ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

Issue 41
November 2014

Nepalese survey: the childhood home of the Lord Buddha

Notes from the NSGG Meeting on recent work in archaeological geophysics

Lightning strikes in Ohio

Welcome to the 41st issue of ISAP News! Read on for details of the survey of a newly discovered monastery at the childhood home of the Lord Buddha in Nepal, lightning strikes detected in magnetic surveys of earthwork and mound sites in Ohio, as well as a round up of events at the recent Near Surface Geophysics Group in London. And, of course, we'd like to take the opportunity to wish everybody a very merry Christmas and a happy and stress-free New Year! (And subtly remind you that membership fees will be due soon...)

As always, many thanks to those who have found time to contribute. And, as always, we'd really like to hear about your projects: 700-ish words and a couple of images would be great. Don't forget that we'd also like your photographs! Please send any contributions, notifications, and cover images for the next newsletter (ISAP News 42) to the email address below by the 28th February 2014. All entries are gratefully received!

Rob Fry & Hannah Brown

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The Cover Photograph Duncan Hale conducting a gradiometer survey at the Paharpur monastery complex in Bangladesh. The surveys were undertaken in response to tourism infrastructure development proposals (Photo: Richie Villis, Archaeological Services Durham University)

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A recently discovered monastery at Tilaurakot, Nepal, childhood home of the Lord Buddha

Duncan Hale & Patricia Voke

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Figure 1 (above) *Figure 1 Aerial image of Tilaurakot*
Figure 2 (below) *Survey within the citadel, near a modern shrine to local deity Samai Mayi*

Tilaurakot is a village in southern Nepal, near the border with India. It was the capital city 'Kapilavastu' of the ancient Shakya republic and is where the Lord Buddha spent his early, princely, life before leaving to seek enlightenment. The site is approximately 25km west of the Buddha's birthplace at Lumbini. The remains of a fortified 'citadel', measuring about 500m by 400m, and a series of external, associated monuments have been included by Nepal in the World Heritage Tentative List since 1996. The current surveys are part of an ongoing conservation and management project for Lumbini and other sites associated with the early life of the Buddha, directed by Prof Robin Coningham (Durham University) and Mr Kosh Prasad Acharya. The project is largely funded by UNESCO Japanese Funds-in-Trust and supported by the Lumbini Development Trust (LDT), the Department of Archaeology, Government of Nepal (DoA) and Durham University.

