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GRIMES GRAVES NEOLITHIC FLINT MINES, NORFOLK REPORT ON GEOPHYSICAL SURVEY, NOVEMBER 1992

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Summary

The proposed extension of the car park at Grimes Graves necessitated the use of geophysical survey in an attempt to locate any archaeological features endangered by the development. Although the conditions for survey proved not to be ideal the results suggested that major features are probably not present.

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GRIMES GRAVES, NEOLITHIC FLINT MINES, NORFOLK.

Report on Geophysical Survey of proposed car-park area.

INTRODUCTION

A geophysical survey was carried out at Grimes Graves, Norfolk, at the request of Historic Properties Midlands Region in order to locate any areas of potential archaeological significance prior to planned improvements to the visitor facilities. An area of roughly 4 hectares was surveyed (centered at NGR TL 8155/9000), extending north-west from the main concentration of prehistoric mineworkings (see Fig. 1). This land is expected to be affected by a proposed expansion of the carpark. No surface remains of flint-mines are mapped in the area, but the possibility that further unrecognised shafts or traces of associated settlement might be present had to be considered.

The site is situated on a stretch of uncultivated sandy heathland, 5 miles north-west of Thetford in south-west Norfolk. Breckland sand overlies boulder clay deposited over chalk.

Previous Geophysical Surveys

A major campaign of geophysical survey was carried out at Grimes Graves in the 1970s as part of a joint[1] research project, sponsored by the British Museum, designed to explore areas of formerly cultivated land beyond the main concentration of visible mine workings (Sieveking *et al* 1973). The survey programme was intended to test the applicability of different methods to the study of the site and the local soil conditions. Limited excavations were also undertaken to test the results of these. Conventional resistivity and magnetic surveys were carried out under the supervision of the Ancient Monuments Laboratory.

In 1970, a preliminary resistivity survey employing a Martin Clark meter, using a Wenner array and 1.5m probe spacing, was carried out over extant hollows and levelled mine-shafts visible as grassmarks. A low resistance response was obtained in all cases from the upper soil fillings of the levelled pits, and a high resistance response from the rubble fills of the extant pits. There were also indications that the survey was picking up traces of rubble spoil heaps surrounding the openings of the mineshafts.

This work was followed up in 1972 by a much larger scale resistivity survey to the west of the main concentration of visible mine workings (see Fig. 1). This second survey, which employed the Wenner and Double Dipole probe arrays and two probe spacings (1.0m and 2.0m) was complicated by the complex superficial geology of the site[2]. The results, though confused, did show some indication of buried mineshafts - again based on high resistance anomalies presumed to have arisen from rings of upcast material spread around the pit openings. There may be some doubt about this interpretation, however, as the data was heavily filtered, a process which can lead to misleading \`artefacts' in the data; the findings of the test excavations were not always consistent with the geophysical interpretation.

The Ancient Monuments Laboratory also carried out trial surveys with a Plessey Fluxgate Gradiometer in 1972, with the object of locating occupation activity associated with the industrial complex. These met with limited success, although levelled pits clearly visible as areas of strong grass growth on aerial photographs, and therefore of the type with an upper accumulation of topsoil, were just detectable. Although it was concluded that conditions at Grimes Graves were not ideal for magnetic detection, none of those areas subsequently tested by excavation proved to be very rich in occupation remains.

Despite these results, it was considered that a larger scale fluxgate gradiometer survey using a more sensitive and stable instrument was appropriate in the present circumstances. Time did not allow for the use of further resistivity survey.

