Pen y Gaer, Llandovery Geophysical Survey

February 2013

EAS Client Report 2013/03

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Technical Information:

NGR

Centred on SN 7798 3861

Location and Topography (Figure 1)

The survey site lies approximately 200 m south west of the farm of Pen y Gaer, Llandovery. It occupies the north western end of a ridge which runs approximately NE – SW. The highest part of this ridge is at the eastern end with steep slopes to the south and east, a slight shelf with moderate slopes to the north and west and a gentler slope to the south west along the ridge. At the time of the survey the field was under improved pasture with closely cropped grass.

The underlying geology is the Burrow-Mottled Mudstone which is within the Cerig Formation and is of Silurian date (http://mapapps.bgs.ac.uk/geologyofbritain/home.html)

It is intended to construct a wind turbine near to the highest part of the hill, with a new road leading up to the turbine along the gentler slopes to the south west.

Archaeological Background

The Historic Environment Record records the presence of an Iron Age hillfort (PRN 6224) at the proposed development location. The Historic Environment Record description reads:-

"Documentary sources of the 1880's recorded that a defended enclosure with well preserved outer ramparts existed at this location, but that in 1833 the landowner decided to completely level the earthwork. The site is recorded on the 1891 Ordnance Survey 1st edition 6 inch map as 'Site of Camp', and this is repeated on later editions. In 1917 the RCAHM recorded that there was nothing visible on the ground, but in 1954 HN Savory describes the enclosure as multivallate, though almost obliterated. The 2008 site visit found no trace of any earthworks at this location."

At the time of the survey very slight earthworks were noted in low raking sunlight. These, however, are so slight it was not possible to define their extent.

Aims of Survey

1. To gather information on the character and extent of surviving deposits and thereby assess the date, character, condition, extent and significance of any archaeological features within the proposed development area.

SUMMARY OF RESULTS

The position of two possible lines of ramparts and associate ditches were located, particularly on the south western slopes of the hill. These would appear to define a defended enclosure with an internal area of approximately 0.6 Ha which used the natural steep slope of the hill to the south east as part of the defenses. Four discrete anomalies may mark the position of the gate structure for the inner rampart. There are few details within the enclosure; however, a possible internal enclosure was recorded.

Outside the possible hillfort few anomalies were recorded, which could not be related to modern disturbance. One anomaly, however, relates to a rectangular platform which may have been a field barn.

Methods

The work took place between 1st and 2nd February 2013. The grid was laid out using a series of measurements taken with tapes. The survey area was aligned with the proposed development with the initial points being defined with a Garmin GPSmap 62S hand held system.

Fluxgate Gradiometer Survey

The Fluxgate Gradiometer Survey was undertaken using parts of twenty three, 30 x 30m, grid squares laid out as in Figure 2. Readings were taken at 0.5m intervals along transects 1.0 m apart. These transects were walked in a zigzag pattern. Readings were taken with the aid of a ST1 sample trigger.

The survey was carried out using a Geoscan FM36 Fluxgate Gradiometer with a ST1 sample trigger. The Grey Scale Plot was produced using Geoscan Research "Geoplot" v.3.00v and X - Y Plot was produced using Golden Software "Surfer" v. 10.7.972.

Magnetic Susceptibility

Soil samples were taken from eight, 30 x 30 m, grid squares laid out as in Figure 6. The samples were dried in an oven and the magnetic susceptibility measured with a Bartington MS2 Magnetic Susceptibility Meter using a MS2B Laboratory Sensor.

Results:

Area

The Fluxgate Gradiometer Survey covered an area of approximately 1.84 Ha.

Display

The results of the Fluxgate Gradiometer Survey are displayed as a Grey Scale Image (Figure 3) and as a X-Y Trace Plot. (Figure 4) and are summarized in Figure 7.

Fluxgate Gradiometer Survey

This survey technique records slight changes in the earths' magnetic field, which may be the results of human activity. The interpretation of the Fluxgate Gradiometer Surveys is shown as Figure 5 and is summarized in Figure 7.

The top of the hill is defined by a series of broad magnetic anomalies which appear to define the positions of the possible ramparts and ditches of the hillfort. The inner rampart would appear to defined by Anomaly A (Figure 5) which forms an area of magnetic disturbance running from the steep natural slope on the eastern side of the hill. This anomaly would appear to define one side of an in-turned entrance and is distinctive with a series of high readings along its edge which might relate to the possible structure of the rampart. Anomaly B runs parallel to Anomaly A and is assumed to represent the ditch associated with the inner rampart. The line of Anomaly B is extended by Anomaly C on what is assumed to be the opposite site of the gateway into the enclosure. There is little or no sign of a possible rampart within the data, associated with Anomaly C, however, there is a marked slope to the west which might make a significant rampart unnecessary. Between Anomalies A and C are four discrete magnetic anomalies (Anomalies D, E, F and G). Each of these is approximately 2.5 m in diameter and possibly defines the gateway structure into the enclosure.

