GAER, LLANDYGWYDD, CEREDIGION GEOPHYSICAL SURVEY

Prepared by Dyfed Archaeological Trust
For CADW

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SUMMARY

During the Prehistoric Defended Enclosures threat-related assessment (Murphy et al 2006) this site (PRN 2084) was visited and described. It was visible as an earthwork monument in a field of improved pasture (NGR SN 2458 4327). The name, Gaer, and the visible earthwork indicated a site of some importance, although its date and nature were ambiguous. It was recommended for scheduling but Cadw required more information about the monument prior to further consideration. Consequently Dyfed Archaeological Trust Field Services were commissioned by Cadw to undertake a topographical and geophysical survey of the monument and its setting in 2009. The fieldwork was undertaken in February 2010.

The surveys revealed the remains of a sub-circular enclosure c.40m – 45m across, formed by a bank with an external ditch, located on the very edge of higher ground. Internally there appears to be further archaeological activity although individual features were difficult to determine, with a possible entranceway to the northwest. Further ditches and possible pits were also recorded adjacent to the enclosure to the north and east that may represent associated archaeology. All adjacent ditches suggest further activity may now lie under the road and adjacent buildings to the north.

Several linear anomalies were recorded across the survey area that appears to be a mixture of possible archaeological features and modern service trenches. On lower ground to the west several ditches and possible plough marks were recorded that may predate the current field layout and agricultural regime, although they also lie in close proximity to strong dipolar responses likely to represent features of modern origin.

There are possible traces of further activity to the south and northwest of the enclosure, although these features were often sinuous in form or faint and indistinct and may therefore represent natural changes in the underlying geology and pedology.

Several apparently modern features were also recorded within the survey area.

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.

INTRODUCTION

Project commission

During the Prehistoric Defended Enclosures threat-related assessment (Murphy et al 2006) the circular enclosure known as Gaer near Llandygwydd (PRN 2084, NGR SN24584327) was visited and described. The place-name and surviving earthwork both indicated a site of some importance, although its date and nature were ambiguous. The report indicated it should be scheduled but Cadw considered they had insufficient information to take such action. Consequently Cadw commissioned Dyfed Archaeological Trust Field Services to undertake a topographical and geophysical survey of the site and its immediate surroundings. The fieldwork was undertaken in February 2010.

Scope of the project

The project was designed to detect archaeological features within the study area by geophysical survey, using a gradiometer, and record topographical features using a Trimble TST.

Report outline

Because of the limited nature of this project, together with the considerable archaeological evidence in the 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).

THE SITE

Location and Archaeological Potential

The site is located in the edge of a field to the east of Llwynduris Farm, *c*.400m south of the village of Llandygwydd in the Teifi Valley, Ceredigion (NGR SN24584327). The site was bounded to the north by a high bank and hedge beyond which lay a minor road with buildings along its northern side, to the east and south by a hedgerow and a farm track and open to the west before ending in another hedgerow.

The following description was made, following a site visit, as part of the Defended Enclosures project in September 2005:

> Located on the crest of a long and fairly steep slope, the earthwork of Gaer commands long ranging views from the northwest through to the south. It is located at a little over 90m above sea level. To the west the land falls away steadily to the floor of the Teifi valley at *c*. 20m. To the east, north and southeast the land rises very gently towards rounded high points a few hundred metres distant.
>
> The earthwork consists of a circular platform about 1.5m high and approximately 35m - 40m across at its widest extent, about 20m - 25m diameter across the top of the platform. There is no obvious external ditch and no entrance onto (into) the platform. The internal area is very slightly dished, rather than flat. A slight, wide earthwork bank leads down the steep slope from the platform; this may be a natural feature. In 2005 the site was under improved pasture.

The nature of Gaer was considered uncertain. The platform nature of the earthwork and absence of a ditch did not indicate an Iron Age defended enclosure or a medieval ringwork. It is too large for a prehistoric burial mound. The closest parallels were thought probably to be the raised raths of Ireland.

At the time of the current survey (February 2010) the field was still under improved pasture. The ground undulates as it drops to the west, recorded on the topographical survey (see fig 2).

The underlying geology comprises of Nantmel mudstones overlain with clayey-gravel glacial deposits. The soils consist of slightly 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 on traverses 1m wide and every 0.25m within a 20m x 20m grid across the whole site. In total an area of *c*.2ha was surveyed. Small strips close to the field boundaries were left un-surveyed due to the presence of post and wire fencing that would have obscured any geophysical results. A Trimble TST was used for the topographical survey.

RESULTS

Limitations

The surveys were undertaken over a total of 4 days in February 2010. 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. Overhead power lines crossed the eastern corner of the field and underground water pipes cross the field from north to south, although these do not appear to have caused any major distortions in the survey results. The sloping ground to the west of Gaer 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 of Nantmel mudstones and glacial clayey-gravels, overlaid with slightly acid loamy 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 data is presented with a minimum of processing (Fig. 3) 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 a range from 10nT to –10nT to remove the extreme values allowing the finer details to show through. 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' (Fig. 4).