METHODS

i) Magnetometry - Figs 2 & 3

The area selected for survey was divided up into a grid of 30x30m squares (see Fig. 1). Each square was then surveyed using a Geoscan FM36 fluxgate gradiometer carried zig-zag fashion along successive 30m long traverses spaced 1m apart. The variation in the vertical magnetic field gradient was recorded in the internal memory of the FM36 at intervals of 25cm along each traverse with the aid of an ST1 sample trigger. Periodically the data was transferred in the field to floppydisk on a portable microcomputer providing facilities for viewing the results. The data was subsequently transferred in the laboratory to a Tektronics XD88 workstation where advanced processing was carried out, and a range of display options are available for presenting the data. The plots supplied in the back of this report represent an appropriate selection from the full range of display options.

ii) Magnetic Susceptibility (MS) - Fig. 4

The magnetometer survey was backed up by MS measurements obtained in the laboratory from 56 samples of topsoil collected at 30m intervals on survey grid intersections. The soil was dried at room temperature and sieved through a 1mm mesh. Mass specific measurements were then obtained using a Bartington MS1 susceptibility bridge and MS2-B laboratory sensor. MS survey can detect areas (rather than features) where sustained burning has taken place in antiquity, indicative of the former presence of prehistoric settlement.

RESULTS

The magnetic signal throughout the area surveyed is generally subdued and unexceptional, and anomalies that may be related to archaeological remains are all but absent. That this response reflects genuine absence of substantial buried features is suggested by the MS values for local topsoil. These are low (ranging from 14 to 45, with a mean value of 28.39 x 10^{-8} SI units/Kg), but heating experiments indicate that the soil nevertheless develops substantial MS after heating. This implies that sustained burning, as might be expected on an occupation site, has not taken place. However, this evidence cannot discount the possible presence of more ephemeral settlement activity; and it is also certainly possible that the magnetic signal from small features, such as post holes, is beyond the resolution of the magnetometer.

Vague indications of several roughly parallel linear features occur in the north-western edge of the survey (squares E-F1) and correspond with a general increase in magnetic susceptibility. These anomalies, although very tenuous, may be archaeologically significant (possibly open-cast mine-workings), but may also be peri-glacial/geological or result from modern activity associated with a meteorological station 75m to the west. The remaining anomalous activity detected (in squares E6, D6-7 and E1-2) is derived from the modern roadway and other recent disturbances. Some of this latter activity probably represents ferrous and baked material associated with an earlier incomplete carpark construction project.

Evidence for mineshafts

No obvious further mineshafts have been detected with confidence; however, a slight increase in the intensity of the magnetic field occurs in part of square B5, and may cautiously be assigned to a local deepening of the topsoil, perhaps the infilled hollow of an unrecorded shaft. However, it should be cautioned that, whilst the magnetometer might be expected to respond to such infillings, it may not do so over other shafts where the fill is sterile of magnetically enhanced material (ie containing chalk rubble alone).

CONCLUSIONS

A substantial sample of the guardianship area has now been surveyed and, together with the results of previous surveys, provides some tentative indications of sub-surface activity. Conditions for geophysical survey have proved to be far from ideal, however.

The results of the 1992 magnetometer survey suggest that there is little evidence for mining or other activity in the area covered. Some caution is required in this conclusion, however, owing to the inability of magnetometry (and, indeed, resistivity survey) to detect minor features. It seems unlikely that there are major features such as infilled mine shafts present (except perhaps in grid square B5, see above), although more extensive resistivity survey would be required to lend confirmation to this conclusion.

Surveyed by : M Cole & A Payne — November 1992

Report by : A Payne — July 1993

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NOTES

1. The geophysical component of the 1972 project was a collaborative effort between the Geophysics Section of the Ancient Monuments Laboratory (magnetometer and resistivity survey by A. J. Clark and D. Haddon-Reece), the Geophysics Section of the Department of Geology, Imperial College (gravimetric analysis, magnetic and resistivity measurements by Mr. J. Milson and Dr. John Ferguson), the Department of Geophysics, Institute of Geological Sciences (seismic surveying by Mr. P. Grainger and Mr. D. Shackleton) and the Oxford Research Laboratory for Archaeology (resistivity survey by Mrs A. Millet).

2. Geological conditions are complicated by changes in the depth of the sand overlying the chalk, and by fossil periglacial features.

