

CADW PROJECT: DAT 129 WEST RATH, WALTON EAST, PEMBROKESHIRE: GEOPHYSICAL SURVEY 2013



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CADW PROJECT: DAT 129 WEST RATH, WALTON EAST, PEMBROKESHIRE GEOPHYSICAL SURVEY 2013

Gan / By

Philip Poucher

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Ymddiriedolaeth Archaeolegol Dyfed Cyf
Neuadd y Sir, Stryd Caerfyrddin, Llandeilo, Sir
Gaerfyrddin SA19 6AF
Ffon: Ymholiadau Cyffredinol 01558 823121
Adran Rheoli Treftadaeth 01558 823131
Ffacs: 01558 823133
Ebost: info@dyfedarchaeology.org.uk
Gwefan: www.archaeolegdyfed.org.uk

Dyfed Archaeological Trust Limited
The Shire Hall, Carmarthen Street, Llandeilo,
Carmarthenshire SA19 6AF
Tel: General Enquiries 01558 823121
Heritage Management Section 01558 823131
Fax: 01558 823133
Email: info@dyfedarchaeology.org.uk
Website: www.dyfedarchaeology.org.uk

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**WEST RATH, WALTON EAST, PEMBROKESHIRE:
GEOPHYSICAL SURVEY 2013**

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WEST RATH, WALTON EAST, PEMBROKESHIRE: GEOPHYSICAL SURVEY 2013

SUMMARY

West Rath (PRN 1346, SN 0079 2288) is a cropmark and earthwork enclosure occupying a hillslope above Cartlett Brook to the west of Walton East in Pembrokeshire. The site was believed to be that of an Iron Age defended enclosure and was assessed as part of the Prehistoric Defended Enclosures project in 2007 (Murphy et al 2007). As a result, it was recommended for scheduling; however its form appeared somewhat confused from both the earthwork remains and aerial photographs of the site, and its full extent was unclear.

Consequently Cadw commissioned Dyfed Archaeological Trust to undertake a gradiometer (magnetometer) survey of the monument in the hope of characterising the site and establishing its extent.

The geophysical survey, undertaken in March 2013, recorded clear evidence of a large enclosure approximately 115m by 108m defended by a series of ditches with internal banks, some of which are still visible above ground. There was no clear evidence of an entranceway, which is therefore assumed to be on the low-lying southern end of the site where the survey results were obscured by valley-bottom silting. A second, smaller enclosure sat inside the larger, terraced into the hillslope and measuring c.58m by c.50m. This was also defended by a ditch and internal bank, and had an entrance on its western side.

There was an indication of general archaeological activity from within the inner enclosure. Ditches and a possible roundhouse were recorded within the outer enclosure, which lay close to the entrance of the inner enclosure. Further, more ephemeral features were indicated in the eastern part of the outer enclosure.

The survey was able to record the form and extent of this enclosure, confirming it is similar to a type of defended enclosure that is generally dated to the Iron Age. Immediately to the south of this site however were the remains of what appear to be a burnt mound, often dated to the Bronze Age, although no direct correlation between the two sites was established.

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

INTRODUCTION

Project commission

West Rath is a cropmark and earthwork enclosure (PRN 1346, SN 0079 2288) to the west of Walton East in Pembrokeshire. Believed to be the site of an Iron Age defended enclosure it was assessed as part of the Defended Enclosures project in 2007, as a result of which it was recommended for scheduling. Despite having some prominent earthworks the exact form of the defensive banks and ditches was not clear and the extent of the site was unknown, therefore more information about the site was required before it could be scheduled.

Consequently Cadw commissioned Dyfed Archaeological Trust to undertake a geophysical survey of the defended enclosure in the hope of clarifying its form, as well as identifying and characterising possible buried archaeological remains.

The fieldwork was undertaken in March 2013.

Scope of the project

The project aim was to characterise by geophysical survey, using a gradiometer, possible buried archaeological features in the area of, and in particular relating to, the defended enclosure of West Rath and to identify the extent of the site.

In addition to clarifying the character of the site, the project offered an opportunity to aid the interpretation of West Rath, and of this type of site across the region. 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.

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.1086
MEDIEVAL	c.1086 – 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 agricultural landscape c.1.3km to the west of Walton East, in mid Pembrokeshire (Figures 1 & 2). The defended enclosure itself, known as West Rath (PRN 1346), lies on south-facing sloping ground at 85m above sea level (SN 0079 2288), just to the south of the summit of the high ground. It sits on the north-eastern side of a stream valley (Cartlett Brook), where the valley slopes are gentler. Cartlett Brook itself is a relatively large and fast-flowing stream eventually draining into the Western Cleddau at Haverfordwest. The south-eastern edge of the site is defined by a smaller curving valley with occasional bedrock exposures, down which runs a local spring draining into Cartlett Brook. Numerous other defended enclosures are visible in the surrounding landscape (Figure 2), the closest being Plenty Park Rath (PRN 1343), which lies 250m to the south occupying high level ground on the opposing side of the valley with steeper slopes and defended by a bank and ditch enclosing a sub-circular area c.80m in diameter. West Rath II (PRN 14301) lies 300m to the northwest, a concentric, crop-marked defended enclosure occupying a west-facing slope. The West Farm lies 600m to the northeast of West Rath, along a well-made farm track known as Castlepark Lane. The landscape of this area is one of medium to large semi-regular fields divided by hedgebanks and fencing, with dispersed farmsteads and small villages.

