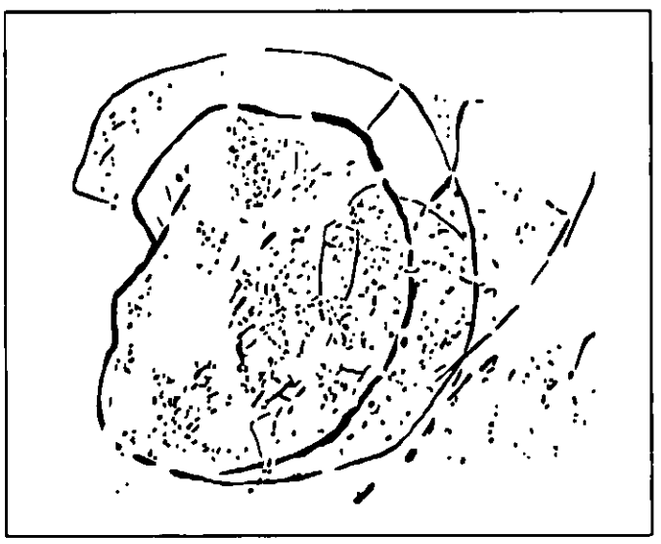
REPORT ON GEOPHYSICAL SURVEY

COOMBE DOWN
Wiltshire

Report Number 92/93



GEOPHYSICAL SURVEYS of Bradford

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Site Summary Sheet

92 / 93 Coombe Down, Wiltshire

NGR: SU 193 520 (Centred on)

Location, topography and geology

The site lies on the edge of the Salisbury Plain, approximately 5 kilometres north-west of North Tidworth and 2 kilometres south-west of the village of Everleigh on the A342 road. The area under investigation lies in a prominent position which offers clear all round views over the surrounding landscape. The field was under pasture at the time of the survey and the underlying geology is chalk.

Archaeology

Extensive and substantial earthworks survive in the southern part of the survey area, particularly on the edge of the plateau and on the steeply sloping escarpment. The visible remains are associated with a Romano-British (R-B) settlement.

Aim of Survey

To investigate the area beyond the visible earthworks with a view to assessing the original extent of the Romano-British settlement and hence the degree of damage to the archaeological site.

Summary of Results *

The survey has identified a previously unsuspected, extensive double-ditched, irregular shaped enclosure, with maximum dimensions of approximately 240 metres east-west and north-south. There is an entrance and associated trackway in the eastern side of the enclosure and there is evidence of zonation of archaeological features within the site. Some areas appear to have dense concentrations of pits, other areas are seemingly devoid of significant features. There are lengths of ditch which further subdivide the site. Overlying the enclosure, particularly in the east, is a series of ditches and pits which are associated with the Romano-British settlement.

*** It is essential that this summary is read in conjunction with the detailed results of the survey.**

SURVEY RESULTS

92 / 93 Coombe Down, Wiltshire

1. Survey Areas

1.1 Approximately 7 hectares were surveyed by fluxgate gradiometer and a small area was selected for detailed investigation using seismic refraction (Figure 1).

1.2 The survey grid was established by **Geophysical Surveys of Bradford** (GSB) personnel and spot heights were taken by **RCHME** surveyors.

2. Display (Figures 2 to 8)

2.1 The results of the gradiometer survey are displayed at 1:1000 in a variety of formats:- X-Y trace, dot density plot and grey scale image (Figures 2 to 4). These display options are discussed in the *Technical Information* section, at the end of the text.

2.2 A simplified interpretation diagram is also produced at a scale of 1:1000 (Figure 5) and plotted onto the base plan at scale of 1:2500 (Figure 8).

2.3 The results of the seismic refraction are plotted graphically alongside the topography and the gradiometry for both lines (Figures 6 and 7).

3. General Considerations - Complicating factors

3.1 In general, apart from the presence of a barbed wire fence which runs down the middle of the survey area, ground conditions were ideal. The fence resulted in a broad band of magnetic disturbance which has unfortunately confused the interpretation of the results in several places. In addition, metal feeding troughs precluded survey of a 50m tract of land near the centre of the survey area.

4. Results

4.1 Gradiometer Survey (Figures 2 to 5)

4.2 The survey has produced a set of remarkably clear magnetic results which indicate a major double-ditched enclosure with an additional complex of archaeological features.

4.3 The general level of magnetic noise in the vicinity of the site is low, as might be expected from an undisturbed chalk site on Salisbury Plain. Past survey work in the area (e.g. particularly in the vicinity of Stonehenge) has demonstrated that occupation sites respond well to gradiometer survey. This is due to the strong contrast between the relatively sterile chalk and the magnetically enhanced deposits which fill the archaeological features. The results of this contrast is clearly visible at Coombe Down in the western limits of the survey area. Outside of the enclosure ditch there is a marked decrease in magnetic anomalies, demonstrating that in this half of the site, past activity was clearly confined to the area within the enclosure. By contrast, the eastern half of the survey is dominated by anomalies associated with the later R-B settlement which is discussed below (Section 4.12).

4.4 The outer ditch (A) of the enclosure would appear to be narrower than the inner ditch (B). The magnetic anomaly suggests a feature approximately 1-3 metres wide for the former, compared with perhaps 4-5 metres for the latter. Both ditches follow a relatively regular line for three quarters of the circuit, but the western segment of the enclosure is unusual. The outer ditch turns through a right angle to form an entrance/gateway (C). Two large pits at this point might be associated with some form of defended gate. From the entrance to the line where it intersects with the modern fence (D), the inner ditch follows a peculiar sinuous course, which is difficult to explain archaeologically. There are no topographic reasons for the changes in direction and unfortunately the presence of the fence obscures the magnetic responses at certain key points which might otherwise help with the interpretation.

