CAPEL IAGO, LLANYBYDDER GEOPHYSICAL SURVEY 2011

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SUMMARY

Records suggest the site of a possible medieval chapel and cemetery in fields surrounding Capel Iago farmstead (NGR SN 547 424), near Llanybydder, Carmarthenshire, however, no systematic archaeological investigation of the area has been undertaken. Consequently Cadw commissioned Dyfed Archaeological Trust Field Services to undertake a geophysical survey, using a gradiometer, of the fields surrounding the farmstead as part of an ongoing research project into early medieval ecclesiastical sites and cemeteries within the Dyfed region. The survey was undertaken in February 2011.

The site of a chapel (PRN 762) is suggested by the farm name of Capel Iago, and antiquarian records of possible stone walls disturbed by ploughing. An ancient yew tree also stands within the field and a holy well (PRN 4775) sits in a field on the opposite bank of an adjacent river (Afon Duar). A standing stone (PRN 1194) has also been recorded nearby. Local tradition also indicates that the neighbouring field to the east, separated by a stream, is called 'yr hen fynwent' or 'the old cemetery', and further antiquarian records suggest remains of cist-graves have been discovered within this field.

The geophysical survey revealed a variety of archaeological features across the survey area, although often difficult to characterise with any degree of confidence. No clear evidence of a chapel building or enclosure was identified within the survey boundary, although the yew tree is still standing and remains of an adjacent ruined wall may indicate a former enclosure was present. This enclosure now lies almost entirely buried under built-up ground, preventing geophysical survey work in that area. Possible trackways were identified by the survey within this field heading in the direction of the yew tree that may indicate this was a focal point of activity.

Within the neighbouring field, the supposed location of a former cemetery, a possible rectangular enclosure was identified, although it could not be determined if this was ecclesiastical or agricultural in character. The survey also revealed disturbed ground within the northwestern corner of the field that could be indicative of general archaeological activity, although individual features were difficult to distinguish. This area of the field lies closest to the yew tree and ruined wall in the neighbouring field. Further, more intrusive, archaeological investigation would be required to determine the nature of the possible archaeological remains in this field.

INTRODUCTION

Project commission

A farm named `Capel Iago' (NGR SN 547 424), is, according to local tradition, the site of a medieval chapel dedicated to St James (RCAHM 1917, 204 no.599; 207 no.606). However, there are no documentary sources for a chapel here, and neither is one marked on any historic map. The two fields that surround the farmstead are said to be named `Capel Iago' and `yr hen fynwent', or `the old graveyard', although these names are not recorded on the mid 19th century parish tithe map. There are also various records from the 19th and 20th century of cist graves being found in these fields, as well as a standing stone and an old yew tree, but no systematic archaeological investigation has been undertaken.

Cadw commissioned Dyfed Archaeological Trust to undertake a geophysical survey of the two fields surrounding the farmstead in the hope of identifying and characterising possible buried early medieval and medieval archaeological remains of a chapel and associated cemetery. The information from the survey could then aid in informing a possible scheduling recommendation, inform management of the site or possibly lead to further investigation of the possible chapel and cemetery.

The fieldwork was undertaken in February 2011.

Scope of the project

This project aims were to characterise by geophysical survey, using a gradiometer, possible buried archaeological features, in particular early medieval and medieval archaeology of a chapel and associated cemetery. The information from the survey would be used in informing a possible scheduling recommendation, inform management of the site and further investigation.

In addition to clarifying the character of the site, the project offered an opportunity to add to an increasing body of important new information on early medieval ecclesiastical and secular sites in southwest Wales, such as those already partially investigated at Porth Clew, Brownslade, Angle, St Brides, St Ishmaels and Maenclochog.

The project will address several issues raised in the Early Medieval Section of *Introducing a Research Framework for the Archaeology of Wales*, including: the evolution of religious sites and the broader impact of the church.

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.*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 within the Duar valley some 3km to the southeast of Llanybydder and the Teifi valley, Carmarthenshire. The farmstead (SN 5475 4224) is situated on the edge of the B4337, the main road through the Duar valley, at the point where the valley begins to open out as it approaches the larger Teifi valley.

The farmstead itself consists of a typical early 19th century courtyard arrangement with a farmhouse and two opposing ranges of former farm buildings, currently undergoing restoration. At some point during the 20th century a large yard has been extended to the west and north of the historic farmstead core, with a horse training ground (ménage) at the northern end.

The field traditionally known as 'Capel Iago' sits to the north and west of the farmstead complex, bounded by the road to the south, the Afon Duar to the north, a tributary stream to the east and hedgebanks to the west. The field slopes gradually to the northeast down towards the Afon Duar, which runs through the area as a fairly shallow and relatively narrow, but fast flowing stream, bounded by trees. A curving bank along the northeastern edge of the field appears to be a modern floodwork defence. The field was under grass pasture at the time of the survey, but was crossed centrally by an area of disturbed scrubby ground.

