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AARGnews

The Newsletter of the Aerial Archaeology Research Group

Issue 72: April 2026

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 - TRAIL Workshop Reports
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 - Publications of Interest

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Aerial Archaeology
Research Group
1983-2026

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AARGnews is the bi-annual newsletter of the Aerial Archaeology Research Group and is the only regular open access periodical dedicated to aerial archaeology. It is a diverse and open forum for the discussion and exchange of new (and old) ideas related to aerial archaeology, remote sensing, and landscape studies.

We welcome articles of any length and format. You can write about your research, methods, techniques, case studies, reviews, opinions, or anything else that might interest our readers. We would particularly welcome the inclusion of photographs, images, maps, plans, or other illustrations to support your article.

If you are not sure whether your idea is suitable for AARGnews, please get in contact and we will be happy to assist you in shaping or fine-tuning your contribution for a forthcoming issue.

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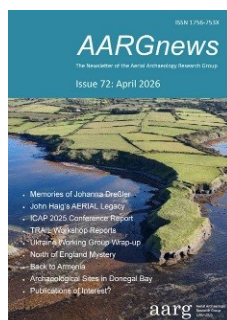
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Cover picture: Doorin Point Promontory Fort, Donegal Bay (Ireland). In 2025, the AARG Fund supported UAV surveys of the northern coast of Donegal Bay, the results from which are reported on pages 46-54 of this issue. The survey forms part of a wider Coastal Zone Assessment programme by *The Discovery Programme* (grant aided by the Royal Irish Academy Archaeology Research Grants, funded by the National Monuments Service) that has identified over 350 archaeological features across two actively eroding headlands. Photo credit: © The Discovery Programme CC-BY-NC-ND.

Martin Fowler ¹¹ editoraargnews@gmail.com

Welcome to the latest issue of *AARGnews*. The articles in this issue span activities in a range of regions, from the British Isles to Slovenia, Ukraine and Armenia, and showcase a wide range of perspectives on aerial archaeology. To whet your appetite, there are passing references to Sherlock Holmes, J. R. R. Tolkien, *Groundhog Day*, and Microchiroptera in some of the contributions, so check them out!

AARGnews 71

With over 200 downloads within two months of publication, *AARGnews 71* was the most downloaded issue since records began². The downloads were no doubt boosted significantly by the social media posts on AARG's [Facebook](#) and [Bluesky](#) channels, deftly managed by Kim Teale, thus bringing news about aerial archaeology to the wider community in fulfilment of AARG's charitable objective to *advance the education of the public in archaeology*.

Scope of Aerial Archaeology

Whilst compiling the *Publications of Interest* (see pages 55-66) with Eileen Kerhouant, we were genuinely impressed by both the sheer volume and

the remarkable geographic spread of research published in the past six months. We identified around 90 articles pertinent to aerial archaeology; almost twice as many as the previous survey, which covered the first eight months of 2025. The scope of these papers is global, stretching from the Galapagos Islands to Japan, Norway to the Falkland Islands, with Europe dominating the map where Italy, Greece and Spain emerge as particular hotspots during this period (see Figure 1). On reflection, perhaps this diversity should not have come as such a surprise. AARG itself, as a microcosm of the wider aerial archaeology community, is notably international, with members currently hailing from 24 countries (compare Figure 1 with the [live map on the AARG website](#)).

A word cloud generated from the

titles of the 90 publications (see Figure 2) reveals that terms such as lidar, UAV, and remote (sensing) feature most prominently. In fact, research utilising lidar and UAV technology constitutes more than a third of the papers reviewed, underscoring how these methods have come to the fore, eclipsing the traditional reliance on aerial photographs and satellite imagery. Notably, the collection also includes a significant number of studies employing artificial intelligence and machine learning techniques for data analysis, alongside sensor fusion approaches that integrate geomagnetic surveys, lidar, and both aerial and satellite imagery.

The emerging field of 'drone magnetometry' challenges established definitions of aerial archaeology, which have historically centred on remote sensing using aerial images covering parts of the the electromagnetic

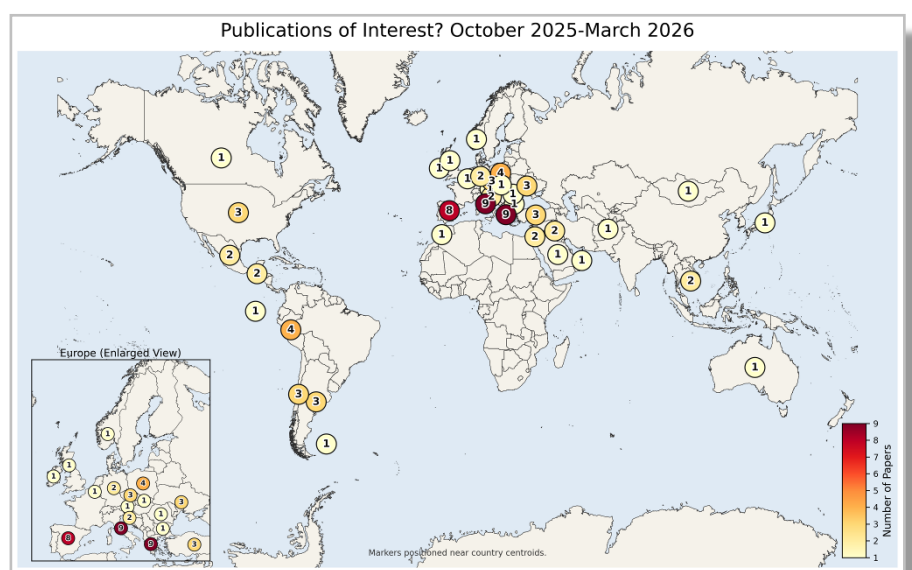


Figure 1. Geographical distribution of the locations of aerial archaeology-related studies taken from a compilation of publications published between October 2025 and March 2026.

² OK, since April 2024! ☺

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Chair's Piece

Łukasz Banaszek ¹

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In my penultimate piece as AARG Chair, I am excited to announce that the Call for Papers (CfP) for the AARG 2026 Annual Meeting in Pilsen, Czechia, opened last week. The deadline for the paper and poster submissions has been set to 31st May 2026 so fire your proposals our way early! The conference themes and other information about abstract submissions are available in the CfP announcement as well as on the [Conference website](#), skilfully created by AARG Webmaster, Andrea Devlahović. We are continuously updating the information on the website regarding social events and conference registration, which will open in early June 2026, building on the organisational skills of Lenka Starková, the 2026 Meeting Secretary. The conference will return to Pilsen after 10 years, but the social events including fieldtrips will take the attendees to different venues. Maybe except for the Pilsner Brewery, which unsurprisingly seems to be the centre of gravity in the city. I hope to see many of you in Pilsen this September, but if you cannot make it, rest assured that we will record and publish presentations on our social media, subject to the presenters' approval.

We will hold AARG's Annual General Meeting (AGM) in Pilsen and following last year's successful hybrid meeting in Trondheim, we will offer the possibility to join the AGM online for those members who cannot be there in person. This year's AGM will see a series of elections as several posts will be available at the AARG Committee and Trustee Board levels. These include two Trustee posts, currently filled by Chris Cox and Wlodek Raczkowski, as well as Chair's, Vice-chair's, Honorary Secretary's and Treasurer's posts. Traditionally, the outgoing Chair takes up the Vice-chair role to support the new Committee, subject to members' approval, and I am happy to stand up and serve in such role for the next three years. We particularly seek candidates to fill in the Chair and Honorary Secretary roles and would welcome notes of interest from our members willing to take on the helm of leading the group and, in return, growing their skills. Wlodek and Chris as well as Rebecca Bennett, AARG Treasurer, have expressed their willingness to serve another term, subject to members' approval. While this means that there is less pressure to fill in those positions, if you would like to take up one of those roles, let us know as none of them will dig their heels in about it. As per AARG's Constitution, the deadline for nominations is early August 2026, i.e., 30 days ahead of the AGM, but we would be grateful if you could send us a note of interest as soon as possible. Everyone on the Committee and Trustee Board is happy to provide details about their role should the

potential candidates need better understanding of the post before nominations.

It is with great sadness that the Committee learned about the premature passing of Johanna Dreßler, the former AARG Secretary, who is survived by her partner and two children. While over the last few years our community has lost several members, Johanna's demise at 46 has dearly saddened the Trustees and Committee members. I would like to thank Rog Palmer for his piece remembering Johanna, as well as to so many of our members for their contributions to our memories of her.

Finally, I would like to thank Martin Fowler and the *AARGnews* Editorial Team members - Carmen-Cornelia Miu (Bem), Gianluca Cantoro, Chris Cox and Eileen Kerhouant - for publishing another fantastic issue of our newsletter. This issue has been produced at a particularly difficult time for some members of the editorial team, and I am extremely thankful for your commitment and team effort.

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Compiled by the AARGnews Editorial Team¹

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Johanna Dreßler (1980-2026)

We were deeply saddened to hear the news that our former AARG member and Secretary, Johanna Dreßler, passed away on 16th March 2026 at the untimely age of 46. Jo was a skilled aviator, aerial photographer, and aerial archaeologist. She is survived by her partner, Matthias, and two young children.

Jo is remembered on pages 10-13 of this issue, where some of her AARG friends and colleagues share their memories and photographs of her.

AARG 2026 Call for Papers

The Call for Papers for the 2026 AARG Meeting in Plzeň (Pilsen), Czechia, is now open! The conference themes are:

- *Archaeological Landscapes in the Heart of Europe,*
- *Aerial Archaeology and Remote Sensing in Built-up Environment,*
- *Environment, Archaeology and Landscape,*
- *Technical developments,*
- *Open Call.*

Further details can be found on page 9 and on the [conference website](#).

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A selection of news items that may of be interest to readers.



AARG 2026 conference poster designed by Andrea Devlahović based on a photograph by Martin Gojda.

The closing date for presentations (20 mins) and posters (A1 portrait) is **31st May 2026**. You can submit your proposal, including title and abstract, via the online form on the [conference webpage](#).

Committee and Trustee Elections

As noted in the Chair's Piece, several of the AARG Trustees and Committee posts are up for re-election at this year's Annual General Meeting. These include two Trustee posts as well as the Committee Chair, Vice-chair, Honorary Secretary and Treasurer. Traditionally, the outgoing Chair takes up the Vice-chair role to support the new Committee, subject to members' approval.

As per the AARG Constitution, the deadline for nominations is 30 days

before the AGM, i.e., early August 2026. A formal notice of the elections will be issued to members shortly. If you are interested in standing for any of these posts, please send a note of interest to the [AARG Chair](#) as soon as possible.

AARG 2025 Conference Videos

Videos of last year's AARG Conference in Trodheim are now available to view on the [AARG YouTube channel](#).

Constitution

The updated AARG constitution that was accepted at the Annual General Meeting on 11th September 2025 has been approved by the Scottish charity regulator, the [OSCR](#), and can be viewed on the [AARG website](#).

AARG Fund

One applicant was successful in their bid to the last AARG Fund round and we look forward to hearing about the project in a future issue of *AARGnews*:

- *Experimental Assessment and Field Validation of UAV Magnetometry at the Roman Fort of Brocavum* (Michal Pisz, University of Bradford).

The next funding round will open in May 2026. Details of how to apply for support for projects can be found on the [AARG website](#).

TRAIL 2025

In October 2025, AARG supported five members with bursaries from the AARG Fund to attend the TRAIL (Training and Research in the

Archaeological Interpretation of LiDAR) workshop in Slovenia, which focussed on airborne laser scanning for farmed landscapes. Through a series of lectures and workshops, the attendees enhanced their knowledge of LiDAR and machine learning for archaeological applications, concluding with a field trip. You can read more about the event on pages 24-28 of this issue.

Joint AARG/ISAP committee meeting

On 13th February 2026, the AARG committee held their annual meeting with their counterparts from the International Society for Archaeological Prospection (ISAP). Items discussed included future meetings and events, representation at the European Association of Archaeologists, and respective funding calls.

Air Photo Exhibition

For our members in the north of England, a selection of aerial photographs taken by one of our long-standing members, Anthony Crawshaw, will be exhibited on the weekends of 6th-7th and 13th-14th June 2026 as part of the *North Yorkshire Open Studios* event at Knaresborough, North Yorkshire. Details can be found on the [event's website](#).

Hungarian Aerial Archaeology Book

Rog Plamer has drawn our attention to a new book by Zoltán Czajlik titled *The Basics of Aerial Archaeology*. The book, in Hungarian, is free to [download here](#).

Cifa IMSIG Spotlight

Laura O'Connor, Chair of the Chartered Institute for Archaeologists (Cifa) Information Management Special Interest Group (IMSIG) writes:

Since launching in May 2025, the IMSIG's online *DigITea* talk series have been exploring the incredibly fascinating world of information management in archaeology and heritage. These informal 25-minute lunchtime talks, followed by live Q&A,



AARG attendees at the TRAIL Workshop in Postojna, Slovenia.

provide a welcoming space to share innovative projects, practical approaches, and emerging ideas in information management.

For AARG members, the overlap with IMSIG is unquestionably clear. Much of the work IMSIG showcases via these talks - from LiDAR and drone survey to mapping, immersive systems visualisation, archiving and data standards - depends on robust digital data management, both a challenge and opportunity AARG members are well acquainted with. The *DigITea* talk series creates not

only a space to reflect on how we collect data, but also how we curate, share, integrate and reuse it.

Join us for a cup of tea and a deep dive into information management case studies - or share your own work with the IMSIG community! Contributions for upcoming sessions are now welcome. If you're working with digital data, from inter-operability and 3D modelling to LiDAR or creative reuse, we'd love to hear from you. Please email cifa.imsig@gmail.com if you're interested in speaking to our members.



One of the photographs to be exhibited by Anthony Crawshaw at the North Yorkshire Open Studios: Wharram Percy Deserted Medieval Village in the snow. © Anthony Crawshaw CC-BY-NC-ND.

AARG Socials round-up

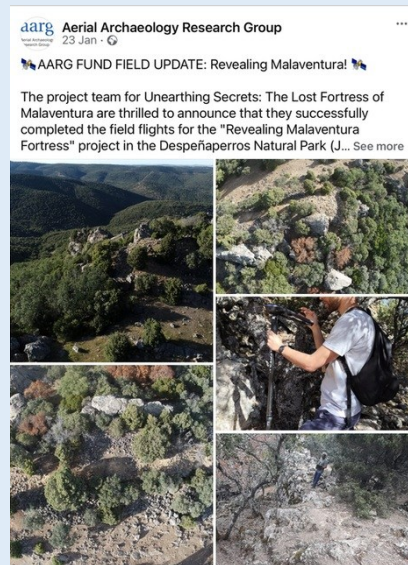
Kim Teale our Social Media Officer writes:

Our socials have been a flurry of activity on [Facebook](#) since October! In case you missed it:

- Some members of AARG attended the TRAIL (Training and Research in the Archaeological Interpretation of LiDAR) workshop in Slovenia.
- We congratulated Lucrècia Centelles Fullana on her Early Career Award 2025 with her paper *Using ALS for Iron Age archaeology in the Valencian region (Spain)*.
- AARGnews Spotlight looked at the amazing results of drone-based magnetometer survey.
- We announced the AARG 2026 location as Pilsen, Czechia!



- A selection of the presentations from the 2025 AARG meeting in Trondheim were made available on the [AARG YouTube Channel](#).
- We published AARG fund field updates from: *Unearthing Secrets: The Lost Fortress of Malaventura in the Despeñaperros Natural Park*



(Jaén); and *Modelling Climate Change Risk To Archaeological Sites In Donegal Bay, Ireland* from the Discovery Programme.

- Deep from the AARGnews archives looked at AARGnews 52 from March 2016 and an article by Marcos Garcia Garcia on *Interpreting social change from above: causewayed enclosures of Northern Spanish Plateau*.

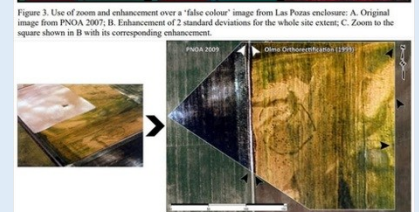


Figure 3. Use of zoom and enhancement over a 'false colour' image from Las Pozas enclosure: A. Original image from PNOA 2007; B. Enhancement of 2 standard deviations for the whole site extent; C. Zoom to the square shown in B with its corresponding enhancement.

- A look back at a paper from AARG 2025 by Grzegorz Kiarszys and Marek Lemiesz titled *27 Days of 'Russkij Mir' in Yahidne and its material legacy: The archaeology of a war crime*.

You can view previous talks and register for upcoming ones on the [IMSIG webpage](#).

IMSIG doesn't stop there! We also recently released an *Information Unplugged* edition of *The Archaeologist* magazine, featuring articles on advanced digital workflows, the role of HERs, heritage science data, FAIR principles, regulatory challenges, archival impacts, and more. CifA members can download a copy from the [CifA website](#).

AutoGR-Toolkit

Gianluca Cantoro reports that version 6 of his AutoGR-Toolkit is now freely available on [GitHub](#) and the [Microsoft Store](#). The toolkit runs under Windows

and comprises a suite of tools for imagery (see [AARGnews 69](#) for further working with aerial and satellite information).

Forthcoming Conferences and Meetings

2026

32nd EAA Annual Meeting 26th-29th August 2026, Athens, Greece.
 Conference website: [https://www.e-a-a.org/EAA/Events/Future Annual Meetings/EAA_2026.aspx](https://www.e-a-a.org/EAA/Events/Future%20Annual%20Meetings/EAA_2026.aspx)

AARG Annual Meeting 2026 10th-12th September 2026, Pilsen, Czechia.
 Conference website: <https://aargonline.com/wp/events/aarg2026-plzen/>

*** Call for Papers ***

**International Aerial Archaeology Conference
Pilsen, Czechia, 10-12 September 2026**

Organised by the [Aerial Archaeology Research Group](#) (AARG),
the [Department of Archaeology](#) at the University of West Bohemia and the [West Bohemian
Museum](#) in Pilsen

The AARG Committee, the Department of Archaeology at the University of West Bohemia and the West Bohemian Museum are pleased to invite the submission of papers for the 2026 International Aerial Archaeology Conference to be held on 10th and 11th September 2026 at the [West Bohemian Museum, Pilsen, Czechia](#) with a field trip on 12th September 2026.

We invite proposals for oral presentations (20 mins) and posters (A1 portrait) aligning with the following themes:

Archaeological Landscapes in the Heart of Europe. This theme will feature papers focusing on archaeological landscapes in and around the Bohemian Massif and Western Carpathians. Contributions may highlight recent discoveries, ongoing research projects and regional perspectives building on aerial archaeology and other remote sensing approaches. Papers addressing the integration of aerial data with other archaeological methods in regional and transregional research are particularly welcome.

Aerial Archaeology and Remote Sensing in Built-up Environment. This theme will explore the use of aerial and satellite data in investigations of archaeological remains in built-up environment. Contributions may address the detection and documentation of buried remains in cities as well as the analysis of historic urban landscapes. In addition, the papers in this theme may explore monitoring of archaeological heritage in rapidly transforming built-up context and assess risks to urban archaeological heritage.

Environment, Archaeology and Landscape. This theme will explore the relationship between past human activities, heritage, and environmental processes. Contributions may address environmental reconstruction building on palaeoenvironmental data, computational landscape reconstruction models, and predictive modelling. Papers in this theme may present the integration of aerial and remote sensing data in multi-layered interpretation of past landscapes and settlement systems. Finally, this theme will address threats to cultural heritage resulting from environmental processes whilst demonstrating how aerial archaeology and remote sensing can help to understand and mitigate the risk.

Technical developments. New prospection methods, data sources, algorithms, and approaches constantly strengthen aerial approach. This theme may include papers on the use of novel sensors, high-frequency and very high-resolution satellite imagery as well as UAVs, now widely adopted in localised surveys. It will also encompass presentations on the use of Artificial Intelligence for big data and large-scale analysis including feature detection. Other papers may showcase improvements to archaeological practice such as novel data visualisation techniques and processing workflows.

Open Call. We invite proposals for the presentations which can cover a wide range of archaeological questions and different research approaches demonstrating strong aerial components. Surveys and research spanning between spatial scales from regional landscape analysis to detailed investigations of individual sites and their structural components are particularly welcome. Papers accepted for the open call will be grouped by motif or location.

To submit your proposal, including title and abstract, please visit the [conference webpage](#).

The closing date for all proposals is Sunday, 31st May 2026.

Further details to follow, but please note that over the last few years, the available slots for presentations have filled up quickly so submit your proposals early.

Memories of Johanna Dreßler

(1980-2026)

From Sara Popović, Vedrana Glavaš and Andrea Devlahović

We met Johanna at one of ArcLand’s workshops at the flying school in Kostolac, Serbia, back in 2011. It was one of those intense gatherings - full of lectures, flying, mapping - but above all, full of laughter and the kind of moments where real friendships are made. And those friendships have lasted, even though we’re countries apart.

Johanna was already AARG’s honorary secretary, and the rest of us quickly joined AARG, continuing those friendships at the annual meetings in Poznań and the year after in Budapest. Wanting to keep that energy of young people coming together, we once organised a young AARG session. It was imagined as a space where we could introduce ourselves, share ideas, projects, but also the struggles of doing aerial archaeology in places where support wasn’t always there. Unfortunately, it didn’t quite work out. The session ran parallel to the official programme, so we missed lectures, and there were no senior members there to give us feedback. In the end, we realised those conversations were better had over a beer. Maybe YAARG didn’t take off - but we certainly shared many beers, in many countries.

Jo loved piercings and tattoos. On one of her thighs, she had a tattoo of a lighthouse in a red-and-white chequered pattern. She said it represented holidays

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AARG members share their memories and photographs of Johanna Dreßler, our former Secretary, who sadly passed away on 16th March 2026. She was a skilled aviator, aerial photographer, aerial archaeologist and to many of us, a good friend.



she spent with her parents in Normandy. Our friendship went beyond AARG, and when she visited us in Croatia, we joked that she must be one of us - because what else could red and white squares mean?

Jo didn’t stay in aerial archaeology, and life happened, and we drifted apart over the years, as people do. But she will always be ours. And that lighthouse - we hope it still lights her way.



From Vedrana Glavaš

From Axel Posluschny



Memory of Young AARG and a visit to Zadar.

ArcLand meeting.

Continued ...



CAA DE & NL in Münster, Germany 19th November 2010.



ArcLand meeting in Rethymno, Crete, 28th September 2012.



TRAIL LiDAR Workshop, Bibracte, France, 14th March 2011

From Gianluca Cantoro

I am very sad about the loss of Johanna. I met her many years ago but I got to know her a bit better while in Rethymno (Crete, Greece) in 2012 when we hosted a Summer School with my colleagues at IMS-FORTH. A colleague of mine took some photos (where you will see also other "known faces") and I am happy to share them with you. Thanks for this opportunity to share these, and I send my love to her family.

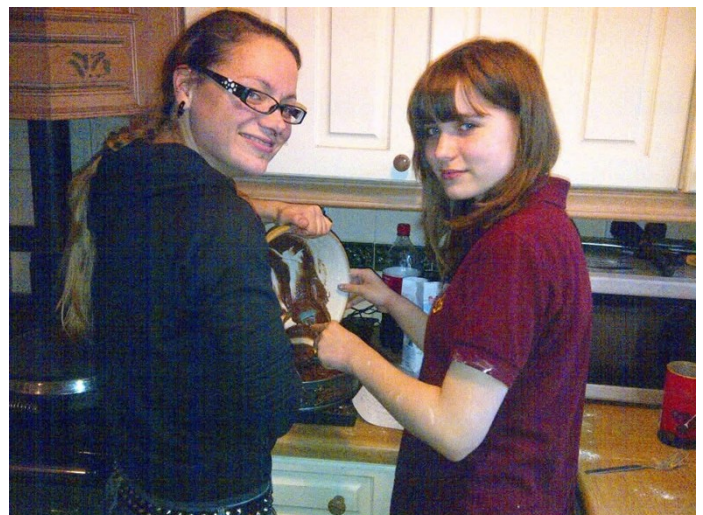


Continued ...



From Chris Cox and Caitlin Lang

Timeless memories of a visit to the Pitt Rivers Museum in Oxford, UK, in 2012 after training at Air Photo Services in Cambridge, and the baking of an epic chocolate cake!



From Rog Palmer

Johanna Dreßler wrote her name in this manner. She died on 16 March 2026. Some will remember Jo as AARG Secretary (2009-2011), but there was more to her than that. In 2005, she attended the AARG meeting in Leuven, joined AARG shortly afterwards and published a summary of her Master’s thesis in *AARGnews* (Dreßler, 2009). She was also trying to find a supervisor for an aerial PhD and beginning to organise meetings in Germany at which people could discuss archaeological uses of aerial photographs. At that time ‘aerial archaeology’ in Germany was dominated by Otto Braasch who was an excellent aerial photographer but went no further than providing and publishing pictures. His dominance was such that Jo was told by several potential supervisors that there was nothing for her to do because Otto had done it all.

In 2011, Jo attended the Training Workshop at Kostolac, Serbia, and followed that with three weeks of advanced training in August at Air Photo Services in Cambridge. Her attendance at both was supported by the EU-funded *ArcLand* project. While she was in Cambridge we struggled to find PhD thesis topics for her and at some forgotten date we spent a week going through Otto’s slides in the collection at Munich in the hope of being able to map them to provide data for her thesis. But no – no control points. We imagined Otto sitting on his bed at night snipping the corners off his slides to remove any possibilities of mapping them.

Possibly while she was in Cambridge, or soon afterwards, we began throwing around the idea of what was to become YAARG – Young AARG – that had a break-away first session during AARG’s meeting in Budapest in 2012. One point of that meeting was to give the chance for the ‘youngsters’ to ask silly questions without disapproval from older members. The circulated outline included some aspects that AARG should be able to organise, as in the



Where Jo belonged and was happiest. Photomontage sent to the author in 2024.

following extract from YAARG’s initial circular:

Due to a lack of education of Aerial Archaeology at most of the European universities, young professionals are struggling with quite similar problems all over Europe. The main difficulties are:

- *getting access to knowledge (i.e. photo reading, understand why we see what we see, interpretation, using software etc.).*
- *getting access to literature.*
- *getting access to expensive software and data.*

Regardless, after that first meeting YAARG fell silent, Jo abandoned any prospects of further archaeological education or jobs and changed course to CAD and design work in Dresden, which she enjoyed. When finances allowed it, she went flying and was

one pilot in a family of pilots all of whom preferred (and some owned) biplanes or tail draggers. Jo’s character and determination made her an essential addition to my ‘daughter’ collection and even though we met infrequently (she had two kids to look after) she leaves a hole in my life.

Reference

Dreßler, J., 2009. GIS-based analysis of aerial photography, soils and landuse. *AARGnews* 38, 18-24. <https://aargonline.com/wp/wp-content/uploads/2022/10/AARGnews38.pdf>

‘For the rectification of digital images from archaeological aerial photographs’ - a Brief Appreciation of John Haigh (1941-2025)

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Background

The routine work of archaeological mapping from aerial photographs, and other airborne remote sensing datasets, today takes place in digital environments, makes use of digital imagery, and can draw on 3D data. Without knowing the age profile of AARG membership, or that of *AARGnews* readership, it is likely that many people now active in such mapping cannot remember their working environment being much different. However, when the authors of this contribution were at university in the mid-1980s and late 1990s, the practical portfolio exercise of mapping archaeological features from oblique aerial photographs was an entirely manual process. It involved rulers, intersecting lines and estimates of where features might lie on a (paper)

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John Haigh was a mathematician at the University of Bradford and a pioneer in the field of computerised rectification and mapping from oblique aerial photographs through his AERIAL software. Here we look back at the development of AERIAL and John's invaluable contribution to the progress of aerial archaeology and mapping that we all take for granted today.

map. This could produce reasonably accurate results with practice but was slow and fraught with issues depending on how oblique an image might be and the degree of topographical variation in the landscape. While computerised methods of mapping from aerial photographs had been under development since the mid-1970s, they were not mainstream and certainly not embedded in routine workflows.

John G. B. Haigh (1941-2025) who died on 19th May 2025 at the age of 84, was a mathematician at the University of Bradford and a pioneer in the field of computerised rectification and mapping from oblique aerial photographs. His AERIAL software, which was first developed in the early 1980s, underpinned the production of accurate mapping of archaeological features from oblique photographs – a key foundation to the understanding of monument types and landscapes in many parts of the UK. Along with other such software, including Irwin Scollar's AirPhoto (Scollar, 1998), much of the aerial archaeological mapping undertaken in the UK has relied on bespoke software such as AERIAL (the title of this appreciation borrows a line from the AERIAL user manual). For the history buffs, Palmer (2000) and Scollar *et al.* (2008) summarise rectification software as

understood at the turn of the millennium and the end of the first decade of the 21st century.

What is the AERIAL software package?

By the time AERIAL 5, the last major iteration of the software, was produced, the program did more than rectified transformations of digital images to produce orthophotographs. However, its core function is rectification of oblique and vertical aerial images and the production of a georeferenced orthophotograph. For this, a 2D projective (plane-to-plane) transformation can be undertaken, and with suitable elevation data a full 3D geometric transformation, taking account of variations in surface height. Version 5.36 also includes two methods to create anaglyphs from a suitable pair of images. Over its development, changes mirrored the development of GIS-embedded workflows with an increasing emphasis on the part of most users on the production of orthorectified images for mapping in GIS. One of the keys to the success of AERIAL was the programme's user-friendly interface which opened up image rectification to users without highly technical expertise.

A brief history of AERIAL

The following draws heavily on a history written by John Haigh and last

updated by him in 2008, supplemented by our own knowledge.

The software which was to become known as AERIAL (Haigh, Kisch and Jones, 1983) was first demonstrated at an Aerial Archaeology Research Group meeting during 1981 in Cambridge. In 1982, Gordon Maxwell and Ian Parker from the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS – since 2015 part of Historic Environment Scotland) visited Bradford to enquire whether it would be possible to install such ‘computing facilities’ in their Edinburgh office. A few months later a freestanding system was installed and became an invaluable investigative tool for RCAHMS, underpinning the analysis and mapping of the burgeoning outputs from the aerial reconnaissance programme (Maxwell, 1983).

The initial versions of the program were written in BASIC for an 8-bit microcomputer connected to a digitising tablet and a pen plotter. Outlines from an aerial photograph of a nearly level site could be transcribed into map co-ordinates by means of a 4-point algorithm. Subsequent improvements to the program allowed the user to define more than four control points, from which the program determined the projective transformation of best fit and estimated the likely errors. Mapped outlines were displayed on screen and stored in a file, rather than being plotted directly, allowing the results to be assessed before they were committed to paper. Output was expressed in national co-ordinates. The software acquired the name AERIAL to identify its role in dealing with aerial photographic material, and to differentiate it from other developments in digital mapping used to process data from the extensive terrestrial surveys conducted by RCAHMS.

