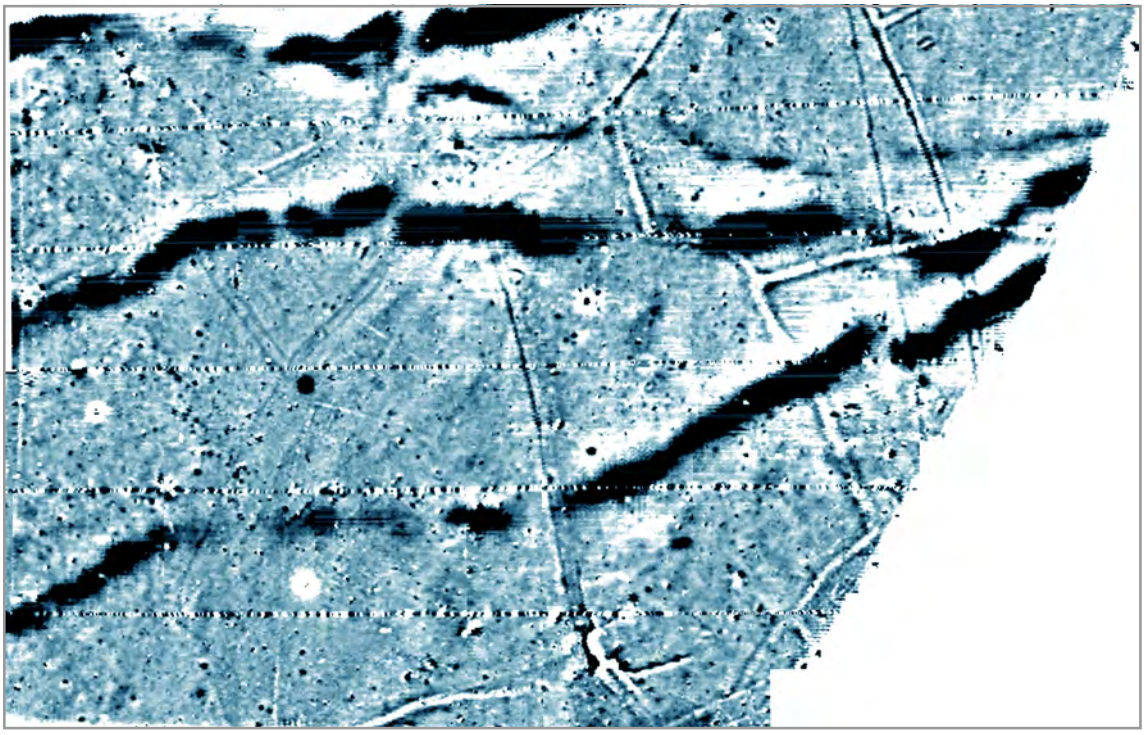
# Glynllifon College Development

## Archaeological Assessment

### Phase 2: Geophysical Survey



Archaeological Assessment
Phase 2: Geophysical Survey

GAT Project No. 2092
Report No. 867
May 2010

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust
Craig Beuno, Ffordd y Garth, Bangor, Gwynedd, LL57 2RT

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## Phase 2: Geophysical Survey

# Glynllifon College, Llandwrog

Report No. 867

Prepared for
Capita Symonds
by
David Hopewell
May 2010

Ymddiriedolaeth Archaeolegol Gwynedd
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**GLYNLLIFON LEARNING VILLAGE (2092)**

**ARCHAEOLOGICAL ASSESSMENT: GEOPHYSICAL SURVEY**

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**ARCHAEOLOGICAL ASSESSMENT: GEOPHYSICAL SURVEY**

## 1. PROJECT BACKGROUND

Gwynedd Archaeological Trust has been asked by Capita Symonds to carry out an archaeological assessment in advance of a proposed development at Glynllifon College, Llandwrog, Caernarfon (SH45335527).

