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CNY

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Rec'd 1997

# **Fluxgate Gradiometer Survey**

carried out for the

**Northern Archaeological Associates**

at

**East Heslerton Wold**

by the

**Landscape Research Centre Ltd**

**Bridge Barn**

**Yedingham**

**North Yorkshire**

**YO17 8SL**

during

**18<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> June, 1997**

**Phone & Fax 01944 728441**

## Summary

A fluxgate gradiometer survey was carried out by the Landscape Research Centre Ltd on behalf of Northern Archaeological Associates over a proposed hydrocarbons drill site. The field on East Heslerton Wold (easting 4936 northing 4753) is situated 1.5 km south of the A64, and has two upstanding earthworks, (the Wold Entrenchments in the north-west corner of the field and notably the East Heslerton long barrow in the south-eastern area of the field), and is also believed to contain a number of round barrows, known from aerial photography (see Figure 1). However, none of these features were to be disturbed by the proposed drill site, and the area surveyed consisted of a block 180m x 90m in the south-western area of the field and a 30m wide strip along the southern boundary of the field. In total, 38 magnetic anomalies were detected. Of archaeological interest were a possible enclosure and a pit alignment, with further anomalies of possible geological origin also being detected.

## Methodology

The subject of this report is the interpretation and discussion of the results of a fluxgate gradiometer survey carried out on behalf of Northern Archaeological Associates. The site is of particular interest because of two upstanding earthworks, and in particular due to the proximity of the East Heslerton long barrow. The fluxgate gradiometer survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36). The zigzag traverse method of survey was used. The survey was conducted by taking readings every 25cm along the north-south axis and every 25cm along the east-west axis (thus 3600 readings for every 30m grid). The sensitivity of the machine was set to detect magnetic variations in the order of 0.1 nanoTesla. The data has been processed and presented using the programs GeoImage (software dealing with the processing of geophysical data) and G-Sys (an in-house developed Geographic Database Management program which can also display, process and present digitised plans and images).

The survey was carried out on the 18<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> of June, 1997. The area surveyed was 2.43 hectares. The surveyors were James Lyall and Heather Clemence, both of the Landscape Research Centre Ltd.

