CLWYDIAN RANGE ARCHAEOLOGY GROUP (CRAG)

ARCHAEOLOGICAL EXCAVATION OF MOEL ARTHUR 2017

Dr Wendy Whitby & Karen Lowery

Archaeological Excavation of Moel Arthur 2017

Contents

Appendices:

1. Brooks I.P., 2014, *Land Below Moel Arthur Geophysical Survey*, Engineering Archaeological Services Limited, EAS Client Report 2014/10.
2. SUERC (Scottish Universities Environmental Research Centre), 2016, Radiocarbon Dating Report: SUERC 66219-66221 (GU40089-40091).
3. Report on the Excavations on Moel Arthur in 2015 by Irene Milhench and Philip Culver on behalf of CRAG
4. Archaeological Services Durham University, 2015, Charcoal Identification and C14 Preparation, Report: 4015.
5. Walker, E., 2016, *Analysis of the flints found on Moel Arthur 2011- 2015.* Unpublished report.
6. 2017 Excavation - Context Index
7. 2017 Finds description table.

General Background

Moel Arthur is located towards the north end of the Clwydian Hills in Denbighshire (SJ145600) and is 456m (Ordnance Survey, 2005) at its highest point. Situated on the summit of Moel Arthur is a hillfort (HER Clwyd Powys 102311; NMR SJ 16 SE) having an internal area of approximately 2 hectares (https://hillforts.arch.ox.ac.uk/). This small but imposing structure occupies a strong defensive position dominating the Bwlch y Frainc pass. The fort consists of multiple ramparts, an inturned entrance with guard chambers, and has evidence of hut circles in the interior (Brown, 2004:73). The hillfort is assumed to be of Iron Age date but only very limited excavation has taken place. W. Wynne Ffoulkes carried out some investigations in 1849 (Wynne Ffoulkes, 1850; Davies, 1949) and discovered sherds of Roman pottery, flint fragments and corroded iron pieces near to the inner rampart. In 1962 a small hoard of three Early Bronze Age flat copper axes was discovered in the southern part of the hill fort enclosure (Forde-Johnston, 1964; Morgan, 1990).

In 2003, a worked flint flake thought to be of Mesolithic date, was found on the north-western slopes of Moel Arthur beyond the hillfort (CPAT, 2003) suggesting that the Moel Arthur area was also subject to early prehistoric human activity. In August 2010 a geophysical survey was carried out by Engineering Archaeological Services Ltd (Brooks, 2014) on the sloping terrace to the north of the hillfort, and to a more limited extent within the hillfort itself. This had been commissioned by the Heather and Hillforts Partnership Scheme to be used as a training event for members of the general public alongside members of the Heather and Hillforts Archaeology Group (HHAG). Further magnetometry and resistivity surveys were carried out by Engineering Archaeological Services Ltd., members of HHAG and students from Holywell High School, in 2011 and 2012 with interpretations carried out by Dr Ian Brooks of EAS Ltd (Figs.1 and 2; Brooks, 2014). These surveys highlighted several geophysical anomalies on the terrace to the north-west of the hill fort. In 2013 HHAG became the Clwydian Range Archaeology Group – CRAG - and began carrying out excavation on the north-west plateau area.

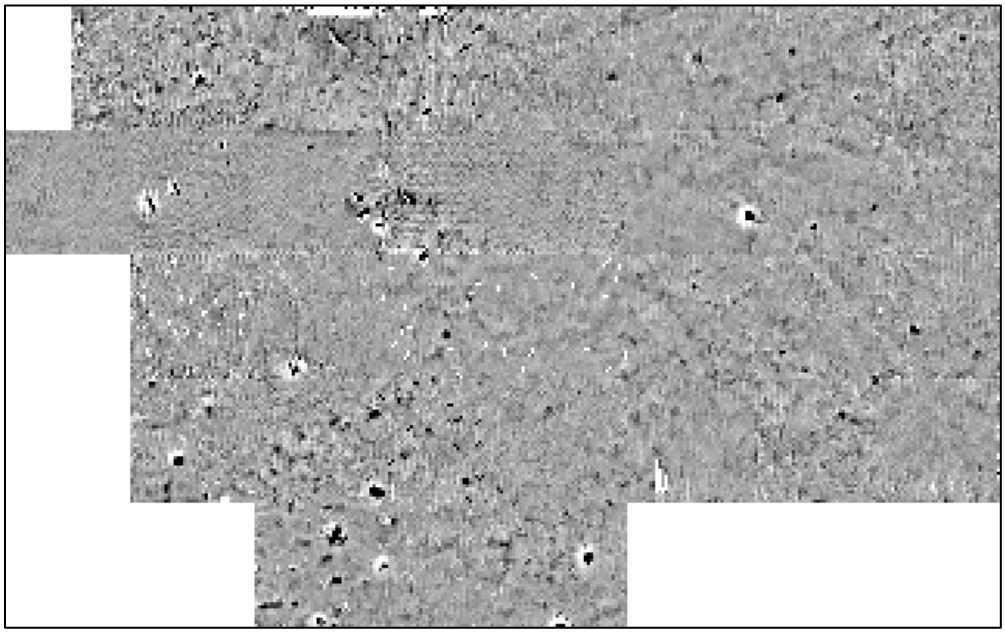


Figure 1 – Magnetometry Survey (from Brooks, 2014)

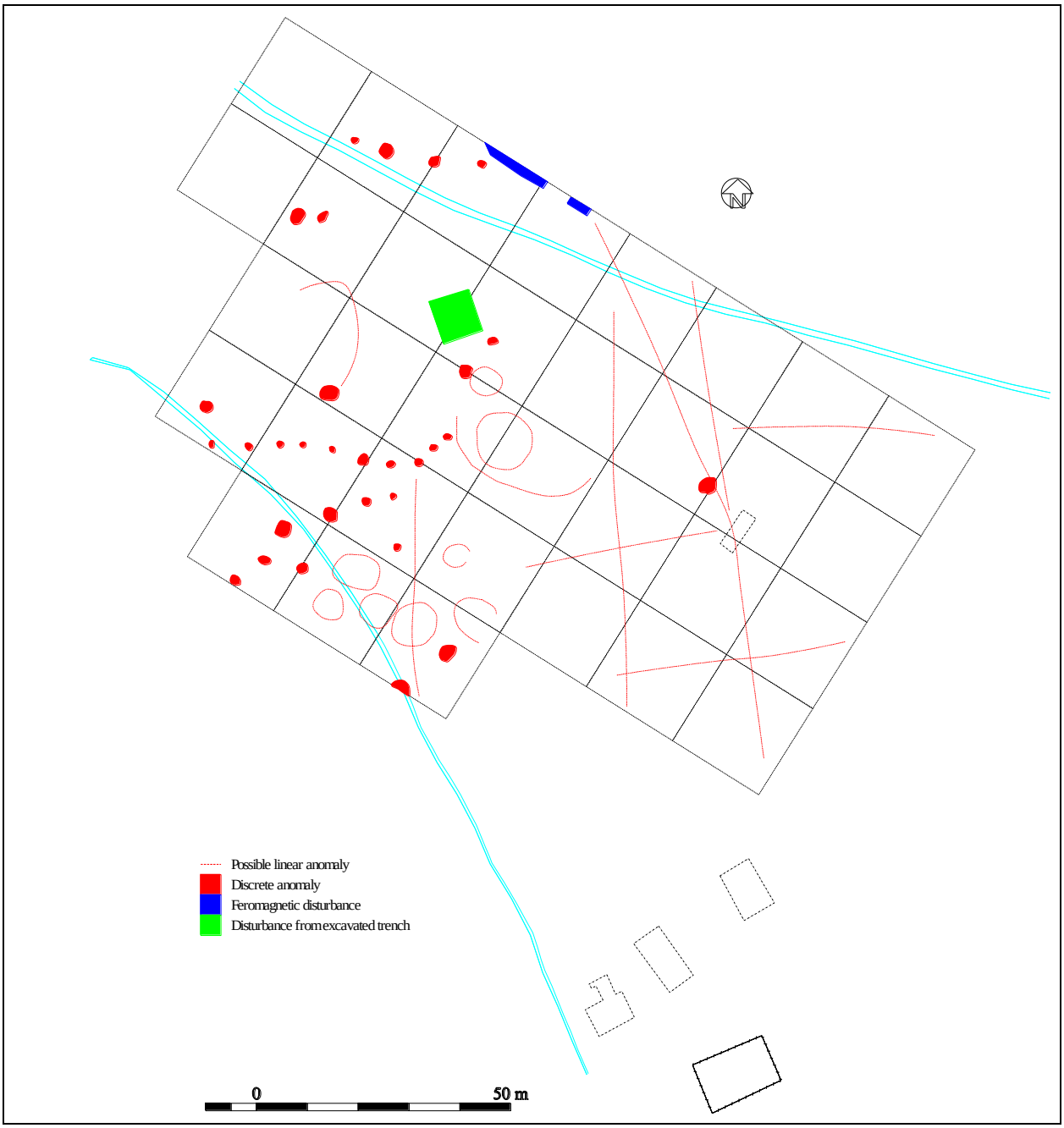


Figure 2 – Interpretation of Geophysical Survey (from Brooks, 2014)

Summary of Previous Excavations on Moel Arthur by Clwydian Range Archaeology Group

2011 - Two trenches revealed a feature interpreted as a rutted track running E-W across the flank of the hill below the hillfort.

2013 - A feature interpreted as a 'burnt mound' was discovered in an area of strong magnetic response revealed by use of a magnetometer. Surrounding the area were medium to large stones set in a rough circle, possibly to support stakes for a roof covering over the feature.

2014 - On the plateau directly below the hillfort two distinct features were uncovered during the dig, a potential roundhouse with associated storage pit thought to be Iron Age, and a structure postulated to be a Medieval 'Hafod'.

2015 - A trench was dug to the south of the 'burnt mound' (trench 2013) revealing a feature that was tentatively interpreted as a 'beehive oven'. Carbonised material was recovered with radiocarbon dates ranging from 6386 cal BC to 4781 cal BC (SUERC, 2016; Appendix 2). Finds included several flint scrapers.

The 2015 report is included as Appendix 3. Reports for the other excavations are forthcoming.

2017 Excavation

Introduction

The excavation took place from July 21st to August 20th 2017. The trench location was chosen due to its proximity to the burnt mound feature discovered in 2013 and an adjacent extant water course.

Figure 3 shows the 2017 trench location in relation to geophysical anomalies and previous trenches.

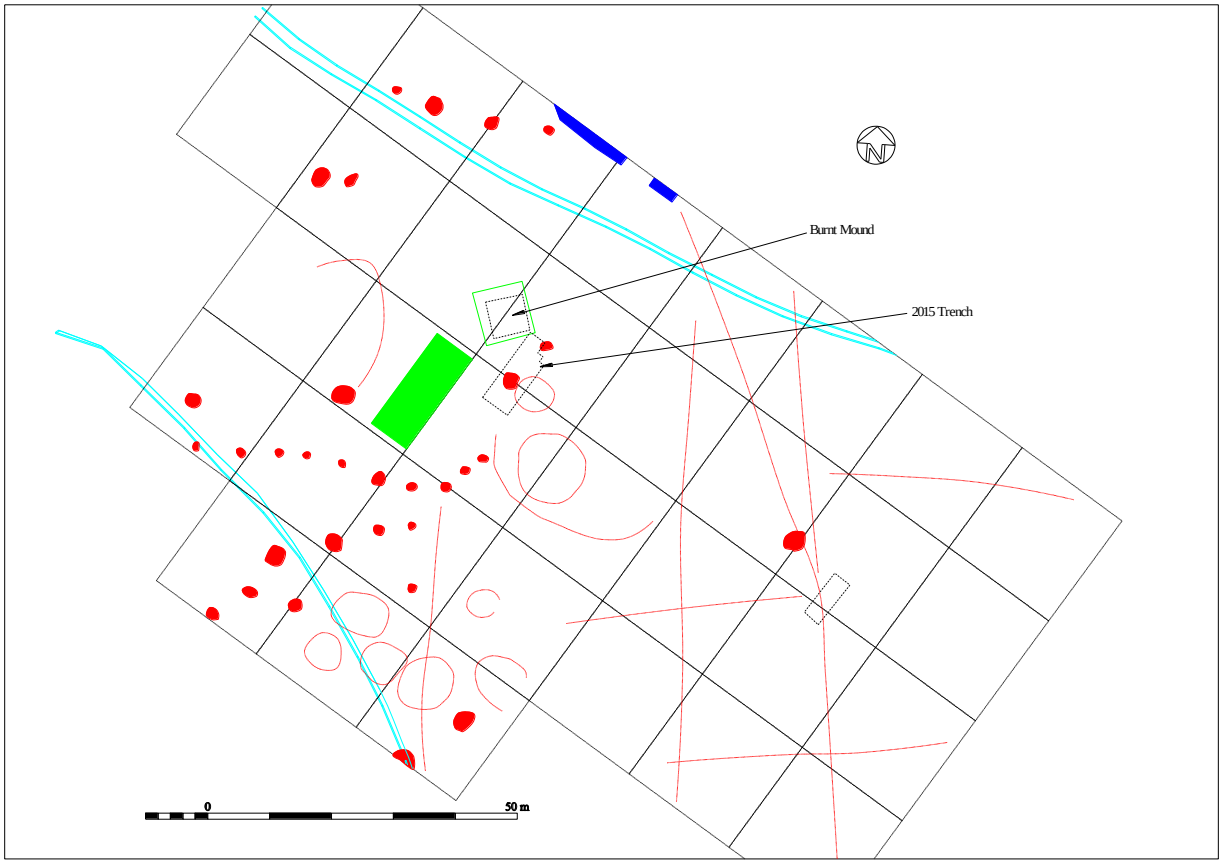


Figure 3 – Location of 2017 Trench (Green Shaded Square) in Relation to Geophysical Anomalies and Previous Excavations

The trench area was 17m x 7m. The area to be excavated was covered by grass/reed vegetation for approximately 6-8m from the north-west edge, with the remainder of the trench covered by heather. Figure 4 shows the site area after the vegetation layer had been strimmed prior to de-turfing.

Figure 4 – Site of 2017 Excavation Trench After Strimming and Prior to De-turfing

Prior to excavation a topographic survey was carried out using a Leica TS05 Total Station (Fig.5, the excavation trench lies within the blue box). Across the area to be excavated heights above sea level range from 408.0m to 408.8m, with an irregularly shaped slight depression evident in the north-east area.

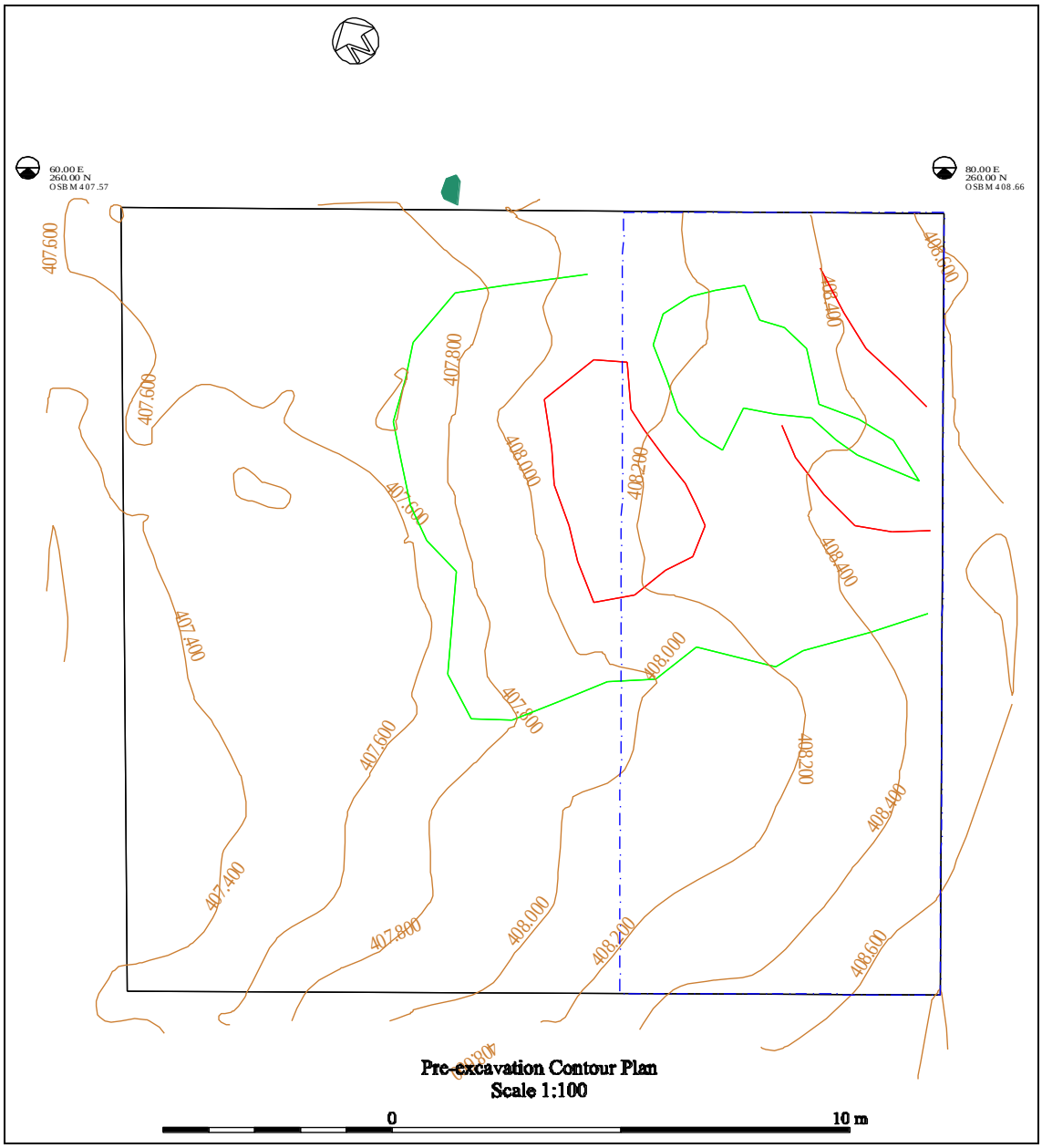


Figure 5 – Topographic Survey of 2017 Excavation Area

Approach to Excavation

All excavation including de-turfing was carried out manually using hand tools. Excavation of the trench was fully recorded using context sheets, section drawing, planning and photography. Overlapping digital photographs were taken with a Panasonic Lumix DCM-TZ60 camera and processed using Agisoft Photoscan v.1.4.1 to produce a 3-dimensional model from which photogrammetric plans can be extracted.

Excavation

Removal of the grass/reed layer (context 1700) and the heather (context 1701, up to 250mm depth) revealed a grey-brown clayey silt (context 1702) covering the whole trench to approximately 250mm in depth. Removal of 1702 revealed three distinct areas as described below. Figure 6 is a plan drawing of the entire trench after removal of context 1702. Figure 7 is a photogrammetric plan of the trench after complete excavation.

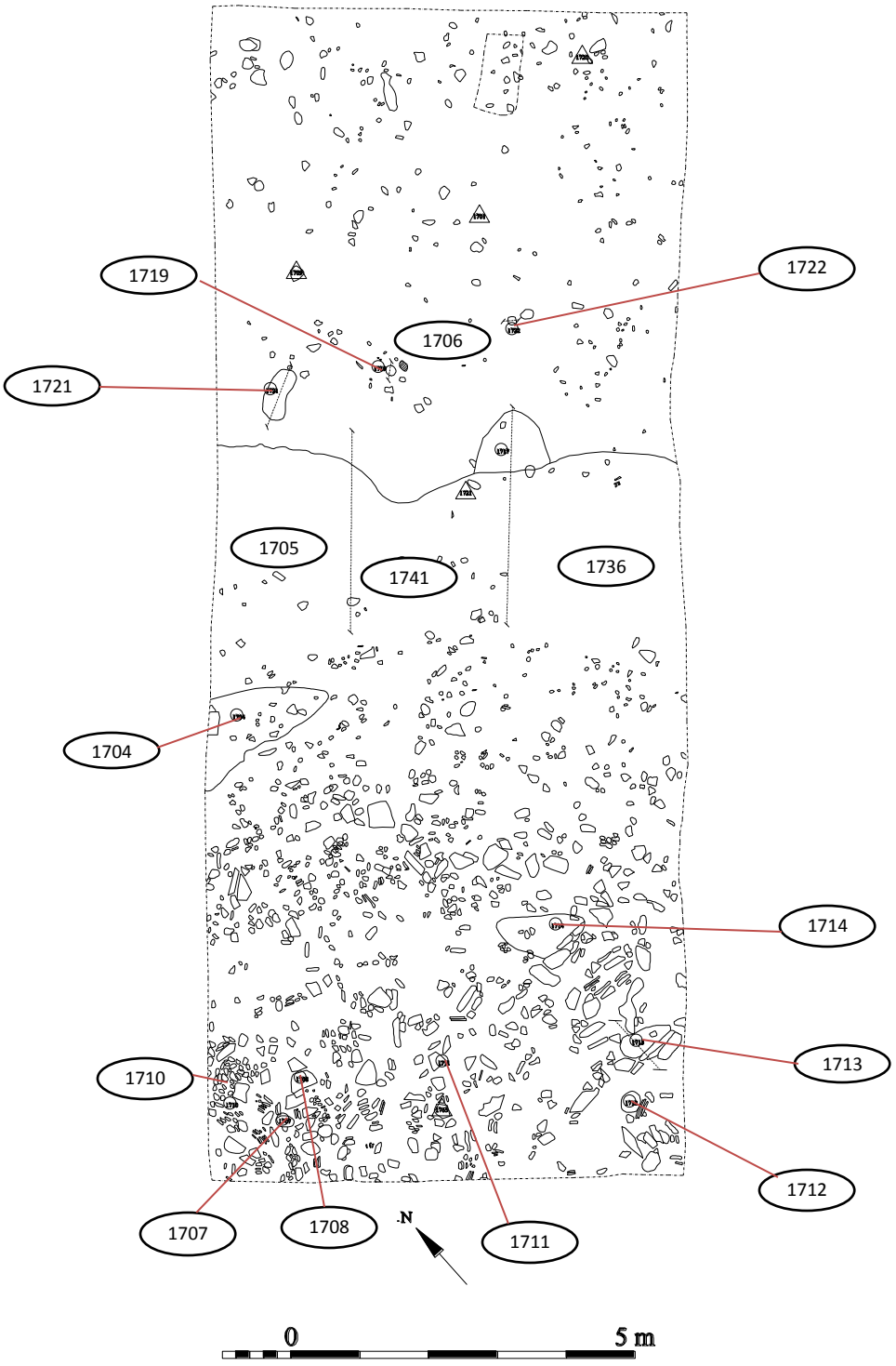


Figure 6 – Plan Drawing of 2017 Trench After Removal of Context 1702

Figure 7 – Photogrammetric Plan of 2017 Trench After Complete Excavation

Southern End of Trench

The southern end of the trench exposed context 1703 - a stony layer fixed within a silty clay matrix containing stones up to 300mm x 500mm. Within 1703 there were two distinct lines of large flat stones (context 1708 and 1711). These ran approximately parallel to each other and perpendicular to the southern edge of the trench, with maximum size of individual stones 300mm x 300mm. The total length of context 1708 was 1850mm and total width 400mm, whilst context 1711 had a total length 2350mm and width of 400mm. These two parallel structures tentatively represent the foundation pads for a small rectangular building (context 1731, Figs.8, 9 and 10).

Figure 8 – Photograph of Context 1731

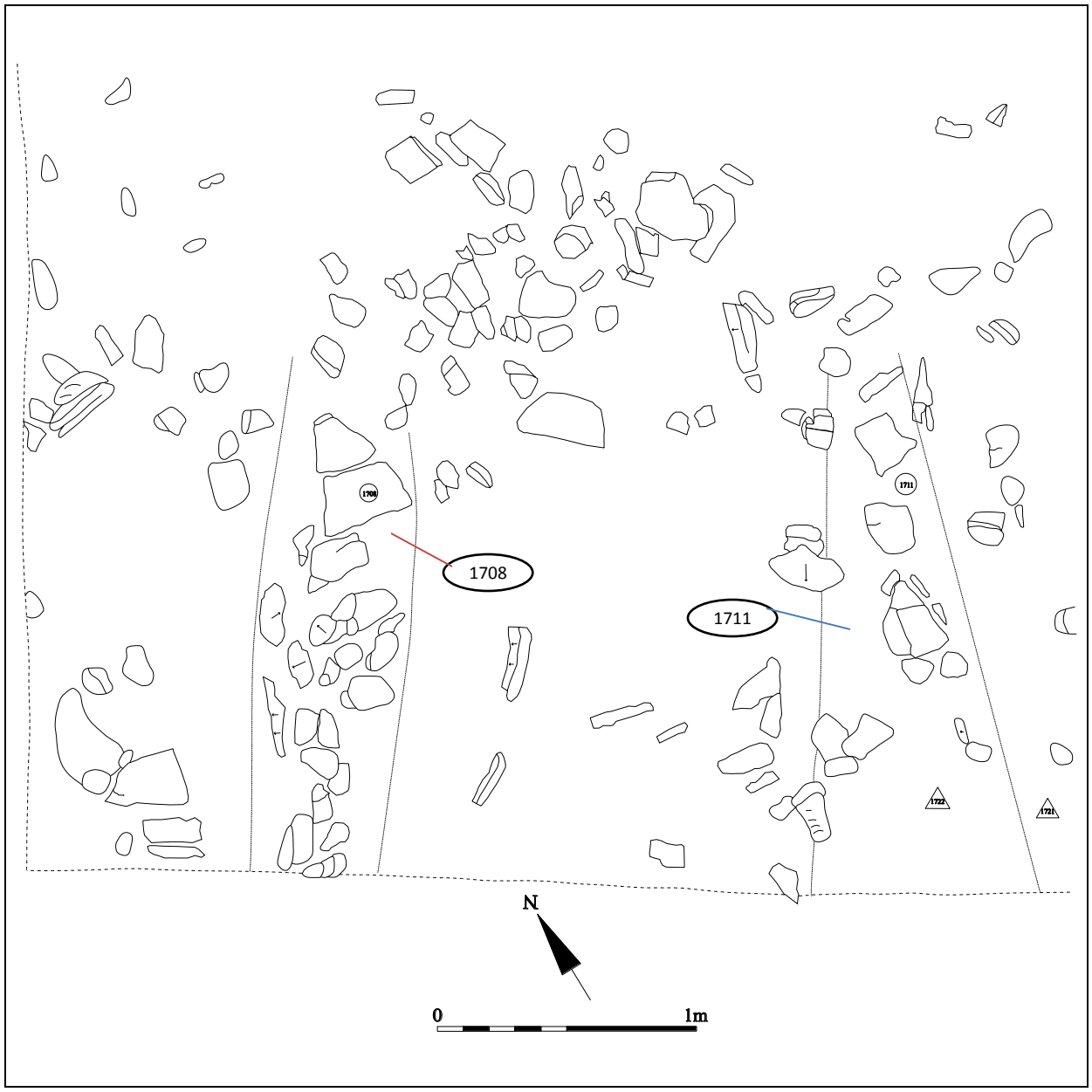


Figure 9- Plan Drawing of Context 1731

Figure 10- Photogrammetric Plan of Context 1731

Examination of the area between the parallel stones (2500mm x 2500mm, context 1730) revealed slipped piles of tabular and sub angular stones (approximately 80% coverage with stones of approximately 200mm size) thought to be collapse material. One of the flat stones forming context 1711 contained a small dimple or depression (80mm diameter and 5mm depth) which appeared to have been pecked into the stone surface (Fig.11; finds number 1763).

