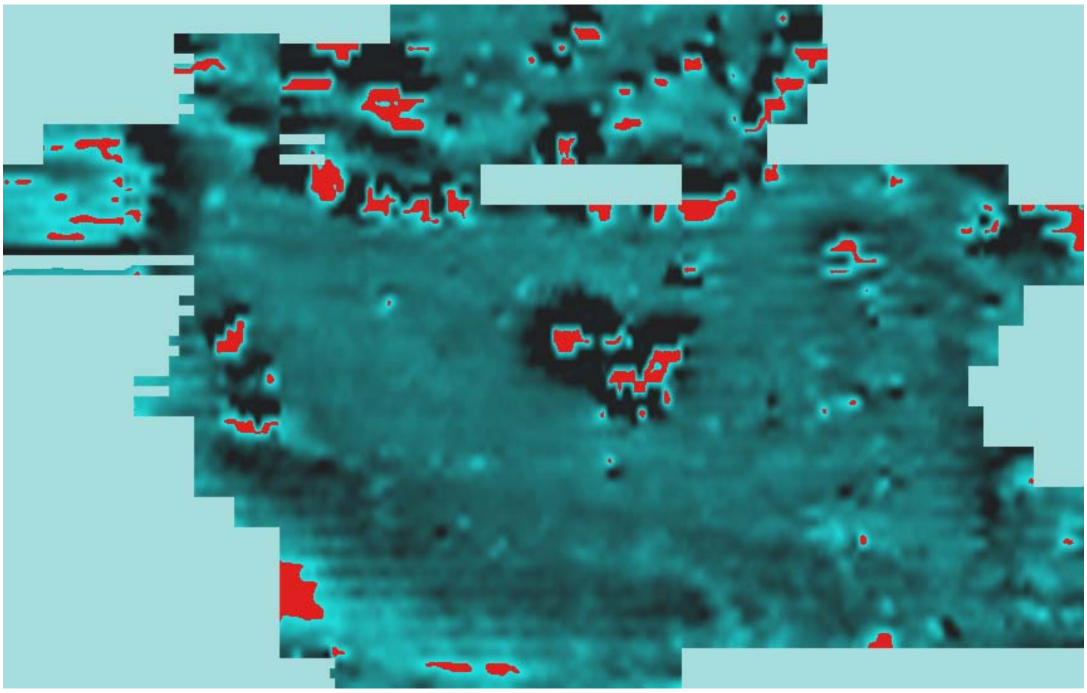
CASTELL ABERLLEINIOG

GEOPHYSICAL SURVEY

GAT Project No. G2004



Report number: 737

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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Prepared for

Menter Môn

By

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Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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CASTELL ABERLLEINIOG: GEOPHYSICAL SURVEY (G2004)

1. INTRODUCTION

Menter Môn commissioned Gwynedd Archaeological Trust to carry out a fluxgate gradiometer survey of an area at SH61637925 just to the south of Castell Aberlleiniog in advance of works improving access to the monument. The site is a motte and bailey castle dating from the 12th Century and comprises a large artificial mound surrounded by a dry ditch. A small bailey, stands between the ditch and a natural scarp to the south. This is defined by the slight remains of a ditch and bank with two terminal mounds adjoining the ditch around the motte. The motte is surmounted by a late medieval stone structure, square in plan with circular towers at the corners (RCAHMW 1937). The geophysical survey area encompasses the majority of the bailey.

2. METHODOLOGY

Fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of investigating archaeological sites and is ideal for detecting features such as ditches, banks and areas of occupation.

2.1 Instrumentation

The survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer. This 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.

These instruments detect 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. This is a simplified description as there are other processes and materials which 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. Strong readings are also produced by archaeological features such as hearths or kilns 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 can produce good results as anomalies can 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 is no extant archaeology.

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 1990).

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.

2.2 Data Collection

The gradiometer includes an on-board data-logger. Readings in the surveys were taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval was 0.5m at and readings were logged at intervals of 0.25m along each traverse giving 3200 readings per grid.

2.3 Data presentation

The data is transferred from the data-logger to a computer where it is compiled and processed using ArchaeoSurveyor 2 software. The data is presented as a 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. 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. 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.

2.4 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.

3. RESULTS

The survey was carried out on 21st April 2008 by David Hopewell. The site had been cleared of under growth in advance of the survey. A plan of the site (Plowman Craven and Associates 1978) was provided by Menter Môn and features shown on the plan were used to locate the geophysical survey grids. The plan is also used as a background to Figs 1 and 2. The survey area was bounded to the north and south by mounds that are thought to indicate the extent of the bailey.

An area of 50m x 30m was surveyed at high resolution. This was larger than the area to be disturbed by the access works but allowed the area to be seen in the context of its surroundings. The area was not ideal for geophysical survey with obstructions produced by steep earthworks, trees and fallen branches. The survey was therefore carried out using a very slow traverse speed allowing obstacles to be negotiated without unduly compromising the data.