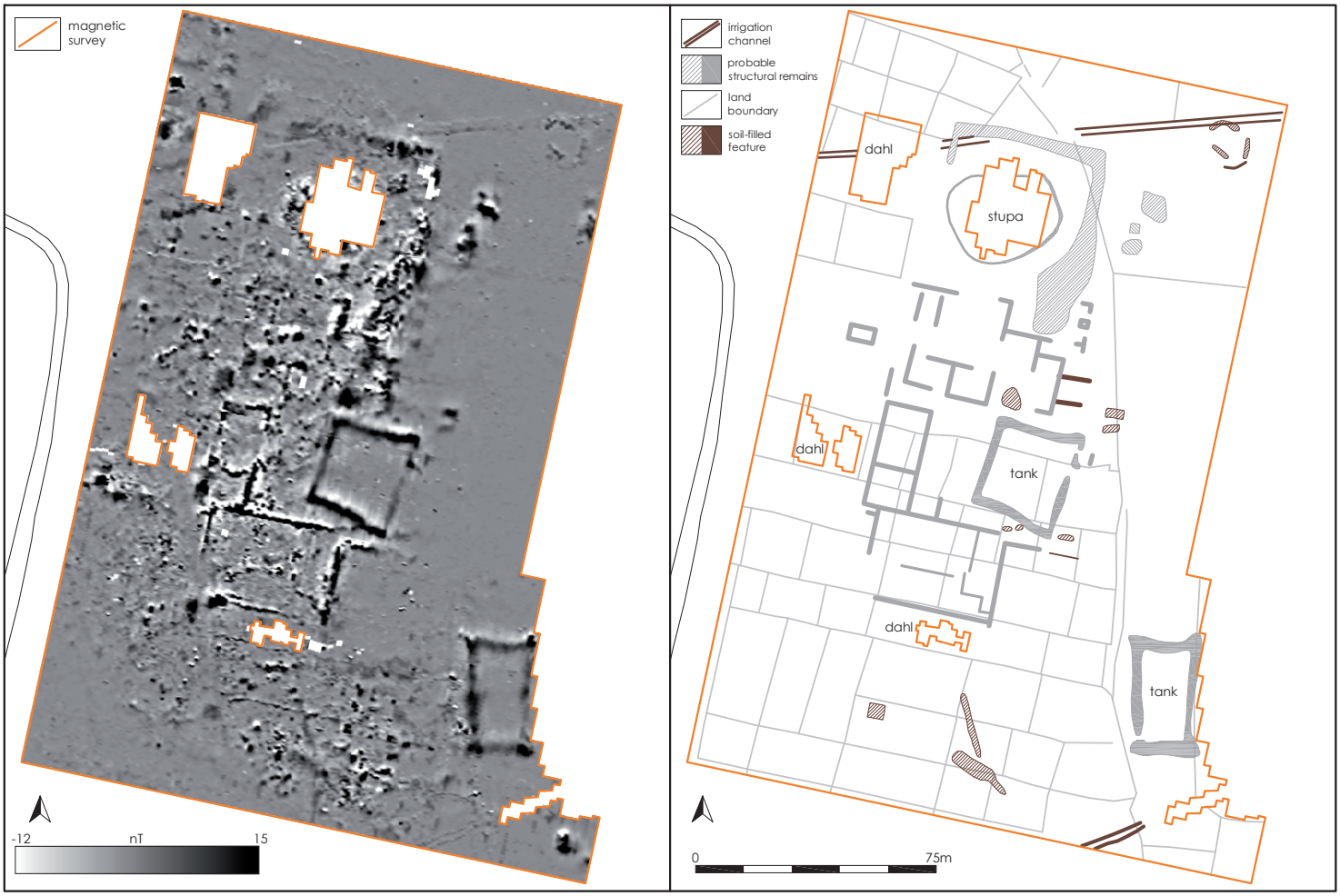
Pilot geophysical evaluations of the site were undertaken in 1997 and 1999, which identified a number of probable wall footings and other features within the citadel (Schmidt et al. 2011). In 2014 a team from Archaeological

Services conducted several larger geomagnetic surveys both within and around the Kapilavastu citadel. The land inside the citadel was very overgrown and surveys could only progress as areas were cleared of scrub vegetation. Towards the end of the fieldwork it was possible to extend certain areas to overlap with others and thus provide one contiguous survey area within the interior. Land outside the citadel generally comprised a lattice of very small fields defined by earth banks, for growing rice, dahl and mustard, with some open ground used for pasture.

A grid system of roads was detected within the main citadel enclosure, broadly aligned north-south and east-west. Several buildings and other probable wall remains were detected along and between the roads; some of the buildings in the west of the site are particularly well defined. A large rectangular structure detected immediately south-west of the central complex is almost certainly a brick-lined tank or pond. To the north of the central complex a rectangular concentration of strong anomalies probably reflects the remains of a substantial building complex, perhaps associated with a courtyard or temple. A Hindu shrine to Samai Mayi currently sits on part of this area of slightly raised ground. Another probable road heads north from here to the rampart, perhaps towards a northern gateway. The possible remains of buildings may have been detected in a 'suburb' to the north of the fortified area. Outside the citadel walls to the south, a broad in-filled moat was detected together with some possible furnace bases along the northern side of a mound of metal-working debris.

Figure 3 (above) *Survey in paddy near the Eastern Stupa*
Figure 4 (below) *Geomagnetic results at the Eastern Stupa*

Whilst the majority of features above were to some extent anticipated, more surprising remains were detected outside the citadel to the south-east. Approximately 150m south-east of the eastern gate is the 'Eastern Stupa', now a scrub covered mound. The stupa was supposedly constructed to mark both the location and the moment when the young prince turned for one last look at his home before leaving to seek enlightenment. Our initial survey



around the stupa revealed a series of possible structural remains and so was extended to cover almost 4ha, mostly to the south of the stupa. It appears that the stupa may at one time have been surrounded by a brick-built path or wall, measuring approximately 50m square. To the south is a series of large rectangular brick-built structures. The largest of these measures approximately 45m by 30m. Several other rectilinear structures, large and small, were also detected parallel and perpendicular to this large structure. Some probable wall remains are more evident than others and some have been inferred from alignments of small, discrete, strong anomalies, which are taken to reflect brick rubble.

