ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

Issue 8, July 2006

Contents

Editor's Note

louise.martin@english-heritage.org.uk

Thank-you once again to the contributors of this issue of ISAP News. Any member of ISAP can submit an article for inclusion in the next newsletter, be it to promote their own work or discuss issues of relevance to us all.

So if there is something you would like to share with us all, please email me sometime before 6th October.

Private-Public Prospection Partnership in Stade (Germany)

Cornelius Meyer, Eastern Atlas, Berlin info@eastern-atlas.com

In the summer semester of 2006 the Archaeological Institute of Hamburg University and eastern atlas Geophysical Prospection from Berlin started a joint course to familiarise students of classical archaeology and early history with geophysical prospection methods. This followed on from Hamburg professor Renate Rolle and eastern atlas working together on a joint project on the huge skythic fortification of Bel'sk, Ukrania. Geomagnetic prospection covers more than 30 ha there.

The new project started as a fortnightly course in April. In six sessions eastern atlas geophysicists Burkart Ullrich and Cornelius Meyer taught geophysical prospection methods in general and with field examples. Both theoretical bases and practical aspects of fieldwork were regarded.

To offer some field exercises to the students without the need to bring them away, we searched for an interesting site nearby the Hanseatic city of Hamburg. Luckily we came across Andreas Schäfer, archaeologist of Stade city council. Stade, a county seat 50 km northwest of Hamburg, has a long history witnessed by a small prehistoric fortification called Schwedenschanze amongst others. Although about 100 times smaller than the Bel'sk fortification, it was a perfect example to demonstrate geomagnetic, geoelectric and GPR measurements.

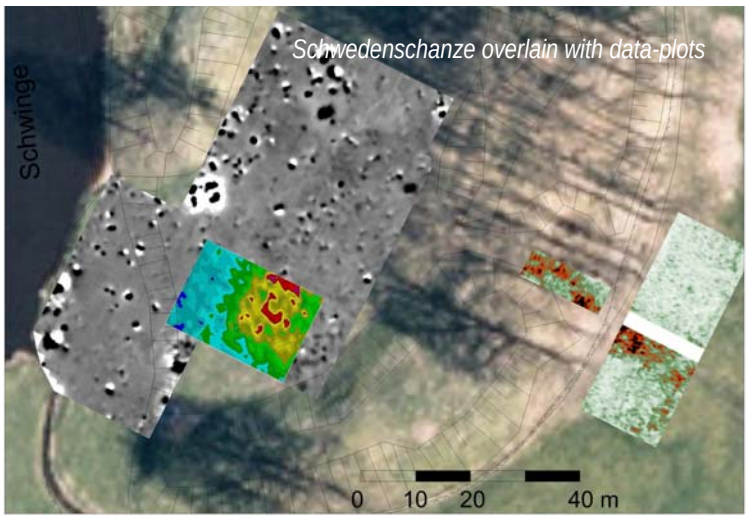
Schwedenschanze, Stade, Germany

On two days, Saturday and Sunday, we have worked with two groups, each of 12 to 15 students on several areas with the three mentioned methods. So, they got the chance to walk over the pasture with the Foerster fluxgate array and with GSSI GPR antennas. To show the principles of geoelectrics they set up several profiles crossing the fort and investigated an area using the Twin-Probe-array.

Students undertaking surveys

The images show some of the results. The geomagnetic prospection indicates some pit structures and a possible wood construction in the interior of the fort. Geoelectric mapping results approved this by low resistivity values in the pit structures and high resistivities in the area of the assumed construction. The GPR survey helped to localize the original entrance. A stripe of high reflectivity corresponds most probably with a causeway through the swampy surroundings.

Students conducting a Foerster survey



The prospection will finally provide the base for a student's excavation starting in August. So, all involved have benefited from this prospection weekend of splendid sunshine. Future archaeologists will be primed for the practice in modern field archaeology, the city council wins a new archaeological highlight in the region and last but not least, geophysical prospection is communicated to those who will need it.

GPR Investigations at Westminster Abbey

Erica Utsi, Utsi Electronics Ltd, Cambridge, UK erica.utsi@utsielectronics.co.uk

In 1268, following a visit by the newly elected Abbot, Richard de Ware, to the Pope in Rome, artisans and materials were brought from Italy to construct the remarkable Cosmati pavement in front of the High Altar of Westminster Abbey in London (Figure 1). Following centuries of wear and tear and as part of the efforts to clean, restore and conserve the mosaic for the future, Ground Penetrating Radar (GPR) surveys were used to:

- Examine the internal structure of the mosaic;
- Check for near-surface delamination;
- Examine the underlying remains of the earlier Abbey; and
- Look for a large royal tomb reputed to be in the area of the High Altar.