Figure 11 – Photograph of Find 1763

Close to the south-eastern corner of the trench there appeared to be a small stone-lined cut (1713) of 1170mm length, 500mm width and 100mm depth. This roughly triangular feature consisted of flat stone slabs containing context 1732, a brown-grey loamy silt.

Central area of trench

A broad band, approximately 3m wide, occupies the middle section of the trench and is defined by context 1737, a cut running across the width of the trench, with a maximum depth of approximately 200mm. Along the northern edge this cut appears as a steep scarp and pitting along this edge is suggestive of possible animal trampling. Animal footprints (context 1747, discussed as part of the northern area of the trench below) were also found in the adjacent area to the north of the cut (context 1749). Cut 1737 forms a divide

between the stony layer 1703 in the southern end of the trench (discussed above), and the silty clay layers of 1706 and 1749 in the northern end of the trench (discussed below). It is proposed (discussed further below) that this cut was a palaeo-channel. Figure 12 shows the plan drawing for this area.

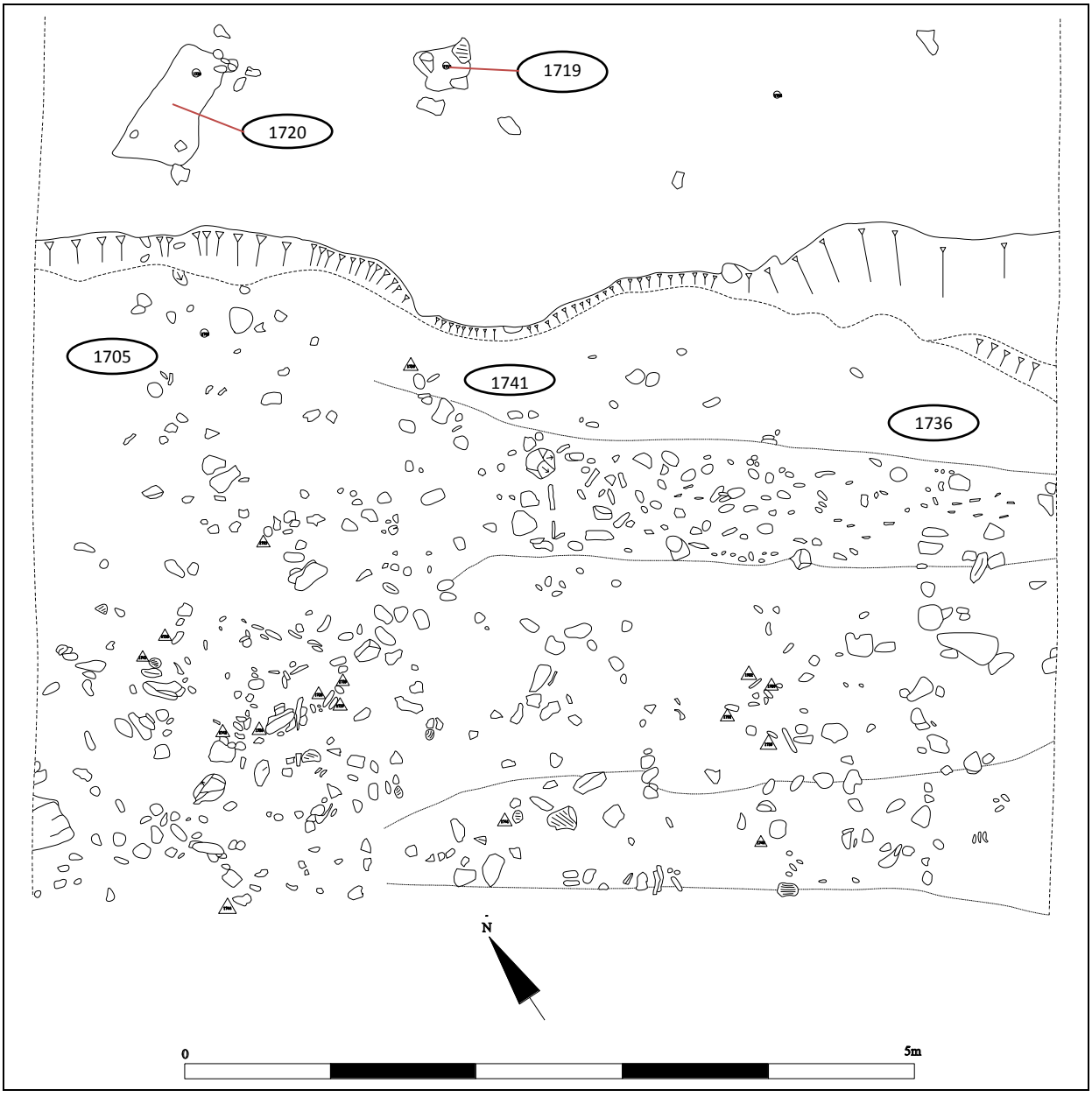


Figure 12 – Plan Drawing of Central Area of 2017 Trench

The upper layer across most of this cut (approximately 3m wide) consisted of smooth orange-brown silty clay with very few inclusions and some flecks of iron panning. This layer was removed as three separate sections, context numbers 1705, 1741 and 1736 (running west to east), although these three contexts are in fact considered to form a single fill layer. The south-west corner of context 1705 was covered by layer 1704, approximately 1300mm x 1300mm in extent, a dark grey silty clay with a distinctive odour.

Context 1736 covered layers 1745 and 1746 within cut 1744. 1745 was a mid brown-grey clayey silt containing angular and sub-angular stones of 60 – 150mm size. This layer was approximately 90mm thick and 1200mm wide. Context 1746 lay in pockets below 1745 and consisted of a pale grey clayey silt layer with fewer inclusions than layer 1745.

Context 1736 also covered layer 1743 which was within cut 1742 just to the north of cut 1744. This layer was pale grey clayey silt spread across 850mm area, with a thickness ranging from 120mm to 50mm. Stone inclusions, typically 80mm length, were predominantly aligned in an east-west direction.

In between cuts 1742 and 1744, and below context 1736 was context 1748. This stony deposit consisted of a grey-brown, orange-specked clayey silt containing mostly rectangular inclusions of 100mm x 40mm maximum size.

Figures 13 and 14 show the section drawings for this central area of the trench after excavation was complete.

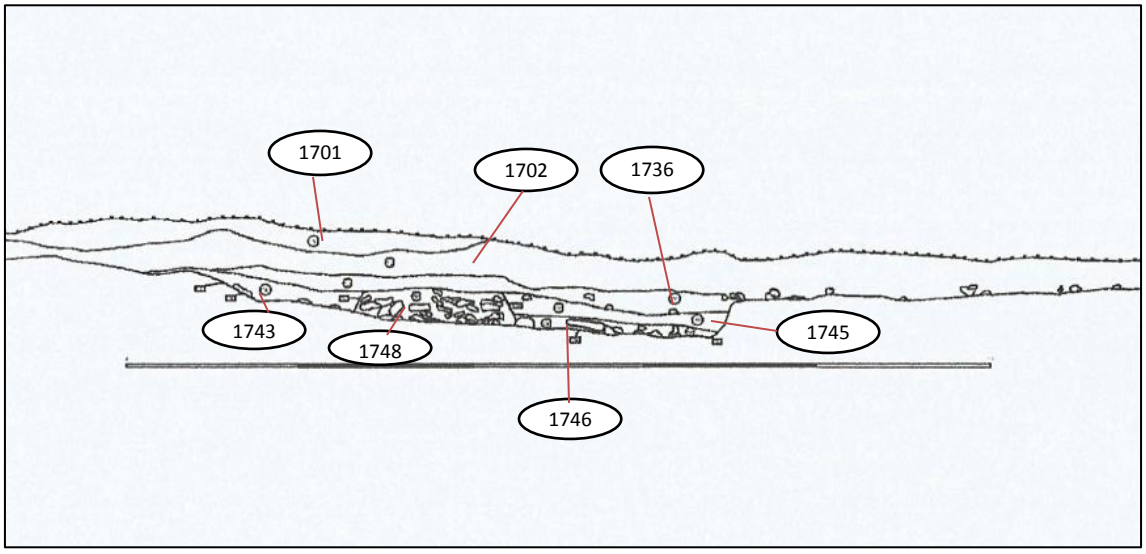


Figure 13 – Section Drawing of the West Facing Wall in the Central Area of 2017 Trench

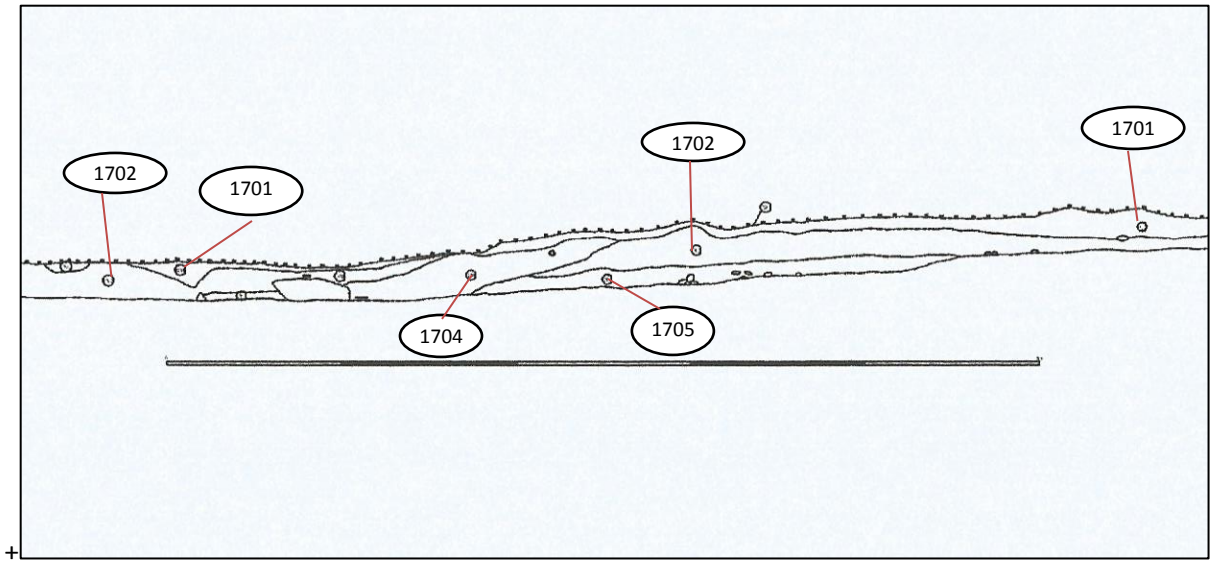


Figure 14 – Section Drawing of the East Facing Wall in the Central Area of 2017 Trench

An unusual collection of stone tools was found within this central area of the trench (Fig.16). The tools were all found within contexts 1704, 1705 and 1736. These tools are discussed in more detail below, but they are all made from limestone, and all have a similar 'teardrop' design spanning a range of sizes (approximately 80 to 260mm length, 30 to 90mm width) This type of tool is not currently known from elsewhere and is not typical of the lithic assemblage previously found at Moel Arthur. The alignment of the tools when found and the lack of evidence for rolling suggests the tools were deliberately deposited in this palaeo-channel location rather than being washed from elsewhere. Limestone is not found naturally on Moel Arthur itself although there is an outcrop of similar limestone approximately 1.5km away on the flanks of the adjacent hill of Penycloddiau.

Figure 15 – Photograph of Some of the Stone Tools *in-situ* in the Central Area of the Trench

Northern End of Trench

Removal of context 1702 at the northern end of the trench exposed context 1706 (Fig.16). This was a yellow silty clay containing polygonal cracks (suggestive of successive wetting-drying processes) and cut by 1737 on the southern side as discussed above. The clay also contains flecks of yellow iron panning, a small amount of root penetration and stone inclusions of various size up to a maximum of 500mm x 220mm. The stone inclusions mainly consist of local shale together with large pieces of white and rose quartz (up to approximately 100mm x 100mm).

Figure 16 – Photograph of Northern End of Trench Showing Context 1706

Three small cuts, 1720, 1739 and 1740 were present within layer 1706. Cut 1720 was an ovoid shape of length 88mm, width 46mm, depth 8mm and contained a brown-grey, slightly clayey silt, context 1734. Cut 1739 was an ovoid depression of 240mm x 170mm, 35mm deep which contained dark brown clayey silt, context 1719. Cut 1740 was a circular depression of 130mm diameter and 30mm depth. This cut contained grey-brown clayey silt, context 1722, and is interpreted as a possible post-hole.

Removal of layer 1706 revealed context 1749 which was a paler white-yellow, slightly silty clay, again with the presence of some polygonal cracks. The polygonal cracking is characteristic of marshy area which has been subject to repeated cycles of wetting and drying. Removal of layer 1706 also revealed a series of animal footprints (context 1747) creating a trail across context 1749. This footprint trail consisted of a minimum of 12 small hollows, typically 60mm x 50mm and 40mm depth. The prints appear to belong to a cloven hoofed animal such as sheep, goat or deer (Fig.17).

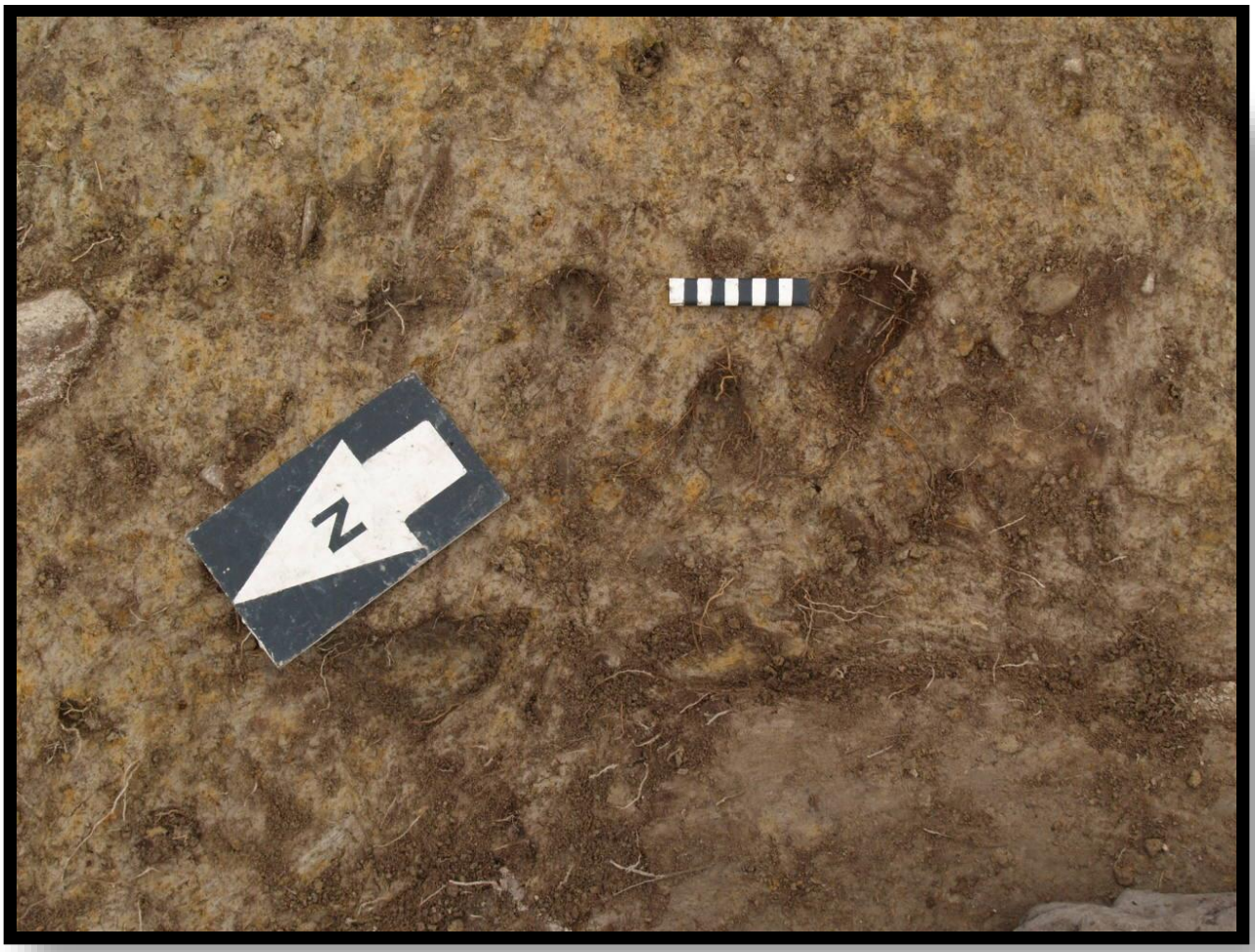


Figure 17 – Photograph of Animal Footprints (Context 1747)

Discussion on finds.

During the excavation of trench 17 in 2017 the one thing that made this trench stand out from all the previous trenches excavated on Moel Arthur to this date was the number of pieces of worked stone identified.

Material

The majority of the stone tools identified were formed from the sedimentary rock limestone. This rock however does not appear to be native to the immediate vicinity of the trench or to Moel Arthur at all; as the natural geology comprises of a very soft shale like rock that has a tendency to shatter along one axis to give smooth angular flakes. Therefore the limestone is thought to have been transported to site, possibly from the neighbouring hill to the north west of Moel Arthur named Penycloddiau, although the origin of the limestone has not been confirmed. A few of the limestone tools are showing signs of decay post excavation, with some of them cleaving apart, probably due to the time they spent in the stream bed and acidic leaching from the peat layer.

A smaller number of identified finds have been made from a mixture of other rocks including chert, rhyolite, sandstone and a fine grained conglomerate. Sources for these materials again are not apparent on Moel Arthur and have either been transported to site or were left as a glacial erratic in the last ice age.

Finds by context

Please note that dimensions for all finds can be found in appendix 7

Context 1703

This context described as a stony (shale) layer was seen at the southern end of the trench. It contained the feature given context 1731 and identified as possible foundation pads for a rectangular building. Within this context a small number of finds were identified (1703, 1722, 1723, 1724, 1764 and 1765). Find 1703 (Figure 18 and 23), identified as a possible "spoke-shave", is a concave side scraper on a poor quality, opaque chert. The most likely source for the chert is the Carboniferous deposits along the North Wales coast or one of its derived deposits. The size and shape of the flake used as a blank would suggest a possible Late Neolithic or Early Bronze Age date.

Figure 18 - Find 1703

Find 1722 is a large comma shaped piece of sandstone showing working on the outer edge identified as a possible quern stone. Find 1765 is an irregular elongated pieces of limestone with evidence of battering at one end. The other finds consist of a possible hammer stone, and water smoothed pebbles.

Context 1704

This context is described as a dark silty clay and was seen roughly on the north south edge of the trench butting up to 1703 to the south and 1705 to the north. During clearing back there was a distinct ‘decaying’ smell associated with this area, and during heavy rain it soon filled with water. It contained a total of 24 identified potential worked finds (1704, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1738, 1767, 1771a,b,c,d, 1774, 1775, 1767a,b,c,d,e, and 1770b,c.). From this group sixteen of them have been identified as stone tools all of them except two, which are more triangular in shape, are elongated showing battering on either one or both ends and signs of shaping (1709, 1710, 1711, 1712, 1713, 1714, 1715, 1738,1770b,c, 1771a,b,c,d, 1774 and 1775). These finds are notable for being made of limestone and a large number of them were grouped together within what was later identified as a palaeo channel. They range in sizes from 87 – 241mm in length, 30 – 89mm in width and 16 – 38mm in thickness (Figure 24 and 25). Another notable find in this context is 1704 (Figure 19 and 23), a hollow based arrowhead which Green describes as "hollow-based arrowheads”. This is an uncommon type in Britain, probably with Irish affinities (Green, 1984: 31). One of the barbs is missing, but the other is defined by bifacial retouch as is the main body of the arrowhead. Probably Early Bronze Age in date.

Figure 19 - Find 1704

Context 1705

This is described as an ‘orange-brown silty clay’ and is the same as context 1736 and 1741 which will be mentioned later. This context abuts 1704 however the south west corner of 1705 was covered by 1704. Only seven potential worked finds were identified from this context (1726, 1727, 1728, 1729, 1735, 1737 and 1768), four of them (1726, 1727, 1728, and 1729) are stone tools made of limestone worked in a similar way to the tools found in context 1704, within this group the second largest stone tool was identified (1726). The other finds consisted of two potential hammer stones showing evidence of battering on the surface and a water smoothed pebble.

Context 1706

This context was found at the north end of the trench and is described as a yellow silty clay containing polygonal cracks. Only a few finds were found in this context (1701, 1720, 1747, 1752, 1753, 1755, 1756, 1758, 1760 and 1761) ranging in identification as hammer stones (1720 and 1760), red soil probably iron panning (1761) and a rounded pebble (1952) However there were two finds of note, (1701) which is a chert flake and (1756) which has a rounded curved edge to two flat surfaces made from rhyolite (a similar looking stone was found in a previous dig).

Context 1711

This context was one of the distinct lines of flat stones found in context 1703 to the south end of the trench (the other line of flat stones was given context 1708). Only one find was identified in this context (1763). This was one of the flat stones thought to be used as foundation pads for a small dwelling. What made this stone different from the others was the presence of a ‘dimple’ (80mm in diameter with a maximum depth of 50mm; Figure 13).

Context 1736

This context is considered to be the same as context 1705 and 1741 and is described as an ‘orange-brown silty layer’. Nine worked pieces of stone were identified (1705, 1716, 1717, 1718, 1730, 1731, 1732, 1733 and 1739). All the finds except for 1705 were similar to the stone tools found mainly in context 1704 and 1705 and grouped together within the area identified as the palaeo channel. They range in size from 77mm – 133mm in length, 27mm – 43mm in width and 15 – 25mm in thickness. The other find in this context is 1705 (Figure 20 and 23) a broken rounded pebble of rhyolite showing evidence of a tapered hole drilled through the centre.

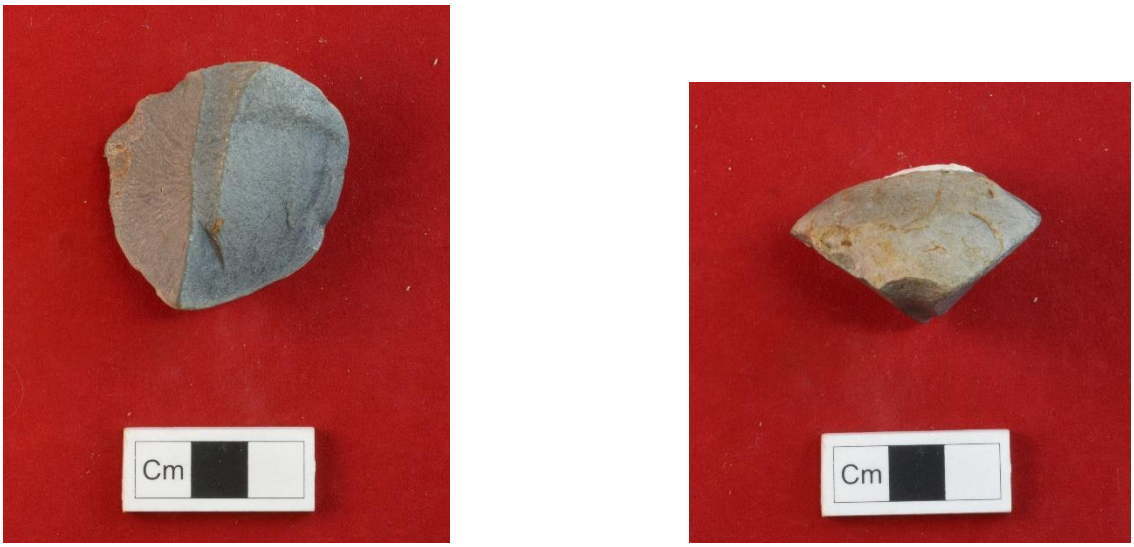


Figure 20 – Find 1705

Context 1741

This context is considered to be the same as 1705 and 1736 and is described as an ‘orangey-brown silty layer’. Only a few potential worked stones were found (1719, 1736, 1741, 1742, 1743 and 1744). However the one thing of note was that was that unlike the other two comparable contexts this context did not have any of the limestone worked tools.

Context 1745

This context is described as a ‘mid brown-grey clayey-silt’, and is seen within context 1744 identified as a palaeo channel. Only two finds have been attributed to this context (1748 and 1754). Find 1754 (Figure 21) is of most interest as it shows working and partial polishing of a large pebble to form a possible axe / hammer head.

