

Crasken Farm, Helston, Cornwall: Report on Geophysical Survey, February 2002

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Summary

A geophysical survey was conducted over the site of a suspected prehistoric enclosure identified from aerial photographs at Crasken Farm, Helston, Cornwall, threatened by development proposals. The site lies immediately to the North of a wider landscape of archaeological activity including the Crasken Round scheduled ancient monument, annex enclosures associated with this Round and an additional prehistoric enclosure. The soil mark identified at the Crasken Farm site is similar to the dimensions of Crasken Round and may well represent an equally significant archaeological feature. To investigate this further a magnetometer survey was conducted over ~4ha of the site and successfully identified a number of linear and circular anomalies. However, the location of the soil mark failed to produce a corresponding magnetic anomaly.

Keywords

Geophysics

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CRASKEN FARM, HELSTON, Cornwall.

Report on geophysical survey, February 2002.

Introduction

The area surrounding the Graded II listed farm buildings at Crasken Farm, Helston, Cornwall contains a rich landscape of prehistoric archaeological activity. This includes the Crasken Round scheduled ancient monument (SMR No. 30106) that consists of a circular ditched enclosure with a diameter of approximately 100m and two adjoining annex enclosures. The location of the central Round enclosure is still preserved within the landscape of field boundaries evident today, that are seen to radiate from the high vantage point of the former settlement.

Following an outline planning application for the development of housing and a relief road over land adjoining Clodgey Lane to the North of Crasken Farm, evaluation of aerial photographs identified a circular soil mark with similar dimensions to Crasken Round. Currently, the developer of the site will not provide information through the planning process and a request was made to English Heritage by Cornwall County Council to assess the potential significance of the soil mark within the wider archaeological landscape.

The soil mark, centred on SW 6706 2828, lies within a ~4.3ha arable field to the North of Crasken Farm (Figures 1, 2 and 5). Well drained fine loamy soils of the Denbigh 2 association (Soil Survey of England and Wales 1983, 541k) have developed over slaty mudstone and siltstone of the Devonian Mylor Beds (Institute of Geological Sciences 1974). The site also lies on the edge of a metamorphic aureole of granite (evident as a building stone within the ancient Cornish field boundaries) and along the SW to NE course of a series of intrusive linear dolerite and greenstone bands. The field had been ploughed in November 2001 and left fallow prior to seeding with an early potato crop in March 2002. Weather conditions were mixed over the three days of data acquisition and included heavy showers and strong winds interspersed with dry, sunny periods.

Method

Magnetometer survey was considered to be the most appropriate geophysical technique to apply given the large area to be investigated and the considerable success of this methodology over similar sites in the vicinity (eg David 1982, Linford 1998). A survey grid was established over the site using a Trimble kinematic differential geographical positioning system to allow data to be collected at ~0.25m intervals along parallel SW-NE traverses separated by 0.5m (Figure 1). Variations in the local magnetic field were recorded with a Scintrex SM4 Smartmag caesium vapour magnetometer. Plots of the data are presented as both an X-Y traceplot and a linear greytone, at a scale of 1:1000 in Plan 3, (a) and (b) respectively. In the traceplot, the only corrections made to the measured values were first to zero-mean each instrument traverse to remove heading errors and then to compress extreme values with absolute magnitudes greater

than 10nT using hyperbolic tangent range compression. This latter operation is similar to the arctangent range compression described by Scollar (1990, p504) but uses the tanh function, it was applied to reduce the visually distracting effect of large spikes in the plot. A greytone image of the magnetometer results is also presented, superimposed on the base Ordnance Survey map data at a scale of 1:2500 (Figure 2).

Figure 4 compares a number of processed versions of the data, used to assist in the interpretation of the survey. Figures 4a and b show the data from Figure 3 plotted with grey and colour scales. Figure 4c shows the results of processing the data with a Wallis statistical differencing filter (Wallis 1976) to enhance its contrast and suppress the obscuring effects of high magnitude ferrous anomalies. A local window width of 15 metres was applied with an edge to background ration of 1.0.

Figure 4d shows the results of transforming the data using the Fourier domain reduction to pole operator (Baranov and Naudy 1964). This operator corrects for the regional angle of inclination of the earth's magnetic field and presents the survey as it would appear if the geomagnetic north pole had been situated directly beneath the site. At Helston in Cornwall the angle of inclination of the earth's field is approximately 65.2° , resulting in magnetic features appearing as bipolar anomalies with a positive component offset slightly to the south of the causative feature and a smaller negative component to the north. However, at the pole the earth's field is vertical (ie: the angle of inclination = 90°) so anomalies are almost entirely positive and positioned directly over their causative features. This data treatment can thus assist in the correct positioning of anomalies.

Figures 4e and f show results of calculating the vertical gradient of the magnetic field from the data after reduction to the pole. As with the Wallis contrast enhancement of Figure 4c, this technique reduces the obscuring effects of the very high magnetic fields caused by ferrous objects such as the pipeline running across the survey. It is thus possible to discern weaker archaeological anomalies in closer proximity to such ferrous sources.

Results

A graphical summary of the anomalies discussed in the following text, superimposed on the base Ordnance Survey map data, is provided in Figure 3.

General response and modern interference

The site has produced a good magnetic response although many of the significant anomalies are quite weak ($<0.5\text{nT}$). More extreme values have been recorded from modern interference including the ferrous water supply pipe [1] feeding an animal trough situated mid-way along the eastern field boundary of the site. Ferrous disturbance is also evident at the edges of the survey and particularly along the northern boundary with Clodgey Lane (A394) [2] and the entrance gate [3] into the field. Disturbance from the road is due to a combination of passing vehicles and the possibility of a midden site in this area, suggested by the profusion of recent pottery scattered within the topsoil. The extant plough furrows have also produced a pattern of parallel linear anomalies and "tram lines" around the edge of the field. However, this plough

pattern, rather inexplicably, appears to fade towards the southern end of the site.

