Recent Work in Archaeological Geophysics

The Geological Society
Burlington House, Piccadilly, London W1J 0BG
Tuesday 6th December 2016

Programme

Lecture Programme:

0915-0950	**Registration and Coffee**
0950-0955	**Introduction**
0955-1010	*After the Earthquake: Geophysical Mapping of Underground Cultural Heritage in Nepal.* A Schmidt, R Coningham, C Davis, K Prasad Acharya and R Bahadur Kunwar
1015-1030	*The GPR Investigation of the Shakespeare Family Graves.* E Carrick Utsi and K S Colls
1035-1050	*Determining Geophysical Responses from Graves.* H C Dick, J K Pringle and R van der Putten
1055-1110	*The Impact of Surface Topography on the Performance of Migration Velocity Analysis of GPR Data.* A Harding, A Booth, N Allroggen, V E Turner, C Dyer, J Henderson and J Marsh
1115-1145	**Tea/Coffee break**
1145-1200	*Geochemistry meets Geophysics: in situ XRF surveying in the characterisation of a conflict archaeology site.* A Booth, V Vandeginste, D Pike, R Abbey, R Clark, C Green and N Howland
1205-1220	*Via Belgica; Surveyed, Excavated and Buried.* J Orbons, R Paulussen and B Weekers-Hendrikx
1225-1240	*All Roads Lead to Tibiscum – Preliminary Results of A Polish Landscape Survey Project on a Roman Fort in Romania.* M Pisz and A Hegy
1245-1300	*The Great Dorset Throw Down: The Infra-Site Landscape of a Verwood Country Pottery*. D Carter, P Cheetham and I Hewitt
1305-1310	**Morning closing remarks**

1310-1430	**Lunch (Lower Library)** – all delegates **NSGG AGM (Lecture Theatre)** – open to all Geological Society members
1440-1455	*In Search of the Lower City of Qalat-Idinka: Magnetometer Prospection of Neo-Assyrian Sites in the Peshdar Plain, Iraqi-Kurdistan.* J W E Fassbinder, A Ašandulesei, K Radner, J Kreppner and A Squiteri
1455-1515	*Recent Results from Verulamium.* K Lockyear
1520-1535	*Geophysical Surveying of the Ancient Egyptian Towns: An Overview.* T Herbich
1540-1555	*Experiences Exploring the Use of Archaeological Prospection Data Within Precision Agriculture Systems in the UK.* H Webber
1600-1630	**Tea/Coffee break**
1630-1645	*What On Earth Is This? Non-Archaeological Information in Landscape-Scale Geophysical Prospection Data.* P Schneidhofer, W Neubauer, E Draganits and E Nau
1650-1705	*The Accessibility of Geophysical Surveys in England, or How Easy (or Not) Is It To Find Out Where a Survey Has Been Conducted.* J Lyall
1710-1725	*The Enigmatic Vanishing of the Geophysicist in Archaeological Prospection at the Beginning of the 3rd Millennium.* C Meyer
1730-1740	**Conclusion**
1745-1900	**ISAP AGM (Lecture Theatre)**

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

Geophysical Prospection at Caisteal Mac Tuathal, Perthshire, Scotland. M Lukas

Reimaging the Black Friary: Recent Approaches to Seeing Beyond Modern Activities at the Dominican Friary, Trim, Co Meath. A Green and P Cheetham

Magnetometer Prospecting of a Major Achaemenid Palatial Structure at Karacamirli, Azerbaidjan. A Persian Paradise in the Caucasus. J Fassbinder, M Scheiblecker, F Becker, K Kaniuth, A Asandulesei and M Gruber

Mining and interpreting archaeo-geophysical data through excavation – a case from prehistoric Knowlton (Dorset, UK). P De Smedt, S Delefortrie, M Gillings, J Pollard and M Green

A comparative approach of EM and magnetic survey for the study of the Neolithic site of Klimonas (Cyprus). C Benech, A Tabbagh and J-D Vigne

Creating Composite Ground Penetrating Radar Datasets from Three Different Antenna Frequencies. J Marsh, A Booth, V Turner, C Dyer, J Henderson, M Guy and A Harding

Beneath the Surface of Roman Republican Cities: Large-Scale GPR Survey of Falerii Novi and Interamna Lirenas (Lazio, Italy). L Verdonck, G Bellini, A Launaro, M Millett and F Vermeulen

Magnetic Modelling Applet Development: An Overview of a Free Web-Based Tool (Commercial Presentation). J Marsh and M Guy

