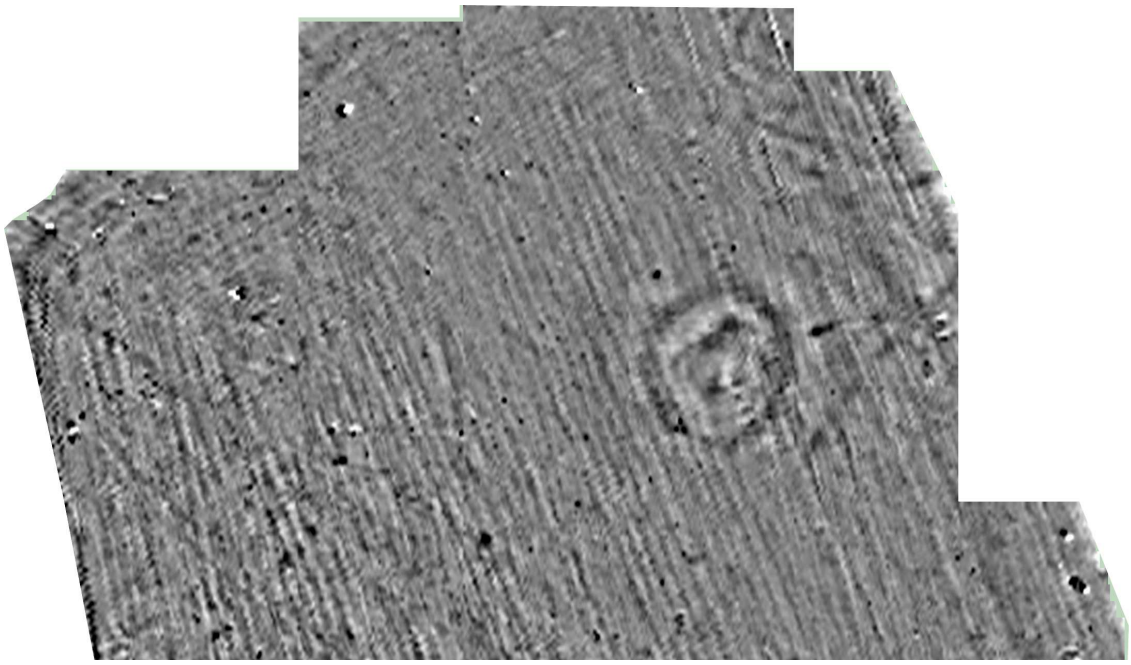
PANT Y BUTLER
LLANGOEDMOR, CARDIGAN
CEREDIGION

TOPOGRAPHICAL AND GEOPHYSICAL SURVEY

REPORT No 2008/118



Prepared by Dyfed Archaeological Trust
For Cadw

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Rhagfyr 2008
December 2008

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CEREDIGION
TOPOGRAPHICAL AND GEOPHYSICAL SURVEY

Gan / By

PETE CRANE BA HONS MIFA
AND HUBERT WILSON

Cadw

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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

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

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Cover: Part of geophysical survey

SUMMARY

Geophysical and topographical surveys were undertaken on a field near the former farmstead of Pant y Butler, Cardigan, Ceredigion. Two known round barrows that can be seen on the survey; there are suggestions of more. Also recorded on the site from aerial photographs was part of a cropmark was interpreted as a Roman fort or Iron Age defended enclosure: the geophysical survey could detect little trace of this cropmark and it is therefore considered to be mainly the result of geological anomalies.

INTRODUCTION

Project commission

Cadw grant-aided Dyfed Archaeological Trust to undertake a geophysical survey and topographical survey on part of a field near to Pant y Butler, Cardigan, Ceredigion (centred on NGR SN 21590 46640) (Figs 1, 2 and 3). The field contains round barrows and a cropmark possibly of a Roman fort or prehistoric defended enclosure.

Scope of the project

The project was designed to establish whether there were significant archaeological features in the area of the survey and if any more detail could be determined than could be seen on the aerial photographs.

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). The Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) hold a collection of aerial photographs of the region.