At the time of the survey the field was covered by improved pasture recently grazed by cattle. The agricultural regime for the field is unknown, but the sloping nature of the field presumably makes it unsuitable for arable. The flatter eastern end of the field (separated by a post and wire fence) appears to undergo ploughing, although is currently under pasture. Recent aerial photography (getmapping 2010) appears to show possible quarrying activity immediately adjacent to the site on its north-eastern side.

The defended enclosure (PRN 1346) was visited as part of the Cadw-funded Defended Enclosures project in 2007 (Murphy et al 2007). It was described as:

a small defended enclosure with a concentric annexe. It occupies a fairly steep south-facing slope at 85m above sea level. This is a difficult site to understand on the ground, and even on aerial photographs its form is a little confused.

The inner enclosure is sub-circular, c.30m diameter with a hollow interior and surrounded by a low bank – best preserved on the up-slope, north, side, and barely perceptible on the south side. Aerial photographs show a clear, cropmarked ditch outside this bank. The entrance is presumably on the south side. The defences for the concentric outer enclosure lie c.45m from the defences of the inner enclosure. The defences of this annexe seem to be composed of two semi-circles, one to the east and one to the west, joined on their north side by a M-shaped arrangement of banks/ditches, and open on their south side. The defences are best preserved on the north side where the ditch is up to 1m deep and the bank up to 0.5m above interior. Aerial photographs show a counterscarp bank on the east side of the defences and what seems to be bivallate defences on the northwest side. The annexe measures c.140m E-W and c.100m N-S.

The underlying geology consists of sedimentary rocks of the middle (Llanvirn) Ordovician overlaid by freely draining acid loamy 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 taken at a medium resolution on traverses 0.5m wide and every 0.25m within a 20m x 20m grid across the site. In total an area of c.3.5ha was surveyed. A Trimble TST was used to tie the grid into the local Ordnance Survey grid.

Limitations

The survey was undertaken over a total of five days in March 2013. Weather conditions were varied, from fine bright days at the beginning to very wet and cold weather with strong gusting winds for the final two days, as a result the gradiometer was regularly re-adjusted in order to compensate for any variations caused by changing temperatures. The fields were bounded by hedgebanks and post and wire fencing, obscuring readings taken in their immediate vicinity. There was a gradual to steep slope down to the south across most of the site, however, the grid was laid out using a combination of Trimble TST and hand tapes, and pacing lines were used throughout the survey in an attempt to limit any variations in the data collection that the sloping ground may have caused.

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 at 'medium' resolution. The data is presented with a minimum of processing (Figure 3), 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 14nT to -14nT.

The processed data is also presented as grey-scale plots overlaid on local topographical features (Figure 4). The main magnetic anomalies have been identified and plotted onto the local topographical features as a level of interpretation (Figure 5).

The survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues, but the interpretation of many of these features is still largely subjective.

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 3 to 5)

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.

The Inner Enclosure

The inner enclosure is identifiable on the ground as a sub-circular area terraced into the sloping ground, although the ground within still has a gentle southward slope, edged around its northern side by traces of a bank.

This enclosure is demarcated on the geophysical survey by a curvilinear feature likely to represent a ditch. This ditch encloses a sub-circular area c.58m east – west by c.50m north – south, with an entranceway on its western side. The entranceway appears to be formed by a gap possibly c.10m wide, with indications that the southern arm of the ditch curves inwards.

When compared to the topographical data it is clear this supposed ditch runs around the outside of the bank that is still visible above ground. The lighter-coloured magnetic responses that line both the internal and external edge of this enclosure ditch may be an indication of both an internal or external bank although it is also possible these readings may simply be caused by the strength of the magnetic responses from the infilling material of the ditch itself.

Internally the readings are somewhat confused, but would appear to indicate some degree of archaeological activity. The dark line that crosses the enclosure roughly north – south is likely to be a natural feature (see 'geological features' below), but both magnetically positive (dark areas) and magnetically negative (light area) responses, particularly around the eastern and southern parts of this inner enclosure, appear to mirror and be contained within the enclosure ditch, indicating these are responses from archaeological features.

Spread across the central part of the enclosure and through the supposed entranceway is an area of relatively little magnetic response, which appears similar to responses to the south, closer to the valley bottom. It is assumed these responses represent areas where thicker deposits of silt have built up, possibly masking (and preserving) underlying features. As these deposits appear to have collected within this inner enclosure then it suggests the interior of this enclosure was perhaps originally more level than it appears today.

The Outer Enclosure

The smaller inner enclosure lies roughly centrally within a much larger enclosure. A relatively straight segment of outer enclosure ditch is visible above ground defining the north-eastern side of the enclosure. This is represented by a ditch up to 1m deep with a clear internal bank (Photo 2) and traces of an external counterscarp bank. This fades out as it turns to the west, but can still be traced as a faint earthwork for several metres. It also fades out to the southeast as it approaches the steep sides of the small spring valley.

