Geophysical Survey at St Lythans, Vale of Glamorgan [ST 100722]

Dr T.P. Young

Abstract

A magnetic gradiometer survey was undertaken over an area of approximately 1.3ha, centred on the upstanding remains of the St Lythans chambered tomb (NPRN 227269).

The survey is interpreted as showing multiple, often rather subtle, sets of lineations representing both joints in the underlying bedrock and relatively recent agricultural activity. Historical use of the site is shown by a former field boundary and a substantial sub-divided enclosure, probably marked by stone banks as well as ditches, associated with a roadside building. Slight anomalies to the southwest of the building suggest an earlier boundary to the road lay south of its present position – suggesting in turn that the roadside building may have been a squatter’s encroachment on the original road line. The building is apparently shown intact on the 1st edition OS survey (surveyed 1877-9), but was unroofed by the 1:2500 1st revision (published 1900) and omitted entirely from the second revision (published 1919). The associated field boundary running to the crest of the hill appears on an aerial photograph of December 1945, but is absent from OS mapping published in 1960.

The area east of the field boundary (including part of the enclosure) shows a lineation in the data parallel to the boundary – which presumably represents ploughing, at least part of which must be post-1945. Lineations also occur on a similar alignment passing to the west of the monument and may have a similar origin. Similar lineations occur in the SE of the study area on a different alignment; they may also represent ploughing, but are more likely the product of wheeled vehicles passing a farm gate in the southern section of the removed boundary.

The ditch around the circular copse appears to be represented by a very small magnetic anomaly, indicating it is of no great size – strengthening the suggestion this is an 18th-19th century landscape feature rather than being more ancient (it is also relevant to note the symbol for conifer trees is employed within it on the 1st edition OS – only changing to deciduous trees later, again suggesting a deliberate plantation).

The barrow itself shows as a rather noisy area, reflecting metallic debris, several items of which are nails marking trench corners from the prior excavations. The only anomalies of potential archaeological significance within it are two arcuate areas of elevated magnetic gradient towards the west of the long cairn which may indicate structural zones (i.e. perhaps zones of dumping of weathered material or soil). There are no clear signs of any associated quarries or ditches.

The strongest anomalies are those associated with probable geological features. These include strong NNW-SSE and NNE-SSW positive linear anomalies that probably represent bedrock joints, and rather more diffuse ENE-WSW directed anomalies that maybe the crop of individual beds. These anomalies are strongest towards their N ends and die out southwards – suggesting they represent joints on a competent rock bed progressively overlain by overburden in an upslope direction.

The western side of the study area is characterised by WNW-ESE directed lineations, most commonly rather broad, low amplitude positive anomalies. The origin of these is also most likely to be associated with the geology, although there is a possibility some might be associated with land drainage.
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Methods

Surveys were laid-out using a Trimble 4700/5700 survey grade RTK GPS system. The base-station was located over an arbitrary point, and data logged during the laying out of the grids. The station coordinates were established subsequently by post-processing using RINEX corrections from the closest five Ordnance Survey active stations.

Grids were laid out from pre-planned “round-number” 20m intervals of National Grid, uploaded to the GPS system, with the stakeout undertaken using a Trimble 5700 RTK rover unit with the 4700 base-station repositioned on the same point. The 20m grids were marked by canes. Since the GPs data were post-processed the grid lines ay at true values offset by less than 1m from the planned locations. The post-processed true coordinates are given on the illustrations in this report. Survey accuracy is believed to be better than 50mm.

Magnetic gradiometry was undertaken with a Bartington Grad 601 Dual. Data were collected at 0.125m intervals on traverses 0.5m apart. Data were downloaded from the instrument, assembled and cleaned using DW Consulting’s ‘Archeosurveyor 2’ software. The grids were assembled, the zero adjusted where necessary, and a destriping function employed for data in which there was an imbalance between the two gradiometers.

The data were exported from Archeosurveyor and interpolated using Golden Software’s Surfer package to reduce pixilation. The modelled grid was produced using kriging to a node spacing of 0.125m x 0.125m. Site plans have prepared in CorelDraw, supplementing the survey data with base mapping reproduced from Ordnance Survey under license AL 52163A0001 (© Crown Copyright).

The project was undertaken for Archaeology Wales, commissioned by Dr Amelia Pannett, and forms part of the Tinkinswood Community Archaeology Project. The survey was undertaken during 6th/7th March 2012.

The site lies on a N-facing gentle slope, with the land as pasture at the time of survey.

The geological setting of the site is complex. The site mainly lies on the outcrop of the marginal facies of the Triassic Mercia Mudstone Group. This marginal facies forms a fringing deposit to upstanding Carboniferous limestones, of which the High Tor Limestone crops out only some 50m southeast of the study area. In the northeast of the study area, the bedrock is formed by the Blue Anchor Formation, which also crops out on the lower ground SW of the site

Results

The survey results are shown in Figures 1 (raw data) and 2 (interpolated data).

