Recent Work in Archaeological Geophysics

The Geological Society
Burlington House, Piccadilly, London W1J 0BG
Tuesday 6th December 2022

Programme

Lecture Programme:

0915-1000	**Registration and Coffee**
1000-1005	**Introduction**
1005-1020	*Integrating Geophysical and Remote Sensing Data for the Modelling of Geoarchaeological Resources in Alluvial Environments.* N Crabb, C Carey, A Howard and R Jackson
1025-1040	*Naught but Tradition Remains? Multi-Instrument Geophysics and the Recovery of the Landscape of Grand-Pre.* J Fowler
1045-1100	*Geophysics Has Its Day in Court: The Verdict on Rewilding Surveys at Court Green Manorial Settlement, Bere Regis.* P Cheetham and D Stewart
1105-1120	*Early Results from Large-Scale Multi-Method Geophysical Surveys at the Battlefield of Waterloo, Belgium.* D Williams, P De Smedt, K Welham and S Eve.
1125-1155	**Tea/Coffee break**
1155-1210	*Exploring Interoperability of Archaeological and Agricultural Geophysics. The Case of East Heslerton.* J Verhegge, R Opitz, E Baldwin, D Powlesland, S Campana, M Vieri, V Mayoral Herrera, V Robinson, R Fry and P De Smedt
1215-1230	*Municipal Garden Waste Compost: Its Effect on Magnetometry Results.* R Ainslie
1235-1250	*Evaluating Methodologies for Magnetometer Surveys in Wooded Areas.* A Schmidt and W Weber
1255-1300	**Morning closing remarks**

1300-1430	**Lunch (Lower Library)** – all delegates **NSGG AGM (Lecture Theatre)** – all welcome
1430-1445	*Large Scale Geophysical Investigations of the Medieval Manor of Austrått in Mid-Norway – Combining Metal Detecting, GPR and Magnetometer Surveys.* A Stamnes
1450-1505	*After the Biblical Flood: Magnetometer Prospecting at Fara (Iraq) to Assess the Excavations at Ancient Šuruppak from 120 Years Ago.* S Hahn, J Fassbinder, A Otto and B Einwag
1510-1525	*3D GPR Survey in the Recognition of Relics of Pre-War Buildings for the Reconstruction of the Saxon Palace in Warsaw (Poland).* M Pisz, R Mieszkowski, S Kowalczyk and E Krogulec
1530-1545	*Tracing Roman Grave Monuments in Ruffenhofen (Bavaria, Germany).* R Linck, A Stele and D Lenz
1550-1620	**Tea/Coffee break**
1620-1635	*GPR at Gorhambury: Surveys by the Community Archaeology Geophysics Group at the Roman City of Verulamium.* K Lockyear
1640-1655	*Old and New Frontiers: Ground Penetrating Radar Surveys at the Roman Fort of Trimontium.* K Armstrong, J Lawton and S Ovenden
1700-1715	*Reminiscences on 30 Years of Magnetic Surveying (Mostly) in the UK.* J Lyall
1720-1730	**Conclusion**
1735-1900	**ISAP AGM (Lecture Theatre)**

Posters (09:30-19:00 in the Lower Library):

Touching the Past: Tactile Models of Geophysical Images for Improving User Access to Archaeological Data Displays. A Booth, B Thomas, R Holt, S Sanchez, L Makin, S Ok, T Roberts and N Linford

Hydrological Assessment of Quarrendon Leas Elizabethan Water Gardens with a Portable Time Domain Electromagnetic System. M Guy and V Guy

EVALUATING METHODOLOGIES FOR MAGNETOMETER SURVEYS IN WOODED AREAS

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The Iron Age banked enclosure in the wooded area of the Messbüsch of Eisenach, Rhineland-Palatinate, Germany, is clearly visible in the LiDAR data, with a size of 40 m × 37 m inside its banks (Figure 1). Although overgrown with trees and shrubs the topographic changes are still evident on the ground. Inside other Iron Age enclosures in Germany and the UK magnetometer surveys had previously identify various internal features (Becker 1985; Marshall 1999; Marshall 2001; Berghausen 2014) and a magnetometer survey was hence selected to provide further information for this site. However, due to the dense vegetation a new survey methodology had to be developed and its results were compared with data obtained using conventional survey practice.

