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AARGnews

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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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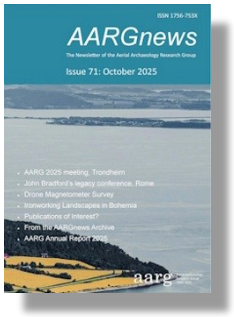
Contents



Cover picture: Taken from the poster designed by Andrea Devlahović for the AARG 2025 conference held in Trondheim, the photograph taken by Jędrzej Koralewski shows the beautiful colourful coast of Trondheim Fjord. Image downloaded from: Pexels.com royalty-free images.

Editorial

Martin Fowler [1]

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Welcome to the latest issue of *AARGnews*. This marks the fifth issue since the editorial team took on the mantle of publication and we hope that you will enjoy reading its varied and interesting content.

AARG 2025

Unfortunately, for the second year in a row I was unable to make the AARG conference. Nevertheless, our roving reporter Valerie Ward was there and provides a report of the meeting along with a set of *Postcards from Trondheim* as a visual reminder of the event. In addition, the five students from the Norwegian University of Science and Technology who helped run the event provide some of their thoughts and views of the conference and presentations.

Survey feedback

Thank you to all of the attendees at Trondheim who completed the *AARGnews Reader Feedback Survey*. Your feedback is invaluable to us and helps guide its content and direction.

Of particular interest are the results to Question 3 that asked *what type of content you would like to see more of*. The top three subjects for which more content was requested were :

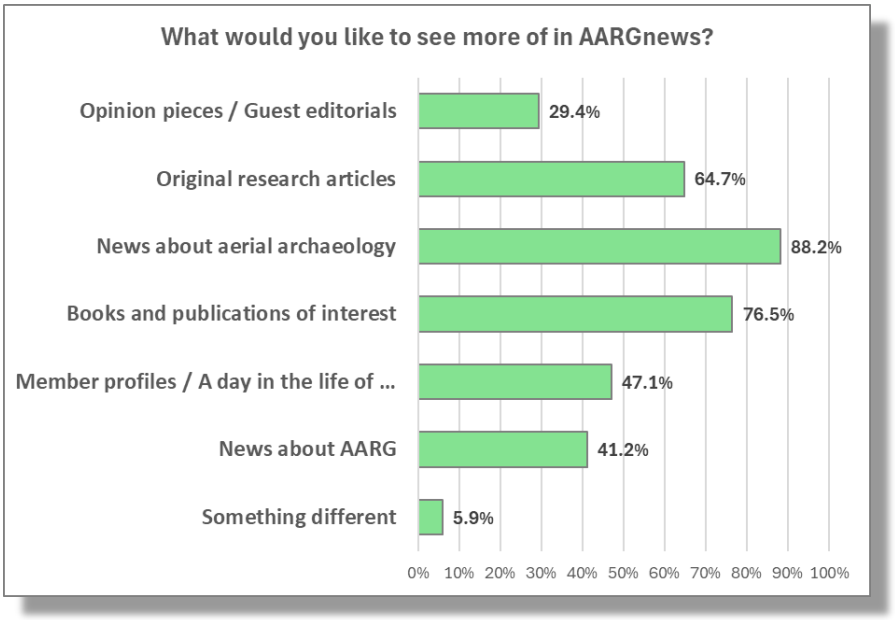
- News about aerial archaeology (88% of responses).
- Books and publications of interest (77%).
- Original research articles (65%).

Whilst the number of original research articles we can publish is largely beyond our direct control and is critically dependent on input from you, our readers, we are better placed to address the other two subjects, which in many respects are related. Indeed, in this issue we include a piece prepared by myself and Eileen Kerhouant detailing 49 articles from the research literature that were published between January and September of this year and which may be of interest. Please let us know what you think of this new feature using the ***AARGnews* 71 reader survey**. If feedback is favourable, we will continue with it in future issues covering articles published in the preceding six months.

Looking at the articles published so far this year, over 80% are open access making them readily accessible to the community. The global interest in aerial archaeology is reflected in the reported case studies, which span almost all continents. Integrating diverse sources of aerial data—from lidar and UAV photogrammetry to synthetic aperture radar and multispectral imagery—yields richer archaeological interpretations than using each source in isolation. AI-driven prospection is becoming mainstream in research. But will these techniques be translated into practical, operational, applications that can be trusted to give accurate results?

Copyright infringement

As mentioned in the AARG *Annual Report 2025* on page 48, we were recently informed about an unlicensed



Responses to Question 3 on the Trondheim AARGnews survey.

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use of an image on the AARG website. The image in question was included on a conference poster published in a past issue of *AARGnews*. It appears that the authors included this image with an incorrect credit and despite *AARGnews*' terms of submission requiring authors to be sure that their images are correctly licensed, the image managed to slip through the net.

The offending image has now been removed from the relevant issue of *AARGnews* on the website and a fee of £100 has been paid for the unlicensed use of the image.

We intend to reduce the risk of copyright infringement in future issues by:

- Drawing attention to the risk with this Editorial.
- Reinforcing the requirement in the *Notes for Contributors* that authors must secure permission from copyright holders for any images or other copyrighted material included in their submissions.
- Increasing our due diligence in reviewing contributions received for publication.

We hope that authors will recognise the importance of us addressing this risk. Whilst it may appear to be unnecessary bureaucracy, it is nevertheless important that copyright is respected and the risk to AARG is reduced accordingly.

In this issue

Elsewhere in the issue, following Łukasz Banaszek's *Chair's Piece*, the *In the News* section provides a selection of news items that may be of interest.

Gianluca Cantoro, Hrvoje Kalafatić and Włodzimierz Rączkowski report on a conference held in Rome in May 2025 to celebrate the legacy of John Bradford's contribution to aerial archaeology.[2]

Kseniia Bondar and colleagues describe the use of a UAV-based magnetometer to conduct an efficient and detailed survey of two plough-levelled Roman forts in Ukraine. The equipment used was originally developed to detect landmines in Ukraine and represents another example of the transfer of technology developed in times of conflict to peacetime archaeological use.

This issue's *Editor's Picture* is a declassified KH-9 HEXAGON satellite photograph of the Iron Age hillfort at the Yarnbury Castle, Wiltshire.

In an article relating to his PhD studies, Tomáš Kroupa presents the results of his work on historical iron-working in Central Bohemia, Czech Republic. His survey is based on airborne laser scanning data together with the analysis of cartographic and written historical sources.

From the AARGnews Archive takes a look back at what was topical 10, 20, and 30 years ago.

In the *AARG Annual Report 2025*, the committee members report on activities and achievements over the past year.

Finally, the *Noticeboard* provides useful information about AARG membership, the resources available to members, and various sources of funds for your studies.

A view of the historic waterfront redevelopment area of Trondheim, Norway. The AARG 2025 conference venue of the Dokkhuset is the green building near the centre of the photograph. Photo: Ole Risbøl.

AARGnews 72

AARGnews 72 is scheduled for publication in April 2026 and we welcome contributions to the issue. The closing date for submissions is **15th March 2026**, but please get your contributions in earlier if you can, as that will help with the production of the issue (and will also help ensure that your contribution is included in the publication!).

Reader feedback …

We value your feedback! So please consider completing this short reader feedback survey on the content of this issue: ***AARGnews* 71 reader survey**. It is totally anonymous and will only take a minute, but your replies will help us to improve future issues of *AARGnews*. Thank you!

[2] To learn more about the life and work of John Bradford, *AARGnews* 31 (2005) includes an article by Francesca Radcliffe providing brief biographical notes.

Chair's Piece

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AARG's Annual Meeting in Trondheim was a particular highlight of the last six months, bringing together members, friends, supporters, and local speakers for two days of insightful talks and lively discussion. The quality and breadth of the presentations were truly outstanding, covering everything from traditional research using aerial archaeology to emerging challenges and opportunities in the sector resulting from automated workflows, the use of artificial intelligence and other techniques. I was especially pleased to see so many great presentations from students and early career researchers supported through AARG Bursary as well from researchers benefitting from AARGFund.

For those who were unable to attend or who wish to revisit the sessions, most talks were recorded and will shortly be available to view via AARG's official YouTube channel. We hope these recordings will serve as a valuable resource and inspiration.

I would like to take this opportunity to thank AARG members attending our charity's Annual General Meeting (AGM) for your vote of confidence in the recent Constitution ballot. Your endorsement has enabled the Committee to move forward with proposed changes to our Constitution, which will help us operate more effectively and inclusively as we grow. These changes reflect our shared commitment to transparency, accountability, and long-term sustainability. On this note, I am pleased to inform you that Kimberley Teale has volunteered to help us with running AARG's social media. I would like to welcome Kim in her new role, and I am sure AARG members will join me in appreciating Kim's dedication to support AARG becoming a stronger community.

Looking ahead, I would like to remind members that our next Committee and Trustees elections are scheduled for 2026. We encourage anyone with a passion for aerial archaeology and a desire to contribute to consider standing for election or nominating a fellow member. The strength of our organisation lies in its diversity and dedication, and we welcome fresh perspectives and new energy. As part of these changes, Susan Curran has announced that she will not be seeking re-election as AARG's Honorary Secretary. I too will be stepping down from my current role as Chair, with the intention of standing for the position of Vice-Chair, subject of course to the approval of our members. While other Committee and Trustee roles will be open to election, many of our current Trustees and Committee members have expressed a willingness to continue for another term, again pending members' approval. This continuity is reassuring and means that there is slightly less pressure to fill these positions, though we still warmly welcome new candidates who wish to contribute.

Although the formal call for candidates will be issued later in 2026, we would be pleased to hear from anyone who may be considering stepping forward to take on a new challenge. If you are thinking about contributing in a more active role, do let us know. Early expressions of interest are always welcome and help us plan ahead.

Finally, I am pleased to acknowledge a generous anonymous donation that will directly benefit students and early career researchers. Such support helps foster the next generation of professionals and researchers in aerial archaeology and remote sensing. Thank you for making a lasting impact! If you would like to contribute to future initiatives, we warmly welcome further donations to help sustain AARG's contribution to deliver and support teaching and training opportunities.

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In the News

Compiled by the *AARGnews* Editorial Team[1]

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

John Haig (1941-2025)

We were sorry to hear the news that John Haigh passed away on 19th May 2025 at the age of 84. Although a mathematician by training, John made a very significant contribution to aerial archaeology – particularly in the UK – through his development of the *Aerial* rectification software, which remains in use today.

The origins of *Aerial* go back to the early 1980s when John was working in the School of Archaeological Sciences at the University of Bradford. He continued to update the software up to 2014, at which point he very generously passed on the intellectual property rights to the national heritage bodies for Scotland, England and Wales.

We hope to include a suitable reflection on John's work in the next issue of *AARGnews*. If you have any personal memories and anecdotes about John that you would like to be included, do drop us an email.

AARG 2025

Last month, 30 papers and 12 posters were presented to 64 delegates from 18 countries at the annual AARG conference held in Trondheim.

The meeting was organised by Ole Risbøl of the Norwegian University of Science and Technology (NTNU) who kindly secured sponsorship from the Trøndelag County Municipality, NTNU University Museum, Department of Archaeology and Cultural History and the Norwegian Archaeological Society.

More details of the conference can be found on pages 11-21 of this issue. Videos of many of the papers presented will also soon be available on the AARG YouTube channel.

Early career award

Congratulations to Maria Lucrècia Centelles-Fullana of the Department of Prehistory, Archaeology and Ancient History, Universitat de València, Spain, who was awarded the AARG Early Career Award for her paper along with Carmen Cuenca-García and Valeria Martín Sidró on *Using ALS for Iron Age archaeology in the Valencian region (Spain): the Sensing Iberianscapes project experience*.

Maria comments: *"It was an honour to receive this year's conference award. I sincerely thank the committee for their warm welcome and support, especially toward newcomers. This encouragement means a lot to me, and I am very much looking forward to attending the AARG meeting in Pilsen next year!"*

The award includes: free registration for the next conference, tickets for the conference dinner and field trip, and a grant of up to €300 to support attendance.

Maria Lucrècia Centelles-Fullana accepting her Early Career Award from Łukasz Banaszek. Photo: Carmen Miu.

AARG's New Social Media Officer

During the conference dinner, Kim Teale mentioned that she'd be happy to help with social media for AARG ... and naturally the Committee quickly accepted her offer of support! Kim has a wealth of experience to bring and we look forward to her developing our social media offering.

Kim adds: *I am a long time follower and admirer of the AARG and only recently became a member a couple of years ago. I'm delighted to be helping with AARG's social media - you have so much to shout about!*

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Kim Teale, AARG's new Social Media Officer

My specialism is terrestrial geophysics, and my day job involves managing a team of brilliant scientific officers for Archaeological Research Services Ltd to undertake geophysical surveys, UAV LIDAR and multispectral surveys, geochemical surveys, as well as geoarchaeological works, palaeo works and osteo works. Remote sensing data is our bread and butter and we couldn't prospect without it, and I love the secrets we can reveal for each site we investigate.

I live in the Peak District in the UK and in my spare time I enjoy rambling, wild swimming and travelling.

AARG Constitution

At the Annual General Meeting held on 11th September 2025, the changes to the Constitution described on page 46 of this issue were unanimously accepted. The updated constitution will be uploaded to the AARG website once it has been approved by the Scottish charity regulator, the OSCR.

AARG Fund recipients

Three applicants were successful in their bids to the latest AARG Fund round and we look forward to hearing about the projects in future issues of *AARGnews*.

- *Revealing Malaventura Fortress: An Archaeological Investigation Through LiDAR Documentation* (Antonio Jesús Ortíz Villarejo).
- *Mapping change to rural occupation in pre- to late Roman Abruzzo: multispectral imaging at Furfo (Italy)* (Stephen Kay and colleagues).
- *Modelling vulnerable sites to climate change around St. John's Point, Co. Donegal* (Susan Curran and colleagues).

Details of how to apply to the Fund for support for projects can be found on the AARG website.

Forthcoming Conferences and Meetings

2025

6th Training and Research in the Archaeological Interpretation of Lidar (TRAIL) meeting, 28th-30th October, 2025, Postojna, Slovenia. Meeting website: https://trail.zrc-sazu.si/

Conference on Cultural Heritage and New Technologies (CHNT), 3rd-5th November 2025, Vienna, Austria. Conference website: https://chnt.at/

Theoretical Archaeology Group Annual Meeting 15th-17th December 2025, York, UK. Conference website: https://tag2025.hosted.york.ac.uk/en/

2026

Landscape Archaeology Conference 18th-20th March 2026, University of Bamberg, Germany. Conference website: https://lac2026.com/

27th European Archaeological Council Annual Meeting 19th-21st March 2026, Altamira – Santillana del Mar, Spain. Conference website: https://www.europae-archaeologiae-consilium.org/annual-meeting-2026

CAA 2026 31st March-4th April 2026, Vienna, Austria. Conference website: https://2026.caaconference.org/

Chartered Institute for Archaeologists Annual Conference 2026 28th-29th April 2026, Edinburgh, UK. Conference website: https://www.archaeologists.net/events-training/events/conference/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

AARG Annual Meeting 2026 September 2026, Pilsen, Czech Republic. Further details will be available on the AARG website in due course.

EAC LiDAR Guidelines video

The video of Rebecca Bennet's talk on 7th May 2025 launching the *Guidelines for the use of Airborne Laser Scanning (LIDAR) in Archaeology* published by the European Archaeological Council is now available on the AARG YouTube channel. Edited by Rebecca Bennett and Dave Cowley, the guidelines are available for download free of charge.

John Bradford's Legacy: Past, Present and Future of Archaeological Practices in the Field of Remote Sensing Methods and Applications

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A conference held in Rome in May 2025 brought together a wide and diverse group of participants to celebrate the legacy of John Bradford's contribution to aerial archaeology and demonstrated that aerial photography—both traditional and modern—is still highly valued by archaeologists.

John Bradford was an exceptionally important figure in Italian, as well as European, archaeology due to his achievements in the application of aerial photography and the development of strategies for studying past landscapes. There is therefore no surprise that a conference dedicated to his legacy and contemporary practices in this field was organized in Italy.

The conference, titled *"Bradford's Legacy (1975–2025)". Aerial images and ancient landscapes*, took place in Rome from May 20th to 23rd, 2025, and was the fourth in the series of the *International Conference on Aerial Archaeology in Italy* (Figure 1). It was organized by the Laboratory for Topography and Photogrammetry of the University of Salento and the Archaeological Mapping Lab of the Institute of Science for Cultural Heritage of the National Research Council (ISPC-CNR), in collaboration with the National Airphoto Archive, the British School at Rome, and Sapienza University of Rome – Department of Archaeological Sciences.

Figure 1. Poster promoting the Conference.

The conference was attended by more than 200 scholars from Italy and abroad, featuring 53 oral presentations and 45 poster contributions. The event was structured into four thematic sessions:

Session 1: Between historical and recent aerial photographs.

Session 2: Aerial archaeology for the study of ancient landscapes.

Session 3: Bradford's legacy.

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Figure 2. Conference snapshots: A – opening ceremony; B – Session 1 in the National Airphoto Archive; C – display of posters in the cloister walk of the National Airphoto Archive; D – Session 4 in the Sapienza University of Rome (Museum of Classical Art). Photos: The authors.

Session 4: Integrated remote sensing methodologies for the study of contexts.

Each session was accompanied by a poster session.

The conference was hosted at different locations in Rome: Session 1 at the National Aerial Photo Library, Session 2 at the National Research Council, Session 3 at the British School at Rome, and Session 4 at Sapienza University of Rome (Museum of Classical Art, Archaeology Lecture Hall). This arrangement allowed participants to experience the aesthetic pleasure of moving through Rome and to appreciate the spectacular architecture of the institutions co-organizing the conference.

It is not surprising that the first session was dedicated to the topic of historical aerial photography and the potential of resources held by institutions such as the National Aerial Photo Archive, the Directorate for Archaeology, Fine Arts and Landscape of Basilicata, the Military Geographical Institute, the Air Force Archive, and the Photographic Archive of the Institute of History and Culture of the Corps of Engineers, among others. Together, these collections form an invaluable resource of aerial imagery, historical maps, and documents that continue to open new avenues of research—for example, in the historical topography of Tripoli-Oea and Benghazi-Berenice in Libya, or settlement patterns along the Volturno River. Re-examining these archival collections highlights how past initiatives—such as those undertaken by Dinu Adamesteanu—continue to shape our current research practices, decision-making processes, and perspectives on archaeological inquiry and interpretation. An important aspect of the work carried out by the National Aerial Photo Archive is not only the accessibility of its resources but also their promotion through initiatives aimed at a broader public audience.

The second session was dedicated to case studies involving the analysis of past landscapes, in which aerial photographs—particularly historical ones—played a crucial role. Most of the examples presented were from Italy, but there were also contributions from France, Albania, and Morocco. The individual case studies varied in their objectives, including the identification of ancient urban layouts, settlement patterns, communication systems, and centuriation patterns. Each research project emphasized different methods of data acquisition, yet historical and modern aerial photographs consistently played a central role. The methodological toolkit was further expanded to include airborne laser scanning, satellite imagery, cadastral map analysis, and geophysical surveys. It was also common practice to visualize the results using GIS technologies.

John Bradford and the inspirations drawn from his research perspective were the focus of the third session. Discussions focused on Bradford's legacy: including aerial photographs, private correspondence, personal documents, and notes preserved in archives, which shed new light on his research and intellectual outlook. Bradford's research initiatives inspired subsequent projects in Ostia, northern Apulia (centuriation studies), Abruzzo, Falerii Novi, Aquinum, Vicus Furfo, Castelporziano, and even Croatia. These projects referenced historical aerial

photographs while also incorporating modern remote sensing techniques. The value of this approach was particularly emphasized in the context of preventive archaeology. A notable departure from strictly academic work was the presentation of a graphic novel project (comic book) about John Bradford. This creative initiative is part of a broader effort to commemorate his remarkable legacy and to promote awareness of his research methods among wider audiences.

The final session featured presentations of case studies that employed a combination of non-invasive methods and combining of their results within GIS platforms. It also addressed specific analytical approaches, such as the use of vegetation indices like NDVI and VARI to enhance information mediated through plant cover. A strong emphasis was placed on the potential of UAVs, which can be equipped with a variety of sensors—including LiDAR, thermal cameras, and multispectral imaging systems.

In summary, the conference brought together a wide and diverse group of participants, primarily from Italy. It demonstrated that aerial photography—both traditional and modern—is still highly valued by archaeologists. The integration and comparison of data obtained through various methods appear to have become standard practice in archaeological research. It is also increasingly common to present research results in the form of maps and plans. In this way, Bradford's legacy is being realized through his concept of 'landscape archaeology'—the use of remote sensing data to reconstruct past landscapes, incorporating topographical elements and identified archaeological features.

While there is clear fascination with the technological possibilities for data acquisition and processing (e.g., machine learning algorithms), this enthusiasm may sometimes overshadow other important issues related to understanding landscape archaeology. But perhaps that is a topic for the next conference.

In the meantime, heartfelt thanks go to the conference Organizers for undertaking this important and demanding task.

Link to the Conference' webpage (including detailed programme): https://www.archeologiaaerea.it/icaa.html

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Book Notice

An Aerial Archaeologist's Logbook, 1970-1995

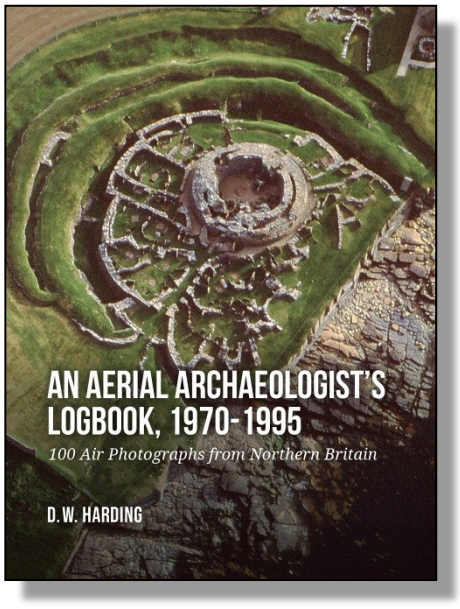

Image courtesy of Sidestone Press.