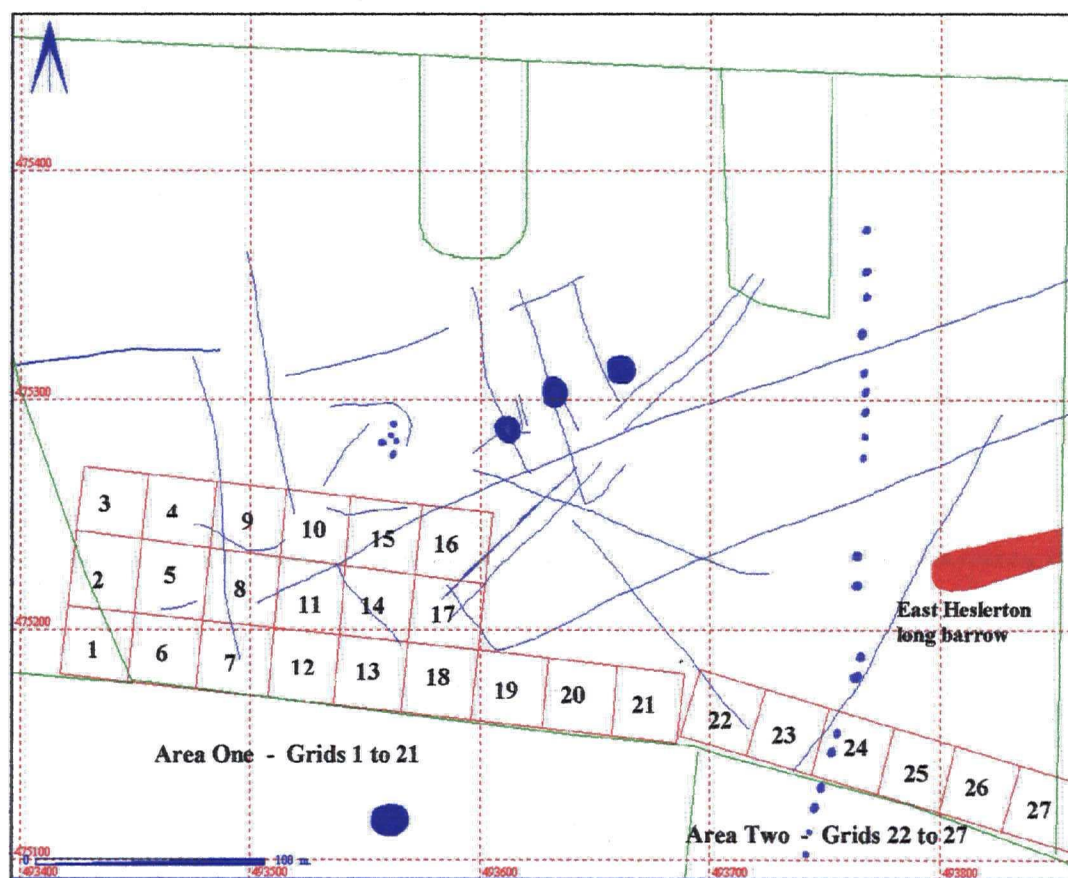


Figure 1. Plan showing the location and number of the 30 m sq survey grids (in red) with the digitised cropmarks (in blue).

The Landscape Research Centre has an ongoing interest in the archaeology of the Heslerton area, and has such has a comprehensive coverage of both oblique and vertical aerial photographs of the area. Figure 1 shows a digitised plot of cropmarks in relation to the survey grid and the East Heslerton long barrow. It shows that the proposed drill site did not impact on any known round barrows, only on some possible ditches, although the access road would have an impact on the north-south oriented pit alignment. The above plot of the pit alignment is not accurately transformed; in fact, the pit alignment enters the field in grid 23 and continues northwards towards the easternmost stand of trees.

#### Gradiometer Results and Interpretation

Due to the nature of the southern field boundary, it was necessary to survey the site in two discrete, but adjoining areas, which are numbered Areas One and Two. All discussion and interpretation of detected anomalies will be by area and anomaly number, and will be located by reference to a specific grid number. Each area will be discussed in turn.

The survey data for each area will be displayed as both a greyscale image and a digitised interpretation of anomalies. The anomalies in the greyscale images are the areas of lighter and darker grey, which indicate areas of higher and lower magnetic response. Please note that the digitised interpretations are indicators of the effects of magnetic anomalies, and actual excavated features may prove to be either larger or smaller than the anomalies visible in the greyscale image. However, experience has shown that about 95% of the time, the anomalies roughly equate to the actual extent of the archaeological features.



