AMGUEDDFA CYMRU

# MM 258 NPRN 275998

# Report for Geophysical Surveys Conducted at Buckholt Wood Hilltop Enclosure with Buckholt Bryngaer CIC Volunteers, 16th October 2023.

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# Contents



# Appendix



# List of Figures

# BUCKHOLT WOOD HILLTOP ENCLOSURE:  MM258

## 1 Introduction

**Fig. 1** October early morning mist:  The view to the south and south-east from Buckholt Wood Hilltop Enclosure, looking towards The Kymin (centre), the Wye Valley (to the right of centre), and Monmouth (right). Larch trees to the south of the enclosure have been felled in response to *Phytophthora ramorum*, a fungal-like organism that causes the death of a wide range of trees and shrubs. The greatest impact so far has been on larch plantations, leading to thousands of hectares of felling around the UK. *Phytophthora* species are microscopic fungal-like organisms closely related to algae. Their name literally means 'the plant-destroyer' and they have been responsible for some of the worst plant disease epidemics in history, including potato blight which led to the disastrous Irish potato famine in the 1800s

(https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/tree-pests-and-diseases/key-tree-pests-and-diseases/phytophthora-ramorum/ accessed 19/10/2023).

Photograph: Mark Lewis, 16-x-23.

Buckholt Bryngaer Community Interest Company (Company number 14681405) has been constituted '*to preserve, protect and maintain the site of an Iron-Age hillfort in Buckholt Wood near Monmouth and open the site up as a communal outdoor space*' (source: Buckholt Bryngaer CIC Evenbrite listing, accessed 16/10/2023), SO5020015900, (figs 1-3).  The wood was mentioned in AD 1282 and has banks around its northern edge which may be linked to the edge of the wood, also serving as a possible edge of the Forest of Dean, for hunting is implied in the name 'Buck-holt' (Townley, 2004: 149-150) – literally 'the wooded hill (OE) of the male deer'.  Stephen Clarke (2008: 146) reports the discovery of small sherds of Iron Age pottery in exposed soil on the sides of a track at Buckholt Woods.  Two of the sherds were identified by Dr Vince as a shell-tempered ware and Malvernian ware.  Clarke (2008: 189) also notes the possibility of Early Medieval reoccupation of the site, noting (Clarke: 195) the reported discovery of a 10th century hoard of Saxon coins from Buckholt Wood and a hoard of short cross silver pennies, issued *c.* AD 991-997, found in the ruins of an old cottage in woodland overlooking Monmouth (within the Buckholt Valley), but seemingly lost. Mark Lewis of Amgueddfa Cymru was approached by Tessa Steel of the Buckholt Bryngaer CIC to attempt geophysical surveying as a free volunteer training event opportunity. Following visits from Amelia Pannett (Field Monument Warden) and Will Davies (Inspector of Ancient Monuments) of Cadw, a Section 42 Consent for geophysical surveys was obtained to work within the Scheduled Ancient Monument specifying:

- That the works undertaken are as set out in the submitted project design.
- That a digital copy of the approved archaeological report shall be submitted to Cadw, the regional Historic Environment Record and National Monuments Record of Wales to be incorporated into these public records.

This is that report.

**Fig. 2** Amgueddfa Cymru geophysics equipment adjacent to an National Lottery Heritage Fund-funded information panel about the site in front of one of the causeways with footpath across the enclosure ditch leading into the enclosure. Looking south-west.

Photograph: Mark Lewis, 16-x-23.

**Fig. 3** The view from the path on the causeway across the enclosure ditch on its northern side, looking along the enclosure ditch to the north-west. Photograph: Mark Lewis, 16-x-23.

## 2. Geology

The hilltop geology is visible in tree throws and as exposed surface stone. The bedrock of the top of the hill comprises Brownstones Formation - Sandstone, micaceous. It is a sedimentary bedrock formed between 419.2 and 393.3 million years ago during the Devonian period (figs 4 & 5, source: British Geological Survey's Geology Viewer https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/ ).

**Fig. 4** Brownstone forming an exposed section of the enclosure rampart revetment wall (the outer face of the inner rampart) on the northern side of the enclosure (looking south-west). Photograph: Mark Lewis, 16-x-23.

**Fig. 5** The edge of the wood currently corresponds with the top of the hill to the east of the enclosure due to larch clearance on its lower eastern slope (fig. 1). Exposed mature trees at the edge of the wood have fallen in recent storms, exposing the underlying geology and red soil, producing tree throws (hollows where the roots have pulled up the underlying soil). Photograph: Mark Lewis, 16-x-23.

