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FLUXGATE GRADIOMETER SURVEY
LAND SOUTH OF WINTON ROAD: PHASE D, CHAPEL HEATH, NAVENBY, LINCOLNSHIRE.

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LAND SOUTH OF WINTON ROAD: PHASE D, CHAPEL HEATH, NAVENBY, LINCOLNSHIRE.

Report prepared for Ploughsound Ltd.
by James Gordon Snee BSc.

Pre-Construct Geophysics
61 High Street
Newton on Trent
Lincoln
LN1 2JP
Tel. & Fax. 01777 228129

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Summary

- *A fluxgate gradiometer survey was undertaken to evaluate the archaeological potential of land south of Winton Road: Phase D, Chapel Heath, Navenby, Lincolnshire.*

- *The survey detected a strong pattern of magnetic variation, the majority of which was caused by geological formations (reticulation within the limestone bedrock).*

- *A pattern of ploughing was detectable from the survey results, in addition to a number of strong anomalies associated with the construction of houses in neighbouring land.*

- *Four large linear anomalies were detected, which may have archaeological potential, and a number of small discrete positive anomalies that could also be of some archaeological significance were also detected.*

Fig.1 Site location. Scale 1:10,000.

Fig.2 Plan showing location of survey grid. Scale 1:1250.

1.0 Introduction

A fluxgate gradiometer survey was commissioned by Pre-Construct Archaeology (Lincoln), on behalf of Ploughsound Ltd. to evaluate the archaeological potential of land south of Winton Road, Navenby, Lincolnshire. This work was undertaken as part of an application for outline planning permission for residential development.

This survey was carried out in accordance with an archaeological project brief issued by the Heritage Officer, and a specification prepared by Pre-Construct Archaeology: dated June 1999. It also followed the guidelines set out in the English Heritage document *'Geophysical Survey in Archaeological Field Evaluation'*, 1995. Consideration was taken of the recommendations set out in the Lincolnshire County Council Archaeology Section publication *'Lincolnshire Archaeological Handbook; A Manual of Archaeological Practice'*, 1998.

2.0 Location and description

Navenby is in the administrative district of North Kesteven approximately 10km south of Lincoln. The proposed development site, an irregular unit of agricultural land measuring approximately 4.4 hectares, is in the south-east of the village and centres on NGR SK ~~59887 35725~~ 9910 5728

The land is agricultural and currently in set aside and has recently been disked. It is bounded by hedges to the east, with a belt of trees to the south. To the north and west there is recently constructed housing.

The geology of the area consists of limestone bedrock over which lies varying depths of brash, sand and gravel, and plough soil.

The area surrounding the current survey has been subject to a number of archaeological investigations of varying types, from the mid-1990 s onwards. These have identified part of a Romano-British ribbon development along Ermine street which lies a little way to the east. To the north and north-east there is strong evidence of at least one Iron Age enclosure and a ceremonial site that appears to have been active from the Bronze Age to the Anglo-Saxon period. To the west there is evidence of Late Bronze Age / Early Iron Age and Romano-British activity. Fieldwalking of the current site identified sparse scatters of artefacts dating from the prehistoric to the medieval periods, although there was a concentration of Romano-British pottery on the south-east edge of the site.

3.0 Methodology

Detailed area survey using a fluxgate gradiometer is a non-intrusive means of evaluating the archaeological potential of a site. The fluxgate gradiometer detects magnetic anomalies caused by areas of high or low magnetic susceptibility. These

areas are caused by changes in the composition of the subsoil or the underlying geology. Archaeological features are the result of man-made changes to the composition of the soil and the introduction of intrusive materials such as brick and stone. These features will create detectable magnetic anomalies. In addition, activities which involve heating and burning will create magnetic anomalies as will the presence of ferrous metal objects. By examining the anomalies detected by a fluxgate gradiometer survey, geophysicists can often translate the data into archaeological interpretation.

