



Funded by
the European Union



ENIGMA

Endorsing safeguarding, protection, and
provenance management of cultural heritage

Pilot Case 2

Identification and Tracing of
Unregistered Cultural Goods

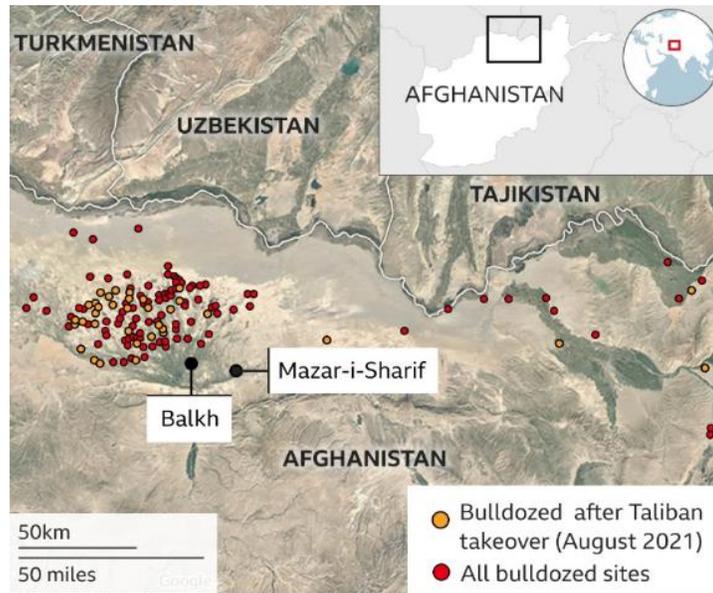


The ENIGMA consortium



The ENIGMA Project

- ENIGMA is a Horizon Europe EU-funded research project, 12 partners, 2023-2025
- Endorsing safeguarding, protection & provenance management of cultural heritage
- Main threats to Cultural Goods consist of armed conflict, natural disasters and human actions.
- Small cultural objects are one of the most illicitly traded, forming a specific focus for ENIGMA.
- Thus, ENIGMA works closely with Law Enforcement Agencies (LEAs), museums and cultural experts.



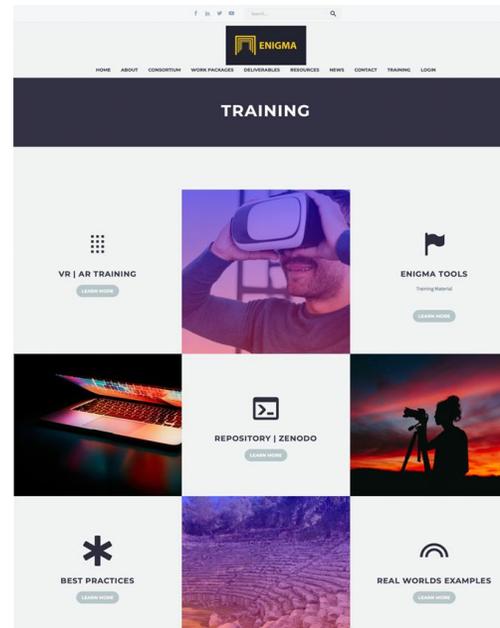
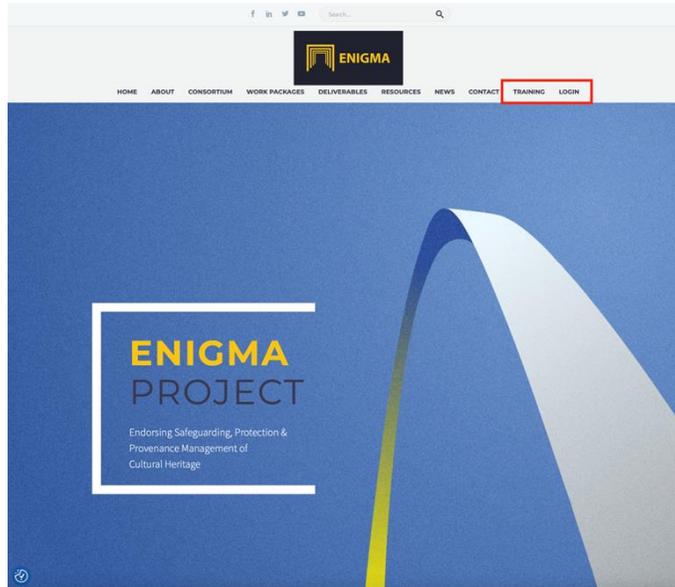
Source: University of Chicago. Image: Google, CNES/Airbus



ENIGMA's Objectives

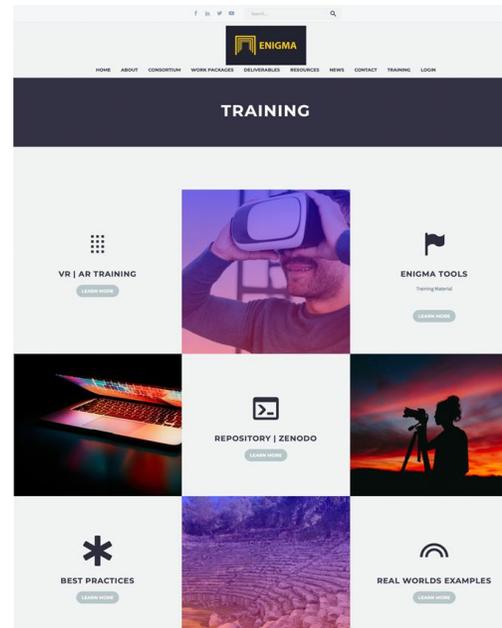
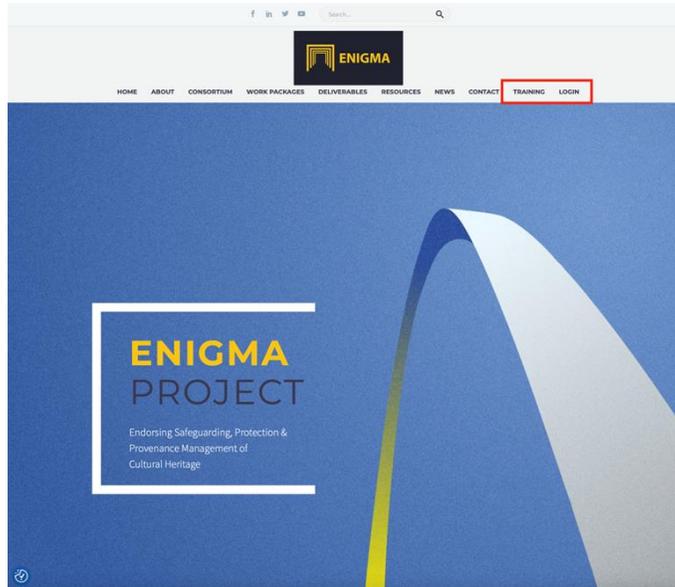
ENIGMA develops tools and technology to help in the fight against looting and the illicit trade and excavation of cultural goods.

- ENIGMA will help to protect cultural goods and artefacts by:
 - Co-designing an authenticity concept for authentication, identification and provenance of cultural goods
 - Use satellite earth observation to monitor heritage sites
 - Develop a decision support platform, validated through pilot cases, for law enforcement agencies and cultural experts.



Learning Objectives (LOs)

- LO1: Recognize the value of the ENIGMA platform and tools for professional settings
- LO2: Categorize and organize information in real-world simulations and scenarios
- LO3: Assess and formulate ENIGMA workflows to enhance performance
- LO4: Apply ENIGMA tools to facilitate collaboration in protecting cultural goods

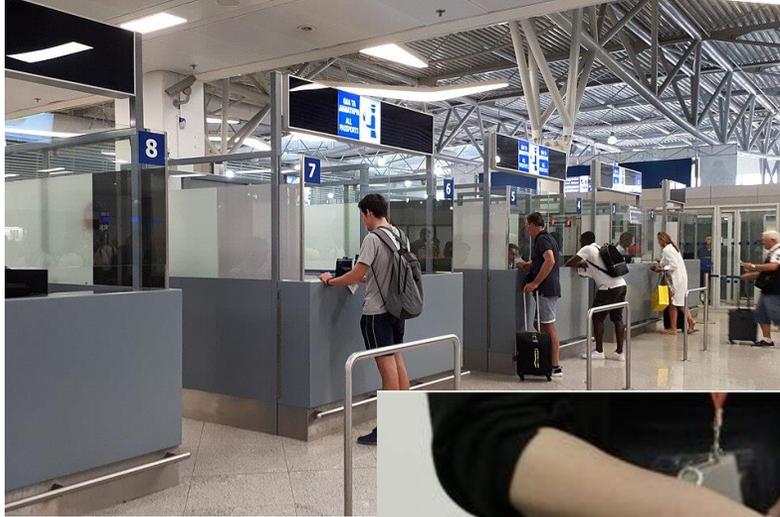


Further Training Resources

Please find further learning materials on the ENIGMA website: eu-enigma.eu (register/login)

- Training manuals
- Training videos
- Best practices
- Real-world examples
- VR learning environment

Public Domain image



Pilot Case 2: What?