### Area One (1.89 hectares) - Results and Interpretation

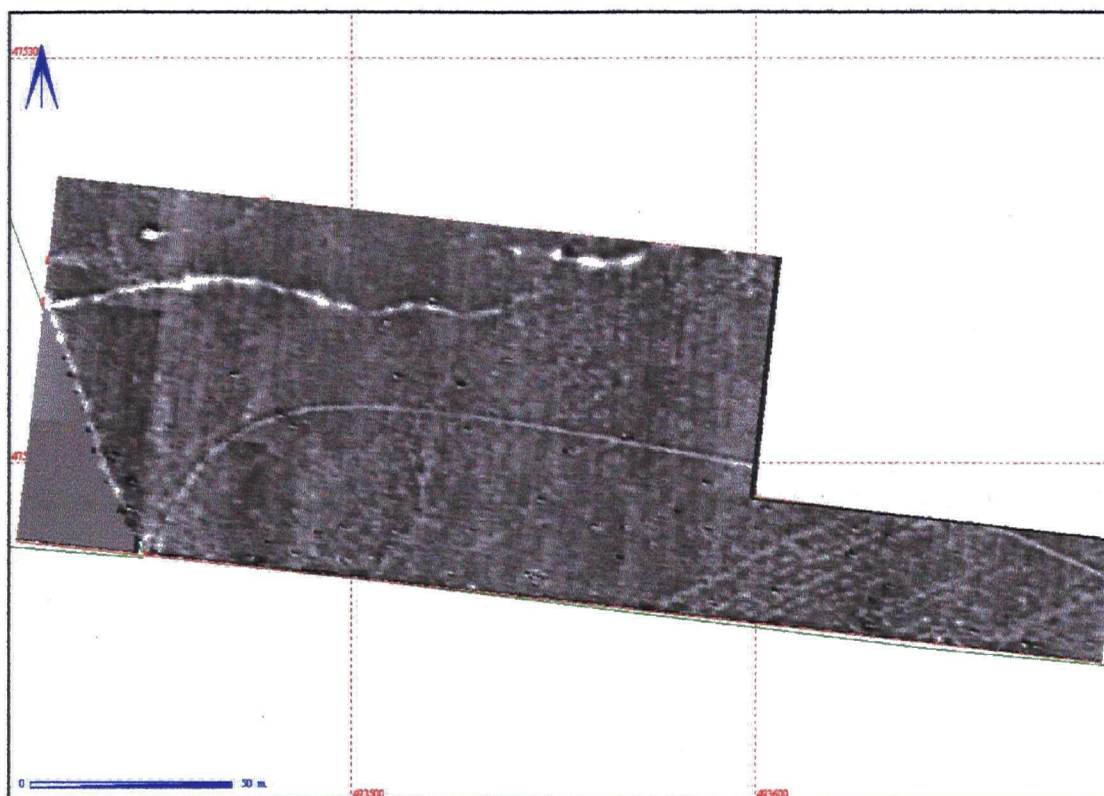


Figure 2. A greyscale plot of the survey data in Area One

Area one consists of 21 thirty metre squares, with grids one and two requiring dummy logging at the western edge. Grids one to eighteen are in a block 180 metres long by 90 metres wide, with grids nineteen to twenty-one continuing along the same axis in a 30 metre wide strip along the path of the access road.

The strongest anomalies all occur in the northern part of the surveyed area. Anomaly S1 (Grid three) is a very strong localised anomaly. While it is possible that this is caused by the presence of burnt material, it is more likely that the cause of this anomaly is a lump of iron near the surface.

The three strong linear anomalies (L2 - Grids two, three, four and nine), (L3 - Grids nine, ten and fifteen) and (L4 - Grids ten and fifteen) are all roughly east-west oriented. These anomalies are problematical, in that their sinuous nature suggests that they might be geological in origin, although their fill material must be highly magnetically susceptible. One possible answer is that they may be filled with a natural clay material high in ferrous content, but this cannot be ascertained from the gradiometer data alone. They happen to coincide with a natural ridge which runs across the entire field, and this lends weight to the interpretation of natural origin. However, it is just possible that they may be archaeological in origin, although if so, their function is difficult to attribute.

Anomalies L5 and L6 (Grid three) and L7 (Grid four) are much less powerful magnetic anomalies. As two of them may continue beyond the edges of the surveyed area, it is difficult to give an informed interpretation of the nature of these anomalies, but their location on the brow of the natural ridge may well indicate that they are of geological origin.

