CAWRENCE ENCLOSURE, CEREDIGION: GEOPHYSICAL SURVEY 2011

Prepared by Dyfed Archaeological Trust
For CADW

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Cadw

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CAWRENCE ENCLOSURE, CEREDIGION: GEOPHYSICAL SURVEY 2011

CONTENTS **PAGE**

FIGURES

PHOTOS

CAWRENCE ENCLOSURE, CEREDIGION: GEOPHYSICAL SURVEY 2011

SUMMARY

Cawrence is one of the best known and most commonly illustrated cropmark enclosures in southwest Wales (PRN 11267, SN226456). However, it is in intensive agricultural regime, and is subjected to annual ploughing and to a three to four year cycle of fertilisation involving deep ploughing and injecting milk waste into the ground. The survival of such sites in more aggressive agricultural regimes has not been tested in southwest Wales. This project was designed to examine damage and survival on this potentially very important site using information gained in the 2004-07 surveys of pastureland sites (Murphy & Manwaring 2004; Murphy, Ramsey & Page 2006) as a control, and also to provide data for the long-term monitoring of damage to and condition of the monument.

Cadw commissioned Dyfed Archaeological Trust to undertake the geophysical survey of the cropmark enclosure and a programme of small-scale test-pitting. The fieldwork was undertaken in September 2011

The geophysical survey records very clear evidence of a ditched enclosure with a smaller internal enclosure. Such enclosures are typically dated to the Iron Age. The main entrance appears to have been via a wide opening in the outer enclosure to the southwest, on the lowest ground, funnelling into the inner enclosure. The survey results also suggest a more complex arrangement of entranceway structures and features surviving at this point. There is a second smaller entranceway into the outer enclosure to the northeast, again with further entranceway features surviving. A possible third entrance was also recorded to the south. Within the enclosure there are suggestions of further archaeological activity, although these are difficult to pick out with any certainty, and may represent a mix of archaeological activity and more naturally occurring changes in the underlying geology. There was the suggestion of a possible prehistoric circular structure within the inner enclosure.

The strength and clarity of the survey results suggests good survival of cut archaeological features, in particular the enclosure ditches and postholes or pits associated with the main entranceway. There is also the suggestion of some more ephemeral cut features surviving, along with the survival of formerly raised archaeological deposits and archaeological layers such as earth banks.

The test pits demonstrate a consistent depth of ploughsoil across the site, of between 0.25m and 0.3m. Evidence indicates that ploughing has consistently cut into the underlying bedrock deposits. This suggests that the majority of upstanding archaeological features and layers along with the more ephemeral cut features are likely to have been previously removed or substantially damaged by the ploughing regime, leaving only the more substantial cut features. The visibility of the above ground features in the survey results has probably occurred due to the ploughsoil in these areas containing a higher concentration of material derived from the former earth banks, and thus creating a difference in the survey readings.

As the field has been subjected to regular intensive ploughing it seems unlikely that the state of preservation of the remaining features will change in the short term. However, as the site lies on a gradual slope it is possible that soil creep over time to the lower slopes will expose deeper deposits on the higher ground to plough damage over the medium term.

INTRODUCTION

Project commission

Cawrence is one of the best known and most commonly illustrated cropmarked enclosures in southwest Wales (PRN 11267, SN226456). However, it is in intensive agricultural regime, and is subjected to annual ploughing and to a three to four year cycle of fertilisation involving deep ploughing and injecting milk waste into the ground. In October 2005 it was noted that deep ploughing was bringing clay subsoil to the surface, almost certainly damaging underlying archaeological deposits associated with the cropmark enclosure. The survival of archaeological remains on cropmark defended enclosures in semi-permanent pasture was previously assessed in 2004-2007 by a series of surveys and evaluations (Murphy & Manwaring 2004; Murphy, Ramsey & Page 2006), but survival in more aggressive agricultural regimes had not been tested. This project was designed to examine damage and survival on this potentially very important site using information gained in the 2004-07 surveys as a control, and also to provide data for the long-term monitoring of damage to and condition of the monument.

Cadw commissioned Dyfed Archaeological Trust to undertake the geophysical survey of the cropmark enclosure in the hope of identifying and characterising possible buried archaeological remains. Due to a short window of opportunity to undertake the archaeological fieldwork within the agricultural regime geophysical survey was to be immediately followed by small-scale test-pitting. The information from the archaeological fieldwork could then aid in informing long term monitoring of damage and condition.

The fieldwork was undertaken in September 2011.

Scope of the project

The project aim was to characterise by geophysical survey, using a gradiometer, and small-scale test-pitting, possible buried archaeological features in the area of, and in particular relating to, the cropmark enclosure. The information from the survey would be used in assessing the impact of an intensive agricultural regime on a defended enclosure and informing long term monitoring of damage and its condition.

In addition to clarifying the character of the site, the project offered an opportunity to address the issue of settlement and land use, identified in the Later Bronze Age and Iron Age section of the Introducing a Research Framework for the Archaeology of Wales. The work will also allow the enhancement of the Dyfed Historic Environment Record (HER).

Report outline

Because of the limited nature of this project, together with the considerable archaeological evidence in the wider area, this report is restricted solely to the results of the geophysical survey and subsequent test-pitting.

Abbreviations

Sites recorded on the Regional Historic Environment Record (HER) are identified by their Primary Record Number (PRN) and located by their National Grid Reference (NGR). Gradiometer readings are measured in nanoTesla (nT).

Timeline

The following table illustrates the approximate dates for the archaeological periods discussed in this report:

PERIOD	APPROXIMATE DATE
PALAEOLITHIC	*c.*120,000 BC – *c.*10,000 BC
MESOLITHIC	*c.*10,000 BC – *c.*4400 BC
NEOLITHIC	*c.*4400 BC – *c.*2300 BC
BRONZE AGE	*c.*2300 BC – *c.*700 BC
IRON AGE	*c.*700 BC – *c.*43 AD
ROMAN	*c.*43 AD – *c.*410 AD
EARLY MEDIEVAL	*c.*410 AD - *c.*1066
MEDIEVAL	*c.*1066 - *c.*1536
POST MEDIEVAL	*c.*1536 – *c.*1900
MODERN	*c.*1900 onwards

Table 1: Archaeological and historical timeline

THE SITE

Location and Archaeological Potential

The site is located in an undulating agricultural landscape *c.*4.5km to the east of Cardigan, in south Ceredigion (Figure 1). The cropmark enclosure itself lies on a gentle west-facing slope at 100m above sea level, just below the summit of the high ground (SN226456). It is situated *c.*400m to the northeast of Cawrence Farm, but on land belonging to Dyffryn Farm (*c.*400m further to the northeast). The land drops away to the west to Nant Arberth, running down a narrow valley to feed the Afon Teifi at Llechryd *c.*2km to the south. The fields around Dyffryn Farm are large arable fields, divided by hedgebanks. The main farm lane to Dyffryn Farm curves around to the north and west of the cropmark enclosure.

At the time of the survey the field was covered by recently cut low stubble, crossed by low ploughing ridges (Photos 1 – 4). Ploughing ready for sowing a winter crop was due to take place shortly after the completion of the archaeological fieldwork.

The cropmark enclosure (PRN 11267) was first identified in 1985 from earlier aerial photographs. More recent aerial photography has better illustrated the site (Figure 4), and it has become one of the best known and most commonly illustrated cropmark enclosures in southwest Wales, but otherwise has not previously been archaeologically investigated.