4.5 For most of its length, the outer ditch forms a berm 30 to 35 metres beyond the inner ditch, however the two ditches converge near to point (E). There is a small ditch (F) which appears to link the two ditches. The others in the eastern half are more likely associated with the later R-B settlement.

4.6 There are several well defined pits within the area of the outer berm, particularly around (G), however the density is considerably less than the inner area. Once again, this interpretation assumes that the pits (H) in the eastern half are associated with later activity.

4.7 Apart from the entrance (C), there are a few other breaks in the outer ditch, but it is difficult to know whether they are associated with later features cutting through the anomalies.

4.8 The main entrance (J) is associated with a band of ground (K) devoid of magnetic anomalies and indicative of a trackway into and through the enclosure. A similar band (L) is visible in the southern half of the site.

4.9 There are several lengths of ditch (e.g. M - O) which form some internal divisions within the enclosure. The greatest number of ditches (e.g. P - S) is associated to the R-B settlement.

4.10 There is a dense concentration of pit-like anomalies throughout the interior. The density is on a par with the results from previous magnetic surveys such as Yarnbury and contrasts with Grovelly Castle. The results are clearly indicative of intensive occupation on the site and if the features date from the same period of occupation, there appears to be little room for any stock. It is possible that the latter may have been kept in the outer berm. It would be interesting to carry out a detailed phosphate and magnetic susceptibility survey. Such work on a defended settlement at Guiting Power in Gloucestershire (Gaffney *et al* 1992) has identified a classic stock habitation divide on the site. However, interpretation maybe confused by later occupation, and this would certainly be the situation in the eastern half of Coombe Down. However, there appear to be large areas of the site which relate to the enclosure and not the R-B settlement.

4.12 The magnetic anomalies associated with the R-B settlement have already been referred to above, in that they are confused with the results from the earlier enclosure. Obviously, the converse applies when discussing the extent of the anomalies from the later period. However, there is little doubt that the R-B remains clearly extend well beyond the visible earthworks.

4.13 A complex of ditches (P - S already mentioned and T to X outside of the enclosure) is linked to the earthworks and suggests that much of the site on the periphery has suffered from ploughing. Subsequent excavation (R Entwhistle *pers. comm.*) has shown that on the edge of the plateau up to 1 metre of stratigraphical deposits are surviving *in situ*.

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5. Seismic Refraction and Resistivity Survey

5.1 Two four-shot in-line seismic refraction surveys were undertaken over the main ditch as shown in Figure 1. The spot heights at each geophone were recorded by **RCHME**. The seismic responses for each shot were printed and the 'first breaks' for each geophone recorded. From this information seismic velocities and depth information was calculated. This survey method is very similar to that carried out to delineate the Vallum at Vindobala, Hadrian's Wall (Goulty *et al* 1990).

5.2 Twenty four geophones were placed at one meter intervals along the survey line. For each line four sets of readings were taken using a nine pound hammer as the energy source. Shots were fired at the position of geophone 1 and at geophone 24. Two additional shots were fired 10m beyond geophone 1 and 10m beyond geophone 24, along the line of the survey. The use of four shots instead of just a single one allows for the correction of non-horizontal and irregular refractors. The use of long shots in particular makes it more likely for intermediate layers to be detected.

5.3 The survey was successful in that the ditch was clearly detected in both surveys. There is good correlation with the magnetic data, as seen in Figures 6 and 7. However, it has not been possible to obtain any finer detail. This is probably due to a combination of the small scale of the survey, the complex geometry of the interfaces and wet ground conditions. A water interface gives a strong reflection and may have led to spurious travel times.

5.4 In addition to the primary ditch several other possible ditches or pits appear to have been detected, and correspond with the magnetic data. The most prominent of these can be seen in Figure 7 and is situated to the east of the primary ditch.

5.5 It is important to note that the primary interface that has been recorded by the survey does not coincide with the ditch bottom found during excavations, although it does have a similar profile. Presumably a strong, shallower interface has been detected.

5. Conclusions

5.1 The magnetometer survey at Coombe Down has identified a previously unsuspected double-ditched enclosure. The morphology is similar to enclosures at Sudden Farm; Boscombe Down West Site P; and Steepleton Hill Farm, Stockbridge (Corney *pers. comm.*). Overlying the enclosure is a series of features which are associated with the R-B settlement.

5.2 The seismic work has confirmed the potential of the technique in selected archaeological situations.

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References

Gaffney C F, Aspinall A, Gater J A, Grove R, Heron C P, Marsh A and Stephens C 1992 *Flexible Prospection Strategies in Archaeology*, Paper presented at **Archaeometry Symposium in Los Angeles**, unpublished.

Goulty N R, Gibson J P C, Moore J G and Welfare H, 1990 *Delineation of the vallum at Vindobala, Hadrian's Wall, by shear-wave seismic refraction survey*, **Archaeometry,** Volume 32, Part 1, February 1990.

The geophysical survey work at Coombe Down was funded by:

1. **English Heritage / Reading University** (Professor Fulford) - Initial survey.
2. **RCHME** (Dr Roger Leech / Mark Corney) - Second and third surveys.
3. **Geophysical Surveys of Bradford** - Seismic work and additional magnetometry.

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GEOPHYSICAL SURVEYS OF BRADFORD**.

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs. Field plots are produced on a portable Hewlett Packard Thinkjet. Further processing is carried out back at base on computers linked to appropriate printers and plotters.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method.