The field traditionally known as 'yr hen fynwent' lies to the east of the farmstead complex, on the opposite side of the tributary stream. This is bounded to the north and east by the Afon Duar, and to the south by a fenceline and remnants of a hedgebank. Towards the northern end of the field the land drops away with a moderate slope towards the Afon Duar, this drop becomes a steep tree-covered slope along the eastern edge of the field. The field was covered under grass pasture at the time of the survey, with an area of wetter reeds in the southwestern corner.

According to local tradition the farm name of `Capel Iago' indicates this was the site of a medieval chapel dedicated to St James (RCAHM 1917, 204 no.599; 207 no.606, PRN 762), however, there are no documentary sources for a chapel here, and no chapel is marked on any historic map. The surrounding fields are said by named `Capel Iago' (NGR SN 547 424) and `yr hen fynwent', or `the old graveyard' (NGR 548 423). However, none of these field names are recorded on the Llanybydder tithe map of 1840 in which the entire holding is just termed `Capel Iago house and land'.

Ploughing in `Capel Iago' during the 19th century revealed `several large boulders which were thought to be the remains of a small building'. An `old yew tree' was present in this field in 1917, and it was also occupied by the Ffynnon Iago Stone (PRN 1194), a probable Bronze Age standing stone. Such a stone could indicate possible Christian re-use of a Bronze Age site. Moreover, a `flag-lined grave' with `side slabs upright and regularly placed' was apparently opened up within `yr hen fynwent' in the late 19th - early 20th century.

Further cist graves were apparently observed in this field during ploughing in 1967 and 1984. The cists were undated but from the description they appear to have been Christian rather than Bronze Age. In addition, the Ffynnon Iago `holy well' site (PRN 4775) lies immediately north of the two fields.

Both fields are now under pasture, on relatively level, poor ground, but have been arable in the recent past. In their present form, they appear to be a part of the surrounding 18th – 19th century field pattern. Neither field exhibits any visible field evidence for archaeological features, other than the presence of a yew tree

within 'Capel Iago'. This yew tree (SN 5476 4240) stands close to the banks of the tributary stream, just beyond the edge of a relatively-recently constructed horse training ground (ménage), which has been built up *c.*2m above the existing ground surface. The tree has apparently been dated, which according to the landowner returned a date of several hundred years old, but the dating method and precise date has not yet been verified. Yew trees have often been associated with early sites of religious significance and are a common feature of churchyards. A low grass-covered stone wall is visible running between the tree and stream bank, appearing to curve westwards into the field a few metres to the north of the tree but the line is then lost. Large flat stones are visible within the line of the tributary stream and the Afon Duar, these stones appear to be naturally occurring fragments of the underlying geology, although some are clearly of suitable dimensions to be used in cist graves.

The underlying geology consists of the Devil's Bridge Formation – interbedded mudstone and sandstone, overlaid by glacial till.

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 on traverses 0.5m wide and every 0.25m within a 20m x 20m grid across the site, although separate grids were laid out for each field. In total an area of *c.*1.8ha was surveyed. Small strips close to the field boundaries were left un-surveyed due to the presence of either rough ground and low-hanging trees or post and wire fencing and ferrous detritus that would have obscured any geophysical results. A Trimble TST was used to tie the grid into the local Ordnance Survey grid.

Limitations

The surveys were undertaken over a total of 4 days in February 2011. Weather conditions were fine and generally dry with the occasional brief shower. The fields were bounded by post and wire fencing amongst the hedgebanks, which may have obscured some of the readings taken in their immediate vicinity. Similarly the farmyard contained a variety of ferrous objects and as it turned out, so did the material used to build up the horse training ground, which cast a large 'shadow' on the survey results. Overhead power lines crossed the northern edge of both fields, although these do not appear to have caused any major distortions in the survey results. The sloping ground within `yr hen fynwent' will have caused some small variations in data collection, 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 pedology 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 data is presented with a minimum of processing (Figures 2 & 4) but the presence of high values caused by ferrous objects and wire fencing 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. 'Capel Iago' was clipped to a range from 6nT to –3.3nT, `Yr hen fynwent' was clipped to a range from 6.45nT to –6.2nT. During the survey various processes such as changes to instrument set-up, instrument drift, variations in orientation amongst others cause directional effects that are inherent to magnetometers that can produce 'striping' in the processed data, thus much of the survey was 'destriped' and 'despiked' (Figures 3 & 5).

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

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

RESULTS

Geophysical interpretation

(Results Figures 2 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.

'Capel Iago' field (Figures 2, 3, 6 & 7)

No. 1

Located *c*.80m into the field from the main road are two parallel linear anomalies crossing the survey area in a NW – SE direction. The northern of the two linear anomalies is defined by magnetically negative readings, the southernmost appears to be picked out more by magnetically positive readings. Magnetically negative linear anomalies often appear to represent buried banks, and conversely positive linear anomalies are often demonstrated to represent buried ditches. These two linear anomalies, however, appear to correspond to and define the edges of a trackway that is visible on the surface of the field, and still in use. The trackway crosses from a gateway in the western field boundary to an opening within the extended farmyard to the east.