The aerial photograph shows an inner enclosure defined by a cropmark ditch, sub-circular in shape, measuring approximately 40m north - south and 30m east - west, with a simple west-facing entrance. Ditches run out to the west from the inner enclosure entrance, presumably flanking a trackway. These ditches seem to terminate before reaching the entrance of the outer enclosure. The ditch of the sub-circular concentric outer enclosure lies between 20m and 35m from the inner ditch. The ditch terminals at the west-facing entrance are slightly in-turned and expanded. There is a second entrance through the outer ditch on the northeast side. There are no earthworks or other surface indications of this site.

The enclosure is not marked on any early map sources, although the First Edition Ordnance Survey map of 1888 (Figure 3) shows a field boundary crossing the field immediately to the east of the enclosure, and a small cottage in the corner of the field to the west, called Llwyn-ffynnon, with a spring close by.

The underlying geology consists of interbedded argillaceous rocks and sandstone, overlaid by freely draining slightly acid soils.

METHODOLOGY

A fluxgate gradiometer was used for the survey, which detects variations in the earth's magnetic field (full specifications are in Appendix 1). Readings were mostly taken at a high resolution on traverses 0.25m wide and every 0.25m within a 20m x 20m grid across the site. Due to time restrictions from the agricultural regime, part of the site was surveyed at a medium resolution on traverses 0.5m wide. In total an area of 2.12ha was surveyed. Surveying was immediately followed by small-scale test-pitting. A total of seven test pits were excavated across the feature, each measuring 1m by 1m and excavated down to the base of the ploughsoil. A Trimble TST was used to tie the grid and locations of the test pits into the local Ordnance Survey grid.

Limitations

The survey was undertaken over a total of four days in September 2011, with the subsequent test-pitting undertaken on a single day. Weather conditions were fine and generally dry with the occasional brief shower and strong winds. The fields were bounded by hedgebanks, which do not appear to have obscured readings taken in their immediate vicinity. The field had clearly been regularly ploughed, evidence of which is visible on the survey results. There was a gradual slope down to the west across the site, however, pacing lines were used throughout the survey and any variations in the data collections are likely to have been small.

The underlying geology and soils did not appear to cause any geological distortions of the geophysical survey results.

Processing and presentation

Processing was performed using *ArchaeoSurveyor 2.5*, detailed explanation of the processes involved are described in Appendix 1. The survey was undertaken in two parts, one at 'high' resolution, and one at 'medium' resolution, but both surveys were processed in the same way. The data is presented with a minimum of processing (Figures 5 & 7), but the presence of high values caused by ferrous objects tends to hide fine details and obscure archaeological features, thus the values were 'clipped' to remove the extreme values allowing the finer details to show through. The survey was clipped to a range from 10nT to –10nT. During the survey the presence of small surface iron anomalies, typically deriving from modern material, causes spikes in the data. These have been removed using median values.

The processed data is presented as grey-scale plots overlaid on local topographical features (Figures 2, 5 & 7). The main magnetic anomalies have been identified and plotted onto the local topographical features as a level of interpretation (Figure 6).

All measurements given are approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.

RESULTS

Geophysical Interpretation (Figures 5 to 7)

The geophysical survey shows a complex range of archaeological activity throughout the surveyed area, therefore only the major features are discussed. Any interpretation from these geophysical results is by its nature speculative and precise details about the context, function, state of preservation and date of any archaeological features would require further intrusive investigation.

Modern features

Striping across the entire survey area is apparent, generally in a west-northwest – east-southeast direction. This is caused by modern ploughing across the site and is apparent on the surface of the field as low narrow plough ridges and furrows.

Crossing the survey area in a straight line from north-northwest to south-southeast is a linear feature identified as two parallel lines of magnetically positive readings (dark) with an area of magnetically negative readings (light) in between. This feature corresponds closely to the former field boundary that is visible on the First Edition Ordnance Survey map of 1888 (Figure 3). It is likely the magnetically positive reading represent ditches on either side of a former hedgebank represented by the magnetically negative readings.

The Outer Enclosure Ditch

Strong positive magnetic responses clearly define the curvilinear ditch of the outer enclosure. This encloses a sub-circular area roughly 85m east-west by 100m north-south (an area of 0.74ha), with a slightly flattened northern edge. It also becomes more flattened to the southwest where a break of *c.*6m in the line of the ditch appears to represent the main entrance into the enclosure (see below). At this point the outer enclosure ditch appears to terminate by turning inwards slightly and enlarging. As this slight enlargement is also seen on aerial photography it presumably represents an actual enlargement in the size of the ditch terminals, rather than a higher response in the survey readings to any specific infilling material within the terminals.

To the northeast lies a second gap in the outer ditch, presumably representing another, smaller entrance into the outer enclosure. There is no apparent change in the line of, or size of the outer ditch at this point, but other features visible at this point also suggest this represents another entranceway (see below).

To the south lies a similar gap in the typically strong readings from the outer enclosure ditch. This gap is of a similar size to the northeast entrance, and readings from the gap itself are also similar to those from the gap to the northeast. It is possible therefore that this represents a third entrance into the outer enclosure, however this is not as apparent on the aerial photographs of the site and there also appear to be no associated features, as are apparent to the northeast. It remains a possibility, therefore, that this gap is representative of differing infilling material of a change in the depth of the outer ditch affecting the geophysical survey results.

Magnetically negative responses (lighter) appear to line both the inner and outer edge of the dark band of the outer enclosure ditch. Such magnetically negative responses often represent features such as raised banks, as can be seen in the more recent ploughed-out field boundary to the east. It is possible therefore that these readings represent remnants of an associated ploughed-out

bank on either side of the outer ditch. However, the relatively sharp distinction between the magnetically positive and negative readings may indicate these negative responses represent 'shadows' from the strength of the positive magnetic response of the ditch itself rather than representing banks in themselves (a common geophysical survey phenomena.

The Inner Enclosure Ditch

As with the outer ditch the inner enclosure ditch is clearly defined by curvilinear magnetically positive readings. The ditch encloses a sub-circular area roughly 35m by 40m (an area of 0.13ha), with a flattened north-eastern side. On the southwest side there is a gap of *c.*7m facing the main entrance in the outer enclosure. The ditch does not terminate here, but turns sharply towards the outer enclosure, splayed outwards to create a funnelled entrance corridor into inner enclosure. These ditches appear to terminate *c.*5m from the outer enclosure ditch terminals.

The Main Entrance

The main entrance to the site appears to lie to the southwest, topographically the lowest part of the enclosure. As mentioned above this entrance is represented in the outer enclosure by slightly in-turned and enlarged ditch terminals and a gap *c.*6m wide. After an apparent gap of *c.*5m, the inner enclosure ditch forms a funnelled entrance corridor into the inner enclosure proper (Figure 7).

There are however several other discrete features in and around these entrances that may be related to entranceway structures. To the west of the outer ditch lie several discrete areas of magnetically positive responses. Such responses are often indicative of cut features, which may be archaeological in origin such as pits or postholes. Two in particular appear almost regular placed *c.*11m beyond the outer enclosure and on either side of the entranceway.

Within the entrance through the outer enclosure ditch itself are further similar magnetic responses that again may be indicative of archaeological features such as pits or postholes. Their location within and symmetry with the entrance may be an indication of some form of gateway or entrance structure.

A similar arrangement of discrete positive magnetic responses is also seen within the bounds of the entranceway into the inner enclosure. At this point two discrete anomalies lie adjacent to each other, seemingly placed centrally within the entrance gap, but set a short distance within the inner enclosure.

Distinctive areas of mixed negative magnetic readings lie in the space between the end of the splayed entrance of the inner enclosure ditch, and the line of the outer enclosure ditch. Specific features are difficult to pick out in this area, but the distinctive negative readings suggest this may be an area of general archaeological activity.

