2 (0.10g)	-	10 (0.12g)
Salix spp	willow	-	-	1 (0.02g)	-
cf Ulmus spp	cf elm	-	-	-	-
Indet charcoal	indet charcoal	-	-	1 (0.02g)	-
Indet small twigs	indet small twigs	-	-	-	-
Indet rhizome	indet rhizome	-	-	-	-
Carbonised cereals					
Hordeum vulgare var nudum	naked barley	-	-	-	-
Hordeum vulgare sl	barley	-	-	-	-
Triticum spp	wheat	1	1	-	-
cf Triticum spp	cf wheat	-	-	-	-
Cereal indet	indet cereal	-	-	-	-
Carbonised seeds etc					
Carex spp	sedge	-	-	-	-
Corylus avellana nutshell	hazel nutshell	-	-	-	-
Euphorbia helioscopia	sun spurge	-	-	-	-
Polygonum aviculare sl	common knotgrass	1	-	-	-
Misc					
cf Fucoid seaweed	cf seaweed	-	1 (0.01g)	-	-

Table 4.11 (continued): Botanical remains from Bronze Age structures and pit groups.

Pit Group 3 *(Table 4.11)*

Pit Group 3 was a group of 15 pits and postholes located to the east of Structure 3. Pits (216/217) dated 1222 – 1044 cal BC (UBA-39271) and (221/220) 3762 – 3642 cal BC (UBA-39272) produced only traces of charcoal but each contained a single carbonised wheat grain, although the AMS dates indicate they were not contemporaneous. In addition, fill (220) also produced a single fragment of possible seaweed, which was the only fragment of seaweed on the site. The site is close to the coast and so it would not have been difficult to collect seaweed but its use on the site is unknown. The fill (226) 914-816 cal BC (UBA-39273) of pit (227) was slightly more charcoal-rich than the other pits in this group, with birch, heather type and willow charcoal present, but there was no evidence for cereals or nutshell.

Pit Group 9 *(Table 4.11)*

Pit Group 9 comprised a group of 11 pits and postholes located to the south of Structure 8 and west of Structure 13. The fill (4000) of pit (4001) produced only small amounts of oak charcoal, but not enough to suggest burning of a post in situ.

Later Structure 4 and Area N

Structure 4 was the only stone-built structure on the site. It comprised a stone-built platform that was aligned east to west. It was found beneath charcoal deposit (255) that was dominated by heather type charcoal, with small amounts of alder and birch also present together with two grains of barley. Deposits (253 and 5059) formed the matrix between the stones of Structure 4. The latter was dated to 972 – 1155 cal AD (UBA-39335). Both deposits contained carbonised heather type stems, with traces of hazel nutshell, while (5059) also contained traces of hazel and oak charcoal (Table 4.12). Once the stone fabric of Structure 4 was removed, two pits were located. The fill (5061) of pit (5062) also produced heather type charcoal, with traces of birch, Scots pine and cherry type charcoal with two indeterminate cereal grains dated to 769 – 888 cal AD (UBA-39336). The heather type stems from this structure could be evidence for either roofing or flooring material.

A shallow curvilinear gully (723) (in Area N) was located to the north-east of Structure 4 but the fill (722) of this gully dated to 3709 – 3638 cal BC (UBA-39357) contained only traces of oak, heather type and hazel nutshell, and the AMS date indicates that the fill of the gully was not contemporaneous with the rest of Structure 4.

Discussion

The excavators considered that at least three periods of occupation had been identified at Carnoustie and this is supported by the carbonised plant remains and the AMS radiocarbon dating.

The early Neolithic

Structure 8 was initially considered to be the earliest evidence for human occupation and AMS dating confirms that this structure was a large early Neolithic timber hall. The second timber hall, Structure 13, dates to the same period.

The charcoal assemblage from Structure 8 was overwhelmingly dominated by oak, which made up over 90% of the charcoal identified from this structure. When just the exterior posthole fills are considered, oak formed 94% of the identified charcoal. The only other type of charcoal that had any significant representation in Structure 8 was alder (7% of all charcoal). All other charcoal types were present at levels less than 1% of the total charcoal identified. It is probable that at least some of this oak was the remains of structural timbers and that the hall was built from oak posts. This would correspond with the charcoal assemblages recovered from other Neolithic halls in Scotland, particularly Balbridie (Fairweather and Ralston 1993), Claish Farm

	Area	Structure 4				Area N
	Context	253	255	5059	5061	722
	Sample	158	142	5032	5033	421
	Description	Deposit between stones at base St4	Layer overlying Structure 4	Fill of structure 4 matrix	Fill of post-hole (5062)	Fill of curvilinear cut (723)
Volume of charcoal >4 mm		<2.5ml	5ml	2.5ml	5ml	<2.5ml
% charcoal >4 mm ID		100%	100%	100%	100%	100%
Charcoal						
Alnus cf glutinosa	alder	-	1 (0.05g)	-	-	-
Betula spp	birch	-	1(0.03g)	-	1 (0.03g)	-
Corylus cf avellana	hazel	-	-	3 (0.09g)	-	-
Ericales	heather type	18 (0.13g)	77 (0.88g)	65 (0.44g)	58 (0.66g)	1 (0.01g)
Pinus sylvestris type	Scots pine type	-	-	-	1 (0.05g)	-
Prunoideae	cherry type	-	-	-	1 (0.04g)	-
Quercus spp	oak	-	-	1 (0.02g)	-	4 (0.03g)
Carbonised cereals						
Hordeum vulgare sl	barley	-	2	-	-	-
Cereal indet	indet cereal	-	-	-	2	-
Carbonised seeds etc						
Corylus avellana nutshell	hazel nutshell	2 (0.01g)	-	1 (0.01g)	-	1 (0.01g)

Table 4.12: Botanical remains from Structure 4 and Area N.

(Barclay et al. 2002) and Lockerbie Academy (Kirby 2011). It has been suggested that these halls were destroyed by fire. If that also occurred at Carnoustie, then it may be that the hall did not have any significant amount of hazel wattle as walls or internal divisions etc. as it would be expected that much more hazel charcoal would have been recorded from the structure if hazel had formed a significant part of the structure.

It is also likely that oak was the main fuel source used in Structure 8, although alder may also have been used. Oak was the dominant tree type present in lowland broadleaved woodland during the Neolithic and so was readily available for both building structures and burning in hearths. From the Bronze Age onwards oak tended to become less abundant and so other tree types were used for hearth fuel whilst oak was kept for construction or for metalworking hearths where high temperatures are required.

Cereal grains were not abundant in Structure 8 (59 carbonised grains were recorded) but naked barley, emmer wheat and bread wheat were all represented. Naked barley, often with emmer wheat, is strongly associated with Neolithic and early Bronze Age sites in Scotland (Bishop et al. 2009). Wheat was slightly more abundant than barley but almost half the cereal grains recovered were too poorly preserved to be identifiable to species. The combination of emmer wheat, bread wheat and barley was also recorded from the Neolithic timber halls at Claish Farm and these cereal grains were particularly abundant at Balbridie. Bread wheat is very rare in the Scottish prehistoric archaeobotanical record but was abundant in Germany and Denmark during this period (Dickson and Dickson 2000, 67). It would seem that bread wheat was not commonly grown or eaten during the Neolithic in Scotland but its presence in features from Neolithic timber halls suggests that it may be associated with the status and function of these particular types of structures. There was no evidence for crop weeds or crop processing waste in any of the samples and so this might indicate that only fully cleaned grain was being brought into the structure.

The only other evidence for food plant remains from Structure 8 were carbonised hazel nutshell fragments, which were recorded from the majority of the features examined, and a few apple pips. Hazelnuts would have been a readily available food resource in the area. Roasting the nuts in the shells may make them easier to crack and also improves the flavour but these shells may just be the waste from raw hazelnuts that had been discarded into the hearth once the nut had been removed.

Apple pips are very rare in the Scottish archaeobotanical record but were found at both Claish Farm and Balbridie timber halls suggesting a connection with these particular structures, again perhaps in terms of status.

The second timber hall, Structure 13, had far fewer contexts examined than Structure 8 and so they may not provide such a comprehensive picture of plant use in the structure. As with Structure 13, oak was the commonest charcoal type present (73% of the total charcoal) with alder being higher than in Structure 8 at around 24%, with hazel at 2%, and birch and willow less than 1%. Again, it is likely that the structure was built from oak but, again, there is little evidence for any substantial use of wattle in the building. The main difference between the carbonised assemblages of Structure 13 and Structure 8 is that there were over eight times as many cereal grains in Structure 13 as in Structure 8. A total of 481 grains were recorded, but almost 60% were too poorly preserved to be identified to type. However, 35% of the cereal grains were identifiable as barley with 12% identifiable as naked barley, providing further evidence for a Neolithic date for this structure. The remaining grains were wheat, with a few further identifiable as emmer wheat but no bread wheat was found in this structure. As with Structure 8, no crop weeds or chaff were identified from this structure. As with Structure 8, hazel nutshell fragments were common in the samples, with over 5 grams of nutshell that was recovered from the fill (1134) of pit (1135). It appears that Structure 13 and Structure 8 may be contemporaneous, which might suggest that Structure 13 had more of a food preparation or storage function.

Areas beyond the halls

'Structure' 9 was a possible structure centred round a heat reddened area of sandy clay that may represent a hearth. The carbonised assemblage was limited, although alder and oak charcoal were present with a single cereal grain and fragments of hazel nutshell. This assemblage is similar to those seen elsewhere and probably represents scattered hearth waste.

'Structure' 10 was located in the south-east corner of the site and comprised a series of pits and deposits. Alder and oak charcoal were the main types present, with cereal grains including naked barley and emmer wheat with traces of hazel nutshell, which are in accordance with the Neolithic date for this structure and probably represents hearth waste.

'Structure' 12 was located in the south-east corner of the site and, like Structure 10, also comprised a series of pits, postholes and deposits. As with Structure 10, there was a mixed charcoal assemblage dominated by oak and alder but the cereal grains were more poorly preserved and so only barley and wheat could be identified rather than the specific varieties present. A possible flax seed was identified. Although flax is generally found in Norse and Medieval or later contexts in Scotland there are also limited finds from the Neolithic including from the timber halls of Balbridie and Lockerbie Academy. It could be that flax was restricted to these higher status sites and that Structure 12 may be related to the two timber halls on the site.

Activities in the outfield and pit groups

The area identified as 'Structure' 7 was defined by a discontinuous layer that produced large quantities of pottery fragments and some lithics but no evidence for postholes or gullies. This layer produced significant amounts of oak charcoal, but with no evidence for postholes this suggests the oak was being used for fuel along with birch and hazel. Only a single possible wheat grain and traces of hazel nutshell were recorded but AMS dating indicates that the use of this area may be early Neolithic in date.

The pit groups are more difficult to interpret as the pits within each group may not necessarily be contemporaneous with each other, as shown by the AMS dates from several of these groupings. The pit group contexts generally contained mixed charcoal assemblages with alder or oak dominating and small quantities of cereals and hazel nutshell present. These assemblages represent scattered hearth/midden waste that was probably spread across much of the site over time.

Pit Groups 5, 6, 10, 13, 15 and 17 all produced very large numbers of hazel nutshell fragments and so may be associated with hazelnut processing or storage and may date to the Neolithic period. In addition, Pit Groups 6, 10, and 26 contained naked barley and emmer wheat and so this cereal combination would also suggest Neolithic dates for some of these features. Pit Group 12 produced large numbers of cereal grains with 388 grains recorded. Of these all the identifiable grains were barley with more than a third of them identifiable as naked barley, but no wheat of any kind was recorded. This pit group also produced carbonised weed seeds, perhaps associated with the cereal grains. This may be related to processing or storage of grain and suggests that different cereal types were stored and/or processed separately.

The late Bronze Age

Structures 1 and 2 were the elliptical structures in the north-east of the site. For Structure 1 the charcoal assemblages are probably the remains of hearth waste rather than structural remains. Cereal grains include naked barley and possible wheat, with traces of hazel nutshell. Large amounts of charcoal were recorded from Structure 2 with alder, birch and hazel all abundant, but only a couple of indeterminate cereal grains were recorded. As with Structure 1, this assemblage would suggest hearth waste. The AMS dating indicates that these structures were late Bronze Age in date, indicating that naked barley was still being grown in this region long after the Neolithic/Early Bronze Age that is the more usual time frame for this cereal.

Structure 3, a possible barrow with a burial lay directly north of Pit Group 2 and over earlier features. The charcoal assemblages contained very little oak charcoal, with alder dominating and so these probably represent the remains of hearth waste, although no cereal grains were recovered and only a small amount of hazel nutshell.

Three circular timber post-built structures, Structures 5, 6 and 14, were found on the site. Structure 5 lay to the south-east of Structure 3 and was built over the north-east corner of Structure 8. As with Structure 3, the charcoal assemblage was dominated by alder, with very little oak present and so was probably hearth waste. A few cereals were recorded, including a single grain of naked barley, but dating again suggests a late Bronze Age date for this structure.

Structure 6 lay to the north of Structure 5 and comprised a timber post structure with an area of heat affected soil and fire cracked stones in the centre. A mixed charcoal assemblage with a few cereal grains, including a single grain of wheat, and traces of hazel nutshell suggest hearth waste from the central hearth area, that had been scattered across the building.

Structure 14 was located to the immediate north of Structure 13 but it produced only a trace of oak charcoal and so it is not possible to say anything further about this structure.

Later activities

A single cultivated flax seed was recorded from Pit Group 18 along with a range of weed seeds, large quantities of heather stems and a few cereal grains including oats and barley. This assemblage was very different from others seen elsewhere on the site and the early medieval AMS date shows that it represents a much later feature or group of features than the majority of features and structures on the site.

Structure 4 was the only stone-built structure on the site and it was located immediately to the east of the south-east end of Structure 8. The carbonised assemblages from Structure 4 were very different to those from Structure 8. The charcoal was dominated by heather type stems with only traces of other charcoal types included Scots pine and cherry type charcoal. The only identifiable cereals were a couple of barley grains, and traces of hazel nutshell were also recorded.

Animal Bone

By Catherine Smith

Introduction and condition of material

Excavations carried out at the site uncovered unexpected riches in the form of building plans, sherds of pottery, lithic artefacts, stone tools and a Bronze Age hoard. More mundane finds were also recovered, however, including fragmentary animal bones and teeth. Sadly the condition of the bone and tooth fragments was extremely poor and the fragment size small, prompting comparisons with crumbs or even dust. All of the bone fragments had been subjected to high temperatures in a fire and were white or grey in colour indicating that all of the organic matter had been burned out, leaving only the mineral component. The teeth were highly fragmented, probably as a result of firing, and no teeth survived entire. Only enamel fragments and the enamel islands within the teeth known as infundibula were recovered. Tooth dentine, which is softer than the enamel, did not survive. The colour of the surviving fragments ranged from ashy grey/white to light brown.

Results

None of the bone fragments were identifiable to species and all of the tooth fragments were thought to have come from cattle. The accompanying catalogue lists the animal bones and teeth by context and finds/sample number (Table 4.13). Fragment numbers above ten were estimated due to the degree of disintegration.

The cattle tooth fragments were all molars and premolars and in most cases it was not possible to distinguish mandibular from maxillary teeth. However, a fragmentary lower third molar (SF 389) was present in context (744) from Pit Group 7, and an enamel fragment (SF 12017) from an upper molar in the same context (744). The occlusal surface preserved in an enamel infundibulum (SF 12019), also in (744), may represent the fifth cusp of a lower third molar and showed signs of wear. If so, it came from an adult animal.

Context	Structure	Finds no	Sample no	Species	Bone	Details	Condition	Burnt/ calcined	Approx no fragments
003	St 1 layer	067		cattle	tooth	M enamel	vp	?burnt	1
003	St 1 layer	069		cattle	tooth	M enamel	vp	?burnt	1
744	PG7 fill of pit 743	385		cattle	tooth	M infundibulum & enamel shell	vp	?burnt	1
744	PG7 fill of pit 743	385		cattle	tooth	M enamel	vp	?burnt	10
744	PG7 fill of pit 743	389		cattle	tooth	M infundibulum; lower	vp	?burnt	4
744	PG7 fill of pit 743	389		cattle	tooth	M3, lower; enamel only	vp	?burnt	1
744	PG7 fill of pit 743	389		cattle	tooth	M enamel	vp	?burnt	20
744	PG7 fill of pit 743	389		cattle	tooth	M/PM enamel	vp	?burnt	100
744	PG7 fill of pit 743	12017		cattle	tooth	M infundibulum; upper	vp	?burnt	1
744	PG7 fill of pit 743	12017		cattle	tooth	M enamel; small fragments	vp	?burnt	60
744	PG7 fill of pit 743	12017		cattle	tooth	M enamel; larger fragments	vp	?burnt	20
744	PG7 fill of pit 743	12018		cattle	tooth	M enamel fragments	vp	?burnt	10
744	PG7 fill of pit 743	12018		cattle	tooth	PM enamel fragments	vp	?burnt	1
744	PG7 fill of pit 743	12018		cattle	tooth	M/PM enamel	vp	?burnt	50
744	PG7 fill of pit 743	12019		cattle	tooth	M infundibulum	vp	?burnt	3
744	PG7 fill of pit 743	12019		cattle	tooth	?M3 infundibulum; signs of wear	vp	?burnt	1
744	PG7 fill of pit 743	12019		cattle	tooth	M enamel fragments	vp	?burnt	40
772	St 1 round fire-pit 751	396		IM		prob. LBSF	c	calcined	1
811	PG6 fill of pit 791	4046		IM		fragment	c	calcined	1
980	St 12 layer	506		IM		fragment	c	calcined	3
2006	PG10 fill of fire-pit 2007	2002		IM		fragment	c	calcined	1
5021	PG15 fill of pit 5022	5028		IM		fragment	c	calcined	4
5055	PG15 fill of pit 5056	5009		IM		fragment	c	calcined	1
5059	St 4 fill	5014		IM		fragment	c	calcined	10
6010	PG10 fill of pit 6011	6003		ungulate	tooth	highly fragmented tooth enamel	vp	?burnt	1

Abbreviations

M	molar	M3	third molar	IM	indeterminate mammal	vp	very poor (condition)
PM	premolar	LBSF	long bone shaft fragment	MNI	minimum number	c	calcined

Table 4.13: Animal bone catalogue.

Context	Structure	Finds no	Sample no	Species	Bone	Details	Condition	Burnt/ calcined	Approx no fragments
11002	PG10 layer	8031		IM		fragment	vp	calcined	8
11007	PG10 fill of pit 11008	8032		IM		fragment	vp	calcined	10
11007	PG10 fill of pit 11008	8032		IM		fragment	vp	calcined	1
255	St 4 fill of 254		142	IM		fragment	c	calcined	27
734	PG18 fill of pit 735		427	IM		fragment	c	calcined	10
3017	PG12 fill of fire-pit 3016		3009	IM		fragment	c	calcined	9
4081	PG16 fill of fire-pit 4082		4041	IM		fragment	c	calcined	1
5015	PG14 fil of pit 5016		5007	IM		fragment	c	calcined	1
9042	PG25 fill of pit 9043		9024	IM		fragment	c	calcined	2

Table 4.13 (continued): Animal bone catalogue.

Based on the number of infundibula (the infolded enamel islands within the teeth) there were at least four different cattle teeth present in (744), the fill of pit (743). There were seven infundibula from lower/upper molars and one from an upper molar. These could have come from a single adult individual. The pit from which the cattle teeth came also contained quartz lithics and was part of a group of 12 pits in Pit Group 7. Small calcined bone and tooth fragments were also found in Pit Groups 10, 12, 14, 16 and 18.

Other tooth and indeterminate bone fragments came from Structures 1, 4 and 12: (003) ditch fill, (255) fill of a trench and (980) an occupation layer. Two features associated with cooking areas also contained bone fragments: (SF 396) was a deposit around a cooking pit (772) closely associated with Structure 1, and (SF 4046) from the basal fill (811) of cooking pit (791) in Pit Group 6 by the eastern edge of the trench, and it is not unexpected that the bone fragments were calcined by heat.

Interpretation

It is unfortunate but not surprising that the conditions of preservation across the site were not conducive to better bone survival. Outwith the Scottish islands, sites of Neolithic and Bronze Age date in mainland Scotland have not tended to produce well-preserved faunal assemblages. In addition, unburnt bone survives even less well than burnt bone since exposure to high temperatures changes the crystalline structure of the inorganic component of the bone allowing it a better chance of survival under burial conditions (Mays 1998, 209). The disadvantage is that burning shrinks and distorts the bone and even though calcined fragments may be retrieved, they are rendered morphologically unrecognisable. Fortunately, tooth fragments may be diagnostic and some did survive at Carnoustie, providing evidence that cattle had been present.

It is not implausible that the lithics found in pit (743) alongside the cattle tooth fragments may have been used in the processes of butchery or skinning of the animal from which the teeth came. Similarly, the fragments recovered from cooking areas may have resulted from food preparation. The animal fragments therefore provide evidence of human interactions with domestic livestock. Although only cattle were positively identified, it is probable that pigs, for which there was evidence at the Neolithic site of Claish near Stirling (Smith 2002) were also kept. The evidence from the hoard analysis also indicate that sheep were being used in the production of sheep skin and woollen cloth.

Soil Micromorphology

By Carol Lang

Introduction

This report summarises the findings arising out of the micromorphological analysis of undisturbed soil samples collected during the excavation by GUARD Archaeology at Balmachie Road, Carnoustie (Figure 4.3). Micromorphological investigation of the soil thin sections aimed to try to:

- determine the formation process of the soil in sample 50A Structure 1 and try to identify if there were different phases of sediment fill;
- determine the formation processes in samples 334/392 and 334/397 from 'Structure' 7 and determine if there had been a hiatus in the development of the sediments and;
- understand the deposition processes for the soil in sample 537 'Structure' 10, and try to determine the use of the structure.

The application of soil micromorphological techniques to the Carnoustie samples - the microscopic analysis of soil/sediment thin sections - can play a significant role in the archaeological investigation particularly when carried out with a methodical approach to observations and their interpretation.

Soil/sediment properties reflect the environment in which they have been formed, and so the recovery of known anthropic sediments from archaeological contexts has the potential to assist archaeologists to understand complex site formation processes related to past land use and the palaeo-environment. By applying micromorphological investigation to undisturbed soils it enables soil development properties to be examined: thickness, bedding, particle size, sorting, coarse to fine ratios, composition of the fine material, groundmass, colour, related distribution, microstructure, and distribution of inclusions, the shape of inclusions, and finally the inclusions to be identified and quantified. Additionally, these analyses can provide details of micro-artefacts, not seen by the naked eye during macromorphological analysis.

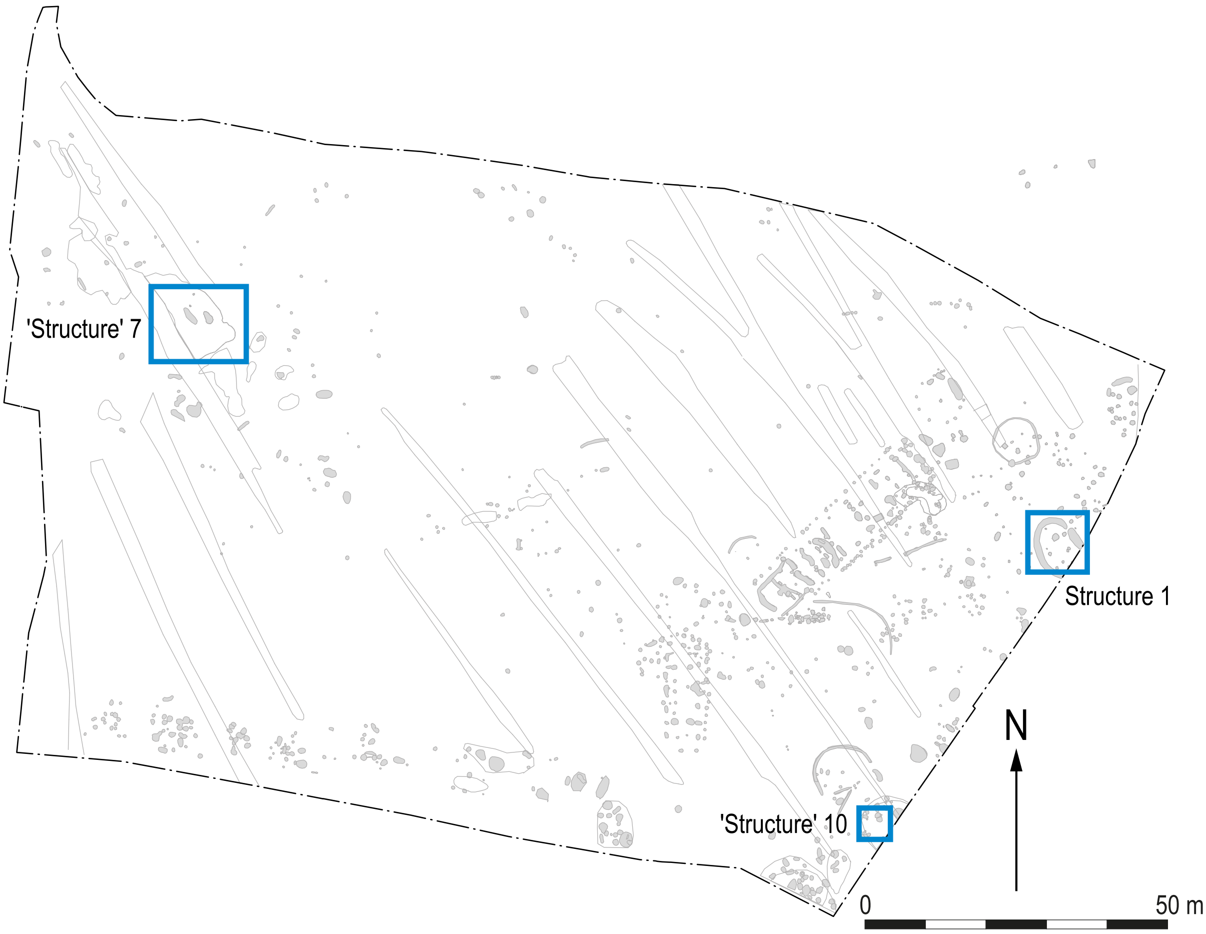


Figure 4.3: Location of the soil samples.

Methodology

The undisturbed soil samples were collected from a geoarchaeological test pit at approximate depth of 0.82 m (c. 27.37 OD). The sample was dried using the acetone exchange process to remove all the moisture and then impregnated using epoxy resin under vacuum. The impregnated soils were cured, and then sliced, bonded to glass slides (115 by 75 mm) and precision lapped to 30µm thickness to produce soil thin sections (Figure 4.4).

By following procedures laid out in the International Handbook for Thin Section Description (Bullock et al. 1985) and Guidelines to Analysis and Description of Soil Regolith Thin Sections (Stoops 2003) soil properties were recorded semi-quantitatively and adapted specifically for the Carnoustie samples. The thin sections were analysed using a Leica DMLP polarising microscope at a range of magnifications (x10- x400) and under Plane Polarised Light (PPL), Crossed Polarized Light (XPL) and where applicable Oblique Incident Light (OIL). Each light source allowed identification of specific microscopic features, such as, mineral and organic components, pedology and feature classification. All features observed were recorded on an Excel spread sheet with the limit of the coarse to fine material being 20µm (c/f20µm). Photomicrographs were taken using a Leica DFC295 camera attached to the microscope and utilising the Leica photographic processing software.

Results and Interpretation

The following sections show characterisation and interpretations of the micromorphological thin sections, with a summary of the frequency and type of pedology in each thin section recorded in a supplementary table (Table 4.14).

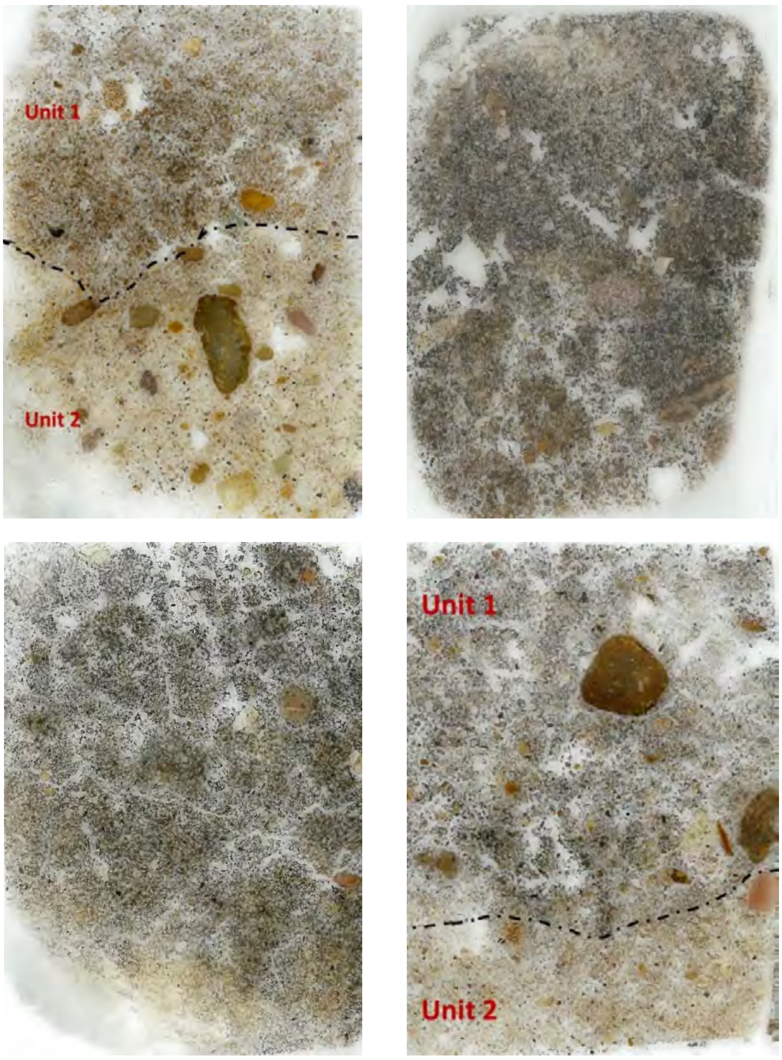


Figure 4.4: The soil thin sections from the three sections with the upper samples (50A Structure 1 and 537 'Structure'10) annotated to delineate the different depositional layers identified in the samples.

Thin Section No:	Unit No:	Related Distribution	c/f (20µm) (ratio)	Course Material Rock/Mineral						
				Quartz	Feldspar	Basalt	Microcline	Granitic Fragments	Amphibolite	Vivianite
334/397 'Structure' 7		Enaulic	2:03	*****	**	**	**	***	**	
50A Structure 1	1	Enaulic	2:03	*****		***		**		**
	2	Enaulic	2:03	*****		***		**		**
334/392 'Structure' 7		Enaulic	2:03	*****	**	***	**		**	
573 'Structure' 10	1	Enaulic	2:03	*****	**	***	**		**	
	2	Enaulic	2:03	*****	**	***	**		**	

Thin Section No:	Unit No:	Related Distribution	c/f (20µm) (ratio)	Course Material Organic					
				Woody Material	Charcoal	Amorphous Organic Matter	Bone	Root	Spherulites
334/397 'Structure' 7		Enaulic	2:03	***	***			**	
50A Structure 1	1	Enaulic	2:03		***		**		**
	2	Enaulic	2:03		***		**		**
334/392 'Structure' 7		Enaulic	2:03		***	**	**	**	
573 'Structure' 10	1	Enaulic	2:03		***	***	**		
	2	Enaulic	2:03		***	***	**		

Thin Section No:	Unit No:	Related Distribution	c/f (20µm) (ratio)	Groundmass					Pedofeatures
				PPL	XPL	Peds	Voids	Development	Redoximorphic nodules
334/397 'Structure' 7		Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Moderate	**
50A Structure 1	1	Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Weak	**
	2	Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Weak	**
334/392 'Structure' 7		Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Weak	**
573 'Structure' 10	1	Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Weak	**
	2	Enaulic	2:03	Dotted	Speckled	SA-B	Channel, Vesicle, Vughs, Chambers	Weak	**

Table 4.14: Supplementary table with a summary of the main micromorphological observations and the frequency of the features from Carnoustie, Angus, Scotland.

Coarse mineral and rock materials from the samples at Carnoustie are derived from the volcanoclastic parent material of the area, with the predominant fractions identified as sub-angular and sub-rounded quartz, basalt, mica schist (Figure 4.5A) and microcline, while large quartzite inclusions (>2500 µm) were identified in all samples.

There was no difference in the coarse to fine (c/f) distribution in the samples with a ratio of 2:3, while the related distribution, the arrangement of the coarse to fine material in the groundmass, was Enaulic. The fine material had a dotted limpidity in PPL illumination, the dotted appearance from the presence of micro-debris (<20 µm) such as redoximorphic nodules, micro-charcoal and amorphous organic matter (Macphail and Goldberg 2018). The microstructure of the samples was sub-angular blocky with all samples exhibiting a weak microstructure. The peds within the microstructures were separated by inter-pedal channel voids and contained intra-pedal vughs, vesicles and chambers.

All samples displayed a moderate frequency of amorphous organic matter in the fine matrix and displayed low frequency of redoximorphic nodules (~5%) development. The nodules were visible in the fine matrix, their development occurring in situ (orthic) through the accumulation of small pockets of localised waterlogging from soil water. The wetting and drying of the soil providing reduction and oxidation to occur and nodules to development, the presence of amorphous organic matter providing an added catalyst for the development of these pedofeatures (Lindbo et al. 2010).

Sample 50A Structure 1

Vivianite was observed in sample 50A Structure 1 (Figure 4.5C) where this secondary phosphate mineral had developed on a phosphate nodule, the nodule possibly a small fragment of bone that had degraded as there was no visible birefringence (Child 1995). The development of the vivianite is indicative of phosphate precipitation normally from the soil colloids, but in this case bone, during localised anoxic periods, normally occurring due to localised waterlogging (Heiberg et al. 2012).

Spherulites (Figure 4.5D) were identified in the sample; embedded in organic material from sample 50A Structure 1, the presence of these features being related to faecal material, the origins of which cannot be determined; however, the level of preservation would indicate relatively dry and pH neutral (Canti 1997).

Sample 537 'Structure' 10

Along with the presence of amorphous organic matter in this sample inclusions of partially degraded woody material (Figure 4.5B) were exhibited in the fine matrix. Dusty coatings (Figure 4.5B) had developed around the woody fragments suggesting there had been some disturbance in the soil (Macphail et al. 1990). The sample displaying a visible difference in the deposited sediment in this section, with the lower material displaying a red/brown colour in contrast to the dark brown of the upper sediment. Additionally, the upper fill displayed a higher frequency of larger coarse fractions.

Samples 334/392 and 334/397 'Structure' 7

Partially degraded woody fragments were identified in sample 397/002, these fragments displaying ferruginisation from the reduction and oxidisation processes affecting the iron minerals in the soil. Additionally, root fragments were also identified. Charcoal (~5%) was exhibited in both samples, while a low frequency of partially degraded bone (~2%) was also observed in 334, the degradation of the bone indicated by the level of birefringence under XPL illumination (Child 1995).

Discussion

The overall composition of all the soils in the samples indicated that they had formed with material from the surrounding area with the coarse mineral/rock fraction of the samples, indicative of the volcanoclastic parent material. All samples contained fragments of charcoal suggesting there had been anthropogenic burning in the local area (Macphail and Goldberg 2018)

Sample 50A Structure 1

The formation of redoximorphic nodules in this sample indicates that there has been wetting and then drying of the soil, with pockets of soil water providing the mechanism for the development of the nodules. Additionally, the presence of amorphous organic matter has provided a catalyst

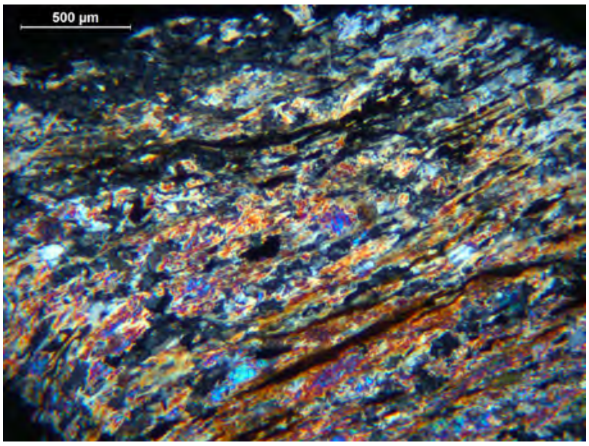


Figure 4.5A: Mica schist fragment typical of the volcanoclastic nature of the rocks and mineral coarse fraction in all sample (XPL).

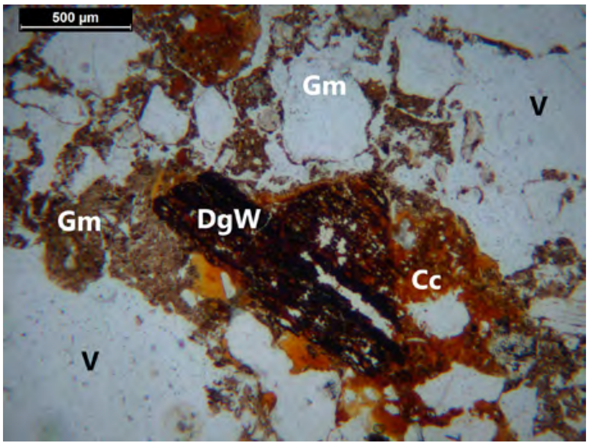


Figure 4.5B: Degraded woody material (DgW) surrounded by clay coatings (Cc) in the groundmass (Gm) and adjacent to voids (V) (PPL).

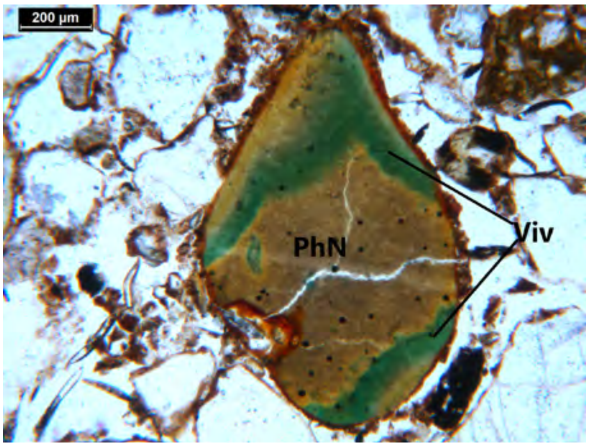


Figure 4.5C: A phosphate nodule (PhN) containing secondary vivianite (Viv) mineral from sample 50A STR1 (PPL).

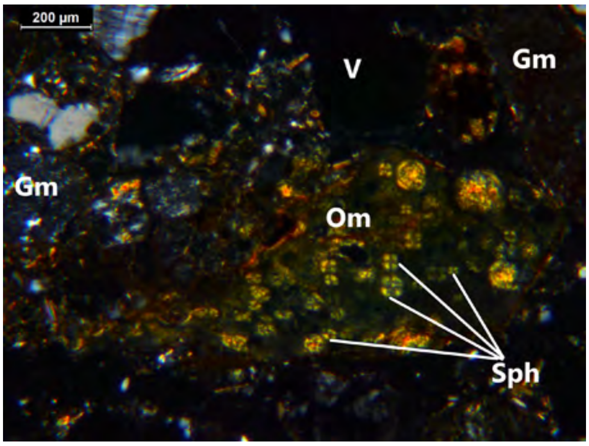


Figure 4.5D: Organic matter (Om) inclusion (Probably faecal matter) containing spherulites (Sph) within the groundmass (Gm) of sample 50A STR1 (Unit 2) and adjacent to a void (V) (XPL).

for this reaction to occur (Lindbo et al. 2010). The presence of the vivianite, which forms during periods of soil waterlogging, also suggests the soil in this sample has undergone waterlogging; the vivianite indicative of prolonged periods of waterlogging (Heiberg et al. 2012).

The presence of a diffused boundary in the sample is evident that soil had developed through two distinct depositional events. The composition of the soil was, however, similar in the composition of the coarse and fine fractions suggesting a similar origin, with the presence of larger fragments of coarse material pointing to colluvial deposition in the lower unit (Unit 2) with the lower unit deriving from alluvial or in wash material due to the finer nature of the sediments.

The presence of faecal spherulites in the lower part of the sample indicated that there has been faecal material deposited in the feature. The microstructure pointing to the faecal material being washed into the features, from the surrounding environment, as there was no evidence of bioturbation from soil meso or micro-fauna.

Sample 537 'Structure' 10

The soil thin section showed evidence of sequential sediment deposition, with a diffused boundary between the sediment in the lower part of the sample (Unit 2) and the upper area (Unit 1). The lower sediment (Unit 2) displaying increased reddening suggesting there had been an increased frequency of wetting and drying, thus reduction and oxidation processes allowing the precipitation, translocation and dissolution of iron, consequently reddening the soil due to the presence of increased sesquioxides. It is evident that there was degraded organic matter throughout the sample, this being a catalyst in the lower unit to increase the presence of sesquioxides (Lindbo et al. 2010). The organic material, across the whole sample, displayed no evidence of structure or cellular form and there were no visible phytoliths indicating there had been complete degradation. There were, however, fragments of partial degraded wood, this being surrounded by dusty coatings, their development would indicate that there has been disturbance of the soil, with soil colloids becoming disaggregated eventually percolating through the sample in soil water, being deposited onto surfaces and in voids. There is no indication of the disturbance; however, it can occur through the removal of surface covering such as grass or due to trampling from animals or humans (Macphail et al. 1990; Usai 2001)

The composition of the sediment and the presence of large fraction in the upper unit (1) would point to different methods of deposition, with the lower material be deposited from alluvial means, while the upper material, due to the large fractions of rock/mineral developing through colluvial deposition.

Samples 334/392 and 334/397 'Structure'7

The upper sample 334/392 and the lower sample 334/397 were very similar in composition, with the size of the coarse fraction comparable and the frequency of amorphous organic matter and charcoal content also comparable, with both samples being collected from 'Structure' 7. The lower sample 334/397 was collected across stratigraphic boundaries, however there was no significant difference in the composition of the upper and lower parts of the sample this indicating successive deposition with no hiatus. The woody fragments, similar to sample 537 'Structure' 10 had inclusions of partially degraded wood; the material had undergone ferruginisation, the reddening of the material due to reduction and oxidation processes and the dissolution of iron.

Root material was evident in the upper sample (334/392), the high levels of birefringence indicative little degradation had occurred (Babel 1975), pointing to these root fragments being modern. Degraded bone was evident in sample 334/392, the birefringence of the bone when examined under XPL illumination providing evidence that there was partial degradation. There was no evidence of bone in sample 334/397, this being the only sample exhibiting no bone, this may suggest that there has not been anthropogenic material in this sample, however, anthropogenic fragments of charcoal were evident, the sample is merely devoid of bone.

Conclusions

The undisturbed soil samples collected from the archaeological investigation of the site at Carnoustie indicated that the sediment in the samples was derived from similar volcanoclastic parent material. It is evident that there was differentiation in the pedogenic processes between samples at the site, while the anthropogenic signature in the form of charcoal was ubiquitous in all samples.

Waterlogging had affected sample 50A Structure 1 and this was evident with the formation of secondary minerals and the development of redoximorphic features. Furthermore, the sample had developed over two deposition events, differentiated by the sediment size with the lower deposits containing faecal matter washed into the features prior to further colluvial sediments being deposited.

The development of the sediment in 'Structure' 10 is very similar to that of Structure 1, with two different depositional event the first containing larger colluvial sediment and a later in-wash event. The lower sediments were affected by the movement of iron sesquioxides due to localised waterlogging. The development of disturbance features in the sediments is indicative of either trampling or exposure of the upper soil surface, the mechanism cannot be determined through the evidence available.

'Structure' 7 displayed evidence of bioturbation from modern roots in the upper sample, while historic woody material was identified in both the upper and lower sample units. There was no evidence that there was a compositional difference in the B-horizon soils of the site 002 and that of the lower sediment in the fill of the feature; delineation was not visible and the development of the sediment in the features showed no hiatus in its deposition.

Multi-element analysis

By Dorothy McLaughlin

Summary

Multi-element analysis was used to help determine if there were discernible differences between four different, but presumed structures, identified at the Carnoustie site and if these differences suggest particular functions at those structures.

Introduction

200 samples were sent to the University of Stirling for multi-element analysis using X-ray Fluorescence (XRF). These samples were collected from four sub-divided structures (Structures 5, 7, 10 and 12) identified during the archaeological excavation. The structure numbers were further differentiated into 5, 5A, 7, 7A, 7B, 10, 10A and 12 to account for samples with duplicate numbers from different contexts. This was a development area on the outskirts of Carnoustie (Figure 1.1), which was used as arable land and was fallow at the time of the excavation (Part 2: The Excavation Results).

Figure 4.6 shows the extent of the excavation features and highlights the structures that are covered by this report. Structure 5 was circular and lay in the north-eastern quadrant of the site and overlying Structure 8, which was not covered in this report. It is possibly an occupation layer that comprised two different soil types identified as two different contexts: (276) dark brown silty sand and (332) dark brown/black silt. 'Structure' 7 was designated as a miscellaneous structure in the north-western corner of the site also thought to be an occupation layer. 'Structure' 10, also designated as a miscellaneous structure in the south-eastern corner contained a semi-circular spread of charcoal-rich silty sand. 'Structure' 12 had a similar sediment composition, also in the south-eastern corner, which was identified as an occupation layer with firm, pale grey-brown with lenses of dark black-brown silty sand (Part 2:

Figure 4.6: Location of individual structures analysed.

The Excavation Results). The geology of the site, comprising fluvioglacial till over sandstone and raised marine deposits, is discussed in Part 1: Site location, topography and geology.

Areas that have seen past human occupation and settlements have a propensity to have an increased intensity of certain elements within the soil such as Zinc (Zn) associated with Lead (Pb) and Tin (Sn) that could be related to metal working (Cook et al. 2005). Elevated levels of Phosphorus (P), Barium (Ba) and Manganese (Mn) can be linked to previous site activity such as soil augmentation for agricultural purposes and the disposal of organic waste. Similarly, the analysis of Magnesium (Mg), Calcium (Ca), Strontium (Sr) and Potassium (K) are also examined to determine and interpret sites thought to have been utilised as settlements (Entwistle et al. 1998). Increased concentrations of Iron (Fe) and Manganese (Mn) can be related to the application of pigments to dwellings or butchery areas (Entwistle et al. 1998; Parnell et al. 2002; Wilson et al. 2005 and 2008). Multi-element soil analysis can help identify spatial patterns within a study area and elucidate whether it was likely to have been used for human and/or animal activity.

Methodology

Samples were collected on site by the archaeological team at GUARD Archaeology Ltd. The following grids show the sampling locations (Figures 4.7-4.11).

Nine elements commonly identified in increased intensity at archaeological settlement sites were considered for statistical analysis (Cook et al. 2005; Entwistle et al. 1998; Parnell et al. 2002; Wilson et al. 2008). Pellets of 5 cm diameter were prepared by pressing approximately 10 g of air-dried soil, previously sieved to 2 mm, to a pressure of 12 tons using a Perkin-Elmer press. Element concentration determination was performed with XRF spectrometry using an Energy Dispersive Thermo Scientific NITON handheld XL3 Series analyser. Five replicates were measured per sample for quality control.

Analysis of variance (ANOVA) was performed using MINITAB 17 software to determine whether there is a relationship between elemental concentrations. Principal component analysis (PCA) was performed using MINITAB 17 statistical analysis software to determine the variation of the variable.

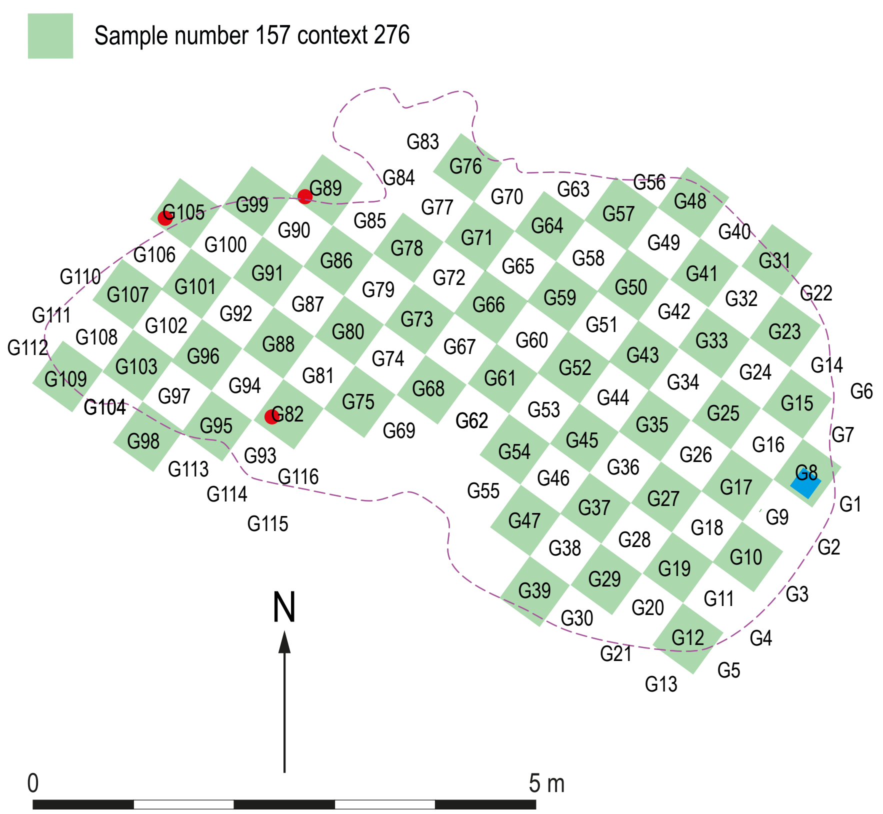


Figure 4.7: Structure 5, context 276 samples (green) from Carnoustie. The red dots indicate grids that were not sent for analysis while the blue square indicates an additional sample that was sent for analysis.

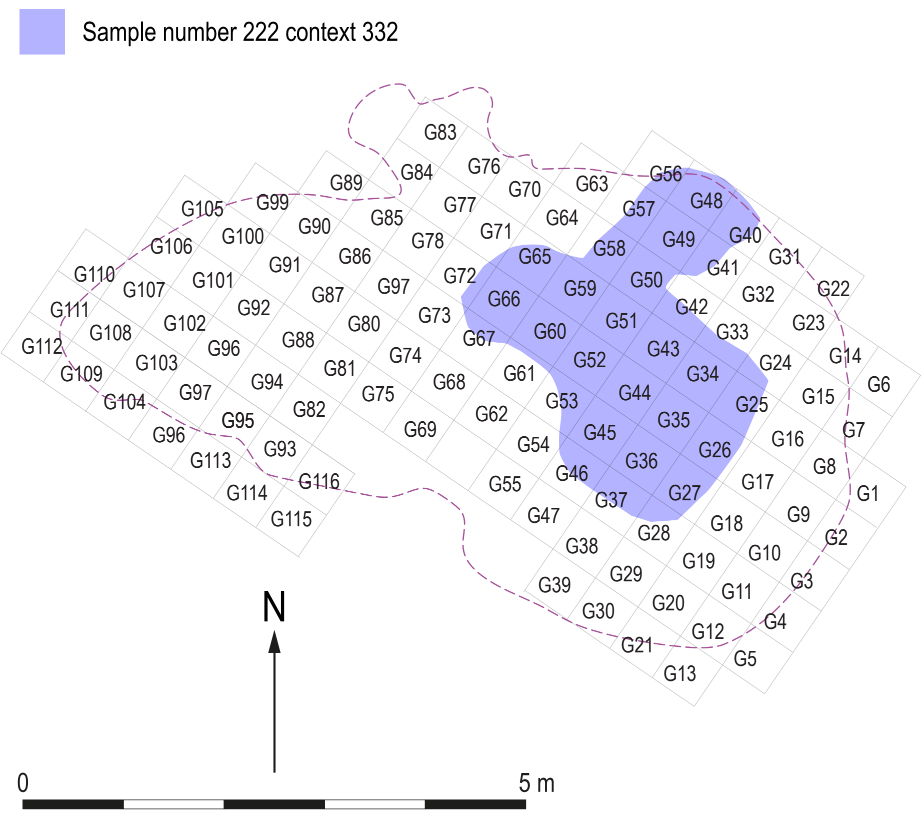


Figure 4.8: Structure 5, context 332.

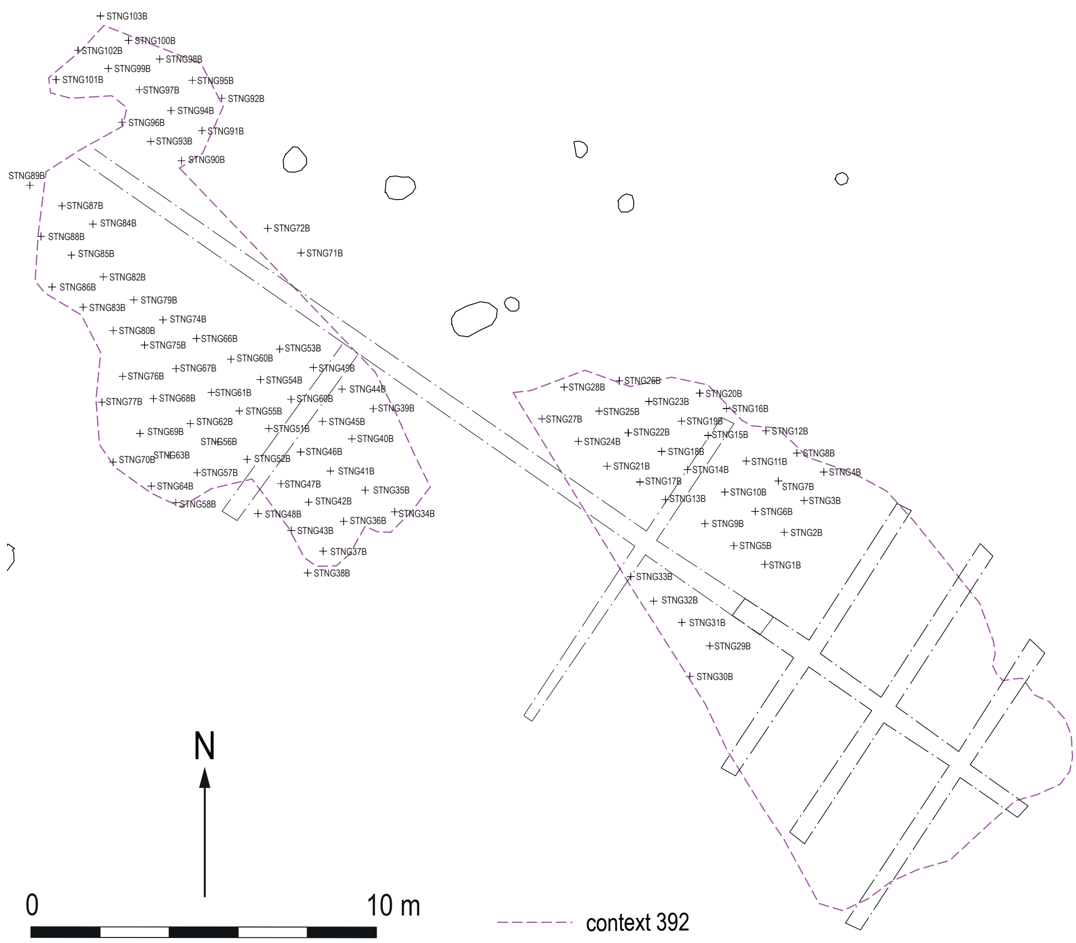


Figure 4.9: The sampling grid for 'Structure' 7.

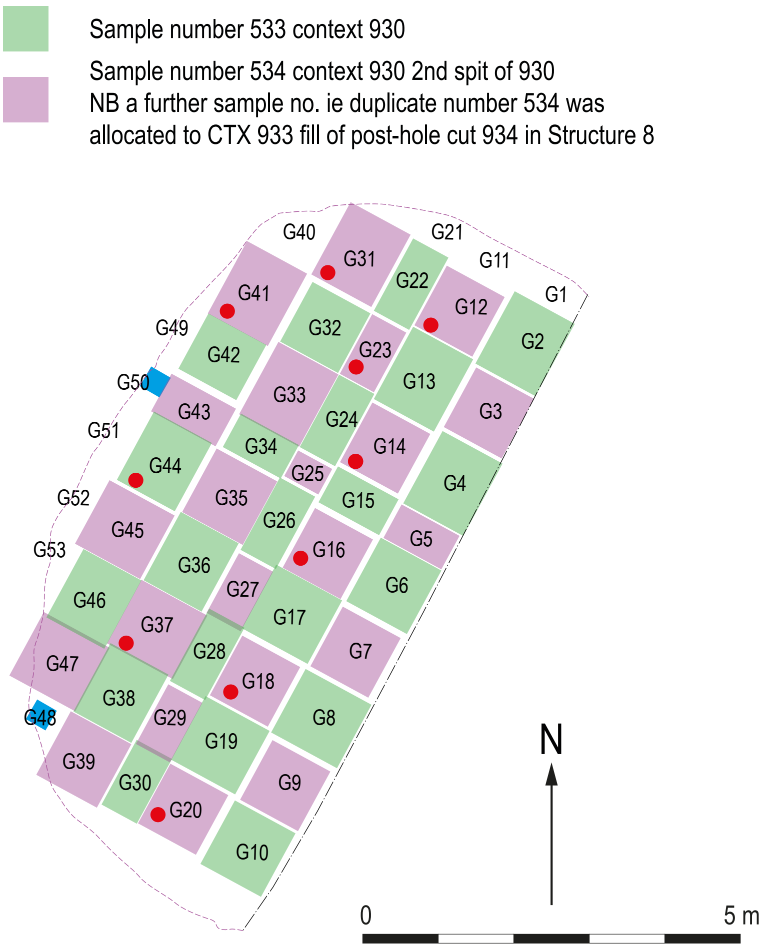


Figure 4.10: 'Structure' 10, sampling number 533 (green) and sampling number 534 (purple). The red dots indicate grids which were not sent for analysis and the blue square indicates additional samples sent.

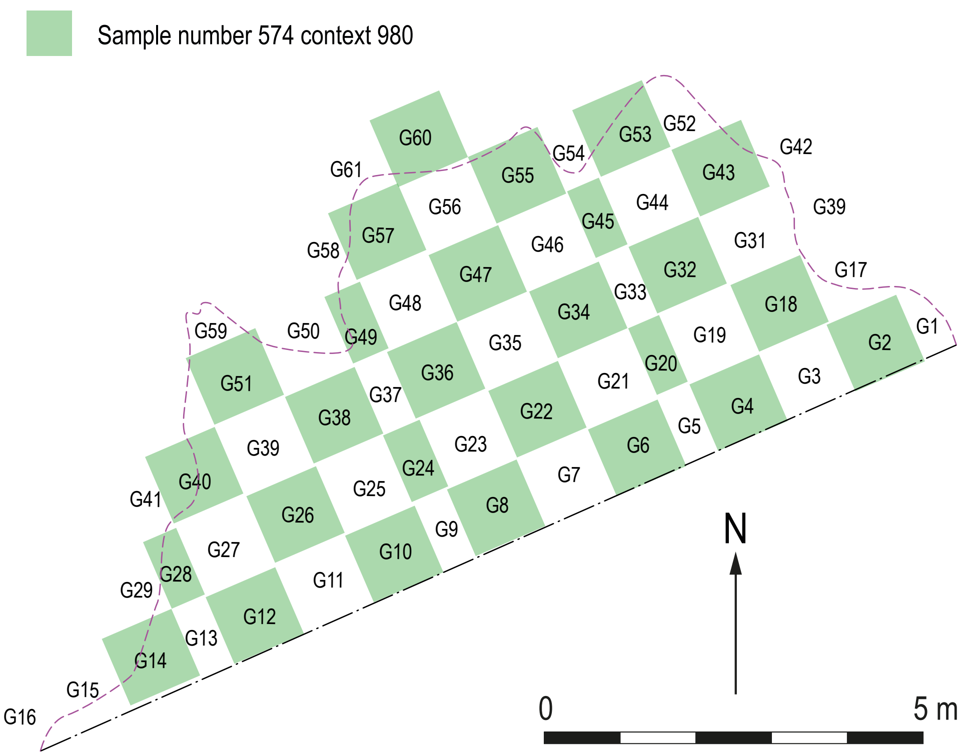


Figure 4.11: Sampling grid for 'Structure 12' (green). The red dots indicate sample grid numbers which were not sent for analysis.

Results

The XRF provided details of the concentration of 36 chemical elements in the samples. An initial examination of the data showed that most of these elements appeared in very small concentrations. Therefore, nine elements displaying increased concentrations were selected for statistical analysis[1] (Figure 4.12). The subgroup of elements comprised Barium (Ba), Strontium (Sr), Zinc (Zn), Iron (Fe), Manganese (Mn), Calcium (Ca), Potassium (K), Phosphorus (P) and Sulphur (S).

The highest levels of Sr (88.31±3.26) and Fe (77.60±3.26) were identified in the control samples with Structure 7A having the lowest levels of Ba, Zn, Fe, Mn and P. Structure 5A exhibited the highest levels of Ba (600.29±51.65), Zn (58.46±13.65), Mn (1908.11±586.96) and P (4420.12±1021.14).

Analysis of variance (ANOVA) was undertaken on the samples to determine the relationship between the sample collected in different contexts (deposits) and the structure. It was evident that there was a strong relationship between the concentration of P and both constant variables of: structure (r2=0.80) and; deposit (r2=0.80). There strong relationship between Fe and structure (r2=0.70) and Mn and both structure (r2=0.67) and deposit (r2=0.67). There was little relationship between the structure and deposit variables when analysed against Ca, Ba, Zn, Zr, K and S.

PCA (Figure 4.13) shows PC1 and PC2 account for 67% of the variability of the elemental concentration. The first three PCs account for 82.8%. PC1 b(41.1%) relates with high positive loadings from P, Fe and Ba are positively while PC2 (25.9%) relates to the negative loading of Zn and positive loading of K. PC3 relates to Sr and Ca. Figure 10 shows 2 distinct soil populations.

Interpretation

It is evident from the analysis that there was a higher concentration of P (Phosphorous) in Structure 5 when compared to the other structures, with almost double the concentration of 'Structure' 7. An increase in the concentration of Ba (Barium) was also identified in Structure 5. This increase in these particular elements, although not conclusively indicative of specific activities are known to be related to basic patterns of anthropogenic enhancement from midden or hearth areas of settlements (Wilson et al. 2005). The ANOVA undertaken on the elemental analysis confirms that P shows a strong relationship between both deposit (all contexts) and all structures. This therefore suggests

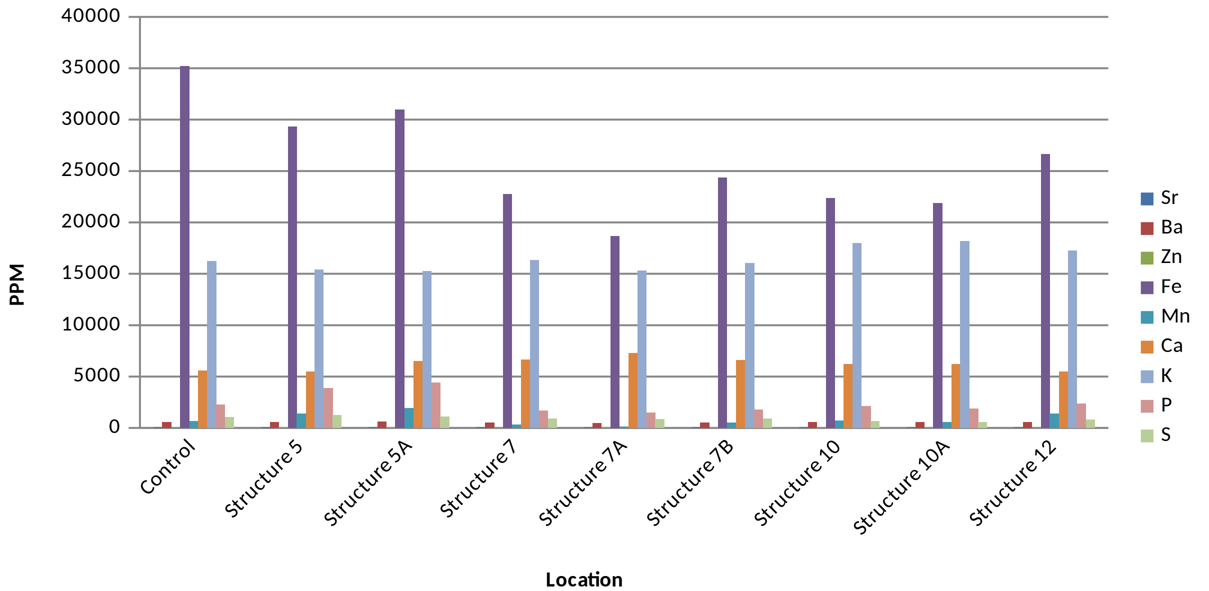


Figure 4.12: Mean concentrations (PPM) of the nine sub-group elements in the different structures compared to the control samples.

1. The table of basic statistics for the elemental analysis of the controls and samples collected from the tested structures at the Carnoustie site forms part of the site archive.

that all sample locations on the site have basic anthropogenic signatures as supported by PCA (Figure 4.13), with Structure 5 having the greatest relationship.

The control samples contained the highest levels of Fe (Iron); this would suggest that there has been a higher level of recent wetting and drying in the location of the controls. Wetting and drying of the soil provides the mechanism for Fe to precipitate, translocate and come out of solution during periods when the soil undergoes redox conditions. Fe forms areas of concentration that are typically identified in mottles or nodules (Lindbo et al. 2010). Additionally, if the controls were taken near the topsoil the organic matter in the soil provides a catalyst to increase this process both in Fe and to an extent Mn. It is evident, however, from Figure 10, the PCA highlights the difference in the control soil compared to the samples collected from the structures, thus indicative of different pedological development.

Conclusions

Multi-element soil analysis was undertaken on bulk soil samples collected from Carnoustie. The elemental data provides evidence for inter-site differences between the samples collected in the different structures. However, there was no notable difference in the intra-site elemental concentrations, this being confirmed through statistical analysis, where two distinct soil signatures were identified: the controls and the structure.

It is evident that there had been anthropogenic activity across all structures, with Structure 5 having the highest concentrations of anthropogenically generated signatures. The concentrations of elements in this location suggest that there had been a high level of activity particularly in this structure. The elemental concentrations cannot, however determine specific activities but it can be hypothesised that either animal penning or concentrated food preparation or 'middening' had occurred.

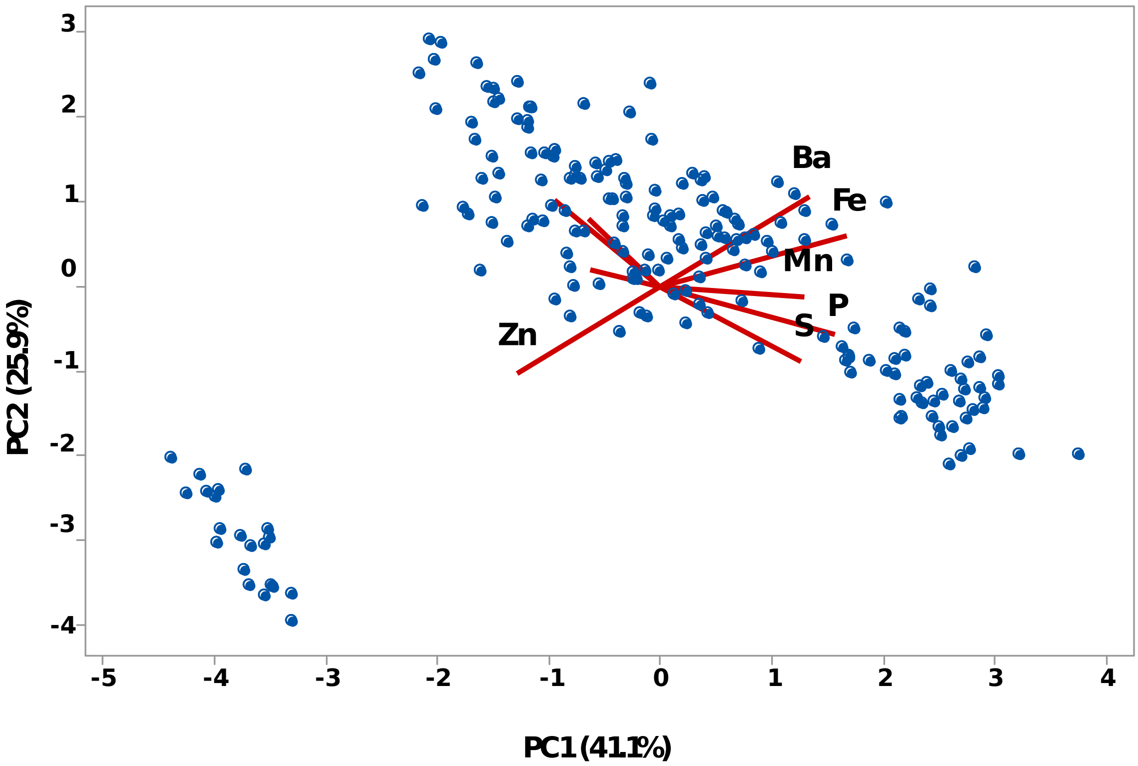


Figure 4.13: A biplot showing PCA of elemental concentrations analysis with PC1 and PC2 accounting for 67% of variability.

