*Moel y Gaer Hillfort Survey*
*May 2008*

***EAS Client Report 2008/10***

***Survey Commissioned***
***by***
***Heather and Hillforts Landscape Partnership Scheme***

***Surveyed***
***by***
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***N^o^ 2869678***

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### *NGR*

### *Centred on SJ 14892 61753*

### *Location and Topography (Figure 1)*

*Moel y Gaer sits in a relatively unusual position for the hillforts of the Clwydian range, occupying a relatively low spur from Moel Famau. The site is intervisible an number of other hillforts including Moel Fenlli, however, whilst Moel Fenlli has views commanding the pass of Bwlch Pen Parras, Moel y Gaer has much better views along the Vale of Clwyd. The proximity of these two hillforts has lead to some speculation that Moel y Gaer acted as an outwork to Moel Fenlli, although this has yet to be tested (Brown 2004, 71).*

*The site has the lowest altitude of the Clwydian hillforts (Brown 2004, 71) and its position on the end of a spur gives it a character similar to a promontory fort. It is also unusual in that the north eastern gateway appears more highly developed than others on the Clwydian Range. Within the hillfort up to 15 potential hut platforms have been identified (Brooks and Laws 2007).*

### *Archaeological Background*

*Only limited excavation has taken place on the site, this is limited to an eight day campaign by Wynne-Ffoulkes in AD 1849 (Brown 2004, 72, Forde-Johnston 1965, 148-149). Concentrating on the defences and gateways Wynne Ffoulkes suggested that the north-eastern entrance was originally paved with small stones and that the inner rampart was probably of stone or was at least stone fronted. Areas of burnt stone were also located near to the north eastern gateway possibly suggesting either major burning of the defences or possibly a partly vitrified rampart (Brown 2004, 72). It has also been suggested, by Willoughby Gardner, that the second ditch and slope were set with a chevaux de fries, although this also is yet to be tested.*

*Forde-Johnston's suggested phasing of the site assumes that the inner bank and ditch, possibly with a counter scarp bank form the initial development of the site. This was then followed by the outer ditch and counterscarp bank on the side facing the relatively easy approach from the saddle (Forde-Johnston (1965, 159).*

*Nineteenth century finds from the site include bronze objects, particularly a looped palstave and an axe (Brown 2004, 72).*

*The outermost rampart, to the north, was inadvertently destroyed by agricultural operations in 1980's (Brown 2004, 71)*

*In 2006 Engineering Archaeological Services Ltd were commissioned to carry out a topographic survey of the site as part of the Heather and Hillforts Project. (Brooks and Laws 2007). The survey took place in early 2007. This survey revealed that Moel y Gaer, Llanbedr is roughly triangular in shape with a possible annex on its northern side. The main ramparts enclose an area of approximately 2.63 Ha with the annex covering a further 0.26 Ha. For the majority of the circumference the defences consist of a single rampart and ditch with a counterscarp bank of some size. Over the narrow neck of land which joins Moel y Gaer to Moel Famau, however, the counterscarp bank has been heightened and a third rampart added. It is curious that for both these outer defences the ditches providing the material for the ramparts are on the inner faces rather than the more usual and more defensive outer faces. At one point along the western, inner rampart a sheep scrape has revealed a short length of possible stone walling, possibly suggesting the rampart was stone faced, at least at one point in its life.*

*Fifteen possible hut platforms were recorded within the hillfort. These are most evident along the steeper western edge where they were cut into the hillside. It is likely that other huts and building were within the hillfort, but did not require the cutting of a platform. There are also a series of quarry hollows within the hillfort which are assumed to provide extra material for the ramparts.*

*Two inturned gateways are present, one facing west and the main gateway facing north east. The north eastern gateway is apparently more complex with an offset gap through the covering outer ramparts giving a dog legged approach even before the inturned corridor is reached. The* *western gateway is in a rather unusual position, overlooking a relatively steep approach to the hillfort and ending in a relatively steep face within the hillfort itself. Less well developed it still has an entrance corridor of approximately15 m in length. There is some indication that this structure may be secondary as the inner rampart on its southern side would appear to turn inwards slightly before it reaches the gateway.*

*The annex on the northern side of the hillfort has suffered in recent times with much of the rampart having been damaged in the 1980's (Brown 2004, 71). It forms a "D" shaped enclosure, approximately 140 m long and 30 m wide which to some degree appears to ignore the local topography, avoiding the obvious natural break of slope which runs through the area contained by the annex rampart. Attached to the eastern end of the annex rampart there is a boundary bank which can be traced out of the 2007 survey area and into the adjacent field (Plate 2). This would appear to define a field system which does not align with the present land divisions and is therefore of uncertain date.*

*There is evidence that at least parts of the hillfort have been subject to a major period of burning. This is most evident in major sheep scrapes on the inner rampart overlooking the entrance to the annex where fire reddened stone is exposed (Plate 3). Below this point within the ditch, and probably associated with an area of modern disturbance was a block of vitrified material (Plate 4). Other fragments of burnt stone were also noted from several places around the periphery of the hillfort.*

*Two rectilinear features were noted either side of the north western gateway. These were both approximately 3 m long and 0.6 m wide and are assumed to be backfilled trenches, possibly part of Wynne-Ffoulkes excavations. A few other sub-rectangular hollows or scars noted, each less than 1 m$^2$, are assumed to be the result of modern disturbance possibly illegal, metal detector, activity. It is noticeable that these holes are often associated with burnt stones and in one case a block of vitrified material.*

## *Aims of Survey*

1. *To record the line and extent of the bank leading from the eastern gateway into the previously unrecorded area.*
2. *To investigate the extent of the burnt area on the inner rampart.*
3. *To investigate the potential level of occupation within the hillfort.*
4. *To investigate the potential use of the annex.*
5. *To provide training in archaeological survey techniques.*

## *SUMMARY OF RESULTS*

*The line of the boundary bank was traced into the field adjacent to the hillfort and its line was extended by a break in slope.*

*The magnetic susceptibility survey defined an area of intense burning on the inner rampart together with scattered evidence for burning along the rampart and associated with one end of the eastern inturned entrance.*

*The Fluxgate Gradiometer and Resistivity surveys suggested a level of activity on the relatively flat ground inside the eastern entrance which also conformed to some of the topographic features previously recorded.*

*The Fluxgate gradiometer survey within the annex also suggested the potential for archaeological activity within this feature.*

## *Methods*

*The survey work was undertaken as part of the "Archaeology Uncovered" event run by Denbighshire County Council's Countryside Service for the Heather and Hillforts Landscape Partnerships Scheme. The work took place between 16th May and 22nd May 2008 with members of the public being involved in all aspects of the survey work. Indeed, all of the field work outlined below was carried out by the members of the public, under instruction, with the exception of Fluxgate Gradiometer survey which was carried out by K. Laws with help from the members of the public. The processing of the data and analysis was carried out by I.P. Brooks.*

*Logistical support, including transport, was supplied by Denbighshire County Council.*

### *Topographic Survey*

*The topographic surveys were undertaken using a Geodolite 506 Total Station (Plate 5). Initial stations were defined by using a Garmin Etrex Summit hand held GPS system, with subsequent stations being surveyed using the Total Station. Features and breaks of slope were defined at a resolution of less than five metres between readings, whilst the general ground form was recorded by a series of ground levels taken on an approximate 15 m grid. The surveys were processed using NRG Engineering Surveying System v. 8.09. This not only allowed for the compiling of the survey drawing, but also calculated the contours and provided the wire frame ground model of the site. The survey was adjusted so that it conformed to the grid of the previous survey and that the two surveys could be combined.*

### *Magnetic Susceptibility Survey*

*The Magnetic Susceptibility Survey was undertaken using a Bartington MS2 Magnetic Susceptibility meter with a MS2F sensor (Plate 6). This has a 15mm diameter sensor giving good contact with the soil surface. Readings were taken along the inner rampart for a distance of approximately 105 m to the west of the eastern gateway. A network of readings was taken so that both the top of the rampart and the slopes were covered (Figure 5). The position of each of the magnetic susceptibility readings were also surveyed using the Geodolite 506 Total station, thereby allowing for a detailed ground model to be generated together with a survey which formed the base of the magnetic susceptibility survey.*

### *Fluxgate Gradiometer Survey*

*The Fluxgate Gradiometer survey was undertaken using parts of nine 20 x 20m grid squares laid out as in Figure 7. Readings were taken at 0.5 m intervals along transects 1 m apart. These transects were walked in a parallel pattern.*

*The survey was carried out using a Geoscan FM 36 Fluxgate Gradiometer with a hand trigger Plate 7). Grey Scale and X - Y Plots were produced using Geoscan Research "Geoplot" v.3.00e.*

### *Resistivity Survey*

*The Resistivity surveys used six of the same grid squares as the Fluxgate Gradiometer survey (Figure 13) using a Geoscan RM15 resistance meter (Plate 8). A single parallel probe setting was used with a separation between the probes of 0.5 m. Readings were taken at 0.5m intervals along transects 1 m apart. Grey scale plots were produced using Geoscan Research "Geoplot" v. 3.00e and X - Y plots using Golden Software "Surfer" v. 5.01.*

*The technique relies on good contact with the topsoil, the survey area, however was covered in bilberry growing to a height of approximately 300mm and thus contact was difficult in some places.*

## *Results:*

### *Area*

*The topographic survey covered an area of approximately 9635 $m^2$ in the fields immediately to the north of the hillfort extending the line of the boundary bank recorded in the previous survey.*

*The Magnetic Susceptibility survey covered an area of approximately 850 $m^2$ along the inner rampart and the inturned section of the eastern gateway.*

*The Fluxgate Gradiometer survey covered an area of 3600m² and the Resistivity Survey an area of 2220 m².*

### *Display*

*The results of the topographic survey area shown as a hachure survey (Figure 2), contour survey (Figure 3) and as a ground model (Figure 4).*

*The Magnetic Susceptibility survey is shown as a filled contour plot (Figure 6)*

*The results of the Fluxgate Gradiometer survey and the Resistivity Survey are displayed as Grey Scale Image and as X-Y Trace Plots. (Figures 8-10 and 14-15) and are summarised in Figure 12, 17 and 18.*