Data quality was moderate for the first day (data collected from the central part of the site) because the chosen zero point straddled one of the subtle features on the upper slope. The imperfection in the data shows as a background noise, particularly at the start and end of lines. Data quality from the second day was good.

The raw data, output as a bitmap image from ‘Archeosurveyor 2’, are represented in Figure 2. The reprocessed (surface-fitted) data are presented in Figure 3a, with the interpretation illustrated in Figure 3b.

Interpretation

The features divide into six main groups:

1. features associated with the roadside enclosure (land parcel 25 of the 1st edition OS mapping).
2. a NW-SE field boundary (separating field 24, of the 1st edition OS mapping, to the west from 74 to the east) and associated features.
3. the boundary of the circular wood.
4. at least two sets of features, concentrated in the area of the barrow, and interpreted as geological joints.
5. very low- amplitude linear features in the west of the study area, possibly, but not certainly of geological origin.
6. marked, but irregular, features on the site of the barrow itself.

These groups are discussed in detail below:

1. The roadside margin area:

The results show a sub-rectangular area of strongly elevated magnetic gradient approximately 16m x 26m (pink tone on Figure 3b) surrounded by and bisected by intense negative anomalies (bold green lines on Figure 3b). Although the surface expression of ditches survives, these negative anomalies are suggestive of stone or stone-faced fieldbanks. The enclosed area shows some fine featuring both parallel and perpendicular to the road. It is unclear to what extent these correspond to original features and to what extent they are the product of post-abandonment improvement by ploughing (narrow black lines. On Figure 3b)

These enclosures (with no illustrated sub-divisions) are included as land parcel 25 of the 19th and early 20th century OS mapping. Immediately outside the surveyed area to the north lay a small roadside building (of which one wall is still standing). The
enclosure presumably represents a rear yard, or more likely garden to this building. The enhanced magnetic properties may indicate disposal of domestic coal ash into the garden soils, but a light 'industrial' activity, such as blacksmithing, cannot be excluded.

To the west of the enclosure several linear magnetic anomalies (orange lines on Figure 3b) follow the line of a prominent break of slope (probably a positive lynchet). These anomalies suggest that the lynchet corresponds to a former field boundary. It is significant that this line corresponds to that of the extant field boundary NE of the former cottage. This suggests that the original road margins were straight, and that the site of the cottage lies within the original road-line. Such a situation is commonly seen where a squatter’s cottage was built on the roadside. In this instance the road margin to the SW has been readjusted to take the land up to the line of the encroachment.

2. NW-SE field boundary: this positive magnetic anomaly (orange line on Figure 3b) is indicative of a small ditch (probably 1m wide or possibly less) separating field 24, of the 1st edition OS mapping, to the west from 74 to the east. The boundary runs upslope from the cottage garden to the surviving field corner on the crest of the hill.

The anomaly is somewhat intermittent to the SE of the barrow, but reappears farther S, before apparently terminating just inside the edge of the survey area at a large dipolar magnetic anomaly. This significant piece of ferrous material may possibly be the remains of a gatepost or similar, for it corresponds closely to the location mapped by the OS for the point where a footpath crossed the boundary. The area in which the anomaly is intermittent corresponds to some marked, but narrow ENE-WSW anomalies (narrow green lines on Figure 3b), which might be geological, but also might be the result of plough destruction of the field boundary.

This area is also marked by a zone of rather speckled texture on greyscale image (pale green tone on Figure 3b), and immediately to the E large boulders or the bedrock surface. These features are probably all associated with the gateway through the field-boundary. To the SW of this area the data show a strong NE-SW lineation (narrow black lines on Figure 3b). This might be due to ploughing, but some at least may be the result of ground disturbance by wheeled traffic passing through the gateway.

The orientation of the field boundary is parallel to some minor, low amplitude lineations both in the area of the enclosure and to its NE and in an area broadly west of the monument (narrow black lines on Figure 3b). The lineations to the east are almost certainly due to ploughing that has occurred since the abandonment of the enclosure. The lineations to the west are less certainly ploughing, but are probably so,

3. the boundary of the circular wood: this boundary is marked by a slight positive magnetic anomaly, probably corresponding to the small visible ditch (within which is a low stone-faced bank). The anomaly (orange line in Figure 3b) is both narrow and of low amplitude, suggesting a small ditch of a maximum of 1m wide.

The subtlety of the anomaly suggests this is a minor feature – and a boundary to a small plantation seems likely, rather than any more ancient earthwork.

The feature bears close comparison with the circular plantations on the skyline around the 18th-19th century mansion at Hensol.

4. at least two sets of anomalies, interpreted as geological joints: These anomalies (narrow orange lines on Figure 3b) are present most clearly in a ENE-WSW belt passing just to the south of the barrow. The anomalies are characterised by being positive and linear, with widths of up to about 2m. The anomalies are strongest towards their northern terminations and diminish southwards – possibly as a result of a decreasing degree of alteration associated with the joints, but more likely because of burial by overburden in an upslope direction above a bedrock ‘ledge’. The generally very magnetically quiet background in this upslope area also supports the idea that overburden (either in the solid geology or the superficial) is progressively concealing the beds whose jointing carries the enhanced magnetic susceptibility.

