Issue 32: August 2012

ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

Contents

The views expressed in all articles are of the author, and by publishing the article in ISAP News, the ISAP management committee does not endorse them either positively or negatively. Members are encouraged to contact authors directly or to use the discussion list to air their views, should they have any comments about any particular article.

Editor's Note

Robert Fry R.J.Fry@student.bradford.ac.uk

Welcome to the 32nd issue of ISAP News! A huge thank you to all who have found the time to contribute to the newsletter, I hope you will find it an enjoyable read.

Included in this issue of ISAPNews are reviews of the CAA ISAP roundtable discussion and the First International Conference on Virtual Archaeology - making this issue a good place to catch up on anything you may have missed over the start of the year. Also included are some great surveys from Ohio, Cyprus and Egypt. We also have the press release of Geoscan's new RM85 resistance meter!

Please send any contributions or queries for the next newsletter (ISAP News 33) to the address above by the ***31st October 2012****. All entries are gratefully received; I will always try to respond to emails in the same day if possible.*

Important Notices

Membership renewal
£7 or €10 for the whole year. Please visit:
http://www.bradford.ac.uk/acad/archsci/archprospection/renew.php

Archaeological Prospection Journal
Take advantage of the great deal offered to ISAP members by Wiley-Blackwell for this journal
http://www.bradford.ac.uk/archsci/archprospection/menu.php?2

Computer Applications in Archaeology (CAA) 2012: ISAP Geophysics Roundtable

Kayt Armstrong[1] K.L.Armstrong@rug.nl
Chris Gaffney[2] C.Gaffney@Bradford.ac.uk

[1] Groningen Institute of Archaeology, Groningen, Netherlands
[2] Bradford University, Bradford, UK

At last year's ISAP AGM it was suggested that we needed more formal discussion time between meetings. In particular this was needed because of the fast pace of change in instrumentation. Advances in technology, data processing and storage capacities have meant that archaeological prospection teams generate exponentially larger data sets, covering large tracts of landscape. In particular, the arrival of radar acquisition at very high sampling densities has created challenges for storing, interpreting and visualising the data. It is now entirely feasible to study whole landscapes by geophysical means, supported by techniques such as Airborne Laser Surveys, Hyperspectral Mapping and Terrestrial Laser Scanning. In the last two years, major projects in Europe have pushed the boundaries of collecting and interpreting data. These projects all intersect with GIS, data management, spatial and landscape archaeology, and areas around the visualisation of archaeological interpretations and their presentation to the public. Areas of overlap with the airborne research groups also occur, for example in the field of developing automatic or human-assisted computer based anomaly recognition. At the 9th International conference on Archaeological Prospection in September 2011, it was agreed that CAA was a good opportunity for dialogue across these fields and exchange of ideas, theories and practice. A round-table session was convened and a call for panel members was circulated widely in the archaeological geophysics, computing and aerial prospection communities.

The panel was eventually composed as follows:

C Gaffney (Discussion Chair), K Armstrong, A Back, S Davis, P Barker, B Vis, S Hay, S Kay, J Ogden and K Loecker

About 40 delegates (with more watching from a streaming room) also attended and made many valuable contributions. First of all, our thanks to all who attended the session. We were very pleased to see so many people there taking part. We gained a lot of knowledge from the delegates about practice in other areas of archaeology that will really help the terrestrial geophysics community move some of these issues forward. The discussion was somewhat UK centric, in part due to the panel members, and in part due to the location of the conference.

Prior to the session we canvassed the panel members and established the main areas of concern/hot topics, and in the session we tackled these roughly in order of importance.

- **Open methods store** (closely linked with what the AARG are doing about similar problems in aerial prospection, using thesauri etc)
- **Metadata and archiving** - minimum standards
- **Big Data**- dealing with large area surveys- processing and interpretation
- **Linked geophysical data**? –and issues of attribution / commercial interest
- **Linking with soils and geomorphological databases**?
- **Visualising interpretations**- how to show uncertainty in reconstructions? (widened to educating audiences / users of our geophysical outputs)

The topics proved to be highly interrelated so the discussion sometimes hopped about a bit, the following covers things in the rough order they were discussed. Please feel free to continue the discussion or round out any points we missed on the ISAP mailing list.

Attendees had expressed a strong interest in hearing more about the Open Methods Store being worked on by the AARG and MAPSIG, so Ant Beck (University of Leeds, DART project) gave a short presentation about this to kick things off. Ant also helpfully made a 'mind map' of the discussion and has made it available at:

http://dl.dropbox.com/u/393477/MindMaps/StandAloneJS/CAA2012.html

To summarise, the Open Methods Store follows principles of Open Science, in that:

- The data being analysed and discussed are available online
- More importantly, the methods are also available online: each tool used to process the data exists in a 'white box' where all of the parameters and assumptions are exposed. These methods should all be open-source.
- Ideally, data is submitted to the methods store in a raw state. It goes through a series of white boxes, and metadata describing these processes is created and updated. The final result is left available online, and each or any of the steps can easily be replicated or modified by subsequent users of the data.
- The data is 'discoverable'- i.e. the metadata exists in such a way that makes the data visible to people searching for it.

Perhaps predictably, the discussion turned to problems of making archaegeophysical data open & discoverable. Peter Barker (Stratascan / IFA GEOSIG) made the very valid point that for the commercial community, client confidentiality clauses often make this impossible, at least for a certain time period following the surveys. It was also acknowledged that there is a wider ethical issue with revealing the location of archaeological sites to the wider public- concerns in particular centred on nighthawking. It was agreed that the Portable Antiquities Scheme has made some real inroads in this area and have useful policies about the precision of their site locations. We also agreed it would be worth seeking their input on any further plans to make geophysical data more open. There was a general consensus that there will always be commercial and ethical barriers to making some archaeogeophysical data 'open' but that there are also cases where this is possible and that the benefits of having data open and discoverable outweigh these concerns in many cases. In fact many of the professional groups in the UK have contributed to the award winning (CBA 2012 Best Innovation) Grey Literature Library where both meta data and reports can be archived (http://archaeologydataservice.ac.uk/archives/view/greylit/).

The discussion at this point moved to the issues of archiving and discoverability. PB explained that Stratascan have a large archive of data that they would be happy to make available to researchers on request, but they never get asked. Evidently there is a problem with discoverability- how do we make the presence of these data and reports known and searchable? We had a wide-ranging conversation about how to flag up to search engines and other web-based research tools that archaeogeophysical information is held by an organisation. To do this well would mean making good use of metadata and tools to make said metadata cross-searchable. It was felt useful to take this discussion to a wider audience- there were some very helpful contributions from the marine geophysics community and people working in linked data fields. Oasis, the AIP project and Fasti were also mentioned as places geophysical data is already been flagged up and indexed. We also already have some guidelines about 'best practice' for geophysical metadata- the guidelines Armin Schmidt wrote for the ADS. It was agreed that Kayt would follow up on some these ideas and that perhaps we could discuss things together on the ISAP list to see if we can find a way to move forward. Generally it seemed that we agreed that whatever the qualms about a totally 'open' approach, we could at least move forward on discoverability- even if we aren't putting the data itself out 'there' we can at least advertise that we hold it and invite researchers to contact us.

We then moved on to talking about an emerging problem- the very large datasets that are now being generated by truly landscape-scale equipment/surveys. Klaus Loecker spoke about what the LBI are doing in this regard and have surveyed areas of several km^2. How do we even start to think about analysing all of this data, let alone storing and processing it all? Their approach is to have a wide ranging team that includes people working on data processing and visualisation as well as the new hardware. For example, their data capture is in xml, and has built-in metadata that is generated alongside the data itself. They have developed the tools to do

this as the commercially available ones can't currently cope.
Klaus said that their largest problems to date have been coordinating permissions for such large and varied areas, and keeping all of the file names and associated land parcels etc all straight. Conceptually as well, they have realised they need to understand seasonality and soil variations better as the surveys are now at a scale where these factors come into play. As they move into describing and analysing their data, they are working on a tool to add-in to ArcGIS that will use a combination of computational and human decision making to identify, describe and interpret anomalies. We widely agreed that this step is totally non-trivial, but that with large datasets some sort of computer assistance is needed to allow interpretation in useful timescales.

We moved on to talking about reports vs. data – might it be more useful to start thinking in terms of the data being the output, rather than a report? At least the technical aspects, describing capture, processing and display? If we capture (using, for example the open methods store approach) metadata about these at the point of collection/ implementation, then could at least some of the things typically included in a report be produced on request from the data itself. PB made the important point that in commercial surveys, the report *is* the product, not the data- the report is what the client is paying for as it digests the information in a way that is useful for them. We also talked about reports as being important for allowing a synthetic approach to a site or landscape that wouldn't be possible from computer generated minutiae. In contrast, we also talked about it being important in these new large projects not to miss out on small 'nuggets' of data and insight because they are swamped in a large pool of information.

