



**International Aerial
Archaeology Conference
AARG 2018**

**Venice, Italy
12th-14th September 2018**

SCIENTIFIC
PROGRAMME



ORAL PRESENTATIONS

Wednesday, September 12th 2018

9:30-11:10 am

Session 1. Local session: Aerial Archaeology in Italy: the last 15 years

This session features papers on aerial archaeology in Italy and is open to papers dealing with a critical, retrospective view of the aerial archaeology in Italy during the last 15 years. Papers should consider lessons learned, key issues, future challenges and opportunities for innovative approaches.

Chaired by Arianna Traviglia

9:30-9:50 am

Aerial photography in the Potenza Valley Survey – *A chi vuole, non mancano modi*

Geert Verhoeven, LBI ArchPro

Frank Vermeulen, Ghent University

This presentation will ponder the aerial archaeology part of the Potenza Valley Survey (PVS). Since the project start in 2000, the main aim of the PVS has been the study of the settlement dynamics along circa 400 km² of the Potenza river valley in central Adriatic Italy (Marche).

This presentation contains three parts (past, present and future), of which the first deals with the airborne data acquisition approaches employed in the PVS during the first decade. Although the gathering of aerial imagery predominantly relied on standard photography from small Cessna's using observer-based sorties, non-visible imaging and unmanned platforms were also part of the toolkit the PVS came to rely upon.

The second part will offer some present-day technological-methodological-theoretical reflection on these airborne imaging solutions. Using "what-if" scenarios, the effectiveness and suitability of the past PVS approach for "doing landscape archaeology" at the scale of a river valley will be called into question. Could we have employed strategies to decrease the subjectivity and bias when collecting airborne imagery?

In the third and final part, the presentation will discuss some future challenges and opportunities for interpretative mapping. Irrespective of the possible data acquisition issues tackled in part two, most forms of aerial photography can deliver meaningful insight about the past if proper post-acquisition pipelines are in place. Two recent PVS mapping projects will illustrate this. Mapping of the Montarice shows how to avoid slow single-image workflows and extract new topographical clues. The Monte Primo case study illustrates how to obtain a full 3D interpretative map.

9:50-10:10 am

Integrated Prospection in Western Sicily: contributions from the Prospecting Boundaries Project

Christopher Sevara, University of Vienna

Michael Doneus, University of Vienna



Roderick Salisbury, University of Vienna
Erich Draganits, University of Vienna
Cipriano Frazzetta, University of Vienna
Sebastiano Tusa, Assessorato Regionale dei Beni Culturali e dell'Identita' Siciliana

Nearing the end of its third and final year, the Prospecting Boundaries project has achieved a new understanding of the archaeological and historical landscape along the Mazaro River, in the hinterlands of Mazara del Vallo. Building on aerial photography campaigns conducted by the University of Vienna in 2003-2004, the project has focused on the use of airborne laser scanning, geophysical prospection, geoarchaeology, historic imagery analysis and historic landscape characterisation to document and interpret modern, historic and prehistoric land use along the Mazaro River. As a result of our methodological developments of integrated prospection in Mediterranean environments, the influence of geomorphological processes on archaeological surveys can now be visualized. Moreover, not only we have located important new archaeological resources, we have gained new insights of the importance of those resources in relationship to the cultural and environmental landscapes of the later pre- and protohistoric periods. In particular, indicators of indigenous archaic period settlement have been found in areas previously thought to be devoid of such sites. In this paper, we present some of the current results of our research, and we examine the role integrated methods have played in bringing the focus of our research from site to landscape in western Sicily.

10:10-10:30 am

The role of aerial photography in the study of high ground settlements in the pre-Roman Abruzzo

Guglielmo Genovese, University of L'Aquila
Alessandra Bassi, Cultural association ARESLab
Ferdinando Marino, Cultural association ARESLab

The University of L'Aquila and the cultural association ARESLab recently began the investigation of the settlement system of the pre-Roman Age in Abruzzo, in particular in the Sirente Valley. In the first stage of the study the approach is based on the landscape archaeology methodology, the aerial and satellite photography interpretations and remote sensing analysis. The Roman conquest process represents a moment of great anthropic transformation of the Appennino abruzzese. Settlement typology change from a dense group of small settlements distributed uniformly on the territories of the Apennines slopes and on the low altitude hilltops to a system of larger settlements with a more complex structure, in line with the Roman mentality and culture. Consequently, the whole aspect of the landscape shows a transformation that, so far, has been studied only through the examination of historical sources. The purpose of the research is to identify and define the relationships between the various settlements in the period preceding the Roman conquest, through the examination of some known case studies and their comparison with the unpublished fortified site of Colle Santoieri, a settlement whose discovery is part of the "Superequum Survey Project", a joint research project between the University of L'Aquila, the cultural association ARESLab and the local institutions that intends to investigate the archaeological area of the ancient Superequum.

10:30-10:50 am

"Where do we go from here?" A perspective on aerial archaeology in Altinum, Italy

Luigi Sperti, Department of Humanities, Ca' Foscari University of Venice
Silvia Cipriano, Borgoricco Centuriation Museum



Angela Paveggio, Ca' Foscari University of Venice
Eleonora Delpozzo, Ca' Foscari University of Venice

Altinum was a Roman city on the via Annia, located not far from the modern city of Venice; during the Late Antiquity it was abandoned and plundered mostly to reuse its building materials. Because of this, the city is now preserved underground, in an unurbanized area. Starting from the 20th century, parts of the archaeological deposit were investigated; during these researches, the attention of scholars and professionals was primarily focused on the necropolis and funerary contexts. As a result, limited data regarding the ancient city and its forma urbis are available nowadays. A noteworthy contribution to the comprehension of these aspects was provided by historical cartography and several aerial photographs of the area, taken in different years: thanks to this, it was possible to identify buildings, roads, and other urbanistic markers. Since 2012 the Department of Humanities of Ca' Foscari University has been carrying out a research project aimed to investigate this topic, namely the different features of the residential area and the relationship between private and public spaces. In particular, the study is focused on a wide field located in the northern central part of the ancient city (the so-called Ghiacciaia area), that was investigated initially by means of an archaeological survey and later through an excavation located on a specific point of interest. This paper intends to present a general overview on the contribution of aerial archaeology in the study of Altinum, and the preliminary results of the topographic study on the data collected during the archaeological survey, in order to relate these two topics and offer a perspective on future researches.

10:50-11:10 am

Now and back then: aerial photography in coastal Daunia. Detecting land management and landscape assets in the territory of Salpia Vetus and Salapia/Salpi

Roberto Goffredo, University of Foggia

Darian Marie Totten, McGill University

Valeria Volpe, IMT School for Advanced Studies Lucca

Starting in the 1950s, aerial photography became instrumental to studying landscapes in coastal Apulia. The systematic aerial photographic research by G. Schmiedt allowed for the identification of the cities of Salpia Vetus and Salapia/Salpi, previously known only from Classical sources. He hypothesized the loci of the urban centers and of their hinterlands, previously concealed by modern land reclamation. From 2013, as part of the 'Salapia Exploration Project', new analyses of a larger set of oblique aerial photographs (IGM 1954, Ortophoto 2000, 2004, 2005, 2012) considerably enlarged the sampled area, illuminating the new features indicative of past human activity, thereby allowing new interpretations of the complex landscapes of these towns. Agricultural activity, field boundaries, and road networks have been readily identified, whereas only a few indications refer specifically to settlements. This pattern is consistent with the results gleaned from field survey data, therefore evoking an image of a coastal and lagoon landscape largely exploited by communities in the long-term for extensive agriculture and commercial purposes. Moreover, the integration of these findings with data gathered through geomorphological analyses shed new light on the interplay between salty and fresh water systems surrounding Salpia vetus, which would have further influenced land use and resource exploitation. Aerial photography thus represents a well-established methodology for detecting landscape modifications, within a large-scale historical-archaeological project, aiming for a better understanding of human-environment dynamics, land management and settlement strategies over time.

Coffee break 11:10-11:40 am



10:40 am-1:00 pm

Session 2. Between the land and the sea

Coastal zones have been foci of activity throughout the human past, for example as valuable areas for resource acquisition (fishing; gathering of shellfish; harvesting of seaweed) and as settlement areas controlling maritime trade. They offer particular challenges as regards airborne remote sensing given that archaeologically they often include remains that are permanently or at least temporarily submerged, and the degree of exposure of these remains may change with each tide. They are also 'at risk' environments, with coastal erosion regularly impacting upon archaeological heritage. This session seeks papers dealing with the use of aerial methods in coastal, shallow and lagoon water archaeological survey, for example surveys of intertidal zones, shallow water surveys or of coastal sites under threat.

Chaired by Michael Doneus

11:40-12:00 pm

Small drone - large impact: modelling a tower karst landscape with a pocket-sized UAV

Thorsten Kahlert, Queen's University Belfast

Ryan Rabett, Queen's University Belfast

Hue Le Thi Thanh Kim, Trang An Management Board

Trang An is a UNESCO world heritage site in the Red River Delta, Ninh Binh province, northern Vietnam. The site comprises a unique ancient limestone karst massif covered by highly adapted tropical limestone forest. Comprising some 2500 hectare of karstic towers, cones and ridges that rise over 200m from the surrounding plains, which lie just above modern sea level, Trang An has been subject to at least three sea transgressions since the late Pleistocene. The transitions from inland to coastal environment challenged all ecological and human communities to adapt their survival strategies meet shifting conditions. The SUNDASIA project is seeking to trace these adaptations through archaeological excavation, landscape modelling, GIS analysis and palaeoenvironmental reconstructions. This paper focuses on the landscape modelling aspect of the SUNDASIA project. It outlines how cost-effective 'structure from motion' unmanned aerial vehicle (UAV) surveys can be used effectively in combination with Lidar to reconstruct current topography at a high resolution, and how the resulting data can be used to refine existing ancient sea level models and to predict how the movement of early foraging communities was influenced by fluctuating sea levels. The resulting landscape model provides a new perspective that challenges existing perceptions about this complex and sometimes deceptive landscape, and provides a powerful tool that can be incorporated readily into existing conservation and management frameworks. The creation of a workable model has also come with numerous practical and methodological challenges, some of which and their associated solutions and work-arounds are presented.

