

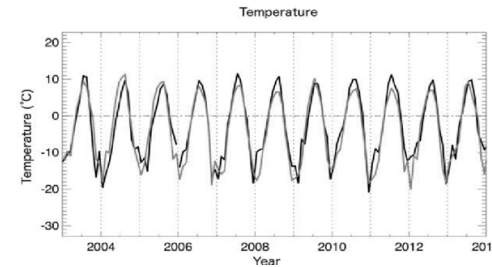
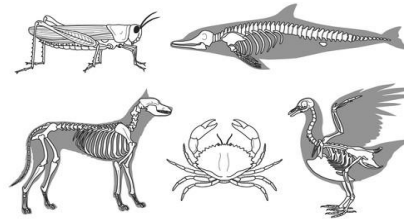
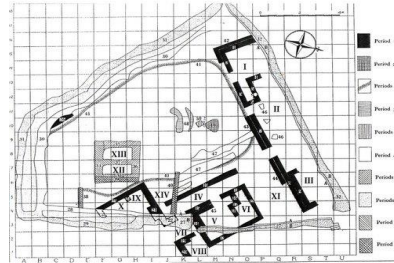
Metadata and semantic tools for data interoperability: some examples from the Digital Cultural Heritage field

FAIR implementation
for NI4OS-Europe service providers

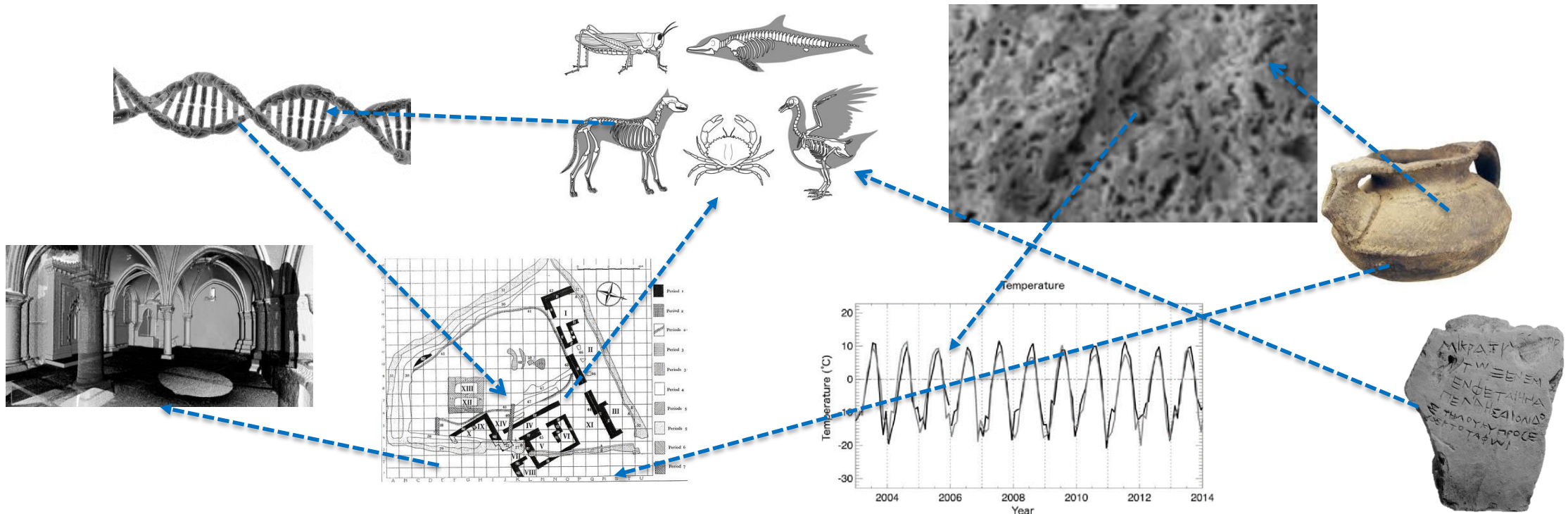
Valentina Vassallo
The Cyprus Institute



Various types of content coming from the Cultural Heritage community



Every sub-field produces datasets that are documented following different approaches and according to different data descriptions



Establishing a knowledge communication framework that guarantees: a comprehensive description and documentation of CH digital resources, their long term preservation, publication, access, use and reuse

Why are these aspects so important?

Findability and Accessibility



Interoperability and Reusability

F Findability

A Accessibility

I Interoperability

R Reusability

Findability and **Accessibility** are guaranteed by the common access at the research infrastructure level, giving direct access to providers' data and enabling search for relevant information through their metadata, by linking them. The possibility to access data at the source enables to investigate data reliability and data transparency.

Interoperability is guaranteed by the use of semantic solutions at the research infrastructure level, aligning the multidisciplinary datasets homogeneously: it facilitates the management, integration, and access to research data by describing their semantic relationships.

Such choice brings to data **Reusability**, giving users the possibility to both find data within a specific research field and reuse them even within other research communities

How?

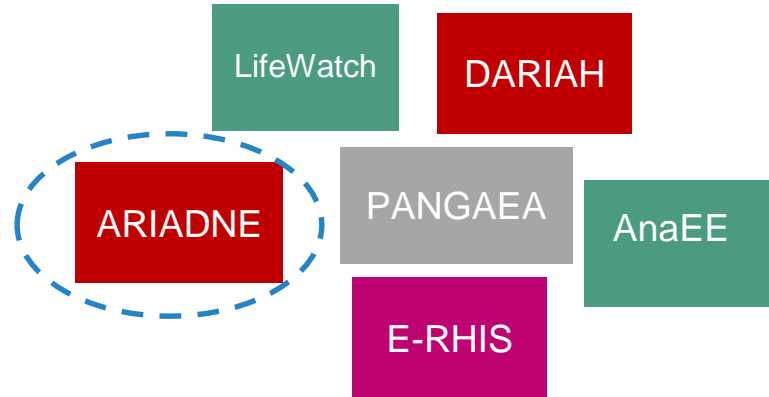
- Tools, standards and guidelines
- Harmonization and interoperability within the (Digital) Cultural Heritage community



Background

Research Infrastructures (RI)

- State of the art about integration and interoperability tools and services



Tools and services

- Biomedical and biological
- Ecology, biodiversity and environmental science
- Life Science
- Cultural Heritage
- Climate Science



- Semantic solutions (data models, ontologies and vocabularies) used for describing, integrating, and normalizing datasets within related domain research infrastructures

Research Infrastructure for Archaeology



All fields Time period Place Title Getty AAT Subject

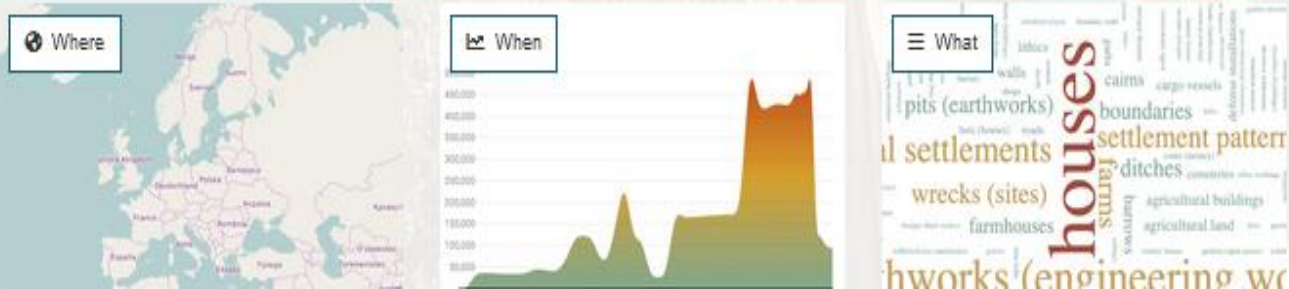
Start a new search...