At this point we naturally moved into talking about how we actually describe and discuss geophysical anomalies- if we aim for linked data, then it would be useful if our text, as well as our data themselves could be reliably searched and cross-indexed. Could we perhaps adopt a thesaurus-based approach? Peter and Klaus pointed out that things are moving very fast, technologically, especially in the GPR world- for example, individual radargrams are rarely reproduced in reports these days, but they contain valuable information that can be totally missed in 'slice' based approaches. We talked as well about quality control based approaches, for example, checking a random sample of individual radargrams. Cristina Serra and Louise Tizzard (both from the marine geophysics end of our discipline) made some really useful contributions to this part of the discussion, about the standards and reporting used by the marine industry. It seems we could possibly learn a lot from them about metadata, standards and shared/agreed vocabularies. We talked a bit here about user-generated thesauri, along the 'folksonomies' principle, where a community come to agreement about a set of terms or definitions, rather than working from something imposed top-down. This seems a good place to mention that during the data-processing discussion we talked about citizen science- harnessing the interest of the 'lay' public to assist in large scale data analysis problems. The best known example of this is probably Galaxy Zoo, and is a useful example for our community because it involves classifying visual phenomena (in this case, galaxies) by form, intensity, size and colour.

We then had a rapid-fire discussion of a number of related topics, for example, linking the data back to its landscape – how do we do this, and move beyond a 'keywords' approach? What exactly do we mean by integration? How do we define *data* integration, as opposed to integration of images for visual interpretation? Chris cautioned us against 'throwing the kitchen sink' at geophysical data, based on his experience of integrating fieldwalking and geophysical surveys in Greek landscapes.

We had a short introduction to how geophysical data (primarily gathered for engineering purposes) is handled in the BeNeLux- there, reporting of all engineering and soil data is mandatory and available to researchers, but as far as Jeroen Verhegge knew, they were no particular standards, so the information varied in quality. This is driven by government/legal mandate, and we widely agreed that some sort of obligation to report *and archive* would be important if this was to work properly in the UK. This is all tied up to the costs of maintaining archival data;- someone has to pay for this, and in commercial practice, it can be difficult to get funding for this if it is not mandatory, the work simply goes to someone cheaper. From an academic perspective, this also gets messy- if someone changes institution or projects, who becomes responsible for their digital data?

There was a short discussion about public engagement. Steve Davis spoke about his experience working with landowners and the public about the Bend of the Boyne WHS. He said that people had been fascinated by, and very willing to engage with the LiDAR dataset there, and the sentiment was echoed by people with similar experiences on geophysical projects. The 'public' are often more knowledgeable and more interested than we think, and this is worth bearing in mind with regard to citizen science approaches, and to worries we have about being more 'open'. In terms of amateur geophysical surveys, there is a breadth of experience of this in the UK; community projects regularly employ geophysics and have produced excellent results, but there was concern raised in terms of the degree of understanding employed in processing and interpreting the data- 'comfortable black boxes' were mentioned. The risks of data loss in this area would also seem to be very high. For example, if the society is driven by one enthusiast, what happens if they move away, or die? Who curates the archive?

By the end of the meeting we had some important conversations, and most importantly, reached out to other disciplines with similar issues. Once this write-up has been distributed we can continue those conversations and work towards some concrete outputs! Perhaps we can update everyone at the AGM?

Ohio's Great Serpent Mound Surveyed

Jarrod Burks jarrodburks@ovacltd.com

Ohio Valley Archaeology Inc.

Serpent Mound is perhaps one of the most iconic prehistoric Native American sites in North America (Figure 1). While images of this ca. 415 m long, serpent-shaped embankment appear in countless books, very little archaeological work has occurred at the site since Frederick Ward Putnam coordinated its purchase and reconstruction in the late 1880s (cf. Fletcher et al. 1996; Putnam 1889/1890). In 2011 a consortium of archaeologists from Ohio and Indiana pooled their resources and expertise to take a much needed closer look at the site. Because of the site's importance and high visitation, our initial research permit only allowed for geophysical survey and limited coring with a GeoProbe 54TR. My role as part of the team was to conduct a magnetic gradient survey and follow up with secondary investigations (additional geophysics and excavations) of any magnetic anomalies of interest.

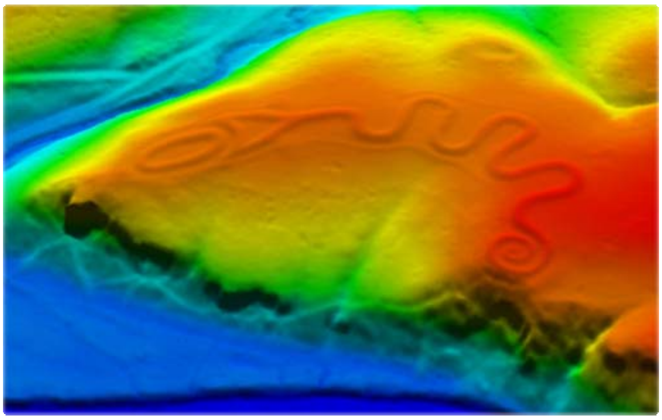


Figure 1 LiDAR image of Serpent Mound (image created by the author, DEM provided by William F. Romain, data from Ohio Department of Transportation).

Figure 2 shows the results of the magnetic gradient survey using a Geoscan Research FM256 fluxgate gradiometer (8 readings per meter along transects spaced 50 cm), with data processing through Geoplot 3.0. As expected, the Serpent itself was easily detected, which is no doubt a factor of its height (2-5 ft) and the fact that a significant portion of its fill was made with topsoil scraped off the surrounding hilltop (both in ancient times when it was first built and subsequently when Putnam's crew brought the embankment's height back up to its mid-1800s height). The iron objects and general clutter near the tail are likely related to a nineteenth-century house that once stood just outside the survey area.

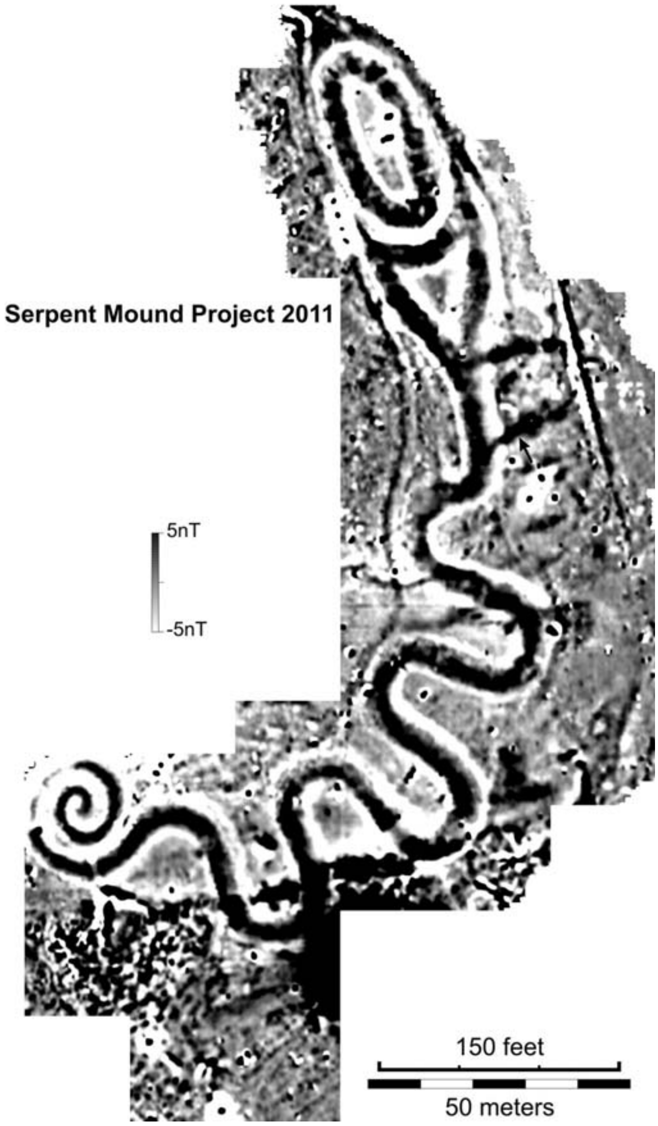


Figure 2. Magnetic gradient map of Serpent Mound (the small black arrow along the southern edge of the newly discovered undulation indicates the location of a 1x5 m excavation trench dug subsequent to the magnetic survey).

