



All fields ▾

Search for resources in the Ariadne catalog ...

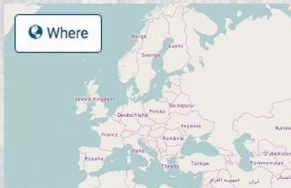


## Welcome

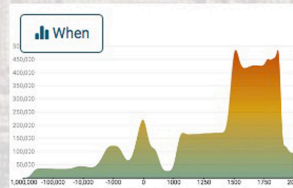
ARIADNE brings together and integrates existing archaeological research data infrastructures so that researchers can use the various distributed datasets and new and powerful technologies as an integral component of the archaeological research methodology.

## Browse the Catalog

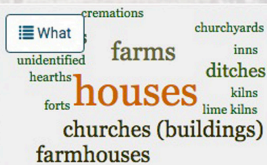
Where



When



What



**Building a research infrastructure for  
Digital Archaeology in Europe**



## **Building a research infrastructure for Digital Archaeology in Europe**

First published in December 2016 by ARIADNE



ARIADNE is a project funded by the European Commission  
under the Community's Seventh Framework Programme

The views and opinions expressed in this booklet are the sole responsibility of the authors  
and do not necessarily reflect the views of the European Commission

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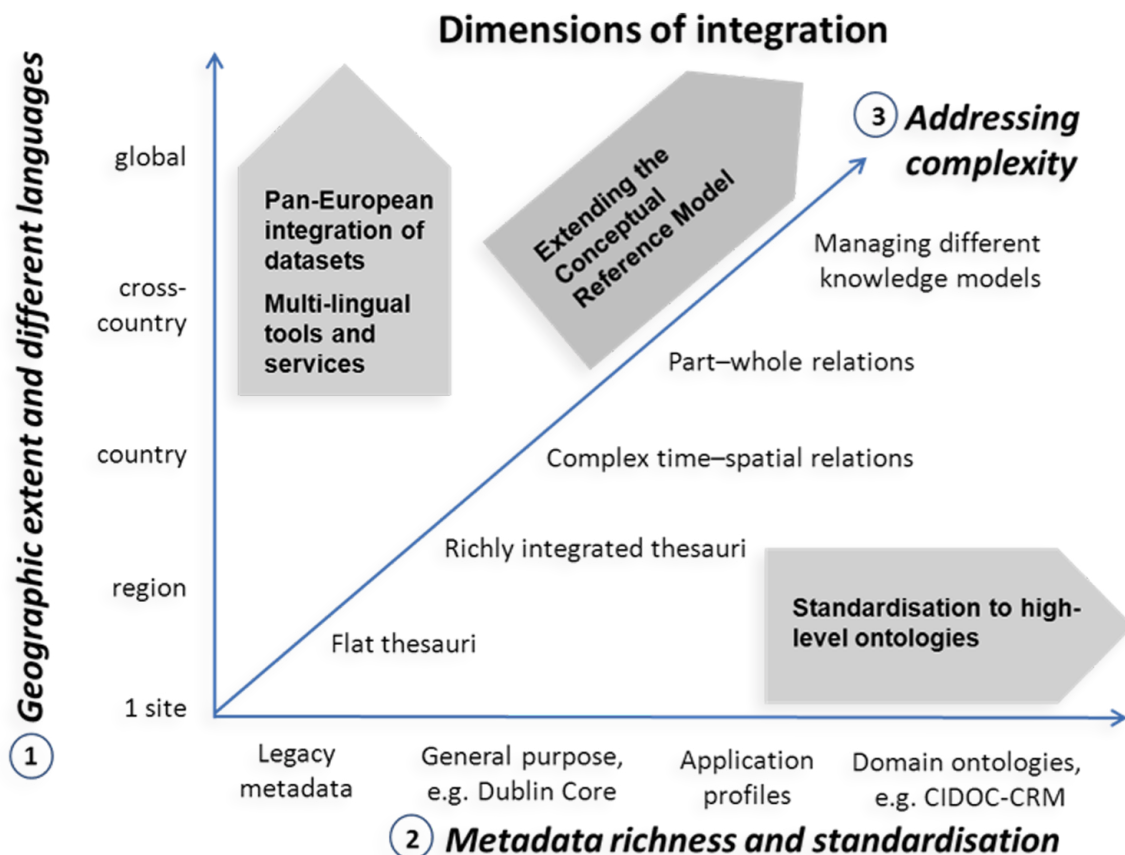


Figure 1: The project roadmap, prepared by Guntram Geser of Salzburg Research.

# ARIADNE: where we stood and where we stand today

**Franco Niccolucci (Coordinator, PIN) and Julian Richards (Deputy Coordinator, University of York)**

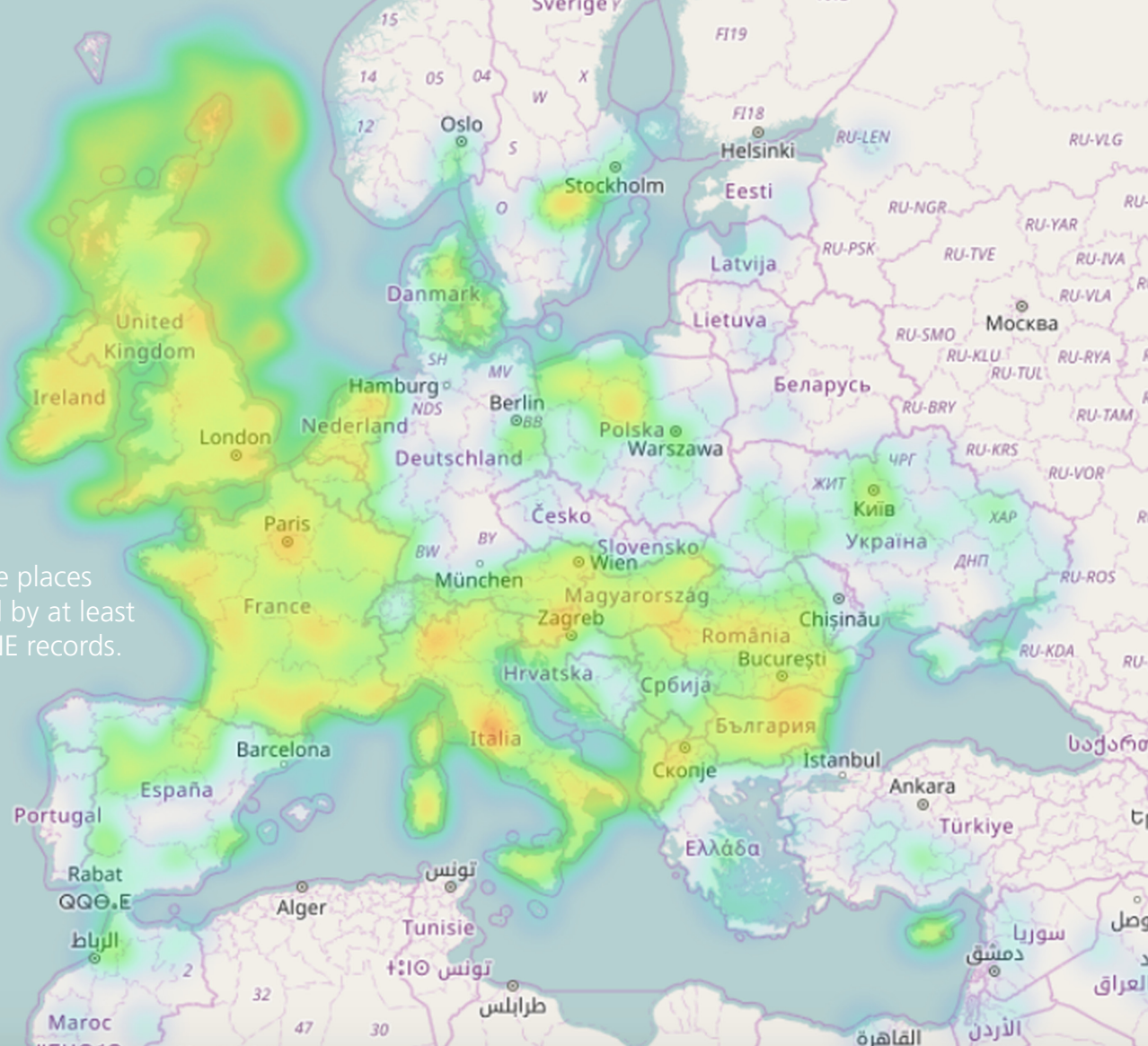
When ARIADNE began in early 2013, we gave ourselves the ambitious task of integrating archaeological information across Europe. At that stage there was no system overarching across borders or languages and there were multiple approaches to recording. There were a number of initiatives that offered access to archaeological datasets with a national or regional scope: most notably, the Archaeology Data Service for the UK, Data Archiving and Networked Services for the Netherlands, and the Associazione Internazionale di Archeologia Classica's Fasti Online service focussed on the Mediterranean region but extending into Eastern Europe.

These systems worked well but were isolated from each other, making searches a cumbersome job when looking for information that extends beyond their regional or thematic scope. For example, trying to find information about Iron Age fibulae required accessing many separate archives, searching within them using different user interfaces, and become familiar with different languages and recording systems. This fragmentation provided those who did not believe in the potential of data sharing in archaeology with examples to stress the lack of usefulness of archaeological data.

ARIADNE's first objective was to provide discoverability for the archaeological information stored in digital archives; and at the same time set up a community of researchers who believe that the technological progress has made access to data as important to research as access and reference to literature. We adopted as our project motto the view of Friedrich Wilhelm Gerhard, German archaeologist and co-founder of the first international archaeological society, that it is an absolute necessity for archaeologists to communicate with each other, leaving the conditions of antiquarians and becoming scientists.

The aim of ARIADNE is to update this perspective to today's digital technology.

The map shows the places that are referenced by at least one of the ARIADNE records.



The diversity of the kinds of digital objects held in archaeological archives and their organisation are additional issues. Having grown independently from each other, existing archives do not have a similar structure. In some archives there is an 'atomic' element that provides a sort of 'envelope' where various kinds of files from the same excavation are stored (text reports, photos, maps and more) as one would do with the paper equivalents. In other archives, each file is a separate and directly accessible piece of information. Others organize the information in databases. So the first task for ARIADNE was to define a model for the classification of these archives, i.e. the individual 'information carriers' and digital objects to be registered by ARIADNE. This led to the ARIADNE Cataloguing Data Model (ACDM), which supports the creation of a sort of identity card for archive to be catalogued, including its main characteristics.