Welcome

Explore the digital resources and services that ARIADNE has brought together from across the World for archaeological research, learning and teaching.

Browse the Catalogue



Some examples

- Two collections:
 1. Collection of ancient coins
 2. Collection of Ancient Greek epigraphies



- The Cypriot Medieval Coins collection documents the use of currency on the island of Cyprus during the 12th-16th centuries (during the Frankish and Venetian period).

Frankish Period (*Cyprus*)

1192-1489

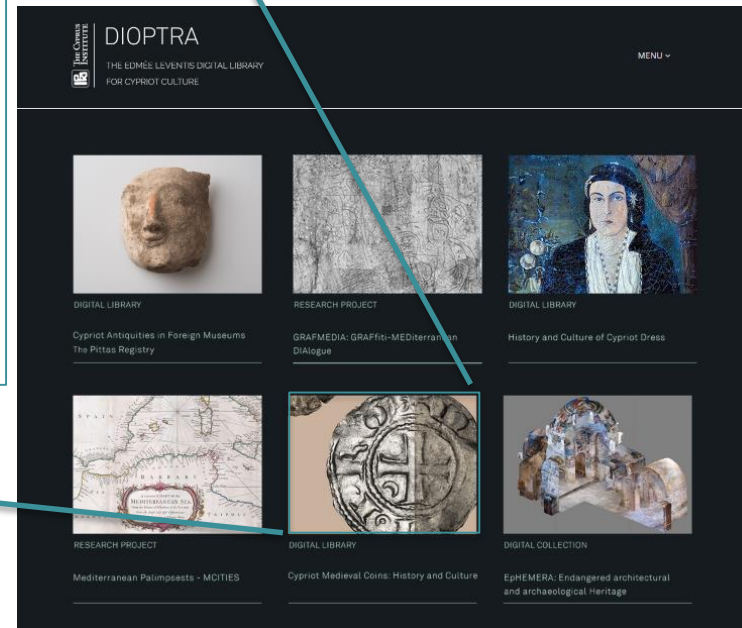
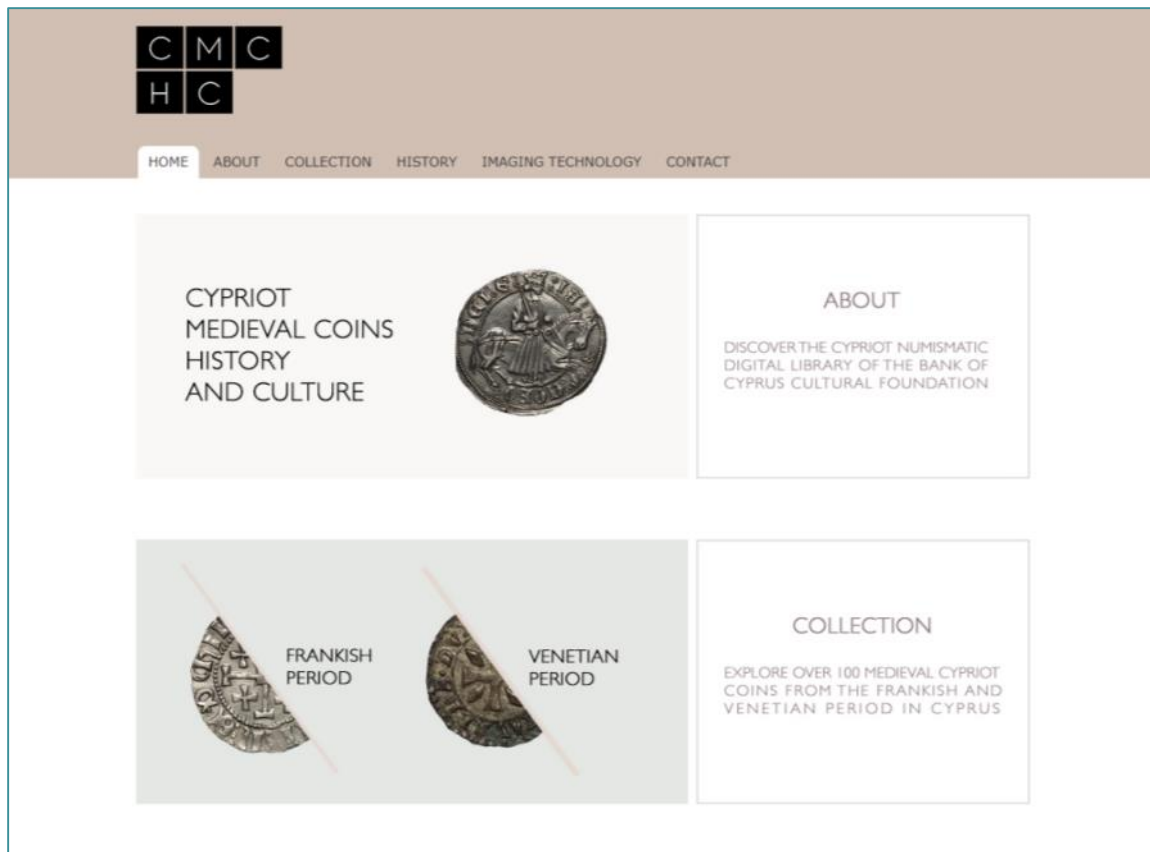
Venetian Period (*Cyprus*)

1489-1571



Cyprus in the Middle Ages (W. J. Blaeu and J. Blaeu, 1635)

