Spalding Bypass Materials Extraction Site, Lincolnshire
Magnetic Susceptibility and Magnetometer Survey

(Survey Ref: 0270693/SPL/LAS)

Produced by
OXFORD ARCHAEOTECHNICS LIMITED
under the direction of
A.E. Johnson *BA(Hons)*

Commissioned by
Lindsey Archaeological Services
on behalf of
Birse Construction Limited (Spalding)

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Oxford Archaeotechnics

Specialist Field Evaluation

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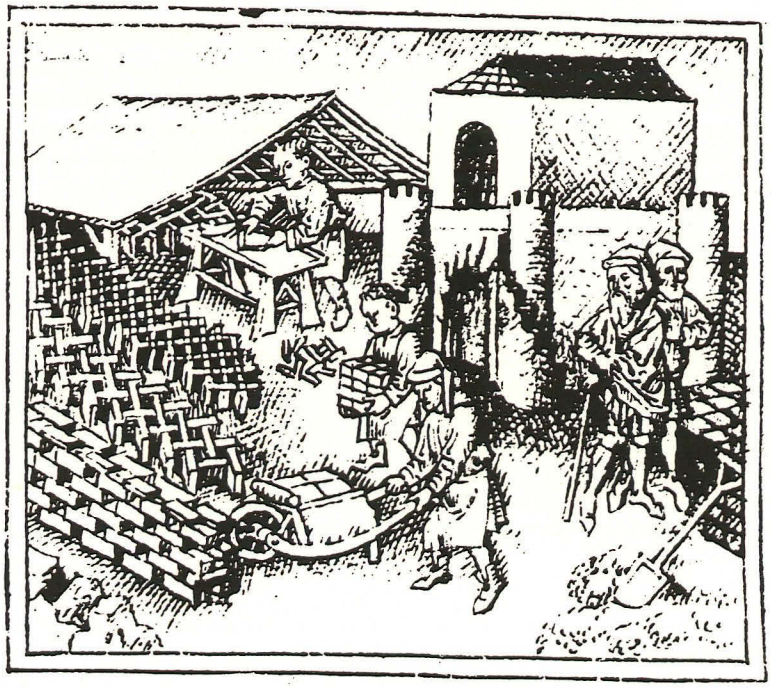
MEDIEVAL BRICKMAKING c.1425



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1. INTRODUCTION

1.1 A field evaluation programme, comprising magnetic susceptibility field sensing, magnetometry, and the extraction by hand auger of topsoil and subsoil samples, was commissioned by Lindsey Archaeological Services on behalf of Birse Construction Limited (Spalding) in advance of the proposed extraction of consolidation material for the new Spalding bypass. The geophysical survey work was carried out at the end of June 1993.

1.2 The Survey Area, (centred at TF 2465 1950) lies c.2.5 km southeast of Spalding. It covers an area of just over 15 ha, comprising a 200 m wide by c.800 m long strip, bounded on the north by the fenceline of the new bypass (under construction at the time of survey) and on the west by the modern A 1073 road (Barrier Bank) (Fig. 1). Two substantial modern drainage cuts run northwest-southeast across the Survey Area; the most westerly terminates some 50 m short of the northwest angle of the Area. The extreme southwestern corner was crossed by high tension power cables (which posed no problems to magnetic susceptibility survey, but produced interference to magnetometry in close proximity to the pylon).

1.3 At the time of the survey, the majority of the land was agricultural set-aside with a considerable amount of self-seeded cereal present, together with grasses and a variety of weeds. Surface ground conditions were generally dry, but with local moist patches. There were substantial areas of sunbaked uneven ground which required levelling prior to survey; in the case of the magnetometer (gradiometer) survey area, this was done by tracking over the ground with a mechanical excavator.

1.4 The Survey Area lies within a zone of silt fen geology; from published accounts, it was expected that the site is underlain by various marine and alluvial silts, with the possibility of localised peat accumulation (but deep and broad spreads of fen peat are not likely).

1.5 The documentary background to the fieldwork, comprising basic Sites and Monuments Record (SMR) data, aerial photographic plots and information from historic maps, was supplied by Lindsey Archaeological Services (Field & Tann 1993).

1.6 The Lincolnshire County Sites & Monuments Record (SMR) has noted cropmarks within the southwestern half of the Survey Area, possibly representing the ditches of a small farmstead (PRN 22341). Photographs held by the Cambridge University Collection of Air Photographs showing these cropmarks have been recently computer-rectified and plotted (Palmer 1993); only photographs covering the southwestern half of the Survey Area were examined. The plot shows a number of ditches following a general southwest-northeast trend, together with a sharp-angled six-sided enclosure (a flattened hexagon shape) (centred at TF 2428 1927) with a smaller ovoid enclosure adjoining its northern side, plus associated ditches, a particularly uncharacteristic shape in this Fenland landscape.

1.7 The air photographs have also enabled the mapping of soil changes, together with the location of underlying silted roddons, features which would have provided areas of slightly higher ground which may have been suitable for former settlement within the low lying silt fens. Extensive field drains and an area of possible quarrying were also noted.

1.8 The geophysical programme commenced three days before the Lindsey Archaeological Services evaluation trial trenching, and continued during the following week in which the machine trenches were being dug. Close liaison enabled optimum use of resources, allowing the immediate investigation by machine trenching of specific magnetic targets, combined with an on-going surveying programme. The opportunity was also taken to examine the magnetic identity of the fills of several features revealed by excavation, a number of which had produced substantial magnetic patterning in the overlying topsoils.

2. MAGNETIC TECHNIQUES

General Principles

2.1 It is possible to define areas of human activity (particularly soils spread from occupation sites and the infill of cut features such as pits or ditches) by means of *magnetic survey* (Clark 1990; Scollar et al. 1990). The results will vary, according to the local geology and soils (Thompson & Oldfield 1986; Gale & Hoare 1991), modified by past and present agricultural practices. Under favourable conditions, areas of suspected archaeological activity can be accurately located and targeted for further investigative work (if required) without the necessity for extensive random exploratory trenching. Magnetic survey has the added advantages of enabling large areas to be assessed relatively quickly, and is non-destructive.

2.2 Topsoil is normally more magnetic than the subsoil or bedrock from which it is derived. Human activity further enhances the magnetic properties of soils locally, and amplifies the contrast with the geological background. The main enhancement effect is the increase of *magnetic susceptibility*, by fire and, to a lesser extent, by the bacterial activity associated with rubbish decomposition; the introduction of materials such as fired clay and ceramics - and, of course, iron and many industrial residues - may also be important in some cases. Other agencies include the addition and redistribution of naturally magnetic rock such as basalt or ironstone, either locally derived or imported.

2.3 The tendency of most human activity is to increase soil magnetic susceptibility. In some cases, however, features such as traces of former mounds or banks, or

imported soil/subsoil or non-magnetic bedrock (such as most limestones), may show as zones of lower susceptibility in comparison with the surrounding topsoil.

2.4 Archaeologically enhanced susceptibility of soils is thus a response of the parent geological material to a series of events which make up the total domestic, agricultural and industrial history of a site, usually over a prolonged period. Climatic factors may subsequently modify the susceptibility of soils, but in the absence of strong chemical alteration (e.g. during the process of podzolisation), magnetic characteristics may persist over millions of years.

2.5 Both the magnetic contrast between archaeological features and the subsoil into which they are dug, and the magnetic susceptibility of topsoil spreads associated with occupation horizons, can be measured in the field.

2.6 There are several highly sensitive instruments available which can be used to measure these magnetic variations. Some are capable, under favourable conditions, of producing extraordinarily detailed plots of subsurface features. The detection of these features is usually by means of a *magnetometer* (normally a fluxgate gradiometer). These are defined as passive instruments which respond to the magnetic anomalies produced by buried features in the presence of the Earth's magnetic field. In order to produce good results, the magnetic susceptibility contrast between features and their surroundings must be reasonably high; a generally raised background, even if due to human occupation within a settlement context, will sometimes preclude meaningful magnetometer results. The sensitive nature of magnetometers makes them suitable for detailed work, taking measurements on a closely spaced (usually less than 1 metre) grid, particularly in

areas where an archaeological site is already suspected, although they can also be used for larger scale prospecting.

