



This volume brings together the proceedings of the 26th EAC Heritage Symposium, which took place in March 2025 in Gdańsk, Poland. The symposium occurred at a time of dual reflection: twenty years after the Faro Convention and ten years after the Amersfoort Agenda. These milestones both marked a shift in European heritage policy, placing people, participation and public value at the heart of archaeological practice. Today, these principles are tested in the way we manage, preserve and reuse archaeological archives.

Inspired by the values promoted by the European Archaeological Council, the contributions collected here examine the 'life after life' of archaeological archives. They explore how digital and physical collections can be made accessible, meaningful and resilient while upholding professional standards and societal expectations.

Across three thematic sections, the volume addresses the FAIRness of archaeological data, the evolving role of archaeological repositories, and the broader societal value of archives. Case studies from across Europe demonstrate the opportunities and risks of the digital transition, the increasing demands placed on repositories and the potential of archives to contribute to science, education, health, community engagement and innovation.

Together, these papers provide a timely and critical overview of current practices and point towards more inclusive, sustainable and socially engaged futures for the management of archaeological heritage.

EAC Occasional Paper No. 21

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Life after life of archaeological archives



Edited by Agnieszka Oniszczuk, Agnieszka Makowska
and David Novák

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**Life after life of archaeological archives –
accessibility and re-use of archaeological collections
in heritage management**

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Proceedings of the 26th EAC Heritage
Management Symposium
Gdańsk, Poland, 27–29 March 2025

Edited by Agnieszka Oniszczyk,
Agnieszka Makowska and David Novák

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Life after life of archaeological archives – accessibility and re-use of archaeological collections in heritage management

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Front cover image: 3D-printed replica of a face urn from the Archaeological Museum in Gdańsk, Poland, based on a comprehensive 3D model, as an illustration of how archaeological collections can be reused (3D model by Ryszard Zimek, graphic design by Karolina Polkowska)

Back cover image: Custom-built cabinet illustrating the ten agents of deterioration, used in the permanent exhibition, Ename Heritage Site (© Martin Corlazzoli)

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Foreword

It is my great honour and pleasure to introduce the proceedings of the European Archaeological Council's 26th Heritage Management Symposium, which took place in 2025 in Gdańsk, Poland. In the magnificent Artus Court, EAC members convened to discuss important topics concerning archaeological archiving and the accessibility and re-use of archaeological collections in heritage management.

The event was kindly hosted by the Museum of Gdańsk, which itself serves as an archive of collections documenting the city's history from the Middle Ages to contemporary times. Gdańsk, as a heritage city *par excellence*, can be seen as a living archive both above and below the surface. What better location to discuss a topic of such significance to archaeological heritage managers across Europe, as well as to the general public?

EAC Volume 21 is a collection of articles offering a rich source of examples, reflections, and inspiration, covering every aspect of archiving. The articles address sustainable and FAIR-based management of archaeological data and archives, challenges and opportunities in heritage data management, possibilities for community engagement, and the role of archives as a resource for innovation and policy development.

Within this volume, you will also find reflections from the insightful discussions held during workshops on sustainability and climate change, landscape management and spatial planning, citizen science and public benefit, and heritage crime. The outcomes of this process will guide the EAC's work in the coming years. The workshops have enabled us to better identify the specific needs of EAC members regarding these topics. It was inspiring to observe the wealth of knowledge, expertise, and experience present, which can be shared collaboratively to enhance and refine our professional practices.

I would like to extend my sincere thanks to the scientific coordinators of the symposium, Dr. Agnieszka Oniszczyk, Agnieszka Makowska, and Dr. David Novák for their outstanding work in organizing the symposium as well as collecting and editing the papers for this volume. I also wish to express my deep gratitude to all the authors for their contributions and for sharing their experiences and insights, from which we can all now benefit in our day-to-day work.

Marjolein Verschuur

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Life after life of archaeological archives – accessibility and re-use of archaeological collections in heritage management. The introduction

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In 2005, the Council of Europe Framework Convention on the Value of Cultural Heritage for Society (Faro Convention) stated that a prerequisite for cultural heritage is its recognition as a reflection and expression of the constantly evolving values, beliefs, knowledge, and traditions of people (Council of Europe 2005, Art. 2). Signatories of the Faro Convention decided to place people and human values, sometimes contradictory, at the heart of an enhanced interdisciplinary concept of cultural heritage. They recognized everyone's right to benefit from the cultural heritage and to contribute towards its enrichment, while respecting the rights and freedoms of others. Respect for the heritage of others as part of the common heritage of Europe is henceforth an obligation. 'In return', the Convention gave people a voice to assign their own meanings and values to those remains of the past that they considered heritage. The Parties to the Convention were also convinced of the need to involve everyone in society in the ongoing process of defining and managing cultural heritage (Council of Europe 2005, Preamble).

Ten years later, in the spirit of the said convention, the European Archaeological Council set out on a mission to embed archaeology in the society. As stated in the Amersfoort Agenda (European Archaeological Council 2015), heritage managers across Europe wanted to:

- “Stimulate and facilitate society's involvement in archaeology, while at the same time encouraging archaeology's involvement in society by linking it to other policy domains and the societal challenges of today's world.
- Know the public: analyse the wants, interests, and expectations of stakeholders in society regarding their involvement in archaeology, preferably through interaction with those stakeholders.

- Integrate archaeology into education for children and young people” (European Archaeological Council 2015, 16).

Within the theme of *Managing the sources of European history*, they expressed a need to “aim for the greatest possible access to digital archaeological resources for various user groups and exploit digital databases to their full potential, including uses for the greater public” (European Archaeological Council 2015, 21).

In order to fulfil its ambitious plan, the EAC’s work in the following years concentrated around the broad topic of making choices, resulting in the publication of EAC Guidelines 3–11, tackling the issues of significance, public benefit, research frameworks, and archaeological archiving. In the broader strategic context, an increasing number of parties have ratified the Faro Convention and there has been a general increase in the attention given to cultural heritage and its potential. For example, from 2017 onwards, European Heritage Strategy for the 21st Century – Culture and Cultural Heritage (Strategy 21. 2017) and related activities were undertaken, and in 2018, the European Year of Cultural Heritage was celebrated.

Year 2025 marked the 10th anniversary of the formulation of the Amersfoort Agenda and the 20th of the Faro Convention. Such a double jubilee called for some form of retrospective reflection on the current state of archaeological heritage management,

Figure 1. The 26th EAC Heritage Management Symposium, Artus Court, Museum of Gdańsk (© Tobiasz Bułyńko, National Institute of Cultural Heritage, Poland)





Figure 2. Participants of the 26th EAC Heritage Management Symposium in front of the Artus Court, Museum of Gdańsk (© Tobiasz Bułynko, National Institute of Cultural Heritage, Poland)

with special attention given to archaeological archives – records and finds that will or at least should outlive the archaeologists of today.

Papers published in this volume were presented during the 26th EAC Heritage Management Symposium held on 27–28 March 2025 in Gdańsk, Poland, where heritage managers gathered to discuss *Life after life of archaeological archives – accessibility and re-use of archaeological collections in heritage management*. On a general level, the topics included the 'FAIRness' of archaeological data, the role of modern archaeological repositories, and the value of archaeological archives in a wider perspective of science and innovation, medicine, education, health and well-being.

Theme 1: What is FAIR archaeological heritage data and are we there yet?

The past three decades have witnessed a significant shift towards digitalization in the management of archaeological heritage. A number of initiatives and individual projects have been established with the objective of digitizing, enhancing, and sharing data. Since 2016, the FAIR principles have served as a gold standard for this endeavour. It is worth noting that ARIADNE RI and SEADDA represent two significant examples of projects addressing this issue on a large scale. A European overview of existing solutions provided during short interventions by the delegates and guests to the thematic session Archaeology and Artificial Intelligence organized in 2021 by the CoE's Steering Committee for Culture, Heritage, and Landscape, revealed a vast collection of GIS database and archiving systems throughout Europe.

It is imperative that archaeological heritage data should be made FAIR, but is it? Do all the relevant stakeholders have an adequate understanding of the heritage assets that we possess and where it can be found? Is there sufficient clarity and explicitness in the communication of the value of our archives? To what extent can archaeological data and systems be made understandable, interesting, and user-friendly for the general public, and not only heritage professionals and developers? How can we ensure and measure that users are satisfied with the product? How can we ascertain the extent of our digital success and what novel methodologies can be employed to enhance it? Are our digital solutions sustainable?

In order to address these pressing questions and challenges, this printed volume presents four papers that tackle digital heritage from different perspectives. The first paper, by Yiu-Kang Hsu and Rorie Edmunds, introduces the concept of using persistent identifiers (PIDs) with prescribed metadata profiles to describe and identify archaeological material and sites, a fundamental aspect of FAIRness. They demonstrate the implementation of the IGSN PID scheme, supported by DataCite, using a case study rooted in the work of the Deutsches Bergbau-Museum Bochum. Their contribution is also valuable because they provide a thorough description of the principles of using PIDs and their potential impact on archaeological practice. The second paper, written by Jonas Abele, Anna-Marie Dürr, Steffen Berger, and Marco Schrickel, focuses on practical data management within institutions responsible for archiving fieldwork data on the state level. The State Office for Cultural Heritage Baden-Württemberg has a long tradition of exploring systemic frameworks to facilitate data standardisation and handling for long-term preservation. While the paper is not directly related to FAIR principles, it illustrates the complex workflows within institutions that provide the necessary digital infrastructure. It also highlights the value of clear guidelines and documentation of processes to ensure that provenance information is available in accordance with best practice. The following contribution from Manda Foster and Jen Parker Wooding presents a comprehensive package designed to promote FAIRness and effective data management planning. They introduce the Dig Digital project, an initiative that has been running in England for the last ten years. This allows us to see the interesting, reusable materials that the project produced, as well as all the steps involved, from analysing the situation and providing measures and recommendations to field units on how to move forward, to evaluating what has proved successful and why. This example, which is worth following, shows the true length and complexity involved in introducing new practices for managing digital data and appraising the FAIR principles. The final paper in the FAIR section aims to highlight the risks associated with the digital world, where data can be severely compromised in the event of unexpected situations and targeted cyber-attacks. Gábor Virágos explains the experience of Hungary in relation to data being threatened as a result of the insufficient adoption of FAIR and other guiding principles in data management and preservation.

Overall, the papers demonstrate the wide range of topics that the digital transition has brought to archaeological archiving, which are difficult to address without sustained and systemic specialist support for the existing research and heritage community.

Theme 2: Unlocking the potential of physical archaeological archives and the (changing?) role of modern archaeological repositories

The EAC guidance thus far has concerned archaeological projects that conclude with the transfer of properly prepared and studied archives to permanent storage facilities. Archaeologists were advised to collaborate with curators from selected repositories, and the necessity of ensuring access to the gathered materials was emphasized. However, the role of repositories as modern archaeological institutions was not sufficiently addressed. Should they and do they have enough capacity to reach the public outside the archaeological sector, either directly or through collaboration with museums and other organizations specialising in outreach activities? How can repositories contribute to the integration of archaeology into society, specifically, how can they facilitate access without compromising the heritage in their care? In what way can archaeological repositories most effectively be used to highlight the participatory potential of archaeology? How can the sometimes contradictory needs of different heritage communities be accommodated in the use of archaeological collections?

Three papers presented within this theme, only begin to address the above questions. Dr Rachel Barret from National Monuments Scotland Archive takes us behind the scenes, describing the amount of work needed to make the ‘analogue’ documentary archives digitally accessible. Complexity of tasks related to varied item types accepted by the archive ranges from the initial assessment, through annotation, conservation up until digitisation and sharing the archives. The paper points at tensions arising from the growing demand for access and understaffing, or more generally, underfinancing of archiving institutions. Peter McKeague, using the example of Scottish maritime heritage, depicts the diversity of available sources that are being brought together, related challenges and emerging opportunities. Interoperable archaeological archives, properly linked to other digital resources can enhance public engagement and enrich the entire maritime community. Lien Lombaert and Lieselotte Desnerck from Flanders tackle the public-oriented functions of repositories, with focus on Ename Heritage Site. They propose specific measures with the help of which archaeological depots can become active agents of public engagement, education, and inclusive heritage care.

Summarising, those three papers should be regarded as illustrating the subsequent phases of archives’ lifecycle in permanent curation, i.e. enabling access, exploring opportunities, and taking action.

Theme 3: Beyond archaeology – the value of archaeological archives

Engaging the wider public by the re-use of archaeological archives should not be focused solely on studying the past. The report entitled *The Benefits of Development-led Archaeology (EAC Guidelines 4)* lists several substantial public benefits that can be achieved and maximised through careful consideration and planning. The value of archaeology as a source of knowledge lies also in its potential to contribute to the development of other disciplines. Questions concerning the use of archaeological archives beyond archaeology were addressed to the speakers invited to Session 3.

How can we use archaeological archives for science and innovation? In what ways can archaeological archives be used for medicine, education, health and well-being, etc.?

Barney Sloane's paper from Historic England demonstrates how materials and samples gathered during excavations can contribute to studies in other research areas and how this knowledge dividend can be unleashed to create tangible public benefit. It presents some incredible case studies that demonstrate what has already been achieved and what could be possible in the near future through the right collaborations. The focus of many examples is on the study of ancient DNA extracted from organic material within archaeological collections, but not only. Agnieszka Oniszczyk demonstrates the significant public benefits that can be realised on a local scale through the use of archaeological archives, as well as the value of interpreting heritage and archaeology issues from a local perspective. The paper proposes the community outreach model based on using one chosen site as a focal point for all activities. In this model, archaeologists act as translators and intermediaries between archives and the community, among other roles. Paulina Florjanowicz shows that archaeological archives are a key source of knowledge, shedding light not only on prehistory, but also on the evolution of archaeology as a discipline, its institutionalisation, and its management over time. It is illustrated in the paper how the history of archaeological policy can be analysed and archival documents and past decisions can be critically assessed to help improve current approaches, ensuring a more sustainable role is played by archaeology in society. On the other hand, Jiří Unger, Dalibor Dzurilla, Martin Košťál, and Jiří Košta remind us that archaeological archives and repositories contain many fascinating stories about our past. These stories are well known within academia, but are largely unknown to the public. 3D computer reconstructions now play a key role in making the past accessible. But how can uncertainty—such as temporal or spatial gaps, missing data, and interpretive bias—be visualised in ways that are comprehensible to diverse audiences? This paper therefore aims to define a practical and conceptual framework for 3D archaeological storytelling that balances scientific transparency and public communication.

Workshops

The 2025 EAC Symposium was also a place to think on future priorities of the association. During the workshop session, the attendees had an opportunity to develop the most recurrent topics collected a year before at the 25th EAC symposium in Brussels. Summary of these discussions supplemented with comments from the Board opens this volume.

Exceptionally high attendance to the Gdańsk Symposium demonstrated that the multifaceted topic of archaeological archives is dear to the hearts of archaeological heritage managers. Therefore, the scientific coordinators would like to use this opportunity to thank all the speakers for their engagement and substantive input bringing inspiration to the archaeological sector throughout Europe.

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The EAC at 25: Looking forward

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Keywords: heritage management, Valletta Convention, Faro Convention, archaeology, cultural heritage, landscape management

Introduction

During the European Archaeological Council (EAC)'s Annual Meeting in 2025, workshops were held to explore heritage management priorities identified by members in a survey conducted the previous year in Brussels (EAC n.d.), namely: the potential of citizen science, the challenge of heritage crime, the role of heritage in landscape management processes, and the issues posed by climate change and the need for sector sustainability. The discussions are reported here, with reflections on ways EAC might support its members in addressing them.

The workshop topics

Citizen science

The Brussels survey showed that EAC members are interested in enabling public participation in heritage management processes and promoting its benefits (Figure 1). The workshops considered the topic of citizen science – the participation of the general public in archaeological investigation and other heritage management activities. They asked what practical steps could be taken to promote citizen science and how citizen science research models can be used to support decision-making.

A focus on the Faro Convention (Council of Europe 2005) is desirable, to enable closer work with communities, and demonstrate heritage as an economic, cultural and intangible community asset. To enable this, there is a need to make the process of managing change within the historic environment transparent, by providing open and accessible data about archaeological research and decision-making. Without this, the ability to engage the public is limited.