In addition to several linear anomalies that we have yet to investigate, and could be drainage related, the most surprising find in the magnetic data is the extra undulation along the east side of the Serpent's neck. This arcing magnetic feature is in fact the same size and shape as the extant undulations, or coils, composing the Serpent's body. The ground to the east of the Serpent's neck, the site of this interesting find, has no topographic evidence of this "lost coil." Comparisons with several old maps (see Figure 3) shows that this newly discovered undulation in the

Serpent was not visible in the 1800s, even in Squier and Davis's map, which documents the Serpent prior to ploughing—nor is the feature evident in any other published maps of the site. The bipolar linear feature crossing the apex of the new undulation corresponds to the location of a wire fence installed by Putnam's crews in the 1880s.

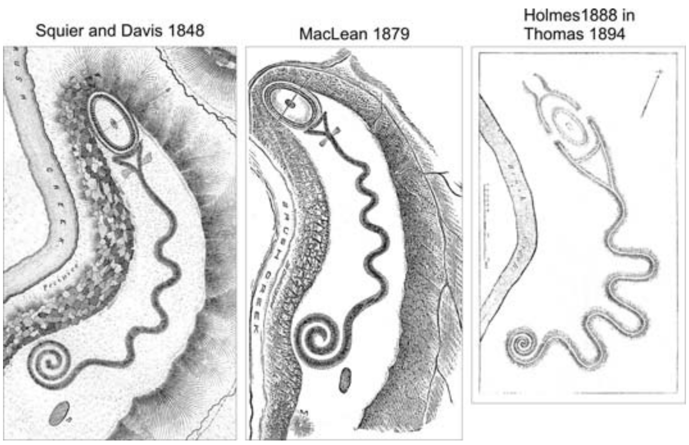


Figure 3. Nineteenth century maps of Serpent Mound.

In June of 2012 we excavated a 1x5 meter trench across a portion of the arcing magnetic feature to determine what, if anything, is still present of this possible lost coil (see Figure 1, the black arrow indicates the location of the trench). A thin layer (ca. 15 cm thick at most) of light colored, silty soil sitting atop reddish clay was found to match the location of the magnetic feature (Figure 4). This soil contained several hundred pieces of lithic debitage, including a projectile point fragment that dates to a period before the construction of the Serpent.

Figure 4. West profile view of a 1x5 meter trench cut across the new "coil"—the light colored soil in the middle two-thirds of the trench match the location of the magnetic anomaly.

So, how was this extra coil missed in the many maps made of the site in the 1800s? It is likely that this undulation was not visible in the 1800s and had been erased in antiquity. Its fill probably was used by the Native Americans to rebuild the Serpent in the configuration that we see today. The scant remains of the lost coil show up so well in the magnetic data because midden-rich sediment was used in its construction and this material was not entirely removed when the undulation was erased. If one examines the basic geometry of the erased coil, it looks like it could reasonably fit (geometrically) with the body of the Serpent, but it would not fit with the head as we see it today. Therefore, if this erased coil is part of a complete (with head and body) pervious iteration of the Serpent, then this coil and the previous iteration of the head were erased prior to the construction of the Serpent's current configuration.

References Cited

Fletcher, Robert V., Terry L. Cameron, Bradley T. Lepper, Dee Anne Wymer, and William Pickard 1996. Serpent Mound: A Fort Ancient Icon? *Midcontinental Journal of Archaeology* 21:105-43.

Maclean, J. P.. 1879. *The Mound Builders; Being an Account of a Remarkable People that Once Inhabited the Valleys of the Ohio and Mississippi, Together with an Investigation into the Archaeology of Butler County, Ohio*. Robert Clarke & Co., Cincinnati.

Putnam, Frederick Ward 1889/1890. The Serpent Mound of Ohio: Site Excavation and Park Construction. *Century Magazine* Vol. XXXIX (new series Vol. XVII):871-888.

Squier, Ephraim G., and Edwin H. Davis 1848. *Ancient Monuments of the Mississippi Valley*. Contributions to Knowledge, vol. 1. Smithsonian Institution, Washington, D.C.

Thomas, Cyrus 1894. *Report on the Mound Explorations of the Bureau of Ethnology*. Twelfth Annual Report of the Bureau of Ethnology, 1890-1891. Government Printing Office, Washington, D.C.

Large-scale Archaeogeophysical Surveys at the Late Bronze Age Settlements at Kalavasos-*Ayios Dhimitrios* and Maroni-*Vournes/-Tsaroukkas* in Cyprus

Michael "Bodhi" Rogers[1] Kevin Fisher[2] Jeff Leon[3] Sturt Manning[3] mrogers@ithaca.edu
[1]Department of Physics, Ithaca College
[2]Center for Advanced Spatial Technologies (CAST), University of Arkansas
[3]Department of Classics, Cornell University

The transition to the Late Cypriot period (after c. 1650 BC) was marked by a series of social and political changes highlighted by intensification of copper production, increased long-distance trade with Near Eastern and Aegean societies, and increased indicators of funerary disparities (Knapp 2008). This led to significant changes to the island's built environment, including monumental buildings, new types of domestic and funerary architecture, and eventually the construction of the first urban centers by the LCIIC-IIIA periods (c. 1340-1100 BC) at several sites including Maroni-*Vournes/-Tsaroukkas* and Kalavasos-*Ayios Dhimitrios* (Manning 1998; Keswani 2004; Fisher 2009). The Late Bronze Age (LBA) urban landscapes that emerged created, and at the same time, were creations of new hierarchical and heterarchial social relationships that were key expressions of individual and group identity (see Fisher 2009 and 2012 in press for a more detailed discussion and extensive bibliography). Attempts to understand these socio-political processes have been hindered, however, due to the fact that most archaeological excavations have focused on elite portions of the settlements, therefore providing only a glimpse into the anatomy of an LBA urban settlement. The KAMBE project aims to address these issues through landscape-scale archaeogeophysical survey and targeted excavation (see Fisher et. al 2011 in press and Leon et. al 2012 in press for more detailed reports on our 2008, 2010, and 2011 field seasons).

The KAMBE Project is a multi-year collaboration between Ithaca College, Cornell University, and the University of Arkansas funded by the (US) National Science Foundation. Our 2008 summer field season used ground-penetrating radar, caesium magnetometry, fluxgate gradiometry, and resistivity to secure preliminary data in support of our grant proposal. After receiving funding in 2010 we returned to the sites in March under moister soil conditions and used ground- penetrating radar, caesium magnetometry fluxgate gradiometry, multifrequency conductivity, and resistivity to identify the optimum soil conditions and instruments

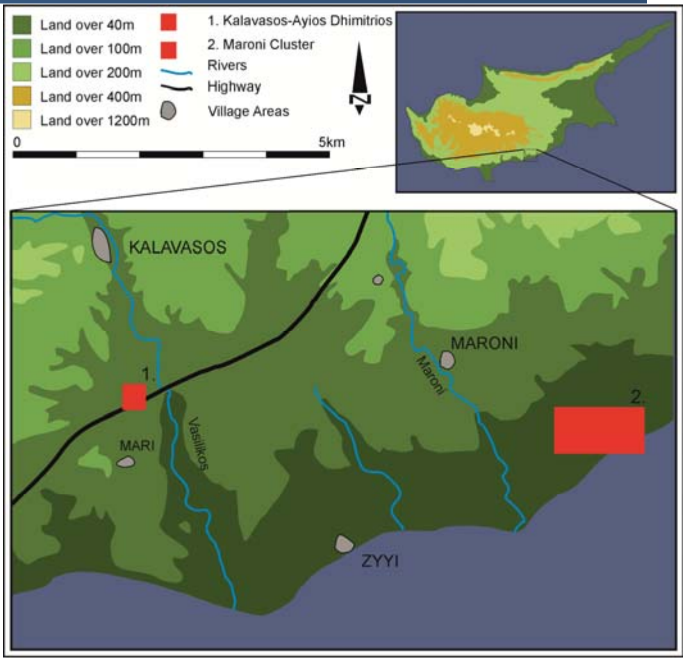


Figure 1: Locations of Kalavasos-Ayios Dhimitrios and Maroni-Vournes/-Tsaroukkas in south-central Cyprus. Figure credit: David Sewell.

to conduct our large-scale surveys. We identified ground-penetrating radar under dry conditions and magnetometry to be optimum for imaging LBA architecture. In 2011 and 2012 we embarked on two summer field seasons using two cart mounted MALÅ X3M with 500 MHz antennae, a Geoscan FM256 gradiometer, two cart mounted dual Geometrics G-858 caesium magnetometer systems, and a GSSI SIR-3000 system with 400 and 270 MHz antennae. Archaeogeophysical survey grids comprised of 20 m x 20 m units were established at both Kalavasos-*Ayios Dhimitrios* (K-AD) and Maroni-*Vournes/-Tsaroukkas* (figure 1) using a Leica TR-1500 total station and the existing archaeological grid system. Most of the GPR survey used 0.50 m spaced transects and 0.02 m inline sampling with additional, targeted sampling at higher resolutions. The Caesium magnetometer survey used two sensors mounted horizontally to cover two lines with transects spaced 0.50 m (effect transect spacing of 0.25 m due to two sensors) and inline sampling approximately 0.05 m. A total of 2 hectares were covered at K-AD (figure 2a) and 7.5 hectares at Maroni (figure 2b).