### *Topographic Survey*

*The line of the boundary bank linking to the outer rampart of the Annex was extended into the neighboring field. It consisted of a low bank, approximately 2.90 m wide and 0.28m high running for approximately 26 m from the fence in a SW-NE direction before turning through a rough right angle and running for a further 11.75m before fading out. The line of the bank is then taken up by a slight break of slope running for at least a further 73 m to the NE.*

*The results are displayed as a hachure plot (Figure 2) and as a contour plot with contours at 0.5 m intervals (Figure 3). It has also been possible to combine the two surveys to create a ground model of the combined survey (Figure 4).*

*These features appear to define the eastern end of an enclosure which is attached to the annex of the hillfort and also defined one side of the approach to the eastern gate complex. It may therefore be contemporary with at least one phase of use of the hillfort.*

### *Magnetic Susceptibility Survey*

*The presence of burnt stone eroding from the inner rampart (Plate 3) and the presence of a block of vitrified material in the ditch (Plate 4) suggested that the inner rampart had been significantly burnt at least in places. The magnetic susceptibility of soils tends to be enhanced by human activity (Clark, 1996, 99), of particular interest the burning of soils can produce the reducing conditions to convert haematite to maghaemite (a crystal form with a much higher magnetic susceptibility)(Clark 1996, 100-101). The technique can therefore be adapted to investigate area of intense heating along the rampart of Moel y Gaer.*

*An area of approximately 850m² was investigated covering the eastern gateway and approximately a 105 m length of the inner rampart. This included an area where a series of sheep scrapes revealed the presence of reddened stone. In all 367 readings were taken both along and across the line of the rampart (Figure 5).*

*The majority of the readings recorded were very low with values of less than 5 (SI), however a number of consistent patches were recorded with higher values. These are shown on Figure 6.*

*There is a large area of enhanced readings (Anomaly A, Figure 6) associated with the area in which reddened stones were noted in the sheep scrapes. The readings form a consistent pattern with a range of higher values in the centre of the anomaly fading towards its edges. Maximum values of 1045 were recorded within the area shown in red. This anomaly is positioned opposite the entrance causeway between the middle ramparts and is at the point where the inner rampart appears to have been heightened as part of the eastern gate complex. It is therefore probable that a significant fire had been set on/within this part of the rampart. The reddening and the presence of vitrified material in the ditch would suggest that this burning event was not a minor, recent event, such as a bonfire or heather burning, but must have reached temperatures in excess of 1000° C (www.brigantesnation.com/VitrifiedForts/VitrifieedHow.htm). One possible interpretation is that this burning represents an early phase gate which was burnt prior to the remodeling of the gateway to create the inturned entrance now evident.*

*A second significant anomaly (Anomaly B, Figure 6) occurs on the northern side of the inturned entrance at a point where one might expect a gate to have been. It is possible that this area of enhanced reading might represent the location of* *part of that gate structure which would have been burnt in situ.*

*Other small patches of enhanced readings were also recorded, however they do not form a consistent pattern as would be expected if the whole of the rampart had been burnt. It is therefore likely that only parts of the rampart have been subjected to higher than usual temperature.*

### *Fluxgate Gradiometer Survey*

*This survey technique records slight changes in the earths' magnetic field, which may be the results of human activity. The interpretation of the Fluxgate Gradiometer Surveys is shown as Figure 11 and is summarised in Figures 12 and 18. Two grey scale plots are presented. The first illustration is at ± 1standard deviation of the values recorded (Figure 8) and the second is clipped to ± 5 nT (Figure 9). The illustration at ± 5nT allows for the more subtle magnetic anomalies to be determined whereas the illustration at ± 1 standard deviation highlights the areas of significant magnetic disturbance.*

*The most dominant feature within the grey scale plots is the response to the burn area of the rampart (Anomaly C). The readings in this area vary between -180 nT and +200 nT reflecting the high level of magnetic disturbance caused by the burning of the rampart at this point. The size of this anomaly is larger than that recorded in the magnetic susceptibility survey; however this may be a function of the different penetration capacities of each of the techniques.*

*All of the ramparts within the survey area would appear to have a magnetic signature, although this is not as strong as the area which has been burnt. The ends of the inturned entrance (Anomalies D and E) protrude into the survey area. These, like the magnetic response of the inner rampart (Anomalies F and G) are stronger than the magnetic responses to the ramparts defining the annex (Anomalies H and I) possibly suggesting a difference in construction or that the inner rampart has been subject to a post-depositional change, possibly the burning of the rampart. The inner rampart anomalies vary between -8 and +10nT were as the outer ramparts, associated with the annex, vary between -3 and + 4 nT. The structure of Anomalies F and G are also of note with a general trend of a negative value (Anomaly G) north of an area of generally high positive values (Anomaly F). This would tend to suggest that the magnetic signature is the result of burning in situ rather than the dumping of magnetically active materials on the rampart.*

*Between the inner and middle ramparts Anomalies J and K would appear to correspond to either side of the base of the ditch and Anomaly L to the base of the middle rampart. Anomaly M; however, does not appear to correspond to any topographic feature and may suggest a level of activity within the Annex. Anomaly N would appear to relate to the edge of the modern, agricultural, damage to the fort at this point.*

*Within the hillfort, there would appear to be a large area of general magnetic disturbance (Anomaly O) possibly relates to archaeological activity. Within this area there are a number of more specific anomalies which can be defined. Anomalies P and Q in particular appear to be discrete magnetic anomalies, possibly the result of human activity. Anomaly P is approximately 5 x 3m in size and has a magnetic signal which reaches 12nT above the background signal. There is also a slight negative halo to the south of the anomaly with values of approximately -2nT. This type of anomaly is often associated with burnt features such as hearths or ovens. Anomaly Q is more dispersed and has less structure than Anomaly O; however the magnetic signature varies between -2 and +5 nT suggesting a level of archaeological activity.*

*There are a limited number of possible linear anomalies within the data (Anomalies R, S, T, U and V) which are difficult to interpret. Anomaly T would appear to relate to the base of a feature recorded in the topographic survey in 2007 and may therefore be of human origins. The other linear anomalies are more difficult to interpret with no convincing plan and may therefore be related to geological features.*

### *Resistivity Survey*

*The resistivity surveys record changes in the local earth resistance. This is largely a reflection of the deposits ability to retain or shed water, thus typically walls and hardened areas such as paths have higher resistance values, whilst features that retain water such as damp ditches or pits have lower values.*

*The interpretation of the Resistivity Survey is shown on Figure 16 and is summarised in Figures 17 and 18.*

*The resistance survey is more difficult to interpret, but does appear to give consistent results. Two large high resistance anomalies (Anomalies RA and RB) are probably the result of the local geology with the underlying rock being near to the surface. The other very high resistance anomaly (Anomaly RC) is a discrete anomaly and may also be the result of local conditions. It might also be the result of a poor reading in difficult conditions.*

*Probably the easiest anomaly to interpret is Anomaly RD. This forms a band of higher readings running from the inturned entrances, up slope to the SW. This is a similar route to that taken by the modern footpath, however the resistance anomaly is approximately 2 m wide and follows a slightly different line. It also covers a much wider area just within the entrance way. It is possible that this anomaly may be the line of an Iron Age roadway leading from the eastern gateway into the interior.*

*The other higher resistance anomalies (Anomalies RE, RF, RG and RH) are more difficult to interpret and whilst they may be of archaeological origins they may also be geological.*

*A number of low resistance anomalies were also recorded; of these Anomaly RI is the largest and appears to occupy a relatively flat area within the hillfort interior. It is approximately 10 x 10 m in size and its position; just south of the end of the inturn to the eastern gateway suggest that this may be the position of a possible structure. If so it is possible that the floor of the structure is sufficiently impermeable to locally retain moisture in the soils above.*

*The other low resistance anomalies (RJ, RK, RL, RM,RN, RO, RP and RQ) are less obvious in there possible interpretations and whilst they may be of archaeological origins they may also be geological in origins.*

*Two feint, linear anomalies were defined with lower resistance (Anomalies RR and RS). RS approximately NW – SE below a natural rock exposure and may be geological in origins, however its line could also be that or an archaeological feature designed to capture any water running off the back slope of the rampart at this point. Anomaly RR is also in an interesting position, possibly acting as a cut off drain diverting water from running through the gateway. This interpretation; however is highly speculative and the results may be geological in origins.*

## *Conclusions*

*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 survey work undertaken for the Archaeology Uncovered event has proved to be very successful. The topographic survey has extended the 2007 survey to include an old field boundary not previously recorded. The detailed surveys however were particularly successful in bringing forth consistent data with some intriguing possibilities.*

*The Magnetic Susceptibility and Fluxgate Gradiometer surveys, in particular have provided complimentary data which suggest that the inner rampart of the hillfort may have been burnt at some time in its life. This burning, however, is relatively minor when compared to the area of the inner rampart above the entrance causeway between the middle ramparts. Here a major burning event took place, shown in the magnetic susceptibility data, the Fluxgate gradiometer survey and on the ground in the form of reddened deposits in the sheep scrapes. Taken with the observations made during the 2007 survey it is possible to suggest that there may have been an earlier phase of gateway at this point on the rampart which was burnt <u>in situ</u> before the* *ramparts were remodeled and the eastern, inturned gate constructed. It was also possible to suggest from the Magnetic Susceptibility data that the inturned eastern entrance may have had a gate at its eastern end which was also burnt in situ probably towards the end of the life of the hillfort.*

*The differences between these two survey techniques, particularly the extent of the burning associated with the possible early phase gateway, is a product of the differing sensitivities of the two techniques. The penetration of the Magnetic Susceptibility meter is relatively slight with only the material in which the sensor is in contact being measured, where as the Fluxgate Gradiometer is a passive machine measuring variability in the whole of the magnetic field.*

*Both the Fluxgate Gradiometer and Resistivity surveys suggest a level of activity within the hillfort, although the nature of this activity is difficult to determine. The Fluxgate gradiometer survey would also suggest the possibility for activity within the annex..*

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## *Acknowledgements*


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## *Techniques of Geophysical Survey:*

