Barnsdale Bar Quarry
Kirk Smeaton

Fieldwalking & Gradiometer Survey
(Western Extension)

November 1995

West Yorkshire
Archaeology Service

West Yorkshire Archaeology Service
14 St John's North, Wakefield WF1 3QA

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1. Summary

1.1 Client

BFI Waste Systems/Quarry Products
Cumberland House
Wintersells Road
Byfleet
Surrey
KT14 7AZ

1.2 Aims and objectives

To attempt to establish the presence or absence of archaeological features within the proposed development area. To map and interpret any anomalies which are detected.

1.3 Method

An area of c. 10.5 hectares, around an area identified as being of possible archaeological interest from aerial photographs, was surveyed using a fluxgate gradiometer. A surface collection field walking exercise was also carried out.

1.4 Discussion of the results

An enclosure system comprising several ditches on a different orientation to the present field layout was detected. Several infilled field boundaries of more recent origin were also detected. In addition, a strongly magnetic curvilinear anomaly, that encompasses an area identified as a possible cemetery was detected. Other discrete anomalies encompassed by this major anomaly may indicate pits or other small infilled features.

The fieldwalking collected many pieces of flint, including cores, two leaf-shaped arrow-heads, and scrappers and blades. From the systematic field collection 84% of the pieces came from the southernmost 165m of the site. The greatest concentrations may correspond with anomalies detected by the gradiometer. The flint assemblage possibly dates from the Neolithic period.

All interpretations are based on the present knowledge of the site.

2. Introduction

2.1 The West Yorkshire Archaeology Service were commissioned to carry out fieldwalking and a fluxgate gradiometer survey over an area of approximately 10.5 hectares on land which will be affected by the proposed expansion of the Barnsdale Bar limestone quarry westwards towards the A1. The fieldwork was undertaken between September 22nd and October 5th 1995.

2.2 Aerial photographs of the area showed a group of discrete non-linear cropmarks within or near the proposed development. It is thought that this might indicate a cemetery of unknown date. A gradiometer survey, subsequent trial trenching and further excavation of the area to the east of the current site (Boucher 1993; Webb 1993; and Brown 1995) confirmed the presence of a system of ditches of probable Iron Age or Romano-British date. There are several other sites in the immediate area, notably the presumed cemetery under Windhill plantation although other investigations have been carried out to the north of this (Abramson 1989 and Simpson 1991).

2.3 The site varies in height from about 53m on the eastern side (on top of the bund) to about 48m at the bottom of the dry valley which bisects the site before rising up again and levelling off at about 51m adjacent to the A1. The underlying geology is Magnesian limestone.

3. Fluxgate gradiometry: technical information and methods

3.1 Geoscan fluxgate gradiometers measure small near-surface variations in the vertical component of the earth's magnetic field. These can be due to permanently magnetised objects such as iron artifacts, areas of *in situ* enhanced (or remnant) magnetism caused by heating, or contrasts in the "magnetisability" (or magnetic susceptibility) of buried deposits.

3.2 In general it is the contrast between the magnetic susceptibility of deposits filling cut features such as ditches and the magnetic susceptibility of the geology into which these features have been cut which cause the most recognisable responses. Other features such as kilns and ovens can be more difficult to identify although their responses are generally stronger than soil filled features. The highest responses are usually due to iron objects and these produce a characteristic response with a rapid change from positive to negative readings.

3.3 There are a number of methods employing the fluxgate gradiometer. The most basic of these is referred to as scanning and requires the operator to identify responses whilst covering the site in widely spaced traverses.

3.4 Detailed gradiometer survey employs the use of an ST1 Geoscan sample trigger and FM36 fluxgate gradiometer to take readings at 0.5m intervals on zig-zag traverses 1m apart within grids measuring 20m by 20m. This means that 800 readings are taken within each 20m grid square. This method was employed during the survey.