The Northeast Entrance

There is no apparent change in the terminals of the outer enclosure ditch around the small entrance to the northeast, but an area of slightly magnetically positive readings lie within the gap and extend beyond the line of the enclosure ditch. This may indicate trampled ground, or possibly a buried deposit around the entrance.

Set *c.*6m in from the outer enclosure ditch is a linear feature represented by magnetically positive readings running parallel to the outer enclosure ditch and extending for *c.*15m. There also appear to be two discrete 'spikes' where the magnetically positive readings are significantly higher than those for the rest of the linear feature. The readings drop off steadily to the northwest. It is unclear what this represents, but it is possible this may be some form of inner boundary ditch with post-settings.

Outer Enclosure Features

There are several discrete areas of magnetically positive responses from within the bounds between the inner and outer enclosure ditch. Such responses could be indicative of cut archaeological features such as pits or postholes. However, it is difficult to categorise such a spread of responses with no immediately obvious pattern. There appears to be a concentration of magnetically positive features around the southern edge of the outer enclosure. These features appear quite large, mixed with magnetically negative responses and spread beyond the limits of the enclosure in a somewhat irregular manner. In that respect it may be that these particular responses represent natural changes in the underlying geology or soils.

Similarly there is a concentration of magnetically positive reading in the northern area of the outer enclosure that may be indicative of an area of archaeological activity. However, these readings also appear to be concentrated within the lines of plough marks and may therefore be related to more recent agricultural activity.

There are faint suggestions of linear features within this outer enclosure. There is one that makes a large sub-circular area *c.*18m across, but these readings are rather ephemeral. There is also a second smaller one *c.*5m across close to the northeast entrance, although again the readings are rather ephemeral. It is possible these may represent archaeological features.

Inner Enclosure Features

Similarly there are a variety of magnetic readings from within the inner enclosure that may be indicative of a range of archaeological activity, but that do not appear to have obvious patterns to them (Figure 7).

When the survey is clipped further (-5nT to 3nT) there is the suggestion of a circular feature, *c.*7m in diameter, placed in the northern half of this inner enclosure. It is possible this represents the ephemeral remains of a circular structure, a round house, not uncommon on prehistoric sites of this nature.

Immediately to the south is an area of mixed magnetic readings that appear distinct from the typical background readings and plough marks. This may represent a concentrated area of archaeological activity, but more precise interpretations are difficult.

Features Exterior to the Enclosure

There is a spread of magnetic anomalies across the area surveyed beyond the obvious limits of the enclosure, but it is difficult to say with any certainty if these anomalies relate to archaeological features.

To the east of the enclosure it was felt that a further, possibly circular, feature was visible on the aerial photographs, hence the extension of the surveyed area at this point. There are clearly areas of strong magnetically

positive readings, some of which may be curvilinear in nature, but it is uncertain without further archaeological investigation if these readings correspond to archaeological features of more natural variations in the underlying geology and soils.

Immediately to the southeast of the enclosure is an area of positive magnetic responses that on initial examination were thought to pick out the four corners of a possible rectangular structure *c.*4m by *c*.6m with an internal area of slightly more magnetically negative readings. Adjoining this to the west was a small area of generally more positive magnetic readings. This may be indicative of an archaeological structure, however, it may not necessarily be associated with the enclosure itself as it also lies adjacent and is aligned parallel to the former field boundary that crosses the survey area.

Test Pits (Figure 8)

T1 (Photos 5 & 6)

Test Pit 1 (TP1) was located on the higher ground to the east, beyond the limits of the enclosure.

It contained a mixed ploughsoil of friable, mid grey-brown, clayey-silt, 0.3m thick, with frequent inclusions of medium to large sub-angular stone fragments, clearly derived from the underlying bedrock.

Below this was a thin deposit of mid orange-brown clayey-sand subsoil, covering bedrock of fragmented grey siltstone.

No finds were recovered.

T2 (Photos 7 & 8)

Test Pit 2 (TP2) was located within the outer enclosure.

This contained an almost identical ploughsoil deposit, slightly shallower at 0.25m deep. A few small fragments of 19th and 20th century pottery and one piece of clay-pipe stem were recovered from this deposit.

The underlying fragmented siltstone bedrock was more exposed below this deposit, with a thinner patchy veneer of light orange-brown clayey-sand subsoil. Ridges were visible within the bedrock, aligned roughly east-west. There was a slight rise to the east within the bedrock, corresponding to the current ground contours.

T3 (Photos 9 & 10)

Test Pit 3 (TP3) was located within the inner enclosure.

This contained a now clearly typical ploughsoil deposit, 0.28m thick, although compacted to 0.19m thick along the path of a tyre track. The stone content became more concentrated towards the base of this deposit.

Bedrock was clearly exposed throughout the test pit beneath the ploughsoil, with little or no clayey-sand subsoil covering.

No finds were recovered.

T4 (Photos 11 & 12)

Test Pit 4 (TP4) was located within the outer enclosure, just to the north of the main southwestern entrance.

This contained a typical ploughsoil deposit, 0.28m thick.

Below this was a consistent covering of mid orange-brown to light yellow-grey clayey-sand subsoil, containing abundant small to medium sized fragments of shattered bedrock. No other inclusions were noted. Bedrock was not exposed, but the stony nature of the subsoil suggests it is only a thin deposit overlying the bedrock.

No finds were recovered.

T5 (Photos 13 & 14)

Test Pit 5 (TP5) was located to the exterior of the enclosure to the west.

It contained a typical ploughsoil deposit 0.26m thick. One fragment of late 19th or 20th century pottery was recovered.

Underlying this was a typical thin subsoil deposit of mid orange-brown to light yellow-grey clayey-sand. However, small fragments of charcoal were apparent in small patches within this deposit. Bedrock became clearly exposed along the northern half of the test pit.

T6 (Photos 15 & 16)

Test Pit 6 was located within the outer enclosure to the north.

It contained a typical ploughsoil deposit 0.28m thick.

Below this was a typical thin deposit of light yellow-grey clayey-sand subsoil overlying partially exposed grey siltstone bedrock.

No finds were recovered.

T7 (Photos 17 & 18)

Test Pit 7 was located within the outer enclosure to the south.

It contained a typical ploughsoil deposit, 0.28m thick.

Below this was the thickest deposit of subsoil noted within the test pits. It consisted of a friable mid orangey-brown clayey-sand, at least 0.08m thick visible in the section. It contained frequent small to medium fragments of shattered bedrock. The bedrock itself was becoming exposed in the southwest corner.

Within this subsoil were darker brown curvilinear deposits of similar friable clayey-sand. The irregular and sometimes ephemeral nature of these deposits suggests they may be evidence of root activity.

No finds were recovered.

CONCLUSION

The geophysical survey records very clear evidence for the Cawrence cropmark as is visible on aerial photographs (eg Figure 4). The geophysical survey confirmed the cropmark comprises a sub-circular ditched enclosure with a smaller, roughly concentric internal enclosure. The main entrance appears to have been via a wide opening in the outer enclosure to the southwest, on the lowest ground, funnelling into the inner enclosure. The survey results also suggest a more complex arrangement of entranceway structures and features surviving at this point comprising pairs of pits or postholes arranged symmetrically with the entrance.

There is a second smaller entranceway into the outer enclosure to the northeast, again with further entranceway features surviving. A possible third entrance was also recorded to the south. Within the enclosure there are suggestions of further archaeological activity, although these are difficult to pick out with any certainty, and may represent a mix of archaeological activity and more naturally occurring changes in the underlying geology. There was the suggestion of a possible prehistoric circular structure within the inner enclosure.