- The dominant cases of smuggling and illicit trade consists of small CGs and thus forms the focus of this pilot study.
- Most existing technologies presuppose documented and registered CGs. However, most looted or smuggled CGs are undocumented with no or limited data.
- Pilot Case #2 focuses on testing and evaluating the search tools for unregistered CGs. Different test cases will be performed based on different CGs documentation info to showcase the advantages of novel documentation proposed in Case #1.



Pilot Case 2: What?

- The pilot simulates real-world scenarios to test ENIGMA tools and workflow: Pilot 2 will validate the efficiency and efficacy of the proposed ENIGMA workflow.
- By using AI, the pilot uncovers possible connections of unknown seized CGs and their potential link to inventoried objects and heritage sites.
- Pilot 2 evaluates the tools in different practices focusing on scenario building from the test cases from Pilot 1.
- The pilot takes place in Greece, and includes test cases from the collections of Heritage Malta and KMKG, Belgium.



Pilot Case 2: Your role

Pilot Case assumes 3 user types:

User 1: General LEA – who can provide basic object information.

User 2: Experienced CH LEA – who can provide extensive information on CGs.

User 3: CH Expert.

Users 1 and 2 can pose several questions regarding CGs to determine its potential legal status and may decide to involve user 3.

Pilot 2 will consider ethical considerations and applicable regulations and procedures that apply for LEAs and participants.

THE SPOILS OF WAR

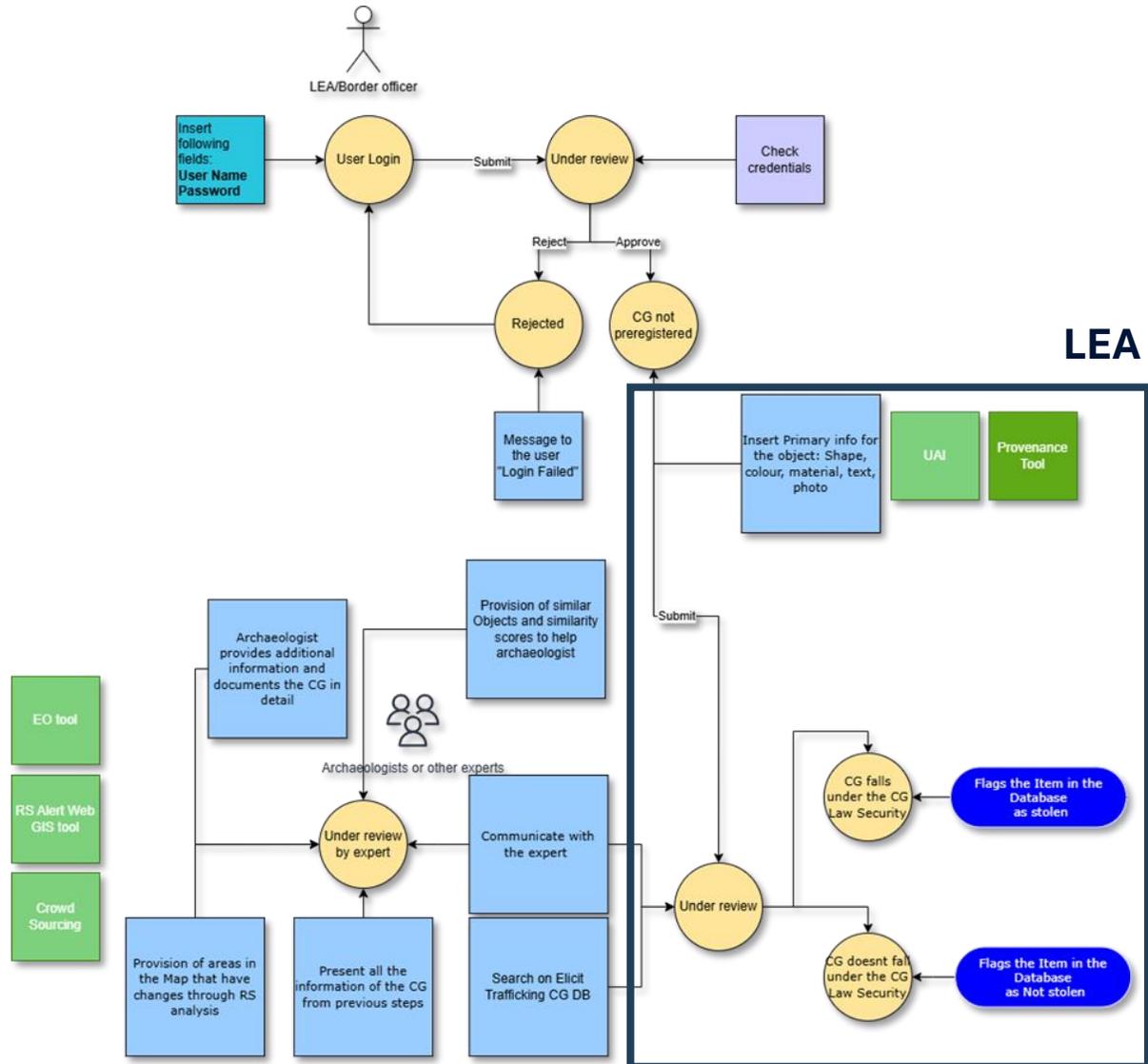
Edited by ELIZABETH SIMPSON



Pilot Case 2: Scenarios

The scenarios confront a LEA with an object. The ENIGMA platform will support the user identification and provenance determination of the object. Pilot 2: tests this problem via different scenarios you may encounter:

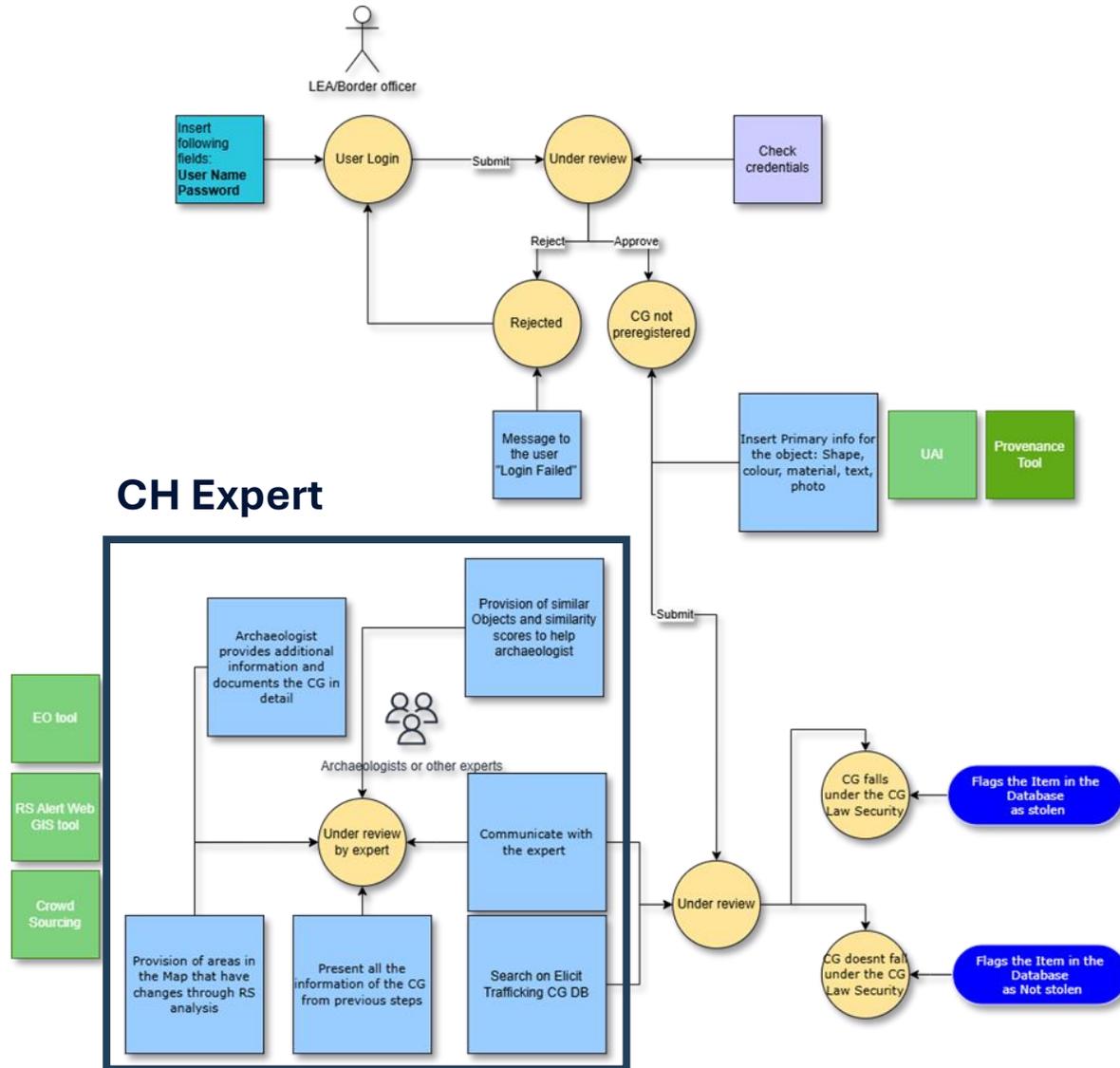
- **1:** stolen CG and declared as such in a database
- **2:** stolen CG but not declared in a database
- **3:** Looted CG from an illegal excavation site
- **4:** Stolen museum object from conflict area
- **5:** Stolen CG from a religious edifice