No. 2

To the north of No.1 a series of similar linear anomalies appear cross the surveyed area in a rough NW – SE direction. These appear mainly to consist of more magnetically negative readings, but some with associated linear positive readings. Superficially these appear very similar to No.1 and may therefore also represent former trackways, however they are not visible on the surface, are not in current use and neither do they correspond to any current field gateways. However, at the northwestern end of the linear anomalies, there is a small break in the field hedge, wide enough for a footpath access, but clearly no longer in use and not marked on any historic map sources. The southeastern end of the trackways appears to head for the area around the yew tree. If the yew tree is connected to a former chapel site then it is possible these linear anomalies mark a trackway access to the chapel site, possibly reduced to a footpath at some later point.

Alternatively such a series of linear anomalies within a field may be the remains of undated ploughing activity.

No. 3

Along the northern edge of the area surveyed a curvilinear anomaly corresponds closely to a break of slope before the ground drops to the riverbank. Topographically this feature has a very regular slope and appears to be a modern machine-built earthwork, presumably acting as a flood bank.

No. 4

Numerous discrete anomalies are spread across the area surveyed, and it is difficult to say with any certainty if they represent archaeological features or modern or natural features. However, some may be of note. Close to the

northern edge of the area surveyed, on level lower ground on the riverbank, are three adjacent discrete magnetically positive anomalies. Such readings are often indicative of cut features such as pits or large postholes.

Their location may be of significance as the riverbank at this point offers easy access into the river at a point where the water cascades over a ledge, possibly remnants of a weir, with a pool of water forming behind. There is a gradual slope from this point up to the site of the yew tree.

Immediately to the north, on the very edge of the surveyed area, is a discrete dipolar (associated conjoining positive and negative) reading. This gives extremely high readings and is likely to relate to a ferrous object of modern origin.

No. 5

Located close to the western boundary of the area surveyed, *c*.50m from the main road is a somewhat irregular linear anomaly. This is defined in the main by magnetically positive readings, but with small discrete areas of both magnetically positive and dipolar readings. It is unclear what this series of readings relates to, but it is located close to an area where fragmented stone has been laid as part of a farm track and may therefore be associated with this possible modern hardcore or drainage works.

No. 6

Within the area of possible trackway or ploughing features represented by No.2 is a discrete area of strong bipolar readings. This features gives off extremely high readings and is likely therefore to represent a ferrous object of modern origin.

Scattered throughout the area surveyed are further smaller discrete areas of magnetically positive and dipolar responses. Some of these may have archaeological significance, but it is possible many may have natural or modern origins. Many of the clusters of dipolar readings are likely to have modern origins, for example in the area immediately to the south of No. 3 as this is believed to be recently built-up ground.

`Yr hen fynwent' Field (Figures 4 – 7)

No. 7

There is an area within the northern half of this field that clearly contains a variety of geophysical readings indicating some form of activity, although it is difficult to pick out individual features with accuracy. At the southern end of this area of activity the readings appear to suggest a linear anomaly running in a roughly SE - NW direction, consisting of magnetically negative readings bounded to its north and to the south by parallel positive magnetic readings. Such an arrangement of linear features appears typical of a former boundary bank with accompanying ditches, a typical response of former field boundaries for example. Topographically this appears to run along the upper edge of a noticeable break of slope within the field, with the ground dropping away to the north onto a more level area along the river bank. These features clearly terminate at an area of readings suggesting a possible turn in this boundary feature to the northwest (No.8).

No. 8

There appears to be a series of anomalies at the NW end of No.7 that runs perpendicular to No.7. This may indicate some form of boundary although the character of the boundary is difficult to distinguish from these readings.

There appears to be a series of five or six discrete areas of magnetically positive readings, often found to be indicative of cut features such as pits or large postholes. They occupy an area of general disturbed ground at the end of No. 7 that may continue to the northeast running up to the banks of the river. This also appears to continue to the southwest and may even cut off the entire field area. Some discrete areas of dipolar readings may indicate ferrous objects within the area. Amongst these discrete areas of magnetic responses are sections of linear anomalies consisting of magnetically negative responses, sometimes indicative of buried banks. Topographically this line would run up and at a slight angle across the rising ground.

At its northeast end, two thinner linear features, consisting of magnetically negative responses, again appear perpendicular to this line, parallel to No.7. They appear to divide this area from the riverbank to the north. Again it is difficult to say with any accuracy what the character of this boundary is but similar thin magnetically negative responses have been found to represent remnants of walling on other sites.

No. 9

This represents the area enclosed by Nos.7 and 8. Within this area are several large but discrete areas of magnetically positive readings, possibly indicative of cut archaeological features such as pits or large postholes.

Topographically this occupies an area of more level ground, although rising along its southern edge.

No. 10

A curvilinear anomaly of magnetically negative readings, with associated curvilinear magnetically positive responses, appears to define the break of slope and encloses a roughly triangular area between Nos. 7 and 8.

This may represent a buried bank and ditch boundary, with magnetic readings suggesting disturbed ground to its north.