## 3. Gradiometer Grid Survey Methodology

Working conditions were challenging due to the presence of cut branches, tree stumps and high vegetation (bracken and brambles) over the survey area. Consequently, as advised by Will Davies of Cadw, paced walking was not possible and single points of data were carefully manually collected (using the instrument's 'single shot' data capture mode) at intervals of 0.5m (x-direction) and 1m (y-direction) using a Bartington Grad-601-2 (dual sensor) gradiometer following careful instrument compass bearing adjustment. A single grid measuring 20m x 20m was surveyed (zig-zag) as a test of the methodology under the unusual working conditions (figs 6 - 8). In the absence of GPS, the location of the corners of the grid at each end of the 20m baseline were measured from the centre of the footpath bisecting the enclosure, adjacent trees, and the centre of the enclosure embankment using measuring tapes.

**Fig. 6** Volunteers lay out the baseline. Transits were measured every 2m and marked at each end with bamboo canes. A yellow rope marked with highly visible marks every 0.5m was laid between the canes for each transit and data was collected manually, with the gradiometer 'pace' set to single shot at each mark. Photograph: Mark Lewis, 16-x-23 (written permissions to take and use photographs were signed by all participants and are archived by Buckholt Bryngaer CIC in accordance with GDPR).

## 4. Results

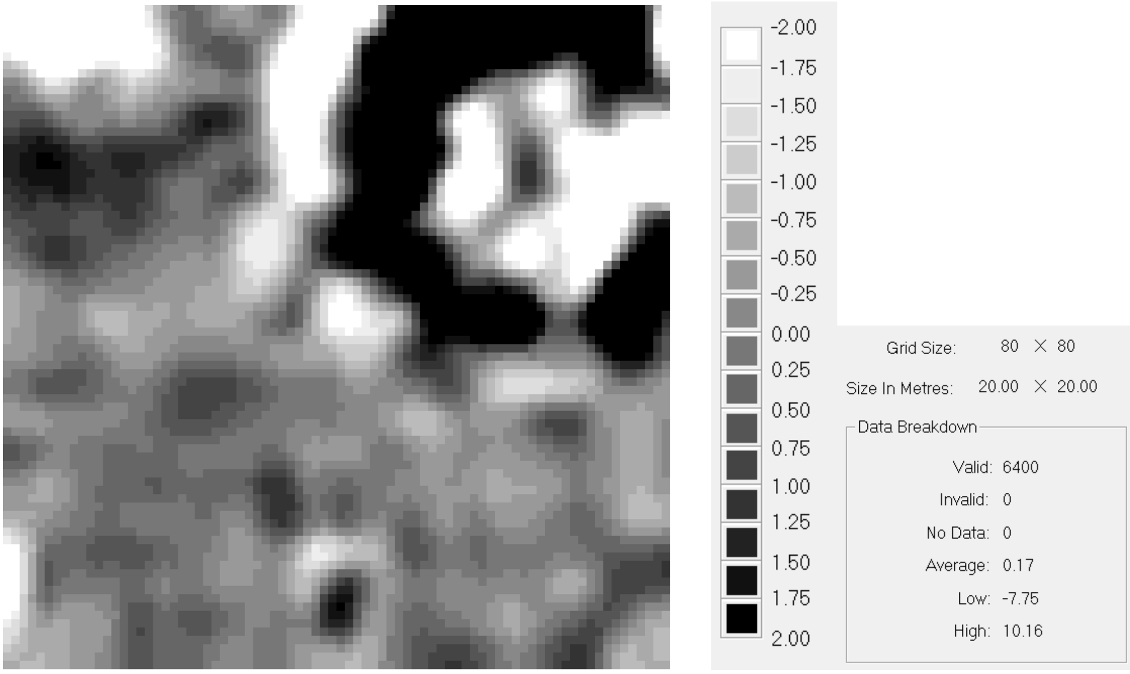
The Bartington Grad 601-2 gradiometer was adjusted by Mark Lewis and he demonstrated the first transit. Subsequent transits were surveyed by non-magnetic volunteers.


**Fig. 7** Location of the 20m x 20m grid plotted on Ordnance Survey data. Processed by Mark Lewis using MAGiC Map Application base map https://magic.defra.gov.uk/MagicMap.aspx, 20-x-2023. Base map © Crown copyright 2023 OS licence 100025805. You are permitted to use this data solely to enable you to respond to, or interact with, the organisation that provided you with the data. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form.

**Fig. 8** Location of the 20m x 20m grid combining Ordnance Survey and Lidar data (SVF) supplied by Simon Maddison: Contains public sector information licensed under the Open Government Licence v3.0. Base map. © Crown copyright 2023 OS licence 100025805. You are permitted to use this data solely to enable you to respond to, or interact with, the organisation that provided you with the data. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form. Processed by Mark Lewis, 20-x-2023.

The gradiometer data was processed using Snuffler software and the results are copied below along with details of the processing undertaken (units nT).

Start →




←End

**Fig. 9** Gradiometer survey results for one 20m x 20m grid within the Buckholt Bryngaer Hilltop Enclosure processed using Snuffler software: **Destriped** [multi zero mean line, orientation: horizontal, effects: everything], **despiked** [threshold: 1.0, flattening effect: normal], **interpolated vertically**, and **interpolated horizontally and vertically**.
Processed by Mark Lewis, 16-x-23.

