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Seamer Carr Landfill Extension North Yorkshire

Gradiometer Survey

September 1996

West Yorkshire Archaeology Service

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Seamer Carr Landfill Extension,

North Yorkshire

September 1996

Gradiometer Survey

by

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Seamer Carr Landfill Extension
North Yorkshire

(TA 030 820)

Gradiometer Survey

1. Summary

Client

Northern Archaeological Associates
15 Redwell Court
Harmire Road
Barnard Castle
County Durham
DL12 8BN

Objectives

To locate the position and extent of archaeological features within the proposed landfill extension area.

Method

To facilitate this objective a detailed gradiometer survey was carried out over 2.5ha which formed part of the proposed lateral extension area.

A Geoscan FM36 fluxgate gradiometer with an ST1 sample trigger was used for the survey. The data was downloaded in the field to a Compaq laptop portable computer and later processed on an Elonex 486.

Results and Conclusions

Of the features identified from aerial photographs only the double-ditched trackway was detected by the gradiometer survey. The remaining features, including the D-shaped enclosure were not detected. Two possible square barrows and isolated anomalies which might be pits or kilns were also identified. Positive anomalies thought to be recent field boundaries were located as were negative anomalies which are thought to be palaeo-channels.

2. Introduction and Archaeological Background

2.1 The West Yorkshire Archaeology Service was commissioned by Northern Archaeological Associates to undertake a geophysical survey at a site to the south-west of the existing landfill and refuse treatment plant at Seamer (see Fig. 1). This survey formed the first phase of an evaluation of the site proposed as part of the mitigation strategy submited with the planning application for the development. The geophysical survey formed part of a wider field survey which included a subsurface contour survey and a fieldwalking survey.

2.2 The area of survey is situated within a landscape of major archaeological importance; the eastern end of the Vale of Pickering is recognised as one of the most important Mesolithic landscapes in Britain. The survival of these early Mesolithic landscapes, including those at Star and Flixton Carrs, has been in part due to the overlying peat deposits which still survive in the Seamer Carr area (located on the northern margin of the former Lake Pickering basin).

2.3 In the area to the west of the landfill extension, a proposed nature conservation area, spot finds have suggested Neolithic occupation on an area of higher ground. In addition cropmark evidence indicates that probable Iron Age or Romano-British trackways and enclosures in the vicinity of Herdborough House Farm extend into the study area from the west. It is in this area that the geophysical survey was carried out.

2.4 The survey site is located on a combination of sands and gravels. Outside, and to the east of the survey area, these are overlain by clays, silts and peat. On the gravel ridges the soils consist of an organic sandy loam topsoil underlain by a coarse sandy loam subsoil. Lower ground within the survey area retains peat derived soils which may be palaeochannels.

2.5 The field had been planted with peas but these had been cropped prior to the survey. No problems were encountered during the survey which was conducted on September 3rd and 4th 1996.

3. Fluxgate Gradiometry: technical information and methods

3.1 In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches, and the magnetic susceptibility of the geology into which these features have been cut, which causes the most recognisable responses. Other features, such as kilns and ovens, can be more difficult to identify, although their responses are generally stronger than soil filled features. The highest responses are usually due to iron objects and these produce a characteristic response with a rapid change from positive to negative readings (iron "spikes").

3.2 There are a number of methods employing the fluxgate gradiometer. The most basic of these is referred to as scanning and requires the operator to identify responses whilst covering the site in widely spaced traverses. This method is used as a means of selecting areas for detailed survey when only a sample area is required or to map out the full extent of features located during a sample detailed survey.

