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Engineering Archaeological Services Ltd.

Cae Capel, Botwnnog, Gwyneddd:
Geophysical Survey
Commissioned by
Robat Williams, RWE Ltd

Analysis by

I.P. Brooks

Engineering Archaeological Services Ltd

EAS Client Report 2023/11

Engineering Archaeological Services Ltd is

Registered in England No 286978

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List of Illustrations

NGR

Centred on: SH 26127 30907

Location and Topography (Figures 1 and 2)

The survey area was located at the south eastern end of the village of Botwnnog, Gwynedd, in a field known as Cae Capel which is adjacent to Ty Capel and opposite the Health Centre. It consisted of a pasture field which was essentially flat, with a very slight ridge running NW – SE across the middle of the field at approximately 16m OD. The underlying geology is the Dol-cyn-afon Formation, a siltstone formed between 485.4 and 477.7 million years ago during the Ordovician period, with superficial glacial deposits of sand and gravel over. (https://geologyviewer.bgs.ac.uk/).

Cae Capel has stone walls, with a metal fence above, along its north eastern and eastern sides and clawdd type boundaries around the rest of the field. At the time of the survey the field was under pasture with grass up to 150 mm long. In the south western corner of the field was a fenced-off area for stock handling and a water bowser was parked next to the boundary with Ty Capel.

The fieldwork took place on 26/10/2023.

Archaeological Background

RWE Ltd. Plan to construct 18, affordable, residential units on a field known as Cae Capel, Botwnnog, as part of the pre-planning archaeological evaluation of the site they have commissioned a Fluxgate Gradiometer survey of the site.

Aims of Survey

1. To investigate, define and record any potentially archaeological features within the development area.

SUMMARY OF RESULTS

RWE Ltd commissioned Engineering Archaeological Services Ltd to carry out a Fluxgate Gradiometer survey in a field known as Cae Capel, Botwnnog, Gwynedd. The fieldwork took place on 26th October 2034. A number of magnetic anomalies have been defined together with areas of ferromagnetic responses which can be related to modern metal objects like fences and gates. The field appears to have been divided at some point in its history with a moderately magnetic anomaly crossing the survey area. This division appears to reflect a kink in the western edge of the current field. The easily available historic mapping would suggest this possible boundary pre-dates the Tithe map of 1839. Another linear anomaly is more curvilinear in appearance, and may therefore be earlier; whilst a third linear anomaly runs parallel to the road and may be modern drainage. There are also a series of three areas of magnetic disturbance in the southern half of the survey area and a possible circular anomaly, approximately 7.5 m in diameter in the eastern half of the survey.

Comisiynodd RWE Ltd Engineering Archaeological Services Ltd i gynnal arolwg Fluxgate Gradiometer mewn cae a elwir yn Gae Capel, Botwnnog, Gwynedd. Cynhaliwyd y gwaith maes ar 26 Hydref 2034. Mae nifer o anomaleddau magnetig wedi'u diffinio ynghyd ag ardaloedd o ymatebion ferromagnetig y gellir eu cysylltu â gwrthrychau metel modern fel

ffensys a gatiau. Mae'n ymddangos bod y cae wedi'i rannu ar ryw adeg yn ei hanes gydag anomaledd magnetig cymedrol yn croesi ardal yr arolwg. Mae'n ymddangos bod y rhaniad hwn yn adlewyrchu cinc yn ymyl gorllewinol y cae presennol. Mae'r mapiau hanesyddol sydd ar gael yn hawdd yn awgrymu bod y ffin bosibl hon yn rhagddyddio Map Degwm 1839. Mae anghysondeb llinol arall yn fwy cromliniol o ran ymddangosiad, a gall fod yn gynharach felly; tra bod trydydd anomaledd llinol yn rhedeg yn gyfochrog â'r ffordd a gall fod yn ddraeniad modern. Mae yna hefyd gyfres o dri maes o aflonyddwch magnetig yn hanner deheuol ardal yr arolwg ac anomaledd cylchol posibl, tua 7.5 m mewn diamedr yn hanner dwyreiniol yr arolwg.

Methods

The survey was based on a series of nineteen, 20 x 20 m squares laid out as in Figures 2 and 3. Readings were taken with a Geoscan FM256 Fluxgate Gradiometer at 0.25 m intervals along transects 1 m apart. The surveys were downloaded onto a laptop, on site, and processed using Geoscan Research "Geoplot" v.4.00. The X - Y plots were produced by exporting the data and processing it using Golden Software "Surfer" v. 10.7.972

A limited number of soils samples were taken to access the Magnetic Susceptibility on the site (Figures 7 and 8). These were dried out in a warming oven, sieved and processed using a Bartington MS2 Magnetic Susceptibility Meter.

Survey Results:

Area

0.58 Ha

Display

The results are displayed as a grey scale image (Figures 3), and as X-Y trace plot (Figures 4). The interpretation plot is shown as Figure 6. The Magnetic Susceptibility results are summarised on Figure 8 and the survey, as a whole, is summarised on Figure 9.

Results:

Fluxgate Gradiometer Survey

The grey scale plot (Figure 4) has a number of areas of ferromagnetic response which are shown in blue on Figure 6. These are largely the response to metal objects, mainly fencing, along the boundaries of the field. Within these responses Anomaly A can be related to a water bowser parked just outside the survey area and Anomaly B the metal gate to the field. Anomaly C occurs in a corner of the field and is probably the result of rubbish dumped in this part of the field.

Three linear anomalies cross the survey area. The most dominant of these (Anomaly D, Figure 6) links the south east corner of the field to the dog-leg in the western boundary and may, therefore, represent a division of the field which has been lost. It runs parallel with B4413 and appears to continue a set of enclosures now occupied by houses, to the north west. Crossing Anomaly D, Anomaly E is a sinuous linear anomaly crossing the survey area roughly in a NW – SE direction. The curvilinear nature of this anomaly may suggest a possible prehistoric date to this anomaly. A third linear anomaly (Anomaly F) is less clear

and runs in a straight line across the survey area. It is possibly the line of a drain within the field; however, it also runs along the line between two rows of grids and may therefore be a product of processing the survey.