Two other large structures were also detected on different alignments to the south and south-east of the stupa, measuring approximately 30m square and 35m x 20m respectively. The anomalies here are broader, more homogenous and less intense than those interpreted as building wall remains, perhaps indicating that they reflect deeper structures or structures built with slightly different materials, such as pounded brickbat as opposed to large, separate bricks. Both structures have magnetically quiet interiors and are almost certainly brick-lined tanks, similar to that detected in the central part of the citadel. These tanks or ponds serve both ritual and practical functions. This complex of buildings and tanks appears to represent a major religious complex associated with the stupa.

These surveys have contributed to a Heritage Impact Assessment and informed decisions regarding the proposed developments of a bus park and other visitor facilities both outside and inside the citadel. Although there is already a 'protected zone' around the stupa, fields have encroached into this area over recent years. It is hoped that the protected area will now be extended to include the monastery and that this larger area will be brought under the control of the DoA or LDT.

Coningham, R, Acharya, KP, & Manuel, M, 2014 Strengthening the Conservation and Management of Lumbini, the Birthplace of the Lord Buddha, World Heritage Property (Phase II), Final Report of the First (Jan-Feb 2014) Season of Field Activities, September 2014. Durham University.

Schmidt, A, Coningham, RAE, Strickland, KM, & Davis, CE, 2011 A Pilot Geophysical Evaluation of the Site of Tilaurakot, Nepal. Ancient Nepal, No. 177, p. 1-16.

Weise, K, 2014 Tilaurakot, the Archaeological Remains of Ancient Shakya Kingdom, World Heritage Tentative List: Heritage Impact Assessmen-t. Report submitted to Department of Archaeology, Ministry of Culture, Tourism and Civil Aviation, Government of Nepal.

The detection of lightning strikes on earthwork sites in Ohio, US

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Figure 1 *2005 magnetic gradient data from the Junction Group earthworks site, Ross County, Ohio, USA.*

In 2005-06, with logistical help from N'omi Greber (Cleveland Museum of Natural History) and partial funding from grant money provided by Wesley Bernardini (University of Redlands), I completed a magnetic gradient survey of the Junction Group —a 2,000-year-old ditch-and-embankment earthwork complex in southern Ohio (**Figure 1**). Little did I know then that this survey would spark a grass roots effort to buy the site in March of 2014. In a mad, three week fund-raising campaign, a small consortium of non-profits banded together and convinced donors to give over $350,000, which served as a match for an even larger grant later secured by the land and nature conservation organization Arc of Appalachia Preserve System. Thankfully, we successfully bought the earthwork site at auction and a total of 193 acres, making the Junction Group Ohio's newest ancient earthwork park: the Junction Earthworks Archaeological Park and Nature Preserve.

With the recent harvest of the last soybean crop ever to grow on the site, the ground this fall and winter is ideal for geophysical survey. In 2005 I used a Geoscan Research FM36 fluxgate gradiometer to collect 8 readings per meter along transects spaced one meter apart. This data density was sufficient for detecting the earthwork ditches and the foundations of most of the embankments. But what of the smaller features not clearly detected in the 2005 data? Earthworks in the Ohio Valley were often accompanied by post circles (i.e., wood henges), free-standing posts, single-set post structures, mortuary features such as crematory basins and burials, and many other kinds of pit-type features. Consistently identifying these types of features requires a higher data density than that collected in 2005.

In November of 2014 I began a re-survey of the Junction Group using a Foerster Ferex 4.032 DLG 4-probe fluxgate gradiometer system, collecting ten readings per meter along transects spaced at 50 cm intervals. **Figure 2** is a side-by-side comparison of a selection of the 2005 and 2014 data. As expected, the higher density data more clearly show the presence of smaller anomalies of interest, including possible post holes or small pit features near the center of the northernmost circle. Many of these anomalies were also detected in the 2005 data, but it is difficult in the lower density data to differentiate small archaeological features from the magnetic anomalies created by bricks, small iron objects, and magnetic rocks.