A second line of defenses would appear to be defined by Anomalies H, I and J. Anomaly H is assumed to be the position of the rampart, whilst Anomalies I and J the ditch. It is noticeable that Anomaly H is less well defined than Anomaly A which might reflect different forms of ramparts being used; however it may equally reflect the differential flattening of these features in the

1830's. The slight kink in the southern end of Anomaly J may suggest that this entrance was also in-turned. It is assumed that the southern end of these defenses would run to the steep slopes along the eastern side of the hill. To the north and west, the line of the defenses is unknown, however the topography of the hill may suggest that a larger enclosure could have been constructed (Figure 8) incorporating the natural breaks of slope. This outer enclosure may have been up to 1.56 Ha in size.

The eastern side of the inner enclosure is possibly defined by Anomaly K. This would give an internal area of approximately 0.62 Ha.

Within the enclosure few magnetic anomalies have been defined. There would appear to be a pentangular enclosure just inside the gateway defined by Anomaly L and a linear anomaly running through the gateway into the central area defined by Anomaly M. This may be related to a track leading into the enclosure and the possible division of the hillfort.

Outside the hillfort, only three anomalies have been defined. Two of these can be related to the modern usage of the field. Anomaly M marks the position of a water tank and its associated use of an old bath as a trough, whilst Anomaly O marks the position of a muck heap. Anomaly H, however, is associated with a rectangular platform near to the edge of the field and is assumed to mark the position of a possible field barn. The alignment and form of this platform would suggest a possible post-medieval date for this feature.

Magnetic Susceptibility

Soil samples were taken from the area of detailed survey in order to assess the magnetic susceptibility of the soils. It was not possible to obtain a subsoil sample for comparison. Samples were taken from eight, 30 x 30 m grid squares laid out as in Figure 6.

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 1	92	137.3
Grid 5	119	160.8
Grid 9	81	114.1
Grid 13	49	69.0
Grid 16	49	67.1
Grid 18	96	110.3
Grid 20	92	129.6
Grid 22	116	133.3

The values as recorded were generally of moderate values suggesting that the area is suitable for magnetic survey.

Magnetic Susceptibility can also be used to indicate areas of potentially archaeological activity. Activity associated with human occupation tends to enhance the magnetic susceptibility of the associated soils (Clark 2000, 99), thus for sites which have been disturbed by ploughing this methodology can be used as a broad prospection technique. It is noticeable that there are enhanced reading in Grid Square 9 which might reflect an increase in human activity in this area. It is curious that the readings from Grid Squares 13 and 16 are lower than the general values recorded. These squares are located between the two ramparts and within the outer rampart complex and it may be that the spreading of the ramparts have given these lower readings.

The slightly enhanced readings in Grid Squares 20 and 22 are probably related to relatively modern activities including the temporary dung heaps near to the gate into the field.

Conclusions

It is a fundamental axiom of archaeological geophysics that the absence of anomalies in the survey data does not mean that there is no archaeology present in the survey area only that the techniques used have not detected it.

The geophysical survey at Pen y Gaer, Llandovery has located a number of anomalies which appear to define two lines of ramparts and associated ditches. The geophysical survey suggests that there is an enclosure of approximately 0.62 Ha on the top of the hill, however a mixture of the geophysical survey and the local topography suggests that this might sit within a larger enclosure of approximately 1.56 Ha (Figure 8). Both of these enclosures would appear to use the natural scarps on the hill as part of their circuits, particularly to the south and east. It is not known if the two enclosures are contemporary with the possibility that they represent a development of the hillfort.

The inner enclosure would appear to have an in-turned entrance to the south west, possibly with a large gate structure defined by four large post pits represented by Anomalies D, E, F and G. It is also possible that the magnetic signature of Anomaly A may suggest a box rampart structure for this internal rampart. The much broader form of Anomaly H could possibly suggest a different rampart structure, although it is unknown what the effect of the flattening of the ramparts in the 1830's would have had on the magnetic signal.

Little activity has been recorded within the enclosure; however the enhanced magnetic susceptibility readings in Grid Squares 9 suggest that a level of human activity took place. Anomaly L would appear to define a division within the hillfort, possibly for stock control.

Outside the hillfort only one anomaly, not of modern origins was located. This was associated with a low, rectangular earthwork and possibly represents the position of a post-medieval field barn.

References

Clark, A. 2000. *Seeing Beneath the Soil Prospecting Methods in Archaeology*. Routledge, London.

Acknowledgements

The survey was commissioned by Jon Lodge. The work was carried out in response to a brief written by L. Austin of the Dyfed Archaeological Trust.

Techniques of Geophysical Survey:

Magnetometry:

This relies on variations in soil magnetic susceptibility and magnetic remenance which often result from past human activities. Using a Fluxgate Gradiometer these variations can be mapped, or a rapid evaluation of archaeological potential can be made by scanning.

