ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

Issue 55

December 2018

ISAP Fund report: micro-geophysical investigations of a macro-geophysical feature

90th Birthday of Prof Irwin Scollar

2018 International Aerial Archaeology Conference

Editorial

Dear Members,

Issue 55 starts with a report about a geophysical anomaly that was not detected during subsequent excavations - an event always leading to interesting discussions ("false positives"). Kris Lockyear was asked to do further geophysical measurements at the site and with support from the ISAP-Fund he was able to shed some light on this peculiar feature.

One of the pioneers of archaeological prospection, Prof. Irwin Scollar celebrated his 90th birthday in November 2018 and several contributions by ISAP members show how he inspired generations of archaeological geophysicists and aerial archaeologists. The abstract book of the day-meeting on archaeological geophysics in London on 4th December 2018 (organised by the Near Surface Geophysics Group - NSGG) was dedicated to Prof. Scollar and all the attendees signed a special copy, which I was able to present to him afterwards. He really liked this special gift.

In 2018 another extremely interesting conference was held by the Aerial Archaeology Research Group (AARG) and some highlights are summarised in a short article. There was even some geophysics presented.

We are currently thinking about ways to make the newsletter more readable for you as we assume that only few people are printing the whole pdf. Please let us know which devices you use to read it and what format would work best for you. In this issue we have experimented, for example, with single-column and double-column layouts and are contemplating A5 size pages.

We had few submissions of articles for this issue of the newsletter and it may hence be worth stressing that in addition to the standard 700-word articles we also would like to present single images of fieldwork or data with a couple of lines of text. What better way to show your favourite results to a larger audience.

With best wishes for a successful spring with only tolerably muddy fields...

Armin Schmidt

editor@archprospection.org

The Cover Photograph shows one of the the magnetic susceptibility surface surveys undertaken at Vulci. (see p. 3).

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Looking for the invisible: a micro-geophysical investigation of a macro-geophysical feature

Kris Lockyear[1], Corinna Riva[1] and Ellen Shlasko[2]

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ISAP-Fund Completion Article

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Introduction

The Etruscan city of Vulci lies 97 km north-west of Rome, Italy. In 2016, as a preliminary stage of a project to examine the Etruscan economy, KL was asked to undertake a gradiometer survey of the putative riverine port for the city. As well as the obvious basalt road, a series of rectangular magnetic anomalies were found (Figure 1). The largest anomaly is about 40 m long and 15 m wide.

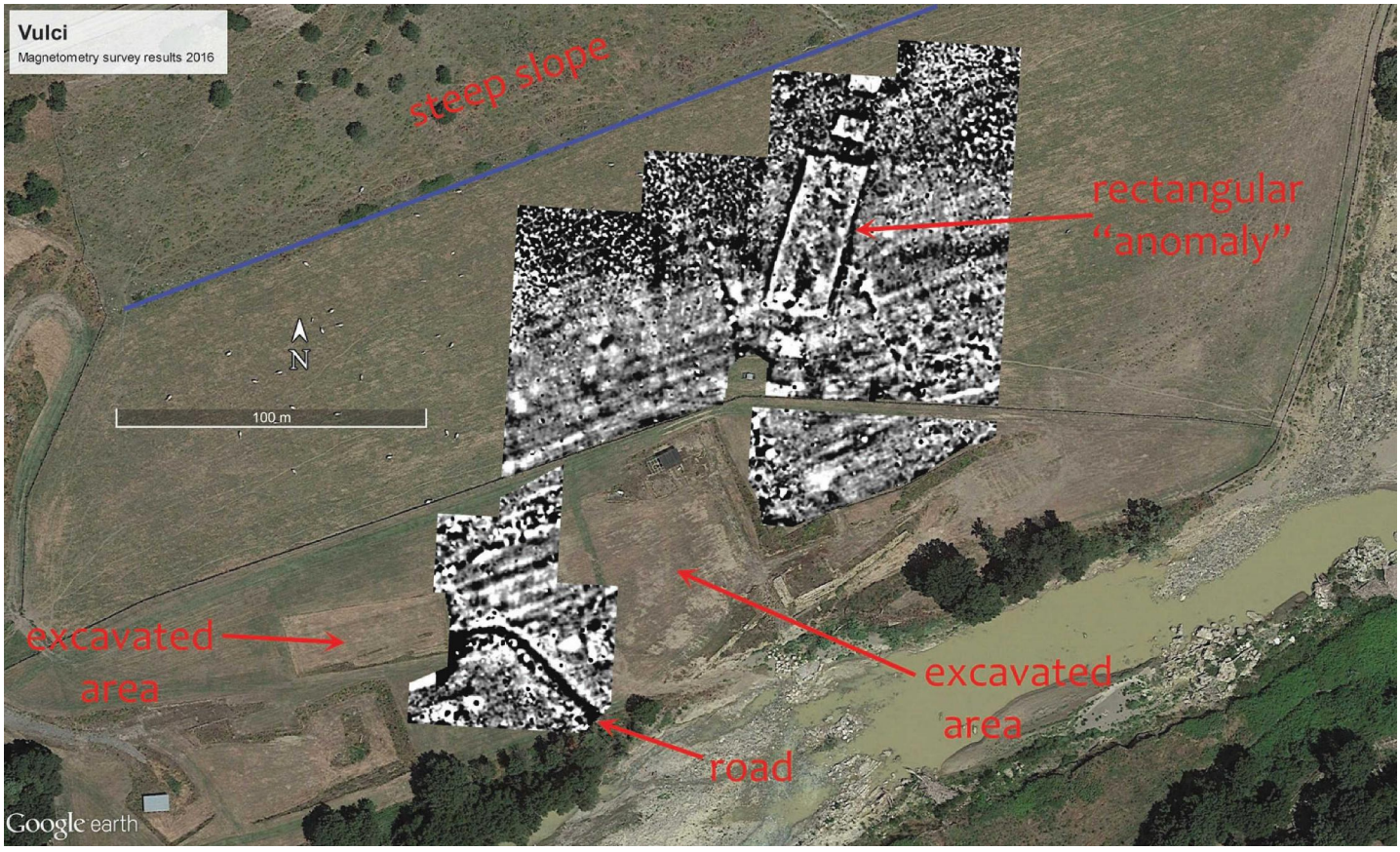


Figure 1: *The magnetic survey results.*

Later in 2016, the British School at Rome undertook a GPR survey over the same area. The survey was very inconclusive. Very few high amplitude reflections were detected, and certainly nothing as clear as the magnetometry results was seen (Hay 2016).

A subsequent machine-excavated trench across one side of the anomaly failed to locate anything visually that could explain the magnetometry results.