The line of this ditch is clearly shown on the geophysical survey results. This forms part of a continuous ditch enclosing an irregular, almost sub-rectangular area although with rounded corners and a curving western side. There is a noticeable spike in the magnetic responses in the south-western segment of this ditch. Such strong bipolar responses are sometimes indicative of

metallic objects, often modern in origin although its position within the line of the ditch is suggestive of something of greater antiquity. The area enclosed by this ditch is approximately 115m by 108m in size. The internal bank is clearly defined along the relatively straight north-eastern side of the enclosure ditch, as is the outer counterscarp bank along this segment. The magnetic responses for the internal bank get weaker as the enclosure turns to the west, but these fainter readings can still be traced along the entire length of the internal side of the ditch as identified within the survey results. Similarly the magnetic responses for the counterscarp bank also get weaker, but can still be traced along the north-western side of the enclosure.

There is a strong indication, particularly along the straight north-eastern edge of the enclosure, of a further internal ditch and bank running parallel to the aforementioned ditch and bank. This secondary internal defence is also suggested intermittently around the western corner of the enclosure.

The survey results also indicate a possible further line of defences along the external side of the ditch on this straight north-eastern side. However, the magnetic responses from this feature are unusually high and vehicle tracks are visible on the ground running along this same line. A recent aerial photograph (getmapping 2010) shows possible quarrying activity within the field and also indicates that the track to this activity ran along this line, therefore it would appear these outer responses are the result of modern activity.

There is however clear indication of an outer ditch having been added to the western side of the outer enclosure. This ditch lies c.5 – 10m further out, and mirrors the line of the curving enclosure ditch. There are indications of a further internal bank and counterscarp bank, particularly around the northern part of this ditch.

The defences of this outer enclosure do not appear to enclose a full circuit, instead presumably making use of the natural slopes of the small valley within the field through which a spring runs (east/south-eastern side). To the northeast the line of the defences becomes obscured by modern activity although the survey results suggest the defences ended at the steep slopes of the small valley that defines the south-eastern side of the site. The valley is at its steepest at this point, with bedrock exposed in places. Due to the sloping wet ground the survey stopped at these steeper slopes along the eastern and south-eastern edge of the site. To the southwest the defences appear to enclose the less-severe slopes in this area, where the ground runs into the flatter valley bottom. At this point the line of the defences is lost, the survey indicating a large, relatively featureless area. This is presumably caused by a greater build-up of silts in the valley bottom, resulting in a deposit thick enough to mask any underlying archaeological remains.

There is no obvious indication within the revealed circuit of these defences of a break in the line that may suggest an entranceway. At the southern end of the line, just as it disappears into the valley-bottom silts, the survey results suggest possible external linear and curvilinear features. One curvilinear feature appears to extend away from the outer ditch, joining another linear feature that appears to begin to mirror the line of the outer enclosure ditches, possibly indicating a third line of enclosure ditching in this area. It is possible these may be associated with an entranceway at the southern, lowest, end of the enclosure, obscured by later silting.

On its south-western side there also appears to be some curvilinear features, or a small outer enclosure attached to the outer ditch line. There is no obvious correlation as to the potential function of this feature.

Features between the inner and outer enclosures

There is a gap of between c.25m to c.35m between the inner and outer enclosure defences, within which lie several possible archaeological features. Striping is visible across the surveyed area, this is not the result of any errors in data collection, nor is it likely to represent ploughing scars, it would appear instead to be caused by the underlying geology. However, this is much less apparent within the bounds of the enclosure, which may be an indication of a greater build-up of overlying soils within the enclosure, itself a possible indication of general archaeological activity.

To the west of the supposed entranceway into the inner enclosure are two linear features that form a T-shape. Such magnetic responses would appear to represent ditches elsewhere within the site. One linear runs roughly ENE – WSW from the inner enclosure ditch to a possible bank associated with the outer enclosure defences, effectively dividing the area in between the outer and inner enclosures. Roughly midway along this is the second linear feature, orientated roughly NW – SE. This would appear to run for roughly 20m, although spikes in the magnetic responses may indicate this linear feature is segmented, or possibly includes postholes.

Immediately to the north of these linear features are the faint traces of a circular feature, roughly 12m in diameter. It is possible this may represent the remains of a roundhouse. Similar faint curvilinear features are visible at the eastern end of the site, although the layout and dimensions of these features would appear to indicate they are not roundhouses. The northernmost appears to enclose a circular area up to 20m in diameter, generally larger than the typical dimensions of a roundhouse. Immediately to the south the faint curvilinear feature does not appear to enclose a circular area. Immediately adjacent to this curvilinear feature is a discrete area of magnetically positive responses that may be indicative of a cut archaeological feature such as a pit.

Several other similar discrete responses are evident throughout the enclosure that could potentially represent pits or postholes, however without more intrusive archaeological investigation it is difficult to determine which may be archaeological features and which may be geological in origin.

Possible burnt mound and valley-bottom silts

At the southern end of the surveyed area is a relatively featureless zone. This corresponds with the low-lying ground at the base of the small valley that lies within the field, along the line of a spring. It was clear from recent cattle trampling that silts had built up in this low-lying area, presumably obscuring underlying features from the gradiometer.

