EUreka3D-XR: XR Applications for Cultural Heritage

Antonella Fresa
Project Coordinator
PHOTOCONSORTIUM

Pisa, 27 February 2025

Image: courtesy of CUT Cyprus University of

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

Today's agenda

- 11.00 Welcome message, *Alessandro Tosi, Director of Museo della Grafica*
- 11.10 Introduction and scope of the workshop, *Antonella Fresa, Photoconsortium*
- 11.20 The virtual visualisation of the middle-ages walls of the city of Girona
  David Iglésias Franch, CRDI Ajuntament de Girona
- 11.40 The XR narrative of archaeological excavations in the Celtic city of Bibracte
  Vincent Guichard, BIBRACTE EPCC
- 12.00 The creation of a new virtual life of Saint Neophytos' Enkleistra in Cyprus
  Marinos Ioannides, Cyprus University of Technology
- 12.20 Q&A
- 12.30 End of the meeting

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

- EC Recommendation in 2021 urges institutions to digitise cultural objects and sites in 3D and share them in the common European data space for cultural heritage

- **EUreka3D** project (2023-2024) allows cultural institutions to store, manage, visualise and publish online their 3D models
- It offers a rich programme of webinars and training resources

A real accessible centre of competence in 3D digitisation!

https://eureka3d.eu/

- 3D and other digital cultural content available online should be reused in new and more engaging applications that enhance the user's experience

EUreka3D-XR

- **EUreka3D-XR – European Union's REKonstructed content in 3D to produce XR experiences (2025-2026)** co-funded by EU
- 12 partners from 8 EU countries and Switzerland
- Continuation project of EUreka3D, to develop innovative re-use scenarios and tools that enable the creation of extended reality (XR) applications, through expanding the features and services already developed and tested in the EUreka3D project
- The main research area of the new action in EUreka3D-XR is focused on **transforming cultural contents** such 2D, 3D, video, texts, maps, stories into **compelling narratives and extended reality scenarios**

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

Contributing to the common European data space for cultural heritage

EUreka3D-XR supports the common European data space for cultural heritage led by Europeana Foundation.

The project will deliver:

- **Tools for the data space:** 5 open-source digital tools for CHIs, to reuse 3D digital content
- **Use-cases and XR scenarios**: 3 innovative applications to demonstrate benefits and success stories realized with the EUreka3D-XR tools
- **New contents in the data space:** a rich corpus of open access digital cultural contents online, editorials and training resources

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

The 5 new tools of EUreka3D-XR

- Online tool for creating **custom AR tours**, retrieving 3D objects from CH repositories and associating them with locations on a map
- **Mobile app** that allows visitors to experience phygital tours, superimposing 3D digital objects onto the physical world
- **3D Modelling** software pipeline that reconstruct cultural heritage sites using AI technologies, digital photo and archival documents
- Web tool for **creating XR/AR experiences** using a range of predefined layouts for UX and UI
- AI-based tool to create the **digital representation of human characters** that interact with visitors of cultural heritage sites

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

The 3 XR scenarios of EUreka3D-XR

Virtual reconstruction of the middle-ages walls of the city of Girona

AR experience at the Bibracte archaeological site

A new life of Saint Neophytos' Enkleistra in Cyprus

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

Thanks for your attention!

Antonella Fresa

Project Coordinator

antonella.fresa@photoconsortium.net
fresa@promoter.it

Image: courtesy of CUT Cyprus University of Technology

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

SCENARIO 1 - GIRONA WALLS

The virtual visualisation of the middle-ages walls of the city of Girona

David Iglésias Franch, CRDI Ajuntament de Girona

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

Why 3D digitisation at Archives? – Memory Twins

Archive is primarily a space for preservation and custody

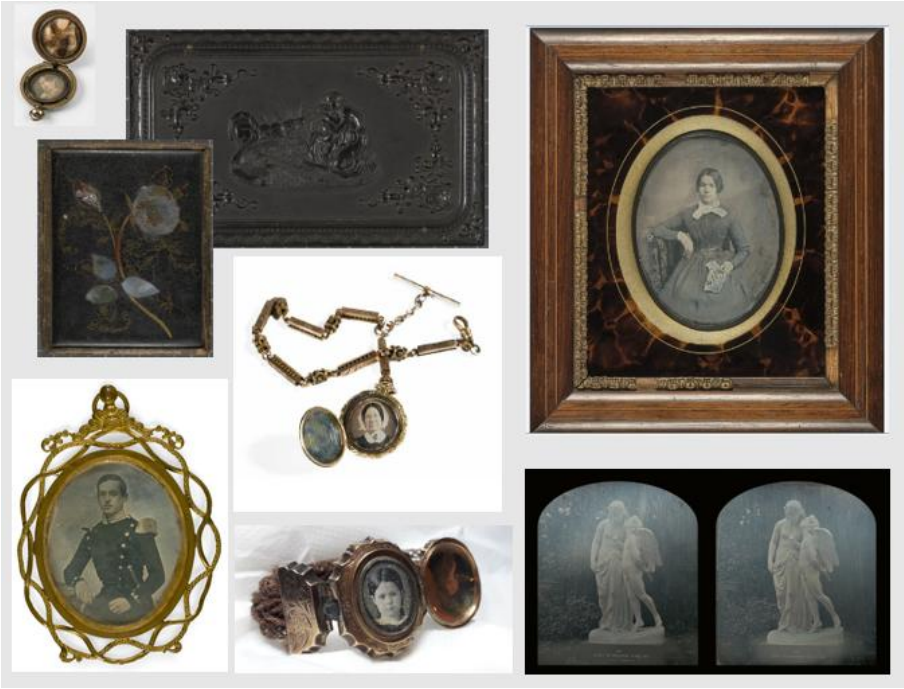
– it is also a space for **discovery**, **knowledge**, **experimentation**, and **creation**

– 3D digitisation, allows the representation of volumetric elements to provide a faithful representation for **analysis**, **research**, and **entertainment**

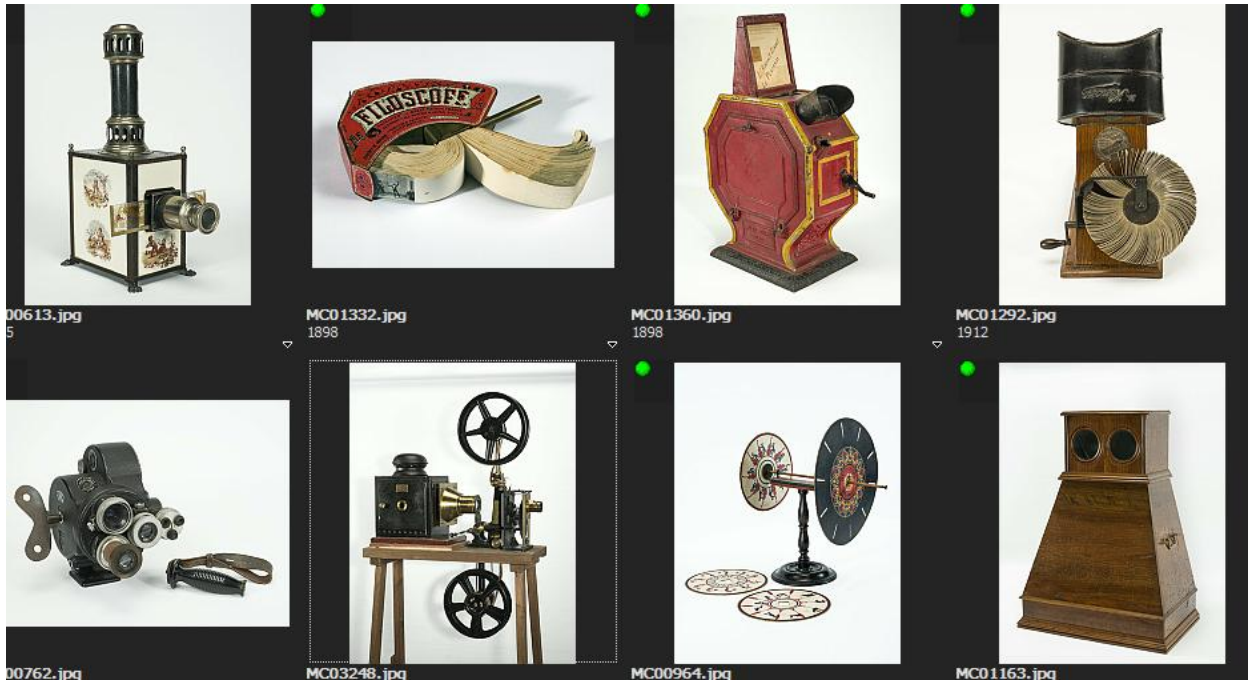
– Archives as a resource of knowledge related to our heritage. The main resource to create **Memory Twins**.

Previous experience

99 daguerreotypes from CRDI collection



50 objects from Cinema Museum Collection



Challenges

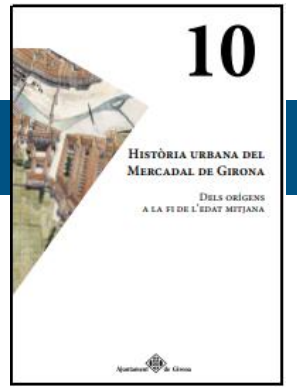
- ✓ **Achieving high-quality digital reproduction**. It requires skilled professionals, a working methodology, the ability to analyse the complexity of the objects to be reproduced, and criteria to assess the results.
- ✓ **Making the content accessible**, which requires not only well-documented objects, but also a specific infrastructure.
- ✓ **Preserving the 3D objects**. It requires the adoption of file formats, and paradata.

ANIVERSARY - 2100 years of History

Now that it has been **2,100 years** since the foundation of Girona by the Romans **(Gnaeus Pompey the Great, in 76 BC),** the city is considering the challenges of the future to debate and rethink what Girona should be like in the next century, that of 2100.

For more than twelve months, conferences, round tables and various events have been scheduled to face and build the future together from where we come from.

The research – The Urban History of Girona Collection

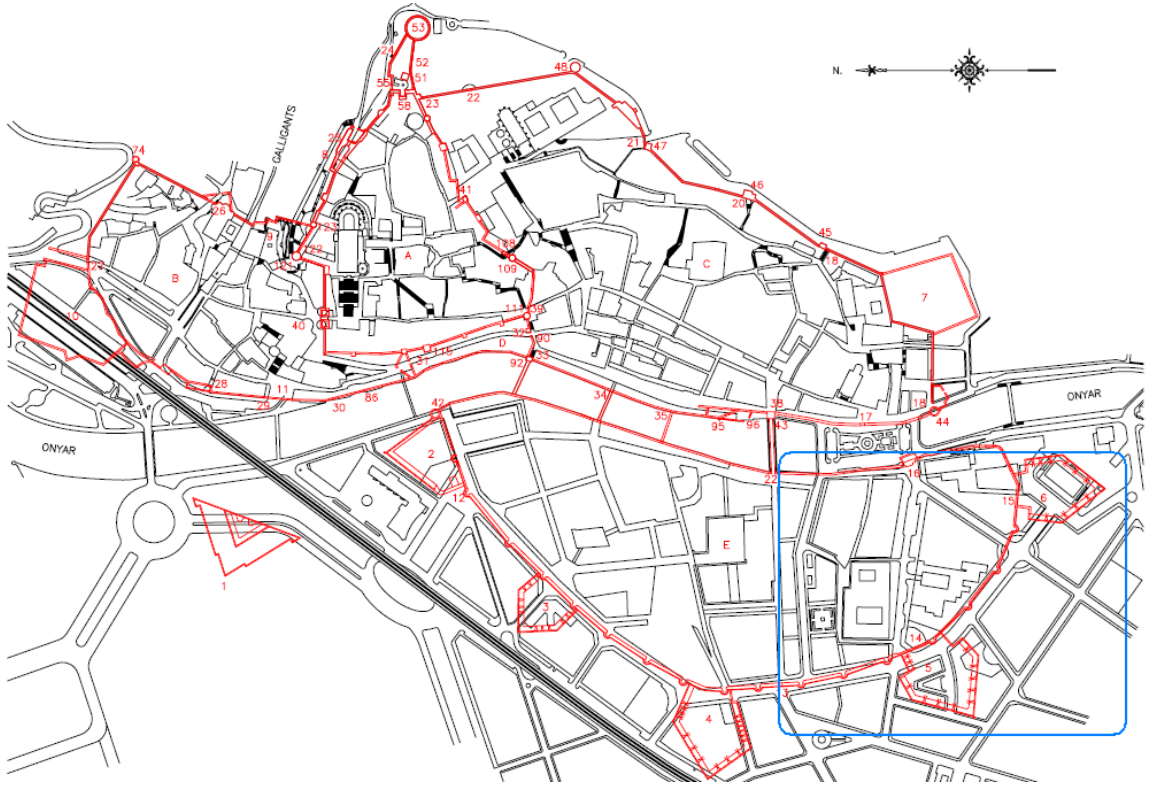


In the early 1990s, the **Urban History Research Group of Girona** was formed, with the aim of investigating the city's medieval past, especially its urban aspects, and of publishing these studies in a collection, edited by Girona City Council.