The processed data is presented as grey-scale plots overlaid on local topographical features (Figs. 4 & 5). The main magnetic anomalies have been identified and plotted onto the grey-scale plots as a level of interpretation (Fig. 6).

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.

Geophysical interpretation
(Results Figs. 2 to 6)

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.

No. 1
The visible earthwork feature known as Gaer is readily identifiable on the geophysical survey results. Although visible on the surface as an earthwork platform the geophysical survey results shows two sets of curvilinear anomalies defining an enclosure. The outer curvilinear anomaly has a higher (positive) magnetic response than the surrounding subsoil, such responses are often indicative of buried ditches. The line of this outer 'ditch' is broken to the east and northwest. To the east smaller discrete areas of positive responses may indicate a continuation of the line of the ditch, or possible a series of pits in this area. The break to the northwest may indicate an entranceway, although this section of the 'ditch' lies at the top of a steep slope and therefore ground slippage may have removed traces of the anomaly in this area. The inner curvilinear anomaly has generally lower (negative) magnetic responses, which appears to be indicative of buried bank material. This internal 'bank' runs in an almost continuous line, but is also broken to the northwest suggesting a possible entranceway or ground slippage. These curvilinear anomalies define a sub-circular enclosure *c.*40-45m across.

Contained within the limits of the enclosure are traces of further positive and negative magnetic responses, which may indicate an area of general archaeological activity. These responses are concentrated mainly on the northwestern side of the enclosure but specific individual features cannot be determined. On the western side of the interior there is also a discrete area of dipolar responses (strong positive magnetic responses with associated strong negative magnetic responses) that is likely to represent a ferrous object of unknown date and context.

No. 2
On the northwestern side of the enclosure (No. 1) are two parallel positive linear responses that appear to extend for *c.*12m but extending beyond the limits of the survey area to the north. These linear anomalies appear to run in a north – south direction and such positive linear responses are often indicative of buried ditches. It is possible the line of these anomalies continues further to the south and overlaps the line of the enclosure's outer ditch, although this area appears to be disturbed by possible slippage at the top of a steep slope.

No. 3
On the eastern side of the enclosure (No. 1) is a positive linear anomaly running roughly north – south for *c.*25m that is likely to represent a buried ditch. At its southern end there is a suggestion of a slight westward turn in the feature, although this also appears to coincide with an adjacent curvilinear anomaly (No. 4). This 'ditch' runs adjacent to the enclosure, although it is unclear from the geophysical survey results how the two features are associated. At its northern end are suggestions of small discrete areas of positive responses on the edge of the surveyed area that may represent a series of pits or similar cut features.

No. 4
Lying adjacent to the linear anomaly (No. 3) is a similar curvilinear positive anomaly. This feature appears to run roughly north – south for *c*.14m before curving to the west and intersecting with No. 3. There is also the suggestion of further positive features in this area but they are difficult to distinguish from the general background responses.

No. 5
To the west of the enclosure lies a series of slight positive and negative magnetic responses, located on and at the base of a steep slope. The relatively slight magnetic responses and its somewhat sinuous form in places may suggest that this is caused by a change in the underlying geology or a movement of the subsoil on the steep slope rather than representing an archaeological feature.

No. 6
Down slope to the west of the enclosure a series of large rounded banks and hollows are recorded on the topographical survey. The hollow forms a wide gully *c*.20m across and running roughly east-west in a slight curve for *c*.100m, defined to the north and south by irregular banks. These appear to correspond to a series of amorphous and sinuous anomalies of both positive and negative responses on the geophysical survey. These responses are distinct from the general geological background but they do not appear to form any coherent or regular archaeological feature and it is possible they may represent more naturally occurring features or changes in the underlying geology.

No. 7
To the south of the enclosure are a series of magnetically weak positive and negative responses. Due to the slight magnetic difference between these features and the surrounding subsoil it is difficult to distinguish the precise nature of these anomalies. Such weak responses may be indicative of natural changes in the underlying geology and pedology, although they lie on relatively flat high ground within the survey area.

No. 8
In the northeastern corner of the field are two strong dipolar linear responses. The linear responses are curvilinear and somewhat sinuous in form, although almost U-shaped in plan. Such dipolar responses often represent ferrous objects. Such strong responses are also often caused by relatively modern features, although it is unclear if this is the case here. These features lie underneath the line of overhead power cables.

No. 9
In the western corner of the survey area are a series of positive linear anomalies, indicative of buried ditches. One linear runs in a northeast – southwest direction for *c*.30m with a slight northwards curve, extending beyond the western limits of the survey area. Towards its northeastern end it is crossed perpendicularly by another linear running for *c*.10m. To the south of this a third linear extends southeastward from the main linear for *c*.25m before fading out. These features lie gradually sloping lower ground overlooked by the enclosure. These ditches also appear to partly enclose an area of possible former agricultural activity (No.10).

No. 10
Lying in the corner of the surveyed area is an area of positive and negative linear anomalies and general magnetic debris, consisting of numerous small dipolar responses spread over the area around linear anomalies No. 9 and possible modern features No.15. The magnetic responses are relatively low (+/- 4nT)

which is often indicative of general ground disturbance with no clear cause. The appearance of linear striations may suggest that this is the result of ploughing in this area.