An unexpected surprise in the 2014 data is a lightning strike

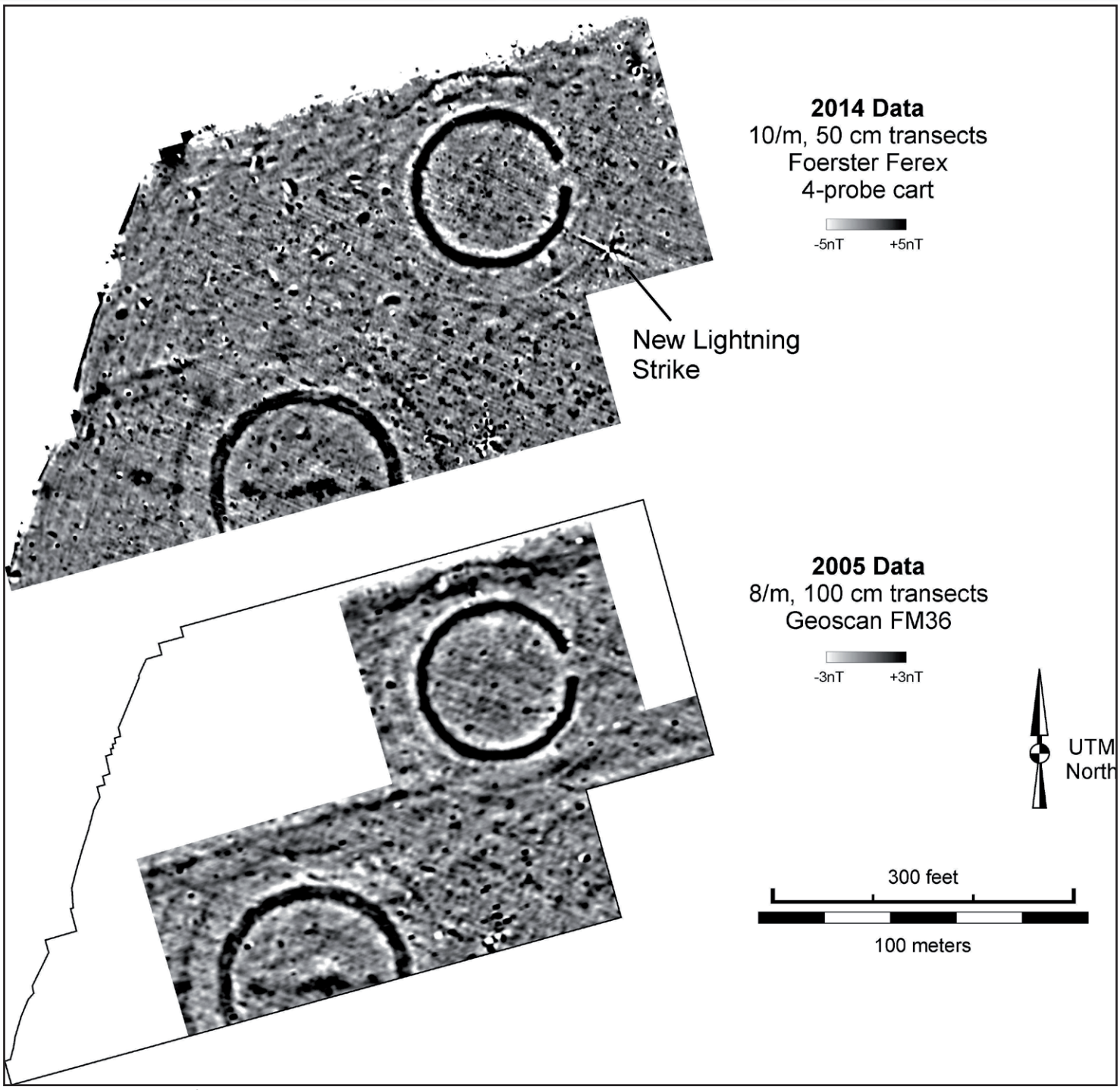

Figure 3 *Comparison of the 2005 and 2014 Junction Group magnetic data.*

anomaly just off the southeast side of the northernmost circle. Apparently lighting interacted with the ground here sometime between 2005 and 2014. This anomaly has the shape and the shifts in polarity that are typical of what Bevan (1995) has suggested is horizontal current flow in the ground—in this case moving in toward the point of the lightning strike. Note the southeast-northwest orientation of this anomaly. It parallels the adjacent linear magnetic features caused by plowing. In fact, it would appear that the lightning strike anomaly is following a plow mark. This suggests that this lightning-related anomaly is present in the soil fairly close to the surface, within the 30 cm thick plow layer.

Similar lightning strike anomalies have been found at many sites in Ohio. The examples in **Figure 3** were detected in relatively shallow soils formed into recent alluvium (Hahn Village site) and late Pleistocene glacial outwash (Hopewell Mound Group). All three strike anomalies in Figure 3 run parallel to prominent plow marks in the magnetic data. Inward and outward current flow are indicated in anomalies at Hopewell Mound Group—a site where dozens of lightning induced anomalies were recently detected (Burks 2013). However, not all large surveys in Ohio yield evidence of numerous lightning strike anomalies. For example, at those sites that have been recently disked or plowed, few such anomalies are present. It may be that the magnetic effects of lightning occur very close to the surface, as with the strikes that produce horizontal current flow in plowed fields. Plowing has no doubt erased many such anomalies,