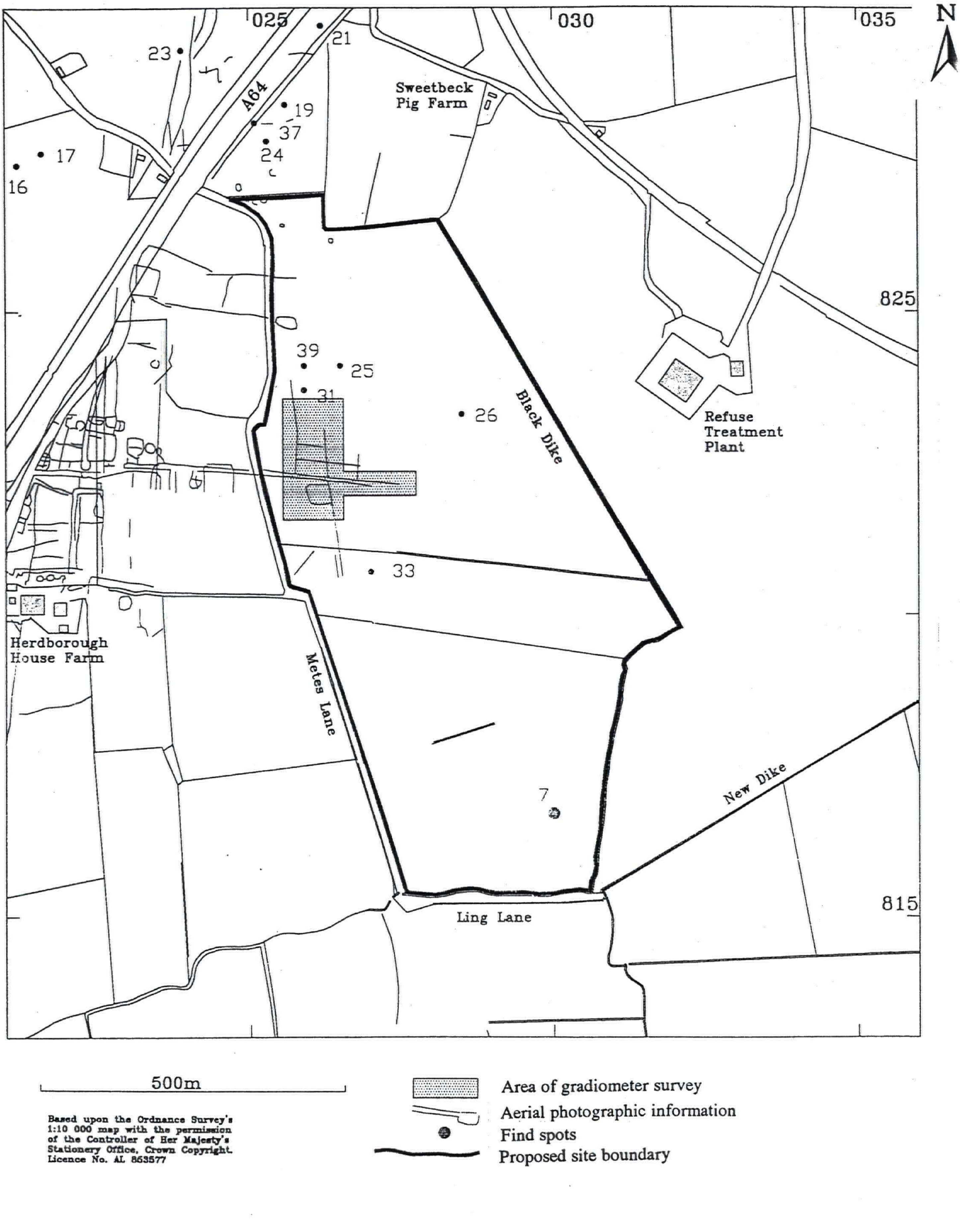

Fig. 1 Seamer Carr Landfill Extension: Site location

3.3 In contrast detailed gradiometer survey employs the use of an ST1 Geoscan sample trigger and FM36 fluxgate gradiometer to take readings at 0.5m intervals on zig-zag traverses 1m apart within grids measuring 20m by 20m. This means that 800 readings are taken within each 20m grid square. In-house software (Geocon Version 8) was used to interpolate the "missing" line of data so that 1600 readings in total were obtained for each complete grid. This method was employed during the survey with traverses orientated south to north.

4. Results

4.1 The data is presented as a 1:2500 grey scale plot in Figure 2, with an interpretation of the data shown in Figure 3. Grey scale, dot density and X-Y trace plots of the data are shown at a scale of 1:500 as an appendix to the main report. The X-Y trace plot is presented as it enables responses due to ferrous material in the topsoil ("spikes") to be differentiated from potential archaeological responses such as those caused by hearths or kilns.

4.2 The types of response generally detected on a site can be divided into five main categories which are described below:

1. **Iron Spikes (Dipolar Anomalies)**
   These responses are also referred to as dipolar and are caused by buried iron objects. Little emphasis can be given to such responses as iron objects are normally recent in origin on agricultural sites.

2. **Rapid, strong variations in magnetic response**
   Also referred to as areas of magnetic disturbance these can be due to a number of different types of feature. They are usually associated with burnt material such as industrial waste or other strongly magnetic material. It is not always easy to determine their date of origin without supporting information.

3. **Positive, linear responses**
   The strength of these responses varies depending on the underlying geology. They are commonly caused by ancient ditches or by more recent field drains.