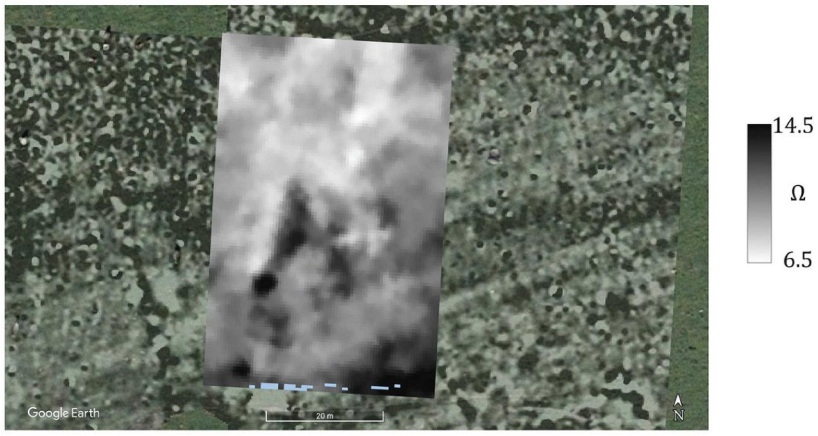
Archaeologists will sometimes say 'the geophysics didn't work' meaning that the survey results did not reflect the visible archaeological phenomena. The geophysical readings are, however, a reflection of physical properties of the underlying sediments. Usually the cause of the uncertainty is that the measured property (magnetism, *etc.*) is insufficiently differentiated between the background and the archaeological target compared to other properties such as colour. In the case of this particular anomaly, we have the opposite problem: the magnetometer readings quite clearly indicate a large rectangular feature that was not reflected either in the GPR results, or visually.

The aim of the project reported on here was to undertake a more detailed investigation of this feature in order to identify what is creating the strong magnetic responses, and to test methods of investigation of such 'invisible features.'

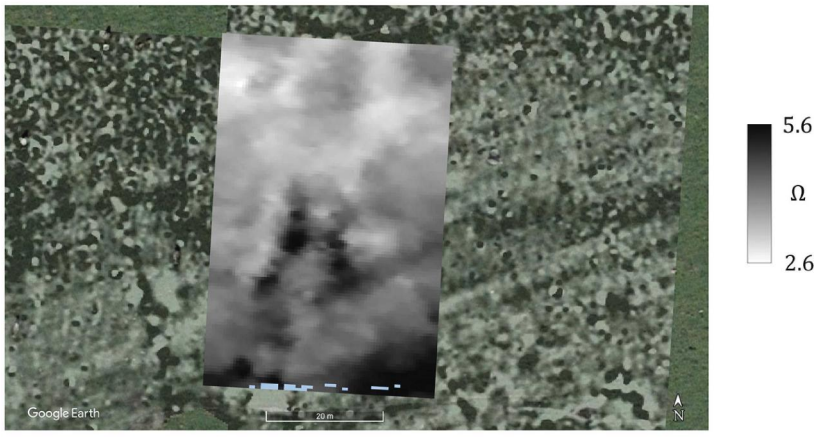
Further area surveys

As a first stage, a 60 m x 40 m earth resistance survey was undertaken using an RM85 meter in a pole-pole configuration. Using the built-in multiplexer, we took 0.5 m mobile probe separation readings on a 0.5 m x 0.5 m grid, and 1 m separation readings on a 0.5 m x 1.0 m grid. The data were downloaded into TerraSurveyor for processing and the results are presented in Figure 2.

(a) 0.5m mobile probe spacing



(b) 1.0m mobile probe spacing



(c) Gradiometry results

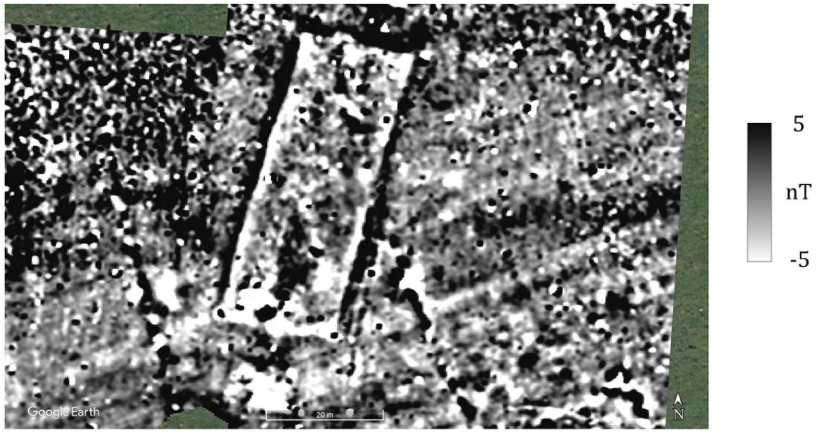


Figure 2: *Results of the earth resistance survey.*

The results do not appear to show any significant archaeological features, and certainly nothing that seems to reflect the large rectangular magnetic anomaly. This supports the results of the GPR survey. The V-shaped high-resistance feature in the middle of the area surrounded by the magnetic anomaly does not correlate with the area of high magnetic responses which runs approximately half way between the outer sides of the rectangular feature. The area of high resistance in the south-east corner of the plot would appear to be related to the

underlying geology reflected in the banding seen in the gradiometer data, reminiscent of that seen at Portus (Keay *et al.* 2005).

Despite the dry conditions, the resistance readings are relatively low. This may explain the poor results from the GPR, as highly conductive soils are not conducive to GPR survey (Conyers 2004).

Following this, a magnetic susceptibility survey was undertaken over the same area by pacing a rough 3 m grid. At each survey point, the surface was skimmed with a mattock and a reading taken on the fresh surface. A Bartington MS2 with a MS2K sensor was used. The location of the reading was then recorded using a dGPS. The results are presented in Figure 3.