No. 11

A series of mainly magnetically negative readings lie in an area on lower, relatively level ground immediately to the northwest of the possible enclosure represented by Nos. 7 and 8. These readings may be indicative of buried pits and ditches, but clearly indicate an area of disturbed ground that may be of archaeological origin. The character of this disturbance remains unclear and it is possible it may represent something as simple as plough activity disturbing the softer ground at the base of the slope, or it may represent some form of more complex archaeological activity.

No. 12

This area of disturbance represented by magnetically positive readings continues to the northwest, but there is a suggesting that the readings represent a curvilinear anomaly that appears to cut off the corner of the field. Such a

curvilinear anomaly may therefore represent a boundary ditch but the feature is not clearly defined.

No. 13

The magnetic readings indicate an area of disturbed ground continues along the northern edge of the field into the northwestern corner. There is only one possible clear archaeological feature amongst these readings however, represented by a discrete area of magnetically positive readings in the corner of the field, close to the confluence of the tributary stream and the Afon Duar.

No. 14

A curvilinear feature comprising of magnetically positive readings crosses the eastern edge of the possible enclosure formed by Nos. 7 and 8. The curvilinear nature of this anomaly is indicative of possible natural origins, and topographically it extends from the base of the tree-covered ridge in the direction of the river, and may therefore represent the remains of a former stream-line. It cannot be shown from the geophysical survey results alone if it is contemporary with the possible enclosure.

No. 15

A clear discrete anomaly lies within the possible enclosure, comprising bipolar magnetic readings. These readings are very high and appear to coincide with a modern telegraph post.

No. 16

Across the higher level ground of much of the southern half of the field there are a variety of discrete areas of magnetically positive and bipolar readings, but there is little to indicate these may be anything other than natural features of general modern agricultural detritus. There is one spike in the readings, a clear dipolar response, labelled as No.16, but the readings from this feature are so high it is likely to represent a modern ferrous item amongst the topsoil.

CONCLUSION

The survey produced a variety of results indicating archaeological activity in the area but assessing the character of these results from the survey alone is problematic. Clearly there is strong circumstantial evidence for a chapel to have been sited in this area, but no definite early-medieval or medieval ecclesiastical features can be identified from the results. The presence of the ancient yew tree and the curving wall within the field known as 'Capel Iago' are probably the best indicators of the location of a possible chapel site. If the wall does represent the edge of an enclosure containing the yew tree and possibly also a chapel, then the curve would suggest the main area of the enclosure lies to the south of the yew tree and underneath an area of built-up ground laid for the horse training area (ménage). If the enclosure is present, then this built-up ground may serve to protect features underneath. This material clearly affected the magnetic readings around it due to ferrous material in its composition, but the suggestion of possible trackways (No. 2) approaching this area could be of significance, adding weight to the suggestion there was a focal point of archaeological activity in this area.

The records suggest the neighbouring field, 'yr hen fynwent', is the site of a cemetery belonging to the chapel. There are records of cist burials, and local information suggested some the stones from these burials had been deposited within the tributary stream and river during field-clearance works. Some of these stones were examined during the survey work, and were indeed of a size that would have provided good cist-material, but such stones were also visible as naturally occurring outcrops in the stream edge. The geophysical survey results from this field indicate archaeological activity is present, but its character and date is difficult to determine, and cannot be conclusively linked to a possible cemetery site. The most obvious feature appears to be a rectangular enclosure, or possibly overlying enclosures and boundaries (Nos. 7 – 10). These boundaries appear to delineate the break of slope and an area of flatter ground at the northern end of the field, close to the riverbank and the area around the yew tree in the neighbouring field. These boundaries are not marked on historic map sources, but without further investigation of this general area it cannot be said whether they relate to a cemetery enclosure or pre-19th century field boundaries. Similarly disturbed ground (Nos. 11 – 13) clearly occupies much of this lower ground, but whether this relates to cemetery activity, agricultural activity, or other uncharacterised archaeological activity cannot be proven on the basis of these results alone.

It appears further archaeological investigations may not reveal much more information about a possible chapel site, as the potential area lies below the made-ground for the ménage. More intrusive archaeological investigation may help to characterise the enclosures and possible archaeological activity in the adjacent field of 'yr hen fynwent', that may be associated with a former cemetery site. A more systematic examination of the river and tributary stream in this area may also reveal features associated with this activity, such as cist-grave remains, river and stream crossings and earlier river management.

ACKNOWLEDGEMENTS

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

ARCHIVE DEPOSITION

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

SOURCES

British Geological Survey, 1994, *The Rocks of Wales* 1:250,000.