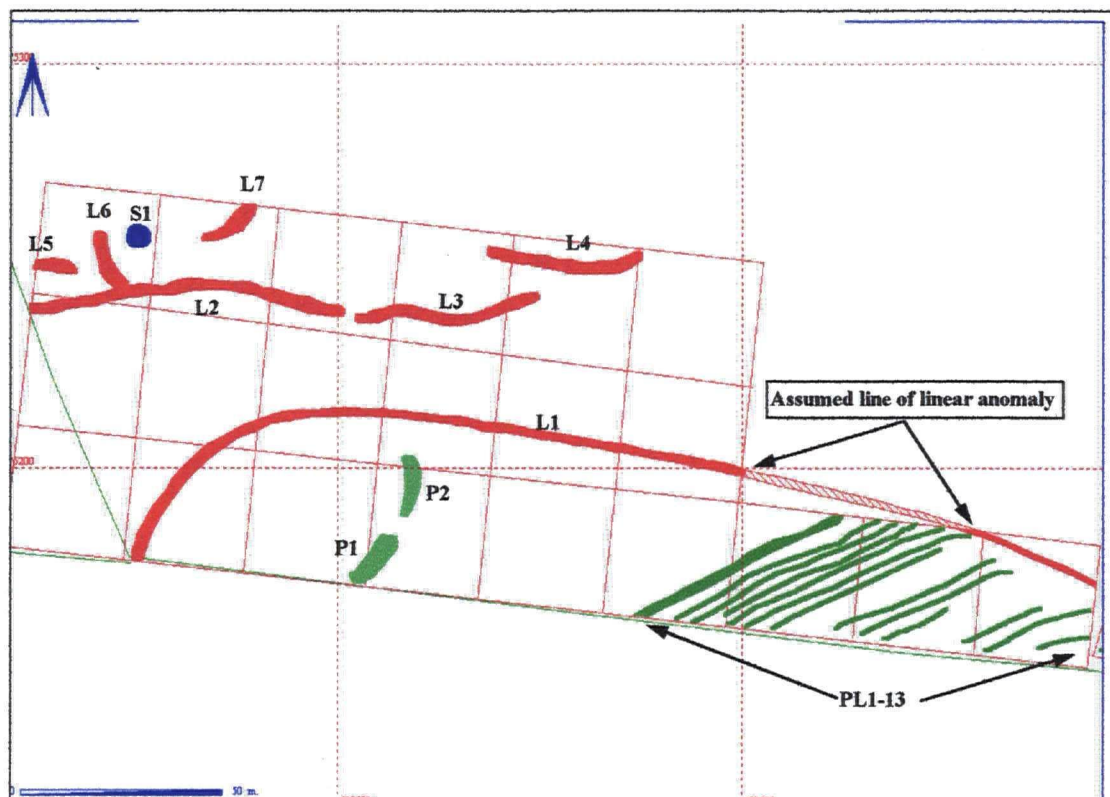


Figure 3. Plan showing digitised interpretation of magnetic anomalies in Area One survey data

Anomalies P1 (Grids seven and twelve) and P2 (Grids eleven and twelve) are weakly positive anomalies, and are possibly two parts of the same feature. The uneven nature of the anomalies again might indicate a geological origin, although as they are directly in the line of the access road they may take on a greater importance.

Anomalies PL1 to PL13 (Grids eighteen to twenty-one) are almost certainly ploughmarks, although PL1 (Grid eighteen and nineteen) is slightly stronger and wider than the others, perhaps indicating a field boundary. Anomaly PL1 appears to mark the western boundary of these ploughmarks, and although very faint traces on roughly the same alignment can be made out in the greyscale image, these were not digitised.

Perhaps the most significant anomaly in this area is the linear anomaly L1 (grids six, eight, eleven, fourteen, seventeen, twenty and twenty-one). The anomaly begins in grid six, heading north-east before turning to the east and continues in an east-south-east orientation until it reaches Area Two (Grid twenty-two), where it turns to the south. The anomaly was traced along its length of 284 metres (if the 55 metre long assumed line between grids seventeen and twenty is correct). The apparent lack of plough damage and the perfect regularity along its length, coupled with the fact that the anomaly apparently enters the field just to the east of the south-west corner of the field, originally led the surveyors to believe that this was a relatively modern feature. However, there were no visible signs for this anomaly at either its entrance or exit from the field (although closer scrutiny might show otherwise), and no obvious reason for its construction, thus hinting at the possibility that it may be archaeological in origin. If this is the case, then it is an enclosure of an unusual shape. The access road would certainly have an impact on the anomaly in grid twenty-two.