The scheme lies within the grounds of Glynllifon, Llanwnda, Gwynedd. Glynllifon was an important estate, owned initially by the Glyn family, who later married into the Wyn family of Bodfean. A part of the estate, including the house, was eventually sold by the Wyn family in 1948, after which it was bought by the County Council for use as an agricultural college. The house is now hotel, but the college is still housed within the grounds, and the former parkland is run as a public park by the Local Authority. The buildings and parkland all form part of a heritage rich landscape, the importance of which is recognised by the high density of listed buildings on the site, and the inclusion of the site within the register of parks and gardens of special historic interest in Wales (Grade I).

## 2. METHODOLOGY

This survey was carried out in response to a design brief produced by Gwynedd Archaeological Planning Service for the second phase of a staged programme of archaeological works comprising a high resolution magnetometer survey, potentially followed by a limited programme of intrusive evaluation or trial trenching. This report presents the results of the magnetometer survey and makes outline suggestions for further evaluation. This report should be viewed in conjunction with the phase one assessment report (Cook, Kenny and Jones 2009 GAT report 834) which records the results of the first phase of assessment comprising Desktop study, field walking and test pits watching brief.

### *2.1 Instrumentation*

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 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 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.

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 area was surveyed at a resolution of 0.5m x 0.25m giving 3200 readings per grid.

### *2.3 Data presentation*

The data was transferred from the data-logger to a computer where it was compiled and processed using ArchaeoSurveyor 2 software. The data is presented as a grey-scale plot (Figs. 1 and 2) 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 (Fig. 3) 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 anomalies 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 were 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. Grey-scale plots are always somewhat pixelated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots are therefore smoothed producing more but smaller pixels. 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

### *3.1 General observations*

An area of 5.3 hectares of improved pasture was surveyed at high resolution (0.5m x 0.25m) by David Hopewell and Matt Jones of Gwynedd Archaeological Trust. The survey produced clear results and detected a wide range of anomalies. There was however, interference from buried geology. The effects of the geology were processed out using a high-pass filter which lessens the effect of gradual large-scale variations in the background magnetic responses but tends to compress the rest of the data. Fig. 1 shows the data after minimal processing and Fig.2 shows the survey after application of a high-pass filter. The

interpretation of the survey results is shown on Fig. 3 and these are overlaid on the 1751 Map of Glynllifon Demesne (Gwynedd Record Office Caernarfon XD2A/1580) on Fig. 4.

The areas of geological interference are indicated on the interpretation plan. More generalised background noise levels were significant with small-scale variations apparently caused by stones in the soil. This makes it difficult to distinguish between natural variations and smaller features such as pits. The survey detected a scatter of small magnetic dipoles, typically caused by stray pieces of iron in the soil. These are usually a result of objects spread over the field during manuring or stray items, such as nuts bolts nails etc. lost during agricultural activity. These are visible as small half-black and half-white dots on the grey-scale plot and are not transcribed on the interpretation plan. A series of five, parallel, single-strand electric fences cross the field and are indicated on Fig.3.

Other anomalies are numbered on the interpretation plan and are described below.

***3.2 Field boundaries***

The most obvious anomalies are a series of linear features consisting of two parallel positive anomalies, which are in some cases separated by a negative anomaly. These are about four metres wide and are best interpreted as field boundaries with the positive anomalies indicating ditches and the negative anomaly a central bank. The features are clearest on the eastern side of the survey (1). The central bank is particularly well defined here and the boundaries define large irregular fields. There appear to be at least two phases of boundaries. Boundary system 1 is crossed by a slightly narrower boundary system (2) of similar character. They appear to be of different phases but it is not clear which is the earliest. The relationship between boundary system 1 and a further similar boundary (3) is also unclear. Boundary 1 runs up to and joins a further boundary (4), suggesting that they are contemporary. Boundary 4 then appears to join a series of faint boundaries that occupy the western part of the survey. Boundary 5 runs from north to south and is fairly well-defined with an intermittently detected bank. The southern part of this feature is less clear and appears to turn to the south-east and may coincide with other features. A series of boundaries (6) apparently continuing from (4) form a rectangular enclosure and then continue to the west and south-west (7). These are visible as faint double ditches with little indication of a central bank. A poorly-defined possible boundary (8) at the south of the survey appears to have been modified to run on a slightly different alignment and may cross and continue (9) beyond boundary 5. The southern part of boundary 5 is unclear and is best viewed on the plot without the high-pass filter (Fig. 1) but there appear to pits alongside the boundary along with an area of increased noise (10). A single linear ditch (11) runs to the east of the north-south part of ditch 2.