Clipping the data can accentuate certain features. Two examples of clipping are included below with their grey-scales.

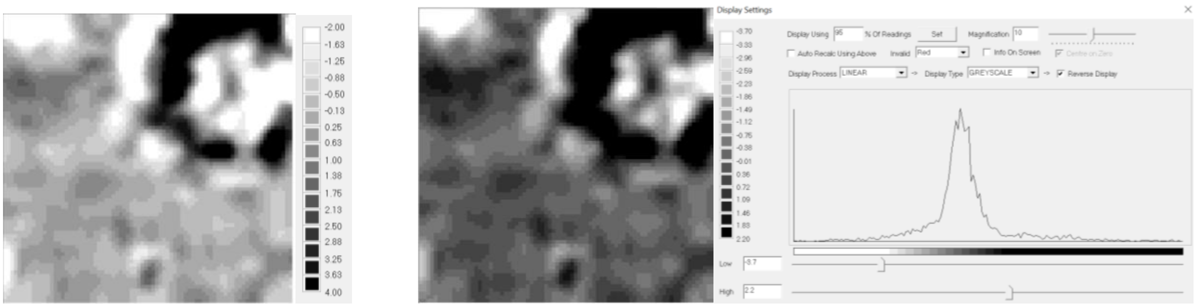


**Fig. 10** Two examples of clipped data for the same dataset as that presented in fig. 9 (above). Clipping can enhance different features within the survey data. The Display Settings included on the right hand side, above, show the clipping parameters for the right-hand dataset of the two shown in this figure. Processed by Mark Lewis, 16-x-23.

## 5. Interpretation of the results

The results (figs 7-10) clearly show a highly contrasting magnetic circular feature approximately 10m in diameter located to the south-east of a second, smaller, magnetic anomaly in the corner of the grid located at the beginning of the first transit (marked START in fig.9), possibly related or similar in type and origin to it. A linear feature clips the south-western corner of the grid and four small sub-circular anomalies are visible in the south-western (second) half of the grid.

### 5.1 The *c.*10m diameter circular feature.

The width of the black and white ring-shaped *c.* 10m diameter anomaly is approximately between 1.7m to 2.8m. This would be thick for a structural wall producing an 'internal' space diameter of *c.* 6.3m. Some staggering appears to be present within the data despite measured 0.5m single shot capture. This is likely to be either due to an accidental and unnoticed failure to record data at one location earlier in that transit resulting in a transit overshoot of one reading or an accidental double shot in a single location resulting in a premature transit conclusion; basically +0.5m or -0.5m in each scenario. Assuming that a transit single reading error had been introduced within the circular feature along one or more of the transits crossing it, correction could result in a more circular feature, possibly with a more linear thin straight central amomally bisecting it. Fortunately, this single anomaly does not prevent the possible interpretation of the overall data-set and the raw data has not been manipulated to correct for it.

The apparent magnetic nature of the *c*. 10m diameter circular feature and a small central feature within it suggests that ferrous (iron-bearing) soil components may have been altered (e.g., reduced to magnetic magnetite and/or maghaemite) by heat, resulting in magnetic alterations in the soil discernable by the gradiometer. Typical archaeological scenarios where iron compounds are altered by heat include kilns and furnaces, often built of clay, which during their heating cycles often exceed the Curie temperatures of magnetite ($Fe_3O_4$) and maghaemite ($\gamma$-$Fe_2O_3$) (578 °C and 578-675 °C, respectively). These iron-oxides are often present in the clay deposits that were used to construct these features. Even if the clays only contained weakly magnetic haematite or goethite, heating and cooling may have converted these into ferri-magnetic iron-oxides (Schmidt, 2007: 2). Whilst Iron Age round houses (with centrally placed hearths) might be expected within a defended hill-top enclosure of this type, their diameters could happily be *c*. 10m and their destruction by fire could account for changes to any clay (or other, e.g., stone) walls, other possible explanations for the data should also be considered.

Powell, Wheeler and Batt (2002, DOI:10.1016/j.jas.2011.11.005) surveyed a magnetically barren patch of ground and then constructed and fired a traditional wood stack charcoal kiln or clamp in order to investigate the effect of the low-temperature charcoaling process on the magnetic properties of the soil underlying the clamp. The temerature of the clamp platform was measured and, in their experiment, never exceeded 100ºC during the firing. They then undertook a magnetometer survey over the burn site. Their results, copied below, show a ring-shaped magnetic feature which they ascribe to the the wood stack sealing material, rather than as a consequence of heat transfer from the charcoaling process, even though some magnetic enhancement to the soil beneath the clamp platform was noted. The post-burn magnetometer data mean was 0.5 nT and the range -2nT to 4 nT. They ascribe the magnetic enhancement to appear to be have been caused by the presence of minerogenic inclusions in the clamp seal which percolated through the wood stack onto the platform.