### Area Two (0.54 hectare) - Results and Interpretation

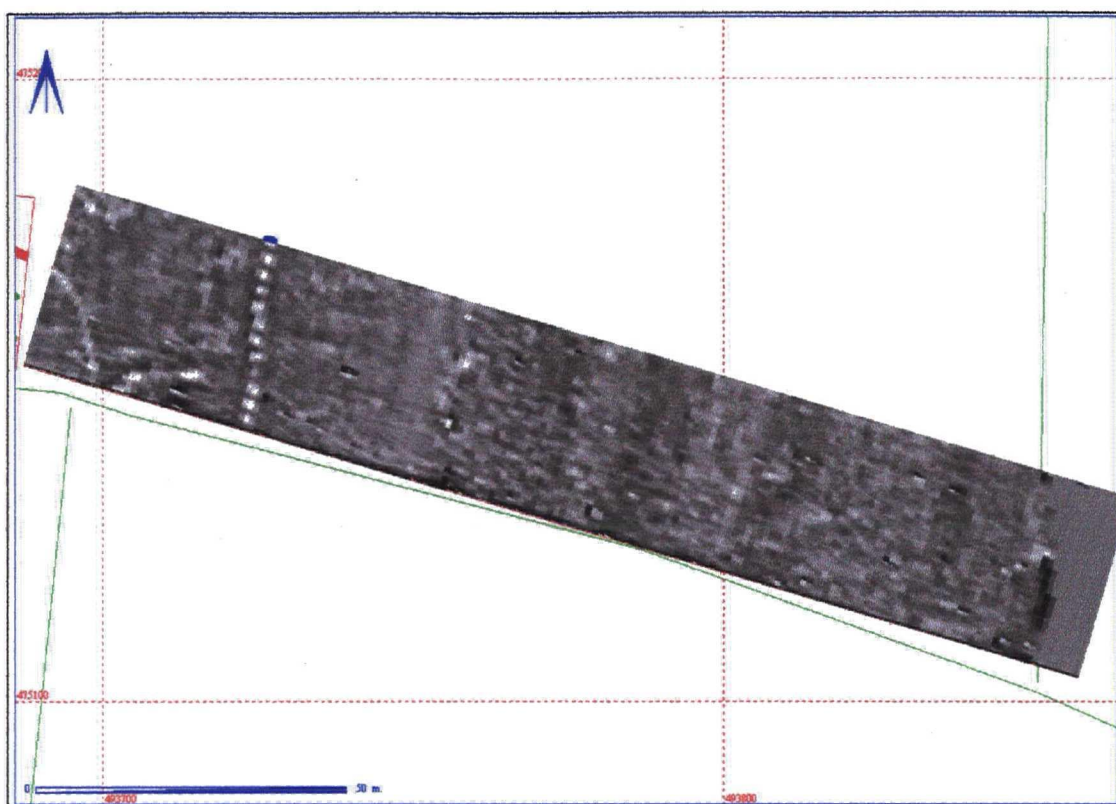


Figure 4. A greyscale plot of the survey data in Area Two

Area two consisted of a line of 6 thirty metre square grids (grids twenty-two to twenty-seven), with grid twenty-seven requiring dummy logging at the eastern edge. All of the magnetic activity occurred in grids twenty-two to twenty-four, although it is just possible that a circular anomaly is visible in the southern central area of grid twenty-five (see Figure 4). However, this feature was too faint to digitise as a definite magnetic anomaly. Also there are two very faint linear anomalies running along the length of the six grids (in the south). These have not been digitised as they almost certainly of modern origin (track marks).

Grid twenty-two clearly demonstrates the return of linear anomaly L1 as it turns to the south. Note that even though ploughmarks PL12 and 13 have a relationship with this anomaly, anomaly L1 does not appear to be affected by these. The implication is again either that anomaly L1 is relatively modern or that the cause of the anomaly is below the level of damage caused by the plough marks.

Anomaly L8 (grid twenty-two) is a slightly stronger, short linear anomaly, of particular note as it appears to continue into the field to the south at almost the same place as anomaly L1. Anomaly L9 (grid twenty-two) occurs in the extreme north-west corner of the grid, and as such is difficult to interpret. Although digitised as a single, curvilinear anomaly, it is possible that it is made up of two separate anomalies, one of which is on the same alignment as the ploughmarks.