Some predicted that attempting to define a model would lead to innumerable discussions and unsatisfactory results. It is pleasing to report that the discussions were shorter than expected and the results have been quite satisfactory from the beginning. Of course, cataloguing archives in practice has dictated a number of adjustments to the ACDM several times and, eventually, lead to a major upgrade. As usually happens, creating and improving the ACDM was not only instrumental in the creation of a good catalogue, the ARIADNE Registry, but also provided insights into the ontological nature of the associated digital objects. The work has generated new research questions about the nature of the digital objects that underpin archaeological knowledge.

A catalogue without search tools is fairly useless. This consideration led to the creation of the ARIADNE portal and the underlying search system, based on the four 'W': What, Where, When and Who facets. Why is implicit and common to all records. Supporting search also implied the standardization and normalization of taxonomies for each one of the four facets; an easy task for some of them and an incredibly difficult one for others. Subject thesauri, period thesauri and geographic information had to be normalized and standardized, overcoming errors in the original data. Errors were also corrected by content providers after checking the data they provided. At present, with about 1,800,000 datasets in the ARIADNE registry, it still happens that we discover an error. For example, because of a error in the geographical coordinates, a dataset for Aquileia in Northern Italy was wrongly located in the Atlantic Ocean on the map (like a new Atlantis).

This is as normal as the discovery of mistakes in the Encyclopaedia Britannica and are progressively corrected through use and continuous review. Without the control made within the Registry such errors in the original data would probably have never been discovered.

Amazing progress has been made in all the dimensions of integration illustrated in figure 1.

With regards to the vertical line – geographic extent – archaeological datasets are now discoverable across almost all Europe. With contributions promised by ARIADNE's associate partners, including regional and national datasets in the queue for content provision, some of the blank spaces on the map will be coloured.

All entries in the ARIADNE register are catalogued in English, but content is maintained in its original language. The content remains with the original provider and only metadata are stored in the ARIADNE Registry. This is a policy which is aimed not only at technological simplification – it would have been impossible, and also misconceived, to create a monster archive encompassing all European archaeological data – but it also solves accessibility issues. The management of access rights, which widely differ according to national regulations and institutional policies, is ultimately left to data owners.

As far as “standardisation to high-level ontologies” is concerned the outcome is exceptional. Not only has ARIADNE developed a specific CIDOC-CRM extension, CRMarcheo, but it has also provided tools to map any existing proprietary schema to this standard. Thus enabling anyone to easily establish the correspondence, and if desired the conversion, between a previous data organization and CRMarcheo.

ARIADNE results concerning “Addressing complexity” are also very good; especially given the complexity of ‘complexity’. A number of experimental activities have produced considerable insights into potentially disruptive techniques such as Natural Language Processing of texts in various languages, including archaeological fieldwork reports. The ARIADNE Data Cloud has been created, enabling users to browse and surf linked information according to the Linked Open Data paradigm, to integrate archaeological databases at item level thereby bringing information that is currently fragmented amongst diverse resources together in the same virtual space.

In conclusion, we have accomplished the planned work and substantially achieved the goals we proposed four years ago as our targets. In some cases we have simply achieved the objective; in others we have gone well beyond it. So, work done? Of course not. When we started, we were aware that, although very ambitious, what we proposed was just the beginning.

We are now past the end of the beginning, perhaps not yet at the beginning of the end. If ARIADNE has arrived there, it is thanks to the enthusiastic efforts of all its partners that the two of us had the privilege of coordinating in these intense, exciting and passionate four years.



**Franco Niccolucci (Coordinator, PIN) and Julian Richards (Deputy Coordinator, University of York)**



# A research infrastructure for archaeology

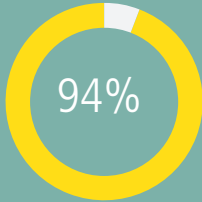
Research excavations, fieldwork and laboratory work and the data that they produce are the foundation of archaeology. In addition to pure research projects, the work carried out by national heritage agencies, local government curators and commercial archaeology services for management, conservation and development control all contribute to the discipline's knowledge base.

Archaeologists have been making increasing use of sophisticated digital equipment and techniques in recent decades. Data is being produced by archaeologists themselves through the equipment used on surveys, in excavations and in laboratories, and through the analysis, visualisation and publication of results. Archaeologists also use data produced by others, such as remote sensing and imaging data, directories, catalogues, bibliographies, reference collections, text and image corpora, and digital editions. During the course of a research project large volumes of data are created and collected, and become part of the research archive.

ARIADNE's main objective is to develop a research infrastructure that enables researchers to access existing archaeological data archives. The idea is to address the need for researchers to consult existing sources when starting new research. In archaeology, as in many disciplines, data and archives from previous projects are distributed between different institutions across Europe and beyond. The research infrastructure being established by ARIADNE is enabling these distributed resources to be brought together.

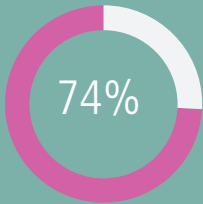
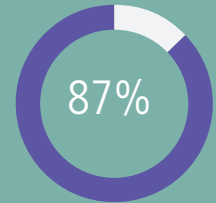
|                     |  |
|---------------------|--|
| <b>Services</b>     | ARIADNE's focus is on providing services and facilities to the research community that improve their access to data, tools and expertise.  |
| <b>Transparent</b>  | Datasets described in a way that makes their authorship, relationships, meaning and significance for archaeology transparent.  |
| <b>Discoverable</b> | Revealing archaeological datasets that otherwise would be difficult to discover by bringing together catalogue information from various institutions located in different countries and offering integrated access with language support.                                  |
| <b>Open</b>         | Promoting the open licencing of archaeology datasets and academic credits for researchers who publish their datasets openly online.  |
| <b>Networking</b>   | ARIADNE has strong roots in the archaeological community through its network of partners, associates, collaborations with archaeological associations and bodies, and the involvement of individual researchers in special interest groups, training and other activities. |
| <b>Innovative</b>   | New tools and services for archaeology researchers   |
| <b>Research</b>     | Addressing the complexity of archaeological data to enable research across borders.  |

# Selected findings from ARIADNE user research



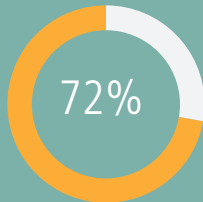
94% of researchers agreed that it is important that datasets are available online in an uncomplicated way.

87% of researchers agreed that they often do not know what research data is available because it is stored in so many different places and databases.



74% of researchers consider it important to have easy access to international datasets.

The additional effort required to prepare data (formatting, metadata, etc.) is considered to be a barrier to data sharing by 80% of researchers.



The perceived lack of professional recognition and reward for sharing data is a barrier to data sharing for 72% of researchers.

A lack of institutional or international repositories for archaeology data sets was a barrier to data sharing for 60% of researchers.



Technology is not considered to be a major issue by repository managers.

# The Ariadne community

ARIADNE's community and network includes the members of archaeological associations (such as the European Association of Archaeologists, Computer Applications in Archaeology and the European Archaeological Council), of digital humanities infrastructures (such as DARIAH) and researchers from across the broad discipline of archaeology. The community is multi-faceted and includes:

- University departments and research institutions, and the individual researchers, research groups and projects based in those institutions.
- Data centres, institutional repositories, national and international data archives, which offer long-term storage, curation and access to archaeological datasets, and the individuals who manage those repositories and provide a source of expertise.
- Museums, which curate analogue and digital archaeology collections, and their curators.
- National agencies responsible for conservation and management of the archaeological resource, and their staff.
- Special interest groups; international communities of interest and expertise in subject domains, around specific techniques (such as 3D, aerial photography and remote sensing, archaeological science, geographic information, excavation etc.) and standards (CIDOC CRM) among others.
- International projects and infrastructures.

It has been an important goal for the project to consult widely to understand the kinds of datasets and infrastructures that exist, and the data, tools and services needed by researchers now and in the future. ARIADNE has carried out two surveys of the user communities and the findings of these have helped to inform the development of the infrastructure and planning for future innovations.

# Building the research data infrastructure

The data landscape across Europe is very diverse. Typically researchers hold their data on their own computers or institutional servers at least during the lifetime of their projects. What happens after projects have finished varies widely from one country to another.

In countries with a developed infrastructure, researchers have access to institutional repositories, data centres, subject or domain archives and are able to choose where to deposit their datasets. Other countries are in the early stages of developing their infrastructure. Archaeological digital data repositories are becoming available but it is still not uncommon for archaeology data to be deposited on a CD with the physical project archive in a museum.

One of the characteristics of archaeology is the wide variety of types of data that are used. The project archive includes reports, texts, images, spreadsheets, databases and other datasets such as CAD, GIS, laser scanning or scientific data. The various formats present different challenges for their curation, preservation and access.

The project archive is particularly important in archaeology as original findings and raw data hold potential for future research as new techniques become available. The project archive is particularly important in archaeology as original findings and raw data hold potential for future research as new techniques become available.

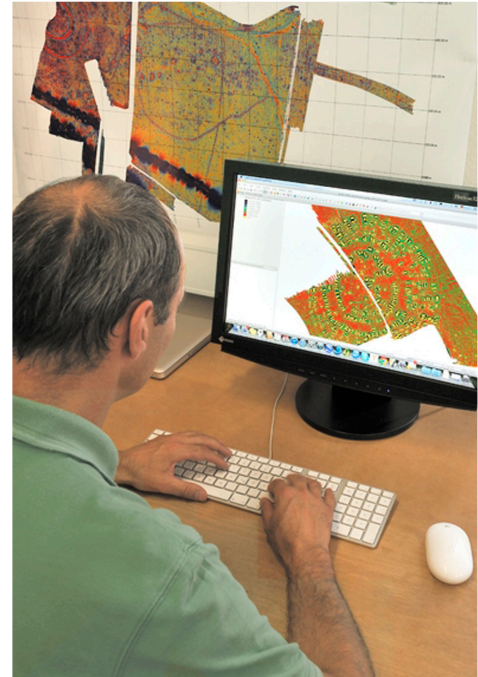


Image © Buch Edition

Archaeological datasets are the foundation of the ARIADNE research infrastructure. But the infrastructure is much more than a collection of datasets; it also offers tools, services, advice on best practices, training, insights into future research practices and access to individual expertise and the research community.