Such an enclosure appears to fit into a type of site commonly dated to the Iron Age. The function of such enclosures has not been firmly established, many described as defensive settlement sites, although often they are viewed as associated with animal husbandry in pastoral economies, although clearly still surrounded by defensible earthworks. The funnelled entrance is believed to help channel animals into the central enclosure with human settlement concentrated within the outer enclosure, often around the main entrance.

The strength and clarity of the survey results suggests good survival of cut archaeological features, in particular the enclosure ditches and postholes or pits associated with the main entranceway. There is also the suggestion of some more ephemeral cut features surviving, along with the possible survival of some formerly raised archaeological deposits and archaeological layers, such ass former banks. A suggestion of an internal palisade is noted in the northeastern part of the enclosure.

The test pits demonstrate a consistent ploughsoil across the site, between 0.25m and 0.3m deep. Ploughing seems to have consistently cut into the underlying bedrock deposits, clearly evidenced by the quantity of broken bedrock found within the ploughsoil itself. Some pockets and areas of a covering subsoil are recorded above the exposed bedrock, but with one exception (T5), this also appeared to be naturally occurring and archaeologically sterile. This suggests that the majority of upstanding archaeological features and layers along with the more ephemeral cut features are likely to have been removed or substantially damaged by the ploughing regime, leaving only the more substantial cut features relatively intact. The visibility of formerly upstanding features, such as banks, within the geophysical survey readings, is likely to be as a result of higher concentration of material derived from the former earth banks being present in the ploughsoil, which has created a difference in the survey readings.

As the field has been subjected to regular intensive ploughing it seems unlikely that the state of preservation of the remaining features is going to change in the short term. However, as the site lies on a gradual slope it is possible soil creep downslope will occur overtime, through ploughing activity, reducing the depth of ploughsoil on the upper parts of the site. In the medium term, as the topsoil depth reduces, ploughing will cut progressively deeper into the underlying bedrock and this into the top of the buried archaeological features. No evidence for deterioration of the monument from the injecting of milk-waste as a fertilizer was indicted from the scope of work undertaken as pat of this project.

ACKNOWLEDGEMENTS

The survey was undertaken by Mike Ings and Phil Poucher of Dyfed Archaeological Trust. I am indebted to Mr D George for allowing access to his land.

ARCHIVE DEPOSITION

The archive will initially be held by DAT, before being passed to the National Monument Record, Aberystwyth.

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Murphy K, Ramsey R & Page M 2006 *A Survey of Defended Enclosures in Ceredigion 2006*. Dyfed Archaeological Trust Report 2006/20

Ordnance Survey 1888 1st edition 1;2500 Map, Cardiganshire XXXVIII.7

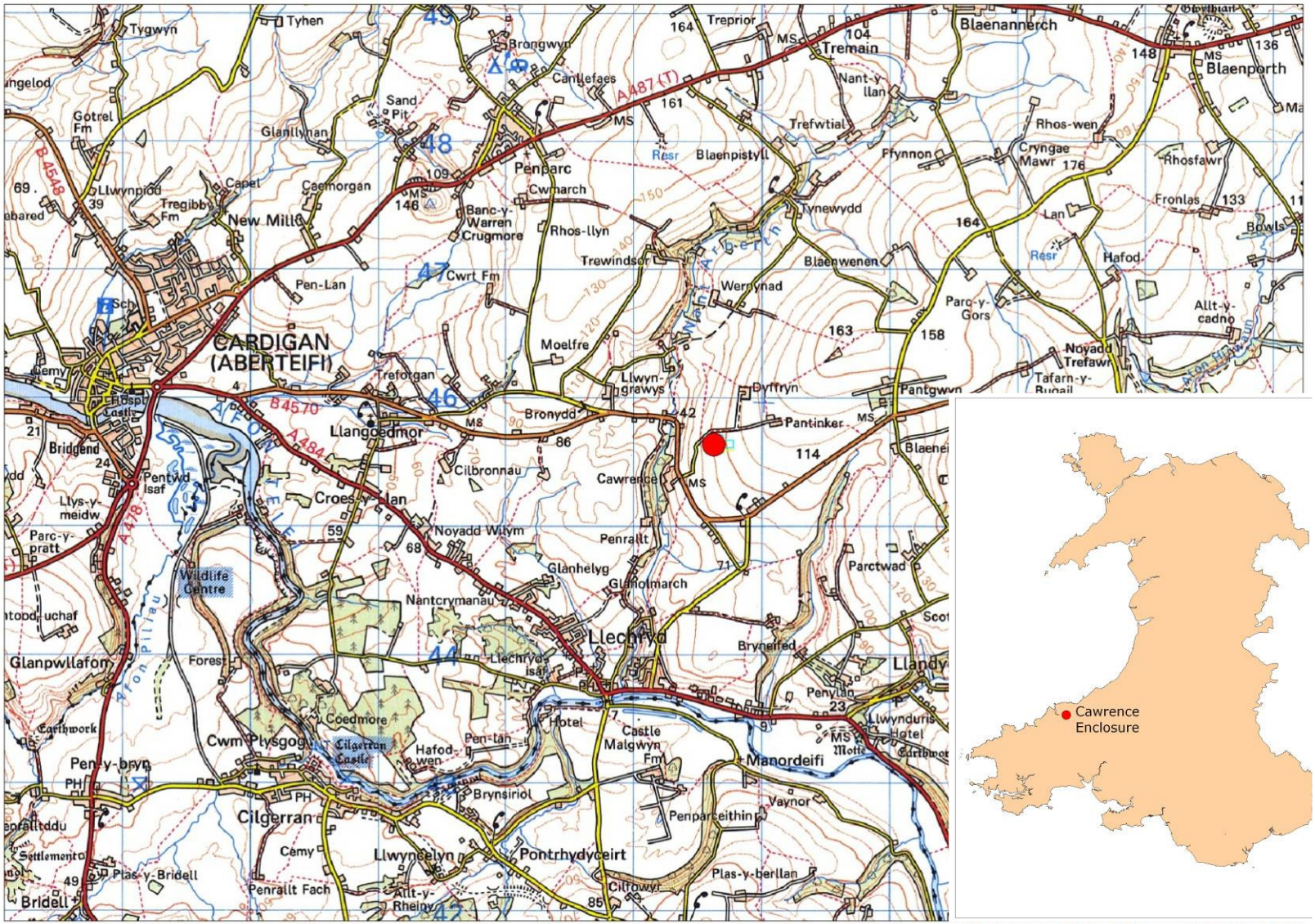

Figure 1: Location map, based on the Ordnance Survey.

