

PROPOSED CENTRE OF INNOVATION AND ENTERPRISE, GOGERDDAN CAMPUS, UNIVERSITY OF ABERYSTWYTH, CEREDIGION: GEOPHYSICAL SURVEY

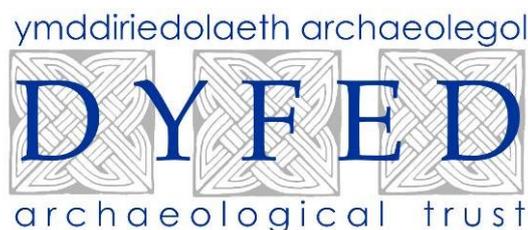


Looking towards northeast extent of North Area from road side.



Prepared by DAT Archaeological Services

For: Aberystwyth Innovation and
Enterprise Campus Ltd



DYFED ARCHAEOLOGICAL TRUST

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**PROPOSED CENTRE OF INNOVATION AND
ENTERPRISE, GOGERDDAN CAMPUS,
UNIVERSITY OF ABERYSTWYTH, CEREDIGION:
GEOPHYSICAL SURVEY**

Gan / By

Alice Day

Paratowyd yr adroddiad yma at ddefnydd y cwsmer yn unig. Ni dderbynnir cyfrifoldeb gan Ymddiriedolaeth Archaeolegol Dyfed Cyf am ei ddefnyddio gan unrhyw berson na phersonau eraill a fydd yn ei ddarllen neu ddibynnu ar y gwybodaeth y mae'n ei gynnwys

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SUMMARY

DAT Archaeological Services were commissioned by Aberystwyth Innovation and Enterprise Campus Ltd to undertake a geophysical survey of two areas within the Plas Gogerddan Campus of Aberystwyth University; areas that may be developed as part of the proposed construction of a new Centre of Innovation and Enterprise. The survey was requested to provide a better indication of the archaeological potential of the site and assist with future management plans. It may also be used to enable targeting of any further archaeological investigation that may be undertaken. Two of the three areas of proposed development were surveyed: the 'North Area' centred on SN 62707 83574 measuring approximately 0.9ha in size; and the 'Cae Lodge Area' at approximately 1ha in size centred on SN 62635 83824. The third area is partly built upon with structures and paths and was not suitable for geophysical survey.

The area surrounding the proposed development contains a high density of archaeological sites of many periods. Nationally significant sites of Neolithic and Bronze Age date associated with funerary and ritual monuments are located directly to the southwest of the existing campus which form part of scheduled ancient monument CD259. The scheduled area of CD259 also contains evidence of Iron Age and early-medieval remains associated with a cemetery site which could well extend into the development area. Therefore the areas proposed for development were thought to have particular archaeological potential for discoveries of prehistoric and early medieval date.

The two areas were surveyed over three consecutive days between the 12th and 14th of July 2016. In total an area measuring 1.2ha was surveyed. The survey was conducted using a fluxgate gradiometer which detects variations in the earth's magnetic field.

Although the entirety of the Cae Lodge Area could not be surveyed due to obstructions, the geophysical survey indicated the presence of a number of buried features; including possible archaeological features reminiscent of the rectangular early medieval burials recorded during the 1986 archaeological excavation of the area now scheduled as PE259 that lies some 300m to the south of Cae Lodge.

The most obvious possible archaeological feature identified by the survey in the North Area is a large negative anomaly which corresponds to a curved double bank or terrace of moderate incline visible on the ground. The negative polarity of this bank suggests that it is largely built from stone. Parallel with the bank on its north side is evidence of a possible inner ditch represented by a positive anomaly. Other lengths of bank and ditches were recorded within this area as well as a negative linear feature probably representing a buried wall.

The date of these features is difficult to ascertain but if the large bank originally formed part of an entire circular enclosure, the size of the enclosure could be estimated at approximately 200m in diameter. This is a size comparable with known Iron Age defended enclosures and early medieval ecclesiastical enclosures, although it is similarly possible that it is a surviving remnant of a former field boundary of unknown date.

The survey results have demonstrated that gradiometer survey worked successfully on the geology of the site and that there is potential for a range of archaeological features to have survived in these two areas, some of which may be a continuation of prehistoric and early medieval features recorded within the nearby area of Scheduled Ancient Monument PE259.

1 INTRODUCTION

1.1 Project Commission

- 1.1.1 DAT Archaeological Services were commissioned by the Aberystwyth Innovation and Enterprise Campus to undertake a geophysical survey of two areas within the Plas Gogerddan Campus of Aberystwyth University (Figure 1); areas that may be developed as part of the proposed construction of a new Centre of Innovation and Enterprise. The survey was requested by the archaeological advisor to the local planning authority in advance of a decision being made on the planning application.
- 1.1.2 The two areas comprise the North Area centred on SN 62707 83574 that measures approximately 0.9ha in size and the Cae Lodge Area at approximately 1ha in size centred on SN62635 83824 (Figure 2). A third area of proposed development was not suitable for geophysical survey due to existing paths and structures.
- 1.1.3 The proposed development lies within an area containing a high density of archaeological sites of many periods. Of national significance are the sites of Neolithic and Bronze Age date associated with funerary and ritual monuments located directly to the southwest of the existing campus which form part of scheduled ancient monument CD259 (Figure 3). The scheduled area of CD259 also contains evidence of Iron Age and early-medieval remains associated with a cemetery site which could well extend into the development areas. A portion of a circular cropmark of likely prehistoric date (NPRN 404548) recorded by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) has been recorded within the Cae Lodge Area. In addition further evidence for prehistoric activity, as well as medieval and post-medieval remains associated with the park and gardens surrounding Plas Gogerddan itself have been recorded in close vicinity to the proposed development.
- 1.1.4 Consequently there was considered to be a strong possibility that archaeological material could extend into the development areas and be adversely affected by the proposed development. The results of the geophysical survey should provide a better indication of the archaeological potential of the site and assist with future management plans. It may also be used to enable targeting of any further archaeological investigation that may be undertaken.

1.2 Scope of the project

- 1.2.1 A specification for a geophysical survey was prepared by DAT Archaeological Services prior to the commencement of works.
- 1.2.2 The specification outlined the following objectives:
- The methodology for the archaeological work which DAT Archaeological Services will undertake;
 - To identify the presence/absence of any potential archaeological deposits through gradiometer survey; and
 - To produce an archive and report of any results.

1.3 Report outline

1.3.1 This report provides a summary and discussion of the geophysical survey and its results. References to cartographic and documentary evidence and published sources will be given in brackets throughout the text, with full details listed in the sources section at the rear of the report.

1.4 Abbreviations

1.4.1 All 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). Sites recorded on the National Monument Record (NMR) held by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) are identified by their National Primary Record Number (NPRN). Scheduled Ancient Monument (SAM). Listed Building (LB). Altitude is expressed to Ordnance Datum (OD). Gradiometer readings are measured in nanoTesla (nT).

1.5 Illustrations

1.5.1 Printed map extracts are not necessarily produced to their original scale.

1.6 Timeline

1.6.1 The following timeline (table 1) is used within this report to give date ranges for the various archaeological periods mentioned within the text.