Resistivity:

This relies on variations in the electrical conductivity of the soil and subsoil which in general is related to soil moisture levels. As such, results can be seasonally dependent. Slower than Magnetometry this technique is best suited to locating positive features such as buried walls that give rise to high resistance anomalies.

Resistance Tomography

Builds up a vertical profile or pseudosection through deposits by taking resistivity readings along a transect using a range of different probe spacings

Magnetic Susceptibility:

Variations in soil magnetic susceptibility occur naturally but can be greatly enhanced by human activity. Information on the enhancement of magnetic susceptibility can be used to ascertain the suitability of a site for magnetic survey and for targeting areas of potential archaeological activity when extensive sites need to be investigated. Very large areas can be rapidly evaluated and specific areas identified for detailed survey by gradiometer.

Instrumentation:

1. Fluxgate Gradiometer - Geoscan FM36

2. Resistance Meter - Geoscan RM15

3. Magnetic Susceptibility Meter - Bartington MS2

4. Geopulse Imager 25 – Campus

Methodology:

For Gradiometer and Resistivity Survey 20m x 20m or 30m x 30m grids are laid out over the survey area. Gradiometer readings are logged at either 0.5m or 1m intervals along traverses 1m apart. Resistance meter readings are logged at 1m intervals. Data is down-loaded to a laptop computer in the field for initial configuration and analysis. Final analysis is carried out back at base.

For scanning transects are laid out at 10m intervals. Any anomalies noticed are where possible traced and recorded on the location plan.

For Magnetic Susceptibility survey a large grid is laid out and readings logged at 20m intervals along traverses 20m apart, data is again configured and analyzed on a laptop computer.

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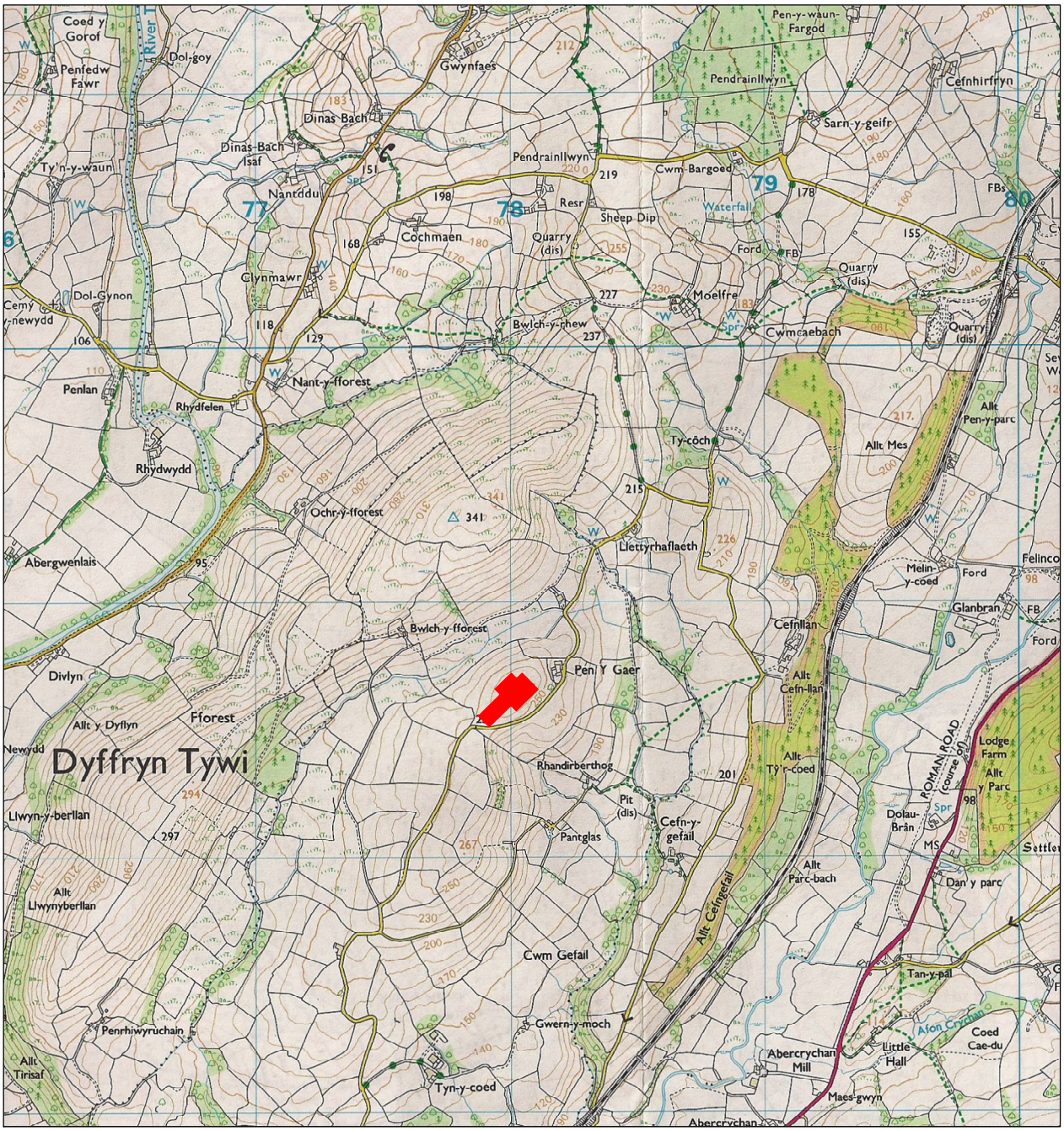