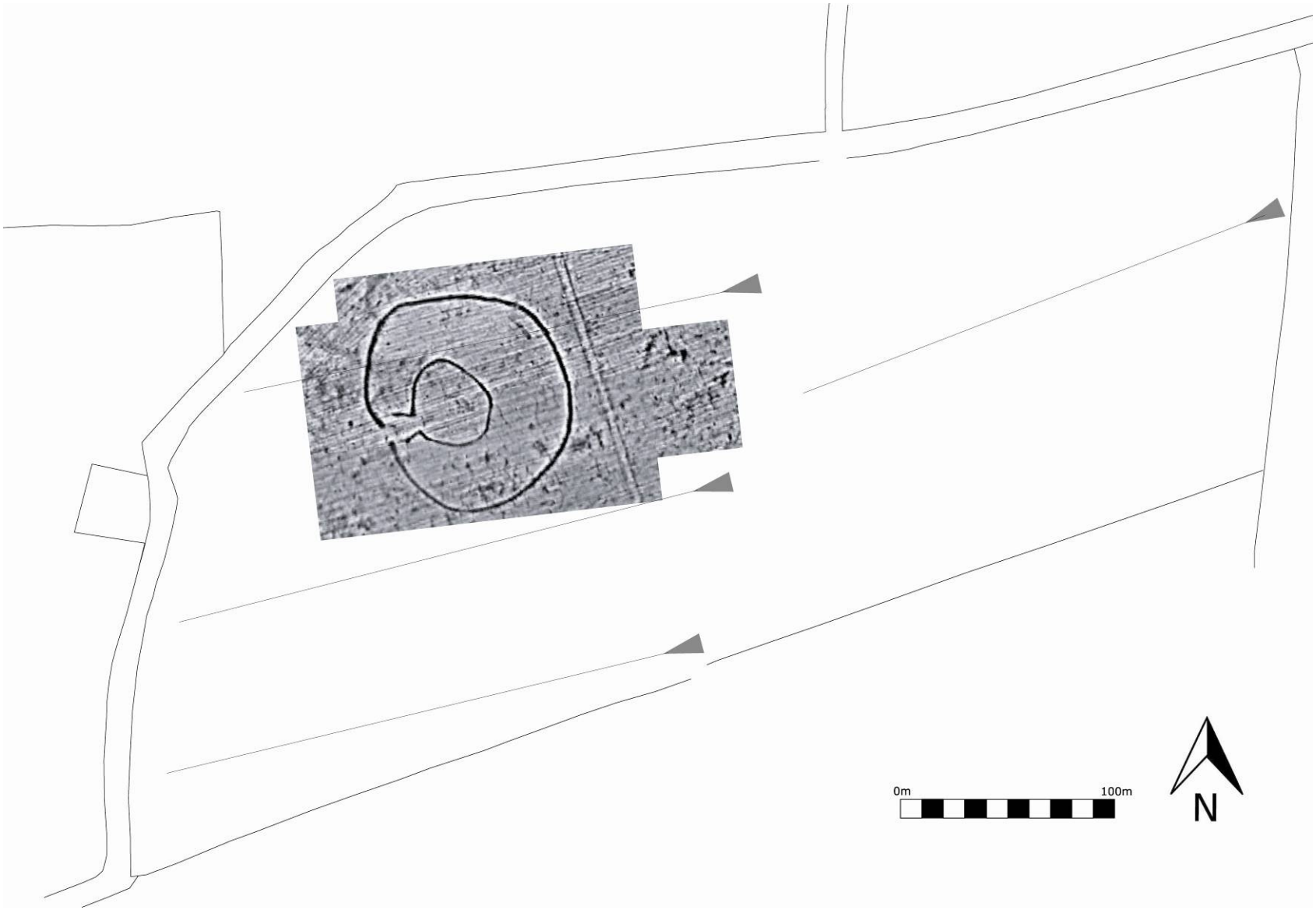

Figure 2: Location of survey area within the field. Hachures indicate general direction of slope.

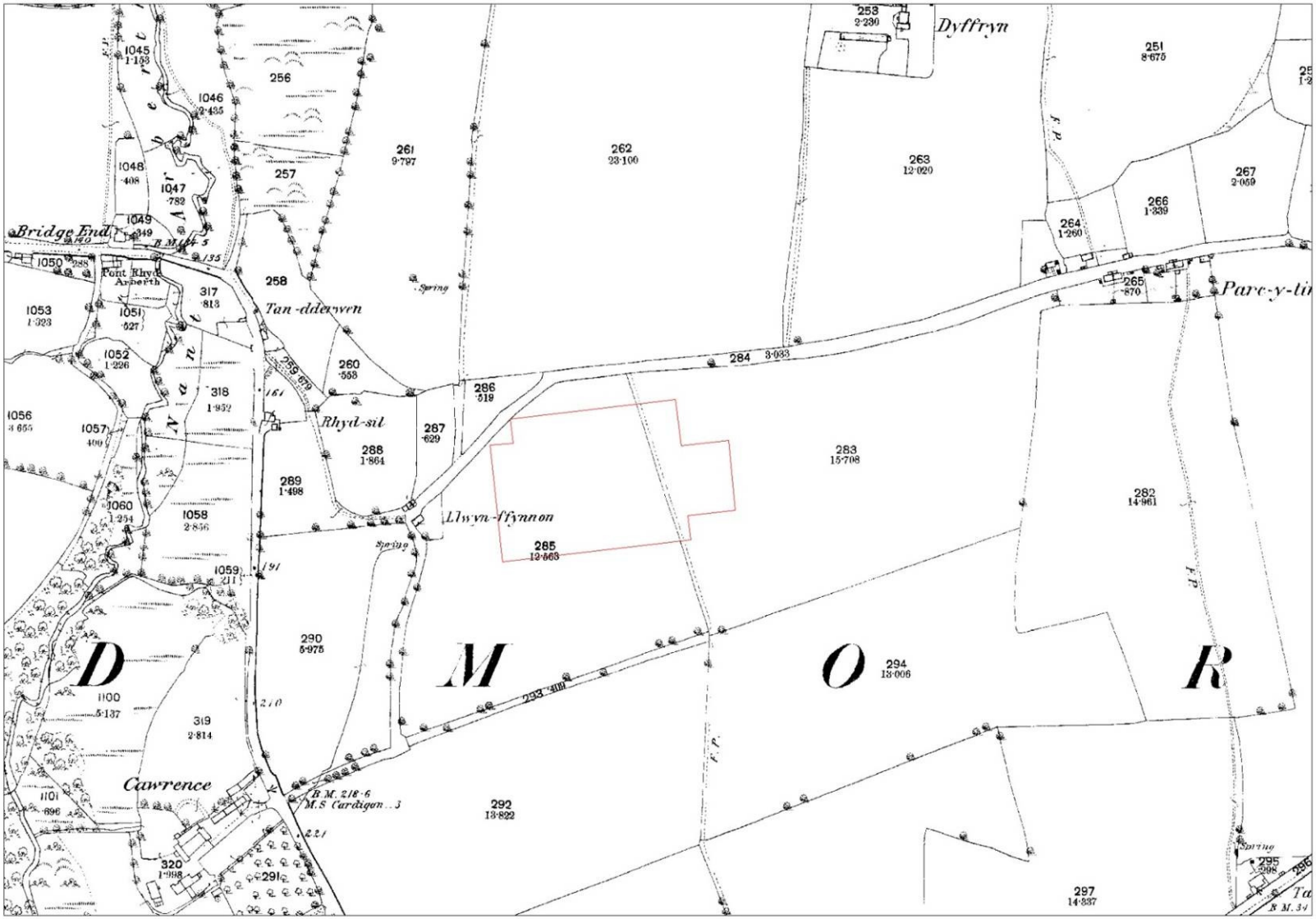

Figure 3: Extract from the 1st edition 1;2500 Ordnance Survey map of 1888. Survey area outlined in red.

