AAR Gn ews
The newsletter of the Aerial Archaeology Research Group

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AARGnews is the newsletter of the Aerial Archaeology Research Group

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[Mystery cover photograph. 17 April 2015]
Frontispiece. Abstract use of ALS on the poster advertising the ArcLand exhibition in Ljubljana.
Editorial ¹

AARGnews list of Contents
Earlier this year I received an email offering a contribution to AARGnews and saying that it was similar to a paper by X that was in an earlier issue. The title of X’s paper was vaguely familiar but I couldn’t find it by visual perusal of recent-past Contents pages. Thanks to Lidka Žuk’s past conversion work, I had Word-readable files of all past issues so decided to make a full list of contents. This is a simple Excel file with columns for title, author(s), issue, page and year that can be sorted in a variety of ways. Because it may be useful to others we may add it to AARG’s website from where it can be downloaded. By the end of my cutting, pasting and converting to table for issues 1 to 50 I still didn’t find X’s paper which Michael Doneus subsequently told me is in Bill and Ioana’s Archives book (Hanson and Oltean 2013).

Digital progress
When making the Contents file, I was surprised how early the first digital issue appeared – AARGnews 35 in September 2007. So we have a 10th (or 20th) birthday to celebrate in a couple of years. Going digital has been very beneficial, not only in helping AARG build a reservoir of money (printing and posting used to take most of the annual subscriptions) that can be redistributed by supporting students and projects, but in saving your editor the trips to the printer, packing and posting the old paper copies. The downside may be that fewer members bother to download the pdf file but contra to that the website statistics show that the AARGnews part of the site is visited by the world at large. In view of that, we could suggest that if you want to influence people, you may do it better by publishing in AARGnews than in the academic-preferred weighty journals.

A(nother) use for aerial images
Darja Grosman sent me a copy of the poster (Frontispiece) advertising the recent ArcLand exhibition in Ljubljana. The abstractness, use of colour and design made me wonder if I can kick the sacred cow and suggest that we have a display of ‘enhanced’ aerial images either at a future meeting or in AARGnews (or both). Most of us have tried pressing a few buttons in computer programs to ‘see what happens’ – so how about sharing your results?

Was 2015 a good year for crop marks?
Aerial photographers seem easily to get excited at the mere suggestion of a crop mark, and summer 2015 was no exception in Britain. The useful Crop condition bulletin collated and circulated by Damian Grady (EH or HE) gave indications of good and improving conditions from June onwards and the rain in July seemed to do little to eliminate the crop markings. In an attempt to elucidate AARGnews readers on general results for 2015, I asked 12 international aerial observers for brief comments for this issue and received three useful replies (see p48). So now you know what’s been going on this year.

On destruction of sites – a personal view
Cropmarks in this issue includes links to uses of satellite images and drones to identify or record destruction in the Near East. This – destruction in the Near East or anywhere else – is nothing new and I’m puzzled why people are now making so much fuss about it. There has been a tradition, perhaps for ever, that the victor, however temporarily a victor, can do

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whatever he (sic) likes in the land of the vanquished. I may be wrong, but I think that participants in the ‘Holy Wars’ of The Crusades did a fair amount of what we would now call vandalism in their 200 or so years of campaigns in the Near East. In cases like that we should be surprised if mindless, or directed, destruction is not done in the name of religion. Nowadays, now humans have become really good at destroying things, we can anticipate the use of HE (High Explosive) to assist in that destruction and should expect the results to be effective. I’m not condoning it, merely saying that we ought not to be surprised at current destruction in the Near East, or anywhere else where there is religion-based conflict.

In time, remains of what we now call ‘recent’ events become valued as evidence of those events. Examples that come to mind are at the World Heritage site at Samarra, Iraq (UNESCO 2015), which flourished between 836 and 892, and in which there is a network of trenches from the First World War. Those trenches are presumably now accepted as interesting relics worthy of preservation. The Berlin Wall marked the partition of political cultures for almost 30 years until that division was abandoned 25+ years ago. The Wall (1961-1989) divided Germany and marked a physical, cultural and, to a degree, symbolic barrier during a critical period of recent cold conflict. The world, Germany especially, celebrated when the Wall was almost completely removed yet its line is of importance to our knowledge of the Cold War. Wasn’t that removal an act of vandalism as well as one of celebration? [As an aside, it is interesting to see in just how many ways that East-West division is still apparent (Noack 2014) including – for any aerial people who are still reading this – from space at night.]

Still on the theme of destruction, I submit that visual evidence of destruction – be it at a ruined castle or by those who take pleasure in voyeuring fresh car accidents – makes a popular tourist attraction. I have, for example, been shown shrapnel scars, blasted building remains and soldier’s dug-out scoops in many countries in central Europe and the Balkans where there has been recent conflict. I even know where to point out the two or three shrapnel scars that mark World War Two damage near my old rooms in Trinity College, Cambridge. Those marks have been preserved (by not being filled in) and some visitors like to see this kind of stuff because it is an unusual piece of local history that can be explained by mixing visualisation and recent memory.

Thus, I would question the wisdom of those archaeologists who are sitting clutching 3D models of sites before ‘Islamic State’ destruction and who vow to go to those sites as soon as the baddies have been removed to restore them (restore the sites, not the baddies) to their former conditions. Even though those ‘former conditions’ may owe a lot to past archaeologists’ imaginations. I offer three points: firstly, that in time evidence of destruction is, or will itself become, a legitimate part of a site; secondly, we should question whether is it right to reconstruct a reconstruction without new and thorough academic investigation; and thirdly, it seems irresponsible to do any archaeological work in affected countries before their humanitarian problems are sorted out.

Deliberate destruction is one thing, and it could be asked whether it is likely that ‘IS’ would be so vandalistic if world media were not watching. Visual aids are a powerful tool that can be used to feed both sides of this argument – the dismay and horror for one side and the power created by destruction and killing for the other. From the aerial perspective, satellite images are used to show before and after condition of sites, monuments and landscapes and
can themselves provide a powerful comparative image set as, for example, to show destruction of the Temple of Bel at Palmyra, Syria (BBC 2015).

The other side of the story concerns damage by present-day military activity and the work of archaeologists to limit that. Searching Google shows that quite a lot has been written about this aspect and I read selectively rather than comprehensively (eg Stone 2011 – a lot of which is free on the web). One paper in that book (Curtis 2011) includes personal experiences of various cooperation and non-cooperation between archaeologists and the military in Iraq. It includes his observation that because Iraq is one vast archaeological site he was reluctant to provide the military with a list of selected sites because by doing so he would give them carte blanche to do whatever they liked in the rest of the country. On this basis – and especially using knowledge gained from aerial evidence – we can suggest that a large part of the world is also one vast archaeological site. Add to this the consideration that if someone starts shooting at you personally, it’s more likely that you’ll dig a hole behind the closest bump in preference to consulting a list of places before crawling to the nearest location where it is approved for you to dig a hole. Archaeologists can be idiotic about preservation and the value of past sites, some of whose ‘importance’ merits questioning anyway, that I sometimes wonder if they live in a parallel universe in which the past is more important than the present or future. It’s easy to say ‘Tut, tut’, ‘Oh dear’ and ‘You can’t dig there, it’s a scheduled site’ but let’s be more realistic – remember we’re talking about the whole world being one big site – and suggest that either we say ‘tough’ to the miniscule amount of damage that conflict has and will cause to earlier sites (National Geographic 2015) or we banish all conflict to Antarctica whose landmass was devoid of human activity until the late 19th century. Ah, but wait, isn’t Scott’s Hut now designated as an Antarctic Historic Site? [as are 91 other sites or objects – Wikipedia 2015] No, we mustn’t squabble there.

Recent publicity about destruction and threats of possible destruction reflects, to me, the biased view of the past that these so-called ‘important’ and World Heritage sites show the world. Archaeology, like history, has targeted the hierarchy and is portraying these as representative of the past. Rubbish – most of these are representative of lucrative tourist attractions. They are a tiny percentage of ‘sites’ from any period of the past, sought out by archaeologists because they got (and probably still get) more fame and funding for finding pots of gold, statues and other junk, than they do for helping to understand what, for example, made it possible for those hierarchical sites to be built and to survive. In the same way that money poured into Stonehenge in England does little to help us understand what went on in the majority of Late Neolithic and Early Bronze Age communities in Britain; so the restoration and flagshipping of palaces, towns and so on is completely unrepresentative of the bulk of past societies and their landscapes. Such sites were and are but a small part of the systems of past communities and in many cases and places we are uninterested in examining the rest of those landscapes\(^2\). So perhaps funding for the restoration of tourist attractions should come from Ministries of Tourism and leave the lesser archaeological resources to investigate parts of the landscape more relevant to how past populations were able to survive and flourish. One additional bonus from digging up peasant sites such as Fred’s roundhouse and examining his field system is that such lowly sites are unlikely to be targets for destruction in any future religious wars.

\(^2\) Except in cases where aerial photographs have been interpreted to map an extent of land. Aerial survey is able to give us information across past hierarchical spectra which is one reason why it is such an important tool with which to examine past societies.
This issue
From Galicia, so relevant to those of us attending the AARG meeting in Santiago de Compostela, is a paper by Ans, et al, who have been using aerial photographs to check location of castro that have been identified or suggested from documentary or other sources. Comparison of aerial images taken about 70 years apart shows how some sites remain intact, while others have suffered from development and population expansion. This paper gives another example of aerial information being just one data source in a project whose results can show the current condition of sites and so may help guide management policies.

Carmen Miu (ex Bem) was working with me during August and is responsible for linking me with her colleagues who made a camera rig to photograph linear structures – part of the Limes in Romania. One aim is to use the photographs to create orthophotos and terrain models, but along the way they discovered and recorded what may be a formerly missing extent of the Roman earthwork. Going back 30-40 years, I remember John Hampton recording linear ditches in Wessex as an overlapping series of near-vertical photographs. I wonder if anyone has experimented with these to see if a DTM can be created...?

Following an editorial comment, Martyn Barber has given us a lengthy ramble through Crawford’s use of aerial photographs and a stereoscope. Any of you interested in the history and ‘origins’ of our speciality should read this. Following from Martyn’s paper – which reinforces some of my own perceptions on how Crawford used aerial photographs – it may be time to examine our origins and perhaps to look wider than this single person for a ‘father figure’. May we need a future AARG debate session may start things rolling?

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Chair(man)’s Piece

Rachel Opitz

September 2015

And now for something completely different. The inimitable phrase from Monty Python could have been quoted before quite a few of the papers given at the AARG Annual Meeting in Santiago. Many of you seem to be doing things I'm not sure would be recognized as appropriate material for an aerial archaeology conference by those outside the field. I mean that in a nice way. The internal AARG trend, if there is one, is toward thinking about landscape, and the thought that aerial perspectives and data captured and interpretations made from above are not only valuable but necessary for archaeological studies of landscape. This trend toward landscape has been happening for a while, but I feel we have reached a tipping point, where the two are so well integrated that any discussion of one implies the other to the extent that it need not be mentioned. The implicit statement is that aerial archaeology is necessary to landscape archaeology, and vice versa.

I want to explore for a moment this business of implied and necessary. We heard papers from Mikolaj Kostroyo and Lidka Zuk, both built firmly on data collected from airborne platforms, both working at times using a 'from above' perspective, both looking at manifestations of individual and collective activities in the landscape, human and animal alike. Both of these would have been at home at LAC or TAG. The importance of the aerial to the story told by Lidka and the agenda laid out by Mikolaj was implied, rather than described in detail. Narratives of human movement through a multi temporal landscape, with the remains of monuments and dwellings and cultivation hidden or left exposed by subsequent land use and landscape processes were built directly on aerial data, in the case of the story told by Lidka primarily the cropmarks studied and mapped by Cathy Stoertz. In Mikolaj’s paper there was the occasional lidar-derived image and lots of zoomed-out from-above scale thinking, helping us to see the archaeological traces of animal agents in ways that prompt us to reflect on animals as active creators of the landscape.

So what does it mean for us as AARG that we have taken such a strong landscape turn, telling stories about places and their occupants and leaving so much about the particularities of the methods and evidence merely implied, at least as presented in our talks and papers?