Period	Approximate date	
Palaeolithic –	c.450,000 – 10,000 BC	Prehistoric
Mesolithic –	c. 10,000 – 4400 BC	
Neolithic –	c.4400 – 2300 BC	
Bronze Age –	c.2300 – 700 BC	
Iron Age –	c.700 BC – AD 43	
Roman (Romano-British) Period –	AD 43 – c. AD 410	Historic
Post-Roman / Early Medieval Period –	c. AD 410 – AD 1086	
Medieval Period –	1086 – 1536	
Post-Medieval Period ¹ –	1536 – 1750	
Industrial Period –	1750 – 1899	
Modern –	20 th century onwards	

Table 1: Archaeological and Historical Timeline for Wales.

¹ The post-medieval and industrial periods are combined as the post-medieval period on the Regional Historic Environment Record as held by Dyfed Archaeological Trust

2 THE SITE

2.1 Site Location

- 2.1.1 The proposed development for the Aberystwyth Innovation and Enterprise Campus is located to the west and south-west of the Institute of Biological, Environmental & Rural Sciences situated on the Gogerddan Campus of Aberystwyth University, some 4.6km north-east of the centre of Aberystwyth. The campus is located at the western floor of a narrow, steep sided and forested valley through which two watercourses converge to become the westward flowing Nant Clarach (Figures 1 & 2).
- 2.1.2 The Gogerddan Campus is situated within the former grounds of Plas Gogerddan (PRN 7075); a late Georgian mansion house. The existing university campus mainly comprises large post-medieval and modern agricultural buildings, blocks of up to three storey high buildings and several glass houses and polytunnels. The A4159 road flanks the western side of the campus. The North Area comprises a small triangular field bounded on the west by a minor B-road. The Cae Lodge Area is located over 0.15km north of the North Area, to the south of Allt Ddêl woodland. It is partially occupied by a large agricultural shed and associated yard.
- 2.1.3 The archaeological and historical background of the site has been detailed in a separate Historic Environment Desk-Based Assessment prepared by DAT Archaeological Services (Bell 2016).

2.2 Geology

- 2.2.1 The bedrock in the vicinity of Plas Gogerddan is sandstone and mudstone of the Aberystwyth Grits group of the Llandovery epoch. Superficial deposits cover the four survey areas: At Cae Lodge 1, the rock type is diamicton, which is Devensian Till of Pleistocene age. Just south of this, and also covering most of the North Area, there is sand and gravel from Devensian Glaciofluvial Ice Contact Deposits, also of the Pleistocene epoch. A strip about 5m wide across the northern edge of the North Area is thought to be alluvial clay, silt, sand and gravel of Holocene age.
- 2.2.2 The bedrock is sedimentary and is unlikely to have added any magnetism to the data collected. All of the superficial deposits, except the alluvium, are likely to have contributed a small amount of their own magnetism to the gradiometer readings, but this has been corrected by calibration of the instrument to an average reading for each survey area. These deposits are unlikely to have given strong magnetic readings above or below the average capable of interfering with readings associated with archaeological features.
- 2.2.3 Geological information has been obtained through the British Geological Survey mapping portal :
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

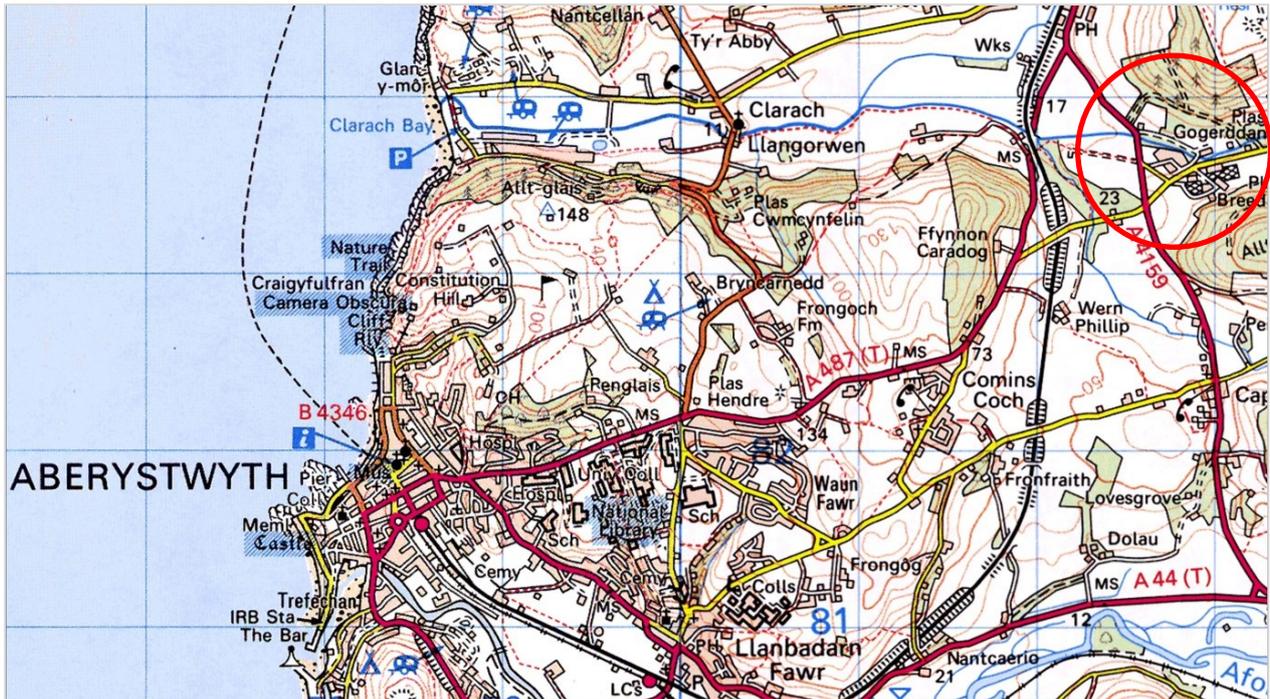


Figure 1: Map showing the location of the Plas Gogerddan Campus of Aberystwyth University (circled in red)

