ISAP NEWS

The Newsletter of the International Society for Archaeological Prospection

Issue 59, May 2020

Editorial

What incredible change! Looking at the cover shot for this issue, to me it seems almost unreal that this would have been a normal view back in 2019 – geophysics in front of Rome's Lateran basilica. And yet, we all expect that our surveys will eventually look like this again. ISAP is supporting its members with online offerings, like the Virtual Coffee Meeting (p16) and a trawl through old archival photographs. Many of the latter were shared on our email list (isap-all@archprospection.org) and some have now found their way into this issue as part of the second instalment of ISAPinacotheca (p19). Michał Pisz was delighted to receive so many contributions and will use some more for future issues. Don't stop, and continue sending us your photographs (email to editor@archprospection.org).

We were pleased to receive from members some interesting reports for this issue and hope you will feel encouraged to submit your own thoughts/images/reports for the next issue. ISAPNews only works if it is supported by the community – we need you.

Armin Schmidt
editor@archprospection.org

The Cover Photograph shows an electrical resistivity survey in front of St. John Lateran Basilica, Rome. Photo Stephen Kay (see p11 for details).

Table of Contents

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Improving One Way of Investigating Australian Rockshelters

ISAP Fund Completion Report

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The goal of this project, supported by the ISAP Fund, was to test if geophysical applications could assist in evaluating earlier site stratigraphy and identify markers for human occupation using ground-penetrating radar (GPR) and magnetic susceptibility on an early settlement rockshelter (Malangangerr Rockshelter) in western Arnhem Land, Australia. The site is unique in that it is situated; a) near the oldest rockshelter in Australia, Madjedbebe, which revealed human occupation at 65,000 years (Clarkson *et al.* 2015; 2017), and b) within the south migration pathways for initial human colonisation of the Australian continent (Norman *et al.* 2018). Although the site was excavated in the 1960s by Carmel Schrire, the site had not been adequately dated nor did the excavations go beyond a depth of 2 m below surface. One goal of the GPR survey was to locate the earlier archaeological trenches and define the depth and character of the shelter's deposits (i.e. bedrock and roof fall) more readily, to assist in the re-excavation that was to take place later in 2019. Magnetic susceptibly and soil chemical analyses were completed on bulk sediment samples collected from the archaeological excavations in an area defined as C9 Column Sample (Figure 1).