Figure 21 - Find 1754

Overall conclusion.

Although this site yielded a large number of stone artefacts showing signs of use and shaping, the large collection of limestone tools are by far the most intriguing. Limestone is considered to be a soft sedimentary rock and although good enough in blocks to be used in building material it is really not thought to be good enough to be used for any type of tool. However this collection of 26 limestone tools, ranging in length and width, is considered to be unique with no other comparable collection to date identified. However other collections of coarse stone tools have been identified on the Orkney and Shetland Isles (Clarke, 2006), some of these tools which have been identified as plough ards bear a slight resemblance to the tools under discussion but not enough for us to believe that these have been used in the same way. These tools do not just show signs of shaping but many of them show battering wear at one or both ends. One possible proposed use for these stone is in the production of rock art, with the discovery of find 1763 (Figure 13) and the dimple a tentative connection may be made. However no rock art has been officially identified in the Clwydian Range but since the discovery of the tools, potential sites have been identified and will need further investigation. Also the majority of the tools were found in two clusters in context 1704 and 1736 identified as a palaeo channel. Were these tools deposited within the channel as

some sort of offering? Are the tools potentially softer mock ups of more prized tools and used as a facsimile sacrifice to the water entities?

Unfortunately there was no organic material discovered on site to enable a carbon dating. However the typology of some of the other worked stone (1703 and 1704) suggest a late Neolithic / early bronze age date as discussed above.

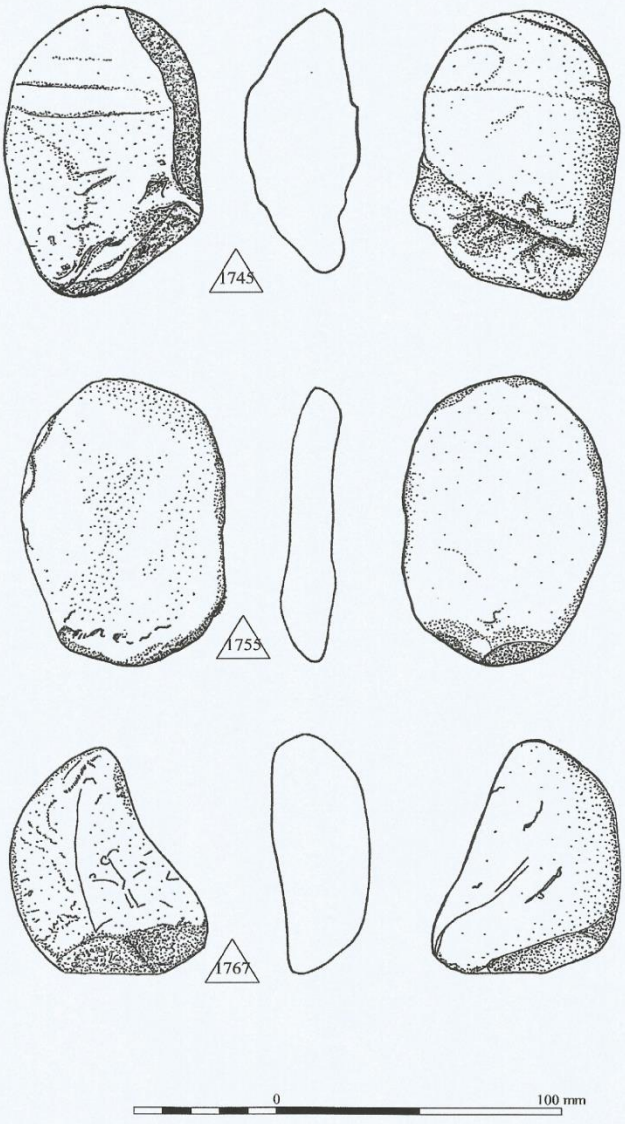


Figure 22

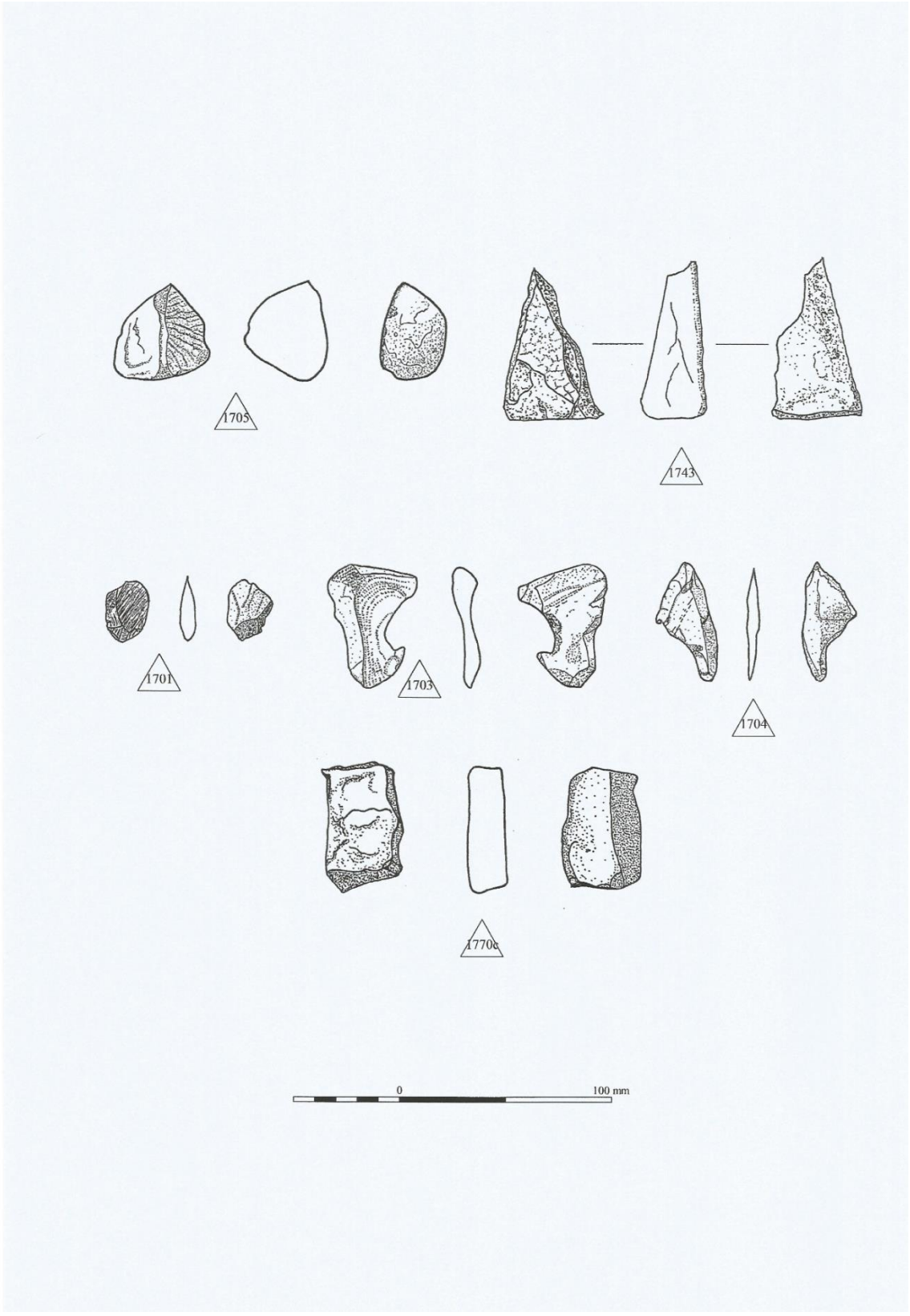


Figure 23

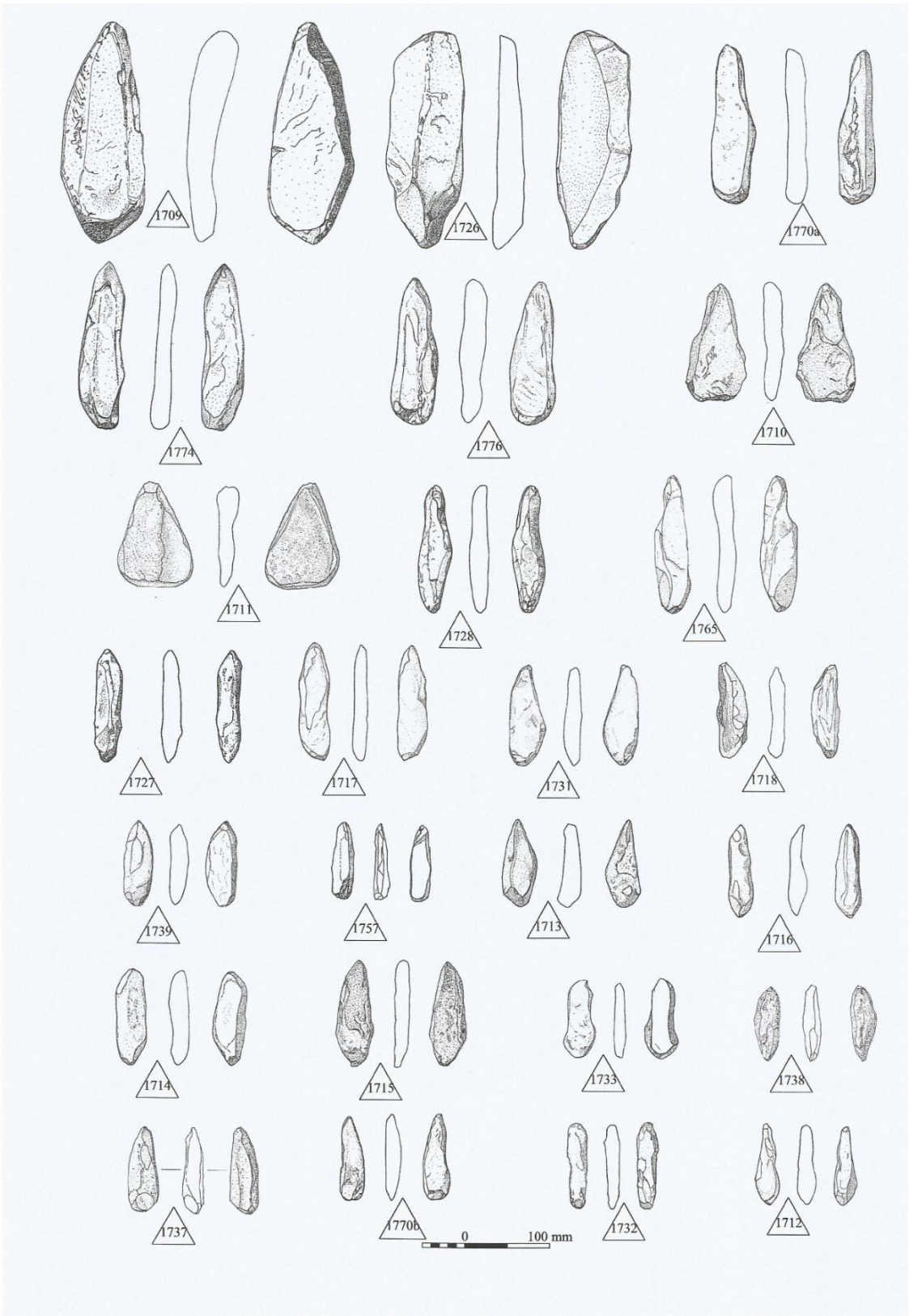

1709
1726
1770a
1774
1776
1710
1711
1728
1765
1727
1717
1731
1718
1739
1757
1713
1716
1714
1715
1733
1738
1737
1770b
0
100 mm
1732
1712

Figure 24

Figure 25 – Stone tool cache

Interpretation of Excavation

The central area of the trench described above is thought to be a palaeo-channel or ancient stream bed (within cut 1737). It would appear from the stratigraphy that there were in fact two earlier palaeo-channel events, within cuts 1742 and 1744. The 26 stone tools discussed in the finds discussion all came from this area.

At the northern end of the trench the polygonal cracking visible in context 1706 is indicative of repeated wetting/drying processes, and this would be consistent with this area having been a marshy area adjacent to the palaeo channel). The animal footprints (context 1747) and the possible trampling effect evident at the northern edge of cut 1737, are likely to be the result of animals coming to the bank of the stream to drink water. This indicates the presence of cloven-hoofed animals on the plateau in ancient times.

The stony southern end of the trench contains one possible feature, 1731, which is believed to be the foundation pads for a collapsed temporary structure, perhaps a shepherd's hut. It is impossible to assign a date to this structure although it may well be a post-medieval structure.

Peat core analysis from neighbouring Moel Llys y Coed indicates that extensive heather coverage happened between AD600 and AD810. Therefore, everything discovered sealed below this heather layer on Moel Arthur and its adjacent plateau are likely to pre-date this period.

The burnt-mound structure discovered in 2013 is adjacent to the 2017 trench. Burnt mounds are a common prehistoric phenomenon, particularly in upland Britain, typically associated with the Bronze Age. Their function still eludes archaeologists although suggestions are outdoor cooking, brewing, a sweat lodge and even metal prospection activities. Radiocarbon dating confirmed an Early Bronze Age date for the burnt mound on Moel Arthur (SUERC, 2013). These structures are usually found adjacent to a water source and the close proximity of the palaeo channel discovered in this year's excavation seems to further validate the interpretation of the burnt mound feature.

The deposition of the stone tool cache at the bottom of the palaeo channel might tentatively be assigned an Early Bronze Age date based on the close proximity of the burnt mound, although Neolithic or Iron Age dates cannot be ruled out given that Neolithic flints have been found during previous excavations on the Moel Arthur plateau, and the hillfort is assumed to be Iron Age.

The hoard of flat copper axes found in the hillfort interior in 1962 (Forde-Johnston, 1964) have also been assigned an Early Bronze Age date based on both typology and chemical composition (Morgan, 1990; Needham, 2017) suggesting that perhaps Moel Arthur was considered to have a symbolic significance at this time. This may in turn add weight to the supposition of an Early Bronze Age date for the deposition of the stone tools in the palaeo channel.

Future Work

For 2018 the Clwydian Range Archaeology Group plan to excavate an area adjacent to the 2017 trench to obtain further understanding of the relationships between the archaeological features revealed so far and perhaps define a more precise chronology. The group also plan to carry out walk-over survey of the wider Moel Arthur area.

Acknowledgements

This excavation was supported by Heritage Lottery Funding, and the Sustainable Development Fund of the Clwydian Range and Dee Valley AONB.

The excavation could not have taken place without the CRAG Management Committee and the volunteers who assisted with excavation and post-excavation activities (all listed below). Thanks are also due to Dr Ian Brooks of EAS Ltd who provided valuable mentoring to CRAG throughout the excavation and post-excavation process.

Management Committee

Karen Lowery
Fiona Gale
Hilary Lidbury
Keith Lowery
Pat Daley
Terry White
Philip Culver
Wendy Whitby
Robert Moore
Simon Shepherd

Excavation

Karen Lowery
Hilary Lidbury
Terry White
Philip Culver
Wendy Whitby
Simon Shepherd
Alice Bray
Tony King
Grahame Thompson
Scott Williams
Peter Jenkins
David Lloyd
Keith Owen
Suzanne Window
Peter Alexander
Steven Toogood
Sion Williams

Post-Excavation

Karen Lowery
Hilary Lidbury
Terry White
Philip Culver
Wendy Whitby
Fiona Gale
Alice Bray
Tony King
Gareth Hughes
Heather Dawson
Robert Moore
Lindy Moore

References

Brooks I.P., 2014, *Land Below Moel Arthur Geophysical Survey*, Engineering Archaeological Services Limited, EAS Client Report 2014/10.

Brown, I., 2004, *Discovering a Welsh Landscape: Archaeology in the Clwydian Range*, Windgather Press, Macclesfield.

Clarke, A., 2006, *Stone Tools and the Prehistory of the Northern Isles*, British Archaeological Records 406, Archaeopress, Oxford.

CPAT (Clwyd Powys Archaeological Trust), 2003, *Projects – Historic Landscapes -The Vale of Clwyd*, http://www.cpat.org.uk/projects/longer/histland/clwyd/clwyd.htm.

Davies, E., 1949, *Prehistoric and Roman Remains of Flintshire*, William Lewis, Cardiff.

Forde-Johnston, J., 1964, 'A Hoard of Flat Axes from Moel Arthur', *Journal of the Flintshire Historical Society*, 21, 99-100.

Grant, F.R., 2009, *Analysis of a peat core from the Clwydian Hills, North Wales*, Royal Commission on the Ancient and Historical Monuments of Wales, Report No: 0209 RCAHMW.

Morgan, D.E.M., 1990, *Bronze Age Metalwork from Flintshire*, North West Archaeological Trust, Report No.4.

Needham, S., 2017, *The Classification of Chalcolithic and Early Bronze Age Copper and Bronze Axe-heads from Southern Britain*, Archaeopress, Oxford.

Wynne Ffoulkes, W., 1850, 'Castra Clwydiana', *Archaeologia Cambrensis*, New Series, I.

Ordnance Survey, 2005, *Clwydian Range/Bryniau Clwyd*, OS Explorer Map 265, 1:25 000 Scale.

SUERC (Scottish Universities Environmental Research Centre), 2013, Radiocarbon Dating Report: SUERC 49808 (GU32372).

SUERC (Scottish Universities Environmental Research Centre), 2016, Radiocarbon Dating Report: SUERC 66219-66221 (GU40089-40091).

https://hillforts.arch.ox.ac.uk/, Atlas of Hillforts, Moel Arthur WA1156 (accessed 12/07/18).

Appendix 1

Survey Commissioned

by

Clwydian Range Archaeology Group

Analysis

by

I.P. Brooks

Engineering Archaeological Services Ltd.

registered in England

Nº 2869678

Land below Moel Arthur Geophysical Survey

September 2014

EAS Client Report 2014/10

Contents

List of Illustrations

NGR

Centred on SH 14420 66352

Location and Topography (Figure 1)

An area of approximately 1.3 Ha on the plateau to the north of Moel Arthur Hillfort was surveyed with a Fluxgate Gradiometer. The survey area occupied a slightly sloping plateau which slopes down towards the north west. The survey area was covered in heather with patches of gorse. Whilst some areas had been cut for the survey and other areas had been cut in recent years and had started to regenerate, the majority of the survey area was covered by heather and gorse up to 1 m deep in places. At the heart of the survey area was a "wet flush", an area of seasonally wet vegetation with organic soils up to 0.5 m thick.

Two footpaths also cross the survey areas, one from the western side of the hillfort and the other part of the Offa's Dyke footpath.

Archaeological Background

Small areas of geophysical survey have taken place within the area of the survey as part of the Heather and Hillforts Landscape Partnership Project in 2010 and 2011 (Figure 12). A further small Fluxgate Gradiometer survey over one of the previously recorded anomalies was undertaken in 2012 to define the position and size of the anomaly. This resulted in a targeted excavation by the Clwydian Range Archaeological Group which revealed the remains of a probable burnt mound which has been dated to 3996 ± 33 bp (SUERC-49808).

Whilst the relatively small surveys, previously undertaken, allowed the location of highly magnetic anomalies, the location and definition of magnetically slight anomalies was difficult. A large scale survey allows for the easier definition of slight anomalies with confidence.

Aims of Survey

To investigate, through magnetic survey, the plateau to the north of Moel Arthur, to define the extent of any archaeological activity and if possible to characterise that activity.

SUMMARY OF RESULTS

Magnetic susceptibility samples taken from within the survey area suggest that the magnetic conditions are not ideal for survey, however it was possible to define two area of possible archaeological activity on either side of the "wet flush". This included a number of anomalies with high magnetic signatures suggestive of a feature which may have been heated. In particular one anomaly near to the excavated burnt mound appears to have a dipolar signal suggestive of a burnt feature.

Other anomalies recorded include some circular anomalies which may be associated with structures and linear anomalies which are possibly geological in origins.

Methods

The General Fluxgate Gradiometer Survey was undertaken using parts of thirty three 20 x 20m grid squares laid out as in Figure 2. Readings were taken at 0.5 m intervals along transects 0.5 m apart at a resolution of 0.1 nT. These transects were walked in a zigzag pattern. For the majority of the survey readings were taken with the aid of a hand trigger because of the level of heather and gorse growth within the survey area. It was possible however to use a sample trigger in five grid squares.

A high resolution survey was also undertaken in one 20 x 20 m square laid out as in Figure 3. Readings were taken at 0.25 m intervals along transects 0.25 m apart. Once again the samples were taken with the aid of a hand trigger, however in the case of this survey the readings were in a parallel pattern.

The surveys were carried out using a Geoscan FM 36 Fluxgate Gradiometer. Grey scale plots were produced using Geoscan Research "Geoplot" v.3.00v (Figure 3). A colour contour plot (Figure 5) and an X-Y plot (Figure 4) were produced by exporting the data into Golden Software Inc. "Surfer" v.10.

Results:

Area

The Fluxgate Gradiometer survey covered an area of approximately 1.3 Ha. A further 400 m^2 were subject to high resolution survey.

Display

The results of the General Fluxgate Gradiometer Survey are displayed as grey scale images (Figure 4) and as X-Y trace plot (Figure 4). The interpretation is shown on Figure 5 and the results are also summarized in Figure 6.

The results of the High Resolution Survey are shown as a grey scale plot (Figure 7), X-Y trace plot (Figure 8) and as a filled colour contour plot (Figure 9).

Filled Colour Contour Plots

This technique was developed by Crew (1997, 1998) at the prehistoric ironworking site of Crawcwellt, Merioneth, to clarify the location and nature of strong magnetic anomalies, particularly to identify the location of *in situ* burnt features associated with ironworking, such as furnaces, smithing hearths and ore roasting areas.

The raw gradiometer data is imported into Golden Software Inc. "Surfer" v.10 and is used to produce a filled contour plot, with a non-linear scale, so that the high positive and low negative readings are emphasised. The scale is selected according to the maxima and minima of the readings, to show *in situ* features in the best possible manner. The clearest results are generally achieved with a scale which doubles, or halves, at each step. In colour the positive readings are represented in shades of yellow to red and the negative readings in shades of blue. The mid-range positive values are represented as white. The data is not manipulated in any way, except to smooth the contours slightly to reduce the linearity which can be caused by an eccentric survey grid.

Areas of burning such as furnaces or hearths, which are still *in situ*, give north-south oriented dipolar signals because of the relatively strong remanent magnetism of the feature. The key element for the recognition of *in situ* features is the occurrence of a discrete negative signal, which in well-defined features can occur as a halo around the northern side of the positive signal.

The apparent orientation and shape of the dipolar signals can vary, depending on a number of factors. The declination can reflect the last firing date of the feature, as the remanent magnetic direction varies with time. The shape of the signal is rarely circular. Most well-preserved furnaces have a vitrified lining which is "C" shaped in plan, which gives a slightly oval signal. Some signals can also be markedly elongated, which may be due to slag tapping channels with a remanent magnetic signal. The negative zone of the dipolar signals is also much weaker than the positive zone and can be distorted by topography and by the presence of slags and other fired features.

The amplitude and size of the dipolar signals also depend on several factors, such as the state of preservation of the feature, its depth and the degree to which the signal is masked by slag deposits. In cases where an *in situ* feature occurs to the south of slag deposits, the negative signal may not show at all. Dipolar signals with other orientations can occur and can be caused by large pieces of magnetic, iron-rich material which are disturbed and no longer in their original orientation. Isolated high readings can also give fortuitous dipolar signals, but these can be discounted by careful inspection of the survey data.

The value of the technique for mapping ironworking sites has now been fully demonstrated by previous Cumbria surveys (Price and Crew 1999, Crew *et al* 2001, Crew *et al* 2002, Crew and Brooks 2002), in the Dartmoor National Park at Auswell Wood (Dean 2000) and at Little Morton Hall, Cheshire (Brooks and Laws 2002).

General Fluxgate Gradiometer Survey

The Fluxgate Gradiometer survey on the plateau below Moel Arthur has revealed a number of magnetic anomalies which are defined in Figure 6 and summarised on Figure 11. These appear to form two main groupings which occupy either side of the "wet flush"

The inadvertent use of metallic markers at one point during the survey gives rise to the ferromagnetic responses marked as Anomaly A. This disturbance covered only an area 24 m long and 1.5 m wide on the edge of the survey. The survey also covered the area of the excavation trench for the burnt mound which is shown by the area of mixed magnetic responses labelled Anomaly B.

There are nine discrete anomalies spread through the survey which have significant magnetic signatures, the majority of which are in the western half of the survey area. Three of these appear to form outliers from the main concentrations of possible activity. Anomaly C is approximately 3 m in diameter with a maximum reading of 25 nT above the background. Anomaly D is less well defined, however it covers an area of 4.5 x 3 m with reading varying between -12 and +45 nT. The third outlier (Anomaly E) is within the eastern end of survey. This anomaly is approximately 3.5 m in diameter with readings between -13and +49 nT, it appears, however, to be more structured than Anomalies C and D with clear positive and negative zones, possibly suggesting an *in situ* burnt feature.

Other anomalies outside the main groups consist of a few discrete anomalies and some very feint linear anomalies (Anomalies F – J) which may be part of a field system, however they might equally be the result of the underlying geology. A small group of discrete anomalies (Anomalies K – M) possibly form a line of features together with Anomaly C possibly marking a line of posts in this part of the survey area.

Group 1 are a series of anomalies on the northern side of the "wet flush" which appear to be directly related to the already excavated burnt mound. This group comprises two discrete, high magnetic anomalies, two circular anomalies and a curving linear anomaly. Anomaly N is a well-defined anomaly approximately 2.5 m in diameter with readings varying between -35 and + 43 nT. At this resolution the anomaly appears to be structured with a negative zone to the north of the positive zone suggesting an *in situ* burnt features. It was therefore decided to carry out a high resolution survey over this feature. Approximately 7.5 m to the north east is another highly magnetic anomaly (Anomaly O). This, however, is smaller (approximately 1.5 m in diameter) and less well-structured than Anomaly N. Two possible circular anomalies have been defined Anomaly P is approximately 6 m in diameter, whilst Anomaly Q is larger at 11 m in diameter. This larger anomaly is better defined and is more likely to be archaeological in origins. It is possible, however that both of these anomalies represent the remains of circular buildings. Anomaly R is a curvilinear anomaly which possibly marks the western and southern sides of Group 1.