D. W. Harding: An Aerial Archaeologist's Logbook, 1970-1995 100 Air Photographs from Northern Britain | Forthcoming
€ 27.50 Paperback | € 60.00 Hardback
Paperback ISBN: 9789464263985
Hardback ISBN: 9789464263992
Imprint: Sidestone Press

Rog Palmer has drawn our attention to this forthcoming book by Dennis Harding, former Abercromby Professor of Archaeology in the University of Edinburgh, that is expected to be published on 17th November 2025 by Sidestone Press.

From the publisher's website: *this volume comprises 100 archaeological air photographs, principally of sites dating to the Iron Age and Roman periods in Northern Britain, resulting from aerial survey between 1970 and 1995, before the advent of drones when archaeological air photography was still dependent upon the use of light aircraft. The principal target areas were the Anglo-Scottish Borders, central Scotland (crannogs) and the Northern and Western Isles (brochs and duns). Practically, in order to maximise intended outcome, the author piloted the aircraft to the target area himself, selecting the optimum orbit and height, and only handing over controls to a co-pilot when taking the photographs. Because of the fugitive nature of some archaeological features, large format cameras were used to maximise definition in addition to single-lens reflex cameras.*

Sidestone Press usually have free or low cost digital access to many of their publications, so it may be an idea to check their website once the book has been published next month.

AARG 2025 Conference Report

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and

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After a previous attempt to hold the conference in Trondheim in 2020 was disrupted by the COVID-19 pandemic, the 2025 AARG conference successfully took place there last month. Highlights of the two days of presentations and posters, and the Halsstein-Alstadhaug-Tautra-Evenhus field trip are reported here.

The 42nd AARG conference ventured North this year. Sitting at 63°25'N and basking in the late autumn sunny weather, the conference meeting was held in Trondheim, Norway, from 10th-13th September. Bringing together 64 delegates from 18 countries to hear about developments in aerial archaeology, the event was organised by Ole Risbøl of the Norwegian University of Science and Technology (NTNU) with sponsorship graciously provided by the Trøndelag County Municipality, NTNU University Museum, Department of Archaeology and Cultural History and the Norwegian Archaeological Society. Five students from the university provided sterling support to Ole during the running of the conference.

After a previous attempt to hold the conference in Trondheim in 2020 was disrupted by the COVID-19 pandemic, the meeting finally went ahead here and comprised a welcome reception, two full days of conference along with the AARG AGM, conference dinner and the option for a full day field trip or half day tour of Trondheim.

Conference poster designed by Andrea Devlahović based on a photograph taken by Jędrzej Koralewski (Pexels.com royalty-free images).

Seven presentation sessions were held over the two days. Abstracts of the 30 papers and 12 posters can be found in the conference booklet on the AARG website and videos of many of the papers presented will soon be available on the AARG YouTube channel. Highlights of the two days of presentations and the full day multi-stop field trip are reported here.

Welcome reception

Events kicked off with a Welcome Reception held at Dokkhuset, which was also the location for the conference itself. A converted boat shed, Dokkhuset is a purpose-built music and concert

The historic waterfront redevelopment area of Trondheim. The conference venue of the Dokkhuset is located just outside the photo to the right. Photo: Valerie Ward.

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venue within the historic waterfront redevelopment area a short distance from the historic centre of Trondheim. The reception provided an informal opportunity for attendees to reconnect with old friends and meet new ones over drinks and canapés.

Conference Day 1

The conference was opened by Łukasz Banaszek, the AARG Chair. Hans Stenøien, Director of the NTNU University Museum gave an opening speech, after which the technical programme commenced with a session on *Pushing the boundaries of survey with UAS*. Papers covered thermal imaging to detect lost megaliths in Ireland, UAV- based lidar to investigate urbanisation and land use, photo-grammetry to detect crop marks using height data and a multi-method approach to surveying regulated hydropower works.

A series of technical presentations related to *Artificial Intelligence and Automation* followed after a coffee break. These topics covered using AI to uncover the past in digital terrain modelling, combining image sampling and data analysis to improve automatic data generation, as well as papers on AI detection by improving the handling of limited data classes through the use of the few-shot object detection system. The session ended with a presentation of SADA, a user friendly ChatGPT tool created for AI powered remote sensing analysis.

After lunch, the session focussing on *Risks, threats and monitoring* started with a talk about the role of aerial survey in supporting Historic England's heritage at risk programme. Next we heard about monitoring the cultural heritage of the Middle East from the air, followed by using lidar to locate sites threatened by looting in continental Croatia. The impact of climate change and coastal erosion on cultural heritage was illustrated by the next two talks; one from the rapidly warming arctic where lidar is being used as a monitoring tool and the other where Earth Observation data are being used to monitor water levels at the lakeshore of a Polish fortified settlement.

The Conference venue: Dokkhuset, set within the historic waterfront. Photo: Ole Risbøl.

Conference presentation at Dokkhuset. Photo: Valerie Ward.

The afternoon poster session provided the opportunity to view a diverse range of topics from hidden Medieval and modern settlement landscapes in south-western Germany to an Early Iron Age palisaded enclosure on Bleakmoor Hill, England, and using ALS to reconstruct the Roman landscape of the greater Zagreb region (Croatia) and NDVI applications in an extensive archaeological survey in Central Italy.

Annual General Meeting

The day concluded with the AARG AGM that included reports by Committee Members on activities and achievements over the past year (see the *AARG Annual Report 2025* on pages 46-52 of this issue), followed by voting on updates to the AARG constitution.

Conference Day 2

On Day 2, four sessions were held covering the themes of *Citizen Science and war heritage*, *Aerial archaeology*

Ole Risbøl receiving his 'thank you' gift from Łukasz Banaszek. Photo: Valerie Ward.

An informal dinner created a great atmosphere for the end of conference dinner at Frati restaurant, Trondheim. Photo: Valerie Ward.

from East to West and from *North to South*, and finally a short session urging us to *Stop and Reflect!*

The first three papers were all related to mapping the landscape, firstly through a large-scale citizen science project using lidar in Norway. An interesting multidisciplinary piece of research based around the Galinidian Saga was a strong reminder of the many interested citizen scientists out in the community who are either conducting their own research, or who may be keen to be recruited into the citizen science community. A mapping the landscapes of occupation project at Lade, Trondheim, was followed by two very thought-provoking war heritage projects: *Predicting the buried past using aerial approaches to locate WW2 hidden graves in Norway* and also the *Archaeology of a war crime* which used aerial images to assist the documentation of recent events of 'Russkij Mir' in Yahidne, Ukraine.

The following two sessions saw presentations from around the globe under the headings of from *East to West* and *North to South*. Starting in Australia where a very different set of landscapes and heritage issues from those found in Europe were showcased. Presentations followed on digital surface models in Mongolia, cropmarks of a Neolithic sacred landscape from the heart of Europe (Bohemia) and ALS based digital terrain models in Croatia.

In from *North to South* we were shown crop marks from central Trøndelag in Norway, and the archaeological landscapes of the Lincoln edge in England. A presentation followed on new perspectives regarding where to look and what to look for to locate hilltop settlements rather than hillforts in England, and finally again using ALS to detect archaeology, this time in the Valencian region of Spain.

The final session asked us to *Stop and Reflect* and comprised a presentation on perfect data, imperfect past, and a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis for aerial survey to better understand the current position of aerial archaeology and to identify areas that can be harnessed in the future.

A rather limited time was left for discussion prior to the wrap up, but it did include time for the big reveal regarding next year's conference in Pilsen, Czech Republic. The AARG Early Career Award was presented to Maria Lucrècia Centelles-Fullana of Universitat de València, Spain, for her paper on *Using ALS for Iron Age archaeology in the Valencian region (Spain): the Sensing Iberianscapes project experience*. A gift was also presented to Ole Risbøl by Łukasz Banaszek on behalf of AARG in recognition of his work organising an excellent conference.

After the conference, many of the delegates were able to attend the free visit to the Sea Ivories exhibition at NTNU University Museum which featured some of the Lewis Chessmen on display.

An unidentified local visitor to the conference. Photo: Valerie Ward.

Conference dinner

The conference dinner was held on Friday evening at Frati's Italian restaurant. Informal seating, where the food flowed continuously to the tables, made for a great end to the conference.

Field trips

A choice of two field trips was available on Saturday: a guided walking tour led by Axel Christophersen around historic Trondheim, or a full day field trip where we were guided by Ingrid Ystgaard, Heidrun Stebergløkken and Geir Grønnesby at multiple sites. These included the Halsstein hillfort, Alstadhaug cultural environment and burial mound, Tautra monastery and Evenhus rock carvings.

The full day trip had a slight detour through the inland farming area avoiding the recent landslips on the coast, to arrive at the first site, the Halsstein hillfort.

The area is peppered in numerous archaeological sites, so it was just a short drive to Alstadhaug burial mound. Afterwards we drove to the island of Tautra across a very unusual single-track bridge - complete with passing places and large metal gates to protect bird life at the island. A delicious lunch at the Tautara monastery followed where we all enjoyed the restaurant and surrounding grounds. After a quick dip at the beach or a beer tasting, it was off to the final stop at the incredible Evenhus rock art stone outcrops where layers of magnificent rock carving could be seen.

Acknowledgements

The conference would not have been possible without the outstanding work of the local organiser Ole Risbøl, supported by the AARG Committee, and his student volunteers from NTNU: Silje Mjølstad, Priyanka Marin Norum-Devkota, Jeanette Stjerne, Guro Tamburstuen Jubal and Ida J. Ulriksen. Together with the financial support from the sponsors, their contributions made the conference a resounding success.

Lewis Chessmen as part of Sea Ivories exhibition, NTNU University Museum, Trondheim. Photo: Valerie Ward.

Field trip: Alstadhaug burial mound. Photo: Valerie Ward.

Field trip: Evenhus rock art. Photo: Valerie Ward.

Postcards from the

42nd AARG Conference

10-13 Sept 2025

by Valerie Ward

TRONDHEIM NORWAY

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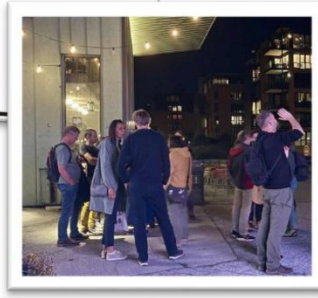
Photo: Eileen Kerhouant

Welcome reception

DOKHUSSET



Session themes

- Pushing the boundaries of survey with UAS
- AI and automation
- Risks, threats and monitoring
- Citizen science and war heritage
- Aerial archaeology from East to West
- Aerial archaeology from North to South
- Stop and reflect!


Poster Sessions
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Photo: Carmen Miu
A big thank you to all the organisers, sponsors, AARG committee, presenters, student helpers and staff
aarg
Aerial Archaeology Research Group
Congratulations to this year's Early Career Award winner: Maria Lucrècia Centelles-Fullana
Photo: Carmen Miu
Photo: Eileen Kerhouant

Photo: Carmen Miu

Halsstein Hillfort

Full Day Field trip

aarg Aerial Archaeology Research Group

- Halsstein Hillfort
- Alstadhaug Burial Mound
- Tautra Monastery
- Evenhus Rock Carvings

Alstadhaug Burial Mound

Lunch at the Tautra Monastery

Evenhus Rock Carvings

Sea Ivories Exhibition

NTNU NATURAL AND CULTURAL HISTORY MUSEUM

Photo: Eileen Kerhouant

Conference dinner

FRATI ITALIAN RESTAURANT

Photo: Eileen Kerhouant

Yellow dress code

Poking fun at writing abstracts

Some of the out-takes and fun stuff

Committee huddles

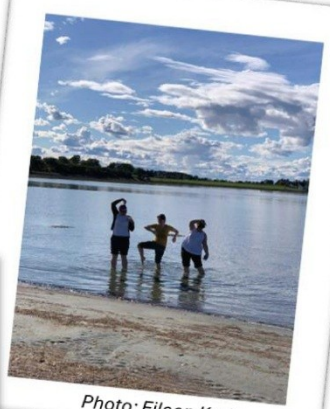

Photo: Eileen Kerhouant

AARG meets YMCA

Students' Viewpoints on the AARG Conference of 2025

Silje Mjølstad [1]

Priyanka Marin Norum-Devkota [2]

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Five student volunteers who helped run AARG 2025 in Trondheim provide some of their thoughts and views of the conference and presentations.

As volunteers at this year's AARG-conference (2025) we were asked to share some of our thoughts and views of the conference and its lectures. This is what we would like to share.

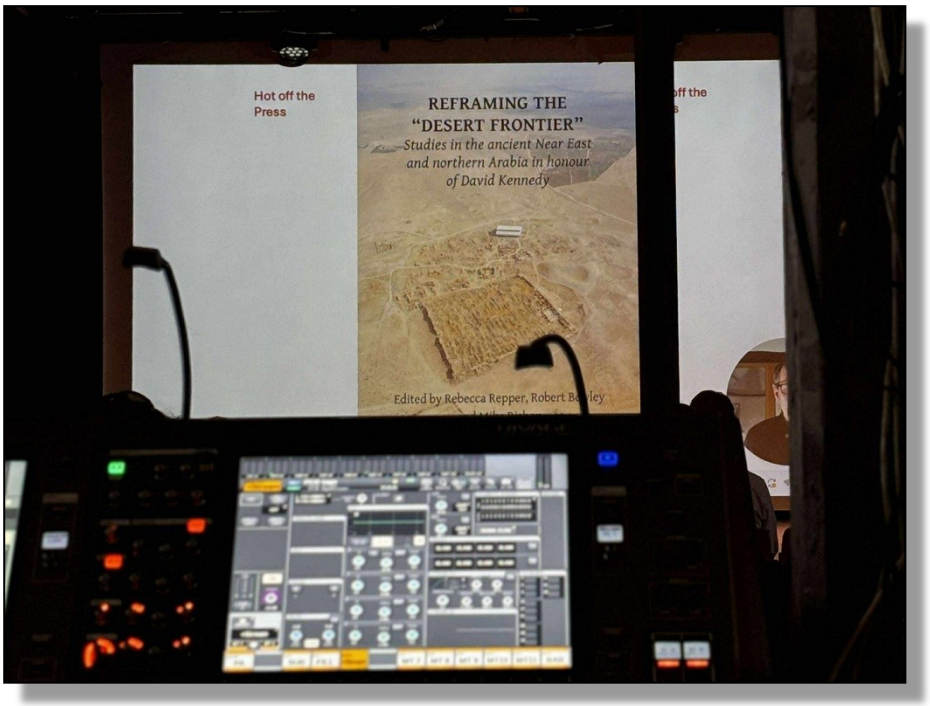
The annual AARG conference, as agreed by the volunteers writing this page, is a great opportunity to get an early glimpse of how the archaeological methods work in practice, as well as interpretation and theory. It is a gateway into a vast archaeological field, aerial archaeology, and the lectures also mirror how many different ways aerial methods can be, and have been, utilized.

It proved difficult to shorten all of the impressions from both days into just one point that captured our interests. Every lecture, every poster and coffee-break conversation sparked a further curiosity, and for some of us also gave way for exploration of new potential paths in the field. Before diving into our individual thoughts of interest, we would like to thank everyone involved, the lecturers, the committee and our own university, Norwegian University of Science and Technology (NTNU), for giving us the opportunity to join.

Aerial photography and satellite imagery ushering in a new age (Silje)

In the first year of our Archaeology course at NTNU, we learn about the difference between material objects and historical text as source material. About how this marks the difference between the disciplines of Archaeology and History. The AARG conference made me realise aerial photographs' potential to break this dualism.

If the use of text marks the difference between pre-historical archaeology and historical archaeology, then photographs could be said to mark the difference between historical archaeology and contemporary archaeology. Mats Burström refers to the contemporary as the time period that is still within living memory (the oldest people's parents' memory) (Burström, 2007, p. 13), but as 'now' becomes 'the past', photographs will remain the same. They contain information in such a different way from both material



A view from behind the scenes at Trondheim. Photo: Guro Tamburstuen Jubal.

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Another view from behind the scenes at Trondheim. Photo: Silje Mjølstad.

evidence and text, they will, and do, provide archaeologists and historians with valuable source material. Because of this, photographs might become the basis of a definition of a new time period, similar to how we separate pre-history and history.

Aerial photographs provide information from an angle that, it seems to me, is often overlooked. In this conference alone aerial photographs provided a source for the extent of Nazi buildings in Trondheim during The Second World War and what remains of them. There are few material traces of all these buildings and they were not fully documented in text.

They also enabled us to see the development of the visibility of different structures in the archaeological landscape at the foot of the Lincoln Edge in England. Another use suggested was tracking the destruction of cultural heritage in the Middle East. These are just some examples from the conference; the possibilities are endless!

Unexpected answers (Jeanette)

As a bachelor student in archaeology, it is incredibly interesting to see how aerial archaeology is used in various fields of study. The AARG brings experts from different parts of the world together in one room in an effort to share their knowledge with each other, and to help further the field of archaeology. Each of the lectures were, in itself, an interesting experience. However, the lecture by Julian Cadamarteri—*Mapping landscapes of occupation at Lade, Trondheim*—gave me the answer to a question I have had for many years: why is there a random wooden airplane outside a shopping centre at Lade? What I learned in the lecture, and was shown with aerial photographs, was that the shopping centre used to be an airplane hangar during WWII, and that the hangar is one of the few surviving buildings in that area, from that time. The plane was a representation of the past.

The excitement I felt when getting that answer, surprisingly from a source I did not expect, showed me a connection between the past and the present in a way that resonated with me, not only as an archaeology student with a love for the contemporary past but, also as a native denizen of Trondheim.

The more you learn, the more you understand just how little you know, however, because of this conference I now have new knowledge, and a renewed excitement for learning.

Conversations and Collaborations (Guro)

As students, it's not often that we get to be in the room and observe while conversations about archaeological projects are taking place. I found it incredibly interesting to observe the conversations and questions surrounding the methods used in each individual projects. Every project raised new questions.

It was exciting to learn about the areas being discussed, as the questions were being answered. The questions and the conversations around the various projects were very educational, in how it demonstrated collaboration and engagement within the field, while also showing how different points of view can provide new perspectives. The collaboration observed at the conference was educational and inspiring.

Climate, questions and reflections (Ida)

It is challenging to limit my thoughts of the lectures to just this short text, as every lecture piqued my interest and made room for reflection. The variety of the lectures also proved the vast utilization of aerial methods, and more in-depth than what we learn in our curriculum.

One of the themes that perhaps I found most interesting, was the theme of threats, risk and monitoring. This is a subject I care deeply for, as more and more cultural heritage sites are at risk with, among other threats, climate changes.

I especially have a deep love of the arctic. The lecture *Coastal erosion and cultural heritage in the rapidly warming Arctic: LiDAR-based monitoring in Svalbard and Nordland County*, hit close to home and gave me both hope that measures are being taken, but also made me reflect on the "what if's". What if the arctic does not get enough attention? Not enough funds? Not enough new students interested in the field? What happens if sites are destroyed, knowledge lost, and what could be done to save what is there if it happens? There are many questions I would like answered, and perhaps this conference and this lecture is giving me a nudge in the direction of being able to answer these myself one day?

It is important to bring climate change into the conversation, as the threats are happening now. Further development in terms of methods of monitoring, training students in the field, and bringing the case into the light are steps of getting an upper hand of the situation.

As a bit of a side point, the later lectures about Citizen Science made me think about the possibilities of using the program to assist in monitoring? The conference has given me much to think about, and has given me a new light to look at the archaeological world and with that, what I might want to work with after graduating.

An exciting insight into the professional world (Priya)

As an archaeology student this was very exciting to be a part of. I'll admit, I was a little intimidated at first being in the same room as so many professionals, but being able to hear about how they work and collaborate was very interesting.

The courses at NTNU are very theoretical, so to see all the practical work that goes into research projects was very fascinating. I was surprised at how technical things could get.

I've never thought about the applications of AI in archaeological work before but considering how fast technology is advancing today the possibilities are quite interesting to think about.

Also, hearing in one of the presentations how they built a drone was really cool to learn about. Really, I shouldn't have been surprised at all about the drone work at a conference for aerial archaeology, but it just reminded me how many different kinds of people and disciplines work together in the pursuit of knowledge. And not only professionals either! It was nice to learn about citizen science and how volunteers with varying degrees of expertise can also contribute.

It was also interesting to hear about the various obstacles that come with using technology like drones and Lidar, like how you have to think strategically about climate and weather conditions when collecting data. In one of the presentations I learned about the use of aerial archaeology in Australia. There were many obstacles and things to think about ranging from climate change, the diverse landscape and terrain, urbanisation and the impact of British colonisation on indigenous peoples. Not to mention how time consuming such work is considering the scale of the area.

I could honestly type up an entire essay on my thoughts.

It was very cool to see experts in the field share and discuss knowledge together, and it gave me insight into professional practice. Being able to observe the conference taught me a lot and really made me think.

Volunteering at AARG 2025 was a mix of thrilling, educational, and just a little intimidating, but in the best way. It was incredibly fun to see how archaeology brings people, technology, and curiosity together. And at the end of it all I left with more questions, new inspiration, and a renewed excitement for my own studies.

Conclusion

Our attempt at filtering down our impressions from the AARG conference to fit on these pages truly captures what a great opportunity it was to be able to volunteer there. Like how professionals from different backgrounds came together to share valuable information through lectures, posters and conversation at the conference, we have come together as volunteers to share our differing perspectives on it in this paper.

The conference inspired philosophical pondering on the value of aerial photography to the archaeologists of today and tomorrow. It gave us answers to questions we have had for a long time. It was an inspiring example of international collaboration. It gave us hope for the future, and a possible future career path. And it gave us insight into the practical aspects of archaeology we have yet to learn about at NTNU.

Overall, we learnt and grew a lot through our participation in the conference, and we hope many more will have the same opportunities in the future!

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

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Ievgen Poliachenko [5,4]
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A UAV-based magnetometer has been used to enable the efficient and detailed survey of two plough-levelled Roman forts, one of which was previously undocumented, in Ukraine thereby contributing valuable data for archaeological interpretation and preservation planning.

