ROMAN FORT ENVIRONS

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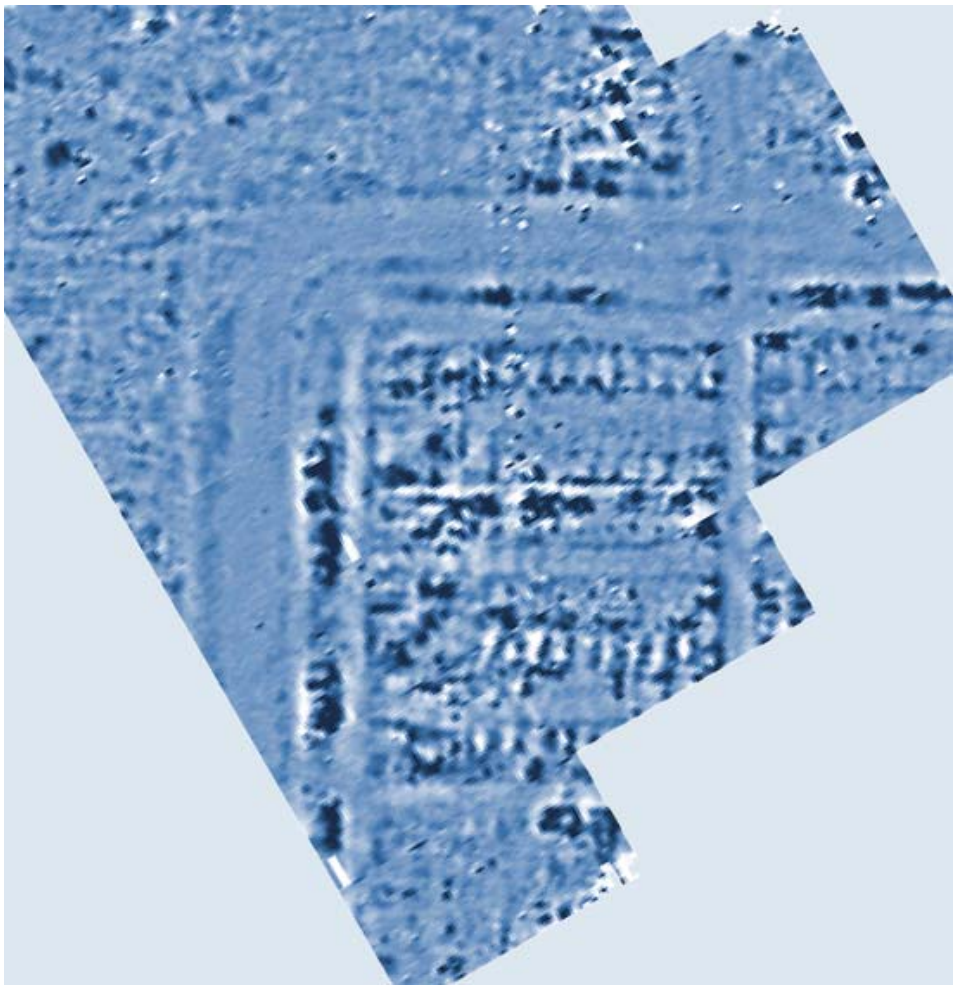
G1827 (2)

Report number : 623



Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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Prepared

By

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for

Cambria Archaeology

Ymddiriedolaeth Archaeolegol Gwynedd
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1. INTRODUCTION

The Gwynedd Archaeological Trust was contracted to carry out fluxgate gradiometer surveys at Trawscoed and Llanio Roman forts by Cambria Archaeology (Dyfed Archaeological Trust). The survey formed part of a Cadw funded pan-Wales study examining aspects of Roman fort environs and Roman roads. Surveys had previously been carried out at several sites within Gwynedd, Powys and Dyfed and had produced good results. The methodology developed in these surveys was adopted in the present project.

2. METHODOLOGY

Fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of surveying large areas. Roman military sites are well suited to this technique as significant magnetic enhancement of the soil is an inevitable result of the day to day activities in a Roman fort. Recent surveys carried out in and around Roman forts in Gwynedd and Cumbria (Hopewell 2005 and Burnham 2001) have demonstrated the suitability of this approach. A wide range of features was detected both within and outside the forts. Most of the sites produced evidence for the presence of *vici* in the form of ribbon development along at least one of the roads leading from the fort.