Several of the boundaries can be related to features on the 1751 Glynllifon estate map (Fig. 4 shows the geophysical interpretation along with the estate map with added annotations in red). Boundaries 4 and 6 including the rectangular enclosure are clearly shown on the map (A and B). The enclosure is shown to be a small copse (C) and faint parallel geophysical anomalies within this could relate to tree planting. A small triangle of boundaries (D) extended as far as the south of the survey area and presumably once continued north along the line of boundary 5. Boundaries 5, 7 and 1 were probably part of the same field system as 4 and 6 but appear to have been removed by the time the map was drawn in 1851. The area of noise and possible pits (10) at the south of boundary 5 may relate to modifications to the boundaries and could be interpreted as pits or tree boles.

The eastern side of the survey is less easy to interpret. The 1751 map is in general quite accurate and can be related to early Ordnance Survey maps and modern features. The boundary and track (E), running roughly north-south that cuts across the eastern side of the survey area does not, however, accurately correspond to any of the geophysical anomalies. It is straight and therefore does not appear to correspond to anomaly 1. It therefore seems likely that there is a slight inaccuracy in the map and the boundary corresponds to anomaly 2 or perhaps 11, although this does not appear to be a substantial boundary. The map shows a further boundary (F) running to the east, this could correspond to a truncation of the eastern branch of anomaly 1 but is more likely to correspond to the southernmost of the eastern branches of 11.

Three weaker linear anomalies 12, 13 and 14, could be realignments of, or other features related to, boundary 7.

### *3.3 Other archaeological features*

An area of noise and a series of small positive anomalies in a rough 25m x 16m oval (15) can be seen just to the north of the junction between boundaries 4 and 5. This group of features appears to respect boundary 5 so could be contemporary. This suggests the best interpretation may be a parkland feature such as a copse with the small positive anomalies being tree boles. The small anomalies could alternatively be interpreted as pits or post-holes and could therefore relate to almost any period. A more definite interpretation would require trial excavation.

The survey area contains many small roughly circular anomalies. Some, as noted above, are clearly stray pieces of ferrous material, others could be pits or natural features such as large magnetic stones. Magnetic scanning, while searching for a suitable zero reference point for the survey, showed that there was a fairly high level of apparently natural variation in the soil that was probably a result of the frequent stones that could be seen both on the surface and in areas of recent ground disturbance. Several anomalies have however been transcribed on the grey-scale plan that could be archaeological features. These are best viewed on Fig. 1 as the data on the grey-scale plot is less compressed.
A scatter of small positive anomalies that could be pits can be seen along the southern and western sides of the survey (16 and 17). These seem to merge into more general areas of noise (18 and 19) along the western edge of the field which appear to be the result of either natural changes in the soil or the spreading of additional soil on the land during terracing for buildings on the southern side of the road. This suggests that the small positive anomalies (16 and 17) are most likely to be the result of natural features such as stones.

Similar anomalies can be seen to the east of boundary 5 although their grouping seems to be more regular, perhaps suggesting pits. A series of small oval anomalies (22, 23 24 and 25) could have either a natural or archaeological origin.

### *3.4 Recent features*

Three strong ferrous anomalies (26, 27 and 28) are steel monitoring stations. A water pipe (29) along the western side of the survey area produced a distinctive narrow negative anomaly. Similar anomalies 30 and 31 are also likely to be modern service trenches, or perhaps land drains.