Pilot Case 2: Workflow Steps

For LEAs (Users 1, 2).

- **Step 1:** Inspect and assess an intercepted object
- **Step 2:** Gather basic information of object (dimensions, weight, photographs, marks, accompanied documents)
- **Step 3:** Enter data into the ENIGMA Platform
 - Provide details
 - Provide documents (if available)
 - Provide Images
 - Provide a 3D model (if possible)
 - Confirm legal status
- **Step 4:** Decide a provisional legal status (legal, advice needed, illegal) after CH Expert feedback.



Pilot Case 2: Workflow Steps

For CH Experts (User 3).

- **Step 1:** You are assigned an array of objects
- **Step 2:** Check the LEA data input, and amend data if needed
- **Step 3:** Review 2D images or 3D Model to the Provenance tool (the platform)
- **Step 4:** The platform generates a similarity score based on your input.
- **Step 5:** Review and/or amend the information. You can refer the object to another expert.

This pilot primarily focuses on LEAs. If needed CH Experts can look into the training material for Pilot 1 for further information.

Basisgegevens (intern rapport)

ROYAL MUSEUMS OF ART AND HISTORY
KONINKLIJKE MUSEA VOOR KUNST EN GESCHIEDENIS
MUSÉES ROYAUX D'ART ET D'HISTOIRE

no domain, deelcollectie Ancient Greece

A.13-1

Hydria
Hydria van het Hadra-type
Hadra-hydria met versiering van bladeren, wijnranken en zeedieren.



"Peintre des Coureurs"
Deuxième moitié du II^e siècle av. J-C

Afmetingen : Afmetingen H x B x D: 37 cm
Materialen/Technieken : Materiaal : Keramiek
Geografische referenties : Productieplaats : Kreta (eiland)
Vindplaats : Cyprus (Arsoë)

Huidige standplaats : Intern, Koninklijke Musea voor Kunst en Geschiedenis, Museum Kunst en Geschiedenis, Sector 1, Verdieping 2, 1.2.07 (tentoonstellingszaal Griekenland - Apamea), Expoë VII 2

Bibliografie
Objecthistoriek
Staat van het object



Step 1: Inspect & assess CG

You are confronted with an object according to the previously mentioned scenarios:

- 1) stolen CG and declared as such in a database
- 2) stolen CG but not declared in a database
- 3) looted CG from an illegal excavation site
- 4) stolen museum object from conflict area
- 5) stolen CG from a religious edifice

- These objects contain limited or no data, as they simulate unprovenanced CGs.
- As a LEA you will generate as much information regarding these objects. Observe and describe what you see.

Basisgegevens (intern rapport)

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KONINKLIJKE MUSEA VOOR KUNST EN GESCHIEDENIS
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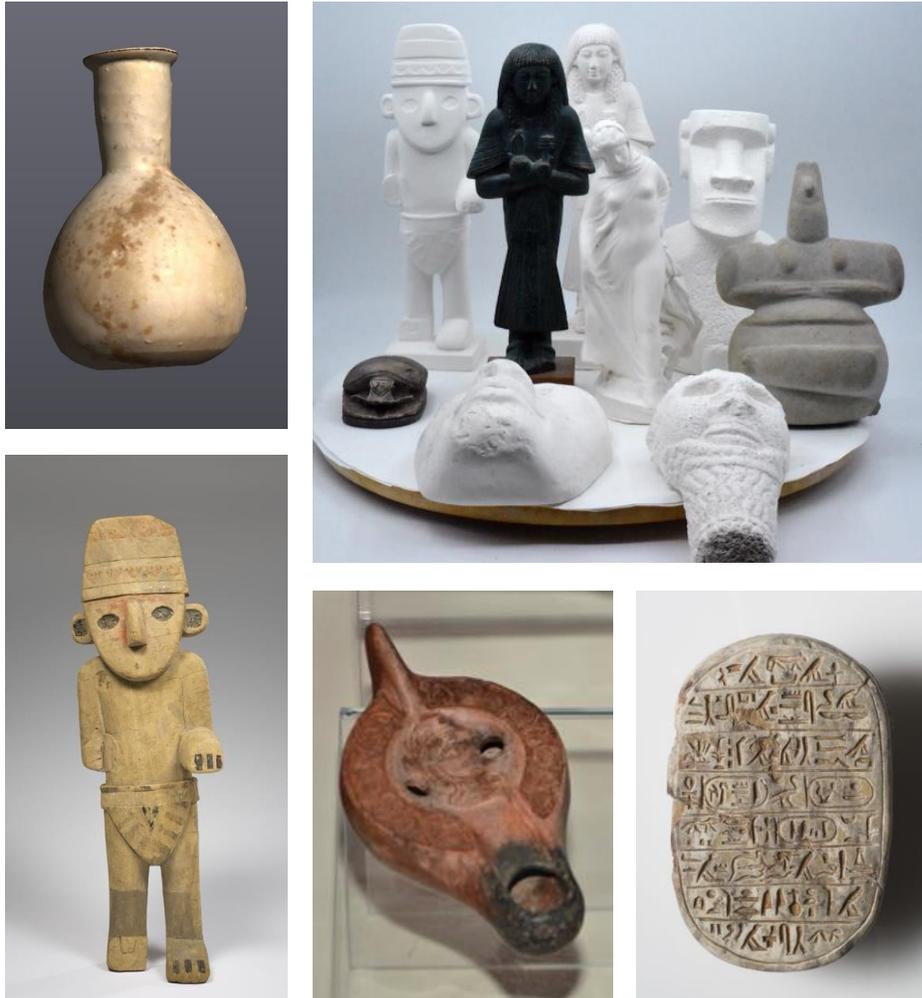
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 Objecthistoriek
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Step 1: Inspect & assess CG

Ask yourself some questions regarding the CG, to generate information. Here are some suggested questions:

- General:
 - Identity of the object: What is it?
 - Provenance: Where does it come from?
 - Does the object seem authentic / original?
 - Is the provenance (documentation) reliable?
 - Is this transport legal?
- Documentation:
 - Does the object come with documentation?
 - What types of documents does it consist of?
 - Are the documents complete and reliable?
 - Can you establish the ownership and destination based on the documentation



Step 2: Gather information

Based on the questions you asked yourself, you can provide a basic description of the object. These could contain info such as:

- Dimensions (L x W x H, etc.)
- Weight
- Marks, anomalies or inscriptions
- Take Photographs
- Are there accompanied documents (IDs, certificates of authenticity, travel documents etc.).