2.7 *Magnetic susceptibility measuring systems*, whilst responding to basically the same magnetic component in the soil, are 'active' instruments which subject the sample area being measured (according to the size of the sensor used) to a low intensity alternating magnetic field. Magnetically susceptible material within the influence of this field can be measured by means of changes which are induced in oscillator frequency. For general work, measuring soil susceptibility *in situ*, a sensor loop of around 20 cm diameter is convenient, and responds to the concentration of magnetic (especially ferrimagnetic) minerals mostly in the top 10 cm of the soil. Magnetically enhanced horizons which have been reached by the plough, and even those from which material has been raised by soil biological activity, can thus be recognized.

2.8 Whilst rarely encountering anomalies as graphically defined as those detected by magnetometers, magnetic susceptibility systems are ideal for detecting the magnetic spreads and thin archaeological horizons which are not seen by magnetometers. By using grids with intervals in the range 10 to 50 m large areas of landscape can be covered relatively quickly. The resulting plot can be used to determine the general pattern of activity and to define the nuclei of any occupation or industrial areas. As the intervals between susceptibility readings generally exceed the parameters of most individual archaeological features (but not of the general spread of enhancement around features), the resulting plots should be used as a guide to general locations rather than an interpretation of specific detail.

2.9 Magnetic survey is not successful on all geological and pedological substrates. As a rule of thumb, in the lowland zone of Britain, the more sandy/stony a deposit, the less magnetic material is likely to be present, so that a greater magnetic contrast in soil materials will be needed to locate archaeological features; in practice, this means that only stronger magnetic anomalies (e.g. larger accumulations of burnt material) will be visible, with weaker signals (e.g. from the fillings of simple ditches) disappearing into the background. Similar problems can arise when the natural background itself is very high or very variable (e.g. in the presence of sediments partially derived from magnetic volcanic rocks).

2.10 The precise physical and chemical processes of changing soil magnetism are extremely complex and subject to innumerable variations. In general terms, however, whatever the agencies at work, there is no doubt that magnetic enhancement created by human activity can provide valuable archaeological information.

2.11 Variations in the subsoil material from which the soils are derived, when modified by agriculture, give rise to distinctive patterns of topsoil enhancement which often cover several hectares. The containment of these spreads by either natural or man-made features (such as contours or hedgerows, etc.) gives rise to a characteristic chequerboard pattern of enhanced soils which persist even after any physical barriers have been removed. These patterns are often further amplified in fields containing underlying archaeological features within reach of the plough.

2.12 Where a general spread of magnetically enhanced soils contained within a long-established boundary becomes admixed over a long period by constant ploughing, it

can be diffused to such a point that the original source is masked altogether. Magnetically enhanced material may also be moved or masked by natural agencies such as colluviation or alluviation. Generally, the longer a parcel of land has been under cultivation, the greater is the tendency for topsoil susceptibility to increase; at the same time there is increasing homogeneity of the magnetic signal within the soils owing to the agricultural mixing of the material. Some patterns of soil enhancement derived from underlying archaeological features are, however, apparently capable of resisting agricultural dispersal for thousands of years (Clark 1990).

Survey Design

2.13 The Survey Area was surveyed into 16 x 1 ha survey grids by EDM Total Station.

2.14 The equipment used for the direct topsoil magnetic susceptibility survey was a Bartington Instruments MS2 meter with an 18.5 cm loop.

2.15 *In situ* magnetic susceptibility readings were taken on a 10 metre grid, an interval proven to give a high probability of intersection with the magnetic signal from a wide range of archaeological sites, particularly those of the later prehistoric, Roman or Medieval periods. However, under favourable conditions the survey technique is equally capable of locating earlier prehistoric features, such as soils dispersed by agriculture from substantial ring ditches or spreads of occupation material. The configuration also allows the detection of ploughed-out earthworks, which can be located as areas of more weakly magnetic soils.

2.16 Areas showing significant magnetic enhancement were examined with a Geoscan Research FM 36 Fluxgate Gradiometer, both by detailed grids (sampling 4 readings per metre at 1 metre traverse intervals in the 1 nT range) and by scanning. The nanotesla (nT) is the standard unit of magnetic flux (expressed as the current density), here used to indicate positive and negative deviations from the Earth's normal magnetic field. The positions of the magnetometer survey grids are shown on Fig. 5. In addition, routine scanning by magnetometer was undertaken to check for any major concentrations of underlying archaeological features whose presence may not have been detected by the topsoil susceptibility survey.

2.17 Field data were stored to 3.5-inch disks, and processed using Geoscan Research Geoplot and Oxford Archaeotechnics Geomath software.

2.18 Selective hand augering was carried out in order to lend subsurface (subsoil and geological substrate) information to the interpretation of surface plots. The Bartington Instruments MS2 meter was used with the MS2B sensor to provide susceptibility information on retrieved field-state 10 ml samples.

2.19 Colour contour and grey scale (shade) plots have been used to present the topsoil magnetic susceptibility data. Magnetometer data have been presented as grey scale and stacked trace plots for areas with significant archaeology. Where informative, reversed shade gradiometer plots (i.e. positive = light shade) have been included.

3. MAGNETIC SURVEY RESULTS

TOPSOIL MAGNETIC SUSCEPTIBILITY SURVEY (Figs. 2, 3 & 4)

3.1 Approximately 1500 *in situ* magnetic susceptibility readings were recorded. Susceptibility is reported in SI:volume susceptibility units (x 10^{-5}), a dimensionless measure of the relative ease with which a sample can be magnetized in a given magnetic field; the lack of dimensions (a common situation in physical science) is an algebraic artefact (the actual units of measurement cancelling each other out in the formula for volume susceptibility) and in no way indicates subjectivity or lack of precision in the result.

3.2 *In situ* topsoil susceptibility measurements generally ranged between 6 and over 300 (x 10^{-5}) SI:volume susceptibility units. The Mean for the Survey Area was 16.5 (x 10^{-5}) SI:volume susceptibility units, although this value was strongly influenced by the extremely high topsoil susceptibility of one area of substantial enhancement (see 3.4 below). The Standard Deviation calculated against the Mean was 7.7 (x 10^{-5}) SI:volume susceptibility units; the outer red topsoil susceptibility contour on the contour plot (Fig. 3) is set at approximately two Standard Deviations.

3.3 The majority of the Survey Area produced a relatively uniform response magnetically. However, one area of particularly strong topsoil magnetic susceptibility was encountered: a broad spread of enhanced topsoils covering almost 1 ha within the northwestern angle of the Survey Area. Other patterns included a linear feature running northwest-southeast across the centre of the

Survey Area, with minor variations in topsoil magnetic susceptibility recorded mainly alongside the southern boundary.

3.4 The principal area of enhancement (Fig. 3, red & purple contours) contains a focus covering some 200 square metres, within which topsoil susceptibility levels peak at over 300 (x 10^{-5}) SI:volume susceptibility units. Such a focus undoubtedly relates to a potent pocket of burnt material and probably indicates the location of a number of substantial hearths or kilns.

3.5 Fragments of brick and burnt clay were dispersed across the field surface within this northwestern angle of the Survey Area.

3.6 The pattern of topsoil susceptibility is remarkably contained, particularly on the west and east of the focus, with diffusion from agricultural activity only just beginning to spread material on the south side. Similar resistance of the topsoil magnetic signal to mechanical dispersal by ploughing and cultivation has been noted by Oxford Archaeotechnics on numerous sites, with examples ranging in date from the prehistoric to post-Medieval periods: the presence of such strongly defined edges to topsoil susceptibility spreads are by no means necessarily indicative of a recent date.

3.7 However, the correspondence in alignment between this susceptibility focus and the existing road and field drainage pattern may be significant. Many of the field boundaries and drains were laid out when this part of the fen was enclosed at the end of the 18th. century (Field & Tann 1993). The Barrier Bank, along which the modern A 1073 runs, is a post-Medieval feature, constructed under an Act of 1666 (Wright 1973). It is nevertheless possible that some much older alignments may

have persisted for a considerable period before their adoption for the new flood barrier at this date.