Group 2 occupies the southern side of the "wet flush" and is more extensive than Group 1. It incorporates six highly magnetic anomalies, a number of other discrete anomalies and a group of six possible circular anomalies. Anomalies S – X are highly magnetic anomalies which are summarised below:

	Diameter	Minimum reading	Maximum reading
S	3 m	-12 nT	22 nT
T	2.5 m	-6 nT	18 nT
U	3 m	-5 nT	20 nT
V	3 m	-7 nT	15 nT
W	3.5 m	-9 nT	32 nT
X	?4 m	-10 nT	37 nT

Of these particularly Anomalies T, V and W appear to have consistent magnetic signatures with negative zones to the north of positive zones suggesting the possibility of *in situ* burnt features. Anomalies Y – AH are a series of discrete anomalies which form a slightly curving line. Each of the discrete anomalies is approximately 1.5 m in diameter suggesting either a line of small pits or large post-holes. It is not certain whether this line of anomalies is related to the possible feint linear anomaly (Anomaly AI).

Anomalies AJ – AO are a series of circular and sub-circular anomalies which appear to form a group in the southern section of Group 2. These anomalies are summarised below

Anomaly	Diameter
AJ	6 m
AK	6.5 m
AL	6 m
AM	9 m
AN	5 m
AO	7.5 m

High Resolution Fluxgate Gradiometer Survey

The high resolution survey was based on a grid which was offset from the main grid in order to cover the high magnetic anomalies within Group 1. The grey scale plot for this survey is shown on Figure 7, the X-Y plot on Figure 8 and the filled colour contour plot on Figure 9.

Whilst the majority of the highly magnetic anomalies within this survey relate to the disturbance of the excavated trench, Two anomalies are worthy of specific comment. The consistent nature of Anomaly N was confirmed by the high resolution survey with a clear dipolar response which is shown arrowed on Figure 9. The lobate nature of the positive zone may suggest that part of the feature has been disturbed, however the clear dipolar alignment suggest that the majority of the feature may be *in situ*.

Anomaly O, however does not have a clear dipolar and is unlikely to be the result of an *in situ* burnt feature, such as a hearth, but may be the result of a deposit of burnt stones.

Magnetic Susceptibility

It was possible to take soil samples in order to assess the magnetic susceptibility of the soils. It was not possible, however, to obtain a subsoil sample for comparison. Both volume susceptibility (direct reading of the samples) and mass susceptibility (reading compensated for the varying mass of the samples) is given below. For the location of the grids refer to Figure 10.

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 1	2	9.1
Grid 2	1	3.4
Grid 3	3	9.7
Grid 4	2	5.7
Grid 5	1	1.6
Grid 6	3	4.8
Grid 7	2	7.4
Grid 8	10	19.6
Grid 9	2	8.3
Grid 10	1	3.0
Grid 11	2	6.1
Grid 12	4	13.8
Grid 13	1	2.1
Grid 14	1	2.2
Grid 15	2	8.0
Grid 16	1	3.6
Grid 17	1	5.0
Grid 18	1	5.3
Grid 19	9	31.0
Grid 20	8	13.6
Grid 21	3	12.5
Grid 22	4	6.3
Grid 23	1	5.9

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 24	7	21.2
Grid 25	1	4.5
Grid 26	1	4.8
Grid 27	1	4.5
Grid 28	5	29.4
Grid 29	1	9.1
Grid 30	2	13.3
Grid 31	7	25.0
Grid 32	10	58.8
Grid 33	4	14.8

The susceptibilities as measured are universally low suggesting that the magnetic conditions were not ideal for magnetic survey. The variability within the readings, however, can be interpreted as reflecting the potential areas of archaeological activity on the site. The higher readings (Figure 10) tend to correspond with the distribution of anomalies suggesting that they are generally the result of archaeological activity on the site.

Conclusions

It is a fundamental axiom of archaeological geophysics that the absence of features in the survey data does not mean that there is no archaeology present in the survey area only that the techniques used have not detected it.

Prior to the current survey only 0.66 Ha of geophysical survey had taken place on the plateau below Moel Arthur (Figure 12). This had taken place over three seasons of work and was restricted to relativcly small areas of cut heather. The undertaking of a consistent area of 1.3 Ha of Fluxgate Gradiometer survey has allowed for a much clearer picture of possible archaeological activity on the plateau to be defined.

Of particular interest are the two groups of activity on either side of the "wet flush". Group 1 appears to be related to the previously excavated burnt mound consisting of two possible circular buildings and related features. One of these (Anomaly N) is a consistent anomaly suggestive of an *in situ* burnt feature. It may, therefore, be the hearth for heating the stones for the burnt mound only 10 m to the north.

On the southern side of the "wet flush" Group 2 is a more extensive group of anomalies. This includes a group of six highly magnetic anomalies which may represent further hearths or burnt mounds, although this is somewhat speculative and can only be confirmed by excavation. Of particular interest is the line of discrete magnetic anomalies (Anomalies Y – AH) which appears to form a possible distinct boundary. If the magnetic signature of these anomalies reflects the sizes of the underlying archaeological features they are quite large, typically 1.5 m in diameter, these would have been a major feature in the landscape.

The circular anomalies within this group are rather feint and therefore the possible round houses they may represent are tentative.

References

Brooks, I.P. And Laws, K. 2002 *Little Morton Hall geophysical survey.* EAS Client Report 2002/8 for the National Trust.

Crew, P. 1997 Geophysical survey and furnace location at ironworking sites. In Crew, P and Crew S. (eds.) *Early ironworking in Europe: archaeology and experiment.* Occasional Paper No. 3, Plas Tan y Bwlch, Maentwrog, 113-115

Crew, P. 1998 Excavations at Crawcwellt West, Merioneth, 1990-1998: a late prehistoric upland ironworking settlement. *Archaeology in Wales* 39, 22-35.

Crew, P. And Brooks, I.P. 2000. *Cumbria 2000: geophysical survey of ironworking sites in the Lake District.* EAS Client Report for the Lake District National Park and the National Trust.

Crew, P. And Brooks, I.P. 2002 *Cumbria 2002: geophysical survey of the ironworking site at Grassguards, Lake District Nation Park.* EAS Client Report 2002/18 for the Lake District National Park and the National Trust.

Crew, P., Laws, K. And Brooks, I.P. 2001 *Cumbria 2001: geophysical survey of ironworking sites in the Lake District.* EAS Client Report for the Lake District National Park and the National Trust

Crew, P., Laws, K. And Brooks, I.P. 2002 *Cumbria 2002: geophysical survey of ironworking sites in the Lake District.* EAS Client Report 2002/34 for the Lake District National Park and the National Trust.

Dean, R. 2000 *A gradiometer survey at Auswell Wood, Ashburton, Devon.* Unpublished report for the Dartmoor National Park.

Price, J. And Crew, P. 1999. *Cumbria 1999: geophysical survey of ironworking sites in the Lake District National Park.* EAS Client Report for the Lake District National Park and the National Trust.

Acknowledgements

The hard work in acquiring the data for these surveys was collected by the members of the Clwydian Range Archaeology Group who battled with deep heather and gorse to carry-out the surveys. Particular thanks are due to Keith, Pat, Philip, Irene, Simon, Terry, Tony and Ralph who were involved with the fieldwork. The surveys were made possible because of a grant from the Cadwyn Clwyd Rural Development Agency.

.

Techniques of Geophysical Survey:

Magnetometry:

This relies on variations in soil magnetic susceptibility and magnetic remenance which often result from past human activities. Using a Fluxgate Gradiometer these variations can be mapped, or a rapid evaluation of archaeological potential can be made by scanning.

Resistivity:

This relies on variations in the electrical conductivity of the soil and subsoil which in general is related to soil moisture levels. As such, results can be seasonally dependant. Slower than Magnetometry this technique is best suited to locating positive features such as buried walls that give rise to high resistance anomalies.

Resistance Tomography

Builds up a vertical profile or pseudosection through deposits by taking resistivity readings along a transect using a range of different probe spacings.

Magnetic Susceptibility:

Variations in soil magnetic susceptibility occur naturally but can be greatly enhanced by human activity. Information on the enhancement of magnetic susceptibility can be used to ascertain the suitability of a site for magnetic survey and for targeting areas of potential archaeological activity when extensive sites need to be investigated. Very large areas can be rapidly evaluated and specific areas identified for detailed survey by gradiometer.

Instrumentation:

1. Fluxgate Gradiometer - Geoscan FM36

2. Resistance Meter - Geoscan RM15

3. Magnetic Susceptibility Meter - Bartington MS2

4. Geopulse Imager 25 - Campus

Methodology:

For Gradiometer and Resistivity Survey 20m x 20m or 30m x 30m grids are laid out over the survey area. Gradiometer readings are logged at either 0.5m or 1m intervals along traverses 1m apart. Resistance meter readings are logged at 1m intervals. Data is down-loaded to a laptop computer in the field for initial configuration and analysis. Final analysis is carried out back at base.

For scanning transects are laid out at 10m intervals. Any anomalies noticed are where possible traced and recorded on the location plan.

For Magnetic Susceptibility survey a large grid is laid out and readings logged at 20m intervals along traverses 20m apart, data is again configured and analysed on a laptop computer.

Copyright:

EAS Ltd shall retain full copyright of any commissioned reports, tender documents or other project documentation, under the Copyrights, Designs and Patents Act 1988 with all rights reserved: excepting that it hereby provides an exclusive licence to the client for the use of such documents by the client in all matters directly relating to the project as described in the Project Specification

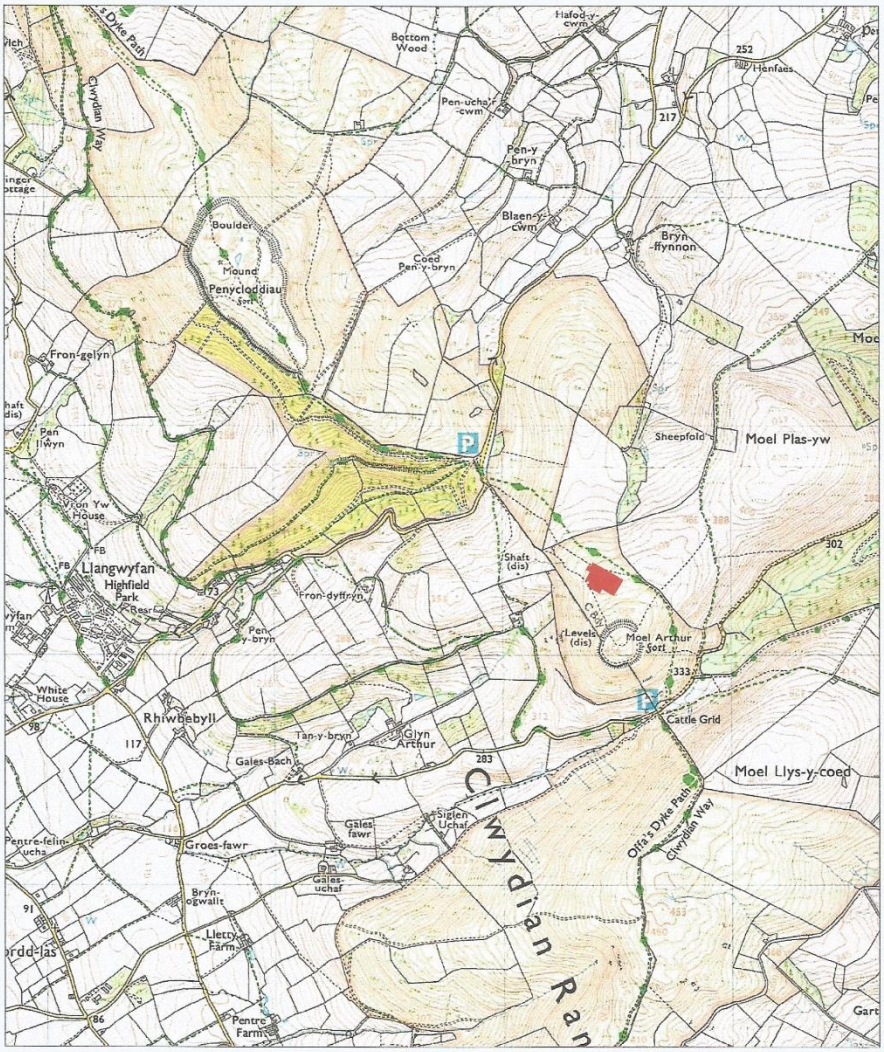


Figure 1: Location
Scale 1:25,000

Reproduced from the Explorer 265, 1:25,000 scale map
by permission of the Ordnance Survey ® on behalf of
The Controller of Her Majesty's Stationary Office
© Crown Copyright 2009
All Rights Reserved Licence Number AL 100014722