THE SITE

Location and Archaeological Potential

The site is located 3km east of Cardigan on the top, southern edge of a broad ridge. The highest point of this ridge lies 1.5km to the north-north-east (SN 21590 46640)(Fig 1). The survey was in the west part of a large "L" shaped field (Fig 2). There are open views from the top of the site in all directions except to the north.

The upper, northwest part of the field is relatively level. The northernmost of the two barrows, PRN 55928, can clearly be seen as a sub circular mound c. 0.75m high, and c. 45m east-west by 36m north-south. The other barrow, PRN 55929, is about 50m to the southwest. It is almost un-noticeable, being 0.2m high, with the diameter difficult to judge but approximately 30m.

Both of these barrows have more stone on their surfaces than in the general area of the field. It was obvious that both barrows have had considerable plough damage and the differential spread on the north barrow may be due to the prevailing direction of ploughing. The southern barrow has, however, been ploughed almost out of recognition.

A field boundary running north-south is recorded on the 1836 tithe map (Fig 3) towards the eastern end of the survey area. This does not appear on the Ordnance Survey 1st edition (1891), or later editions. The location of this boundary seems to coincide with the natural break of slope to the east.

A cropmark site, PRN 35728, was first recorded in 1995-6 from an oblique aerial photograph. This appears to show a right-angled double corner along with two other adjoining linear features. One obvious interpretation was that this represents the corner of a Roman fort.

This field has been under barley in recent years, although the last crop lifted was oil seed rape. After this crop had been harvested, the site was fertilized with milk slurry which was ploughed in as it was applied.

METHODOLOGY

Topographical Survey Instrumentation

A total station theodolite was used for the topographical survey recording readings along the tops and bottoms of features together with a number of spot heights, so that both contour and hachured plans could be produced.

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 interval was 0.5m. Readings were logged at intervals of 0.25m along each traverse giving 3200 readings per grid square (medium resolution).

Geophysical Survey Data presentation

The data was transferred from the data-logger to a computer where it was compiled and processed using ArchaeoSurveyor 2 software. The data is presented as grey-scale plots (Figs 5 to 6) 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. This is supplemented by an interpretation diagram showing the main features of the survey with reference numbers linking the anomalies to descriptions in the written report (Fig 6). It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous

surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most susceptible to misinterpretation due to the propensity for the human brain to define shapes and patterns in random background 'noise'. An assessment of the confidence of the interpretation is given in the text.

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.

Interpretation and reliability

An interpretation diagram is produced for each data set. It should be emphasised that this cannot be seen as a definitive model of what lies below the ground surface. The survey results indicate the general shape of features and the intensity of the magnetic response. The shape of the feature is the principle diagnostic tool. This can produce definite results in some cases (e.g. a Roman fort is readily identifiable) but often produces a range of possible interpretations. A simple linear anomaly could be interpreted as, amongst other things: a ditch, a drain, a plastic water pipe, a ploughed out bank, or a buried trackway. The intensity of the magnetic response gives further information, a strong response indicates burning, iron or thermoremnancy in geology. Comparison with known features from other surveys is always useful; the general appearance of an anomaly can give additional information to an experienced geophysicist. When all factors are taken into account the interpretation of major features such as defensive ditches and buildings is usually reasonably secure. Interpretation becomes less definite as anomalies become weaker and begin to blend into the background noise. The human brain attempts to identify known objects within relatively random patterns and this can tend to lead to less than reliable interpretations.

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.

RESULTS

Limitations

The first attempt to survey the site was on 2nd September 2008 but this had to be postponed as milk slurry was being ploughed into the field as a fertiliser. This meant that pipes would be dragged across the area to which access was required. The project was restarted on 30th September and continued until 3rd October.

The ploughing in of the milk slurry had resulted in a large number of spaced plough ruts. These, along with the high stubble left over from the oilseed rape crop, hindered smooth walking of the geosurvey traverses and this ploughing also affected the level of spot heights to some degree. Furthermore magnetic disturbances caused considerable problems in locating a calm response area to calibrate the gradiometer (the adjoining two fields were no better). Along with vehicle ruts, the disturbances can be clearly seen in the survey (Fig 5).