4. Results

4.1 The presentation of results

4.11 The data has been presented in three formats: greyscale, dot density and XY-trace. The latter is important for the interpretation of isolated responses. These have been produced at a scale of 1:500 and are included in Plots 1, 2 and 3 as appendices to the main report. A grey-

scale plot of the data has been overlaid on the site development plan at 1:1250 (Fig. 1) to help show the area and location of the site covered by survey and the positions of features within the site. A schematic interpretation of the data is presented as Figure 2 at a scale of 1:2000. The distribution of flints in relation to the interpreted geophysical anomalies is shown in Figure 3, also at a scale of 1:2000.

4.2 Fieldwalking methodology, results and discussion

4.21 The same southern and western base lines were used as in the gradiometer survey with traverses spaced 3-4m apart within 20m by 15m blocks.

4.22 Systematic collection of finds from the surface of the field recovered 110 pieces of flint. Of these 84% came from a strip 165m wide at the south end of the site (see Fig.3). The remainder were randomly scattered across the rest of the site. A similar distribution was found in 1993 (when 20 pieces were recovered from the surface). All the aforementioned flint objects were looked at together with 11 finds collected from the south of the site during the geophysical survey this year (Appendix 1).

4.23 The assemblage contains a number of tools and other artifacts associated with the manufacture of flint implements. The finds are summarised below:

TYPE	No.	%
Flakes	52	37.0
Blades	23	16.0
Spalls	20	14.0
Unworked	15	11.0
Cores	8	7.0
Scrapers	9	6.0
Bladelets	5	3.5
Core rejuvenators	5	3.5
Leaf arrowhead	2	1.0
Serrated blades	1	0.5
Gun flint	1	0.5
TOTAL	**141**	

The majority of the assemblage (61.5%) comprises flint artifacts associated with the manufacture of flint tools with a further 11% consisting of unworked nodules. There were also a large variety of types of flint with the most frequent being mid grey/brown in colour. Of the systematic fieldwalk finds, 28% of the pieces had cortex and 54% were patinated to some extent. The ratio of tools to debitage is 8:25 with 73% of the tools being blades.

It is not possible to date flint finds precisely, however, components of an assemblage this size can provide indications as to its date. Of the finds the most chronologically constrained example is the leaf-shaped arrowhead. This type of artifact is normally associated with Neolithic material and, more often than not, from the latter part of this period (*c.*3500BC-2000BC). Scrapers of the type found here are normally associated with either the Neolithic or Bronze Age. Whilst micro-blades or bladelets and the pyramidal cores from which they are made are commonly thought of as originating in the mesolithic, although it is probable that the tradition continues into the Neolithic. The concentration of material in comparison to the

general background scatter observed to the north of the site tends to imply it is all from one occupation period as it originates from a discrete area. Whilst the pyramidal cores and bladelets could be Mesolithic in date a lack of microlithic material in the assemblage is probably real, as the number of spalls attests a good rate of collection of smaller artifacts, and therefore it is more likely the assemblage is later than this period. Similarly, whilst a number of the scrapers could be seen as being Bronze Age in origin, they are equally at home in the Neolithic alongside artifacts such as the serrated blade and leaf-shaped arrowheads. It is more likely, therefore, that the assemblage belongs to the Neolithic than to another period.

The type and frequency of the artifacts combined with the amount of cortex present reflects local flint production using regionally accessible raw materials. The range of artifacts tends to imply occupation on the site.

4.24 It is interesting to note that the concentration of flint occurs near the projected line of a large linear feature observed in the quarry section and during the watching brief in the adjacent site. This feature has been interpreted as being natural in origin due to its size (> 10m across and 3m deep) and to the lack of finds within it. Considering the discovery of flint on the surface it would appear reasonable to assume that the occupation activity associated with these finds is more likely to be connected with near surface shallow features that post-date what is probably a geological feature.

4.3 Gradiometer Survey

4.31 The data was investigated at a number of levels with -1 to 2nT being chosen as the most presentable for the purpose of the report.