https://youtu.be/XPBAxxTv_vk

Co-funded by the European Union

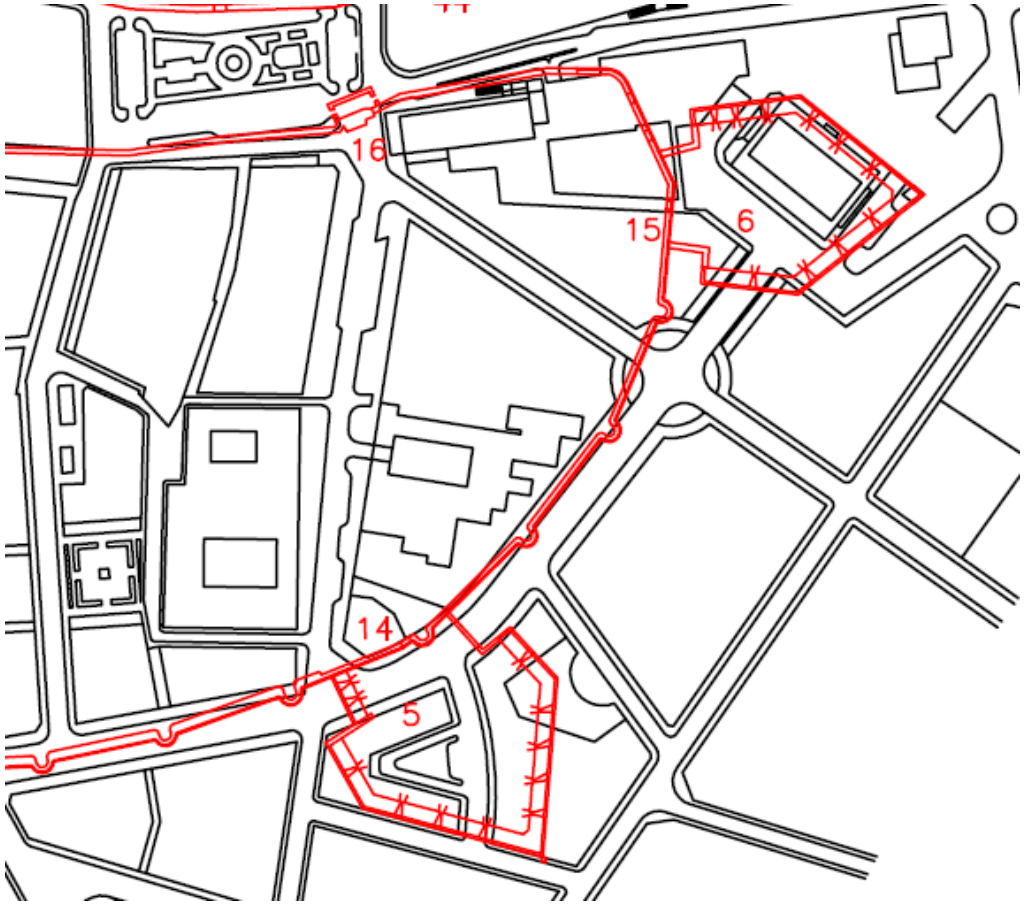
The project: Scenario 1

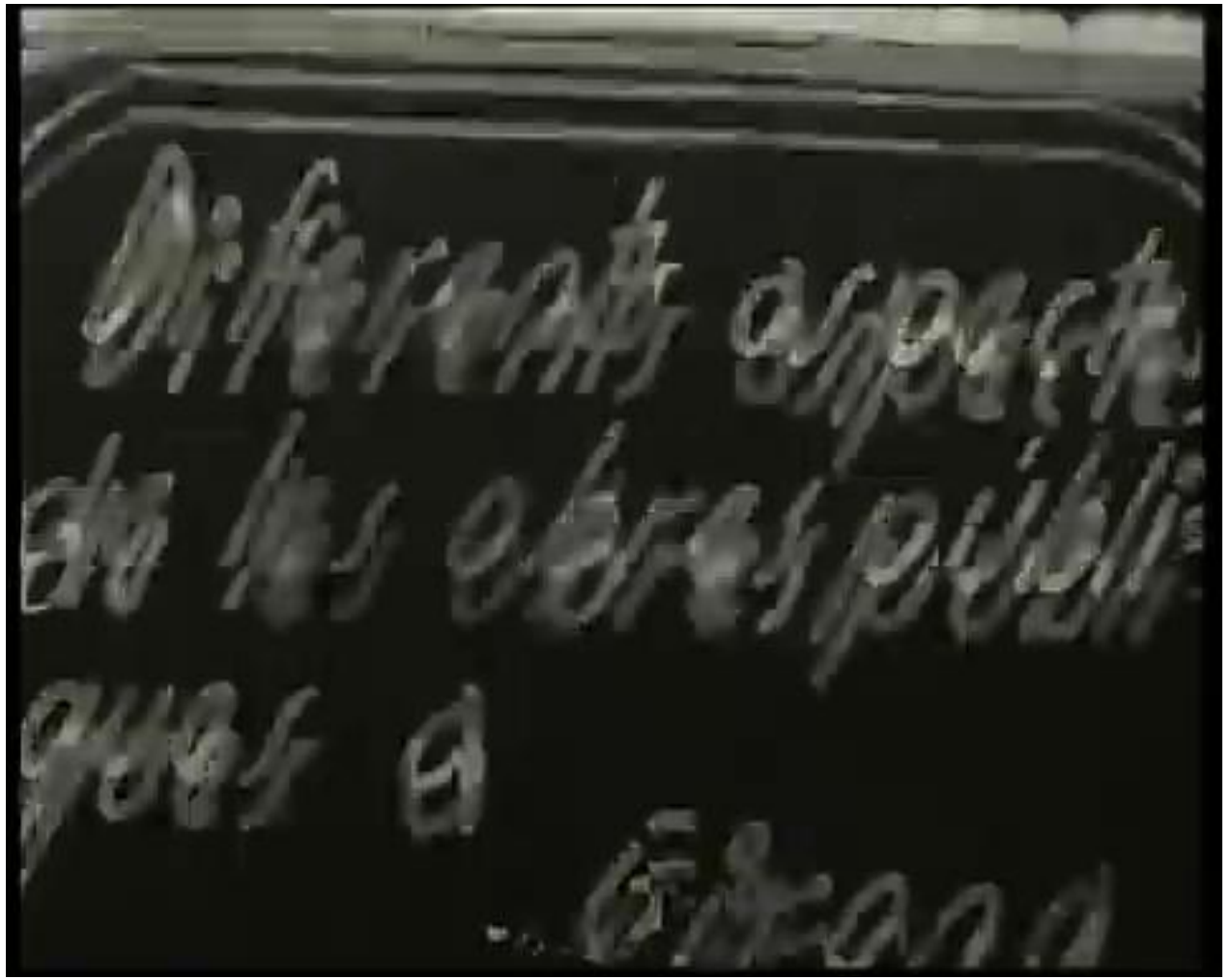


EUREKA3D XR

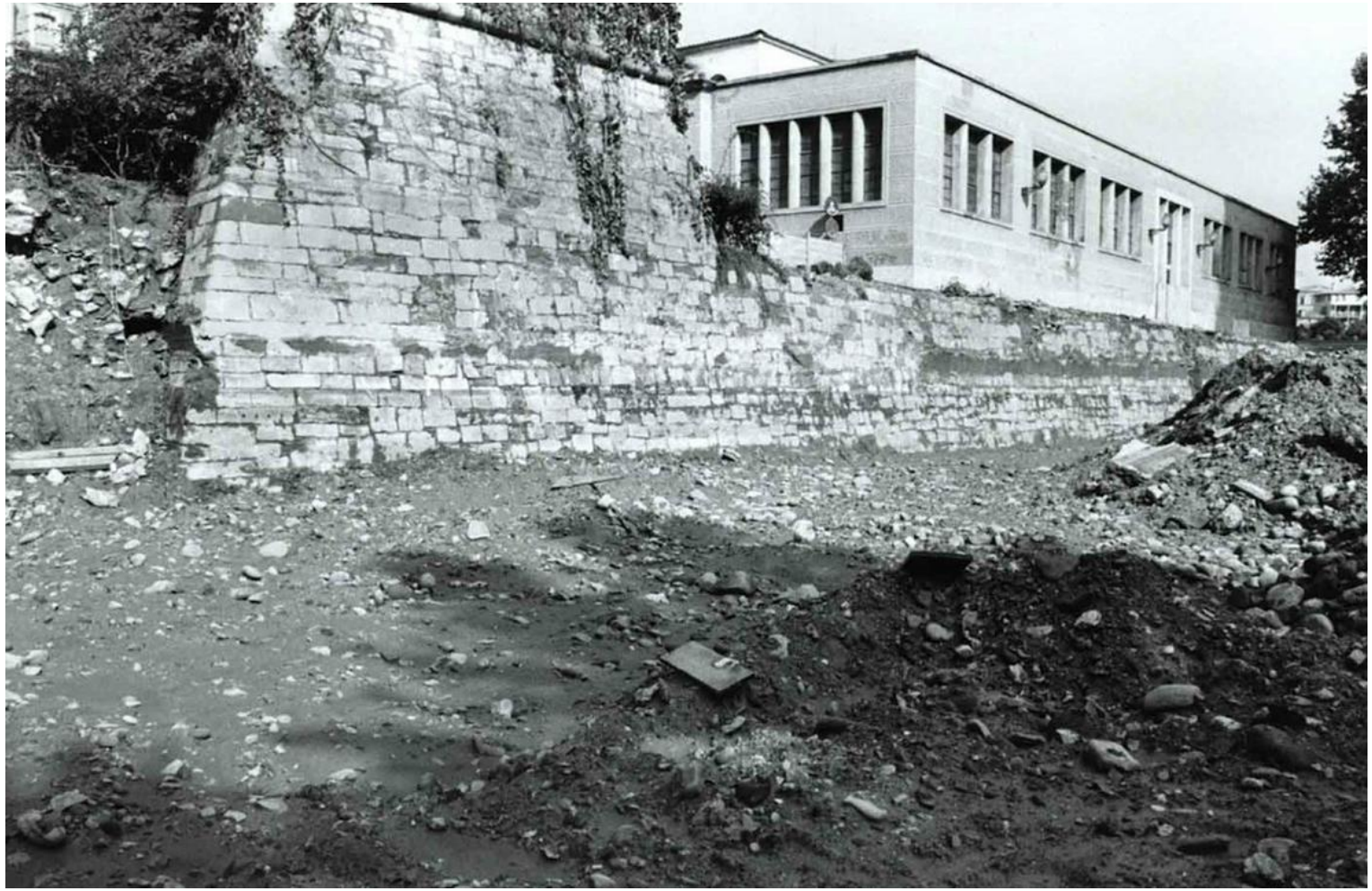
Co-funded by the European Union

The project: Scenario 1





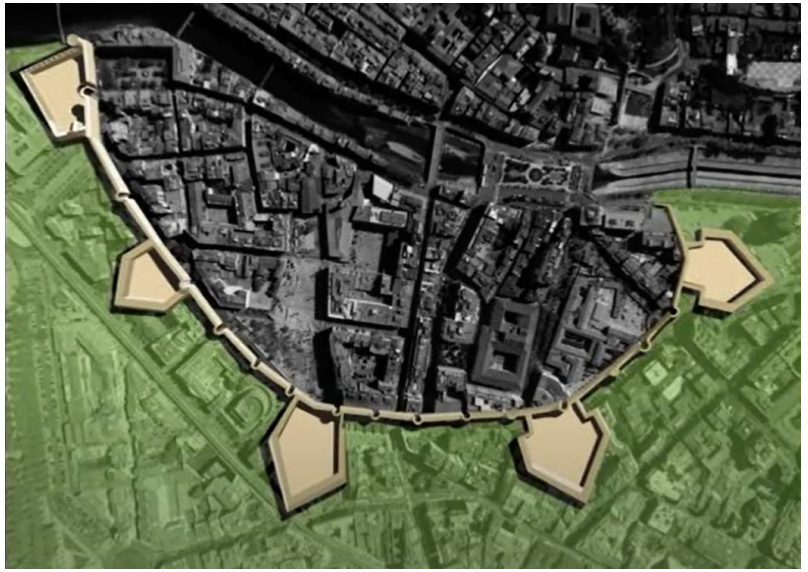
The project: Scenario 1



EUREKA 3D XR

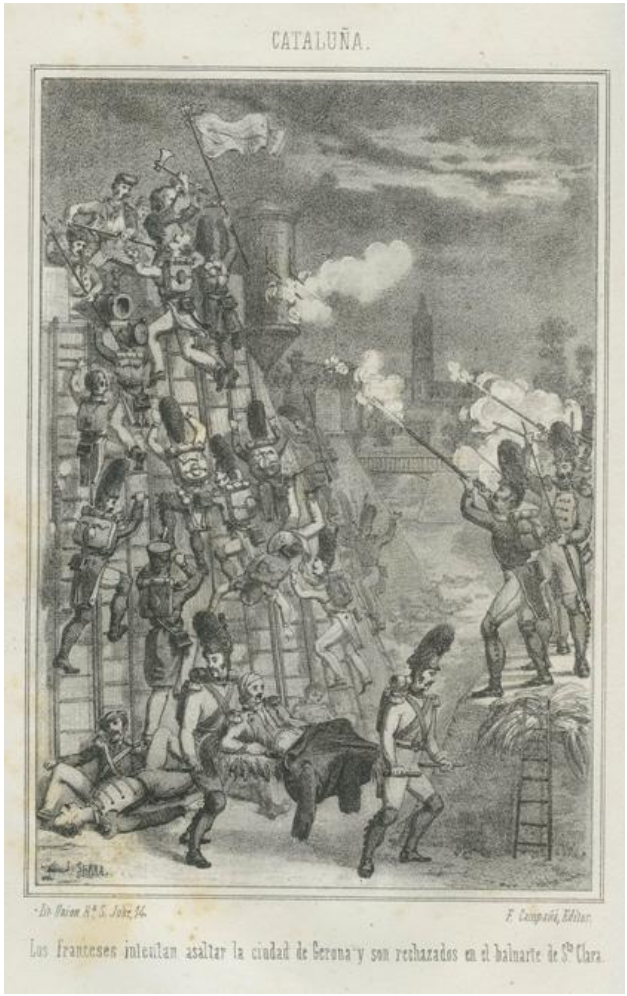
Co-funded by
the European Union

Visualization of the walls (2002)