Introduction

History offers many examples where military activity has driven technological progress across various fields. The ongoing war in Ukraine has accelerated the development of Unmanned Aerial Vehicle (UAV) - based intelligence and strike solutions. These unmanned systems have also proven particularly valuable in humanitarian efforts, such as the demining of recaptured territories affected by the conflict. Notably, the NATO SPS project MinesEye, currently being implemented by the Postup Foundation (Poland) in partnership with the Institute of Geophysics of the National Academy of Sciences of Ukraine (https://postup.com.pl/en/demining), is focused on developing a UAV-based, multi-sensor system for detecting areas potentially contaminated with unexploded ordnance (UXO). The system's primary sensor is a magnetometer, enabling rapid and efficient surveying of large terrains. From the other hand, in recent years, drone-based magnetometer surveys have proven to be highly effective in mapping archaeological sites (Stele *et al*., 2023; Schmidt *et al*., 2024). UAV magnetometry systems, currently employed in demining operations in Ukraine, demonstrate sufficient accuracy, spatial resolution, and sensitivity to detect subtle magnetic anomalies beneath the surface—such as those generated by buried architectural remains, artifacts, or ancient burial grounds.

The objective of this study was to apply this highly efficient geophysical method to investigate and clarify the structure of the Roman fort Kamianka V, which was established in the first century AD along the northwestern frontier of the Olbian state in the Northern Pontic region (Figure 1, next page).

In addition, we measured a previously undocumented structure approximately 1.9 km southeast of Kamianka V, revealed by satellite imagery analysis. This feature closely resembles the shape and dimensions of the internal fortifications of the main site (Figure 2). It is located in proximity to the Dovha Mohyla burial mound and near a field road leading toward Olbia Pontica (Figure 3).

The deployment of UAV-based magnetometry significantly enhanced the scope of the investigation by enabling the efficient and detailed survey of both sites and their surrounding areas, thus contributing valuable data for archaeological interpretation and preservation planning.

Archaeological context

At the beginning of the 1st century AD, following several decades of

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depopulation and decline in the Olbian *chora*—a consequence of the destruction of Olbia by the Getae in the mid-1st century BC—a new defensive network of fortified sites emerged around Olbia. This Roman-era defence system encompassed the fortifications of the *polis* itself as well as a series of settlements and fortified points situated along the Buh, Dnipro, and Berezan estuaries (Ruban and Buiskikh 1976; Buiskikh 1991; Gudea 2005).

In 2011, a previously undocumented fortified site dating to the Roman period was discovered and subsequently designated as Kamianka V (Kozlenko 2016). Based on the findings of surface inspections and excavations, the site is interpreted as a Roman military field camp (*castellum*) or possibly a *numeruskastell* — a small fort used to house auxiliary troops. Kamianka V covers an area of approximately 7 hectares and is located near the village of Kamianka, Mykolaiv Region (N46.79°, E31.70°) (Figures 1–4).

The fort is parallelogram-shaped in plan (measuring 260 × 270 m) and is enclosed by a 10–15 metre-wide earthen rampart, now heavily eroded by prolonged agricultural activity, and an accompanying defensive moat. Within the main enclosure, two smaller internal fortifications are present, each measuring approximately 70 × 70 metres.

The moat itself has a width of 5.3 metres at the top, narrowing to 0.6 meters at the bottom, with a depth of 1.8 metres below the surrounding terrain. Despite the degradation of the ramparts due to ploughing, remnants up to 0.3 metres in height are still visible on the surface.

Based on the ceramic assemblages and numismatic evidence, the construction of Fort Kamianka V is dated to the third quarter of the 1st century AD. This timeframe coincides with the initiation of the Olbian era, the conclusion of the Roman-Bosporan War, and the military and political campaigns in the Northern Black Sea region led by the Roman governor of Moesia, T. Plautius Silvanus Aelianus. The fort's establishment also reflects the strategic alliance between Olbia and the Sarmatians during this period.

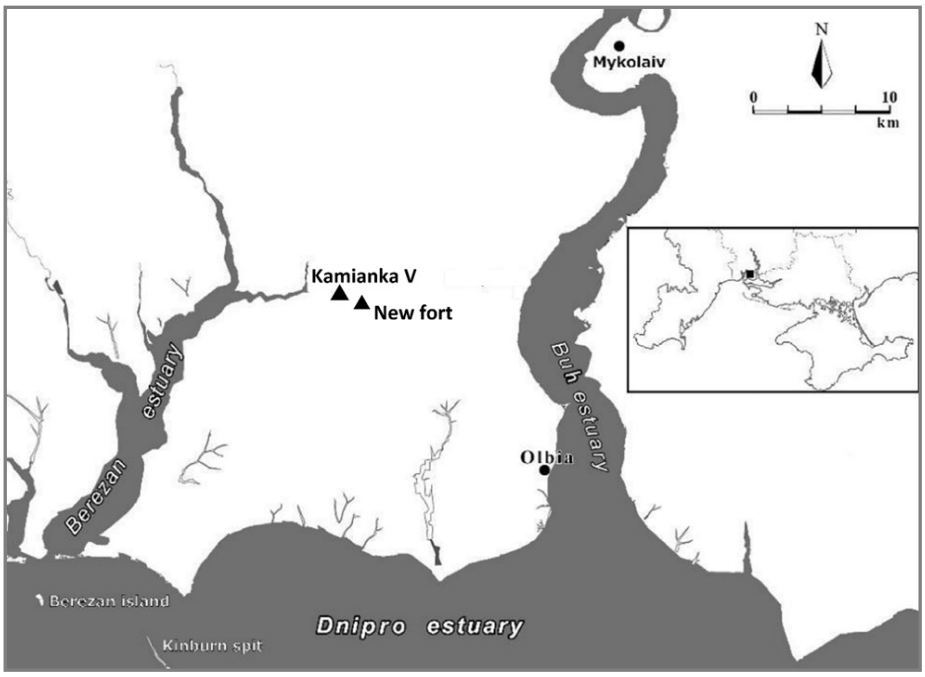

Figure 1. Location of the studied sites in the chora of Olbia Pontica.

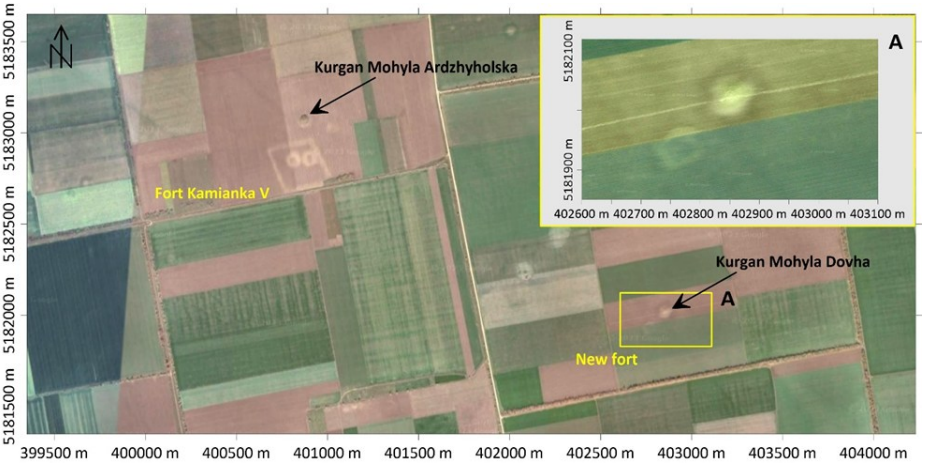

Figure 2. Location of two Roman forts next to burial mounds (kurgans) (basic map: Google Earth. (2024). Satellite imagery. Retrieved June 4, 2024, from https://earth.google.com/).

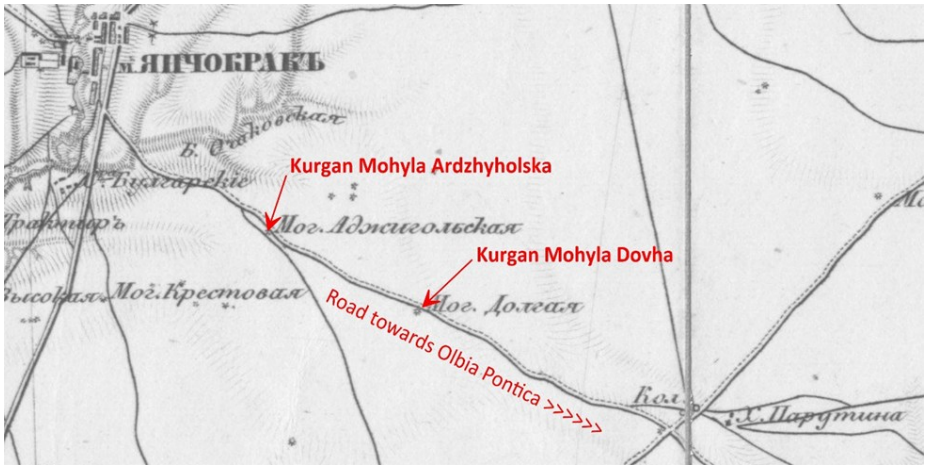

Figure 3. Location of the burial mounds (kurgans) on a Shubert`s historical map (Shubert, 1865).

A limited ground-based magnetometer survey conducted in 2023 confirmed the presence of a double outer moat and provided reconstruction of the eastern internal fortification's geometry.

Method

The UAV-based magnetometer survey was conducted using two MinesEye UXO detection systems, each comprising a DJI Agras T30 drone integrated with a SENSYS MagDrone R3 magnetometer. The magnetometer unit is equipped with two three-axis fluxgate sensors, mounted with a 1.0-meter spacing in a protective aluminium frame. To minimize magnetic interference from the UAV platform, the system includes an extender, made of non-magnetic materials, which positions the magnetometer 2 meters below the drone. Data acquisition is managed via an onboard data logger (Figure 5).

We utilize a GNSS RTK system consisting of the Emlid RS3 base station and the Emlid Reach M2 rover. The rover is integrated into the data logger, centrally positioned within the drone, while the magnetometer is offset due to an extender. While the drone follows its flight path, the magnetometer deviates from its standard position only during initial acceleration. Once the system reaches cruising speed, it stabilizes, maintaining a constant relative position between the magnetometer and rover for approximately 90% of the survey area. The magnetometer offset correction is applied during post-processing.

The height of the magnetometer over the ground surface, due to the use of a self-transforming extender, was ~1.0 m, the drone's flight speed was 15 km/h.

The post-processing routine has been done using MagDrone DataTool (SENSYS) and Oasis montaj (Geosoft).

Results

The magnetometer survey comprehensively covered the entire Kamyanka V Roman fort and its surrounding area, totalling 160,000 m². The southern edge and south-eastern corners of the fort were not surveyed due to terrain obstructions. The resulting magnetic anomaly map is highly informative (Figure. 6) and supports a confident archaeological interpretation.

Figure 4. Fort Kamianka V. View from the northeast.

Figure 5. Surveying using the MinesEye system (Sensys R3 in drone-based GNSS mode mounted on extender).

Based on the magnetometry results, the outer fortification line comprises a double moat enclosing remnants of earthen ramparts still visible at the surface. The outer moat is represented by a positive magnetic anomaly of 12 nT maximal intensity. It`s width is approximately 3.5–5.0 meters. Located 3–4 meters inward, a narrower inner ditch, measuring less than 2 meters wide, was also identified. No entrance to the fort was detected, as there are no visible gaps in the moat system. However, according to the recent reconstruction of the Roman fort in Ungra, Transylvania, by Hegyi *et al*. (2025), the entrance to the fort might have a bridge over the moat. In this case, a gap in the large outer rampart is expected. Due to the poor preservation of the ramparts, detecting subtle terrain feature such as small gully is challenging; however, remote sensing techniques like photogrammetry or LiDAR can significantly enhance their visibility. A modern gravel road currently crosses the site, visible as a linear positive anomaly along the southern edge of the fort.

The magnetic survey further delineated the layout of two smaller internal fortifications, each characterized by rounded outer and square-like inner moats. In the eastern

enclosure, a linear positive anomaly was partially identified between the ditches, likely corresponding to the remnants of a palisade. Entrances to both inner structures are visible on their southern sides, marked by gaps in the moat anomalies. The inner free space of the eastern enclosure measures 34 × 34 metres, while the western one is approximately 30 × 30 metres.

To the northeastern periphery of the fort, a ring-shaped positive anomaly with an intensity of up to 5 nT and an outer diameter of 63 meters was identified. This feature likely corresponds to a ring ditch of a ploughed -out Bronze Age (?) burial mound (kurgan). It is possible that, along with Mohyla Ardzhyholska, this kurgan was reused by Roman forces for defensive purposes.

The UAV magnetometer survey of a square-shaped feature identified in satellite imagery near Mohyla Dovha confirmed the presence of a Roman fortification (Figure. 7). The associated anomaly, measuring 2–10 nT, corresponds to a ditch outlining the fort. The external dimensions of the newly discovered fort are 41 × 42 metres, with a clearly defined entrance located on the southern side.

Figure 6. Fort Kamianka V, results of drone-based magnetometer survey

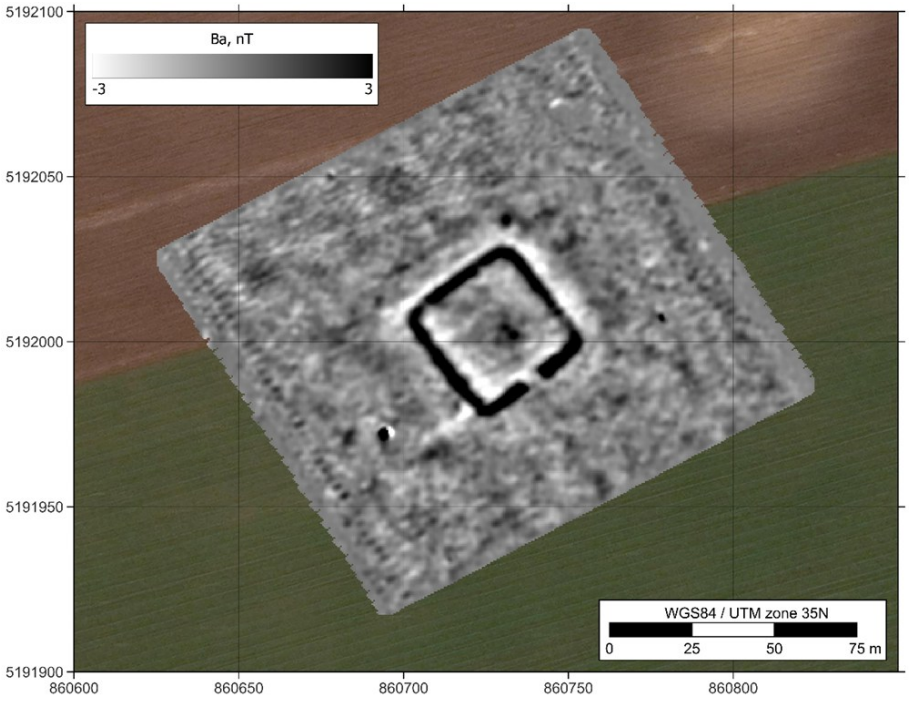

Figure 7. New fort near Mohyla Dovha kurgan, results of drone-based magnetometer survey

Conclusions and outlook

This short study has provided:

- New insights into the structure of the Roman fort Kamianka V were obtained through drone-based magnetometry.
- Additionally, the survey led to the discovery of a previously unknown Roman-period fortification.
- The results underscore the significant value of non-invasive geophysical techniques, particularly UAV-mounted magnetometry, in revealing the architectural details of Roman earthworks in the Northern Black Sea region.
- We anticipate that the outcomes of this project will contribute to the revision of national guidelines for cultural heritage research and conservation, promoting the broader adoption of advanced remote sensing technologies in archaeological investigations.

Acknowledgement

This study was undertaken with support provided by the Aerial Archaeology Research Group, through the AARG Fund grant scheme.

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Editor's Picture

Yarnbury Castle Hillfort, Wiltshire

KH-9 HEXAGON satellite photograph of Yarnbury Castle hillfort, Wiltshire. North is to the top. Extract from a scanned image downloaded from the US Geological Survey EarthExplorer website. Entity ID: D3C1206-300341F015.

For over 40 years I have often marvelled at the ramparts of the hillfort at Yarnbury, Wiltshire, UK, as I passed by it whilst driving along the A303 on my way to and from the West Country.

The photograph, taken on 15 August 1973 from an altitude of 162 km by a KH-9 HEXAGON photoreconnaissance satellite, clearly shows the multivallate ramparts of the hillfort which enclose an area of approximately 11 ha. Within the hillfort interior an earlier enclosure can be discerned.

Cutting across the photograph the A303 trunk road can be clearly identified as it passes to the south of the hillfort, with the eastern part showing the bright while chalk from recent road improvements.

On the eastern edge of the image and to the south of the A303, the outlines of the banks and ditches of an ancient field system can be seen. Elsewhere, hints of other plough-levelled features can also be found.

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

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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.

Introduction

Iron and steel are some of the most basic and most widely used materials in history. The introduction of iron metallurgy and the metal's widespread use marks a significant threshold in the history of humankind. As one of the Czech Republic's leading researchers on archaeometallurgy, Radomír Pleiner argues iron and steel tools notably contributed to the everyday life of prehistoric societies in Europe by allowing for vaster deforestation of the living space and further ease in woodworking (Pleiner 2000, 24). Iron and steel then continued to play a vital role as materials used for creation of a variety of artifacts - be it working tools or weapons.

The Brdy region used to be the main iron production territory of Bohemia for centuries. The ironworking tradition spans to at the very least 14th century and is to some extent still present in the form of small companies. However, most of the industry collapsed during the late 19th century in an era of rapid technological and logistical transformation (Pleiner *et al*. 1984, *passim*).

Ironmaking and ironworking process in the studied area was centralized in the ironworks areas - at the furnaces and iron hammer mills. It was heavily dependent on water to run the bellows and the hammers (Hofmann 1981, 16). However, to keep the process going a number of different types of resources was needed. It is mainly the archaeological features connected to these "supportive crafts" and supportive infrastructure, that can be studied using landscape archaeology methods such as ALS data prospection.

This paper aims to evaluate the traces the long lasting ironworking process left in the landscape around two major ironworking centres of Central Brdy Mountains region - Dobřív and Strašice (Figure 1 overleaf). These important settlements, or to be more precise their surroundings, have not yet been the subject of systematic landscape archaeology research. The presented prospection and assessment of archaeological features thus forms a first step in the process of detailed study of this historical ironworking landscape.

The ironmaking processes

The chemical reduction of iron ore and the obtaining of the metal from it can be accomplished using two different ways - processes. As for the case of Bohemia, the older one - direct ironmaking process - was almost completely, if not completely, replaced by the indirect process of making iron in blast furnaces (Maur 1998, 26). This significant change in technology happened in the late 16th and early 17th century with the introduction of blast furnaces to Brdy region (Maur 1997, 12).[2]

The direct process of making iron from its ore takes its name from the fact that the product (so called bloom) of the bloomery furnace was directly malleable and after the removal of slag (gangue residue and impurities) from the bloom, the iron could be used right

[2] The first blast furnaces in Bohemia were also built in the late 16th century in Ore Mountains, but as some authors note, the furnaces built in this region are an expansion of contemporary Saxon industry and didn't play the vital part in the spread of the indirect process technology, which was taken on just a few years later by the imperial ironworks in Brdy region (Hofmann 1996, 8; Kořan 1946, 33; Maur 1979, 41; 1997, 12; 1998, 23).

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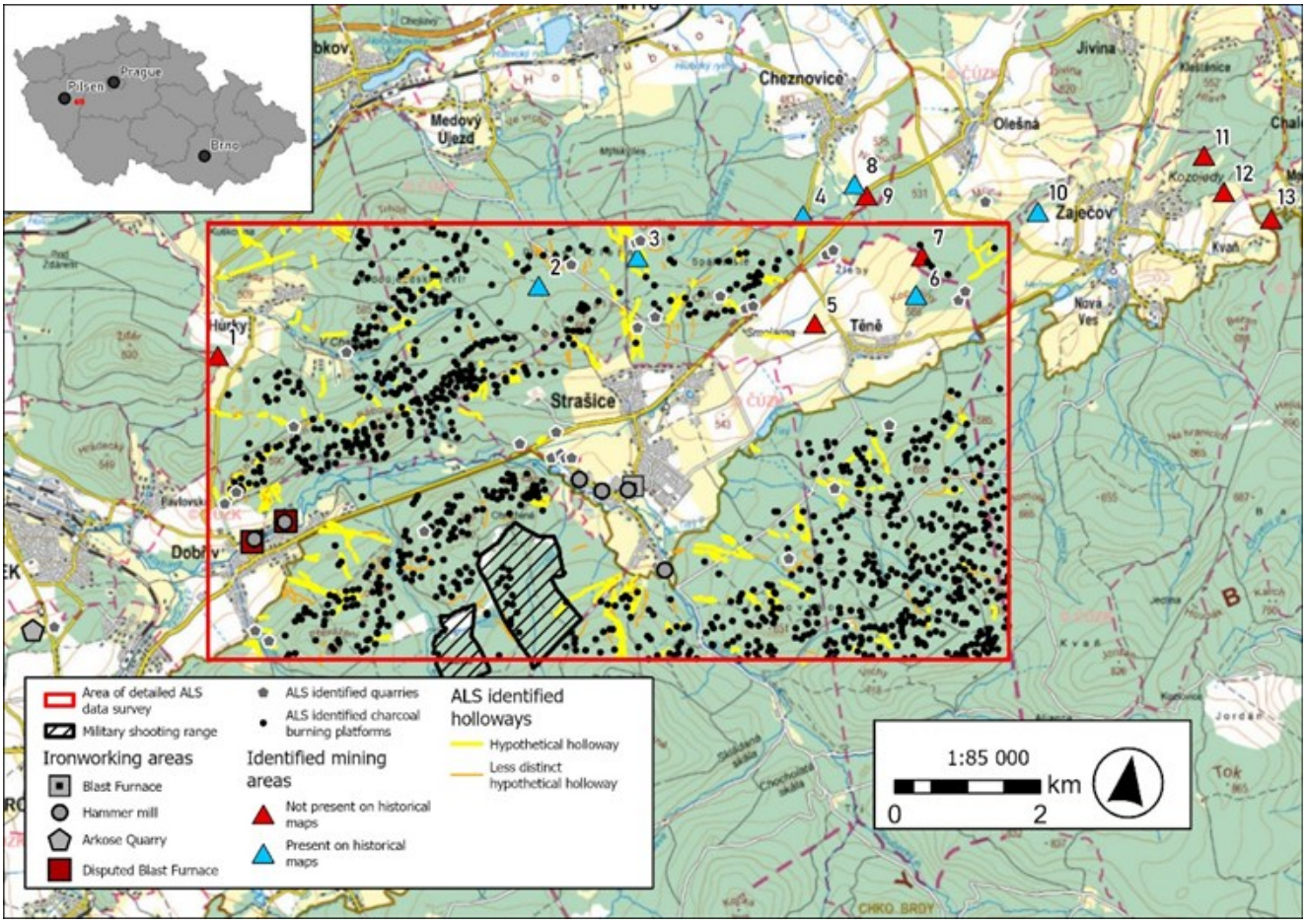

Figure 1. Overview map of the studied region. Upper left corner: The position of the studied region in the Czech Republic. Basemap: State Administration of Land Surveying and Cadastre.

away. The earliest direct archaeological evidence of local (Czech) iron metallurgy dates back to the end of the 6th century BC, the Hallstatt period of the Iron Age (Merta 2012, 9; Pleiner *et al*. 1984, 14–16). The direct process was also used during the medieval era and at the beginning of the early-modern period.

