ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

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Contents

Editor's Note

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Welcome to the 16th issue of ISAP News. In the recent months some of our members have been busy using equipment in more unusual environments and developing or testing a variety of new pieces of kit, assessing their suitability for archaeological prospection. This is great news for us all, but what is even better is the results and progress are shared with us all through this newsletter which is just what it was intended for.

Keep up the good work, and keep sharing your results! Any item for ISAP News 17 should be sent to me by 17th October 2008.

Georadar Studies in a Sand Dune Archaeological Site in Bahia De Los Muertos, Baja California Sur, Mexico

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Introduction

The archaeological site of Ensenada de los Muertos is in a sand dune close to the costal line of a shallow water cove. It is 50 km southeast of La Paz city and to the south of Cerralvo's island.

Seven inverted pyramid test pits were excavated in 2003 as a part of an archaeological salvage project discovering archaeological remains 5 m deep, in contact with the paleodune. The most outstanding discoveries were 25 individual skeletal remains comprising 15 burials.

Preliminary analysis of excavated materials, provided evidence to support that we are dealing with the most important archaeological site of the region, despite the fact there is no fresh water nearby.

Radiocarbon dating has shown that around 2000 ybp the human occupation became to be important, reaching its peak by the time of the Spanish contact.

Recovered archaeological remains revealed hunter-gather temporal camps based on the discovery of burned rock clusters. In addition, we found some lithics and shell workshops, grinding areas, food preparation areas including animal bones, besides ritual activities areas.

All available information from this site has been provided by the excavation of only 1% of the sediments in the dunes, which means that this promising site can offer more information if properly studied.

Goals

Determine the paleodune's topography with georadar profiles carrying out a systematic study trying to reach the geological contact.

Detect concentrations of lithic material, bones, shells and any other materials that could be associated with areas of human activity and settlements.

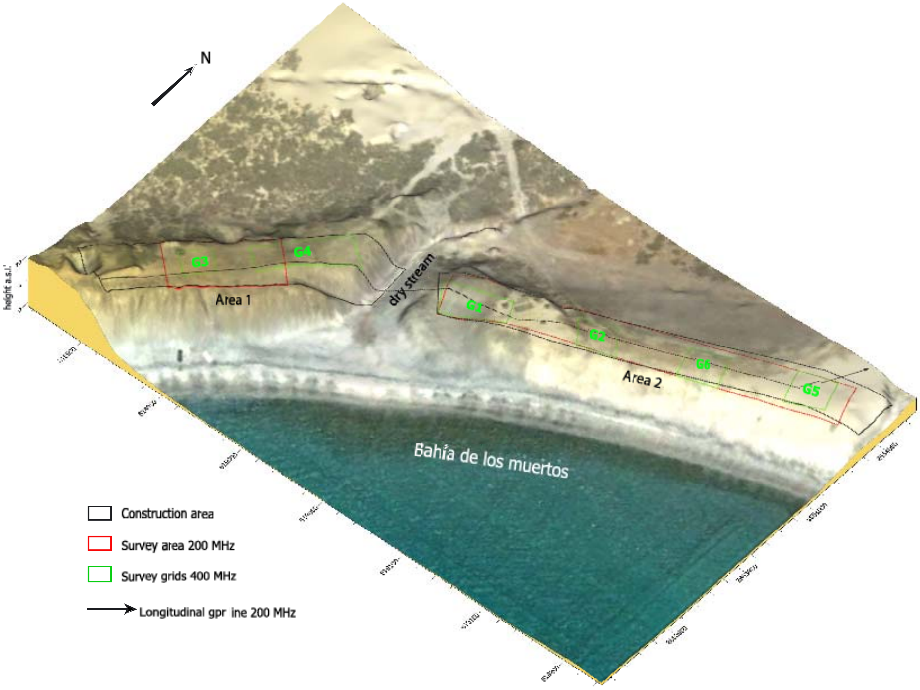

Figure 1: 3D terrain model of the Bahia de los Muertos showing studied areas (in red), 380 m profile line (in black) and location of the grids (in green).

Methodology

The total area was divided in to two study sections, divided by a creek cut. As a first approach general lines with 200 MHz antenna were carried out following the modern earth road that cross the studied areas. Based on preliminary results some grids were placed in specific places where anomalies were evident. In these places we worked with 1 and 2 m line intervals and 400 MHz antenna.

Field data acquisition used a SIR System 2 with monostatic antennas of 200 and 400 MHz in continuing mode. Overall, 148 georadar lines were carried out in the studied sections, summing up 4600 m, with settings of 32 traces per second, 512 and 1024 samples by trace.

Data processing used the Radan 6 de GSSI for noise removal and improving resolution, topographic correction, horizontal distance normalization and depth estimations.

Results

We were successful to determine the depth and contour of the lithified geological contact, called paleodune. This survey was a challenge due to the vicinity of the sea and its contribution of humidity and salt, considering we were looking for the 5 m depth contact found in some test pits.

The georadar 380 m long profile produced a general view of the contact with the paleodune following a clear reflection present between 3 and 5.5 m depth in most of the radargrams.

