# BRYNGLAS, DOLAUCOTHI, CARMARTHENSHIRE

## Geophysical Survey

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**DYFED ARCHAEOLOGICAL TRUST**

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# Brynglas, Dolaucothi, Carmarthenshire
# Geophysical Survey

Gan / By

PETE CRANE BA HONS MIFA

*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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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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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 Murphy

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

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*Cover Photo: General View. View SE*

## SUMMARY

*A geophysical survey was undertaken on part of a field to the rear of Brynglas, Dolaucothi, Ceredigion, in advance of a new soakaway. No significant archaeological features were revealed although a few small anomalies are likely to be of archaeological interest.*

*It is recommended that an archaeological watching brief is implemented during groundworks.*

# INTRODUCTION

## Project commission

Dyfed Archaeological Trust was contracted by Emma Plunkett-Dillon, National Trust Archaeologist to undertake, as soon as possible, a geophysical survey in advance of a proposed replacement soakaway at one end of a field behind Brynglas, Dolaucothi, Ceredigion (centred on NGR SN6613540389) (Figs 1 and 2)

## Scope of the project

The project was designed to answer whether there were significant archaeological features in the area of the proposed soakaway.

## Report outline

Because of the limited nature of this project, and the considerable archaeological evidence and historic documents relating to the Dolaucothi gold mine and the Roman fort nearby at Pumpsaint, this report is restricted to the results of the geophysical survey only.

## 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

### Archaeological potential and location

The Roman activity at Dolaucothi gold mine and the adjacent fort are well known and due to the close proximity of this site there was considerable archaeological potential.

The site is relatively level and located in part of a pasture field, situated on the edge of a valley. The field is divided by a wide deep depression, caused by water run-off from former mining activity. On either side of this depression are mature trees. Within the depression there is the remains of a large corrugated iron shed. The part of the field under investigation is to the northeast of the depression. At the northwest end of the field the ground falls steeply, again this edge is lined with trees. To the northeast there are trees on undulating ground. The house and garden of Bryngas lie immediately to the southeast.

### History

No archaeological work had previously taken place on this site and neither have any finds been recovered. It is not intended here to go into the archaeology of the area due to the limited nature of this stage of the evaluation.

## METHODOLOGY

### 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 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 undetectable features. 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 a grey-scale plot (Fig 2) 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 3). 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 survey was undertaken on the 12th November 2008 under fair weather conditions. The site area was approximately 0.25ha with the majority under short grass. It was relatively level with just a few undulations. Around all but the southwest side there were wire fences. There were overhanging branches on the northeast side and also on the southwest, where there were also two fallen trees that impeded the survey (Cover and Photo 1).

The underlying geology was Silurian, Undivided Llandovery; this did not appear to cause any geological survey problems. There was a little background magnetic noise from recent detritus. The only obvious ferrous material was the manhole cover for the existing soakaway.

**Geophysical interpretation**

The results of the survey clearly two separate anomalies to the northwest (1) and (2)(Fig 3). These are probably pits containing material with a thermoremnant (heat affected) response of 30nt to 32nt positive. The fill of these features is likely to be re-deposited otherwise a bipolar response as in a hearth or oven would be observed.

In the middle, toward the southeastern end of the area there are one or two possible pits (3) or part of a gully. To the south of this there is a sub-linear anomaly (4) that may be part of a gully, the fill of which may contain some heat-affected material. It is considered that both of these features are artificial and may be of archaeological significance.

At the far southeast end of the area is the active soakaway with a metal manhole cover (5). Other anomalies within the survey area are likely to be small ferrous debris but could be brick or ash.

There are a number of very faint anomalies. These are thought to be caused either by differences in the subsoil or small movements in the topsoil. However, they could be archaeological features that give little or no magnetic responses.

## CONCLUSION

It is considered that there are unlikely to be major archaeological features in the survey area. It would be advisable to avoid those features listed above and to undertake a watching brief during all groundworks due to the archaeological sensitivity of the area in general.

## ACKNOWLEDGEMENTS

Hailey Nicholls, work experience archaeological student, for assistance with the survey.