2.1 Instrumentation

All geophysical work was carried out using a Geoscan FM36 Fluxgate Gradiometer. This 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. 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 thermoremnant magnetic field upon cooling. 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 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 Geoscan FM36 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 500mm apart. Their Mumetal cores are driven in and out of magnetic saturation by a 1,000Hz 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 machine 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 Roman fort environs surveys were taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval was one metre. Readings were logged at intervals of 0.5m along each traverse giving 800 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 Geoplot 3.0 software. The following two display options are used in this report along with an interpretation drawing.

a) X-Y plot

Each traverse is shown by a line trace. These are presented side by side allowing the full range of data and the shape of any anomalies to be seen.

b) Grey-Scale

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.

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. The trace plots show raw data and can thus be used to assess the magnitude of anomalies modified for grey-scale plots. Any further processing is noted in relation to the individual plot.

2.5 Grid locations

The survey grids were located by measurements to fixed points such as field boundaries.

3. THE GEOPHYSICAL SURVEY RESULTS

3.1 Introduction

The surveys were carried out in during November 2005 by the author with assistance from Pete Crane. The survey areas were flat and provided few obstacles to the survey. The survey at Trawscoed was however hampered by prolonged torrential rain and flooding.

3.2 Results from Trawscoed (Figs 1-3)

A roughly rectangular area with dimensions of 160m x 120m was surveyed. This included the northern quadrant of the fort and areas to the north and east of the defences. Stronger anomalies probably created by thermoremnant magnetism from burning are indicated on the interpretation plan in black.

The northern corner of the fort shows up clearly on the grey-scale plot. The rampart (1) is well defined and shows signs of burning in places. A single ditch (2) lies immediately to the outside of this and is most clearly visible at the corner of the fort. A sharply delineated 10m wide band of very low magnetic (3) activity lies to the outside of the ditch. Weak linear responses in this area suggest the presence of a second ditch (4). A wide anomaly perhaps indicating a bank runs along the north-eastern side of the area. Similar clear zones, often containing what appear to be defences from earlier phases of the fort, have been recorded around several other Welsh forts, most notably Cefn Caer, Pennal (Hopewell 2005). Six blocks of barracks (5) are well defined in the northern quadrant of the fort along with the edge of a similar arrangement in the eastern quadrant (6). Rows of post holes are visible along one side of the central pairs of barracks in the northern quadrant. These could indicate the presence of a veranda but definite interpretation is not possible without excavation particularly given the fact that Davies records at least two phases of building here. Part of the central range (7) is also visible but it is not possible to identify any buildings here.

A road (8) runs out of the north-eastern gate (9). Small anomalies to either side of the gate could indicate the post holes of timbers supporting guard towers. An area of thermoremnant anomalies to the north-west of the road (10) probably indicates the presence of a fairly substantial building. Large courtyard buildings interpreted as *mansiones* have been detected in similar positions in the environs of other forts (Hopewell 2005). Further activity (11) also appears to be present to the south-east of the road although too small an area was surveyed to allow any features to be resolved. A linear anomaly (12) crosses the road at an oblique angle. This is best interpreted as a substantial ditch and could indicate the presence of a large camp although further survey would be required to test this hypothesis.

The rest of the area outside the defences can be divided into two zones. The area to the north-east of the fort (13) contains a series of faint parallel anomalies probably indicating ploughing. This respects the fort defences and is therefore likely to be contemporary. To the north east of this is a fairly quiet area containing a scatter of thermoremnant anomalies (14) probably indicating low level activity (hearths or camp fires etc) outside the fort. A further faint linear anomaly (15) apparently truncated by the defences could be tentatively interpreted as a track or small bank.

A line of noise (16) cutting across the defences and barracks at right angles indicates the position of Dr Jeffrey Davies' excavation trench of 1974 (Davies 1984)

Conclusions and summary

The survey sampled both the interior and exterior of the fort and produced clear results in both cases. The fort defences, roads and a series of six barrack blocks are clearly visible probably corresponding to Davies' period 2. Extra-mural activity in the survey area seems to consist mostly of scattered hearths and agriculture although an anomaly alongside the road to the north-east could represent a *mansio* or other large building.

3.3 Results from Llanio (Figs 4-6)

Two roughly rectangular areas with dimensions of 80m x 40m and 60m x 60m were surveyed. They were in adjacent fields and were designed to sample the extra mural activity to the east of the fort.

A 5m wide linear anomaly (1) runs due east-west across area 1 and is flanked by scattered patches of thermoremnant responses and overlapping linear and rectangular features (2 and 3). This is typical of a Roman road and *vicus*. Almost identical results were obtained from Cefn Caer, Pennal (Hopewell 2005). Subsequent trial trenching revealed several phases of rectangular wooden buildings arranged with their short axes towards the road. Each contained a hearth.