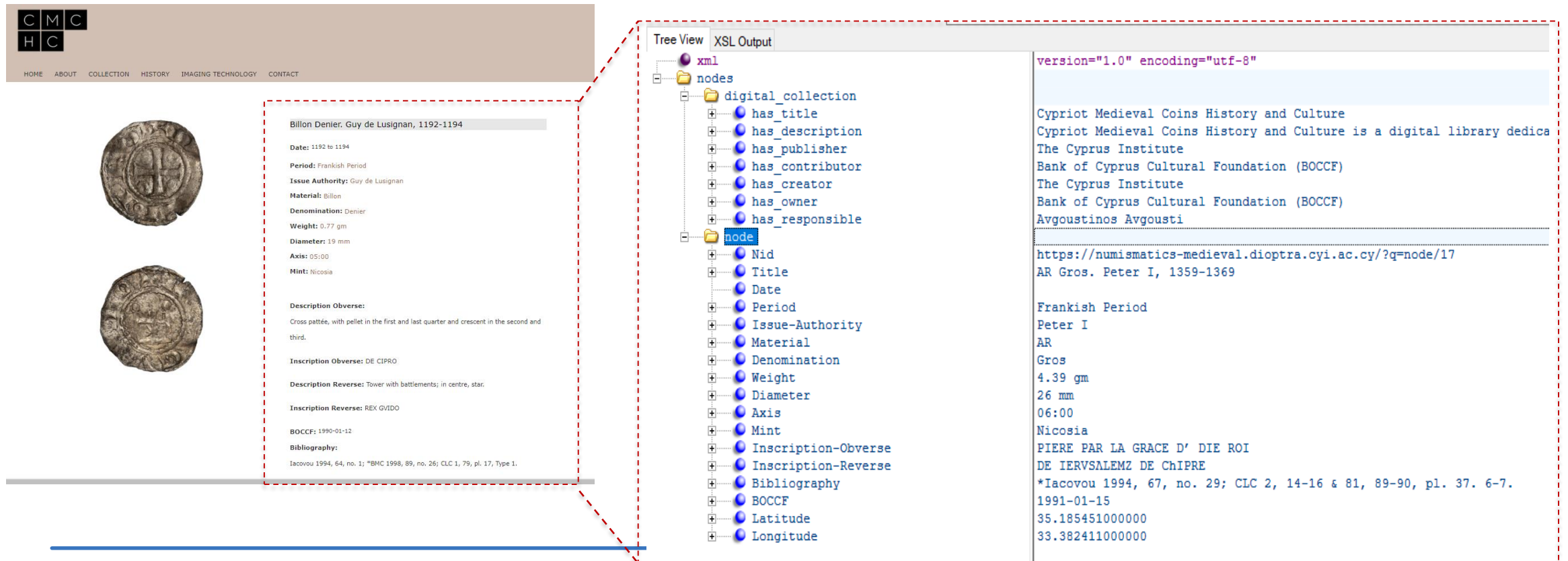
Cypriot Medieval Coins



Beyond the access to the coinage of the period, the digital platform offers an interactive exploration of the medieval collection with the implementation of Reflectance Transformation Imaging (RTI) and high-resolution super-zoom, complemented with text descriptions, links to other collections and repositories.

Metadata

- ❑ No standardized description
- ❑ Creation and use of a in-house metadata standard



The image shows a website interface for a digital collection of coins. On the left, there are two images of a coin. The main content area displays the following metadata for a 'Billon Denier, Guy de Lusignan, 1192-1194':

- Date:** 1192 to 1194
- Period:** Frankish Period
- Issue Authority:** Guy de Lusignan
- Material:** Billon
- Denomination:** Denier
- Weight:** 0.77 gm
- Diameter:** 19 mm
- Axis:** 05:00
- Mint:** Nicosia

Description Obverse: Cross pattée, with pellet in the first and last quarter and crescent in the second and third.

Inscription Obverse: DE CIPRO

Description Reverse: Tower with battlements; in centre, star.

Inscription Reverse: REX GVIDO

BOCCF: 1990-01-12

Bibliography: Iacovou 1994, 64, no. 1; *BMC 1998, 89, no. 26; CLC 1, 79, pl. 17, Type 1.

On the right, an XML tree view shows the structure of the metadata. The root is 'xml', followed by 'nodes', 'digital_collection', and 'node'. The 'node' contains the following elements:

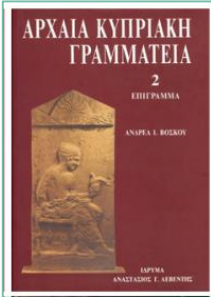
- Nid
- Title
- Date
- Period
- Issue-Authority
- Material
- Denomination
- Weight
- Diameter
- Axis
- Mint
- Inscription-Obverse
- Inscription-Reverse
- Bibliography
- BOCCF
- Latitude
- Longitude

The XML output on the right shows the following content:

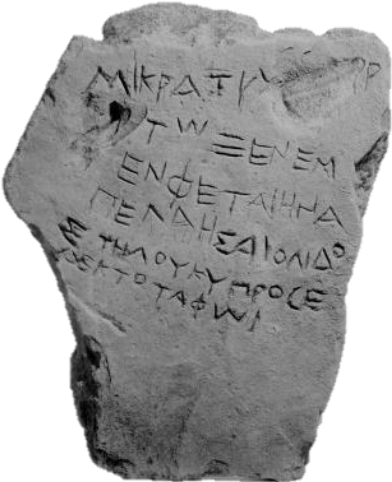
```
version="1.0" encoding="utf-8"
Cypriot Medieval Coins History and Culture
Cypriot Medieval Coins History and Culture is a digital library dedica
The Cyprus Institute
Bank of Cyprus Cultural Foundation (BOCCF)
The Cyprus Institute
Bank of Cyprus Cultural Foundation (BOCCF)
Avgoustinios Avgousti
https://numismatics-medieval.dioptra.cyi.ac.cy/?q=node/17
AR Gros. Peter I, 1359-1369
Frankish Period
Peter I
AR
Gros
4.39 gm
26 mm
06:00
Nicosia
PIERE PAR LA GRACE D' DIE ROI
DE IERVSALEMZ DE CHIPRE
*Iacovou 1994, 67, no. 29; CLC 2, 14-16 & 81, 89-90, pl. 37. 6-7.
1991-01-15
35.185451000000
33.382411000000
```

Archeia Kypriaki Grammateia

The Archeia Kypriaki Grammateia consists of a corpus of Ancient Greek Cypriot inscriptions collected in a series of volumes. The ancient texts corpus includes a wide range of literary genres (e.g., epic, lyric and dramatic poetry, epigrams on stone, prose, medical and philosophical texts). Specifically, the digital collection documents the corpus of the Cypriot ancient epigrams inscribed in stone and found both in Cyprus and abroad (e.g., Greece).



From 7th century BC
to 5th-6th century AD



E21

Μικρά Τύχη] Μυρτώ, ξένη, μέμφεται, ἦν ἀπ' Ἐλαίης
2 Αἰολίδος τηλοῦ Κύπρος ἔδεκτο τάφοι.

E21

Ἡ μικρὴ Μυρτὼ τὴν Τύχη, ξένη, μέμφεται, ποῦ ἀπ' τὴν Ἐλαία
τῆς Αἰολίδας μακριὰ ἢ Κύπρος δέχτηκε σὲ τάφο.

11 E21 ΣΧΟΛΙΑ 285
 *Α. Βουσιού, «Ἡ Ὀμηρικὴ Ἀλλογενὴ τῶν Ἀσίων καὶ τῆς Ἀτρικ», *ΕΚΕΚ* 12 [1983] 318 κέ.). Τὸ ἐδῶ ἀλέσας ἀρκαίαν θάλασσαν φανέται νὰ ἀνήκει μὲλλον σὲ τὴν ἀρχαία κυπριακή (ἔρασις νεώτερη τῆ ζωῆ σου), μὴ δὲν ἀποσπαστικὰ νὰ ἐπισημαίνεται κατὰ τὴν ἐπίσημη μετὰ. σφαιρὰ: ἐπισημαίνεται νὰ ἐπισημαίνεται τὸν ἐξοχὸν καὶ ἔρασις τῆ ζωῆ σου (ἢ ἀσπὴ, καὶ κατεπισημαίνεται τὸν ἐπὶ τὸν οὐκ εἶ ἀρκαίαν θάλασσαν). Γὰρ τὸ ἀλέσας θάλασσαν πρὸ τοῦ ἀλέσας γένους (πρὸ μετὰ). ἄρασις μόνο σφαιρὰ, *ἀλέσας*. *Επὶ*. 1956, κ.ά.). Ὁ ἀρκαίαν ἀλέσας θάλασσαν κ.τ.ε. σφαιρὰ σὲ τὴν ἀρχαία καὶ σὲ τὸν ἀρκαίαν θάλασσαν. βλ. π.χ. *Αἰολ. Πλατ.* 7.188.2 ἀρκαίαν... θάλασσαν καὶ 12.14.2 ἀρκαίαν... θάλασσαν πρὸ *ἀλέσας*. *Επὶ*. 11 θῆσις ἀρκαίαν (πρὸ ἀλέσας σφαιρὰ καὶ σφαιρὰ) καὶ *ἀρκαίαν* κ.τ.ε. πρὸ ἀρκαίαν... σφαιρὰ καὶ *ἀρκαίαν* ῥωμαίων τὸν ἀρκαίαν τὸν θάλασσαν.