Sharing and dissemination of results is central to our discipline whether through publications, by depositing finds and archives with a repository, or by contributing to the registers of archaeological sites and fieldwork maintained by national and international bodies. The adoption of digital technologies by researchers is enabling new forms of publication and creating the potential for new forms of access to research results.

There is a trend towards publication online. Scientific journals are moving towards digital editions. Researchers can now publish their results themselves on their own websites or in project websites. Repositories and data archives also offer opportunities for researchers to publish their results. In today's world, reports, which previously would have been deposited on paper with the archive, can now be published online along with research datasets.

Yet there are challenges. There is a huge amount of archaeological data already in existence. New data is being added as a result of use of electronic recording equipment in fieldwork or digitisation initiatives. Much of this data is currently not readily available on the web to the research community or the wider public. In part this is due to the fact that data being held by many separate institutions and individuals. The additional time taken to prepare an archive and limited academic recognition for researchers who make this commitment are known to be barriers to publication online.

ARIADNE aims to reduce the barriers and to foster the culture of data sharing and re-using amongst the archaeological research community so that our results and research data become widely available.



# Overcoming fragmentation

All researchers are familiar with the process of finding what sources and interesting resources exist at the beginning of a new research project. Gathering this information can be time consuming. Archives, data and findings are distributed between institutions and projects. It can be difficult to find out which hold relevant resources. There is a basic communication issue, it is difficult to identify a research theme across datasets compiled in by different researchers in different countries using different vocabularies.

ARIADNE is tackling the difficulties researchers face in identify which resources exist by building infrastructure that allows them to search for datasets across the whole of Europe. The ARIADNE portal (<http://portal.ariadne-infrastructure.eu>) builds on experience by the Archaeology Data Service (ADS) and Data Archiving and Networked Services (DANS) in developing online indexes of archaeology project archives in the UK and the Netherlands. Both ADS and DANS provide researchers with practical search services that enable them to browse and use archaeological datasets.

Integrating datasets from researchers across Europe into a common portal poses social as well as technical challenges. Achieving interoperability, which enables a search across all the varied datasets to return relevant results, involves agreeing standards and terminology. Creating a network of researchers and institutions who are interested in sharing their data and in contributing to building standards is the social dimension of ARIADNE. By encouraging institutions and archaeologists to communicate, by sharing best practices, and by offering training in data creation, we aim to increase the potential for trans-national research and access to archaeological datasets.

The feedback that we have had from ARIADNE user research is encouraging. The results show that there is substantial demand from researchers for open access to datasets.

# Integrating research data in ARIADNE

Institutions and individual researchers with archaeological datasets will, we hope, be interested to know what is involved. How can your datasets become part of the ARIADNE research infrastructure?

Most people are working with data that has already been captured. We refer to this as “legacy data” because it has been created using a pre-existing system with a particular documentation scheme and language. The data may conform to a recording system, established for a project perhaps following a national or international standard, but there is often some local customization. Typically people add elements or use vocabularies for their project.

ARIADNE aims to offer its users a detailed description of its partners’ datasets and their contents. Thus the first step we take is to make an assessment of the original dataset and any descriptive metadata. Next, we work with partners to map their datasets with the ARIADNE Catalogue Data Model (ACDM). This mapping allows standardized descriptions of the datasets to be integrated into the ARIADNE registry and a single large searchable index to be created.

To allow users to search across datasets recorded in different languages, we ask our partners to provide mappings from subject terms in their dataset to concepts in the Art & Architecture Thesaurus (AAT). This work supports multilingual searching on the ARIADNE portal and increases the visibility of partners’ datasets to users worldwide.

Period indexing is another dimension commonly used in searches. As archaeological periods have geographic and temporal boundaries (the Roman period in Britain began after France and ended before that of Rome), ARIADNE partners’ have contributed to the PeriodO initiative to share their knowledge of archaeological periods in their countries. The results are available from PeriodO as Linked Open Data for use in the ARIADNE portal and other systems, where they improve the discovery of datasets relating to a time period or culture.



All fields ▾

Search for resources in the Ariadne catalog ...



## Welcome

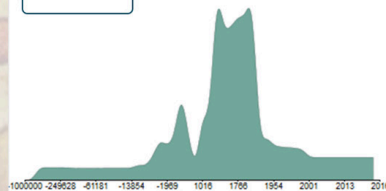
ARIADNE brings together and integrates existing archaeological research data infrastructures so that researchers can use the various distributed datasets and new and powerful technologies as an integral component of the archaeological research methodology.

## Browse the Catalog



A small bar chart icon with three bars of increasing height.

When



A small icon representing a list or menu, consisting of three horizontal lines.

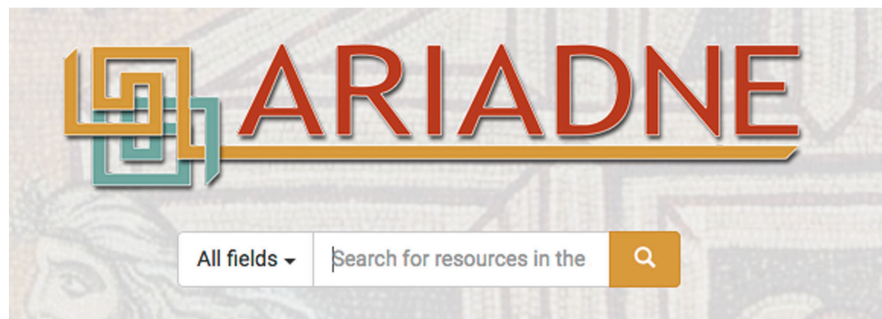
What

# ARIADNE Portal and Services

The ARIADNE portal supports the project mission to “bring together and integrate existing archaeological research data infrastructures so that researchers can use the various distributed datasets”.

For users the portal (<http://portal.ariadne-infrastructure.eu>) provides a single platform that they can use to search the datasets provided by ARIADNE partners. For the first time major collections published by the Archaeology Data Service, DANS, FASTI-Online and the Deutsches Archäologisches Institut in their online catalogues can be searched together along with collections provided by ArheoVest Association, Institute of Archaeology of the Czech Academy of Sciences, the Italian Ministry of Cultural Heritage, the “Athena” Research and Innovation Center, Cyprus Institute, the Discovery Programme, INRAP, Bulgarian Academy of Sciences, Österreichische Akademie der Wissenschaften, Swedish National Data Service and the Slovenian Academy of Sciences and Arts.

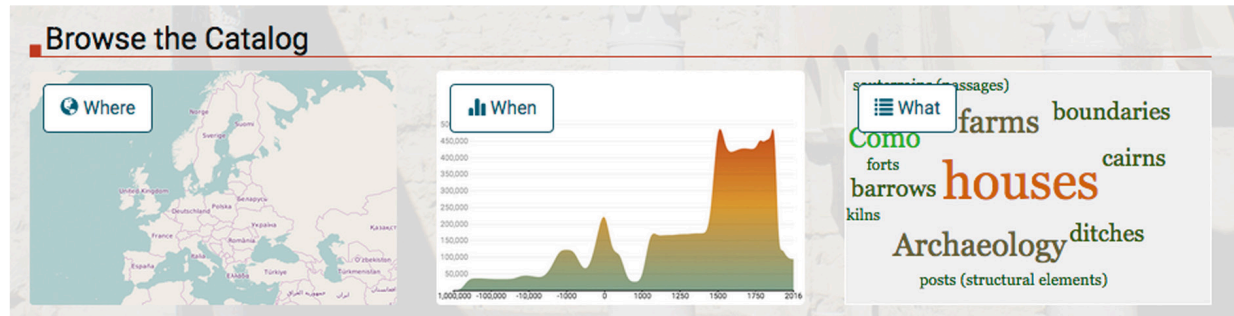
**“ARIADNE to me is a first step to joining up the archaeological dots in the brave new digital humanities world.”**



# Discovering new resources

The portal offers users a simple friendly interface (<http://portal.ariadne-infrastructure.eu>). It includes the familiar search box, which, once users start typing, suggests keywords based on the content that is actually available from ARIADNE. Typing the single letter “f” offers the option of searching for fortifications, flat-bottomed watercraft and fragments. The magic of this search technology is that it accesses the multi-lingual vocabularies. Typing the letter “f” offers the option of searching for ‘blanks’, which are ‘flan’ in Spanish and ‘Halbfabrikat’ in German.

The keyword search is a very quick and easy way of starting to use the ARIADNE portal. For users who would like to browse the catalogue to see what type of content is available there are three starting points: Where, When and What.



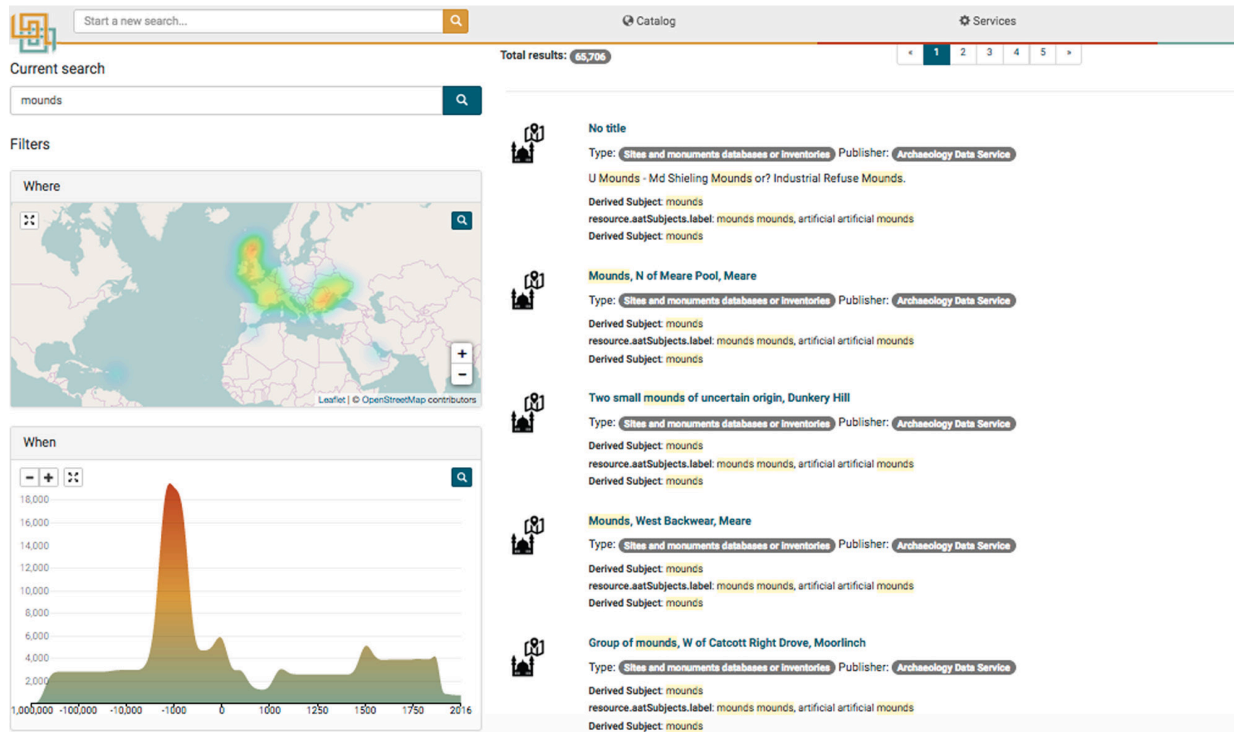
Choosing to begin exploring ARIADNE by clicking on “What” is a very good way of getting an idea of the overall semantic scope of the collection. This browse option displays a word cloud based on the subject concepts included in the content metadata.