(b) Resistance Meter - Geoscan RM4 or RM15

This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections".

(c) Magnetic Susceptibility

Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

Display Options

The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.

(a) X-Y Plot

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the indiviual anomalies. Results are produced on a flatbed plotter.

(b) Dot-Density

In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.

(c) Contour

This display joins data points of an equal value by a contour line. Displays are generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.

(d) 3-D Mesh

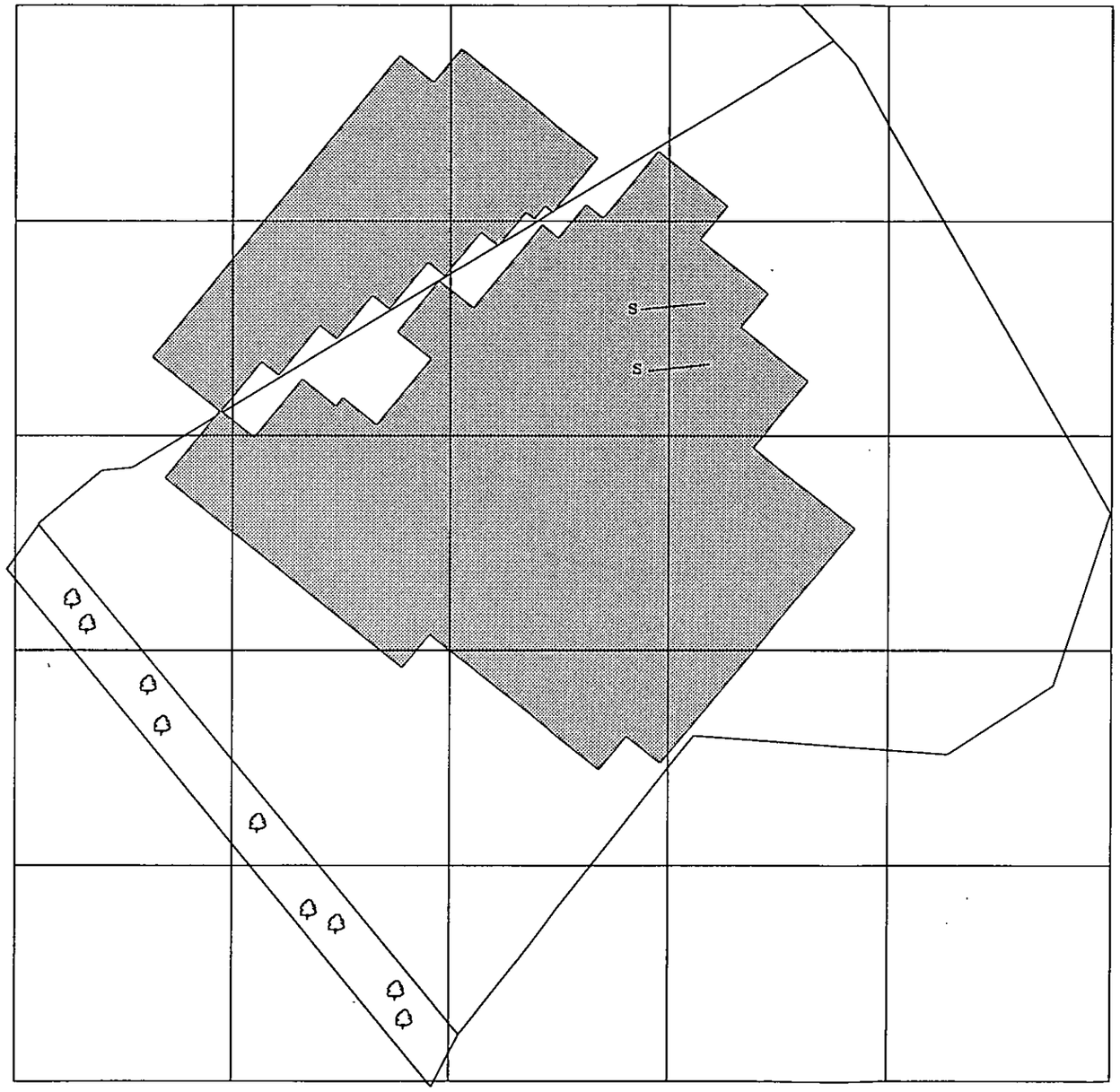
This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (a) above).

(e) Grey-Scale

This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. While colour plots can look impressive and can be used to highlight certain anomalies, grey-scales tend to be more informative.