The underlying geology is Ordovician, Ashgill Llandielo that did not appear to cause any geological survey problems. However, some of the surface stones did give anomalies

Topographical interpretation

The only features visible from the survey are the two barrows (Fig. 4). The northern barrow PRN 55928 is quite clear but the southern PRN 55929 is only just discernable as a slightly higher area and its extent is somewhat vague. There is no sign of the cropmark site PRN 35728 being present even as a slight earthwork.

Geophysical interpretation

The ditch (1)(Fig 5) of the northern barrow PRN 55928 shows quite clearly. This ditch is 18m to 20m in diameter. Outside this ditch there is a "halo" of material, 27.7m diameter. Within the ring ditch (1) there are a number of anomalies: two dark anomalies on the west side and a smaller one or two to the west, where there is a suggestion of a dark ring c. 5m diameter. The ring ditch is probably the extent of the original construction of the barrow, although the "halo" and the total spread of this barrow, up to 40m diameter, suggests that it may have been extended beyond the ring ditch. It is possible, however, that it may have been an unusually high barrow that has been substantially spread by ploughing. The features within the ring ditch are not at all distinct, possibly due to plough damage, but there would appear to be some pits and the 5m diameter dark ring could represent a large central feature.

The ring ditch (2) of the other barrow PRN 55928 can only just be distinguished. The ring ditch is c. 11m diameter, and there may be a small central feature, lighter with a darker exterior. Also within the ring ditch, on either side of the possible central feature, there are two dark spots, which could be secondary cremations. The black and white anomaly on the edge of the ring ditch is ferrous.

There are three other possible ring ditches (Fig. 6: 3,4 and 5), of 7m, 8m and 23m diameters. The last of these (5) partly coincides with a contour line (Fig 4), and may therefore just survive as a very slight earthwork. However, all of these may be anomalies caused by modern agricultural vehicles or ploughing.

There are two linear or sub-linear features (6 and 7) towards the east of the survey area. The western of these (6) may be partly responsible for part of the cropmark PRN 35728. Both of these features contain material that may be thermo-remnant (heat affected). However, this may be geological (igneous) in origin as there are apparent southwest-northeast underlying geological features. To the north of the area there are lesser linear anomalies (8 and 9), which are even more likely to be geological rather than archaeological.

A parallel linear feature (10) is almost certainly the remains of the field boundary seen on the 1836 tithe map, with the darker stripes being the boundary ditches.

Another discontinuous linear anomaly (11) runs from the southeast to the northwest. This may be the remnant of a track or possibly a service trench with a non-ferrous pipe.

There are a large number of small dark anomalies. Three of the larger of these (12, 13 and 14) may be small hearths or pits containing heat affected material. The other anomalies scattered over the area could be small hearths, large postholes, tile or brick, and ferrous detritus.

DISCUSSION AND RECOMMENDATIONS

Clearly the two barrows have suffered from considerable plough damage. Both may have been devalued beyond a point where preservation through statutory designation is not feasible. Both will deteriorate with further ploughing. The larger of the two barrows is clearly a complex monument, although exactly how complex is not clear from current information. Therefore evaluation by one or more trial trenches should be considered.

The three other possible barrows (3, 4, and 5) are totally ploughed flat. As long as no deeper penetration of the field takes place, further damage to these is unlikely. However, it is recommended that evaluation trenches are excavated to confirm, or otherwise, the existence of these features and to firmly establish their vulnerability.

The cropmark site PRN 35728 would appear either to be insubstantial or not archaeological. It definitely does not appear to be part of a Roman fort or defended enclosure.

Of the other features, the pit or hearth (12) to the north of the north barrow, PRN 55928, would be worth investigating during evaluation of this barrow. Consideration should also be given to look at the largest of the possible hearth sites (14).

CONCLUSION

This project has suggested that there are likely to be more barrows present than the two visible on the surface, but that the cropmark site is neither a Roman fort nor defended enclosure, and may be the results of geological features and recent agricultural activity.

ACKNOWLEDGEMENTS

Thanks to David George, Dyffrin Farm, Llangoedmor, for permission to undertake this project on his land. I would also like to thank to Hubert Wilson for undertaking the topographic survey and for most of the figures in the report and Andrew Shobbrook, for assistance with both the topographic and geophysical surveys.

ARCHIVE DEPOSITION

The archive will initially be held by DAT, before passing it onto the National Monument Record, Aberystwyth.