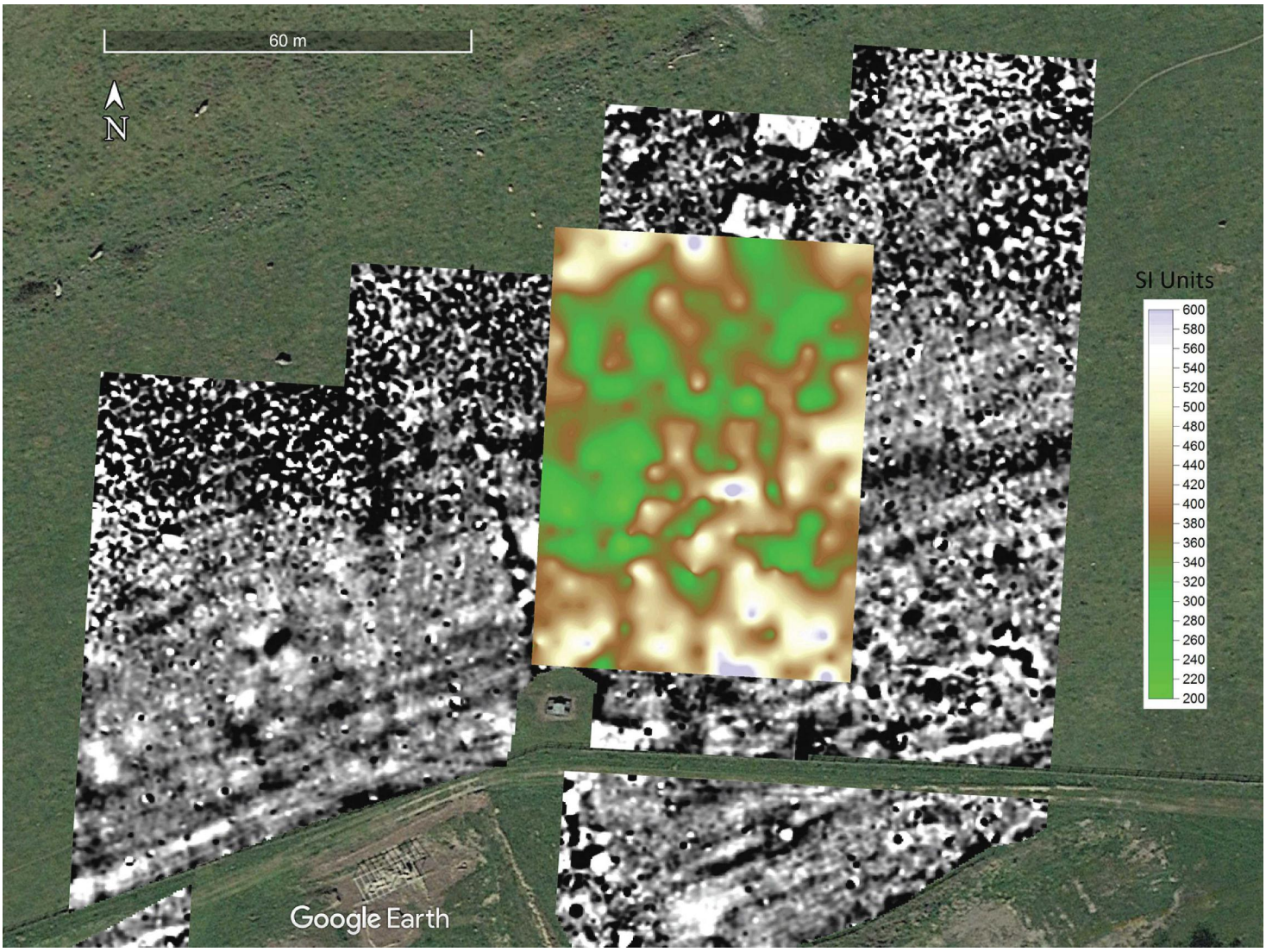


Figure 3: *Results of the surface magnetic susceptibility survey.*

They show a general trend for lower values in a broad band diagonally across the upper half of the survey area, with higher readings in the lower half. This trend reflects the underlying banding seen in the gradiometer survey. The rectangular anomaly is not visible in the results. We can, therefore, discount the possibility that a relatively modern event that impacted the surface soils was responsible for the gradiometry results.

The excavation

A 4 m x 1 m trench was laid out across the western edge of the magnetic anomaly. The top 20 cm were removed by machine and then cleaned by hand. Magnetic susceptibility readings were then taken in a 10 cm grid across the surface using the MS2K sensor (see cover image of this issue). As the long-horned cattle were returned to the field each evening, maintaining neat trench edges proved challenging!

The cleaned surface after the removal of spit 1 by machine, showed very little visible variation (Figure 4). The soil colour and texture were fairly consistent across the trench and appeared to be the lower part of the A horizon. The magnetic susceptibility readings, however, suggested a diagonal split into a low susceptibility area to grid north and a high susceptibility area to grid south (Figure 4, left).

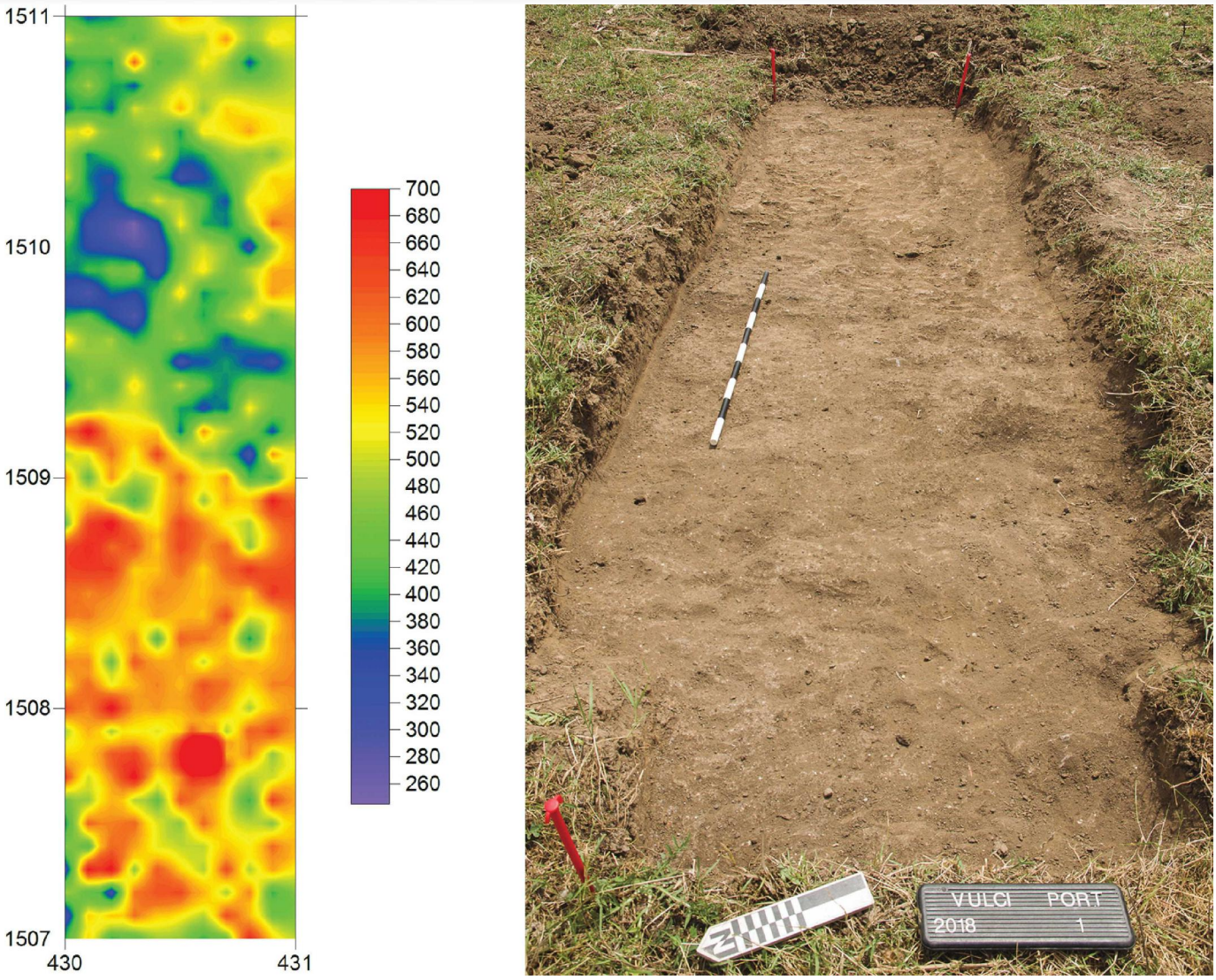


Figure 4: *Spit 1. Note the damage to the sections caused by the cattle*

Removal of another 15 cm spit by hand revealed two contexts. These were of broadly similar colour, with context 2 to grid south being a dark brown (10YR 3/1) clayey silt and context 3 to grid north being a yellowish brown (10YR 5/4) silty clay. The interface between the two contexts is shown in Figure 5, left, by the white line. Context 2 generally had a higher magnetic susceptibility than context 3, suggesting higher levels of organic and/or burnt material in its make-up (Figure 5, left).

We managed to excavate and record seven spits in the time available, and the visible differences continued with depth, although became much less marked geophysically. A three-dimensional rendering of the results helps to visualise the feature more clearly (Figure 6).

Discussion

Prior to the original machine-cut test trench we had speculated that the anomaly was the result either of burning or of a concentration of igneous rocks. The GPR results suggested that the latter was unlikely, and indeed very few rocks, and none of any size, were recovered from our test trench.