No. 11
In the southern corner of the survey area are traces of a positive linear feature that appears to form an L-shape in plan. Only a small segment of this feature lies within the survey area but the positive response suggests a ditched feature.

No. 12
Running roughly northeast – southwest across the centre of the survey area is a long negative linear anomaly. Such negative anomalies are often indicative of buried banks or sometimes even walls, however in this instance this feature appears to correspond with the line of an asbestos water-services pipe as indicated by the landowner.

No. 13
Towards the southern end of the site are two faint positive linear anomalies running roughly north – south across the survey area, visible for a length of *c*.45m but possibly extending further. Such anomalies may indicate buried ditches. Parallel ditches can sometimes be indicative of drainage alongside a central trackway and represent further archaeological activity in this area. However, these anomalies also appear to occur in an area of known water-services that cross the field from north to south as indicated by the landowner.

No. 14
To the northwest of No.13 lies two similar parallel positive linear anomalies running roughly north – south. They appear to extend beyond the limit of the survey area to the south, but fade out to the north after a distance of *c*.90m.

No. 15
At the western edge of the survey area are a series of very strong dipolar anomalies. Such strong responses are often indicative of ferrous objects that often prove to be modern in origin.

CONCLUSIONS

The geophysical survey results show a variety of archaeological activity across the survey area although there is a clear concentration of activity around the earthwork remains of Gaer. The geophysical survey results show that the earthwork monument appears to consist of a sub-circular enclosure *c*.40m – 45m across formed by a bank with an external ditch (No. 1). There is a probable entranceway to the northwest although this lies in an area of possible ground slippage. A second, less clear, entranceway lies to the east where the outer ditch appears to break up into a series of possible pits although the inner bank is continuous in this area. Prior to the geophysical survey no ditch was apparent at this site, which cast doubt on its function as a defended enclosure or castle site. However, the ditch is clearly visible on the geophysical survey and this bank and ditch arrangement would appear to be defensive in character. The general archaeological activity inside this defensive enclosure would also suggest possible domestic activity within, although distinct features cannot be distinguished. Defended enclosures are a common feature of the Iron Age throughout southwest Wales, and Gaer is compatible with other examples at the lower end of the range size. Another likely possibility for a circular defensive enclosure of this size is a medieval ringwork castle. Such castles, defended by a palisaded embankment and ditches, are known throughout this area. Internally the arrangements could be varied, with the earlier castles consisting of timber buildings, which may not necessarily be visible to on a gradiometer survey. Such ringwork sites often dated to the early period of castle building in Wales in the late 11th and 12th centuries. There is no documentary or historic evidence for a castle site at this location however, and a more prominent castle mound is recorded close by on the banks of the River Teifi (PRN 2076, SN 2379 4331). The local tradition is that this monument represents the remains of a Roman watchtower but the geophysical results do not appear to support this supposition.

The place-name 'Gaer' maybe of use in determining age. The place-name element gaer (meaning fort) is often attached to Iron Age defended enclosures or hill-forts in southwest Wales, and rarely, if at all, to medieval defended sites. These later, medieval sites usually attract the place-name element castell or castle. This element in its Welsh form, castell, is also used for some Iron Age sites. The place-name, therefore, hints at an Iron Age date for the site rather than medieval.

It would appear likely that surrounding ditches (Nos. 2 to 4) are associated archaeological features, although No. 2 does appear to lie close to a former entranceway into the field from the road (there is currently no direct access from the road to the field). All features appear to extend beyond the field limits to the north, suggesting associated archaeology may be concentrated to the north, under the road and buildings opposite. It appears somewhat unusual that there are no definite traces of further archaeological features extending along the flat higher ground to the southeast. The traces of positive magnetic anomalies to the northwest and south of the enclosure are too indistinct to be positively associated with archaeological features. Noticeable topographical features to the northwest appear to correspond to changes in the natural geology and pedology as visible on the geophysical survey.

At the western end of the area surveyed lie several apparent ditches (No. 9) associated with an area of general magnetic debris (No. 10). This has the appearance of ploughed soil, but it appears unusual to only be recorded in this area, there is no clear topographical evidence to indicate why this should be. The association with the ditches may suggest an earlier system of field enclosures. This area was the final area to be surveyed, which unfortunately meant there was no further opportunity to extend the survey in this area.

Linear features running across the site (Nos. 13 – 14) may be archaeological features although the also appear to lie in close proximity to areas of known modern services (No. 12). Strong magnetic responses such as No. 8 and No. 15 are likely to represent modern ferrous items.

ACKNOWLEDGEMENTS
The survey was undertaken by Mike Ings, Andy Shobrook and Phil Poucher. I am indebted to Mr I & V Nicholas 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

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

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

Murphy K, Ramsey R & Page, M 2006, *A Survey of Defended Enclosures in Ceredigion*. Dyfed Archaeological Trust Report No.2006/20, PRN 54269.

Parker Pearson M, 2005, *Bronze Age Britain*. Batsford, London.