All three browse options (what, where and when) are offered as additional filters on the search results page. The figure below shows the spread of content relating to “mounds” across Europe in an arc from the north of Scotland to Romania mainly concentrated in the period around 1000 BP.



This type of visualisation is a great way of helping users to explore the catalogue. Researchers can use the filters to narrow their searches to a particular region or time period, and the visualisation to identify new areas that may be related to their research interests.

The search results provide a list of the datasets that are available. More detailed information is available for each dataset, which includes a description and a link to the content if it is available on the web.

## Orfenskoto Tumuli 2007

Fasti record for interventions in the year 2007 at Orfenskoto Tumuli

tumuli

### Metadata

|               |  |
|---------------|--|
| ARIADNE ID    | 23555374   |
| Original ID   | fasti.sea_cd.AIAC_3728   |
| Language      | English  |
| Resource type | Event/intervention resources                                       |
| Subject       | tumuli   |
| Dating        | -0600 -- -0300   |
| Place         | [24.097738, 41.619644]   |
| Type          | Collection   |
| Publisher     | International Association for Classical Archaeology [Organization] |
| Issued        | 2006-09-07T00:00:00.0  |
| Modified      | 2011-05-05T15:07:13.0  |

### Responsible persons and organisations

|       |  |
|-------|--|
| Owner | International Association for Classical Archaeology [Organization] |
|-------|--|

[📄](#) [🔗](#) [✉️](#)

Access resource on the web

Resource is part of

FASTI

Geographically similar

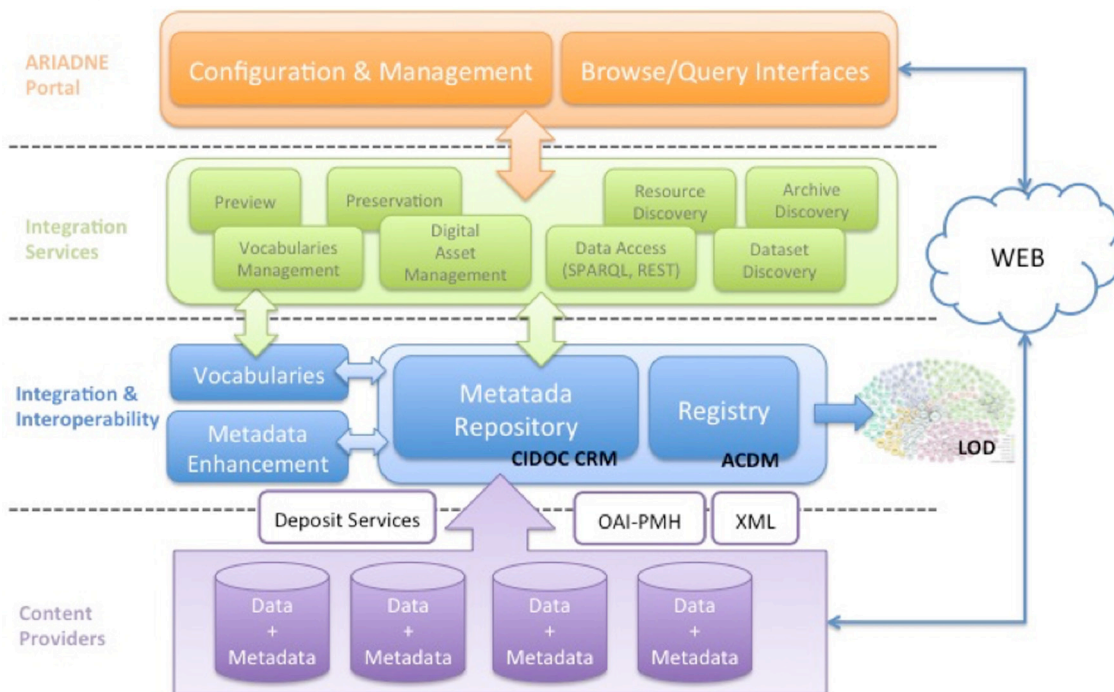
Thematically similar

Balakchiiskata Mogila Tumuli 2008

The listing encourages researchers to explore the catalogue by highlighting other content in the same geographic region or related to the same subject topic.



## Repository and Services Architecture



# ARIADNE Architecture

The ARIADNE Portal offers a central point of access to the archaeological resources made available from partner institutions throughout Europe. Behind the portal lies the ARIADNE registry and a set of services that are used to manage information about the datasets, collections, vocabularies, metadata schemas and mappings.

The registry is used to gather information about data resources and services, and to support the search functionalities offered by the portal. Partners provide a description of their resource in a form based on the ARIADNE Catalog Data Model (ACDM). This description is ingested with any data into the MORE repository, implemented for ARIADNE by the Digital Curation Unit of the Athena Research Centre. Once it has been ingested, a set of services are available to manage the data including:

- an identity service that discovers aggregations of objects, e.g. that a dataset is part of a collection
- an enrichment service to provide WGS84 coordinates (used on Google maps) for all spatial references
- an enrichment service that normalizes temporal information and maps it to a PeriodO URI
- an enrichment service that ensures all records contain at least one AAT subject term

The enriched metadata are stored in the ARIADNE Registry in RDF and in an Elastic Search cluster that powers the ARIADNE portal. The enrichments are important because they allow datasets captured by very different projects to become interoperable on three levels:

- thematically, based on subject concepts
- spatially, based on place names, address information and latitude/longitude coordinates
- temporally, based on period name and date ranges.

Mapping of the dataset's native schema to the CIDOC-CRM provides for a higher level of semantic interoperability.

# ARIADNE visual media service

Create your online showcase for 3d models, images and RTI.

[Upload »](#)[Browse »](#)

## 3D models

3D representations produced with 3D scanners or photogrammetry are extremely high-resolution and hard to visualize at interactive rate. This service produces a web page that supports interactive visualization of your data, after converting it into an efficient multiresolution encoding.

[View details »](#)[Demo](#)

## RTI images

Relightable images (called Reflection Transformation Images, RTI, or Polynomial Texture Maps, PTM) are becoming an [increasingly used media](#). This service closes a current gap, giving support for easy publication on the web and interactive visualization of RTI images.

[View details »](#)[Demo](#)

## High-resolution images

High-resolution images are a commodity resource in archaeology. Unfortunately, they are most often disseminated and published on the web by using low-resolution versions (a single 40Mpixel images is 120MB in uncompressed format and around 10MB when lossy compressed).

[View details »](#)[Demo](#)

<http://visual.ariadne-infrastructure.eu>

# Media Services

Going beyond search and discovery, ARIADNE is providing tools to improve the management of visual media and terrain data. These are implemented online as services in a move towards the modern web-based approach where users access both software and content online.

While capturing visual media and terrain data is standard working practice for archaeologists, publishing the content online is less so. It is a rapidly developing area. Until recently the general approach involved users downloading (very) large files and installing software on their own computers to view the content. The quality and detail in the media were often simplified to reduce file sizes for web publication. Modern web-based approaches are enabling high-resolution, high-quality content to be inspected online by users in standard web pages. This offers users a much more satisfying experience.

ARIADNE has developed a set of media services to enable researchers to work with visual media and terrain data online. These services are accessible as standard web applications.

The Visual Media Service (<http://visual.ariadne-infrastructure.eu>) supports 3 media formats:

- 3D models
- RTI images (relightable images)
- High Resolution images





# Landscape Services

Landscape Services for ARIADNE are a set of responsive web services that include large terrain datasets generation, 3D landscape composing and 3D model processing, leveraging on powerful open-source frameworks and toolkits such as GDAL, OSGjs, OpenSceneGraph and ownCloud. Here a few examples of 3D datasets produced by the services:



## Cloud Service

This is the main service to **access**, **manage** and eventually **share** your online data. This includes DEM input data, Geo-images, 3D models, etc.

[Cloud Service](#)

## 3D Terrain Service

You can use this service to process DEM, geo-images and shapefiles to produce large 3D terrain Datasets optimised for real-time visualization and web streaming.

[3D Terrain Service](#)

## Terrain Gallery

View, download or delete your generated 3D Terrain datasets. You can also interactively explore a 3D dataset online and present it in your web site, through desktop browsers, smartphones or tablets.

[Terrain Gallery](#)

<http://landscape.ariadne-infrastructure.eu>

# Landscape Services

Using these services researchers can upload media files and transform them automatically into formats that are suitable for publication online.

**3D models** – Researchers can upload 3D models in one of the standard formats (ply, obj, stl, dae, ...). The service then performs some simple cleaning operations (e.g. removal of geometric artifacts) and converts the models into a multi-resolution format (.nxs). The service then creates and publishes a simple webpage, which allows users to visualize the models in a WebGL frame on all the main browsers. Researchers receive the URL of the web-page, a zip file containing the multi-resolution nxs model and the html/js files of the webpage.

The service is based on 3DHOP components (<http://vcg.isti.cnr.it/3dhop/>) using MeshLab (meshlabserver.exe) for model preparation, NXS Builder (nxsbuilder.exe) and a final script to prepare the webpage.