SU 19400 52300



SU 18900 51800

COOMBE DOWN

Location of Survey Areas

Area of Gradiometer Survey

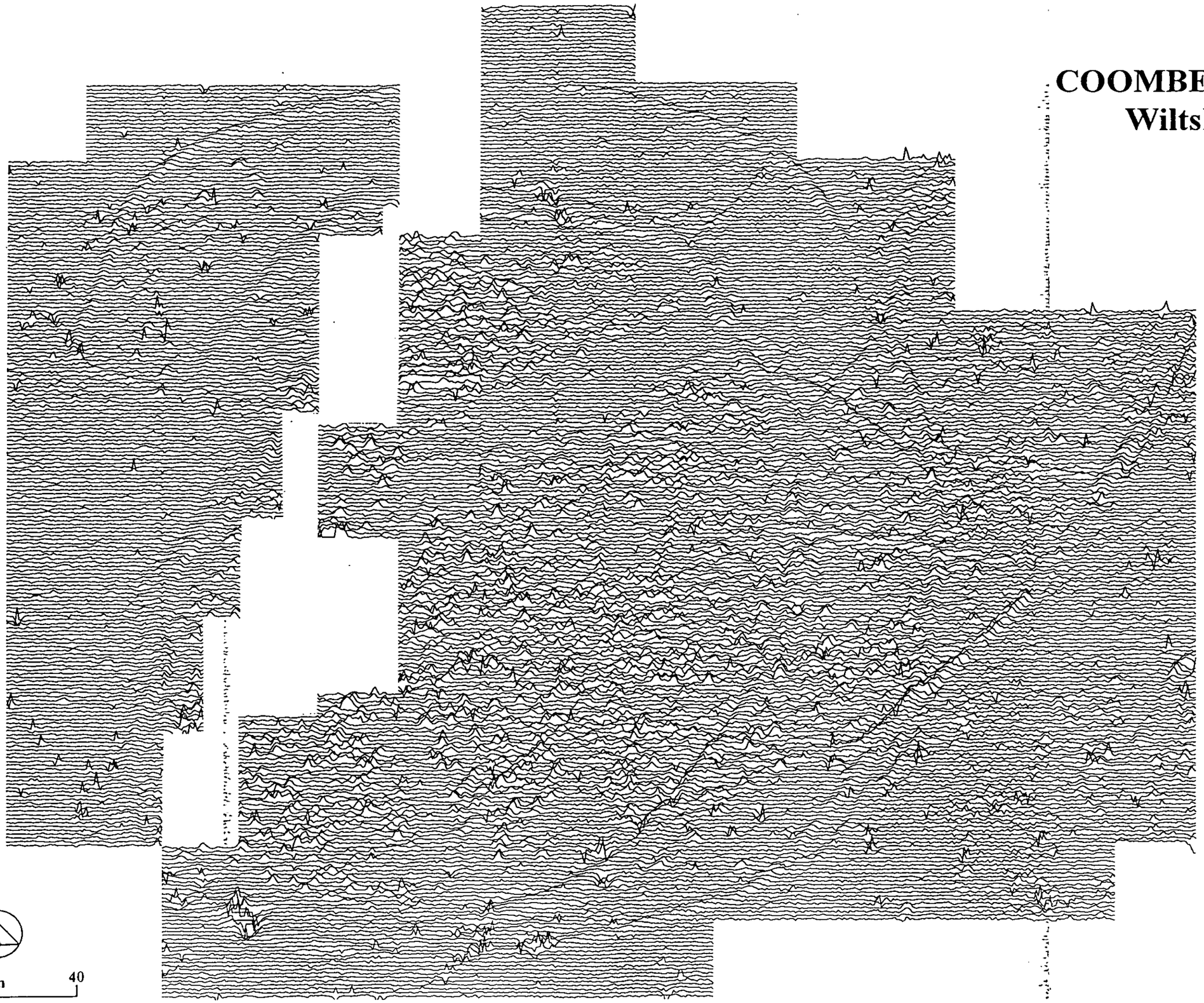
S — Seismic Profile

1 : 2500

Based on plans provided by RCHME with permission.