SOURCES

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

Llangoedmor Tithe Map 1836

Ordnance Survey First, Second and 1964 editions. 6 inch

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

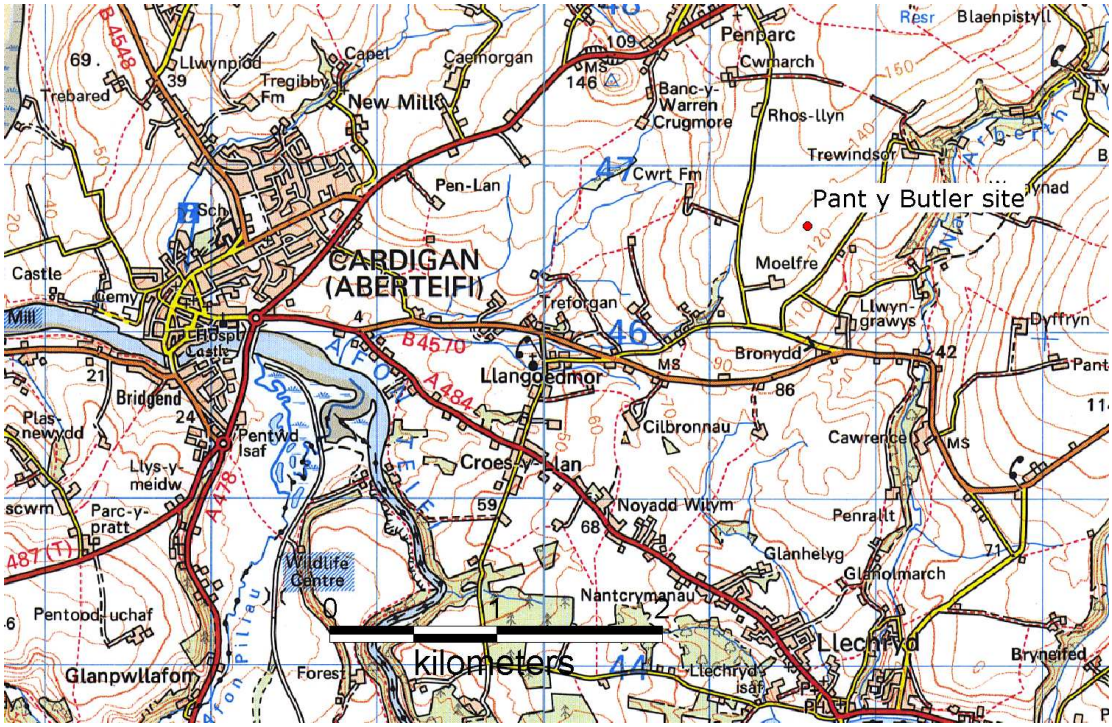

Figure 1: Location, SN 2159046640
Reproduced from the 1997 Ordnance Survey 1:50,000 scale Landranger Map with the permission of The Controller of Her Majesty's Stationery Office, © Crown Copyright Cambria Archaeology, The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF. Licence No AL51842A.