Figure 1: Location

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Figure 2: Pen y Gaer, Llandovery
Location of Survey
Scale 1:2000

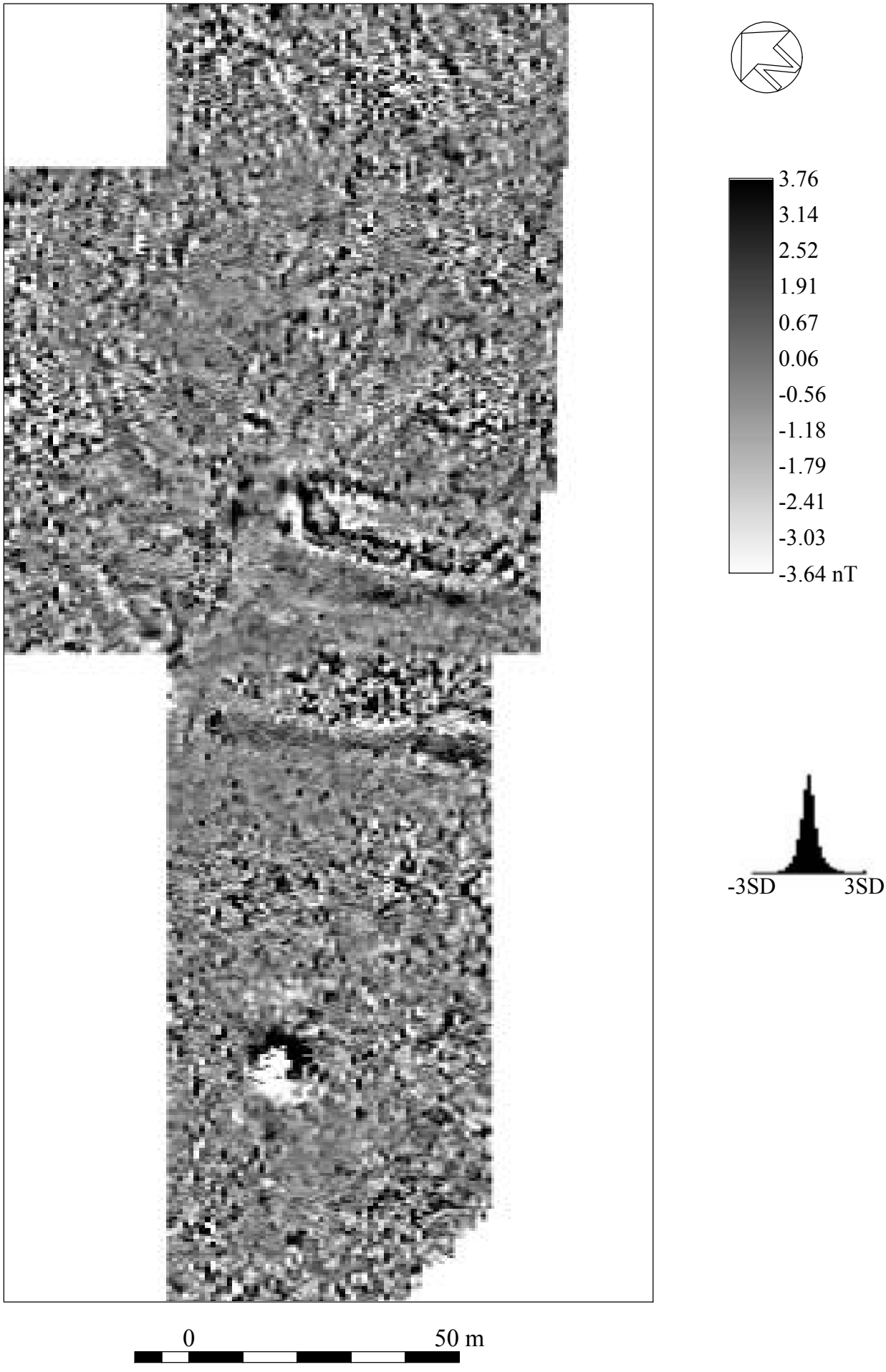

Figure 3: Pen y Gaer, Llandovery