Figure 1

COOMBE DOWN
Wiltshire

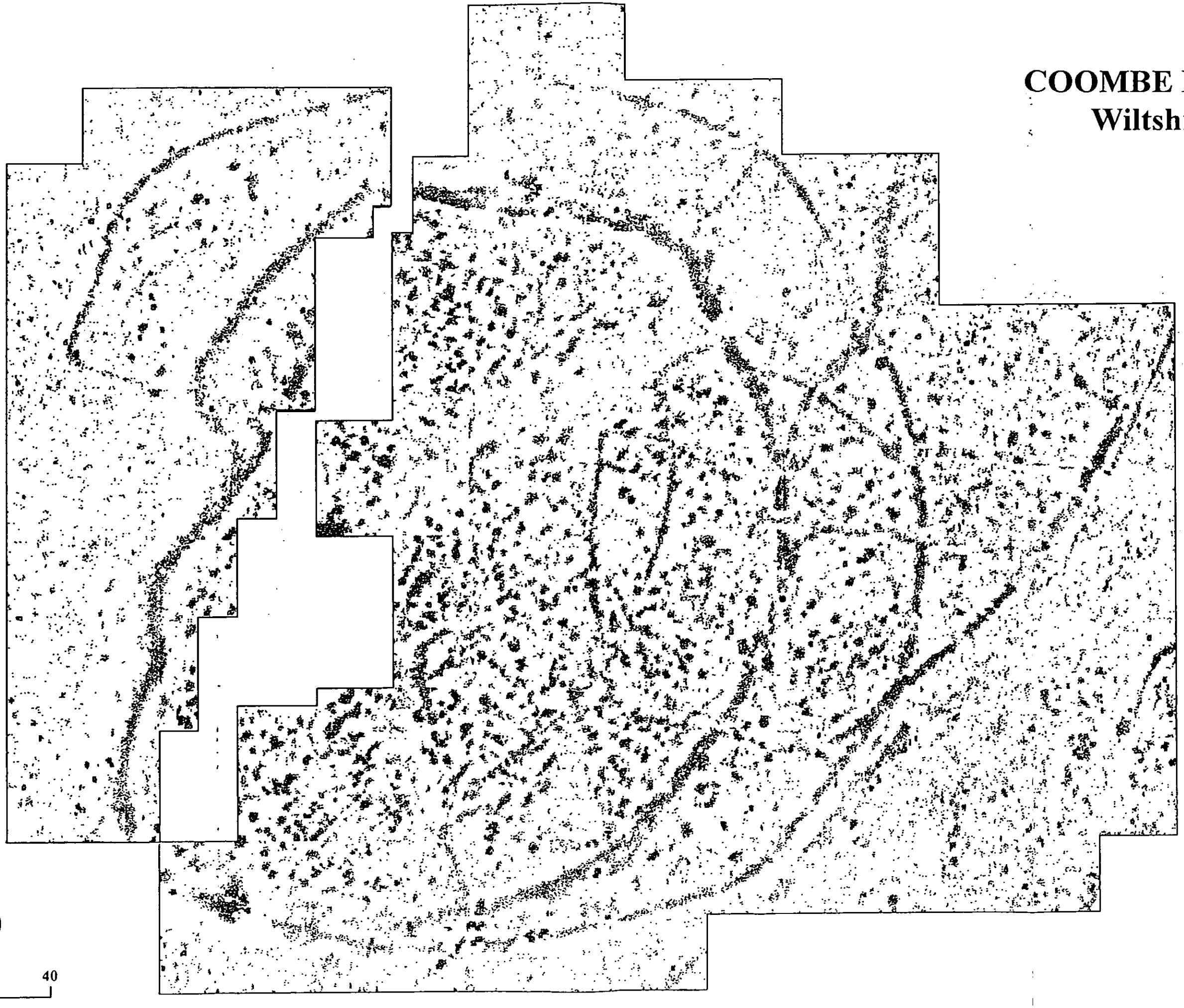


30 nT

0 m 40

Figure 2

COOMBE DOWN
Wiltshire



3.0