### *Magnetometry:*

*This relies on variations in soil magnetic susceptibility and magnetic remenance 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 pseudosection 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 FM36***

***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 at either 0.5m or 1m intervals along traverses 1m apart. Resistance meter readings are logged at 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:*

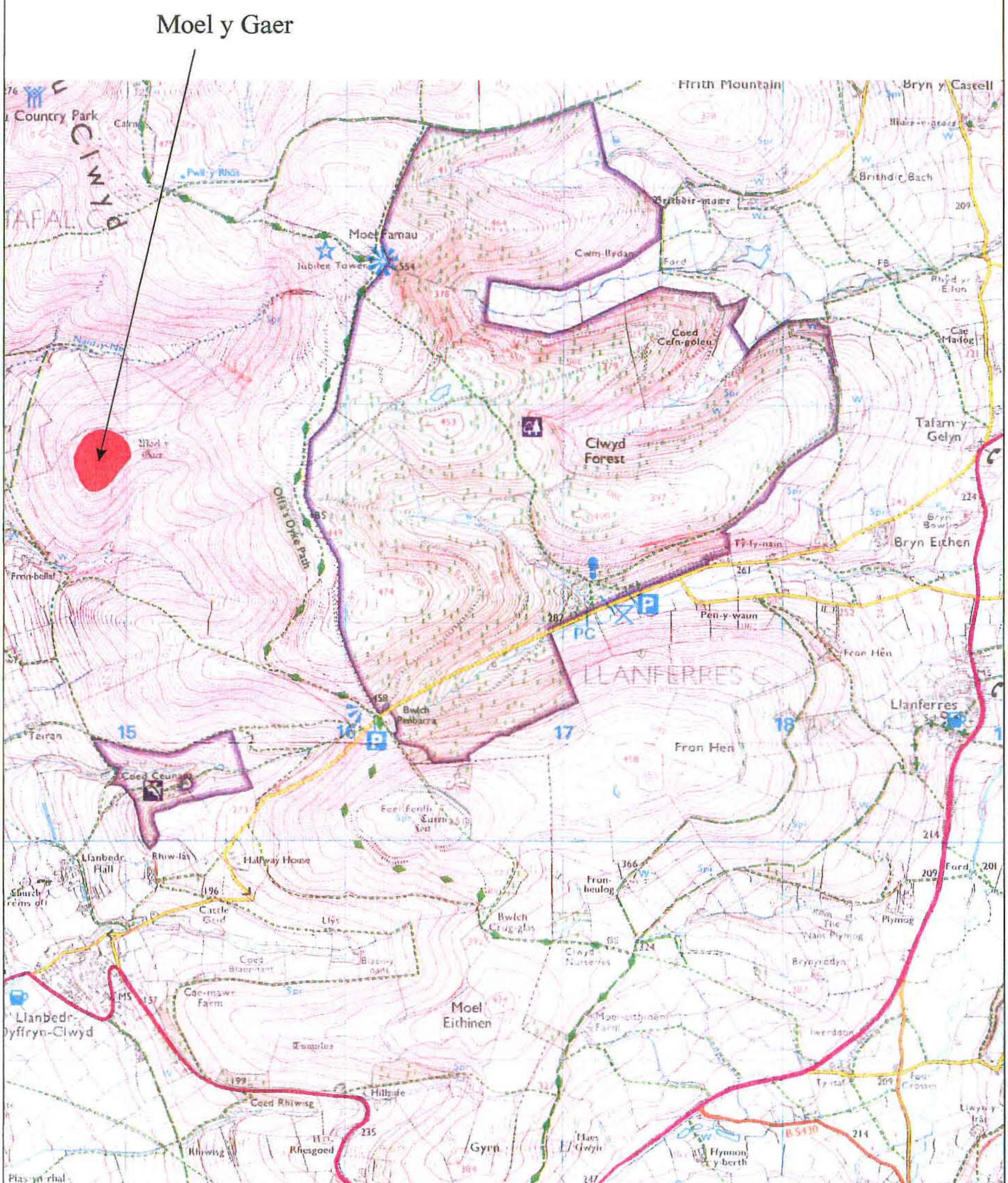