The original machine-cut trench showed no visible evidence of burning that might account for the high readings seen in the gradiometer survey. The high readings may be the result of the sheer bulk of context 2, combined with a relatively high magnetic susceptibility of the material.

The date of the feature remains unknown. The finds from context 2 consisted of a very small number of very small sherds, which must be residual material, given we are on the edge of a major Etruscan and Roman town. The occurrence of the feature at about 30 cm below current ground surface suggests that it is likely to be later than the Roman city, but how much later is unknown.

The initial aim of this project was to see if careful use of geophysical survey techniques could identify a feature not visible to the human eye. Spit 1 clearly showed that this was possible (Figure 4), but as we excavated more

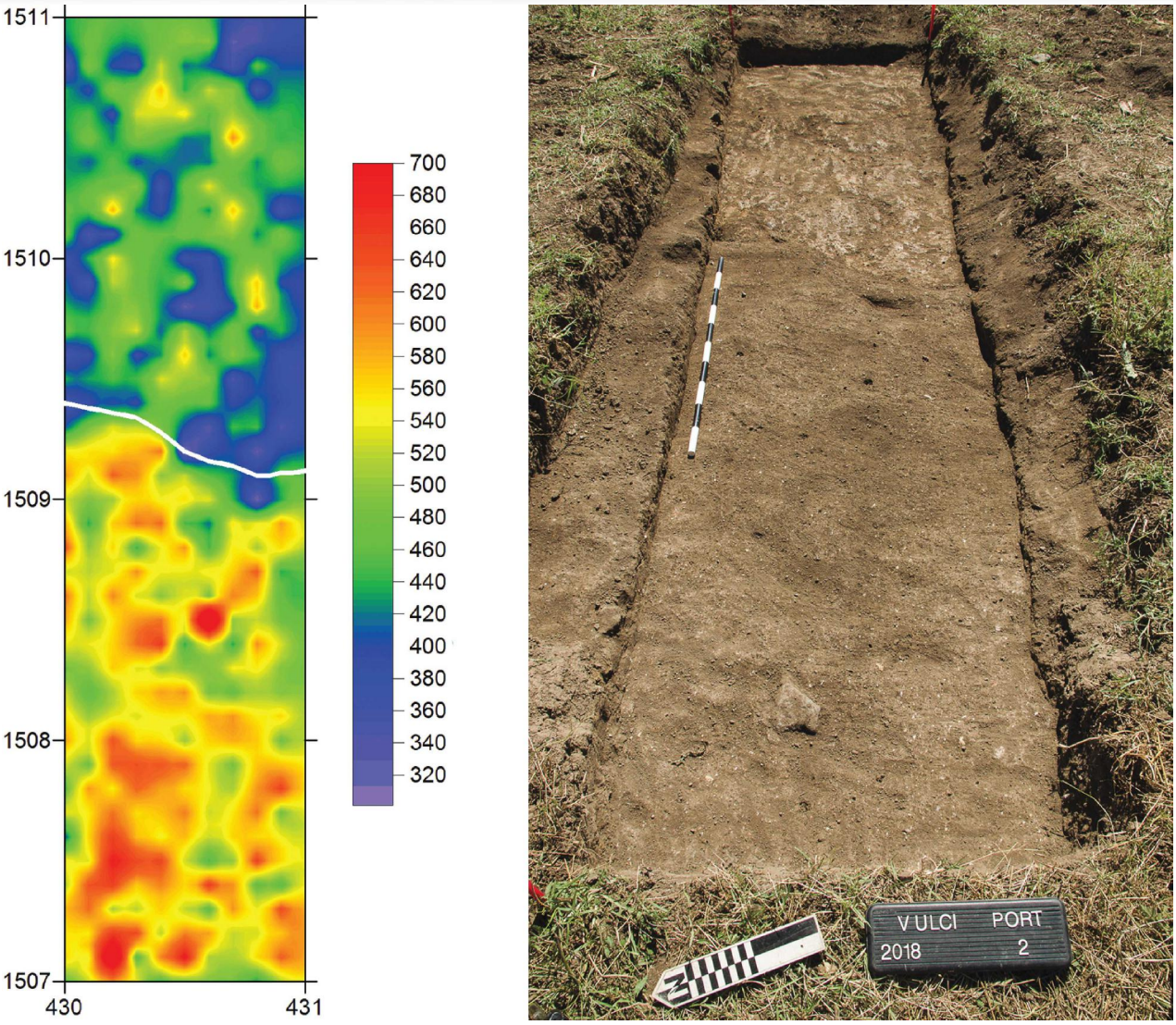


Figure 5: *Spit 2. The white line indicates the edge between the two contexts based on colour and texture, as planned in the field.*

deeply it became clear that we could see two contexts, and these two contexts were reflected in the magnetic susceptibility readings. We have, through this short piece of work, managed to identify the origin of the magnetic features seen in the gradiometer survey (Figure 1), although their interpretation remains open.

One clear lesson, and one which will not come as a surprise to geophysically-minded archaeologists, is that the interpretation of survey results requires careful consideration of formation processes.

The use of geophysical techniques in an excavation is comparatively rare, at least in the UK, despite the benefits that have been demonstrated in the past (*e.g.* Lyall & Powlesland 1996). Magnetic susceptibility survey seems especially appropriate at the small scales usually encountered during excavation (see, for example Dalan 2008) and has proved successful here.

Acknowledgement

The authors would like to thank the Fondazione Vulci, the Soprintendenza Archeologia, Belle Arti e Paesaggio per l'area metropolitana di Roma, la provincia di Viterbo e l'Etruria Meridionale for enabling this project, and ISAP for the grant which allowed this research to take place. A full version of this report is available from the first author.