Topographic Correction of Geophysical Data: Comparison of Photogrammetry and GPS Data in the Correction of Poor Accuracy Height Values at Grave Creek Mound, WV, USA. A Corkum, C Batt, J Davis, C Gaffney, and T Sparrow

Cluster Analysis of GPR Profiles Using Image Intensity Distribution and Pattern Descriptor Learning: Applicability for Archaeological GPR Data. L Wei, Q Dou, D Magee, A D Booth and A G Cohn

Recent Geophysical Results from The South Hill at Olynthos, Greece. C Gaffney, T Sparrow, T Horsley, Z Archibald, L Nevett, B Tsigarida, A Corkum and D Stone

On the Trail of the Illyrian Rulers. Achievements and Obstacles During the Multi-Method Geophysical Survey in Shkodër (Albania) and Risan (Montenegro). M Pisz, A Hegy and D Gergely Páll

Geophysical Investigations at the Viking – and Early Medieval Assembly Site of the Frosta Thing. A A Stamnes

Where - the hell - is the western continuation of earthworks Niedersickte? A discovery story in three stages. C Schweitzer

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

Allied Associates Geophysical Ltd

Bartington Instruments Ltd

DW Consulting

Geomatrix Earth Science Ltd

Geoscan Research Ltd

Guideline Geo

Sensys Gmbh

BENEATH THE SURFACE OF ROMAN REPUBLICAN CITIES: LARGE-SCALE GPR SURVEY OF FALERII NOVI AND INTERAMNA LIRENAS (LAZIO, ITALY)

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Interamna Lirenas and Falerii Novi (Lazio, Italy) were founded in 312 and 241 BC, respectively. Although the fourth–third centuries BC are important in the development of Roman cities as a new urban form, our knowledge of sites remains limited. The study of the early phases of Interamna Lirenas and Falerii Novi should allow us to better understand the scale and character of Roman Republican cities (street grid, public buildings, domestic space). Today, both sites are used as arable land and therefore easily accessible. They have been the focus of investigations by the University of Cambridge and the British School at Rome over several years, including field survey, topographical survey and large-scale magnetometer survey (see e.g. Keay et al. 2000; Bellini et al. 2013).

The current GPR prospection of the two complete towns (each between 25 and 30 ha) takes place within the 'Beneath the surface of Roman Republican cities' project, a collaboration between the University of Cambridge, Ghent University, the British School at Rome and the Soprintendenza Archeologia del Lazio e dell'Etruria Meridionale. Around two thirds of the total area has been covered in the 2015 and 2016 seasons. We use a network comprising thirteen 500 MHz antennas, mounted in parallel onto a wheeled, wooden frame and towed by an all-terrain vehicle. Data are recorded in parallel, slightly overlapping 2 m wide swaths, so that the spacing between the transects is 12.5 cm or 6.25 cm (the latter requires a second pass). Readings are taken every 5 cm along the transects. RTK GNSS positioning information is fed into a navigation system guiding the driver so that the desired trajectory is followed. The geophysical survey data is visualised after completion of each line, to quickly detect possible gaps in the coverage of the survey area and assure data quality.

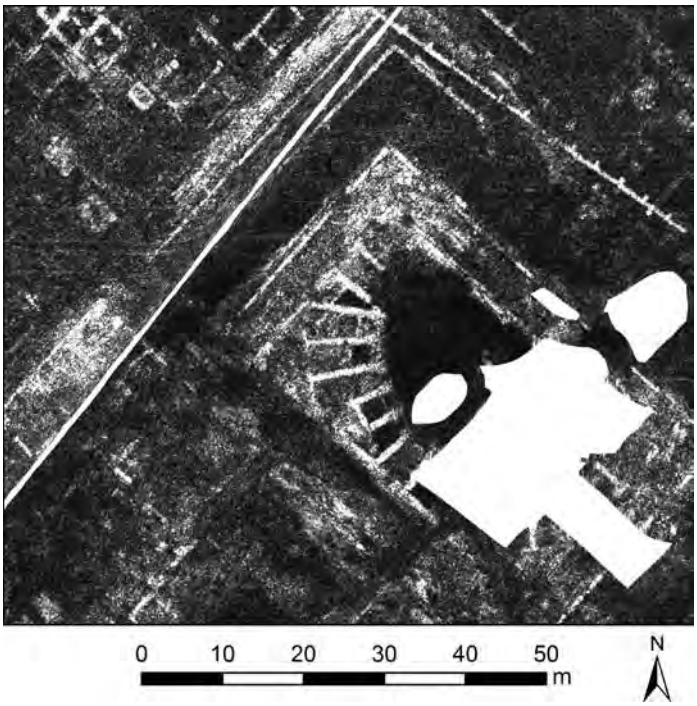

Fig. 1: GPR slice at a depth of ~50–55 cm from Interamna Lirenas, showing the northwestern half of the theatre, not yet excavated at the time of the survey in July 2015.