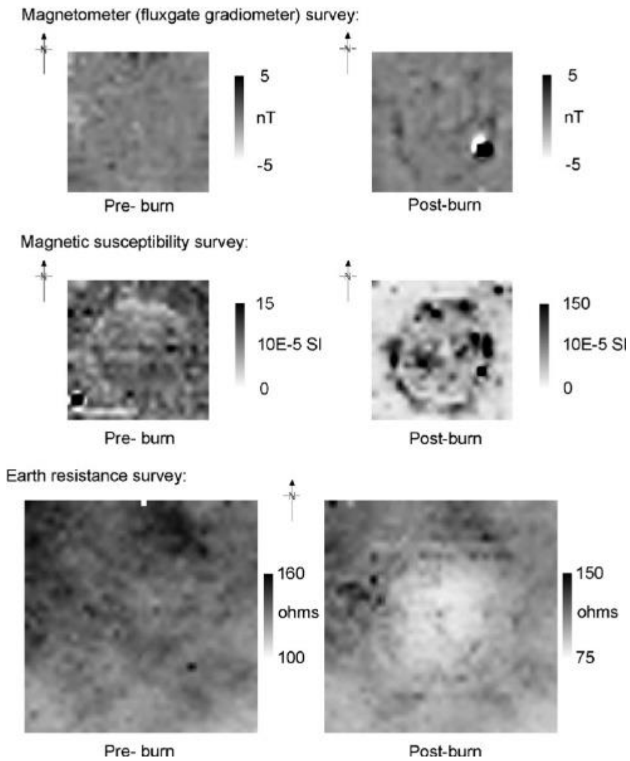



**Fig. 11** Gradiometer and other geophysical surveys of an experimental charcoaling site. From Powell, Wheeler and Batt (2002).

Powell, Wheeler and Batt's (2002) results, and their interpretation of them, and the data from Buckholt Bryngaer may be compared with gradiometer data for a medieval wood stack site at Eskdale in Cumbria, reproduced below (Schmidt, 2007).

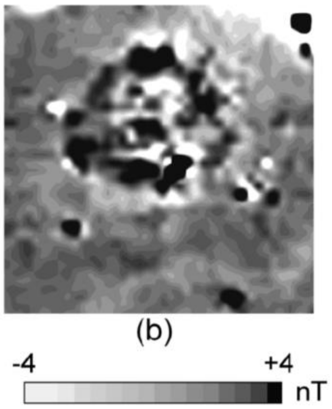
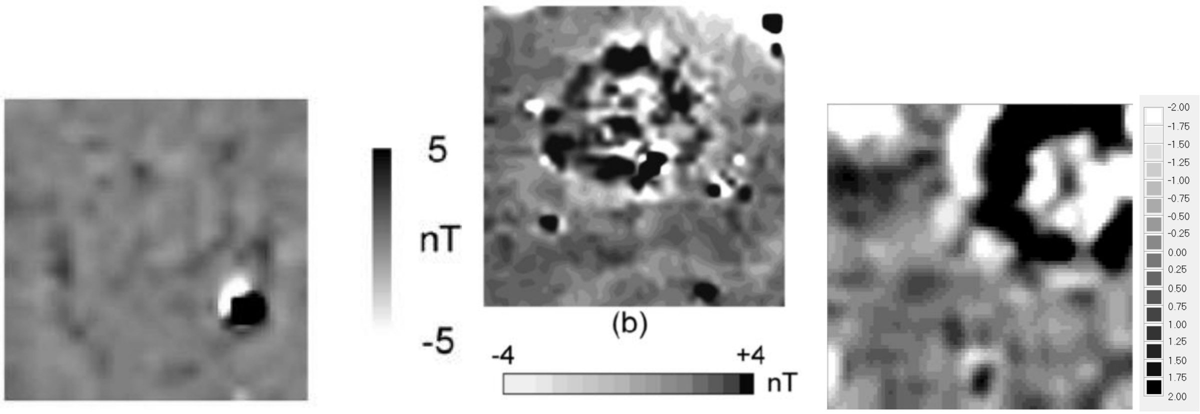



**Fig. 12** Fluxgate gradiometer survey (Geoscan FM36) data for a Medieval charcoal production site at Eskdale, Cumbria. Grid 40m x 40m, spatial resolution 1m x 1m. From Schmidt (2007).

Comparison of the Buckholt, experimental, and medieval, Eskdale, data (below) suggests that the Buckholt feature data could be consistent with its identification as an historical charcoal production site.




Modern experimental clamp | Medieval Eskdale clamp | Buckholt Bryngaer data

**Fig. 13** Comparison of the Buckholt Bryngaer *c.* 10m diameter circular feature with the, medieval, Eskdale and experimental charcoaling site gradiometer results.