Recalling last year’s debate session on detail vs. broad brush approaches, I find myself thinking about the craft of aerial interpretation, and the need to ‘get it right’. Our basic and fundamental task is to read the landscape as recorded from above by identifying, mapping, and interpreting (in whatever order you loop through those steps) the elements that compose it. Parsing the elements of the landscape soundly and tightly tying the narratives we construct to this makes the difference between an archaeological story, one grounded firmly in our understanding of the evidence, and a fiction that might help us to think about the past generally, but where the dissonance created by getting the details wrong perturbs those who know. How we signal that we are telling ‘serious’ stories, where we are attempting to get the details right, and the details are meaningful, remains - for me - an open question. Within the

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academic and heritage professions those making reconstructions in the form of drawings or physical models do this, and do it well. The success in communicating the fact-through-fiction in these media may be, at least in part, because as a discipline we recognize reconstructions as intentional and informed visual stories. Operating largely outside the archaeological and heritage professions, good historical fiction is grounded in an informed understanding of the past, though here the responsibilities of the authors are more to telling the tale than to getting the details of its factual basis right at all times. As archaeologists I like to think our balance of responsibilities is different. Our task then, as we try and tell about the landscape, is to stay closely tied to the details of our understanding of the evidence, without breaking the thread of the story.

In a positive light, I see these attempts to push in new directions and use our particular perspective and body of evidence to speak to the larger project that is archaeology as indicative of our looking outward, and ongoing determination to keep our work fresh, bringing our voice and perspective to a wide variety of archaeological questions. This orientation was evident in the reports and opening or continuing of dialogues coming from ARIADNE, ArchaeoLandscapes International, and the community-engagement focused Flying Circus. We had a longer than usual business type session at the beginning of the meeting, a direct result of having more groups and projects in which members of the AARG community are active members. Deliberate steps to engage with not just the academic, but a broader public community are being taken.

While the Circus is in early days, putting an emphasis on aerial methods as something basic and necessary not just for those formally studying archaeology, but for anyone interested in it, is reflective of this broader turn. This year’s debate & discussion session on the political implications of our work, featuring papers by Robert Bewley and Chris Cox, presented by Rebecca Bennett, equally spoke to the role of aerial approaches and methods as something basic and necessary, a ‘first-in’ tool of choice in difficult and rapidly evolving situations, both humanitarian and archaeological.

Returning for a moment to the more strictly archaeological realm to consider the business of being necessary, of course it is possible to do a landscape archaeology without drawing on the aerial - anything is possible. But at this point in our disciplinary history, it would be a deliberate choice, and perhaps a strange one, to avoid any use of overview maps, air photos, satellite images, or any of the other tools that make up the background and skeleton to most projects considering a past-in-present landscape. To be ‘necessary background’ for work in landscape archaeology without fading into the background of conversations about landscapes is a delicate act. I can’t claim to know the trick to doing it, but can hope that continuing to interrogate and revise our own practices, teach the fundamentals, and talk and write about our own motivations and enthusiasms will take us in a good direction.
AARG notices

The Derrick Riley Bursary

The Derrick Riley Bursary still exists. It is £500 a year, usually a single award, but sometimes is split and given to two people.

There should be an application form on the Sheffield Archaeology Department website and a Riley Bursary page on the Sheffield website where potential applicants will be able to find information and download the application form.

Finding the relevant page represents the first challenge, but if you can’t please contact Bob Johnston (r.johnston@sheffield.ac.uk) who administers the bursary.

Please apply for this even though it is not used only for conference attendance. AARG has limited funding and access to the Riley Bursary extends this amount to something more useful. No whinging about lack of money if you don’t apply.

ISAP Fund

In August 2015, ISAP announced establishment of a fund to provide support of up to £1000 to assist with members’ projects [membership costs less per year than AARG does] that ‘further the objectives of the Society’.

Info and application form from the ISAP web site: http://www.archprospection.org/isap-fund

Information for AARGnews contributors

AARGnews is published at six-monthly intervals. Copy for AARGnews 52 needs to be with me by February 14, 2016. Editorial policy (for want of a better word) tends to be that if I am sent interesting contributions they go in unless there’s a danger of an issue overflowing. Vague instructions for contributors are on the AARG website, or use this issue as a guide.

Please do not use any ‘clever’ formatting and avoid footnotes.

Good-quality jpegs are suitable for illustrations. Tiffs are for archives.

And please send us your nominations for future AARG conversations.

Address for contributions: rog.palmer@ntlworld.com
AARG’s Flying Circus

Rog Palmer

AARG as a group has been actively involved in teaching since the 1990s. Without AARG, the teaching in Europe that followed the Kleinmachnow meeting would have been either impossible or nothing more than flying and aerial photography. Mainland Europe is fortunate that most of the people now working with aerial photographs have full-time posts in universities and easier access to students and teaching than the Brits who have most of their aerial people in government service and thus teaching is ‘outreach’. AARG, and before them the Council for British Archaeology’s Aerial Archaeology Committee, attempted to offer and encourage more aerial teaching in UK universities but the general response was that the universities are happy as things stand. Aspects of this and other teaching initiatives, prospects and needs were detailed in AARG’s first Occasional Publication (Cowley and Palmer 2009).

Students aside, there are others in Britain – the community archaeology groups – who are actively undertaking a range of archaeological projects and who may welcome some instruction in uses of aerial photographs (identified as such by Boutwood and Winton, 2009). The idea for involving AARG with community archaeology in the UK arose at the committee meeting in September 2014 (see Opitz 2015, 7). It was followed by some outline ideas and emails between us, given some extra dimensions by Carenza Lewis who was then Director of Access Cambridge Archaeology. By chance, her administrator, Laure Bonner, is a founding member of Stour Valley Community Archaeology and offered them as a guinea pig for a first day school. The group has been doing documentary research, field walking and excavation in quite a large area of the Stour Valley, part of which was described by Davy Strachan (2000; 2001). They were also interested in use of drones over their area – something that could easily be organised as, for example, photographing fields at potentially good times from which they have field walking results.

The first Circus took place on 13 June 2015 at Hill Farm, Gestingthorpe, a farm owned by one of the participants who had established his own museum with a classroom attached. It provided an ideal space and was free of charge with chairs plus desks for the 21 people who attended and a projector for me. The day was planned to run from 10-4 with a few shortish breaks and I’ll give some detail of the main themes as the committee hope to encourage others to become involved in community archaeology teaching and AARG can offer a package that

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2 http://www.access.arch.cam.ac.uk/
includes PowerPoint presentations with – currently – very short notes. The first Flying Circus sessions comprised:

1. Talk on using aerial photographs with the main themes being:
   - Tell me what you see – a guided class discussion about one photograph;
   - What aerial photos show (shape, condition, context);
   - Post-depositional processes – what is left for us to see and how we see it;
   - Types of aerial images – biased and unbiased – effects of lighting on viewing.

This session included quite a lot of audience participation (simple photo reading example, discussion of lighting and perception).

2. Photo reading 1:
   - Starting with each individual saying one thing about a photograph;
   - A series of examples to illustrate particular points – crop variations, non-archaeological, etc – to make them think and ask questions.

3. Photo reading 2:
   - Examples they provided (very few);
   - Examples within their area that I had grabbed from GE in an hour or so.

4. Seeing in three dimensions:
   - Anaglyphs – a slide show with discussion about how to take them;
   - Brief introduction to ALS, mostly using results;
   - SfM – method, free software, results. Possibilities from their drones;
   - Hands on stereo test followed by example images with limited questions.

At the end we asked if any would be interested in a second session about transformation, interpretation and mapping. Yes please.

Feedback was largely positive, with photo reading being the most popular – they enjoyed the chance of working out what things were and trying to understand some of the non-archaeological features. As often with older participants, this group brought their own experiences and local knowledge to the discussion.

Anaglyphs were enjoyed but there were mixed responses about using a stereoscope. There were complaints from people who couldn’t fuse images but the others really appreciated the 3D view and asked where they could buy stereoscopes. Also, teaching use of a stereoscope is not easy with one teacher and 21 participants so I may drop that from any of my future Circuses. Perhaps it is something that is best left for longer workshops with more specialist participants?
Future UK Circuses? As well as the day for mapping with this group, I was asked if I could do another introductory day for a Colchester group. But if AARG wants to broaden things out (i.e., out of East Anglia) we’ll need to find more teachers – so please form a tidy queue.

One further question asks whether Flying Circuses are also part of the schools and workshops run by AARG members in mainland Europe where the situation is different. In some countries, students may have good basic aerial teaching at universities but then may benefit from focused schools or workshops – where I am using ‘focused’ to mean that they fit either specific ‘local’ themes and conditions or will study particular technical applications. To the best of my knowledge, there is no such thing as ‘community archaeology’ in mainland Europe so we would expect ‘students’ there to be either real students or young professionals.

Another point was the suggestion to build up a Circus archive of material that could be used by other teachers. To some extent this may be useful although I know from past workshops with others that we all have different ways of teaching much the same thing and that, for example, most of my presentations and illustrations would be of little use to someone teaching in Greece (to choose a random place) or, closer to home, in lumpier parts of Britain. And one thing all those Euro-schools taught us is that we need to use local examples as much as possible – hence my hour or so on Google Earth looking for examples in the Stour Valley. Perhaps a final point regarding teaching material is that most of us know one another and the material we use so it is easy to send an email to Fred and ask for the sequence of slides he used in a particular presentation. Fred is usually an obliging chap and at recent workshops there has been considerable exchange of files.

Toby Driver was asked to produce a few cartoons for the Flying Circus – three are included in this piece – and his output far exceeded my expectations. Thanks Toby.

References:
Location of hillfort culture settlements by means of aerial archaeology in the municipality of Carral, Galicia

Pablo Fernández Ans¹, Marta Molina Huelva², Ángela Barrios Padura³

Keywords: Aerial Archaeology, Hillfort or “Castrexa” Culture, Mapping Interpretation, Cartography, Geo-historical analysis.

Abstract
The use of aerial photography as an archaeological tool allows the identification of archaeological remains and human settlements, and may also provide knowledge about their evolution within their surroundings. However, this identification must be accompanied by the support of documentary or oral sources as, in some cases, aerial photography by itself does not allow their identification, due to the changes and the evolution of the countryside.

Using the potential of aerial photography to identify the archaeological heritage, various Iron Age settlements were analysed in an area of the northwest of the Iberian Peninsula, specifically in an area in the municipality of Carral. These settlements are termed “castros”, and are characteristic of the Hillfort or Castro (Castrexa Culture) in Galicia.

1. Introduction
From the 19th century, changes have occurred in the way the land is occupied, whether through the needs of agricultural use, the increase of infrastructure, or the manner in which new ways to inhabit it have been developed. These changes, generated by human pressure, have hidden or, in numerous cases, erased archaeological settlements which, once abandoned, have been concealed by the topography, with their archaeological heritage and location having been blurred with the passage of the centuries.

New free and open access to digital tools and the digitalization of existing documentary collections, are essential in identifying these archaeological elements in the land. These tools have great potential and offer the researcher the possibility of complementing traditionally used resources. Utilities, such as those developed in the international sphere by Google Maps and the Europeana European initiative, are complemented with local research applications, such as those of the region of the Autonomous Community of Galicia. Among the latter maybe highlighted those of the “Instituto de Estudos do Territorio de Galicia (CMATI)”, the services of digitisation of historical cartographies and documents of “Galiciana, Biblioteca Dixital de Galicia”, and the “Infraestrutura de Datos Espaciais de Galicia (IDEG)”, essential tools in cartographic research in this region.

Technological development is generating new tools, such as the use of drones for obtaining high-resolution aerial photographs of specific areas in real time, which complement research studies.

With respect to the digitisation of collections of aerial photographs, the series of photographs “American Flight, Series A” was taken in Spain by the government of the United States between 1945 and 1946. They were taken at the end of World War II for strategic

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reasons in the face of possible conflicts with the Soviet Union. This resource consists of 435 reels of film at a scale of 1:50,000.

As Fernández García (Fernandez and Linares 1997) indicated, “... the flight series A... offers us a snapshot of the Country in the first stage of its long post-war period, during which the dominion of the traditional agrarian activities was reinforced, without the processes having yet begun that were to have a major economic and spatial importance”.

These aerial photographs are considered unique of their type from the past that are available to us today, hence their enormous importance. The “American Flight” can be considered as the unique photography of the past preserved.

2. Objective

The objective of the present study is to use aerial archaeology to identify and to catalogue Iron Age settlements, called castros, in the municipality of Carral. These settlements are characteristic of the Castrexa Culture in Galicia. Some are perfectly locatable at the present time whilst others have left no trace.