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

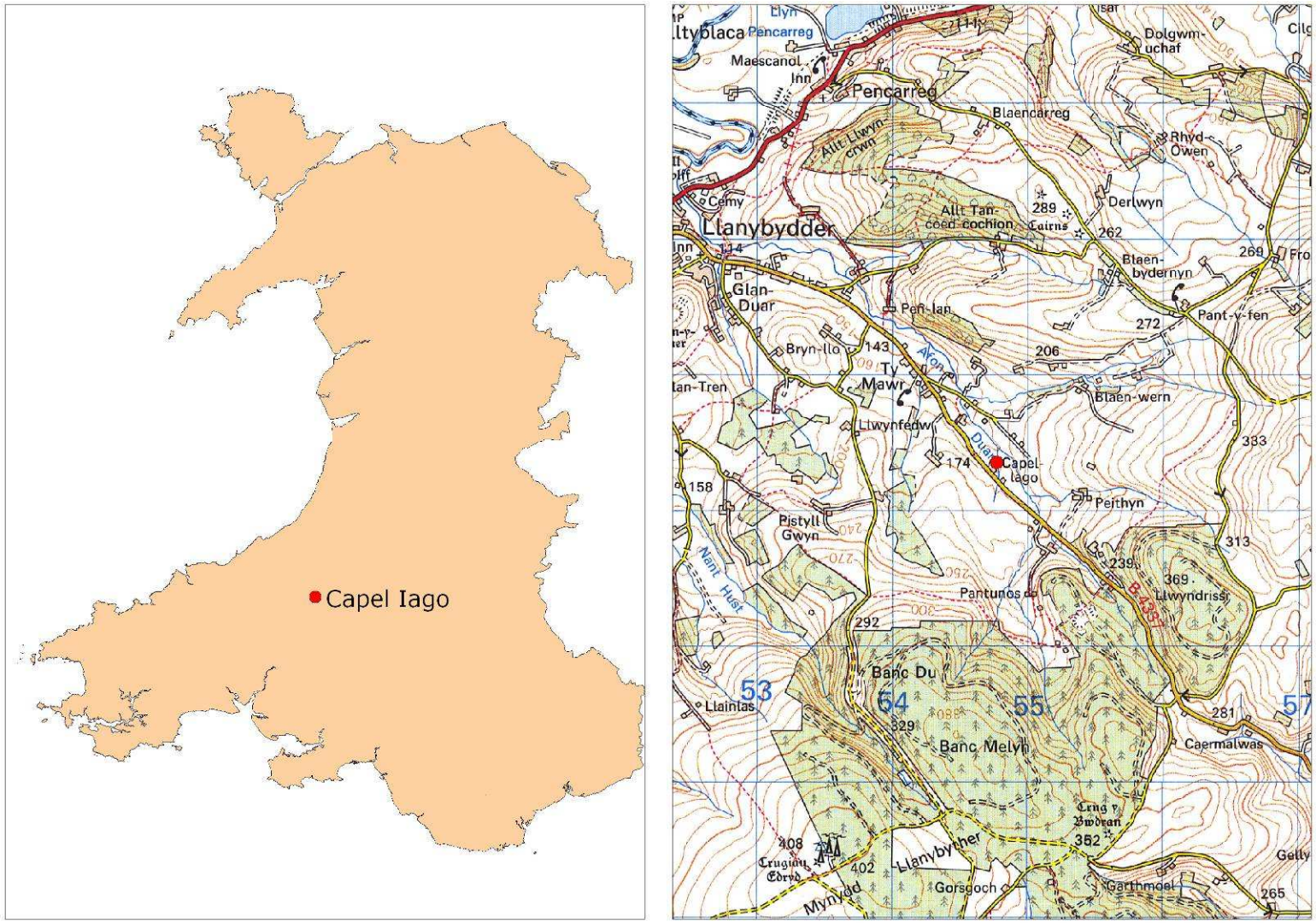

Figure 1: Location map, based on the Ordnance Survey.