If the interpretation of the Buckholt Wood circular feature within the 20m x 20m grid surveyed is correct as a charcoal wood stack site, the dark, central, feature may represent the location of the central 'motty peg' of the wood stack. The 'motty peg' was used as a central support for the construction of a wood stack and was then removed to make a central chimney down which a charge of burning charcoal and wood fragments were dropped to initiate the charcoaling process, before being capped with turf to restrict air-flow (fig. 14).

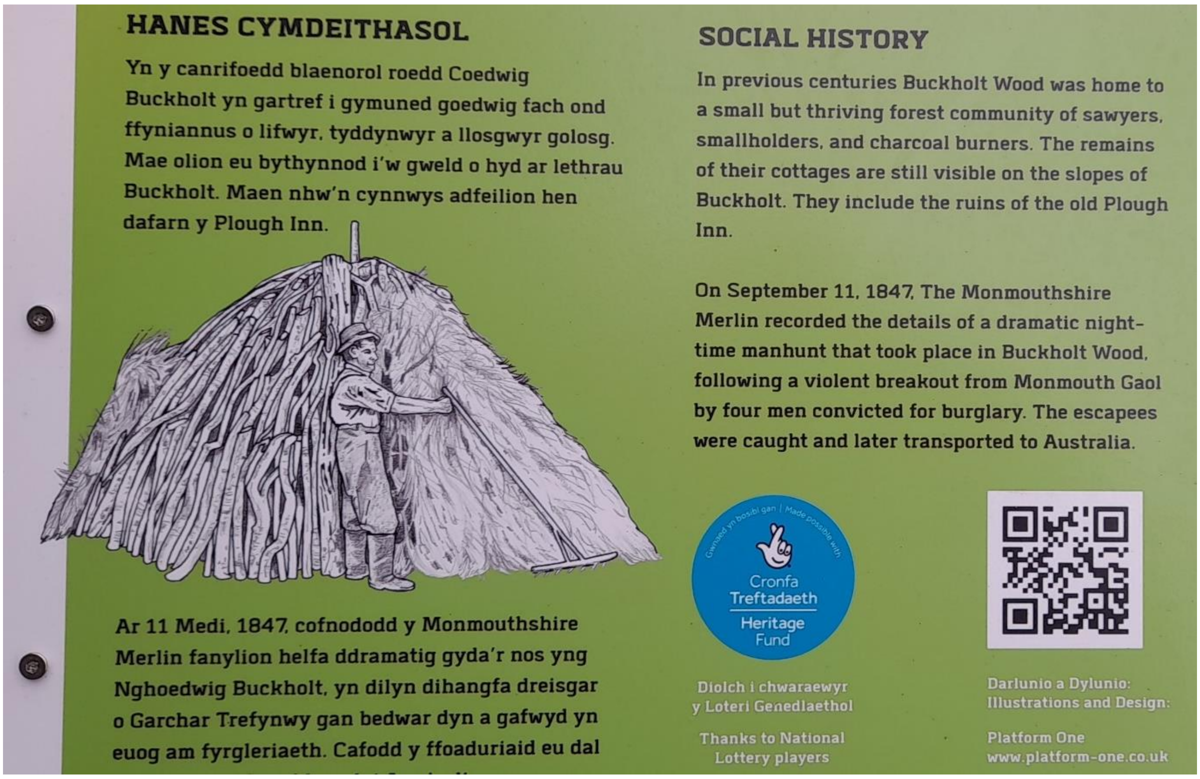



**Fig. 14** Charcoal production at Buckholt Wood as illustrated by Platform One on the new (prescient?) information panel funded by the National Lottery Heritage Fund, located where the linear north-east to south-west modern footpath crosses the north-eastern enclosure banks and ditches (see also fig. 2, above).

The author of this report is most grateful to Simon Maddison of Chepstow Archaeological Society for producing the Lidar presented here by applying a technique called Sky View Factor (SVF). He has used the latest 1m Welsh lidar which covers the Buckholt Wood hilltop site, and it seems to have successfully penetrated the woodland to the east of it. Simon notes that it would be possible to generate GPS coordinates for all the features revealed, which would aid tracking them on the ground.

The circular feature identified in the 20m x 20m geophysical survey grid is visible in the Lidar data (cf. figs 15 & 16, below, and fig. 8, above). Wider landscape interrogation using this Lidar data suggests that several very similar features exist across the hill, within and outside the enclosure. These seem to form a pattern that could be interpreted as a line along the scarp edge then through the enclosure, including the feature surveyed here, a line on the acclivity beneath the enclosure, and more similar features approximately 150 from the scarp-edge row, forming a parallel line to the north-east. These, and their spacing, may be linked to historical woodland management and its charcoal production. The 4m diameter and 1.5m high experimental wood stack clamp constructed by Powell, Wheeler and Batt (2002: 1199) required 4 tons of British hardwood. If the feature surveyed here is indeed a charcoal production site, its date is likely to be medieval or post-medieval to early modern.