Increasing engagement skills within the profession, and promoting the value of citizen science to the sector is vital to develop its role within authorised decision-making processes. Finally, it was noted that greater understanding of what young people value is needed to engage them more effectively. Embedding archaeology into school



Figure 1. Word cloud from the 2024 Brussels survey (© European Archaeological Council)

curricula is a challenge, but piloting youth boards to increase representation of young people in decision-making on heritage-related issues is a valuable option.

Heritage crime

Heritage crime is a common concern for EAC members, but there are sharp differences in the prevalence of different types of heritage crime across Europe, due to varying legal frameworks and enforcement strategies, which are themselves impacted by factors such as global conflict. Looting and trafficking are key concerns for some nations, but almost completely absent for others. Damage to monuments is a universal concern, whether arising from intentional targeting of heritage, or as a consequence of general vandalism or unintentional damage, caused by lack of understanding of heritage vulnerability.

It can be difficult to combat the harm caused by heritage crime, or even demonstrate the value of combating it to decision-makers, due to numerous barriers: lack of reliable data, lack of effective enforcement, poor understanding of legislative tools available. There is not enough expertise regarding archaeology within, or coordination between, agencies for effective enforcement.

Rates of illegal metal-detecting varies geographically and the risks are increased by armed conflicts. However, legal metal-detecting can fall within citizen science: it is important to distinguish this as legal metal-detecting can improve knowledge and heritage protection outcomes.

Landscape management and spatial planning

Many EAC members are concerned that archaeology increasingly finds itself as one of a number of competing priorities during broader decision-making processes. In particular, the rate at which priorities are changing and the speed at which decisions are being made is a concern.

The importance of securing archaeology as a priority in landscape characterisation and change processes was noted. Heritage is often excluded, or an afterthought, in decision-making regarding landscape, particularly in activities such as nature restoration, and there are risks from inconsistent practice or lack of integrated approaches to landscape.

The European Landscape Convention (Council of Europe 2000) could underpin the role of archaeology in landscape change, but interpretation and communication of heritage aspects is needed to ensure it is effective. Good communication about definitions of nature and heritage, data about landscape change and positive, accessible messages about heritage significance are needed. The absence of commonly understood standards and good quality data and supportive materials is a barrier to effectively communicating the public benefit of heritage landscapes.

Sustainability and climate change

The Brussels survey showed that the concerns of EAC members fall into two related areas. Firstly, creating environmental sustainability in archaeological working practices generates several challenges, from balancing carbon reduction requirements with the core activities underpinning the profession, to the knowledge and skills gaps in understanding how sustainability changes impact archaeological practice and resources.

Secondly, the biggest challenge was considered to be building an evidence base for the impact of climate change, and climate change mitigation measures, on the archaeological resource. The potential for archaeological work to become part of climate change adaptation schemes presented new opportunities for knowledge exchange.

The different legislative frameworks across Europe, with climate change adaptation being planned at different levels to those which control the management of archaeological sites, can produce inconsistencies in how the archaeological record is impacted. Concern was raised that archaeology needs to work more closely and effectively with other sectors to ensure it is well integrated with climate adaptation measures, and seen as part of the solution.

Discussion and conclusions

The EAC published the Amersfoort Agenda (EAC 2015) to provide a strategic approach to meeting the challenges facing archaeological heritage management in Europe in 2015. Based on member consultations, the Agenda aimed to support heritage management practice to move from the context of the Valletta Convention (Council of



Figure 2. 2025 workshops in the Museum of Gdańsk
 (©Tobiasz Bułyńko, National Institute of Cultural Heritage, Poland)

Europe 1992) to that of the Faro Convention (Council of Europe 2005). Three key themes were identified – Embedding archaeology in society; Dare to choose i.e. transparent decision-making; and Managing the sources of European history – which have guided the work of EAC in the years since.

The concerns explored in the Gdańsk workshops (Figure 2) show that the challenges facing archaeological heritage management in Europe in 2025 remain broadly within the themes expressed in 2015. However, there have been some shifts in emphasis.

It is clear that the EAC has not finished its work on the ‘Embedding archaeology in society’ theme, as members wish to promote the potential of society to participate in, rather than simply engage with, heritage management. The primary needs are for clear messages to show to decision-makers, and practical guides to help heritage managers improve practice.

Heritage crime is an increasing problem facing members, one largely absent from the 2015 priorities; this in part is linked to broad-scale geopolitical change. The 2026 EAC heritage symposium in Altamira, Spain is going to explore the questions raised, to establish how EAC can help address this complex issue.

Finally, the workshops on landscape management, and climate change and sustainability show there is a large interrelated area of potential work for the EAC and its members. New pressures have created an urgency to act, but the themes remain similar to those in 2015: the need for transparent decision-making, advocacy for archaeological heritage, and standards to support good management, and accessibility, of the European heritage resource. In 2025, the focus is on broadening understanding about the scale of protection needed for archaeology and heritage to a landscape level. Two potential areas are advocacy concerning the headline message and technical help with definitions and practice.

As the EAC already has working groups on topics which relate to these broad landscape management issues, the first task will be to consider the overall framework to ensure there is no duplication of effort, so areas of action can be defined to help tackle these significant challenges and opportunities.

Acknowledgements

The EAC extends thanks for the reports produced by the chairs (Marta Arcos García, Daniel Miles, Barney Sloane, Marjolein Verschuur) and rapporteurs (Rebecca Bennett, Agata Byszewska-Łasińska, Nina Glińska) of the workshops.

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26TH EAC ANNUAL MEETING AND HERITAGE MANAGEMENT SYMPOSIUM

GDAŃSK — POLAND
27 — 29 MARCH 2025


PROGRAMME

- 1 **ARCHAEOLOGICAL MUSEUM IN GDAŃSK**
Blue Lamb Granary
- 2
- 3 **MUSEUM OF GDAŃSK**
Artus Court



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Archaeological
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 National Institute
of Cultural
Heritage

 MUSEUM
OF GDAŃSK

 Archaeological Museum
in Gdańsk

 Instytucja Kultury Samorządu
Województwa Pomorskiego

WEDNESDAY 26 MARCH 2025

WELCOME RECEPTION 1

18:00 – 22:00 Visit to the museum exhibition and welcome reception

THURSDAY 27 MARCH 2025

EAC GENERAL ASSEMBLY AND CONSILIUM 3

9:30 – 10:40 EAC General Assembly and publications launch
 10:40 – 11:10 Break
 11:10 – 13:00 Workshop sessions on EAC future priorities. Separate information will be provided to those delegates who registered an interest in participating in the workshops.
 13:00 – 14:00 Lunch

EAC 26TH HERITAGE MANAGEMENT SYMPOSIUM 3

14:00 – 14:40 26th Heritage Management Symposium: welcome speeches and introduction to the symposium

SESSION 1

WHAT IS FAIR ARCHAEOLOGICAL HERITAGE DATA AND ARE WE THERE YET?

Chair: David Novák | Institute of Archaeology of the Czech Academy of Sciences in Prague

14:40 – 15:00 NFDI4Objects – Providing Infrastructure for FAIR Research Data for the Material Remains of Human History
Julian Hollaender | NFDI4Objects/Landesamt für Denkmalpflege im Regierungspräsidium Stuttgart
Christin Keller, Philipp von Rummel | German Archaeological Institute/NFDI4Objects

15:00 – 15:20 Digital archaeological primary documentation data in Baden-Württemberg (Germany): The LAD-BW's path from standards to archives
Anna-Marie Dürr, Jonas Abele, Marco Schrickel, Steffen Berger, Julian Hollaender | Landesamt für Denkmalpflege im Regierungspräsidium Stuttgart

15:20 – 15:40 Persistent Identifiers: Road to the FAIRness of Archaeological Samples at the Deutsches Bergbau-Museum Bochum
Yiu-Kang Hsu, Thomas Stöllner, Ingolf Löffler, Jan Sessing | Deutsches Bergbau-Museum Bochum
Rorie Edmunds | Datacite

15:40 – 16:10 Break

16:10 – 16:30 FAIR or complicated? The Hungarian Case
Gabor Viragos | Independent Specialist
Attila Kreiter | Hungarian National Museum Public Collection Centre

16:30 – 16:50 Work Digital, Think Archive, Create Access: Exploring the Legacy of the Dig Digital Project
Jen Parker Wooding | Chartered Institute for Archaeologists, UK
Amanda Forster | Tacit Heritage, UK

16:50 – 17:30 Discussion

17:30 Close

18:30 Reception – Piwnica Rajców (cellar of the Artus Court)

FRIDAY 28 MARCH 2025

EAC 26TH HERITAGE MANAGEMENT SYMPOSIUM 3

SESSION 2 UNLOCKING THE POTENTIAL OF PHYSICAL ARCHAEOLOGICAL ARCHIVES AND THE (CHANGING?) ROLE OF MODERN ARCHAEOLOGICAL REPOSITORIES Chair: Kaat De Langhe | Flanders Heritage Agency

9:30 - 9:40	Welcome
9:40 - 10:00	The maritime record in Scotland from recording to presentation Peter McKeague Historic Environment Scotland
10:00 - 10:20	Collecting Ireland's Archaeological Heritage: the continued lifecycle of records Rachel Barrett National Monuments Service, Dept of Housing, Local Government & Heritage, Ireland
10:20 - 10:40	Managing archaeological archives in Iceland, challenges and steps towards solutions Ármann Guðmundsson, Hrönn Konráðsdóttir The National Museum of Iceland
10:40 - 11:10	Break
11:10 - 11:30	Repository research Nathalie Vossen Information and Heritage Inspectorate, Netherlands
11:30 - 11:50	Bringing Archaeology Home: Reconnecting Heritage with Its Community Lien Lombaert, Lieselotte Desnerck Heritage Depot Ename, Belgium
11:50 - 12:10	Archaeological archives in Wallonia: Conservation, resilience and digital transformation Sophie Denoël, Claire Goffioul Walloon Heritage Agency
12:10 - 13:00	Discussion
13:00 - 14:00	Lunch

SESSION 3 BEYOND ARCHAEOLOGY – THE VALUE OF ARCHAEOLOGICAL ARCHIVES Chair: Adrian Olivier | Historic Environment forum

14:00 - 14:20	Pick one – using "old" archives to integrate community around local heritage Agnieszka Oniszczyk National Institute of Cultural Heritage, Poland
14:20 - 14:40	Legacy and Springboard: Archaeological Archives and Scientific Innovation Barney Sloane Historic England
14:40 - 15:00	Looking Back to Move Forward – The Benefits of Researching Archaeological Archives for Policy Making Today Paulina Florjanowicz National Institute for Museums, Poland
15:00 - 15:30	Break
15:30 - 15:50	The availability and use of accessible digital archives and data from excavations on transport infrastructure projects in Ireland James Eogan Transport Infrastructure Ireland
15:50 - 16:10	5DCulture: Realizing the potential for reuse of our archaeological archives Anthony Corns, Robert Shaw, Rebecca O'Reilly, Siva Namberi, Hannah Boyd, Lesley Davidson The Discovery Programme
16:10 - 16:30	Breathing Life into Archaeological Archives: Crafting Compelling Narratives with 3D Digital Storytelling Jiri Unger Institute of the Archaeology of the Czech Academy of Sciences in Prague, v.v.i. Dalibor Dzurilla Visuin Martin Kostal Department of Archaeology and Museology of the Masaryk University in Brno Jiri Kosta National Museum in Prague
16:30 - 17:10	Discussion

SATURDAY 29 MARCH 2025

8:30 - 17:30	Excursion
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Persistent Identifiers: Towards the FAIRness of archaeological samples for scientific analysis

YIU-KANG HSU¹ and RORIE EDMUNDS²

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Keywords: Persistent Identifier (PID), International Generic Sample Number (IGSN ID), metadata, controlled vocabulary, FAIR Principles, Deutsches Bergbau-Museum Bochum, DataCite

Persistent identifiers (PIDs) are fundamental infrastructure that ensures research outputs remain discoverable, accessible, and reusable over time (CODATA RDM Terminology WG 2023). By providing globally unique, web-resolvable references, PIDs enable reliable access to digital and physical research entities, overcoming the limitations of local identifiers and fragile URLs. Within many disciplines, PID adoption is well established, particularly for publications, datasets, and researchers (Figure 1). Archaeology, however, has lagged behind in consistently applying PIDs to one of its most critical entities: the archaeological sample. This gap hampers integration of analytical data, hinders comparability across projects, and risks the loss of valuable contextual knowledge.

The International Generic Sample Number (IGSN ID) offers a long-lasting solution to data findability (DataCite e.V. 2022). Originally designed for geoscience samples, the IGSN ID is applicable across disciplines, and it has evolved into a globally recognized PID system that is managed through a partnership between IGSN e.V. and DataCite. As a form of Digital Object Identifier (DOI) (Figure 2), each IGSN ID provides a permanent digital footprint for a material sample, linking it to rich metadata and ensuring long-term discoverability (Figure 3). Crucially, IGSN IDs are suitable for archaeological samples, sites, and aggregates; they also enable the representation of hierarchical relationships between samples, preserving the complex parent–child structures often inherent in archaeological material.

Recognizing the need for discipline-specific guidance, the IGSN–DataCite Archaeology and Cultural Heritage Community of Practice (CoP: IGSN e.V. 2024) was established in 2022, bringing together archaeologists, data managers, and metadata specialists. Through iterative testing with real sample metadata and cross-mapping with existing community vocabularies, the CoP has developed an Archaeological Sample Metadata Profile (<https://igsn.github.io/archcop-metadata-profile/>) to

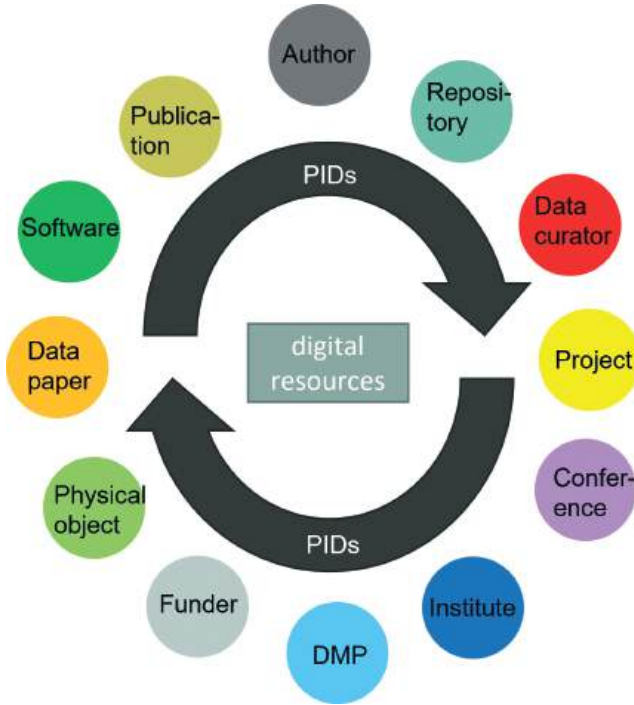
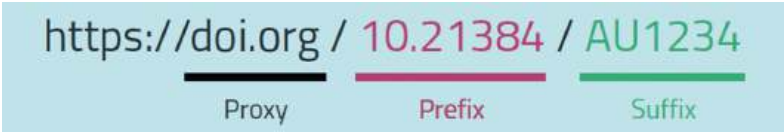


Figure 1. Academic resources that are commonly registered with PIDs

standardize the description of samples (Table 1). The profile also provides a stable framework for registering IGSN IDs for archaeological samples, with a complementary Crosswalk Recommendation (<https://doi.org/10.5281/zenodo.17446558>) ensuring that the metadata properties are aligned with and can be consistently captured by the DataCite Metadata Schema (DataCite Metadata Working Group 2024). Importantly, both outputs are living documents, released for community adoption and open revision, thereby encouraging broad uptake and long-term refinement.