Further thermoremnant responses (4) can be seen in area 2 although there are no associated buildings. These are more likely to be the result of camp fires or rubbish burning. A single, narrow linear feature (5) perhaps a drain, also runs across the centre of the area. These features cannot reliably be assigned to any period, particularly given their proximity to the modern farm. It should, however, be noted that the drain is aligned to the Roman road as opposed to the modern features. Elsewhere in area 2 there are larger scale, diffuse changes in the magnetic responses. These are most likely to be the result of natural variations in the subsoil or bedrock although a centrally placed anomaly in a roughly rectangular area of variation (6) at the south could indicate a building or enclosure.

Conclusions and summary

The survey produced clear results and revealed activity in both areas, most notably a road and *vicus* in area 1. The survey was designed to sample the area to the west of the fort and has shown that the area contains significant archaeology and is suitable for geophysical survey. The small survey areas however make interpretation of larger scale features and general settlement patterns difficult.

4. REFERENCES

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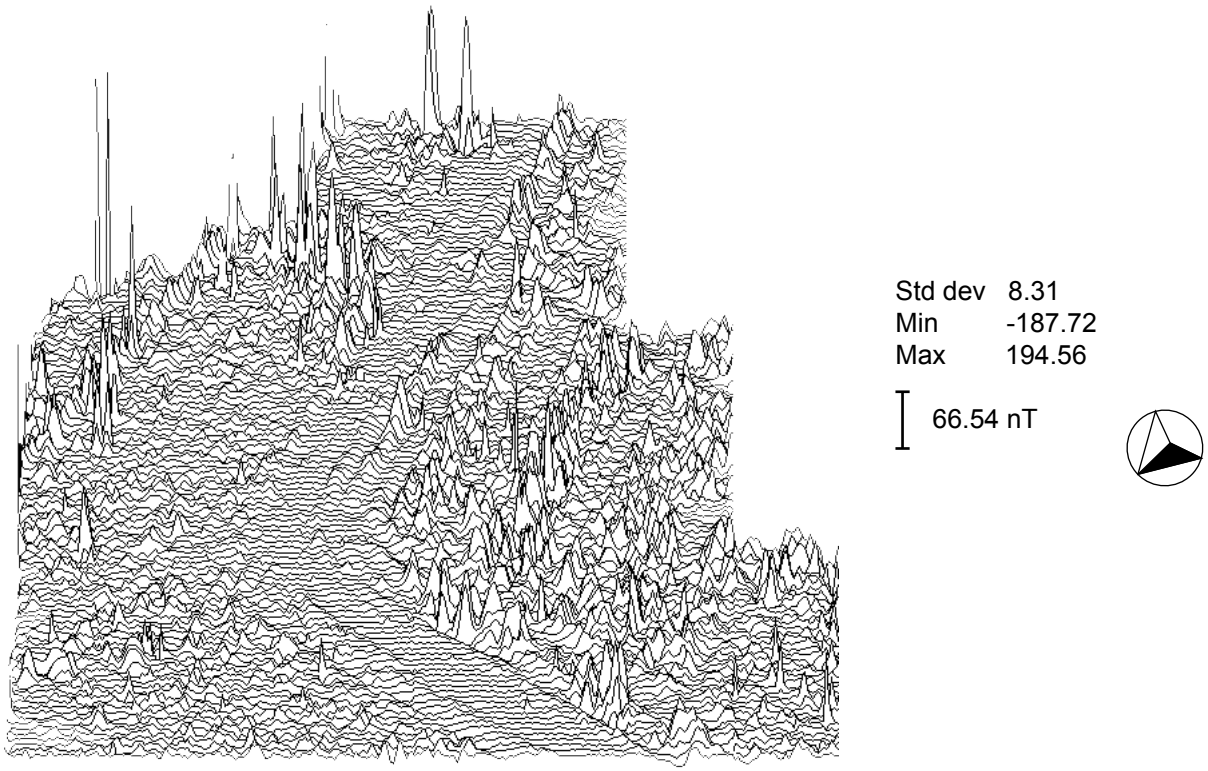