Reference

Sieveking, G de G, Longworth, I H, Hughes, M J, Clark, A J, and Millet, A, 1973 A new survey of Grimes Graves, *Proc Prehist Soc*, **39**, 182-218

PLANS ENCLOSED

1. Location of geophysical surveys 1992 & 1972 (1:2500 scale)

2. Grey-scale plot of raw 1992 magnetometer data (1:2500) in locational context.

3. Plots of 1992 raw (range truncated) magnetometer data (1:1250)

4. Grey-scale plot of magnetic susceptibility data (1:2500) in locational context.

GRIMES GRAVES

Magnetometer Survey 1992

LOCATION

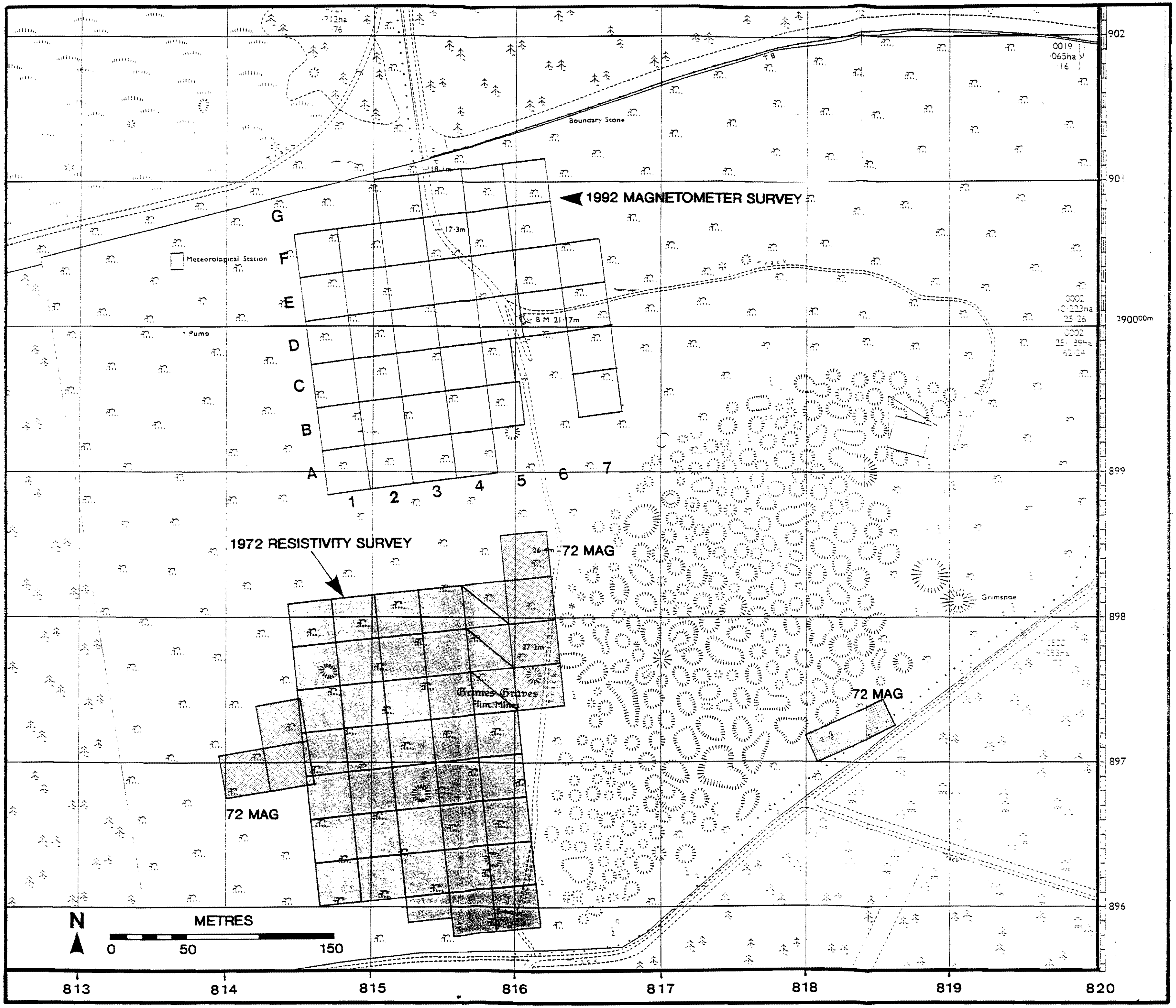

FIG. (1)