Figure 1: Moel y Gaer, Llanbedr
Location
Scale 1:25,000

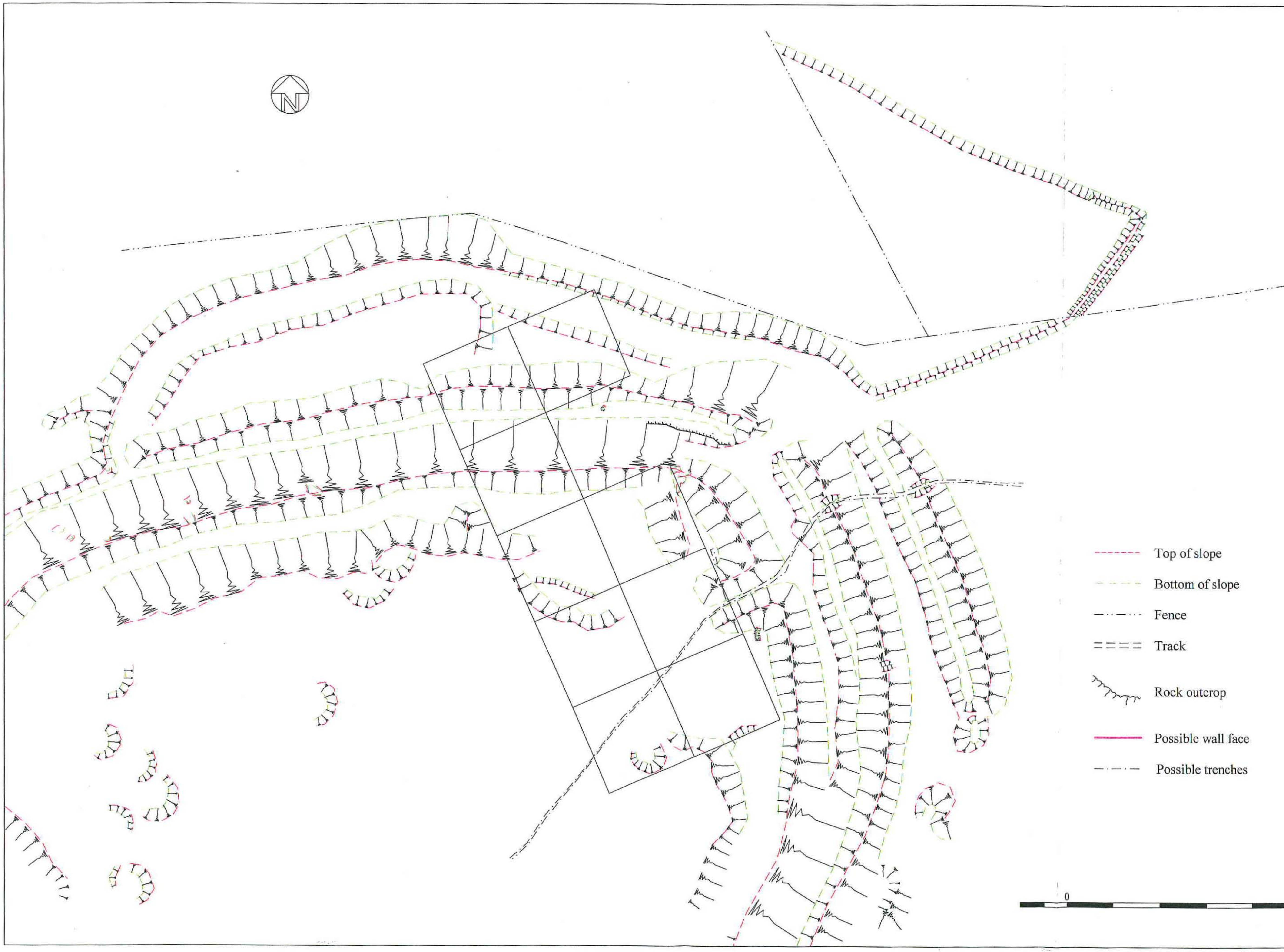



Figure 2: Hachure Survey
Scale 1:750

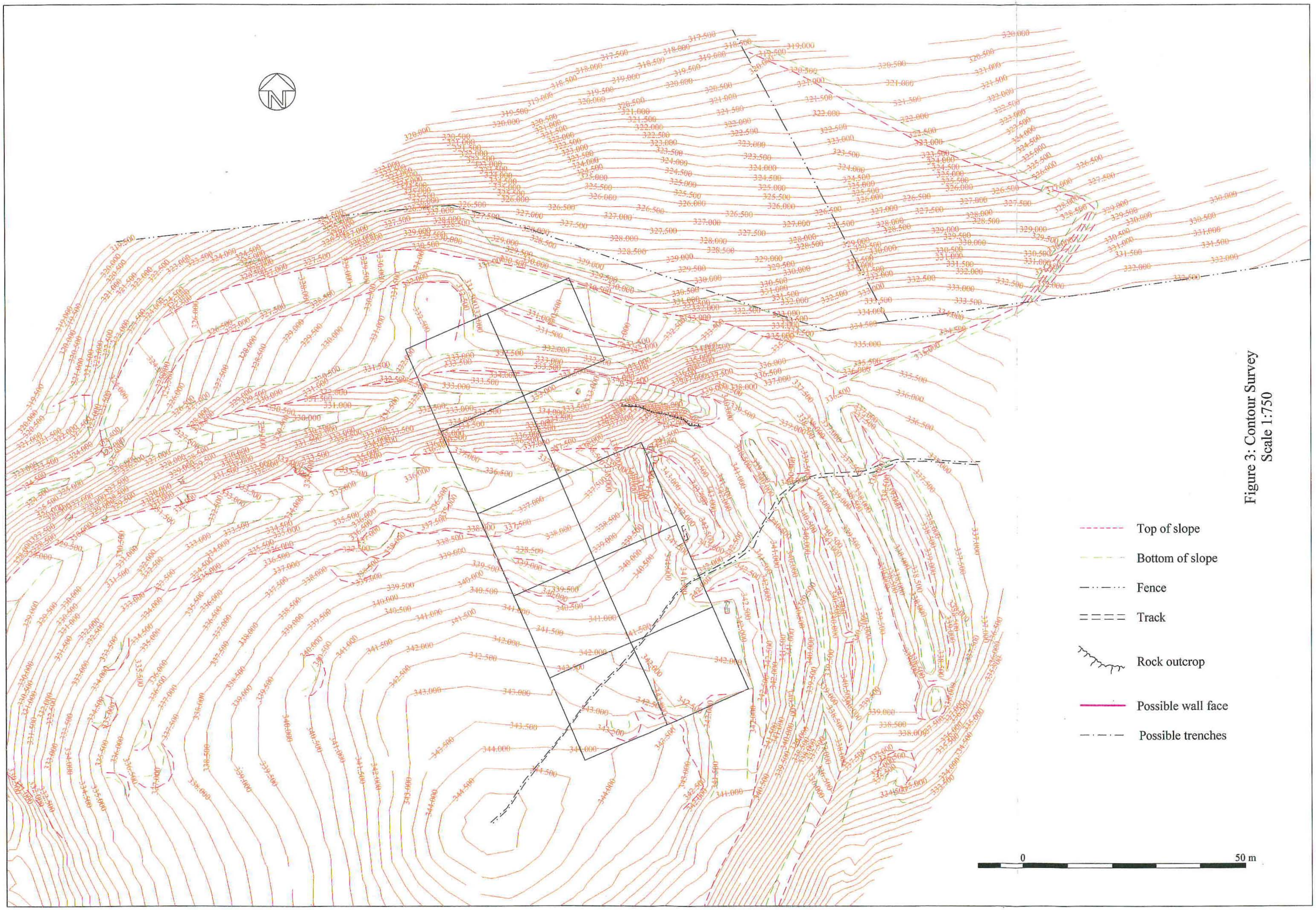



Figure 3: Contour Survey
Scale 1:750

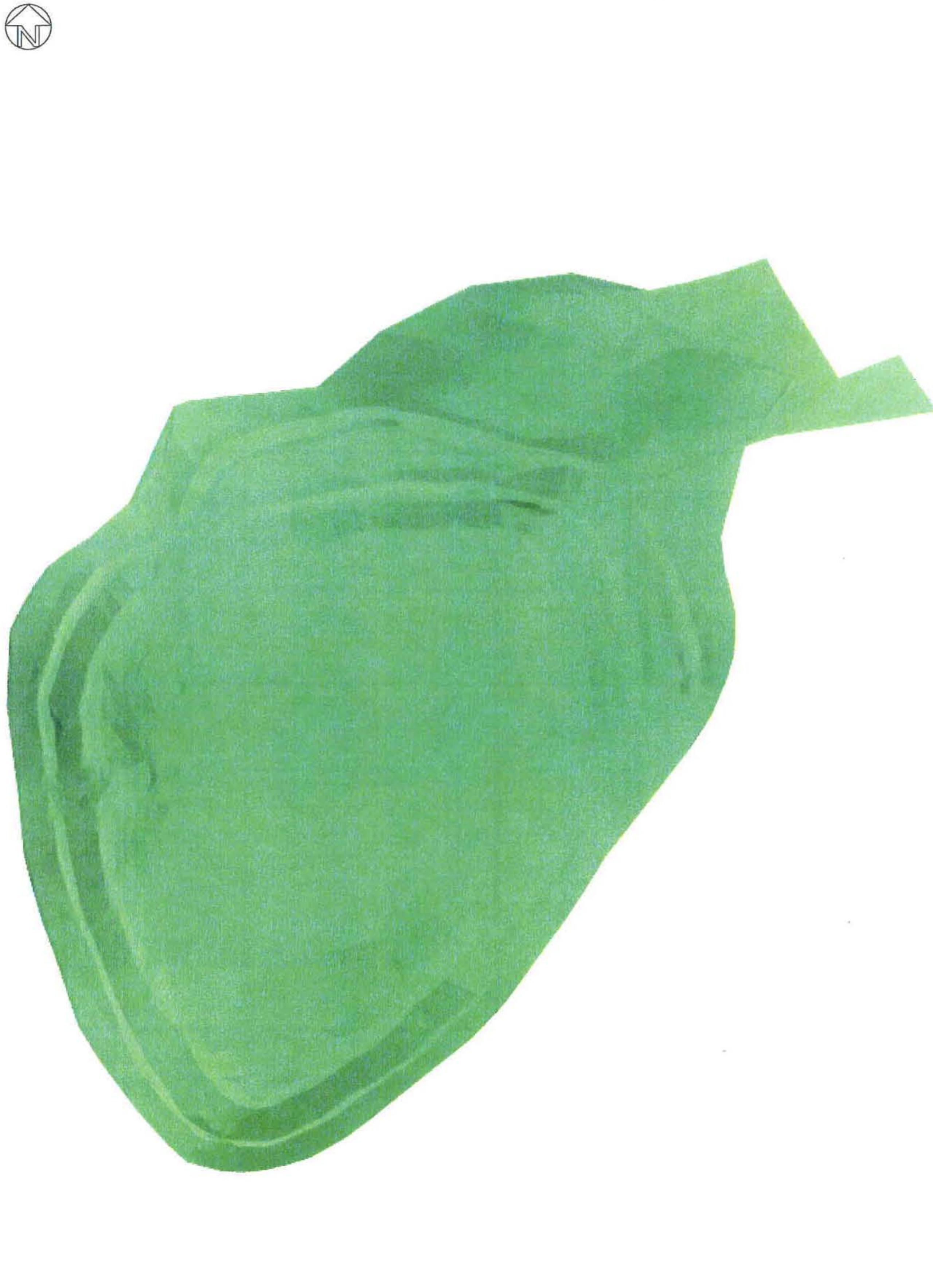



Figure 4: Ground Model
Scale 1:2000

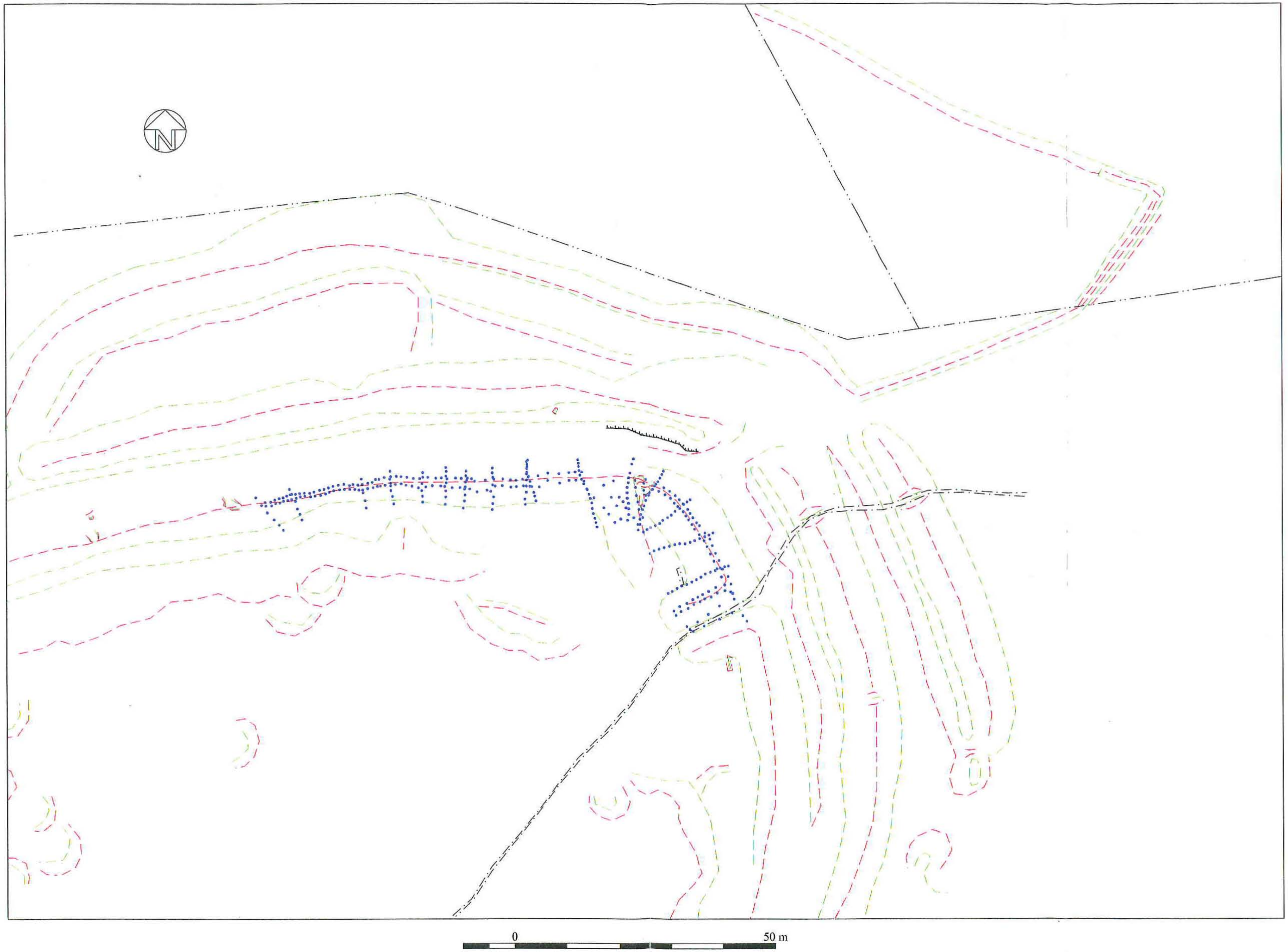



Figure 5: Location of the Magnetic Susceptibility Readings