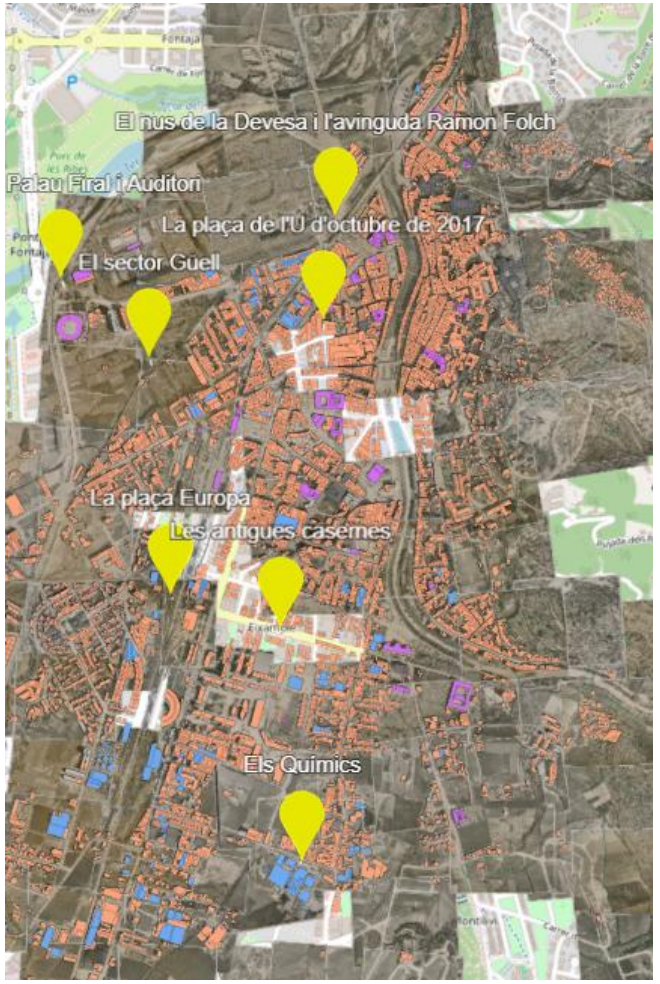


https://youtu.be/XPBAxxTv_vk

The records: engravings, photographs, audiovisuals, maps, text, …



Experience on re-use of photography and audiovisuals

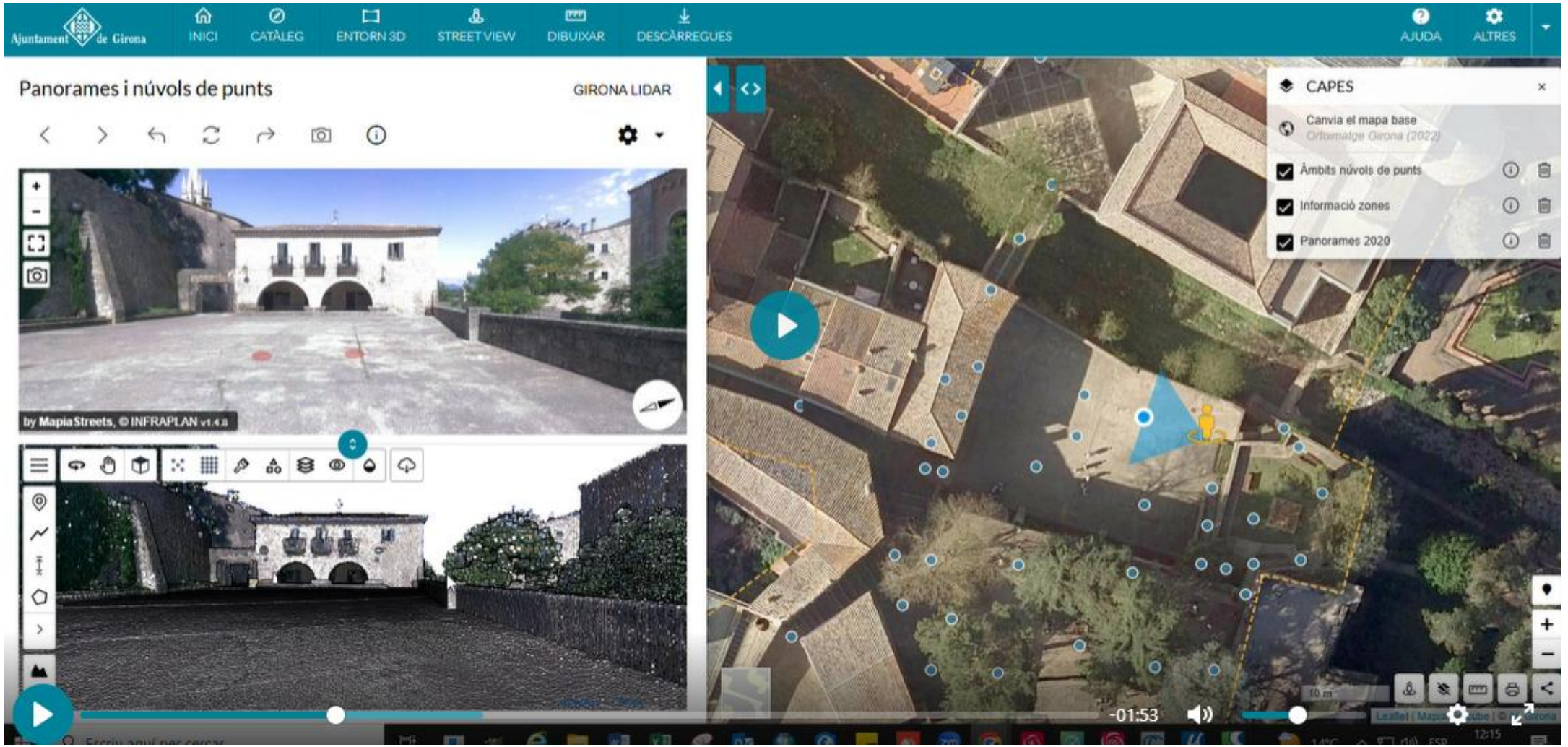


EUREKA 3D XR

https://umat.girona.cat/vu/mapa/cadastre1970/

Co-funded by the European Union

3D digitisation of monuments in Girona

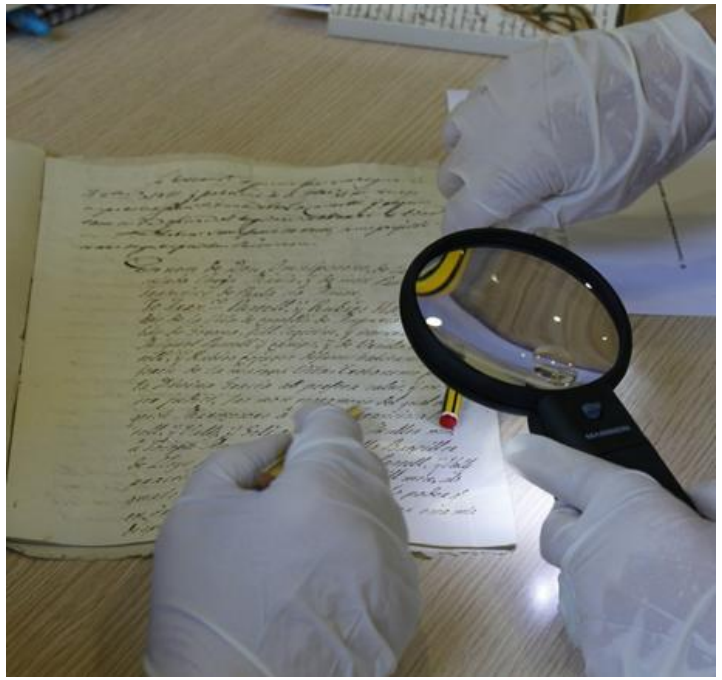


https://lidar.girona.cat/mapa/#/home

Co-funded by the European Union

THE PROJECT BEGINS

Next steps …



1. Archival research

2. 3D modelling. By Swing IT.

3. XR experiences using EUreka3D-XR tools

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

SCENARIO 2 - BIBRACTE ARCHAEOLOGICAL SITE

The AR narrative of archaeological excavations in the Celtic city of Bibracte

Vincent Guichard, BIBRACTE EPCC

Co-funded by the European Union

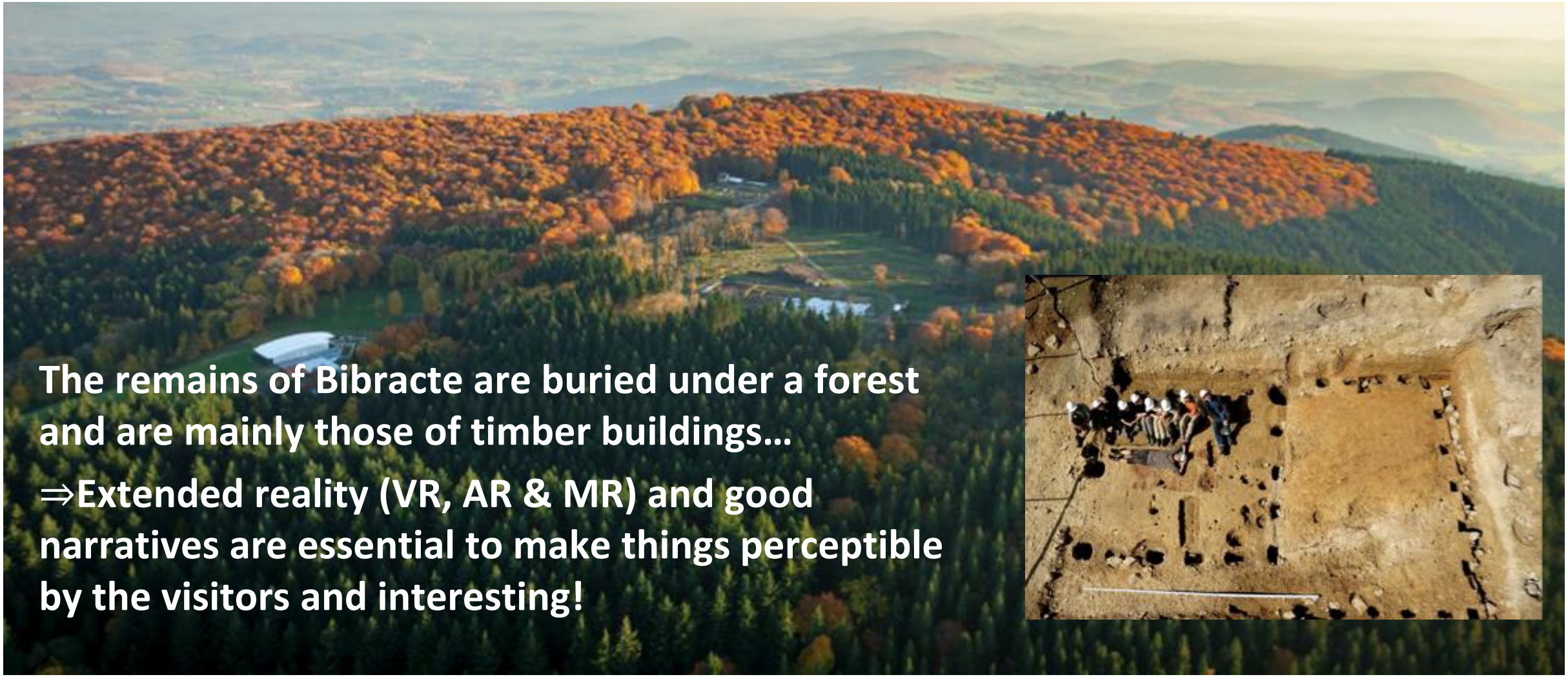
Official Media Partner
DIGITAL CULTURE
www.digitalmeetsculture.net

Bibracte

✓ The site of a town of the 1th century BC
✓ A major archaeological site in modern Burgundy intensively excavated in the 19th century
✓ Since 1984, an integrated site management system and a research project shared by different European universities

EUREKA 3D XR
Co-funded by the European Union

The XR challenges at Bibracte



The remains of Bibracte are buried under a forest and are mainly those of timber buildings…

⇒Extended reality (VR, AR & MR) and good narratives are essential to make things perceptible by the visitors and interesting!