There are two, short, curving anomalies that are rather feint within the grey scale plot. Anomaly G appears to form a circle, approximately 7.5 m located at SH 26175 30901. Whilst this might be the result of a circular feeder, it would seem more likely that it may be a ring ditch and therefore prehistoric in date. The second is an arc near to the boundary with the B4413, about half way along the boundary. Its function is unknown and may be an effect of the boundary and road beyond.

Three, amorphous, areas of magnetic disturbance have been defined in the southern part of the survey. Anomaly I covers an area of approximately 20 x 8 m with a series of discrete anomalies which are typically 6 – 9 nT above the background. The anomaly is somewhat diffuse and no certain form can be determined. The function of this anomaly is uncertain, but it might be geological in origins or possibly the result of the disturbance of an enhanced magnetic anomaly such as a bonfire. Anomaly J is approximately 13.5 x 11 m in size being an area of slight magnetic variability. The location of this anomaly, just inside the gate to the field may be significant. Anomaly K is a larger, diffuse, anomaly approximately 24.5 x 20.5 m which contains a series of discrete, moderately magnetic areas up to 14 nT above the background and is of unknown origins.

Magnetic Susceptibility (Figure 7 and 8)

Eight, small, soil samples were taken for Magnetic Susceptibility analysis. It was not possible, however, to obtain a subsoil sample for comparison. Both volume susceptibility (direct reading of the samples) and mass susceptibility (reading compensated for the varying mass of the samples) is given below. The location of the samples is shown on Figure 7 and the results on Figure 8.

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
1	150	208.3
3	157	203.9
7	142	200.0
9	148	205.6
11	122	164.9
13	144	197.3
17	167	216.9
19	145	188.3

The samples, as measured, are generally of moderate-to-high values suggesting that, the conditions for magnetic survey, were suitable.

Assuming a consistent geological regime across the survey area, the magnetic susceptibility can be used as a proxy for the level of archaeological activity (Clark, 1996, 99). Those recorded from the survey areas, are fairly consistent, however two readings stand out from the rest. The sample from Grid Square 17 is noticeably enhance. This can be correlated with Anomaly K suggesting a possible increase of archaeological activity in this area. It is also noticeable that both of the readings near to the southern field boundary have lower values,

possibly reflecting the proximity to this boundary and the erosion of material from the clawdd walls spreading out across the field.

Conclusions (Figure 17)

It is a fundamental axiom of archaeological geophysics that the absence of features 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 most dominant anomaly recorded is the linear anomaly (Anomaly D, Figure 6) which crosses the field in a north-west to south-east direction and appears to follow the line of a dog-leg in the western boundary. It is suggested that this is probably a lost field boundary, if so it must date from before 1839 as it does not appear on the "Tithe map of Botwnnog in the county of Carnarvon" (Figure 10.1) (https://places.library.wales/viewer/4618393#?cv=&h=331&xywh=1867%2C12527%2C2821%2C1492). The associated apportionment schedule records that Plot 331 was part of Rhydgoch Farm, called Caer cappel and was owned by John Griffiths and the tenant was John Williams (https://places.library.wales/viewer/4564324#?cv=10&h=331&xywh=-687%2C-68%2C2775%2C1357). It was under arable agriculture at that time. It also does not appear on the Ordnance Survey, Carnarvonshire XLV.3 map published in 1900 (Figure 10.2). There is an outside possibility that this anomaly may be a modern service, however, the landowner had no knowledge of a pipe crossing the field in a conversation on 26/10/2023.

Anomaly E (Figure 6) is also assumed to be a disused field boundary, however its somewhat sinuous in character may suggest it was part of an earlier field system, predating the current layout, possibly prehistoric in date. The only other linear anomaly (Anomaly F) is probably a modern field drain.

The other anomalies are less well defined than the linear anomalies, but include hints of possible prehistoric activity (Anomaly G) and some areas of mixed reading which could be either, areas of human activity or a reflection of variability of the underlying geology. The corelation between Anomaly K with the enhanced magnetic susceptibility readings from Grid 17 (Figures 7 – 9) may suggest a level of archaeological activity in this area.

References

Clark, A. 1996. *Seeing beneath the soil prospecting methods in archaeology.* Routledge, London

Acknowledgements

This survey was commissioned by Robat Williams of RWE Ltd. It was monitored for the Gwynedd Archaeological Planning by Tom Fildes.

Techniques of Geophysical Survey:

Magnetometry:

This relies on variations in soil magnetic susceptibility and magnetic remanence 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 dependant. 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 pseudo-section 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 FM256

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 between 0.25m and 1m intervals along traverses 1m apart. Resistance meter readings are logged at 0.5m or 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 analysed on a laptop computer.

Copyright:

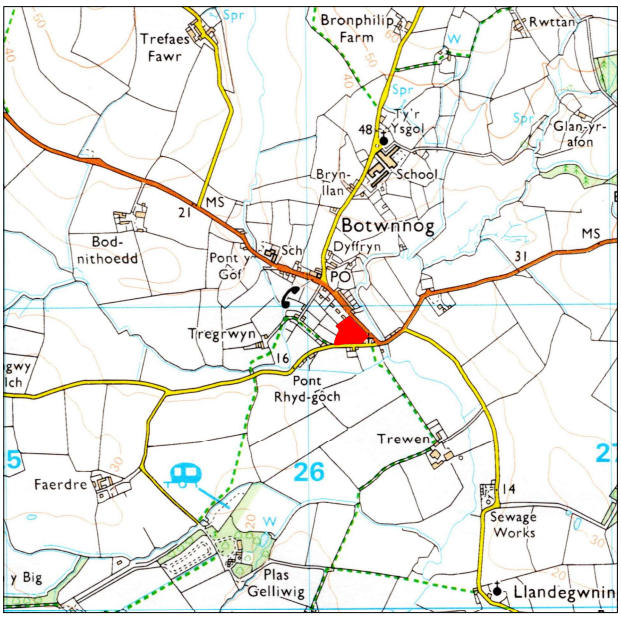


Figure 1: Location
Scale 1:25,000

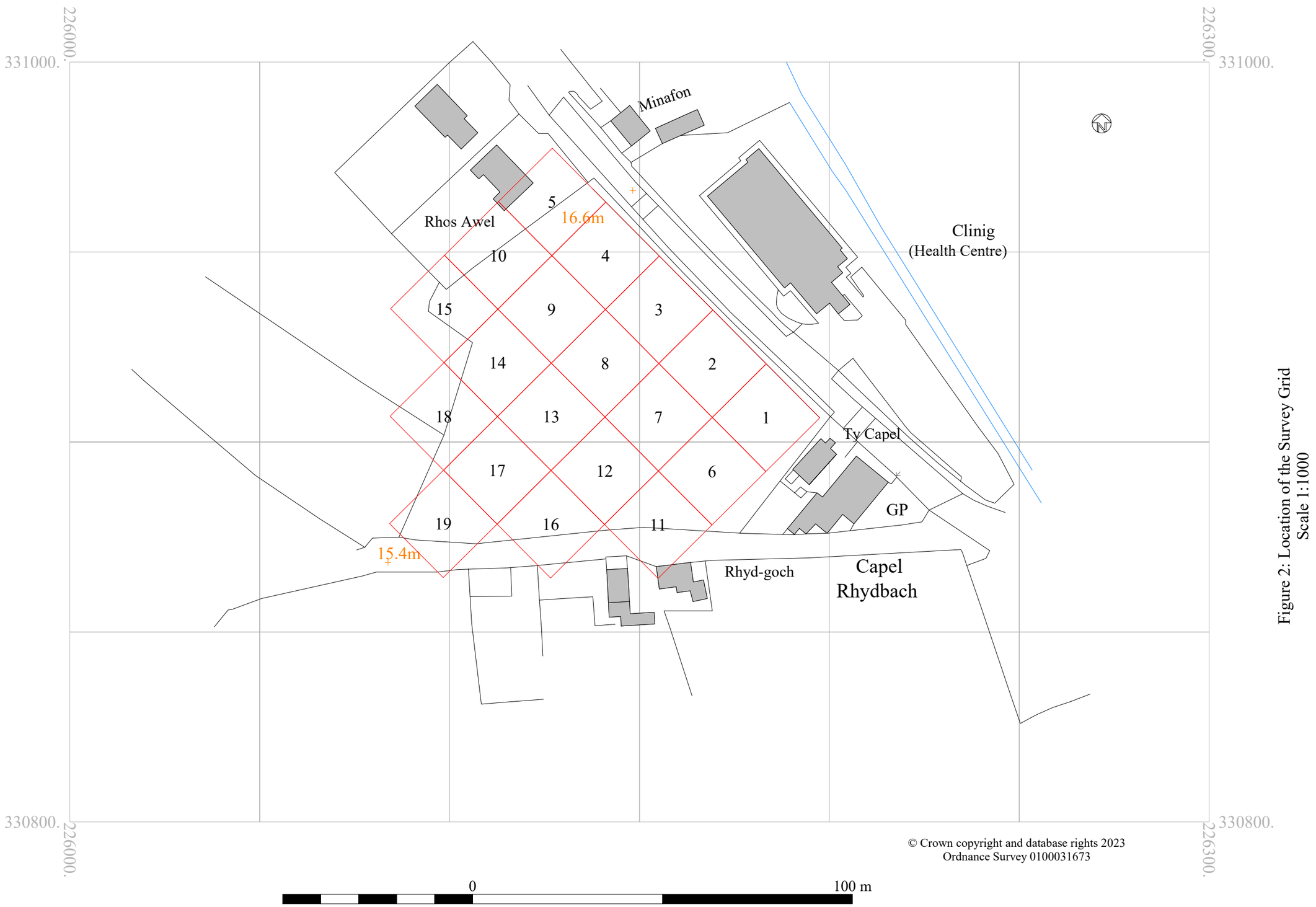


Figure 2: Location of the Survey Grid