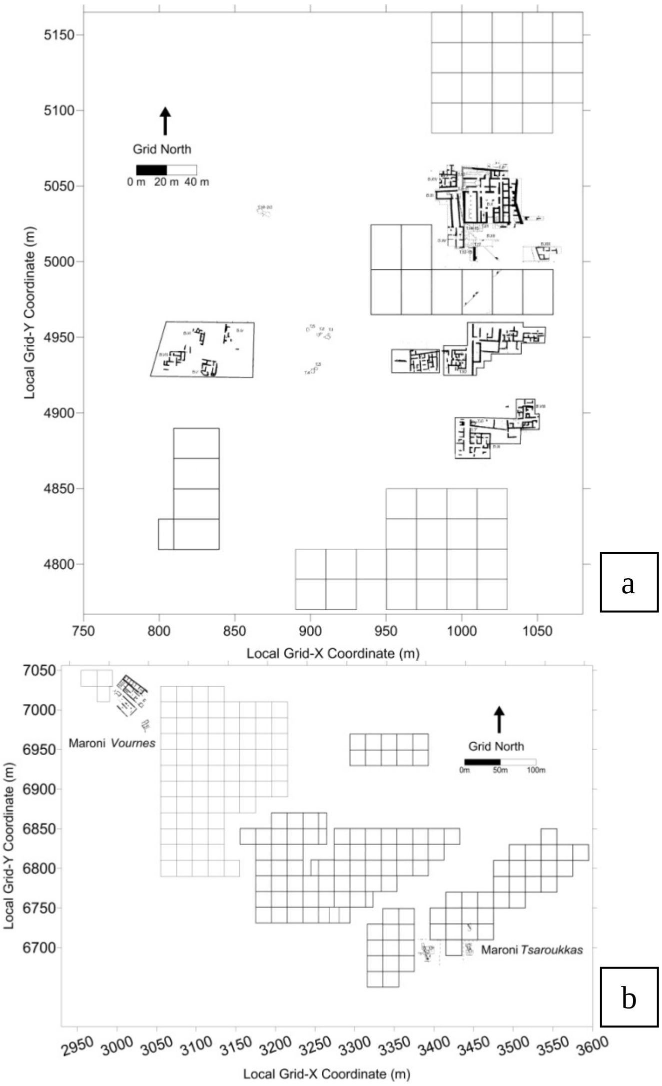


Figure 2: Location of archaeogeophysical surveys in context of the previous excavations at (a) Kalavasos-Ayios Dhimitrios and (b) Maroni-Vournes/-Tsaroukkas.

GPR surveys at K-AD successfully imaged LBA architecture and aspects of urban structure. At K-AD, the main N-S running LBA road appears in the GPR data aligned with previously excavated results to the north and south of our survey, and GPR shows a possible previously unknown constriction point in the road (figure 3). Spatially significant GPR reflections to the east and west of the main N-S road might indicate further built structures (figure 3). GPR and magnetic surveys at Maroni have identified a previously unknown large structure that is likely from the LBA (figure 4 overleaf) and structures associated with the coastal port of Maroni-*Tsaroukkas* (figure 5 overleaf). Excavations at K-AD and Maroni in 2012 have identified LBA walls aligned with GPR and magnetic features. Our 2012 field season marks the last season under our current funding. Current work is focused on processing and interpreting our 2012 data and placing it in context of our previous work.

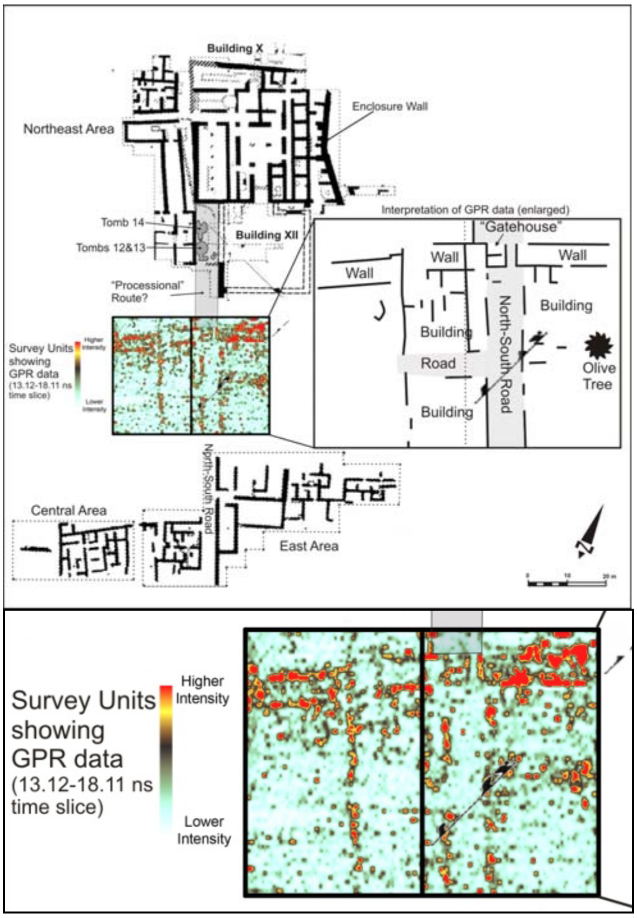


Figure 3: Results of GPR survey at K-AD between the previously excavated areas with an interpretation of the survey.

Acknowledgements

We thank the Department of Antiquities, and especially its Director, Dr. Maria Hadjicosti, and Dr. Giorgos Georgiou, for permission and assistance in carrying out this fieldwork. We are also grateful to Alison South for her continued assistance, support, and access to unpublished materials, and to the Cyprus American Archaeological Research Institute (CAARI) and its staff. The KAMBE Project is supported by the (US) National Science Foundation Grants # BCS-0917732, #BCS-0917734, #BCS-0722572. We also thank the Ithaca College Capital Equipment Fund, the Ithaca College Educational Grant Initiative, the Cornell Department of Classics, the American Schools of Oriental Research Heritage and Platt Grants, the Social Sciences and Humanities Research Council of Canada, the Center for Advanced Spatial Technologies, and Prof. Jesse Casana and the 2012 University of Arkansas Archaeological Field School, and all of whom have provided funding and material support for various phases of this project. The project thanks the many students and staff who have contributed over the years.

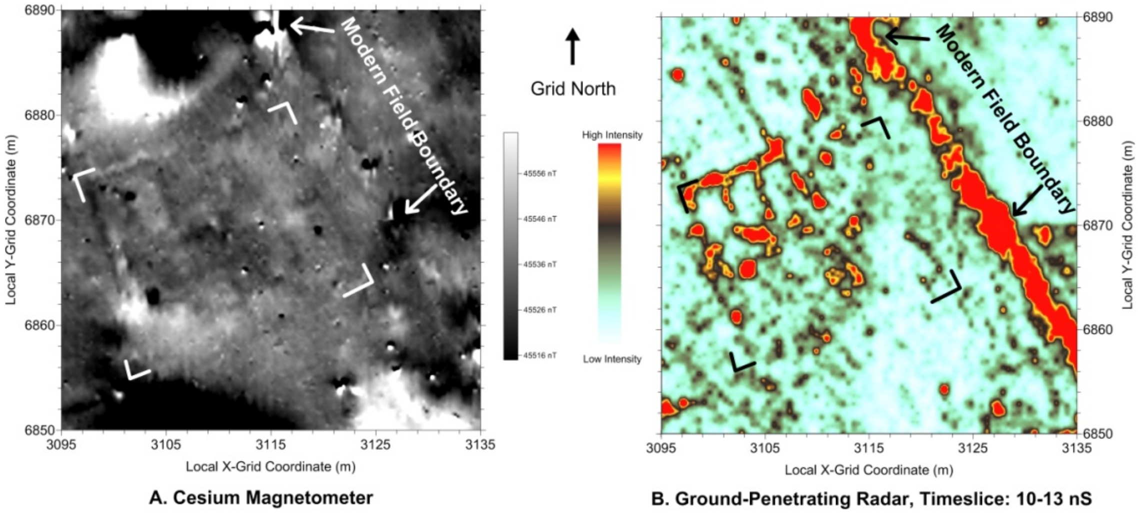


Figure 4. Results of GPR survey at Maroni-Vournes/-Tsaroukkas identifying a previously unknown building that is likely from the LBA.