EUREKA 3D XR

Co-funded by the European Union

The XR challenges at Bibracte

Extended reality and narratives are dealt in many different ways, esp.:

✓ Guided tours of the site, including excavations in progress

✓ A site museum showcasing the results of the excavations and replacing them in a European context

EUREKA 3D XR

Co-funded by the European Union

The XR challenges at Bibracte

… also using a wide range of mediation tools in the museum, like:

Physical models and dioramas ✓

3D projection on a physical model ✓

Interactive 3D augmented reality on a map ✓

The XR challenges at Bibracte

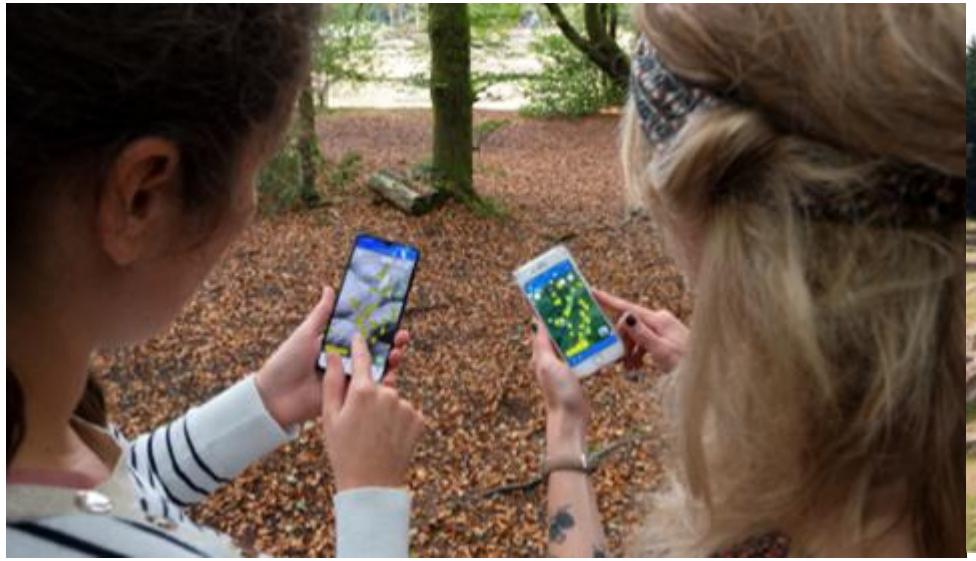
… and in field :

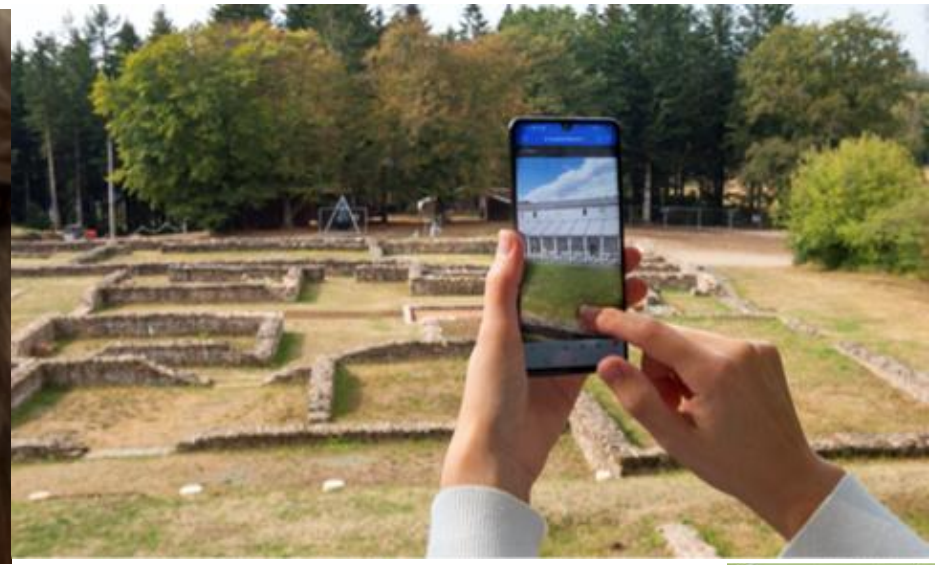
✓ Interpretation panels

✓ Physical models

✓ …

The XR challenges at Bibracte





… and in field (continued):

✓ A mobile app for a geolocalized tour of the archaeological site, also available as a webapp: https://boussole.bibracte.fr/
(Bibracte's compass, a proprietary solution relying on its own database)

✓ Powered by a CMS integrated with that of the bibracte.fr website

✓ Including a few 3D restitution sketches

The XR challenges at Bibracte

3D restitutions : sketches rather than illusionist restitutions
as archaeologists are unable to reconstruct precisely the volumes and the textures.

In the same way as the wooden models do it inside the museum, the graphic style of the restitutions should help the visitors to understand that they are facing a representation of the past, not the past itself

The XR challenges at Bibracte

All in all, visitors to Bibracte are proposed, to spend a full day at the site, including :

✓ A self-guided tour of the museum, assisted by an audioguide

✓ A “culinary archaeology experience” at Le Chaudron, the museum restaurant

✓ A guided tour of the archaeological site and/or workshops for children

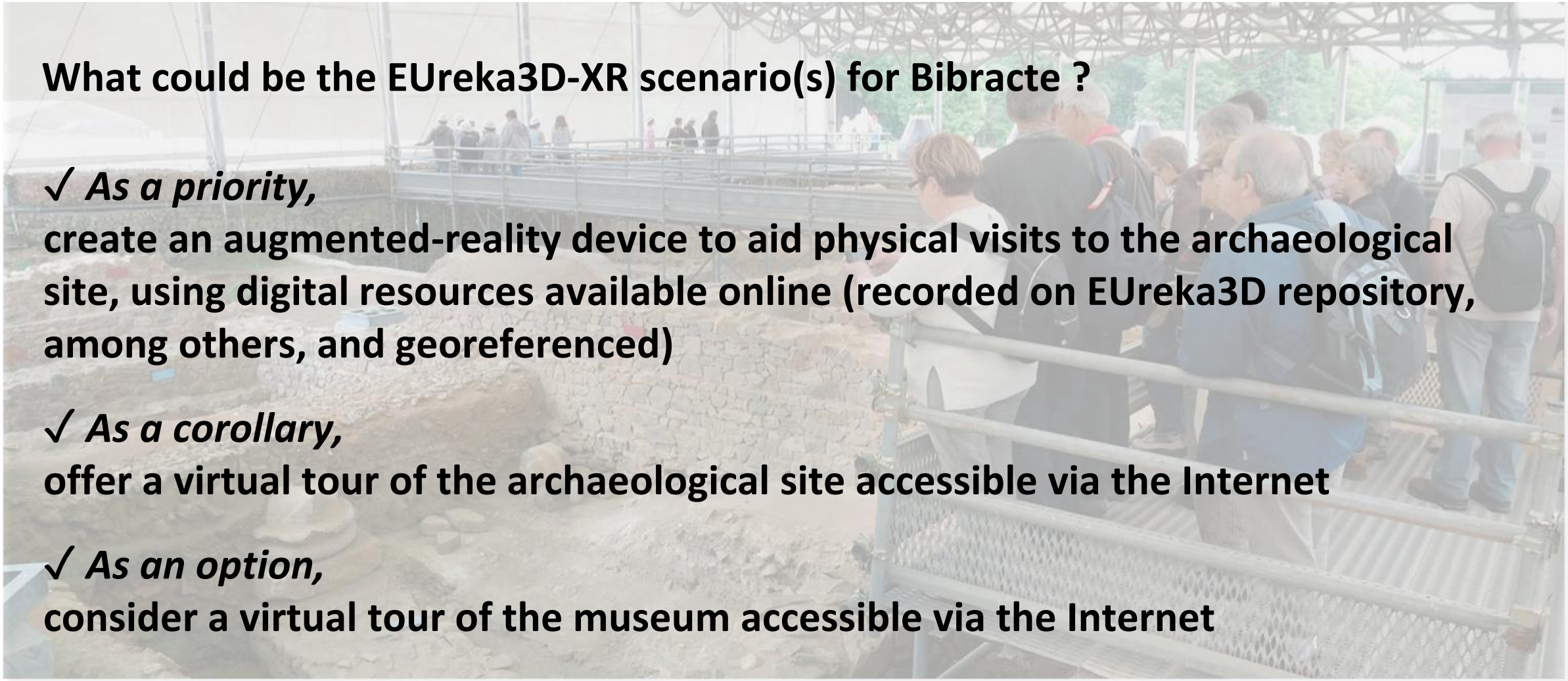
✓ Not forgetting a visit to the museum store.

Around 50,000 visitors benefit from this offer, but it's far from being available every day of the year. Just as many people visit the site, which is open-access, without any assistance.

These visitors are the priority target of the EUreka3D-XR scenario.

EUREKA3D XR
Co-funded by the European Union

The project: scenario 2



What could be the EUreka3D-XR scenario(s) for Bibracte ?

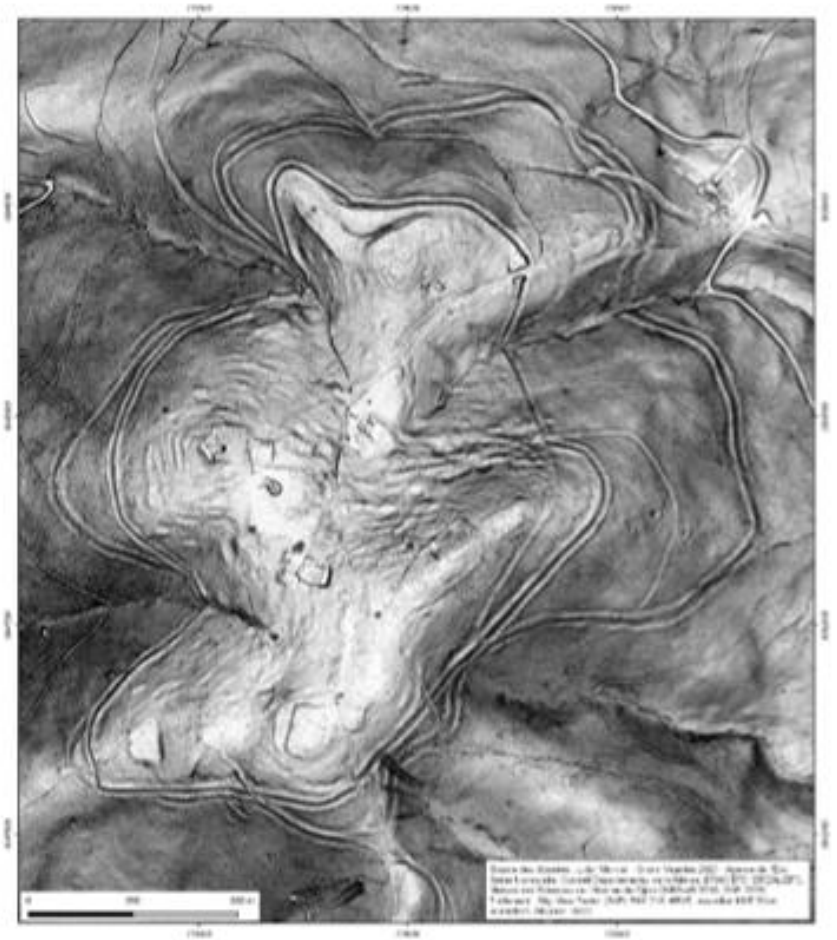
✓ *As a priority,*
create an augmented-reality device to aid physical visits to the archaeological site, using digital resources available online (recorded on EUreka3D repository, among others, and georeferenced)

✓ *As a corollary,*
offer a virtual tour of the archaeological site accessible via the Internet

✓ *As an option,*
consider a virtual tour of the museum accessible via the Internet

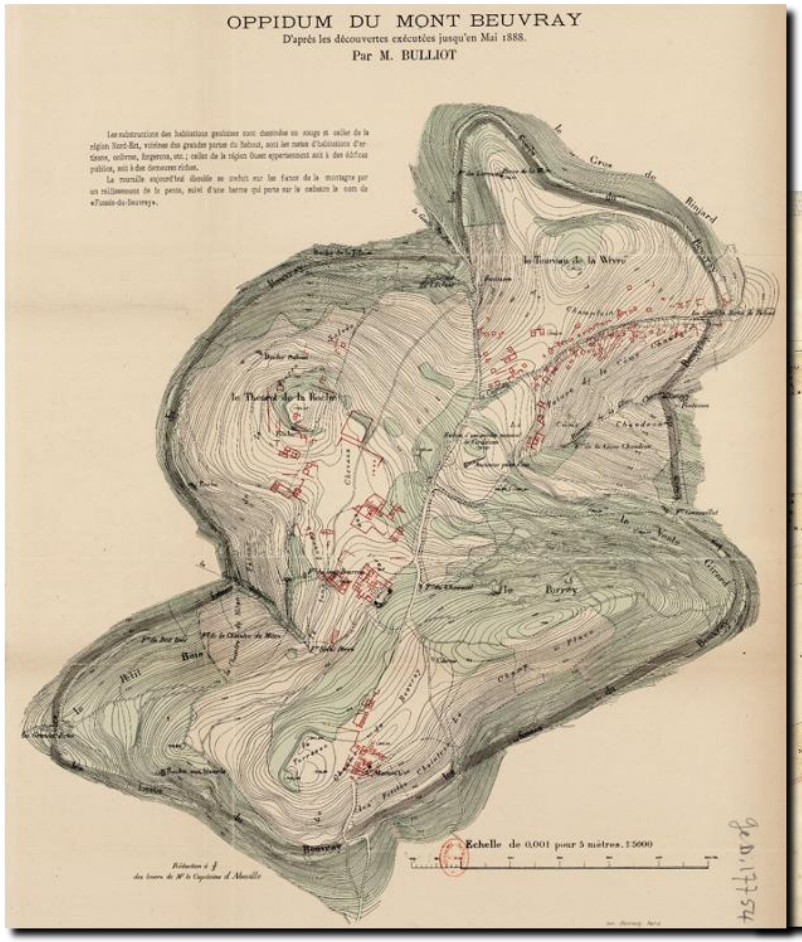
The project: scenario 2 - What kind of digital resources are available?