## 4. SUMMARY AND CONCLUSIONS

The survey detected a series of field boundaries, each consisting of a bank with ditches to either side. The boundaries enclosed a system of irregular fields and an intersection of boundaries towards the east of the survey suggests that two phases of enclosure were present. Some of the boundaries were shown on the 1751 Glynllifon estate map, but many had been removed by this date. It seems likely that the estate map shows the fields during a period of land improvement with smaller irregular fields being replaced by larger regular fields or open parkland. By 1824 all of the boundaries had been removed and the area was open parkland containing small stands of trees (Map of park and demesne lands at Glynllifon: Gwynedd Record Office XD2A/857).

Other less definite features detected by the survey consisted of faint traces of other boundaries, a group of possible pits (perhaps indicating a parkland feature), features around a former boundary close to the current farm buildings and a scatter of small anomalies that could be interpreted as pits or natural features. The interpretation of these less definite features must be seen as provisional. Further investigation by trial excavation would be recommended in order to allow better interpretation. The anomalies identified in the geophysical survey are summarised in the table below.

| SUMMARY OF GEOPHYSICAL ANOMALIES | | |
|---|---|---|
| **Anomaly number** | **Provisional interpretation** | **Provisional period/date** |
| 1 | Field boundary, bank and two ditches | Early 18th century |
| 2 | Field boundary, bank and two ditches | Early 18th century |
| 3 | Field boundary, bank and two ditches | Early 18th century |
| 4 | Field boundary, bank and two ditches | Early 18th century |
| 5 | Field boundary, bank and two ditches | Early 18th century |
| 6 | Field boundary, two ditches encloses former copse | Early 18th century |
| 7 | Field boundary, ? single ditch | Early 18th century |
| 8 | Field boundary, ? single ditch and bank | Early 18th century |
| 9 | Field boundary, ? single ditch and bank | Early 18th century |
| 10 | Noise and pits/tree boles associated with 5 | Early 18th century |
| 11 | Single ditch | Early 18th century |
| 12 | ? Single ditch | Unknown/ Early 18th century |
| 13 | ? Single ditch | Unknown/ Early 18th century |
| 14 | ? Single ditch | Unknown/ Early 18th century |
| 15 | Area of noise and oval arrangement of pits? parkland feature | Poss. 18th century could be earlier |
| 16 | Pits or natural features | Unknown |
| 17 | Pits or natural features | Unknown |
| 18 | Area of noise, probably natural variation or dumped soil | Unknown |
| 19 | Area of noise, probably natural variation or dumped soil | Unknown |
| 20 | Pits or natural features | Unknown |
| 21 | Pits or natural features | Unknown |
| 22 | Small oval feature, unknown origin | Unknown |
| 23 | Small oval feature, unknown origin | Unknown |
| 24 | Small oval feature, unknown origin | Unknown |
| 25 | Small oval features, unknown origin | Unknown |
| 26 | Modern steel monitoring station | Modern |
| 27 | Modern steel monitoring station | Modern |
| 28 | Modern steel monitoring station | Modern |
| 29 | Modern water pipe | Modern |
| 30 | ? Modern water pipe | Modern |
| 31 | ? Modern water pipe | Modern |

## 5. GENERAL RECOMMENDATIONS

The survey has identified the remains of a field system that appears to date from the early 18th century along with a few less well-defined features that probably also relate to parkland and post-medieval/modern agriculture. Further evaluation of any anomalies that will be affected by the development is recommended. This should consist of trial trenching and sample excavation. The gradiometer survey produced clear results and detected a wide range of features. It is therefore probable, that the survey detected most larger-scale archaeology. Smaller features are difficult to distinguish from background variations produced by the subsoil. The most obvious smaller anomalies have been transcribed even though they are probably natural features. Further evaluation of these features by trial excavation should allow better overall interpretation of the results.