Grey Scale Plot
Scale 1:1000

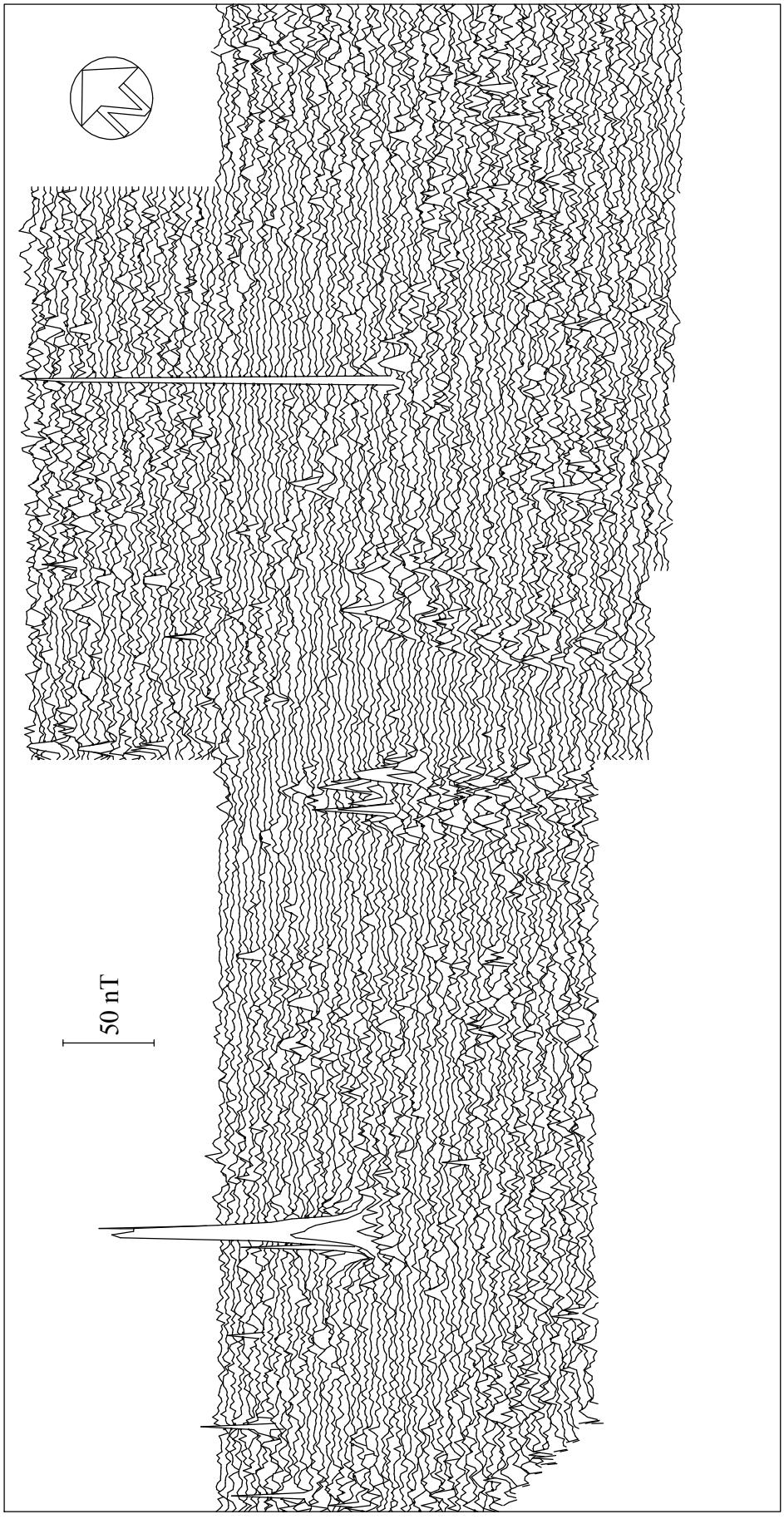

Figure 4: Pen y Gaer, Llandovery
X - Y Plot
Scale 1:1000

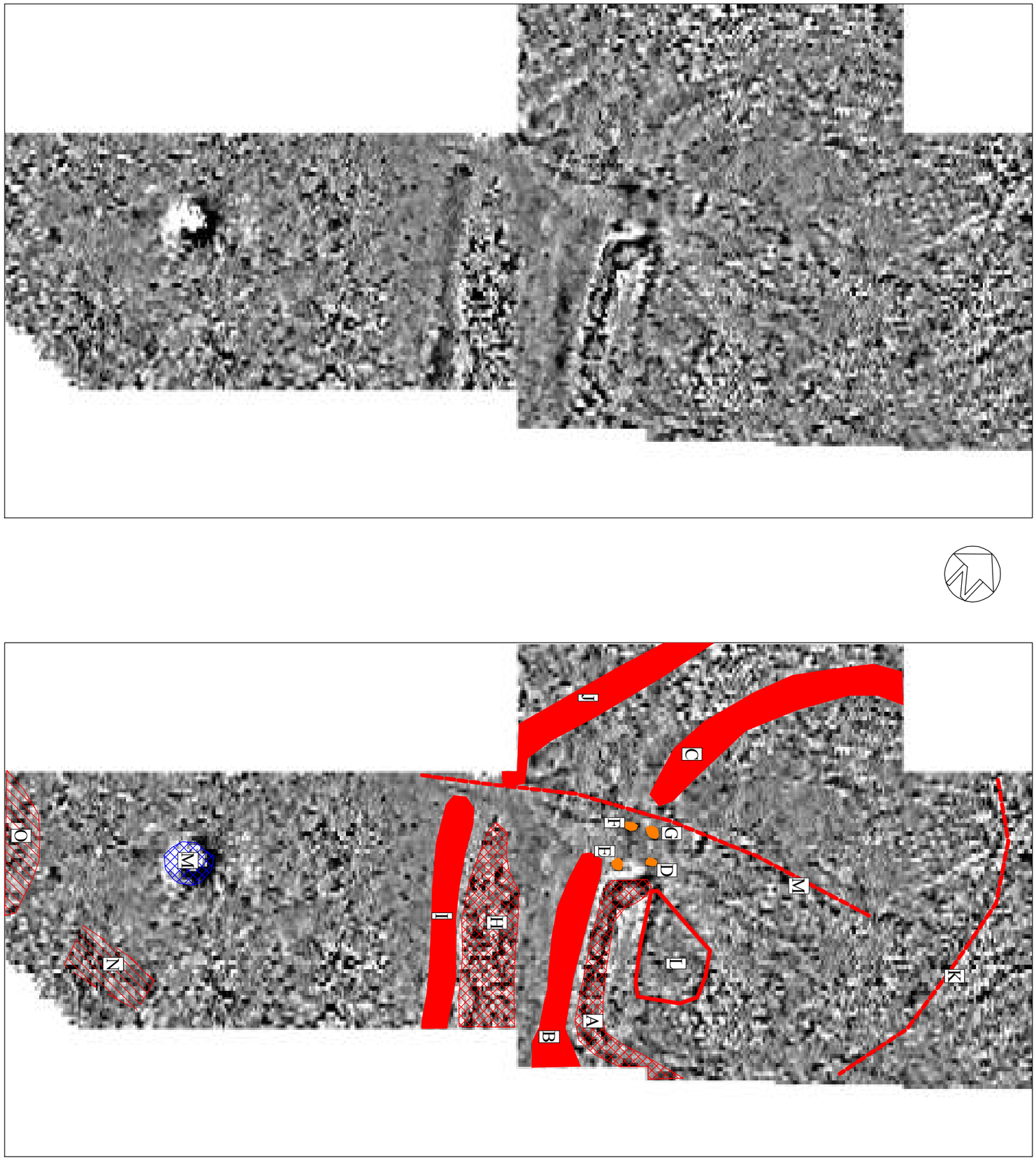

Figure 5: Pen y Gaer, Llandovery