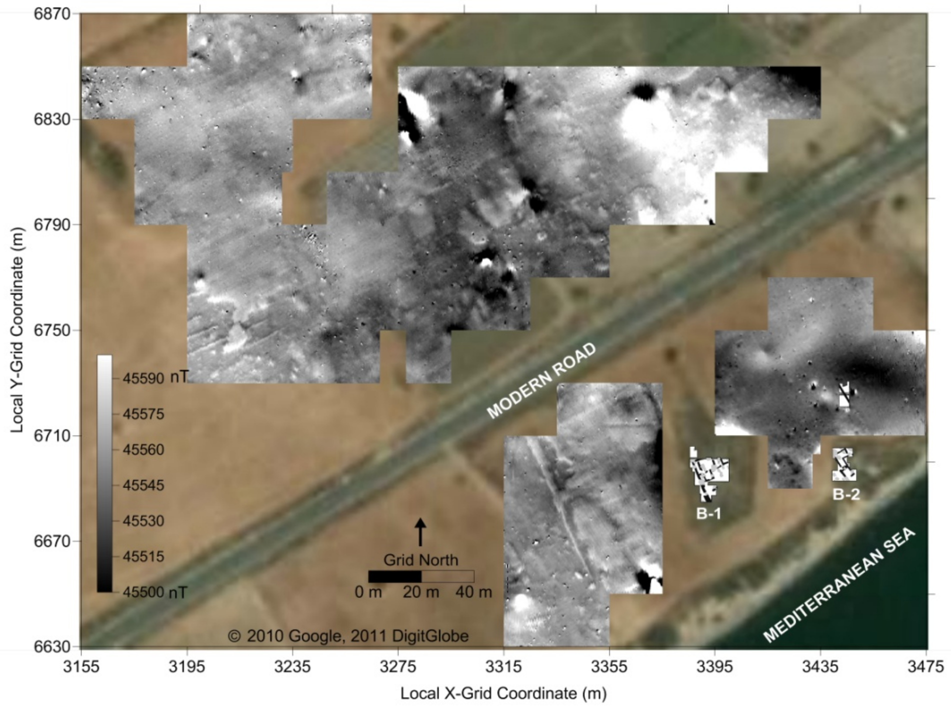


Figure 5. Results of total field magnetic survey at Maroni-Vournes/-Tsaroukkas overlain on Google Earth view of area (mainly agricultural fields with a sealed road running diagonally across the area shown). B-1 and B-2 identify drawings of previously excavated Late Bronze Age buildings overlain on the plot.

References

Fisher, K.D. 2009: " "Elite place-making and social interaction in the Late Cypriot Bronze Age", *Journal of Mediterranean Archaeology* 22.2, 183-209.

----- In press, 2012: "Rethinking the Late Cypriot built environment: households and communities as places of social transformation", in *The Cambridge Prehistory of the Bronze and Iron Age Mediterranean*, edited by A.B. Knapp and P. van Dommelen. Cambridge: Cambridge University Press.

Fisher, K.D., J.F. Leon, S.W. Manning, M. Rogers and D. Sewell In press, 2011: "The Kalavasos and Maroni Built Environments Project: Introduction and preliminary report on the 2008 and 2010 field seasons", *Report of the Department of Antiquities, Cyprus*.

Leon, J.F., K. D. Fisher, S.W. Manning, and M. Rogers. In press, 2012: "Interim Report on the Kalavasos and Maroni Built Environments Project: The 2011 Field Season", *Report of the Department of Antiquities, Cyprus*

Knapp, A.B. 2008. *Prehistoric and Protohistoric Cyprus: Identity, Insularity, and Connectivity*. Oxford University Press, Oxford.

Keswani, P.S. 2004. *Mortuary Ritual and Society in Bronze Age Cyprus*. Equinox: London.

Manning, S. W. 1998: "Changing pasts and socio-political cognition in Late Bronze Age Cyprus", *World Archaeology* 30 (1), 39-58.

Clickable Links: www.dwconsulting.nl

Press Release: RM85 Resistance Meter is now available from Geoscan Research!

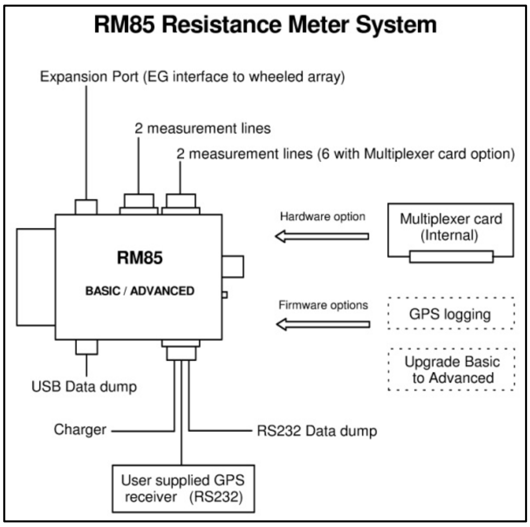
Roger Walker info@geoscan-research.co.uk

Geoscan Research

The new Geoscan Research RM85 Resistance Meter is now available and the first units have been shipped to our customers. This replaces our well-known RM15 Resistance meter.

There are two models available: BASIC and ADVANCED. Both models can be used in Probe Mode where conventional probes are inserted into the ground for area mapping or vertical profiling. The ADVANCED model has a wider range of currents (up to 10mA), wider range of operating frequencies (17.5 to 142.5 Hz in 13 steps plus user defined) and higher output voltage (100V) to allow operation in more demanding situations. A half current setting (Compliance Boost) allows the user to optimise signal to noise ratio against probe contact resistance.

An optional integral programmable Multiplexer card is available for either BASIC or ADVANCED models. This allows the RM85 to automatically configure and log data from multi-probe arrays – the number of measurement lines increases from the standard 4 up to 8. Eight different programs can be defined, each consisting of up to 16 configurations. Compared with the RM15/MPX15 system the new RM85 with integral Multiplexer card is now much lighter and weighs 0.55kg less.



The ADVANCED model can also be used in Wheel Mode where it is mounted on an MSP40 Mobile Sensor Platform (with spiked wheels in place of the probes) for fast, detailed resistance mapping and, optionally, simultaneous magnetic surveys with the FM256. A real time resistance reading output is available for the ADVANCED model for connecting to external wheeled systems. There is also a GPS logging option for the ADVANCED model that records GPS position with each reading (user supplied GPS unit) and provides real time monitoring / feedback of GPS signal Quality and DOP.

Flash memory is used to store readings: 2745600 for the BASIC model, 5491200 for the ADVANCED model. If the GPS option is fitted then the reading capacity will be 164,000 readings; this is sufficient for surveying 2ha at a 0.25m sample interval with an MSP40 system (logging alpha and beta measurements). Data can be downloaded using either a USB or RS232 connection at up to 115200 baud. There is an external compartment for the NiMH battery pack with fast charging and LED status. An expansion port can connect and communicate with external modules such as an interface for a wheeled array.

The RM85 has improved noise rejection capability whilst providing much faster speeds compared to an RM15. In probe mode, survey time can be almost halved for Twin arrays, especially when multiplexed. This is due to changes to the multi-pole measurement filters, a wider range of operating frequencies, a wider range of Auto-Log delays times, and the addition of Speed Boost and Insertion Delay settings. As the reading settles Speed Boost logs data at an earlier but predictable part of the waveform. Insertion Delay allows the user to set a time to get all the probes correctly inserted into the ground but then use a fast Auto-Log Delay time for the multiplex steps; this can be useful in dry conditions. The RM85 also offers significant speed improvements with wheeled arrays, such as the MSP40, compared to an RM15 based system: – 0.3s/m whilst logging alpha and beta readings at 4 samples/m or 0.6s/m whilst logging alpha, beta and gamma plus GPS position.