3.8 The second major pattern of enhanced topsoil susceptibility is represented by strong linear susceptibility contours which show localised peaks of over 100 SI units. The contours become more diffuse towards the southeast (Fig. 3). This apparent lack of continuity is probably the result of varying fill and perhaps selective agricultural activity rather than reflecting any physical change in the nature of the underlying cut feature: magnetic susceptibility survey on a 10 m grid would not normally be expected to provide such a continuous linear pattern, but rather a general indication of linearity, and in this respect this feature showed an exceptional response to the survey and computer plotting.

3.9 Inclusions of quantities of burnt material are, again, the most likely source for these high magnetic susceptibility readings. There were no indications of any concentrations of burnt deposits nor artefactual material in the vicinity of the high reading areas, but subsequent machine trenching showed the presence of glassy slag and industrial residues incorporated into the ditchfill. It is possible that the source lies in the industrial site located some 100-150 m to the west, and that this ditch had been deliberately infilled with debris derived from this location. There is, however, a zone of remarkable magnetic stability between the two spreads, with the topsoil generally yielding measurements of less than 10 (x 10^{-5}) SI:volume susceptibility units.

3.10 There is also a slight topographic hollow between the two areas, visible adjacent to the new road embankment, which may represent the position of a former clay extraction pit.

3.11 A third area of magnetic variability lies within the southwestern part of the survey, south of the existing drain in the vicinity of the hexagonal enclosure plotted from air photographs (see 1.6 above). Note, in passing, that the two existing drains show as white lineations on Fig. 2 but have been removed from Figs. 3 and 4. A spread of enhanced topsoils deriving from the industrial site in the northwest corner of the Survey Area has been spread southwards and has, to some extent, masked the potential for revealing more subtle information relating to the soils overlying this enclosure. Nevertheless, there are sufficient magnetic contrasts in its vicinity to indicate a general area of activity distinct from any 'contamination' from the nearby industrial site.

MAGNETOMETER (GRADIOMETER) SURVEY

3.12 Scanning by magnetometer across the two major spreads of enhanced topsoils indicated the presence of substantial underlying features.

3.13 The linear zone of enhancement which runs across the centre of the Survey Area was immediately apparent as a topsoil magnetic susceptibility pattern, resulting from the agricultural dispersal of the underlying fill of a substantial ditch which must contain a considerable quantity of burnt material/soils; this identification was almost immediately confirmed by trial excavation (see 1.8 above). The topsoil magnetic susceptibility pattern was clear and precise, enabling its line to be marked out accurately on the ground for trial trenching. It was not felt necessary to define it further by magnetometry.

3.14 The focus of the broad spread of magnetically enhanced topsoils in the northwest corner of the Survey Area was targeted for detailed magnetometry (gradiometer survey). A 90 x 60 m area was selected, sampling 4 readings per metre, on 1 m traverses. The resultant plots (Figs. 6 & 7) revealed the presence of a number of strong magnetic anomalies (up to 50 nT).

3.15 The dominant form of the gradiometer plot is the suggestion of a c.50 m square area defined by various distinct elements, the most obvious of which appear to represent the structural remains of flue systems arranged in both parallel and radial patterns.

3.16 The parallel system, along the southeastern boundary of the complex, seems to extend for 50 - 60 m and is represented by at least nine walls (c.10 m long), with perhaps twice this number suggested.

3.17 The northwest corner and northern side of the complex contain two semi-circular sets of substantial radial flue walls, each having five or six arms, again up to 10 m in length and extending to a diameter of some 20 m. The radial systems focus on separate, possibly square, kilns or hearths, some 5 m across. The more easterly of the two foci appears to have a second weak square, again some 5 m across, located immediately to the north of the presumed focus, perhaps a deeply buried or magnetically weak element which appears to mirror the focus of the radial pattern.

3.18 Within and in proximity to the 50 m core of the complex there are a number of subtle anomalies which suggest weak linear and curvilinear features, together with a few pits and perhaps postholes (postholes may be expected to show if sufficient quantities of highly susceptible material had subsequently been incorporated into the void left by the former post).

3.19 These various subtle traces may represent the location of ancillary structures such as workshops and the flat, well-drained, drying areas known as 'Hacksteads' (where bricks were stacked and covered), similar to those shown in an illumination from an early 15th. century Dutch Bible (*Nederlandische Bijbel*, Utrecht, 1425; Add. M.S. 38122 fol.78v) (reproduced as the frontispiece to the present report) (cf. documentary evidence cited by Lloyd 1935; Brooks 1939; Wight 1972 & discussion of both documentary and archaeological evidence by Drury 1981). Areas of limestone flooring chips, identified as possible drying areas and clamp bases, together with a tile store, the remains of a possible workshop and clay mixing pan, and pits, have

been excavated in the vicinity of a Medieval tile kiln at Boston, Lincolnshire (Mayes 1965).

3.20 In addition, there is a substantial cut feature, extending for at least 50 m, running diagonally across the eastern corner of the gradiometer plot. Despite the disparities in alignment, it may be contemporary with the main complex, as it defines and contains the spread of fired material which extends up to 10 m south of the presumed buildings. Two broad and weak parallel anomalies, lying 15 m apart, and outside but co-linear with the principal elements to the west of the plot, are not conclusively part of the complex.

3.21 Several of the features revealed by magnetometry were investigated by hand auger, to reveal quantities of well-fired clays, together with some glassy slag and glazing residue, which were encountered to a depth of 1.1 m below present ground level, without the deposits being bottomed. A piece of green-glazed brick was also recovered from a contractor's trench within the new road corridor immediately adjacent to the area surveyed by magnetometer.

3.22 A second area of 90 x 60 m was targeted for magnetometry on the site of the hexagonal cropmark enclosure, plotted from aerial photographs, and situated within an area of marginally enhanced topsoils. In the absence of a specific magnetic susceptibility target, the magnetometer survey was located by Total Station using the aerial photographic plot (Palmer 1993) (Fig. 5).

3.23 The gradiometer plots (Figs. 8 & 9) show a contrast between relatively strong (up to 10 nT) anomalies within the western third of the grid, and a much more stable zone over the remainder. The strong anomalies detected lie on a predominantly

east-west alignment, and show broad and relatively diffuse patterns similar to those occasionally encountered upon geological bodies where former infilled natural channels are present. Hand augering into these anomalies produced no evidence of any archaeological deposits or artefacts. Two exploratory machine trenches located in the extreme (south)west and north(west) angles of the magnetometer survey area also failed to locate any archaeological features.

3.24 It is significant that the line of contrast within the magnetometer Survey Area appears to conform with the southwestern boundary of the hexagonal cropmark.

3.25 Trial auger holes produced variable material, with generally relatively clean silts contrasting markedly with heavier and wetter clays (with the clays producing the strong gradiometer anomalies). The magnetically stable area appeared to be reasonably well drained, whereas auger holes sunk into the clays showed standing water at a depth of 1 m.

3.26 Traces of the hexagonal enclosure are weakly visible within the more magnetically stable part of the Survey Area. The identified enclosure ditches were extremely difficult to detect with the magnetometer, with little magnetic contrast between their fills and the natural silts into which they were dug. Hand-augered silt samples indicated magnetic susceptibility measurements in the range of 15-20 SI units, a relatively high figure compared with much of the Survey Area. Samples from the fill of the enclosure ditch measured 25 SI Units, insufficient magnetic contrast to produce good anomalies.

3.27 Despite these difficulties, careful examination of the gradiometer plots (Figs. 8 & 9) indicates extremely weak lineations (as mapped by Palmer 1993). Testing by hand

auger confirmed the presence of underlying cut features. The locations where the enclosure can be identified on the gradiometer plot could not be tested by mechanical excavator owing to the proximity of the overhead power cables. However, the position of the southeast angle of the enclosure, predicted by projecting the line of the weak magnetic anomaly, and by reference to the aerial photographic plots, was located immediately in an exploratory machine-dug trench. Having established the position of this enclosure angle, it was possible to target accurately a second machine-trench to examine the northernmost extent of the cropmark complex; this consists of a sub-rectangular appendage.

3.28 Following trial excavations, the ditchfill was assessed in the field with the magnetic susceptibility loop, and was again found to contain fills averaging 25 SI units. Such values would normally be expected to give reasonable gradiometer plots against a low and stable background, but again the contrasts were insufficient, with the local natural silts ranging up to 20 SI units. Furthermore, the presence of peat lenses significantly reduced the overall magnetic susceptibility of the ditchfill.

