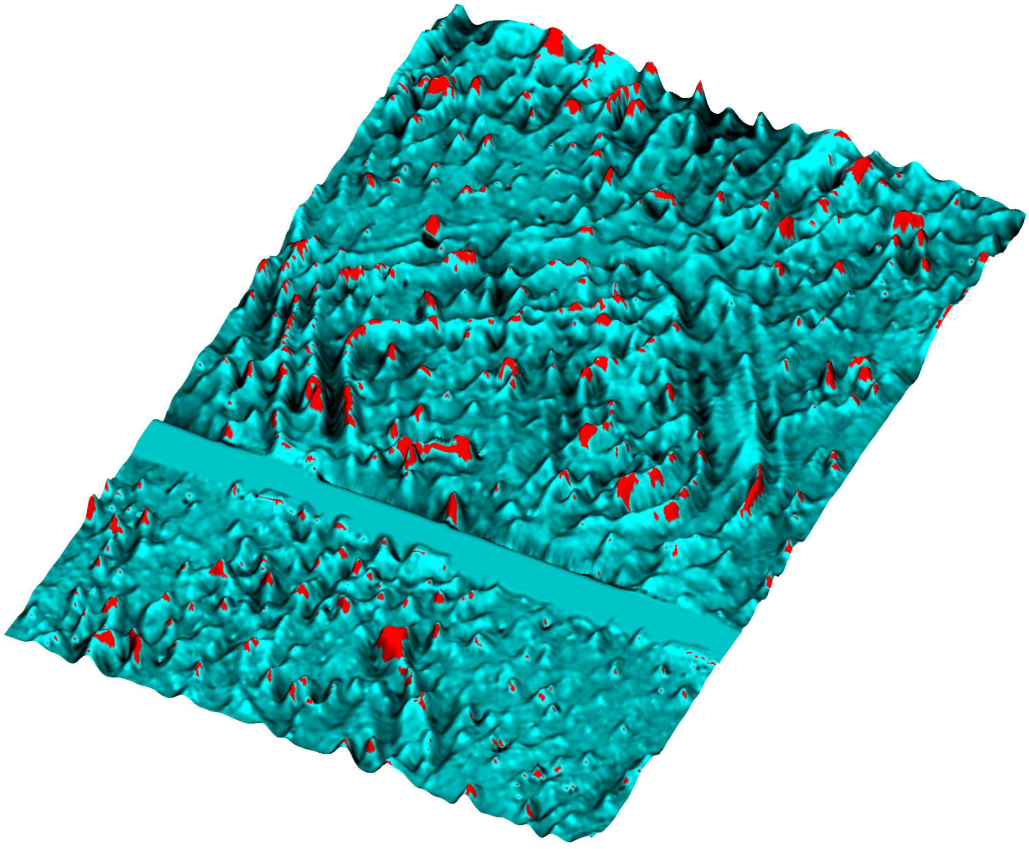
ROMAN FORT ENVIRONS

GEOPHYSICAL SURVEY AT TRAWSCOED ROMAN FORT AND ERGLODD FORTLET

G1827 (2)

Report number : 667



Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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Prepared

By

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for

Cambria Archaeology

(Front cover: Erglodd survey, 3D view)

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GEOPHYSICAL SURVEY AT TRAWSCOED ROMAN FORT AND ERGLODD FORTLET

1. INTRODUCTION

The Gwynedd Archaeological Trust was contracted to carry out fluxgate gradiometer surveys at Trawscoed and Erglodd 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.

Instrumentation

The 2006 surveys were carried out using a Bartington Grad601 dual gradiometer which consists of two gradiometers working in tandem. 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 as fired clay acquires a permanent magnetic field upon cooling. Not all surveys can produce good results as results can be masked by large magnetic variations in the bedrock or soil and in some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features.

The gradiometers are hand held instruments and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. Each of the pair of sensors on the Grad601 consists of two vertically aligned fluxgates set 1m 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 machine is capable of detecting changes as low as 0.1nT.

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 1.0m at Trawscoed and 0.5m at Erglodd. Readings were logged at intervals of 0.25m along each traverse giving 1600 and 3200 readings per grid respectively.

Data presentation

The data is transferred from the data-logger to a computer where it is compiled and processed using ArcheoSurveyor 2 software. The results are presented as grey-scale plots along with interpretation drawings.

Definition of a Grey-Scale plot

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.