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GRIMES GRAVES

Magnetometer Survey 1992

LOCATION

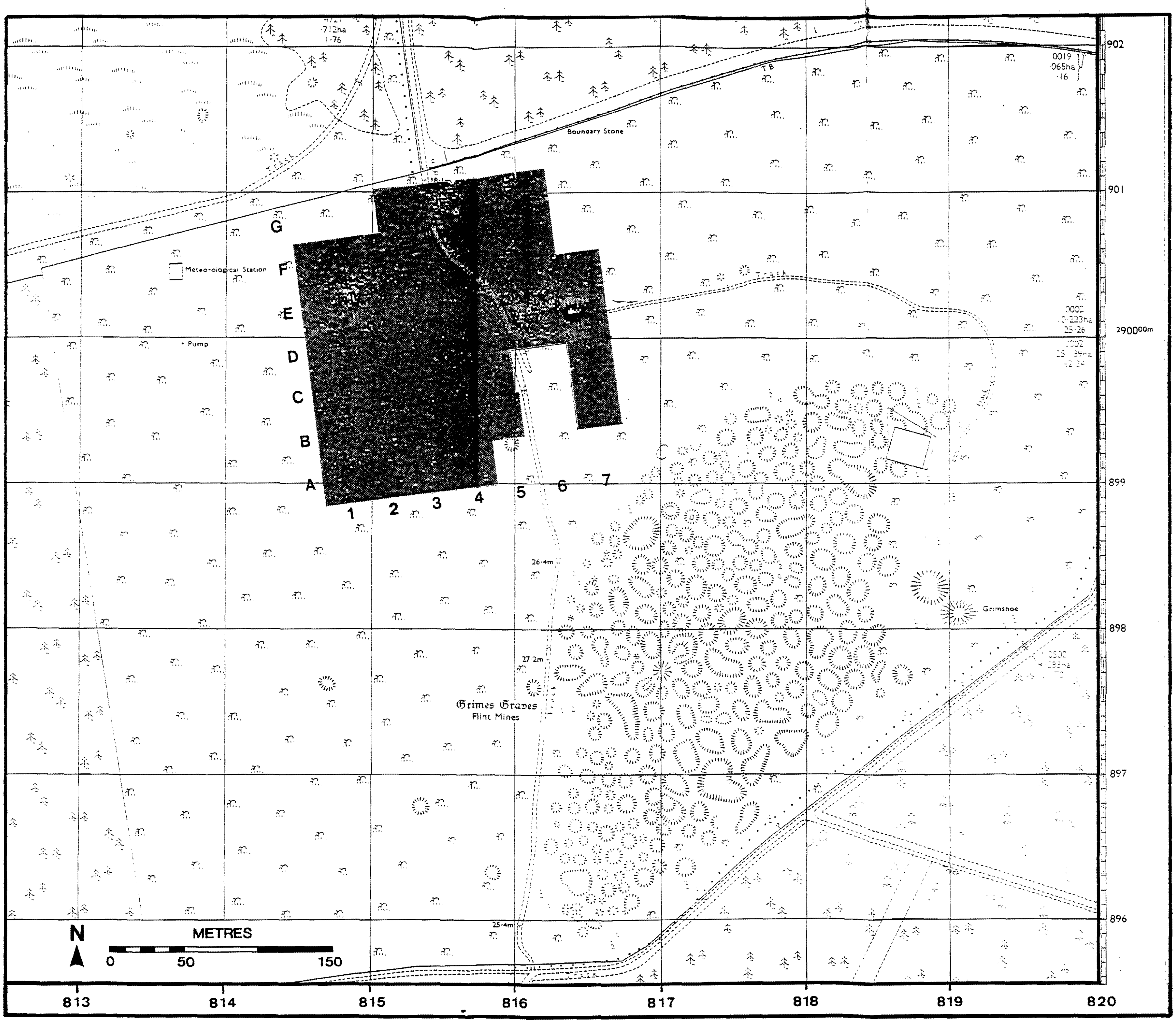

FIG. (2)