As a result of the 200 MHz antenna survey it was possible to produce a 3D virtual reconstruction of the paleodune contact. In addition 400 MHz antenna provided detailed information of possible remains in the studied grids to guide the best location for future test pits to continue with the archaeological research project.

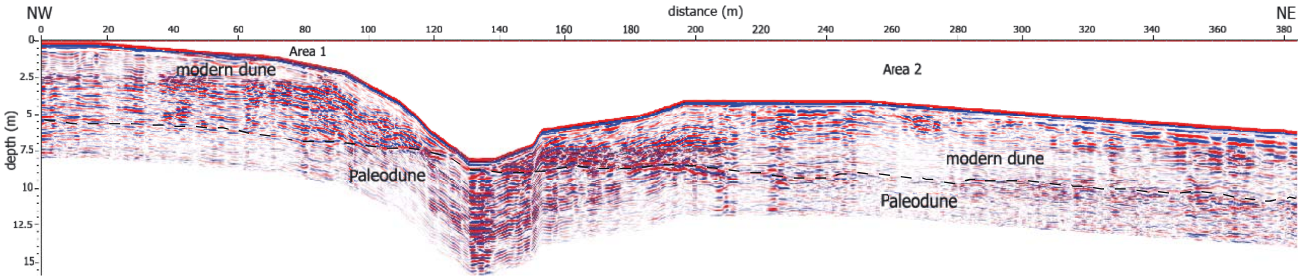

Figure 2: Radar profile with 200 MHz antenna, showing the clear reflection of the paleodune.

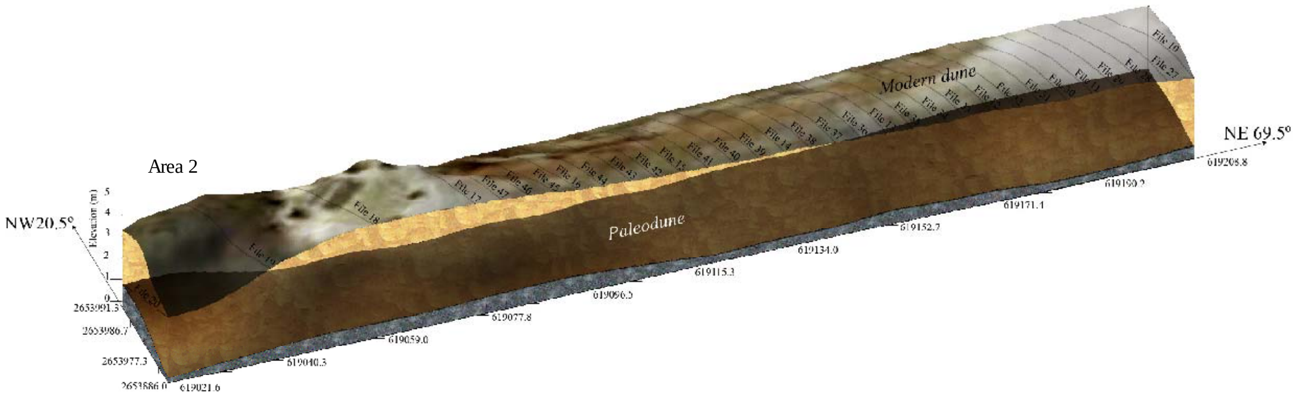

Figure 3: 3D model showing the modern and the paleodune surfaces. Between them most of the archaeological material has been recovered.

Pilot study of the new multichannel GPR system MIRA for large scale, high-resolution archaeological prospection at the site of the Viking town Birka in Sweden

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Introduction

While magnetic prospection methods are able to cover several hectares per day using arrays of magnetometers with dense sample spacing, ground-penetrating-radar (GPR) surveys for archaeological prospection are generally conducted using single antenna systems, resulting in relatively slow measurement progress and limited area coverage with often low sampling intervals (profile spacing of 0.5m, 1.0m or greater).

Over the last years attempts for increased efficiency and resolution of GPR measurements through the use of multichannel antenna arrays can be observed, both from operators (Leckebusch 2005) and GPR system manufacturers.

In May 2008 the GPR manufacturer *Malå Geoscience AB* in collaboration with the archaeological prospection unit of the Swedish National Heritage Board conducted a large scale archaeological prospection pilot study with the recently launched *Malå Imaging Radar Arrays* (MIRA). Purpose of this project was to test the performance of the GPR and corresponding positioning systems in practice at a site where well expressed archaeological structures are known to exist in the ground.

Survey site

The site of the Viking age town and trading place Birka is located on the island of Björkö in Lake Mälaren approximately 30 km west of Stockholm. Birka, which is believed to have been Sweden's first real town, existed presumably between 790 and 970 AD. Today Birka constitutes together with the site Hovgården on the neighbouring island of Adelsö an UNESCO world cultural heritage site.

Figure 1: View of the survey area with the hill fort in the background. Between 790 and 970 AD at this place a busy Viking town was located, teeming with craftsmen, traders, soldiers, travellers and first Christian priests. The extent of the GPR survey area covering three hectares is marked with a red line. The first two tracks are indicated with white arrows.