Interpretation
Scale 1:1000

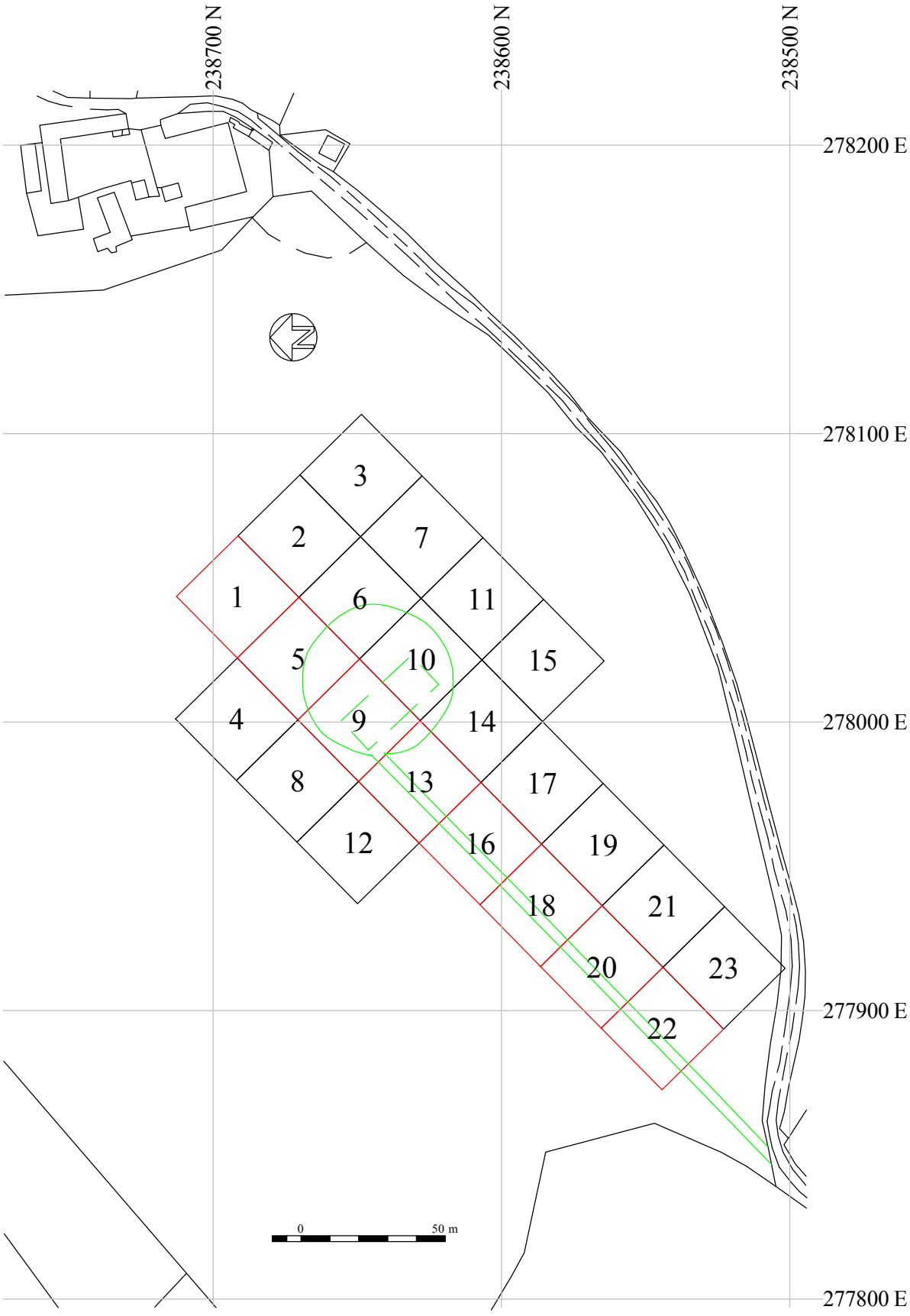

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Figure 6: Pen y Gaer, Llandovery
Location of the Magnetic Susceptibility Samples
Scale 1:2000