Figure 2. An IGSN ID name is made up of a prefix beginning with 10. and a suffix, separated by a forward slash. The prefix ensures that the IGSN ID is globally unique. The suffix can be customized to incorporate local identifiers



General Identifiers

Program: ICDP
 Expedition: ICDP 5054
 Type: Hole
 Name: 5054_1_A
 IGSN: ICDP5054EHW1001
 Comment: valid alias: ICDP5054EEW1001
 Parent IGSN: N/A
 Release Date: 2017-3-1

Sampling Location

Latitude: 63.40163
 Longitude: 13.202917
 Coordinate System: WGS84
 Elevation: 522.51
 Final Depth: +1980.29
 Location Type: N/A
 Location Name: Åre, Jämtlands län, Sweden
 Location Description: COSC-1 is located in the vicinity of the abandoned Fröå mine
 Country: Sweden
 Province: Jämtlands län
 County: N/A
 City: Åre

Geology

Material: Rock
 Rock Classification: metamorphic rocks
 From Corrected Depth: 102.7
 To Corrected Depth: 2502.8
 Depth Reference: meter below ground level
 Geological Age: mid-paleozoic
 Geological Unit: N/A

Methods

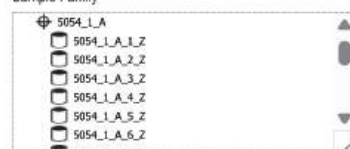
Downhole Logging: Acoustic televiwer LU, DIP OSG, DLL OSG, ELOG LU, FAC40 OSG, Focused electric LU, Full-waveform sonic LU, Full-waveform sonic OSG, Magnetic susceptibility OSG, Mudparameter OSG, NN, Sidewall density LU, Temperature/Conductivity LU, Temperature/Conductivity OSG, Temperature/Conductivity UU, Three-arm caliper LU

Drilling

Drilling Method: Coring > RockCorer wireline diamond coring, HQ and NQ bit size
 Operator: Lund University, Engineering Geology Larsson Drilling Consulting AB
 Funding Agency: Swedish Research Council (Vetenskapsrådet)
 Total Length: 2400.1m
 Comments: valid alias: ICDP5054EEW1001
 Platform Type: drill rig
 Platform Name: Atlas Copco CT20C
 Platform Description: slimhole wireline coring system
 Chief Scientist: Chris Juhlin
 Start Date: 2013-09-05
 End Date: 2014-08-26

Repositories

Current Repository: Bohrkernlager für kontinentale Forschungsbohrungen, Berlin-Spandau, Germany
 Current Repository Contact: Jochen.Erbacher@bgr.de
 Original Repository: N/A
 Original Repository Contact: N/A

Sample Family

☛=Hole, ☐=Core, ☐=Core-Section, ☐=Core-Sample
 The Sample Family shows a sub-sampling graph. Select entries to navigate samples. Core-Samples are issued to scientists on request. The naming convention for a Core-Sample is: Expedition_Site_Hole_Core_Section_from-to(m). Hole, Core, and Core-Section are following the same schema respectively.

Location Map

Drilling Start/End: 2013-09-05 / 2014-08-26 *
 Latitude: 63.40163 * Longitude: 13.20292 *
 Åre, Jämtlands län, Sweden

Publications & Datasets

Lorenz, H., Rosberg, J.-E., Juhlin, C., Bjelm, L., Almqvist, B. S. G., Berthet, T., ... Tsang, C.-F. (2015). COSC-1 – drilling of a subduction-related allochthon in the Paleozoic Caledonide orogen of Scandinavia. *Scientific Drilling*, 19, 1–11. doi:10.5194/sd-19-1-2015

Lorenz, Henning; Rosberg, Jan-Erik; Juhlin, Christopher; Bjelm, Leif; Almqvist, Bjørn; Berthet, Théo; Conza, Ronald; Gee, David G.; Klonowska, Iwona; Pascal, Christophe; Pedersen, Karsten; Roberts, Nick; Tsang, ChinFu (2015): COSC-1 operational report - Operational data sets. GFZ Data Services. <http://doi.org/10.1594/GFZ-SDDb.ICDP.5054.2015>

Figure 3. A landing page for a geosciences sample (IGSN: ICDP5054EHW1001: <https://doi.org/10.60510/icdp5054ehw1001>) published by the GFZ Helmholtz Centre for Geosciences. Notice that the 'sample family' is incorporated top-right of the landing pages

#	Property	Obligation	Definition
1	Project	M	The title (and any alternatives) of the site or project.
2	investigationType	R	Lists all investigation types relevant to the resource. Should follow a standard vocabulary.
3	investigationDates	M	Full date range using RKMS-ISO8601 format, indicating when the archaeological project was carried out or the processing dates. For ongoing or multi-annual investigations use the dates of the specific project for which the investigation took place.
4	collectorExcavator	M	Details of the creator(s), compiler(s), funding agencies, or other bodies or people intellectually responsible for the sample collection.
5	Publisher	M	The organization that is registering the metadata record for the sample.
6	Contributor	R	Other individual(s) or organization(s) who have contributed to the collecting, analysis, or managing of the sample.
7	sampleTitle	M	Title or name that enables discovery and distinction of the sample.
8	Description	R	Detailed description of the sample. Should include information about the sample and its collection not captured in other properties.
9	Subject	R	Keywords for the subject content of the sample. Keywords should be taken from standard vocabulary.
10	otherIdentifier	M	The project/reference/catalogue/sample number(s) used to identify the sample on site.
11	collectionDate	M	Date when sample was collected following W3CDTF format. May optionally include the time at which the sample was collected.
12	collectionMethod	R	How the sample was collected. Where possible, terminology should follow a standard vocabulary.
13	stratigraphicContext	R	The site or project specific identifier of the stratigraphic or survey unit from which the sample was collected. Considered mandatory in the case of samples collected during surveys and excavations.
14	sampleDepth	R	Depth of the sample within the stratigraphic context.
15	sampleWeight	R	Weight at the point of collection, before analysis.
16	sampleMaterialType	M	The type(s) of material(s) that compose the sample. Should follow a controlled vocabulary.
17	Colour	R	Colour(s) of the sample following a standard vocabulary.
18	absoluteDating	R	Numerical age or range of the sample. Dates and ranges should follow W3CDTF and RKMS-ISO8601, respectively.

#	Property	Obligation	Definition
19	relativeDating	R	Cultural and user created values for relative dating of the sample. Should follow a standard vocabulary.
20	generalKeywords	O	User-created values to describe aspects of the sample not covered by other metadata.
21	currentStatus	R	Information concerning the current status of the sample. It is recommended to also indicate the date the status was revised.
22	Relations	R	Relationships to other research outputs/entities that are identified by a globally unique identifier.

Table 1. A summary of main properties of the Archaeological Sample Metadata Profile developed by the IGSN–DataCite Archaeology CoP. Here, M = Mandatory, R = Recommended, and O = Optional

There are substantial benefits to IGSN ID adoption in archaeology. Beyond compliance with the FAIR (Findable, Accessible, Interoperable, Reusable) Principles (Wilkinson *et al.* 2016), IGSN IDs enhance the visibility, credibility, and citability of archaeological samples. As these PIDs are managed by the trusted DOI system, they inherit its robustness and authority. Furthermore, the implementation of IGSN IDs aligns with the CARE (Collective benefit, Authority to control, Responsibility, and Ethics) Principles (Carroll *et al.* 2020) by enabling the integration of community-based labels and notices that recognize indigenous data sovereignty. By embedding them within a global, interoperable infrastructure, IGSN IDs maintain the long-term research value of (often unique) archaeological samples.

The practical application of these concepts can be seen at the Deutsches Bergbau-Museum Bochum (DBM), which is developing a comprehensive data infrastructure as part of the German NFDI4Objects (<https://www.nfdi4objects.net/en/>) initiative (Figure 4). At the DBM, PID strategies are being integrated across laboratory workflows, covering four key areas: (1) metadata profiles for samples, instruments, analytical techniques, and services; (2) electronic laboratory notebooks (ELNs) for recording and managing research activities; (3) service catalogs to expose analytical capacities across partner institutions; and (4) repositories for the long-term preservation of archaeometric data. Each component makes systematic use of PIDs to ensure interoperability and sustainability.

Metadata profiles play a central role. For archaeological samples, the DBM plans to adopt the CoP's Archaeology Sample Metadata Profile that can be harmonized with the DataCite Metadata Schema. To capture domain-specific metadata, the TerraLID profile (Klein *et al.* 2022) is chosen for samples with lead isotopic measurements. Scientific instruments comply with the PIDINST schema developed by the Research Data Alliance, while analytical services draw on profiles suggested by the European

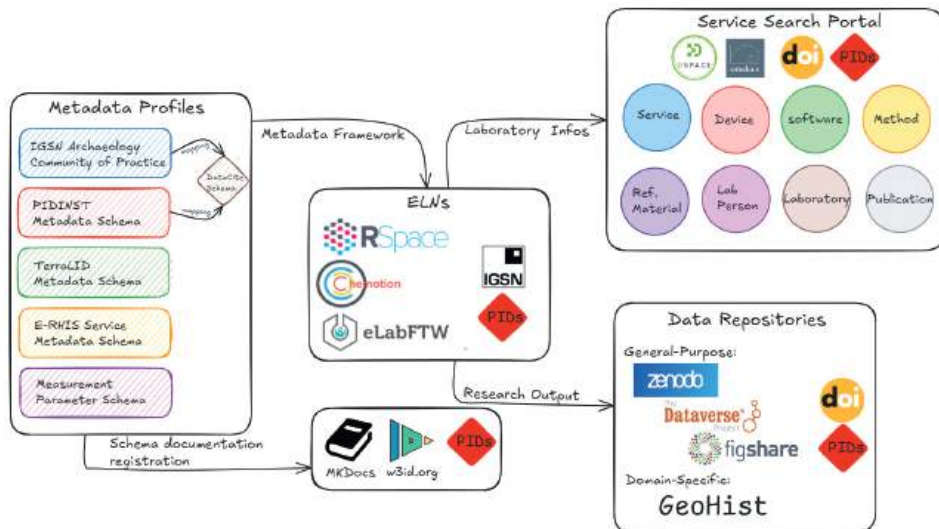


Figure 4. A FAIR research infrastructure for analytical data at the research laboratory of the DBM

Research Infrastructure for Heritage Science. A working group is also drafting metadata for common archaeometric techniques, ensuring that instrument parameters critical to interpretation are permanently recorded. Collectively, these profiles enable samples, devices, services, and experimental protocols to be consistently documented and linked.

On the other hand, ELNs (such as RSpace) serve as a critical tool to integrate IGSN IDs directly into laboratory workflows. This allows persistent identifiers PIDs to be assigned early in the sample lifecycle – ideally at the point of collection. In addition, ELNs facilitate the use of standardized metadata profiles (as mentioned above) in experiments and enable collaboration, internal knowledge sharing, and seamless export of data to repositories such as Zenodo or Dataverse.

Another important research output of the DBM's initiative lies in a service catalog. It aggregates information about analytical capacities across German archaeometry laboratories. By exposing services, instruments, and expertise through a structured, PID-enabled platform, the catalog enhances visibility and supports common access to scarce laboratory resources. Finally, a dedicated repository, GeoHist (Georesources in Human History: <https://www.nfdi4objects.net/en/portal/services/geohist/>), is being established to curate digital resources on human engagement with raw materials. Linking samples, analytical data, and instruments within a single access point, GeoHist represents a key step toward sustainable, integrated data management.

Together, these efforts demonstrate how archaeological/archaeometric data can be transformed from fragmented, institution-specific practices into a Linked Open Data

infrastructure (Schmidt *et al.* 2022). The adoption of IGSN IDs and standardized metadata frameworks not only ensures that archaeological samples meet the requirements of the FAIR Principles, but also embeds them into the broader Open Science ecosystem (UNESCO 2022). By doing so, archaeology improves the sustainability of its data, increases efficiency, and preserves the long-term value of its unique material record.

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The full version of this paper is available at
<https://doi.org/10.11141/ia.72.4>

Digital archaeological primary documentation data in Baden-Württemberg (Germany). The LAD-BW's path from standards to archives

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Keywords: archaeological primary documentation data, digital legacy data, long-term data preservation, format migration, data management workflows, standardised processes, State Office for Cultural Heritage Baden-Württemberg (LAD-BW), NFDI4Objects

Origin and current status of long-term data storage

The tasks of the State Office for Cultural Heritage Baden-Württemberg (LAD-BW) include recording, documenting, and researching cultural monuments in the state. Within the framework of these activities, primary documentation data are generated, which today exist almost exclusively in digital form. Since 2016, an increasing number of trial trenching surveys and excavations at archaeological sites have been conducted by private archaeological companies, expanding the circle of data producers. Since 2018, guidelines (*Firmenarchäologie* n.d.) have governed the structure of these data, from folder hierarchies to file formats, with explicit consideration of long-term archiving. Of particular importance was the introduction of the ADAB folder (Bibby 2021). This folder contains the core information of each project (spatial boundaries as a geodata file, metadata, a selection of images, and a PDF report) and makes it available in the LAD-BW's information system (ADABweb, no date).

From project to data package – An overview of data management

The focus of the following account is the standardised data package and the associated processes of data management (see data management workflow, Figure 1). The Submission Information Package (SIP) contains all the primary documentation data of a project deemed worthy of archiving.

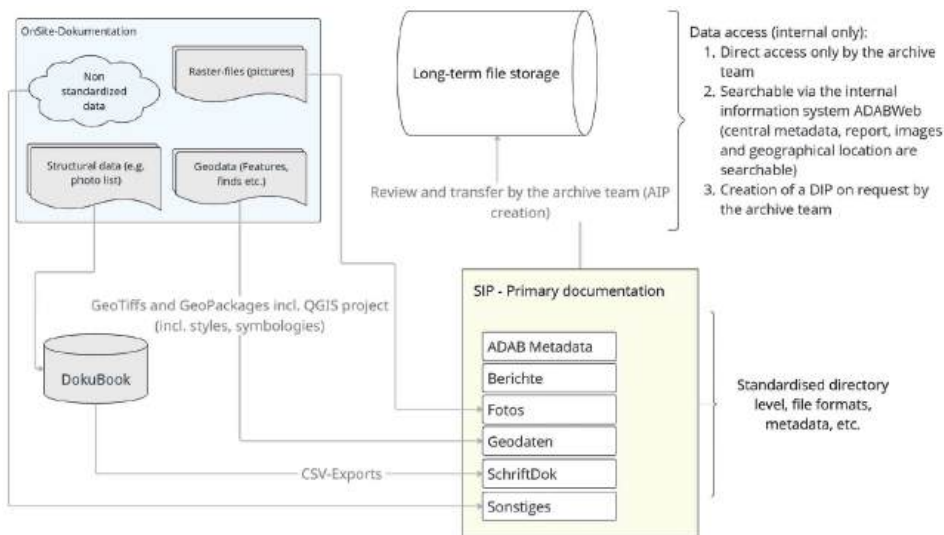


Figure 1. Data management plan for the primary documentation data of archaeological projects at LAD-BW (graphics by Jonas Abele)

At least the data resulting from excavations, trial trenching, and construction supervision are largely standardised by the excavation guidelines. In addition, every project produces a set of information and data considered worthy of archiving but not addressed by the guidelines, which can create difficulties in the storage structure. At the end of each project, a package of primary documentation data is transferred to long-term storage as a Submission Information Package (SIP). During ingestion, compliance with the guidelines is checked, additional metadata are generated, and the ADAB folder is incorporated into ADABweb.

Review and analysis of data storage

The long-term repository currently contains more than 6,400 data packages with a total volume of around 70 TB (as of July 2025). A significant increase is visible since 2016 with the rise of commercial archaeology, further amplified by construction activity between 2020 and 2022 (Figure 2). Since 2023, growth has slowed down, although there are time lags between fieldwork and data submission.

All data packages since 2018 are described with a uniform set of metadata, while earlier projects require retrospective enhancement. Particularly the digital data from 2000–2018 are highly heterogeneous in structure, making common metadata essential for searchability. To a lesser extent, analogue projects have been digitised and integrated into the archive.