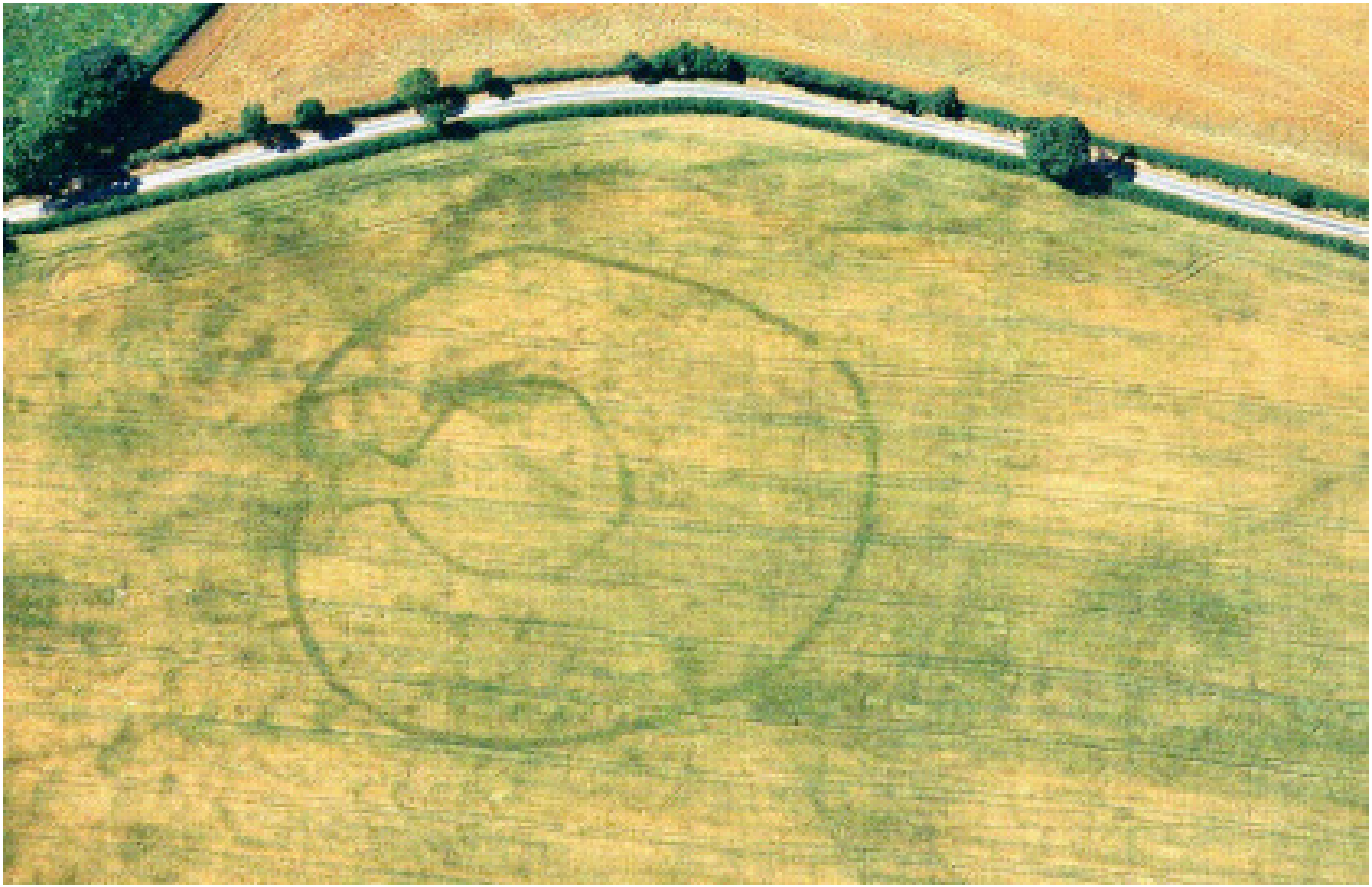

Figure 4: Aerial photograph of Cawrence Enclosure. Crown Copyright © reference 96-CS-1435