Data Processing

The data is presented with a minimum of processing. 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. Corrections are also made to compensate for instrument drift and other data collection inconsistencies. 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 principal 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.

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 and November 2006 by the author and Pete Crane. The results from Trawscoed in 2005 were previously reported on in Hopewell 2006 and Hopewell and Crane 2005 but are repeated here. The interpretation of the results was carried out by the author along with a little “fine-tuning” following discussion with Dr Jeffrey Davies who has excavated at both sites.

3.2 Results from Trawscoed (Figs 1-2)

The survey area was flat and generally ideally suited to geophysical survey with only occasional obstacles in the form of trees and a small barn. The 2005 survey was however hampered by prolonged torrential rain and flooding. A roughly rectangular area with dimensions of 160m x 120m was surveyed in 2005. Two further areas with dimensions of and 80m x 80m and 170m x 115m were surveyed in 2006. The second area was bisected by a field boundary. The surveys included the northern quadrant of the fort and extensive areas to the north and east of the defences. The 2005 survey was carried out at a resolution of 1.0m x 0.5m and the 2006 at 1.0m x 0.25m.

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 (indicated in black). 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). 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 (1984) 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 or series of buildings. The results from trial trenching in this area, suggests that the best interpretation is a series of narrow buildings aligned with their narrow ends to the road (Davies pers. comm.). Further activity 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 line of noise (16) cutting across the defences and barracks at right angles indicates the position of Davies' excavation trench of 1974. The area immediately to the north-west of the fort contains a series of anomalies that are aligned to the fort defences. Anomaly 12 is probably a road that can be seen as a parch mark in dry summers. The area (11) to the north-west contains a series of faint parallel anomalies possibly agricultural in origin. The edge of this area is well defined and is aligned with the outer defences of the fort suggesting that the features are contemporary.

The area to the north and east of the fort contain a large number of anomalies, only a few of which can be shown to be contemporary with the fort. A 5.0m wide linear anomaly (13) at the north of the survey is best interpreted as the Roman road bypassing the fort. It is only intermittently visible to the east of the fort, (14 and perhaps 15). The junction with road 8 is probably beneath the wooded area in the centre of the survey.

Three clear circular anomalies (16 to 18 with diameters of 10m, 10m and 15m respectively) appear to bear no relationship to the Roman road system and are best interpreted as Bronze Age ring ditches or barrows. A less well defined anomaly (19) could represent an additional barrow.

Three areas of weak anomalies 20, 21 and 22 could be interpreted as containing rectangular buildings. These bear no obvious spatial relationship to any other features on the survey so could be of any period including Roman. The anomalies are however poorly defined and could be the result of chance occurrences such as intersecting plough scars.

The survey is criss-crossed with linear anomalies which probably represent many phases of boundaries and drains. Anomaly 23 is a stone lined drain the capping stones of which are visible in the field. This appears to be a modern feature associated with the estate buildings at the north. Anomaly 24 is very similar and could therefore be a further drain. Anomaly 25 is probably a substantial ditch but cannot be assigned to any period. Anomalies 26-28 appear to be ditches, perhaps part of an earlier field system. Anomaly 29 is almost certainly a former field boundary with differing levels of background noise on either side of it indicating different agricultural practices. Other linear features, 30 to 34 are probably agricultural in origin but again cannot be assigned to any period.

The areas to the north and east of the fort contain many small, roughly circular, discrete anomalies. Examination of the raw unprocessed geophysical data shows that these can be divided into two groups. Area 35 consists of anomalies with readings in the region of 20 to 60nT. These are not in the form of small dipoles indicating ferrous iron and can therefore best be interpreted as the result of thermoremnant enhancement and are similar to anomalies caused by hearths or bonfires seen on other sites. Given their proximity to the road running from the fort these could well represent activity associated with a *vicus* running alongside road 8. Most of the rest of the small discrete anomalies are of a magnitude that is only a few nT above background levels. These are most likely to be pits and are concentrated in two main areas. The first is close to the north of the survey (35 and 36). This consists of a series of small groups of pits (36) and two larger pits (37) along with a scatter of others. They seem to be most numerous to the west of ditch 25 and could be associated with this feature. A Roman origin is possible but later land management, perhaps in the form of root removal during the clearance of woodland, is also possible. A linear alignment of small pits (38) could well be the result of the removal of trees or a hedge.