The present study has sourced written references, cartography and aerial photogrammetry from 1945, called “American Flight, Series A”, comparing them with aerial photographs taken during 2015. This has allowed verification of the evolution of the land and the present state of conservation. The study area, Carral, in the Autonomous Community of Galicia, is indicated in Figure 1; Figure 2 shows its location in the historical map of 1696 of the Regno di Galicia, by the geographer Cantelli da Vignola.

Figure 1. Spain, Galicia region and general location of the study area

Figure 2. Area of study in the historical map by Cantelli da Vignola, 1696
3. The influence of demographic pressure on the land

The settlements and human infrastructure have not made a uniform impact on the land during the different stages of history, and that impact has been mainly due to population growth and agricultural activity.

Galicia has almost as many toponym variants as the rest of Spain. The changes in the fabric of the Galician landscape during the last 50 years have been made even more complex, due to abandonment of the countryside, urbanization of the rural environment, changes in the agrarian systems and to the creation of roads that modify the fabric of the habitat (Sánchez Pardo 2013:84). The same author (ibid:446) indicates: “Most geographers and historians share the idea that the general structure of the settlement, in traditional rural Galicia, has remained relatively stable since at least the Later Middle Ages until the 60’s of the last century. This means that we can learn about the origins and evolution of rural settlement from its present, by means of regressive analysis”.

Data from the Spanish National Statistics Institute (INE), from 1842 to 2011, the years for which data exist, were consulted to investigate the demographic evolution of the number of inhabitants and homes, in order to study the evolution of the municipality of Carral. These data are shown in Figure 3, which also shows the date of the American Flight in the years 1945–1946. The graph shows a population growth during the decade of the 1930s, while the number of homes remained stable. It was at the start of the 21st century when both the population and the homes increased, generating urban pressure, reaching 2,300 homes in 2011; this number is double that of the 1940s, the time of the American Flight, when there were 1,100 homes.

4. The organisation of the population in Castros

The current total number of castros that exist in Galicia is unknown. In addition, the different zones offer very different densities, which is why their quantification is difficult. There are a high number of toponym variants in Galicia, 570 according to the source http://toponimia.xunta.es/Buscador, and of those, 421 include the name of “castro”. However, regarding the different numbers of castros, authors quantify them from 1,300 to 5,000. Specifically, the geographer Abel Bohuier (Villares 1984) establishes a margin between 2,000 and 2,500. The same numbers are indicated by the archaeologist Felipe Arias Vilas “it is
calculated that there are between 2,500 and 3,000 castros, reaching 5,000 for some authors, such as Angel del Castillo” (Arias1984:17).

The updated query of databases gives approximately 2,080 inventoried castros in the official Xunta de Galicia web page (http://inventariopatrimoniocultural.xunta.es/) and 624 castros in the “Patrimonio Galego” initiative, both still in the updating phase. This large number of castros and their distribution, is due to the idiosyncrasy of the dispersion of population in the Autonomous Community of Galicia and the north of Portugal, with a high density of occupation of the space and a wide network of roads and communication routes.

Regarding their distribution, the historian Manuel Murguía indicated “that they form a circle around themselves does not seem strange if, as the locals assure us, the castros can be seen one from another and the valleys or zones that they dominate form a circle”, (Murguía 1865:526). This proliferation and dispersion of castros, generates a highly humanised landscape, accumulating a legacy that remained inhabited from the Iron Age to mediaeval times and maintains a strong rural character at the present time.

5. Methodology

To locate settlements by means of aerial archaeology it is necessary to complement the geographic analysis with an historical analysis, establishing a method of analysis that Orella Unzué terms “geo-historical analysis” (Orella 2010:266), which combines field work, plans and maps of the land and an ethnographic study through interviewing the inhabitants, all of which are basic for approaching the study of documents and aerial photography.

The area of research was limited to the municipality of Carral, which has varied historical remains and which has been an area of confluence of various routes (Freire Priegue 1998); the most important being the Camino Inglés de Santiago, or the English Way to Santiago, the backbone of the region, which links the axes of commercial development between A Coruña, Betanzos and Santiago de Compostela.

The methodology was established in two phases:
- Firstly, the references on historical settlements were identified geographically, consulting documentary references (Vilar Hermidas 1996, 1999), urban plans of the Council of Carral, and topographic maps at a scale of 1:25,000 of the Spanish National Geographic Institute (IGN).
- Secondly, the different archaeological environments were located in the present cartography, to collate them with the oldest available aerial photogrammetry, the so-called “American Flight, Series A” (1945-1946) and “Series B” (1956-1957).

5.1. Identification of castros

Ten archaeological elements were identified according to documents from various sources in the municipality of Carral, and are indicated in Table 1.

<table>
<thead>
<tr>
<th>Historical element</th>
<th>Municipality</th>
<th>Current situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Church &amp; Castro de Paleo complex</td>
<td>Paleo, Carral</td>
<td>existing (forest road) damaged (agricultural works)</td>
</tr>
<tr>
<td>Castro de Ans</td>
<td>Carral</td>
<td>damaged (house construction)</td>
</tr>
<tr>
<td>Castro de Ameás</td>
<td>Ameás, Carral</td>
<td>damaged (agricultural works)</td>
</tr>
<tr>
<td>Castro-Fortress Castelo⁴</td>
<td>Ans de Tellado, Carral</td>
<td>hidden</td>
</tr>
</tbody>
</table>

⁴Another example might be O Castelo, in the south east of Paleo parish (Carral). In the American Flight photographs, it is possible to distinguish an oval feature of about 83 by 58 m in diameter, which is still visible in recent aerial photographs.
According to previous research, remains of ceramics and querns have been found in some settlements, as in the case of the church of Paleo (Erias 1990) and the Castro de Ameás (Fernández 2013). Others have been the object of archaeological excavations, as with the Castro de As Travesas (Fernández and Castro 2011). In addition to the ten castros identified in Carral, which are included in an area of 48 km², there are also another twenty-one castros nearby, pertaining to the neighbouring municipality of Abegondo, in an area of 84 km². Thus, we can define the density of castros in these areas which, in the case of Carral is one castro per 5 km², and in Abegondo, a greater density is found of one castro per 4 km².

These results were compared with those estimated for Galicia (total surface area of 29,574.4 km²), and high, medium and low ratios which corresponded to an estimation of 5000, 3000 and 2000 castros respectively; this gave densities for high (one castro per 6 km²), medium (per 10 km²) and low ratios (per 15 km²). They were also compared with the densities suggested by the historian Sánchez Pardo for the historical land of Nendos or Nemitos (Sánchez Pardo 2006)⁵, with a density of one castro per 8 km² (558 km², 72 castros). The results show that the density of castros in the municipality of Abegondo is very high, greater than the estimated high ratio for Galicia (Figure 4).

5.2. Photo-interpretation of documented castros and the land in the aerial photographs of the American Flight

In this phase, all the settlements in the aerial photographs taken in the American Flight from 1945 were identified, and were in turn compared with the documentary sources. Representative examples of those identified castros are shown below, to demonstrate the different models of occupying the land. The photo-interpretation appears according to the scale of analysis, whether at a detailed small scale, or at a large scale of the land. For each

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⁵Nendos or Nemitos, an area of land of about 558 km², which now includes the municipalities of Carral and Abegondo.
case, parameters were studied at the large and small scale, referring to the evolution of the land.

Those parameters at the large scale are:
- Uses of the adjacent land in the period of study, 1945 and 2015
- Whether their relationship with the land remains: Yes or No
- Whether the main communication routes remain: Yes or No

At the small scale:
- Arrangement of the land in 1945 and 2015
- Number of homes and buildings in 1945 and 2015

Figure 5 shows the case of the Castro of Ans. The aerial photographs taken in the American Flight (left) and present aerial photography from 2015 are compared (right). Their GPS coordinates of latitude (north) and longitude (west), are indicated for their geographic location, in addition to the elevation (metres) of the land, as well as the approximate dimensions.

Figure 5. Castro of Ans, dimensions 150 x 105 m, in 1945 (left), and in 2015 (right)
Latitude = 43.224819653; Longitude = -8.353978268; elevation=147.1m

The Castro of Ans is characteristic of those located next to communication routes and populated areas. In this case it has been absorbed by the urban growth of the town of Carral (point 1 in Figure 5). The aerial photographs show the evolution in the uses of the land, changing from a cultivated zone to residential areas and a countryside without cultivation, with the main communication routes remaining (routes A and B in Figure 5).

Study of the parameters in the Castro of Ans:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian/urban, educational and agrarian
- Relationship with the land remains?: No
- The main communication routes remain?: Yes

At the small scale:
- Arrangement of the land 1945/2015: 4 plots/7 plots, the geometry of the plots has varied
- Number of homes and buildings 1945/2015: 0/8

The Castro of Ameás developed on a hillside next to a communication route (Figure 6, point A), without large population areas nearby, which is why the site has been completely conserved. The aerial photographs show continuity in the uses of the land, with the “croa”
(central zone) of the castro (Figure 6, point 1) remaining in agrarian use, although a reservoir has been constructed within it.

![Figure 6. Castro of Ameás, dimensions 190 x 200m, in 1945 (left) and in 2015 (right) Latitude = 43.241003079; longitude = -8.322291796; elevation = 211.6m](image)

Study of parameters in the Castro de Ameás:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian, forestry/agrarian, forestry and residential
- Its relationship with the land remains?: Yes
- The main communication routes remain?: Yes

At the small scale:
- Arrangement of the land 1945/2015: 5 plots / 7 plots, the geometry of the plots has varied
- Number of homes and buildings 1945/2015: 0/2

The Castro-Fortress Castelo, is located next to a small water course (1 in Figure 7), elevated on a small promontory, next to main secondary communication routes (A and B in Figure 7). There are no populated areas nearby, which is why the site has been completely conserved. The aerial photographs shows continuity in the uses of the land, although with more extensive wooded areas at the present time.

![Figure 7. Castro-Fortress Castelo, dimensions 90 x 80 m, in 1945 (left), and in 2015 (right) Latitude = 43.215644068; longitude = -8.361546551; elevation = 97.8m](image)

Study of parameters in the Castro-Fortress Castelo:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian, forestry/agrarian, forestry, residential
- Its relationship with the land remains?: Yes
- The main communication routes remain?: Yes
At the small scale:
- Arrangement of the land 1945/2015: 2 plots / 2 plots, the geometry of the plots has not varied
- Number of homes and buildings 1945/2015: 0/0

The castro A Torre / Detorre is situated on a hillside, next to a river on its North side (1 in Figure 8), where there is a considerable incline; it developed between two communication routes (A and B in Figure 8), without nearby population areas. The aerial photographs show the line of vegetation of the river course and a continuity in the uses of the land, due to its steep topography (delineated by the dotted line between 2-3 in Figure 8), with large wooded areas.

![Figure 8. Castro A Torres / Detorre, dimensions 60 x 80m, in 1945 (left) and in 2015 (right) Latitude =; longitude = -8.372587112; elevation = 164.5m](image)

Study of parameters in the castro A Torre / Detorre:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian, forestry/agrarian, forestry
- Its relationship with the land remains?: Yes
- The main communication routes remain?: Yes

At the small scale:
- Arrangement of the land 1945/2015: 1 plot / 1 plot, the geometry of the plots has not varied
- Number of homes and buildings 1945/2015: 1/2

The castro of Hervices/Forteillo is situated next to a communication route (A in Figure 9), and is limited on its North face by a pronounced hillside and by a river (Figure 9). It is in a rural area, with zones of dispersed dwellings to the North (1 in Figure 9). The aerial photographs show the line of vegetation of the river course (2 in Figure 9) and a concealment of the castro due to the change from agricultural use to forestry, with the main wooded areas remaining.
Study of parameters in the castro of Herves/Forteillo:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian/forestry
- Its relationship with the land remains?: Yes
- The main communication routes remain?: Yes

At the small scale:
- Arrangement of the land 1945/2015: 1 plot /1 plot, the geometry of the plots has not varied
- Number of homes and buildings 1945/2015: 0/0

The castro As Travesas is located next to main and secondary communication routes (A and B in Figure 10), without nearby population areas. The aerial photographs (Figure 10) show the different lines of walls of the castro, currently visible with the archaeological works undertaken; the pressure of an electricity station next to its eastern part (1), and industrial uses (2), as well as the variation of the secondary route (B).

Study of parameters in the castro As Travesas:
At the large scale:
- Uses of adjacent land 1945/2015: agrarian/agrarian, industrial
- Its relationship with the land remains?: No
- The main communication routes remain?: Yes
At the small scale:

- Arrangement of the land 1945/2015: 1 plot / 1 plot, the geometry of the plots has varied
- Number of homes and buildings 1945/2015: 0 / 0

In each case, it has been possible to study the evolution of the land by means of aerial photographs, analysing changes in land use, urban pressure and the existence of communication routes.