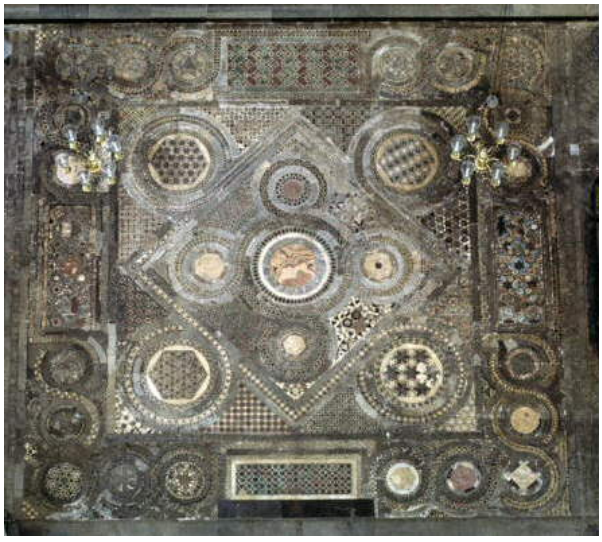


Figure 1: courtesy of the Dean & Chapter of Westminster Abbey, an aerial view of the Cosmati Pavement

The first two of these investigations were carried out using a very high frequency radar, Groundvue 5 (central frequency 4GHz). In order to ensure close definition, the sampling interval was set to 0.5cm and transect spacing to 5cm. Two laser lines were used as survey reference lines. An infra-red detector on the radar recorded the position of the reference lines automatically. A third laser line was used to mark each transect path. The resulting definition of the mosaic is sufficiently detailed to allow the Abbey Conservation team to view the complex detailed construction of the mosaic in a series of time slices (e.g. Figure 2). This enables them to monitor the way in which individual elements change with depth as a result either of the initial construction or subsequent repair.

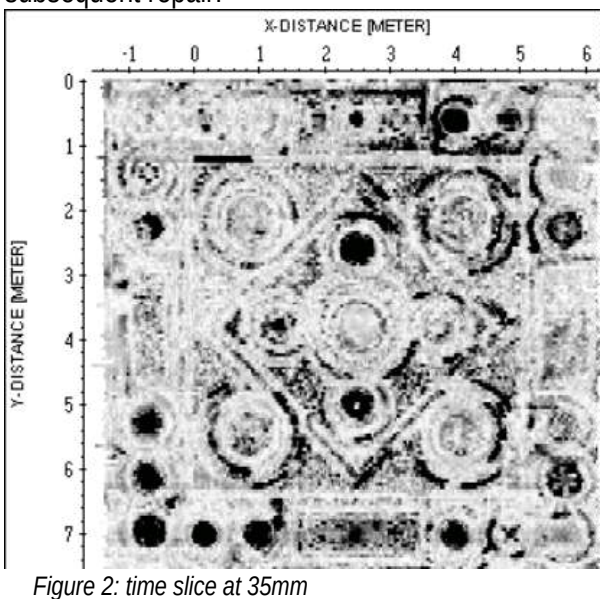


Figure 2: time slice at 35mm

In addition, the survey provided information on two 13th Century burials built into decorative panels to the north and south respectively of the mosaic. Although these are of similar date, the radar data indicates differences in burial practice. Comparison of the 2-dimensional data and time slices indicates the presence of grave goods (Figure 3).

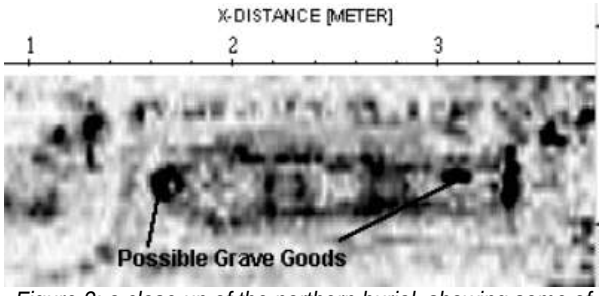


Figure 3: a close up of the northern burial, showing some of the grave goods

In order to test some of the survey conclusions, a simple 2-dimensional and 3-dimensional computer model of a chalice and paten at the head of a coffin was constructed using GPRMax. This confirmed that both coffins were made of Purbeck marble. The timing of the signals was matched to those at the head of the north coffin by adding 5cm to the chalice stem & reducing the paten diameter by 2cm. Comparison of the simulated data with that from the survey also illustrated that the real burials contained considerably more material than the simulation.