In 1986, RCAHMS combined with its fellow organizations in England (the Royal Commission on the Historical Monuments of England – RCHME, subsequently English Heritage and now Historic England) and Wales (the Royal Commission on the Ancient and Historical Monuments of Wales – RCAHMW) to sponsor a new version of AERIAL for IBM-compatible personal

computers, which were then becoming an accepted standard. The outcome was a definitive version, designated as AERIAL3, which became widely used in Britain (Haigh, 1989). This version was written in FORTRAN to improve its speed and convenience and worked successfully on analogue prints and plotters. It was limited by the assumption that the subject of the photograph was a flat plane, which was inappropriate for hilly landscapes where significant errors might arise without any indication from the control information. The next version, AERIAL 4 (Haigh, 1991), allowed the user to digitise up to about 200 discrete points on a contour map of the site, from which the program could construct a digital elevation model and use it to correct for variations in surface height.

With the introduction of the Microsoft Windows environment during the early 1990s, the production of a Windows version of AERIAL became imperative (Haigh, 1993; Haigh and Ipson, 1993). The digitising tablet was replaced by on-screen digitisation of control points from digital images scanned from prints or negatives and map. This allowed digital rectified images to be produced in digital format (Figure 1). The Windows version, AERIAL 5

(Haigh, 1996, 1998, 1999), first appeared in 1995 having gone through over thirty significant modifications, in response to the requirements of RCAHMS and other major users. This development was important in providing georeferenced digital image outputs, anticipating the routine adoption of GIS to combine imagery and mapping when it was still a specialist piece of software.

Subsequent developments included the ability to create elevation models from gridded data such as LiDAR, with much improved accuracy relative to contour mapping, and a module to produce anaglyphs from two suite aerial images. In many ways more important was ensuring Windows 10 compatibility. The development of the software was a side project to John Haigh’s main research focus at Bradford, funded in large part by contributions from RCAHMS and English Heritage. In recognition of this ongoing funding, Haigh passed the rights to the software to the UK Heritage Agencies, where it is still used as one of the basic tools of the trade in extracting understanding from the information on aerial photographs.

Impacts

The successes of aerial archaeology are sometimes told from the perspective of site discovery and photography. Without



Figure 1: A member of English Heritage’s Aerial Survey team using AERIAL 5, probably in the late 1990s. © Historic England.

wishing to detract from those achievements, it is probably fair to say that the fundamental underpinning of being able to map information from aerial images has been overshadowed. So, in producing this appreciation of John Haigh's contribution to aerial archaeology, we have included a very selective summary of some projects that relied heavily on mapping produced in AERIAL software, and latterly using the orthophotographs it produced.

England

From the mid-1980s, the RCHME began to develop methods for mapping extensive areas from aerial photographs (Horne, 2011). By the early 1990s, these became formalised as the National Mapping Programme (NMP) which aimed to produce aerial mapping data across large areas to a consistent set of standards. The NMP continued under the auspices of English Heritage and its methodology still underpins Historic England's large-area Aerial Investigation & Mapping projects to this day. Early projects employed manual rectification methods but digital rectification using AERIAL was soon adopted. By the late 1990s, its use was standard for all NMP projects and smaller site-based investigations (Figure 2).

The Yorkshire Wolds and Nottinghamshire: The Yorkshire Wolds project (Stoertz, 1997) ran from 1985 to 1990 and was a precursor to four pilot projects that led to the establishment of the NMP. While project mapping was hand-drawn, a bespoke digitising programme developed for the RCHME was initially used to transform images for mapping (Burnside *et al.*, 1983) but latterly an early version of AERIAL was also used (Stoertz, 1997, 11). At a similar time, the Nottinghamshire NMP project (1992-1997) also began to selectively use AERIAL 4.20 alongside manual transcription methods (Deegan, 1999, 7-8).

Northamptonshire: The first project to systematically employ digital rectification was the Northamptonshire NMP project (1994-2001). Northamptonshire County Council had been using AERIAL since the early 1980s and the

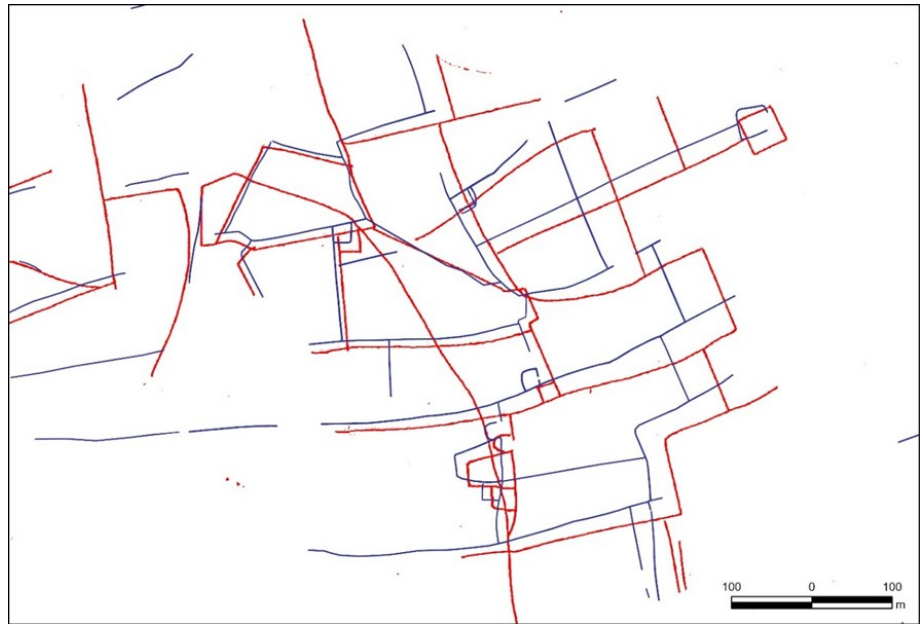


Figure 2. Comparison of the results of manual rectification (red) and digital rectification using AERIAL (blue) near Bawtry, South Yorkshire, England. © Historic England.

county was selected as one of the first NMP projects (Deegan and Foard, 2007, 3). As well as pioneering the use of AERIAL rectification as standard, Northamptonshire was also the first NMP project where mapping was carried out entirely in a digital environment, paving the way for the methods used today.

Continuing work: Around 54% of England has now been covered by large-area aerial mapping projects and Historic England continues to undertake and grant-fund this work. AERIAL has been, and continues to be, an indispensable tool that is used by all specialist practitioners working on these projects and its use is defined in Historic England's Aerial Investigation & Mapping Standards (Historic England, 2025).

The aerial mapping is a hugely valued dataset that is used to support the day-to-day work of researchers, Local Authorities and other heritage agencies in managing the historic environment (Evans, 2019, 4-9). Key to its value is the spatial accuracy afforded by AERIAL, which allows users to have confidence in using aerial mapping data in contexts ranging from archaeological mitigation and development control to defining the statutory boundaries of

nationally significant scheduled monuments.

On a more fundamental level, AERIAL has also helped to demonstrate the validity of aerial mapping as a technique amongst the suite of intrusive and non-intrusive archaeological survey methods. When compared to the results from geophysical surveys³ or archaeological excavations, AERIAL rectifications have regularly been found to be highly accurate, challenging assumptions that 'ground truthing' of aerial data is a prerequisite for aerial mapping to be trusted (Figure 3).

Scotland

Mapping from aerial photographs has supported the understanding of many aspects of Scotland's past, including the cursus monuments (Brophy, 2015) and timber monuments (Millican, 2016) of the Neolithic, later prehistoric settlement (RCAHMS, 1994, below; Cowley, 2009), the Roman period (Hanson and Maxwell, 1986; Jones, 2011), and the medieval and later landscape (Brown, 2012; RCAHMS, 1994). Much of this work has been undertaken using AERIAL software,

³ John Haigh also wrote the algorithm that the Historic England Geophysics Team use for resistivity grid matching.

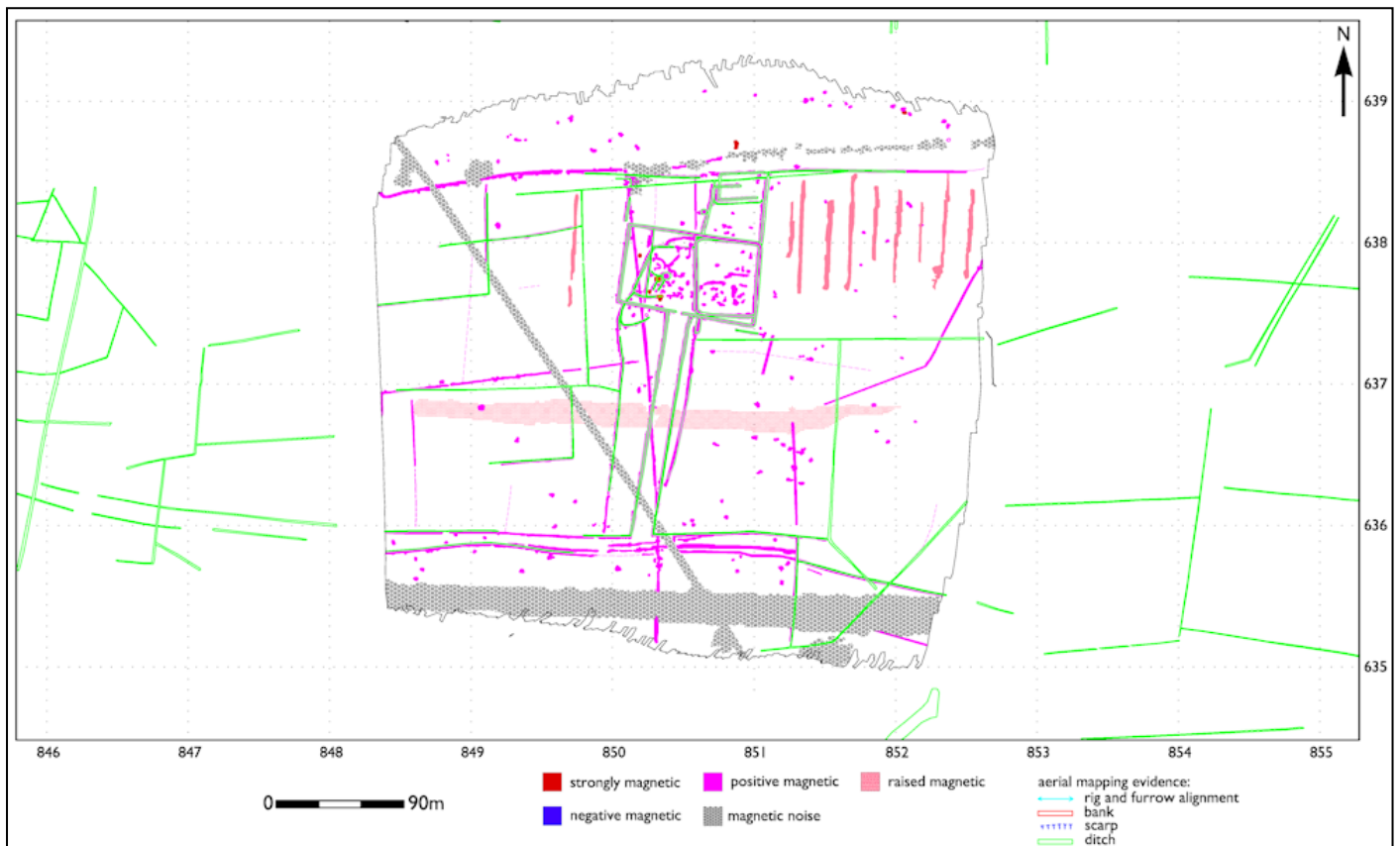


Figure 3. Comparative results of aerial mapping and geophysical survey at Little Chalfield, Wiltshire, England. As well as demonstrating the complementary nature of the techniques, the results also show a positional difference of only a few centimetres. © Historic England.

which is the primary means with which all RCAHMS/HES aerial photo-based mapping of cropmarked evidence is undertaken. With more than 9000 sites on record from cropmark information, over 5000 have been mapped at a scale of 1:2,500 using AERIAL. This information is used to create accurate site records that inform research, designation and development control.

South-East Perth: While piecemeal mapping of information from aerial photographs was part of RCAHMS' routine work since the early 1980s, the volume on South-East Perth (RCAHMS 1994) was the first substantive area-based investigation of a lowland landscape that drew heavily on aerial photography. For the sections on prehistoric ritual and funerary monuments and settlement evidence, as well as the Roman evidence, mapping is especially important. Produced during a period before AERIAL generated orthophotographs, the mapped outputs are represented by sensitive hand drawings using differing weights of

stipple to convey the character of the cropmark evidence (Figure 4).

East Lothian: The south-east of Scotland has long been a highly productive area for cropmark evidence, the cumulative products of which stimulated Colin Haselgrove's

Traprain Law Environs Project (Haselgrove, 2009) in East Lothian. This project investigated later prehistoric settlement through selective excavation and wider studies of the cropmark record (Cowley, 2009; Cowley *et al.*, 2009). The latter

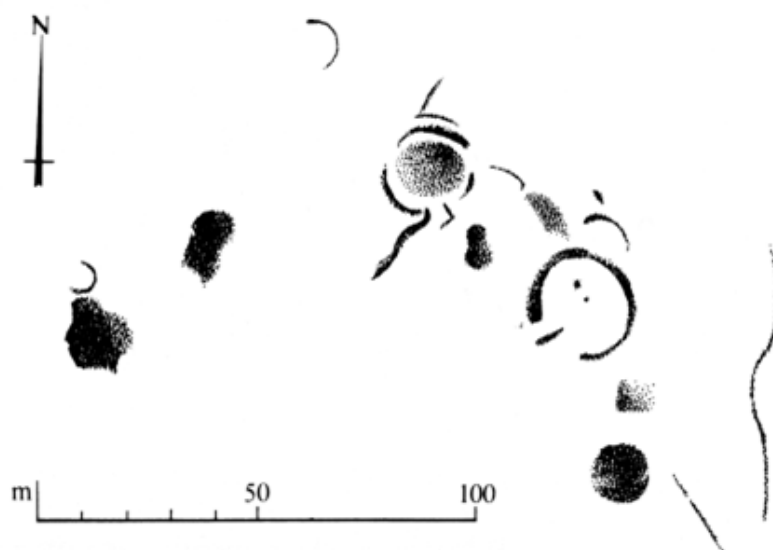


Figure 4: A hand drawn representation of a later prehistoric settlement complex in south-east Perthshire, based on outputs from AERIAL software. Extract from SC2213691, © HES.

provided an opportunity to pull together aspects of the later prehistoric settlement patterns, such as the later Iron Age rectilinear settlements (Figure 5) in a systematic manner for the first time. More recently, the mapped evidence from East Lothian supported an analysis of the later prehistoric demography of the area – a project that moved a long way from the nuts and bolts of rectification of oblique images, but still it all started with the mapping.

Mapping Matters

John Haigh made a valuable contribution to the progress of aerial archaeology and mapping, developing software that has supported significant advances in our understanding of the past. John was far-sighted in his work, and in conversation on more than a few occasions he expressed a slight exasperation in the slowness of GIS uptake by the heritage agencies, for example. In this, he could see clearly how the AERIAL software was an element in an interpretative mapping workflow. And in a context where the achievements of aerial archaeology are often expressed by the aerial photographers, John Haigh was a pioneer of a world of digital mapping that we all take for granted today.

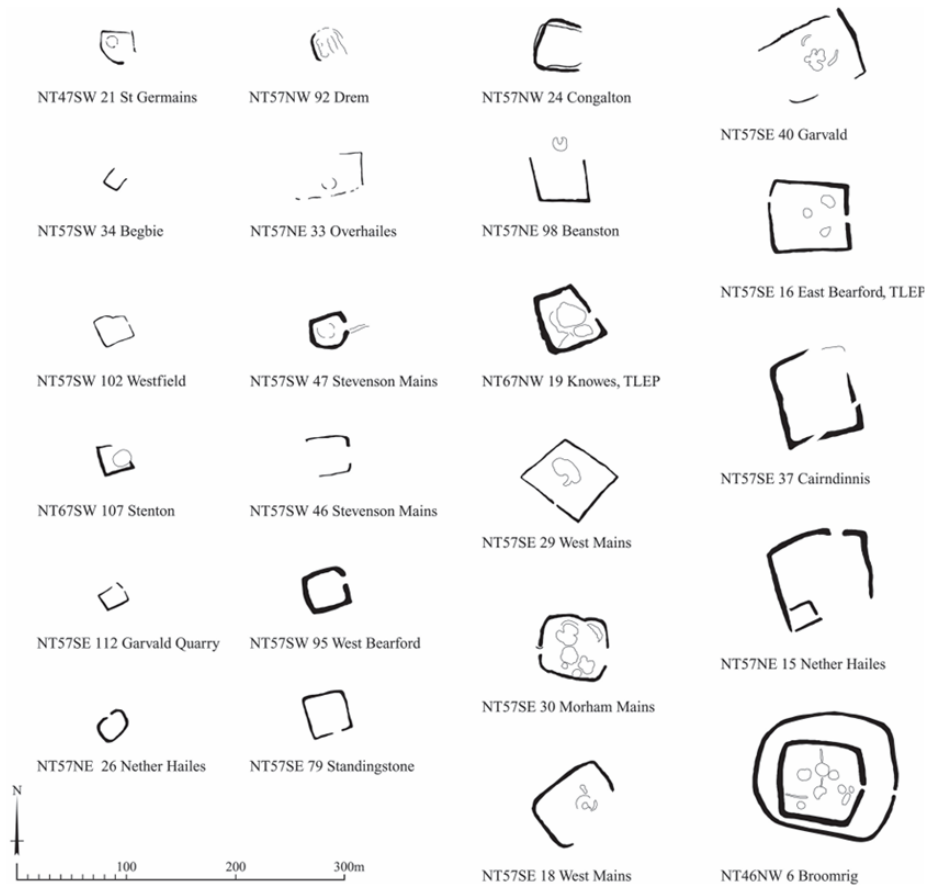


Figure 5: Comparative plans of settlements such as these in East Lothian, Scotland, support analysis of broader patterning, including modelling scenarios for ancient demography. GV004485 © HES.

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Where Now the Horse and the Rider? Some Thoughts on the ICAP 2025 Meeting in Ghent

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The author presents a report on the 16th International Conference on Archaeological Prospection (ICAP 2025) that took place in Ghent, Belgium, in September 2025. He provides some thoughts on the subject of archaeological prospection and the value to AARG of attending ICAP meetings.

Introduction

During our last meeting in Trondheim, I was kindly approached by the illustrious and honourable members of our committee with a request: would I be willing to write a report on the International Conference on Archaeological Prospection (ICAP) meeting I was planning to attend? This was not, I should clarify, because I was the most qualified nor the most eloquent. It seems I was simply the only AARG member going to ICAP that year ... and when there is only one candidate, there is only one choice. Quality, as you can imagine, was not the decisive factor. So, here I am.

Back to the topic at hand, the 16th International Conference on Archaeological Prospection (ICAP 2025) took place in Ghent, Belgium, from September 15th to 20th, 2025. As usual, it brought together a large group of researchers and practitioners from around the world who work in geophysics, remote sensing, and archaeology.

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It goes without saying that the biennial ICAP meetings are one of, if not the, best places to be if one wants to partake in non-invasive archaeology. You can see high-quality research first-hand and also mingle directly with people who have a strong influence on the discipline itself. It is also a good opportunity to explore new avenues of collaboration with some of the best experts around. The atmosphere is always open and inviting.

The conference, held at Ghent University on behalf of the International Society for Archaeological Prospection (ISAP), had quite a packed schedule. There were four days of oral sessions, a large poster exhibition, a hands-on pre-conference workshop on open-source data processing tools and a field trip to the Zwin estuary. The poster session was a highlight for me. There were, I believe, around 100 posters and the atmosphere was very open and relaxed, no doubt helped along by the refreshments provided by the organisers.

So, what's the takeaway from ICAP 2025 in Ghent? Smooth progress or a field at a turning point? Let's 'dig' in...

Ubi sunt...

Most presentations were focused on multimethod prospection, data processing, palaeo-landscape

reconstruction, geochemistry and technical innovation. The feeling I had was that the discipline is entering a phase of consolidation and re-evaluation. There are now decades of collective experience to build upon and that is paired with technological advancements that continue to push the discipline forward with tons of new case studies and data. The sessions clearly showed that technical skills and hardware expertise have generally grown across the field, especially with the increasing availability of new equipment.

There is a growing agreement about how things should be done technically speaking. These ideas are centred on the three "Ss": sensitivity, speed and sampling. Archaeological prospection definitely shows a high level of technical maturity and know-how in this regard. Also, there is a shared sense of where further technical development should head (funnily enough from an AARG perspective it's drones!). My first ICAP meeting was in Vienna in 2013, and many of the ideas presented then as groundbreaking can now be seen as standard practice and are widely accepted within the community. The technological progress in the meantime can be seen with the naked eye and the expectations that improvements in sensitivity, speed and sampling would produce higher-quality data have been clearly confirmed empirically across the board during the last 10 years or so.

One of the strongest thematic threads in the past few years and at ICAP 2025 was the growing interest in coastal, marine and palaeo-landscape research such as in the work presented by Arne Anderson Stamnes and Søren Munch Kristiansen. Their *PastCoast* project showed how large-scale GPR surveys can provide detailed information on beach-ridge systems and changing shorelines. By surveying Iron Age coastal sites, they presented how GPR can trace palaeo-beach ridges with enviable clarity (the animations of the time-slices were truly mesmerizing, almost like an LSD trip). As an example, they identified 29 individual beach ridges within just a few metres of elevation. A significant case study showing how geophysical work can move easily from geomorphology into archaeology and *vice versa*. Another captivating perspective continued with Vincent Gaffney's contribution *Into the "Empty Quarter": Tentative Steps Towards the Peopling of Doggerland*. The study of the Doggerland landscape has shifted from a marginalised and 'impossible' topic to a new frontier of archaeological research, clearly pushing boundaries with the help of high-resolution marine data.

Large-scale prospection appeared in a terrestrial form, amongst many others, in the presentation by Peter Milo and colleagues on the early medieval settlement of Pliska, the first European capital of the Bulgarian Khans. Although I have seen a fair share of large-scale datasets, the sheer volume of this project was impressive to say the least. Over the past five years the team has surveyed 18.42km², effectively covering the entire Outer City. They applied pushcart surveys to later switch to motorised systems (even using two systems at the same time) in effect giving a daily coverage of close to 80 hectares. Their results revealed more than 51,000 archaeological features, going from pits and sunken dwellings to fortification systems. This allowed them to draw a completely new understanding of Pliska as an organised urban landscape, complete with major north-south and east-west streets, fenced compounds and multi-phase settlement zones. According to the authors, this



Ghent was an amazing setting for an archaeological prospection conference as a city full of great opportunities for a GPR survey.

research now holds the title of the largest magnetic survey ever completed for archaeological purposes. I wonder for how long will they keep this record? The interpretative map they produced (the result of 229 days of work) shows what is an early medieval city with a layout pattern straight from the steppes of Asia!

One of the presentations that made the greatest impact on me was Eileen Ernenwein's talk, *Retraction and Reflection: The Gunung Padang Controversy and the Challenges of Peer Review in Archaeological Prospection*. It was good to finally see someone address the issue openly and directly. Perhaps my views are biased due to the fact that one of my own submissions to *Archaeological Prospection* was rejected within two hours, with the unexpected explanation that it was "too good for a short report". I admit I remain confused in a bitter sort of way, even though I finally took the rejection letter off my dartboard months ago. In that light, the Gunung Padang affair has left a much deeper and more permanent bad taste in my mouth because it points not only to a single unfortunate incident but to really, really serious and worrying underlying symptom of structural problems in the ENTIRE system. In my mind, this is a clear sign of American corporate culture permeating into academia, a match

NOT made in heaven, an abomination. Ernenwein's presentation confronted these issues by starting with describing the failure of peer review in that case, the ease with which pseudoarchaeological narratives can exploit the ambiguity of non-invasive data and, what is most despicable, the pressures placed on editors and reviewers in a greed-driven publishing environment where all that matters are billions of dollars in revenue. The fact that many journals charge substantial open access publication fees, while relying on unpaid reviewers and editors whose labour is voluntary, is a scandalous abuse of an old academic tradition to say the least. Even more surreal is the recent decision by several large publishers to license academic work (produced at great personal as well as public cost) to companies training commercial LLMs. Truly, we are living in a remarkable age.

Another talk of note from my perspective was Héctor Orengo's keynote talk. It dealt with AI in archaeological prospection but unlike many talks on the subject in recent years, this one actually reflected on why and how we should adapt AI techniques. Archaeological data is messy, nuanced and often ambiguous, which makes it very different from the neatly labelled datasets most AI models are trained on. Seeing someone acknowledge that was a nice change. According to Orengo, the challenge is making sense of the data, not acquiring it. His point was that AI

can help but only if grounded in archaeological thinking rather than treated as a magical shortcut. One of the few AI-related talks I've heard that took the discipline seriously instead of just the technology.

Lastly, the final session was closed with a wonderful *in memoriam*, delivered by Immo Trinks, honouring the life and work of Manuel Gabler, who tragically and suddenly passed away in August 2024. Manuel had a profound impact on the discipline. He was known for working on archaeological sites from Austria to Sweden and Norway, and he was one of the pioneers of implementing large-scale approaches to geophysical prospection. It was a moving tribute to a colleague whose influence on the field will not be forgotten.

If anyone is interested in getting into the deep end of it, then all the abstracts are available for free and published in the *ArcheoSciences* journal (2025/1, no. 49-1) on the Cairn.info website: <https://shs.cairn.info/revue-archeosciences-2025-1?lang=en>.

Reflections on archaeological prospection

As usual, the conference also left me with a few broader questions and reflections on where archaeological prospection stands today. Although I may be completely wrong on that, I have the feeling that some important issues would benefit from more attention. First of all, for a group centred around archaeological prospection, there is surprisingly little discussion about what the term actually means and how it is understood by professionals across Europe and beyond.

There was once a short debate on the ISAP mailing list and from the people who spoke up it was clear that by prospection it is understood by them specifically to mean non-invasive prospection. Yet if you zoom out and take a broader view of how prospection (simply put meaning the discovery of sites) is actually carried out in many European countries, then you might find it ironic that it is mostly done by topsoil removal or test trenching, not by geophysics or aerial photography (e.g., France, Sweden). Czech researchers in



Conferences are not only about the science... they are also a great chance to broaden your perspective on other cultures. And in Belgium, that apparently includes learning to appreciate Kwak beer. When in Rome ...

my favourite publication *Nedestruktivní Archeologie* proposed thinking of archaeological prospection as a spectrum of methods, from non-invasive to partially invasive to fully invasive, combined and applied in the right order. I tend to agree with that approach.

It is also ironic that most archaeology in the world (perhaps up to 90%, if I had to guess) is done in the commercial/rescue/salvage sector rather than the academic one and yet that group is usually poorly represented at archaeological meetings of any kind. This is part of the wider problem of being stuck in one's own bubble and I would reckon that input from that group would be a key missing piece of the puzzle. Maybe they could explain why, from my now almost twenty years of practice, geophysical prospection often feels like starring in *Groundhog Day*. I find myself constantly wondering why I am always explaining: "No, that's not how it works. It's not an X-ray, okay? No, it can't find swords. No, I can't set the radar to 11. No, no, no." Some people find this annoying because in an era of

wishful thinking, many do not want to hear facts about how science actually works and just expect results by I don't know... manifesting them?

Interpretation is another area that seems to be poorly represented and perhaps one of the main problems in non-invasive archaeological prospection. A lot of effort has gone into creating guidelines, and I fully support that. I have to give credit to the English Heritage guidelines, which I happily indulged in at the beginning of my career as they were basically the only freely available, accurate and credible source of information on geophysical prospection and many related topics like surveying.

But guidelines only work if someone actually reads them... and understands them. And even then, they rarely address interpretation, which in my observation is often treated by some practitioners as an exercise in cold reading and again wishful thinking. Interpretation is supposed to be part of a collaborative and integrative procedure that takes time and effort. Lack of appreciation for the needs of creating a good data-driven interpretation leads many to dismiss geophysics entirely.

Speaking about procedures, it would be good to discuss the role of non-invasive prospection within the broader process of archaeological research. After observing the reality of rescue archaeology (an area where non-invasive methods could help profoundly), I must admit that it often feels just a missed opportunity to carry out geophysics only over a site that will be excavated anyway. That is simply not where the method excels. Its real value lies earlier, when we are trying to determine whether areas are (in a rescue project scenario) worthy of rescuing by excavating in the first place. Another recurring issue is that survey results are sometimes printed and handed to excavators with no annotation whatsoever. The diggers then receive a greyscale map full of indistinct blobs that mean nothing to them, become frustrated and direct their anger at the method itself (and at me but I'm innocent I always do annotations!). And so, the cycle repeats. And I keep ripping hair from my head in frustration.

Thoughts for AARG

I was asked to articulate what ICAP could imply for AARG, however I feel obliged to warn everyone that articulate is a strong word for what follows. From a personal perspective, I've always valued attending both meetings. Coming from an academic tradition that tended to dismiss, ignore, or outright mock anything outside the "traditional" approach, where anyone not obsessed with inscriptions or fibulas was treated as a bit of a freak. It was cleansing to find myself among people who actually knew and valued different approaches.

But I must admit that some of the doubts and questions I hoped would finally be addressed... are rarely addressed. And that leaves an itch I can't quite scratch. So much is changing in Europe that archaeology is facing a level of endangerment we haven't seen since... the industrial revolution? From my perspective, the single most important mission we have as archaeologists is to save sites, monuments and artefacts from eternal oblivion. You cannot protect or rescue something if you don't even know it exists. It's that simple. And this is precisely where non-invasive prospection plays a critical role. Yet implementing it on a Europe-wide scale remains a mess, full of confusion, inconsistent regulations, lack of common understanding and coherence within the discipline itself. Unfortunately, my brain is too small to wrap itself around the full complexity of the problem.

Then there is the matter of gatekeeping, with all its positive and negative sides. Times have changed. Aerial archaeology used to be a fairly small club, simply because access to planes and cameras was expensive and limited. The same was the case in geophysics with equipment that used to be expensive and hard to handle being now far more accessible. Anyone who went through the challenge of trying to download data from a logger manufactured in the 1980s or 1990s knows what I'm talking about. So, for a long time, organisations like AARG or ISAP were the places you had to go if you wanted to learn to do things

properly. Now people can buy a drone, look at Google Earth, or get a budget GPR and just go out and do as they please. Nothing can stop them. And this is both good and bad. However, maybe some gatekeeping would be sensible?

I feel that both groups are understandably looking for new avenues of growth in these new realities. Which road should we be taking? Should we become a lobby group, pressuring people to use the technology correctly? Focus on organizing conferences? Should we focus on education? Coordinate volunteer groups? Social media promotion? Or should we keep a strictly scientific profile and remain networks primarily for researchers? I truly don't know.

What I unwaveringly believe is that AARG and ISAP do have an important role to play. I'm seeing more and more sites being destroyed or overbuilt, often rescued only at the last possible moment thanks to non-invasive surveys. And I keep wondering how many were missed because someone deemed (based on what data?) that only a single method was to be used like topsoil stripping or field walking instead of combining techniques.

On a related, more down-to-earth note, it needs to be said that the ICAP conference in Ghent had easily over 150 submissions. This only shows there is a definite niche to fill and demand for such events exists. There are some non-invasive sessions at EAA, LAC, rarely at the CAA and apart from those, no one else really caters to such a topic.

Summing things up

The title of this short review borrows from the Old English *ubi sunt* literary tradition adapted amongst others in Tolkien's *Lament for the Rohirrim*.² It asks what becomes of things once thought to be unchangeable. To me, this seems very fitting for the era that has come upon us suddenly with all

the strangeness of a 1960s pulp sci-fi novel.

