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Nosterfield - Tilcon Quarry

Geophysical Survey

June 1991

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Geophysical Survey at Nosterfield, North Yorkshire, June 1991.

Introduction

This report covers the results obtained from a geophysical survey conducted from the 4th to the 7th June 1991, as part of an archaeological evaluation in advance of development by Tilcon Ltd. at Nosterfield Quarry. Crop mark photographs in the North Yorkshire County Council Sites and Monuments Record indicate the presence of several archaeological features nearby, to the south of the larger area surveyed. There are also a number of upstanding ancient monuments in the proximity of the quarry, including a group of three henge monuments.

Summary

The survey did not produce high quality data due to the nature of the site, but there are a number of identifiable anomalies. Two oval shaped anomalies are possibly geological and a number of linear anomalies suggest a ploughed out field boundary perhaps part of a medieval strip field system.

Background

The site lies just south of Nosterfield, on the south-east side of Moor Lane opposite the entrance to the Tilcon Quarry at Nosterfield.

The survey was conducted in two distinct areas. For convenience these are referred to as the 'main area' and the 'smaller area'. The 'main area' consists of an area of c.2.5 hectares at the north-east end of the proposed development, corresponding to what will be Phase 1, and includes mounds A, D, and E. The 'smaller area' is about 0.1 hectare, and located at the south-west end, alongside the embankment of a disused railway. This corresponds to the area of Phase 3 which will be occupied by mound C.

The area encompassed by the 'main area' is generally level, but falls off slightly at the southern corner. Slight undulations are visible on the surface of some parts of the site, which run north-west to south-east.

Method

The survey was carried out using a Geoscan FM18 fluxgate magnetometer covering the main area in 30m. square blocks with a sample interval of 25cm. x 1m, giving 3600 points for each square. For the small area 10m. square blocks were used, taking the survey to the edge of the crop standing at the time Approximately 95,000 data points were gathered and processed using Geoimage software on a Mesh 486B microcomputer.

Results

The results are presented in figures 1 to 9 and 11 to 12. There is, unfortunately, a very low variation in the magnetic susceptibility of the surface of the site at Nosterfield, and consequently the data obtained is very flat. Figures 3, 6, 11, and the top plot of figure 5 are plotted using a bandwidth of 25nT, in other words the greys relate to readings up to 12.5nT either side of the median, readings that are outside of this range are shown as the lightest or darkest shade. Figures 4, 7, 8, 12, and the lower plot of figure 5 use a narrower range of the data, a bandwidth of 10nT, which focuses in on the small spread of the readings observed. Figure 10 shows the distribution of the number of readings obtained, and the bandwidths used.

The low contrast in susceptibility is highlighted by a comparison with the data range from part of another survey undertaken recently in advance of archaeological excavation at West Heslerton, North Yorkshire. This is illustrated in figure 10.

The low range of the measured signal at Nosterfield increases the relative effect of unavoidable extraneous factors influencing the readings such as, for example, wind buffeting of the instrument, temperature variation, and striping due to bidirectional surveying. Even though extensive computer enhancement and filtration have been applied to the data, these factors are still observable in the plotted results.

The 'smaller area' to the south-west is right by the railway embankment which is made from material that has a strong magnetic effect. When this fact is compounded by the low contrast in susceptibility, and the small area, circumspection needs to be used if this part of the survey is to be interpreted.

Notwithstanding the above paragraphs, a tentative interpretation is offered below for the anomalies detected in the 'main area'.

Interpretation

The overlay to figure 3, the 'main area', shows: two approximately oval shaped anomalies, A and B; an "L-shaped" anomaly C; and the two intermittent lines marked as D which indicate the direction of a number of almost parallel weak anomalies.

A and B measure approximately 7m x 11m, and while physically large, the anomaly is not great in terms of signal strength. No obvious archaeological explanation can be offered for these features, and they may well be geological in nature.

C is a band of anomalies running in a slightly curved north-westerly line for 160 metres from the south-east corner of the area surveyed, then turning south-west for 55 metres to leave the area near its south-west corner. Along the length of this is a large number of small but stronger anomalies which might indicate the effect of small metallic objects in the soil. This might be a ploughed out field boundary, with the concentration of metallic objects caused by such things as broken parts of plough-shares which have been thrown to the edge of the field.

A series of weak anomalies run parallel to the long edge of C, and these are represented in the interpretive drawing (figure 3, overlay), by two broken lines, D.

Together C, D, and the slight undulations still extant in the field, which are also parallel with the long arm of anomaly C, suggest that what we are seeing is evidence of ploughed out rig and furrow bounded by a field boundary C.

No anomalies were detectable in the 'smaller area' that can be interpreted meaningfully.

Conclusion

Magnetic prospecting at the Nosterfield Quarry did not produce clear cut data, and the results are therefore difficult to read. The plots provided, particularly the interpretive one, should be seen as plots of maximum potential.

The data will be retained at the Landscape Research Centre Ltd., and will be available for inspection for a period of 12 months.

M. Griffiths in association with the Landscape Research Centre Ltd.

Appendix:

MAGNETOMETER SURVEY

Buried archaeological remains such as pits, ditches, banks and walls may, depending on the material filling them or used in their construction, cause small localised variations in the Earths magnetic field. Although very small, too slight to be noticed by a compass, these changes can be measured by more sensitive magnetic instruments. By collecting a large number of measurements over an area the variations can be plotted and a 'picture' of buried features built up.

Essentially the technique detects contrasts between the natural sub soil and intrusive elements. For example, a ditch cutting deep into the sub soil and filled over time by topsoil and rubbish will appear slightly more magnetic than the surrounding natural. This is because the material filling the ditch has a higher magnetic susceptibility than the natural, a result of chemical differences between the two. Under normal conditions a wall would appear less magnetic than its surroundings, and thus give a low reading. However, results are dependant on the magnetic properties of the area and the outline given could be reversed in certain conditions.

Pieces of iron, and fired clay such as hearths and ovens have a much more marked effect. In some instances this can be used to detect specific features, pottery kilns or metal working areas. A kiln produces a magnetic signal many hundred times that of a ditch or pit and a piece of iron can produce one several thousand times greater. Unfortunately pieces of iron are quite common in the soil and if present in too great a quantity can mask the more subtle archaeological features.

The equipment used, a Geoscan FM18 fluxgate magnetometer, is a light rigid aluminium tube 50 centimetres long, with a fluxgate sensor mounted at cither end. A data logger (a small computer), the power supply, and the controls are also mounted on the carrying handle to make the instrument fully portable. In use the two sensors are aligned, balanced, and zeroed and the instrument is then carried vertically alongside the operators body. The upper sensor is less influenced by the ground and so provides a reference to the background magnetic field of the Earth. Subtracting the lower sensors' reading from the upper sensors' reading the magnetometer can detect the presence of buried anomalies. By walking in a grid pattern and taking readings at regular intervals it is possible to cover an area both quickly and accurately measurements being stored in the data logger. The data collected is periodically transferred or dumped to a portable computer in the field. Using appropriate software the grids can be reconstructed and data presented in a pictorial form. As the instrument is highly sensitive and the magnetic variations very slight substantial computer processing is required to enhance the signal and minimise the effect of buried metal fragments such as horse shoes, fragments of plough-shares etc.