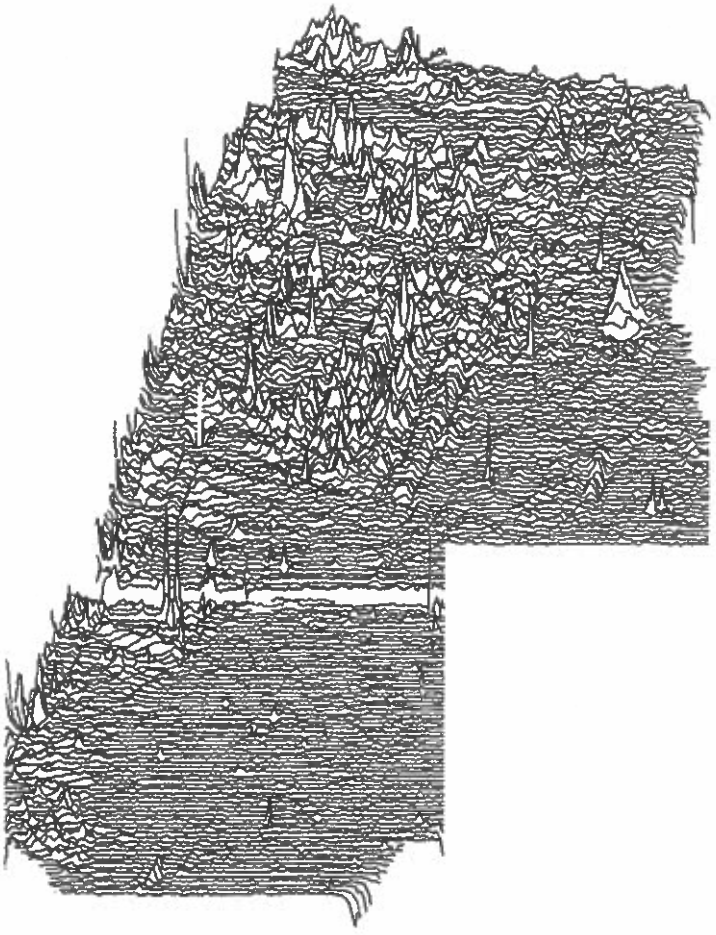
ROMAN FORT ENVIRONS

GEOPHYSICAL SURVEY AT LIANDOVERY ROMAN FORT

G1827 (2)

Report number : 543



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 a fluxgate gradiometer survey at Llandovery Roman fort 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, and Powys 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 2003 and Burnham Keppie and Fitzpatrick 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 a total station survey carried out by Pete Crane and Hubert Wilson. Hubert Wilson also prepared the background maps for Figs 3 and 4.

3. THE GEOPHYSICAL SURVEY RESULTS

3.1 Introduction

The survey was carried out in during September 2004 by the author and Pete Crane. Two separate areas of survey were carried out. Area A covered all of a roughly triangular field with maximum dimensions of 150m x 170m. The Roman fort occupies the south-eastern part of the field. Jarrett (1969) recorded four principal phases of occupation here, the first being pre Flavian and the latter extending into the mid second century. The initial phases comprised earth and timber ramparts and wooden buildings. In the third phase, early in the second century, a stone revetment was added to the rampart and the central range of buildings was rebuilt in stone. The final phase saw a reduction in area before abandonment *c.*160 AD The area to the north-east of the fort is very steeply sloping with a further level area in the north- west end of the field. The sloping area proved to be difficult to survey and some minor inaccuracies and additional magnetic noise will have been produced here. Area B was an

Area A seems to be entirely NW of fort

irregular area with maximum dimensions of 210m x 135m covering most of a further two fields. The fort rampart could be seen as an earthwork at the south-western end of the fields. A further shelf extended across much of the south-western field.

The data is presented as two trace plots (Figs 1 and 2), a grey scale plot (Fig. 3) and an interpretation diagram (Fig. 4). The grey scale plot was smoothed in order to reduce pixellation by interpolation in the Y-axis and the application of a low pass filter.

3.2 Results

The outline of the north-eastern part of the fort is defined by a 10 to 15m wide, magnetically quiet band containing the defensive ditches. The line of the ditches is not altogether clear but two (1 and 2) can be seen on the northern corner and a possible third (3) delineates the outside of the defences. There may also be the remains of an earlier rampart visible amongst the ditches on the north-west side. The interior of the fort contains a mass of overlapping anomalies almost certainly indicating several phases of occupation. The gradiometer cannot differentiate between the different phases and the greyscale plot therefore shows all detectable phases superimposed on each other making interpretation difficult. The rampart is probably indicated by a band of fairly random responses (4) with a break indicating the *porta principalis sinistra* (5) and a wider band of responses indicating a possible re alignment of the defences (6). The *via principalis* (7) is well defined with an internal drain running along its south-west and possibly its north-east side. The outline and some internal details of a building with dimensions of 15m x 25m (8) in the *Latera praetorii* can be seen. This produced high magnetic responses (see trace plot Fig. 1) suggesting destruction by fire. The interior of the building is not particularly clear but there are suggestions of multiple, closely spaced, transverse features possibly indicating the floor supports of a double granary. The north-western end of this range is fairly well defined. The area to the south-east is less clear and appears to consist of several phases of activity. The *praetentura* appears to contain barracks arranged *per strigas*. The suggested outline of two buildings (9 & 10) are shown on Fig. 4 but cross walls in between the buildings and other anomalous wall lines indicate that more than one phase of buildings is present.