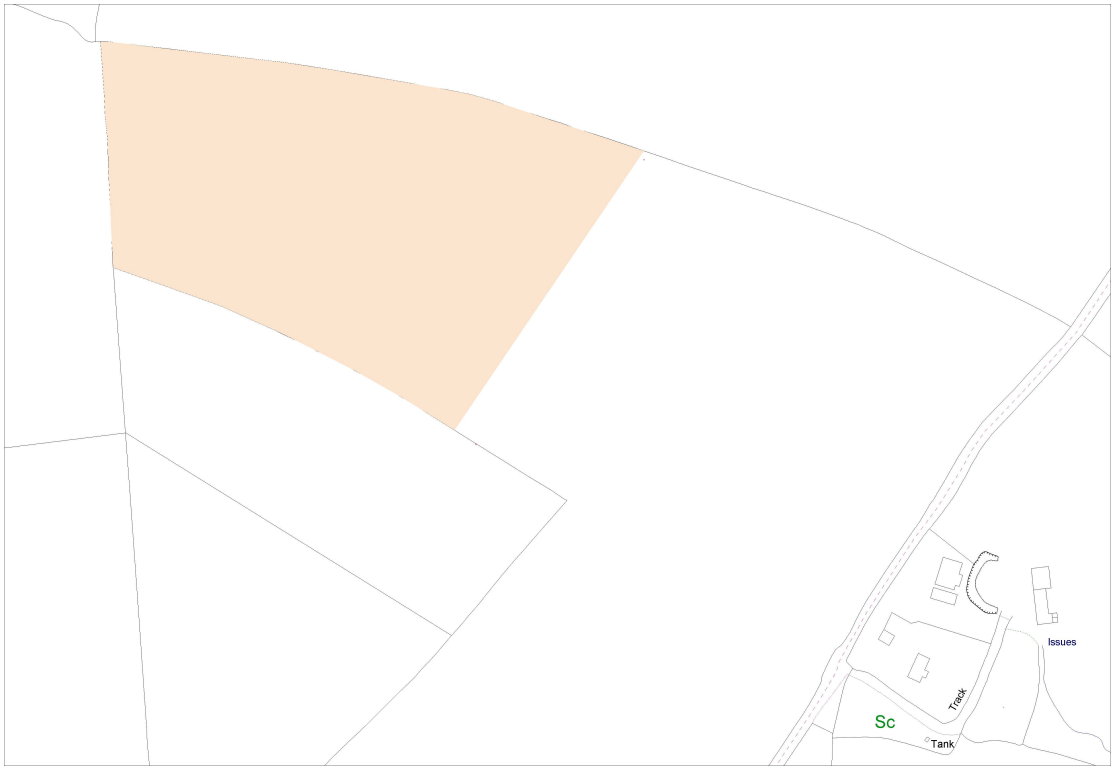

Figure 2: Location of geophysical survey (centred on NGR SN 21590 46640)
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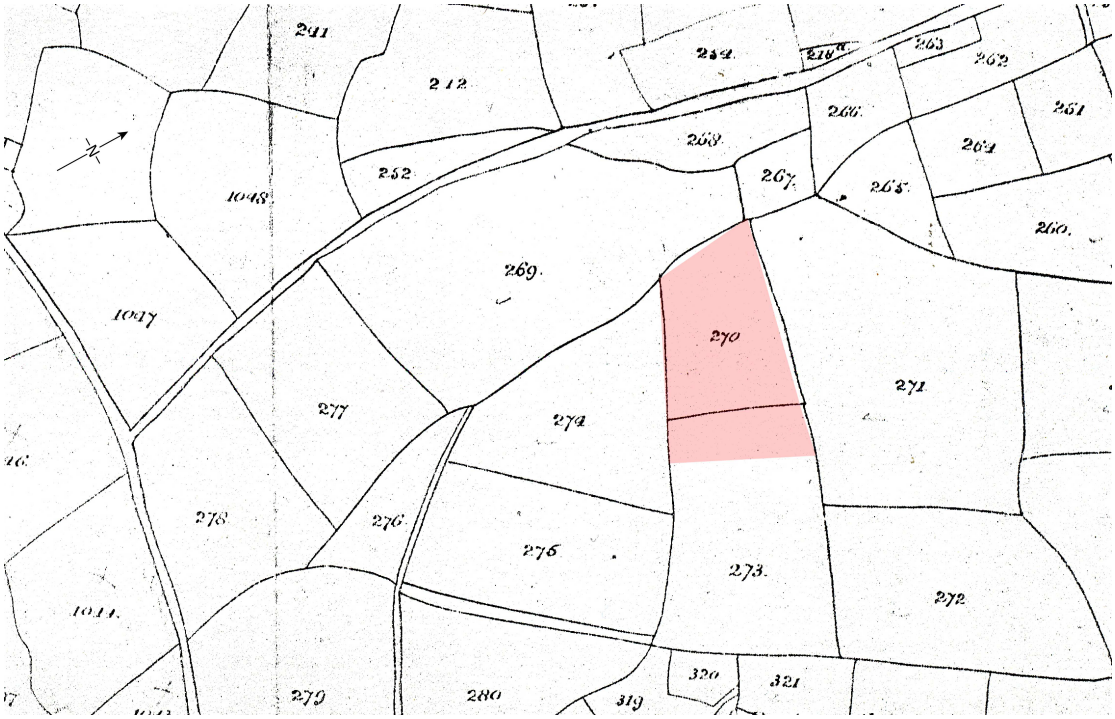