Scale 1:1000

Figure 3: Location of the Survey
Scale 1:1000

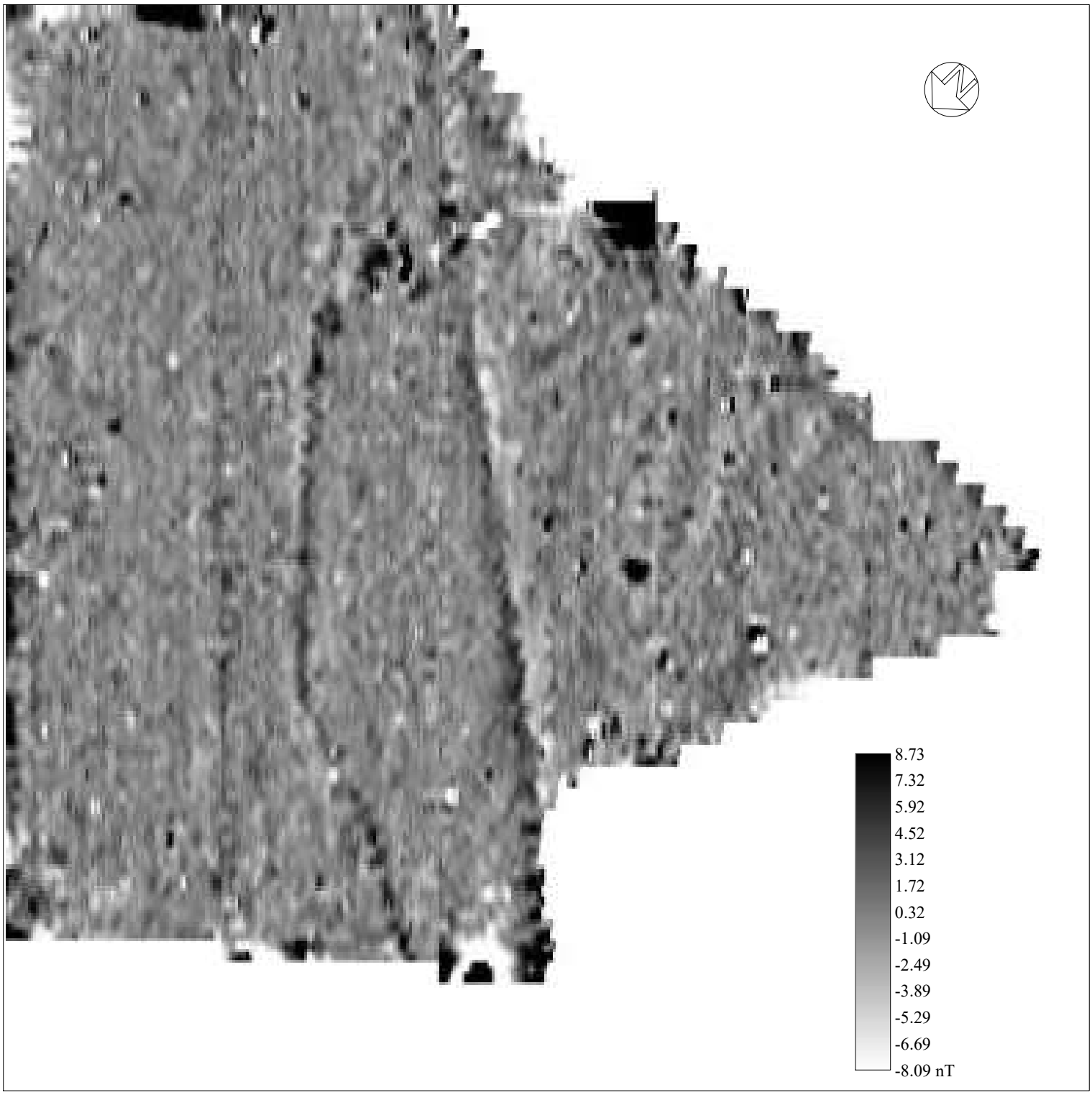


Figure 4: Grey Scale Plot