Metadata

- ❑ “*CyInscriptions*” metadata schema creation (compliant with community standards and CIDOC-CRM ontology)
- ❑ Analysis of the epigraphic data, e.g. conservation place(s), discovery place...

Myrto's epigram image (E21 in Voskos, 1997)

Inscription

Title: Myrto's epigram image (E21 in Voskos, 1997)
Inventory number: IG 208
Period name: Cypro-Classical / Hellenistic
terminus ante quem: Late 4th century B.C.
terminus post quem: Early 3rd century B.C.
Description: The old image represents the funerary epigram dedicated to the young(?) Myrto (E21 in Voskos, 1997), who died in Cyprus, far from her homeland Elia
Link: <http://akg.cyi.ac.cy/2-15CENB5NCF800NCEB9N9ACENB3NCF81NACENB1NCEBNCNCEBNCNCEB1B-1NCEB1NCEBNCNCF8N9ACENB0NCF8N3NCEBNCNCEBNCNCEB8NCF8N9-1NCEB5NCF800NCEB9N9ACENB3NCF81NACENB1NCEBNCNCEBNCNCEB1NCF84NCEB9N9>
Purpose of inscription: Funerary
Genre: Funerary epigram
Metre: Elegiac couplet
Author of inscription: Unknown
Honoree: young(?) Myrto
Event of inscription: Myrto's death
Locations mentioned: Cyprus, Aeolian Elia
Language: Ancient Greek
Scripture: alphabetic
Writing direction: left to right
Style of writing: uneven capital letters
Size of letters: various sizes
Style of letters: undefined
Number of lines: 6
Spelling errors/variants: μυδρα: instead of μιδρα: (line 3)
Writing technique: written without a special care
Other notes: (below the lettering of lines 1 and 4 may be seen the graffiti which formed the rough draft of the inscription. These were faithfully followed in the rest of the lines.

Project Information

Name: EAGLE Project
Principle investigator: S. Hermon
Collaborators: V. Vassallo, E. Christophorou
Rights: The Cyprus Institute - STARC
Start date: April 2013
End date: March 2016
Country: Cyprus
Project info: <http://www.eagle-network.eu/>

Description of Collection

Name: Archaia Kypraki Grammateta
Country: Cyprus
Language: Ancient Greek
Type: Epigraphic collection

Support

Support type: Plaque
Material support: Limestone
Condition support: Good
Height: 44.5cm
Length: 30cm
Thickness: 5.5cm
Conservation status: Relatively good
Place of conservation: The Cyprus Museum
Country of conservation: Cyprus
Place of discovery: Politiko
Ancient name: Thymassos
Region/district: Nicosia
Country: Cyprus
Discovery date: June 1959

XML Metadata - C:\Users\vassallo\Desktop\Epigraphies_Archaia\AKGDC_E21\AKGDC_E21_image_support_Eu.xml

File Edit View Insert Window Help

C:\Users\vassallo\Desktop\Epigraphies_Archaia\AKGDC_E21\AKGDC_E21_image_support_Eu.xml

Tree View XSL Output

xml
#comment
Project
Project:starac
Project information
Admin data
Descriptive data
Record information
Bibliographical notes
Relations
RWO collection
General info
Administrative data
Record information
External object reference
Descriptive data
Type
Description
Chronology
period name
time span
start Date
end Date
Geographical information
Appellation
Toponym
Historic toponym
Geopolitical area
Spatial reference
System
Coordinates
altitude MaSL
Cadastral reference
Inscription
ID
Name
Server location
Name
Server location

version="1.0" encoding="utf-8"
This document was created with Syntex Serna Free.

project

Epigraphic collection
Archaia Kypraki Grammateta is a corpus of Ancient texts that includes a wide range of literary genres such as epic, 1

7th century BC
5th-6th century AD

Cyprus

WGS84

35 N
33 E

698c603a-68dc-4caf-b4e3-93f36f60d999

<http://akg.cyi.ac.cy>

29 April 2015
Cyprus
En
The Cyprus Institute - STARC

Archeia Kypriaki Grammateia

STARC repo
Explore STARC digital collections

HOME page | EXPLORE repository | HELP with the repository | CONTACT comments, inquiries | ABOUT who we are

You are not logged in. [Login](#) or [sign up](#) to the system.

Browse objects
Clear all
Collections

- Famagusta_Gate
- Paphos_Theatre
- Agios_Georgios_Hill
- Byzantine_Museum
- Dromolaxia - Vizakia (Hala Sultan Tekke)
- Cyprus_Folk_Art_Museum
- Art Gallery
- The_Cyprus_Museum
- Gramatia
- Der Avedissian-Hawley
- Tombs of the Kings
- Church of Panagia Angeloktistis
- Sanctuary of Apollo Hylates at Kourion
- Salamis Terracotta Fragments
- Ancient Books
- K2R
- test
- Kazaphani boat

Object type

- 3D Pdf
- Images
- X3DOM
- Videos
- Commentaries

Image size

Items per page: 20 40 80

1 2 3 Next Last

Myrto's funerary epigram (E21 in Voskos, 1997)

Myrto's epigram image (E21 in Voskos, 1997)

Philostratus' epigram - Modern Greek text (E2 in Voskos, 1997)

Philostratus' epigram - Ancient Greek text (E2 in Voskos, 1997)

Idagygos'epigram - Ancient Greek text (E3 in Voskos, 1997)

Glefkita's epigram - Modern Greek text (E4 in Voskos, 1997)

Glefkita's epigram - Ancient Greek text (E4 in Voskos, 1997)

Myrto's funerary epigram (E21 in Voskos, 1997)

Simalos' epigram - Ancient Greek text (E1 in Voskos, 1997)

Simalos' epigram - Modern Greek text (E1 in Voskos, 1997)

Idagygos'epigram - Modern Greek text (E3 in Voskos, 1997)

Philostratus' epigram - Ancient Greek text (E2 in Voskos, 1997)

The collection gives access to different resources such as the transcribed Ancient Greek text, the translated Modern Greek text, the scholia, the support image and 3D.

Object	Format
	Text
	Image
	3D
	Audio

STARC repo
Explore STARC digital collections

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You are not logged in. [Login](#) or [sign up](#) to the system.

TARC Repository

is repository holds digital objects created in various objects over the last 5 years at the STARC research center of the Cyprus Institute. Together with digital objects it presents novel interactive methods for accessing and exploring information. Feel free to explore content and bits in what we hope will be enjoyable experience.

TARC

Science and Technology in Archaeology Research Center (STARC) of The Cyprus Institute is devoted to the development, introduction and use of advanced science and technologies in the field of archaeology, cultural heritage and history of the region.