All these can be inserted as input on the ENIGMA Platform.



Step 3: Accessing ENIGMA

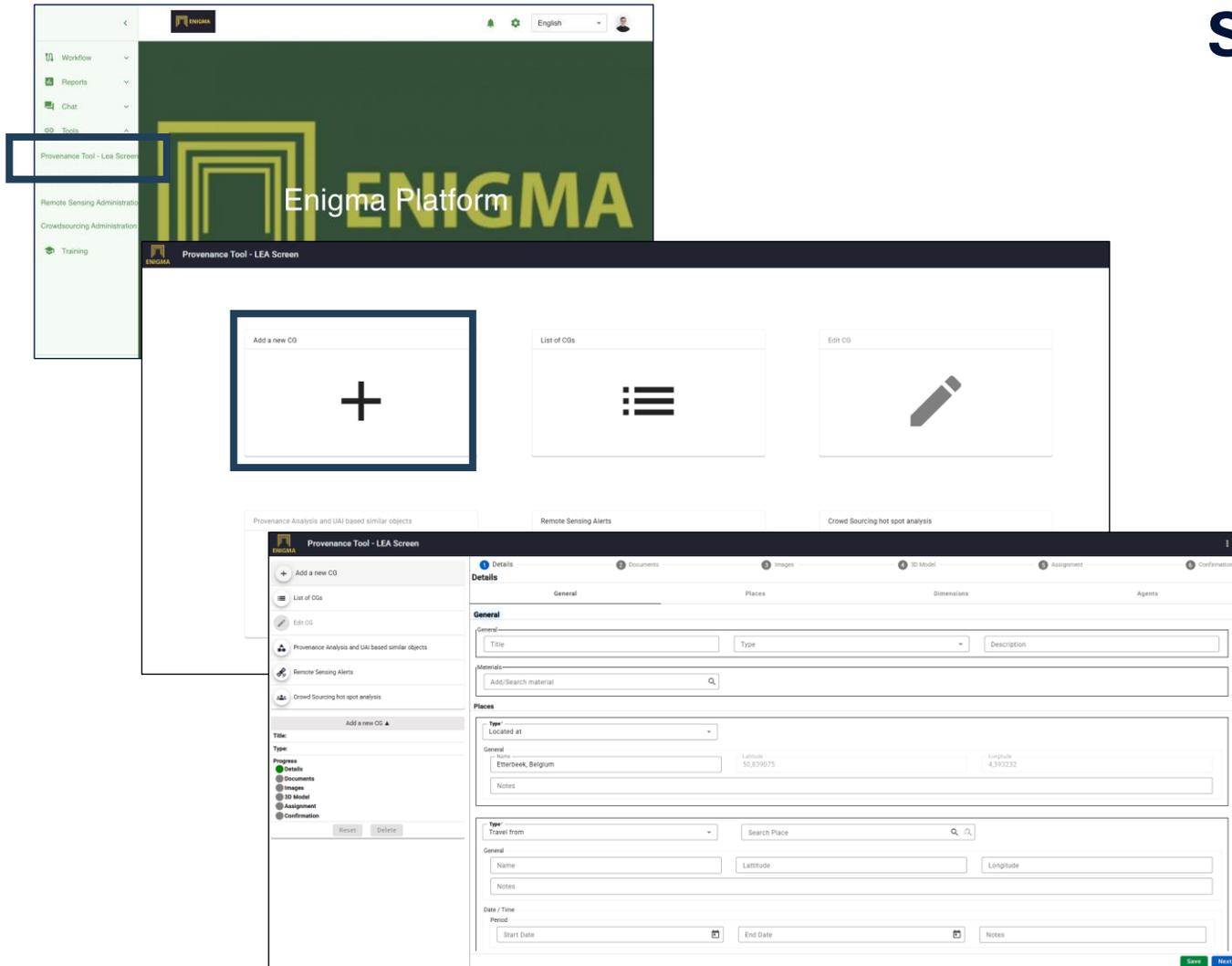
- Accessing the platform:
<https://enigma.cellock.com/>
- Please use the **login details** that have been provided to you.
- The Platform follows data standards and schemes from AAT, ULAN, TGN, EDM, CIDOC CRM and Dublin Core.
- These standards allow for data entry consistency and interoperability.
- ENIGMA uses metadata entry paired with AI and ML tools for provenance.



Step 3: Accessing ENIGMA

- Login to **eu.cellock.eu** to access the tool
- Login details for you have been provided
- Top right: click login/register
- Left: click log in
- Enter your email and password
- Click login

You now have access to the Expert section of the ENIGMA Platform.