Scale 1:500

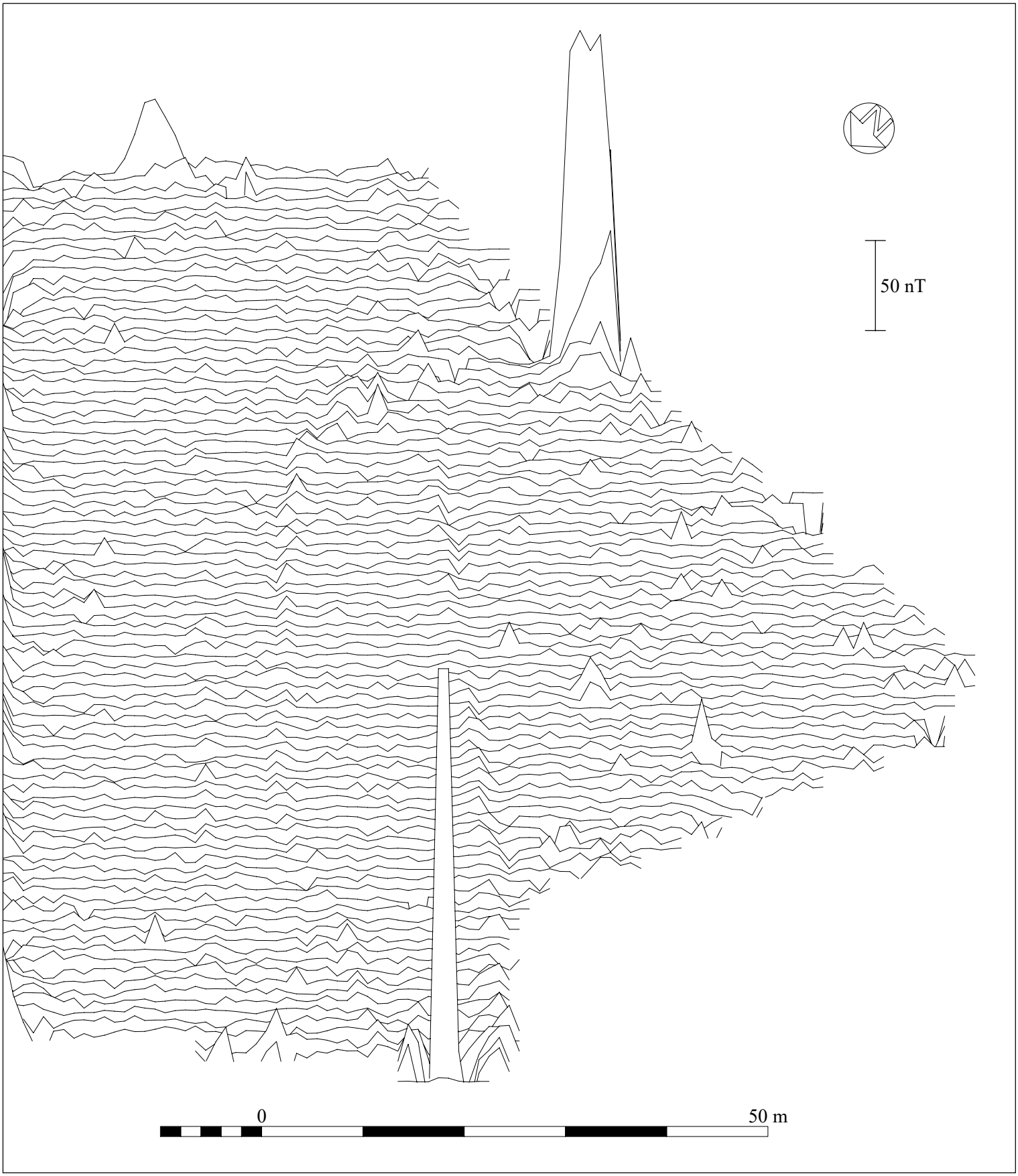
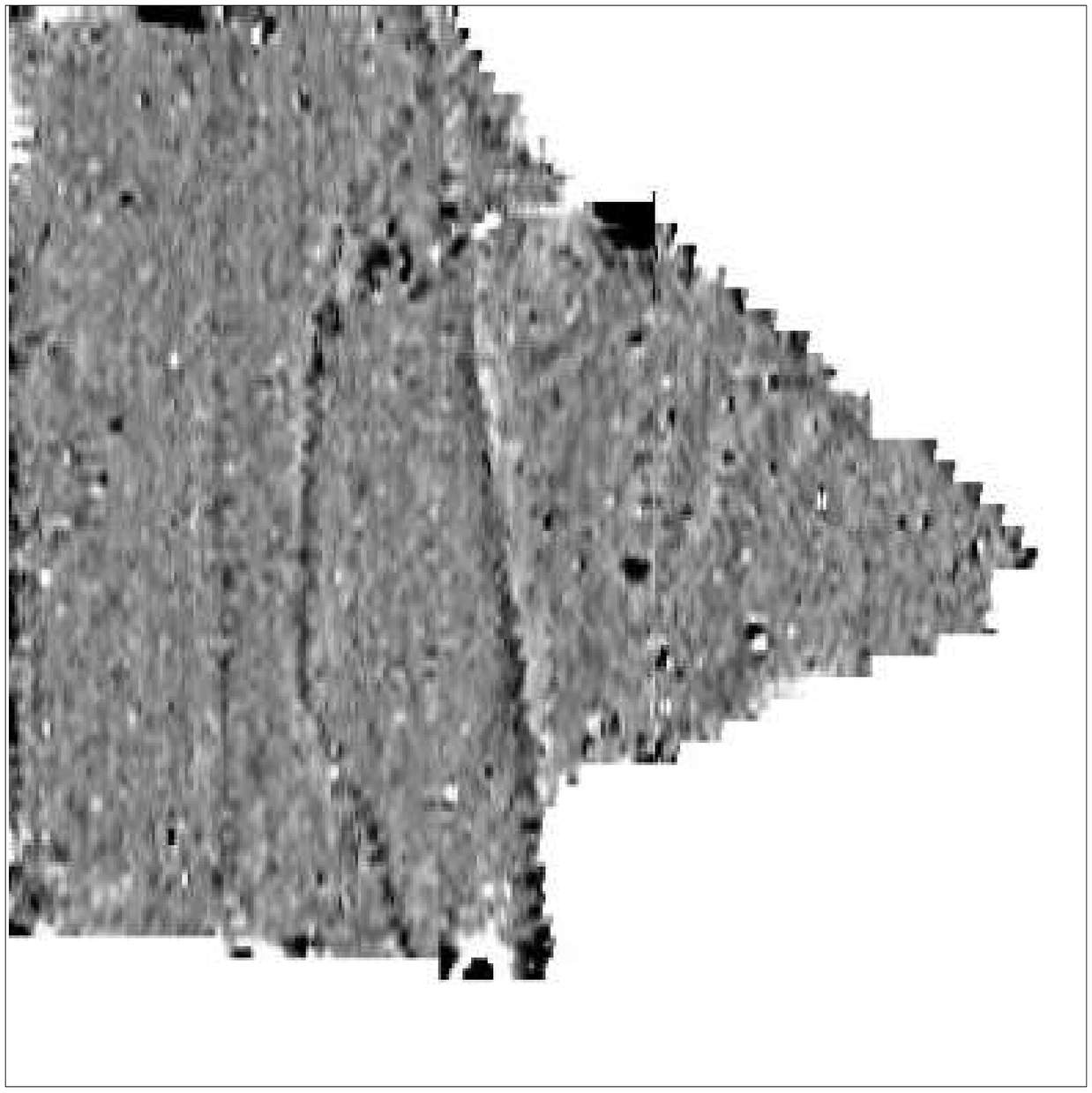
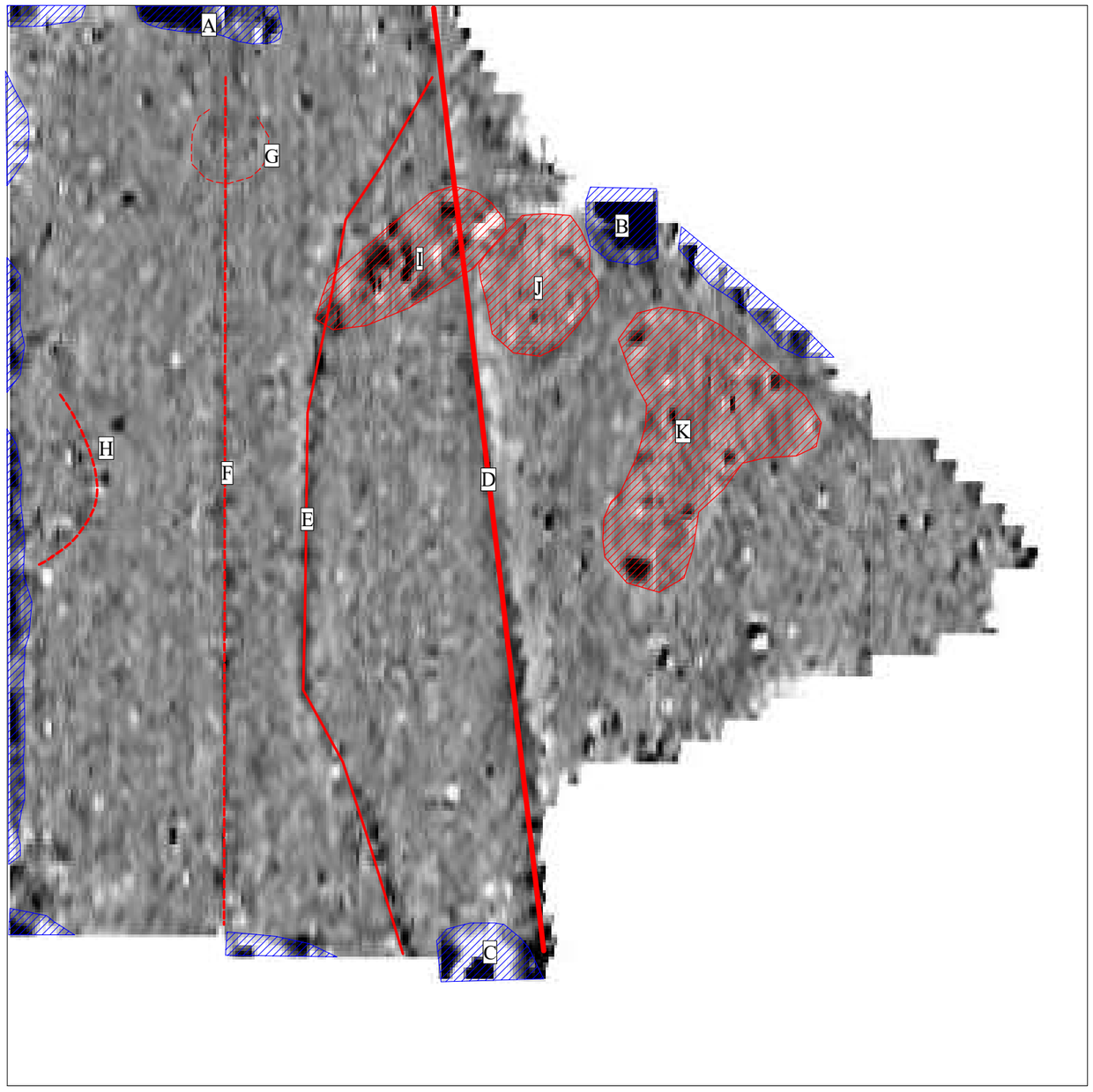