The area survey was conducted using a *Geoscan Research* fluxgate gradiometer (model FM36) with an electronic sample trigger set to take 4 readings per metre (a sample interval of 0.25m). The zigzag traverse method of survey was used, with 1m wide traverses across 30m x 30m grids. The base line was established by measuring out from the southern and western field boundaries. The sensitivity of the machine was set to detect magnetic variation in the order of 0.1 nanoTesla.

The data from the survey was processed using *Geoplot* version 3.0. The data was desloped (a means of compensating for sensor drift during the survey by subjecting the data to a mathematical bias sloping in the opposite direction of the bias created by sensor drift). The data was clipped to reduce the distorting effect of extremely high or low readings caused by ferrous metals on the site, and the result was plotted as a number of greyscale images (smoothed on Fig. 2, unsmoothed on Fig. 3).

The survey was carried out by Mr D Bunn and the writer, between the 19th and 22nd July 1999. The weather was variable with spells of bright sunshine, occasional showers and persistent gusty winds. The area surveyed measured approximately 3.7 hectares.

4.0 Results

The site displayed a large degree of magnetic variation (Figs. 3, 4 & 5). This was largely due to the geology of the area; the reticulation caused by natural fractures in the limestone bedrock. This was compounded by the effect of ploughing which showed on the greyscale as faint striations oriented approximately east to west. There were also a number of areas of modern disturbance. Rubble that had been scattered on the edges of the site from adjoining house building was detected (Fig. 6 : 1,2 & 3). The survey detected a number of tracks produced by heavy machinery; probably due to the increased concentration of limestone fragments caused by soil compaction (Fig. 6 : 4 to 8).

Relatively few magnetic anomalies of archaeological significance were detected. A small curvilinear anomaly (Fig. 6 : 9) was detected in the north-west corner. This may be the result of a particularly strong natural anomaly or it may be the result of a ditch (possibly as part of an enclosure). In the south-east corner was a larger linear anomaly which may have been caused by a ditch, possibly for an enclosure. Close to this were two other less prominent anomalies, which may be part of the natural reticulation, but they may be caused by the presence of linear ditches (Fig. 6 : 11 & 12).