A more diffuse pattern of amorphous response [4] (see key, Figure 5), trending approximately SW-NE, may be related to bands of intrusive Dolerite and Greenstone mapped on a similar orientation in the area.

Significant anomalies

The most striking responses are the series of rectilinear anomalies [5] – [12] that cross the site and are, no doubt, related to former field boundaries. A number of similar features have been interpreted from aerial photographs (RAF S40/S18/3229 1951) and these include both double-ditched responses similar to [5] and [7] and a curvilinear ditch section that adjoins [9] to the E of the survey. Fragments of less intense ditch-type anomalies [8] and [12] are also evident but these do not fully respect the orientation of the more intense linear responses.

Of greater interest is the circular anomaly [13] found to the NE of the survey with a diameter of ~20m and the associated curvilinear response [14]. Whilst [13] has a considerably smaller diameter than the Crasken Round the dimensions are similar to the circular annex enclosure identified from aerial photographs found to the south of this monument. The soil mark adjacent to [13] and [14] fails to produce a distinctive magnetic anomaly that might be expected from the ditches of a Round, but does enclose a region of slightly enhanced magnetic response [15]. Unfortunately, the northern extent of the soil mark falls within the obscured area of magnetic disturbance [2] along the course of the modern road. However, a sufficient portion of the cropmark exists beyond the magnetic disturbance to identify a corresponding magnetic anomaly if one exists. Additional, more tentative curvilinear anomalies are found at both [16] and [17] (see key, Figure 5) but these exhibit a much reduced magnitude of response.

Two scatters of discrete (non-ferrous) anomalies [18] and [19] are found in the north and south of the survey area respectively. To the north, these responses [18] are negative suggesting an area of reduced magnetisation that may be caused by large fragments of the underlying siltstone in topsoil. Indeed, one such fragment was noted on the surface of the field during the survey. The scatter of positive discrete anomalies [19] to the south of the survey appears more significant and may well represent a distribution of pit-type responses. However, the absence of additional geophysical evidence for settlement activity in this area, such as hut circles or enclosure ditches, urges a degree of caution and suggests a geological origin can not be entirely discounted.

Conclusion

The geophysical survey at Crasken Farm has successfully identified a number of significant magnetic anomalies related to former field boundaries and at least one small circular enclosure. However, none of these anomalies correlate directly with the location of the soil mark identified from aerial photography that prompted the investigation. Given the generally favourable response over the site it seems unlikely that a causative feature on the scale suggested by the soil mark could fail to produce a distinctive magnetic anomaly. However, it is possible that the

original feature has been highly truncated through ploughing, leaving only the area of slight magnetic enhancement detected by the survey.

Despite this disappointment the discovery of a circular enclosure adjacent to the soil mark within the footprint of the proposed development suggests the presence of significant remains in this area. Further investigation of the soil mark is therefore recommended, either through trial trenching or earth resistance survey, to test the apparent negative geophysical evidence produced by the magnetic survey.

Surveyed by: N Linford
P Linford

Date of survey: 25/2/2002 – 1/3/2002

Reported by: N Linford & P Linford

Date of report: 6/3/2002

Archaeometry Branch,
English Heritage Centre for Archaeology.