The indirect process took place in a charcoal-fueled blast furnace which, unlike the bloomery furnaces, produced pig iron - molten iron high in carbon. This iron could be either directly used for casting or it could be refined in hammer mills to produce malleable iron. Hofmann (1981) argues that the ability to produce cannons and artillery ammunition was one of the driving factors of the technological innovation in Brdy region and Bohemia. He also notes that it is possible that by the end of the 16th century, all the ore resources easy to smelt were depleted and the ore that was mined was substantially harder to smelt in a bloomery furnace. Furthermore, the blast furnaces were running in campaigns that lasted several weeks, later on even months and thus provided enough iron for continuous refining. This created a substantial income for the owner (Hofmann 1981, 48–50).

The blast furnace needed much more ore and charcoal to be run in comparison to the earlier facilities and so the supply area grew in size. The ore and the charcoal were transported to the furnace from greater distance. There had to be plenty of material in stock before the start of the blast furnace campaign (Kořan 1946, 82; Pleiner *et al*. 1984, 102). The ironworking process also occupied more space in the settlement - while during the direct process era the furnace and the hammer mill were situated near each other (sometimes even in one building), the production of a blast furnace supplied several hammer mills which were normally spread along a water current (Kořan 1946, 37, 112). This clearly demonstrates that while the whole production grew in intensity, some links of the process (for example charcoal making) grew extensively. The presence of a single blast furnace in a central place affected the whole landscape around it, even more than the bloomery ironworks beforehand.

History of Dobřív and Strašice ironworks

The earliest written mention of ironworking in the studied region comes from the year 1379. Written in this year is the urbarium of the fiefs of the House of Rosenberg, in which the ironworks in Strašice is indirectly mentioned. The book mentions that the bloomers have 2 *lanei* of land by Strašice[3] (Hofmann

[3] *Ibidem penes eandem villam sunt II lanei huthniconum* (Truhlář 1880, 53). Compare the word huthnic with the Czech word hutník - smelter, ironworker.

1998, 1998:5). The area of the mentioned medieval ironworks was located by Karel Nováček on the southern edge of the current town. There he found several slag heaps, remnants of two water reservoirs and subtle elevations of terrain marking the remnants of the buildings. The sherds obtained through fieldwalking and small -scale excavation allows dating of the site to the 2nd half of 14th century or the 1st half of 15th century (Krofta 2022, 243; Nováček 2007, 167). The earliest certain mention of ironworking in the neighbouring Dobřív is from the year 1526 (Rožmberský 2010, 45), but there is very little information on this oldest phase of the ironworks.

It is at the turn of the 16th and 17th century, that the blast furnace technology is introduced to the region through the immigration of a Wallonian smelting specialist - Jindřich Kašpar de Sart (Sarth). De Sarth built the first blast furnace in the region in the year 1595 in Králův Dvůr ironworks. Several years later, possibly around 1603, he comes to Strašice where he also builds a blast furnace. By 1614 another blast furnace was built in the neighbouring Dobřív by Salomon Schürer (Šalamoun Šírer). Both Strašice and Dobřív ironworks were eventually bought by the Bohemian Royal Chamber and incorporated into a complex of ironworks directly owned and managed by the Bohemian Royal Chamber which was formed mainly during the 17th century (Hofmann 1968a, 22–23).

The blast furnaces were accompanied by hammer mills for refining of the pig iron and further iron production. The production was quite intense, by 1753 there were 2 blast furnaces and 4 refining hammer mills in Strašice, Dobřív had 1 furnace and 4 refining hammer mills (Hofmann 1981, 229, 238). In the middle of the 18th century, the Brdy ironworking was in its most extensive phase - there was the highest number of hammer mills and blast furnaces in the region's history. The production of Brdy region in the half of the 18th century contributed to 85.3% of all iron produced in Bohemia (Hofmann 1968b, 51). In the year 1817 Dobřív blast furnace was shut down, but the hammer mills continued the production using pig iron from other furnaces. Later on, a rolling mill was built in the furnace's place (Hofmann 1981, 229). As for the Strašice ironworks, by 1875 there were 2 blast furnaces, 2 refining hammer mills and a foundry. After this year, the blast furnaces were shut down and the hammer mills sold. Only the foundry remained (Hofmann 1981, 238).

The production of the ironworks during the direct process era focused mainly on ammunition and malleable iron production. During the Thirty Years War, the Brdy region ironworks were the main producer of artillery ammunition and sapping tools for the army of the Austrian Empire. After the war, the production focused mainly on malleable iron (Hofmann 1981, 19:83). The production of cast ware began to be significant at the end of the 18th century (Hofmann 1968b, 50).

In the year 1868 the whole domain including the ironworks was sold by the Royal Chamber and eventually bought by Bethel Henry Strousberg, a German businessman who planned to build and modernize the ironworking industry in the Brdy region. However, the crash of Vienna stock market in the year 1873 put a halt to Strousberg's plans. All of his estate including the ironworks was sold in auctions, however the ironworking industrial complex was dismantled, the ironworks and their facilities were sold separately, not as a whole (Tuma 2018).

Earlier archaeological research in the area

While there is a number of publications on the region's history from the perspective of written sources (especially Hofmann 1968a; 1981; Kořan 1946; Pleiner et al. 1984 and a number of local studies in various historical journals), the archaeological research remains scarce. The only archaeological project undertaken to this date is sub-project of "Neglected Archaeology" at the Department of Archaeology of University of West Bohemia in Pilsen between 2006 and 2008. The sub-project was led by Dr. Karel Nováček and focused mainly on surface feature recognition and a limited excavation at the aforementioned medieval ironworks area. The projects proved the potential of the region for archaeological research of ironworking and its resource base and supportive crafts (Nováček 2007). A number of studies aimed at the study of charcoal burning platforms was published in the broader Brdy region (e.g. Bobek 2008; Matoušek and Brejcha 2017; Matoušek et al. 2020) but none of these studies focused on the charcoal burning platforms structure in the landscape in a major scale.

This quite unique potential for archaeological prospection and research results from the sparse population of the region as well its heavy afforestation. This is especially true for a part of the study area where a military training range was created in the 1920s. The villages present in this area were finally evacuated in 1950s and the whole area was sealed from further large scale building activity - apart from the shooting ranges built (sadly) at the closest vicinity of the former villages. Finally, in the year 2016 the military training area was cancelled and Protected Landscape Area Brdy (PLA Brdy) was created, which continues to protect the landscape from further change (Nováček and Krofta 2018). It must be however noted, that the present forest industry actually poses a significant threat to the archaeological features of Brdy region (even inside the PLA) and currently poses a significant threat to the landscape heritage.

Methods

Literature and historic maps research

Firstly, the available material published in journals and monographies was studied as well as available cartographical sources. Georeferencing these maps using GIS software adds the ability to gain even more precise information on the position of the represented production sites which can be the prospected using ALS and groundtruthed in a later phase of the research. These sources also

significantly ease the interpretation of some detected features. The maps used for the presented study were acquired in State Regional Archive in Prague (SOA Praha, fund NAD 397 - Velkostatek Zbiroh), the Fund of Historical Maps of Czech Geological Service (ČGS) and using a web historical map collection Chartae Antiquae (Chartae Antiquae MS2 & MS3).

ALS data prospection

The ALS data used for the systematic research were provided by State Administration of Land Surveying and Cadastre. The data were used to create a Digital Elevation Model (DEM) of the study region using ArcGIS Pro 3.3.1 software with 1 m cell size. The resulting DEM was then used to create ALS data visualization rasters using Relief Visualization Toolbox 2.2.1 (Kokalj and Hesse 2017).

The visual and manual data prospection of ALS was carried out in GIS using a systematic method during which the landscape was divided into individual 500x500 m grids and all the grids were prospected individually. The interpreted features were then sorted into separate Geodatabase feature layers according to their interpretation. The visualizations which seemed to provide the best results in the studied environment and context were Hillshading from multiple directions, Slope, Positive openness, Simple local relief model, Sky-view factor, and their respective combinations. The interpretation of ALS data proved to be a viable method for the study of the ironworking landscape as most of the studied archaeological features show distinct geomorphological characteristics which can be easily identified on LiDAR visualizations. The use of ALS for the study of ironworking has been already demonstrated for example in Poland or Norway (Rutkiewicz and Malik 2018; Stamnes, Risbøl, and Stenvik 2019).

Spatial analysis methods

The below described archaeological features and areas were analysed using spatial analysis methods in GIS. The analyses were selected to answer specific questions for each segment respectively.

In case of charcoal burning, the overall spatial structure and concentrations of the identified charcoal burning platforms was studied using Kernel Density analysis (Wheatley and Gillings 2002, 186 - 187; Bevan 2020). For the analysis itself a tool "Kernel Density" from ArcGIS Pro Spatial Analyst Toolbox was used. The radius field was left blank to be automatically calculated by the software based on the number of inputs and their spatial configuration.

The position of the identified mining areas was studied in comparison with available geological maps (Geological Map of the Czech Republic 1:50 000). A general trend in the location of the extraction areas was sought after. Furthermore, the size of the mining areas was compared to try and address the possible intensity and/or duration of the mining. In an attempt to identify older mining areas, that might have been undamaged by mining in the 19th century, the position of the identified areas was also compared to the available 19th century map of the studied area with marked mine positions (ČGS-SM-S12-11/014).

Results

Charcoal burning platforms

Charcoal was a critical resource used for the fueling of both the bloomery furnaces and the blast furnaces, as well as the hearths in the hammer mills (Pleiner et al. 1984, 71). Based on this fact, it can be assumed that the charcoal production was already underway in the Middle Ages, however currently there is no direct evidence of medieval charcoal making in the study area. The first direct evidence of charcoal making is the mention of charcoal burning in a contract regarding the sale of wood to Strašice ironworks by the domain owner in 1532 (Hofmann 1998, 1998:5–6).

The production areas can be archaeologically identified by the distinct morphology of the feature - an oval or round platform cut into a slope, most of the times with a black, charcoal-rich layer underneath the upper forest litter layer. These features are also very well identifiable using ALS prospection and have been studied by landscape archaeologists across the Czech Republic and Europe (Bobek et al. 2021; Rutkiewicz, Kalicki, and Fularczyk 2022; Schneider et al. 2020).

From the Kernel Density analysis of identified charcoal burning platforms (CBP) it is evident that the features concentrate on the slopes surrounding the settlements of Strašice and Dobřív (Figure 2). The highest concentrations of CBPs reach 64 platforms per square kilometer. First of these concentrations is located on the ridge located to the north of the main valley road, the second one can be observed in the southeastern corner of the analysed area where there seems to be a gradually growing density of features connected to charcoal burning. The concentration on the ridge east of Dobřív and west of Strašice is also a significant one. On the other hand, there seems to be a lack of charcoal burning traces in the vicinity of Těně village, located on the eastern flank of the prospected area..

It is quite possible that this phenomenon is partially caused by better visibility of the platforms in the steep terrain around Strašice and Dobřív. This terrain was heavily forested throughout history, as can be deduced from historical maps, and formed a perfect environment for charcoal production. On the other hand, the environs of Teně consist of much more open landscape which was historically used as farmland - driving the charcoal production to the dense forests south of the village. It is also possible that the absence of charcoal burning platforms near Těně is related to the small size of ironworks that worked that area between the 16th and the early 19th century. For its whole history it consisted of a single blast furnace and a single hammer mill (Hofmann 1981, 239; Šťovíček 1984, 15).

When compared with data from other European regions, the observed charcoal burning platforms density is not an insignificant one, although it is

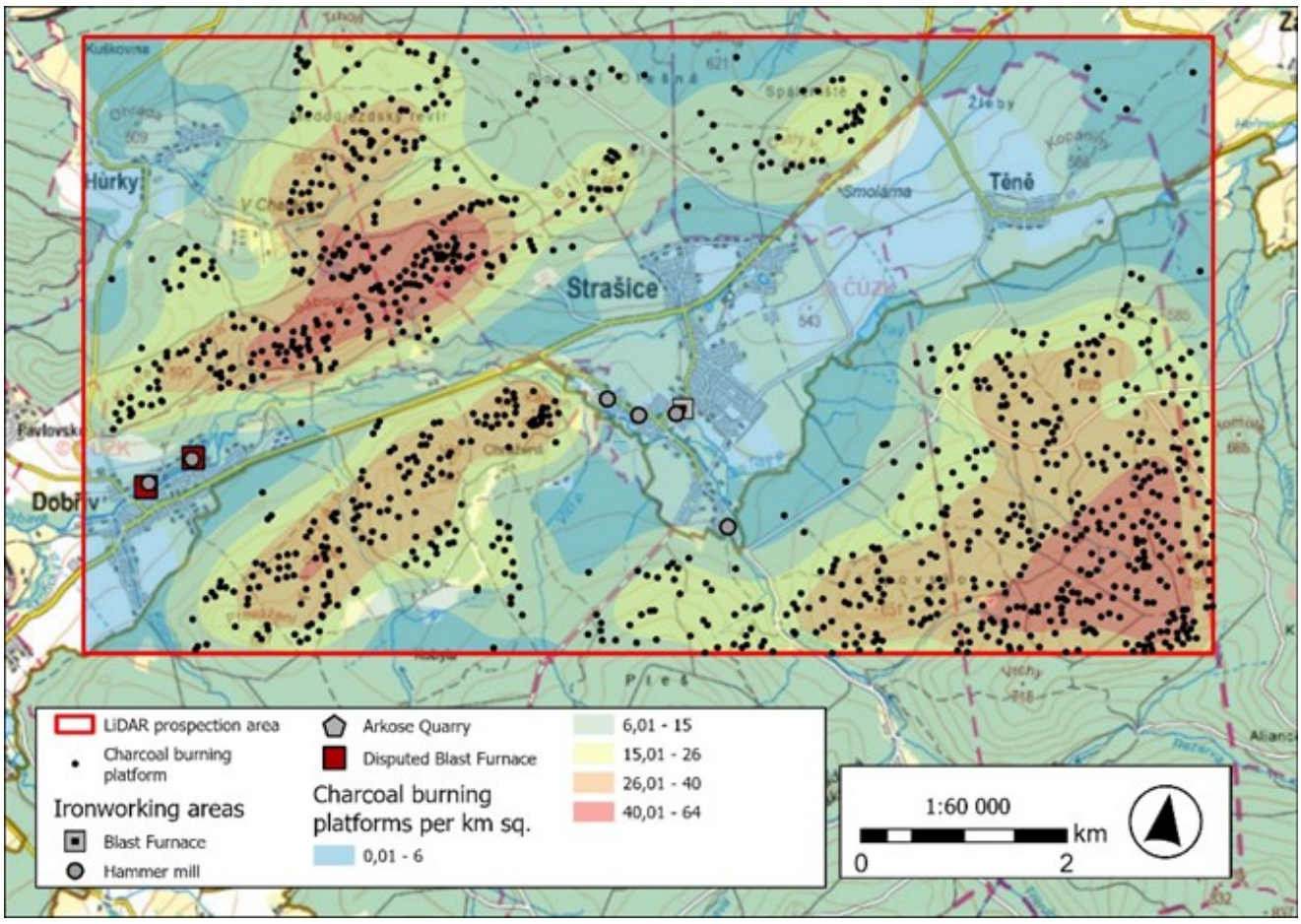

Figure 2. Results of Kernel Density analysis based on ALS indicated charcoal burning platforms. Position of ironworking facilities based on detailed map of Strašice water regime (Map of water regime in Strašice, unknown origin) and literature research. Basemap: State Administration of Land Surveying and Cadastre.

not among the highest (Raab et al. 2022, 4). This result is however influenced by the current state of research and will be possibly altered by future research.

Iron ore mines

It is suggested, that the medieval and early post-medieval smelters used local ores, mostly weathered outcrops - such as limonites - which were located in the vicinity of the medieval ironworks. The reduction of these ores was quite easy in comparison with the non-weathered ores (Pleiner *et al*. 1984, 71; Pleiner 2000, 88). With the onset of the use of the indirect ironmaking process, the economic model of the ironworks also changed. The adoption of the indirect reduction process and the need for suitable and abundant resources lead to the transport of ores of different provenience to the furnace and their subsequent mixing in different ratios. It is also apparent that by the beginning of the 17th century the non-weathered ores were mined - mostly hematite (Kořan 1972, 27). The ore could be transported from quite a significant distance, especially if it was of better quality then the local ores. This can be well documented by the case of the iron ore mined in the mines of the towns Pilsen and Rokycany in the vicinity of Klabava village (about 11 km from Dobřív). The ore was used at least from 1699 to 1704 in the blast furnace of Dobřív and the *schichtmeister*[4] was very satisfied with it. When the stock of the ore was running low, the workers mixed it with local ores which however lead to lower production and this caused problems with the supply of the hammer mills (Jindřich 2008, 41).

[4] *Schichtmeister* (*šichtmistr* in Czech) was an assigned official in charge of the ironworks (Pleiner *et al*. 1984, 146; Kořan 1946, 113).

The mining areas are quite distinct archaeological features which can be easily identified on LiDAR data. The mining pits are most of the times grouped closely together and form a stretch of disturbed landscape following the ore source. The strategy of mining was given by the nature of the ore - it sometimes occurred in a form of lentils which had to be searched for, rather than a form of a continuous vein (Kořan 1972, 27). Other types of features connected to ore extraction were also observed and will be discussed below.

Thanks to the use of ALS data prospection 13 certain ore mining areas were identified in the broader vicinity of Strašice and Dobřív. Several types of features or feature concentrations were observed (Figure 3 and Figure 4).

The most distinctive are mining fields which can be identified by a significant concentration of shaft openings and gangue heaps (Figure 3:C). Typically these follow a general

direction, but there doesn't seem to be a strict order as for the position of individual shafts. This type of mining didn't possibly reach any significant depths, the strategy was chosen in places where other methods of mining proved too difficult or costly (Nováček, n.d.-a).

Single or less concentrated shafts were also found (Figure 3:B). They are generally accompanied by much larger gangue heaps. These features could be possibly interpreted as relicts of more deep shaft mines, possibly with adits running under the surface. Identified lines of pits without adjacent gangue heaps can be interpreted as surface indications of collapsed adits (Nováček, n.d.-a)

The last possible method of iron ore extraction is open pit mining. This method was definitely used in the case of quarries near Hrádek, mentioned here mostly as a source of heat resistant stone (Lang 2004). Based on the comparison of historical maps and ALS data, it is evident that this technique was used also at "Kopaniny" mine, east of Těně. Only the open-pit mines on the eastern slope of the hill are marked in the available maps (Figure 4). This means that the "Kopaniny" mining field on the western side of the hill could be quite possibly older. Iron ore from Těně is mentioned in the 17th century and continues to be used, even though it was of poor quality, in the 18th century (Jindřich 2008, 41; Kořan 1946, 90; 1972, 27).

Some of the mines identified on ALS were marked on the available maps from the 19th century - 2nd and 3rd Military Survey and Map of Zbiroh Domain. (Chartae Antiquae Military Survey 2; Chartae Antiquae Military Survey 3; ČGS-SM-S12-11/014). The 3rd Military Survey captured the state of the landscape in the very end of the smelting era in Brdy, therefore it can be generally assumed that the mines not captured on any of the analysed maps might be older.

The identified mining areas seem to concentrate in the eastern part of the studied area around Strašice and Těně and more to the east in the environs of Kvaň. The ore from this area was, according to historical written sources, sought after and used quite often both in Dobřív and Strašice (Jindřich 2008, 41; Kořan 1972, 27). All the observed

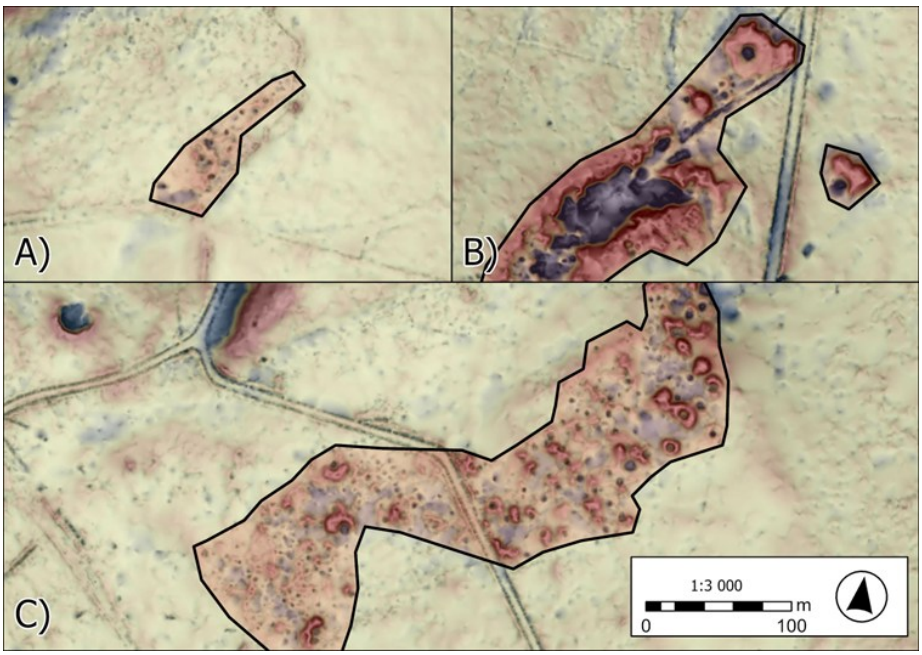

Figure 3. A) Mine No. 12: Small concentration of mining shafts; B) Janovky mine (No. 4) - examples of isolated shaft openings with large gangue heaps; C) Jáma mine (No. 2) - example of significant concentration of shafts and gangue heaps. Combined ALS data visualizations - SLRM, Slope and Sky-view factor.