The area where once houses, farms, workshops, roads, harbour and fortification constructions, graves and possibly a church were located is today a meadow largely free of obstacles, only gently varying in topography (Fig. 1). Since the town has been abandoned for so far unknown reasons in the second half of the 10th century the place has remained largely undisturbed, except of some agricultural land use. Below the uppermost plough layer of approximately 35cm thickness a cultural layer of up to 2 metres thickness in central parts of the town, containing Viking age structures, can be expected to extend across an area of 15 to 20 hectares, the so called *Black Earth* of Birka.

Scientifically documented archaeological excavations have been conducted over an area covering less than 1% of the entire town area. Aside from systematic, though scarcely documented, excavations by Hjalmar Stolpe in the years 1870-1890, a relatively large excavation project had been conducted in 1990-1995 by Björn Ambrosiani, covering approximately 750 square metres in the central town area and resulting in more than 90,000 finds. Further excavations had been undertaken by the archaeological research laboratory of Stockholm University.

In 1990 Harald Stümpel and colleagues of Kiel University conducted first georadar test measurements on the island, covering a 50m by 50m area with an analogue 120 MHz Oyo antenna system.

In May 2006 the archaeological prospection unit of the Swedish National Heritage Board surveyed a 100m by 50m measuring area in the Black Earth using a 500 MHz single antenna system with 25cm profile spacing and 5cm inline trace spacing. These measurements resulted in data of high quality showing Viking age roads, houses, an older town wall including port and constructions within the wall, property plots and small trenches (Trinks *et al.* 2007).

The new test survey site was selected to cover entirely the in May 2006 prospected area for comparison purposes. Prior to the survey the grass on the site was mowed in order to obtain optimum measurement conditions.

The Malå Imaging Radar Arrays (MIRA)

The tested MIRA system consists of 17 GPR antennas (400 MHz) positioned in two overlapping rows of 9 transmitter and 8 receiver antennas. Each receiver antenna is recording signals of two adjacent transmitter antennas, resulting in 16 channels with a crossline trace spacing of 8cm (Fig. 2).

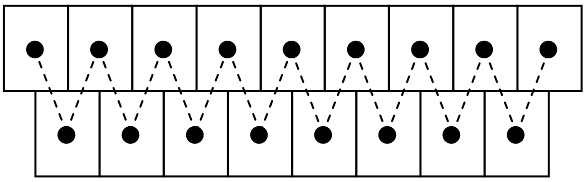

Figure 2: Sketch MIRA antenna arrangement. Dotted lines indicate transmitter and receiver antenna combinations.

The 16 channel system covers a 128cm wide swath for each driven track or profile. Inline GPR trace sampling is by default set to 8cm with a trace stacking factor of 4. It is possible to choose smaller inline trace spacing.

Figure 3: The Malå Imaging Radar Array mounted with hydraulic lift in front of a John Deere tractor. The yellow antenna box contains the 17 radar antennas. The prism for positioning using a robotic tachymeter can be seen next to the antenna box.

The antenna array is placed in a box fastened ahead a motorized front mower with hydraulic lift (John Deere). Power supply and a field computer for data collection are mounted on the vehicle (Fig. 3).

Accurate positioning of the GPR measurements is crucial. For this purpose a *Real Time Kinematic* (RTK) GPS or alternatively a robotic tachymeter can be used. The reference signal from a GPS base station or the position information from the tachymeter is transferred via radio link to the measurement vehicle, where the information is recorded together with the GPR data. Additionally, an odometer attached to one wheel of the measurement vehicle is generating trigger pulses with constant, calibratable distance intervals. The RTK-GPS antenna, respectively the tachymeter prism, is mounted at shallow height next to the antenna array.

For orientation purposes spray paint makers can be placed on the ground to mark the start and end points and course of individual profiles (Fig. 4).

Figure 4: Antenna box with RTK-GPS antenna for positioning. The spray paint cartridge for marking on the ground is located next to the GPS-antenna shaft.

When using a prism in combination with a robotic tachymeter measurements can currently only be conducted in one direction (not zigzag) due to the requirement for an unobstructed line-of-sight.

Merging of subareas measured with different tachymeter establishments is possible through the use of a set of common, freely selected tie-points located in the vicinity of the survey area.

Description of the survey

During the test survey the use of both RTK-GPS and a robotic total station (Trimble 5600) for positioning were tested (Fig. 4 & 5). While the use of the GPR system itself is rather straight forward (plug-and-play), the integration of the positioning systems can involve a greater degree of complexity. During the first tests it soon became clear that the radio link between the tachymeter and the measurement vehicle needs to be sufficiently powerful in order to avoid gaps in the positioning.

In order to avoid interference between the radio of the robotic tachymeter (generally operating at 410-470 MHz) with the 400 MHz GPR system a radio operating well above 800 MHz was used for transmission of the position information. The latest generation of robotic total station radios operates at 2.4 GHz transmission frequency. Radio signal quality was improved by mounting both radios at about 2m height (Fig. 3).

Figure 5: Robotic tachymeter (total station) with the MIRA system visible in the background.