**RTI images** – Researchers can upload re-lightable images (RTI) in the standard formats (ptm or hsh) singly or in batches. The service converts the images into webRTI and publishes a simple webpage; the image can then be viewed in all the main browsers.

The service uses WebRTIBuilder (WebRTIBuilder.exe) for processing the image, a script to prepare the webpage and components of the WebRTI viewer (<http://vcg.isti.cnr.it/~palma/dokuwiki/doku.php?id=research>).

**High Resolution images** – Researchers can upload one or more high-resolution images in one of the standard formats (jpg, png, tiff, ...). The service then transforms the image into a web compliant format, images are divided into chunks with different resolutions enabling progressive transmission. It then produces a basic html visualization page where it is possible to navigate the image in a WebGL frame in all the main browsers.

In this service all the operations are performed by local scripted codes (an executable for processing of the image and a script to prepare the webpage).

The ARIADNE Landscape Services (<http://landscape.ariadne-infrastructure.eu>) focus on processing, managing and publishing large 3D interactive Terrain datasets within a collaborative workflow. The services

- Provide a cloud-based data management service, which allows for collaboration between the members of research teams working together on DTMs/DEMs, imagery and shapefiles.
- Support 3D landscape reconstruction tasks and projects in Virtual Archaeology
- Provide services to disseminate interactive landscapes online, through a gallery

Researchers can upload terrain data (DTMs/DEMs, imagery and shapefiles) to their workspace using the Cloud Service. The 3D terrain services can then be used to process their data for real-time visualisation and web streaming. Users can choose different options to control the format, resolution and dissemination segments, the service takes care of multi-resolution management, geometry/texture compression and much more. Researchers can work independently or collaboratively on their terrain projects by specifying whether other users (members of their research team) can have access to their workspace.

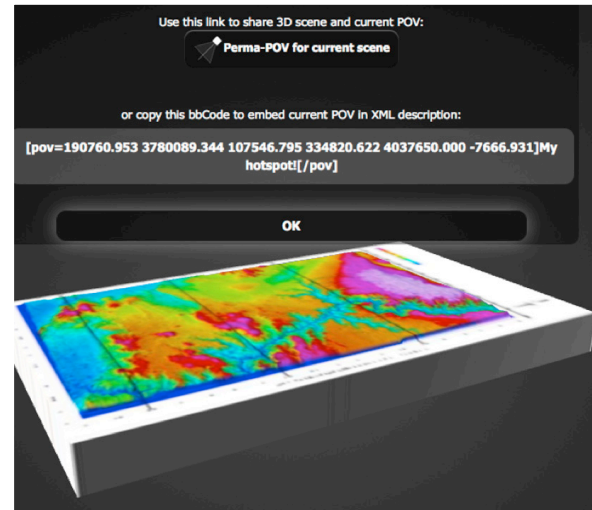
The Gallery service allows users to manage their 3D terrain datasets. These can be kept private until ready for publication, downloaded for use on the researchers own machines or published through the service. The dissemination service offers a high level of customization. The features include:

- Paged multi-resolution on desktop and mobile browsers for efficient streaming
- Camera and Point-of-View management
- Embed options
- Metadata presentation
- Support for touch and multi-touch devices
- Multi-texturing and spherical panoramas

For researchers the ARIADNE Visual Media and Landscape Services offer access to web-based services that enable them to process their high quality datasets and prepare them for publication online on their project websites.

The Services are very easy to use. There are simple web forms to upload media files and to provide information about the object. Processing is automatic and transformation is managed in a way that maintains the quality and detail. The services generate HTML visualization pages, which can be embedded in researchers' own websites, and download files for archiving or storage on their local server. All the services allow researchers to choose whether to keep their media private or to make it publicly available via the service.

For public users, the transformation of these media formats for web publication means that they can view high quality archaeology visual media online quickly and easily without needing to download specific software. The ARIADNE Visual Media Service represents a first step towards integrating high quality visual media in publications alongside other datasets.



*"I return now from Archeovirtual (BMTA Paestum) where we presented a project developed with the ARIADNE landscape service (Museo virtuale della valle del calore)."*

# Special achievements

## Best Practices

## Improving interoperability using Linked Open Data

Subject vocabularies

Mapping to the Getty's Art  
and Architecture Thesaurus

PeriodO: time

## Contributing to standards

CIDOC CRM: extensions for Archaeology

ARIADNE Catalogue Data Model

## Natural Language Processing

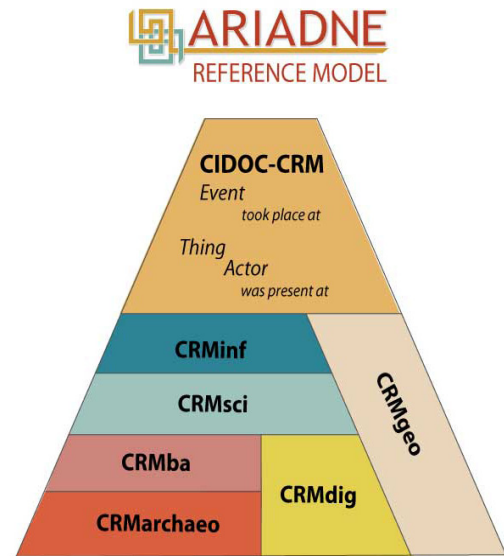


# Contributing to standards development: CIDOC CRM

The CIDOC CRM is a formal ontology designed to support interoperability of heterogeneous datasets. It was developed by a team of experts from across the cultural heritage (archaeology, museums, history of arts, natural history, libraries, philosophy) and computer science for the International Council of Museums (ICOM) documentation committee (CIDOC).

The CIDOC CRM provides a relatively compact general model for describing cultural heritage. It is designed to support extensions where these are required for specific disciplines. In the case of archaeology, several extensions have been developed. Some by ARIADNE itself and some by related projects. The ARIADNE reference model consists of the CIDOC CRM plus the following extensions:

- CRMinf: for inferences and arguments in the descriptive sciences
- CRMsci: for scientific observation, measurements and processed data.
- CRMgeo: for space and time.
- CRMdig: for provenance of digital representations such as 3D models.
- CRMba: for historic and prehistoric buildings.
- CRMarchaeo: for the archaeological excavation process



<http://www.ariadne-infrastructure.eu/index.php/Resources/Ariadne-Reference-Model>

ARIADNE has contributed to the development of the CIDOC CRM by analysing sample data structures and datasets, and by organising a series of workshops to bring together experts to discuss the semantics in their data:

- Excavation Data and Applications: included discussions on sites and monuments, cemeteries, coins and finds.
- Context, Stratigraphic Unit, Excavated Matter and Period Thesaurus and Gazetteer Definition; compared site, excavation and find recording sheets.
- Scientific Data: scientific investigation methods in archaeology, biodiversity and geology. Six methods were considered: geophysical survey, DNA analysis, Dendrochronology, Isotope analysis, TL/OSL ceramics analysis and the elemental analysis of archaeological objects.



**Participants at a CIDOC CRM workshop, Plakias, 2014**



# ARIADNE Catalogue Data Model: ACDM

The ARIADNE Catalogue Data Model is the schema that was developed to catalogue datasets in the ARIADNE registry. It supports the list of datasets that are available and underpins searches on the portal. ACDM extends existing data registry standards: DCAT, ISO/IEC 11179 and Dbpedia. The model covers:

- Archaeological Resource, which is sub-divided into:
  - Data Resource, these are the collections, datasets and data provided by partners
  - Language Resource, the vocabularies, metadata schemas, gazetteers and mappings provided by partners
  - Services, developed by the project and partners and made available as part of the infrastructure.
- Foaf:Agent, describes the various actors involved in creating, managing and publishing data and services.

ARIADNE partners provide ACDM records describing their datasets for inclusion in the ARIADNE registry. ACDM records are then exported from the registry to ElasticSearch, which supports search and discovery in the ARIADNE portal.

A mapping between ACDM and the CIDOC CRM is being carried out to support integration at both the level of the Data Resource and items within data resources.

# Vocabulary Matching Tool

## Source Vocabulary

(FISH Archaeological Objects Thesaurus) ?





Axe
Axe
AXE (TOOL)
AXE (WEAPON)
AXE HAMMER

AXE MOULD
AXE TRIMMING FLAKE
AXEHEAD

AXEHEAD ROUGHOUT
BATTLEAXE
Core Axe

CORE AXEHEAD
End Winged Axehead
Flake Axe

CUTTING EQUIPMENT → AXE (TOOL) *Axe Celt*

A tool with an edged head and a wooden shaft, used for a variety of purposes.

HATCHET

## Target Vocabulary

(Getty Art & Architecture Thesaurus) ?





ax chairs
ax heads
axe money
axes (tools)
axhammers

barking axes
battle-axes
beginning axes
double axes

flanged axes
ge (ceremonial knives)
palstaves

socketed axes
stone working axes
throwing axes

cutting tools → axes (tools) *ax (tool)* *axe (tool)*

Cutting tools that consist of a relatively heavy edged, squarish head fixed to a handle, the edge or edges being parallel to the handle so as to be suited for striking, hewing, cleaving, or chopping, trees, wood, ice, or another material. For axes used as weapons, typically having wider blades, use "axes (weapons)."

## Concept Matching












Show  entries

Search:

| Source Concept          | Match       | Target Concept            | Created                  |
|-------------------------|-------------|---------------------------|--------------------------|
| <span>AXE (TOOL)</span> | close match | <span>axes (tools)</span> | 2016-11-12T14:06:04.567Z |

Showing 1 to 1 of 1 entries

Previous  Next

# Linked Open Data: subjects, languages, period and place

In a large scale repository which incorporates archaeology dataset metadata records from multiple data providers in many languages, subject metadata is key to enabling search. Traditionally subject vocabularies are associated with one dataset. Integrating many different datasets created using different vocabularies brings issues of interoperability, which affect the capability of the system to find related items. Search across datasets created by different projects only works well if there is a system for sharing meanings.