Whilst the Lidar data suggests that the *c*. 10m diameter feature surveyed here is sufficiently similar to the other features noted across the wood to be considered to be similar in nature and date to them, ground-truthing the geophysical anomaly with a small archaeological excavation trench following GPS location should rapidly resolve its precise nature, and hopefully provide sufficient evidence to date it (e.g., through Radiocarbon Dating).

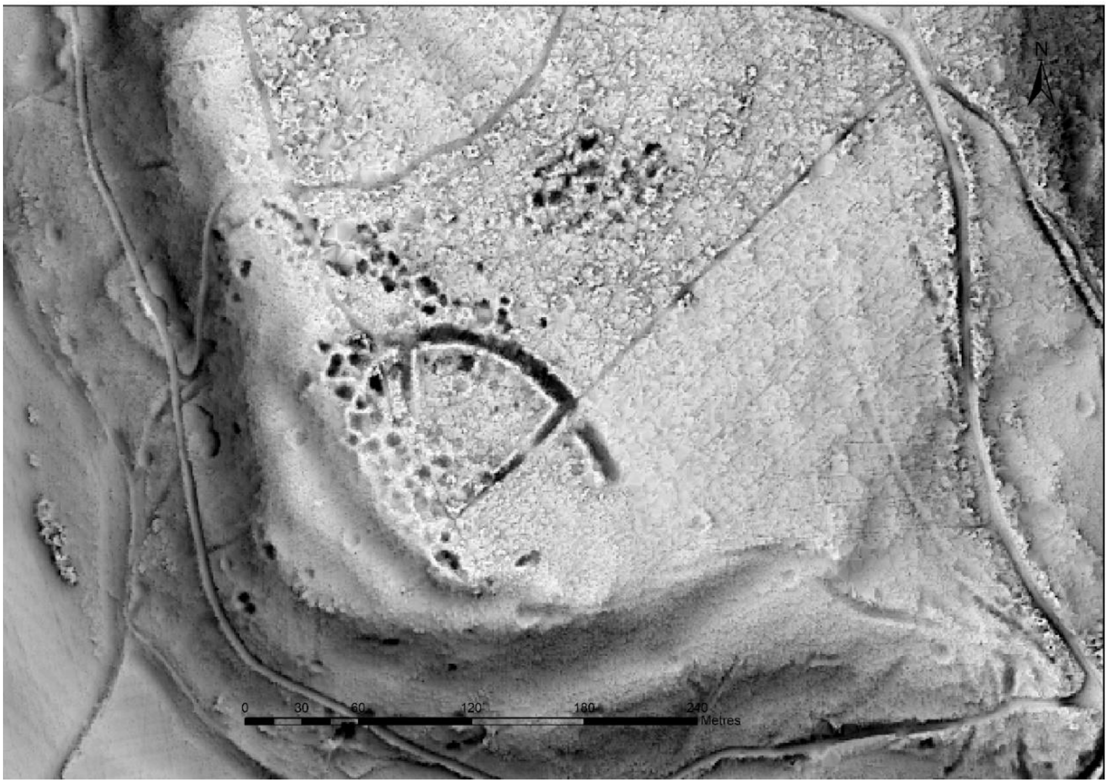



**Fig. 15** Lidar data (Sky View Factor (SVF) applied) processed and kindly supplied by Simon Maddison CEng FIET FBCS. North at top of image. Contains public sector information licensed under the Open Government Licence v3.0.