6. Conclusions

The use of aerial photographs as an archaeological tool has allowed identification of archaeological remains and human settlements, and knowledge to be gained about their evolution within their surroundings. However, this identification must be supported by documentary or oral sources, as in some cases aerial photographs alone do not allow their identification, due to the changes and the evolution of the land.

In the present study, the aerial photographs of the municipality of Carral were corroborated with documentary information, and field inspections during which ceramic and stone remains were found at surface level at some locations. This methodology allows non-destructive archaeological analyses for historical recovery and cataloguing to be made.

Thanks to the use of aerial photographs, some castros were located in the municipality of Carral which had not been previously identified. This has fulfilled the study objective of geographically locating and cataloguing the castros, which widened the geo-historical knowledge of the land. This identification is the first step to including these castros in the list of protected elements of historical heritage and in the municipal urban plans, enabling them to be the objects of future protection and other archaeological research.

The results obtained in this article demonstrate the possibilities offered by aerial photography for historical and archaeological research, not only on population settlements, but also for the study of communication routes.

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PATRIMONIO GALEGO. http://patrimonioygallego.net/
A story about one shot from three thousand five hundred
Eugen S. Teodor¹, Carmen C. Bem, Dan Ștefan

Introduction

The research project Limes Transalutanus² is using aerial photographs from three sources: publically-accessible orthophotographs (Romanian origin in several editions, Google Earth, Bing, others), snapshots from light aircraft, and UAV missions. The first kind of imagery has the advantage of a complete coverage but is provided at a relatively low resolution (0.5 m per pixel); the last has excellent resolution (6-8 cm), can be captured almost anytime and everywhere, mostly in sensitive areas, but flight duration limits work to relatively small areas (one mission covers less than a square km). The snapshots taken from an airplane are the middle term, working with an intermediate resolution and able to survey relatively large areas.

Following some technical tests from October 2014 and June 2015, the first aircraft mission was done in 29th July 2015, taking off from Geamăna airfield, near Pitești city, heading almost south to reach Danube at the fort Flămânda, 7.5 km east of the harbour Turnu Măgurele. The route was chosen to follow as close as possible the line of the Roman limes from the first half of the third century, known as Limes Transalutanus³. On the floor of the airplane was fixed a rig with two cameras supposed to take automatic pictures⁴, intended as raw images for orthophotographs, with autonomy of around 90 minutes, enough for the route southward.

The way back, heading towards Pitești, followed a route paralleling the first about 1.5 km westward, due to the fact that the mission was accomplished in the late afternoon (between 17:15 and 19:35), in order to have a good backlight for oblique snapshots, taken from the cockpit with a third camera⁵. It worth mentioning that Romania has not a national plan for aerial archaeological research and, except a few historical photos published⁶, the aerial documentation for Limes Transalutanus is today limited at some recent UAV’s products, meaning good quality but low coverage. In an aircraft mission of 140 minutes, we have acquired about 3500 photos, vertical and oblique, from three cameras, for all the length of the studied Roman frontier, 145 km long⁷. Their processing is meant to offer new hints for future more detailed field research, airborne (drone) and on the land surface.

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² Granted by the Ministry of Education and Research (http://uefiscdi.gov.ro/Public/cat/593/PARTENERIATE.html), ID number PN-II-PT-PCCA-2013-4-0759. For details about the project, see Teodor and Ștefan 2014 a and Teodor and Ștefan 2014 b). For supplementary documentation, the reader can use some older syntheses, like Napoli 1997, 39-41, 322-335; see also the assemblages known as Brazda lui Novac, intersecting Limes Transalutanus twice, including in Urlueni area, as in our Fig. 2, in Napoli 1997, 335-341. See also Gudea 1997, 65-66, 70-81, mainly for the older literature, and less for geographical identifications (mostly wrong!). For English readers – see Gudea 1979.
³ A complete map of Limes Transalutanus can be found in Teodor and Ștefan 2014 b, 33, Fig. 1.
⁴ Canon SX260, 12 Mpx, 24 mm, oblique at 5 seconds; Canon A4000, 16 Mpx, 24 mm, nadir at 4 seconds (see Figure 1). We have chosen light, compact cameras, to avoid adverse vibrations experienced in previous flights, when a DSLR was tested.
⁵ Sony NEX 5R, 16 Mpx, 40 mm.
⁶ Bogdan Cătăianu 1997, figs. 52-54
⁷ As an aerial route. On the ground it measures 155 km.
The flight conditions were hazier than anticipated, with poor visibility especially to the side. Thus, the planned altitude of 1000 m was dropped to 600 m, losing the degree of overlap necessary to transform the automatic pictures to orthophotos, but resulting in clearer images that were useful individually. The overall results of the first airplane mission are far from being great, but some of those pictures could tell interesting stories. This report will focus on one such case.

One shot of Limes Transalutanus

The area of interest is located northeast of the pair forts at Urlueni, where the *limes* was crossing the river Cotmeana. The former *vallum* is visible, mainly in aerial imagery, for 2.5 km, heading east-north-east, until the beginning of the Lerul Valley where it is lost. From that point the Roman border is supposed to turn north and follow the ridge between the valleys of Cotmeana (west) and Zbâgleaza (east). There are two testimonies in this respect. One from Pamfil Polonic, a toponographer from the late 19th century, working for the head of the Museum of Antiquities. He wrote that the embankment could be followed east of Urlueni for about 8 km but made no mention of an angled turn at the Lerul Valley. However, he included the detail that he was able to follow the *vallum* up to the lands of the village Vlășcuța, which strongly suggests the turn (see Fig. 2). A second source of information is Ioana Bogdan Cătâniciu, who carried out some fieldwalking in the area in the 1970s, noting that the embankment could be followed up to a point located in the eastern side of the Hărsești Forest.

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8 His notes about *Limes Transalutanus* remained unpublished until very recently (Teodor 2013, 205-211). For the specific lines about Vlășcuța see Teodor 2013, 208, page 125 of the original notebook. An English version of the book from 2013 is ready for print (August 2015). In that, the referenced text is Teodor 2015, 220.

9 Bogdan Cătâniciu 1997, 84.
Field research during the spring of 2015 did not identify the embankment on the Trojanul Hill. This included three drone missions: the first in the area where the embankment is vanishing, at the supposed angled turn, a second around Hârsești Forest and a third between the two. Unfortunately, no evidence of the embankment was identified on the resulting images, either when they had been transformed to orthophotos or combined into digital terrain models.

Despite such disappointments, we believe that the embankment should be present in the area. This is not only due to the archaeologists’ encounters, but also because of toponyms of features south of Hârsești Forest. ‘Dealul Trojanului’ (Trajan’s Hill) is immediately north of Lerul Valley and identifies the highest land between the valleys Cotmeana (westward) and Zbâgleaza (eastward) that extends towards Hârsești Forest. A related toponym is ‘Valea Trojanului’ (Trajan’s Valley), linking Hârsești Forest and the village Hârsești (see again Fig. 2). The word ‘troian’ certainly originates in the name of the Roman Emperor, Trajanus, as it was pronounced in the Late Antiquity. An example is the ‘Troyan Pass’ in northern Bulgaria, but the average Romanian speaker no longer makes the connection, ‘troian’ now usually meaning any embankment, either of earth or snow. ‘Dealul Trojanului’ has thus the translation ‘The Embankment’s Hill’, and ‘Valea Trojanului’ would be then ‘The Valley driving to the embankment’.

Figure 2. The map of the interest area, with the white arrow indicating the location and direction of the photo 6767 (see Fig. 4). EU-DEM as terrain support.
Before our flight, the only clue about the area where the embankment should be found, near Hârsești Forest, was on a military orthophotograph\(^\text{10}\) (Figure 3). On that, the cropmark is too faint to be more than a ‘working hypothesis’. Fortunately, the hypothesis was confirmed by aerial reconnaissance on 29\(^\text{th}\) July, 2015.

The airborne oblique, taken from about 600 m altitude and 1.5 km west in the late afternoon (7:14 pm, summer time, see Figure 4), provides clear confirmation of the trace previously observed on the military orthophotograph. This is really important because it indicates, for the first time, a position in a forest where we hope to find evidence of the antique construction in far better condition than will survive in the intensive agricultural plots.

Looking now to the overall situation in the micro-region (see again Fig. 2), one can see that the azimuth of that segment of embankment has interesting extensions: it meets southwards exactly the point where traces of the embankment are lost (177°, 2.7 km away). On the reciprocal alignment (357°), 1.9 km to the north is the Vlășcuța Mound. The mound is absent from 20\(^\text{th}\) century Romanian military maps, but it appears on the Third Austrian Survey\(^\text{11}\). If the mapped position is accurate (the map has the small scale of 1:200,000) then the distance between the northern extension of the segment of *vallum* near Hârsești Forest and the Vlășcuța Mound would be about 60 m, a typical one in the relationship between the

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\(^\text{10}\) Made by Direcția Topografică Militară (Military Survey Service). They are uncompressed tif files, better than anything else on the Romanian market (the civilian provider of similar products sells only jpeg files, see, for instance, [http://geoportal.anepi.ro/geoportal/viewer/index.html](http://geoportal.anepi.ro/geoportal/viewer/index.html)). The History National Museum from Bucharest has the right to use military orthophotographs for scientific purposes due to a Protocol between the Ministry of Defence and Ministry of Culture made in September 2013.

\(^\text{11}\) The collection of maps was published around 1910, but data were gathered after 1881, when Romania became a sovereign monarchy and a close ally of the Austro-Hungarian Empire. The Romanian military topographic service was built in a close cooperation with the Austrian Army (Netzhammer 2010, 104-125). The maps can be downloaded at [http://www.geo-spatial.org/download/harile-austriece-1910-reprojektate-in-stereo70](http://www.geo-spatial.org/download/harile-austriece-1910-reprojektate-in-stereo70) (in Romanian projection, Stereo 70) from, but also in the original projection from the Hungarian provider [http://lazarus.elte.hu/hun/digkonyv/topo/3felmeres.htm](http://lazarus.elte.hu/hun/digkonyv/topo/3felmeres.htm).
watchtowers and the embankment, as seen mostly on the southern sector of the *limes*, between the Danube and Vedea Rivers.

As concerns the location or even the existence of the *vallum* north of Vlășcuța, there is no clue so far, but as concluded by Pamfil Polonic, the location of the fortresses known northward can give a general idea about the route followed by the Roman border: the fort Izbășești is to be found 7 km further, on the azimuth 340°, and the double fort from Săpata de Jos, which is located at a distance of 18.7 km, as the crow flies, with the direction of 347°. The Roman road should be located somewhere east of those forts. Pamfil Polonic was convinced that the embankment was never built in this region, not only because he was not able to find it, but also because in the collective folk memory it was completely missing. The next known segment of an embankment is located east of the village Albota, which is 27.3 km north-northeast of the Vlășcuța Mound.

A last thing about the mission on 29th July 2015 is that we have also a vertical snapshot of the segment of embankment northeast of the Hârsești Forest (Figure 5). This has high resolution and confirms the exact location of the monument. The embankment has a slightly different orientation to the direction of ploughing, a fact which partially explains the difficulty to spot it across the field.

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12 A rationale which could not make sense for a British researcher, due to a specific trait of *Limes Transalutanus*: the forts are not located on the border, but several hundred metres behind. Even supposing that the embankment might be absent here and there, there must have been a survey road of the guards, on the line considered as frontier.
Concluding, the flight from 29th July 2015 fulfilled some of our expectations, providing some hints and directions for the future field research, as pictured by the analysis of the snapshot number 6767. On the other hand, the technical project of the automatic image acquisition needs improvements in order to protect completely the cameras of the oil drops from the engine’s exhaust. We need, furthermore, better conditions of flight, in order to accomplish all the required parameters, as the 1000 m height, needed for a good overlapping of the pictures. The objective of producing long range orthophotos is motivated not by the photos themselves (we have already several complete coverages of the area), but of the intermediary Digital Terrain Model, coming with the same data. The field research proved, so far, that the Roman monuments (embankments, roads, towers) are extremely damaged, flattened down, with heights generally lower than half a metre, difficult to spot if the observation conditions are not perfect (like no vegetation, freshly harrowed, good light). A high definition DTM (below half a metre) could be really helpful for spotting today unknown Roman monuments.

