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Engineering Archaeological Services Ltd.

Bontnewydd School, Gwynedd: Fluxgate Gradiometer Survey



Commissioned by R. Farmer Housing and Property Department Gwynedd County Council

Analysis by I.P. Brooks Engineering Archaeological Services Ltd

EAS Client Report 2023/09

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NGR

Centred on: SH 48141 59964

Location and Topography (Figures 1 and 2)

The survey was located within the playing fields of Ysgol Bontnewydd, Bontnewydd, Caernarfon LL55 2UF. The main area consisted of the area of playing fields to the west of the current school buildings. A second area, approximately 20 m x 20 m in size, to the south of the current buildings was also inspected, but it was decided that the level of magnetic disturbance associated with this area was too great.

At the time of the survey, the playing field was under short, maintained grass.

The survey took place on 21/09/2023.

Archaeological Background

It is planned to carry out construction works at Ysgol Bontnewydd including the demolition of the historic school buildings fronting onto Dol Bueno. The area of the current school building was an agricultural field until at least 1963 (Figures 3 and 4) based on easily available historic mapping. The earliest available map is the 1841 Tithe Map of part of the parish of Llanbeblig, County of Carnarvon (Figure 3.1). This was drawn before the school was set up in Bontnewydd with Plot 177 being described as a "homestead" called Caer Pwll on the apportionment (https://places.library.wales/viewer/4557698#?cv=22&h=1177&xywh= -673%2C-67%2C2703%2C1322). The field on which the current school is built consist of a meadow called Cae Pella (Plot 1178) and an arable field called Cae Canol (Plot 1179). The original school was constructed after 1844 when there is a draft grant of a piece of ground, part of a farm called Cefnywerthid in the village of Bontnewydd, p. Llanbeblig as a site for a school for poor persons in p. Llanbeblig, and for the residence of the master of the school by John Griffith Griffith of Plas Llanfair (National Library).

The earliest map to show a school is the first edition Ordnance Survey map published in 1888 (Figure 3.2) which shows a building along the western boundary of a plot facing onto Dol Beuno. Later maps (Figures 3 and 4) show a developing range of outbuildings associated with the school, particularly from 1918 (Figure 4.1) onwards.

Aims of Survey

1. To record any geophysical anomalies within the survey area which may be related to archaeological activity.

SUMMARY OF RESULTS

The Fluxgate Gradiometer survey within the grounds of Bontnewydd School took place on 21/09/2023. The majority of the magnetic anomalies recorded can be related to modern disturbance of the site. Only two anomalies that may be archaeological in origins were located. It was considered that an area at the eastern end of the school grounds, near to the original school buildings was not suitable for magnetic survey.

The survey was commissioned by R. Farmer, Housing and Property Department, Gwynedd County Council.

Cynhaliwyd arolwg Fluxgate Gradiometer ar dir Ysgol Bontnewydd ar 21/09/2023. Gall mwyafrif yr anomaleddau magnetig a gofnodwyd fod yn gysylltiedig ag aflonyddwch modern ar y safle. Dim ond dau anghysondeb a ddarganfuwyd a all fod yn archeolegol eu gwreiddiau. Ystyrir nad oedd ardal ym mhen dwyreiniol tir yr ysgol, ger adeiladau gwreiddiol yr ysgol, yn addas ar gyfer arolwg magnetig.

Comisiynwyd yr arolwg gan R. Farmer, Adran Tai ac Eiddo, Cyngor Sir Gwynedd.

Methods

The survey was based on a series of eleven, 20 x 20 m squares laid out as in Figure 2. 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 soil samples were taken to access the Magnetic Susceptibility on the site (Figure 10). These were dried out in a warming oven, sieved, and processed using a Bartington MS2 Magnetic Susceptibility Meter.

Survey Results:

Area

0.32 Ha

Display

The results are displayed as a grey and colour scale images (Figures 5 -7) and as a X-Y trace plot (Figure 8). The interpretation plot is shown as Figure 9. The Magnetic Susceptibility results are summarised on Figure 10 and the survey, as a whole, is summarised on Figure 11.

Results:

Fluxgate Gradiometer Survey

The plots are dominated by a series of ferromagnetic responses which are the effect to modern metal objects within the environment. These are shown in blue on Figure 9. Anomaly A is the response to the metal fence along the northern edge of the survey area, whilst Anomaly B marks the services under the path along the eastern side of the school buildings. It is also possible that the range of anomalies along the northern edge of the survey

(Anomalies C - G) are part of a metal pipe along this side of the school ground. The other ferromagnetic responses (Anomalies H - Q) are of unknown origins, but are likely to be either metal objects within the topsoil or areas of burning.

Along the western side of the survey area Anomalies R and S mark the magnetic signal of the brick wall marking this boundary of the school field.

Only two anomalies of possible archaeological origins were recorded which are shown in red on Figure 9). Anomaly T is a broad band of slight magnetic disturbance, approximately 6.5 m wide, running east – west. It appears to be associated with a second linear anomaly (Anomaly U), which is approximately 2 m wide, and runs NE – SW. Both of these anomalies are difficult to interpret and whilst they appear to be archaeological, they may be geological in origins.

A possible area for survey at the eastern end of the school yard was inspected, however this area proved to be unsuitable for magnetic survey. There is play equipment along the northern side, whilst the proximity of metal fencing to the south and a metal service cover means that the available area would be very restricted.

Magnetic Susceptibility (Figure 10)

Three, small, soil samples were taken for Magnetic Susceptibility analysis from the dryer, south western side of the survey area. Unfortunately, it was not possible 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 results on Figure 10.

Sample	Volume susceptibility χ _v	Mass susceptibility χm
1	248	406.6
3	193	301.6
6	190	267.6

In general, the readings are moderately high suggesting that the area is suitable for magnetic survey, however, only a limited number of samples were taken.

There is some variability within the readings with Grid 1 having higher values than the other two samples. 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). This would suggest the potential for a higher level of human activity in this area of the field, possibly associated with Anomaly T (Figure 9).

Conclusions (Figure 8)

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 majority of the magnetic anomalies recorded can be related to one of two broad causes.

References

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

Acknowledgements

This survey was commissioned by R. Farmer, Housing and Property Department, Gwynedd County Council. Thanks are also due to Gareth Jones, the Head Teacher of Bontnewydd School, for allowing the survey to take place whilst the school was open.

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.

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Figure 1: Location Scale 1:25,000





3.1: 1841 Tithe Map Part of the parish of Llanbeblig, County of Carnarvon



3.2: Caernarvonshire XV.SE Published in 1888



3.3: Caernarvonshire XV.12 published in 1900

Figure 3: Historic Mapping 1841 - 1900 Rescaled to approximately 1:10,000



4.1: Caernarvonshire XV.12 published in 1918



4.2: Caernarvonshire XV.SE published in 1953



4.3: SH45.NE-A published in 1963









Figure 6: Grey Scale Plot at ± 5 nT Scale 1:500





20 m









20 m 0

Figure 8: X Y Plot Scale 1:500



0

<u>20</u> m

Ferromagnetic response Effect of brick boundary wall Area of magnetic disturbance (possible archaeology)



Figure 9: Interpretation Scale 1:500