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

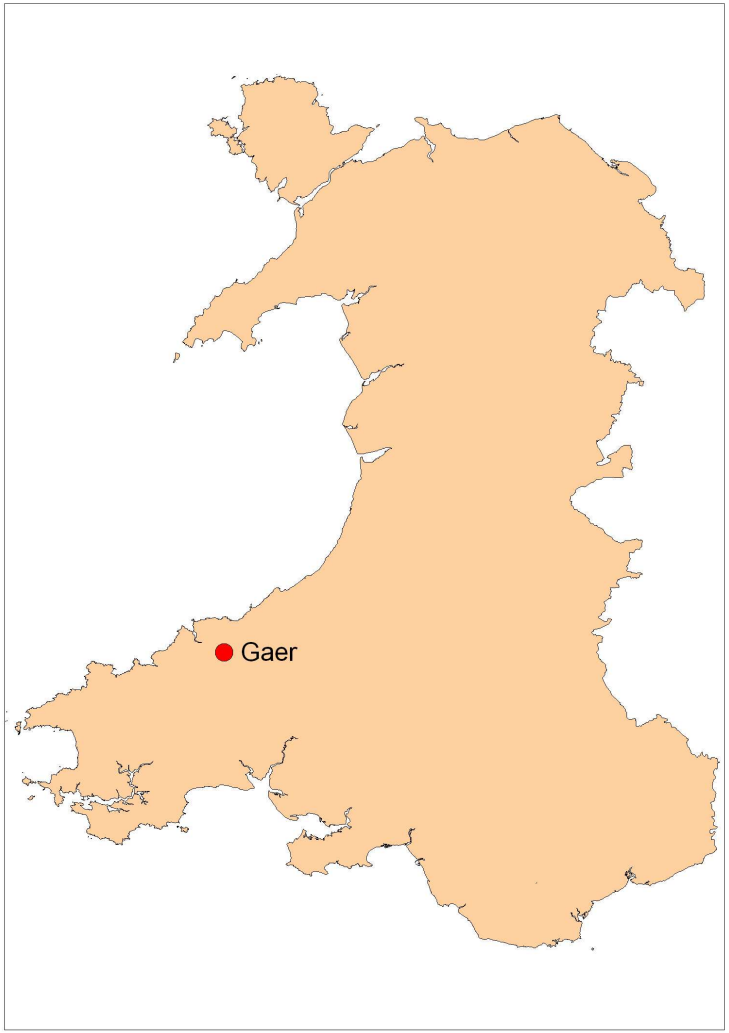
Geophysical survey is an immensely useful tool but it should be realised that while a survey will detect a wide range of features, it may not detect *all* buried features. A gradiometer survey detects changes in magnetic flux density and relies on there being a detectable difference between the archaeology 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.



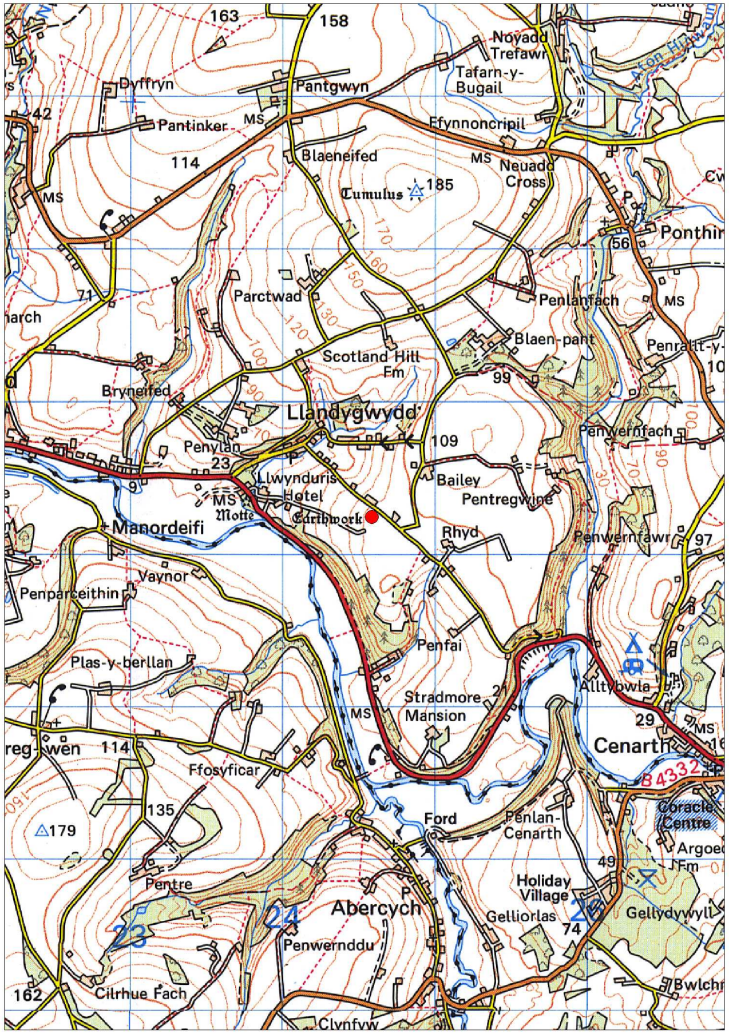


Figure 1: Location map, based on the Ordnance Survey.

