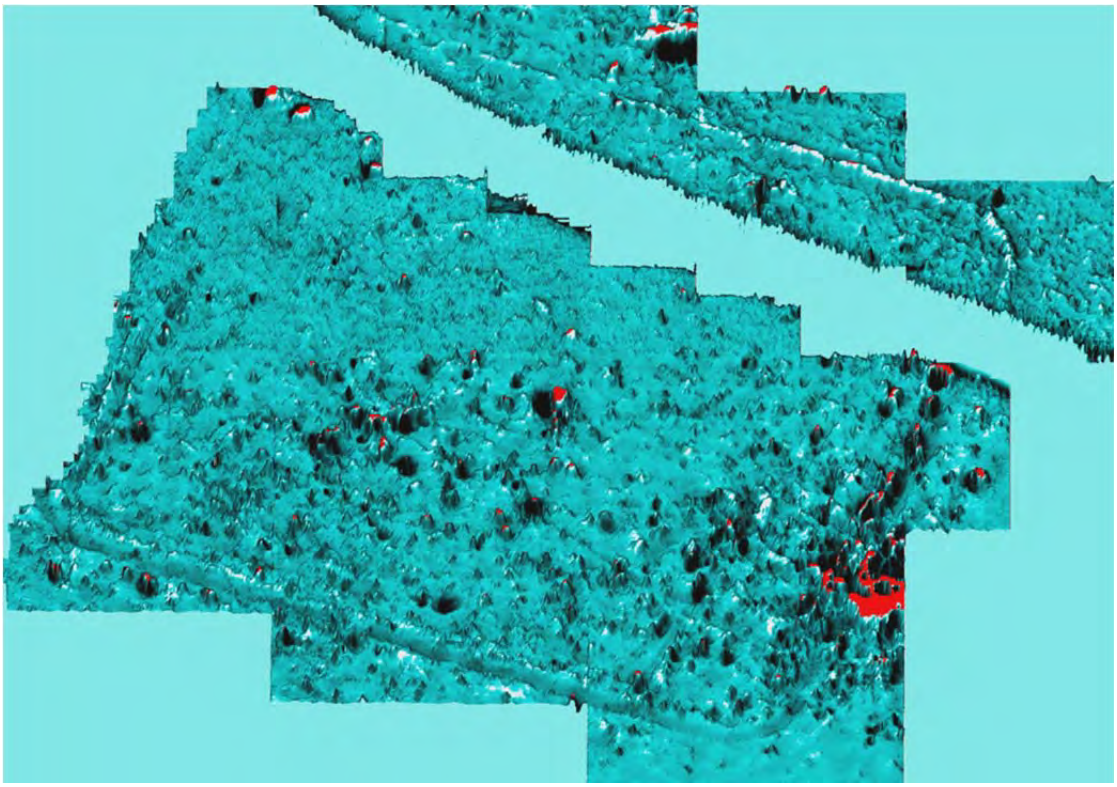
GWANAS FAWR
POSSIBLE ROMAN FORT

GEOPHYSICAL SURVEY

GAT Project No. G2009



Report number: 735

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

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Prepared for

Snowdonia National Park Authority

By

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GWANAS FAWR POSSIBLE ROMAN FORT: GEOPHYSICAL SURVEY(G2009)

1. INTRODUCTION

A hitherto unknown Roman military site was recognised at Gwanas Fawr (SH77111645) 4km south-east of Dolgellau from the air, by Bob Jones, a pilot from Welshpool Airport with long experience of archaeological aerial reconnaissance. The site survives as a rectangular, bivallate earthwork, with rounded corners. The enclosure has external dimensions of 168m x 130m. It was inspected by Dr Jeffrey Davies (University of Wales Aberystwyth) who concluded that the site has all the hallmarks of a Roman auxiliary fort built of earth and timber.

The site is potentially of great importance to our interpretation of the Roman occupation of Wales. The Roman military remains in this area are not well understood and the confirmation of the presence of an auxiliary fort in the area would greatly assist in the interpretation of the other Roman remains in southern Gwynedd. The fort stands in fields that have been only partially improved and appear not to have been ploughed.

The Snowdonia National Park Authority commissioned Gwynedd Archaeological Trust to carry out a fluxgate gradiometer survey of the potential fort and its immediate environs as part of a wide-ranging assessment of this site being carried in conjunction with RCAHMW and Aberystwyth University.

2. METHODOLOGY

Fluxgate gradiometer survey provides a relatively swift and completely non-invasive method of surveying large areas and is ideal for detecting large-scale features such as ditches, banks and areas of occupation. It would almost certainly reveal enough evidence to test the hypothesis that there is a Roman fort at Gwanas Fawr.