The excitement of technological advance remains within the field of archaeological prospection but perhaps it should no longer be the lone driving force. Instead, prospection would profit now to confront fundamental questions and qualitative challenges e.g., how do we interpret with care? How do we integrate with other disciplines? How do we ensure that our increasingly powerful tools serve archaeological understanding rather than overshadow it? It's not as though this isn't happening; it's just that maybe more thought should be put into shifting the general focus from acquisition to interpretation, from hardware to understanding. It is ARCHAEOLOGICAL prospection after all, not SENSORS & ANTENNAS.

Some more food for thought is that what journalists refer to as the "silver tsunami" is also upon archaeology. Kris Lockyear's talk on *Twelve Years of Community Geophysics* showed how many community groups are closing simply because their members are ageing and no younger replacements are in sight, whether due to lack of resources or interest. This is worrying. Archaeology survives only because society believes heritage is a value worth protecting, yet the world is changing rapidly, and more and more people are questioning whether protecting 'shoddy old monuments' is necessary at all (to paraphrase: *where now the trenches and the trowels?*).

Finally, I would like to say that the organisation of the event was impeccable. My sincere thanks go to everyone involved in making ICAP 2025 happen. Organising a conference of this scale is never easy, yet everything ran smoothly. With this optimistic note, I would like to end by wishing all the best to the organisers of the next ICAP meeting, which will take place in 2027 in Brno, Czechia. You knew exactly what you were getting into and yet you still agreed to do it. Good luck!

² See: https://tolkiengateway.net/wiki/Lament_for_the_Rohirrim (Ed).

TRAIL 2025 – Airborne Laser Scanning for Archaeology in Farmed Landscapes

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Introduction

Thanks to the generous scholarship provided by the organisers of TRAIL 2025, which covered the participation fees, travel costs and a one-year AARG membership, we were able to attend the

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The authors received support from the AARG Fund to attend the 2025 TRAIL meeting in Slovenia, where they participated in a collaborative and informative workshop. The event brought together archaeologists, students, and professionals to learn about processing, analyzing and interpreting Airborne Laser Scan (LiDAR) data. Training included using QGIS plug-ins for automated feature detection in open, farmed landscapes complementing traditional woodland surveys.

event in Postojna this year. We would like to express our sincere thanks to those responsible for this wonderful opportunity. We would now like to share our experience.

The sixth TRAIL Meeting⁵, dedicated to the applications of Airborne Laser Scanning (ALS) in archaeology, took place from 28th to 30th October 2025 in Postojna (Slovenia) and highlighted a theme that has received relatively little attention compared to wooded environments, namely the potential of lidar in landscapes heavily reshaped by agricultural practices.

The meeting took place in a particularly stimulating atmosphere and brought together researchers, PhD students, and professionals in archaeology and heritage management. The participants had a broad range of experience, from new users just beginning to work with LiDAR data to more experienced practitioners wishing to improve their knowledge. The presence of fifty participants, including several leading specialists in archaeological remote sensing, encouraged rich and fruitful exchanges. The friendly and collaborative atmosphere was also strengthened by informal sessions,

⁵ Training and Research in the Archaeological Interpretation of Lidar (<https://trail.zrc-sazu.si/>)

which supported discussion beyond the official programme and reinforced friendship among the participants. These three days thus provided an excellent opportunity to explore the processing, analysis, and interpretation of LiDAR data.

The TRAIL meeting followed a two-part structure. The opening day was dedicated to an introductory workshop, along with keynote presentations and lectures delivered by invited specialists, interspersed with a poster session that allowed participants to present their own research. The subsequent two days were devoted to practical workshop sessions and were complemented by a field-trip afternoon, which offered a refreshing break and a welcome opportunity to step away from the computer screen.

The training part

The four workshops enabled participants to acquire knowledge and skills related to several key stages of the LiDAR data-processing workflow, from data acquisition to archaeological interpretation.

Regarding the acquisition of raw data, part of the workshop “Archaeological ground point filtering of lidar point clouds”, presented by Michael Doneus, Hannah Weiser and Zoran Čučković, was devoted to the planning of acquisition missions using the HELIOS++ software (Winiwarter *et*

al., 2022). HELIOS++ is an open-source laser-scanning simulation (VLS) software designed for all types of platforms (terrestrial static or mobile, UAV-based, or airborne laser scanning). Developed in C++, it remains easy to use thanks to a graphical interface accessible through a Jupyter Notebook. The purpose of acquisition simulation is to obtain data that are optimally suited to a specific research question. HELIOS++ therefore makes it possible to generate 3D point clouds using different acquisition platforms and scanning parameters, such as flight altitude or maximum scan angle, and to assess whether a planned acquisition meets our specific expectations and requirements. HELIOS++ also makes it possible to generate 3D point clouds by creating and testing multiple scenarios using different acquisition platforms and scanning parameters, such as flight altitude or maximum scan angle, and to assess whether a planned acquisition and all its parameters meet our specific expectations and requirements.

Two workshops were dedicated to point cloud processing and to the crucial step, particularly in archaeological applications, of ground point classification. The first, “*Processing UAS LiDAR data*”, presented by Jitte Waagen, Luka Škerjanec, Elise Fovet and João Fonte, introduced us to the different classification strategies applied to ALS data as well as to high-resolution point clouds acquired by UAVs, and in particular to their management, as their large size can pose challenges for data processing. The classification was carried out using [LAsTools](#), a toolkit that combines open-source and closed-source components, with some tools fully free to use and others available free of charge but with usage limitations. As part of TRAIL 2025, a four-week licence was provided to all participants. Important explanations were provided on the influence of certain parameters, such as step, spike, and offset. Some of the data-handling options offered by the free and open-source software [CloudCompare](#) were also tested.

The second workshop “*Archaeological ground point filtering of LiDAR point clouds*” introduced us to another approach to ground point filtering:

adaptive classification based on spatial segments. Particularly well suited to heterogeneous landscapes with varied topography and vegetation, adaptive classification makes it possible to create filtering workflows in which each algorithm and its parameters are adapted to a specific terrain type (or spatial segment) within a dataset, for example, using one filtering setup for densely vegetated areas and another for open areas. This classification approach is carried out using AFwizard (Adaptive Filtering Wizard), an open-source Python package (Doneus *et al.*, 2022). Thanks to its graphical interface accessible through a Jupyter Notebook, AFwizard allows the user to quickly test and directly visualise the effects of different algorithm and parameter combinations on the various terrain types within a dataset and thus identify the filter tunings best suited to each area.

Finally, two workshops were dedicated to the archaeological interpretation of the data. In the first one, entitled “*Gentle introduction to the archaeological interpretation of airborne LiDAR-derived data*” and presented by Rebecca Bennett and Luka Škerjanec, we explored the processes of identifying and interpreting potential archaeological features from LiDAR-derived data. The workshop was also an opportunity to present the *EAC Guidelines for the Use of Airborne Laser Scanning (Lidar) in Archaeology* (Bennett *et al.*, 2025), which provides guidance for all phases and topics related to the integration of ALS into archaeological and cultural heritage projects. Using the book as a guide, we then delved into the interpretation process, focusing in particular on two key aspects of this work. First, the need to take into consideration past and contemporary landscape processes that may have influenced the appearance of archaeological features, such as ploughing or erosion, as well as the need to be careful with natural and modern anthropogenic features that may look like archaeological

features. Second, and linked to the first point, the importance of integrating various types of data, such as modern and historic aerial photographs and maps, or existing heritage records, in order to verify, correct, complete and enrich our interpretation. The workshop concluded with a practical interpretation exercise based on several case studies.

As part of the interpretation of lidar data, the second workshop, entitled “*Automatic Detection of Archaeological Features (ADAF)*” and presented by Žiga Kokalj, Nejc Čož and Jürgen Landauer, focused on the use of artificial intelligence and machine learning for the automatic recognition of archaeological features. After a short introduction to deep learning in archaeology, we tried the ADAF (Čož *et al.*, 2025) software, which is an open-source tool accessible through Jupyter Notebooks, and went through the process of automatic detection. Thanks to the user-friendly interface in the Jupyter Notebooks, the software and the workflow are very accessible. During the workshop, we used the implemented model, which is currently optimised to detect three classes of archaeological features: barrows, enclosures and ringforts. There is also a notebook allowing users to train new models and personalise feature detection for their own data or research questions. In addition, the detection results are provided as vector data and can therefore be easily visualised and analysed in a GIS environment such as QGIS. To conclude this workshop, we also tried [LandTalk.AI](#), developed by Jürgen Landauer, which is a QGIS plugin dedicated to detection and interpretation based on image analysis carried out with AI models such as Gemini or GPT. With one click, you obtain your results as a map layer, along with a confidence percentage and explanations about the identification.

While all the workshops provided participants with a solid foundation in LiDAR data processing and analysis, one of the (many) strengths of TRAIL and its workshops is that all the software presented is free and/or open source. This makes it easy to quickly envision applying the newly acquired skills to our own research projects or datasets.

Informal Events

In addition to the extensive professional programme at the TRAIL 2025 workshop, participants had an excellent opportunity for networking, facilitated by several informal events.

The first of these took place on Tuesday evening when, thanks to Žiga Kokalj, we were introduced to Slovenia's wine regions. Žiga presented three regions, with a detailed focus on his personal favorite: Primorska, located in the southwestern part of the country. Naturally, as the fine wines flowed, the presentation became increasingly relaxed between tastings — which is no surprise, as our dedicated expert showcased around eight different selections! The wines proved truly delicious and the participants visibly started to enjoy themselves. The most dedicated attendees even decided to revisit the poster section, as professional conversations often become truly passionate and memorable after a glass or two of good wine.

On Wednesday, 29th October, we could choose between two field trips: visiting the nearby Postojna Cave or the

Šilentabor Hillfort. A group of about 15 people chose to visit the Postojna Cave. This cave system is one of the main attractions of Slovenia's natural tourism, being known as one of Europe's largest and most visited karst cave systems. Žiga Kokalj, who guided us there, claimed to be visiting the cave for at least the tenth time, yet he still hasn't tired of the place's magic. The tour began with a ride on the unique double-track cave railway, which transported us deep into the 24km-long system, where sights like the massive Concert Hall and the rare Olm (human fish) greeted us. Indeed, we had a truly stunning and unique experience

On Wednesday, our final night in Postojna, we continued the years-long tradition of an international potluck dinner at TRAIL workshops. This was truly one of the most memorable moments of the event, as participants arriving from many European countries all brought food and drinks from their home countries. Delicious cuts, cheeses, spreads, and sweets from countries including Italy, Germany, Slovakia, and of course,

Slovenia, offered their best contributions to this beautiful evening. Alongside the good food, the company naturally consumed hearty amounts of excellent beers, wines and spirits sourced from the aforementioned regions. The friendly atmosphere and the blending of cultures during the shared meal provided a perfect conclusion to the workshop.

Conclusion

Overall, we found our time in Postojna hugely enriching and inspiring for our own projects. We would like to thank the organising team for making the bursary possible. We hope to build on the knowledge we gained and participate in similar events in future.

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ALS Development and the Quest for a Single Image: Reflections Inspired by the TRAIL Workshop

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Supported by a bursary from the AARG Fund to attend the 2025 TRAIL Workshop held in Postojna (Slovenia), the author discusses the impact of Artificial Intelligence on feature detection on LiDAR images, the challenges of maintaining consistency and quality amid technological change, and the need for stable visual reference images. The importance of interpretation in turning technical advances into meaningful archaeological stories is emphasised.

LiDAR guidelines as an island of stability within the fast-moving flow of technological change?

It is intriguing that in 2025, alongside the TRAIL workshop, the *Guidelines for the Use of Airborne Laser Scanning (LiDAR) in Archaeology* (Bennett and Cowley, 2025) were also published. Both initiatives address the use of ALS data, which makes them suitable for comparison.

But does it make sense to compare a book with a workshop? I believe this is an important question. The *Guidelines* provide a comprehensive, long-term framework: a broad synthesis of accumulated experience, structured into a universal workflow and applicable across diverse contexts of LiDAR use. In contrast, the TRAIL workshop concentrated on the latest trends and emerging possibilities, aiming to generate results in the near future.

Will Artificial Intelligence (AI) - the central focus of TRAIL - become the true game-changer in ALS feature detection and interpretation? And which

parts of the optimal ALS workflow, as described in the *Guidelines*, are likely to be most radically transformed?

How distant is a future? Should we move forward with AI now, or should we wait and see how the situation develops?

Technological change is accelerating, and this raises an important question for our practice. In archaeological monument care, the issue is particularly delicate. At the National Heritage Institute, for example, we must document archaeological monuments - interpreted features in this case. Interpretation is closely tied to detection capabilities, visualization methods, and the time invested. And here lies the problem.

It is valuable to have powerful techniques, but not when consistency is required. Homogeneity is essential when building state lists. The same challenge applies to data quality. National grids provide universal coverage, but often at the cost of archaeological precision. In smaller areas, we sometimes use higher-quality data, more finely tuned to our interests - if resources allow. Yet this creates a dual system: broad but compromised national data and localised but superior datasets. Both are useful, but they must be

combined, which is a complex and ongoing task.

In practice, this becomes a never-ending process. Balancing innovation with stability, precision with coverage, and efficiency with homogeneity is the central challenge. AI may offer breakthroughs in detection and interpretation, but the question remains: how do we integrate such disruptive tools without undermining the consistency required for long-term heritage records?

Archaeology as a porn: we need pictures to say what is important.

LiDAR offers many forms of visualisation, but only a few are truly effective and efficient. Each technique emphasises different archaeological features, which can create inconsistencies. Workflows have been developed to reduce this problem: blended images can combine multiple visualisations to mitigate differences and produce more balanced, repeatable results, while locally adaptive workflows can adjust to diverse geographical conditions. From a technological perspective, then, achieving one "optimal" image is not an insurmountable challenge. But does it make sense to pursue such a definitive visualisation?

The idea of a single, authoritative image is compelling, especially in light of future technological advances. If we

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can produce a visualisation that is unlikely to be radically altered by newer methods in the near term, we gain something stable - an image that can be shared, archived, and integrated into more persistent evidence systems. Yet the decision is not simple.

This line of thought points toward the concept of a global catalogue: a visual representation of universal heritage. An international gallery of exemplary LiDAR images could make archaeological features more accessible to non-specialists and demonstrate that much of European - and indeed global - history shares common roots. The path toward such a catalogue, however, is far from straightforward. It requires balancing technological innovation with the need for stability, accessibility and shared meaning.

Down a rabbit hole: we can see a lot, but perhaps we need to see less.

A broad overview of ALS applications - poster sessions once offered a good example - presents a dazzling array of techniques and visualizations. Yet this abundance can complicate the search for simple, consistent solutions. It is easy to spend a substantial part of one's scientific career immersed in visually impressive and intellectually fascinating topics. The difficulty arises when we must produce comparable results over longer periods. Academic research and monument care often diverge here,

especially when selection is required: what exactly should we be searching for and at which stage of technological development should we make decisive choices?

The answer likely lies in the input question. If we know what we are searching for, we can judge when our techniques are sufficiently advanced to visualise the features we seek. Both the *Guidelines* and the main trends discussed within TRAIL share this common goal. They are part of a repeatable process aimed at improving detection and expanding coverage across an ever-broader spectrum of archaeological features. They must function this way; otherwise, they fail to serve their purpose.

The real challenge lies in human-based detection. It depends heavily on skill and experience and, therefore, does not evolve as rapidly as machine learning. Technology continues its natural transformation, but human interpretation remains more binary: we need the moment when someone can confidently say, "There is something here."

Don't forget to be interpretative. When should archaeology become the storyteller?

The detected ALS features have spatial and documentation contexts, but they also carry an inner context - the lives of the people who built and used them. We should strive to restore

this context even though interpretation can sometimes be misleading, especially in monument care and presentation. What does this mean in practice?

Interpretation becomes a kind of fossilisation step within the ongoing flow of technological progress. It is necessary if we want to add functional meaning, closely tied to archaeological value, and essential for disseminating results to a broader public. Each ALS visualisation is only one possible model of the current "surface reality." Interpretation is always a reduction: we must omit alternatives. The central question is not how to interpret, but when - particularly in relation to previous ideas and accumulated knowledge.

The challenge of producing a "definitive picture" of features or anomalies is closely linked to confidence levels. We need to establish thresholds - at least for some sites - when we can say, we know enough now to add them to a form of "world evidence."

Stable images have an additional advantage: they provide a baseline against which future technological developments can be measured. If new methods redraw them, the progress becomes visible and demonstrable.

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Have We Wrapped Up the Ukraine Working Group?

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I've explained the beginning before. Putin annoyed me when he invaded Ukraine early in 2022. Was there anything I could do to help Ukraine, to show support, even if only symbolically? At the time, AARG's Sentinel 2 (S2) and Photo Reading groups were active so, after checking soil maps, I added an S2 tile to that project and began to look around the country using Google Earth (GE) and include any puzzle pics into Photo Reading evenings. On the basis of that plus a bit of reading around the internet and chats with Chris Cox, Darja Grosman and Martin Fowler, I proposed the idea of a Ukraine Working Group (WG) to AARG. That was accepted in April 2022 after which I put the idea to members of the Photo Reading WG and began attempts to find Ukrainian archaeologists who may be interested in using aerial images. [AARGnews 64](#) included the first note about the Ukraine WG and the following issue carried four longer contributions arising from that project. There was also a Ukraine session in AARG 2022.²

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Here follows an informal summary, more or less from memory, of AARG's Ukraine Working Group. It omits the three(ish) years of blood, sweat and beers spent sticking pins into Google Earth and notes some of the contributions published in AARGnews along the way. Because those pieces included archaeological illustrations, those reproduced here are some photo reading examples to offer general puzzles that many of us enjoy thinking about.

The WG seemed to get off to a good start, but did it have much direction or ambition? Not really. Other than sticking pins into sites in GE, I had no real plan. We kept to the S2 tile because it had a range of soils and, to find out how to proceed, volunteers from the Photo Reading group searched through two adjacent 10 x 10km squares – our basic working unit – and noted (using pins and polygons) what they identified. The result gave us an idea of the archaeological sites we might expect and guided us towards an effective method to pin sites in GE.

Meanwhile, Darja and I read and discussed everything we could find to add substance to the image information. Our initial aim was to work through the S2 tile area – 110 x 110km – to which the first Ukrainian archaeologists we contacted persuaded us to add another 10 x 110km strip, after which they no longer contributed to the project. Others of the Photo Reading group began to realise how much work was involved and (reluctantly?) some dropped out leaving us with a core of three 'workers' along with Darja in an academic capacity. Meanwhile, we had found a Ukrainian archaeologist, Alex Kariaka, who had used and published satellite images to study a local

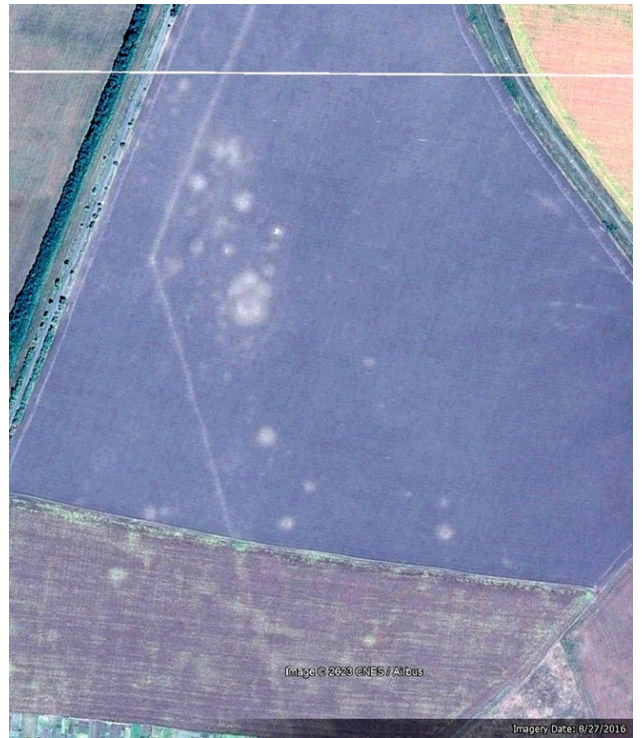
landscape (translated into English for [AARGnews 65](#)).

The project was given shape as well as a useable end product by Martin Fowler who, in his word, 'tamed' the people and the project by developing a way of getting our GE pins and their data into a database that would allow visualisation in GIS. Martin described his FROGLET workflow in [AARGnews 65](#) and needs to be acknowledged as the person who enabled the project to reach a useful end product. Of which more below. Martin also searched USGS for a suitable series of HEXAGON satellite photos, identified a series taken on one clear date in 1982 and applied to the AARG Fund to pay for them. A session in Photo Reading about geolocation started the process of matching HEXAGON to GE and we soon had a complete set of reasonably located sub-images.

Meanwhile, Valerie Ward and I were left to identify and pin sites in GE and to check one another's pinning and to get more familiar with types of sites in our area. Valerie also did a lot of research on Trypillia sites – the well-known 'megsites' and smaller variants – and consolidated the published lists of these from several sources. At the same time, using image sources, Valerie was able to accurately locate some that had been misplaced (see [AARGnews 66](#)). We also found a few new ones.

I had a few small distractions that were expanded among the Photo Reading WG. Sometimes it was simply to ask what a farmer had been doing to produce the ground effect we could see;

² A list of publications resulting from the project can be found on the [AARG Ukraine WG website](#) – Ed.



L07_121. An example of what Valerie christened ‘Mickey Mouse sites’ visible as a large extant mound with two ‘ears’. We had many of these which may remain from Bronze Age design or mayandi – saltpetre workings. Or both. Google Earth image GE20170603.

L10_001. Another form of Mickey Mouse, perhaps with three ‘ears’, in a field in which there were about 100 other mounds. The N-S linear is a pipeline. Google Earth image GE20160827.

sometimes it included archaeological content and questions. We compared what we called ‘mounds with satellites’ with *maydani*, the Ukrainian name for mounds remaining from saltpetre production, which also showed us ways in which saltpetre was produced. I’m not sure if we resolved the question whether mounds with satellites may have had a Bronze Age origin and were later reused or if the whole lot remain from saltpetre working. Or both....

The other distraction was the amount of 20th century stuff we were finding: collective farm buildings, ‘fuel stores’, new pipelines, old railway lines and roads, factory complexes and mineral extraction, plus a few Cold War sites. The HEXAGON photographs from 1982 showed a lot of the Soviet landscape up and running, but by the earliest GE images (2007) sites had been abandoned, often demolished, but still retained their land parcels. None of this was of interest to Alex, for whom ‘archaeology’ ended at AD 1650 or thereabouts, and he couldn’t understand why we bothered to record the stuff. We explained our reasons and expanded these for the Ukrainian publication *Arheologia* in



K07. After an initial, ‘Wow, finally a site’ moment on sub-image F025-i from HEXAGON 19820518, we checked on other images including the overlapping HEXAGON strip and found no other evidence. We agreed it was a processing fault that created a 200m diameter ‘enclosure’.



A07. Walking man. We were unable to agree if this was caused by burning or cultivation. GE20140314. It remained visible, gently fading, for at least one month. Google Earth image.

2023 as it is likely to be a block for other local archaeologists until the stuff becomes sufficiently old to be of interest to them. Or, as has happened elsewhere, the ‘end date’ for archaeology moves progressively closer to modern times.

Alex provided access to information that otherwise we would have been unable to find – probably wouldn’t have known about – such as the archival records of sites found during earlier field survey. We hoped to be able to compare records in the Talne area with what we had identified from satellites, but the locational information of archival material was poor. For example, a surface collection interpreted as a settlement may be located ‘2km northeast of the village’.

Pinning of all 66 of the 10 x 10km squares was completed around the end of 2024 and that included re-evaluation of the earlier squares we had done. That was worth doing as we learned quite a bit in those first few months and going

over old ground meant that the whole area was more or less done to one standard. Our site total was 10,608 of which 7,639 were ‘archaeological’. At the same time, we had produced a second report for *Arheologia* which was published at the end of 2025.

While this had been going on, Martin had been working on the Esri web app that is now named VISUALS (Visualising the Interpretation of a Satellite-based Ukraine Archaeological Landscape Survey, or in short, Visualising Ukraine’s archaeological landscape from satellite data, see pages 33-37 of this issue). It’s a brilliant name because it says what the program and its users are able to do and explains how it can be done – or that’s how I think of it. VISUALS allows open access to our results and the opportunity to mix and match different layers of sites and other information. It is a really good way of playing with the data but because it is

still under development, the latest edition can be reached through a link on the AARG website: [Ukraine Working Group](#). AARG have agreed to fund availability of VISUALS until 2030. A note about the survey and VISUALS published in an edition of *Ukraine’s Space in Historical Research* (Fowler *et al*, 2025) at which Alex presented a talk on the topic at a meeting in Kyiv in November 2025.

That’s the beginning and (probable) end of the project. We examined about 1% of Ukraine, found more than 10,000 sites (of all origins and dates) and kept ourselves busy for three years. We await any interest from Ukrainian archaeologists – although there may be none since one of their ‘experts’ (he has a drone) published a paper in 2024 outlining a ‘methodology of analysing aerial and satellite images to detect archaeological sites’ (Hnera, 2024). Based on previous Ukrainian work (which is minimal) he proposed that the solution will appear after all aerial images are put into a GIS and an algorithm is asked to detect the sites. Unfortunately, if that level of work is favoured in Ukraine there will be little opportunity for thoughtful knowledge-based interpretation and questioning of the evidence.

One of Alex’s interests is the history of archaeology and by rummaging in his institute’s basement he was able to find quite a lot more about one of their pioneer interpreters, Kostiantyn Shyshkin, whose work on military aerial photographs resulted in his publication of a significant number of early (1960-80s) discoveries. Alex located some of Shyshkin’s original drawings and photographs and published papers in Ukraine (Kariaka, 2023; 2024) with one translated into English for [AARGnews 66](#). The Ukraine project can perhaps claim a small part in encouraging Alex’s search and gaining a home result.

Of course, there are other questions that we can pose but not answer without being in Ukraine and without an extra 50 years or so to work on them. For a start, we encourage similar surveys to be done elsewhere so as to begin to get an idea about similarities and differences in planned landscapes. I would argue that lines of mounds that follow high ground



F07. Farmer's games. The sun is just E of S so showing the circular features as 'mounds'. Contemporary tracks avoid them/ None of this was visible in bare soil/germinating crop four months earlier nor in 2019 or later years. Google Earth Image GE20180922.



F08. Stubble burning. We identified examples of this up to and including GE20080808. Google Earth image.

(look almost anywhere on VISUALS) are evidence of planning and therefore that different mound patterns in our area may be a way to identify Bronze Age territories. Can similar widespread rows be identified elsewhere in Ukraine? Does fieldwork indicate any suggestion of local groups? Those are some of the thoughts that occurred when pinning. These are probably 'western European' thoughts which may of little interest to Ukrainian archaeologists who are welcome to make any use of our data in their archaeological processes.

Perhaps our greatest failure has been our inability to make contact with any

students. Alex works in the National Academy of Sciences, not in the academic world, and we have been unable to make any useful contacts in Ukrainian academia. Without student interest it may be difficult to introduce our methods and ideas while the established professionals continue to equate archaeology with excavation and, amongst the youngsters, a 3D visualisation from a drone is seen as 'aerial archaeology'. But we'll see how things develop.

What may be our greatest achievement was not foreseen, nor really wanted. Could it be that our

project in Ukraine is what led to the increased Russian interest in AARG's web site (as shown by the number of visits to the AARG website, see [AARGnews 69](#), 34 and [AARGnews 71](#), 51), even though there are now no Russian members of AARG? Perhaps we ought to encourage Russian archaeologists to become interested in work from above?

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Developing VISUALS: A Web Application to Visualise the Results of the AARG Ukraine Working Group Landscape Project

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The VISUALS web application provides an interactive means by which the results of the AARG Ukraine Working Group's archaeological landscape survey of an area in Ukraine can be visualised beyond the constraints of static distribution maps and the written word. Supported by a grant from the AARG Fund to cover the online availability of VISUALS until 2030, it is freely accessible to everyone through a link on the [Ukraine Working Group page of the AARG website](#). To help others who may be thinking of using this type of approach in their projects, this article briefly describes how VISUALS was developed, some of the issues encountered and where it may be headed in the future.

Introduction

Between 2022 and 2025, the AARG Ukraine Working Group (WG) conducted an archaeological landscape survey of a 6,600km² area in the Cherkasy Oblast of Ukraine using open-source satellite images (Palmer, Ward, and Fowler, 2025; see also pages 29-32 of this issue). Over 10,000 features were identified using a combination of HEXAGON satellite photographs dating from 1982 and Google Earth Pro (GE) images from 2007-2022. In addition to papers describing the results of the survey (listed on the [AARG Ukraine WG website](#)), an interactive web application, named VISUALS, has been developed to show the results of the survey. This article briefly describes how I went about developing VISUALS and where it may be headed in the future. A complementary paper presented to Ukraine's Space in Historical Research meeting held in Kyiv in November 2025 provides further details on what can be done with

VISUALS (Fowler *et al.*, 2025).

The genesis of a web app

VISUALS, Visualising the Interpretation of a Satellite-based Ukraine Archaeological Landscape Survey, was inspired in part by Historic England's Aerial Archaeology Mapping Explorer (Crutchley, 2024) as well as the ease with which an interactive web application could be developed using the *Instant Apps* capability of ArcGIS Online to show the results of an echolocation survey of bats (Microchiroptera) around my village (Fowler, 2023). From the start of the project, I envisioned some form of interactive means of displaying the results of the survey that would overcome the limitations of the written word where it can be difficult to show the complexity of the data without the recourse to a plethora of figures and tables. What eventually became known as VISUALS evolved as the project progressed.

Making Google Earth pins 'intelligent'

GE was the primary means by which features identified through the comparison of multitemporal satellite images were recorded during the project. Whilst this was easy to do,

the resulting pins, lines and polygons are potentially not very intelligent as any data included in the description box of the feature is essentially free text. A means was therefore developed to capture specific data relating to each feature using hashtag delimited data fields (e.g. #Description=) that were included in the text of the description (Figure 1A). These fields essentially covered the *what* and *when* of the feature and complement the *where* provided by the WGS84 (EPSG:4326) latitude and longitude coordinates of the placemark provided by GE.

The survey resulted in some 10,608 pins of point features of interest together with smaller numbers of line (~500) and polygon (~1,000) features, with each line and polygon feature having a corresponding pin. The pins and lines were coloured yellow for 'archaeological' and white for 'non-archaeological features'. Initially the yellow and white pins were kept together in the same folder in GE with the intention of separating them during the processing of the saved Keyhole Markup Language (KML) files. It was later found to be more efficient and accurate to keep the two types separate because of unexpected idiosyncrasies in the naming of pin types of the same colour by GE, which upset their subsequent identification.

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To extract the individual fields from the GE pins into a database table, a semi-automated pipeline, FROGLET, was developed using Microsoft Excel (Fowler, 2022). In essence, pins from the 66 ten-kilometre grid squares that covered the survey area were saved from GE as a KML file and imported into Excel as an XML schema based on the source data. They were then processed to extract their geographical coordinates and individual hashtag delimited fields before being saved as a database table (Figure 2). Several additional fields were added to the database table during FROGLET processing, primarily to help with managing and quality control of the data (Table 1).