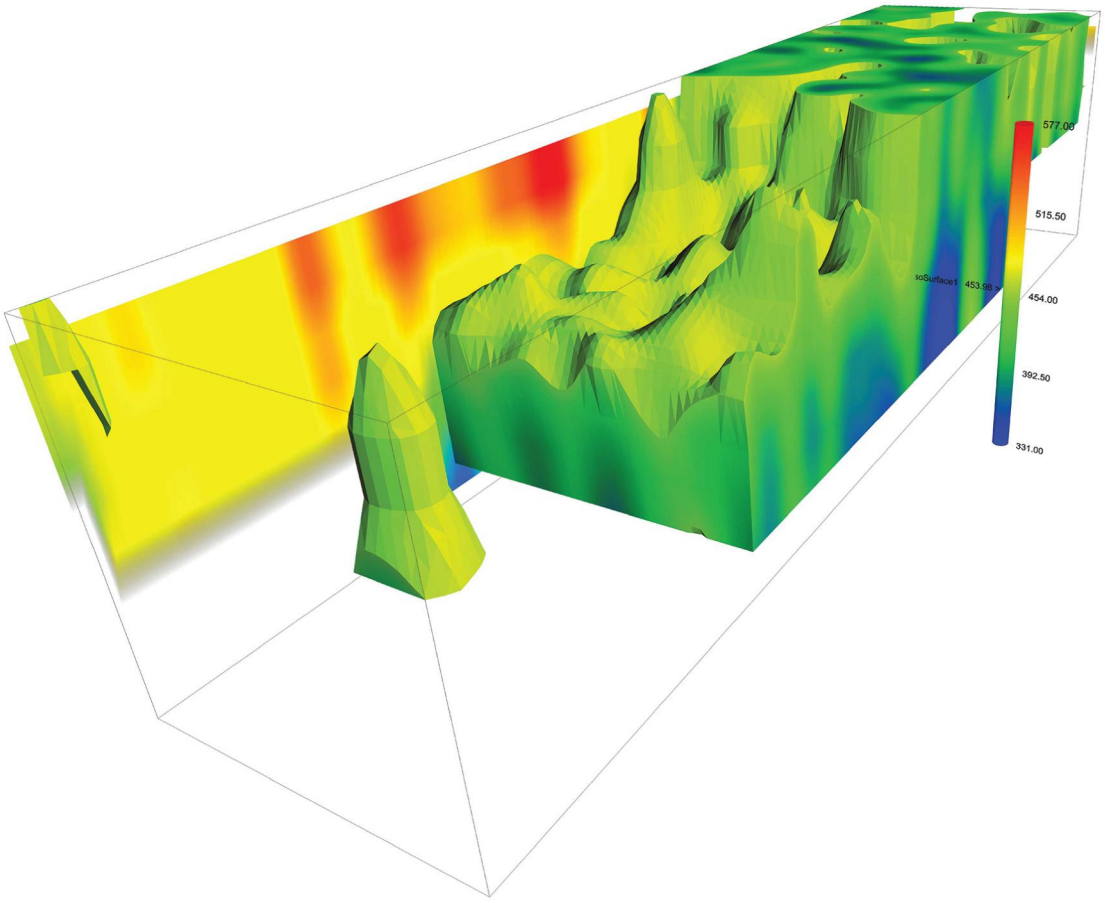


Figure 6: *Three dimensional representation of the data using TerraSurveyor 3D.*

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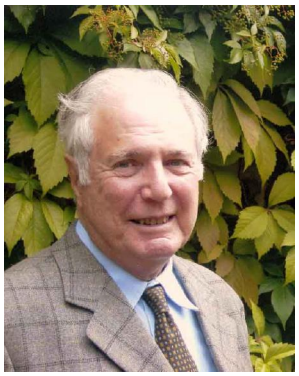
90th Birthday of Prof Irwin Scollar

Contributions by ISAP members



Irwin Scollar has shaped archaeological geophysics and aerial archaeology with many amazing innovations and the famous "black book" (1990). He has celebrated his 90th birthday in November 2018 and many ISAP members have benefitted from his immense wealth of knowledge. The contributions of ISAP members below are testimony of the profound influence he has had on the discipline. An online version of this text can be found at archprospection.org/prof-irwin-scollar .

Chris Gaffney (ISAP Chair) and Armin Schmidt (ISAP Honorary Secretary)

Short Curriculum Vitae

Irwin Scollar was born in 1928 in New York City. He completed his BSc degree in Electrical Engineering at the Lehigh University in 1948 and graduated from Columbia University in 1951, where he studied Classical Archaeology. In 1959 he received his PhD in Prehistoric Archaeology at Edinburgh University, UK. He moved to Germany in 1959 to work at the Rheinisches Landesmuseum in Bonn and retired in 1991. Important milestones of his professional career in archaeological prospection were the introduction of systematic aerial photography from 1959, the systematic research and application of geophysical prospection from 1960 and the computer evaluation of archaeological sites in Germany from 1961. One of his great achievements was the design and installation of the first large-scale system for computer image processing in archaeology in 1975. The volume 'Archaeological Prospection' published by Scollar *et al.* (1990) is still a standard, summarizing his important contributions to this field of research. In addition to his work at the Rheinisches Landesmuseum, he received a lectureship at Bonn University between 1961 and 1966. From 1970 to 1974 he was consultant to the Gesellschaft für Mathematik und Datenverarbeitung for image processing methods. Since 1980 he held a lectureship at the University of Cologne in computer methods for archaeology and in 1989 received an honorary professorship at Cologne.

More details and a list of references can be found at the University of Cologne, on ResearchGate and on Academia.edu.

From the booklet of the International Conference and Workshop Pioneering Archaeological Prospection, Laa, Austria 2011 (Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology)

An Inspiration

Ever since I started in archaeological prospection Irwin's publications and thoughts were an inspiration. Always sharp and ahead of its time there were insights amass. So I hunted down even the most obscure references. Here is a short extract (my translation) from Scollar, I. (1974). Einleitung. In E. M. Wilkinson, C. E. Mullins and A. Tabbagh (eds) Technische und Naturwissenschaftliche Beiträge zur Feldarchäologie: vi-viii. Köln: Rheinland-Verlag GmbH.

> *"All contributions of this volume of Archaeo-Physika require the reader to have specialised knowledge in physics and mathematics. Even if the older generation of archaeologists may feel excluded, the hope is that in future the propspects for this area of research will be better. Experts in archaeological organisations with the required scientific background will have no difficulties to fully appreciate the articles by Wilkinson, Mullins and Tabbagh."*

Similarly ahead of its time were the software developments for air-photo rectification (airphoto). And when I complained to Irwin in 2014 about the end of support for the full package AirPhoto3 in favour of the free and user-friendly(!) AirPhotoSE, he just commented: "You are probably the last who still uses the gazillions of options in AirPhoto3". And this was not meant as a compliment!

Armin Schmidt (Honorary Secretary ISAP, and Dr Schmidt - GeodataWIZ)

From the early days ...

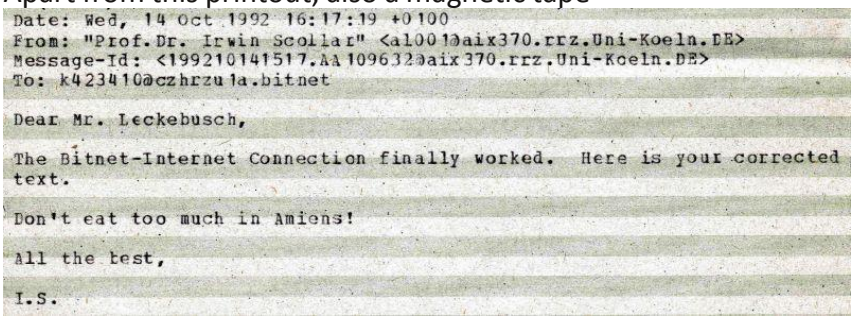
I had my first contact with Irwin in 1983 when I was at high school and wanted to build a bleeper. At that time there were not many magnetometers around and hence I wanted to build an acoustic proton-magnetometer (for those of you who don't know what a bleeper is). I wrote him a letter and got a response about hundred times longer than what I had written. He explained all the details and gave a lot of tips in this first letter and in all the others following. I was

really surprised that one of the most advanced scientists in archaeological prospection helped me so much (we only met in person much later). The first letter I wrote was in German but he answered in English and this has not changed until today.

Later on I visited him at the Landesmuseum in Bonn and I remember very well the lunch we had together. I expected that we would go to a restaurant, but Irwin simply took some sheets of the coloured printer paper (Figure 1) used it as a tablecloth in front of the screen and started eating... Life can be so easy.

Living with computers was very different in those days. The printing paper mentioned, for example, had grey and blue stripes. Some of these sheets survived with me so that I can show one of the email replies from Irwin (Figure 1). As one can see the Internet was very difficult to navigate at that time as there were different independent networks. Sending a message from one network to another was a complicated affair. You had to know the path of your message in advance and then use the appropriate syntax using semicolons or commas instead of a point etc. Therefore there were complete Internet Mailing Guides you had to consult before sending a message.