The *retentura* is crossed by a modern iron water pipe (11). There are clearly several phases of buildings in this range. The outline of a long building arranged per strigas (12) could indicate more barracks but a larger rectangular building seems to overlie this (13) and other anomalous walls suggest further phases of building.

A line of noise (14) running down the slope from the *porta principalis sinistra* could indicate the line of a road, possibly turning to the north-east on the level ground at the bottom of the slope. Several other line anomalies are visible in area A, 15 is a relict field boundary shown on the 1840 tithe map. Anomalies 16 & 17 are probably ditches or drains but could be assigned to almost any period. The double linear anomaly 18 crossing the fort ramparts could be the result of drains but could be interpreted as part of an enclosure or large building. The high responses along the edge of the field (19) are modern concrete structures and piles of rubble.

Much of area B is dominated by a mass of overlapping anomalies many of which show signs of significant thermoremnant magnetism. Detailed interpretation is not possible in this area and Fig 4 only aims to illustrate certain features of the results. The main area of activity lies immediately to the north-east of the fort defences (1 & 2) and appears to be surrounded by a series of ditches. An array of three possible ditches (21) can be seen on the north-east side although they can only be traced for about 30m with any certainty. These could be the ditches of a much larger earlier fort now largely masked by later activity. Anomaly 31 could also belong to this phase.

The northern limit of much of the activity seems to be defined by the rounded corner of a rampart or ditch perhaps indicating that this area was, for some of its history, enclosed within an annexe of the fort. A further ditch (23) to the north-west of this appears to be one side of an enclosure truncated (or magnetically masked) by the annexe. The activity within the annexe is characterised by large numbers of overlapping features on different alignments and this clearly represents several phases of occupation. There appear to be two major areas of strong magnetic enhancement consistent with heavy burning.

Area 23 appears to consist of a mass of burnt buildings one of which (24) has dimensions of 25m x 15m. These are fairly well defined at the west where two or three rectangular structures are visible (14). Elsewhere the anomalies are fairly random indicating a mass of burnt rubble.

Two or perhaps three lines of strong anomalies (25) cut by what is probably a post-Roman field boundary (26) were detected immediately to the north-east of the fort. These are best interpreted as a series of kilns or ovens. A further series of similar anomalies (27) appear to be enclosed within a building or enclosure. Several other strong anomalies detected elsewhere in area B (28, 29, and 30) could be interpreted as either being either the result of industrial activity or burnt buildings. A well-defined anomaly with dimensions of 7m x 4m (32) appears to be a rectangular building standing within a rectangular enclosure.

The area (33) beside the modern road, in contrast to the rest of the annexe, exhibits little evidence for heavy burning but contains a series of overlapping linear anomalies some of which can be resolved into buildings (e.g. 34). This could be the part of strip development alongside either a road from the fort, which could have run close to the line of the present road, or a Roman road recorded about 70m to the south east (PRN 3419). This fairly low level of activity seems to extend alongside the modern road to the north-east end of the survey area. There is a lot of modern noise alongside the road making it difficult to see any detail and only a single rectangular structure (35) with dimensions of 18m x 15m can be resolved with any certainty. Several other linear features can be seen in this area although most seem to fade away as they approach a magnetically very quiet area (43) that occurs across most of the field to the west of Llanfair Farm. Feature 36 may be part of a field boundary shown on the tithe map of 1840, 37 and 38 are presumably ditches or drains but could be of any period. A series of three narrow negative anomalies (39) are probably modern water pipes leading to a manhole in the field (44). The status of the magnetically quiet area 43 is unclear. It is currently quite wet and could have been very marshy before the railway was built, thus limiting activity. A double linear anomaly (40) is visible as a well-defined bank in the field. This is not shown on the tithe map suggesting that it is early. Several other linear features including boundary 36 seem to fade as they run into the area and it is possible that this area was landscaped or infilled when the railway was built. If this is the case, bank 40 would be a modern feature.

Two other linear anomalies can be seen in area B. Feature 41 is very narrow and is probably a modern drain or pipe. Feature 42 could be part of the annexe defences or possibly a continuation of bank 40.