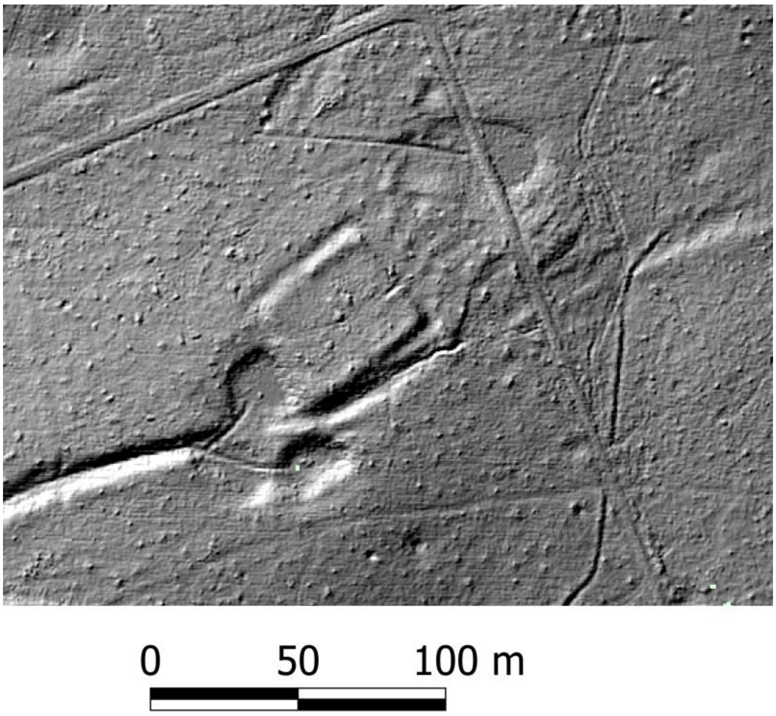

Figure 1: LiDAR data of the Iron Age enclosure in Eisenach (LPG LPO, Geobasisinformation of the Vermessungs- und Katasterverwaltung Rhineland-Palatinate, Germany, interpolated to 0.5 m × 0.5 m)

The only viable option for a magnetometer survey appeared to be using a handheld single sensor instrument, for which a Geoscan FM256 fluxgate gradiometer was chosen. Due to the small size of expected features a spatial survey resolution of at least 0.25 m × 0.5 m was deemed necessary. Stationary measurements (i.e. holding the instrument still at each measurement position) would therefore have been too slow and it was necessary to collect data while moving through the vegetation.

The survey area was subdivided into 25 data grids of 10 m × 10 m using tapes and ranging rods since no reliable signals could be obtained from GPS or Total Stations. The start and end positions of each 10 m survey line were marked with small flags of matching colours to help with the orientation while moving through the woods. To avoid obstacles (mostly trees) the start and end positions were then adjusted slightly in such a way that straight lines could be walked, all in the same direction (unidirectional survey; NE to SW). The root-mean-square (RMS) deviation from the correct positions was 0.12 m and 0.36 m for start and end points, respectively (Figure 2). Due to the varying vegetation a constant walking pace could only be maintained for each individual survey line, not for all of them, as is required in conventional survey practice. Therefore during data recording both start and end of each line had to be marked with a handheld trigger, similar to the methodology frequently used with caesium magnetometers. To accomplish this with a Geoscan gradiometer a larger length was selected for the data grids (20 m) and when the recording was stopped, reaching the end of a line, the remaining 'unused' data points were filled with 'dummy readings'. Each stored survey line hence contained a different number of valid measurements.

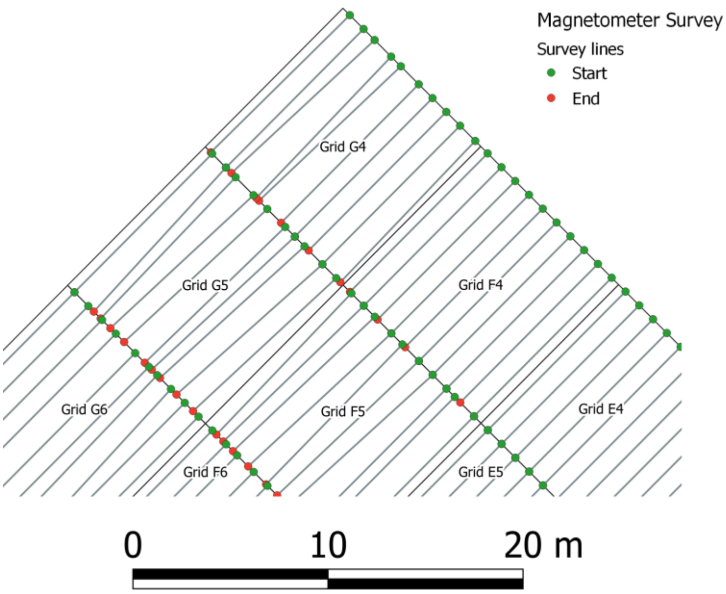

Figure 2: Excerpt of the survey area showing the deviation of start and end positions from a regular raster.

This adjusted data collection methodology required new processing schemes. First, the actual x/y position of each measurement was calculated from the known start and end position of each survey line, and the resulting data set was then interpolated to a regular grid of 0.125 m × 0.125 m. Second, given that the deviation of the survey lines from the correct position was small (see above) the recorded data were re-sampled to 0.125 m and then stored as regular survey lines for further processing in Geoplot, ignoring their slight slanting. A comparison of the results from these two processing schemes showed only small changes in the shape and position of anomalies and the simpler second approach was chosen for further analysis.