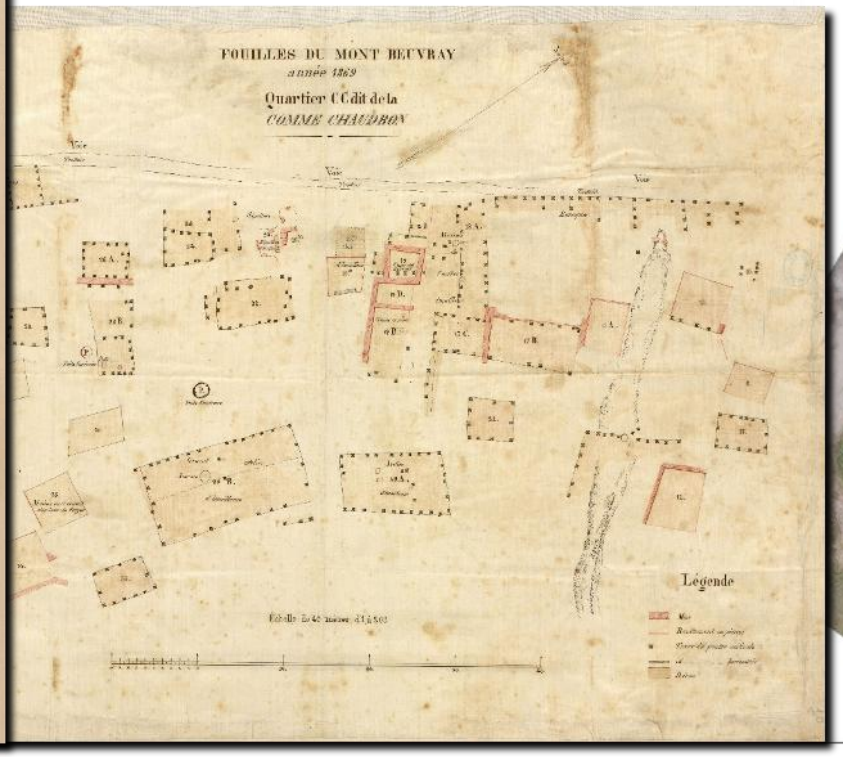
✓ A full high-resolution LIDAR model of the site (much better than Google Map!)



The project: scenario 2 - What kind of digital resources are available?

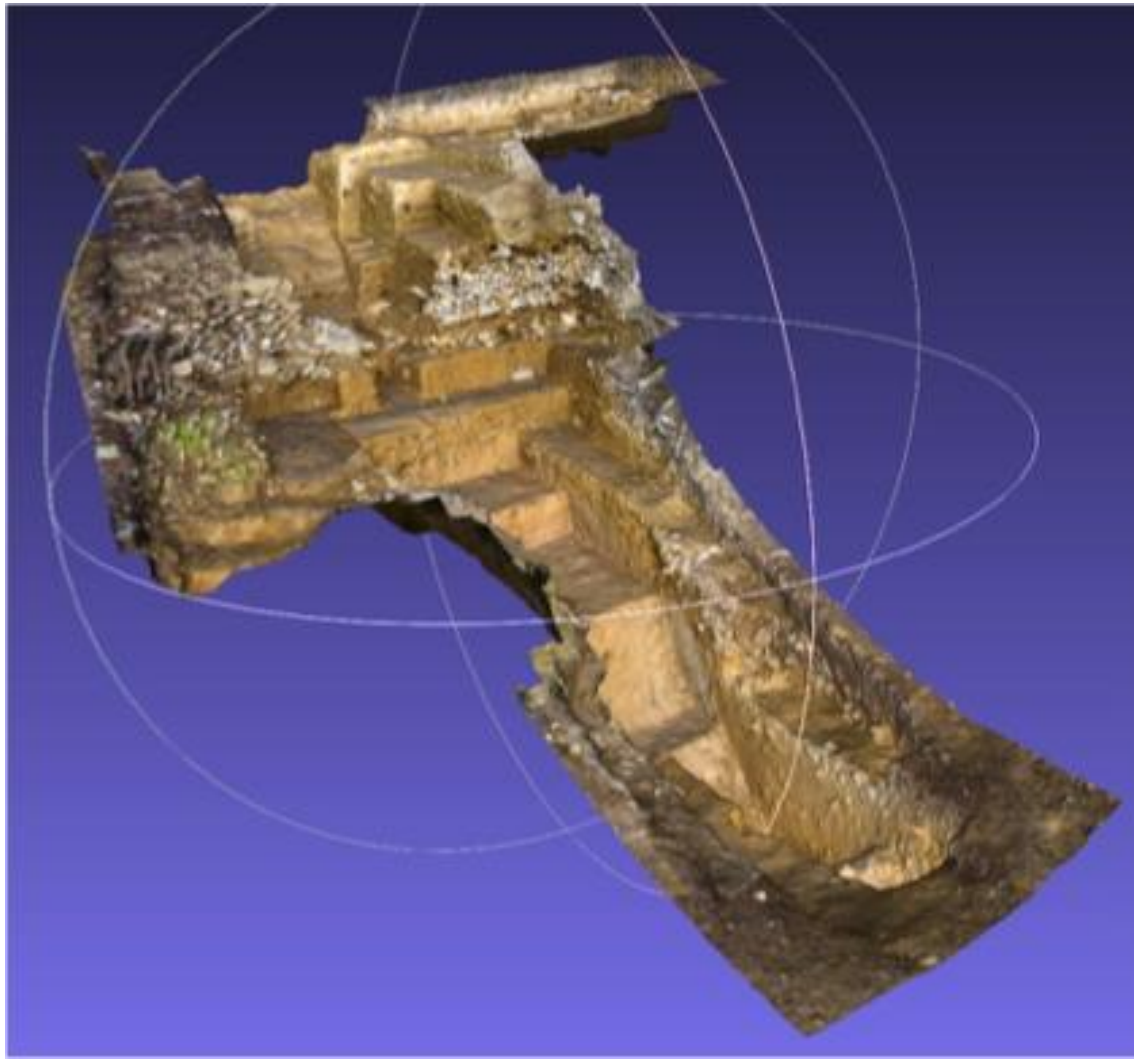
✓ **A wide range of site maps and field surveys, including many orthophotographs (to be converted to 3D models?)**





The project: scenario 2 - What kind of digital resources are available?

✓ Many 3D models of archaeological excavations



The project: scenario 2 - What kind of digital resources are available?

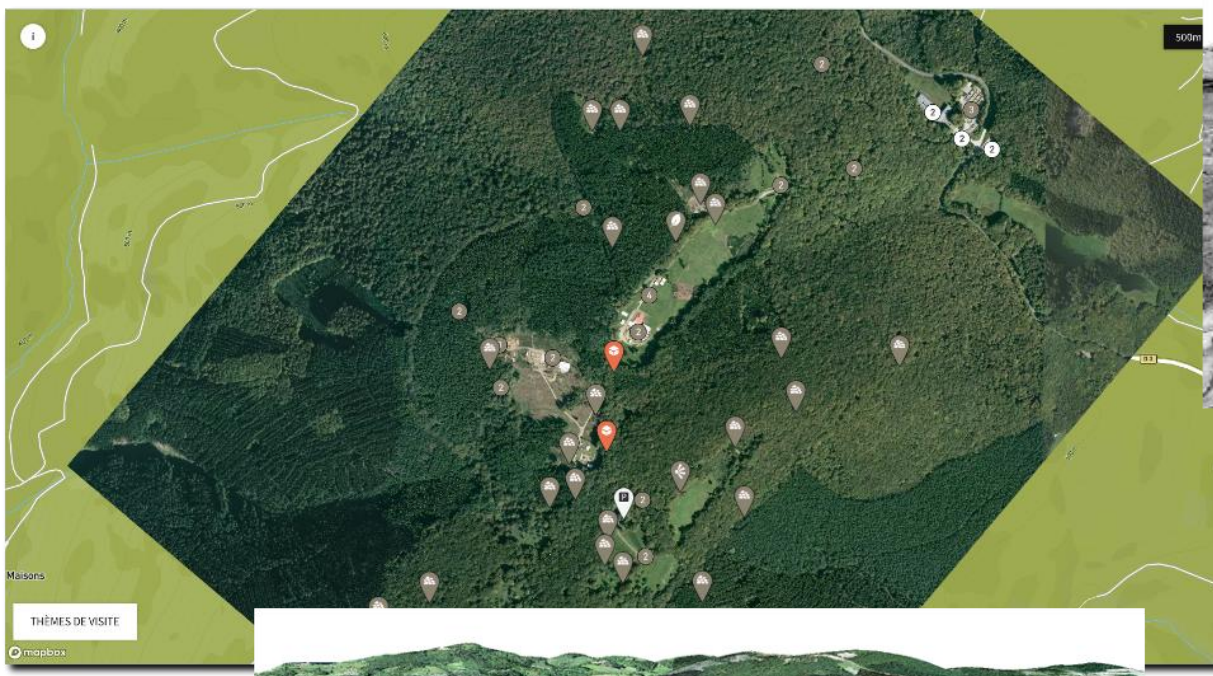
✓ 3D models of archaeological artifacts (130 were produced within EUreka3D)
and thousands of 2D pictures

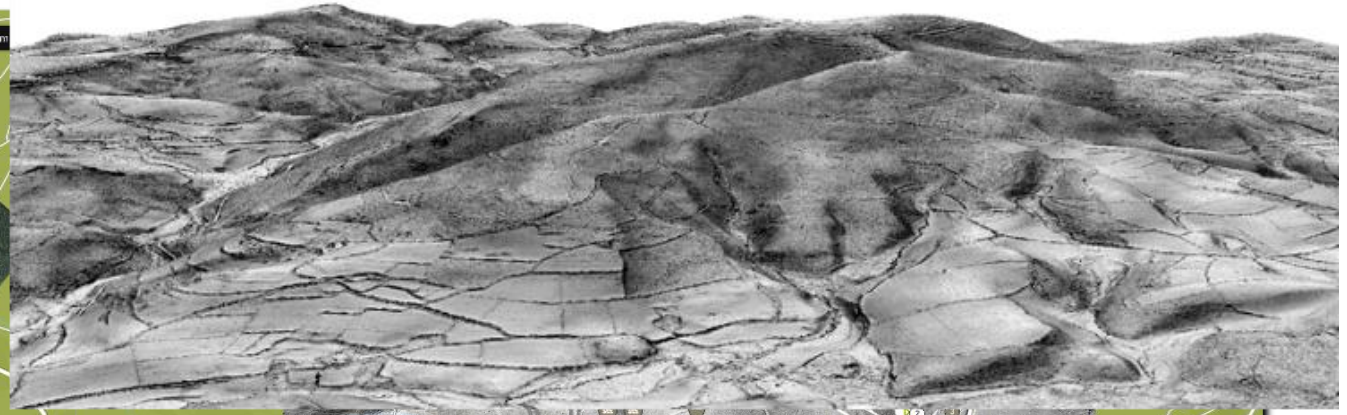
The project: scenario 2 - What kind of digital resources are available?

✓ All the interpretative content used in the museum & on the site (texts, images, videos, etc.)

The project: scenario 2 - What kind of narrative can we imagine?