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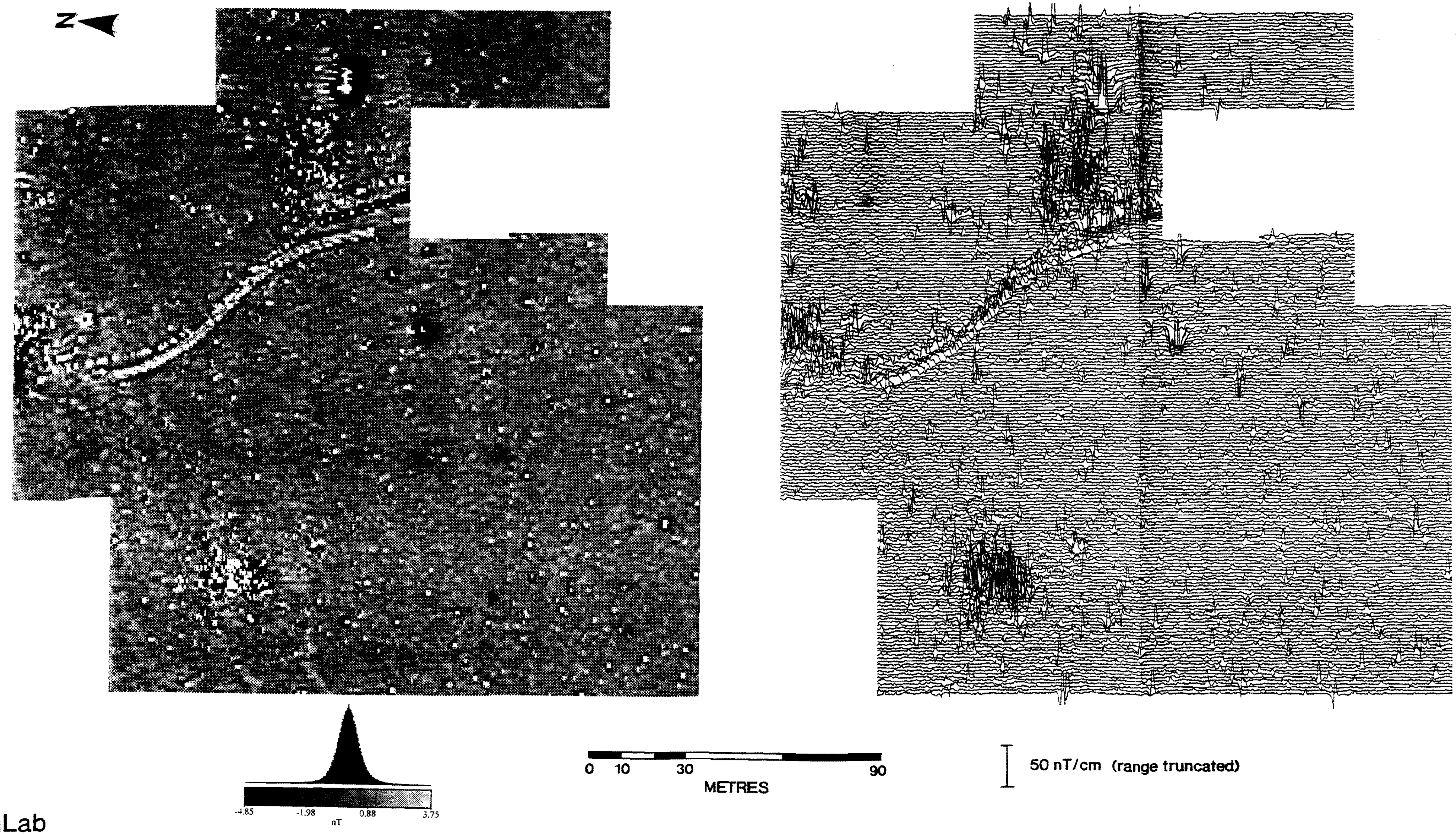
GRIMES GRAVES Magnetometer Survey 1992