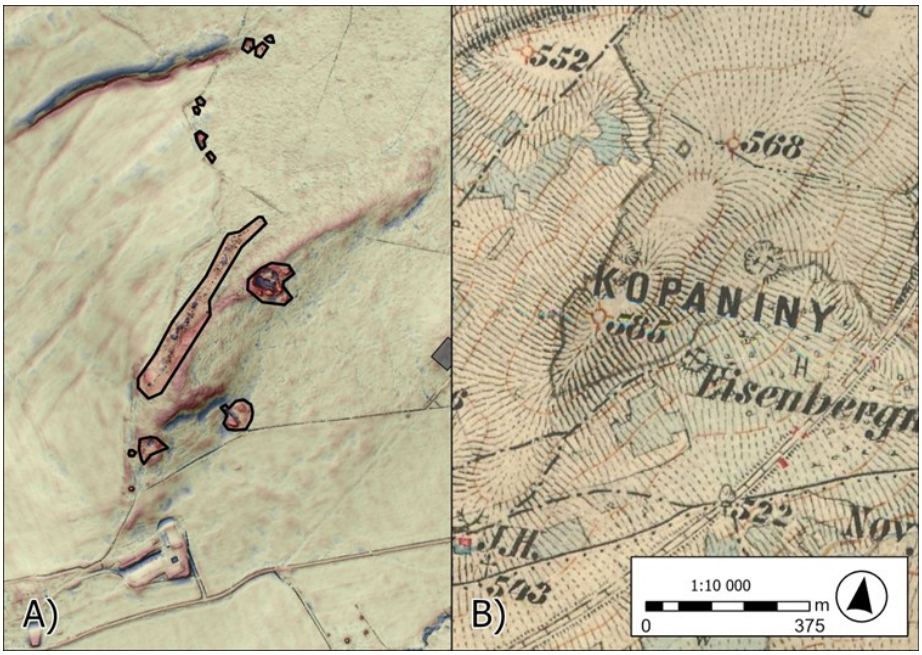

Figure 4. Kopaniny mine (No. 6). Comparison of ALS data visualization (A; combination of SLRM, Slope and Sky-view factor) and the map of 3rd Military Survey from 1879 (B; Chartae Antiquae MS3). © Faculty of Environment, The Jan Evangelista Purkyně University in Ústí and Labem, © digitised by VÚGTK, v. v. i. - www.chartae-antiquae.cz

mining areas are oriented in a roughly southwest - northeastern direction (Figure 5). This orientation marks a strong correlation between the visible archaeological features and the geological environment of the studied area. The mines are almost exclusively located on the Ordovician sediments of Barrandien which contain iron ore in several layers. These sediments emerge in the the western part of Barrandien and reach up to Pilsen. They formed a material basis for the historical ironworking tradition in wider

Pilsen and Brdy regions. The mining of these iron ores culminated in the 2nd half of the 19th century, right before the smelting industry collapsed (Kořan 1978, 17; Ševčík 2004, 103).

Four of the identified mining areas stand out due to their total area and appearance as well as number of identifiable mining features. These are the Jáma (literally meaning a pit in Czech), Janovky, Kopaniny and Josef mines. According to the available literature and earlier historical research Jáma and Janovky have a long mining history, as well as Kopaniny, which was already mentioned. However, no more precise dating was ever brought up. It is apparent that all these old mining sites were either continuously or just occasionally used even in the 19th century (Kořan 1978, 19). "Jáma" mine could have been mined only for a short time in the 19th century, because it only appears on the analysed domain map (ČGS-SM-S12-11/014). Kořan mentions test mining on this site between 1842 and 1844. However, an account from 1842 states that the mining on this site is "old" and that the shafts on the site are only 8 to 10 meters deep (Kořan 1978, 19). The mining must be apparently prior to the year 1828. In this year a forest management map was created and a toponym "Welki Jami" (Big Pits) appears roughly in the area of Jáma mine, but no active mine is marked on the map (SOA Praha, VS Zbiroh, inv. no. 4244) As for Josef mine, no information on the mine was found.

In the "pits and shafts" category a clear disproportion in covered area can be observed. While the aforementioned mines of Kopaniny, Jáma, Janovky and Josef consist of tens of thousands of square metres, other detected mining areas are incomparably smaller and reach only several hundreds or thousands square metres. This phenomena can be interpreted in different ways. The identified areas could either be old mining sites not present in the maps from the 19th century or remnants of small-scale test mining (Figure 3:A). Aditionally, these could be small iron deposits which could be mined by local farmers as a means of nonagricultural means of subsistence. This practice was proposed in the context of the archaeologically studied deserted medieval village at Sloupek (about 9 kilometres northwest from Strašice) where an ore roasting feature was excavated and small shaft clusters were identified in the vicinity of the village (Vařeka 2018, 36–39).

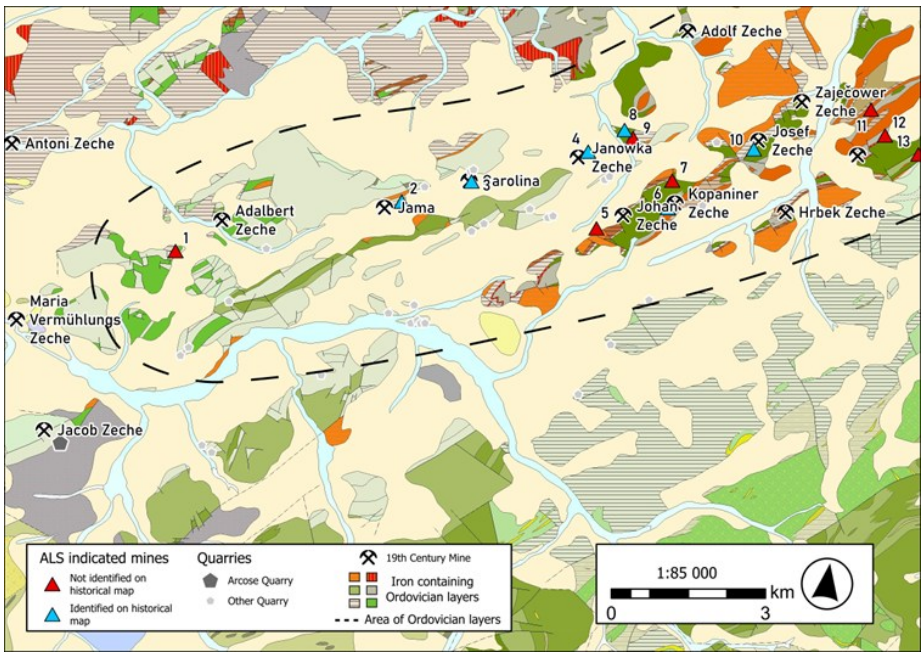

Figure 5. The correlation between Ordovician geological layers and ALS detected mining areas. 19th century mines location based on the overall map of the Zbiroh domain from the half of the 19th century (ČGS-SM-S12-11/014). Basemap: Geological map of the Czech Republic 1:50 000.

No.	Name	Area (sq. m.)	Type	Identified in 19th century maps
1	-	3 786	Pits and shafts	No
2	Jáma	35 517	Pits and shafts	Yes
3	Carolina	642	Collapsed adit?	Yes
4	Janovky	21 893	Single shafts and adits	Yes
5	-	4 108	Ploughed out pits and shafts?	No
6	Kopaniny	36 553	Pits and shafts, open pit mining	Yes
7	-	2 617	Pits and shafts	No
8	-	744	Single shaft	Yes
9	-	2 051	Pits and shafts	No
10	Josef	32 395	Pits and shafts	Yes
11	-	4 778	Pits and shafts	No
12	-	3 364	Pits and shafts	No
13	-	2 896	Pits and shafts	No

Table 1: Identified mining areas and their observed attributes.

Stone quarries

Heat resistant stone played a crucial role in the construction of the furnaces and thus it can be considered a critical and valued material (Kořan 1946, 143; Pleiner *et al*. 1984, 106–7). The stone used for the inner lining of the furnaces

was mostly arkose (arkosic sandstone) which had a high heat resistance given the high content of feldspar (Lang 2004, 11). The inner lining of the blast furnaces had to be constantly repaired or renewed altogether. The analysis of reports made by Dobřív's *schichtmeister* between October 1703 and the end of 1705 shows that in the given time frame the inner lining had to be completely removed and rebuilt 5 times. On average the lining lasted around 20 weeks (Jindřich 2008, 42).

The arkose quarrying was concentrated around Hrádek, Dobřív and Mirošov settlements in the western part of the study area (Figure 1 and Fig.ure 5). Before the opening of these quarries at the beginning of the 18th century, the heat resistant stone was acquired in the environs of Strašice. These quarries from the western-most part of the Royal Chamber domain supplied the whole ironworks complex, because there was no better source for this kind of stone (Jindřich 2007, 123). The stone from the Dobřív and Hrádek quarries was even traded to different parts of Bohemia and Moravia, as well as Austria, Bavaria and other parts of Germany (Jindřich 2007, 124).

During the ALS data prospection, 30 areas were identified that could be interpreted as quarries, areas which abruptly cut into terrain elevations. Quite often these are accompanied by holloways indicating the repeated transport of the material away from the site. When compared with the geological map (Figure 5) most of them don't cut into Ordovician sediments and so their interpretation as open pit mines is less plausible. However, this hypothesis needs to be tested in the future by surveying with a geologist. The quarries aren't of any extraordinary extent, mostly consisting of only several hundred square meters, and don't seem to form any kind of clusters and concentrations. Concerning the extent, the aforementioned arkose quarries near Hrádek are a major exception. The affected land at this site reaches to almost 81 000 square meters. It must be however noted that this site served not only as a quarry but also as an open pit mine for iron ore extraction. It was still functional in the late 19th century (Lang 2004, 10–11).

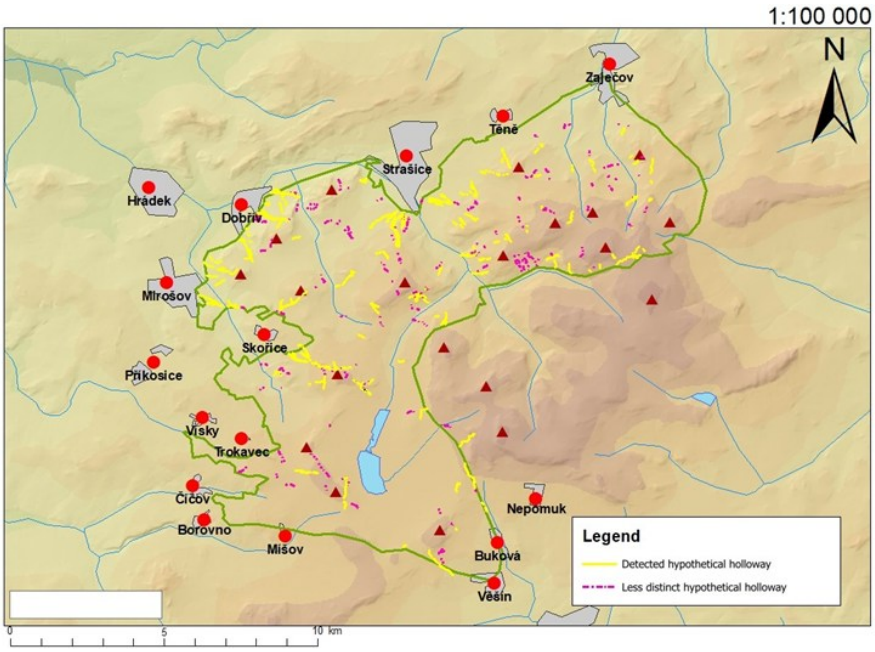

Figure 6. ALS indicated holloways in wider Central Brdy Region (Kroupa 2021, 78).

Holloways

The holloways identified during the ALS prospection are present both north and south of the settlements. Most of these features form small clusters of several parallel branches which can further indicate the longevity and/or the intensity of the use of these routes. Especially when compared with a wider region, the clustering around Strašice and Dobřív can be noted (Figure 6). Connection of the detected holloways to the ironworking process becomes apparent when compared with the detected charcoal burning platforms. Most likely, the vast majority of these features are a trace of transport of charcoal from the place of its making to the ironworks and individual hammer mills (Figure 1). There is no doubt that other forest crafts and activities taking place around the settlements might have also caused the creation of these distinct features such as for example medieval tar making (Nováček 2007, 168). Even this craft could however be connected to ironmaking as tar was used as a lubricant for the wooden features in the ironmaking and ironworking facilities.

Other features of the ironworking landscape

There are a number of other distinct features connected to the ironworking landscape which could be studied using remote sensing methods - e.g. water channels and races, ponds or slag heaps. These features however are quite difficult to investigate in the study area as they were probably altered or

Figure 7: A) A charcoal burning platform located near Dobřív. Photo: Author 2021; B) A small mining shaft in mining area No. 1 near Hůrky. Photo: Author 2025

destroyed during the transformation of the settlements in the 20th century. It is known for example that the slag heaps in Strašice were largely leveled out in the 20s and 30s of the 20th century, some of the material used for road construction (Nováček, n.d.-b). Some of the older slags might have as well been recycled due to their content of residual iron or used as a flux in the ironmaking process (Kořan 1980, 30–31; Pleiner *et al.* 1984, 116–17). Due to the aforementioned problems with these structures in the studied area, they weren't included in this study.

Discussion

The presented study presents the current state of research in a small part of a wider region with rich ironworking and iron making history which for centuries shaped the societies living in the region. But it also affected the landscape around it, albeit through the people and their activities in the hills and forests around the studied settlements.

The paper didn't focus on the actual places of production, well nested among the other buildings and acting as the center of the whole production process. It rather aimed to study the extremities of this *chaîne opératoire*, the supportive crafts of the iron industry such as ore mining and charcoal burning. All the addressed branches of ironmaking and ironworking landscape are quite intricate and offer many questions and research goals. There is a need for further research effort, certainly in cooperation with a historian and a geologist, to be able to tackle them properly and in detail that they need and deserve. A microregional study of indicated holloways is also a possibility for future research. The detailed study of individual path concentrations would contribute greatly to the understanding of the landscape dynamics in the region and could further emphasize the presumed strong connection of the seemingly empty areas with the socio-economic environment of the ironworking settlements.

Much more can be also done by further application of remote sensing methods. The lack of conclusive traces of ore mining in the southern part of the studied area (in the forests of present-day PLA Brdy) is evident and should be properly addressed. During the ALS data prospection phase several promising features were identified and shall be studied in the future. Or concerning the position of Dobřív blast furnace which has recently been disputed (Tuma and Vaindl 2023). The overall landscape archaeology provides important context, but at the presented current state of research it cannot contribute to this issue. There doesn't seem to be any difference in holloway concentrations which would indicate major transportation of charcoal and ore towards one site or other - a possible indication of a presence of a blast furnace on top of a regular hammer mill. Maybe future research will help to solve this matter.

The region also offers a good opportunity to study the development of technology, mainly the medieval technology and possibly also the appearance and adaptation of blast furnaces in Czech lands. The potential is really significant, especially bearing in mind how little archaeological research is available on High and Late Middle Ages ironmaking in Bohemia (Ježek et al. 2011; Krajíc and Matoušek 1985; Pleiner 1971; disputed by Nováček 2001, 286). In relation with the medieval and post-medieval ironmaking is the presence of the features connected to these phases of production. Questions of the possibility of identification and the methods to achieve this identification arise. There is for example the question of medieval iron ore mining. As has been shown above, the landscape and its resources has been intensively worked. It is quite possible and even probable that most of the older features were simply worked over by a younger effort to extract the resources - be it iron ore or for example charcoal.

One of the most complicated matters when it comes to research of he ironworking landscape is the dating of indicated features. The quarries, mines and charcoal platforms are almost impossible to date using just non-destructive remote sensing methods. This even more emphasizes the importance of historical written and cartographic sources and their thorough utilization in the future.

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Publications of Interest?

January to September 2025

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This is a collection of recent articles that may be of interest to the aerial archaeology community. The time period covered is from January to September 2025.

Introduction

The following is a collection of 49 articles published between January and September 2025 and may be of interest to the aerial archaeology community. 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 six subject areas, although inevitably many span one or more areas:

- AI and Machine Learning.
- Lidar and UAV-Based Surveys.
- Satellite Imagery and Synthetic Aperture Radar.
- Aerial Photographs and Photo-grammetry.
- 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. Many of the articles (>80%) are open access and are indicated by 🔓; those residing behind a paywall are indicated by a 🔒.

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1. AI and Machine Learning

Survey on the Application of Robotics in Archaeology

Panagiota Kyriakoulia *et al*., *Sensors* 25, 4836-4836. (2025) 🔓

Summary This study reviews how robotic systems, integrated with technologies like lidar, GIS, 3D modelling, and sonar, are enhancing archaeological excavation, documentation, and preservation. It highlights the potential of underwater, aerial and terrestrial robotics within fieldwork and museum settings. An emphasis on interdisciplinary collaboration and respect for cultural integrity may help overcome some of the technical, economical and ethical challenges associated with their utilisation.

Machine Learning-Based Detection of Archeological Sites Using Satellite and Meteorological Data: A Case Study of Funnel Beaker Culture Tombs in Poland

Krystian Kozioł *et al*., *Remote Sensing* 17, 2225 (2025) 🔓

Summary This research project developed machine learning models that use vegetation indices and meteorological data to improve the detection of Funnel Beaker megalithic tombs in Poland via satellite imagery. By analyzing factors like NDVI, NDWI, NDMI, NAI, and weather variables, the models predict site visibility under different environmental conditions. The results help optimize aerial survey timing, enhance site detection, and reduce costs, with the approach applicable to various archaeological settings.

Automated Detection of Hillforts in Remote Sensing Imagery With Deep Multimodal Segmentation

Daniel Canedo *et al*., *Archaeological Prospection* 32, 297–311 (2025) 🔓

Summary Recent advances in remote sensing and AI have enabled automated detection of archaeological sites, although interpreting complex site shapes remains challenging. This work introduces a computer vision system using multimodal semantic segmentation with lidar and aerial images to detect hillforts, followed by expert -reviewed retraining to reduce false positives. In Northwest Iberia, false positives dropped by 99.3% and the system achieved F1 scores of 66% and 59% in Iberia and England, respectively. The method is scalable to diverse archaeological sites, with future efforts focusing on predictive modelling to further refine searches.

AI-ming backwards: Vanishing Archaeological Landscapes in Mesopotamia and Automatic Detection of Sites on CORONA Imagery

Alessandro Pistola *et al*., *PLoS One* 20(8), e0330419 (2025) 🔓

Summary By retraining a deep learning model with historic CORONA satellite imagery, detection accuracy for archaeological sites in the altered Abu Ghraib district improved significantly, achieving over 85% IoU and 90% overall accuracy. The enhanced model also identified four previously unknown sites, demonstrating the value of AI and older imagery for revealing archaeological evidence now lost to modern development.

Tracing Past Agrarian Field Systems Through Ai-Based Analysis of Satellite Imagery in Konya, Central Anatolia, Türkiye

Melda Küçükdemirc, *Archaeological Prospection* Early Access (2025) 🔒

Summary This study assesses AI methods for detecting historic agrarian fields in Konya, Türkiye, finding that fine-tuning the ResNet50V2 model offered the best balance of flexibility and efficiency. The approach achieved high accuracy and robustness on seven satellite images, although limited high-resolution data restricts wider application. The results highlight AI's value in archaeological land-use analysis for both pre-survey and post-survey work.

An Open-Source Machine Learning–Based Methodological Approach for Processing High-Resolution UAS LiDAR Data in Archaeological Contexts: A Case Study from Epirus, Greece

Nicodemo Abate *et al.*, *Journal of Archaeological Method and Theory* 32, 38 (2025)

Summary This study presents a novel, open-source approach for detecting archaeological features using UAS lidar and Random Forest classification in CloudCompare's 3DMASC plugin. After optimising parameters through experimentation and enhancing data with the Relief Visualisation Toolbox, the methodology was validated at Kastrí-Pandosia in Epirus, Greece. It successfully identified defensive walls, terracing and possible ancient routes, demonstrating the effectiveness and cost-efficiency of this method for documenting archaeological sites, especially in complex or remote areas.

A Technical Note on AI-Driven Archaeological Object Detection in Airborne LiDAR Derivative Data, with CNN as the Leading Technique

Reyhaneh Zeynali *et al.*, *Remote Sensing* 17, 2733-2733 (2025)

Summary This technical note reviews 45 studies on the use of Machine Learning (ML) and Deep Learning (DL), notably Convolutional Neural Networks (CNNs), for automated detection of archaeological features in airborne lidar data. CNNs, including U-Net, VGG-19 and YOLO models, consistently achieved high accuracy in identifying sites such as ancient city walls, Maya settlements and shipwrecks. Traditional ML methods like random forest also performed well for tasks such as detecting burial mounds. Challenges remain, including limited labelled datasets, high false positive rates, and inconsistent evaluation metrics. The note highlights the potential of integrating lidar with ML/DL for archaeology and stresses the need for further interdisciplinary collaboration to overcome current limitations.

AI in the Fields: Challenges and Insights in Detecting Agrarian Footprints from Satellite and LiDAR Data

Melda Küçükdemirci, *ArcheoSciences* 49, 553-556 (2025)

Summary Deep learning detects patterns in large datasets, but practical AI requires precise validation, faces data quality and access issues, and raises ethical questions in heritage remote sensing.

Beyond the Greater Angkor Region: Automatic Large-scale Mapping of Angkorian-period Reservoirs in Satellite Imagery using Deep Learning

Jürgen Landauer *et al.*, *PloS one* 20(3): e0320452 (2025)

Summary Archaeologists use high-resolution satellite imagery and remote sensing to locate archaeological sites, such as those in the Greater Angkor Region. Areas beyond this region remain unmapped due to the labour-intensive nature of manual feature identification. This paper demonstrates that a deep learning model, Deeplab V3+, can accurately and efficiently detect Angkor-period reservoirs in satellite images. The approach offers a valuable tool to accelerate and enhance archaeological mapping, supporting broader research into ancient urbanism and statehood in Southeast Asia.