12:00-12:20 pm

Crossed contribution of topo-bathymetric LiDAR data and drone photogrammetry for intertidal archaeology: a case study of the ancient fish-traps in Brittany (France)

Thibaut Peres, University of Rennes, CNRS, CReAAH

Marie-Yvane Daire, University of Rennes, CNRS, CReAAH

Laurence Hubert-Moy, University of Rennes, CNRS, CReAAH



The Channel-Atlantic coastline of France contains a large number of archaeological remains related to the practice of fishing, from the Mesolithic to the present day. In Brittany, more than 750 fish-traps were identified and studied by aerial and pedestrian surveys. Only a few of them were studied in details, mostly because of restriction access (Submersion, etc..). Since 2009, airborne topo-bathymetric LiDAR (Light Detection and Ranging) data have been acquired after Storm Xynthia, mainly as part of the Litto3D® project, in order to manage coastal development and study environmental risks such as coastal erosion. These high resolution 3D remote sensing data, progressively available throughout the French coastline, have great potential for detection and monitoring of old fish-traps that are permanently or temporarily submerged and spread over several thousands of km along the coastline. Our methodological approach includes two steps. Firstly, some ancient fish-traps were identified and characterized at regional scale from topo-bathymetric LiDAR data using a semi-automatic method. Secondly, morphometric measurements were made at local scale using 3D models performed with drone images. This approach allows the detection of archaeological structures that are not visible on 2D aerial imagery, and above all a semi-automated detection of remains over a large coastal area. Our results show that airborne topo-bathymetric LiDAR and drone photogrammetry, which is especially suitable for intertidal archaeology, can be successfully applied for topography and structural mapping of archaeological remains such as ancient fish-traps.

12:20-12:40 pm

Aerial approaches to monitor the dynamic coast and identify the prehistoric to medieval maritime communities of the Irish Sea

Edward Pollard, The Discovery Programme: Centre for Archaeology and Innovation Ireland
Daniel Hunt, Royal Commission on the Ancient and Historical Monuments of Wales

Irish Sea heritage includes cairns, causeways and promontory forts, which have long been exposed to marine processes but threatened further by wetter climate, storm surges and rising sea level. Archaeologists are now tasked with the challenge of how to accurately record, monitor and preserve these sites in such dynamic environments. Furthermore, it is important to interpret original extent, landscape setting, date and purpose of these features, which are understudied due to their maritime orientation and remoteness from modern development. The EU-funded CHERISH (Climate, Heritage and Environments of Reefs, Islands and Headlands) project based in Wales and Ireland uses aerial photography and LiDAR to identify threatened sites and determine erosion rates; along with locating places for field survey, laser scanning, palaeo-environmental sampling, optically stimulated luminescence dating, and unmanned aerial vehicles. Results show aerial and concurring coastal survey is an effective tool for threatened sites. Estuary flooding of reclaimed land reveals prior access of medieval ecclesiastic settlement to tidal channels. Cliff failure divulges stratigraphy of Iron Age to Early Medieval forts and larger examples have associated boat harbours and dominate sea routes. Comparable sites in Scandinavia and France suggest diverse identities exploited the marine resources, trade and pilgrimage routes.

Poster session 12:40-1:00 pm

Lunch break 1:00-2:00 pm



2:00-6:10 pm

Session 3. Aerial archaeology in collaboration

Increasingly, new methods and approaches come to aerial survey through collaboration with other disciplines (e.g. computer science; medical imaging; human geography). In this session we seek to explore these collaborations. Submissions can include papers on automation of feature detection, new ways of visualizing data (both technical and in a social sciences sense) and novel prospection methods which showcase the development of aerial archaeology 'in collaboration'.

Chaired by Till Sonnemann

2:00-2:20 pm

AgriSat: a general purpose Earth observing nanosatellite constellation

Michele Maris, INAF/Trieste Astronomical Observatory

Federico Dogo, PICOSATS

Anna Gregorio, Trieste University / PICOSATS

We present here a study for a constellation of nanosatellites devoted to Earth Observation. The study is a collaboration between PICOSATS, a spinoff of Trieste University, and the Trieste University, INAF/Trieste Astronomical Observatory and European Space Agency. In the project from 12 to 48 satellites will orbit the Earth in a polar orbits at about 450 km altitude. Each satellite will be equipped with a hyperspectral camera, able to provide images in four to twelve bands from blue to near infrared. The camera resolution at ground will be in the range 10 - 30 meters and each satellite will scan the ground at a speed of about 7 km/s producing stripes extending for tens of km. Depending on the selected orbits, number of satellites and attitude, the same site will be repeatedly observed with a cadence spanning from one day up to one week. Originally designed for agricultural applications, the system can be easily reconfigured for other uses. Among them: site surveys, prospection, surveillance and observation of seasonal variability. From the point of view of archaeological applications, such constellations can be considered complementary to drones, since they are able to repeatedly observe the same site over a long period of time, covering in few seconds areas larger than those covered by drones.

2:20-2:40 pm

Aerial and ground based remote sensing for archaeological and cultural resource assessments in support of the proposed Appalachian Geopark

Charles Yuill, West Virginia University

Wennie Tabib, Carnegie Mellon University

This presentation will present current and emerging remote sensing methods that are being utilized for documenting and prospecting for archaeological features within a region that is proposed for the Appalachian Geopark. Geoparks are United Nations sponsored areas that serve to link and interpret important geologic and cultural histories and how they are often critically joined determinants of past regional settlement patterns. These remote sensing methods include: traditional aircraft remote sensing imagery and Lidar; drone based imagery and Lidar; terrestrial laser scanning; new high resolution satellite systems such as the Planet satellite constellation; and experimental drone Lidar data collection that was implemented for documenting historic mining (older than 4,000 years in some cases) in caves. The study area is in the Central Appalachian Mountains of the USA and is over one million acres in area. The region contains some of the oldest Native American migration routes in North America, early European



settlements, the earliest coal and iron mining in the Appalachians, and one of the richest karst regions in the world. Integration of these various technologies as well as the roles that such data collection is assuming in the framework of a large interdisciplinary research team will be the focus of the presentation.

2:40-3:00 pm

Airborne remote sensing in the field: collaboration and context on Arran

Lukasz Banaszek, Historic Environment Scotland

Dave Cowley, Historic Environment Scotland

An archaeological survey of the island of Arran being undertaken by Historic Environment Scotland draws on a combination of Airborne Laser Scanning data and field observation. This project aims to create a comprehensive record of the island's earthwork archaeology and to develop a methodology for rapid large area mapping. The survey methodology combines remote sensing and field archaeological skill sets, with a desk-based mapping stage followed by a programme of fieldwork. In an iterative approach to survey, levels of confidence in desk-based interpretation are used to inform patterns of fieldwork, which are structured to explore the representativity of the ALS-based mapping. This iterative methodology is central to developing workflows that emphasise collaborative working across desk-based and fieldwork contexts.

3:00-3:20 pm

LARICI – Searching for surface and subsurface archaeological deposits in Wasit- (Iraq) with COSMO-SkyMed radar imagery

Deodato Tapete, Italian Space Agency (ASI)

Francesca Cigna, Italian Space Agency (ASI)

Arianna Traviglia, Ca' Foscari University of Venice

Lucio Milano, Ca' Foscari University of Venice

Alessandra Gilibert, Ca' Foscari University of Venice

In recent years, space-borne high resolution Synthetic Aperture Radar (SAR) imagery has been tested for archaeological prospection in arid/semi-arid environments. Assessing the capabilities of SAR to detect buried and low-relief features is among the main goals of the research project "LARICI: Landscape Archaeology Radar in Central Iraq", a collaboration between researchers in Earth Observation of the Italian Space Agency (ASI) and archaeologists of Ca' Foscari University of Venice. The geographic focus of this experimental research is the Wasit Governorate, Central Iraq, where a systematic archaeological survey has never been conducted. We tasked ASI's constellation COSMO-SkyMed to cover the region at 3-m spatial resolution. Archaeological features were extracted from semi-automated SAR image processing and then compared with locations and surface properties of levelled archaeological mounds and other categories of archaeological features that were either known from published literature, derived from the examination of declassified CORONA images from the late 1960s, or surveyed during the last field-walking in April-May 2018. In this paper, we present the first results of LARICI, and focus the discussion on how the multi-disciplinary collaboration between different professionals is feeding into a novel methodology of image analysis and interpretation that LARICI aims to develop. Our aim is not only to address the specific research questions about the archaeology of the Wasit Governorate, but also to propose a new workflow that could encourage further dissemination and uptake of space-borne high-resolution SAR imagery in the archaeological community.