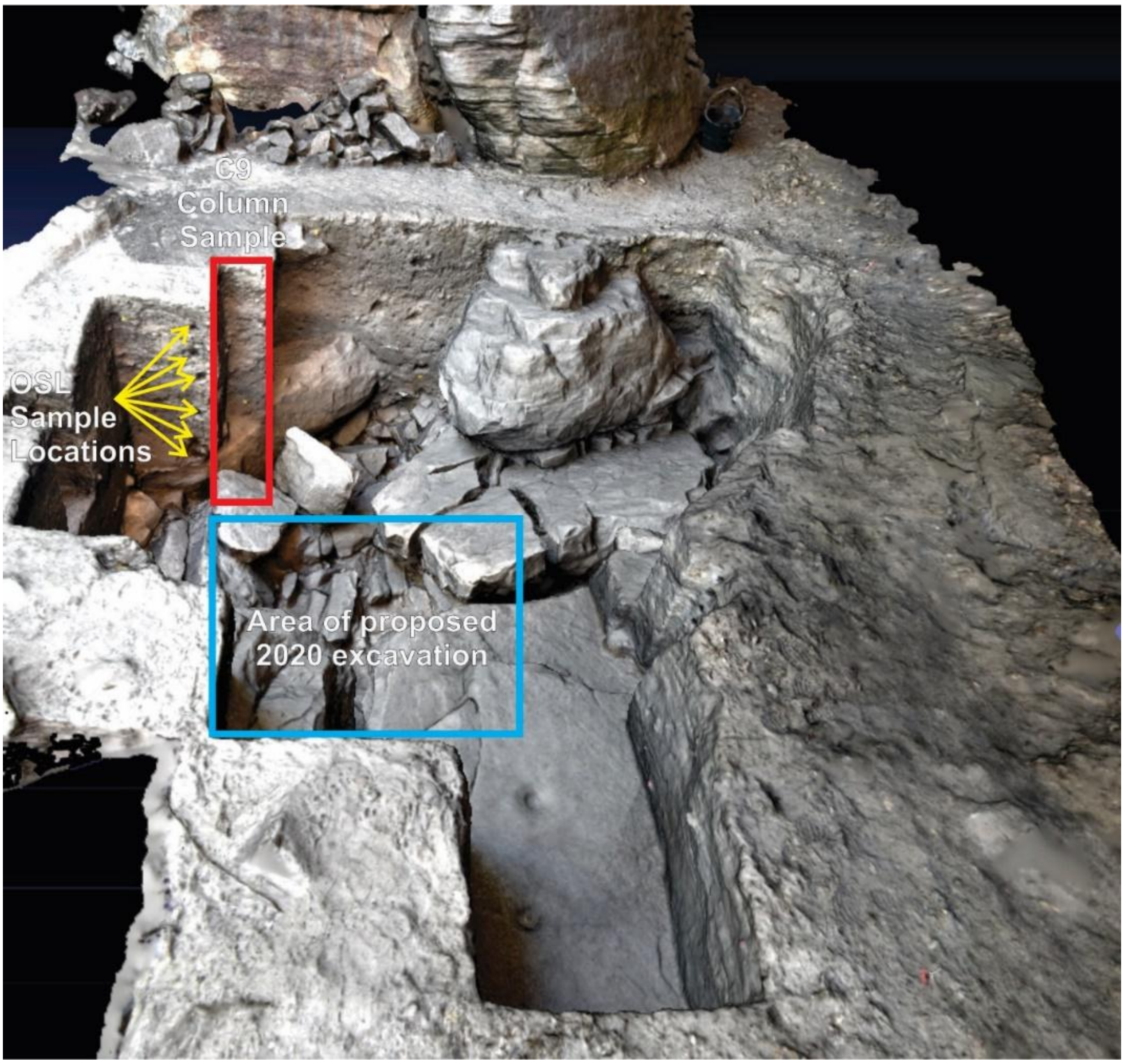

Figure 1: Re-excavated Malangangerr site showing the past and proposed archaeological excavations, and the locations of the C9 Column Sample and the optically stimulated luminescence (OSL) sampling.

A Geophysical Survey Systems, Inc. SIR-3000, 400 MHz antenna was used to collect the GPR data (Figure 2). Transects were spaced every 0.5 m and sixteen-bit data were collected with a 40 ns time window. Data were processed (time zero correction and bandpass filter) and converted into slice-maps using GPR-SLICE v7.0. One approximately 12 m × 8 m geophysical grid was positioned in the location of Schrire's previous excavations. Sixty-four magnetic susceptibility samples collected every 2.5 cm from the C9 Column Sample were packed in small non-magnetic Although P15 boxes (5.28 cc volume) and measured with a Bartington Instruments MS2B sensor. Mass and volume low-field magnetic susceptibility (χ and κ) measurements were recorded, as well as dual frequency measurements (460 and 4600 Hz) for the investigation of frequency dependence of susceptibility (χfd).

Additionally, phosphorus (P), calcium carbonate (CaO) equivalent, major oxides including aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3), and loss on ignition (LOI) were completed on the 64 bulk sediment samples collected and compared to the stone artefact totals. Seven stratigraphic units were identified during the 2019 excavation season based on textural and Munsell colour changes.

Figure 2: Dr Kelsey Lowe showing the Njanjma Rangers how GPR works.

The GPR data identified reflections in the subsurface deposits that later proved to consist of buried rocks, roof fall and tree-roots. These features show as highly reflective anomalies due to their physical properties (Figure 3). Areas of weaker reflections are characterised as sandy sediments. The previous 1960 excavations show up clearly as areas with only weak GPR reflections, because the sediments had been excavated and most of the larger rocks and rubble found within them were removed. All high-amplitude reflections are also visible as strong planar reflections in the corresponding GPR profiles (Figure 4). Many of these are visible in the area outside the shelter, while the rest of the planar reflections are visible just below the drip line. The maximum depth reached for this GPR survey was approximately 3 m, at which it appears that a change in subsurface material occurs across the site. This change could relate to a transition in the underlying bedrock of the shelter.

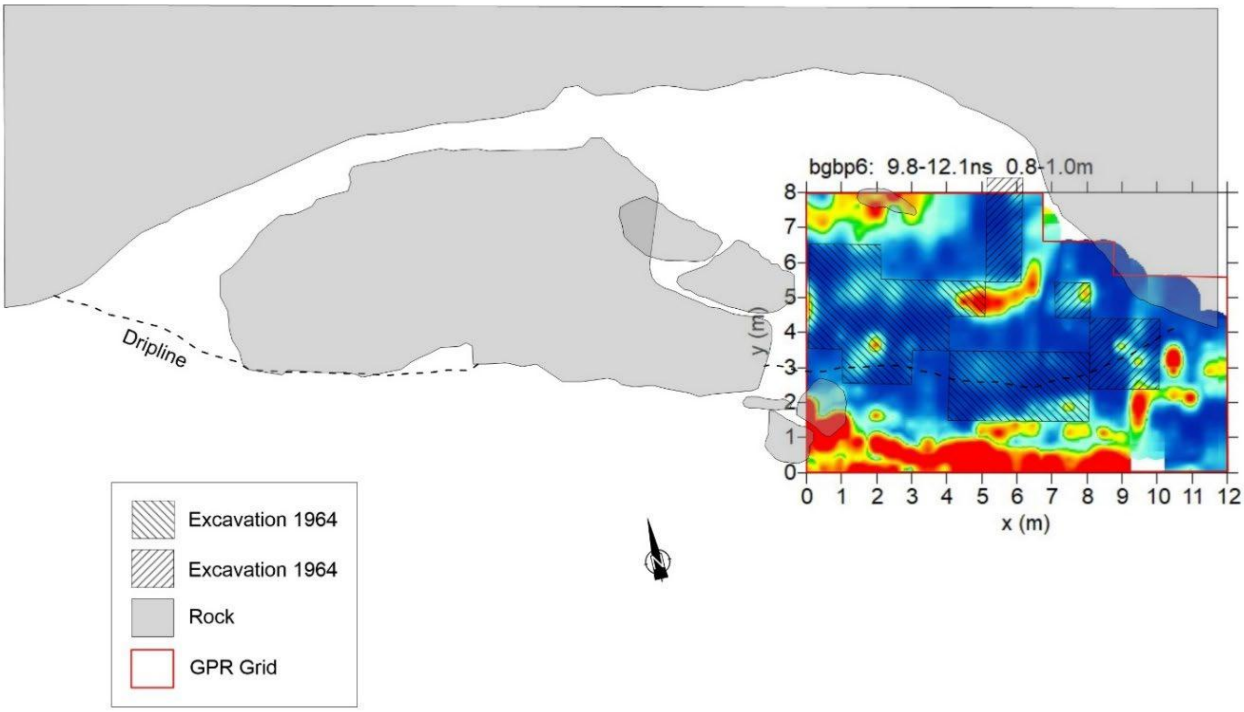

Figure 3: GPR overlay from 0-1 m showing previous excavations and high-amplitude reflections (in red).