The high frequency GPR survey was recently published as "Improving Definition: GPR Investigations at Westminster Abbey", in the proceedings from GPR 2006, the 11th International Conference on Ground Penetrating Radar, Columbus, Ohio, June 2006.

The low frequency GPR results will be published when these have been tested against recent measurements of pillar bases remaining from the time of the earlier 11th Century Abbey.
We hope to be able to provide you with more definitive information on this issue which concerns many of us, by the time of the next newsletter.

A Critical Look at Some Filtering Procedures

Emily Hinz, Department of Geosciences, the University of Texas at Dallas eahinz@utdallas.edu

The field of data presentation in archaeological geophysics has generally been limited, whereas the fields of remote sensing and computer image processing have been exploring various ways to improve rasters for data presentation for decades. For instance, the enhancement and speckle suppression of Synthetic Aperture Radar (SAR) images has been widely reported (see Dong et al. 2001; Gibson 1998), and there have been advancements in edge detection and enhancement in the remote sensing community, which has traditionally used such practices to aid in automated image classification, and in the computer science community, which has suggested such applications as feature recognition and matching.

During a semester spent at the Archaeology Department, Glasgow University in 2005, the opportunity was taken to explore the use of some filtering procedures applied to magnetic and electrical data sets obtained at Glasgow from recent surveys at Roman forts (Auchendavy and Balmuildy) along the Antonine Wall (Jones, Leslie and Johnson 2006).

The results summarized here, in order of data alteration and algorithm complexity, aim to encourage greater experimentation with filtering procedures:

1) On images with prominent edges, the careful application of an edge detection algorithm can yield an image resembling a relief plot which is useful in highlighting structures that are sometimes lost in normal grey-scale displays of the data.

Most edge detecting algorithms rely on a change in the gradient of the pixel values to flag an edge and so commonly compute a first derivative in combination with a moving window (Gibson 1998). The Prewitt algorithm was applied to the resistivity and gradiometry data sets obtained at Balmuildy after initial smoothing with a Sigma filter to reduce the false detection of background noise as edges. Fig. 1 shows the results of the Prewitt filter oriented separately NE and SE and then added

together. The resulting image was superior to the original and Sigma filtered grey-scale images of the data, as sharp edges that were hidden by low contrast were revealed in the edge detection composite. On the down side, there was a loss of clarity with some structures, for example the ditch of the Antonine Wall, clearly visible as a defined edge in 1A, is less apparent in 1C.

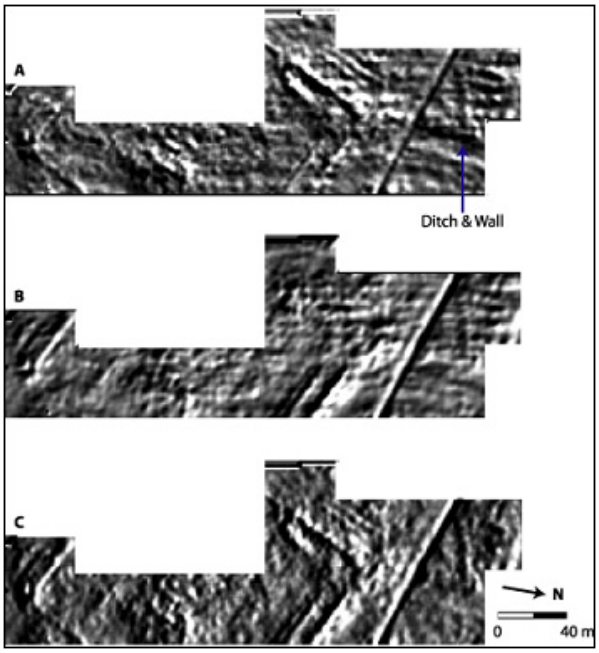


Figure 1: Balmuildy fort resistivity data. (a) NE directional Prewitt filter, (b) SE directional Prewitt filter, and (c) Addition of (a) and (b).

2) As regards filtering methods, median filtering in principle is superior to mean filtering (as found in Geoscan's Geoplot) because it is less sensitive to spikes in its neighbouring pixels and also is better at preserving existing edges. In the event, it was found to create blotchy images with some loss of shape of the edges as a result of the local region filter tending to expand the areas of similar values.