4. **Isolated positive responses**
   These exhibit a magnitude of between 2nT and 300nT and, dependent on the strength of their response, can be due to pits, hearths, ovens or kilns. They can also be due to natural features on certain geologies. It is, therefore, very difficult to establish an anthropogenic origin without an intrusive means of examining the features.

5. **Negative linear anomalies**
   These are normally very faint and are commonly caused by features such as plastic water pipes which are much less magnetic than the surrounding soils and geology. They too can be caused by natural features on some geologies.

Fig. 2 1:2500 Grey scale plot of gradiometer data

4.3 Five positive linear anomalies have been identified; **A**, **B**, **C**, **J** and **K**. The first three of these are orientated roughly east-west while the remaining two run north-south. Anomaly **A** is very weak and intermittent and at its eastern extremity shows as two parallel anomalies 5m apart.

4.4 From the X-Y trace plot it can be seen that several sharp peaks occur within, or immediately adjacent to, Anomaly **B**, which is also divided into eastern and western halves.

4.5 Anomaly **C** is a faint curvi-linear anomaly. It is "masked" by an area of magnetic disturbance at its eastern end.

4.6 Two small $5m^2$ anomalies, **D** and **E**, can be seen at the southern end of the site. The response from **D** is much stronger than from **E** but both have a peak in the response in the centre of the area encompassed by the anomaly.

4.7 Two parallel anomalies, **J** and **K**, orientated north to south and 35m apart can be seen in the eastern extension of the area.

4.8 Seven curvi-linear negative anomalies, two of which occur as pairs, have also been identified. Only **L**, **M**, and **N** are labelled on Figure 3.

4.9 Four clusters of isolated positive anomalies, **F**, **G**, **H** and **I** were noted.

4.10 A very weak circular anomaly, **O**, can be seen at the extreme north-eastern edge of the site.

5. Discussion

5.1 The gradiometer survey was located over the eastern edge of a complex area of cropmarks thought to be Iron Age or Romano-British in date (See Section 2.3). Linking the enclosure system adjacent to Herdborough House to the current survey area is a trackway running from east to west. To the north of the trackway are at least four rectangular enclosures measuring 50m by 20m (see Fig. 1) while to the south is a single square enclosure $40m^2$. Of these cropmark features only the double ditched trackway (Fig. 3 - Anomaly **A**) has been the detected by the gradiometer. The remainder of the positive linear anomalies, with the exception of **C**, are also thought to be due to infilled cut features but it is not readily apparent whether they are natural or man-made, or if they are man-made, whether they are ancient or modern.

5.2 The strongest response is that given by Anomaly **B** which was not observed as a cropmark although it is on the same alignment to those features which have been identified in this way. The number of "spikes" in or adjacent to it suggest that it might be an infilled hedge boundary; ferrous material often collects or is thrown into hedge bottoms. The first edition Ordnance Survey map (see Fig. 4) shows that this is in fact the case.