References

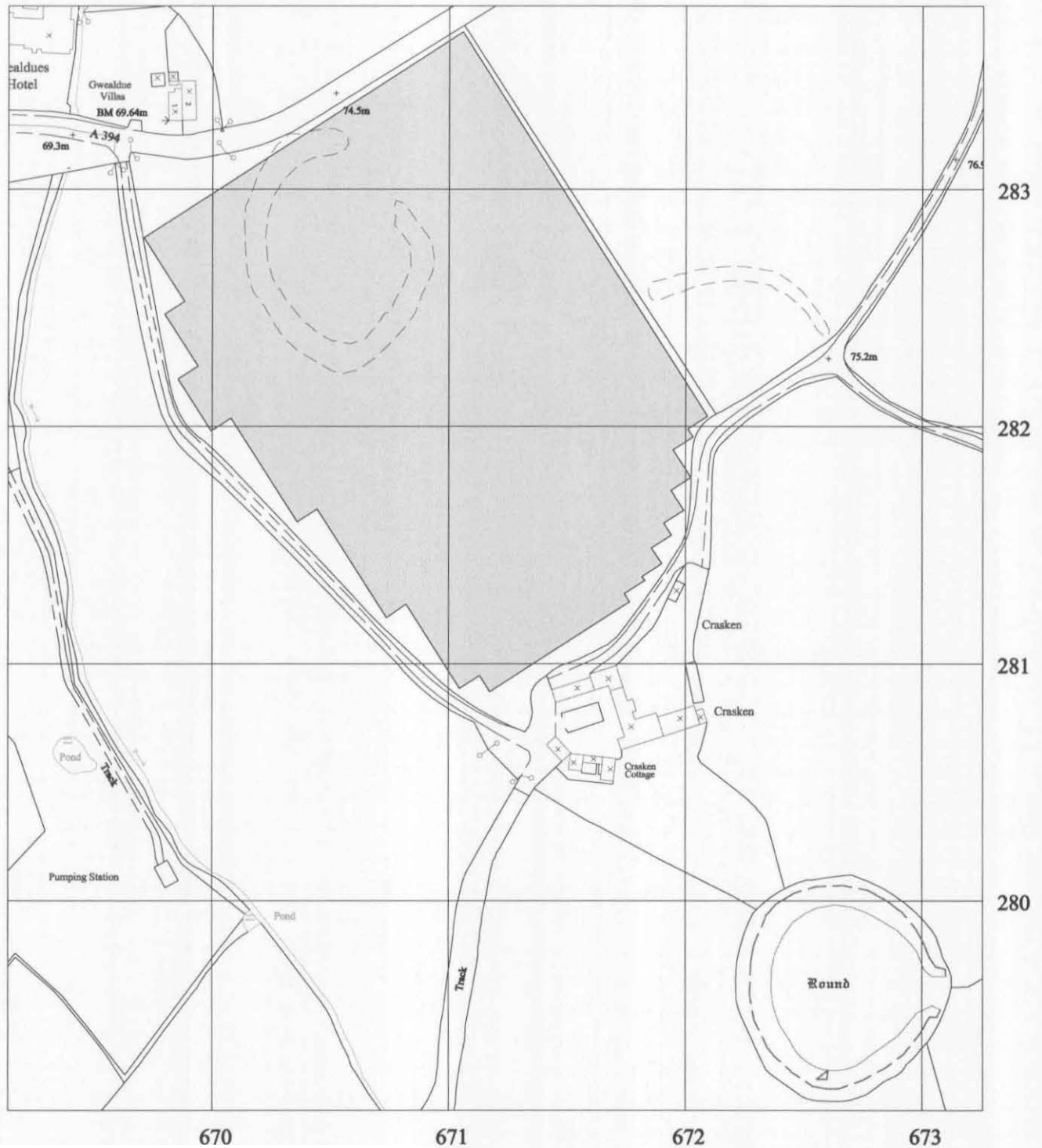
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- Figure 2* Linear greytone plot of magnetometer data superimposed over base OS map (1:2500).
- Figure 3* Traceplot and linear greyscale representation of magnetometer data (1:1000).
- Figure 4* Processed versions of the magnetometer data (1:2500).
- Figure 5* Graphical summary of significant geophysical anomalies (1:1000).

CRASKEN FARM, HELSTON, CORNWALL.
Location of magnetometer survey, February 2002

SW 6728



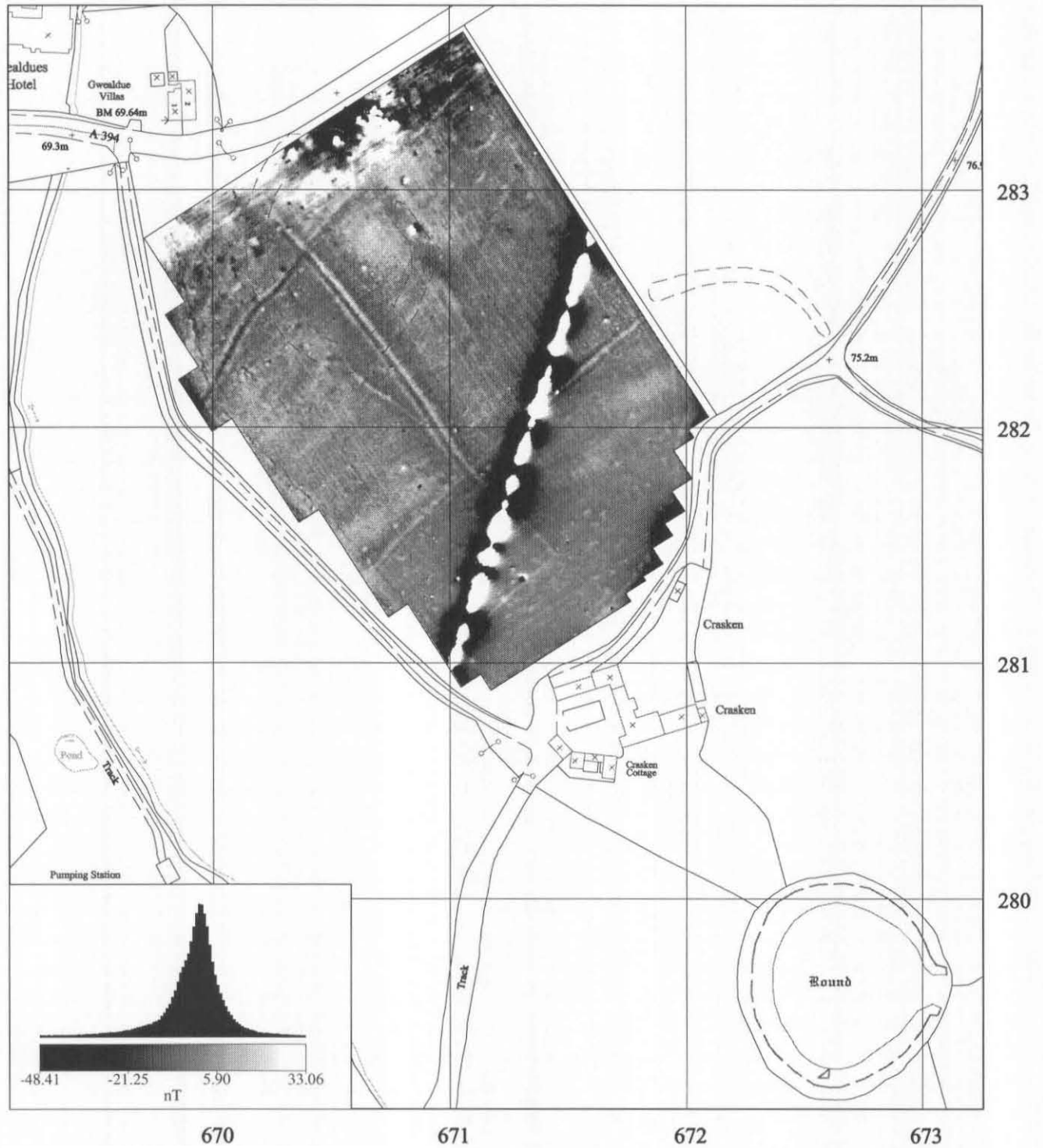
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0 150m
1:2500