Scale 1:750

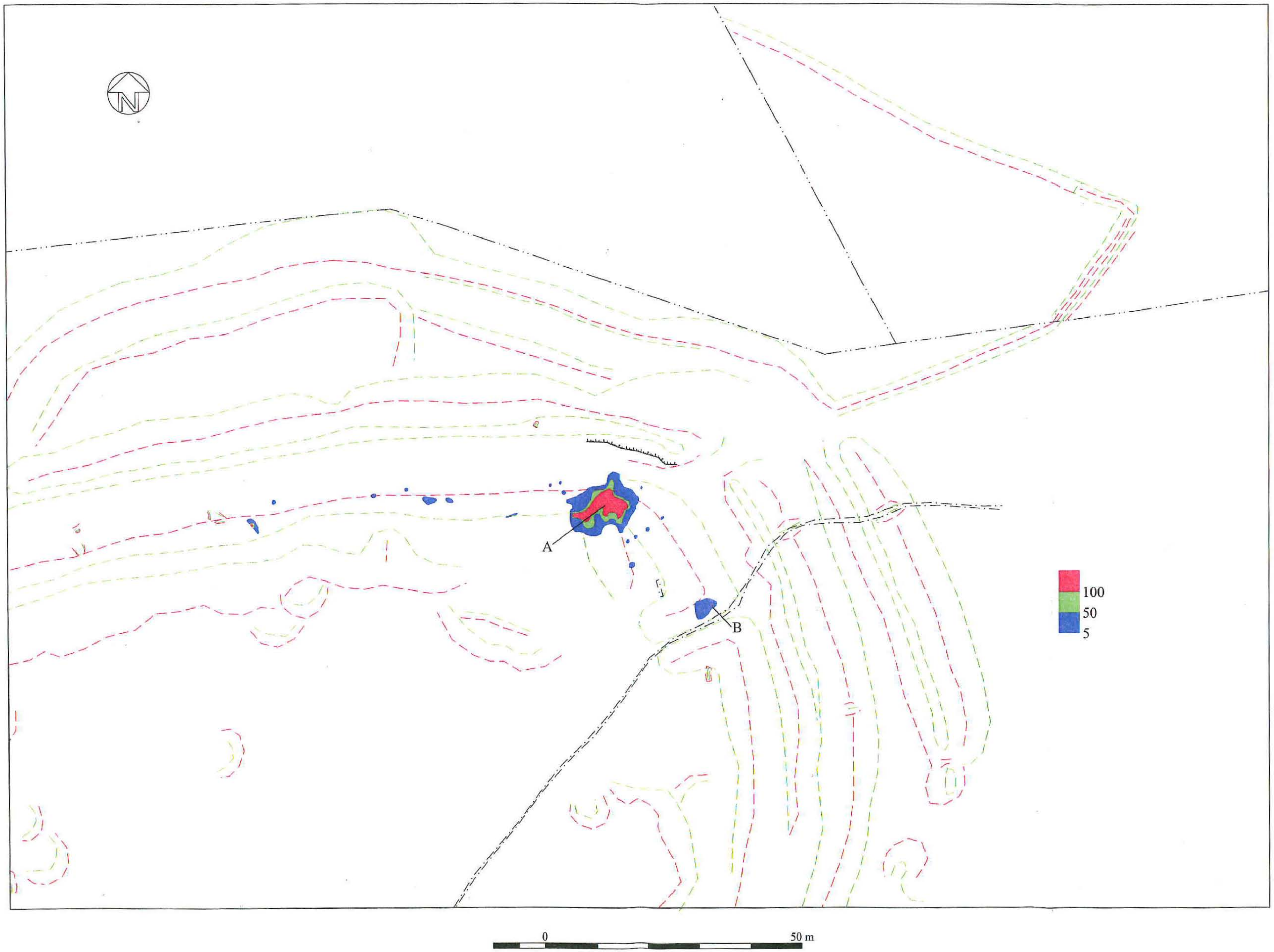



Figure 6: Magnetic Susceptibility Results
Scale 1:750


Figure 7: Location of Fluxgate Gradiometer Survey
Scale 1:1250

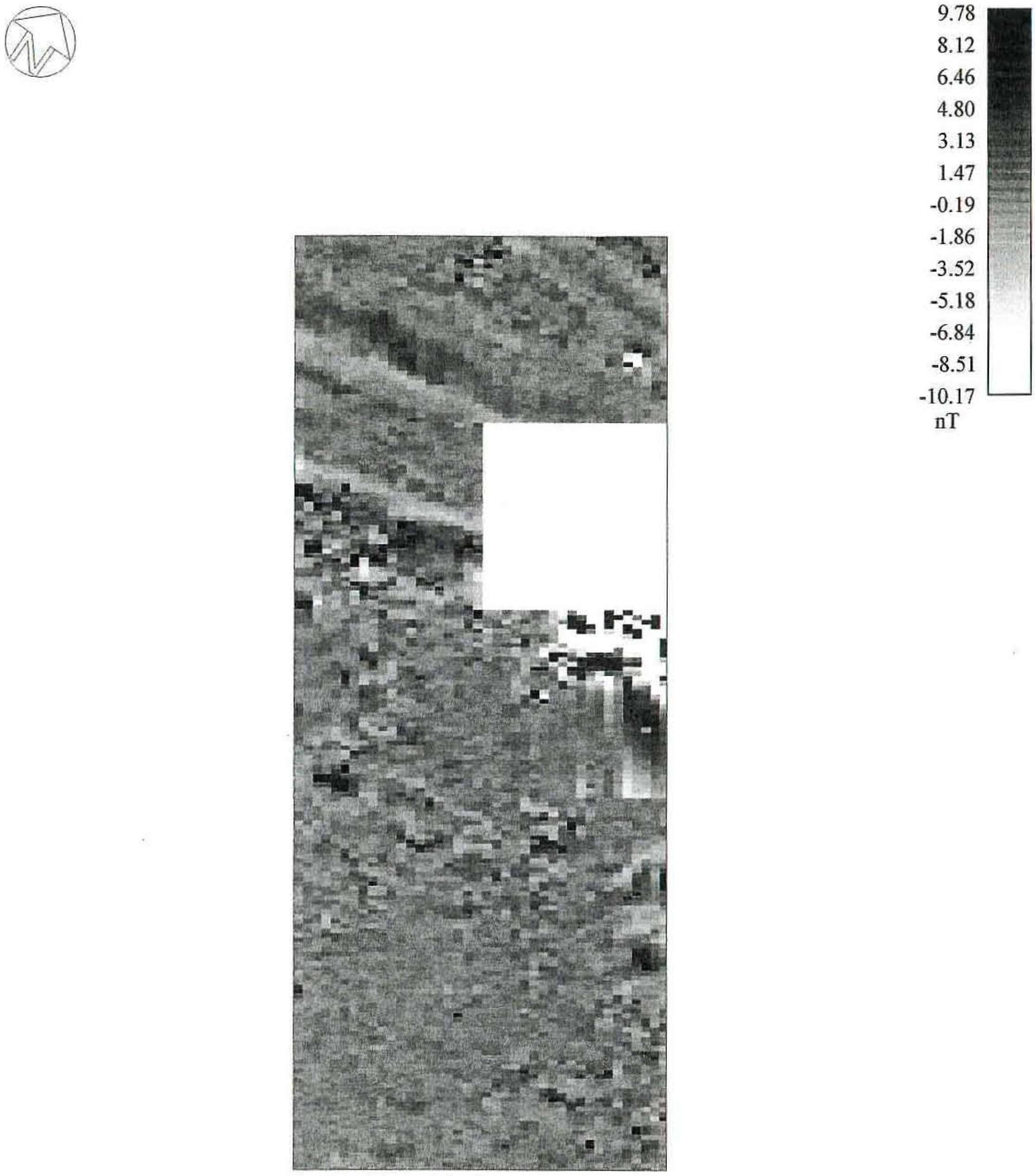



Figure 8: Fluxgate Gradiometer Survey
Grey Scale Plot
Scale 1:750

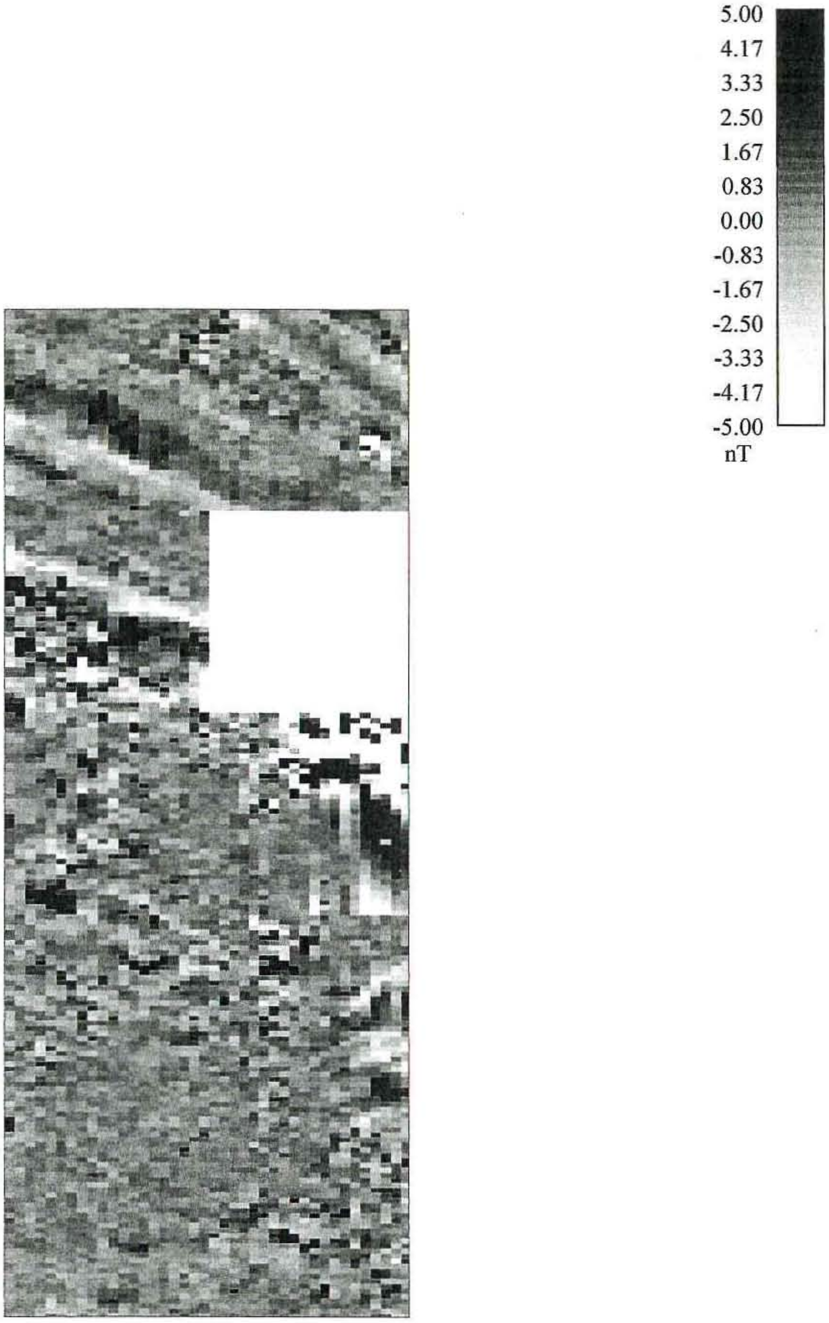



Figure 9: Fluxgate Gradiometer Survey
Grey Scale Plot clipped to ± 5 nT
Scale 1:750