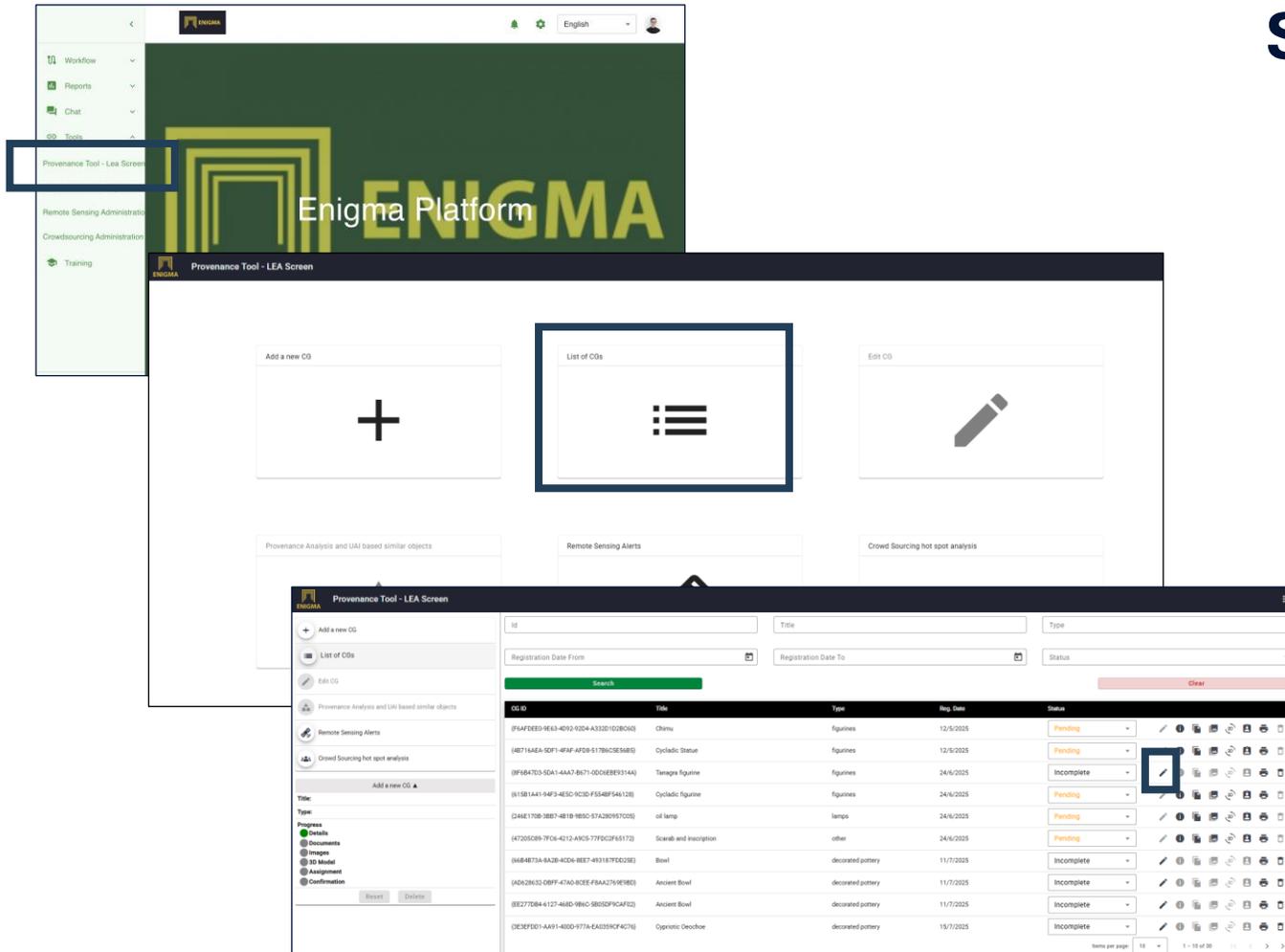


Step 3: Enter data into ENIGMA

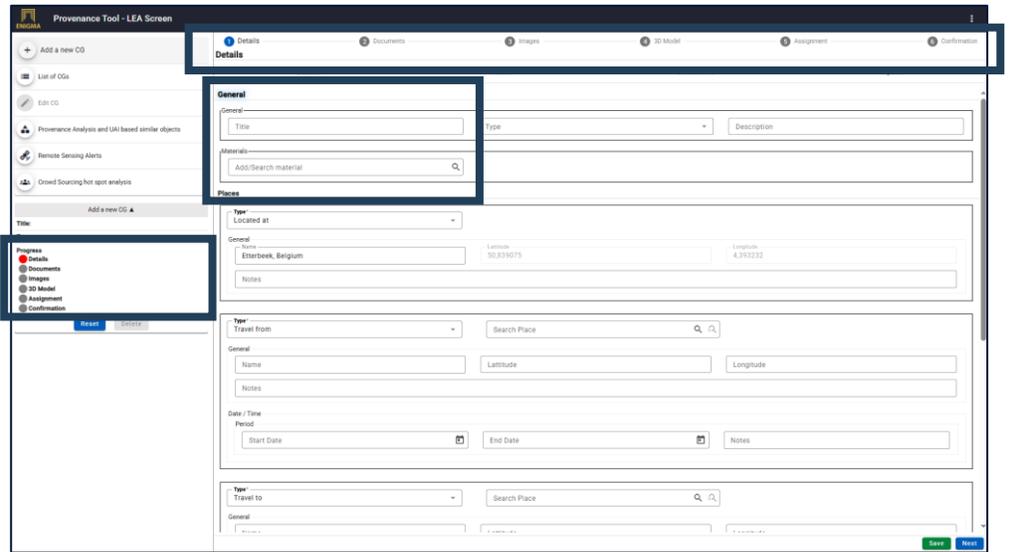
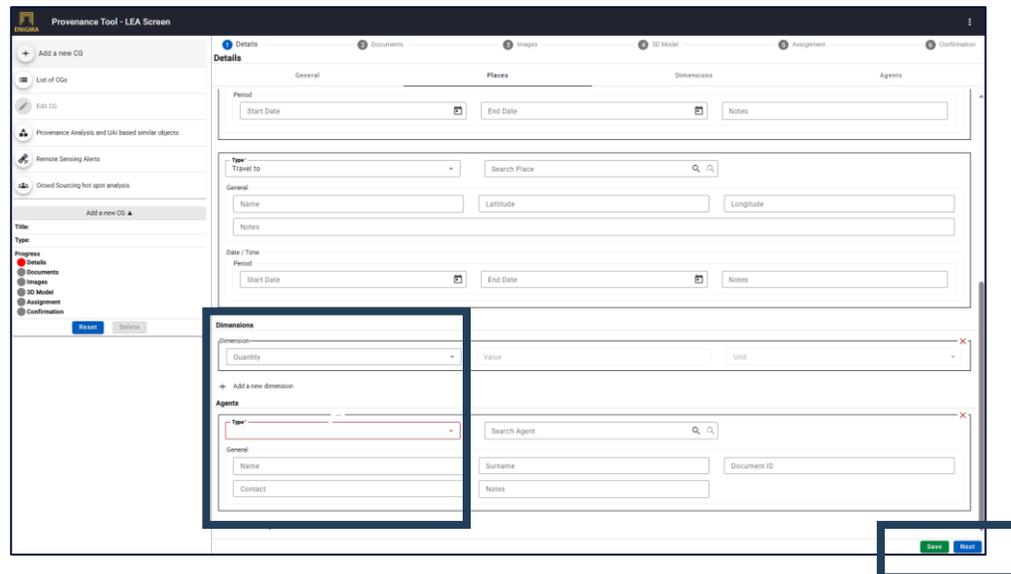
- Access: Provenance Tool – Lea Screen
- You can choose to immediately enter the object details (add a new CG) or work on a current CG (list of CGs) or work on a current CG (list of CGs)
- Click: Add a new CG
- You will then see the Details screen for adding object information

Step 3: Enter data into ENIGMA

- Access: Provenance Tool – Lea Screen
- You can choose to immediately enter the object details (add a new CG) or work on a current CG (list of CGs)
- Click: List of CGs
- You will then see a list of all CGs that have been entered into ENIGMA
- The edit the object data, click the pen icon on the right



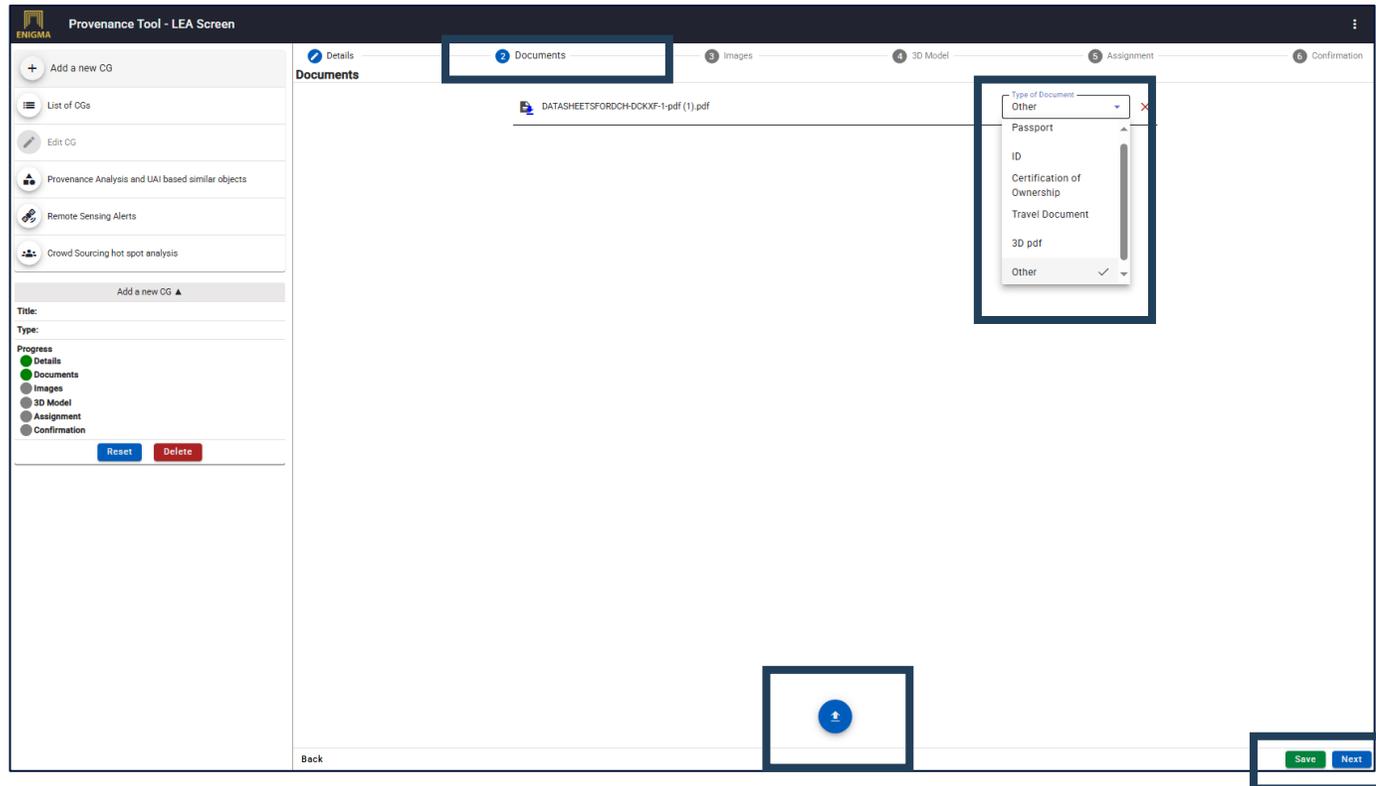
CG ID	Title	Type	Reg. Date	Status
(F5AFDEE9-9E43-4D92-92D4-A333D102B040)	Chimu	figurines	12/5/2025	Pending
(4B7164EA-S071-4F4F-4F26-51789C3E598D)	Cycladic Statue	figurines	12/5/2025	Pending
(8F6847D3-5DA1-4AA7-8671-0006EE93144)	Tenagra Figurine	figurines	24/6/2025	Incomplete
(515B1441-9473-4E3C-9C3D-F5548F54412B)	Cycladic figurine	figurines	24/6/2025	Pending
(244E170B-38E7-4B1B-9E3D-57A2B93702D)	oil lamp	lamps	24/6/2025	Incomplete
(47205089-7FC4-4212-49C5-779D3CF65172)	Scraps and inscription	other	24/6/2025	Pending
(9484B73A-8A2B-4C06-8E27-4931870C20E)	Bowl	decorated pottery	11/7/2025	Incomplete
(42429632-08F7-47A0-82EE-F8A42169E98C)	Ancient Bowl	decorated pottery	11/7/2025	Incomplete
(8E277084-6127-464D-894C-5802F9CAF62)	Ancient Bowl	decorated pottery	11/7/2025	Incomplete
(DE3EFD01-4A91-402D-977A-EA0395CF4C7B)	Opticist Oocchoe	decorated pottery	15/7/2025	Incomplete