4.32 Perhaps the most obvious recent feature is identified by the linear anomaly, W, that runs from south-west to north-east in the southern half of the site. From Figure 1 it can be seen that it is parallel with the other field boundaries that extend eastwards away from the A1. This anomaly aligns with a field boundary marked on the first edition Ordnance Survey of *c.* 1850.

4.33 Although the remainder of the hedge boundaries in the survey area have been ploughed out since recent mapping, their positions can still be seen as linear magnetic anomalies (see Fig. 2). The direction of the most recent ploughing and seeding still respects these former boundaries, being aligned at right angles to the A1. These most recent agricultural operations also show as the intermittent linear striations which can be seen across most of the site within the magnetic data.

4.34 Iron objects buried in the topsoil produce what are called "iron spikes" in the data. These are best seen on the XY-trace plot. Several of these stronger responses have been identified on the interpretation plot (Fig. 2). Generally these are not indicative of buried archaeology. More generalised areas of magnetic disturbance, R and S, can also be seen.

4.35 The remainder of the anomalies are probably archaeological in nature. Essentially these comprise a series of linear anomalies, B to K, radiating at right angles away from a central spinal north-south orientated anomaly, A. Anomalies A and F have gaps of 60m and 20m respectively. These may be deliberate entrances or alternatively may indicate plough damage. Anomaly J has two other anomalies immediately adjacent and parallel to it.

4.36 Three other anomalies (the pair of short parallel anomalies, M and a round cornered section of enclosure, L) can also be seen in the north-western corner of the site. These may not be contemporary with the rest of the anomalies mentioned above.

4.37 By far the strongest response is that of Anomaly N. This curvilinear anomaly, as can be seen from Figure 1, runs along the bottom of the dry valley at about 50m OD before turning to the south-west running up slope along the 56m contour line before disappearing. This anomaly encompasses the area in which the grave type features were spotted on the aerial photographs.

4.38 Three groups of discrete high response anomalies, T, U and V, that are not iron spikes can also seen; all within the area encompassed by the curvilinear anomaly, N.
Other similar responses are keyed near O and Q (Fig. 2), whilst the discontinuous linear anomaly P may link G with one of the anomalies parallel to J.

4.39 Other discontinuous linear anomalies are X, Y and Z and could relate to smaller sub-divisions or earlier enclosures.

5. Discussion

5.1 From Figure 1, which shows the data from both the 1993 and 1995 gradiometer surveys, it can be seen how the orientations of the field/enclosure systems have changed with time. At the time of survey most of the hedges in the immediate area had been removed, probably within the last twenty years. Before this, the fields immediately adjacent to the A1 were orientated with their long axes at right angles to the road, with the second row of fields aligned parallel with the road. Most of these boundaries have been detected by the gradiometer. The first edition Ordnance Survey map, published in the 1850's, shows one additional hedge boundary not recorded on the 1:2500 OS map. This, too, was detected during the survey. Although not marked on the first edition map the anomaly demarcating the 1993 and 1995 surveys also aligns with boundaries extant until recently and is therefore also interpreted as a former field boundary.

5.2 The remaining anomalies are on a slightly different alignment to the recent field system. However, most of the linear anomalies detected (A-K) form a coherent field system.

5.3 There are several exceptions. The first of these are the parallel anomalies, M, which are probably ditches either side of trackway. They lead towards the nearby Roman road. The other major exceptions are Anomalies J and L. Anomaly J aligns with the series of ditches that were excavated in 1993.

5.4 The strongly magnetic anomaly, N, remains enigmatic. As mentioned previously (Section 5.27) it runs along the bottom of a dry valley before turning south-west up the valley side where the responses weaken and peter out when the ground becomes level. This encompasses the area in which the grave type features were identified on the aerial photographs. The probable reason the responses are so strong along the valley bottom is that the general migration of topsoil down slope together with the accumulation of wind blown material will have led to a much greater complexity of deposits at the bottom of the valley than at the top, thus producing a higher magnetic contrast. Conversely, the depth of topsoil will be shallow at the top of the slope. This was seen to be the case during the survey with the topsoil visibly lighter in colour due to the mixing with the paler sub-soil. Fragments of limestone were also

present on the crest of the hill. All these processes could explain why the anomaly, N, appears to peter out at the top of the slope as the valley simply no longer exists here.