but more recent no-till and minimal-disturbance farming practices may be damaging portions of these near-surface anomalies, leaving behind what appears to be atypical lightning induced anomalies that are in fact simply portions of the typical horizontal and vertical current flow anomalies we are used to seeing in magnetic data.

My thanks to Bruce Bevan for his insights about lightning induced magnetic anomalies. Plans are underway to conduct further tests in the field on select anomalies and compile data related to their amplitude, morphology, size, and current flow direction, building on the work of Jones and Maki (2005) in the general region. Though lightning strike magnetic anomalies are not to date of much archaeological importance, understanding them is germane to the craft of interpreting magnetic data from archaeological sites. For the uninitiated geophysics practitioner, lightning induced anomalies can present a big interpretive challenge that often leads to incorrect analyses of magnetic data. Hopefully the lightning strike data from Ohio will move us a little closer to understanding these enigmatic anomalies that we sometimes encounter in our magnetic surveys.

Bevan, B, 1995 Research Focus-Magnetic Surveys and Lightning. Near Surface Views, October Issue, pgs.7-8.

Burks, J, 2013 Large Area Magnetic Gradient Survey at the Hopewell Mound Group Unit, Hopewell Culture National Historical Park, Ross County, Ohio. Contract Report #2012-52-1. Ohio Valley Archaeology, Inc. Columbus, Ohio. Report prepared for the Midwest Archeological Center, National Park Service, Lincoln, Nebraska.

Jones, G, & D. Maki, 2005 Lightning- induced Magnetic Anomalies on Archaeological Sites. Archaeological Prospection 12:191-197.