Figure 3: Location of survey on part of Llangoedmor tithe map 1836

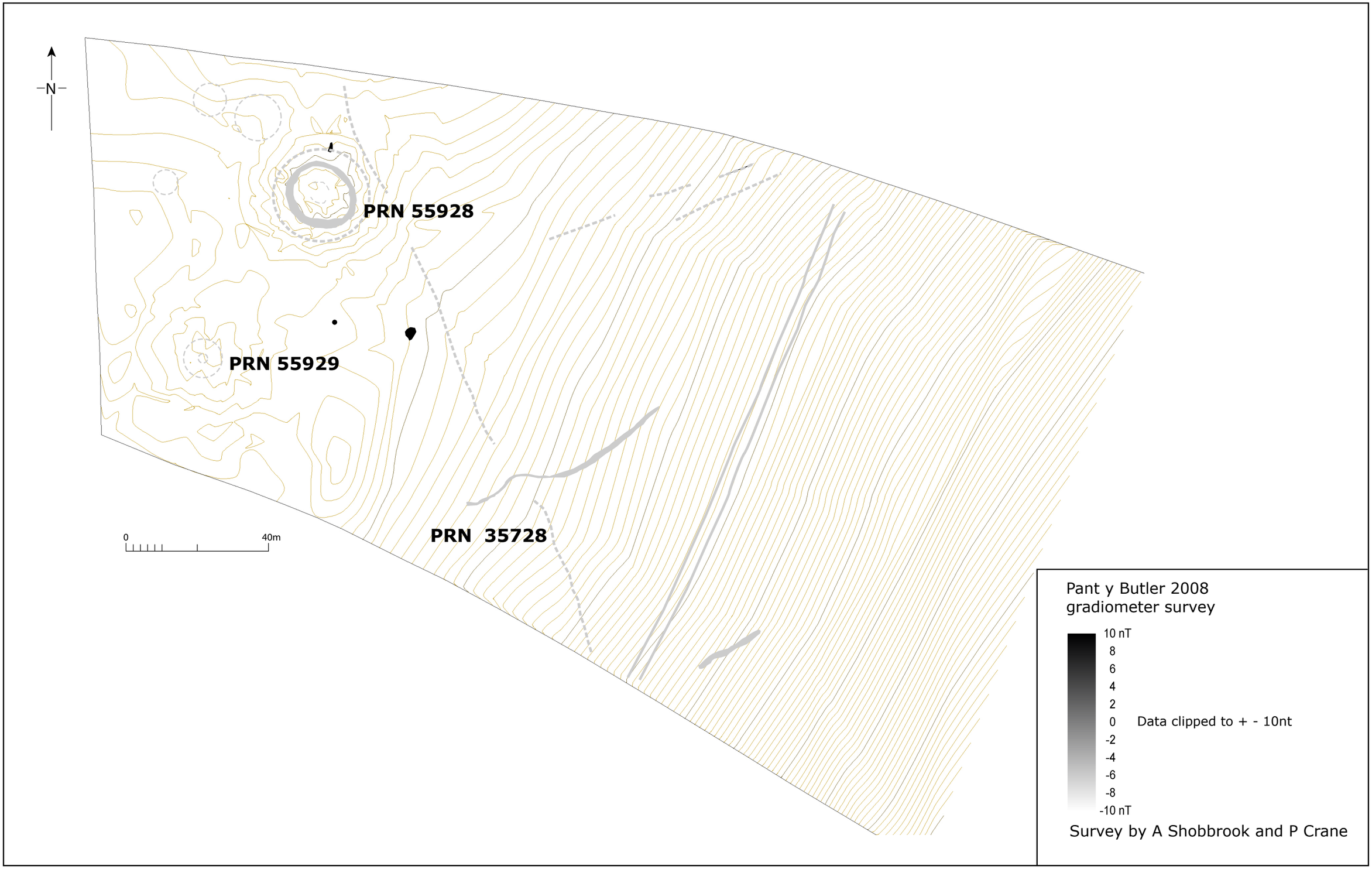
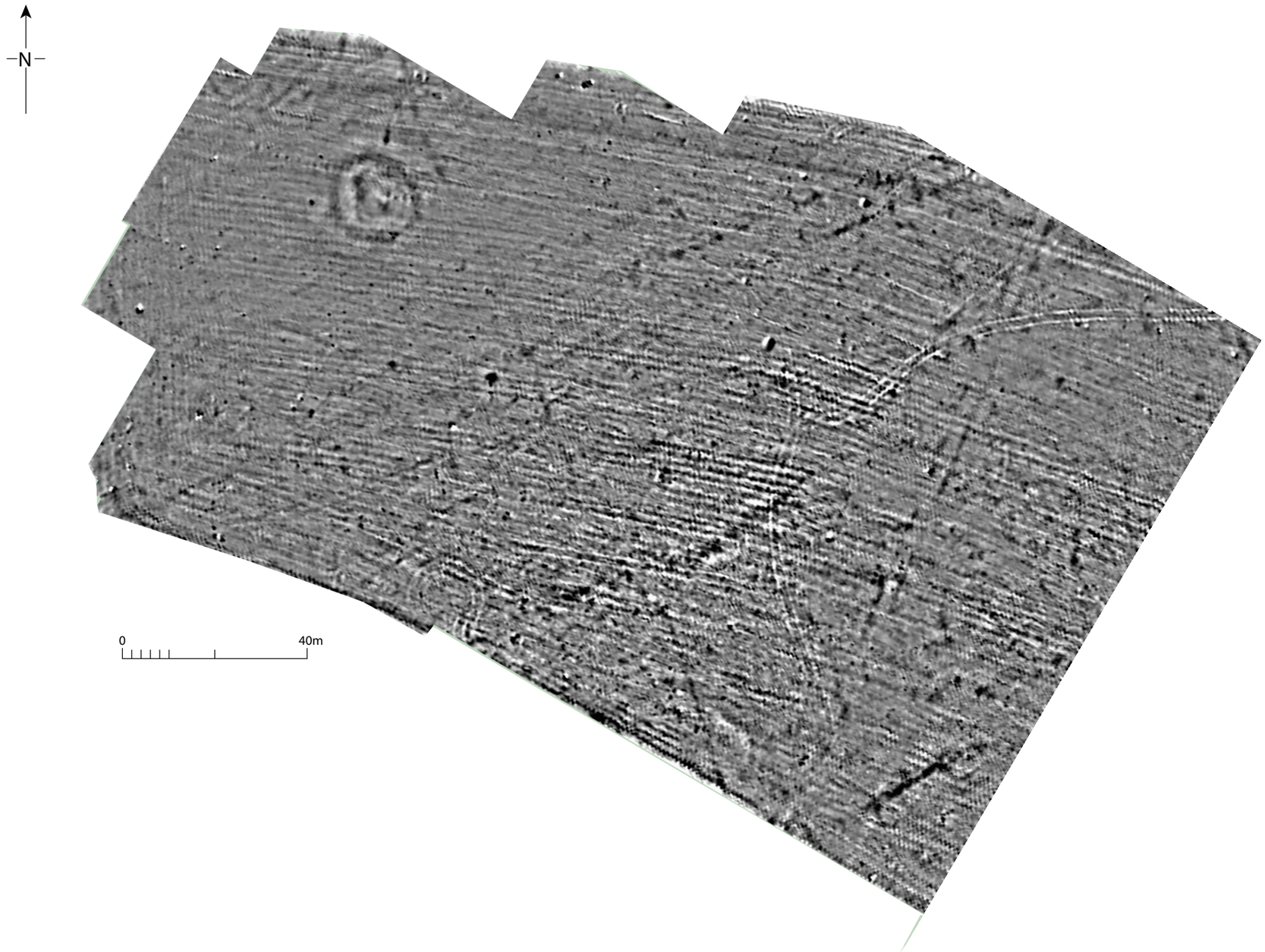