nT
0.1

0 m 40

Figure 3

COOMBE DOWN
Wiltshire

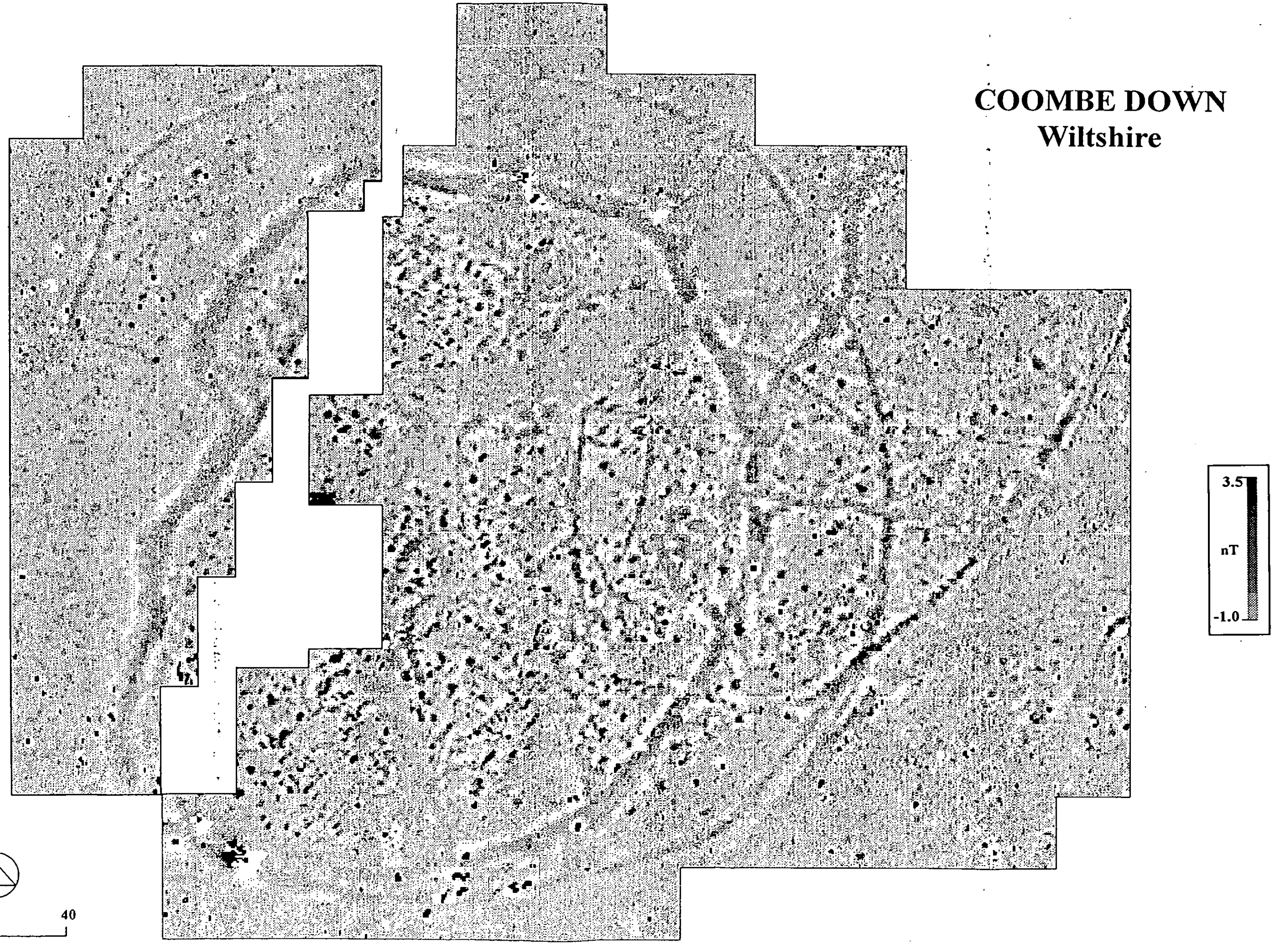
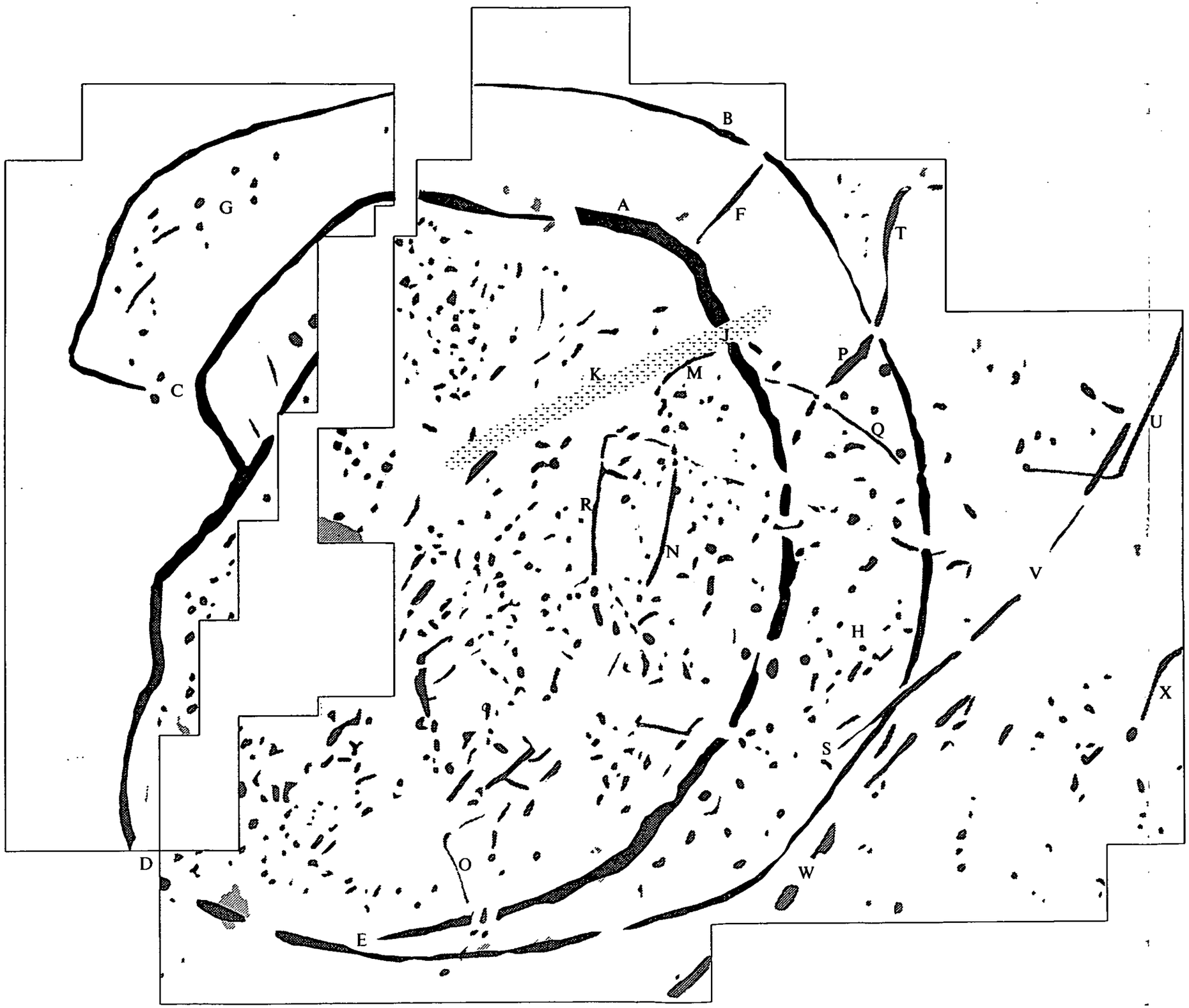


