A Window on the Hidden Bronze Age Landscape of Caithness

Field Surveys and Excavations at Skaill

AOC 60084

AOC Archaeology Group

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Field Surveys and Excavations at Skaill

On Behalf of: **Castletown Heritage Society**
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SUMMARY

This report presents the results of programme of archaeological surveys and trial excavations undertaken by the Castletown Heritage Society with local volunteers and AOC Archaeology Group on the Bronze Age Landscape of Caithness. The project ran as a series of four week long field schools training volunteers in techniques of field survey, systematic soil sampling and targeted excavation. The project made use of an existing LiDAR data set centred on Baillie Hill to the southeast of Dounreay, Caithness. Excavations and a systematic soil survey were carried out at Skaill, NE of Baillie Hill, and demonstrated occupation and agricultural activity in both the earlier and middle Bronze Age.

INTRODUCTION

Throughout 2015 and 2016, Castletown Heritage Society and AOC Archaeology Group undertook a community-led archaeological research project exploring the hitherto undiscovered Bronze Age landscape in Caithness, in the north-east of Scotland. The project made use of existing LiDAR data and comprised a wide range of training, learning and outreach activities, including training workshops, field surveys and trial excavations and post excavation analysis. An outreach programme, including public talks, reconstruction and experimental workshops and schools engagement activities also accompanied the project.

LiDAR has transformed the way archaeologists approach the study of prehistoric settlement and agriculture. Bringing to light very slight features that are difficult to detect with the naked eye, aerial laser scanning allows archaeologists to identify areas of settlement, looking beyond individual structures or monuments to understand better the relationship between sites and their landscape.

This project aimed to develop integrated approaches to the study of archaeological sites in their landscape, training volunteers through a summer field school in techniques of field survey, systematic soil sampling and targeted excavation in order to arrive at a fuller understanding of daily life in the Bronze Age of Caithness. The project had the scope to be innovative and ground-breaking in terms of academic research, while simultaneously providing enthusiastic volunteers with unique opportunities to gain new skills in the interpretation of their heritage.

SITE DESCRIPTION AND BACKGROUND

The LiDAR data that forms the basis of the project was undertaken in the summer of 2011 as part of the archaeological mitigation for the windfarm at Baillie Hill. The LiDAR survey was intended as a means of mitigating against the visual impact of the windfarm construction on the archaeological landscape and to improve public access to and interpretation of the Hill of Shebster and Cnoc Freiceadain chambered cairns (see Cavers 2012).

The LiDAR survey cover an area of some 85 km^2, extending from Crosskirk in the east to Dounreay in the west on the northern coast of the Pentland Firth. Loch Calder forms the south western and Shurrey the south eastern extent of survey area. The LiDAR survey area covers a wide expanse of the landscape with a wide variety of land use and topography being recorded. The landscape of the survey area is typical of the general Caithness area, with wide expanses of fairly flat lower lying land with the low rounded hills of Stemser and Shebster hill rising to no more than 150m. The Forss water extends through the survey area flowing northwards out of Loch Shurrery, just to the south of the survey area. A wide range of land uses are recorded by the RCAHMS, including early prehistoric ritual and funerary landscapes, later prehistoric settlement and agriculture, medieval and post medieval agricultural landscapes, improved rectilinear fields and farms originating in the 1700's and more recent small holdings. Within the study area, there are large areas of modern forestry plantation especially in the area to the west of Loch Calder.

AIMS AND OBJECTIVES

The LiDAR survey revealed a spectacular range of unrecorded monuments across the study area. Although these were documented and recorded through the original LiDAR analysis in 2011, none were visited at that time in order to verify their authenticity.

One of the major contributions of the Baillie Hill LiDAR survey was to demonstrate how extensive the relict Bronze Age settlement agricultural landscape in inland Caithness was. Much of this archaeological resource was unrecorded prior to the survey, so that the further investigation of these remains had the potential to make a major contribution to knowledge of the Bronze Age in Caithness, a period far less well known than the preceding Neolithic or later Iron Age of the county.

A Window on the Hidden Bronze Age Landscape of Caithness therefore aimed to maximise the value of these new discoveries, by 'ground-truthing' the newly-discovered monuments and creating detailed records based on field observations. The project took the form of a training field school, whereby participants were given training in the identification of archaeological remains both in LiDAR data and in the field, and in the techniques of archaeological field survey.

METHODOLOGY

The fieldwork programme was undertaken as a series of four week-long fields school blocks, focussing on techniques of field survey, systematic soil sampling and targeted excavation in order to arrive at a fuller understanding of daily life in the Bronze Age of Caithness. Following completion of the field schools participants were encouraged to continue recording activities, developing skills learned during each week.

Week One: Understanding LiDAR and the archaeological landscape of Caithness

The first week of the summer school focussed on the use of LiDAR in archaeology, and on understanding the Baillie LiDAR dataset. Participants were introduced to the technology and how to work with it, before developing skills in the identification of archaeology. Classroom-based workshops focussed on the inspection of LiDAR using free software such as Google Earth, and on the use of online historic and mapping resources. Fieldwork in Week 1 built on the classroom work and covered:

- Using LiDAR in the field: how to work with LiDAR data on field tablets or other mobile devices, and how to work with printed, scaled maps to interpret archaeology
- Mapping archaeology, covering how to produce simple maps using GPS and other techniques to record archaeological sites in the field
- **‘**Ground truthing’ sites through LiDAR: exploring how features visible in LiDAR data relate to ‘lumps and bumps’ on the ground, and what these mean.

The walkover survey element of the project was carried out between 22nd and 27th June 2015 . All visited sites were recorded using mapping-grade GPS and an associated GIS feature set running on a ruggedised field tablet. In addition, a paper record was created using AOC Archaeology Group’s

standard recording pro-formas, each including a measured sketch. Digital photographs were taken of every site visited and an associated photographic register created.

Week Two: Mapping the Bronze Age

In the second week of the field school, participants on the project learned how to create accurate records of the sites they find in the field, creating detailed survey plans and maps. Training was given in a range of survey types, including manual taped offset and plane table survey, building up to hi-tech methods such as total station and GPS survey.

The topographic survey works were carried out between 13th and 18th July 2015. Detailed topographic survey of all visible features of the surveyed sites was undertaken using a Trimble R6 differential GPS using real-time corrections via the VRS Now Service and a Trimble S6 robotic total station, with the local site grid registered to OS using differential GPS. This was supplemented with hand drawn plans at an appropriate scale using plane table and tape and offset methods.

Week Three: Detecting and Recording the Bronze Age

In the third week of the field school, participants developed their landscape investigations further by planning sampling strategies that test theories about the nature and extent of prehistoric settlements. This stage of the field school introduced volunteers to the investigation stage of an archaeological research project, where information about the extent and character of archaeological sites is gathered.

Geophysical survey of three hut circles, identified and recorded in weeks 1 and 2, and their environs was undertaken at Skaill, north of Baillie Hill. A systematic sampling of the soils on and around the hut circle settlements was undertaken in order to establish the extent of the 'zone of influence', or the extent of modified soils around the settlement. Three trial trenches were excavated to investigate the potential survival of direct evidence for agriculture (i.e. ard marks in subsoil); to investigate the potential for survival of buried soils in sediment traps (e.g. adjacent to structures); and to confirm and clarify the identification of newly-recorded sites.

Geophysical Survey

Geophysical survey was undertaken at Skaill farm in Week 3 of the field school. Training was given in the operation of the geophysical survey equipment, and project participants undertook the survey under the supervision of AOC staff.

The technique used was fluxgate gradiometry, which measures variations in the earth's magnetic field caused by the presence of buried archaeological remains, soil and subsoil disturbances, heating and firing, and the presence of metallic objects. The survey was carried out using a Bartington Grad601-2 fluxgate gradiometer, working with typical reconnaissance survey resolution parameters, namely with a sample interval of 0.25m and a traverse interval of 1m; data was collected in a zig-zag pattern.

Data was downloaded and processed using Geoscan Geoplot 3, with minimal de-spiking and de-stripe corrections applied to the data. Greyscale plots were produced and overlain on the LiDAR data.

Excavations

In week 3, archaeological excavation works comprised three trenches, of which two were excavated across the upstanding remains of two hut circles while the third excavated lay in an area of potential prehistoric agriculture. The trenches were excavated by hand and all features and structures revealed were cleaned by hand before being recorded by digital photography, drawn to an appropriate scale and a written record produced using AOC *pro forma* context sheets.

Week Four: Uncovering the Bronze Age

The fourth week of the field school involved detailed exploration of a hut circle at Bailie Hill identified during the field survey programme through excavation. The aims of this block of fieldwork were to understand how the buried archaeology related to the features detected by LiDAR. Training for field school participants focussed on the techniques of archaeological excavation, finds recording and soil sampling, as well as recording excavations with context records, archaeological drawing and survey.

Excavations

The archaeological excavation works comprised the hand excavation of two trenches over opposing quadrants of an upstanding hut circle at Baillie Hill. The trenches were excavated by hand and all features and structures revealed were cleaned by hand before being recorded by digital photography, drawn to an appropriate scale and a written record produced using AOC *pro forma* context sheets.

RESULTS

Survey Results

A total of 52 sites were visited during the targeted walkover and topographic survey of the LiDAR study area. The most common site type recorded were hut circles, with 31 examples being recorded. Further sites recorded were cairns and cairn fields along with burnt mounds and boundary banks. It should be noted that the visited sites do not form a comprehensive record of the Bronze Age settlement archaeology identified within the study area but are rather a sample of sites, selected for a compromise between ease of access, estimated level of survival and suitability to the training aims of the project.

Several smaller regions within the study area were visited, comprising those areas with the densest concentrations of previously unrecorded monuments. These regions included the area around Broubster, Allt Torigil, Shebster, Achnabust and Lieurary (see Figure 2).

Broubster

Spread across the landscape at Broubster (Figures 3 & 4) a number of prehistoric remains sit within an area of post-medieval settlement and agriculture. The majority of the sites comprise a cluster of hut circles and a cairn field in an area of unimproved pasture to the north of the area. To the south of the hut circle cluster is an area of post-medieval settlement and agricultural remains centred on five farmsteads of Tornaheaten; Clachvol; Bualmore; Meindval and Claban (NMRS nos: ND06SW 118; 45; 120; 46 & 47) comprising buildings, kilns and enclosures with extensive areas of rig and furrow extending across the landscape. Some slight traces of the prehistoric landscape are however preserved below the later remains. These sites comprise the poorly preserved remnant s of possible hut circles (sites 20, 21, 23) overlain by later rig and furrow cultivation. South of the post-medieval