3:20-3:40 pm

Before and beyond the “Ground-Truth mythistory”: back to basics and into the near-future of Aerial Archaeology

Armando De Guio, University of Padua

Our research teams have been cumulating in the last 40 years a vast amount of remote/field experience in a number of pilot-projects covering a variety of temporal/spatial/functional and problem-oriented domains of enquiry (from Paleometallurgy, Archaeology of War and Ethnoarchaeology in the central Alpine Area to the “Landscape of Power” of the Bronze Age Po Plain, to the “Archaeology for Development” in sub-Saharan Africa). We think that the time is come for all of us to face a thorough review of some basic, founding principles and procedures of Remote Sensing Archaeology as well as to address its present status of the art and a few extraordinary near-future perspectives, mainly through the lens of a number of our case-studies. That means to start by recovering the key notion of the sheer complexity of the surface archaeological record formation processes: a “Sur-Facies” (as we defined it years ago in a pioneer object-oriented frame of reference), due to the cumulative morphogenesis of physiographic, biological, human and human-driven (e.g. agrarian mechanics) actors and “scripts”. At the same time we are forced to lower how epistemological exposure to the “Ground Truth Evidence”, by strengthening first of all the internal sources of validation (“Remote Sensing Evidence”): this could be implemented by relying on a number basic formalisms, such as the trace-seriation algorithm proposed in our developing “(post)Harris Project” and some emerging meta-strategies of (semi)automatic FOPSR (Feature/Object/Pattern/Scenery Recognition), ideally under an equally formalised RUM (Risk and Uncertainty Management, e.g. Bayesian, Fuzzy, Dempster-Shafer...) self-disciplined evaluation.

Coffee break 3:40-4:10 pm

4:10-4:30 pm

Better Together – Combining Citizen Science and Data Science in Archaeological Prospection

Karsten Lambers, Leiden University

Quentin Bourgeois, Leiden University,

Dave Cowley, Historic Environment Scotland

Wouter Baernd Verschoof-van der Vaart, Leiden University

Archaeology is facing a constantly increasing quantity and complexity of remote sensing data that potentially hold information about archaeological traces in the landscape. In order to deal with this challenge, in recent years archaeology has sought collaboration with different disciplines. In Citizen Science, volunteers assist in detecting and mapping archaeological traces (e.g., the GlobalXplorer project), whereas in Data Science, quantitative and computational tools assist in finding patterns and objects (e.g., recent projects by the Norwegian Computing Centre). So far, both approaches have rarely been used in conjunction in archaeological prospection, and have even been contrasted as ‘automated site discovery vs. brute force methods’ in a recent article. We believe that both approaches can be fruitfully combined for the benefit of archaeological prospection on a regional scale. While Citizen Science provides valuable local knowledge as well as manpower, Data Science contributes probability estimates to the detection and recording of archaeological traces. In July 2018 we organise a one-week workshop in Leiden titled ‘Tracing the Past’ that brings together experts from volunteer and academic archaeology, heritage management, the geosciences and computer science. Our goal is to develop a



joint workflow of archaeological prospection that smoothly integrates different types of data, methods and approaches for the mutual benefit of all disciplines involved. An ongoing investigation of a Neolithic and Bronze Age landscape in the central Netherlands serves as a case study. In this paper we will report on the outcomes of this workshop and perspectives resulting from it.

4:30-4:50 pm

Challenges and opportunities for airborne lidar campaigns in monsoon Asia

Damian Evans, French Institute of Asian Studies (EFEO)

Nina Hofer, French Institute of Asian Studies (EFEO)

Recent years have seen a number of landscape-scale archaeological lidar campaigns in South and Southeast Asia. Some were engineered entirely by archaeologists; others were carried out with the involvement of archaeologists as part of broader collaborations involving ecologists, heritage managers, hydrologists, agronomists, architects and urban planners. The projects benefited from a diverse range of funding from private and public sources including research grants, development aid, and funds from non-profits such as the National Geographic Society. In the absence of state-sponsored lidar acquisitions generating open data, which are virtually unknown in the tropical world, the scale and expense of wide-area acquisitions usually necessitates these kinds of broad-based partnerships, which are always productive and beneficial on some level, but tend also to create a range of tensions between stakeholders with competing and sometimes incompatible objectives. Lidar is also a disruptive technology which, as it challenges arbitrary territorial and disciplinary boundaries that have been carefully crafted over decades, tends to generate a significant amount of resistance. In this paper we review the various research collaborations and outcomes that have been achieved in our region of interest relating to airborne lidar, and critically examine some of the successes and failures, locating our analyses within broader currents and issues in contemporary archaeology. Despite perceptions of lidar as being technically complex and very expensive, we argue that the barriers to the method reaching its potential are principally political, cultural and regulatory, not financial or technical.

4:50-5:10 pm

The use of R-CNNs in the automated detection of archaeological objects in LiDAR data

Wouter Baernd Verschoof-van der Vaart, Leiden University

Karsten Lambers, Leiden University

To cope with the ever growing set of largely digitally and easily available remotely sensed data, computer-aided methods for the (semi-) automatic detection of archaeological objects are needed. This research project explores recent advancements in computer sciences, such as deep learning and Convolutional Neural Networks (CNNs), in order to develop a generic, flexible and robust automated detection method for archaeological objects in remotely sensed data. The aim of the project is to implement these methods into a user-friendly workflow. In this paper the first developed workflow for the automated detection of archaeological objects in LiDAR data will be presented. This workflow is based on R-CNNs (Regions with CNN features). Unlike normal CNNs, that classify the entire input image, R-CNNs address the problem of object detection, which requires correctly localizing and classifying (multiple and possibly overlapping) objects within a larger image. Within the workflow the input as well as the output of the R-CNN are handled in a GIS environment (QGIS), in order to make the method more usable for archaeological purposes. The proposed technique has been trained and tested on LiDAR data gathered from a forested area in the central part of the Netherlands. This area contains a multitude of archaeological objects, including (Prehistoric) barrows, Celtic fields and (Medieval) charcoal kilns. This paper will present the results of the initial tests of the workflow. By implementing this new technique we have been able to develop a method to automatically detect and categorize these archaeological objects.



5:10-5:30 pm

Stratigraphy from topography

Michael Doneus, University of Vienna

Terrain models from airborne laser scanning reveal a multitude of relief features surviving from a complex sequence of (pre-)historic occupation. In order to understand this 'palimpsest', functional units need to be identified and chronologically put in order. The presentation will demonstrate the use of a Harris Matrix to build a coherent chronological model of all mapped features from a complex case study. Each intersection displays a temporal succession of its features and therefore functions as a node within a stratigraphic sequence. Linking the resulting harris matrix with the GIS-based interpretation map, a relative sequence of archaeological structures can be inferred and functionally interpreted. The result is a diachronic sequence of human activity in a dynamic landscape.

5:30-5:50 pm

The potential of geoscientific terrain analysis and machine learning to classify landforms and archaeological topography in Southeast Asia

Nina Hofer, French Institute of Asian Studies (EFEO)

Damian Evans, French Institute of Asian Studies (EFEO)

Large scale airborne laser scanning is still gaining popularity as a method in many disciplines, including archaeology. In the last few years, the creation and use of different visualization methods to identify archaeological patterns in high-resolution terrain data has increased in importance. Since technologies are developing rapidly and enabling large data acquisition, archaeologists can benefit by applying machine learning approaches to handling such big datasets. By using methods from different fields of knowledge, we explore the potential of topographic data for automated landform and feature classifications, instead of using their visualizations for optical interpretation. We therefore use techniques from geomorphology and morphometry to create topographic datasets, which are the basis for feature classifications using and comparing supervised machine learning and neural network algorithms. By using our 2015 ALS datasets from Cambodia, we are focusing on tropical landscapes and distinct morphologies, to explore 1) structures that can be classified automatically in those geographical conditions and 2) applicable geoscientific approaches.

5:50-6:10 pm

Aerial imagery for the UK High Speed 2 (HS2) Environmental Impact Assessment: An amazing early career opportunity

Chris Cox, Air Photo Services Ltd

Aerial Imagery for the UK High Speed 2 (HS2) Environmental Impact Assessment: An amazing early career opportunity This paper sets out how an innovative, newly developed and ambitious project has contributed to the development of new generation aerial archaeology skills Our specialism desperately needs new entrants to ensure continuity of skills and development of new techniques for the future, emphasising teaching and learning new workflows at the cutting edge of what has become a very technical, alongside analytical, discipline. For the last year, APS has been working on the aerial imagery interpretation work for the EIAs on 10 sections of the UK HS2 Phase 2b route from Bolsover to Leeds through Derbyshire and Yorkshire, as an integral part of the wider UK Arup+ consultancy consortium. There are lots of challenges associated with such a large and complicated project - not least that our newly formed team includes three early career archaeologists, new starters to the world of aerial



archaeology, analytical interpretation and remote sensing. We've worked with air photo archives to view thousands of paper and digital images. We've gathered new data from established sources, and bespoke Lidar multi and hyperspectral remotely sensed data, bespoke, high resolution aerial mosaics, and produced reports that identify the archaeological resource in a staged manner over a complex 100 x 2 km survey corridor. The paper explores innovation, training and team collaboration. How does our approach compare to others projects within the EU and how are other organisations delivering training on this scale?

5:30-6:00 pm

General discussion

Thursday, September 13th 2018

8:30 am-12 pm

Session 4. Monitoring changes

Aerial survey is increasingly used to monitor changes at archaeological sites. This has become especially important in recent times as regards tracking damage caused by looting/deliberate destruction of heritage (e.g. by ISIS in the Middle East), environmental degradation (e.g. erosion of coastal sites) and encroachment of settlement/agricultural activity in archaeological landscapes. For this session we seek papers focused on the use of aerial methods in such monitoring programmes, particularly over medium to long time scales.