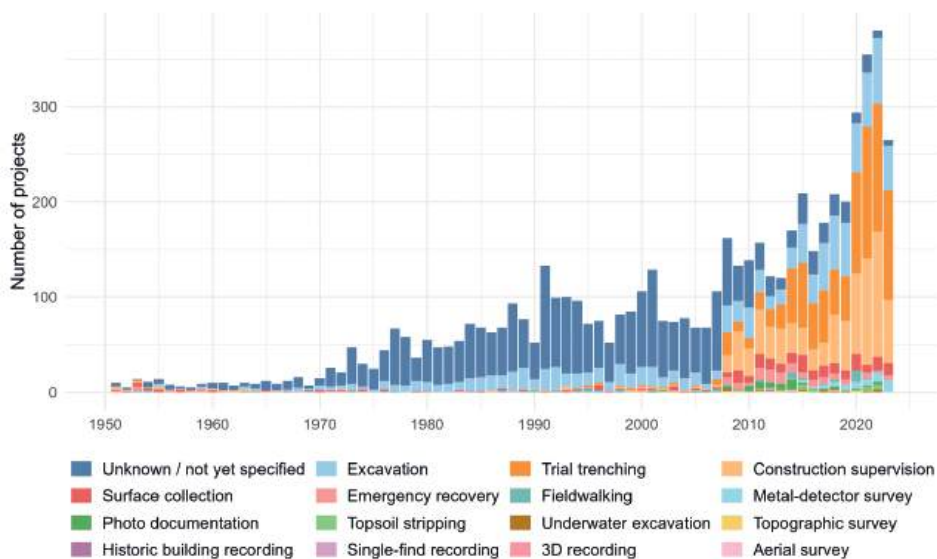


Figure 2. Total number of primary documentation data packages stored in the long-term data storage, broken down by year and type of fieldwork activity (graphics by Jonas Abele)

Quantitative analysis of the data reveals four phases in the development of file formats: (1) early digital beginnings (1990–1999), (2) CAD adoption (2000–2012), (3) the transition to GIS and Structure-from-Motion (2013–2017), and (4) consolidation through the excavation guidelines since 2018. These phases illustrate the historically evolved and highly diverse nature of the data.

Data analysis: formats

A complete survey of the file formats in the repository identified over ten million individual files in 370 different formats. Their archival suitability was assessed based on established references, showing a substantial share of only conditionally archivable or even non-archivable formats, particularly in the years 2000–2017 (Figure 3). The excavation guidelines introduced in 2018 have since stabilised the situation by enforcing preservation-ready formats, though challenges remain with formats such as QGIS project and style files.

Data analysis: storage

Quantitative analysis highlights the high diversity of file formats and allows the identification of four phases in the digital transformation of excavation practice, from early analogue-to-digital steps, through CAD, to GIS and Structure-from-Motion, and finally consolidation with the guidelines.

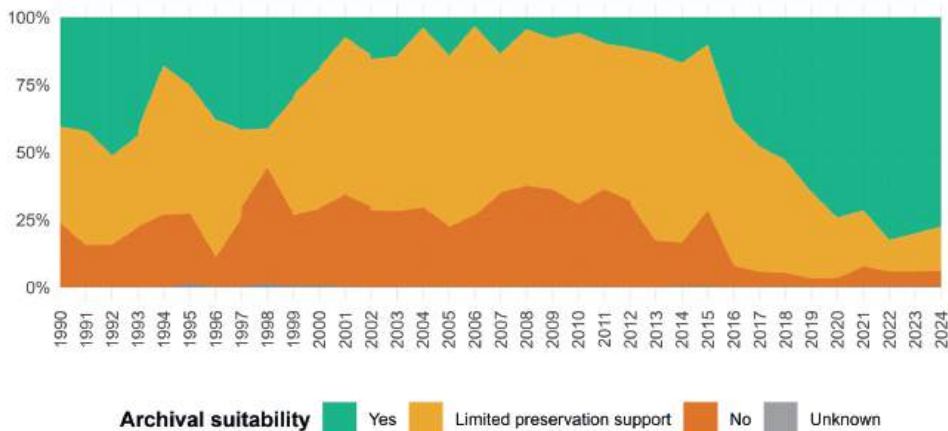


Figure 3. Archival suitability of file formats in the long-term data storage of primary documentation data for archaeological projects in the LAD-BW (graphics by Jonas Abele)

Storage analysis further revealed that project sizes have grown dramatically, driven above all by photographic documentation and orthophotos from Structure-from-Motion. Image files, especially JPG and TIFF, now account for nearly 90% of total storage consumption. A particularly critical issue is the large volume of proprietary Metashape project files and associated SfM raw data, which occupy several terabytes of storage while lacking long-term preservation readiness.

Legacy data project

Within NFDI4Objects – the National Research Data Infrastructure for the Material Remains of Human History – the LAD-BW contributes to developing standards for the creation and management of primary documentation data, with a particular focus on strategies for handling digital legacy data. Important measures include data hygiene, preservation planning, and format migration, aiming for both long-term preservation and efficient resource use.

A key challenge is that the deposited data packages were deliberately compiled as complete documentation sets and were expected to remain unchanged. Nevertheless, analyses have shown that data hygiene under clearly defined criteria is indispensable. A prominent example is the large volume of SfM data deposited between 2018 and 2021, including raw images, Metashape project files, and exported orthophotos and DEMs.

Documentation strategy: standardised processes

For all work involving the data, clearly defined, standardised processes have been introduced. These link decision points with specific actions and define the prerequisites

for carrying out migration or selection steps. The standardisation provides a schematic framework for implementing appropriate data processing workflows.

Both the applied process and the individual steps within a data package are documented in tabular form and appended to the package. An essential component is the creation of file lists with SHA256 checksums, recorded both before and after the standardised process. These lists, together with the documentation, are stored in an additional SIP folder, ensuring the traceability of all changes.

The processes follow a strict naming convention: the prefix “sp_”, followed by a subject area (currently DEL for Delete and DM for Data Migration), and a four-digit identifier (e.g., 0001). If a process is revised, the update is indicated by a version suffix (e.g., v1, v2), while earlier versions may remain in use if applicable.

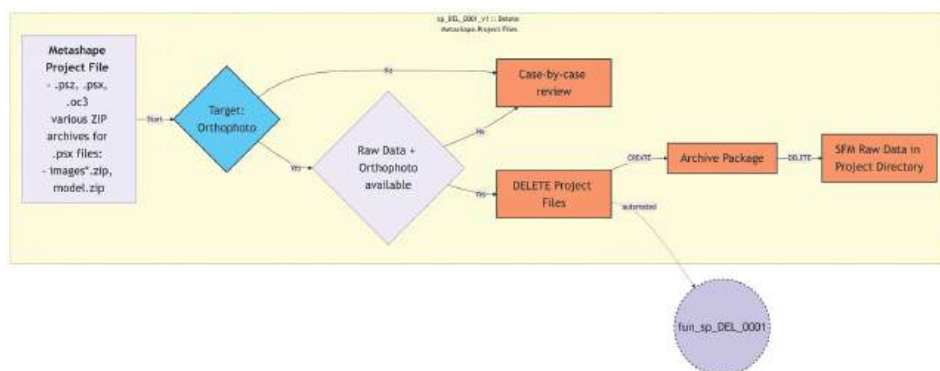
In practice, this strategy has proven effective, especially for documenting deletion procedures that are critical from an archival perspective, as it guarantees transparency and verifiability across different projects.

Standardised process for the curation of SfM raw data: ‘sp_DEL_0001_v1’

An example of such a standardised process is sp_DEL_0001_v1, which describes the deletion of non-preservation-ready Metashape project files (Figure 4). It applies when the primary aim of the SfM documentation is the creation of an orthophoto. In contrast, complex 3D documentation of features requires individual assessment.

Before deletion, it is verified that the raw data (photographs and measurement data) and the georeferenced orthophoto (GeoTIFF) are present. If these prerequisites are met, the project file can be removed, while the raw data are separated into a dedicated data package.

Figure 4. The standardised process “sp_DEL_0001_v1” for documenting the deletion of Metashape project files (graphics by Jonas Abele)



Future guidelines will require SfM raw data to be submitted as independent packages, shifting the focus from archaeologically defined results to the spatial situation at the moment of recording. In this framework, primary models (e.g., burials, deposits, architectural structures) are considered preservation-worthy, whereas secondary models created solely for orthophoto generation are not.

Conclusion and future directions

The heterogeneous and historically evolved data collection in the LAD-BW's long-term storage poses a major challenge for preservation planning and alignment with FAIR principles. The Legacy Data Project, initiated within the framework of NFDI4Objects, provides an opportunity to address this complex issue systematically.

Standardised processes and workflows have been successfully tested but require further optimisation; refined scripts will be centrally documented and made available via GitHub. Migration cannot be reduced to file formats alone, as folder structures and file names often serve as information carriers. Preservation planning therefore must be comprehensive, extending beyond individual files.

Future priorities include revising the excavation guidelines and developing new supportive systems, such as a geodatabase for excavation-related spatial data, to enable user-friendly, guideline-compliant data creation and data management.

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Work digital, think archive, create access: exploring the legacy of the Dig Digital project

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Introduction

The question of how to manage digital archives in archaeology has been a topic of interest for years. This article discusses the development, implementation and legacy of Dig Digital, a professional Toolkit (<https://www.archaeologists.net/digdigital>) providing guidance and resources for practitioners that embeds and promotes FAIR (Findable, Accessible, Interoperable and Reusable) Guiding Principles into the management of archaeological project data.

Exploring the problem: the idea for Dig Digital is born

In 2018, DigVentures and project partners, the Chartered Institute for Archaeologists (CIfA), were commissioned to undertake a project exploring the development of a standard for digital archives. That idea developed into the 'Dig Digital Toolkit' but was born out of discussions which first took place several years prior. A report for the Society for Museum Archaeology highlighted that the issue of data in archives was not being addressed, estimating that 1.25 million digital files that could not be deposited with a museum were being held in contracting organisations (Edwards 2012). The Archaeological Archives Forum (AAF) established a working group focusing on digital archives in 2014 with a joint statement from members calling for archaeologists and heritage practitioners working across archaeological projects to support implementation of good practice for digital data. The initial idea for Dig Digital started to take root. Then, in response to the Mendoza Review in 2017, Historic England recommended that long-term storage and preservation of digital archive material should be undertaken by a specialist repository, rather than museums (Trow 2018). This provided the mandate needed to move forward and develop a dedicated project focused on the management and archiving of digital data generated from archaeological investigations – Dig Digital.

Researching what was needed: consultation and guidance

The importance of archaeological archives is highlighted in several ClfA Standards and guidance documents but the most relevant for archaeological data archives is the *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives* (2014, updated 2020) supported by guidance documents created by the Archaeological Archives Forum (Brown 2011). The ClfA Standard outlines that the defined outcome for any archaeological project is a stable, ordered and accessible archive. This may be the case for many physical archives, but could the same be consistently demonstrated for digital archives?

Until recently, most project briefs issued as part of UK development-led archaeology did not specify any specific requirements for digital archive material. ALGAO England's *Planning for Archives* report (Donnelly Symes 2019) reported that 23.5 per cent (12/51) of responding services had no requirements for digital archives and revealed confusion over what constituted a digital archive. The problem, therefore, appeared to be twofold – lack of understanding around requirements for digital data and the capacity of receiving museums to hold digital assets. This lack of clarity was recorded in the early stages of the Dig Digital project, with the 2019 *Starter for Ten* consultation survey suggesting that only 7 per cent (10/139) of project team respondents felt requirements for digital data were clear. An overwhelming 96 per cent (26/27) of museum practitioners indicated a need for more guidance, and all respondents felt that general everyday guidance which helped to embed a 'whole organisation' awareness and approach would be welcome. The Dig Digital survey results asked for clear signposting of how ClfA Standards and guidance relate to digital data, as well as a need for guidance to help meet those Standards.

Digging digital: developing the guidance and tools needed

An early product of the Dig Digital project was the creation of the *Work Digital, Think Archive, Create Access* guidance document which linked working practices in archaeology, including ClfA Standards and guidance, with other key frameworks and resources that considered digital research data, namely the FAIR Guiding Principles (Forster 2019). As well as offering an in-depth and comprehensive guide to managing digital data within projects, the report developed some straightforward and simple guiding statements to support a FAIR approach (Figure 1).

At the same time, existing ClfA guidance was updated to make clear how and when digital archives should be considered – including the need for an archiving strategy in project designs – see ClfA Universal guidance for archaeological excavation 2023, 2.12 (I). As a result, archiving strategies would now include a Data Management Plan (DMP) and a Selection Strategy as fundamental components to good practice, embedding tools to support data management as part of project design processes and delivery expectations. A downloadable and editable DMP template, tailored to archaeology, was created for Dig Digital based on an example from the Digital Curation Centre. This complemented the already existing ClfA resources focused on the archive selection



This document forms part of the 'Work Digital, Think Archive, Create Access.' guidance for digital archives prepared by DigVentures, on behalf of Archaeological Archives Forum, and with Chartered Institute for Archaeologists. The project was funded by Historic England (Project No. 7796).

Figure 1. Work Digital, Think Archive, Create Access – guiding statements (© DigVentures, Cifa)

process – namely the *Toolkit for Selecting Archaeological Archives*. The guidance and supporting tools were starting to take shape – now it was time to focus on accessibility.

Designing a resource that is easy to use

To make the 40 page *Work Digital, Think Access, Create Archive* guidance document more user friendly, it was adapted into a web-based Toolkit format that, in addition to DMPs, included other useful resources (Figure 2):

The resources include:

- the **Dig Digital health check** and Action Plan – designed to help identify training and capacity needs and create a clear, actionable plan,
- **info sheets** – these add detail to the web resource, providing depth and examples for specific areas relevant to digital data management (for planning archaeologists, museum practitioners and archaeological specialists),
- **quick guides** – these are shorter reference documents highlighting key information or links to useful resources, as well as examples of selection, metadata creation and documentation,

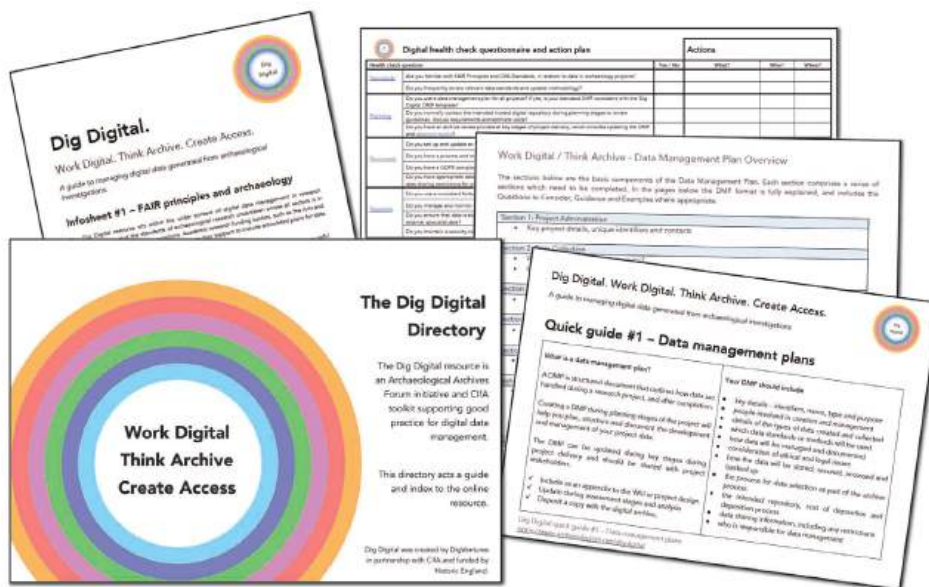


Figure 2. As well as webpage content, the toolkit includes several resources to aid implementation of the Dig Digital approach (© DigVentures, ClfA)

- **case studies** – several examples that explore projects with team members, sharing experiences of approach, learning and advice, and
- A **Data Management Plan (DMP)** template tailored to archaeology – based around an example from the Digital Curation Centre.

This created a portfolio designed to be tailored to the specific needs of the user and provided a bespoke plan identified through the Digital Health Check and Action Plan. The Plan creates a roadmap to implement change within an organisation or project team, signposting specific needs and actions. The Directory provides a simple PDF format which can be used to locate resources within the toolkit, and additional info sheets, quick guides and case studies support learning and action in different ways.