Step 3: Provide details

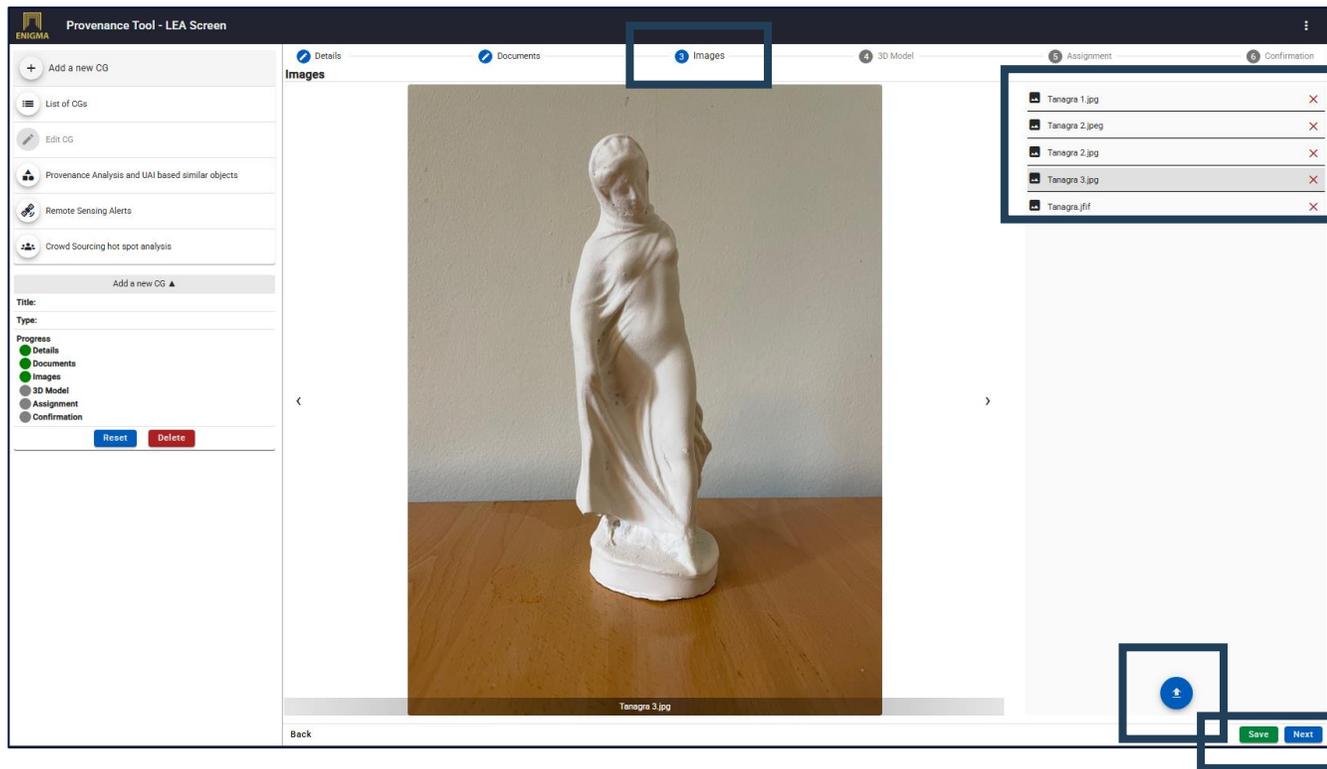
- Left: You can see in what part of ENIGMA you are working, and check the status (red= not saved; green= saved)
- Top: Section Tab with object details, document uploads, images, 3D models etc
- Add: object information. E.g., general information, travel information, dimensions, agents
- On the bottom right: click save or next to proceed
- Use CH vocabularies (AAT, etc.)

Step 3: Provide documents

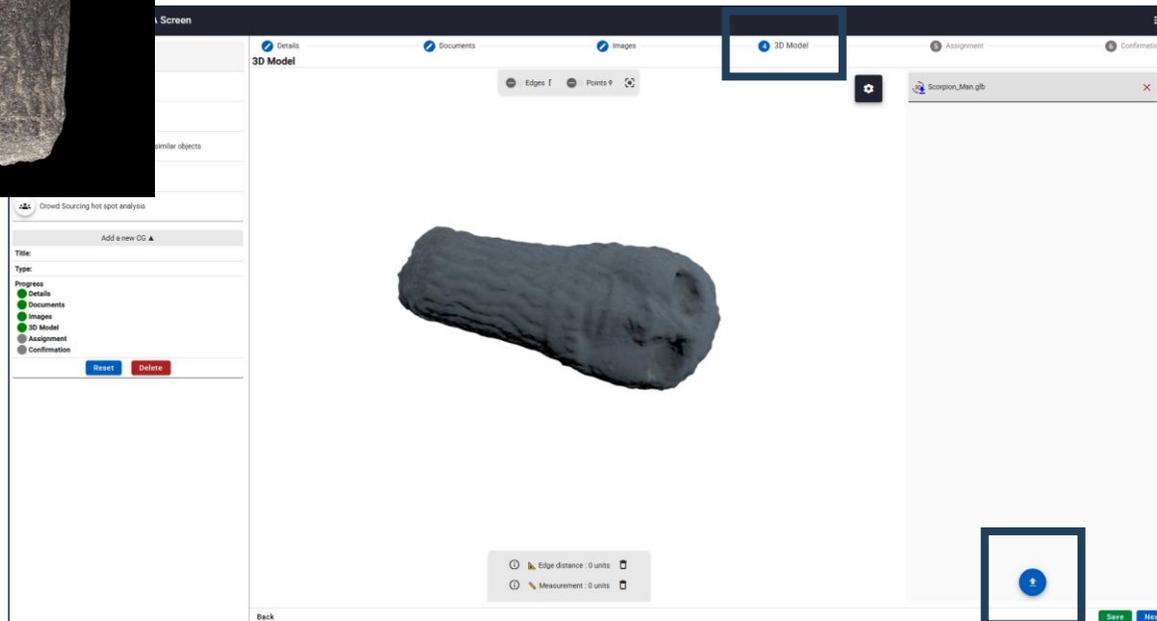


- If documents are available, you can upload these by clicking the arrow in the blue circle on the bottom
- The uploaded document will appear on the screen.
- Choose the drop-down menu to identify the type of document (ID, certificate of ownership, travel documents, etc.)
- On the bottom right: click save or next to proceed