Part 5: Material Culture Evidence

Introduction

By Beverley Ballin Smith

This section deals with the research into the inorganic artefacts found in features on the site, and what they can tell us about the raw materials that were exploited from the natural environment, what they were used for, and in some cases how they were used. It also demonstrates to us that people in prehistory knew exactly what raw materials they needed and that they knew where to look for them, indicating that they had a deep understanding of the attributes of specific lithologies. Stone was important, but the right type of stone was needed for the manufacture of specific tools. The use of stone resources also needed skilled craftspeople - those that could transform them into tools that were needed for daily survival: axes for the construction of houses and for the procurement of firewood, scrapers for making arrows and processing skin and hides, arrowheads for hunting and defence, sickles for harvesting grain and knives for making tools of wood, antler and bone. Tools were vital, but their specific individual shapes, their style, were also important, highlighting the development of identity and cultural connections.

Some stone, such as pitchstone in the early Neolithic, Yorkshire flint in the middle and later Neolithic, and cannel coal in the Bronze Age are raw materials originating from beyond Carnoustie's immediate hinterland. The occurrence of these items suggests that communication and exchange networks were already in existence, established during the Mesolithic and developing further during the early Neolithic and later periods, as supplies and demand changed and, in some cases, increased. The appreciation of the exotic Arran pitchstone, a different raw material to that procured locally, or later, a bangle of cannel coal that was a personal item, showed that prehistoric people were not dissimilar to ourselves: they liked nice and rare things.

The exploitation and procurement of resources for pottery making was probably much simpler than those for stone tool manufacture, but skills were also needed. Whereas stone could be altered by hand into a tool that was still stone, the making of pottery required fire and high temperatures to transform its raw ingredients into something else: ceramic. The Carnoustie pottery assemblage demonstrates change over time. It shows that its potters during the early Neolithic experimented with a variety of shapes and sizes of pots most likely for a variety of different purposes, and made them more ergonomic, but they also experimented with decorative elements on some pots. During the early Bronze Age decorative and functional funerary vessels were present, succeeded in time by less well-made cooking pots. Much of the pottery recovered from Carnoustie's Neolithic and Bronze Age features and contexts finds parallels at sites across the wider region, demonstrating the links and communication between communities and the sharing of cultural traits.

Although this section primarily deals with objects, items such as the small number of fired-clay pieces found in a few contexts, it suggests the construction of wattle and daub panels in buildings. These formed the exterior walls and internal partitions certainly during the early Neolithic, but their use continued into and throughout the Bronze Age, where wooden buildings were constructed. Again the use of natural resources, cheap and easy to find, were essential for making life easier and more pleasurable.

Some artefacts and exotic raw materials must have been considered 'precious'. Pitchstone, for example, may have been deposited in pits and postholes as foundation deposits for the timber buildings. This aspect of artefacts and tools is discussed further in PART 7: *The Discussion.*

The lithic assemblage

By Torben Bjarke Ballin

Introduction

The purpose of this report is to characterize the lithic artefacts in detail, from the excavation and from soil samples with special reference to raw-materials, typological composition and technology. From this characterization the finds are dated and interpreted to the degree this is possible with reference to comparable sites elsewhere (Figure 5.1). The analysis of the lithic material is based upon a detailed catalogue (a Microsoft Access database) of all the lithic finds from the site, and the artefacts are referred to by their number (CAT no.) in this catalogue.

The assemblage

General overview

From the excavation at Carnoustie, 630 lithic artefacts were recovered. They are listed in Table 5.1. In total, 88% of this assemblage was debitage, whereas 3% were cores and 9% were tools.

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 where L ≥ 2W. In the case of blades W > 8 mm, in the case of microblades W ≤ 8 mm.

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

Tools: Artefacts with secondary retouch (modification).

GD: Greatest dimension.

Av. dim.: Average dimensions.

Raw materials – types, sources and condition

The assemblage comprised six main groups of raw material (Table 5.2), namely flint (23%), quartz (61%), quartzite (10%), the chalcedony family (4%), pitchstone (1%), and stone (1%). The two dominating groups were flint and quartz, representing approximately one-quarter and two-thirds of all finds, respectively.

The flint included two sub-categories: one dominated by light-brown, orange and red varieties, and one dominated by mottled light-grey and almost black varieties. The former group is thought to be local material collected along the nearby shores of the North Sea, and flint of this kind is quite common in assemblages from eastern Scotland such as The Kingfisher Industrial Estate, Aberdeen, and Nethermills Farm on the Dee (Ballin 2008a; 2017a), whereas the latter is generally referred to as Yorkshire flint, although it cannot be ruled out that the black flint may have been procured from sources even further afield (Ballin 2011b; 2016). The local flint: Yorkshire flint ratio of the collection was 68:32.

In this region, the local reddish flint was used throughout prehistory, whereas the so-called Yorkshire flint was used mainly during the middle and late Neolithic periods. Tables 5.6-5.7 (see below) show how the site's two early Neolithic timber halls (Structures 8 and 13) were entirely devoid of Yorkshire flint, whereas this type of flint was common in the pit groups defined by later Neolithic objects (e.g. Pit Groups 5, 13, and 15).

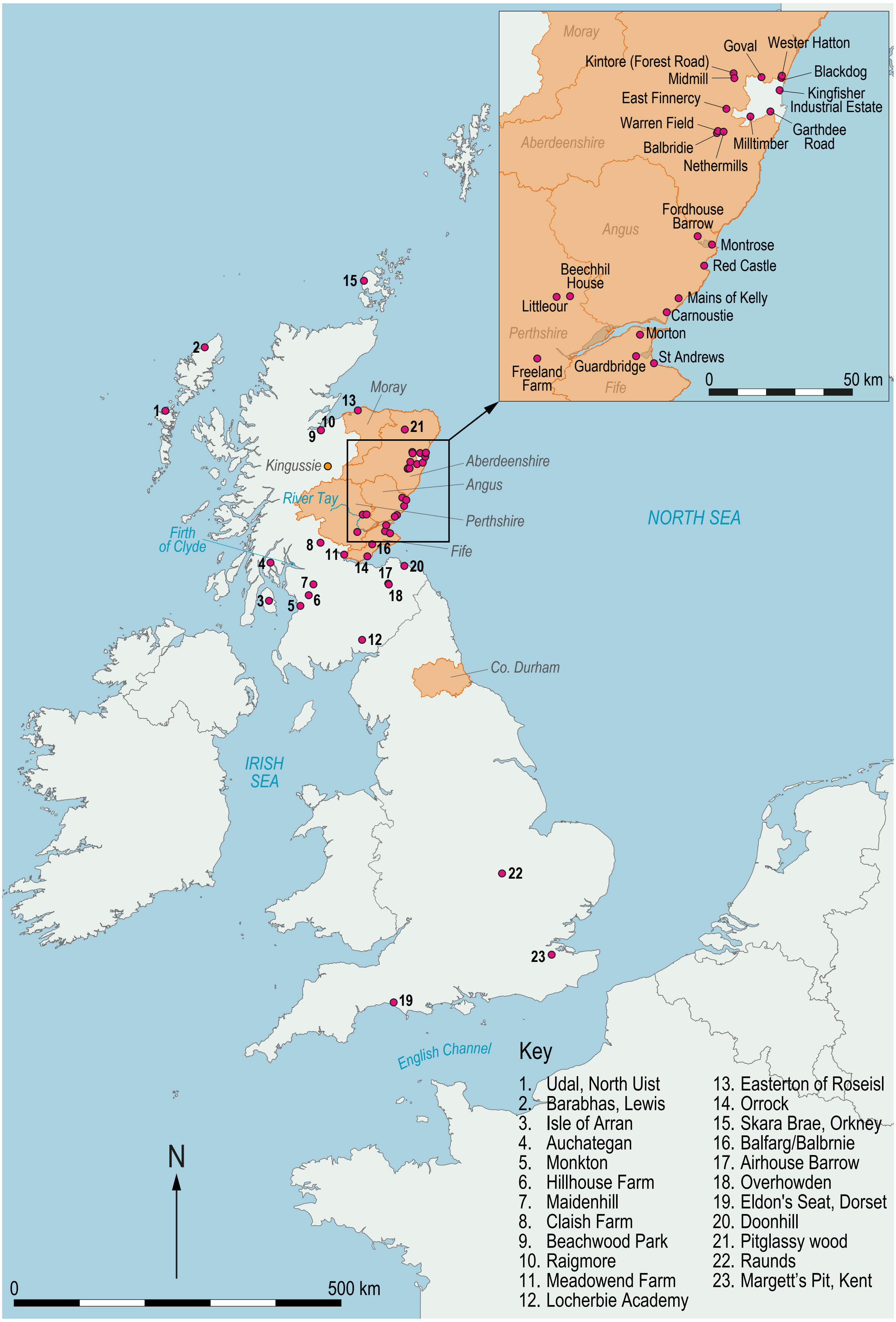


Figure 5.1: Map of sites mentioned in this section.

Most of the flint was fine-grained and homogeneous, but the local flint also included some medium-grained pieces (e.g. scale-flaked knife CAT 47). End-scraper CAT 302 was a chalcedony-like form of local flint. Most of the flint (72%) was tertiary material without cortex (Table 5.3) – practically all the cortical material was local flint with abraded cortex, whereas only two of 26 pieces of Yorkshire flint had some cortex. This supports the suggestion that one group of flint was procured from local beach walls, whereas the other group of flint may have been imported into the area as decorticated nodules or ready-to-use blanks.

The quartz was generally white milky quartz, and like the local flint the cortex of primary and secondary quartz pieces tended to have been abraded by natural forces. Although it cannot be ruled out that these pieces were also procured from beach walls along the North Sea coast, they might just as well have been collected from nearby water-courses.

	Flint	Quartz	Quartzite	Chalcedony family	Pitchstone	Stone	Total
Debitage							
Chips	36	17		8	3		64
Flakes	49	290	40	10	2	4*	391
Blades	9	10	3				22
Microblades	2	2					4
Indeterminate pieces	5	47	8	5		2	67
Crested pieces	3	1		1			5
Total debitage	104	367	51	24	5	2	553
Cores							
Split pebbles		1					1
Core rough-outs	1						1
Single-platform cores		1	2				3
Discoidal cores, plain		1					1
Discoidal cores, Levallois-like	1						1
Irregular cores		5		2			7
Bipolar cores	3						3
Total Cores	5	8	2	2			17
Tools							
Leaf-shaped arrowheads	2						2
Oblique arrowheads	1						1
Triangular arrowhead	1						1
Short end-scrapers	11	2	3				16
Blade-scrapers	1						1
Scraper-edge frags	1						1
Backed knives			2				2
Scale-flaked knives	4						4
Piercers	1						1
Truncated pieces	3						3
Serrated pieces	1						1
Combined tools	2						2
Points			1				1
Pieces w invasive retouch	2						2
Pieces w edge-retouch	5	4	3			1**	12
Pounders		2	3				5
Total tools	35	8	12			1	56
Total	144	383	65	26	5	7	630

*Stone includes 2 baked mudstone   ** baked mudstone

Table 5.1: General artefact list.

Raw material	Quantity	Percent
Flint	142	23
Quartz	383	64
Quartzite	42	7
Chalcedony family	26	4
Pitchstone	5	1
Stone	4	1
Total	602	100

Table 5.2: The recovered raw materials.

	Quantity		Percent	
	Flint	Quartz	Flint	Quartz
Primary	1	27	2	9
Secondary	16	114	26	38
Tertiary	43	161	72	53
Total	60	302	100	100

Table 5.3: Reduction sequence of all unmodified flint and quartz flakes.

Quartzite only comprised c. 7% of the collection, and these usually brown or purple-coloured pieces also had abraded cortex. The raw quartzite may have been collected from the same sources as the quartz. This raw material was fine-grained, and it was formed by the alteration of sandstone. It is quite common in the local area, and the Neolithic Fordhouse Barrow near Montrose, also Angus, was capped by purple quartzite cobbles which were later 'mined' and knapped by (probably) Bronze Age people (Ballin 2004).

A total of 26 pieces were based on raw materials of the chalcedony family (for discussion of this group, see Ballin forthcoming). They were all fairly small mostly chip-sized specimens, with most flakes measuring between 20-30 mm. Two small cores had a greatest dimension of c. 25 mm. Most of the members of this group were either chalcedony proper (bluish-grey) or agate (pink with concentric circles), although a solitary piece of brown carnelian was also recovered (CAT 6, from the outland). Raw materials of the chalcedony family were formed by the solidification of hydrothermal fluids in lavas, and they are particularly common in the River Tay estuary area and along the east-coast of Fife and Angus. The assemblage from the early and late Mesolithic site of Morton (Coles 1971a, 291), just outside and south of the mouth of the estuary, was characterized by the extensive use of chalcedony proper, and the assemblage from the late Mesolithic site of Freeland Farm in the inner part of the estuary was dominated by brown carnelian (Nicol and Ballin 2019).

Five pieces of pitchstone were also recovered. This form of volcanic glass (a close 'cousin' of obsidian) was procured from the Isle of Arran in the Firth of Clyde (Ballin 2009a; Ballin and Faithfull 2009). The distribution of diagnostic pitchstone objects and associated materials like Cumbrian tuff and pottery of the Carinated Bowl Tradition suggests that in southern, central, and eastern Scotland most pitchstone probably dates to the early Neolithic period (Ballin 2015; 2017b). Some diagnostic middle Neolithic pieces from southern and central Scotland were based on porphyritic pitchstone (Ballin 2009a; Ballin *et al.* 2008), whereas all pieces from Carnoustie were black, aphyric specimens supporting the suggested early Neolithic date (see dating section).

Four objects were based on different forms of coarse-grained rock. They were two flakes and two indeterminate pieces, three of which were igneous types of rock (CAT 494 from Pit Group 14, 501 and 513 both Pit Group 13), whereas three were baked mudstone CAT 605, 606, both Pit Group 3, and 626 from Structure 8), one raw material was indeterminate (CAT 112, Structure 13). These raw materials may also have been collected from streams or beach walls.

A total of 111 pieces (18%) were burnt. These pieces are discussed further in the distribution section below.

Debitage

The debitage (557 pieces) includes 64 chips, 395 flakes, 22 blades, four microblades, 67 indeterminate pieces and five crested pieces (Tables 5.1 and 5.5). The low number of chips (12%) reflects the fact that only selected contexts were sieved. As demonstrated in Ballin (1999b), the chip ratio of sieved early prehistoric assemblages usually varies between c. 30% and 55%.

Table 5.4 shows the composition of the debitage of the two numerically largest sub-assemblages, the flint and the quartz. There are several important differences, such as the flake:blade ratio and the ratio of indeterminate pieces. Where the flint has a flake:blade ratio of 82:18

that of quartz is 96:06, and where the ratio of indeterminate pieces of the flint is 4, that of quartz is 13. Most likely, these differences reflect the different flaking properties of the two raw materials, with flint being better suited for blade production, whereas quartz flakes in a more intricate manner, making it more suitable for the production of short, robust flakes. However, the differences probably also reflect different dates, where most of the flint may date to the Neolithic period (where proper blades were manufactured), whereas most of the quartz may date to the Bronze Age (where proper blades were no longer produced) (see Dating and Discussion sections, below).

	Quantity		Percent	
	Flint	Quartz	Flint	Quartz
Chips	36	17	34	4
Flakes	49	290	48	79
Blades	9	10	9	2
Microblades	2	2	2	1
Indeterminate pieces	5	47	4	13
Crested pieces	3	1	3	1
Total	104	367	100	100

Table 5.4: Relative composition of the flint and quartz debitage.

The flint blades probably date to two different periods, namely the early Neolithic and the later Neolithic. However, it is difficult to define comparable sub-assemblages dating to these two periods, as the early Neolithic material may be under-represented, whereas the later Neolithic material probably reflects the prehistoric systemic context better (Schiffer 1972). As the early Neolithic structures (e.g. Structures 8, 8s and 13) probably represent domestic settlement (although it has also been suggested that they may have been associated with ritual activities or used as meeting places; e.g. Brophy and Sheridan 2012, 50), most of the finds (for example from knapping floors) would be expected to be scattered across the floors of the houses. The site strip was carried out with great care and once occupation layers were apparent below topsoil, particularly in the locale of Structures 8, 8s and 5 the remainder of any deposits and underlying features were cleaned and excavated using only hand tools (Warren Bailie pers. comm.). The later Neolithic pit groups probably represent ritual activity, with some activities taking place around the pits but with many finds having been intentionally deposited in the pits, from where they were subsequently recovered.

Table 5.5 shows the applied percussion techniques of the two main raw material groups, the flint and the quartz. They show that approximately one-third of the flint flakes and blades were detached from their parent cores by the use of soft percussion, half of the blanks by the use of hard percussion and only one-tenth by the use of bipolar technique. More than two-thirds of the quartz blanks were detached from the cores by hard percussion, with practically no soft percussion blanks having been recovered, and with one-tenth of the blanks being bipolar specimens. The flint's mixture of soft and hard percussion probably reflects that these pieces include early Neolithic (soft percussion; cf. Garthdee Road; Ballin 2014) as well as later Neolithic (hard percussion; cf. Overhowden; Ballin 2011b) specimens, whereas the quartz's notable domination by hard percussion pieces simply reflects the fact that this raw material was not suited for soft percussion production (Ballin 2008b).

	Quantity		Percent	
	Flint	Quartz	Flint	Quartz
Soft percussion	13	3	32	2
Hard percussion	20	123	49	69
Indeterminate platform technique	3	11	7	6
Platform collapse	1	21	2	12
Bipolar technique	4	19	10	11
Total	41	177	100	100

Table 5.5: Applied percussion techniques: definable unmodified flint and quartz flakes and blades.

Relatively little early Neolithic material was recovered, and therefore also relatively few microblades (Figure 5.2). As demonstrated by several early Neolithic assemblages from domestic sites (e.g. Garthdee Road, Aberdeen, and Auchategan, Argyll; Ballin 2014; 2006), as well as assemblages from radiocarbon-dated early Neolithic pits (Ballin 2015; 2017b), many Scottish early Neolithic assemblages are characterized by the dominance of soft percussion microblades and narrow broadblades. Later Neolithic assemblages from Scotland tend to be dominated by robust hard percussion broad blades, which occasionally grow to significant sizes (cf. Guardbridge; Ballin 2016), and the two peaks in the flint curve (Figure 5.2) may represent later Neolithic activity.

Approximately one-quarter of all broadblades are based on Yorkshire flint, and these blades tend to be the largest in the collection. The largest pieces are two broken blades which are just short of 60 mm long, suggesting that the original intact pieces may have been 70-80 mm long. As most of these long blades are tertiary specimens, it is highly likely that the original raw flint nodules measured 100-120 mm. The surviving intact blades are few in numbers (14 pieces), with average dimensions of 31 by 13 by 5 mm, considerably smaller than the largest fragmented blades (Figure 5.3).

Sixty-six indeterminate pieces were found during the excavation, approximately half of which were burnt. It is thought that these pieces may mainly represent pieces which fell into domestic hearths, or which were deliberately burnt in connection with ritual activities, causing them to disintegrate.

The assemblage includes five crested pieces, three of which are of flint, with one quartz and one carnelian. Two are blades, two are flakes and one is an indeterminate piece. In addition, one serrated blade (CAT 46, Figure 5.4), one short end-scraper (CAT 84), and one blade-scraper (CAT 121, Figure 5.4) are based on large crested pieces, and they are all of Yorkshire flint. They are all intact, and CAT 84 has a GD of only 25 mm, whereas CAT 46 and CAT 121 both have a GD of c. 44 mm. It is uncertain whether the blanks were struck from traditional platform cores or from the flanks of Levallois-like cores like CAT 75 (Figure 5.5, see below, also Ballin 2011a; Suddaby and Ballin 2010).

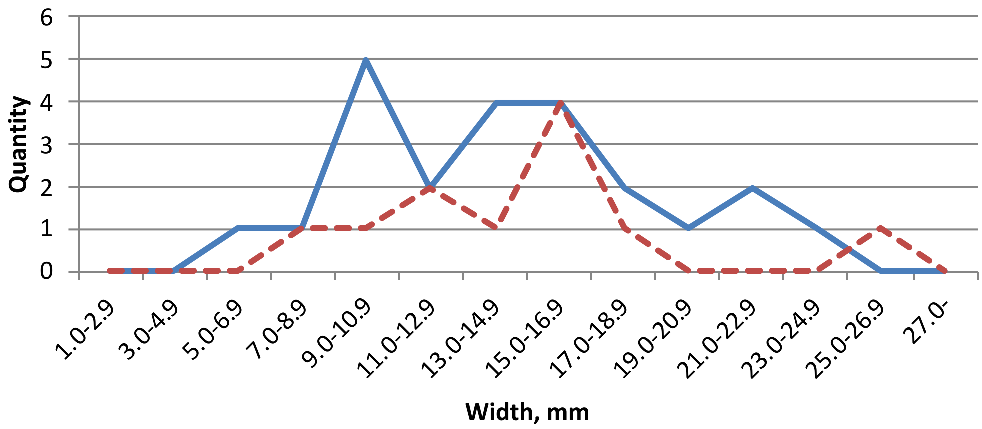


Figure 5.2: Widths of all unmodified and modified blades and microblades; blue = flint, red = quartz.

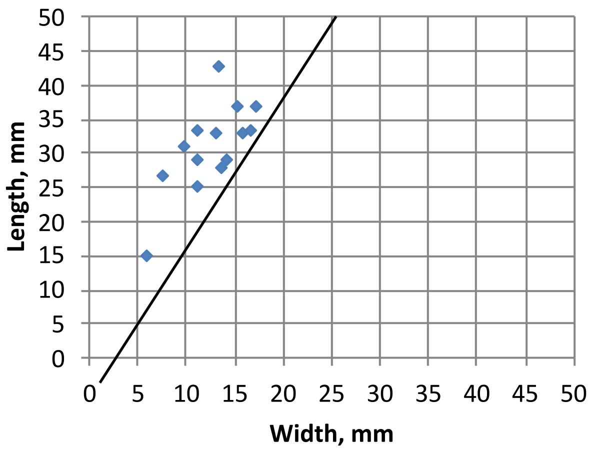


Figure 5.3: The length:width of all intact unmodified blades and microblades. The line represents the metric divide between blades and flakes.

Seven Levallois-like flakes (Ballin 2011a; Suddaby and Ballin 2010) were also recovered from the Carnoustie site. None was retrieved from the location's early Neolithic structures, with three deriving from Structures 5, 10 and 11, and four from Pit Groups 13, 15 and 16. For further discussion of these pieces, see the Distribution and Dating sections (below).

Although this section has focused mainly on the most numerous raw material categories, quartzite is also relatively common (51 pieces of debitage). The quartzite debitage is dominated by 40 flakes, supplemented by three large, probably unintentional blades, and eight indeterminate pieces. These pieces clearly represent a separate, probably Bronze Age, industry (Ballin 2004; Ballin and Cameron 2020).

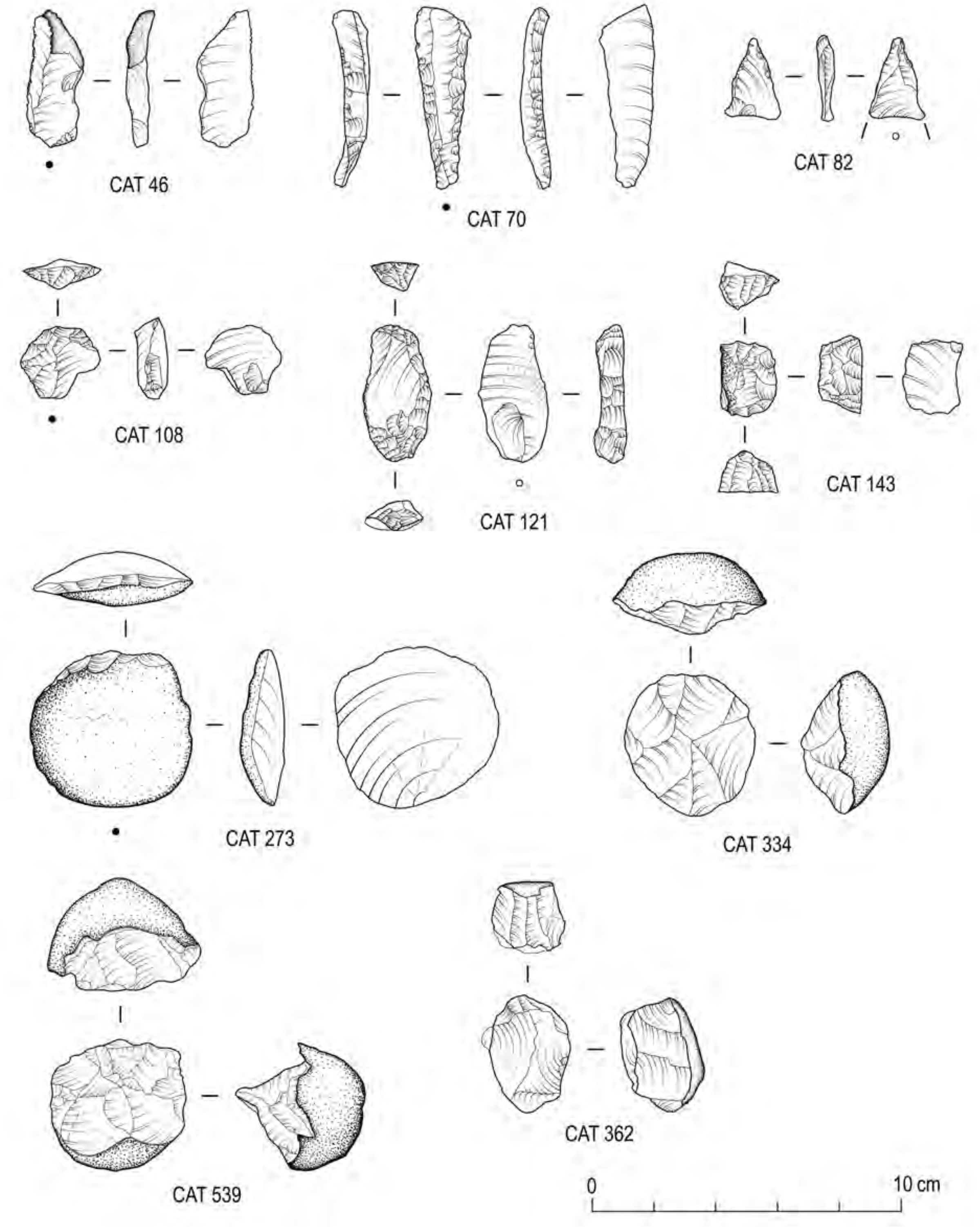


Figure 5.4: CAT 46 serrated blade, CAT 70 scale-flaked knife, CAT 82 piercer, CAT 108 scraper, CAT 121 blade scraper, CAT 143 double scraper, CAT 273 quartz scraper, CAT 334 discoidal core, CAT 539 single platform core, CAT 362 irregular core.

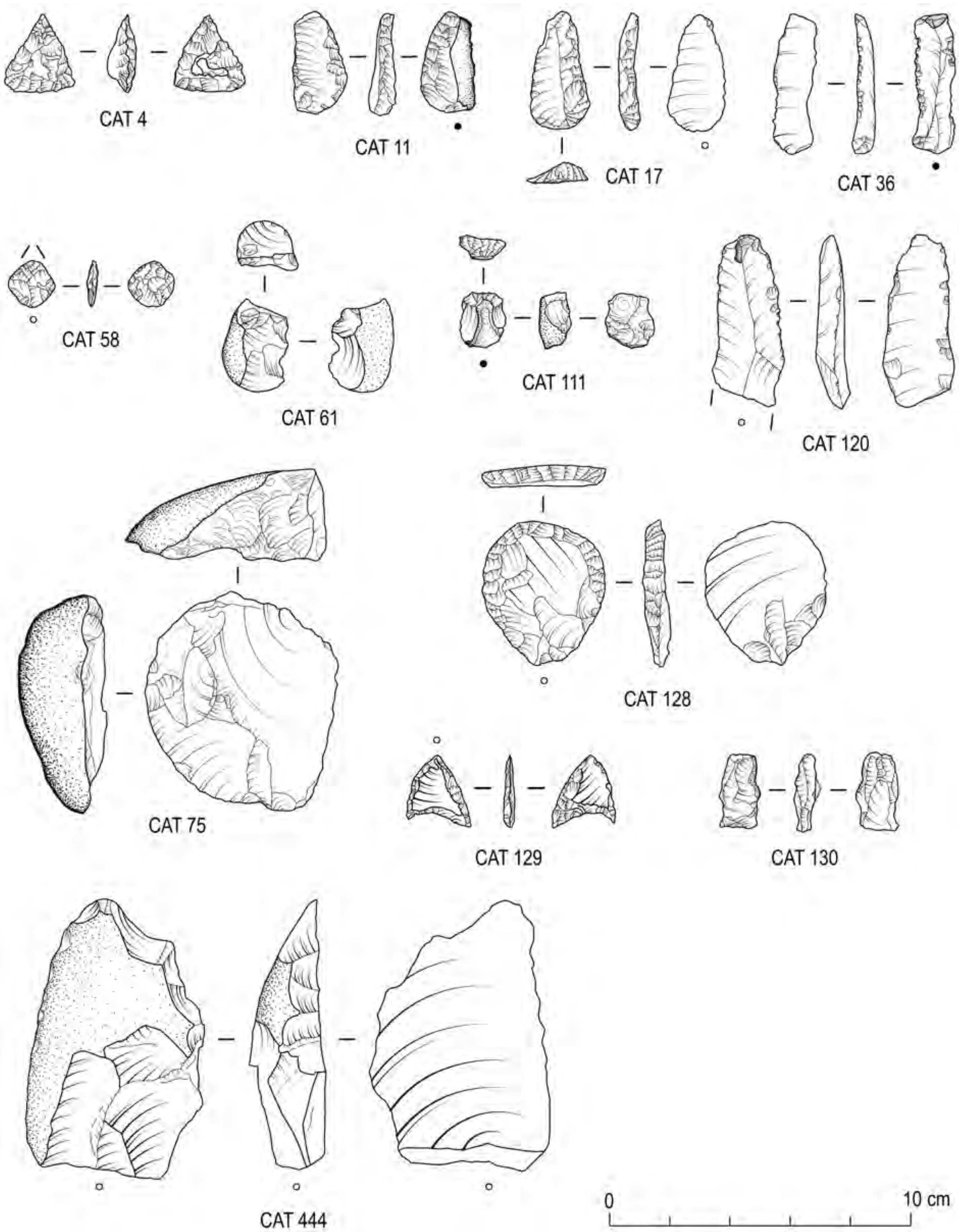


Figure 5.5: CAT 4 arrowhead, CAT 11 scale-flaked knife, CATs 17 and 36 combination tools, CAT 58 leaf-shaped point, CAT 61 core roughout, CAT 111 scraper, CAT 120 truncated piece, CAT 75 Levallois-like core, CAT 128 scraper, CAT 129 oblique arrowhead, CAT 130 bipolar core, CAT 444 point.

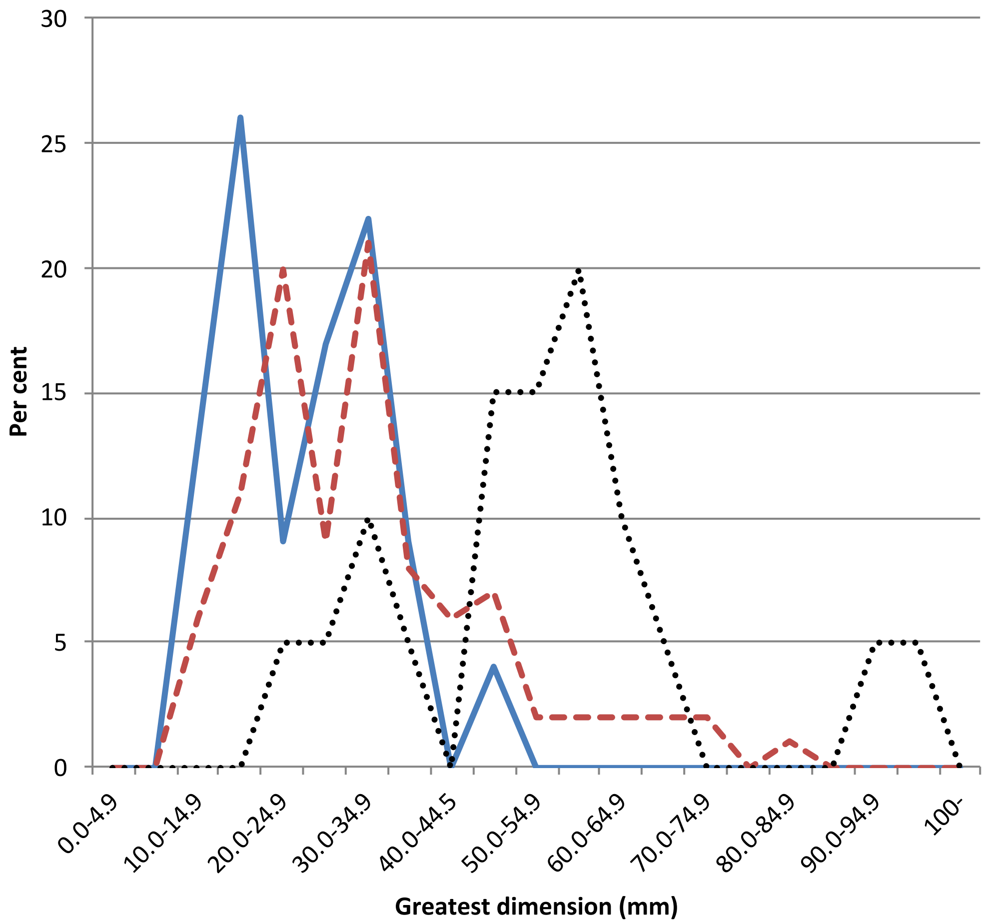


Figure 5.6: Greatest dimension (mm) of intact flakes of flint (blue), quartz (red) and quartzite (black).

As shown in Figure 5.6, the quartzite flakes are considerably larger on average than the site's flint and quartz flakes. These flakes were generally detached by the application of hard percussion (90% of the flakes are hard-hammer pieces), from large single-platform cores with cortical platforms (31% of the flakes have cortical platforms). This industry is characterized and discussed in greater detail in connection with the Technology, Distribution, and Dating sections below.

Cores

The assemblage includes 17 cores: one split pebble, one core rough-out, two single-platform cores, one plain discoidal core, one Levallois-like core, seven irregular cores, and three bipolar cores. Simpler cores like irregular and bipolar specimens (Table 5.1 and Figure 5.7) dominate at the expense of more sophisticated core types, like single-platform and Levallois-like cores. The fact that bipolar cores are common (one-fifth of all cores) but bipolar blanks rare (one-tenth of all debitage) suggests that many platform cores may have been heavily reduced and subsequently knapped by the application of other approaches. Six cores are of flint, eight are quartz, one is quartzite and two of agate.

The dimensions (L by W by T) of cores were measured in the following ways: in the case of platform cores, the length was measured from platform to apex, the width was measured perpendicular to the length with the main flaking-front orientated towards the analyst, and the thickness was measured from flaking-front to the often unworked/cortical 'back-side' of the core. In the case of bipolar cores, the length was measured from terminal to terminal, the width was measured perpendicular to the length with one of the two flaking-fronts orientated towards the analyst, and the thickness was measured from flaking-front to flaking-front. More 'cubic' cores, like cores with two platforms at an angle and irregular cores, were simply measured in the following manner: largest dimension by second-largest dimension by smallest dimension. The sizes of the intact cores are shown in Figure 5.7.

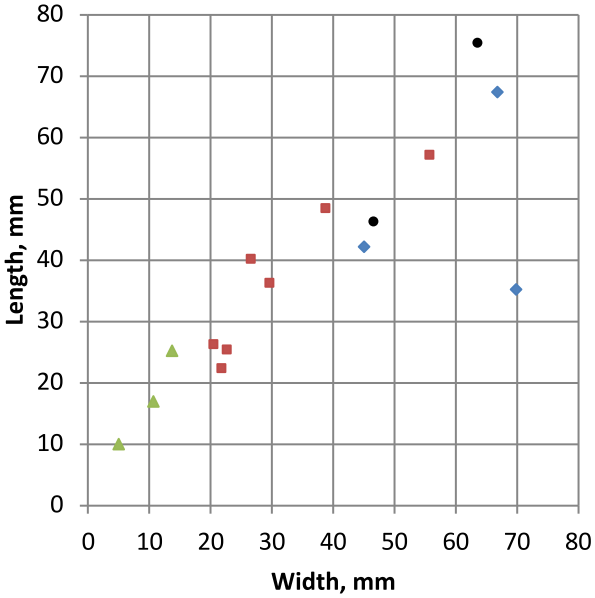


Figure 5.7: Dimensions of all intact cores: Blue = single-platform cores; red = irregular cores; green = bipolar cores; black = discoidal/Levallois-like cores.

Pre-cores: Two pre-cores were found, namely one split pebble (CAT 499, Pit Group 13) and one slightly more sophisticated core rough-out (CAT 61 from Structure 11, Figure 5.5). CAT 499 is of quartz, and has a GD of 62 mm. It was split by striking it once at one end, and it is uncertain whether an attempt was made to produce a platform core or a bipolar core. CAT 61 is of flint, and it measures 31 by 20 by 17 mm (Figure 5.8). In this case, a small nodule was provided with a plain platform and a lateral crest, and it is thought that this piece was abandoned as one of the chips detached to form the crest released a deeply hinged chip, ruining the core's flaking front. This piece has a cortical 'back-side' and it clearly represents an attempt to create a conical core.

Figure 5.8: CAT 61 core roughout.

Single-platform cores: This category included two pieces, namely one quartz specimen (CAT 539, Pit Group 14) and two quartzite specimens (CAT 443, Pit Group 13 and CAT 608, Structure 4). The former measures 42 by 45 by 36 mm and the latter two 67 by 67 by 32 mm, and 35 by 70 by 61 mm. CAT 539 (Figure 5.4) is a small squat core with a cortical 'back-side', whereas CAT 443 is a relatively thin, slightly larger core; both pieces have a plain platform. Due to the flatness of CAT 443, it is possible that this specimen represents an attempt to shape a Levallois-like core, but that it was abandoned when one corner broke off, before any lateral crests could be made, or the platform prepared by fine faceting (Ballin 2011a; Suddaby and Ballin 2010). CAT 608 corresponds morphologically to the quartz single-platform cores recovered from later Neolithic and early Bronze Age sites on the Western Isles, such as Barabhas (the Elliott Collection - Ballin 2018a) and Udal RUX6 (Ballin 2018c) (Figure 5.9).

Various discoidal core forms: The archetypal discoidal core is a well-executed core shaped by alternating removals across two opposed faces, where a negative scar from a previous removal became the platform of the next removal (Wickham-Jones 1990, 58). The Carnoustie assemblage included no such cores. However, this general category embraces other discoidal sub-types, some of which are expedient forms, whereas others are highly sophisticated. The simpler forms are flaked flakes/Kombewa cores (Ashton *et al.* 1991; Inizan *et al.* 1993, 57) and plain unifacial disc cores, whereas Levallois-like cores (Ballin 2011a; Suddaby and Ballin 2010) represent a more complex operational schema.

The Carnoustie collection includes two forms of discoidal cores, namely one plain discoidal core of quartz (CAT 334, 'Structure' 12, Figure 5.4) and one Levallois-like core of flint (CAT 75, unstratified, Figures 5.5 and 5.10). The former is a unifacial specimen, where one face was reduced by detaching small flakes by repeatedly striking the circumference of the piece. It has a cortical lower face, and it measures 47 by 46 by 27 mm. The latter is a considerably larger core (75 by 64 by 28 mm), with a finely faceted platform, but it was probably abandoned at an early stage when one lateral side broke off, and before any lateral crests had been formed.

Figure 5.9: Single platform cores from RUX6, Udal, North Uist.

Figure 5.10: CAT 75 Levallois-like core.

Irregular cores: The collection's seven irregular cores include five quartz specimens including CAT 362 (Figure 5.4) and two of agate. The former are relatively large, having GDs of 40-60 mm (one has a GD of c. 25 mm), whereas the latter are small, having GDs of c. 25 mm (Figure 5.7). These cores are defined by having been reduced from at least three directions (for which reason the category is also occasionally referred to as multi-directional cores).

Bipolar cores: Three bipolar cores (Ballin 1999a) are all of flint. One (CAT 130, from the outland, Figures 5.5 and 5.11) is of grey flint (possibly Yorkshire flint), whereas one (CAT 589, Pit Group 15) is of black Yorkshire flint. CAT 554 (Structure 8) is heavily burnt. The average GD of the category is c. 17 mm. All bipolar cores are bifacial specimens with one reduction axis (one set of opposed terminals).

Figure 5.11: CAT 130 bipolar core.

Tools

The 49 tools (Table 5.2) include a number of implement categories, such as four arrowheads, 18 scrapers, six knives, one piercer, three truncated pieces, one serrated piece, two combined tools, one point, two pieces with invasive retouch, 13 pieces with edge-retouch, and four pounders. With 178 pieces, the scrapers clearly dominate the formal tools (33% of all tools and 45% of the tools less pieces with invasive or edge-retouch). The implements mainly include pieces of flint (35 pieces), with eight pieces being quartz and 12 quartzite. The sizes of the site's scrapers and knives are shown in Figure 5.12.

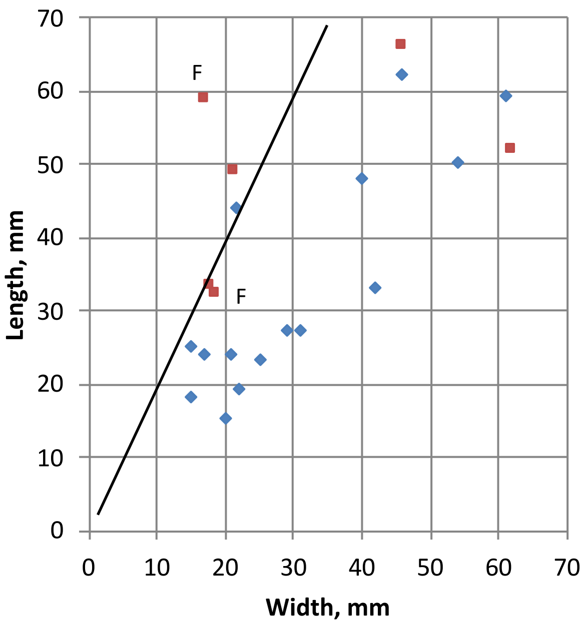


Figure 5.12: Dimensions of all intact scrapers (blue) and scale-flaked knives (red); 'F' indicates a proximal-medial fragment. The line represents the metric divide between blades and flakes.

Arrowheads: This category comprise two early Neolithic leaf-shaped points (CAT 58 'Structure' 10, and CAT 72 Structure 13) and two later Neolithic oblique arrowheads (CAT 4 from Structure 1 and CAT 129 from Pit Group 13), all of flint, but CAT 129 is probably based on grey Yorkshire flint. One of the leaf-shaped points (CAT 58, Figures 5.5 and 5.13) is a small, squat, double-pointed specimen, measuring 15 by 15 by 2 mm. It belongs to Green's Type 4A (Green 1980, 72). The other leaf-shaped point is a burnt lateral fragment of indeterminate sub-type, and it has a GD of 26 mm. CAT 129 (Figure 5.14) is a typical oblique arrowhead, measuring 26 by 20 by 3 mm (Figure 5.5). It belongs to Clark's Type E or F (Clark 1934, Figs 1-2; Ballin 2011b, 11), and it has a relatively long lateral barb. The tang has bifacial retouch along both edges, whereas the cutting-edge has unifacial retouch. CAT 4 is a slightly unusual, idiosyncratic piece Figures 5.5 and 5.15). It has a roughly triangular outline, but the fact that one lateral side is slightly concave suggests that this may be a variant of an oblique arrowhead of Clark's Type G. Evans (1897) shows several similar pieces, such as his Figs 332, 333, 334 and 341. The piece is unusually thick, measuring 27 by 23 by 8 mm.

Figure 5.13: CAT 58 leaf-shaped point.

Figure 5.14: CAT 129 oblique arrowhead.

Figure 5.15: CAT 4 oblique variant arrowhead.

Scrapers: These implements include one blade-scraper, 16 short end-scrapers, and one scraper-edge fragment. Thirteen of the scrapers are of flint, two are quartz, and three are quartzite. The blade-scraper is a complex piece with two opposed working-edges. It is based on a crested blade of black Yorkshire flint, and it measures 44 by 22 by 10 mm. It has blunting retouch along its left lateral side, proximal end, probably to protect the user's fingers when using the piece unhafted. Fine spin-offs along both lateral sides suggest that the piece may also have been used as a knife.

Apart from one scraper on a recycled bipolar core (CAT 122 Pit Group 13), the short end-scrapers are all based on hard percussion flakes, and they comprise 11 pieces of flint (two are of black Yorkshire flint, and one of grey Yorkshire flint), two of quartz, and three of quartzite. The flint scrapers include five relatively small irregular pieces: CAT 22 Structure 5, CAT 59 'Structure' 10, CAT 108 Pit Group 16 (Figure 5.4), CAT 111 Pit Group 15 (Figure 5.5), CAT 302 Structure 11 with the specimens' GDs varying between 20-42 mm. Two of the blanks are Levallois-like flakes (CAT 22 and CAT 108). CAT 143 from Pit Group 13 (Figure 5.4) is a small double-scraper with a well-executed working-edge. It measures 19 by 22 by 14 mm. Two well-executed pieces are in black Yorkshire flint: CAT 128 (Figure 5.5), CAT 131 both Pit Group 13), one measuring 48 by 40 by 8 mm and the other only 26 by 23 by 6 mm. The former is a highly regular piece with the modification of the working-edge continuing up along both lateral sides, and the proximal end has been thinned by ventral retouch, possibly for hafting. CAT 122 (27 by 29 by 6mm) is based on a recycled bipolar core, and it has a regular convex, steep scraper-edge on one lateral side of the original core.

Three specimens (CAT 67 'Structure' 12, CAT 84 Pit Group 6, CAT 110 Structure 8) are heavily burnt and disintegrating, and their burnt state suggests some form of 'destruction by fire' and subsequent deposition in connection with either burial or ritual activities.

The two quartz scrapers (CAT 418 Structure 8, CAT 39 'Structure' 9) are both fairly irregular pieces (GDs = 24-34 mm), whereas the three quartzite pieces: CAT 138 Structure 8, CAT 273 'Structure' 10, (Figure 5.4), CAT 613 Structure 5, are very large oval scrapers (GDs = 54-62 mm), based on primary hard-hammer flakes with minimalistic distal working-edges. The sizes of the intact end-scrapers are indicated in Figure 5.12.

Backed knives: The collection includes two backed knives of quartzite, CAT 62 Pit Group 13 and CAT 631 'Structure' 10. The former is based on a primary hard-hammer flake measuring 66 by 46 by 15 mm, and its distal end is missing. Its entire right lateral side has been backed by inverse abrupt retouch, and the opposed cortical edge represents the cutting-edge of the piece. The latter is a similar piece, also of quartzite. It is based on a secondary hard-hammer flake (52 by 62 by 18 mm). A very large/thick bulb of percussion was removed by inverse retouch, which also functions as backing. The distal edge, opposite the modification, is chipped from use and also displays gloss. The latter suggests that the piece may have been used to process vegetable matter.

Functionally, the quartzite knives are related to the so-called 'Skaill knives', a concept introduced by Childe in connection with his work at Skara Brae on Orkney (Childe and Paterson 1929, 242; also see Clarke 2006, 16). Skaill knives are defined as unmodified and modified flakes of (mostly) Orcadian flagstone, and being somewhat more coarse-grained than for example flint or chert, even unmodified pieces would have been able to cover the same functions as for example finely serrated pieces. It is, however, problematic to refer to all unmodified and modified flakes of Orcadian flagstone (and for example also those of quartzite) as knives. Instead, it is suggested – as with other raw material types – that modified pieces are called formal knives, unmodified pieces with use-wear suggesting cutting are referred to as informal knives, and flagstone, quartzite, etc. flakes without modification or use-wear are simply flakes, that is, debitage.

Scale-flaked knives: Four scale-flaked knives are all based on hard percussion broadblades of flint: CAT 11, from the outland, is of black Yorkshire flint, and CAT 60 from Structure 11, is based on a Levallois-like blade, with their sizes being indicated in Figure 5.12. Two (CAT 47 from Pit Group 5, CAT 70 from 'Structure' 12) are proximal-medial fragments (GDs 33-60 mm), whereas the other two are intact, measuring 33 by 18 by 7 mm (CAT 11) and 49 by 21 by 7 mm (CAT 60), respectively. CAT 47 and CAT 60 both have one unifacially modified cutting-edge, CAT 70 has two unifacially modified cutting-edges (Figure 5.4), and CAT 11 (Figure 5.5) has one bifacially modified working-edge. The cutting-edges of CAT 60 and CAT 70 are associated with notable *gloss*, suggesting that they were used for the processing of vegetable matter (sickles?) (see PART 5: *Use-wear*). A large blade-scraper in black Yorkshire flint from Guardbridge, Fife, also displayed *gloss*, and use-wear analysis by Peter Bye Jensen, University of Southampton (Bye Jensen 2016) showed that it had probably been used to plane fresh sticks or branches. Use-wear analysis by Randy Donahue, University of Bradford (Ballin 2011b, 24) showed that four scale-flaked knives from sites near the Overhowden Henge, Scottish Borders (Ballin 2011b, 24) had been used for cutting cereal or grasses.

Truncated pieces: Three truncated pieces are based on blades of either grey (CAT 1 unstratified, 136 from Pit Group 15) or black Yorkshire flint (CAT 120 from Pit Group 13). They either have curved or oblique distal truncations. The two smaller grey specimens are intact and measure 35 by 15 by 3 mm (CAT 1) and 27 by 10 by 3 mm (CAT 136), whereas the largest and most impressive piece (CAT 120) is a medial-distal fragment measuring 58 by 24 by 7 mm. CAT 1 has been thinned dorsally and ventrally at the proximal end, probably to allow it to be hafted. CAT 120 displays crude macroscopic use-wear, suggesting use as a knife, probably to process relatively hard materials (Figure 5.5).

Serrated pieces: Only one serrated piece was retrieved, namely CAT 46 from Pit Group 5 (Figure 5.4). This piece is based on a crested broad blade of grey Yorkshire flint, and it has fine serration along its left lateral side (10-12 teeth per cm). The serrated cutting-edge has been partially modified by dorsal scale-flaking. It measures 44 by 18 by 7 mm. In her analysis of serrated pieces (or microdenticulates), use-wear analyst Helle Juel Jensen, University of Aarhus, suggested that these pieces may have been used for either sawing (e.g. wood, bone, antler) or cutting/sickling vegetable matter (Juel Jensen 1994, 59).

Piercers: One piercer was also found (CAT 82, Structure 8, Figure 5.4). Only the tip survives (GD = 26 mm), and this implement was formed on a plain flake. The tip is quite acute, but the working-end shows clear abrasion from having been used.

Combined tools: This category includes one scale-flaked knife/serrated piece (CAT 36, Pit Group 5, Figures 5.5 and 5.16) and one blade-scraper/scale-flaked knife (CAT 17, Structure 8, Figure 5.5). The former is the proximal-medial fragment of a hard percussion blade of grey Yorkshire flint, and it measures 42 by 14 by 6 mm. It has a crudely serrated edge along the left lateral side (c. five teeth per cm), and a scale-flaked cutting-edge along its right lateral side. It has *gloss* along both working-edges. The latter piece is intact (38 mm by 19 mm by 5 mm), and it is based on an indeterminate blade of local honey-brown flint. It has a regular scraper-edge at its proximal end, and scale-flaking along its right lateral side. The cutting-edge is associated with *gloss*.

Points: One large point CAT 444 from Group 13 is based on a flake of quartzite (90 by 58 by 26 mm). This piece has a robust tip at its distal end (Figures 5.5 and 5.17). These sizeable pieces are common in later Neolithic/early Bronze Age contexts (cf. Udal RUX6, North Uist, and Barabhas, Lewis; Ballin 2018c, 152; 2018a, 64).

Figure 5.16: CAT 36 combined tool.

Figure 5.17: CAT 444 point.

Pieces with various retouch: This category includes two flint fragments (GD = 17-18 mm) with invasive retouch along one edge, as well as 12 flakes or flake fragments with edge-retouch (five pieces of flint, four of quartz and three of quartzite). It is thought that this tool group includes artefacts, or fragments of artefacts, with different functions.

Pounders: These specimens are all fragments of large tools of either quartz or quartzite. Pounders are defined as usually fist- to hand-sized tools (smaller specimens are not uncommon) with pecked, faceted ends. Three pieces (CAT 184 from Structure 8, CAT 445 from Pit Group 13, CAT 488 from Pit Group 6) are flakes or indeterminate pieces which may have been detached during use or when abandoned pounders were recycled as pot-boilers and disintegrated (two are heavily burnt). The largest piece (CAT 504 from Pit Group 13) is one half of a large used nodule of quartzite which broke across. It has a GD of 88 mm. CAT 621 from 'Structure' 7 measures 49 by 77 by 32 mm, and it split along two axes. One end is missing, and it also split along its long axis due to pressure at its pecked working-end.

Technological summary

This technological summary is based on information presented in the raw material, debitage, core and tool sections above. The assemblage clearly includes early and later Neolithic elements, but it is also thought that some lithic artefacts (especially the quartz and quartzite pieces) date to the Bronze Age. As mentioned above, it was only possible to safely identify a small number of artefacts as early Neolithic. It is generally thought that the lithic technology of this period focused on the production of microblades and small broadblades by the application of soft percussion (cf. Garthdee Road, Aberdeen; Ballin 2014), and although it is quite likely that most of the site's soft percussion blanks relate to the early Neolithic period, the absence of other diagnostic pieces than the two leaf-shaped points, and the scarcity of lithic finds from the two timber halls (Structures 8 and 13), makes it impossible to define a reliable technological profile for this period.

In contrast, many pieces clearly date to the later (either middle or late) Neolithic period, including diagnostic pieces like large hard percussion blades, grey and black Yorkshire flint, oblique arrowheads and various forms of relatively large blade-based cutting implements (scale-flaked knives, truncated pieces, serrated pieces, and combined tools). Most of these pieces were recovered from the various pit groups, and the following operational schema is based on analysis of these pieces.

After the early/middle Neolithic transition, large volumes of Yorkshire flint was imported into the region (Ballin 2011b), with this raw material probably amounting to c. 90% of all lithic raw material used, supplemented by some Scottish flint and local chert. In the Grooved Ware (late Neolithic) period, 'black' flint became widely used (Figure 5.18), and it cannot be ruled out that this type of flint was procured from sources further afield, such as East Anglia (compare the site's black flint with the black flint mined at Brandon in Suffolk for post medieval gunflints, Ballin 2013, Fig. 2). The preference for 'black' flint during the Late Neolithic period is shown by the raw material composition of the finds from pits at Guardbridge in Fife, where very large blades and tools of this material was associated with Grooved Ware pottery (Ballin 2016). By the beginning of the middle Neolithic period, the exchange in Arran pitchstone had dropped to a trickle, apart from along the western seaboard of Scotland (Ballin 2009a; 2015).

Although traditional reduction techniques were still applied, the Levallois-like technique had been introduced around the early/middle Neolithic transition and was in use until the end of the late Neolithic (Ballin 2011a; Suddaby and Ballin 2010). In total, seven Levallois-like blanks were recovered from the site. This technique typically left finely faceted platform remnants, like the platforms of some blanks and tools recovered at the present site. Three tools are based on crested flakes or blades (CAT 46 from Pit Group 5, 84 from Pit Group 6, 121 from Pit Group 13) of Yorkshire flint, and it is possible that the blanks of these later Neolithic implements were struck from the flanks of Levallois-like cores. The blades were now predominantly robust hard percussion blades, and tools were made by a combination of edge-retouch and invasive retouch.

Most of the quartzite pieces from the site are thought to represent a local Bronze Age flake industry (see below). The operational schema is almost identical to that defined for several later Neolithic/early Bronze Age quartz industries from the Western isles (Udal RUX6, North Uist, and Barabhas, Lewis; Ballin 2018c, 152; 2018a, 64), where large quartz cobbles were reduced with little initial core preparation. This left the site's single-platform flake cores with cortical platforms, and 31% of the quartzite flakes from Carnoustie have cortical platform remnant. The flakes were detached by the application of hard percussion, and as quartzite is an extremely dense type of rock the cores needed to be hit very hard to detach the blanks. To avoid platform collapse, the platforms were struck well behind the platform-edge, resulting in the production of wedge-shaped flakes (thick at the proximal end and thin at the distal end), and the cores became squat with very acute platform-edge angles (see Figure 5.9).

This industry has been documented elsewhere in the vicinity, such as at Fordhouse Barrow in Angus (Ballin 2004), and Laurencekirk, southern Aberdeenshire (not far from Fordhouse Barrow; Ballin and Cameron 2020). Fordhouse Barrow was capped with quartzite boulders collected in the local area, and these pieces were later scavenged by Bronze Age knappers who left an assemblage of worked quartzite on the monument. Similar quartzite artefacts have been collected in the vicinity of the barrow (Saville 2009). Most likely, these quartzite artefacts testify to the existence of a local Bronze Age industry in the Angus/

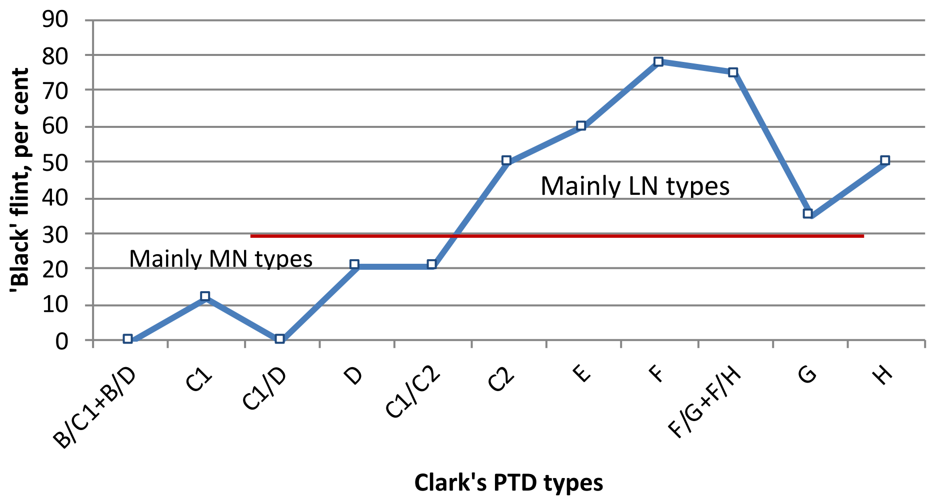


Figure 5.18: The proportion of 'black' flint by later Neolithic arrowhead type (from Ballin 2011b). The point types B-D are usually referred to as chisel-shaped arrowheads, and the types E-I as oblique arrowheads (Clark 1934).

southern Aberdeenshire area, which exploited quartzite cobbles from the Lower Devonian outwash fans in the Montrose area (Cameron and Stevenson 1985, 18-21).

Distribution and activities

Tables 5.6 and 5.7 show the distribution of, more or less, diagnostic lithic objects across the site. Early Neolithic pieces were recovered from Structures 8, and 13, as well as Pit Group 6, whereas later Neolithic pieces were recovered from Structures 1, 5, 11 and 'Structures' 7 and 12, as well as Pit Groups 5, 13, 15, and 16. From 'Structure' 10, early as well as later Neolithic pieces were recovered. One typical Levallois-like core was retrieved from the site surface outside these structures and pit groups. Although the many roundhouses, as well as the discovery of a bronze hoard, suggest that the site was settled and visited during the Bronze Age, no diagnostic pieces were attributable to this period.

	Leaf points	Pitchstone	Total
Str 8		4	4
Str 10	1		1
Str 13	1		1
Pit Gr 6		1	1
Total	2	5	7

Table 5.6: The distribution of diagnostic early Neolithic artefacts.

	Yorkshire flint	Levall flakes	Obl. + triang. arrowheads	Levall cores	Total
Str 1			1		1
Str 5		1			1
Str 7	2				2
Str 10		1			1
Str 11		1			1
Str 12	1				1
Pit Gr 5	2				2
Pit Gr 13	8	1	1		10
Pit Gr 15	12	2			14
Pit Gr 16		1			1
Other	1			1	2
Total	26	7	2	1	36

Table 5.7: The distribution of diagnostic later Neolithic artefacts.

However, it is thought that quartzite blanks, cores, and tools were produced by a Bronze Age industry (see Dating section). Although quartzite artefacts were recovered across most of the site, they were particularly common in Bronze Age contexts. Although some quartzite objects were recovered from early Neolithic as well as later Neolithic contexts (5-19% of the sub-assemblages), they made up a significant proportion (41%) of the sub-assemblage from Structure 5 (a roundhouse), which also yielded a fragment of a shale bracelet, a possible loom weight, and prehistoric pottery. The Bronze Age hoard was discovered approximately 5 m north of Structure 5 and it is possible that this hoard was deposited by the inhabitants of the roundhouse.

Practically all the quartzite and quartz from this structure was recovered from occupation layer (276). The flint, on the other hand, was mostly recovered from posthole (364) and, although attributed to Structure 5, this feature is actually located slightly outside the building, in the wall-line of Structure 8, and most of the flint attributed to Structure 5 may therefore date to the early Neolithic period. The lithic industry associated with Bronze Age Structure 5 seems to have focused mainly on the reduction of quartz and quartzite, rather than flint. Notable numbers of quartz flakes and tools were also recovered from Pit Groups 13 and 15.

Most of the pitchstone was recovered from Structure 8 (both structures), and like in other Scottish timber halls (e.g. Doon Hill and Warren Field; Ballin 2009b; Warren and Dolan 2009), it was recovered from features within the building, suggesting intentional deposition. Interestingly, all the pitchstone from Structure 8 was found in linear trenches, such as context (505) (the large timber hall) and (672), with two pieces deriving from posthole (704) which was associated with trench (676) (from the smaller timber hall). The association of pitchstone in timber hall postholes and trenches suggest that they may have been deposited as part of some sort of cornerstone or foundation rituals.

Table 5.8 shows the distribution of all artefacts across the site. The distribution of the debitage and the cores suggests that primary production may have taken place in Structures 5 (Bronze Age disturbance of the long timber hall Structure 8), 'Structure' 7 (the outland), Structure 8 (the long and smaller timber halls), Structure 9 (external activity to Structure 8), 'Structures' 10 and 12 (other Neolithic structures?), and Structure 13 (long timber hall adjacent to Structure 8), as well as around Pit Groups 5 and 6 (intimately connected with the timber halls), and the SW Pit Groups 13, 14 and 15. It is quite understandable that knapping was carried out within the above domestic structures, but it is less clear why flakes and blades were produced around the pit groups, which may largely have been the focus of ritual activities. The most logical explanation is that 1) domestic activities took place in these areas, 2) at a later time (which could have been days, months or years) ritual pits were dug through these knapping floors, and 3) the knapping debris then entered the pits with the back-fill.

Table 5.9 is a summary of Table 5.8, and it shows the distribution of the main tool categories across probably domestic structures and ritual pits. Generally, there is little difference between the composition of the two groups (domestic structures and ritual pit groups), which probably reflects two things, namely that the pits were dug through layers of domestic waste, and that the pieces actually intentionally deposited in the pits are pieces which would generally have been used in connection with the daily subsistence-related work on the site. The main differences regard numerically smaller implement groups where percentages may be affected by random statistical fluctuations.

However, although the many tools deposited in the pits may have been tools needed on a daily basis, several of these implements were probably treasured pieces, as many are in precious exotic Yorkshire flint and many are quite large and well-executed. It is impossible to guess exactly what ceremonies took place around the pits, and why selected tools were deposited in them, but the fact that many seem to have been used for scraping (hides?) and others for the processing of vegetable matter (cereal?) suggests some kind of fertility rites based on a *quid pro quo* arrangement with the gods/deities/ancestors: 'We offer you these implements (and possibly pots with foodstuffs) and you secure our livestock and next year's harvest'.

Dating

The assemblage includes numerous diagnostic elements, such as raw materials, various core and tool types, and technological attributes. Although the site's roundhouses, as well as the discovery of a bronze hoard, suggest a possible Bronze Age presence, most lithic elements (apart from the site's quartzite industry) are associated with the early and later Neolithic periods. The diagnostic lithic elements are split spatially between 1) the timber halls (Structures 8 and 13) and a small number of other structures and pits, and 2) the pit groups along the site's south-western edge, supplemented by a small number of structures, and 3) Structure 5, which seems to have housed a knapping-floor based on the reduction of mainly quartzite. Group 1 is associated with early Neolithic elements, Group 2 with later Neolithic elements (Tables 5.6 and 5.7), and Group 3 with a Bronze Age quartzite industry.

Raw materials: Two groups of raw materials are diagnostic, namely the Arran pitchstone, the Yorkshire flint and the local quartzite. Five pieces of pitchstone were recovered, and four of those were found within both the large and small timber halls of Structure 8. In southern, central and eastern Scotland, pitchstone exchange appears to have taken place mainly during the early Neolithic period (Ballin 2015; 2017b), and the recovery of these pieces within an impressively large early Neolithic hall supports this date (cf. Brophy and Sheridan 2012, 50). One piece of pitchstone was retrieved from Structure 6.

At Carnoustie, Yorkshire flint was found exclusively in pits, and mostly pits belonging to one of a number of pit groups located along the south-western edge of the excavation. Most of these pieces were recovered in Pit Groups 13 and 15 (nine and 12 pieces, respectively), with individual pieces deriving from Pit Group 5 and 'Structures' 7 and 12. This raw material has been associated with a later Neolithic exchange network (Ballin 2011b). Approximately half of the Yorkshire flint is so-called black flint, which tends to form part of Grooved Ware assemblages (cf. the pit assemblage from Guardbridge in Fife, which was associated with Grooved Ware pottery; Ballin 2016), that is, it is generally of a late Neolithic date (Figure 5.18). All black flint from Carnoustie was found in pits belonging to Pit Groups 13 and 15.

	Structures													
	1	2	4	5	6	7	8	9	10	11	12	13	14	15
Debitage														
Chips				1	1		16	2	3		9	4		
Flakes	4	1	1	23	1	24	50	13	29	2	26	23	1	2
Blades	1						2	1	4			2		
Microblades						1	1							
Indeterminate pieces	1					4	12	1	1		2	4		
Crested pieces						2	1				1	1		
Total debitage	6	1	1	24	2	31	82	17	37	2	38	34	1	2
Cores														
Split pebbles														
Core rough-outs										1				
Single-platform cores			1											
Discoidal cores, plain												1		
Discoidal cores, Levallois-like														
Irregular cores							1		1		1	3		
Bipolar cores						1	1							
Total Cores			1			1	2		1	1	1	4		
Tools														
Leaf-shaped arrowheads									1			1		
Oblique arrowheads														
Triangular arrowhead	1													
Short end-scrapers				2			2	1	2	1	1			
Blade-scrapers														
Scraper-edge frags							1							
Backed knives									1					
Scale-flaked knives						1				1	1			
Piercers							1							
Truncated pieces														
Serrated pieces														
Combined tools							1							
Points														
Pieces with invasive retouch											1			
Pieces with edge-retouch				1	1		3	1				2		
Pounders							2							
Total tools	1			3	1	1	10	2	4	2	3	3		
Total	7	1	2	27	3	33	94	19	42	5	42	41	1	2

Table 5.8: Distribution of artefact types across all structures and pit groups.

	Pit Groups																	Unstratified	Total
	1	2	3	5	6	7	10	12	13	14	15	16	17	19	23	24	26		
Debitage																			
Chips				11	4						4		1			1	1	6	64
Flakes		11	1	13	26	2	5	2	68	11	42	2	2		1	2	1	6	395
Blades	1			1	1	1			4		4								22
Microblades							1			1									4
Indeterminate pieces		2		4	8	2			17	1	4	2		1				1	67
Crested pieces																			5
Total debitage	1	13	1	29	39	5	6	2	89	13	54	4	3	1	1	3	2	13	557
Cores																			
Split pebbles									1										1
Core rough-outs																			1
Single-platform cores									1	1									3
Discoidal cores, plain																			1
Discoidal cores, Levallois-like																		1	1
Irregular cores												1							7
Bipolar cores											1								3
Total Cores									2	1	1	1						1	17
Tools																			
Leaf-shaped arrowheads																			2
Oblique arrowheads									1										1
Triangular arrowhead																			1
Short end-scrapers					1				3		2	1							16
Blade-scrapers									1										1
Scraper-edge frags																			1
Backed knives									1										2
Scale-flaked knives				1															4
Piercers																			1
Truncated pieces									1		1							1	3
Serrated pieces				1															1
Combined tools				1															2
Points									1										1
Pieces with invasive retouch											1								2
Pieces with edge-retouch			1			1			1		2								13
Pounders					1				2										5
Total tools			1	3	2	1			11		6	1						1	56
Total	1	13	2	32	41	6	6	2	102	14	61	6	3	1	1	3	2	15	630

Table 5.8a: The distribution of diagnostic later Neolithic artefacts.

	Quantity			Percent		
Type	Structures	Pit groups	Total	Structures	Pit groups	Total
Arrowheads	3	1	4	12	4	8
Scrapers	9	8	17	34	33	34
Cutting tools: scale-flaked, truncated pieces and serrated pieces	5	4	9	19	17	17
Piercers		1	1		4	2
Points		1	1		4	2
Combined tools	1	1	2	4	4	4
Various retouch	7	5	12	27	21	25
Pounders	1	3	4	4	13	8
Total	26	24	50	100	100	100

Table 5.9: Distribution of the main tool categories across domestic structures and ritual pits.