Fig. 1 Trawscoed gradiometer survey: Trace plot

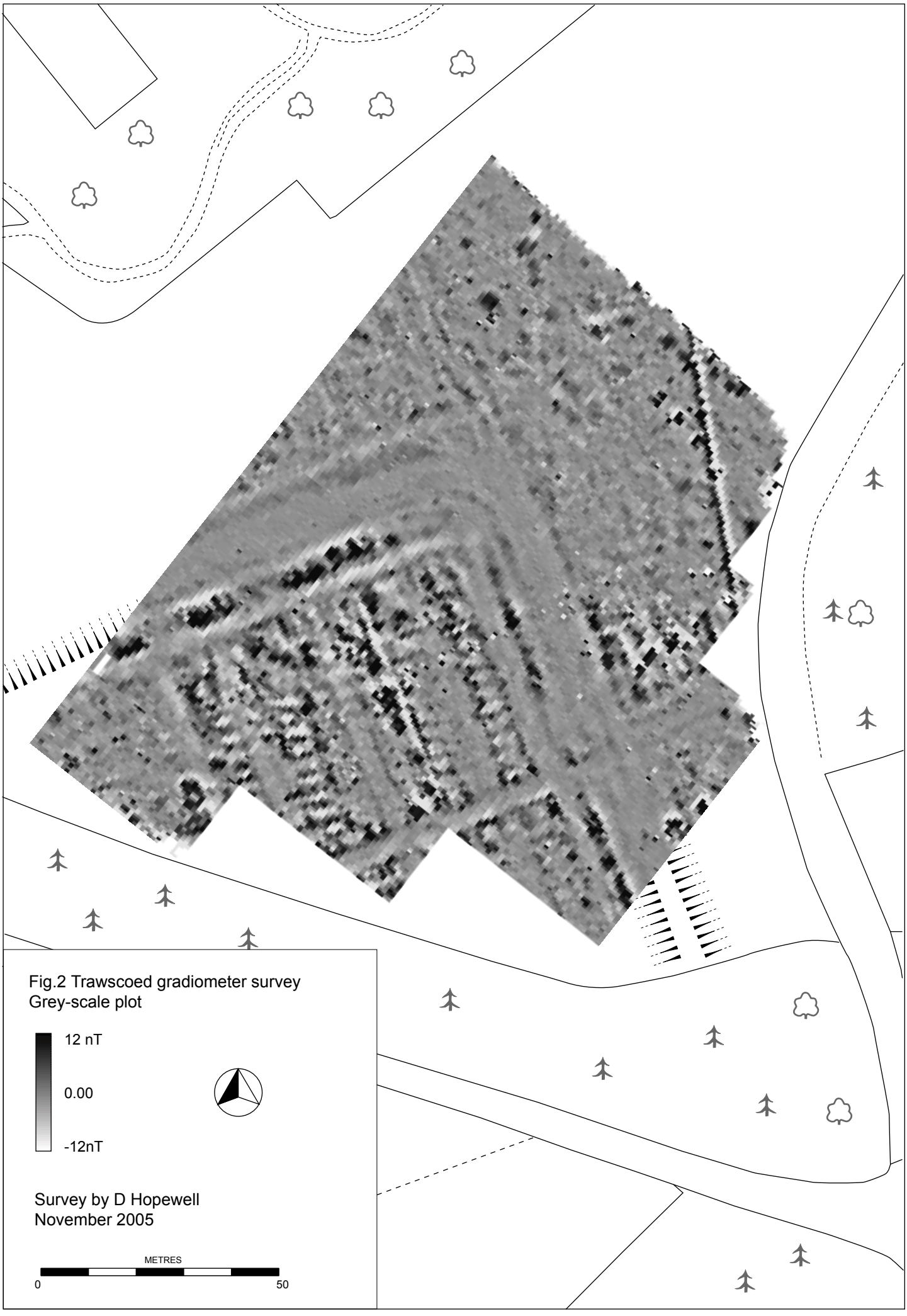
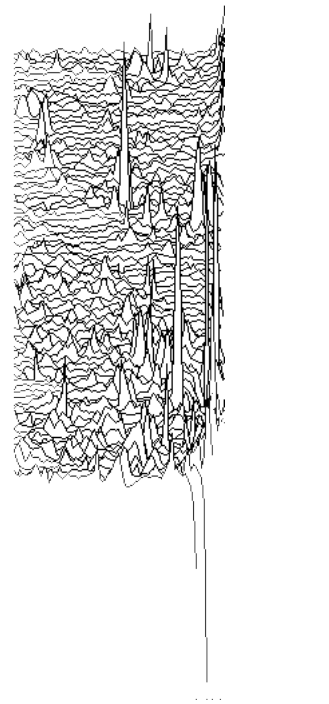