5.5 Isolated high responses O, Q, T, U and V, have been identified across the whole of the site. These responses might be caused by pits, or any other feature filled with magnetic material, or by areas that have had their magnetism enhanced by heating such as a hearth or kiln.

6. Conclusion

6.1 Several linear anomalies forming a system of enclosures has been identified. Other linear anomalies correspond to recent field boundaries. A curvilinear anomaly that probably relates to the silting of a dry valley although the possible presence of a mortuary enclosure on the same line can not be discounted. Several pit/kiln type anomalies were also detected.

6.2 In the south of the site a concentration of flint artifacts might indicate the presence of Neolithic occupation on the site.

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Acknowledgments

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Appendix 1

Flint from Fieldwalking

Grid no.	L	W	T	Description
1D	23	9	1	Flint flake, mid grey.
1F	20	24	8	White flint flake.
1G	9	8	6	Flint lump. ?Worked dark grey flint.
1G	23	12	5	Step fractured flake. Mid grey flint with light flecks.
1H	40	25	12	Shattered nodule.
1H	40	18	10	Waste flake, with cortex. Mid grey with light flecks.
1I	25	11	2	Proximal end of snapped blade. Light grey flint with dark flecks.
1I	10	6	2	Spall in cream flint.
1I	43	15	10	Flake/blade from prepared core. Patinated white/cream.
1I	25	15	10	Shattered, unworked river flint.
1J	20	20	2	Light grey patinated flake.
1J	20	10	3	White flint flake.
1J	20	8	6	White flint flake.
1J	35	15	5	Grey brown waste flake with cortex.
2A	30	25	30	Pyramidal core. Dark grey flint almost entirely covered with white patina. Mesolithic/Neolithic.
2A	7	11	3	Spall with cortex. Grey brown patinated flint.
2B	34	13	5	Waste flake in white flint.
2B	11	13	3	Waste flake. Mid grey flint with light flecks. Cortex at proximal end.
2C	25	25	10	Pot lid fracture. Mid grey flint with cortex.
2C	19	17	5	Gun flint. Dark grey flint.

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
2D	18	10	3	Waste flake. Mid grey flint.
2E	42	20	20	Possible fragment of shattered core. Cream flint with dark flecks.
2E	9	12	2	Spall. Cream flint with dark flecks.
2E	15	10	4	Water worn, unworked flint stone.
2F	10	6	3	Spall. Light grey flint.
2G	20	15	25	Black flint micro core possibly from tabular nodule. Minute blade scars. Mesolithic?/Neolithic?
2G	20	30	10	Natural shale?
2I	21	28	4	Proximal end of flake in cream flint.
2I	20	9	3	Flake in cream flint. Bulb not identifiable.
2I	24	16	9	Battered lump of flint, possibly originally a scraper. Cream flint.
2J	21	16	3	Distal end of snapped waste flake. Light grey flint.
2J	10	17	4	Spall. Mid grey patinated flint.
2K	10	10	3	Spall. Mid grey flint, light patina. Cortex at proximal end.
3A	45	25	4	Leaf shaped arrowhead. Grey brown flint with heavy white patina. Retouch on both surfaces but more on dorsal. Broken slightly at proximal end. Neolithic.
3B	22	10	4	Proximal end of snapped flake. White flint.
3B	16	13	3	Waste flake, grey brown flint.
3C	22	20	9	Lump of unworked flint.
3I	42	32	6	Distal end of snapped blade, use wear on both sides.
3J	23	35	13	Core preparation flake.
3J	35	12	3	Bladelet, possible use wear on both sides. Patinated flint.
3J	33	10	3	Brown flint bladelet, use wear on both sides.