The Bronze Age period, (and particularly its later part) has been associated with a more expedient procurement strategy, where certain raw materials were used simply because they were the easiest ones to get at, rather than because they had good flaking properties or were visually attractive. This resulted in raw materials being exploited because those sources were closest to the settlements, including the scavenging of flint eroding out of barrows (as at Raunds in Northamptonshire; Ballin 2002), or the scavenging of cobbles used to cap burial mounds (as at Fordhouse Barrow, Angus; Ballin 2004). It cannot be ruled out that the quartz artefacts scattered across all structures and pit groups may date to the Bronze Age period, and that it is contemporary with the site's roundhouses.

However, the site's quartzite objects probably also date to the later Bronze Age. This is suggested by the fact that much of the quartzite was associated with an occupation layer and knapping-floor in roundhouse Structure 5, from which a fragment of a shale bracelet and a possible loom weight were recovered, and which was located just 5 m from the site's impressive metal hoard. This likely later Bronze Age date of the quartzite industry is supported by analysis of the lithic finds from Fordhouse Barrow, (Ballin 2004), as mentioned above, where its quartzite capping stones were scavenged and used as a lithic raw material resource.

Typology: The assemblage also includes a number of diagnostic core and tool types, with a number of arrowheads falling into the category of strictly diagnostic pieces. Two early Neolithic leaf-shaped points (Green 1980) were retrieved from 'Structure' 10 and Structure 13 (the smaller long timber hall), whereas a late Neolithic oblique arrowhead was found in Pit Group 13 and a middle or late Neolithic triangular point (possibly belonging to Clark's Type G) was found within Bronze Age Structure 1 (Ballin 2011b, Panel 1) as a residual artefact.

Most of the site's scale-flaked knives, serrated pieces and combined tools are thought to date to the later Neolithic. However, in Scotland pieces belonging to these categories were also manufactured during the early Neolithic and the early Bronze Age period, and their attribution in this case to the later Neolithic period is mainly based on the fact that most of them are either based on Yorkshire flint or quite large hard percussion blades, or both. Two fragments with invasive retouch are only broadly datable to the early Neolithic – early Bronze Age period (Butler 2005).

Technological attributes: As the blade production prior to the early/middle Neolithic transition was mainly based on soft percussion and after this watershed on hard percussion (cf. early Neolithic Garthdee Road, Aberdeen, and Overhowden and Airhouse, Scottish Borders; Ballin 2014; 2011b), the site's soft percussion blanks are most likely to date to the early Neolithic. The many hard-hammer broadblades and tools based on such blanks are most likely datable to the later Neolithic period.

At the same time, when soft-percussion was replaced by hard-percussion, the sophisticated Levallois-like technique was introduced (Ballin 2011a; Suddaby and Ballin 2010). A typical Levallois-like core was found on the site, but outside the main structures and pit groups, but middle or late Neolithic Levallois-like flakes and blades were recovered from Structures 5, 11 and 'Structure' 10, and Pit Groups 13, 15 and 16. Invasive retouch was generally used during the early Neolithic – early Bronze Age period (Butler 2005).

The industry responsible for the reduction of the site's quartzite followed an operational schema which is broadly similar to the operational schema defined for later Neolithic/early Bronze Age quartz assemblages on the Western Isles (Udal RUX6, North Uist, and Barabhas, Lewis; Ballin 2018c, 152; 2018a, 64), supporting a relatively late date for this material.

Associations: In addition, lithics were associated with diagnostic structures and pottery styles. The structures include early Neolithic timber halls and probably Bronze Age roundhouses, as well as a number of different forms of pottery (see PART 5: *The pottery* and PART 3: *Radiocarbon dates*, Table 3.1). The discovery of a bronze hoard supports the suggested Bronze Age presence at the site.

Discussion

As mentioned above, the site's features (timber halls, roundhouses and pit groups, as well as one bronze hoard) suggest that the location was visited at least three times in prehistory, namely during the early Neolithic (the timber halls), the later Neolithic (the pit groups), and the Bronze Age (the roundhouses and the hoard), but diagnostic lithic elements only safely support two of these dates. The timber halls are certainly early Neolithic (leaf-shaped points, pitchstone), whereas the pit groups seem to be exclusively later Neolithic (oblique arrowheads, Yorkshire flint, Levallois-like technique), and the roundhouses are likely to be of a Bronze Age date, as indicated by the quartzite knapping floor in Structure 5.

In a number of recent papers (Ballin 2019a; 2018b), the author has pointed out that the excavation techniques generally applied to excavate prehistoric sites in Scotland may be flawed in some cases, in the sense that they destroy part of the evidence needed to answer certain essential questions. The presence in many pits and postholes of minuscule, chip-sized knapping waste (which may have entered the features with the back-fill) indicates that knapping floors were frequent removed (i.e. scraped off by mechanical excavators) in our effort to reach the features below the plough soil, and that much evidence of a domestic nature (such as knapping floors) therefore did not survive. However, in the case of the site at Carnoustie, the excavators were already aware of the presence of occupation layers established at evaluation stage and therefore tentatively removed the topsoil and overburden to reveal the underlying deposits and features.

In the present case where lithics were not prevalent from the occupation layers that did survive, this poses a problem in terms of answering relevant questions. It is still uncertain exactly what sort of settlement or which set of activities the early Neolithic timber halls represent – do they represent traditional domestic settlement, or were they special houses associated with special, communal activities (Brophy and Sheridan 2012)? Without the buildings' cultural layers (including knapping floors, if they were ever there) it is difficult to answer these questions. Generally, relatively little lithic material is recovered from structures like this, but the more or less standardized deposition of exotic Arran pitchstone in postholes and pits within these buildings suggests that they may have had a special status (e.g. Warren Field, Aberdeenshire, Doon Hill, East Lothian, Claish, Stirlingshire, and Balfarg, Fife; Warren and Dolan 2009; Ballin 2009b; Barclay *et al.* 2002; Barclay and Russell-White 1993).

The pits within the later Neolithic pit groups contained a large number of lithic artefacts which are clearly knapping waste. This suggests that *either* activities which would usually be characterized as being of a domestic nature (such as knapping) took place around the pits, and that specially selected exotic and well-executed pieces were then intentionally deposited in those pits, *or* that ritual pits were dug through already existing knapping floors, where this material (which could potentially have pre-dated the ritual activities by weeks, months or years) then entered the pits with the back-fill.

The artefacts thought to have been ritually deposited in the later Neolithic pits appear to mainly represent two sets of tools, namely tools for scraping (wood, meat and bone, see PART 5: *Use-wear*) and others for the processing of plant material (cereals?), suggesting some kind of fertility rites based on a *quid pro quo* arrangement with the gods/deities/ancestors: 'We offer you these implements (and possibly pots with foodstuffs) and you secure our livestock and next year's harvest'. However, ritual life in the later Neolithic period was probably a complex affair, including different rituals for different purposes. Rituals at Midmill, Kintore, in Aberdeenshire (Ballin 2010 in Murray and Murray 2013) seem to have focused on the deposition of particularly large and well-executed blades in Yorkshire flint, rather than tools, where the comparison of the flint from ritual pits (Area 1) and domestic pits (Area 2) revealed a number of interesting differences: Area 1 – no cores, 80% tertiary material, no bipolar flakes, 35% exotic material, and 28% burnt pieces; Area 2 – c. 8% cores, 52% tertiary material, 20% bipolar flakes, almost no exotic material, and only 6% burnt pieces. It is uncertain which ritual activities took place at Midmill.

Use-ware analysis on stone tools

By Peter Bye Jensen

Introduction

Analysis was conducted to investigate possible use-wear traces on a selected assemblage of stone tools from lithic artefacts from the Neolithic phases of the excavation of Carnoustie. The analysis focused on examination of possible surviving prehistoric residues, use-wear traces and traces of manufacturing. Many of the stone tools showed evidence of use, and therefore show potential for further analysis of similar artefacts from the site.

Methodology

Use-wear analysis of lithic artefacts is widely known as a functional analysis of stone tools (Tringham et al. 1974, Keeley 1980, Van Gijn 1990 and 2013, Jensen 1994, Bye-Jensen 2019). The analysis used a microscope in low and high magnification, e.g. x20 and x200. The lower magnifications inform about the edge-damage and edge-rounding a flint tool sustains through abrasive use, whilst the higher magnifications may convey what contact material the flint tool was used to process and how.

The interpretation is based on the experimental experience of the author. The aim was to establish an analogy between the observed prehistoric wear traces and experimental wear traces. When successful the analysis can answer questions about the activities that were carried out on a site, such butchering, woodworking, hide processing and crafting in a variety of materials. The presence of use-wear can be everything from Generic Weak Polish (GWP) to extensive wear. The generic weak polish is, therefore, a category used to describe a weak use related trace that cannot be linked to a specific contact material.

The present analysis has been achieved with a new technology in USB microscopes that enables easy reproduction of analysis results, image stacking and affordability (Bye-Jensen 2019). To support the analysis some artefacts have been tested with a conventional metallographic microscope. The current analysis was carried out with x20, x100 and x200 magnification.

Before cleaning the artefacts, a low magnification scan was performed to search for surviving prehistoric residue, e.g. ochre, fibre or blood. All analysed flint artefacts were subsequently cleaned with a mild detergent prior to high magnification analysis.

Abbreviations used:

ED – Edge-damage, ER – Edge-rounding, GWP – Generic Weak Polish, Pos – Possibly

Results

A selection of 23 stone tools was examined for use-wear analysis. Two were of pitchstone, but 21 were of flint. The flint varied from the common brown type to a coarse grey type, a reddish type and finally a dark grey type. The latter type was of very good quality.

A detailed surface examination was carried out to look for surviving residues such as ochre, blood, fat, fibre or starch. This analysis did not find any traces of surviving prehistoric residue.

The use-wear analysis was successful in observing traces of use, and in some cases, establish what contact material the stone tool had processed. The worked materials on this site range from hide (fresh and dry) and plant material, to wood and meat. Only one tool had been extensively used, but most tools showed moderate to light use.

The selection of tools for analysis was distributed across the following tool types:

Tool type	No
Blade	3
Blade/Scraper	1
Combined tool	1
Debitage/blade	3
End-scraper	5
Flake	2
Oblique truncation	2
Piercer	1
Scale-flake knife	4
Serrated pieces	1
Total	23

Table 5.10: Tools selected for analysis.

The spatial distribution of the stone tools was distributed over 16 features with one unstratified find. Four tools came from the fill (6014) of pit (6015) in Pit Group 13, two from the fill (888) of pit (889) in Pit Group 5 and three from the fill (557) of pit (558) in Structure 8. It is not possible to contribute with a detailed intra-site analysis as they are not representative of the whole assemblage, but rather a selection of this. A complete analysis would perhaps alter the weight of inferred activities. However, this use-wear analysis has recorded traces of everyday activities of a Neolithic settlement.

These activities include hide-processing as well as woodworking (see Table 5.11). Two flint tools had been used for harvesting vegetable matter or possibly cereal crops. This observation could further our understanding of harvesting methods of the later Neolithic periods (see Figures 5.19 and 5.20). The soil samples taken in Structure 11 might contain macrofossils that could be connected to the evidence of the wear from plant material on CAT 60, and CAT 70 from Structure 12.

The date of the later Neolithic (3500-3000 BC) is based on the typology of a number of blank and tool types (including CAT 46, pit 889 in Pit Group 5, Figure 5.21), which are datable to the general middle/late Neolithic period (see *The Lithics Assemblage above).*

Conclusion

The use-wear analysis of 23 selected lithic tools was successful in observing traces relating to use of the artefacts, most of which were made of flint. The use of the lithic tools was generally light to moderate.

CAT No	Context	Type	Description	Use	Possible use	Edge-rounding	Edge-damage	Polish	Polish contact material	Suggested activity	Note
131	8040 Pit Group 13	Flint	End scraper	x		x	x	x	Wood -fresh	Woodworking -scraping	Use traces found on ventral lateral distal, plus left and right edge. Striatin from distal edge in 20 deg angle. GWP on most edges ventral, wood polish from moderate work on ventral lateral distal. GWP on dorsal lateral.
108	4083 Pit Group 16	Flint	End scraper	x		x		x	GWP	Scraping abrasive/ hard material	Use traces found ventral lateral distal, plus left and right edge. A few weak striations ventral. GWP on dorsal lateral.
73	1248 Structure 13	Flint	Blade	x			x	x	GWP	Butchering? Cutting	Ventral lateral right is the primary use edge. GWP on both ventral and dorsal lateral. ED suggests work on hard material. Perhaps butchering.
23	504 Structure 8	Pitchstone	Flake		x				GWP	?	No certain traces of use. GWP on ventral lateral right, but not certain.
142	10035 Pit Group 13	Flint	Blade	x			x	x	Meat/ bone	Butchering? Cutting	ED on both edges plus distal suggests multi-lateral tool. Use of tool is possibly for cutting meat orbutchering. Polish only on ventral lateral left.
27	557 Structure 8	Flint	Debitage/ blade		x		x			?	DOT ONE. Three flakes in one bag. Repacked and marked with one, two and three black dots for distinction. No certain use/wear. ED ventral lateral left near proximal.
27	557 Structure 8	Flint	Debitage/ blade	x		x	x	x	Wood -fresh	Woodworking -scraping	DOT TWO. Three flakes in one bag. Repacked and marked with one, two and three black dots for distinction. Use/ wear on lateral ventral left. ED ventral lateral left.

Table 5.11: Catalogue of possible use of lithic artefacts. GWP = Generic Weak Polish.

CAT No	Context	Type	Description	Use	Possible use	Edge-rounding	Edge-damage	Polish	Polish contact material	Suggested activity	Note
27	557 Structure 8	Flint	Debitage/ blade				x				DOT THREE. Three flakes in one bag. Repacked and marked with one, two and three black dots for distinction. No certain use/ wear. ED ventral lateral left. Very weathered.
1	u/s	Flint	Oblique truncation	x		x	x	x	GWP	Possible work in fresh material.	Use-wear on ventral and dorsal near distal tip. Polish is likely to be from fresh hide or fresh wood, but not developed enough for certain assessment.
126	6014 Pit Group 13	Flint	Blade		x		x		GWP	?	ED suggests use in a moderate to hard material. However, no certain usewear was found. ED could also be micro-retouch.
82	642 Structure 8	Flint	Piercer	x		x	x		Hide	Extensive hide processing - drilling motion.	Use-wear on ventral lateral suggest hideprocessing. No polish on tip of flint tool, however, the abrasive material that rounded this tool is most likely dry hide.
120	6014 Pit Group 13	Flint	Oblique truncation		x		x	x	GWP	?	No certain traces of use. GWP on distal lateral, but not certain.
121	6014 Pit Group 13	Flint	Blade scaper	x		x	x		GWP	?	Very light usewear on distal edge/ scraper s edge.
47	888 Pit Group 5	Flint	Scale-flaked knife							n/a	Not analysable.
273	930 ‘Structure’ 10	Flint	End scraper	x		x			Bone/ wood	Moderate work in hard bone or wood.	Use-wear on dorsal retouched edge is possibe from moderate word in bone or wood.
60	984 ‘Structure’ 11	Flint	Scale-flaked knife	x		x	x	x	Plant	Cutting plant material - light use as sickle	Usewear/gloss from moderate plant working. UW on ventral lateral left and dorsal right. Only ED on ventral lateral right.

Table 5.11 (continued): Catalogue of possible use of lithic artefacts. GWP = Generic Weak Polish.

CAT No	Context	Type	Description	Use	Possible use	Edge-rounding	Edge-damage	Polish	Polish contact material	Suggested activity	Note
17	412 Structure 8	Flint	Combined tool	x		x	x	x	Hide	Distal edge - scraping dry hide/ ventral lateral left possible cutting bone/ antler material	Use-wear on ventral lateral distal and left (distal to mid lateral).
128	6014 Pit Group 13	Flint	End scraper	x		x		x	GWP/ wood	Light possible scraping/ planing wood	Use-wear on ventral lateral - all edges. Polish not very developed. Possible wood polish from light working scraping wood.
11	397 'Structure' 7 the outfield	Flint	Scale-flaked knife	x		x	x	x	Hide - fresh	Moderate work in fresh hide - scraping.	Use-wear on ventral lateral left.
31	703 Structure 8	Pitchstone	Flake		x			x	GWP	?	Use-wear on ventral lateral left.
46	888 Pit Group 5	Flint	Serrated pieces	x			x	x	GWP	?	Serrated edge flake. GWP, however, some patches of polish resembles the polish seen on other serrated edge flakes in Southern Britain.
70	980 'Structure' 12	Flint	Scale-flaked knife	x		x		x	Plant	Cutting plant material. Moderate use as sickle	Use-wear on both ventral lateral left and right. Mostly mid to proximal on both edges. Dorsal only GWP. Sickle gloss from moderate work in both ventral lateral left and right. Possible cutting grass or herbs.
143	10036 Pit Group 13	Flint	End scraper	x		x	x	x	GWP	Scraping a softer material (soft fresh wood?)	UW on ventral. Mostly distal. GWP on dorsal lateral sporadic. Striations perpendicular to edge on ventral.

Table 5.11 (continued): Catalogue of possible use of lithic artefacts. GWP = Generic Weak Polish.

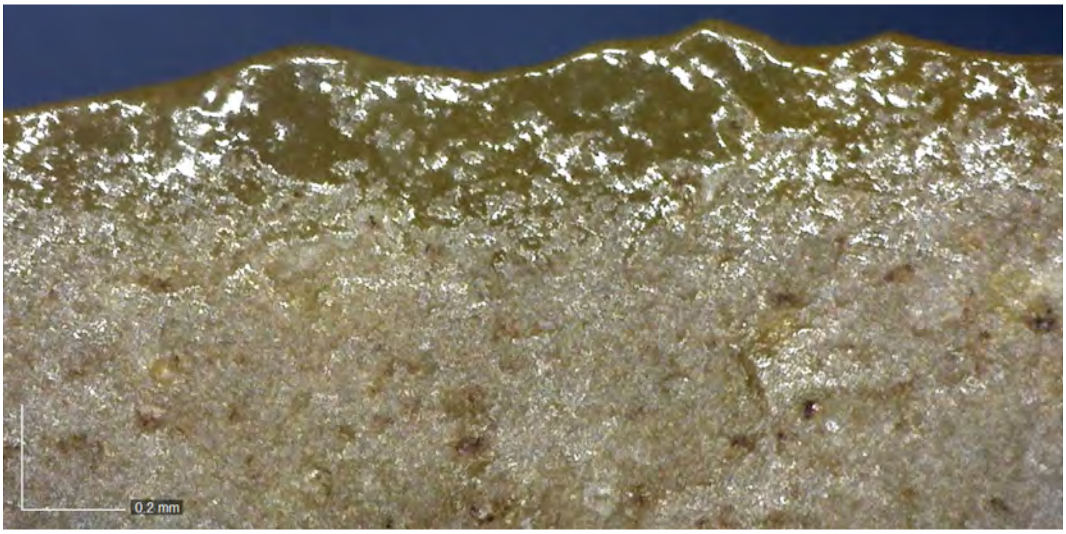


Figure 5.19: CAT 70, ventral lateral left, x20 magnification. Photo: Peter Bye Jensen.

Figure 5.20: CAT 70, ventral lateral left, x200 magnification. Photo: Peter Bye Jensen.

Figure 5.21: CAT 46, ventral lateral left, x20 magnification. Photo: Peter Bye Jensen.

Stone artefacts

By Beverley Ballin Smith and Alison Sheridan

Introduction and methodology

The excavations produced a limited number of worked artefacts. For an excavation of the size of Carnoustie, it would have been expected that more than 15 worked stones would have been found even though a larger number of cobbles or split rock samples were initially collected. However, the paucity of stone tools could be a product of taphonomic processes at work on the area since the Neolithic.

During the post-excavation analysis all the stones were gently brushed or washed before being measured, and where possible weighed, before examination with a 6x hand lens and photographed. Their attributes and statistics were compiled in an archivable database devised using Microsoft Excel. Unworked stone was separated out of the worked collection and discarded, leaving a total of 15 worked pieces. The collection was analysed according to CIfA's Standards and Guidance for the collection, documentation, conservation and research of archaeological materials (2014 revised 2020).

Most of the stone artefacts and rock samples were collected by hand from the excavation, and although soil samples were taken and later sieved, only a few additional unworked pebbles were found. The worked stones predominately span the period between the early/middle Neolithic through to the early medieval period, a time span of approximately 4500 years.

The results

The raw materials

The local geology of the area is described in detail in PART 1: *Landscape setting*. To summarise - the raised beach comprises sandstone capped by glacial till which includes some larger stones, usually grey or orange/pink sandstone and predominantly cobbles of fine-grained, smooth quartzite. The prehistoric inhabitants of the Carnoustie area were skilled at exploiting their environment - it was a matter of survival. By doing so they could find the right raw material for the required tool, whether that be locating suitable stone from the subsoil, a nearby stream bed, or from deposits along the shoreline. Through exploration and exploitation of their environment, people could adapt the available local resources for their day-to-day needs. All the raw materials used (Table 5.12) during the Neolithic period for tools, mostly found in the two timber halls of Structure 8 and Structure 8s, were of local origin. They included fine-grained sandstone with other rock types, most likely water-rolled boulders (dolerite and mica schist). One stone, a garnet-albite-schist used for a polished stone axehead, could have been a glacial erratic found in the local moraine or on the shore (see Sheridan below).

Raw material	Structure or Area	Tool type	Numbers of tools
Quartzite	Structure 1	Worked cobble	1
Quartzite	Rig and furrow Slot B	Pebble polisher	1
Quartzite	Structure 5	Pounder	1
Quartzite	Structure 5	Pebble polisher	1
Quartzite	Structure 5	Polisher	1
Quartzite	Structure 5	Small cobble polisher	3
Igneous rock	Structure 5	Small cobble polisher	1
Cannel coal/shale	Structure 5	Bangle	1
Dolerite	Structure 8 hall	Quern	1
Schist?	Structure 5	Spindle whorl	1
Micaceous schist	Structure 8 hall	Quern	1
Garnetiferous mica schist	Structure 4	Rotary quern	1
Garnet-albite-schist	Structure 8 small hall	Polished stone axe	1
Fine-grained Sandstone	Structure 8 hall	Hone	1
Fine-grained Sandstone	Pit group 5	Whetstone	1

Table 5.12: Tool types by raw material, area and type.

During the Bronze Age there was a noticeable shift in raw material use to that of quartzite cobbles. These derived from the subsoil and were used for hand-sized polishers or pounders, although a mica schist pebble was used to manufacture a spindle whorl. Most of these tools were found in Structure 5, a possible workshop (see Part 4: *Multi-element analysis*), with another in Structure 1. One other item from Structure 5 was a cannel-coal or shale bangle. Its presence demonstrated the likely importation onto the site of a personal item made elsewhere, most likely from raw materials found, for example, across the River Tay estuary in Fife (see Sheridan below).

Evidence of the use of stone during the later history of the site was limited to one half of a rotary quern, intimately associated with Structure 4, and made from garnetiferous mica schist, a rock most commonly associated with the Grampian Highlands (McMillan 1997). This piece was most likely a traded object brought to the site in the early medieval period.

The artefacts

Most of the tools recovered from pits and postholes were utilitarian. The alteration of a cobble, block of stone or boulder through use, creates different patterns of wear, and it is the type and amount of wear, as well as the wear-patterns themselves that are recorded and interpreted here. The wear-patterns demonstrate how a tool was used, and from this we can try to determine the tool's function. However, it is not always easy to identify what use the tool was put to or what materials it was used on. A quern (for grain) or a hone (for metal blades) is straightforward, as examples are used today. However, the finding of a hone or a whetstone from Neolithic contexts suggests a purpose other than to sharpen or put an edge on a metal object.

Tools were often discarded once they had broken or worn out through heavy use, and sometimes they were reused for other purposes. One of the objects, a bangle fragment, is considered to be a personal object in that it would have been worn by an individual, and it was also easily transportable. The spindle whorl could equally fall into this category, as it also was probably owned and used by an individual. Although some of the tools could equally fall into the category of being personal items, in general they either formed part of tool kits (perhaps the polishers from Structure 5) or were too heavy to be portable (querns and hones).

In this collection, however, there is an exceptional piece that was obviously made as a tool but was seemingly never used - the axehead.

Axehead

By Alison Sheridan, National Museums Scotland

This Neolithic stone axehead, SF 8017, was found in context (591) the fill of pit (592), within the Structure 8s small hall (Figure 5.22a, b, c).

It is a complete axehead in pristine condition, and quite possibly never used. It is minimally asymmetrical in plan, with one side fairly straight for much of its length and the other slightly more convex; plump sub-oval in cross-section, with narrow slight facets on the sides; slightly asymmetrical in longitudinal section, with one face more markedly convex than the other, with the blade lying closer to the less convex face. In theory this could have been hafted as an adze-head as well as an axehead, although it lacks the marked longitudinal asymmetry of adze-heads. The butt is shallowly convex in plan and is faceted in profile; the blade is shallowly convex. There are numerous shallow striations all over the surface, from its grinding smooth and polishing to a low sheen. On one edge there is a natural surface irregularity that has not been ground away, and on the surface there are also minute hollows where individual mineral grains had fallen out during the grinding and polishing process. There is minute chipping to the blade but this will not have been the result of use. There is no obvious haft stain, and in any case the position of the axehead in the pit indicates that it will have been unhafted when deposited.

The axehead has been made of a schistose stone, variable in its texture and a variegated greenish-grey, blackish and creamy colour. The stone has kindly been identified by Dr Peder Aspen (former curator of the Cockburn Geological Museum, University of Edinburgh) as a garnet-albite-schist, a metamorphic rock originating in the Highlands. This is not a rock that had commonly been used to manufacture axeheads, but its non-local ultimate origin does not mean that the parent material had been obtained from very far away from Carnoustie: it is not impossible, and indeed is quite probable, that an erratic cobble had been collected from the shore nearby and ground into shape.

Stone axeheads were an essential tool of farming communities, and many will have been required in the construction of the large early Neolithic timber buildings at Carnoustie. It is a moot point as to whether the deposition of what appears to be an unused axehead in a pit constitutes a symbolically-significant act, but this is indeed a possibility.

ML 170 mm, MW 63.5 mm (towards the blade end), MT 35 mm (corresponding to the widest area).

Figure 5.22: Axehead a) and b) surfaces, c) side view.

Hones

Two hones/whetstones were found in association with early Neolithic structures.

SF 377, the larger of the two, was found beside the apex of the rounded north-east gable to the smaller timber hall of Structure 8, with two querns (discussed below) forming a small group of tools (see Figure 2.12). They were placed in a shallow scoop or pit (context 698/697) in subsoil that was met by the outer edge of the gable trench. Although described individually, they are discussed as a group below, and their relationship with the building(s).

The hone is a medium-sized irregular block of fine-grained horizontal bedded orange-red sandstone (Figure 5.23). Most of the stone is natural and unmodified, but parts of its upper surface are well-worn. The area between its widest parts and towards its edges shows evidence of wear. The stone surface is flat but with an area in the centre and towards one edge of the stone, which is highly smooth. The stone has also taken on a darker colour across the area of wear, possibly from mechanical abrasion but also possibly from fats or oils used with the tool that needed sharpening. The wear-pattern seems to indicate angled use of a broad stone tool on its surface, being predominantly rubbed from one edge and into the middle of the surface, to stop just below its centre, where there appears to be a faint line where the polishing or rubbing stopped. The opposite side of the surface is also worn, but not to the same extent.

The finding of this stone in an early Neolithic context for the sharpening or polishing of what is presumed to be a stone tool is rare. The depositional context of this stone outside the building was c. 1.5 m away from the pit inside the building, which contained the axehead (above). The possibilities that there was a relationship between the two cannot be ignored and is explored further below. Was the hone used to put an edge on the axehead, or to polish it?

Weight 4558 g, ML 288 mm, MW 190 mm, MT 40 mm.

A second, small hone or whetstone is SF 444 from Pit Group 5, context (889/888), was discovered in a fire-pit south east of Structure 8 that is dated to the middle Neolithic period (3499 – 3118 cal BC UBA-39314). It was located together with a range of sherds from pottery vessels spanning the whole of the Neolithic, indicating the fire-pit was well used, and a broken whetstone could have been dropped into it.

Figure 5.23: SF 377 hone.

The stone is a proportion of what is likely to have been a rectangular block of brown fine-grained sandstone, possibly a beach stone. The edges of the stone are naturally smooth and it is doubtful the stone was modified apart from one surface which has been worn extremely smooth through use. Parts of this surface towards the stone's edges remain unworn. The piece possibly broke during use. Again, the question remains as to what material was used on this stone to create the flat smoothed surface. It is possible that bone or wooden tools could have been sharpened or smoothed on the stone, but a harder fine-grained material, such as another piece of stone seems the most likely explanation for the wear-marks.

Weight 256 g, ML 97.1 mm, MW 65.5 mm, MT 24.6 mm.

Saddle querns

Parts of two saddle querns were found in a shallow pit, context (698/697), together with hone SF 377 on the very edge of the apex of the trench of the north-east gable of the Structure 8 small timber hall. Together they form an interesting group of worked pieces. Both querns would have required a rubbing stone which would have crushed the grain and ground it on a roughened working surface of the static and heavier quern, but none were recovered.

SF 351 is a small mica-schist boulder with its upper surface used as a saddle quern for hand-milling of grain (Figure 5.24). There is some chipping or flaking around its edges that altered the stone to the desired shape, but the raw material is liable to flake naturally. The upper surface is concave and was pecked to roughen it before use. The worked area measures 260 mm by 210 mm and has some recent damage around its edges.

Weight 14.8 kg, ML 350 mm, MW 250 mm, MT 90 mm.

SF 352 is a larger stone than the previous quern and has been identified as a dolerite boulder. Its upper concave surface has been used for hand milling of grain. The base and most of the sides of the boulder are unworked, but the narrow end of the piece has lost a sliver of rock from the side, and the surface of the stone is missing at that point. However, this may have occurred before it was used. The concave face of the quern has been pecked all over and then worn smooth. The area of wear measures 400 mm by 290 mm.

Weight n/m g, ML 400 mm, MW 550 mm, MT 190 mm.

Figure 5.24: SF 351 quern.

Rotary quern

SF 89 was found on the northern edge of Structure 4, in material (context 255) that filled the stone-filled trench (context 254) of the linear structure. The radiocarbon date from this feature indicated a date range at the end of the first millennium AD and the beginning of the second. The quern is one of the latest objects found on the site.

It is a large sub-circular quern of garnetiferous mica schist broken across one edge, but not through its perforation. Approximately c. 25% of the stone is missing. It is identified as an upper stone (the moveable piece) to a two-piece rotary quern unit, but the lower stone, which would have been static, is not present. The upper stone is perforated by a central, slightly splayed hole measuring 110 mm by 100 mm with smoothed worn sides. It would have rotated on a spindle fixed in the lower stone, which also allowed the grain to pass down to the lower stone, to be ground between the dressed surfaces of both stones. The edges of the upper stone, from its slightly domed upper surface, have been shaped by generally rounding it by hammering or flaking. Its lower surface, the working face, has been dressed by rough pecking and then worn smooth through use to its edges. It is a well-worn piece, but the rock used is relatively soft and is not uniform in grain size or texture.

Weight n/m, ML 660 mm. MW 560 mm, MT 60 mm.

Cobble tools

All these tools, with their various attributes, apart from one found in rig and furrow deposits are associated with the latter part of the Bronze Age. Most were found within the surviving occupation layers of Structure 5, a roundhouse. The use of the building suggests that both domestic and craft/industrial (workshop) activities took place there, perhaps at different times (see Part 4: *Multi-element analysis*).

One cobble tool, SF 8 a polisher/grinder, came from an unstratified context adjacent to hearth (006) in Structure 1 (Figure 5.25). It is a smooth quartzite cobble with one surface polished and made darker through use. The tool would have been held in the hand and used in a circular motion on another object, such as stone, metal or possibly even leather. It has also facetted and ground areas around its edges, indicating its use as a grinder. However, the polished wear has been supplanted by its use as a grinder, signifying that the use of the stone for grinding is secondary to that of its use as a polisher. There is another area of polish on the opposed surface, but it is less noticeable. The narrowest area of the stone, which is concave with natural veins present in the stone, is highly polished.

Figure 5.25: SF 8 cobble tool.

Weight 1106 g, ML 107 mm, MW 87.5, MT 80 mm

SF 100 is a quartzite pounder from the occupation deposits (context 276) within Structure 5. It has light peck marks around its sides (circumference) and slightly heavier wear towards and at the apex of the stone. It has some soot adhering to its surfaces from the floor or a hearth. This stone would have been held in the hand in a vertical position and while gently striking a dense material, such as grain or stone, to break it down into smaller pieces. It is quite likely the tool would have been used with another stone or anvil on which the material to be crushed would rest.

Weight 542 g, ML 95.2 mm, MW 77.1 mm, MT 48.4 mm.

SF 106a is a small quartzite pebble polisher also from Structure 5, context (276). It has part of its lower surface polished and flattened due to wear.

Weight 110 g, ML 54.2 mm, MW 41.8 mm, MT 37.2 mm.

Found with the latter, is SF 106b another quartzite cobble polisher from Structure 5, context (276). It is a larger and more distinctive tool with areas of noticeable polish on two surfaces (Figure 5.26). The use of the tool has produced slight concavities on these surfaces and there is very slight facetting around parts of the polished areas. It is highly likely that this tool has been used on fine-grained dense material, possibly metal, due to the amount of polished and faceted wear the stone has received.

Figure 5.26: SF 106b cobble tool.

Weight 446 g, ML 87.7 mm, MW 62.9 mm, MT 58.7 mm.

Another small polisher is SF 109, also from Structure 5, context (276). It is an igneous cobble, which has one slightly concave surface with a distinct area of polish. A smaller concave area is noted at the broader end of the tool, which is also polished.

Weight 258 g, ML 71.9 mm, MW 53.4 mm, MT 46.8 mm.

SF 135 is a small, quartzite bun-shaped cobble polisher from Structure 5, context (276). The shape of this stone would have fitted well in the hand, and allowed the concave lower surface to come into contact with the material that needed smoothing or flattening. The wear on the stone is dark and suggests it was heavily used for polishing. There are possibly two areas of wear on the domed upper surface, which have produced slight facets with the sides of the stone. However, these areas are not dark in colour like the lower surface wear. There is also some damage, possibly recent, to the sides of the stone.

Weight 270 g, ML 80 mm, MW 67.4 mm, MT 35.2 mm.

The last pebble polisher is SF 143 from context (223), the lower part of a furrow from Rig and Furrow Slot B. It is a small quartzite pebble with its lower convex surface polished smooth. The dark area of polish is clearly demarcated from the paler sides of the pebble. Darker polished areas are also noted on the sides and upper surface of the stone.

Weight 80 g, ML 53.4 mm, MW 39.6 mm, MT 24 mm.

Personal items

Cannel coal or shale bangle fragment

By Alison Sheridan, National Museums Scotland

Description

The late Bronze Age cannel coal or shale bangle fragment, SF 284, was found in context (401) the fill of pit (462) in Structure 5.

It is a fragment constituting just over a third of a bangle with an exterior diameter of c. 108 mm; its internal diameter is c. 77 mm, hoop width 15.2 mm to 17.7 mm and hoop thickness 13.3 mm to 14.2 mm (Figure 5.27). The hoop is an elongated, round-edged D in cross-section and the bangle had broken across the hoop. There are numerous striations from the manufacture process running around the interior of the hoop and further, shallower striations on the outer surface that may relate to the grinding and polishing the exterior of the hoop, as well as some scratches that may have been received during the bangle’s use life, or after its breakage. The outside of the hoop had been polished to a medium sheen. The fact that the knife-cut striations are still visible on the interior of the hoop suggests that this bangle may not have been worn for very long before it broke.

The bangle is blackish-grey, with extraneous fine brown sediment attached to its surface. The fracture surfaces reveal the finely laminar structure of the parent material, which is a cannel coal or (more probably) oil shale, rather than jet. Compositional analysis through X-ray fluorescence spectrometry, undertaken by Dr Lore Troalen (NMS), confirmed this identification.

Figure 5.27: SF 284 bangle fragment.

Discussion

This is an example of a late Bronze Age high-status item of jewellery, rare in Scotland, that could well be contemporary with the metalwork deposit found approximately 5 m away; elsewhere, the recurrent association of such bangles with other valuable items including metalwork suggests that they formed part of the late Bronze Age 'vocabulary of esteem' among the elite.

Its size suggests that it had been made for an adult, and it is large enough for a man. Late Bronze Age comparanda from Scotland and northern England include a set of three similar bangles from the metalwork hoard found at St Andrews (Cowie et al. 1991; Sheridan and Davis 2002, 820), one from a hoard from Orrock, Fife (Piggott 1948), five from a hoard in a cave at Heathery Burn, County Durham (Britton 1968, nos 7–11) and one from a hoard at High Throston, County Durham (Vyner pers. comm.). All of these hoards contain metalwork comparable to that found at Carnoustie, thereby confirming the broad contemporaneity of the bangle with the nearby metalwork deposit: sunflower-headed bronze pins are known from St Andrews and Orrock, for example, while spearheads were present at St Andrews, High Throston and Heathery Burn; the last-named hoard also contained a sword. The discovery of a cannel coal or oil shale bangle in a domestic context in northern Britain, datable from the roundhouse by which the pit was located, represents a welcome addition both to the contextual range of findspots and (via the dates obtained for Structure 5) to the chronological evidence for the use of this object type during the late Bronze Age (for a broader discussion of cannel coal, shale and jet bangles in late Bronze Age Britain, see Brück and Davies 2018).

It is hard to tell whether locally-available cannel coal or oil shale had been used to manufacture this bangle, since sourcing these particular materials requires sampling of the object. However, there are abundant supplies of cannel coal in the coalfield deposits of Fife, and shale is also available within a few kilometres of Carnoustie, so in theory this need not have been an exotic import. While late Bronze Age bangles are likely to have been made by specialists, the scale of production in northern Britain may not have been large, to judge from their rarity. For southern Britain, Brück and Davies (2018) mention late Bronze Age workshop-scale bangle production at Eldon's Seat, Dorset (using local Kimmeridge shale: Cunliffe and Phillipson 1968) and at Margett's Pit, Kent (with the raw material there being a sandstone rather than shale, contra Brück and Davies: Sarah Steele pers. comm. and see https://www.wessexarch.co.uk/our-work/margetts-pit-burham-kent), but no such production sites of late Bronze Age date have been found in northern Britain (note that, regarding Eldon's Seat, Cunliffe and Phillipson propose a date of the seventh to sixth century BC for the earliest phase of shale-working there, which places it within the early Iron Age even if the associated pottery follows late Bronze Age tradition).

As for how the bangle had been made, there are two basic methods: the first involves pecking or gouging a hole in the centre of a roughout then expanding the hole by cutting, and the second involves cutting a disc from the centre, leaving a disc-shaped waster or 'core', usually with a bevelled edge (from where the disc had been cut from either side of the roughout). The latter technique, rare in Scotland, is characteristic of Iron Age and early medieval bangles (Hunter 2016), and no pre-Iron Age example of a disc-shaped waster is known. At Eldon's Seat, both techniques of manufacture are attested but, as noted above, this is likely to date no earlier than the seventh century BC. This suggests that the

Carnoustie bangle had probably been made by expanding a small central hole; the cut-marks running around the interior of the hoop are consistent with this suggestion.

Spindle whorl

SF 92 is a badly damaged piece from the occupation deposits (context 276) from Structure 5. It is an irregular but flat stone of possibly schist worked as a spindle whorl, with a perforation which is off-centre (Figure 5.28). Both surfaces are flat but heavily marked and the irregular edges of the stone indicate that it was either badly damaged or poorly made. The perforation has been mainly drilled from one face only, which is slightly unusual. There is some finishing off and gentle flaking around the perforation which measures 8.8 mm by 8.8 mm on the reverse. The perforation on the obverse measures 19.1 mm by 16. 7 mm and shows signs of pecking as well as elliptical wear around the hole.

Figure 5.28: SF 92 spindle whorl.

The whorl would have tightly fitted on a round wooden spindle. A length of thread would have been attached to the spindle above the whorl to enable raw wool to be spun into yarn. The spindle is then dropped (hence the name drop-spindle), and set spinning by the standing spinner. The weight of the whorl kept the spindle in motion and fibres of wool are twisted together to make a thread. The spinner would gently tease out the fibres from a handful of wool as the whorl was in motion. When the thread got to be too long, the spinner would then wind it around the spindle above the whorl, attach it again firmly and then repeat the spinning action until there was sufficient thread on the spindle or the spindle was full. This was the age-old method of spinning yarn until the invention of a spinning wheel.

Weight 34 g, ML 48.8 mm, MW 48.3 mm, MT 10 mm.

Discussion

Four stone artefacts were found inside the early Neolithic timber halls (Structure 8 and Structure 8s) with a further Neolithic artefact, a hone/ whetstone, associated with external activity to the south and east. Three of the artefacts, two querns and a hone were found together, with the polished stone axe found close by. These were the sum total of all the coarse stone tools for the whole of the Neolithic occupation of the site. The paucity of other stone tools contemporary with the structures is noted elsewhere in the early Neolithic: the Claish by Stirling (Barclay et al. 2002), Garthdee in Aberdeenshire (Murray and Murray 2014); and on the recent work on the Aberdeen western peripheral route at Milltimber (Dingwall et al. 2019). All these sites that produced evidence of early Neolithic settlement also produced sherds of contemporary carinated bowl pottery and lithic artefacts, as did Carnoustie (see PART 5: *The pottery* and *Lithic artefacts*), but the absence of coarser stone tools is noticeable.

There are probably several reasons for this at Carnoustie, where all the buildings were wooden. The necessity for axes (one axe is present in the collection) and knives and scrapers (present as smaller flint tools, see PART 5: *Lithic artefacts*) were possibly more important than larger cobble hand tools, usually associated with stone structures. Dense bones from large mammals such as cattle and deer were more likely to have been used as grinders and pounders, but this organic tool-kit component (including wooden items) is completely missing from the archaeological record for this site, along with other bone tools such as chisels, points, scoops and pointed pieces (see Ballin Smith 2018, Figures 5.61 and 5.62 from the later Neolithic site at Udal, North Uist). Whist two querns were associated with grinding grain and two hones/ whetstones with the polishing or edging of other stone (including bone and wooden) tools, all the other everyday domestic items could have been made from bone, wood, or in some cases antler.

It is quite likely that the limited use of stone for tools persisted at this site until the Bronze Age, when the new technology of copper alloy metals was introduced. The interesting collection of quartzite cobbled tools with their distinctive, and in some cases heavy wear patterns, may indicate their use with metalwork. The suggestion that Structure 5 could have been a workshop during its later use persists, especially with the nearby burial of the contemporary dated bronze hoard. The spindle whorl SF 92, from the same building, gives a limited glimpse into the domestic life at this time along with pottery Vessel 144, and the pattern of woven fabric impressed into its base (see PART 5: *The pottery*).

Another possible reason that stone tools are rare is the disturbance caused by the construction of Bronze Age structures on top of, or near to, the Neolithic buildings, with the possible reuse of useful stones that were picked up through chance discovery. However, it is more likely that the various farming and tilling practises that persisted to almost the present day probably caused the most loss of stone tools. Mechanical abrasion, frost action, stone clearance, deeper ploughing and soil movement have all played their part in the reduction of the archaeological record and of its remains.

Of significance is the placing of two worn querns and a used hone almost in the centre gap between the third pair of pits/postholes (from the north-east end of the building), for the large roof bearing posts for the Structure 8 long timber hall. The shallow scoop or pit into which these tools were placed was also on the very edge of the north-east gable of the Structure 8s small building. Whether this was by chance, or represents a specific demarcation of activities in the long building, or whether there was some arcane system of belief in operation, is discussed further in PART 7: *Discussion*.

The presence of the cannel coal or shale bangle is the only identified stone object brought to the site, perhaps from Fife, the nearest source of the raw material. Its links with the metal hoard indicate contact with people outside the immediate local area, and the possibilities of trading for what was likely to be considered a luxury item. It has to be considered whether this was carried by foot or by boat, and the possibilities of route-ways by land and water. The bangle hints of life and society beyond the settlement, of the personal or collective desire for unusual and possibly expensive items, and of culture, economics and to some extent fashion.

Conclusions

This small assemblage reflects the domestic, manual labour of life during the Neolithic and Bronze Ages. The stones from early the Neolithic indicate the necessities of life – the milling of grain, and the axe for cutting down trees and shaping the timber for building, with a hone for sharpening its edge. However, the placing of used and unused objects in or beside the buildings may go beyond their domestic value and hint at other values, those of belief systems and superstition.

The change in tools during the Bronze Age demonstrates changes in technology but also trade, and the opening up of settlement life to that beyond their traditional geographical boundaries.

The Pottery

By Beverley Ballin Smith

Introduction

The collection comprises 155 vessels, represented by single pieces, groups of sherds, or in one or two instances, almost whole pots. Most of the pottery is from the early Neolithic and comprises a few Carinated Bowls but mostly modified vessels of the same period. The bowls were clearly associated with the pits and postholes of the timber halls and a high number of sherds were found in Structure 8 (Figure 5.29). The variety of bowls, in some cases with complex decoration, and the development of carinations and lugs indicate that potters were not adverse to experimentation. One pot from Structure 8 was a rare example of the survival of an unfired pot. The so-called 'Structure' 7, part of the outback area beyond the settlement, contained most sherds, as it was possibly a refuse or manured area. However, early Neolithic pottery was also found in all other structures, groups of pits, the rare occupation layers, and in postholes, indicating its wide distribution across the site.

During the middle and later Neolithic, typical decorated pottery of those periods was found, but in much lower numbers than previously (Figure 5.29). The early Bronze Age was characterised by vessels associated with burial and ritual activities, and included fragments of three All Over Corded Beakers, the remains of four urns and a Food Vessel. The remaining vessels from later Bronze Age activities and structures are generally poorly manufactured, plain cooking pots.

The collection is varied and complex, not least because of the intrusion of later activities into earlier contexts resulting in sherds of different periods being found together. The vessels from all phases generally reflected styles and decorative motifs seen on pottery in the east of Scotland region and across the country as a whole.

Analysis of the pieces

All the sherds were gently brushed before analysis and all were examined using a x6 hand lens. The attributes and statistics of the collection were compiled in an archivable table devised using Microsoft Excel. The pottery was analysed according to the revised guidelines of the Prehistoric Ceramics Research Group (2010), the CIfA's *Standards and Guidance for the collection, documentation, conservation and research of archaeological materials* (2014, revised 2020).

The assemblage is a collection of prehistoric hand-made pottery. It analysis is described and discussed as a single collection and then by structure, pit group and area. The total collection amounts to 2570 sherds, excluding small fragments or crumbs less than 10 by 10 mm, but including one, mostly whole, vessel and significant proportions of at least one other (Table 5.13). The whole vessel was lifted with its surrounding soil with the intention of excavating it under laboratory conditions. However, most sherds were recovered and bagged on site during the excavation, and a small number of sherds and fragments, were retrieved from soil samples that had been processed after the excavations.

As expected, most of the sherds are body sherds with almost three times as many rims as base sherds, even though their relative percentages are low, they are roughly average for prehistoric assemblages. Table 5.13 displays the total number of sherds from each location, but the general view of the collection from the analysis and the excavated evidence is that early Neolithic pottery was distributed everywhere across the site. The greatest concentrations are from within the timber halls and smaller related structures, but the reuse of the site over a long period of time enabled sherds of the early Neolithic period to appear in Bronze Age contexts and in the rare later structures, as later pits and postholes were dug through to earlier levels and then backfilled.

The total weight of the assemblage is 28503.2 g but not all structures or pit groups produced pottery. Omitted from Table 5.14 are Structures 11 and 14, Pit Groups 11, 18, 20, 21, 23 and 24, and pottery from Pit Group 4 that was divided between Structures 6 and 8 during the post-excavation analysis. The largest amount of pottery by number was from the outback area ('Structure' 7) to the north of the buildings, closely followed by that of pottery from Structure 8. As can be seen from Table 5.14 early Neolithic pottery was found in most locations. The heavier average sherd weights are where there is later pottery, be that later Neolithic or Bronze Age in date.

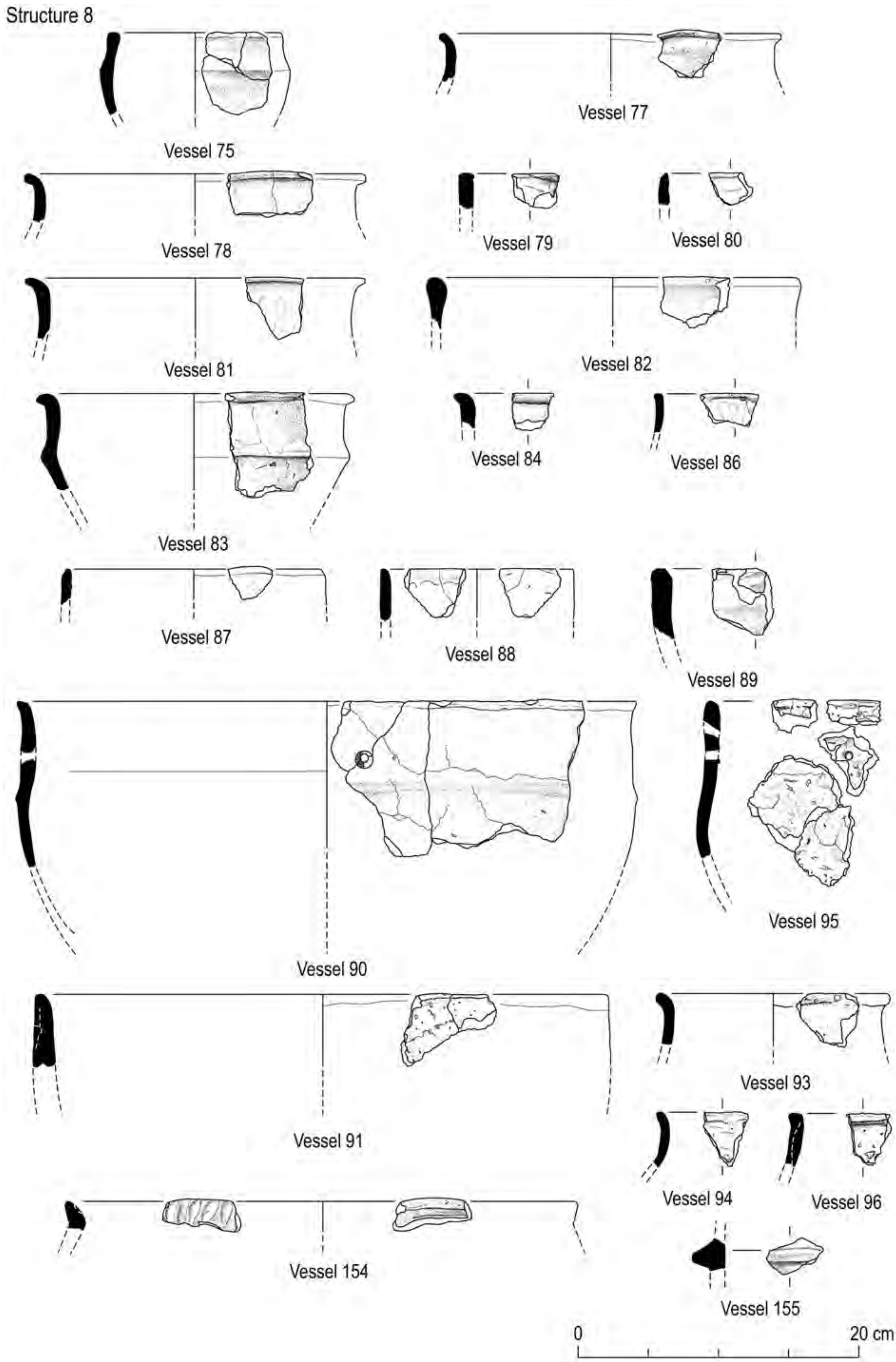


Figure 5.29: Vessels from Structure 8 long timber hall.

Location	Rims	Bases	Bodies	Crumbs Present	Total Nr
St1	4		66	✓	70
St2	1	1	1		3
St3	1		75	✓	76
St4			1		1
St5	18	1	76	✓	95
St6	1	4	1	✓	6
St8	63	17	213		293
St9	3		30		33
St10	5	9	32	✓	46
S12	15	7	77		99
S13	9	1	92		102
PG1	22	4	127	✓	153
PG2	16		49		65
PG3	2				2
PG5	14	21	63		98
PG6	15		130	✓	145
PG7	5		15	✓	20
PG8	4		19	✓	23
PG10	12	14	148	✓	174
PG12	3		8	✓	11
PG13*	8	3	115		126
PG14	10	3	108	✓	121
PG15	11	5	134	✓	150
PG16	9	4	107	✓	120
PG17	3	1	16		20
PG19			1		1
PG22			1		1
PG25		1	2		3
Area/St7	28	5	263		296
Areas A, C, E, G	22	4	191	✓	217
Totals	304	105	2161		2570
Percentages	12%	4%	84%		100%

* Numbers do not include a whole pot

St = structure PG = pit group

Table 5.13: Sherd form numbers by location.

Post-depositional changes

The average sherd weight assessed against the total number of sherds and their overall weight as in Table 5.14, gives some idea of fragmentation. Where the sherd weight is low and the number of pieces is high, such as in Pit Group 14 or Structure 1, it indicates that the pottery has been much disturbed and fragmented. In these particular examples, pottery was found in pits that were possibly used many times and were often dug through earlier stratigraphy. Also, sherds could be dropped or discarded into a fire-pit when vessels broke, as the burning of many sherds indicates. The back-filling of a pit could include residual or waste sherds from the surrounding area, many of which display evidence of worn edges and surfaces. The abrasion, heating and cracking of sherds can have many causes, and buried sherds could be subject to repeated disturbance.

In examples where pottery was buried deeper in a posthole or hearth, such as V109 from Structure 8, and the highly decorated rims of V20 and V25 found in Pit Group 5, sherds were often exceptionally well-preserved, including the survival of burnished surfaces. Pottery found at the junction of the plough soil/subsoil, often exhibited characteristics of abrasion, with loss of surface finishes, partial loss of surfaces, and weathering.

Disturbance in recent decades has come from heavier machinery used on fields, with ploughs dragging up sherds from features and causing mechanical abrasion. V129 an early Bronze Age urn from Pit Group 13 lay close to the surface of the subsoil and appeared to have been run over by a heavy wheeled mechanical vehicle. The pot moved and became distorted by the impact, part of its rim was broken off and compressed into the vessel's contents, and its base was lost. The pot was lifted in a block of soil, but it was so badly fragmented that it could not be excavated. Human remains did not survive.

General characteristics and dating of the pottery

Raw materials

All the pottery in this collection is handmade, using locally available clay resources close to the settlement - probably the place of manufacture - with deliberately added materials (temper or filler): sand, gravel, rock, and chopped dried grasses, cereal straw or chaff. The addition of the latter may have been as waste materials from cereal processing or from the gathering of fodder or bedding materials. Mineral temper could have been collected from the shore, the sides or beds of streams, or as occasional stones or gravel found in the subsoil. Some preparation was needed before mineral temper was used: larger stones had to be broken up or ground down into much smaller pieces, and sand and gravel were no doubt sorted to remove larger fragments. All the sherds examined contain mineral and organic temper in differing amounts that were added to the raw clay. It is possible that different potters may have had their own 'recipes' of specific handful amounts of sand or stone to clay, but clearly differentiated fabrics were not identified as the resources used over time were very similar. This has also been remarked upon by Sheridan (2014, 49) in her examination of the pottery from Garthdee Road, Aberdeen.

The pottery ingredients had several functions. The addition of organic temper to the raw clay enabled it to become more pliable and workable, and the finished product was relatively light in weight if none or only a little mineral temper was added. Organic material also allowed finer, thin-walled vessels to be made. However, the addition of mineral temper (stone), provided strength to the finished vessel, prevented it from shrinking and cracking during the drying process after forming, but also made it heavier. However, added stone (especially quartz) helped the vessel to withstand thermal shock during heating and cooling, which would have taken place when fired and when in use on the hearth (Kilikouglou, et al. 1998).

Location	Total sherd Nos	Total weight (g)	Average sherd weight (g)	Period
St1	70	519.6	7.4	LBA
St2	3	35.8	11.9	M/LN
St3	76	832	10.9	EBA/BA
St4	1	4.2	4.2	n/d
St5	95	745.6	7.8	EN with BA
St6	6	70.9	11.8	EBA
St8	293	3406.8	11.6	Predominantly EN
St9	33	294.8	8.9	MN
St10	46	710.5	15.4	EN/?, BA
St12	99	845.3	8.5	EN/?
St13	102	1124.8	11.0	E/M/LN, EBA
PG1	153	2021.1	13.2	EN, LBA?
PG2	65	627.5	9.7	EN
PG3	2	51	25.5	E/MN & LBA
PG5	98	1781.8	18.2	E/M/LN
PG6	145	1603.6	11.1	EN/?
PG7	20	176	8.8	EN
PG8	23	192.3	8.4	EN/?
PG10	174	1531	8.8	E/M/LN, EBA/BA
PG12	11	108.9	9.9	BA
PG13*	126	1246	9.9	EN, MN, LN, EBA
PG14	121	825.7	6.8	EN, BA
PG15	150	1321.2	8.8	EN/M/LN, N, LN/EBA
PG16	120	3570.1	29.8	EN, N, EBA
PG17	20	121.6	6.1	EN
PG19	1	3.8	3.8	n/d
PG22	1	13.5	13.5	n/d
PG25	3	27.5	9.2	EN
Area/St7	296	2338.5	7.9	EN/N
Areas A, C, E, G	217	2351.8	10.8	EN, LN/EBA
Totals	2570	28503.2		

Key
n/d not determined

St – structure	LN - late Neolithic
PG – pit group	N – Neolithic
n/d - not determined	EBA - early Bronze Age
EN - early Neolithic	LBA - late Bronze Age
MN - middle Neolithic	BA - Bronze Age

Table 5.14: Locations producing pottery, total weight of sherds.

Most of the early Neolithic vessels from Structure 8 had visible amounts of organic temper but the mineral temper is frequently recorded as sparse, sometimes as low as 2% of the mix. The minerals most frequently identified were quartz sand, quartz rock fragments and mica, and although the grain size was often described as fine to coarse, there was a tendency for fine or medium sized mineral temper to be used, rather than coarse. In some vessels, such as V011 and V109, the amount of organic material was noticeably higher than in other pots, giving the pots a corky appearance, where it had burnt away during firing. Both these vessels are from the smaller hall, Structure 8s.

There is an indication that some vessels from the middle to late Neolithic contained a high percentage of organic matter, rather than mineral temper, which was probably necessary for the execution of clear decorative designs, for example, V130 and V135. There seems also to be some discrimination in the amount and size of temper used in clay for the bases of vessels (generally more coarse material for V58) and in rim coils (finer material in V28). In the collection in general, there is a wide variety of temper size and amounts, with some unidentified mineral.

In the early Bronze Age, variety is noted in the amount and type of temper used, as it was dependent on the type of vessel to be produced. Beaker pottery usually has sparse grit, for example V70, where as an urn, such as V19, can have much larger and often unidentified fragments of mineral temper. V13 also has a very coarse mineral mix which was dominated by quartz. Pots, from the middle to later part of the early Bronze Age and throughout the rest of the period tend to be heavy and generally thick-walled. During the later Bronze Age, quartz rock with mica remains the main mineral used in pottery manufacture, but other unidentified minerals are also present.

Early Neolithic vessels

Making the pot - vessel and rim forms

The earliest pots, those of the early Neolithic Carinated Bowls were made with a gentle shoulder or carination that separated the neck and rim from the belly of the vessel, and a round-bottomed base that could sit in the ashes of the hearth or fire/pit. They were probably made using a pinch- or thumb-pot method (opening up a lump of clay with the thumb, and then working it with the thumb and fingers to create the base and sides of a vessel) combined with the addition of coils for the upper part of the vessel and the rim. No complete profile of a vessel from this period survives on the site, but V90 (Structure 8, Figure 5.29), is probably the most typical.

The shape of vessels during the early Neolithic, from the simple gentle carinated round bottomed bowls, developed into a variety of modified forms that demonstrated there was experimentation in creating a wider variety of pots: open mouthed larger bowls up to 310 mm in diameter with slightly everted rims and slight carinations were present (Figure 5.30), to narrower mouthed pots and bowls with a variety of rim forms (Figure 5.31), to smaller pots such as V78 from Structure 8, with a diameter of c. 120 mm and a weak carination (Figure 5.29), and cups such as V73 from Structure 13 (Figure 5.30).

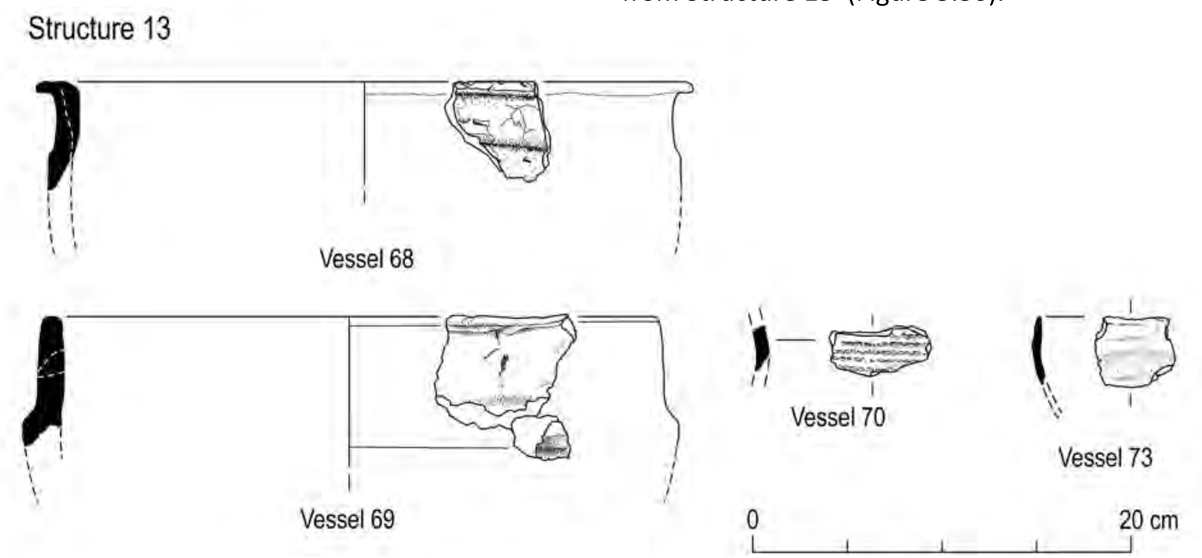


Figure 5.30: Vessels from Structures 8 and 13 long timber halls.

There are also sherds with pronounced carinations such as V44 from 'Structure' 10 (Figure 5.32), but where the size of the vessel can only be indicated as large. The variation in size and form indicates that a range of different vessels was produced, presumably with different functions. Although some rounded base sherds were recognised during the analysis none could be reconstructed due to the amount of abrasion and burning they had suffered when in use.

The rims of the vessels are generally round topped and have profiles that are straight, oblique and, rounded and everted. The majority of early Neolithic pots have straight or oblique necks to the carination, but in modified and smaller vessels the simple rounded rim can be slightly angled to the interior of the pot, or the neck can be concave. From the carination the vessel body angles downwards and inwards to a narrower, rounded base.

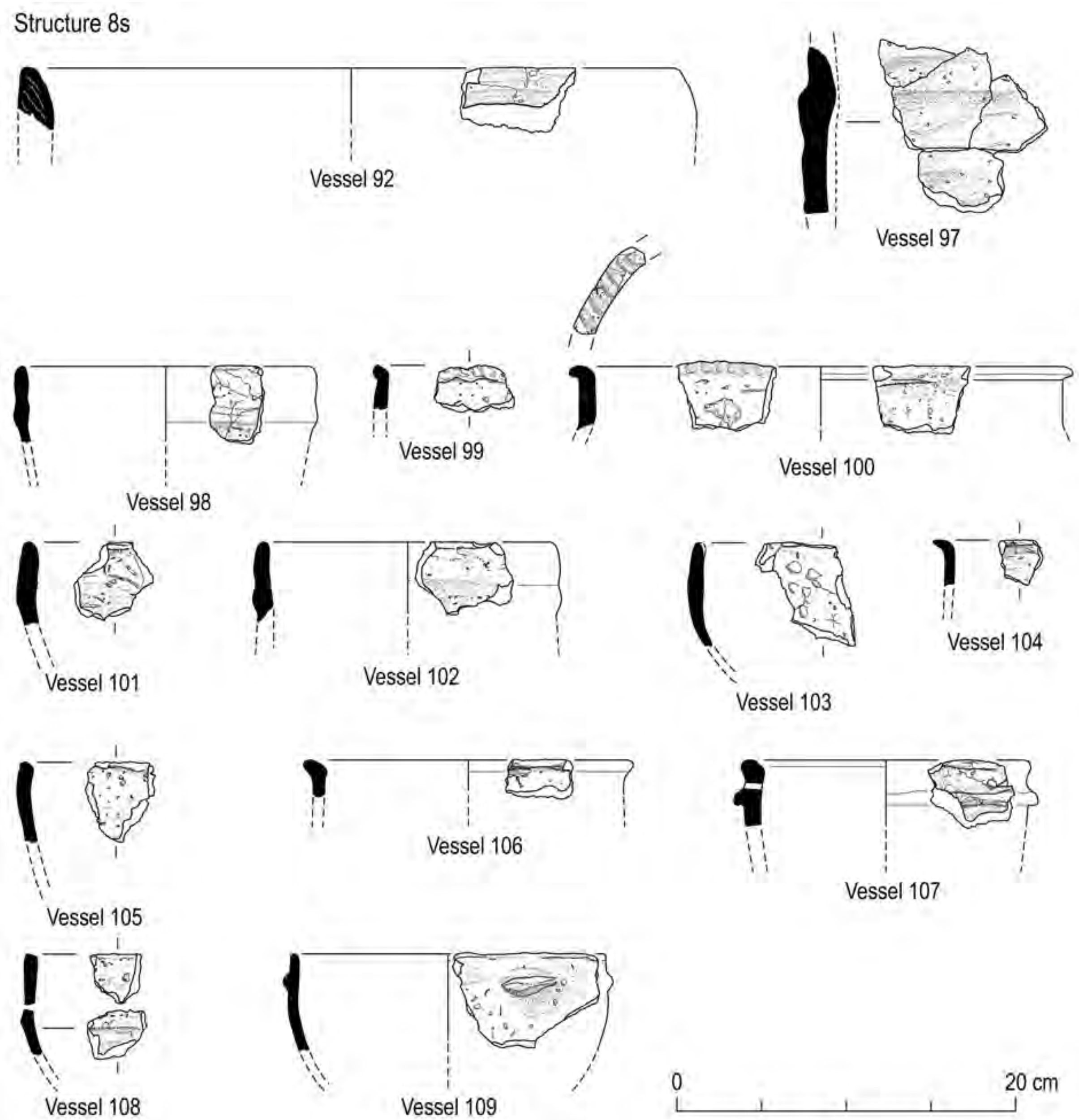


Figure 5.31: Vessels from Stucture 8s smaller timber hall.

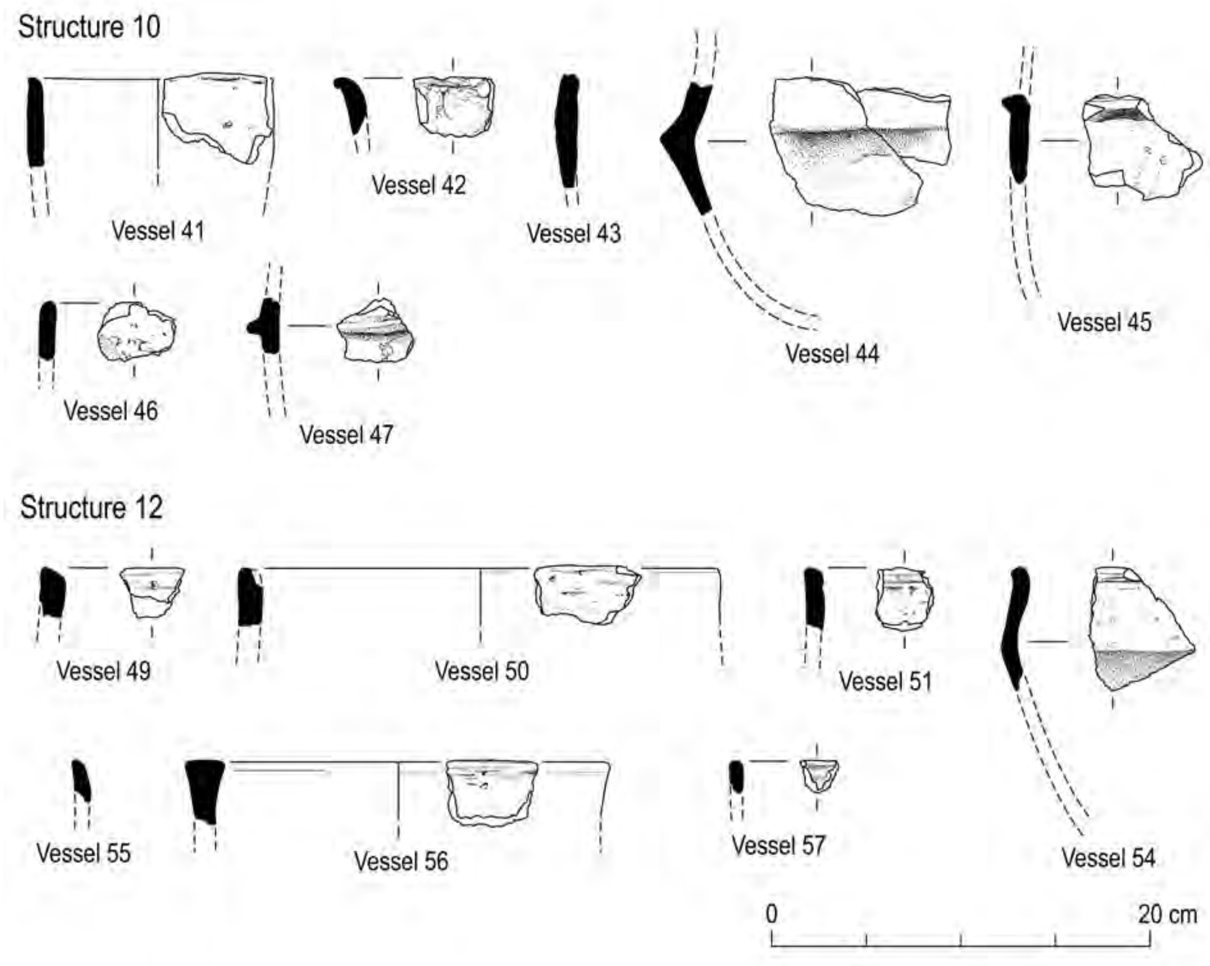


Figure 5.32: Vessels from 'Structures' 10 and 12.