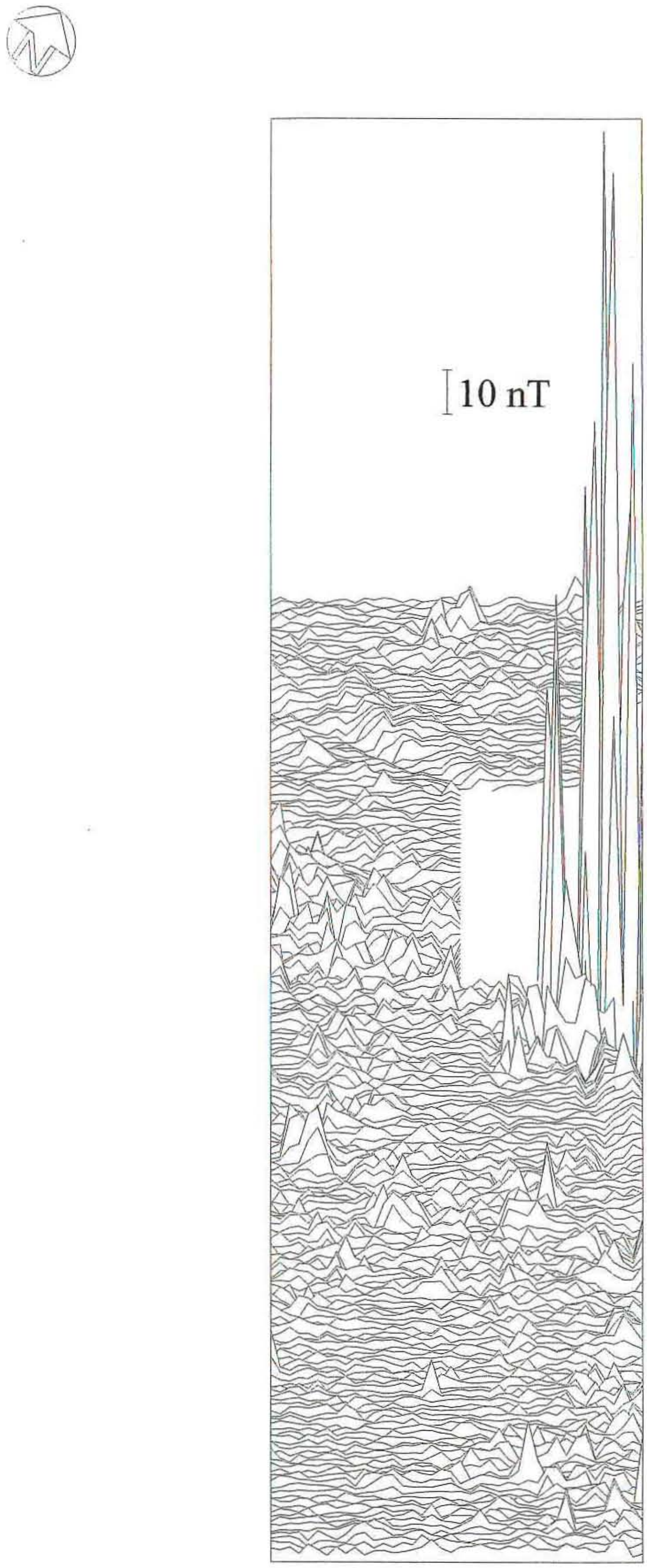
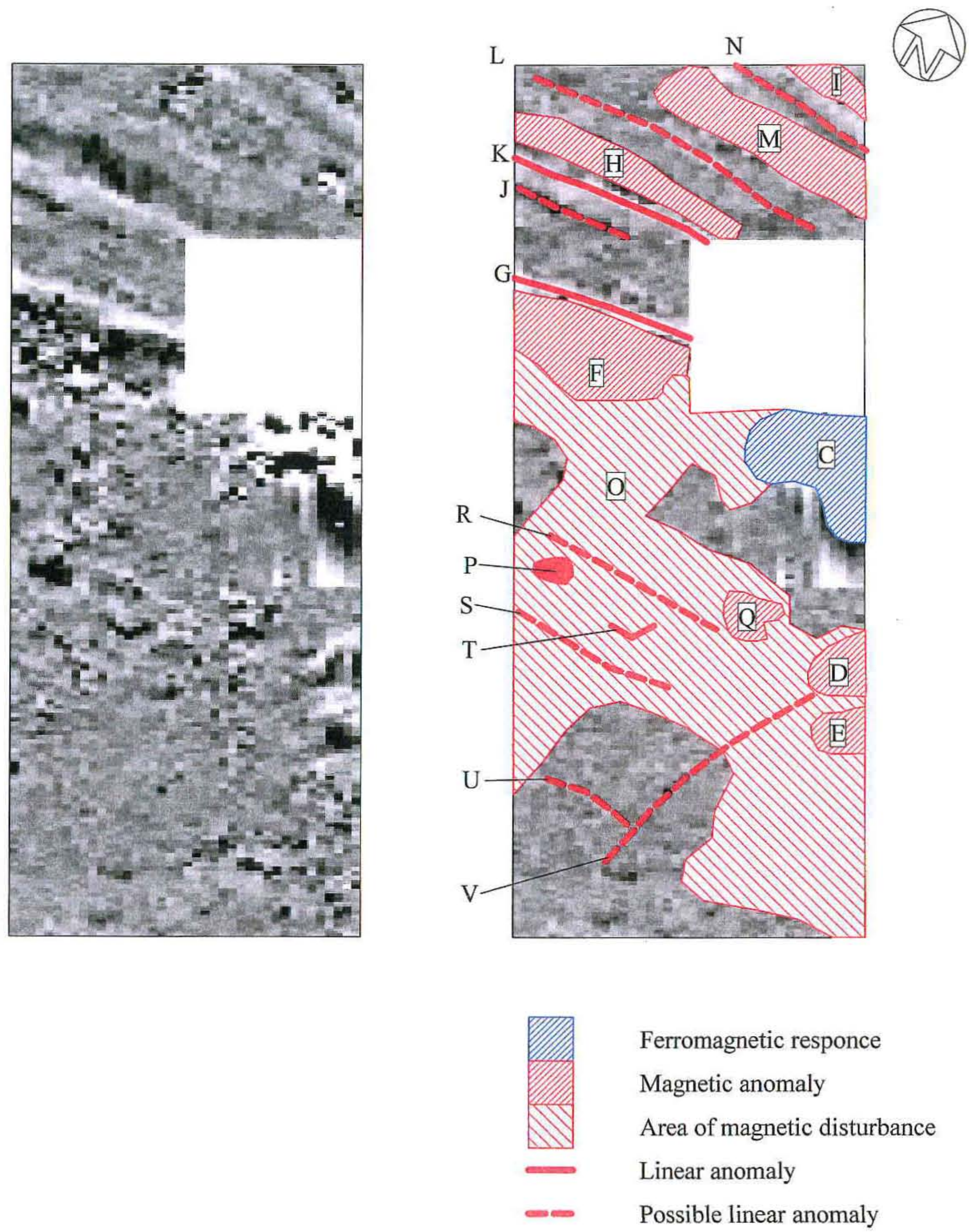



Figure 10: Fluxgate Gradiometer Survey
X-Y Plot
Scale 1:750




| Figure 11: Fluxgate Gradiometer Survey Interpretation | Scale 1:750 |
| --- | --- |