The results are shown on Fig. 1 with interpretation on Fig. 2.

A diffuse 8m to 9m wide negative anomaly (1) runs around the south, west and eastern sides of the bailey and probably indicates the remains of a defensive bank. There are two possible alignments on the southern side, one being linear (1) and the second curving slightly (2). This could be interpreted as two different phases of defences or may simply be a result of the spreading of bank material as a result of agricultural activities or landscaping. There appears to be a break in the south-eastern corner perhaps indicating an entrance (3). The edge of the ditch around the motte is well defined (4), perhaps indicating stone revetment. It is however somewhat masked by strong anomalies (5 and 6) indicating ferrous objects, almost certainly fragments of a wire fence, in the soil. Further similar anomalies (7-9) are scattered around the site, 7 and possibly 8 are the result of barbed wire dumped in a former patch of brambles. Most, but not necessarily all, of the scatter of ferrous anomalies in the ditch (9) are a result of modern debris. There are no clear anomalies within the bailey itself although a line of patches of increased noise (10) could indicate internal features, perhaps buildings or the line of an entrance road.

4. CONCLUSIONS

The defences of the bailey, possibly spread by later activity were detected. A possible entrance and slight areas of magnetic noise could indicate a road leading to a bridge across the motte ditch. Unfortunately the results around edge of the ditch were mostly masked by modern ferrous material so no further information could be recovered. No further structures were detected within the bailey. It should be noted that while this suggests that there are no remains in this area, it does not prove that there is no extant archaeology because not all features can be detected by the gradiometer.

5 . REFERENCES

Clark, A. J. 1990 *Seeing Beneath the Soil*, London 69-71.
RCAHMW 1937 *An Inventory of the Ancient Monuments in Anglesey* 123-4