Vessels with modified shapes such as open, everted rims, concave necks and narrower mouths than the diameter of their carination such as V83 from Structure 8 (Figure 5.29) suggest they could have been cooking pots suspended over a fire, or hung from a wall or rafter if used for storage. The enlargement of some curved rims could have been made deliberately to allow space for a sinew or leather strap to be secured beneath them without them slipping off the vessel, and to allow the pot to hang securely. It is possible that an exaggerated carination, like V20 from Pit Group 5 (Figures 5.33 and 5.34), could have performed the same function.

There seems to have been a requirement for the hanging or suspension of some vessels and this is best illustrated by the plain, but well finished pot V90 from Structure 8 (Figures 5.29 and 5.35). A splayed hole (measuring 13 mm externally and 6.5 mm internally) was carefully bored through the wall of the pot from its exterior surface to the interior after it had been fired, but the pot cracked at the perforation before it was finished. The fabric of this vessel contained some coarse grains of quartz rock and presumably a sizeable piece was encountered during the drilling process that was responsible for cracking the pot. A minimum of three perforations would have been needed to successfully suspend or hang a vessel.

In contrast to the above, V107 (Figure 5.31) from Structure 8 had the remains of two perforations below the rim, c. 5 mm in diameter and c. 33 mm apart. The perforations were made after the pot had been formed but had not been tidied up before firing. It has been calculated from the rim diameter of c. 160 mm that it probably had a total of 13 perforations around its circumference. Whether these were a decorative feature as there were more than were needed for suspending the vessel, or a means of tying on a lid, is open to conjecture. However, Sheridan (2002, 86) noted decorative perforations below some rims in the material from Balbridie near Banchory, and at Easterton of Roseisle, Moray (Henshall 1983, Figure 3, 19).

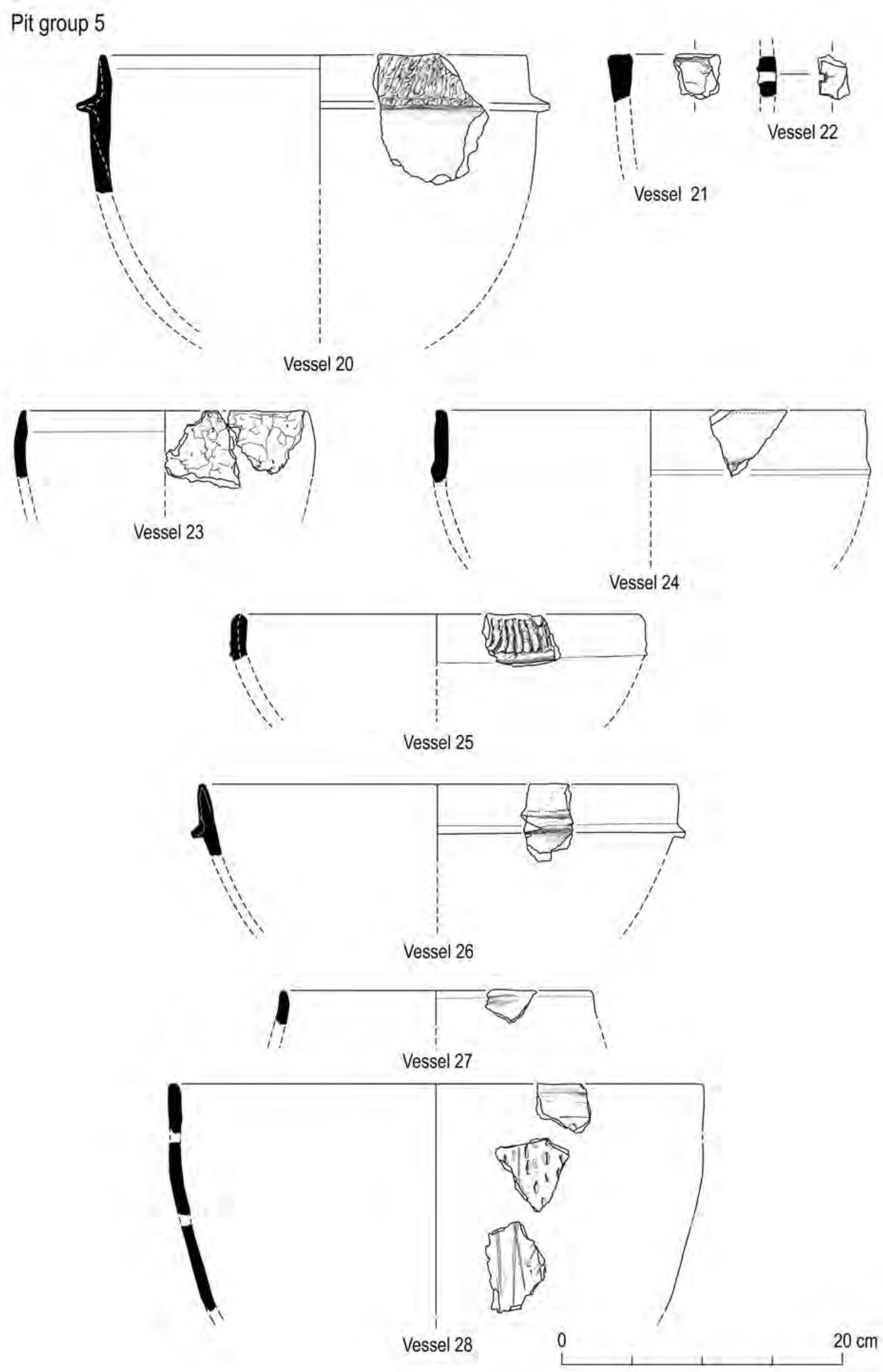


Figure 5.33: Vessels from Pit Group 5.

Figure 5.34: V20 rim and carination.

Modification of the tradition Carinated Bowl form had been noted by Henshall (1983) especially in the north-east region, hence her 'modified CBNE style', and is also referred to by Sheridan (2009, 92) as 'style drift'. This can be most aptly applied to the Carnoustie pottery, and examples are described and discussed further below.

Modifying the traditional bowl - carinations to lugs

During the analysis it became clear that potters during their experiments with rim and vessel shapes, also considered the carination, the feature that separates the upper portion of a vessel from the plainer lower portion and that in some cases was decorated (see below). Due to building alterations and the reuse of pits and to changes that took place on the site, there is no clear pattern of development of the carination that can be securely demonstrated chronologically within the early Neolithic time frame, but there are changes that can be discussed.

One of the first questions to be considered is why there was a carination and what was its function? There are several reasons that can be explored. In the construction of a round-bottomed bowl there may have been a point where more clay (a coil or coils) was needed to finalise the vessel shape by making it taller with the addition of a neck and a rim. The joining of a coil of clay to the basal part of the vessel required some skill to firmly lute the join. The carination, at the vessel shoulder, was probably made by pinching the clay of the two pieces together. Instead of being smoothed away, as it would have been in some pots, the join was emphasised and gradually became a somewhat

Figure 5.35: V90 rim with carination and perforation.

prominent and noticeable feature in the vessel form. The carination also allowed the formation of a neck, and permitted more variation in the neck angle and rim form of a hand-built vessel.

Both Henshall (1983, 20) and Sheridan (2009, 85) remarked that the early Neolithic assemblages from Easterton of Roseisle, Moray and Warren Field, Aberdeenshire, had thinning of the vessel walls above the carination, which created a weak point in the vessels. This same tendency is noted in only a few vessels of the Carinated Bowl tradition at Carnoustie (V38, Pit Group 7, Figure 5.36, and V108, Structure 8 in particular, Figure 5.31), rather than the modified vessels, but may account in part for the large number of detached rims.

Figure 5.36: Vessels from Pit Group 6, 7 and 8.

The carination was also functional, in that it separated the lower, sooty and burnt part of the pot, the part that nestled in the ashes of the hearth, from the part visible above the flames - the food-related and sometimes decorative upper part of the vessel. In simple vessel forms the carination also functioned as a 'stop'. In handling a round bottomed vessel with a smooth surface, the expansion of clay at the carination stops the pot from sliding through the hands and dropping onto the floor. When the shape of vessels developed to include a distinctive concave neck with an open everted rim form above the carination, the pot could be successfully lifted by hands placed around its neck and below the rim without fear of dropping it or its contents.

There was an inherent problem in handling or carrying round-bottomed vessels, as seen in the rare perforations noted in the collection, and where carinations did not always protrude significantly from the vessel body. In this assemblage the form of carinations varied from slightly rounded to acutely angled (V44 from Structure 10, Figure 5.32). The most extreme of the developed forms of carination was noted in pots from Pit Group 5 (the external activities associated with Structure 8), where it had become a prominent ledge. Examples include a plain vessel, V26, where the neck disappeared to become a simple but slightly inverted rounded rim c. 340 mm in diameter, and V20, a slightly smaller diameter vessel than V26, but with a protruding carination and a similar inturned rim with an internal bevel (both Figure 5.33). Both pots were highly sophisticated but V20 was more so. Its belly had been burnished and its rim and neck were heavily decorated with an all-over vertical incised design. The carination was also deeply incised to match with the design on the rim and neck, and had regular cuts like a pie crust. A similar pot, V25, also had a ledge below its highly decorated rim with a diameter of c. 290 mm (Figures 5.33 and 5.36), but it was less prominent and less well executed than on V20.

The carinations on these bowls (V20, V25 and V26) suggests they were made as proto-handles. Although sooted, all three vessels may have been made for the storage or serving of food. The pots could have been handled using the protruding carination as a form of handle, or from immediately below it. The practical considerations of an exaggerated carination were also matched by the visual impact of the vessel - the proportions and shape of the bowl, their unusual design, and in two cases their unusual decoration.

V107 (Figure 5.37) from Structure 8 is a less well-made vessel than the above. The rim is rounded and slightly everted but is asymmetrically moulded. The plain carination was added as a strip of clay to the vessel body. It is rounded and cord-like in shape, but was unevenly moulded and finished. The sherd broke at a point where the carination appears to have become slightly narrower, indicating it may not have been continuous around the body of the pot. This vessel also had the remains of two perforations, and gives the impression that the potter was experimenting with a number of ideas, and that the finishing of the pot was not important.

Figure 5.37: V107 rim with carination and perforation.

A reasonably-sized rim fragment of a fine-walled but corky bowl, V109 also from Structure 8 (Figures 5.31 and 5.38), is similar in shape to V20 and V26 from Pit Group 5 but it is much smaller than them in size with a diameter of c. 180 mm. What is unusual about this piece is the replacement of the carination by lugs, one of which survives. The small longitudinal lug, 26 mm long and 10 mm wide, is positioned where the carination would have been, approximately 13 mm below the rim top, but either end of it blend into the body of the vessel. It is possible that there were another three lugs around its circumference. The bowl was light in weight due to the lack of mineral temper, and was highly polished to give it a burnished sheen.

Two other lugs from two other vessels were found as separate pieces, V147 (Figure 5.39) from the outland area beyond the settlement and another, V155, from Structure 8 (Figure 5.30). They were both similar in appearance to the lug on V109, but each had a different profile. The V147 lug measures 36.5 mm by 13 mm by 22 mm, is unevenly moulded and the moulding marks beneath it have not been removed. In contrast, the lug forming V155 measures 41 mm by 11.5 mm by 16.7 mm, and has been smoothed and well finished.

Two lugged vessels were found at Wester Hatton on the line of the Aberdeen peripheral ring-road. Both were similar to the Carnoustie vessels described above and were considered modifications to the Carinated Bowl tradition with a spread of radiocarbon dates between 3810 – 2880 cal BC (Lochrie 2019, 285-288). Further lugged vessels have been found at Balbridie near Banchory (Sheridan 2002, 86), Easterton of Roseisle, Moray and Pitglassie Wood and East Finnercy, Aberdeenshire (Henshall 1983, Figures 4-6).

Figure 5.38: V109 with lug.

The production of vessels with carinations persisted in bowls with round bottoms. However, as pots developed flat bases, and different methods of manufacture come into play in the middle and later Neolithic (see below), carinations mostly disappeared.

Decoration/finishing

Several of the pots from the early Neolithic display decoration, as with V20 and V25 above (Figures 5.33, 5.34 and 5.36), it was usually confined to the rim and the neck, the sections of the vessel above the carination. One of the simplest forms of ornamentation of some vessels was associated with the finishing or final stages of production. It involved a method of luting the coils of clay together, which comprised the gentle fluting of the clay by the potter running the fingertips down the surface of the vessel, to create parallel and predominantly vertically aligned concave marks. Initially, these marks may not have been intended as decoration, but instead of smoothing them entirely away, the potter kept them for their decorative effect. Vessel 35 from Pit Group 6 (Figures 5.36 and 5.40) is a good example of this as fingertip drag marks were noted on both its exterior and interior surfaces, with the addition of short, closely positioned fingertip marks on the top of the rim to give it a faint ridged appearance. The surface of the vessel was polished afterwards and many of the slight ridges between the fluting were smoothed away, almost as if the potter was indecisive as to whether to keep the marks or remove them. This form of decoration is noted on a number of

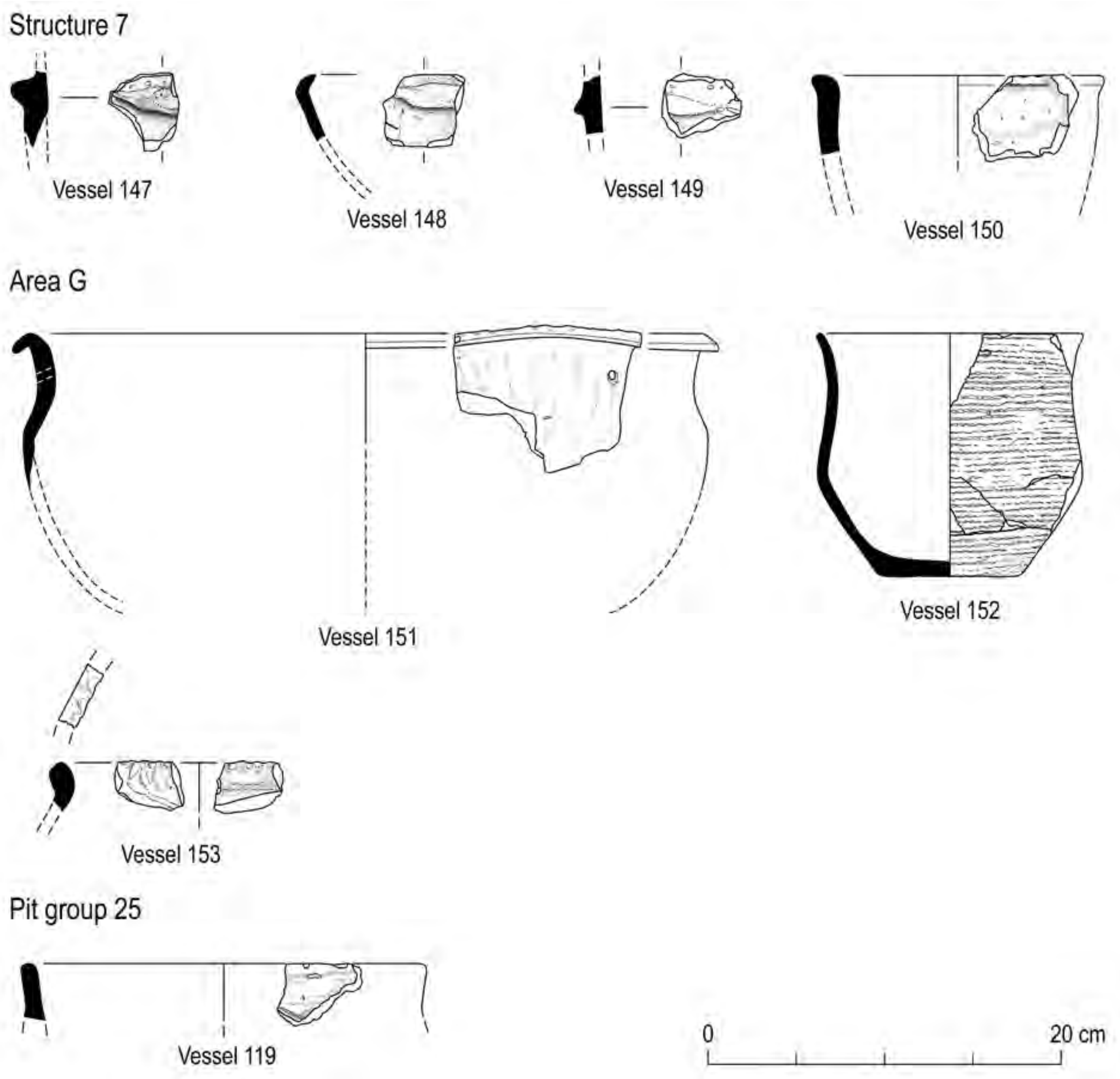


Figure 5.39: Vessels from the Outland, 'Structure'7, Area G and Pit Group 25.

vessels and seemed to have been popular, in the north-east of Scotland (Henshall 1983, Figures 2 and 4; Lochrie 2019, Illus 2.57 and 6.36; Sheridan 2014, Illus 25 and 28; Sheridan 2009, Figure 39, 16), but examples exist from other areas such as Hillhouse Farm, Highlees, South Lanarkshire (Sheridan 2020).

Figure 5.40: Interior of V35 with finger rilling.

The rim sherds of V151 from the outland (Area G) were very similar to the above, but the finger fluting is more distinctive as the marks made are slightly curved to the right (Figure 5.39 and 5.41). The upper parts of the exterior and interior of the vessel are finished in the same way and the top of the rim is faintly ridged by finger indentations, and is not dissimilar to an example from Easterton of Roseisle (Henshall 1983 Figure 2, 10). V153 also from Area G (Figure 5.39) was decorated similarly but although the sherd is heavily abraded the finger marks are still visible.

Similar external surface marks were noted on the neck of V81 and V86, and on the top of a fragment of rim V154, all from Structure 8 (Figure 5.30). Also from the small hall Structure 8s, was V100, which has more prominent parallel finger indentations decorating only the rim top (Figure 5.31). V145 from Pit Group 16 has faint indentations, producing a gently ridged surface to the rim top (Figure 5.49).

Although this surface finishing is described here as decoration, and certainly its occurrence on rim tops and on the upper interior parts of the vessel indicate it was intentional ornamentation, there may have been a more purposeful aim in its execution. Like the carination and lugs discussed

Figure 5.41: V151 with decorative finishing.

above, a vessel with a slightly ridged surface is easier to handle and less prone to slipping when being moved. The evidence from Blackdog near Aberdeen of a vessel with fluting surviving near its base suggests that in this example, it was more purposeful than decorative (Lochrie 2019, illustration 6.36).

The finishing of plain vessels once leather hard, including smoothing the surfaces to remove finger moulding marks and other inconsistences of manufacture. Initially, the fingers were used on the vessel surface to smooth it, but often a handful of dried grass was used. However, although grass impressions are not common on surfaces of early Neolithic pots in this assemblage, evidence suggests grasses were used, but that the marks were largely removed by subsequent polishing. Fingernail nicks have also been identified beneath the rim of V8 from Pit Group 3 (Figure 5.56). The sherd is heavily abraded and the removal of the surface finish revealed the moulding marks beneath the rim.

In order to gain a more even, smoothed and polished surface Sheridan (2009, 87) suggests animal skin could have been used, and a coarse piece could have acted like sandpaper to gently remove blemishes. Many of the vessels also had the remains of a high sheen, indicating they were burnished. To achieve this, a much harder but very smooth tool, such as a quartzite pebble, or possibly even a dense wooden or bone implement, was rubbed across the leather hard surface. The fine mineral fraction in the clay or filler would move to the surface during burnishing process to help create a polished and shiny surface. It is remarkable that evidence of burnishing has survived both the firing of some of the pots and also their use on the hearth, as the sheen can easily be removed by heat as well as mechanical abrasion.

One of the most unusual pots, V97 was found in the fill of the reuse of a large posthole within the smaller hall, Structure 8s (Figures 5.31 and 5.42). It differed from all the other vessels found across the excavated area in that its fabric is extremely fragile and largely unfused, so much so that it considered to have been either very lightly fired or it is an unfired piece. It comprised 13 body sherds, the largest of which formed the carination of a substantial thick-walled vessel. The interior surface is entirely missing, presumably due to it being in contact with the subsoil. The pot has very little mineral filler, with only fine mica and organic material present. However, what has helped the sherds survive is the hardening of the exterior surface by smoothing and burnishing and by the taphonomic conditions of the posthole in which it was buried. Another important aspect of this pot is that it demonstrates pottery was made, and or fired, within or close to Structure 8.

One of the interesting aspects of the Carnoustie assemblage is the range of modifications that took place to the traditional Carinated Bowl shapes. None of them are particularly different from those noted earlier by Henshall (1983) but significantly more examples have survived. Among them are the range of rim shapes, the exaggeration of carinations to such an extent that development of lug from the carination can be inferred, finger fluting, and the use of dense rim/neck decoration especially on vessels from Pit Groups 5 and 6. These examples indicate that potters experimented to produce a variety of sizes and shapes of vessels for different uses, including pots with holes for suspension that were not simply functional but also visually fascinating.

Figure 5.42: V97 lightly fired vessel.

Use of the pots

Approximately half of the pots recovered from early Neolithic contexts exhibited evidence of being used for cooking or being placed on the hearth. They have carbonised food residues adhering to their rims, exterior surfaces and sometimes their internal surfaces, with other sherds displaying thin areas of soot externally. However, the location of these sherds is as equally important as their surface residues. Many were found in features which have been identified as fire-pits, the primary heating, lighting and cooking areas, and in other pits which may have also functioned as single-use bonfires or hearths. During use, the bottoms of pots would redden though repeated use and were subject to spalling and high abrasion. It would seem likely that cooking pots were not long lived and once they cracked or broke they would have been discarded, and sherds would be incorporated into the fills of many of the pits.

From research into the function of handmade pots, Hally (1986, 280) indicated that round-bottomed vessels, with their greater surface areas were more efficient at absorbing heat than flat bottomed pots. They were also made more efficient on the hearth if the potter raised the shoulder/carination above the vessel base and reduced the diameter of the vessel mouth. Early Neolithic potters designed vessels that were the most suitable and most efficient for their purposes, and they experimented with raising the carination and reducing the diameter of the rim, as can be seen in this collection. This is not to suggest that all open mouthed vessels of this period were for storage or that ones with reduced mouths were solely for cooking. There are obviously variations in between, including smaller pots with reduced rim diameters that may have been for storage, food or drink.

Figure 5.43 illustrates the diameter range from 90 mm to 400 mm of the early Neolithic rim sherds that could be measured and the number of pots identified. Although the numbers are statistically low, the chart shows that there were two popular sizes, 170-180 mm and 240-260 mm across the range. Although Carnoustie provided smaller rim diameters the collection is comparable to the c. 130 mm to 400 mm range recorded by Sheridan (2002, 81) for pots from the Claish Neolithic structure near Callander, Stirlingshire.

Middle and later Neolithic vessels

The presence of middle Neolithic activity on the site is demonstrated by the survival of a small number of sherds of both plain and decorated vessels, of Impressed Ware typical of the period. The distribution of these pots includes the earlier Neolithic buildings to some extent, and activities in the north-east, across Structure 8 and its external activities (Pit Group 5 and Structure 9), to Pit Group 8 in the south corner, and includes Pit Groups 10, 13 and 15 along the south-west edge of the site (see Table 5.15).

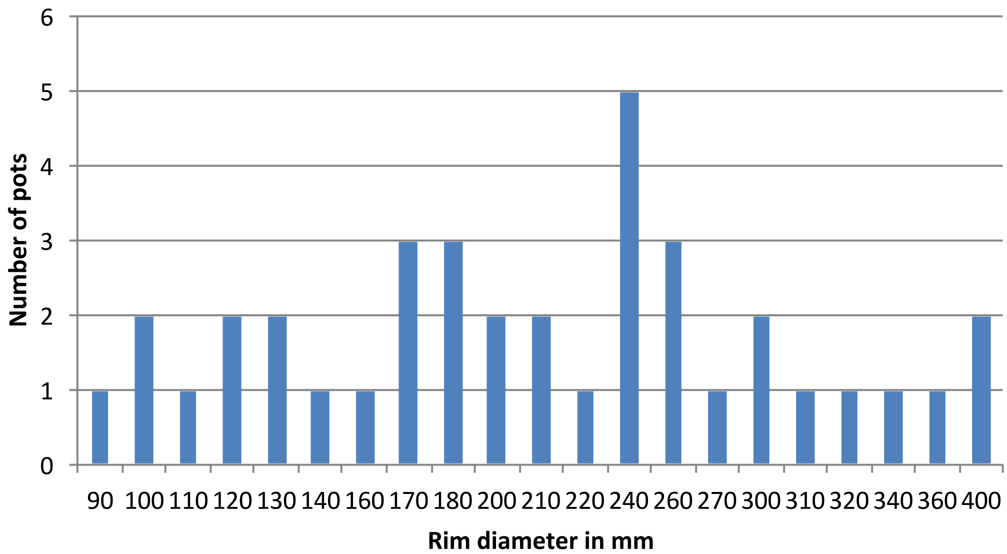


Figure 5.43: Rim diameters and number of pots in the early Neolithic.

	Vessels								
Location	EN	MN	LN	N	BA	EBA	LBA	Uncertain	Total
St1							V1, V2		2
St2		V3							1
St3					V4	V19			2
St5	V110, 111, 112 115, 116 117				V113, 114				8
St6						V13			1
St8 Large	V14, 15, 16, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 93, 94, 95, 96, 154, 155								27
St8 small	V92, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109	V92							14
St9		V17, 18							2
St10	V42, 44, 46 ,47			V45	V41, 43				7
S12	V48, 49, 52, 54, 55, 57			V51, 53	V51, 56	V50			10
S13 L	V68, 69					V70			3
S13 S	V71, 72, 73	V72							3
PG1	V5						V5, V6, V7		3
PG2	V10, 11, 12								3
PG3	V8	V8					V9		2
PG5	V20, 24, 26, 27, 28	V28		V21, 23				V22, 25	9
PG6	V29, 30, 31, 34, 35, 36							V32, 33	8
PG7	V37, V38								2
PG8	V39							V40	2
PG10	V59, 61, 62, 64, 66, 67	V61, 65	V58, 63, 65?		V60	V58			10
PG12					V118				1
PG13	V126, 131? 133, 134	V127, 128, 131?	V130, 131? 132			V129			9
PG14	V122, 125				V121, 123, 124				5
PG15	V138, 140, 141, 142	V135, 136		V139		V137			8
PG16	V143, 145			V146?		V144, 146			4
PG17	V120								1
PG25	V119								1
Area/St7	V148			V147, 149					3
Area G	V150, 151, 153					V152			4
	106	14	6	9	12	10	6	5	155

Table 5.15: Vessels by period.

	Vessels								
Location	EN	MN	LN	N	BA	EBA	LBA	Uncertain	Total
St4									1 unassigned body sherd + daub
PG19									Unassigned burnt sherd
PG22									Unassigned body sherd
Area A									Unassigned burnt body sherds
Area E									Unassigned burnt body sherds

Table 5.15 (continued): Vessels by period.

All these pots are of different vessel forms from those of the early Neolithic and some carry incised or impressed decoration with a variety of motifs. One of the best preserved pieces is V92, a rim from a heavy vessel with a diameter of c. 380 mm (Figure 5.31), within the fill of a posthole towards the south-western end of Structure 8. The sherd has a width of c. 20 mm and represents a vessel that was substantially heavier than any of those from the early Neolithic. It was made in a similar way with quartz rock, mica and sand added to the clay, as well as organic material. The rim is straight with a rounded/slightly flattened top and a round back. Although not decorated, the piece has horizontal marks from wiping or smoothing the surfaces, which gives the rim exterior a slightly ridged appearance.

Vessel 3 was a residual small sherd found in the fill of a late Bronze Age fire-pit in Structure 2 (Figure 5.55). The piece has suffered burning and abrasion, but it is decorated with incised ovals, probably positioned around the belly of the pot. Two further pieces of middle Neolithic incised wares are from 'Structure' 9, an area of predominantly early Neolithic activity to the east of Structure 8. The two sherds of V17 comprise a decorated rim and a plain body sherd (Figure 5.55), which were found in a posthole or pit in the southern part of the group of features. The rim is straight but very slightly everted and is decorated below its top with a horizontal line of two double and oblique incised marks, possibly made by the end of a bird humerus. This is a common motive in Impressed Ware pottery as vessels from the Central Belt, and also Dumfries and Galloway, have been found with it (see Ballin Smith 2019, Figure 9, vessel 8; Ballin Smith 2021a, Vessel 14 from Maidenhill and Ballin Smith 2021b, Vessel 1 from Borrow 1 Dunragit).

A second vessel V18, a rim and body sherds from 'Structure' 9 (Figure 5.55), were widely scattered and deposited in a number of different features of the pit group. The rim is the most informative piece as it indicated that the vessel had a slightly bulbous body. The sherd is decorated with three rows of oblique, combined fingertip and finger nail impressions by a right-handed person. Other conjoined sherds indicate that the decoration may have been present all over the body.

Some sherds of V28 (Figure 5.33) were found in a pit in the north of Pit Group 5 with several early Neolithic rims (V20, 25, 26 and 27). Other sherds of the same vessel were located in a separate pit, in the same area, suggesting later activities disturbed earlier ones, and sherds from broken vessels were scattered around. However, V28 comprised a rim with a flat to rounded top, which was incised with two horizontal lines externally. A separate sherd of the same vessel has both incised fine vertical lines and finger nail incisions in vertical rows, and another sherd is decorated with vertical incised lines.

Another possible vessel of this period found in Pit Group 8 was V39 (Figure 5.36), but it was poorly made and badly abraded, and therefore its inclusion here is uncertain. The flat-topped rim has a short neck with a high shoulder and is decorated with parallel fingernail incisions both on the rim top and on the neck. From the position of the motifs a left-handed person made the marks. From the same pit was V40, (Figures 5.36 and 5.44) the most unusual of the whole assemblage. It comprises a single well-burnt sherd that has both a rim and an edge to a flat base, although deformed. This squat vessel is 46 mm tall and its length is 45 mm. Its exterior has 10 roughly parallel oblique incised marks running round the body towards the base of the vessel that may be a product of finishing than decoration. The piece remains an enigma as there seem to be no parallels in shape and may be unique in a middle Neolithic context (Alison Sheridan, pers. comm.)

Further middle Neolithic activity was noted along the south-west border of the excavated area. Pit Group 10 included V65 (Figures 5.45 and 5.46), where the slightly unevenly moulded rim sherds suggested the vessel had a straight or slightly bulbous body. It is decorated by deep fingertip indentations forming a horizontal row approximately 10 mm below the rim top. The pottery is burnt and prone to cracking, and further evidence of decoration is lost.

Other decorated pots, from Pit Group 13 include V127 and V128 (both Figure 5.45). The slightly inturned but abraded rim of V127 has an uneven flat top but indicates the vessel had a rounded belly. The sherd is decorated with an incised row of fingernail marks 18 mm below the rim top that are positioned c. 14 mm apart, with three additional fingernail incisions randomly placed below them. They are all produced by a right-handed person. Below these marks six incised lines radiate out from the central two, which form an inverted 'V'. They are made by a pointed implement, possibly a piece of sharp bone or flint (Figure 5.47).

V128 is slightly different from the previous example even though it is also decorated with fingernail marks. Its slightly inturned rim suggests a barrel-shaped vessel which was not well made as moulding marks are common and joins between some coils are noted. The exterior of the pot is plain but the interior has seven remaining fingernail marks deliberately placed in two oblique rows that were not wiped away (Figure 5.48). A perforation 5.5 mm in diameter was noted below the rim on a separate non-joining sherd.

Pit Group 15 also produced middle Neolithic vessels. V135 is a rim and body sherds of a curving flat bottomed vessel (Figures 5.49 and 5.50) that is abraded and burnt, and contains noticeable organic temper but only sparse mineral content in the clay. The rim is slightly inturned and it tapers to a thin but flat rim top. It is decorated with three rows of small incised scoops that measure 6.3 mm by 3.9 mm and which are positioned c. 6.5 mm apart horizontally and 4.2 mm vertically.

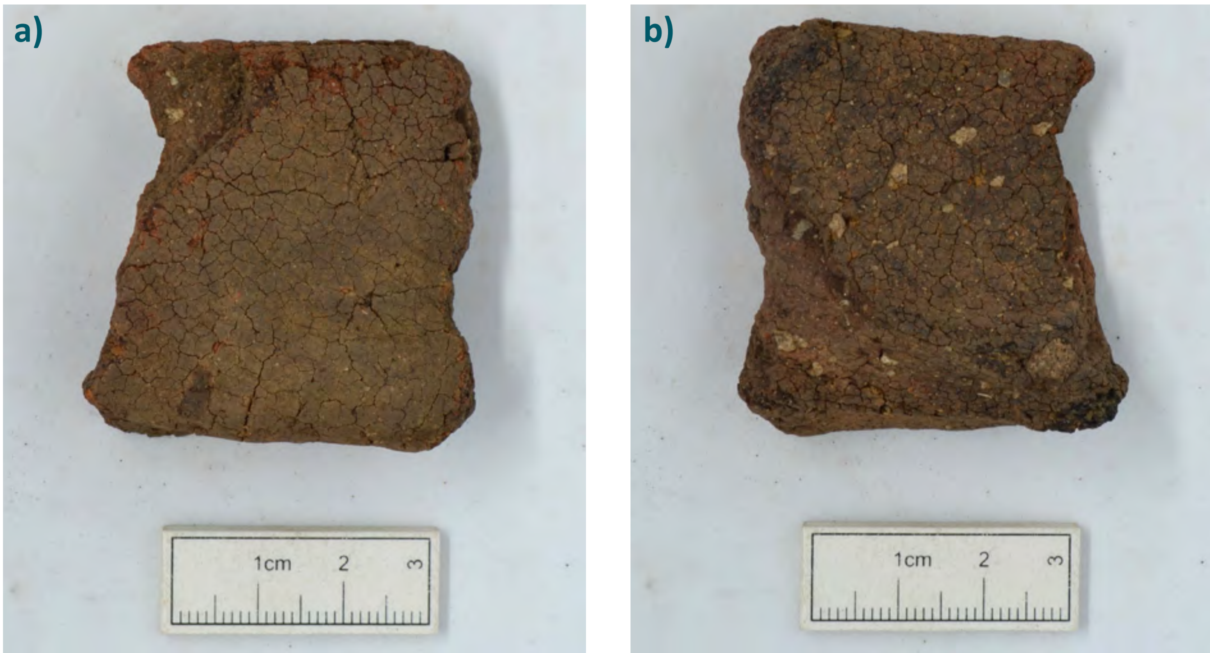


Figure 5.44: V40 unusual shallow vessel, a) exterior, b) interior.

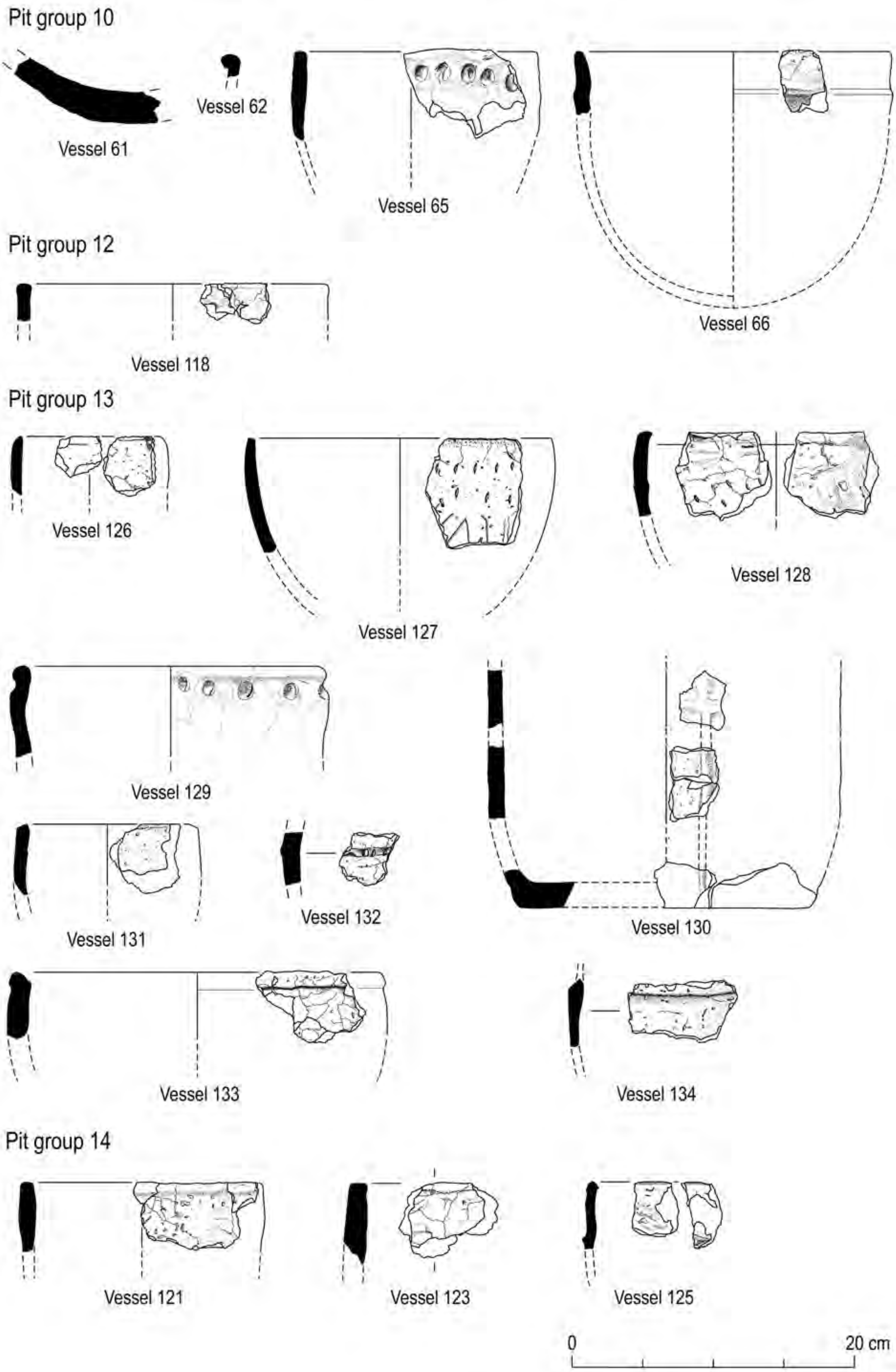


Figure 5.45: V40 unusual shallow vessel, a) exterior, b) interior.

V136 is also a slightly corky pot comprising mostly body sherds and a flat base sherd. Some of the sherds are decorated with a deep finger-pinched, closely positioned motif, where the nail indentation is prominent (Figure 5.49). The design is horizontal, and is sometimes bordered with a narrow finger runnel beneath. One sherd has the remnants of two pinched motifs, which are possibly incised on an applied strip, with a finger runnel beneath. A perforated sherd is also part of this vessel.

The remains of a further two vessels are from Pit Group 13, V130 a base and body sherd, and V132 indicate the presence of late Neolithic Grooved Ware pottery, in this part of the site only (both Figure 5.45). The flat base of a likely open bowl V130, with a diameter of c. 140 mm, and the accompanying sherd, both have a slightly corky appearance. The rim is pointed and triangular in profile, with evidence of vertical applied strips on its exterior. The body sherds are also decorated with vertical applied strips between 8 mm and

Figure 5.46: Decorated vessel V65.

Figure 5.47: Decorated vessel V127.

Figure 5.48: Internal decoration of V128.

10 mm in width and one sherd has applied strips forming a cross. V132 predominantly comprised thick-walled body sherds, which are corky and also heavily burnt. One sherd has an applied strip 7.6 mm wide, which is decorated with oblique incisions and others from the same pot also have an applied and distorted strip up to 8.4 mm in width.

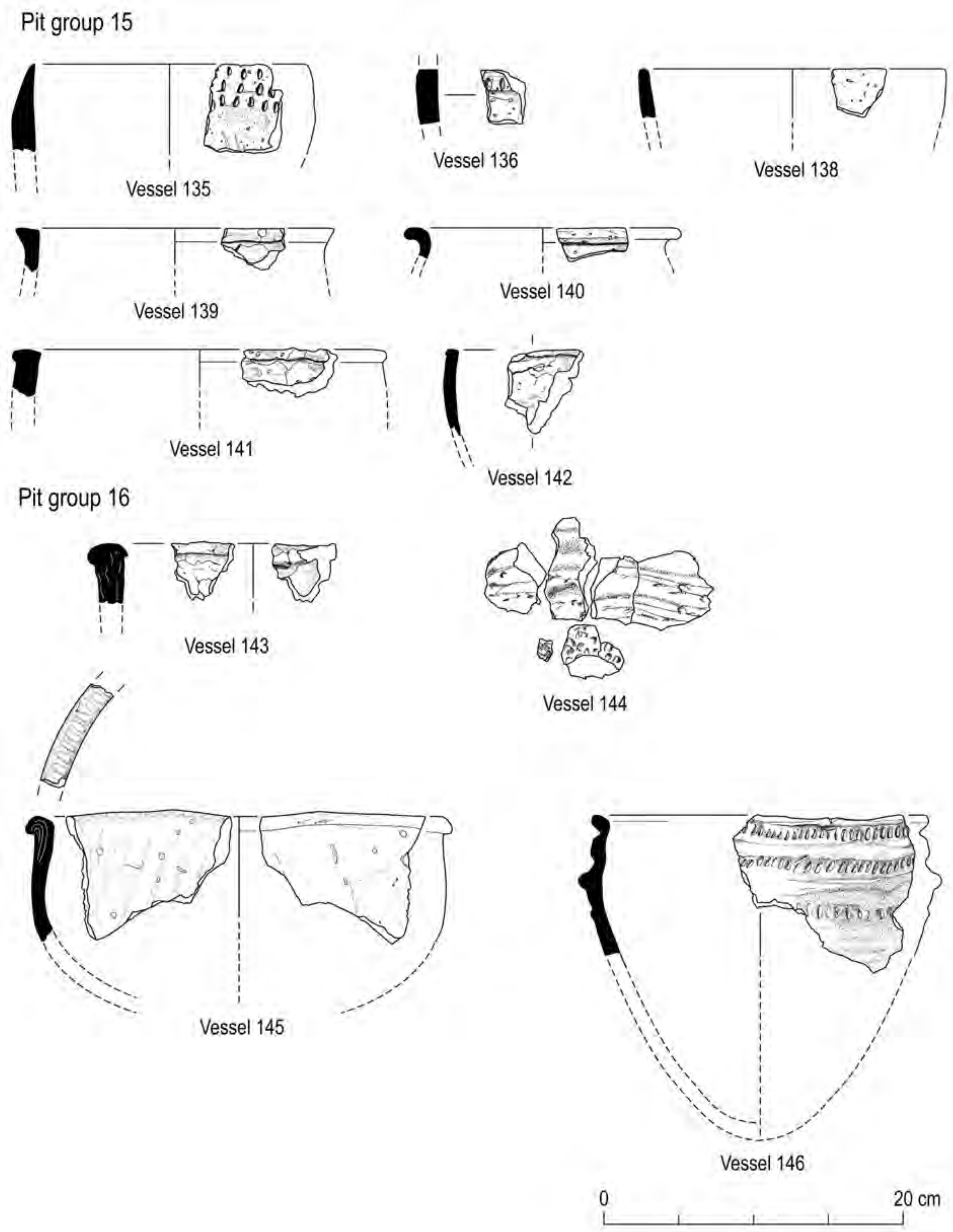


Figure 5.49: Vessels from Pit Groups 15 and 16.

Figure 5.50: Decorated vessel V135.

Pit Group 10 produced V63 (not illustrated), which is considered to be fragments of another Grooved Ware vessel. It includes six heavily burnt sherds with an applied cordon that in two conjoined sherds is pinched, while on others it is relatively flat. There is one thick base sherd but all the pottery is in poor condition and prone to lamination. The pot surfaces were smooth, possibly wiped and with surviving finger moulding.

The characteristics of Grooved Ware include flat bases, bucket-shaped or barrel-shaped vessels with applied decoration, incised grooves and small applied roundels. V130 and V132 share some of these characteristics and their identification can be added to the number of known pots from the region, including Angus, Perthshire, Raigmore Inverness (Simpson 1996a) and Fife. Three decorated vessels were found near Carnoustie at Mains of Kelly in pits (Cleal and MacSween, 1999, 201), a small assemblage came from Red Castle near Montrose (Alexander and Rees 1997) and another small assemblage from Beech Hill House at Couper Angus (Stevenson 1995). Several pots were recognised from a pit within the Neolithic structure of Littleour, North of Perth (Sheridan 1998a), but the decoration was unlike the Carnoustie examples. The largest and most informative collection of Grooved Ware pots to date in eastern Scotland is from the henge and enclosure at Balfarg, Fife. At this site the decoration on the vessels is extensive, with horizontal patterns of plain and wavy cordons and incised lines or grooves, and similarities can be noted with the sherds from Carnoustie. V130 is not unlike Balfarg pot P54 which displays applied vertical ribs, which link the decorative elements and has a similar basal diameter (Henshall 1993, 99 and Illus 28). V132 can be compared to Balfarg P58a (ibid, Illus 29) with its slashed cordon or strip.

The later Neolithic vessels from Carnoustie indicate Impressed Wares with decoration that was widespread throughout Scotland, with finger nail or fingertip impressions being common, as are incised motives using small bones, and other fine edged tools. What is missing from this collection are the highly decorated and distinctive wide rimmed bowls, with impressed cord/whipcord or bird bone designs on the rim-top, such as those from Monkton in Ayrshire (Ballin Smith 2015, Figure 6). The recognition of rare pieces of Grooved Ware adds to the distribution of this vessel type in east and north-east Scotland but not necessarily to the dating of its currency (see discussion below). However, the decline in vessel numbers towards the end of the Neolithic indicates a change in settlement pattern, and probably one in society.

Bronze Age vessels

The early Bronze Age vessels

From the middle part of the third millennium BC, the early Bronze Age, further changes are noted across the site where pottery of different types was manufactured to that seen previously. Most of this pottery is associated with the activities of burial of individuals, and although limited in numbers provides information on burial customs. Other pottery is domestic.

The best preserved vessel from this period is V152 (Figures 5.39 and 5.51), an almost compete Low Carinated Beaker (c. 80% is present) with an All-Over Corded (AOC) design. This type of Beaker (the European Bell Beaker) is the earliest to be found in Scotland and was predominantly used as grave goods (Needham *et al.* 2019, 174). V152 was buried in a pit in the middle of the outland area (Area G). The large steep-sided pit with a flat base contained lithic artefacts as well the Beaker, but little if anything remained of the cremated human remains the burial would have contained. The Beaker is less than 150 mm high, has a rim diameter of 140 mm and a basal diameter of c. 80 mm. A similar, thicker-walled, plain but slightly smaller example to V152 was found at Beechwood Park, Raigmore Inverness, identified as a Continental Beaker (Sheridan and Hammersmith 2006, 80-81).

A second example of an AOC Beaker is the single, small sherd of V137 found within a pit in the middle of Pit Group 15, with two rows of horizontal cord impression (not illustrated). It is difficult to evaluate the shape of the pot and whether V137 and the lithic artefacts found with it, represents a burial. The pit group is complex, with vessels from the early and middle Neolithic scattered amongst the fills of its fire-pits and V137 could be simply a stray sherd from another vessel buried elsewhere on the site.

Figure 5.51: Low carinated Beaker V152.

Although Low Carinated decorated Beaker sherds are found on many excavations in Scotland, there are clear parallels in other parts of the east and north-east of the country with V152, with similar examples found at St Andrews in Fife, Castle Huntly in Angus and other examples in Aberdeen and (Clarke 1970, 281, 4-7). A smaller, plain version of this Beaker type was found at Beechwood Park, Raigmore, Inverness (Suddaby and Sheridan 2006, 80-81, 83-84), where it was considered early in date and possibly Continental. Their research, plus the date range defined by ScARF (Downes 2012, Section 1), suggests that the currency date range of these pots is c. 2400 to 2200 to as late as 2050 BC.

The final Beaker vessel to be described from the excavation is represented by three sherds from the middle of the pot of V70, another AOC vessel whose base and rim are missing (Figure 5.30). The surviving evidence suggests that the pit dug into the middle of Structure 13, the long timber hall, and into which this vessel had been buried, had been badly truncated with the rest of the pot ploughed away. Evidence of any accompanying cremation burial did not survive.

The remaining early Bronze Age vessels are urns with one possible Food Vessel. The destruction of decorated urn V129 (Figure 5.45) from Pit Group 13 has been described above. It is decorated around its rim with evenly spaced deep fingertip depressions but the rest of the vessel is likely to have been plain. It would have contained the remains of a cremated individual and was inserted vertically into the pit that was dug to receive it. However sherds of a middle Neolithic vessel, V128 (Figure 5.45), also became incorporated into the material used to backfill the pit.

Pit Group 16 contained the remains of two vessels V144 a probable urn and V146 a possible Food Vessel (Figure 5.49), accompanied by sherds of an early Neolithic vessel V145 (Figure 5.49). Sherds from the urn and the Food Vessel were found in the fills of two adjoining pits on the northern edge of the central arrangement of pits in this group, suggesting the disturbance of a burial that had itself been dug through early Neolithic remains. Complicating the issue was an early Neolithic radiocarbon date (UBA-39343 – see PART 3: *Radiocarbon dates*) from one of them.

Over 2 kg of pottery from the urn V144 survived, amounting to 65 sherds (Table 5.14), with wall thicknesses of 17 mm to 25.4 mm. Although the rim had been lost, two parallel cordons remained and were added on to the exterior of the vessel as a thick slab, with fingertip marks impressed into the clay below them (Figure 5.52). The construction of this pot was unusual in that it was built up with layers or slabs of clay placed on top of an already formed vessel. The layering was noticed where surface areas had been lost and in viewing sections through the sherds. The lower portion of the vessel was randomly decorated by incised marks made most likely by the end of a twig and a rounded topped tool. The base sherd has a deep finger indentation and produced evidence that the pot sat on a coarsely woven material during its construction as the surface of the base is impressed with lozenge-shaped marks (Figure 5.53). The pattern of this material is markedly different from the fabric found with the metal hoard (see Part 6: *The late Bronze Age metal hoard*) that suggests its impressions may have been that of open woven matting, possibly of plant origin rather than wool. When the exterior surfaces of this vessel were smoothed, moulding marks, and marks of fingertips and finger nails, were not removed and its finish remains rough. Some of the sherds of this pot are also burnt, but no cremated bone was found with it.

Closely associated with the urn, was a large rim sherd and a conjoining body sherd from a decorated bipartite Food Vessel V146 (Figure 5.49). The plain rim is everted with an internal bevel, but it is unevenly moulded because of the coarse grits in the fabric. The pottery is decorated by vertical but closely spaced deep fingernail scoops in three bands: one below the rim, the middle one below a raised plain field and the last band is positioned below a lug (Figure 5.54). The latter is c. 60 mm in length by c. 11 mm in width and is c. 8 mm deep, and is probably one of three or four placed around the pot.

Figure 5.52: Heavily decorated vessel V144.

Figure 5.53: Textile/mat impressions in base of V144.

Figure 5.54: Possible Food Vessel V146.

These highly decorated vessels have been found quite frequently across the north-east Scotland, (Cowie 1978, fig 36) with applied and incised decoration in many different permutations. V146 seems simpler in its decoration in comparison to existing examples, but the moulding of a lug provides another dimension to the wide variety of styles present in these vessels. Food Vessels are associated with cremations and they are noted from 2140 – 1980 cal BC and end c. 2020 – 1865 cal BC. However, their main period of use, overlapping with both Beakers and urns is c. 2100 to 1750 cal BC (Needham et al. 176-177).

The final early Bronze Age vessel was located in a small pit within the ditched enclosure of Structure 3, which contained the remnants of a plain urn V19 (not illustrated) with both the rim and the base missing. No human remains survived from this burial.

Later Bronze Age vessels

Identifying the later vessels from the site is difficult because of their generally poor manufacture and condition, which includes abrasion, surface loss and lamination. Some examples could be misidentified and there are hints that designs of earlier pots were copied, if examples were found when erecting Bronze Age structures or through the digging of pits. The pots can, however, be divided into two groups, those that were clearly associated with Bronze Age structures and those that intruded into earlier stratigraphy. The former group includes predominantly plain vessels that are round-bodied or straight sided to bucket-shaped, with or without possible malformed carinations. In contrast to many of the vessels from earlier periods these pots are generally poorly made with their finishing a low priority in their production. Sherd weights are low (Table 5.14) indicating high fragmentation.

V1 and V2 from Structure 1 (Figure 5.55), V6 and V7 from Pit Group 1 (Figure 5.56), V4 from Structure 3 and V9 from Pit Group 3 (Figure 5.56), are defined by their uneven moulding, malformed rims, grass marks, and rough surfaces both internally and externally. Some sherds have laminated and been infiltrated by roots. The sherds forming Vessel 13 from Structure 6 are particularly misshapen (Figure 5.55). Most have evidence of carbonised food remains or sooting indicating their primary purpose was probably as cooking pots.

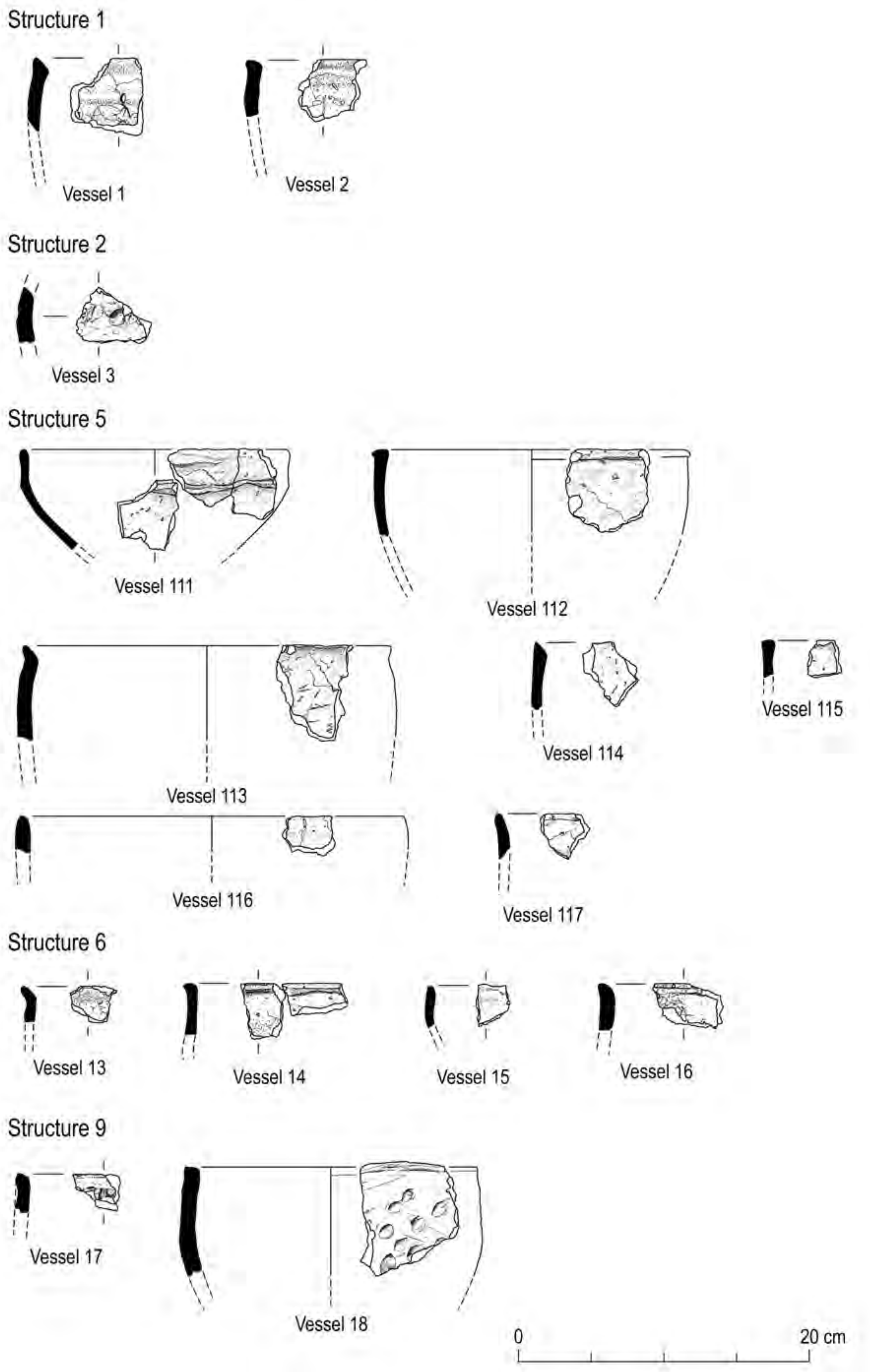


Figure 5.55: Vessels from Structures 1, 2, 5, 6 and 'Structure' 9.

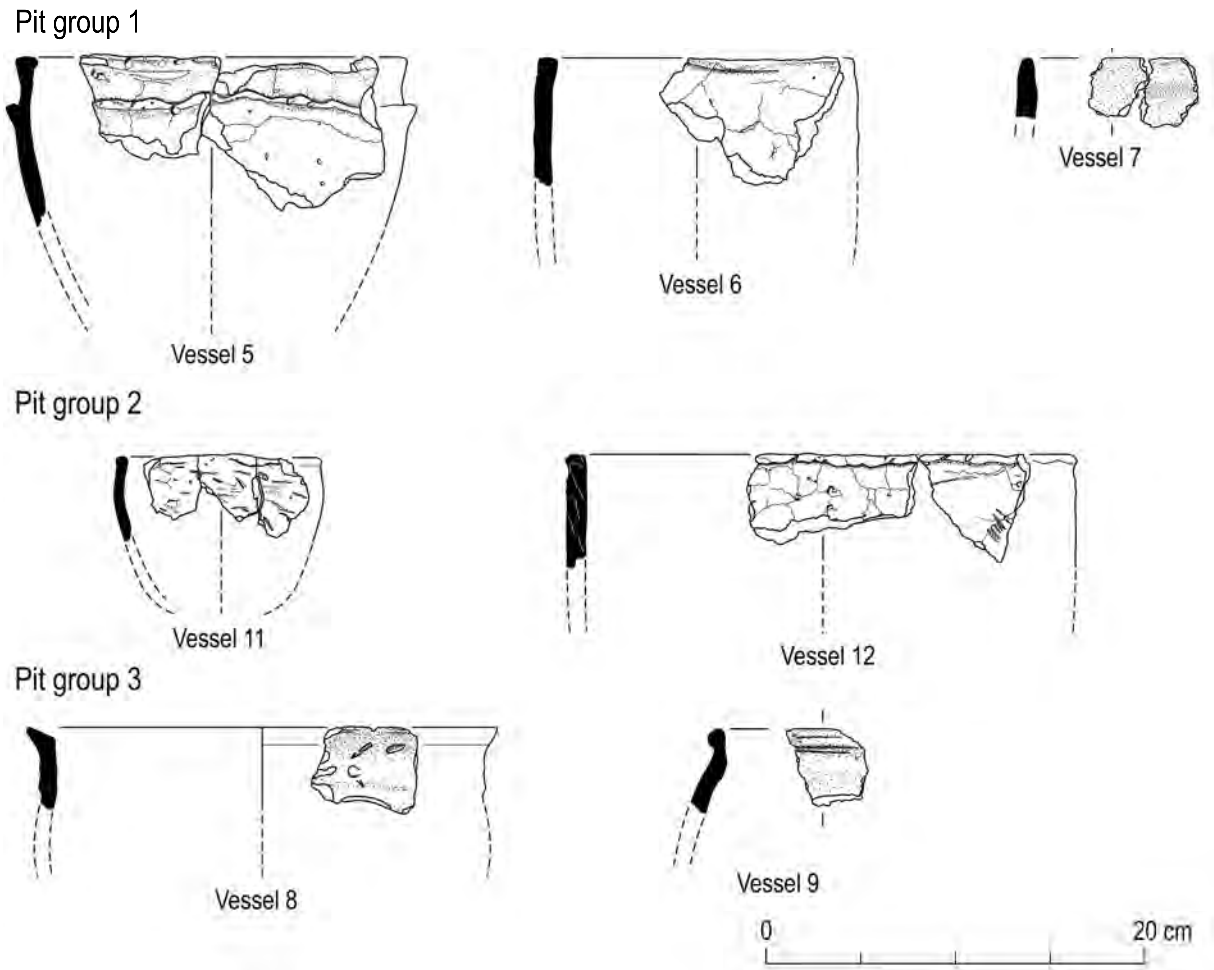


Figure 5.56: Vessels from Pit Groups 1, 2 and 3.

The remaining pots are not clearly associated with contemporary structures, and may be a result of activities linked to pits dug into earlier stratigraphy: V41 and V43 are from 'Structure' 10 (Figure 5.32), and V50, V51 and possible V56 are from 'Structure' 12 (Figure 5.32). The sherds suggest straight-sided or slightly barrel-shaped pots with flat, tapering, or almost T-shaped rims.

Amongst the latter group is V23 from Pit Group 5 (Figure 5.33). It has up to 15% largely coarse quartz grits that shows through the pot surface. The rim has an internal bevel and moulding marks, and sooting is common. V32 and V33 from Pit Group 6 (Figure 5.36) are poorly moulded but have shoulders or carinations. Both are heavily sooted and their identification is uncertain. V58 from Pit Group 10 is part of a flat base; V118 from Pit Group 12 (Figure 5.45) is densely tempered with an unidentified hard mineral and its rim is flat and slightly everted; and V121, V123 and V124 from Pit Group 14 (Figure 5.45), are badly moulded with visible surface grass marks and poor finishing.

Discussion and conclusions

It is without doubt that early Neolithic vessels, amounting to 68% of the total vessels identified, dominate the assemblage from this excavation. If pots from the whole of the Neolithic are considered together, they account for c. 81% of all the vessels, with the remainder being Bronze Age, or of uncertain date. This demonstrates the dominance of Neolithic settlement and cultures on the site, and especially that of the early Neolithic, but also the requirements of people for a variety of clay vessels. The traditional early Neolithic Carinated Bowls are present but in small numbers suggesting that the first occupation of the site could have been part of the initial settlement of the area (see Sheridan 2007 for her evidence on the establishment of Carinated Bowl cultures in Scotland and elsewhere). However, modified wares form the majority of vessels identified. This suggests that at Carnoustie, the form of the traditional Carinated Bowl was transformed by experimentation and adaptation during the life of the settlement in the early Neolithic period.

In this respect Carnoustie differs from other similar sites of the period with large wooden structures. Traditional Carinated Bowls dominate the Claish, Stirling (Sheridan 2002), Lockerbie, Dumfries (Sheridan 2011), and Warren Field, Aberdeenshire (Sheridan 2009), but the Carnoustie pottery is more comparable to the modified assemblages of the north-east including that of Balbridie in Aberdeenshire (Sheridan 2007, 456), and with the Easterton of Roseisle assemblage (Henshall 1983), where there are clear similarities. The recently published excavation findings along the Aberdeen Western Peripheral Route indicate the presence of early Neolithic modified wares from the sites of Blackdog and Wester Hatton (Dingwall et al. 2019, 281-285). Together, with Carnoustie, they add to the occurrences of modified wares in the area, and help to consolidate their distribution from the Moray coast and Aberdeenshire, to as far south as Angus. Carnoustie, on the apparent southern edge of this style, points towards networks of communication across the region, which allowed for common features of 'style drift'.

Sheridan (2007 456) indicates that traditional Carinated Bowls were in use in Scotland from the 40th and 39th centuries cal BC till c. 3700 cal BC (the latter from evidence of Garthdee Road, Murray and Murray 2014), but that the modified wares came in quickly with equally early dates, for example from Balbridie. The earliest dates from Carnoustie of the middle of the 40th century cal BC to the end of the 38th century BC (Structure 8 large hall) to as early as the 37th century cal BC (Structure 8s hall, see Table 5.13) are from contexts that include both traditional and modified Carinated Bowl sherds. The reworking of the structural components of the large timber hall and the establishment of its smaller building do little to clarify the understanding of the date ranges, except to indicate, as at Balbridie, modification of pots was potentially early. There is a suggestion by Lochrie (in Dingwall et al. 2019, 243), that modified Carinated Bowls with round-bases continued into the middle Neolithic from evidence from the site of Goval on the Aberdeen Western Peripheral Route, and a vessel from Kintore in Aberdeenshire (MacSween 2008, 175).

In comparison with the early Neolithic vessels, the evidence for the middle Neolithic pots at Carnoustie is slight (c. 9% of all vessels), with ten definite and four probable Impressed Ware vessels. The distribution of these pots across the site is not centred on the known structures from the early Neolithic, but on a group of pits south of the Structure 8 timber hall known as 'Structure' 9, and also Pit Groups 10, 13 and 15 that indicate a movement away from previously occupied areas. An assemblage of Impressed Ware sherds, larger than that at Carnoustie was associated with the later Neolithic activity at Balfarg. Sherds were characterised as worn and were often found as individual pieces (Cowie 1993, 121-126). The largest assemblage of Impressed Ware bowls to date was found recently at Meadowend Farm, Clackmannanshire, where the majority of pots were clearly associated with groups of pits. Tools similar to those at Carnoustie were used to create comparable decorative motifs, but with the addition of whipped cord (Sheridan 2018, 31, 34).

The currency of the pottery at Meadowend Farm was c. 3350 – 3000 cal BC (Sheridan 2018, 47), which is considered the accepted date range for Impressed Wares in both Scotland and England. The middle Neolithic activities at Carnoustie seem to span a time period from as early as the middle of the 37th century cal BC to the latter half of the 34th century cal BC, which are dates more likely to reflect disturbance of earlier features. However, the burial context of V72 in Structure 13 was dated to the very end of the 35th century cal BC to the first half of the 31st century cal BC, 3494 – 3093 cal BC (UBA-39328). Other middle Neolithic radiocarbon dates from pit groups, with or without, Impressed Ware pottery, lie more within its accepted date range.

The Grooved Ware sherds from Carnoustie comprise three definite and three probable vessels and account for c. 4% of the total pottery assemblage. In comparison with the largest Grooved Ware assemblage on mainland Scotland from Balfarg/Balbirne (Henshall 1993) that from Carnoustie is very small. However, even this small amount of late Neolithic material culture is important in our understanding of changes at the site during the latter part of the period. Evidence for late Neolithic activity was from along the south-western edge of the site, related to groups of pits (Pit Groups 10 and 13) that also produced middle Neolithic Impressed

Wares. Neither of these pit groups produced late Neolithic radiocarbon dates, although the nearby Pit Group 15 and the more distant 'Structure' 9 did, suggesting that occupation was slightly more widespread across the site than the pottery suggests. Even so, late Neolithic material culture at Carnoustie does not add further to the dating of the currency of Grooved Ware in Scotland, which is accepted as c. 3000 cal BC to c. 2500 cal BC (Cowie and McSween 1999, 54; Brophy and Sheridan 2012 Section 5.1.3). Somewhere in that timeframe the Neolithic settlement and cultures at Carnoustie came to an end.

The sparse distribution of pottery during the middle and late Neolithic continues in to the Bronze Age with only ten early Bronze Age vessels. The survival of the Low Carinated Beaker V152 suggests it was early in the migration of ideas and people from Continental Europe, perhaps as early as c. 2450 – 2200 BC (Suddaby and Sheridan 2006, 83-84; Needham *et al*. 2019, 174; Downes 2012, Section 1). Its simplicity of burial in a pit, rather than in a cist, also reinforces its early date and the idea that this burial practice came in from the Continent (Sheridan 2007, 104). Although there is generally some overlap in the use of Food Vessels with that of later Beakers between c. 2100 – 1750 cal BC and their association with mainly cremations (Needham et al. 2019, 176-77), the remains of Food Vessel V146, tells us little about the use of the site during this time. Early Bronze Age burials are seemingly widespread but with a small concentration of ritual vessels, including an urn, associated with Pit Group 16. This was an area of much disturbance and radiocarbon dates span a time frame from the late Mesolithic to middle Neolithic.

A small concentration of poorly made pottery in the north-east corner of the site reflects the reuse of the site for mainly domestic dwellings during the mainly middle and later Bronze Age. The occurrence of early Neolithic pottery in Bronze Age levels by the reworking of earlier stratigraphy restricts further understanding of the role of pottery had in society at this period and its research value.

Clay and fired clay

By Beverley Ballin Smith

Introduction

Small fragments of raw clay and fired clay (daub) were found in features in Structures 4, 8 and 13, and in Pit Groups 10 and 13. Although these pieces are a very small component of the artefactual record for the site, their presence indicates the use of clay as a raw material from the early Neolithic. A total of 40 pieces and fragments weighing 287.4 g came from nine samples hand-picked during retrieval from the site and from the processing of soil samples[1].