2. Lidar and UAV-Based Surveys

LiDAR Applications in Archaeology: A Systematic Review

Giacomo Vinci *et al.*, *Archaeological Prospection* 32, 81–101 (2025)

Summary Over the past twenty years, LiDAR technology has revolutionised the study and documentation of cultural landscapes, revealing previously unknown sites and structures. Despite many case studies, a comprehensive review has been lacking. This systematic survey covers 291 published works from 2001–2022, providing an annotated bibliography and quantitative analysis. Most studies focus on Europe (167) and the Americas (104), with fewer in other regions. The impact of lidar is strongest where open data is available, particularly in Europe and North America. Success depends on material culture, vegetation, and data resolution, with tropical rainforests yielding especially notable results. Greater LiDAR data availability promises significant advances in cultural heritage research and protection.

UAVs and Social Science: A Transformative Perspective

Authors: Ricky Anak Kemarau *et al.*, *Social Science Quarterly* 106, (2025)

Summary This study outlines how unmanned aerial vehicles (UAVs) are transforming social science research by enabling efficient detailed data collection in disciplines such as anthropology, geography, and archaeology. Originally used for military purposes, UAVs are now valuable in civilian and academic settings, driving methodological innovation. The paper reviews key applications and ethical considerations, emphasising the need for interdisciplinary collaboration and strong ethical guidelines to ensure UAVs are used responsibly and effectively in future research.

Guidelines for the Use of Airborne Laser Scanning (Lidar) in Archaeology (EAC Guidelines 10)

Rebecca Bennett & Dave Cowley (Eds). https://doi.org/10.5281/zenodo.14609210 (2025)

Summary These guidelines, initiated by the European Archaeological Council, serve as a collaborative reference for integrating ALS data into cultural heritage work. Developed online by 49 co-authors based on a 2022 survey of over 100 respondents from 30 countries, the guidelines reflect broad expertise and community needs.

Remote Sensing Analysis and LiDAR Experimenting in the Espique Valley (La Peza, Granada, Spain)

Jesús Rodríguez Bulnes *et al.*, *Archaeological Prospection* 32, 395–407 (2025)

Summary The Espique valley, a secluded area with rich archaeological remains, is being studied by MEMOLab UGR. Recent research uses lidar technology at both landscape and ground level, enabling integrated high-resolution documentation to analyse settlement development and land use over time.

Mega-fortresses in the South Caucasus: New Data from Southern Georgia

Nathaniel L. Erb-Satullo *et al.*, *Antiquity* 99, 150 – 169 (2025)

Summary Recent research into large settlements has led to a reassessment of what

drives population aggregation. Aerial and ground surveys of the Dmanisis Gora mega-fortress (South Caucasus, c. 1500–500 BC) reveal extensive fortifications and stone structures but only low-intensity, possibly seasonal, occupation. The site's exceptional size offers new insights into population aggregation models in Eurasia.

Drone Survey to Monitor Erosion Impacts on Coastal Archaeological Sites

Ellie Graham, *Journal of Field Archaeology* 50, 22–41 (2025).

Summary Coastal areas are among the first to face severe climate change impacts, threatening Scotland's rich coastal archaeological heritage with increased erosion and flooding. While large-scale assessments and monitoring of key sites like Skara Brae exist, there is a need for detailed, site-level vulnerability analysis. This paper discusses ongoing research using drone surveys to assess and manage individual site risks, helping to bridge the gap between broad assessments and specific threats.

In between the Sites: Understanding Late Holocene Manteño Agricultural Contexts in the Chongón-Colonche Mountains of Coastal Ecuador through UAV-Lidar and Excavation

Andrés Garzón-Oechsle *et al.*, *Journal of Field Archaeology* 50 42–59 (2025).

Summary UAV-based lidar mapping of 1.2 km² in Bola de Oro, southern Manabí, Ecuador, uncovered Manteño-era (ca. a.d. 650–1700) modifications such as agricultural terraces, drainage channels, and water retention ponds. These features, confirmed by ground-truthing and excavation, reflect significant efforts to manage water in the region's challenging cloud forest landscape, likely in response to climate pressures from ENSO events during the Medieval Climate Anomaly and Little Ice Age.

Archaeological LiDAR in Mediterranean Karst Landscapes. A Multiproxy Dating Method for Archaeological Landscape and a Case Study From Prehistoric Kras Plateau (Slovenia)

Edisa Lozić & Benjamin Štular, *Archaeological Prospection* 32, 119–137 (2025)

Summary The Kras Plateau case study documents two prehistoric hillforts and a newly identified agro-pastoral landscape, previously obscured by dense vegetation. lidar revealed hundreds of archaeological features, but dating these was challenging. The study introduced a multiproxy dating approach - combining remote sensing, historical maps, stratigraphy, associated finds and kernel density estimation - to objectively show that these features are contemporaneous with Late Bronze and Iron Age hillforts, not post-Medieval periods. This has significant implications for dating prehistoric Mediterranean karst landscapes.

A Shadow of Its Former Self: Exploring the Urban Landscape of Iron Age Hillforts Through an Integrated Analysis of Drone LiDAR and Geophysics

Victorino Mayoral Herrera *et al.*, *Archaeological Prospection* 32, 179-196 (2025)

Summary LiDAR is commonly used to analyse archaeological landscapes over large areas, aided by open access datasets, although these often miss subtle features at site level. Higher resolution Airborne Laser Scanning (ALS) can reveal finer details, such as the internal layout of ancient settlements. This paper presents a case study of Iron Age hillforts in southwest Iberia, detailing how lidar and photogrammetry were combined with advanced visualisation and detection methods to reconstruct urban landscapes and interpret cultural features.

Noninvasive Archaeological Site Characterization: Case Studies from Fort Ellice 1 and 2, Canada

Scott Hamilton & Nick Kuncewicz, *Drone Systems and Applications* 13, 1-32 (2025)

Summary This case study examines the effectiveness of aerial remote sensing for non-invasive archaeological investigation at two western Canadian fur trade posts with minimal surface remains. It compares public domain imagery at various resolutions with UAV data, and explores how integrating these sources with archival images aids in interpreting subtle archaeological features.

Bronze Age Monumental Earthworks of the Friuli Plain (NE Italy): from LiDAR-based Morphometric Analysis to the Reconstruction of Settlement Patterns and Organization

Giacomo Vinci & Federica Vanzani, *Archaeological and Anthropological Sciences* 17, Issue: 1 (2025)

Summary This study employs high-resolution lidar data to analyse Bronze Age earthworks in the Friuli Plain, northeast Italy. By comparing lidar models with historic topographic surveys, the research refines knowledge of these structures and reveals advanced construction techniques. Calculations of workforce investment indicate that building times varied greatly, with major embankments like the Udine mound requiring far more labour than others, implying a hierarchical settlement system with Udine as the central site. The findings provide new insights into the organisation and social structure of Bronze Age communities in the region.

Evaluation of 3D Models of Archaeological Remains of Almenara Castle Using Two UAVs with Different Navigation Systems

Juan López- Herrera *et al.*, *Heritage* 8, 22-22 (2025)

Summary This study compares two UAVs, the DJI Phantom 4 and Matrice 300 RTK with a Zenmuse P1 camera, for 3D mapping of the Almenara Castle ruins in Cuenca, Spain. Utilising advanced navigation systems and sensors, the researchers achieved accurate and high-resolution 3D models with reduced flight and data collection times. The results show that these UAV-based methods produce precise volumetric data for archaeological excavations and are highly effective for cultural heritage preservation, documentation, and virtual visualisation.

Drone-Based High-Resolution LiDAR for Undercanopy Archaeology in Mediterranean Environment: Rusellae Case Study (Italy)

G. P. Cirigliano *et al.*, *Archaeological Prospection* 32, 644-655 (2025)

Summary This paper introduces a new methodology using drone-based lidar to successfully identify and map archaeological features beneath dense Mediterranean woodland in southern Tuscany, Italy. The approach yielded high-resolution data over 550 ha, revealing previously unknown sites and offering fresh perspectives on historic landscapes.

Aerial Remote Sensing and Urban Planning Study of Ancient Hippodamian System

Dimitris Kaimaris & Despina Kalyva, *Urban Science*, 9, 183-183 (2025)

Summary In ancient Olynthus, Greece, a drone (UAS) captured both RGB and multispectral images of the site. These were processed using Ground Control Points to produce highly accurate digital surface

models and orthophotomosaics. By fusing RGB and multispectral data, the study achieved imagery with significantly improved spatial resolution, enabling more detailed analysis. The resulting data facilitated a summary of the Hippodamian system at Olynthus, including urban layout, building types, and aspects of socio-economic organisation.

Making the Invisible Visible: The Applicability and Potential of Non-Invasive Methods in Pastoral Mountain Landscapes—New Results from Aerial Surveys and Geophysical Prospection at Shielings Across Møre and Romsdal, Norway

Kristoffer Dahle *et al*., *Remote Sensing* 17, 1281-1281 (2025)

Summary Shielings are seasonal settlements in upland pastures across Scandinavia and the North Atlantic. Recent research in Møre and Romsdal, Norway, confirms their existence by the Viking Age. While remote sensing and non-invasive methods can reveal some sub-surface archaeological features, their effectiveness varies due to landscape, soil, and vegetation conditions. Techniques like lidar and thermography aid visual documentation but face practical limitations, and ground-penetrating radar is often inefficient. Systematic soil coring remains most reliable, though non-invasive approaches help bridge initial surveys and excavation. The study stresses the importance of choosing methods suited to specific site environments.

From Air and Ground: Integrated Non-destructive Prospection at the remains of the Former Monastery in Münchsmünster (Bavaria, Germany)

Roland Linck & Florian Becker, *AARGnews* 70, 19-26 (2025).

Summary The medieval monastery of Münchsmünster is nowadays completely destroyed. Consequently, alongside archaeological excavations, non-destructive approaches like aerial archaeology and geophysical prospection provide the only means to document the buried remains. Preserved features, such can be mapped by photogrammetry. Such integrated projects provide valuable information for heritage protection, as well as archaeological and historical research.

Archaeological Sites in the Midst of War: Khirbet Keila, Palestine, a Case Study

Salah Hussein Al-Houdalieh & Hasan Said Jamal, *Journal of Field Archaeology*, 50, 363–377 (2025).

Summary This study examines the impact of ongoing conflict in the Gaza Strip and West Bank on Khirbet Keila, a historically significant Palestinian archaeological site. Over nine months, six site visits documented extensive looting and damage, highlighting the vulnerability of such sites in conflict zones. The research calls for urgent protective measures and greater international awareness to safeguard cultural heritage under threat.

3. Satellite Imagery and Synthetic Aperture Radar

Integration of Satellite and Aerial Images with Multichannel GPR Surveys in the Archaeological Area of Augusta Bagiennorum for an Improved Description of the Urban Setting

A. Vergnano et al., *Journal of Applied Geophysics* 232, 105579 (2025).

Summary The Augusta Bagiennorum archaeological site in northwest Italy has been studied since the late 19th century, but previous surveys were limited in scope. To enhance understanding of the urban layout, researchers combined aerial and satellite imagery with multichannel Ground Penetrating Radar (GPR). Aerial images revealed cropmarks indicating buried structures, while GPR confirmed and detailed these findings, also aiding georeferencing. This integrated approach verified the site's overall extent, identified structures beyond known boundaries, and revealed that some streets do not follow typical Roman grid patterns. Such methodology offers valuable, multiscale insights for similar archaeological studies.

A Landscape Survey in Ukraine Using Open-source Satellite Images: Results of AARG's Ukraine Working Group

Rog Palmer *et al*., *AARGnews* 70, 13-18 (2025).

Summary We summarise some results of AARG's Ukraine Working Group (2022-2025) with examples of habitation sites and mounds plus one of the case studies we produced to show results of interpretation and mapping in small areas. In addition, there are examples of 'recent archaeology' – former collective farms and abandoned villages, of which some have damaged or destroyed earlier features.

Persian Paradises: Unveiling the Sasanian Dastgerd of Mohammadabad-Baghdasht, South of Jereh, Pars, Iran

Parsa Ghasemi, *Journal of Field Archaeology* 50, 305–326. (2025)

Summary This article details the discovery and mapping of a large, previously unknown Sasanian agricultural estate (*dastgerd*) in the Mohammadabad-Baghdasht Plain, southern Pars, Iran. Researchers used historical aerial photos, satellite and drone imagery, and landscape survey data. The estate, dating from the Sasanian period and later, features multiple garden designs, notably the fourfold *chaharbagh* with central pools and water channels, alongside other square and rectangular gardens. Irrigation relied on the *kariz* system and the Shur-e Jereh River. Two new gardens were identified alongside previously known agricultural sites.

Identification of Architectural Roman Remains in the Complex Archaeological Site of Buto 'Tell El Fara'in', Northern Egypt, Using Geophysical and Remote Sensing Data

Mohamed A. R. Abouarab *et al*., *Archaeological Prospection* 32, 437-457 (2025)

Summary The case study at Kom C, Buto (Tell El Fara'in), northern Nile Delta, Egypt, demonstrates that integrating remote sensing techniques with both vertical magnetic gradient and electrical resistivity tomography measurements - supported by both 2D and 3D analyses - enables effective identification and mapping of complex buried archaeological features. Despite challenges from soil salinity and structural overlap, this approach, combined with excavation permitted accurate interpretation of Late Roman architectural remains and pottery workshops. The study underscores the importance of combining satellite and geophysical data for understanding complicated archaeological sites.

Locating al-Qadisiyyah: Mapping Iraq's most Famous Early Islamic Conquest Site

William M. Deadman *et al*., *Antiquity* 99, e6 (2025)

Summary The Battle of al-Qadisiyyah (*c*. AD 637/8) marked a decisive Arab Muslim victory over the Sasanian Empire. Recent satellite imagery has pinpointed its probable location in southwest Iraq.

Tackling the Thorny Dilemma of Mapping Southeastern Sicily's Coastal Archaeology Beneath Dense Mediterranean Vegetation: A Drone-Based LiDAR Approach

Dario Calderone *et al.*, *Archaeological Prospection* 32:139–158 (2025)

Summary This article assesses drone-based ALS for archaeology at Heloros, Sicily, using a RIEGL VUX-UAV22 sensor to generate high-resolution point clouds. Surveying over 1.6 km^2, the data surpassed government ALS datasets. Vegetation-free imagery, visualised in GIS, enabled efficient mapping of features beneath dense Mediterranean vegetation. The drone-based system proved portable and operable by in-house staff, allowing flexible, on-demand surveys and enhancing the value of ALS for archaeological landscape analysis.

Mapping and Geospatial Analysis of Ancient Terrace Agricultural Systems in Lucanas Province, Peruvian Andes, Based on Satellite Imagery, High-Resolution DSMs, and Field Surveys

Christian Mader *et al.*, *Geoarchaeology* 40: e70002 (2025)

Summary This paper provides geospatial maps and data for 16 ancient terrace agricultural systems in the upper Río Grande de Nasca drainage, Lucanas province, Peru. Located between 1,200 and 3,800 m above sea level and dating from 1000 BCE to 1532 CE, the terraces were studied using archaeological, geomorphological, and drone surveys, as well as satellite imagery and high-resolution DSMs within GIS. The analysis covers features such as elevation, terrace area and wall characteristics to provide insights into prehispanic land use, indigenous agricultural practices, and responses to environmental change.

Remote Sensing Archaeology of the Xixia Imperial Tombs: Analyzing Burial Landscapes and Geomantic Layouts

Wei Ji *et al.*, *Remote Sensing* 17, 2395 (2025)

Summary This study uses multi-resolution and multi-temporal satellite data, alongside deep learning, to investigate the Xixia Imperial Tombs in northwestern China. By combining automated and manual analysis of imagery, the research identifies burial mounds, examines landscape features, and enhances archaeological detection. Importantly, declassified imagery helped pinpoint a probable location for the ninth imperial tomb. The approach demonstrates how advanced remote sensing and machine learning can aid in the detection and preservation of archaeological sites.

Utilizing SAR Imagery for Enhanced Archaeological Site Detection

Mateusz Ilba, *Journal of Field Archaeology*, 1–14. (2025)

Summary ICEYE satellite SAR (Synthetic Aperture Radar) imagery proved highly effective for archaeological site detection, clearly identifying 77 out of 161 surveyed sites, compared to lower success with aerial photographs and digital terrain models. SAR was particularly effective for sites from the Pre-Roman, Roman, and Migration periods, but less so for Neolithic sites.

SARchaeological Prospection: Synthetic Aperture Radar for the Reconstruction and Mapping of Temperate Floodplain Environments

Nicholas Crabb *et al.*, *Archaeological Prospection*, Early View (2025)

Summary Temperate river floodplains often hide well-preserved archaeological remains beneath thick sediments, making traditional survey methods ineffective. Subsurface mapping using both intrusive and non-intrusive techniques helps reveal these buried features. While lidar and passive remote sensing have been used, this study evaluates satellite Synthetic Aperture Radar (SAR) for mapping and reconstructing floodplain landforms in Herefordshire, UK. SAR successfully identifies recent flood events and subsurface complexities, informing models of archaeological distribution and preservation. Although lidar may offer higher resolution, SAR provides a valuable alternative for geoarchaeological investigations.

Identifying the Preserved Network of Irrigation Canals in the Eridu Region, Southern Mesopotamia

Jaafar Jotheri *et al.*, *Antiquity* 99, e20 (2025)

Summary The Eridu region in southern Mesopotamia, inhabited from the sixth to early first millennium BC, features a well-preserved network of artificial irrigation canals as interpreted from satellite imagery.

4. Aerial Photographs and Photogrammetry

Utility of UAS Photogrammetry and Thermal Sensors for Identifying Locations and Understanding Functions of Puebloan Gravel Mulch Fields in Northern New Mexico

Kaitlyn E. Davis *et al.*, *Archaeological Prospection* 32, 313-327 (2025)

Summary This article reports on the use of unmanned aircraft system (UAS) aerial remote sensing to enhance understanding of 13th-century Pueblo agricultural features in New Mexico's Northern Rio Grande. Building on earlier research, it examines how Pueblo people cultivated crops like maize, cotton, and wheat in challenging environments by modifying their surroundings - specifically through cobble-bordered gravel mulch field systems that help retain heat and moisture. The study evaluates airborne photogrammetry and GIS analysis to map and investigate the function of these fields, while also considering the value of infrared imaging for assessing their thermal properties. The findings are discussed in relation to the priorities of the Tewa people for future arid-land farming.

The First Results of Remote Sensing Studies of Mounds with "Mustaches" in Northern Kulunda, Southwestern Siberia

E. V. Balkov *et al.*, *Archaeology, Ethnology & Anthropology of Eurasia* 52, 117-124. (2025)

Summary In 2019, unusual mounds with "mustaches" were found on the floodplains of the Kulunda steppe. Remote sensing in 2023 at Karasuk-1 and Troitskoye-1 used aerial photography and geophysical methods to study their design. Troitskoye-1 has five mounds: electrical tomography showed homogeneous, conductive mound platforms. Central mounds lack eastern "walls", possibly for ritual access. Aerial data at Karasuk-1 revealed cup-shaped depressions on the western "mustache" ends, with the northern "mustache" broken. No extra features were found nearby, and both complexes appear to be autonomous and built simultaneously.

Historical Roots of Heritage Horticulture in the Southern Coastal Plain of Israel

Motti Zohar *et al.*, *Land* 14, 285-285 (2025)

Summary This study examines the historical agricultural landscape of the southern coastal

plain of late Ottoman and British Mandatory Palestine, now southwestern Israel, through old maps and aerial photographs. It highlights the innovative use of coastal dunes and shallow water tables to develop sustainable, export-oriented agriculture, including citrus and grape cultivation. Many of these resilient systems remain today, underscoring their historical and economic value. The research stresses the importance of preserving this heritage amidst urbanisation and shows how studying past agricultural practices can inform historical geography and future sustainability.

Underwater Mapping in Shallow Coastal Waters Using MBES and Photogrammetry: Applications in Archaeology and Marine Habitat Monitoring

Sašo Poglajen & Mojca Poklar, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* XLVIII-2/W10-2025, 223-229. (2025)

Summary This study demonstrates the use of Multibeam Echosounder (MBES) and Structure-from-Motion (SfM) photogrammetry for detailed underwater mapping in shallow Slovenian coastal waters. MBES provided broad structural data, while photogrammetry offered precise visual detail, especially for habitat boundaries and fine archaeological features. Their combined application enabled reliable habitat classification and thorough documentation of submerged cultural sites.

5. GIS and Landscape Mapping

Parallel Roads, Solstice and Sacred Geography at the Gasco Site: A Chacoan Ritual Landscape

Robert S. Weiner *et al.*, *Antiquity* 500-516 (2025)

Summary Monumental roads built by the Chaco Canyon society (9th-13th centuries) at the Gasco Site have been newly documented using lidar and fieldwork. The Gasco Road is longer than previously thought and aligns with natural springs and the winter solstice sunrise over Mount Taylor, a mountain sacred to Indigenous peoples. This underscores the importance of landscape and celestial features in ancient ritual practices.

The Afterlife of Roman Roads in England: Insights from the Fifteenth-Century Gough Map of Great Britain

Oksanen & Stuart Brookes, *Journal of Archaeological Science* 179, 106227 (2025)

Summary This paper introduces a new GIS database of travel routes in England and Wales based on the fifteenth-century Gough Map, arguing that its network of red lines depicts medieval roads linking settlements. The study assesses which routes originate from Roman Britain, using a mix of computational and qualitative methods. The nature of Roman route survival and transformation over the past millennium is explored at both national and regional levels.

The Landscape of the Zanj Rebellion? Dating the Remains of a Large-scale Agricultural System in Southern Iraq

Peter J. Brown *et al.*, *Antiquity* 99, 1065-1081 (2025)

Summary Abandoned ridge and earthwork features across the Shaṭṭ al-ʿArab floodplain in southern Iraq mark historic agricultural expansion. Previously believed to date only to the early Islamic period and the 'Zanj rebellion', new absolute dating reveals they were used for much longer and are a key part of Iraq's landscape heritage.