The anomalies interpreted as joints are dominantly NNW- SSW except in the western part of the areas where they become dominantly NNE-SSW.

In the same area there is a more subtle series of magnetic anomalies of low amplitude and a wavelength of several metres, oriented ENE-WSW (pale purple lines on Figure 3b). These are probably also of geological origin and their approximately contour parallel orientation may suggest that they are the expression of bedding.

5. low- amplitude linear anomalies, west of the area: (blue lines on Figure 3b) these are possibly, but not certainly of geological origin. Some elements within this set are well- marked in the area of the probably lynchet – where bedrock features might be expected to be deeply buried. An alternative interpretation might be that these features are agricultural in origin.

6. features on the site of the barrow: The area of the barrow shows a rather complex sequence of anomalies (Figure 5). The stones at the east end are surrounded by significant magnetic noise (probably as the result of being the centre of visitor activity). Where visible, the excavation trenches show as slightly lowered magnetic gradient – but only the trenches towards the west of the barrow are even moderately clearly imaged.

To the west of the stones, the northern half of the barrow appears to be characterised by mainly a low areal anomaly (particularly marginally), probably representing the spread of stone associated with the cairn. This is cut by an arcuate area of elevated magnetic gradient (pink area on Figure 3b), passing obliquely across the mound. This might indicate either a cut into the mound material, or possibly a differential structural component (more weathered or more soil-rich material?).

The western end of the cairn is marked by a concentric arrangement of anomalies of uncertain origin (grey tone on Figure 3b); these might be associated with the cairn or might be a product of recent investigations and/or backfilling. Registration of the trench plan and geophysical survey in this area is confirmed by the identification of the magnetic anomalies associated with the nails at several trench corners..
Summary

The survey demonstrates that the cairn was constructed close to the northern margin of the outcrop of a strongly-jointed bed within the Triassic bedrock. The development of marked joints, together with the progressive disappearance of the jointing below the upslope overburden, would be compatible with the bed being of an unusual, distinctive, perhaps relatively competent lithology. These might be features compatible with the origin of the megalithic stones of the monument themselves – and origin close to the point where they now stand might be possible. Part of the modern apparent topography of the cairn may be the influence of this significant bedrock ‘step’.

Although some featuring within the area of the main body of the cairn is visible, at present it is not possible to discriminate between these anomalies being due to original constructional features of the mound and an origin on more recent disturbance. The zones of varying magnetic gradient are arcuate across the width of the long cairn and are not symmetrical about its axis. Careful inspection of the excavation records may be able to lead to an identification of the origin of the geophysical zonation. It is possible that a zone of reduced magnetic gradient (slightly darker tone on Figure 5) might indicate the outer edge of the cairn on the North side, but there is no equivalent anomaly to the South.

There is no evidence for a discrete surrounding ditch or major quarry features.

Later activity on the site is represented by the development of a lynchet along the lower (northern) margin of the field. The alignment would suggest this was originally continuous both east and west of the roadside building.

The roadside building was probably, on the basis of its location a squatter’s cottage. The restriction of the road to the north probably resulted in the later re-orientation of the field boundary west of the building.

The enclosure to the rear of the cottage was subdivided into several discrete ‘gardens’, not indicated on OS mapping. The strong magnetic signature of this enclosure indicates a considerable deposition of magnetically susceptible material within the enclosure – although waste from domestic fires is probably most likely, it is just possible that the high susceptibility might indicate smithy waste.

Figure Captions

Figure 1: location of the study area and survey grids. Black lines indicate the location of the 2011 Archaeology Wales trenches. The pecked line marks the approximate limit of the cairn. The base mapping is reproduced from Ordnance Survey Mastermap under license AL 52163A0001 (© Crown Copyright).

Figure 2: bitmap image of the magnetic gradiometer data after destriping. The greyscale runs from -5nT (black) to +5nT (white). Grid squares are 20m across.

Figure 3a: greyscale image of the interpolated magnetic gradiometer data. The greyscale runs from -10nT (black) to +10nT (white).

Figure 3b: summary interpretation of the magnetic gradiometer survey. See text for full explanation.

Figure 4: simplified interpretation of the principal features. Black lines indicate approximate location of Archaeology Wales trenches. Solid black lines indicate former roadside field boundary and enclosure associated with cottage (grey). The former field boundary is shown in dark blue. Dashed line indicates extent of anomalies associated with the barrow. The pink tone indicates the interpreted extent of the highly-jointed bedrock ‘ledge’. The base mapping is reproduced from Ordnance Survey Mastermap under license AL 52163A0001 (© Crown Copyright).

Figure 5: greyscale image of the interpolated magnetic gradiometer data for the area of the barrow itself. White line show the 2011 Archaeology Wales excavation trenches. The greyscale runs from -10nT (black) to +10nT (white).
Figure 3