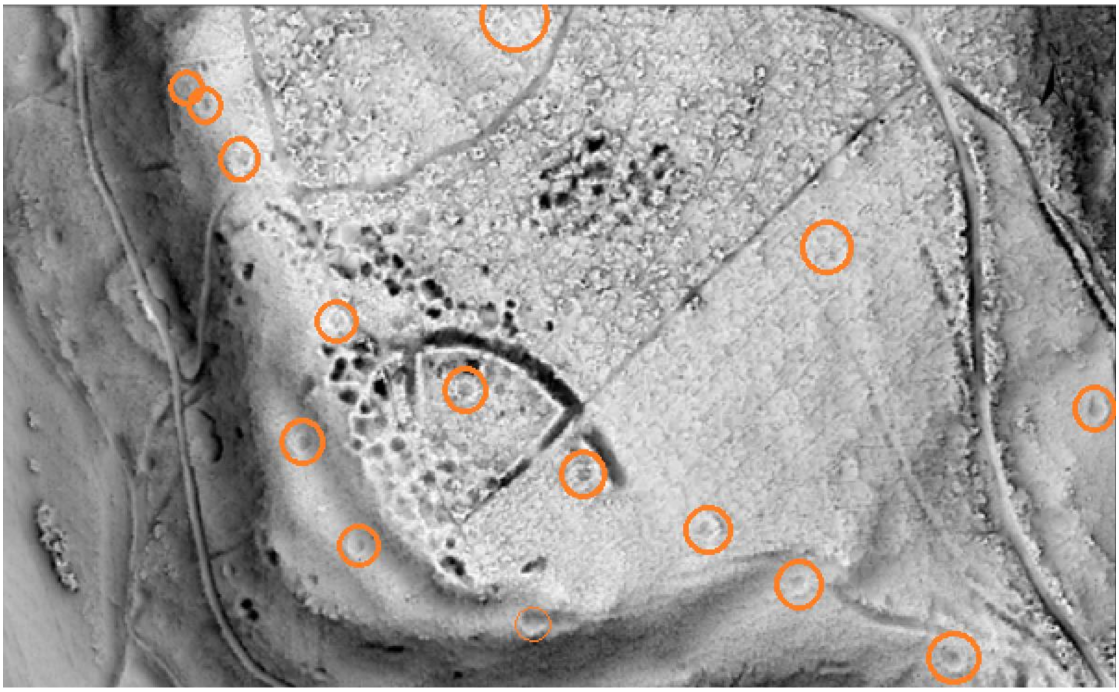


**Fig. 16** Lidar data (processed and SVF applied by Simon Maddison) for the hilltop enclosure site and its environs with similar features circled by Mark Lewis. North at top of image. Contains public sector information licensed under the Open Government Licence v3.0.

# Appendix

## A Wenner Array line survey pseudosection across a rectangular hollow within the north side of the enclosure ditch.

A shallow rectangular *c.* 3.1m long, 1m wide, hollow at the base of the ditch on the north side of the enclosure is believed to be a backfilled trench that was excavated by students of Woolwich Polytechnic College during the 1970s when the site was surveyed by them with Barry James (who taught there), but, as far as is known, never written up or published (Stephen Clarke, Tessa Steel and Janet Bailey, personal communications. See also Clarke (2008: 146) and see fig. 17, below). Tessa Steel and Janet Bailey also report that a number of these features may be observed, at intervals, around the enclosure ditch between its ramparts.

## Wenner Array methodology

15 small stainless steel electrodes were inserted approximately 5cm into the ground with 0.5m between each of them to create a pseudosection length of 7m, centred on but exceding the length of the identified rectangular feature. 50m copper cored cables were used to connect sequences of four of the electrodes to a Frobisher TAR 3 resistivity meter (Line Mode). The end electrodes of the array were located part way up the adjacent banks, *c.* 1.6m (southern) and 1.4m (northern) above the base of the feature (fig. 17).

**Fig. 17** (Left) scuffed leaf mould showing the ends of a rectangular depression bisecting the north-eastern section of the enclosure ditch located *c.* 38.5m from the centre of the footpath on the causeway entrance on the north-western edge of the enclosure (shown in yellow, right).

# Results

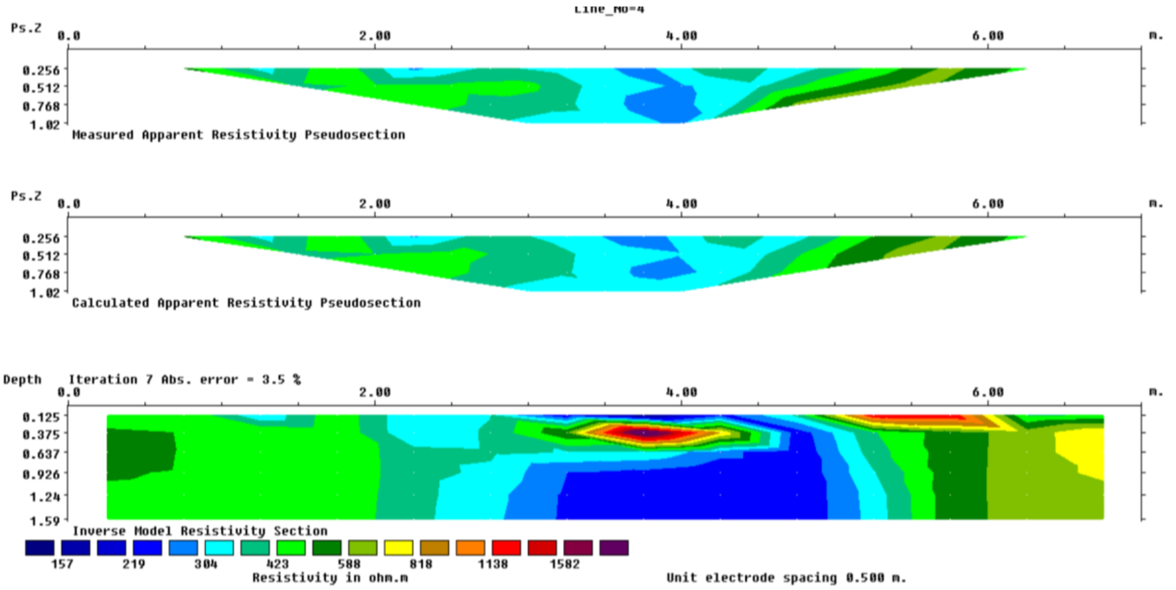



**Fig. 18** The Wenner Array pseudosection, processed using Res2Dinvx64 software by Mark Lewis with no additional processing.