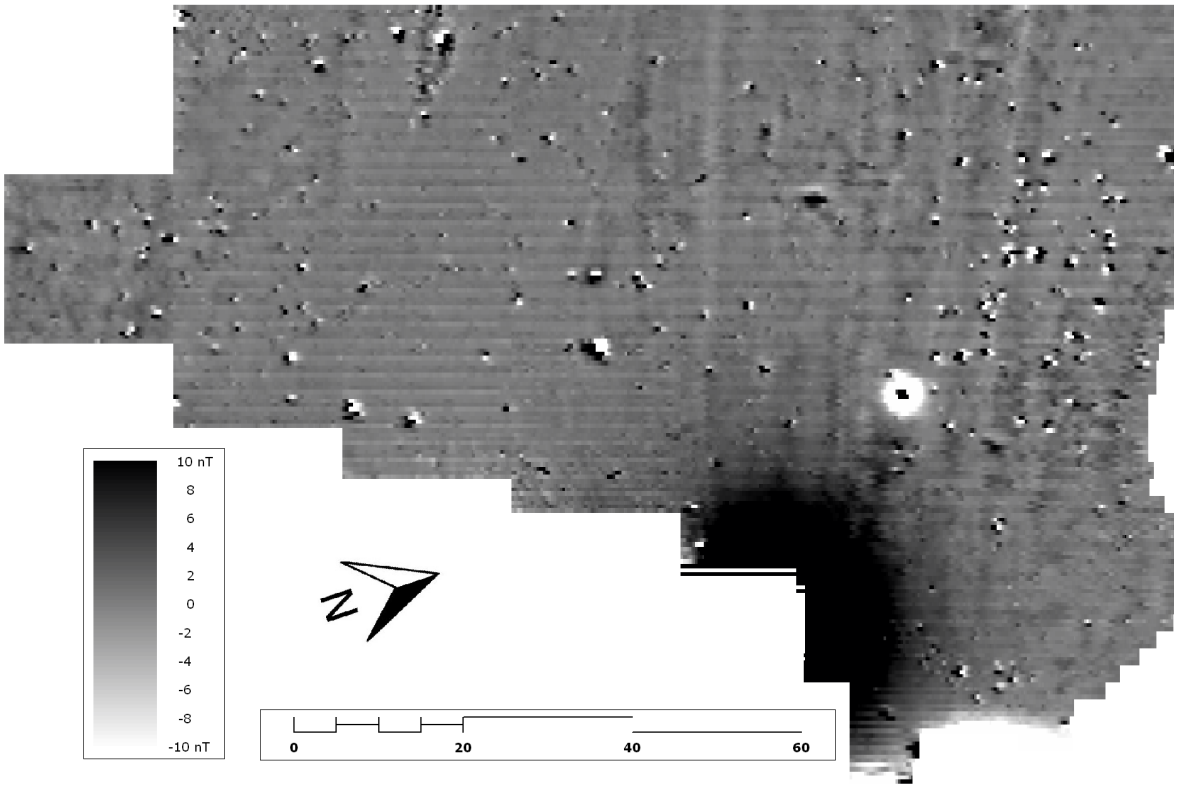

Figure 2: Geophysical survey results of 'Capel Iago' field, presented as a greyscale plot and clipped to a range from 10nT to –10nT but otherwise unprocessed.

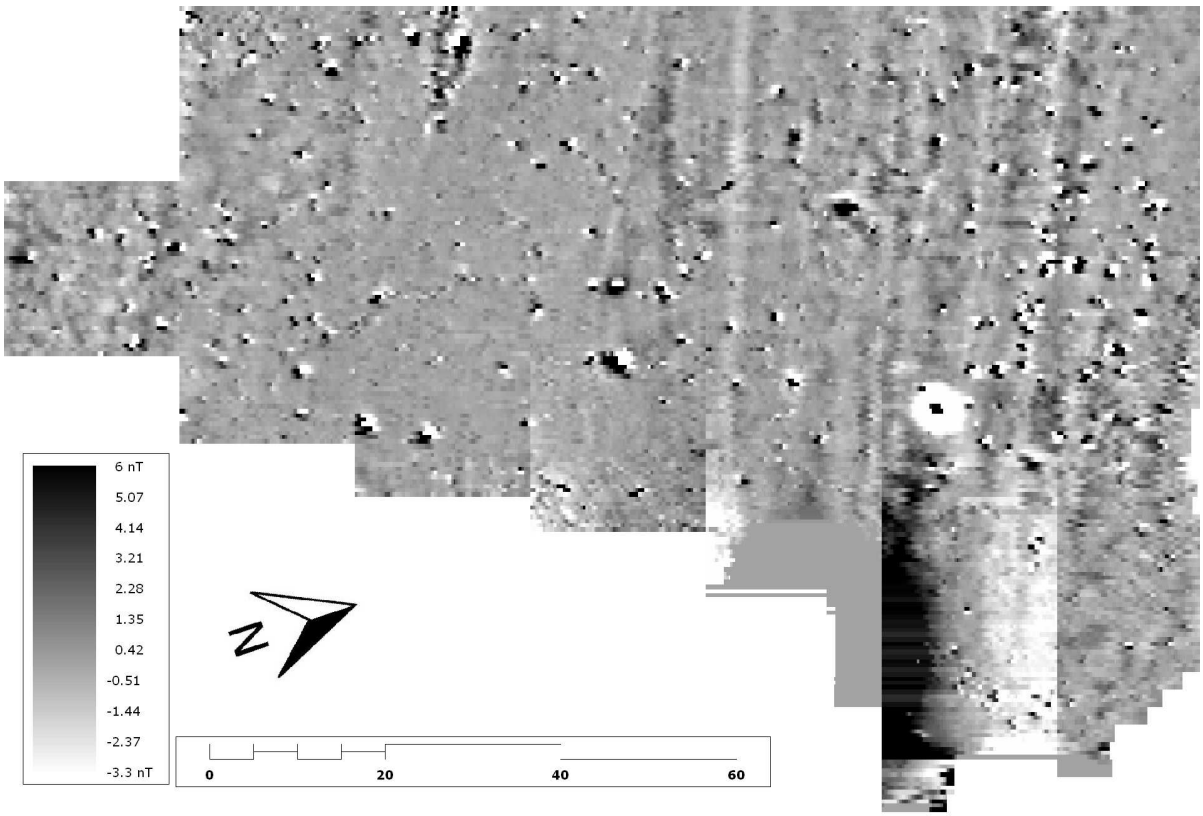

Figure 3: Geophysical survey results of 'Capel Iago' field, presented as a greyscale plot and clipped to a range from 6nT to –3.3nT, destriped and despiked