3.29 A 20 x 20 m area immediately adjacent to (and within) this revealed enclosure ditch was subjected to both a 1 m gridded magnetic susceptibility survey, and further gradiometer survey in the hope of detecting any weak internal features. Neither produced convincing results, and no significant magnetic anomalies were detected within the enclosed area.

4. CONCLUSIONS

4.1 Topsoil magnetic susceptibility survey has identified the site of a significant industrial complex. Magnetometry has further defined a series of both parallel and radial structures within the complex. The strength of the magnetometer signal (up to 50 nT), combined with the brick debris observed on the field surface suggested the presence of brick-built or fired-clay structures, probably the remains of pottery or brick/tile making kilns. The parallel flue arrangement is similar to the Medieval tile kiln (early 14th. century) excavated in the nearby town of Boston (Mayes 1965).

4.2 At the time of preparation of this report no dating evidence for the site was available, although a possible 15th. or 16th. century date has been suggested from cursory examination of the brick and glazing residues. There is no documentary record for brick- or tile-making in or around Spalding, although bricks were used in the construction of Ayscoughfee Hall, Spalding, in the early 15th. century, and the 15th. century nave of Cowbit parish church, situated c.2 km from the Survey Area (Wight 1972).

4.3 Despite the proximity of substantial quantities of fired structures close to the surface, no obvious indications of this industrial site were visible as cropmarks from the air.

4.4 A linear feature, probably a substantial ditch, also containing further industrial residues has also been plotted.

4.5 The site of a hexagonal enclosure, visible on the air photographs, was located, but proved to have a negligible magnetic signature. No significant anomalies were identified within the enclosure; field tests demonstrated a marked lack of magnetic contrast between the fill of the enclosure ditch and the surrounding silt deposits into which it had been dug. Considerable variability in the natural silts and clays generally created unfavourable conditions for the detection of weaker archaeological features. In addition, the inclusion of organic materials (peat) within the fills of some cut features substantially reduced their magnetic susceptibility. However, even under these conditions, one would have expected a much stronger signal had the hexagon contained a major activity area incorporating burnt features (e.g. persistent settlement or industrial activity).

4.6 The general variability of the geology made magnetometer scanning unrewarding outside those areas identified as having some archaeological potential by the topsoil magnetic susceptibility survey.

4.7 Topsoil susceptibility mapping of cultivated Fenland soils at several locations in Lincolnshire and Cambridgeshire has now proved an effective method of locating archaeological sites, notably (but not exclusively) those where underlying industrial activity is present. The northeastern part of the Spalding Survey Area does not contain any archaeological material with a significant magnetic signature detectable from the surface.

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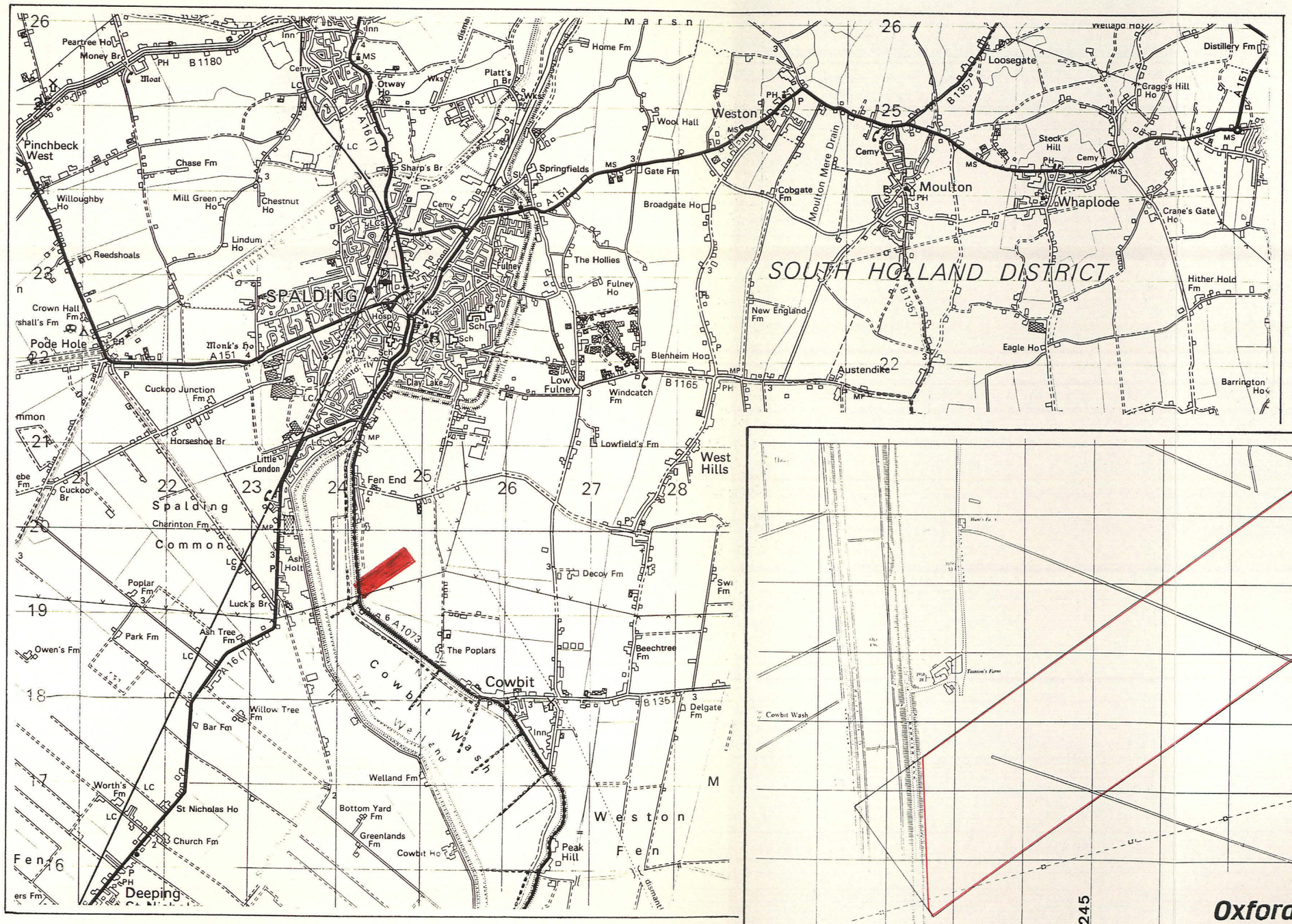
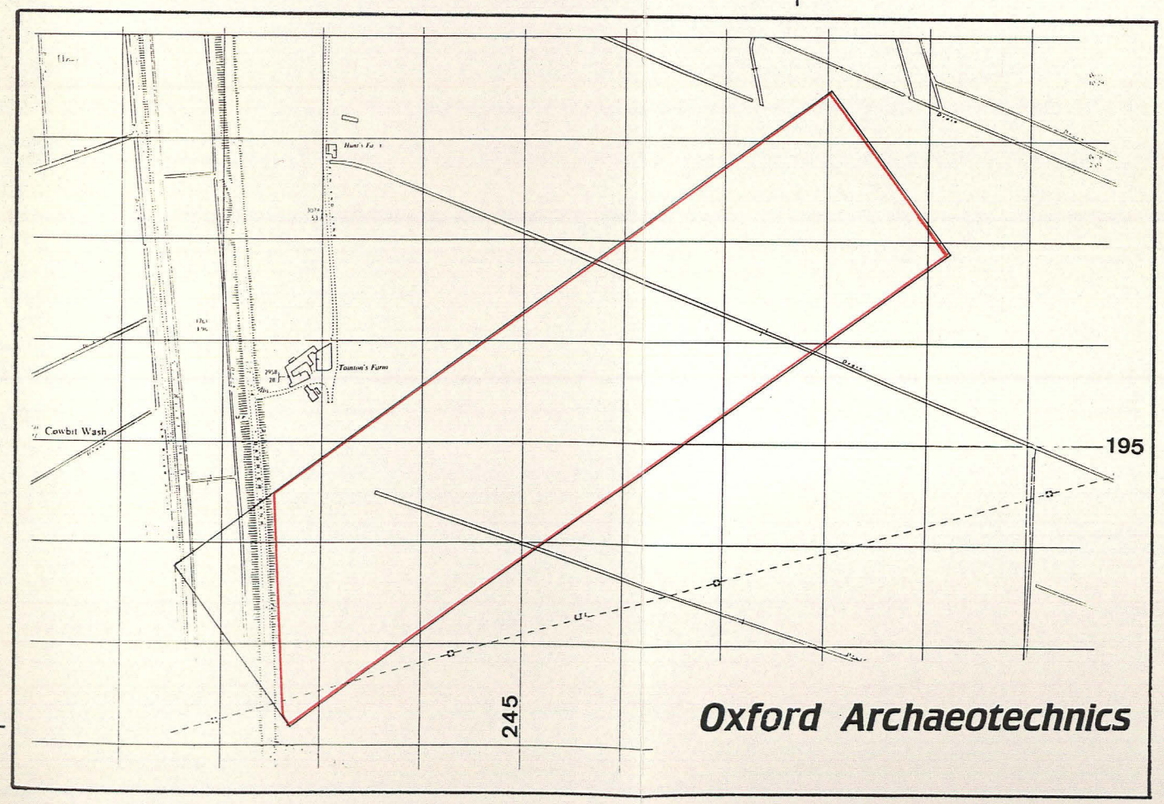
FIGURE CAPTIONS