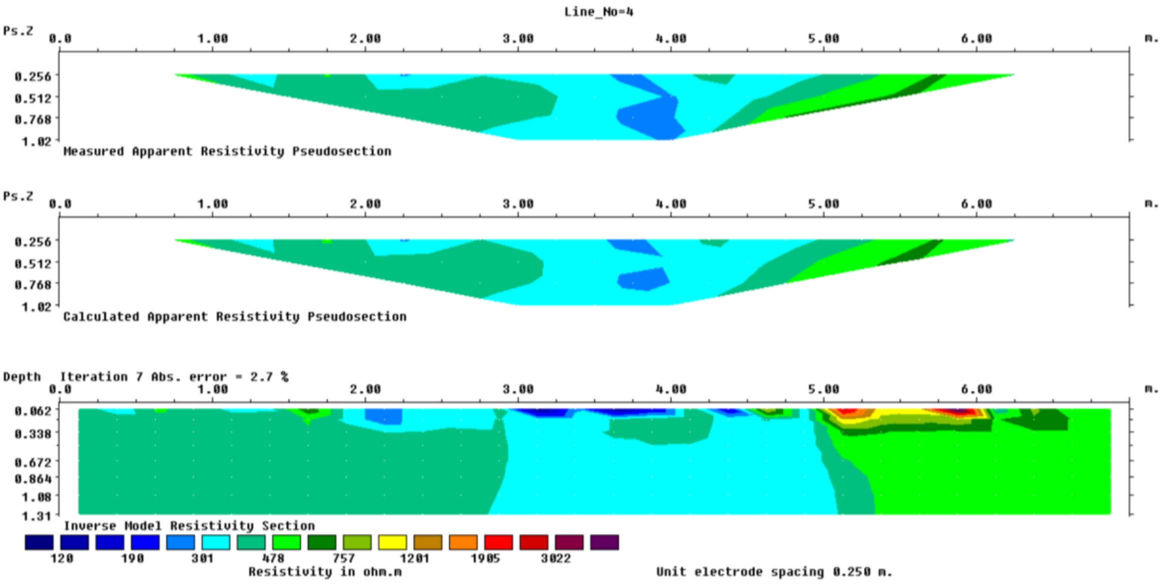



**Fig. 19** The Wenner Array pseudosection, processed using Res2Dinvx64 software by Mark Lewis with discretisation using a half-spacing transform.

## Interpretation

The Wenner Array pseudosection produced using a 7m long line of 15 electrodes (0-14) was not of sufficient length to produce data from the bottom of the feature (fig. 18). Nonetheless, even without plotting the electrode locations as per the profile of the ditch with its banks on either side, the results, plotting the electrodes as a horizontal plane, using a 0.5m electrode spacing, do suggest the presence of a backfilled excavation trench with mostly damp, conductive, soil and relatively little stone other than a thin, flat, layer just below the surface. Discretization (processing as a half spacing) can have an edge-sharpening effect on the data. Discretized data (half-spacing) is presented in fig. 19. It is also consistent with the presence of a trench not bottomed using the 15-electrode array. At face value, the (uncalibrated) data suggests a trench (and ditch bottom) depth exceeding 1.02m. More accurate information from depths exceeding 1m, with the potential to bottom the feature, might be attainable using a longer line of electrodes centred on the feature (e.g., an array of 30, or more, electrodes).

## References

Clarke, Stephen, 2008. **Down the Dig: Monmouth – An Adventure in Archaeology.** Monmouth Archaeological Society. ISBN 978-0-9558242-1-0

Powell, Alan J., Wheeler, Jane and Batt, Cathy M., 2012. Identifying archaeological wood stack charcoal production sites using geophysical prospection Magnetic characteristics from a modern wood stack charcoal burn site. **Journal of Archaeological Science** Volume 39, Issue 5, 1197-1204. https://www.researchgate.net/publication/257154725_Identifying_archaeological_wood_stack_charcoal_production_sites_using_geophysical_prospection_Magnetic_characteristics_from_a_modern_wood_stack_charcoal_burn_site/link/5c531818a6fdccd6b5d75186/download

Schmidt, A., 2007. Archaeology, magnetic methods. In D. Gubbins and E. Herrero-Bervera (eds) **Encyclopedia of Geomagnetism and Paleomagnetism**: 23-31. Encyclopedia of Earth Sciences Series Heidelberg, New York: Springer. https://www.researchgate.net/figure/Medieval-charcoal-production-site-in-Eskdale-Cumbria-a-Magnetic-susceptibility-survey_fig1_228666190

Townley, Elizabeth L., 2004. **The Medieval Landscape and Economy of the Forest of Dean.** Dissertation submitted to the University of Bristol for the Degree of Doctor of Philosophy. https://research-information.bris.ac.uk/en/studentTheses/the-medieval-landscape-and-economy-of-the-forest-of-dean, accessed 21/10/23.

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