The use of clay in wattle constructions

Fired clay is the burnt remains of natural or raw clay usually dug from the subsoil or stream/river sides that was used for construction. It was mixed with an organic additive or binder such as animal dung and straw to make it more pliable, and occasionally small stones were added to give it strength. This mixed material is generally referred to as 'daub'. Daub is not pottery, but it was used in an unfired or unburnt raw state as a light weight non-load-bearing constructional material. It was used as an insulating building material by infilling the spaces between withies and hurdle-type wooden constructions for the walls and internal partitions of buildings during prehistory and for smaller structures such as ovens, hearths and furnaces. Figure 5.57 is an example of withy panels in a reconstructed prehistoric barn that have been daubed externally. Clay was generally locally available and it was also cheap and plentiful, as was the organic binder. Daub has a long history of use, not just in Britain but also worldwide, and the different base materials and additives produced different variants such as *adobe, cob* and *daub* (Graham 2004, 27). The combination of wooden withies (hazel, alder and willow) and clay is traditionally known as wattle work or 'stake and rice' in Scotland (Walker and McGregor 1996, 38). If protected from the weather by the roof of a building it provided a windproof and partly waterproof cladding.

1 The pieces were gently brushed with a soft brush before examination with a X6 hand lens and their attributes were compiled in an archivable table devised using Microsoft Excel. The pottery was analysed according to the *revised guidelines of the Prehistoric Ceramics Research Group* (2010), the CIfA's *Standards and guidance for the collection, documentation, conservation and research of archaeological materials* (2014, revised 2020).

Daub is generally a soft material when found in archaeological contexts and especially when compared to sherds of pottery. It was hardened by burning, and this mainly occurred if it was used for the covering of a primitive oven where it would have been exposed to heat and fire, or though accidental burning, e.g. if it was used with withies for the walls of a structure that was burnt down. The presence of burnt clay is important for site interpretation, as it can support or enhance the understanding of an abandoned or demolished structure. In Scotland, due to taphonomic processes (mainly water and root penetration, and mechanical abrasion) much of the fired clay material is lost from the archaeological record, especially if it was not hardened sufficiently through burning. Fired clay pieces normally survive as irregular, abraded soft clay lumps.

Results of the analysis

Deposits of natural clay and sandy clay were found in the subsoil along the eastern and south-western margins of the excavated area (see PART 1: *Landscape setting*), and may well have been used for either pottery making or construction, or both. The natural yellowish-brown-pink colours of the clay samples reflected the sandstone parent bedrock, but these changed colour to grey/buff to orange/red when burnt. Table 5.16 indicates the number of pieces and the weight from the different contexts in which this material was found.

Unfired clay

Small amounts of raw or processed clay survived on the site from a small number of pits and a fire pit. The clay from pit (704) within the Structure 8s small timber hall contained a small amount of mineral temper and some charcoal, and the sample from the fire-pit in Structure 13 contained both stones and some organic material that had been mixed into it. There are two explanations for this. The first is that pockets of clay could have been encountered when the pits were dug, or secondly, they could have been deliberately lined or capped with clay. This seems plausible for both pits, especially as pit (704) contained a deliberate deposition of items, and there is a suggestion it might have been capped with clay. For the fire-pit, which was well used, a clay lining might have had a function in maintaining its depth and shape.

Figure 5.57: Withy panels in a reconstruction of a prehistoric barn. Photo: © Beverley Ballin Smith.

Structure/Pit Group	Contexts	Nr pieces	Weight (g)
Structure 8 long timber hall	Daub from 328/329 pit in NE gable of long hall	2*	13.2
Structure 8 small hall	Daub from 701/702 pit in construction trench 688 of wall	2	3.4
Structure 8 small hall	Clay from 703/704 pit	5	13.1
Structure 13	Clay from 1210/1211 fire-pit	8	52.9
Structure 13	Highly burnt clay 1210/1211 fire-pit	3	14
Pit Group 10	Daub from 11002, a layer overlying and filling pits 11003,11004,11009/11005 and 11010/11011	5	50.4
Pit Group 13	Processed clay from fill of pit 6014/6015	1	47.8
Pit Group 13	Clay from 7041/7042 pit located under deposit 4030	10	80.4
Structure 4	Daub from 5060 fill at base of structure	4*	12.2
	Totals	40	287.4

* includes fragments

Table 5.16: Type and number of clay fragments and their weight by context.

Fired or burnt clay

The remainder of the samples are of burnt clay or daub. The earliest is likely to be SF 112 comprising two pieces from the north gable of Structure 8, the large timber hall. The fragments are vesicular due to the burning out of organic material but they are also shaped. The largest piece measures 24 mm by 18.8 mm by 15.5 mm and has one surface that is uneven and slightly concave. The other measures 15.5 mm by 18.5 mm by 17.1 mm. It is flat at one end and the two flattish surfaces come together to form a ridge suggesting it was close to the side, top or bottom of a wattle and daub panel. The other sample SF 9033, from a construction trench to one of the walls of the small hall Structure 8s is also an angular piece. In this example two flattish/slightly concave faces form a ridge between them (Figure 5.58) and have slight impressions of the wood they were pressed against. The material has very little mineral content but it had an obvious organic component. The piece measures 12.4 mm by 11.5 mm by 17.5 mm.

From the hearth of the Structure 13 large timber hall are three highly burnt clay pieces, two of which join (SF 4033) to measure 35 mm by 30.1 mm by 17.7 mm. These fragments are highly vesicular but are also squared on one edge. Although their precise identification is uncertain due to the high degree of burning, the shaping of the edge suggests they are daub and have come from a wattle and daub panel. Although this hearth produced raw clay (see above) the small burnt clay pieces suggest that parts of an old wattle panel could have been burnt on it.

Figure 5.58: Shaped burnt clay SF 9033 from the Structure 8 small hall.

Another sample that suggests it was used in construction was SF 8024 from a layer overlying hearths in Pit Group 10. The daub pieces were burnt and unusually hard as they contained small stones in addition to organic matter and were therefore heavier than those examples already discussed. The largest fragment was most likely pressed against a withy as faint impressions in the clay remained. It measures 43.7 mm by 34 mm by 20.3 mm.

Four small daub pieces from the infill of Structure 4, an historic feature, with stone and mica inclusions suggests they were likely to be residual, possibly derived from Structure 8 whose buried features were situated close by.

Pit Group 13 is interesting from the point of view that it produced two samples. SF 7007 was a burnt clay sample found within pit (7042), which may have been used to line the feature in preparation for the reception of a burial urn with a cremation, or was left over clay from the manufacture of the urn that found its way into the backfilling material. The second sample SF 6020 (Figure 5.59a and b) is a single piece of burnt clay that appears to be squeezed or moulded together, as if it was left over from pottery making for example. Its length is 76 mm, its width 40 mm and its thickness 31 mm.

Discussion

Fired clay pieces are not datable in themselves, but they appear to have been used with wattle as infilling panels between wall posts in the earliest timber structures on the site and also later on in the Neolithic. Although the evidence is limited, the form of some of the daub pieces and the rare concave shapes and other impressed patterning, indicates that clay had been pressed against withies or the frame of a withy panel. The use of clay for construction with wood, identified as alder with hazel and also willow, was apparent on the excavated area from the early Neolithic, although in limited quantity when compared with the dominant oak charcoal assemblage. Oak lath or strips of bark have been known to have been used (Reid 1989, quoted in Graham 2004, 3.5) and it is possible they could have been used at Carnoustie, although there is no confirmatory evidence.

Two pieces of daub shaped around a withy or straw were found in a posthole, along with Grooved Ware pottery, located close to the north wall of the Neolithic timber building at Littleour, Perthshire. Both were burnt (Sheridan 1998b, 67 and illus 52). A number of fired clay pebbles were also found in postholes and a beam-slot of the early Neolithic timber hall at Lockerbie Academy (Anderson 2011, 18). Although these were small fragments weighing only c. 9g, both examples indicate that timber halls other than at Carnoustie had walls of wattle panels.

The loss of evidence of its use in later periods at Carnoustie, and especially in the middle and late Bronze Age may be due to taphonomic conditions coming into play with the movement of soil, and the disturbance of the area by ploughing and by drain digging. However, the use of raw and fired clay was not confined to the construction of buildings, as there is slight indication that some pits and fire-pits may have been lined with clay. This may have been necessary if pits were dug in sandy parts of the site, or if the sides and bases of fire-pits needed repairs or support.

Clay as a raw material could have derived entirely from the exposed edges of the raised beach and it is also possible that this same resource was also used for pottery making (see Part 5: *The pottery*). The two separate samples from Pit Group 13 are most likely dated to the early Neolithic and also to the early Bronze Age, where clay lumps, fired or unfired suggest they were left-over or discarded pieces from pottery making. Sheridan (2014, 35, 49) identified two small clay lumps as potters' clay from the samples found in the floor layer of the early Neolithic structure at Garthdee Road, Aberdeen.

Clay was obviously an important resource, but in an unfired condition it would disappear quickly from the archaeological record, except under exceptional circumstances. The small numbers of fragments that have survived provide limited, but nevertheless, important information about its use in construction and for the making of pottery vessels.

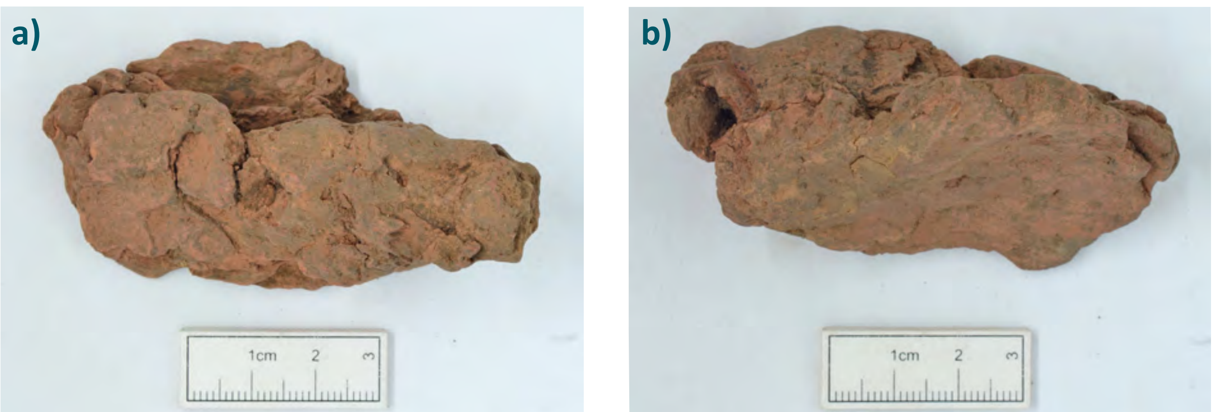


Figure 5.59: Shaped burnt clay SF 6020 a) and b) from Pit Group 13.

Part 6: The late Bronze Age metal hoard

By Warren Bailie, Alan Hunter Blair, Jordan Barbour, Esther Cameron, Trevor Cowie, Jane Evans, Susanna Harris, Raphael Hermann, Will Murray, Peter Northover, Brendan O'Connor, Vanessa Pashley, Ernst Pernicka, Susan Ramsay, Alison Sheridan, Beth Spence and Lore Troalen

Introduction

By Warren Bailie and Alan Hunter Blair

On Friday 9th September 2016, a remarkable discovery was made at the Carnoustie site. During the machine stripping of topsoil c. 0.3 m in depth, a number of copper alloy objects were uncovered embedded in the subsoil (Figure 2.64). The machinery not only partly revealed the objects, but the blade of the mechanical bucket had tilted and slightly damaged the blade of a bronze sword of what was later identified as a Ewart Park type, and a bronze spearhead with an embossed gold band around the base of its socket. It was also apparent to excavators that organic material, including fragments of wood - possible scabbard fragments, was preserved around the objects.

The excitement in discovering such a rare metal hoard had to be measured. Its significance, and safety, was considered paramount. Given the sensitivity of the possible organic material once exposed to the air, and the potential for other metal objects already visible on the surface, it was quickly decided that the preservation of all the objects, both organic and metal would be best served by lifting them and the surrounding soil immediately to enable excavation in controlled conditions in GUARD Archaeology's facilities.

The objects, along with their surrounding pit fill and subsoil matrix (the contextual material) were lifted as an 80 kg block, which was secured and then transported to the GUARD Archaeology Ltd facilities in Glasgow. There, it and the objects were stored within a secure and stable environment while arrangements were made for the appropriate investigative and excavation processes to be undertaken. Will Murray, of the Scottish Conservation Studio, was engaged in the first instance to ensure that any necessary preservation measures were undertaken ahead of the formal assessment and excavation.

When examined more closely, it quickly became apparent that the preservation of organic material was quite extensive, and the partial survival of a wooden scabbard and fragments of textile were noted. Later, further metal objects were also uncovered, including a copper-alloy decorated pin, a copper-alloy chape, a copper-alloy annular mount, and a sword pommel of lead-alloy.

The preservation of prehistoric archaeological organic materials is very rare in Britain due to aerobic and often dry soil conditions. The survival of a wooden scabbard around the sword puts this hoard in rare company. The only other single example of a surviving Bronze Age sword scabbard in Scotland, is that found relatively nearby at Pyotdykes Farm north of Dundee in 1963 (Coles 1964; Figure 6.1).

Figure 6.1: Map of sites mentioned in this section.

The initial assessment

By Beth Spence and Will Murray

Before the laboratory-based excavation, the block of soil containing the hoard was transported from the GUARD Archaeology facilities to the Small Animal Hospital at Garscube, Glasgow in order to carry out X-ray imaging and a CT-scan (Figure 6.2) to inform all prospective specialists about what else could lie in the surrounding subsoil matrix.

The aim of this non-intrusive investigation was to establish the number, position and size of the visible objects, as well as establishing the presence of any unknown objects. Horizontal images were produced of the block from above, and vertical images were taken through it. Due to the clarity of the images, the extent and location of metal objects were successfully identified. The images were referred to during consultation with the conservator and other specialists prior to the excavation of the block, and again during the excavation process in order to identify sensitive areas prior to the objects being fully revealed.

The block was also photographed using a digital camera from several angles prior to its excavation, to record as much information as possible about the position of the objects and their orientation.

Four fixed marker points were used throughout the excavation process for photographing the block at various stages of excavation. A nominal system of compass points was also used in order to locate the direction of photos, corresponding closely to the orientation of the feature on site. The block was drawn at a scale of 1:10 and the plan produced (Figure 6.3) that detailed the 10 mm by 10 mm grid which was used throughout the excavation for locating materials, objects and fragments, including environmental samples. The grid provided co-ordinates for all materials and samples recovered during the excavation.

The laboratory excavation of the hoard in its block was undertaken by GUARD Archaeologist Beth Spence (Figure 6.4), under advice from the conservator Will Murray, who carried out a conservation assessment[1]. Various specialists visited during the process of excavation to offer their thoughts on the finds at an early stage.

The excavation revealed that the hoard consisted of the following metal objects:

- a leaf-shaped sword of copper alloy (bronze) with a metal pommel, that was buried in its wooden scabbard which had a bronze chape,[2]

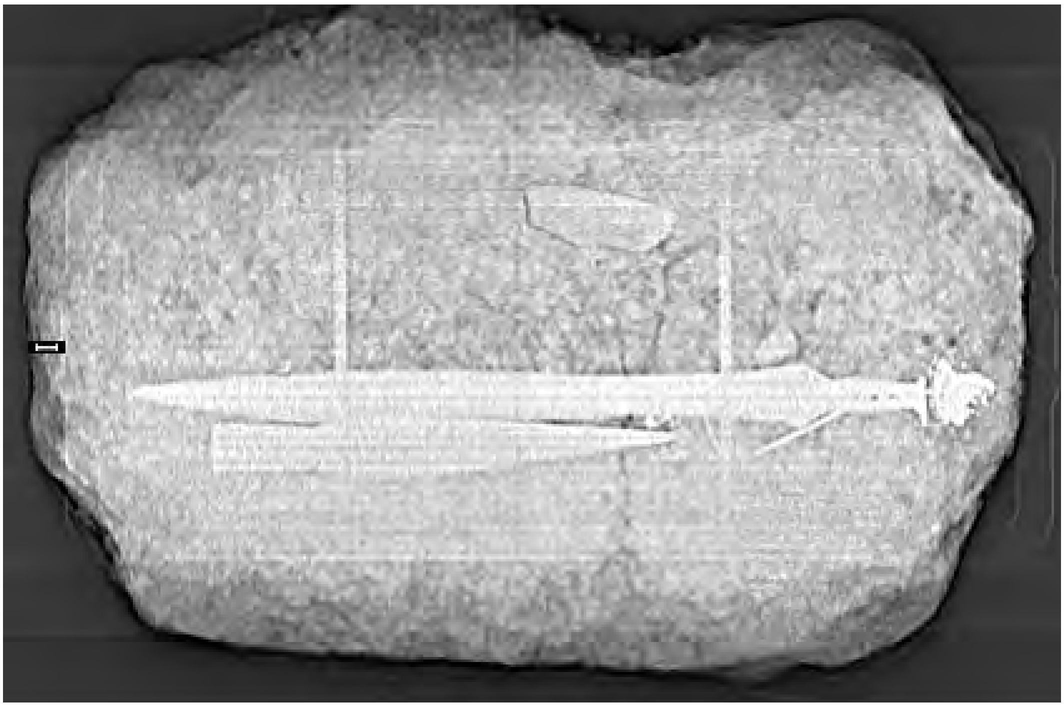


Figure 6.2: X-ray image of block showing the object locations.

1 Full details of both the excavation and the assessment can be found in reports held in the project archive.

2 The chape had been partly destroyed by the metal bucket of the mechanical excavator.

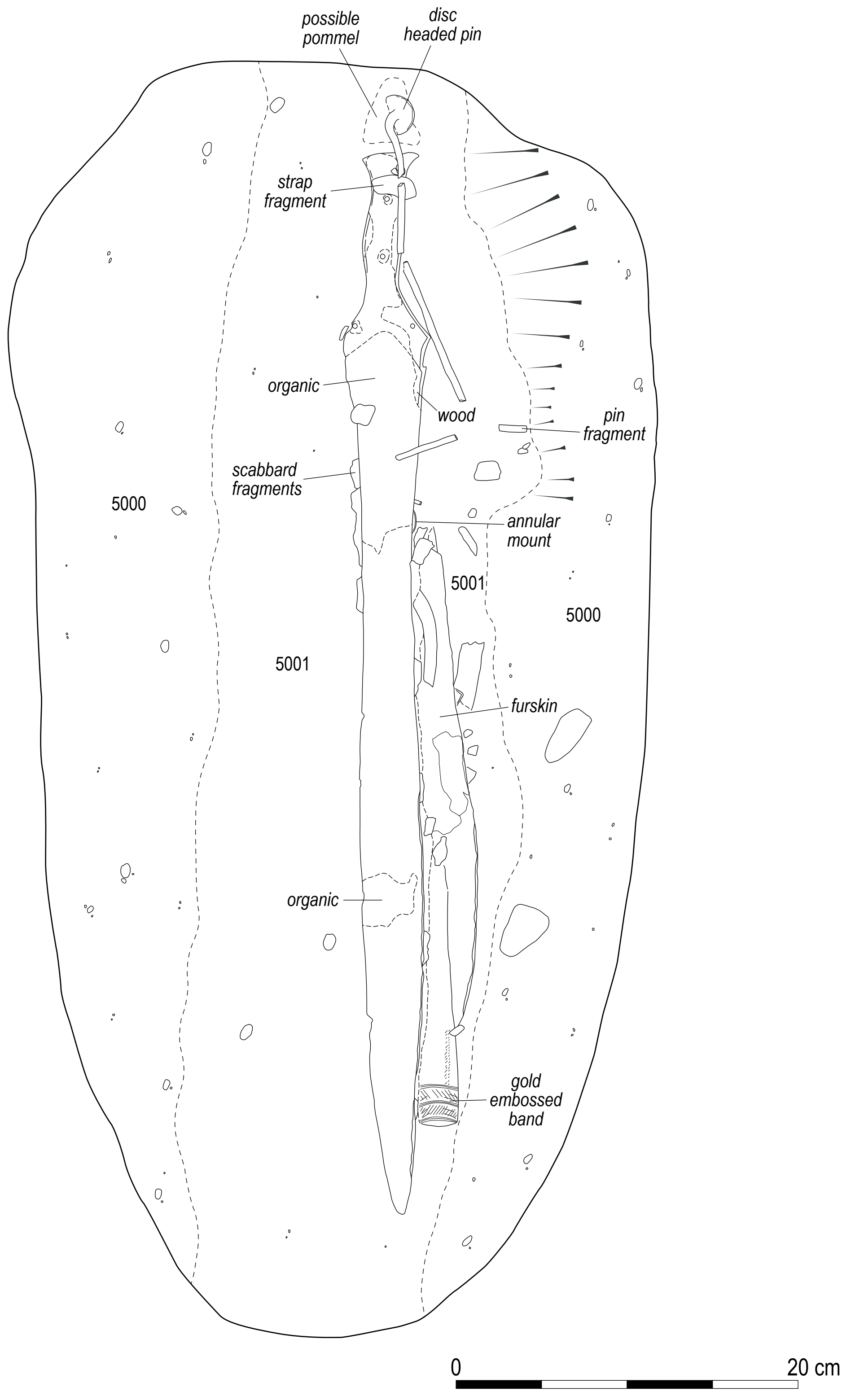


Figure 6.3: Plan of the Carnoustie Hoard in situ by Jordan Barbour, from Spence (2017, 10, Figure 2).

Figure 6.4: Beth Spence excavating the artefacts in the block. Photo: Will Murray.

- a socketed bronze spearhead, wrapped in an animal skin, which was laid partly over the sword and with its tip pointing towards the sword hilt. Fragments of woven textile were found in the area of its gold foil encircled socketed end[3],
- a swan's neck, sunflower-headed bronze dress pin, which was broken into five pieces at some time before its discovery, but probably post-deposition. Its remains overlay the hilt of the sword, and traces of woven fabric were spotted in its immediate vicinity,
- a circular, half-cylindrical bronze mount with the remains of two loops on its concave side. This was found beneath the sword blade, roughly in line with the tip of the spearhead. There were also traces of woven fabric in this area,
- a mysterious circular organic object, named as 'the biscuit' during the initial assessment. This was found close to the mount.

A long and narrow item of organic material was also noted in the area of the hilt that was initially considered to have been a strap. Subsequent microscopic investigation revealed, however, that this was a root of a small tree that had grown in the area after the metalwork had been deposited.

The hoard was buried in a shallow pit and traces of a stain in the subsoil surrounding the group of artefacts were noted. One interpretation is that it was the possible decayed remains of a wooden container enclosing the hoard, although there was no evidence to confirm this. An alternative interpretation, is that the dark stain was due to earthworm activity creating a worm-sorted layer around the wrapping (Limbrey 1975, 30), until metal corrosion products produced a hostile microenvironment that deterred both earthworm and micro-organism attack (see *Post-depositional processes affecting the hoard*).

The conservation assessment established that the degree of organic preservation was far superior to what might be expected for a dryland site due to the micro-climate of the surrounding sediment and the mineralisation of some organic materials through their proximity to metal objects. The assessment also underlined the importance of undertaking rapid specialist analysis and research, in order to prevent further deterioration of the remains before their consolidation.

3 The spearhead was buried without its wooden shaft.

Specialist study and analysis

By Warren Bailie, Esther Cameron, Jane Evans, Susanna Harris, Raphael Hermann, Will Murray, Peter Northover, Brendan O'Connor, Vanessa Pashley, Susan Ramsey, Alison Sheridan and Lore Troalen

During 2018 and with advice from Alison Sheridan of National Museums Scotland, a team of specialists was brought together to undertake more detailed analysis.

The analytical studies included the micro-CT scanning of the spearhead, the pommel and the 'biscuit'; microscopic examination; compositional analysis using X-ray fluorescence spectrometry in portable form (pXRF) at the GUARD lab, and the fixed equipment at the National Museums Collection Centre, Granton); lead isotope analysis at the NERC Isotope Geosciences Laboratory, Keyworth; and scanning electron microscopy and electron probe analysis[4]. The results of the analyses in digest form are presented below as a narrative for each of the objects, followed by a discussion of their deposition and of the wider significance of the finds collated by Alison Sheridan.

The individual components

The sword

The sword (Figure 6.5) consists of a leaf-shaped bronze blade that terminates in a T-ended hilt tang, with four rivets that would have secured the tang to an organic hilt, plus a pommel that would have been fixed in some way to the hilt. The overall length of the sword is 889 mm; the length of the blade and hilt tang is 638 mm; and that of the tang, 103 mm. At its widest point, the blade measures 44 mm, and the width at the shoulder of the hilt tang is 49 mm, although it would probably originally have been a few millimetres wider as part of the shoulder on one side had broken off presumably in prehistory (Figure 6.6 and 6.7). This occurred on the opposite side of the sword from the side damaged by the bucket of the mechanical excavator. The hilt rivets have diameters ranging from 3.1 mm to 4.1 mm, and to judge from their lengths, the hilt would have been around 12-13 mm thick.

The blade has a gently rounded mid-section and a gently concave outer section, curving to slightly bevelled edges. Slight asymmetry of the blade edge towards the tip (Figure 6.5), suggests that the sword may have seen some action during its lifetime, being resharpened after combat. There are nicks in the blade but these all appear to relate to recent damage; they lie along the recently-damaged side. As the blade approaches the hilt, on one side it kinks inwards, marking the junction between the blade and the hilt, but this feature is absent from the other side. This is known as a ricasso notch; beyond that point, and leading to the shoulder of the hilt, is an unsharpened area called a ricasso.

The shape of the lower edge of the hilt is revealed by a broad, roughly omega-shaped area of dark brown compact organic material (Figure 6.8), which lies over part of the hilt tang and is still to be identified. Microscopic traces of a material that appears to be horn (Figure 6.9) were spotted by Will Murray during his conservation assessment; whether the organic material found around the base of the rivets (Figure 6.10) is wood or horn remains to be seen. It may well be that the hilt had been a composite of horn and another organic material.

The pommel is highly degraded and friable through being oxidised over time, and its original shape is hard to assess, although it may have been a flattish dome or cone (Figure 6.2 and 6.11). Its lower edge is slightly broader than the T-end of the hilt tang, and this offers a hint as to the original width of the hilt at this point. The material was found to be an alloy of tin and lead, with surface compositional analysis by pXRF suggesting a ratio of 90% tin to 10% lead (although it is known that tin migrates to the surface, causing surface enrichment over time, so the actual tin-to-lead ratio for the pommel overall was probably lower). Its tin isotope ratios are consistent with an origin in Cornwall (Brügmann et al. 2017) but there is some overlap of the tin isotope ratios from other deposits formed during the Variscan. The lead isotope ratios relate only to the provenance of the lead and this is consistent with the lead ores from England and Wales (Rohl 1996; Rohl and Needham 1998), but probably excluding deposits from central and

4 The individual detailed specialist reports form part of the project archive.

Figure 6.5: Image of the sword, after conservation, and scale drawing. Photo: Will Murray

Figure 6.6: Lower part of hilt and upper part of blade, showing a detached fragment from the hilt shoulder towards the bottom of the photo. Note also the absence of a ricasso notch on this side. Photo: Will Murray.

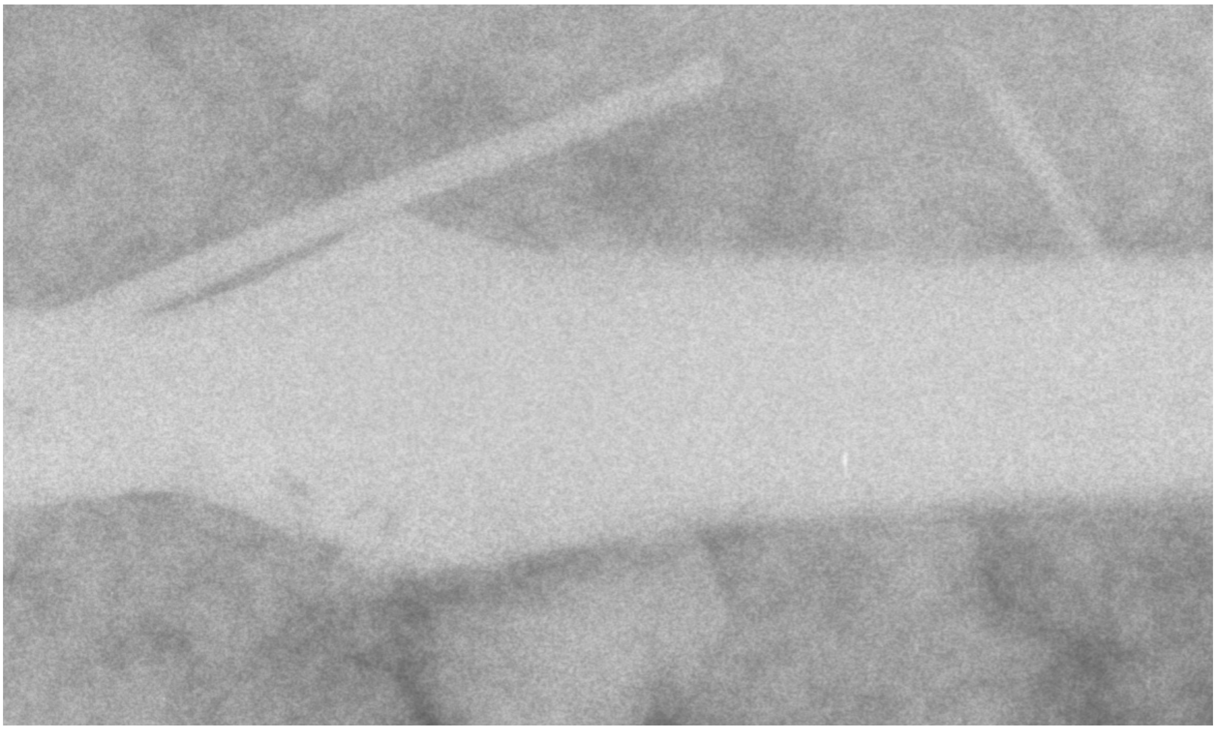


Figure 6.7: X-ray of the same area of the sword, showing that the hilt shoulder on the lower side of the image is less angular than the shoulder on the other side.

Figure 6.8: Remains of the organic hilt; at the left, the shape of the bottom edge of the hilt is shown by a roughly omega shaped 'hollow'. Photo: Will Murray.

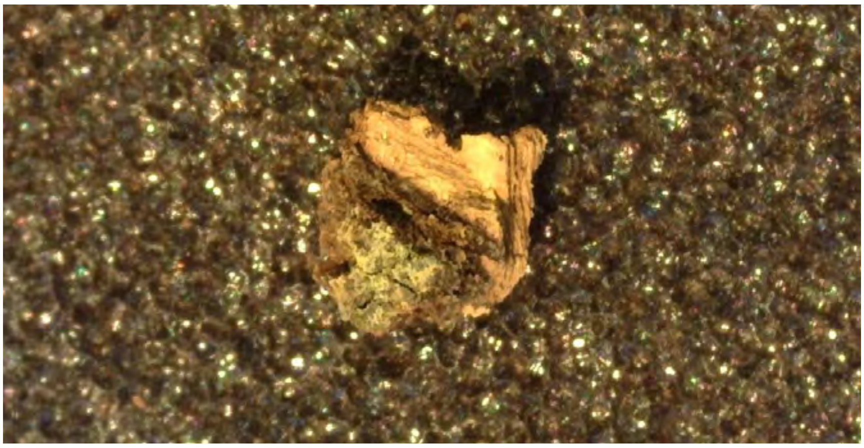


Figure 6.9: Fragment of horn from hilt. Photo: Will Murray.

Figure 6.10: Hilt tang with fragment of horn or wood attaching to a rivet. Photo: Will Murray.

southern Wales, and possibly Shropshire and the Lake District. However, similar lead isotope ratios are also found in Germany, especially the Eifel region (Durali-Müller 2005; Bode 2008)[5].

The base of the pommel was located around 10 mm beyond the end of the hilt tang, suggesting that the organic hilt had extended beyond the end of the tang by this distance. Micro-CT scanning of the pommel (Figure 6.12) did not reveal any feature that would suggest exactly how it had originally been fixed to the hilt: had the hilt ended in a tenon that projected into a socket in the pommel? Had the pommel been heat-fused to the hilt in some way?

Overall, the sword can be classified as being of Ewart Park type. This type of sword was current mostly between 900 BC and 800 BC, and numerous examples are known from northern Britain, although the distribution extends widely over Britain (Colquhoun and Burgess 1988, plates 127-32). The radiocarbon date obtained for the Carnoustie scabbard (see below) is slightly earlier than this and is discussed below.

Compositional analysis of the sword blade by Peter Northover revealed it to have a mean composition of 89.86% copper, 8.08% tin and 1.04% lead, with traces of several other elements; the arsenic and antimony content are below 0.4% and the nickel content is below 0.2%. This composition is characteristic for Ewart Park swords (Northover 1988).

Figure 6.12: CT scan looking down from the top of the pommel.

Figure 6.11: The pommel in situ. Photo: Will Murray.

5 Analysis undertaken by Ernst Pernicka, Curt-Engelhorn-Zentrum Archäometrie gGmbH and The University of Heidelberg, Germany.

Figure 6.13: Remains of the scabbard (top) from the underside of the sword.

The scabbard

The scabbard was found as a series of relatively well-preserved fragments of thin wood (Figure 6.13). It was preserved better on the underside of the sword i.e. the side less vulnerable to disturbance by heavy excavation equipment than on the upper side. Microscopic examination of the wood[6] revealed that it was hazel, cut into long strips a few millimetres thick; in some fragments it was observed that the wood had been cut at 45 degrees to the grain. How the two sides of the scabbard fitted together is still unclear, but traces of a black organic material were noted on both sides of each scabbard fragment and on the blade of the sword. These were shown by scanning electron microscopy[7], to consist of a starchy material, possibly a form of glue (Figure 6.14). The scabbard may therefore have been of composite construction, with the starchy glue used to attach an organic liner and cover to the wood. Furthermore, a narrow strip of organic material running down the centre of the scabbard's internal surface (Figure 6.15) hints at some complexity in its construction.

That the scabbard had been attacked by boring insects, probably after its deposition, is shown by the presence of tiny holes and frass (insect excreta)[8] near the hilt end of the scabbard (Figure 6.16).

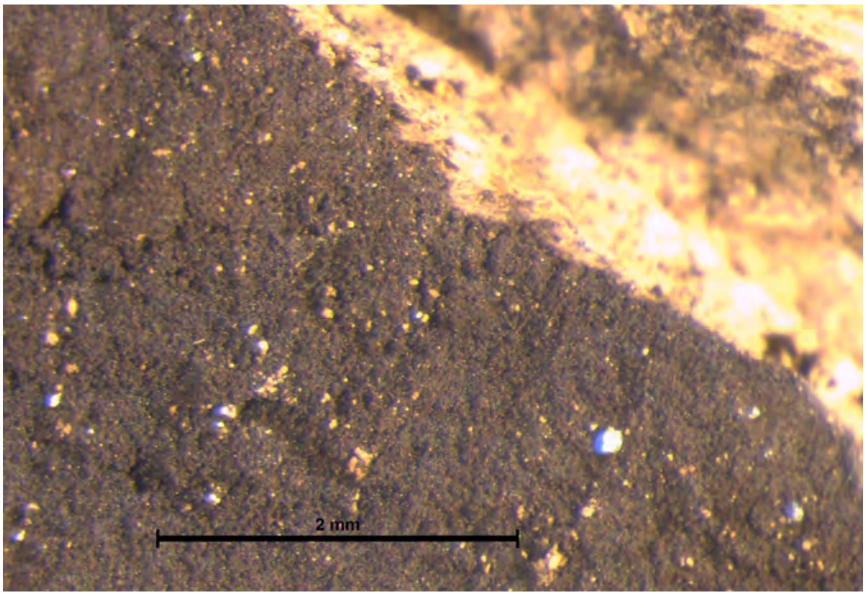


Figure 6.14: Conventional binocular microscope image of surface of scabbard; the dark material is the starchy substance that was identified as such in the scanning electron microscope. Photo: Alison Sheridan.

6 By Susan Ramsay

7 Undertaken by Lore Troalen, NMS

8 This was noted by Will Murray during his conservation work see also Murray's 1916 *Conservation Report* in the site archives.

Figure 6.15: Inner surface of scabbard, showing a strip of organic material running down its centre. Photo: Will Murray.

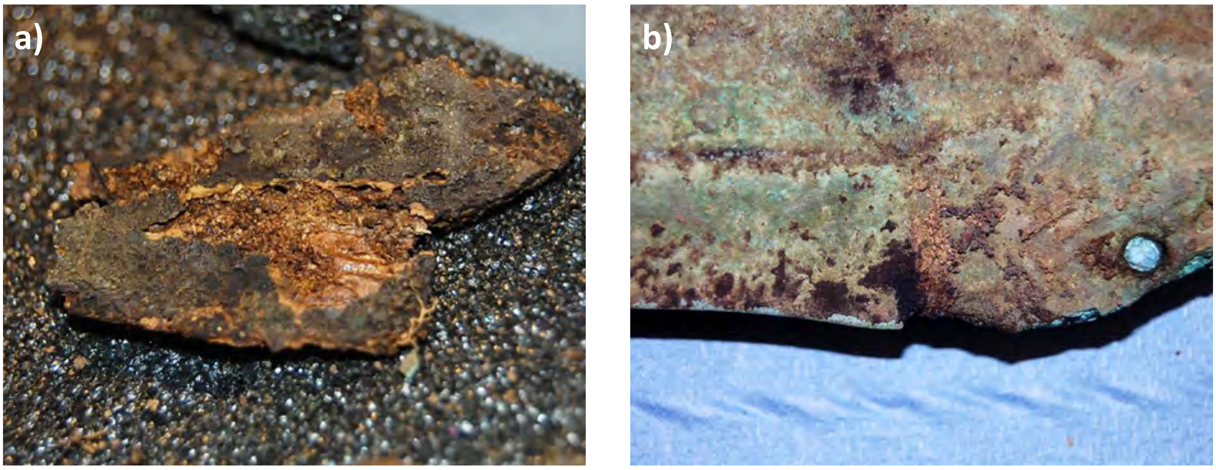


Figure 6.16: a) Fragment of scabbard with insect boring holes, b) Insect frass beside the ricasso notch. Photos: Will Murray.

The chape

Only a small portion of the chape – a metal protector for the blade tip end of the scabbard – survived the process of discovery by the mechanical excavator during the topsoil strip. Its constituent fragments were found under the tip of the sword. Sufficient remains survived of the chape to show that it is of tongue-shaped form (Figure 6.17), is of copper alloy, and the refitted fragments amount to c. 36 mm in length. How it had been fixed to the scabbard is unknown.

Figure 6.17: The surviving portion of the tongue-shaped chape. Photo: Will Murray.

The annular mount

This copper alloy object (Figure 6.18) was found resting mostly underneath the sword, close to the tip of the spearhead, with just a small part of its edge projecting from beneath the sword. It is a hollow ring-shaped object, with a diameter of 26.5 mm and a hoop width of 7 mm; part of its outer edge is missing, presumably corroded away. On the outer surface there are two low transverse ribs, and on the hollow side – the side facing the sword – there are stumps of metal left by two loops that will have served to affix the object to another object, by one or more straps. Beside one of these loops, is what appears to be, the remains of a casting core fragment (Figure 6.19), left from the manufacture of the object.

Figure 6.18: Exterior of the annular mount, showing the two ribs. Photo: Will Murray.

Figure 6.19: Interior of the annular mount, with fragment of casting core in situ at lower left area of the hoop. Photo: Susanna Harris.

The item is most likely a decorative mount, perhaps for the scabbard or for a baldric; i.e. a sword belt, although no other evidence of one was spotted; but it is not sufficiently robust to have been a load-bearing connector on a strap. A scabbard ornament seems to be the most likely interpretation.

Beneath this mount, i.e. in contact with its convex surface, and within its centre hole, fragments of woven textile and fragments of animal hide were found (Figure 6.20). These are described and discussed below.

Figure 6.20: Fragments of woven textile and animal skin found below the annular mount. Photo: Susanna Harris

The spearhead

This piece is a long, leaf-shaped socketed spearhead, 378 mm long and c. 65 mm at its widest, with a midrib, a socket c. 27 mm in diameter at its end that extends up much of the midrib, and a peg-hole on one side of the socket for securing it to a wooden shaft (Figures 6.21-6.24).

Around the socket, but not extending over its end, is a band of applied gold foil, 21.6 mm wide, with a design of two sets of three lines and one set of two, each c. 0.4 mm wide, framing a herringbone pattern (Figure 6.23). Micro-CT scanning revealed that the design was present on the copper alloy beneath the gold, probably incised into the metal, rather than cast-in (although this needs to be verified). This indicated that the gold had been applied as a seamless foil band, and pressed into the incised lines to take the design (Figure 6.24). The micro-CT scanning

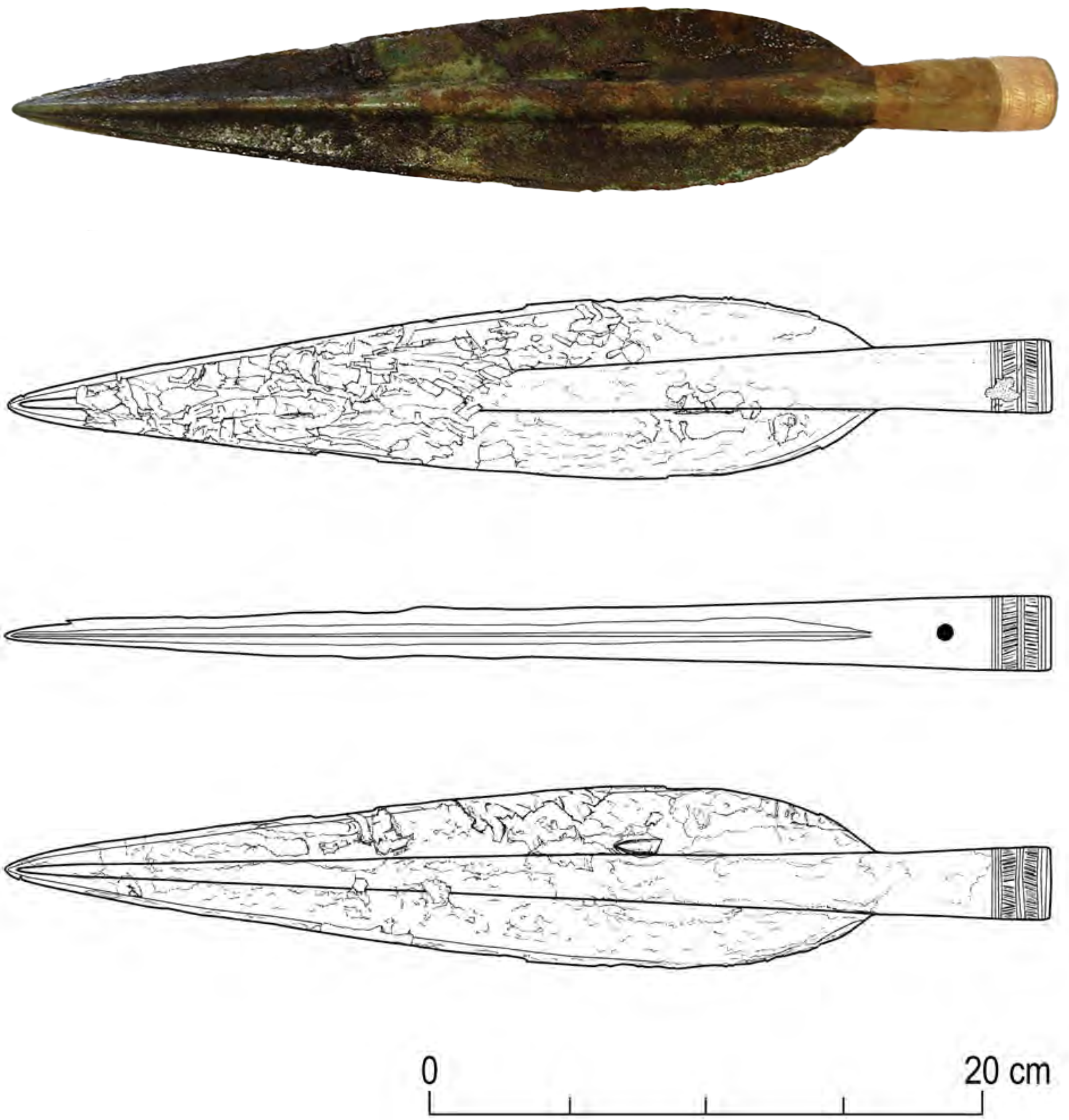


Figure 6.21: The spearhead after consolidation and scale drawing. Note: the contrast in colour between the blade and the socket relates to the area covered by consolidant. Photo: Will Murray.

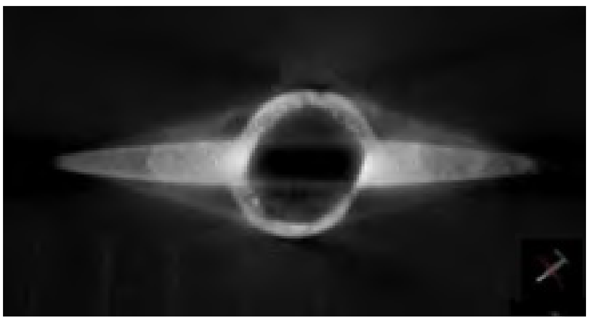


Figure 6.22: Micro-CT scan image across section of the spearhead.

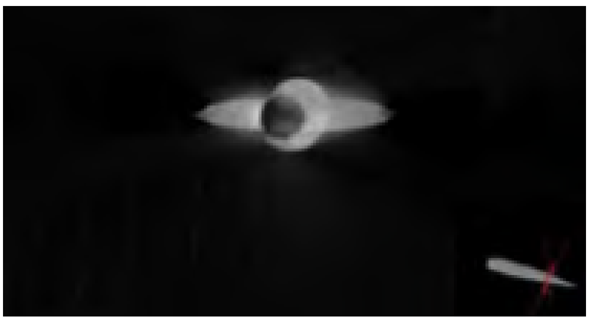


Figure 6.24: Micro-CT scan image showing that the inner end of the socket is not symmetrically-positioned. The small image at the bottom right indicates the position (in red) of the CT 'slice'.

Figure 6.23: The gold binding on the end of the spearhead socket. Note the whitish corrosion product in the grooves on the right-hand image. Photo on left: Will Murray; on right: Alison Sheridan.

also revealed that the socket kinks slightly as it approaches its narrow end. This suggests that during the casting of the spearhead, the core that had been used in the three-part mould may not have been wholly straight. There is some minor nicking to the blade, and that the gold appears to be slightly worn[9], but whether this means that the spearhead had seen active service is unclear. Whitish material found in the area of the gold band was found to be a corrosion product.

The spearhead is of Type 11A in the latest typology of British late Bronze Age spearheads (Davis 2015), and is among the longest examples of its type.

Investigation of the contents of the socket revealed that there were no traces of wood present from a shaft; instead, a considerable amount of fresh-looking grass stems was found, stained by the copper. This suggested that a very small rodent (such as a field mouse), may have set up house in the fairly recent past in the socket.

Compositional analysis of the bronze of the spearhead[10] revealed that it is of 86.7% copper, 11.4% tin and 0.68% lead, with trace amounts of several other elements. Lead isotope analysis[11] revealed that the lead probably originated in a central English ore field. Compositional analysis of the gold[12] using XRF revealed the gold to be of high purity, and lead isotope analysis of it showed that it grouped with southern Irish and southern British ore compositions. Further analysis is needed to check whether the lead in the gold had been present as a natural inclusion, or had been added; an origin of the lead content in an English ore field seems likely (see *Metallurgical Analysis*, below).

The remains of animal hide were present over much of the surface of the spearhead, with its hair side in contact with the metal (Figure 6.25). The remains of woven textile were found adhering to the socket, both above and below the metal (Figure 6.26). These organic remains are described and discussed further below.

Figure 6.25: Detail of the sheepskin wrapping at the tip of the spear. Photo: Will Murray.

9 Peter Northover commented on this.

10 Undertaken by Peter Northover,

11 By Jane Evans and Vanessa Pashley

12 By Lore Troalen

Figure 6.26: Fragment of woven textile adhering to the gold socket band. Photo: Alison Sheridan.

The pin

A complete but fragmented bronze sunflower-headed, swan's neck pin was found lying over the pommel, hilt and upper blade area of the sword, its head at the pommel end (Figure 6.27). The pin had broken into several fragments, probably in antiquity as the fracture surfaces are not fresh. Its overall length is c. 239 mm, with a shank diameter of 4.25 – 5.9 mm, and a head diameter of 26.6 mm. The head is c. 2.3 mm thick over most of its surface. The exterior of the head is decorated with a design of concentric circles, each around 0.25 mm wide. The design may well have been made using the lost wax method of casting rather than by scribing a design into the head after casting. The centre of the head has a low nipple (Figure 6.28). This marks the point where, on the back of the head, the shank of the pin is attached.

Fragments of woven textile were associated with this pin, including in the narrow area between the shank and the back of the pinhead – thereby indicating that the pin had been in use, securing a piece of textile.

Compositional analysis using XRF revealed that the pin, like the sword and the spearhead, is of leaded bronze (see *Metallurgical analysis*, below).

The animal skin wrapping for the spearhead

This was examined[13] using scanning electron microscopy (Figures 6.29 and 6.30). It was concluded that the substance was sheepskin, but not that obtained from a late Bronze Age sheep bred for its wool. The closest modern parallel for the sheep whose skin was used at Carnoustie is the wild sheep.

The position of the sheepskin fragments indicate that it had been wrapped around both sides of the spearhead. Whether the animal skin that was found beneath the annular mount is part of the same wrapping material remains to be elucidated.

Figure 6.27: The pin as found. Photo: Will Murray.

13 Examined by Esther Cameron

Figure 6.28: The pin after cleaning. Photo: Will Murray.

Figure 6.29: Conventional binocular microscope photograph of a fragment of the sheepskin, with the individual hairs clearly visible. Photo: Alison Sheridan.

Figure 6.30: Scanning electron microscope image of individual wool fibres. Image: Lore Troalen and Susanna Harris.

The woven textile fragments

Fragments of textile found associated with the pin, the spearhead socket area and the annular mount were examined using scanning electron microscopy[14]. Susanna Harris concluded that all were of sheep's wool (Figure 6.30), and that at least two different textiles were represented. One, found around the socket of the spearhead (Figure 6.26), is a fine, tabby weave, woven using z-spun thread with one thread system finer than the other. The other, found associated with the pin and the annular mount (Figure 6.31), is a slightly coarser fabric, woven with z-spun yarns with thread systems of similar diameter. There is no sign of any dye in either fabric.

Figure 6.31: Fragment of woven textile on shaft of pin. Photo: Susanna Harris.

14 Examined by Susanna Harris

Susanna Harris suggested that the finer material had probably been used to wrap around and protect the gold end of the spearhead, while the slightly coarser fabric could either have been a garment, or a piece of cloth used to wrap the metal objects. The fact that fragments of this fabric were found both underneath the sword and above it strengthens the idea that it had been wrapped around the sword and the wrapping had encompassed the annular mount as well. The textile fragments found between the head and shank of the pin indicates that the pin had been used to secure the loose ends of this fabric.

The unidentified organic object ('biscuit')

This enigmatic object, found near the sword hilt, has been baffling, and continues to mystify. In its cleaned state, it measures just over 30 mm in length. Micro-CT scanning failed to reveal any internal features; nor did the removal of surrounding sediment to reveal its extent uncover any clues as to what it had been. In its current, cleaned state, it has one forked end and one foot-like end (Figure 6.32 b); further research is required to clarify its raw material and to identify what it had been. If its forked ends are spaced at the same distance as the two loops on the interior of the annular mount, then this might this have been a strap that had run through the loops.

Other finds

Examination of plant remains[15] revealed the presence of various items that were extraneous to the deposit. The grass stems found in the socket of the spearhead have already been mentioned, but also present, in the sediment surrounding the artefacts, were two carbonised cereal grains (including one of barley); unburnt seeds of plant species that grow on waste ground (e.g. fat hen); charcoal of various species; and root wood. The cereal grains and charcoal could have derived from the Bronze Age settlement in the immediate vicinity, while the waste-ground plants may represent modern contaminants, and the roots relate to plants or trees that grew in the area, that had entwined around the archaeological material.

Figure 6.32: The enigmatic organic object, the so-called 'biscuit', a) in situ to the left of the annular mount, b) after removal of surrounding sediment.

15 By Susan Ramsay

The radiocarbon date

A sample of the wooden scabbard was submitted to SUERC for radiocarbon dating, which yielded a date of 1071-940 cal BC at 68.2% probability, or 1118-924 cal BC at 95.4% (SUERC-75019 (GU45283).

Metallurgical Analysis

By Peter Northover

The original proposal for the technical study of the bronze weapons included provision for a metallographic survey in order to determine the condition of the sword and spearhead when they were deposited. However, in order to preserve the adherent organic material, it was decided that the disturbance of cutting solid samples was too great, with a high probability of some of the organics becoming detached; accordingly, this part of the study was not proceeded with. At the same time, it was decided that the metal items other than the sword and spearhead, were too corroded and fragile to sample: surface XRF analyses were made of these objects and are reported separately, but the results fit very well with the data presented here.

Sampling and analysis

Three samples were taken: the first two were drilled with a handheld model-maker's electric drill with a 0.9 mm diameter bit from near the tip of the sword blade (#R5225) and the socket of the spearhead (#R5226). The third was shaved with a scalpel from the gold band around the socket of the spearhead (#R5356) in such a way as to minimise the effects of any surface oxidation or enrichment. The samples were all mounted in a carbon-filled, thermosetting resin, ground and polished to a 1µm thickness. Analysis was by electron probe microanalysis using wavelength dispersive spectrometry. Operating conditions were an accelerating voltage of 20kV, a beam current of 30nA, and an X-ray take-off angle of 40°. Counting times were 10s or 20s per element, and pure element and mineral standards were used. Eighteen elements were analysed as listed in accompanying Table 6.1, with the exception of bismuth in gold where the bismuth line used is obscured by interference from the gold spectrum. Detection limits were 100-200ppm for most elements, except 300ppm for gold in bronze.

Five areas were analysed on each sample, the areas being matched to the size of the individual drillings and would be from 25m to 50µm across. The individual analyses and their means, normalised to 100%, are given in Table 6.1; all concentrations are in weight %.

The use of drilled samples precluded any metallographic study, save to determine that the particles analysed were free from corrosion.

The sword and spearhead

The sword and the spearhead were cast in very similar bronzes. Inspection of the individual analyses in Table 6.1 shows that analysis #R5526/2 had elevated levels of nickel, antimony, and silver; such particles also exist in sample #R5525 but were not selected when the analysis was set up. For the sake of comparability the mean for #R5526 is given again, but with #R5526/2 excluded; the similarity that now exists means that we can treat the two compositions together. In the comparison the effects of segregation must also be considered; although segregation will probably not be severe there would be a difference between the two compositions even if they were poured from the same melt, with the sample from the tip of the sword being some of the first metal to freeze and that from the socket the last to freeze. The expected result would be a higher tin content in the spearhead sample, and this could well be part of the difference seen here. On the other hand, the lead content is small enough not to be much modified.

The sword and spearhead were cast in a medium tin, low lead bronze with 8.1-9.7% tin and 0.8-1.0% lead; the principal impurities were 0.15-0.18% nickel, 0.25-0.30% arsenic, 0.33-0.35% antimony, and 0.07-0.13% silver, together with traces of iron, cobalt, and sulphur; the silicon identified will stem either from the sample preparation process or the environment.

To place these weapons in the context of Scottish Late Bronze Age metalworking we have a body of over 400 bronze objects which have been accumulated from a number of projects: the penetration of Wilburton metal into Scotland

(Northover 1982), the metallurgy of cauldrons and buckets (Northover 2010), Scottish swords (Bridgford 2000), and an extensive study of Scottish late Bronze Age hoards carried out in association with the publication of the St Andrew's hoard (Cowie et al. 1998). As an introduction to the qualities of Scottish Late Bronze Age metalwork we look first at the alloys used with histograms for the tin and lead contents. For clarity the objects have been classified as tools, weapons, ornaments, and other, with the histograms plotted separately for each; the ornaments mainly comprise pins and bracelets, while other includes mainly components of bronze vessels, both sheet and cast.

The tin contents are displayed in Figure 6.33: in viewing these it must be remembered that the highest values recorded are influenced by corrosion and by some local segregation of the high tin ad eutectoid. There will also be some effect from the sort of segregation described in relation to the sample sites. Nonetheless, it is clear that the typical bronze is medium tin bronze with about 8-11% tin, with some bias towards higher tin contents in ornaments and the vessel components. For these last there is no peak in the distribution which is a consequence of the rather heterogeneous collection of material in this class.

With lead (Figure 6.34) there are clearer differences between the four classes. The shapes of the histograms for the tools and weapons are noticeably different from those for ornaments and other types, with the tools and weapons both having almost of 70% of the analyses with less than 2% lead. At this level the lead is very unlikely to be a deliberate addition made specifically for the casting of those objects, rather the results imply a considerable history

Sample	Object	Part	Fe	Co	Ni	Cu	Zn	As	Sb	Sn	Ag	Bi
R5225/1	Sword	tip	0.04	0.01	0.16	92.16	0.00	0.24	0.23	6.97	0.05	0.00
R5225/2			0.02	0.03	0.17	90.44	0.02	0.24	0.36	8.41	0.14	0.00
R5225/3			0.05	0.00	0.12	88.74	0.00	0.24	0.30	8.06	0.10	0.00
R5225/4			0.02	0.02	0.17	87.86	0.00	0.26	0.41	8.87	0.16	0.00
R5225/5			0.07	0.02	0.17	90.09	0.00	0.27	0.35	8.08	0.17	0.04
R5226/1	Spearhead	socket	0.03	0.00	0.18	87.01	0.00	0.28	0.39	10.25	0.11	0.00
R5226/2			0.01	0.01	0.29	79.59	0.00	0.36	1.08	18.28	0.20	0.00
R5226/3			0.01	0.03	0.19	92.48	0.02	0.17	0.15	6.65	0.03	0.00
R5226/4			0.00	0.03	0.19	85.24	0.00	0.41	0.54	11.94	0.15	0.00
R5226/5			0.00	0.01	0.19	89.04	0.01	0.29	0.33	9.89	0.00	0.00
R5356/1	Carnoustie LBA spearhead	gold band	0.03	0.01	0.00	6.01	0.00	0.00	0.00	0.00	14.92	0.00
R5356/2			0.00	0.01	0.00	6.09	0.00	0.00	0.00	0.10	15.08	0.00
R5356/3			0.02	0.00	0.01	5.69	0.00	0.00	0.00	0.07	15.16	0.00
R5356/4			0.00	0.02	0.00	6.20	0.00	0.00	0.01	0.07	14.92	0.00
R5356/5			0.00	0.00	0.00	6.22	0.00	0.00	0.02	0.03	15.05	0.00
R5225/ Mean	Sword	edge	0.04	0.02	0.16	89.86	0.00	0.25	0.33	8.08	0.13	0.01
R5226/ Mean(a)	Spearhead	socket	0.01	0.02	0.20	86.67	0.01	0.30	0.50	11.40	0.10	0.00
R5226/ Mean(b)		socket	0.01	0.02	0.18	88.44	0.01	0.29	0.35	9.68	0.07	0.00
R5356/ Mean	Spearhead	gold band	0.01	0.01	0.00	6.04	0.00	0.00	0.01	0.05	15.03	0.00

Table 6.1: Analysis of Bronze weapons.

Sample	Object	Part	Pb	Au	Cd	S	Al	Si	Mn	P
R5225/1	Sword	tip	0.00	0.07	0.02	0.00	0.00	0.00	0.02	0.02
R5225/2			0.06	0.09	0.00	0.02	0.00	0.00	0.01	0.00
R5225/3			2.36	0.00	0.00	0.01	0.00	0.00	0.01	0.00
R5225/4			2.14	0.00	0.00	0.07	0.00	0.00	0.00	0.00
R5225/5			0.62	0.00	0.00	0.09	0.00	0.00	0.01	0.00
R5226/1	Spearhead	socket	1.62	0.00	0.00	0.00	0.01	0.13	0.00	0.00
R5226/2			0.16	0.01	0.00	0.00	0.00	0.00	0.00	0.00
R5226/3			0.18	0.08	0.00	0.00	0.00	0.00	0.00	0.01
R5226/4			1.27	0.08	0.00	0.15	0.00	0.00	0.00	0.00
R5226/5			0.18	0.00	0.00	0.00	0.02	0.01	0.03	0.01
R5356/1	Carnoustie LBA spearhead	gold band	0.00	78.90	0.00	0.05	0.00	0.03	0.05	0.00
R5356/2			0.06	78.60	0.00	0.03	0.00	0.03	0.00	0.00
R5356/3			0.00	79.01	0.00	0.00	0.00	0.03	0.00	0.00
R5356/4			0.00	78.73	0.00	0.01	0.00	0.03	0.02	0.00
R5356/5			0.00	78.64	0.00	0.01	0.00	0.02	0.00	0.00
R5225/ Mean	Sword	edge	1.04	0.03	0.00	0.04	0.00	0.00	0.01	0.00
R5226/ Mean(a)	Spearhead	socket	0.68	0.04	0.00	0.03	0.01	0.03	0.01	0.00
R5226/ Mean(b)		socket	0.81	0.04	0.00	0.04	0.01	0.04	0.01	0.00
R5356/ Mean	Spearhead	gold band	0.01	78.78	0.00	0.02	0.00	0.03	0.01	0.00

Table 6.1 (continued): Analysis of Bronze weapons.

of recycling, perhaps with some input of new, unalloyed, or at least unleaded, metal. The detail differences between the histograms for tools and weapons might, in part, be chronologically linked; just over half the weapons with over 2% lead are either types in the St Andrew's hoard which can be attributed to the Blackmoor phase at the start of the Ewart Park period, or are part of the Duddingston Loch find attributed to the same phase (Bridgford and Northover forthcoming). We should note, though, that the radiocarbon date for the Carnoustie scabbard also matches a date in the Blackmoor phase but the sword only has 1% lead. In contrast, ornaments and vessel parts and objects such as chapes are much more likely to be cast in leaded bronze and there may have been a significant element of choice in this for reasons of castability. There is a caveat to be made here because the population of ornaments is dominated by two hoards, St Andrews and Balmashanner so our interpretations should be a little cautious.

The question of the origins of the bronze will be discussed further (see *lead isotope analysis*) where the impurity patterns will be reviewed in relation to the same object classes to discover whether there are any correlations between them. All the analyses have been made by electron microprobe analysis but over the twenty years in which the data were collected three different instruments were used. The results have been found to be very consistent except for arsenic where different routines were used on each instrument and detection limits varied so arsenic data will not be included in this discussion. The key impurities here are nickel and antimony and plots of nickel against antimony are given in Figure 6.35 for each of the four object classes.

The nickel and antimony are components of a Ni/As/Sb/Ag impurity pattern common in northwest and Alpine Europe in the Late Bronze Age (e.g. Northover 1983; Rytchner and Kläntschi 1996; Liversage 2000). In Britain in predominates in

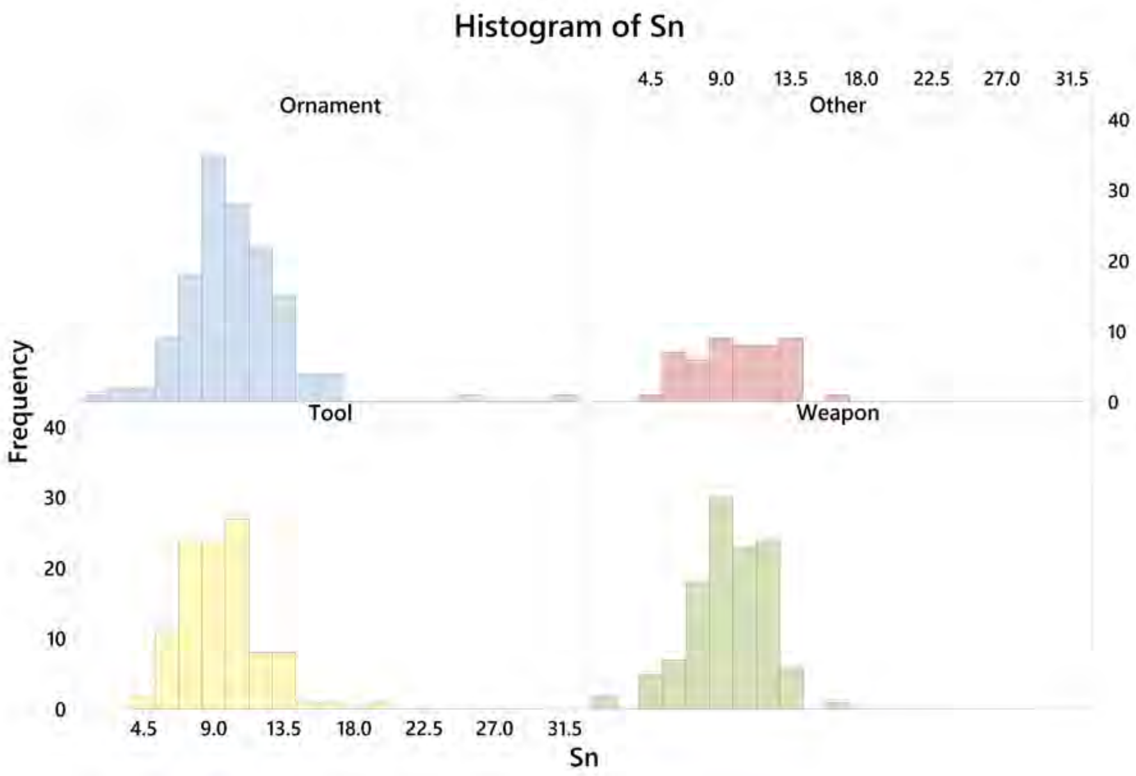


Figure 6.33: Histogram of tin (Sn) content of the four object classes.

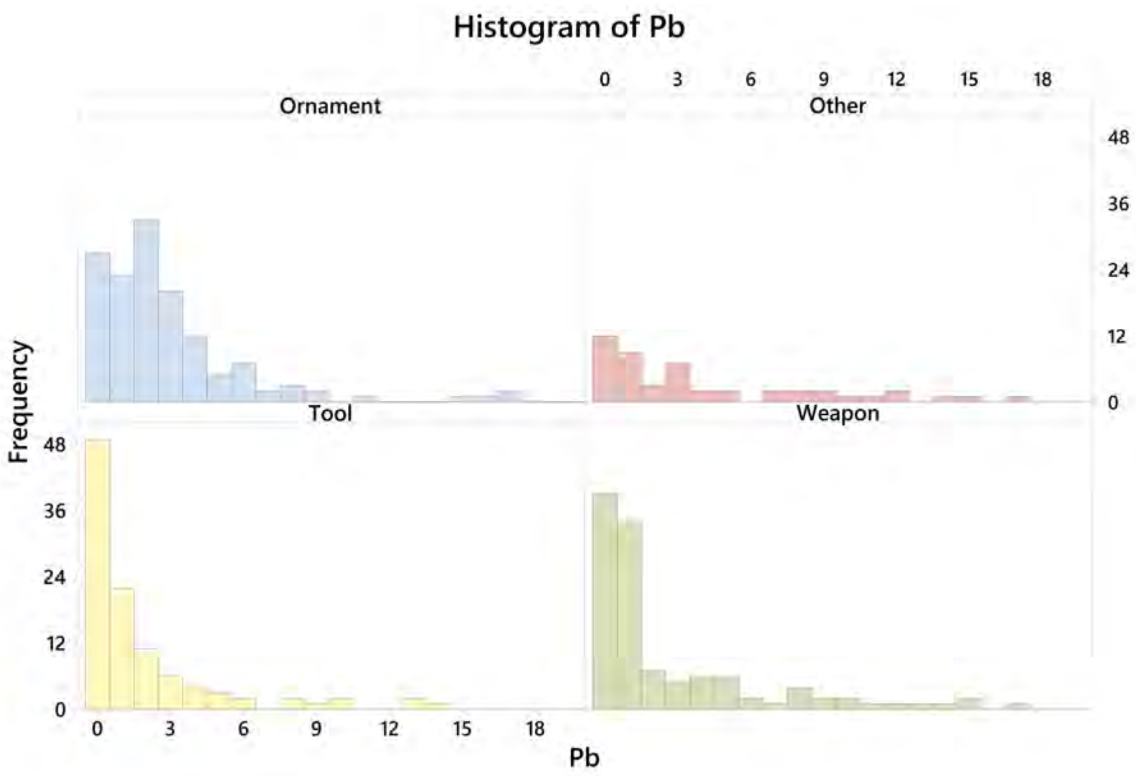


Figure 6.34: Histogram of lead (Pb) content of the four object classes.