Frontispiece	Medieval Brickmaking from a Dutch illuminated Bible, c. 1425. (British Museum Add. M.S. 38122 fol. 78v.)
Figure 1.	Location map (based on OS 1:50,000 Map 131 and OS 1:2500 Sheet TF 2419, reproduced by OAA, Licence No. AL547441, with the permission of the Controller of HMSO, Crown Copyright).
Figure 2.	Topsoil magnetic susceptibility survey: grey scale plots (Geoscan Research Geoplot Licence No. GPB 885-6).
Figure 3.	Topsoil magnetic susceptibility survey: contour plot. Scale 1:2500.
Figure 4.	Topsoil magnetic susceptibility survey: wire-frame plot.
Figure 5.	Location plot. Scale 1:5000.
Figure 6.	Grid A-B. Magnetometer survey: smoothed shade plot (Geoscan Research Geoplot Licence No. GPB 885-6).
Figure 7.	Grid A-B. Magnetometer survey: trace plot (Geoscan Research Geoplot Licence No. GPB 885-6).
Figure 8.	Grid C-D. Magnetometer survey: smoothed shade plots (Geoscan Research Geoplot Licence No. GPB 885-6).
Figure 9.	Grid C-D. Magnetometer survey: trace plot (Geoscan Research Geoplot Licence No. GPB 885-6).

SPALDING, LINCOLNSHIRE

LOCATION





MAGNETIC SUSCEPTIBILITY & MAGNETOMETER SURVEY

Fig.1

Site : spalding Mesh : all	Mag. Susceptibility Survey Size x 1	Block Off
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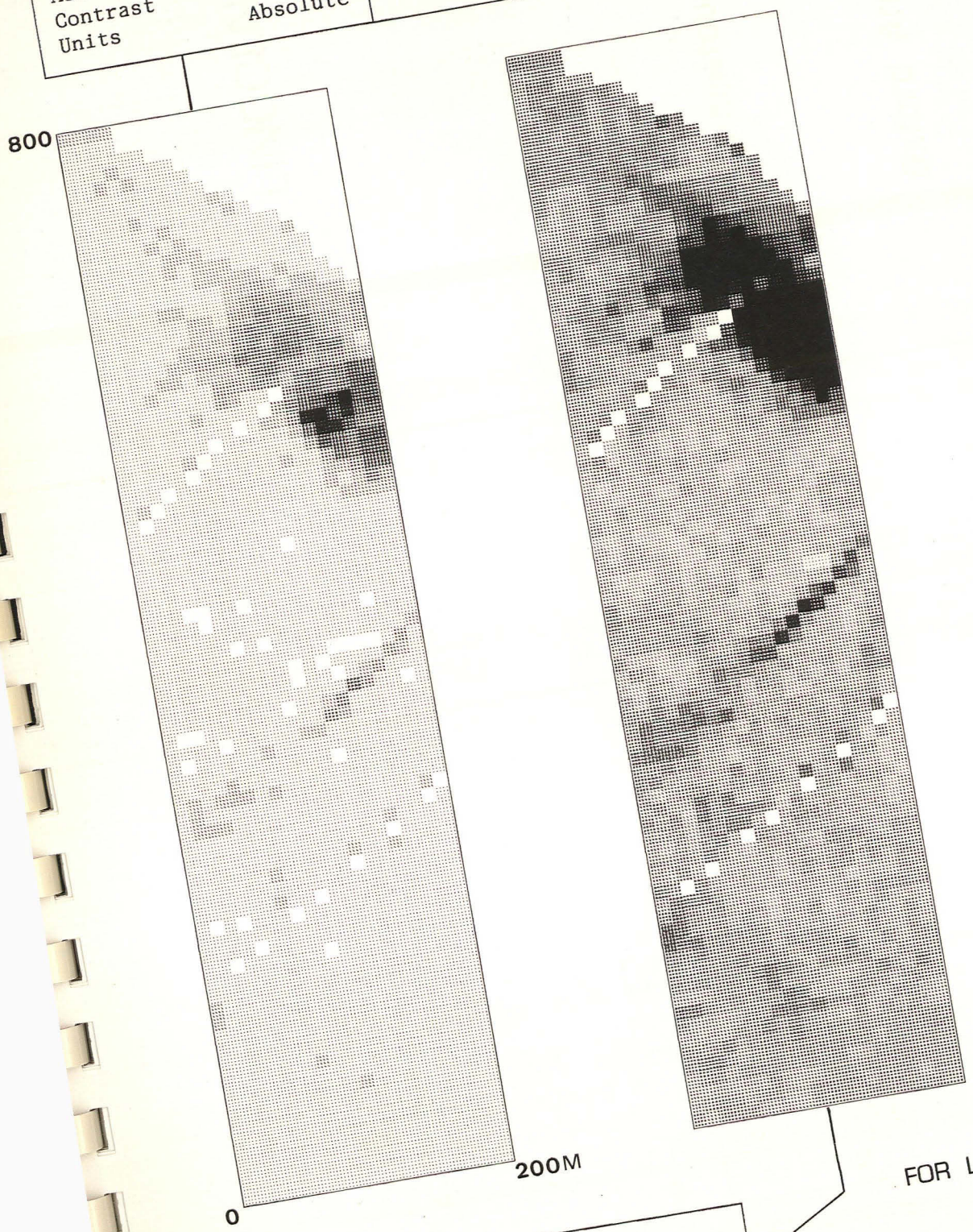
Minimum 0 Maximum 200 Contrast 1 Units Absolute		



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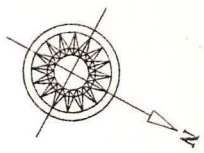
Units	Absolute