On low-lying ground close to the south-western side of the field (the southern end of the surveyed area) lies a horseshoe-shaped bank standing 0.75m high and measuring at most 13.5m long and 4m wide. It sits alongside the line of the spring which drains from the field into the nearby Cartlett Brook. In both its form and its location this feature is typical of a burnt mound, formed by piles of heated stone and charcoal. The heated stone would originally have been used to heat nearby water troughs or containers, and such features are often found to date to the Bronze Age. This feature is visible on the geophysical survey results, although as a surprisingly faint feature given the anticipated charcoal and heated-stone content. The bank is depicted as a curvilinear feature of largely magnetically positive responses, with magnetically negative responses indicating a deposit of different material in front (on the eastern side) of the curvilinear mound.

Adjacent to this possible burnt mound a series of segmented linear features appear to edge the area of valley-bottom silts. This may indicate the line of a former stream or spring as it runs into the nearby Cartlett Brook. It is possible this line may be associated with the potential burnt mound that lies nearby, alternatively the line may have been enhanced in more recent years to aid the drainage of the field for agricultural reasons.

Geological features

Three irregular linear features are visible within the surveyed area, all similarly orientated in a roughly NNE – SSW direction. The somewhat irregular nature of these features would suggest they are caused by changes in the underlying geology. Rock exposures are visible along similar alignments framing the small valley that lies within the field to the east and southeast of the enclosure.

Strong magnetic responses are recorded in the northeast corner of the surveyed area. Further surveying would be required around this area to determine the true nature of this feature, but it lies on high ground at the head of the small valley within the field and the irregularity of its form may also indicate it is geological in nature.

Modern activity

Very strong bipolar magnetic responses were recorded in the north-eastern part of the surveyed area, lying close to the head of the small valley within the field and obscuring the line of the outer enclosure defences. Such strong responses are often found to be of modern origin, and this area would appear to correspond to an area of possible quarrying or similar earth-moving activity that is shown on recent aerial photographs (getmapping 2010). As mentioned above the trackway to this site ran along the outer edge of the enclosure defences and would appear to account for the strong linear responses along the north-eastern edge of the enclosure.

CONCLUSION

The geophysical survey was successful in depicting the extent and form of West Rath (PRN 1346), a defended enclosure that is partially visible as an earthwork and cropmark site. The survey shows the site to be a large irregular, almost sub-rectangular, enclosure set into the south-facing hillslope above a stream, measuring approximately 115m by 108m. The enclosure is defended by at least one, and probably two parallel lines of banks and internal ditches around at least three quarters of its circuit. The remaining section either utilises the natural defences of steeper hillslopes to the southeast or is obscured by later silting to the south. An external third line of bank and ditch defences have also been added to the western half of the enclosure. There is no obvious break in the line of these defences to indicate an entranceway, suggesting it may have been in the lowest southern part of these defences, where the geophysical results are obscured by later valley-bottom silting.

A second, smaller enclosure sits centrally within this outer enclosure, terraced into the hillslope. This is formed by a ditch and internal bank, enclosing a sub-circular area c.58m east – west by c.50m north – south. It has an entrance on its western side, its form partially obscured by later silting. The magnetic responses from inside the enclosure suggest general archaeological activity, particularly around the southern and eastern parts of this inner enclosure, but the exact form of this activity is unclear.

An area between c.25m and c.35m lies between the inner and outer enclosure defences. The survey results suggest a thicker deposit of soils within this area when compared with the results from outside the main outer enclosure. This area is also divided by probable ditches close to the entrance into the central enclosure. There is the faint suggestion of a possible roundhouse close to these ditches. There are further similar faint curvilinear features on the eastern side of the enclosure, although the form and dimensions of these suggest they are unlikely to be roundhouses.

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. Although there is the suggestion of at least one possible roundhouse within this enclosure there is a lack of clear settlement activity which may be an indication this site is more agricultural in nature. Clearly more intrusive archaeological investigation would be required to determine the true nature of such a site.

To the south of this enclosure stand earthwork remains that are of a form typical of burnt mounds. The feature is also visible on the survey results, where it is shown standing next to a stream or spring line, also a typical location for a burnt mound. Such features are often, although not exclusively, dated to the Bronze Age.

The survey results also revealed areas of modern disturbance and underlying geological features. These geological features are visible on some of the aerial photographs of the site (Photo 1). The geophysical survey has been able to demonstrate that they are of geological origin thus is able to clarify the somewhat confused layout plotted from these aerial photographs.

The strength and clarity of the survey results suggests good survival of cut archaeological features, in particular the enclosure ditches although there is also the suggestion of some more ephemeral cut features, soil layers and former raised banks surviving.

ACKNOWLEDGEMENTS

The survey was undertaken by Andy Shobbrook and Phil Poucher of Dyfed Archaeological Trust. I am indebted to Mr & Mrs John of Walton Grange, and the tenant of The West Farm for allowing access to their land.