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
3K	17	12	2	Waste flake, patinated.
3K	15	15	2	Waste flake. Mid grey flint.
4C	25	20	3	Waste flake with cortex. Light grey.
4D	40	20	30	Frost shattered flint nodule, brown with white patina.
4D	25	10	5	Bladelet, retouch on both sides. Cream flint with specks.
4E	10	15	5	Flake lump. Grey with light patches.
4F	40	12	3	Blade/flake of grey flint with cortex.
4F	25	10	7	Possibly a broken end of a scraper in grey brown flint with cortex. Neolithic/Bronze Age.
4G	28	30	10	Circular scraper, with cortex. White flint with pale grey bands. Proximal end snapped off. Neolithic/Bronze Age.
4G	25	10	6	Distal end of waste flake in patinated flint, with cortex.
4I	25	20	8	Natural brown flint.
4I	36	20	4	Knife/scraper, distal end retouched on dorsal surface. Right hand side shows use wear. Grey brown patinated flint. Neolithic.
4I	12	6	2	Spall, patinated.
4J	10	5	3	Snapped spall. White flint.
4J	10	10	3	Spall with cortex. White flint.
4K	30	20	2	Flake. Grey brown patination.
4K	30	45	8	Core preparation flake with cortex.
5A	30	15	6	Waste flake with cortex. Grey brown but heavily patinated.
5D	50	18	2	Well formed blade with retouch on right hand side. Grey brown flint with light flecks.
5D	21	12	10	Small battered lump of mid grey flint.
5E	40	30	25	Battered nodule of cream flint with dark specks.

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
5H	20	9	3	Proximal end of snapped bladelet with possible use wear on right hand side. Patinated grey flint.
5I	60	50	35	Nodule of light grey flint, possible blade scars but heavily battered. Cortex present.
5I	24	11	4	Proximal end of a snapped blade with retouch/wear on left hand side of ventral surface. Cortex on right hand side.
5J	19	10	3	Waste flake. Light grey patinated flint.
5J	17	10	4	Waste flake, rough surfaces, white patina.
5K	11	16	2	Spall. Mid grey flint with light flecks.
5K	15	5	3	Spall. Mid grey flint.
6A	20	12	3	Snapped blade. Retouch on left hand side of dorsal surface at proximal end. Mid grey flint with light specks.
6D	47	25	10	Flake showing possible use wear on right hand edge. Mid grey heavily patinated flint. Cortex.
6F	30	17	5	Serrated blade. Appears to be serrated on both sides. Neolithic/Bronze Age.
6H	60	12	6	Backed blade in brown flint. Use wear on left edge cortex on right. Possible damage at distal end from use as a point.
6K	20	10	3	Waste flake/spall. Grey brown flint.
6K	40	15	2	Shattered piece of heavily patinated nodule.
7C	45	17	6	Blade? Possible use wear on left side of dorsal surface. Grey brown patinated flint.
7D	14	7	2	Spall. White flint.
7F	15	10	3	Spall. Pale grey flint with cortex.
7G	13	20	3	Waste flake. Cortex at proximal end. Grey flint.
7H	30	15	4	Step fractured waste flake with cortex. Mid grey patinated flint.
7K	30	10	8	Possible backed bladelet with cortex. Patinated grey