3) Many of the more advanced smoothing filters involve the calculation of the variance of the pixel from some averaging value taken from within a window surrounding a pixel. These are often referred to as adaptive (Mather 1999) or statistical filters. In fact, the Lee, Sigma, and Frost filters belonging to this category were found to produce visually analogous results, although the Frost filter greatly helped in removing the effects of rig and furrow in resistivity data from a field adjacent to Balmuildy fort (Fig. 2).

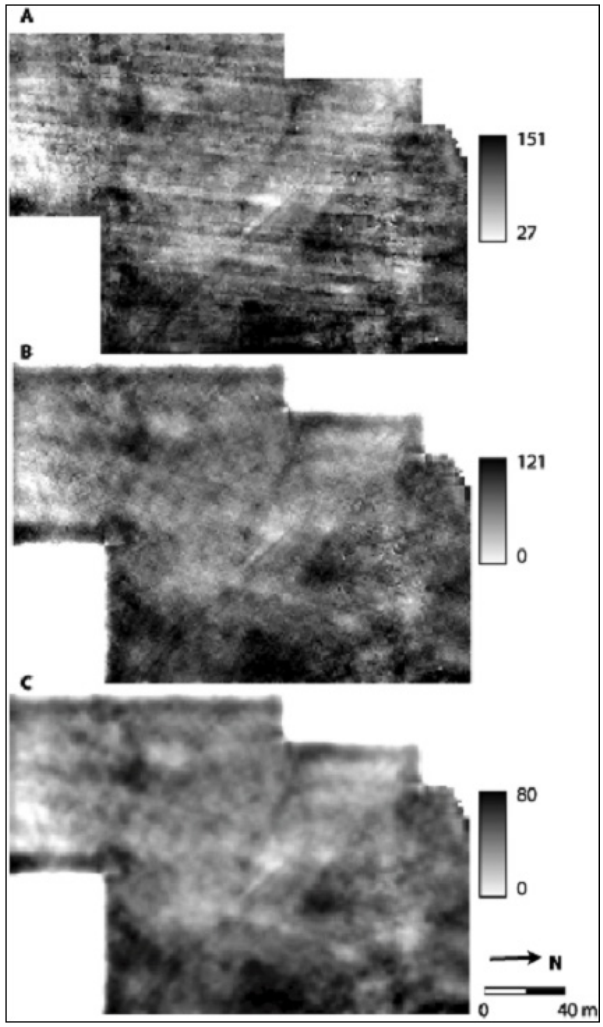


Figure 2: Balmuildy resistivity data, south of the fort. (a) Original image, despiked and edge-matched, (b) Periodic noise removal filter on A, and (c) Sigma filtered image, window size of three with periodic noise removal filter.

4) There were no discernible differences in the output of four data stretching methods: clipping, histogram equalization, Gaussian and arctangent function.

Bibliography

Dong, Y., Milne, A.K., and Forster, B.C., 2001, Toward edge sharpening: a SAR speckle filtering algorithm. IEEE Transactions on Geoscience and Remote Sensing 39, 851-863.

Gibson, C.J. A new edge detection technique for SAR images with speckle, 1998, Geoscience and Remote Sensing Symposium Proceedings. IGARSS 1998 IEEE International 1, 333-335.

Jones, R.E., Leslie, A. and Johnson, P.G., 2006, Recent geophysical surveys at Roman forts in Central Scotland, in R.E. Jones and L. Sharpe (eds) Going over old ground, BAR.

Mather, P.M., 1999, Computer processing of remotely-sensed images: an introduction, Wiley & Sons.

Conference, Seminar and Course Announcements

Developing International Geoarchaeology Conference 2007 (DIG 2007), and Workshop of the Archaeological Soil Micromorphology Working Group, Cambridge, UK, April 16-21, 2007

Second Circular: Registration, costs, presentation titles and short abstracts

The University of Cambridge, Cambridge, UK, is pleased to announce that it will be hosting the second Developing International Geoarchaeology Conference between April 18th and 21st, 2007. This conference follows the highly successful DIG 2005 conference in St. John, New Brunswick, Canada, which was established as a forum for international communication on geoarchaeological topics. The goal of the DIG conferences is to bring together a wide variety of international researchers, practitioners and students in what is a diverse and interdisciplinary field in order to facilitate discussion, stimulate research, and promote international scholarship in geoarchaeology.

DIG 2007 will be held in the McDonald Institute for Archaeological Research at the Department of Archaeology, University of Cambridge, and in Corpus Christi College. Conference delegates will be able to have accommodation in Corpus Christi College, or in a number of B&Bs and hotels around Cambridge by individual arrangement.