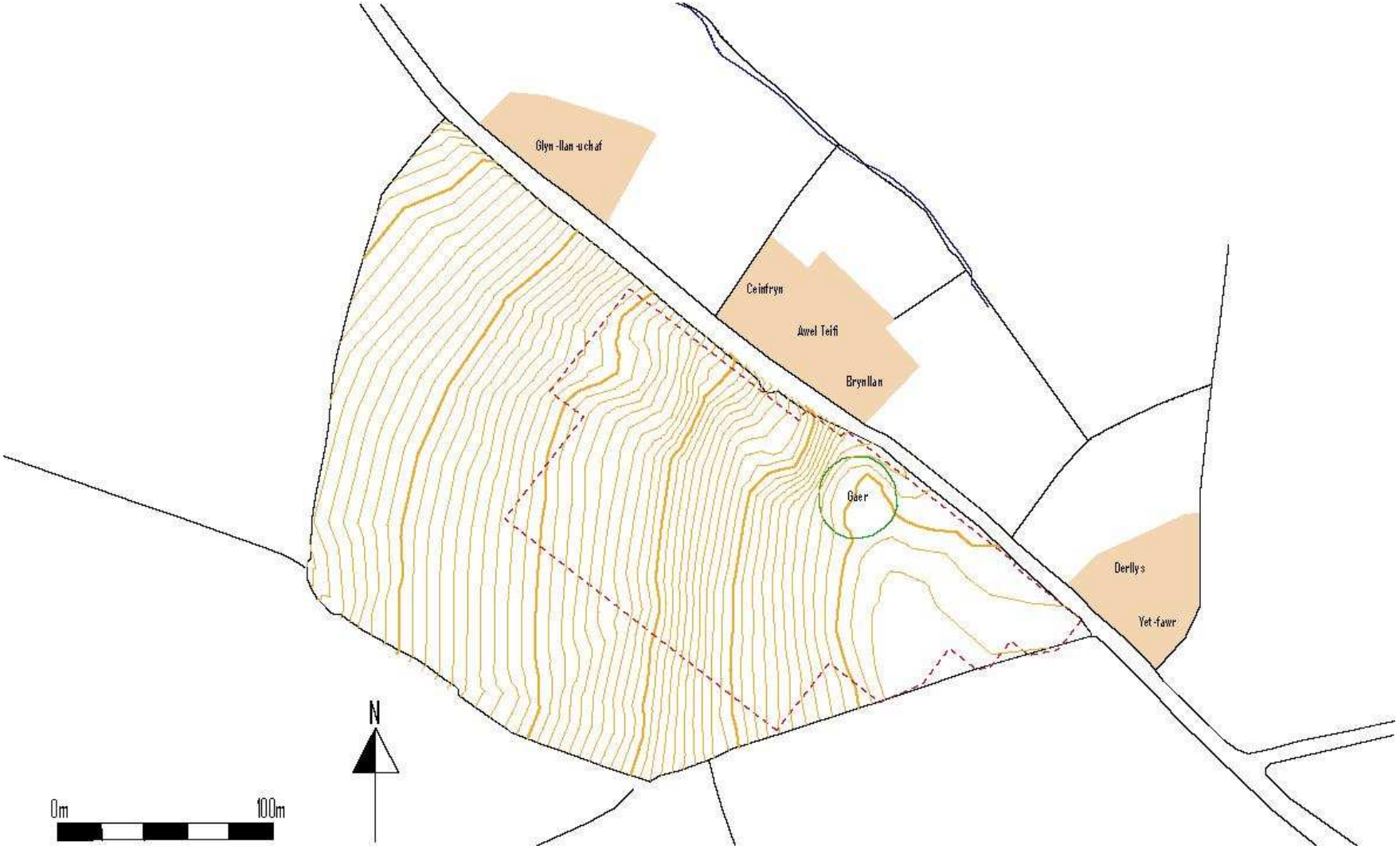


Figure 2: Topographical survey of the survey area, showing contours at 0.5m intervals. The area of geophysical survey area is outlined in red, the earthwork remains of Gaer are outlined in green.