Chaired by Lenka Starkova

8:30-8:50 am

Aerial archaeology supporting heritage management and monitoring in the difficult archaeological landscapes of the Mediterranean. Case study area: southern Euboea, Greece

Anke Stoker, Vrije Universiteit Amsterdam

The goal of this PHD study is filling in gaps in the archaeological record and developing aerial archaeology further as an effective tool, suitable for investigation and monitoring of difficult Mediterranean landscapes. Applied and tested are aerial reconnaissance, study of archival verticals, multispectral satellite images, and targeted checks on the ground, aiming at feature classification, GPS measurements, geotagged photography, and the systematic sampling of representative surface finds). Special attention is paid to difficult terrain such as the barren, rocky uplands and areas with sedimentary infill (basins, plains, mountain valleys), where ongoing geological processes (erosion, sedimentation, submergence) affect the preservation as well as the identification of findspots and sites. Since the 1950s, human interference is more disruptive to the archaeological record than ever before. Pre-1950s aerial photographs therefore play a crucial role, because of the excellent visibility of ancient pathways and roads. These linear features are currently hidden or invisible (destroyed, buried, submerged, overgrown). Several ancient findspots (farmsteads, sanctuaries, graves, quarries, harbours) were identified by



reconstructing this changed network of communication and transport. Oblique aerial photographs, produced during repeated reconnaissance and survey flights, contribute to the identification of unknown findspots and to recording ongoing threats. All results (incl. raw data, metadata, geotagged photographs) will become available to the Greek archaeological service in interactive maps to facilitate heritage management.

8:50-9:10 am

APIS – An archaeological information system and powerful tool for archaeological prospection and monitoring of sites

Ulrike Fornwagner, University of Vienna

Michael Doneus, University of Vienna- Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology

Johannes Liem, University of London

Christopher Sevara, University of Vienna

Archaeologists and heritage managers are in need of dynamic spatial inventories for prospection data that provide them with multipurpose tools to understand information about the change through time of archaeological heritage within its landscape context. Specifically, linking interpreted site information with the respective non-invasive prospection data is a key prerequisite for monitoring changes at archaeological sites over long periods of time and handling the respective source data. APIS, the Archaeological Prospection Information System, provides storage and easy access to all data concerning aerial photographs and archaeological sites as a single GIS-based application. APIS is designed to work with imagery and geospatial data from all over the world. Furthermore, the application has been developed in an open source environment and can thus be freely distributed and modified. As such, it provides users with an easy workflow for data management, interpretation, storage, and retrieval of aerial imagery for archaeological and heritage management applications.

9:10-9:30 am

Extracting archaeological looting patterns from satellite images using automatic procedures

Rosa Lasaponara, CNR-IMAA, Italy

Nicola Masini, CNR-IBAM, Italy

Vandalism and illegal excavations represent one of the main risks which affect archaeological heritage throughout the world. Actions oriented to quantify the damage and prevent looting can be supported by satellite technologies which can provide reliable information to: (i) detect and quantify devastation and looting phenomenon even over large areas, (ii) set up tools to undertake monitoring also for remote areas or sites not accessible due to war or other limiting factors. Up to now the identification and quantification of looting has been generally approached by visual inspection of optical aerial or satellite pictures. Recently pioneering investigations based on an object oriented approach for the automatic identification of changes due to illegal excavations of have been conducted. Herein we propose an approach based on local indicator of spatial analysis, unsupervised classification and segmentation. Results obtained from the satellite based analysis have been conducted in some pilot areas selected in Syria and in Peru. The assessment of the reliability of satellite based results was conducted through field surveys in Peru and using visual inspection for the Syrian case study. Results from the evaluation procedure showed satisfactory performances from both the two analysed test cases. The outcomes of this study has implications for the protection of archaeological sites not only in the investigated areas but also in similar environmental conditions across the world.



9:30-9:50 am

Digital modelling of the historical heritage of Mosul

Lenka Starková, University of West Bohemia in Pilsen

The digital map portal and database of historical monuments of Mosul presents the unique architectural heritage of the town of Mosul, which was seriously assailed by the ideologically motivated attacks of the radical organization ISIS. The project of Monuments if Mosul in Danger combines information, gained from the archaeological and historical research, with modern technology and introduces current reconnaissance techniques, which were used to document architectural monuments. Thanks to the financial support from the Oriental Institute, Academy of Science in Prague, most of the destroyed monuments of Mosul have been located and part of them digitally restored. The combination of 3D reconstructions of destroyed buildings and the historical aerial and satellite images from the National Archives and Records Administration in Washington DC (NARA) and the University College London archive (UCL) offers a unique opportunity to create the digital map of individual site locations and to analyse the Mosul city expansion in past (19 – 20th century). The paper offers a methodical approach for documenting and mapping of the architecture, working with limited data sources (absence of terrain altimetry, plan documentation, impossibility of field research, inaccuracies of documents, etc.) and focusing on the issues of historical heritage in the war zones.

Coffee break 9:50-10:20 am

10:20-10:40 am

Where have all the barrows gone? - Recent remote sensing in arable landscapes

Peter Halkon, University of Hull

James Lyall, University of Hull

John Deverell, SHLC University of Hull

Manuel Fernandez-Gotz, University of Edinburgh

The Yorkshire Wolds contains internationally important archaeology, largely revealed through aerial survey and mapped by Cathy Stoertz (1997). Excavation and geophysical survey over the last two decades, however, shows that many sites, even those listed as Scheduled Monuments are in danger of destruction. Large-scale geophysical survey on the Iron Age “type site” cemetery at Arras in 2017 showed considerable differences with past aerial coverage. A similar effect was noted elsewhere in the region. Given the dual threats of plough damage and the withdrawal of EU CAP funding due to Brexit, despite promises of continued protection by the UK government, is it time where destruction makes preservation untenable, to recommend full excavation whilst information can still be retrieved?

10:40-11:00 am

Low passed landscapes: how smooth is your topography?

Piotr Wroniecki, University of Wrocław

The aim of this presentation is to propose an initial conceptualization of the effect of modern and mechanized agricultural processes on contemporary landscapes. These changes of topography can be compared to the application of a low-pass filter, which is a signal processing technique generally referred



to as a smoothing, anti-aliasing or blur filter. It has applications in many areas including foremost electronics, all the way through photography, acoustic engineering or geophysical data processing. Low-pass filters help in removing “short-term fluctuations” by attenuating high frequencies and hence are also a valid processing technique for any kind of DTM data, including airborne laser scanning derivatives. The high resolution of ALS datasets often induces recognizable levels of noise and is extremely apparent in woodland and foliage cover areas. Other areas (especially those that are or have been subject to agricultural processes) visually resemble datasets that have been already treated with a low-pass filter. This outcome is in fact mainly caused by mechanized soil cultivation, which in a way may be described as a form of “analogue data preprocessing”. Such an understanding of the mechanisms shaping landscape changes can be implemented as mathematically based tool, allowing calculation and forecasting future state of preservation of archaeological monuments and landscapes. It has also broader implications in both heritage management and research archaeology. Past and present land use is a major factor impacting responsiveness of various remote sensing techniques in archaeological applications and hence research approaches and interpretations.

11:00-11:20 am

Mapping of archaeological and geological features at the Iron Age site of Goričan

Miroslav Vuković, University of Zagreb

Hrvoje Potrebica, University of Zagreb

Mislav Fileš, University of Zagreb

The necropolis of Goričan is the largest Iron Age mound necropolis in Croatia. Over thirty mounds were excavated in several campaigns between 1960s and 1980s. To this day no comprehensive publication of the finds or the site was produced. We started mapping visible archaeological features like barrows, pits, embankments and ditches, by reviewing the available aerial and satellite imagery. The first results of that analysis suggest that the number of burial mounds is much higher than previously thought. Some of the images reveal ditches around mounds and traces of possible grave chambers in the central part of some mounds. Beside the archaeological features, the ancient landscape was dominated by a clearly visible feature which was initially determined as paleo-channel of the nearby river Mura. This made process of interpretation of the images much more difficult since it was hard to differentiate between ditches and traces of ancient water flows. It seems that some of the barrows were situated along that feature and no visible barrow remains were cut with it. That would fit to the proposed paleo-channel interpretation but it could also be interpreted as a path or road through the necropolis. Visible ditches and embankments could be related to the supposed settlement, or they could be traces of smaller natural water flows. Our paper stresses the importance of systematic mapping of both archaeological and geological features. The proximity of the river must have caused flooding in the Iron Age and we may presume the existence of some form of a water management system. In this case further research might discover traces of such system.

11:20-11:40 am

Wind of change: tracking rapid development in cultural landscape of eastern Croatia

Bartul Šiljeg, Institute of Archaeology, Zagreb

Hrvoje Kalafatić, Institute of Archaeology, Zagreb

Urban development and the building activities that can be followed through last five decades in eastern Croatia on the featured examples from Josipovac, Čepin, Osijek, and Klisa, show all the dramatics and speed of actions which seriously threaten and damage archaeological sites. We can divide this period in two main phases. Last two decades we were witnesses of large infrastructure projects like roads, highways and canals in eastern Croatia. System of monument protection was efficient and many



archaeological sites were saved by rescue excavations. But period from 1960' to 1990' was not covered with systematic monument protection work. Landscape reconstructions made by mapping the specific changes in landscape through aerial remote sensing approaches show large negative impact of construction works on archaeological sites in this development phase. The presentation will focus on results of the analysis of satellite imagery and aerial photography, also showing achieved results during the low altitude aerial survey. The satellite imagery and aerial photography data were analyzed to examine any kind of correlation between environmental, archaeological and aerial imagery data and the results were compared with the results of the field survey.

Poster session 11:40-12:00 pm

Lunch break 12:00-1:00 pm

1:00-3:00 pm

Session 5. Drones in aerial archaeology (to drone or not to drone)

While there is no doubt that drones have democratized aerial archaeological survey, what next for the drones/UAV in aerial archaeology? While site-based drone survey is now common practice in excavation and structure-from-motion photogrammetry is regularly used to create detailed 3-D models of sites and structures, what is the next step for surveys of this sort? As is sometimes the case with lidar and terrestrial laser scanning, is there a risk that making a model has become the raison d'être for the use of drones in archaeology? To explore these ideas papers focusing on critical or theoretical aspects of drone use are particularly welcome.