Figure 4: Topographic survey, contours at 0.1m, with featues interpreted from the geophysical survey. Scale 1:1000 at A3



Pant y Butler 2008
gradiometer survey

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0
-2
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-10 nT

Data clipped to + - 10nt

Survey by A Shobbrook and P Crane

Figure 5: Gradiometer survey, grey-scale. Scale 1:1000 at A3

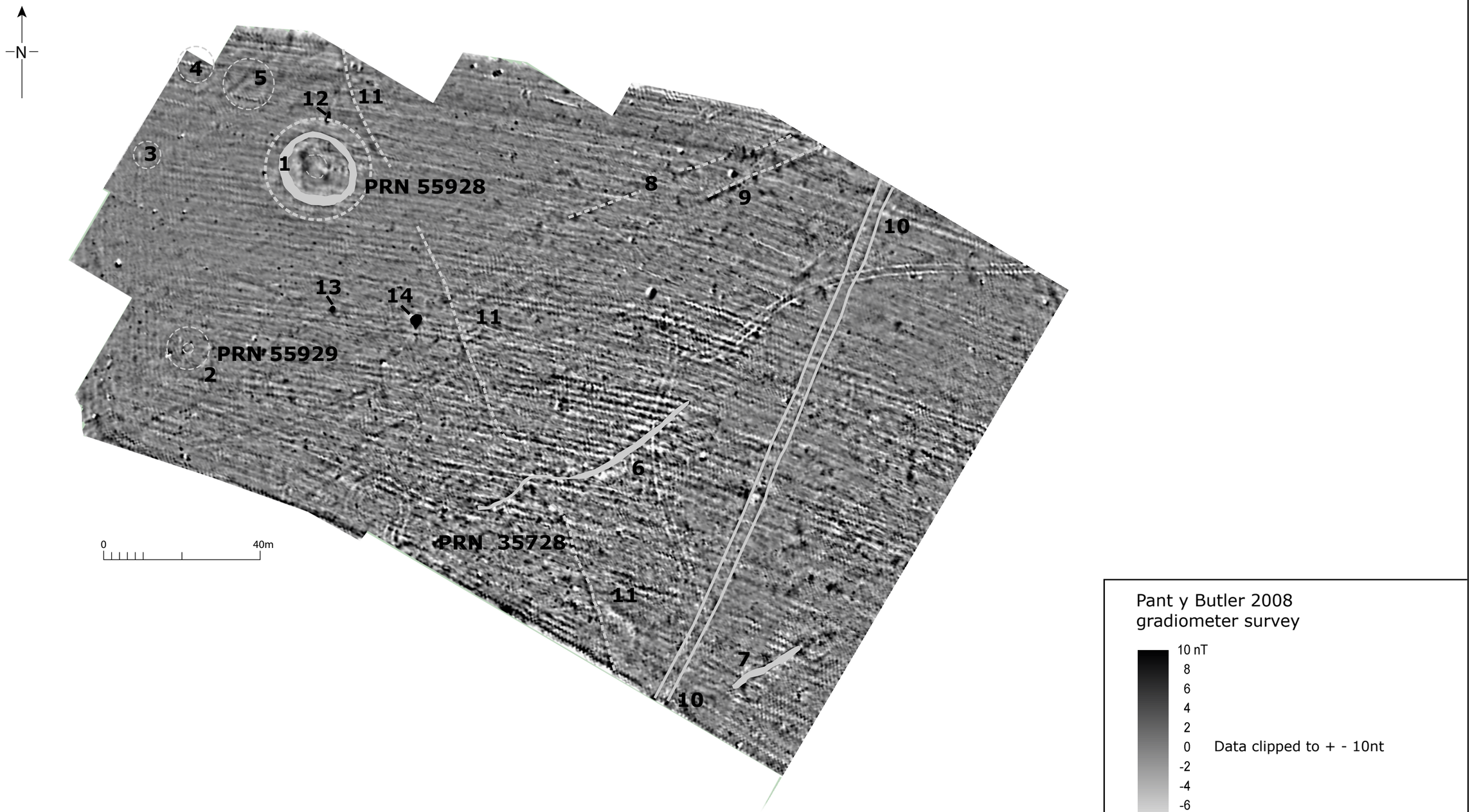

Figure 6: Gradiometer survey, grey-scale. Interpretation. Scale 1:1000 at A3

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

Swydd / Position: Senior Archaeologist

Llofnod / Signature ..... Dyddiad / Date

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

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

Swydd / Position: Trust Director

Llofnod / Signature ..... Dyddiad / Date

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