Mapping Ghent's Cultural Heritage: A Place-based Approach with Web GIS

Ducatteeuw *et al.*, *International Journal of Digital Humanities* 7, 91-113 (2025)

Summary Space and place shape how people engage with cultural heritage, and GIS offers tools for managing spatial heritage data. Despite efforts to link GIS with the semantic web, adoption by heritage organisations is limited due to issues with spatial metadata, gazetteers, and data infrastructure. This article uses the Ghent Mapped project to highlight key challenges and suggests best practices for improving spatial heritage metadata management and sharing.

6. Miscellaneous and Interdisciplinary Studies

Past Landscapes of Bias: Refuse at Abandoned Cold War Soviet Nuclear Bases in Poland

Grzegorz Kiarszys, *European Journal of Archaeology* First View 1-21 (2025)

Summary This article examines refuse dumps at three abandoned Soviet nuclear bases in Poland, using methods such as satellite imagery, aerial and laser scanning, UAV surveys, and archival reports. The discovery of Cold War-era refuse that conflicts with other evidence highlighted survivorship bias, leading to a re-evaluation of previous archaeological remote sensing interpretations.

Sowing, Monitoring, Detecting: A Possible Solution to Improve the Visibility of Cropmarks in Cultivated Fields

Filippo Materazzi, Journal of Imaging 11, 71-71 (2025)

Summary This study investigates how combining UAS-based multispectral remote sensing with targeted agricultural practices, such as high-density barley sowing and natural cultivation, can improve cropmark detection in challenging archaeological contexts on the Vignale plateau (Falerii, Italy). Monitoring with a weather station and multispectral imaging revealed that enhanced crop uniformity aids cropmark identification, while rainfall and temperature significantly affect results. The interdisciplinary approach also involved local students and stakeholders, demonstrating that tailored agricultural strategies and advanced technology can boost non-invasive archaeological research.

On the Fringes of the Empire: Multidisciplinary Investigations at the Roman Fort in Ungra, Transylvania

Alexandru Hegyi *et al.*, *Journal of Field Archaeology* 50, 425–443 (2025)

Summary The Roman fort near Ungra in southeastern Transylvania provides fresh perspectives on Roman military operations in Dacia. Using satellite imagery, drone and geophysical surveys, excavations, and digital reconstruction, the study highlights the fort's double ditch and rampart system, its timber and stone construction phases, and finds such as the Principia and military artefacts. The fort's strategic position enabled control over communication routes and formed part of a network with the nearby Hoghiz fort. Digital reconstructions further illuminate Roman military architecture and frontier dynamics in the region.

A further Neolithic 'Rondel' in Franconia?

Andreas Stele *et al.*, *AARGnews* 70, 27-31 (2025)

Summary This study explores the circular ditch enclosure at Sulzheim using aerial and magnetometer surveys. While definitive Neolithic dating is unconfirmed, structural features and comparisons with other Bavarian and European sites strongly suggest a Neolithic origin.

From the *AARGnews* Archive

October 2025

Martin Fowler [1]

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The online AARGnews archive represents a valuable resource on Aerial Archaeology that spans over 30 years. Here we look back at what was topical in AARGnews 10, 20, and 30 years ago.

10 years ago (Issue 51, 2015)

In his editorial, Rog Palmer provides a personal view on the destruction of archaeological sites and the value of recent relics that in the future may be considered worthy of preservation. Rachel Opitz, in her *Chair(man)'s Piece*, (*sic*) considers some of the papers presented earlier in the month at the AARG Annual Meeting in Santiago de Compostela and comments on the craft of aerial interpretation and the need to 'get it right'.

Elsewhere in the issue, Rog Palmer describes *AARG's Flying Circus* held as a 'community outreach' day school in June 2015 with members of Stour Valley Community Archaeology. Of particular note, his piece includes several humorous cartoons by Toby Driver.

Pablo Fernández Ans and colleagues present the results of a study of hillfort settlements in the Galicia region of Spain based on the study of a collection of aerial photographs taken between 1945 and 1946. Comparison with images taken around 70 years later shows how some sites remain intact, while others have suffered from development.

Eugen Teodor and colleagues describe the collection and interpretation of photographs taken from a light aircraft flying along the course of around

150 km of the Roman frontier, in Romania. Over some 140 minutes of flying, around 3,500 vertical and oblique photographs were taken and were being interpreted, along with images from Google Earth and UAV missions, as part of the *Limes Transalutanus project*.

An extensive piece by Martyn Barber recounts O.G.S. Crawford's use of aerial photographs and a stereoscope.

To round off the issue, a short Flying Review of 2015 is provided including a selection of aerial photographs from the Czech Republic, Denmark, and England. An announcement is provided of a book on aerial archaeology in Denmark that was published in June 2015.

20 years ago (Issue 31, 2005)

The editorial considers two (then) new books that may be of interest to AARG members and, inspired by a piece by Lidka Żuk later in the issue, briefly muses on *'where we are'* in respect to *'real archaeology'*. Summaries are provided of three Culture 2000 training schools that took place since the previous issue in April 2005. From his involvement in Culture 2000 teaching, the editor suggests two points that need to be emphasised when teaching the subject (and are probably worth repeating here for those new to aerial archaeology). The first is the need to describe and/or illustrate the types of features that existed in the past and to talk through what may be, and what will not be, visible some 2000 years after their abandonment. Secondly, to make it clear that sub-surface features are unlikely to be visible at all times of the year.

In the first of three contributions by Toby Driver, his *Chairman's Piece* looks back on his role of chairing the Group over the previous three years and which he describes as being *'like sitting in a Cessna prospecting for cropmarks in Wales ... long periods of reflectiveness with a trickle of duties punctuated by exhausting episodes of frantic, non-stop work'*. [2]

Toby's second contribution is an update on an excavation that was in progress on a square later-prehistoric enclosure discovered as a cropmark two years earlier. His final piece is a short note on the sad loss of the exceptionally well preserved Ty'n y Waun moated site

[2] A bit like editing *AARGnews*!

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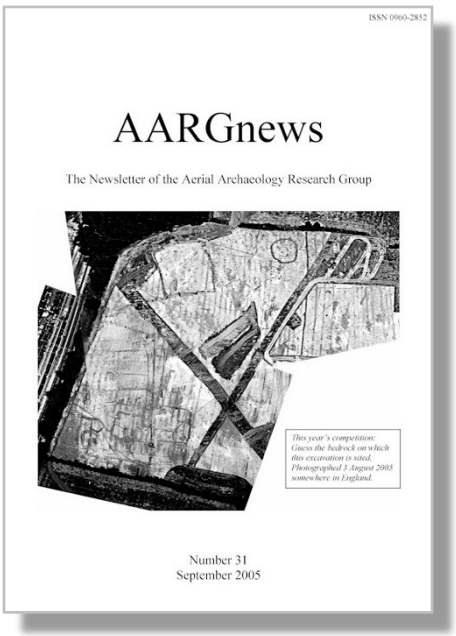

due to either bulldozing or ploughing activity.

Francesca Radcliffe provides brief biographical notes on John Bradford (1918-1975). As reported on pages 8-10 of this issue, his legacy was the subject of a conference in Rome in May 2025. Readers wishing to learn more about this pioneer of aerial archaeology will find of much of interest in Francesca's article.

Michael Doneus and Katharina Rebay provide an engaging article describing the role of aerial archaeology in the study of prehistoric and antique roads crossing the eastern Austrian Alps.

Lidka Żuk reflects on the aerial session held at the Theoretical Archaeology Group's conference in Glasgow, To learn more about *hermetic circles* and *hermeneutic spirals* in the practice of aerial archaeology, do read her article.

In a short response to recent criticism, David Wilson defends his proposal that *Illustration* is at the head of his list of the uses of air photographs.

The impact of the change from film to scanned digital products of Declassified Intelligence Satellite Photographs, in particular those taken by the CORONA programme, is the subject of a study by myself.

Finally, Rog Palmer describes the newly-launched Google Maps service which at the time offered basic cover of most of the world from low resolution Landsat Thematic Mapper images, although blocks of some higher resolution images were available. Twenty years on, Google Earth, which also launched in 2005, now provides multitemporal high resolution imagery of the globe and has found extensive application in aerial archaeology.

30 years ago (Issue 11, 1995)

The editorial announces that the printers[3] of *AARGnews 'now have the technology to scan in a photograph, play with it, and drop it into the required space on a page'*. Not surprisingly, the issue is replete with aerial photographs; from crop marks in Cambridgeshire and wartime defences in East Lothian, to the fun fair at Blackpool!

Marilyn Brown in her *Chairman's Piece* (*sic*) muses on Autumn, a key season for those concerned with aerial reconnaissance marking the end of the summer flying season and the opportunity to take stock of the year's discoveries.

In an article with Helen Curtis, I describe the interpretation of a very high resolution satellite photograph from the Russian space programme covering the Stonehenge environs. The KVR-1000 photograph had a resolution of the order of 2m and for probably the first time it was truly possible to go from satellite image to archaeology, rather than *vice versa*.

Davie Strachan considers the use of vertical photography in the inter-tidal zone. He concludes that verticals should, whenever possible, be consulted and that both the discovery and mapping of inter-tidal sites is best achieved by oblique (or vertical) reconnaissance targeting small areas of coast at the lowest possible tides.

Some thoughts on mapping are provided by Rog Palmer, in particular the choice of 1:10,000 as a basic mapping scale which he considers too small a scale to indicate much other than a location, relationships, and approximate shape and dimensions of those features mapped. Scale also

impacts on the level of interpretation and it is not the drawing scale that is crucial, rather the reasons for producing the mapping.

Roger Featherstone reviews the allocation of Regional Reconnaissance Grants by the Royal Commission on the Historical Monuments of England Air Photography Unit in the financial year 1995-96. Allocations were made to 16 organisations from a budget of £15,000, equivalent to approximately 145 hours of flying.

In a second article devoted to high resolution Russian satellite imagery, I briefly describe the various products that were commercially available. At the time of writing, these were some of the highest-resolution satellite products available and pre-dated the declassified satellite photographs from the US CORONA programme which became available (and more affordable!) the following year.

Reflecting the pre-digital camera age, Rog Palmer describes his experiences of using Kodak Technical Pan, an extremely fine-grained film.

Finally, an author index is provided to *AARGnews* issues 1-10. Don't forget that the complete, searchable, index for all issue of *AARGnews* is now available online at the *AARGnews* Zotero library

[3] *AARGnews* was a paper product in those days

AARG Annual Report 2025

The AARG Committee Members

The AARG Committee members report on activities and achievements over the past year.

Chair's Report (Łukasz Banaszek)

AARG Conference

This September, the AARG Meeting takes us to Trondheim, Norway offering an exciting and busy scientific and social programme. As a reminder, we attempted to organise AARG meeting in Norway in 2020, but the COVID-19 pandemic disrupted our plans. Ole has secured sponsorship from the Trøndelag County Municipality, NTNU University Museum, Department of Archaeology and Cultural History and the Norwegian Archaeological Society, thus reducing the cost of the event. AARG Committee is thankful to Ole Risbøl, Meeting Secretary, for his perseverance and commitment to organising this event as well as to the sponsors for their support.

We have 30 interesting presentations distributed over two days as well as a poster session showcasing a dozen or so posters on Thursday, 11th September. We have got about 70 members and non -members registered for the conference and social events and the scientific programme shows that we attract speakers and audience from all over the world.

The Committee is happy to share that we have confirmed the venue and pencilled in dates for the AARG 2026 conference, which we will reveal at the Annual General Meeting (AGM) in Trondheim on the first day of the event. We have also pencilled in a venue for the 2027 meeting. While we believe we have a strong candidate to organise that meeting we encourage our members to speak up if they are happy to provide us with a back-up option for the 2027 meeting and/or welcome AARG in 2028.

AARG Trustees

At the AGM 2024 Toby Driver, former AARG Chair representing the Royal Commission on Ancient and Historical Monuments of Wales, was unanimously elected as the third member of the AARG Trustee Board, thus joining Chris Cox and Włodek Rączkowski. Trustees have an important role in providing strategic direction for the Group and ensuring that it operates in an appropriate manner. AARG Committee continues to work with the Trustees on the most important issues such as the Constitution amendments, and the two governance boards have been meeting regularly throughout 2025.

Constitution update

Although over the years AARG's Constitution was changed many times, no amendments were recorded by the OSCR, the Scottish Charity Regulator. This was the case until our last AGM in 2024, during which we amended the Object of the Charity. As a result, the official version of the document, i.e., the one held by OSCR, is the original 1992 version with last year's amendments to the Object.

The Committee took the text of the most up to date version of our 'non-official' constitution, i.e., never submitted to OSCR, and added it to the Name and Object as approved by the OSCR last year. In addition, the Committee suggest further changes to that amalgamated version that tidy up the document, as well as:

- correct and simplify information about Trustees,
- describe the link between Trustees and Committee,
- include Lead Editor and Webmaster as core voting members of the Committee,
- offer free conference registration and fieldtrip for up to two Meetings Secretaries per event,
- separate Chair, Vice Chair and Honorary Secretary from Lead Editor, Webmaster and Treasurer by limiting the term of the former group to 2x3 years and allowing indefinite number of 3-year terms for the latter,
- acknowledge that all meetings can be in-person, online or hybrid.

The proposed update of the Constitution was shared with all AARG members for consultations in July 2025 and the Committee greatly appreciate the input provided. **The post-consultation version of the document is attached to this report and will be subject of voting during the AGM.** The proposed changes need to be agreed by the membership and we need to notify OSCR about the change soon after. The proposed changes are urgently required, and the move will strengthen the organisation and governance for the years to come.

Collaboration with ISAP

In line with the Memorandum of Understanding with ISAP, in early 2025 the Committee held a meeting with our counterparts in the partner

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organisation. We have discussed EAA Archaeological Prospection Community activities at EAA Meeting in Rome in 2024 as well as engagement with non-AARG/ISAP member at the future EAA AP meetings. We summarized AARG and ISAP meetings happening in 2025 and beyond - ICAP will take place in Ghent (15-20 September 2025) and in Brno, Czechia in 2027. **If you are an AARG member planning to attend ICAP in Belgium and are willing to represent AARG at that meeting, please let AARG Committee know as soon as possible**.

Together with the ISAP Committee we continue our involvement in overseeing the EAA Archaeological Prospection Community and use the development of that body for the benefit of AARG and ISAP. Both Committees jointly covered the 2025 EAA Annual Membership expenses for Paul Johnson, the Chair of the EAA Archaeological Prospection Community as a result of decisions made by the Committee in 2024.

Collaboration with Landscape Survey Group (LSG)

In May 2025, we signed a Memorandum of Understanding (MoU) with the Landscape Survey Group (LSG) that establishes a framework for cooperation between the Parties for the shared use of web hosting services, including server resources, bandwidth, and related technical support. AARG Committee agreed to provide shared web hosting services to LSG, via our current hosting provider which allows for multiple domains. LSG agrees to comply with the terms of use, including the Acceptable Usage Policy of and security requirements set by AARG. This MoU is fee based with the parties agreeing to equally split the costs of hosting. LSG shall pay 50% of the cost of the hosting package to AARG at the service renewal date, currently every three years, or pro rata thereof based on the renewal date of the hosting contract. The current total cost of hosting is £470.53 across three years.

EAC Lidar Guidelines

In March 2025 we observed the publication of the Guidelines for the use of Airborne Laser Scanning (Lidar) in Archaeology launched by the European Archaeological Council (EAC). Many of our members contributed to the delivery of this volume, which came to fruition under the editorial oversight of long-standing AARG members Rebecca Bennett and Dave Cowley. The publication builds on a project led by Chris Gaffney and Rachel Opitz, co-chairs of the EAC Remote Working Interest Group, and a sector survey done by AARG, outcomes of which are presented on our YouTube channel.

I would like to thank everyone involved in the production of the guidelines which demonstrate AARG's commitment to connect researchers and professionals across Europe, as well as our group's position in the wider archaeological and heritage landscape. I encourage you to go to *AARGnews* 70 and read Rebecca's report from the EAC Conference in Gdańsk where the book was premiered. If you are interested in learning more about the guidelines, we recorded the virtual book launch delivered by Rebecca in May 2025 and the video is available on AARG's YouTube channel.

The publication is available for download here: https://zenodo.org/records/14609210

AARG Socials

On top of distributing relevant information via email, sent primarily by Susan Curran, AARG's Honorary Secretary, we have been communicating with members and the wider world via social media. We have paused our activity on X but opened a Bluesky account which we run together with our Facebook page. We currently have 4.5k followers on Facebook and 432 on Bluesky.

In addition, we have published 25 videos from the last year's meeting on our channel on YouTube. The Committee agrees that the Group would benefit from having a dedicated role to deal with social media so **if you feel you could help us out and become a Communication Manager, please give us a shout.**

AARG Fund and Bursaries

In 2024 we moved application to AARG Fund to rolling deadlines and we observed a raise in applications.

In early 2025 AARG Fund supported the Ukraine Working Group in setting up an ArcGIS Online account which will be used to host the findings over the next few years. As a result of the Winter 2025 AARG Fund round, the Committee decided to support another project investigating archaeology in Ukraine by Kseniia Bondar and the team. They completed their work in Ukraine and will present the results in Trondheim during the poster session.

We have supported further three projects in 2025. Applications from Antonio Jesús Ortíz Villarejo (*Revealing Malaventura Fortress: An Archaeological Investigation Through LiDAR Documentation*), Stephen Kay and the team (*Mapping change to rural occupation in pre- to late Roman Abruzzo: multispectral imaging at Furfo (Italy))* as well as Susan Curran and the team (*Modelling vulnerable sites to climate change around St. John's Point, Co. Donegal*) have been successful and the projects are ongoing.

Applications from Kseniia Bondar as well as Stephen Kay, long-standing members of ISAP, demonstrate that our cooperation with our sister organisation is working well and **I remind our members that you are eligible to apply for ISAP Fund**.

AARG Fund Autumn Call will open in mid-September and this will be the last call in 2025. The call will accept small project applications only (<£500).

AARG Bursary remains our most popular funding scheme attracting student and young researchers to join us for the Annual Meeting. This year we have supported three students and two Prize winners (Simon Seyfried, winner of the 2023 prize was unable to join us in York last year). In 2025, the AARG Ukraine Bursary has been granted to one applicant. Finally, we have supported the participation of five students/young researchers in the *Training and Research in the Archaeological Interpretation of Lidar* (TRAIL), organised by the Slovenian ZRC SAZU with AARG's involvement. We are covering the registration fee,

contributing towards the travel costs and offered free AARG membership.

AARG Archive

Lidka Żuk continues to help the Committee with organising Rog Palmer's digital AARG archive that he shared with us in 2024. We are still waiting for Rog to ship the paper archive to us, which we will digitize thereafter. **If you have documents that you feel should be included in the AARG Archive as they would allow us to document the history of the organisation and promote our work, please get in touch with the Committee members**.

Copyright infringement

We have recently been informed by PicRights, acting on behalf of Associated Press (AP), about an unlicensed use of the AP imagery on our website. The imagery in question was included on a post-conference poster published in the past issue of *AARGnews*. We have investigated this matter and it appears that the authors reproduced this image with an incorrect credit and despite *AARGnews'* terms of submission to the members newsletter requiring authors to be sure that their images are correctly licenced there has been an oversight on our part.

We have removed the image from our website with immediate effect and are trying to resolve this issue with AP and PicRights. However, if this is unsuccessful, AARG will be liable to pay £200 for the unlicensed use of the imagery.

This issue has been discussed by the Committee as well as the *AARGnews* Editorial Board. A note about copyright infringement will be included in the editorial to *AARGnews* 71 and changes will be made to *AARGnews*' instructions for contributors with explanation of responsibilities for copyright infringement.

Treasurer's Report (Rebecca Bennett)

This report to the AGM contains the figures and formal financial reporting for 1 January 2023 to 31st December 2024. However as it is made mid-financial year, it also includes an informal update for the 6 months of 2025 for the interest of the committee and members.

Financial Report 2024

Procedure

The accounts for 2024 were compiled by AARG Treasurer Rebecca Bennett and were submitted to our Auditor Helen Winton for auditing approval prior to them being forwarded to the Office of the Scottish Charity Regulator (OSCR) for acceptance. Thanks are due to Trustee Chris Cox and Auditor Helen Winton, for additional cross-checking of the 2024 accounts.

Headlines

- As per the OSCR format (where all finances held across all accounts are converted to £ Sterling at 31/12/2023 and totalled) the total assets of The Aerial Archaeology Research Group are
- £23,735 and AARG has recorded a surplus for the year of £2394.
- The closing balance of the Sterling account is £17,130.04
- The amount in the sterling account has decreased by £2515.82 due to the revenue from the successful AARG 2024 and increased membership conference accruing in the Paypal account (see below). This was not transferred to the HSBC account prior to year end.
- The closing balance in the Euro account (HSBC) is €395.17.
- The closing balance in the HSBC Euro account has decreased by €572.63 due to making the final outstanding payment for the 2023 conference and payment of bursaries for attendance at the 2024 conference
- AARG also has £5,264.87 and €1,122.64 respectively in the charity's Paypal account.
- Membership income rose significantly to £2514 from £1623 in 2023 (54% increase).
- Despite the efforts of the committee to promote the AARG Fund via rolling deadlines, there was no expenditure as the single successful submission required administrative processes that were not completed until January 2025.
- The Committee awarded six bursaries supporting conference attendance for early career researchers to the value of £1,450.52 and the shared costs of EAA membership for the AARG / ISAP representative (£42).
- Committee expenses were minimal at just £9.
- The cost of supporting software (Zoom and webhosting) increased from £239 to £642 despite the committee ending our Otter.ai susbscription, as 2024 was the start of the next 3 year cycle of pre-paid webhosting.
- The cost of banking charges (HSBC and Paypal) increased again by £175 from £385 to £560. This increase was due to Paypal fees to handle higher numbers of payments for the conference than 2023.

Treasurer's Report

At the start of 2025 AARG remains in a strong financial position having delivered a very successful conference and workshop for members in York.

Membership income was £1,310.00 and €1,457.60 respectively, a 54% increase from £855.00 and €883.00 in 2023. Thank you to all members who continue to support the group via prompt payment of membership fees. This leaves AARG with healthy overall balances of £22,394.91 and €1,517.81, a strong position which will allow us to expand our support via the AARG Fund and Conference Bursaries.

Overheads

The group's overheads remain good value despite the larger spend this year (paying for the next 3 years web hosting in advance). The work of the committee and members (via the working groups) continue to be supported by software subscriptions to Zoom and Google Drive storage.