The reason for adopting a semi-automatic process was because of several idiosyncrasies that resulted when KML files were imported into Excel worksheets including duplicate entries for individual pins. In addition, occasional errors in the pin descriptions (mainly duplicate or missing #-tag fields) that were made when pinning features in GE corrupted the data and needed to be manually corrected. Whilst these issues could no doubt be trapped using a fully automated process, a semi-automatic approach was considered a pragmatic alternative.

‘Cleaning’ the database

The outputs from the reduction by FROGLET of the pins from the 66 grid squares were then combined into a master database table in Excel comprising 10,608 rows of data. This was then semi-automatically ‘cleaned’ to:

- Correct the misidentifications by FROGLET of archaeological/non-archaeological features resulting from idiosyncrasies in the naming of pin types by GE.
- Remove any trailing spaces at the end of the feature types which could cause problems with seemingly identical types being considered to be different by a GIS.
- Update the feature types to correct typos and synonyms.

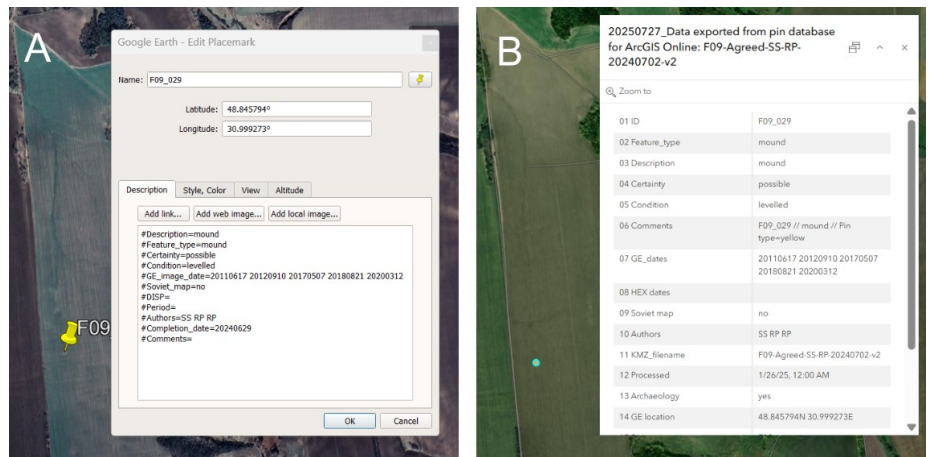


Figure 1. Examples of data fields for feature number F09_029, a mound, pinned using Google Earth and after processing as displayed in VISUALS. A. Google Earth pin showing the hashtag delimited fields in the description box. B. The same pin in VISUALS showing some of the hashtag fields that have been extracted from the GE pin using FROGLET. Note that several additional fields have been added to the VISUALS feature by FROGLET. Background images: A. Google Earth. B. ArcGIS Online.

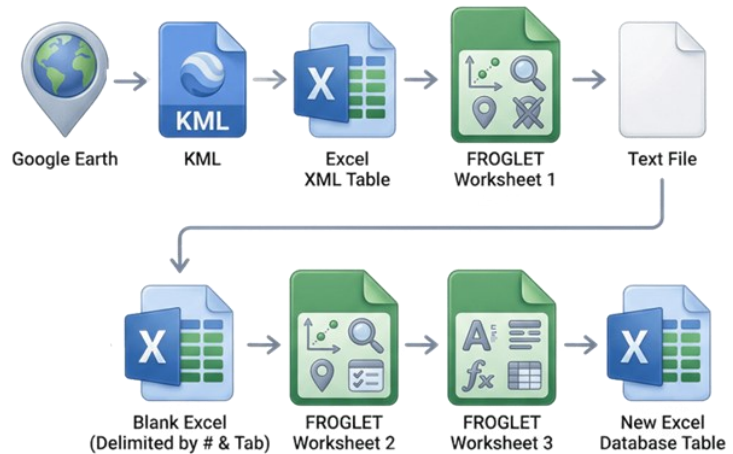


Figure 2. Flow diagram of the extraction of data fields from Google Earth pins into an Excel database table using FROGLET. In essence, the process is:

- ◇ Pins are saved from GE as an uncompressed KML file and imported into Excel as an XML table.
- ◇ Cells corresponding to the pin name, description, pin colour, and latitude and longitude coordinates are then cut and pasted into the first FROGLET worksheet.
- ◇ This worksheet extracts the geographical coordinates from a text string into numbers, provides a degree of quality control and identifies any duplicate entries for individual pins.
- ◇ The resulting table is then saved as a text file.
- ◇ The text file is imported into a blank Excel workbook as delimited text using # and tab delimiters to give columns corresponding to the #-tag fields.
- ◇ The data are copied and pasted into the second FROGLET worksheet which provides further quality control checks and adds additional new fields relating to the processing of the data.
- ◇ Finally, the data are pasted into a third FROGLET worksheet which formats the data for saving into a new Excel workbook as the database table.

Changes made to the master database were saved for audit purposes in a separate database table.

A subset of fields from the ‘cleaned’ database was then saved as

a separate Excel workbook for input into ArcGIS Online (Table 1). This workbook included an additional field that concatenated the latitude and longitude fields into a single field and

was done to overcome a limitation of VISUALS that truncates these fields to integer degrees when they are displayed in a pop-up box for a feature.

What about the lines and polygon features?

You may be wondering what happened to the line and polygon features that were mapped from GE? Whilst their description boxes contain the same hashtag delimited data fields as their corresponding pins, they were not compatible with FROGLET because they include multiple geographical coordinates. Nevertheless, the KML files of these line and polygon features can be readily displayed in a GIS, but they are otherwise relatively ‘dumb’ and are not searched directly.

The lines and polygons were therefore manually sorted in GE into groups corresponding to archaeological and non-archaeological features based on their colours as per the schema used for the pins. The archaeological features were further manually sorted into those corresponding to:

- Habitation sites,
- Hillforts,
- Enclosures,
- Field systems,
- Banks,
- Ditches,
- Tracks,
- Groups of mounds,
- ‘Unidentified’.

Because the large number of non-archaeological polygon and line features (~1500) included a wide range of feature types, from collective farms and fuel stores to Cold War military sites to ‘unidentifieds’, they were simply sorted into those features that covered the western, centre, and eastern areas of the study area for ease of manipulation. The archaeological and non-archaeological polygons and lines were then saved as separate KML files.

Building the VISUALS web application

Having produced a database of point features, the next step was to import the data as feature layers for display on a

Field	GE pins	FROGLET output	Export to ArcGIS Online	Comment
Pin ID	✓	✓	✓	Unique ID for the feature
Description	✓	✓	✓	Brief description of feature
Feature type	✓	✓	✓	Type of feature
Certainty	✓	✓	✓	Certainty of the archaeological nature of the feature
Condition	✓	✓	✓	Extant, plough-levelled, etc
GE image date	✓	✓	✓	Dates visible on GE
Soviet map	✓	✓	✓	Shown on Soviet map?
DISP	✓	✓	✓	Date visible on HEXAGON
Period	✓	✓	✓	Period to which the feature relates
Authors	✓	✓	✓	Who pinned the feature
Completion date	✓	✓	✓	Date when the feature was pinned
Comments	✓	✓	✓	Descriptive comments
Latitude	✓	✓	✓	Generated by GE
Longitude	✓	✓	✓	Generated by GE
Square		✓	✓	Location square of feature
Flag		✓		Flag to allow specific pins of interest to be easily recalled
Pin colour		✓		Colour of pin (Yellow/White)
Processed		✓	✓	Date KML was processed
KML filename		✓	✓	Name of KML file
Count		✓	✓	Number for numerical processing
Archaeological feature		✓	✓	Yes/No whether considered archaeological
GE location			✓	Concatenation of latitude and longitude

Table 1. Data fields included in the original GE pin descriptions, the output from FROGLET for the master database, and the export from the master database to ArcGIS Online for display in VISUALS.

map using ArcGIS Online. Early in the project, the interim pin data from the various grid squares were imported as Excel tables to visualise the progress of the project (see, for example, the maps that accompany the various progress reports that appeared in *AARGnews* between 2022 and 2025) and to develop an understanding of how the software could be used to good effect.

Once the master database of 10,608 sites was complete and cleaned, it was found that using an Excel table to import the data into ArcGIS Online feature layers appeared to considerably slow down the display of the data. An alternative file format had therefore to be sought. Converting the Excel table into a shapefile of points appeared to solve the problem but introduced a new problem. Because of the shapefile specification, field names were truncated to 10 characters and, more importantly, text field content was limited to a maximum of 254 characters thus truncating the descriptive text comments for many of the sites. Eventually, it was found that the GeoJSON format preserved the Excel table content and did not appear to slow down the display of the data. It was, therefore, used to import the point data into ArcGIS Online. Line

and polygon data were imported as KML files.

Once imported, the project data were filtered into several layers (e.g. archaeology, non-archaeology, 20th century features) for display on the map together with several additional layers (e.g. negative areas, drainage, soil types etc.), as summarised in Box 1. Further details of the map layers can be found in the accompanying paper (Fowler *et al.*, 2025).

Having compiled the map, the *Instant Apps* functionality of ArcGIS Online was used to produce a prototype interactive web application. *Instant Apps* comprise several templates that can be easily configured to display maps built in ArcGIS Online. For VISUALS, the Basic (Media Map) template was chosen as it provided the required functionality to interact and visualise the project data included in the map. It was very easy to configure, taking around five minutes to produce and publish the first version of the app using the express setup settings. This was very much a prototype to understand what could be achieved. Subsequent iterations were made to the layout to improve the design and to add additional functionality using the ‘advanced settings’ of the template.

Initially, the prototype was hosted online using my personal ArcGIS Online account, but in January 2025

AARG kindly agreed to fund the hosting of the public version of VISUALS until 2030 through a grant from the AARG Fund. VISUALS is freely accessible through a link on the [Ukraine Working Group page](#) of the AARG website.

What does VISUALS do?

Rather than providing a detailed description of the functionality of the app, I suggest that you just jump in and give it a go. You can't break it! Just click on the link on the Ukraine Working Group page on the AARG website and you will go straight to the VISUALS splash page where you enter the app. After an information page is displayed, you will be presented with the user interface (Figure 3) which has buttons located around the sides to access various actions. These include buttons to:

- Turn on and off feature layers.
- Display a legend of features that are selected.
- Search the feature layers for text strings.
- Toggle the basemap between a map and a satellite image.
- Toggle the user interface language between English and Ukrainian.
- Zoom in and out.
- Save screenshots and export the map to PDF.
- Draw an elevation profile.
- Add sketch points, lines, polygons and circles on the screen
- Measure distances areas and coordinates.

To learn more about functionality of the web app, a full description of the app as of November 2025 can be found in the accompanying paper (Fowler *et al.*, 2025). Example use cases are also included to show how it could be used to formulate, and potentially answer, archaeological questions based on the included data.

Of course, 'there's no such thing as a free lunch' and whilst *Instant Apps* provided an easy way to build a web application to visualise the project data, it does come with limitations. For

Box 1
VISUALS map data layers

Project data:

- **Archaeology.** These refer to both prehistoric and historic sites.
 - **Point features.** Segregated into the feature types: mound, habitation, hillfort, enclosure, field system, other.
 - **Lines and polygons.** Feature types: habitation, hillfort, enclosure, field system, bank, ditch, track, mound (group), unidentified.
- **Non-archaeology.** This category documents features, either natural or other artefacts (modern agricultural or image-based), that on certain images could be confused with archaeology.
 - **Point features.** Combining all feature types.
 - **Lines and polygons.** Western, centre, and eastern areas of the study area.
- **20th Century features.** Features or sites from the 20th Century which may be considered to be 'archaeology' at some point in the future.
 - **Point features.** Includes: Collective farm, fuel store, abandoned village, shrunken village, Cold War sites.
- **Known sites in the Talne environs .** Data in this layer were compiled by O. Kariaka and shows information resulting from historical fieldwork available in unpublished archive literature and a publicly available Ministry of Culture database.
- **Trypillia mega sites.** Data relating to Trypillia sites results from a search through published literature and databases conducted by Valerie Ward.

Additional layers:

- **Negative areas.** These are defined in this project as areas that preclude the identification of archaeological sites such as areas obscured by overhead canopy and areas of the ground which may have been significantly disturbed. They were transcribed from 1:250,000 scale [Joint Operations Graphic \(JOG\)](#) charts and cover built up-areas, woodland, and lakes.
- **Drainage.** Lakes or broader rivers which result from modern damming transcribed from the JOG charts.
- **Soil types.** Two maps of soil types covering the study area are included. One is the online Soil Types in Ukraine. The other is a transcription of a rectified version of the 1:2,500,000 soil map of Ukraine published by the General Directorate of Surveying and Cartography of the Soviet Ministry, GUGK, SSSR in 1977.
- **World shaded relief.** An alternative background map without the distraction of boundaries, names and modern roads.
- **Cosmetic.** Grid lettering, project area, and 10km grid squares from the original design of the project based on a Sentinel 2 tile.

example, the map scale is fixed in the bottom left corner of the screen and the points, lines, and polygons that can be added by the sketch tool are all the same colour and style. There is also no ability to annotate the map with text, which would be a useful addition. Nevertheless, the benefit of easily producing an application that has ~90% of the desired functionality outweighs the limitations. And since the capabilities of ArcGIS Online and

Instant Apps are being enhanced on a regular basis, some of these limitations may well be overcome in the future and additional functionality added that could improve the utility of the app.

Future development

As with any software development, VISUALS is still a 'work in progress'. Future development is envisaged to:

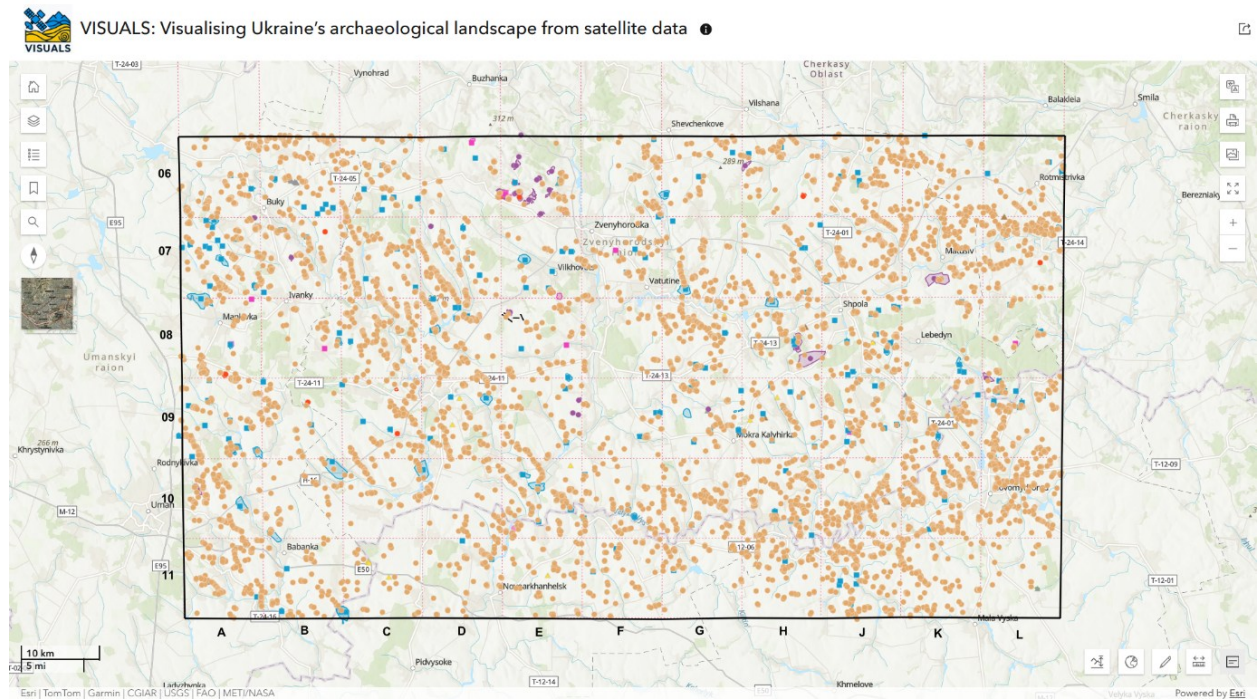


Figure 3. The main display of VISUALS showing the distribution of point, line and polygon archaeological features in the survey area. Most mapped features are mounds (brown) along with habitation sites (blue), hillforts (purple) and field systems (plum). Buttons are located around the sides to access various actions. Left (top to bottom): Default map view; Layer list; Legend; Bookmarks; Search; Reset map orientation; Toggle basemap. Right (top to bottom): Language switcher; Print; Export to PDF; Enter full screen; Zoom In and Out. Bottom (left to right): Elevation profile; Overview map; Measurement; Splash page.

- Add a bilingual English/ Ukrainian User Guide.
- Make the line and polygon feature layers more intelligent so that the different feature types can be easily displayed.
- Explore further ways of visualising the results of the survey using different *Instant Apps* templates.

Conclusions

A freely available web application has been developed for the interactive

visualisation of the results from the Ukraine WG landscape survey. Together with the articles and formal papers resulting from the project, it is hoped that VISUALS will encourage Ukrainian archaeologists to become more aware of the uses of aerial photography and satellite imagery in archaeological investigations and help develop a landscape approach to archaeology in the country. Hopefully, the ease with which VISUALS was developed by a relatively novice user may encourage others to consider adopting this approach to complement

written publications arising from their work.

Acknowledgements

AARG has generously provided a grant from the AARG Fund to cover the online availability of VISUALS until 2030. Rog Palmer, Valerie Ward and Oleksandr Kariaka, along with others who contributed to varying degrees, provided the essential project data upon which VISUALS is based. Thank you.

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When You Have Eliminated the Impossible...

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“... when you have eliminated the impossible, whatever remains, *however improbable*, must be the truth.”
 Sherlock Holmes in *The Sign of the Four*
 by Sir Arthur Conan Doyle.

Recently, I was reminded of the precarity of air photo and lidar interpretation. Someone suggested that a cropmark I had very tentatively identified as a Neolithic or Bronze Age enclosure might instead have been caused by groundworks for a National Aviation Day event in 1933.² The concentric cropmarked circles are near a temporary airfield that hosted Cobham’s Flying Circus; they may have been a landing target for parachutists or hot air balloons. An intriguing and quite unexpected idea!

The conundrum

This came whilst I was contemplating a

² <https://heddonhistory.weebly.com/blog/cropmark-at-hepscott-manor-farm>

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A tiny cluster of at least 15 small circular platforms were discovered on lidar imagery of the open moorland in the north of England. Without the benefit of ground investigation, the working hypothesis is that they are platforms or stances for timber houses, possibly Bronze Age. However, unenclosed platform settlements are very scarce in the north of England, so could there be an alternative explanation?

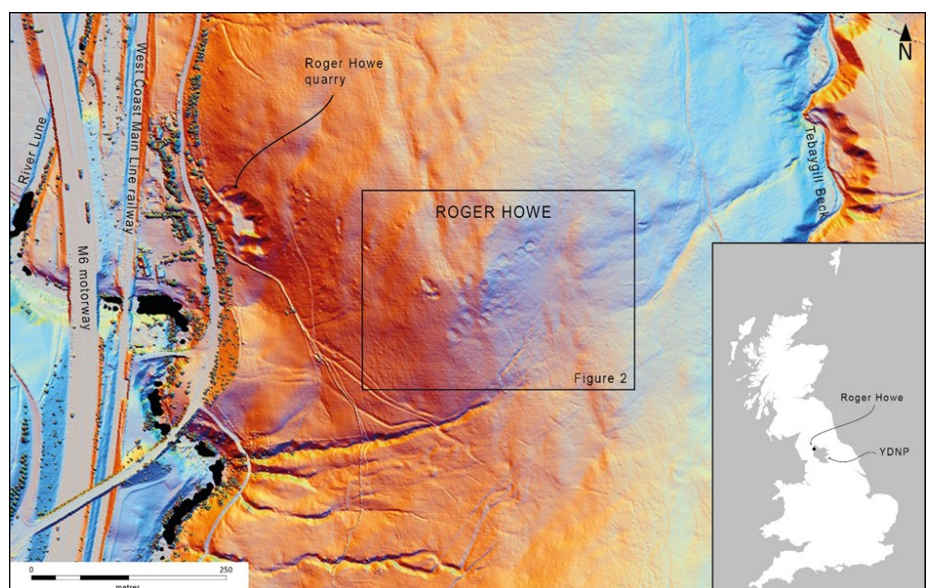


Figure 1. This image has the hill known as Roger Howe at its centre and covers approximately 840m left to right and 570m top to bottom. The background is a lidar visualisation that shows the topography. To the left (west) of Roger Howe, the land falls away into the valley of a meandering river. A wide motorway, railway line and minor road cross and recross the meanders. East of Roger Howe, the land falls away to a small beck. East of the roads, the landscape is quite featureless, there are no field boundaries, roads, buildings or trees. A small inset map shows the location of YDNP in relation to Great Britain and a dot marks the location of Roger Howe on the edge of the YDNP. A black outline box indicates the position of Figure 2. Visualisation generated using the RVT toolbox 2.2.1 from 2022 1m resolution lidar DSM © Environment Agency database right 2022. All rights reserved.

puzzling site encountered during the Westmorland Phase 2B project (WD2B).³ The site is in the Howgill Fells, which are part of the Yorkshire Dales National Park (YDNP). It lies just 500m east of the Lune Gorge,

³ Westmorland Phase 2b is funded by Historic England. Its aim is to produce baseline archaeological data for areas added to the Yorkshire Dales National Park in 2016.

where the river, the M6 motorway, the West Coast Main Line railway and local roads compete for space.

This site presents on lidar imagery as a tight cluster of at least 15 small circular platforms, each facing south or south-west. These features are barely perceptible on conventional aerial imagery. The cluster is located on open moorland on the southern flank of Roger Howe, the lowest platform is at 285m above sea level, the highest is at

315m. These platforms appear to be cut into the hillside and slightly built up on the downslope edge to create a near-level surface approximately 10m in diameter. My working hypothesis, which so far is without the benefit of ground investigation, is that these are platforms or stances for timber houses. The known Iron Age and Roman settlements in this area are on the lower slopes of the Lune Valley but there are remote post medieval farmsteads at similar altitudes.⁴ The apparent absence of stone footings or walls suggests that these predate the Iron Age and perhaps the climatic deterioration that could have made even seasonal occupation at this altitude less feasible. There is evidence of Bronze Age activity in the vicinity: a Bronze Age cairn 500m to the north, though not inter-visible with the putative settlement, and a Bronze Age spear head, found 900m to the east in the late 19th century.⁵

A challenge to my hypothesis is that unenclosed platform settlements are very scarce in the north of England. There are a handful of examples in Cumbria and Northumberland and examples in North Yorkshire have been hard to find.⁶ Yet they are not uncommon in Scotland, with notable concentrations in the Borders.⁷ Does regional scarcity render this interpretation improbable?

The Roger Howe example was discovered by lidar imagery. Given that

⁴ For example, Iron Age or Roman settlements at High Carlingill and Low Borrow Bridge 1.6km and 2.3km to the south and post medieval farmsteads Gelstone and Waskew Head 0.7km and 1.2km to the east.

⁵ See Heritage Gateway Historic England research records [1025448](#) and [13271](#).

⁶ In Cumbria, house platforms have been reported on Heathwaite Fell, Cumbria (Quartermain and Leech 2012, 277-278), and in Northumberland, at Fredden Hill and Cochrane Pike (Gates 1983, Fig. 2). House platforms have also been identified within enclosures, for example west of Ayle in Northumberland (Heritage Gateway Historic England research record [1537991](#))

⁷ For example, Green Knowe (Jobey 1980), as well as similar, but so far undated examples at [Glenwhappen Rig](#) and [Little Dod](#).

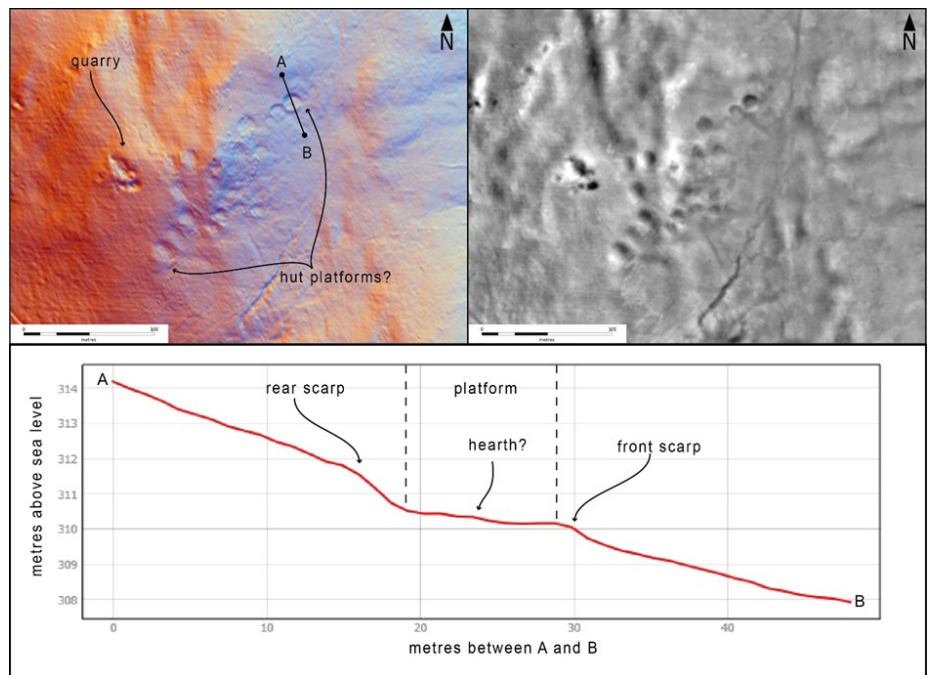


Figure 2. This figure is in three parts. Top are two lidar visualisations of the same 350m by 250m area centred on the earthworks on Roger Howe. The left demonstrates the rise and fall of the land by lighting it from several different directions. The one to the right accentuates minor features at the expense of the broader terrain, showing the platforms as darker circles and the raised lips as white crescents. Below these is a profile that shows how the land falls across one of the platforms, first steeply, then levelling out, rising very slightly to a lip and then falling again. The height scale is greatly exaggerated. Visualisations generated using the RVT toolbox 2.2.1 from 2022 1m resolution lidar DSM © Environment Agency database right 2022. All rights reserved.

lidar imagery has not yet been systematically examined for substantial tracts of the upland in the north of England, I am not dissuaded by the lack of analogous sites in the region.

Alternative interpretations

Returning to Holmes' strategy for mystery solving, what other activities might have produced these earthworks on Roger Howe?

There is evidence of small-scale stone quarrying scattered across the Howgill Fells and a larger industrial-scale quarry just 300m to the north-west of the platforms. The smaller quarries probably provided stone for the walls that enclosed the valley-side fields and marker cairns on the moors. Although of similar size, the smaller quarries are generally irregular in shape and depth; they are quite different from the platforms.

Small, terraced platforms, not dissimilar to some of the Roger Howe features, were identified on lidar

imagery in Barbon Park, approximately 20km to the south of Roger Howe (Oakey *et al.*, 2015, Fig. 16). These were interpreted as post medieval charcoal burning platforms and this was confirmed by subsequent excavations (Hazell and Crosby, 2023, 36-37). The WD2B project has identified potential charcoal burning platforms just 2km south of Roger Howe, at in Borrowdale Wood.⁸ Both the Barbon Park and Borrowdale Wood examples are smaller than the Roger Howe features, and they are well-spaced across large areas of ground. More significantly, they are located close to or within woodland. Roger Howe has certainly lacked the raw materials for charcoal in recent centuries, and perhaps since the clearances in the Neolithic and Bronze Age.⁹

⁸ Yorkshire Dales National Park monument record MYD74406

⁹ <https://nationalcharacterareas.co.uk/howgill-fells/description/>

The remains of Second World War installations such as searchlight batteries and gun emplacements are often cited as candidates for misidentification as earlier features (Wilson, 1982, 172). These were often positioned to defend significant infrastructure and, at that time, nearby Tebay station was a crucial junction of north to south and east to west rail routes. Usually, 1940s RAF vertical air photos can be relied upon to help distinguish Second World War infrastructure from earlier monuments. The earliest coverage available for this area was taken in 1954, however, which gives time enough for earthworks to meld into the landscape after the war. Instead, it is the number of platforms on Roger Howe that does not accord with the usual configuration of gun and searchlight positions in rural areas.

More recent activities might produce similar features. Poaching and erosion around sheep and cattle ring feeders can produce circular wear patterns. There is no evidence, however, for ring feeders at

this location on the air photos in and after 1954.

In recent years some areas of the Howgill Fells have seen activity associated with peatland restoration and water management. On Blease Fell, 2.3km south of Roger Howe, small dams have been built across existing peat crags to slow the flow of water and help the accretion of organic material. Elsewhere in northern England, scallop bunds have been created for similar purposes.¹⁰ Where applied across large areas, this fish-scale patterning is easily identified as a modern intervention, but in smaller areas it could be confusing. Although very slight, the Roger Howe earthworks can be detected in stereo on the 1954 vertical air photos, so they clearly predate these more recent initiatives.

¹⁰ Search for Darwen Moor in Google Earth to see extensive scallop bunds installed after 2023.

The denouement

Unfortunately, there is no Holmesian denouement to the Roger Howe mystery, at this time. It is not a fiction with Conan Doyle in full control of the narrative and all its red herrings and plot twists. There are undoubtedly numerous causes that I have not yet even conceived, some perhaps as obscure as Cobham's Flying Circus. I'd be delighted to hear what those might be so please send me an email if you have any ideas. Hopefully, in the future I can follow this up with some insights from a field visit.

Acknowledgement

Figures 1 and 2 are generated from Environment Agency lidar data which is distributed under the Open Government Licence, please see <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/> for details.

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Back to Armenia

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After a break of over 20 years, new data (including Google Earth and declassified HEXAGON satellite photographs) provides the opportunity to complete an unfinished project to identify and map, from above, the archaeological content in a small part of Armenia.



Frontispiece. The paramotor usually caused kids to magically appear, as here when we were preparing it for a test flight in 2003. Mt Aragats is in the background.

Introduction

With the Ukraine project at its end – or taken as far as it can be without active local involvement – I needed something to keep me sitting at my computer. Readers of older issues of *AARGnews* will remember that AARG had been contacted in 2000 by Hayk Hakyoban, an archaeology lecturer at Yerevan University, Armenia, asking if we could help establish aerial survey in his country. No one else was interested so, after an exchange of emails with Hayk

in which we discussed various options, I offered to go over later in 2000 and see what might be possible. I visited quite a few times in the next five years during which we visited a wide range of ground locations, took almost 2000 obliques, enjoyed the local food and drink, and I ran a ground school. Hayk died a few years ago but I kept in contact with a few non-archaeological people there.

Hayk and I had different ideas of what ‘aerial survey’ comprised. He would have been happy photographing sites he knew (and he told me that Armenian archaeologists knew where all the sites were) whereas I wanted to use it as a way of examining an area and identifying some of the archaeological content that I was sure their archaeologists didn’t know about.