## 6. REFERENCES

Cooke R. Kenny J. and Jones M., 2009. *Glynllifon College Development: Archaeological Assessment* Unpublished GAT report No 834

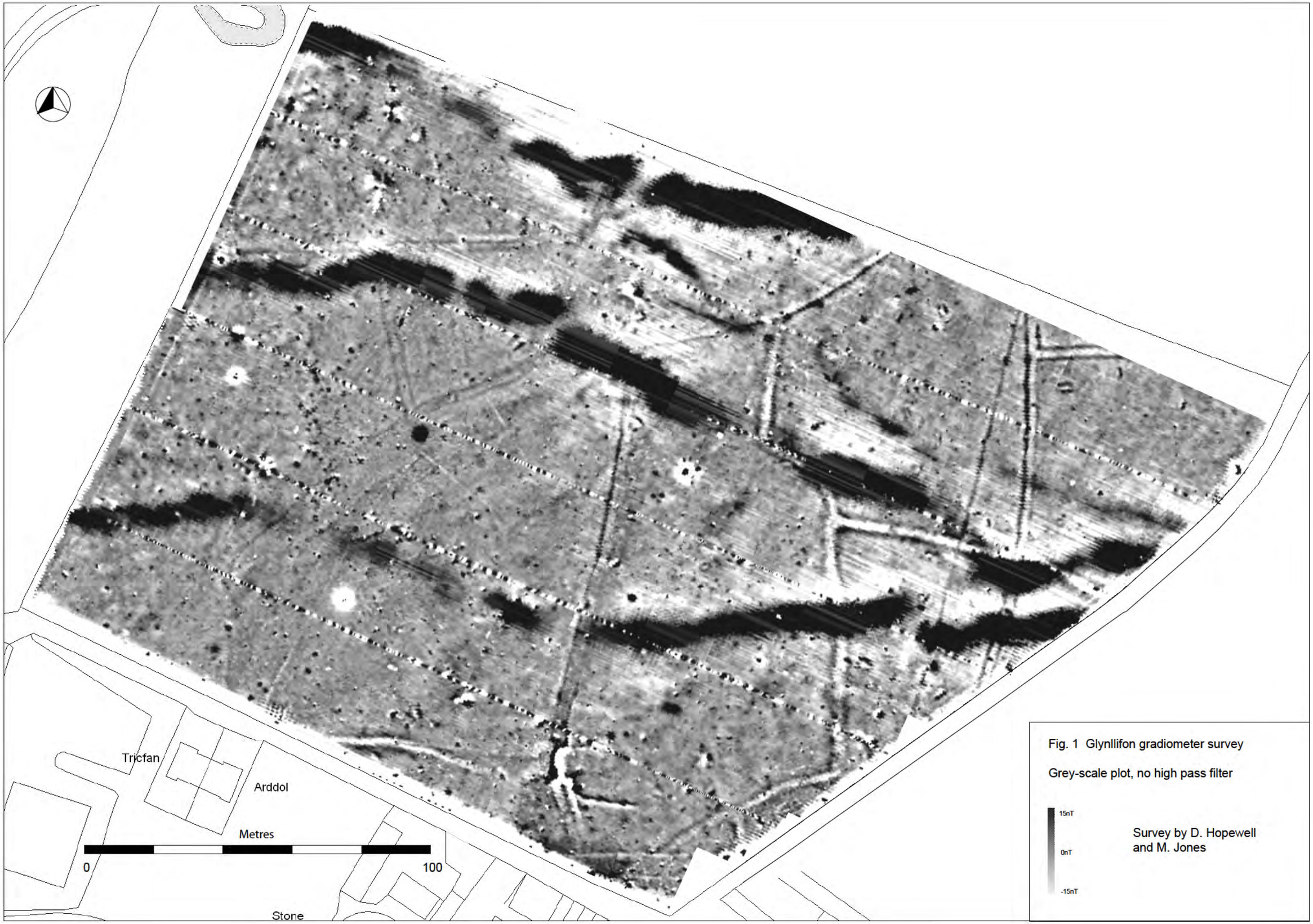



Fig. 1 Glynllifon gradiometer survey

Grey-scale plot, no high pass filter