Figure 5: X-Y Plot
Scale 1:500





Linear anomaly
Moderately magnetic linear anomaly
Possible linear anomaly
Area of magnetic disturbance
Ferromagnetic response

0 50 m

Figure 6: Interpretation
Scale 1:500

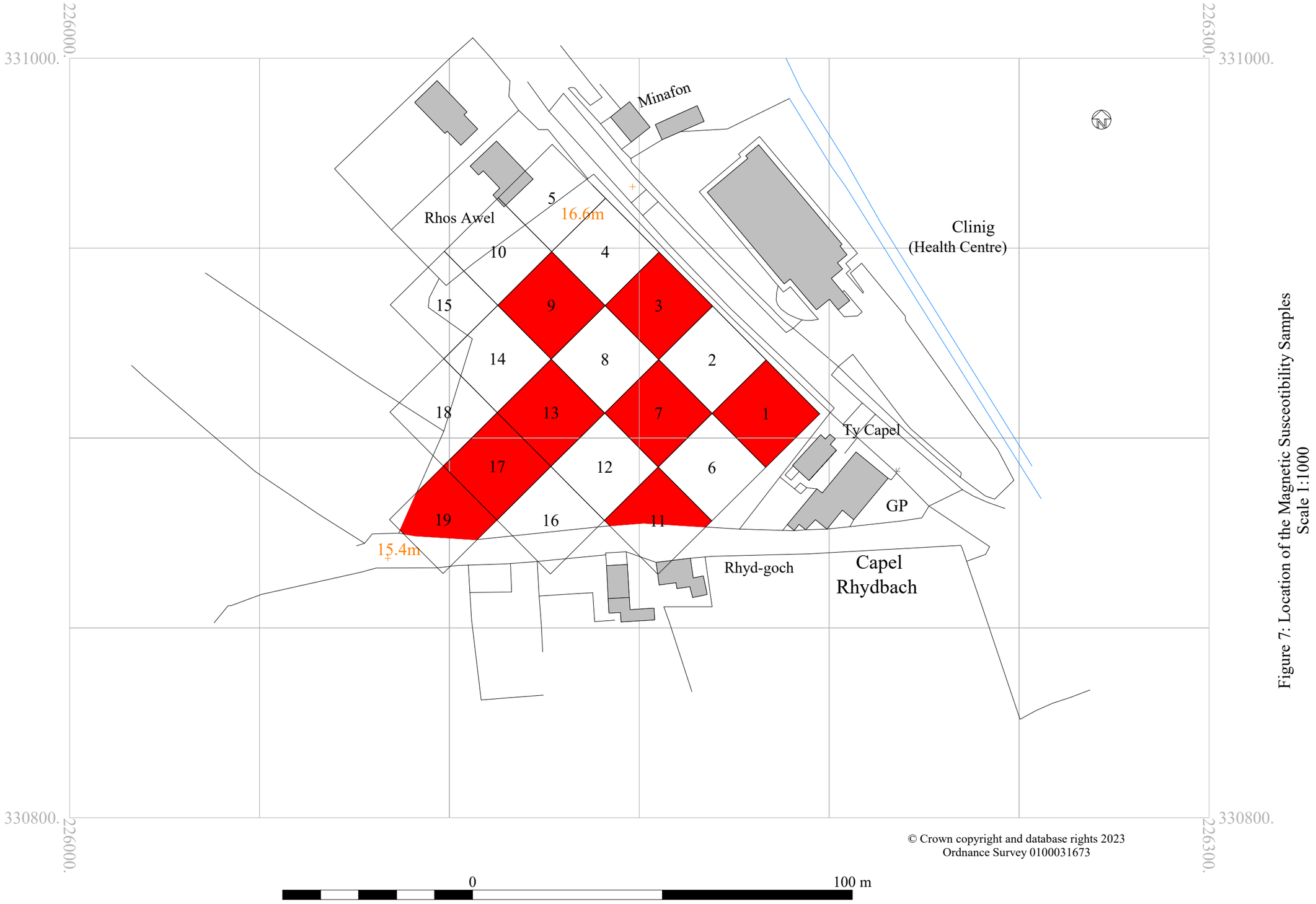