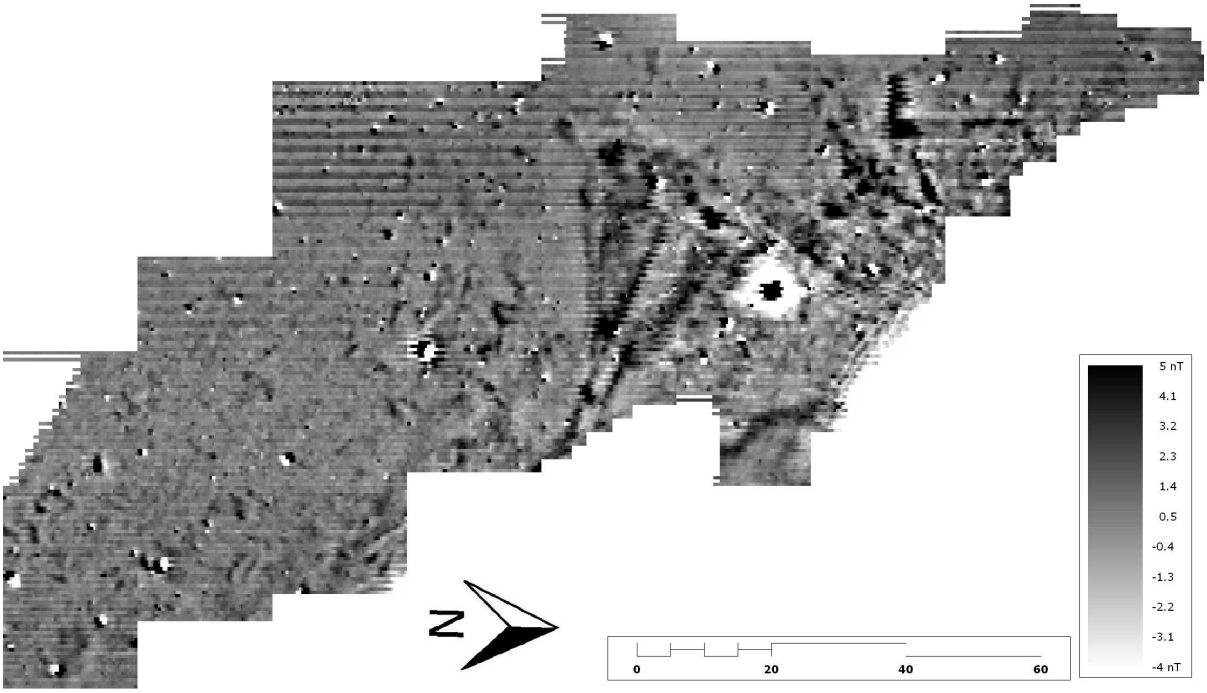

Figure 4: Geophysical survey results of 'yr hen fynwent' field, presented as a greyscale plot and clipped to a range from 5nT to –4nT but otherwise unprocessed