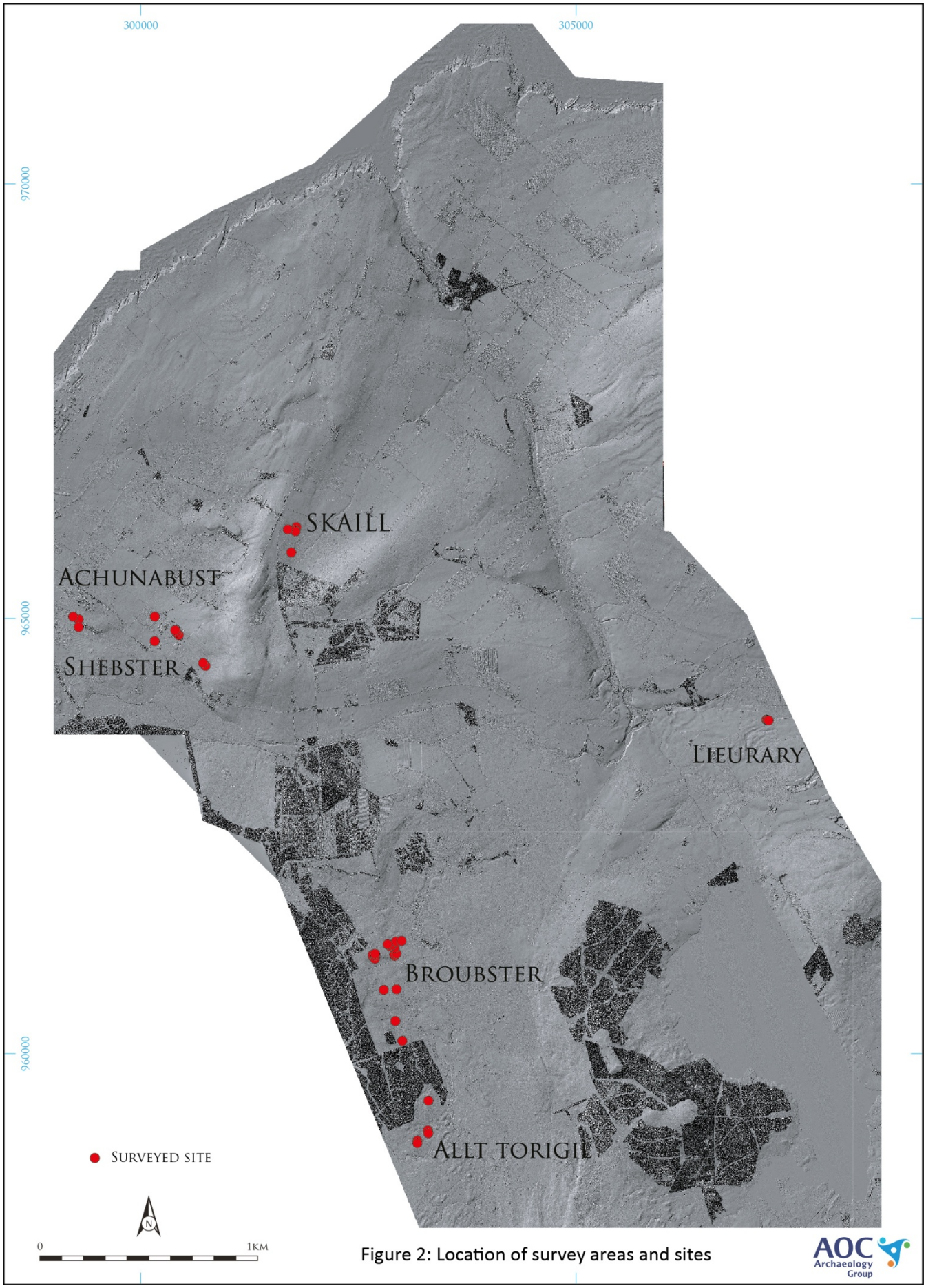


Figure 2: Location of survey areas and sites

Figure 3: The archaeological landscape at Broubster

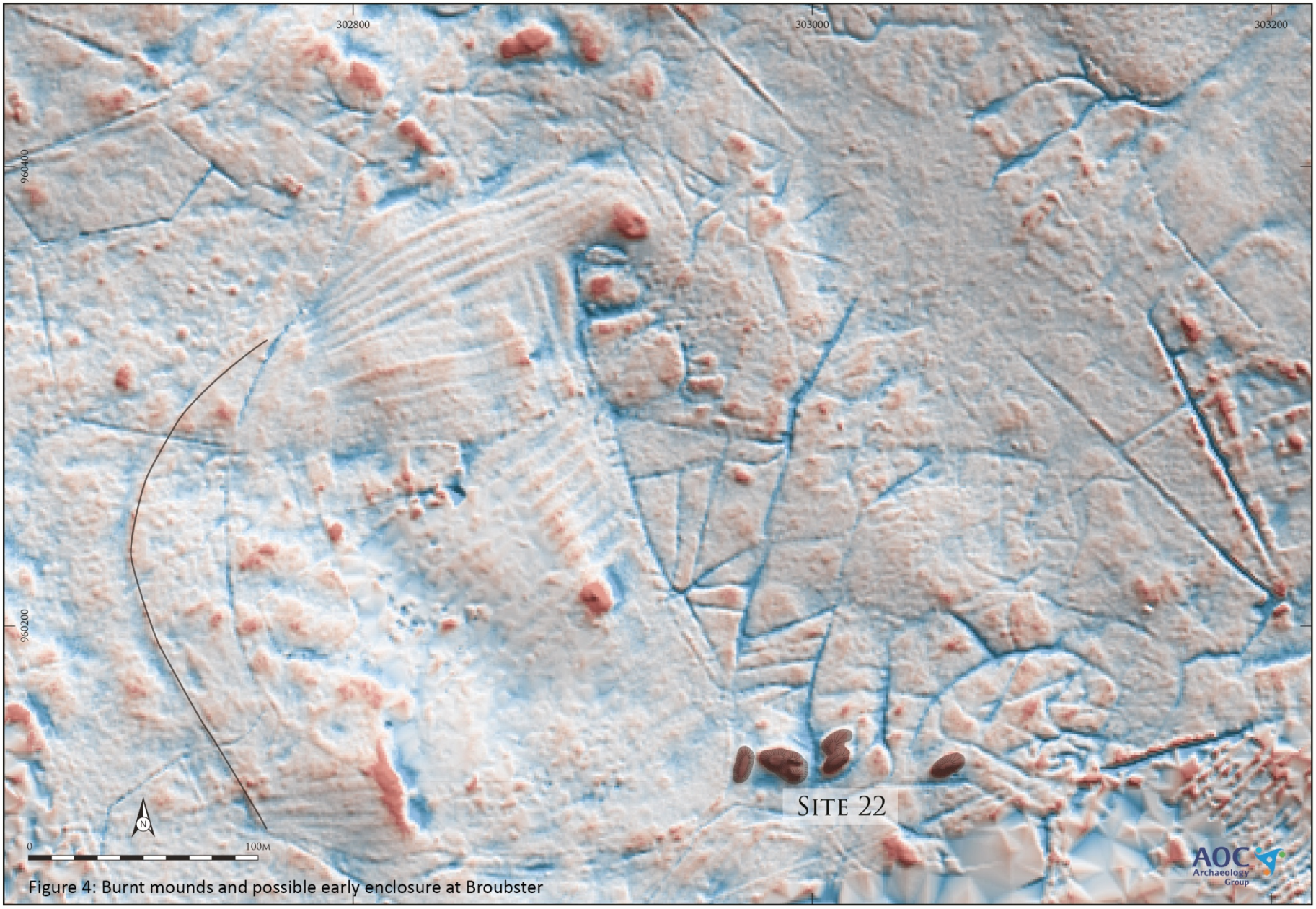


Figure 4: Burnt mounds and possible early enclosure at Broubster

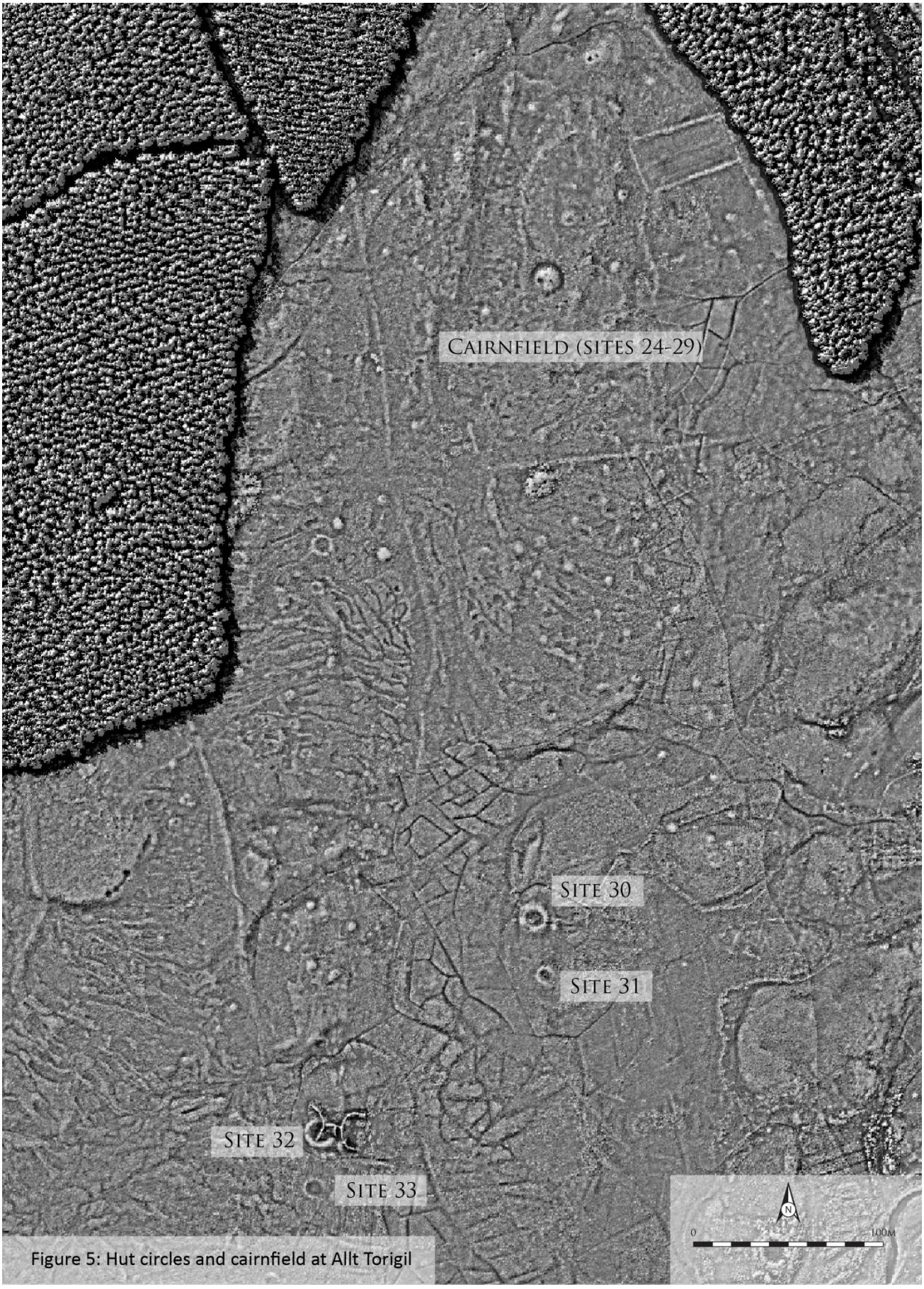


Figure 5: Hut circles and cairnfield at Allt Torigil

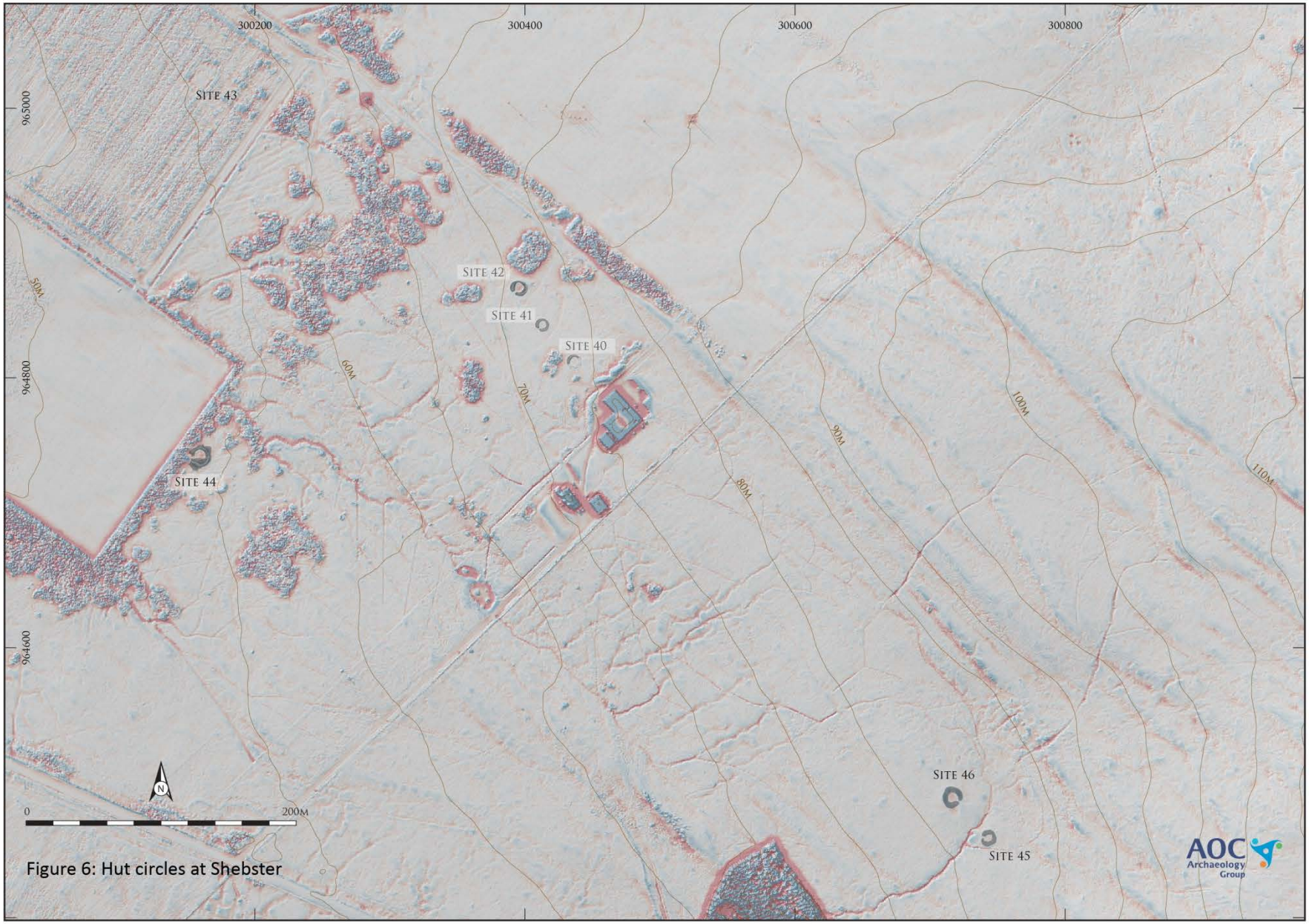


Figure 6: Hut circles at Shebster

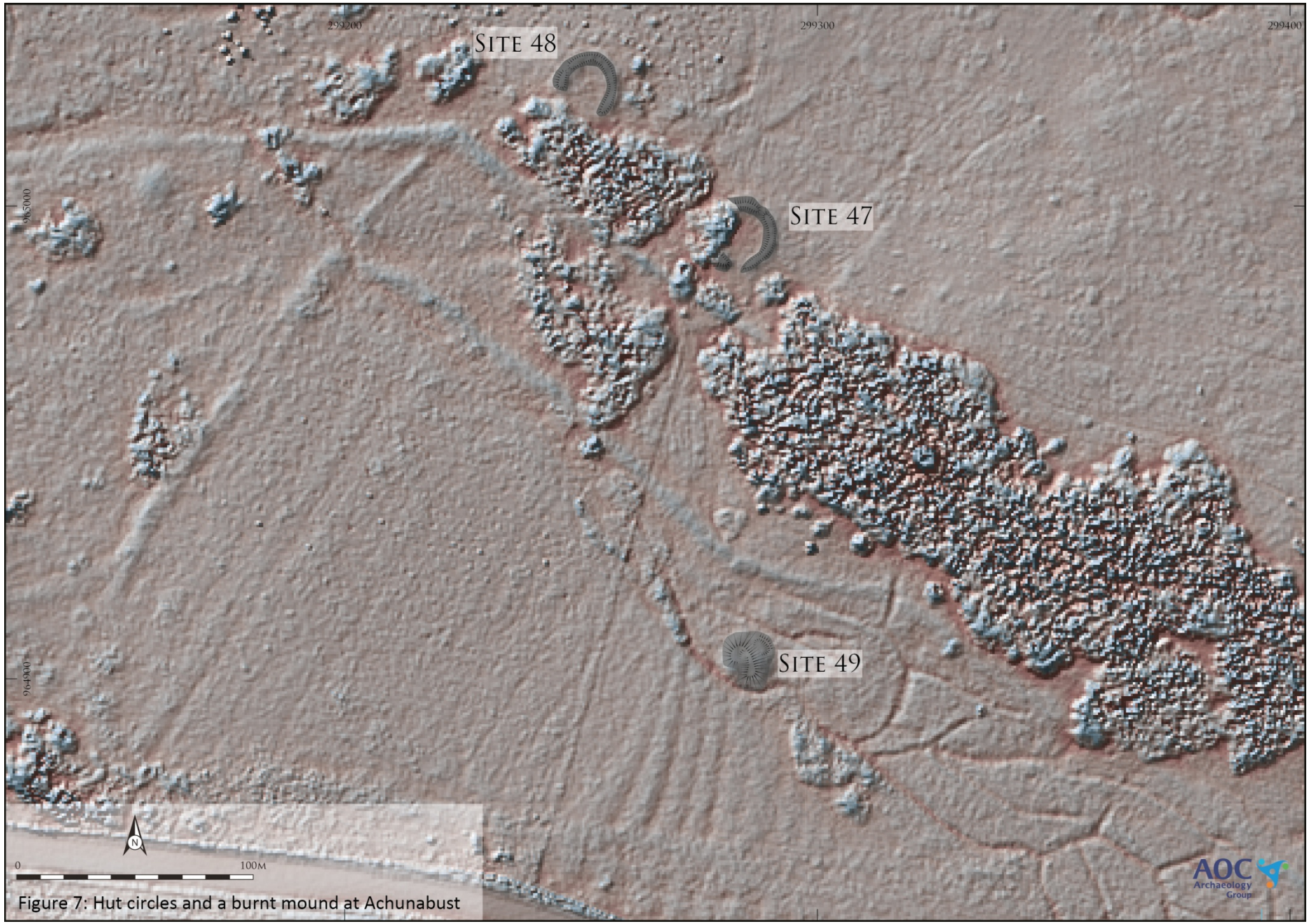


Figure 7: Hut circles and a burnt mound at Achunabust

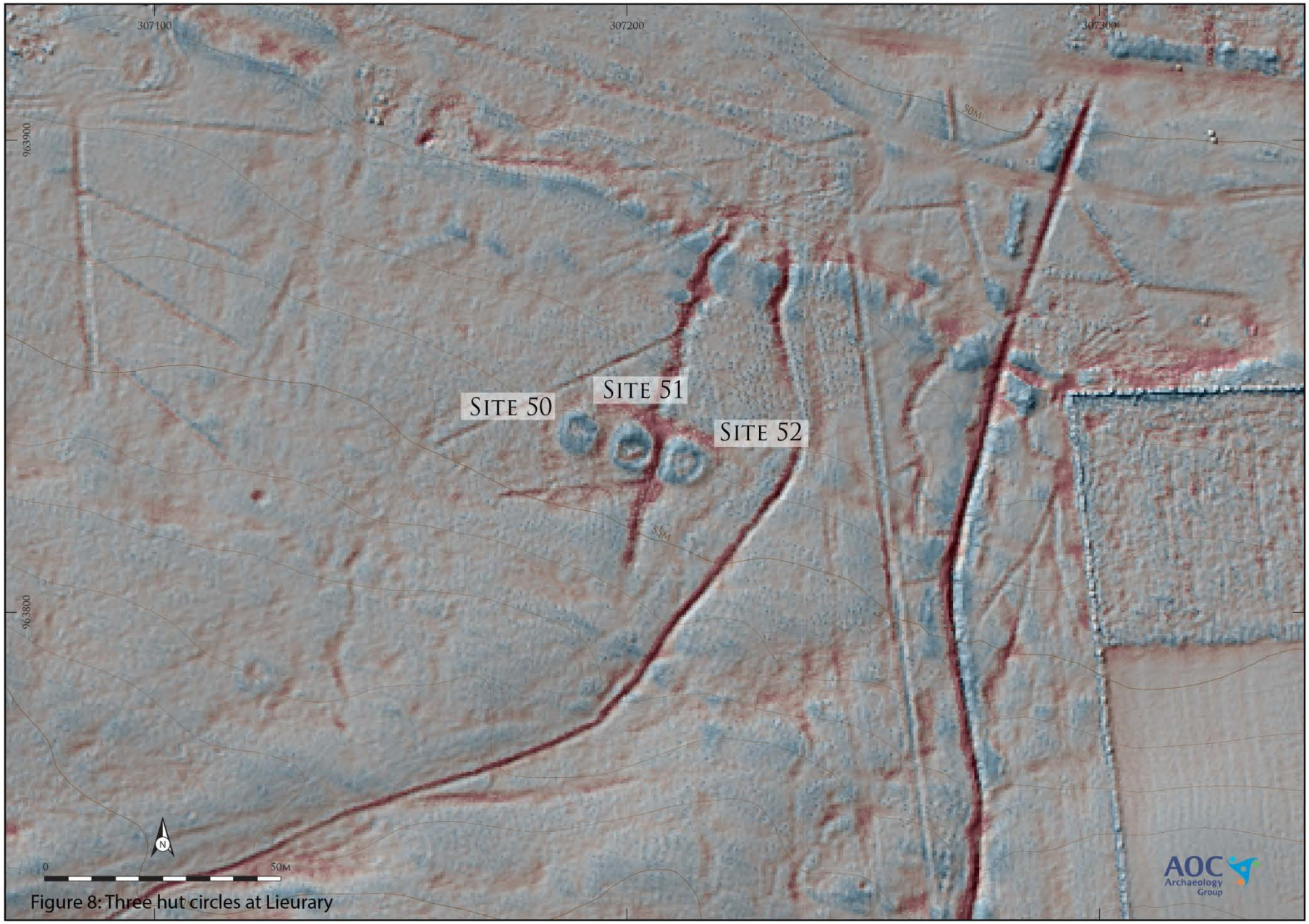


Figure 8: Three hut circles at Lieurary

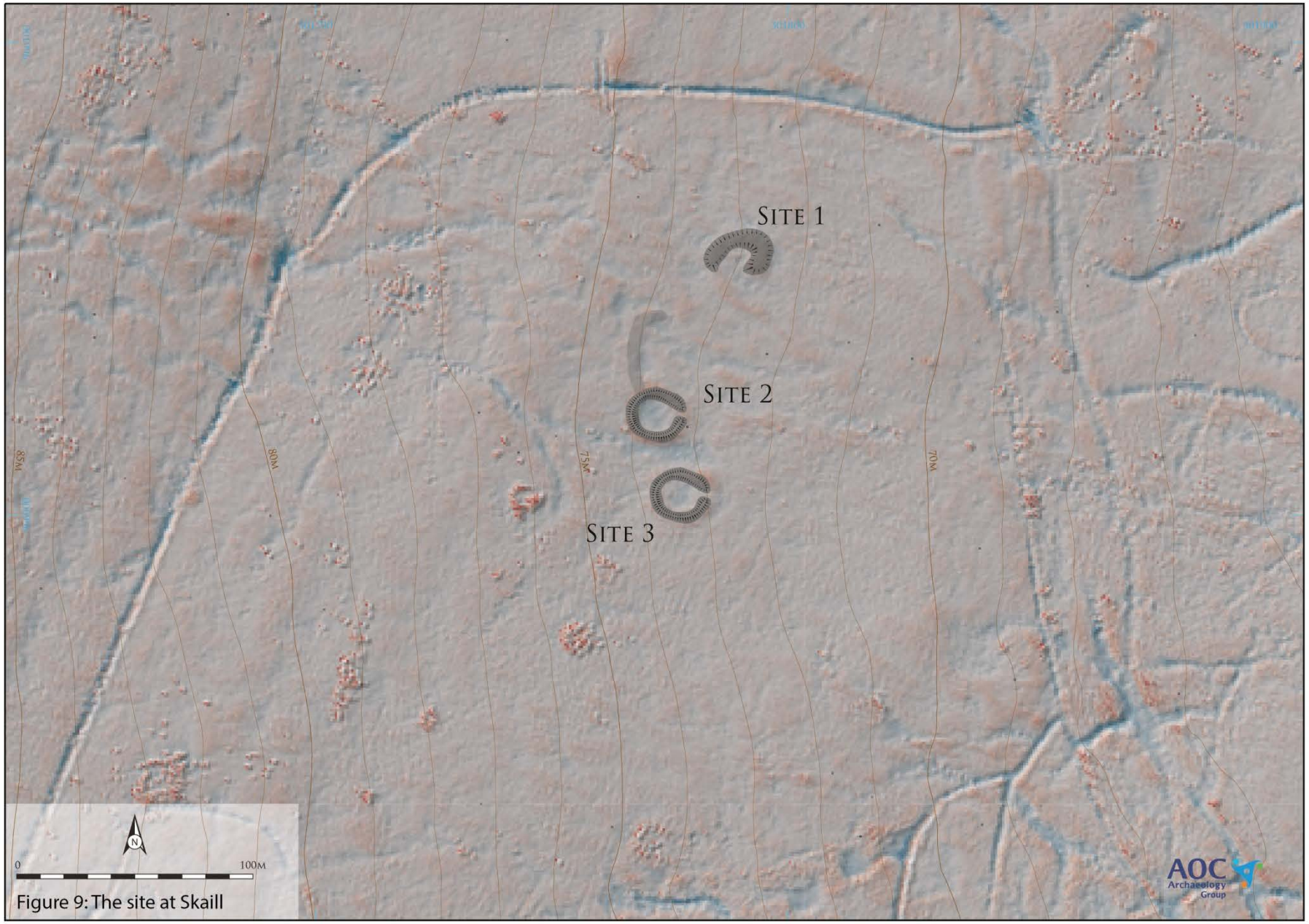


Figure 9: The site at Skaill

settlement lie four burnt mounds (site 22), along with a curvilinear enclosure that may be of earlier date than the mainly linear boundary banks associated with the post-medieval settlement.

Plate 1: Hut circle (site 12) at Broubster

The landscape at Broubster demonstrates the palimpsest of activity often revealed by LiDAR survey. The prehistoric landscape, represented by a scatter of hut circles, cairns and burnt mounds survives mainly around the fringes of post-medieval settlement and agricultural remains of farmsteads, enclosures and rig and furrow cultivation. The best preserved prehistoric remains lie on the more marginal unimproved pasture away from the focus of the post-medieval settlement. Within the core of the post-medieval settlement, traces of the prehistoric use of the area are attested by the fragmentary remains of hut circles and possible earlier enclosures. This pattern of preservation is typical for upland sites with prehistoric remains preserved on the more marginal land, often unimproved pasture, which has not been intensively utilised in later periods. The slight traces of prehistoric settlement preserved below the post-medieval settlement and agricultural remains demonstrate the widespread use of the landscape in the prehistoric period. These fragmentary remains may not have been identified without the use of the LiDAR survey as they are masked and hidden by the later remains.

Allt Torigil

To the south of Broubster, at the confluence of the Allt Torigil burn and the Forss Water (Figure 5) lie four hut circles (sites 30-33) and a cairnfield (sites 24-29) extending across an area some 700m by 400m. The prehistoric features lie in an area of umimproved hearther moorland with little evidence for later intensive agricultural activity. The use of the area as pasture in the post-medieval period is attested by the presence of a sheep fank overlying one of the hut circles (Site 32).

Plate 2: Surveying the sites at Shebster

Shebster

At least six hut circles lie on a slight terrace to the northwest and southeast of Brae House at Shebster (Figure 6). The sites lie in an area of unimproved pasture on a gentle southwest facing slope. To the northwest of Brae House three (sites 40 – 42) of the hut circles are evenly spaced along a slight terrace with the fourth (site 44) lying further downslope to the southwest. A possible hut circle (site 43) may have lain in the improved field to the northwest where the landowner reported that recent ploughing had brought stone to the surface. Continuing the linear arrangement of sites area two hut circles to the southeast of Brae House (sites 45 & 46).

Achunabust

Two hut circles and a burnt mound lie in an area of rig and furrow and enclosure banks at Achunabust to the east of Shebster (Figure 7). The hut circles (sites 47 & 48) are partially covered by gorse but are well preserved with in each case a well preserved ring bank 14m and 16m in diameter repectively. The burnt mound (site 49) lies immediatly to the north of a small stream channel, that was presumably its water source.

Plate 3: Recording the burnt mound (site 49) at Achunabust

Lieurary

Three well preserved hut circles (sites 50 – 52) lie close together on a gentle northeast facing slope at Lieurary (Figure 8). The hut circles are aligned NNW-SSW and the bank of the hut circle is almost abutting the next one along.

Surveys: Summary

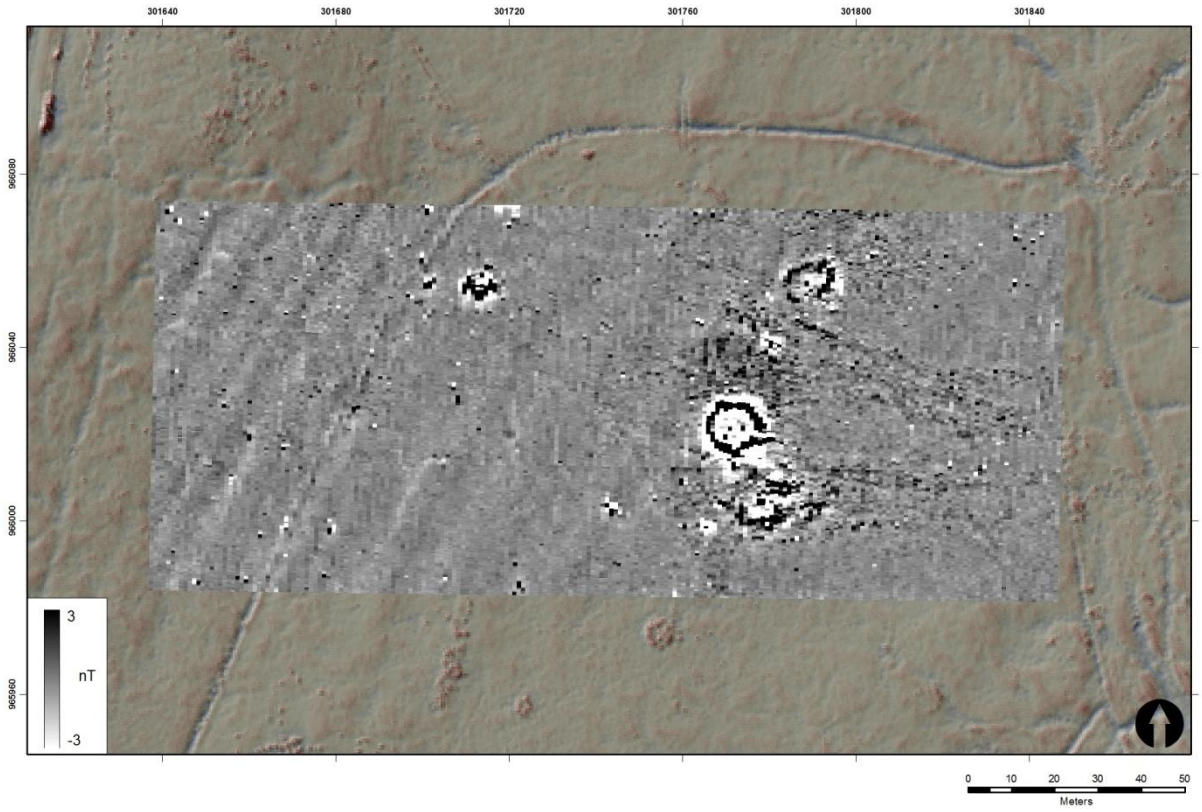
In total, 52 monuments were visited and surveyed as part of the project (see Appendix 1). This survey represents the first systematic collation of field evidence for hut-circles for an area of Caithness, and contributes greatly to our knowledge of the Bronze Age settlement landscape of the county. The recurrent patterns of survival, typically in the form of clusters of hut-circles located around the fringes of medieval and post-medieval ploughing. The complex of Bronze Age monuments of Broubster are particularly illustrative: upstanding remains are only obvious to the field surveyor in those areas outside the extents of later agriculture, although LiDAR demonstrates the survival of much earlier structures beneath historic ploughing and ridge and furrow.

EXCAVATIONS AT SKAILL

One typical cluster of structures, comprising at least two possible hut-circles either side of a relict stream bed, was located at Skaill, 500m NE of Baillie Hill. This site was selected for further investigation for a number of reasons. Firstly, the hut-circles there were apparently well preserved, with evidence for orthostatic wall facing and little sign of disturbance. Secondly, the buildings were very representative of the majority of hut-circles surveyed during the project, and offered the opportunity to characterise these sites in terms of structure, function and chronology. Thirdly, the possibility existed that a range of potentially Bronze Age features were present on the site, with a

possible burnt mound located to the north of two likely hut-circles. Finally, issues of practicality were relevant to the selection of Skaill for excavation: the project is grateful for the support of Mr and Mrs Cormack, owners of the site, for permission to carry out the work.

Five trenches were excavated. The first three of these were exploratory and aimed to characterise the possible burnt mound to the north of the site, the second hut circle to the south of the site, and to explore the potential for evidence of cultivation in the vicinity of the settlement. Trenches 4 and 5 were placed over the central and best-preserved hut circle, and were more extensive.



Geophysical results from the survey at Skaill

Geophysical Survey Results

The geophysical survey carried out prior to excavation indicated the presence of strong magnetic readings in and around all three structures at Skaill. The central building, structure 2, gives by far the strongest signals, indicating the presence of materials or deposits significantly affected by heat. Other features within the data are the presence of a disturbed area between structures 1 and 2, equating with the area thought to be a possible annex or enclosed yard adjoined to structure 2.

Trench 1

Trench 1 was excavated over the upstanding remains of a semi-circular bank, measuring 12.3m by 8.2m, surviving to a height of 0.2m and a spread of material measuring 3-4m. A central depression opened to the south of the site (Walkover survey site 1). This site was thought during the walkover survey to be a burnt mound, excavation of test pits for soil sampling across the site quickly revealed

that this was not the case and a larger trench was excavated across a stretch of the bank. Trench 1 measured 3.1m NE-SW by 1m.

Removal of a dark greyish brown humic silty clay topsoil (100), up to 0.15m thick from across trench 1 exposed a bank [101]. Bank [101] was composed of an inner [102] and outer [103] faces of flat slabs with an earth or turf core (104). Bank [101] was 1.4m wide from inner to outer face and survived up to 0.11m high. The inner face [102] comprised two flat slabs measuring up to 0.7m by 0.4m by 0.2m set on a NW-SE alignment. The outer face [103] comprised a single stone measuring 0.4m by 0.3m that projected out of the trench. The core of bank [101) was a mottled dark grey brown to dark orange brown sandy loam with iron panning on its upper interface with the topsoil above, this extended between the inner [102] and outer face [103]. Collapse or slumping deposits of silty clays were present to the interior (106) and exterior (105) of the bank, these were up to 0.09m thick.

Plate 4: Trench 1 post-excavation showing the inner facing stones [102] of the hut circle bank

Below collapse/ slumping deposit (106) in the interior of the structure was an occupation deposit (107) of compact dark grey silty clay containing charcoal flecks, this deposit abutted the inner facing stones [102] and was up to 0.05m thick. A radiocarbon date obtained from occupation deposit (107) gave a date range of 1507-1410calBC (Calibrated to 2σ, SUERC-65622; Table 1). Preserved below bank [101] was a buried ground surface (108) of mid grey brown silty clay with charcoal flecks, this deposit was up to 0.05m thick. The natural subsoil was a grey orange silty clay glacial till.

Trench 2

Trench 2 was excavated over the upstanding remains of a penannular bank set in rough grazing with mixed grasses, soft rush and gorse on gentle undulating SE facing slope, approximately 10m S of site 2. It measures 11.5m externally N-S and 12.2m E-W whilst the bank is approximately 1.3m wide and 0.25m in height with facing stones surviving in the NW quadrant. The entrance measured 1.2m wide and faces WSW. Trench 2 measured 3.5m NNE-SSW by 1m.

Removal of up to 0.12m of dark grey brown humic silty clay topsoil (200) from across the trench exposed an upstanding bank [201] 2.2m wide and surviving 0.18m high. Bank [201] was composed

of an earth and turf core (202) of brown grey silty clay with lenses of pale grey sandy clay forming the main component of the bank, stones (203) up to 0.2m by 0.1m by 0.1m were spread through the bank, but did not form a facing course. Bank [201] had been heavily disturbed by animal burrows and tree roots. Collapse or slumping deposits of silty clays overlay bank [201] to the interior (204) and exterior (205) of the hut circle. A radiocarbon date obtained from bank material (202) gave a date range of 1448-1292calBC (Calibrated to 2σ, SUERC-65626; Table 1).

Plate 5: Excavating trench 2 showing composition of hut circle bank.

Underlying the slumped bank material (204) to the interior was an occupation deposit (206) of a charcoal flecked mid grey silty clay. Set into the surface of occupation deposit (206) was a hearth [209] that comprised three flat slabs set in a sub-circular arrangement within a shallow cut [210] and overlain with a peat ash deposit (208) of bright red-orange silt with frequent charcoal. Preserved below bank [201] was a buried ground surface (207) of mid grey silty clay that was up to 0.15m thick and had possibly been deepened through by prehistoric agriculture. Underlying buried ground surface (207) lay a grey orange glacial till clay (215). Cut into the natural were two ard marks [211 & 213] 0.07m and 0.04m wide respectively, both of which were 0.02m deep and extended E-W across the trench. The ard marks [211 & 213] were filled with a grey silty clay (212 & 214) very similar in character to the buried ground surface (207).

Trench 3

Trench 3 was excavated to the east of the hut circle investigated by trench 2 in an area with no upstanding monuments. Trench 3 was a slot trench measuring 6.5m N-S by 0.5m aiming to look for traces of prehistoric cultivation associated with the hut circles to the north and west. A deposit of dark greyish brown humic silty clay topsoil, up to 0.2m thick was removed across the trench to expose the orange grey silty clay glacial till natural subsoil. No features of archaeological interest were observed in trench 3.

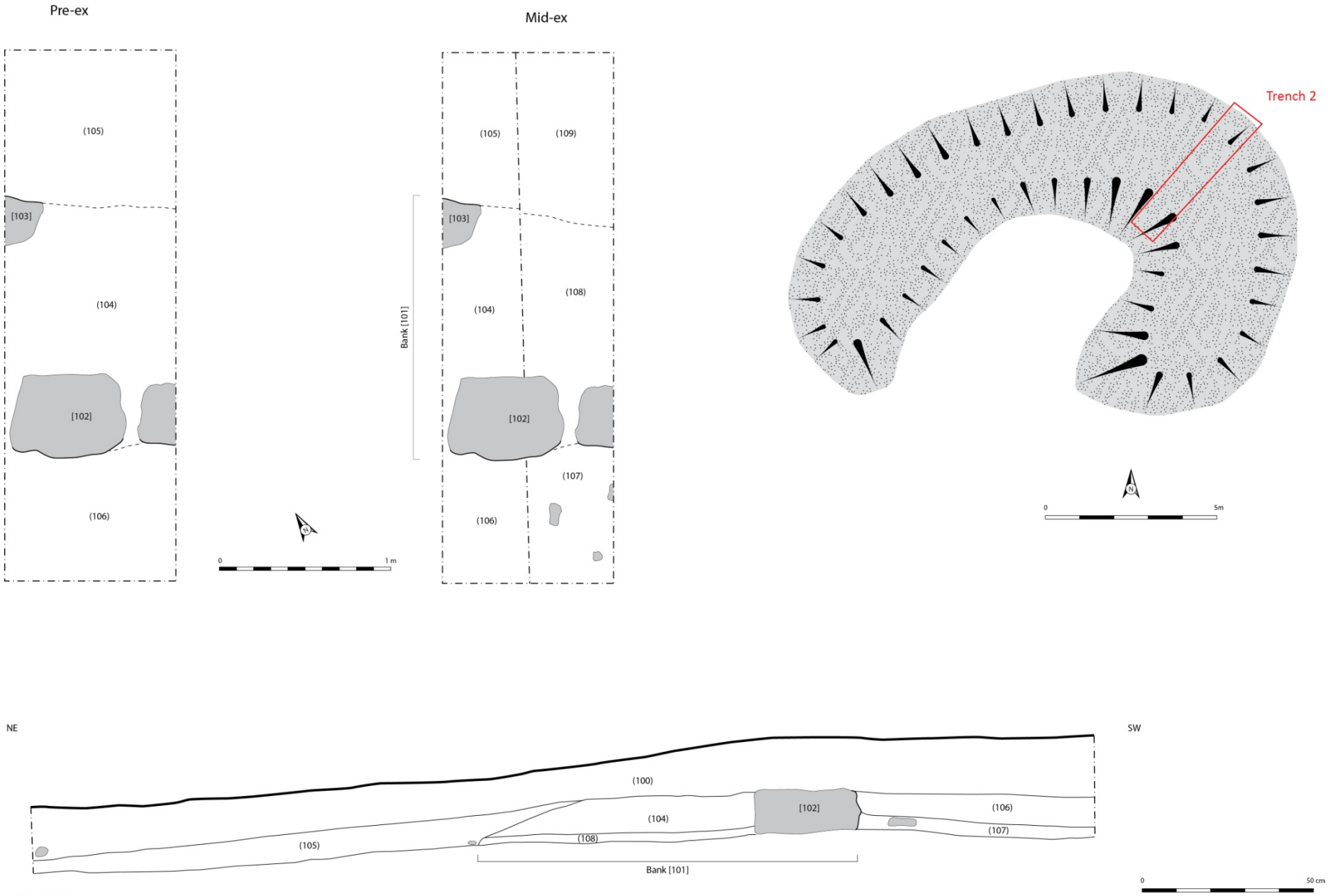


Figure 10: Trench 1 plans and section

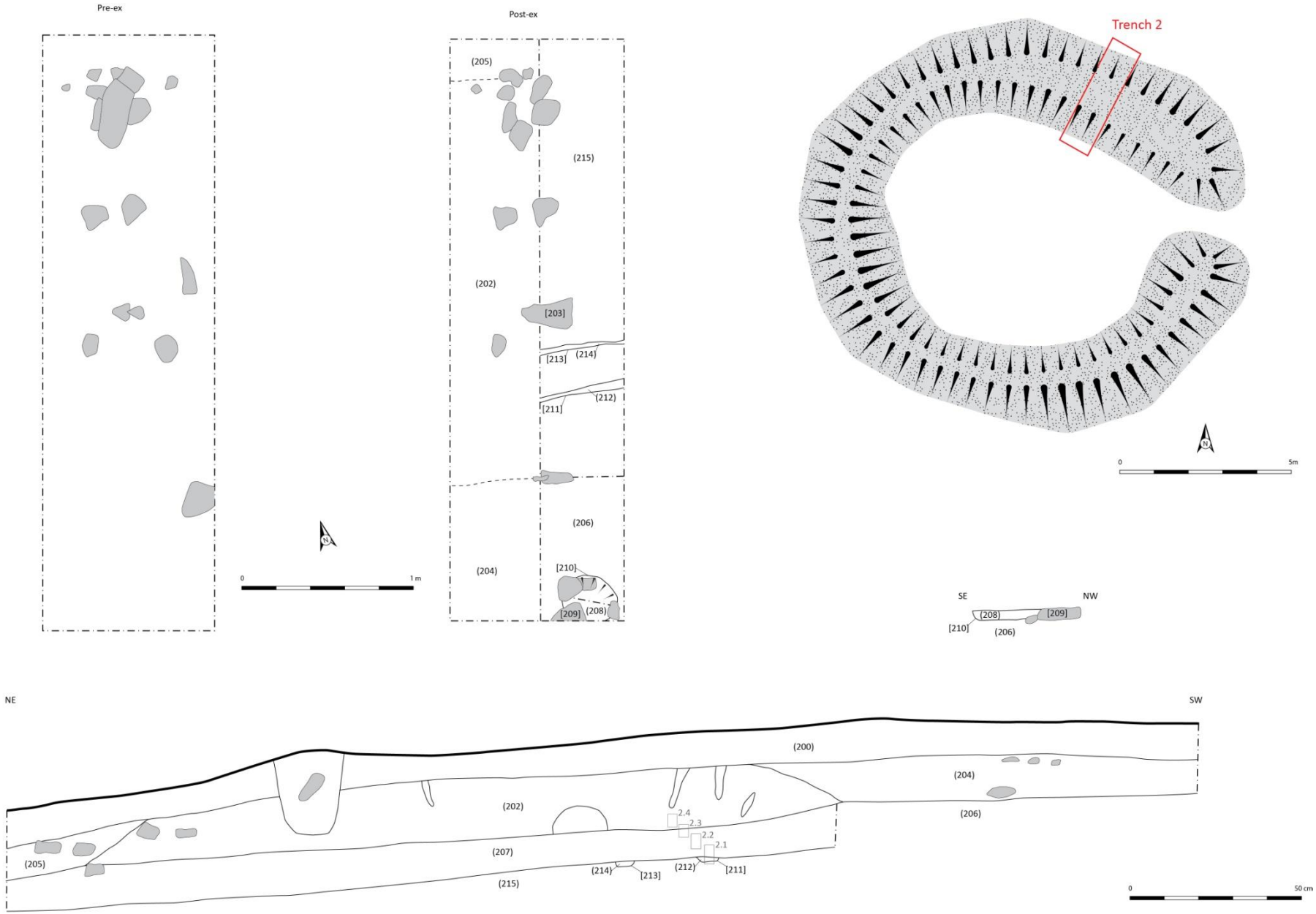


Figure 11: Trench 2 plans and section

Plate 6: Hearth [209] showing peat ash (208) fill and stone setting

Trenches 4 and 5

Trenches 4 and 5 were excavated over opposing quadrants of the central hut circle at Baillie. This monument (walkover site 2) was a well preserved hut circle set in rough grazing with mixed grasses, soft rush and gorse on gentle undulating SE facing slope, lying approximately 40m S of site 1. It has an outer diameter of 13.2m and a bank of earth and stone 2.5m thick with an obvious SE facing entrance. Abutting the northern bank of the hut circle is an L-shaped bank extending 17m northwards which may be a possible enclosure relating to the hut circle. Trench 4 was excavated over the NW quadrant, the turf and topsoil (400) were removed from across the trench, excavation into the underlying deposits and features comprised sondages running E-W and N-S. Trench 5 was an L-shaped trench excavated into the SW quadrant. Across Trenches 4 and 5 up to 0.2m of turf and topsoil was removed to expose the underlying features.

The outer bank

In all of the areas where the outer bank was excavated a consistent series of deposits was recorded. The core of the outer bank of the hut circle was formed of distinctive 'burnt mound material' (see below) of heat shattered stone in a dark brown to black sandy silt matrix with abundant charcoal (402, 501, 504 & 505). Two radiocarbon dates obtained from this material (501) gave date ranges 2341-2138calBC (501A) and 2455-2146calBC (501B), (Calibrated to 2σ, SUERC-63629 & 63630 respectively; Table 1). Overlying the bank to the interior of the hut circle was a deposit of orange brown sandy silt (401 & 503), deposit (503) extended across the full extent of Trench 5. Deposit (401) did not fully cover the interior of the hut circle within Trench 4. Two edge set possible inner facing stones [425] for bank (402) were present in its western arc. Extending around the exterior of bank (402) in its north-western arc was a series of flat slabs [421].