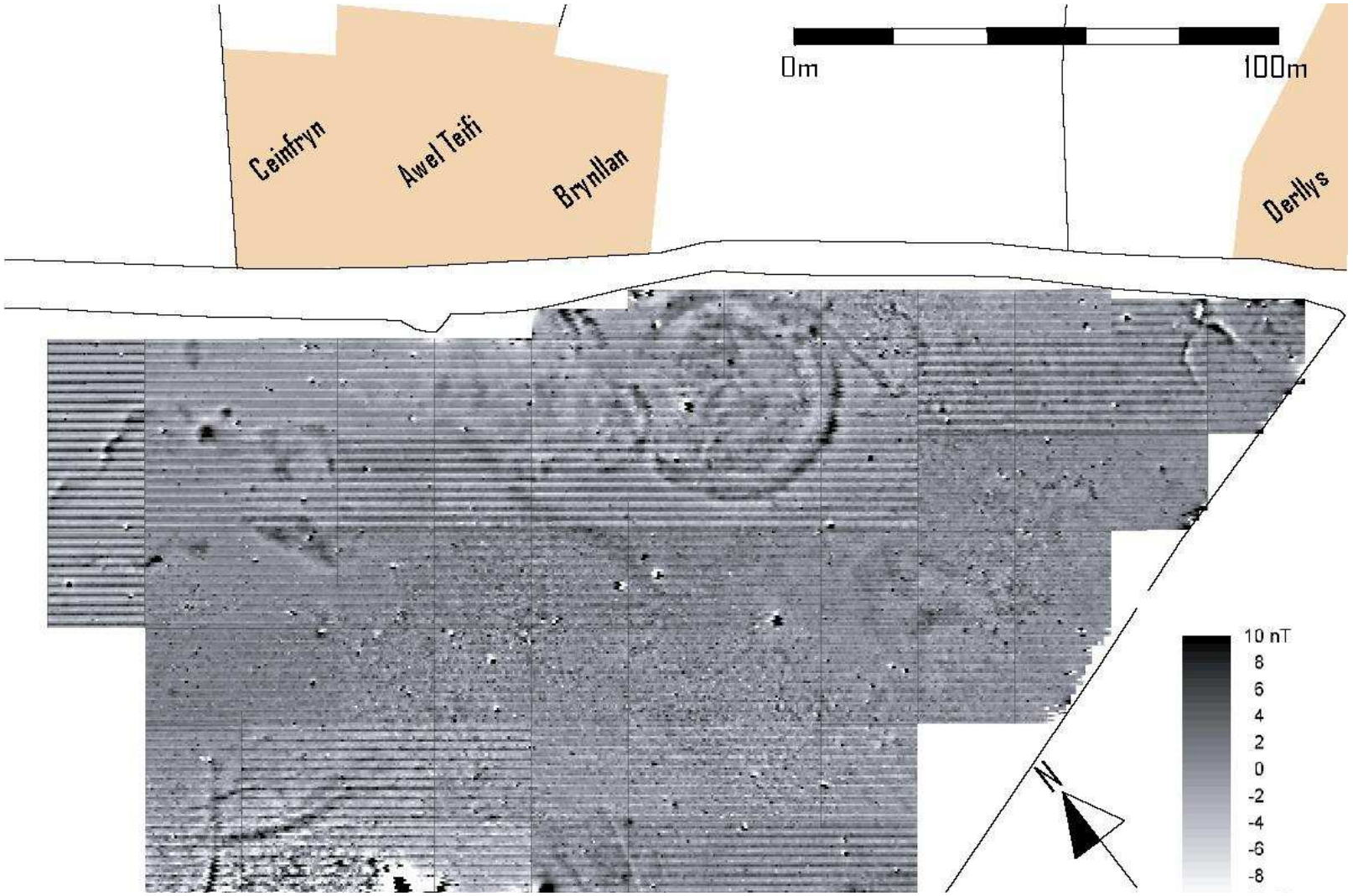


Figure 3: Geophysical survey results, clipped to +-10nT but otherwise unprocessed.