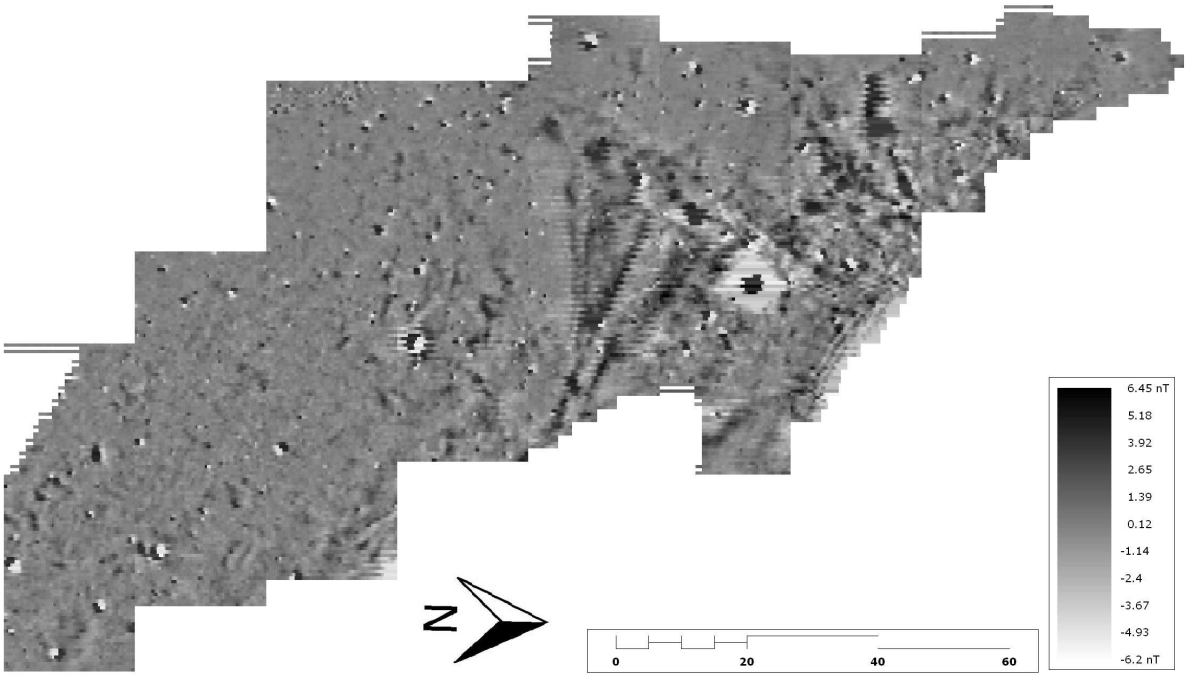

Figure 5: Geophysical survey results of 'yr hen fynwent' field, presented as a greyscale plot and clipped to a range from 6.45nT to –6.2nT and despiked.

Figure 6: Geophysical survey results presented as grey-scale plots, overlaid on local topographical features

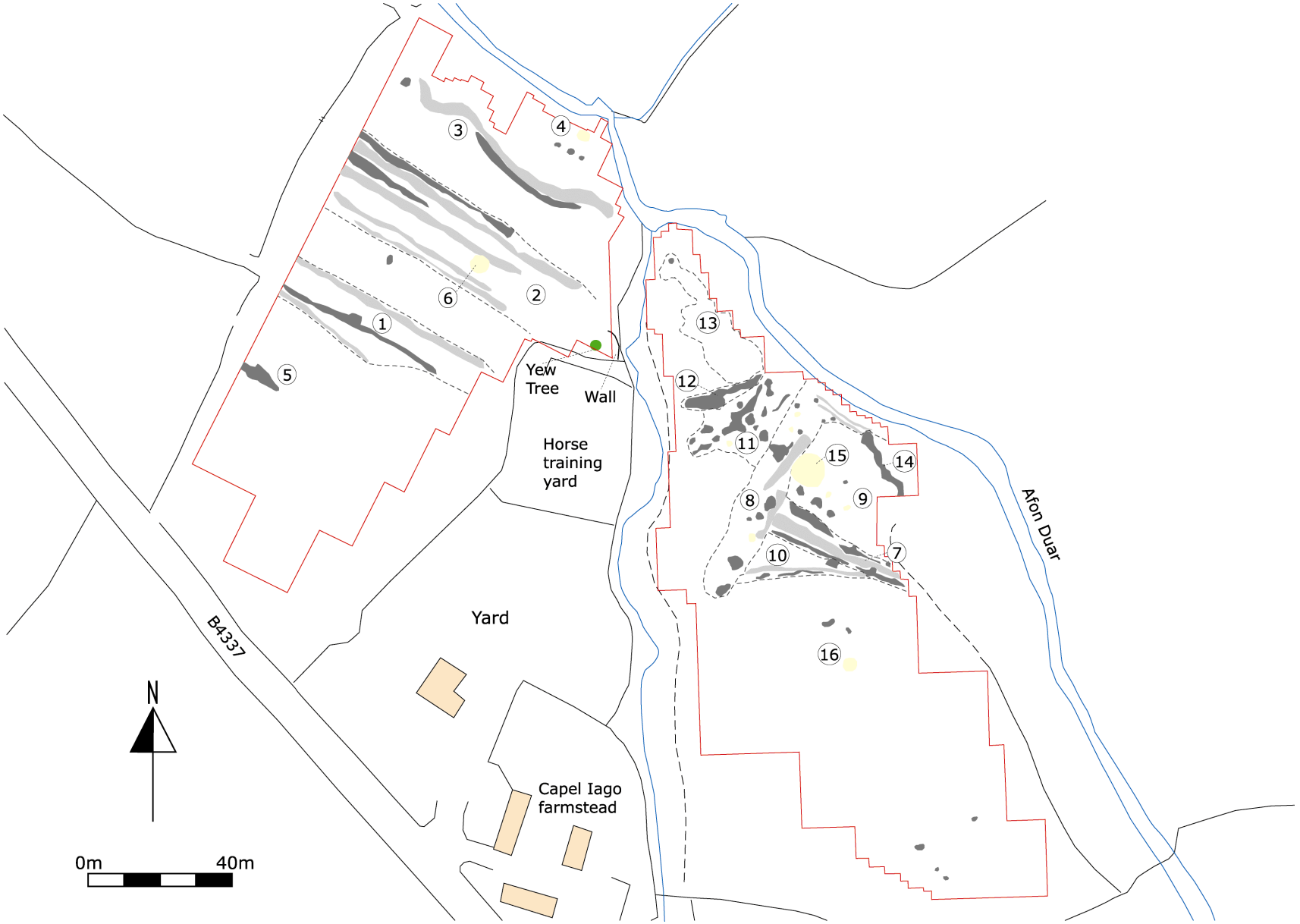

Figure 7: Interpretation of the geophysical survey results. Negative magnetic readings are represented by light grey areas, positive magnetic readings by dark grey areas. The numbers refer to the 'Geophysical Interpretation' section of the main text.

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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