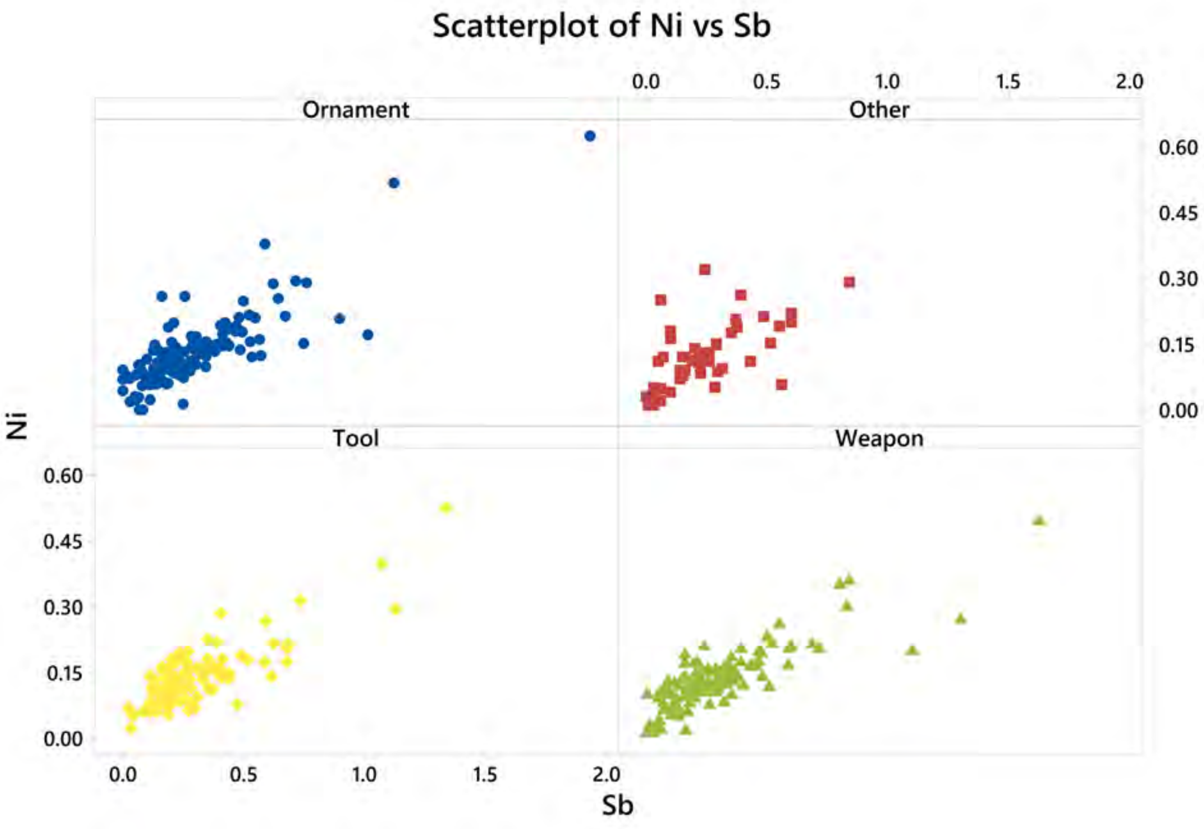


Figure 6.35: Scatterplot of nickel (Ni) vs antimony (Sb) for the four object classes.

eastern England and Scotland and is much less important in the central southern and south-western England and in Wales. This difference stems from different source areas for bronze imported from the Continent and, for Wales, from Ireland. Where the pattern does occur, nickel and antimony are strongly correlated as we see in Figure 6.35. The degree of scatter is much greater from ornaments and vessel parts suggesting a greater diversity in origin for the metal, and also that some may be direct imports, especially with the vessels.

Now we can turn to how the Carnoustie weapons lie with in this general picture of Scottish late Bronze Age metalwork. In Figures 6.36 and 6.37 the compositions of the two Carnoustie weapons are highlighted in plots respectively of lead against tin and nickel against antimony. In Figure 6.36 the Carnoustie results show very clearly how typical they are of the low lead majority of Scottish late Bronze Age weapons, while the nickel and antimony contents (Figure 6.37) are equally representative of the main trend of impurity patterns and we can conclude that it is highly probable that the weapons were made in Scotland. How local this was to Carnoustie is a question we cannot as yet answer.

The other bronzes

The X-ray spectra from the remaining three bronzes, collected by Lore Troalen, can be found in the project archive. Not all significant peaks are labelled but careful inspection of the spectra reveal that all three can be described as leaded bronzes, and all exhibit the Ni/As/Sb/Ag impurity pattern discussed in relation to the sword and spearhead. It is thus entirely possible that all three bronzes were made in Scotland but there are good reasons for considering the possibility that one or more were imports from further south.

The sunflower pin is the most recognisable of the three, and its composition can be compared with six other sunflower pins that have been analysed in Scotland. Of the six, five have the same Ni/As/Sb/Ag impurity pattern; two are unleaded, two have close to 1.5% lead, and two have over 4%, all typical for the spread of alloy contents for ornaments shown in Figures 6.33 and 6.34. The pin with a different impurity pattern has low concentrations of the key impunities but does contain 1.2% sulphur. Such a pattern with a high sulphur content is strongly associated with late Bronze Age copper ingots in southern and

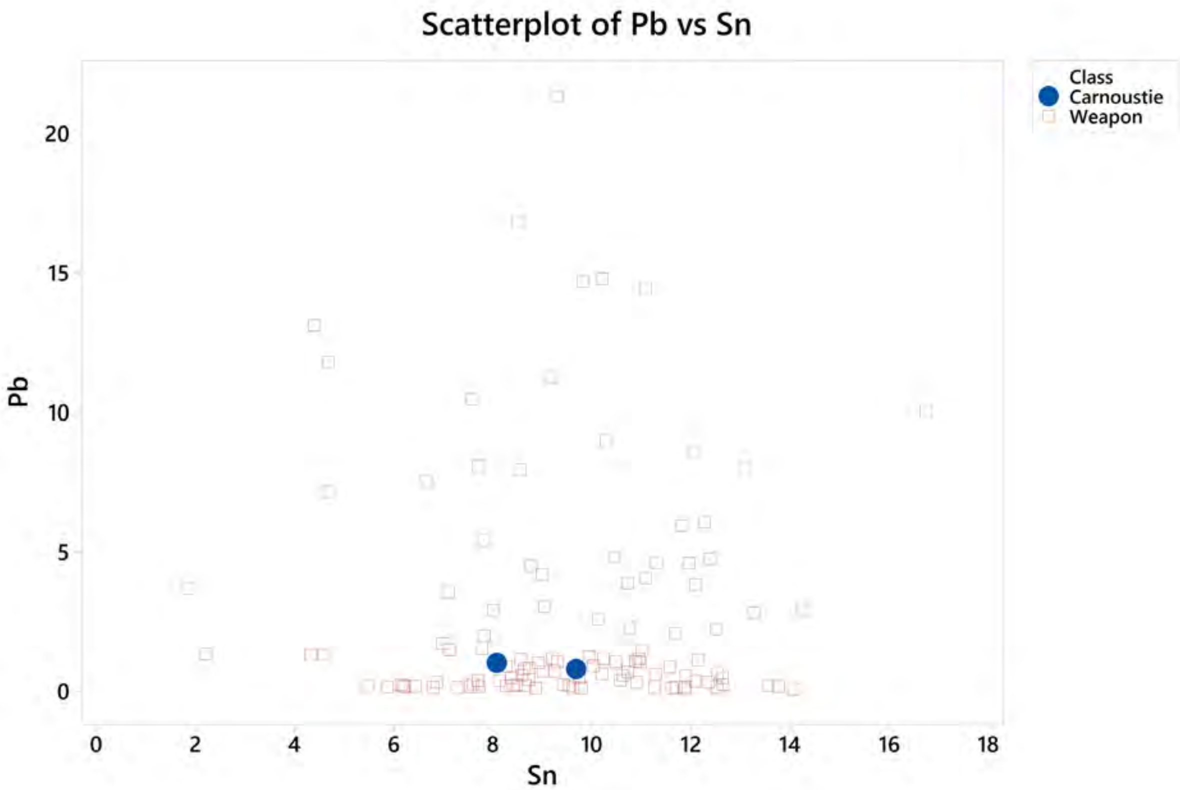


Figure 6.36: Scatterplot of lead (Pb) vs ti (Sn) for Scottish late Bronze Age metalwork.

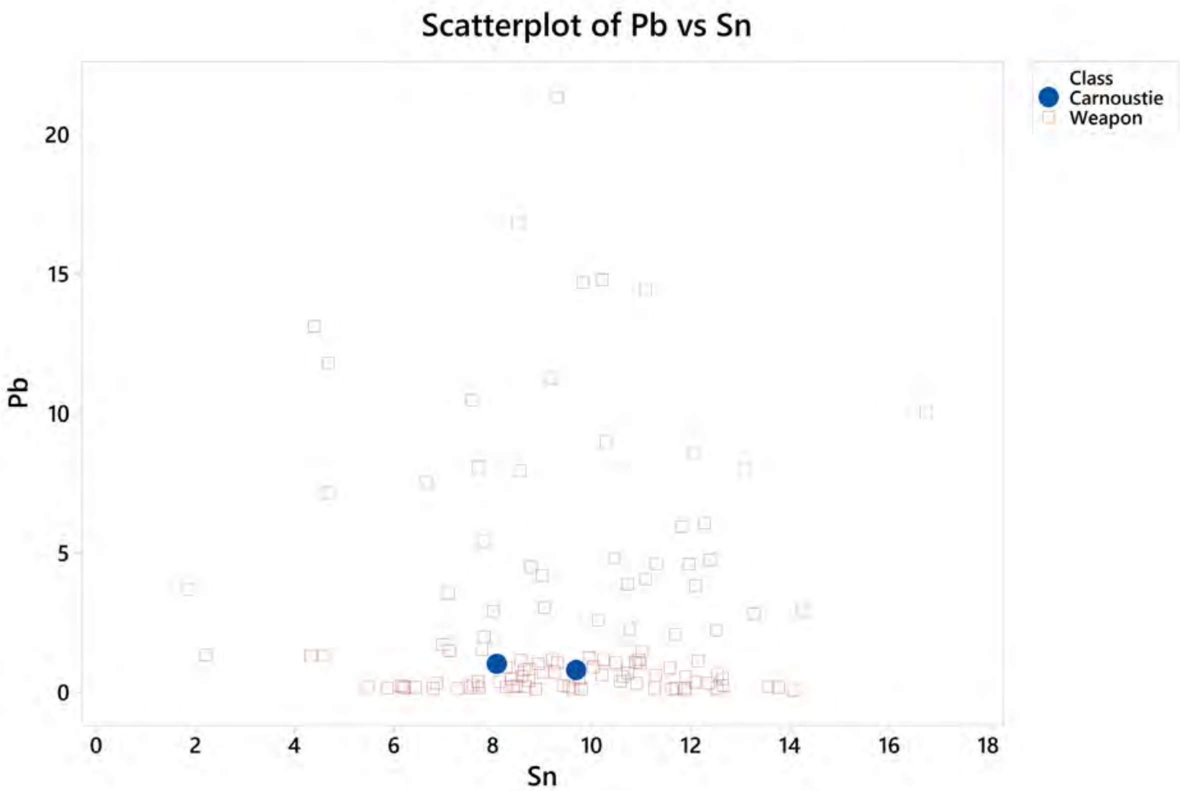


Figure 6.37: Scatterplot of (Nickel (Ni) vs antimony (Sb) for Scottish late Bronze Age metal work.

eastern England (Northover 2014), an artefact not found in Scotland. Sulphur contents decrease with successive re-melting and concentrations of 1% and more can be regarded as an indicator that this pin was made from newly made bronze. Almost all the compositions in the Scottish dataset have much less than this, with only three other examples so far known with over 1%. It is thus a very realistic possibility that this pin, which belongs to the St Andrew's hoard, is a direct import, and if one pin can be imported another might be as well.

Of the small number of Scottish tongue chapes only three have been quantitatively analysed, those from Cauldhame and Gogarburn House, and a fragment in the St Andrew's hoard. Collectively the Scottish chapes are a largely self-consistent group with a maximum length of 150 mm, broadly contemporary with the Blackmoor phase in England, and very probably were made in Scotland. The three analysed examples have the Ni/As/Sb/Ag impurity pattern, although that from Cauldhame has high enough concentrations of antimony and arsenic to be classified as being the 'S' metal of the Wilburton period (Northover 1982), but this does not preclude its being a Scottish product. The annular ornament may well also be a Scottish product but without a more definitive identification it is difficult to make comparisons.

The gold

The virtual certainty that the gold band on the spearhead socket would be alloyed meant that a trace element analysis in pursuit of a provenance for the gold would not be useful although, with hindsight, it may have a given a clearer estimate of the lead content. The sample was analysed by electron microprobe analysis to determine the alloy content. The gold contained 6.0% copper, 15.0% silver, 0.05% tin, and an uncertain lead content, uncertain because lead is irregularly distributed in the gold. This can be compared with the copper and gold contents of Scottish Bronze and Iron Age gold (Figure 6.38; the data are those published by Axel Hartmann (1982) and the Carnoustie analysis has been adjusted to match Hartmann's analyses presentation). Iron Age analyses are included because there is some typological overlap between middle Bronze Age and Iron Age ribbon torcs and not all identifications are secure.

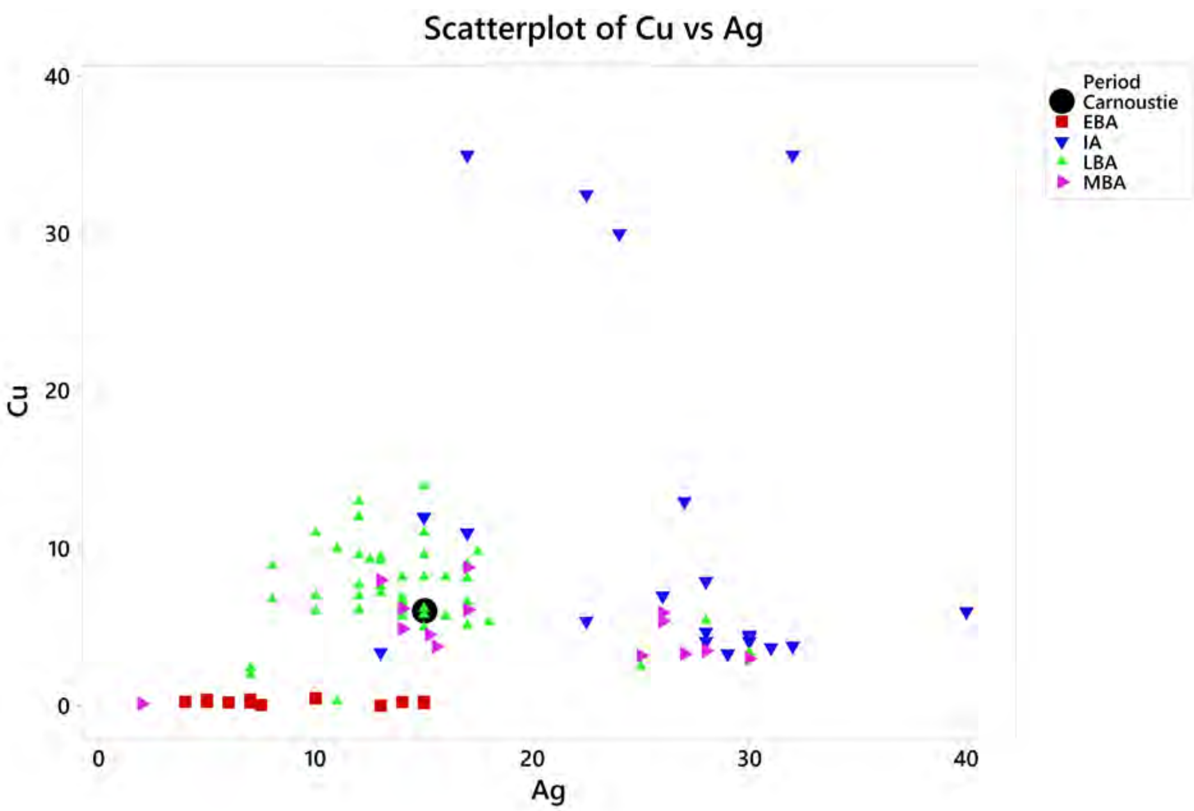


Figure 6.38: Scatterplot of copper (Cu) vs (silver) Ag in Scottish Bronze and Iron Age gold.

In interpreting Figure 6.38 it must be remembered that the refining of gold was unknown so that the silver content is entirely natural, and that natural gold contains only minimal amounts of copper, meaning that the early Bronze Age gold is essentially unalloyed. The later results separate into two main groups, one mainly late Bronze Age and the other mainly Iron Age with middle Bronze Age objects overlapping with both, in the latter case all the pieces are ribbon torcs. The Carnoustie alloy is closely matched by both middle and late Bronze Age objects, a middle Bronze Age example being the flange-twisted torc from The Minch (Cowie 1994), the two results for which lie just below that for Carnoustie.

The tin and lead contents of the Carnoustie band are very much at the low end of the range for both middle and late Bronze Age gold in Scotland, but they are paralleled by the Minch torc, the first flange-twisted gold torc to be found in Scotland. Further parallels for both alloy and tin and lead contents can be found in a group of three torcs from Pembrokeshire (Aldhouse-Green and Northover 1994). This raises the very real possibility that the gold band is made from a piece of middle Bronze Age gold alloy, either curated or opportunely found; it may be suggested that the gold has been alloyed with some copper and some low tin bronze.

Lead isotope analysis

The analytical methods, the results, and the geological aspects of the lead isotope analysis by Jane Evans and Vanessa Pashley can be found in their report in the project archive; the discussion here is of how the lead isotope data illuminates the history of the metal. The analysis showed that effectively no environmental lead entered the corrosion products and so the observation that the ratios for the spearhead and the sword are valid and very close indeed, coupled with the very close similarity of the compositions we can argue the metal in the two weapons has a common history. The lead contents are higher than would be expected for just an impurity and must, as argued above, derive from alloying additions of lead modified by recycling. Evans and Pashley show that the lead is not Scottish but comes from south of the Iapetan suture, that is an area called Avalonia, comprising England, Wales and southern Ireland. The Ni/As/Sb/Ag impurity pattern is associated with a continental source for at least a substantial proportion of the copper (Northover 1983), imported to eastern Britain as bronze, alloyed with lead, and re-used, possibly several times, before arriving in Scotland. There is no evidence in this data of any direct import into Scotland.

The lead isotope analysis for the gold gave a result that was remarkably close to those for the lead in the bronze. The first thought was that this was the result of the gold having been alloyed, at least in part, with the same type of bronze as was used to cast the weapons. Further consideration showed that the tin and lead contents were too low to justify this conclusion. It was then that a broader companion of gold compositions led to the possibility that the gold was originally produced in the middle Bronze Age. We have already noted that the torc from The Minch is the only torc of its type from Scotland and, apart from ribbon torcs, middle Bronze Age gold objects are rather scarce in Scotland. It is therefore entirely plausible that this piece of gold was imported from the south and subsequently reused. The lead isotope ratios would allow a Welsh, southern Irish, or even Cornish origin: the last mentioned is perhaps least likely since middle Bronze Age gold objects are scarce there.

Construction, condition, and conclusions

The need to preserve the attached scabbard fragments and other organics limited examination of the sword. The construction of Ewart Park swords is very well known from the study of the weapons themselves, from their moulds (Bridgford 2011; Needham and Bridgford 2013) and experimental metallurgy (Faoláin and Northover 1999). Sword blades were cast in a pre-heated, bivalve ceramic mould made from a wooden pattern, the mould then being encased in a ceramic outer wrapper. The main variables are the blade cross-section and the arrangements made for the placement of the rivets and how they were made (see Needham and Bridgford 2013). After the mould has been dried and fired it has to be preheated before use to ensure the mould matrix is dry. This arrangement means that the cooling of the blade can be slow which causes lead and tin to be segregated towards the centre line, as noted in the discussion of the alloy above. The blade has been quite badly affected by corrosion and damage by the machine excavator during discovery with much of one cutting edge missing on one side and part of the shoulder on the other. However, analysis by Raphael Hermann suggest that some of the damage was the result of combat (Figure 6.39). Twelve marks could be identified on the cutting edge not impacted by the machine excavator. Only five of those marks, however, are primary combat marks, the other seven are most likely the result of secondary "rebound" impacts, where the blade made repeated contact with an opponent's weapon during essentially a single action. The wide-angled notch and indentations are indicative of clashing contacts with the cutting edge, socket and shaft of a spear. The grazes and round notch indicate clashing contacts with the cutting edges of other bladed weapons, but are too general to propose any further suggestions regarding their origin.

The spearhead was also cast in a bivalve ceramic mould but here with a long, slender, tapering core suspended via a dowel which also formed the peg-holes in the socket. The slenderness and the fragility of the core suggest that it must have been formed round some reinforcement (which may have been combustible. The CT scan revealed no evidence of any chaplets for centring the core at any point along its length although a fine wire or thin piece of sheet could have been used and, after fusing with the hot metal, leaving no trace. What is clear is that the core fractured, leaving a kink in the profile of the mid-rib, but the two parts did not move enough to touch the mould matrix and leave a more visible defect. Nonetheless, this would be a point of considerable point of weakness and hamper any use of the spear in combat, if this was ever intended. The CT scan also revealed the original grooved decoration of the socket and that the forming of the gold band round it had ridged the inner surface of the gold, the attachment of which was entirely mechanical. The gold need not have been part of the original ornament of the spearhead but was added when a piece of gold became available.

Based on the metallurgical and lead isotope studies we can say that all the bronze objects could have been, and probably, were made in Scotland, but from metal imported from further south, eastern England for the bronze and, perhaps the Irish Sea area for the gold. If any object was a direct import, it would be the sunflower pin. We can also say that the sword was a viable weapon that had probably seen some use in combat, but the weakness in the spearhead would have made it vulnerable in use.

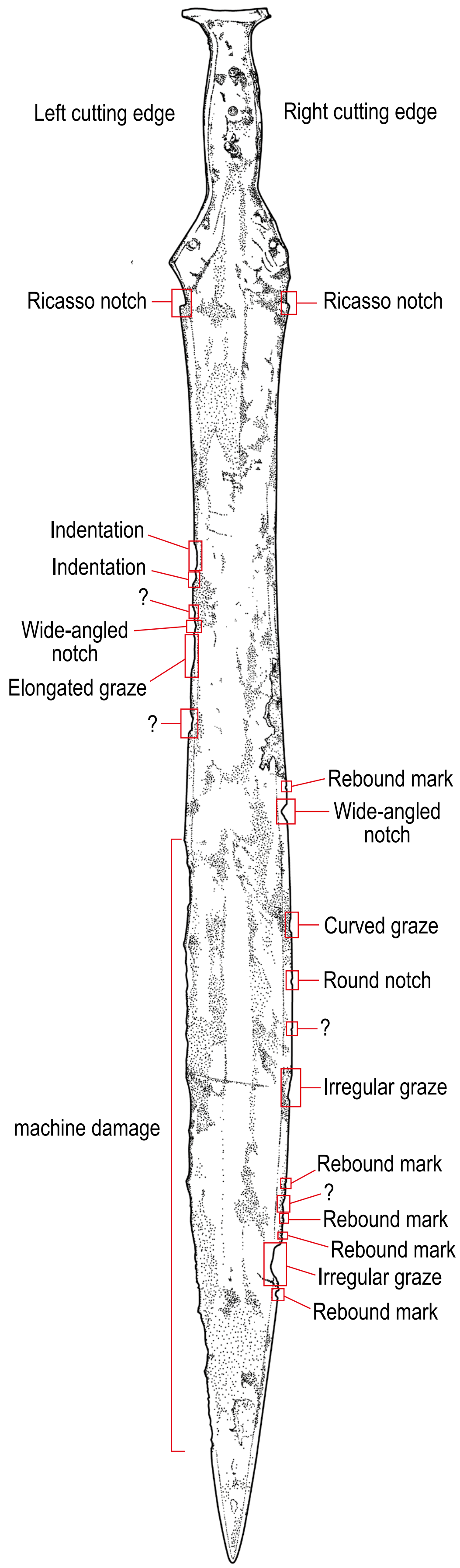


Figure 6.39: Carnoustie sword annotated use wear.

Discussion

By Alison Sheridan

This deposit of a set of weaponry plus a pin is of considerable significance, both nationally and internationally, for six principal reasons.

Firstly, it provides a very rare example of the survival of late Bronze Age organic items in Britain and Ireland - the wooden scabbard, the sheepskin wrap, the woven textiles and the mystery object. It is exceptionally rare for any remains of a scabbard to survive, and the presence of substantial parts of a scabbard at Carnoustie may well help to elucidate the nature and function of the annular mount. Regarding the textiles and sheepskin: before the discovery of the remarkably-preserved waterlogged early Bronze Age cist at Whitehorse Hill on Dartmoor (Jones 2016) and the late Bronze Age settlement at Must Farm, Cambridgeshire (http://www.mustfarm.com/progress/site-diary-6-textiles/), only a handful of textile and animal hide fragments were known from Britain and Ireland (Bender Jørgensen 1992, 18-20; Wincott Heckett 2012, 432-3; Hurcombe 2014).

Secondly, the gold-bound spearhead is one of only five surviving spearheads adorned with gold binding in Britain and Ireland (Figures 6.1 and 6.40; Coles 1971b; Davis 2015, 46 n. 1), the others being from Pyotdykes near Dundee (Coles et al. 1964), Harrogate, Yorkshire (Davis 2015, no. 486), Lough Gur, County Limerick, south-west Ireland (Coles et al. 1964, pl. XVIII) and 'Ireland' (ibid.; Waddell 1998, 239). There is also a record of 'spear-heads, probably of bronze, which it is said were ornamented on the sockets with gold' found at Macnaughton's Fort in Galloway during the early nineteenth century (Coles 1893, 112). Another gold-embellished spearhead, found in the River Thames near Taplow, Buckinghamshire, has gold studs rather than a band (Davis 2012, No. 701). While the shape of the known gold-bound spearheads varies, that of the Harrogate example is closest to the Carnoustie example.

Thirdly, the survival of a pommel is an exceedingly rare occurrence.

Fourthly, the fact that it has been possible to obtain a radiocarbon date is very important, since dates for Ewart Park phase metalwork in Scotland are sparse (ScARF 2012, table 2). That the Carnoustie date of 1118-924 BC is slightly earlier than the traditional 900 – 800 BC date bracket for Ewart Park metalwork demonstrates how this new information is a valuable addition, which extends the currency backwards in time.

Fifthly, the fact that this was a dryland find, in the vicinity of a late Bronze Age settlement, is very unusual indeed albeit increasingly occurring given the context of the Rosemarkie hoard (Buckley and Woodward forthcoming) and the Peeblesshire Hoard and this helps us in our attempt to understand why it was deposited. McNaughton's Fort near Dumfries also yielded a dryland find of possible gold-decorated bronze spearheads, together with arrowheads and worked flints found in the narrow fort ditch (Scott-Elliot, Simpson and Coles 1966, 73).

Finally, the fact that a very similar deposit was found at Pyotdykes, just 20 km to the west of Carnoustie, is remarkable. Along with numerous other finds of late Bronze Age metalwork in

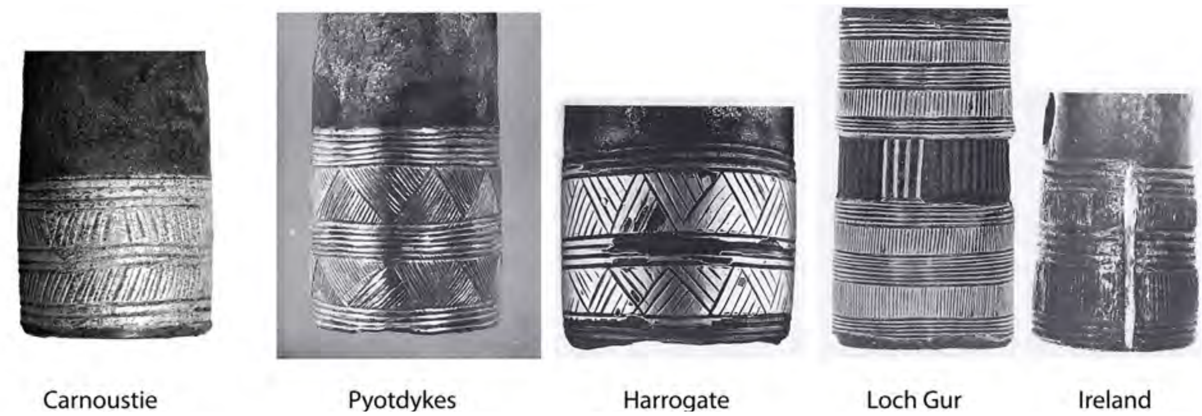


Figure 6.40: Decorated gold bindings on bronze spearheads.

Tayside and Fife, this attests to the wealth of the late Bronze Age elite in this part of Scotland. The Pyotdykes deposit comprised two swords (with traces of a composite wood and animal skin scabbard associated with one) and a gold-bound spearhead; a plug of woven nettle-fibre or flax fabric was found in the spearhead socket. The Pyotdykes weaponry of two swords, scabbard fragments and a gold decorated spearhead yielded a radiocarbon date of 900 – 790 BC (Sheridan 2025).

Before considering the parallels for, and the broader social context of, the Carnoustie deposit, it would be useful to consider the sequence of actions involved in depositing it and to address the question of whose possessions these would have been, and why they were buried.

Having decided to bury what may well have been his most precious possessions – and the word 'he' is used, since weaponry appears to be associated with men – the owner decided to carefully wrap the objects to protect them. It appears that the sword in its scabbard together with the annular mount was wrapped in a garment or a piece of cloth of woven wool, fastened with a fine pin – the kind of pin that could have fastened a cloak. After that, the blade of the spearhead was wrapped around with a piece of sheepskin and its socket protected by a piece of fine woven woollen cloth before it was buried in a shallow pit.

The fact that the items had been deposited with such care, and that the find spot is within a settlement of late Bronze Age date, suggests that they had been buried for safe-keeping. In other words, this does not look to be a metalworker's stash of waste bronze for recycling, nor does it resemble a votive deposit, many (but by no means all) of which are found in watery or wetland contexts. If this is indeed a burial for safekeeping, then this constitutes a rare and important example of this kind of behaviour - an example that is probably comparable with the Pyotdykes hoard, and possibly that at Macnaughton's Fort. The practice of depositing valuable metalwork is well known in Late Bronze Age Britain and Ireland and indeed further afield, and parallels for the individual object types – and for the combination of the types – are easy to cite.

Among the many comparanda for the Carnoustie sword, an example from Mey, Caithness (Colquhoun and Burgess 1988, 94, no. 512; NMS X.DL 50) offers a close match, differing only in having one fewer rivet holes in its hilt. While sword pommels are rare, good examples of cast copper alloy pommels are known from the hoards found at Grosvenor Crescent, Edinburgh and at Tarves, Aberdeenshire (Coles 1962, 53, 97-8, 118-9, figs 2.4, 6; Colquhoun and Burgess 1988); and at Tosson in Coquetdale, Northumberland, a pommel of tin-lead alloy was found (Colquhoun and Burgess 1988, 92 no. 98, pl. 175C, 6-7). Scottish finds of late Bronze Age chapes are listed by Coles (1962, 86), and to these can be added the tongue-shaped chape from the St. Andrews hoard (Cowie et al. 1991). As for the annular mount, comparanda are very rare but include one from the Grosvenor Crescent hoard from Edinburgh (Colquhoun and Burgess 1988, pl. 174, 9).

The rare comparanda for spearheads with gold foil have been mentioned above. Spearheads with decorated sockets are commoner, with numerous examples documented by Richard Davis in his review of late Bronze Age spearheads in Britain (2015, e.g. pl. 97, showing examples on Type 11 spearheads). The designs usually feature bands of horizontal lines, sometimes framing triangular or other designs. As for the distribution of Type 11A spearheads in general, this is widespread across Britain (ibid., pl. 154), and Davis lists 525 examples. And as for parallels for large late Bronze Age spearheads from Scotland, the following can be cited: Bracadale, Skye (blade only: ibid., 74 no. 288; NMS X.DG 114), Eyre Point, Raasay (lacking socket mouth and point: ibid., 75, no. 290; NMS X.DG 113), Loch Kinord, Aberdeenshire (ibid., 74 no. 285; University of Aberdeen Museums, Aberdeen, ABDUA:19672), near Banff (also lacking mouth and point: ibid., 74 no. 286; Banff Museum) and Wigtownshire (ibid., 75 no. 294; NMS X.DG 15).

The sunflower-headed swan's neck pin is an artefact type whose design elements have an international distribution (Coles 1961). In 1961 and 19602 John Coles listed eight examples in Scotland hoard (Coles 1961; 1962, 89), and to these can be added the five found in the large hoard at St Andrews, Fife (Cowie et al. 1991).

Comparanda for the textiles include fragments found in the hoards from St Andrews (Gabra-Sanders 1994) and Pyotdykes (Coles et al. 1964).

As for parallels for the overall assemblage of metalwork, these include (in various permutations) the hoards from Grosvenor Crescent in Edinburgh (Colquhoun and Burgess 1988, nos. 474, 488, 513, 530, 547 and 607A, pl. 174); from Tarves, Aberdeenshire (Coles 1962, 97-8, fig. 6); from Pyotdykes north of Dundee (Coles et al. 1964); and from St Andrews, Fife (Cowie et al. 1991). The Grosvenor Crescent hoard comprised seven swords (of which one had a bronze hilt and domed pommel, and one is lost), an annular mount, a ring, the head of a sunflower-headed swan's neck pin, and possibly a socketed axehead. The Tarves hoard comprised two swords (including one with a cast bronze pommel), a tongue-shaped chape and a sunflower-headed swan's neck pin. The Pyotdykes hoard, as noted above, comprised two swords (one in a scabbard) and a spearhead with gold binding and with a plug of woven textile in the socket. The far larger hoard at St Andrews contained (inter alia) large spearheads, a tongue-shaped chape and five sunflower-headed swan's neck pins. The combination of a single sword with a single spearhead seems to be matched only at Dalton-in-Furness in Cumbria (Colquhoun and Burgess 1988, 89-90 no. 462, pl. 173A; Davis 2015, 164 no. 1150). The association of one or more swords with one or more spearheads is relatively common, not just in Britain but further afield, especially along the Atlantic façade of Europe.

The fact that international parallels can be found for the objects, and the combination thereof discovered at Carnoustie reminds us that their owner belonged to an elite that was well-connected both in terms of material and culture. The term 'Atlantic Bronze Age' has been coined to describe the period, roughly between 1100 BC and 800 BC, when extensive, interlocking networks of contacts were operating up and down the Atlantic façade and across the North Sea as well. These allowed wealthy and powerful community leaders to interact and compete with each other internationally in various ways – by exchanging goods and gifts, by feasting, by participating in ostentatious votive deposits that showed off their wealth in bronze, and by fighting (see, for example, Needham and Bowman 2005 on the widespread distribution of flesh-hooks and other feasting gear). Fashions in weaponry and jewellery would be shared at an international scale, and clearly it was important for high-status men to show off their credentials as warriors – hence the frequent finds of weaponry. As noted above, Tayside and Fife appear to be rich in finds of late Bronze Age metalwork, as can be seen, for example, in the review of such finds from the River Tay (Cowie and Hall 2010), and the directionality of the links is well illustrated by the hoard, mostly of jewellery, found at Balmashanner in Angus (Coles 1962, 98-9). Here, connections with Scandinavia, Ireland, northern England, central Europe and Atlantic Europe are attested, and it appears that eastern Scotland was an important stopping-point on the two-way transfer of amber and metal between Ireland and Scandinavia.

Thus, the Carnoustie find has a lot to tell us about the socially stratified nature of late Bronze Age society, and about the sophisticated, cosmopolitan elite in this part of Scotland. The owner of the objects found at Carnoustie was undoubtedly a wealthy, important member of the community.

Post-depositional processes affecting the hoard[16]

By Jordan Barbour

Introduction

This investigation was conducted to provide an overview of some of the major post-depositional processes in evidence on the materials comprising the Carnoustie Bronze Age hoard, which includes several copper-alloy objects (a sword, spear head and sunflower headed pin), lead-alloy, gold, and several different types of organic materials (Figure 6.3). Macroscopic analysis of the artefacts in the hoard suggest that the copper-alloy objects have survived well through the formation of compact layers or patina of insoluble corrosion products, whilst the organic materials have survived an environment seemingly unfavourable to organic preservation through the creation of a biocidal microenvironment in the local environment around the copper-alloy. The results of this investigation indicate that copper-alloy has a strong potential to preserve organic material in environments ordinarily unconducive to their preservation.

The copper-alloy materials within the hoard are in very good condition, with the original surfaces of the objects well preserved. The preservation of organic materials is a rarity in the UK's typical dryland soil conditions, and the survival of a wooden scabbard around the sword puts the Carnoustie sword alongside only one other example of a surviving Bronze Age sword scabbard, that from Pyotdykes near Dundee (Coles 1964). Given the remarkable preservation, an analysis of the major post-depositional processes which have created the conditions for the hoard's survival has been undertaken.

The depositional environment and post-depositional processes

The soil from which the hoard was recovered is classed as a Brown Earth with a high proportion of sand (70-80%), slight acidity (pH 6-6.7), low organic matter, and free drainage of water (Walker 1982, 74; Laing 2016, 40-41; National Soil Map of Scotland), ensuing that an aerated or oxidising environment has prevailed.

The GUARD Archaeologists reported that the field from which the hoard was recovered had been deeply ploughed, and remarkably the artefacts lay at a depth of only c. 0.3 m from the field surface but remained untouched by farm machinery. The pit containing the hoard was well-defined and was not severely truncated (see above). After its deliberate burial, the shallow pit into which the hoard was placed was infilled relatively quickly (Spence 2017, 9). In very general terms, it can be said that any object which was buried quickly and removed from near-surface zones where bacteria and fungi are most active (Schiffer 1987, 147) has a better chance of preservation than those which are exposed and buried over longer periods (Cronyn 1990, 28). The depositional environment is exceedingly complex, and requires understanding of the post-depositional processes involved (Caple 2001, 588) in order to understand preservation or degradation potentials.

The artefacts uncovered by archaeologists are not typically in the same condition as when they were originally deposited. During their burial, most materials undergo a vast range of transformations through physical, chemical, and biological processes, which together act to exert profound changes on the artefacts from which they are comprised. This degeneration leads to

16 This is a much abbreviated version of the author's MLitt thesis presented to the University of Glasgow in 2018. A copy of the full thesis can be found in the Special Collections Department of the university library.

the loss of information which can be total when environmental conditions are unfavourable to their preservation. It is obvious that some durable materials such as stone, pottery and some types of metal survive better than others.

The Metals: corrosion

Copper alloy and lead alloy metals are prone to electrochemical corrosion in the UK and a moist environment is required for corrosion to proceed along with the presence of oxygen and/or hydrogen ions. Some metals exhibit no corrosion in natural environments and gold is the notable example of this, being one of the least reactive metals. Copper alloys, however, are susceptible to corrosion in most natural environments.

The copper-alloy artefacts *(Figures 6.5-6.10)*

Copper and copper-alloys are generally seen to preserve extraordinarily well in most soil environments. This is mostly due to the fact that copper and its alloys are among a group of metals which often form a so-called passivating layer of stable corrosion products. This layer, or 'patina', protects the metal from corrosion by blocking access to water and oxygen, two of the major elements involved in electrochemical corrosion.

The copper alloy artefacts of the Carnoustie hoard all show dark green, compact patinas, across the entirety of their surfaces, indicating a generalised pattern of corrosion. Apart from some flaking at the edges of the sword, this appears to have preserved the original surfaces of the copper-alloy artefacts very well.

However, the copper alloy pin had broken into five separate pieces some time before its excavation, as indicated by the corroded nature of the fracture surfaces. The breakage of the pin indicates that some kind of disturbance was evident in the depositional environment. It is suggested that tree root growth could have fractured the pin, which seems possible, since the locations of the fragments seems to indicate that the pin was broken by a pushing or dragging motion (Figure 6.27). However, there is a clear potential for heavy farm machinery to have exerted downwards pressure on the artefacts in the hoard, potentially causing the fracturing of the pin (Dain-Owens et al. 2013, 1175).

The gold band

The socket of the spearhead has an applied band of gold foil (Figure 6.23). Gold, being the noblest of metals, is not known to undergo corrosion in natural environments (Goffer 1980, 258). However, archaeological gold is seldom pure, and typically contains other elements which can themselves corrode (Cronyn 1990, 235-236).

It was noted during conservation that a whitish material was found adhering to the gold band within the grooves of the decoration. This was said to be a corrosion product, but the report does not state its specific composition (Spence 2017, 10-11), and appears to suggest that the gold, though relatively pure, contains lead. Lead is known to produce white corrosion products, which might explain the whitish accretions on the gold surface, though it is difficult to say exactly how lead corrodes from gold.

The lead-alloy pommel *(Figures 6.11 and 6.12)*

The pommel was in a highly degraded and friable condition. Tylecote (1983, 403) states that, in general, archaeological lead from most soil conditions appears to preserve very well. Given this, it is surprising that the lead-alloy pommel was so deeply corroded, reported as being very soft and almost clay-like in texture (Spence 2017, 13).

Decay of organic materials

In terms of organic artefact preservation, the soil constituting the hoard's depositional environment would not be expected to be particularly conducive to the survival of organic material. Wood (Hedges 1990, 111), textiles (Janaway 2002, 381) and skins (Cameron et al. 2008, 244) are in general expected to survive only in consistently dry environments (including very cold environments where liquid water is scarce), permanently waterlogged environments, or anoxic environments (i.e. those lacking in oxygen). The hoard's depositional environment appears to lack any of the criteria typically recorded at archaeological sites where extensive organic preservation is in evidence. It is generally recognised that microorganisms are the primary agents of organic decay within soils (Hopkins 1996, 73), and the seasonal wetting of a burial environment can be seen to produce 'flushes' of intense microorganism activity (Kibblewhite et al. 2015, 250).

The wooden sword scabbard

Wood is generally only expected to survive under very dry, waterlogged, or anoxic conditions. The environment prevailing around the hoard cannot be said to have had any of the environmental conditions typically associated with a heightened potential for the survival of wood.

Different types of wood are known to exhibit different levels of resistance to decay, and this also factors into the expected behaviour of wooden materials in the soil matrix. Hazel wood (and members of the birch family in general) are generally thought to have a relatively low natural resistance to fungal and bacterial decay (Schiffer 1990, 166).

Despite the clear potential for significant fungal and bacterial decay, the wood of the scabbard appears to show little sign of such attack. Reports commissioned from specialists in archaeological wood give no mention of any significant damage to the scabbard caused by microorganism activity, excepting a small amount of evident insect burrowing noted during the conservation treatment (Figure 6.16). The physical integrity of the scabbard has been maintained markedly better on the underside of the sword, though the most obvious reasons for this is probably the protection from downwards pressures, water percolation and abrasion by shifting soil, or perhaps disturbance by the excavation machinery. Given the clear potential for degradation of the wood through microorganism activity, it is clear that some factor has hindered the proliferation of fungi and bacteria in the burial environment.

The textile fragments

Fragments of at least two different textiles are preserved within the hoard. They were discovered in three locations including: adhering to the pin shaft near the head of the copper-alloy pin; underlying the copper-alloy mount; and adhering to the gold band of the copper-alloy spearhead (Spence 2017). The textiles were identified by specialists as wool: a protein-based animal (sheep) fibre composed primarily of keratin.

The survival of textiles in general in archaeological contexts is often said to be exceedingly rare. However, wool appears to be one of the fibres most resistant to decay in archaeological contexts (Goffer 1980, 250; Cybulska and Maik 2007, 187). The pH conditions of a burial environment are also known to affect fibre preservation potential, with animal fibres generally surviving better in acidic environments, such as that seen in the hoard's depositional environment (Wild 2003, 8).

The sheepskin *(Figures 6.25 and 6.29)*

Leathers and other skin products, primarily composed of collagen, tend to show superior preservation in acidic (<pH 5) and anaerobic conditions (Sanford 1975, 59), or in very dry environments (Cameron 2008, 251), which can also preserve skin products, though often in a very brittle form. However, the sheepskin, though very fragmented, appears to have maintained some of its integrity despite the unfavourable hydrological circumstances.

The survival of skin products is to a great extent dependent on the treatment of the product before deposition. In general, skins which have been tanned have a better preservation potential as the tanning process decreases the absorption of water (Cronyn 1990, 264-265). Whether the sheepskin has been tanned is currently unclear, though the blackening of the material may suggest the oxidation of tanning fats within the skin (ibid, 266).

Interaction between the metals and organic materials

Copper is well known to exhibit toxicity towards microorganisms (Borcow 2005, 2163) and is indeed frequently utilised as a bactericide and fungicide. The exact mechanism behind copper's biocidal properties is not completely understood, but multiple concurrent mechanisms are currently proposed by researchers. One of the most important of these mechanisms involves the production of compounds damaging to cellular material.

It was also noted that this enhanced preservative effect was limited to material in more or less direct contact with the copper, indicating that the free copper ions involved generally seem only to accumulate in great enough concentrations to induce a biocidal effect at, or very near, the metal surface (Evans and Limbrey 1974, 187; Janaway 2002, 397). Indeed, the textiles present in the hoard are preserved only in close association with copper alloy materials (the pin and annular mount), and the sheepskin is reported to have been wrapped quite tightly around the spearhead, thereby maximising diffusion of copper ions into the material (Spence 2017, 15). Similarly, given that the scabbard was designed to fit around the sword, has also clearly benefited from this close proximity.

In addition to the biocidal effects of free copper ions, the movement of copper into hygroscopic organic materials may improve their preservation potential through the process of mineralisation, whereby a positive replica of the material is formed by metal corrosion products within the material (Janaway 1983, 49). High mineral content is generally indicated by decreased flexibility and frequently staining (Hovmand and Jones 2001, 27), with staining in the presence of copper expected to be green. It is not entirely clear if significant mineralisation has occurred in the case of the sheepskin in the hoard, but it seems likely that at least some of the collagen has been replaced by metal ions, which could perhaps account for its preservation and its rather brittle condition, as indicated by its fragmentation.

The close proximity of the organic materials to corroding copper will have worked to preserve the textiles and sheepskin through 1) the creation of a microenvironment hostile to microorganisms which degrade organic materials, and 2) the partial replacement of organic materials with insoluble metal corrosion products which preserve the characteristics of the original organic material.

It is interesting to note the preservation of textile fragments in direct contact with the gold band on the shaft of the spearhead. These fragments appear whiter than the other textile fragments, and the portion of the sheepskin in contact with the gold band also appears to show whitening. Gold is not widely cited in archaeological literature as having biocidal properties, though recent studies are beginning to confirm the antimicrobial effects of gold nanoparticles (Lima 2013).

If the gold is leaded, then it is also perhaps possible that the white colouring of the skin and textile in close association with the gold band is caused by lead corrosion products which have diffused into the organic materials. Lead appears to have some antimicrobial properties towards some bacteria (Yasuyuki et al. 2010, 855) but the influence of lead as a biocide in the burial environment has not been widely observed in the archaeological literature.

Interaction between the lead-alloy pommel and the other materials in the hoard

It is possible that the close presence of organic material, particularly the wood of the sword scabbard, has hastened the corrosion of the lead. Wood and other cellulosic materials have long been known to acidify their local environment when undergoing decay (Krauskopf 1979). Lead shows significantly increased rates of corrosion, particularly in conjunction with formic acid; another organic acid released from wood (Niklasson et al. 2007, 624; Unger et al. 2001, 46). Thus, the deep corrosion seen in the lead-alloy pommel could perhaps be explained by its close proximity to the wooden scabbard, which presumably released organic acids into the aqueous environment during the process of decay. Alternatively, or perhaps in conjunction with the organic materials, it may also be possible that an electrochemical, galvanic reaction has occurred between the lead-alloy pommel and the copper-alloy of the sword hilt.

More contemporary studies on the corrosion of lead-tin solders used to connect modern copper pipes suggests that significant corrosion can, under some conditions, occur within a relatively short time-scale (Gregory 1990, 112), suggesting that the corrosion of the lead-alloy pommel through its close proximity to the copper-alloy sword is a distinct possibility.

Conclusions

It would appear that the preservation of organic material in the hoard was largely due to its close association with the several copper-alloy artefacts. The corrosion of the copper objects allowed for the creation of microenvironments close to their metal surfaces which were hostile to soil microorganisms. Being one of the major causes of organic decay, the elimination of this factor allowed for the partial preservation of this diverse array of organic materials. Despite this, the aeration and hydrological conditions in the depositional environment allowed for various forms of chemical decay to continue, as evidenced by the blackening and fragmenting of the wooden scabbard and sheepskin. The ordinarily unfavourable conditions for the preservation of organic material is also illustrated by the fact that they do not appear to have survived in areas which were not in close association with the copper-alloy material, as suggested by the survival of only portions of what was larger textiles adhering to the copper-alloy objects.

The copper-alloy in the hoard appears to have undergone a corrosion process which allowed for the formation of a compact patina; preserving the form of the original artefacts. The ubiquitous presence of CO^2 in the atmosphere, and the hydrological conditions bringing that CO^2 into contact with the copper-alloy, created a green patina probably composed primarily of insoluble malachite. In particular, a presumed low quantity of chlorides within the soil probably hindered the development of a more disfiguring corrosion front.

In addition to these factors, it was also apparent there was some element of luck. The hoard, its uppermost parts lying at just 0.3 m below the modern ground surface, remained untouched by the plough during the three millennia since it was buried, despite the fact that the field was heavily ploughed to depths of up to 0.4 m in places.

Archaeological Implications

The Carnoustie hoard is one of several Bronze Age weapon hoards which have in association copper alloy pins. Other examples from Scotland and Northern England (Figure 6.1) include those from Grosvenor Crescent, Edinburgh; Tarves, Aberdeenshire and Point of Sleat (Burgess and Colquhoun 1988, 91, 92 and 100). However, the Carnoustie hoard is the first to have surviving evidence of textiles which had been used to wrap the objects, with the pin used to fasten the textile wrapping. The presence of a pin strongly suggests that some kind of wrapping material was present at the deposition of a hoard, but the survival of the organic material in the Carnoustie hoard, provides solid evidence for this.

The wrapping of swords prior to burial appears to have been a relatively common phenomenon in later Iron Age cultures across Europe (Gleba 2012, 142). One could posit that this perhaps indicates reverence for weaponry in a culture commonly thought of as martial, though a more prosaic reason could be that Bronze Age people were simply well aware of the potentially destructive effects that corrosion could have on metallic objects. In this case, wrapping the bronze objects may simply have been a way to protect them from the elements as best they could. If, as is suggested above (see *The late Bronze Age metal hoard*), the hoard was deposited with the intention for eventual retrieval, it would certainly make sense that the depositor(s) would wish to ensure the survival of their buried possessions.

The survival of the textiles also provides yet another opportunity to reiterate the importance of thorough examination of archaeological copper alloy objects, which have a strong potential to preserve textiles, both protein-based and cellulosic (Janaway 1983, 48; Coles 1968, 197), even in environments which might initially be dismissed by excavators as totally unconducive to their preservation. The evidence preserved in such cases is frequently in the form of small, very delicate fragments adhering to the metal surface (as is the case here), or in the form of pseudomorphic fibre impressions preserved within corrosion products (Janaway 1983, 48-9). In either case, much degraded evidence can provide a certain amount of information to a skilled textile specialist.

Perhaps one of the most intriguing objects within the hoard is the lead-alloy pommel. The pommels of Bronze Age swords are quite a rare find, and most of the swords uncovered have been without pommels. Notable examples of Bronze

Age swords from Scotland/Northern England discovered with attached pommels present are those from Tarves (Burgess and Colquhoun 1988, 92 and plate 172B), Tosson (ibid, 92 and plate 175C), and Grosvenor Crescent Edinburgh (ibid, 91 and plate 174). Surviving pommels are typically of copper-alloy, with the swords from Tosson in Northumberland, the only swords with pommels of lead-alloy. Further afield in eastern England, another Bronze Age sword with probable lead pommel has been recorded (Coombs 1992, 509 and Fig. 3).

Given the relative rarity of surviving pommels, and working under the assumption that the vast majority of swords had pommels, some have proposed that metallic pommels were rare. Rather, most pommels may have been fashioned from more perishable materials, such as wood (Whittaker 2010, 66). Indeed, replicas of Bronze Age swords typically feature wooden pommels. Despite their rarity, metallic pommels are the only type of Bronze Age sword pommel we have direct evidence of.

The lead pommel of the Carnoustie sword had evidently undergone significant and deep corrosion, which had seriously damaged the integrity of the artefact. This is possibly due to a galvanic reaction occurring with the bronze. Given the potential for the galvanic corrosion of any lead-alloy pommel, perhaps in conjunction with corrosion by organic acids released from any wood present (e.g. from the scabbard), it could be suggested that lead-alloy pommels may have been more common than the surviving evidence indicates: the archaeological record having been biased away from them through a low preservation potential when in association with copper alloys.

It must also be noted that very many of the Bronze Age swords currently recorded were discovered in the nineteenth or early twentieth century, prior to a widespread recognition of severely degraded archaeological remains. Simply put, antiquarians and archaeologists, where evidence of a lead-alloy pommel still survived, may simply have failed to recover the seriously degraded material, either through oversight or through wont of a framework which could recognise the value of such remains. Pommels of lead-alloy may perhaps have been more common than we currently have evidence for.

Part 7: General discussion

Beverley Ballin Smith

The changing landscape and environment

From the middle of the seventh millennium BC (c. 6450 BC) to near the beginning of the fifth millennium (c. 4080 BC), people of the late Mesolithic left limited evidence of their visits in the excavated area at Carnoustie as they moved through the landscape. They left behind burnt fuel from alder and hazel wood in their fire-pits, possibly from dry branches gleaned from the surrounding woodland or forest, and also remnants of hazel nuts, that most ubiquitous of gathered plant foodstuffs (Tipping 2003, 24). The gently sloping surface of the post-glacial raised beach supported other tree species such as mature oaks and probably birch, in addition to alder and hazel. As alder grows in wet or damp conditions, its presence in the archaeological record suggests that damp places also existed in the woodland. Its main use could have been for tent poles or as supports for windbreaks. The reliance on hazel shrubs as a resource indicates they were easily accessible for foragers. Hazel shrubs are attracted to light conditions and they tend to grow along woodland or forest margins, in forest clearances, or as copses (Godwin 1975, 269), suggesting that the woodland cover during the late Mesolithic was not total.

In the early Neolithic, from as early 4000 BC to c. 3500 BC, major events affected the natural vegetation of the raised beach. These included the initial land-taking or *landnam*[1], whereby the clearance of woodland took place in preparation for opening up the immediate landscape. This was for habitation and crop growing by pioneers taking control of an area of land and thereby asserting 'ownership' of it. Although we have no direct evidence to suggest this, parts of the raised beach woodland may have already been opened up by grazing native animals such as deer, wild cattle, later domestic cattle, and through storm damage. With fertile soil and an elevated view to the sea, these assets perhaps made the site an attractive one for settlement.

The building of the longest timber hall presently known in Scotland was another major event. The construction of a large wooden structure required substantial timber resources as well as space for the actual building. It necessitated the cutting down of mature oak trees from the local environment for its main posts and supports, additional structural timbers from alder and birch trees and hazel shrubs, as well as roofing materials of oak shakes[2], turf or thatch. Also needed was the labour and skills to cut down the trees and undertake the carpentry work and to produce and maintain the necessary flint and stone tools for the work. The preparation for construction suggests that people were already familiar with the area or living in it, but their very existence undoubtedly altered their natural surroundings. As well as the construction of one large timber hall, a second one was built at roughly the same time and, although smaller, it too commanded considerable timber and roofing resources.

Only scant evidence has survived to confirm the use of hazel wattle with clay daub as infilling between the oak posts of the timber hall walls. Some hazel charcoal came from the fills of postholes forming the structure's walls, and tiny fragments of fired clay hint at the use of wattle hurdles in Structure 8 and also Structure 13. Throughout the early Neolithic there were continuous demands on the local environment, for building maintenance, fuel and food, and it is likely that the raised beach woodland cover was thinned out and pushed further and further back.

1 A term applied in 1941 by the Danish palaeoecologist Johannes Iversen for clearance of the natural forest or wildwood (Godwin 1975, 465 and bibliography).

2 A shake is traditionally a hand-split tapered, wedge-shape piece from a log, similar to a shingle.

Over the course of the early Neolithic the long timber halls were replaced by smaller structures, and part of the footprint of the Structure 8 hall was used for a smaller building, and part of the footprint of Structure 13 was also partly used for a later building. These alterations may have necessitated some reuse of oak timbers as well as the felling of trees for new ones, but the impact this had on the landscape may have been limited compared to the original construction of the larger buildings.

Throughout the early Neolithic it is quite possible that crops were grown in plots on the raised beach given the fertility of the land and its soils. The occurrence of grains of naked barley, emmer and bread wheat from features in both halls suggest that plots for growing cereals were probably located nearby but not necessarily within the excavated area. The presence of these three cereals also mirrors that found at the timber halls of Balbridie and Claish (Figure 7.1), but as stated in PART 4 *(Archaeobotany*), the occurrence of bread wheat in a Scottish prehistoric context is rare, and suggests that its consumption was uncommon.

Cultivated plots or small fields by their definition equate to open spaces and indicate a lack of trees, but it cannot be assumed that the raised beach was devoid of trees altogether. The archaeobotanical analysis found the remains of hazel nuts and rare apple pips in the Structure 8 and Structure 8s timber halls. The incidence of apple pips in prehistoric Scotland is rare, but their association with other early Neolithic timber halls such as Claish and Balbridie, has already been remarked upon (PART 4: *Archaeobotany*), implying the likely high status of the buildings and therefore their owners or users. The continued occurrence of hazel nuts in the fills of pits and postholes also infers that hazel bushes survived in the locale, perhaps even increasing in their distribution through regeneration or deliberate management and encouragement by coppicing.

Hazel is one of those useful shrubs/trees. Its bark and bast fibres could be used for basketry, its wands were used for hurdle fencing, thatching spars and tool handles, and the oil in its nuts could have been used on finer woodwork such as tool handles (Mabey 1979). At a later date, even the scabbard from the Bronze Age Hoard was made from hazel wood (see Part 6: *The late Bronze Age metal hoard*).

There are few weed seeds, if any, to confirm grazing or waste ground in the vicinity of the buildings, and there is little surviving evidence at this time of soil erosion or buried soils under colluvium moving down the raised beach from the north. Equally, because of subsequent and later activities there is no firm evidence for the manuring of the outland during the early Neolithic or its use for crop growing. Radiocarbon dates and the quantities of Carinated Bowl pottery found in the north-west of the excavated area ('Structure' 7), suggest this may have been a midden in the early Neolithic, with hearth waste from the burning of oak, birch and hazel wood, and the discarded shells of roasted hazel nuts dumped there.

The pit groups in the eastern part and along the southern edge of the site add little to the evidence of land-use and environmental changes in the early Neolithic. The charcoal assemblages found in the fills of their pits contained mainly oak and alder charcoal with a small amount of cereal and the ever-present hazel nutshell, sometimes found in large quantities (Figure 4.2), confirming that these woodland species were present nearby and that hazel was successfully growing in the area.

Towards the end of the early Neolithic, in c. 3500 BC, and into the middle and late Neolithic, changes are noted on the site. The evidence suggests that there are fewer people inhabiting the area, with structural data confined to a small part of the Structure 8 long hall and to the oval building built across part of the Structure 13 hall. The same tree species as earlier were utilised in their construction and for fuel, but changes in building shape and size may reflect a diminished resource of mature oak trees for timber. The large numbers of hazel nutshells found in the hearths and pits of the pit groups in the south-east corner of the area and along its southern border, suggests that hazel as a species was still prolific and continued to be an important food resource. The presence of naked barley and emmer wheat indicates that plots or fields were still cultivated and the food economy of the later Neolithic,

Figure 7.1: Map of sites metioned in this section.

like the early Neolithic, was dependent on both agriculture and foraging. The sparse remains of domesticated animal bones (see PART 4) indicate that cattle were kept during the Neolithic but the evidence is so slight that analysis of the role they played in the economy of the site and their effect on the vegetation cover cannot be discussed further in any meaningful way.

From the beginning of the early Bronze Age c. 2250 BC and throughout the period to about the tenth century BC, changes are seen in the archaeological record that affected the natural local environment. A small number of round to oval buildings were constructed over this long period of time that used predominantly alder, birch and hazel in their construction. Although oak was present in some of these buildings it might have been as firewood rather than as structural timber. What is strikingly different in the archaeological record is the use of wood from tree types less commonly used in the early Neolithic structures, such as willow, cherry types and elm. These species seem to form a clear group whose occurrence is repeated throughout this period. It is also suggested that this group of species, when found in features associated with the footprints of earlier buildings, could be evidence of intrusive later activities.

The reduction of oak in the archaeological record, seen from the later Neolithic but most noticeable in the Bronze Age, suggests that oak had been overexploited and had not regenerated, and therefore had been largely lost from the area. Faster growing alder, willow, birch and hazel may have taken advantage of the more open landscape and grown opportunistically, indicating that woodland was more mixed but also shrubby in appearance, and perhaps limited in extent to field margins and less agriculturally productive areas. The occurrence of elm is interesting, as there are only two examples of it - from Pit Group 10 and Structure 5. In spite of early Neolithic radiocarbon dates from some of the pits in Pit Group 10, the archaeobotanical remains from other features with their mixed woodland species, together with hazel, hazel nutshell, willow and cereals, remain undated, but most likely indicate Bronze Age activities.

Heather-type species were relatively common in most of the Bronze Age structures and seemed to have played an increasingly important role. This suggests, along with the presence of willow and the decrease in oak, that there had been marked changes in the local environment, and that increasing damp conditions had played a part. People living on the raised beach at this time may have had to travel further for resources such as turf and heather to be used for roofing as well as fuel and bedding. The large timbers of oak used in the early Neolithic had been replaced in these later buildings by shorter-lived species of alder and birch, with hazel and occasionally cherry-types. The increase in heather-type species suggests the decline in fertility and management of the soils in the vicinity and perhaps their abandonment for agriculture later on in the Bronze Age.

Cereal grains, notably barley, were found in about half the Bronze Age buildings but the highest number was associated with a pit in Pit Group 12, along with weed seeds. The evidence suggests that part of a crop of mainly barley had been harvested, along with weeds growing in the field, and was being processed or stored (see PART 4: *Archaeobotany*). The unsorted crop probably did not travel far, implying that a field or fields of barley were being grown in the near vicinity, and thereby reinforcing the implication that probably most of the raised beach area was open at this time and some of it in active agricultural use - most likely in the early Bronze Age.

The evidence from the late Bronze Age hoard (see PART 6) also concerns the environment, but whether that evidence is entirely local is uncertain. The hoard was wrapped in a sheepskin from a wild sheep, and wool associated with the metalwork was from a wool producing sheep. Whether they were wild or domestic sheep, , this evidence is important and implies that sheep were part of the agricultural economy. The spearhead socket had charcoal and carbonised cereal grains within it, one of which was barley, but other material was intrusive and of more recent origin. The grain and the charcoal are considered to have come from the activities of people contemporary with the hoard and in close proximity to its place of deposition. One other piece of evidence, demonstrating that hazel shrubs were still a component part of the landscape, was the wooden scabbard that was made from this species. The scientific analysis of the hoard has in a small way elaborated some of the missing elements from the domestic occupation of the site, if we accept that they were locally procured.

There is a significant gap in information on the local environment from the late Bronze Age to about the late-seventh to the mid-twelfth century AD. Of the most recent structures and features identified, only Structure 4 and the adjacent Pit Group 18 presented evidence about vegetation changes in the area. These included the dominance of heathery turf for roofing, bedding or for fuel, and the crops grown included oats and flax. Heather type species prefer acid soils and oats prefer cool damp conditions and often marginal or poorer soils, suggesting that the local environment had been affected by prolonged wet periods and cooler temperatures during this period.

Two events may reflect an open landscape after the Neolithic, and although undated, could have occurred during the Bronze Age, but most probably later. The contours are relatively gentle over the raised beach, but micromorphological analysis, of the main contexts or layers overlying the features of 'Structure 10' and also those of Structure 1 provided evidence of waterlogging in these two areas (see PART 4). This could be partly due to the natural bands of clay, and sandy clay, found respectively in the subsoil beneath these two structures, but also to periods of increased rainfall and runoff. The waterlogging in 'Structure 10', at the lowest part of the site, was followed by an accumulation of colluvium deposits. Any exposed topsoil in the northern part of the raised beach may have experienced erosion and soil creep in wet conditions, but this could also have been the result of ploughing down the contours rather than across them, which may have exacerbated soil movement. Additional micromorphological analysis over 'Structure' 7 identified degraded old woody fragments, charcoal, degraded bone and modern roots, suggesting the remains of a hedgerow or shrubs, plus the dumping of domestic debris, but again of unknown date.

The dampness of the local environment in medieval and post-medieval times is illustrated by the place names surrounding 'Cornisty' (Carnoustie) on General Roy's Military Survey of Scotland, 1747-55. They include Bogloch, Mosstown, Boghall and Ever(?) Mosstown. The map (Figure 7.2) also shows a landscape almost devoid of trees, as it is today, but with a few farming settlements surrounded by a row of trees or hedges, and the dominance of rig and furrow cultivation. A far cry from the wild wood the first settlers at Carnoustie encountered.

Figure 7.2: The Roy map extract of the Carnoustie area (the site highlighted in red) in the Military Survey of Scotland. © British Library Board. All Rights Reserved.

Taphonomic effects

Waterlogging, soil creep and the accumulation of colluvium will to a certain extent have affected the preservation of the archaeological record, as some features will have been denuded of their upper layers (and therefore of their environmental and material culture), and others will have been buried under deeper topsoil (also perhaps causing the mixing of finds). However, other factors have affected the surviving remains of structures from all periods. Movement of soil downhill did not stop at the south-western and south-eastern edges of the site but proceeded beyond them, as did some of the prehistoric structures and activities. It is expected that artefactual remains and structures disappeared with landscaping activities associated with the construction of David Moyes Road and the western extension of Shanwell Road (Figure 1.1). However, even before these recent events it is highly likely that the agricultural activities of the past had a significant effect on the survival of archaeological remains.

Comparing the depth of pits and postholes of Structures 8 and 13, the long timber halls, with those from Balfarg (Barclay and Russell-White 1993), Claish (Barclay et al, 2002), Locherbie (Kirby 2011) and Warren Field (Murray and Murray 2004) shows noticeable differences in preservation and taphonomic processes. Although this observation is very generalised, and with the realisation that not all of these sites had equally deep postholes around the footprint of their buildings, the postholes from Structures 8, 8s and 13 were very shallow in comparison. Most of the other sites had postholes averaging c. 0.4 m to 0.6 m in depth, while those forming the long walls of Structure 8 were only between 0.17 to 0.2 m deep, with the occasional deeper posthole (0.36 m) at its north-east gable. The significant reduction in the depth of the Carnoustie structures' features from half to one third of those from the other sites implies that there was a corresponding loss of information, material culture and environmental evidence.

This loss of evidence is most noticeable across the activities of the southern half of the excavated area. It cannot be entirely attributed to soil creep and water/soil run off or indeed modern ploughing and drainage, although all three will have had an impact. The most likely activity to have taken place that has affected the overall survival of structures is that of Medieval/ post-Medieval rig and furrow agriculture that was apparent across the site (Figure 7.3). The rigs survived c. 100 m in length but were undoubtedly longer; they were c. 12 m wide and predominantly straight with narrow to wide furrows; and there were no apparent boundaries or banks to them within the excavated area. Although some areas of rig and furrow in the north-east of Scotland are described by Halliday (2001, 18) to have survived post-Improvements in agriculture, i.e. from the first half of the eighteenth century, Dixon (1994, 38) suggests that rig and furrow in Scotland originates from the medieval period. It is therefore quite possible that the Carnoustie rigs were not just one maintained system, as their deviations indicate movement and change over time.

The rigs were initially created by digging out the furrows (drainage channels) and heaping the soil on top of the area to be cultivated. The process of heaping up the sods towards the centre of the rig (or ridge) would have continued with the traditional fixed mould-board plough (Dixon 1994, 37). Needless to say, on the Carnoustie soils, the creation of this agricultural system would have greatly disturbed the prehistoric remains below by removing the remains of the upper parts of features. Another factor that is relevant to the taphonomic conditions on the site is the orientation of the rig and furrow. Whereas today's modern ploughing is normally achieved by running along the contours of a field, the rigs and furrows were placed at an angle of 90° to them. The positive effects of this were the draining of water off the rigs to flow downslope down the furrows. However, the negative effects on the prehistoric archaeological features beneath were that erosion of the tops of exposed postholes and pits would have taken place, and their contents would have moved downhill and slowly disappear from the site. After several centuries of this system of agriculture, it was replaced by more modern methods including deeper ploughing and the laying of drains. Together, these activities account for the very shallow survival of most of the prehistoric features on the site and the almost total disappearance of old ground surfaces.