✓ **Provide a better understanding of the topography and the evolution of the site**

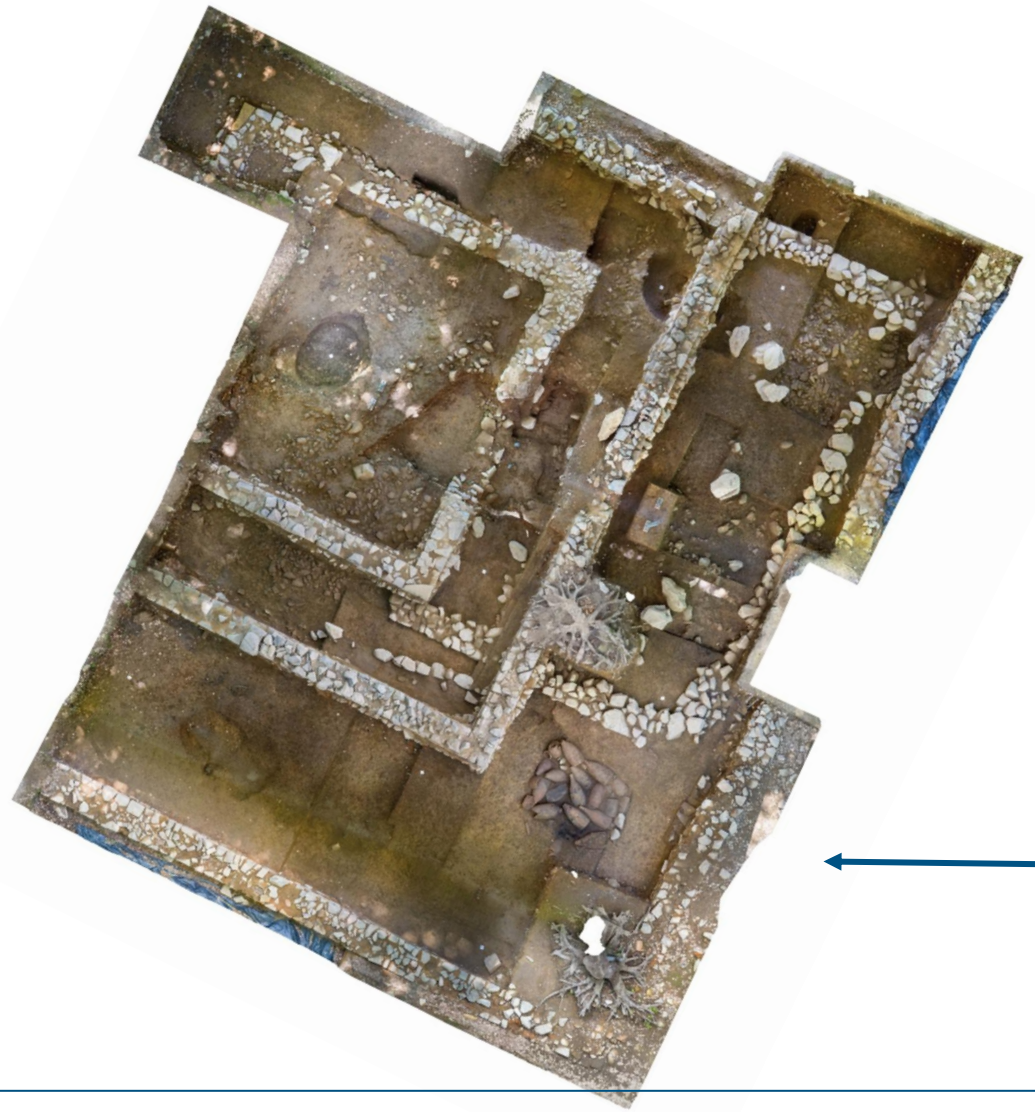




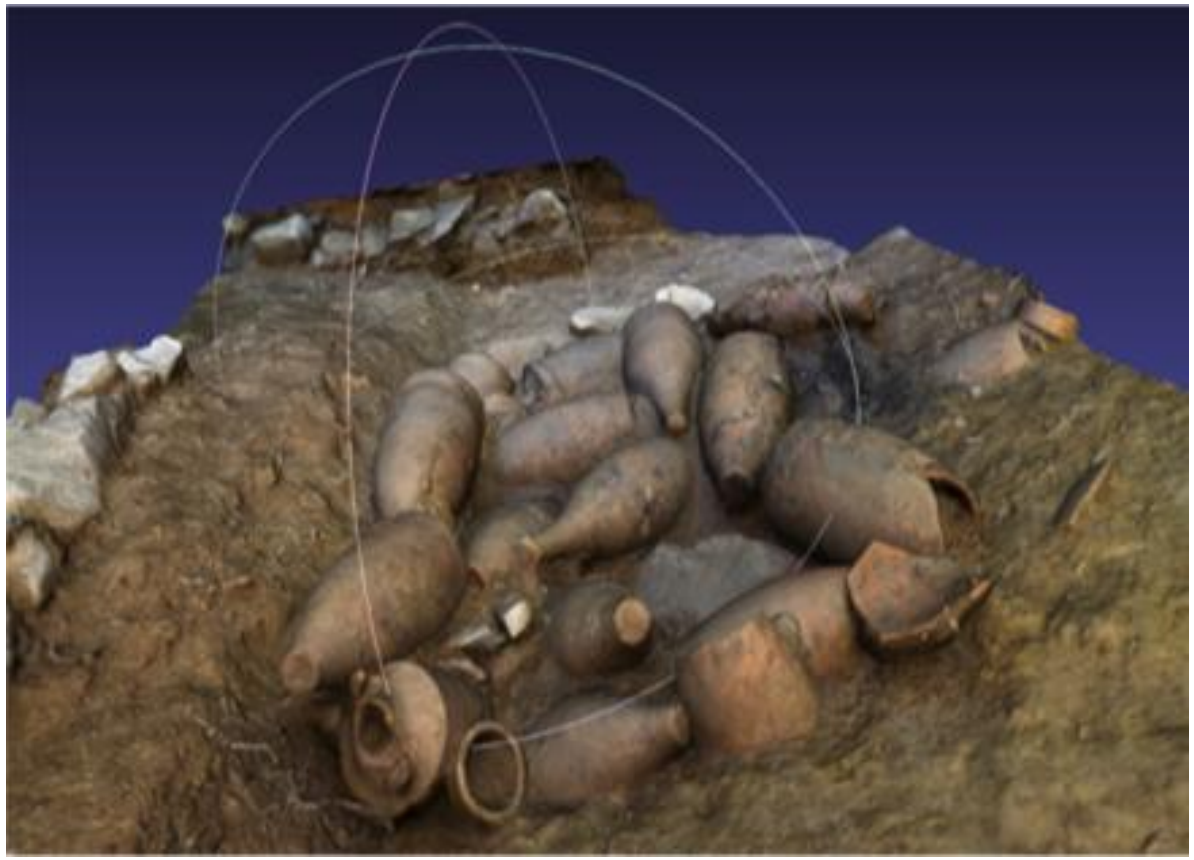
EUREKA 3D XR

Co-funded by
the European Union

The project: scenario 2 - What kind of narrative can we imagine?



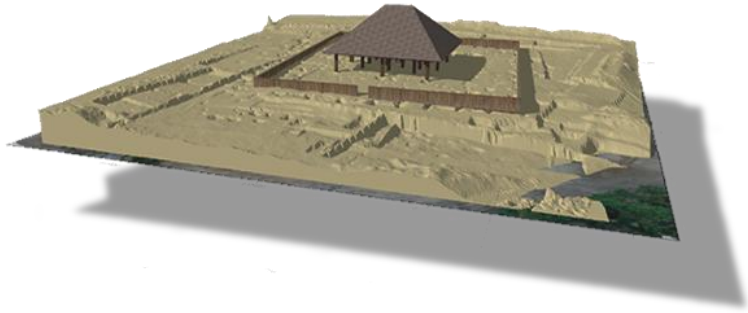
✓ **Show the invisible: backfilled excavations and details of past excavations**

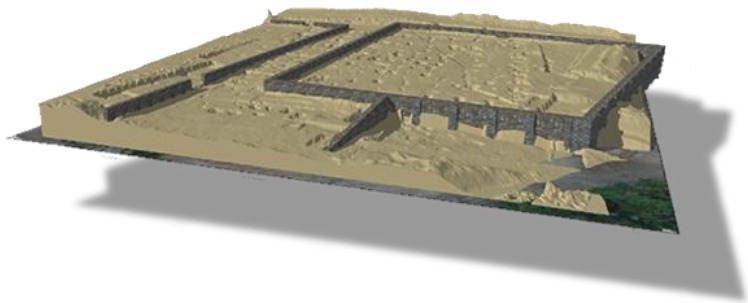


EUREKA 3D XR
Co-funded by the European Union

The project: scenario 2 - What kind of narrative can we imagine?

✓ **Show the invisible: the evolution of the site and the ancient buildings**





EUREKA 3D XR

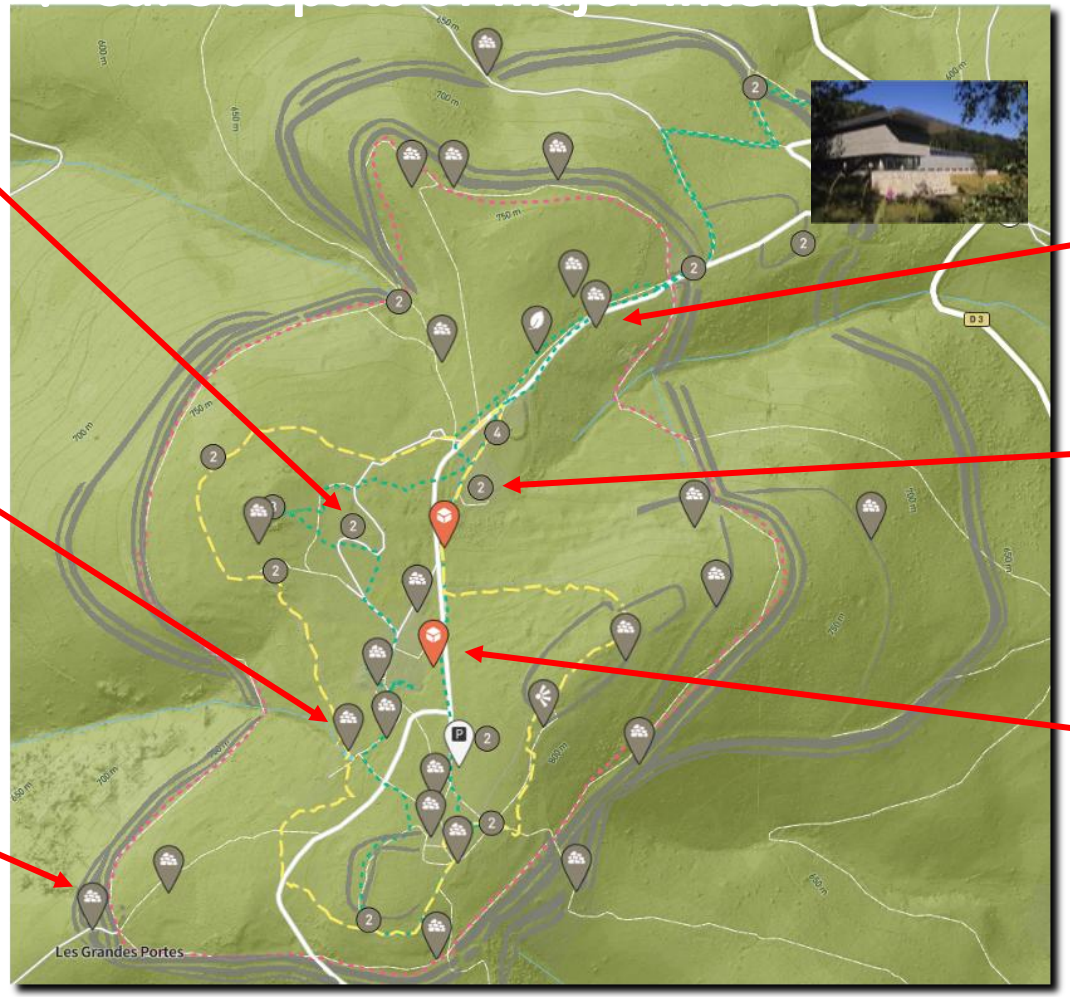
Co-funded by the European Union

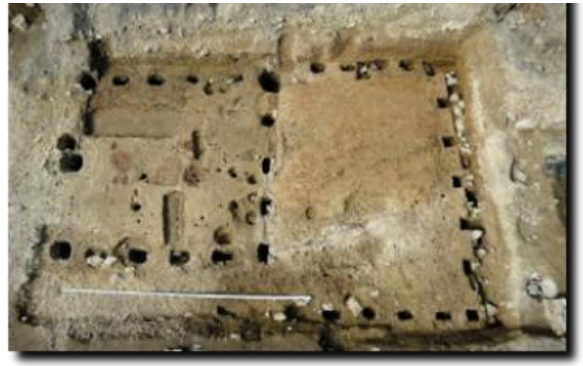
The project: scenario 2 - What kind of narrative can we imagine?