Fig.2 Trawscoed gradiometer survey
Grey-scale plot

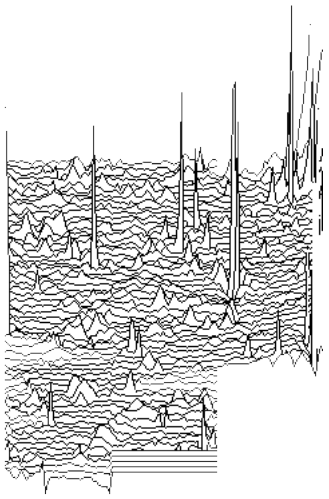
Survey by D Hopewell
November 2005

Fig. 3 Trawscoed gradiometer survey
Grey-scale plot



Area 1
Std dev 10.47
Min -200.85
Max 161.80

66.54 nT



Area 2
Std dev 10.97
Min -198.39
Max 197.98

43.87 nT

Fig. 4 Llanio gradiometer survey: Trace plots

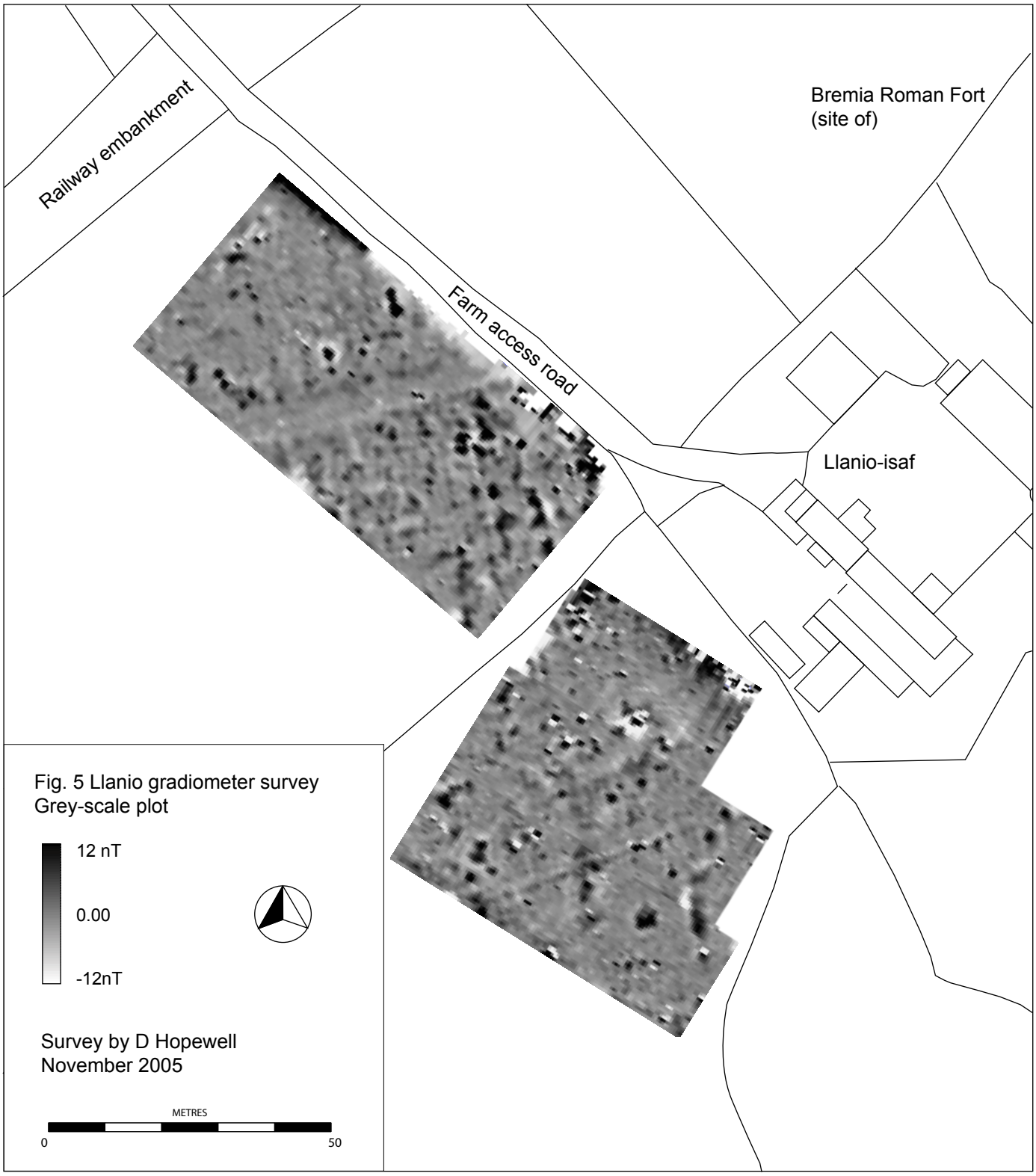


Fig. 5 Llanio gradiometer survey
Grey-scale plot

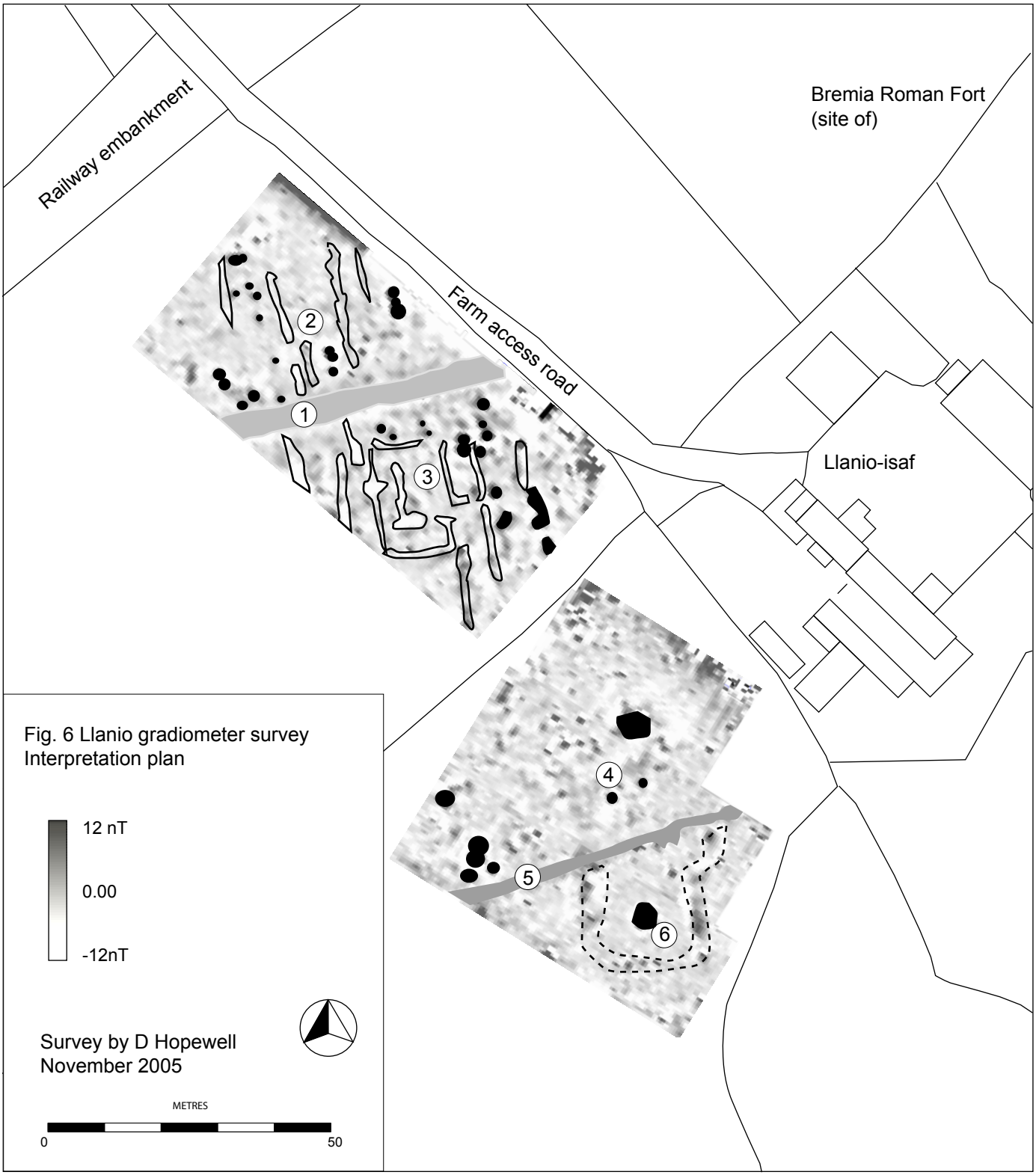


Fig. 6 Llanio gradiometer survey
Interpretation plan

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