Figure 1; Crasken Farm, Cornwall, Location of magnetometer survey, February 2002.
*Dashed lines show locations of enclosure soil mark and removed field boundary
transcribed from aerial photograph.*

CRASKEN FARM, HELSTON, CORNWALL.
Location of magnetometer survey, February 2002

SW 6728



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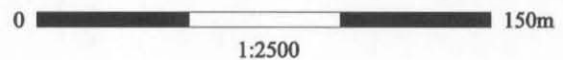
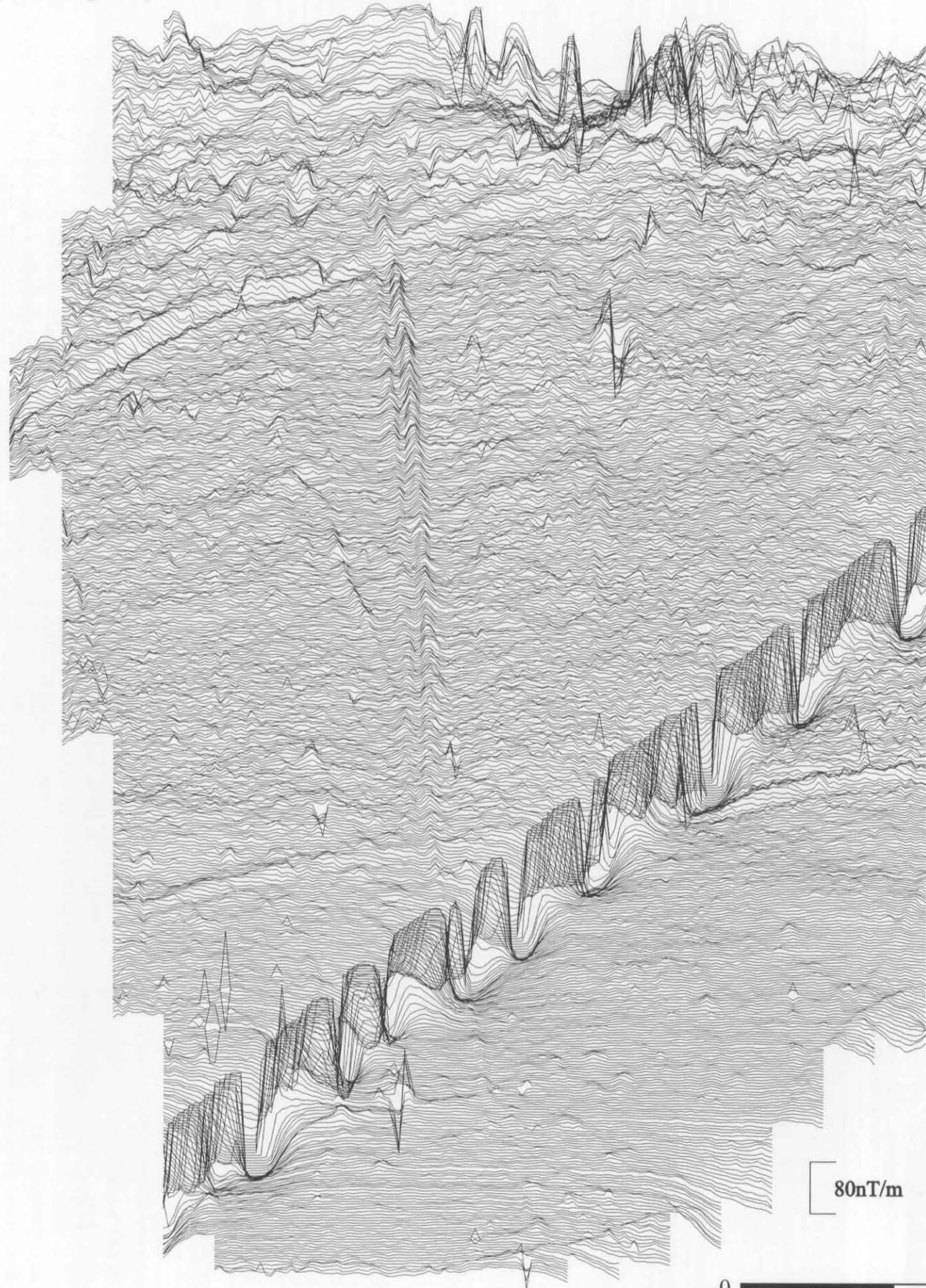


Figure 2; Crasken Farm, Cornwall, Greyscale image of the magnetometer data superimposed over the base OS map. Dashed lines show locations of enclosure soil mark and removed field boundary transcribed from aerial photograph.

Figure 3) CRASKEN FARM, HELSTON, CORNWALL. Magnetometer survey, February 2002.