✓ **Show in the context of their discovery objects visible in the museum**

(and bring in the virtual visit of the museum the context of discovery of the objects on display)

The project: scenario 2 - Quantitative aspects





The project: scenario 2 - Expected results

✓ A **free tool** (combining online tool and tour application) enabling CHI to design geolocalized tours combining 3D and XR, more powerful than those already existing on the market (guidiGO, Playvisit & Mapme)

✓ A **multiplied impact** through capacity bulding actions aimed at:

. regional museums and heritage sites, via the régional heritage and digital network (90 actors),

. national museums, archaeological sites and independent cultural mediators via the PREAC (Pole for artistic and cultural education) network (1,200 contacts),

. european museums and archaeological sites via Bibracte's European networks(15 actors).

Designed by macrovector / Freepik

EUREKA 3D XR

Co-funded by the European Union

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

SCENARIO 3 - Saint Neophytos, CYPRUS

The creation of a new virtual life of Saint Neophytos' Enkleistra in Cyprus

Marinos Ioannides,

UNESCO Chair on Digital Cultural Heritage

Cyprus University of Technology

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA 3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

CYPRUS

Member
of the EU since 2004

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

The Monastery of Saint Neofytos

Co-funded by the European Union

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

The Monastery of Saint Neofytos

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

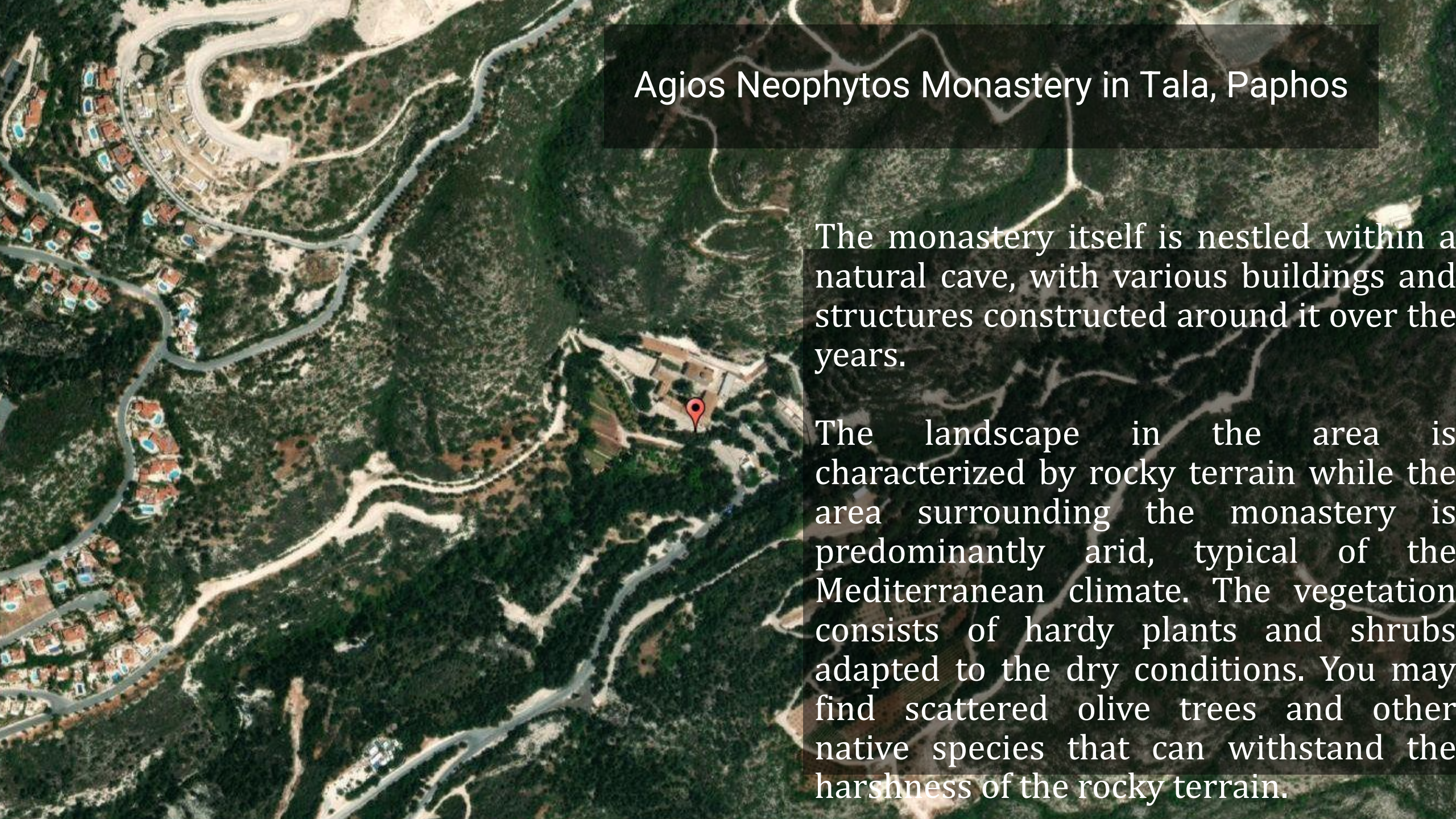
St Neophytos Enkleistra

- **The site of a monastic community established in the 12th century AD**
- **A series of 4 interconnected caves carved out of a cliff face by hand**
- **A site of significant religious and historical importance but with poor accessibility**

A monument at risk from environmental change and touristic activity

Co-funded by the European Union

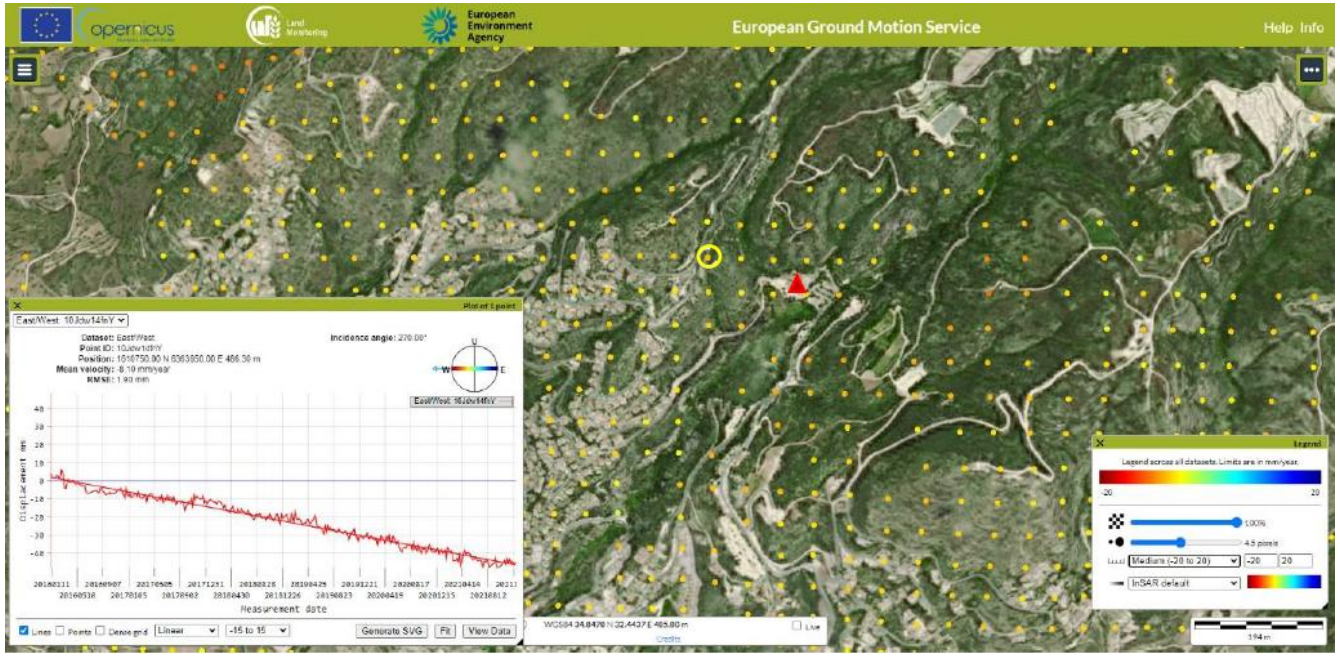
Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net



Agios Neophytos Monastery in Tala, Paphos

The monastery itself is nestled within a natural cave, with various buildings and structures constructed around it over the years.

The landscape in the area is characterized by rocky terrain while the area surrounding the monastery is predominantly arid, typical of the Mediterranean climate. The vegetation consists of hardy plants and shrubs adapted to the dry conditions. You may find scattered olive trees and other native species that can withstand the harshness of the rocky terrain.

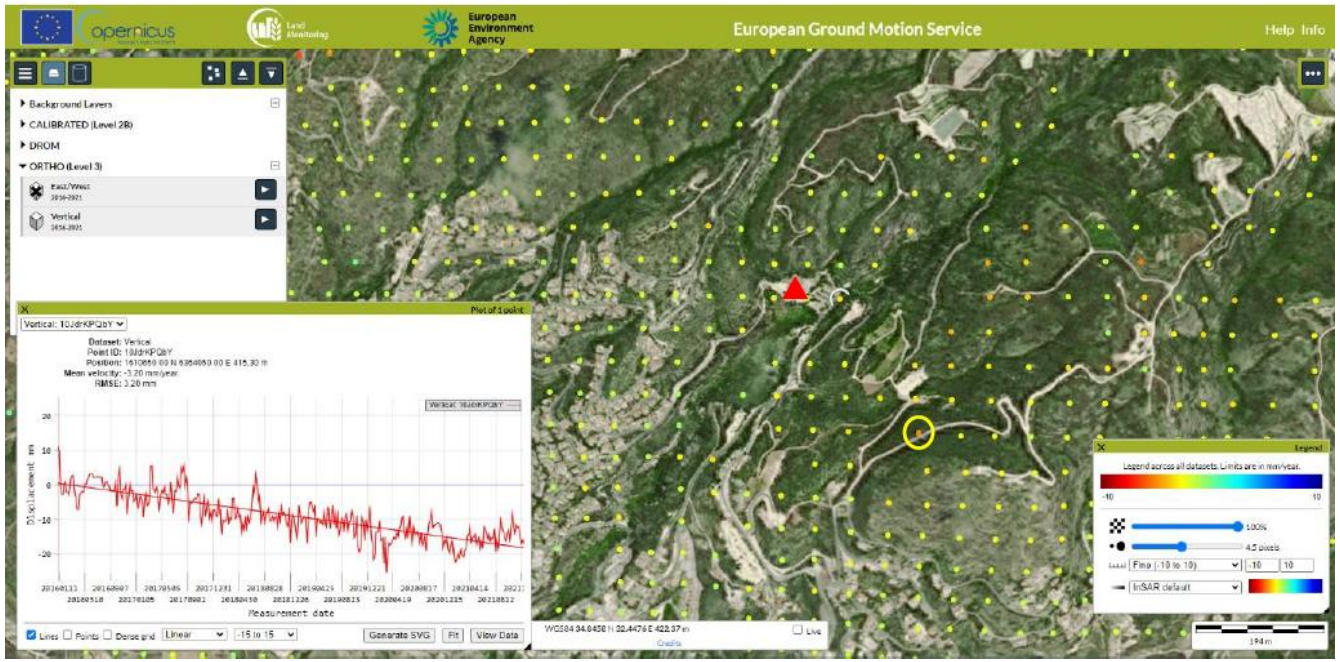


Horizontal Displacement

Average of -8 mm per year is occurred at the location of the monastery

A total of -40 mm displacement west of the monastery in year 2021

Agios Neophytos Monastery in Tala, Paphos



Vertical Displacement

Average of -3.2 mm per year

-16 mm displacement in year 2021 at the location of the monastery

250 m near the monastery – top of the hill = -20 mm in year 2021.

the European Union

DIGITAL CULTURE
www.digitalmeetsculture.net

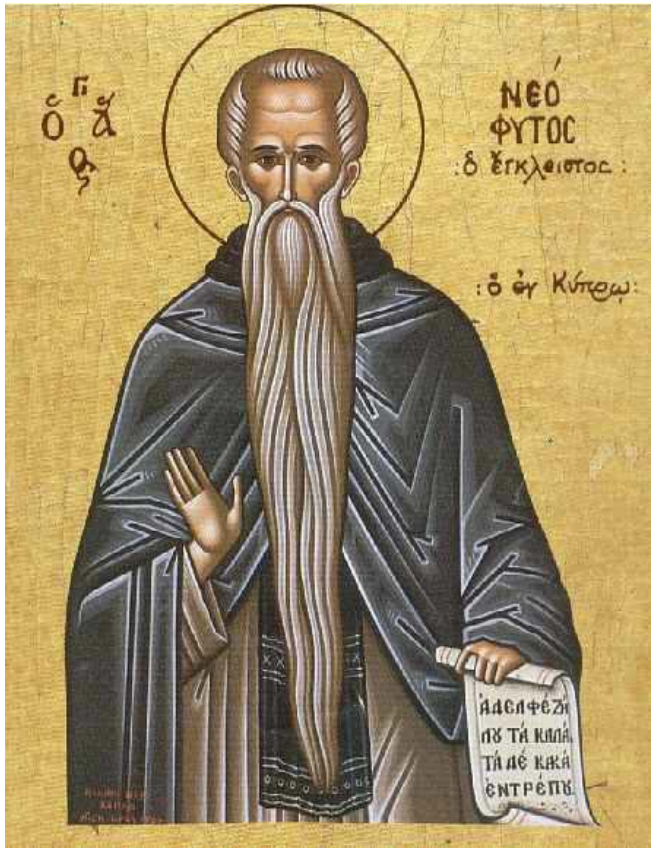
Turning back time with EUreka3D-XR

Turning back time with EUreka3D-XR

The Vision

Transport the viewer back to the time of St Neophytos

- Recreate the enkleistra (hermitage caves) to their state circa 1214 AD
- Populate the enkleistra with digital representations of the monks
- Stage a partial recreation of St Neophytos' liturgy in the virtual space
- Enable the real monks to tell the history of the enkleista through their digital representations
- Allow the viewer to ask the digital St Neophytos questions about his life and times