We sketched out some ideas during my visit in 2000. Hayk

proposed working in an area that included a handful of hilltop sites and somewhat reluctantly let me have copies of 1:100,000 maps that covered it. I’ll remind readers that this was some 10 years after the collapse of the Soviet Union, of which Armenia was part, and things like maps were ‘secret’ and, of course, I was not allowed to see any existing vertical aerial photos. To add to that ancient perspective, this was an era before Google Earth (GE) was available (my first notice of it seemed to be in 2005 – [AARGnews 31, 38](#)) and the best of the freely-available satellite images was Landsat with its 28.5m resolution. Did I also mention that we were not allowed to fly as the president had banned civil aviation? The best solution to the secrecy and no flying was to buy strips of CORONA negatives from USGS, which I did soon after my first visit (Figure 1). They provided a first look at the country and

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Figure 1. USGS web site showing Armenia and the five CORONA strips purchased in 2000. Entity ID: DS1115-2154DF091-095, 20 September 1971.

were, and continue to be, archaeologically informative.

However, my Armenia project was never properly finished. Would it now be possible to make use of the newly-available declassified HEXAGON photographs and images in GE to draw it to an end and to reach any conclusions? Martin Fowler, Valerie Ward and Darja Grosman were interested in the idea and we have had a

few Zoom meetings to juggle ideas and eventually to outline a relatively small project.

Declassified satellite pictures

I bought CORONA cover after my visit to Armenia in 2000. In those days it was supplied on film, as positive or negative copies, and I bought negatives so I could make

prints in my darkroom. Those prints could then be scanned and this was an easier option for me than making high resolution scans from the films. Digital copies were examined on screen at about 1:15,000 scale and extracts made with locations marked roughly on the 1:100,000 maps. Prints could also be taken into the field. A note on my use of CORONA was published as part of a Eurisy meeting in 2002 and included paired examples of sites from CORONA and field visits (e.g., Site 141 in Figure 2).

Since that time, satellite photographs from the US HEXAGON programme have been declassified and some cloud-free dates for our area are now freely-available from USGS. Because their resolution is superior to that of CORONA, they will become the primary source of ‘early’ (1975) cover for our area and have been georeferenced for use in QGIS and GE.

Oblique photography

In 2001, thanks to the generosity of the British Council, we were able to buy a paramotor that had seats for two people and we made a dozen flights over a two year period. The initial flights in 2002, with a substantial Russian pilot plus a fairly substantial me, weighed too much. So I asked Antje Faustmann (who was a small and sporty archaeologist) if she could come and fly. Antje made the first photographic flights in Armenia in May 2003 with Karen Martirosyan (a wiry Armenian paratrooper) as pilot.

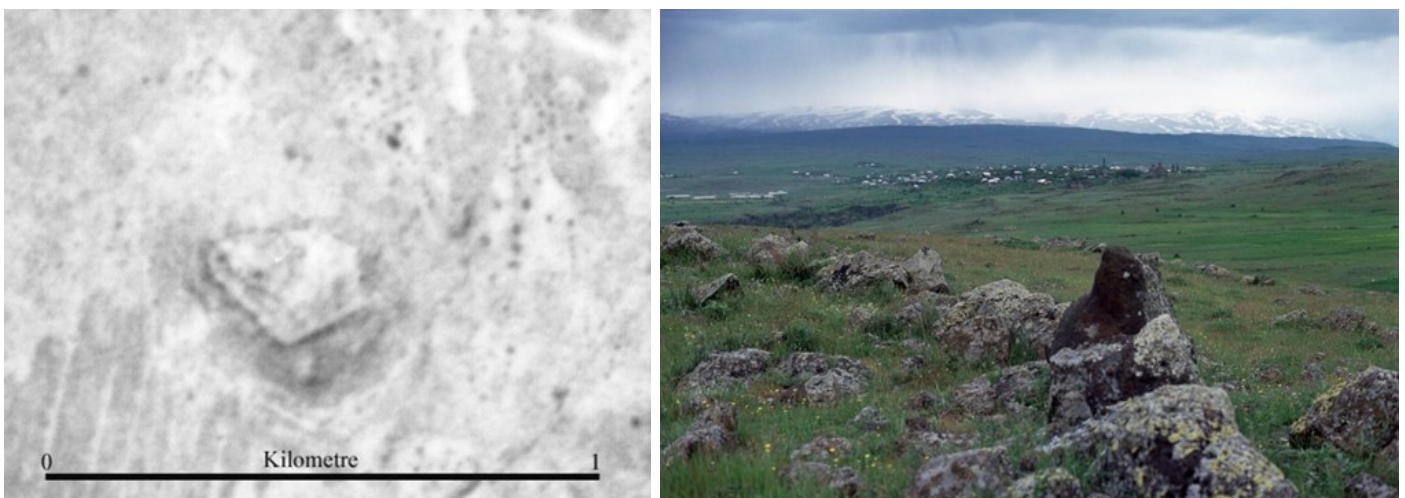


Figure 2. Site 141, a defended hilltop enclosure. Left: with South to the top from CORONA (20 September 1971). Right: ground view looking West(ish) (5 June 2002).



Figure 3. A small abandoned village at about 1770m. Note the large stock enclosure remains in use and there are droves extending up and downhill. Photo: Karen Martirosyan, 17 August 2004.



Figure 4. Notes in red made in the field that indicate we found and numbered 'Castle, 3 tombs (23); big tomb (24); tomb altar (25)' (Anush Margaryan email, 2 January 2026) Aerial oblique: Karen Martirosyan, 15 August 2004.

However, even with two lightweights, our starting altitude of about 1700m asl restricted our above-ground flying height. So, in August 2004 we flew with only Karen acting as pilot, navigator and photographer. He was not an archaeologist and the best brief I could give was to fly a systematic pattern and photograph anything that didn't look natural. After each flight, we looked through photos using the camera screen and Karen became more capable and observant on each flight. After that, I behaved like most aerial photographers and pulled out a handful of the best pictures for talks and publications and the remainder stayed on computer drives.

The abandonment of the work was obvious at the end of 2025 when I returned to the Armenia project. Most images seemed to be straight from the camera, so my first task was to tweak (enhance) the whole collection of 1955 images. This not only provided a set of reasonable images, but also gave me time to have a proper look at them on a sensible-sized computer screen. This was also an opportunity to site (locate) the obliques a bit more accurately than had been possible using the 1:100,000 maps. In 2025, I could pin locations in GE and transfer them to QGIS where I had previously set up a project using the Gauss Krueger coordinate system that I had used for field GPS readings and flight tracks.

What is on the pics?

Results from the oblique photos can be crudely classified as modern landuse, known archaeological features, obvious relatively recent features and other slighter traces of possible archaeological interest. Known archaeological features in our area include a few hilltop enclosures (see Figure 2) and the more recent sites include villages that were said to have been destroyed during Soviet times to force people to move to more easily controlled locations. Structures there remain at about 1m high and the village layouts are clear from the air and include broad streets, houses with stock compounds, larger stock enclosures and a source of water

(Figure 3). Worn and sometimes marked droves to pasture can be identified leading from/to some of these villages.

Armenia is a land of volcanoes and stones, In cultivated areas, stones have been cleared and sometimes heaped on or around small areas of locally high ground and thus preserve archaeological material in those places. This activity has left us some sites of possible archaeological interest, as we noticed in 2004 when Hayek and I spent two days with students in an area covered by three obliques (Figure 4). The higher ground had pottery from M-LBA and the medieval period, with plentiful remains of structures (Figure 5). Checking obliques, it was apparent that traces of similar structures could be



Figure 5. Tired students sitting on a rectangular structure that was noted during field work to check features on aerial obliques (19 August 2004).

suggested on many of the local high areas. These include forms with straight sides and of less regular shape that may benefit from more detailed interpretation or drawing.

A diversion to Ushi

Ushi is a modern village which has a low hill on its western side on which is a known BA defensive enclosure and a monastery. The latter having been excavated and was awaiting reconstruction when I first visited in 2001. We photographed Ushi from the paramotor on three dates but it had become a site of interest before our flights. After making our ground visit in 2001 to see the ruined monastery and parts of the large BA hilltop fort, we took the wrong road and needed to turn the car around. That pause gave me, ‘a superb view over a low-sun lit hill which was covered with lynchets and field walls’ (notebook, 12 October 2001) which the local archaeologists at that time had little knowledge or interest in the field systems (Figure 6). For me, however, Ushi became one of the most interesting sites I had seen in that country. The Ushi field system is clearly visible on declassified satellite pictures, as are a couple of small settlement sites nestled within the fields (Figure 7). Parts are also on our oblique photographs but they do not cover the hill completely. Together, these will form the basis for mapping the area. Without going into details, some of the field walls are of cyclopean construction that places them in the IA (Hayk, *pers. comm.* 2005) and we looked for relationships between walls and the BA structure. Unfortunately, spoil heaps from the monastery excavations have masked the relationship of that building and the field walls on the south side of the hill. Recent GE images show considerable modern expansion between the village and monastery and a fair chunk of the field system has already been levelled and destroyed.

Correlation with existing knowledge

In 2004, Hayk had sent me some of the SMR information. Sites had numbers,



Figure 6. My first look at the field system at Ushi. Even by this date (12 October 2001) there were new houses on the left, expanding from the modern village which is to the right. The two spoil heaps (right-centre) are below the monastery excavation/reconstruction and the BA enclosure is behind (and uphill from) that.



Figure 7. Ushi field system from CORONA (20 September 1971 – with South to the top). The dark mass above the frame centre is the BA enclosure(s) and the monastery is the smaller polygon on its south side. Most of the land divisions in this area appear to be part of a field system. The modern village of Ushi extends left from the dark features on the left edge of the image.

placenames, types and detailed dates but locational information was descriptive (e.g., a fairly precise location for the ‘big burial of Talin’ was ‘on the E edge of Talin, left of the road Yerevan-Talin’). In an attempt to modernise these, some had been given coordinate values but they were to the nearest 100m and often were

duplicated for a group of sites. In the field, we had tried to locate a hilltop enclosure using the SMR but the closest we could get was that the one we were trying to identify could have been one of two. Recently, Darja spent some time trying to identify sites using the SMR but had no reported success. In my opinion, this shows the SMR to be

insufficiently accurate to help pinpoint sites, or to compare aerial information with what is known.

What next?

From our earlier work, it would seem useful to identify structures and possible structures that were recorded on our obliques. The 2004 field days may let us attach date ranges and forms to those and could be enough to activate local fieldwork, especially since I recently discovered that Diana Mirjanyan, one of the students I taught in 2004, is now head of medieval archaeology in Yerevan. We have begun to chat about the possibilities of a joint project and the involvement of her students.

Meanwhile, Valerie has been combining the feature types identified in the SMR and those from Adam Smith's (2008) *Project Aragats* to provide the basis of a list of 'types' documented from ground survey that we can enhance

for our own survey. We will add in some recent types such as collective farms and shepherds' camps (negative zones for earlier archaeological features) as well as abandoned villages (see Figure 3). Mapping these may provide the beginning of a village typology such as has been done for medieval villages in England by Brian Roberts (1977).

In the 20 years since my initial project ended, there have been many changes. One of potential use is the resurgence of amateur flying using microlights. Use of these would open up possibilities for making low-altitude aerial surveys and photography, if these were seen as useful for archaeology in Armenia. Now too, GE provides high resolution vertical cover and has already led to discoveries of 'kite' structures in Armenia (Gasparyan, *et al*, 2013). The

potential of declassified satellite photographs seems to remain untapped.

GE also makes obvious how parts of some villages in our area have expanded in the last 20 years. Destruction of parts of the field system at Ushi (above) is one result and we intend to indicate similar expansion, and loss of archaeological potential, in other parts of our area.

Acknowledgements

Grants for parts of the work between 2001 and 2005 were given by the British Academy, and the Association for Cultural Exchange. Funding that enabled us to buy the paramotor came via Roger Budd who was then Director of the British Council in Armenia. More recently, Monday evening chats with Darja Grosman have let us discuss sites and thoughts arising from her rapid appraisal of the Northern 20,000 sq km of the country using GE.

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Modelling Climate Change Risk to Archaeological Sites in Donegal Bay (Ireland)

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Introduction

Coastal erosion is a natural process that is being exacerbated by climate change. Precipitation is projected to increase in the autumn and winter along with increases in extreme temperatures (Nolan, 2024). Increased rainfall along with sea level rise can bring more regular occurrence of flooding, rockfalls and landslides along the coast. There is uncertainty on the impact of climate change on North Atlantic storms though Storm Éowyn brought hurricane force winds on 24th January 2025 to Ireland and Britain, causing damage to trees, houses, and infrastructure. However, damage to archaeological heritage within rural coastal areas did not form part of the initial reports.

The north-western coast of Ireland is a rugged landscape of cliffs, bays and headlands including St. John's Point and Doorin Point. These points protrude into Donegal Bay, exposed to Atlantic storms and continuous wave and tidal

Coastal archaeological landscapes are increasingly threatened by erosion driven by sea-level rise, changing storm regimes, and intensified precipitation associated with climate change. This paper presents the results of a 2025 Uncrewed Aerial Vehicle (UAV) survey, supported by the AARG Fund, conducted at St. John's Point and Doorin Point on the northern coast of Donegal Bay, Ireland. The survey forms part of a wider Coastal Zone Assessment (CZA) programme that has identified over 350 archaeological features across two actively eroding headlands.

Six shoreline locations were selected for UAV survey based on their cultural significance and vulnerability to erosion. High-resolution orthomosaics and Digital Elevation Models (DEMs) were generated to record approximately 30 archaeological features. These include a medieval harbour associated with Killaghtee church, a possible early medieval eroding slag heap at Templesoogagh, a ringfort at Menamny undergoing cliff retreat, a complex intertidal harbour system at Ballybodonnell, a promontory fort at Raneely on Doorin Point, and cairns and a hut site exposed within the dune system at Hall Demesne near Mountcharles.

The UAV survey enabled detailed mapping of intertidal and cliff-edge features that are difficult to document through traditional ground survey. The results highlight the diversity of coastal activity along the Donegal coastline, including settlement, maritime infrastructure, and industrial production, while also demonstrating landscape change affecting these sites. The survey provides a high-resolution baseline dataset for monitoring future coastal erosion and illustrates the value of UAV-based approaches for the documentation and management of vulnerable coastal cultural heritage.

action. St. John's Point is a narrow headland which extends for 10km into Donegal Bay and Doorin Point

lies around 6km to the east, protruding around 8km (Figure 1). This area contains evidence of over 6000 years of

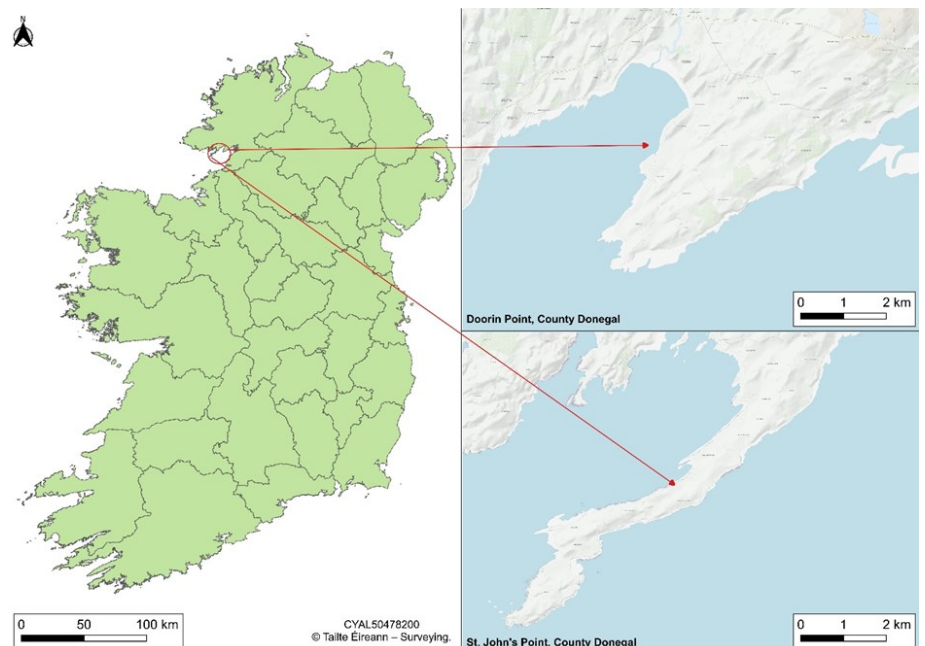


Figure 1. Site Location.

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cultural activity - from a burial cairn, to a medieval castle, to a Napoleonic signal tower - indicating a high potential for a variety of known and unknown sites to be vulnerable to sea level change and erosion. Intertidal and coast edge surveys in 2024 and 2025 revealed the extent of this resource along with their condition, vulnerability, and importance. This led to making recommendations as to how to record these features in more detail before being lost to erosion. This varied from recommending taking no further action, monitoring, excavation, and geophysical survey to undertaking aerial surveys. The 2025 AARG Fund award allowed a return to St. John's Point to undertake Uncrewed Aerial Vehicle (UAV) survey around some of these newly identified features and plan to record already known vulnerable sites identified during the Doorin Point survey. These surveys record the extent and size of features identified in the Coastal Zone Assessment (CZA), and are a baseline against which future surveys can assess how climate change is affecting the cultural heritage along the Atlantic coast.

Site Background and Previous Investigations

According to the Sites and Monuments Record (SMR) (www.archaeology.ie), there are 51 recorded monuments located along the headland of St. John's Point (Figure 2). The ruins of the late medieval McSwyne's or McSweeney's Castle on a 20m-wide promontory had been highlighted as particularly vulnerable to erosion and of high cultural value to the local community. The likelihood of further heritage under threat led, in 2024, to a CZA of the headland funded by the Royal Irish Academy (RIA). This recorded 138 features and reported the first artefacts found in the topographic archive for this section of coast (Pollard *et al.*, 2024a). CZAs involve desk-based assessment, archaeological and geological field survey to identify and assess archaeological potential and risk to coastal cultural heritage. UAV modelling of the castle and an associated friary on the headland took place as part of this earlier survey as these sites were

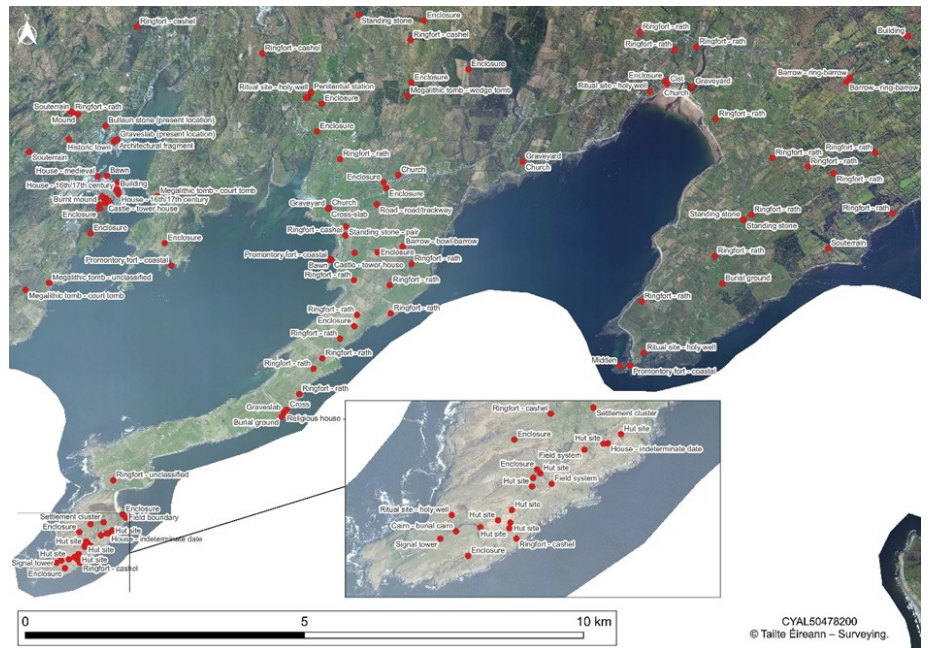


Figure 2. Aerial Image of St. John's Point and Doorin Point with Recorded Monuments (after www.archaeology.ie).

already known to be vulnerable. These showed surrounding settlement, graveyard, and landing places. Photogrammetry of the eroding cliff at the castle recorded a complex sequence of use before the castle was built, including occupation, shell middens, and abandonment in the form of building collapse.

Recommendations from this CZA informed the undertaking of a campaign of UAV survey in 2025 to record a further four sites encompassing about 30 features that were identified as being of high cultural value and under threat of erosion. The objective was to record sites before they are lost to erosion and look to identify further features where components were only detectable in the eroding cliff or partially exposed on the intertidal zone. This wider view will help understand the erosional processes affecting identified features in the form of caves, slumping, and landslides. In 2025, the follow-on CZA around the neighbouring Doorin Point, which lies about 6km to the west of St. John's Point (see Figure 1), assessed a further 214 features, of which two areas were chosen for UAV recording.

The UAV Survey

In 2025, six shoreline areas were surveyed around St. John's Point and Doorin Point. Around St. John's Point, these were a harbour associated with a medieval church site, a slag heap area (probably early medieval), an early medieval ringfort or rural settlement enclosure, and an undated harbour enclosed by a boulder spit with walls, cleared shores, boat channels, and a cairn. As part of the Doorin Point survey, two areas encompassing a promontory fort and possible Bronze Age cairns were also recorded with UAV.

The surveys recorded the extent of the eroding intertidal and coastal features associated with these sites by taking oblique aerial images and, through photogrammetry, produced Digital Elevation Models (DEM) of the landscape. The UAV survey was undertaken using a DJI Matrice 4E with ground control points surveyed using a Trimble R12i GNSS operating with the Trimble VRS now RTK corrections (Figure 3). To make the most of the daily tidal cycle, the UAV survey recorded the foreshore sites around the low spring tides so the intertidal features could be recorded. The sites which had

more features on the eroding cliff and above the high water mark (HWM) were investigated when the tide was higher and it was no longer optimum to record the intertidal areas.

Site 1: Killaghtee Harbour

In the townland of Killaghtee, on the NW side of St. John’s Point, is a later medieval church with a 7th-century cross-inscribed slab in the graveyard. A bay 300m to the west is associated in local tradition as the landing place of the church. The CZA recorded an artificially cleared shore and a drystone pier within the bay. The drone was flown over the bay, covering surrounding scrub, grass-land, and marsh mostly used by sheep, up to the old railway line (Figure 4). The orthoimage and relief-shaded DEM extend for about 300m along the coast and about 100m out to sea beyond the bay mouth, revealing the outline of a stone pier at the mouth of the bay and an artificially cleared shore (Figure 5). The artificially cleared shore is largely covered over by seaweed within the bay but appears to be continuing lower than the pier below the low water mark (LWM). The pier emanates from the bedrock on the southern side. Stonework of a section of the pier can still be seen along the eastern side with other areas covered in seaweed or collapsed.

The traceable area of pier is at least 19.63m long x 6.3m wide, with the most intact walling found along the eastern landward side for 5.4m. It has the potential to be up to c. 27m in length with the intertidal bedrock leading up to the eroding cliff. Within the bay the cleared shore could be up to 22m wide in a SW direction for 68m, though seaweed has grown on loose larger stones that have washed in since abandonment. On the seaward side of the pier, the clearing is about 20m wide extending for about 70m in a SW direction.

Site 2: Templesoogagh (iron smelting)

In 2024, an eroding slag heap was identified near the SW point of the headland, extending for 3m along the cliff (Figure 6). The placename



Figure 3. Working shot: UAV launch at the Scar.

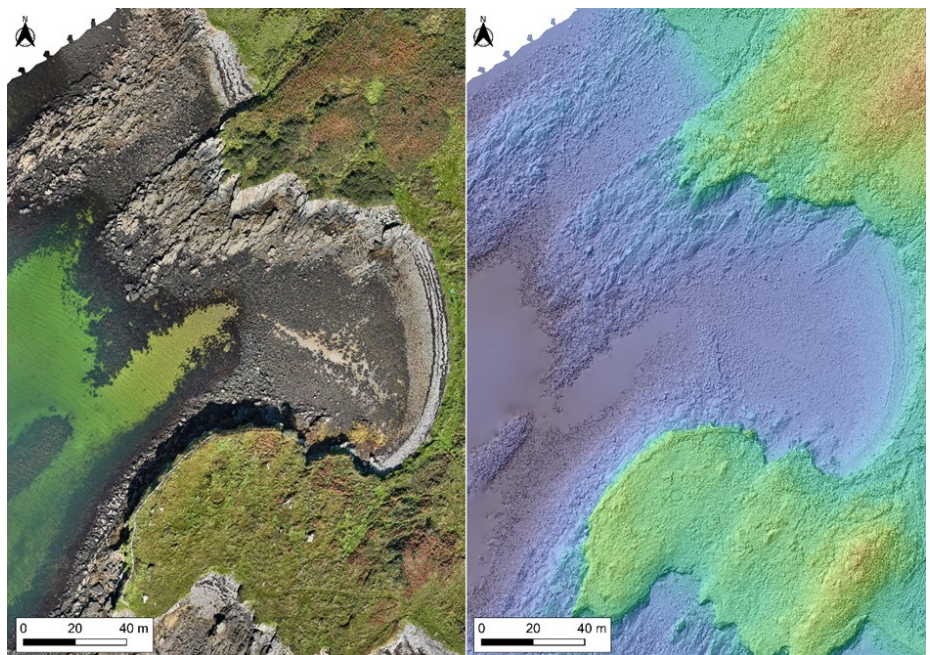


Figure 4. Killaghtee Harbour: UAV-derived Orthomosaic (left) and Relief-shaded DEM (right).



Figure 5. Oblique Aerial View of Killaghtee Harbour stone pier and artificially cleared shore.

‘Templesoogagh’ suggests a medieval stone church (Hurley, 1979). A layer of burning of the glacial clay can be seen in the cliff stratigraphy below the slag. To date, only one other early medieval slag heap has previously been recorded in Ireland; thus indicating the importance of this discovery at St. John’s Point. Also visible are ridges running perpendicular to the shore that could be lazy beds. In addition, the DEM shows a mound extending about 3.45m landward from eroding coast at the position of the slag heap (Figure 7). It possibly widens to c. 6.3m diameter parallel to the shore. The DEM and obliques suggest flat areas in the grass on the western slope of the hill landward and on a terrace as the hill slopes to the SW. The widest area is on the hilltop, about 20m in diameter and located c. 25m from the slag heap.

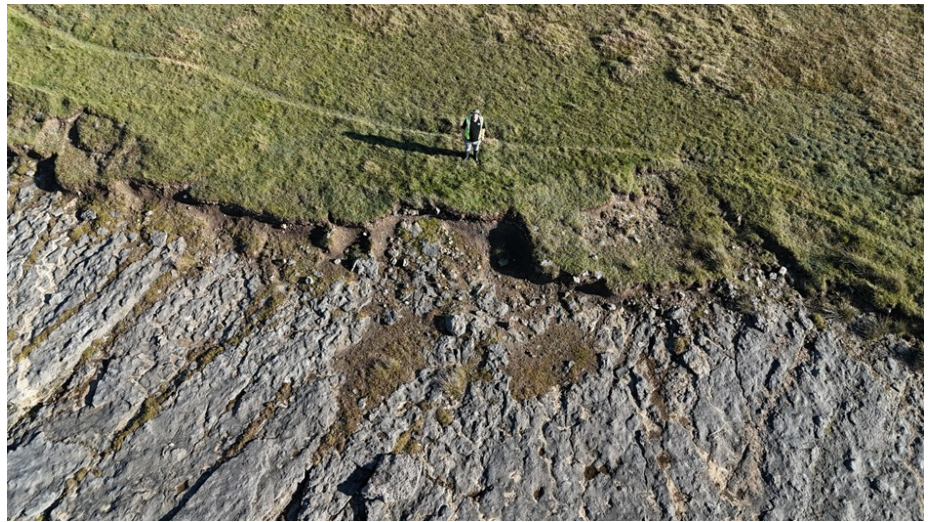


Figure 6. Archaeologist above the slag mound at Templesoogagh.

Site 3: Menamny Ringfort (SMR: DG098-024)

On the eastern side of St. John’s Point are two ringforts actively slumping off the glacial till cliff. These would be circular enclosures associated with rural medieval farming and perhaps fishing. They measure c. 30m in overall diameter. The ringfort at Ballysaggart (DG098-030) was investigated by aerial survey in 2024, as recommended in the CZA, as part of the survey around the nearby friary (Pollard *et al.*, 2024a). The aerial survey in 2025 recorded the erosion around another ringfort in Menamny townland along with possible internal and external structures.

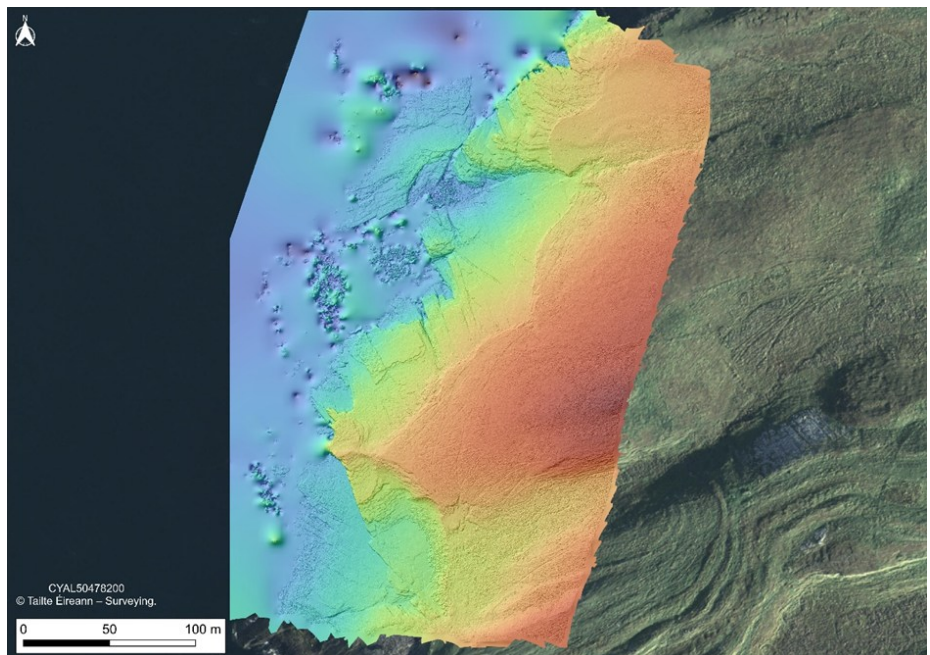


Figure 7. UAV-derived Relief-shaded DEM of Templesoogagh.

The ringfort is raised above the wetter surrounding grassland. The orthoimage shows the surrounding field systems in addition to older areas of slumping on the lower cliff slopes to the south of the ringfort where larger bushes have had time to grow (Figure 8). The most recent slumping is on the northern side of the ringfort where it meets the field boundary. In all, there is about 35m of slumping slope between the top of the cliff and the HWM.

The DEM shows a bank around the ringfort, which is more obvious on the eastern side (Figure 9). The surrounding bank is about 4.2m wide. The enclosure is 31.51m wide in diameter but where erosion has taken place, the diameter is

only 22.9m wide. This suggests at least 8m of erosion has occurred of the ringfort. The ditch of the ringfort has been reused in the field boundary and infill can be seen in the cliff as a darker soil against the glacial and ringfort deposits.