The research project *Limes Transalutanus* is at the half way and we believe that we will be able, finally, to get a high resolution DTM, for much of the route of the former frontier, as a guideline of the future investigations. Of course, orthophotos and DTM are not the only motivations of the intended aircraft flights, the role of the manual oblique snapshots in the aerial reconnaissance being too well known to be advocated here.

**References**


Crawford in 3-D: the stereoscope in early aerial archaeology

Martyn Barber

“The value of air-photos in archaeology will be very great in the future. They can be used in discovering and making plans of ancient sites. They will be particularly valuable in teaching a class indoors the methods of field-archaeology”

(OGS Crawford 1921, 46).

Introduction

The immediate origins of this article lie in some comments that appeared in an earlier issue of AARGnews (no. 49, September 2014, p5) concerning the question of whether or not OGS Crawford ever made use of a stereoscope. These comments had in turn arisen from a reading of the book Seeing from Above (Dorrian & Poussin 2013), reviewed in the same issue (Raczkowski 2014). This may seem a relatively straightforward matter, easily dealt with by a simple yes/no answer, but the fact that the answer is ‘no’ has obvious implications for the way we understand the origins and development of aerial archaeology. The established history of the discipline traces current methods and practices back to their presumed introduction, in technologically less sophisticated form, by pioneering figures such as Crawford in the wake of the First World War. It seems to make sense that Crawford would have used a stereoscope. That he did not raises questions about how he used and understood aerial photographs.

Aerial archaeology’s origin myth, particularly in the English-speaking world, tends to centre almost exclusively on Crawford, who is placed at one end of a continuum of technological and methodological progress that has led directly and inevitably to the present, in much the same way as Crawford himself once claimed to see the origins of the aeroplane in the eolith (Crawford 1921, 6). He appears as an innovator, taking advantage of the procedures developed on the Western Front in order to set archaeology more firmly on a modern, scientific footing. Harnessing the camera to the aeroplane, and making full use of the cartographic techniques he had learned while in uniform, he provided archaeology with the means to greatly increase its capacity for discovery, thereby enhancing knowledge and understanding of a past that seemed to exist independently of the methods used to discover it.

There are many problems with this story. Among the most pertinent for this article are the absence of any consideration as to why Crawford thought aerial photographs might be of value to archaeology, and how he actually used them (and I’m not just referring here to the methods employed to reproduce archaeological detail on a map). Instead, it is assumed that there is in essence very little difference from the how and why of today. Moreover, there is no real consideration of context. Rather than viewing him as a man whose apparently unique combination of knowledge, experience and personal circumstances allowed him to take the first vital steps towards the modern discipline of aerial archaeology, it may be more useful to consider Crawford as someone who recognised in the aerial view something that would enable him to tackle some of what he saw as the most pressing archaeological concerns of the early 20th century. His use of aerial photographs was heavily influenced by his own

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1 martyn.barber@historicengland.org.uk
2 In attempting to address these comments, I am taking the opportunity to draw on some of the material omitted from the pages of Mata Hari’s Glass Eye... (Barber 2011) for reasons of time, space, and/or editorial disinterest. I am also drawing heavily on work – not all mine – to be published elsewhere.
developing understanding of the past and how to recover it, particularly for prehistoric ‘Wessex’, a temporal and geographical region that he was the first to define (in print\(^3\)) in his book *Man and His Past* (Crawford 1921). Understanding what he was up to requires rather less attention to cropmark formation processes, cameras and aeroplanes, and rather more to geography, anthropology, folklore and place-name studies, among other subjects, as well as to the social and intellectual networks within which Crawford moved between his student days at Oxford and his arrival at the Ordnance Survey (and beyond).

There isn’t the space to deal with all of this here. Instead I will be concentrating on the issues of most concern to the matter of the stereoscope. After a consideration of the source material, I will look at the key methodological aspects of Crawford’s aerial archaeology – his acquisition and taking of photographs, and the techniques he used to extract archaeologically useful detail from them. Then I will look at Crawford’s understanding of, and general approach to, archaeology prior to 1922, when field archaeologist Dr JP Williams-Freeman first made him aware of the real potential of aerial photographs for his particular brand of field archaeology. Finally, I will return very briefly to the small matter of the interest in the aerial view outside archaeology.

**Finding Crawford**

Between 1908 and 1922, Crawford accumulated considerable experience in excavation, field archaeology, and in the mapping of various archaeological phenomena. His recognition of the possibilities offered by aerial photographs post-dates the First World War, but cannot simply be reduced to being a direct and inevitable outcome of his military service. His approach to understanding prehistory in particular grew out of his studies of both geography and anthropology at Oxford, and, just as importantly, from discussions among the loose network of acquaintances who gathered for weekends at the Boxford, Berkshire home of Harold and Carlie Peake (Crawford 1955; Hauser 2008; Wickstead 2014). By 1922, Crawford also had a considerable publication record stretching back to his undergraduate days\(^4\), although much of what he wrote in the decade and a half prior to *Air Survey and Archaeology* (Crawford 1923; 1924) is rarely acknowledged these days, let alone cited. Instead, his output is generally reduced to a handful of ‘milestones’ such as *Wessex from the Air* (Crawford & Keiller 1928). Effectively decontextualizing his aerial-based work, the publications that informed his use of aerial photographs and aerial survey, and which influenced some of the key figures of British archaeology between the wars, are largely ignored\(^5\).

Unfortunately, our sources for Crawford’s life and work were, for the most part, written by the man himself. The challenges inherent in using autobiographical works and personal archives as sources for biography and history are well known, and Crawford certainly presents challenges. The inadequacy of relying solely on what Crawford chose to make available to later generations has been clearly demonstrated by Kitty Hauser (2007; 2008). His autobiography *Said and Done* (1955) provided him with the means to present a particular

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\(^3\) Crawford, Harold Peake and others had certainly been discussing a ‘Wessex region’ study prior to the First World War.

\(^4\) There is a detailed, but incomplete, bibliography down to the end of the 1940s in Grimes (ed) 1951.

\(^5\) Crawford’s first published book, *Man and His Past* (1921), was particularly highly regarded by the up-and-coming modernizing and professionalizing generation of prehistorians – Stuart Piggott, Gordon Childe, Grahame Clark, Glyn Daniel and so on – while the influence of Crawford and other members of the Boxford circle, such as HJ Fleure, on the work of Cyril Fox, particularly the latter’s *Personality of Britain* (1932), is more than evident.
version of himself, his life and work, and his achievements, and has perhaps too often been taken at face value. His personal archive, held at the Bodleian Library, was carefully sorted and weeded (Fig. 1). An unknown quantity of documents was destroyed after his death under the terms of his will, complementing the less considered work of the Luftwaffe in November 1940. Others were retained – and accompanied by a series of somewhat teasing explanatory essays – on condition that they remained sealed until the year 2000. Crawford clearly expected to be re-evaluated on the basis of this archive come the next millennium, a process that began with Kitty Hauser’s research. He was wrong in one key respect though – he fully expected some kind of atomic warfare to have occurred (and the effect of the subsequent fallout to have dissipated sufficiently to allow a revival of scholarly enquiry in Oxford) by 2000, this rather pessimistic view having taken hold post-1945, replacing earlier hopes of revolution.

There are other pieces of Crawford in many other places, of course. He rarely kept copies of letters that he sent, for example, but some of his recipients (e.g. Stuart Piggott, Alexander Keiller, HG Wells) did. His personal collection of photographs – he reckoned to have taken around 10,000 – is housed at the Institute of Archaeology, Oxford; material relating to his days at the Ordnance Survey can be found there as well as in the National Archives and the Historic England Archive, and so on. Overall, sources for reconstructing the man and his methods are complex, fragmented, and – in all senses of the word – partial.

Crawford and the practice of aerial archaeology

(i) collecting

Both his personal archives and some of the few recollections of Crawford by others suggest that he was someone who perpetually walked the fine line between collecting and hoarding.

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6 These are, of course, photographs mostly taken with his feet firmly on the ground, and span the period from his schooldays at Marlborough in the first years of the 20th century until the year of his death, with the exception of the years from c1918 to 1931, when he did not own a camera.

7 Or whatever it is called by the time this appears. The Historic England Archive includes the Crawford Collection of aerial photographs which, it is worth reiterating, mainly comprises photographs that he collected while at the Ordnance Survey between the wars. Contrary to popular belief, very few of these were taken by him. He was not a keen aerial photographer. They were mainly harvested from various RAF sources, as well as some individual flyers such as George Allen and Gilbert Insall.
For example, according to his former assistant at the Ordnance Survey, RA Jerrard, by 1922 Crawford had accumulated over half a million postage stamps. Geoffrey Alington, with whom Crawford flew frequently in the later 1930s, described Crawford’s Nursling home as “littered with pieces of ancient pottery, flint arrow heads, flints, coins, and the whole house was quite obviously stored with archaeological treasures on the deep litter system. How he ever found a wanted piece remains a total mystery...”, adding that dinner by the fire, “while the flames...flickered on the grinning skulls on the tables, was quite an eerie experience” (Alington 1994), the eeriness no doubt enhanced by the vast cobwebs draped around the house. Crawford’s housekeepers were forbidden from disturbing either the spiders or their webs, the latter perhaps offering some degree of stratigraphical control.

That he was more than capable of instilling order on what some saw as chaos is shown by things like the detailed indexes for his 10,000 photographs, which also provide by far the best record of his activities and whereabouts from the mid-1930s onwards. Crawford himself underlined the importance of systematic collecting and keeping in Said and Done (pp70-1), referring to the Bodleian librarian EWB Nicholson, who was “laughed at because he used to collect such ephemeral printed matter as paper bags (which then had the tradesmen’s names and other printed matter on the outside) and tram-tickets”; he also mentioned John Johnson, former Printer to Oxford University, whose “fascinating collection of ephemera” formed “one of the lesser-known museums at Oxford”. Crawford insisted (in a way that suggested that he too may once have laughed at Nicholson) that ephemeral things were what archaeology was all about, and that the collection of contemporary ‘ephemera’ was essential “for future historians of social life”, acknowledging here the authority of Pitt-Rivers, who had also stressed the importance of common things.

This attitude may explain the considerable number of invoices contained within his own personal archive at the Bodleian, recording all manner of purchases – books, clothes, shoes, hotel rooms, whiskey (and sometimes whisky) etc – from innumerable sources, and there are certainly further echoes in his photographic habits of the 1930s and 1940s, as discussed by Kitty Hauser (2008), and in his unpublished manuscript ‘Bunk of England’ (a.k.a. ‘Bloody Old Britain’), a partly tongue-in-cheek attempt to apply archaeological methods to the study of contemporary, everyday, Britain.

Such purposeful and systematic collection was also at the heart of Crawford’s archaeology – the collection of ‘facts’ and records of ‘facts’. There was always a system at work, whether dealing with Bronze Age axes, aerial photographs, or the eye-goddess. His methods for acquiring aerial photographs from 1921 onwards are well-known – he regularly visited RAF bases and collected negatives that contained (or had the potential to contain) something of archaeological interest; he circulated lists of places that he wanted photographs of to those same RAF bases; and on extremely rare occasions, such as for Wessex from the Air, he operated an airborne camera himself.

By the mid-1930s the collection had, in his own words, become “a sort of reference library” which the Ordnance Survey Archaeology Division (i.e. Crawford and his small band of draughtsmen-fieldworkers) could draw on when necessary. “Whenever interest was focused

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8 RA Jerrard: ‘Memories of OGS Crawford’ (Historic England Archive JER01).
9 Susan Jerrard pers. comm.
10 These indexes, home-made, are held with the photographs at the Institute of Archaeology, Oxford.
11 Ephemera collected by both Johnson and Nicholson can be found in the Bodleian.
on a given site, the first thing to do, after locating it on the six-inch map, was to consult the air-photograph of it” (Crawford 1955, 215), although this approach was, for a number of years, only possible in one small part of the British Isles – “I had naturally collected more air-photographs of Wessex, particularly of Salisbury Plan, because of my own interests in the area, which I knew well from field-work” (ibid.). Some of the reasons for this ‘Wessex’ focus are considered below.

His visits to RAF bases, and the lists of targets that he provided for them, concentrated on bases whose flying impinged to a greater or lesser degree on the wider ‘Wessex’ region (when George Allen first made contact with Crawford in the early 1930s, he was sent a copy of RAF Bicester’s list to work through). Crawford’s lists didn’t just include known sites as yet unrepresented in his growing collection – he also used sources such as Anglo-Saxon boundary charters, place-names and folklore as clues to the possible locations of prehistoric and Roman sites. Despite his oft-stated preference for vertical photographs (see below), he was not requesting blanket vertical survey coverage of these places, but photographs of anything seen by pilot or observer at or near those locations, whether earthwork, soilmark or cropmark, which might necessitate a subsequent visit on the ground.