Figure 4

COOMBE DOWN
Wiltshire

Simplified Interpretation

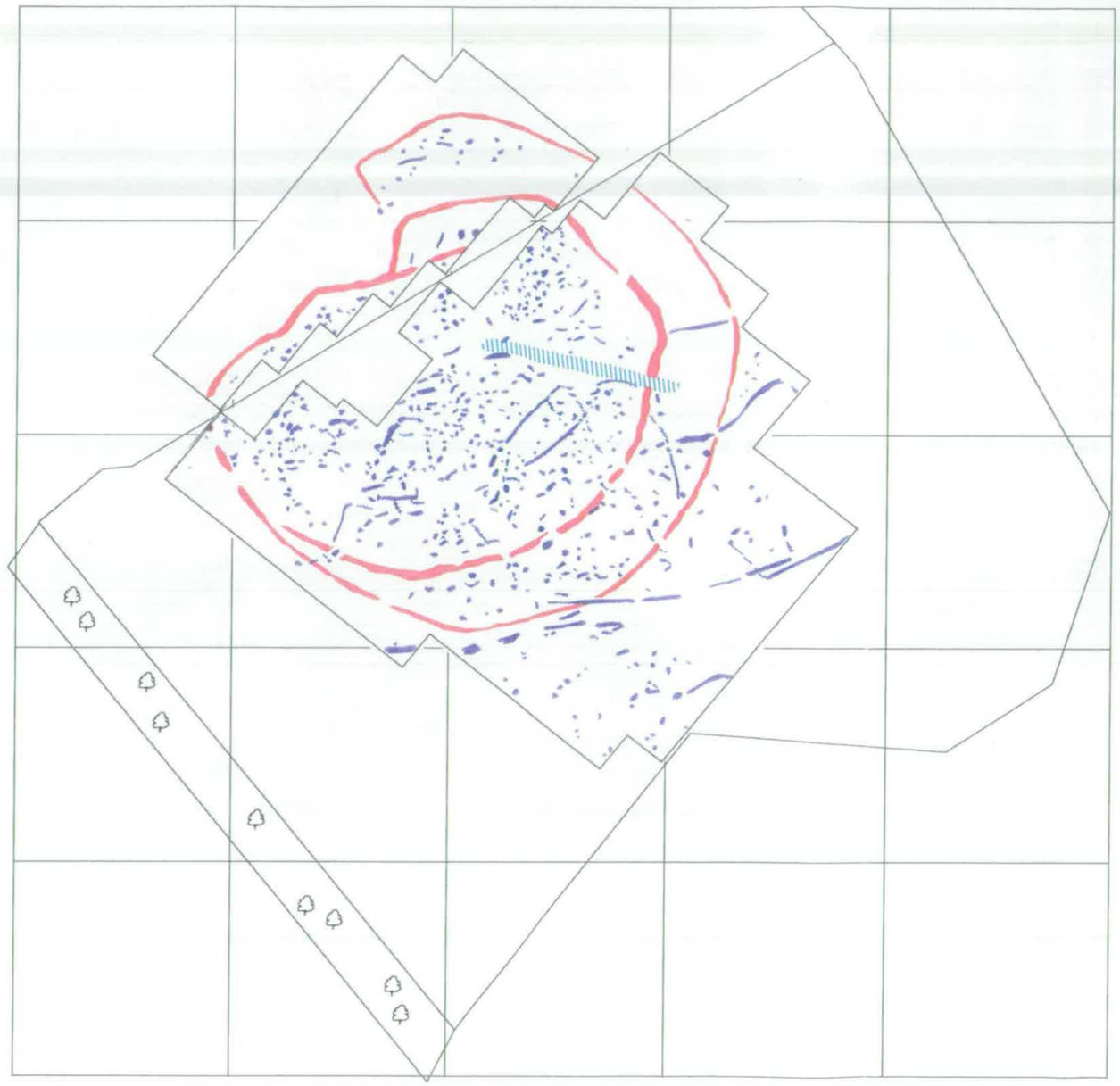


- Enclosure Ditches
- Other Ditches / Pits
- Trackway
- Ferrous

0 m 40

Figure 5

SU 19400 52300



SU 18900 51800

COOMBE DOWN

Simpified Interpretation

Enclosure Ditches

Other Ditches / Pits

Trackway

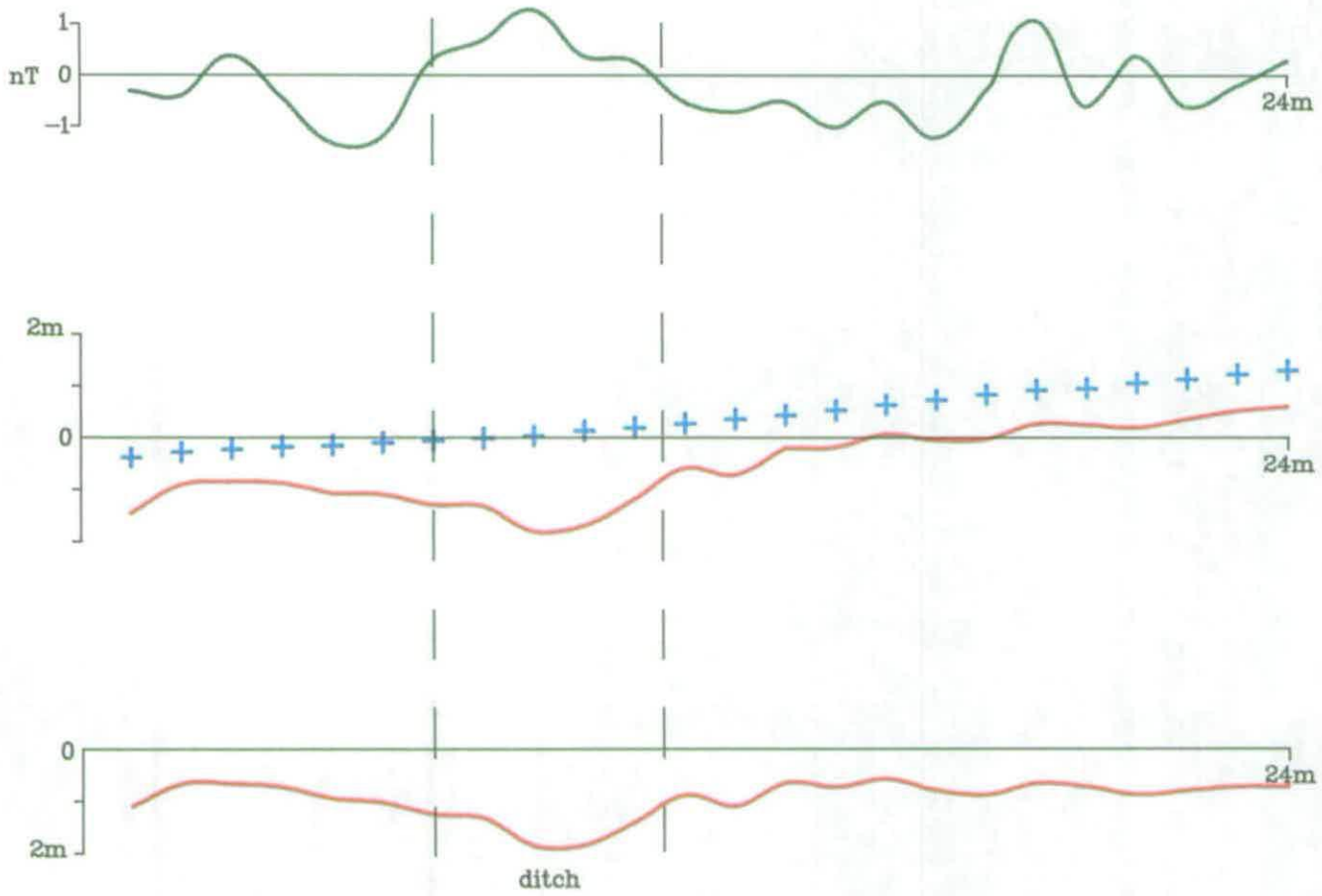
1 : 2500

Based on plans provided by RCHME with permission.

Figure 8

COOMBE DOWN

Comparison: Seismic and Magnetic Profiles: Line 1



a) Magnetic response (nT)

b) Topographic profile (m) (from a plan produced by RCHM(E))