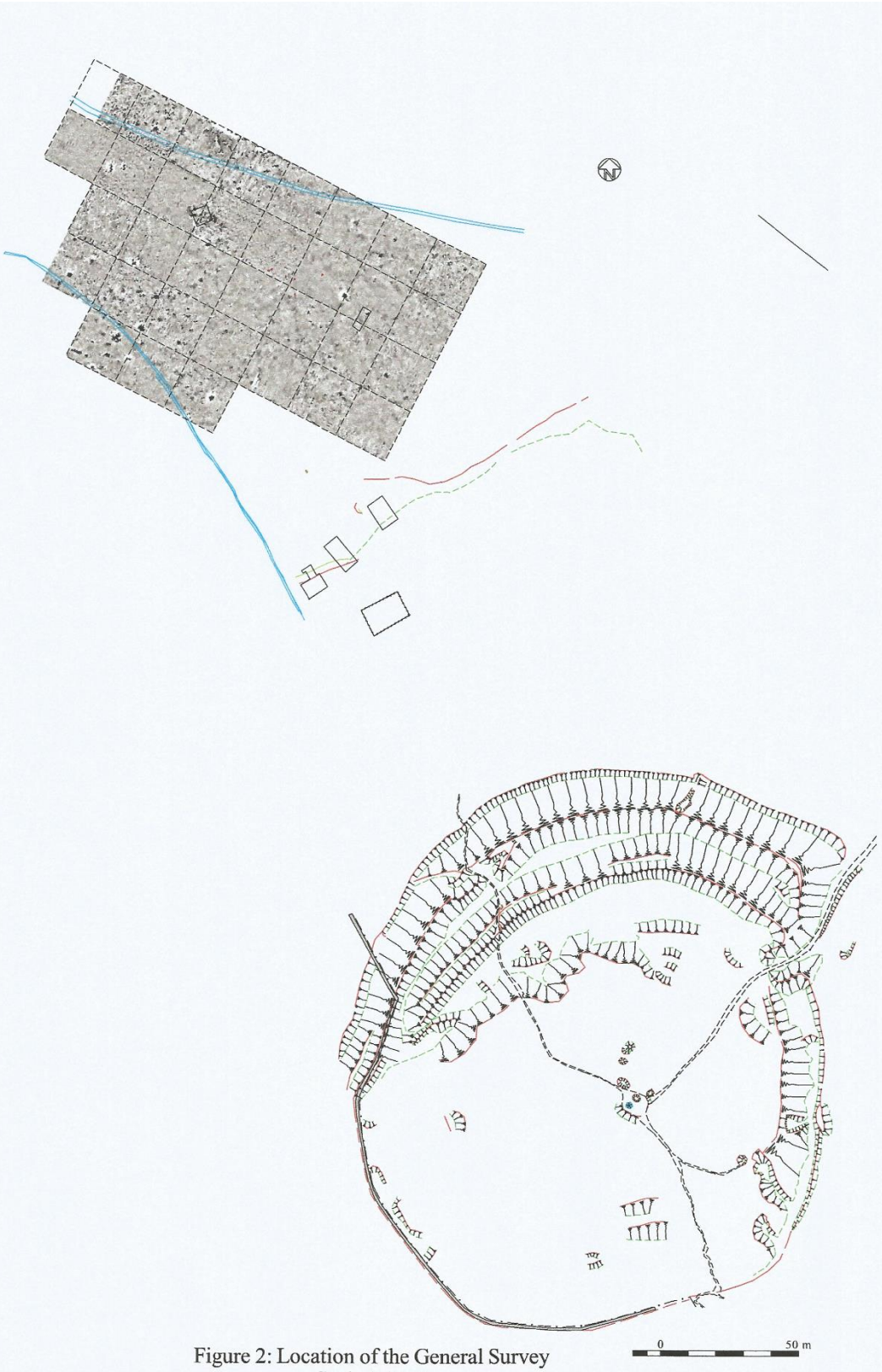


Figure 2: Location of the General Survey
Scale 1:1750

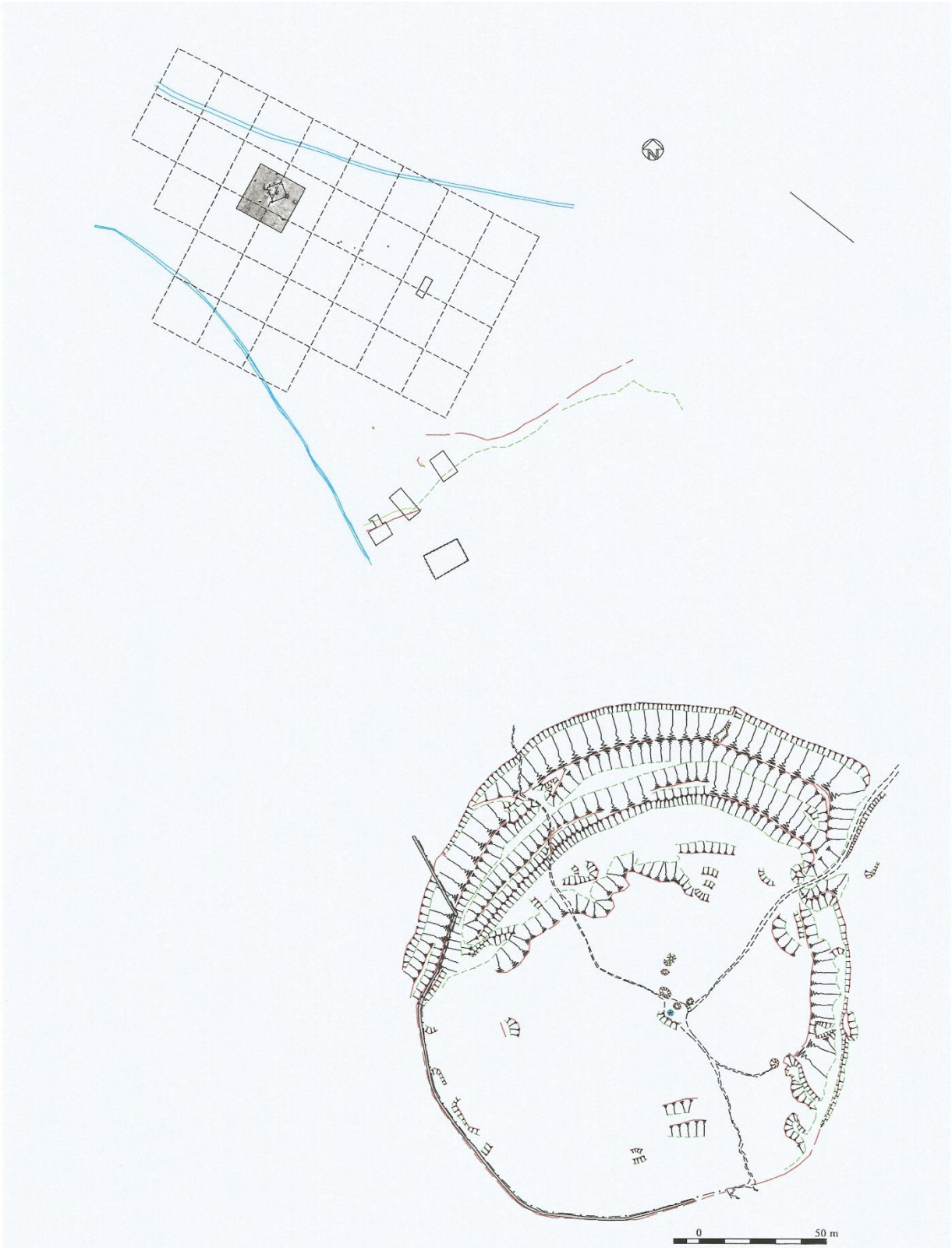


Figure 3: Location of the High Resolution Survey
Scale 1:1750

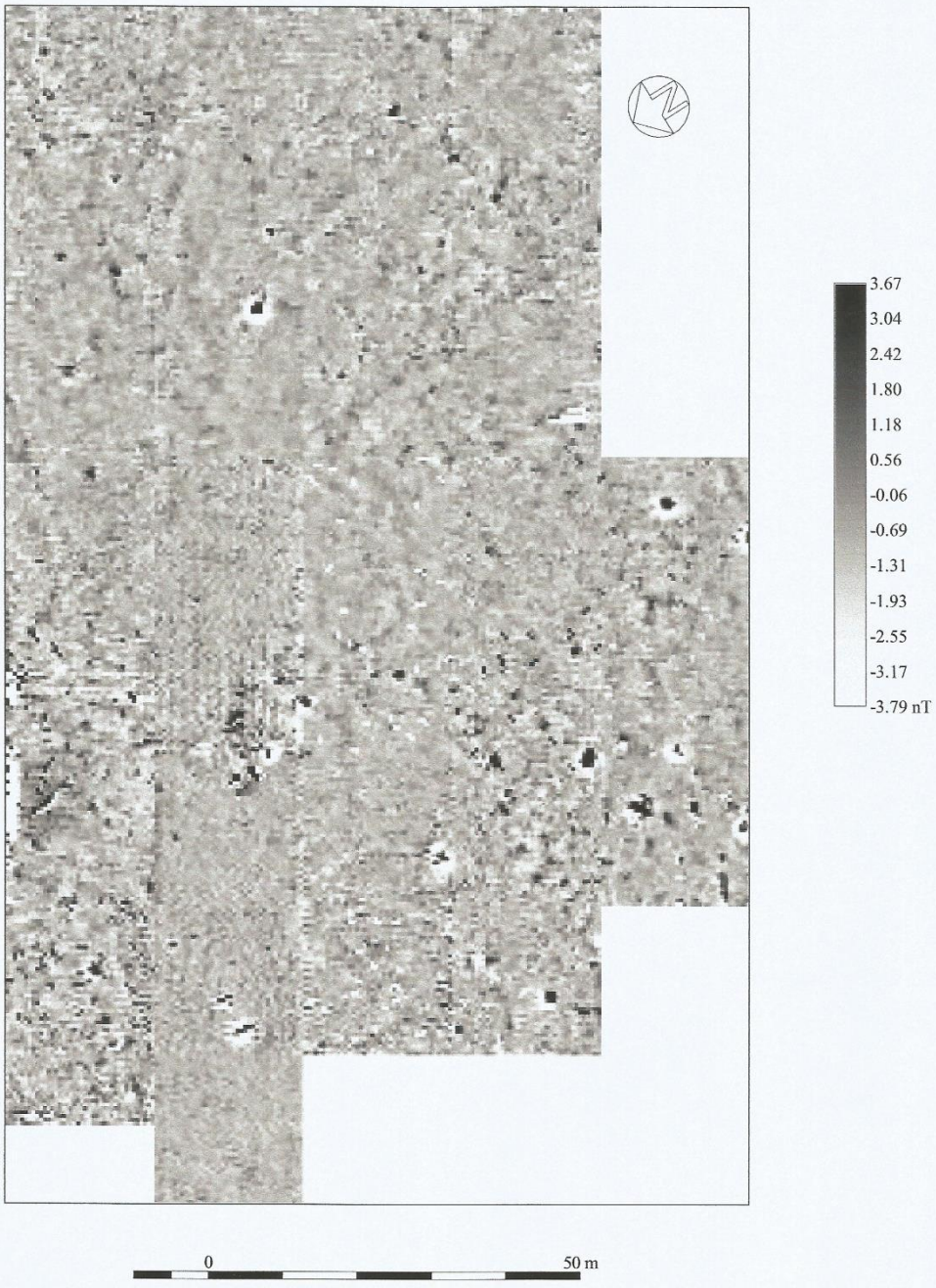


Figure 4: Grey Scale Plot of the General Survey
Scale 1:750

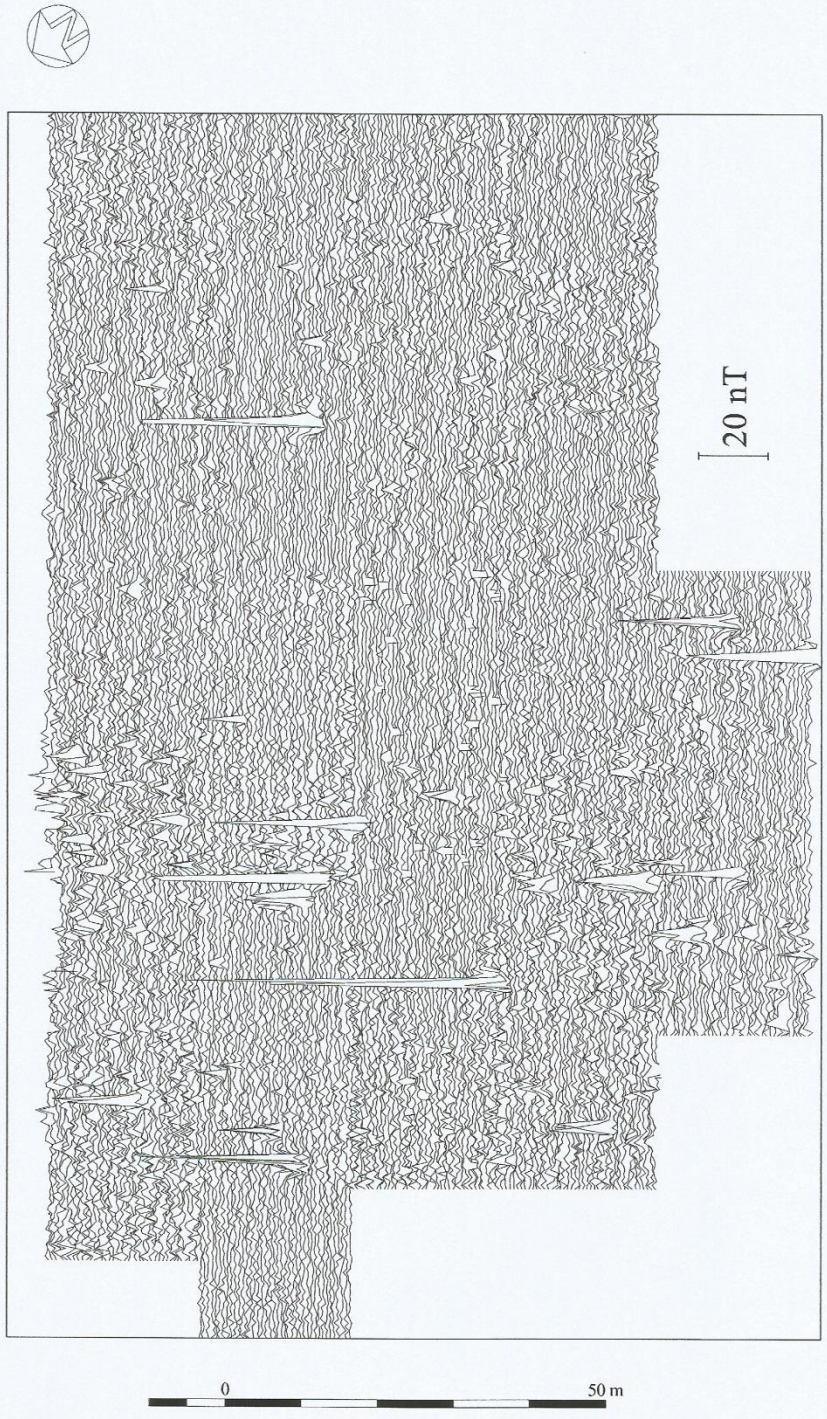


Figure 5: X-Y Plot of the General Survey
Scale 1:750

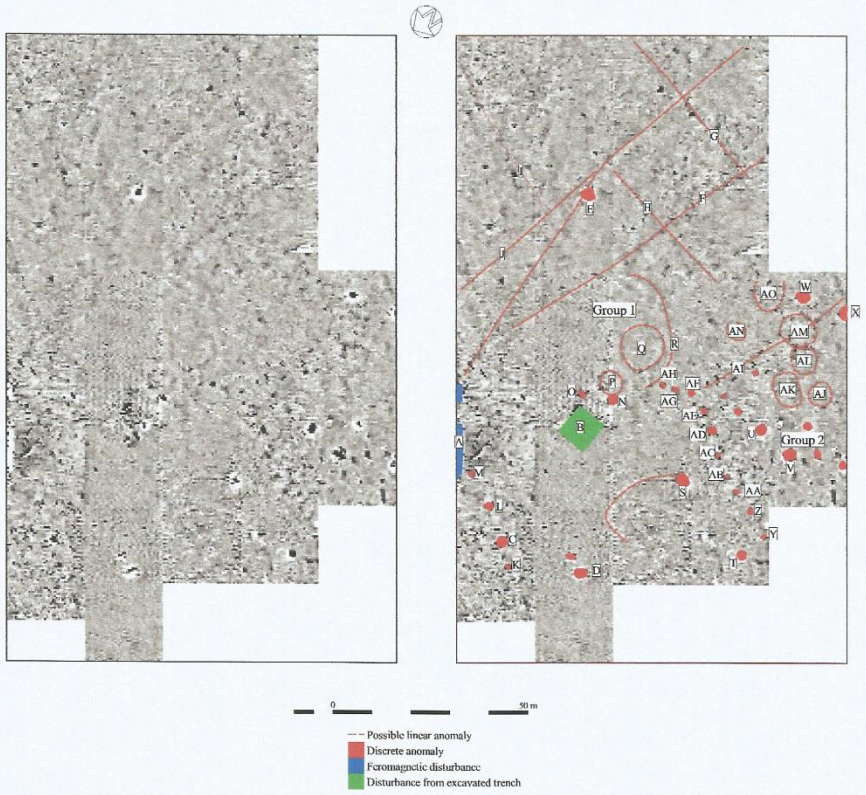


Figure 6: Interpretation of the General Survey
Scale 1:750

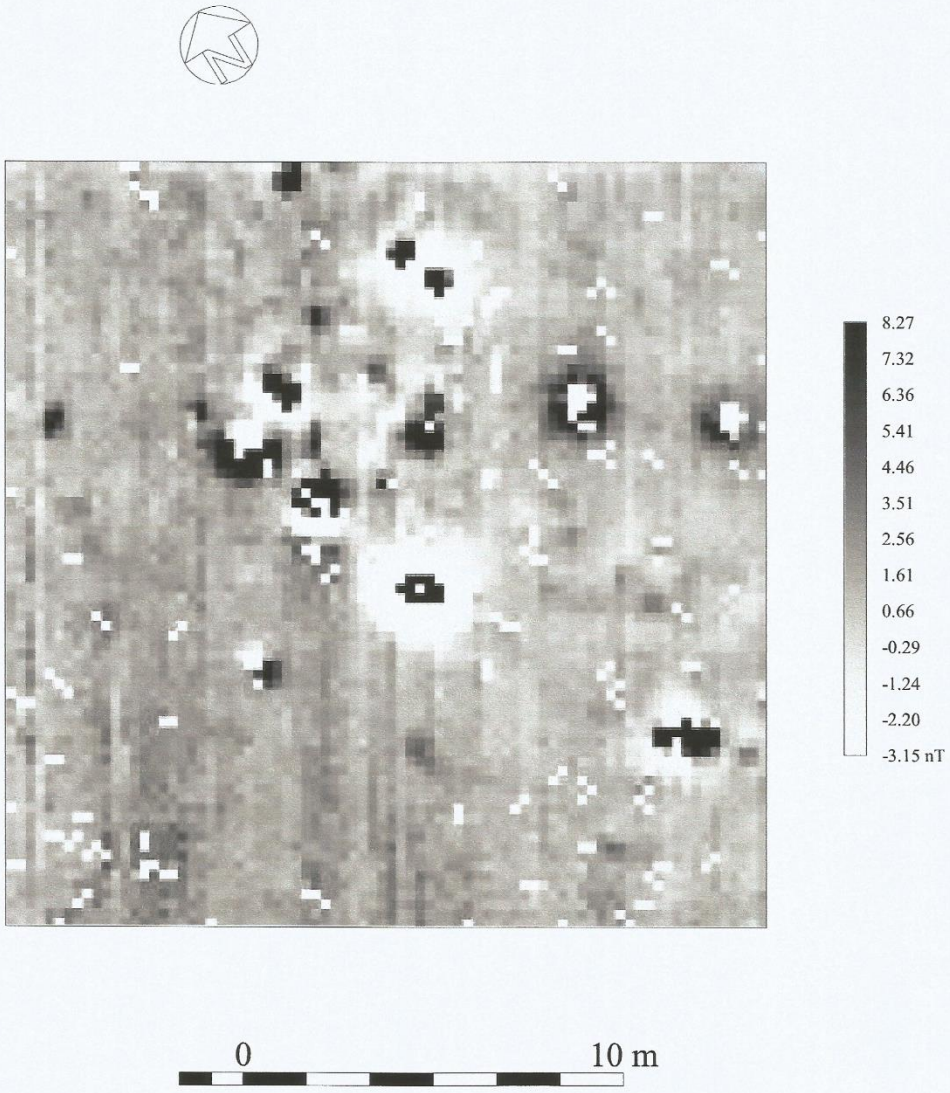


Figure 7: Grey Scale Plot of the High Resolution Survey
Scale 1:150

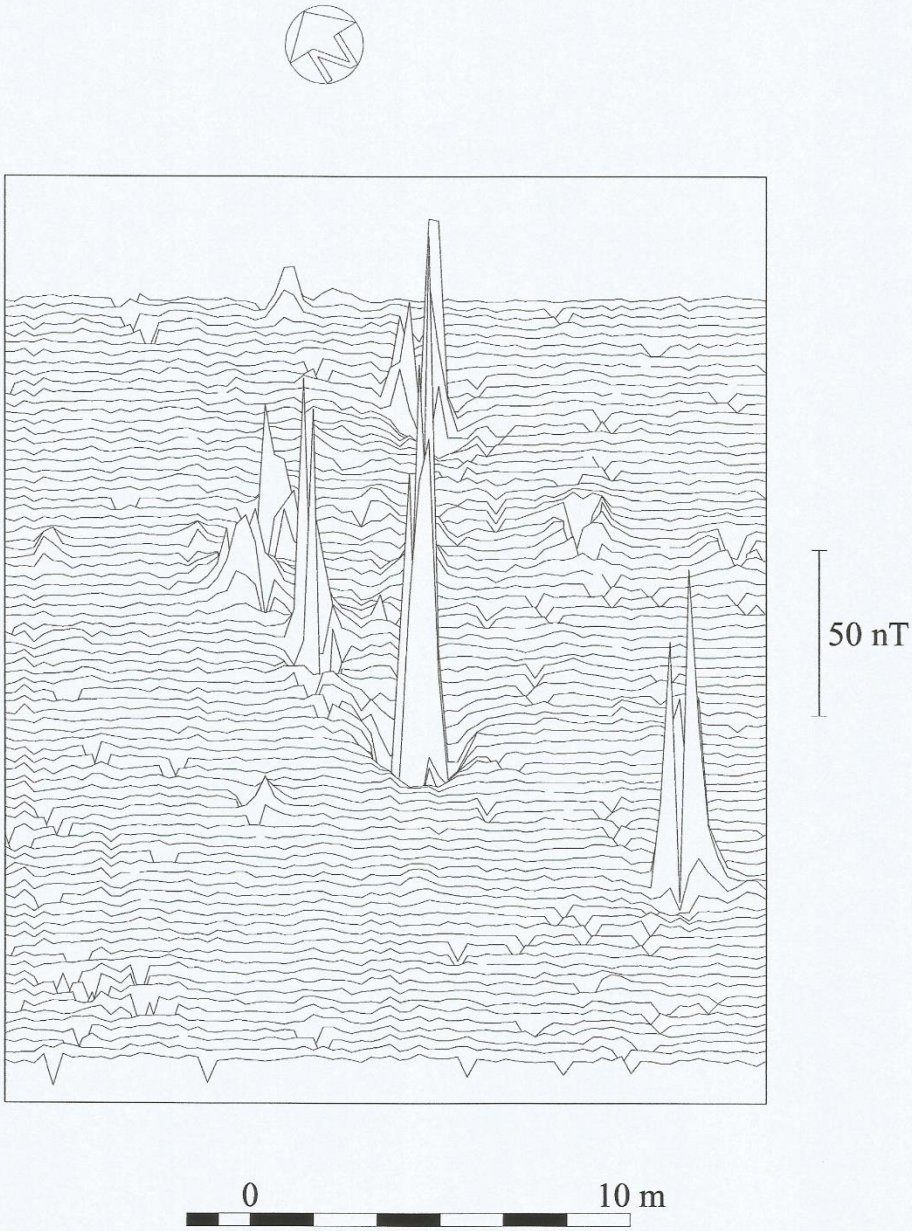


Figure 8: X-Y Plot of the High Resolution Survey
Scale 1:150

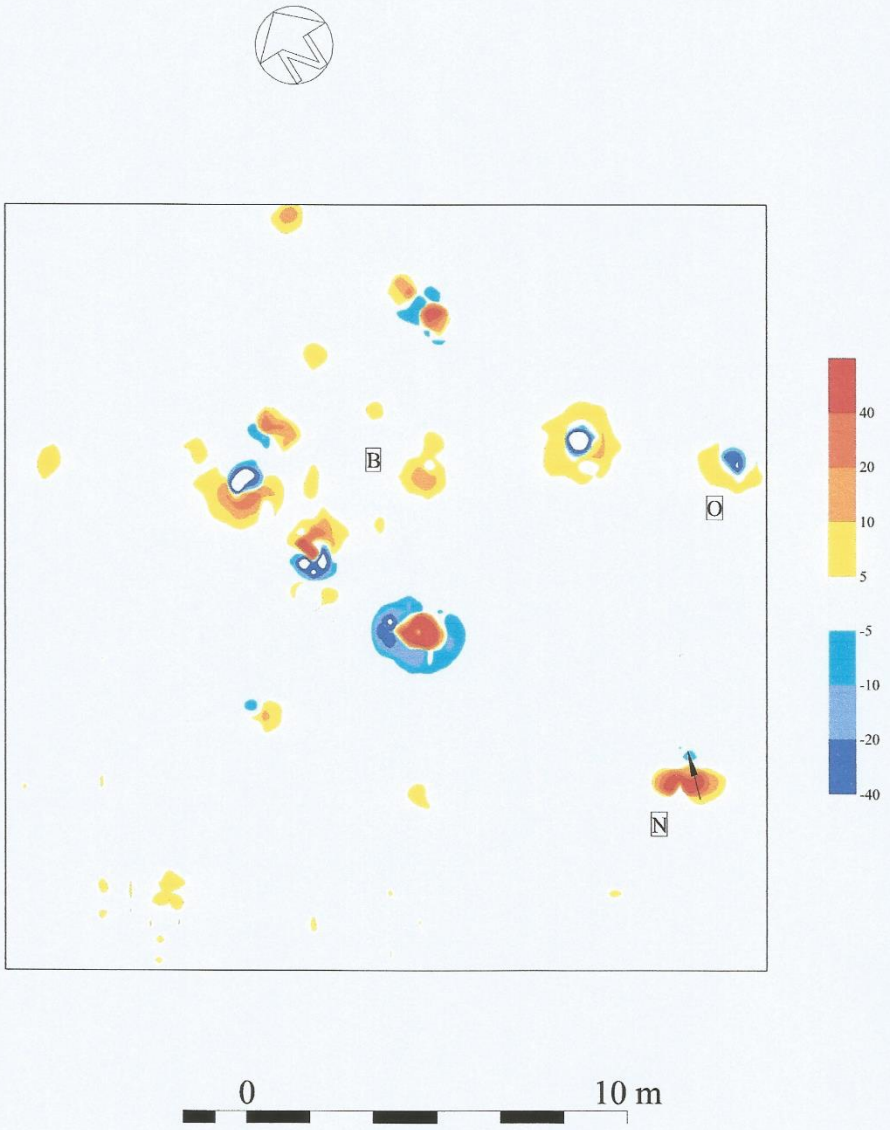


Figure 9: Filled Colour Contour Plot
of the High Resolution Survey
Scale 1:150

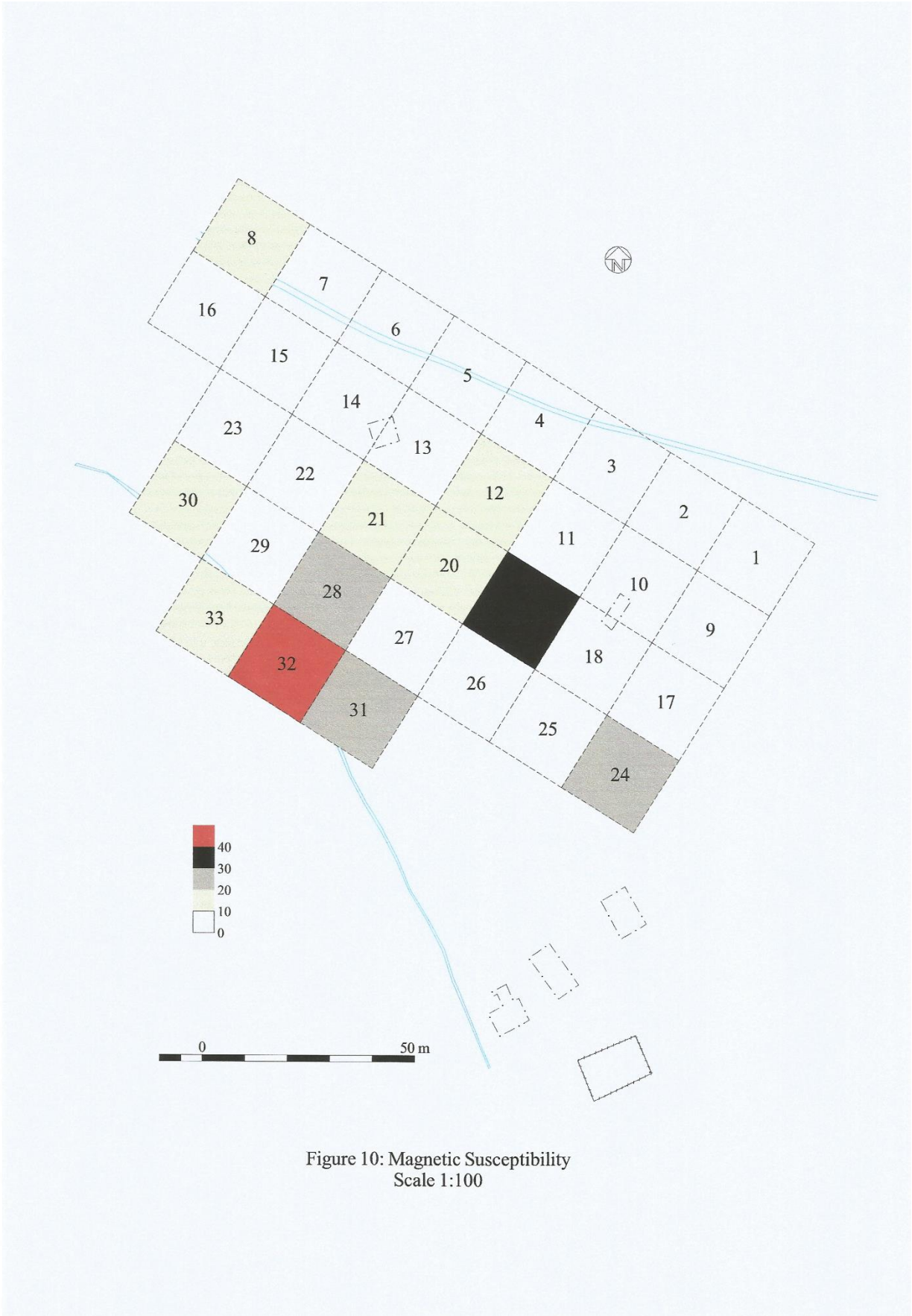


Figure 10: Magnetic Susceptibility
Scale 1:100

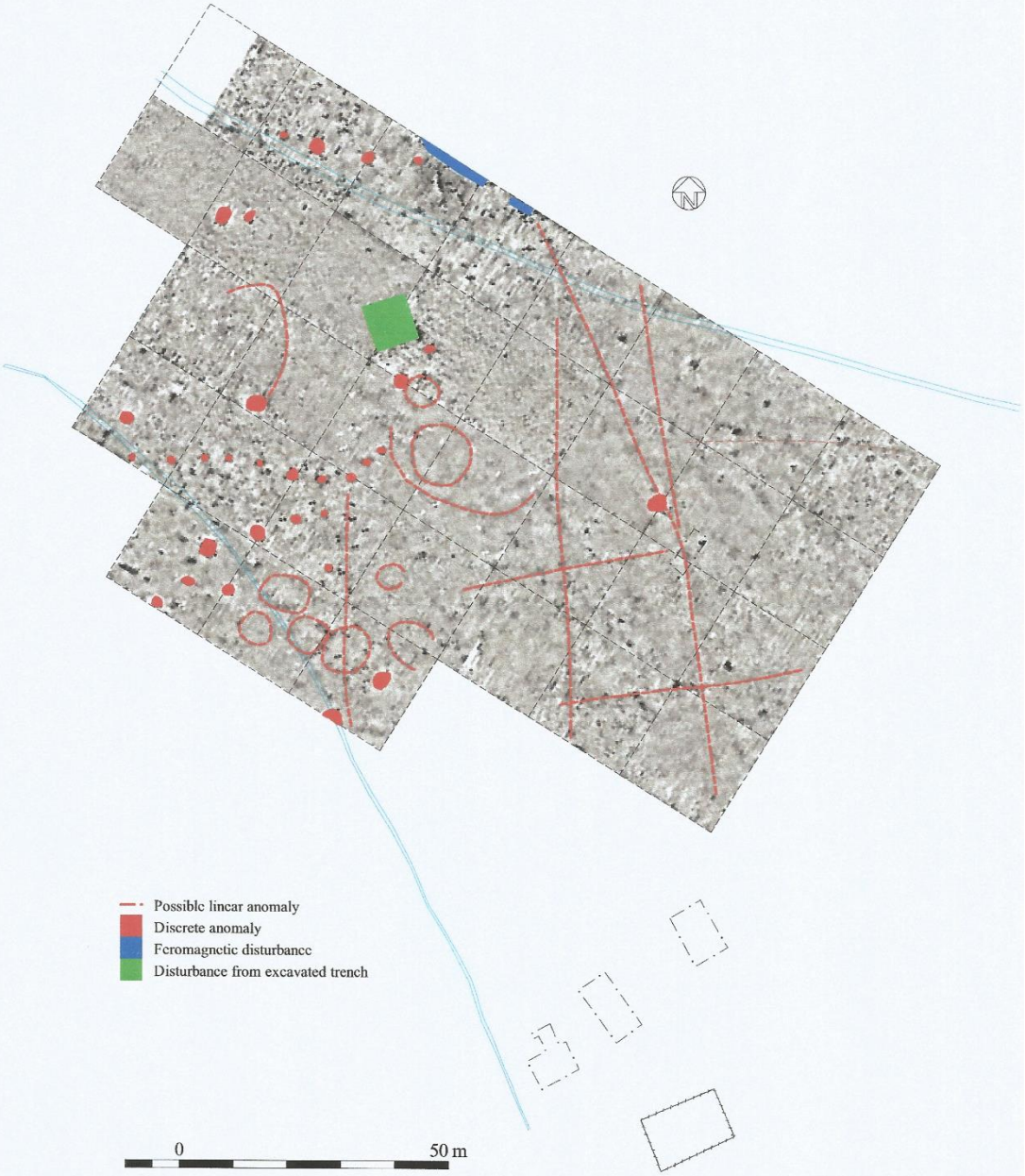


Figure 11: Summary
Scale 1:1000

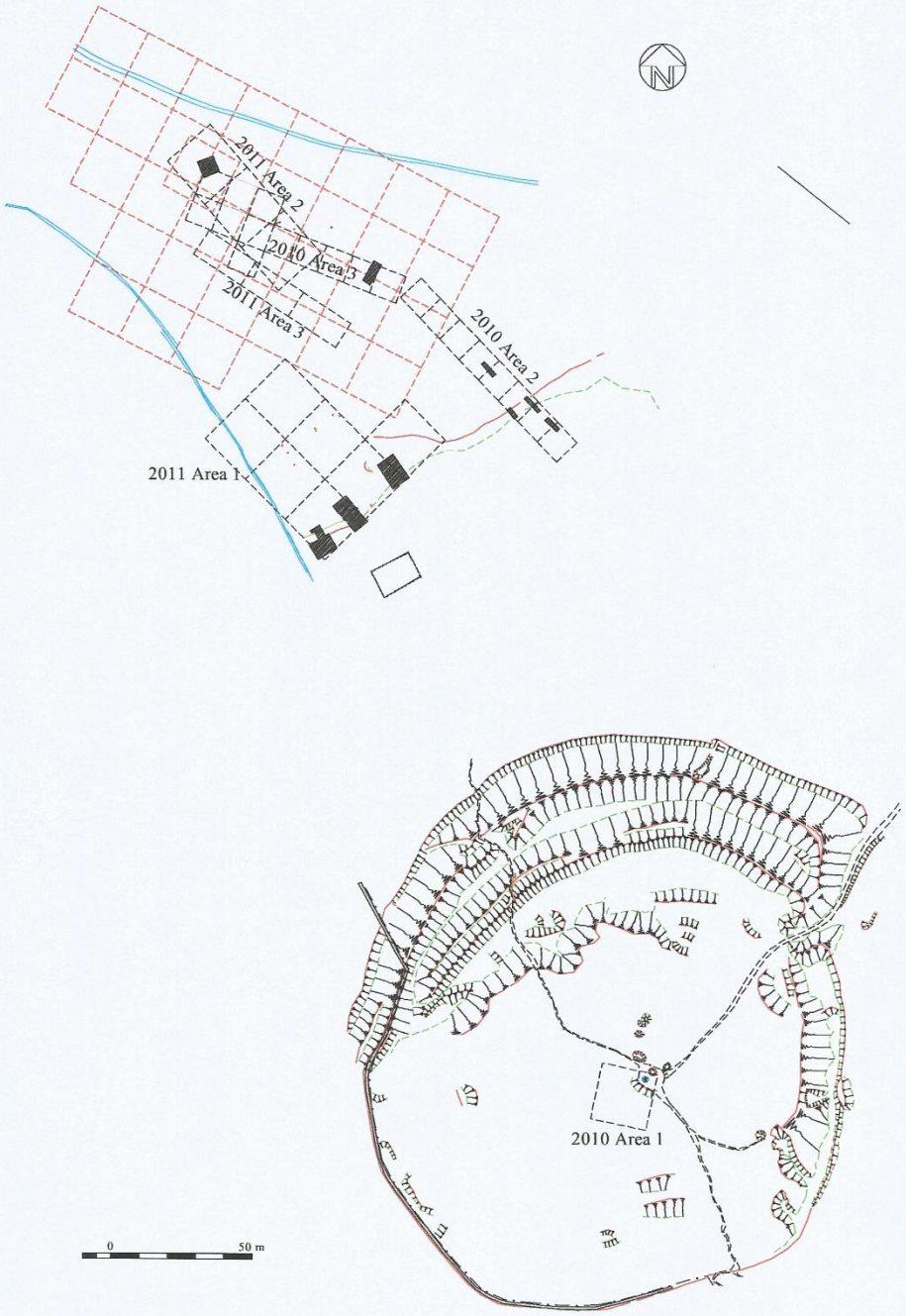


Figure 12: Relationship Between the Previous Surveys
and the Current Work
Scale 1:2000