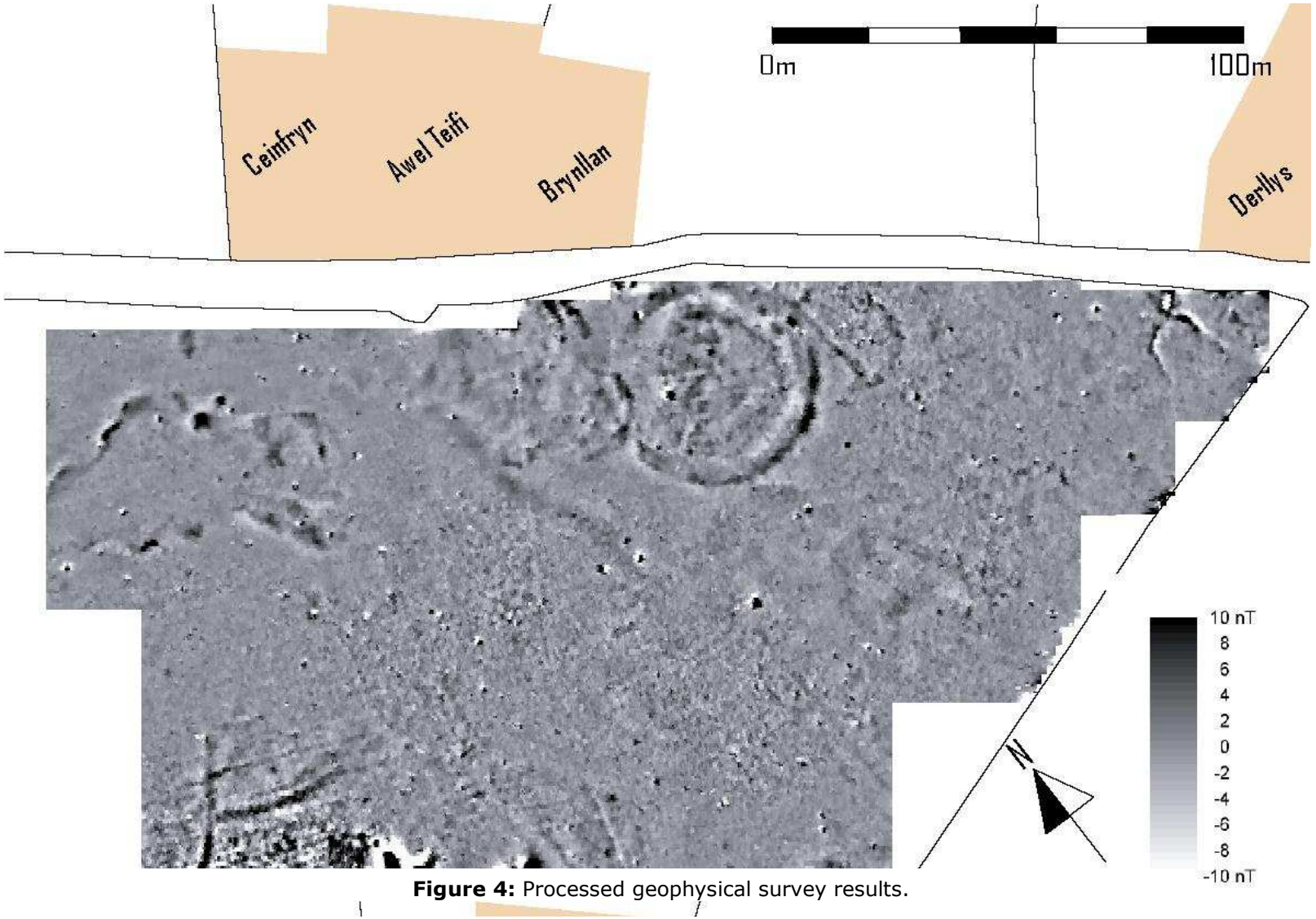


Figure 4: Processed geophysical survey results.

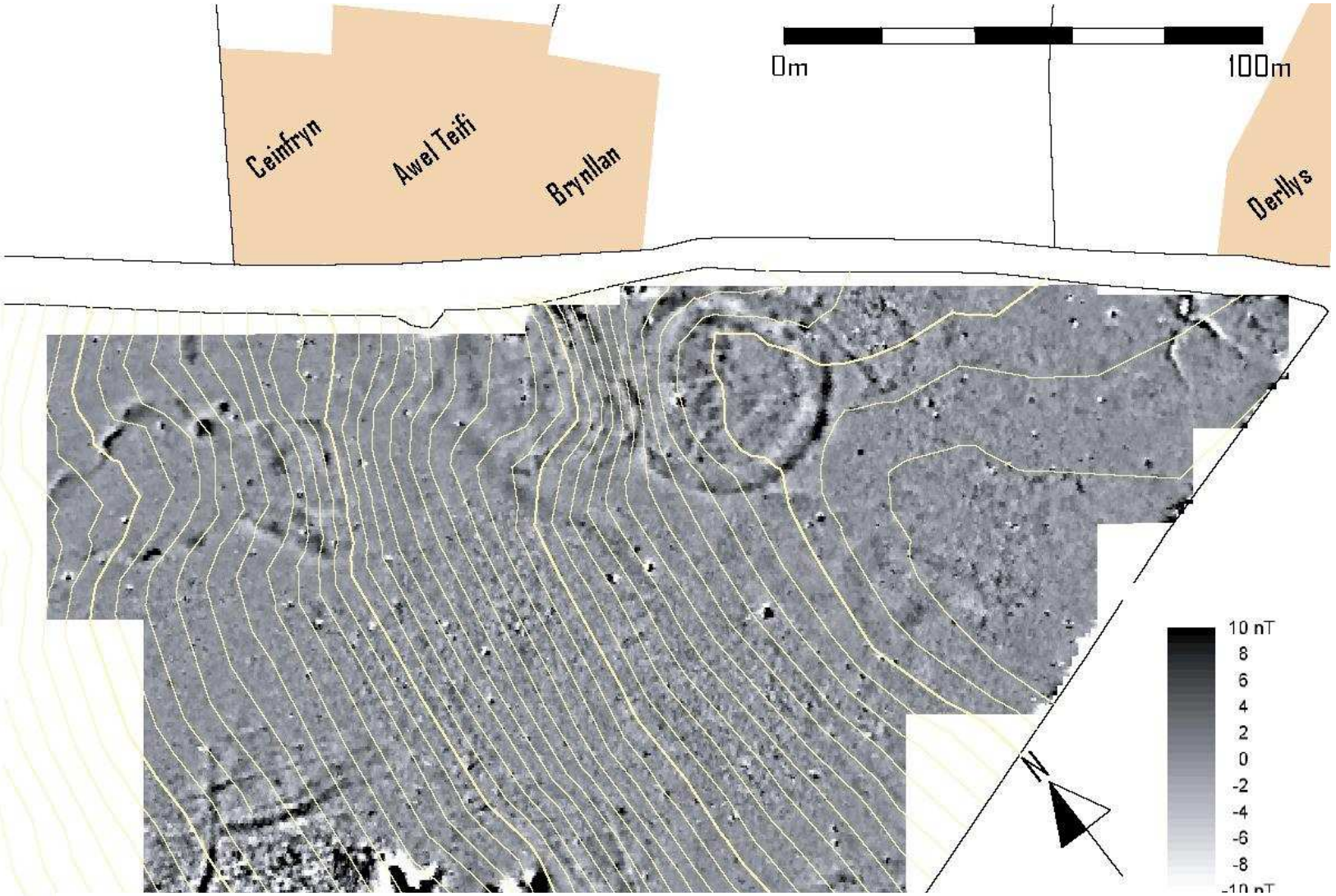


Figure 5: Processed geophysical survey results overlaid by contours at 0.5m intervals.