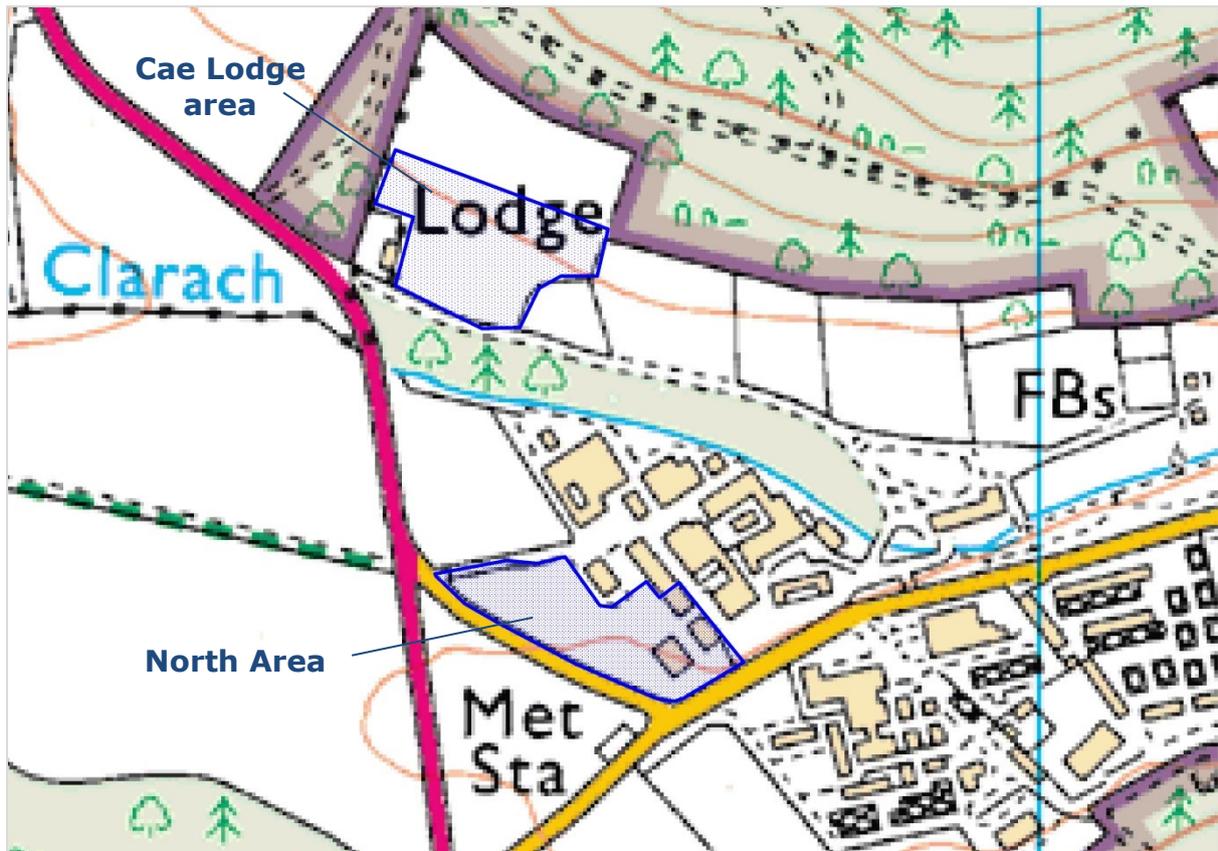


Figure 2: Map showing the location of the two areas surveyed using magnetometry at the Plas Gogerddan Campus of Aberystwyth University (shaded in blue)

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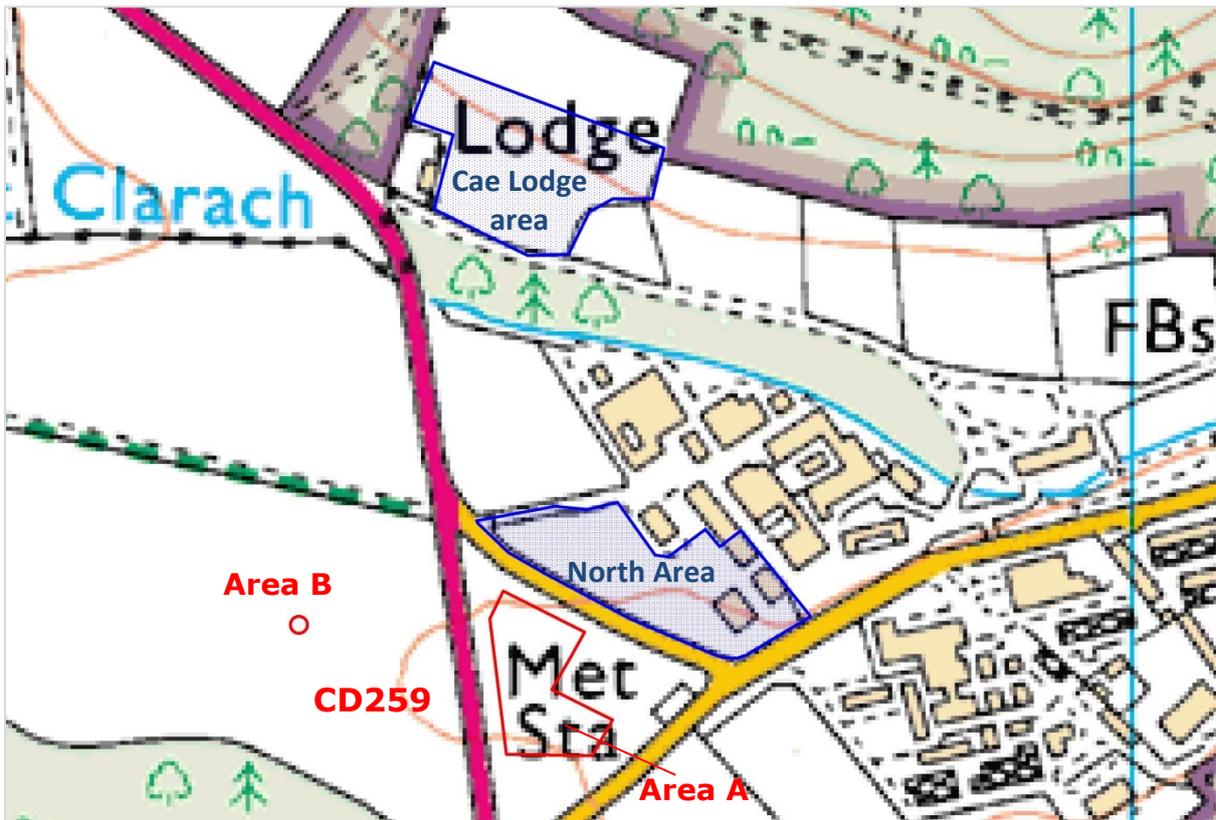


Figure 3: Map extract showing the 2 areas that comprise SAM CD259; outlined in red.

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3 GEOPHYSICAL SURVEY METHODOLOGY

- 3.1 A fluxgate gradiometer with a DL601 data logger that detects variations in the Earth's magnetic field was used to conduct the magnetometry survey. A sample interval of 0.25m (four readings per metre) was used with 1m wide traverses across 20m x 20m grids using the zigzag traverse method of collecting data. The fluxgate gradiometer's sensitivity was set to detect magnetic variations to the nearest 0.1 nT.
- 3.2 A Trimble TST was used to tie the survey grid into the local Ordnance Survey grid.
- 3.3 The data was processed using Terrasurveyor 3.0 and is presented with a minimum of processing. The presence of high values caused by ferrous objects, which tend to hide fine details and obscure archaeological features, have been 'clipped' to remove the extreme values allowing the finer details to show through.
- 3.4 The processed data has been presented as a greyscale plot, overlaid on local topographical features. The main magnetic anomalies have been identified and an interpretation of those results is given
- 3.5 The resulting 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 fluxgate 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.
- 3.6 All measurements given will be approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by their relative depth and magnetic strength.