Figure 7: Location of the Magnetic Susceotibility Samples
Scale 1:1000

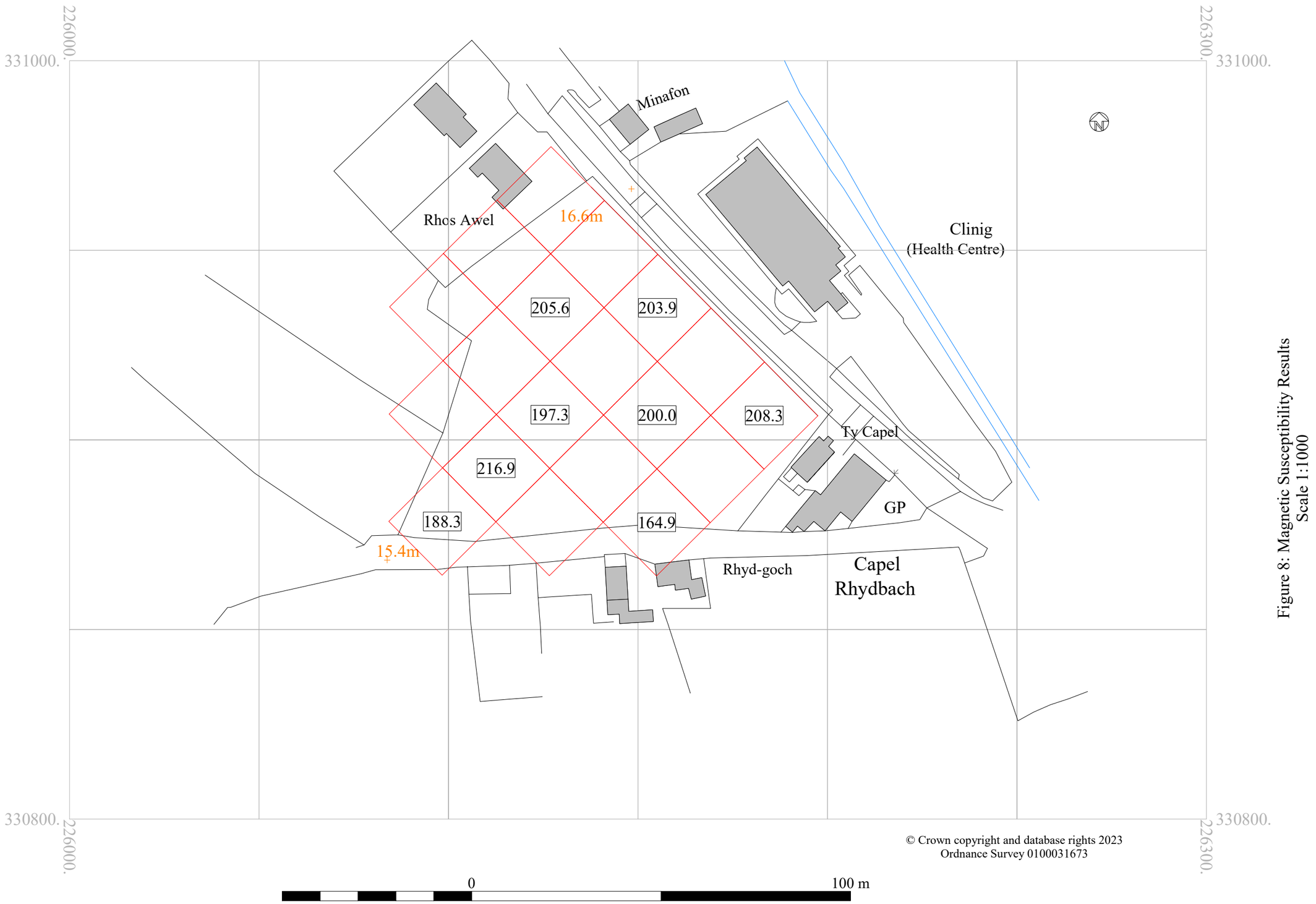


Figure 8: Magnetic Susceptibility Results
Scale 1:1000

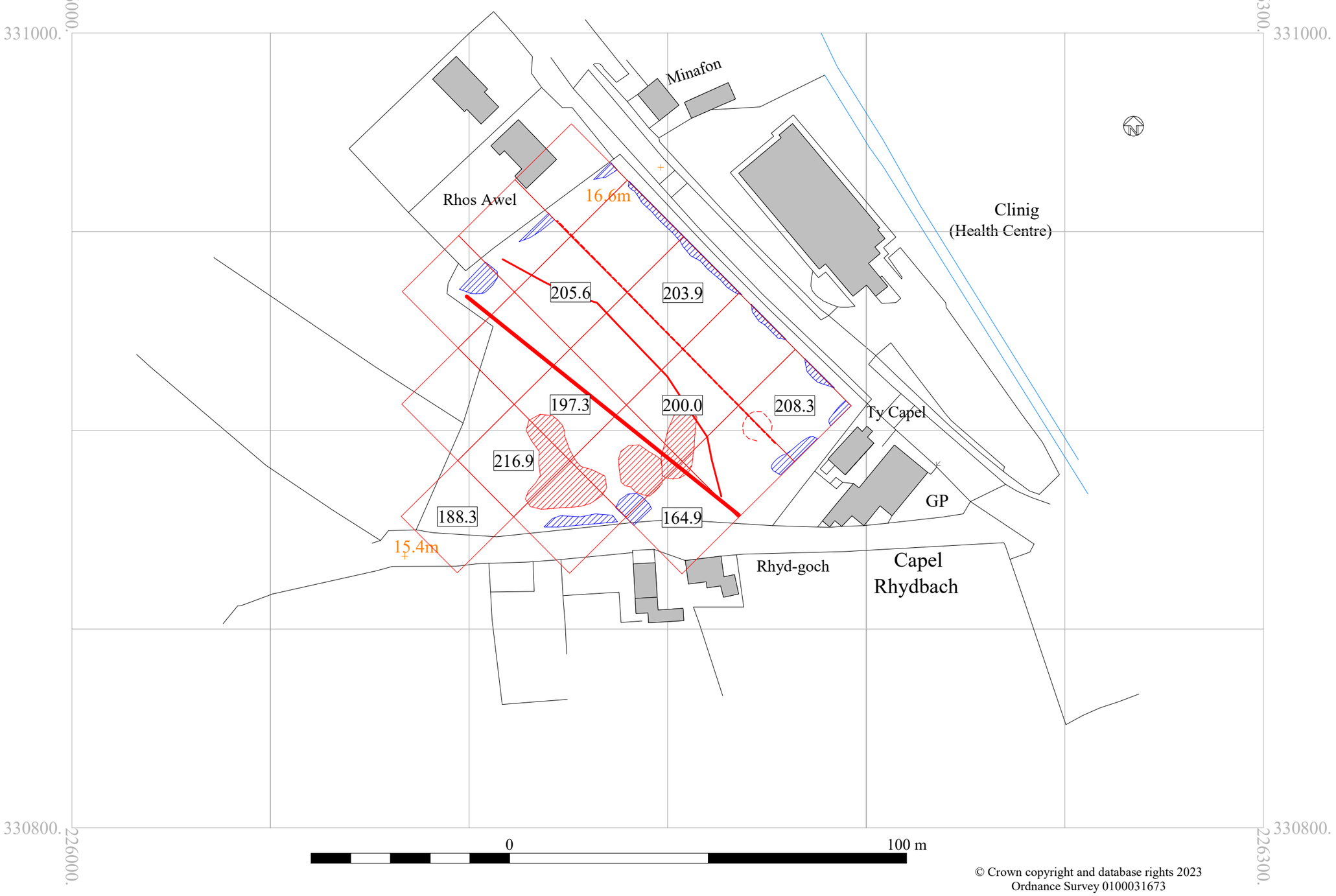


Figure 9: Summary