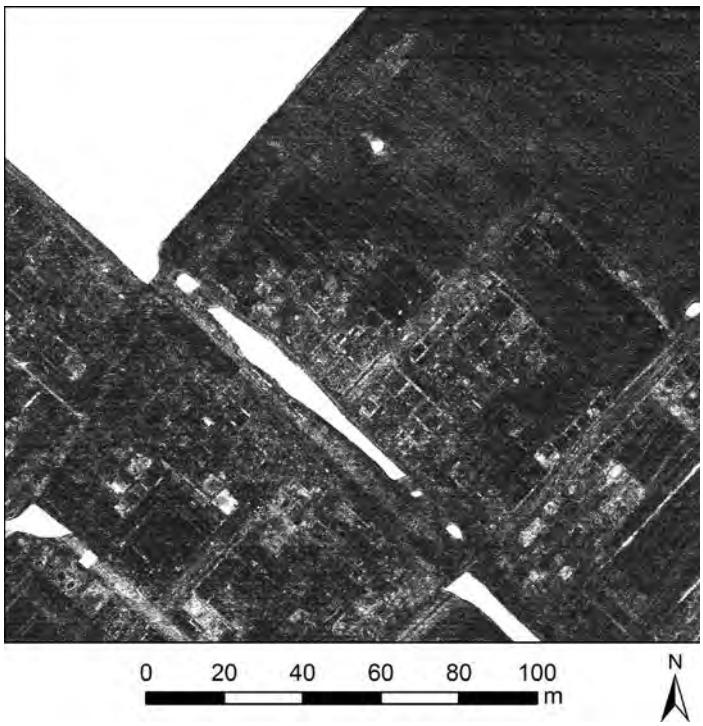

Fig. 2: GPR slice at a depth of ~50–55 cm from Interamna Lirenas, showing the northern part of the site. The topography slopes down in northeastern direction, towards the edge of the town.

Data processing included dewow, time zero alignment, gain, low-pass filtering, background removal and suppression of variations in the amplitudes recorded by the different channels, visible as stripes in the time-slices. To determine the GPR wave velocity and the depth of the archaeological features, migration velocity analysis was performed on selected vertical profiles and horizontal slices. At Interamna Lirenas, also direct observations of the depth were possible in the theatre area, where in 2013 an excavation was started (Bellini et al. 2014; Ballantyne et al. 2015). At the time of the 2015 GPR prospection, only the southeastern half of the theatre had been excavated, while the northwestern half was included in the GPR survey (Figure 1). After the extension of the excavation to the northwestern half in 2016, detailed depth information has become available, allowing accurate calculation of the wave velocity for this area. After time-to-depth conversion and topographical correction, a 3-D interpretation drawing of the GPR anomalies was produced, manually and using automated detection tools (Verdonck 2016).

To make a 3-D comparison between the theatre excavations and the GPR results, a scan of the northwestern half of the theatre was made using a robotic reflectorless total station. Although the scan resulted in a low resolution compared to a survey with a terrestrial laser scanner (approximately 150 points/m²), this sample density was sufficient for the assessment and visualisation of the GPR wave attenuation. The GPR produced high-resolution information on the radial walls supporting the upper part of the *cavea* (seating area) and on the *scaena* wall which forms the background of the *pulpitum* (stage), down to a depth of >1.5 m (Figure 1). However, the lower part of the *cavea* and the wall separating the *pulpitum* from the orchestra (the semi-circular central part of the theatre) are absent in the GPR images, indicating that structures starting at a depth greater than around 80 cm were not detectable by the GPR at the time of the prospection, which took place during a long period of dry weather.

This observation, in combination with the presence of a very large quantity of building material and other Roman artefacts at the surface, seems to indicate that most foundations visible in the time-slices may be equally shallow. Moreover, the question arises whether the absence of features in the GPR data in the lower areas near the edges of the town (Figure 2) is due to a real absence of foundations, or to the

presence of colluvium and an insufficient GPR penetration depth. Further investigations (augering, test excavations and measurements of the soil conductivity) are required to clarify this.

Although the archaeological interpretation of the GPR results is still ongoing, they seem complementary to the results of previous work. For example, at Falerii Novi, the GPR provided more information about some public monuments (e.g. temples, theatre, U-shaped building with porticoes), whereas the smaller buildings, often showing as clear magnetic anomalies, are defined less clearly in the GPR data.

Bibliography

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Acknowledgements

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