## ARCHIVE DEPOSITION

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

## SOURCES

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

Photo. 1: General view northwest

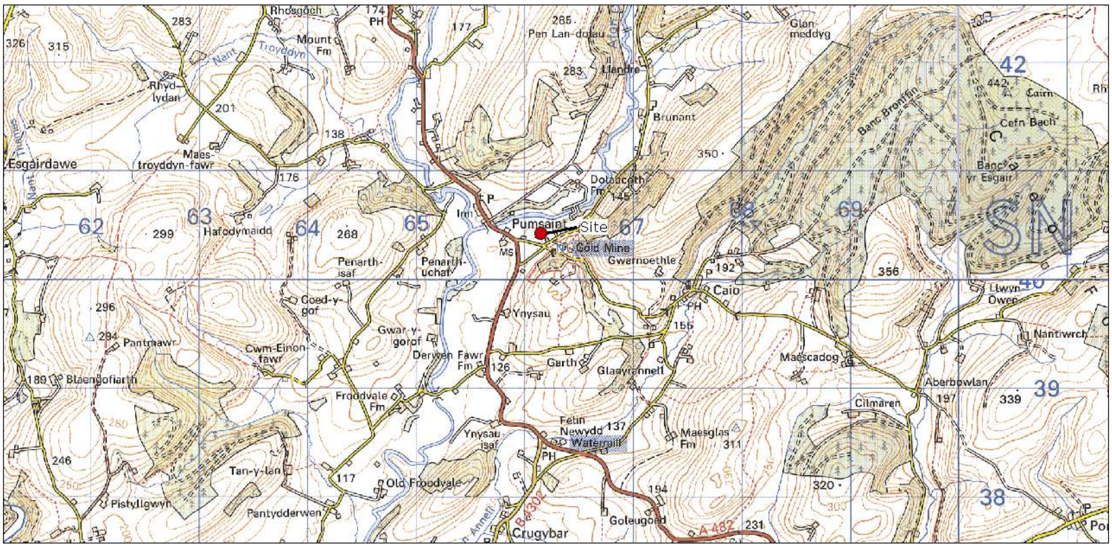


**Figure 1: Location of Brynglas, Dolaucothi**