Apart from this printout, also a magnetic tape


Date: Wed, 14 Oct 1992 16:17:19 +0100
From: "Prof.Dr. Irwin Scollar" <al0010@aix370.rrz.Uni-Koeln.DE>
Message-Id: <199210141517.AA109632@aix370.rrz.Uni-Koeln.DE>
To: k423410@czhrzu1a.bitnet

Dear Mr. Leckebusch,

The Bitnet-Internet Connection finally worked. Here is your corrected text.

Don't eat too much in Amiens!

All the best,

I.S.

Figure 1: *early 'email' communication.*

survived, which I have kept. It is labelled: ANSI LABEL, magpic, FILE=MAG.FTN, Block Size 4096. It was the main software Irwin used to create the greyscale images out of magnetic data that were published in several of his papers and books. Of course the program was written in the most advanced language at that time, in FORTRAN. All his code was running on a big VAX, an excellent computer that continued working for a very long time. Unfortunately during one night the museum raised the mains voltage by 5 V. This was a very bad morning for Irwin: When he switched on his old 'workhorse' at the start of the day, instead of the normal start-up there was only a distinct smell and some smoke…

Nevertheless Irwin never gave up and switched to more modern computers. After geophysical data processing and seriation he started working on aerial photo rectification and lately satellite data. Most of us will know the program AirPhoto and he also realised the potential of structure-from-motion at a very early time. Today this technique is used by many people to create 3D models of any type and size in archaeology.

Irwin Scollar is an archaeologist by profession and decided to use his sound technical background to help archaeologists with modern techniques, whatever that was in the period. I am very glad to know him and I am deeply grateful for all his personal help and support.

Juerg Leckebusch (Wüest Engineering AG)

Polish things

Writing this 'birthday memory' for Irwin made me realise that I've known him for more than half my life – a life that is some 15 years shorter than his own. However… In 1974, the Council for British Archaeology held what it called a 'symposium' that was later published as Aerial Reconnaissance for Archaeology edited by David Wilson. In this, Irwin had a contribution about transformation of oblique aerial photographs that included a computer method that accurately converted a point from an image into its x, y and z coordinate values. Transformation of single points is fine if your case study is a group of Roman camps, as Irwin's was, but a couple of years later I began a research project which would have as its root a map of archaeological features in 4000 sq km of Wessex. My sites were wiggly things and I needed a means of transforming those with reasonable accuracy to 1:10,560 maps. I wrote to Irwin, or Dr Scollar as he then was to me as a mere student, to ask if he thought this would be possible and we began a discussion of appropriate mathematical methods. At the same time, I was talking over the possibilities with people in the Computer Lab, Engineering and Scott Polar here at Cambridge. As Irwin would say, 'to make a long story longer', I eventually succeeded in writing a computer program that enabled me to transform sites in my area. I sent him a copy of the code and there followed an invitation to his laboratory in Bonn where I spent a month in December 1977 and ended up with a more-elegant version of my program thanks to Bernd Weidner, Irwin's assistant at that time. After a little more correspondence, with Irwin urging me to follow various mathematical ideas and me wanting to get on with my archaeological project, we lost contact for 20 years.

Early in 1998, Otto Braasch told me that Irwin was writing a program for transformation of whole oblique aerial images and I contacted him asking to be a beta tester, an offer he gladly accepted. There followed many hundred emails that, we both agree, eventually made his AirPhoto 3 a good and effective program. I used AirPhoto variants in my commercial work and for

research, and it became the program that was taught in the many workshops in continental Europe that were organised on behalf of AARG. AirPhoto was good in those contexts because output could be set to the local grid – a grid sometimes added by Irwin to the program a few days before the workshop. One case of such was a Polish grid that comprised five unequal portions and I know was a challenge for Irwin to program. Anyway, the Polish grid system was added in time for our workshop in Poznań and I suggested that we teachers should get Irwin a thank you present that I could deliver a week later when I was going to visit him.

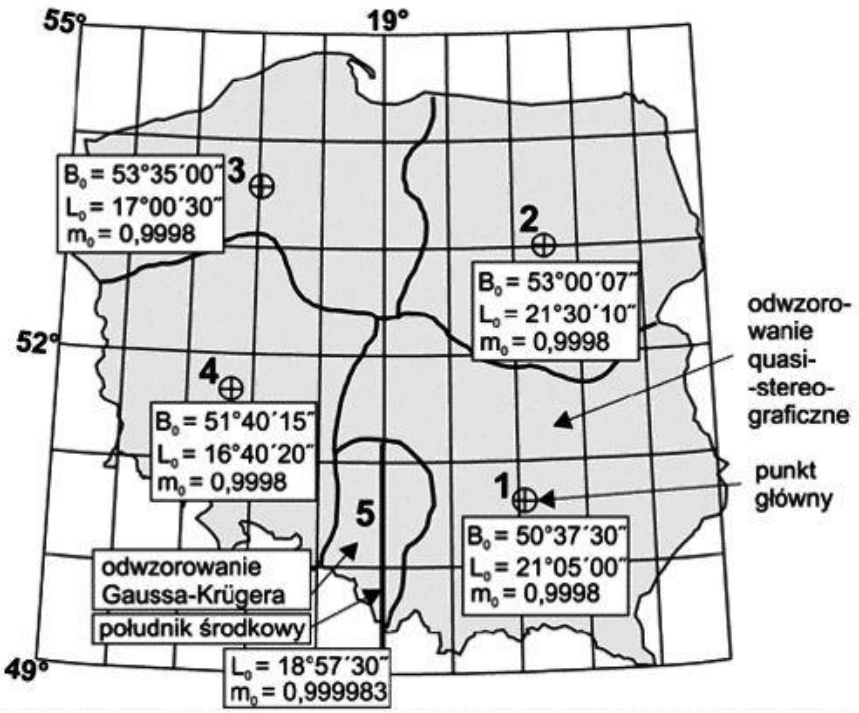


Figure 2: *Poland's division into five zones ("Strefa") in CS-1965*

At his request, we bought a Krakov sausage. It was of generous size, perhaps 20 cm long by 5 cm in diameter, which travelled back to Cambridge in my hold luggage along with some of its relatives. A week later, I set off to Stansted taking just a small backpack with the sausage packed near the top as I thought it may be something unexpected by the security people. Sure enough, I watched my bag go through the x-ray scanner once, then twice, after which a bloke called me over. Unzipping my bag, he said there seemed to be a bottle of water in it, then he pulled out the offending item. "Oh, it's just a sausage", he said and put it back. I'm good at saying the wrong thing at the wrong time, but for once I kept quiet while thinking to myself 'plastic explosive?' The sausage was duly delivered with our thanks for the Polish grid system. His wife let him have a slice but is very strict about their diet and I wondered if the rest was consigned to the bin. But the thought was there as are my best wishes to Irwin on his 90th birthday. When things have calmed down after those celebrations, I look forward to continuing our occasional Skype chats.

Rog Palmer

A delayed backfire of the Cold War

Writing this happy-birthday message made us think of some of our past contacts with Irwin and his software AirPhoto.