Figure 12: Fluxgate Gradiometer Survey, Summary
Scale 1:500

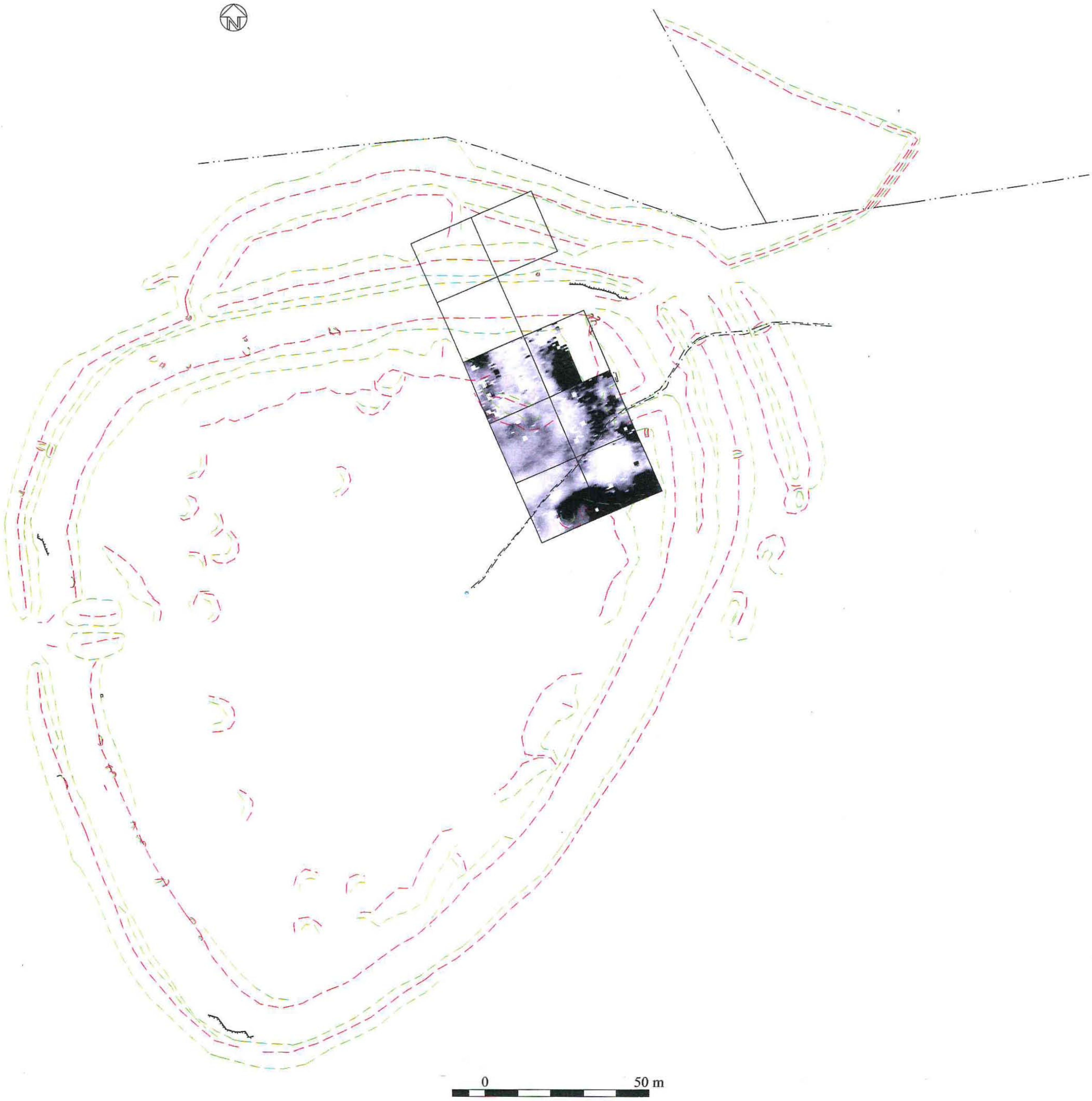



Figure 13: Location of Resistivity Survey
Scale 1:1250

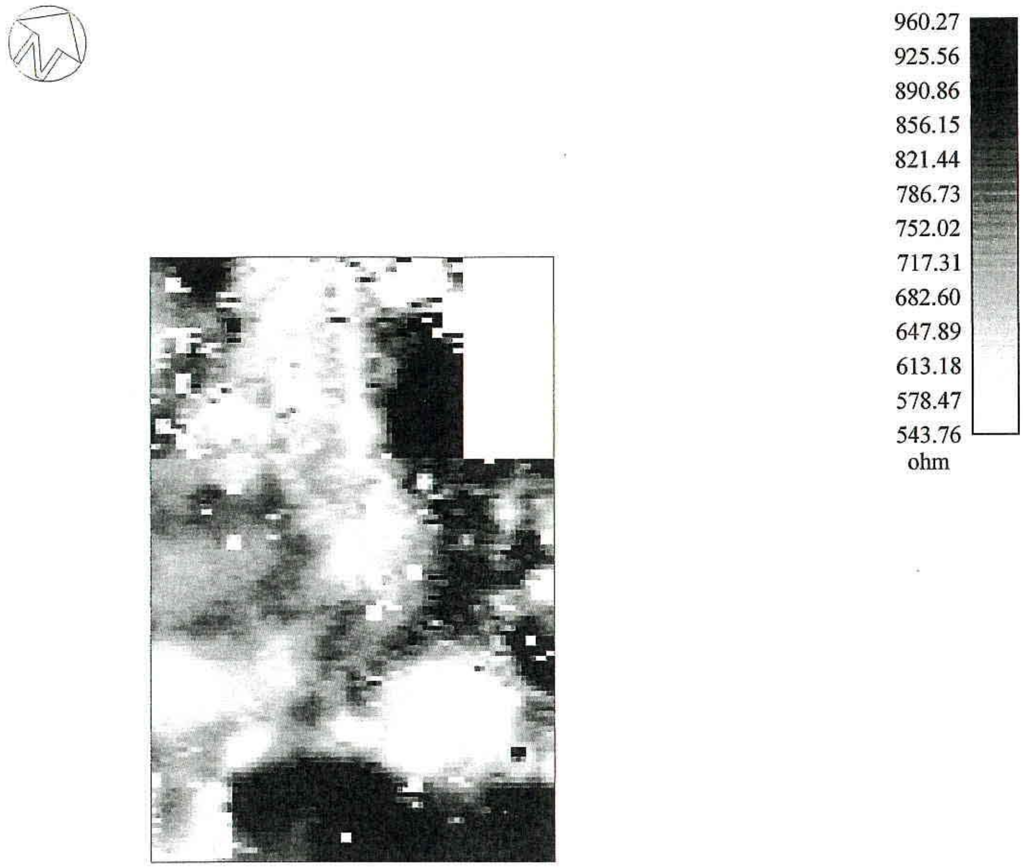



Figure 14: Resistivity Survey
Grey Scale Plot
Scale 1:750

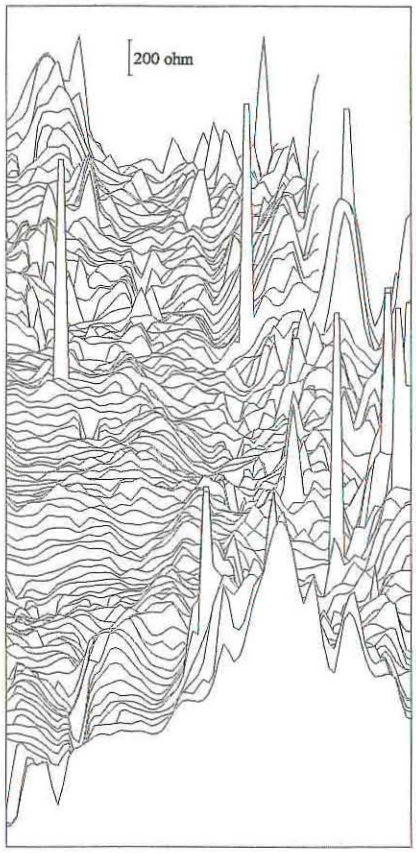



Figure 15:Resistivity Survey
X-Y Plot
Scale 1:750

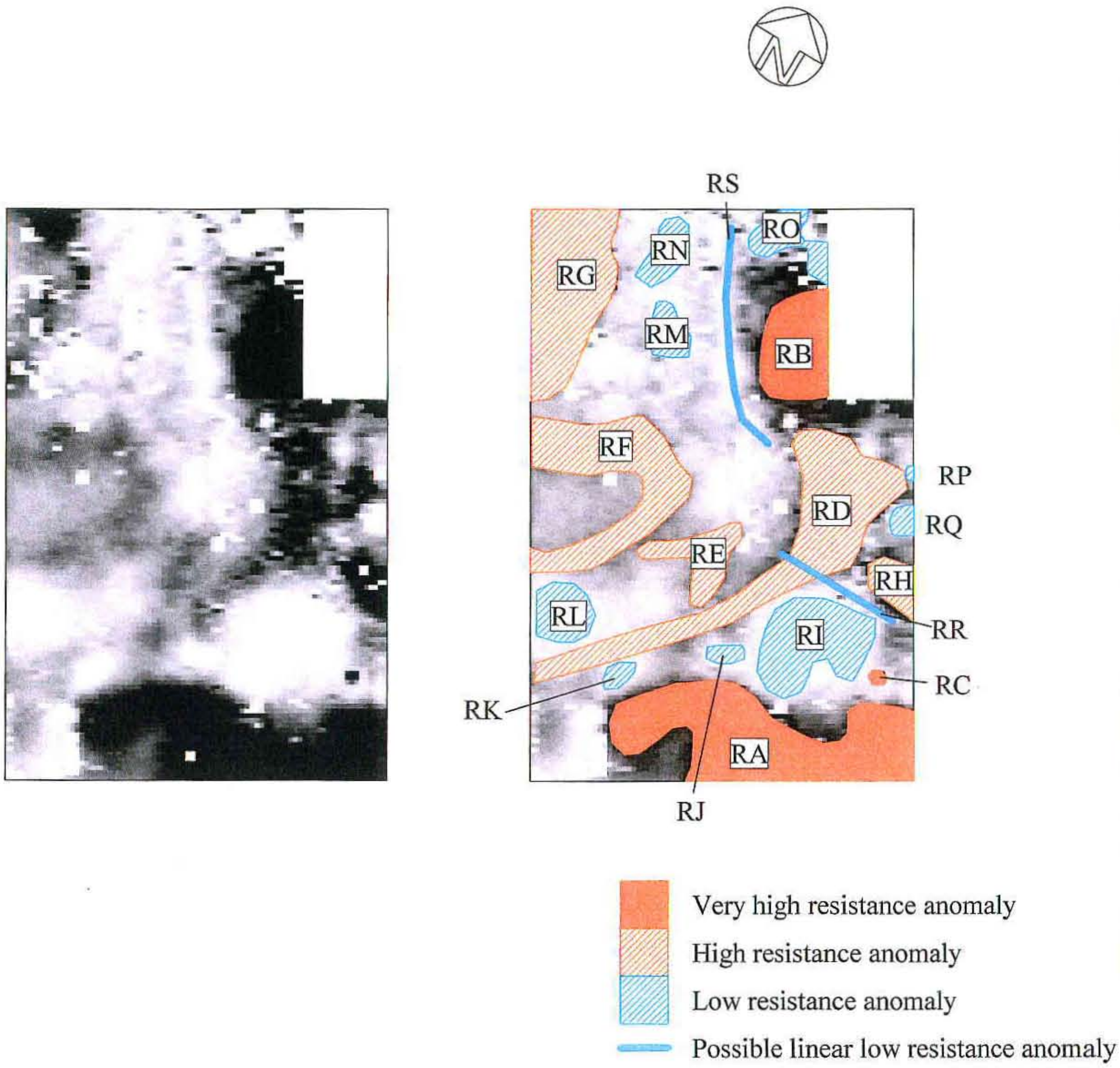



Figure 16: Resistivity Survey Interpretation

Scale 1:750


Figure 17: Resistivity Survey,
Summary