2.1 Instrumentation

Most of the survey was carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer. This uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies. The northern part of the southernmost field was surveyed using a single sensor Geoscan FM36 which produces results that are compatible with the Bartington Instrument.

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 because fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalised magnetic enhancement around settlement sites.

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 natural 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 Bartington Grad601 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 1.0m 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 instrument 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 surveys were taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval was 0.5m at and readings were logged at intervals of 0.25m along each traverse giving 3200 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 ArchaeoSurveyor 2 software. The data is presented as a grey-scale plot where 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. This is supplemented by an interpretation diagram showing the main features of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most susceptible to misinterpretation due to the propensity for the human brain to define shapes and patterns in random background 'noise'. An assessment of the confidence of the interpretation is given in the text.

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. Any further processing is noted in relation to the individual plot.

3. RESULTS

The survey was carried out between 4th and 15th February by David Hopewell and Rob Evans from GAT and John Burman from the Merioneth Geophysical Research Team. Assistance with access, site clearance and project coordination was provided by Snowdonia National Park. Louise Barker of RCAHMW carried out a topographic survey of the site that included the position of the geophysical survey grids.

The majority of the survey area was in rough ground with areas of bog and some upstanding earthworks. Some of the boggy areas were difficult to traverse and a small amount of additional noise was probably added to the data due to excessive movement of the gradiometer sensors. This was however not significant and did not compromise the data. Background noise levels were fairly low. The ditch on the western side had been adopted by a trackway and then a drain and this was over 1.5mdeep and could not be surveyed. The site was bisected by a metalled track. The majority of the site was to the south of the track and in an area of rough grazing that had been somewhat improved by

the addition of land drains and some stone clearance. The northern defences were in a heavily improved field to the north of the track.

A rectangular area with dimensions of 180m x 190m was surveyed with the traverse direction at an angle to the site defences. An 80m x 20m extension was added to the eastern side in order to investigate the corner of a low earthwork adjacent to the track.

The following geophysical anomalies were detected (Figs 1 and 2):

1. A 3.5m wide anomaly corresponding to the defensive ditch. This forms a rectangular enclosure with rounded corners and dimensions of 155m x 128m enclosing 1.98 ha. Opposing entrances, 5m to 6m wide were detected in the in the northern and southern sides and were set at 71m from the western end. The western ditch was not surveyed and magnetic noise obscured the position of the eastern entrance. Probing with a ranging rod demonstrated that the ditch on the southern side was at least 1.2m deep.

2. A 4 to 6m anomaly corresponding to the rampart. On the south and eastern sides of the site this shows a clear linear edge on its inner side as a separate narrow anomaly. The rampart produced a very strong anomaly on the eastern side with a pronounced inner edge. This was initially interpreted as being a result of burning but subsequent excavation showed it to be produced by iron panning in the turf facing. The rampart did not produce an anomaly in the intensively cultivated northern field.

3. The interior of the fort contains many small anomalies most of which are probably the product of large stones in the soil or pieces of scrap iron (visible as half black half white dipoles on the grey-scale plot). A few are stronger positive anomalies with a negative halo that may indicate thermoremnant magnetism from hearths.

4. A line of five evenly-spaced small anomalies aligned with the ditch and along the line of the counterscarp bank that is visible as an earthwork in the field. These could represent small hearths or large pits.

5. A linear anomaly nearly parallel with the line of the ditch on the western side of the fort. It could be part of the rampart but seems to run inside the line of the curve of the rampart at the south-west corner of the fort so is best interpreted as a later feature, either the remains of a field boundary or upcast from the ditch.

6. A linear anomaly, not parallel to the defences and probably a modern field drain

7. A linear anomaly visible on the ground as a modern drain.

8. An area of very strong anomalies extending from marshland into the line of the ditch. Anomalies of this magnitude are usually caused by burning, iron or geology. Iron panning produced very strong anomalies in the nearby rampart and it seems likely that this has a similar origin.

9. The rounded corner of a low earthwork to the east of the putative fort is visible on aerial photographs. The area was surveyed in order to test the hypothesis that this was the corner of another Roman earthwork. A line of small anomalies, probably caused by small scraps of iron in the soil, mark the line of the earthwork. No anomalies consistent with a ditch were detected and it seems most likely that the scraps of iron are nails or other debris from a former field boundary.

4. CONCLUSIONS

The survey revealed the defences of a rectangular enclosure with rounded corners and opposed gates with a distinct Roman military character. The interior of the enclosure produced no indications of buildings or any other activity apart from a few possible hearths. Almost all forts that have been subjected to geophysical survey have produced detectable anomalies in the interior. At the very least, roadside drains, ovens against the ramparts and areas of noise indicating the site of the major buildings would be likely, even within a wooden fort.