Implementing change and embedding good practice

In the final project stage, delivered in 2024, additional resources were created to further support implementation, raise awareness and provide training opportunities. These included (see links in resources section below):

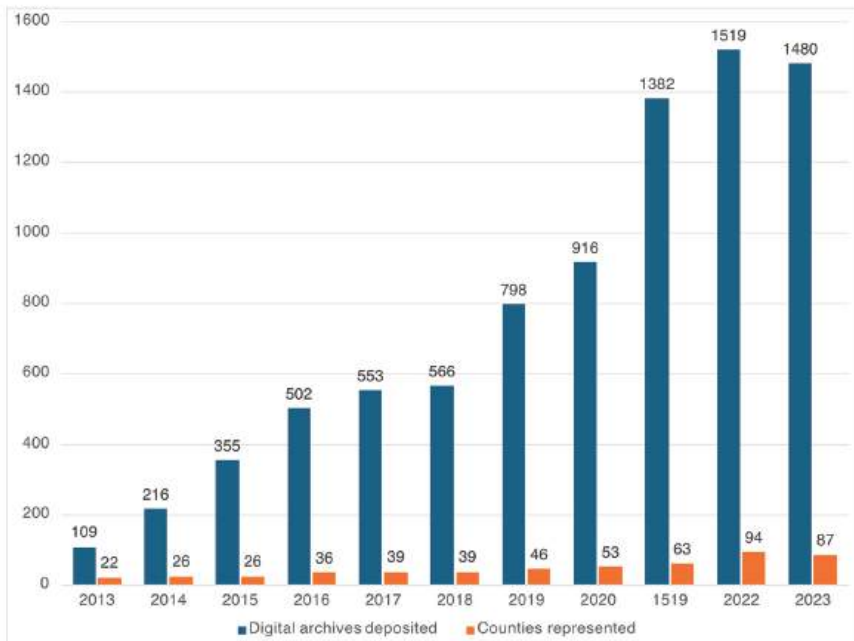
- A **Joint Statement** from members of the Archaeological Archives Forum raised awareness to and endorsed the Dig Digital resource.
- An **eLearning module** supporting the creation of FAIR, sustainable and ethical archives that was made freely available for over a year via the ClfA webpages.

- An **online course** – Dig Digital: data management for archaeological archives – housed within DigVentures’ suite of self-guided online courses provides a structured approach for anyone wanting support to implement the toolkit.

Providing a clearer pathway towards sustainable good practice and implementation for archaeologists working in the UK has been the overall goal of Dig Digital from the outset. ClFA provides the ethical framework, sector reach, influence and enforcement, and the FAIR Guiding Principles provides the good practice framework for designing resources and tools. But is practice changing?

Evidence from UK based digital repository Archaeology Data Service (ADS) suggests increased depositions have happened over the last decade (Figure 3) and, importantly, that archives are from sites located in an increasing number of counties. Follow-up surveys within the Dig Digital project delivered in 2021 also indicated that practitioners felt more confident around requirements, leading to increased planning for and implementation of processes which support digital data management. Interestingly, all areas surveyed showed an increased awareness and application of archive practice – such as collecting metadata and using filename conventions (Figure 4). Only one

Figure 3. Data provided by Archaeology Data Service shows the number of deposited digital archives against local authorities represented (Counties) and new projects initiated (as recorded on OASIS) (source: ADS 2024)



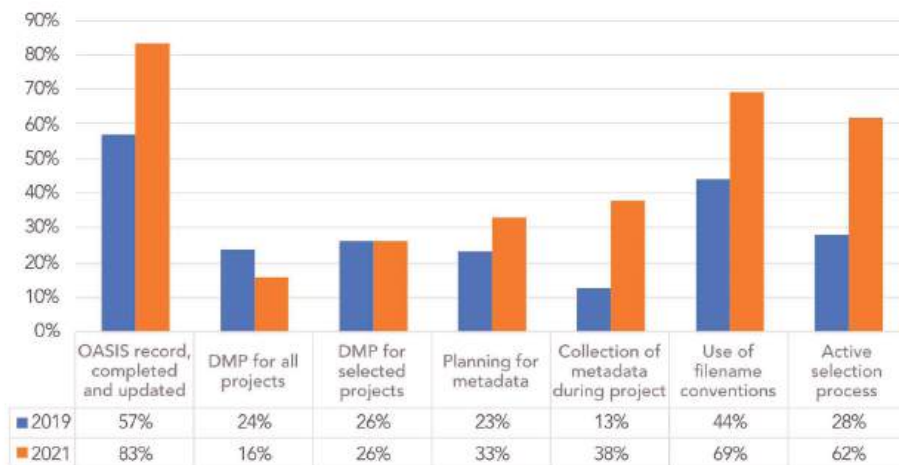


Figure 4. Data from Dig Digital surveys carried out in 2019 and 2021 demonstrated change and increased confidence (© DigVentures, ClfA)

area showed a downward trend – the question of DMP use in all projects. The reason for this can only be guessed at but perhaps an increased understanding means a more accurate picture was recorded.

The legacy of Dig Digital: work digital, work ethically

The Dig Digital approach promotes the view that it is the responsibility of all archaeologists, and not just those responsible for archive deposition, to help create good archives (Figure 5). Archives created from archaeological research of all types should be Findable, Accessible, Interoperable and Reusable by anyone well into the future. The Dig Digital resource promotes the importance of the whole project team in embedding data friendly practices within a project or organisation. It is built upon making changes within workflows and decision making from the beginning of a project, continuously building an ordered, stable, and accessible archive through project delivery – not at project closure stages. From that perspective, Dig Digital's legacy is in emphasising the importance of being an archives advocate, which focuses on working ethically to recognised Standards and guidance, planning for archives from the outset of projects and applying FAIR principles.

Acknowledgements

The Dig Digital project has benefited from the support of many. These include the Archaeological Archives Forum, Historic England and their team (Claire Tsang, Duncan Brown and Dan Miles). ClfA (Dr Jen Parker Wooding and Kate Geary) and the ClfA Archives Special Interest Group (Dr Sam Paul). The Federation of Archaeological Managers and Employers (FAME) representatives (Helen Parslow) and Archaeology



Figure 5. A callout for all archaeologists to be an archives advocate from the CIfA eLearning module on the creation of FAIR, sustainable, and ethical archives (© DigVentures, CIfA)

Data Service (ADS) team (Dr Katie Green and Dr Nicky Garland). Thank you to all those who responded to consultation surveys, took part in workshops, and most recently, the pilot group for the online course development. Dig Digital was delivered by Dr Manda Forster with the support of colleagues at DigVentures.

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Other links and resources

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- CIfA Standards and guidance documents. <https://www.archaeologists.net/work/standards>
- CIfA Toolkits. <https://www.archaeologists.net/work/toolkits>
- Digital Curation Centre. <https://dcc.ac.uk/about/>
- Dig Digital: data management for archaeological archives (online course). <https://digventures.com/product/dig-digital-online-course/>

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FAIR or complicated? The current state of archaeological heritage data management in Hungary

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Keywords: cultural heritage, archaeological data management, critical data architecture, data security, FAIR data management principles

Introduction

The question of whether archaeological heritage data truly adheres to FAIR principles is one of the most pressing challenges facing contemporary heritage management. The Hungarian case study exemplifies the paradoxical situation many nations face: simultaneously possessing rich archaeological resources while struggling with data accessibility and security challenges.

Originally intended to showcase Hungary as an instructive case study, this analysis underwent significant revision following a major cybersecurity incident that occurred weeks before the presentation of this research, fundamentally altering perspectives on archaeological data management and highlighting critical system vulnerabilities.

The paradox of simultaneous wealth and poverty in archaeological data

Multiple database systems

Hungary's archaeological data management exemplifies a complex ecosystem characterized by multiple, competing database systems serving different constituencies. This fragmented landscape creates both opportunities and challenges for researchers and heritage professionals.

The official registry: limited accessibility

The primary official repository is the Public Archaeological Site Registry (<https://www.oeny.hu/oeny/ivo/>), operating under the Ministry of Construction and Transport's authority. Despite official status and legal authority, this database presents significant limitations. Access remains severely restricted, with even professional archaeologists facing retrieval barriers. Available metadata encompass only fundamental information: geographical location, spatial extent, chronological periods, and basic research documentation.

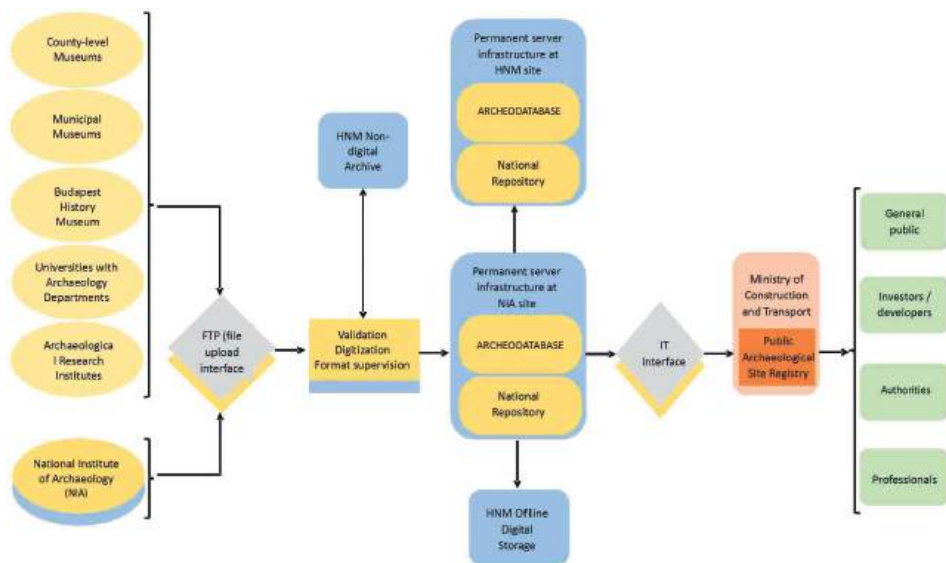


Figure 1. Schematic overview of a model to develop a single, complete national database structure for archaeological heritage avoiding unnecessary multiplications (Virágos 2025)

The database also contains substantial amounts of incorrect or uncertain accumulated data, while absent online documentation severely limits academic utility. Nevertheless, it remains the sole authoritative source for official data acquisition, particularly for development project assessments.

ARCHEODATABASE as a research tool

In contrast, ARCHEODATABASE represents a more accessible, comprehensive approach emerging from EU ARIADNE project initiatives (<https://archeodatabase.hnm.hu/>). This system houses approximately 64,000 archaeological sites with partially verified metadata, supported by 1.3 million archaeological documentation files.

The database operates through a three-tiered architecture: Primary Database (publicly accessible), Data Archive (National Repository), and backup systems ensuring preservation. Advanced mapping displays and filtering options facilitate efficient data exploration, significantly enhancing archaeological research processes.

Persistent challenges

Critical limitations include dependence on voluntary submission of documentation and technical complexity managing diverse file formats. Access control measures create barriers while language limits international accessibility as most detailed documentation is available only in Hungarian. Despite these issues this dataset is still the most comprehensive and best usable source of professional data.

Security vulnerabilities and the imperative of protection

The cybersecurity crisis

A sophisticated cyberattack in early 2025 successfully breached the National Museum's firewall systems, specifically targeting National Institute of Archaeology servers. Attackers employed ransomware tactics, encrypting all files and demanding substantial ransom. Most critically, the incident revealed incomplete backup systems, leaving potential data loss extensive.

Critical implications

The scope of potentially compromised data extends beyond archaeological records to employee personal information, digital signatures, banking data, security codes, and strategic investment documentation. The broad exposure of data even includes the possibility of also targeting government investment information, potentially involving major infrastructure projects.

Necessary responses

The incident demands comprehensive responses recognizing archaeological data as unique, non-renewable cultural resources requiring national-level protection. Emergency response planning needs immediate attention, with institutions requiring both comprehensive protocols and practical rather than only theoretical implementation capability.

Fundamental challenges and the path forward

Institutional misalignment

The current crisis is due to institutional misalignments which prioritize political considerations over professional requirements. The perspective of treating museums primarily as artifact collections demonstrates a fundamental misunderstanding of contemporary archaeological practice that requires a complex data management discipline where information assets hold equal importance to physical artifacts.

Reconceptualizing archaeological assets

Archaeological data are assets equivalent to museum artifacts, requiring fundamental shifts in institutional thinking and resource allocation. Balancing access and protection needs sophisticated approaches moving beyond simple binary choices between openness and security.

Conclusion

Hungary's archaeological data management reveals that achieving FAIR principles requires more than technical solutions or policy adjustments. The fundamental challenge lies in establishing institutional frameworks prioritizing professional expertise over political convenience.

The solution requires establishing independent archaeological professional institutions with autonomous financial management, professional leadership, and

independence from other heritage administrative structures. Such institutions would possess authority and resources necessary for comprehensive data management strategies balancing accessibility with security.

The Hungarian case demonstrates that ‘Are we there yet?’ regarding FAIR archaeological heritage data must be answered with ‘no’. The recent cybersecurity incident is a critical reminder that data accessibility without adequate protection puts at risk essential digital assets. Developing truly FAIR archaeological heritage data systems requires sustained professional leadership, adequate resources, and institutional frameworks recognizing archaeological information as national assets worthy of protection and professional management.

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Unlocking the potential of physical archaeological archives and the (changing?) role of modern archaeological repositories



Aerial view of the *Chalk the Past* pilot in Zele (2024), showing chalked outlines of archaeological features in the urban landscape. A participatory model developed at the repository of Ename Heritage Site (© Provincie Oost-Vlaanderen)

The Maritime Record in Scotland from recording to presentation

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Keywords: National Record of the Historic Environment, Scotland, maritime archaeology, databases, digital archiving, data reuse

With approximately 18,743 km of coastline along the high-water line, 462,315 km² of sea and over 900 islands, Scotland has a rich and diverse marine heritage. Historic Environment Scotland (HES) maintains the National Record of the Historic Environment (NRHE); an integrated record of the archaeological, maritime and built heritage of Scotland (Figure 1). The maritime component extends to the 200 nautical mile limit. HES is also responsible for formally protecting Scotland's heritage through Designations, including Scheduled Monuments and Historic Marine Protected Areas. Information in the NRHE supports decision making, research, and casework within HES and is an essential consideration in Environment Impact Assessments and planning applications (Figure 1).

The Maritime component developed in the mid-1990s following recommendations in the Joint Nautical Archaeology Policy Committee's Code of Practice for Seabed Developers (1995) to seek advice on the possible archaeological potential of proposed developments at the earliest opportunity. Wreck locations were primarily sourced from the UK Hydrographic Office Wreck database and documentary sources (Larn & Larn 1998 and Whittaker 1998). There are currently 4,644 wrecks and 1386 other obstructions as well as 223,231 casualties and five find spots but no submerged palaeo-landscapes in the record. The focus was and is very much on recording location but there is much more potential for developing content from the activities (Events) and archives that inform the record.

The structure of the NRHE records information about:

- Place (Site and Wreck) – the current understanding of the total knowledge about a site or wreck location.
- Events or Activities – unique observations and interventions in time and space. Where there are a number of related Events (such as diver inspections and separate multi-beam and side scan sonar surveys) these may be grouped under a *Project Event*.

