

## Magnetic Susceptibility

### Magnetic Susceptibility

The magnetic susceptibility of a material is its ability to become magnetised by an external magnetic field. Iron and its compounds have a large positive susceptibility and iron compounds are a significant portion of most modern soils. However, iron compounds have different magnetic susceptibilities due to their different chemical structures. The compounds usually found in soils can be converted into different compounds that have a greater magnetic susceptibility by a number of processes, most notably burning of the soil and biological activity such as the breakdown of organic matter. Thus areas of enhancement may indicate areas of anthropogenic activity such as past settlement sites.

These altered iron minerals remain in the topsoil despite ploughing and enhance the magnetic susceptibility of that soil. This can be measured using a field coil as described below.

### The Instrument

In situ readings of magnetic susceptibility enhancement are taken using the Bartington MS2D field coil which has a diametric of 185mm. This is placed flat on the ground surface and an alternating magnetic field is induced into the soil in a hemisphere below the coil to a depth of approximately 200mm. The magnetic field re-emitted by the iron minerals in the soil is measured. The difference between the frequency originally transmitted and that re-emitted is the magnetic susceptibility of the material under the coil.

### Methodology

Using this technique provides a quick method to scan a large site for areas of higher magnetic susceptibility and hence possible past human activity. The survey would usually be carried out by taking readings at 10m or 20m centres. The results are usually displayed as a greyscale plot. Any enhanced area can then be targeted with surveys using other higher resolution techniques, such as a detailed magnetometer survey. It is advisable to test magnetically 'quiet' areas with a small section of detailed survey to ensure archaeological features have not been missed by the magnetic susceptibility survey.

Magnetic susceptibility surveys using the field coil cannot determine between anthropogenic or natural enhancement. However topsoil samples may be taken and analysed in a laboratory to clarify the likely origin of any enhancement.



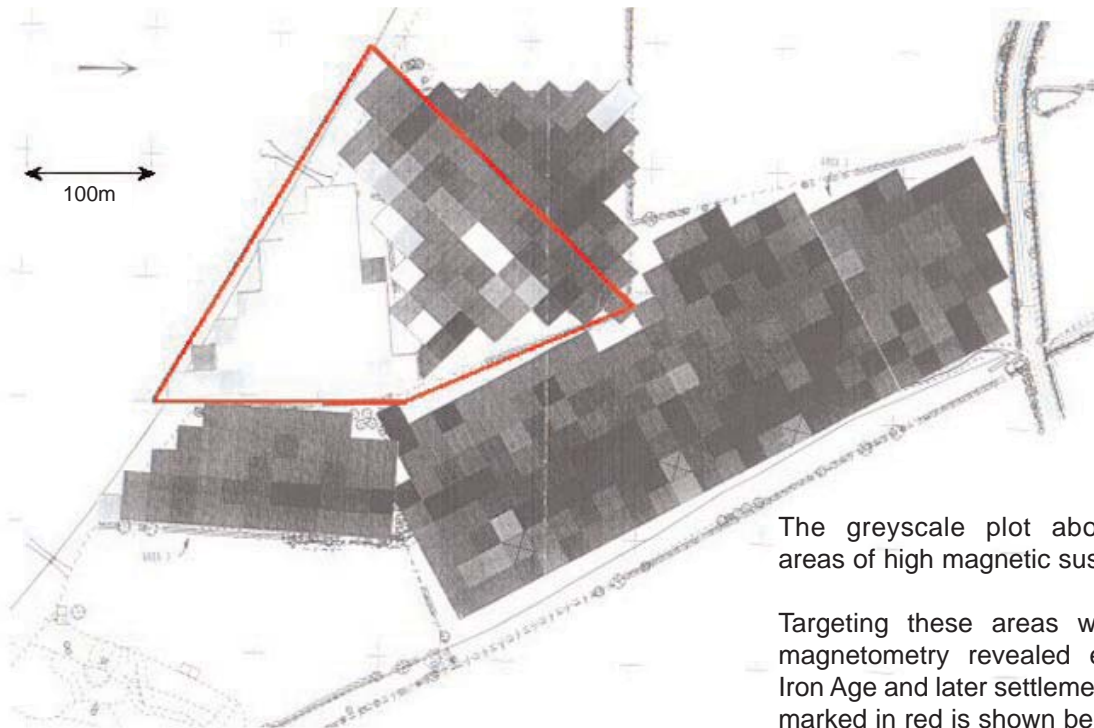
*Operator using the Bartington MS2 Instrument and MS2D field coil.*

### Applications

- Assessment of archaeological potential over large areas
- Pinpoint areas for further detailed geophysical techniques
- Development site surveys
- Large area research projects.