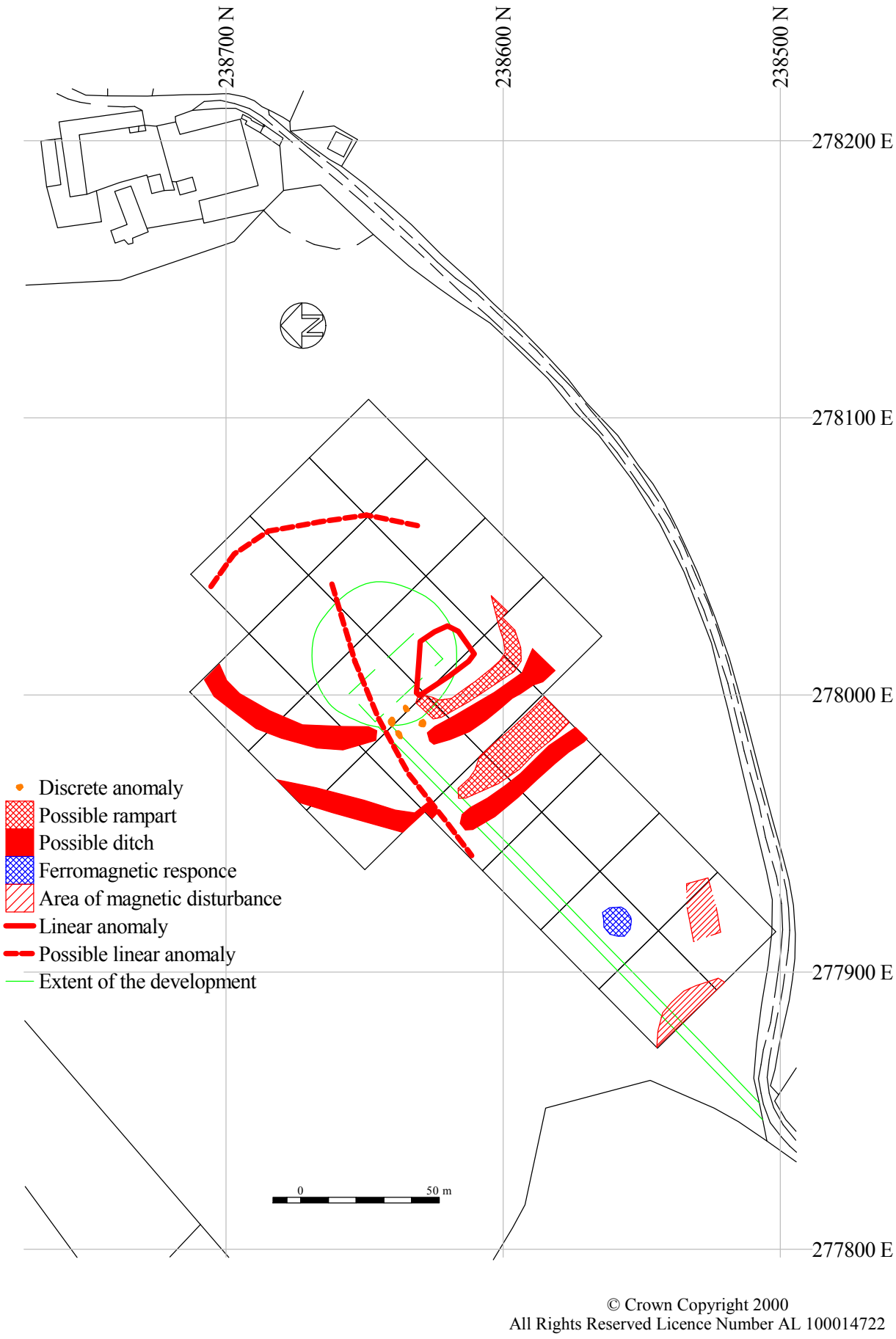

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Figure 7: Pen y Gaer, Llandovery
Summary
Scale 1:2000