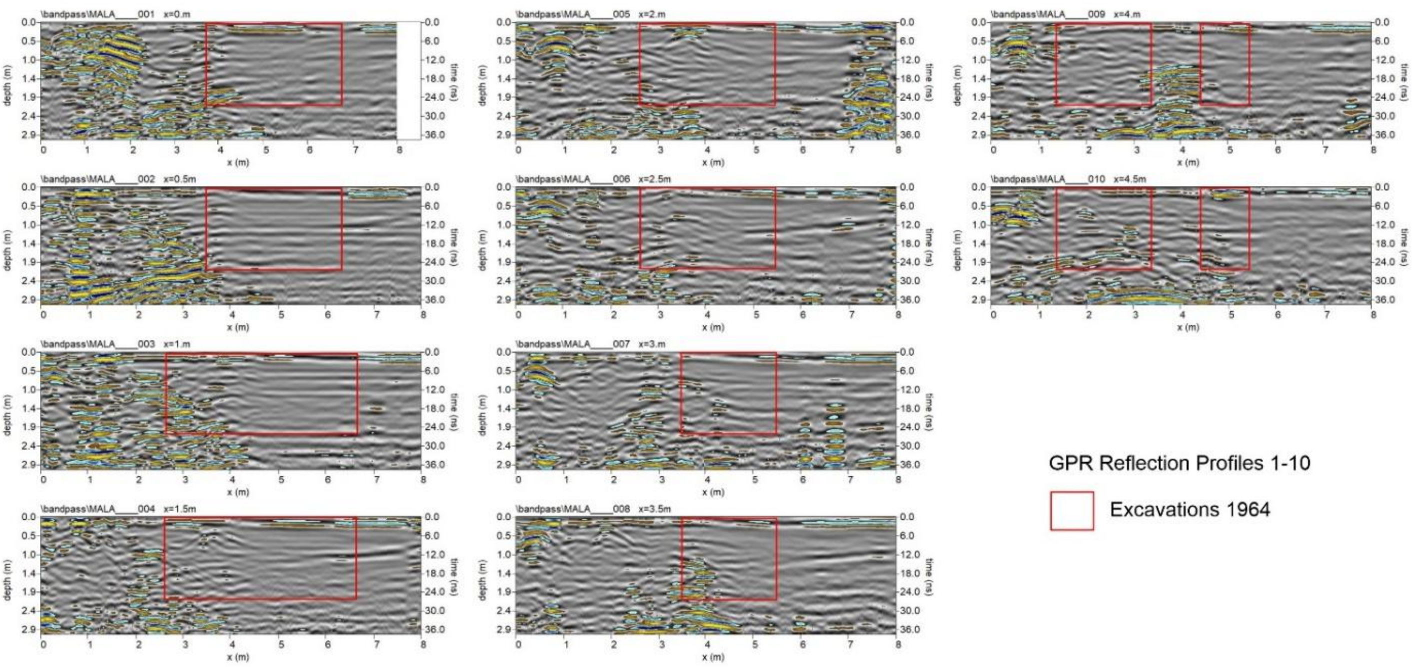

Figure 4: GPR reflection profiles of GSA01 showing previous excavation location.

The magnetic susceptibility analysis reveals a positive correlation between the relative abundance of aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3). Susceptibility values begin to increase around 150 cm below the surface, at the position where stone artefacts begin to occur in the sequence (Figure 5). This enhanced magnetic signature is also present at the neighbouring Madjedbebe site (Clarkson *et al.* 2017). The signatures at Malangangerr are also influenced by the relative proportion of aluminium and iron oxide in the sediment, a phenomenon of anthropogenic firing as these minerals can transform into more strongly magnetic minerals by heating (Lowe *et al.* 2016). Samples contain lower susceptibility values in Stratigraphic Units 3 and 4. Susceptibility increases slightly in Stratigraphic Unit 2, and this coincides with increases in LOI, P and CaO (Figure 5).