Parallel profiles of up to 170m length were measured in one direction, surveying at a speed of approximately 4km/hrs. The survey speed was limited due to the relatively slow positioning system used. A more advanced, faster total station would permit higher survey speeds. In the grass the vehicle tracks where clearly visible and permitted in combination with degradable colour spray paint markers a good guidance to achieve complete area coverage. Successive profiles were measured with a small overlap in order to avoid gaps in the data.

Within the first five hours 56 profiles were measured covering approximately 150m by 61.6m (~9000m^2) with an inline and crossline GPR trace spacing of 8cm, corresponding to a total of 134.4 line kilometres measured with the 16 channels. In comparison, two surveyors using a manually operated single antenna with 25cm crossline and 5cm inline GPR trace spacing manage to cover an area of 50m by 50m within six hours (equivalent to 10 line-km) using marker lines spaced with 1m intervals, provided that the survey area is regular (constant profile length) and staked out.

Over the course of three days an interconnected area covering three hectares was surveyed in the Black Earth area of Birka. This data is currently being processed and analysed.

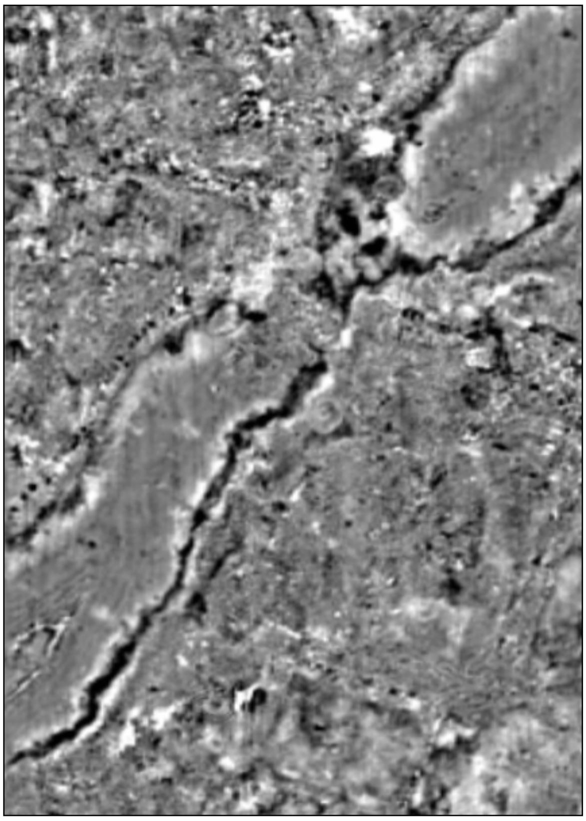

Figure 6: Georadar depth-slice at approximately 0.5m depth showing the older town wall stretching diagonally across the image, including a port in the central upper part. The dimension of the image is approximately 50m height and 34m width. The data shown is generated from full amplitude traces, not Hilbert transformed traces. A rectangular structure, presumably a building plot, can be seen at the lower edge of the image. Left of the lower branch of the town wall a row of black spots possibly indicates postholes or associated stones.

Preliminary conclusions

A considerable increase in both GPR survey speed (16 fold) and sampling density compared to single channel measurements has been demonstrated to be achievable. The laborious setup of survey grids and placement of profile lines on the ground are superseded by the use of alternatively a robotic tachymeter or RTK-GPS.

A first analysis of sections of the data indicates high data quality and much increased resolution. Very dense profile spacing and accurate data positioning permits the generation of depth-slice images of superb quality (Fig. 6). The resolution of the 400 MHz system appears appropriate for a large range of archaeological prospection applications.

Practical open issues are the implementation of an option for surveying in zigzag mode, which would result in even further increased efficiency.
This could be relatively simply solved by using an additional prism with appropriate visual screening and minor modifications in the positioning and data acquisition software.

Besides from the use of spray paint (or possibly foam) to mark the already covered area it would be possible to make use of existing commercial real-time navigation and guidance software.

An important issue is the handling of the increased amount of data. The uniform sample spacing of 8cm in both inline and crossline direction results in approximately 156 GPR traces per square metre. Assuming that each GPR trace consists of 512 samples (16 bit integer) this amounts to 160 kB of data per square metre, or 1.6 GB of data per hectare. A great advantage of the system is its ability cover large areas quickly, thus considerable amounts of data will have to be dealt with.

A comprehensive publication of this survey and its results in form of a scientific article is planned.

References

Leckebusch J., 2005. Use of antenna arrays for GPR surveying in archaeology. *Near Surface Geophysics*, 3, 109-113.

Trinks I., Larsson L.-I. and A. Eder-Hinterleitner, 2007. *Mapping of Sweden's first town Birka using georadar and magnetometer prospection.* ŠTUDIJNÉ ZVESTI ARCHEOLOGICKÉ ÚSTAVU SAV 41, 2007. Archaeological Prospection. Nitra. 245-246. ISBN 978-80-89315-00-0.

A New Magnetic Cart System for Archaeological Prospection

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Introduction

Magnetic surveys are common and often successful tools in archaeological prospection. As the sites to be surveyed vary in size, soil conditions and natural cover, it is important to make use of flexible systems that can carry different kinds and numbers of magnetic sensors as well as that are able to adjust the line spacing depending on the objective of the investigation.