Vocabulary mapping is a way of sharing meanings and improving the interoperability of different datasets. In ARIADNE the approach has been to use the Getty's Art and Architecture Thesaurus (AAT) as a central hub for mappings and to provide a switching language that enables multilingual search. Partners have provided mappings of the subject vocabularies used in their datasets to the AAT using an interactive vocabulary mapping tool was developed for the project by the University of South Wales. Subject vocabularies for archaeology

- Several major archaeological vocabularies have been published online for reuse in a wide variety of applications:
- DANS list of monument types (Archeologische complextypen): <http://rce.rnviewer.net/nl/structures>.
- FASTI Online list of monument types: [http://www.fastionline.org/data\\_view.php](http://www.fastionline.org/data_view.php).
- MiBAC ICCU terminology for archaeological site types: <http://www.iccd.beniculturali.it/getFile.php?id=182>
- Heritage Data Vocabularies, 14 thesauri including the Historic England Monument Types Thesaurus: <http://www.heritagedata.org/blog/vocabularies-provided/>
- DAI multilingual archaeological dictionary: <http://archwort.dainst.org/thesaurus/en/>

# Mapping to AAT

The ARIADNE approach of mapping these local vocabularies to the AAT is more manageable than mapping to multiple different vocabularies. Using the AAT as a hub means that a concept in the central spine is related to concepts in other vocabularies and in different languages, which supports multilingual searches in the ARIADNE portal.

The AAT is a faceted poly-hierarchical thesaurus with a good breadth of coverage for the domain and clear scope notes defining the usage of each concept. The Getty Vocabularies are available as Linked Open Data through a SPARQL interface (<http://vocab.getty.edu/sparql>).

The University of South Wales has implemented an interactive Vocabulary mapping tool for ARIADNE. This is an Open Source lightweight browser based application, which works directly with live Linked Open Data. For ARIADNE this means that the tool is querying the AAT's external SPARQL endpoint rather than storing a local copy of AAT.

Users of the Vocabulary mapping tool see a list of concepts from their source dataset on the left-hand side. The AAT is displayed on the right-hand side. Scope notes are displayed for each vocabulary to allow users to make more informed choices when deciding on mappings between concepts. The tool allows users to reflect the degree of certainty they have by enabling mapping between concepts to be expressed as either a `skos:exactMatch` or `skos:closeMatch` relationship.

Once a vocabulary has been mapped, the results may be saved locally or exported in a number of output formats. The collective results of the partner's vocabulary mapping form the basis of a semantic framework for mediation of queries in the ARIADNE portal.

## Multilingual cross search

A free text search to find datasets relating to “cemeteries” would not match the term “cemetery”, equivalent terms in other languages or semantically related terms such as “graveyards” or “catacombs”. Searching on concepts from the AAT rather than free text enables alternate concepts and labels in other languages to be included in the search. For example, concept 300266755 has:

- **Preferred labels:** “cemeteries” (en), “campos santos” (es), “campi santi” (es), “cimetières” (fr), “begraafplaatsen” (nl)
- **Alternate labels:** “cemetery” (en), “campos santos (cemeteries)” (en), “campo santo (cemetery)” (en), “campo santo” (es), “campo santo” (it), “cimetière” (fr), “cœmeterium (cemeteries)” (la), “camposanto (cemetery)” (en), “camposanto” (it), “begraafplaats” (nl)

The hierarchical structure of AAT also allows for semantic expansion of search queries to include narrower descendants of a concept. For example, concept 300266755 is sub-divided into “cemeteries by form” (graveyards, catacombs, coumbaria, necropolises, memorial parks, etc.) and “cemeteries by function” (cineria, pet cemeteries, war cemeteries, churchyards, etc).

The benefits for ARIADNE is that by mapping partner vocabularies to AAT search can locate concepts originating in separate datasets using the existing subject vocabulary. Queries can be expanded to cover several languages without requiring content providers to carry out a large amount of work.

[Catalog](#)

## ring brooches

**Getty AAT ID** 300263352

**Note** Brooches in the shape of a ring, with a movable pin that may extend beyond the diameter of the ring; usually of metal and often ornamented. Used to fasten costume and worn especially during the Medieval period in Europe.

**URI** <http://vocab.getty.edu/aat/300263352>

**Broader**  brooches

### Terms

|         |               |                   |                 |             |                  |                |                |             |
|---------|---------------|-------------------|-----------------|-------------|------------------|----------------|----------------|-------------|
| English | ring brooches | brooches, annular | brooch, annular | ring brooch | annular brooches | annular brooch | brooches, ring | ring-brooch |
|         | brooch, ring  | ring-brooches     |                 |             |                  |                |                |             |
| Spanish | broches       | ring brooch       | broche          |             |                  |                |                |             |
| Dutch   | ringbroches   | ringbroche        |                 |             |                  |                |                |             |

### Provider mapping

#### ANNULAR BROOCH

**Match URI** <http://www.w3.org/2004/02/skos/core#exactMatch>

**Source URI** [http://purl.org/heritagedata/schemes/mda\\_obj/concepts/97114](http://purl.org/heritagedata/schemes/mda_obj/concepts/97114)

## PeriodO and the problem of time

Archaeological researchers, on the ancient world in particular, refer to periods rather than to dates. But the same period names can mean different things. The time-range differs from place to place and from scholar to scholar. This makes it impossible to create a gazetteer of stable, globally-citable, temporally specific period concepts. Yet there is a need for a shared reference point to help researchers to find information, to support analysis and as an aid to understanding for students and the public.

The PeriodO project (<http://perio.do/>) offers a solution to the problem by creating a gazetteer that documents definitions of periods by authoritative sources. ARIADNE has contributed to this solution by providing PeriodO with documentation for the archaeological periods used by its partners in their datasets. This documentation defines the chronology of, say, 'Early Bronze Age' for a given area. The definitions are now being delivered by Perio.do as linked open data with permanent URLs for use in information systems.

The PeriodO gazetteer is allowing historical and archaeological periods to be integrated into the Linked Data ecosystem.

Until now, there was no interoperability between the very specific period vocabularies used in individual datasets with each other to allow a search to return all records associated with a date range or period concept. Following the collaboration with PeriodO this type of search is supported on the ARIADNE portal.



Canonical / ARIADNE Consortium. ARIADNE Data Collection. 2015.

## ARIADNE Consortium. ARIADNE Data Collection. 2015.

Permalink: <http://n2t.net/ark:/99152/p0qhb66>

|                       |  |
|-----------------------|--|
| <b>Title</b>          | ARIADNE Data Collection  |
| <b>Citation</b>       | ARIADNE Consortium. "ARIADNE Data Collection". 2015. <a href="http://www.ariadne-infrastructure.eu/Resources/PeriodO/documentation">http://www.ariadne-infrastructure.eu/Resources/PeriodO/documentation</a> . |
| <b>URL</b>            | <a href="http://www.ariadne-infrastructure.eu/Resources/PeriodO/documentation">http://www.ariadne-infrastructure.eu/Resources/PeriodO/documentation</a>  |
| <b>Year published</b> | 2015   |
| <b>Creators</b>       | ARIADNE Consortium   |

### Editorial note

Periodizations gathered from ARIADNE partners on the national level in a series of EU countries, as well as periodizations from some non-EU Fasti Online contributors. Some of the definitions are derived from other PeriodO collections; where this is the case, a note has been included with the PeriodO URI of the definition from which it is derived.

Period list

[JSON-LD](#)

[Turtle](#)

[CSV](#)

Viewing 601 - 625 of 659

ARIADNE collection in PeriodO

# Place

The ability to find datasets by a place-name or map search is particularly important for archaeological researchers. But different datasets are typically prepared using national map reference systems and local place name gazetteers. The geographic information needs to be normalized and standardized to allow for searches across the different datasets.

- ARIADNE has provided a set of metadata enrichment micro-services in the MORE repository to support:
- Latitude/Longitude coordinates to be provided for place names in the datasets
- Place-names to be provided where coordinates are registered in the datasets
- Conversion of national map coordinates into international Latitude/Longitude coordinates used for web mapping
- Normalization of place data (this is used to extract place names from strings of information incorporating the name of a site with other location details).

These services use a series of Linked Open Data resources such as the place name gazetteer maintained by Pelagios, which allows ancient place names to be resolved to modern place names and map locations.

# Natural Language Processing

The research archive for archaeology includes large quantities of text documents including unpublished fieldwork reports (the 'grey literature'), journal articles and other texts. Although some descriptive metadata exists for these documents it is often quite limited. Grey literature has long posed a significant problem for the archaeological domain; much fieldwork is taking place and generating important knowledge about the archaeology of an area yet these reports have limited visibility to research. User studies by ARIADNE confirm that the archaeology researcher community faces issues in knowing what data is available, how to locate relevant data and how to distil relevant results.

Natural Language Processing (NLP) techniques offer ways of mining the knowledge that is contained within text documents and increasing their visibility. Text mining techniques can be used to identify and extract keywords and phrases from large volumes of text, which can then be added to the metadata.

The University of South Wales, Leiden University and the Archaeology Data Service have investigated the applicability of data mining solutions to ARIADNE and the archaeological domain. The team began by inspecting unpublished fieldwork reports from several repositories around the world to understand the characteristics of the domain and its data. Based on this study, the partners explored rule-based and machine learning approaches, the use of archaeological thesauri in NLP and various information extraction methods. Their work included:

- A pilot study for a Dutch NER pipeline to annotate documents with Actor, Place, Monument, Archaeological Context, Artefact, Material and Period.
- Creation of a Named Entity Recognition (NER) Web Service API for extraction of resource discovery metadata from documents.

The results have shown the potential of these techniques to improve the discovery of research datasets.

# Best Practices

Part of ARIADNE's mission is to contribute to the social aspects of the research infrastructure for archaeology by sharing best practices and the expertise that institutions have acquired within countries and internationally. One of our aims has been to build capacity in countries that are beginning the process of implementing their digital infrastructures for archaeology and the humanities, by sharing this expertise with institutions across Europe.

Inspired by a series of Guides to Good Practice (<http://guides.archaeologydataservice.ac.uk>) published by the Archaeology Data Service with Digital Antiquity in the USA, ARIADNE has produced a series of guides and case studies for archaeological researchers. The series was informed by a survey of ARIADNE partners which identified the availability of:

- Guidelines on data and reports and the structure of national databases,
- Guidelines and recommendations for excavation and fieldwork
- Guidelines for survey techniques (e.g. lidar) or data types (e.g. 3D, dating techniques, etc).
- Guidelines from projects such as ArchaeoLandscapes and 3D ICONS.

Seven major themes were identified in terms of partners' practice and areas of expertise: Digital archives and repositories, National databases, Excavation and Field Survey Data, Geophysical survey data, Aerial Survey Data: Lidar and photography, 3D Datasets, and Scientific Analysis and Dating.