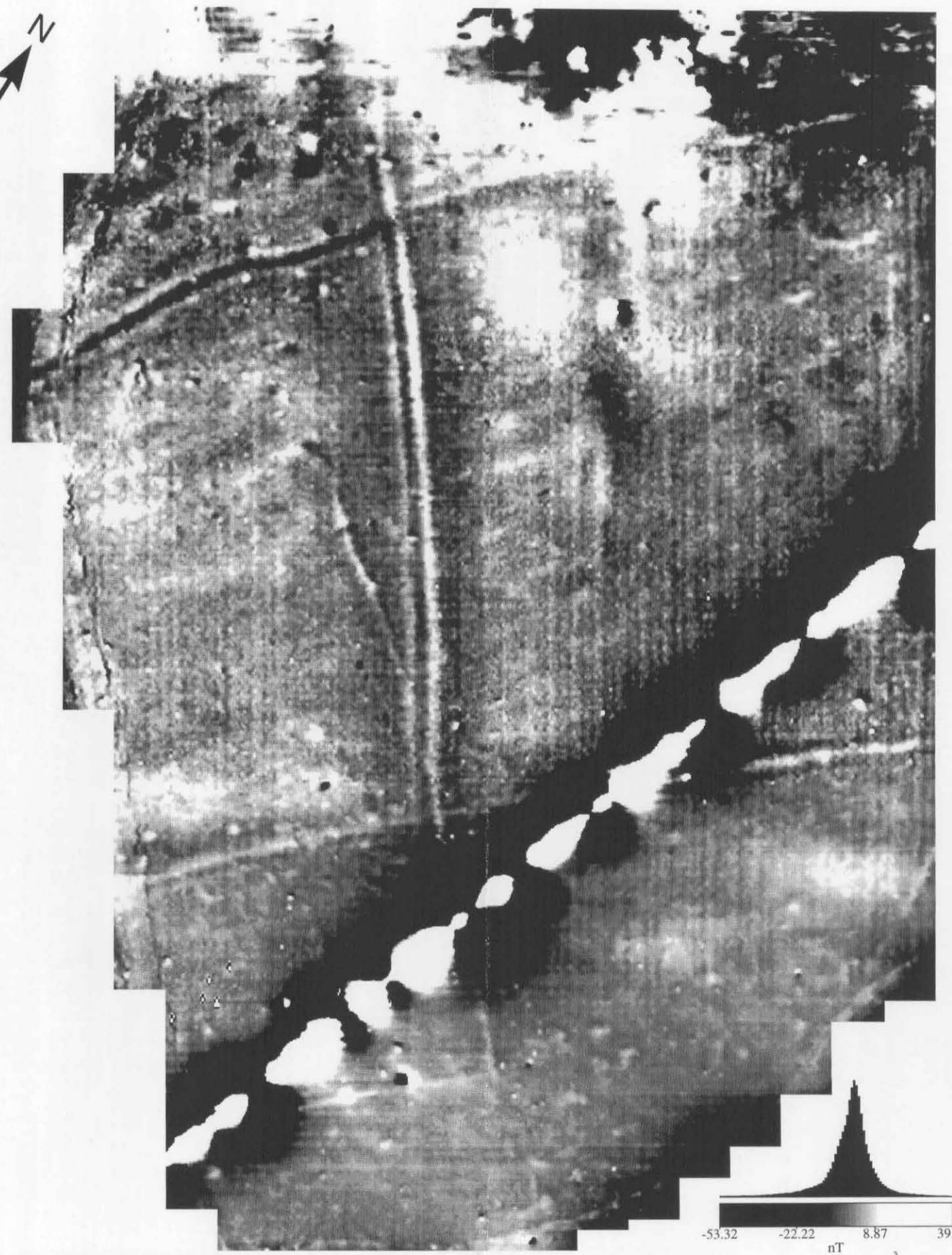
(a) Traceplot of data (extreme values suppressed).



80nT/m

0 1:1000 90m

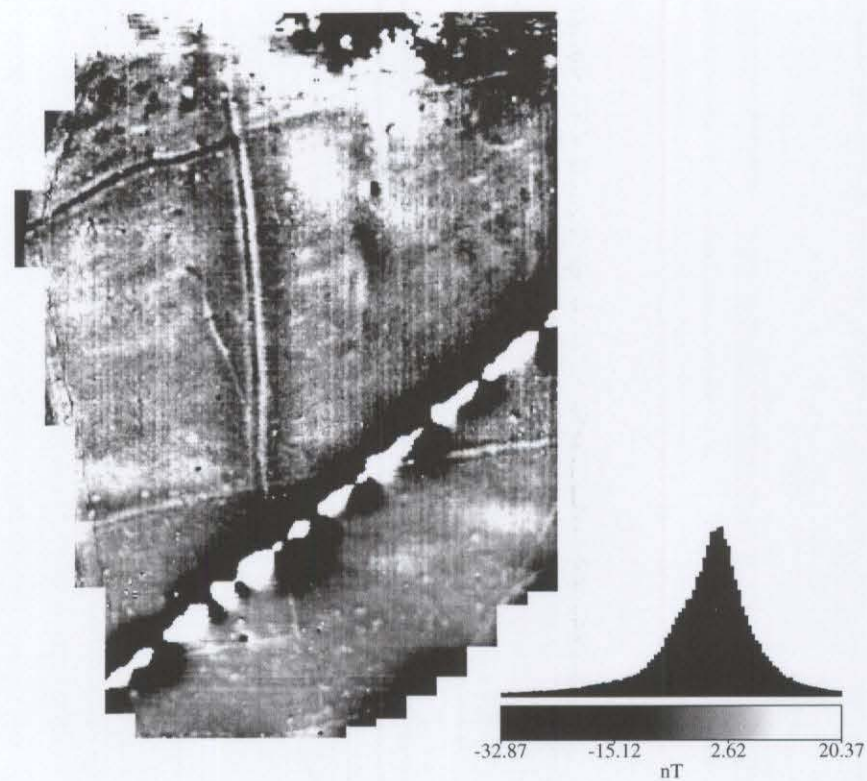
(b) Linear greytone plot between +/-10nT.