Fig.3 Smoothed greyscale image. Scale 1:1000

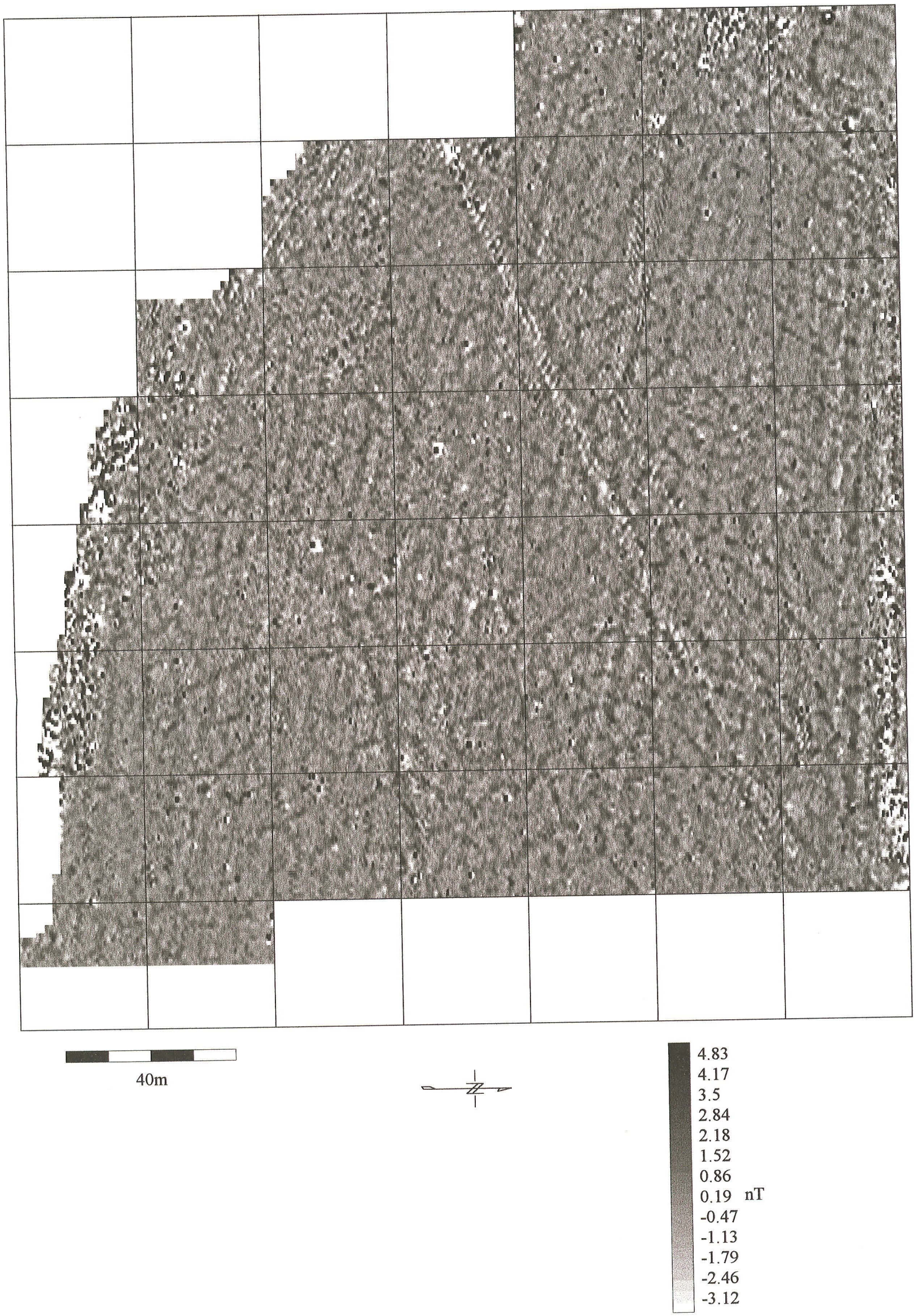


Fig.4 Unsmoothed greyscale