Plate 7: Excavating the hut circle at Skaill

Together these elements formed the outer wall of the hut circle. The core of the wall was composed of burnt mound material (402), this appears to have been faced to the interior with turf which has subsequently slumped and collapsed into the interior (401) interspersed within this turf wall were stones (404). Several interpretations are possible for the slabs [421] to the exterior of the hut circle, these may be collapsed upright facing slabs or a foundation for a turf facing that has slumped to the exterior, they may also be to direct water run-off from the roof around the outside of the structure. The internal diameter of the outer bank was between 8.5m and 9m giving an internal area to the hut circle of around 60m^2.

Plate 8: Trench 4 showing paving in interior and post holes of post ring

Interior features

A number of cut features were identified within the hut circle, these features were deeper and better preserved to the eastern, downslope side of the hut circle within trench 5. Five of these features [408, 416, 406, 514 & 512A] formed a sub-circular arrangement with a diameter of 3.5m and are suggested as being the remains of a post ring. The post holes of the ring beam were typically sub-circular in plan with packing stones and measured between 0.2m and 0.6m in diameter with depths of between 0.07m and 0.31m.

Internal to this suggested post ring lay features possibly relating to a central hearth. These comprised two narrow and shallow linear cuts [410 & 412] set at perpendicular to each other that might have been sockets for orthostats forming the edge to a hearth. Both [410 and 412] extended 0.6m within the excavation area, were 0.08m wide and 0.04m deep and were filled with deposits of mid brown sandy silts (411 & 412 respectively). No in-situ burnt deposits were identified within these features possibly implying that the fire was in some way raised above the natural subsoil, possibly on a stone slab.

Two postholes were possibly associated with the suggested hearth [414 & 525]. Posthole [414] lay immediately to the W of the hearth and was a small sub-circular cut measuring 0.2m in diameter and was 0.04m deep. Posthole [525] lay to the SE of the hearth and was sub-oval on plan, measuring 0.5m by 0.5m in the excavation area, with a maximum depth of 0.29m.

Plate 9: Excavating trench 5 with pit [512] in foreground

The largest internal cut feature was a large oval pit [512] measuring 1.21m by 0.85m and 0.42m deep oriented NW to SE. Pit [512] had near vertical sides and a flat base and was filled with two deposits. The basal fill (519) of pit [512] was a dark red clayey silt with black clay lenses. The upper fill (513) was a silty clay with lenses of re-deposited natural subsoil. Cut into the upper fill (513) of pit [512] was posthole [512A] with in-situ packing stones, part of the internal post ring. A radiocarbon date obtained from this material (513) gave a date range of 1727-1528calBC (Calibrated to 2σ, SUERC-63631; Table 1).

Extending between the bank (402) and the suggested post ring within trench 4 was an area of rough paving [405]. Paving [405] was composed of mainly large flat slabs, typically 0.5m by 0.3m and 0.1m

thick roughly adjoining with smaller stones filling the gaps. These slabs were set in a mid grey sandy clay (418/419) bedding or levelling layer. Within trench 4 paving [405] was clear and well preserved, in trench 5 there were patches of possible paving or disturbed paving stones [517 & 524] along with [521 & 509] in the entrance which suggested that this area might have been paved also.

Entrance features

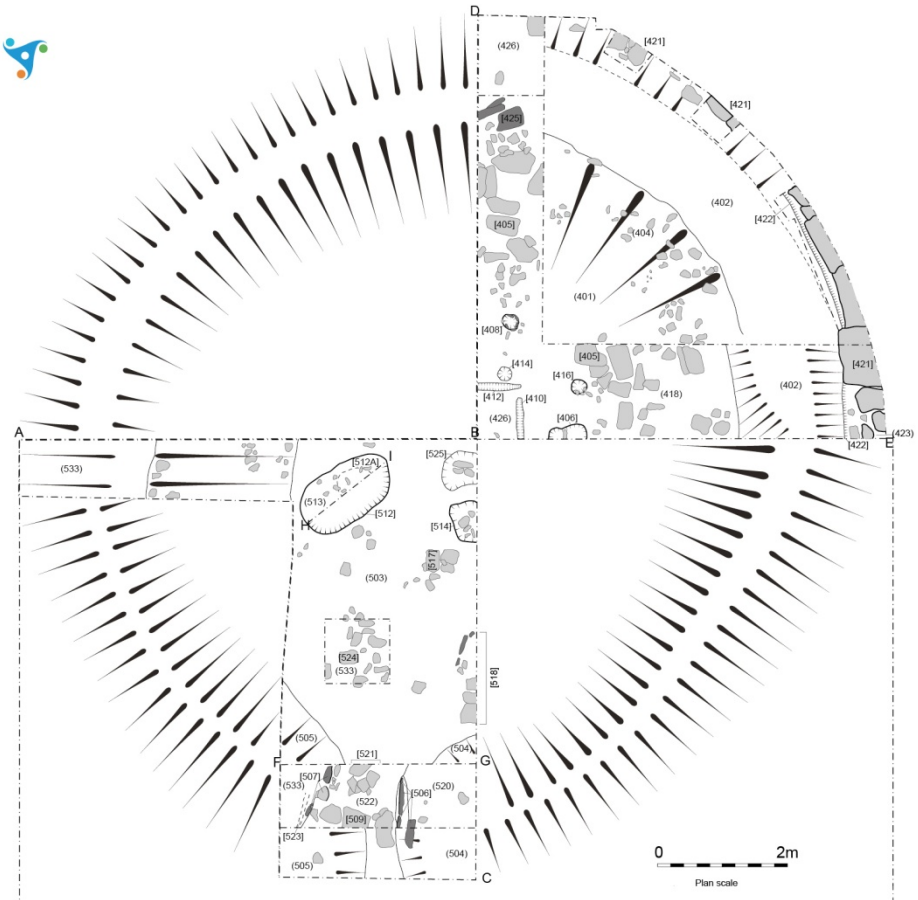
A 1m by 3m sondage was excavated across the entrance in order to investigate the features in this area. A series of cuts, deposits and structures were identified suggesting that this area had been remodelled and altered on several occasions.

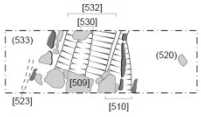
Plate 10: Hut circle entrance showing erosional hollow [532] and kerbs (506 & 507)

The upstanding bank forming the outer wall of the hut circle was, as in other areas composed of 'burnt mound material' (504 & 505) to N and S of the entrance respectively. Overlying banks (504 & 505) within the entrance was mid grey silty clay (508) slumping or collapse deposits from banks (504 & 505) similar to (503). Removal of (508) exposed a series of stone structures. Forming a kerb for the northern bank (504) was a series of three slabs (506) set on their edge within a construction cut [510]. A stone kerb also defined the south side of the entrance (507), kerb (507) comprised three stones two of which were set upright. These two sets of stones form either side of an entrance 1.1m wide. Within the entrance was an area of paving [509 & 521] formed of slabs typically 0.4m by 0.3m and 0.1m thick, these slabs were set in a mid grey sandy clay (522) bedding or levelling layer. Removal of paving slabs [521] and their bedding layer (522) showed that these had been laid in a broad erosional hollow [532] extending the full width of the entrance between kerbs [506 & 507]. Cut into the base of hollow [532] was a linear cut [530] running through the entrance 0.25m wide and 0.17m deep. This possible drain or flue was filled with mid grey sandy clay (531).

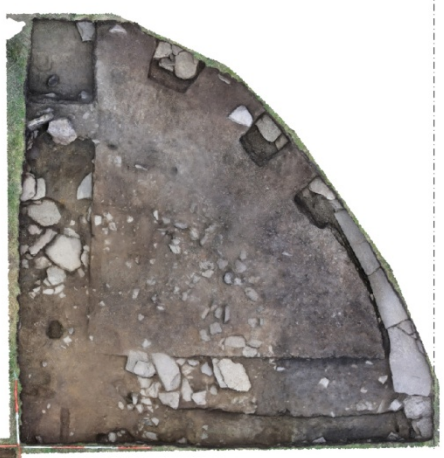
Pre-hut circle activity

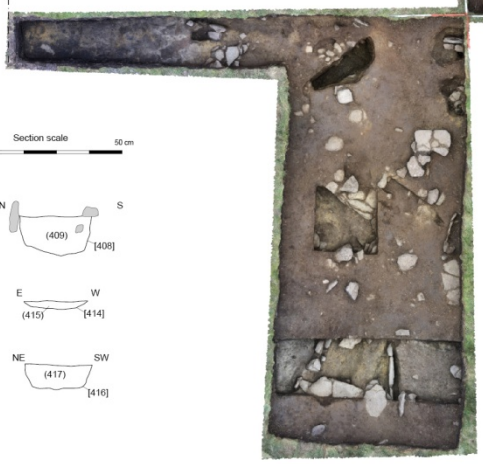
The core of the hut circle bank (402, 501, 504 & 505) was composed of 'burnt mound material' a distinctive mix of burnt and heat shattered stone and charcoal rich soil that is the waste product derived from using hot stones to heat a water filled trough. That this material had been used to

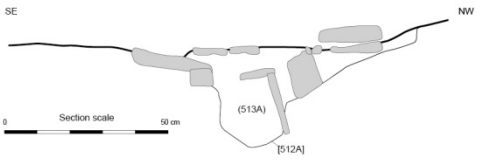


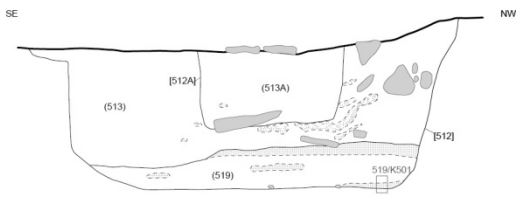


Post-ex plan of entrance sondage









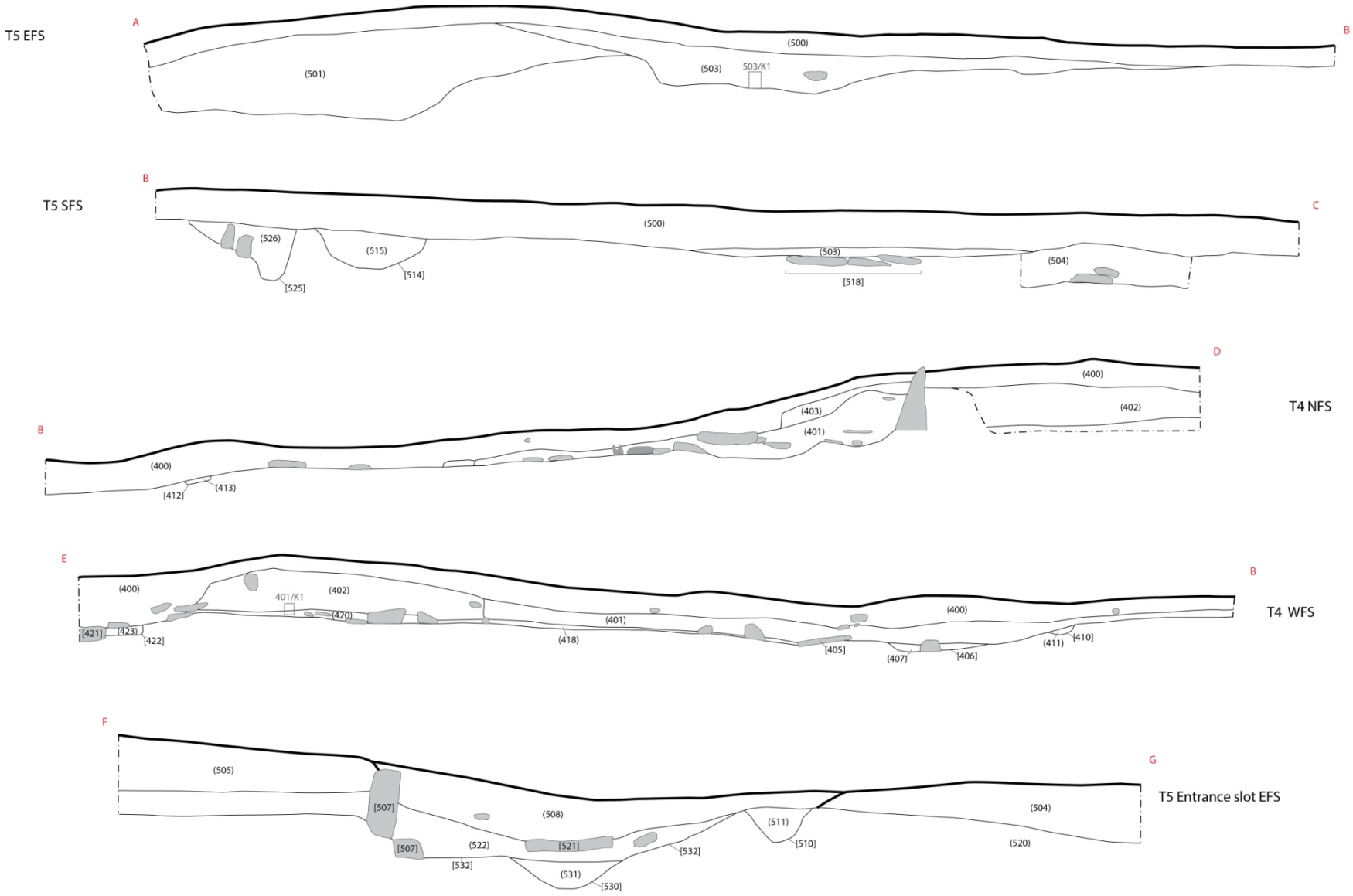


Figure 14: Trenches 4 & 5 sections

create the bank of the hut circle is suggestive that an existing burnt mound had been modified in order to create the hut circle. The largest feature within the hut circle, pit [512] may be associated with the burnt mound rather than the hut circle. The clay rich basal fill of pit [512] may be the remnants of a clay lining to a cooking trough associated with the burnt mound. Supporting this is the later post hole of the ring beam cut into the upper fill of the pit, suggesting that the pit had been in-filled by the time the hut circle was constructed. The LIDAR data shows a number of relict stream beds running past the hut circles in this area that may have provided the necessary water source for the burnt mound.

Plate 11: Hut circle bank (501) showing its composition of 'burnt mound material'

Two possible ard marks [523 & 528] were identified underlying the hut circle showing the prior agricultural use of the area. Both [523 and 528] were narrow (0.08m – 0.10m) and shallow (0.04m) linear cuts. Ard mark [523] was preserved below bank (505) to the S of the entrance, while [528 lay within the interior of the hut circle below collapse deposit (503).

Site	Laboratory code	Material	Context	Uncalibrated date BP	Calibrated 2σ
2 (trench 5)	SUERC-63629 (GU 39197)	Charcoal: Alder	501A	3798±31	2341-2138calBC
2 (trench 5)	SUERC-63630 (GU39198)	Charcoal: Alder	501B	3824±31	2455-2146calBC
2 (trench 5)	SUERC-63631 (GU39199)	Charcoal: Alder	513	3334±31	1727-1528calBC
1 (trench 1)	SUERC-65622 (GU39899	Charcoal: Alder	107	3184±30	1507-1410calBC
2 (trench 4)	GU39901	Charcoal: Alder	418	Failed	-
3 (trench 2)	SUERC-65626 (GU39900)	Charcoal: Alder	202	3118±30	1448-1292calBC

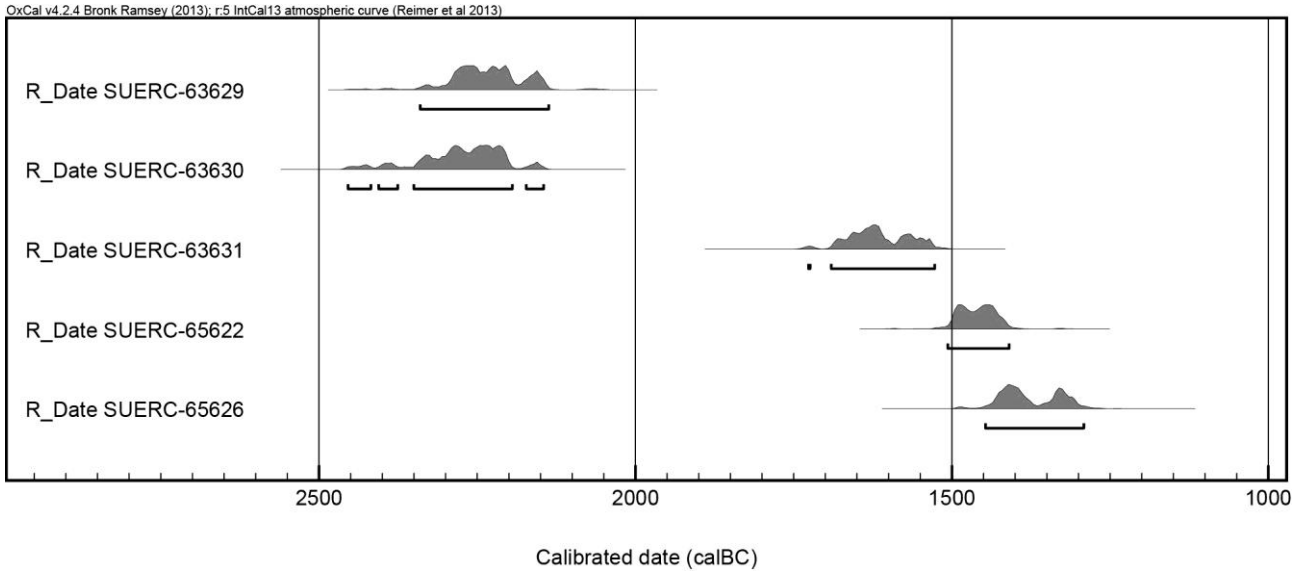


Table 1: Summary of the radiocarbon dates, with calibration ranges plotted below.

ENVIRONMENTAL REMAINS

Jackaline Robertson

Factual Data

A total of 37 bulk samples were submitted for environmental assessment from the archaeological project based on the LiDAR data set centred on Baillie Hill to the southeast of Dounreay, Caithness. The samples were collected from a series of floor, occupation deposits and burnt bank features believed to date to a Bronze Age hut circle. The main objectives of this assessment was to provide training for the volunteers based at Castle town heritage centre in the correct procedures for soil sampling and processing while also recovering any surviving artefactual and environmental evidence to provide further information on the archaeological nature and function of this site. During excavation it was noted that earlier activity in the form of a burnt mound was present. It was anticipated that any artefactual and environmental finds could help clarify the relationship between the hut circle, burnt mound and pits.

Methodology

The bulk samples were processed in their entirety in laboratory conditions in Castletwon heritage centre using a floatation method designed to retrieve charred macroplant remains and artefacts (cf. Kenward *et al*. 1980). The sediment consisted of a sandy silt which did not require any pre-treatment. The retents were slowly air dried in the laboratory in Caithness and were subsequently stacked sieved using 4mm, 2mm and 1mm sieves and then scanned by eye by the volunteers. The flots were transported to the AOC laboratory based in Edinburgh and were scanned using a low power microscope. All plant macrofossils were examined at magnifications of x10 and up to x100 where necessary to aid identification. Identifications were confirmed using modern reference material

and seed atlases stored at AOC Edinburgh (Cappers *et al* 2006; Jacomet 2006). Taxonomic and nomenclature for plants follows Stace (2010).

Charcoal larger than 4mm was selected for species identification. Large concentrations of single species of charcoal within a single context was interpreted as the burning of a single structural artefact such as post or stake where as a mix of wood species was more likely to have derived from fuel debris. This is an oversimplification of charcoal analysis but as the assemblage from this site was relatively small the conclusions can only be described as arbitrary.

Results

The results are presented in Appendix 8 (the carbonised macroplant) and Appendix 9 (the charcoal species).

The charred macroplant assemblage was small, poorly preserved and scattered in bank of hut circle [106], bank [202] ground surface [207] and beam support [513 lower]. There was no evidence of selective or deliberate disposal. The species identified were one barley caryopsis (*Hordeum* sp), seven sedge nutlets (*Carex* sp) and a further three seeds which could not be identified further due to poor preservation.

A total of 89 charcoal fragments (125g) were recovered from 14 contexts. The species were alder (*Alnus glutinosa* L) which accounted for 73% followed by birch (*Betula* sp) 20%, hazel (*Corylus avellana* L) 3%, heather (*Calluna Vulgaris* L)3% and apple/pear/hawthorn/quince (*Maloideae* sp) 1%. The charcoal was concentrated within three contexts; hut circle deposit [402 N-S sondage] which totalled 21.4g, burnt bank [501] 19.8g and [501 lower] which had 63.4g.

The only artefactual finds noted were burnt and heat affected stones present in most of the retents.

Discussion

Barley tends to be the dominant cereal crop cultivated in the North of Scotland as this species unlike wheat is better suited to the intemperate climate and acidic soil conditions. Sedge typically grows in damp habitats and this could have been an accidental weed inclusion within the macroplant assemblage but equally this species has been deliberately collected for use as a building, flooring, fuel and bedding material.

The largest concentration of charcoal was present in [501 lower] and was composed of a single species. These remains probably accumulated from the burning of a small discrete structure such as an alder post or stake. The next largest accumulations were noted in contexts [402 N-S sondage] and [501] which was made up of mixed species that probably derived from fuel debris. The remaining charcoal fragments were scattered throughout the remaining 11 contexts in small numbers and were probably fuel debris. The relatively small size of this assemblage indicates that there was never a large scale burning event on this part of the site.

Conclusion

The charred macroplants from the Skaill excavation samples are all common finds from Bronze Age sites in the North of Scotland which suggests that the landscape surrounding the site was made up an acidic damp habitat. The wood species are also typical finds for this area of Scotland and indicate that the population had access to a range of woodland resources which were exploited as a building material and for fuel.

ARTEFACTS

Dawn McLaren

The finds assemblage from the excavation was very limited, and restricted to coarse stone and natural deposits. The following catalogue lists those finds collected during the excavations at Skaill.

CATALOGUE

SF 001 Amorphous fragment of dark brown/black desiccated peat, surfaces coated in residual soil. A second fragment, a stone, has been discarded. Collected in the field as possible pottery shards but is natural. Context: Transect 1, Test pit 4, deposit 2.

SF 002 Fragment of charcoal. Retrieved in the field as possible pottery shards. Context: Transect 4, Test pit 5.

SF 003 Hollow flattened spherical accumulation of dark brown/black desiccated peat. The item resembles a small, squat, globular pot of coarse, low-fired ceramic with a plain, slightly inverted rim and was collected in the field as such. Yet, after careful initial surface cleaning and x-radiography it became clear that this item was not ceramic but rather a desiccated natural organic-rich material, probably peat, which had infiltrated a bowl-shaped negative feature (?the base of a small post-hole) in the natural soil. The item measures 93.2 mm in length and is 83.5 mm in width, sub-circular/oval in plan and inconsistent in texture with low-fired prehistoric ceramic. Examination of the material under binocular microscope reveals that it comprises two layers which are poorly distinguished: the inner layer is darker and richly organic, the outer is more silty which suggests it was in contact with the natural subsoil. The material has very few inorganic inclusions and fine natural rootlets run throughout the thickness. With the aid of x-radiography, the bowl-shaped hollowed interior is shown to be square in plan (D 42 x 49 mm) rather than circular, as though the peat formed around a narrow, dressed, upright timber post or stake. The x-rays also show that the 'body' of the item varies in thickness from 11.5 mm to 25 mm, a variation not likely with a handmade pottery vessel. Context: 401.

SF 004 Large quantity of fractured, angular fragments of a thick layer of dark brown/black desiccated peat. Under magnification the material is fairly homogenous but horizontal layering is observed with fairly frequent rock and rootlet inclusions. Collected in the field as possible fragments of daub but is natural. Context: 401.

SF 005 Multiple flat and slightly curving plates of dark-brown/black desiccated peat, surfaces coated in residual earth. Under magnification, the material is homogeneous with occasional rock inclusions and rootlets. Retrieved in the field as possible pottery shards. Context: 402.

SF 006 Grinder. Small, flattened ovoid, water rounded, quartzite pebble with a curving narrow band (W 11 mm) of abrasion at one blunt rounded end from use as a small grinding implement. L 44.5 W 38 T 21.5 mm. Context: 414.

SF 201 Two small angular fragments of dark brown/black desiccated peat, surfaces coated in residual soil. Retrieved in the field as possible pottery shards but is natural. Context: 200.

SF 202 Amorphous flattened ovoid lump of dark brown/black desiccated peat, surfaces coated in residual soil. Retrieved in the field as possible pottery shards but is natural. Context: 202.

EXCAVATIONS AT SKAILL: DISCUSSION

The excavations at Skaill, although limited in extent, have provided valuable insights into the character of typical Bronze Age settlements in Caithness. As might have been anticipated, the buried archaeology is more complex than the superficial remains indicated, and at least two phases of activity are evident from the excavated results.

Early tillage

The earliest activity detectable at Skaill is the evidence for tillage of the soil beneath the buildings, represented by the plough scores in the subsoil in trench 2, and beneath the burnt mound in trench 5. Although only small areas were uncovered, the scoring of the till suggests the use of an ard to break the soil. Ard marks have been encountered on numerous excavations in Caithness, often visible in the natural subsoil beneath archaeological deposits. Ard cultivation traces at Cnoc Stanger were extensive, but the short 'pull' lengths recorded at that site were taken by the excavator as evidence that the ard that created them was pulled by human, rather than animal traction (Mercer 1996:165-6). Though only exposed in small areas at Skaill, the ard marks here were similarly short and interrupted, and might follow a similar interpretation. Underlying the burnt mound 'bank' at Skaill, some of the ard marks are unlikely to post-date the mid to late third millennium BC, but those outside the sturctures could be related to agriculture associated with the settlement. As has been noted in several other syntheses, Bronze Age cultivation was often located in very close vicinity to settlements themselves, in 'scrappy' and irregular plots (e.g. Halliday 1999:56; Downes (ed). 2012:65; McCullagh and Tipping 156-7; Barber 1997: 146-8).

Burnt Mound

The earliest dated elements of the excavations at Skaill were the remains of a burnt mound that was later modified to form the central hut circle on which the excavations were centred. The presence of a burnt mound at the site pre-dating the hut circle was mainly indicated by the distinctive ‘burnt mound material’ that had been re-used to build the outer bank of the hut circle. The only other excavated feature that may relate to this earlier site is the large pit [512] with a possible clay lining at the base, located within the hut-circle, that might originally have been the 'trough' or tank associated with the burnt mound. Two radiocarbon dates were obtained from the burnt mound material (501A & B) that gave the broadly consistent date range of 2341-2138cal BC and 2455-2146cal BC at 2σ (SUERC 63629 & 63630).

The construction of the hut circle dramatically altered the burnt mound meaning that it is difficult to be certain about much of the burnt mound. Typical examples of burnt mounds have a central trough surrounded by a kidney shaped mound of discarded burnt stone; it would seem likely that a similar arrangement existed at Skaill, with a mound of discarded stone surrounding a possible central pit [512]. A local water supply is an essential requirement for burnt mounds and a number of relict stream channels can be seen on the LiDAR terrain model running either side of the burnt mound site. A large modern drain now cuts across the landscape to the west of the hut circle; it is likely that this has contributed to the drying out of these channels.

Hut Circle

The structural elements of the Skaill hut circle show many of the typical architectural features of roundhouses of the first and second millennium BC, such as a penannular ring bank forming the outer wall of the structure, a post ring and a southeast facing entrance. Other structural elements of

the hut circle were slab paving around the outer edge of the interior space and flat slabs laid around the exterior of the ring bank. A possible hearth setting may have been formed by the perpendicular linear slots [410] and [412]: although this evidence is tentative, hearth stones would have been readily removed and reused, and would be very susceptible to post-abandonment disturbance.

The complete lack of material culture from the excavations is a hindrance to the interpretation of the structure. Conventional indicators of domesticity- burnt bone, pottery, stone tools- were conspicuously absent from the excavated deposits, and although charcoal was ubiquitous, this was mainly restricted to deposits deemed likely to relate to the precursor burnt mound. This is not, of course, to say that the structure was not domestic in character, but it is pertinent to consider that not all round buildings in prehistory were houses and, if used alongside structures 1 and 3, could have performed some non-domestic role, such as a barn or byre. However, such interpretations must remain speculative, with the recognition that Bronze Age hut-circles of the northern highlands rarely produce large quantities of artefacts of any sort.

Structurally, the building is typical of the known Highland Bronze Age settlement record. The stone revetted wall, retaining a rubble and soil core is perhaps more closely related to the buildings excavated by Mercer at Cnoc Stanger (Mercer 1996:168-75), and the flag paving surface at Skaill is very reminiscent of that site. Similarly, the orthostatic revetment of the bank is presumably a variation on the coursed rubble revetting found on broadly-contemporary sites like Navidale (Dunbar 2007: 141). The similarity in construction to the roundhouse excavated at Loch Shurrery (MacLaren 2003: 5) demonstrates that the character of the wall of Highland roundhouses was not particularly chronologically sensitive: the Shurrery roundhouse was of very similar construction and contained deposits yielding radiocarbon dates that calibrate in the last 350 years BC, some 1000 years later than the example at Skaill.

Although somewhat ephemeral, the shallow post pits (or pad sockets) located in the interior of the Skaill roundhouse are suggestive of an internal post-ring, a feature well documented in the numerous excavated roundhouses at Achany Glen, Lairg (McCullagh and Tipping 1997) as well as at Navidale (Dunbar 2007). The implication is that the structure was almost certainly roofed, with a central ring beam supporting rafters that rested on the ring-bank (see Figure 16). The construction of the drain in the entrance suggests that some effort was expended to keep the interior of the building dry, while the flagstone paving surrounding the ring bank is feasibly interpreted as a dry walkway around the circuit of the building, over ground that would have become trampled an muddy under the eaves of a pitched roof. The impression given is that of a well-used building in a working farmstead.