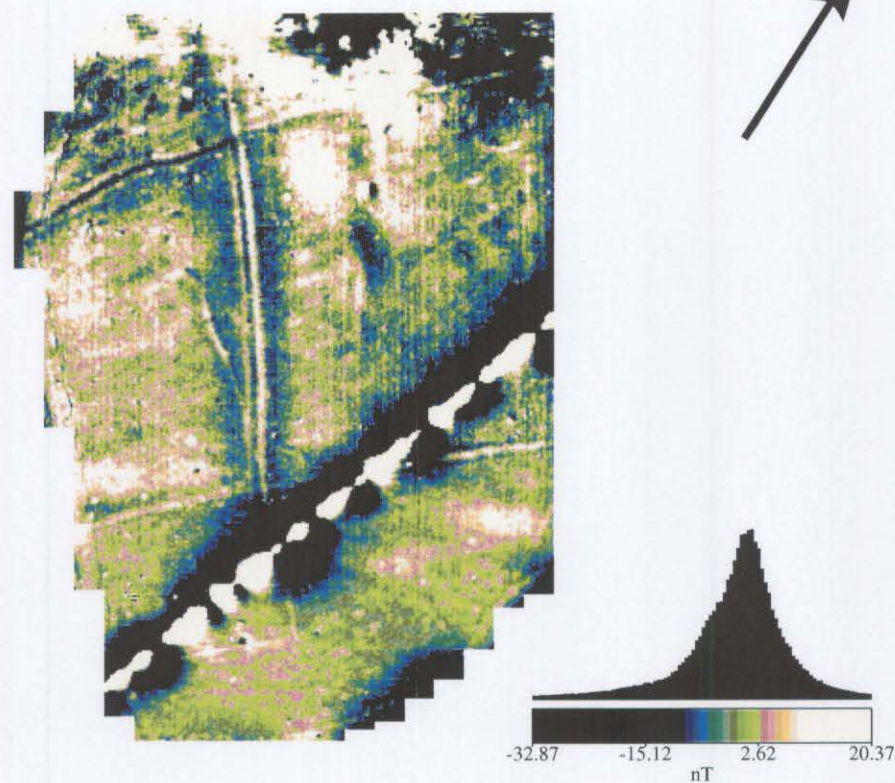
-53.32 -22.22 8.87 39.97
nT

Figure 4) CRASKEN FARM, HELSTON, CORNWALL. Processed magnetometer survey, February 2002.

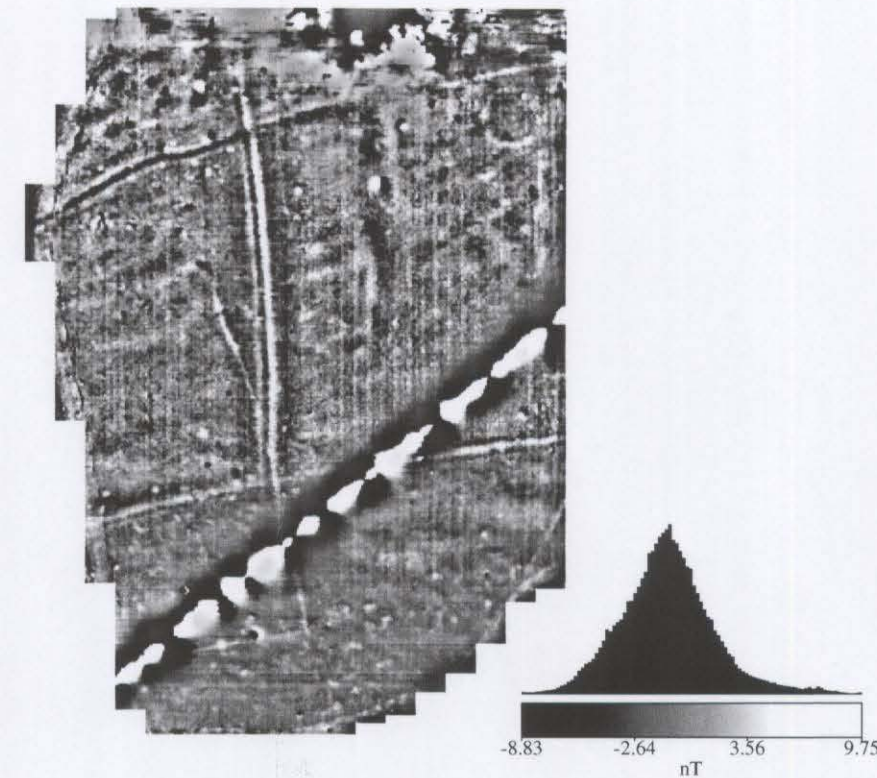
(a) Linear greytone plot of data between ± 10 nT.