EUREKA3D XR

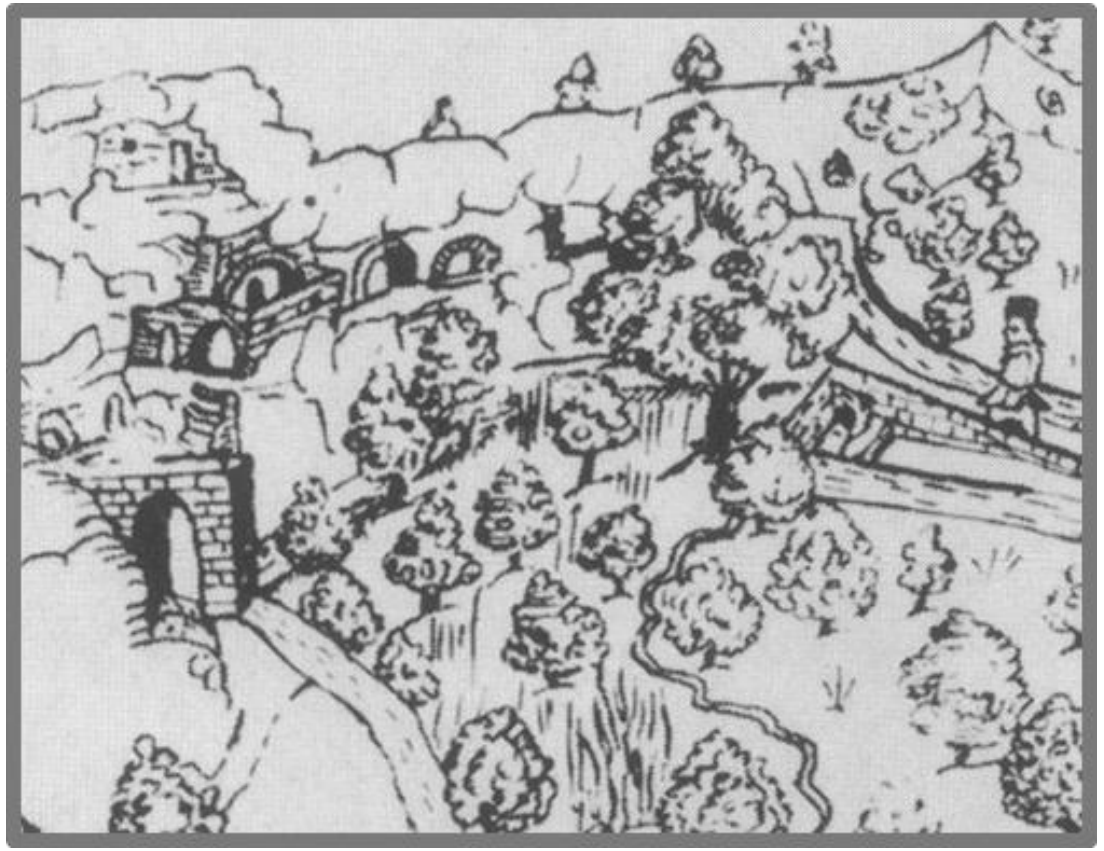
Co-funded by the European Union

Turning back time with EUreka3D-XR

The Process

Reuse High-Quality MemoryTwin assets to create a new visitor experience

- Assess the current digital assets identifying relevant components to the narrative
- Directly engage the monastic community to tell the history of the saint and the religious community he founded
- Work to resolve visulisation challenges of restoring frescos, architectural elements and artifacts that are now absent
- Explore how far current technology can be used to create a sense of embodiment and emotions engagement with CH

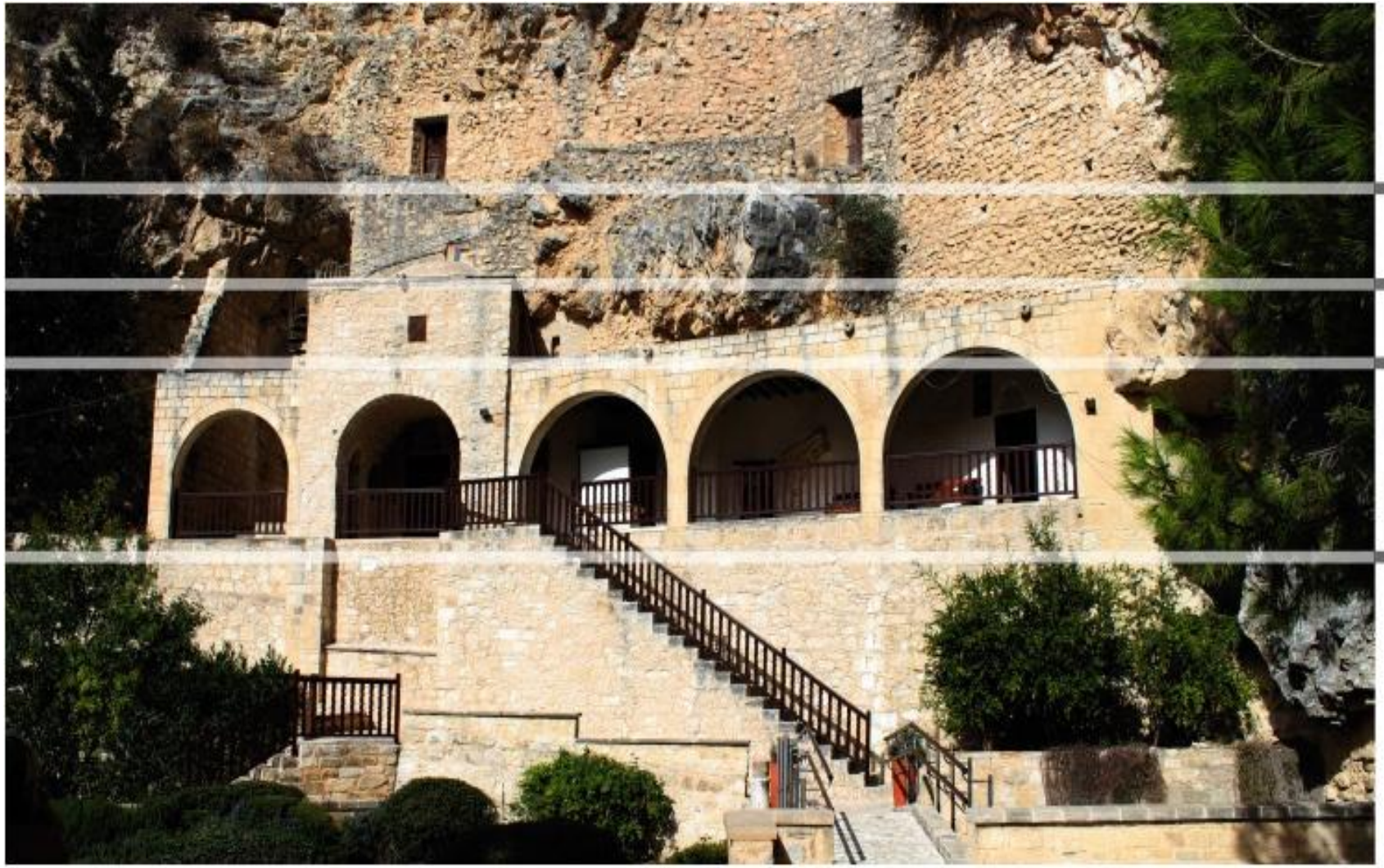


The Purpose

To Extend the EUreka3D model into the Cross Realty Domain

- Provide access to the monument though XR implementation
- Develop new methods for exploring cultural heritage data (exploiting MemoryTwin repositories)
- Engaging communities in line with CARE principles
- Aligning dissemination to the ICOMOS Principles of Saville and the London Charter

The Challenges



LEVEL 4:
(left to right)
New Zion, Saint John the Baptist cell

LEVEL 3: Hagiasterion

LEVEL 2: Sacristy

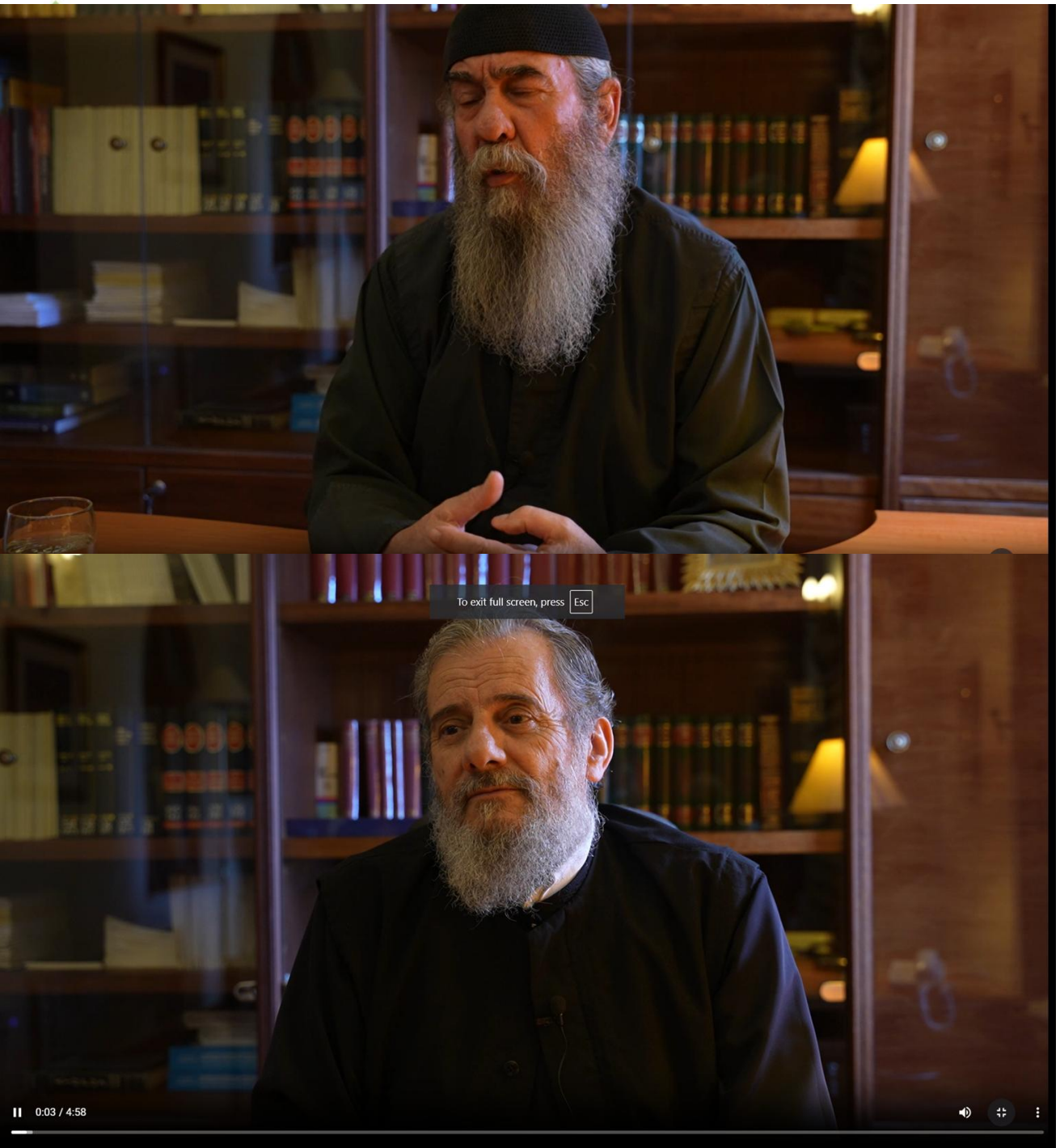
LEVEL 1:
(left to right)
Naos, Bema, Cell, Refectory.
open spaces: Kitchen, Narthex, beranta

LEVEL 0

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net

Storytelling



EUREKA3D XR

COMMON EUROPEAN DATA SPACE FOR CULTURAL HERITAGE

THANK YOU

Questions, Remarks, Comments

Co-funded by the European Union

Official Media Partner
DIGITALiCULTURE
www.digitalmeetsculture.net