4 RESULTS

4.1 Introduction

- 4.1.1 The site was surveyed over three consecutive days between the 12th and 14th of July 2016. In total an area measuring 1.2ha was surveyed. Unfortunately the Cae Lodge Area could not be surveyed in its entirety; the area was a mixture of pasture, scrub and hardstanding and stored on the scrub area were farm machinery and equipment. However, three areas were accessible and these are termed: Cae Lodge 1 (an area of pasture), Cae Lodge 2 (hard standing) and Cae Lodge 3 (an area within the scrub after the machinery had been cleared) in Figure 4. The whole of the North Area was surveyed.
- 4.1.2 Figure 4 shows the location of the areas surveyed. Figures 5 and 8 show the survey results for the Cae Lodge and North Areas respectively, presented in greyscale against local topographical features. Interpretations of the data for Cae Lodge 1, Cae Lodge 3 and the North Area are discussed separately and are illustrated in Figures 6, 7 and 9.
- 4.1.3 The area of Cae Lodge could not be surveyed in its entirety because of farm machinery stored in the field; not all of which could be moved. Much of the western half of Cae Lodge was covered by hard standing and this is where much of the machinery was eventually moved to. Some parts of the hard standing were clear of magnetic items and a small area (Cae Lodge 2) was surveyed in order to ascertain whether or not magnetism in the gravel surface material would be strong enough to mask any features buried below it. This was done in an area of a clear circular cropmark recorded in aerial photographs taken by the RCAHMW (NPRN 404548). Unfortunately the gravel proved too magnetic for further survey to be practical, thus only the surveys of Cae Lodge 1 and Cae Lodge 3 produced data showing buried features. The unsuccessful results for Cae Lodge 2 are not presented in this report.
- 4.1.4 In the greyscale images, positive magnetic anomalies are displayed as dark grey to black, while negative magnetic anomalies are displayed as light grey to white. In the geophysical interpretation images, dipolar features are represented in red, positive features are represented in green, and negative features appear in blue.
- 4.1.5 Regions of positive relative magnetic field strength may be associated with high magnetic susceptibility, soil-filled structures, such as pits and ditches. Regions of negative relative magnetic field strength may correspond to features of low magnetic susceptibility, such as wall footings and other concentrations of rock, or voids. Paired positive-negative (dipolar) magnetic anomalies typically indicate ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.
- 4.1.6 Numerous small dipolar features can be seen to cover the areas surveyed. These are likely to represent small ferrous objects such as horseshoes or nails, which are commonly found distributed across sites. Where a field boundary contains ferrous material such as wire-fencing, a dipolar effect can be seen where the survey encroaches near to it. This dipolar 'shadow' is visible in nearly all instances where the survey meets the field boundaries.
- 4.1.7 Extra processing of the data was required for the North Area in order to compensate for a fault in one of the sensors which caused it to over-read on westerly traverses and under-read on easterly traverses. It is not known what caused this error, but it is most likely that the gradiometer did

not calibrate fully during setup. This extra processing has caused a minor loss of data and image resolution.

- 4.1.8 Data and image resolution has also been slightly reduced by application of the 'de-stagger' process to the data. This needed to be done due to small pacing errors by the operatives. The processing has resulted in anomalous stripes in the images at the edges of grids, which should not be mistaken for features. Some of the data in the Cae Lodge area has also had to be 'de-striped,' due to the sensors not being held vertical for some of the grids.
- 4.1.9 It is possible for some archaeological features to remain undetected due to their similarity in magnetic susceptibility to the surrounding natural geological deposits.

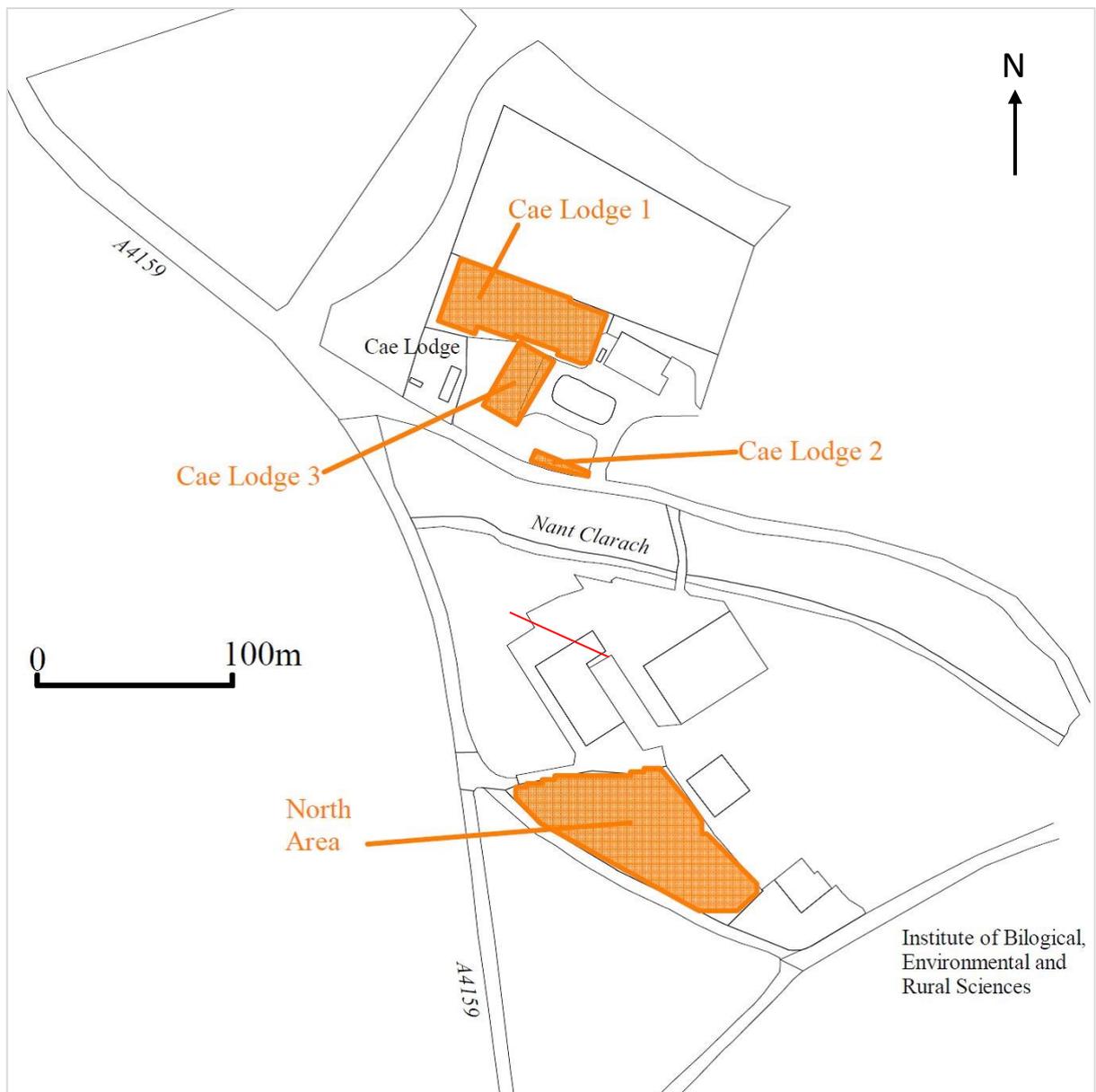


Figure 4: Map showing the location and outlines of the four areas surveyed using magnetometry at the Plas Gogerddan Campus of Aberystwyth University