image. Scale 1:1000

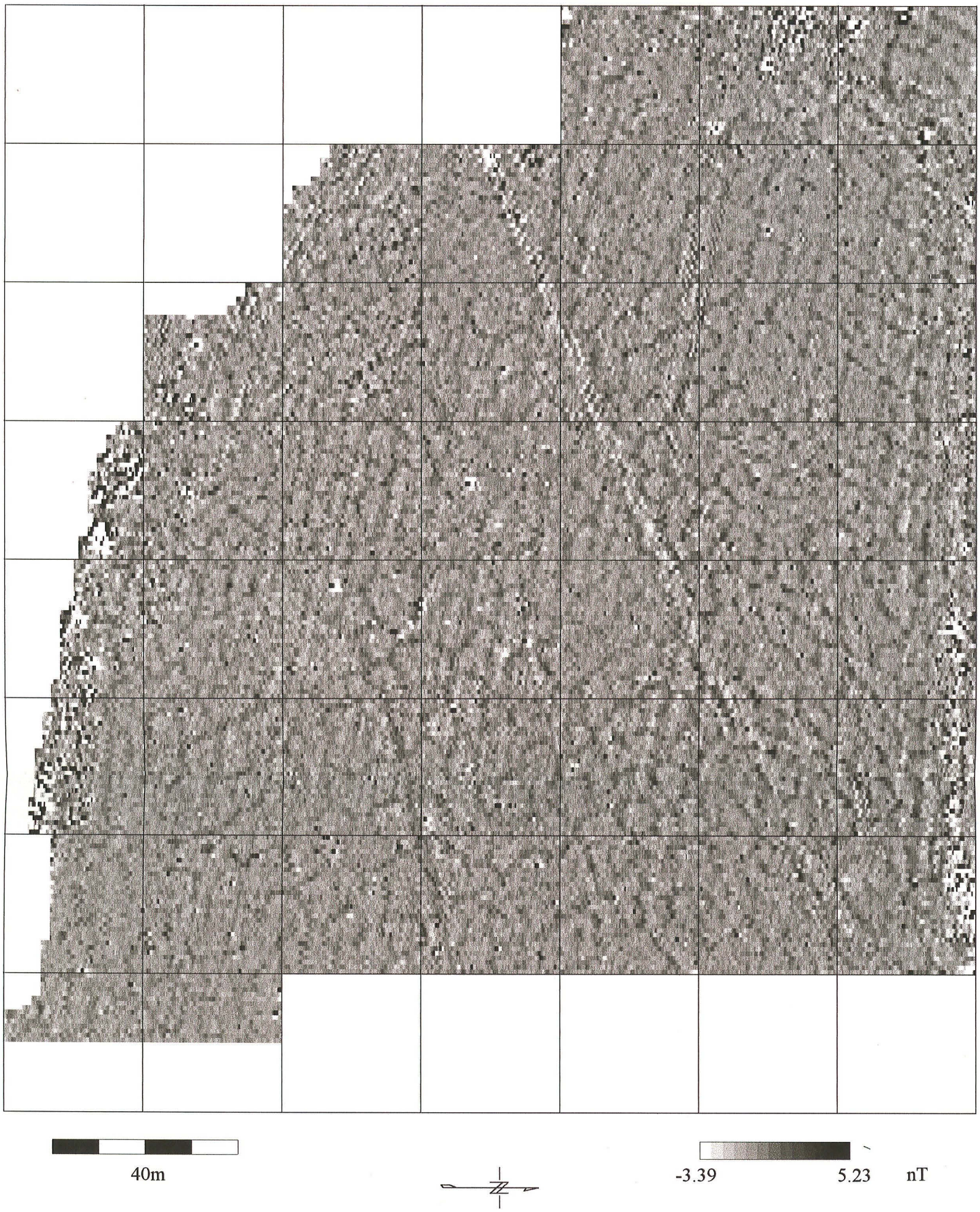


Fig.5 Unclipped greyscale image. Scale 1:1000