Chaired by Geert Verhoeven

1:00-1:20 pm

UAV-based multitemporal investigations of archaeological proxy indicators

Nicola Masini, CNR-IBAM

Paola Manzari, INAF-IAPS

Cosimo Marzo, Italian Space Agency

Canio Sabia, CNR-IBAM

Rosa Lasaponara, CNR-IMAA

Crop-marks are the most important proxy indicators of the presence of archaeological buried remains. Their characteristics and information provided on human past depend on the nature of expected features, land use, meteorological parameters, soil and vegetation types. The interaction of these factors is crucial for the major and minor visibility of crop-marks over seasons. Hence, the need to improve the knowledge of 'vegetation-mark phenomenology' by a multi-temporal investigation. This can be based on a holistic approach jointly using aerial prospection, information on meteorological conditions and in situ survey of soil and vegetation. Today, the availability of low cost UAV makes this approach feasible. Herein, a multitemporal analysis of archaeological proxy indicators, linked to variations in vegetation growth and soil moisture, has been performed in some areas of archaeological interest in Apulia region where the geo-pedological conditions favoured the preservation of crop marks revealing a long human frequentation since Neolithic age. In particular, results from the aerial observations evidenced not only the expected crop-marks, linked to wheat cultivation, during spring season but, also, differences in vegetation growth mainly in August and October due to the presence of spontaneous herbaceous plants favoured by the particular meteorological conditions. Outputs from our investigations revealed new



insights on the characteristics archaeological vegetation marks in relation with vegetation types and meteorological conditions.

1:20-1:40 pm

Towards automating drone flights for archaeological site documentation

Juergen Landauer, Landauer IT Consulting

Modern commercial drones have already been adopted by archaeologists for high-quality 3D photogrammetry due to their relatively high sensor accuracy (GPS, camera) at affordable costs. Additionally, some "autopilot" tools such as Pix4D etc. have emerged where a drone can follow a predefined path (usually a lawnmower pattern) while taking pictures. This approach works well with rather flat surfaces but leads to gaps and areas of limited accuracy at typical archaeological sites, especially with partially occluded features such as ditches and surfaces with sharp edges (e.g. walls). Users then must capture additional images or take images at different angles – a rather time consuming and tedious process which also requires a high expertise not available to all. Therefore, we developed a software platform where the drone would assess the quality of the images and the emerging 3D model during flight and adjust its flight path if certain quality criteria are not being met. For this, we utilise recent scientific progress taken from computer vision and robotics, (especially view-planning in real-time) and adopt it to the archaeological scenario outlined above. This allows various degrees of automation ranging from optimising the overlap between images to a fully automatic capturing process. A case study based on data captured from the Roman-era Mithras temple of Mundelsheim (Germany) demonstrates the usefulness of this approach: Initial results promise to obtain a more precise photogrammetric output (3D model, orthophotos, DEM) at reduced computation time. The prototype is implemented based on open-source software and we plan to release it for the research community.

1:40-2:00 pm

UAVs as a key to siteless surveys: a case from the Kurdistan Region of Iraq

Matthias Lang, University of Tuebingen

Jason T. Herrmann, University of Tuebingen

Benjamin Glissmann, University of Tuebingen

Paola Sconzo, University of Tuebingen

The role that UAV-derived data has played in the Eastern Ḥabur Archaeological Survey (EHAS, University of Tübingen) has matured from simple site documentation to providing the basis for hypothesis development and testing. Our use of UAV-derived data began with simple site recording for the creation of orthomosaics and surface models and provided an important baseline for tracking site degradation in an area with rapid urban and agricultural intensification. However, the way we have utilized data from UAVs has since matured to where aerial images and derived data have become an integral part of the scientific research process, particularly in reconstructing patterns of ancient settlement, land use, and communication. Here, we provide two examples of how UAV data can be used beyond simple site description based on extensive landscape-scale surveys. First, these data have provided a means to detect a route stretching kilometers across the Zagros piedmont from the confluence of the Tigris and Ḥabur rivers toward a major Bronze Age center, confirming the location of a route predicted through GIS analysis. This same broad survey has also helped to serve a second function, by exposing hundreds archaeological features of over kilometers and providing a way to document upland pastoral and agricultural installations that have heretofore been logistically out of reach. We close with a short discussion of how UAV surveys have made true 'siteless survey' a reality and are ultimately transforming the way archaeological survey data is collected and conceptualized.



2:00-2:20 pm

UAVs in Bohemian archaeology. A brief overview and considerations upon the role of the sophisticated toy

Gojda Martin, University of West Bohemia

Unmanned aerial vehicles (UAV) certainly belong to the group of the most potential tools/techniques/methods which during the last decade have influenced the development in archaeological remote sensing in many ways. The paper presents in its first part a brief introduction to the applications of UAVs, specifically in heritage management, research and popularization. During the last few years UAVs have globally been contributing to the recording, mapping and documenting of archaeological landscapes, sites and monuments, and also in Bohemia the variety of abilities of this kind of a technical device is primarily appreciated by field archaeologists, but also by researchers. Second part of the presentation brings an overview of the first attempts to apply UAVs for the production of orthorectified georeferenced cropmarked sites' maps, 3D models and site detection via RGB/NIR high-resolution data in current Bohemian (Czech) archaeology.

2:20-2:40 pm

Topographic Drone-Photogrammetry to improve analysis of GPR studies at heritage sites

Till Sonnemann, University of Bamberg

GPR surveys can provide high resolution 3-dimensional information about the subsurface of archaeological sites, or the interior of heritage structures. For areas with height differences, the analysis can sometimes be significantly improved by incorporating topographic information into the professional GPR software. Recording high resolution imagery of a survey area using drones, and the processing of the photos to create surface models using Structure from Motion (SfM), has shortened the process and enhanced the results significantly. Interpolated surface models produce a high end DEM for analysis and visualization. The paper addresses different sample cases from recently conducted GPR surveys and their improvements made by incorporating topography from drones.

2:40-3:00 pm

Should we drone or should we draw? Drone, 3Ds, orthoimages and interpretative frameworks

Diego Calaon, Ca' Foscari University of Venice

Martina Bergamo, Ca' Foscari University of Venice

Andrea Cipolato, Ca' Foscari University of Venice

Jacopo Paiano, Ca' Foscari University of Venice

Drones are often employed as support devices during excavation. The aerial point of view is pivotal to have a global view of the site and to produce the 3d model has become a common practice. During Torcello excavation in 2017 and 2018, we used drone regularly to implement the daily photogrammetry of the excavation phases, and we produce orthoimages and plans directly from 3d models. A legitimate doubt arises: how much the new "fancy" system is adjusting the interpretative framework by which we collect our pivotal data? Drastically diminishing the traditional drawings and on-site measurements, thanks to the drone we are relocating the moment of the crucial stratigraphy interpretation in front of a computer screen. How much we are influenced by the technology, and how much we rely on the supposed clarity of the "from above" point of view? Is this view from the sky changing our excavation approach?



Coffee break 3:00-3:30 pm

3:30-4:30pm

Session 6. Managing the land

Traces of agriculture and land management are perhaps the most ubiquitous of all archaeological remains visible from the air. These range from field systems and enclosures to evidence of ridge and furrow cultivation to traces of olive groves and orchards. Despite their social significance such features are often overlooked in favour of more 'monumental' remains. In this session, we invite papers that focus on critical aspects of enclosure, past agricultural regimes and water management.

Chaired by Stephen Davis

3:30-3:50 pm

Lidar traces used to produce models of Roman land organisation in the southern Black Forest area

Ralf Hesse, State Office for Cultural Heritage, Baden-Württemberg, Germany

John Peterson, University of East Anglia, UK

More than 800,000 Lidar traces have been mapped in Baden-Württemberg. Over half represent former field boundaries, signs of earlier landscapes. Groups of traces seem to form grid patterns at different angles. Some are so regular that they may be the remnants of Roman cadastres. While some grid patterns appear to be local in extent, one grid pattern with regionally consistent orientation of about 22.5° was discovered in the south-western part of the state, extending north of the Swiss border for a distance of about 90 km. One way of modelling these possible systems is to assume that they have rational tangent relationships to North. In the histogram of orientations, the most popular is indeed 22.5°. This corresponds approximately to $\tan^{-1}(2/5)$, so the regional grid could be modelled with orientation set at this value, i.e. 21.8°. Another approach is to construct a model of the same grid on the assumption that the longest collinear sets of traces in this area are likely to be survivors of axes of the grid, and that it can be reconstructed from a pair of them at right angles, using their intersection as a false origin. A pair were found, one at about 22.5° to (geographic) North and the other orthogonal to it, within 0.08°. Using UTM coordinates, with UTM grid orientation of 23.613°, the grid incorporating these possible axes could be displayed on Google Earth and seen to fit three known segments of Roman road. Could these rival hypotheses be tested by studying the distribution of Roman settlement with respect to the grid lines of these competing models?

3:50-4:10 pm

Politics written in land

Sara Popovic, Juraj Dobrila University

This paper will present the first results of the ArchaeoCulTour project which aims to investigate the archaeological heritage of Vrsar municipality in Istria, an area mostly covered with dense Mediterranean forest. Interpretation of LiDAR data resulted in detecting different, multi-temporal spatial organisation of this landscape. More than 8 km of previously unknown Roman land division lines, a prehistoric hillfort, caves and rock shelters as well as numerous paths and many other detected built structures, gave us the



starting point for the reconstruction of historic land uses. Mapping this features in GIS as well as the characterisation of the terrain morphology led to the conclusion on where can we expect a better state of preservation of archaeological remains. On the other hand it brought to light questions about the process of Roman agrarian allotment in relation with prehistoric hillforts.