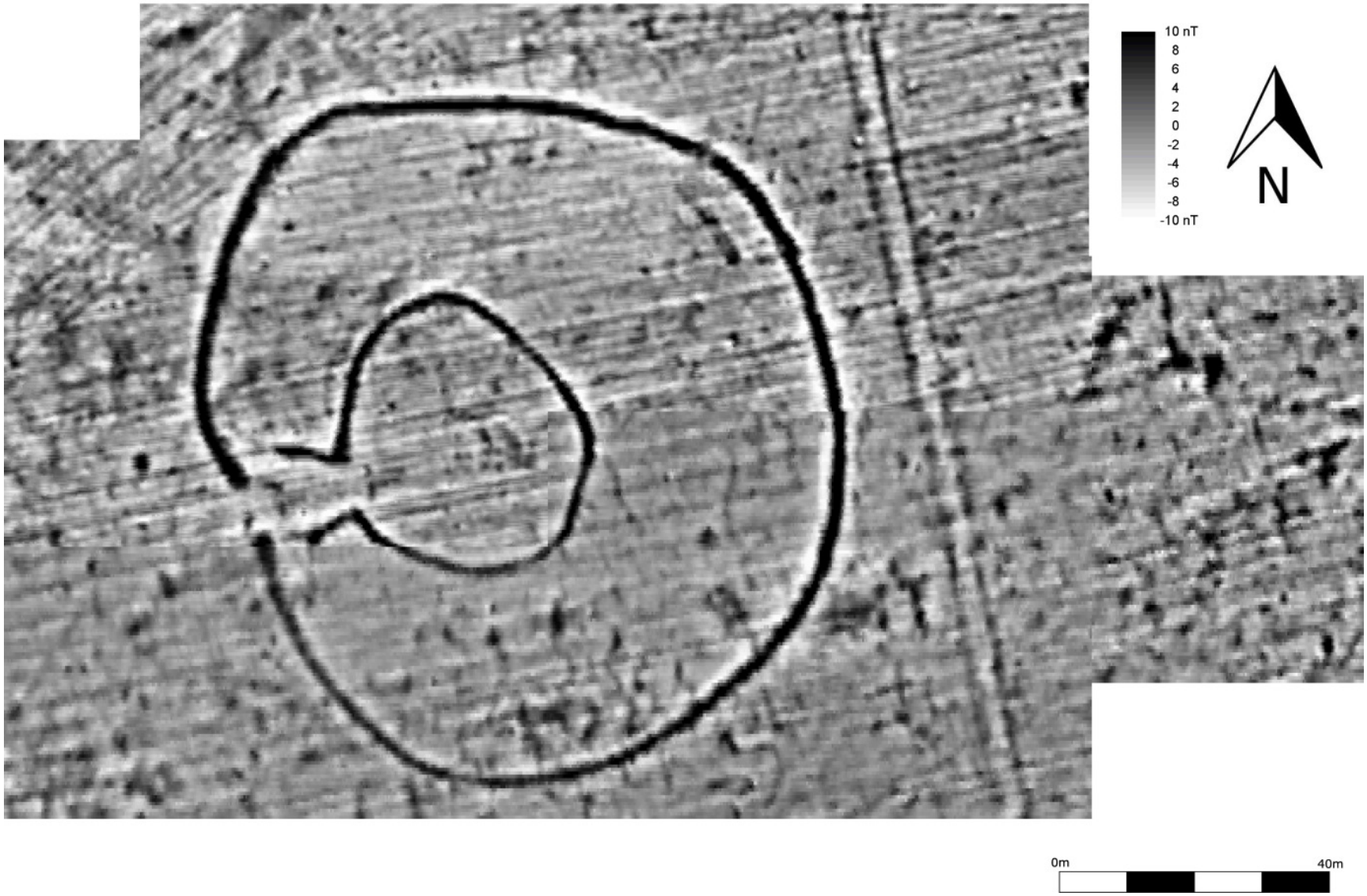

Figure 5: Geophysical survey results

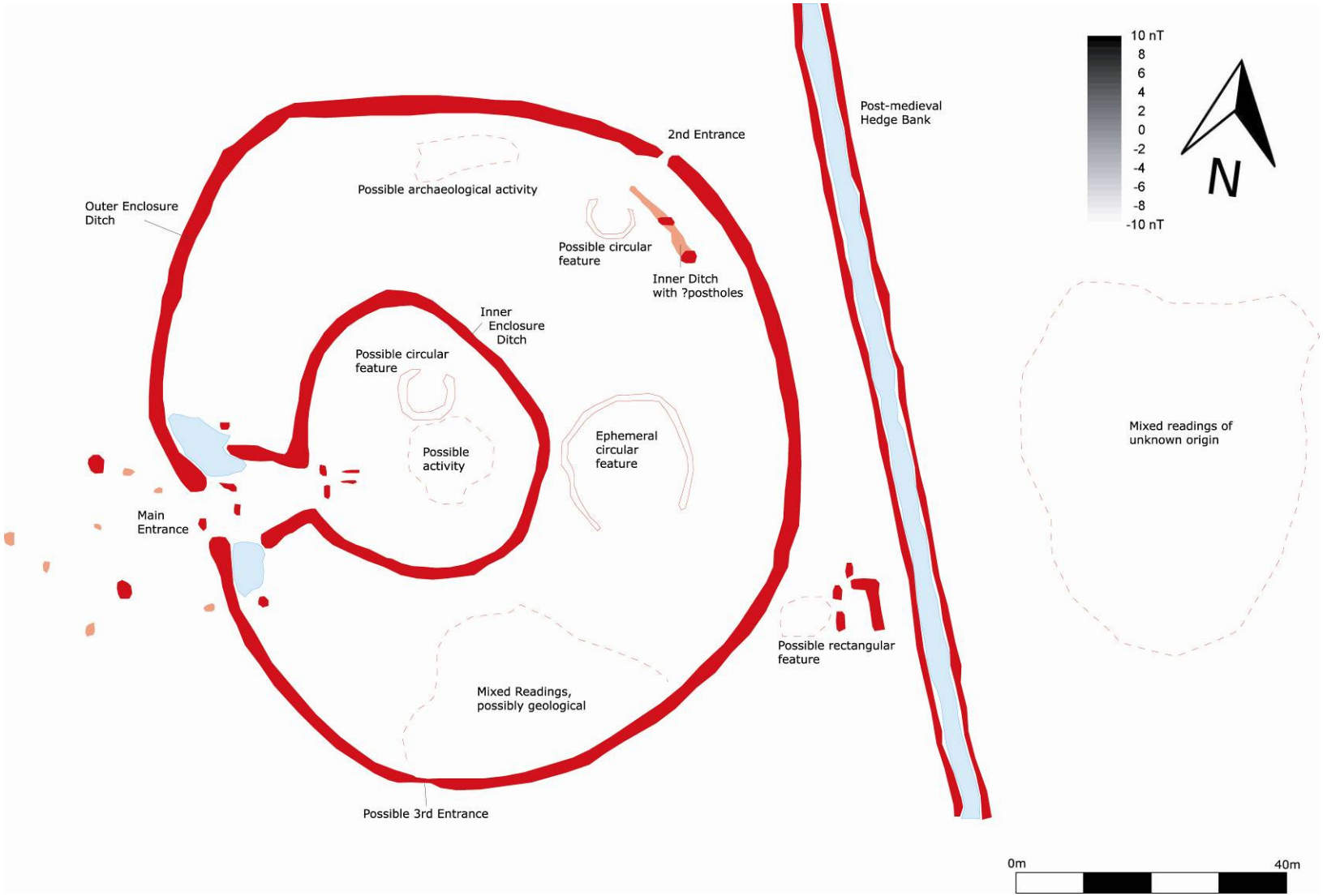

Figure 6: Interpretation of geophysical survey results. Red highlights areas of magnetically positive results, blue highlights areas of magnetically negative results.

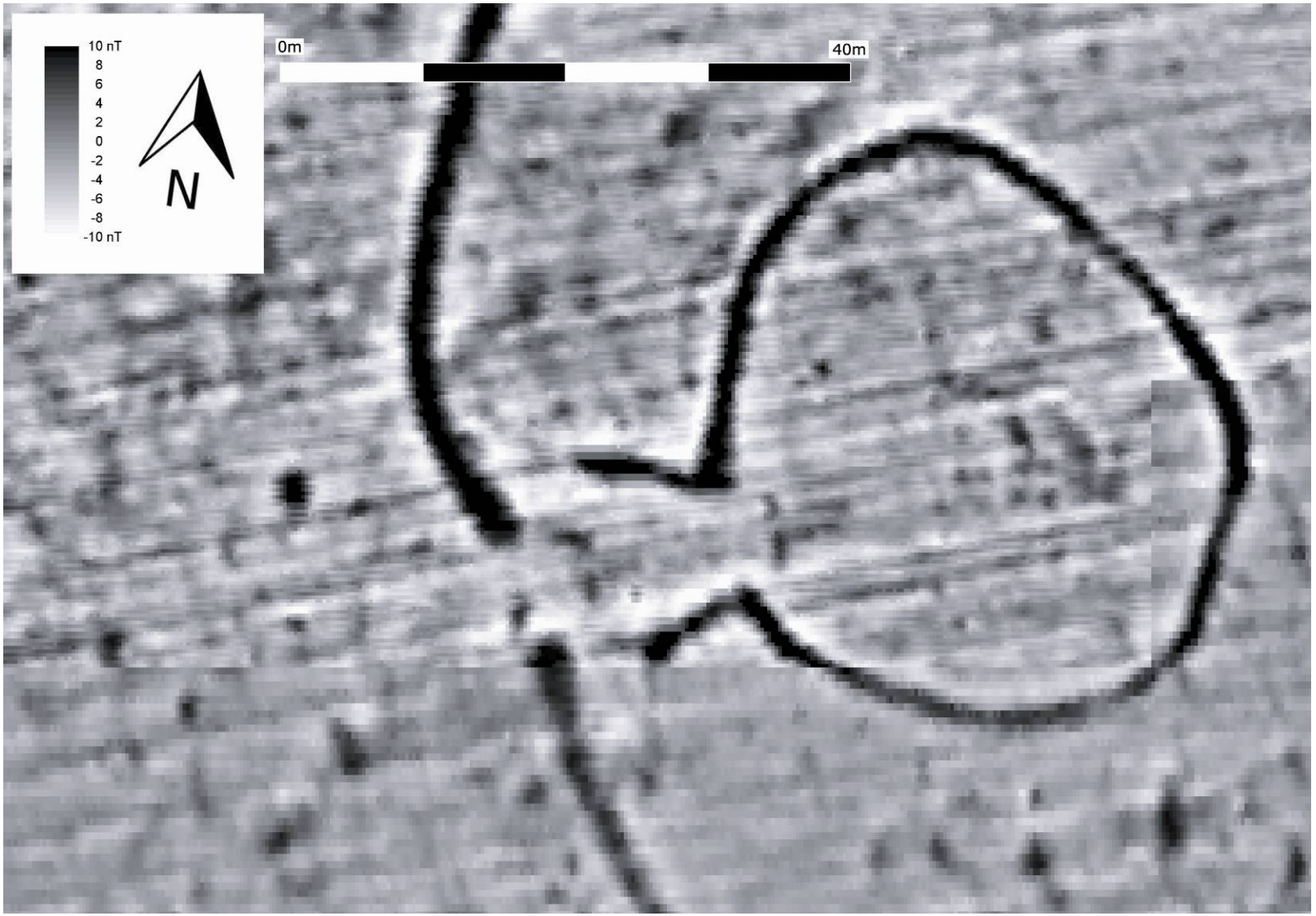

Figure 7: Close-up of main entranceway and inner enclosure.