FIG. (3)

a) Greyscale - raw data

b) X-Y traceplot - raw data



AMLab

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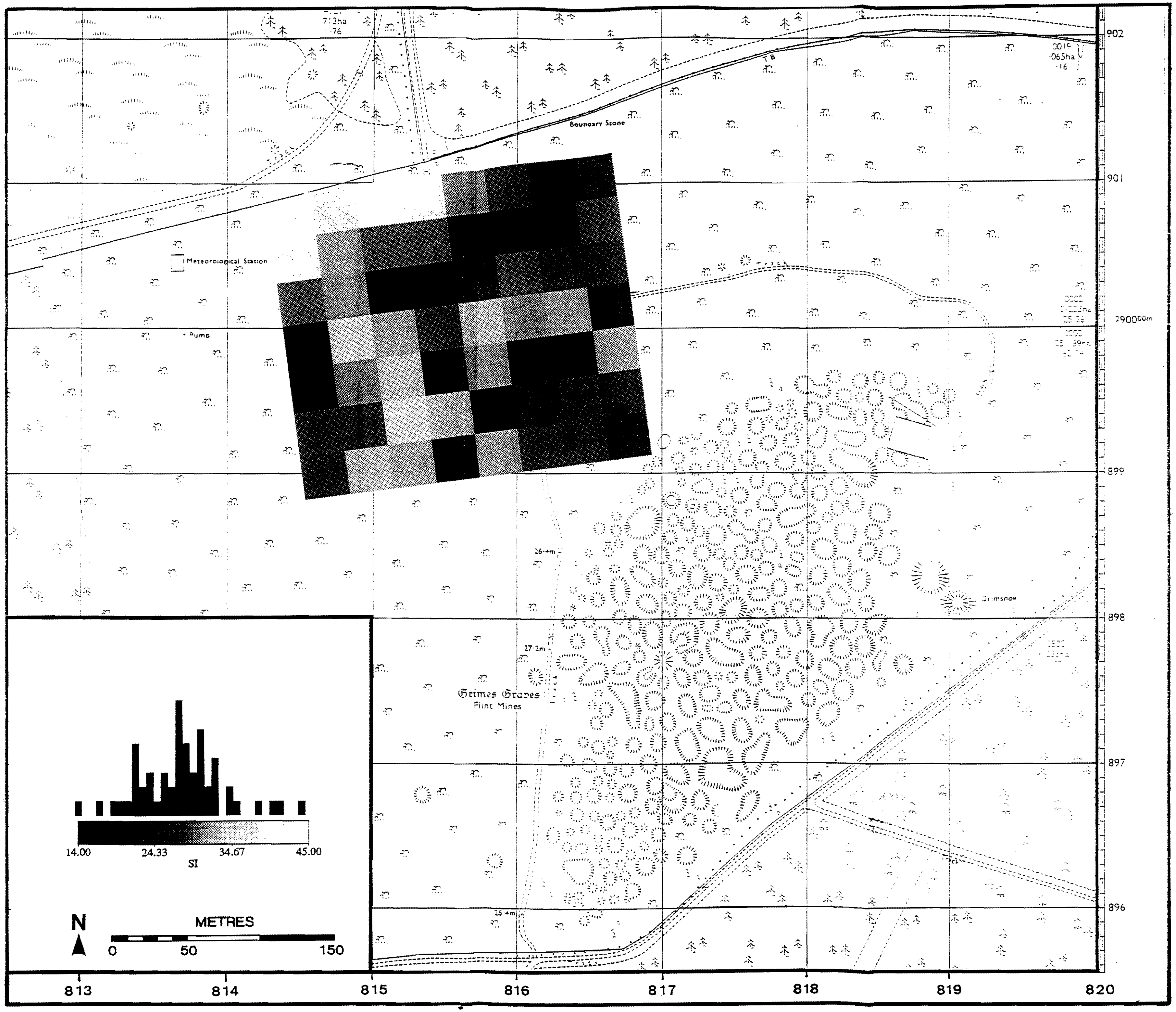
Magnetic Susceptibility

(Volume specific units)

FIG. (4)



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