Crawford’s own comments, and the surviving ‘Crawford Collection’ held by Historic England, suggest that he did not collect stereo pairs. This is partly, but not entirely, explained by RAF practice in the inter-war years – most aerial photography undertaken by RAF flyers in the course of training was either based around pin-pointing (in which pressing a button photographed a target rather than dropping a bomb on it) or the creation of mosaics from partially overlapping verticals shot in sequence. A similar procedure informed the Wessex from the Air flights, which involved a mixture of pin-pointing and mosaic-making – Crawford decided in advance on the targets for each flight, while an eye was kept open for anything unexpected en route. In addition of course, when visiting RAF bases Crawford was examining and collecting negatives, generally of glass (Fig. 2), which tended not to lend themselves to casual stereoscopic viewing.

(ii) photographing

In her chapter in the book From the Air, Rebecca Jones (2005) described a series of flights undertaken by Crawford over Scotland in the summer of 1930. As she noted, one of the more remarkable features of this whole episode (to the modern reader) was Crawford’s failure to take a camera up in the air with him. In 1930, and on other occasions, he carried copies of the appropriate sets of maps, plus anything else necessary to record what he saw from the cockpit, but no camera. What was essential on these flights was Crawford’s ability to observe, and to record those observations in a concise and meaningful manner that drew on both his wartime and archaeological expertise. His wartime experience in the Royal Flying Corps was not primarily as a photographer, but as an observer. In fact, while flying during the war, Crawford claimed to have “devised a new way of recording my observations of trains, dumps and such like, graphically on an outline map (which I drew each time) instead of by the long and laborious business of map references” (Crawford 1955, 128). Crawford’s 1930 flights

12 In the 1930s, Lincolnshire-based archaeologist Ethel Rudkin was asked, via Charles Phillips, to keep an eye out for place-names containing the element ‘Shuck’ or variants thereof, as Crawford felt that names referring to the devil in his (or her) variant forms might indicate the presence of a megalithic site (Pacey 2002, 38).

13 Crawford gradually branched out from a predominantly Wessex focus for various reasons, chief among them initially being the Ordnance Survey’s map revision programme, and his interest in mapping Roman Britain.
were all about identifying sites and placing them on the map as precisely as possible, highlighting those that warranted a ground visit. No photograph was necessary, and in any case, Crawford would not have been able to take the ‘right’ kind of photographs.

Fig. 2 – The faint cropmark traces of the course of the Stonehenge Avenue, as spotted by OGS Crawford in early 1923 on a glass negative. Crawford collected at least 6 negatives taken on the same flight (15th June 1921). The degree of overlap between each image is variable, but minimal. Historic England Archive CCC8544/75. Photo: M Barber; © Historic England.

When photographs were taken, they performed a specific purpose. To Crawford, an aerial photograph was a key component in establishing the ground plan of a site – or, rather, a major step towards doing so. It was an aid to fieldwork. Having a photograph of a site was no substitute for actually going there. Consequently he favoured verticals over obliques, and could be highly dismissive of the value of the latter. In his first letter to George Allen in 1932, Crawford impressed on him this preference for verticals, and continued to do so as package after package of obliques arrived in the post. Allen, of course, flew solo in a Puss Moth. Taking obliques with a hand-held camera was a far safer option that leaning over a floor-mounted fixed vertical camera, as well as offering a more reliable opportunity for correctly framing a site. It was only in the late 1930s that Allen began to take verticals on anything like a regular basis.
Crawford remained forthright about this into the 1950s, telling a post-war CBA conference\(^{14}\), for example, that “it does not seem to me that any case can be made out for obliques, the whole purpose... is to recover the PLAN...; obliques are pictures, not plans” (his emphasis)\(^{15}\). It is important to stress here that when Crawford was appealing to the likes of Allen for verticals, he was not advocating blanket overlapping vertical coverage – this was still carefully targeted, individual images with the site framed through the viewer by the photographer, not automated survey.

(iii) planning

Recognition of the potential offered by aerial photographs was not a direct consequence of Crawford’s wartime experience. Instead, three years after Major Beazeley’s *Air Photography and Archaeology* had been published by the Royal Geographical Society (Beazeley 1919), it was brought to Crawford’s attention in 1922 by the Hampshire-based field archaeologist JP Williams-Freeman, who Crawford had first met while excavating on the Berkshire Downs with the Peakes in 1910\(^{16}\). Williams-Freeman had been shown some vertical aerial photographs by Air Commodore Clarke-Hall at Weyhill Aerodrome which showed extensive traces of plough-damaged lynchetts visible as soil marks in ploughed fields on the Hampshire Downs. “I set to work”, said Crawford many years later “and had the marks transferred to the map. There was nothing difficult in doing this; we had done the same thing with the German trenches during the war” (Crawford 1957, 86). This was true up to a point, of course, but Crawford’s mapping here differed from wartime practice in several key respects.

At a time when flying a truly straight and level course at the required altitude was somewhat difficult to achieve, few vertical aerial photographs were truly vertical. It had become established practice during the war to ‘rectify’ the situation, usually through a process of tilting and projection, or tilting and re-photographing. In the years immediately after the war, real progress was made in the development of mechanical and instrumental methods for mapping from both corrected and uncorrected individual photographs, and subsequently from overlapping stereo pairs. There is no evidence, however, that Crawford used anything other than simple manual methods for mapping directly from single uncorrected verticals.

Wartime conditions on the Western Front had also provided limited opportunities for follow-up fieldwork. With aerial archaeology, however, Crawford saw the photograph as merely the first stage in producing a plan (or ‘diagram’) of a site, especially for things like extensive areas of plough-eroded lynchetted field systems, which could be very difficult and time-consuming to get to grips with on the ground. With those Hampshire lynchetts of 1922, once a basic plan had been drawn up from the photographs, “I checked some of the marks by ground

\(^{14}\) This was a conference looking at the urgent need to record the medieval field systems, including ridge & furrow, of Northamptonshire, in recognition of the damage being done by post-war arable agriculture. Aerial survey was seen as key to recording the current extent of surviving earthwork remains. The conference was held on 15 December 1950. Typescript notes and correspondence in the Bodleian’s Crawford MSS.

\(^{15}\) Crawford seems to have been aiming these remarks partly at JK St Joseph. He ended this particular note by complaining of “the very marked deterioration in the quality of archaeological aerial photographs”, in the decade since Allen’s death. “The standard has been lowered, and there is a danger that archaeologists will rest content with a lower standard than formerly. I have observed that archaeologists sometimes seem to regard as good photographs specimens which would not have been so regarded ten or fifteen years ago”.

\(^{16}\) Williams-Freeman is generally credited with devising the term ‘field archaeologist’ to describe those undertaking fieldwork that did not involve excavation – i.e. the observation, analysis and survey of earthworks and other upstanding remains.
Fig. 3 – Mosaic of three overlapping verticals taken by the School of Army Co-operation, Old Sarum, January 12th 1924, of earthworks on Charlton Down, Wiltshire. Featured in Crawford (1924), his caption noted that “it has not been possible to make an examination on the ground they cover”. Consequently, “any deductions from them would be hazardous”.
inspection... The next thing to do was to get hold of as many air-photographs as possible and examine them for other marks...” (ibid.), followed, of course, by further fieldwork. The vertical photograph was to Crawford (and many others) essentially a map in itself, but one that required considerable work to turn it into something archaeologically useful and cartographically acceptable. Additionally, the plan or diagram was an effective means of displaying archaeological detail when that detail spilled beyond the confines of the frame of a single photograph. It was not the only means of doing so, however: some of Crawford’s key publications on aerial survey instead featured mosaics of prints accompanied by an explanatory sketch (e.g. Fig 3, or the Stonehenge Avenue in Crawford 1924).

By the time of the flights and fieldwork undertaken for *Wessex from the Air* in 1924, Crawford’s methods had developed a little, partly because of the nature of that project. Again, the process used for converting verticals into plans was not explained until some time later – he provided a brief account in *Said and Done*, and a more informal version to a BBC radio interviewer in December 1955 (‘Reminiscences of a Field Archaeologist’: typescript preserved in the Bodleian).

When published, *Wessex from the Air* contained 50 plates, each representing a site that “had first to be visited and walked over on the ground”17. A matte print was made of each plate, matte being preferred because it offered “a rough surface...on which you can write with a pencil”. Then, with the print mounted on cardboard, “you get a six-inch Ordnance map, and you go out into the country and you...walk over the ground which you’ve previously photographed...and you note what you can see on the ground”18. As well as annotating each print in the field, Crawford subsequently “drew an explanatory diagram”, combining the detail visible on the photograph with observations made on the ground, which formed the basis of the site plan that eventually appeared in *Wessex from the Air*, this publication version being prepared not by Crawford but by an Ordnance Survey draughtsman.

The *Wessex from the Air* flights appear to represent the only occasion in the British Isles on which Crawford himself took verticals. As was pointed out in the aforementioned issue of *AARGnews*, some sites in that book were indeed represented by two or more overlapping photographs – Hambledon Hill in Dorset, for example, and the postulated course of Avebury’s Beckhampton Avenue. However, this was not done to enable stereoscopic viewing, but to compile mosaics in order to capture the entirety of a site that was otherwise too extensive to be captured on a single plate at the altitude flown. Crawford was insistent that photographs not be taken at too great a height as this would result in a loss of visible detail19, hence the occasional need for a sequence of exposures. Because the camera was not automated, the degree of overlap was determined by the photographer (i.e. Crawford or Alexander Keiller).

The photomosaic is an overlooked element of aerial survey practice in the inter-war years (but see, for example, Saint-Amour 2013). Alongside the map created from them, they were a standard product of many commercial surveys during this period, and of course had been produced in considerable quantities during the war as well. The 60% overlap between successive prints, which became standard practice for vertical aerial survey during the 1920s,

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17 All quotes in this paragraph are taken from ‘Reminiscences of a Field Archaeologist’.
18 This method is, of course, not a million miles away from that described by Beazeley (1919).
19 The scale of each photograph was, of course, dependent on the focal length of the camera and the altitude of the aeroplane.
was established not for the purposes of stereoscopic viewing, but to overcome problems in mosaics. Ongoing difficulties in maintaining a straight and level flight path could thus be remedied by ensuring that any given point would feature on three successive photographs 20.

When Crawford joined the Ordnance Survey in 1920, he joined an organisation that had been deeply sceptical about the value of aerial photography to cartography since the 1880s (Barber 2006; 2011; Wickstead & Barber 2012; 2014; 2015), and remained so into the 1930s, despite the extensive experience gained during the war. Suspicion was also directed at stereoscopy. Director-Generals such as Sir Charles Close, the man who appointed Crawford as the organisation’s first Archaeology Officer, regarded the procedures adopted on the Western Front for mapping from aerial photographs as expedient, and retained a marked suspicion of any attempt to use stereoscopic devices of any kind for mapping. Manuals and training had been introduced during the war in an effort to discipline the attention of interpreters, but the stereoscope offered an uncontrollable, individual viewing experience, while the stereo-plotters for aerial photographs being developed in the immediate post-war years were regarded essentially as devices for practising photogrammetry on an illusion (Wickstead & Barber 2012; 2014; 2015).

In 1930, General MN MacLeod responded to a paper by Captain Martin Hotine RE on ‘The Application of Stereoscopic Photography to Mapping’ by pleading guilty to having “belittled the stereoscopic illusion” on a previous occasion. He continued: “A word about the stereoscope. I do not expect many of you to have used it. Some people are, I think, at first inclined to distrust the stereoscope as an instrument of precise measurement. There seems too much scope for judgment in using it…”, admitting that during the war, the main emphasis had been placed squarely on the individual photograph. Post-war, the efforts of Hotine and others had eventually “brought home to us that the ‘unit’ as regards air photographic mapping is the overlap – the stereoscopic pair – not the single photo” (MacLeod in Hotine 1930).