GR GEOSCAN RESEARCH

The First International Conference on Virtual Archaeology

Daria Hookk[1] Hookk@Hermitage.ru
Armin Schmidt[2] A.Schmidt@GeodataWIZ.com

[1]The State Hermitage Museum, Russia
[2]GeodataWIZ, UK

The First International Conference on Virtual Archaeology was organized by the Department of Eastern European and Siberian Archaeology of the State Hermitage Museum in Saint-Petersburg (Russian Federation), which also provided the splendid venue for this event from 4-6 June 2012.

The concept of virtual archaeology was first proposed by Paul Reilly in 1990 introducing the use of 3D computer models based and virtual reality for the visualisation of archaeological data. Since then virtual archaeology has developed into a broad field of research and applications, while still missing its fundamental definition. Stratified archaeological deposits are complex data volumes perfectly suited for virtual approaches of investigation once the data from various sources are collected, including archaeological prospection results of whole landscapes or terrestrial laser recording of excavations. Integrated analysis and interpretation is then possible within an interactive virtual reality or augmented reality environment.

Participants from 17 countries (Austria, Australia, Belgium, Bosnia-Herzegovina, Cyprus, France, Germany, Italy, Japan, Netherlands, Romania, Russian Federation, Spain, Sweden, UK, Ukraine, USA) participated in discussions of up-to-date computer technologies for archaeological prospection, data processing, modelling, archaeological reconstructions and visualisations,

as well as fundamental thoughts on what real and reconstructed heritage means. The conference program included oral presentations, posters and workshops on the technologies and advances in archaeological prospection; multi-dimensional modelling of landscapes, monuments, objects and artefacts; GIS investigations of natural and historical processes; monitoring of cultural heritage; and virtual reality design. The extremely well organised event (with an unforgettable social programme) provided simultaneous translations between Russian and English, which not only made it easy to follow the presentations but also facilitated lively debate amongst all participants. This provided very welcome opportunities to exchange ideas amongst all participants, breaking down perceived language barriers.

During the final discussion session participants came to the conclusion that the narrow view of 'Virtual Archaeology', as being just 'Virtual

Reality' needs to be expanded. Instead, it should be seen as an integration paradigm that allows many modern three-dimensional datasets to be analysed together, taking account of preliminary reconstructions of archaeological sites and guiding further investigations, for example through archaeological prospection, historical research or excavation. In this iterative and incremental process, the virtual representation of results is only one, albeit important, outcome. And by using 3D printing technologies results may even be created as physical reality. Participants agreed that one of the obstacles to realising this vision of virtual archaeology is the poorly developed professional network and that further discussions of methods, projects and events should be continued online on the project web site (www.virtualarchaeology.ru) and in follow-on conferences.

Access to the abstracts in English and Russian languages and photos from the conference are available on the project web site, which is supported by a grant from the Russian Foundation for Humanities (project No 12-03-14006). The extended papers of the conference presentations, including illustrations, will be issued as a special volume in the scientific series of the State Hermitage Museum.

New Geophysical Survey of the City and Necropolis at Antinoupolis, Middle Egypt

Kristian Strutt[1], James Heidel[2], Angus Graham[3] K.D.Strutt@soton.ac.uk

[1]Archaeological Prospection Services of Southampton (APSS), Department of Archaeology, University of Southampton
[2]President of the Antinoupolis Foundation, Inc. and architect for the University of Florence's mission to Antinoupolis
[3]Egypt Exploration Society (EES) field director

Between 11th and 14th February 2012 a geophysical survey was conducted at Antinoupolis, in El Minya Governorate, Egypt. Work was carried out on behalf of Antinoupolis Foundation (www.antinoupolis.org), as part of the fieldwork of the Florentine archaeological mission at the site directed by Prof. Rosario Pintaudi of the Istituto Papirologico at the Universita di Firenze.

Antinoupolis was founded by the Roman Emperor Hadrian on his imperial tour of Egypt in October of 130 AD, although some remains at the site pre-date this foundation, a temple of about 1250 BC from the reign of Ramses II. The city of Antinoupolis was created to be the new god's (the compound deity Osir-Antinous's) cult centre, and the city was lavishly endowed with elaborate monuments, including a temple, to celebrate the new god, some of which were still extant at the turn of the eighteenth century, were documented by the French at that time. The city of Antinoupolis became an active Christian centre, with settlement continuing well into the medieval period. Many early travellers' accounts from this time detail the features of the city including dozens of monasteries and churches and many impressive Roman monuments from the era of the city's foundation, some remaining in use. The city's population finally suffered a severe decline at some time in the medieval period, and dwindled to the small Moslem village on the riverbank which exists today.

Today the circuit of the city walls enclose c. 113 hectares, forming a rough trapezoid about 1.5 km by 0.75 km., and this area is largely covered with tumbled architectural fragments and enormous mounds of pottery and debris. Outlying associated features are extensive and include cemeteries, monasteries, quarries, and other ancient remains. Throughout the first decades of the twentieth century the city's surface was excavated and disturbed by locals looking for treasure and fertilizer from the silt-rich mud brick and by early excavators, such as Albert Gayet and J. de M. Johnson, looking for inscribed papyrus fragments and mummies. Some very interesting papyri were recovered, although the evidence recorded little information about the city's inhabitants or urban form.

The 2012 geophysical survey season was designed to test two specific survey techniques at the site with a view to commissioning future geophysical survey at the site to map the extent and nature of buried archaeological deposits associated with the Hadrianic, late antique and early medieval city and its associated necropolis. The techniques of magnetometry and Electrical Resistivity Tomography (ERT) were applied at the site to trial the effectiveness of the methods.

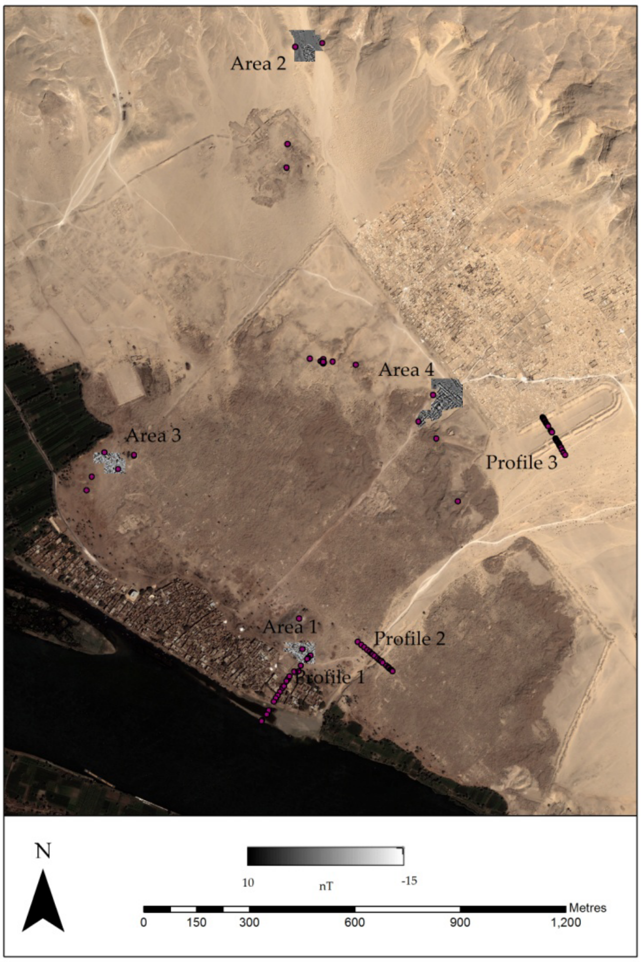


Figure 1 Location of the different survey areas at Antinoupolis

Four areas were surveyed using magnetometry (Fig. 1) to assess the effectiveness of the technique over differing geological and archaeological deposits.

Area 1 focused on part of the ancient city in the immediate vicinity of the mission house, adjacent to an open SCA excavation trench. Area 2 was located over deposits in the wadi to the north of the city and the north cemetery to assess the use of magnetometry in locating mud-brick tombs and ceramics in sandy deposits. Area 3 was located at the northern end of the Cardomaximus to assess the tell deposits in the area associated with a large depression at the end of the principal street of the site, and Area 4 focussed on the East Gate of the city, to assess the mixed sandy and tell deposits in the area, and find the possible remains of a large structure supposedly located in the area (Fig. 2). In addition three ERT profiles were surveyed (Fig. 3) at the site, to assess the application of the technique, and to measure the depth of archaeological deposits across the harbour edge of the city (Profile 1), the wadi crossing along the Cardomaximus (Profile 2) and the remains of the hippodrome to the north of the city (Profile 3).

Figure 2 Magnetometer survey being conducted at the East Gate

The results of the survey indicate that both techniques of magnetometry and ERT work effectively at Antinoupolis. The magnetometry in areas 1 to 4 indicate the presence of buried archaeological depsosits in varying degrees of preservation, with the results from areas 2 and 4 providing the clearest indications.