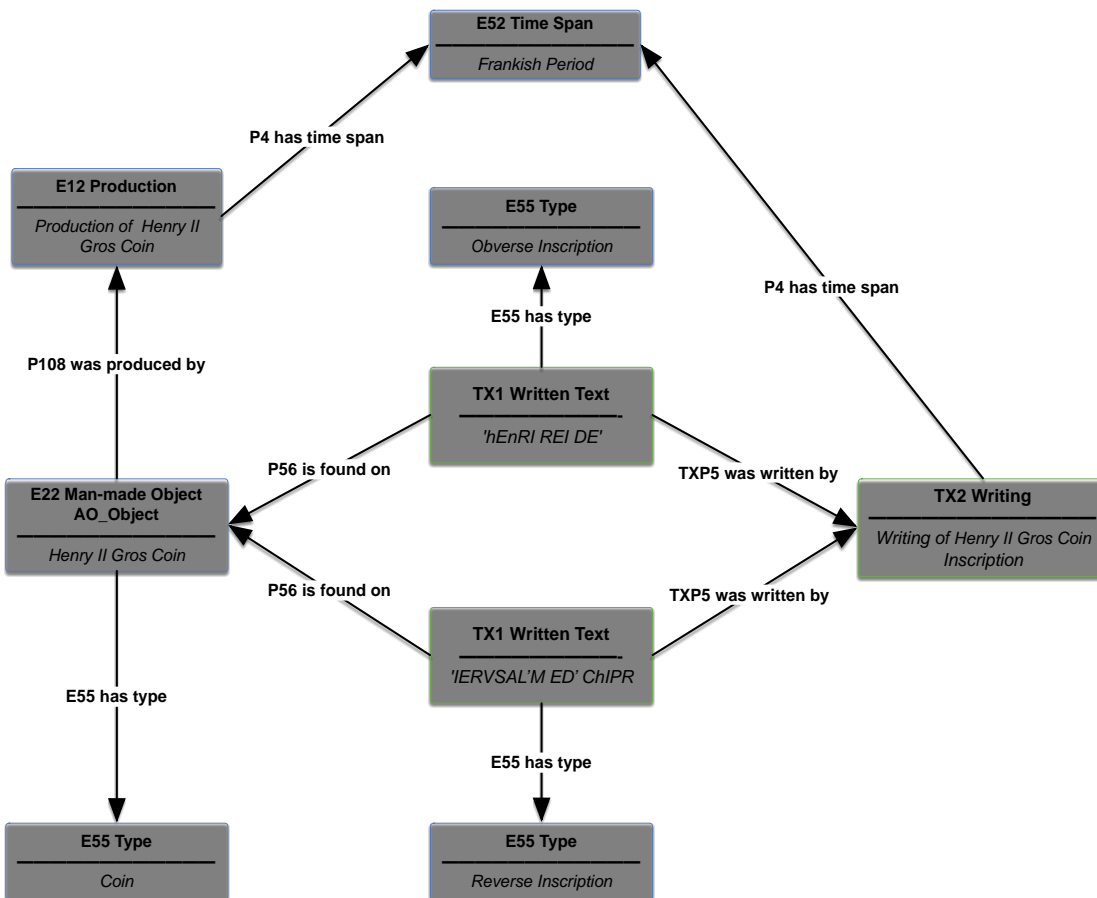
Feature extraction

©2014 The Cyprus Institute

Mapping

□ Mapping to ontology (e.g. CRMtux)

Semantic alignment



inscriptions on coins

obverse 'hEnRI REI DE'

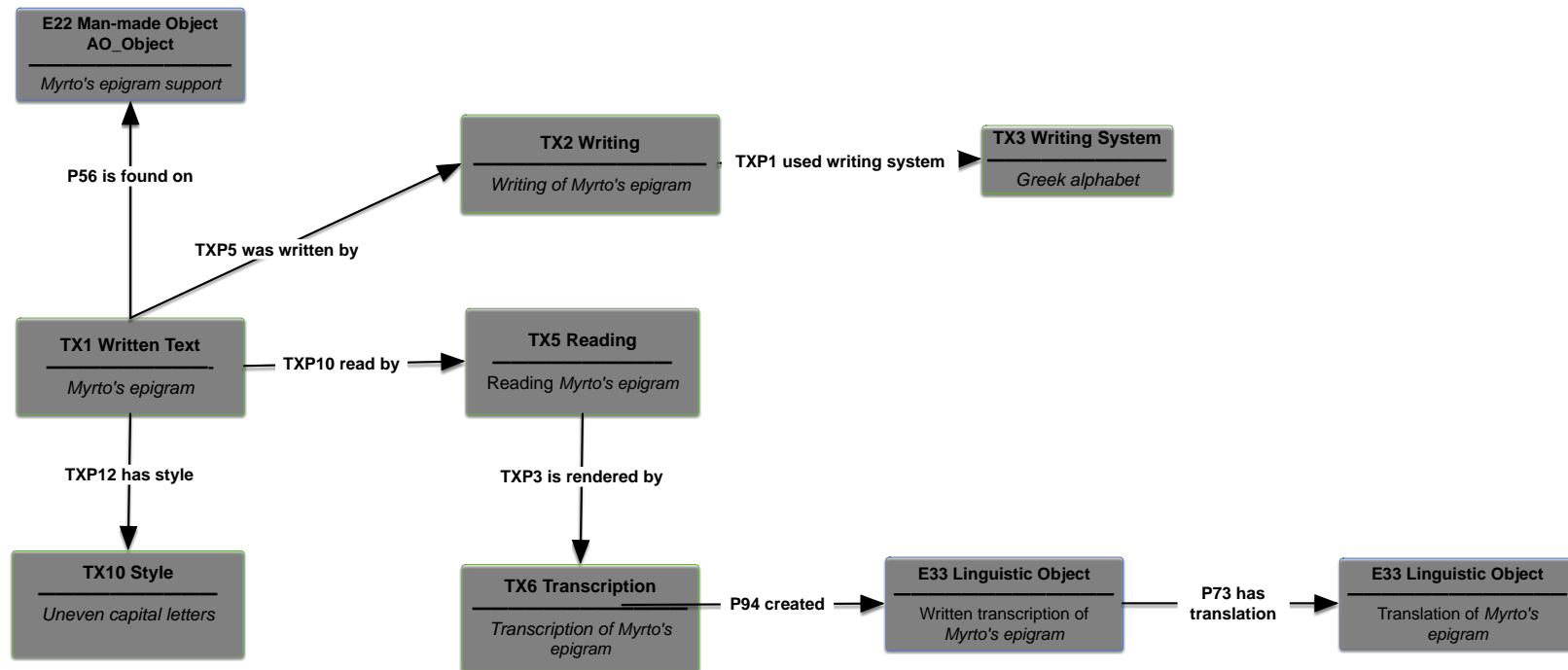
reverse 'IERVSAL'M ED' ChIPR



Mapping

Semantic alignment

□ Mapping to ontology (e.g. CRMtex)



Mapping (X3ML mapping tool)