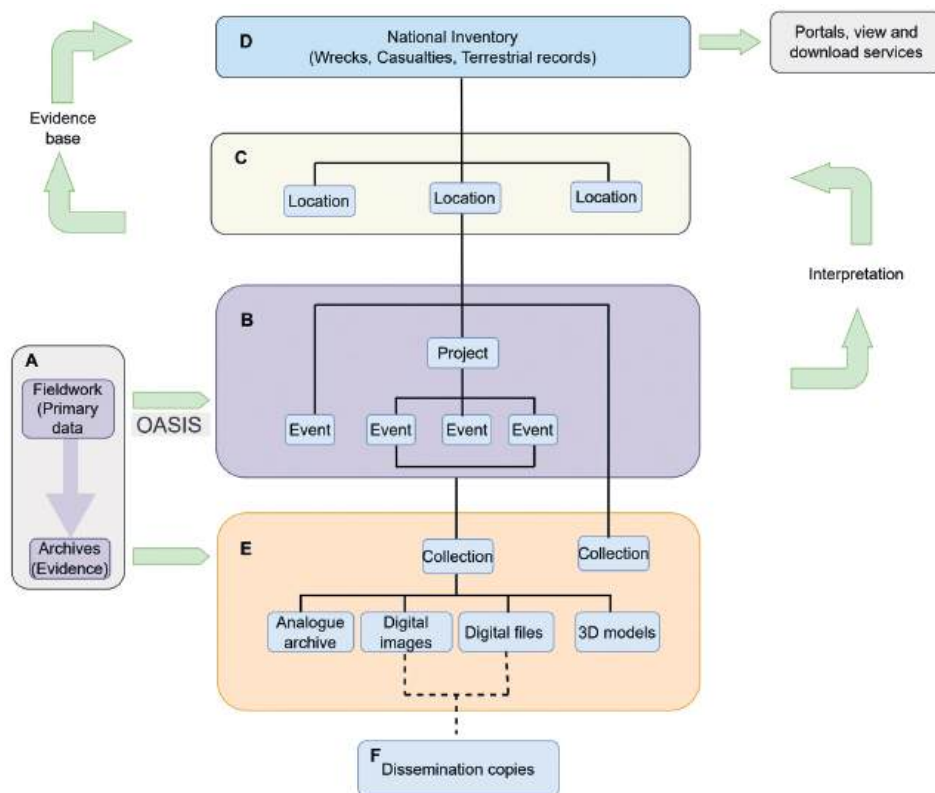


Figure 1. Relationships between the key components of the NRHE: Site and Wreck records, the Events (activities) that inform our understanding of those records, and the associated archive from fieldwork and research (© Crown Copyright Historic Environment Scotland 2025)

- Archives – formally accessioned archives from Projects and Events including both analogue (plans, manuscripts, photographs etc) and digital (images, videos, digital documents, databases, spreadsheets, CAD and GIS files etc). Archive items may either be catalogued individually under a general collection (for older entries) or as part of a specific project archive. Dissemination copies of some of the digital formats are available for download through <https://www.trove.scot/> (see below).
- Authority Files – reference vocabularies used for indexing records. Examples include the Maritime Craft Thesaurus (Scotland) (<http://purl.org/heritagedata/schemes/3>) available as Linked Open Data at <https://heritagedata.org/> and an Events thesaurus referencing the Forum on Information Standards in Heritage (FISH) Event Type Thesaurus at http://purl.org/heritagedata/schemes/agl_et. Individual concepts are identified through Persistent identifiers (PURLs) so, when heritagedata.org migrates to a new host (Lingo) the resource may still

be found through the PURL. The authority files are used in OASIS, an online reporting form allowing researchers to report the results of their fieldwork, including project reports, with the relevant Historic Environment Record and adding Events to the NRHE.

The value of the information in the NRHE goes beyond cataloguing. It is realised through the relationship between individual events and archives that inform the understanding and interpretation of a wreck (or site).

The NRHE is published online through Trove.scot (<https://www.trove.scot/>), an online searchable database of HES resources and PastMap (<https://pastmap.org.uk/>) for location based searches. HES spatial datasets are also published as Web Map and Web Feature Services under an Open Government Licence (<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>) available from Trove.scot and the HES Download Portal (<https://portal-beta.historicenvironment.scot/apex/f?p=PORTAL:downloads::::DATASET:ALL>), as well as spatialdata.gov.scot (<https://www.spatialdata.gov.scot/geonetwork/srv/eng/catalog.search#/home>) and, for marine related datasets, the MEDIN Portal (<https://portal.medin.org.uk/portal/start.php>). Both Scottish Government's National Marine Planning Interactive (<https://marinescotland.atkinsgeospatial.com/nmpi/>) and SEWeb (<https://map.environment.gov.scot/sewebmap/>) portals consume these services to present historic environment data alongside other environmental and societal data.

Partnerships

Over the last decade HES has developed several partnerships with the wider marine community. The Unpath'd Waters project (Sloane and Unpath'd Waters Consortium 2025) highlights the huge potential of maritime archaeology. For the first time users can search resources from the national heritage agencies across the UK and the Isle of Man and the Archaeology Data Service seamlessly through the Unpath'd Waters Portal (<https://unpathd.ads.ac.uk/>) (Richards et al 2025). HES is a member of organisations that actively encourage the preservation and reuse of expensively gathered data. The Marine Environment Data Information Network (MEDIN) promotes the preservation, sharing of, and improved access to digital data from across the marine environment whilst the UK Centre for Seabed Mapping coordinates the collection, management and access of publicly funded data. These partnerships highlight both the depth of information about our maritime heritage beyond wreck location and how historic environment data contributes to the wider marine ecosystem.

Structure of the maritime record

Compared to terrestrial archaeology, maritime archaeology presents particular challenges in terms of heritage management, accessibility and public engagement. The NRHE is very much a record of loss. Originally compiled from the UKHO wrecks database and comprehensive lists of reported losses, content is either quite technical or extremely brief. It is potentially confusing with multiple locations and records for the same vessel compounded by the temptation to identify an anomaly with a reported

loss in the same area. Adoption of the Events–Monuments–Archive structure can help order different strands of information and begin to address and bring order to some of that uncertainty.

Related resources

It is currently beyond the resources of the Record to comprehensively document ships biographies (details about the construction, voyages, and crew). In any case much of this information has been thoroughly researched and published elsewhere on dedicated websites. A pragmatic short-term solution is to manage cross-references to related websites to add value to the maritime record – albeit at the risk of link rot. The same low-tech approach is used to virtually reconnect information about the individual wrecks with related artefacts catalogued in the National Museums Scotland collections.

Archival potential

More can be made of the archives resulting from excavations and surveys. The following examples highlight the potential of data reuse beyond the original purpose the data was collected for.

Videos from excavations and diver inspections as well as virtual dive trails enable non-divers to visualise and explore wrecks through the lens of the marine archaeologist. Perhaps the biggest enhancement to the record is realising the potential of remote sensing surveys. A review of the series of remote sensing surveys conducted over the remains of the German Imperial Navy's High Seas Fleet scuttled in Scapa Flow, Orkney in 1919 highlights the selective nature of archive deposition when compared to the EAC Guidelines for the use of Geophysics in Archaeology (Schmidt *et al.* 2016). Although project reports and associated images are usually deposited the primary data is rarely archived. Although not archived at HES, data from the 2001–2006 ScapaMap project (Oxley 2002) is available to download from The Scapa Flow Historic Wrecks website (<https://www.scapafloowrecks.com/>) albeit in a proprietary *Fledermaus* format. Rowland & Anderson (2010) reused the data to produce 3D models of eight of the German High Seas fleet and O'Connor to create a Virtual Reality GIS (O'Connor 2023).

These reuse cases demonstrate the potential of reusing expensively gathered data to study wrecks and engage the public. The modelling of data from different remote sensing surveys could become a valuable tool in helping monitor both changes in the seabed and any deterioration in the vessel structure over time. Yet unless that data is properly archived, ideally in a trusted digital repository, that potential cannot be realised. The first steps are to ensure that anyone commissioning a project requires a Data Management Plan that outlines how data is handled during and after the project including that primary data is deposited as part of the archive, under an Open Licence so that that data can be found and reused. In the words of MEDIN 'measure once, use many times' (MEDIN 2025).

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The continued lifecycle of archaeological archives in Ireland

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Keywords: archaeology, archives, archaeological archives, preservation, digitisation, access, National Monuments Service, Historic Environment Viewer, Virtual Reading Room, Irish archaeology

The National Monuments Service (NMS), Ireland, sits within the Department of Housing, Local Government, and Heritage and is responsible for the promotion, preservation, and protection of Ireland's archaeological and built heritage. The NMS Archive, one of eight units within the organisation, retains the documentary heritage of all known archaeological monuments in Ireland, with records dating from the late nineteenth century and including information on newly identified sites. The archive comprises in excess of 500,000 individual records in a range of formats, each with specific storage and preservation requirements. As the NMS archivist, I am solely responsible for the organisation, storage, preservation, digitisation, and provision of access to the collections for both internal and external stakeholders.

Internal stakeholders include the other seven units within the organisation namely, Archaeological Survey, Licensing and Planning, Monument Protection, Underwater Archaeology, World Heritage, Photographic Unit, and Administration. Each unit regularly transfers records to the archive with each requiring different levels of access. External stakeholders include other government departments and agencies such as the NMI and the Office of Public Works (OPW), both of which are specifically mentioned in the Historic and Archaeological Heritage and Miscellaneous Provisions Act [No.26 of 2023].

This article will discuss how the archaeological collections of Ireland are currently managed in line with archiving principles, how the provision of access is the ultimate goal, and how this is being achieved in spite of resourcing challenges. There has been a distinct shift in public demand for access to records towards the expectation of receiving digital files. It is important to recognise that most records are not suitable to be digitised instantaneously upon deposit with an archive. Processing collections includes preparing, indexing, cataloguing, and digitising records that were not originally born digital, in advance of any provision of access, and requires consistency,



Figure 1. Stages of archiving collections in advance of providing access

attention to detail, and most importantly, time. Ninety percent of the NMS Archive collections are not born digital, therefore the work only begins in making the information accessible when the records are deposited.

The lifecycle of records, from creation to deposit, is a concept familiar to many. However, it is often assumed that, once deposited, the records are boxed away forever, but that is where the work begins for archive staff, particularly when the records are not born digital. There are at least four additional stages in the archive process before any material can be made available in digital format. These include assessment, arrangement and description, preservation and conservation and will be explained in further detail below (Figure 1).

Appraisal is the process of distinguishing records of continuing value from those of no further value. Material is assessed to determine the relevance to the collection policy or business function of an organisation, or whether they would be of interest to researchers. Appraisal decisions can vary depending on specific collection policies of each archive. In the case of the NMS Archive, items are assessed based on their relevance to Ireland's archaeological heritage.

One collection that demonstrates the appraisal process are records deposited by commercial archaeological companies. Documentary archives produced in the course of an excavation are often overlooked as a source but can be invaluable to researchers of archaeology. Material can include plans, drawings, specialist reports, photographs, site notebooks, radiocarbon date certificates etc. In 2008, we set about developing guidelines on depositing these types of records as a direct response to the risk posed by the potential closure of the companies in financial difficulty.

A comprehensive list of the type of material was produced, indicating what the NMS Archive will and will not accept from depositors. This important first stage resulted in fifty acceptable record types identified. A further list of the records that may be considered and those that will not be accepted were also decided upon. Open communication with depositors is encouraged and any suggestions for new record types to be added will be taken into consideration. See <https://www.archaeology.ie/publications/nms-deposit-guidelines/> for the guidelines for depositors and the full list of types of items that will and will not be accepted.

With no additional staff available to catalogue these deposits, this project required a certain level of creativity. However, it was found that the NMS Archive is in the position to purchase archival quality boxes for depositors, which effectively eliminates any additional financial cost to depositors. This innovative approach is the 'carrot and stick' concept at its most effective.

The process of arrangement and description of records allows for them to be easily identified by researchers. The creation of a unique identifier for each record is usually necessary at this stage and is essential for security, preventing duplication, and ensuring consistent cataloguing. These do not need to be complex; it is a vital step that allows for the file to be easily located, for additional content information to be added, and used as metadata for digitisation.

In 2020, the Covid 19 pandemic allowed for a cataloguing project of a previously unsorted collection of over 9,000 Topographical Files to advance. Dating from the 1930s and 1940s, this collection comprises a series of envelopes containing extracts from journals, survey notes, pen and ink sketches, and photographs relating to sites, monuments, and finds on a county basis. The most important part of this project was the assignment of a unique identifier to this collection for the first time. In this instance the code is simply TOP/GA/0001, referring to the collection name, the Topographical Files; the county name, Galway; and the numerical sequence of envelopes relating to that site. Simply yet effective, the addition of an identifier immediately enhanced access possibilities for this collection.

For archives to be used by the widest audience possible, collections must be accurately described. Many archives have their own cataloguing guidelines, however these should all adhere to the best practice cataloguing standard ISAG(G), developed by the International Council on Archives. Some of the most common fields of description are the unique identifier, title, repository information, period covered, extent or volume, language, scope and content, and access conditions. The hierarchical structure of catalogues indicates that they should be arranged from the general to the specific. Although different archives may have different cataloguing needs due to differing record types, consistency and adherence to accepted professional standards is essential.

In addition to establishing intellectual control over collections, archivists must also oversee the physical preservation of collections. Where possible, plastic is preferable to the use of metal as the latter can cause damage to paper files due to degradation.



Figure 2. Storage of preserved and catalogued collections
 (© Photographic Archive, National Monuments Service, Government of Ireland)

Documents are unfolded or unrolled where possible. Material is packed into acid-free folders and placed in acid-free boxes. Photographs and fragile documents are placed in polyester pockets. Environmental conditions are monitored to ensure that the temperature and humidity levels remain within acceptable standards.

A legacy collection of approx. 70,000 NMS business records dating from 1936 are currently being processed. This project includes describing the content of each file, updating the location, and rehousing the files into archival quality boxes (Figure 2). An important additional aspect of this work is the removal of all metal treasury tags and metal staples.

This brings us to the final stages of the archival process, digitisation and access. An unexpected obstacle to making one of the largest collections in the NMS Archive available digitally is the sheer volume of records and the fact that this is an active collection, with new and additional information of up to 2,000 files incorporated annually. The Archaeological Survey of Ireland (ASI) collection comprises c. 160,000 files relating to every known monument in the country, to date. Each site has an original hard copy file recording the location and condition of the monument, field surveys by NMS staff, and journal references. They can also contain sketches and photos (Figure 3).

Although several platforms are available for sharing digital archive collections, such as the Digital Repository of Ireland (DRI), this collection is not suited for this due as it remains active. Therefore, further consideration needs to be given as to how to make the larger, active, collections more available.

limitations has allowed for us to face certain challenges, to adapt, and to continue to work on progressing collections under our care. Additional contract staff has provided much needed support on cataloguing and preservation requirements. Also, data entries have been diligently corrected to allow for more accurate searches by users. The results of this tireless work may not be immediately obvious to others, and may be perceived as being rather slow, but progress is being made on a daily basis and the NMS Archive continues to demonstrate that the ongoing effort to catalogue and prepare collections now, will allow for continued accessibility for many years to come.

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From storage to street: reimagining archaeological repositories through community engagement

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Introduction

In Flanders (Belgium), archaeological repositories have long been perceived as the end-point of excavated heritage – sites of conservation rather than communication. Yet their potential to engage communities and animate the archaeological record is increasingly recognized. This paper presents a participatory model developed at the repository of Ename Heritage Site, where archaeology is reintroduced into public space through outreach and education. The project *Chalk the Past* visualises archaeological traces in residential areas and reconnects residents with the hidden histories beneath their feet. It demonstrates how repositories can become active agents of inclusive heritage care.

From excavation to storage: gaps in public engagement in Flanders

In Flanders, archaeological research is closely tied to urban development. Excavations are mostly triggered by construction, and though results are scientifically valuable, they rarely reach the communities living above these historical layers. Urban plans are typically finalised before archaeological investigations begin, leaving little scope to integrate findings into the identity of new neighbourhoods. As a result, many residents remain unaware of the deep history beneath their homes.

The rapid conversion of open spaces into housing further limits opportunities to preserve or interpret archaeology *in situ*. Excavation reports often appear years after construction (Meylemans *et al.* 2025), while resulting collections are stored with little public visibility.

Since the Immoveable Heritage Decree (Vlaams Parlement 2013), Flanders has developed a system of accredited archaeological repositories (Martens, Jacobs & De Langhe 2015). Sixteen depots operate across the region, safeguarding collections from specific municipalities. These vary in scope and accessibility, reflecting the decentralised nature of Flemish heritage care.

To coordinate this landscape, the Flemish Repository Network was established. It streamlines the deposition processes, guides new repositories, and promotes harmonised standards (De Langhe 2018). Yet its focus remains logistical, rather than public-facing. Nonetheless, studies (Danniau, Reniere & Trachet 2020) show repositories are ideally placed to act as hubs for participatory archaeology – connecting research, collections, and communities.

The Ename repository as a public actor

The Ename repository houses immovable cultural heritage ranging from architectural fragments to religious objects from churches under restoration. In collaboration with heritage consultants, it integrates pest treatment and preventive conservation into wider advisory work. Notably, it hosts Belgium's first anoxia chamber, operational since 2015, for treating collections.

For archaeological archives, the repository acquires and safeguards collections from 21 municipalities, assuming full legal ownership and long-term care. The remaining 34 are covered by four other repositories, ensuring regional coverage. While storage rooms are not freely accessible, visitors can view them through a glass wall. A visitor zone features alternating displays, and guided tours highlight objects, linking stored heritage to community identity.

Figure 1. Collecting grafting material from a veteran heritage tree in Zwalm as part of the Heritage Trees Project (© Provincie Oost-Vlaanderen)



Beyond its technical role, the repository pioneers outreach (Bauters & Lombaert 2019), including the award-winning *Heritage Trees Project*. This initiative treats veteran trees as living heritage, documenting their origin and condition in a GIS database (Figure 1). Reintroduced grafts are replanted at heritage sites, distributed to communities, or established in sustainable locations (Vandecatsye & Lombaert 2023). Its ecological and emotional resonance inspired the conceptual framework for *Chalk the Past*, where heritage is rooted in place and community.