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
				brown flint. Retouch or use wear on ventral surface although flake scars unpatinated and could be recent.
7L	23	30	5	Distal end of flake. Unusual black shaley-type material. Dorsal surface appears polished in comparison to ventral. Fragment of polished axe? Neolithic?
8B	30	15	17	Core preparation/rejuvenation flake. Mid grey flint.
8E	16	16	2	Waste flake. Light grey flint with dark flecks.
8E	16	31	10	Core preparation flake. Pale grey flint.
8E	31	25	15	Core rejuvenation flake. Mid-light grey, some cortex. Pyramidal in shape. Mesolithic/Neolithic.
8F	25	20	6	Waste flake. Mid grey flint with specks.
8I	35	27	11	Crude scraper or scraper blank. No sign of retouch but possible use wear on edges. Pale grey flint. Neolithic/Bronze Age.
9C	30	26	10	Steep edged, side and end scraper, some cortex. Dark grey flint with light flecks. Neolithic/Bronze Age.
9C	25	15	4	Waste flake. Light grey/brown flint with some patination.
10D	23	26	4	Proximal end of core preparation flake. Cortex. Light grey flake with white flecks.
10J	20	12	2	Waste flake/spall. Light brown flint. Some cortex at distal end.
11L	11	10	2	Spall, white flint with cortex.
18A	32	12	3	Distal end of snapped bladelet. Grey flint with light patches.
15H	12	36	4	Step fractured distal end of broken flake. Hint of retouch on right hand side of ventral surface, the flake having a chisel-like appearance at this end. Grey flint with hint of patination.
15G	19	26	6	Proximal end of waste flake with cortex on left hand side. Mid grey flint with flecks.

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
15J	33	22	10	Side and steep nosed end scraper. Distal end retouched and possibly left side as well. Cortex on proximal end and right side. Grey-brown flint with hint of patination. Neolithic/Bronze Age.
15J	30	22	11	Core rejuvenation flake. Blade scars on right edge. Cream flint with brown specks. Mesolithic/Neolithic.
19G	30	22	10	Shattered proximal end of flake from pebble. With brown cortex. Dark grey, slightly patinated.
20A	30	15	5	Naturally shattered gravel flint with cortex. Grey flint.
20A	20	14	2	Proximal end of snapped blade. Grey flint with heavy white patina. (Prepared core?). Mesolithic/Neolithic.
22I	12	13	3	Spall. Light grey flint with white patination?
23D	26	14	4	Possible distal end of blade flake. Both ventral and dorsal surfaces show possible use wear on left edge.
23J	32	36	8	Snapped distal end of a core preparation flake. Cortex present on extremities of distal end where the flake has step fractured. Dark brown flint.
23J	20	14	5	Waste flake. Mid brown flint. Faint patination.
23K	15	11	2	Spall. Light grey flint.
23K	15	26	4	Waste flake. White patinated flint.
25F	16	16	3	Distal end of waste flake. Patinated pale brown flint.
26F	20	35	8	Scraper in blue-grey speckled flint. Proximal end with cortex and some cortex adhering to distal end. Retouch on all sides except proximal. Neolithic/Bronze Age.
26L	26	16	4	Proximal end of snapped blade in chert.
28L	22	13	6	Proximal end of snapped blade?/preparation flake with cortex. Grey flint with light patches.

Flint recovered during Geophysical Survey from the south of the site

	L	W	T	Description

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Grid no.	L	W	T	Description
	40	13	5	Blade with distal end missing. Cream flint with specks.
	20	15	3	Distal end of snapped blade showing use wear.
	30	20	2	Broken off point of leaf shaped arrow head. Grey banded flint well worked on both sides. Neolithic.
	21	10	2	Spall
	20	10	2	Spall
	30	15	3	Flake
	20	20	5	Flake
	40	30	15	Unworked lump
	48	30	15	Core rejuvenator, possibly used as a scraper.
	25	25	12	Possible pyramidal core.
	25	25	10	Micro core.

Surface finds from 1993 at south west end of the site

Quantity	**Description**
2	Unworked lumps
9	Waste flakes
1	Micro core
1	Flake used as core
5	Blade fragments
1	Blade made into a scraper
1	Core rejuvenator

L=length from proximal to distal end (mm); W=width perpendicular to length (mm); T=maximum thickness (mm)

Fig. 1 Site location showing gradiometer data (1993 & 1995 surveys)