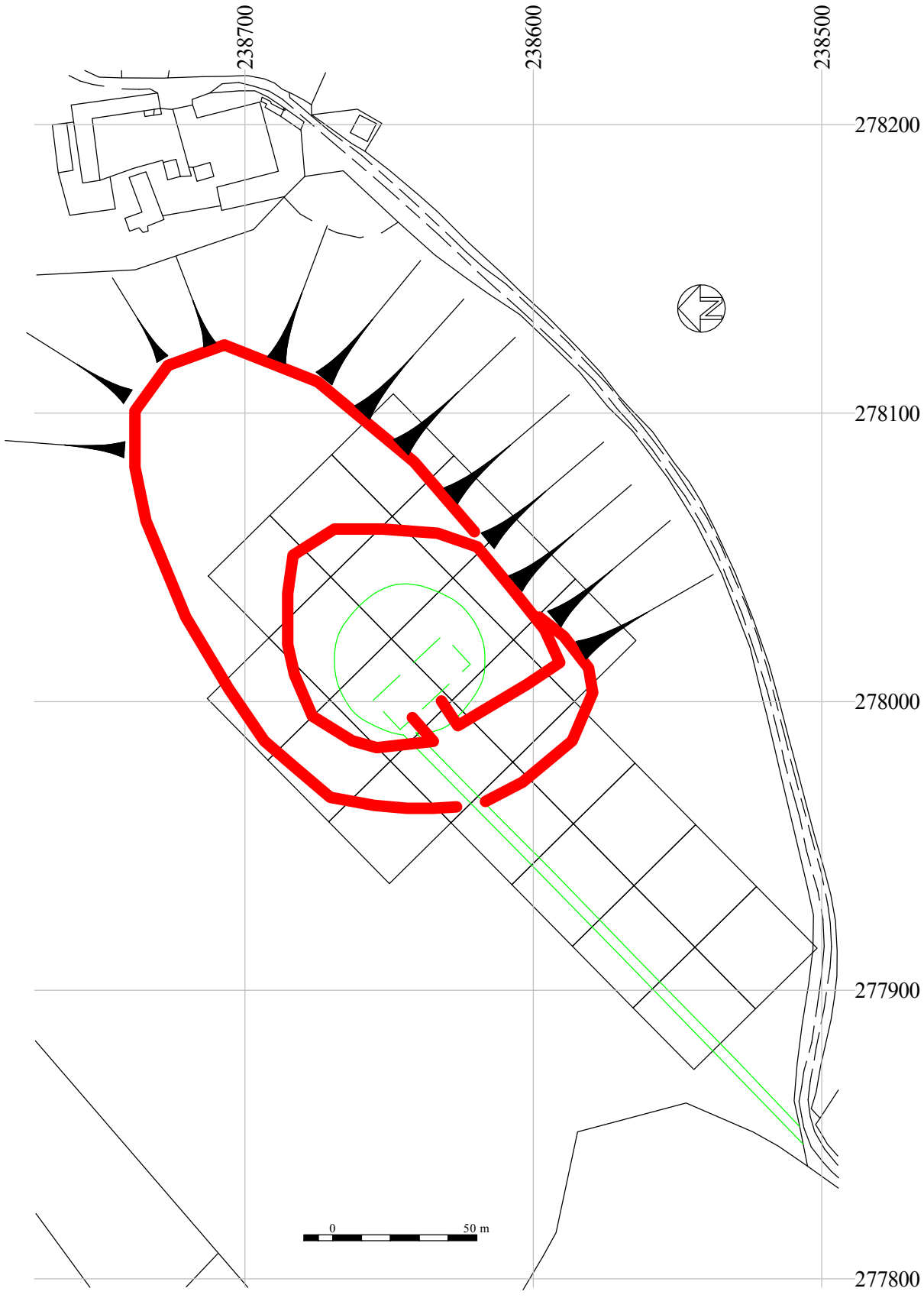

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Figure 8: Pen y Gaer, Llandovery
Speculative Extent of the Ramparts
Scale 1:2000