Today many multi-sensor systems are pulled by a vehicle. They are able to survey large sites in a short time interval. However, they require an environment that is accessible by car. Hand driven systems are more flexible in terms of the ground conditions but usually they carry fewer sensors and are less efficient.

The objective of this article is to present a new hand operated wheeled cart system that allows the magnetic investigation of large areas in a reasonable time, that is able to survey rough terrains and that is easy to transport at the same time.

The Cart System

The cart frame consists of light GRP and aluminium material and is constructed to be folded up when transporting. The total weight, including 6 sensors, data logger and power supply (LiFe batteries) is approximately 35 kg. Folded up and packed in two boxes it can easily be transported in airplanes.

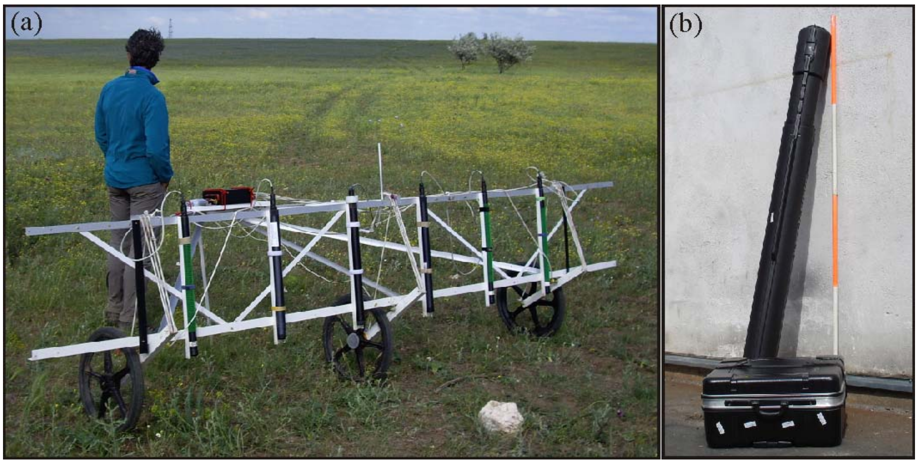

Figure 1: (a) Cart system: 4m width, set up with 6 Foerster gradiometers, sensor separation 0.5m; (b) Folded up system

The cart uses three wheels with special wheel suspensions which make it possible to drive in rough terrain. Compared to carried systems an improvement of data quality is achieved because the cart runs more evenly and the sensors have an almost constant distance to the ground.

The frame of the cart is designed to carry different magnetic systems. So far it has been successfully run with up to 6 Fluxgate and 4 Cs sensors. The sensor separation can be chosen between 1m, 0.8m and 0.5m. Depending on the investigation area (soil vegetation, trees or other limiting factors) the cart width ranges between 2.5 m and 4 m.

SENSOR TYPE	CART WIDTH					
	2.5m (3 wheels)		4m (3 wheels)		5m (4 wheels)*	
	Sensors	*Spacing*	*Sensors*	*Spacing*	*Sensors*	*Spacing*
Fluxgate gradiometer (Foerster 4.021/4.032)	6	0.5m	6	0.5m	11	0.5m
	4	0.8m	6	0.8m	7	0.8m
	-	-	5	1.0m	6	1.0m
Cs magnetometer (Geometrics G858)	4	0.5	-	-	-	-

* planned and in testing phase

For further projects it is planned to use a 7 to 11-sensor system as well as to add a fourth wheel and extend the cart width to 5m. Therefore a 24 Bit multi-channel logger (22 Bit noiseless at 50 samples per second) is under construction and in the testing phase.

Large-Scale Investigation on Crimea Peninsula

Funded by the Freie Universitaet Berlin (Germany) and in cooperation with the Centre for Black Sea Studies, Aarhus (Denmark) about 130 ha of magnetic surveying were realized in the Northwest of Crimea peninsula (Ukraine) this year. The purpose of the project was to investigate sites that will be affected by the construction of a new wind park near the coast. In order to save archaeological information about 64 locations (windmill sites and cable lines) were prospected. The individual sites covered areas between 1 up to 10ha.

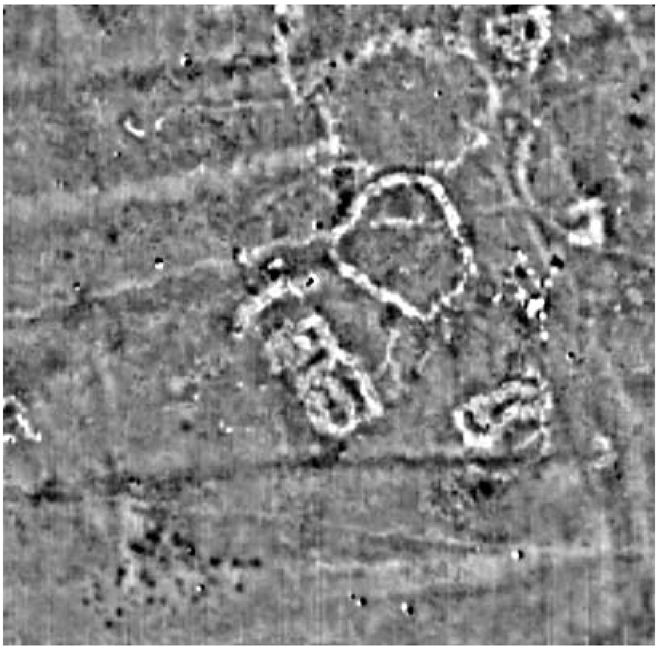

Figure 2: Geomagnetic results; size: 100m x 100m; line separation 0.5m; inline sample separation 0.05m; dynamic range ± 6nT.