Results from the cemetery and wadi in Area 2 (Fig. 4) indicate the presence of extensive mudbrick tombs across the shoulder of land at the entrance to the wadi, corresponding with dumps of ceramic and animal bone in the area. The bottom of the wadi itself appears to be devoid of structural remains, although some tombs are present in the results along the channels on the north side of the wadi.

Results from Area 4 in the vicinity of the East Gate provide the most impressive example of the response to magnetometry from the 2012 season (Fig. 5). The line of the defensive city wall is visible, with an inwardly curving entrance at the

Figure 3 ERT survey along Profile 1 (through the modern village to the river's edge)

East Gate. Within the walled area two sets of triple foundations mark the northern and southern sides of a massive peristyle or structure with outer paving and structures immediately to the north-east. A line of possible column bases marks the north-eastern side of the structure, with two large rooms or chambers marking the sides of the entrance to the feature. An open area in the centre of the structure is visible, together with a number of smaller rooms. The dimensions of the structure, at 95m across and at least 130m in length, gives an indication of the scale and nature of possible buried archaeological features associated with the city.

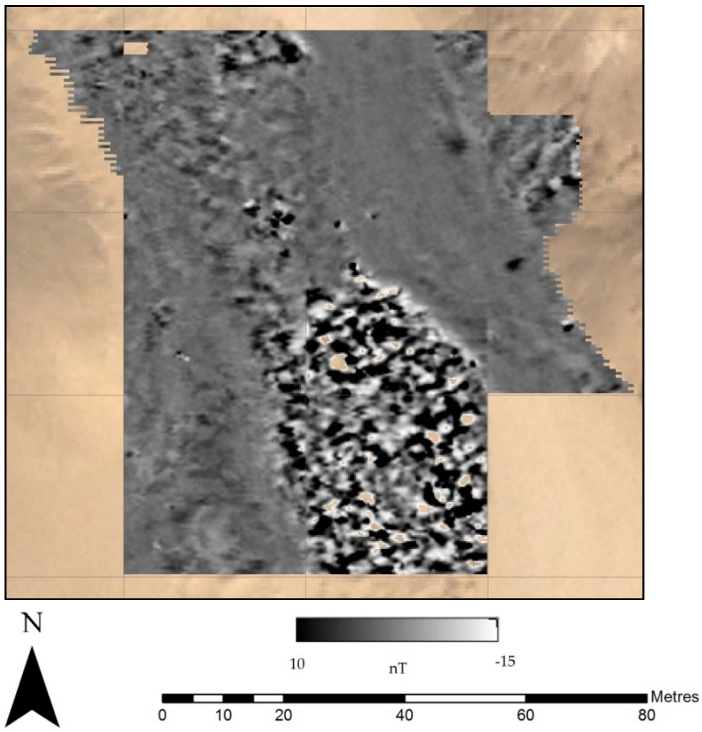


Figure 4 Greyscale image of the survey results from Area 2 at the necropolis

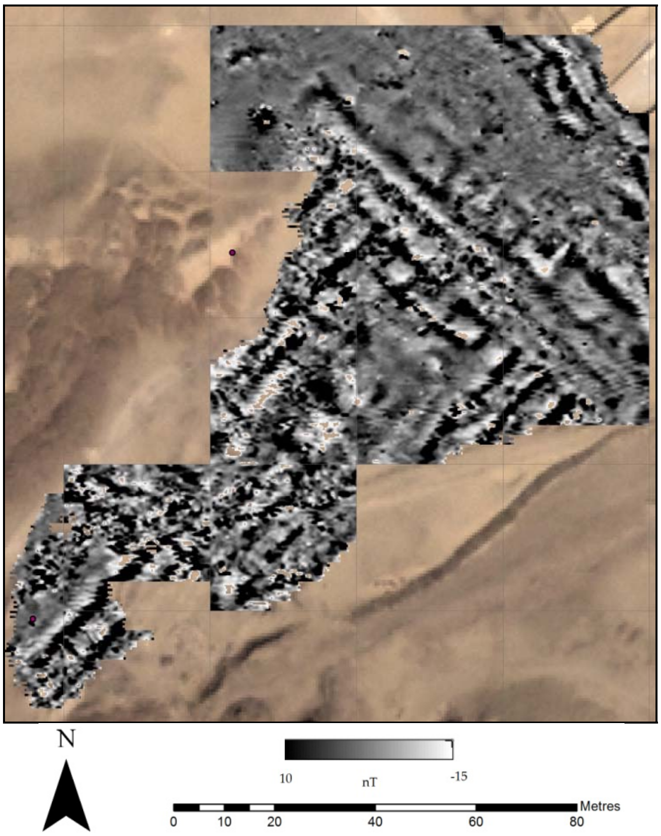
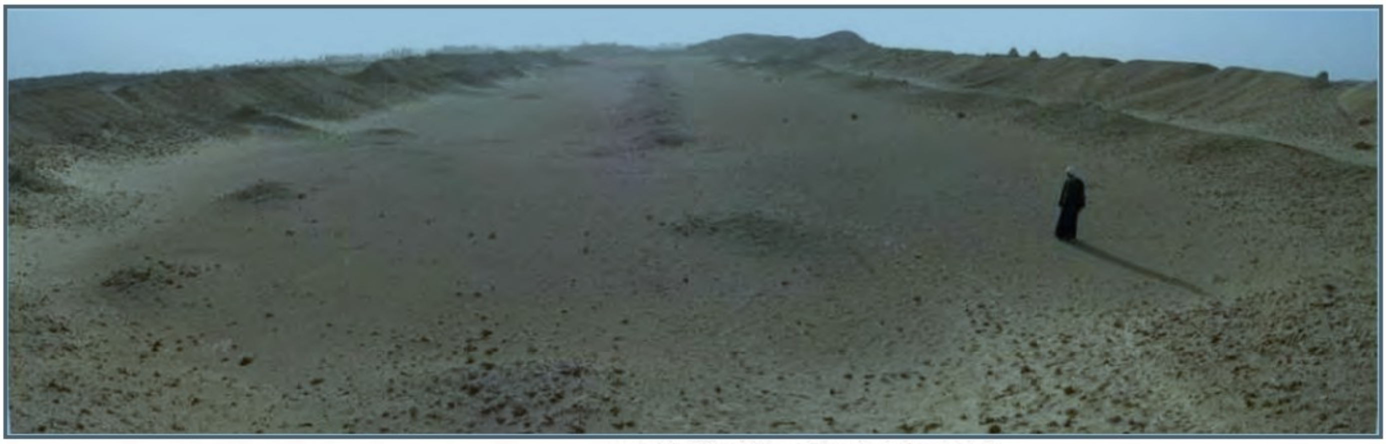


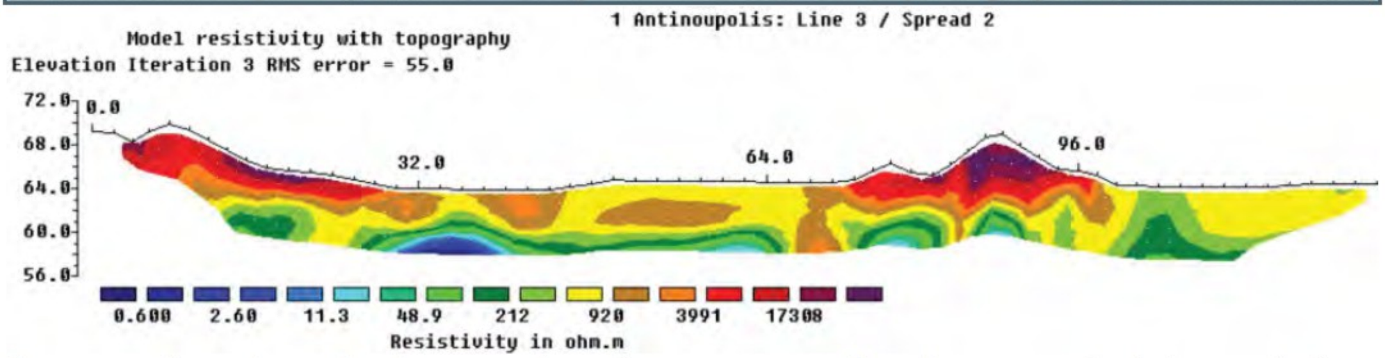
Figure 5 Greyscale image of the magnetometer survey results from Area 4 at the East Gate.