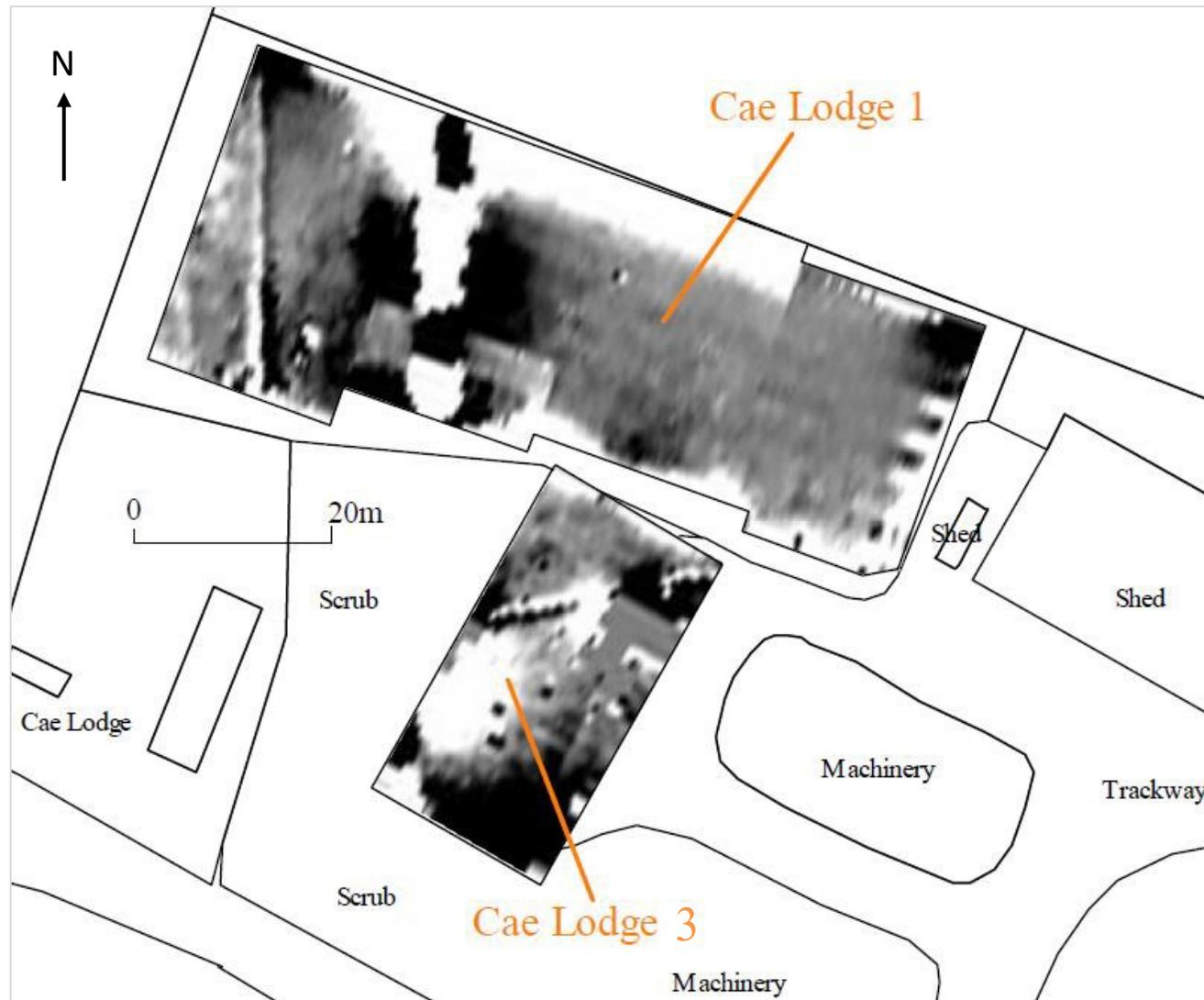


Figure 5: Processed data for the two survey areas at Cae Lodge, as a greyscale plot, overlaid on local topographical features. The results are presented over a range of $\pm 10\text{nT}$ around the local average value of magnetic field strength.

4.2 Cae Lodge 1 & 3 (Photos 1-3)

- 4.2.1 Figure 5 shows a greyscale plot of the data collected in these two areas. It can be seen that there are some very strong positive (black) and negative (white) magnetic signals. Most of these are dipoles, as highlighted in the interpretation plots in Figures 6 and 7.
- 4.2.2 Looking at Cae Lodge 1 (Figure 5), the strongest dipole is the feature running north-south through the western half of the image, seen as alternating white and black. This is probably due to an underground electricity cable. This has unfortunately hidden any subtler magnetic responses that we could have hoped to see, as have the dipolar areas around the edge of the survey area, caused by metal fences and gates. Another dipole feature, although not quite as strong, that also runs north-south but to the west of the larger dipole feature, shows as a thin black stripe parallel to an equally thin white one. This probably represents a metal cable but with far less or no electrical current running through it, or alternatively it could be a magnetic metal pipe. The small, discrete dipole features in other parts of the survey are caused by magnetism in objects such as nails.
- 4.2.3 Around the main dipole created by the power line there are large regions of both positive and negative relative magnetism, outlined in Figure 6 in green and blue respectively. While these are likely to be part of the dipole signal, it cannot be ruled out entirely that one or more of them may represent other buried features. The areas of positive magnetism may be present due to large pits now filled in with soil. The negative areas outlined in blue to the south of the large positive regions may correspond to spreads of rubble, but it is considered more likely that they are a result of the data processing necessary in this section of the grid.
- 4.2.4 Of more interest is the square positive feature labelled A in Figure 6 with what appears to be a smaller sub-circular positive feature circled within it. The plan of this feature is reminiscent of the rectangular early medieval burials recorded during the 1986 archaeological excavation of the area now scheduled as PE259 (Murphy 1986 & 1992), that lies some 300m to the south of Cae Lodge.
- 4.2.5 Many of the other small positive features in Figure 6 are likely to be soil-filled pits; some of which may be archaeologically significant and prehistoric in date, although pits are common features of settlement and ritual landscapes throughout many archaeological periods. A linear negative feature running nearly north-south through the southwest corner of the image may well represent the buried remains of a wall. The two small discrete negative anomalies in the northwest corner of the image could be either buried stones or voids.