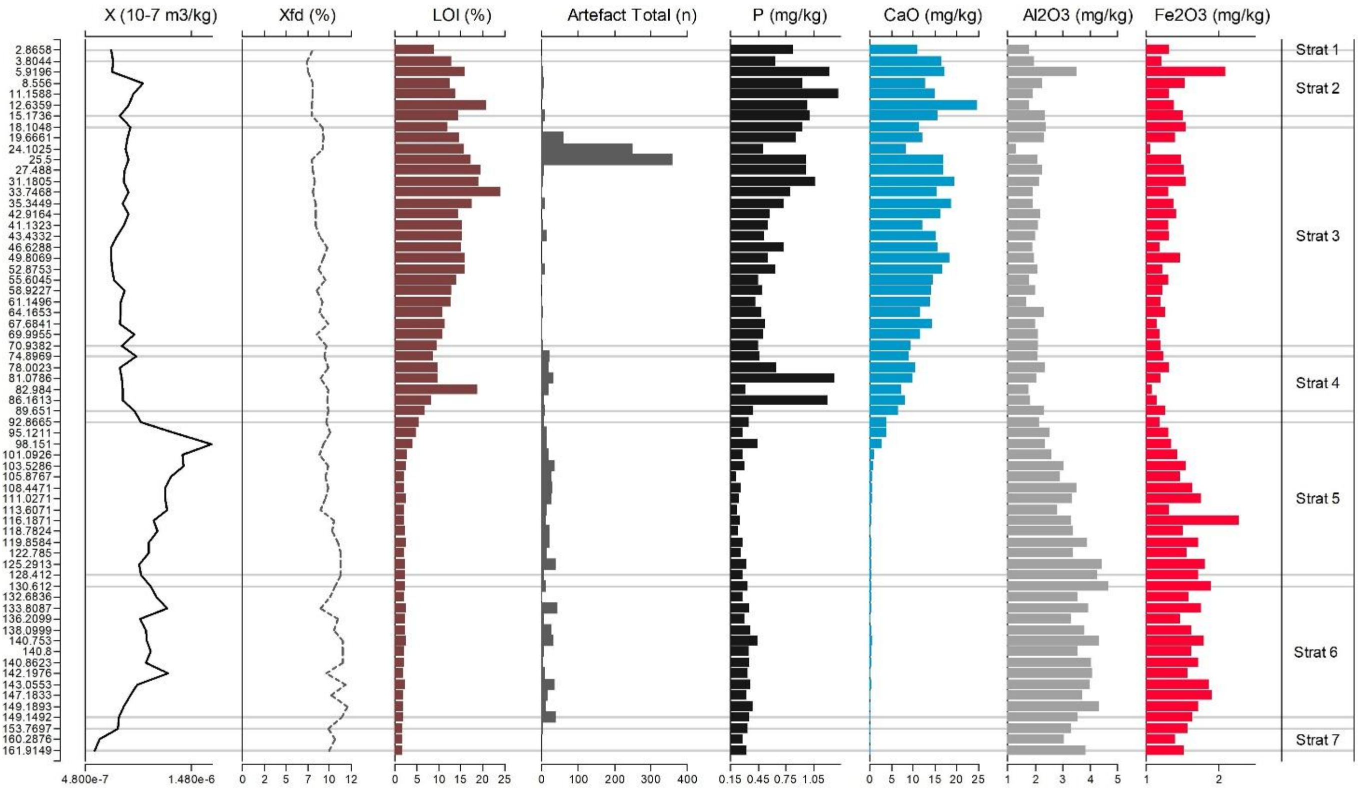

Figure 5: Profiles of measurements of low-field magnetic susceptibility (χ) and frequency dependence of susceptibility (χfd%) with artefact counts (stone), phosphorous, calcium equivalent and aluminium and iron oxide, showing the defined Stratigraphic Units.

The ISAP-funded project has met most of the initial expectations by resulting in a more refined understanding of spatial aspects of the Malangangerr site where applicable. Specifically, it demonstrates that there are robust GPR anomalies located directly below and outside the shelter's drip line, which relate to roof fall and bedrock. It also detected the previous 1960s excavations.

The magnetic susceptibility analyses were useful in determining the onset of human occupation at the site, by showing that enhanced susceptibility values coincide with the increases in stone artefacts. These increases are a result of anthropogenic burning – an identifiable marker for human occupation in this sandstone environment.

This project furthered the aims of ISAP firstly by involving improved data collection protocols in shelter and cave environments by offering one way to assess subsurface deposits before implementing costly excavations. In this case, GPR was advantageous for locating previous excavations within a small shelter site and for locating potential areas for future excavation. Often Australian cave and rockshelter sites are quite small (approximately 5 m x 10 m) in size, confined (low ceilings) and contain a lot of roof fall and bedrock material both on the surface and subsurface, which can make archaeological excavations difficult to complete and costly.

Secondly, the geoarchaeological analyses allowed a more detailed interpretation of the geophysical results, through re-excavation and subsequent sedimentological and mineral magnetic analysis. In this case, the previous 1960s and current archaeological excavations have refined our understanding of the specific geophysical signatures in a sandstone rockshelter and how they relate to ancient human activity. A major issue in current geophysical prospection is to understand geophysical signatures more accurately, as demonstrated by the recent formation of the COST Action SAGA (Soil-science & Archaeo-Geophysics Alliance). This is undoubtedly the case in Australia as well, where it is necessary to refine our understanding of specific geophysical signatures and how they relate to ancient human modifications of the environment.

Lastly, the work completed here provided critical information about buried cultural deposits using minimally-invasive methodology that can offer the best protection possible to the site itself. In Australia and arguably elsewhere in the world, cultural heritage is continuously under threat of damage or destruction due to either natural (i.e. weathering/wind) or human action (i.e. development). When disturbed or destroyed, archaeological sites lose most or all of their scientific value and heritage significance which limits the ability to understand the cultural traditions of people. From a heritage management perspective, maintaining site integrity is also of great importance, particularly if Indigenous communities are looking for alternative means for site management. The partnership with the Njanjma Rangers allowed for the investigation to be undertaken collaboratively through a training workshop on site. This provided the Njajma Rangers with a chance to see and utilise new technology (capacity building) while also learning how this technology can assist them with the management of the Malangangerr rockshelter through a presentation of the processed data.