#	SOURCE	TARGET PATH NAME	TARGET	CONSTANT EXPRESSION	IF RULE	COMMENTS
1	node		AO_Individual_Data_Resource	<pre>[AO_Concept = "Coin"] [has_active_object] [has_language] [was_created_on] [has_access_rights] [has_type] [has_access_policy] [was_issued] [was_modified] [is_part_of] [has_description] [has_visual_component] [has_visual_component]</pre>		
1.1	Nid		has_landing_page			
1.2	Title		XMLSchema#string			
1.3	Period		AO_Temporal_Region	<pre>[from] [until] [has_period] [AO_Concept = "http://n2t.net/ark:/99152/p0m63qj8zr"]</pre>	text() = Franchisk Period	
1.4	Period		AO_Temporal_Region	<pre>[from] [until] [has_period] [AO_Concept = "http://n2t.net/ark:/99152/p0m63qj8zr"]</pre>	text() = Venetian Period	
1.5	Issue-Authority		P108_was_produced_by	<pre>[has_type] [has_title] [has_time_interval] [has_identifier]</pre>		

TARGET PATH NAME	TARGET	CONSTANT EXPRESSION	IF RULE	COMMENTS
	AO_Data_Resource	<pre>[has_ARABIAN_active] [has_active_object] [has_language] [was_created_on] [has_access_rights] [has_type] [has_access_policy] [was_issued] [was_modified]</pre>		
	is_part_of			
	AO_Collection			
	has_spatial_coverage			
	AO_Spatial_Region			
	has_place_name			
	XMLSchema#string			
	has_spatial_coverage			exists(text())
	AO_Spatial_Region_Point			
	has_latitude			
	XMLSchema#decimal			exists(text())
	has_spatial_coverage			
	AO_Spatial_Region_Point			
	has_longitude			
	XMLSchema#decimal			
	has_temporal_coverage			
	AO_Temporal_Region			
	has_native_period			
	AO_Concept			
	has_title			
	XMLSchema#string			
	has_identifier			
	XMLSchema#string			
	has_description			
	XMLSchema#string			
	has_landing_page			
	Thing			
	has_publisher			
	AO_Agent	[has_homepage]	[Thing = "https://www.cyl.ac.cy/"]	
	has_name			
	XMLSchema#string			
	has_contributor			
	AO_Agent	[has_homepage]	[Thing = "https://www.bocccf.org"]	

To solve semantic heterogeneity:
mapping from different metadata
to a single semantic solution

PeriodO matching

client.perio.do/?page=period-view&backendID=web-https%3A%2F%2Fdata.perio.do%2F&authorityID=p0m63nj&periodID=p0m63nj8xr

PeriodO

Home
Data sources
Settings
About

Data source
Browse periods
Browse authorities
Review submitted changes
History
Settings

Authority
View
History

Period
View
History

Canonical > Andrea Berlin, The Levantine Ceramics Project, 2012 > Frankish > View

Frankish

1191 – 1489 | Cyprus
Defined by Andrea Berlin, The Levantine Ceramics Project, 2012.
Permalink <http://n2t.net/ark:/99152/p0m63nj8xr>
Download JSON, Turtle

▼ Period details

	Label	Start	Stop	Spatial coverage	Pub. date
98	view Arab Conflict	647	965	Cyprus	2012
99	view Late Byzantine	965	1191	Cyprus	2012
100	view Frankish/Ayyubid Periods	1099	1291	Israel, Jordan, Lebanon, Syria	2012
101	view Frankish	1191	1489	Cyprus	2012
102	view Fatimid/Mameluke Periods	1291	1516	Israel, Jordan, Lebanon, Syria	2012
103	view Later Islamic Period	1291	1516	Israel, Jordan, Lebanon, Syria	2012
104	view Ottoman Period	1453	1922	Turkey	2012

Authority [view](#) Period [view](#)

Permalink <http://n2t.net/ark:/99152/p0m63nj> Permalink <http://n2t.net/ark:/99152/p0m63nj8xr>

Source Original label
Title Frankish
The Levantine Ceramics Project Start
1191 1489

PeriodO is a public domain gazetteer of scholarly definitions of historical, art-historical, and archaeological periods.

PERIOD

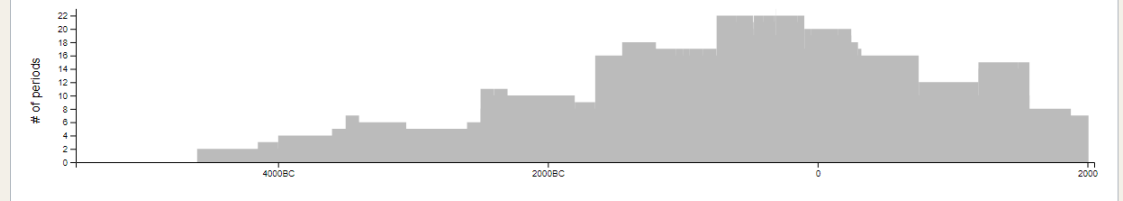
Venetian Period

<http://n2t.net/ark:/99152/p0m63nj9vq>

▼ Temporal coverage

Temporal extents covered by the listed periods

Timeline style ▼



▼ Periods

128 periods

7117 periods not shown. Adjust filters to see more

Click a period to select it, then use up and down arrows to change the selection

	Label	Start	Stop	Spatial coverage	Pub. date
	1 BP (2000)			Cyprus	2015
	30			Cyprus	2012
	0 BP			Cyprus	2007
	1 BP (2000)			Cyprus	2015
	30			Cyprus	2012
	0 BCE			Cyprus	2007
	30			Cyprus	2012

Period [view](#)

Permalink

<http://n2t.net/ark:/99152/p0qhb666vcf>

▼ Filter periods

By label

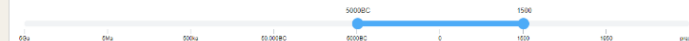
Show periods with matching labels—regular expressions are supported

Match labels Match labels + alternate labels

e.g. bronze

By time

Show periods that start within the selected range



By place

Show periods linked to any of the selected places

No places selected. Select places

By authority, language or spatial coverage

Show periods having the selected authority, language or spatial coverage

Authority

- 35. Pyla-Koskipeitris I : archaeological survey of an ancient coastal town. 2014.
- 29. Androv-Jamesson. Cyprus antiquities local periods. 2007.
- 25. Andrea Berlin, The Levantine Ceramics Project. 2012.
- 20. ARIADNE Consortium. ARIADNE Data Collection. 2015.
- 6. Ecole française d'Athènes. La Chronique des fouilles en Igcne / Archaeology in Greece Online. 2019.
- 4. British Museum.