When Irwin arrived in Germany, the Cold War had already enveloped Central Europe in the Iron Curtain. Little could he expect that its remnants would be chasing him well into the 21st century. In 1960's the Soviets' growing paranoia to protect parameters of the Pulkovo-1942 grid system (a paranoia caused amongst many factors by the development of the Keyhole satellite surveillance programme and GPS) forced the Eastern Bloc to withdraw it from the civilian use. Instead countries of the Warsaw Pact were obliged to introduce separate coordinate systems and so the most peculiar CS-1965 was born in Poland. The entire country was divided into five irregular zones which used two different projections and false eastings and northings in each zone. Furthermore, the grids were not concordant and it was impossible to combine maps along zone boundaries. In practice it meant an introduction of five separate grid systems (Figure 2 - Poland's division into five zones ("Strefa") in CS-1965).

Although the state-of-the-art system CS-1992 was implemented after the fall of communism, CS-1965 provided a full coverage for the country and for very remote areas it is still the only set of maps at 1: 10,000. This turned out important when we started extensive aerial reconnaissance in Poland. To be able to rectify oblique aerial photographs there was no other option but to ask Irwin to add CS-1965 in AirPhoto. In Spring 2007 after little over a month of email exchanges about ellipsoids, projections and datum, frantic digs for parameters in various institutions and learning how to answer Irwin's questions, he announced a successful implementation of the system which despite its peculiarities proved fully functional.

Four years later Irwin's attempts to improve some tools prompted us to inform him that we were just witnessing the very end of CS-1965. At that time topographic maps were converted from CS-1965 into CS-1992 and full sets of maps were made available via a geoportal. To this information only one answer could come:

Subject: S65 Strefa Boundaries

Date: 2011-01-26 09:14

From: Irwin Scollar <al001@uni-koeln.de>

I'm sure that everyone will be pleased to see the end of CS-1965! I certainly will be among them. It caused me more work than any other of the 50 grid systems supported in AirPhoto.

With best wishes to Irwin on his 90th birthday from the Polish aerial team.

Lidka Żuk, Włodek Rączkowski, Wojtek Mania

A visit to Japan

The time when we were first in contact was in the early 1970s. One of the elder colleagues from the Nara National Research Institute of Cultural Properties sent several aerial photographs to him asking whether some image enhancement could be applied. Through Irwin's processing the moat of a mounded tomb, which was under a paddy field, became clear.

In the middle of 1980s, Irwin and his wife were invited to Japan as a specialist in photogrammetry by the Japanese Society of Photogrammetry and Remote Sensing (JSPRS). During their stay in Japan they visited our Institute in Nara on their way to Osaka. I had the opportunity to accompany them and introduce them to archaeological sites and historic places in the area. Irwin made several useful suggestions on archaeological prospection during our travel, especially when seeing 'black' paddy fields. The time when we saw those fields was shortly after the harvest, and the straw scattered on the surface had been burnt. He pointed out that the homogeneous top soil and the burnt straw may result in difficulties when processing magnetometer survey data from the areas.

Figure 3: *Yasushi Nishimura and Irwin Scollar at the ICAP conference 2001 in Vienna*

The photograph (Figure 3) shows us together at the ICAP conference 2001 in Vienna, where Irwin gave one of the keynotes.

Yasushi Nishimura (National Research Institute for Cultural Properties, Nara Japan)

Pioneer of Archaeological Prospection Irwin Scollar turns 90

Archaeological prospection is celebrating one of its very first pioneers: Irwin Scollar turned 90 in November 2018. Since the early 1960s, the US-born engineer and archaeologist has considerably influenced archaeological geophysics and aerial archaeology and his vast knowledge and ground-braking innovations have been an inspiration to a worldwide community in this discipline.

In October 2011 it was the LBI ArchPro's honour to jointly organize the 'Pioneering Archaeological Prospection' conference with Irwin Scollar in Austria. Some of the very first pioneers in the field, such as Martin Aitken, Mike Tite, Albert Hesse, John C. Belshé, Yasushi Nishimura, Otto Braasch and Helmut Becker presented a retrospect on the early beginnings of archaeological prospection.

To mark the birthday of this highly respected luminary we have compiled recordings from the conference session as well as from a personal interview with Irwin Scollar in 2013: https://youtu.be/fTQjtttmDf0

The linked article was written by LBI ArchPro historian Roland Filzwieser and is based on a series of face-to-face interviews he did with Irwin Scollar in 2011: https://archpro.lbg.ac.at/archpro-pioneer-irwin-scollar-turns-90

Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology

2018 International Aerial Archaeology Conference

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The 2018 International Aerial Archaeology Conference, organised by the Aerial Archaeology Research Group (AARG) was held from 12th-14th September 2018 in Venice, Italy (conference web site https://bit.ly/2OcI2HK and on Twitter @AARG_Venice2018 https://bit.ly/2OgQLJ4). The 35 oral and 22 poster presentations were grouped into 6 sessions and delivered in the splendid rooms of Ca' Foscari University of Venice. The audience might have been forgiven for being distracted by the opulent design of the conference hall - but it turned out that the interesting presentations kept everyone captivated.

While in the past aerial archaeologists, like archaeological geophysicists, were sometimes accused of indulging in 'stamp collecting' of images or data, this conference proved how far the subject has evolved and how diverse the topics are that are now embraced under the AARG umbrella. In this regard it was clearly mirroring the diversity shown in archaeological geophysics at ICAP2017 in Bradford. The following summaries of papers is a reflection of my own interests and not an evaluation of these presentations. The informative abstracts are available online and are well worth reading: https://bit.ly/2PsclPr .

The topics discussed in the conference can broadly be grouped into four categories: optical and radar imagery from different platforms (satellite, aircraft and UAV), Airborne Laser Scanning (ALS), data and image processing, and archaeological interpretation. While the different image acquisition techniques are traditionally linked to specific study areas and practices (e.g. earth observation remote sensing), the products are mainly distinguished through their spatial resolution and (multi-spectral) bandwidth. This is linked to some differences in the required data processing, with multi-spectral evaluation and pan-sharpening dominating satellite data, and structure-from-motion (SfM) image fusion being a necessary approach for UAV-acquired images. By contrast the topography information from ALS data is often an excellent complement to image data from aforementioned techniques. The link between ALS investigations and traditional image-based approaches is the study of archaeological landscapes that is important when analysing the results. The final interpretative steps are increasingly aided by automated data analysis and the vast advances of Artificial Intelligence (AI) in many subject areas are now also being harvested in aerial archaeology.

Charles Yuill presented results from different techniques assisting with the assessment of the new Appalachian Geopark. This included the 3D recording of cave systems with UAVs using the SLAM algorithm for the navigation in these places where GPS and line-of-sight steering is not possible. The SLAM algorithm can be considered as continuous SfM processing that outputs 3D data and the location of the platform continuously. Unfortunately it can suffer from drift but the cave system was mapped successfully with this UAV technique.

While data acquisition can be made fairly objective (even if preconceived ideas of the project team may influence technological decisions), the archaeological interpretation of resulting data is, by necessity, interpreter-related, and hence subjective. Lukasz Banaszek presented the initial results of a test whereby eight interpreters with different skill levels were presented with the same ALS data from Scotland's Arran region. Their individual interpretations and mapping were compared, showing interesting differences.

A paper bridging topics from ALS data analysis to

processing and interpretation was presented by Michael Doneus, demonstrating how the stratigraphy of intersecting ALS features can be recorded in a large Harris Matrix (including approximate dates for certain features, e.g. 'late monastic phase') that then helps to unravel the chronology of the whole landscape, which he considers to be more than the often quoted 'palimpsest', since it has an internal chronology.