4:10-4:30 pm

Land-use and agricultural space in High Medieval Ireland, c. 1100AD - 1350AD: new evidence from the air

Mick Corcoran, University College Dublin / Teagasc

Much of what is currently understood about agricultural space and practice in High-Medieval Ireland is based around an arguably out-dated narrative built around a system of dichotomies – Gaelic Irish vs. Anglo-Norman, dispersed vs. nucleated settlement, pasture vs. arable, etc. There has been insufficient effort aimed at employing modern archaeological evidence to refine this narrative to construct an appropriately complex and dynamic picture of how medieval societies interacted with their landscapes. In recent years, the availability of high-resolution geospatial data (e.g. LiDAR and satellite imagery), in addition to findings from modern excavations, has resulted in the identification of archaeological remains that do not conform to traditional models and are likely the result of agricultural decision making by individual agents or small communities. It has also enabled the more nuanced understanding of the interaction between recorded settlement sites and their landscape environs. This paper will describe the results of recent doctoral research undertaken by the author, whereby a series of land-use characterisations were constructed using digital terrain models (from LiDAR data) and multi-spectral satellite data (Landsat 8). These land-use characterisations informed the development of a new model for agricultural land-use in Medieval Ireland. This model, it is hoped, will provide new pathways to understanding, firstly, how people used and negotiated landscapes in medieval Ireland and, secondly, the degree to which decisions about land-use were influenced by broader environmental and climatological influences.

DISCUSSION SESSION

4:30-5:15 pm

Can we stop flying now?

Chaired by Steve Davis

Discussants: Dave Cowley and Peter Halkon

Does flying still work the way it used to?

Dave Cowley, Historic Environment Scotland

Aerial archaeological prospection has unquestionably made a huge contribution to archaeological knowledge in many areas. However, there is a danger that past glories are cited as a reason to keep on flying, often on the basis of anecdote and impressionistic statements of continuing good returns rather than informed by critical review of returns and the continuing ability to generate new knowledge. Drawing on a review of aspects of a national aerial survey programme, now in its fifth decade, this paper



discusses the continuing value of aerial prospection in Scotland. This is especially important to inform responses to climate and land use change, and the emphasis that is placed on research and development of new methods of survey. The paper will conclude with a personal perspective on a world beyond observer-directed aerial archaeology, and the development of an aerial perspective fit for the 21st century.

Why there is still a place for conventional aerial photography and repeated missions over the same area

Peter Halkon, University of Hull

The summer of 2018 has been a remarkable one for aerial archaeology as it has been a record year for the revelation of cropmarks. From Ireland and Wales in particular there have been headline media stories and even BBC Look North for my region provided a 10 minute feature which attracted attention from as far away as Canada. The flying I have done has been over a 30 km block in east Yorkshire which I have traversed during suitable summers for several decades. Repeated flying using conventional oblique techniques has yielded dividends. I have deliberately flown some fields in June, July and August and each time different features have been apparent. Aerial reconnaissance has also been invaluable in monitoring landscape changes such as new drainage schemes in sensitive areas and the rapid growth of housing development around the major towns in the region. This is of particular concern at Pocklington where major finds have been placed into a wider landscape context by aerial survey and this year previously unrecognised ritual and burial monuments discovered. It has been said that the appearance of cropmarks means that sites are already being destroyed by arable agriculture and repeated surveys enables monitoring of this erosion. An innovation for me this year has been working with Historic England and in particular Yorkshire Aerial Archaeology and Mapping using drones. The output from this enables downloading of geotiffs and much easier mapping of features, however due to height restrictions and other constraints drones cannot yet replace the keen eye of the aerial archaeologist taking oblique photos from the open window of a plane.



POSTER SESSION

Session 1. Local session: Aerial Archaeology in Italy: the last 15 years

Pompeii from above: the role of aerial photography in the prefiguration of the unexcavated city urban design

Marco Fabbri, Tor Vergata University of Rome
Alberta Martellone, Pompeii Archaeological Park
Massimo Osanna, Pompeii Archaeological Park
Arianna Spinosa, Pompeii Archaeological Park
Gianluca Vitagliano, Pompeii Archaeological Park

When, in 1910, the Italian Military Engineers executed the first 'Rilievo Aerofotografico' (Aerial survey) of Pompeii, the city inside the walls was excavated for only half of its total surface, excluding the eastern extent of Via dell'Abbondanza (Street of Abundance), the excavation of which was started soon after.

This first aerial photography of the site – as well as those following – takes on two meanings: on one hand, it documents – from a temporal point of view – the image of the unveiled city, in its configuration as a result of excavations, restorations, integrations, reconstructions. On the other, it provides a zenith view of the unpaved areas with historical signs of land parcelling on which, if possible, the faint traces of the ancient city can be read. For the first time, archaeologists are able to see in a single glance Pompeii within the walls as a combination of excavated and perceived areas.

The aerial photography immediately shows the relationship between the two areas of the site: it crystallises the configuration of the city at a given time, which reveals a temporal hiatus between the beginning of the survey and its termination.

Therefore, the contribution intends to investigate the role of aerial photography in relation to the 'expansion' of the excavated city, measuring the accuracy of the perceived urban design which archaeologists and historians had to deal with in the last century. In this perspective, particular attention will be paid to the most recent aerial photography experiences that have confirmed and clarified the articulation of the road layout in the northern part of the city, currently undergoing excavation.

Session 2. Between the land and the sea

"...ad frequentes agros tribus maritimis patavinorum vicis ...pervenit": Cleonimo's adventure among Patavium, Metamaucus and Venice lagoon

Valentina Girotto
Guido Rosada, University of Padua

Il corso terminale del fiume Brenta, sfociante nel settore centrale della laguna, è stato di recente oggetto di numerosi studi, che hanno cercato di far luce sulla valenza topografica antica e sull'articolazione cronologica delle sue ramificazioni a valle di Padova. In particolare, le datazioni proposte per i rami meridionali, coincidenti con il "Meduacus Minor" delle fonti itinerarie antiche, potrebbero restituire un nuovo quadro demografico e topografico delle fasi di romanizzazione dell'agro patavino, anche alla luce di nuove considerazioni civico-funzionali degli insediamenti sorti lungo questi stessi paleoalvei, in particolare i siti archeologici di Lova (Campagna Lupia) e di Vallonga (Arzergrande), presso i quali sembra potersi collocare l'approdo dello spartano Cleonimo nel 302 a.C.



From the sky, over water and land: integrated methods for determining the archaeological potential of the Saint Ariano Island (Venice Lagoon).

Daniela Cottica, Ca' Foscari University of Venice

Arianna Traviglia, Ca' Foscari University of Venice

Paola Sfameni, Arcomai

This poster will showcase the results of research activities undertaken in 2008-2011 year in the Lagoon of Venice by a team at Ca' Foscari University of Venice (directed by Dr D. Cottica) as part of a project of recovery, protection and enhancement of the historical and archaeological heritage of Costanziaco, an island in the northern fringe of the lagoon of which only two strips survive nowadays, the abandoned islands of Saint Ariano and La Cura. The project aims to cast a new light on the interaction dynamics between humans and environment in an area with considerable hydrogeologic dynamism, characterised by the typical barene -shallows that emerge from the water during low tides and are covered by vegetation of brackish water. The unique setting of this project, the Lagoon, requires a multifaceted approach including remote sensing analysis, survey and excavation. Several types of remote sensing data have been employed for the research, including aerial photos (from historical oblique images to modern orthophotos) and archive satellite images (Ikonos and Quickbird). Images are treated in order to improve the visibility of the traces and different processes are adopted accordingly to the different types of encountered environment (barene, land, lagoon waters etc.) identifying from time to time the ones which best fit the goal of emphasising features that can be related to the archaeological past of the islands. Stratigraphic analysis enables to verify information extracted via remote sensing analysis, with a focus on the extent and development of the monastery of Saint Ariano.

Session 3. Aerial archaeology in collaboration

Going the Spectra: Tackling Hyperspectral Data for Archaeological Purposes

Agnes Schneider, Philipps-University Marburg

Simon Seyfried, Philipps-University Marburg

Fabian Herche, Philipps-University Marburg

Paul Magdon, University of Göttingen

Lukas Lehnert, Philipps-University of Marburg

Hanna Meyer, Philipps-University of Marburg

Such as Archaeology, Aerial Archaeology has often borrowed methods and approaches from other disciplines. This is the case with the use of Hyperspectral data. Spaceborne Hyperspectral data has been used at most since some decades in archaeological research and the biggest obstacle constitutes the spatial resolution, which is crucial for identifying archaeological remains. Airborne Hyperspectral Imagery can cope with this problem, delivering adequate spatial and spectral resolution.

The department of Climate-geography and Environmental Modelling of the University of Marburg developed an R package (hsdar) to handle, manipulate, analyse and also simulate hyperspectral data. Being implemented in R, this package is open-source, open-access and enables the reproducibility of results.

We would like to present the R-Package through a case study using Airborne Hyperspectral data from an area near Münsingen in Baden-Württemberg, which presented cropmarks at the time of the data acquisition. To show and test the potentials of Hyperspectral data (analysis) for the characterization of archaeological remains and to present the package an area with and without cropmarks was spectrally



analyzed (noise-extraction, calculation of indices and red-edge inflection point) and compared. The Hyperspectral data was thankfully provided by the Central Project 3 of the Biodiversity Exploratories.

Identification of graves of war crimes using remote sensing methods. Areas of Poznań affected by the activities of World War II

Kuba Łada-Siwiec

The main aim of the work is an attempt to answer the question: if and how is it possible to investigate the places of hidden corpses of war crimes using remote sensing methods, especially ALS? The idea of the work is a result of reflection on the following questions: what is the methodology during research when it comes to developing ALS data and interpretation? Previous practice raises the issue about the possibility of developing a typology of graves and its usage in prospection. Non invasive methods are part of a multi stage scheme including: interviews with witnesses, historical queries, the use of non invasive methods, data interpretation, exhumation. The greatest emphasis will be set on the use of airborne laser scanning supplemented with aerial photographs and satellite imagery. GIS will be used in order to present the integrated results in a transparent way. The investigated areas are the regions of Poznań: urban area, fragments of forests and parks, suburban agriculture, which were affected by the events of World War II.