Scale 1:1000

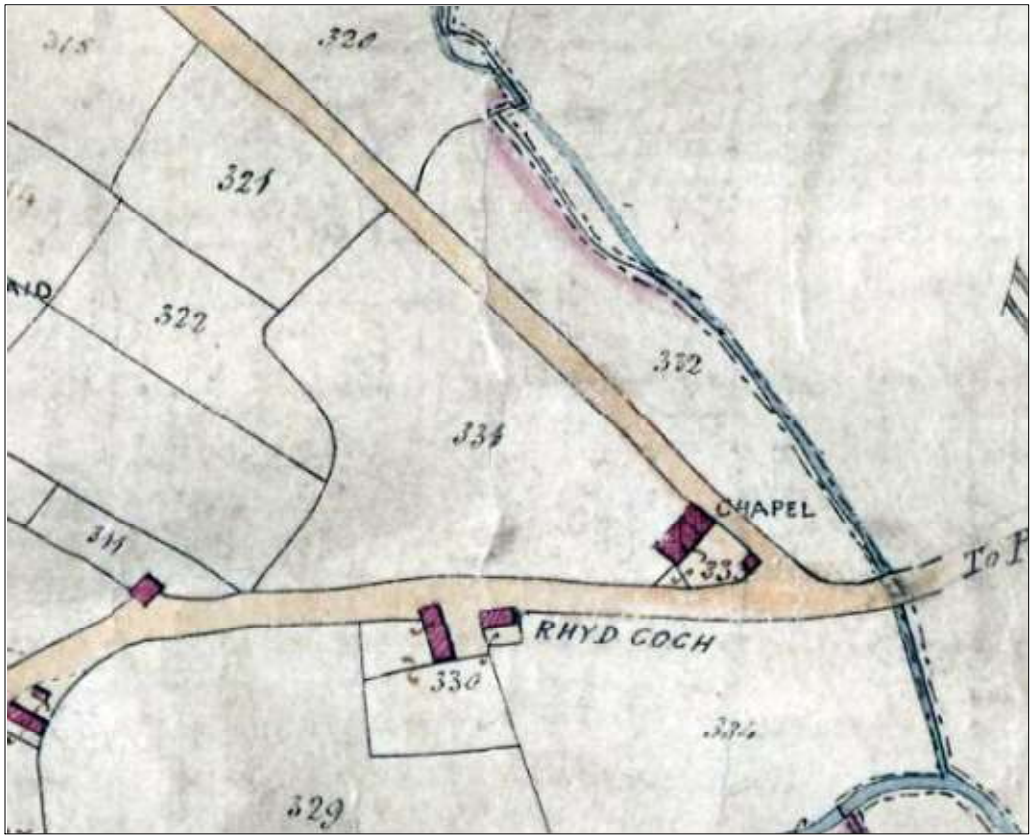


Figure 10.1: 1839 Tithe map

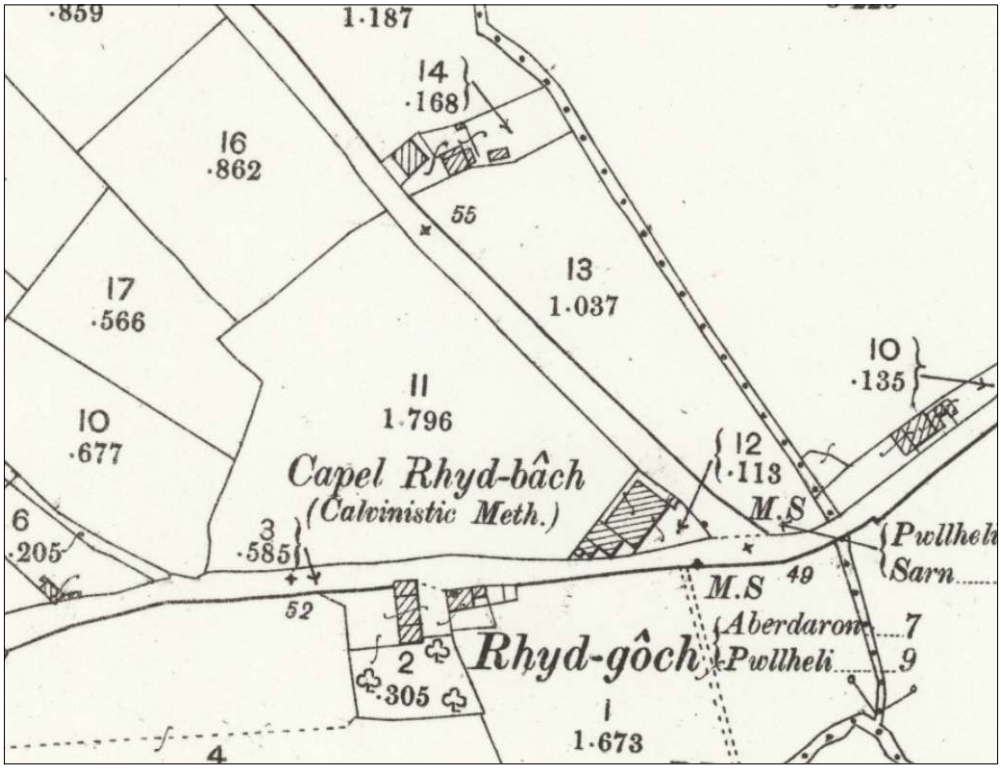


Figure 10.2: Ordnance Survey Carnarvonshire XLV.3. map, Published in 1900

Figure 10: Historic Mapping
Re-scaled to 1:2,000