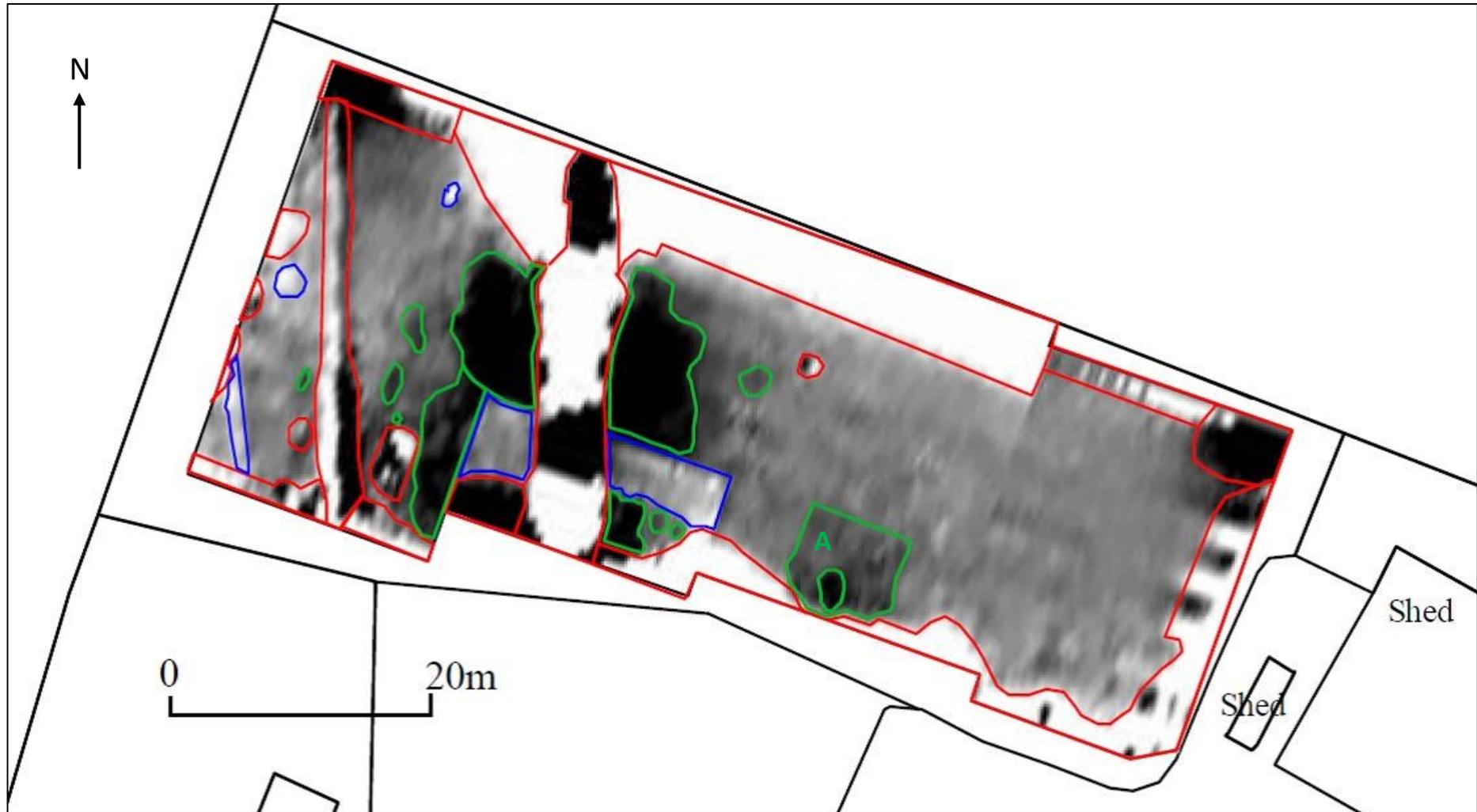


Figure 6: Interpretation of magnetometry survey results for Cae Lodge 1 overlaid on the greyscale plot (Dipole features outlined in red, positive features in green and negative features in blue)

- 4.2.6 The interpretation of features in Cae Lodge 3 survey area is shown in Figure 7. There are unfortunately many areas of very high magnetism. These were caused by two large pieces of farm machinery that could not be moved, an electricity sub-station, and other large metal items of farm equipment. The dipole signals resulting from the high magnetism have made it impossible to see buried features within much of the surveyed area. Two buried magnetic cables or pipes have been picked up running through the area – labelled A and B.
- 4.2.7 Small positive features can be seen throughout the parts of the survey area not obscured by dipoles. These are possibly buried soil-filled pits, although those closest to large dipole signals are probably only a result of that interference. No negative anomalies were detected. Feature C is reminiscent of perhaps a partially-surviving early medieval rectangular burial.

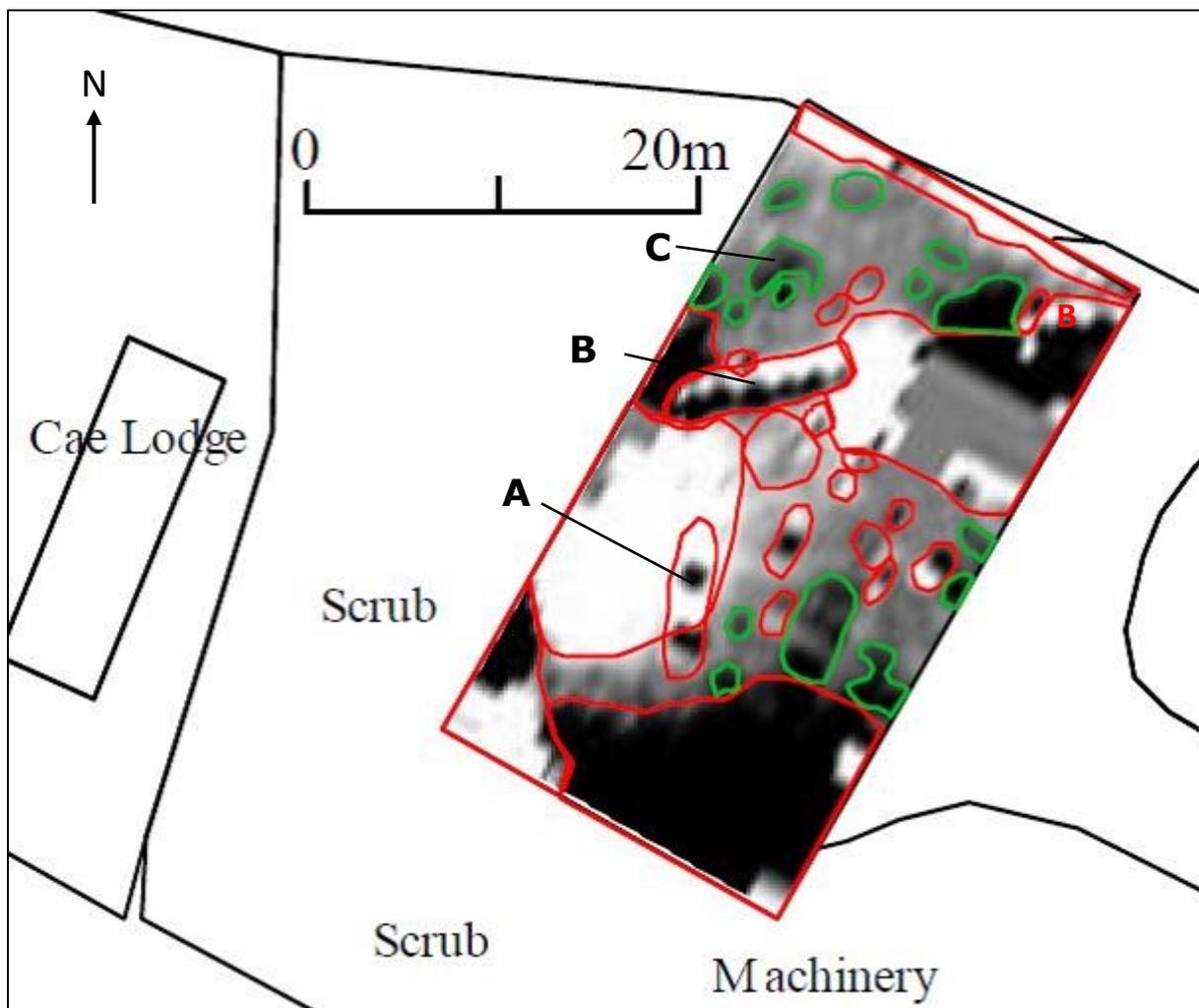


Figure 7: Interpretation of magnetometry survey results for Cae Lodge 3 overlaid on the greyscale plot (Dipole features outlined in red and positive features in green)