For the survey the 4 m wide cart, set up with 6 Foerster gradiometers and a 6-channel data logger heslog DLAD 62001 was used. The sites were mainly flat with a natural cover up to 40 cm, but with local terrain steps up to 50 cm.

Depending on the archaeological relevance (e.g. evidences of settlements) a sensor spacing of 0.5 m or 0.8 m was used. That way a daily output of up to 10 ha for a sensor spacing of 0.8 m and 5 ha for a sensor spacing of 0.5 m could be realized. The 130 ha were surveyed within 22 days. Fig. 2 shows an example of the survey results recorded with a sample interval of 0.5 m by 0.05 m.

Perspective

Over the course of the next months the system will be continuously enhanced. Using the new multi-channel data logger and differential GPS survey large scale surveys in archaeological research projects or in archaeological prospecting related to road and railway constructions will be facilitated and, thus, costs will be reduced.

Preliminary Field Trials with the MVM1 Magnetic Viscosity Meter

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I recently had the opportunity to test a prototype down-hole probe designed to work with the new MVM1 magnetic viscosity meter manufactured by Pulsepower Developments, Oxford, UK. This time-domain electromagnetic instrument is calibrated to read 'frequency dependence of magnetic susceptibility' (κ_{fd} or χ_{fd}). The magnetic viscosity results obtained in the field with the MVM1 can be directly compared to commonly used laboratory instruments.

The frequency dependence of magnetic susceptibility is defined as ($\kappa_{fd}=\kappa_{lf}-\kappa_{hf}$) where κ_{lf} is low frequency and κ_{hf} is high frequency magnetic susceptibility. Volume frequency dependent susceptibility (κ_{fd}) is used here so that the MVM1 down-hole results are directly comparable to the Bartington MS2-H down-hole logger.

Calibrating the MVM1

Measured in the time domain, the amplitude of the magnetic viscosity response decays logarithmically verses time with an ideal slope of t^{-1}. The MVM1 has fourteen sample windows in the range of 10-100 µS. In the laboratory, one sample delay is selected to read directly as κ_{fd} so a calibrated plot of the magnetic viscosity decay curve can be mapped (Figure 1, Table 1).

	Bartington MS2-B				Pulsepower MVM1-B	
Sample	κ_{lf} 10^{-5} SI	κ_{hf} 10^{-5} SI	κ_{fd}%	κ_{fd}	κ_{fd} @ 30 µs	t^{-1} slope
Bessemer Grey	1933.2	1687.3	12.72	245.9	244	-1.17
Ft. St. Joseph Daub	1437.1	1319	8.22	118.1	118	-1.2

Table 1: Bartington and Pulsepower Developments laboratory sensor susceptibility and magnetic viscosity data for the Bessemer Grey and Ft. St. Joseph burnt clay samples plotted in Figure 1.

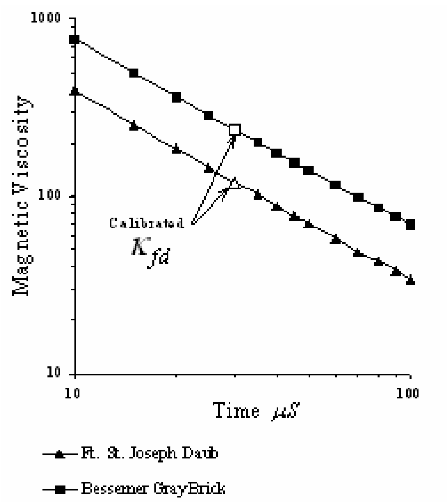

Figure 1: Log-log plot of the viscosity decay of two burnt clay samples. The first is a modern brick (Bessemer Grey from the Old Carolina Brick Co.), while the second sample is an archaeological sample of French colonial daub (late-17th-mid-18th century) from Fort St. Joseph, Michigan. The decay curves are calibrated in the time-domain to read κ_{fd} at 30 μS.

Because the logarithmic decay plot is directly calibrated to κ_{fd}, archaeological samples from diverse context can be compared in absolute terms to each other (Table 1). During the field trials, the 30 µS time-delay was calibrated to read κ_{fd}.

Results of the Down-hole Tests

The magnetic viscosity results presented here were performed during the 2008 National Park Service "Current Archeological Prospection Advances for Non-Destructive Investigations in the 21st Century" in the state of North Dakota, USA. The NPS workshop was hosted at the Biesterfeldt Site. Bieserfeldt is a contact-period Native American village site. Approximately half of this site has been plowed during some time in the past.

Pit-house "E" is one structure that was plowed and there are no surface expressions to indicate its exact location. Prior to this study, House E was delineated with a high degree of accuracy using the Bartington MS2-H down-hole system (Dalan, et al. 2007).