The individual Guides to Good Practice and Case studies produced by ARIDADNE were as follows:

**Dendrochronological Data in Archaeology: A Guide to Good Practice.** This guide ([http://guides.archaeologydataservice.ac.uk/g2gp/Dendro\\_Toc](http://guides.archaeologydataservice.ac.uk/g2gp/Dendro_Toc)) was contributed by DANS and provides guidance on the production, documentation and storage of dendrochronological datasets. It builds on good practices established by organisations in the Netherlands and the United States, specifically the Tree Ring Standard (TriDaS).

**Case study: The dendrochronology of the Early-Medieval Emporium Dorestad (the Netherlands).** This case study ([http://guides.archaeologydataservice.ac.uk/g2gp/Dendro\\_CS](http://guides.archaeologydataservice.ac.uk/g2gp/Dendro_CS)) was contributed by DANS and provides a real-world worked example of the re-analysis of dendrochronological data using the Tree Ring Data Standard and associated tools.

**3D Datasets in Archaeology: A Guide to Good Practice.** This guide ([http://guides.archaeologydataservice.ac.uk/g2gp/3D\\_Toc](http://guides.archaeologydataservice.ac.uk/g2gp/3D_Toc)) was contributed by DAI in collaboration with ADS and DANS. The guide provides guidance on the production, documentation and storage of 3D datasets (specifically 3D models) and is designed to complement existing Guides on Laser Scanning, Photogrammetry, CAD and Structured Light Scanning. It builds on the good practice guidelines developed by the 3D-ICONS project, particularly the work on data creation pipelines.

**Case Study: Selection and Retention of files in big data collections: the example of the Pergamon excavation of the DAI Istanbul.** This case study ([http://guides.archaeologydataservice.ac.uk/g2gp/CS\\_ARIADNE-DAI-Schafer](http://guides.archaeologydataservice.ac.uk/g2gp/CS_ARIADNE-DAI-Schafer)) was contributed by DAI and addresses the selection of data from a large dataset created through long, multi-phased and multi-disciplinary processes, and the best way of documenting such datasets so that the processes, relationships and dependencies can be understood easily.

**RTI Guide.** A guide focussing on the documentation and preservation of Reflectance Transformation Imaging (RTI) datasets is in preparation. This will address the need for guidance on data acquisition and processing, data selection, documentation and preservation.

# Training and services for archaeologists

Access to training is especially important in a discipline that is embracing new techniques and technologies, particularly for young researchers who are entering the profession.

Archaeologists have been making increased use of electronic recording equipment and software in recent decades. Research is becoming more data-intensive. Repositories, digital archives and data services are more and more important. Archaeologists are thinking about how to analyse their own research datasets and are looking for tools and services to help with this. The digital environment is bringing new opportunities for research teams to collaborate online (across disciplines and country borders), to share data and discuss results. There is a growing expectation that research datasets will be deposited in an archive where they can be made accessible for re-use in new research.

In spite of these trends, the fact is that most archaeologists today are working with legacy datasets that are not openly accessible online. Many archaeologists are learning new skills – to use new technologies and best practices in managing their datasets. Visual media are an example of technologies that are widely adopted in archaeology where there is need for training. This is due to range of media types (2D, 3D, high resolution, laser scanning, video, and so on) and the complexity of making the right choices of equipment, processing and visualisation software; mastering data creation and metadata capture; publication and longer-term preservation.

One major goal in ARIADNE is to help our community in building a clear view of the technical possibilities, clarifying the potential for access and re-use of archaeological datasets, and the data management needs with respect to storing, discovery, accessing, connecting with other data, and visualisation. We see building a new and improved consciousness as an important service to our community.

***“Archaeological research data is becoming more and more complex, projects like this are increasingly important.”***



Training the next generation of researchers



Training in ARIADNE goes under the heading of Transnational Access (TNA). The idea is to provide opportunities for researchers to build their “next generation skills” by visiting facilities outside their home countries. The ARIADNE TNA programme has offered researchers access to the expertise and services available from the partners in the research infrastructure. Throughout the project there have been various opportunities for researchers to take part in:

- Training events during international conferences such as those organised by the European Association of Archaeologists and Computer Applications in Archaeology
- Individual visits to data centres managed by partners in the ARIADNE consortium, which have offered access to their expertise, tools and methods for working on specific research questions and data related issues.
- Group visits to ARIADNE data centres for training on:
  - Legacy Data and Dataset Design
  - Scientific Datasets
  - 3D Documentation of Fieldwork and Artefacts

*“I gained an insight into the application of methods for the curation and management of digital datasets in different contexts, on different projects, including the application of CIDOC-CRM for structuring information or the use of controlled vocabularies. Secondly, the expert and peer review of my project throughout the sprint process provided invaluable inputs to the future development of this initiative, for example I will apply concepts such as paradata in the delivery of my project. Finally, it provided an opportunity to develop and refine the communication of aspects of my project to other researchers”.*



Patricia Ferreira Ulguim, Teeside University participated in TNA at the Digital Curation Unit of the Athena Research Centre

## 2D/3D Documentation for Archaeology

CNR-ISTI hosted three summer schools for this TNA in Pisa. The main goal of the training was to enable researchers to implement modern approaches to documenting archaeological sites and artefacts using 3D and enhanced 2D media.

The training offered a mixture of presentations, demonstrations and hands-on experience with the technologies being presented (both hardware and software). Participants were invited to bring specific problems and projects that they are working on as a case study. CNR-ISTI then dedicated time during the visit to advise on the case study and practical experience in using the technologies on a real dataset.

The topics covered in the training included:

- ICT and visual technology concepts
- 3D scanning and data processing
- Image-based approaches for 3D digitization
- Colour acquisition and mapping on 3D models
- RTI images acquisition and visualization
- Publication and visualization of 3D/2D models on the web
- Advanced manipulation of 3D models
- Use of 3D in Cultural Heritage projects

Participants worked on their case studies throughout the week; these were presented on the final day of the visit and discussed with the group.

The feedback given by the participants in the TNA was positive. The opportunity for CNR-ISTI to witness a number of interesting case studies contributed to their understanding of the researcher community's needs from the tools and technologies.

# Legacy Data and Dataset Design

TNA on Legacy data were offered by both CNR-ISTI in Pisa and by the Digital Curation Unit of the Athena Research Centre in Athens.

CNR-ISTI's NeMIS Laboratory hosted three summer schools on “Legacy data and the design of archaeological datasets” in Pisa. The aim was to introduce participants in the school to metadata design and semantic web technologies, to enable them to work with their existing datasets and to design new datasets with rich semantics (by providing explicit representation of concepts and their relationships) and based on standards to enable interoperability. The school included lectures, to introduce the CIDOC CRM and semantic web knowledge representation languages, and hands-on practical sessions. Participants were invited to bring case studies so that their research problems and data requirements could be analysed, and their datasets designed during the course of the school in discussion with the experts from CNR-ISTI.

The Digital Curation Unit hosted two summer schools and one expert forum on “Legacy data and the digital curation of archaeological knowledge” in Athens. The aim was to discuss the curation of the data produced by fieldwork projects, museum archaeological collections, commercial and community archaeology, and ways of making the data and the knowledge accessible to archaeologists and scholars. The training offered a mixture of presentations, demonstrations and collaborative work on the case studies brought by participants.

The topics covered in the training included:

- The principles, methods and concepts for organizing archaeological resources
- The ARIADNE portal and registry services
- Metadata, semantics and ontologies
- The CIDOC CRM
- Digitisation and access projects; involving the various communities in planning projects (heritage, developers, archaeologists, government, public and indigenous/descendent peoples)
- The benefits and challenges of opening access to archaeological datasets

Participants worked on their case studies in sprints throughout the week of the training. Each participant presented their case studies and the challenges that they are facing in. Participants were divided into groups to discuss their case studies in depth with the experts present at the training. The goal of the sprint sessions was to work together to develop a “solution space” or a plan to meet the challenges, which was presented by the participant at the end of the week.



**3D training in progress**

# Mapping existing datasets to CIDOC-CRM

PIN hosted one summer school and a series of individual training visits from research teams on “Mapping existing datasets to CIDOC-CRM” in Prato. The main goal of the training is to enable scholars and professionals to implement mappings of their existing datasets to the CIDOC CRM to enable data conversions.

Each participant in the training was invited to bring a case study and sample dataset to work on during their visit. This meant that visits can be adapted to the needs of particular individuals and research teams. The aim of the training is to provide an in depth introduction to the CIDOC-CRM and ontologies and to provide time for practical hands-on work developing mappings for the case studies brought by participants with support from the experts at PIN.

*“The course provided an invaluable introduction to the relevance of the CIDOC-CRM to the dataset I worked with.”*

Each researcher and research team that has taken part in the TNA has brought a project and/or dataset with them to map to the CIDOC-CRM (and other related extensions). Some examples of the projects include:

- a study of ancient metallurgy and the related human interaction during the Bronze Age integrating archaeological and geographical data with quantitative data from chemical and spatial analysis,
- Investigation of the English landscape and the dietary behaviour from Prehistory to the Middle Age integrating artefacts, historic maps and chemical analysis data,
- Mortuary Archaeology using CIDOC CRM concepts to describe events and actions related to grave-reopening
- The experimental use of CRMepi on Sicilian ancient inscriptions
- Other projects concerned integrating research data resources relating to prehistoric Cretan village buildings, Neolithic Greece and Western Anatolia, cultural heritage information related to Cyprus and archeometry data from medieval glassy objects.

## Other activities

ARIADNE has had a programme of activities to raise awareness of ARIADNE amongst the community of scholars, researchers, students, deans, repository managers, directors of research institutions, international networks and related disciplines. Partners have participated in conferences and events, and the project has organised one-day training workshops and conference sessions, and has published reports, papers, best practice guides and training materials.

Special Interest Groups have been established for researchers with an interest in: 3D and visualization; Archaeological Research Practices and Methods; Remote Sensing and Spatial Data; Scientific Data; Excavation and Monument Data; Grey Literature; Metadata and Semantics; and Linked Data. These groups have met in person and virtually to share information about the state-of-the-art in their fields, to exchange information, identify issues and plan future activities.