In an area where vegetation was low enough to use the standard fluxgate gradiometer survey procedure (same walking pace for *all* lines) a comparison was made between the new adjusted methodology, and the usual uni-directional and bi-directional collection. There were no discernible differences in the data.

The final survey data for the site were dominated by many small and weak anomalies (Figure 3a) that are presumably caused by ammunition, since the woods were used as a shooting and training area for the Belgian army after the Second World War. Due to the strong screening effect of these ferrous anomalies there are no anomalies visible that could be attributed clearly to Iron Age habitation remains, even when masking all those weak anomalies that have peak values in the range 1-3 nT (Figures 3b and c).

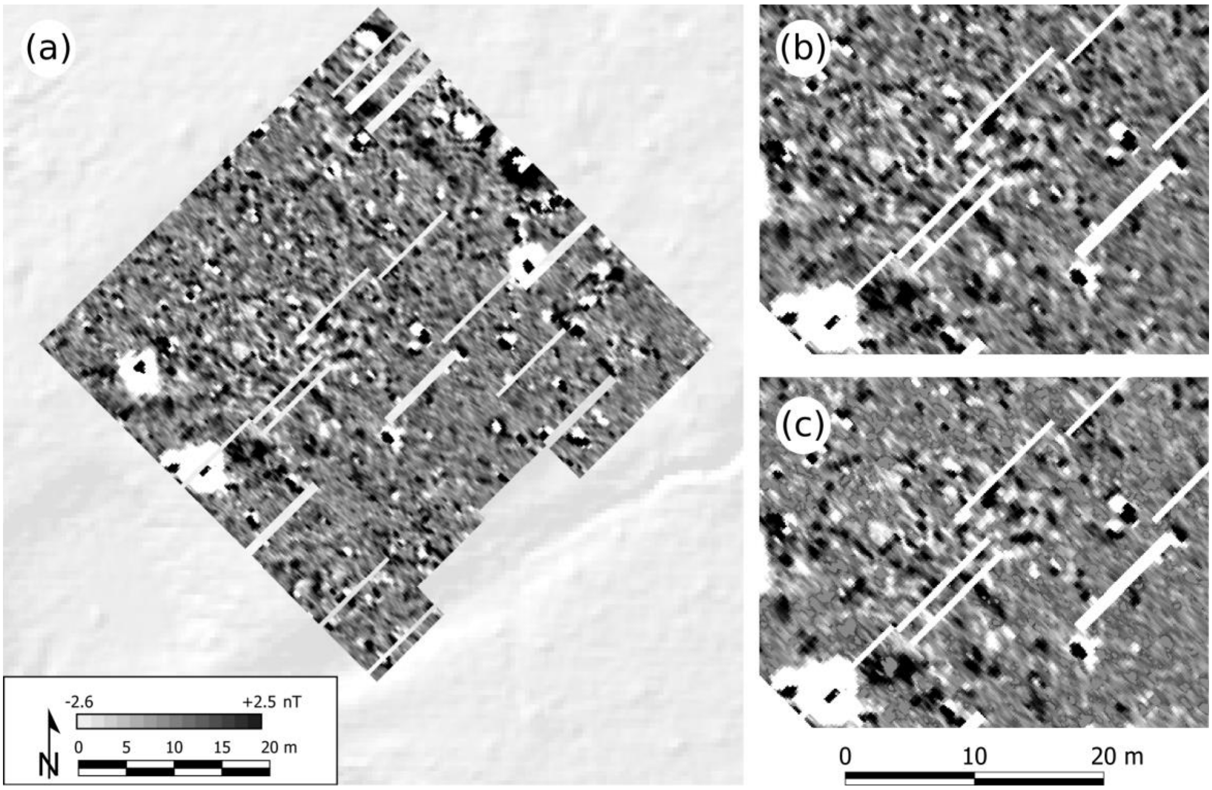

Figure 3: (a) Overview of all data; (b) excerpt; and (c) excerpt, anomalies with peak values between 1-3 nT masked in grey.

Bibliography

Becker, H. 1985. Luftbild, Magnetik und digitale Bildverarbeitung zur Prospektion archäologischer Fundstätten. *Archäologische Informationen* 8(2): 135-142.

Berghausen, K. 2014. *Magnetometrische Untersuchungen an keltischen Viereckschanzen in Bayern*. Schriftenreihe des Bayerischen Landesamtes für Denkmalpflege. Munich, Germany: Volk Verlag.

Marshall, A. 1999. Magnetic prospection at high resolution: survey of large silo-pits in Iron Age enclosures. *Archaeological Prospection* 6(1): Nov-29.

Marshall, A. 2001. Functional analysis of settlement areas: prospection over a defended enclosure of iron age date at The Bowsings, Guiting Power, Gloucestershire, UK. *Archaeological Prospection* 8(2): 79-10