Borehole #1 is located within the House E structure and a cultural layer at 25-30 cmbs was noted during coring. Using the Bartington MS2-B sensor and the Pulsepower Developments MVM1 laboratory sensor, magnetic viscosity test were performed on collected soil samples (Figure 2A). The cultural layer between 25-30 cmbs corresponds to an increase in both magnetic susceptibility and magnetic viscosity at this location. These data are in good agreement with the Borehole #1 down-hole logs (Figure 2B, Figure 2C). A possible buried paleosoil is present between 50-60 cmbs on all of the logs. Borehole #2 is located ~7 meters outside of House E and is presented here for comparison (Figure 3). No obvious cultural soils were observed in the soil core at borehole #2.

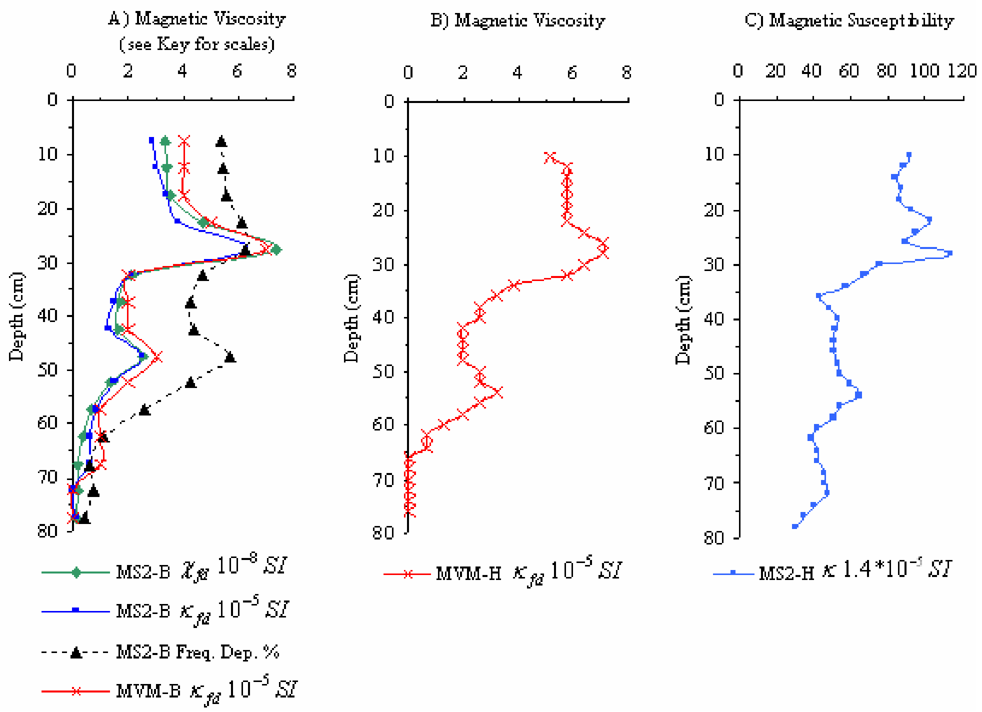

Figure 2: Borehole #1, inside House E. A) Soil samples collected at 5 cm intervals. Diamonds, squares and triangles measured on a Bartington MS2-B dual frequency sensor. Cross "X" measured on a Pulsepower Developments lab sensor. Note the different scales in the key. B) MVM1 prototype down-hole probe data collected at 2cm intervals. C) MS2-H down-hole magnetic susceptibility data collected at 2 cm intervals.

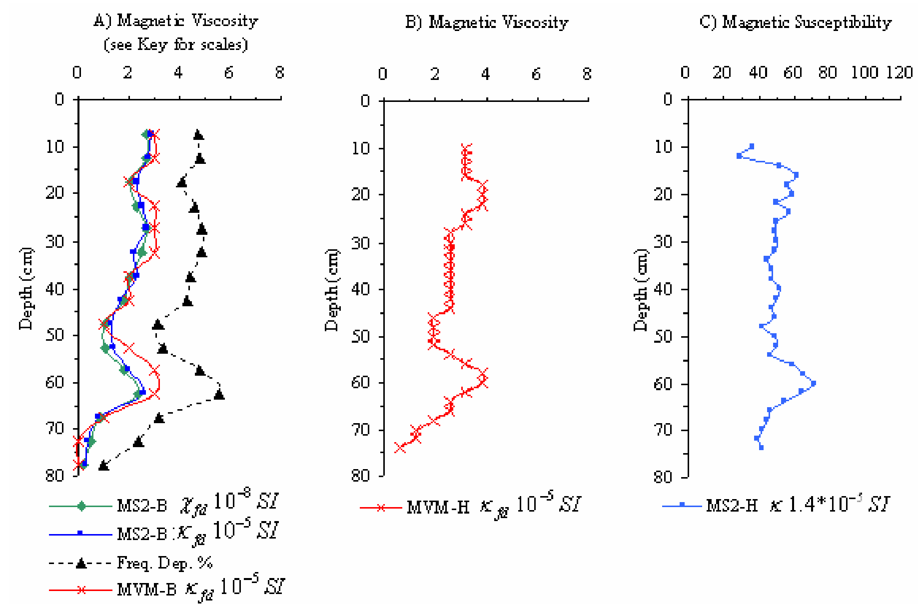

Figure 3: Borehole #2, outside House E. A) Soil samples collected at 5 cm intervals. Diamonds, squares and triangles measured on a Bartington MS2-B dual frequency sensor. Cross "X" measured on a Pulsepower Developments lab sensor. Note the different scales in the key. B) MVM1 prototype down-hole probe data collected at 2cm intervals. C) MS2-H down-hole magnetic susceptibility data collected at 2 cm intervals.