ARCHIVE DEPOSITION

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

SOURCES

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Ordnance Survey 1889 1st edition 1:2500 Map, Pembrokeshire XXIII.2

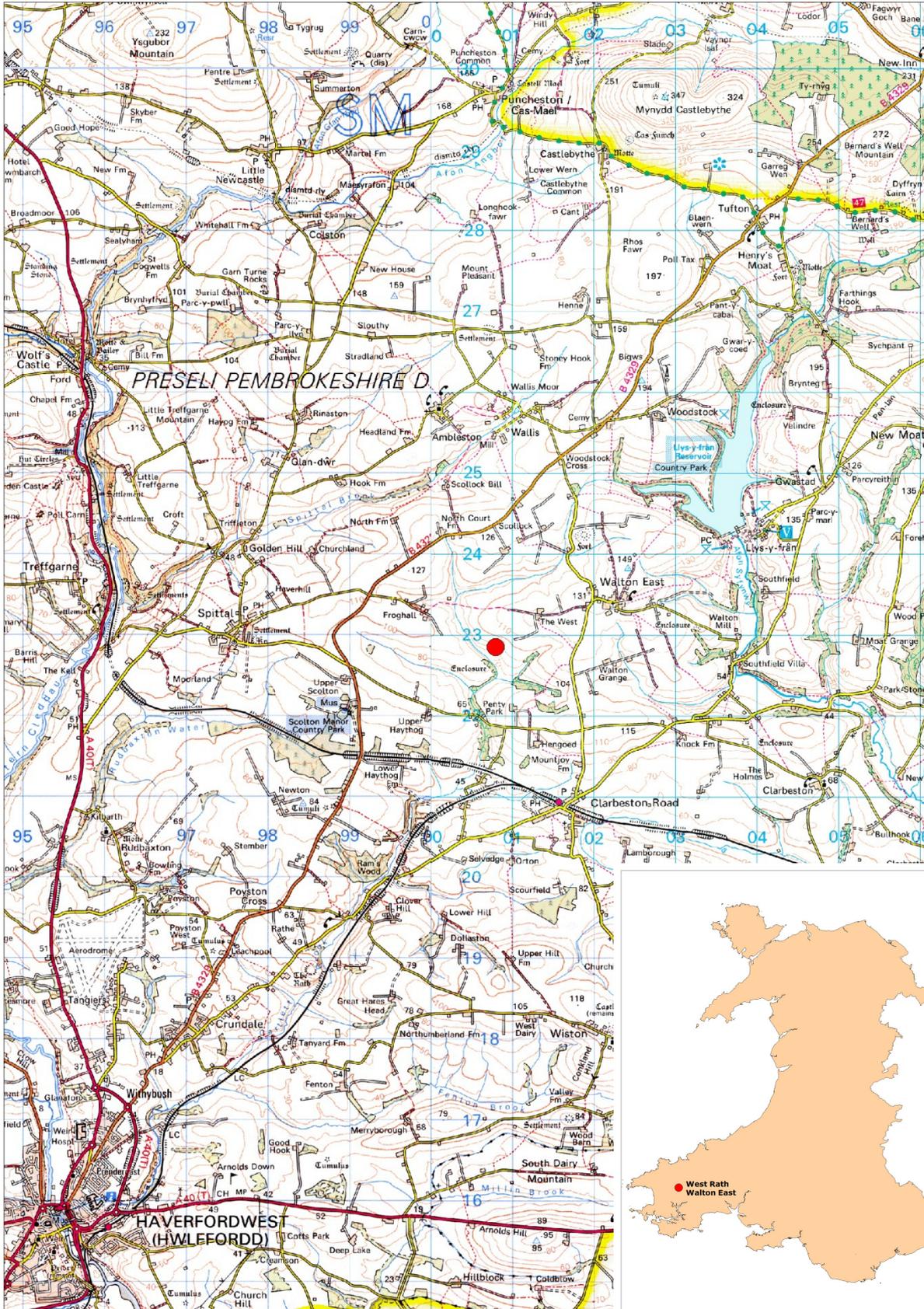


Figure 1: Location map, based on the Ordnance Survey.