Ulrike Fornwagner reported new developments of the APIS archiving system for aerial images, including the calculation of the photographs' footprints from the meta-data recorded by the camera system (position and attitude). All this is made wrapped into a familiar user environment through a QGIS plugin.

A very topical presentation by Rosa Lasaponara and Nicola Masini demonstrated advances in using satellite data to detect and monitor the looting of archaeological sites using various algorithms that help with the identification of archaeological looting features (ALF).

Remote sensing data, historical images and new 3D models were used by Lenka Starková for the virtual reconstruction of some of the destroyed historical monuments in Mosul.

Peter Halkon focused on the barrows in Arras, in the Yorkshire Wolds, and compared the archaeological features that were recorded in aerial photographs of different seasons. Interestingly, geophysical surveys by Martin Aitken from 1959 provided a ground record that helped to evaluate the aerial results.

Using the evocative title 'low passed landscapes' Piotr Wroniecki demonstrated that the impact of ploughing on earthwork-features is comparable to low-pass filtering their ALS data. Some members of the audience, who questioned why one would use low-pass filters on ALS data were reassured that this was a curiosity driven exploration, rather than a new processing technique.

The current practice of regular and pre-programmed flight paths for UAV mapping was challenged by Juergen Landauer who proposed to use SLAM algorithms (see above) to adapt automatically the flight paths of UAVs to optimise coverage of recorded objects, thereby converting them to Unmanned Aerial Robots (UARs).

An interesting crossover from aerial data to geophysical survey was presented by Till Sonnemann who showed how surface models derived from drone-photogrammetry can be used for the topographic correction of GPR data.

The increasingly popular use of drone photogrammetry for the documentation of archaeological excavations was explored by Diego Calaon who compared the detailed recording of excavation results by manual drawings in the trench with the digitisation of orthophotos of the trench created from drone images. It showed clearly that the additional information available inside the trench (e.g. vertical sections, 3D shapes) helps to understand and map some of the more complex contexts.

The conference was closed with a panel discussion by Dave Cowley and Peter Halkon centred on the topic 'Can we stop flying now?'. The discussants and the audience agreed that this is not the case, especially in light of the exceptional results from the dry summer of 2018.

AGM: AARG and ALI

iThe conference was followed by the AGMs for AARG and ArchaeoLandscapes International (ALI) with some topics of interest to ISAP members. AARG had decided that their half-yearly newsletter would become Open Access and this has now been implemented https://bit.ly/2qhQegh. Also the studentships for attending the AARG conferences were well funded and supported six students. ALI, of which both AARG and ISAP are the two 'parent organisations' is supporting international funding applications through its membership network. This allows identifying project partners and providing expertise in the many aspects of archaeological prospection.

Overall this very well organised conference provided an enjoyable framework for the exchange of ideas and highlighted some of the new developments within the remit of aerial archaeology.

The images in this article were taken from the conference's Twitter feed (see above).

Journal Notification

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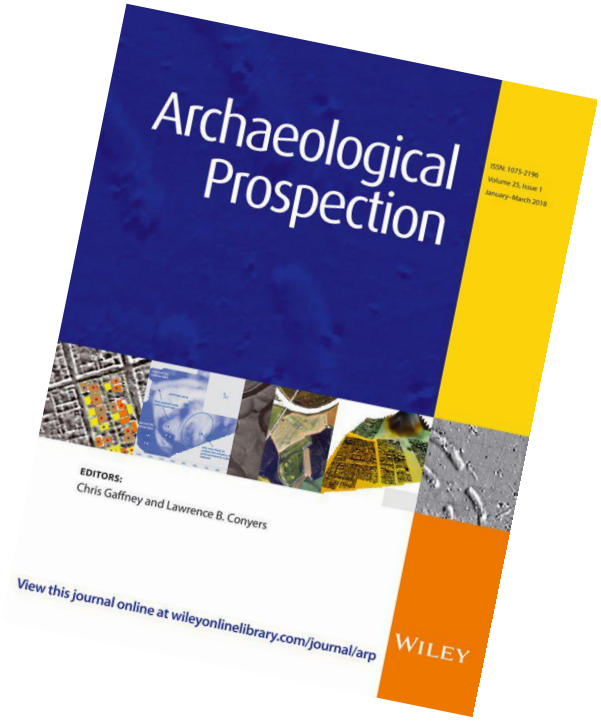

Large-area high-resolution ground-penetrating radar measurements for archaeological prospection

Immo Trinks, Alois Hinterleitner, Wolfgang Neubauer, Erich Nau, Klaus Löcker, Mario Wallner, Manuel Gabler, Roland Filzwieser, Julia Wilding, Hannes Schiel, Viktor Jansa, Petra Schneidhofer, Tanja Trausmuth, Vlad Sandici, David Ruß, Sebastian Flöry, Jakob Kainz, Matthias Kucera, Alexandra Vonkilch, Tomáš Tencer, Lars Gustavsen, Monica Kristiansen, Lise-Marie Bye-Johansen, Christer Tonning, Thomas Zitz, Knut Paasche, Terje Gansum, Sirri Seren

Preliminary results of an integrated archaeo-geophysical survey on the basis of ancient finds unearthed by an illegal excavation at Kılıç Ören site (Isparta, Turkey)

Sedat Yilmaz, Erdinc Oksum, Olcay Cakmak, Onur Dogan, Erkan Tekelioğlu

Very-high-resolution electrical resistivity imaging of buried foundations of a Roman villa near Nonnweiler, Germany

Osamah Saad Al-Saadi, Volkmar Schmidt, Michael Becken, Thomas Fritsch

Capabilities of consistent application of geophysical and geochemical surveys of medieval settlements destroyed by plowing

Igor V. Zhurbin, Alexander V. Borisov

Three-dimensional modelling of a pre-Aksumite settlement at the archaeological site of Seglamen, Aksum, northern Ethiopia using integrated geophysical techniques

Assefa Getaneh, Tigistu Haile, Luisa Sernicola

Complex prospection of medieval underground salt chambers in the village of Wiślica, Poland

Tomisław Gołębiowski, Bernadetta Pasierb, Sławomir Porzucek, Monika Łój

Durrington walls and the Stonehenge Hidden Landscape Project 2010–2016

Vincent Gaffney, Wolfgang Neubauer, Paul Garwood, Christopher Gaffney, Klaus Löcker, Richard Bates, Phillipe De Smedt, Eamonn Baldwin, Henry Chapman, Alois Hinterleitner, Mario Wallner, Erich Nau, Roland Filzwieser, Jakob Kainz, Tanja Trausmuth, Petra Schneidhofer, Georg Zotti, Agatha Lugmayer, Immo Trinks, Alexander Corkum

Geophysical prospection pilot in rock-cut tombs: The case study of Anghelu Ruju necropolis (Sardinia)

Valeria Testone, Vittorio Longo, Paola Mameli, Daniela Rovina

Book Reviews

Anthropological research framing for archaeological geophysics: Material signatures of past human behaviour

Chrys Harris

Archaeological remote sensing in North America: Innovative techniques for anthropological applications Edited by Duncan P. McKinnon & Bryan S. Haley, the University of Alabama Press, Tuscaloosa, AL, 2017, 304 pp., $59.95, ISBN 978–0–8173-1959-5 (hardcover), ISBN 978–0–8173-9141-6 (eBook)

Rinita A. Dalan

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