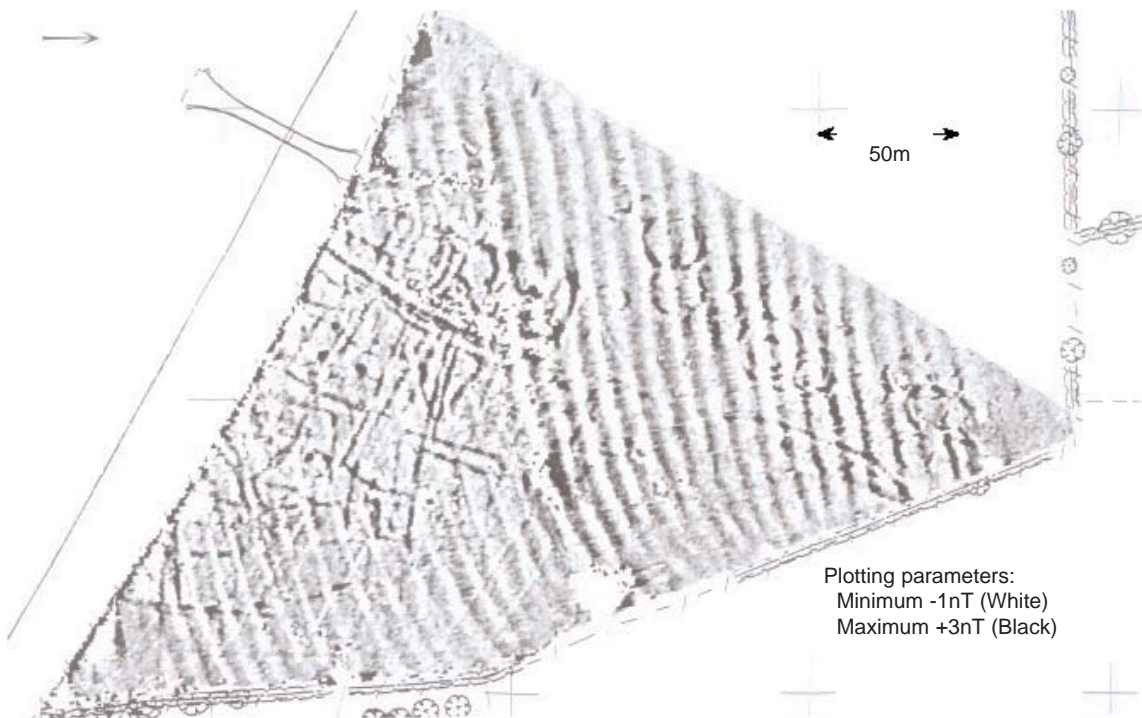
### Advantages

- Rapid assessment over large areas
- Allows targeting of detailed geophysics resulting in economic surveys
- Definition of site boundaries
- Does not require the survival of distinctive archaeological features
- Useful in understanding landscape evolution through analysis of displaced soils.



The greyscale plot above reveals areas of high magnetic susceptibility.

Targeting these areas with detailed magnetometry revealed evidence of Iron Age and later settlement. The area marked in red is shown below.



Plotting parameters:  
 Minimum -1nT (White)  
 Maximum +3nT (Black)

Peter Barker C Eng MICE MIWEM MIFA  
 Stratascan Ltd  
 Vineyard House  
 Upper Hook Road  
 Upton-upon-Severn  
 Worcs. UK  
 WR8 0SA  
 Tel: +44 (0)1684 592266  
 Fax: +44 (0)1684 594142  
 Email [info@stratascan.co.uk](mailto:info@stratascan.co.uk)  
[www.stratascan.co.uk](http://www.stratascan.co.uk)

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