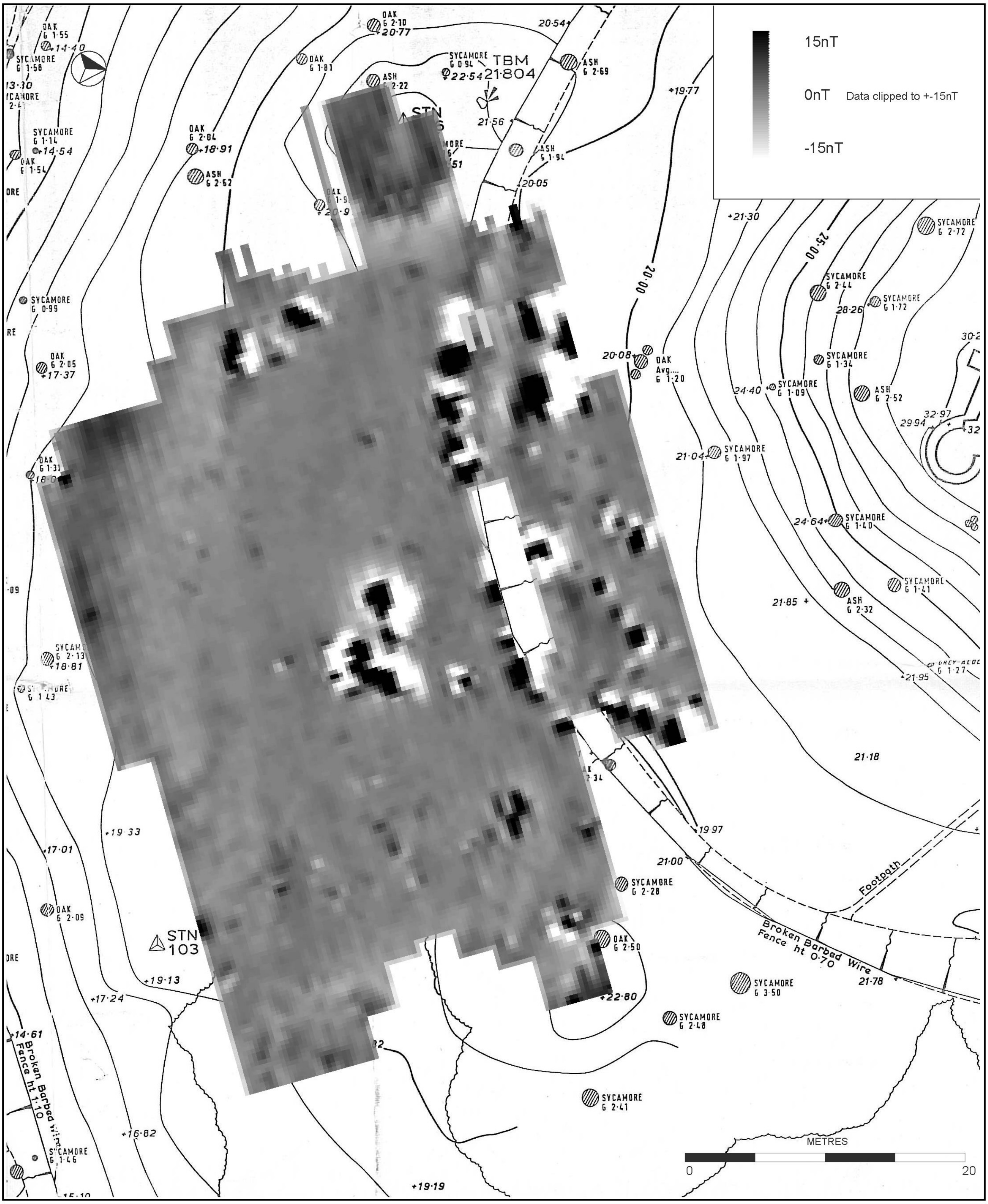

Fig. 1 Castell Aberlleiniog gradiometer survey: Grey-scale plot

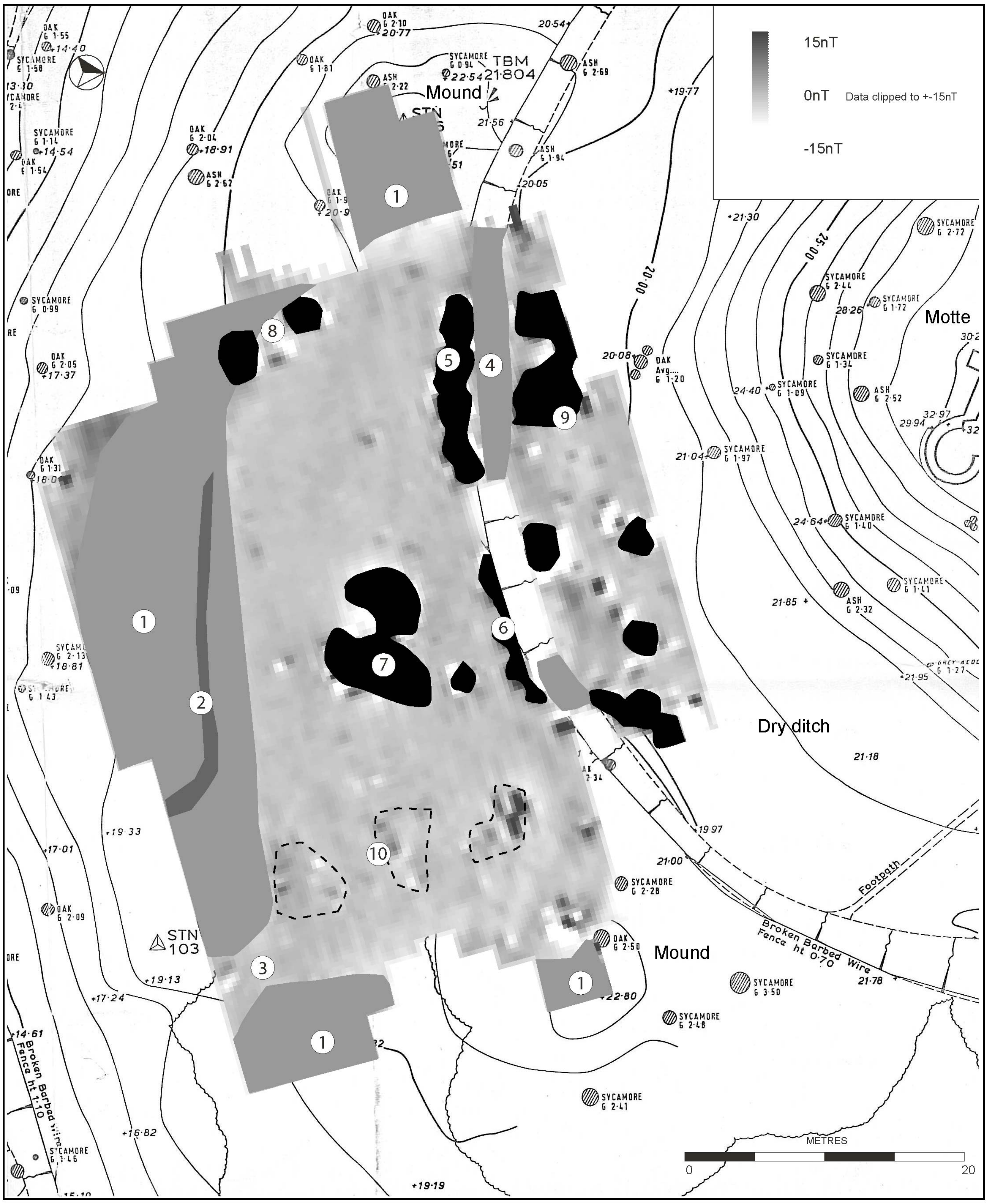

Fig. 2 Castell Aberlleiniog gradiometer survey: Interpretation

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