Bank charges remain a constant expenditure and it is still and aim of the committee to find an alternative banking

provider who do not charge a monthly standing fee for charities. Despite work by the Treasurer and Chair, it was not possible to move accounts in 2024; however, this process is now underway and should be completed by the middle of this year (in advance of the 2025 Conference).

Investing Resources

While being fiscally prudent, the AARG Committee remains committed to ongoing allocation of budget in direct support of the membership. In addition to our allocated budget in 2024 we received a generous anonymous donation of £1000 and the proceeds of the sale of Anthony Crawshaw's surplus books which he so kindly brought along to the conference. The Committee was pleased to be able to support six bursaries for early career members to attend AARG 2024 in York (total value £1,450.52).

The lack of applications to the AARG fund limited spending against this budget as did the fact that the single successful project (Ukraine Working Group Web App, £900) required an administrative process that meant the allocated funds could not be spent before the end of the financial year. This grant has been accrued as a commitment for 2025.

It is still the intention of the Committee that any surplus from events will go directly to support the next round of small grant schemes and conference bursaries, along with an agreed portion of the AARG reserves. To add to this the AARG committee are also exploring ways to support additional training opportunities for the membership outside the annual conference. The committee have also made a commitment to support the EAA membership of a joint representative of AARG/ISAP so that we can improve our connections and representation of archaeological prospection within the wider European archaeological community.

As we enter 2025 in a strong financial position, I extend my personal thanks to all those who have continued to support AARG and look forward to seeing you all in person in Trondheim.

Mid-Year Addendum

The following points of note are to be made regarding finances in the period 1st Jan- 7th Aug 2025.

Membership Income – We have seen an overall increase in membership income again to £1014 (up from £915) and €1065 (down from €1125) respectively.

AARG Fund – So far this year the Committee have granted awards to four recipients totalling €3,668, with a commitment of €659 (20% on project completion). This is a welcome increase on applications and awards from last year.

Conference Bursaries – Our conference bursary scheme to support students and early-career professionals to attend our in-person events has been awarded to four applicants this year. The bursary comprises the cost of conference attendance for each participant and up to €300 towards travel or accommodation expenses (to be used as the recipient sees fit). We will be honouring the financial support to the Prizewinner from 2023 (as they were unable to make last year's conference) and so will be funding two Prizewinners to attend AARG Trondheim.

We have also provided grants for attendance of five students to the upcoming Training and Research in Lidar (TRAIL) meeting 28 to 30 October 2025, Postojna, Slovenia to a total value of €575.

Landscape Survey Group – We have agreed to provide hosting for the Landscape Survey Group Website via our web hosting package. This agreement effectively halves our ongoing hosting costs (as there is no

Receipts and Payments Account for the 12 months ended 31 December 2024

As per OSCR guidance all € converted to £ and all amounts rounded to the nearest pound sterling.

Receipts	2024	2023
Membership subscriptions	**£2,514**	**£1,623**
Grants & donations (incl. sponsorship)	**£1,155**	£0
Conference fees	**£12,759**	£6,160
Total receipts	**£16,428**	**£7,784**

Payments	2024	£2,023
Conference expenses	**£11,330**	£7,796
Committee expenses	**£9**	£0
Website and Software	**£642**	**£239**
Student bursaries & grants	**£1,493**	**£1,987**
Bank charges (including PayPal fees)	**£560**	**£385**
Total Payments	**£14,034**	**£10,406**
Surplus/ (deficit) for year	**£2,394**	**-£2,622**
All funds are unrestricted		

Statement of Balances	2024	2023
Bank and cash in hand		
Opening OSCR balance (01/01/2024)	**£21,324**	**£24,325**
Cash in hand	**£86**	£90
PayPal account balance	**£6,192**	£731
Bank Account	**£17,456**	20593
Closing balance in bank 31/12/2024	**£23,735**	**£21,324**

additional cost to adding a second website to our current package).

Financial Provider – In June we received the excellent news that HSBC (our current banking provider) will no longer be charging Charities for their sterling accounts. This removes one of the main drivers to switch provider and will save AARG c.£150 per year. Given the ability to accept payments in Sterling or Euro via Paypal the treasurer is reviewing the requirement for a HSBC Euro account and will report back to the committee in due course.

Best regards, Rebecca Bennett 7th August 2025

Honorary Secretary Report (Susan Curran)

As of 11th August 2025, the current AARG membership stands at 162 members; this is largely consistent with 2024 when we had 160 members registered at the same time last year.

The Membership total consists of the following:

- Institutional Membership: 3
- Honorary Membership: 4
- Individual Membership: 134
- Student Membership: 21

2025 saw 32 new membership registrations (i.e. those not carried over directly from 2024), some of whom are brand new members while others are former AARG members returning after a membership 'break'. This figure includes 5 new student members who were granted free Membership for 2025 as part of their AARG-sponsored TRAIL bursaries. It is very positive to see AARG maintain its strong membership levels for a second year.

Our members come from 24 countries, and we were delighted to welcome a new member from Hungary this year. The UK comprises the highest number of members, followed by Germany, USA and Poland.

2025 memberships per country

Country	No. Members
Australia	2
Austria	6
Belgium	1
Bulgaria	2
Canada	1
Croatia	4
Czech Republic	5
Denmark	2
France	3
Germany	14
Hungary	1
Ireland	4
Italy	4
Netherlands	3
Norway	5
Poland	8
Portugal	2
Romania	1
Slovenia	3
Spain	6
Switzerland	1
UK	74
Ukraine	1
USA	9
Grand Total	**162**

AARGnews Editorial Team Report (Martin Fowler)

AARGnews issues 69 and 70 were published in October 2024 and April 2025 respectively by the Editorial Team comprising Martin Fowler, Chris Cox, Carmen-Cornelia Miu (Bem), Gianluca Cantoro, and Eileen Kerhouant. We have continued to evolve the look and feel of the publication, introducing new sections along with help with navigating to articles, as well as increasing the potential for engagement with external audiences.

AARGnews 69 included a report of the AARG Conference in York together with a collection of 'postcards' illustrating aspects of the meeting. Other contributions included a reflection of the late Roger Featherstone's contribution to the development of Czech aerial archaeology, a novel application of a drone to create a vertical image of a Roman mosaic within the tight confines of a museum, and an update on the work of Historic England to provide greater access to their data through the online Aerial Archaeology Mapping Explorer and Aerial Photo Explorer applications. Continuing in the vein of software tools, the latest version of the AutoGR-Toolkit was described, and the issue was rounded off with a visit to the *AARGnews* archive looking back at what was topical in *AARGnews* 10, 20, and 30 years ago, along with the annual reports from the AARG committee members.

AARGnews 70 marked the passing of Gordon Maxwell with a formal obituary along with informal memories of him by two AARG members. Other contributions included a short report on the annual meeting of the European Archaeological Council held in Gdańsk and a summary of the findings of the AARG Ukraine Working Group's three-year landscape survey of part of Ukraine using open-source satellite imagery. The multidisciplinary nature of archaeological studies was illustrated by two articles describing the use of aerial photographs and geophysics to investigate the remains of a medieval monastery and a circular ditch enclosure in Germany. Readers' thoughts were sought on an enigmatic feature from Ukraine in a revival of the Wazzat? feature last seen in *AARGnews* 62 and was followed by a short article that attempted to answer the question 'Does anyone read *AARGnews*?'

We extend our gratitude to all contributors to *AARGnews* 69 and 70. *AARGnews* is your publication, and we look forward to receiving your contributions to future issues.

Webmaster Report (Andrea Devlahović)

AARG Website (aargonline.com)

The website continues to operate on the WordPress content management system, using the Elementor website builder alongside various open-source plugins. Throughout the reporting period, regular updates were implemented to ensure the platform, plugins, and associated components remained secure, stable, and fully functional. No major issues or service interruptions were encountered.

Content & Analytics

Ongoing content management has focused on keeping key areas of the site up to date. Minor updates have been made to site text and structure as needed.

Analytics monitoring has been maintained to track visitor engagement and traffic trends. In addition, **download metrics for *AARGnews*** were regularly compiled and provided to the Lead Editor to support editorial planning and evaluation.

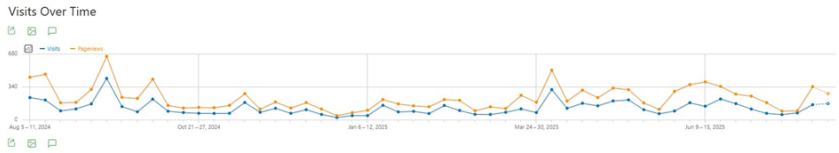
From **11th August 2024** to **7th August 2025**, the official AARG website received:

- 6,214 visitors
- 11,389 page views, of which 9,216 were unique

The top three countries generating traffic during this period were again the **United Kingdom**, **United States**, and **Germany**.

Almost 75% of users accessed the AARG website via desktop computers, which contrasts with global trends: as of 2025, 96.3% of internet users access the internet using a mobile phone, and over 64% of global website traffic originates from mobile devices.[1]

Among the most visited pages were those related to the **AARG Annual Meetings** and ***AARGnews***.



COUNTRY	VISITS	ACTIONS	ACTIONS PER VISIT	AVG. TIME ON WEBSITE
United Kingdom	1,783	3,850	2.2	2 min 5s
United States	717	1,224	1.7	48s
Germany	434	805	1.9	2 min 1s
Russia	274	653	2.4	2 min 7s
Italy	259	772	3	3 min 7s
Poland	236	518	2.2	3 min 20s
Norway	233	470	2	1 min 57s
Croatia	199	859	4.3	6 min 45s
Spain	177	418	2.4	2 min 3s
Ireland	160	367	2.3	1 min 56s
Totals	**6,214**	**13,470**	**2.2**	**2 min 10s**

TYPE	VISITS
Desktop	4,635
Smartphone	1,334
Phablet	145
Tablet	93
Unknown	6
Totals	**6,214**

PAGE TITLE	PAGEVIEWS	UNIQUE PAGEVIEWS
Aerial Archaeology Research Group	2,306	1,927
AARG2025 Trondheim • Aerial Archaeology Research Group	1,975	1,533
AARG2024 York • Aerial Archaeology Research Group	1,656	1,327
AARGnews • Aerial Archaeology Research Group	1,586	1,234
Become a Member • Aerial Archaeology Research Group	599	467
Grants & Bursaries • Aerial Archaeology Research Group	479	398
AARG 2025 Annual Meeting Payment • Aerial Archaeology Research Group	349	91
About Us • Aerial Archaeology Research Group	291	254
Events • Aerial Archaeology Research Group	264	230
Aerial Archaeology • Aerial Archaeology Research Group	237	213

Conference Webpage

In preparation for the **AARG 2025 Annual Meeting**, a dedicated conference webpage was created and regularly updated throughout the planning period. Built using a template developed specifically for this purpose, the page features key information including the programme, registration links, venue details, and other participant resources. Additionally, the official conference booklet was designed and created, with supplementary information added to enhance clarity and usability. This process involved formatting and presenting the content in an accessible and professional format, making the booklet a valuable companion resource.

With registrations now closed and the final programme published, the webpage serves as the **central reference point** for attendees in the lead-up to the event.

Development

No major new features were introduced this year outside of the conference page. The existing structure and tools remain fit for purpose. No significant technical issues were encountered. Regular maintenance and updates ensured smooth and uninterrupted site performance.

Starting in December 2024, AARG began working in **partnership with the**

[1] Exploding Topics, "Mobile Internet Traffic: Trends and Statistics 2025," accessed August 2025,.

Landscape Survey Group (LSG) to establish a joint hosting arrangement. Under this agreement, LSG will host their website on the same server used by AARG through our hosting service provider. A Memorandum of Understanding has been signed between both groups, and the migration of the LSG website is currently underway.

Future Work

Two areas have been identified as points of development in the coming year:

- Update the *Group History* section: this section would benefit from review and revision to reflect AARG's ongoing evolution,
- Compile an archive of Past Events: Creating a structured, accessible archive will enhance the site's value as a resource and historical reference for members and visitors alike.

AARG YouTube channel

(youtube.com/@aerialarchaeology)

As of 7th August 2025, the AARG YouTube channel has **73 subscribers** and hosts **45 videos**, comprising presentations from the 2023 and 2024 Annual Meetings in Zagreb and York, as well as the EAC Lidar Guidelines Virtual Book Launch. The channel has accumulated **1,133 views** with an estimated **76.4 hours** of total viewing time. This represents a 170% increase in subscribers, and an increase of 461% in views and 453% in viewing time.

AARG Google Group

(groups.google.com/g/aarg-group/)

As of 7th August 2025, the AARG Google Group remains active with **104 members**, including **26 new members** who joined during the reporting period. This represents a 32% increase in total membership and more than double the number of new members compared to last year. However, only four new conversations were initiated during 2025. It would be valuable to encourage members to participate more actively by starting discussions, sharing resources, and connecting with peers.

Trustees Report (Chris Cox)

This year, there have been no major issues to report. AARG has, however:

- strengthened our governance by the amendments to the Constitution which have been agreed by the Committee and Trustees and will be hopefully approved by the membership during the 2025 AGM;
- set up regular meetings between the Trustees and General Committee; and
- investigated and is resolving a potential copyright breach which involves one small image published in *AARGnews*. As an *AARGnews* Editorial Committee member, as well as Trustee, Chris Cox reports that this has been discussed at our last editorial meeting and is in progress of resolution. Also, changes will be made to *AARGnews*' instructions for contributors in the light of this issue, to ensure that the contributors correctly attribute, and are responsible for, all copyrighted items which are submitted in our publications or indeed on posters displayed at AARG meetings texts etc.

Toby Driver has joined Wlodek Raczkowski and Chris Cox as a Trustee this year and the Trustees wish to thank Darja Grosman for her service as a Trustee until her recent retirement from this position.

Working Groups Report (Rog Palmer)

AARG photo reading group

This group is currently inactive.

AARG Ukraine WG

A three-year project, undertaken by the Ukraine Working Group, began in 2022 as a response to Putin's aggressive war on Ukraine. We chose to examine a 110 x 60 km area with mixed soils to produce a dot distribution map and database of archaeological features identified. Source data were Google Earth images (2007 to 2022), and declassified HEXAGON photographs taken in 1982. The intent was to provide both archaeological value to Ukrainian archaeologists and demonstrate ways in which aerial or satellite images, which are currently underused in Ukraine, may benefit research in that country.

Our survey recorded 10,608 features of which 7,639 are considered to be archaeological and include habitation sites, hillforts, mounds and field systems. Not all are new. A further 447 features were recorded from the Soviet era which are now abandoned or destroyed and some 2,522 non-archaeological features have been identified, many of which have the potential to be confused with archaeological features when viewed from an airborne perspective.

A second report has been submitted to *Arheologia* in which we examine habitation sites, of which we identified some 240, in more detail, consider the designs of lines of mounds and present three case studies of local areas that have been mapped in some detail. We are, however, still waiting for our second report to be published in Ukraine.

Our results have been transferred to an interactive web app by Martin Fowler, and Alex Kariaka, our Ukrainian collaborator, plans to visit some sites in the field later this year.

Finally, we wrote a short note for *PAST* (Prehistoric Soc newsletter) about some of the results of the Ukraine WG.

Noticeboard

Compiled by the *AARGnews* Editorial Team [1]

[1] editoraargnews@gmail.com

Useful information about AARG membership, the resources available to members, and various sources of funds for your studies.

AARG Membership

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.

As a member, you are eligible for participation in the different AARG Working Groups and the AARG Photo reading meeting, that take place once a month. You will also benefit from reduced conference fees and immediate access to the latest issues of *AARGnews* sent by email. You are also eligible to apply for the various AARG scholarships.

AARG members are kept informed via email of the annual conference, publication of new issues of *AARGnews* and occasional papers, as well as the occasional day schools which are arranged for the discussion of specialized topics.

Membership of AARG is open to individuals and institutions at following rates:

- Individual (£15 / €17).
- Student (£10 / €12).
- Institution (£25 / €29).

You can easily apply online for membership via the Membership page of the AARG website.

AARG YouTube Channel

AARG's YouTube channel is now live and operational! Currently, the channel showcases videos of presentations from the 2023 conference held in Zagreb and the 2024 conference held in York.

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.

To access the Aerial Archaeology Research Group's YouTube channel, please go here: Aerial Archaeology Research Group - YouTube.

Facebook and Bluesky

Don't forget to regularly visit the AARG pages on Facebook and on Bluesky to keep up to date with what's happening.

AARG Google Group

The AARG Google Group is a virtual place where members can interact with each other, exchange ideas, share new finding or even advertise job opportunities and vacancies. You can join the group here. You must be an AARG member to join the group, so do join AARG if you are not yet a member.

AARG Fund

Since 2021 AARG offers funding for its members and Working Groups for projects that further the objectives of the Group. Applicant who is currently a member of AARG and has been so for at least 2 consecutive years or is an employee of an organisation that has AARG corporate membership may submit a funding Application as Principal Investigator (PI).

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.

AARG Student/Early Career Researchers Bursaries

AARG has a limited number of Student/ Early Career Researcher bursaries for attendance at its annual meeting. These bursaries are intended to support *bona fide* students/early career researchers who are interested in aerial archaeology

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and wish to attend and present at the AARG conference.

If you wish to apply for a bursary, you should write an email headed with*Student/young researcher bursary application* to aargchair@gmail.com with the following information:

- your interests in archaeology and aerial archaeology,
- place of study/work,
- the name and contact details of a supervisor or employer (email) who can provide a reference,
- why you would benefit from attending the conference,
- an estimate of travel costs and accomodation to attend.

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.

ISAP Fund

The International Society for Archaeological Prospection have a fund to provide support of up to £1000 to assist with members' projects [membership costs less per year than AARG does] that 'further the objectives of the Society'. Guidelines and application form from the ISAP web site.

Derrick Riley Bursary

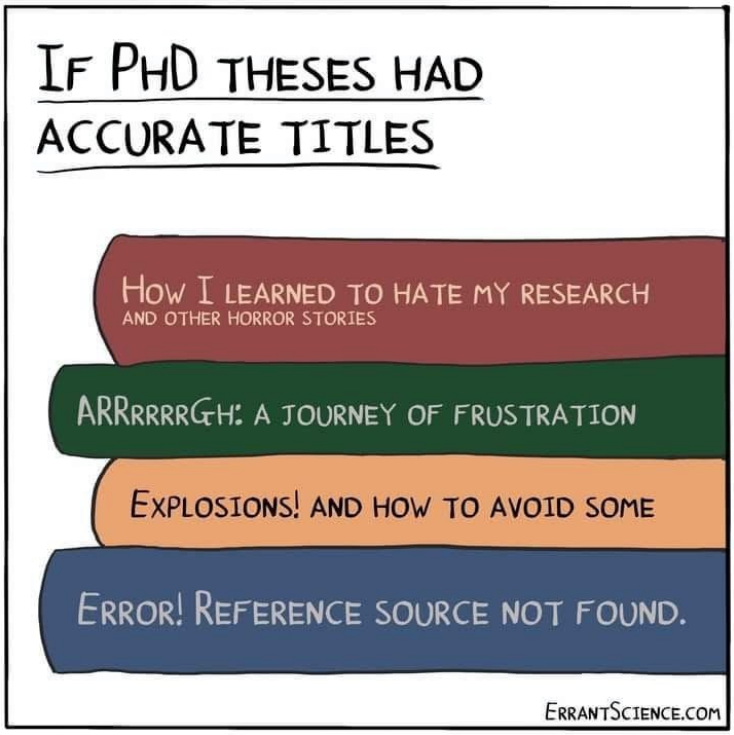
The Derrick Riley Fund was established in 1994 to foster and support the study of aerial archaeology by young scholars. It provides grants to undergraduate and postgraduate students in the UK and overseas to fund research and further training in aerial archaeology. The fund is administered by the Department of Archaeology at the University of Sheffield. Further information can be found here.

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 ...



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It looks like there could be a typo in the title of the second volume … *AARrrrrGhnews: A Journey of Frustration …*

AARGnews – Notes for Contributors

The *AARGnews* Editorial Team [1]

[1] editoraargnews@gmail.com

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. We would particularly welcome the inclusion of photographs, images, maps, plans, or other illustrations to support your article. If you have any questions or suggestions, please feel free to contact us.

Other than the requirement for contributions to be in English*, there are no strict instructions for contributors, although there are some preferences which will help with the production of an issue as detailed below.

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).

Articles should be up to a maximum of eight A4 pages in length including illustrations. For information, a typical page of text equates to approximately 700 words. Shorter informal contributions of three or four pages in length are also welcome. Longer contributions can be fitted in, if necessary, but may have to be held over to the next issue.

* Don't worry if English is not your first language — we can help you with that.

Please keep your formatting simple as we will edit your article to the *AARGnews* style. A single column of text on each page with figures and tables included where you would like to see them would be ideal. Footnotes should be kept to a minimum and certainly **not** used for references. They have to be manually inserted when setting up pages in Publisher and are a pain to manage. That said, authors' contact details (i.e., email address, *ORCID* iD if needed) are usually footnote 1.

Abstract. Please include a short abstract for articles longer than 3-4 pages. Three or four lines should suffice.

References. Include a list of references at the end of the article in alphabetical order using the Chicago Manual of Style format, e.g.,

> In the main text: Jones (2023).
>
> In the list of references: Jones, I., 2023. "Remote sensing and the search for the Dial of Destiny" *AARGnews* 67: 1-3.

Images and tables. Good-quality JPGs at 300dpi are perfect and should be pasted in the text where you would like to see them along with a suitable caption. Do not send high resolution TIF images as they will be too large to use! Tables should be included in the text at the desired position.

Please ensure that you have permission to images in your article, Appropriate acknowledgements should be included in the captions to figures.

Authors are responsible for securing permission to include any illustrations or other content subject to copyright. Without such approval, we regret that your article cannot be published in *AARGnews*.

Please include acknowledgements in the captions to figures and tables.

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Submission deadlines. The deadlines for submission are **15th March** and **15th September** for the April and October issues respectively. You can also submit your contribution at any time, in which case it will be considered for the next issue.

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

'Offprints'. Contributors will be sent a link to the full PDF copy of the relevant issue of *AARGnews* together with a PDF 'offprint' of their paper.

We look forward to reading your articles and sharing them with the AARG community!