Appendix 2

Scottish Universities Environmental Research Centre

Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, Glasgow G75 0QF, Scotland, UK
Director: Professor R M Ellam Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

16 March 2016

Laboratory Code	SUERC-66219 (GU40089)
Submitter	Tony King Clwydian Range Archaeology Group
Site Reference	MAN015
Context Reference	1111
Sample Reference	10
Material	Charcoal : hazel
$\delta^{13}C$ relative to VPDB	-25.4 ‰
Radiocarbon Age BP	7517 ± 28

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :- 16/03/2016

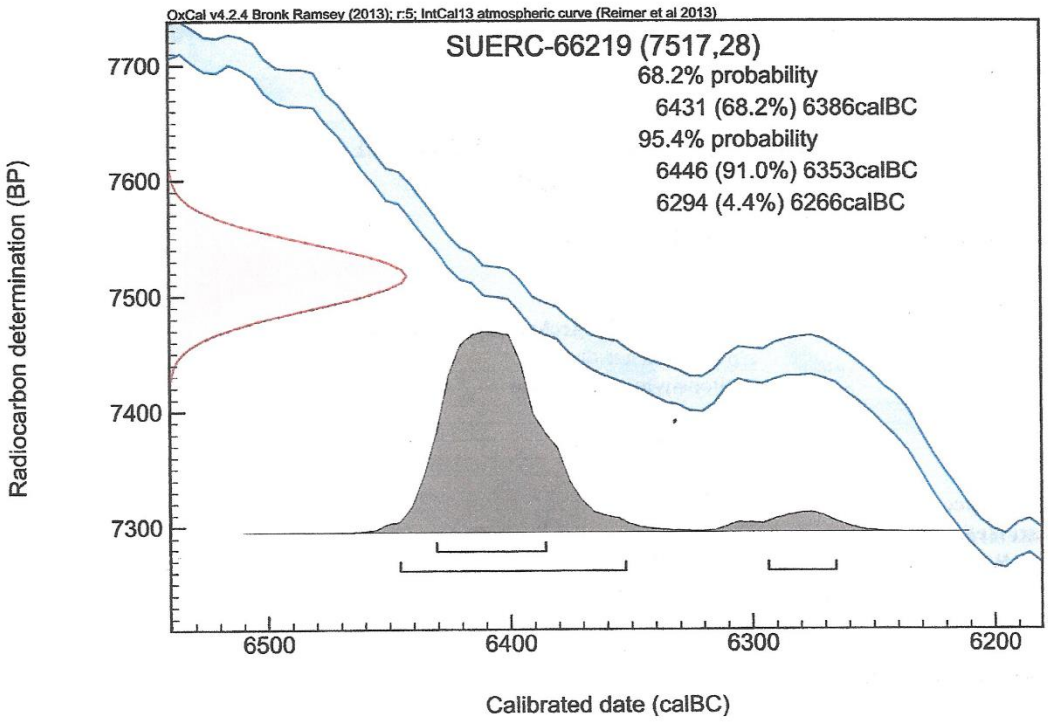
Checked and signed off by :- Date :- 16/03/2016

University of Glasgow

The University of Glasgow, charity number SC004401

The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336

Calibration Plot



Scottish Universities Environmental Research Centre

Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, Glasgow G75 0QF, Scotland, UK
Director: Professor R M Ellam Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

16 March 2016

Laboratory Code	SUERC-66220 (GU40090)
Submitter	Tony King Clwydian Range Archaeology Group
Site Reference	MAN015
Context Reference	1111
Sample Reference	16
Material	Charcoal : oak
$\delta^{13}C$ relative to VPDB	-26.7 ‰
Radiocarbon Age BP	7163 ± 28

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

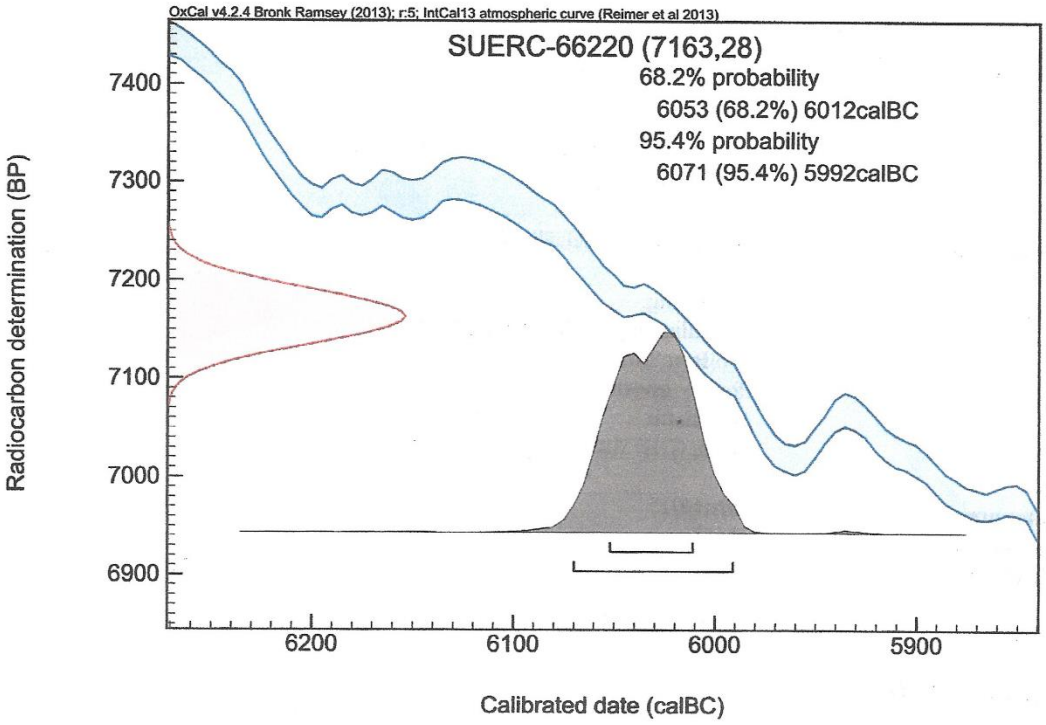
Conventional age and calibration age ranges calculated by :- B Tripney Date :- 16/03/2016

Checked and signed off by :- P. Naysmith Date :- 16/03/2016

University of Glasgow
The University of Glasgow, charity number SC004401

The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336

Calibration Plot



Scottish Universities Environmental Research Centre

Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, Glasgow G75 0QF, Scotland, UK
Director: Professor R M Ellam Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

16 March 2016

Laboratory Code	SUERC-66221 (GU40091)
Submitter	Tony King Clwydian Range Archaeology Group
Site Reference	MAN015
Context Reference	1113
Sample Reference	17
Material	Charred nutshell : hazel
$\delta^{13}C$ relative to VPDB	-24.0 ‰
Radiocarbon Age BP	5939 ± 25

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- B Tripney Date :- 16/03/2016

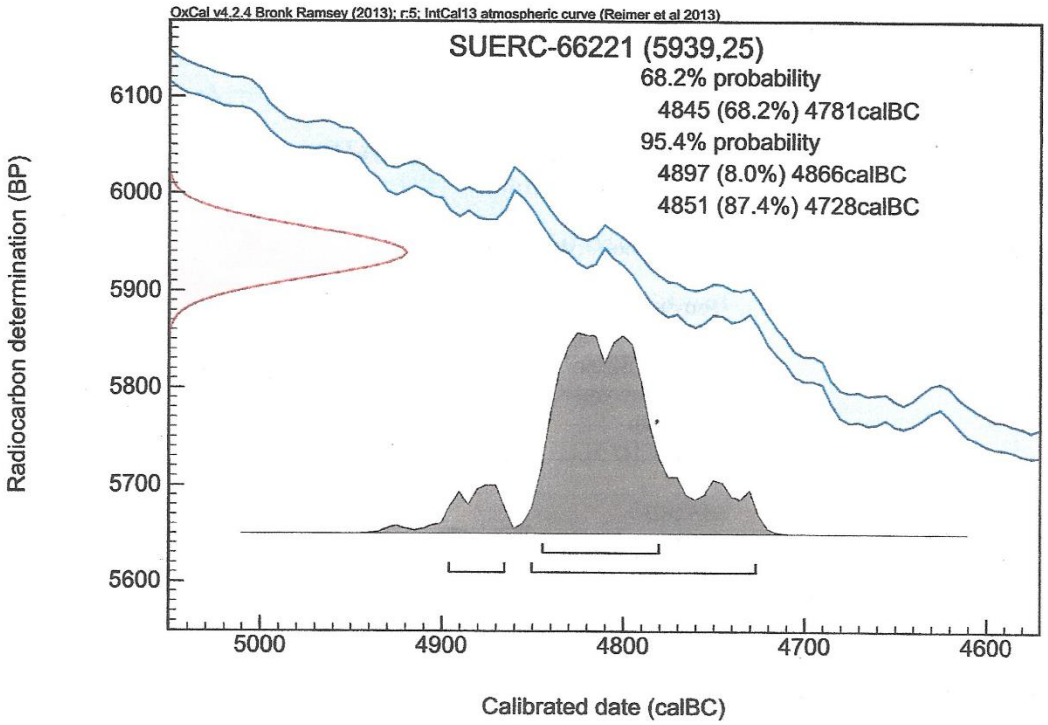
Checked and signed off by :- P. Naysmith Date :- 16/03/2016

University of Glasgow

The University of Glasgow, charity number SC004401

The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336

Calibration Plot



Appendix 3

Clwydian Range Archaeology Group

Report on the Excavations on Moel Arthur 2015

by Irene Milhench and Philip Culver on behalf of CRAG

Fig. 1. General view of the Clwydian Range looking North from the slopes of Moel Arthur. The excavation site is on the pale strip cut into the heather in the middle distance. Note the neighbouring hillfort of Penycloddiau at the top left of the picture.

Non–Technical Summary (Based on I.M.)

In the spring and summer of 2015 an archaeological excavation was carried out on the sloping terrace on north western flank of Moel Arthur, part of the Clwydian range of hills on the border of Denbighshire and Flintshire. This followed a geophysical survey of the area during the autumn of 2014.

Earlier excavations in 2011 and 2012 had revealed Late Neolithic/Early Bronze Age worked flints and a possible trackway higher up the slope, followed in 2013, by excavations lower on the terrace, which discovered further flints and a possible burnt mound.

In 2015 two trenches were opened (Trench 11 & Trench 12) to investigate strong ferromagnetic signals shown by the recent survey. Trench 12 proved to be largely sterile and uncovered a significant natural rocky outcrop which could have accounted for the signal in this area. Trench 11, however, produced several worked flints, small amounts of red ochre and areas of burning shown by the presence of charcoal and dark soil. Several stones appeared to have been deliberately placed and a number of very shallow stake holes were uncovered suggesting a temporary shelter or possibly a windbreak surrounding a hearth. This trench is a few metres SE, of Trench 8 (the possible burnt mound) excavated in 2013, and higher up the slope. Charcoal samples from the hearth were sent for Carbon 14 Dating and returned results ranging from 6386 cal BC to 4781 cal BC.

The excavation results, together with further radiocarbon dating of charcoal, and a paleobotanical report on soil samples sent for analysis, indicate that there has been activity on this terrace over a long period, probably from the Mesolithic period onwards.

1. Introduction

1.1 Background.

Moel Arthur is located towards the north end of the Clwydian Hills in Denbighshire (SJ145600) and is 456m at its highest point. It is a small hill fort of only 5 hectares and occupies a strong defensive position dominating the col Bwlch y Frainc. To its northwest is the hill fort of Pennycloddiau, approximately 2km away. It is defended by two strong banks and ditches with a counterscarp bank on the north side. It has an in-turned entrance to the northeast with what appears to be guard chambers. There is evidence of hut platforms on the interior of the hill fort and a Mesolithic flint was found nearby. Excavation carried out in 1849 by Wynne Ffoulkes recorded some possible stone structures along with Roman pottery and flints. In 1963 a small hoard of three early Bronze Age Irish flat axes were discovered on the southern part of the Iron Age enclosure (Brown 2004. p.52).

In August 2010 a geophysical survey was carried out by Engineering Archaeological Services Ltd. on the sloping terrace to the north of the hillfort. This had been commissioned by the Heather and Hillforts Partnership Scheme to be used as a training event for members of the general public alongside members of the Heather & Hillforts Archaeology Group (HHAG) (in 2013 this group was renamed The Clwydian Range Archaeology Group – CRAG).
Further surveys were carried out by Engineering Archaeological Services Ltd., members of HHAG and students from Holywell High School in 2011 and 2012 using a fluxgate magnetometer. These surveys highlighted a number of anomalies on the terrace to the northwest of Moel Arthur Hillfort. Some of these have been investigated by excavation over the following years.

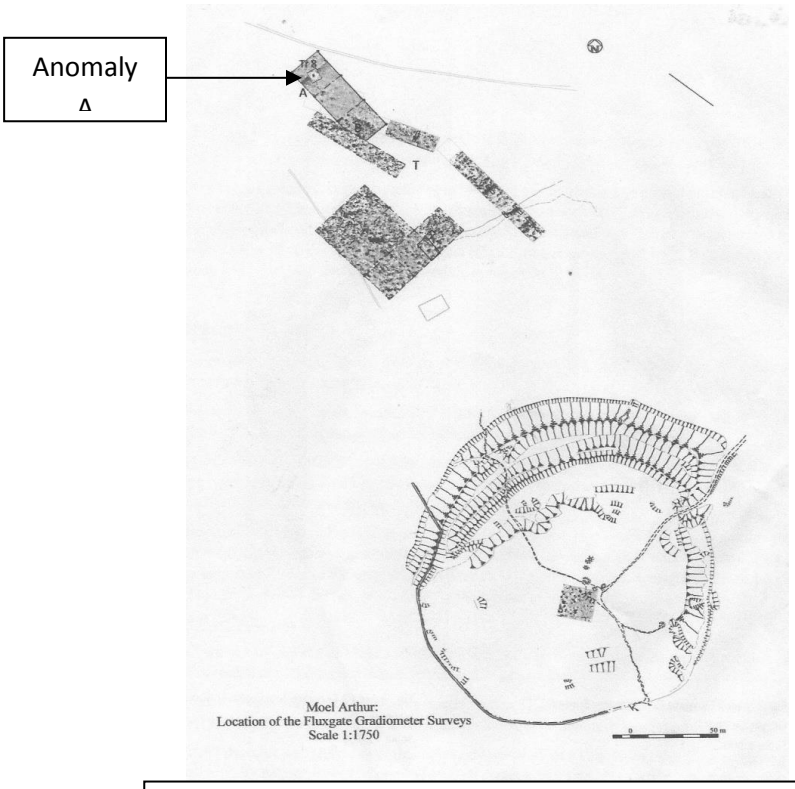


Fig. 2. Plan of Moel Arthur and the terrace to the north east, showing the results of the 2012 geophysical survey.

1.2 Previous Excavations.

1.2.1 2011

In May 2011, excavations by the HHAG took place over a two week period to investigate anomalies found during the 2010 geophysical survey.

Five trenches were excavated by hand. Two trenches produced nothing at all. One showed a layer of flat stones that appeared to have been laid. Another produced a possible trackway, illustrated by ruts leading towards a large terrace further to the west of Moel Arthur. A small flint flake was also found. (HHAG 2011).

1.2.2 2012

In May a new trench was opened was opened under the direction of Sarah Peverly, a local archaeologist attached to the Heather and Hillforts Project.

Further evidence of the trackway discovered the previous year was uncovered, together with a number of apparently worked flints and a barbed and tanged arrowhead of possible early Bronze Age date.

In October a new trench (Tr.3 - in 2013 renamed Tr. 8) was opened further down the slope to investigate a ferromagnetic anomaly further to the north (A on the plan) shown by further geophysical work in June of this year. This uncovered a circle of larger stones and two more flints. As there was no time for further investigation the trench was closed with a view to returning the following year.

1.2.3 2013

In January of this year the Heather and Hillforts Archaeology Group was renamed the Clwydian Range Archaeology Group (CRAG), the name used from now on in this report.

In May this year Trench 3 was re-opened and extended to 6m square and renamed **Trench8.** This exposed an area of heat shattered stones, several pieces of red ochre and a small flint

flake. It appeared these stones formed the filling of a sub-circular pit containing some small charcoal fragments.

Returning to the site in July the pit was further excavated down to bedrock. Further flints were found, soils samples taken and fragments of charcoal and carbonised hazel nutshell removed for carbon 14 dating and paleo-environmental analysis. At the end of the excavation period the trench was backfilled after depositing current 10p piece at the bottom of the pit.

The findings were interpreted as the remains of a burnt mound with the fire-cracked stones being used to heat water in the pit. The charcoal and nutshell were analysed by SUERC (Scottish Universities Environmental Research Centre) and produced a radiocarbon date of 3996 +/- 33 BP (SUERC 49808 [GU32372].

This places the pit in use during the late Neolithic/Early Bronze Age, predating the Iron Age hillfort.

1.2.4 2014

In September 2014 a further geophysical survey was carried out by CRAG

Volunteers, under the supervision of Dr. Ian Brooks, on the terrace surrounding the 2013 Trench 8, on a grid approximately 160m x100m running North West to South East. (Brooks 2014). A range of anomalies was highlighted by this report, providing material for several further years of excavation if this could be achieved. It was decided by the group that an area just to the south of Trench 8 (the possible burnt mound from 2013) would be investigate initially, covering the anomalies N, O & P noted in the report (See Fig.3). It was felt that any hearth associated with the burnt mound was likely to be situated in this area.

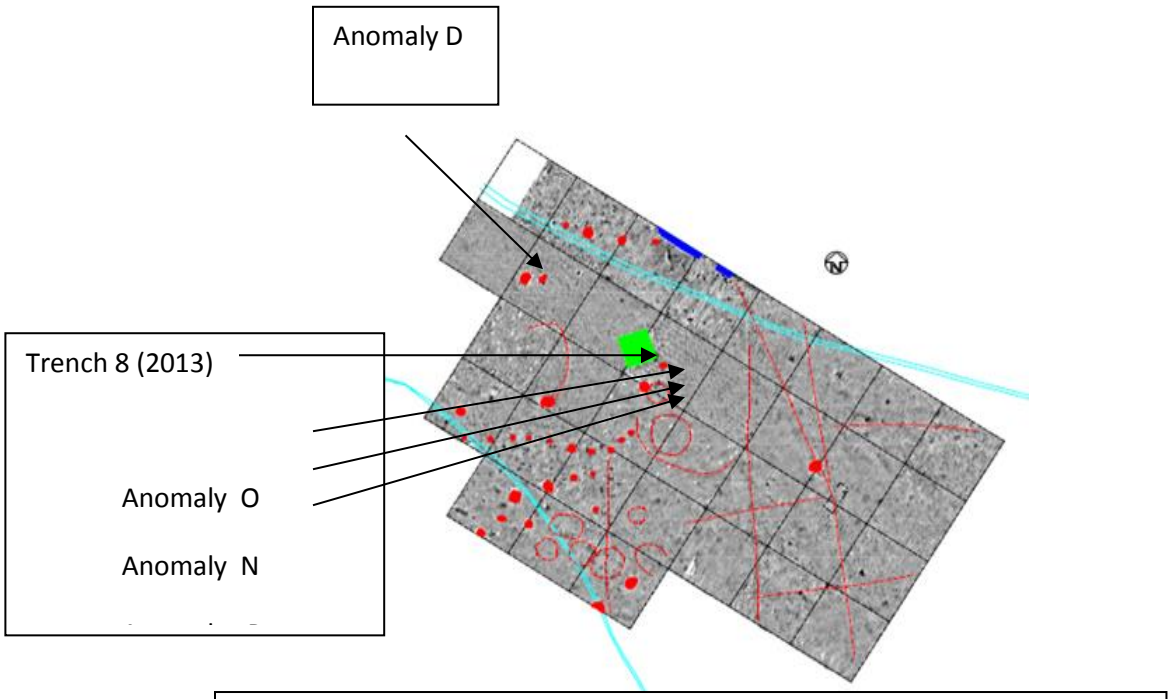


Fig. 3. Interpretative plan of geophysical survey from Sept 2014 highlighting a range of anomalies over the area.

Grid squares are 20 metres.

2. The Team for the 2015 Excavations.

15 members of CRAG took part in the excavation over two 2 week periods from May 23rd to June 5th and then 25th July to 7th August. During second fortnight we were joined by two secondary school pupils from Holywell and three university students from Liverpool and Chester. There were usually between 8 and 11 people on site on any one day. The site was supervised by Irene Milhench, and we received periodic visits from Fiona Gale (Archaeologist with the Denbighshire Countryside Service) and Ian Brooks (Engineering Archaeological Services).

The Following people were involved:

Alice Bray	David Matthews
Chloe Clapham	Irene Milhench
Philip Culver	Robert Moore
George Davis	Ralph Newsam
Afnan Ezzeldin	Calum Richardson
Nick Harrison	Simon Shepherd
Tony King	Elizabeth Slingsby
Hilary Lidbury	Graham Thompson
Karen Lowery	Terry White
Keith Lowery	Diane Williams

3. The 2015 Excavations.

The excavation site is centrally placed on a terrace to the Northwest of the Moel Arthur hillfort, approximately 450 m x 300 m in extent, which slopes gently to the Northwest before dropping steeply to the pass containing the unclassified country road between Nannerch and Llandyrnog. There are spectacular views (on a good day) to the West over the Vale of Clwyd as far as Snowdonia; to the Northeast over the Dee Estuary to the distant Wirral and to the north up the Clwydian range to the neighbouring hillfort of Penycloddiau about 2 km distant (See Fig. 1.) During the May/June fortnight the weather was mainly dry apart from the middle weekend

when the trench flooded after heavy rain on the Friday which prevented any activity on that day. A stiff breeze most of the time soon dried the ground, and kept the team well wrapped up. On the best days the views were superb. The July/August fortnight started unpromisingly with thick mist, but turned out to be mainly dry and sunny.

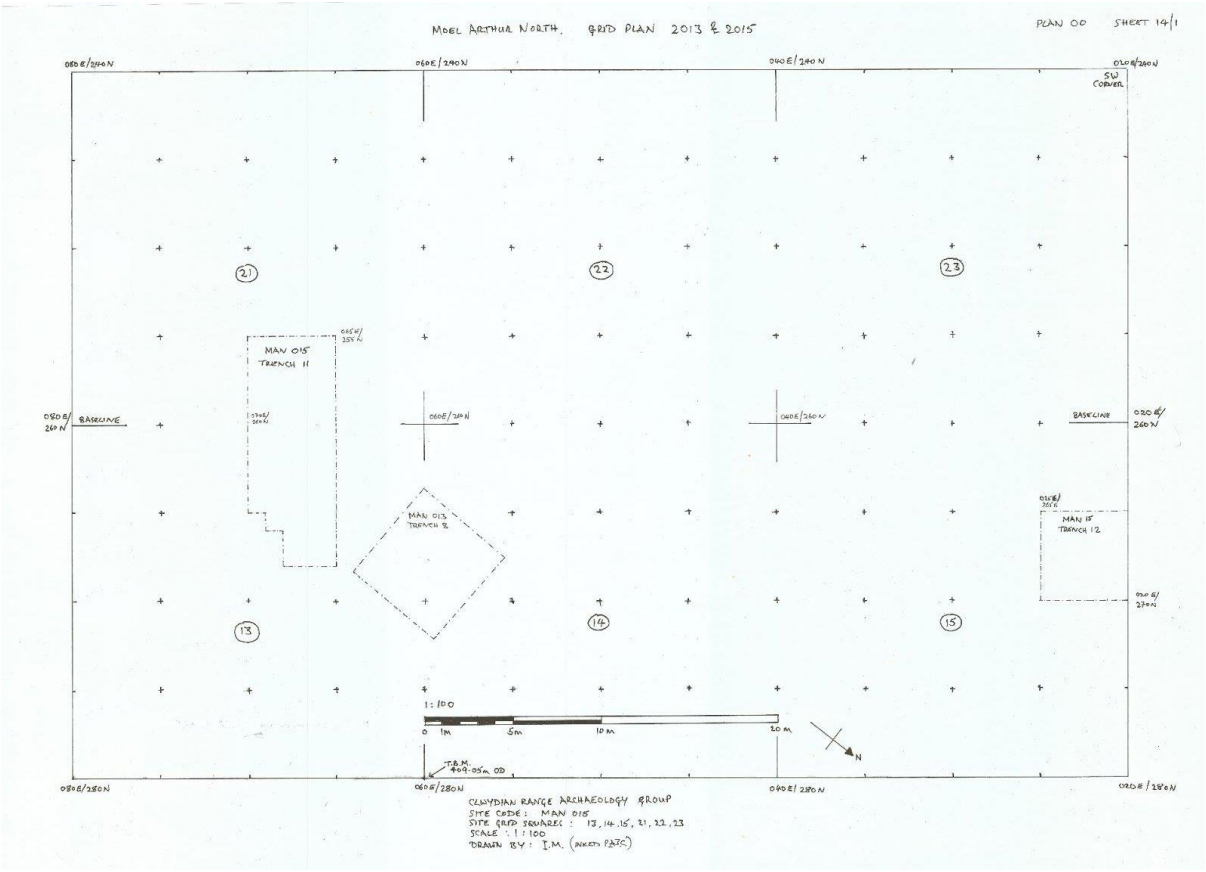


Fig. 4. Plan 00. Overall site plan showing the positions of **Trench 3/8 (2013**), **Trench 11 (2015)** and **Trench 12 (2015).**The temporary bench mark (TBM) was surveyed in by GPS at 060E /280N measuring 409.05m OD

3.1 May/June 2015

An archaeological excavation took place on the North western flank of Moel Arthur to investigate ferromagnetic anomalies found by the group during geophysical survey carried out in September 2014 (Brooks 2014).