Step 3: Provide images

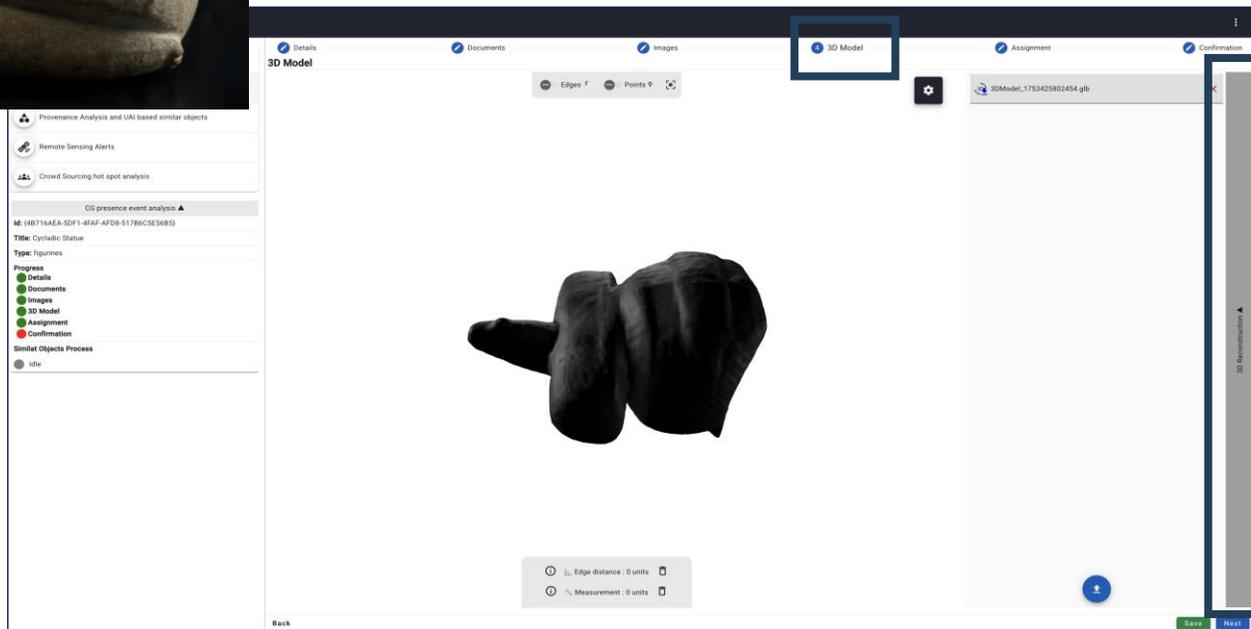


- In this section you can upload 2D images (a single photo or a series of photographs)
- you can upload images by clicking the arrow in the blue circle on the bottom
- The images will appear on the right-hand side of the screen
- This information is essential for determining the object's authenticity and similarity check for both LEAs and CH Experts
- Save the process if amendments were made



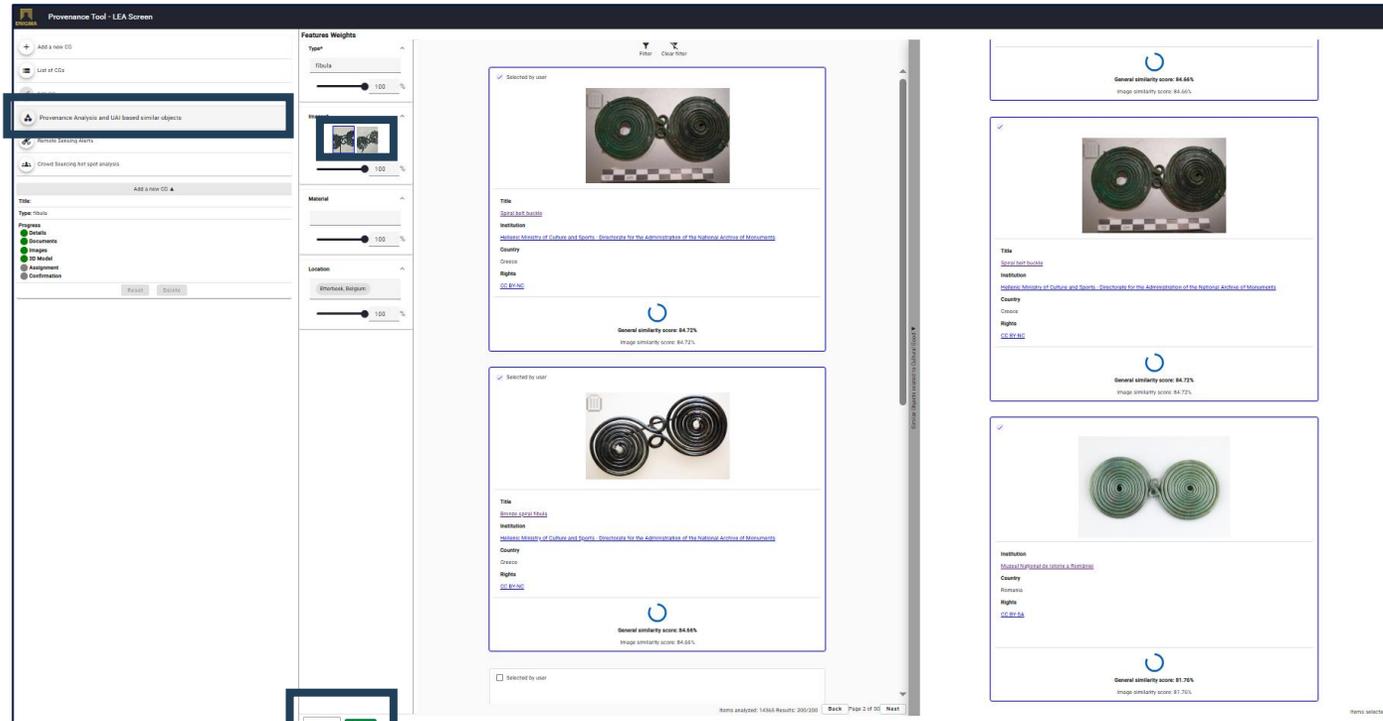
Step 3: Provide a 3D model

- In this section you can upload or generate a 3D model
- Top screen: If you have the infrastructure to make a 3D scan on-site you can upload the model, by clicking the arrow in the blue circle
- The model will appear on the screen
- On the bottom, click save and proceed to the next screen



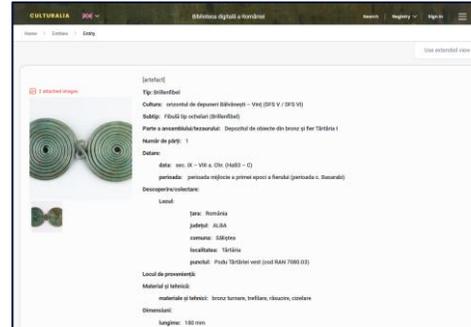
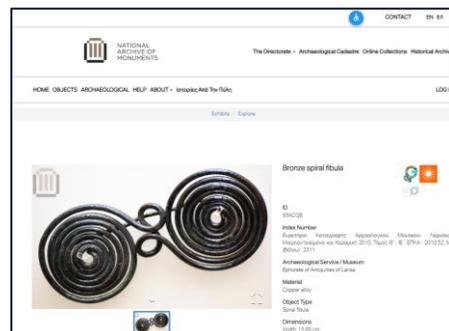
Step 3: Provide a 3D model

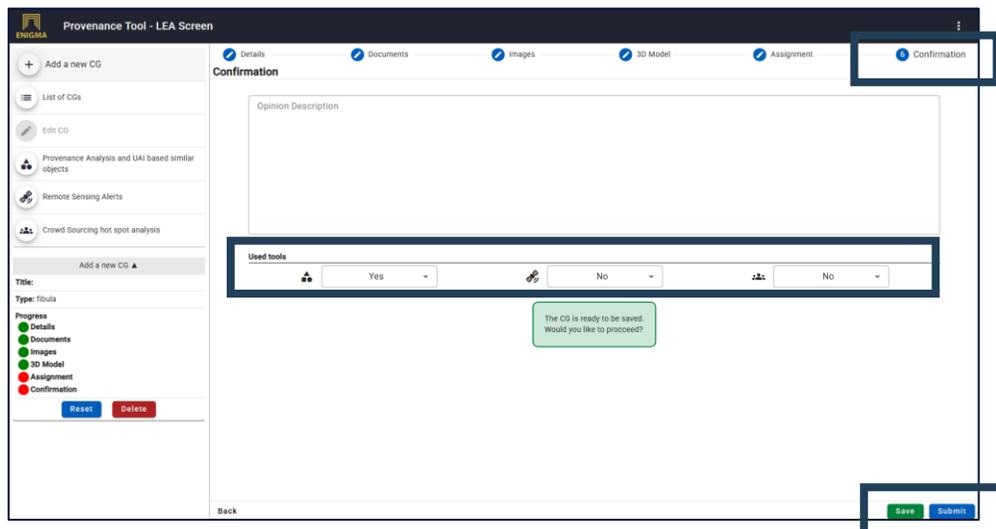
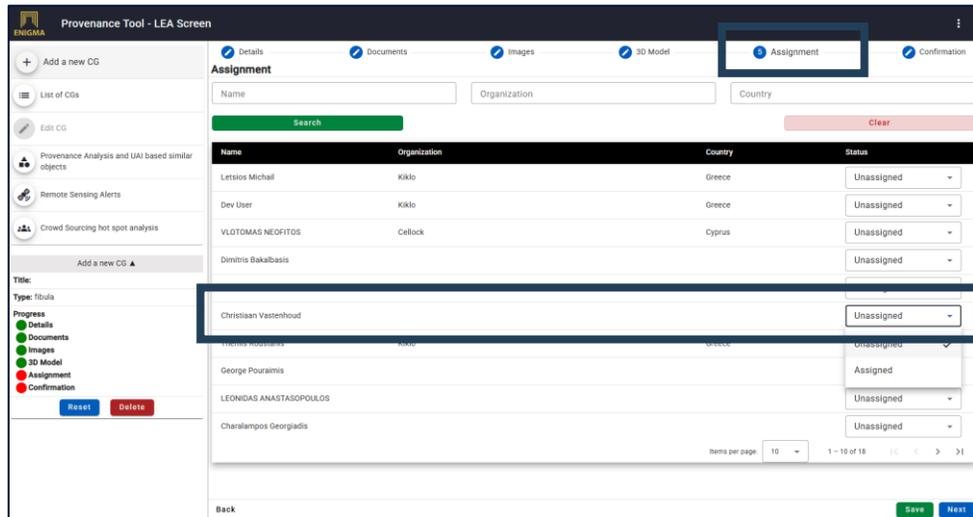
- If you don't have a 3D model, you can use ENIGMA for a 3D reconstruction which will help CH Experts in their assessment.
- Click the 3D Reconstruction bar on the right
- You will then have the option to Create a 3D from images, a description or a video
- Click Run process
- The model will appear on the screen
- On the bottom, click save and proceed to the next screen