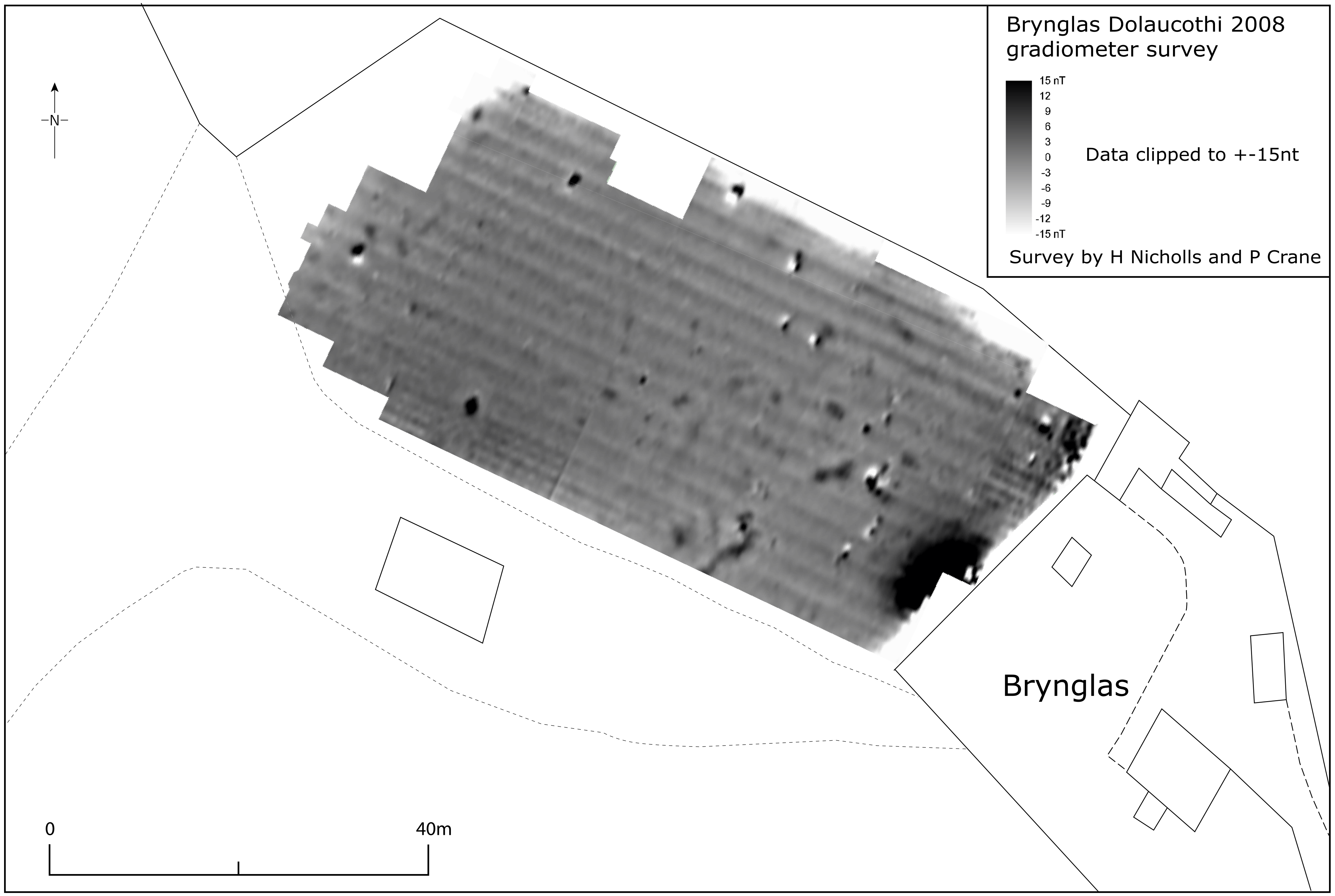


**Figure 2: Brynglas, Dolaucothi. Gradiometer Survey: Grey-scale plot. 1:500 at A3**

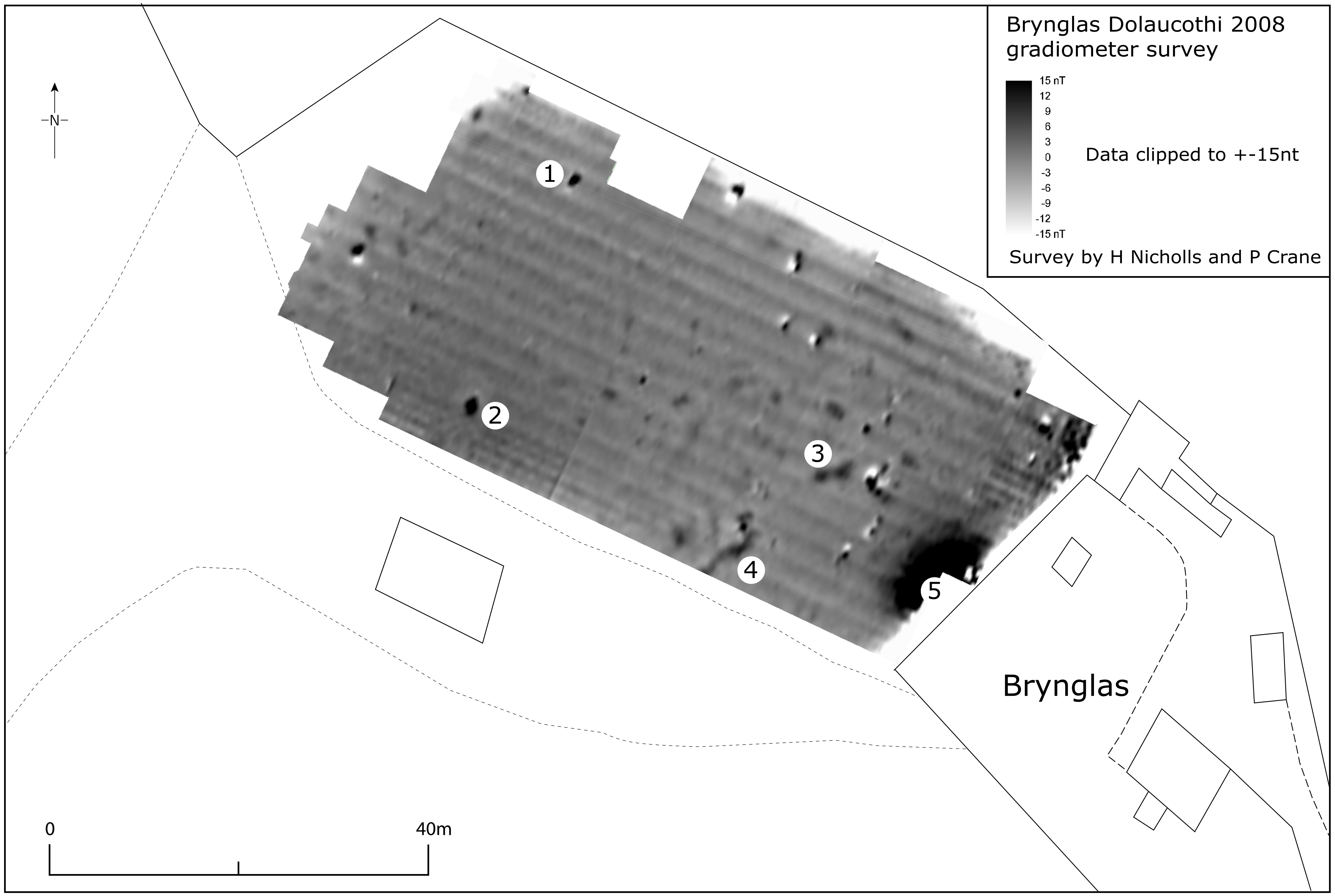


**Figure 3: Brynglas, Dolaucothi. Gradiometer Survey: Grey Scale interpretation. 1:500 at A3**