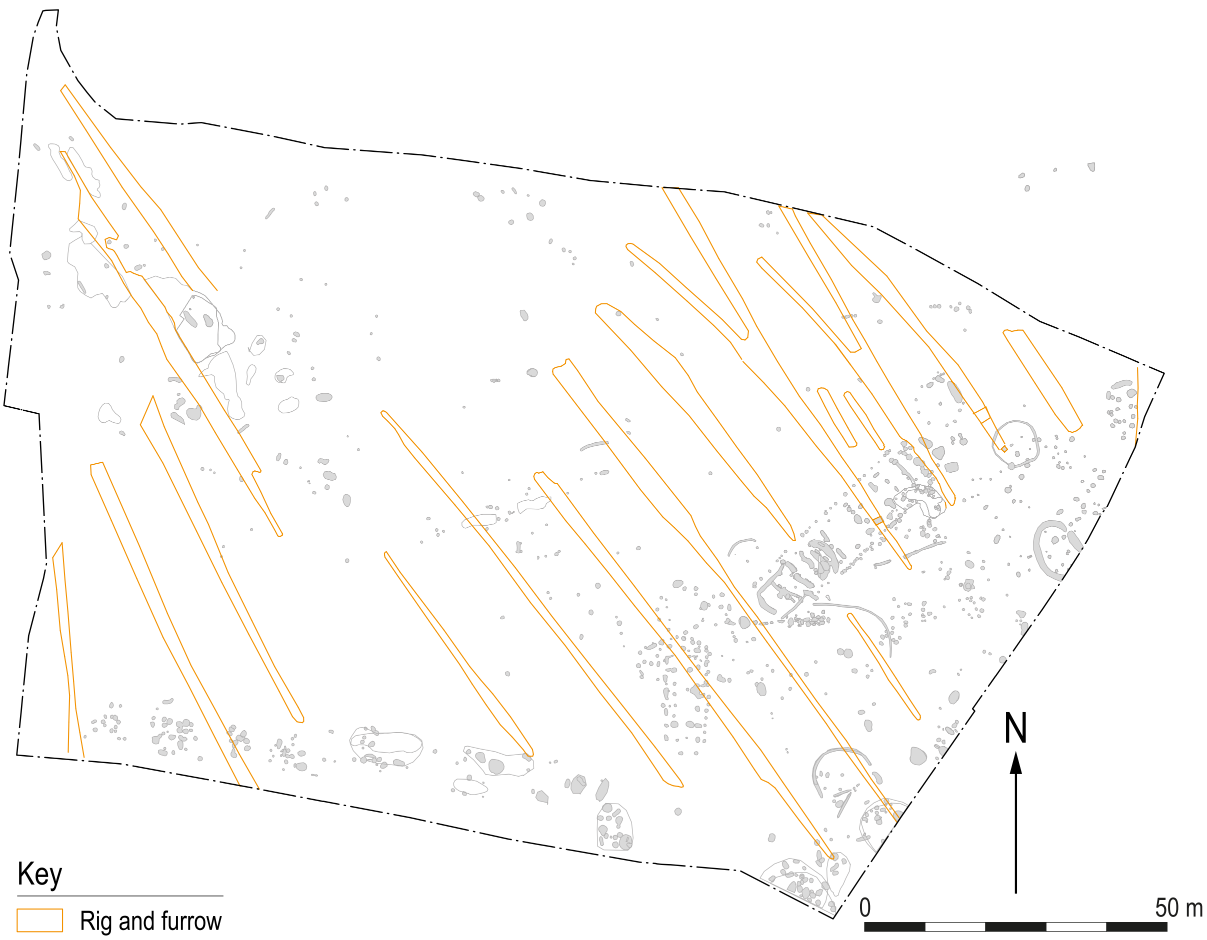


Figure 7.3: Distribution of rig and furrow across the excavated area.

The early Neolithic

Around the beginning of the fourth millennium BC, an oak structure, a timber hall, completely alien to the landscape was erected in a clearing within the remains of natural woodland. It was fully formed, architecturally sophisticated, large, complex, and required skills of design, planning, execution and carpentry. Where had the idea for the structure come from? Was this a dwelling or a building designed for a special purpose, and why here? This section attempts to address these questions.

Although the large timber hall was the first building erected on the site, it was not the first activity noted there. The background scatter of knapping debris which became included in the backfilling material of structural pits and postholes is likely to have been the result of previous domestic camps on the site. This residual debris may therefore provide an answer to the question of 'why here?', as people had used the site previously, and it could already have been a popular focal point for gatherings.

The timber building was not alone on the raised beach landscape as one other seemingly contemporary building was erected. While the emphasis of this section's discussion is on the early Neolithic timber buildings there is evidence of other more temporary activities which largely focussed around fire-pits. These activities took place south-east and south-west of these buildings after their demise.

The timber buildings

Given the long history of erosion and truncation across the excavated area, as discussed above, it is remarkable that the remains of two long timber halls and two smaller buildings that were intimately associated with them survived. Structure 8 is the largest building within the excavated area and the longest timber hall in Scotland to date. It is also one of a slowly growing number of such buildings that have been recognised and investigated over the last thirty years. Much has been written about these large timber structures from the early Neolithic, Barclay in particular, often with others (for example 1993, 1998, 2002, 2003a and b, and 2004), and also Sheridan (2013), where they are described as *halls* (the former), or *houses* (the latter), but to others they are *cult houses* (Brophy 2007) - nouns that are loaded with meaning.

The origins of the large timber buildings

It is clear from research (Barclay 2002 and Sheridan 2013 and others) that the origins of these buildings lay in continental Europe, across the English Channel in northern France and those southern parts of the loess plains of the Low Countries bordering the North Sea. Currently, it is only in Denmark that the development of wooden houses from their origins as small oval houses in the early Neolithic to long rectangular houses in the late Neolithic is clearly demonstrated (Nielsen 1997). There the use of a central single load-bearing post or a line of posts running through the centre of a building was consistent throughout the progression to larger, longer buildings. This specific progression is not identified in Scotland.

Large rectangular buildings constructed of oak posts were commonplace on the north European plains, being part of the evidence of the colonisation of land for food production by the first farmers. The bringing together of recent archaeological evidence from wetland and settlement sites led to the publication of a two-volume work on the prehistory of the Netherlands (Louwe Kooijmans et al. 2005), which also addresses the Neolithisation processes of people and the landscape. Chapters in the first volume provide some similarities with the Structure 8 building at Carnoustie, and perhaps hint at its origins, although 500 years or so earlier. With the better preservation of organic materials in the Dutch examples, it is possible to extrapolate the gaps in our knowledge in Scotland.

The early Neolithic in the Netherlands is dated from c. 4900 – 4200 BC and is characterised by the LBK (Linearbandkeramik) settlement sites of clusters of long rectangular buildings, often positioned on the edges of plateaus. The structures were between 8 m and 35 m long and between 5 m and 8 m in width, and comprised usually five partitions of three rows of large oak posts within the walls of the buildings. The walls were formed of posts or planks set into bedding trenches, with infills of wattle and daub panels, the gable ends of the buildings were usually straight, and the roofs were most likely straw covered, such as the houses in the settlement at Geleen-Janskamperveld (de Grooth and van de Velde 2005, 221-223, 226-228; Figure 7.1). Buildings were most often orientated NW/SE with an entrance in the SE, but the arrangements of the internal partitions varied. Evidence from a contemporary well at Küchoven, indicated that woodwork even at this early date was sophisticated enough to include tongue and groove joins.

These examples from the Netherlands also demonstrate the existing exchange networks operating in the fifth millennium BC. The stones for adzes for wood working came from outcrops in Central Europe, the Eifel region and Belgium. Cultural links were also noted with the French Mediterranean areas, Normandy, the Moselle, Rhine and Meuse areas (de Grooth and van de Velde 2005, 234-235). Obviously, major rivers, their deltas, and presumably the north European coastline were important transport routes, and Sheridan and Pailler (2011) argue for a series of incursions to west and east coast Britain and Ireland by boat from northern and western France because of the links with Carinated Bowl pottery. However, it must have been equally possible for boats from the southern Low Countries to cross the North Sea from the beginning of the fourth millennium BC and sail up the east coast of Britain bringing not just a suite of cultural novelties as described by Sheridan (2013, 285) but also people, domestic animals, ideas, information and skills in house-building.

It is clear from the comparison of the Scottish early Neolithic long halls, including those from Carnoustie that there are similarities with earlier continental examples, and that there are also similarities and differences between the Scottish examples. Barclay et al. (2002, 109, 111) compared plans of Claish with Littleour, and Claish with the two Balfarg structures, both of which showed similarities in layout, but also developmental changes (Figure 7.4). No two buildings were precisely the same. Although plans and designs of buildings are recognisably

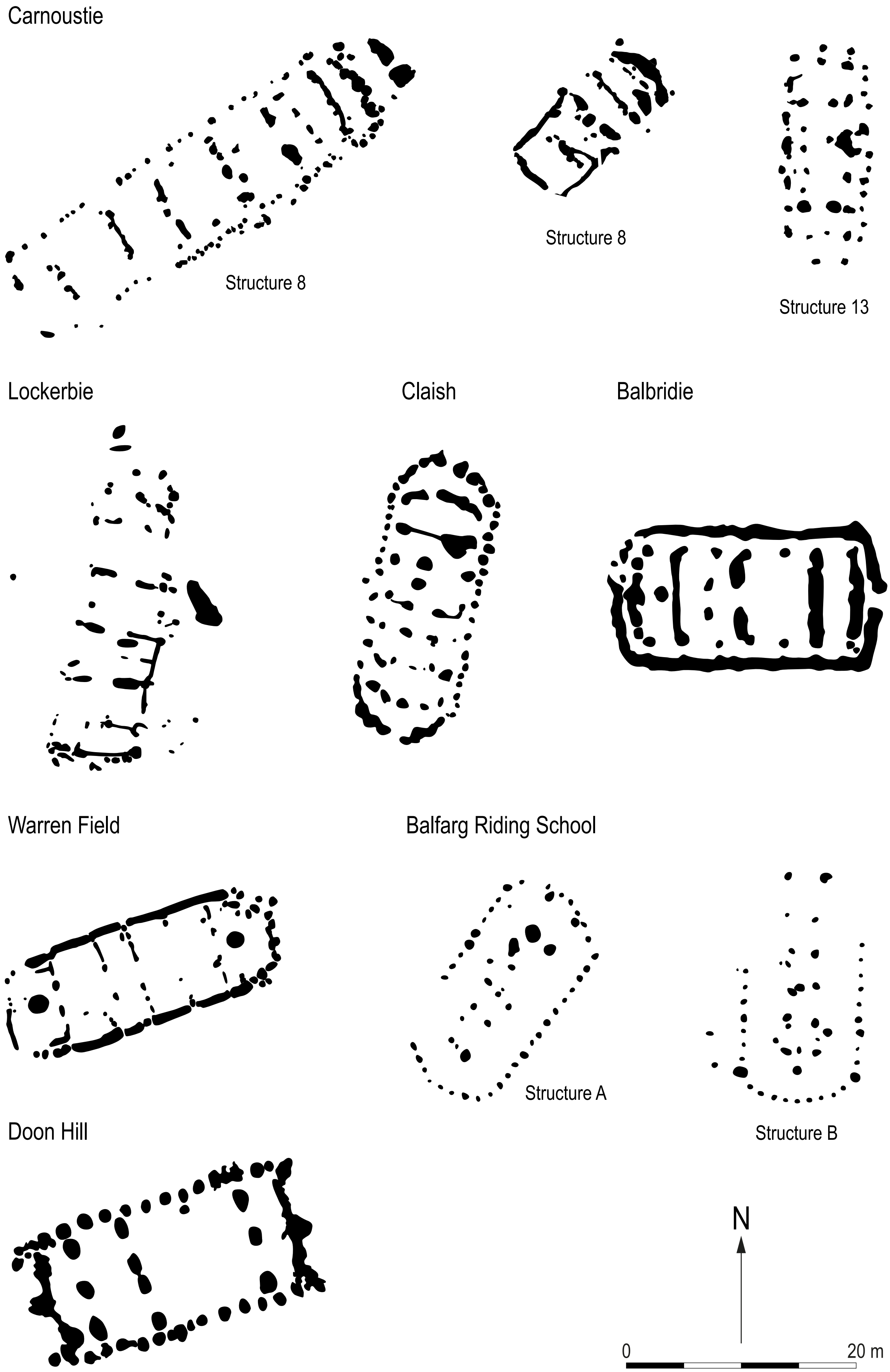


Figure 7.4: Comparison of Scottish timber halls.

similar, they show divergence, and a response to a variety of factors and conditions requiring local adaptations such as their location, orientation, the available woodland and other resources, individual or communal requirements, constructional capabilities and skills, intended use, etc. The construction of the long timber hall at Carnoustie, Structure 8, also embodied intangible aspects of belief and ritual (see below) that were also transferred to the small Structure 8s timber building constructed later within it.

Radiocarbon dates from the Structure 8 timber hall

The radiocarbon dates from the Carnoustie timber halls were not from their oak structural timbers, but from associated charcoal from shorter lived tree species found in the same postholes or pits. The earliest date for the Structure 8 timber hall was from the middle of the 40th century cal BC (3960 cal BC) to the end of the 38th century cal BC (3703 cal BC), to as late as the middle of the 37th century cal BC (3636 cal BC) (Table 2.2a). This latter date is probably due to replacement of timbers and alterations. In her study of Neolithic houses of Britain and Ireland, Sheridan suggests that the construction of these large building took place between the 41st/40th to the 38th centuries BC (2013, 290). During those dates not only was the Structure 8 hall and that of Structure 13 (see below) built at Carnoustie, but also those further afield at Warren Field, Balbridie and Lockerbie.

Structure 8 – large timber hall, layout and construction

In her discussion of Neolithic houses, Sheridan notes that the Warren Field timber hall at Crathes in Aberdeenshire was initiated by the erection of two large posts at either end of its long axis (2013, 287-289). These massive pits were c. 1 m deep and contained axial posts c. 0.4 m to 0.5 m in diameter (Murray et al. 2009, 39-40), and were considered symbolic rather than structural by the excavators. Other large halls, such as Claish and Balbridie might also have had these axial posts (Figure 7.4).

Given that nothing of this size had been noticed in the Carnoustie hall, the plans and data were revisited. Running through the hall from one gable end to the other and on a definite central axis were four pits: (347) in the north-east; c. 11 m south-west of it was a much used and larger pit (562); c. 6 m south-west of the latter was (698), a smaller and shallow pit with a deposit of stone artefacts – two quern fragments and a whetstone; and c. 11 m south-west of that was another pit (708), which was capped with stone (Figure 2.3). The alignment and the distances between the pits appear regular and deliberate, and marked out the initial length and main divisions of the building. In the shallow stratigraphy of the site these features could be considered *symbolic marker pits* as they remained visible throughout the life of the building, one as a hearth, another containing a deposition of artefacts, or another with stone capping (Figure 7.5). Their meaning may have been more than mundane (see *Beliefs* below), as the two furthest to the south-west were clearly important to the subsequent positioning of the Structure 8s small building within the large timber hall (see below). These marker pits were too small to have supported timbers of any size, except (562), which was deepened and enlarged during its subsequent life as a hearth, but they are interpreted as the initial foundations or markers for laying out the plan for the building's construction.

The next events required the digging of large pits/postholes for the symmetrical positioning of load-bearing oak timbers c. 0.5 m in diameter or more to hold up the roof (Figure 7.5). The first pair of pits (no. 1) was positioned half way between the two marker pits at the north-eastern end of the building, another pair (no. 2) was positioned either side of the third marker pit with the deposition of artefacts, and the third pair (no. 3) was placed between the third and fourth marker pits, but slightly further to the south-west than in the middle. A single 2.94 m long pit, (672) (no. 4) at the very south-western end of the building plan was most likely dug for the reception of two posts, but this may be the result of the reorganisation of the gable at a later date. At the north-east end of the building two further large pits/postholes (345 and 098) (no. 5) were also dug just beyond it, probably for timber supports. The regularity of the distribution of these important oak timber posts in the building plan is striking and the only deviation is the wider gap between load-bearing positions 2 and 3. The explanation for this was to allow for the position of opposed entrances in the long walls of the building (Figure 7.5). The oak posts formed a central aisle c. 4.5 m wide running through the building.

The main timber postholes/pits were also important in the context of the founding of the building because of the cultural and environmental remains they included: either tokens were deliberately placed in the pits with the posts or included accidentally during the backfilling processes. The south-eastern pit of load-bearing pits (no.1), forming the north-eastern limit of the central area, contained a substantial amount of pottery, some of which was likely to have been deposited or accumulated in the base of the pit after the post was erected (Figure 7.6). Other sherds in its backfill material included rims from another six vessels and a small number of additional body sherds, some of which were burnt and abraded, which could indicate that these were pieces from an older occupation surface, which was included with the backfill. It is also possible that when the post was renewed or reinforced the sherds were retained, replaced and possibly added to, along with a deposit of hazel nuts. All the pottery appears to be of the Modified Carinated Bowl tradition (see Part 5: *The Pottery*), but also included in the backfill was a single piece of unworked quartz. The north-western pit of this pair contained only a modest amount of pottery body sherds but also three pieces of quartz in its backfill, one of which was a crested blade or flake. It is thought that most of the quartz was residual, but that quartz artefacts such as the crested blade may have been deliberately placed in the pit (Figure 7.6).

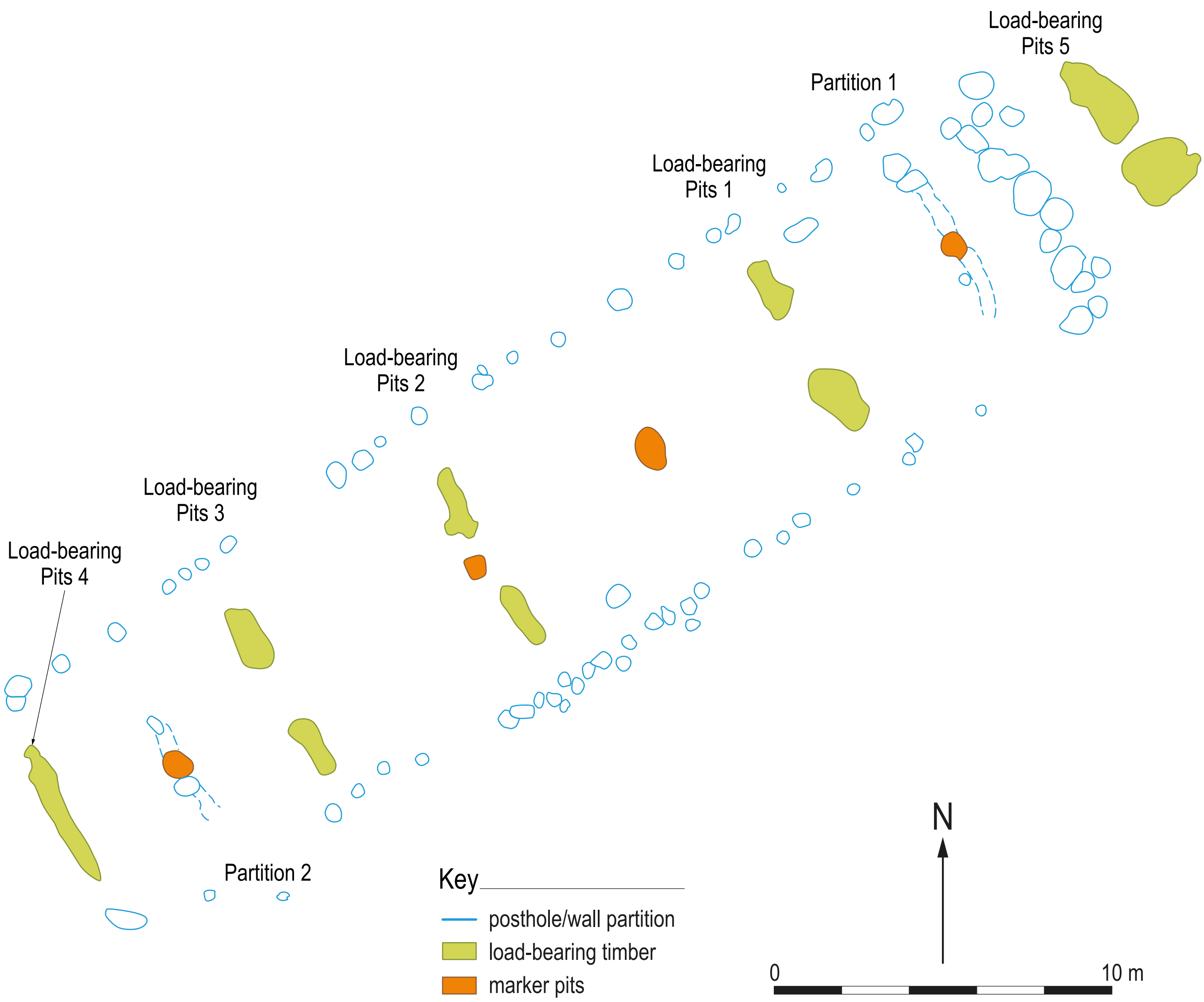


Figure 7.5: Interpretation of Structure 8 long timber hall.

The other pair of load-bearing pits (no. 2) that formed the south-western limit of the central area of the building also contained sherds of pottery in their backfills. The north-western pit had what is interpreted as part of one pot, and a piece of quartz, while the south-eastern pit had rim sherds of two different vessels with additional sherds and two pieces of quartz. In addition to the artefacts carbonised cereal grains were found in both pits – the north-west pit had evidence of barley and emmer wheat, wheat and cf. wheat but also a rare crab apple pip and hazel nuts (Figure 7.6). A smaller number of similar cereal grains were located in the south-east pit, but no pips or nuts. The south-east pit of the third pair of load-bearing pits also contained parts of one pottery vessel, a piece of quartz and also cereal grains of barley and wheat. The north-west pit of this pair had a short end-scraper of quartzite and a piece of flint. The inclusion of this material in these features is significant as it suggests a certain amount of deliberate deposition of items that were replicated in most of the load-bearing pits.

As mentioned earlier, there had been considerable forethought and planning in establishing the main timber foundations for this building. The design included a central aisle, two side aisles and a hearth. Unlike Balfarg structures 1 and 2, Claish,

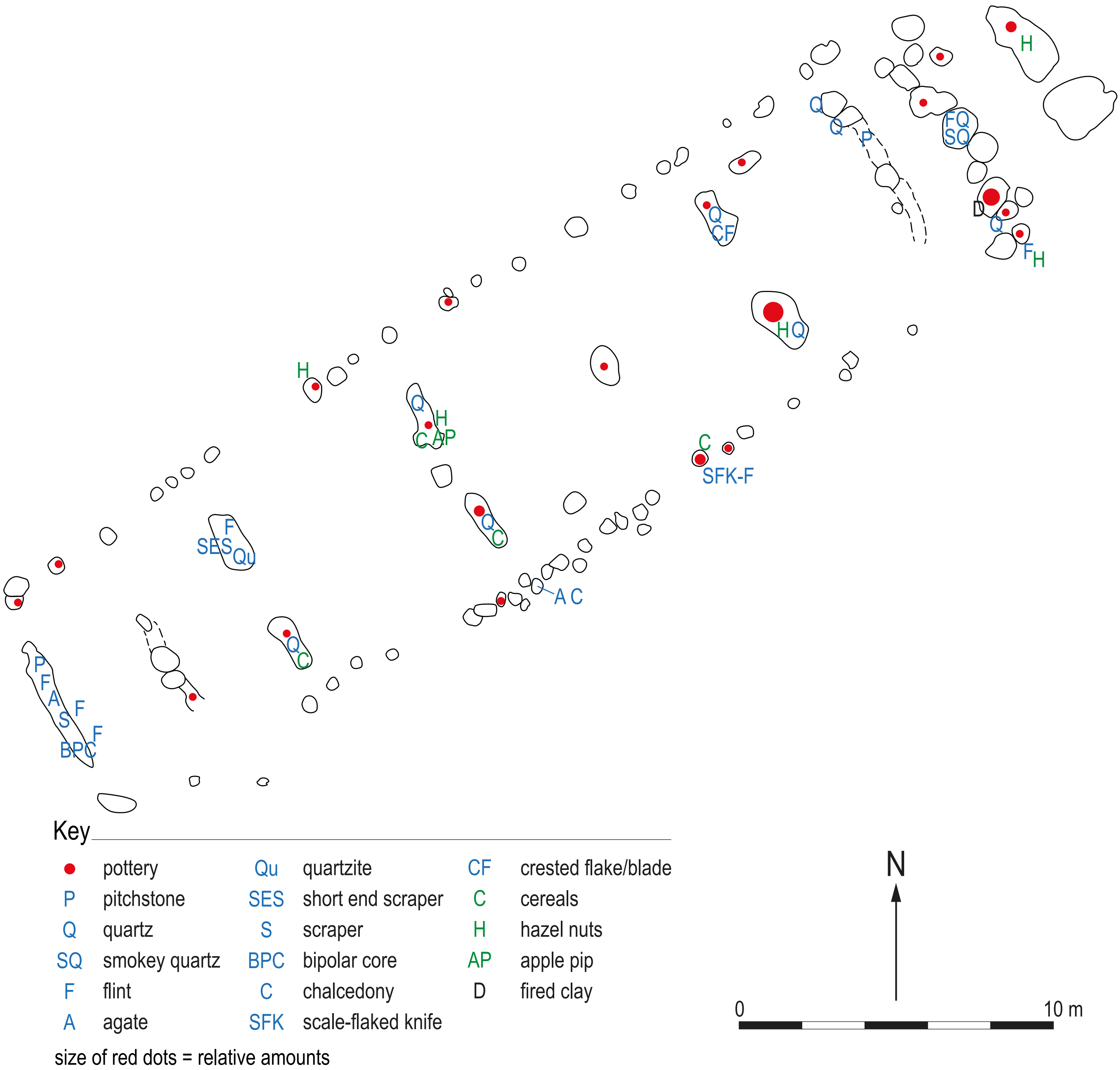


Figure 7.6: Location of artefacts and organic remains in the Structure 8 long timber hall.

Doon Hill, Warren Field and others (Figure 7.4), the Structure 8 pits/postholes did not survive as circular features dug deeply into the subsoil but had more elongated outlines, possibly due to re-digging during the replacement of timbers or to the doubling up of posts. In none of the pits/postholes for the load-bearing timbers were the remains of burnt posts present. However, it was considered likely that the bases of the posts were charred before being placed in the postholes as a means of increasing the longevity of their use (see PART 4: *Archaeobotany*). Most of the features of the timber hall at Balbridie produced archaeobotanical remains including significant amounts of cereal grains of the same species as at Carnoustie, but also of importance was the presence of crab apple and also hazel nuts (Fairweather and Ralston 1993, 317). An emmer wheat grain impression was also noted on a sherd of Carinated Bowl pottery from the Warren Field timber hall (Murray et al. 2009, 87, Figure 43), indicating the cultivation of both bread wheat and barley, but again crab apple was of some significance.

Once the overall building plan had been established for the Structure 8 long hall, other elements of the building were added and problems were dealt with, although the latter may not have been apparent during the initial layout. However, one issue was the necessity for a larger structural post to be positioned in the centre of the bowed north-east gable to support the roof, as the span between load-bearing posts no. 1 and no. 5 was over 11 m. Posthole (305) was positioned approximately 3.5 m south-west of, but centrally to the load bearing timbers no. 5, to take a post c. 1 m in diameter. Its backfill contained pieces of flint, quartz and smoky quartz, but no pottery. The south-west gable was re-dug later but its fill contained single pieces of pitchstone, flint, agate, a flint scraper and a bipolar core, also in flint, some of which could have been placed there during its later alteration (Figure 7.6).

An inner wall or partition (no.1) to the north-east gable was probably constructed as part of the original design. Comprising posts and a narrow trench, it was positioned to either side of the north-easternmost marker pit, and additional posts may have been added at either end over time. A piece of quartz was found in its two north-western postholes and a piece of pitchstone in the trench. A companion wall or partition (no. 2) was constructed in front of the south-western gable to either side of the stone-capped marker pit located there. A small shallow pit to the north-west and a pit within a shallow gully to the south-east are all that survive of the feature (Figure 7.5).

The main body of the construction was completed by the addition of straight external walls, positioned externally to the load-bearing posts, which comprised smaller posts of oak and some alder, with hazel wattle panels infilling between them. Remarkable and presumably special deposits were also found in a few examples of the postholes of the long walls, the southern one in particular. The north-east gable is particularly interesting as the posthole at the junction of it and the southern long wall contained the rims and body sherd of a pot, the largest amount of hazel nutshells from any feature found in the building and a piece of flint (Figure 7.6). Along the gable another larger posthole had the rim of vessel V74 and sherds of another, and one of the large pits for a supporting timber just beyond the gable contained four rims from three separate vessels together with a small number of body sherds and hazel nutshells. In the long southern wall roughly opposite marker pit (562) in the centre of the building, one posthole stands out as different from the rest by its contents. Posthole (413) contained eight rims from four different vessels, with a very small number of body sherds, three cereal grains, and a scraper/scale-flaked knife in flint, suggesting deliberate deposition. Another posthole (534), in the south wall and close to the load bearing pits no.2, appears unusual as it contained a piece of agate and one of chalcedony. A further posthole, (544), close to the position of marker pit (698), had a modest amount of pottery of two rims representing one vessel, but its partner in the northern long wall by posthole (482) contained rim sherds from a single vessel as well as some hazel nutshells (Figure 7.6). Out of all the other postholes forming the two long walls and the north gable, only seven other postholes contained any evidence of material culture – mainly one or two plain pottery body sherds, and two postholes had a single piece of quartz each.

The building measured c. 34.5 m in length, c. 8.6 m in width and encompassed an internal area of c. 296 m². The roof comprised tie beams resting on the load-bearing timbers and the gable posts, with rafters supported on the tie beams which in turn supported the ridge pole and the numerous purlins needed for the roof covering. Low Countries examples of early Neolithic long buildings suggest an angle of 45° for the roof pitch (de Grooth and van de Velde 2005, 226). With this suggested type of construction, no weight from the roof rested on the building walls (Figure 7.7).

The roof covering has to be considered from the resources available locally. Wood could have been the most obvious choice, perhaps in the form of shakes. It is presumed doubtful that initially there would have been sufficient wheat or barley straw for thatching a roof of this size from the immediate local environment. Turf may have been available from open parts of the landscape, but that would have led to an increase of weight on the roof and also caused depletion of the fertility of land for the growing of crops. It is also unlikely that heather was present in the immediate landscape at all or in sufficient amounts for covering the roof until later on in the Bronze Age. However, it is possible that a combination of resources such as tree bark, oak shakes or laths, reeds, straw, possibly turf and even hides or skins could have covered the roof.

Beyond Scotland a small but increasing number of early Neolithic buildings have been found in Wales that offer parallels to the Carnoustie structures. One of the most interesting and not too dissimilar in design to Structure 8 was a smaller but substantial rectangular timber building excavated in Wales at Parc Bryn Cegin in Llandygai (Kenney 2009, 26-7). It was 15.5 m long and 6 m wide and had five pairs of posts forming a central aisle 2 m wide. Like Structure 8s it had straight gullies for planking, but these were at its gables and were supported by large posts. It had a deliberate deposit of a fragment of a saddle quern, located in a pit in the middle of the building. There was also some indication that the building during its lifespan had been extended and that after its demolition, part of it was reused due to the presence of two fire-pits. It was a slightly later construction than Structure 8 and was dated between 3800 – 3670 cal BC to 3690 – 3610 cal BC (Kenny et al. 2021, 31-52).

Figure 7.7: Reconstruction of the Structure 8 long timber hall. By Gillian Sneddon.

Structure 8 – the demise of the large timber hall and the construction of Structure 8s – the small timber building

The demise of the Structure 8 large timber hall was intimately connected with another event - the construction of a smaller timber building (Structure 8s) within its footprint at its south-west end. The scenario of a building constructed within a building is also noted at Doon Hill, where Hall B replaced Hall A within the footprint of the latter (Ralston 2019, 17-19). An important detail in the construction of the smaller building at Carnoustie, and it was certainly the same at Doon Hill, is that the outline of the larger timber building was identifiable, and both affected and constrained the new construction. However, it was not just the location of the walls or even the gable of the Structure 8 large timber hall that were important, but also the location of significant features - marker pits (698 and 708), and the load-bearing posts (no. 2 and no.3), which implies their locations were not lost in an accumulation of occupation deposits or debris. Due to the loss of the upper levels of postholes, it is not known whether the Structure 8 large timber hall burnt down, as was the case with Warren Field (Murray et al. 2009, 58), where it was suggested that the ritual timbers and deposits in the axial pits were removed before the fire. From the evidence, fire was also responsible for the destruction of the large timber halls at Claish (Barclay et al. 2002, 103), Balbridie (Ralston 1982, 239), Lockerbie (Kirby 2011, 26) and Doon Hill (Ralston 2019, 17), with noticeable carbonised post-pipes. Recent excavations at Dorestone Hill in Herefordshire found the burnt remains of a timber hall dated to the 38th century BC, together with early Neolithic carinated pottery that lay beneath a stone and earth long barrow. Massive pits for loadbearing timbers and burnt wooden planks were evidently part of the building along with a worn earth floor. The firing of the structure was considered to have been deliberate by removing a 'house of the living commemorated and monumentalised on the same footprint by a *house of the dead'* (Overton, Ray and Thomas, 2022, 28-29).

Wholesale destruction of a building by fire can be an act of closure, cleansing or a removal before rebuilding. If fire was responsible for the demise of the Carnoustie timber hall there had to be enough markers left in order to position the new smaller building accurately. However, the situation at Carnoustie may be different from the other timber halls given that no specific evidence survived of the burning down of the large timber hall. There are some similarities to the events at Warren Field (Murray et al. 58) in the perpetuation of marker (axial) pits and curation of the large pits for load-bearing timbers and their deposits. The south-westernmost parts of the Structure 8 large timber hall may have been taken down, in order to facilitate the construction of the Structure 8s, the small building, but parts of the north-eastern third of the timber hall, may have been left recognisable for later modification or use. The early 40th century dates (3941 – 3709 cal BC, UBA-39305 and 3941 – 3642 cal BC, UBA-39308), produced for some of the features of the small building may be due to mixing of material from the walls of the large timber hall into the new wall trenches, and the effects of an inconveniently sited animal burrow. The small building is likely to have been constructed, and used, during the latter quarter of the 38th century to the middle of the 37th century (3775 – 3640 cal BC, UBA-39307, or slightly later; see Table 2.2).

There are clear similarities in design between the large timber hall and the smaller building, and in plan the latter appears to be a condensed, much shorter version of the former, as it only measured 14 m by c. 7.4 m and enclosed an area of 104 m². It had curved gables: the south-western one was rebuilt on the line of the gable to the large timber hall, the north-eastern-one was new, but its location was exceedingly carefully placed. It butted up against marker pit (698) with its deposit of stone artefacts, and close to the position of the load-bearing timbers (No. 2) (Figure 7.8). By doing so its presence expressed a statement of being part, or a continuation, of the large hall, and that the beliefs expressed in the marker pit, were also valid for the new building and may have legitimised it. Further depositions associated with main structural elements of this building included cultural material found in both gables. In the fill of the north-east gable were four rim sherds from two different pottery vessels, with a small number of body sherds, one piece of quartz, a cereal grain of emmer wheat and one other that was unidentified (Figure 7.9). The south-western gable fill contained a piece of exotic pitchstone, plus one piece of flint and one of agate, a flint scraper and also a flint bipolar core suggesting deliberate deposition (see *Beliefs,* below). It was remarked above that some or all of these may have derived from the construction of the large timber hall.

The new building also used the same entranceway position as in the previous structure, with possible porches in either long wall, and the positions of load-bearing posts (No. 3) were reused in its design. Again, these two post-pits contained a flint and a quartzite scraper (the north-west), and pottery, cereal grains of barley (3) and wheat (2) and a piece of quartz (the south-east), which could have been deposited earlier or added to during the new construction (Figure 7.9).

Also brought into the construction, perhaps as a stone base for another load-bearing timber, was the south-westernmost stone-capped marker pit (708) that lay half way between the walls, the gable end, and the load-bearing post-pits (No.3). The reuse of older building elements is also noted at Doon Hill, where Hall B replaced Hall A, and reused some of its prominent features (Ralston 2019, Figure 7).

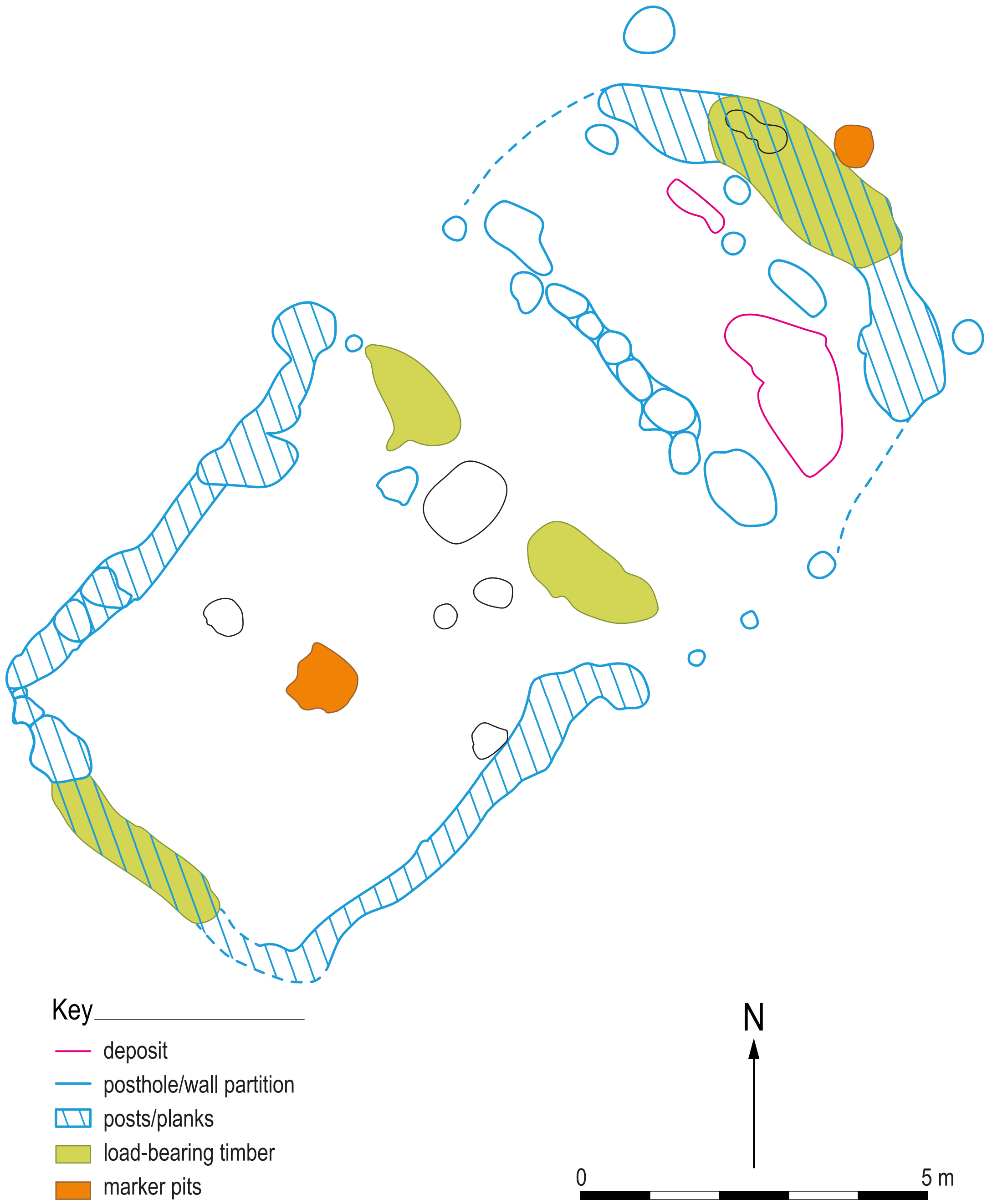


Figure 7.8: Interpretation of the Structure 8s small timber hall.

The erection of the smaller building, however, contrasted with that of the larger timber hall, by its use of construction trenches instead of only postholes or pits for its gables and the walls of its south-western end. The evidence for the side walls of the north-eastern end of the building is missing due to damage caused by rig and furrow cultivation at that point. However, the evidence implies that planks and posts were used for its walls and gables, and the timber in the north-east gable was noted as having been replaced over time (Figure 7.8). Construction trenches with the carbonised remains of planking were also part of the original design for the Lockerbie timber hall (Kirby 2011, 10 and illus 4 and 6), and the timbers of the long walls of Balbridie are also considered to have been placed in trenches (Ralston 1982, 239).

The internal north-eastern wall of the entranceway of the Structure 8 small building is likely to have been built with wattle and daub

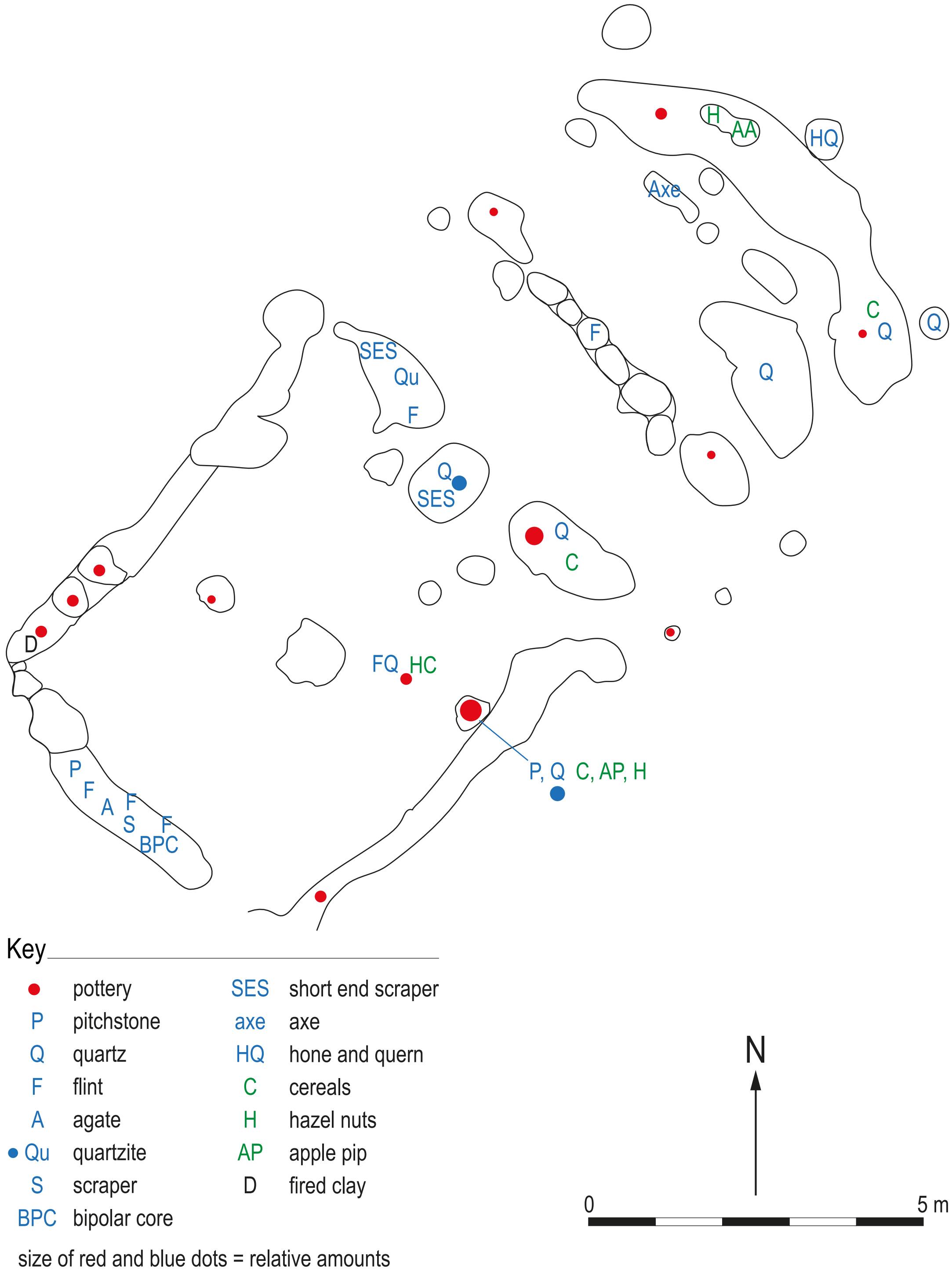


Figure 7.9: Location of artefacts and organic remains in the Structure 8 small timber hall.

panels between posts, as there was evidence of shallow postholes within its narrow construction trench. The change in building styles from that used in the large hall to those in the smaller building may reflect a change in the availability of mature trees as well as of human resources needed for the building of the new structure.

Establishing the structure of the roof is more difficult than with the larger hall because it appears that different techniques were used for it. The depth of the construction trench for the south-west gable suggests that load-bearing posts could have been positioned there and also in the north-east gable even though the feature was badly truncated. An additional timber in the centre of the building within pit (627) may have helped to support the roof and the planked and post walls may also have been load-bearing (see Figure 7.10). Pit (627) was also furnished with a deposit of eight pieces of quartz including a short end scraper, suggesting that the deposition of specific items of material culture and belief were also a part of this building's construction (Figure 7.9).

Internal features of the building are not well understood because of the intrusion of at least one animal burrow, in conjunction with the negative effects of a field drain and remains of a rig and furrow system that caused the loss of features and the significant reduction of depth of others. The north-east gable had a linear arrangement of small pits in front of it, for an inner wall or partition, one of which contained the deposition of an unused polished stone axe of early Neolithic date, made of stone from the Highlands (Figure 5.22). The pit with its axe lay just over 2 m away from the marker pit (698) with its deposition of two querns and a whetstone – with the north-east gable of the building intervening between the two. The deposition of the axe was not interpreted as being part of the initial layout of the large timber hall, but as part of the foundational 'consecration' of the smaller structure and is discussed further below. However, there could have been a temporal link between the two deposits, as the whetstone and the axe may have been intimately connected.

Figure 7.10: Reconstruction of Structure 8 small timber hall. By Gillian Sneddon.

There was no recognisable fire-pit in the centre of the south-western half of the building, and apart from a small number of shallow pits, only one other pit (704), was of any significance. It was positioned close to the south-east wall of the building and deposited in it were seven different pottery rims with a few body sherds, two pieces of pitchstone and eight fragments of quartz. In addition, the presence of 11 cereal grains, some identified as barley, hazel nuts and two apple pips, mark it as special (see *Beliefs*. below). Charcoal, burnt clay and fire-cracked stone were also identified in the complex fills of this pit, suggesting that at some stage it could have been used as a hearth, or it was infilled with hearth waste or even capped with clay. Significant alterations to this building were not noted, but a number of small shallow postholes in its floor could relate to its use.

The construction of one building inside the footprint of another, apart from the two buildings at Doon Hill, is exceedingly rare and therefore has significance beyond the practical and functional. The structures at both Carnoustie and Doon Hill were elevated by the topography and they were visible in the landscape, and both had views to the sea, even though the latter was enclosed within a stockade (Ralston 2019). How meaningful our observations are for interpretation of the siting of these buildings is not known. To those that used these buildings their location was of such significance that both the timber halls were replaced by another similar but smaller structure within the same building footprint. In the case of Doon Hill the burning of the earlier building enabled a new construction. At Carnoustie there is little evidence for the same sequence of events, but the foundations of the old timber hall had meaning and clearly affected the design of the new building.

The physical remains of a previous use of an area would complement peoples' memories of activities that took place there: memory and its longevity is an aspect of intangibleness that we often overlook or underestimate. There are copious examples of early Bronze Age cremations or cists inserted into late Neolithic chambered tomb mounds that emphasis the longevity of our prehistoric predecessors' memories, including that of a middle Bronze Age cremation cemetery complex at Boreland Cottage Upper at Dunragit in Galloway, sited over an earlier Neolithic cursus, which half a millennium later was used for further cremations (pers. comm. Warren Bailie).

Whether the small hall (Structure 8s) should also be called a timber hall is a moot point, as it has already been referred to as a smaller version of the larger hall. Although it was small, it was of similar dimensions to the Littleour structure (Barclay and Maxwell 1998, 122, Illus 91), to Balbridie (Ralston 1993, Figure 2) and to several early Neolithic houses of 10 m to 15 m length found in Ireland and identified as being built between 3730 – 3660 cal BC (Smyth 2014, 48). That date range fits well with the Carnoustie small building, and with the Irish end date for these buildings of 3605 cal BC (ibid.; Cummings 2017, 79 quoting Whittle *et al.* 2011). Some of the Irish examples were constructed over earlier activity, some were burnt down after their final use, some were domestic and others appeared not to be. Examples such as Haggardstown in Co. Louth, Ballyglass in Co. Mayo and Tankardstown South 2 in Co. Limerick (Figure 7.1) appear similar in plan to the small Structure 8s building. It is also suggested that these structures could be scaled-down versions of the larger timber halls found in Scotland and England (Cummings 2017, 80, Figure 4.21), reinforcing the idea already suggested that the Structure 8 large timber hall was replaced by another, much smaller version – the Structure 8 small timber building or hall.

Final reuse of the north-eastern part of the Structure 8 large timber hall

Although the Structure 8 small timber hall replaced the south-western end of the large hall, other evidence suggests that the location of parts of the latter were either marked in some way or were identifiable, and that later activities took place there.

Three posts indicative of a partial wall were erected between the location of the inner gable wall of the large hall in the north-east and the position of the former load-bearing pits (No. 1). The middle posthole (360) contained two grains of barley and provided a middle Neolithic radiocarbon date range (see Table 3.1, UBA-39285). Another possible wall was erected to the west side of former marker pit/hearth (562). Further additions in the immediate area included the insertion of a new fire-pit, (580), to the south-east of the marker pit (Figure 7.11). An agate core was found within the fill of the new fire-pit, along with 19 pieces of early Neolithic pottery all heavily burnt, but which included two rims and the body and base sherds of different vessels, most likely indicating activities relating to its use, rather than a specific special deposit. The pits/postholes to either side of it all contained sherds pottery of early Neolithic date, much of it abraded and burnt. One of the features produced a radiocarbon date (Table 2.2, UBA-39290). These events are dated from the middle of the 37th century cal BC to the last quarter of the 34th century cal BC, the end of the early Neolithic and into the middle Neolithic.

It is plausible that these features, dated as late as they are, indicate either a structure constructed over the location of the large timber hall, or activities associated with the memory of the place. The occurrence of burnt pottery of earlier date in these later features shows how widely spread early Neolithic pottery was across the excavated area, and how it may have been intimately associated with the large timber hall. This suggests a sequence of events similar to that identified for Structure 13 (below), but at a slightly later date in the middle Neolithic. The location of the large Structure 8 timber hall suggests that its original importance and meaning still had resonance for people several centuries after any visible remains had been eradicated.

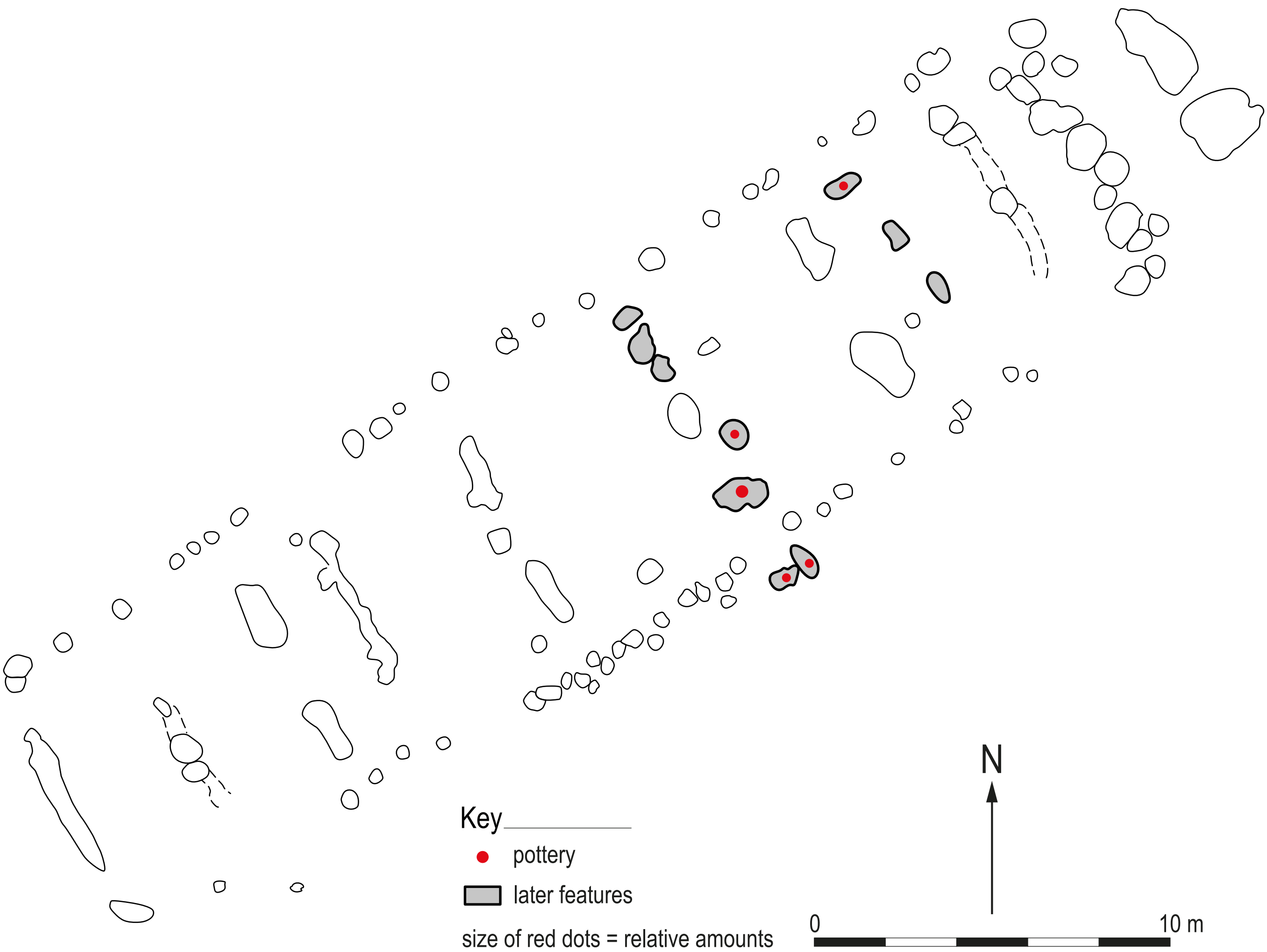


Figure 7.11: Structure 8 - later dated features.

Structure 13

The earliest radiocarbon date for Structure 13 (Table 2.3), like that of the Structure 8 large timber hall, falls within the 38th/39th century BC bracket for the construction of these large early Neolithic timber buildings in Scotland (Sheridan 2013, 289). This date suggests that it is highly likely that this second timber building was constructed at the same time as, or closely following, the construction of the Structure 8 timber hall – as a contemporary, accompanying building. Further dating evidence for Structure 13 is limited, largely because of its shallow stratigraphy and the lack of carbonised botanical remains. Although considerably smaller than the Structure 8 building, there is no doubt that it too was a timber hall. Its other radiocarbon dates, suggest rebuilding and reoccupation during the latter part of the early Neolithic and into the middle Neolithic, from the 37th century BC to the 34th century BC (Table 2.3). Alterations included modifications of the west wall and the use of its hearth, with intrusive activities from a later oval structure that was built partly over it.

Evidence that the structure was rebuilt or refurbished on a number of occasions is supported by the less clear pattern of the arrangement of its pits and postholes. Its plan of construction is not as straightforward as the Structure 8 timber hall but an attempt has been made to infer the sequence of events from the limited evidence. However, additional events that cloud the picture of the detail of this timber hall, apart from the construction of Structure 13n, a middle Neolithic oval timber building, include the insertion of pits/postholes of the Bronze Age porch of Structure 14 over the northern part of the building. The timber hall had also been cut through from north to south by a drainage pipe in recent times, and there is evidence of two runs of rig and furrow that disturbed the building in a NW/SE direction, removing evidence from its north and central portions, and from its southern extent.

As far as can be ascertained, given the loss of evidence, the timber building measured c. 19.75 m in length and c. 7.25 m in width, and was therefore a little more than half the length of the Structure 8 hall and approximately 1.5 m narrower. The area enclosed by the building was half that of the large hall at c. 148 m². It was also orientated north/south and positioned at an obtuse angle to the larger building and c. 10.5 m away from it to the south-west. This relationship of other early Neolithic halls and houses can be seen in Ireland, such as Tankardstow in Co. Limerick, Monanny in Co. Monaghan and Ballintaggart in Co. Down (Smythe, 24, Figure 3.2). To some extent Structure 13 mirrored the larger Structure 8 hall, in its shape with its long straight walls and curved gables, but the setting out of its foundation plan is less easy to determine. No definitive marker pits for its central axis have been identified at either end of the building or at its centre. However, a deep pit (1168) to the north, positioned in the middle of the inner gable wall or partition, and a very shallow one (1107) in the middle of the southern inner gable wall, could have fulfilled that function (Figure 7.12). The disparity in their size and depth is due to their location relative to the later runs of rig and furrow.

Situated c. 9.4 m apart at either end of the central area of the building were two rows of large pits orientated east/west. Each row comprised three pits: one to the western side of the longitudinal axis of the building and two to the east to take load-bearing oak posts c. 0.4 m or larger in diameter. The largest posts were positioned in the westernmost and central pits of the southern row, supplemented by a smaller post to the immediate east. Smaller diameter posts were erected in the north row, again with a similar arrangement. This indicates that the longitudinal axis did not lie centrally within the building but was offset by c. 0.5 m to the west. The main internal feature was a large hearth or fire-pit (1211), situated in the middle of the building between the two rows of load-bearing posts but towards the eastern wall (Figure 7.12). The position of the hearth is the most likely reason for the offset posts and the passageway through the building. If this was the intended original design it implies that the interior arrangement of the building functioned very differently from that of the Structure 8 timber hall. However, if this was not the original design, it meant that the timbers used initially were not of the necessary size or strength to support the roof satisfactorily, and had to be reinforced by additional posts. A further inference of this arrangement could be that the best and largest timbers were used in the Structure 8 large hall and that wood of smaller trees was used for the Structure 13 construction, reflecting perhaps its secondary status and importance.

The wall timbers of the east wall of the building were fairly regularly spaced, presumably to take wattle panels, except for curving slightly around the hearth where some adjustments to the posts were made, whereas the evidence indicates that the west wall had additional complications. The features of the southern extent of the west

Figure 7.12: Interpretation of the Structure 13 timber hall.

wall survived less than 0.2 m deep, but one pit/posthole (1087; Figure 2.18) was typical of the others. It showed an elongated profile, indicating the re-digging and enlargement for replacement posts or the need to reinforce the original post by the addition of an extra one or two. The fact that most of the west wall postholes had elongated profiles suggested that the problem was an ongoing one, and to such an extent that it had probably been rebuilt/repaired many times. Another solution to the problem of the weak wall was that supports were added to its central section to strengthen it from the inside. The orientation of the building may have been a cause of the problem, as the west wall would have been exposed to prevailing south-westerly winds.

Within the arc of the southern gable, a line of three postholes of various sizes spanned the width of the building between the long walls, suggesting that there was an inner wall to the gable. Three deeper postholes at the north end of the building could have had a similar function or had been additional roof supports (Figure 7.12). No entranceway into the building was identified. However, the erection of a possible screen (1147/1149), situated north-east of the hearth, may indicate that a doorway was positioned between it and the northern row of load-bearing posts. The later oval building, Structure 13n, obscured this part of the timber structure and its eastern arc of walling removed earlier features that were particularly shallow in this area, and perhaps indicate the position of the doorway.

In comparison with the large Structure 8 timber hall, no foundation deposits were identified in the fills of its main load-bearing post-pits. A leaf-shaped flint arrowhead was found in a small posthole (1130) in the west wall and this may represent a special deposit. However, the presence of grains of barley and wheat from within the three large pit/postholes of the west wall in the central area of the building and nearly 200 grains of cereal from the hearth, and a large deposit of almost 370 fragments of hazel nutshells in its adjacent posthole in the east wall of the building, suggest extensive use of the area, rather than structured deposition. Whether some of the grain and hazel nuts were deliberately deposited in pits and postholes is not clear because of the enlargement of the features due to the refurbishment of the west wall in particular. A small chip of agate was located in one west wall pit, and pieces of quartz were found both in the hearth and a nearby pit, but they may be residual material that was accidentally incorporated into the features during their use or during the renewal of posts. The large number of hazel nutshell fragments and a few cereal grains in the east wall posthole near the hearth could indicate hearth waste. A large number of discarded sherds from pottery vessel V69 were recovered from the hearth (Figure 7.13).

Much of this material is indicative of the general use of the hearth and the central area, corresponding to the scenario at Balbridie where very high numbers of cereal grain (barley and bread wheat) were found in most of the features of the timber hall (Fairweather and Ralston 1993, 316-317), suggesting that storage and/or drying of grain may have taken place. The picture of activity and deposition within the Structure 13 timber hall is conjectured from a very limited amount of evidence. Had other soil samples produced archaeobotanical remains from other parts of the building, or more evidence of material culture been found, a clearer picture of events, i.e. cereal distribution, might have come to light to inform on not just activities within the building, but perhaps also the purpose of the structure.

The life of this large timber building may have been much shorter than suggested by the time ranges of the radiocarbon dates, but knowledge of its location persisted. The position of the hearth, for example, may have been marked and it could have been reused countless times during the middle Neolithic by occupants of the oval building that was built adjacent to it.

Currently, the presence of two contemporary large timber halls on one site is exceedingly rare in a Scottish context, the Balfarg structures being the only other comparable examples albeit the excavator there suggests that these were later in date and possibly unroofed and therefore not directly comparable to the scenario at Carnoustie (Barclay and Russell-White 1993, 175-178). The close proximity of the two large Carnoustie halls, and their similarities and differences in plan, might suggest they had somewhat different functions within the same social context. When the slightly later third hall (the Structure 8s building) is added into the mix, the picture becomes more complex and nuanced and is discussed further below.

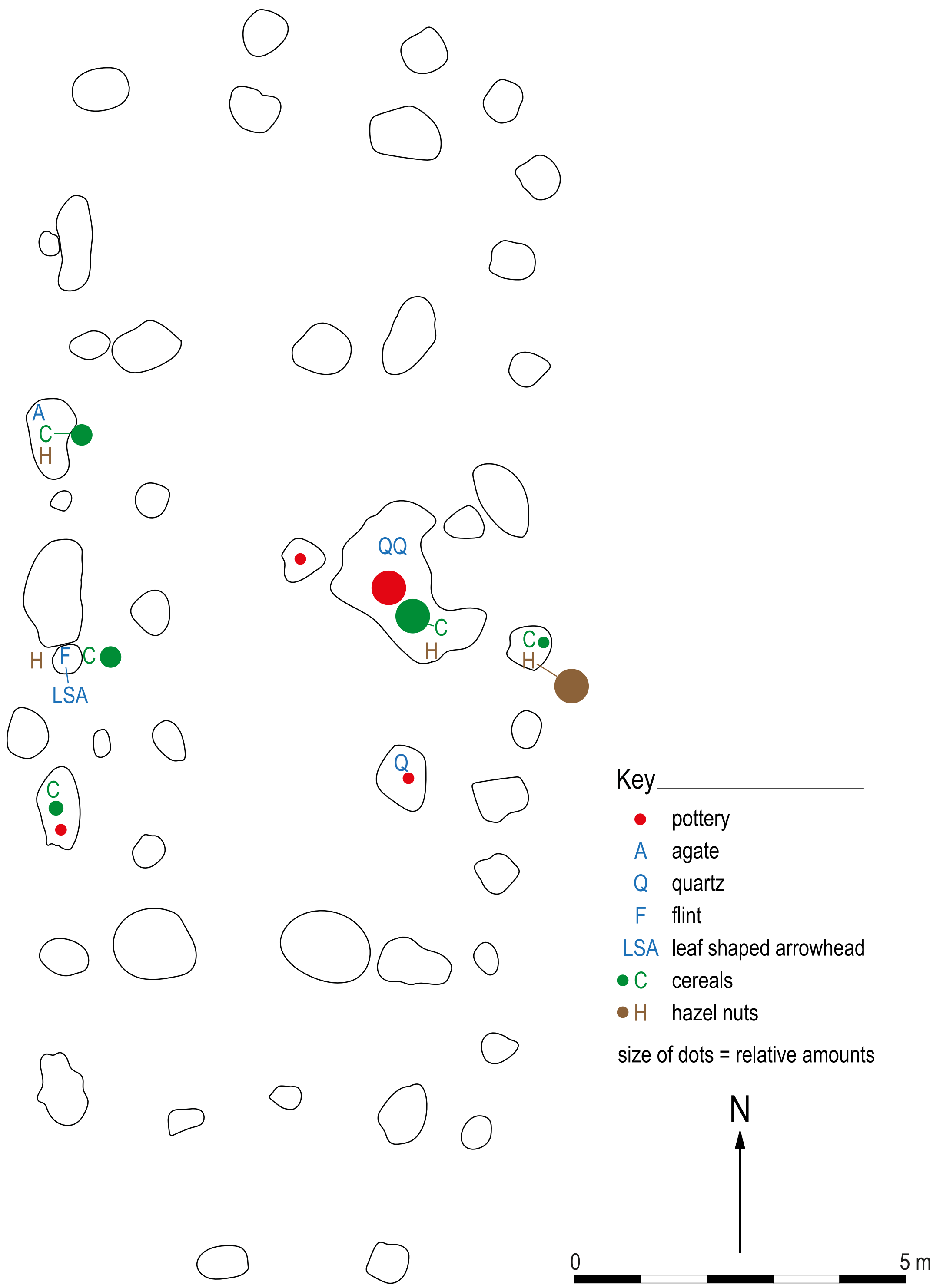


Figure 7.13: Location of artefacts and organic remains in the Structure 13 timber hall.

Structure 13n – the oval structure

The construction of this 13 m long by c. 8 m wide structure was aligned at right angles to the timber hall and overlay the earlier building's footprint in the north-east. This fragmentary building expressed a change of concept from the plan, orientation and function of the earlier hall. Although considered middle Neolithic from its single radiocarbon date (UBA-39328, Table 3.1) of the 31st to the 35th centuries cal BC, the builders of the oval building suggested intimate knowledge of the location of the Structure 13 hall. Certainly there was overlap in the radiocarbon date ranges between the construction of the new building and the use of the hearth in the old. Was there a prolonged use of a rebuilt north end of the old hall, long after the rest of the building had fallen out of use, including that of the site of the hearth, which may have been an external feature at that time? This would account for the mixed pattern of features there, and perhaps it also explains why the new structure was built to follow the outline of the north gable and part of the east wall, even if it extended westwards and formed an oval shape.

The new structure was in a much better position to catch the daily passage of the sun than the old, but its oval shape paralleled the rounded gable ends of the earlier hall (Figure 7.14). Oak would be the obvious choice for building, but the deepest surviving postholes were those in the east, and one in the north, suggesting its roof may have rested on both the smaller and larger diameter posts forming its circumference. A partition separated the west end of the structure with its two fire-pits from the east, and a further group of small postholes at its east end may have also formed a partition there. However, none of the features of this building were examined for charcoal from the timber used in its construction: the exception was the analysis of carbonised remains from one of its hearths.

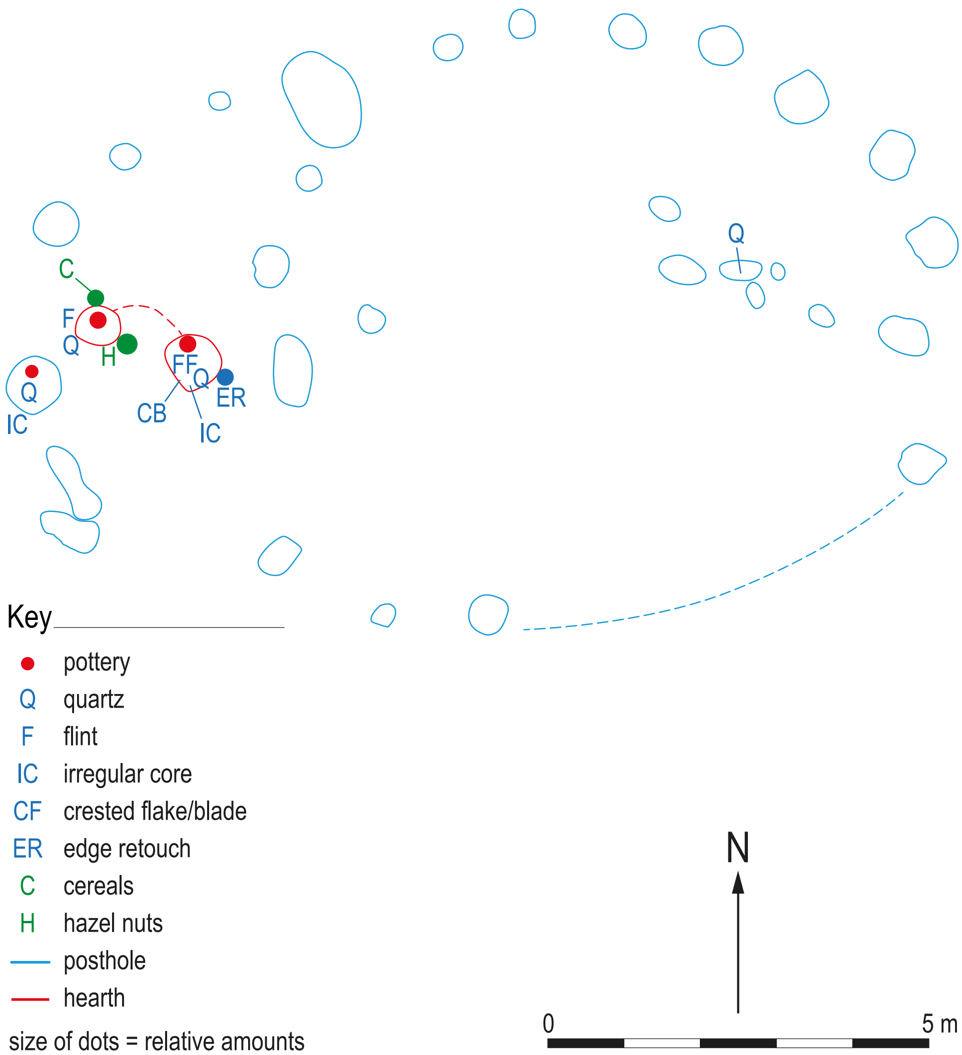


Figure 7.14: Interpretation of the Structure 13n oval building.

The function of this structure appeared much more clearly domestic than its predecessor buildings, but as with the evidence from the Structure 13 timber hall, both material cultural and archaeobotanical evidence was limited. Activities were largely confined to the west end of the structure and were centred on the two hearths where lithic tools in flint and quartz were recovered and sherds from two different pottery vessels were mixed into the fills of both fire-pits. Evidence of cereal grains and hazel nutshells was only located in the westernmost fire-pit (Figure 7.14).