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Large scale urban geophysical prospection: The Rome Transformed Project 2019 – 2024

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The purpose of this short report is to inform ISAP members of a new large-scale geophysical prospection project that is being undertaken in Rome. In October 2019 Newcastle University, together with the British School at Rome (BSR), Università degli Studi di Firenze and the Italian Consiglio Nazionale delle Ricerche (CNR) were successful in a funding bid to the European Research Council for a project aimed at investigating the Caelian Hill in Rome (https://cordis.europa.eu/project/id/835271). The project aims to improve our understanding of Rome and its place in cultural change across the Mediterranean World by mapping political, military and religious changes to the Eastern Caelian Hill from the first to the eighth centuries. It will assess the buildings that drove these changes, producing academically robust visualisations, appropriately contextualised. Building upon the 3D recording work conducted at St. John Lateran Basilica (Haynes et al, 2018), the survey will expand eastward towards the Basilica of The Holy Cross in Jerusalem, including a large stretch of the Aurelian walls, Republican tombs and the Claudian aqueduct.

A major component of the project, led by Ian Haynes (Newcastle University), involves extensive geophysical prospection across the open spaces within the south-eastern quarter of Rome inside the Aurelian walls (Figure 1). Previous GPR investigations by Salvatore Piro (CNR) focused around the St. John Lateran Basilica (Piro *et al.* 2017, Haynes *et al.* 2017) and traced a series of earlier structures. As part of the new research, Salvatore Piro will further expand the study area employing different frequency antennas (a GSSI 300/800 MHz dual-frequency digital antenna) as well as re-examining some of the areas in more detail (Figure 2). This work will be supported by an ERT survey conducted by the BSR as previous results (Piro *et al.* 2017: 440) indicated a significant change in the morphology of the subsoil in front of the basilica (Figure 3).

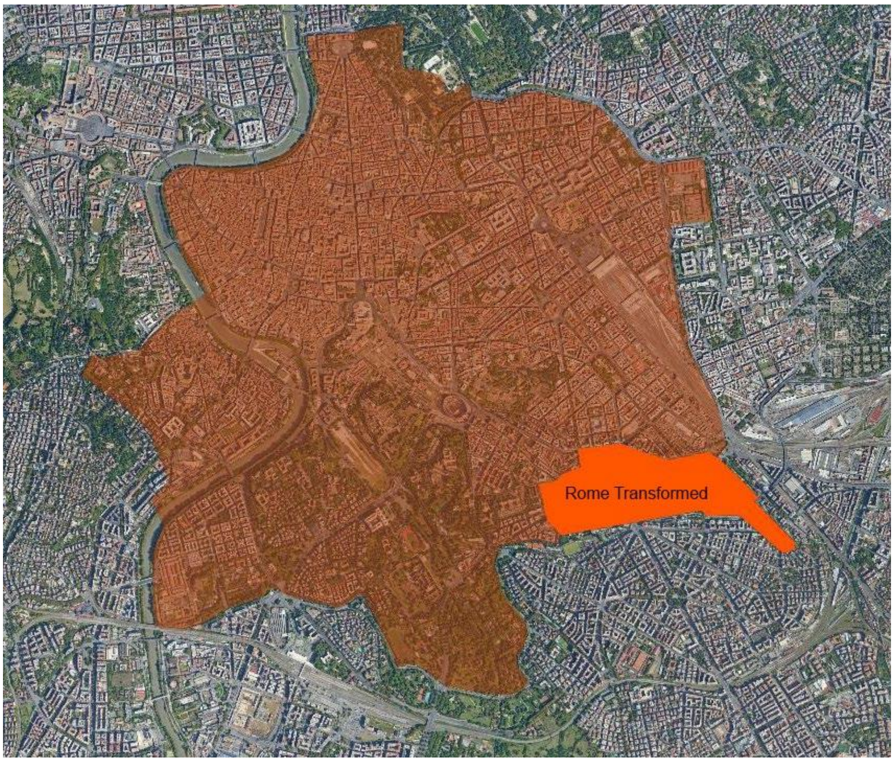

Figure 1: The Rome Transformed study area.

Figure 2: The CNR team surveying in front of St. John Lateran Basilica using a 70 MHz monostatic antenna, March 2020. Photo Ian Haynes.

With the support of the British Embassy in Rome and the British Ambassador to Italy and San Marino Jill Morris CMG, survey commenced in January 2020 with a GPR prospection (GSSI 200 MHz antenna) by the BSR in the grounds of Villa Wolkonsky, the ambassador’s residence alongside laser scanning of the tomb of Tiberius Claudius Vitalis and of the ancient Neronian Aqueduct - a branch of the Aqua Claudia, as well as a structural analysis of all these monuments.

Figure 3: ERT survey by the BSR in front of St. John Lateran Basilica. Photo Stephen Kay.

The geophysical prospection will be further enhanced through the support of Geostudi Astier (led by Gianfranco Morelli) who will provide GPR surveys using the IDS Stream multi-channel system to survey the main thoroughfares that pass through this part of the city. The aim is to complete the geophysics data capture by September 2021 after which a series of technical reports will be drawn up and integrated with the laser scanning, archival and documentary analysis as well as the standing building survey. Finally, the geophysical survey will be integrated with the environmental sampling that will be undertaken by the project through a series of new boreholes as well as a resampling of older cores. We look forward to updating colleagues as the project progresses.

Acknowledgments

The Rome Transformed project is led by Professor Ian Haynes (Newcastle University) together with Professor Paolo Liverani (Università degli Studi di Firenze), Stephen Kay (BSR) and Salvatore Piro (CNR). This project has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No. 835271).