Step 3: Check similarity

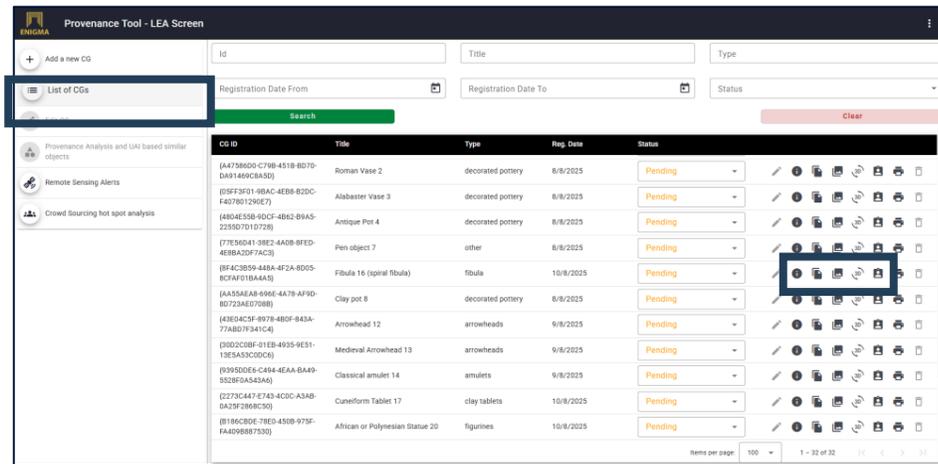
- Left: Work in the Provenance Analysis and UAI based section
- Click an image and 'submit' on the bottom. It will take 5 minutes to check similarity
- ENIGMA will check its database of 500,000 objects
- The 100 best matching objects will be generated to help authenticate the object
- You can click the link to see the original object in other museum collections





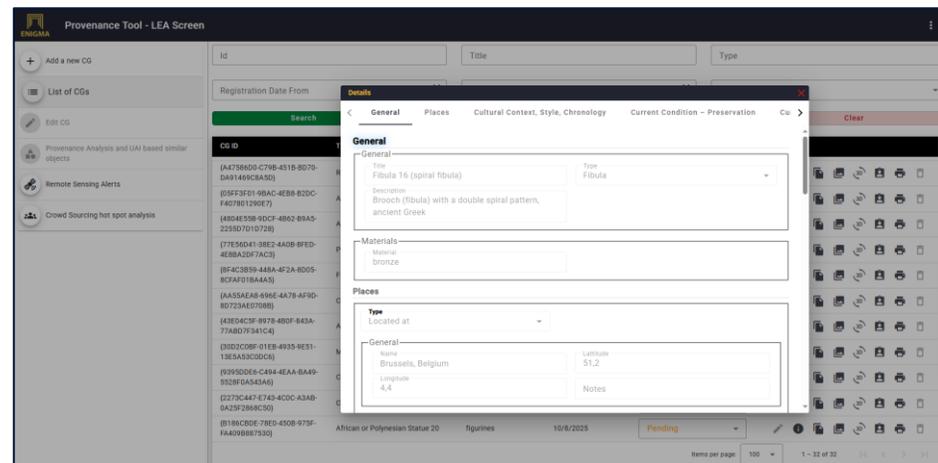
Step 3: Confirm legal status

- Go to the Assignment section
- A list of Experts appear
- On the right, you can select 'Assigned' in the drop-down menu to assign the CG to an expert for review
- Finally go to the confirmation section.
- You can provide an opinion to the Expert, which they can later alter if needed
- Also select the tools you have used on the bottom
- Bottom right: Submit the details



Step 4: Update legal status after CH Expert input

- After the CH Expert has provided a review, you can access the CG information via the ‘list of CGs’ section (top screen).
- The object status has now changed to pending and you can no longer edit the CG info.
- However, you can see the Expert opinion by clicking the icons on the right and a pop-up box will appear (bottom screen)



ENIGMA
CULTURAL GOOD REPORT

DETAILS

GENERAL

Cultural Good ID {E02DCA1D-FB8B-4C70-A2D4-858D7C1712D5}

Title Demo test

Type lamps

Description None

Materials ceramic

PLACES

Located at: Palma de Mallorca, Spain (39.6, 2.6)

Travel from: Malta (35.9, 14.4)

Travel to: Thessaloniki (40.7, 23.0)

CULTURAL CONTEXT, STYLE, CHRONOLOGY

No chronological periods provided

CREATOR, AUTHOR, ARTIST, ETC

No agents provided

DIMENSIONS

Height: 10.0 cm

Mass: 124.0 g

CURRENT PHYSICAL STATE

No shapes provided

Clear

Title	Type	Reg. Date	Status						
Roman Vase 2	decorated pottery	8/8/2025	Pending						
Alabaster Vase 3	decorated pottery	8/8/2025	Pending						
Antique Pot 4	decorated pottery	8/8/2025	Pending						
Pen object 7	other	8/8/2025	Pending						
Fibula 16 (spiral fibula)	fibula	10/8/2025	Pending						
Clay pot 8	decorated pottery	8/8/2025	Pending						
Arrowhead 12	arrowheads	9/8/2025	Pending						
Medieval Arrowhead 13	arrowheads	9/8/2025	Pending						
Classical amulet 14	amulets	9/8/2025	Pending						
Cuneiform Tablet 17	clay tablets	10/8/2025	Pending						
African or Polynesian Statue 20	figurines	10/8/2025	Pending						

Items per page: 100 | 1 - 32 of 32

Step 4: Update legal status after CH Expert input

- Moreover, you can generate a report
- On the right you can click the print icon. This will generate the UAI Record containing all information
- Based on the report and Expert opinion, you can decide on the next steps
 - Is the object legal or not?
 - Can the object be released or not?
 - Is further advice needed or not?
- You have now determined the authenticity and provided basic provenance information of the object.



ENIGMA Next Steps

- This pilot forms part of a tool validation process and 4 pilots in total, the other being:
 - **Pilot 1:** Novel Documentation of Museum items
 - **Pilot 3:** Monitoring Endangered Heritage Sites
 - **Pilot 4:** Validation of the ENIGMA Platform
- Your inputs help us to refine and improve our platform and technology
- Your input helps us to refine our training materials and presentations
- We aim to develop tools up to prototype level at the end of 2025



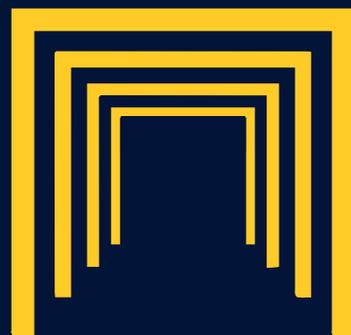
getting started ...

Thank you for your attention





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