Given this wartime background, it is perhaps instructive that the nearest Crawford ever came (in print, anyway) to discussing an issue of relevance to stereoscopy was in the context of a problem familiar to stereoscope users – that of determining whether a feature being examined through the stereo lenses is positive or negative (e.g. a ditch or a bank? A hollow or a mound?). The case in question concerned a mound – the Butte de Warlencourt – a site which, coincidentally, was also featured in the RFC’s (1916) manual Notes on the Interpretation of Aeroplane Photographs as an example of this phenomenon, and how to deal with it. The manual offered sound and practical procedural advice to the interpreter in order to ‘correctly’ identify the Butte as a mound. Crawford (1955, 118) applied his archaeological knowledge and experience to correct an interpreter’s error in drawing the feature as a hollow – the map called it a ‘Butte’, and a ‘Butte’ must be a mound 21.

20 The ‘Eastbourne Experiment’, undertaken by the Ordnance Survey in 1925 in order to (somewhat belatedly) assess the suitability of aerial survey for mapping in Britain, required only a 50% overlap – to ensure that any given point appeared on at least two photographs – to aid mosaic making and mapping. At no point in the design and undertaking of the experiment was the use of stereoscopic viewing considered necessary. Indeed, it seems that at this point in time, the Ordnance Survey possessed no stereoscopes (Barber 2013).
21 The phenomenon of ‘reversible relief’, as it was known – among other names – long before the invention of either the stereoscope or the camera, is a result of the inadequacies of human visual perception, not a procedural error caused by arranging photographs incorrectly (Barber 2011, 98-9; Wickstead & Barber 2012, 85).
Prehistoric Geography

Crawford’s approach to archaeology, and especially to prehistory, developed during the first two decades of the 20th century, a period that tends to be hastily passed over in histories of (British) archaeology. He was introduced to the subject while at school – Marlborough College – his enthusiasm fired especially by the experience of visiting earthworks on the chalk downs, and the potential for a more structured approach to exploration offered by Ordnance Survey maps22. Marlborough was one of many schools to take advantage of a scheme introduced in 1903 to provide cheap special editions of one-inch Ordnance Survey maps, these being passed on free to pupils (Herbertson 1903). The Marlborough Sheet covered not just the immediate environs of the college and the town – to the east it stretched almost as far as Crawford’s East Woodhay, Berkshire home, offering the potential for exploration within and outside term-time23.

At Oxford, Crawford began studying Classics, but in his final year switched to the Geography Diploma, originally introduced as a postgraduate qualification but subsequently opened up to undergraduates, Crawford being among the first of the latter to take it. After graduating, he had a brief stint as a Junior Demonstrator in the Geography Department before taking the Anthropology Diploma as a pre-condition for participating in the Routledge’s planned Easter Island expedition, scheduled for 191324.

At the time Crawford took these Diplomas, both Geography and Anthropology were still in the process of gaining a firm foothold at Oxford in particular and within British academia in general. At Oxford, this involved a process of establishing disciplinary boundaries as well as efforts to place both on a sound, modern scientific footing. Each provided Crawford with differing but complementary approaches to identifying traces of the past in the present. Here I will (briefly) concentrate on the contribution of geography to Crawford’s archaeology25.

The teaching of geography at Oxford brought to Crawford’s attention much that is familiar from some of his later archaeological innovations, particularly the distribution map and the period map. Historical Geography was, by the end of the 19th century, emerging as a distinct sub-discipline freed from earlier obsessions with political histories and boundaries. Instead, the ‘natural region’, defined on the basis of geology, topography, hydrology, climate and other factors was becoming the accepted unit of geographical study (e.g. Mill 1900a & b; Herbertson 1905). All Geography Diploma students at Oxford were required to submit a detailed study of such a region as their thesis. Crawford’s, published in 1922 (delayed mainly by the war), had focused on the region around Andover in Hampshire (Crawford 1922a), and

22 Key publications aiding this early exploration, noted by Crawford on more than one occasion, included the Hubbards’ (1904) Neolithic Dew-Ponds and Cattle-Ways, and AH Allcroft’s (1908) Earthwork of England.
23 Crawford’s own copy of this map – which he later described as a ‘cartographic atrocity’ – is in the Historic England Archive. The sole annotation is his name and the date, added in pencil. A section of the map covering the area closest to his home has been cut out and removed.
24 Crawford never reached Easter Island, jumping ship at the Canary Islands following a dispute with Kathleen Routledge. A somewhat sanitised account appeared in Said and Done. The full correspondence plus a more detailed written account of what happened (as far as Crawford was concerned) was included among the material at the Bodleian sealed until 2000.
25 As Kitty Hauser pointed out, Crawford’s anthropology never strayed far from what he learned at Oxford. He made little reference to subsequent developments, retaining an adherence to the comparative method and the doctrine of survivals throughout his life. As numerous Antiquity articles, as well as books like Archaeology in the Field (1953), made clear, he considered travel to places like the Hebrides and the Sudan as journeys in time as much as in space.
was clearly regarded as an exemplary study, not least by Crawford himself. Representing his first extended episode of fieldwork, he provided a detailed account of the archaeological aspects in *Said and Done* (much of this falling outside the scope of a geographical study). The Andover Region, of course, later formed the core of the region studied for *Wessex from the Air*.

Crawford laid out the principles of his geographical approach to prehistory in two publications substantially written before he joined the Ordnance Survey, and before aerial photographs had been brought to his (archaeological) attention. These were a paper entitled *Prehistoric Geography*, which appeared in the American journal *Geographical Review* in April 1922 (Crawford 1922b), and his book *Man and His Past* (Crawford 1921), which he began writing in the latter stages of the First World War. At the heart of this approach was the distribution map. For each archaeological period, “before we can begin to generalize..., the facts have first to be discovered, collected, classified and mapped. It is not until this preliminary – and very laborious – research has been accomplished, that the archaeologist is in a position to study the geographical aspect of his chosen period” (Crawford 1922b, 257). Moreover, he continued, “it is only by the informed imagination of the specialist that the distribution map can be adequately interpreted. This map is the goal of the whole undertaking, and its explanation in terms of geographical influence is one of the finest intellectual pleasures that exist”. An historical narrative emerged from the geographical analysis of a succession of distribution maps, each effectively representing a stratigraphical layer of British history, a horizontal slice through time26. Geographical methods allowed the archaeologist to trace the evolution of culture from the earliest times to the present, “and having strengthened our vision by scanning the vistas of the past, we find that we can also view the future with less uncertainty. We may not be able yet, perhaps, to see far into it, but we have acquired the time-habit of mind, and that is what matters” (Crawford 1921, 37).

For the earliest periods, environment presented a strong influence on populations and, therefore, on distributions of ‘facts’: “primitive man selected those regions which were free from dense forest and marsh and which also provided good open pasture land to graze his flocks and herds upon” (Crawford 1922b, 258; see Fig 4). Hypothetical restorations of past environments were a feature of historical geography from at least the mid-19th century, as were the kind of assumptions Crawford was making about the earliest periods. He viewed the “history of civilization” as “the history of the gradual reversal of man’s place in nature” (Crawford 1921, 120), the gradual “wane of the influence of environment on man, and the growth of his control over that environment”. That control was made possible via technological progress, the results of which were diffused via economic activity or population movement (peaceful or otherwise).

For the Neolithic period (and when Crawford was writing, the British Isles had no Mesolithic), distribution maps seemed to confirm the long-held notion that the earliest inhabitants had occupied the chalk downlands – areas such as Salisbury Plain – where the thin soils were believed to have been incapable of supporting the kind of dense woodland that

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26 This was, of course, a substantial part of the reasoning behind the many period-maps published by the Ordnance Survey from the mid-1920s, beginning with Crawford’s ‘Roman Britain’ map.
would have proved impenetrable to people armed only with stone axes, and thus offered an ideal habitat for the flocks and crops of the first farmers\textsuperscript{27}. To Crawford, Wessex was the Neolithic region par excellence, “an enchanted castle of upland pastures, surrounded by the thorny hedge of lowland clay-forests” (ibid. xii), which had “reached a fairly high level of culture as early as the beginning of the Bronze Age, when Stonehenge was probably built” (ibid., 158). This social, cultural and economic pre-eminence could be explained by sound geographic reasoning.

Crawford’s aerial archaeology in the 1920s was all about adding ‘facts’ to his distribution maps of the past, beginning with prehistoric Wessex: “The growing map is the source of all inspiration; to work without it as a goal is to wander aimlessly into blind alleys” (ibid., 226). Photographs (vertical ones) captured known sites and, increasingly, unknown ones and provided the basis for a plan of each, created by combining the photographic image with fieldwork and documentary research, as exemplified by the approach taken in \textit{Wessex from the Air}. Aerial photographs offered an additional tool to the field archaeologist and, in Crawford’s hands in the 1920s, served mainly to reinforce existing ideas about the past. Stereo pairs and stereoscopes were not required.

\textsuperscript{27} This idea of a largely treeless pastoral setting as the ‘natural’ state of the chalk downlands represented the landscape to which, it was being argued from the early 1920s, Stonehenge should be ‘restored’, a process that was envisaged as requiring the conversion of modern arable to grass, and the removal of all unnecessary modern intrusions, such as existing visitor facilities, fences, and the A344 (Barber 2014).
Crawford and the 3rd Dimension

The straightforward answer to the question ‘did OGS Crawford use a stereoscope?’ is, then, ‘no he (probably) didn’t’. He never mentioned one in any of his published writings on aerial archaeology, nor in what survives in the archives; his approach to archaeological fieldwork, and the way he incorporated aerial photographs into that approach, strongly suggests that a 3D view was unnecessary to him; his systematic collecting and photographic habits displayed a marked absence of stereo pairs; and his wartime experience, both in mapping and flying, suggest that his employment of a stereoscope would be less rather than more likely (and the same applies to his employment within the Ordnance Survey). Likewise with other inter-war aerial archaeologists – even if, say, George Allen had wanted to capture stereo views (and although Crawford repeatedly stressed his preference for verticals, he never – in the surviving correspondence – asked for overlapping verticals), flying solo and taking obliques with a hand-held plate camera meant he was highly unlikely to succeed. The regular use of stereo pairs and stereoscopes is something that, in the British Isles at least, entered aerial archaeology in the wake of the Second World War, partly as a result of the wartime experience gained by numerous archaeologists in air photo interpretation, but also because of the increasing accessibility of vertical stereo aerial photography from the late 1940s onwards, very little of it originally taken for archaeological use.

In any case, it may not be clear to a non-specialist that the stereoscope has ever played a role in aerial archaeology. It is perfectly possible to sit down and read a choice selection of publications on aerial archaeology from the last century or so – from Air Survey and Archaeology and Wessex from the Air in the 1920s to Wilson’s (2000) Air Photo Interpretation for Archaeologists or Brophy & Cowley’s (2005) From the Air – and encounter hardly any reference to stereo-viewing. Why on earth would anyone think that the stereoscope had ever been of use to the air photo interpreter? Meanwhile, anyone reading any publication on aerial archaeology might be forgiven for thinking that there was little interest in the aerial view (or the stereoscope) outside archaeology, so rarely is non-archaeological literature cited, something that is also a marked feature of Crawford’s work. Seeing from Above is merely one of many publications of recent years (eg Wilder 2009; Daston & Galison 2010; Cosgrove & Fox 2010; Bohrer 2011; Adey et al 2013; Haffner 2013) to deal with matters of interest to readers of AARGnews.

Acknowledgements

Thanks to Sally Crawford at the Institute of Archaeology, Oxford for access to the Crawford material there; Colin Harris and other staff at the Bodleian for help with the uncatalogued Crawford MSS; assorted staff at the Historic England Archive for retrieving bits and pieces of OGS; and Kitty Hauser and Susan Jerrard for useful snippets. Helen Wickstead provided sound advice on what to leave out, and Rog Palmer has been extremely patient.

28 Luftbild und Vorgeschichte, published in 1938 in Germany, featured an essay on aerial photography by Crawford and a selection of aerial photographs mainly taken by Allen, the Ordnance Survey and the RAF. It included 3 anaglyphs plus a pair of anaglyph glasses. However, these were in the section on German aerial photography.

29 Gilbert Insall’s method of photographing Woodhenge in 1926 suggests that any attempt to capture an overlapping stereo pair would probably have been fatal (Barber 2011, 159).
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Flying review 2015

Czech Republic – Martin Gojda
Just a brief report not only about how buried sites/features have been visualized via cropmarks this year in Bohemia. Honestly, since 1997 when my Institute became the owner of the Cessna 172, OK-EKD, I never spent – in the obvious period of May-July – so little time flying 300 metres above the Earth’s surface as happened this year. This is due to the circumstances connected with the process of closing down the long-term programme in which the Institute of Archaeology (my Prague employer) organized (via myself) annual prospection flights. Consequently, the aircraft has been offered to the second-hand market to be sold. This step was done during late spring this year but before that the craft had to pass through various exams and repairs. As a result the number of prospection flights was limited to just a few. Just in mid-June I managed to use the OK-EKD continuously, during the annual training course for students of archaeology that we (with Lucie) have organized since 2003.