Narrow curvilinear anomalies 39, 40 and 41 are probably natural periglacial features. Feature 42 is also likely to be a natural variation in the subsoil.

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. A road bypassing the fort is clearly visible at the north and south ends of the survey area. A series of three or four Bronze Age ring ditches are visible in the eastern half of the survey. Other activity in the survey area seems to consist mostly of scattered hearths, pits and agricultural features that cannot be reliably assigned to any period although many will be associated with post Roman agriculture and estate improvement.

3.3 Results from Erglodd (Figs 3-4)

Survey conditions were generally good. The survey was carried out at a resolution of 0.5m x 0.25m. Background noise levels were generally low but there was a scatter of strong dipoles across the survey (seen as sharply defined half black and half white patches on the greyscale). These features are larger than the spikes in the data caused by stray fragments of iron debris in the soil and are probably the result of iron rich boulders in the subsoil.

The defences of the fortlet are visible as a series of 5 roughly concentric square or sub rectangular anomalies. These presumably represent a series of ditches and slots recorded in a trial excavation across the defences on the north-western side of the fort by Davies in 1976-7 (Davies 1980). The two wider anomalies (1 and 2) correspond to two defensive ditches and the two narrow outer anomalies (6, and 7) to obstacle or palisade trenches. The outer defences are also clearly visible on a Cambridge University Collection aerial photograph (CBH 49 1976). The inner enclosure is only faintly visible on the aerial photograph and was identified by Davies as being the earliest phase. This has dimensions of 32m x 40m (0.13 ha) and the northern half is most clearly defined. The western corner is unclear and there appear to be two alignments (1 and 3) of the north-eastern side suggesting that the ditch was recut at some point. Alignment 3 may continue (4) on the outside of the outer ditch (2). The outer, phase II, enclosure (2) has dimensions of 50m x 46m (0.23 ha). There appears to be a centrally placed entrance (8) through the phase II ditch (2) in the north-eastern side. There is however, no obvious break in the line of either the phase I defences (1 and 3) or the outer slot (7). The ditch on the eastern side of the entrance is offset to the southwest by about 5m. A faint anomaly (5) suggests that it may have originally continued in line with the ditch on the other side. There also appears to be a connection between the inner and outer ditches on the eastern side of the entrance. The course of the defences in this area is not clear but there appears to have been some remodelling perhaps to form a small annexe or maybe a smaller circular enclosure (9).

Davies identified two relatively slight slots, running outside the main defences, interpreted as obstacle or palisade trenches. The outer (7) encloses a 64m x 64m square area with rounded corners and slightly curving sides. The inner runs (6) between this and the outer ditch. The two slots are very close together on the north-western side and appear as a single anomaly. Elsewhere they are clearly visible as two separate features. The possible entrance on the north-east side does not seem to be present in the phase I defences. A fairly clear ditch terminus is however visible in both the phase I and II defences on the

south-western side indicating that there was probably an entrance here (10). Unfortunately the hedge bank interrupts the survey at this point so no further details were recovered.

There are several anomalies enclosed by the inner rampart that are best interpreted as the remains of buildings. A series of faint narrow linear anomalies (11) which could be the foundations of wooden buildings extend across the whole of the interior although they are most obvious on the north-western side. They are however not clear enough to fully resolve into separate structures and interpretation could also be hampered by the presence of more than one phase of activity. A rectangular structure (12) with dimensions of 12m x 6m and a central division is fairly well defined on the south-eastern side. This appears to be more substantial than 11 perhaps indicating a stone building. A fairly strong tadpole shaped anomaly (13) is also clearly visible on the aerial suggesting the presence of a cut feature such as a pit. The high readings (24 nT) could indicate a thermoremnant response but seem a little low for a heavily burnt feature such a kiln.

Conclusions and summary

The geophysical survey results correlate well with the aerial photographic evidence and subsequent trial trenching that discovered a 0.24 ha fortlet with a turf rampart enclosed by two ditches (St Joseph, 1977 and Davies 1980). The phase I fortlet has been shown to be smaller than previously thought at 0.13ha. The entrance is probably on the south-west side although a second entrance through the phase II defences may be present on the north-east.

There were no buildings of readily identifiable function (e.g. barracks) in the interior but the slight indications present suggest that an early phase of wooden buildings was succeeded by at least one stone structure.