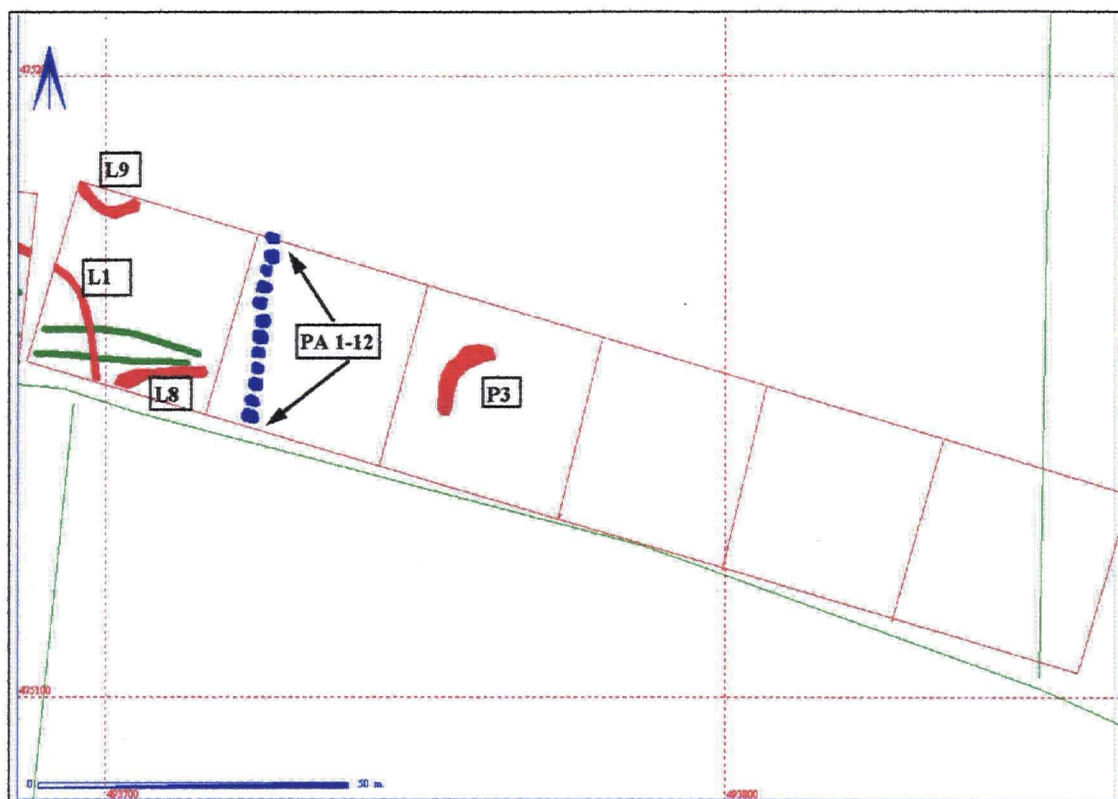


Figure 5. Plan showing digitised interpretation of magnetic anomalies in Area Two survey data

Anomaly P3 (grid twenty-four) is a very faint localised anomaly, possibly made up of two separate anomalies.

The most significant, and certainly archaeological in origin, set of anomalies are those numbered PA 1 to 12 (grid twenty-three). These are part of a pit alignment, typologically of probable Bronze Age date. Of particular note here is anomaly PA 4, which shows a significantly lessened magnetic response than the other eleven pits in the alignment. This may indicate either that it is filled with different material from the others, or that it has been cut through by a later event.

### Conclusions

In conclusion, it can be stated that the magnetic response of the surveyed area was generally good, detecting a number of anomalies of possible archaeological origin. In all, 38 magnetic anomalies were detected, these being 1 probable iron anomaly, 13 probable plough marks, 9 linear anomalies, 3 possible anomalies and 12 pits of a linear pit alignment. In particular, the detection of the pit alignment and a possible linear enclosure are of note. Some of the linears are enigmatic anomalies which might be geological in origin, although filled with a highly magnetically susceptible material.

Report by James Llyall

Landscape Research Centre Ltd



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