A trench 10m x 5m was laid out in grid square 13 to cover anomaly N and P as shown in the report from EAS Ltd who undertook the survey with the group.
After taking off the heather turves and trowelling off the peat layer (1101) there appeared to be a few dark patches which required further attention as these may indicate possible features including post holes etc. On further investigation these just turned out to be dark patches of the context (1101). The under-surface of the turves was also examined and two of the worked flints found on the site came from these (less than 10cm under the current land surface).

The area in the centre of the trench (11) was sectioned to determine the results of the ferromagnetic anomaly seen on the geophysics survey. However again there was no indication of any archaeological activity in this area. A sondage was cut across this area to determine a sequence of contexts, and found they were similar to the sondage within Trench 8 in 2013.

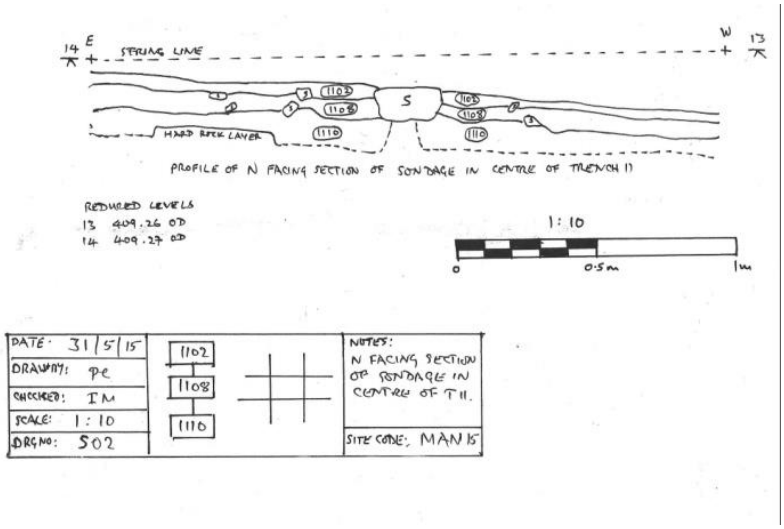


Fig. 5. Section through sondage on the centre of Trench 11

The dark area in the northern end of the trench was sectioned and this proved to be a bit more interesting. There was a group of stones which appeared to have been piled up on the left hand side of the section. This group of stones was not very deep. The thin section of burning was fairly spread out, and could be the result of people spreading burnt material around when walking about the area, as there appears to no deep penetration of hard burning as would be found in a hearth. There were several thin pockets of sand within the context (1109) which could indicate a possibility that the area had been exposed to wind-blown particles at some time.

It is probable that the stones had been washed down over a long period and at times of prolonged rainfall when the water runoff from the hillside was a lot faster and heavier. The stones then reaching some kind of blockage (e.g. tree or bush roots) collected and were piled up on top of each other. This could also account for the other possible feature in the North east corner where there appears to be an area built up of clay with very small stones throughout (1104).

An extension at the north end of the trench was put in to establish the possibility of both the built up stones and the burning was indeed continuing further but so far this has proved inconclusive.

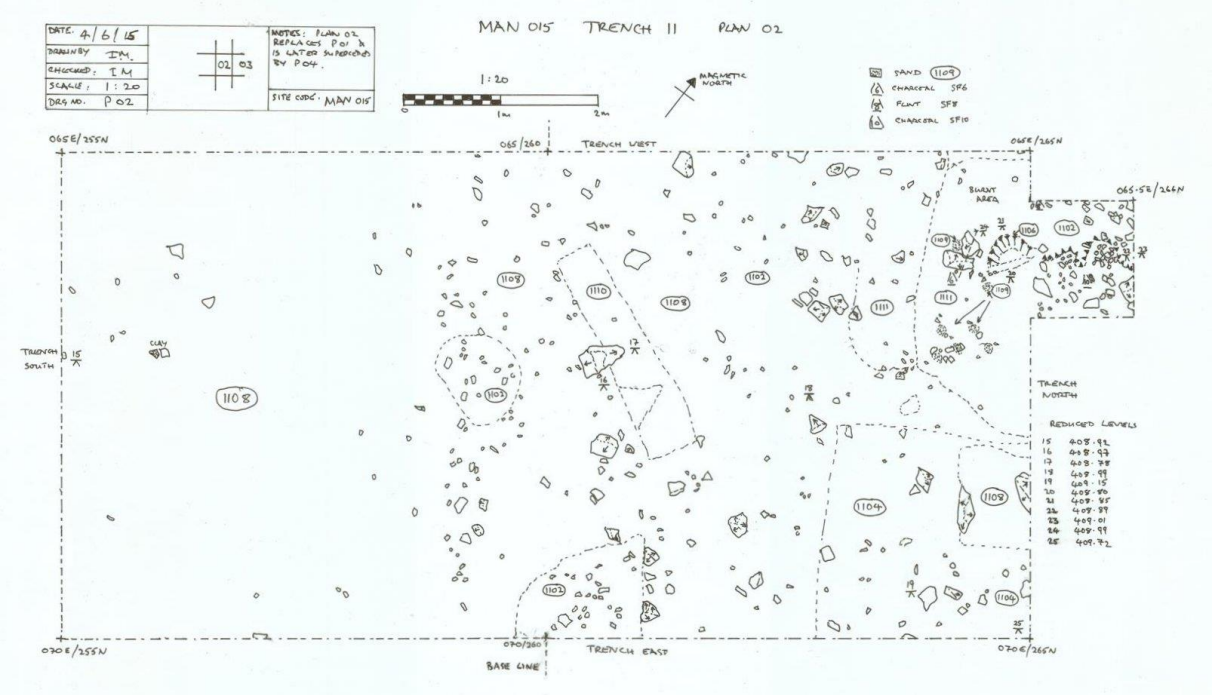


Fig. 6. Plan of Trench 11 on 4th June 2015 - showing the build up of stones at the northern end of the trench and the two large upright stones towards the Northwest corner.

Other areas where investigated around two large upright stones in the Northwest corner but there was no evidence for postholes. However at this stage it was felt that we needed to go deeper to confirm this. The thin dark brown context (1104) underlying the clay (1102) is probably due to extensive clearance burning during the late Neolithic /early Bronze Age. The southern half of the trench had significantly fewer stones and was largely devoid of any features.

At the end of the fortnight the Northern end of the trench was covered with terram and the trench backfilled and re-turfed.

3.1.1 Finds in Trench 11 - May/June

There were six flints found in between contexts (1101) and (1102), also some pieces of Red Ochre (haematite).

Fig 7. Flints found during May/June (Scale 15cm) (NB: The right-hand flint flake was found later during July/August - see below)

Fig 8. Red ochre /clay

3.2 July / August 2015

At the end of July Trench 11 was re-opened, together with a new 5 m square trench (Trench 12) sited 40 metres to the North West of Trench 11.

3.2.1 Trench 11.

The north end of June's trench was opened to expose the stones and dark areas found at that time.

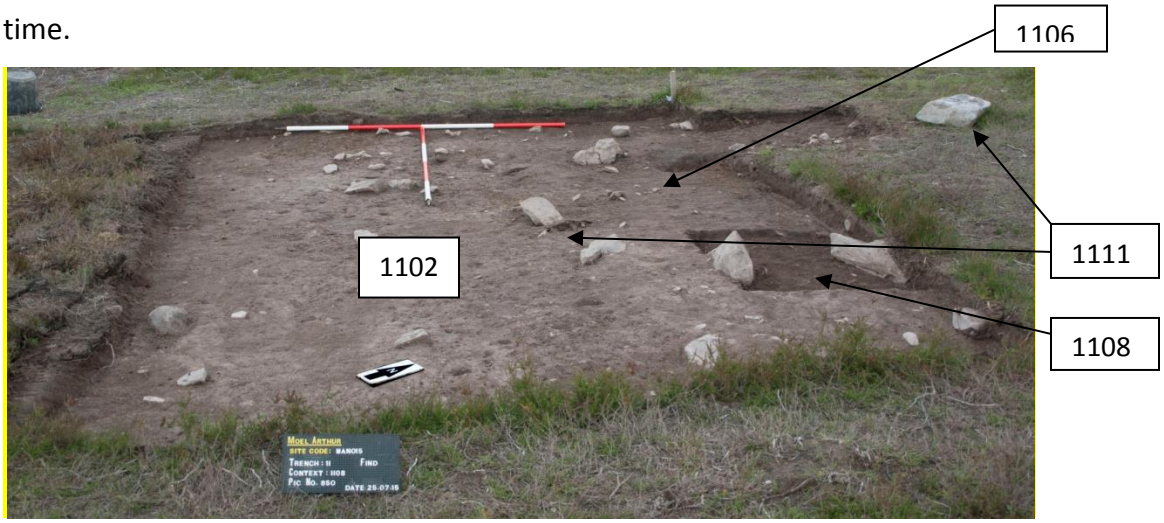


Fig. 9. Showing Trench 11 re-opened. (Scale 2m)

The area between the two upright stones was excavated down to the dark context (1108). A large stone at the edge of the trench in June was removed and a burnt area (1111) discovered below it. There was no other sign of any archaeology around these stones at this level.

Fig. 10. Showing north east extension of Trench 11. (Scale 2m)

The original trench was extended to the North, (3 m x 3 m) to include a number of features, stones and apparently burnt areas which had been appearing at the close of the June season. The feature (1106) did not appear to continue into the area, and there were no other obvious features at this level.

The context (1111) extended towards feature (1106) with definite signs of burning and several pieces of charcoal were recovered from this context. The large stones did not show any signs of burning.

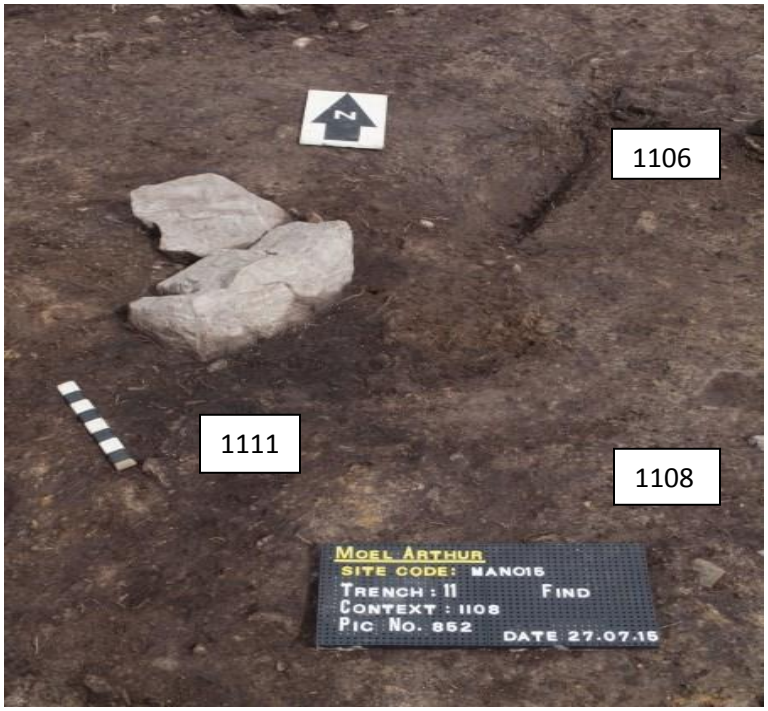


Fig . 11. Showing context (1111) (Scale 80mm)

A section cut adjacent to the large stone showed the burnt area was localised and underlain with context (1110) which underlies (1108) throughout the trench. A further dark area of soil – possibly burnt – appeared in the north east edge of the extension. This was given contest number (1112). No charcoal was found here however. It consisted of black hard burnt organic material and stones.

Fig . 12. Showing context (1112) (Scale 1m)

Meanwhile, back in the main part of Trench 11, further trowelling through (1108) revealed an arc of small pits filled with silvery sand and, in some cases, clay lumps. These were treated a shallow stake holes and given cut and fill numbers, the whole area being called (1113). The stake holes were all approximately 3cm deep.

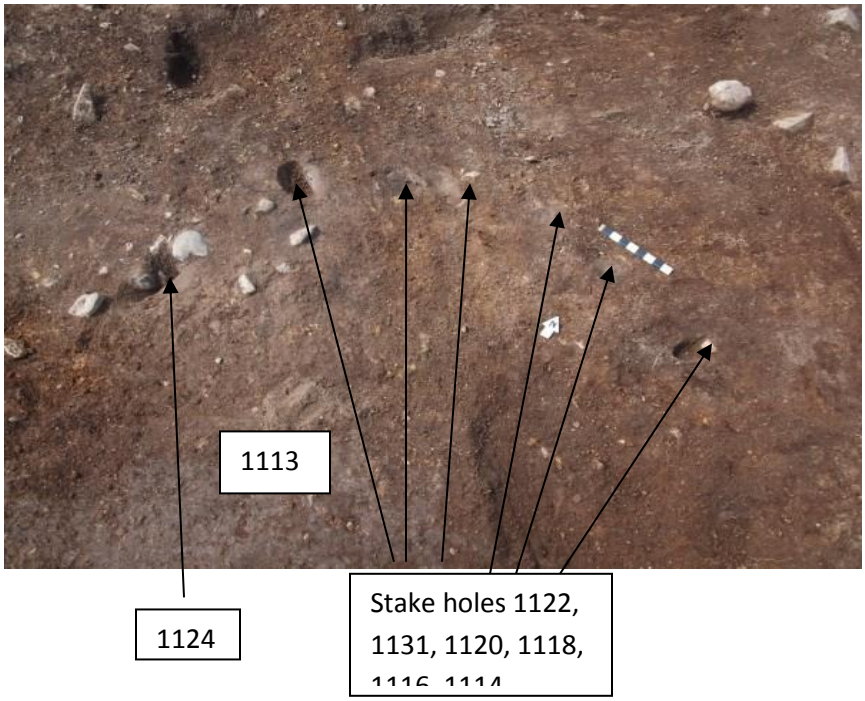


Fig. 13. Showing arc of stake holes. (Scale 80mm)

Further trowelling showed burnt areas appearing within context (1113). The fan shape of this arc of holes suggested a light structure possibly surrounding an oven. Underneath hole (1124),

next to a small group of stones, was a somewhat larger hole and packed with clay [1141] and (1142).

Two large stone to the south east, set on edge, seem to bear a relationship with the arc of stake holes. The burnt area extends out between these stones and then fans out to the south. This area was underlying (1108). Further stones which seemed to have been placed on their edges were explored near the eastern trench edge, however they are placed deeper and may not have any connection with the group in (1113). Further stake holes appeared as context (11110 was excavated down to (1110). Some filled with sand and some with clay. Several hand sized lumps of clay were found, some with circular holes stamped into them.

Fig. 14. Showing clay packed hole with indentations. (Scale 100mm)

The whole trench was excavated down to the context (1110) which was a hard packed orangey-brown clay layer, considered to be the underlying natural soil level. There were no signs of archaeology below this level. The overall depth of the trench down to (1110) was between 10 and 12 cms.

After recording and section drawing, the trench was back filled and re-turfed.

Fig.15. View of Trench 11 looking south showing semi-circular arrangement of ‘stake-holes, area of burnt soil and large stones possibly forming a flue. (Scale: 2m)

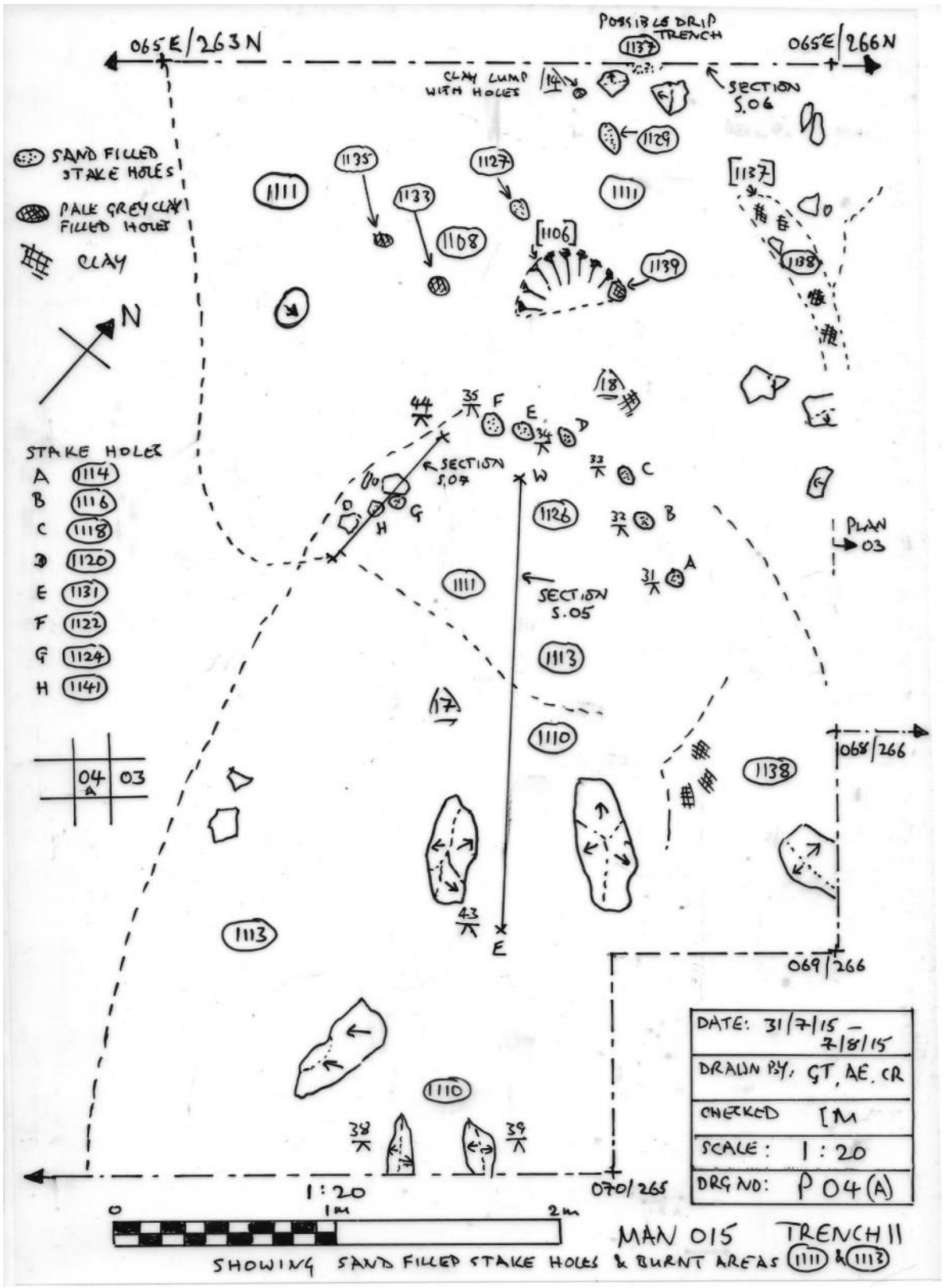


Fig. 16. Plan of the north end of Trench 11 showing the upright stones and arc of stake holes together with further stake holes to the north east.

3.2.2 Finds in Trench 11 – July/August

Several small flint flakes, a possible hammer stone, and a modern lead bullet were found.

Fig. 17. Possible hammer stone (Scale 80mm)

Fig 18. Flint

Fig 19. Flint flakes

Fig. 20. Flint

Fig 21. Lead bullet

3.2.3 Trench 12

Trench 12, five metres square, was opened to the north west of the site to investigate an anomaly labelled D on the magnetometry report. This was trowelled down to the bed rock, which was very close to the surface here and could account for the anomaly. A darker area in the south west corner was explored. It proved to be a hollow in the rock filled with dark peaty material. There was a suggestion that the bed rock had been deliberately cut into. However on reflection this was considered to be the action of water or ice.

There was nothing that could be called a feature, and the trench was not planned. A few pieces of apparently worked chert were recovered. Levels were taken and the trench back-filled.

Fig. 22. Trench 12 (Scale 2m)

3.2.4 Finds in trench 12

5 pieces of worked chert including a core.

Fig., 23. Chert core and worked pieces.

4. Discussion

The use and significance of burnt mounds is still controversial, varying from use in cooking, provision of sweat lodges/saunas, marking boundaries, retreats for ritual purposes (possibly taking of hallucinogens) or for metal working (Pryor 2003. p.192; Champion 1999. p.102; Darvill 2002. p.59). However the presence of large quantities of fire heated and cracked stones present in all such sites implies the existence of a substantial hearth in the neighbourhood.
Following the discovery of a possible burnt mound on the North-East slopes of Moel Arthur in 2013 (Milhench 2013) a further geophysical survey was carried out with the aim of locating such a hearth in the area and any other features which might have been linked with the site. As mentioned above (para.1.2.4) the survey located a number of anomalies, and the 2015 excavations concentrated on those closest to the burnt mound (Trench 8).

The nature of the site, with its thin covering of peat and clay over the underlying chert - a

maximum depth of about 20 cms – makes it very difficult to distinguish a time scale for the various finds. There had certainly been burning in the area, probably over many centuries, and the charcoal recovered and sent for analysis returned dates ranging from about 6300 calBC to 4700 calBC, which corresponds with the Atlantic phase pollen zone when the vegetation is likely to have consisted of extensive woodland up to 700m with a preponderance of oak, ash, lime, alder and hazel (Aldhouse-Green 2000, p.24ff). This, together with the flints ranging from the Mesolithic to the Bronze Age found nearby in recent years, suggests that there had been human activity, including the use of fires, throughout these periods. Whether any of this was linked to the possible burnt mound was impossible to determine.

Most Mesolithic settlement, prior to the Mesolithic/Neolithic interface (around 5300BC), seems to have been on lowland sites around estuaries and the coastal plain. However, rising sea levels in this period may have made the upland areas more attractive to mobile groups for hunting or recreational activities (Aldhouse-Green 2000, p.41; Brown 2004, p.32).

The discovery of the semicircular row of shallow post holes, together with other shallow hollows filled with silty sand, the general spread of burning, and the position of larger stones set on edge, would appear to indicate that some kind of light-weight construction, possibly made of withies, had been made. This could have been used either as a windbreak for a hearth or, if these had been covered with heather or turves, some form of shelter. A similar collection of postholes indicating a light shelter have been reported from Pembrokeshire, Brennig and not far away from here at Rhyddlan (Aldhouse-Green 2000, p.32). Such a construction could only have been very temporary and was probably repeatedly replaced of a long period of time as the need arose. Coupled with the finds of simple flints and knapping debitage, it seems likely that the site was used over a long period, by small groups passing through the area, maybe following their own animals or on the hunt for food.

While the conclusions are necessarily rather vague, the number of possible features demonstrated by the geophysical survey suggests that, time and money permitting, the area still has considerable potential for excavation over future years.

Acknowledgments

CRAG would like to thank the members of the Denbighshire and Flintshire Countryside Services and all the volunteers for the invaluable help and encouragement received.

Appendices

1 Finds

2 Site levels

3. Brooks, I.P. (2014) *Land below Moel Arthur. Geophysical survey. September 2014.*

4. Archaeological services. Durham University (2015). C*harcoal identification and C14 preparation. Report 4015.*

5. Scottish Universities Environmental Research Centre [SUERC] (2016). *Radiocarbon dating report, Report No: SUERC 66219 (GU40089).*

6. Walker, E (2016) Analysis of the flints found on Moel Arthur 2011 - 2015

References

Aldhouse-Green, S. (2000) "The Mesolithic Period" in Lynch, F., Aldhouse-Green, S., & Davies, J.L. (eds.) *Prehistoric Wales.* Stroud: Sutton Publishing.

Archaeological services. Durham University (2015). C*harcoal identification and C14 preparation. Report 4015.* See appendix 4.

Brooks, I.P. (2014) *Land below Moel Arthur. Geophysical survey. September 2014.* See appendix 3.

Brown, I. (2004). *Discovering a Welsh Landscape (Archaeology in the Clwydian Hills)*, Macclesfield: Wingather Press.

Champion, T. (1999). "The Later Bronze Age", in Hunter, J. & Ralston, I. (eds.) *The Archaeology of Britain,* London: Routledge.

Darvill, T. (2002). *The Concise Oxford Dictionary of Archaeology,* Oxford, OUP.

Heather & Hillforts Archaeology Group [HHAG]. (2011). *Evaluation report No.1. Exploratory excavation investigating a number of features identified by Geophysical survey on Moel Arthur,* Heather and Hillforts Partnership Scheme, Denbighshire County Council.

Milhench, I. (2013). *Report on the excavations of a burnt mound on Moel Arthur 2013,* Heather and Hillforts Partnership Scheme, Denbighshire County Council.

Grant, F.R. (2009). *Analysis of a peat core from the Clwydian Hills, North Wales,* Unpublished report prepared for the Royal commission on the Ancient and Historical Monuments of Wales, Report No: 0209 RCAHMW.

Pryor, F. (2003). *Britain BC,* London: Harper Perennial

Scottish Universities Environmental Research Centre [SUERC] (2013). *Radiocarbon dating report, Report No: SUERC 49808 (GU32372),* Unpublished report.

Scottish Universities Environmental Research Centre [SUERC] (2016). *Radiocarbon dating report, Report No: SUERC 66219 (GU40089).* See appendix 5.

Walker, E (2016). *Analysis of the flints found on Moel Arthur 2011- 2015.* See appendix 6.

Appendix 4

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Clwydian Range Archaeology Group

Moel Arthur Hillfort
Clwyd
Wales

charcoal identification and C14 preparation

report 4015
December 2015

Durham University

Contents

© Archaeological Services Durham University 2015
South Road · Durham · DH1 3LE · tel 0191 334 1121 · fax 0191 334 1126
archaeological.services@durham.ac.uk · www.dur.ac.uk/archaeological.services

1. Summary

The project

1.1 A small bulk sample and hand-recovered charcoal were taken during an archaeological excavation at Moel Arthur Hillfort, Clwyd, Wales. This report presents the results of assessment of the bulk sample and charcoal identification.

1.2 The works were commissioned by the Clwydian Range Archaeology Group, and conducted by Archaeological Services Durham University.