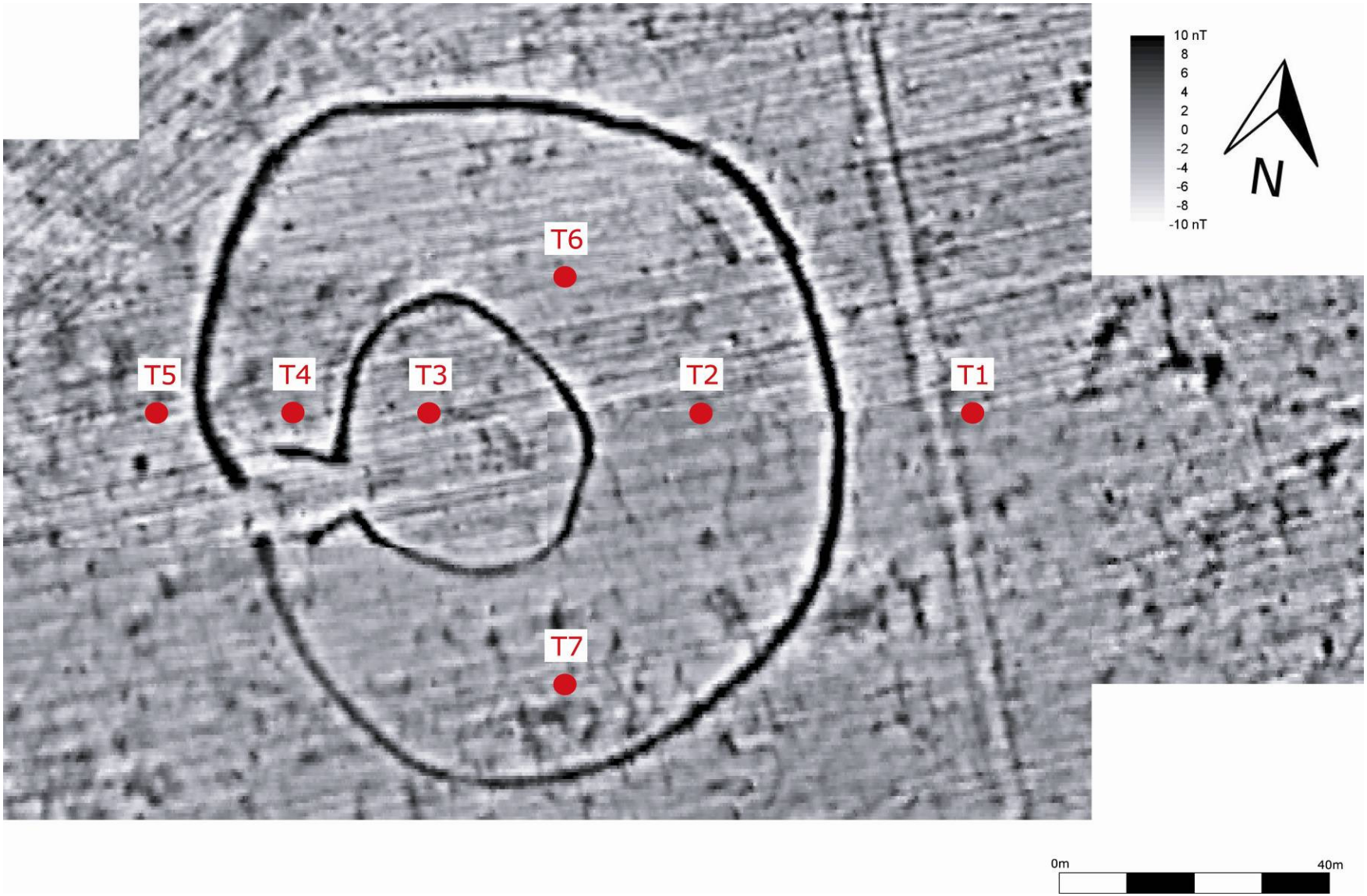

Figure 8: Location of test pits (in red), overlaid on the geophysical survey results.

PHOTOGRAPHS

Photo 1: General view looking SSW across the survey area.

Photo 2: General view looking WSW (downslope) across the survey area.

Photo 3: General view looking SSW across the survey area.

Photo 4: General view looking WSW from the survey area with the Preseli Hills in the distance.

Photo 5: Test Pit 1 (TP1), looking east. 1m scales.

Photo 6: North facing section of Test Pit 1 (TP1). 1m scale.

Photo 7: Test Pit 2 (TP2), looking south. 1m scales.

Photo 8: South facing section of Test Pit 2 (TP2). 1m scales.

Photo 9: Test Pit 3 (TP3), looking east. 1m scales.

Photo 10: West facing section of Test Pit 3 (TP3). 1m scale.

Photo 11: Test Pit 4 (TP4), looking east. 1m scales.

Photo 12: North facing section of Test Pit 4 (TP4). 1m scales.

Photo 13: Test Pit 5 (TP5), looking west. 1m scales.

Photo 14: South facing section of Test Pit 5 (TP5). 1m scale.

Photo 15: Test Pit 6 (TP6), looking east. 1m scales.

Photo 16: West facing section of Test Pit 6 (TP6). 1m scale.

Photo 17: Test Pit 7 (TP4), looking south. 1m scales.

Photo 18: North facing section of Test Pit 7 (TP7). 1m scale.

APPENDIX 1: METHODOLOGY AND INSTRUMENTATION

Geophysical Survey Instrumentation

A fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of surveying large areas.

The survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer, which uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies.

The instrument detects variations in the earth's magnetic field caused by the presence of iron in the soil. This is usually in the form of weakly magnetised iron oxides, which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil therefore contain greater amounts of iron and can therefore be detected with the gradiometer. There are, however, other processes and materials that can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs which usually produce very high readings and can mask the relatively weak readings produced by variations in the soil. Archaeological features such as hearths or kilns also produce strong readings because fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the surrounding soil leading to a more generalised magnetic enhancement around settlement sites.

Not all surveys produce good results as anomalies can also be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material within the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in features being un-detectable. It must therefore be stressed that a lack of detectable anomalies cannot be taken to mean that that there are no below ground archaeological features.

The Bartington Grad601 is a hand-held instrument and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 1.0m apart. Their Mumetal cores are driven in and out of magnetic saturation by an alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output (Clark 1996).

The gradiometer can detect anomalies down to a depth of approximately one metre. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The instrument is capable of detecting changes as low as 0.1nT.

Geophysical Survey Data Collection

The gradiometer includes an on-board data-logger. Readings in the surveys were taken along parallel traverses of one axis of a grid made up of 20m x 20m squares. The traverse intervals were either 0.5m or 1.0m apart. Readings were logged at intervals of 0.25m along each traverse giving 3200 readings per grid

square (medium resolution on 0.5m traverses), or 1600 readings per grid square (low resolution on 1.0m traverses).

Geophysical Survey Data presentation

The data was transferred from the data-logger to a computer where it was compiled and processed using ArchaeoSurveyor 2.5 software. The data is presented as grey-scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. A separate grey-scale plot with interpretation of the main features is also included as necessary.

Geophysical Survey Data Processing

The data is presented with a minimum of processing although corrections are made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some noisy or very complex sites can benefit from 'smoothing'. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of low pass filtering can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

Reliability

Geophysical survey is an immensely useful tool but it should be realised that while a survey will detect a wide range of features, it may not detect *all* buried features. A gradiometer survey detects changes in magnetic flux density and relies on there being a detectable difference between the archaeology and the substrate. This may not occur for many reasons (e.g. a cut feature being backfilled with subsoil). It must therefore be stressed that a lack of archaeological responses from a geophysical survey does not prove that there is no archaeology present.

Grid locations

The survey grids were located by measurements to fixed points such as field boundaries located during the survey.

Bibliography

Clark A J, 1996, *Seeing Beneath the Soil* (2nd edition). Batsford, London.

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Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau sydd gennych ar gynnwys neu strwythur yr adroddiad hwn

As part of our desire to provide a quality service we would welcome any comments you may have on the content or presentation of this report

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