Exhibition as engagement at Ename Heritage Site

The participatory ethos of *Chalk the Past* forms part of a broader institutional vision at Ename Heritage Site, where public engagement is a guiding principle. This is embodied in the new permanent exhibition (2024), which invites visitors to explore the layered relationship between people, landscapes and heritage.

It challenges conventional museum narratives by presenting heritage as part of everyday environments – visible in soil, architecture and vegetation. Through tactile installations, digital storytelling and authentic objects, visitors learn to decode their surroundings as historical archives.

A central feature integrates damaged artefacts from the repository to illustrate conservation challenges. These are shown with interpretive tools explaining research

Figure 2. Custom-built cabinet illustrating the ten agents of deterioration, used in the permanent exhibition (© Martin Corlazzoli)



and deterioration processes (Figure 2). The exhibition is physically and conceptually linked to the repository, reinforcing that heritage care and engagement are interdependent.

Chalk the past: methodology and future implementation

Chalk the Past is a participatory outreach project that visualises archaeological features in contemporary residential areas. Using chalk outlines, display cases and authentic finds, this initiative makes archaeology tangible in everyday environments. Sites are selected based on excavation results, diversity of finds, and community potential.

The methodology combines scientific accuracy with creative engagement. Cartographic overlays are adapted for public display, and finds from the repository are reintroduced into their original contexts. Display cabinets are placed in accessible locations such as libraries and town halls (Figure 3), while on-site events allow residents to handle real artefacts. These tactile encounters foster emotional connections and transform abstract archaeological data into lived heritage.



Figure 3. Mobile display case featuring archaeological finds and interpretive tools (© Provincie Oost-Vlaanderen)

Educational activities are tailored to different age groups. Children engage in chalking, storytelling, and object handling; teenagers explore stratigraphy, excavation methods, and historical interpretation. Inclusive design ensures participation of children with disabilities, supported by adapted materials. A teach-the-teacher model enables local educators and local partners to replicate the project independently, assisted by a digital manual and educational toolkit currently in development as part of the 2026 programme.

Following a successful pilot in 2024, the project will be expanded in 2026 across at least four sites, enabling refinement of its methodology and collaborative framework. Supported by targeted funding from the Flemish Heritage Agency, the initiative will be coordinated by the Province of East Flanders in partnership with five repositories and a wide network of local stakeholders, including municipalities, universities, schools, and heritage associations. Importantly, the concept is deliberately low-threshold and adaptable: while the full programme involves multiple partners, it can be scaled down to a single community or school context without additional staffing.

Impact and recognition

Chalk the Past has gained local and international attention through presentations at ICOM Paris (2024) and EAC Gdańsk (2025). It fosters community building, spatial identity and historical awareness, transforming archaeological reports and stored collections into shared narratives.

Figure 4. Aerial view of the *Chalk the Past* pilot in Zele (2024), showing chalked outlines of archaeological features in the urban landscape (© Provincie Oost-Vlaanderen)



Residents participate in storytelling, guided tours (Figure 4) and visual reminders – murals, info panels and digital reconstructions. The participatory approach encourages ownership and pride, while its flexible format allows adaptation across contexts.

The initiative strengthens the role of repositories as public-facing institutions. By bringing stored objects into streets and schools, it challenges perceptions of repositories as closed spaces, repositioning them as dynamic actors in heritage interpretation. This aligns with broader heritage management trends emphasising co-creation, accessibility and emotional engagement.

Conclusion

Chalk the Past exemplifies how archaeological repositories can transcend traditional roles and become catalysts for inclusive heritage futures. By embedding archaeology in public space, the Ename repository reframes heritage as a shared responsibility and source of identity.

Its participatory design and scalable model offer a blueprint for community-based heritage care. Archaeology need not remain confined in reports or repositories: it can be reanimated as shared heritage in everyday life.

As implementation unfolds in 2026, its success will depend on the creativity of residents, educators and professionals. The project thus reimagines archaeology as visible, relevant, and embedded in community life.

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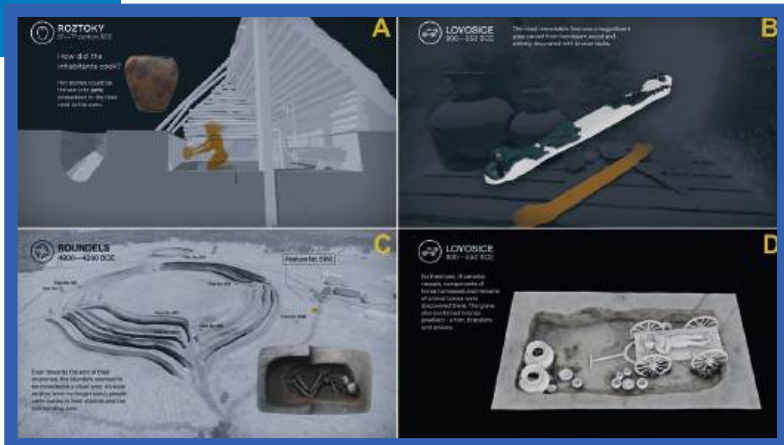
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Beyond archaeology – the value of archaeological archives



3D digital storytelling for the public. Visualisations combine archaeological evidence, analogies and creative decisions. A photo-realistic render was used in the video only for completely credible data or contexts (Jiří Unger, Dalibor Dzurilla, Martin Košťál, Jiří Košta)

Pick one – a model of a site-centred approach to community integration around local heritage

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Keywords: archaeological heritage potential, archaeological outreach, public benefit, re-use of archives, heritage community

In order to ensure day-to-day protection of sometimes remote archaeological sites, heritage managers must boost the interest of local communities in heritage that can improve their quality of life and give them a sense of belonging.

The community outreach model proposed in this paper is based on using one chosen site as a focal point for all activities. Explaining heritage-related issues and archaeology through the local perspective, brings archaeological heritage closer to the people and integrates community around common values. Remaining local, it can be best suited for the needs of the public.

This model results from participation of Poland's National Institute of Cultural Heritage (NID) in an EU project entitled *TRIQUETRA. Toolbox for assessing and mitigating Climate Change risks and natural hazards threatening cultural heritage*, funded from the EU HE research and innovation programme under GA No. 101094818 in 2023-2025 (Ioannidis 2025).

The TRIQUETRA project aims to develop methodologies and tools to assess, quantify and mitigate various risks to archaeological heritage. This approach is tested at eight pilot archaeological sites, including a Late Bronze/Early Iron Age fortified settlement in Smuszewo, Poland (Figure 1). The site was discovered in the 1860s, but remains relatively undisturbed with wooden structures preserved 0.6–1 m below ground, as confirmed within the TRIQUETRA project (unpublished results).

One of strategic goals of the TRIQUETRA project is also to increase public engagement and awareness of threats and the protection of cultural heritage as essential conditions for its preservation for future generations. The project outreach activities in Poland and the resulting model of community integration around local heritage are based on ideas and joint efforts of the core TRIQUETRA team in NID composed of three archaeologists: Agnieszka Makowska, Agata Byszewska-Łasińska and the author.



Figure 1. Aerial view of Smuszewo site 3, Polish pilot site of the TRIQUETRA project (photo by W. Rączkowski, AMU)

The proposed model of archaeological outreach (Figure 2)

Archaeological heritage can instigate discussion on diverse issues, which is why, before entering any project of archaeological outreach, the educators involved must limit themselves to a narrower range of topics, possible to convey in a given time limit. Clear specification of goals and message allows, subsequently, for choosing an archaeological site best suited for the project needs. The significance of the selected site should be relatively easy to grasp and advocate for outside the archaeological sector; however, the choice is not to be limited to the most obvious examples. Argumentation should be grounded in heritage values to empower archaeological educators.

Before major resources are committed to transform plans into actions, the project leaders should secure actual local support from people responsible by law for the chosen site (local authorities, land owners etc.) or from local heritage or historic societies and activists. Personal contacts are the best way to initiate friendly cooperation and know each other's expectations. While pitching their ideas, the project team should be specific and use public benefit argumentation adjusted to their interlocutors.

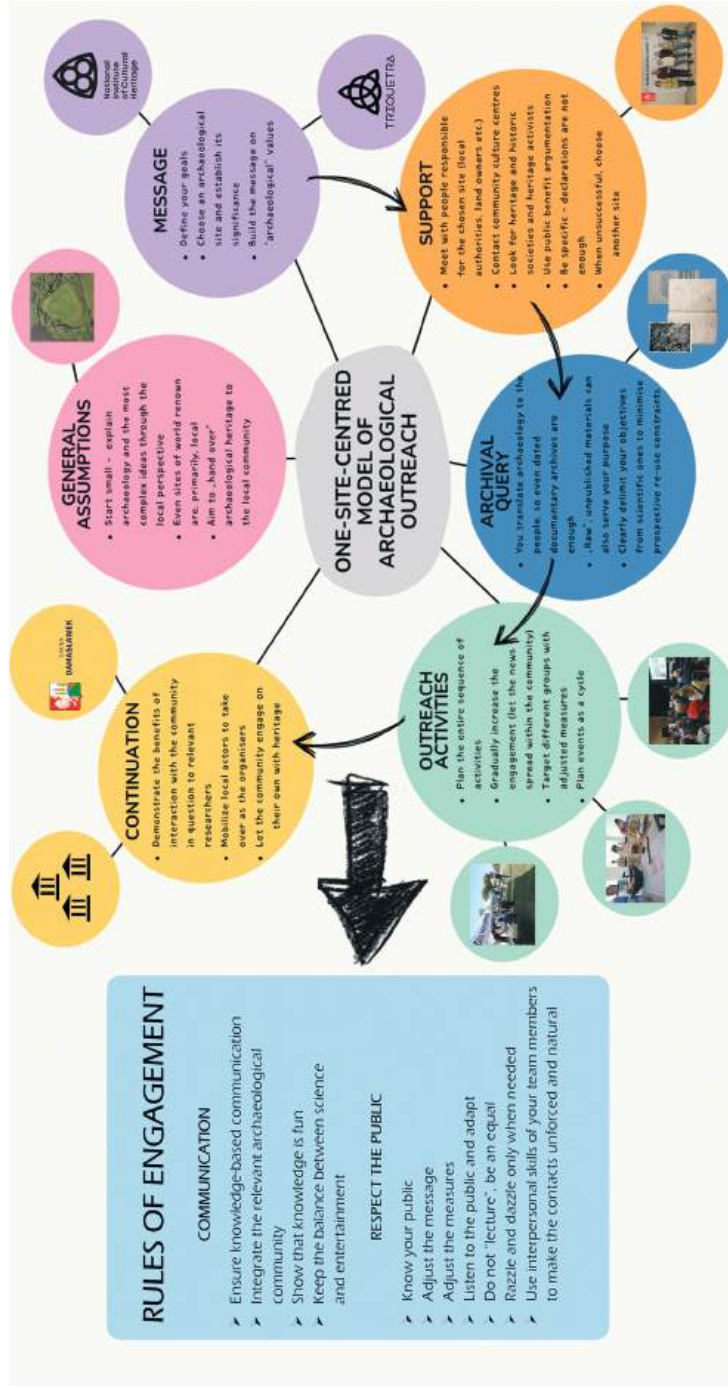


Figure 2. Summary of the proposed approach to local communities (prepared by A. Oniszczuk, NID)

The support is crucial, so, when unsuccessful, the project leaders should consider another location for their outreach.

Only after the chosen site is confirmed as a focal point of the communication project, full archival query should start. Owing to the fact that archaeologists will act as translators – the intermediaries between archives and the community, even unpublished and sometimes incomplete legacy documentation may be of use. Whenever possible, sources referring to personal experiences of the community should be used, for example private photographic archives or local press releases.

Activities planning should from the beginning encompass the entire sequence of events. To make the most of closer human relations in local communities the engagement should gradually increase to let the news spread.

It is advisable to anchor the events in already existing more established initiatives. Their character must be carefully considered beforehand, so that the archaeological message suits those occasions.

Within their project, archaeologists should ensure knowledge-based communication. They should demonstrate that knowledge is fun, while keeping the balance between science and entertainment. The educators should approach the community as equals – just one heritage community talking to another. In order to keep the contacts unforced and natural, interpersonal skills of the project team should be considered since the planning stage.

The technical measures used for communication may be very simple. Exaggerated attempts to dazzle the public may create an unnecessary distance. The educators should remain attentive to their public. They should aim at mobilising local actors in order to secure the future of local heritage. In parallel, the benefits of interaction with the local community should be demonstrated to relevant researchers and heritage professionals, who could continue with their story after the first project ends.

In successful outreach projects, bonds between heritage professionals and the local community are created. Attachment to the chosen archaeological site creates a sense of ownership in all the parties involved. However, the educators must be vigilant to identify a moment to step down from leadership in heritage-related activities. The community acting on its own is a measure of their success.

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Legacy and springboard: The untapped potential of archaeological archives for scientific innovation

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Archaeological archives are traditionally seen as repositories of cultural heritage, enabling reinterpretation of past findings, supporting museum displays, and informing educational collections. However, this paper argues that their potential extends far beyond archaeology, offering unique opportunities for scientific innovation across disciplines such as genetics, health, climate science, and biodiversity. These archives contain irreplaceable materials – human remains, ancient DNA (aDNA), plant macrofossils, faunal remains, and more – that cannot be replicated in laboratories and thus serve as a springboard for interdisciplinary research.

The paper presents a series of case studies to illustrate how archaeological archives have already contributed to scientific breakthroughs and how they could be further harnessed to address global challenges.

Case studies

Human evolution

Ancient DNA research has revolutionized our understanding of human history. Since the first extraction from an Egyptian mummy in 1984, technological advances have enabled sequencing of genomes over a million years old. These studies have revealed migration patterns, interbreeding among hominin species, and genetic adaptations. Despite over 6,000 ancient genomes reconstructed, much remains unexplored. International collaboration is growing, but UK archives have yet to be systematically integrated into such efforts.

Physical health

Research into aDNA has shed light on the origins of multiple sclerosis (MS), a disease disproportionately affecting Northern Europeans (Barrie *et al.* 2004). Genomic studies traced MS risk genes to steppe pastoralists who migrated into Europe 5,000 years ago. These genes underwent positive selection due to environmental pressures. The UK's MS Society recognizes this research as a potential pathway to new treatments and prevention strategies, demonstrating how archaeological archives can inform modern medicine.



Figure 1. Archaeological archives contain enormous untapped potential for driving scientific innovation in response to global challenges; LFA Sachsen, Dresden, 2019 (photo by Christoph Blesl)

Pathogens and diseases

Bubonic plague: Analysis of skeletal remains from the Black Death era has helped reconstruct the genetic history of *Yersinia pestis*, the plague bacterium. Nearly 200 ancient genomes have been published, offering insights into the pandemic's origins and evolution. Research suggests the plague influenced the modern human gene pool and that changes in virulence may explain its cyclical outbreaks (Gaul & Spyrou 2025).

Leprosy (Hansens disease): Archaeological samples have revealed strains of *Mycobacterium leprae* dating back 4,000 years. Recent studies show medieval strains in humans are genetically linked to modern animal hosts like red squirrels (Urban *et al.* 2024). Understanding zoonotic transmission and disease progression through archaeological remains could improve public health strategies in countries where leprosy persists.

Climate change

Modern agriculture relies heavily on a few staple crops vulnerable to climate stress. Archaeology offers evidence of ancient, resilient crops that could diversify and strengthen food systems. The AEGIS project, backed by \$85 million in funding, aims to sequence ancient plant DNA to identify traits for climate resilience. This initiative exemplifies how archaeological archives can contribute to sustainable agriculture (Watson 2024).

Biodiversity

Fallow deer, now overpopulated in Britain, were introduced around 1000 AD. Archaeological research revealed their historical management, including hunting

by women and ritual butchering. A recent project used this knowledge to promote sustainable deer management, train diverse deer stalkers, and redistribute venison through food banks. This case shows how archives can inform ecological and cultural solutions (Sykes 2017).