The photograph shows a site which, this late May, produced distinctive cropmarks of sunken huts (datable due to their plans and size most probably to the first half of the first millennium), of an above-ground early Iron Age house (excavated elsewhere and dated precisely) and several pits. Since 1998, when the site was evidenced for the first time, cropmarks over this settlement have been recorded in only four years, but were never so sharply developed/visualized as this year.

I am describing all that just to inform you that my experience this year was too short to submit fully reliable information upon the character of crop-marking process in my country. Anyway,

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the short-time campaign indicated that at least in the core area of Bohemia (three districts north-west of Prague which in a long-term perspective are the most fruitful for the production of cropmarks) this year must have been highly productive in most (if not all) areas with high crop-marking potential (i.e. on sands/gravels of lowland river basins). Although not comparable with the 2011 cropmark production, a top year in the period 1992 – 2015 in which more than eighty new sites were identified on the same territory where during the last fifteen years or so no more than 20 sites were discovered annually, I would put this season in the group of 5 – 7 years most cropmark productive.

**Denmark – Lis Helles Olesen**

2015 has been one of the worst summers, if not the worse, in our project, *An aerial view of the Past - Aerial Archaeology in Denmark*, which started in 2008. Spring and summer until August was very wet and cold, and crops were 3-4 weeks later than in a normal summer. A small area in the south-western part of Jutland showed good cropmarks for around one week in the middle of July. We ended up making only six flights and around 20 hours in the air.

![Photo: Houses, pithouses and fences from Late Iron Age in the foreground. Houses from the Middle Ages in the background.](image_url)

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**Balkans – Darja Grosman**

I have not done much flying this year. Karst and all the standing structures were green, overgrown early due to a lot of rain in early spring. The winter was no winter at all so the winter crops exploded early - not much to see.

Most of the spring crops produced short time visible germination marks. I do not know what was going on at the Pannonian edge. At the moment (August) even parch marks are vanishing due to extreme drought.

Shallow water was too ‘hot’ too soon, so the clear visibility was only early, early in the morning. Late May the quality went down below 50%. I will try again in late October, if this heat does not persist into early autumn.

Not much of a report, I know but it is not much fun in this heat; we took less fuel than usual due to the heat every time we went up this summer. Gliding rocks!

**From one small field in England – Rog Palmer**

A flight into Stansted on 3 July 2015 passed near to a lot of responsive fields. The pilot was not very cooperative but I managed to snap a few crop-marked fields including the one illustrated that has an archaeological evaluation trench cutting a curving trackway that I had photographed in 2010 when we were allowed to fly between Stansted and Luton airports.

That flight alerted me to conditions on ‘unfavourable soils’, information which was passed to others in Britain via Damian Grady’s *Crop condition bulletin*. Of course, it then rained for a week, but during the next two or three weeks, several observers made flights over clay areas with, it seems, good results.

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Luftfotoarkæologi i Danmark (Aerial Archaeology in Denmark)
by
Lis Helles Olesen¹ and Esben Schlosser Mauritsen

A new book on aerial archaeology in Denmark was published in June 2015. It shows results from the first four years of Holstebro Museum’s project An aerial view on the past – aerial archaeology in Denmark. The project is the first big effort combining aerial archaeology and other non-destructive methods in Denmark.

The book comprises 13 chapters with 416 pages and more than 400 illustrations of which most are aerial photos taken in the project.

The chapters are:
1. Background for the project,
2. Aerial archaeology – definition, aim and status,
3. Methods,
4. Localities,
5. Results of the aerial surveys,
6. Aerial archaeology and geophysical surveys on the island Föhr,
7. Viking Age and Middle Ages by Nissum Fjord,
8. Late Iron Age and Viking Age along the river Varde Å,
9. Viking Age, aerial archaeology and metal detectors,
10. Vertical photos,
11. Laser scanning,
12. Aerial archaeology and physical planning, 13. Perspectives.

The text is in Danish with summary and captions in English. The price is around 47 Euro + postage (Weight 3 kg).

Order from sandie.nielsen@kulmus.dk

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Cropmarks
Harvested by Rog Palmer

**Spitfires in Burma**
The link takes you to a report on the recent quest to locate these supposedly buried aircraft and includes a chunk on examination of aerial photographs.


**Aerial camera(s)**
Phase One, manufacturer of ‘proper’ aerial cameras announced a new mini-camera, the iXU, in March this year. It’s aimed at the serious drone market but would also fit happily in a Cessna – pointing either through a convenient hole in the floor or using a flying door (see *From the Air*, 108-109). These cameras are probably fairly expensive as would be expected for an 80MP sensor in a body weighing about 950 gm.

Phase one: [http://industrial.phaseone.com/default.aspx](http://industrial.phaseone.com/default.aspx)

**Satellites record destruction in the Near East…**
An article by Stephen H Savage, a specialist satellite image analyst (yet he still shows us the photos upside down) making comment about comparisons between Corona images and those from the present. Discussion is about damage caused by construction during the past 40 years, more recent damage caused by military activity, and looting (see also below). An interesting dilemma occurs re the military activity by, as he put it ‘anyone who fights in the Middle East’, which can be seen to damage sites – but if he reports that military activity the result, depending on who is in occupation at the time, may be considerably more damage caused by bombing.

http://www.slate.com/articles/technology/future_tense/2015/03/satellite_images_show_isis_other_groups_destroying_archaeological_sites.html

…as do drones
A closer look at damage to specific burial sites in Jordan that includes a comment that looters get poor reward for their work. It seems that antiquities are like hard drugs and with each successive move towards the collector or consumer, the price gets higher.


**A really good use for drones**
No comment…

http://www.bbc.co.uk/newsround/32142774

**RIEGL RICOPTER**
Following the note in *AARGnews* 49 about its miniature ALS scanner, Riegl now manufacture a machine to fly it. Maximum take-off weight is 25 kg for which it claims a 30 minute flight time. How soon before one of the ‘aerial cam’ companies offers ALS of your back garden?

Panorama type things
Those of you who like to play with images and make 3D or virtual reality things may be interested in ‘Roundme’ which is, it says, ‘a simple and beautiful app [which I recently learned meant ‘program’ in the old language] that allows you to create, share and explore Spaces’. You need to sign up to use the site properly but the basic website includes examples that range from aerial views to the inside of a café.

https://round.me/

Cultured crop marks
Arty ‘crop marks’ in rice from Japan.

http://www.bbc.co.uk/news/video_and_audio/must_see/33579367

(thanks to Dave Cowley)

Archéologie & photographie aérienne
A summary history of aerial photographers, mostly French as is the text, with mugshots and examples of their work.

http://pfiev.free.fr/a_histo.htm

(thanks to Carmen Miu)

CUCAP online catalogue
No one seems exactly sure what the medium/long term future of the library at CUCAP will be, but while the bosses have been deciding, Alan Martin the librarian, has been busy digitising a selection of obliques that can be seen via a click on the on-line catalogue. The on-line photographs include all the 35mm colour and FCIR slides taken from the mid-sixties onwards and make these available for the first time in an easily-viewable format. Thumbnails include complete cover of Ireland (c.12,500) but coverage of the UK is more scattered as around 16,000 have been digitised so far (out of 240,000!). Alan has achieved this by scanning prints and slides at low(ish) resolution and so has been able to process a lot of material rapidly. His argument for this – and perhaps other archives should perhaps take note – was that there is little point in scanning everything slowly to produce high resolution tif files when very few of these would ever be required at that resolution. Any copies that are required at high resolution can be made on demand.

http://www.geog.cam.ac.uk/cucap/about/
Another map collection
McMaster University, Hamilton, Canada, has a web link to a lot of its library including collections of maps and ‘historical’ maps. The latter, many purchased in the 1970s from British booksellers, include some from WW1 showing trenches, etc, in France, Belgium and other theatres, along with a selection of (mainly RFC) aerial photographs which, unfortunately, are displayed with north to the top so that the shell-pocked landscape looks as if the moles have invaded. The collection also includes some from WW2, the Korean War and other conflict zones. Many of these maps are of British and US Military origin. Other ‘Topographic maps’ range (in alphabetical order) from Africa to Yugoslavia and include, for UK readers, 1:63,360 editions from 1940.

http://library.mcmaster.ca/maps/ww2/ww2_Multiple_Ed_Cambridge.htm

(thanks to Carmen Miu)

Fly like a bird?
An exercise machine tied in with virtual reality and a big fan lets you fly – apparently – like a bird. You could probably stick a camera on your head and take images to make 3D models of pots while you’re ‘flying’. Suitable for anyone with lots of space and money.

http://somniacs.co/

GNSS newsletter
This may have been mentioned before but reminders are free. This website carries many stories and press releases about new and forthcoming equipment and may be of use to some of you, especially those undertaking ground survey or intending to be more serious about their use of UAV/UAS.

http://gpsworld.com/

(thanks to Irwin Scollar)
Books of interest?

Rog Palmer¹


Experiments in clear and turbid water assessed the penetration and results of using the green wavelength of an airborne laser scanner to resolve underwater topography. The paper includes a methodological introduction explaining ALB – airborne laser bathymetry – which is followed by case studies and details of data processing. The clear water off Croatia allowed laser penetration up to 11m and resolved a number of underwater structures. The murky lake in Austria was 1.6m deep and high-resolution penetration to that depth was achieved along with the resolution of a number of wooden logs. Technical information in this paper dates to early 2015 and is as up-to-date as possible in a technology that is rapidly developing. This, and discussion of the results, make this paper essential reading for anyone else wanting to pursue this method.


The authors, clearly terrified of having north anywhere but upright, have devised a hill-shaded model that can be merged with an ortho image. This allows shadows to fall towards the viewer thus avoiding reversal of topography that is common with sunlit verticals in the northern hemisphere.


I never fail to be impressed by the amount of drivel that Earsel manages to publish. OK, some contributions in this volume offer useful testing of new technology (eg, by Trier, *et al*) but many seem to have been written by children who have been shown their first aerial images. In particular, the few papers that try to interpret new – or old – information seem not only to be reinventing the wheel, but the sledge that came before the wheel. Anyway, it is free so you can download it, enjoy the contents and think on the paradox that enables those with little understanding of image interpretation get the money to play while those with the experience and confidence not to call for everything to be ‘ground truthed’ sit by and watch the world move backwards.

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Those of you with an ArcLand connection probably received an email on 20 August and downloaded the pdf copy of this book which comprises a series of two-page poster-type presentations on themes and topics that merged together to make the ‘ArcLand whole’ and, hopefully, will show the EU and the broader public that their money was well spent. PDF copies are freely available at:

http://archiv.ub.uni-heidelberg.de/propylaeumdok/volltexte/2015/2513


Notice of a new book that is ‘Written by world-leading specialists in their own field, the papers in this book trace the whole process of detecting and interpreting the marks that humans have left in landscapes.’ More information on the contents can be found via the link below and we hope to include a review in the March 2016 issue.

http://www.postclassical.it/pca_studies.html
The Aerial Archaeology Research Group

AARG is a lively and friendly international group of young and old researchers. It provides a forum for the exchange of ideas and experience on archaeology and landscape studies using all forms of remote sensing, especially airborne and satellite based techniques.

AARG is actively involved in promoting the collection, interpretation and application of remote sensing data in fostering research, conservation and public understanding. Its members are among those pushing the boundaries of the collection and analysis of air- and space-borne sensors.

Since its foundation in the early 1980s, AARG has vigorously encouraged discussion and cooperation through its annual conferences, workshops, specialist publications and biannual newsletter, AARGnews.

Membership is open to all who have an interest or practical involvement in aerial archaeology, remote sensing and landscape studies.

AARG is a registered charity: number SC 023162.

AARG homepage. http://aarg.univie.ac.at/

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Student scholarships. AARG has a limited number of student scholarships for attendance at its annual meeting. These are aimed at supporting bona fide students who are interested in aerial archaeology and who wish to attend.

Anyone wishing to apply should write to AARG’s Chairman (aargchair@gmail.com) with information about their interests in archaeology and aerial archaeology, as well as their place of study. The annual closing date for applications to the annual AARG conference is 31 May, other meetings for which scholarships may be available will be advertised on an ad hoc basis.