4.3 North Area (Photos 4 & 5)

- 4.3.1 Figure 8 shows a greyscale plot of the data collected in this survey area, and Figure 9 an interpretation of the features therein. Dipole signals from the fence around the field obscure any other features in their vicinity, and along the southwestern edge of the field, roughly circular dipole anomalies caused by metal fences around the individual trees that form a line parallel with the road, also dominate the picture. Many more, small, discrete dipole features were found in this field in comparison to the areas surveyed at Cae Lodge. Two buried power cables, labelled A and B on Figure 8, were found to run down the eastern edge of the field, preventing the discovery of any subtler remains there.
- 4.3.2 All positive and negative features detected in this field were linear in nature. The largest feature is a negative anomaly (C) which corresponds to a curved bank or terrace of moderate incline visible on the ground. The negative polarity of this bank suggests that it is internally built of stone. Also just visible on the ground is what appears to be an outer bank parallel to (C) and this also shows as a negative feature in the magnetometry data (D). Between these two banks a dip could be seen and the data seems to suggest that this could be an in-filled ditch or trackway (E). However, the magnetic readings between the two banks are not much higher than the average across the field so it may indicate only a slight feature.
- 4.3.3 A more convincing ditch is represented by positive anomaly F, parallel with the bank on its north side. Two further possible ditches (G) also appear to be aligned with the bank, as is a negative linear feature probably representing a buried wall (H).
- 4.3.4 In the southeast part of the field there is one final linear feature – this time a strong positive anomaly lying alongside a strong and wider negative one (H). This is likely to be the remains of a stone bank and ditch, but it is possible that the negative component of the feature is partially or wholly the result of nearby magnetism from fences. This feature also shares a common alignment with the large bank. It is possible that the line of trees in this field preserves the continuation of this feature all the way along the edge of the field.
- 4.3.5 The date and function of these features is difficult to estimate, as ditches and banks have been used to enclose spaces for a variety of reasons since Neolithic times. As a stone built bank, and according to known archaeological site types, the large bank would be most likely to date from the Iron Age onwards. It can be estimated from the curvature of the bank that, if it originally formed part of an entire circle, that circle would measure approximately 200m in diameter. This is a size comparable with known Iron Age defended enclosures and early medieval ecclesiastical enclosures, and also medieval defensive ringworks, but it is similarly possible that it is a surviving remnant of a former field boundary of unknown date.

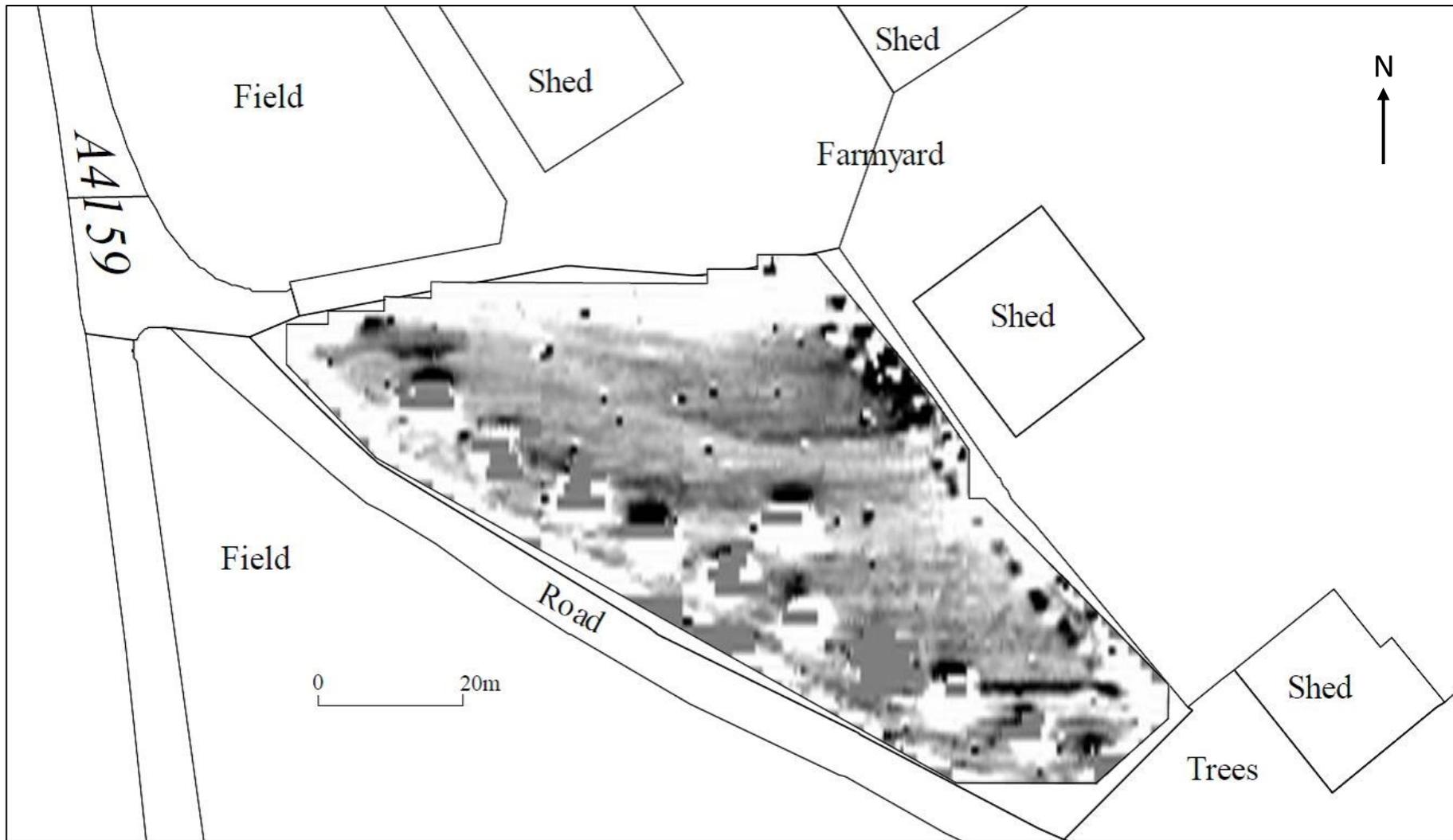


Figure 8: Processed data for the North Area, as a greyscale plot, overlaid on local topographical features. The results are presented over a range of $\pm 12\text{nT}$ around the local average value of magnetic field strength.