FOR LOCATION SEE FIG 5

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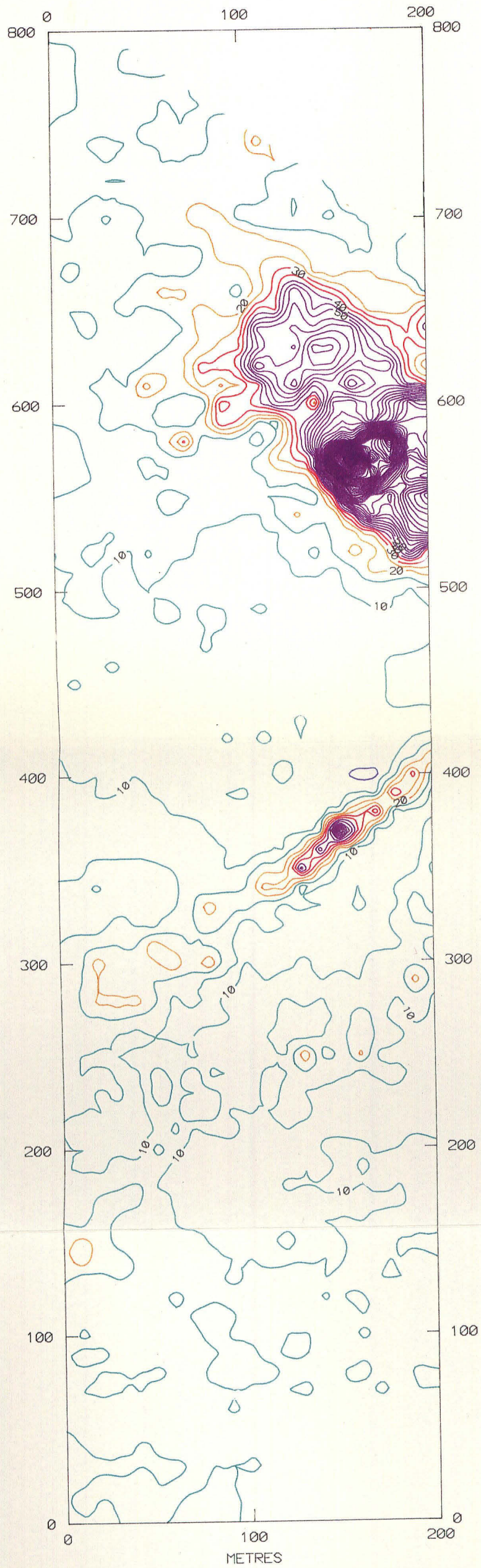
Fig.2

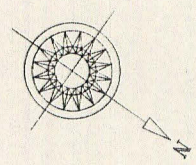
MAGNETIC SUSCEPTIBILITY & MAGNETOMETER SURVEY

SPALDING, LINCOLNSHIRE



1:2500

FOR LOCATION SEE FIG 5



TOPSOIL SUSCEPTIBILITY CONTOURS

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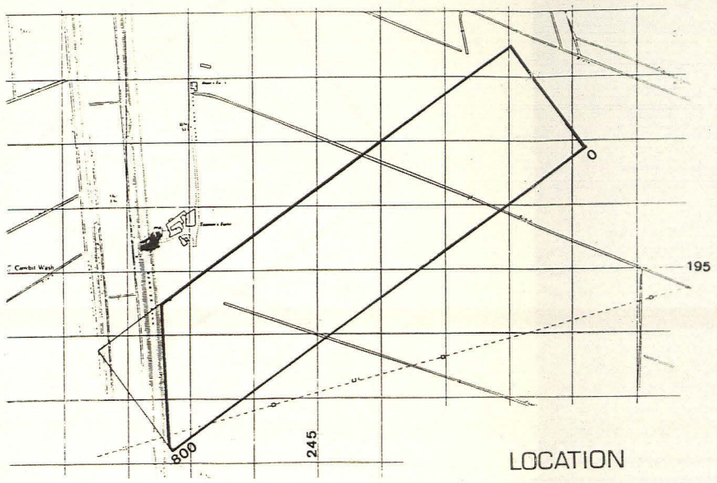
10 SI CONTOUR INTERVAL (VOLUME SUSCEPTIBILITY)

Fig.3

SPALDING, LINCOLNSHIRE



LOCATION

MAGNETIC SUSCEPTIBILITY & MAGNETOMETER SURVEY

TOPSOIL SUSCEPTIBILITY

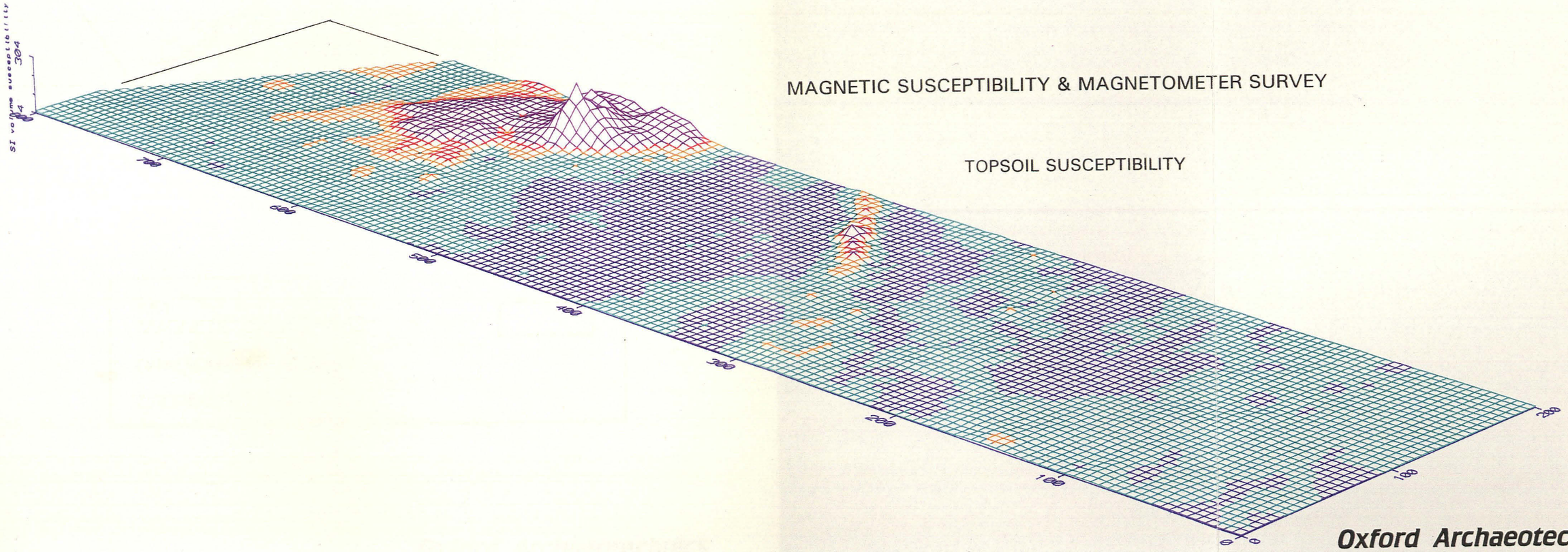


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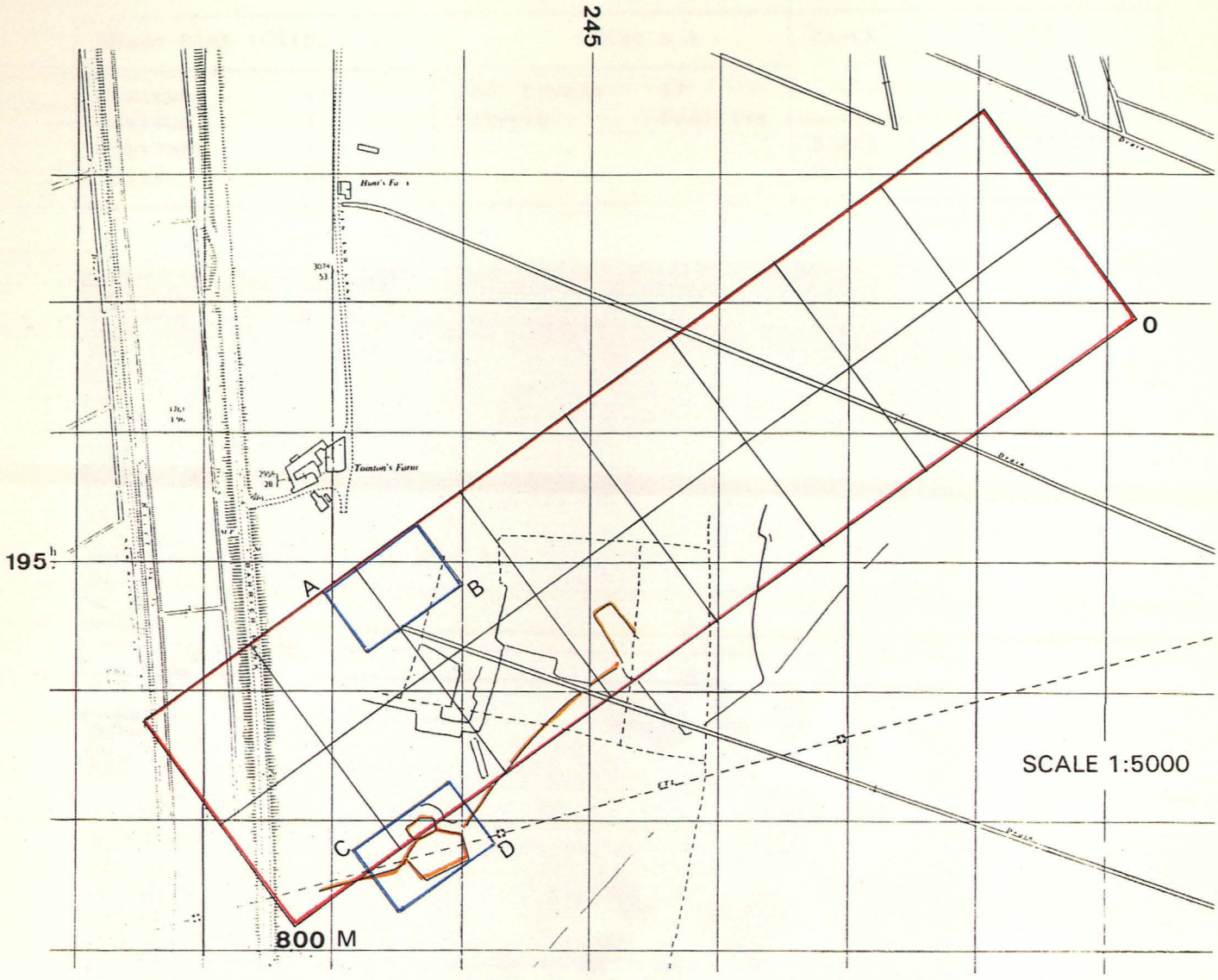
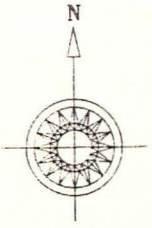
Fig.4