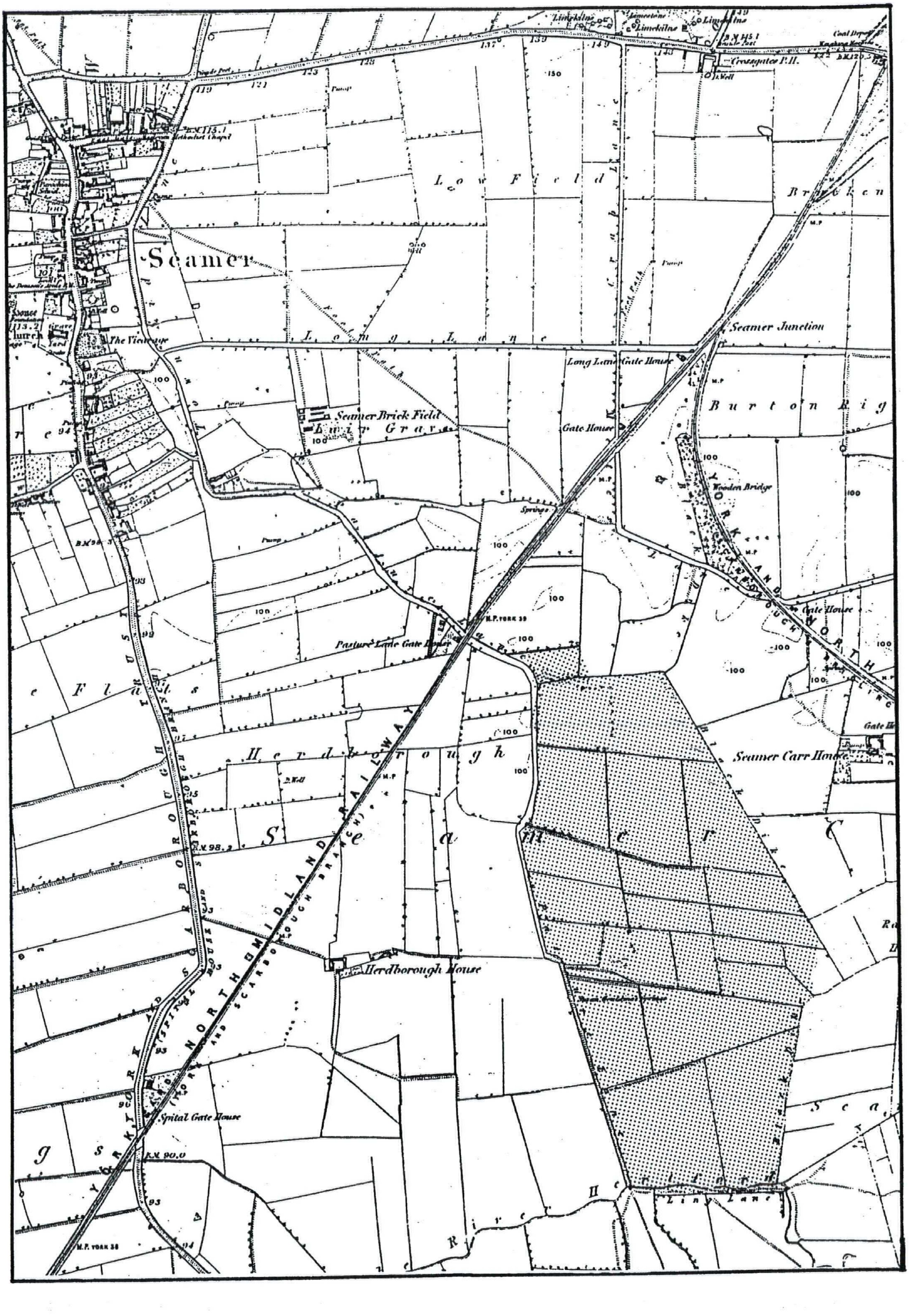

Fig. 4 1st Edition Ordnance Survey showing extension area

5.3 Of the two parallel linear anomalies **J** and **K** the former is in approximately the same place and orientation as one of the cropmark features. However, unlike the cropmark it continues to the south of the trackway. These are probably ditches forming part of the cropmark complex.

5.4 The size and shape of Anomalies **D** and **E** is not inconsistant with their interpretation as square barrows which are known to extend as far north as the Scarborough area (*pers. comm* P. Cardwell). The shape and size of the high response in the middle of the anomalies indicate that it is possibly caused by magnetically enhanced material such as fired clay rather than ferrous material which would have resulted in larger, spikier response. Interestingly both these "features" are located within the D-shaped enclosure (not detected in the gradiometer survey) south of the trackway.

5.5 The responses from the clusters of isolated positive anomalies also indicate a non-ferrous origin. Again they could be due to burnt features such as hearths or kilns, where soil has been magnetically enhanced by heating, or by pits filled with enhanced soil. Only Anomaly **H** falls within the D-shaped enclosure.

5.6 The curvi-linear anomalies **L**, **M** and **N** show as negative features because the material within them is less magnetic than the surrounding topsoil. These are thought to be silted up streams (palaeo-channels), as is Anomaly **C**.

5.7 The lack of success in detecting the cropmark features is typical of sandy soils in the Vales of York and Pickering and is probably a combination of the lack of contrast between the topsoil and the fill of the features (due perhaps to a low susceptibility of the glacial drift material) coupled with a variable depth of overlying topsoil.

6. Conclusion

6.1 Of the cropmark features thought to be part of an enclosure system only the trackway north of the D-shaped enclosure was detected during the current survey. However, supporting evidence for the existence and orientation of an enclosure system linked by the trackway is given by the first edition Ordnance Survey map which shows that the orientation of the fields in 1850 was, as it still is albeit with fewer divisions, aligned roughly on the points of the compass; the same as the cropmark features. This stongly suggests that the more recent hedge boundaries followed the line of the much earlier ditch layout. Although the survey has shown that anthropogenic features can be detected on the prevailing soils and geology by gradiometry it does not explain why one field boundary extant in 1850 (Anomaly **B**) is clearly detected while two others, extant at the same time but likewise ploughed out now, were not. One explanation could be that the undetected boundaries were hedges with no ditches whereas those that were detected followed the line of the much earlier ditched system. The depth of topsoil could also affect the strength of response from an anomaly so that it might remain undetected.