Irish Air Corp Aerial Photographs and Vertical Negatives Collection: Designing a System Model for a Digital Archive

Sharon Healy, National University of Ireland Maynooth

This research set out to identify issues and offer solutions to allow for the development of a system model for a web-based resource to provide access to the Irish Air Corps Aerial Photographs and Vertical Negatives collection (ACAP). The ACAP is a unique collection, being the only state aerial photography record of Ireland from the 1930s-1980s. Within the ACAP collection are analogue aerial photographs, vertical negative films, and coastal survey negative films. Further to this, are a collection of flight lines (or logs), which are records of a flight for a photo mission, and a collection of plotting maps. Following an appraisal of the negative films, it was assessed that while many of the films were in good condition, some films suffered from vinegar syndrome, while other films were at risk of deterioration due to rust and mould. Thus, the Irish Military Archives undertook the task of digitising the entire ACAP collection, and the subsequent task of developing a methodology to provide online access to the ACAP digital collection, now consisting of more than 45,000 images. While the plotting maps (1950s-1980s) and flight lines (1960s-1980s) provide sufficient detail to cross-reference the dates and locations of a photo mission, and thus, enable the indexing of a set of images in a digital archive; information for photo missions prior to the 1950s is limited or non-existent. This research further identifies an approach to overcome this challenge via crowdsourcing through social media, whereby members of the public are invited to contribute to the identification of dates, locations and heritage sites on sets of images with little or no archival records.

Object-based image analysis for archaeology: classification of 'simple' and 'complex' archaeo-objects

Luigi Magnini, University of Padova

With the advent of very high-resolution (VHR) data and their increasing of processing times, the shortcomings of a manual approach to archaeological photo-interpretation are now apparent. Object-based image analysis (OBIA) seems to be one of the more promising tools for overcoming this problem.



For better discussing the most effective methods of OBIA approaches in archeology, a distinction must first be made between the analysis of simple archaeological objects and complex archaeological objects. This partition constitutes the core-concept to understand the different data processing modes necessary to extract meaningful information from the image-objects and thus to create a better correspondence with the geo-objects and, consequently, with the archaeo-objects. According to this theoretical proposal, archaeo-objects correspond to anomalies potentially related to ancient anthropic activities: simple archaeo-objects are essentially related to archaeological entities which can be described with a limited set of classification parameters and that return an easier correspondence between image-objects and geo-objects; instead, complex archaeo-objects are anomalies that, despite being perceived by the human brain as one single entity, are automatically segmented into different image-objects. Among the reasons for this discrepancy, the most common are the intrinsic inhomogeneity of the structures or the disturbance of secondary factors, such as post-depositional processes or modern anthropic interventions. A general overview on the use of OBIA in archeology and its possible impact on the discipline will also be presented through targeted case studies.

Searching the AMPBV landscape from remote: aerial survey in the Po plain through new technologies

Laura Burigana, University of Padova

Searching the AMPBV landscape from remote: aerial survey in the Po plain through new technologies
The development of the Terramare culture during the Bronze Age in the Po plain had a great impact on the landscape, leaving an extremely articulate network of sites, connections and productive infrastructures. If the traces of this palimpsest have been over time partially erased by agricultural activities, on the other hand cultivations helped to preserve vast areas from building, making possible for archaeologist to perform extensive monitoring and investigations through aerial survey. Since the mid 80's the AMPBV group (Alto Medio Polesine Bassa Veronese, coordinated by prof. Armando De Guio - Univ. Padova) has been carrying on researches in the southern Verona Valleys and in northern Polesine area, relying mostly on non-invasive techniques and in particular remote sensing, recently including among its assets UAV technology. The acquisitions from the drone sensors have been processed and compared with different data, such as lidar derived DTM and high-resolution multispectral images. In order to extract at best their information, all datasets went through multiple treatments, like hillshade, Sky View Factor, Local Relief Model in the case of raised relief maps, whereas for RGB and multispectral images we basically relied on band computation, data fusion and enhancing operations. The work of processing and analysis allowed us to test the effectiveness of different remote visualization strategies for the study area. It also helped to identify new elements of the landscape testifying the relation between settlements, polities and the surrounding environment.

Whodunit - On the confusion of the first active use of aerial photography at an excavation site

Till Sonnemann, University of Bamberg

When searching for 'the first' use of aerial archaeology for a lecture, the author came across a number of papers who independently describe this event to have happened in Persepolis in 1879 when the inventor of the gas turbine used an air balloon to record an excavation. When searching for and eventually finding the quoted publication, there was however no aerial image or mentioning of this task. The poster will present a whodunit detective story on when academia goes off the rail, showing the lapses that can happen when copying from secondary sources, and leaving the question, once a myth like this is set, (how) can it be stopped? To give you already the answer to who was first: most sources agree it was



Gicaomo Boni, while directing the excavations of the Forum Romanum in 1889/90. There is at least photographic evidence of an air balloon on site as well as of the recorded images.

Session 4. Monitoring changes

Applying combined remote sensing and field survey methodology to identify a buried archaeological site on Didi Shiraki Plain, Kakheti, Georgia

Giorgi Kirkitadze, Ilia State University

Mikheil Elashvili, Ilia State University

Presented research is the first documented attempt to create an archaeological map of the Didi Shiraki Plain (1:120,000 scale). Due to the presence of a Soviet military air force base on Didi Shiraki Plain, access to the study area was limited until the end of the 20th century. Starting from the 90s, despite the various archaeological expeditions, several large-scale buried archaeological sites went unnoticed by the researchers, mainly due to the lack of remote sensing data. Based on the limited published data, sparsely studied archaeological sites on Didi Shiraki Plain date back to the Late Bronze and Early Iron ages and can be attributed to a distinct local culture. In the current study, we present the combined methodology of remote sensing and field survey, which allowed us to identify new archaeological sites on Didi Shiraki Plain. The applied methodology includes: i) Using open source satellite data for aerial reconnaissance, ii) Using close-range aerial photogrammetry on the pre-selected areas to generate high-resolution ortho mosaics and digital elevation models for specific sites, iii) Field archeological survey at selected - most prominent places, iv) Data integration in geographic information systems and Spatial-correlative analysis of field and remote sensing data, v) Creation of digital archaeological map of Didi Shiraki Plain. The presented study provides relatively complete information on spatial distribution, shapes, and sizes of previously unknown buried archaeological sites. The results of our research may be applied in further archaeological studies, as well as in management and protection of potential cultural heritage objects.

Monitoring by Drones: Impact of Environmental Factors on Cropmarks

Agnes Schneider, Philipps-University of Marburg

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Anna-Theresa Hobert, Philipps-University of Marburg

Felix Teichner, Philipps-University of Marburg

Christoph Reudenbach, Philipps-University of Marburg

The Archaeological Seminar of the Department of Archaeology and the GIS Lab of the Environmental Informatics of the Philipps-University of Marburg started a joint environmental change-monitoring project of certain areas in Hesse, Germany. As a starting point diverse test-sites – case studies were chosen in the central region of Hesse dating to the Late-Iron Age – Early Roman (probable cemeteries with burial mounds and enclosures) and Roman period (two Castella), which were detected on Google-Earth images in a previous project. The aim of our undertaking is to monitor the effect of environmental factors on cropmarks caused by different archaeological remains (stone structures for eg.) in different types of vegetation (crops, clover and grass) with a Parrot-Sequoia multispectral sensor on a RTF 3DR Solo. For better control and reproducibility the UavRmp Package based on R (developed in the GIS Lab



and released on CRAN) is used to produce the control files for the missions. We would like to present some results of our monitoring-survey.

Session 5. Drones in aerial archaeology (to drone or not to drone)

Application of UAV systems and integrated geomatic techniques for the documentation of the monumental remains of the Roman arches of Burnum (CROATIA)

Alessandro Campedelli, University of Bologna

Marco Dubbini, University of Bologna

For some years now the field of Cultural Heritage has attracted an increasingly frequent interest from the scientific community, which has led to the development of interventions and advanced methodologies, increasingly multidisciplinary. In this context, despite the problems due to more and more limited resources, attention to digital metric documentation remains high. The idea that the knowledge of a good can not only concern its artistic history, but must also include its own material characteristics, position, form and state of conservation has strengthened. Thanks to the evolution of digital techniques and technologies linked to Geomatics, today it is possible to obtain information aimed to the accurate metric description of archaeological structures. These techniques represent an essential tool for analysis, monitoring, conservation and restoration, without neglecting the dissemination and virtual tourism of cultural heritage. The contribution concerns the deepening of digital aerial photogrammetry with the UAV system and verification of the metric reliability of the models generated by open source software. The remains of the forensic basilica of the archaeological site of Burnum (Croatia) were examined, represented by two monumental arches in blocks of local limestone, with spans of over four meters and preserved for over six meters in height. In order to test the metric accuracy of the three-dimensional photogrammetric model, geometric comparisons were made between the cloud obtained from the integrated image dataset from UAV and the cloud obtained by laser scanning.