The overlapping anomalies representing both the defences and the interior clearly indicate a multiphase site of some complexity, suggesting that the site was occupied for a fairly long period. The apparent changes in the layout of the interior hint at changes in the function of the site during its occupation.

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Fig. 1 Trawscoed gradiometer survey
Grey-scale plot
12 nT
0.00
-12nT
Survey by D Hopewell and Pete Crane
November 2005 and 2006
METRES
0
50


Barn
Fig.2 Trawscoed gradiometer survey
Interpretation
Survey by D Hopewell and Pete Crane
November 2005 and 2006
METRES
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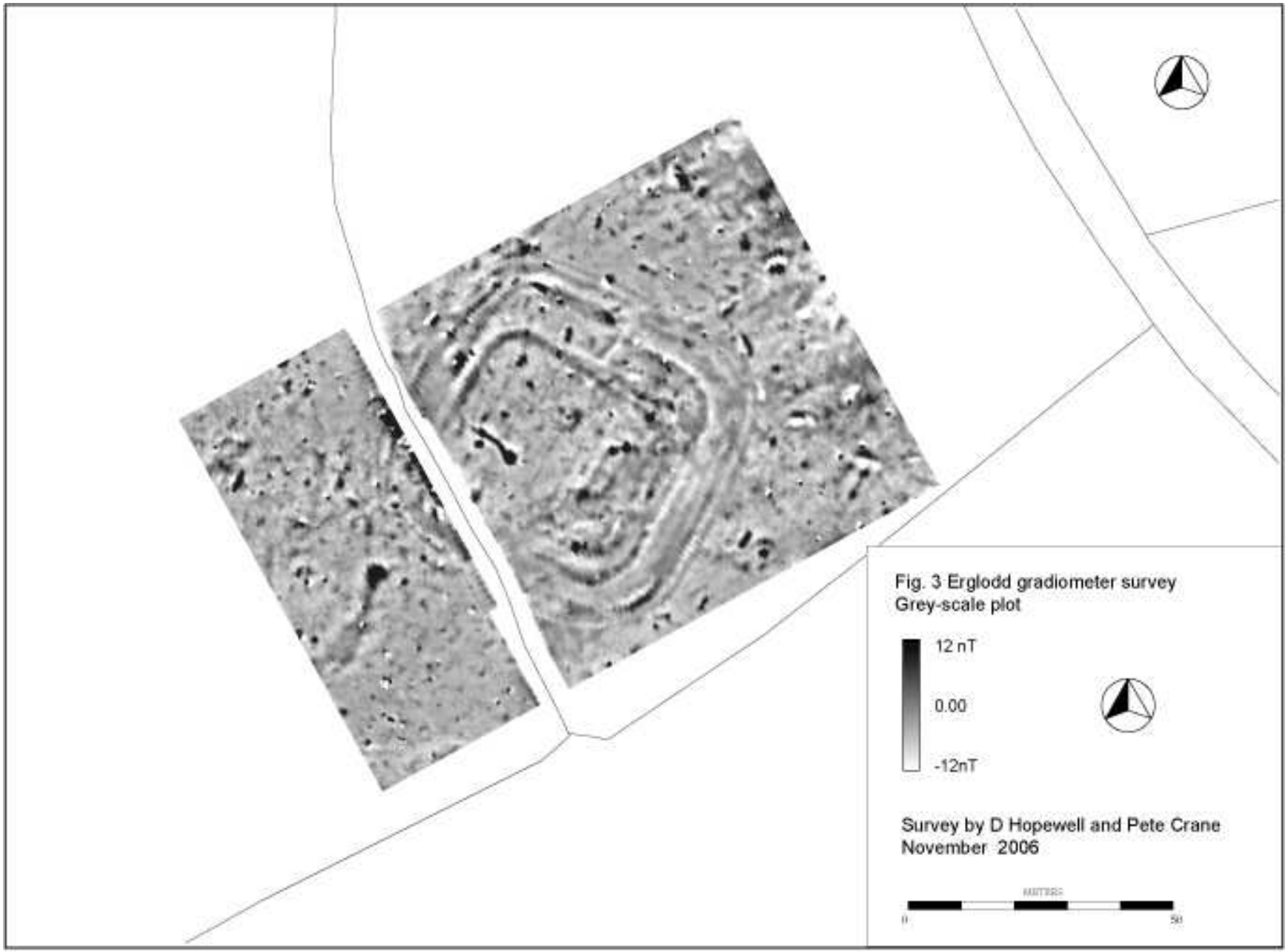