Chronology

In the context of the known chronology of burnt mounds in Scotland, the Skaill site falls at the earlier end of the date range, but nonetheless well within the conventional chronology of burnt mounds sites. Although encountered throughout prehistory in Scotland, burnt mounds are nonetheless most commonly associated with the Bronze Age, and the majority of dates fall in the range of the mid-second to early first millennium BC (Barber 1990a). The Skaill site was probably active in the period c. 2300 to 2150 BC, i.e. in the very early Bronze Age of Caithness. Although the form of the original site cannot now be determined owing to the reworking of the monument into a settlement, there is little to suggest that the Skaill burnt mound was unusual or exceptional in its north Highland context. Interpretations of burnt mounds range cooking sites and hunting camps to sweat lodges or saunas (Barfield and Hodder 1990) . Perhaps of most interest in the context of the wider Caithness landscape is the insight that the Skaill burnt mound gives into the settled landscape in the very early Bronze Age, a period that is not well known or understood in contexts outwith ritual and burial. The dates from Skaill accord with those from timbers from Pullyhour henge (Bradley and Lamdin-

Whymark 2008; *Discovery and Excavation in Scotland* 2008:201), but these are considered to be ancient in their context and to have derived from bog pine. Dates from the beaker burial at Achavanich place the cist in the last centuries of the third millennium BC, as do those from the urn from Tulach an t'Sionnach, Assery (Sharples 1986; Corcoran 1967). These urns fall in the category of late re- or continued- use of earlier megalithic monuments, a well-known phenomenon in Caithness (Heald and Barber 2015: 60-2). Although the chronology of the Tri n Sithean cairns on Cnoc Freiceadain (c.300m SW of the Skaill site) is not known, it is a reasonable inference that these follow the wider Caithness pattern, and would have continued to be important monuments well into the early Bronze Age. The Skaill burnt mound illustrates a rare glimpse of the more prosaic activity that took place in the landscape immediately surrounding this important ritual focal point.

One of the most intriguing aspects of the excavated hut circle is the re-use of the burnt mound to form the outer bank of the structure. The radiocarbon dates demonstrate that there was a considerable time difference- around 400 to 900- years between the use of the burnt mound and the hut circle. The phenomenon is not unknown: the same pattern of reuse was encountered at Ceann na Clachan in the Western Isles (Armit and Braby 2002) although in the case of that site the association of the building was apparently much more direct in chronological terms, with the sequence of buildings most probably related to the activities that had created the burnt mound (Armit and Braby 2002:253-4). Similarly, buildings have been found within numerous burnt mounds in Orkney, as at Liddle and Beaquoy (Hedges 1975) and at Meur, Sanday (Toolis 2007.) among others, as well as at Tangwick in Shetland (Moore and Wilson 1999). As at Ceann na Clachan, however, these seem for the most part to be structures associated with the use of the burnt mounds themselves.

At Skaill, the builders of structure 2 made use of the earlier burnt mound as a source of raw material, in this case as a rubble and earth core for the roundhouse wall. The time that had passed between the formation of the mound and the construction of the roundhouse makes it implausible that the burnt mound could have been visible as anything other than a grassy mound, but perhaps this is to make an assumption of total abandonment of the area in the interim that is equally unlikely. As noted by Fouracre (see *Soils Survey*, below), the investment in the improvement of soils through tillage and manuring that was apparently well underway at Skaill before the later third millennium BC may have meant that the site was valuable farm land, and although tilled ground associated with settlements may have been fairly limited in extent (cf Halliday 1999:56), the duration of use of farmed parcels of land may have been considerable. The Skaill burnt mound may have been a feature of the local landscape that was known but unused prior to the construction of structure 2.

Reuse of burnt mounds is not unknown, and several examples have been recorded where burnt mounds have been reused for very similar purposes hundreds or even thousands of years after the original phase of use. At Stronechrubie in Assynt (Cavers et al 2013) and Derskelpin in Galloway (Moore 2010), burnt mounds produced evidence for use in both the middle Bronze Age and the early medieval period. It is likely that the persistence of memory of earlier monuments, even over considerable timescales, is too often overlooked. The reuse of the Skaill burnt mound raises interesting questions about how the older monument was viewed by the builders of the hut circle, and whether it was a conscious use of a recognised site or more prosaic use of a useful source of building material. Possibly related to this is the positioning of the hut circles below the chambered cairns of Cnoc Freiceadain on the skyline to the southeast. Indeed later prehistoric artefacts have been found from within the chambers of cairns in Atlantic Scotland (Hingley 1996).

The radiocarbon dates show that it is possible that sites 1 and 3 were occupied contemporaneously however the probability is that these sites were occupied sequentially or periodically one after the other representing a progressive use of the landscape or replacement of houses as they fall into

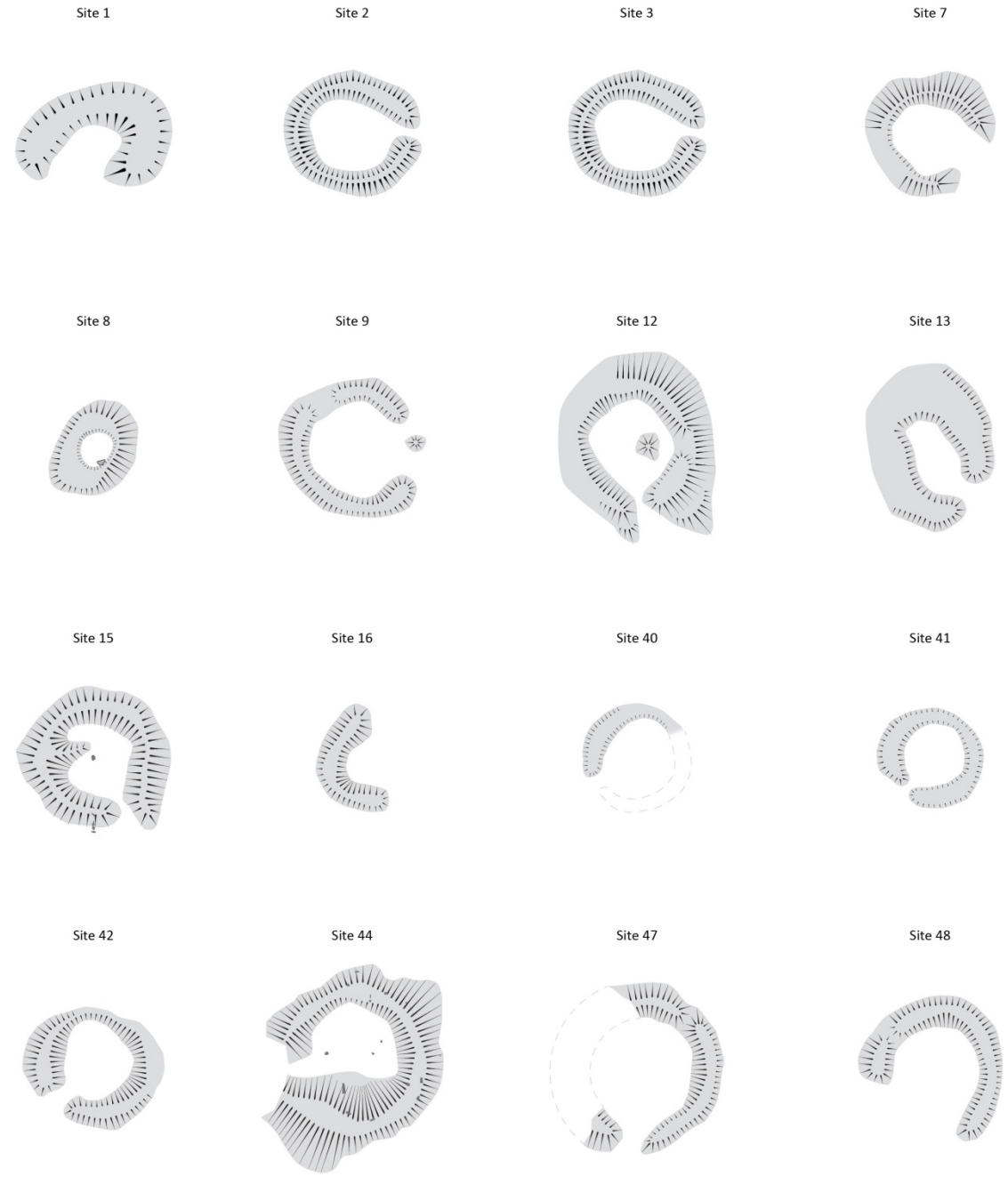


Figure 15: Comparative plans of hut circles

disrepair and were abandoned. This is in marked contrast to the structures excavated at Cnoc Stanger (Mercer 1996), Reay around 5km to the west of Skaill, where a number of circular or oval structures were superimposed on top of each other, separated by tilled and cultivated soils. The only firmly dateable structure at Cnoc Stanger is later than the structures at Skaill; however, radiocarbon dates from possibly residual material hint at occupation of the site in the same period.

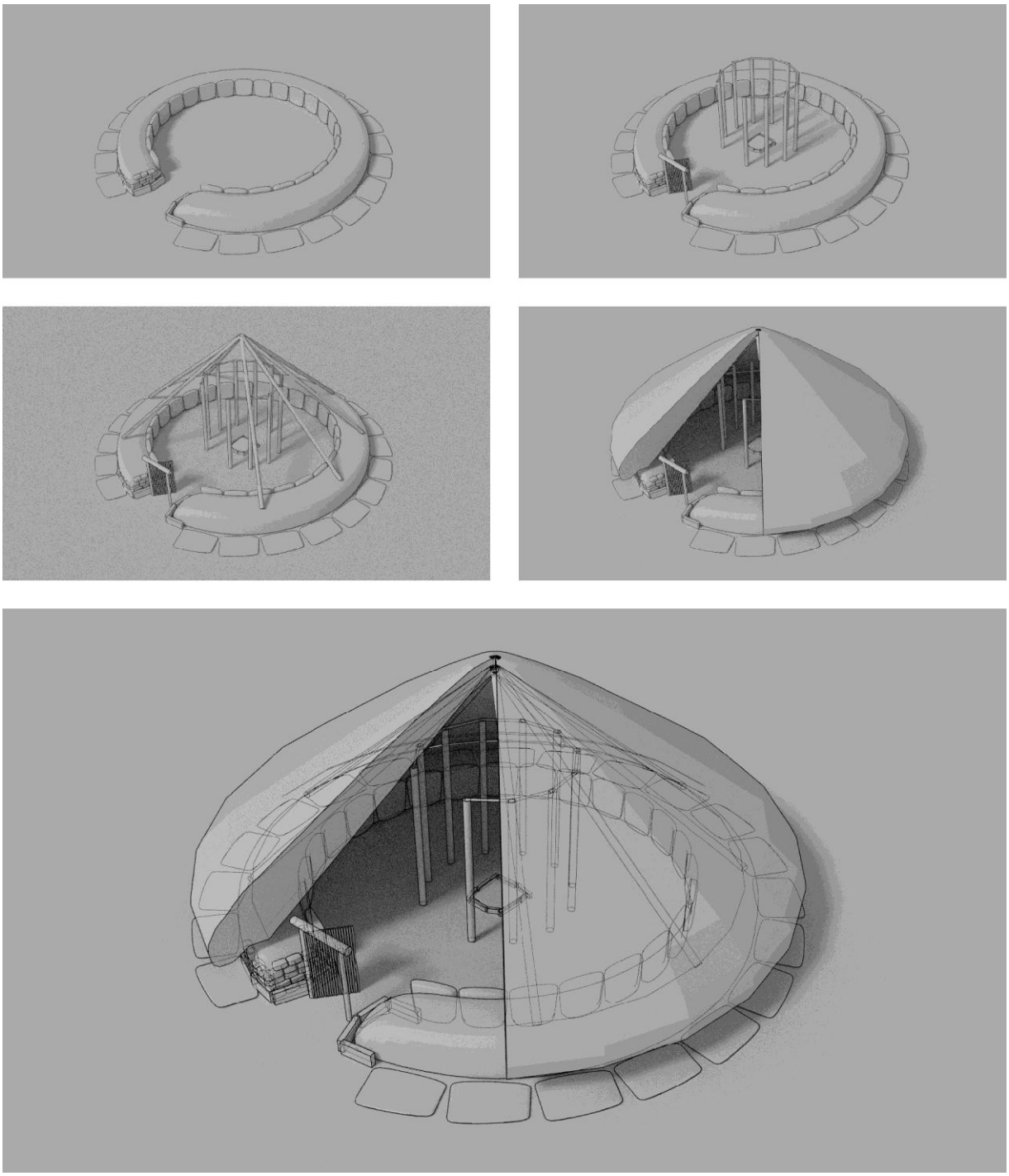


Figure 16: *Possible reconstruction of the Skaill roundhouse, showing the arrangement of rafters resting on a stone-revetted bank, supported by an internal post-ring.*

THE SOILS SURVEY

Lynne Fouracre

A programme of systematic soil sampling was undertaken across the survey area (see Figure 1) with the aim of undertaking subsequent soils analysis designed to determine the composition of both on-site and off-site archaeological soils and sediments, and provide an insight into the interpretations of the activities and conditions that created those soils and sediments. Samples were taken at regular intervals across the length of the archaeological site, as well as within the different levels of vertical stratigraphy at the site. The use of domestic waste was a common occurrence in Bronze Age Soils (see Barber 2003, Macphail et al 1990). However, while charcoal, animal bones and artefacts are easily recognisable during excavation other manuring material can only be identified microscopically or chemically. Thin section analysis is therefore an important method for identifying materials that have been added to the soils, and the use of micromorphology in conjunction with geochemical analysis has been shown to be particularly informative (Guttman 2001, 52). This report focuses on the results of geochemical and micromorphological analyses and in particular discusses how phosphate and micromorpholgical analyses, have been used to locate and interpret activity areas associated with human and animal activities within the survey area.

The occupation deposits and buried land surfaces excavated at each of the three excavated structures present an opportunity to differentiate between discrete areas of occupation and use and also allow these to be set in context with pedogenetic processes to which each site has been subject, both during and after its occupation. The analysis of microstratigraphy and microstructure of the archaeological sequences and examination of the relationship among construction features, sediments, and their archaeological findings is essential for interpreting natural depositional processes and palaeoenvironmental changes (Karkansas and Goldberg 2007, 63) human-induced soil formations and disturbances, land management, (Simpson and Barret 1996), and the use of space and structure of sites (Matthews et al. 1997) which can be difficult to resolve at the macro scale.

SITE DESCRIPTION AND GEOLOGICAL BACKGROUND

The survey area is located within an area of rough pasture in open undulating land, approximately seven kilometers west of Thurso and three kilometers south-east of Dounreay (Figure 1). Solid Geology is part of the Sandside Bay Sandstone Member comprising sandstone, siltstone and limestone. These rocks were formed from rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium. Superficial Geological deposits are part of the Broubster Till Member formed up to two million years ago in the Quaternary Period. These rocks were formed in cold periods with Ice Age glaciers scouring the landscape and depositing moraines of till with outwash sand and gravel deposits from seasonal and post glacial meltwaters (BGS Viewer). Soils are of the Thurso Association, mineral soils, comprising peaty gleys developed on a superficial geology sandy loam, loam and sandy clay loam with noncalacerous gleys, brown forest soils and peat as minor components. The peaty gleys are developed on the compact till and often have organic staining in the upper part of the Eg horizon and a Bs horizon is usually present over a paler indurated horizon. A dark brown Ap horizon overlies a yellowish brown strongly indurated B-horizon which has a coarse platy structure, commonly with reddish iron staining or black manganese mottles. Occasionally an iron pan, or the trace of one is present on the upper surface of the indurated horizon. It is probable that these soils have been developed from peaty podzols by cultivation over a long period (Futty and Towers, 1982, 11).

The Bronze Age in Caithness is characterized by what are taken to be permanent settlements and permanent fields. These fields may not necessarily have physical boundaries but may be identified by the amended soils where preserved by burial. Arable soils have been identified within this landscape through the identification of ard marks during excavation (above) and the charred remains of cultigens (see *Environmental Remains,* above). Geochemical analysis (particularly phosphate analysis) and soil micromorphology were used in an attempt to identify areas of arable land use and obtain more detailed information about the particular materials which were added to the soil.

Slot trenches were excavated through the bank and interior of a putative hut-circle at Skaill smallholdings, Stemster Hill, Caithness. The bank was found to comprise mainly 'burnt mound material', i.e. heat-shattered stone, burnt soils and charcoal, lined with facing stones. The interior contained several features possibly relating to the internal architecture of the building, though these were mostly shallow and difficult to confidently identify as structural. A single large pit, located within the interior, was the most substantial feature, though it is not certain whether this feature relates to activity within the building or to an earlier burnt mound, from which the building was constructed. Two other buildings were investigated, including a possible second hut circle to the south and a building of indeterminate character to the north. The hut circle to the south produced evidence for a turf or earthen bank and the remains of a hearth within the interior.

The excavations yielded little material culture and as such geochemical and micromorphologcial analyses to identify features not often visible in the archaeological record may provide more insight into how the excavated structures and surrounding landscape were used.

SOILS SURVEY: AIMS AND OBJECTIVES

The aims of the sediment analyses of the samples were:

- To map relative phosphate concentration across the study area.
- To analyse the relationship between surviving field remains and the spatial distribution of soil phosphate concentrations and if possible differentiate between areas of settlement and agriculture.
- To establish a soil phosphate 'signature' for Bronze Age settlement in Caithness that could be used to identify similar Bronze Age sites in the region.
- To assess the usefulness, as well as the precision, of rapid qualitative of phosphate analysis when compared with quantitative laboratory analyses.

The aims of the soil micromorphological analysis focus on a set of general research questions about the nature of the excavated deposits and include:

- The process of deposition
- The character of the material deposited with particular reference to hut circle bank construction materials (402), (202)
- Identification of occupation deposits (503)
- Identification and characterisation of deposits within possible burnt mound structure (519)

- Identification and characterisation of buried ground surfaces (420) (206)
- Identification and composition of possible ard mark (212).

SOIL SAMPLES PROCESSING: METHODOLOGY

The soils analysis program was undertaken in three stages:

Stage One: pH and qualitative phosphate analysis

Soil samples were collected from A (topsoil), B (relict or buried soils) and C (subsoil) horizons from test pits located on a 30m grid across the study area at Baillie Hill. The coarse grid employed was dictated by the exploratory nature of the investigation but was judged sufficiently spaced to identify settlement activity (see Orser 1996). Transects of samples on a 1m spacing were collected from on and around the recorded hut-circles at Baillie Hill, providing a reference sample for settlement activity and in order to identify activity areas within known structures. Control samples were collected from areas considered to be removed from the main focus of activity, on the basis of above-ground observations.

The qualitative phosphate test was undertaken within controlled laboratory conditions and uses weak HCl to test for available phosphate using a semi-quantitative procedure that measures the results of phosphate extraction through colorimetric determination. The applicability of readily available P testing to archaeological sites is discussed by Holliday and Gartner (2007, 313-314) and limitations are further discussed by Terry et al (2000). The tests undertaken here, while recognising the limitations of available P testing, provide an opportunity to map basic P concentration across the site and to compare the results against quantitatively obtained laboratory results from the same samples.

The methodology used follows that outlined by Eidt and Wood (1974, 51-54) modified by Ullrich (2007, 100-104).

To perform the test, 50 mg of soil are placed in the centre of a small round of filter paper and treated with two drops of Reagent A (ammonoium molybdated and hydrochloric acid), followed by two drops of Reagent B exactly 30 seconds later. Ammonium molybdate is used because it allows phosphates to bond easily, and creates a visible blue color when treated with ascorbic acid (Reagent B), rendering the phosphate content visible. The test, therefore, is a measurement of how many active phosphates can be extracted by the HCl and bonded with the ammonium molybdate in 30 seconds by recording visible aspects of the reaction. The amount of phosphate within a sample directly influences the speed and the chroma of the appearing colour. Resultant colour, length of lines radiating from the sample are all measured after two minutes. The time it takes for the colour blue to appear is also recorded. This is an accurate illustration of the percentage of inorganic active phosphates in the soil (Eidt and Wood 1974: 51-52). A system of assigning each reaction a numerical level is applied and the average score over the three measured attributes (time of reaction, chroma of colour and length of lines) is used as a measure of relative phosphate content (following Ullrich 2007 51-52).

It is recognised that this procedure does not extract a quantitative measure of phosphate. However, this archaeological survey is concerned with relative phosphate rather than absolute phosphate. A relative analysis compares the phosphate concentrations of multiple soil samples from the site to assign distinctions of phosphate level on a graded scale from one to six. Then the relative amounts of phosphate are used to create a gradated spot map and used to distinguish intra-site boundaries and usage.

pH has long been known to play a major role in P solubility and precipitation. An increase in pH decreases the P-binding capacity of Fe and Al compounds in acidic soils and as such samples were also tested for pH.

Stage Two: Quantitative phosphate analysis

Approximately 20g of wet soil was dried at 40°C for 24 hours before being dry-sieved through a 2 mm gauge to remove stones and larger particles. The sieved material was then placed in a weighed crucible and placed in an oven at 100°C for five minutes to drive off any latent moisture within the soil. The crucible and soil were then weighed before being placed in a furnace for four hours at a temperature of 550°C to incinerate the organic component and release the phosphate bound therein. The crucible and material were then weighed and the percentage organic content (by weight) calculated.

Phosphate was extracted from selected finely ground samples using 2 N H2SO4, and concentrations were determined in a spectrophotometer using ammonimum molybdate and ascorbic acid at a wavelength of 880 nm.

The results were compared with a standard curve of known P concentration (mg/g^{-}1) and percent transmittances.

It is recognised that the reagents employed in the method described above are incapable of fully digesting all P-bearing minerals and compounds in the soil and as such the P values provide a relative measure of P concentration rather than an absolute one.

In addition, in order to facilitate the interpretation of the phosphate results and general characteristics of sediments determinations were made of loss-on-ignition (LOI), which provides an estimate of the organic matter concentration an important diagnostic properties of all soils and sediments. Higher concentrations of organic matter are indicative of inputs of organic rich materials and/or conditions in which organic decomposition is inhibited (Heron, 2001).

Stage Three: Micromorphological Analysis

Nine samples were prepared for analysis using the methods of Murphy (1986) at the University of Stirling in the Department of Environmental Sciences. The thin sections have been described using the terminology of Bullock et al (1985) and Stoops (2003). The coarse/fine limit of 10µm is used for both the mineral and organic components.

Micromorphology is an analytical technique by which soils and sediments are made into thin transparent glass mounted slides (usually 30µm thick) which can be examined using a petrographic microscope. Interpretation of microstratigraphic sequences in thin section is based on internal and comparative analysis of the type, frequency, morphology and structural relationships of depositional components and boundaries in each sequence and their spatial, temporal and sociocultural contexts within settlements. Analysis of micromorphological soil features can identify elements relating to human activity which may not be identifiable during excavation and also allow these to be set in context with both the natural pedogenic and disturbance related processes to which an archaeological site is subject, both during and after its occupation.

When estimating abundance of fabric constituent the following terms (after Stops 2003; 49) have been used:

Abundance	Area %
Very dominant	>70
Dominant	50-70
Frequent	30-50
Common	15-30
Few	5-15
Very few	<5

When estimating abundance of pedofeatures the following terms have been used:

Abundance	Area %
Many	5-10
Occasional	2-5
Rare	1-2
Trace	<1

SOILS SURVEY: RESULTS

General Characteristics of the soils and sediments

The results for pH show that soils are circumneutral to mildly acidic, with the pH ranging from 4.69 to 6.50. The results show that topsoil (deposit 1), has a mean pH value of 5.08 ± 1.12, while natural sub-soils display a mean pH value of 5.7 ± 0.8. Overall pH average is 5.63. The spatial range of pH values is highly variable but soil pH has been demonstrated to be relatively consistent throughout both occupied and unoccupied areas. A general trend towards lower more acidic pH is identifiable across Transects 2 and 4 i.e across the areas of settlement reflecting perhaps the greater organic content of these soils.

Organic matter is a major biological and anthropogenic source of soil P. Organic amendments to soils, microbial activity, weathering, and land-use all affect the forms, interactions, and redistribution of P compounds. The susceptibility of soil P forms to dissolution, desorption, and transformation is affected by organic matter, pH, soil moisture, particle size, and mineral content (Crowther 1997).

Identified Phosphate Patterning Results

The survey shows a good relationship between surviving field remains and the spatial distribution of soil phosphate concentrations and differentiates between areas of settlement and those of agriculture. Using a base level of phosphate concentration of 0.5, which is found within the control areas at the edge of the survey grid, values of 4 or higher are judged to be areas of phosphate concentration. The results indicate a much greater accumulation of phosphates around the settlement itself and lower concentration within the fields. This is demonstrated by Figure 17 produced using the ‘nearest neighbour’ analyst tool in ArcGIS to interpolate between areas of similar relative phosphate concentration, to produce a spatial distribution map of relative phosphate concentration. These values have been derived from relative phosphate concentration of deposit 2 i.e those derived from the buried soil horizon below the topsoil or A horizon. The phosphates in the topsoil (A horizon) showed a similar but less clear patterning of results and generally diminished with distance from the known site areas.

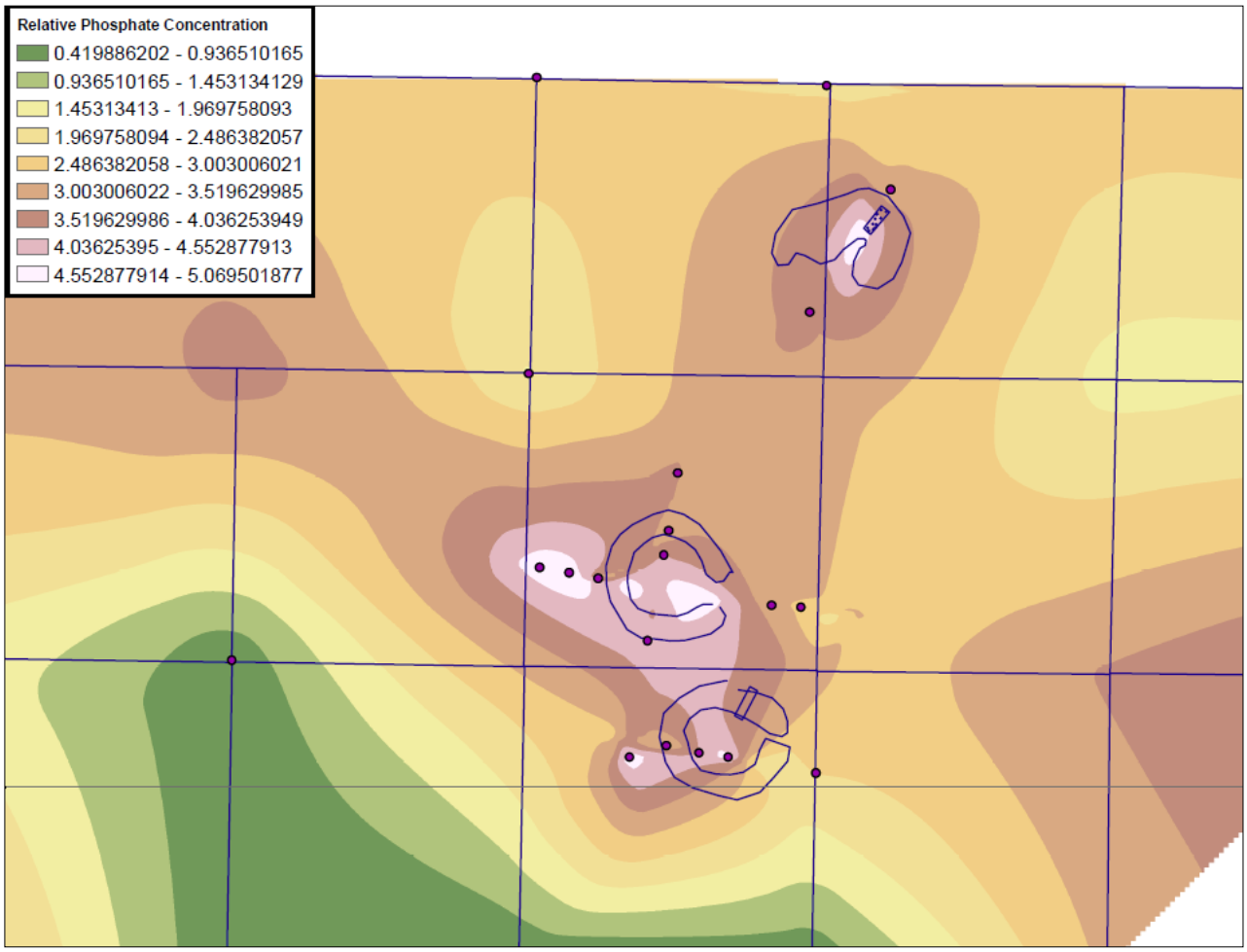


Figure 17: Relative phosphate concentration in relation to the structures at Skaill.

Phosphate peaks are identifiable within sites 1-3 indicating that anthropogenic activity within the structures has resulted in relatively high phosphate levels when compared with areas outwith the known settlement. Average P concentration within the hut circle and burnt mound interiors is in the range of 1.9-2.7 mg/g^{-1}. Patterning within the structures themselves is less clear. Areas that exhibit a variety of phosphate levels in a relatively small locale are often identifiable as interior areas. The location of relatively high and low phosphate concentrations clustered near each other suggests the presence of divided interior space (Craddock et al. 1985: 368; Matthews et al. 1997: 293). Peaks in relative phosphate concentration in the centre of structures may be indicative of hearth or food preparation areas with areas of lower concentrations indicating areas kept relatively free of domestic waste. Lower values within the structure banks as observable at site 3 are to be expected as bank and ditch features manifest in the phosphate record as linear bands of relatively low and high phosphate content respectively (see Yerkes et al. 2007: 866). This is a result of organic debris collecting in ditches and the inability of organic debris to remain fixed in banks (see Ullrich 2013, 50).