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ISAP Virtual Coffee Meeting

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Given the difficulties of direct contact between ISAP members due to the Covid-19 pandemic, the ISAP Management Committee had organised an informal online meeting; our first Virtual Coffee Meeting. It was held on 22 May 2020 and the Open Source Jitsi platform was successfully used for members to join and chat.

It was refreshing not to have to go through an agenda and the mood was pleasantly upbeat. The topics discussed were diverse, ranging from the new speed limit on Dutch motorways (only 100 km/h) to a new book on archaeological practice which, disappointingly, only has about half a page dedicated to geophysics.

The new Caesium magnetometers from Geometrics (the MFAM Module) are very small (ca. 3 cm^3) and are apparently used in the MagArrow UAS-enabled magnetometers. One of these was used by Helen McCreary with a

DJI drone to investigate well heads from old oil fields and produced a good magnetometer map.

Immo Trinks has published a paper in *Remote Sensing* on the use of coherence analysis for the investigation of GPR data volumes (DOI: 10.3390/rs12101583) and pointed out that the site and data conditions have to be suitable for it to work well. Dean Goodman had already implemented a similar algorithm into the GPR-Slice software some time ago, and the new article may promote further use of this feature.

There was some discussion about the recently accelerated movement of the magnetic pole towards Siberia (BBC, DOI: 10.1038/s41561-020-0570-9 and online-view). The relevant article in *Nature Geoscience* was of particular interest as it shows nicely that the illustrations of the earth's magnetic field as a dipole, which most people will have seen, are a gross simplification of the many field areas on the earth's mantel that only eventually combine to look similar to a dipole field at a sufficiently large distance.

One of the main obstacles to fieldwork was felt to be the lack of available accommodation, which meant that everything has to be done in one day. As a result, all surveys in the Austrian lakes had to be postponed by the LBI since the drive from Vienna would have taken approximately 3h one way. Hopefully the situation will have improved by the time this article is published.

Overall, participants greatly enjoyed the opportunity to chat with each other and it is planned to schedule another such online meeting in the near future.


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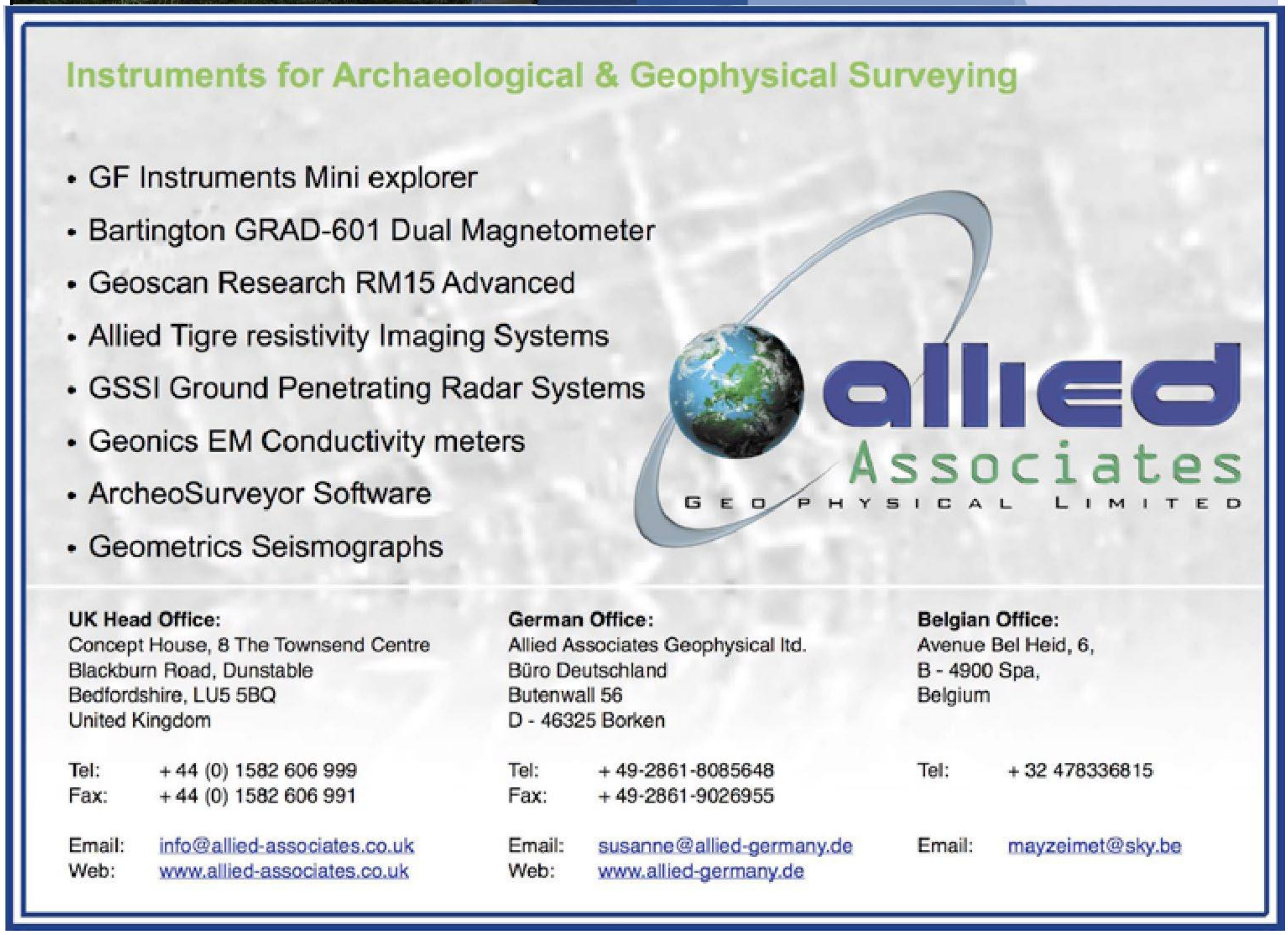
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ISAPinacotheca

The *ISAPNews* Gallery

Michał Pisz – ISAPinacotheca Associate Editor

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Introduction

Dear ISAP Members,

In recent months, we have all found ourselves in a very unusual, unprecedented situation. For many of us the COVID-19 pandemic meant a return from the field to house confinement, for others (including myself) the research season ended literally just before the start.