Scale 1:500

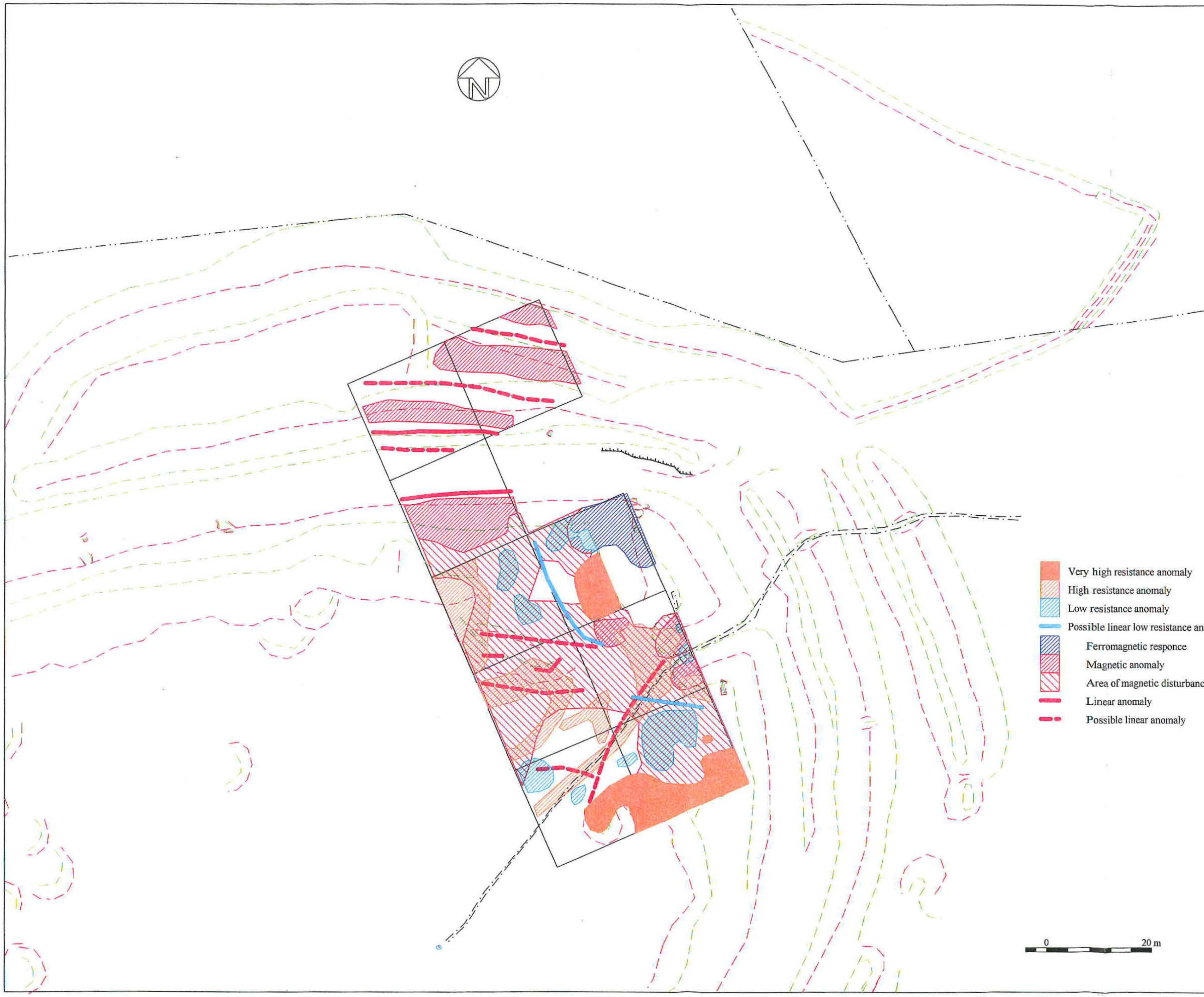



Figure 18: Summary
Scale 1:750

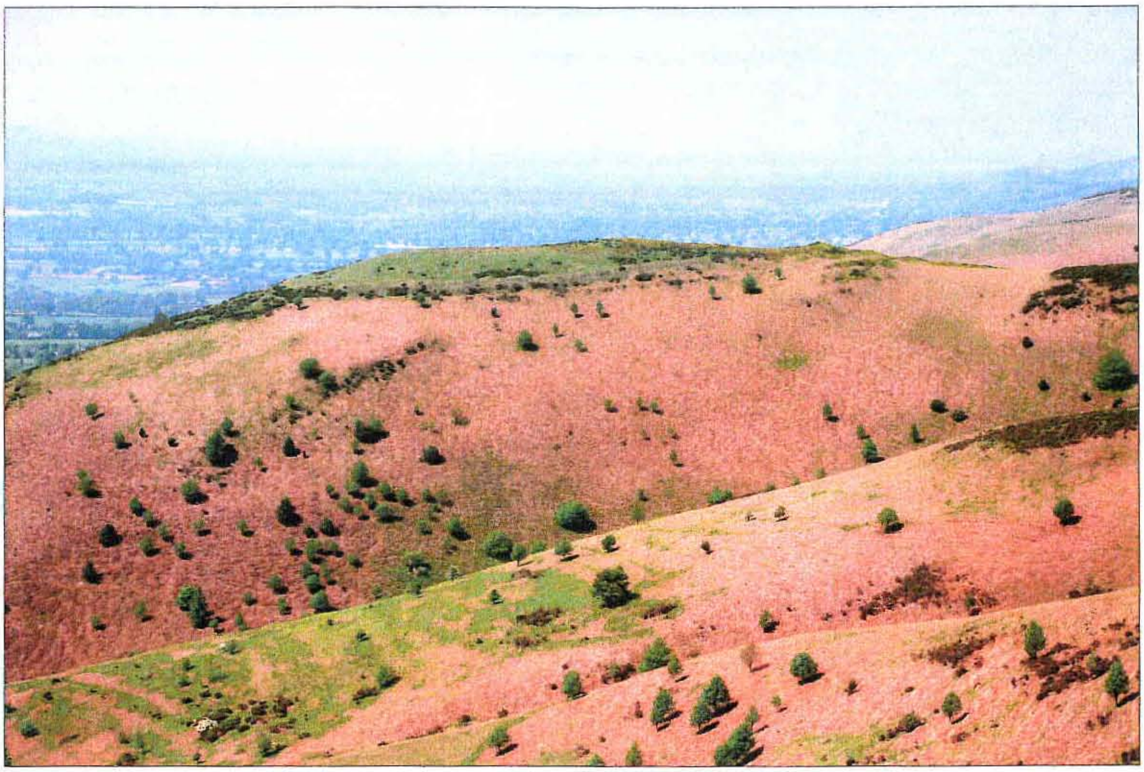


Plate 1: General view of Moel y Gaer from the south east

Plate 2: The boundary bank

Plate 3: Fire reddened rocks showing in a sheep scrape

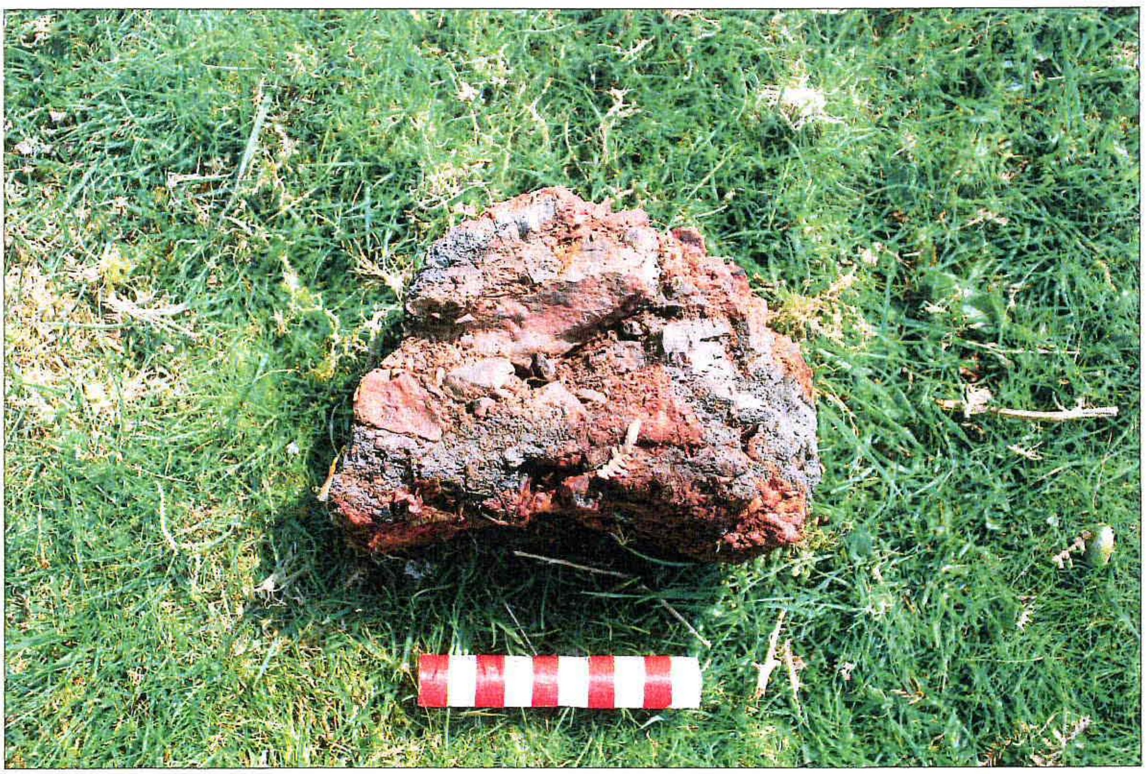


Plate 4: The vitrified block found in the ditch

Plate 5: The total station in use

Plate 6: Magnetic susceptibility survey

Plate 7: Fluxgate Gradiometer survey

Plate 8: Resistivity survey