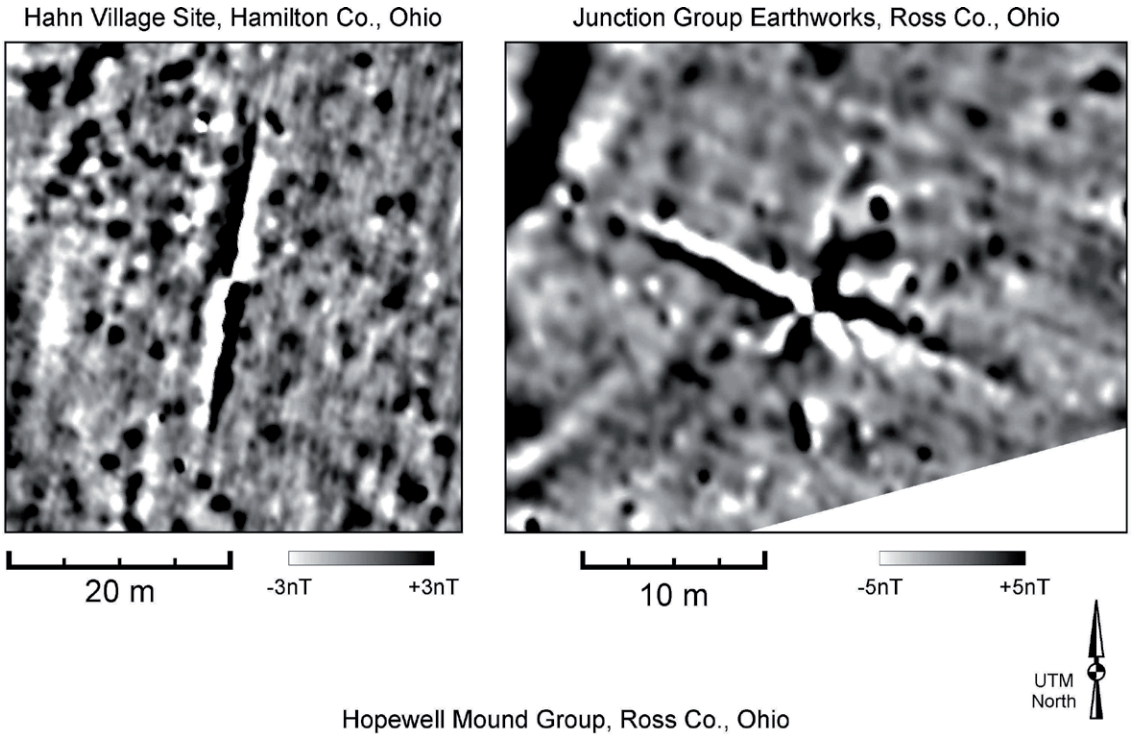

Figure 3 *A selection of lightning induced anomalies following plow marks at Ohio archaeology sites.*

NSGG Recent Work in Archaeological Geophysics Meeting, 2nd December 2014

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Facts & Figures provided by Paul Linford, English Heritage (paul.linford@english-heritage.org.uk)

The 2014 NSGG Recent Work in Archaeological Geophysics meeting was held at Burlington House, London, on the 2nd December. As ever, the biennial day conference was well attended, however this was the largest event yet, with around 142 participants, which easily beats the previous record attendance of 128. About 10% of the delegates came from overseas, which is amazing for a one-day conference. While most were from Europe, the furthest travellers were from Michigan in the US and Nova Scotia in Canada. 22% of the delegates were students and ISAP gave bursaries to 9 of these who were the lead authors of presentations.

14 papers and 19 posters were presented covering technical, methodological and interpretive aspects of archaeological geophysics, with a high percentage of the work involving students and young professionals from a number of organisations; very encouraging for the future of the discipline. 18 posters are listed in the programme but Adam Booth stepped in with a 19th on portable XRF as a field measurement tool at the very last minute to fill a slot originally reserved for the IfA GeoSIG (unfortunately too late to be included on the poster voting form).

The morning session focused on site based survey, beginning with a report on work headed by a team from Keele University on a Black Death Cemetary in Charterhouse Square in South Islington, where radar and EMI were used in an attempt to identify further burials from a cemetary partially excavated during Crossrail construction. The session then moved on to Salisbury Plain, as Peter Masters from Cranfield University described using geophysical survey in the recovery of a spitfire aircraft, subsequently excavated as part of the Operation Nightingale project. Moving northwards, Chrys Harris, a PhD student at Bradford University, discussed the results of a whole suite of multi-method survey undertaken at Fountains Abbey, North Yorkshire, which revealed complex building development to the west of the extant structures, together with the sheer scale of the Monks' Cemetery to the east. The session was rounded off by Kris Lockyear, who talked about his work with community archaeology groups in Hertfordshire and the surrounding area, using a Foerster instrument purchased under an AHRC scheme. Of particular note was the work at Veralamium which gave a fascinating insight into this Roman town.