To console yourself in this difficult period, take a look at our gallery!

In addition, I would like to express my huge thanks to everyone who responded to the request to send archival photos. All photos and descriptions have been archived and they will be successively published in ISAPinacotheca - and there is something to look at!

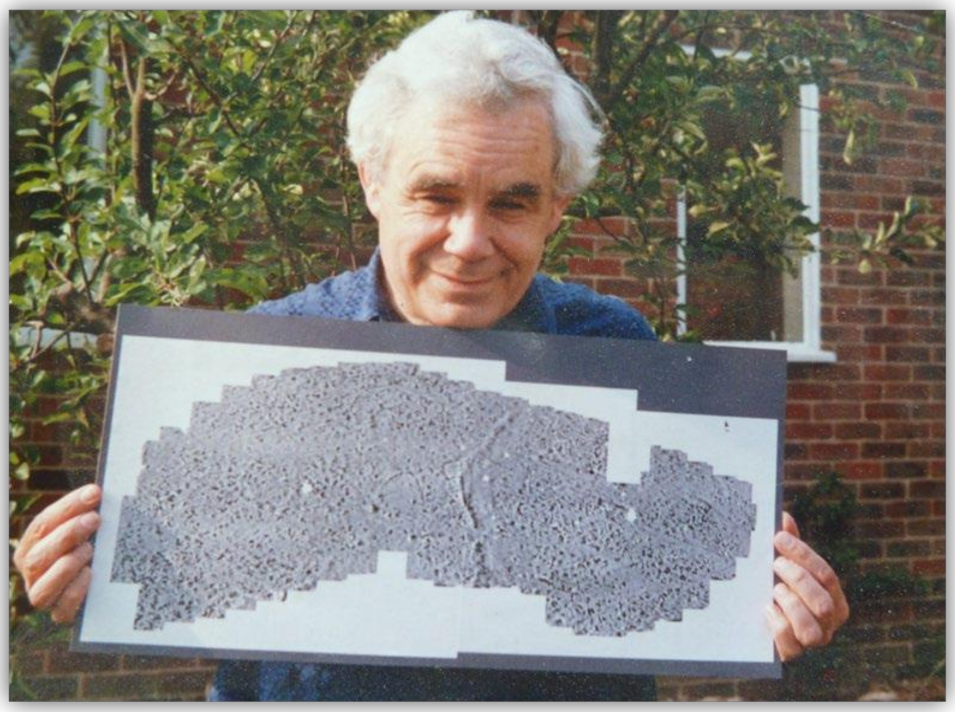

Figure 6: Tony Clark proudly holding a large poster sized greyscale plot of the completed overall survey after the data was extracted from all those tiny Epson Dictaphone cassette tapes, stuck together and printed. That was a task in itself back in 1980s (Picture and description from Andy Payne).

Figure 7: *Benny Rieger performing a test survey over a Roman cellar with his home-made resistivity meter. The first survey ended with really bad results, caused by some pcb failures. But after everything had been modified he decided to give it another try. Finally there were really good result for such a unit* (Picture and description from Benny Rieger).

Figure 8: Left to right: Fro Rainey, Beth Ralph and Marina Someone holding the sensor. Note that this was in the days when Fro was calling out each reading, written down by Beth and plotted out - usually by me - in the evening (Rog Palmer about the 1970' survey in Kingscote, Gloucestershire).

Figure 9: A typical situation when surveying in the Balkans. The Croatian landowner showed up with a self-made rakija and didn't let go. Apparently a Bartington case is a good field table (picture by Radek Mieszkowski).

Figure 10: This picture from August 1986 shows Joep Orbons carrying the back-breaking EM31. He joined Rory Mortimer and familiarised himself with the EM31; it was his first field-experience with geophysics. After this, he continued his studies of physics and took up geophysics for archaeology two years later, follow by a master in archaeology, never leaving the instruments and data processing since (picture and description from Joep Orbons).

Figure 11: Taken in the mid 1980's the photo shows a site in Fife, Scotland. John Gater decided to use freshly cut straw to mark out the archaeological features in the field (picture, description and innovative feature extraction method from John Gater).

Figure 12: Andrew David back in 1980 surveying with a Littlemore 1m fluxgate gradiometer with Beverly Thomas managing the x-y plotter (content provided by Paul Cheetham).

Figure 13. During Michel Dabas' PhD, in 1986, he was developing with Albert Hesse, Alain Tabbagh and Alain Jolivet (pictured in front of the tractor) the first automated system for resistivity mapping (description and picture taken in Minot-Brevon provided by Michel Dabas).