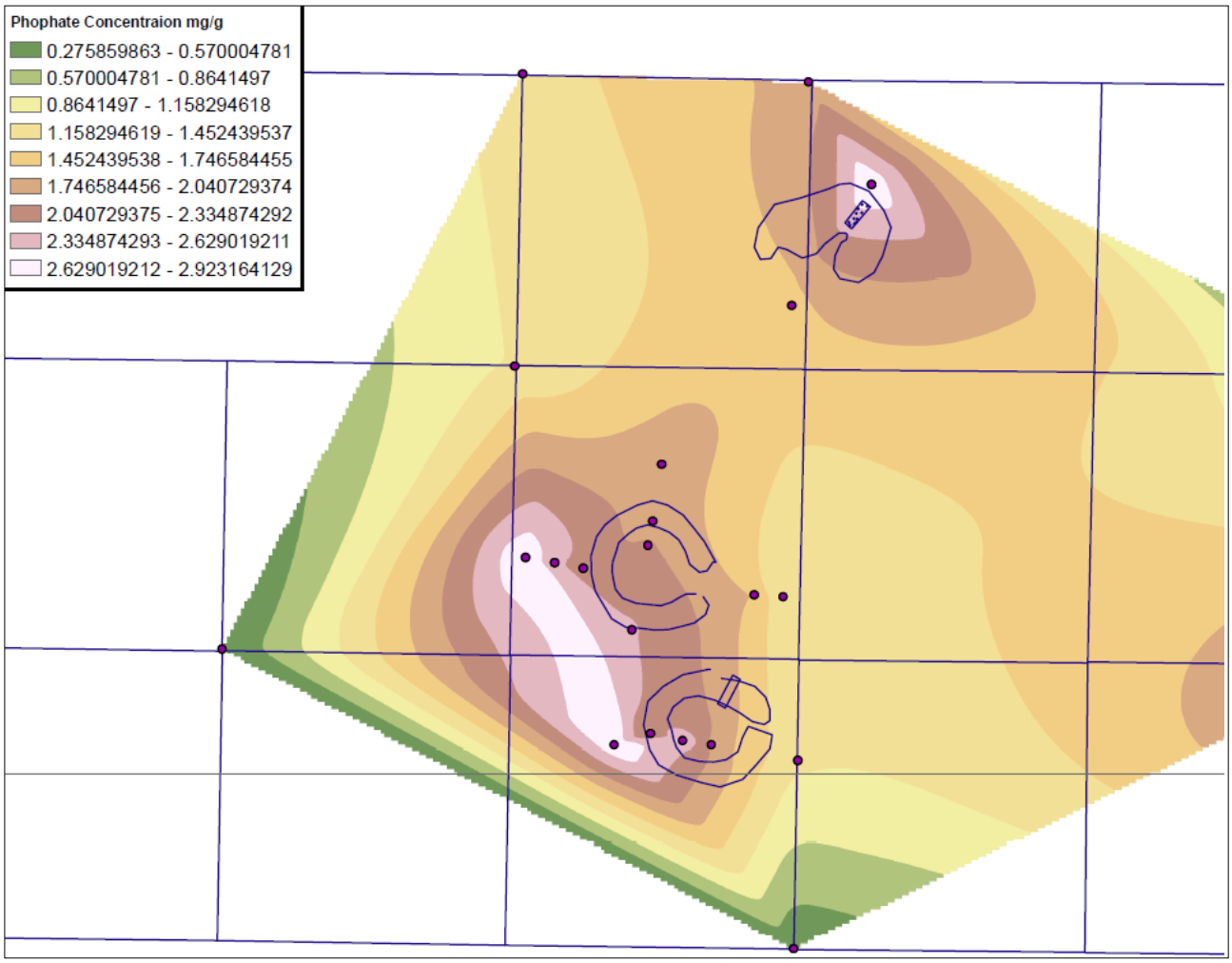


Figure 18: Phosphate concentration in relation to the structures at Skaill.

Interestingly, the highest relative concentration of phosphates is located directly west of site 2. A peak in relative phosphate concentration is also observable west of site 3. These peaks in relative phosphate concentration outwith the identified sites are of interest. It is possible that they indicate the presence of either earlier or later structures and would be consistent with the evidence from the excavations of the sites 2 and 3 which could suggest that these sites were occupied sequentially or periodically one after the other representing a progressive use of the landscape or replacement of houses as they fall into disrepair and were abandoned (see *Discussion*). However given the location of both peaks immediately west of known structures, it is perhaps more likely that they reflect the dumping of domestic waste material outside of the main occupation area. The two phosphate peaks west of sites 2 and 3 could therefore be tentatively identified as indicative of domestic middens. Increased areas of phosphate content can also relate to exterior walls where debris was deposited as a result of clearing the interior (Terry et al. 2004: 1245). It is also possible that increased phosphate content against the exterior of walls can result from the natural accumulation of organic debris in a protected area. A further two peaks of relatively high phosphate concentration are observable approximately 30m east and west of the main settlement areas. These relatively high concentrations may point to a difference in land-use within these areas. The peak west of the main settlement is in close proximity to an anomaly noted on the geophysical survey and may be

indicative of another archaeological site or an area of maddening. The low phosphate levels in the fields south of the settlement sites may suggest less intensive use of the land or arable use without the addition of manure as fertiliser.

The phosphates show variation with depth with higher readings found most frequently within the B-horizon. Anomalous higher readings of phosphate were obtained within the base of profiles in Transect 6 Test Pit 9 located in an outlying area. The variation in P concentration at different depths probably reflects the differing quantities of P added to the soils. The collection of phosphates in the topsoil has been identified as an effect of plant growth (Proudfoot 1976: 103). The upward movement of phosphates within a soil profile allows for the displacement of phosphates from lower horizons to the topsoil. The rate of this vertical movement is related to the quantity of root growth, and of phosphate uptake by those roots. This creates a build-up of active phosphates in the topsoil, thus forming a phosphate 'shadow' in the topsoil that mirrors levels found in sub-soil horizons. The C horizon samples were largely taken for comparison with those further up the soil profile because they represented "sterile" soil unaffected by anthropogenic phosphate sources. This is reflected within the results which show, on average, lower phosphate content within C horizon samples.

An apparent differentiation is thus seen between areas of settlement and those of agriculture. The low phosphate levels in the enclosed fields, and beyond them, may suggest arable use without the addition of manure as fertiliser. The surviving field and settlement remains identified by LiDAR and subsequently excavated assist in the understanding of the phosphate values. They may also act as a key in providing confidence in the interpretation of phosphate patterns from other areas within the LiDAR survey area where the opportunity for more detailed survey and excavation has not yet arisen. While the absolute phosphate values themselves cannot be projected from one site to another, the general distribution patterns of phosphate concentrations identified within this study could be used as a means of targeting future excavations. The phosphate analysis results in the creation of an archaeological soil phosphate 'signature', which can help to delineate to edges of occupation within the survey area and could be compared to other areas targeted through predictive modelling. The identification of structures not visible on the ground surface is possible in phosphate analysis through identification of the specific patterns described above.

Methodological Results: Discussion

Reviews of the basic principles and applications of phosphate analysis are presented by Bethel and Máté (1989), Crowther (1996, 1997, 2002), Heron (2001) and Holliday and Garner (2007). Many anthropogenic activities deposit elements in soil. The majority of the elements left behind are rapidly depleted from the soil or the elements are mobile and do not remain in the original location. Phosphorus binds rapidly with Fe, Al, or Ca in soil and becomes relatively immobile. Prolonged occupation of a settlement causes phosphorus to accumulate, and as a result areas of human occupation show large concentrations of phosphorus when compared to native phosphorus.

The methods of phosphate analysis available and applied within an archaeological context are vast and their various limitations and applicability are well documented (see Holliday and Gartner 2007). The adapted Eidt and Wood method selected for the *Window on the Hidden Bronze Age Landscape of Caithness* project was selected following a review of the literature on available and efficacy of methods. Comparison of laboratory testing methods with the semi-quantitative spot testing methods shows that spot test levels are not as exact as laboratory methods, but do fall into definable ranges that are comparable to the laboratory tests (see Ullrich 2007; Hamond 1983; Smyth et al. 1995). The level of definition obtained from the rapid spot testing field technique is thus sufficient for the accurate determination of phosphate patterning over archaeological sites. Bjelajac et al. (1996)

tested the accuracy of the Eidt and Wood spot test methodology for identifying buried archaeological features. The study showed a 97% accuracy rate on invariant classification for the Eidt and Wood methodology. As discussed above, a modified chart of phosphate levels was employed following the methods of Ullrich (2007, 100-104) recalibrating the phosphate levels set out by Eidt and Wood (1974) to allow for variations in the individual measured attributes and allow for a more refined phosphate score based on average reactions.

The soil sampling strategy undertaken included the taking of multiple samples from each transect, test pit and deposit to allow for the testing of the same suite of soils samples at the Castletown Heritage Centre and within AOC's laboratory. This allowed for direct comparison of different qualitative and quantitative phosphate results and further allowed to test the reproducibility of results. Reproducibility was tested by selecting a random sample of soils for testing using the adapted Eidt and Wood ring-test method. The relative phosphate concentration was determined by analysing the samples in triplicate using the ring-method. The average phosphate concentration for each sample was compared to determine the reproducibility associated with the method of extraction. The results showed a small deviation (average ±0.11) from the average phosphate concentration between samples. This is judged acceptable for archaeological purposes where only a relative phosphate concentration is required.

Comparison between the qualitative and quantitative phosphate analyses showed a general correlation with those samples classed as 'high' relative phosphate revealing a generally higher P value (typically in the range of 2.1-1.9 mg/g^{-1}) and those classed as 'low' relative phosphate in the range of 0.2-1.4mg/g^{-1}). In view of this correlation it is therefore reasonable to assume that for those samples not tested quantitatively in the laboratory that these values can be roughly applied to the relative phosphate concentration. Thus the lowest band of relative phosphate concentration of 0.42-0.94 roughly translates to 0.27-0.57 mg/g^{-1}. Spot test results on an arbitrary scale (1-6 in this study) can thus be broadly correlated to mg/g^{-1} photometric laboratory results. Most of the results for the soil samples in the study area did correspond to the spot test results in relative value and show a definite link between high- and low-level results from the spot and laboratory tests. However a number of anomalous variations were identified demonstrating a need for a degree of caution when extrapolating results across the survey area. For example, the qualitative tests for samples from transect 3 test pit 7 resulted in a relative phosphate concentration value of 3.75 which should translate to within the range of 2.04-2.33 mg/g^{-1}. However the laboratory analysis produced a result of 1.6 mg mg/g^{-1}. It is further imperative to note that the quantitative laboratory range of P values that correspond to spot test levels in these samples should not be projected onto other sites. The levels obtained through this study cannot correspond to any sample set other than their own. The tests do indicate, however, that correlation between laboratory test results and spot test results occur in the vast majority of cases.

Phosphate testing and landscape survey

The ability of phosphate analysis techniques to accurately identify archaeological features, as well as less tangible components, makes phosphate testing highly applicable to a landscape wide study, as undertaken here. The utilisation of this information to create use-of-space models helps determine land-use patterns over sites, allows for greater trends between sites to be identified and aids in the archaeological interpretation of large- and small-scale intra-site dynamics. Specific phosphate levels cannot be compared across sites due to the large number of natural and modern variables that can affect phosphate background levels and retention. Site-wide phosphate patterns, however, can be compared to other tested sites to determine if a variety of sites were used in similar or different ways (See Ullrich 2013, 53).

Micromorphological Analysis

Summaries of the Micromorphological Analysis results are presented in Tables 1 to 10 in Appendix 2. The positions of the kubiena samples are shown on section drawings (Figures 10-11).

Mineralogy of the sand grains and lithology of the rock fragments from throughout the sample sequence represent a soil parent material (gravels derived from sandstones (Bown et al 1982)) present over much of the surrounding area. Rock fragments are predominantly sandstones and most are classified as lithic greywackes (see Mackenzie and Adams 1994, 109). In all layers >95% of mineral grains are quartz with the remainder being mainly feldspars and biotite with rare chlorite and microcline. Quartz grains are mainly angular to sub-angular. No erratics introduced by human occupation were observed in any of the samples.

The birefringence of the fabric was low in most of the samples. High birefringence is generally due to a high clay content to high calcium carbonate fraction. Although both clays and calcium carbonate are prone to leaching from surface horizons and accumulating at depth, there was not any notable accumulation of either mineral. The coarse material is frequently randomly distributed in the groundmass giving rise to a dominance of porphyric related distribution types.

There is evidence for both depletion and accumulation of iron across the samples. The leaching of iron down the soil profile is an effect of weathering, and is mainly linked to rainfall. The accumulations of iron as nodules, segregations and hypocoatings are the result of soil formation processes in a cool, wet climate. The depletion of iron in the mineral grains is evident as bleached areas around the rims of grains and is evidence of acidification.

A brief description and interpretation of the results is presented below by context number, where the same context occurs in more than one sample they are discussed together. Samples and context are described and discussed from the base-up in order of sediment deposition.

Trench 4 Test Pit 5 (Site 3)

Two kubiena samples were removed from test pits prior to the excavation of site 3. Trench 4 test pit 5 was located within the centre of site 3 and taken through a series of hypothesised occupation deposits (elsewhere referred to as deposit 2). A total of six discrete layers were located within these two sections (with the characteristics of the sediment identified at the top of sample K9 sufficiently similar to identify it as the same deposits at the base of Sample K8). All layers have been subject to some degree of post-depositional reworking by soil biota indicative of a relatively gradual accumulation of sediment during which each successive layer was exposed to near-surface pedoturbation following deposition.

Plate 12: Scan of Thin Section Sample K9

Plate 13: Scan of Thin Section Sample K8

Deposit 2.1

Located at the base of Sample K9, Deposit 2.1 is a dark yellowish brown poorly sorted sand deposit clearly differentiated from the overlying layer by its lighter colours as visible in Plate 2 and high proportion of coarse mineral material. There are no anthropogenic indicators and coarse organic matter is limited to few plant tissue remains and organ residues, often highly birefringent and associated with channel voids indicating that they are associated with post-depositional mixing by root material. Identified pedofeatures include many redoximorphic features including iron (fe) and/or manganese (mn) accumulations and nodules and iron oxide depletion coatings to voids and around mineral grains. These features are indicative of podsol formation (Lindbo et al 2010) a process which may have been caused or accelerated by the subsequent construction of the hut circle (see Simpson et al 1998). Passage pedofeatures infilled with smooth ellipsoid organo-mineral excrements are indicative of mixing by soil biota. In places the microstructure is crumb like and made up of coalesced excrement features. Limited evidence for horizontal banding within this layer is indicative of accumulating sediment.

Deposit 2.2

Deposit 2.2 is distinguished from the underlying layer by a higher occurrence of redoximorphic pedofeatures as well both coarse and organic matter which combined give this layer a dark reddish brown colour in PPL. The layer is isotropic and black with an undifferentiated birefringence fabric owing to the frequency of fine amorphous organic matter in the groundmass. Frequent angular black flecks throughout the groundmass may be micro charcoal that has washed or been trampled in from overlying layers. Weak banding and parallel orientation with the top of the slide of indicative of gradual sediment accumulation. Pedofeatures are largely excremental in nature and indicative of soil reworking further evidenced by the predominantly crumb microstructure.

Deposit 2,3

Deposit 2.3 contained within the top of K9 and base of K8 has a complex microstructure dominated by an excremental crumb fabric which in places have coalesced to create a massive microstructure. The banding observed in the underlying deposit is largely absent in this deposit which has been subject to a greater degree of reworking possibly indicating longer exposure to surface pedogenesis. Evidence of incipient podsol formation is present in the form of occasional typic anorthic nodules Rock fragments are very rare and the coarse mineral fraction is less than in the underlying layers. Coarse organic matter is limited to very few woody root and tissue fragments with 'disappeared' interiors. Organic matter increases towards the top of the layer close to the interface with Deposit 2.4 where a cluster of charred material was also identified.

Deposit 2.4

This is a patchy heterogeneous layer which is dark yellowish brown in PPL with a weakly developed sub-angular blocky structure. Although subject to some reworking as evidenced by partially infilled passage features and rounded ellipsoid excrements, excremental pedofeatures are fewer than in underlying layers. There is a higher incidence of organic matter including tissue and organ residues. Clusters of blackened organic matter may be disaggregated charred material.

Deposit 2.5

This comprises a layer of predominantly charred internally amorphous fragments and charcoal embedded within a dark yellowish brown groundmass. The layer contains a mix of carbonised and oxidised residues indicating that some mixing of this burned material has occurred after it cooled down. Further post-depositional mixing is indicated by channel and partially infilled passage features which dissect the charred and carbonised material.

Deposit 2.6

Deposit 2.6 is an unsorted heterogeneous deposit with a coarse mineral component dominated by sand sized quartz inclusions. Identifiable plant tissues are rare and most coarse organic matter is fragmented and strongly decomposed (following Fitzpatrick 1993) and comprises common reddish brown rounded internally amorphous features and common single cells and disaggregated groups of cells. Cellular charcoal is absent but there are common large internally amorphous black fragments (100-200µm) and frequent black punctuations <20µm.). Observed pedofeatures include occasional infilled passage features and occasional fe/mn nodules. Evidence for bioturbation includes few channels and chambers, rare excremental pedofeatures and traces of modern roots.

Discussion

Micromorphological analysis of the samples from trench 4 transect 5 has allowed for the identification of six discrete layers. Subsequent mixing has blurred the distinction between these layers and the banded layers within them and the process of deposition is not clear. However located at the base of this hypothesised occupation sequence deposits 2.1-2.2 contain limited or no evidence for anthropogenic activity and likely represent the gradually accumulating buried ground surface upon which the structure was later constructed. Anthropogenic markers in deposits at the top of 2.3 and within layers 2.4 -2.6 along with their compact heterogeneous nature are indicative of general occupation accumulation including within deposit 2.5 incorporation of large quantities of burned material probably hearth waste. Given their location within the hut circle structure, these layers probably represent the gradual accumulation of occupation deposits. The incorporation of a thick layer of hearth waste in deposit 2.5 may reflect a change in use of space within the structure. It can be summarised as a biologically-worked fill with a marked anthropogenic signature fine charcoal-rich with burned bone, of likely domestic occupation/combustion zone /trampled floor origin. This anthropogenic signature is reinforced by an enhanced marked phosphate-P concentration (2.67 mg/g^{-1}).

Extensive biological reworking has produced a channel and chamber to crumb microstructure in all layers. The boundaries between the layers are diffuse and the mixing of the sediments by soil fauna and to a lesser extent soil flora has prevented the identification of difference in use and activities across the sequence. The degree of biological reworking also differs throughout the layers and indeed is responsible for many of the observable characteristics and features of the sediments. Factors that determine soil fauna activity include food sources, moisture, pH, temperature and soil disturbance and in some instances are able to point to disturbance and or changing environmental conditions (see Kooistra and Pullamn, 2010).

Context 211

Context 211 occurs in a thin band at the very base of sample K4., It was described during fieldwork as the cut of linear ard mark into the natural sub-soil. The deposit is grey in PPL with a gefuric c/f related distribution. The deposit is composed of nearly equal amounts of lithic clasts and fine sand sized quartz with very rare disaggregated organic matter. Pedofeatures are largely redoximorphic in nature. At the boundary between the hypothesised cut (211) and fill (212) of the ard mark is an area with increased mn and fe staining which is distinguished by its darker reddish brown colour.

Context 212

Context 212 occurs within K4. It was described in the field as a firm mid grey silty clay with occasional charcoal and gravel and interpreted as the fill of an ard mark. In thin section [212] is light yellowish brown (10YR 6/4) in PPL. It is a randomly sorted deposit characterised by porphyric c/f related distribution, apedal, mainly massive but rarely apedal channel structure. The context shows strong influence of iron and maganese oxidation. There are several microfabric types occurring in patches throughout the layer. Coarse mineral material is clustered and occasionally banded (possibly at the limit of the ard mark cut which is demarked by planar voids. Coarse organic components comprise rare ovoid and rugose aggregates of organic stained, dark brown (PPL) silt. Fine angular black fragments of 10-100µm in size are probably charcoal. Frequent fe/mn anorthic nodules and iron staining commonly associated with old root channels.

Plate 14: Scan of Thin Section Sample K4

Discussion

While it is not possible to unequivocally identify the features observed in the base of sample K4 to an ard mark, a number of the identified characteristics of the deposits are consistent with implement marks. The concentration of textural pedofeatures at the boundary of the hypothesised cut are consistent with in situ ard ploughing, as produced experimentally by ard ploughing (Lewis 1998) and examined at Lincent, Belgium (Lewis 2007). As discussed by Lewis (2007) there may be a tendency for manganese and iron to be precipitated at the edge of ard mark features due to changes in soil density and related pore pressures and this would explain the increased concentration of fe/mn pedofeatures at the boundary between 211 and 212. Iron oxidation, leaching and possibly reduction are all involved in making ard marks visible to the naked eye and would therefore have served to make this feature visible during excavation. The association of textural pedofeatures and ancient tillage of poorly stable (eroded) subsoils is well documented; (Dimbleby and Evans 1974; Macphail 1998; Macphail et al. 1990). The ard mark appears to have been cut into a peaty quartz sand material (211) and filled by the soil (212) demonstrating that the horizon was cultivated. The soil shows evidence of mixing (which in view of its association with an ard mark is likely plough mixing) and structural disturbance, alongside biological working, as found in all types of arable soils (Courty et al., 1989; Jongerius, 1970; Mücher et al., 1990). Once ploughing has occurred, biological activity will work the soil, and this will happen rapidly.

Context 207

Context 207 occurs at the top of K4, within K5 and at the base of K6. It was described in the field as a firm mid grey silty clay with occasional charcoal and gravel and interpreted as a buried ground surface, possibly deepened by prehistoric agriculture, upon which the hut circle was constructed .

The microstructure of this deposit varies throughout the sample sequence but is commonly a complex weakly to moderately developed sub-angular blocky microstructure with channels and chambers. Occasional weak banding of sand sized coarse mineral material is indicative of gradual accumulation although frequently the microstructures has been entirely reworked into a series of rugose porous aggregates. The weakly developed sub angular microstructure relates to phases of incipient soil development.

The context contains phytoliths (indicating the presence of grass) and a very few diatoms (indicating wet surface conditions) (Simpson et al 1998), although these materials could also indicate the

addition of animal dung (see Courty et al 1989). Indications of light burning (charcoal) are evident throughout the context, and small amounts of ash from turf or manure burning are also present. There are very few burned peat or soils clasts. Although soil phosphate levels obtained from around this context were enhanced, the soil organics are mostly decomposed. Frequent excremental pedofeatures may be indicative of enhanced biological activity which is associated with large amounts of organic material in the soil. The pedofeatures include dark brown areas with dense black organics, areas of dense mineral material and a more yellow-brown micromass. The majority of the boundaries between pedofeatures are sharp; this and the inclusion of broken organics indicate that the context has been disturbed, suggesting a low level of cultivation.

The very thin clay coatings on the mineral grains could have been formed by several processes. Clay is mobilised in the soil in wet, acid conditions and the coatings could therefore have formed in the acid, peaty conditions observed across the landscape. Clay is also mobilised by disturbance to the soil, and the coatings could therefore have developed due to cultivation. Clay moving down the soil profile would also account for the observed occasional linings on soils voids.

Discussion

Micromorphological evidence from Context 207 are consistent with interpretation of it as a soil deepened significantly by the addition of organic material and this is supported by high LOI results from around the hut circle and high P values from within the soil beneath the hut circke. In view of its association with an ard mark Context 207 can further be interpreted as a fertilised artificially deepened agricultural ploughsoil.

Context 202

Context 202 is present in Sample K7 and at the top of Sample K6. [202] was described as a mid-brown grey firm silty clay with lenses of pale grey sandy clay with occasional charcoal and gravel and made up the earth and turf core of bank [201]. K7 consists entirely of 202 and has no macroscopically visible boundaries although a number of microfabric types were identified microscopically.

Discussion

Context 420

Context 420 occurs within the base of K1 and was described during excavation as a mid-grey firm sandy clay with moderate small stones and rare charcoal flecks. It was observed below the hut circle bank (402) and measured 0.05m thick. It has been interpreted as the buried ground surface upon which the hut circle was constructed.

In thin section [420] is heterogeneous in colour ranging from strong brown (10YR 4/6) to reddish yellow (10YR 6/8). It a randomly sorted deposit characterised by porphyric c/f related distribution, aggregation in sub-angular blocky peds, moderate separation, and is partially accommodated with planar voids. Frequent rededoximorphic pedofeatures including many fe/mn nodules are indicative of incipient podsol formation. Anthropic indicators include frequent angular flecks of charred material throughout the matrix and common charcoal towards the top of the layer (possibly washed in from above). Two fragments of bone measuring 200 and 400µm respectively are located in the centre of top of the layer. The proportion of coarse organic material and phytoliths decreases with depth. The context contains frequent phytoliths (indicating the presence of grass) and rare diatoms (indicating wet surface conditions) (Simpson et al 1998), although these materials could also indicate the addition of animal dung (see Courty et al 1989).

Discussion

Iron pan formation is often found directly below occupational surfaces as the subsoil becomes compacted and drainage is inhibited, representing the 'reactive' zone of occupation surfaces (Simpson et al 1998) thus any interpretation of the 'natural' soil on which any occupation surface was formed must be treated with great caution. In view of the increased organic matter content and frequent phytoliths towards the top of this layer as well as identification of bone fragments it would appear that 420 represents a buried soil which may have been subject to some cultivation or manuring prior to construction of the hut circle structure.

Context 402

Context 402 occupies the upper two thirds of sample K1. It was described in the field as part of the core of the outer bank of the hut circle formed of distinctive 'burnt mound material' comprising heat shattered stone in a dark brown to black sandy silt matrix with abundant charcoal. (402) is dominated by coarse mineral grains with common fragments of carbonised peat and charcoal mixed with deposits of unburned soil material. The mineral and carbonised material mix is typical of a burnt mound deposit representing the degraded remains of heated rocks along with residues of the fuel used to heat them. Excremental pedofeatures are rare and the preservation of sharp boundaries between micro fabric types further indicates limited post-depositional mixing suggestive of rapid deposition and limited exposure. Boundaries between microfabric types are commonly vertically aligned at 45-90º indicative of dumping/slumping rather than gradual accumulation. Coarse mineral fragments are commonly dipping at 45º angle and are further indicative of a dumped deposit. There are rare patches of micro-fabric with a channel and chamber to crumb microstructure and frequent infilled passage features. These patches like other micro-fabric types have sharp boundaries with the groundmass and are likely to have been reworked prior to deposition within their current location. This excremental fabric is thus indicative of incorporation of a mixed soil component along with burnt mound material within the construction material of the hut circle bank.

Discussion.

The mixed composition of (402) is thus consistent with the interpretation of the construction of the bank using burnt mound material. Incorporation of mixed soil types suggests perhaps that the burnt mound was dug out and patches of underlying and surrounding soil incorporated into the bank construction material. The re-use of burnt mound material within other later structures, although unusual, is not unknown and was documented during micromorphologcial study of burnt mound deposits at Cean nan Clachan where the floor of later structure was found to contain deposits very similar to those obtained from within a burnt mound, indicative that the burnt mound was quarried to create the later structure (Armit and Braby 2002: 252).

Context 503

Context 503 occurs within sample K2 it was described in the field as a deposit of dark brown sandy silt, highly compact containing frequent plant roots and occasional small stones. It was recorded overlying the bank to the interior of the hut circle and interpreted as a possible occupation deposit. Viewed in thin section (503) is a relatively homogenous unsorted deposit yellowish brown (10YR 5/6) in PPL with a weakly speckled b-fabric and a porphyric c/f related distribution. The homogeneity is in large part derived from post-depositional reworking of this deposit as evidenced by frequent excremental fabric pedofeatures and the crumb microstructure formed of coalesced aggregates of a mixture dominantly of enchytraeid and earthworm excrement (see Kooistra and Pullman, 2010). The

porosity is variable, up to 15% in places and locally as low as 5% where earthwork and arthropod excitements have coalesce to create a massive compact microstructure. Post-depositional reworking by flora is also evidenced by few large pseudomorphic voids rarely with traces of outer lignified woody material and 'disappeared' interiors. The presence of highly birefringent woody root organ residues is also evidence of penetration by plant material. The yellowish brown colour of the matrix and common yellow depletion pedofeatures around coarse material are indicative of iron oxide depletion. The coarse organic component is largely heavily decomposed and dominated by single and disaggregated cells. Anthropic indicators include rare internally amorphous charred material and frequent silt sized black charcoal flecks. The context also contains frequent phytoliths which are indicative of the presence of grass.

Discussion

503 has been almost entirely reworked by soil meso and microfauna and is an excremental fabric. The crumb to massive microstructure attests to this extensive post-depositional pedoturbation and most pedofeatures are excremental in origin. Anthropogenic indicators inlude few internally amorphous possible carbonised fragments, fragmentary charcoal and frequent phytoliths. In view of its location within a hut circle it is probable that 502 represents an occupation horizon subject to exposure following deposition allowing for its complete reworking.