SPALDING, LINCOLNSHIRE



MAGNETIC SUSCEPTIBILITY & MAGNETOMETER SURVEY



KEY
MAGNETIC SUSCEPTIBILITY SURVEY
GRADIOMETER SURVEY
CROPMARKS

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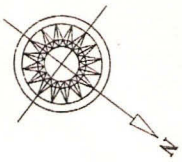
Fig.5

Site : spalding Mesh : 1-6	Gradiometer Survey	Scale	1:443
Shade Plot (Clip)	Size x 1	Block	Off
Minimum -1 Maximum 1 Contrast 1 Units Std.Dev.	Grey Levels 17 Palette Positive	Black Positive White Negative	

A

B



FOR LOCATION SEE FIG 5

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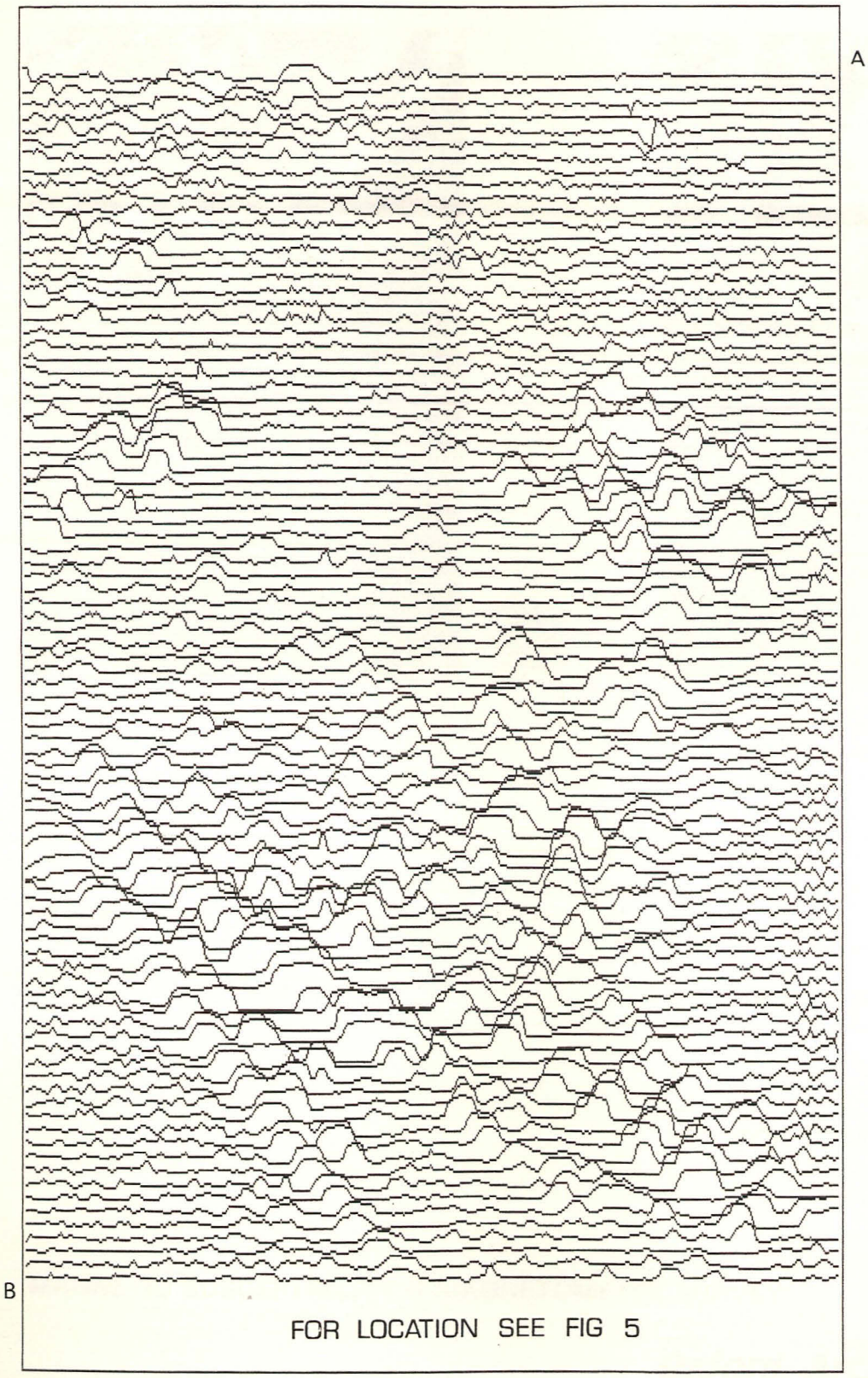
Fig.6

Site : spalding Mesh : 1-6	Gradiometer Survey	Scale Resolution	1:472 43.6nT/cm
Trace Plot (Standard)	Size x 0.5	Block	Off
View Front X-Displ. (%) 0 Y-Displ. (%) 0 Hidden Line Off	Resolution 1 Units Std.Dev.		