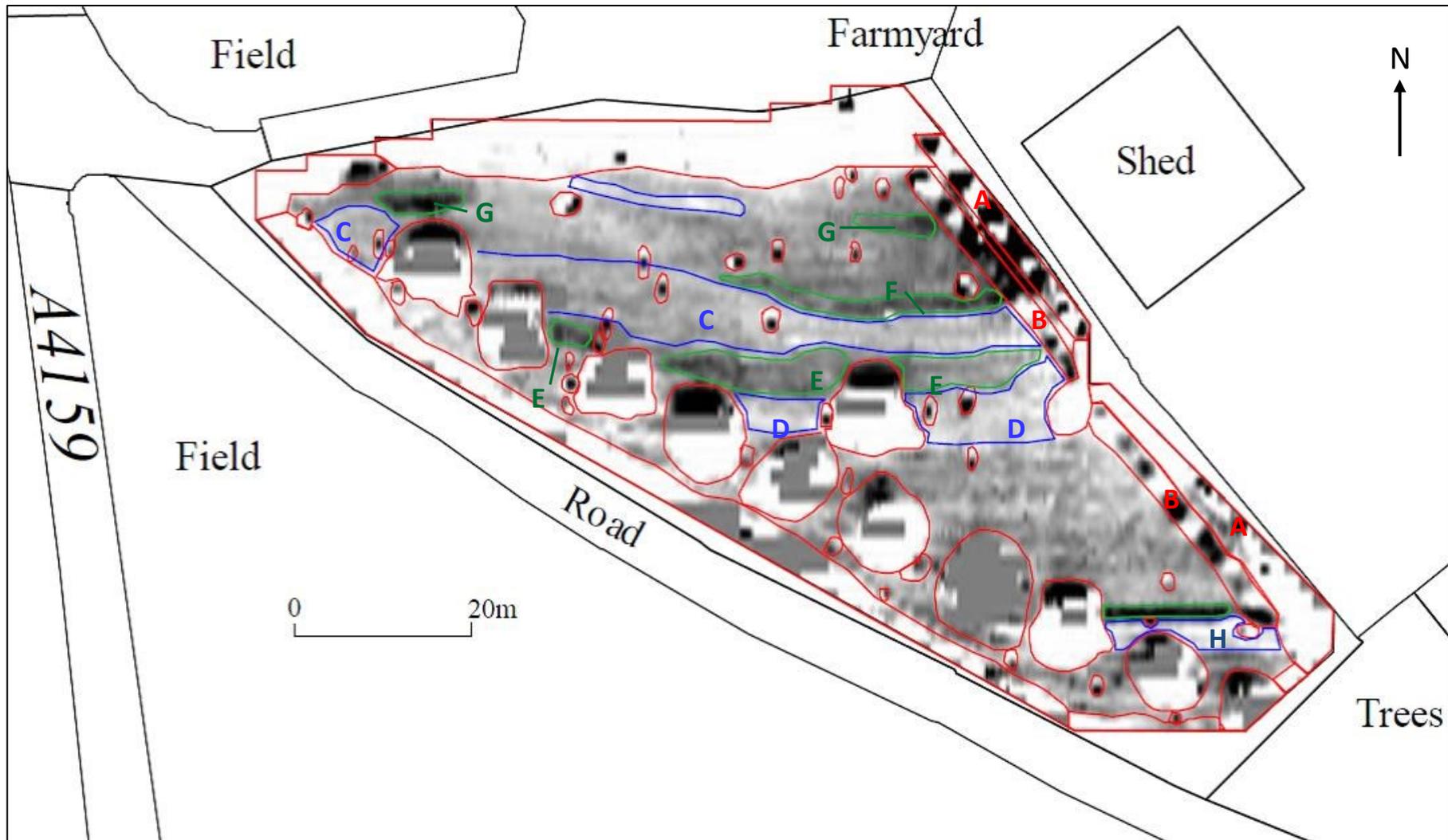


Figure 9: Interpretation of magnetometry survey results for the North Area overlaid on the greyscale plot (Dipole features outlined in red, positive features in green and negative features in blue)

5 CONCLUSIONS

- 5.1 The geophysical survey has revealed a variety of archaeological features across both survey areas.
- 5.2 Although the entirety of the Cae Lodge Area could not be surveyed the geophysical survey indicated the presence of a number of buried features; including possible archaeological features reminiscent of the rectangular early medieval burials recorded during the 1986 archaeological excavation of the area now scheduled as PE259 that lies some 300m to the south of Cae Lodge.
- 5.3 The most obvious possible archaeological feature identified by the survey in the North Area is a large negative anomaly which corresponds to a curved double bank of moderate incline visible on the ground. The negative polarity of these banks suggests that they are largely constructed from stone. Parallel with the inner bank on its north side is evidence of a possible inner ditch.
- 5.4 In the southeast of the field there is further evidence for a possible bank and ditch and it is possible that the line of trees in this field preserves the continuation of this feature along the its western edge.
- 5.5 Other lengths of bank and ditches were recorded within this area as well as a negative linear feature probably representing a buried wall.
- 5.6 The date of these features is difficult to estimate but if the large curving bank originally formed part of a complete circular enclosure, the size of the enclosure could be estimated at approximately 200m in diameter. This is a size comparable with known Iron Age defended enclosures and early medieval ecclesiastical enclosures.
- 5.7 The survey results have confirmed that the proposed development area has significant archaeological potential for a range of archaeological features to have survived in these two areas, some of which may be a continuation of prehistoric and early medieval features recorded within the nearby area of Scheduled Ancient Monument PE259.
- 5.8 The survey results should not be seen as a definitive model of what lies beneath the ground surface, as not all buried features will provide a magnetic response that can be identified by the gradiometer.

6 PHOTOS

6.1 Cae Lodge Area



Photo 1: Looking west from entrance into Cae Lodge showing the area of scrub and hard standing after it had been cleared of the farm machinery that could be moved.



Photo 2: Looking northwest at the Cae Lodge 3 survey area.



Photo 3: Looking west at the pasture of the Cae Lodge 1 survey area.

6.2 North Area



Photo 4: Looking roughly east at the North Area. The curve of the raised bank or terrace can be seen in the background.



Photo 5: Looking approximately northwest across the North Area. The line of trees that runs parallel with the minor road can be seen in the background and from the middle of the left side of the picture can be seen the raised bank or terrace curving round.

7 SOURCES

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PROPOSED CENTRE OF INNOVATION AND ENTERPRISE, GOGERDDAN CAMPUS, UNIVERSITY OF ABERYSTWYTH, CEREDIGION: GEOPHYSICAL SURVEY

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Alice Day

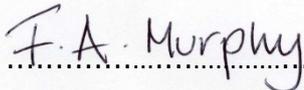
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Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by
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Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau
sydd gennych 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

ymddiriedolaeth archaeolegol



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