Site 4: The Scar Harbour at Ballybodonnell

On the NE side of the headland at Ballybodonnell townland is an intertidal complex (recorded in the 2024 survey), consisting of a metallised surface, seven artificially cleared shores and intertidal walls, two boat

channels cut through a boulder spit, and a stone cairn (Figure 10). An artificially cleared shore to the north of the boulder spit is still in use today by fishermen who remove the stones that have washed in after storms. The south-orientated boulder spit, which is orientated at 45° to the shore encloses a sandier substrate harbour within the feature as the spit curves to the southwest seaward. Boat channels or canals were identified cutting perpendicular through the spit, appearing as linear depressions. Similar harbours have been recorded around Orkney and Caithness, suggesting the spread of a maritime tradition (Pollard *et al.*, 2016). The lack of stratigraphy and

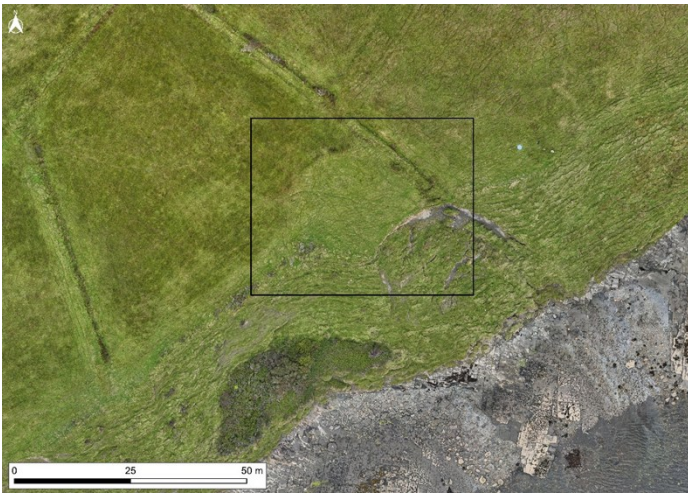


Figure 8. Menamny ringfort: UAV-derived Orthomosaic.

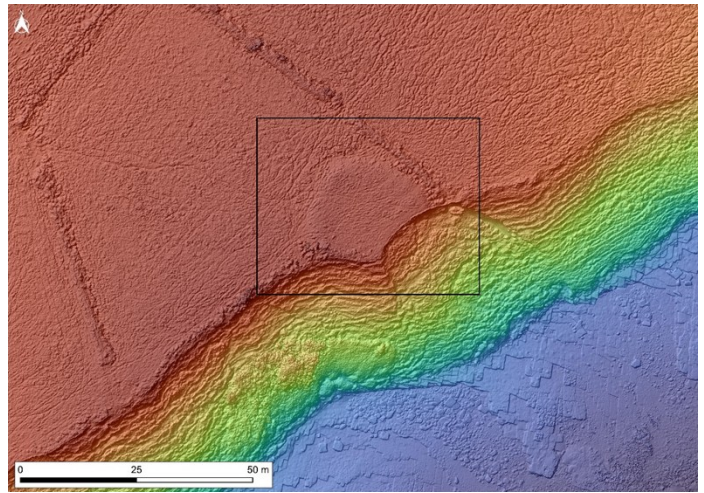


Figure 9. Menamny ringfort: UAV-derived Relief-shaded DEM.

artefacts makes the date of construction unclear, but medieval fishing activity and control of the sea routes has been suggested. The photogrammetry and modelling of this section of coast aimed to include neighbouring fields as well as the intertidal features to determine any relationship between settlement and sea access.

Features recorded in the 2024 survey are marked on the orthomosaic and DEM (Figure 11). These show the cleared shores to the north and south of the spit and the channels through the spit. Feature 108, the pier, is 3.342m wide and extends for 7.43m in a NW-SE direction into the boulder spit from the sandy beach near the HWM (Figure 12). This can be identified as two parallel walls perhaps marking the edges of a pier. This pier stone structure begins 13.768m from the HWM cliff to the NW, which may be an indication of how much erosion has occurred since the feature was constructed. The pier leads in the direction of a boat channel (Feature 109), which crosses the boulder spit perpendicular to direction of the spit and feature 108. The boulders have been quarried out of the boulder spit to form this boat channel. The boat channel is 9.5m wide and 35m long extending in a NE-SW direction.

A drystone wall (Feature 110) runs along the line of the boulder spit. This can be identified extending for 32.12m and 1.65m in width though the wall has collapsed as it has not been maintained in this dynamic intertidal environment. It can be traced to almost reaching the



Figure 10. Oblique Aerial View of the Scar Harbour.

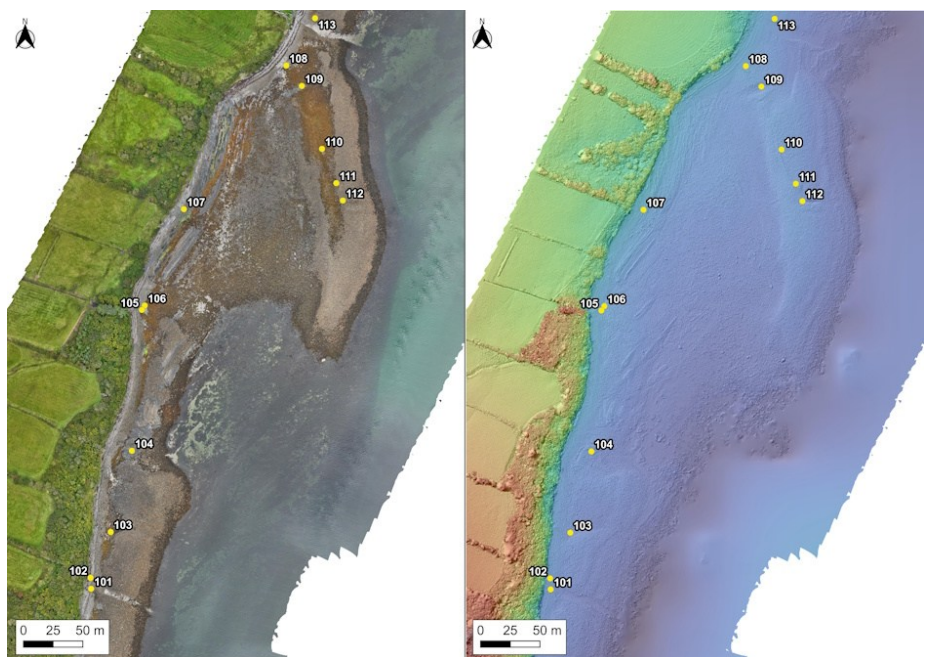


Figure 11. The Scar Harbour: UAV-derived Orthomosaic (left) and Relief-shaded DEM (right).

cairn (Feature 111), finishing about 3m to the north. The cairn, which has a depression on the northern side, measures 8.75m in diameter and is positioned at the highest area of the spit. The second boat channel (Feature 112) only survives today as 20m long x 2.75m in an EW direction across the spit; the spit is about 66m wide. Feature 112 runs to about 7.5m south of the cairn. A similar channel may be 5m south of Feature 112 but has now been partially filled in with boulders from lack of use since the abandonment of this harbour.

Further south, within the harbour, and even for 250m beyond the boundary of the spit, is evidence of further artificially cleared shores for landing boats. Feature 107 is a cleared area of shingle about 6m wide and 21m in length. Features 105 to 106 are an intertidal wall and a 6.06m wide artificially cleared shore just north of where a modern access has been made. Stone boulders mark the sides of feature 104 that was a landing place, measuring 6.23m wide and 13.57m in an EW direction, across flat sloping bedrock. Feature 101, which is a cleared shore 6.5m wide and extends for 51.72m in a SE direction, has traces of a wall. Although Feature 101 is clearer than feature 103, which suggests more recent use, Feature 103 is more traceable on the orthoimage where it is filled by seaweed nearer the HWM. However, both have overgrown HWM areas so no direct shore access, which suggests a long period of abandonment.

Site 5: Doorin Point Promontory Fort (SMR: DG098-034) and Midden (SMR) DG098-043) at Raneely

An oblique aerial image of the promontory fort at the southern end of Doorin Point can be seen in Figure 13, with the Eagle’s Nest - the islet to the SW of the promontory - visible in the background. A coastal promontory fort is a natural headland that has been modified by constructing earthworks and/or a stone wall across a promontory neck (Pollard *et al.*, 2024b). The extent of erosion around the surrounding cliffs suggests this was probably joined to the mainland when the fort was probably

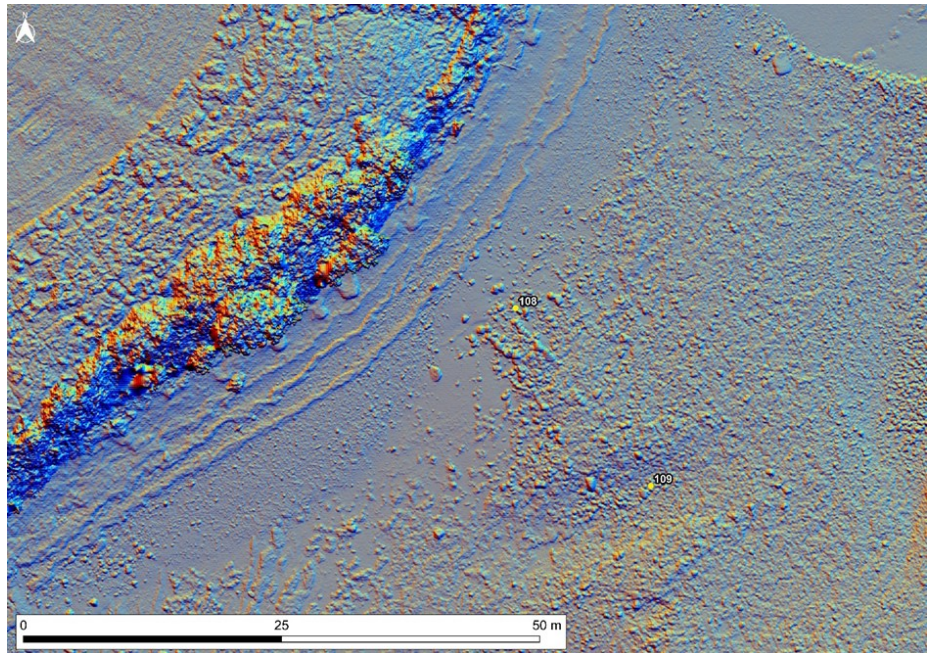


Figure 12. Feature 108 at the Scar Harbour: UAV-derived Multi-directional Hillshade Model.

constructed around 2,000 years ago, though this type of site continued in use into later periods.

Figure 14 shows the orthoimage and DEM of Doorin Point. The water was very clear, so the surrounding intertidal zone can be seen even though the survey was undertaken during mid tide. The quarried landing place (Feature 106) can also be seen where rock has been removed at a different angle to the bedrock jointing, although it has been filled by boulders since the last time it was in use. This measures 15.76m wide and extends in a SW direction for about 92m. Also evident is the ditch that drains the site

of the Friar’s Well (Feature 212). The presence of a holy well near the promontory fort increases the significance of the site as the inhabitants would have controlled access to this venerated site as well as monitoring the bay.

The promontory fort points SW into the bay with the surface sloping from the NW side down to the SE. The embankments at the landward end extend for about 33m NE-SW. The three banks can be seen clearly but it is noticeable that the inner bank is higher and wider than its continuation to the south. This could indicate that the bank has included an earlier Bronze Age



Figure 13. Oblique Aerial Image of Doorin Point Promontory Fort.

mound in its construction or is a lookout post over the landing place, fort entrance, and surrounding sea. This would make it a similar feature to St. John's Mount, a distinctive cairn near the southern end of St. John's Point. The causeway across the banks heads towards the mound but then turns south and crosses the inner bank to the south of the mound.

The possible mound is 18m in diameter. Excluding this wider section as part of the embankments, the embankments measure about 31m in width. At the neck of the promontory fort, the embankments measure 19.9m at their narrowest. The crest of the inner embankment is about 9.7m to the centre of the inner ditch. It is about 4.04m from the crest of the middle embankment to the centre of ditch to the north. It is about 4.2m from the crest of the outer embankment to where the land begins to slope up again to the NW where the fence and farmland is though whether there ever another ditch here is unclear.

The Eagle's Nest has grass-covered soil for 38.18m by up to 13.65m. Most of this width is steep cliff with only about 1-2m flat terrain. In the DEM, slumping can be seen around the shell midden and hut site wall on the Eagle's Nest.

Site 6: Hall Demesne Hut Site and Cairns (SMR: DG099-020, DG099-021, DG099-024)

At Hall Demesne, a 750m long sand spit has formed at the mouth of Eddrim Creek. A sand dune system has grown on this spit, which is being eroded by river and wind exposing blow outs. This was a target for the UAV survey due to eroding cairns, a hut site, and records of human bones being exposed in the SMR and National Museum of Ireland topographic records. The 2025 survey recorded further intertidal cairns, shell middens and cart tracks on the foreshore.

The orthomosaic and DEM of the island produced from the UAV survey can be seen in Figure 15. Although there is collapse of the sand dune covering the site, the hut site was measured at 5.271m to 6.825m in external diameter, and 3.184m to 3.242m in internal diameter.

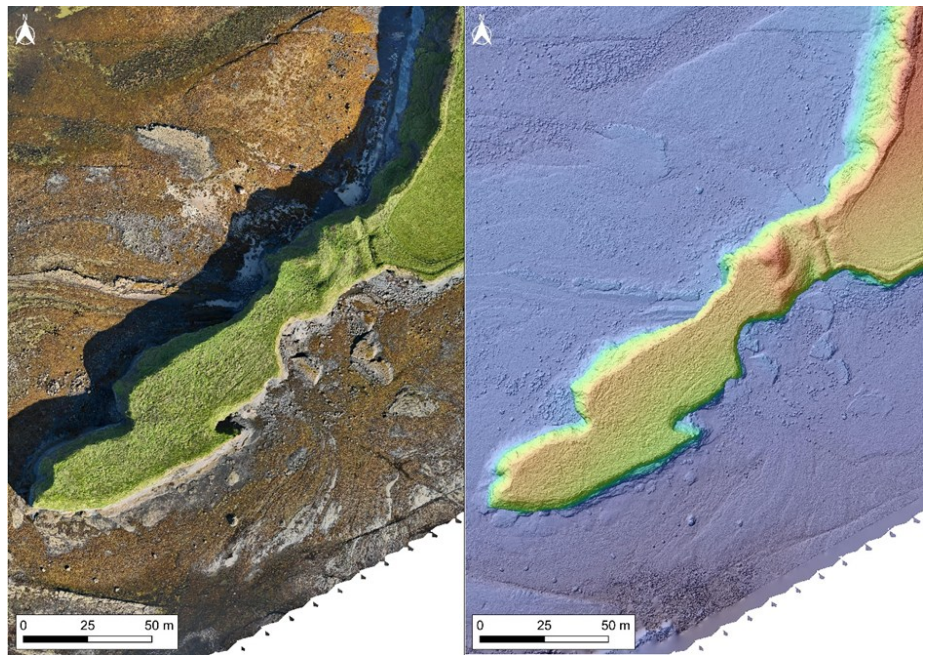


Figure 14. Doorin Point: UAV-derived Orthomosaic (left) and Relief-shaded DEM (right).

The wall width of the hut site is 1.19m. Hut sites and cairns may date from the Bronze Age but there is also an historical record of medieval monastic activity along the shore in this area (Meehan, 2005: 48).

A further row of intertidal cairns can be seen protruding into the entrance of Eddrim Creek (Figure 16). This is at the eastern end of the sand spit where the Eddrim river flows out

towards Donegal Bay. These were measured from the highest, closest to the HWM, in a seaward direction as 4.06m diameter (Feature 184), 4.40m diameter (Feature 180), 3.93m diameter (Feature 181), and 3.59m diameter (Feature 182). It can be suggested that these cairns marked the depth of water at the entrance so boats knew when they could sail into the creek or knew when it was possible to cross the ford across the

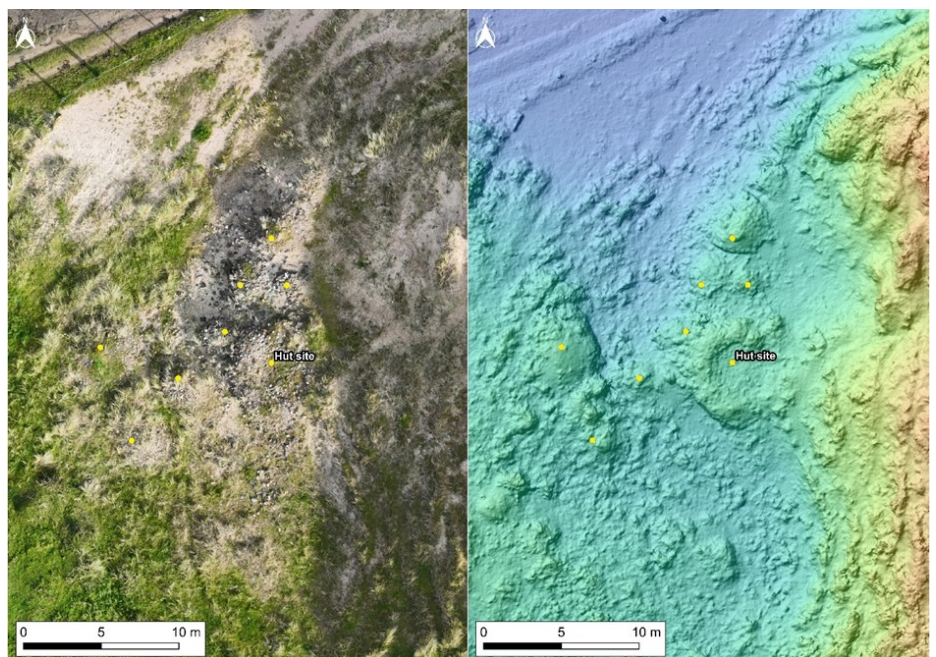


Figure 15. Hut Site at Hall Demesne: UAV-derived Orthomosaic (left) and Relief-shaded DEM (right).

river eastwards. The cairns are just to the south of a cleared shore where boats may have landed, waiting to cross the river at high tide or sail out into the bay.

Discussion

The UAV surveys undertaken at St. John's Point and Doorin Point provide an important high-resolution record of vulnerable coastal archaeological landscapes that are increasingly threatened by erosion, sea level change, and climate change. The integration of orthomosaics and DEMs has allowed the identification and measurement of archaeological features that are partially obscured on the intertidal zone and coast edge. These datasets not only document the present condition of the sites but also establish a baseline against which future change can be monitored.

A key outcome of the survey is the demonstration of how coastal geomorphological processes are actively impacting archaeological remains across a range of site types, from medieval harbours to promontory forts. Evidence of slumping, cliff retreat, dune blow outs, and the movement of intertidal sediments was visible at several locations. At Menamny ringfort, for example, the DEM indicates that approximately 8m of the enclosure has already been lost to coastal erosion. This provides a quantifiable measure of landscape change affecting a known monument and illustrates the vulnerability of ringforts located on glacial till cliffs.

The survey also demonstrates the value of aerial recording for identifying features that are difficult to observe at ground level. At Killaghtee Harbour, the orthomosaic imagery revealed more completely the extent of the intact and collapsed parts of the pier and associated artificially cleared shore, much of which is obscured by seaweed. The continuation of the cleared shore below the low water mark suggests that the harbour infrastructure extended further into the intertidal zone than previously recognised. This supports the interpretation of the bay as a structured landing place associated with the nearby ecclesiastical site and highlights the

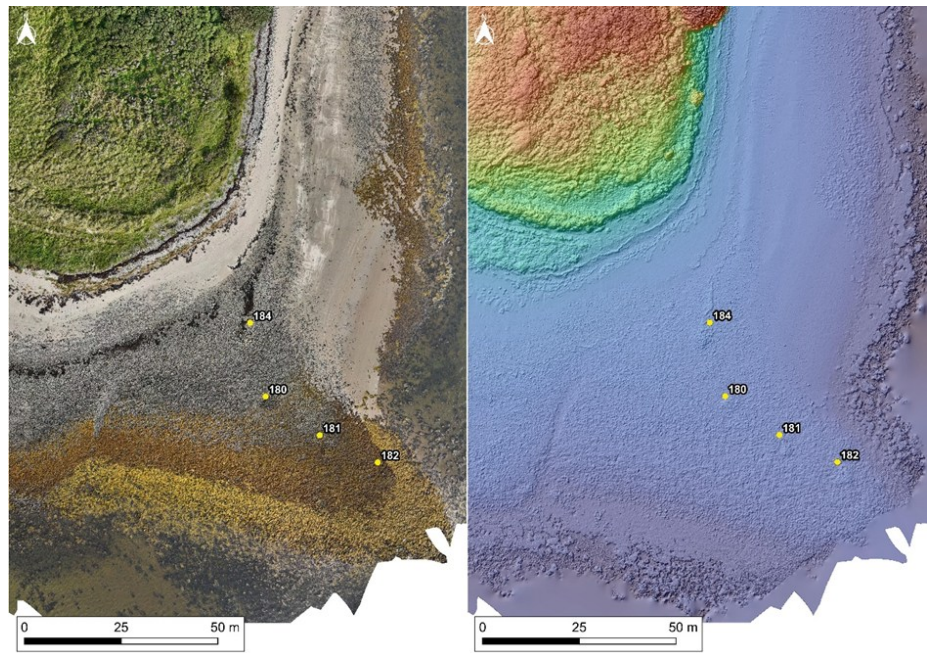


Figure 16. Intertidal Cairns at Hall Demesne: UAV-derived Orthomosaic (left) and Relief-shaded DEM (right).

importance of maritime access for coastal religious communities.

Similarly, the complex harbour system at Ballybodonnell, known as the Scar, illustrates a sophisticated adaptation to a dynamic coastal environment. The presence of cleared shores, boat channels cut through the boulder spit, and intertidal walls suggests a complex designed to facilitate landing, launching, and sheltering of vessels. Moreover, comparable features recorded in northern Scotland indicate the possibility of shared maritime practices across the North Atlantic seaboard. The absence of artefactual or stratigraphic evidence makes precise dating difficult; however, the scale and organisation of the features support interpretations of sustained fishing or trading activity, potentially during the medieval period.

The identification of an eroding slag heap at Templesoogagh is particularly significant given the rarity of early medieval iron-smelting evidence in Ireland. The presence of burnt clay beneath the slag deposits suggests in situ industrial activity rather than redeposited waste. If confirmed through further investigation, this would provide valuable insight into small-scale iron

production within coastal rural landscapes associated with the 'temple' placename suggesting ecclesiastical presence.

At Doorin Point, the UAV survey provides a clearer understanding of the promontory fort's defensive earthworks and its relationship to surrounding landscape features. The triple embankments at the neck of the promontory demonstrate deliberate fortification of the natural headland, while the proximity of a landing place and the Friar's Well suggests that the site may have controlled both maritime access and a location of ritual significance. The possible incorporation of an earlier prehistoric mound within the inner embankment raises the possibility of multi-period occupation.

The surveys nearing the estuary at Hall Demesne illustrate a different but equally significant form of coastal archaeological vulnerability. Here, wind erosion and river action within a dynamic dune system are exposing cairns, hut sites, and shell middens. The presence of aligned intertidal cairns near the entrance to Eddrim Creek suggests they may have functioned as navigational markers or tidal indicators for boats approaching the estuary. Such features demonstrate how coastal communities structured the maritime

landscape not only through harbours but also through navigational aids integrated into the natural environment.

Taken together, the results highlight the diversity of cultural activity along the Donegal coastline, ranging from prehistoric funerary and settlement sites to medieval maritime infrastructure and industrial activity. However, these same locations are now among the most vulnerable to environmental change. The UAV methodology proved particularly effective for documenting complex coastal sites, allowing rapid recording of

large areas during optimal tidal conditions and generating precise spatial data that would be difficult to obtain through traditional survey methods alone. Nevertheless, UAV surveys are limited in their ability to provide chronological information or subsurface detail. Therefore, further investigation through targeted excavation, geophysical survey, and environmental sampling is necessary to refine interpretations and establish a clearer chronology.

Acknowledgements

We are grateful to the Aerial Archaeology Research Group (AARG) who provided funding for the drone surveys through the AARG Fund in 2025. The coastal zone assessments were grant-aided by the Royal Irish Academy Archaeology Research Grants, funded by the National Monuments Service. Thanks to the communities and landowners for their sharing of local knowledge and permission to survey.

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Publications of Interest:

October 2025 to March 2026

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Introduction

The following collection of 90 articles published between October 2025 and March 2026 may be of interest to the aerial archaeology community. A few articles that were missed by the previous compilation² have also been included.

Articles were identified using various search engines (lens.org, [Google Scholar](https://scholar.google.com), [Google Scholar Labs](https://labs.google.com)) and the online tables of contents of key archaeological journals (*AARGnews*, *Antiquity*, *Archaeological Prospection*, *Journal of Field Archaeology* and *Journal of Archaeological Science*). Whilst it is not guaranteed to be an exhaustive search of the literature published during this period, it nevertheless provides an indication of recent research in the field.

For convenience, the articles have been classified into the six subject areas that were used in the previous compilation, although inevitably many span one or more areas:

- AI and Machine Learning;
- Lidar and UAV-Based Surveys;
- Satellite Imagery and Synthetic Aperture Radar;

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A collection of 90 recent articles that may be of interest to the aerial archaeology community. The time period covered is from October 2025 to March 2026.

- Aerial Photographs and Photogrammetry;
- GIS and Landscape Mapping;
- Miscellaneous and Interdisciplinary Studies.

Each article includes a brief AI-assisted summary along with a hyperlink to the published version of the article. The majority of the articles (>80%) are open access and are indicated by ; those residing behind a paywall are indicated by a .

1. AI and Machine Learning

A Deep Learning Method for the Automated Mapping of Archaeological Structures from Geospatial Data: A Case Study of Delos Island

Pavlos Fylaktos *et al.*, *ISPRS International Journal of Geo-Information*, 2025, 14(6), 220.

Summary: This study showcases how artificial intelligence, particularly Mask R-CNN convolutional neural networks within a GIS framework, and using WorldView-3 satellite imagery can advance archaeological research. The approach proved effective in identifying and segmenting ancient structures on Delos Island, achieving high precision (F1 Score of 0.93% at a 0.9 threshold) and successfully mapping 25.91% of initial vector data. Whilst not a replacement for fieldwork, these automated methods offer substantial support by reducing costs and time. The research also highlights challenges, including the diversity of archaeological remains and difficulties in standardising data libraries, but anticipates further innovation as AI technologies evolve.

² *AARGnews* 71, 38-43 (2025).

Advances in Remote Sensing for Archaeological Prospection: AI-based Computational Analyses and Big Datasets

Hector A. Orengo, *ArcheoSciences* 49, 551-552 (2025).

Summary: Technological advancements have expanded remote sensing for archaeology, increased availability of high-resolution remote sensing data, enhanced computational power and analytical methods for data processing.

AI Chatbots and Remote Sensing Archaeology: Current Landscape, Technical Barriers, and Future Directions

Nicolas Melillo & Agapiou Athos. *Heritage* 9, no. 1: 32 (2026).

Summary: Recent developments in AI and machine learning have significantly enhanced archaeological research, particularly through deep learning methods and remote sensing technologies. Studies demonstrate the effectiveness of convolutional neural networks - such as Mask R-CNN within GIS frameworks - for automated mapping of archaeological structures, achieving high precision and reducing the need for extensive fieldwork. The increasing availability of high-resolution geospatial data and advanced computational analyses has expanded archaeological prospection, though challenges remain regarding data standardisation and the diversity of archaeological remains. AI chatbots and automated methods offer substantial support, reducing costs and time, and are anticipated to drive further innovation as technology evolves.


Archaeological Site Detection: Latest Results from a Deep Learning Based Europe Wide Hillfort Search

Jürgen Landauer *et al.*, *Journal of Computer Applications in Archaeology* 8, 42-58 (2025).

Summary: The study shows that increased access to high-resolution LiDAR data is revolutionising landscape archaeology,


enabling large-scale surveys. By using Convolutional Neural Networks (CNNs) for semi-automated detection, the researchers identified new hillfort sites in England, Germany, and Italy. While automation reduces manual effort and is adaptable to different terrains, expert validation remains crucial for accuracy and managing false positives. The combined use of AI and human review provides an effective and scalable method for archaeological site discovery and heritage management.

Automated Analysis of Slavic Buried Settlements Based on LiDAR Point Cloud, UAV and Image Processing

Klaudia Pasternak & Anna Fryškowska-Skibniewska, [Journal of Cultural Heritage 73, 305-316 \(2025\)](#). 


Summary: This paper presents an automated approach for identifying fortified settlements using laser scanning data from airborne and UAV sources. By analysing Digital Elevation Models and applying shape-based indices to filter out irrelevant structures, the methodology accurately detects settlement contours and vertical profiles. Its effectiveness was demonstrated on historical sites in Poland.

Automatic Detection of Archaeological Features from Airborne Laser Scanning Data using Deep Learning: Development and Evaluation of the ADAF tool

Nejc Čož et al., [Journal of Archaeological Science: Reports 71, 105733 \(2026\)](#). 

Summary: The ADAF tool leverages deep learning to automate the detection of archaeological features from airborne laser scanning data, offering easy accessibility without requiring prior machine learning expertise. Trained on extensive Irish datasets, it identifies enclosures, ringforts and barrows, and can be adapted for use in other regions. Tested on a development corridor in Ireland, ADAF achieved an 84% recall rate and uncovered 116 new potential sites beyond manual detection.


Deep Learning–Based Detection of Ancient Agricultural Terraces Using Multisensor Data Fusion: A Case Study from the Bozburun Peninsula, Turkey

Emin Atabey Peker, [Advances in Archaeological Practice First View 1 – 2 \(2026\)](#). 

Summary: This study demonstrates the use of deep learning, specifically U-Net architectures, to efficiently identify ancient agricultural terraces in the Bozburun Peninsula, Turkey. By fusing high-resolution aerial imagery and elevation data, the early


fusion model achieved notable precision and accuracy in mapping terraces over a large area, outperforming manual methods in precision but with slightly lower recall. The results highlight deep learning's promise for scalable and objective documentation of Mediterranean cultural landscapes.

Evaluating Broadscale Deep Learning for Maya Settlement Detection in G-LiHT Lidar

Benjamin J. Britton et al., [Journal of Archaeological Method and Theory 33, 15 \(2026\)](#). 


Summary: This study presents the development of Q2000, a broadscale deep learning model using Lidar data to detect ancient Maya settlements across the Yucatan Peninsula. Unlike previous localised models, Q2000 efficiently generalises across varied regions, achieving high accuracy and robust performance with a relatively small training set, thereby demonstrating the effectiveness of a pan-Yucatan approach for archaeological feature detection.

Learning Anomalies to Highlight Archaeological Structures in Cluttered 3D Point Clouds: Demonstration on Terrestrial Scans of Desert Kites

Reuma Arav, [ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences., X-M-2-2025, 13–20 \(2025\)](#). 