The second of the morning sessions had a more technical theme, as Armin Schmidt of Groningen University discussed his revised approach to the inversion of magnetic anomalies, using data collected as part of the Raganello Archaeological Project as his basis. This relied on using possible archaeological interpretations to generate magnetic models which could be tested and compared to responses seen in the data. Angeliki Zisi then introduced her work on the ultrasonic properties of waterlogged wood, where careful study of the responses obtained in the laboratory under certain conditions should facilitate in-situ measurements in the future, allowing a far greater understanding of the nature of waterlogged organic remains without the need for excavation. Rounding off the session, Finnegan Pope-Carter, from Bradford University and GSB Prospection, talked about ArchaeoPY, a coding cooperative intended to permit the generation and dissemination of bespoke code, specifically tailored for use with archaeological geophysical data. He described some of the work the group had already completed and strongly encouraged others to get involved.

Following a fine buffet lunch provided to all delegates by the NSGG (a welcome new addition to the day), the afternoon session kicked off with a paper by Richard Bates of St Andrews University, discussing his work in the intertidal zone, on a number of Welsh sites, to facilitate paleo-environmental reconstruction. Of particular interest was the use of modelling to aid and improve data interpretation. Pier Barone then took us to warmer climes, describing how archaeological legislation and the way that archaeological geophysics are used in Italy differ greatly from our own experiences in the UK. He gave an overview of a number of instances where survey had been of great benefit and expressed his desire that its use become more structured and widespread than was currently the case. Finally the last Bradford student, Mary Saunders, spoke about her PhD work in the Yorkshire Dales and the ways in which our geophysical interpretations can be put into a more archaeological framework through Historic Landscape Characterisation.

The final session of the day began by show casing the work Duncan McNeill, formerly of Geonics and a man described as 'always having an EM38 in the back of his truck', presented by his friend Jonathan Fowler, Saint Mary's University, due to the former's ill health. A number of North American surveys were described, with the authors keen to stress how useful they had found the technique in identifying areas of burning. Returning to Europe, Lieven Verdonck, Ghent University, introduced a new method for removing background noise from GPR data in order

to increase anomaly visibility and enhance interpretation. This stimulated lots of interesting discussion from the audience, centred around where data processing ends and interpretation begins. Duncan Hale from Archaeological Services University of Durham then presented work in the sand dunes of Dubai, perhaps the epitome of a methodologically challenging survey, and which produced difficult to interpret data. The final paper of the day came from Paul Cheetham, Bournemouth University, upset by the inclusion of dowsing in the National Trust magazine and its use over historic gardens. He showed data from a number of geophysical surveys of such sites, emphasising the importance of seasonality and sample interval in this kind of work. Finally he pointed out what he felt was the first geophysically identified exedra or medieval turf seat.

The Lower Library housed the traditional display of posters, with the ISAP prize for best poster this year awarded on the basis of a ballot of all delegates rather than on the decision of a panel of assessors. Following the count, it was Hannah Brown, University of Bradford, who was awarded the fifty pound prize for her poster describing her collaborative work with York University at Torksey, Lincolnshire.

The various interest groups representing archaeological geophysics were well represented at the meeting with the Near Surface Geophysics Group and ISAP both holding their AGMs in the lecture theatre at different times during the day and the Institute for Archaeology's Geophysics Special Interest Group distributed a flier summarising the outcomes of the Archaeological Geophysics Contractor's conference they held in Bradford in March.

The meeting was brought to a close by the ISAP AGM, before concluding in the Chandos, St Martin's Lane - the Walkers of St James having been quickly drunk dry! All in all, it was a very varied and enjoyable day and it is almost certain that all who attended are already looking forward to the next meeting in 2016.

The organisers say...
"This is the first time we've tried providing lunch for everyone and we would be interested to hear what people thought given that we did have to nudge the registration fees up slightly to be able to do it. Comments so far have been positive and it certainly seemed to give people more time in the Lower Library during lunch break to look at the posters and speak to the exhibitors."

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National Park Service's 2015 Archaeological Prospection Workshop

The National Park Service's 2015 workshop on archaeological prospection techniques entitled Current Archaeological Prospection Advances for Non-Destructive Investigations in the 21st Century will be held May 25-29, 2015, at the Tobias-Thompson Complex sites in Rice County, Kansas.