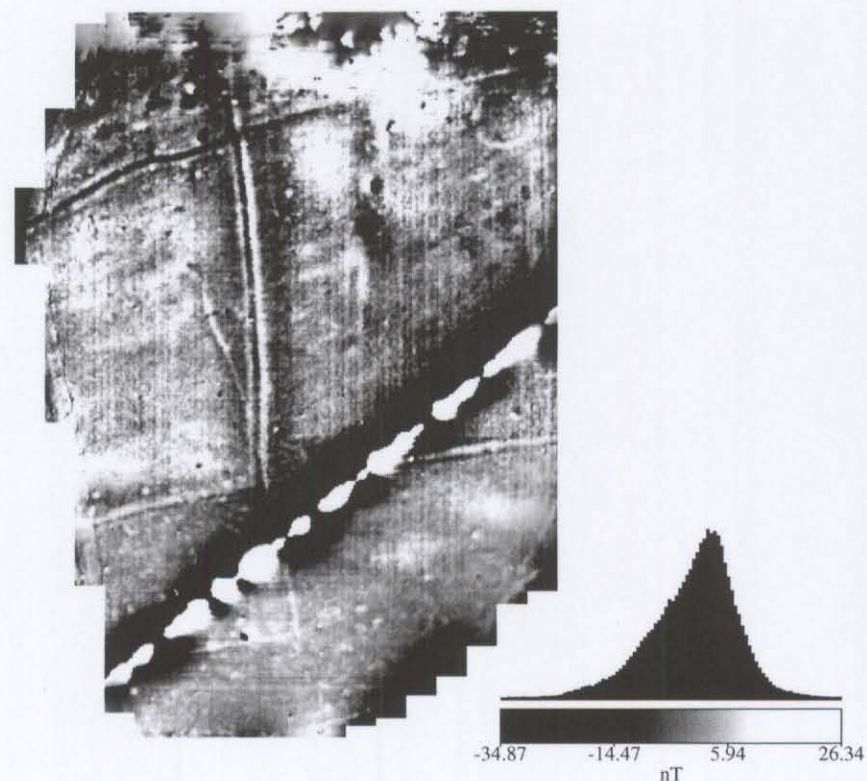
(b) Data from figure 4a plotted with a colour scale.



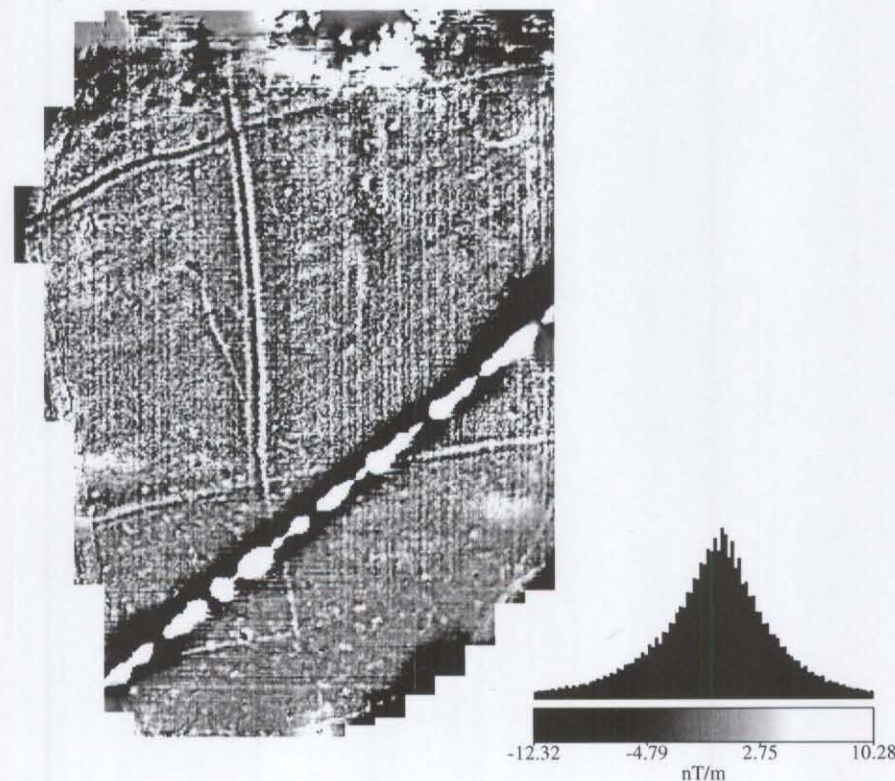
(c) Data after application of Wallis contrast enhancement, plotted between ± 5 nT.



(d) Data after reduction to pole plotted between ± 10 nT.



(e) Vertical gradient of data after reduction to pole, plotted between ± 5 nT.



(f) Data from figure 4e plotted with a colour scale.