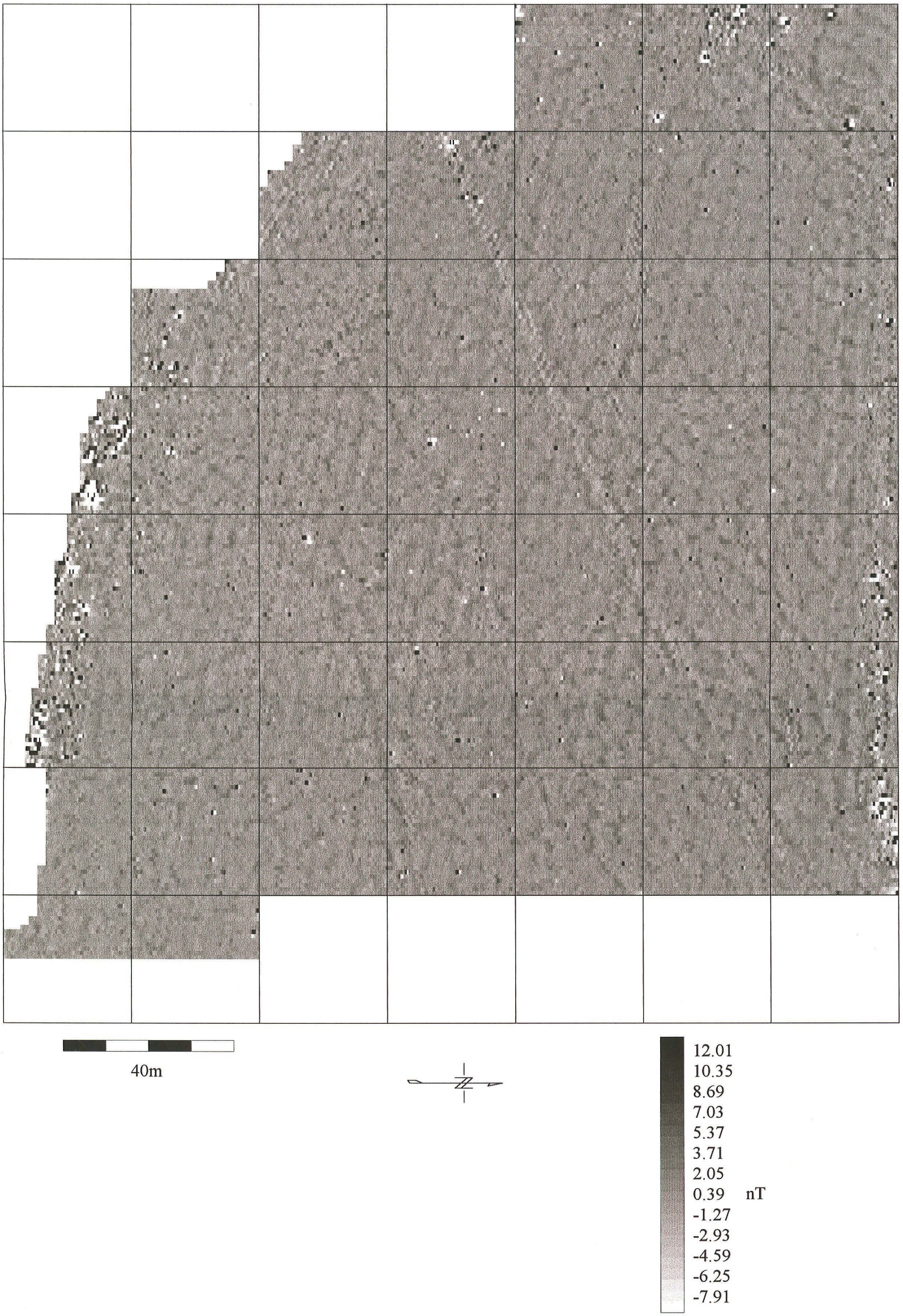
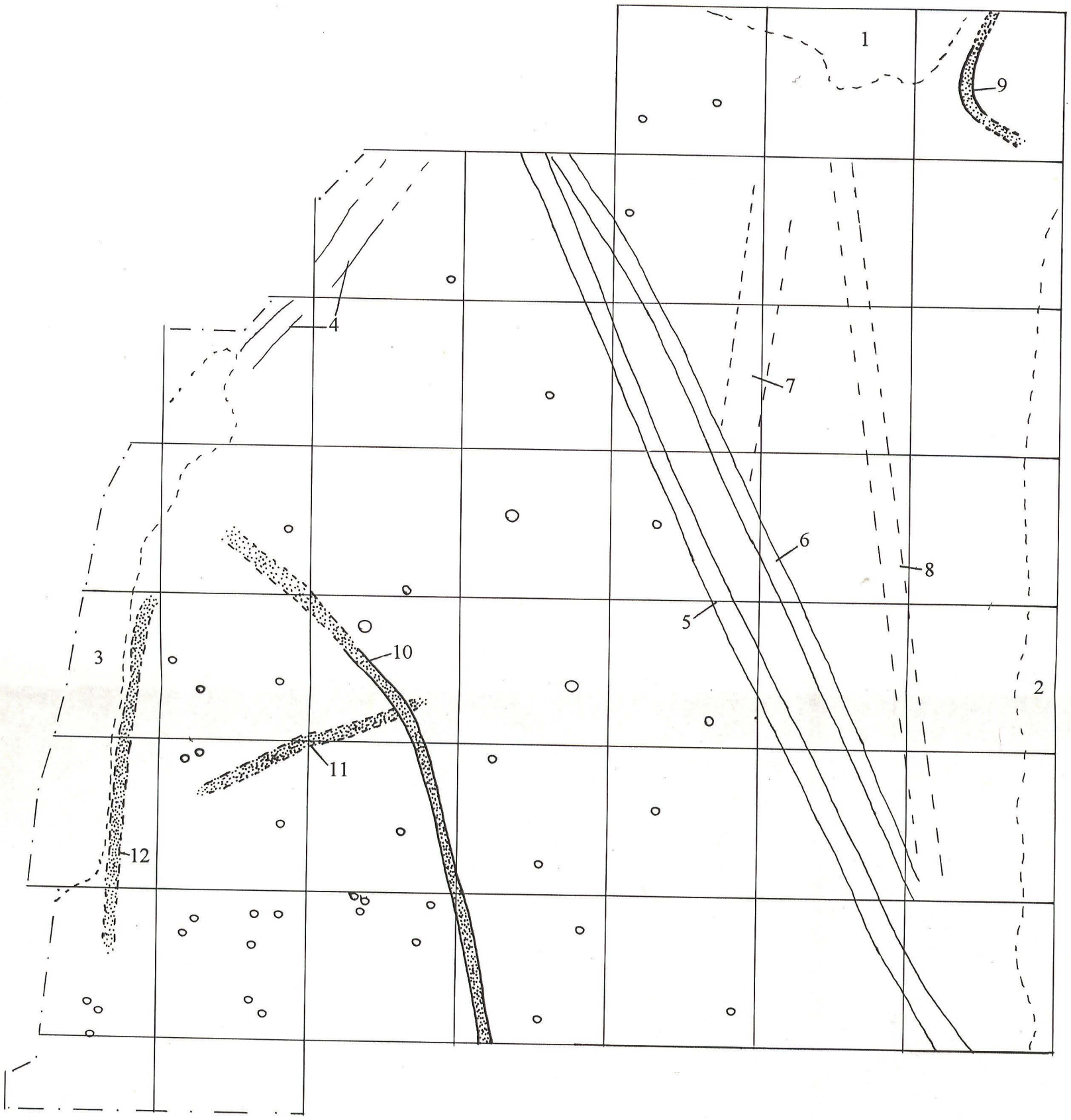
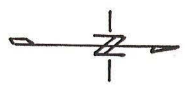