Drone mapping in Iraqi Kurdistan

Karel Pavelka, Czech Technical University in Prague

Jaroslav Šedina, Czech Technical University in Prague

Karel Pavelka jr, Czech Technical University in Prague

Small archaeological areas can be effectively mapped by low cost techniques like using drones. That is why geometrical resolution of RPAS can be in cm, which is necessary for small areas documentation or analysis. Typical outputs, used in archaeology, are digital surface models (DSM) for detecting of terrain features, orthophotos can be used for crop marks or soil marks, 3D models are good for objects or structures. This contribution refers about projects in Iraqi Kurdistan. Iraq is still no-fly zone, there is a problem to collect new aerial photos. Drones seem to be a very useful technology, but in Iraq it is not easy to use drones from security reason, obtaining of a permission from relevant military or government representation is problematic. In 2015 a set of very good orthophotos and DSM have been made using winged drone in archaeological site Makhmur (old settlement from 9th to 11th century AD). The result shows advantages of using RPAS for precise DSM creation which serves better details as a satellite data in terrain indices. This site is lying in the low-cultivated dry landscape and is, therefore, perfectly visible in the relief, but western part has been recently flattened due to town expansion and some areas on the south started to be cultivated few years ago. Results give us the possibility to analyse original landscape before industrial, war or agricultural changes. In 2018, orthophoto and 3D model of a shrine in Alqosh



city (on the North of Kurdistan) using multicopter has been made. These outputs can be used for future restoration of this object. Both case projects show advantages of using drones in archaeological praxis.

Drone vs conventional site survey

Matjaz Nekrep Perc, University of Maribor
Rok Kamnik

The paper deals with archaeological site survey in the northern part of Slovenia. We have compared results from two sources of point clouds: a detailed geodetic survey of the site using Leica TS 50 robotic total station and photogrammetry using the drone.

The contribution of UAV platforms to reconstruct the Romano-Byzantine Kastro of Gortyn (Crete)

Simone Amici, La Sapienza University of Rome

Gortyn is one of the largest metropolis of the Mediterranean area, inhabited from the Prehistoric to Medieval time. The archaeological mission of Sapienza, University of Rome, tries to understand the topographical and urbanistic contents through UAVs. Aim of this proposal is to edit a detailed plan of the site in order to create the most accurate archaeological map of the site. The focus of this project is in the acropolis area: the Kastro, a Roman building with multiple reuses along the centuries (III-VII A.D.). For the first time, an updated aerophotogrammetric documentation and reconstruction of the monument, realised with UAVs and topographical instruments (TS, DGPS and Laser Scanner), is here presented. The future goal is to create a GIS map of all the city and its territory.

UavR – package twins for data acquisition, processing and analysis for (RTF) low-budget drones based on R

Christoph Reudenbach, Philipps-University of Marburg
Agnes Schneider, Philipps-University of Marburg
Luise Wraase, Philipps-University of Marburg

The use of UAVs for data acquisition for archaeological site-monitoring or documentation at excavations (for eg.) is becoming common ground. Many ways exist to process and analyze the acquired data. We would like to present the Uav-R Package family designed and developed in the GIS Lab of the Environmental Informatics of the Philipps-University of Marburg to facilitate and automatize the acquisition (Level1)-, processing (Level2)- and analysis (Level3 products) of UAV generated data. The UavRmp – R based Mission Planner package creates a reproducible, terrain-following flight route/control files based on the flight altitude, a DEM (optional), image-overlap, wind-condition, battery-life and UAV type passed to the script. The UavRst – Remote Sensing Toolbox package enables to run certain algorithms on the UAV derived imagery and point clouds for preprocessing and classification based on machine learning and segmentation. The package family is still in development (the first release is already on CRAN) and the algorithms are assembled mostly for geo-environmental use, but they are also very useful for archaeological analysis of UAV derived data and they are open source and access and reproducible, as they are implemented in R. We would like to present the package-twins on a specific case-study in the region of the Late-Iron ge Oppidum Dünsberg in Hesse, Germany.

Session 6 Managing the land



A centuriatio seen from above: airphotography, field surveys and archival research for detecting past landscape systems in the territory of Vibinum (Bovino, Foggia)

Valeria Volpe, IMT School for Advanced Studies Lucca

Traces of ancient agriculture and land management are some of the most prominent archaeological features in the Apulian landscape. Whether fossilized in the modern fields and visible as cropmarks or, in the most resilient situations, still in use in the contemporary field systems, they represent the material sign of a long-lasting human-environment relationship. The poster details this complexity in the context of the Roman colony of Vibinum (modern Bovino), retracing both historical and methodological processes. Thanks to the integration of data from remote sensing, aerial photography, field surveys and archival research, it is possible to hypothesize that this Roman limitatio, also attested by ancient sources, has been a stable feature in the ager vibinas throughout the centuries. Its centuriatio, according to recent archaeological investigations, can be recognized in a portion of its territory, NW of the urban center. Such recovery was possible through aerial photography, a fundamental tool for analyzing an inertial land asset in an area characterized by low urbanization and good preservation levels of both archaeological remains and environment. By bringing archaeological and documentary data, we can detail the permanence of steady land management. Moreover, analysis of Vibinum's landscape suggests to further question the reasons for this alleged success over time, a result of compliance with geomorphological assets and the installation of sustainable water systems, road structure and property regimes. Landscape is therefore intended as a historical source to be archaeologically and stratigraphically investigated overcoming an exclusive site-centered perspective.

Desolate field systems and new "post-crisis" settlement traces in Western Jutland, Denmark

Mathias C. Broch, The Cultural Heritage Museums in Holstebro Municipality

Danish research has largely disbanded the ecological crisis during the first millennium AD. However, remnants of the crisis endure in the sandy areas of Western Jutland. Here 200 AD marks the abandonment of 'Celtic' field systems and a following 800-year settlement sparsity. Heathland expansion during this period coincides with ideas of a new pastoral-nomadic society. However, during our aerial surveys, several settlements from this period have appeared. With this poster, I will focus on the new "post-crisis" sites and discuss how they relate to the "pre-crisis" landscape architecture.

Landscape archaeology: the Swedish Geodatabase example of multi-stratified monitoring

Felice Perciante, Lund University

The anthropic evolution and the use of new technologies both in agriculture and engineering in the last thirty years has led to continuous transformations of the contemporary landscape. Today even the large estates are threatened by heavy mechanization interventions that endanger the already fragile traces of archaeological evidences hidden in the contemporary landscape. In some cases, in fact, aerial and satellite supports are the only source of proof and reading of anthropic and natural historical signs. This contribution offers an example of a study developed in Sweden and based on geodata made available to public administration on an accessible platform for scholars engaged in various research sectors. In detail, a work of archaeological photoreading and photointerpretation on three different historical contexts relevant to the Blekinge and Skåne regions of southern Sweden was carried out, affected by future anthropic interventions (new construction and agricultural divisions). The study, conducted on multi-spectral supports and on SAR data, followed first the classical methodology of aerial archeology with optical and stereoscopy reading. Then the capacities offered by the supports for automatic and semi-automatic identification of traces were evaluated. The aim was to implement the information system



derived from published data or commercial archeology interventions in order to characterize the territories on which these works are going to be realized. The results, although uncertain as they are not yet subject to ground surveys, are very interesting and describe a much more complex picture than what has been known until now.

Landscape of relict border from years 1920-1939 on Pommerania (Poland), a remote sensing perspective

Filip Wałdoch, Adam Mickiewicz University

Purpose of this poster is answer the question: what relicts of the Border and borderland have been preserved in the landscape of Pomerania? Field of research is a fragment of past polish-german boundary between Łukomie Lake and Kamionka River. For answer question, I use few kinds of date: historical cartographic source, remote sensing and field prospection. During research of every level of landscape connected with the demarcation of boundary and its infrastructure or material remains of living and use in boundaries area (e.g. farms, orchard, mills, cemeteries). I will present case study characteristic for every to set apart landscapes. Social-politics changes provide near completely destroy material relicts of the border and its infrastructures. The surviving border guard stations or border pole are individual cases. The research carried out shows how carefully efface former polish-german border. The best visible is cultural-religious boundaries landscape. This is evidenced by abandoned cemeteries and farms. Despite total abandonment and partial destruction still to resemble about multiculturalism of the then borderland.

The crop circle mystery. Another case study of a pitfall in the air photographs interpretation.

Zuzanna Kowalczyk, Adam Mickiewicz University Poznań

Martyna Andrzejak, Adam Mickiewicz University Poznań

In European archaeology, we know many examples of modern activities or agricultural operations that cause cropmarks 'imitating' archaeological features. It often causes pitfalls in the interpretation of air photographs. Similar situations happen also in Asia where the interpretation is even more difficult. An archaeologist enters a new environment with his/her research questions, knowledge and experience. He/she is considered to be an authority in the field of the past. However, he/she is a stranger.

In the poster, we will analyze a case study of circular cropmarks from Dewil Valley, Palawan, Philippines. As a part of the interpretation process, we have consulted the local community and conducted surface surveys. The marks are located on rice fields near multiphase cemetery and religious sites. Potentially there could be some remains of settlements.

We will also present examples - puzzles of different kinds of crop circles from Poland. All the cases emphasize the importance of doing local research and combining two types of knowledge: the theoretical and the pragmatic one. Such examples can be a valued lesson not only for young archaeologists.

The threat of intensive agriculture on the ancient landscape: Ager Picentinus

Felice Perciante, University of Salerno

Computer and mechanical evolution in all sectors but above all in agriculture is making man a passive spectator of the destruction of the historical memory of our ancient landscapes that coexist in latent forms in the contemporary gaze. The increasing demand for food and consequently the intensive exploitation of the subsoil is leading to the use of more refined but at the same time highly destructive



agricultural techniques. The aerial supports before and the satellite have after been for many years the main source of research and especially of monitoring by the bodies responsible for the protection and enhancement of cultural heritage. The advent in many places of our country (Italy) of roofing systems (greenhouses) if on the one hand they help to protect buried evidence, through superficial workings, on the other they hide them to the synoptic view guaranteed by aerial visions. In fact, greenhouses are often a favourable environment for illicit actions such as clandestine excavation. With this contribution the results of a study conducted by the writer in an area of the Ager Picentinus are discussed, today strongly influenced by new productive sites. Here, thanks to aerial and satellite supports, it has been possible to identify hidden traces of the past that are slowly disappearing.