Fig. 3 Erglodd gradiometer survey
Grey-scale plot

Survey by D Hopewell and Pete Crane
November 2006

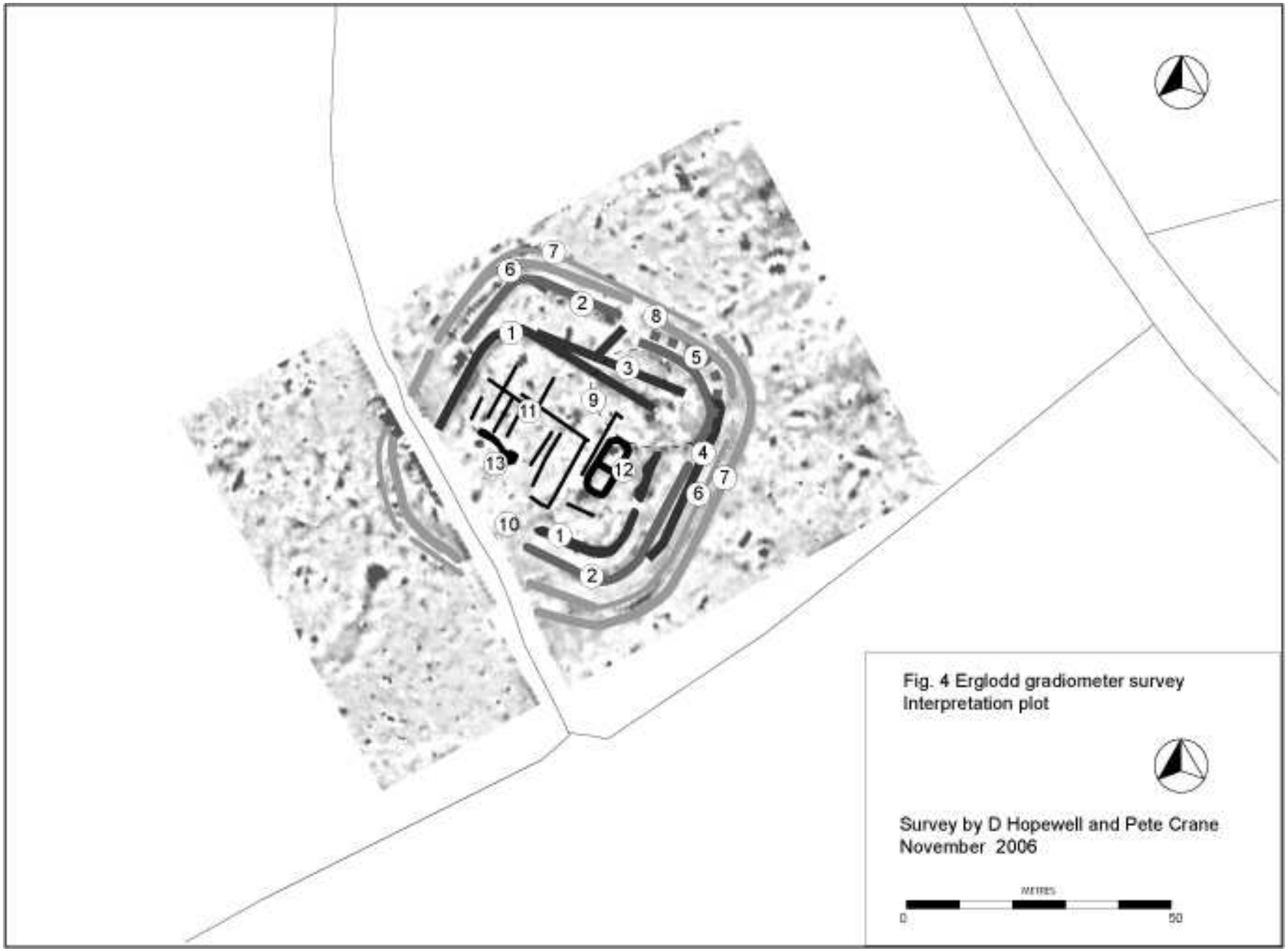
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Fig. 4 Erglodd gradiometer survey
Interpretation plot
Survey by D Hopewell and Pete Crane
November 2006
METRES
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