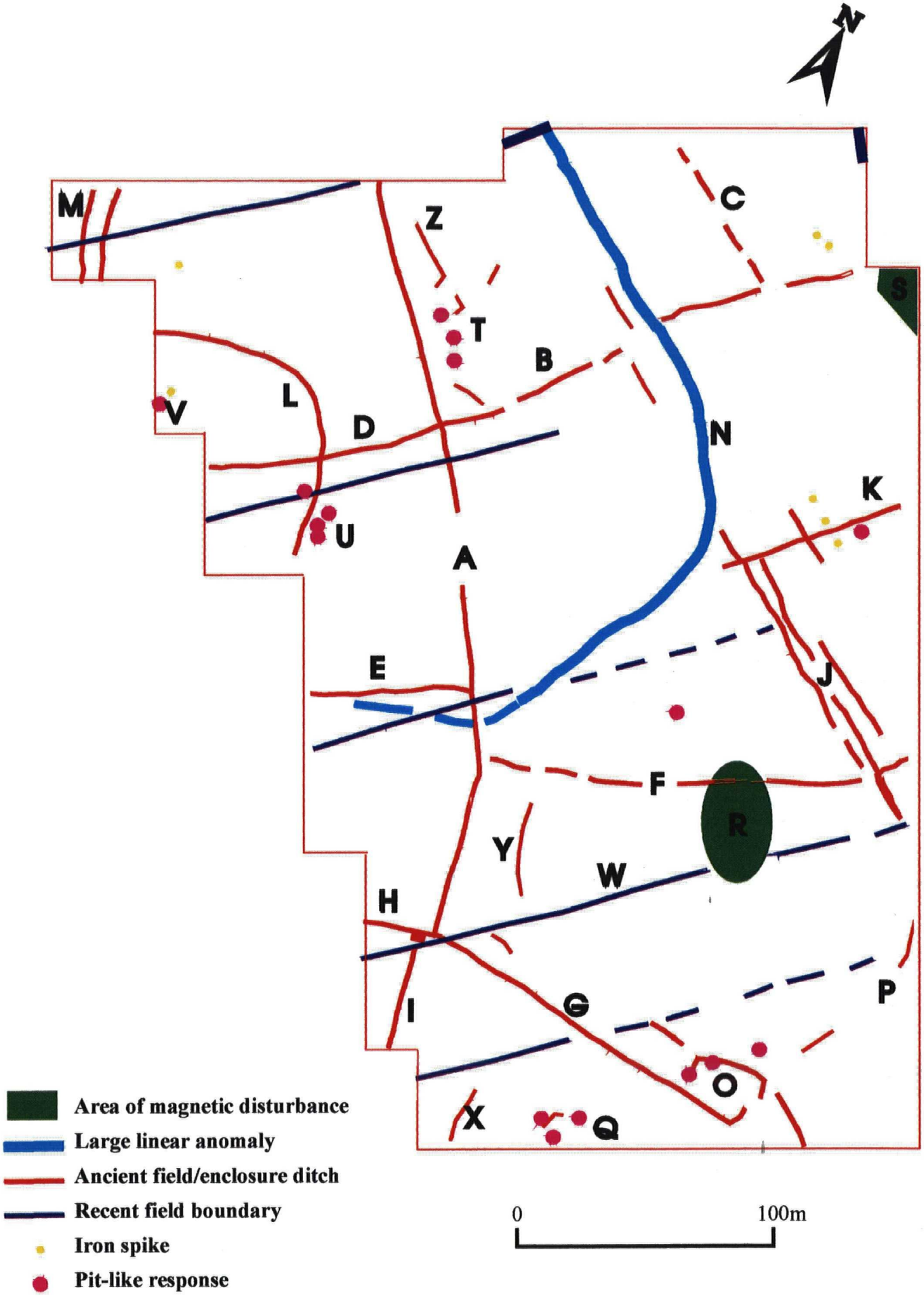

Figure 2 Schematic interpretation of gradiometer data

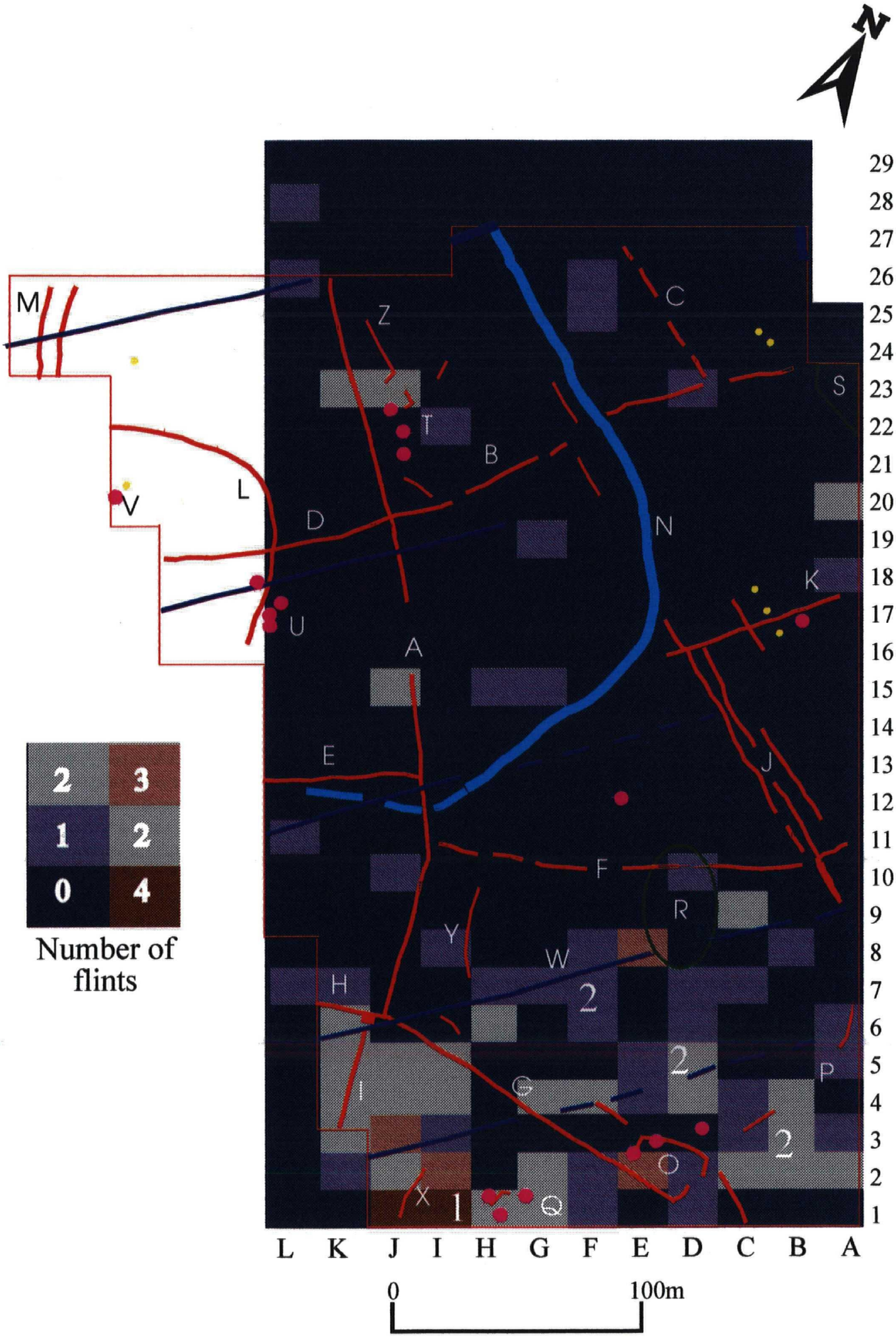

Figure 3 Fieldwalking results showing the distribution of flint and the geophysical anomalies

SNY 879 6x OVER SIZE GEOPHYSICAL PLOTS

NOT SCANNED SEE ORIGINALS.