Context 519

Context 519 occurs within sample K3. It was described as moderately compact dark red clayey silt containing regular fragments of charcoal and forming the lower deposit within pit [512]. It is interpreted as the pit fill of a possible burnt mound trough. When examined in thin section this pit fill was found to comprise four distinct layers. The boundary between all layers is diffuse (>60µm). Fluctuating water tables and/or water saturation affected the sample with all layers exhibiting intrusive redoximorphic pedofeatures such as iron hydroxide and manganese nodules and iron hydroxide coatings. Unlike other samples studied as part of this project; this sample has been subject to very limited post-depositional pedoturbation which has allowed for the preservation of discrete banding within layers.

Layer 1

The sediment at the base of the context is a very poorly sorted grey (10YR 5/1) sand with a complex massive microstructure with very few channels and chambers. It is a predominantly mineral deposit dominated by quartz minerals few of which have preferred orientation of 45º. The coarse mineral component exhibits weak banding indicative of gradual accumulation of sediment. Coarse organic matter is limited to rare patches of strong brown (10YR 4/6) amorphous material mixed in with the finer organic groundmass. Noted pedofeatures include general iron staining noted around weathered material and few weakly to moderately impregnated fe/mn hydroxide nodules.

Layer 2

Overlying the banded sandy deposit, layer 2 is more compact unsorted deposit. It has a complex massive microstructure with rare vughs and some channels. The porosity is variable, up to 10% in places but commonly as low as 2%. The matrix is speckled brown (10YR 5/4) in PPL with a slightly speckled b-fabric and an open porphyric c/f related distribution. Few weathered rock fragments are also present. The organic fraction of the layer is represented by few sub rounded organic reddish brown to black clasts. Few dark reddish brown to black sub angular fragments rarely with traces of cellular structure are also present. Common subangular to angular black fragments (10-60µm) of probable organic origin are distributed throughout the matrix and contribute to the speckled appearance of this layer at lower resolutions. Noted pedofeatures are limited to general iron staining around weathered rock fragments and in association with organic material.

Layer 3

Layer 3 exhibits a complex weakly developed sub angular blocky microstructure with accommodating planes and some channels. Porosity is up to 10%. The matrix is heterogenous in colour and varies from yellowish to reddish brown in PPL. Redder matrix colours are more common towards the top of the layer where organic matter content is higher. The layer has a speckled crystallitic b-fabric and c/f related distribution is porphyric. Phytoliths are common throughout the matrix and frequent in patches associated with organic material. The organic fraction of the layer is represented by few deformed amorphous organic reddish brown to black clasts and rare reddish brown organ residues Common sub rounded to sub angular black fragments (10-200µm) of probable organic origin are distributed throughout the matrix and contribute to the speckled appearance of this layer at lower resolutions. Pedofeatures are predominantly related to the formation of hydromorphic oxic material and include very few hypocoatings of iron hydroxides on voids and very few amorphous iron/manganese oxide nodules

Layer 4

The sediment is an unsorted heterogeneous banded deposit. It has a complex massive microstructure with rare channels. The deposit contains very few voids, with those present often showing referred orientation pattern parallel to the top of the slide a characteristic typical of ditch deposits (Mucher et al 2010). The matrix is speckled light yellowish brown in PPL and has crystallitic b-fabric. The c/f related distribution is open porphyric. Anthropic indicators include patches of frequent phytolithis indicative of patches of grass ash, few burned peat fragments and soils clasts as well as very few disaggregated charcoal fragments.

Pedofeatures are predominantly related to the formation of hydromorphic oxic material and include very few hypocoatings of iron hydroxides on voids and very few amorphous iron/manganese oxide nodules. There are very few channel voids and chambers part infilled with faecal pellets.

Discussion

The base layer of (519) can be characterised as a heterogeneous fine sand deposit which has been subject to limited post depositional mixing by soil flora and fauna. The well preserved sedimentary banding would not have survived lengthy duration of near-surface pedogenesis and is indicative of formation of the overlying deposit soon after deposition.

Layer 2, by contrast, contains little evidence for banding or gradual accumulation. Its compact nature, dipping nature of the coarse mineral component are consistent with a dumped deposit. Anthropic indicators are near absent. Layer 2 therefore appears to represent a ‘clean’ or compacted layer deposited following initial accumulations of deposits at the base of the pit.

The layering visible within the upper layers (3, and 4) of (519) is more typical of ditch deposits as they exhibit different size distributions of mineral grains and with different degrees of sorting. For example, layers 3 and 4 are distinguished by differences in their coarseness and organic matter content. Layer 4 is significantly coarser and conations a higher proportion of organic matter than the underlying layer. (519) thus appears to be formed of a series of colluvial deposits representing gradual sedimentation of the ditch from the ditch sides and upcast bank followed by capping of lining of the pit with a ‘clean’ compacted deposits after which the pit was gradually infilled.

SOIL SURVEY: CONCLUSION

Soils analysis

Results from the phosphate prospection of the Skaill survey area successfully identified the occupation areas and also indicated both an interior division of space within the structures and differences in land use surrounding the structures themselves.

Comparative analysis of phosphate concentrations across the study area has allowed the relative phosphate concentration of the sample locations to be designated as high, low, or moderate relative phosphate and phosphate patterning has been mapped accordingly. Large landscape sites such as undertaken here, which produced over 200 soil samples, can thus be analysed efficiently to produce interpolation maps showing the relative concentrations of phosphate across a large area. The results demonstrate the usefulness and applicability of such surveys to landscape studies and further demonstrate how the undertaking of such surveys should allow archaeologists to adapt the survey and gather additional data in areas of high phosphate that may have otherwise been missed using traditional techniques. Ultimately, the phosphate patterning map is a tool to be combined with other archaeological methods to determine boundary lines of expansive archaeological sites and delineate the individual structures within a landscape. The soil survey undertaken for the *Window on the Hidden Bronze Age Landscape of Caithness* project has clearly demonstrated the archaeological potential of the area and has also demonstrated the potential of reconnaissance surveys undertaken beyond traditional areas of archaeological excavations. Phosphate analysis offers a simple and effective means for the creation of use-of-space models and determination of land-use patterns over entire sites for inter- and intra-site comparisons and to contribute to a greater understanding of the relationships between field systems and settlement. The soils and field systems surrounding an archaeological site potentially hold the key to understanding the organisation and management of land in early societies, and this understanding is fundamental to an understanding of how these societies functioned.

Micromorphological analysis

By analysing and characterising the matrix of these deposits and comparing their results with the other excavated circular structures and with wider micromorphological and anthropological studies it has been possible to identify a range of anthropogenic and pedogenic site formation processes. Samples removed from the interiors of the hut circles, although too biologically reworked to infer use of space, displayed a composition, heterogeneity and porosity consistent with compacted/trampled occupation horizons and show similarities to those observed within hut circle occupation sequences in Wester Ross (Roy 2014, Wildgoose and Welti 2013) and Sutherland (Roy 2016, Dagg 2015). The identification of discrete layers within thin sections from occupation horizons hints at changes in intensity of occupation which at the very least has affected organic matter content and the degree of post-depositional reworking.

The buried soils upon which the hut circle was constructed have been found to have been subject to high levels of biological activity. The presence of organic matter some of which contains charred material is indicative of the use of domestic waste and manure as fertiliser. It has been suggested that there was successive occupation and abandonment of structures within this landscape and this is indicated by re-use of burnt mound material in the hut- circle structure. It is probable that one of the factors that encouraged the Bronze Age occupiers of these structures to re-use material within this location was the value of the heavily fertilised soils around the settlement.

The sample removed from Site 2 provided further insight into the probable re-use of burnt mound material for the construction of the hut-circle bank. The micromorphological evidence allowed for identification of several microfabric types the sharp boundaries between which were is indicative of

incorporation of burnt mound material with other sediment rapidly deposited without the exposure to post depositional reworking elements.

Bronze Age phosphate-enriched animal trampled soils developed over river alluvium. Ensuing probable local cultivation (alongside likely continuing stock management) led to colluviation, and evidence of in situ ard-cultivation in the accreting soils is recorded.

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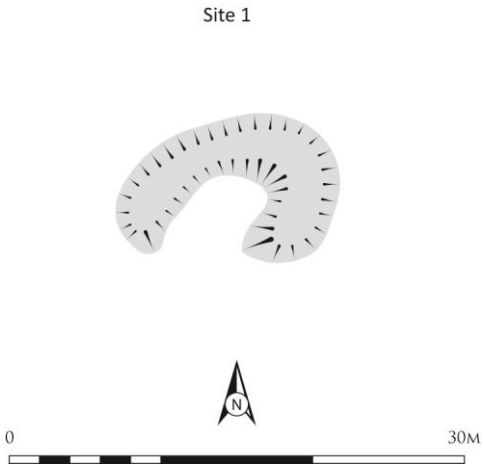
A Window on Bronze Age Caithness
Data Structure Report

Section 2: Appendices

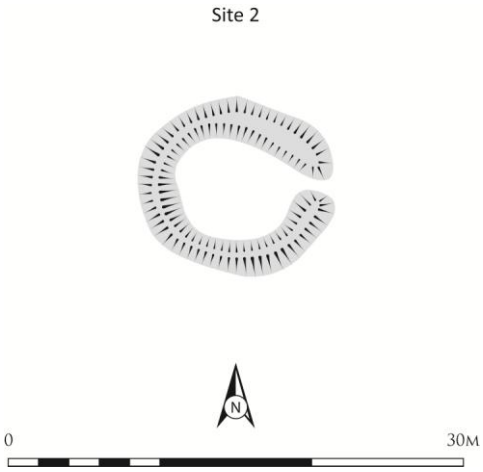
AOC Archaeology Group

APPENDIX 1: SITE GAZETTEER

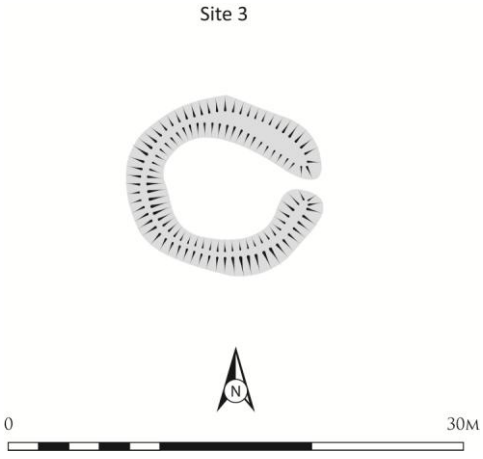
Site 1
Site Type Hut Circle
A hut circle lying within 50m of possible burn beds and is set in rough grazing with mixed grasses, soft rush and gorse on gentle undulating SE facing slope. The site comprises a semi-circular bank, measuring 12.3m by 8.2m, surviving to a height of 0.2m and a spread of material measuring 3-4m. It has a central depression opening to the south of the site.



Site 2
Site Type Hut Circle
A well preserved hut circle set in rough grazing with mixed grasses, soft rush and gorse on gentle undulating SE facing slope, lying approximately 40m S of site 1. It has an outer diameter of 13.2m and a bank of earth and stone measuring 1.4m thick and an obvious SE facing entrance. Abutting the northern bank of the hut circle is an L-shaped bank extending 17m northwards which may be a possible enclosure relating to the hut circle.



Site 3
Site Type Hut Circle
A hut circle set in rough grazing with mixed grasses, soft rush and gorse on gentle undulating SE facing slope, approximately 10m S of site 2. It measures 11.5m externally N-S and 12.2m E-W whilst the bank is approximately 1.3m wide and 0.25m in height with facing surviving in the NW quadrant. The entrance measuring 1.2m wide and faces WSW.



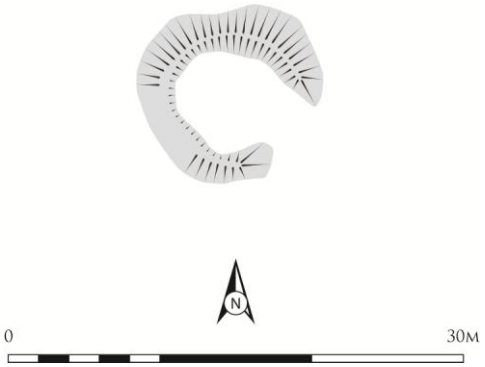
Site 4
Site Type Possible Enclosure
Possible sub-square enclosure measuring approximately 25m by 30m and lies 100m W of site 3. Mostly indistinct but is clearest at the NW corner and the SE side.

Site 5
Site Type Possible Hut Circle
Possible hut circle set in rough grazing with mixed grasses on a gentle SE facing slope. The bank wall measures 9m diameter x 1.5m width x 0.2m height. There is a possible E facing entrance and the sites has been disrupted on N, E and W sides by drainage.

Site 6
Site Type Hut Circle
Situated on a flat grassy area in a generally undulating landscape containing numerous hut circles of which Site 6 is the most southerly of the group. Stone and earth bank well preserved in places but may be cut through by a track running E-W on southern side of site. The bank measures 12.5m external diameter, 5.5m internal diameter whilst the bank measures 3.5m width and remains to a height of 0.6m. The entrance on the south west measures 2m wide. Site 7 is 1 metre to the north. It lies in an area of small cairns mainly to the west.

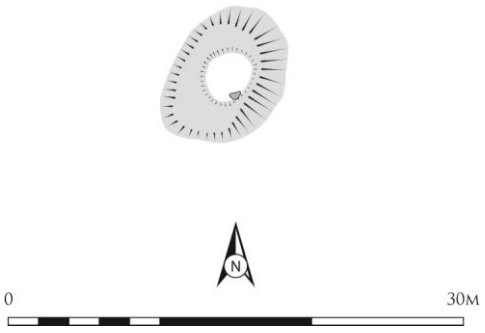
Site 7
Site Type Hut Circle
Poorly preserved penannular earth and stone bank with an external diameter of 12m, internal diameter of 6m, maximum width 3.5m and remains to a maximum height of 0.3m. There is no evidence of a specific entrance as the bank is not clearly defined. Situated on a flat grassy area in a generally undulating landscape containing numerous hut circles of which Site 6 is the most southerly of the group and Site 6 lies 1m to the S of Site 7. It lies in an area of small cairns mainly to the west.

Site 7



Site 8
Site Type Structure / Hut Circle
Well preserved possibly hut circle measuring 8m external diameter, 3.3m internal diameter, measures 0.6m wide and remains to a height of 1.1m. There is a possible entrance in the SW of the site. There is one very large internal facing stone within the SW of the bank. Site 8 lies in a generally undulating landscape containing numerous hut circles and is situated on a gently sloping E facing hill side. It lies 14m NE of Site 6 and there is an area of small cairns lying to the W.

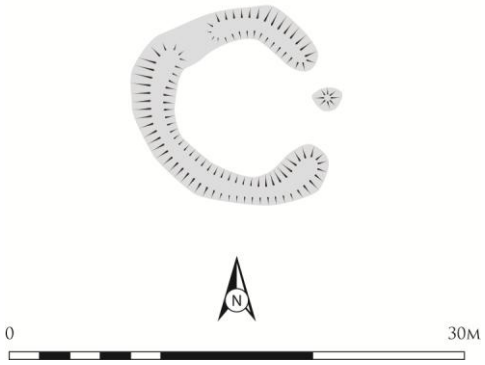
Site 8



Site 9
Site Type Hut Circle
A partially preserved earthen bank with a possible entrance in the SE section of the bank. Measures 13.3m external diameter, 8.5m internal diameter, maximum width of 3m and remains to a height of 0.4m. The site is situated in a flat area, covered in heather, rough grass and some bog cotton, in a

generally undulating landscape containing numerous hut circles. Site 9 lies 55m to the north of Site 7 and Site 12 is 70m to the NE. There is also an area of small cairns mainly to the W.

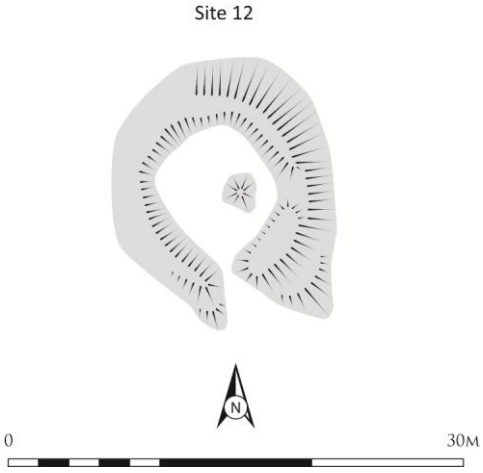
Site 9



Site 10
Site Type Cairn Field
Cairn field containing at least 12 cairns, covering an area measuring 100m x 30m, ranging from 1m-5m in diameter and up to 0.8m in height. It lies on an E facing slope of heather and rough grazing within a generally undulating landscape containing numerous hut circles.

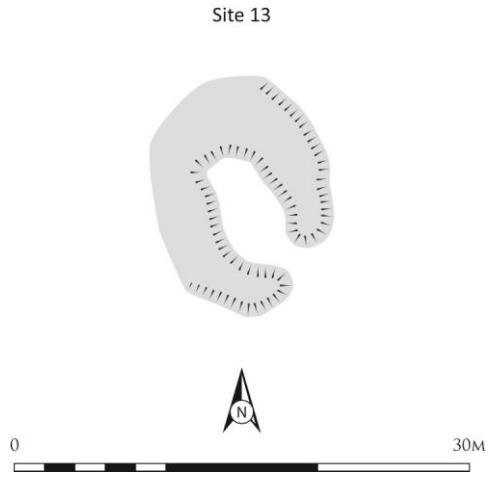
Site 11
Site Type Structure
A sub-oval to sub-rectangular structure comprised of a stone and earth bank. The site measures 7.3m long and between 3.8m and 5m wide externally and 5m long and a width between 1.9m-2.2m internally, with a slight depression at the SW end. The bank itself varies in width from 0.5m to 1.7m and remains to a height of 0.3m. There is no evidence of an entrance. The site lies in a generally undulating landscape and is roughly in the centre of an area of several hut circles and small cairns. Site 11 lies 21m to the NW of Site 9.

Site 12



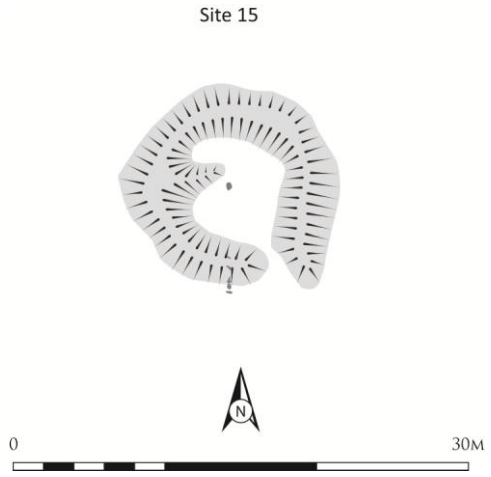
Site 12
Site Type Hut Circle
A sub-circular hut circle with external dimensions of 16m long and 13m wide with internal dimensions of 7.5m x 6.6m. The bank varies in width from 1.7m on the W slope to 4.8m on the E and remains to a height up to 0.75m. There is a rubble platform in the centre which may be clearance stones. There is a possible entrance in the S and a significant dip in the bank in the E. There is a facing stone in the N of the interior and a couple of small stones visible in the outer bank. Site 12 lies to the N of the hut circles and the cairn field, Site 10, in a generally undulating landscape of heather and rough grazing.

Site 13
Site Type Possible Hut Circle
An ephemeral ring shaped earthen bank measuring 12m in diameter, 1m wide and remains to a height of 0.2m. There is a possible entrance in the SE quadrant.

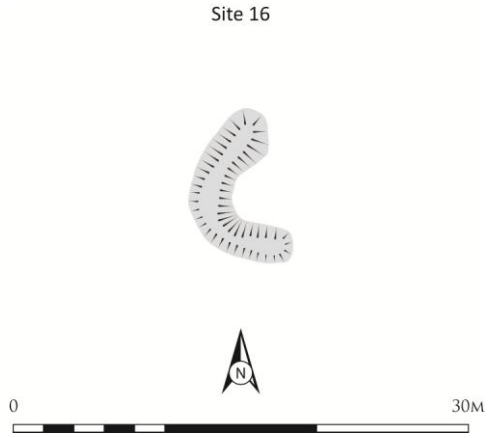


Site 14
Site Type Boundary Wall
Linear turf bank running on an E-W alignment measuring approximately 20m in length. Site lies 60m to the E of Site 12.

Site 15
Site Type Hut Circle
Well preserved hut circle on a gentle SE facing slope of rough grazing of mixed grasses and heather. Comprised of a penannular earth and stone bank measuring 14.6m external diameter and 7.1m internal diameter and survives up to a height of 0.7m. Possible facing stones are visible within the bank especially in the S area. An entrance lies to the SE measuring 0.8m wide, with a curved bank extending from the E side of the entrance. Within the centre of the Hut Circle is a curving bank 2.5m in length and 1.5m wide that may be a secondary structure.



Site 16
Site Type Hut Circle
A poorly preserved penannular shaped earth and stone bank with no clear entrance measuring 10.3m x 6.3m and remains to a height up to 0.2m. Lies 10m N of Site 15.



Site 17
Site Type Boundary Wall
A vestigial stone and earth curvilinear boundary wall on a very gentle heather covered SE facing slope. The curvilinear wall originates SE of Site 18 and curves round to the S. Some stone is visible in the wall but it can be mainly traced by heather covered mounds along its length.

Site 18
Site Type Possible Structure
Comprised of a single earth bank but has been robbed to possibly construct Sites 15 + 16. The NW

arc of the possible hut circle remains measuring 7m long and 1.5m wide on a NW-SE alignment.

Site 19
Site Type Boundary bank
A poorly preserved stone built boundary wall covered in turf measuring 13m in length and 1m wide running on a SE-NW alignment. The site lies 10m to the N of Site 18.

Site 20
Site Type Cairns
Lying within a gently sloping area of boggy rough ground lays two small cairns. The northern cairn measures 3.5m in diameter and survives up to 0.5m high, the southern cairn measures 3m in diameter survives up to 0.75m high.

Site 21
Site Type Possible Hut Circle
Poorly preserved hut circle lying on a gentle NE facing slope, in an area of post-medieval settlement. It is comprised of an earth and stone bank measuring 15m diameter and 2.2m wide. It is best preserved to the S with no visible entrance. Within the centre of the bank lies an area of dumped stone measuring 2m in diameter. A few internal facing stones remain in the SW quadrant.

Site 22
Site Type Possible Burnt Mounds
On a gentle NE sloping slope, with good views to the north and east lie at least 4 possible burnt mounds extending over an area measuring 100m by 20m. The western most of the burnt mounds is sub-oval measuring 18m x 9m and immediately to the E lies the best preserved of the mounds which is sub-oval and measures 20m x 13m x 1.5m high with a central depression. The east central mound is sub-oval, measuring 22m x 16m. The eastern mound is sub oval and measures 21m x 12m.

Site 23
Site Type Hut Circle
In an area of open rough grazing lies a possible hut circle comprised of an earthen bank 9m in diameter and surviving 0.25m high with possible internal facing stones in the NE and NW and external facing stones to the S and SE. The western arc of the bank appears to make use of a natural bedrock outcrop 0.5m high. A possible entrance lies in the eastern arc. Extending to the E from the hut circle is a possible field boundary extending for 10m and comprising boulders up to 1m in diameter. To the west of the hut circle is an area of rig and furrow.

Site 24
Site Type Cist and Cairn
On a raised plateau in a clearing of modern forestry plantation lays a cist and cairn. The grass covered sub-circular cairn measures 7.3m in diameter and survives 1m high. In the centre of the cairn lies a possible cist, measuring 0.5m x 0.75m. A possible displaced capstone, measuring 1.1m x 0.7m x 0.1m, lies on the SW flank of the cairn.

Site 25
Site Type Cairn
In a clearing in modern forestry lies a stone cairn measuring 7m in diameter and survives to a height of 0.75m. It is located roughly 40m NE of Site 24.

Site 26
Site Type Cist Cairn
In a clearing in modern forestry plantation lies a much reduced cist and cairn. The sub circular cairn measures 10m in diameter and survives up to 1m high. Within the centre of the cairn the NE orthostat of a cist remains in-situ, but the other side slabs and cap-stone appear to be missing. In this area there appears to be an area of burial and ritual activity (Sites 24, 25, 26, 27) in an area of higher

ground overlooking an area of hut circle settlements.

Site 27
Site type Possible cairn
In a hollow at the base of a W facing slope lies a possible well preserved cairn. The sub-oval cairn measures 8m x 6m N-S and E-W respectively and may utilise bedrock in its construction. It lies 18m E of Site 24.

Site 28
Site Type Cairn
On a raised plateau lies a sub circular turf covered cairn, measuring 16.4m in diameter and 1.8m high. The site has been disturbed by possibly antiquarian excavation with two depressions, to the SW and SE. A small walkers cairn has been constructed on top of the cairn. It lies approximately 20m to the S of Site 26.

Site 29
Site Type Possible cairn
At the base of an east facing slope is a sub-circular grass covered cairn measuring 6.1m in diameter and 0.7m high. Disturbance in the E quadrant may be the result of antiquarian excavations. Situated 26m downhill, to the E of Site 27.

Site 30
Site Type Hut Circle
On a gentle SE facing slope lays a hut circle comprised of a penannular bank measuring 18m in external diameter, 5m wide and 0.9m high. There is a clear entrance in the SE with a mound 2.5m in front of the entrance measuring 2m x 3m.

Site 31
Site Type Hut Circle
A penannular shaped hut circle measuring 10m diameter, 1.5m wide but spreads up to 2.5m in places and survives up to 0.7m high. An entrance can be seen on the SE side and measures 3m wide. The site lies 20m S of Site 30.

Site 32
Site Type Hut Circle
Penannular turf and stone hut circles with an external diameter of 16.5m with an entrance to the SE of the bank. NE quadrant overlaid by complex stone sheep pen. It is well preserved in places and is located 30m to the N of Site 32.

Site 33
Site Type Hut Circle
Penannular earth and stone bank measuring 12m external diameter and the bank measures 1m wide and survives to 0.2m height. 5m section of the bank is missing in the SE quadrant which may have included the entrance. Site is located 30m S of Site 32.

Site 34 – void

Site 35
Site Type Cairn
A possible cairn measuring 6m diameter and survives to a height of 1.2m. Exposed stones lie in a hollow in the top of the cairn. It is situated on the bottom of the E facing slope.

Site 36
Site Type Possible Burial Mound
A possible burial mound measuring 7m in diameter and survives to a height of 0.5m. It is only visible due to antiquarian investigation in a 3m x 2m pit. There is no visible cist or capstone.

Site 37
Site Type Hut Circle
Well preserved penannular hut circle with a stone and earth bank. The site measures 14m diameter and survives up to 0.5m in height. The bank itself measures 2m thick at greatest extent with a distinct SE facing entrance and slight depression or

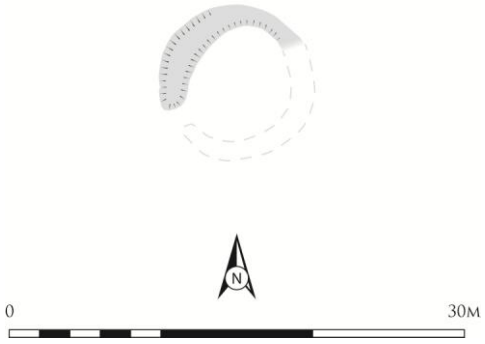
collapse on NW side. It is located on a flat grassy area approximately 150m SW of Site 27.

Site 38

Site Type Possible Hut Circle

Circular or penannular shaped mound measuring 8m in diameter and survives up to 0.7m high. There is a possible W facing entrance and facing stones are visible in the S interior face. The site has been disturbed by antiquarian investigation and sculpting.

Site 40



Site 40

Site Type Hut Circle

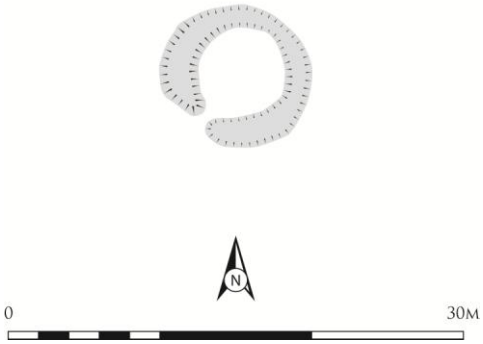
A penannular earthen bank measuring roughly 10m diameter externally and 7m internally. The bank measures between 1.1m -2.4m wide and survives to a height of 0.3m. There is an entrance to the SW measuring 1.3m wide. Sites 40, 41 and 42 lie on a flat terrace on the SW facing slope.

Site 41

Site Type Hut Circle

Penannular shaped site measuring 10.2m diameter externally and 5.9m internally. The earthen bank itself measures between 1.1m - 2.6m in width and survives up to 0.3m high. There is an entrance in the SW measuring 0.6m. This is the middle of three hut circles (Sites 40 to 42) lying on a flat terrace in a gentle SW facing slope.