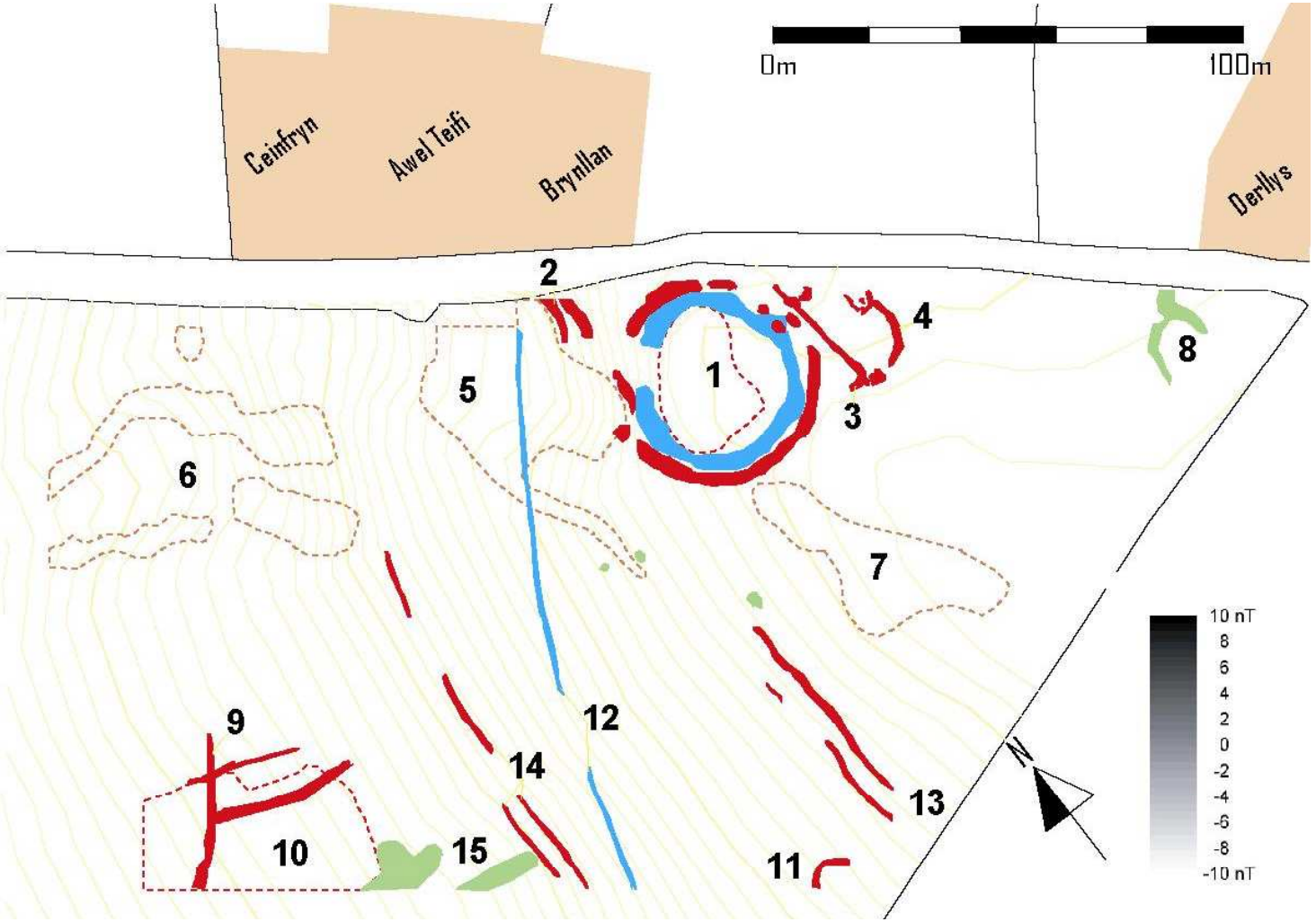


Figure 6: Interpretation of the geophysical survey results, overlaid with contours at 0.5m intervals. Numbers relate to 'Geophysical Interpretation' section in the main text. Red highlights the main positive anomalies, blue highlights the main negative anomalies, green highlights the main bipolar anomalies.

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

Philip Poucher

Swydd / Position: Archaeologist

Llofnod / Signature  Dyddiad / Date 1/03/2010

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

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

Swydd / Position: Director

Llofnod / Signature  Dyddiad / Date 1/03/2010

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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