Summary This paper outlines a machine learning approach to automatically highlight archaeological features in 3D point cloud data, addressing the common issue of such features being overlooked or removed during digital terrain modelling. By learning to reconstruct the surface from the raw data and identifying anomalies - areas where reconstruction errors are large - the method effectively marks regions likely to contain archaeological structures. The technique is demonstrated on terrestrial laser scans of desert kites across the Middle East and Central Asian arid and semi-arid regions, showing it can reveal these features without requiring expert input or labelled training data.


Mapping Hidden Heritage: Self-Supervised Pre-training on High-Resolution LiDAR DEM Derivatives for Archaeological Stone Wall Detection

Zexian Huang et al., [Science of Remote Sensing 13, 100372 \(2026\)](#). 

Summary: This study introduces DINO-CV, a self-supervised framework that leverages high-resolution airborne LiDAR


data to efficiently map historic dry-stone walls, overcoming challenges posed by dense vegetation and limited labelled data. Tested at the Budj Bim Cultural Landscape in Australia, the method demonstrates strong mapping accuracy and scalability, offering promising applications for both archaeological and environmental monitoring in difficult-to-access areas.

Semi-automated LiDAR Vegetation Classification for Mediterranean Archaeology: Designing a Pipeline Leveraging a Multi-Layer Stacked Ensemble Approach

Nicola Lercari et al., [The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-M-9-2025, 821–826 \(2025\)](#). 


Summary: This paper introduces a new machine learning pipeline for semi-automated classification of vegetation in drone-based LiDAR point clouds from Mediterranean archaeology. By combining feature engineering, ensemble classifiers, and deep learning, the method achieves high accuracy in distinguishing vegetation from archaeological structures, improving the mapping and visualisation of hidden heritage features in densely vegetated landscapes.

Semi-automatic Detection of Building Stones and Wall Segments of Archaeological Ruins

Erel Uziel et al., [Journal of Archaeological Science 185, 106430 \(2026\)](#). 

Summary: This study introduces a semi-automatic approach that utilises drone imagery and deep learning to identify building stones and wall segments in archaeological sites. The method produces georeferenced layers for individual stones and site plans, demonstrating reliable performance across diverse landscapes and conditions. These digital outputs facilitate further analysis of construction styles and site layouts, supporting broader archaeological research. Pre-trained models are provided for immediate application and refinement.

Visual Foundation Models for Archaeological Remote Sensing: A Zero-Shot Approach

Jürgen Landauer & Sarah Klassen, [Geomatics 5, no. 4: 52 \(2025\)](#). 

Summary: This study evaluates visual foundation models using a zero-shot approach for detecting archaeological features in remote sensing data. The models are tested on satellite imagery, aerial LiDAR, and drone video, showing comparable results to human experts and standard automated methods. Notably, this method reduces the need for human

intervention and training data, providing open-source tools for reproducibility and suggesting a scalable workflow for future remote sensing projects.

2. Lidar and UAV-Based Surveys

A UAS Lidar Case Study in the Archaeological Landscape of Ancient Halos, Greece

Jitte Waagen *et al.*, *Journal of Greek Archaeology* 10, 149–163 (2025). [📄](#)

Summary: This paper outlines the technical approach and initial findings from UAS lidar surveys at ancient Halos, carried out collaboratively by several institutions. The study focuses on mapping diverse archaeological features - including burial sites, settlements, fortifications, and infrastructure - which represent human activity from the Neolithic period onwards.

Adopting an Open-Source Processing Strategy for LiDAR Drone Data Analysis in Under-Canopy Archaeological Sites: A Case Study of Torre Castiglione (Apulia)

Nicodemo Abate *et al.*, *Remote Sensing* 17, no. 7: 1134 (2025). [📄](#)

Summary: This study presents an open-source machine learning approach using UAV LiDAR data to improve the detection and visibility of archaeological features at Torre Castiglione, Italy. By applying a Random Forest algorithm to segment vegetation from ground and structures, the methodology enhances site interpretation and reveals hidden details under dense canopy, demonstrating both effectiveness and user-friendliness for documenting challenging archaeological landscapes.

Aerial Remote Sensing for Precision Archaeology Using RGB–Multispectral Image Fusion of UAS Data

Dimitris Kaimaris, *Drones and Autonomous Vehicles* 3(2), 10009 (2026). [📄](#)

Summary: This paper presents a reproducible workflow for documenting archaeological sites using unmanned aircraft systems (UAS) combined with advanced image processing techniques. The approach integrates RGB and multispectral (MS) imagery through a sophisticated fusion method that significantly enhances the documentation capability of archaeological investigations.

Assessing the Effectiveness of UAV Photogrammetry, Terrestrial Laser Scanning and iPad LiDAR for Complex Cultural Heritage Sites Documentation and WEB-Based VR Visualization

Abdurahman Yasin Yiğit *et al.*, *Archaeological Prospection* 33, 229–256 (2026). [📄](#)

Summary: This study examines Avdalaz Castle's documentation challenges and solutions, highlighting its architectural and cultural significance. By comparing UAV photogrammetry, terrestrial laser scanning and iPad LiDAR, the research demonstrates how integrating these methods enables comprehensive recording of complex features. The resulting 3D model, visualised in a web-based virtual environment, improves accessibility and supports digital preservation for both researchers and the wider public.

Comparative Analysis of UAV-based LiDAR and Photogrammetric Systems for the Detection of Terrain Anomalies in a Historical Conflict Landscape

Marcel Storch *et al.*, *Science of Remote Sensing* 11, 100191 (2025). [📄](#)

Summary: This study evaluates three UAV-based systems - two LiDAR scanners (RIEGL miniVUX-1UAV and DJI Zenmuse L1) and an optical camera (SfM photogrammetry) - for detecting terrain anomalies in historical conflict landscapes. Results show that lower-cost systems can rival high-end LiDAR in areas with sparse vegetation, but all methods struggle under dense vegetation, with the RIEGL miniVUX-1UAV consistently delivering the best performance. The SfM approach is suitable only in specific, less vegetated scenarios, highlighting the limitations and advantages of each technology for archaeological documentation.

Comparing Lidar Analysis and Field Documentation in Archaeological Surveys: Feature Recognition, Quantification, and Land-use Modeling with the Small Cycladic Islands Project

Alex R. Knodell *et al.*, *Journal of Greek Archaeology* 10, 49–69 (2025). [📄](#)

Summary: Between 2019 and 2024, the Small Cycladic Islands Project (SCIP) conducted extensive surveys of 87 uninhabited Cycladic islands. In 2022 and 2023, lidar data was collected over 97 islands to enhance previous survey results, guide future fieldwork, supplement existing research on well-studied islands, and cover inaccessible areas, thereby broadening archaeological understanding across the archipelago.

Comparison of DJI Zenmuse L1 and RIEGL miniVUX-3UAV Data for DTM Generation in the Forestry Area for Archaeological Purposes

Magdalena Pilarska-Mazurek *et al.*, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-1/W4-2025*, 103–108 (2025). [📄](#)

Summary: This article compares Digital Terrain Models (DTMs) generated from point clouds using two UAV-mounted laser scanners - DJI Zenmuse L1 and Riegl miniVUX-3UAV - in forestry areas. The study finds that while high accuracy is not always necessary, the DTMs produced offer enhanced ground detail, supporting more thorough archaeological analysis.

Detection and Documentation of a Submerged Neolithic Pile Dwelling Settlement using Airborne Laser Bathymetry and Multimedia Photogrammetry - A Case Study at Lake Mondsee

Katharina Riederer *et al.*, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-2/W10-2025*, 247–254 (2025). [📄](#)

Summary: This study compares airborne laser bathymetry (ALB) and multimedia photogrammetry for documenting a submerged Neolithic pile dwelling settlement in Lake Mondsee, Austria. The findings show that ALB, using a UAV-mounted laser scanner, is more effective for detecting small underwater features at greater depths, whereas photogrammetry is limited by water conditions and is best suited for identifying larger structures in shallow areas. Overall, ALB is confirmed as the more reliable method for detailed underwater archaeological surveys in moderately turbid lakes.


Developing Reproducible Lidar Classifications for Greek Archaeology: Assessing an Area-based Verification Strategy for Lidar-based Archaeological Prospection in the Cyclades, Greece

Brody W. Manquen *et al.*, *Journal of Greek Archaeology* 10, 70–87 (2025). [📄](#)

Summary: In the past ten years, archaeologists globally have increasingly adopted lidar technology, especially for mapping areas beneath dense vegetation. While its use has expanded, expertise with lidar remains uneven across regions. Early applications in the Maya Lowlands highlighted its transformative potential and ongoing research has led to more sophisticated uses, such as studying social inequality and ancient land use. The field has


also progressed by refining survey methods and addressing challenges from initial missteps, notably in data verification and classification.

Drone and Airborne Lidar in Greece: a Mediterranean Perspective on Processing Techniques and Cultural Landscapes

Jesús García Sánchez *et al.*, [Journal of Greek Archaeology 10, 197–214 \(2025\)](#). 


Summary: Landscape research in the Mediterranean has progressed through various theoretical approaches, from early studies influenced by Annales and New Archaeology to postcolonial and post-processual perspectives that offer richer insights into ancient societies. Technological advancements, particularly the rise of geospatial data and lidar, have shifted the focus from simply managing field data to using digital datasets as primary sources for archaeological and historical investigation. Both digital and traditional field data are now regarded equally as archaeological evidence, with aerial photography and lidar being key tools in landscape research.

Drone-based Laser Scanning for Improved Archaeological Surveys in Heavily Vegetated Zones: A Roman Coastline Case Study

Luca Alessandri *et al.*, [IEEE 12th International Workshop on Metrology for AeroSpace \(MetroAeroSpace\) \(2025\)](#). 


Summary: This paper discusses how advances in drone-based laser scanning, particularly with miniaturised sensors, are transforming archaeological surveys in densely vegetated areas. A case study near Rome used a drone-mounted LiDAR to investigate suspected human-made landscape features obscured by thick vegetation. While the technology offers high resolution, filtering out non-ground points remains challenging due to limited laser echoes. The study is exploring optimal filtering methods to improve ground point detection, with early findings highlighting the importance of laser echo strength and frequency for successful results.

Drone-Based Magnetometer Survey of Roman Forts in the Northern Black Sea Area (Ukraine)

Kseniia Bondar *et al.*, [AARGnews 71, 22- 26 \(2025\)](#). 

Summary: A UAV-based magnetometer has been used to enable the efficient and detailed survey in Ukraine of two plough-levelled Roman forts, one of which was previously undocumented, thereby contributing valuable data for archaeological interpretation and preservation planning.

Enhancing Quarry Landscape Interpretation With UAV LiDAR and Morphometric Clustering: A Case Study from the Euganean Hills, Italy

Josiah Olah *et al.*, [Journal of Archaeological Science 186, 106478 \(2026\)](#). 


Summary: This study introduces a workflow for interpreting archaeological landscapes in their early stages by using UAV-mounted lidar, advanced digital terrain models, clustering techniques, and ground validation. Applied in the Euganean Hills of Italy, it enabled the identification and verification of numerous quarry sites, revealing patterns in their morphology and historical exploitation. The method proves especially valuable in challenging, rugged environments, offering a practical and cost-effective approach for rapid archaeological interpretation where traditional aerial data and surveys are limited.

Evaluating the Absolute Accuracy of UAV RTK Photogrammetry and LiDAR for 3D Cultural Heritage Documentation: a Comparative Study of DJI Zenmuse P1 and L1 Systems

Lovre Panda *et al.*, [Applied Geomatics 17, 711-731 \(2025\)](#). 

Summary: This article highlights the importance of 3D documentation for safeguarding cultural heritage against threats such as conflict and climate change. It evaluates the accuracy of UAV-based RTK lidar and photogrammetry systems in capturing detailed 3D data. Findings reveal that aerial photogrammetry using the P1 camera achieves the highest accuracy, while L1 RGB is sufficiently precise for heritage documentation. Additionally, comparative analysis shows the L1 RGB camera outperforms L1 lidar in accuracy by approximately 5cm.


Evaluation of Medieval Land Transformation for the Construction of Hilltop Castles Based on Topographic Analysis of LiDAR DEMs

Risa Terui *et al.*, [Physical Geography \(2026\)](#). 

Summary: This study investigates the influence of medieval hilltop castles on landforms and landslide risk in western Japan. By analysing airborne LiDAR data from 39 castle sites and 39 natural ridges, the researchers found that castle-modified ridges show greater variation in slope and curvature, highlighting their altered


topography. The method developed can help identify previously unknown human modifications to ridges and assess the landslide susceptibility of castle sites.

High Resolution Lidar Mapping of Belgian Historical Forests Reveals Unique Pre-historic and Roman Landscape Features

Erwin Meylemans *et al.*, [ArchéoSciences 2025/1 n° 49-1, 517-520 \(2025\)](#). 


Summary: Recent LiDAR surveys have transformed the ability to detect and map archaeological sites hidden beneath forested areas. In Flanders, this technology has uncovered well-preserved prehistoric and Roman landscapes that were previously concealed. However, ongoing modern forestry practices pose a risk to the continued preservation of these valuable archaeological features.

High-resolution Drone Lidar for Mediterranean Archaeology: Point Classification, Feature Detection, and the Potential for Cultural Heritage Management

Evan I. Levine *et al.*, [Journal of Greek Archaeology 10, 164–184 \(2025\)](#). 

Summary: The use of airborne laser scanning (ALS), or lidar, has revolutionised archaeological research by enabling the detection and mapping of sites hidden beneath dense vegetation. Advances in drone-mounted lidar technology have made high-resolution data collection more accessible and affordable, allowing archaeologists to document landscapes with greater precision and flexibility. This increased availability is fostering new research questions and expanding the scope of lidar-based studies to previously unexplored regions.


Innovative Strategies and Use of UAVs to Survey and Monitor Archaeological Sites in Conflict/Post Conflict Zones. The Case Study of the Fortified Citadel of Shahr-i Zohak in Bamiyan (Afghanistan)

Daoud Bouledroua & Brendan Cassar, [The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-M-9-2025, 171–178 \(2025\)](#). 

Summary: This paper outlines the challenges and strategies involved in using UAV mapping and photogrammetry to model archaeological sites in conflict or post-conflict zones, focusing on the fortified citadel of Shahr-i Zohak in Afghanistan. Despite obstacles such as limited access, unexploded ordnance, equipment portability, and lack of connectivity, the research successfully produced highly accurate 3D models by employing Skydio drones and


careful flight planning. The study demonstrates that UAV-based photogrammetry can provide valuable damage assessments in regions where on-site expertise is difficult to obtain and offers practical recommendations for similar projects in challenging environments.

Integrated Surveying for Architectural Heritage Documentation in Iraq: From LiDAR Scanner to GIS Applications

Gehan Selim *et al.*, [Remote Sensing 17, 3632 \(2025\)](#). 

Summary: This study highlights the pivotal role of remote sensing technologies, particularly lidar-based Terrestrial Laser Scanning (TLS) and GIS, in the digital documentation and preservation of historical monuments. By integrating high-resolution imagery and advanced software, it achieves accurate 3D visualisations of heritage sites. The digital survey of the Shanasheel house in Al-Basrah, Iraq, illustrates how these methods support conservation and risk assessment, facilitating the protection of culturally significant landmarks from urban and environmental threats.

Integration of Magnetic Survey, LIDAR Data, Aerial and Satellite Image Analysis for Comprehensive Recognition and Evaluation of Neolithic Rondels in Eastern Croatia

Rajna Šošić Klindžić *et al.*, [Remote Sensing 17, 3508 \(2025\)](#). 

Summary: Over a decade of monitoring, this study used satellite imagery, aerial surveys, LiDAR data, and geomagnetic prospection to investigate Croatia's first two Neolithic rondels at Markušica Brošov salaš and Gorjani Topole. Satellite and aerial images enabled accurate identification of the sites as Neolithic rondels, while LiDAR and geomagnetic techniques revealed further details invisible from the surface. The research highlights the effectiveness of combining remote sensing and geophysical methods for archaeological detection and interpretation, providing new insights into Neolithic monumentality and land use, and offering a methodological model for future studies in Central and Southeastern Europe.


Issues of Sampling and Representativeness in Large-Scale LiDAR-Derived Archaeological Surveys in Mediterranean Contexts

Giacomo Fontana, [Archaeological Prospection 32, 103-117 \(2025\)](#). 

Summary: This paper reviews the growing use of landscape-scale LiDAR in archaeology, with particular focus on the challenges of sampling and


representativeness in large-scale Mediterranean surveys. Using the Ancient Hillforts Survey in south-central Italy as a case study, it demonstrates significant variability in detecting different archaeological site types with low-resolution, open-source LiDAR data. The authors argue that careful sampling and methodological refinement are essential to minimise bias and ensure more accurate spatial analysis of archaeological distributions.

Lidar and Landscapes in the Archaeology of Greece

Alex R. Knodell & Bonna D. Wescoat, [Journal of Greek Archaeology 10, 1-2 \(2025\)](#). 


Summary: In recent years, lidar technology has been increasingly adopted by archaeological projects in Greece, though its use remains relatively new to the discipline. To foster discussion and collaboration, an international workshop held at the American School of Classical Studies at Athens in March 2024 provided a platform for sharing research, demonstrating widespread interest and diverse applications of lidar in Greek archaeology.

Multispectral Data and LiDAR for Enhanced Georeferencing of Gdanska Glow's 17th-Century Fortifications

Pawel Tysiac *et al.*, [Archaeometry 68, 94-106 \(2026\)](#). 

Summary: This study introduces an innovative remote sensing technique for detecting 17th-century features linked to the historic fortifications of Gdanska Glowa in Poland. By combining multispectral imaging, detailed elevation models, vegetation analysis and machine learning, it identifies subtle traces of former earthworks. The method offers a scalable and reproducible tool for archaeological research, supporting future heritage conservation, though on-site verification is still required.


Remotely Piloted Aircraft Systems (RPAS) for Monitoring Archaeological Sites in Nunavik in the Face of a Changing Climate

Amedeo Sghinolfi *et al.*, [Canadian Journal of Remote Sensing Vol. 52, 2600120 \(2026\)](#). 

Summary: This paper examines the use of remote sensing, particularly Remotely Piloted Aircraft Systems (RPAS) equipped with photogrammetry and lidar sensors, in archaeological research. Surveys conducted in Nunavik, Northern Québec,


demonstrate that photogrammetry is effective in documenting sites impacted by lidar can reveal features obscured by shrubbery. However, lidar's performance is limited in areas with very dense vegetation.

Research, Application, and Innovation of LiDAR Technology in Spatial Archeology

Carolina Collaro & Martin Herkommer, [Encyclopedia of Information Science and Technology, Sixth Edition \(2025\)](#). 


Summary: This article describes a collaborative expedition by the University of Jaén, the University of San Carlos, and Quantum Systems GmbH, which employed LiDAR technology on fixed-wing VTOL drones in Guatemala's Maya Tropical Forest. The study explores the practical advantages and difficulties of using LiDAR in dense, vegetated environments for spatial archaeology, highlighting both the preservation and ongoing degradation challenges faced by Maya sites, as well as the broader implications for digital archaeological methods.

Roman Forts in the Northern Black Sea Area Through the Lens of Drone-Based Magnetometry

Kseniia M. Bondar *et al.*, [Archaeological Prospection 33, 275-287 \(2026\)](#). 

Summary: This study assesses the effectiveness of drone-mounted magnetometers for archaeological surveys in the Northern Black Sea region, focusing on Roman forts. Using DJI Agras T30 drones with SENSYS MagDrone R3 sensors, researchers mapped two sites, reliably detecting ditch structures and confirming unusual fort layouts. The method proved accurate and corresponded closely with ground-based surveys, enabling the identification of new Roman-period features and demonstrating strong potential for large-scale, high-resolution mapping of sites often concealed by agricultural activity.


Standardizing Visualization in Ancient Maya Lidar Research: Techniques, Challenges and Recommendations

Žiga Kokalj, [Archaeological Prospection 32, 967-988 \(2025\)](#). 

Summary: This paper reviews the use of airborne laser scanning (ALS, lidar) for studying ancient Maya landscapes, noting that while lidar offers unparalleled visibility in forested areas, visualisation methods are often inconsistent. It advocates for standardised and reproducible approaches, highlighting the combined VAT technique as robust and suitable for diverse terrains. The paper also recommends best practices for

publishing lidar images, including proper metadata and open-source workflow guidelines, stressing the importance of transparency and standardisation as collaborative projects and national datasets expand.

The Ethics of Aerial Lidar Mapping: A Call for Informed Consent

Christopher L. Hernandez, *American Antiquity* 91, 1-19 (2026). 


Summary: Aerial lidar has transformed archaeological surveys by enabling precise mapping of vast, forested regions, sparking widespread enthusiasm and large-scale data collection initiatives. This article cautions against unchecked expansion, emphasising the ethical concerns of scanning Indigenous territories without meaningful engagement or consent. The author contends that federal permissions are insufficient and calls for culturally sensitive, informed consent from local and descendant communities to counter colonial practices. Using the Mensabak Archaeological Project as an example, the article advocates for collaborative, human-centred approaches to aerial lidar mapping.

Tracing Roman Roads through LiDAR and Aerial Photography: the Case of Via XVIII in the Allariz-Maceda Region

Samuel Ni3n-3lvarez, *Acta Archaeologica* 95, 39-53 (2025). 

Summary: This study examines Roman roads in the Allariz-Maceda region, focusing on via XVIII (via Nova). Employing GIS, aerial photography, and LiDAR terrain modelling, the research aims to trace routes and uncover new connections, benefiting from the area's rich road epigraphy. The methodology includes node analysis and digital models, and the study provides an overview of Roman road features and detailed descriptions of identified sections, interpreting their characteristics in relation to Roman infrastructure standards.


Unveiling Medieval Landscapes: A Virtual Reconstruction Through LiDAR and Extended Matrix Methodology, the Case of Torre di Castiglione (BA)

Gabriele Ciccone *et al.*, *Digital Applications in Archaeology and Cultural Heritage* 39, e00464 (2025). 

Summary: This paper aims to demonstrate how the integration of non-invasive LiDAR data with the Extended Matrix methodology can enhance the scientific rigor and transparency of virtual reconstructions. By applying this approach to the Torre di Castiglione site, the research not only contributes new insights into a little-known

medieval landscape but also expands the applicability of EM to non-destructive archaeological contexts.


Volumetric Study of the Roman Quarries of Rodadero de los Lobos - Piqu3n (C3rdoba Mountain Range) Using LiDAR UAV (in Spanish)

Juan Carlos Moreno Escribano *et al.*, *Virtual Archaeology Review* 16,116-129 (2025). 

Summary: This article examines the stone extraction process at Rodadero de los Lobos quarries in the C3rdoba highlands, Spain, utilising LiDAR technology mounted on a UAV to overcome challenges posed by dense vegetation and steep terrain. The study provides previously unavailable surface data, revealing Piqu3n Farmhouse as the region's largest source of stone and assessing the extent of historic resource exploitation.


3. Satellite Imagery and Synthetic Aperture Radar

A Multisensor Remote Sensing Approach to Archaeological Prospection: Integrating UAV and Google Earth Data in the Bayan Gol Valley, Mongolia

Peter Heimermann *et al.*, *Archaeological Prospection* 33, 109-130 (2026). 

Summary: This study compares drone-based remote sensing with Google Earth satellite imagery for archaeological surveys in Mongolia's Bayan Gol Valley. Using a UAV with RGB and multispectral sensors, researchers achieved higher feature detection than satellite images, while Google Earth offered useful historical context. The findings show that combining UAV and satellite data improves archaeological mapping, especially in landscapes affected by modern changes.

Application of Planimetric Models of Satellite Imagery to Study Pre-Hispanic Water Management Systems in the Southern Puna, Argentina

Victoria C. Ar3valo & Lorena Grana, *Archaeological Prospection* 33, 149-160 (2026). 

Summary: This research utilised remote sensing and advanced spatial modelling to investigate pre-Hispanic irrigation systems at the Red Miriguaca 1 site in Argentina. By integrating satellite imagery, digital elevation models, and ground data, the study mapped canals and water intake structures, revealing previously unknown connections between irrigation networks. The approach offers a cost-effective method for reconstructing ancient water

management in arid landscapes.


From Earth to Sky: Large-scale Archaeological Settlement Patterns in Southernmost South America based on Ground Surveys, UAV LiDAR, and Open Access Satellite Imagery

Jo Sindre P. Eidshaug *et al.*, *Journal of Island and Coastal Archaeology* 20 (2025).




Summary: This paper summarises how large-scale archaeological surveys in coastal, remote regions like southern Tierra del Fuego are often hindered by logistical and environmental challenges. The study demonstrates that remote sensing, particularly using freely available satellite imagery from platforms such as Google Earth, ESRI, and Bing, offers an efficient and cost-effective solution for identifying ring-shaped shell middens. Through comparison with UAV LiDAR and ground surveys, the research confirms the reliability of these identifications, enabling analysis of settlement patterns across 3,000km of coastline. The findings reveal that these middens are unevenly distributed, being concentrated in sheltered areas along the Beagle and Murray Channels.

Lidar and Satellite Data for Climate Monitoring and Archaeology Management in The Yaxha' Lagoon Landscape in Guatemala

Carolina Collaro, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-M-9-2025*, 353-360 (2025). 

Summary: The Yaxh3 lagoon, situated within Guatemala's Maya Biosphere Reserve and 'El Triangulo Cultural' National Park, is home to significant Maya archaeological sites and wetlands. The park faces growing challenges from climate change, especially water stress. To address these, the use of VTOL UAV-mounted LiDAR and satellite data enables accurate monitoring of vegetation, rain erosion, and landscape changes, supporting sustainable preservation of both biodiversity and cultural heritage.


Reassessing Rujm el-Hiri: Aerial Imagery and Stone Circles in the Proto-historic Southern Levant

Michal Birkenfeld *et al.*, *PLoS One* 21(3): e0339952 (2026). 

Summary: This study reveals Rujm el-Hiri - traditionally viewed as an isolated protohistoric monument with unclear funerary, ceremonial, or astronomical purposes - as the most elaborate example within a widespread regional tradition of large circular basalt stone structures. Through high-resolution satellite imagery, geophysical modelling, and spatial analysis,


over 30 previously undocumented structures were identified within a 25km radius, all sharing consistent architectural features of concentric and radial basalt walls often associated with dolmens, tumuli, and field systems. Remote sensing techniques proved critical for overcoming previous survey limitations and revealing the complex archaeological landscape that shaped protohistoric landscape organisation and monumentality in this region.

Satellite Imagery for Documenting Ancient and Historic Movement: Case Studies from Syria, Iraq, and Ukraine

Oleksandr Kariaka & Michelle de Gruchy, [Space in Historical Research 6, 10-21 \(2025\)](#). 

Summary: This article examines how satellite imagery, both historical and modern, can be utilised to document ancient and historic movement routes, focusing on erosional features known as hollow ways. Drawing on case studies from southern Ukraine, northern Syria, and southern Iraq, the authors compare older satellite images (Corona, Hexagon) with contemporary sources such as Google Earth. The study finds that single historical images often reveal more movement traces than entire collections of modern imagery, while each source contributes distinct insights into the landscape's past movement patterns.


Satellite Thermal Data Applied to Landscape Archaeology: Mounds in Michigan (1200–1600 CE)

Meghan C. L. Howey & Michael W. Palace, [Proceedings of the National Academy of Sciences 123 \(8\) e2528379123 \(2026\)](#). 

Summary: This article describes how recent advancements in satellite-based remote sensing, big data, and machine learning have made it easier to conduct large-scale geographical analyses in archaeology. By using multitemporal and multisensor satellite data, archaeologists can investigate connections between cultural, ecological, and climatic factors, even when direct site detection is challenging. The authors showcase an automated approach using Landsat 8 Thermal Infrared Sensor data to analyse thousands of Michigan's inland lakes, focusing on thermal patterns and lake shapes. Their findings reveal that lakes with Late Precontact burial mounds (circa 1200–1600 CE) have distinct thermal profiles - warming later in spring, cooling later in autumn, and exhibiting more regular shapes - indicating that ancient communities selected sites with advantageous resources and longer growing seasons. The study emphasises the need to reevaluate the role of maize in subsistence and ceremonial practices in the


Great Lakes region and presents a reproducible workflow for integrating thermal data into archaeological landscape research worldwide.

Super-Resolution Remote Sensing Datasets for Application to Caral–Supe Archeological Sites Employing SAR and DEMs

Jungrack Kim & Ramesh P. Singh, [Remote Sensing 18\(6\), 854 \(2026\)](#). 


Summary: This study evaluates the effectiveness of super-resolution remote sensing products derived from publicly available datasets for archaeological surveys in the Caral–Supe region of Peru. By leveraging deep learning techniques, specifically the ESRGAN architecture, the researchers integrate SAR imagery and digital elevation models to enhance detection of subtle and buried features. Their approach enables the identification of previously undocumented archaeological structures, demonstrating that advanced super-resolution methods offer a cost-efficient and practical alternative to traditional aerial photography and commercial satellite imagery for high-resolution archaeological mapping.

The Longue Durée of Andean Movement Networks: Case Study in the Lauca Altiplano

Thibault Saintenoy *et al.*, [Journal of Field Archaeology 50, 717-736 \(2025\)](#). 

Summary: This case study explores the long-term history of movement networks in the Lauca Altiplano of the south-central Andes, an area rich in ancient infrastructure linked to major historical routes such as those connecting the Potosí silver mines. Unlike most Andean research, which centres on specific periods like the Qhapaq ñan, this study uses a multi-scale methodology - integrating historical maps, satellite imagery, field surveys, and data from way station settlements - to reveal the enduring resilience of the road network. The findings indicate that indigenous communities largely managed these routes, with minimal investment from the Inca and Spanish Empires, and that the network persisted until modernisation in the region.


Understanding the Form and Timing of Damage to Archaeological Sites During the Syrian Conflict by Combining Evidence From Remote Sensing With Ground Observation

Adnan Almohamad *et al.*, [Archaeological Prospection 32, 813-826 \(2025\)](#). 

Summary: This case study evaluates the use of satellite remote sensing versus ground observation in monitoring damage to archaeological sites in conflict-affected areas, specifically northwest Syria. While remote sensing is commonly employed to track site conditions due to limited on-site assessments, the study investigates how well satellite data reflects actual ground realities. By analysing data from 19 sites, it compares the effectiveness of both methods and examines the timing and types of damage in relation to local political events.


4. Aerial Photographs and Photogrammetry

Cloud-based Analysis of Aerial Imagery for Unveiling Ancient Archaeological Patterns

Pietro Fusco, Alba Amato & Salvatore Venticinque, [Journal of Cloud Computing 14:22 \(2025\)](#). 


Summary: This paper demonstrates how deep learning and computer vision techniques, deployed on Cloud computing infrastructure, can automatically identify archaeological remains from aerial imagery - such as evidence of Roman Centuriation at of Marcianise, Italy - across large geographic areas where traditional methods are ineffective. The methodology addresses the computational challenge of processing extensive datasets while maintaining scalability, enabling archaeologists to discover and evaluate ancient finds more efficiently than conventional approaches allow.

Digital Surface Models of Crops Used in Archaeological Feature Detection – A Case Study of Late Neolithic Site Tomašanci-Dubrava in Eastern Croatia

Rajna Sosic Klindzic *et al.*, [Peer Community Journal 5, e140 \(2025\)](#). 