Fig.6 Plan showing interpretation of anomalies. Scale 1:1000.



13 (Small discrete anomalies)



Across the whole of the survey area were a number of small discrete positive or dipolar (positive and negative) anomalies. It is likely that the majority of these are caused by pieces of ferrous debris in the topsoil (particularly the dipolar anomalies) but it is possible that some of these may represent small pits. These anomalies appear more concentrated in the south-west quarter of the site (Fig. 6 : 13).

5.0 Conclusions

The general pattern of magnetic variation detected in this survey is mainly the result of natural reticulation and ploughing (probably starting in the medieval period). A certain amount of modern disturbance was also detected.

Four linear anomalies were detected that may be archaeologically significant, although the natural variation makes interpretation difficult.

The detection of dipolar anomalies is a common feature during magnetometer survey, as ferrous objects (litter) are often encountered in topsoil. That said, the possible pits detected during the survey may have some archaeological significance.

Detailed survey by fluxgate magnetometer is only capable of detecting features that alter the magnetic susceptibility of soils or are magnetically different to the soils around them. It remains a possibility that there are archaeological features within the survey area that are not detectable.

6.0 Acknowledgements

Pre-Construct Geophysics would like to thank Ploughsound Ltd for this commission.

7.0 Appendices

7.1 References

Clark, A J — 1990 *'Seeing beneath the soil.'*

David, A — 1995 *Research & Professional Services Guidelines No 1; 'Geophysical Survey in Archaeological Field Evaluation.'*

Gaffney, C, Gater, J & Ovenden, S — 1991 *IFA Technical Paper No 9; 'The use of Geophysical techniques in archaeological evaluations.'*

Orr, K — 1998 *Archaeological Project Brief for Geophysical Survey as Part of an Evaluation.*

Palmer-Brown, C P H — 1999 *Specification for an Archaeological field*

7.2 Summary of survey parameters

Instrument:	Geoscan Research Fluxgate Gradiometer FM 36 with Sample Trigger ST1.
Resolution:	0.1 nT
Grid size:	30m x 30m
Sample interval:	0.25m
Traverse interval:	1m
Traverse method:	Zig-Zag