Language

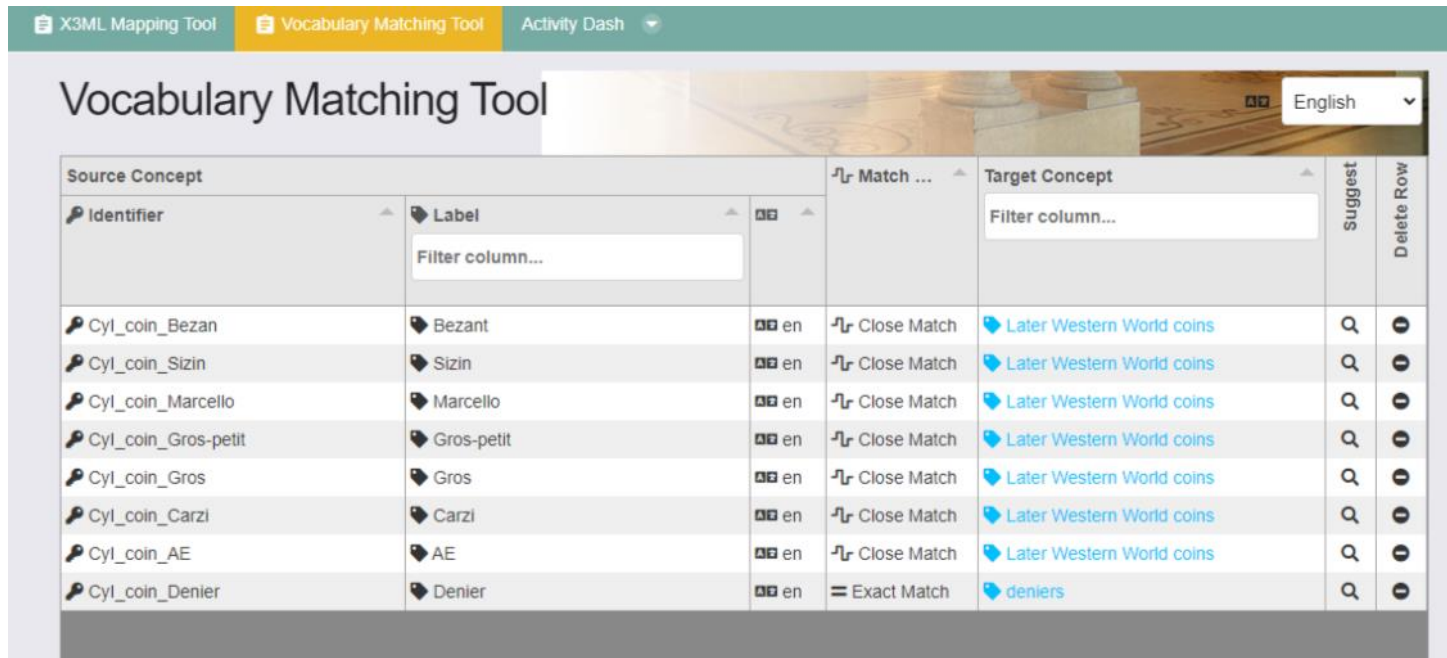
- 122 English
- 6 French

Spatial coverage

- 108 Cyprus
- 699 (no value)
- 154 France
- 116 Crete
- 109 Czech Republic
- 97 Greece

Vocabulary Matching Tool

- ❑ Terminology extraction
- ❑ Matching between the terms and the AAT entries



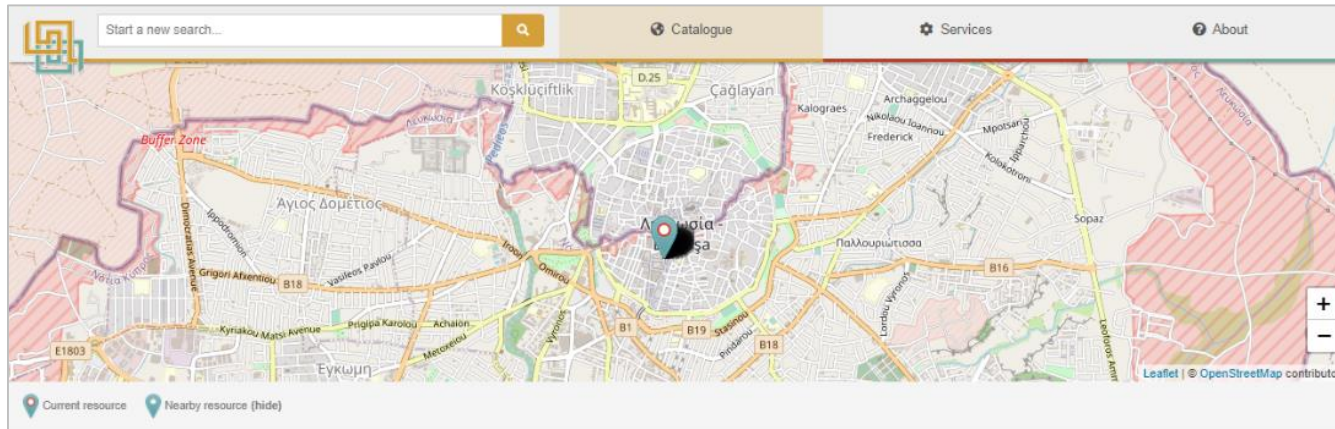
The screenshot shows the 'Vocabulary Matching Tool' interface. It features a table with columns for 'Source Concept', 'Match', and 'Target Concept'. The 'Source Concept' column is further divided into 'Identifier' and 'Label'. The 'Match' column shows the match type (e.g., 'Close Match', 'Exact Match'). The 'Target Concept' column shows the matched term (e.g., 'Later Western World coins', 'deniers'). The table lists several source concepts and their corresponding matches.