Survey by D. Hopewell and M. Jones

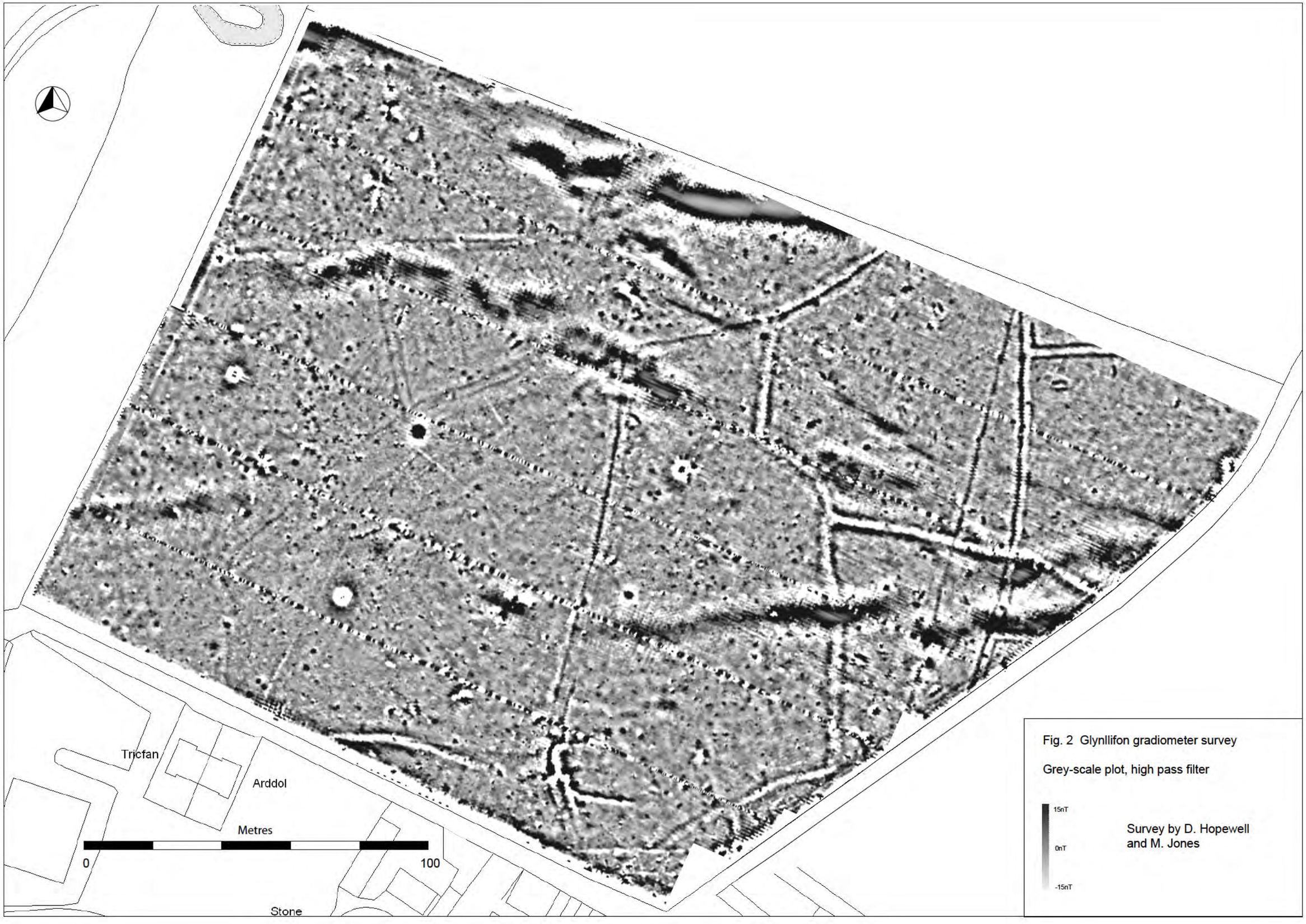
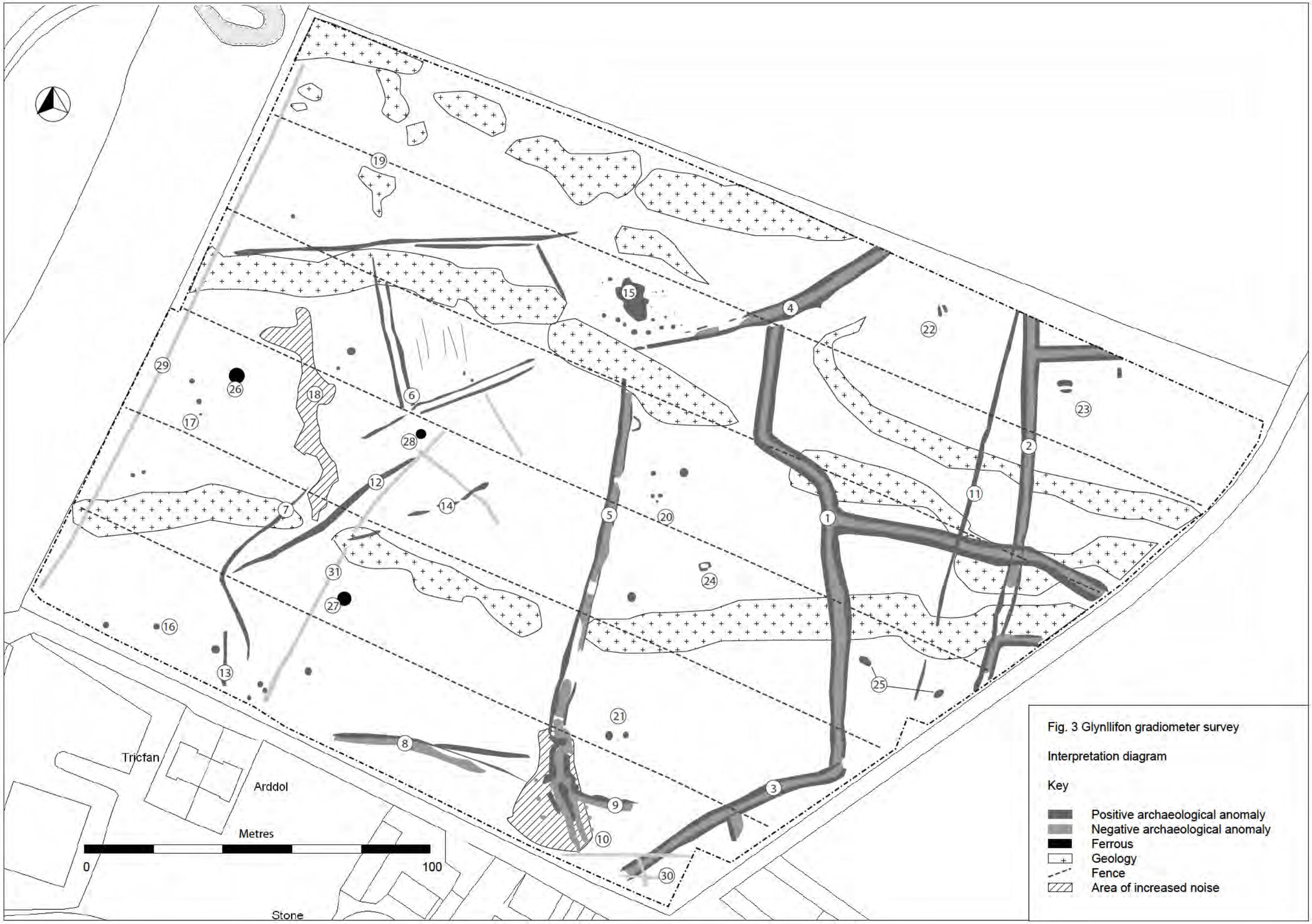
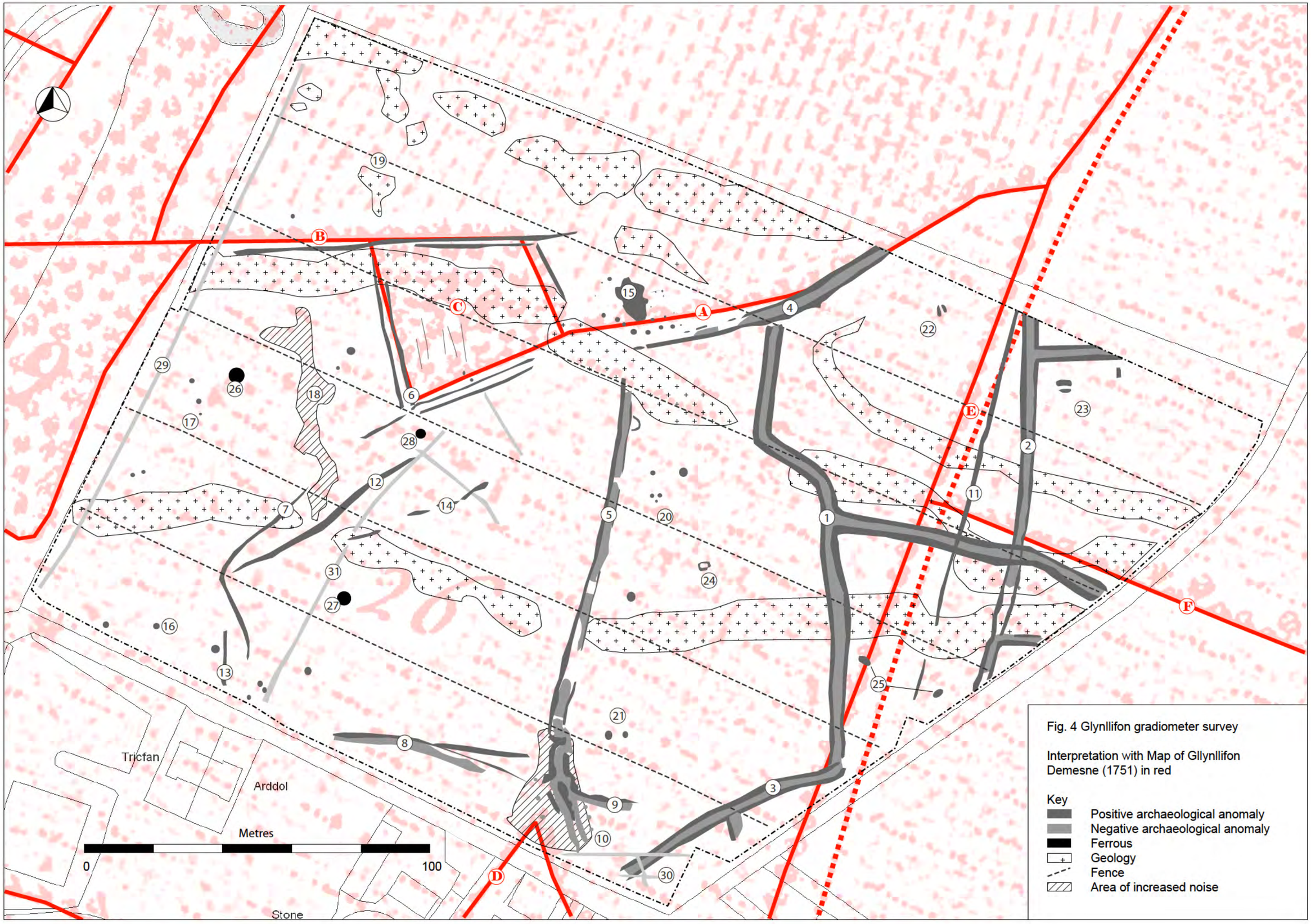



Fig. 2 Glynllifon gradiometer survey

Grey-scale plot, high pass filter


Tricfan
Arddol
Metres
0
100
Stone
Fig. 3 Glynllifon gradiometer survey
Interpretation diagram
Key
Positive archaeological anomaly
Negative archaeological anomaly
Ferrous
Geology
Fence
Area of increased noise


B
C
A
E
F
D
Tricfan
Arddol
Stone
Metres
0
100
Fig. 4 Glynllifon gradiometer survey
Interpretation with Map of Gllynllifon Demesne (1751) in red
Key
Positive archaeological anomaly
Negative archaeological anomaly
Ferrous
Geology
Fence
Area of increased noise

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