The conference will be preceded by a 2-day workshop of the Archaeological Soil Micromorphology Working Group on April 16-18th. This will be held in the McBurney Geoarchaeology Laboratory of the Dept of Archaeology at Cambridge, and participants are encouraged to bring/show their own thin sections.

Further information and details of the schedule, accommodation and costs can be found on the conference website: www.arch.cam.ac.uk/dig2007

Delegates wishing to present papers or posters are asked to give the title of their presentation and to send a short abstract (less than 300 words) by October 31st.

Conference delegates are requested to submit their registration form (http://www.arch.cam.ac.uk/dig2007/DIG-2007-registration-form-2.doc), clearly giving the number of nights/costs of accommodation required, and whether they are attending the workshop, the conference dinner and the field-trip.

All those attending are requested to send the full cost of accommodation and conference/dinner fees by January 15th, 2007.

Conference Organisers: Dr. Charles French and Karen Milek
Email: digarch@hermes.cam.ac.uk
Telephone: +44 1223 333533/339354
Address: Department of Archaeology, University of Cambridge, Downing Street, Cambridge, CB2 3DZ, United Kingdom.

EIGG and Forensic Geology Group Day Meetings, London, UK: 19 and 20 December 2006

ENVIRONMENTAL AND INDUSTRIAL GEOPHYSICS GROUP | **FORENSIC GEOLOGY GROUP**

Two day meetings at Burlington House, Piccadilly, London: 19th–20th December 2006

19th December: ***Recent Work in Archaeological Geophysics***

Shallow geophysical techniques are playing an increasing role in the evaluation of archaeological sites, in their discovery, interpretation and management. This will be the seventh in a succession of biennial meetings in which contributors from the UK and further afield present and debate the results of recent research and case studies. Suppliers of equipment and software also attend and the meeting therefore represents an invaluable opportunity for both archaeological and geophysical practitioners to take advantage of recent research and developments.

Convenor: Dr Andrew David, English Heritage, Fort Cumberland, Eastney, Portsmouth, PO4 9LD, UK; Tel.: +44 (0)23 9285 6764; email: Andrew.David@english-heritage.org.uk

20th December: ***Geoscientists at Crime Scenes***

This follow-on meeting, which aims to capture shared interests between the archaeological, geological, humanitarian and law enforcement communities, will follow a macro- to micro-scale organisation. The initial sessions will include geophysics, aerial, satellite and landscape interpretation. These will be followed by presentations on anthropology, buried materials, trace evidence and innovations in materials analysis.

Convenor: Dr Alastair Ruffell, School of Geography, Archaeology & Palaeoecology, Queen's University, Belfast, N. Ireland, BT7 1NN; Tel.: +44 (0)28 9097 340 email: a.ruffell@qub.ac.uk

It is anticipated that each meeting will attract 60 or more participants. As well as oral presentations, there will be space for commercial and poster displays.

Those interested in contributing to either meeting are warmly encouraged to contact the respective convenors, and to submit abstracts of up to 1000 words in length, accompanied by suitable illustrative material, no later than the 31st August 2006. These will be collated and made available to all those attending.

Attendance will be free to members of the Geological Society. Non-members will be asked to pay £20 to attend a single day or £30 for both days. Registered students can attend for £10 or £20, respectively. A further charge will be made for commercial exhibitors.

Pre-registration and payment is preferred and will be possible between 1st July – 1st December 2006. Please contact: Louise Martin, English Heritage, Fort Cumberland, Eastney, Portsmouth, PO4 9LD, UK; email: Louise.Martin@english-heritage.org.uk

ENVIRONMENTAL AND INDUSTRIAL GEOPHYSICS GROUP

Two day meetings at Burlington House, Piccadilly, London: 19th–20th December 2006

I would like to register for attendance at the following day meeting(s):

19th December: *Recent Work in Archaeological Geophysics* ☐

20th December: *Geoscientists at Crime Scenes* ☐

Participant details:

Title *First name* *Surname*

Address:

Telephone number:

Email address:

Method of payment: (unfortunately we cannot accept credit/debit card payments)

I am enclosing a cheque (made payable to EIGG). I understand that this will not be cashed until after the day meetings have taken place. ☐

I wish to pay on the day (by cash or cheque) ☐

Registration fee:

Geological Society member – membership number:	Free	☐
Non-member – 1 day	£20	☐
Non-member – 2 days	£30	☐
Student – 1 day	£10	☐
Student – 2 days	£20	☐

Signature: Date:

Please return to: Louise Martin, English Heritage, Fort Cumberland, Eastney, Portsmouth, PO4 9LD, UK by 1st December 2006.

Commercial Advertisements