Site 41

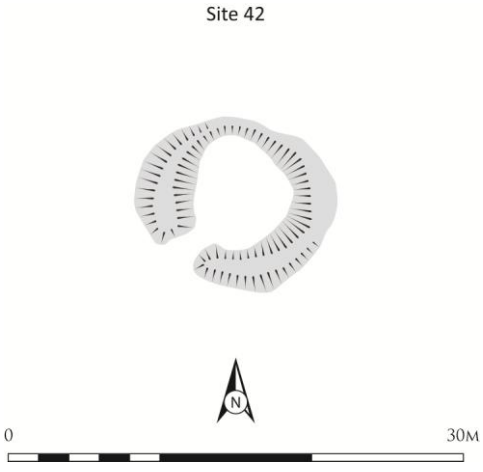


Site 42

Site Type Hut Circle

Pennanular shaped hut circle measuring roughly 12m diameter externally and 7m internally with a 1m wide entrance in the SW. The bank itself measures between 1.2m – 4m and survives up to 0.4m in height. This is the NW of three hut circles, Sites 40, 41 and 42, lying on a flat terrace on a gentle SW facing slope. There are possible facing stones visible in inner surface of bank in the NE quadrant and random stones visible in top of bank throughout.

Site 42



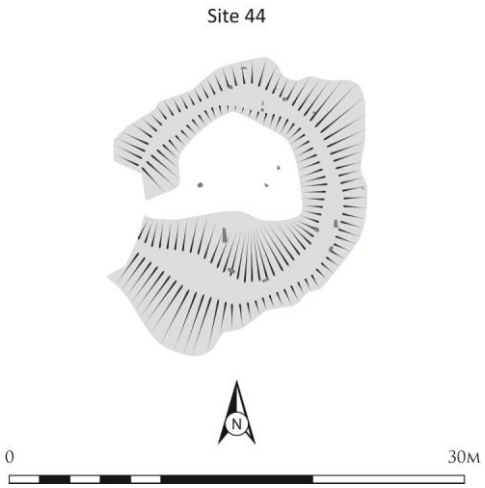
Site 43

Site Type Possible Hut Circle

Landowner (Helen Harper) reports that a visible ring bank existed here in the last 30 years. However, all that remains following modern agricultural activity is ephemeral bank measuring

roughly 16m x 14m with a surrounding spread of stones measuring up to 1.1m in diameter.

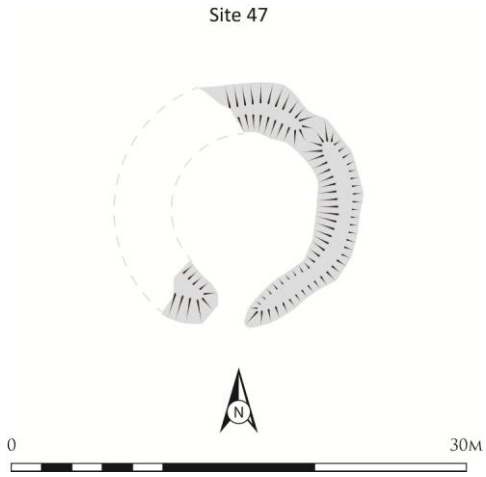
Site 44
Site Type Hut Circle
Penannular earthen bank with scattered exposed stones on and in interior. Measures 17m diameter externally, which may be exaggerated by spread of bank towards to S and measures 7m diameter internally. An entrance in W – SW side measures 1m wide but is slightly obscured by vegetation.



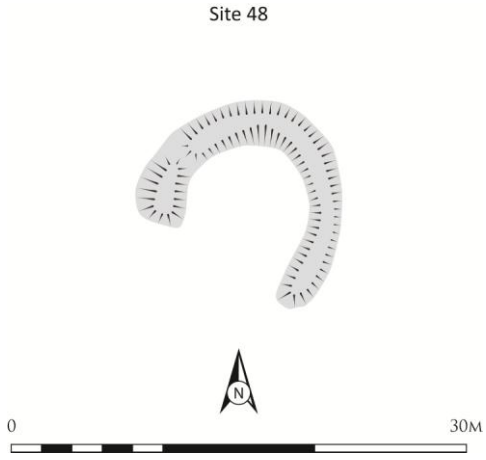
Site 45
Site Type Hut Circle
Well defined low turf bank with occasional stone forming western half of a circle, eastern face of which is very poorly preserved. The site measures 10m external diameter and survives to a height of 0.3m. The bank measures 1.5m wide. No entrance was located. Located on open plateau running N – S and lies 40m SE of Site 46.

Site 46
Site Type Hut Circle
Penannular turf and stone bank, reasonably well preserved. Measures roughly 15m external diameter and survives to a height of 0.7m. The bank measures 3.2m wide and no entrance was found. Located on open plateau running N-S, 40m NW of Site 45.

Site 47
Site Type Hut Circle
Well preserved penannular bank, obscured by gorse in NW quadrant and western outer edge clipped by modern fence line running N-S. The sites measures 16.5m in diameter externally, surviving to a height of 0.5m and the bank is 2.9m wide. There is a possible entrance in SW quadrant. It lies on top of low ridge running E-W, 40m SE of Site 48.



Site 48
Site Type Hut Circle
Hut circle, set in open country of mixed grasses and gorse. The earthen bank measures 15m diameter externally, 4m wide and survives to a maximum height of 0.6m. The entrance appears to be facing SW but is obscured by gorse. The sites lies 40m NW of Site 47.



Site 49
Site Type Possible Burnt Mound
This possible burnt mound is set in open country close to a modern road. The mound lay approximately 2m south of a stream, probably natural, running E-W. The sub-circular mound was

13m in diameter and 0.9m high. It had a distinct depression running N-S across the centre, which might have been the location of the trough.

Site 50
Site Type Hut Circle
Circular bank measuring 9.8m E-W x 9.1m N-S and survives to a height of 0.45m. There are a couple of visible upright stones within the bank in the E quadrant. There is no discernible entrance and it is the least disturbed site of Site 50, 51 and 52.

Site 51
Site Type Hut Circle
Roughly circular shaped bank measuring 9.7m E-W and 9.4m N-S and survives to a height of 0.3m. There are a number of large stones on the surface and the site has been disrupted in the N due to the erection of a telegraph pole. There is a possible entrance in the SW quadrant and possible facing stone on the SE and the ENE.

Site 52
Site Type Hut Circle
Circular bank measuring roughly 10m diameter and survives to a height of 0.45m. The site has been disturbed by cattle erosion.

APPENDIX 2: Site Coordinates

The following table provides the Ordnance Survey coordinates for the sites listed in Appendix 1.

Site No.	Eastings	Northings	Site Type
1	301787	966053	Burnt Mound
2	301771	966022	Hut Circle
3	301777	966004	Hut Circle
4	301689	966026	Enclosure
5	301729	965762	Hut Circle
6	302916	961123	Hut Circle
7	302912	961138	Hut Circle
8	302936	961149	Hut Circle
9	302915	961215	Hut Circle
10	302867	961233	Cairnfield
11	302881	961246	Possible hut circle/building
12	302932	961287	Hut Circle
13	302836	961256	Hut Circle
14	302995	961294	Boundary wall
15	302664	961117	Hut Circle
16	302664	961138	Hut Circle
17	302690	961090	Boundary wall
18	302694	961125	Possible hut circle
19	302691	961147	Boundary wall
20	302791	960732	Cairnfield
21	302938	960739	Hut Circle
22	303004	960145	Burnt Mound
23	302924	960374	Hut Circle
24	303304	959458	Cist Cairn
25	303304	959458	Cairn
26	303304	959458	Cist cairn
27	303304	959458	Possible cairn
28	303304	959458	Cairn
29	303304	959458	Possible cairn
30	303297	959115	Hut Circle
31	303303	959083	Hut Circle
32	303178	958997	Hut Circle
33	303177	958969	Hut Circle
34	303304	959458	*Discounted*
35	303304	959458	Possible cairn
36	303304	959458	Possible burial
37	303304	959458	Hut Circle
38	303304	959458	Possible Hut Circle
39	303304	959458	*Discounted*
40	300436	964812	Hut Circle
41	300413	964840	Hut Circle
42	300395	964867	Hut Circle

43	300160	965024	Hut Circle
44	300159	964741	Hut Circle
45	300743	964458	Hut Circle
46	300715	964490	Hut Circle
47	299285	964993	Hut Circle
48	299250	965024	Hut Circle
49	299286	964904	Burnt Mound
50	307188	963838	Hut Circle
51	307199	963834	Hut Circle
52	307212	963830	Hut Circle

APPENDIX 3: PHOTOGRAPHIC REGISTER

Walkover Photographs

Frame	Site Number	Description	From
1001-2	1	View of burnt mound Site 1	N
1003-4	2	View of hut circle	NE
1005-6	2	View of hut circle through entrance	SE
1007-8	2	View of hut circle inner wall	SE
1009-10	2	View of hut circle exposed stone in facing	SE
1011-12	3	View of hut circle	SW
1013-14	3	View of hut circle entrance from exterior	E
1015-16	3	View of small stone in Western bank of hut circle	E
1017-18	5	View of possible hut circle	E
1019-20	5	View of possible hut circle	NW
1021-22	6	View of hut circle	SW
1023-24	6	View of hut circle	W
1025-26	6	View of hut circle showing track cutting through hut circle possible entrance	NW
1027-28	7	General view of hut circle	SE
1029-30	7	General view of hut circle	SW
1031-32	7	Facing stone in hut circle	W
1033-34	8	General view of hut circle	S
1035-36	8	General view of hut circle	SW
1037-38	8	Facing stone in hut circle	SW
1039-40	9	General view of hut circle	NNE
1041-42	9	Detail of entrance	SE
1043-44	11	General view of hut circle	W
1045-46	11	General view of hut circle	S
1047-48	10	General view of 2 clearance cairns on E facing slope	E
1049-50	10	General view of cairn field	W
1051-52	-	Working shots	-
1053	-	Volunteers at Site 12	-
1054-55	12	Detail of entrance	S
1056-57	12	Volunteers working	-
1058-59	12	General view	SW
1060-61	12	General view	SE
1062-63	12	Detail of interior rubble	S
1034-35	12	Detail of interior facing stone on N side	SW
1066-67	12	General view	NNE
1068-69	13	General view	N
1070-71	13	General view	SE
1072-73	14	General view along boundary	E
1074-75	15	General view of hut circle 15	SE

Frame	Site Number	Description	From
1076-77	15	Detail of extended entrance	S
1078-79	15	Detail of exposed stone on Southern exterior	S
1080-81	15	General view of possible earlier hut circle	SE
1082-83	15	NNE bank of possible earlier hut circle	NE
1084-85	16	General view of possible hut circle 16	E
1086-87	17	General view along wall/bank	NE
1088-89	17	General view along wall/bank	E
1090-91	17	Detail of stone in bank	E
1092-93	18	General view of bank	N
1094-95	18	General view of bank	S
1096-97	18	General view of structure	-
1100-101	30	General view of hut circle interior	E
1102-103	30	General view of hut circle exterior E side	E
1104-105	30	General view of hut circle exterior E side	SE
1106-107	30	Detail view of entrance	SE
1108-109	30	Detail view of entrance	SE
1111-112	31	General view of hut circle	E
1113-114	31	General view of hut circle	E
1115-116	31	General view of hut circle	N
1117-132	Possible Broch	General views of possible broch	-
1133-134	32	Detail view of hut circle entrance	SW
1135-136	32	Area of hut circle within sheep pen	SW
1137-138	32	General view across hut circle	WSW
1139-140	32	General view across hut circle	W
1141-142	32	General views of hut circle interior	S
1143-144	32	General views of hut circle interior	SSE
1145-146	32	General views of hut circle interior	SW
1147-148	33	General view across hut circle	NNE
1149-150	33	View of entrance on SE	SE
1153-154	45	General view of hut circle	WSW
1155-156	46	General view of hut circle	W
1157-159	46	General view of hut circle	S
1160-163	-	Working shot	-
1164-165	44	Working shot	-
1166-167	44	Working shot	-
1168-169	44	Working shot	-
1170-171	44	Working shot	-
1172-173	48	General view of hut circle	S
1174-175	48	General view of hut circle	SSW
1176-177	49	General view of possible burnt mound	N
1178-179	49	Detail of centre of burnt mound	N
1180-181	49	General view of possible burnt mound	S
1182-183	49	General view of possible burnt mound	SE
27-28	-	General view of probable post-medieval structure	N
29-30	20	Cairn in SW	N
31-32	20	Cairn in South	SW
33-34	21	General view of hut circle	W
35-36	21	General view of hut circle	NW
37-38	21	General view of hut circle	SE
39-42	21	View along possible field boundary to NW of hut circle	SW
43-45	22	General view of central burnt mound	NE
46-47	23	General view of hut circle	W
48-49	23	Field boundary	E
50-51	23	Hut circle with field boundary	E
52-53	24	BA cairn with cist general view	W
54-55	24	BA cairn with cist detail of cist/capstone	W
56-57	25	Possible cairn	N
58-59	27	Possible cairn on rocky outcrop	W
60-61	26	Cairn general view	E
62-63	26	Detail of upright slabs (cist)	SE
64-65	28	General view of cairn	SW

Frame	Site Number	Description	From
66-67	28	Walkers cairn on Site 28	SW
68-69	28	General view of cairn	SE
70-71	29	General view of cairn	E
72-73	35	General view of cairn	E
80-81	37	General view of hut circle	S
82-83	37	Detail of facing stone interior Northern wall	S
90-91	40	General view of hut circle	S
92-93	40	General view of hut circle	W
94	-	Void	-
95-98	41	General view of hut circle	E
99-100	41	General view of hut circle	NE
101-102	41	General view of hut circle	SW
103-104	42	General view of hut circle	SW
105-106	42	General view of hut circle	W
107-109	42	General view of hut circle	S
110-113	42	General view of hut circle	W
114-115	43	General view of putative hut circle	W
116-117	43	General view of putative hut circle	SW
118-119	43	General view of putative hut circle	SE
120-121	47	General view of hut circle / enclosure	NE
122-123	47	General view of hut circle / enclosure	NNE

Topographic Survey Photographs

Frame	Site	Description	From
2000-2011	-	Working Shots	-
2012-2015	22	General view of burnt mounds	-
2016-2018	22	General view of burnt mounds	-
2019-2020	22	General view of burnt mounds	-
2021-2024	22	General view of burnt mounds	-
2025-2026	22	General view of burnt mounds	-
2027-2030	22	General view of burnt mounds	-
2031-2034	22	General view of burnt mounds	-
2035-2036	22	General view of burnt mounds	-
2037-2038	22	General view of burnt mounds	-
2039-2040	-	General view of landscape	-
2041-2086	-	Working shots	-

Geophysics, Soil Sampling and Trial Excavation Photographs

Frame	Trench	Description	From
3000-3001	1	Trench 1 mid-ex showing inner facing stones	SW
3002	1	Trench 1 mid-ex showing inner facing stones	SE
3003	1	Trench 1 mid-ex	NE
3004	1	Trench 1 mid-ex	N
3005	1	Trench 1 mid-ex	E
3006	1	Trench 1 mid-ex	S
3007	1	Trench 1 mid-ex	W
3008	2	Trench 2 mid-ex	NE
3009	2	Trench 2 mid-ex	E
3010	2	Trench 2 mid-ex	S
3011	2	Trench 2 mid-ex	SW
3012	2	Trench 2 mid-ex	W
3013	2	Trench 2 mid-ex	E
3014	1	Trench 1 post-ex	SW
3015	1	Trench 1 post-ex	W
3016	1	Trench 1 post-ex	S
3017	1	Trench 1 post-ex	E
3018	1	Trench 1 post-ex	NE

Frame	Trench	Description	From
3019	1	Trench 1 post-ex	N
3020	1	Trench 1 post-ex	NW
3021	1	Trench 1 NW facing section	NW
3022	2	Trench 2 mid-ex	NE
3023	2	Trench 2 mid-ex	SW
3024	2	Trench 2 mid-ex	S
3025	2	Trench 2 mid-ex	E
3026	2	Trench 2 mid-ex	W
3027	2	Trench 2 mid-ex	N
3028	2	Trench 2 mid-ex	NE
3029	2	Trench 2 mid-ex	N
3030	2	Trench 2 mid-ex	E
3031	2	Trench 2 mid-ex	S
3032	2	Trench 2 mid-ex	SW
3033	2	Trench 2 mid-ex	W
3034-3037	-	Working shots	-
3038	3	Trench 3 post-ex	S
3039	3	Trench 3 post-ex	N
3040	2	Trench 2 post-ex	N
3041	2	Trench 2 post-ex	NE
3042	2	Trench 2 post-ex	E
3043	2	Trench 2 post-ex	SW
3044	2	Trench 2 post-ex showing hearth [210]	SE
3045	2	Trench 2 post-ex showing hearth [210]	NE
3046	2	Trench 2 post-ex showing hearth [210]	NW
3047	2	Trench 2 post-ex showing hearth [210]	SE
3048	2	Hearth [210]	NE
3049	2	Hearth [210] NE facing section	NE
3050	2	Ard marks [211 & 213]	SE
3051	2	Ard marks [211 & 213]	SE
3052	2	Ard marks [211 & 213]	NW
3053	2	Hearth [210]	NE
3054	2	Hearth [210]	SE
3055-3058	-	Working shots	-
3059	2	Trench 2 post-ex	N
3060	2	Trench 2 post-ex	NE
3061	2	Trench 2 post-ex	E
3062	2	Trench 2 post-ex	S
3063	2	Trench 2 post-ex	SW
3064	2	Trench 2 post-ex	W
3065	2	Hearth [210]	SE
3066	2	Hearth [210] NE facing section	NE
3067	2	Hearth [210]	SE
3068	2	Trench 2 NW facing section	NW
3069	2	Trench 2 NW facing section	NW
3070	2	Ard marks [211 & 213]	SE
3071	2	Ard marks [211 & 213]	NW
3072-3075	-	Working shots	-
3076-3078	2	Trench 2 NW facing section with kubiena tin sample	NW
3079-3083	-	Working shots	-
3084-3093	1	Trench 1 pre-ex	Various
3094-3099	2	Trench 2 pre-ex	Various
3100	1	Trench 1 showing inner facing stones [102] and occupation deposit (107)	SE
3101	1	Trench 1 showing inner facing stones [102] and occupation deposit (107)	SW

Excavation Photographs

Frame	Trench	Description	From
4000-4005	Tr 4	Trench 4 Pre excavation	E
4006-4008	Tr 4	Trench 4 Pre excavation	S
4009	Tr 4	Paving [421] to exterior	N
4000-40011	Tr 4	Paving [421] to exterior	E
4012-4013	Tr 4	In-situ inner facing stones of bank	E
4014-4015	Tr 4	Possible vessel	E
4016-4018	Tr 4	Possible vessel	S
4019-4020	Tr 4	Tr 4 N-S sondage showing paving 405 on bank 402	S
4021-4022	Tr 4	Tr 4 E-W sondage showing 405 and 402	E
4023-4024	Tr 4	T4 N-S sondage	S
4025-4026	Tr 4	Tr 4 E-W sondge	E
4027-4028	Tr 4	Tr 4 showing bank 402 and paving 405	S
4029-4030	Tr 5	Tr 5 Pre excavation	SW
4031-4034	Tr 5	Tr 5 Pre excavation	W
4035	Tr 4	Tr 4 E-W sondage showing paving 405	E
4036-4037	Tr 4	Stone sockets 410 / [412]	N
4038	Tr 4	Stone sockets 410 /[412]	E
4039	Tr 4	Tr 4 N-S sondage showing paving 405	S
4040-4041	Tr 4	Post hole [416] pre excavation	S
4042-4043	Tr 4	Paving [421]on bank 402 in N-S sondage	N
4044-4045	Tr 4	Bank 402 in E-W sondage	W
4046-4047	Tr 5	Possible hearth stone [516] and post hole [514]	E
4048-4049	Tr 5	Possible hearth stone [516] and post hole [514]	S
4050-4051	Tr 5	Tr 5 pre excavation	E
4052-4053	Tr 5	Possible paving	S
4054-4055	Tr 5	Possible paving	W
4056-4057	Tr 5	Possible tank / hearth 518	S
4058-4059	Tr 5	Possible tank / hearth 518	SE
4060-4061	Tr 5	Bank 504 an 505 forming entrance	E
4062-4063	Tr 5	Bank 504 an 505 forming entrance	N
4064-4065	Tr 5	Bank 504 an 505 forming entrance	S
4066-4067	Tr 5	Tr 5 Pre excavation	E
4068-4069	Tr 4	Post hole [408] showing packing stones	W
4070	Tr 4	Post hole [408] showing packing stones	N
4071	Tr 4	Post hole [408] showing packing stones	E
4072-4073	Tr 5	Slot across entrance	E
4074-4075	Tr 5	Slot across entrance	E
4076-4077	Tr 5	Pit [512] Mid excavation	NE
4078-4079	Tr 5	Pit [512] Mid excavation	NE
4080-4083	Tr 4	Tr 4 E-W sondage general view	E
4084	Tr 4	Paving 405 in E-W sondage	E
4085-4087	Tr 4	Paving 405 in N-S sondage	S
4088-4092	Tr 5	Tr 5 E facing section	E
4093	Tr 5	Tr 5 N-S SF2 post excavation	S
4094-4095	Tr 5	Post hole [514] Mid excavation showing packing stones	S
4096-4097	Tr 5	Sondage across entrance post excavation	S
4098-99	Tr 5	Sondage across entrance post excavation	E
4100	Tr 5	Sondage across entrance post excavation	E
4101-4102	Tr 5	Sondage across entrance post excavation	S
4103-4106	Tr 5	Sondage across entrance post excavation	N
4107-4123	Tr 4	Tr 4 Post excavation	Various
4124-4129	Tr 4	Tr 4 N facing section	N
4130-4135	Tr 4	Tr 4 W facing section	W
4136-4137	Tr 4	Tr 4 W facing section	NW
4138-4139	Tr 4	Tr 4 W facing section	SW
4140-4141	Tr 4	Tr 4 N facing section	NE
4142-4143	Tr 4	Tr 4 N facing section	NW
4144-4145	Tr 4	Tr 4 Stone sockets 410 / 412 post excavation	W
4146-4147	Tr 4	Tr 4 Stone sockets 410 / 412 post excavation	N
4148-4149	Tr 4	Post hole [416] post excavation	N
4150-4151	Tr 4	Pit [406] in Post hole [408] post excavation	W
4152-4153	Tr 4	Pit [406] in Post hole [408] post excavation	S

Frame	Trench	Description	From
4154-4155	Tr 4	Paving [421]	E
4156-4157	Tr 4	Paving [421]	SW
4158-4159	Tr 5	Pre excavation shot of 525	S
4160-4161	Tr 4	Paving [421] in sondages	W
4162-4163	Tr 4	Paving [421] in sondages	W
4164-4165	Tr 5	Stones 527 in 1m x 1m sondage	N
4166-4167	Tr 5	Stones 527 in 1m x 1m sondage	E
4168-4169	Tr 5	Pit [514] post-excavation	S
4170-4171	Tr 5	Pit [512] post-excavation	NW
4172-4174	Tr 5	Entrance slot post-excavation	Various
4175-4176	Tr 5	Pits [514 & 525] post-excavation	S
4177-4180	Tr 5	Pit [512] post-excavtion	NW
4181-4184	Tr 5	Entrance slot post-excavation	Various
4185-4187	Tr 5	1m x 1m sondage post-excavation	Various
4188-4192	Tr 5	Pit [512] post-excavation	Various
4193-4196	Tr 5	Entrance slot post-excavation	Various
4197-9198	Tr 5	Pits [514 & 525] post-excavtion	S
4199-4201	Tr 5	Entrance slot post-excavation	Various
4202-4232	Tr 4 & 5	Trenches 4 and 5 post-excavation	Various
4233	Tr 5	Pit [512] showing kubiena tin sample	NW
4234-4239	-	Working shots	-
4240-4241	Tr 4	Trench 4 section showing kubiena tin sample	W
4242-4245	-	General views of backfilling	-

APPENDIX 4: CONTEXT REGISTER

Trench	Context	Context Type	Description
1	100	Deposit	Mid grey brown humic silty clay measuring c.0.15m deep. **Turf and topsoil**
1	101	Structure	Bank of hut circle comprising inner face [102], outer face [103] and core (103). **Bank of hut circle**
1	102	Structure	Inner face comprising 2 flat slabs measuring C 0.7m x 0.4m and S end of bank [101]. **Inner face of earth bank of hut circle**
1	103	Structure	Single flat slab measuring 0.4m x .3m **Outer face / kerb of earth on stone bank [101]**
1	104	Deposit	Mottled dark grey brown to a dark orange brown sandy loam with iron panning at upper interface. Extends between inner and out face [102] and [103]. **Earth / turf core of wall [101]**
1	105	Deposit	Dark grey silty clay with occasional roots, gravel and manganese. Extends between [103] and N end of Tr 1. **Collapse / slumping of bank [101]**
1	106	Deposit	Compact orange grey silty clay with occasion small stones. Extends between [102] and S end of Tr 1. **Collapse / slumping of bank [101]**
1	107	Deposit	Compact dark grey silty clay with moderate charcoal or occasional gravels and occasional larger stones. Extends between inner face [102] and S end of trench. **Occupation / floor surface**
1	108	Deposit	Compact mid grey brown silty clay with frequent manganese and occasional charcoal. Measures up to 0.05m thick. **Buried ground surface**
1	109	Deposit	Grey orange compact silty clay. **Natural**
2	200	Deposit	Dark grey brown humic silty clay with occasional gravel. **Turf and topsoil**
2	201	Structure	Composed of earth / turf (202) and stone (203). **Upstanding bank of hut circle**
2	202	Deposit	Mid-brown grey firm silty clay with lenses of pale grey sandy clay with occasional charcoal and gravel. **Earth and turf core of bank [201]**
2	203	Structure	**Stone within bank [201]**
2	204	Deposit	Dark orange grey brown silty clay with occasional charcoal and gravel. Extends between bank [201] a S end of trench. **Collapse / slumping of bank [201]**
2	205	Deposit	Dark orangey grey brown silty clay with occasional charcoal gravel. Extends between bank [201] and N end of trench. **Collapse / slumping of bank [201]**
2	206	Deposit	Compact mid grey silty clay with moderate charcoal and occasional gravel and manganese. Extends between bank and S end of trench. **Possible occupation deposit**
2	207	Deposit	Firm mid grey silty clay with occasional charcoal and gravel. Throughout trench 2. Roughly c.15m thick. **Buried ground surface – possibly deepened by prehistoric agriculture**
2	208	Deposit	Bright red-orange soft silt with frequent charcoal. Surrounded by hearth stones [209], measuring up to 0.05m thick. **Peat ash fill of hearth [209]**
2	209	Structure	Hearth setting comprising 3 flat stones measuring up to 0.2m x 0.2m x 0.05m. **Hearth setting**

Trench	Context	Context Type	Description
2	210	Cut	Sub circular cut measuring 0.35m x 0.35m containing hearth stones [209] and ash deposit (208). **Construction cut for hearth [209].**
2	211	Cut	Narrow linear cut orientated E-W running the length of sondage, measuring 0.07m wide by 0.02m deep. **Cut of linear ard mark**
2	212	Fill	Mid grey silty clay, similar to (207). **Fill of ard mark [211]**
2	213	Cut	Narrow linear cut orientated E-W running across Tr 2 ssondage. Measures 0.04m wide and 0.02m deep. **Ard mark**
2	214	Deposit	Mid grey silty clay, very similar to (207). **Fill of ard mark [213]**
2	215	Deposit	Mid-grey orange clay with occasional gravel and stone. **Natural**
4	400	Deposit	**Turf and topsoil**
4	401	Deposit	Dark orange brown sandy silt with frequent stones measuring up to 0.3 x .0.3 x 0.1m and moderate charcoal inclusions. **Collapse/slumping of bank (402)**
4	402	Deposit	Dark brown to black sandy silt wit heat shattered stone with abundant charcoal. **Hut circle bank material**
4	403	Deposit	Yellow brown sandy silt
4	404	Deposit	Tumbled rubble comprising angular flagstone fragments measuring c. 0.2m across **Rubble tumble from bank**
4	405	Structure	Flagstone paving in Tr 4, best preserved in W sondage, flagstones measure up to 0.4m across.
4	406	Cut	Pear shape cut in plan with a flat base, measures 0.05m deep. **Cut of shallow pit**
4	407	Deposit	Compact dark brown sandy silt **Fill of pit [406]**
4	408	Cut	Circular cut in plan with steeply sloping sides which meet a flat base. Measures 0.13m deep. **Cut of small post hole**
4	409	Deposit	Mid brown sandy silt of moderate to loose compaction with occasional charcoal chunks. Packing stones line the cut. Measures 0.12m diameter and 0.13m deep. **Fill and packing stones of post hole**
4	410	Cut	Shallow cut for orthostat located near centre of structure. **Cut of stone socket**
4	411	Deposit	Mid brown sandy silt, moderately compact measuring c0.04m in depth. **Fill of stone socket [410]**
4	412	Cut	Shallow cut for stone socket measuring 0.3m x 0.08m x 0.04m. **Cut of shall stone socket**
4	413	Deposit	Mid brown sandy silt **Fill of stone socket [412]**
4	414	Cut	Shallow circular pit measuring 0.18m diameter and 0.04m deep. **Shallow pit or post hole**
4	415	Deposit	Compact mid brown sandy silt measuring 0.18m diameter and 0.04m deep. **Fill of shallow pit [414]**
4	416	Cut	Shallow steep sided post hole measuring 0.2m diameter and 0.08m deep. **Cut of small post hole**
4	417	Deposit	Mid brown moderately compact sandy silt **Fill of small post hole [416]**