Lodging will be at the Lyons Inn and the Celebration Center in Lyons, Kansas. The lectures will be at the Community Room at the Lyons State Bank in Lyons, Kansas. The field exercises will take place at the Tobias-Thompson Complex sites in Rice County, Kansas. Eight sites showcase the Little River Focus of the Great Bend Aspect dating from 1500-1700 AD. The sites have been related to the historic Wichita and may have been among the villages visited by Coronado in Quivira in 1542.

Co-sponsors for the workshop include the National Park Service's Midwest Archeological Center and the National Center for Preservation Technology and Training, the Department of Anthropology at Wichita State University, and the Archaeological Division of the Kansas State Historical Society. This will be the twenty-fifth year of the workshop dedicated to the use of geophysical, aerial photography, and other remote sensing methods as they apply to the identification, evaluation, conservation, and protection of archaeological resources across this Nation.

The workshop will present lectures on the theory of operation, methodology, processing, and interpretation with on-hands use of the equipment in the field.
There is a registration charge of $475.00.
Application forms are available on the Midwest Archeological Center's web page at http://www.nps.gov/mwac/. Payment may be made by credit card through the Friends of NCPTT for non-government employees. Federal employees may pay by check, through a training form (SF-182) or by credit card through the Friends of NCPTT.

For further information, please contact Steven L. DeVore, Archeologist, National Park Service, Midwest Archeological Center, Federal Building, Room 474, 100 Centennial Mall North, Lincoln, Nebraska 68508-3873: tel: (402) 437-5392, ext. 141; fax: (402) 437-5098; email: steve_de_vore@nps.gov

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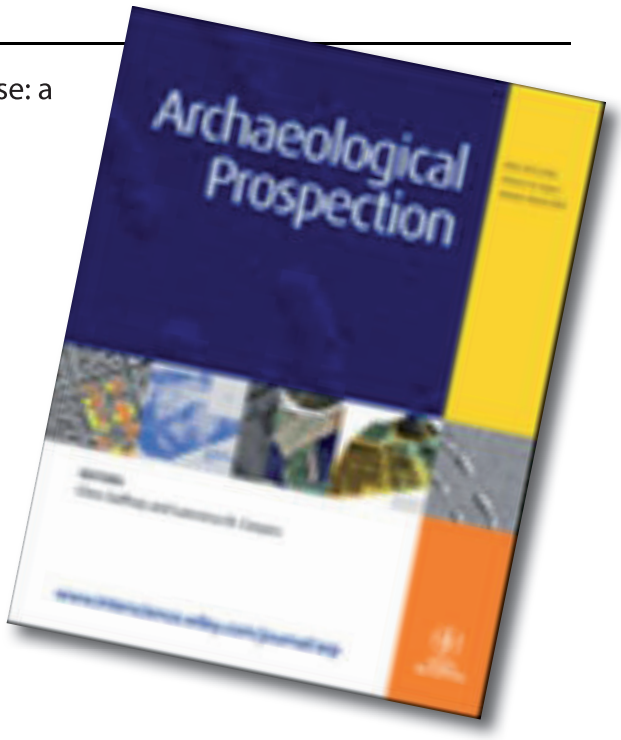
Journal Notification

Archaeological Prospection 21(4)



A Multidisciplinary Approach to Medieval and Early Modern Land Use: a Case Study from Southeastern Austria
K. Patrick Fazioli

Magnetic Susceptibility Detection of Small Protohistoric Sites in the Raganello Basin, Calabria (Italy)
P. M. Van leusen, A. Kattenberg & K. Armstrong

Geophysical Survey in Sub-Saharan Africa: magnetic and Electro-magnetic Investigation of the UNESCO World Heritage Site of Songo Mnara, Tanzania
K. Welham, J. Fleisher, P. Cheetham, H. Manley, C. Steele & S. Wynne-Jones

Lidar Investigation of Knockdhu Promontory and its Environs, County Antrim, Northern Ireland
R. W. A. McNeary

Assessing the Condition of the Rock Mass over the Tunnel of Eupalinus in Samos (Greece) using both Conventional Geophysical Methods and Surface to Tunnel Electrical Resistivity Tomography
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Book Review: Earth Resistance for Archaeologists, A. Schmidt.
H. Brown

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Cover image: Magnetometer survey on the West Bank of Thebes, Egypt (photo: Angus Graham)