It is possible that the interior of the fort has been ploughed during field clearance and that all archaeology has been destroyed. The topsoil is however very shallow and the upstanding earthworks

well defined so this seems to be unlikely. There is also a possibility that internal features exist and are not being detected by the gradiometer but this also seems to be unlikely given the clear results from the defences and modern features. The most likely interpretation is that there were no buildings and roads in the interior and that the site at Gwanas Fawr is a marching-camp. If this is so, it would be one of the smallest camps in Wales and the Marches and also one of the most heavily defended (c.f .examples in Davies and Jones 2006). It could alternatively be interpreted as an unfinished and abandoned auxiliary fort although the defences seem to be relatively slight. The site is clearly unusual and more information may emerge through excavation. Classification is problematic but it is clear that the defences represent more than the slight fortifications of most marching camps which have very slight ditches, less than 2m wide and 1m deep (Davies and Jones p.24). This suggests that the site was occupied for more than a few nights and was perhaps a short-lived campaign base that did not progress beyond a tented encampment.

5 . REFERENCES

Clark, A. J. 1990 *Seeing Beneath the Soil*, London *69-71*.
Davies, J. L. and Jones R. H. 2006 *Roman Camps in Wales and the Marches*, Cardiff

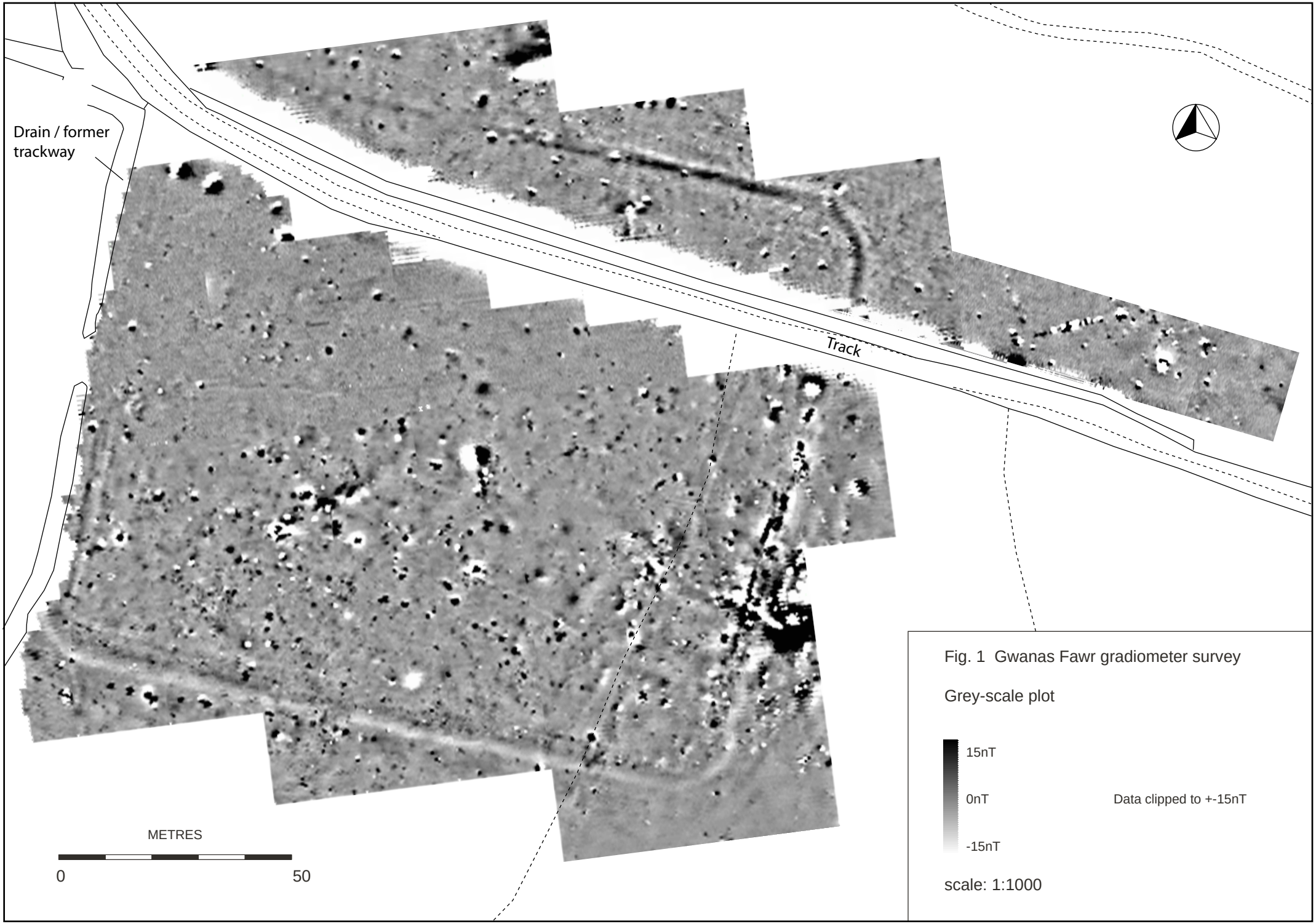

Fig. 1 Gwanas Fawr gradiometer survey

Grey-scale plot

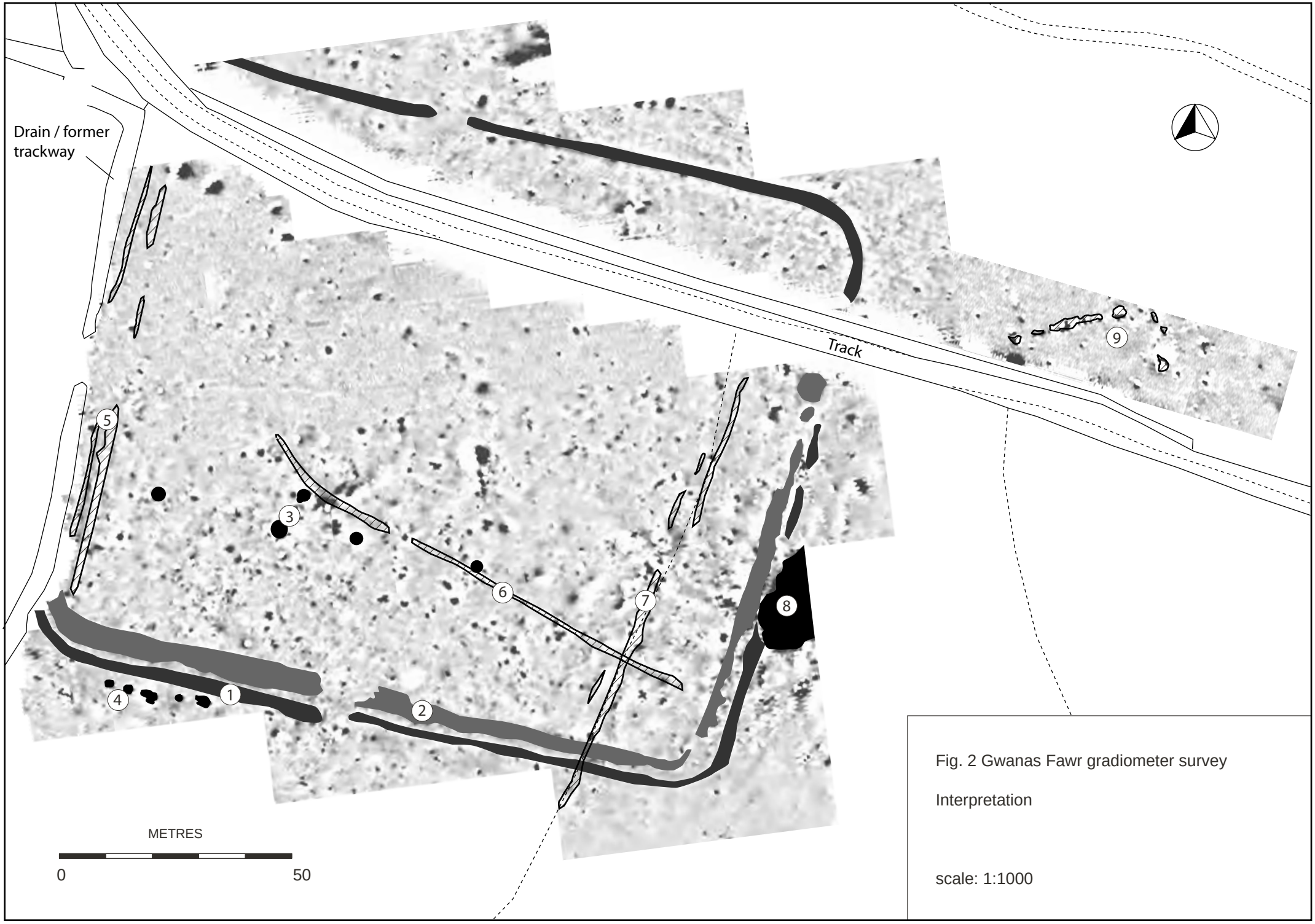

Fig. 2 Gwanas Fawr gradiometer survey

Interpretation

scale: 1:1000

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