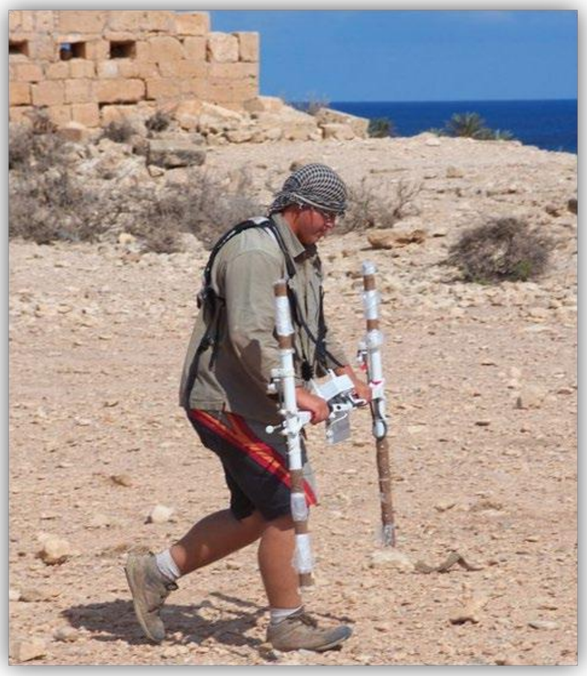

Figure 14: Looking through all these archival photos made me too go back to the beginnings of my adventures with geophysics. In September 2009 I took part in a survey in Ptolemais, Libya. I remember numerous wounds, abrasions, sunburn and dehydration. It was love at first sight! (Michał Pisz).

Journal Notification

[Archaeological Prospection 2020: 27(1)]

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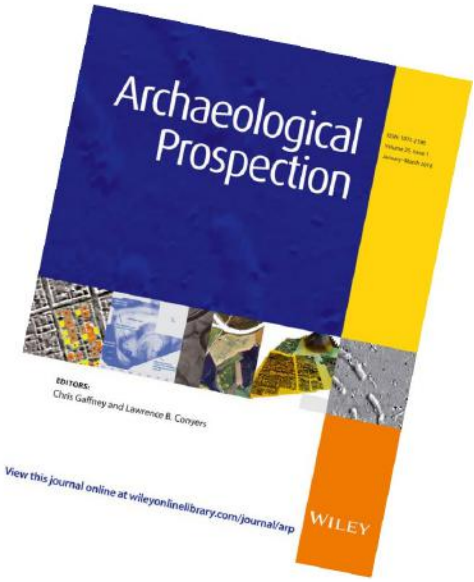

An object-based approach to support the automatic delineation of magnetic anomalies

Alexandru Hegyi, Milja-Miroslav Vernica & Lucian Drăguţ

Geo-environmental evaluation for the preventive conservation of open-air archaeological sites: the case of the Roman Necropolis of Carmona (Spain)

Javier Elez, Juan Carlos Cañaveras, David Benavente, Angel Fernández-Cortés, Soledad Cuezva & Sergio Sánchez-Moral

Diffraction stack imaging as a potential tool for detecting underground voids – the case of the ancient copper mines of Timna Valley (Israel)

Neta Wechsler, Matan Shustak & Erez Ben-Yosef

The contribution of new geophysical measurements at the previously excavated neolithic rondel area near Bylany, central Bohemia

Roman Křivánek

Book Review: Introduction to ground penetrating radar: Inverse scattering and data processing, by Raffaele Persico

Neil Linford

Evaluation of a geotechnical compaction model to estimate sediment deformation

Bradley G. Fritz, Douglas P. McFarland & Nathan R.J. Phillips

Perfect vivianite crystals excavated from a highly sealed ancient tumulus in Jing'an County, Jiangxi Province, China

Fen Huang, Chang Qing Xu, Zhi Min Jin, Mao Lin Hu & Hai Cai

Archaeological Prospection 2020: 27(2)

The Yığma Tepe of Pergamon: stratigraphic construction of a monumental tumulus from seismic refraction measurements

Rebekka Mecking, Matthias Meinecke, Ercan Erkul, Birte Driehaus, Andreas Bolten, Felix Pirson & Wolfgang Rabbel

Deep learning based automated analysis of archaeo-geophysical images

Melda Küçükdemirci & Apostolos Sarris

Fusion of geophysical images in the study of archaeological sites

Alexandra Karamitrou, Petros Bogiatzis & Gregory N. Tsokas

New historical data on the Teutonic Order crusades in Prussia: geophysical and archaeological research into an earth-and-timber stronghold and city of the 1230s at Starogród, northern-central Poland

Marcin Wiewióra, Bogusz Wasik, Paweł Molewski, Krzysztof Misiewicz, Wiesław Małkowski & Miron Bogacki

An accessible, agile and low-cost workflow for 3D virtual analysis and automatic vector tracing of engravings: Atlantic rock art analysis

Mariluz Gil-Docampo, Simón Peña-Villasenín & Juan Ortiz-Sanz

Genesis of magnetic anomalies and magnetic properties of archaeological sediments in floodplain wetlands of the Fossa Carolina

Andreas Stele, Jörg W.E. Fassbinder, Joachim W. Härtling, Jens Bussmann, Johannes Schmidt & Christoph Zielhofer

Geophysical survey of the Iberian site (seventh–third centuries bc) of Masies de Sant Miquel (Catalonia, Spain). Interpretative challenges of geophysical data of an Iberian town

Roger Sala, Helena Ortiz, Joan Sanmartí, Ekhine Garcia-Garcia, Maria Carme Belarte, Jaume Noguera, Jordi Morer, Eduard Ble, Josep Pou, David Asensio & Rafael Jornet

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