Source Concept	Match	Target Concept
Cyl_coin_Bezan	Close Match	Later Western World coins
Cyl_coin_Sizin	Close Match	Later Western World coins
Cyl_coin_Marcello	Close Match	Later Western World coins
Cyl_coin_Gros-petit	Close Match	Later Western World coins
Cyl_coin_Gros	Close Match	Later Western World coins
Cyl_coin_Carzi	Close Match	Later Western World coins
Cyl_coin_AE	Close Match	Later Western World coins
Cyl_coin_Denier	Exact Match	deniers



```
{
  "sourceURI": "CyI_coin_Bezan",
  "sourceLabel": "Bezant",
  "sourceLabelLanguage": "en",
  "matchURI": "http://www.w3.org/2004/02/skos/core#closeMatch",
  "targetURI": "http://vocab.getty.edu/aat/300184573",
  "targetLabel": "Later Western World coins",
  "created": "2021-11-02T12:54:07.938Z",
  "updated": "2021-11-02T12:56:09.435Z",
  "id": 1
},
{
  "sourceURI": "CyI_coin_Sizin",
  "sourceLabel": "Sizin",
  "sourceLabelLanguage": "en",
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Integration and publication (interoperability)



Cypriot Medieval Coins History and Culture

Description

Cypriot Medieval Coins History and Culture is a digital library dedicated to the study, promotion and dissemination of the history of Medieval Cypriot Coinage (12th-16th centuries)

Metadata

Original ID: CYI-CMC-HC

Landing page: <https://numismatics-medieval.dioptra.cyi.ac.cy/?q=coins-views-fields>

Language: English

Resource type: Coin

Subject - Original: Coin

Place: Cyprus

View resource at provider

Json Xml Cite Issue

Resource has parts

AR Gros. Henry II (second period of reign), 1310-13

AR Gros-petit. Henry II (second period of reign), 131

Billon Denier. James I(?), 1382-1398

AR Gros. Hugh IV, 1324-1359

AR Gros-petit. Hugh IV, 1324-1359

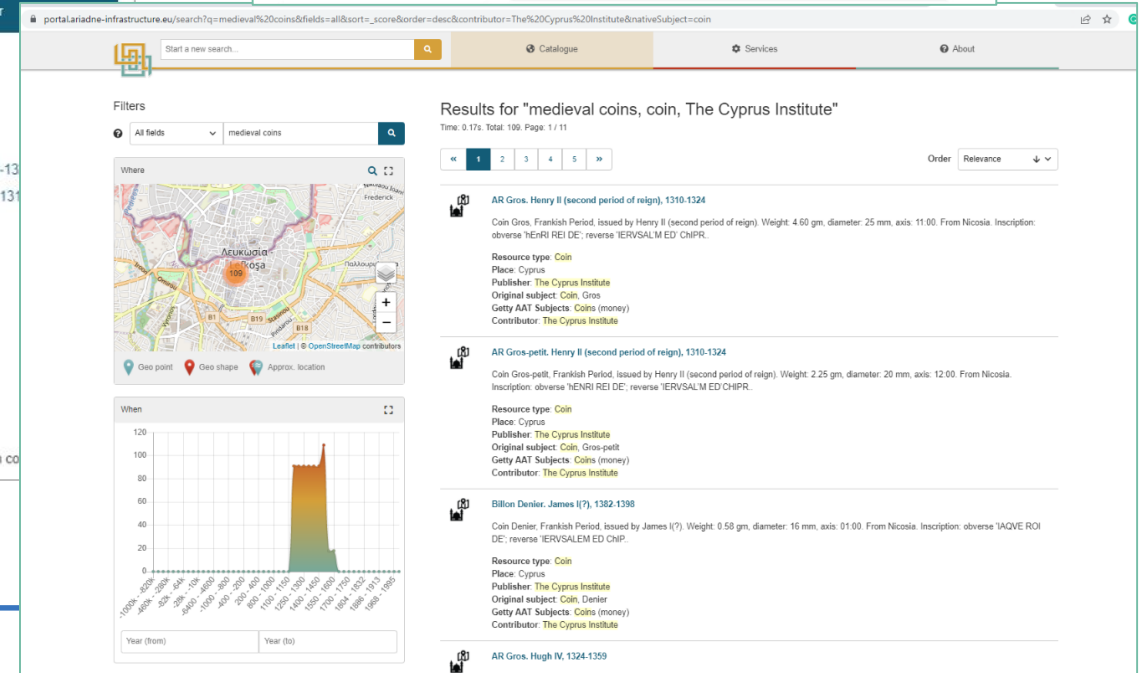
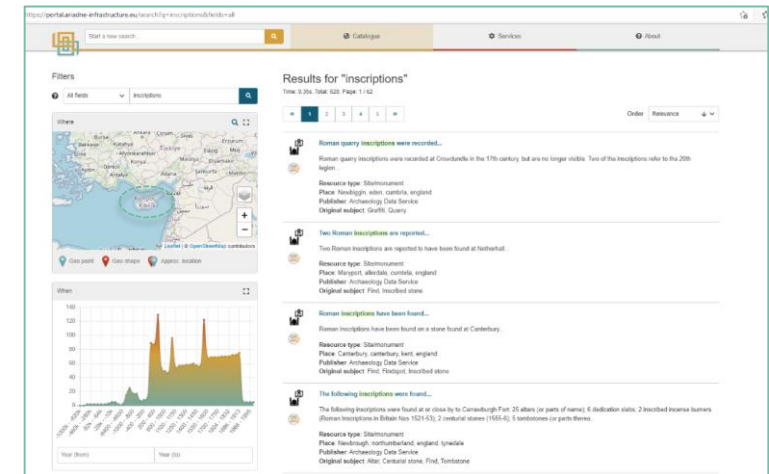
AR Gros-petit. Hugh IV, 1324-1359

AR Gros. Peter I, 1359-1369

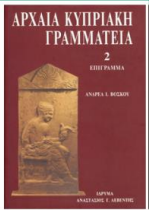
Show all parts (109)

Thematically similar

Thematically similar resources based on terms in co

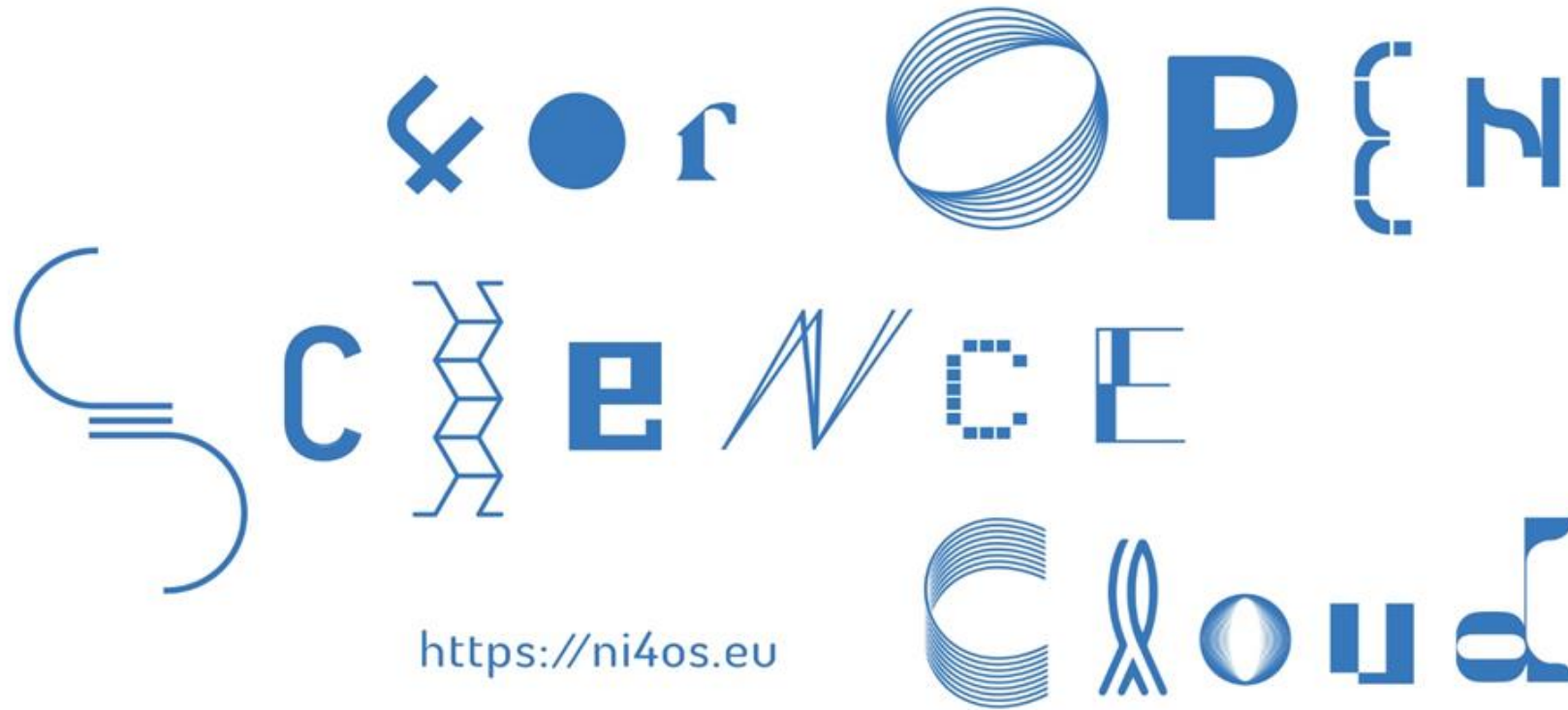


Integration and publication (interoperability)



Recommendations

- ❑ Case study addressing the issue of the development of a semantic knowledge framework to support the data management of multidisciplinary research infrastructures and guarantee its FAIRness
- ❑ Semantic solutions (e.g., metadata, ontologies, controlled vocabularies, thesauri and other knowledge organization systems) are fundamental for the implementation of the FAIR principles, especially, for instance, concerning the Interoperability principle



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