Results

1.3 The bulk sample [1113] produced a small flot predominantly comprising humified organic soil, small fragments of charcoal and modern roots. Identified fragments of charcoal were all recorded as hazel. A poorly preserved fragment of charred hazel nutshell was present in the sample residue.

1.4 Three fragments of hand-recovered charcoal from context [1111] sample 10 were all identified as hazel. A hand-recovered fragment of charcoal from [1111] sample 16 was identified as oak stemwood.

2. Project background

Location and background

2.1 A bulk sample [1113] and hand-recovered charcoal [1111] were taken during an archaeological excavation by the Clwydian Range Archaeology Group at Moel Arthur Hillfort, Clwyd, Wales. This report presents the results of palaeoenvironmental assessment of the bulk sample and charcoal identification.

Objective

2.2 The objective of the scheme of works was to assess the palaeoenvironmental potential of the sample, and identify fragments of charcoal suitable for AMS radiocarbon dating from contexts [1111] and [1113].

Dates

2.3 Samples were received by Archaeological Services on 30th November 2015. Assessment and report preparation was conducted between 13th and 19th December 2015.

Personnel

2.4 Assessment, charcoal identification and report preparation were conducted by Lorne Elliott.

Archive

2.5 The site code is **MAN015**. The residue, flot, charcoal and charred plant remains are currently held in the Palaeoenvironmental Laboratory at Archaeological Services Durham University awaiting collection or return.

3. Methods

3.1 The bulk sample was manually floated and sieved through a 500μm mesh. The residue was examined for shells, fruitstones, nutshells, charcoal, small bones, pottery, flint, glass and industrial residues, and was scanned using a magnet for ferrous fragments. The flot was examined at up to x60 magnification for charred and waterlogged botanical remains using a Leica MZ7.5 stereomicroscope. Identification of these was undertaken by comparison with modern reference material held in the Palaeoenvironmental Laboratory at Archaeological Services Durham University. Plant nomenclature follows Stace (1997). Habitat classifications follow Preston *et al.* (2002).

3.2 The charcoal fragments were identified, in order to provide material suitable for radiocarbon dating. The transverse, radial and tangential sections were examined at up to x600 magnification using a Leica DMLM microscope. Identifications were assisted by the descriptions of Schweingruber (1990) and Hather (2000), and modern reference material held in the Palaeoenvironmental Laboratory at Archaeological Services Durham University.

3.3 The works were undertaken in accordance with the palaeoenvironmental research aims and objectives outlined in the regional archaeological research framework and resource agendas (Caseldine 2004).

4. Results

4.1 The bulk sample [1113] produced a small flot predominantly comprising humified organic soil, small fragments of charcoal and modern roots. The charcoal fragments were subangular in shape and in poor condition due to mineral inclusions which prevented identification in some instances. Identified fragments from this sample were all recorded as hazel. A poorly preserved fragment of charred hazel nutshell was present in the sample residue.

4.2 Three fragments of hand-recovered charcoal from context [1111] sample 10 were all identified as hazel. Anatomical properties indicating the presence of reaction wood (sparse vessel arrangement) were noted in all of the fragments. This is characteristic of eccentric growth in roots, branches or stems (Schweingruber 1990).

4.3 Context [1111] sample 16 was a hand-recovered fragment of charcoal encrusted in clay. Once cleared of clay, the fragment of charcoal was identified as oak stemwood in relatively good condition (firm) and with abundant mineral inclusions.

4.4 The results of the palaeoenvironmental assessment are presented in Appendix 1. Material available for radiocarbon dating is presented in Appendix 2.

5. Sources

Caseldine, A, 2004 *A Research Framework for the Archaeology of Wales: environmental archaeology*. National Seminar Paper

Hather, J G, 2000 *The identification of the Northern European Woods: a guide for archaeologists and conservators*. London

Preston, C D, Pearman, D A, & Dines, T D, 2002 *New Atlas of the British and Irish Flora*. Oxford

Schweingruber, F H, 1990 *Microscopic wood anatomy*. Birmensdorf

Stace, C, 1997 *New Flora of the British Isles*. Cambridge

Appendix 5

Walker, E., 2016, *Analysis of the flints found on Moel Arthur 2011- 2015*

Photo No	Year	Trench	Find No.	Context	No. of finds	Object name	Material	Colour	Period	Other Characteristics	Description	Length mm	Width mm	Thickness mm	Weight g
R01	2011	IV	1	9	1	Tanged knife	Flint	Black	Bronze Age		Made on a crested blade of plano-convex profile and finely pressure flaked	55.7	17.5	10.9	9
R02	2012	3/8	1	3001	1	Flake	Flint	Black	Prehistoric	Distal end is absent.	A hard hammer struck flake with a predominantly cortical dorsal surface.	28.5	24.9	7.6	6.8
R03	2012	3	2	3001	1	Knife	Flint	Grey	Bronze Age		A knife made on a blade. Just one length is retouched with scalar retouch. There is a flake scar towards the distal end of the tool. The other length provides a natural backing to the tool.	39.1	17.5	6.4	5
R04	2012	4	1	1	1	Flake	Flint	Black	Prehistoric		Some traces of white cortex on the dorsal surface.	15.9	14.6	2	0.6
R05	2012	1	2	2	1	Scraper	Flint	Yellowish-brown	Prehistoric	Damage to distal end	A convex scraper made on a cortical flake. The steep retouch runs around 50% of the circumference of the tool.	25.2	26.3	10	9.2
R06	2012	1	3	u/s	1	Barbed and tanged arrowhead	Flint	Black	Bronze Age		A small barbed and tanged arrowhead with a square ended tang. One of the barbs has a square end, the other is fractured obliquely.	18.5	16.7	3.5	0.8
R07	2012	1	4	3	1	Proximal end of a blade	Flint	White	Prehistoric	Proximal fragment	A proximal end of a white patinated flint blade.	9.5	3.1	6.1	0.6
R08	2012	1	5	3	1	Blade fragment	Chert	Pale grey	Prehistoric	Mesial fragment	A fragment of a blade that has been trimmed on the ventral surface with removals struck from each end.	16.6	11.1	3	0.5
R09	2012	1	6	3	1	Flake fragment	Chert	Grey	Prehistoric		A flake fragment	16.3	13.6	5.9	0.7

R10	2012	1	7	6	1	Core	Flint	Black	Prehistoric		A nodular piece of flint which has had a number of flake removals struck from it.	37.7	43.5	24	25.7
R11	2012	1	8	6	1	Flake	Flint	Grey	Prehistoric		An irregular shaped flake which is struck from a fos-siliferous piece of flint.	36.5	24.5	8.3	4.9
R12	2012	1	9	6	1	Flake fragment	Flint	Black	Prehistoric	Proximal end	A proximal end of a flake which has a white cortex on	19.5	26	5.7	2
R13	2012	2	10	42	1	Quartz crystal	Quartz	White							
R14	2012	1	11	14	1	Natural piece of stone	Conglom-erate with quartz crystals	Grey							
R15	2012	1	12	6	1	Flake	Flint	Black	Prehistoric		A thick flake with traces of cortex at the distal end.	35.5	27.3	14.5	13.6
R16	2012	1	13	6	1	Scraper	Flint	Yellow-ish-brown	Prehistoric		A large irregular transverse scraper made on a flake The scraping edge shows signs of rounding which might be from use as the flake scars on the dorsal surface are	29.6	38	10.8	15.4
R17	2012	1	14	6	1	Burnt flake	Flint	White	Prehistoric		A small round burnt flake	15.3	14.5	4.2	1
R18	2012	1	15	6	1	Spall	Flint	white	Prehistoric		Small flint knapping spall	5.3	6.3	1.6	<0.1
R19	2012	1	16	16	1	Quartz crystal	Quartz	White							
R20	2012	1	17	16	1	Burnt spall	Flint	white	Prehistoric	Burnt	A small flint knapping spall which has been burnt	6.6	10.8	2.5	0.1
R21	2012	1	18	6	1	Piece of quartz	Quartz	White							
R22	2012	1	19	16	1	Flake	Flint	Black	Prehistoric		A large flint flake which has a differential patination. Half the flake is developing a white patination whilst the remainder of the flake is upatinated.	32	27.5	7.9	6.8

R23	2012	1	20	16	1	Knife	Flint	Pale grey	Bronze Age	A flake with a convex backing to it. The backing is shallow and therefore most likely to be a knife.	28	22.9	5.7	3.1
R24	2012	1	21	19	1	Flake fragment	Flint	Black	Prehistoric Proximal end	A proximal end of a hard hammer struck flake which has a very pronounced bulb of percussion.	15.1	18.9	4.2	0.8
R25	2012	1	22	16	1	Spall	Flint	Black	Prehistoric	A flint knapping spall	8.1	8.6	1.5	0.2
R26	2012	1	23	19	1	Blade fragment	Flint	White	Prehistoric Mesial fragment	A mesial fragment of a blade.	10	12.1	2.2	0.3
R27	2012	1	24	21	1	Spall	Flint	Black	Prehistoric	Small flint knapping spall	8.1	7.9	1.9	<0.1
R28	2012		25		1	Utilized blade	Flint	White	Prehistoric	A complete blade with utilization evidence along one length. The utilized length is concave in shape.	44.8	27	7	7
R29	2012		26		1	Miscellaneous retouched flake fragment	Flint	Black	Prehistoric	A hard hammer struck thick flint flake, with a cortical dorsal surface. There appears to be an area of very steep retouch along one edge. The retouched area is straight.	23.9	33.1	10.4	6.9
R30	2012		27		1	Spall	Flint	White	Prehistoric	A flint knapping spall	7.6	7.5	1.5	<0.1
R31	2012		28		1	Bifacially flaked flake	Flint	Pale grey	Prehistoric	A thick flint flake which has bifacial flaking on both faces.	24.5	22.5	8.3	4.4
R32	2013	9	1		1	Burnt blade fragment	Flint	Pink	Prehistoric Burnt	The mesial end of a burnt flint blade.	15.9	10.5	3.1	0.4
R33	2013	9	2		1	Burnt flake	Flint	Pink	Prehistoric Burnt	A round flint flake	15.5	14.7	2.5	0.7
R34	2013	9	3		1	Burnt flake	Flint	Pink	Prehistoric Burnt	A round flint flake struck from a plain strikiing platform.	19.5	18.1	6.5	2.2

R35	2013	9	4		1	Prismatic bladelet core	Flint	Yellow-ish-brown	Meso-lithic / Neolithic	A prismatic bladelet core. Worked all the way around the circumference. The core has no cortex remaining. The single platform has been used to strike bladelets and the base of the core is pointed.	25.8	31.9	28.6	21
R36	2013	9	5		1	Large utilized blade	Flint	Black	Bronze Age	A large utilized flint blade with an area of cortex at the distal end. One of the lengths has irregular chipping running along its length, suggestive of its having been used expeditiously. The other length has a natural flat edge to it giving it a natural backing. The flake is hard hammer struck from a plain platform.	71.2	36.4	13.4	31.5
R37	2013	3/8	1	3003	1	Natural red clay?	Clay?	Red						
R38	2013	3/8	2	3003	1	Natural red clay?	Clay?	Red						
R39	2013	3/8	3	3003	1	Spall	Flint	Orange	Prehistoric	A small flint spall	8.5	6.7	1.3	<0.1
R40	2013	3/8	4	u/s	1	Natural red clay?	Clay?	Red						
R41	2013	4	5	4001	1	Flake	Flint	Yellow-ish-brown	Prehistoric	Small flint flake with cortical dorsal surface	9.5	12.2	2.6	0.3
R42	2013	4	6	4002	1	Flake	Flint	Yellow-ish-brown	Prehistoric	A hard hammer struck flint flake	39.2	24	7	7
R43	2013	4	7	4001	1	Flake fragment	Flint	Grey	Prehistoric	A hard hammer struck flint flake. Part of the proximal end is missing.	27.5	19.8	3.1	1.5

R44	2013	3/8	8	3006	1	Burnishing stone	Stone not determined	Black	Uncertain - date by context?	A burnishing stone worked along one length.	82.7	43.1	25	158.5
R45	2013	8	10	3002	1	Thumbnail scraper	Flint	Grey	Bronze Age	A small thumbnail style convex scraper. The retouch runs around about 60% of the circumference. The proximal end of the flake from which the scraper is made is missing.	18	17.1	5.5	1.9
R46	2013	8	11	3002	1	Scraper fragment	Flint	Black	Prehistoric Fragment	A fragment of a scraper. The scraper is made on a thin flake and the retouch is present along one end where it is very marginal but forms a convex scraping edge.	18.8	23	4.7	2
R47	2013	8	12	3006	1	Natural red clay?	Clay?	Red						
R48	2014	10	1	2	1	Flake fragment	Flint	Black	Prehistoric	A flint flake fragment. The proximal end is missing.	32.9	39.4	5.5	6.3
R49	2014	10	2	10	1	Natural stone	Stone not deter-	Black						
R50	2014	10	4		1	Flake	Flint	Black	Prehistoric	A thin flint flake	16.6	16.4	3.2	0.6
R51	2014	10	5		1	Burnt flake fragment	Flint	Dark Grey	Prehistoric Burnt	An irregular burnt flint flake fragment	11.3	21.5	4.4	0.8
R52	2014	10	6		1	Large scraper	Flint	Black	Bronze Age	A large scraper with a convex scraping edge at the distal end of a flake. The dorsal surface is cortical and the retouch is formed through this.	44.6	32.3	10.1	14.7
R53	2014	10	7		1	Possible core fragment	Flint	Grey	Prehistoric	A possible core fragment. The piece is irregularly knapped, but there are some flake scars that suggest that this piece of flint has had some flake removals struck from it.	27.6	17	12.2	5.3

R54	2014	10	8	u/s	1	Flake	Flint	Grey	Prehistoric		A flint flake	24.4	16.9
R55	2015	11	1	1101	1	Blade	Flint	Orange	Prehistoric		A primary cortical flint blade.	36.4	15.5
R56	2015	11	2	1102	1	Blade	Flint	Grey	Prehistoric		A flint blade	31.8	11.9
R57	2015	11	3	1101	1	Crested piece from core rejuvenation	Flint	Grey	Prehistoric		A crested flake detatched to rejuvenate the core.	37.2	17.6
R58	2015	11	4	1102	1	Burnt spall	Flint	Pinkish grey	Prehistoric	Burnt	A lightly burnt spall of flint	13.7	8
R59	2015	11	5	1101	3	Natural red clay?	Clay?	Red					
R60	2015	11	7	1102	1	Natural red clay?	Clay?	Red					
R61	2015	11	8	1102	1	Scraper	Flint	Black	Bronze Age		A small convex scraper made on the end of a small blade. The scraping area is very steep with convex shape.	23	16.4
R62	2015	11	6	1102	1	Charcoal sample	Charcoal		Undated				
R63	2015	11	9	1102	1	Spall	Flint	Grey	Prehistoric		Small flint spall	4.1	8.3
R64	2015	11	9	1102	1	Burnt piece of general flint knapping debitage	Flint	Grey	Prehistoric	Burnt	Burnt piece of general flint knapping debitage	13	10.5
R65	2015	11	11	1102	1	Lead bullet	Lead		Post medieval				
R66	2015	11	12	1108	1	Flake	Flint	Black	Prehistoric		An irregular black flint flake with a cortical edge.	30.8	16.3
R67	2015	12	13	1201	1	Core	Chert	Black	Prehistoric		A core with removals struck from a single flat striking platform.	39.7	29.2
R68	2015	12	13	1201	1	Flake	Chert	Black	Prehistoric		A thin flake.	25.8	16.6
R69	2015	12	13	1201	1	Piece of general knapping debitage	Chert	Black	Prehistoric		Irregular piece of possible knapping debitage	38.5	17.4

R70	2015	12	13	1201	1	Piece of general knapping debitage	Chert	Black	Prehistoric	Irregular piece of possible knapping debitage	22.3	26
R71	2015	12	13	1201	1	Piece of general knapping debitage	Chert	Black	Prehistoric	Irregular piece of possible knapping debitage	18.3	25.5
R72	No date	3	n/a	n/a	4	Not reported	Rock					
R73	No date	n/a	n/a	n/a	2	Not reported	Pebbles					
R74	2014	10	n/a	u/s	1	Not reported	Rock					
R75	2015	11	SS15			Not reported	Soil Sample					
R76	2015	11	SS18			Not reported	Soil Sample					

Appendix 6

CRAG 2017 Excavation Context Index

CONTEXT NUMBER	DESCRIPTION	RELATIONSHIPS
1700	Grass and rushes layer	Above 1702
1701	Heather roots and peat	Above 1702
1702	Grey-brown clayey-silt	Below 1700 and 1701
1703	Stony (shale) layer	Below 1702. Contains 1708, 1711, 1730 and 1731. Abuts 1704 and 1705.
1704	Dark grey silty-clay	Below 1702. Abuts 1703 and 1705
1705	Orange-brown silty-clay	Below 1702. Within 1737. Abuts 1703 and 1704. Same as 1736 and 1741
1706	Yellow silty-clay	Below 1702. Cut by 1720, 1737. Above 1749.
1707	Brown clayey-silt	Below 1702. Same as 1703
1708	Line of large flat stones (shale)	Below 1702. Within 1703 and 1731. Abuts 1730
1709	Brown clayey-silt	Below 1702. Same as 1703
1710	Brown clayey-silt	Below 1702. Same as 1703
1711	Line of large flat stones (shale)	Below 1702. Within 1703 and 1731. Abuts 1730
1712	Brown clayey-silt	Below 1702. Same as 1703
1713	Small triangular pit	Below 1702. Contains 1732
1714	Brown clayey-silt	Below 1702. Same as 1703
1715	Brown clayey-silt	Below 1702. Same as 1703
1716	Yellow clayey-silt	Below 1702. Same as 1706
1717	Brown clayey-silt	Below 1702. Above 1706. Cut by 1737
1718	Brown clayey-silt	Below 1702. Same as 1706
1719	Dark brown clayey-silt	Below 1702. Within 1739
1720	Ovoid depression	Below 1702. Contains 1734 and 1735. Cuts 1706.
1721	Brown clayey-silt	Below 1702. Same as 1706
1722	Grey-brown clayey-silt	Below 1702. Within 1740
1723	-	-
1724	Dark brown clayey-silt	Below 1702. Same as 1706
1725	Dark brown clayey-silt	Below 1702. Same as 1706
1726	Large single stone	Below 1702. Within 1706
1727	Dark brown clayey-silt	Below 1702. Same as 1706
1728	Dark brown clayey-silt	Below 1702. Same as 1706
1729	Dark brown clayey-silt	Below 1702. Same as 1706

1730	Grey-brown clayey-silt matrix containing 80% tabular stone (shale) inclusions	Below 1702. Within 1703 and 1731. Abuts 1708 and 1711
1731	Possible stone foundation pads of crude shelter	Below 1702. Contains 1708, 1711 and 1730
1732	Brown-grey silt	Below 1702. Within 1713
1733	-	-
1734	Brown-grey clayey-silt	Below 1702. Above 1735. Within 1720
1735	Orange silty-clay	Below 1734. Within 1720
1736	Orange-brown silty-clay	Below 1702. Same as 1705 and 1741. Within 1737
1737	Steep scarp edge	Below 1702. Contains 1704, 1705, 1736, 1741
1738	Dark grey silty-clay	Below 1702. Same as 1704
1739	Circular depression	Below 1702. Contains 1719
1740	Circular depression	Below 1702. Contains 1722. Cuts 1706
1741	Orange-brown clayey-silt	Below 1702. Same as 1705 and 1736. Within 1737
1742	Palaeo-channel	Below 1736. Contains 1743
1743	Pale grey clayey-silt	Below 1736. Within 1742
1744	Palaeo-channel	Below 1736. Contains 1745
1745	Mid brown-grey clayey-silt	Below 1736. Within 1744. Abuts 1746
1746	Pale grey clayey-silt	Below 1736. Within 1744. Abuts 1745
1747	Series of 12 hoof prints	Below 1706. Within 1749
1748	Grey-brown clayey silt with orange specks	Below 1736. Abuts 1742 and 1744
1749	White-yellow slightly silty clay	Below 1706. Cut by 1737

Appendix 7

2017 Finds description table

Specimen	Context	Length (mm)	Width (mm)	Thickness (mm)	Mass (g)	Shape	Batter	Material	Comments
1701	1706	27	20	7	5				flake
1703	1703	55	41	13	21	triangular, curved cut-out on one edge		Chert	spokeshave
1704	1704	54	29	8	9	leaf-shaped		limestone	arrow head, one tang missing
1705	1736				47			rhyolite	quadrant of sphere 54mm diameter, tapered axial hole
1708	1704	123	71	84					angular rock
1709	1704	241	89	38	914	boat shaped hollow surface	pointed end	limestone	shaped tool
1710	1704	143	69	23	261	triangular	pointed end	limestone	shaped tool.
1711	1704	121	86	28	294	triangular	pointed end	limestone	shaped tool
1712	1704	93	28	22	62	elongated triangle	pointed end	limestone	shaped tool
1713	1704	103	38	27	108	triangular	both ends	limestone	tool. One long side cleaved
1714	1704	108	36	24	117	laminar	one end	limestone	shaped tool
1715	1704	119	41	16	117	laminar	no sign	limestone	shaped tool
1716	1736	108	31	23	97	cylindrical	both ends	limestone	shaped tool
1717	1736	133	34	18	126	laminar	pointed end	limestone	shaped tool
1718	1736	107	35	16	84	laminar	both ends	limestone	possible tool
1719	1741	40	32	10				limestone	struck flake
1720	1706	107	71	67					hammer stone

1722	1703	110	50	550		Coma shaped wedge		Sandstone	Possible fragment of quern (workings on outside)
1723	1703	94	60	39					broken pebble
1724	1703	96	78	51					hammer stone
1726	1705	240	84	38	728	elongated triangular cross-section	pointed end	limestone	shaped tool
1727	1705	116	28	21	84	cylinder pointed ends	both ends	limestone	shaped tool
1728	1705	149	37	22	152	elongated trapezoid	one end	limestone	damaged
1730	1736	77	27	18	50	elongated cylinder	.	limestone	shaped tool
1731	1736	122	43	20	138	laminar	both ends	limestone	shaped tool
1732	1736	101	27	17	61	flattened cylinder	both ends	limestone	shaped tool
1733	1736	93	37	15	70	laminar, dumb bell	one end	limestone	damaged tool
1735	1705	77	64	43					hammer stone
1736	1741	89	72	34		ovoid	no	Glacial erratic	flat bottom side indicating polishing
1737	1705	100	35	24	104	irregular	pointed end	limestone	shaped tool
1738	1704	87	30	21	64	laminar	both ends	limestone	shaped tool
1739	1736	100	36	25	117	cylindrical	one end	limestone	shaped tool
1741	1741	91	81	43		ovoid	potential battering at one end	conglomerate (glacial erratic)	
1742	1741	69	46	32					pebble
1743	1741	73	59	41		irregular	No	Glacial erratic	Potential smooth sides caused by polishing
1744	1741	129	72	64					hammer stone
1748	1745	75	61	34					worked stone
1752	1706	55	53	47					partially worked pebble
1753	1706	80	74	53					river washe cobble

1754	1745	105	69	40	355	ovoid	one end	chert	partially shaped tool
1755	1706	105	68	18	212	flattened oval		?	contains mica-like particles
1756	1706	45	46	30				rhyolite	fragment of whetstone
1757		88	23	16	42	laminar	both ends	limestone	shaped tool
1758	1706	68	63	18		rounded end with broken half	at distal end	glacial erratic	Rounded flat stone with depression in centre possible lamp well.
1759		42	50	16		triangular section			
1760	1706	120	90	550		Rounded distal end tapering to broken end	battering at distal end	Sedimentary	Hammer stone of unknown sedimentary stone showing battering on distal end broken at proximal end.
1761	1706								Reddish deposit (soil)
1762	1702	5							Flake flint (spalls)
1763	1711	145	165	33 *25 (58)		rectangular flat stone with dimple		Shale	Stone broke when been retrieved combined depth = 58 mm dimple found 75mm from top and 55 mm from right side. Dimple diameter 18mm and 5mm in depth
1764		83	67	45					broken cobble
1765	1703	160	47	25	186	elongated irregular	one end	limestone	shaped tool

1768	1705	115	92	36		rounded cobble with broken bottom	possible battering to rounded surface		rounded top surface showing possible battering
1771	1704	104	65	16		triangular, laminar	one end	limestone	shaped tool + three rocks
1774	1704	198	51	23	307	elongated narrow stone	one end (one end broken)	Limestone	Stone tool - Indications of working (smoothing on sides deliberately shaped to a point at end and battering at end flat on the bottom
1775	1704	177	56	27	437	elongated stone	both ends	Limestone	Stone tool - Indications of working (smoothing on sides, worked end to a deliberate point showing battering at ends, flat on the bottom
1776	1711								
1702a + b	1730	5							Two shards of flint / quartz (Spalls)
1766a	subsoil	50	15	15		hooked		potential iron	Corroded metal
1766b	subsoil	50	16	16		partial hook			Corroded metal
1767a	1704	85	63	28				chert	one flat surface possible whetstone
1767b	1704	101	57	22		laminar	both ends		possible tool
1767c	1704	98	59	22		rectangular		limestone	curved ends sides very flat
1767d	1704	92	88	30		irregular shape		Limestone	large flake with concoidal fracture

1767e	1704	82	63	26		rectangular shape with rounded ends		Limestone	flat bottom and distal end
1770a		43	40	18	69	Rectangular		Limestone	Potential broken shaft of stone tool
1770a	u/s	8	35	7		triangular flake		Limestone	flake showing concoidal patterning
1770b	1704	98	31	19	69	Extended tear drop to point	both ends	Limestone	Stone tool - Indications of working (smoothing on sides and battering at ends flat on the bottom
1770b	u/s	52	50	39		rounded		glacial erratic	two flat surfaces
1770c	u/s	110	31	24		Extended tear drop with slight curve	both ends	Limestone	Stone tool - Indications of working (smoothing on sides and battering at ends flat on the bottom
1770c	1704	184	47	24	269	elongated tear point	both ends	Limestone	Stone tool - Indications of working (smoothing on sides and battering at ends flat on the bottom