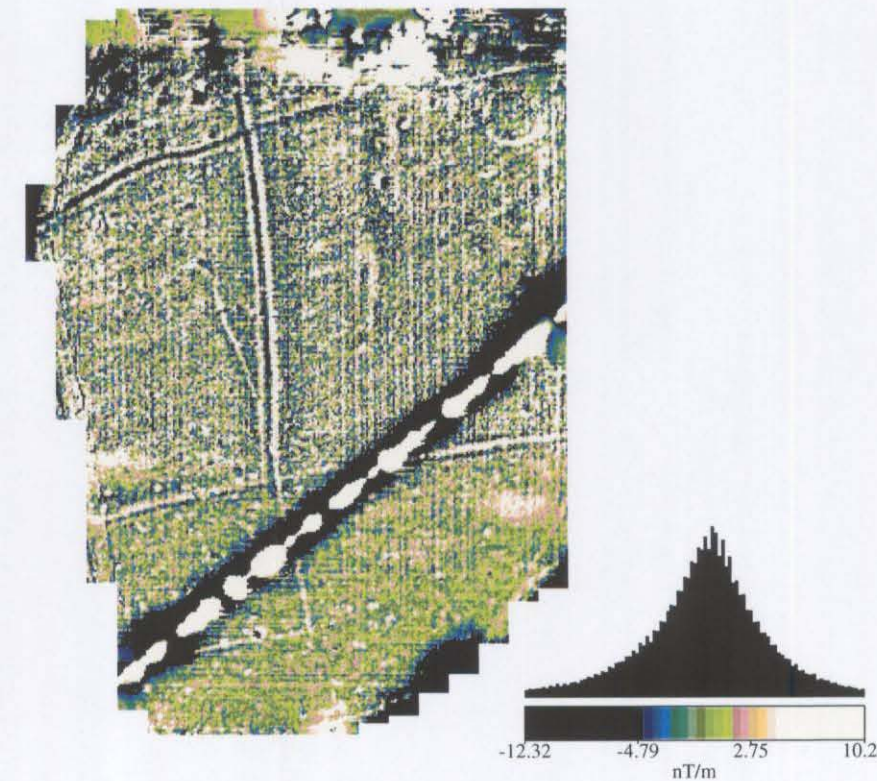
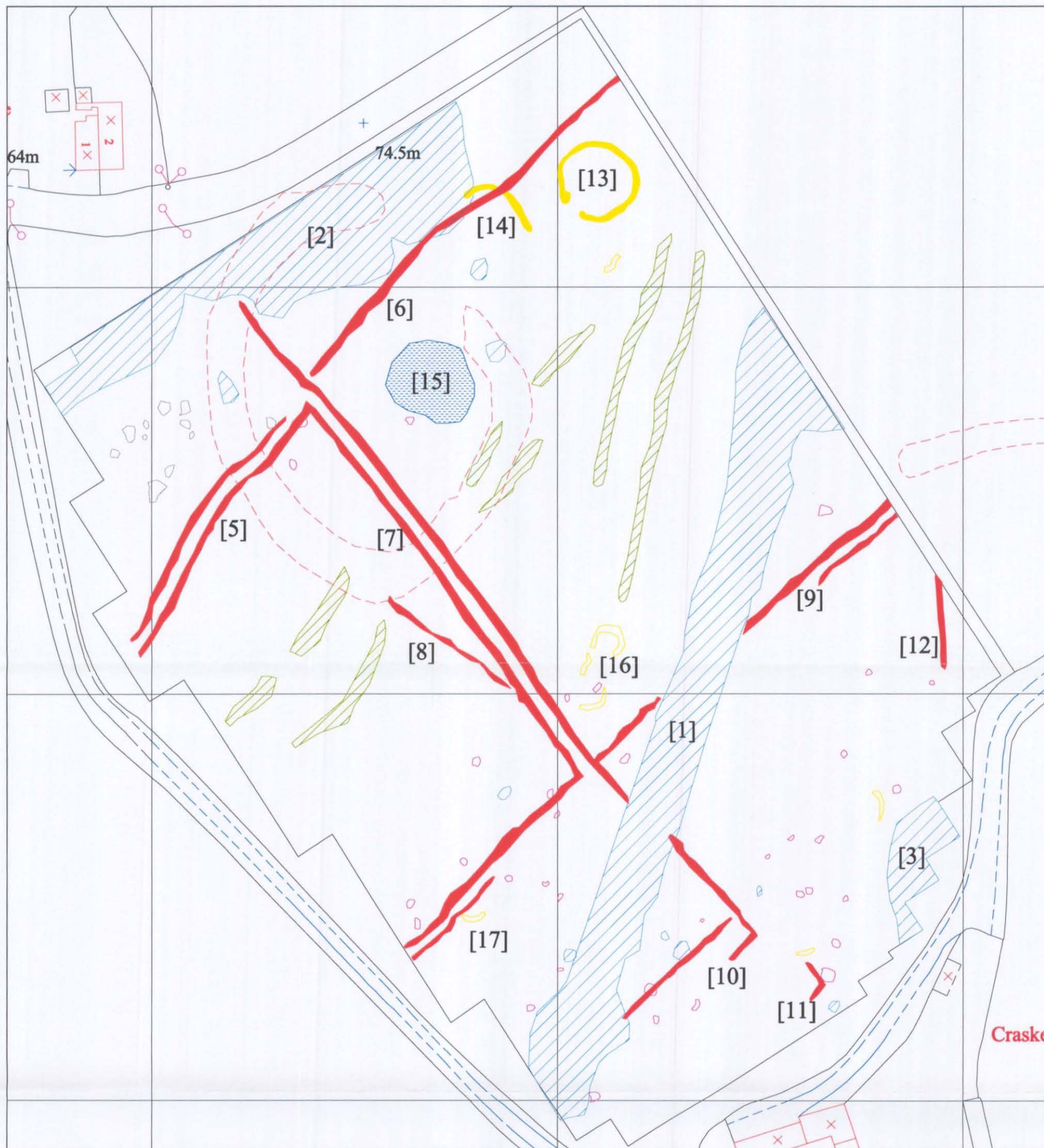










Figure 5) CRASKEN FARM, HELSTON, CORNWALL.
 Interpretation of magnetometer survey, February 2002.

SW 6728



Key

- | | | | |
|--|--|--|--|
|  Ferrous disturbance. |  Curvilinear anomaly, unfilled = tentative. |  Area of enhanced magnetisation. |  Pit-like anomaly [19]. |
|  Linear anomalies
?field boundaries. |  ?Geology [4]. |  Negative anomaly -
?buried boulder [18]. |  Soil mark evidence
transcribed from aerial
photograph. |

0 ————— 60m
 1:1000