The ERT results from profiles 1-3 in general indicated that the technique is applicable at the site. Results from Profile 1 indicated the presence of archaeological deposits alongside the SCA excavation trench to a depth of 3-4m. These end abruptly close to the western edge of the excavation house, with river sediment and kom sediment dominating the western portion of the survey. There appears to be scant evidence of a harbour edge or wharf in the results further to the west of the excavations.

Profiles 2 and 3 both indicate the presence of archaeological deposits across the wadi along the Cardomaximus and over the hippodrome. It is interesting to note the lack of archaeological structures along the Cardomaximus in the wadi itself, with the exception of a central area of high resistivity, possible associated with structural remains for the line of the Cardomaximus. The presence of foundations of the structure for the hippodrome were also visible in Profile 3 (Fig. 6).

Results of the first season of survey at Antinoupolis indicate that magnetometry applied within the city, and across the necropolis of the city, would assist in understanding the layout and nature of the urban plan and cemeteries at the site. Targeted ERT survey will also help to address some of the more specific questions about the possible harbour area of the city and the sub-structure of the larger edifices. It is hoped that more exciting results will be forthcoming in the following seasons of work.





Third Announcement: NSGG day meeting on Recent Work in Archaeological Geophysics

Geological Society of London, Burlington House, Piccadilly, London
4th December 2012

4th December 2012: *Recent Work in Archaeological Geophysics*
Near surface geophysical techniques are now a well established tool for the evaluation of archaeological sites from their initial discovery to subsequent interpretation and management. However, this success has brought new challenges with ever larger areas needing to be surveyed rapidly and greater demands to characterise buried remains without excavation meaning ongoing improvement of techniques and methodologies is necessary. Meanwhile exciting new archaeological discoveries continue to be made with geophysics and it is valuable to share these with colleagues.

This will be the tenth in a succession of biennial meetings in which contributors 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 archaeological and geophysical practitioners, students, academic and amateur researchers to catch up with recent research and developments. The meeting typically attracts 100 or more participants and, as well as oral presentations, there will be space for commercial and poster displays.

There are still plenty of slots for both oral and poster presentations. Those interested in contributing are warmly encouraged to contact the convenor and to submit abstracts of up to 1000 words in length, accompanied by suitable greyscale illustrative material, no later than the 31st August 2012. These will be collated and made available to all those attending.

Pre-registration for the meeting is now open and details are available on the NSGG website:

http://www.nsgg.org.uk/meetings/

The rates are:

- Member of the Geological Society or BGA - £15
- Student - £15
- Non-Member - £25
- Exhibitor's Stand - £175 (please contact the convenor to reserve)

which include entrance to the talks, a printed book of abstracts and tea/coffee and biscuits at breaks. Pre-registration will be available until the 23rd November 2012.

*Please note that unlike recent previous meetings in this series there will regrettably **not** be a forensic geosciences meeting the following day as the Forensic Geosciences Group have a prior conference commitment during August.*

Convenor: Paul Linford, English Heritage, Fort Cumberland, Eastney, Portsmouth, PO4 9LD, UK; Tel: +44 (0)23 9285 6749; Fax: +44 (0)23 9285 6701
email: Paul.Linford@english-heritage.org.uk

Journal Notification

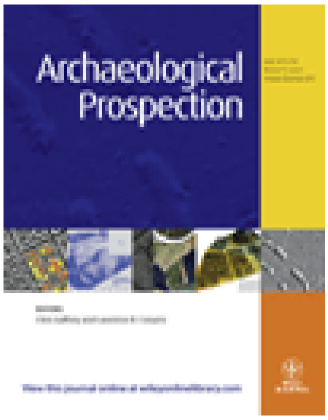
Archaeological Prospection

Archaeological Prospection – 19(3) and a new Impact Factor

It does not seem a year since I last reported on the Impact Factor (IF) for Archaeological Prospection. Last year we were very pleased to announce the IF had risen to 1.368. I think that you can imagine that we are even more delighted to report that last year the IF went up 19% to 1.628. This is an exceedingly good IF for a specialist journal and the highest value we have ever achieved. The Editors would like to thank those who contributed articles and the reviewers whose attention to detail has helped increase the value of those articles. The Editorial Board, many of whom are ISAP members, should be congratulated for supporting and steering the Editors throughout the year. We know that many of you will be in the field over the summer and we hope that you will consider Archaeological Prospection for the publication of your research.

Dr Chris Gaffney & Prof. Larry Conyers

The third Issue of the year is now heading towards the printers.
Papers and Short Reports include:



Leucci *et al.*
Insights into the buried archaeological remains at the duomo of Lecce (Italy), using GPR surveys.

Tamba
Testing the use of geostatistics to improve data visualization. Case study on GPR survey of Tarragona's Cathedral

Novo *et al.*
The STREAM X multi-channel GPR system. First test at Vieil-Evreux (France) and comparison with other geophysical data

Simon *et al.*
Investigating magnetic ghosts on an Early Middle Age settlement on stripped areas and top layers.

Gustafsson and Viberg
Tracing High Temperature Crafts. Magnetometry on the island of Gotland, Sweden..

Bennett *et al.*
The Application of Vegetation Indices for the Prospection of Archaeological Features in in Grass-Dominated Environments.

Boschi
Magnetic prospecting for the archaeology of Classe (Ravenna)

MSc Archaeological Prospection - Shallow Geophysics

MSc. Archaeological Prospection – Shallow Geophysics, The University of Bradford, UK.

The course is a highly focused postgraduate degree programme which develops specialist skills in the theory and practice of archaeological prospection, in particular in near-surface geophysics.

It provides students with knowledge and experience of the principal geophysical and geochemical techniques currently available for the detection of buried archaeological features and other near-surface targets. The course provides appropriate background to materials and soil science, together with the relevant mathematical principles.

Other methods of detection such as remote sensing, topographical survey and field-walking are introduced as essential components of an integrated approach to landscape assessment. Sampling procedures and the computer treatment and display of field data from all methods are critically examined with the aid of case studies based on field experience. Skills and knowledge are developed through lectures, seminars, laboratory and fieldwork classes and a substantial individual research dissertation.

Special Features:

- In-depth specialist training, including hands-on experience in the Division's geophysics and computer laboratories and in the field
- First destination figures indicate that about 85% of postgraduates in Archaeological Sciences achieve work or further studies in the discipline or cognate areas

Course Syllabus

- Electrical Methods of Survey
- Magnetic and Electromagnetic Methods of Survey
- Site Evaluation Strategies
- GIS for Practitioners
- The Nature of Matter
- Treatment, Display and Interpretation of Field Data
- Soils and Chemical Prospection
- Dissertation (MSc)

For more information, visit: http://www.bradford.ac.uk/postgraduate/archaeological-prospection-shallow-geophysics/ or contact Dr Chris Gaffney (c.gaffney@bradford.ac.uk).

UNIVERSITY OF BRADFORD
MAKING KNOWLEDGE WORK

MA/MSc Archaeological Survey and Landscape

MA/MSc Archaeological Survey and Landscape

The survey of sites and landscapes is one of the most fast developing and dynamic areas of archaeology. New technological and methodological advances mean that we can now reveal entire buried sites without excavation, and map entire landscapes.

This new Masters course will give you direct and practical experience of the latest geophysical and topographical survey techniques and approaches. The course is designed to develop your skills of analysis, interpretation and visualisation of survey results. It also allows you to understand the results in a wider context through the application of theoretical frameworks across a broad range of regions and periods. A unique attribute of the course is that it allows you to undertake research-led survey work at Portus, the port of Imperial Rome, and other Classical sites in Italy, conducted in close collaboration with the British School at Rome, one of Britain's leading research institutes abroad, as well as on sites in the UK.

Southampton has an excellent international reputation as a leader in the development and application of advanced survey techniques. Our staff have many years' experience undertaking surveys in the UK, France, Italy, Spain, North Africa and the Middle East. They will teach you cutting-edge scientific techniques for the study of sites and landscapes, including geophysical and GIS-based skills; they are supported by state-of-the art computing facilities and equipment. You will learn about a full range of different scientific methods in the classroom as well as being fully involved in fieldwork and data-processing on research-led projects. This course will fully prepare you for future research or for professional employment in the archaeological sector. If you so choose you can further enrich your learning experience by taking stimulating options in such fields as Maritime Archaeology, Roman Archaeology and Archaeological Computing, amongst many others.

For more information, **www.southampton.ac.uk/humanities/v400_survey**

Typical Core Modules:
Desk-based Archaeological Evaluation
Archaeological Survey and Recording
Archaeological Geophysics
Dissertation

Typical Optional Modules:
Core Computing
CAD/GIS for Archaeologists
Geoarchaeology
Maritime Archaeology

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