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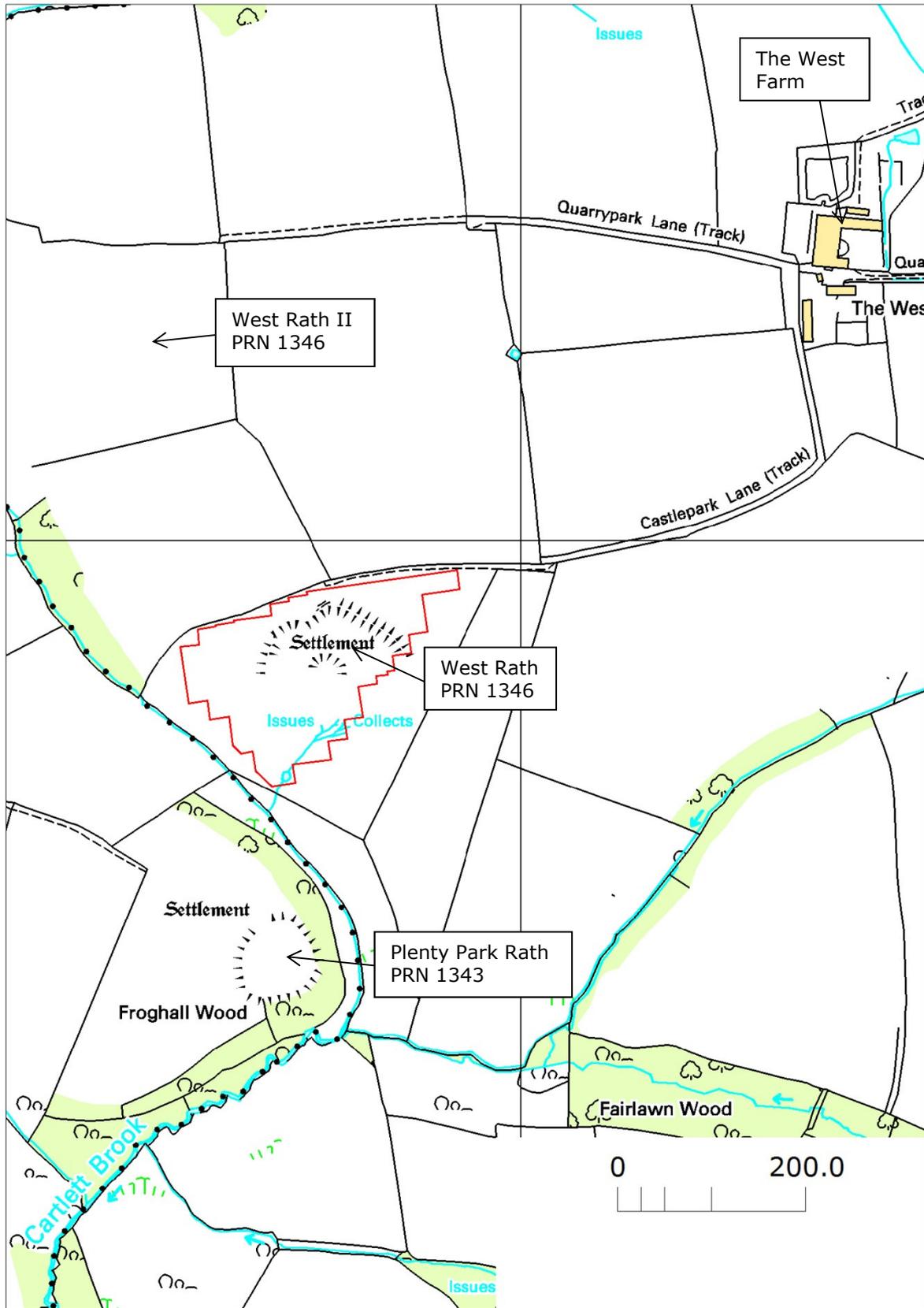


Figure 2: Location map showing the area surveyed (in red) and nearby defended enclosures mentioned in the text. Scale in metres.

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Photo 1: Aerial photograph of West Rath (PRN 1346), taken looking WNW. RCAHMW
Crown Copyright © reference DI2006_1557



Photo 2: Looking SE along the above-ground remains of the defensive bank at the north-eastern edge of the enclosure.