Healing and wellbeing

Two projects demonstrate the therapeutic potential of museum artefacts:

Heritage in Hospitals: Patients interacting with museum objects reported improved wellbeing, suggesting heritage can play a role in healthcare (Chatterjee *et al.* 2015).

Romans at Home: Sensory experiences using artefacts and scents helped people with dementia, showing how archives can support mental health (Drew 2024).

One health and archaeology

The World Health Organization's 'One Health' approach emphasizes the interconnectedness of human, animal, and environmental health. Archaeology offers deep-time perspectives that can enrich this framework. By treating the past as a series of natural experiments, archaeology can help anticipate and mitigate future health challenges (Bendrey & Fournié 2023).

Driving a Step-Change

To unlock the full potential of archaeological archives, the paper proposes a strategic shift involving infrastructure, collaboration, and advocacy.

- **Supporting and investing in archives** – Archives are fragile and underfunded. Sustainable management requires selective retention, national databases, and integrated storage infrastructure. Project designs should identify scientific potential beyond historical value, especially for sites rich in organic remains.
- **Coordinating knowledge transfer** – Effective communication between archaeologists, curators, and scientists is essential. Forums such as conferences and workshops should promote interdisciplinary collaboration. Scientific publications should include keywords like 'archaeological archives' to improve visibility and citation tracking.
- **Unlocking potential and driving impact** – Research frameworks should span disciplinary boundaries, combining archaeological and scientific agendas. Evaluation of outcomes is crucial to demonstrate impact and secure funding. Regular impact reports and transparent methodologies will help persuade policymakers and funders.

Conclusion

Archaeological archives are more than historical records – they are untapped reservoirs of scientific data with the potential to address global challenges. By reframing archaeology as a contributor to innovation, health, and sustainability, we can shift perceptions from archaeology as a cost to archaeology as a gain. Achieving this

requires overcoming infrastructural and institutional barriers, fostering interdisciplinary partnerships, and advocating for long-term investment. The benefits – ranging from improved public health to climate resilience – make this a goal worth pursuing.

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Looking back to move forward – the benefits of researching archaeological archives for policy making today

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Keywords: Polish archaeology, heritage policy, Biskupin, Kazimierz Michałowski, Józef Kostrzewski, pseudoarchaeology, Soviet influence, Nazi propaganda, public engagement, archaeological education, ideological instrumentalization

Introduction

Archaeological archives are a vital resource for understanding not just the past but also the development and management of archaeology as a discipline. Studying these materials – ranging from legal documents to private letters – helps trace policy evolution and assess how past decisions shaped today's practices. Such analysis raises important questions: Are current archaeological policies still relevant, or are they outdated legacies? Understanding these dynamics is crucial to navigating archaeology's role in modern Poland.

The state of archaeology in Poland

Poland lacks a coherent national archaeological policy. The field remains marginalized within broader heritage strategies, and the absence of a national archaeological museum – downgraded to a regional status after 1999 – symbolizes this neglect. Education reflects similar disregard: prehistory is virtually absent from curricula, contributing to public disinterest and weak support for protective laws. This vacuum allows pseudoarchaeology and fringe theories to flourish.

In popular perception, archaeology is often linked to Egypt (due to Prof. Michałowski), Indiana Jones, or Biskupin. These associations highlight both universal misconceptions and Poland's unique cultural memory. The popularity of Indiana Jones in the 1980s, during communist repression, imbued the character with symbolic meaning – freedom, knowledge, and resistance – motivating many to enter the field.

Poland's archaeological trajectory differs markedly from Western Europe. While Western states funded archaeology to construct national myths, Poland – partitioned

in the late 18th century – received little to no support. Despite this, Polish archaeology remained relatively independent, even if institutionally weak.

Interwar period and early policy

After regaining independence in 1918, Poland adopted advanced heritage policies. A 1920 ministry brochure emphasized national responsibility for preserving historical monuments. In 1928, the State Archaeological Museum was established in Warsaw, promoting politically neutral, methodologically advanced research. Its founders opposed politicizing archaeology, especially in contrast to Germany, where archaeology served nationalist agendas. Prof. Jakimowicz and Prof. Kostrzewski both condemned this misuse, even as Kostrzewski used Biskupin to counter Nazi narratives by demonstrating the site's Prešlavic roots. By 1939, Biskupin had drawn 100,000 visitors (Figure 1).

Figure 1. Professor Roman Jakimowicz and Professor Józef Kostrzewski (both in the middle) at the excavation site in Biskupin, late 1930s (archives of the Archaeological Museum in Poznań)



World War II and Nazi ideology

After Germany's 1939 invasion, archaeological looting began, framed by Nazi ideology. The *Ahnenerbe*, a Nazi organization, falsely accused Polish archaeology of politicization while engaging in precisely that. Excavations at Biskupin were launched to prove Germanic origins but quickly abandoned when results didn't support Nazi claims. Polish scholars uniformly rejected collaboration.

Soviet occupation

The USSR invaded from the east weeks later. Soviet authorities projected an image of continuity but implemented harsh repression, including mass arrests and deportations. Scholars like Prof. Leon Kozłowski, imprisoned by the Soviets, criticized the lack of academic freedom under totalitarian regimes, arguing that scientific advancement required independence from doctrine.

Postwar period and Soviet influence

Post-1945, Poland fell under Soviet influence. Some archaeologists saw opportunity in the westward shift of borders, but political loyalty soon outweighed academic merit. Talented but controversial figures like Włodzimierz Hołubowicz rose rapidly, using their influence to silence critics. Accused of threatening colleagues and even collaborating with Germans, he remained protected by the regime. After his death in 1962, his work was boycotted for decades in a collective act of *damnatio memoriae*.

Public perception post-war

Having experienced the dangers of politicized archaeology under two regimes, postwar archaeologists retreated into empirical, apolitical work. While this ensured scientific neutrality, it also isolated archaeology from society. Interpretations that could be twisted ideologically were avoided, and the field grew insular and inaccessible to the public.

Into this vacuum stepped Prof. Kazimierz Michałowski, who conducted excavations in Egypt and positioned archaeology as a tool of cultural diplomacy. His work aligned with Soviet outreach in the decolonizing Mediterranean. Michałowski's dominance extended into academia and public life, popularizing 'Mediterranean archaeology' to the extent that the Polish public associated archaeology primarily with pyramids, not domestic heritage. Only recently have prehistorians begun re-engaging the public to promote Poland's own archaeological legacy (Figure 2).

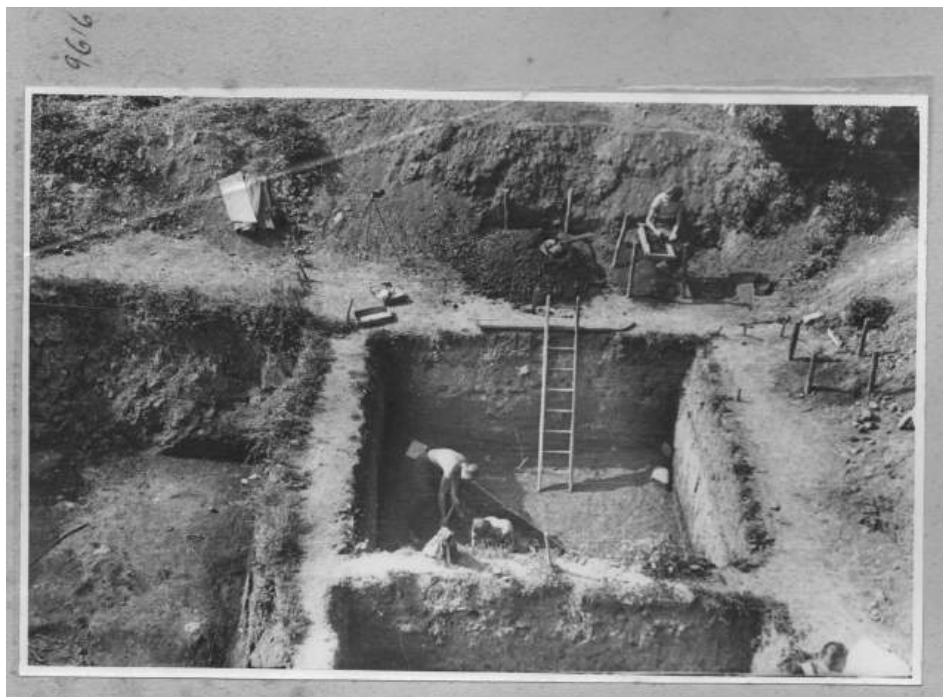


Figure 2. Excavations in Międzyrzecz, Western Poland in early postwar years. The town of early mediaeval origin was part of Poland until 1793 and then again after 1945 (archives of the Archaeological Museum in Poznań)

Policy recommendations

Reflecting on this history, the following are proposed:

1. **Avoid ideological instrumentalization:** Archaeological policy must remain apolitical.
2. **Establish a national archaeological policy:** Prioritize archaeology within heritage frameworks.
3. **Value archaeological heritage equally to written history:** Museums and curricula should reflect this.
4. **Include prehistory in education:** Integrate prehistoric content into national history teaching.
5. **Teach public engagement in archaeology programs:** Train future archaeologists in outreach strategies.

Finally, knowing the history of archaeology is essential for responsible practice. The discipline's past warns against politicization while pointing toward the importance of

critical self-reflection – an attitude that is slowly gaining ground and offers hope for the future of Polish archaeology.

All quoted Polish texts were translated by the author.

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Breathing life into archaeological archives: 3D digital storytelling for the public

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Keywords: digital storytelling, 3D digital reconstruction; virtual archaeology; archaeological visual language; data uncertainty; transparency in visualisation; public communication of heritage

Introduction

Archaeological archives contain countless fascinating stories about our past. Yet while these are familiar to specialists, they often remain inaccessible to the wider public. In recent decades, digital technologies have transformed the way we can present heritage. Three-dimensional reconstructions, in particular, have become a powerful tool for opening archaeology to new audiences. They allow complex contexts to be communicated clearly, while also engaging emotions and imagination.

The power of 3D visualisation

Images are among the most direct forms of human communication. In archaeology, where information is often fragmentary, visualisation makes it possible to transform incomplete data into comprehensible narratives. Digital reconstructions not only show shapes and spatial relations but also create immersive experiences that help the public imagine past worlds. At the same time, 3D reconstructions are not simple illustrations: they are interpretive acts that combine archaeological evidence, analogies and creative decisions.

A key challenge is uncertainty (MacEachren *et al.* 2005). Archaeological evidence is rarely complete. Reconstructions must therefore make transparent which elements are based directly on data and which are hypothetical. Different styles of visualisation – for example non-photorealistic rendering, use of transparency or stylised animations



Figure 1. The final design of the 3D computer reconstruction models of the archaeological sites (clay render, NPR, transparency)

– help communicate this uncertainty. Rather than presenting one ‘true’ image of the past, they invite viewers to reflect on multiple possibilities (Beale & Reilly 2017).

Figure 2. A photo-realistic render was used in the videos only for completely credible data / contexts



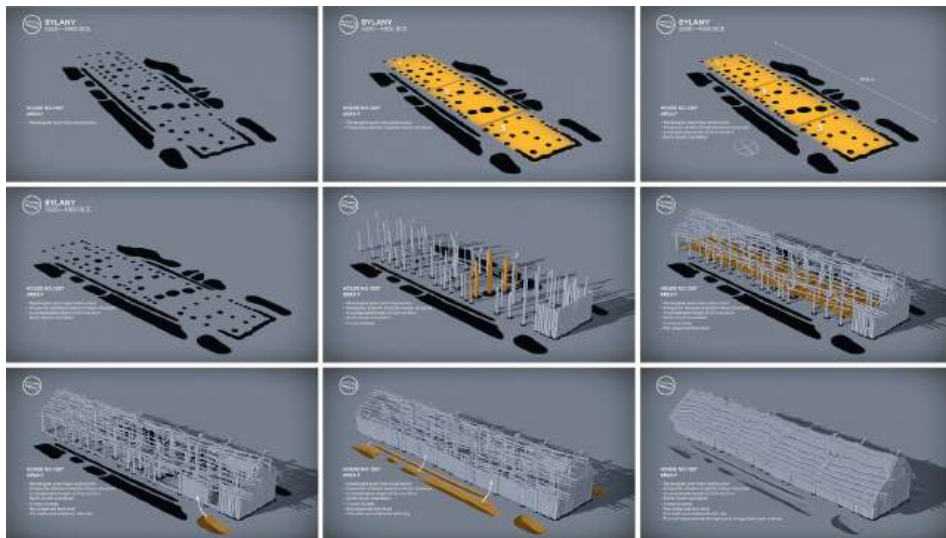


Figure 3. The step-by-step animation of the genesis of a 3D computer reconstruction of a specific object immediately communicates its credibility

Figure 4. Characters not only provide a clear sense of scale but also enhance emotional engagement, allowing viewers to more easily identify with the reconstructed past



Methodology: from idea to image

The transformation of archaeological data into a visual narrative is not a straightforward technical task, but rather a multi-stage process that requires close collaboration between experts. Our approach can be summarised in three main stages: defining the core message, conceptualising the visual form, and developing the final images and animations (Campbell & Cox 2018).

The first stage begins with the definition of the core message. For each reconstruction, we asked: what should the visitor understand within the first few seconds? This was followed by identifying supporting themes, usually related to location, architecture and artefacts. Often a distinctive object or feature was chosen as an emotional anchor to guide the narrative.

The second stage, conceptualisation, included sketches, storyboards and preliminary renderings. This stage is crucial because it establishes not only the narrative sequence but also the balance between scientific precision and accessibility. Storyboards allowed us to test pacing, framing and level of detail before investing time in final 3D modelling. Draft captions and pictograms were also designed at this stage, ensuring that text and imagery worked together rather than competing for attention.

The third stage, creation, involved modelling, rendering and animation. Here different visual styles were deliberately employed to communicate the reliability of data. Clay rendering and non-photorealistic rendering (NPR) provided a neutral and stylised look, signalling that the reconstruction is interpretive. Transparency was used to indicate hypothetical features, for example speculative reconstructions of structures or vegetation. Conversely, photorealistic rendering was reserved only for elements that were directly scanned or measured, such as artefacts captured with Structure-from-Motion or laser scanning (Roussou & Drettakis 2003). This combination of styles enabled us to remain faithful to data while still creating engaging visuals.

A further methodological element was the use of perspective and scale. Most views were designed from the 'pedestrian horizon', placing the viewer at human eye-level. This perspective proved most effective for generating emotional immersion. Other projections, such as axonometric views, were used when relationships between structures needed to be clarified. Colour was applied sparingly to highlight key artefacts against otherwise grey-toned reconstructions. This selective use of colour helped direct visitor attention and reinforced the main message of each video.

Finally, information graphics such as pictograms, timelines and scales were embedded directly into the videos (Johnson & Sanderson 2003, 5). These elements increased clarity and provided quick orientation without requiring long explanatory texts. The goal was always to make the reconstruction legible to both experts and lay visitors, while preserving transparency about what was certain and what was speculative.



Figure 5. Diagrams, maps, and schematics embedded directly in the video

Case study: National Museum in Prague

Between 2020 and 2025, a multidisciplinary team created a series of short 3D reconstruction videos for the permanent archaeological exhibition of the National Museum in Prague. Each video lasted between 1.5 and 2.5 minutes and presented one important site from Czech prehistory and early history – from Palaeolithic hunters at Lubná to Slavic settlements in Roztoky. The aim was to provide visitors with a clear, emotionally engaging introduction to the sites and artefacts.

To maintain clarity, the videos were silent and relied on moving images, pictograms and short texts. Visual language was kept consistent: each site was introduced with simple icons and a key artefact served as an emotional anchor for the story. The design team deliberately avoided full photorealism, which can suggest a false sense of certainty. Instead, they used stylised renderings and varying transparency to show which parts of the reconstructions were firmly based on evidence and which were hypothetical.

Discussion and conclusion

This case study shows how 3D reconstructions can bridge the gap between archaeological knowledge and public understanding. By adopting a flexible and transparent approach, they make it possible to respect both scientific accuracy and the need for accessible storytelling. Reconstructions thus stand at the boundary of science and art: they are rooted in data, but their impact lies in their ability to inspire curiosity and empathy.

Future work should focus on developing a more standardised visual language for archaeological reconstructions. This would strengthen transparency, enable comparisons between projects, and help audiences better understand what is known, what is uncertain, and what is imagined.

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