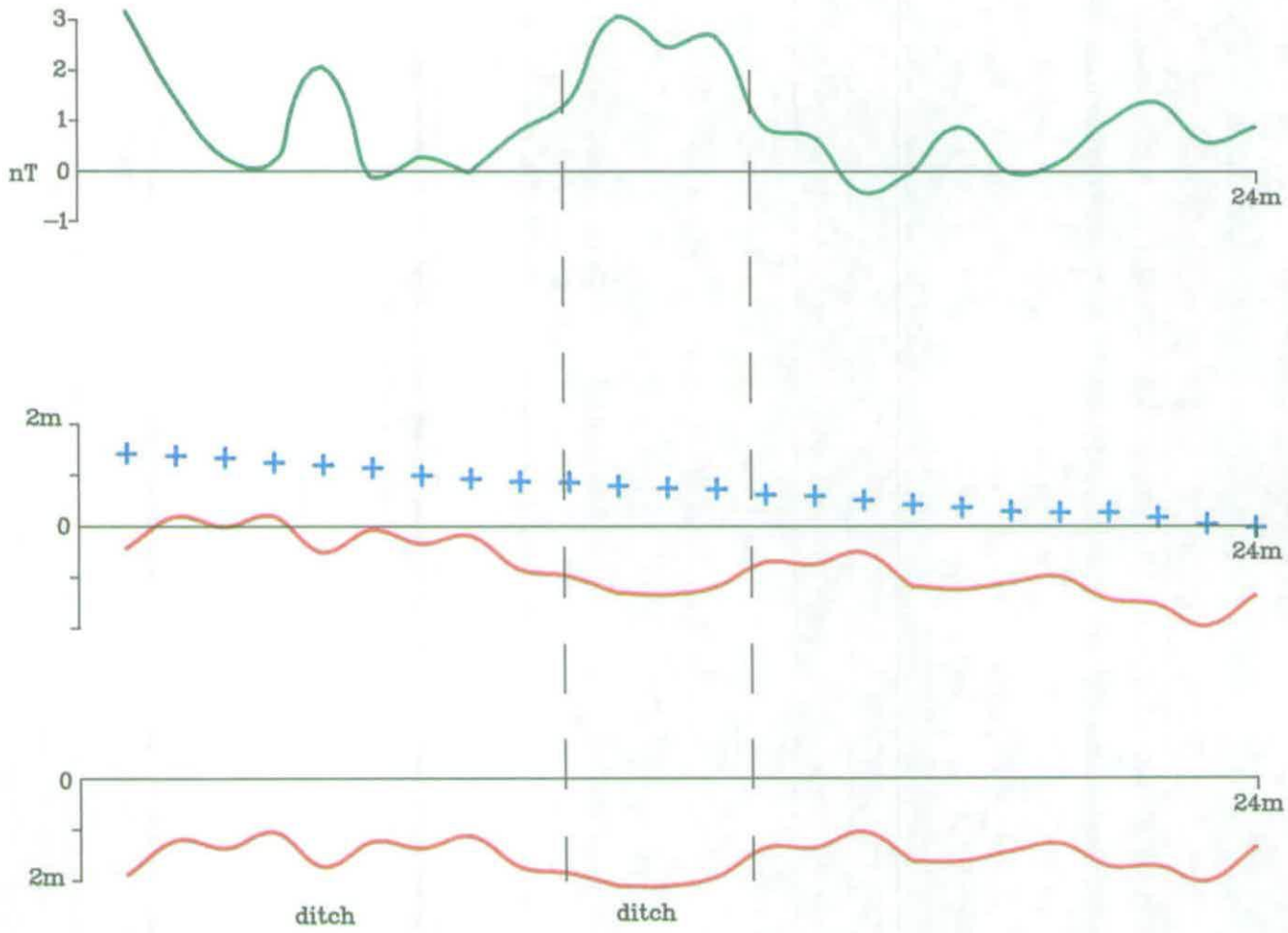
c) Seismic response: depth (m) below actual ground surface

d) Seismic response: depth (m) relative to "zero" surface

Figure 6

COOMBE DOWN

Comparison: Seismic and Magnetic Profiles: Line 2



a) Magnetic response (nT)

b) Topographic profile (m) (from a plan produced by RCHME)

c) Seismic response: depth (m) below actual ground surface

d) Seismic response: depth (m) relative to "zero" surface

Figure 7

GEOPHYSICAL SURVEYS of Bradford

Specialising in Archaeological Prospecting