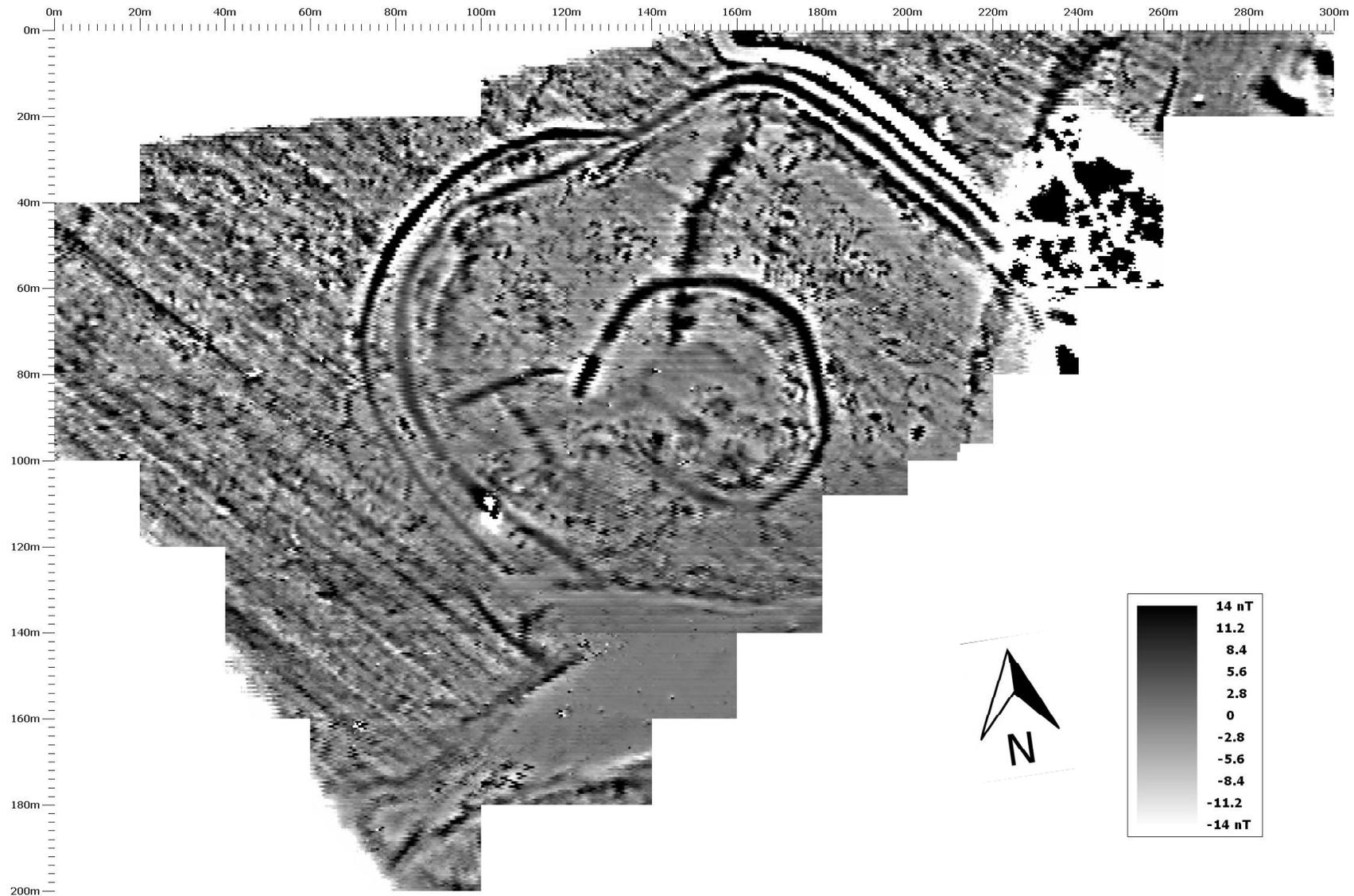


Figure 3: Geophysical survey results presented as a greyscale plot, clipped from 14nT to -14nT but otherwise unprocessed.

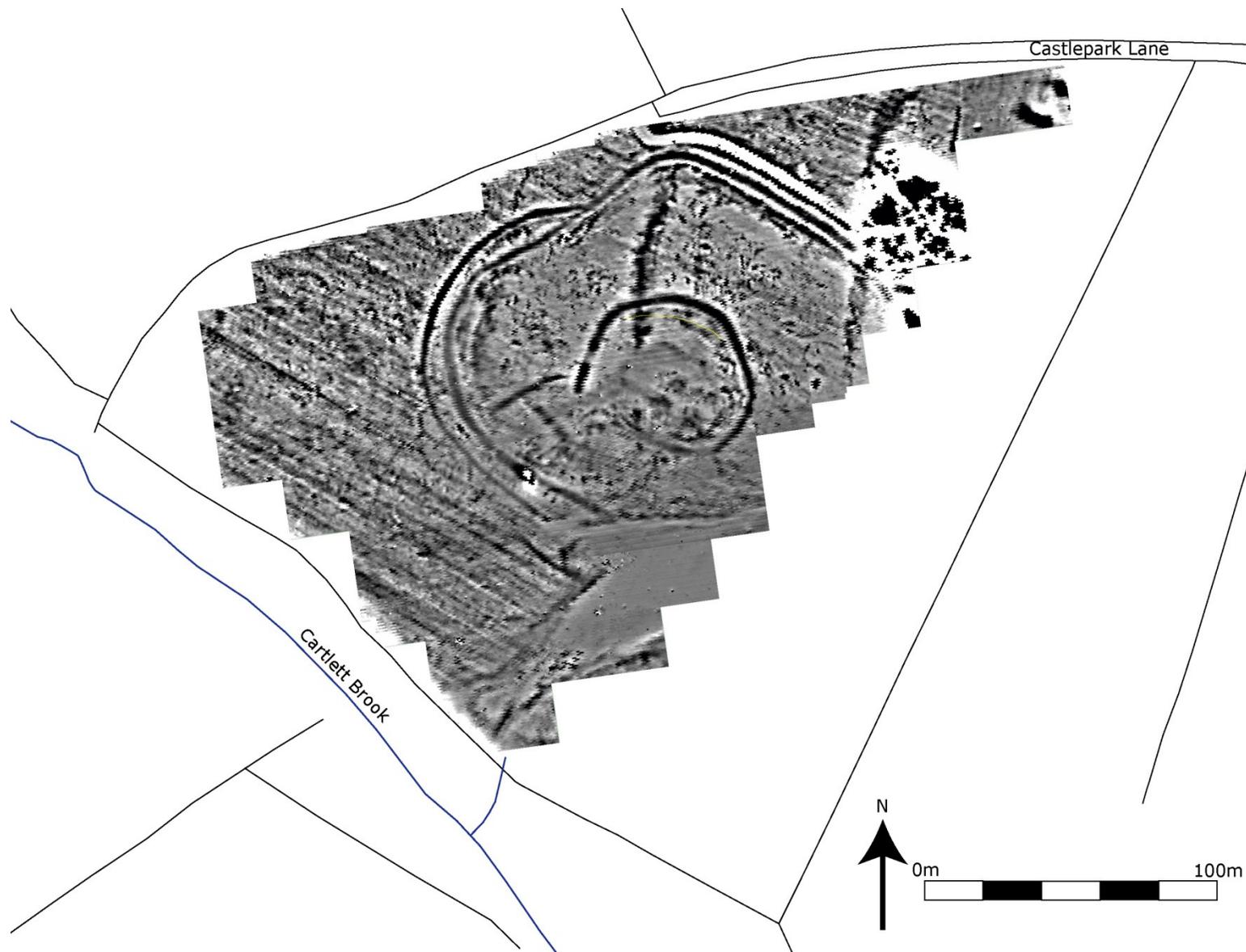


Figure 4: Geophysical survey results overlaid on local topographical features.