This building overlay an earlier building and past activities but is not unique on the site (see Structure 5, below). Its shape indicates something new, as it transformed the rectangularity of the earlier building plan into a compressed bow-ended shape – an oval, which was half the size of the timber hall. Whereas the various elements of the Structure 8s small hall perpetuated the tradition of structured deposition and beliefs from the large hall, and was intimately connected with it in time and space, the Structure 13n oval building lacked the ritual inferences from the past. This may be because the gap in time was too great and changes in society had taken place (see below).

Oval/circular houses of later Neolithic date are particularly numerous in Ireland, although the term 'later' includes also middle as well as late Neolithic structures. The interpretation of these buildings is that they are examples of permanent dwellings built with supporting posts and often a central hearth (Malone 2006, 61-62, Figure 29), and the form of the Lough Gur, Co Limerick houses are particularly relevant to the Structure 13 oval building (Figure 7.1). On the Scottish mainland, an example of a probable circular building, Structure A, was found at Lambs' Nursery, Dalkeith (Cook 2000, 108), but late Neolithic in date. A variety of structures including F136 at Beckton Farm near Lockerbie dated to the early/middle Neolithic 3650-3100 cal BC (Pollard 1997), and the oval structures at Chapelfield in Stirlingshire, where Atkinson considered them also to be examples of more permanent dwellings to a settled population after the middle of the fourth millennium BC (2002, 184). These structures were stratigraphically later than a number of pits dated to the early Neolithic which had depositions of stone tools, pitchstone and pottery (ibid, 186), although one similar pit was likely to be contemporary.

The Structure 13n oval building is most likely to be the first example of a permanent domestic house on the excavated area, and the word 'house' is appropriate in this context. While the other cited examples are generally later in date they are often associated with Grooved Ware pottery (Brophy 2016, 215). The roughly oval building at Garthdee Road in Aberdeen, although of early Neolithic date, is a similar sized construction to that of the Structure 13n oval house, but its preservation was much better with floor deposits, copious amounts of early Neolithic Carinated Bowl pottery, lithic artefacts, cereal grains and hazel nutshells. Its excavators maintained that the building had close parallels with other smaller early Neolithic timber structures such as those at Raigmore and Kinbeachie in Highland, and Forest Road and Deer's Den by Kintore in Aberdeenshire (Murray and Murray 2014, 57-59, illus 33), and stressed that smaller timber buildings may have been in use at the time of the larger timber halls, thus emphasising the diversity of settled communities in the early Neolithic. The Raigmore example is very similar in size to the Carnoustie oval house, but with double postholes and a central hearth, but its possible association with Grooved Ware pottery and the complexity of being built upon by a later kerbed cairn make its date uncertain (Simpson 1996a; see also Sheridan and Brophy 3.3.1.3 Neolithic ScARF). At Carnoustie, there are other middle Neolithic radiocarbon dates from features to the south-east and south-west of the timber halls, where activities took place but no permanent dwellings were built (see below).

Belief systems and the function of the timber halls

Much has been written about the timber halls and, although few in number, they have generated much debate over recent decades about their function and about the communities that built and used them. The Carnoustie timber halls will continue that debate, because of their interrelatedness, the replacement of one by a hall in relative miniature and the apparent perpetuation of belief systems. Whittle views these buildings as the equivalent of monuments, which expressed the beliefs, identity and values of the communities to which they belonged (1996, 15). There is no doubt that the Structure 8 large timber hall was monumental in its size and architecture. It required not just a family group, but a large community to resource the construction and to build it. It seems logical from the collective effort in building the hall that it was also used by an extensive community. It was erected at a time when cultivation was a pioneering occupation in Scotland and where a mobile life of hunting and gathering for most people was still very much in evidence, and therefore it could have expressed a variety of beliefs and community identities. Brophy suggests that timber halls were not simply functional buildings where rituals also took place, but that they were considered sacred places central to the life of communities and their social structures (2007, 89, 90).

The concept of monumental wooden buildings was imported into Scotland by early Neolithic communities, but the physical presence of such a timber structure took on special and perhaps different meanings and functions to that originally intended, and most likely represented a sense of place for people. The Carnoustie buildings, elevated and prominent in the landscape, were erected at an intersection of different environments (forest/woodland, sky/sea, higher land/shore/coast, open areas/cultivated land), and probably close to routeways where people may have congregated naturally at various seasons of the year. Thomas suggests that the 'complex seasonal round' was an opportunity for people to gather, and the availability of hazel nuts in autumn is a strong indicator that that season was an important one for meeting, feasting and celebrating (1996, 4). If the Carnoustie timber halls were such a focal point, was their significance great enough to attract interest from people from a much wider area, or people who travelled long distances? We know from the materials found in the fills of structural pits in the buildings that some artefacts came from distant places and represent deliberate deposition, such as fragments of Arran pitchstone, an axe of garnet-albite-schist and a piece of smoky quartz from the Highlands, while other materials were found more locally such as agate, quartz and chalcedony. The Ballygalley houses in Co Antrim produced high numbers of many different exotic materials which had a non-local origin including pitchstone and quartz, so much so that together they were considered to be a redistribution centre (Simpson 1996b, 129-132). The situation was not the same at Carnoustie. It was more nuanced, and the evidence suggests that near and distant members of the wider community carried rare and interesting stones and other items with them, some of which were either deliberately deposited, lost or discarded, but ending up in the backfilling materials used in the construction of the halls.

One of the most important elements in the construction of the timber halls was the organisation and ritual around the laying out of the building plan, with emphasis on alignments and divisions. To some researchers like Lewis Williams and Pearce (2005), the Neolithic cosmos might have been reflected in the internal spatial arrangement of the timber halls, making them highly ritualised places. Unlike Warren Field, with its two axial pits interpreted as containing totemic posts, similar pits noted at other timber halls (Murray et al. 2009, 52-53), the four marker pits in the large Structure 8 hall, two of which were reused for the small hall, and most likely two pits in the Structure 13 building, were slight in comparison. Nevertheless, their role and significance in the buildings cannot be underestimated. They defined the dimensions of the structures, and demarcated the areas between them. The ideas behind the use of space in the buildings had already been formed at the planning stage, and the marker pits were integral to their interior organisation.

Although all the marker pits continued to function as visible or known symbols within the Structure 8 large hall at junctions of possible spatial change, only one, the third from the north-east end of the building, received any form of deposit, in this case a used whetstone and fragments of two querns. As a permanent offering the querns could be interpreted as ensuring a good harvest and fertility of the land (new cultivation methods), and the whetstone for keeping axe edges sharp and thereby ensuring the continuity of the traditional ways of the community (clearance of woodland and the use of trees as a resource). These stone tools could have brought together the changing aspects of new and old social identities. But there may be more unexplained superstitions and meanings to this deposition. The link between the whetstone in the large timber hall and the unused polished stone axe in the small hall has already been noted, and the juxtaposition of the two produces a powerful image. Not only was the axe symbolically important in keeping a roof over one's head and a fire in the hearth, but the whetstone that put an edge on it and other axes, could have been imbued with certain powers and therefore possibly considered an important magical object in its own right.

The deposition of these objects in the marker pit was a significant act, as was its location. The position of the marker pit in the gap between the first pair of load-bearing timbers encountered after entering the building would have meant that people would have had to pass over or around the deposition in order to proceed to the large central space. This group of stone tools, laden with symbolic connotations, provided a threshold that was also layered with symbolism due to its position between a constricted space and an open one – in essence - a liminal boundary.

After the establishment of the marker pits, the erection of three sets of large load-bearing posts enabled their pits/postholes to include elements of material culture. Whether these were simply the discarded remains from tool knapping, broken pieces of pottery and hearth sweepings or objects of greater value, is a moot point. The pattern of deposition is repeated from feature to feature, warranting further discussion. Five of the six pits each contained rim sherds, or parts of a pottery vessel and at least one piece of quartz, and four of the pits had hazel nuts or cereal grains, and in one case both. The latter also had a rare crab apple pip together with cereal grains and hazel nuts, suggesting if not deposition/ backfilling in autumn, when the products of harvest gathering were used as backfilling material. The sixth pit contained a piece of flint and a quartzite end-scraper in its fill. The fill of the trench for the south-western gable contained no environmental evidence but instead it had a piece of pitchstone, one of agate, one of flint, together with a flint scraper and a bipolar core. The evidence from this building indicates that either primary production of lithics took place there, or that residual material was included in the backfilling material of the pits/postholes. However, the presence of pitchstone is unusual, and according to Ballin (see PART 5: *Lithic artefacts* and also Ballin 2009a, 72-73) it denotes deliberate deposition, as it was a highly valued exotic material. The cultural material from these features indicates that some acts of structured ritual took place, combined with the accidental inclusion of residual or waste materials.

In the north gable of the Structure 8 large hall further material cultural evidence was present: a piece of pitchstone as well flints and quartz. One posthole, in the long southern wall of the building and close to its centre contained cereal grains and a flint scale-flaked knife - a valued tool that was most likely used in harvesting the grain. Together they suggest a deliberate deposition. Another example was in the Structure 8s small timber hall where one interesting pit (already described) in its southern wall had a piece of pitchstone, pieces of quartz, the rim sherds of several vessels, cereal grains, hazel nutshells and two apple pips. A variation of this combination of materials was also noted in the structural pits in the centre of the Structure 13 hall where more cereal grains, hazel nutshells, a piece of agate and a flint leaf-shaped arrowhead were found. It is unlikely that the arrowhead was lost or discarded and therefore the implication is that this too was a deliberate deposit. Quartz fragments and pottery were also present in the building but mainly in and around the hearth. Some pits within the Warren Field timber hall were also considered to have structured deposits, with organic food-stuffs being prominent, but they also included evidence of material culture (Murray et al. 2009, 41).

The content of pit/posthole fills largely reflects what the community/communities were doing - holding social gatherings, collecting and sharing foodstuffs, bringing or making objects including those considered precious like pitchstone, as well as the carrying out of seasonal rituals.

The question of functions

Once the Structure 8 large hall was built, access to the spaces defined by the posts may have been different for some or all of the community depending on their uses. Analysis of the function of the Claish timber hall suggested that elements of the building were designed to allow access or to prevent it, and that therefore certain spaces were 'impenetrable' (Barclay et al. 2002, 104-106, Illus 25). Barclay defined up to seven separate areas in that building, which were similar in terms of space allocation to the Balbridie timber hall (Fairweather and Ralston 1993). Seven separate areas were also demarcated in Structure 8 by the load-bearing posts and the inner gable walls or partitions, while the smaller hall at Warren Field (Murray et al. 2009, Figure 21) had five and that at Lockerbie had either six or seven (Kirby 2011, Illus 4). However, we are not much wiser in terms of defining how those spaces were used due to the lack of occupation deposits. Topping explored the symmetry of Balbridie and its complexity of barriers and spaces and concluded that it might have been a regionally important 'cult house' (1996, 163-166). If this was the case with Balbridie, it may have been equally true of Claish, Warren Field, Lockerbie and also the Carnoustie timber halls.

The Structure 8s small timber hall cannot be considered in the same way due to its notably reduced size, but the marker pits from the large hall dictated its location and presumably its function. Its south-western half was an open area, but beyond the entranceway the northern part of the structure was almost enclosed, and it was here that the polished stone axe was located. Sheridan (PART 5: *Stone tools*) thought that the unused axehead could possibly be interpreted as a symbolic deposition, and certainly in comparison with the other ritual deposits positioned close by, it seems significant. Ancient Classical writers considered stone axes to have had magical powers, and they were collected as 'thunderbolts' to as late as the post-medieval period and used as a protection in buildings against lightning strikes (Merrifield 1987, 10-16). A stone axe found within the wall core of one of the late Neolithic buildings at Udal could suggest that the practice started even earlier (Ballin Smith 2018, 176-177). It is presumed that the Carnoustie polished stone axe was considered to be sacred or a special object, and as such its magic or power could have been considered 'dangerous' (see Merrifield 1987, 44). Careful burial in an enclosed and possibly dark part of the small building may have been the best way of ensuring that its power was safely contained.

Whether the Carnoustie timber halls were designed solely for special purposes, or were dwellings or both, cannot be answered with any degree of certainty. Perhaps as Topping suggests they should be considered as 'domestic ritual monuments' (1996, 163), a term which adds layers of complexity to their already perceived design. Given their origins and size, they obviously had special status. They were large enough for an extended community, but without the survival of their floors with artefacts there is little evidence to suggest what went on in them, and it is almost impossible to identify specific areas of use. The addition of a second timber hall, adds an extra complication to the possibilities, as it was designed with slight variations and perhaps was of slightly lesser quality and status than the large hall it was contemporary with. The surviving evidence suggests its function may have been more domestic due its large hearth and sparse to no ritual depositions but, as the adage indicates 'absence of evidence is not necessarily evidence of absence' (attributed to Sir Arthur Conan Doyle and Carl Sagan). The question arises, as to why there were two contemporary large timber halls. Was the community larger than anticipated or was there a functional separation between the two?

Associated with these questions is the replacement of the largest hall by a smaller version, but with enough symbolism and associations from the past attached to it that it appeared to carry on the ritual aspects of the large hall. Even though its construction was different, it appeared to have had high status and importance, perhaps as a small cult building. Does its structural downsizing, reflect a corresponding change in the size of its community, or does it reflect other changes in society and in the landscape during the latter part of the early Neolithic?

To some extent this can be explored by looking beyond the buildings to what was happening elsewhere within the excavated area at Carnoustie during the time of the timber halls, and especially in the areas at the southern limits of the raised beach. While the evidence of activities external to other timber halls in Scotland is generally sparse or non-existent, the pits and other features at Carnoustie are not unique in this matter, as there was a similar situation outside House 1 at Ballygalley in Co. Antrim, albeit the features there were of uncertain date (Simpson 1996b, 124-125). Distributed across the area in front of the Structure 8 large timber hall and to the south of the Structure 13 hall, but predominantly along the southern margins of the site, were a number of discrete groups of pits, with the occasional posthole, but with little to indicate the presence of any other permanent structures during the early Neolithic. However, from their radiocarbon date ranges (Table 2.4) it is unlikely that any of the groups of pits, and therefore the activities associated with them, were contemporary with the construction and use of the two large timber halls.

The picture is of two large timber buildings constructed and used in splendid isolation, until one of them was replaced by a much smaller structure. These important buildings probably had multiple functions predicated on bringing together people from different communities or the wider locale to share common rituals and traditions at specific times of the year. The details of their use are lost in the passage of time but curation of the structures was important in terms of maintaining their associated traditions. Only during the later use of the Structure 8s small hall was there evidence of people camping and gathering outside the building to carry on the seasonal round of activities.

Continuation of activities to the end of the Neolithic

The demise of the timber halls did not mean an end to the site or to people visiting it. The large number of groups of pits centred largely round single or multiple fire-pits, covers a long time period from the later part of the early Neolithic to the end of the late Neolithic (Tables 2.4-2-6). The number of pits suggests that some people remained mobile, but perhaps only at certain times of the year, when small groups of people continued the tradition of (food) gathering at the raised beach area where memories of the timber halls and their associated rituals may have been passed down the generations. Many of the pit groups were palimpsests of evidence of countless revisits that often yielded mixed assemblages of cultural evidence and radiocarbon dates of several different periods, including from the Bronze Age. To the north-east of the excavated area, at Newton Farm, similar clusters of prehistoric pits were found in 2004, many of them of early Neolithic date with Carinated Bowl pottery and lithics, indicating the popularity and significance of the raised beach during that and later periods for transit as well as for seasonal camps and rituals (White et al. 2009).

The surviving features at Carnoustie are interpreted as remains of short-lived domestic camps, some of which provided evidence of specific activities. In the southern corner of the excavated area the primary production of lithics, with possibly structured deposition of tools, took place during the early and later Neolithic at three separate groups of pits. Some well-made special pieces such, as a leaf-shaped arrowhead from ‘Structure’ 10 and a scale-flaked knife from ‘Structure’ 12 were found among the occupation debris surrounding and overlying pits and fire-pits. It is not known whether these items were ritually deposited in pits, or if repeated pit-digging disturbed the deposits of earlier knapping floors. A similar scenario occurred at Pit Group 6, where a piece of pitchstone was found in the fill of one fire-pit in an area where there was much knapping of quartz around other fire-pits. However, in Pit Group 13, and to a smaller extent in Pit Group 15, knapping of quartzite took place, and it is here that Ballin (see Part 5: *Lithic artefacts*) has suggested that the pit groups may have taken over some of the ritual activities associated with the timber hall in the structured deposition of lithics in particular.

Some of these pit groups produced evidence that wheat, barley and hazelnuts were eaten, and that several different pottery vessels were used, suggesting that pottery could have also been made there during the early to later Neolithic. However, some pits produced radiocarbon dates that were similar to the end use of the Structure 8s small timber hall (Pit Groups 3, 10, 11 and 17, and ‘Structure’ 12), from the end of the 37th century cal BC to the beginning of the 36th century), especially along the south-western edge of the excavated area, suggesting there may have been external activities related to the hall or its demise. Throughout the later Neolithic the activities of large social gatherings and ritual behaviour on this part of the raised beach appear to dissipate or move elsewhere. The large timber halls were no longer needed and it seems likely that there were changes in the ritual (religious) aspects of life and perhaps in society generally.

However, there is slight evidence to suggest that limited communal activities took place at the end of the early Neolithic due to the presence of two large fire-pits in Pit Group 6 on the south-eastern edge of the raised beach, facing the sea. Although shallow, one of these pits was in excess of 1.5 m in diameter and the other was double that size. The larger included fragments of pottery from vessels spread around the area of the pit group but also a fragment of burnt animal bone, while the smaller pit had no material evidence associated with it. These excessively large burnt areas, may have been the sites of bonfires for the bringing together people from the immediate area for feasting and ceremonies at a time of transition into the middle Neolithic.

The sporadic uses of the area continued during the middle Neolithic, some of which coincided with a final intrusion of activities in the northern part of the footprint of the Structure 8 large timber hall, with the later use of the hearth in Structure 13, and the erection of the Structure 13n oval building before the end of the 34th century cal BC. From then on there seems to have been a tailing off of activity across the excavated area to the end of the middle Neolithic at the beginning of the 31st century cal BC. Pit Groups 14 and 17, Area B and 'Structure' 12, indicate small concentrations of persistent activity along the southern margins of the site during this time, again in a domestic setting, but with the addition of isolated and rare activity along its north-eastern edge at Pit Groups 24 and 28.

Late Neolithic activity was more restricted in its distribution, and largely limited to 'Structure' 9 and Pit Groups 5, 13 and 15, from the evidence of radiocarbon dates and that of material culture. 'Structure' 9 was dominated by a large pit with an extensive area of deep burning around it. Charcoal from the pit provided a radiocarbon date range at the very end of the middle Neolithic and into the late Neolithic (Table 2.4), and therefore later than the large burnt areas noted above in Pit Group 6. Interpretations of this feature could imply that it was the site of bonfires or of a pottery kiln given the widespread burning around it, but there are no artefacts associated with it. The number of postholes, fire-pits and other pits around it, although not necessarily contemporary, indicates that it was a focus of some activity.

The knapping of quartz took place within 'Structure' 9 during this period, but Yorkshire flint, a better quality exotic material, had found its way to Carnoustie and was used at Pit Groups 5, 13 and 15 for tool making. The appearance of Yorkshire flint in the material cultural record suggests that long distance travel and exchange were ongoing; even if the popularity of some materials and areas had declined, others were established. Ballin (Part 5: *Lithic artefacts*), suggests that many of the tools created from this new raw material during this period were treasured personal items, as they were large and well-made compared to tools of earlier dates. Other pieces may have been used for hunting, such as possibly an oblique arrowhead found in Pit Group 13. This latter area also had extensive evidence for the knapping of quartzite, including the presence of a core and cobble pounders.

Use-wear analysis of some tools indicated that a range of other activities took place at these pit groups. Many of the tools examined were used for the processing of hides and possibly also cereals, and others were made for working wood, including a saw or sickle from Pit Group 5. The finding of these important, personal items in the fills of pits and fire-pits suggests that they were not simply discarded or dropped, but were deliberately deposited. The situation was similar, but with a different emphasis at Midmill in Kintore in Aberdeenshire (Ballin 2010), where blades, rather than tools, were deposited in pits during the late Neolithic. However the action of deliberately burying or leaving behind a useful tool is interpreted, there was a ritual aspect to it – an offering to gods, spirits or ancestors in a *quid pro quo* arrangement perhaps, as Ballin has suggested (Part 5: *Lithic artefacts*, discussion). The ritual aspects of life performed during the late Neolithic originated from those taking place in association with the earlier timber halls but they had undoubtedly adapted and changed over time.

Pit Group 13 was also important for providing the main evidence of late Neolithic Grooved Ware pottery: pots with applied decoration (V130 and V132), located in the fills of a fire-pit. These sherds were found together with other sherds of pottery from early and middle Neolithic vessels, as well as prepared clay, in addition to the knapping debris from quartzite (noted above), and possibly quartz. A number of sherds of another Grooved Ware vessel (V63) were also found distributed across the fills of two fire-pits with the remains of highly burnt animal bone within Pit Group

10. However, neither of these vessels was linked to a radiocarbon date. These examples indicate the different activities related to pit use, which happened not just once, but several times in some cases: continued use, redigging, emptying of some of their contents, reuse with reburning of materials already in the pit, and the final filling in, which could include cultural material emptied from other pits, and then weathering. The interpretation of their contents as structured deposition is not as straightforward as it sometimes might seem. Brophy has explored the wide-ranging contents of early Neolithic pits in Aberdeenshire from different points of view but suggests that in general they reflected varied community lifecycles (2016, 181 ff.). The life cycle aspect, whether community or individual, of the use of pits at Carnoustie was clearly prevalent during the whole of the Neolithic and later, but the giving back to the earth by burying objects, seeds, fruits etc. (ibid, 192-3), was clearly a deeply embedded practice in Neolithic communities. The late Neolithic evidence from Pit Groups 10 and 13 may add other nuances. The Grooved Ware vessels were heavy, thick walled, and although decorated, may not have been easily transportable. The burial of the pots in fire-pits for safe keeping and reuse on another visit may have been part of the tidying up processes before leaving the site – intentional actions that were neither disposal of rubbish, nor ritual deposition.

The later Neolithic pits at the site can be compared to those found at Newton Farm, to the immediate north-east but also on the raised beach, where two pits with up to six vessels of Grooved Ware pottery between them, but mixed with Bronze Age material, were located amongst clusters of pits predominantly dated to the early Neolithic (White et al. 2009, 17-19). The sparse number of later features identified at that site adds weight to the interpretation of the few remains of late Neolithic activities at Carnoustie as reflecting changes in society and perhaps also to a reduced number of people visiting the area. Throughout the Neolithic there was a move towards more permanent ways of life, with cultivation affecting the need for permanent domestic structures, but the groups of pits at Carnoustie tell a slightly different story - of the persistence of travel across the landscape by increasingly smaller numbers of people.

The early Bronze Age

Burials

For the first time, from about the 25th century BC or slightly later (2571 – 2348 cal BC), there is evidence within the excavated area of aspects of ritual that concerned the disposal of the dead (Table 2.7). The evidence predominantly comprises pottery vessels related to funerary customs, which were badly disturbed by later activities, but there is nevertheless sufficient remains to indicate that randomly distributed burials took place, and at a time when occupation of the area for domestic activities cannot be verified (Figure 7.15). The declining and intermittent use of the site during the latter part of the Neolithic suggests that it may have been uninhabited for some time, perhaps because of a depletion of the soils or the over-exploitation of the natural environment, with domestic settlement moving further along the raised beach.

One of the first burials included V152 (Figure 5.39), an early Continental Low Carinated Beaker. This type of vessel is one of the earliest Beaker vessels found in Scotland with dates between 2400 and 2200 BC, to as late as 2050 BC (Suddaby and Sheridan 2006). Other examples of this type of vessel have already been described from east and north-east Scotland (see Part 5: *The pottery*), suggesting strong influences from the Low Countries of Europe in terms of bringing in new customs and burial rites during this period. Like all the other burials within the excavated area, there was no formalisation or permanent arrangement of the actual grave. All the vessels, including their human remains (although these rarely survived), were deposited in simple pits in the ground with no cist or stone-lining. Fragments of two other Beaker vessels discovered include one dug into the middle of the early Neolithic timbered hall, Structure 13 (most likely a burial), and one in a fire-pit in Pit Group 15. Both these vessels were reduced to a small number of sherds due to later disturbances.

One of the most interesting possible burials is that of a fragmentary decorated urn V144 with a possible Food Vessel V146, from Pit Group 16 (Figure 5.49). The pottery was distributed across

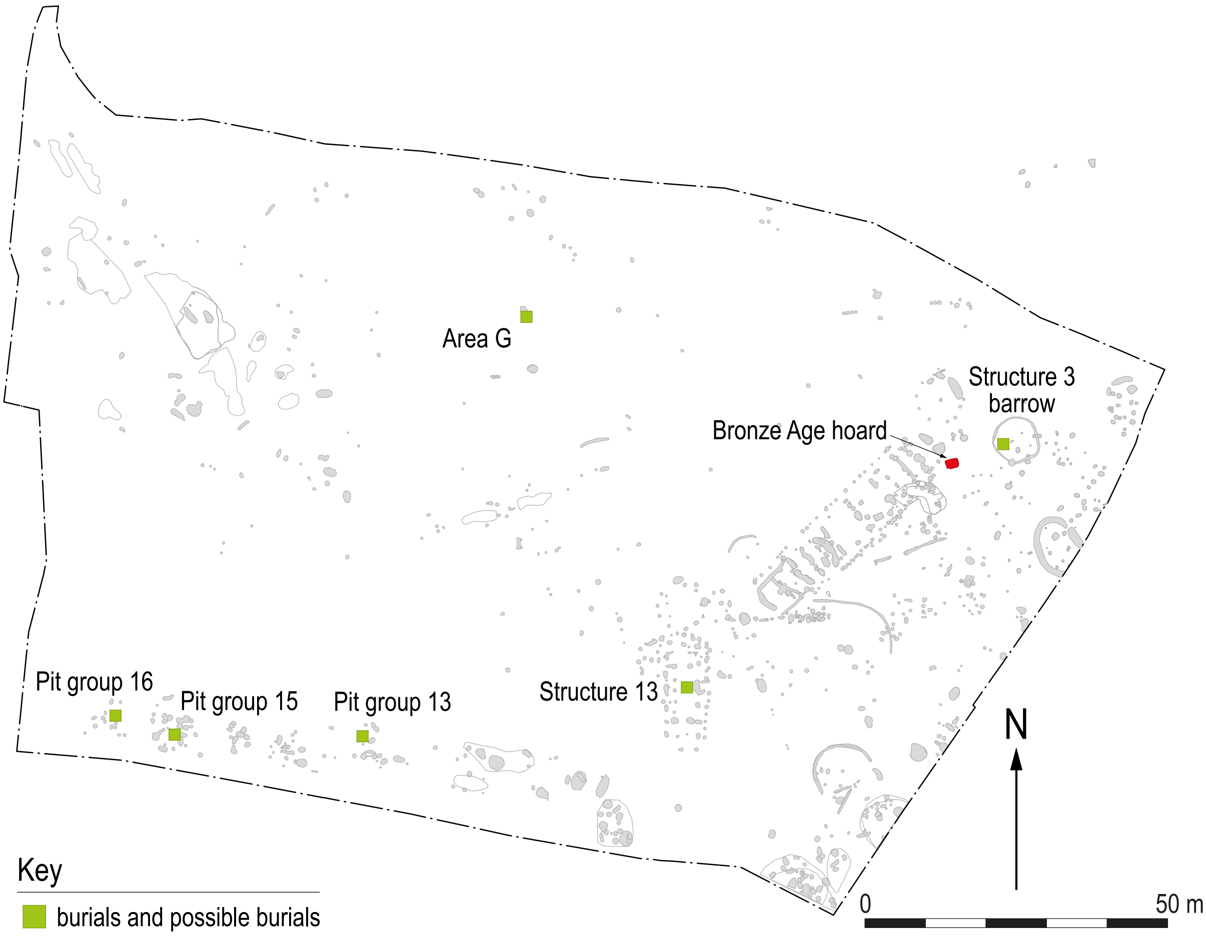


Figure 7.15: Location of early Bronze Age burials across the site.

two adjacent fire-pits indicating that later pit digging disrupted and scattered the contents of a grave, and that its vessels were broken up. Two slightly later burials are represented by plain urns that survived in poor condition from Pit Group 13 and also Structure 3, but no additional grave goods were found with them. Structure 3 is dominated by an irregular, narrow and shallow annular ditch 7.5 m in diameter that is superimposed over earlier features, including a fire-pit whose contents are dated to the later part of the early Neolithic. The fill of the ditch is dated from the beginning of the 13th to the beginning of the 11th century cal BC (Table 2.7) and it is suggested that it probably outlines an earthen barrow that was erected over the off-centre positioned burial with its late urn (Figure 7.15). The loss of the barrow is most likely due to the superimposition of medieval or later rig and furrow cultivation over part of the feature. In comparison with the Bronze Age houses excavated close by (see below), Structure 3 is very different in style from the buildings, even if its internal area is similar in size to some of them. The houses do not have annular narrow ditches, and its irregular shape, in conjunction with the lack of a coherent domestic pattern to its internal features, suggests that its function was different.

The distribution of the Bronze Age funerary pottery at Carnoustie was haphazard and random across the excavated area, indicating that there were no links to the past, and even the Beaker vessel dug into Structure 13 is likely to have been fortuitous. The isolated burials took place over a long time period, demonstrated by the different types of funerary vessels deposited in the grave pits. This situation was in contrast to another site, also on the same raised beach but a kilometre away to the west at Upper Victoria Link (Figure 7.1), where a small cemetery of eight cist burials with Beakers and other grave goods was excavated in 2019 (Watt 2019, 29). The location and conditions for preservation were obviously better there than at Carnoustie as organic objects survived. A small prehistoric annular ditch was also located at this site amongst other ring-groove structures considered to be domestic, but all were severely truncated.

In contrast to the Neolithic, where there were no burials within the excavated area, these funerary vessels tell us something about the treatment of the dead in the early Bronze Age. Burial in, or with, a pottery vessel in a pit in the ground was the common custom on this site as there was an absence of suitable stone in the immediate area for the construction of cists. The variation noted in the vessel styles shows that the local population was not only aware of changing customs, but used and adapted them to express their beliefs and cultural identities in the early Bronze Age.

Later Bronze Age domestic structures

Following on from the burials, the rare appearance of domestic pottery considered to be Bronze Age was found in occasional pit groups across the area, often mixed into earlier dated features. However, it was only at the transition of the middle to late Bronze Age, from the late 12th century cal BC that the area began to be occupied by domestic dwellings (Figure 7.16). This period of occupation was relatively short-lived, lasting only about three centuries to the beginning of the 9th century cal BC, but in that time frame seven definite buildings and one possible structure have been identified. These buildings were mainly concentrated towards the north-east corner of the excavated area, with one positioned where the Structure 8 large timber hall had been, and another partly overlay the north gable to the earlier Structure 13 timber hall and that of its oval building Structure 13n. Although some structures and features may have been contemporary, such as Structure 1 and Pit Group 1, in general it is likely that a structure was erected on a new plot when it replaced an older one that was no longer fit for purpose. In the later Bronze Age, the same building footprint was not reused. On this site it is most likely that a single farmhouse and perhaps an ancillary building, was rebuilt several times.

Figure 7.16: Location of Bronze Age round and oval houses, and the hoard.

There are similarities and differences between these buildings in shape and construction plan, and although there are radiocarbon dates from some of the structures, some only yielded one date, or the dates derived from the fills of shallow ditches, rather than pits or ground surfaces within the structures. Matching radiocarbon dates with structural forms to provide a sequence of construction for the buildings is difficult with so few dates. Also, the material cultural evidence does not help to discriminate between the form and the dates of structures. There is little except pottery and stone artefacts, and much of that is mixed with a general scatter of earlier material, mainly of early Neolithic date. There are two main building shapes: oval (Structures 1, 2 and Pit Group 1) and round (Structures 5, 6 and 14, with probably structures in Pit Group 3, and possibly Pit Group 7) (see Figure 7.17).

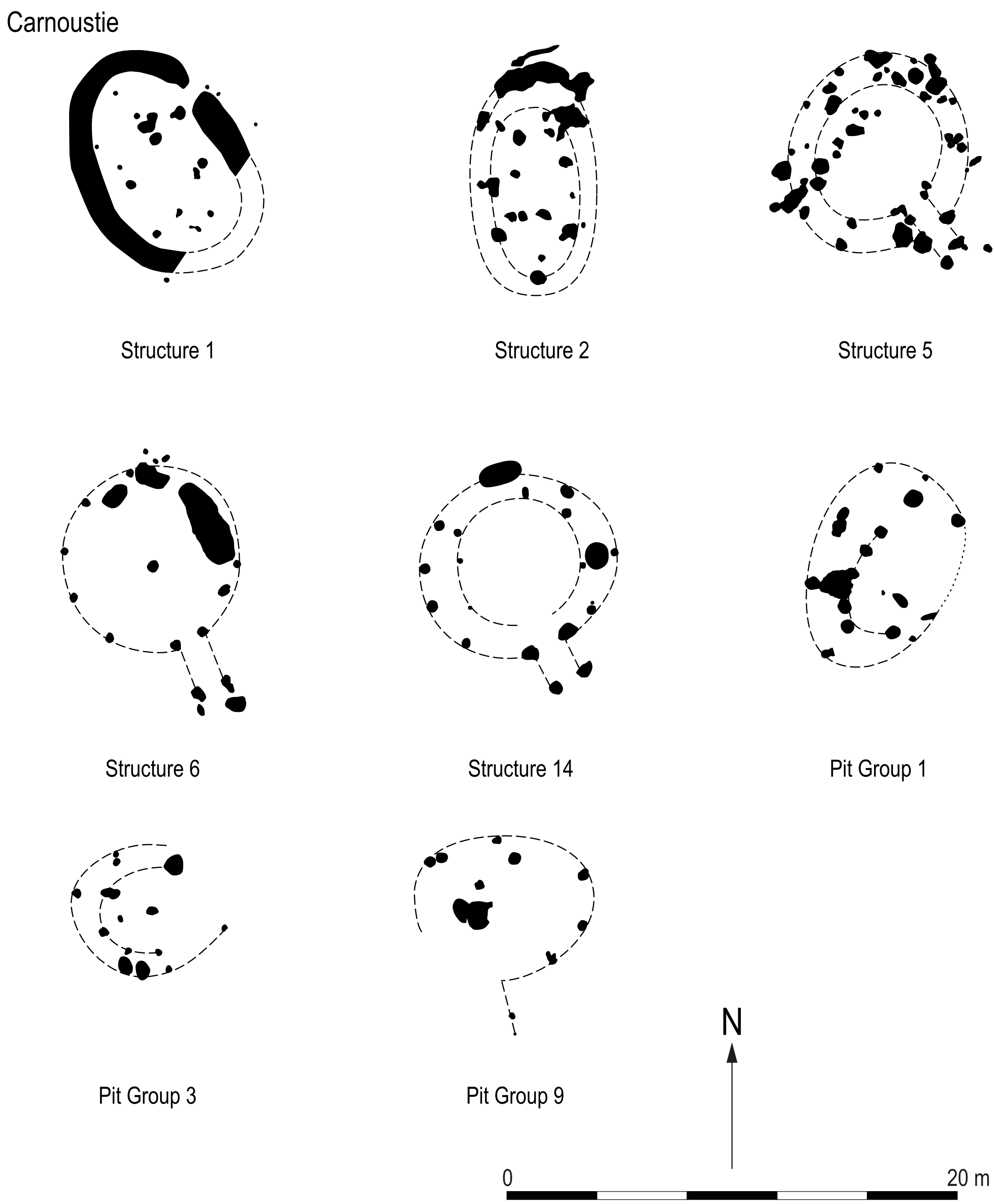


Figure 7.17: Comparison of late Bronze Age round and oval houses.

Oval buildings

Parts of Structures 1 and 2 and Pit Group 3 lay outside the excavated area and therefore their entire ground plans were not complete, although the area of their internal space is considered to be roughly the same. Structure 1 was defined by a penannular broad shallow ditch with an entrance in the north-east. Structure 2 had a segmented ditch but very little of it survived, and its entrance was not identified. Pit Group 3 did not have a ditch but, like the others, its internal space was outlined by posts. Structure 1 had a square arrangement of posts in the centre of the building to support the roof, as well as an outer ring of posts. Additional postholes were noticed in Structures 1 and 2 especially, but they were probably present in all of them to support weak timbers and to prolong the buildings' use. The timber used in these structures was varied but included oak, alder, birch, hazel and a little willow, and was probably the same species of wood burnt in their fire-pits.

The internal arrangement of each building included one or more fire-pits. The single fire-pit in Structure 1 lay close to the entrance; in Structure 2 there was a central fire-pit with another in its southern end. Pit Group 3 had five large pits in the centre of the building that were likely to have functioned as fire- and waste-pits, with the sherds of three contemporary pottery vessels distributed throughout their fills. In Structure 1, the remains of one pottery vessel were found in its fire-pit, and sherds of the same pot and another vessel were located in its surrounding ditch. The sherds of a single pottery vessel located in both fire-pits of Structure 2, were probably residual. Cereal grains were found in Structures 1 and 2 with hazel nutshell fragments in the former, but no archaeobotanical material of this type survived in Pit Group 3. Apart from pottery, none of the buildings had any other contemporary artefactual material present. Although lithics were associated with Structure 1, they were all residual pieces, including a late Neolithic triangular point in flint found in its ditch fill.

The function of these buildings is most likely domestic in spite of the paucity of material culture. However, micromorphology analysis of samples from Structure 1 indicated that there was a sequence of colluvium deposits overlying evidence of waterlogging that accumulated over faecal material, suggesting that the history of that building is likely to have included the stalling of animals. Structure 1 and Pit Group 3 seem to have been contemporary buildings with similar radiocarbon date ranges from the middle of the 11th to the beginning of the 10th century cal BC. Structure 2 is possibly earlier with date ranges from the end of the 12th to the beginning of the 10th century cal BC.

Roundhouses

The three late Bronze Age buildings with the best-preserved ground plans were Structures 5, 6 and 14, which were of similar diameter, c. 7.8 m internally. The internal outlines of these structures were clearly observed during the excavation by a ring of postholes, ten in the case of Structure 6 and eight for Structure 14, and all had entrances with porches facing south-east. Although an outer wall groove encircle the inner ring of posts did not survive, as for example at West Acres (Toolis 2005, 488), the location of the outer wall (posts with wattle and daub panels) of these buildings is indicated by the external postholes of their entrances (see Figure 7.17). The outer wall, running around the building from the outermost part of the entrance, may have effectively doubled or more than doubled the ground plan of the buildings and Structure 6, the largest roundhouse, may have had a diameter of c. 15 m. These were much more impressive structures than previously considered from the surviving excavated evidence.

The outline of Structure 14 was not entirely complete as large shallow pits were present in its northern arc where postholes would have been. This building also differed from Structure 6 in having an inner ring of six postholes, and an apparent fire-pit between the two post rings in the eastern arc of the building. However, this could have been a later, or even an earlier feature, or more likely the alteration, refurbishment or enlargement of the building at some stage during its lifespan.

The internal arrangement of Structure 6 appears simple but included a central fire-pit, the use of which was radiocarbon dated from the third quarter of the 14th century to the first half of the 12th century cal BC (Table 2.8). It also had an 'erosion' gully or large pit in the north-east quadrant, possibly from the stalling of animals, which contained sherds of an early Bronze Age vessel, and residual lithic material. A radiocarbon date of the early 13th century to the early 11th century cal BC came from organic material in the gully fill. Recent research on ditches or gullies within houses, usually identified in the north to north-eastern arcs (Lochrie in Ginnever and van Wessel 2019, 200) is considered to be the result of the mucking out of stalled animals, with the corresponding hollowing out of the floor level. Other pits noted in this building's northern arc could be earlier than the structure as one had the remains of the same early Bronze Age vessel and a corresponding early Bronze Age radiocarbon date range (Table 2.8). Structure 6 provided evidence of archaeobotanical remains, which included charcoal from alder, birch, hazel, cherry type trees, willow and oak, with a few cereal grains from the fire-pit and traces of hazel nutshells.

Although the surviving archaeological remains are slight from these three Buildings (Structures 5, 6 and 14) their impressive size indicates that they may have been houses for extended families, and possibly also for stalled animals during the winter months.

The Structure 5 roundhouse and the hoard

This building was of similar size to Structure 14, and with a similar ground plan. It comprised an inner and outer ring of posts, with an entrance and porch facing south-east. However, the survival of interior deposits indicated that it was considerably better preserved than the other roundhouses on the site. The double ring of posts and the extension to its entrance indicates that at some stage the building was rebuilt and enlarged.

The interpretation of this structure is more difficult than that of the other roundhouses as it was built over part of the north-eastern end of the large Structure 8 timber hall, and its construction not only contained a large number of residual features but artefacts from the early Neolithic. Not all its floor plan survived equally well, but enough was present to confirm its general construction, and the fact that many of its timbers were replaced or needed extra support. The main features that dominated the northern arc of the building were two superimposed floor deposits from which a variety of contemporary artefacts, as well as residual pieces, were found. These included stone pounders and polishers, a spindle whorl, part of a cannel coal bangle, pottery and quartzite lithic objects. The analysis of the latter defined quartzite as an important raw material, and the evidence for its use in this building for the manufacture of tools indicated it was probably a later Bronze Age workshop (see PART 5: *Stone artefacts*).

Multi-element analysis of the floors of Structure 5 revealed them to be high in phosphorous and barium, caused by anthropogenic enhancement, derived either from hearth areas (concentrated food preparation) or from animal penning (middening) (see Part 4: *Multi-element analysis*). The faecal material found in the Structure 1 oval house indicated that stalling of animals took place there, and the implication is that that they may also have been stalled in Structure 5 at some stage during the life of the building. However, the cultural material found within the floor deposits suggests that domestic activities, as well as tool making and other pursuits, took place in the northern arc of the building, where a number of smaller fire-pits were located.

The radiocarbon dates indicating the use of this building are from the floor deposits which range from the first quarter of the 12th century to the beginning of the 10th century cal BC, but an early Bronze Age date from one of the building's postholes was returned from what is considered to be residual material being included in its backfill. The dates suggest some overlap in use between this building and Structure 6. The high status cannel coal bangle fragment is late Bronze Age in date and suggestions of a link between it and the metalwork hoard found behind the north-eastern arc of this building have already been made by Sheridan (PART 5: *Stone artefacts*). The dating of the hoard (PART 6), using a piece of the hazel wood scabbard, produced a date range 1118 – 924 cal BC (SUERC-75019, GU45283), which overlapped with that of the use of Structure 5, 1118 – 931 cal BC (UBA-39283) from the first quarter of the 12th century to the end of the first quarter of the 10th century cal BC (Table 2.8), suggesting a convincing link to the acquiring of the metalwork and its burial in the ground behind Structure 5. There is no suggestion that the hoard was made in Structure 5 as there was no evidence of actual metalworking.

A number of objects indicate connections between the material culture of the Structure 5 and that of the hoard, such as the piece of woven textile (the presence of a spindle-whorl for yarn production suggests textiles were made in the building), the sheepskin that the hoard was wrapped in (possibly indicating that sheep formed part of the settlement's agricultural economy), and perhaps the manufacture of the hazel wood scabbard (use of local hazel wood), but these links are tenuous and the only suggestion of a local input into the wrapping of the hoard is its burial at Carnoustie. Questions remain as to how the hoard and also the bangle were acquired, why the hoard was buried behind the house - between it and the large Structure 6 roundhouse entrance, and what was special about this roundhouse and Structure 6 (if the latter were still in use) that their occupants came into possession of the objects of the hoard.

The presence of these high status and expensive exotic metal and stone objects at the location (see Discussion by Sheridan in PART 6: *Specialist study and analysis*) indicates that there was contact in the late Bronze Age with people bringing goods into the area from afar, and that there were extensive economic factors at play, where wealth, social rank, and to some extent fashion, were important to the inhabitants at Carnoustie, and also to those at Pyotdykes some 10 km away, where another similar hoard was found (see PART 6 and Figure 7.1). Sheridan has remarked that Tayside and Fife, in particular, are areas that are unusually productive in the occurrence of metal objects from this period, suggesting also that eastern Scotland was not only a wealthy area but that it was important for maintaining exchange networks and routeways that extended between the North Sea (to and from Scandinavia) and across the North Channel (to and from Ireland). Were it not for the hoard and the implied high status of its owner, the surviving evidence from Structure 5 suggests a more mundane story, of a building that during its life functioned as a domestic dwelling, as well as a workshop and possibly a byre.

Sheridan (Part 6: *Discussion*) comments that the Carnoustie hoard is unusual in that it was found on a dry-land site and was not a votive offering. Its close association with a late Bronze Age settlement is also rare. Macnaughton's Fort in Galloway has been mentioned above, in that it was recorded in the nineteenth century as the (dry-land) location of 'bronze' spearheads ornamented with gold on their sockets (Coles 1893, 112). The whereabouts of the spearheads, if they still exist, is not known, but in order to find out more about their findspot further work was undertaken in the 1960s by Scott-Elliot, Simpson and Coles (1966). Their conclusion was that the site was probably an enclosed or fortified farmstead with an outer ditch, a rampart, and an inner palisade trench. The middle Iron Age radiocarbon determination of c. 280 BC was from a mixed sample of charcoal from the fill of the palisade trench but the spearheads, most likely of late Bronze Age date were thought to have come from the ditch fill, indicating that the defences were earlier. Although there are many unknowns and uncertainties, Macnaughton's Fort provides some parallels with the Carnoustie hoard.

Other roundhouses

The partial remains of two additional roundhouses were also identified within the excavated area, Pit Group 3 to the north-east situated between Structure 3 (the barrow) and the oval house of Pit Group 1, and Pit Group 9 to the south-east of the Structure 14 roundhouse. Parts of these structures were removed by rig and furrow agriculture, but of the two, Pit Group 3 is the more convincing (Figure 7.17). The latter is slightly smaller in internal diameter at c. 6.5 m than the other roundhouses but it was built with an inner and outer ring of posts, possibly a central post as well, but its eastern arc and entranceway were not present. A large pit in its northern portion contained sherds of a late Bronze Age vessel as well as birch, heather type and willow charcoal, suggesting it could have been a fire- or waste-pit. Two pits in the south of the structure contained residual early/middle Neolithic material. The larger pit in the outer ring of posts returned a radiocarbon date of the first quarter of the 12th century to the middle of the 11th century cal BC (Table 2.8), and it contained alder charcoal and a grain of wheat. The fill of the smaller pit included a wheat grain and a possibly a fragment of seaweed, a unique occurrence on the site. Seaweed has traditionally been used for food for humans as well as animals, but more importantly as a fertiliser and possibly even for animal bedding. The presence of heather-type charcoal may suggest that turf was used as a roof covering for this structure.

The remaining possible roundhouse, Pit Group 9, survived as a northern and eastern arc of six postholes, with an additional two suggesting a possible entrance to the south east and was about the same size or a little larger than the Pit Group 3 roundhouse. A large off-centre pit may have been a fire-pit, but there were no finds from it and it remains undated.

The roundhouses, and to some extent also the oval ones, epitomise a break with the past and signify the changing fortunes of the raised beach, as it was again considered a valuable asset with people living and farming there. From its apparent abandonment towards the end of the Neolithic and its intermittent use for burial during the early Bronze Age, the establishment and visibility of a new timber building(s) with its conical roof on the more open landscape of the raised beach area, indicates that the surrounding landscape was under new ownership. Apart from rebuilding a house on a different plot within the same area there is the suggestion of permanence, of farming, most likely land management, and also economic stability.

Between 2001 and 2002, over 70 middle Bronze Age structures were excavated at Corrstown in Northern Ireland, which provides a good comparison for the establishment and use of the late Bronze Age buildings at Carnoustie. Although slightly earlier in date, and with middle Bronze Age material culture, the houses of this settlement usefully demonstrate similarities in form and size with both the oval and roundhouses of Carnoustie. Most of the structures at Corrstown had external segmented ditches, with paved or cobbled entrances and porches predominantly facing south-east. Some were constructed with a single ring of posts, but others had an inner and outer ring. Not all houses had a central hearth or any detectable hearths, whereas others had pits and internal divisions. Their life spans were estimated to be between 30 and 80 years, with evidence of rebuilding (Ginn and Rathbone 2012, 222). The Corrstown houses also included residual early Neolithic pottery, predominantly pottery of middle and late Bronze Age date, stone tools and a collection of metalworking moulds, even though there was no evidence of metalworking on the site, and cereal grains of mostly barley (ibid, Chapter 3).

In spite of the number of houses at Corrstown it was not possible for the excavators to distinguish any linear difference between oval(ish) houses and the roundhouses, and this too is a problem at Carnoustie because of the paucity of reliable dates. Although oval-shaped houses have been presented first in this discussion and the roundhouses second, because the latter shape becomes dominant during the Iron Age period, there is not sufficient evidence to suggest that one type of house pre-dates the other in an exclusive manner. Pope (2015, 177-178) in her analyses of Scottish roundhouses, from both upland and lowland regions, notes that from c. 1400 BC variation of the architectural plans of houses is common, but the circularity of buildings becomes dominant by the 12th century BC. At Carnoustie roundhouses are the dominant form and the size of buildings is fairly constant apart from that of Pit Group 3, which is smaller, whereas Pope suggests house diameters tended to increase over time. There is a suggestion that Structure 6 was the largest. However, apart from the two oval houses at Carnoustie with their ditches, all the roundhouses are seemingly without banks, ditches or traces of ring grooves, which are commonly noted elsewhere. The extended entrances to three of the roundhouses are the only evidence to indicate that the features demarcating their outer walls have been lost from the archaeological record, probably owing to plough truncation.

Roundhouses are more frequently identified in north-east and eastern Scotland, with some such as Culhawk Hill found at Kirriemuir in Angus dated to the Iron Age, even though it has many similarities with the Carnoustie buildings. Like its Bronze Age predecessors it had an internal ring of posts surrounded by a ditch, indicating that once established in the early to middle Bronze Age this house style continued in eastern Scotland, and elsewhere, into the Iron Age period. At Culhawk Hill, a spindle whorl as well as quartz and quartzite lithics were recovered but no pottery or metal objects (Rees 1998, 113), suggesting some of the material culture at this site could have been residual or that lithic artefacts carried on being important into the middle Iron Age. Other roundhouses, predominantly in Aberdeenshire, include the middle Bronze Age house at Deer's Den in, Kintore (Alexander 2000) and Bronze Age roundhouses excavated at the nearby Forest Road site at Kintore (Cook and Dunbar 2008, 89-110).

Recent work on the Aberdeen Western Peripheral Route, produced evidence of a number of roundhouses between the rivers Dee and Don (Nether Beanshill, Gairnhill and Chapel of Stoneywood), and at Wester Hatton north of the River Don. The middle Bronze Age (1550 – 1150 BC) roundhouse at Beanshill had an outer and inner ring of posts separated by a gully, a central hearth and an entranceway to the south-east. Its gully fills included small amounts of largely undiagnostic lithics and pottery, but with archaeobotanical evidence suggesting its roof was covered with heather thatching. Other middle Bronze Age roundhouses located at Gairnhill, Chapel of Stoneywood and Goval were all similar to that at Beanshill (Ginnever and van Wessel 2019, 144-9, 157, 174-178, Wessel 2019, 235-236). Six other roundhouses in a separate part of the Gairnhill area were all late Bronze Age, dating from 1150 to c. 800 BC, and suggest, like at Carnoustie, that there was deliberate relocation to a new plot once the old roundhouse had served its purpose. The majority of these buildings had a single ring of posts, except House 4 which had an inner and outer ring, but each had a narrow ditch or gully on the northern or eastern arc of the building, with predominantly south-east facing porches and entrances. Their diameters were between 6 m and 8 m and evidence of wattle panelling was found in the ditch of House 4. Plain pottery was found associated with most of the roundhouses with some flint and occasional stone artefacts (Ginnever and van Wessel 2019, 157-172, 184-189). It is also noted that additional post-built roundhouses with internal gullies and external ditches were found at Wester Hatton from the end of the early Bronze Age to the late Bronze Age (van Wessel and Wilson 2019, 266-276).

Further afield, at Lamb's Nursery, Dalkeith, Midlothian, there were up to three middle Bronze Age roundhouses, one with a thin external ditch and an internal ring of posts, a second with a post-ring, while the third may have had an external ditch. The best preserved, Structure B, had lithics and late Neolithic pottery, as well as some later prehistoric pottery, and a possible ritual deposit of human or animal bone in a pit in the centre of the building (Cook 2000). Of the two Bronze Age roundhouses from Colinhill in Strathaven in South Lanarkshire (Spence 2019), one had a ring ditch and internal ring of posts, while the other a post-ring. Both had entrances to the south-east and radiocarbon date ranges of the early 22nd century to the late 13th century (Structure A with the ring ditch) and the mid-14th century cal BC to just before the middle of the 12th century cal BC (Structure B). These buildings also contained a mixture of residual lithics in feature fills and deliberate deposits of contemporary and 'special' lithic material in postholes and the ring ditch (Ballin 2019b, 24-25), indicating that rituals and traditions of foundation deposits for the building were still carried out at this time. There was, however, little evidence (remaining) of structured deposits within any of the roundhouses at Carnoustie.

The comparison of some of the other roundhouses, especially in the north and north-east of Scotland, emphasises their variation in architecture and construction over time, with ditches or gullies and one or two rings of posts, as well as the orientation and length of the entrance. The roundhouses at Carnoustie were simple in their design, but the oval houses showed more variation, not just in floor plan but also in the addition of a ditch, whether penannular or segmented. In the late Bronze Age, the plan of the houses became entirely circular with one or possibly two rings of posts. With the present evidence it is difficult to determine whether these variations were due to refurbishment/rebuilding, the availability of suitable timber, or a result of the intended function of the structure. The evidence of possibly stalling of animals in some of the buildings could imply that these domestic houses also functioned as overwintering quarters for livestock and where people and animals co-existed.

The roundhouses demonstrate that the middle and later Bronze Ages were characterised by a sedentary lifestyle, where house plans were based on shared cultural values and lifeways. At Carnoustie there is little evidence of how rituals and customs were expressed by people living there compared to other areas, for example, at Cladh Hallan in South Uist, where the curation and burial of mummified ancestors was an important aspect of life in the roundhouses (Parker Pearson et al. 2021 116 ff). and where simpler but deliberate burials of ‘precious’ ancient artefacts in structural postholes at the Colinhill roundhouses took place (Spence 2019). The reliance on stone tools was very much in evidence at both Carnoustie and other settlements, where bronze tools were undoubtedly expensive and were not used for the mundane tasks of daily life. The acquiring of precious metal objects at both Corrstown and Carnoustie, although there was apparently no bronze working at either site, demonstrates changing aspirations of some members in society with the status and wealth, or implied wealth, this gave them.

Early medieval and later uses of the site

After the beginning of the early 9th century BC, indicated by an intrusive date from a pit in the structure of Pit Group 1, settlement activities appear to cease entirely within the excavated area for almost 1500 years until near the end of the 7th century AD. Numerous postholes in the outland and within the former settled areas suggest the erection of fences and boundaries, indicating that the area may have been entirely given over to cultivation or grazing. Some of the postholes in Pit Group 21, for example, were radiocarbon dated (Table 2.9) to indicate early medieval activity in the outland up to the end of the 10th century AD, where the digging of field boundaries or drainage ditches seems to have taken place (Figure 2.65). None of these features, however, produced any contemporary material culture.

Narrow straight or curved ditches noted in Areas G, J and N also suggest agricultural activities with drains or even field boundaries, with that in Area N incorporating residual early Neolithic material in its backfill (Table 2.9). The most complex of these later features was an undated D-shaped ditched enclosure (Structure 11), with apparent gateways in its ditch for stock management. Similar agricultural structures and other features, such as a corn-drying kiln, pits, a sub-rectangular enclosure and a linear ditch were also noted at Milltimber in Aberdeenshire and an early medieval curved gully with timbers at Goval also in Aberdeenshire (Dingwall et al. 2019, 78-81 and 240-41).

The only other later feature which produced late radiocarbon dates of the middle of the 8th century to the late 9th and the late 10th to middle of the 12th century cal AD is Structure 4, located close to the curved gully in Area N. It was the only stone-built feature within the entire excavated area, where stone was used to infill a shallow gully that had a posthole at either end. The stone and its accompanying organic debris were probably waste materials that included an upper rotary quern. The continuation of a fence-line to its west might suggest this was a gateway between two fields that had hollowed through use and needed infilling and levelling off. It was either preceded or succeeded by another fence line.

Many of these features were truncated by medieval rig and furrow cultivation, which made a significant impact on most of the major structures of the site. This form of agriculture was also noted at the nearby farm of Clayholes, which included a D-shaped enclosure (Suddaby and Anderson 2009), suggesting widespread landscape changes including the establishment of medieval farms and ownership of land.

Part 8: General Conclusions

By Beverley Ballin Smith

The changing patterns of life at Carnoustie

The earliest evidence of human use of the raised beach within the excavated area took place c. 8500 years ago in the middle of the late Mesolithic period. Hunter-gatherers camped at the site and left evidence of their visit. Over the next 2000 years there were further visits by hunter-gatherers but by about 4000 BC it may have become an established place for the gathering together of people, perhaps on a seasonal basis. We can only infer from the scattered evidence of knapped flint in the fills of pits and postholes from the first buildings on the site, that prior to their construction domestic activities took place across the area.

The recognition of the prior use of the site, together with the possibility of the meeting of routeways through the landscape, as well as its local resources, meant that it was the ideal place for something totally unfamiliar and revolutionary to happen in the early Neolithic. Developments were beginning to change the traditional way of life, with relatively large sedentary farming communities replacing small mobile hunter and gatherer groups, and this involved the construction of a permanent structure of a special nature. It was not a small building, as might have been expected, but instead its size was phenomenal. Its presence made an immense statement of power, achievement and monumentality. Currently we do not fully understand the social and other changes that took place: the *landnam* - the clearance of the forest and the claiming of land, the purpose and design of the large timber hall, and the role that superstition and religion played in peoples' lives.

In her introduction to the 1970 edition of her book *The Neolithic Revolution,* Sonja Coles reflected

> *"there is no doubt that the Neolithic was a 'revolution' in man's way of life, it has been suggested that the word 'evolution' is more appropriate since the transformation was so gradual.'*

The erection of a monumental timber hall (twice the size of a modern detached house), was an astonishing achievement, revolutionary in its concept. There was no evidence to suggest a gradual transformation or evolution of structures on the excavated area prior to its construction, as there had been no permanent building preceding it. To the people that made it happen and used the building, it must have been magical and almost otherworldly. The magical aspects of the building were there from the beginning, from the controlled laying out of its ground plan and the construction of its massive frame. Some special items were deposited in its foundations, indicating that superstition and belief systems were in operation. These systems imply that they were developing along with the construction of permanent buildings and indicate that the complexities of life and society were also slowly evolving.

The construction of the second timber hall adjacent to the first, with its seemingly more domestic attributes, suggests that communal gatherings may have been large, and the halls were in demand for a long period as the changes to the second hall attest. Over time the buildings fell into disrepair and a new, much smaller timber hall was constructed within the foundations of the largest hall. The downsizing to a timber hall in miniature suggests changes, not just in society but in beliefs and traditions. The small hall is viewed as an attempt to carry on the old customs but to increasingly smaller social gatherings.

The construction of the timber halls further opened up the landscape to subsistence agriculture that extended across the raised beach beyond the excavated area, and new farming communities became established that are likely to have had their own traditions. The social systems which led to the construction of the timber halls changed over time, and the focus of large communal gatherings moved away to other places and to other types of monuments.

The evidence indicates that the attributes of the raised beach in the excavated area at Carnoustie, along with perhaps memories or stories of the location of the timber halls, persisted as an enticement for people during the latter part of the early Neolithic to the end of the late Neolithic around 2500 BC. Short-lived or semi-permanent domestic settlements occupied areas towards the edges of the excavated area, and avoided the footprints of the earlier timber halls. It seems likely that groups of people, or families, returned to the same spot time and time again, leaving behind their discarded refuse and infilled fire-pits. The impression of the evidence is that over the centuries fewer and fewer people returned to the site, and eventually abandoned it.

From the end of the late Neolithic until c. 2200 BC, the early Bronze Age, there was a hiatus in the archaeological record, suggesting that the land was turned over to grazing animals rather than cultivation. The next events, however, are not of settlement or even agriculture, but of activities associated with the burial of individuals – the first graves. At this time there was a gradual change in the wider society, most noticed in the treatment of the dead. A small number of isolated burials identified on the site with Beaker pottery, and later cremated remains in larger urns, demonstrated the variety of burial customs and traditions that had become established in society, accompanied by changes in pottery styles and vessel function. However, these few burials did not translate to resettlement of the area.

Another few centuries passed from the early Bronze Age into the middle Bronze Age, before the excavated area became occupied by permanent settlers. Around 1380 BC, a domestic timber building oval in shape, most likely a single farmhouse, and perhaps with an ancillary building, was constructed towards the north-eastern edge of the site. It is important because it demonstrates a significant change from that of the early Neolithic buildings, not just in function, but in the variety of designs that followed in subsequent structures. This structure was replaced several times, with each new building constructed on a new plot of land. Although there is no certain sequence in the shape of these buildings they tended to become increasingly round towards the end of the Bronze Age.

The most informative of these roundhouse dwellings, Structure 5, was erected over the foundations of the largest timber hall, an act that implied that the memories of the past use and traditions of the site had been lost. Over the course of its lifespan, this roundhouse became a workshop and also a byre indicating not just the domestic and agricultural lifestyle of its inhabitants but also the repurposing of the building. However, its interpretation of function is made more complex by the burial of a hoard of precious weapons and jewellery behind the building during its use. Without these valuable objects, there was little in the archaeological remains of this roundhouse to indicate a high-status household. The prestigious metalwork, made from materials originating outwith the region, suggest that their owner was both wealthy and powerful, and was likely regarded as having status and influence by others. This typifies a significant change in society, along with the burials, from the community aspects of life in the early Neolithic, to one in the Bronze Age where (some) individuals were considered different from others.

After the ninth century BC the archaeological record again becomes silent, with no further evidence for activities within the excavated area for almost a thousand years. The next evidence of use was of agricultural activity from the early medieval period. The features that remained from this later period were widely dispersed over the areas of prehistoric buildings and activities, but there is no indication of a contemporary farmhouse at the location. The excavated area was eventually turned over completely to rig and furrow cultivation until the land was enclosed for modern-day fields. Landownership is difficult to trace back in time, but the present day Clayholes Farm, or what was Newton Farm, incorporated the excavated area into their landholding, until it became detached for educational purposes. The cycle of land use is ever changing, but the evidence from Carnoustie indicates a story going back in time to the beginnings of agriculture and permanent buildings in Scotland.

Part 9: Afterword

Answering the research questions

By Beverley Ballin Smith

Throughout the compilation of this volume the research questions listed in PART 1 were always to the fore. We explored the conditions present on the site at the start of the archaeological investigation and how those affected the survival, not just of artefacts, but also of environmental samples. The archaeological record is depleted, but both geology and soils had a part to play as well as later land uses in what survived and what did not.

It was clear from the start of our investigations there were identifiable patterns of settlement and buildings, but they were far from simple to understand. The teasing out of the history of overlapping structures and features has needed radiocarbon dates to suggest a chronology over time and space, but also the evidence and dating of artefacts, and input from archaeobotany. By looking at the different aspects of structures supplemented by archaeobotanical evidence, geology and an understanding of the landscape, it has been possible to look at the broad environmental changes over time. These have included the opening up of the wildwood, the regeneration of shrubs, land abandonment and historic farming. Some of the processes involved have been natural and others man-made, but they have demonstrated the inter-relation of humans and land, and that those changes are never static. Although some cereal grains survived on the site, the other aspects of the agricultural economy – the bones of cattle, sheep and other domestic animals, were largely lost. We do not have a good picture of the role domestic animals played in the economy of the site, although through the scientific analysis of soils in some buildings, the stalling of animals during the late Bronze Age is likely to have taken place, but whether they were cattle or sheep, or both, can only be guesswork.

The material culture of the site – the pottery, lithics, stone objects and the late Bronze Age hoard produced a wealth of information about locally manufactured products and those items that came from elsewhere. The changes to pottery and lithics over time produced the over-arching impression that the peoples of Carnoustie were well aware of current trends and new fashions, new raw materials in the case of lithics, and stylistic influences from across the wider region. The pottery showed inventiveness and experimentation with a division between domestic and ritual (burial) pottery becoming apparent during the early Bronze Age. The only other objects that had a clear social role were largely those that came from outside the region – an axehead from the Highlands, pitchstone from Arran, flint from the Yorkshire area, a cannel coal bangle possibly from Fife, but more importantly the late Bronze Age metalwork hoard manufactured from materials originating from far afield. The latter linked the North Sea area with Ireland through Angus, Fife and Tayside, demonstrating exchange networks that crossed the country. The late Bronze Age roundhouse at Carnoustie was well positioned with regard to these networks and the acquiring of the hoard gave status and prestige to its owner, and through the owner to the settlement.

Throughout the story of this small part of Carnoustie the links with other areas such as north-east Scotland, the Island of Arran, England and the Low Countries of Europe were important for the establishment and survival of the site, and the innovations that took place there. The story that has emerged from the excavated area demonstrates that we are never far from a past that can take us back some 8000 years or more.

Carnoustie has been an exceptionally interesting site. What we have learnt of the human past in this area is due to modern development. The disturbance of the landscape at this time and in this particular place has allowed us to tread in the footsteps of our long-distant predecessors.

Community involvement and outreach

By Warren Bailie

From the outset, there was a lot of interest in the archaeological excavation at Carnoustie, even before the discovery of the largest ever Neolithic Hall in Britain and Ireland, and before the hoard had been uncovered. This interest was from the local community, local councillors, Carnoustie High School and the press. The story about the discovery of the hoard was picked up by television, radio newspaper, magazine and online media across Scotland, the UK and as far afield as the USA, Canada and Spain. The site also featured on the BBC's *Digging for Britain* Series 6, a programme which showcases the most significant archaeological discoveries of the year. This is not surprising as it is not every day that one finds a gold decorated bronze spearhead wrapped in sheepskin and a bronze sword with a wooden and bronze scabbard wrapped in woollen cloth. These prehistoric organic materials are extremely rare, as are the Neolithic halls, so maximising the knowledge we could extract from the hoard, and the public benefit of the project was a crucial part of our approach (Figure 9.1). Indeed, communicating the results of our work to as wide an audience as possible accords with Scotland's Archaeology Strategy and is one of the key principles of GUARD Archaeology and.

As well as organising site open days and school visits, we provided work experience placements for two secondary school pupils interested in studying archaeology at university, and the project also provided an employment opportunity for a local early career archaeologist. Our interaction with local schools did not end with the excavation. As part of the ongoing post-excavation process, we also provided hands-on workshop sessions for Carnoustie High School students to illustrate and photograph various artefacts from the excavation.

The pupils' involvement in the project has been recognised by each of the participants receiving a *Heritage Hero Award Certificate* in association with Archaeology Scotland.

As part of the post-excavation programme, GUARD Archaeology commissioned Neil Burridge to create a replica hoard comprising a spear, sword, pin and scabbard. This replica hoard is currently displayed in Carnoustie Library along with two diorama reconstructions by Jim Conquer, also commissioned by GUARD Archaeology, representing the Neolithic and Bronze Age settlement activity discovered on the Balmachie Road development. An accompanying

popular booklet (Bailie et al. 2019) was produced by GUARD Archaeology with copies of this distributed to *AngusAlive*, local schools and societies with copies also provided to Angus Council and the council archaeologists, Claire Herbert and Bruce Mann.

Numerous lectures and presentations on the discoveries took place:

- Archaeological Research in Progress 2017 Conference, National Museums Scotland, Edinburgh, 27 May 2017
- Live Heritage Week Carnoustie, 4 September 2017
- Tayside and Fife Archaeology Conference 2017, University of Dundee, 4 November 2017
- Cumbernauld Historical Society, Cumbernauld, 15 November 2017
- First Millennia Studies Group, University of Edinburgh, 9 January 2018
- Renfrewshire Local History Forum, Paisley Museum, 8 March 2018
- Peeblesshire Archaeological Society, Peebles, 15 March 2018
- Carmyllie Heritage Society, Carmyllie, 20 March 2018
- Archaeological Research in Progress 2019 Conference, Royal Society of Edinburgh, 25 May 2019
- Carnoustie High School, 17 June 2019
- Chartered Institute for Archaeologists Workshop, Historic Environment Scotland, Edinburgh, 6 December 2019
- Friends of Carnoustie & District Heritage, Carnoustie, 19 February 2020
- Glasgow Archaeological Society, Glasgow, 22 October 2021

To make new knowledge about the site and its artefacts readily accessible, we maintained a blog throughout the ongoing post-excavation programme (http://guard-archaeology.co.uk/carnoustieHoard/). This enabled anyone to follow the progress of our work and the blog can also be used as a valuable learning resource long after the project has been completed, demonstrating the progress of an excavation all the way to publication and beyond. In order to continue to provide wider public benefit from the project, this GUARD Archaeology publication is freely available for anyone to download and read, from *Archaeology Reports Online* (https://www.archaeologyreportsonline.com).

The legacy of this project therefore lies, not simply with nationally significant discoveries and the findings from the extensive research and analysis undertaken by specialists from across Britain, but with the impact the project has had upon the local and wider community, encouraging and enhancing the interest of the Carnoustie community in the lives of their predecessors for many generations to come.

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