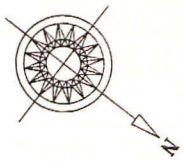
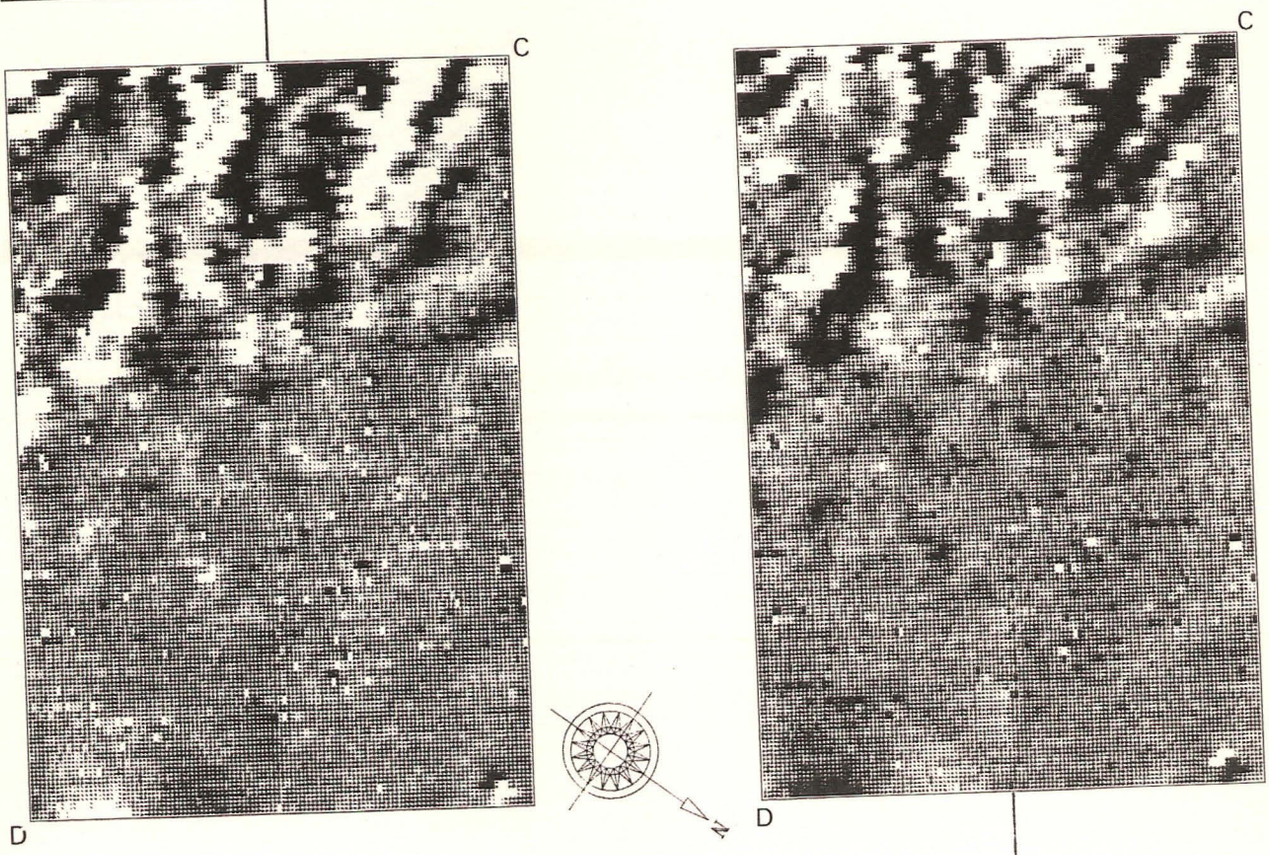


Fig.7

Site : spalding Comp. : 7-12	Gradiometer Survey		Scale 1:886
Shade Plot (Clip)		Size x 0.5	Block Off
Minimum -1 Maximum 1 Contrast 1 Units Std.Dev.	Grey Levels 17 Palette Negative		Black Negative White Positive



Site : spalding Comp. : 7-12	Gradiometer Survey		Scale 1:886
Shade Plot (Clip)		Size x 0.5	Block Off
Minimum -1 Maximum 1 Contrast 1 Units Std.Dev.	Grey Levels 17 Palette Positive		Black Positive White Negative

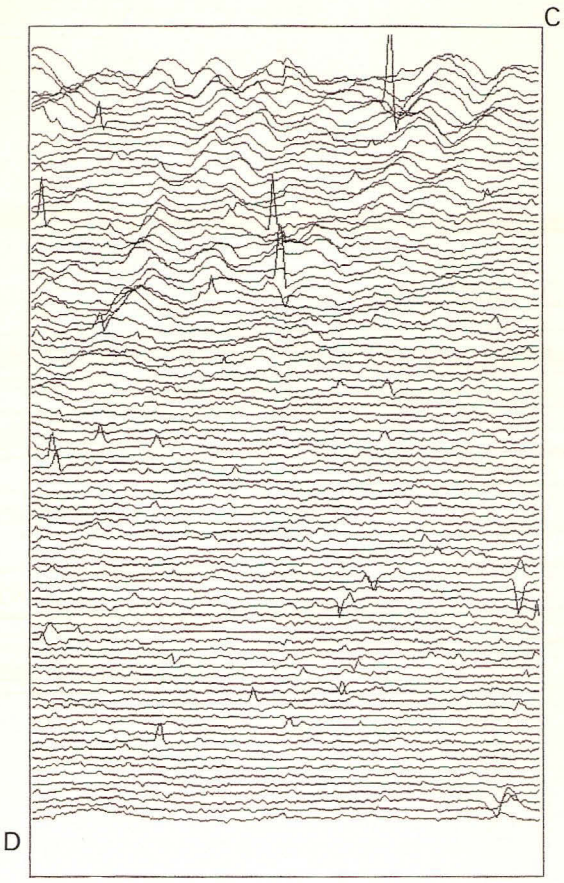
FOR LOCATION SEE FIG 5

MAGNETIC SUSCEPTIBILITY & MAGNETOMETER SURVEY

Oxford Archaeotechnics

Fig.8

Site : spalding Comp. : 7-12	Gradiometer Survey	Scale Resolution	1:886 36.6nT/cm
Trace Plot (Standard)	Size x 0.5	Block	Off
View Front X-Displ. (%) 0 Y-Displ. (%) 0 Hidden Line Off	Resolution 1 Units Std.Dev.		



FOR LOCATION SEE FIG 5

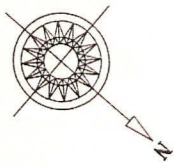


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Fig.9

INTERNAL QUALITY CHECK

Survey Reference:	0270693 /SPL/ LAR		
Primary Author:	AW	Date:	13.7.93
Checked by:	APJ	Date:	13-7-93
Checked by:	SJC.	Date:	13/7/93
Further corrections:		Date:	

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QUALITY CONTROL QUESTIONNAIRE

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PLEASE ANSWER *ALL* THE FOLLOWING QUESTIONS BY RINGING THE ANSWER OPTION WHICH MOST CLOSELY MATCHES YOUR DESIRED RESPONSE (SPECIFY OTHERWISE IF NECESSARY)

(1) ***What is your interest in this particular site/project?*** [ring two categories if necessary]

[direct involvement] Client Client's Agent Curator Other Archaeologist Local Public Other

[observer] Developer Developer's Agent Curator Other Archaeologist General Public Other

(2) ***How would you qualify this report with respect to overall presentation, lay-out and graphic material?***

very poor poor middling good very good

(3) ***How would you qualify this report with respect to overall clarity of argument?***

very poor poor middling good very good

(4) [where applicable as judged from the viewpoint of individual readers] ***How would you qualify this report with respect to clarity of technical explanation?***

very poor poor middling good very good not applicable in my case

(5) ***How would you qualify this report with respect to completeness of reference to relevant data?***

very poor poor middling good very good unable to comment

PLEASE TURN OVER

(6) ***Drawing on your own knowledge, how many significant inaccuracies does this report appear to contain?***

very many many some few none unable to comment

(7) ***How would you qualify this report with respect to fulfilment of the brief and/or specification?*** [observers cf. introductory chapter]

very poor poor middling good very good unable to comment

(8) ***On the basis of criteria you yourself judge the most important, how would you describe the apparent overall quality of this report?***

very poor poor middling good very good unable to comment

(9) [direct involvement] ***How would you qualify the supporting service (in terms of ease of communication, punctuality, quality of response, readiness with explanation, preparedness, reasonableness, etc.) surrounding the circumstances of this report?***

very poor poor middling good very good not applicable

(10) [Client and Client's Agent only] ***How would you qualify this report and the supporting service with respect to value for money?***

very poor poor middling good very good not assessed not applicable

REPORT TITLE:

REPORT DATE:

RESPONDENT NAME:

RESPONSE DATE:

Please feel free to add comments on any point (including the actual structure of the questionnaire) if desired and to encourage any other interested persons to fill out further copies. Note that the primary addressee of this copy of the report will receive a loose copy of the questionnaire and a stamped-addressed envelope; another copy of the questionnaire is bound into the back of the report as a model for further responses. The completed questionnaire(s) (marked with identification of the report in question, the name of the respondent and the response date) should be posted to: OAA Ltd., Lawrence House, 2 Polstead Road, Oxford OX2 6TN. Dr. Simon Collcutt will be happy to reply to any queries on 0865 310209.

THANK YOU FOR YOUR KIND AND VALUABLE ASSISTANCE

QUALITY CONTROL

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