Conclusion

A newly developed magnetic viscosity meter was tested for its ability to detect cultural deposits at the Biesterfeldt site. The results of the down-hole tests are encouraging. Previously, measurements of κ_{fd} were confined to a laboratory setting. These preliminary results suggest that it is now possible to record magnetic viscosity in the field as κ_{fd} with the new MVM1 instrument.

ISAP Announcement

The successful recipients of the ISAP student travel bursaries, of £100 each, for the GPR 2008 conference were Alexandre Novo, University of Vigo, Spain and Lieven Verdonck, Ghent University, Belgium. Congratulations to you both.

Journal Notifications

Archaeological Prospection

Those of you who were at the ISAP conference will remember a lively discussion on the value of a publication with an Impact Factor (IF). Essentially, an IF is regarded as a measure of the 'value' of the articles that are published in a particular journal and is based on how many times papers and reports published over a two year period are cited the following year by other articles. This measure was conceived for medical publications, but has been accepted for other subject areas. Evidently, a two-year 'citing life' for a paper is very tough in a discipline like ours, but we just have to accept the criteria if we want Archaeological Prospection to be recognised as a leading journal. There are a number of positives in this process including an indication of the worth or impact that a paper has in the short run. This should produce more lively debates in the journal and encourage a greater number of papers that at the forefront of research.

It isn't an easy process to get accepted for an IF and it was about three years ago when the publishers found out that Archaeological Prospection had been approved for inclusion on the ISI list. Now after independent monitoring of the output of the journal and measuring its influence on other periodicals we have an IF for 2007 of 0.660. This is a really good start for a specialist journal and the authors must be congratulated for producing excellent papers that were published in 2005/6. To put this into some context Geoarchaeology and Archaeometry, which are also in the Wiley-Blackwells group, have 2007 IF of 0.716 and 0.883.

So what papers have been published this year that will contribute to the IF of the journal? The first two issues include the following must read articles:

A review of the role of magnetic susceptibility in archaeogeophysical studies in the USA: recent developments and prospects. Rinita A. Dalan

Common- and multi-offset ground-penetrating radar study of a Roman villa, Tourega, Portugal. Brooke A. Berard, J. M. Maillol

Non-destructive electrical resistivity tomography for indoor investigation: the case of Kapnikarea Church in Athens. G. N. Tsokas, P. I. Tsourlos, G. Vargemezis, M. Novack

Archaeological prospecting at the Double Ditch State Historic Site, North Dakota, USA. Kenneth L. Kvamme

Electromagnetic conductivity mapping for site prediction in meandering river floodplains. Lawrence B. Conyers, Eileen G. Ernenwein, Michael Grealy, Kelsey M. Lowe

Three-dimensional, multi-offset ground-penetrating radar imaging of archaeological targets. Adam D. Booth, Neil T. Linford, Roger A. Clark, Tavi Murray

Rapid and sensitive magnetometer surveys of large areas using SQUIDs - the measurement system and its application to the Niederzimmern Neolithic double-ring ditch exploration. Volkmar Schultze, Sven Linzen, Tim Schüler, Andreas Chwala, Ronny Stolz, Marco Schulz, Hans-Georg Meyer

Data processing issues in large-area GPR surveys: correcting trace misalignments, edge discontinuities and striping (p 133-149). Eileen G. Ernenwein, Kenneth L. Kvamme

Initial results using GPS navigation with the Foerster magnetometer system at the World Heritage site of Cyrene, Libya. Chris Gaffney, Vince Gaffney, Richard Cuttler, Ron Yorston

As ever, ISAP members receive a huge discount on the price of this journal. Archaeological Prospection is the only IF journal dedicated to subject area and details of how to take advantage of this ISAP member benefit can be found on the website (http://www.bradford.ac.uk/acad/archsci/archprospection/).

Chris Gaffney

Conference, Seminar and Course Announcements

“Recent Work in Archaeological Geophysics” and “Geoscientific Equipment and Techniques at Crime Scenes”

Burlington House, Piccadilly, London, UK, 16 - 17 December 2008

ENVIRONMENTAL AND INDUSTRIAL GEOPHYSICS GROUP

FORENSIC GEOSCIENCE GROUP

EIGG Environmental & Industrial Geophysics Group

FGG

Two day meetings at Burlington House, Piccadilly, London: 16th–17th December 2008

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

16th December: *Recent Work in Archaeological Geophysics* ☐

17th December: *Geoscientific Equipment and Techniques 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	£25	☐
Non-member – 2 days	£40	☐
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 2008.

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