Trench	Context	Context Type	Description
4	418	Deposit	Mid grey sandy clay with occasional gravel and charcoal flecks within N-S sondage underlying paving [405] **Levelling / backfilling for [405]**
4	419	Deposit	Mid grey compact sandy clay with occasional gravel and charcoal flecks. Underlying paving stone [405] within E-W sondage. **Backfilling / leveling deposit for [405]**
4	420	Deposit	Mid grey firm sandy clay with moderate small stones and rare charcoal flecks. Preserved below bank (402) within N-S sondage. Measures 0.05m thick. **Buried ground surface**
4	421	Structure	Flagstone paving around outskirts of hut circle bank (402). Comprises overlapping flagstones measuring up to 1.2m x 0.6m x 0.1m and arranged outside outskirts of hut circle bank (402). **Paving around hut circle or collapsed wall facing slabs**
4	422	Cut	Curvalinear cut running around outskirts of hut circle (402). Seen intermittently around bank (402). Vertical sided with harp breaks of slope and measures 0.06m. **Construction cut for [421]**
4	423	Deposit	Mid grey sandy clay with occasional stone **Fill of construction cut [422]**
4	424	Deposit	Deposit of angular slabs measuring 0.4m x 0.3m x 0.1m sitting in a matrix of mid grey sandy clay with occasional charcoal. **Tumble from wall (402)**
4	425	Structure	2 sandstones slabs set upright to interior of hut circle bank (402) within E-W sondage. Comprises two slabs – one set upright whilst other is slumped out at base. **Internal facing stones of wall (402)**
5	500	Deposit	**Turf and topsoil**
5	501	Deposit	Burnt bank comprised of moderate to loosely compact containing frequent angular shattered stones up to 0.05m across and occasional charcoal. Matrix is a dark brown black sandy silt. **Burnt bank**
5	502	Deposit	Dark orange brown sandy silt overlying burnt bank deposit (501). **Same as (503) VOID**
5	503	Deposit	Dark brown sandy silt, highly compact containing frequent plant roots and occasional small stones. **Deposit within hut circle**
5	504	Deposit	Dark grey and black compact clayey gravel with heat shattered stones with moderate charcoal flecks. Forms a low mound at E. Measures i.1m x 2.4m x 0.24m. **Bank of hut circle, formed from redeposited burnt mount material.**
5	505	Deposit	Dark grey to black compact clayey gravel and heat affected stones with moderate charcoal. Measures 1.3m x 3.1m x 0.2m. **Bank of hut circle forming southern side of entrance**
5	506	Structure	Series of 3 slabs measuring up to 0.4m x 0.2m **Upright slabs forming N side of hut circle entrance**
5	507	Structure	Series of kerb stones. Comprised of 4 sub-rounded stones on ESE-WNW alignment. **S edge of hut circle entrance**
5	508	Deposit	Mid grey compact silty clay with moderate angular stones and charcoal flecks. Measures 0.8m x 0.7m. Depth unknown **Trample deposits within hut circle entrance**
5	509	Structure	3 flat sub-rectangular slabs measuring up to 0.5m x 0.3m x 0.1m aligned N-S. **Rough paving at entrance to hut circle**
5	510	Cut	Linear cut orientated E-W. Sharp break of slop and near vertical sides. **Construction cut for hut circle [506]**

Trench	Context	Context Type	Description
5	511	Deposit	Mid grey sandy clay with occasional gravel and charcoal. **Fill of construction cut [510]**
5	512	Cut	Cut of post hole measuring 1.1m x 0.77m x 0.36m **Possible ring beam support**
5	513	Deposit	Very compact silty clay in parts giving way to softer silty clay. Many stones packed still in situ. Measures 1.1m x 0.77m x 0.36m. **Fill of ring beam support [512]**
5	514	Cut	Sub circular to oval shaped cut orientated E-W with sharp break of slop, steep sides and a rounded base. **Cut of posthole**
5	515	Deposit	Mid grey compact sandy clay with several large packing stones. **Fill of post hole [514]**
5	516		**VOID**
5	517	Structure	Flat slab cracked into several pieces measuring 0.7m x 0.5m x 0.1m. **Possible paving or displaced wall**
5	518	Structure	3 rough set slabs in a NW-SE alignment and 3 flat slabs to the E of the edge set stones. Measures 1.3m x 0.3m. **Possible hearth**
5	519	Deposit	A dark red clayey silt forming lower deposit within pit [512]. Moderately compact soil containing regular fragments of charcoal. **Lower fill of pit [512]**
5	520	Deposit	Dark grey firm sandy clay with frequent gravel and occasional charcoal flecks. **Buried ground surface**
5	521	Structure	5 flat slabs at entrance to hut circle **Paving within entrance**
5	522	Deposit	Mid grey firm sandy clay with occasional charcoal and manganese staining. **Bedding or leveling deposit for paving [521]**
5	523	Cut	Linear cut orientated SE-NW measuring 0.55m x 0.08m x 0.02m Filled by a mid grey sandy clay with occasional charcoal. **Cut of ard mark**
5	524	Structure	Area of 10 flat slabs measuring 0.4m x 0.3m x 0.1m (same as [527]. **Paving within interior of hut circle**
5	525	Cut	Contains edge set stones within matrix (526) **Cut of small pit**
5	526	Deposit	**Fill of pit [519]**
5	527	Structure	Tumble of fragments flagstones located under occupation deposit (503). Measures around 0.3m across. **Disturbed flagstone flooring / rubble from bank**
5	528	Cut	0.8m x 0.1m x 0.04m. **Ard mark**
5	529	Deposit	Grey brown sandy silt **Fill of ard mark [528]**
5	530	Cut	Linear cut orientated NW-SE. Has a sharp break of slop at the top with shallow sides and a rounded base. **Cut of drain running out of hut circle**
5	531	Deposit	Mid grey firm sandy clay with occasional charcoal and stone. **Fill of drain [530]**
5	532	Cut	Shallow linear cut orientated E-W with a gentle break of slop, shallow sides and a rounded base. **Erosioned hollow within hut circle entrance**
5	533	Deposit	**Natural**

APPENDIX 5: DRAWING REGISTER

Drawing No.	Site no.	Trench No.	Details	Scale
1	9	n/a	Plan of hut circle	1:100
2	11	n/a	Plan of sub-rectangular structure	1:50
3	16	n/a	Plan of possible hut circle	1:50
4	41	n/a	Plan of hut circle	1:50
5	7	n/a	Plan of hut circle	1:50
6	40	n/a	Plan of hut circle	1:50
7	12	n/a	Plan of hut circle	1:50
8	15	n/a	Plan of hut circle	1:50
9	8	n/a	Plan of sub-oval structure	1:50
10	42	n/a	Plan of hut circle	1:50
11	6	n/a	Plan of hut circle	1:50
12	49	n/a	Plan of burnt mound	1:50
13	1	1	Trench 1 pre-ex plan	1:20
14	3	2	Trench 2 pre-ex plan	1:20
15	1	1	Trench 1 Mid-ex plan	1:20
16	3	2	Trench 2 post-ex plan	1:20
17	1	1	Trench 1 NW facing section	1:10
18	3	2	Trench 2 NW facing section	1:10
19	3	2	Hearth [210] NE facing section	1:10
101	2	4/5	Pre-ex plan Tr 4 and Tr 5 – hut circle	1:50
102	2	4/5	Mid-ex plan of Tr 4 and Tr 5 overlay of plan #1	1:50
103	2	4	Detail of Tr 4 central area	1:20
104	2	4	W facing section	1:10
105	2	5	NE facing section	1:10
106	2	5	Plan of sondage across entrance	1:20
107	2	4	N facing section	1:10
108	2	4	NW facing section	1:10
109	2	5	NE facing section	1:10
110	2	4	N facing section	1:20
111	2	4	W facing section	1:20
112	2	5	E facing section	1:20
113	2	5	S facing section	1:20
114	2	5	E facing section	1:20
115	2	4	Post-ex plan	1:50

APPENDIX 6: FINDS REGISTER

Trench No.	Find No.	Context No.	Description
n/a	001	Transect 1. TP	Possible pottery
n/a	002	Transect 4 TP 5	Possible pottery
2	201	200	Possible pottery
2	202	202	Possible pottery
4	1	400	General topsoil finds
5	2	501	Charcoal lump
4	3	401	Possible vessel
4	4	401	Possible daub
4	5	402	Possible ceramic
4	6	415	Quartz pebble
5	7	513	Charcoal

APPENDIX 7: SAMPLES REGISTER

Trench No.	Context No.	Quantity
1	104	2 x 5l bag
1	106	2 x 5l bag
1	107	2 x 5l bag
1	108	1 x 5l bag
2	202	2 x 5l bag
2	206	2 x 5l bag
2	207	2 x 5l bag
2	208	1 x 5l bag
2	212	1 x 5l bag
2	214	1 x 5l bag
4	401	1 x 10l tub
4	402	1 x 10l tub
4	402 N-S sondage	1 x 5l bag
4	403	1 x 10l tub
4	409	
4	407	1 x 10l tub
4	411	¼ x 10l tub
4	413	¼ x 10l tub
4	415	¼ x 10l tub
4	417	¼ x 10l tub
4	418	1 x 5l bag
4	419	1 x 5l bag
4	420	1 x 5l bag
4	424	1 x 5l bag
5	501	1 x 10l tub
5	501 lower	1 x 10l tub
5	502	1 x 10l tub
5	503	1 x 10l tub
5	504	1x 10l tub
5	508	1 x 10l tub
5	511	1 x 10l tub
5	513	1 x 5l bag
5	513 lower	1 x 10l tub
5	515	1 x 5l bag
5	517	¼ x 10l bucket
5	518	1 x 10l tub
5	522	1 x 10l tub
5	526	1 x 10l tub
5	531	1 x 10l tub

APPENDIX 8: Carbonised Macroplant Remains

Feature			Bank of hut circle	Bank 201	Ground surface	Beam support 512
Context			106	202	207	513 Lower
Trench			1	2	2	5
Sample Vol (l)			18	20	16	10
% Sorted			100	100	100	100
Species	Name	Part				
Hordeum sp	Barley	Caryopsis		1		
Carex sp	Sedge	Nutlet		6	1	
Indet	Unknown	Seed/nutlet	1		1	1

APPENDIX 9: Charcoal remains, by species

Feature	Context	Trench	Species	Name	No	Weight (g)
Floor surface	107	1	*Alnus Glutinosa*	Alder	3	0.3
Bank 201	202	2	*Alnus Glutinosa*	Alder	1	N/A
Hut Circle	402	4	*Alnus Glutinosa*	Alder	6	
Hut Circle	402	4	*Betula* sp	Birch	4	2.6
Hut Circle	402 N-S Sondage	4	*Alnus Glutinosa*	Alder	7	
Hut Circle	402 N-S Sondage	4	*Betula* sp	Birch	3	21.4
Deposit	403	4	*Alnus Glutinosa*	Alder	1	0.1
Stone socket 412	413	4	*Alnus Glutinosa*	Alder	10	3.8
Back fill 405	418	4	*Alnus Glutinosa*	Alder	1	0.6
Surface	420	4	*Alnus Glutinosa*	Alder	5	
Surface	420	4	*Betula sp*	Birch	2	
Surface	420	4	*Corylus avellana* L	Hazel	3	5.7
Burnt bank	501	5	*Alnus Glutinosa*	Alder	6	
Burnt bank	501	5	*Maloideae* sp	Apple/pear/hawthorn/quince	1	
Burnt bank	501	5	*Betula* sp	Birch	3	19.8
Burnt bank	501 Lower	5	*Alnus Glutinosa*	Alder	10	63.4
Deposit Hut circle	503	5	*Betula* sp	Birch	1	0.3
Bank of hut circle	504	5	*Alnus Glutinosa*	Alder	5	
Bank of hut circle	504	5	*Betula* sp	Birch	1	2
Hearth	518	5	*Alnus Glutinosa*	Alder	10	3.5
Drain 530	531	5	*Betula* sp	Birch	3	
Drain 530	531	5	*Calluna vulgaris* L	Heather	3	1.5
				Total count	89	125

Appendix 10: Relative Phosphate Concentration and pH Results

Sample No	Transect No	Test Pit No	Deposit No	pH	Relative Phosphate Concentration score (average)
5	5	4	1	6	5.25
6	7	3	1	5.28	4.416666667
8	3	7	1	5.11	4.25
10	8	5	1	6.12	4.583333333
12	1	11	1	5.19	4
13	1	4	1	5.22	1.166666667
15	4	4	1	4.94	3.166666667
18	3	1	1	5.6	3
21	3	2	1	5.11	1.583333333
33	3	6	1	5.69	4
36	4	6	1	-	3.75
38	2	4	1	-	0.416666667
39	4	5	1	-	3.166666667
40	2	6	1	-	1.75
42	4	8	1	-	3.333333333
48	4	1	1	-	2
56	4	7	1	-	2.416666667
57	4	2	1	-	1.916666667
59	2	5	1	5	2.666666667
60	2	3	1	6	1.416666667
64	4	3	1	5.58	3.916666667
67	7	5	1	5.66	3.666666667
70	6	2	1	5.75	3.333333333
79	3	4	1	6.1	4.666666667
80	2	7	1	5.4	4.75
86	2	13	1	5.71	4.75
93	2	9	1	4.96	4.833333333
94	2	10	1	5.21	4.75
95	2	11	1	5.06	4.5
96	2	12	1	5.71	4.25
103	2	1	1	6.1	3.833333333
105	1	7	1	5.7	2.583333333
106	1	10	1	5.59	2.416666667
117	4	4	1	5.7	4.5
118	7	7	1	5.6	4
120	8	7	1	5.9	1.833333333
122	1	8	1	5.6	4.166666667
128	1	5	1	-	1.916666667
134	1	6	1	-	3.833333333
138	1	3	1	-	3.916666667
139	1	7	1	-	3.666666667
140	1	7	1	-	3.833333333
141	1	7	1	-	3.75
142	1	1	1	-	3.583333333
145	6	4	1	-	0.416666667
148	8	6	1	-	0.5
149	8	4	1	-	2.666666667
159	8	5	1	-	2.833333333

Sample No	Transect No	Test Pit No	Deposit No	pH	Relative Phosphate Concentration score (average)
162	5	7	1	-	3.083333333
2	4	5	1	-	4.75
9	4	7	1	-	4.25
16	3	6	1	-	3.916666667
27	2	4	1	-	3.416666667
30	2	5	1	-	3.416666667
34	3	2	1	-	3.333333333
35	4	5	1	-	3.583333333
37	4	8	1	-	3.75
43	5	4	1	-	3
46	3	7	1	-	3.083333333
47	4	1	1	-	3.583333333
63	1	11	1	5.8	3.25
66	4	3	1	5.66	4.083333333
69	7	5	1	5.7	3.833333333
72	6	2	1	5.9	4.083333333
76	4	2	1	5.64	5.083333333
77	4	7	1	5.22	4.166666667
82	3	1	1	6.17	3.833333333
84	2	11	1	5.75	4.583333333
88	2	12	1	5.57	4.616666667
98	2	13	1	5.21	4.416666667
1	4	8	1	-	4.333333333
119	8	4	1	5.6	4
3	4	5	2	-	4.916666667
7	7	4	2	-	3.583333333
11	1	7	2	-	3.416666667
14	4	8	2	-	2.5
17	2	3	2	-	1.916666667
23	4	4	2	5.19	4
26	2	4	2	5.71	2.916666667
29	8	3	2	5.67	2.583333333
31	4	5	2	5.4	3.75
32	4	8	2	5.3	3.583333333
44	4	1	2	5.8	2.833333333
49	2	5	2	5.8	3.166666667
50	4	6	2	5.82	2.083333333
51	3	2	2	6.24	3.25
52	3	6	2	6.03	3.583333333
53	3	7	2	5.5	3.75
61	2	3	2	5.5	3
62	8	3	2	5.9	2.583333333
65	4	3	2	5.74	2.916666667
68	7	5	2	5.51	3.25
71	6	2	2	5.76	3.333333333
96	3	4	2	5.55	4
74	4	2	2	5.53	4.75
75	3	4	2	5.9	4.75
78	3	4	2	5.76	5.166666667

Sample No	Transect No	Test Pit No	Deposit No	pH	Relative Phosphate Concentration score (average)
81	3	1	2	5.63	5.166666667
83	2	11	2	5.55	4.916666667
85	2	12	2	5.43	5.166666667
87	2	16	2	5.56	5
89	2	9	2	5.34	5.166666667
90	2	7	2	4.69	4.833333333
91	2	8	2	4.75	4.916666667
92	2	10	2	5.22	4.416666667
97	2	13	2	5.7	4.333333333
99	6	7	2	5.66	4.416666667
101	1	12	2	5.3	0.5
102	2	2	2	5.4	3.083333333
104	1	7	2	5.82	3.833333333
107	1	5	2	5.8	3.416666667
108	1	3	2	5.8	3.25
109	4	2	2	6.25	3.25
110	1	4	2	6.02	3.583333333
111	3	2	2	5.9	3.166666667
112	2	10	2	5.5	3
113	1	6	2	5.5	1.083333333
115	7	3	2	6.01	3.833333333
116	7	1	2	5.9	3.583333333
121	2	9	2	5.4	3.583333333
123	1	4	2	-	2.583333333
124	1	4	2	-	3.166666667
125	2	1	2	6.12	2.75
127	1	12	2	-	3.833333333
130	2	9	2	-	3.416666667
131	2	9	2	-	3.666666667
132	2	9	2	-	3.583333333
133	1	1	2	-	3.25
135	1	2	2	-	3.666666667
136	1	3	2	-	3.75
137	1	11	2	-	4
143	1	5	2	-	4.083333333
144	1	8	2	-	4.333333333
146	5	4	2	-	0.416666667
150	5	5	2	-	0.5
151	5	6	2	-	3.083333333
154	7	4	2	5.7	1.916666667
156	5	2	2	-	3.166666667
163	5	3	2	-	0.5
164	6	3	2	-	0.5
165	6	1	2	-	3.333333333
166	8	6	2	5.8	2.75
167	7	7	2	-	1.75
168	6	4	2	-	1.75
169	8	5	2	-	2.333333333
170	8	7	2	-	2.916666667

Sample No	Transect No	Test Pit No	Deposit No	pH	Relative Phosphate Concentration score (average)
171	5	1	2	-	2.5
179	7	6	2	-	1.75
180	6	5	2	-	1.75
	6	6	2	5.9	3.583333333
			2	-	2.666666667
20	2	8	3	-	0.416666667
24	2	5	3	-	0.416666667
25	6	7	3	-	0.416666667
58	2	3	3	-	0.416666667
152	5	2	3	-	0.5
153	5	6	3	-	0.5
155	5	5	3	-	0.5
157	3	7	3	-	0.5
158	5	3	3	-	0.5
160	7	3	3	-	0.5
173	8	3	3	-	0.5
177	6	3	3	-	0.5
178	6	1	3	5.8	0.5
19	6	6	3	-	1.583333333
22	2	3	3	-	0.416666667
28	6	1	3	-	2.75
41	2	6	3	-	2.083333333
45	4	7	3	-	0.833333333
54	2	10	3	-	3.25
55	4	6	3	-	2.416666667
100	2	12	3	5.9	0.5
114	7	4	3	5.6	3.666666667
126	1	12	3	-	3.25
129	1	3	3	5.6	3.333333333
147	8	6	3	-	2.333333333
161	4	5	3	-	2.666666667
172	5	6	3	5.5	3.333333333
174	6	5	3	-	3.583333333
175	6	3	3	-	3.166666667
176	8	7	3	5.7	1.75
5	5	4	1	-	5.25

Appendix 11: Loss on Ignition and Comparative Qualitative and Quantitative Phosphate Results

Transect No	Test Pit No	Loss on Ignition %	Relative Phosphate Concentration	P mg/g^{-1}
5	5	35%	0.5	0.34
3	2	6.50%	3.166666667	2.9
3	7	4.50%	3.75	1.6
8	5	7.30%	2.333333333	1.85
4	6	14.20%	2.083333333	1.87
4	5	13.81%	3.75	2.67
1	8	8.80%	4.333333333	2.37
4	3	7.14%	2.916666667	1.88
1	5	17.24%	4.083333333	2.15
7	7	6.06%	1.75	0.36
7	4	6.66%	1.916666667	1.18
1	5	16.66%	4.083333333	1.73
2	11	16.66%	4.916666667	2.4
4	4	10.52%	4	1.96
1	4	15.38%	3.166666667	1.76
1	2	12.00%	3.666666667	1.97
1	12	11.584%	3.83333333	2.9
2	4	4.76%	2.91666666	1.21
2	5	7.89%	3.16666666	1.73
2	10	50%	3	2.23
2	12	8.33%	5.16666667	2.95
4	8	5.71%	2.5	1.21
6	3	12.50%	0.5	0.27
6	7	7.80%	4.416666	2.34
7	4		1.911	1.18
8	4		2.66666667	1.31

Appendix 12: Thin Section 1 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	(420)	65/35	++++ ++ + +++ t	10YR 4/6 strong brown to 10YR 6/8 reddish yellow. Weakly speckled b-fabric (isotropic where masked by OM)	t + +++ ++ +++ ++	+++ ++ ++	Ttt Ttt t	Complex. Weakly developed sub angular blocky, with few channels and chambers	Randomly oriented. Frequently randomly distributed. Charred material clustered in top of layer	Porphyric (ranging from close to open)
2	(402)	70/30	+++ ++ + +++ +++	10YR 6/3 light brown to 2.5/3 very dark brown to black. Heterogeneous Faintly speckled b-fabric	+ t +++ + +++ ++	+++ ++ +	tt tttt t	Complex weakly developed sub angular with few channels.	Randomly oriented. Randomly distributed	Close Porphyric

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 13: Thin Section 2 Summary of Results

Layer	Layer	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	503	60/40	+++ + + t +++	10YR 5/6 Dark Yellowish Brown Relatively homogeneous with black punctuation Speckled calcitic b-fabric	t t +++ + +	+++ + +++	Tt Tt tt t	Complex. Weakly developed massive with few channels and chambers. Patches of crumb excremental microstructure	Randomly oriented. Randomly distributed Unsorted	Porphyric (ranging from close to open)

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 14: Thin Section3 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	519	50/50	+++ + + ++ + t	10YR 5/1 Grey with patches of 10YR 4/6 Strong Brown. Heterogeneous Slightly speckled b-fabric		++	ttt	Complex. Massive with very few channels and chambers microstructure	Common dipping of minerals at 45º. Frequently randomly distributed, weak banding of sand sized minerals.	Porphyric (ranging from close to open)
2	519	75/25	++++ ++ + +++ +++	10YR 5/2-10YR 5/4 Brown.		+	ttt	Complex. Massive with very few channels and chambers	Randomly oriented. Randomly distributed Unsorted	Porphyric
3	519	70/30	+++ ++ + +	10YR 6/4 Light Brown	T ++++ +++ ++ +++	++ +++ +	tt	Complex. Massive with few channels and chambers	Randomly oriented. Randomly distributed Unsorted	Porphyric
4	519	65/35	++++ +	10YR 5/4 Light Brown. Heterogeneous and patchy.	T +++ +++ ++ +++	++	Tt tt	Complex. Massive with few vughs, channels and chambers	Weak horizontal alignment parallel with top of slide. Moderate banding of sand sized minerals. Bands of finer and coarse material	Porphyric

Appendix 15: Thin Section 4 Summary of Results

Sample	Layer	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Microcline Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	212	70/30	++++ + + +	10YR 6/4 Light Yellowish Brown Heterogeneous Slightly speckled b-fabric		+ ++	++++	Complex. Weakly developed vughy microstructure	Randomly oriented. Clustered distribution	Porphyric (ranging from close to open)
2	206	65/35	+++ ++ +++	10YR 5/4 Yellowish Brown	++ ++ ++ ++ T +	+ +++ ++	++ + ++	Complex. Weakly developed channel and chamber.	Randomly oriented. Clustered distribution of sand sized quartz	Porphyric (ranging from close to open)

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 16: Thin Section 5 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
	1		Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	206/207	70/30	+++ ++ ++ + ++ +++	7.5YR 4/2 Brown. Heterogeneous Undifferentiated b-fabric	t ++ ++ 	+ ++ ++	Tt ttt	Complex. Massive with few channels and chambers	Randomly oriented. Few clusters of coarse OM	Close porphyric
2	206/207	60/40	+++ ++ ++ + ++ +++	7.5YR 5/6 Strong Brown, Faintly Speckled b-fabric	++ +++ +++ +++ ++	+ +++ +++	T ttt	Complex. Massive crumb like in places	Randomly oriented. Randomly distributed Unsorted	Close porphyric

Appendix 17: Thin Section 6 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	206/207	65/35	+++ ++ ++ + + ++ +++ ++	10YR5/6 Yellowish Brown Heterogeneous Speckled b-fabric	+ ++ +++ +++	+ +	Tt tt	Weakly developed sub angular blocky	Randomly oriented. Randomly distributed Unsorted	Close Porphyric
2	206/207	60/40	+++ ++ ++ + ++ +++ ++ ++	7.5YR 5/6 Strong Brown, Faintly Speckled b-fabric	+++ +++ +++ ++	+ +++ +++	T ttt	Complex. Massive crumb like in places	Randomly oriented. Randomly distributed Unsorted	Close porphyric
3	204	75/35	+++ ++ + + ++ ++++ ++ +++	10YR 6/6 Brownish Yellow	+ T ++ ++ + +	+ ++ +++	Tt t	Complex vughy with channels and chambers	Randomly oriented. Randomly distributed Unsorted	Gefuric

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 18: Thin Section 7 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	(202)	65/35	+ + +++ + +++ ++ +++	10YR 5/3 Brown Heterogeneous Speckled b-fabric commonly isotropic (masked by OM)	+ + + ++ +++	+++ + ++	ttt	Complex. Weakly developed vughy microstructure with few channels	Randomly oriented. Randomly distributed Unsorted	Porphyric (ranging from close to open)
2	(202)	60/40	+++ t + ++ ++ +++	10YR 3/4 to 10YR 5/4 Brown. Heterogenous. Speckled b-fabric	+++ ++ +++ +++ + ++	+ +++ ++	t tt	Complex. Weakly developed channel and chamber with patches of crumb microstructure	Randomly oriented. Randomly distributed Unsorted	Porphyric (ranging from close to open

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 19: Thin Section 8 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral										Fine Mineral			Coarse Organic				Amorphous Fine Organic			Pedofeatures			Microstructure	Coarse Material arrangement	C/F related distribution
			Diatoms	Phytoliths	Rock fragments	Chlorite	Microcline	Biotite	Feldspar	Quartz			Colour PPL	Groundmass b-fabric		Carbonised	Charcoal	Humified OM	Single Cells	Organ Residues	Plant tissues		Yellow	Reddish brown	Black		Intrusive	Fabric	Impregnative	Depletion			
1	Tr 4 TP 5 Deposit 2	70/30	t	+		+	+	+	+	++++			10YR 7/3 Very Pale Brown Heterogeneous. Speckled b -fabric			+		+	++		++		++	+	+	ttt	T	Tt		Complex. Pellicular intergrain with patches of weakly developed sub angular blocky.	Randomly oriented. OM more frequent towards top of layer. Weak banding of coarse sand sized material.	Gefuric
2	Tr 4 TP 5 Deposit 2	60/40	++	++		+	+	+	+	++			10YR 4/6 dark yellowish brown. Speckled b-fabric			+	+	+	++	+	++		+	+	++	ttt	Tttt	Tt		Complex. Weakly developed subangular block with few channels and chambers	Randomly oriented. Randomly distributed Unsorted	Close porphyric
3	Tr 4 TP 5 Deposit 2	50/50	++	++		+	+	+	+	++			10YR 3/6 Very dark yellowish brown with frequent black patches Isotropic undifferentiated b-fabric			+++	+++	+	++	+	++		+	+++	++++	ttt	Tttt	Tt		Complex. Weakly developed subangular block with few channels and chambers	Randomly oriented. Randomly distributed Unsorted	Close porphyric
4	Tr 4 TP 5 Deposit 2	60/40	+++	+			+	+	+	+++			10YR 5/6 Yellowish brown. Heterogeneous Speckled b-fabric					++	++	++	+		++	+	+++					Complex. Weakly developed subangular block with few channels and chambers	Randomly oriented. Weak banding of OM	Porphyric.

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)

Appendix 20: Thin Section 9 Summary of Results

Layer	Context	C/F ratio	Coarse Mineral	Fine Mineral	Coarse Organic	Amorphous Fine Organic	Pedofeatures	Microstructure	Coarse Material arrangement	C/F related distribution
			Quartz Feldspar Biotite Muscovite Chlorite Rock fragments Phytoliths Diatoms	Colour PPL Groundmass b-fabric	Plant tissues Organ Residues Single Cells Humified OM Charcoal Carbonised	Black Reddish brown Yellow	Depletion Impregnative Fabric Intrusive			
1	Tr 4 TP 5 Deposit 2	40/60	++++ ++ ++ ++ ++	10YR 3/4 Dark Yellowish Brown Heterogeneous Speckledb-fabric	++ + ++ +++	+ + +	Tttt T ttt	Complex. Weakly developed sub angular blocky, patches with channels and chambers and patches of crumb structure	Weak orientation parallel to top of slide. Weak banding of sand sized quartz	Porphyric (ranging from close to open)
2	Tr 4 TP 5 Deposit 2	4	++++ ++ ++ + ++	10YR 5/4 Yellowish Brown to 5YR 3/4 dark reddish brown. Undifferentiated b-fabric	++ ++ + +++ ++	+++ ++ +	Tt T tttt	Complex. Predominantly crumb with weakly developed sub angular blocky towards base.	Weak orientation parallel to top of slide. Weak banding of sand sized quartz	Porphyric patches gefuric

Key: t=trace +=Very few, ++= Few, +++= Frequent/Common, ++++Dominant/Very Dominant

Pedofeatures t=trace (<1%) tt=rare (1-2%) ttt=occasional (2-5%) tttt many (5-10%)









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