The project has organised training workshops on:

- Online access of archaeological datasets
- Data management planning for archaeologists
- Managing legacy datasets

ARIADNE publishes reports, guidelines, training materials, news and other information on the project website: <http://www.ariadne-infrastructure.eu>.

The website statistics show that interest in ARIADNE is international with visitors being referred to the site by project partners' websites and social networks such as SlideShare, LinkedIn and Twitter. Through its partners and followers @ARIADNE\_Network is part of a networked community on Twitter, sharing and exchanging news about access to archaeological research datasets amongst other topics.

# Innovation agenda

ARIADNE has published an innovation agenda to promote efforts to build e-infrastructures, data and knowledge resources for archaeological research in Europe and beyond. We hope to foster coordination and synergies between initiatives in the discipline and have based our innovation agenda on user needs surveys, interviews and background studies.

The agenda has the following focus areas over the next 5-10 years:

- Research e-infrastructures and digital resources for archaeological research and the related domains
- Open sharing and re-use of data: promoting a culture of data sharing, re-use and citation, removing barriers to data sharing
- Data archives for the curation of archaeological research data: reliable and cost-effective community archives for long-term data curation and access
- Capacity building: guidance, training and support for data practices
- Providing services and enabling novel applications

The presence of different stakeholders (research institutions, laboratories, cultural heritage agencies, museums and archives) with differing levels of resources necessitate cost-effective solutions. Coordinating efforts should bring benefits at community-level with digital resources that are easier to access and infrastructures that are less expensive to run.

Building capacity amongst the actors, trust in the solutions and the legal aspects, and managing the costs are the primary challenges in building a rich, coherent and sustainable research infrastructure for archaeology. ARIADNE has built a strong and vibrant network of archaeological researchers and can play a valuable role in advancing the innovation agenda.



## Future

ARIADNE has been a successful project and has achieved excellent results and built a vibrant community.

The project phase of ARIADNE, funded by the European Commission, will end on 31 January 2017. However, ARIADNE will continue to be active after the 1st February 2017. We will continue community networking and dissemination through the association being established by the ARIADNE partners, which is open to all interested parties to join on a voluntary basis. Core research will, of course, continue independently. Work during the project has opened new avenues being pursued by ARIADNE partners already involved in joint research within the project. Training will continue to be offered but, without the EC financial support from the project, trainees will need to find resources from elsewhere to participate.

Thanks to the support provided by some of the ARIADNE partners the content of the ARIADNE portal and registry will continue to be maintained and updated. Expansion to include other repositories, additional countries and under-represented content categories (such as archaeological science, GIS, and others) requires financial resources. As does continuing the development of services supporting dataset integration and enrichment, the search system and other services provided by the portal. We can make some progress by securing funds for individual projects to support specific activities such as adding a new content provider or creating new services. But the next major phase of the project needs funding, which we will be actively pursued in the next EC programmes for infrastructures.

Another component of our sustainability strategy is embedding ARIADNE into projects listed in the ESFRI roadmap and permanent European research infrastructures. DARIAH, the European research infrastructure on digital humanities, and E-RIHS, the forthcoming European research infrastructure on heritage science, offer opportunities for continuing the current ARIADNE activity and securing at least its continuation at the present level.

Our aim is for expansion and development to make the outcome of ARIADNE's work a world-class infrastructure, unique in its kind and a service for archaeological research worldwide.

## ARIADNE partners and associates

### **PIN s.c.r.l. Educational and Scientific Services for the University of Florence**

[www.poloprato.unifi.it](http://www.poloprato.unifi.it)

PIN is the project co-ordinator and leads work within the project on interoperability and dissemination; PIN provides training and access to expertise in the CIDOC CRM.

### **Archaeology Data Service**

[archaeologydataservice.ac.uk](http://archaeologydataservice.ac.uk)

ADS is the deputy project coordinator and leads work on good practices and training, contributes archaeology datasets and contributes to work on interoperability, standards and community building.

### **International Association for Classical Archaeology**

[www.aiac.org](http://www.aiac.org)

AIAC is a contributor of archaeology datasets to the infrastructure, contributes its expertise in developing online access to FASTI ONLINE, and contributes to work on community building and dissemination.

### **ArheoVest Association**

[arheovest.com](http://arheovest.com)

Arheo is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

### **Institute of Archaeology of The Czech Academy of Sciences, Prague**

[www.arup.cas.cz](http://www.arup.cas.cz)

ARUP-CAS is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

### **"Athena" Research and Innovation Center**

[www.athena-innovation.gr](http://www.athena-innovation.gr)

The Digital Curation Unit of Athena RC leads on the design and implementation of the ARIADNE registry and contributes to work on standards, best practices and community building. The CETI unit of Athena RC is a contributor of archaeology datasets and leads in providing access to expertise in scientific datasets.

**The Cyprus Institute Limited**[www.cyi.ac.cy](http://www.cyi.ac.cy)

CYI-STARC, the Science and Technology in Archaeology Research Center is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

**Consiglio Nazionale delle Ricerche**[www.isti.cnr.it](http://www.isti.cnr.it)

Three units in CNR have participated in ARIADNE. NeMIS Lab coordinates the implementation of ARIADNE's services and contributes its expertise by offering training on data modelling and interoperability. The VC Lab leads on the development of Visual Media Services contributing its expertise on 3D data capture and processing. The VH Lab leads on the development of Landscape Services contributing its expertise on terrain datasets.

**Deutsches Archäologisches Institut**[www.dainst.org/dai/meldungen](http://www.dainst.org/dai/meldungen)

DAI is a contributor of archaeology datasets to the infrastructure and leads tasks on user needs, contributes to work on identifying best practices, community building and to the implementation of portal services.

**Data Archiving and Networked Services**[www.dans.knaw.nl](http://www.dans.knaw.nl)

DANS is a contributor of archaeology datasets to the infrastructure and contributes to work on specifying ARIADNE services, interoperability, best practices and training.

**The Discovery Programme: Centre for Archaeology and Innovation Ireland**[www.discoveryprogramme.ie](http://www.discoveryprogramme.ie)

Discovery is a contributor of archaeology datasets to the infrastructure and contributes to community building by supporting the special interest groups.

**Foundation for Research and Technology**[www.ics.forth.gr](http://www.ics.forth.gr)

FORTH leads on the CIDOC-CRM and to work developing extensions to the model to enable accurate documentation which addresses the complexities in specific archaeological datasets.

**Institute of Heritage Sciences, Spanish National Research Council**[www.incipit.csic.es](http://www.incipit.csic.es)

INCIPIT-CSIC leads work on innovation in archaeological research methodology contributing its expertise in conceptual modelling and the study and interpretation of the archaeological record.

**The French National Institute for Preventive Archaeological Research**[www.inrap.fr](http://www.inrap.fr)

INRAP leads on user acceptance testing of ARIADNE services, and contributes archaeology datasets to the infrastructure, and to work on standards, best practices and dissemination.

**University of Leiden**[www.universiteitleiden.nl](http://www.universiteitleiden.nl)

Leiden leads on data mining and natural language processing for ARIADNE.

**Ministry of Cultural Heritage, Activities and Tourism, Union Catalogue of Italian Libraries**[www.iccu.sbn.it](http://www.iccu.sbn.it)

ICCU is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

**Hungarian National Museum**[hnm.hu](http://hnm.hu)

MNM-NOK is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

**National Institute of Archaeology with Museum, Bulgarian Academy of Sciences**[naim.bg](http://naim.bg)

NIAM-BAS is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

**Österreichische Akademie der Wissenschaften**[www.oeaw.ac.at](http://www.oeaw.ac.at)

OAW is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

**Salzburg Research Forschungsgesellschaft m.b.H.**[www.salzburgresearch.at](http://www.salzburgresearch.at)

SRFG leads on community building, for capturing user needs and developing ARIADNE's innovation agenda and action plan.

**Swedish National Data Service**[snd.gu.se](http://snd.gu.se)

SND leads work on data mining and natural language processing in ARIADNE and to the implementation of portal search services, and contributes archaeology datasets to the infrastructure.

**University of South Wales**[www.southwales.ac.uk](http://www.southwales.ac.uk)

The University of South Wales leads work on linking archaeological data, contributing its expertise in ontologies and semantic annotation, and to work on data mining.

**Research Centre of the Slovenian Academy of Sciences and Arts**[www.zrc-sazu.si](http://www.zrc-sazu.si)

ZRC-SAZU is a contributor of archaeology datasets to the infrastructure and contributes to work on standards, best practices and dissemination.

In addition to the formal project partners, ARIADNE has exchanged cooperation agreements with several institutions who have become associate partners:s:

- Aarhus University, Denmark,
- Centre National de la Recherche Scientifique, France
- Fornleifastofnun Íslands, Reykjavík, Iceland
- Israel Antiquities Authorities, Israel
- Istituto per i Beni Artistici, Culturali, Naturali della Regione Emilia, Italy
- Soprintendenza Speciale per il Colosseo, Il Museo Nazionale Romano e l'Area Archeologica di Roma, Italy
- Dipartimenti TeSIS e di Informatica di Verona, Italy
- Vilnius University, Lithuania
- VU University Amsterdam, Netherlands
- Museum of Cultural History at the University of Oslo, Norway
- Direção-Geral do Património Cultural, Portugal
- Universidade do Minho, Portugal
- Centro Nacional de Investigación sobre la Evolución Humana, Spain
- Instituto Universitario de Investigación en Arqueología Ibérica, Spain
- Instituto Andaluz del Patrimonio Historico, Spain
- IAIMS (Federated Archaeological Information Management Systems), Australia
- Digital Antiquity, USA
- tDAR (the Digital Archaeological Record), USA

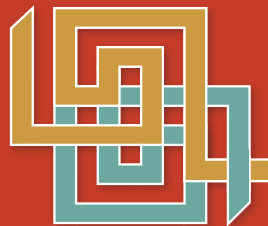
ARIADNE collaborates with various international networks including:

- DARIAH (Digital Research Infrastructure for the Arts and Humanities)
- EHRI (European Holocaust Research Infrastructure)
- CENDARI (Collaborative European Digital Archive Infrastructure)
- DCH-RP
- the EAGLE project
- EAA (European Association of Archaeologists)
- CAA (Computer Applications in Archaeology)

ARIADNE: Advanced Research Infrastructure For  
Archaeological Dataset Networking in Europe

<http://www.ariadne-infrastructure.eu>





[www.ariadne-infrastructure.eu](http://www.ariadne-infrastructure.eu)