3.3 Conclusions and summary

The survey revealed a great deal of activity throughout much of the three fields to the north-west of the modern road. The outline of the fort is clearly visible, as are some of the internal buildings including a possible granary and barracks. There are, however, several phases of buildings and defences present making detailed interpretation impossible. There appears to be a substantial annexe to the north-east of the fort. This again contains several phases of activity. A possible array of three ditches could indicate the presence of a large early invasion fort perhaps comparable in size and function to Caersws I and Llanfor. Any early phases are masked by strongly levels of magnetic enhancement indicating either industrial activity or destruction by fire. Lines of strong anomalies immediately to the north-east of the fort may indicate a series of kilns or ovens. Industrial activity on this scale could indicate a works depot attached to the fort and this would certainly help to explain the high levels of thermoremnant magnetism in this area. Comparison with the lines of kilns at Holt (Petch 1969) adds weight to this hypothesis. It is difficult to discern any pattern across the rest of the annexe area although there are suggestions of a phase of roadside *vicus* development and there were apparently several substantial buildings that were destroyed by fire towards the northern corner.

It should be noted that there is no particular reason to assume that all of the buildings within the annexe area are Roman. It is possible that some of the phases are medieval, associated with the early ecclesiastical site at Llanfair. It has to be recognised that there is little in the annexe that can be recognised as being typically Roman by shape alone and any interpretation as such, in advance of excavation, must therefore be considered to be provisional.

4. REFERENCES

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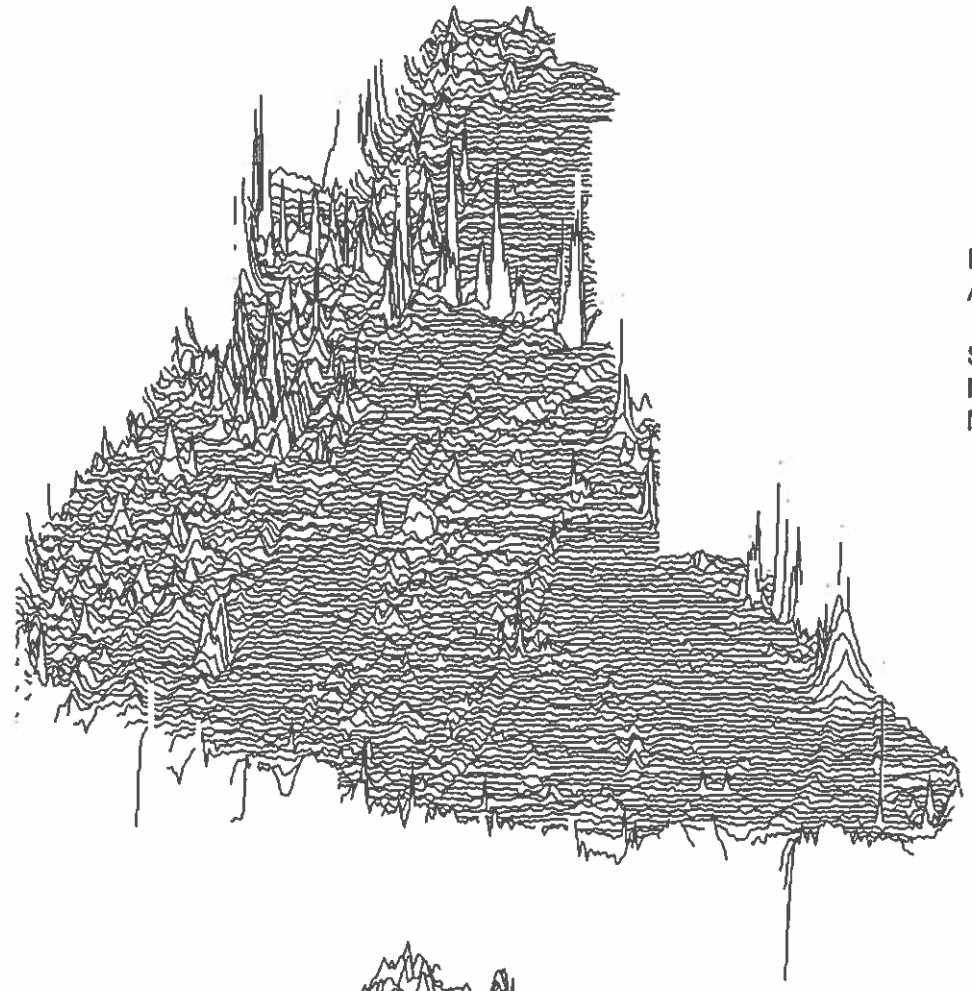

Fig. 1 Llandovery gradiometer survey
Area A, trace plot

Std dev 8.56
Min -195.25
Max 168.74

68.5 nT

Fig. 2 Llandovery gradiometer survey
Area B, trace plot

Std dev 12.57
Min -197.02
Max 209.63

75.48 nT

Fig. 3 Llandovery Gradiometer survey
Grey-scale plan

14 nT

0.00

-14 nT

Survey by D Hopewell and P Crane.
September 2004

railway cutting

Area B

Area A

Llanfair Farm

Llanfair Church

N

0 100 m

Scale 1 : 1000

Fig. 4 Llandovery Gradiometer survey Interpretation plan

14 nT

0.00

-14 nT

Survey by D Hopewell and P Crane. September 2004

railway cutting

Area A

Area B

Llanfair farm

Llanfair Church

N

0

100 m

Scale 1:2000