Summary: This study investigates Neolithic settlements of the Sopot culture in Eastern Slavonija by employing aerial archaeology combined with multiple verification methods. Researchers used drone photography at the Tomašanci-Dubrava site to capture high-resolution orthophotos of cropland, which revealed subsurface archaeological features that influence plant growth patterns visible in digital surface models. The findings were validated through magnetometry, excavations, and field surveys, and the paper discusses how this drone-based approach could be scaled up using airborne laser scanning (ALS) data or state geodesic aerial photographs to map and study archaeological landscapes across larger regions.

Effectiveness and Limitations of Low-Cost Aerial Survey of Archaeological Stone Architecture in Arid Andean Contexts (La Rioja, Northwest Argentina)

Gonzalo García *et al.*, [Archaeological Prospection early view \(2026\)](#). 


Summary: This research addresses the challenge of systematically documenting stone architecture across agropastoral societies in northwestern Argentina by developing a low-cost drone survey methodology. The team conducted 28 drone flights at varying altitudes across 11 archaeological sites in La Rioja province's arid Andean region, measuring variables including flight altitude, vegetation cover, structure visibility, and ground sampling distance (GSD). The resulting high-resolution data enabled precise quantification of residential enclosures. Optimal flight altitude and GSD parameters were established to balance survey efficiency with the level of architectural detail needed for different research objectives.

Hiding in Plain Sight: Rethinking the Size and Complexity of Iron Age Hillforts in NW Iberia Thanks to Aerial Archaeology and Geophysics

César Parcerro-Oubiña *et al.*, [Archaeological Prospection 33, 63-85 \(2026\)](#). 


Summary: This paper moves Iron Age archaeology of Northwestern Iberia beyond the traditional focus on castros (hillforts) to explore the broader settlement landscapes using remote sensing. The researchers apply LiDAR, aerial imagery, and geophysical survey to investigate external spaces around these fortified settlements, an area largely neglected in previous research. While remote sensing applications historically faced obstacles - including limited data availability and the region's challenging landscape of dense forests, scrubland, and fragmented fields - recent technological advances have made such investigation feasible. Despite persistent environmental challenges that obscure soil visibility and complicate large-scale surveys, the study demonstrates that remote sensing techniques can fundamentally reshape understanding of Iron Age settlement patterns, land use, and regional organization by moving beyond the castros-centric approach.

Modelling of the Mid-Late Holocene Coastline Variations of the Ras al-Jinz Site (Sultanate of Oman) Using UAV Technology Photogrammetry, Electromagnetic Survey, and Sedimentary Archives

Jérôme Lejot *et al.*, [Journal of Archaeological Science 184, 106408 \(2025\)](#). 

Summary: Using geomorphological analysis combined with high-resolution UAV imagery, structure-from-motion photogrammetry, and archaeological data, the researchers reconstructed coastal environmental conditions across the Middle and Late Holocene of eastern Oman. Archaeological sites at Ras al-Jinz 3 provided critical chronological markers for understanding marine fluctuations during periods of rapid coastal change which significantly altered coastline configurations and fishing territories for hunter-gatherer populations. Through 3D spatial analysis using GIS and dated stratigraphic sequences, the researchers created a palaeogeographic reconstruction that explains the distribution of archaeological sites within Ras al-Jinz Bay, demonstrating how marine oscillations directly influenced settlement patterns and resource availability during the Holocene.

Monitoring Archaeological Sites Affected by Natural and Anthropogenic Hazards Using Multitemporal UAV-Photogrammetry: A Case Study from the Barranca Valleys, Peru

Edyta Puniach *et al.*, [Journal of Field Archaeology, 51\(3\), 159-178 \(2026\)](#). 

Summary: This study applies high-resolution, multi-temporal UAV photogrammetry to nine archaeological sites in Peru's Barranca Valleys to monitor site degradation and threats. The research represents the first large-scale case study of this kind in the region, addressing the broader challenge that while UAV photogrammetry has advanced archaeological documentation, many applications lack rigorous accuracy assessment. The surveys were strategically timed to capture geomorphic changes during the forecasted 2023-2024 mega El Niño, while simultaneously documenting anthropogenic pressures including urbanisation, agricultural expansion, and looting. By integrating orthomosaics, digital elevation models, image cross-correlation, and horizontal displacement analysis with explicit accuracy evaluation, the study establishes a robust, multi-source framework for assessing site degradation and long-term monitoring of threatened heritage sites.


Optimizing UAS Thermal Imaging for Archaeological Prospection: Effects of Time of Day, Season, and Surface Conditions at a Historic African American Cemetery

Noah Hal & Eileen G. Ernenwein, [Journal](#)

[of Archaeological Science 188, 106501 \(2026\)](#). 


Summary: This study investigates optimal protocols for thermal remote sensing in archaeology. Conducted at Sinking Springs Cemetery in Virginia - a site containing unmarked graves of enslaved and freed individuals of colour dating to the late 18th century - the research systematically tested UAS-based FLIR thermal imaging under varying temporal, seasonal, atmospheric, vegetation, and moisture conditions. Results demonstrate that data collection after sunset during the warm season yields the most reliable results, while daytime flights typically fail due to uneven solar heating, though persistent overcast conditions can overcome this limitation. The study also reveals a practical concern: grass clippings from mowing create thermal noise that obscures underlying grave signatures. These findings provide concrete guidance for standardizing thermal archaeological surveys and highlight the importance of environmental and operational factors in thermal sensor deployment.

UAV Photogrammetry for the Protection of Cultural Heritage: Methodologies, Case Studies, and Applications

Charalabos Ioannidis *et al.*, [Proceedings Volume 13816, Eleventh International Conference on Remote Sensing and Geoinformation of the Environment \(RSCy2025\); 138160A \(2025\)](#). 

Summary: This paper outlines key UAV photogrammetry methodologies, including data acquisition through imagery and ground survey, image matching, image orientation and sparse reconstruction via Structure from Motion, multi-view stereo processing for 3D point cloud and model generation, digital surface model production, and orthophoto creation. The study explores integration with complementary technologies such as lidar sensors and remote sensing imagery, examines machine learning applications for processing photogrammetric products, and discusses combined workflows with GIS and Building Information Modelling. Greek cultural heritage case studies demonstrate the practical effectiveness of UAV-based 3D modelling for efficient and accurate documentation of sites with complex and varying geometries.

Use of UAV Photogrammetry in Archaeological Sites; The Example of the Ancient City of Lystra

Abdullah Varlık *et al.*, [International Journal of Engineering and Geosciences, 2026, 11 \(2\), 432-441 \(2026\)](#). 

Summary: This study applied UAV photogrammetry at the ancient city of Lystra, Türkiye, to produce Digital Elevation Models, Orthophotos, and 3D Models for pre-excavation preparations. The approach significantly reduces both time and costs in excavation planning while improving the accuracy of archaeological data and enhancing analysis of surface remains. The findings demonstrate how effectively UAV technology can be integrated into excavation planning, cultural heritage documentation, and archaeological surveying. Future research directions point toward integrating multiple sensor types to enable more comprehensive analyses of archaeological sites.

5. GIS and Landscape Mapping

A Look Back at the Irrigated Areas of the Medieval Town of Tāmdult (Morocco)

Patrice Cressier & Ricardo González-Villaescusa, *Land* 15(1), 69 (2026). [📄](#)

Summary: Tāmdult was one of three major caravan ports in the Western Maghreb from the 9th century onward. Field surveys and aerial photographs in 1999 revealed well-preserved traces of large-scale agricultural systems and irrigation canal networks adjacent to the ruins, though the chronological relationship between Tāmdult and Aqqa remained unclear. Recent satellite imagery (2023) and WebGIS analysis have now refined these observations, confirming joint urban and agricultural development while revealing previously undetected details including water distribution channel branching, regular agricultural land parcels, and interstitial rural settlements that indicate hierarchical landscape organization. This research demonstrates how contemporary remote sensing technologies illuminate the role of urban elites in constructing rural landscapes within pre-Saharan contexts shaped by climate and settlement structure.

A Tethered Hunting and Mobility Landscape in the Andean Highlands of the Western Valleys, Northern Chile

Adrián Oyaneder, *Antiquity* 99 (408): 1640–1657 (2025). [📄](#)

Summary: This study examines the persistence of foraging economies in northern Chile's Camarones River Basin, challenging the assumption that the adoption of food-producing economies around AD 650 entirely eliminated highland foraging practices. Using freely accessible satellite imagery, primarily sourced from Google Earth and Bing sensing data, the author identified small-scale settlements and hunting installations in upland areas, revealing archaeological evidence for

continued foraging activity. When combined with colonial-era ethnohistorical records from the 16th and 18th centuries documenting foraging groups, these findings suggest that foraging endured into the late colonial period rather than disappearing after the transition to agriculture and herding. This reinterpretation demonstrates how integrating remote-sensing archaeology with historical documentation can reveal complex subsistence strategies and settlement patterns previously obscured by conventional archaeological narratives.

Approaching Marginal Landscapes in Archaeology: the Case of Ravenna's Reclaimed Wetlands

Michele Abballe *et al.*, *Journal of Field Archaeology* 50 (8), 680–699 (2025). [📄](#)

Summary: This study employs a multiscale approach integrating historical, geomorphological, sedimentological, geochemical, paleontological, and satellite remote sensing data to examine human-environment interactions across landscapes in northern and northwestern hinterland of Ravenna that have undergone extensive wetland reclamation from the Middle Ages to the present day. The integration of diverse datasets enabled detailed analysis of landscape transformations driven by reclamation processes and flood events. The research reflects on the interpretive challenges specific to reclaimed wetlands, questions their characterisation as "marginal" landscapes, and advocates for innovative research methodologies to address the particular limitations these environments present.

Digital Spatial Technologies to Compose the Map of the Southeast Iberia Megalithic Phenomenon. The Case Study of Fonelas (Granada, Spain)

Carolina Cabrero González *et al.*, *Archaeological Prospection* 33, 257-273 (2026). [📄](#)

Summary: Megalithic landscapes in Southeast Iberia are poorly documented in rugged terrain where conventional survey methods prove ineffective. This study addresses this gap by applying a multiscale approach combining remote-sensing techniques (LiDAR-derived Digital Terrain Models, historical aerial imagery, and RPAS photogrammetry) with systematic pedestrian survey to the megalithic necropolises of the Fardes River (Granada, Spain). Initial digital analysis identified 40 circular anomalies (10–15m diameter) consistent with known

burial mounds, of which field verification confirmed 20 as genuine archaeological features comprising tumuli graves and orthostatic stone structures. Subsequent RPAS photogrammetry produced high-resolution imagery and 3D models for detailed documentation and interpretation. The iterative workflow, where digital detection guides targeted fieldwork and field observations inform subsequent technological application, proved highly effective, achieving a 50% verification rate through complete ground-truthing of all detected anomalies.

Exploring the Battlefields of the Malvinas/Falklands War (1982): Archaeological Mapping of Mount Longdon and Mount Tumbledown

Luis V.J. Coll *et al.*, *International Journal of Historical Archaeology* (2026). [📄](#)

Summary: This study presents the first archaeological survey of the 1982 Malvinas/Falklands War battlefields conducted by Argentine researchers, focusing on Mounts Longdon and Tumbledown which were sites of intense Argentine-British military clashes. The research employs an integrative methodology combining remote sensing (aerial and satellite imagery, drone photography) with ground surveys to reconstruct the battles along two key research lines: logistics and command. Remote sensing techniques enabled comprehensive terrain coverage including inaccessible areas, while archaeological mapping recorded and georeferenced war-related structures, features, and artifacts in a non-intrusive manner using GIS for data storage and spatial analysis. Integration of published war diaries and veteran interviews provided essential contextual information for interpreting spatial patterns and archaeological findings. The study demonstrates how contemporary archaeological methods can illuminate twentieth-century military history through systematic documentation and comparative spatial analysis of battlefield landscapes.

Reconstruction of Roman Roads in the Bay of Cádiz: Application of GIS and Remote Sensing for the Analysis of Historical Routes

Francisco Javier Catalán González, *Acta Archaeologica* 95(1) (2025). [📄](#)

Summary: This study uses Geographic Information Systems (GIS) and remote sensing to reconstruct and analyse Roman roads in the Bay of Cádiz, a region with complex coastal and fluvial topography. By integrating aerial orthophotography and LiDAR data through a paleodigital terrain model, historical route structures are


identified and analysed. Least-cost path (LCP) analysis and friction maps assess transibility and reconstruct optimal routes between key archaeological sites, proving particularly effective in dynamic coastal environments where sedimentation, water bodies, and geomorphological changes obscure ancient paths. Validation against archaeological evidence and historical sources confirms the reliability of the reconstructed routes, providing a robust framework for understanding mobility in antiquity. The methodology offers a transferable model for investigating transportation networks in similarly complex landscapes, with potential applications for heritage conservation, landscape archaeology, and studying historical adaptation to environmental challenges.

Research of Ironworking Landscapes: Brdy Mountains Study Case, Central Bohemia

Tomáš Kroupa, [AARGnews 71, 27-37 \(2025\)](#). 

Summary: The study presents the results of a non-destructive archaeological survey around historical ironworking settlements Strašice and Dobřív in Brdy Mountains Region in the western part of Central Bohemia, the Czech Republic. Based on a systematic prospection of aerial laser scanning data and analysis of both cartographic and written historical sources, it aims to map out and evaluate the archaeological features in the landscape around these two proto-industrial and industrial centres in the region, which has a rich ironworking tradition reaching to the 14th century.

Revealing the Multicultural Landscape of Nejedek

Michaela Prišťáková *et al.*, [Interdisciplinaria Archaeologica XVII, 75–85 \(2026\)](#). 

Summary: This study investigates long-term settlement dynamics in the region between Lednice and Bulhary in South Moravia, Czech Republic. Using non-invasive prospection methods - magnetometry survey, aerial and satellite imagery, and GIS analysis - the project examines spatial organisation and continuity of human activity from the Neolithic to the Middle Ages. The results demonstrate that this landscape functioned as a multicultural and strategically significant zone throughout prehistory and early history. Despite modern disturbances, the study confirms the area's high archaeological potential and establishes a solid foundation for targeted future excavations.


The Past at Risk: Assessing Climate and Geological Hazard for the

Preservation of Archaeological Sites in Coastal Peru Using Open-access Data

Ana Mauricio & Francesca Fernandini, [Frontiers in Environmental Archaeology 4, 1612708 \(2026\)](#). 


Summary: This study addresses the preservation of Peru's exceptionally rich coastal archaeological heritage, which spans from the Terminal Pleistocene to Inca times (13,000 BP–1532 AD) and faces constant threat from climate change and human activities. The research employs a multidisciplinary, low-cost methodology combining remote sensing analysis with open-access geological, archaeological, and climatic data, along with GIS and aerial imagery, to identify the most significant geological and climatic hazards - particularly El Niño effects—affecting coastal archaeological site preservation. The methodology provides a transferable framework designed to support local and regional authorities in decision-making for planning and preserving Peru's pre-Hispanic cultural heritage, demonstrating how contemporary remote sensing and GIS technologies can address heritage conservation challenges in complex environmental contexts.

The Walled Oases Complex in North-west Arabia: Evidence for a Long-term Settlement Model in the Desert

Guillaume Charlux & Majed Alonazi, [Antiquity 99, e40 \(2025\)](#). 

Summary: Recent investigations in north-west Arabia using Bing and Google Earth satellite images, along with field visits, have revealed that many major oases in the region were enclosed by a network of monumental walls. Confirmation of four newly identified walled oases demonstrates that this Walled Oases Complex had a substantial impact on long-term socioeconomic development in the region.


VISUALS: An Interactive Web Application to Assess Results of a 6600 Sq Km Landscape Survey in Cherkasy Oblast, Ukraine

Martin Fowler *et al.*, [Space in Historical Research 6: 22–34 \(2025\)](#). 

Summary: To encourage use of data collected during a survey from satellite sources of 6600 sq km of the Cherkasy oblast, we offer a guide to using our results in an interactive web application. This contribution notes the options available in that app and gives examples of possible uses that may be posed to answer

questions regarding archaeological landscapes in this part of Ukraine. We hope that it will encourage local archaeologists to try it for themselves


Wall-to-Wall Mapping of Anthropogenic Features in the Poiplie Region (Slovakia): Integrating Airborne LiDAR Visualisations, Field Research and Cartographic Sources

Juraj Lieskovský *et al.*, [Archaeological Prospection 33, 161-176 \(2026\)](#). 

Summary: This research documents the rapidly disappearing anthropogenic heritage of Central and Eastern Europe through systematic LiDAR-based mapping and archival analysis. The study identified historical landscape features in southern Slovakia, including hemp-retting pits, Second World War trenches, and historical field patterns.


6. Miscellaneous and Interdisciplinary Studies

“Hidden” Landscape of Prehistoric Burial Monuments: The Use of Remote Sensing in the Detection of Neolithic Long Barrows in Bohemia (Czech Republic)

Petr Kristuf *et al.*, [Archaeological Prospection Early View \(2026\)](#). 

Summary: This study investigates how integrated remote sensing methods can recover and contextualise these buried monuments in heavily cultivated landscapes, specifically examining two long barrows (Dušníky 1 and Nižebohy) near Mount Říp in northwestern Bohemia. The research employs a multi-method approach combining three complementary technologies: oblique aerial photography, magnetic survey, and airborne laser scanning. Despite severe levelling from ploughing, the results demonstrate that these heavily modified monuments remain detectable when multiple non-invasive techniques are used in tandem. ALS successfully identifies subdued barrow earthworks, while aerial imagery and magnetometry reveal crucial details about internal structure, monument layout, and associated burial features.


Aerial Digital Archaeology and Data Ethics through the Lens of Actor-Network Theory

Sayumphu Ros, [Ethics in Progress 16, 137-159 \(2025\)](#). 

Summary: Actor-network theory emphasises the importance of technology in archaeological research, particularly in aerial digital archaeology. It deconstructs objective narratives by revealing the complexity of knowledge production, including the


archaeologist's expertise, excavation tools, technology, and the researcher's cultural background. The researcher's cultural context plays a role, as Western archaeologists may have different approaches and interpretations from those of researchers from developing countries. The theory also highlights the power dynamics of the network, with those controlling it – through technology, funding, and interpretation – wielding greater influence. This raises ethical concerns, especially in cases of “parachute science”, where foreign researchers conduct research in developing countries. A strong ethical framework is therefore needed to address these issues, and to promote collaboration and knowledge transfer. Actor-network theory encourages a more collaborative, ethically sound approach to understanding the past, especially when using aerial digital archaeology. This article systematically argues for such an approach.

An Interdisciplinary Workflow for the Comprehensive Study of Ancient Quarried Landscapes

Rebecca Levitan *et al.*, [Antiquity 99, 1677–1690 \(2025\)](#). 

Summary: This research presents an innovative interdisciplinary approach to systematically study and document ancient quarry landscapes, specifically examining two marble quarries on the Mediterranean island of Naxos. The methodology integrates multiple complementary techniques: lidar technology for three-dimensional topographic mapping, photogrammetry for detailed spatial documentation, along with sculptural and architectural analysis, geoscience investigation, ecological study, and traditional archaeological survey. This comprehensive workflow creates a sophisticated framework capable of capturing the full complexity of quarried landscapes while generating reproducible documentation standards applicable to similar sites across the Mediterranean and beyond.


Digital Reconstruction of the U.S. Base in Baltra, Galápagos Islands: A Forgotten Chapter of WWII in South America

Leo Zurita-Arthos *et al.*, [The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLVIII-3/W4-2025, 71–77 \(2026\)](#). 

Summary: This research project undertook a comprehensive 3D digital reconstruction of the Second World War U.S. military base on Baltra Island in the Galápagos during its operational period using integrated methodologies combining photo-grammetry, remote sensing analysis, and archaeological


investigation. The team digitized and georeferenced historical aerial photographs and maps, reviewed archival documentation, and processed contemporary remote sensing data. Drone-based field surveys generated orthophotos and digital elevation models (DEMs), which enabled precise three-dimensional modelling of surviving structures. The study documented the scale of wartime development and illustrates the lasting material, ecological, and social legacy of wartime military activities in the Galápagos Islands.

From Surface to Subsurface: Mapping the Chalcolithic Cucuteni Settlement of Muntenii de Jos (Eastern Romania) Using Remote Sensing Techniques

Radu-Alexandru Brunchi *et al.*, [Studia Antiqua et Archeologica 31, 184-192 \(2025\)](#). 


Summary: This paper combines aerial and geophysical methodologies to investigate the Muntenii de Jos – La Biserică Chalcolithic settlement. Drone flights captured high-resolution orthomosaics and digital surface models, while a sophisticated five-sensor gradiometer conducted detailed magnetometer surveys. The fieldwalking and geophysical surveys conclusively dated the settlement to the Cucuteni A-B phase (4050-3800 BC). By integrating the aerial and magnetometry data within a GIS framework, the researchers generated a high-resolution subsurface map that reveals the settlement's spatial organisation and internal structure.

Gordon Stirling Maxwell MA FSA FRSE FSAScot

William S Hanson, [Proceedings of the Society of Antiquaries of Scotland 154, 1–8 \(2025\)](#). 

Summary: Gordon Maxwell was far more than a distinguished Roman archaeologist - he was a pioneering figure in developing aerial reconnaissance as a tool for archaeological investigation in Scotland. His innovative use of aerial photography fundamentally transformed how scholars understood the Lowland archaeological heritage of Scotland.


Indigenous Accounting and Exchange at Monte Sierpe (‘Band of Holes’) in the Pisco Valley, Peru

Jacob L. Bongers *et al.*, [Antiquity 100, 145–163 \(2026\)](#). 

Summary: This study employs a combination of drone imagery and sediment samples to examine Monte Sierpe, a 1.5-kilometer-long construction


in southern Peru containing approximately 5,200 precisely aligned holes dating to at least the Late Intermediate Period (AD 1000–1400) with evidence of continued use during the Inca period (AD 1400–1532). The results suggest that Monte Sierpe functioned as a sophisticated local, Indigenous system of accounting. Exchange with the holes possibly serving as a tally or tracking mechanism for managing economic transactions and resources within the region.

Investigations into the *Forma Urbis* of the Roman City of Aquinum (Lazio, Italy): Integrating Non-invasive

Prospection Methods and Excavations Giuseppe Ceraudo *et al.*, [ArchéoSciences 49, 83-86 \(2025\)](#). 


Summary: Data obtained from documentary sources, ancient maps and historical aerial photography of the Roman city of Aquinum were enhanced by traditional and more advanced approaches. These comprised large scale magnetometer surveys, GPR prospection and remote sensing thus allowing the *Forma Urbis* to be delineated in great detail.

Landscapes of Enslavement: Investigations of Nazi Concentration Camps in Czyżówek and Karczmarna, Poland

Paweł Konczewski *et al.*, [Antiquity 99, e49 \(2025\)](#). 

Summary: Archival photos and data from lidar, geophysical surveys and excavations were used to help uncover the physical realities of two Second World War Nazi sub-camps, Czyżówek (AL Halbau) and Karczmarna (AL Kittlitztreben), in the Gross-Rosen network, now in south-west Poland.

Lines on the Landscape: Exploring an Integrated Remote Sensing Approach to Survey Roman Roads in the Southwest Iberian Peninsula

Gil Vilarinho, [Acta Archaeologica 95, 20–38 \(2025\)](#). 

Summary: This study explores a comprehensive methodological approach that integrates airborne lidar and aerial imagery with archaeological data, historical and cartographic sources, alongside legacy data, to identify and analyse Roman roads. Through two complementary case studies from the southwestern quadrant of the Iberian Peninsula, insights are provided into previously unidentified road segments.


New Evidence for Pleistocene Hominin Presence in the North-east Arabian Desert, Iraq

Ella Egberts *et al.*, [Antiquity 99, e51 \(2025\)](#). 

Summary: Satellite imagery, elevation


model and geological data were analysed in QGIS and combined with field observations to produce a preliminary geomorphological map of Najaf province in Iraq. Different geomorphological features were targeted for fieldwalking to assess their archaeological potential and to enhance our understanding of hominin behaviour and dispersal across South-west Asia.

Recovering the Disappearing Yamnaya Kurgan Landscape of Northeastern Bulgaria by Multi-method Remote Sensing

Nikolai Paukkonen *et al.*, [Remote Sensing Applications: Society and Environment](#) 40, 101789 (2025). 

Summary: This study presents a non-invasive archaeological survey conducted in northeastern Bulgaria, specifically focusing on identifying and documenting kurgan (burial mound) features. The work combined drone-mounted LiDAR, magnetometry, multispectral imaging, and high-resolution photogrammetry to survey the landscape.


Redefining Archaeological Research: Digital Tools, Challenges, and Integration in Advancing Methods

Stella Sylaiou *et al.*, [Applied Sciences](#) 15, 2495 (2025). 

Summary: This paper provides a

comprehensive exploration of the diverse array of digital technologies that have fundamentally transformed modern archaeological data acquisition. The major types of digital tools are systematically categorised and examined, including GIS, GPS, remote sensing technologies, 3D scanning and photogrammetry, drones and aerial photography, as well as mobile applications and digital recording systems. Each category of digital tools is thoroughly illustrated with practical examples demonstrating their specific applications in archaeological research.


The Co-Evolution of Aerial Survey Technology and Epistemic Injustice: From Colonial Instruments to Digital Scanners in Cambodia

Sayumphu Ros, [Herança-History, Heritage and Culture Journal](#) 8, 75-85 (2025). 

Summary: This article investigates the co-evolution of aerial survey technology and epistemic injustice in Cambodian archaeology, tracing developments from French colonial photogrammetry to contemporary LiDAR mapping. Using Science and Technology Studies (STS) approach grounded in Actor-Network Theory (ANT), it examines how human

and non-human actors - colonial surveyors, satellites, algorithms, GIS systems - interact to shape heritage narratives and constrain Khmer epistemologies.

Urbes Revelantur. New Remote and Proximal Sensing Investigations in the Abandoned City of Suasa (Marche, Italy)

Giuseppe Guarino *et al.*, [ArchéoSciences](#) 49, 97-100 (2025). 

Summary: Targeted flights were carried out with a drone equipped with a lidar sensor, a RGB + thermal camera and a multispectral camera to investigate the abandoned Roman *municipium* of Suasa. Operating at 60 m AGL and tied to centimetre-accurate GNSS targets, the surveys generated a 10 cm-GSD DTM and a nine-band spectral orthomosaic. These new layers served as the georeferencing base for 1988 oblique photographs, resolving long-standing spatial inconsistencies and sharpening the urban map of the *municipium*.

Noticeboard

Compiled by the AARGnews Editorial Team¹

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Membership is open to all who have an interest or practical involvement in aerial archaeology, remote sensing, and landscape studies. By becoming an AARG member, you become part of the community with its network, resources, and information. You also get a chance to share your ideas and research with other members.

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We encourage you to explore the channel, watch the videos, and subscribe to stay updated on future uploads. Your support and engagement are vital in promoting our group's research outcomes and fostering a collaborative academic community.

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Funding for project work will preferentially be awarded to Applications that demonstrably advance knowledge and understanding within the field of aerial archaeology. By this we mean projects in support of one or more of the following broad purposes: field or desk-based work, publication (excluding journal publication costs), public engagement, collection of airborne remote sensing data, education and training (of an individual or a group).

More information on who can apply, the scope of the Fund, as well as commitments expected of the successful candidate can be found on the [Grants page of the AARG website](#).

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- your interests in archaeology and aerial archaeology,
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- the name and contact details of a supervisor or employer (email) who can provide a reference,
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You should be willing to provide a poster, or an abstract for a paper under one of the conference session themes listed on the event website.

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The Derrick Riley Fund was established in 1994 to foster and support the study of aerial archaeology by young scholars. It provides grants to undergraduate and postgraduate students in the UK and overseas to fund research and further training in aerial archaeology. The fund is administered by the Department of

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AARGnews

AARGnews is published twice a year in April and October. It is a diverse and open forum for the discussion and exchange of new (and old) ideas related to aerial archaeology, remote sensing, and landscape studies.

Contributions for *AARGnews* need to be with the [Editorial Team](#) no later than **15th March** for the April issue and **15th September** for the October issue. Brief notes for contributors can be found on the next page.

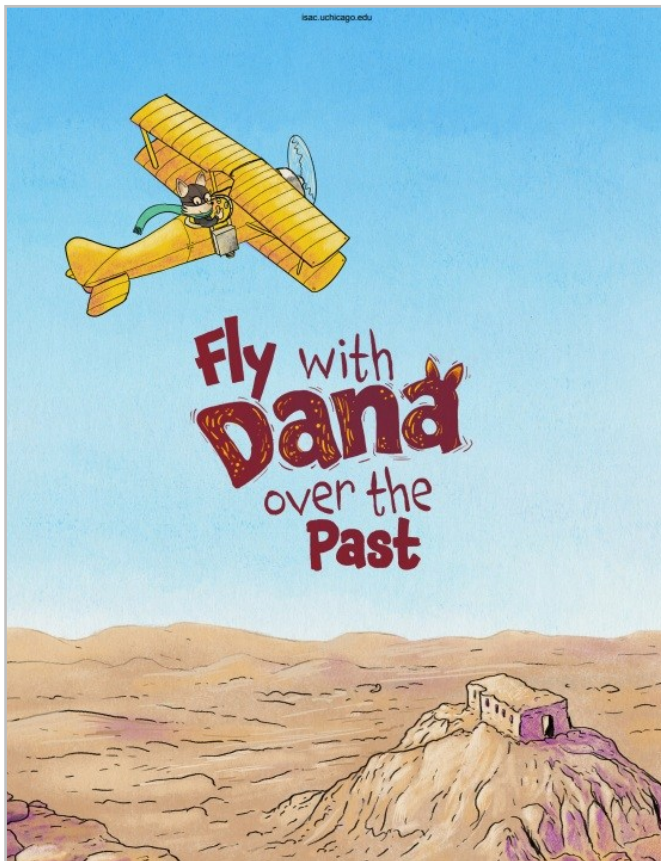
And Finally...

For our younger readers, and those of us who are still young at heart, the Institute for the Study of Ancient Cultures at the University of Chicago has produced a booklet *Fly with Dana over the Past*.

Written by Marie-Laure Chambrade and Jérôme Agostini, with the assistance of Marc Maillot, Kiersten Neumann, and Thomas Boudier, the book follows Dana, a young fox and archaeologist, as she explores the past through photographs of the Earth taken from an airplane, a balloon, and a drone. Learn about the history of aerial archaeology in West Asia while colouring and drawing, help Dana find her way in a labyrinth, and practice reading aerial images like an archaeologist.

The booklet can be downloaded from https://isac.uchicago.edu/research/publications/misc/Fly_with_Dana

Thanks to Rog Palmer for drawing our attention to this booklet.



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AARGnews – Notes for Contributors

The AARGnews Editorial Team¹

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AARGnews is the bi-annual newsletter of the Aerial Archaeology Research Group. It is a diverse and open forum for the discussion and exchange of new (and old) ideas related to aerial archaeology, remote sensing, and landscape studies. Past issues can be found at <https://aargonline.com/wp/aarg-news/>.

We welcome articles of any length and format. You can write about your research, methods, techniques, case studies, reviews, opinions, or anything else that might interest our readers. **Contributions should be inclusive and respectful to all.**

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Format. Send your contribution as a .docx file with your last name and a short title in the filename (e.g., Jones-The dial of destiny.docx).

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To submit your article, please send it to the Editorial Team at editoraargnews@gmail.com.

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