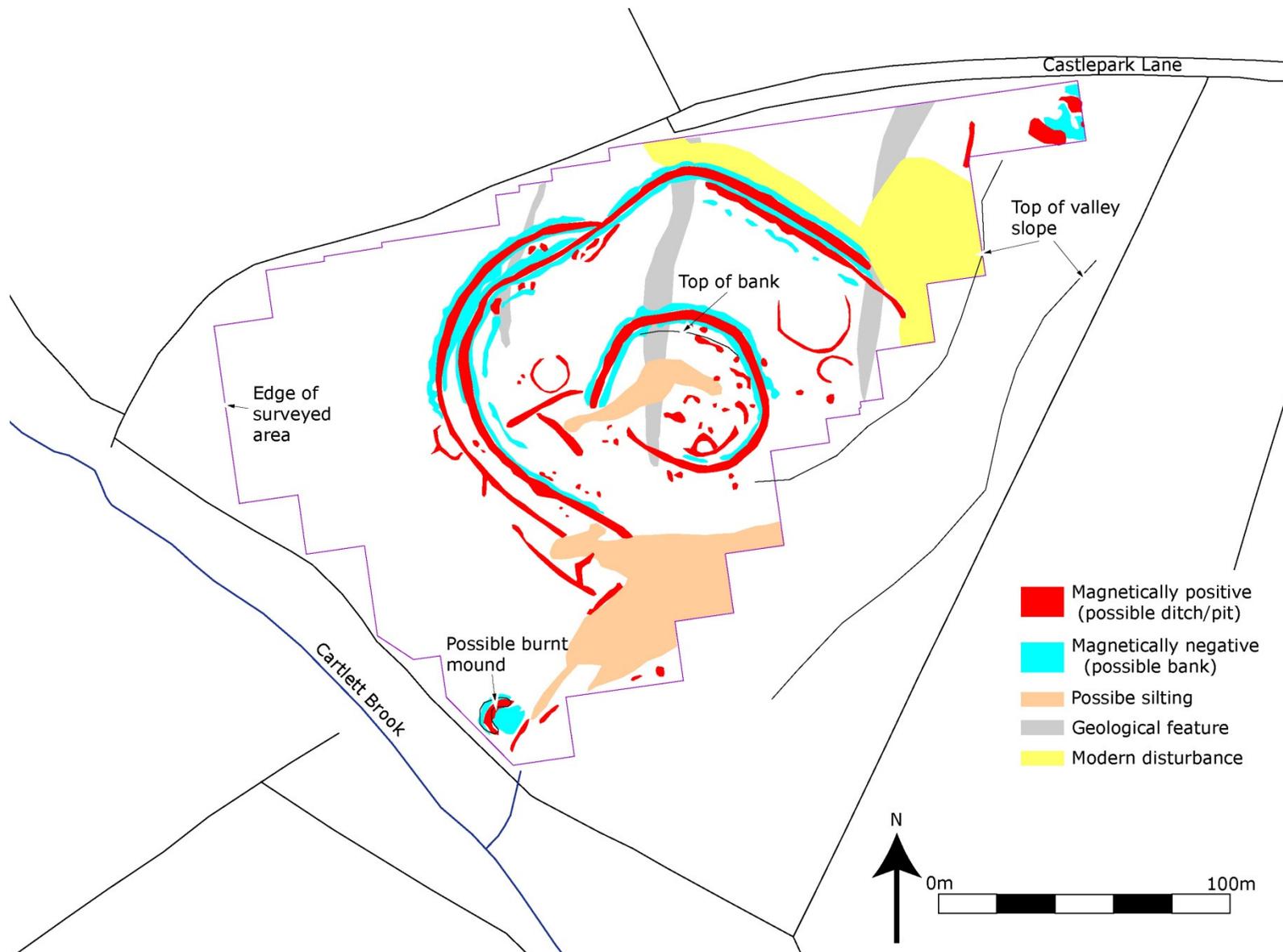


Figure 5: Interpretation of geophysical survey results.

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 thermoremanent 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 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.

WEST RATH, WALTON EAST, PEMBROKESHIRE GEOPHYSICAL SURVEY 2011

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Paratowyd yr adroddiad hwn gan / This report has been prepared by

PHILIP POUCHER

Swydd / Position: ARCHAEOLOGIST

Llofnod / Signature



.... Dyddiad / Date 28/03/13

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by

JAMES MEEK

ar ran Ymddiriedolaeth Archaeolegol Dyfed Cyf.
on behalf of Dyfed Archaeological Trust Ltd.

Swydd / Position: HEAD OF FIELD SERVICES

Llofnod / Signature



Dyddiad / Date 28/03/13

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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