Acknowledgements

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	September 1996

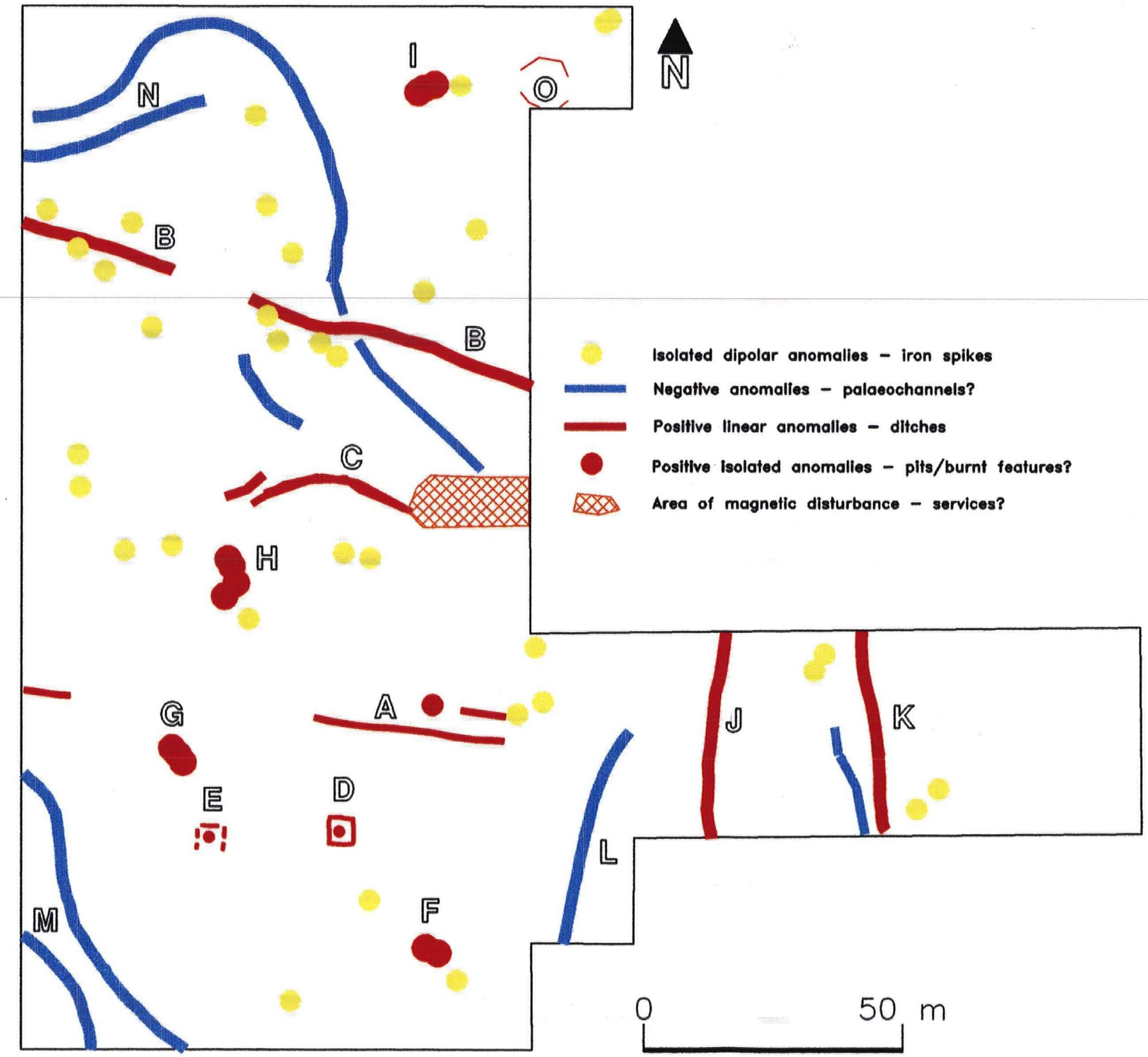

Fig. 3 Interpretation of the gradiometer data

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Dot Density Plot, X-Y Trace Plot & Grey Scale Plot not scanned
Please see Parish File for originals