DATA MANAGEMENT IN PRACTICE

Applying CIDOC CRM in an Academic Research Data Management System
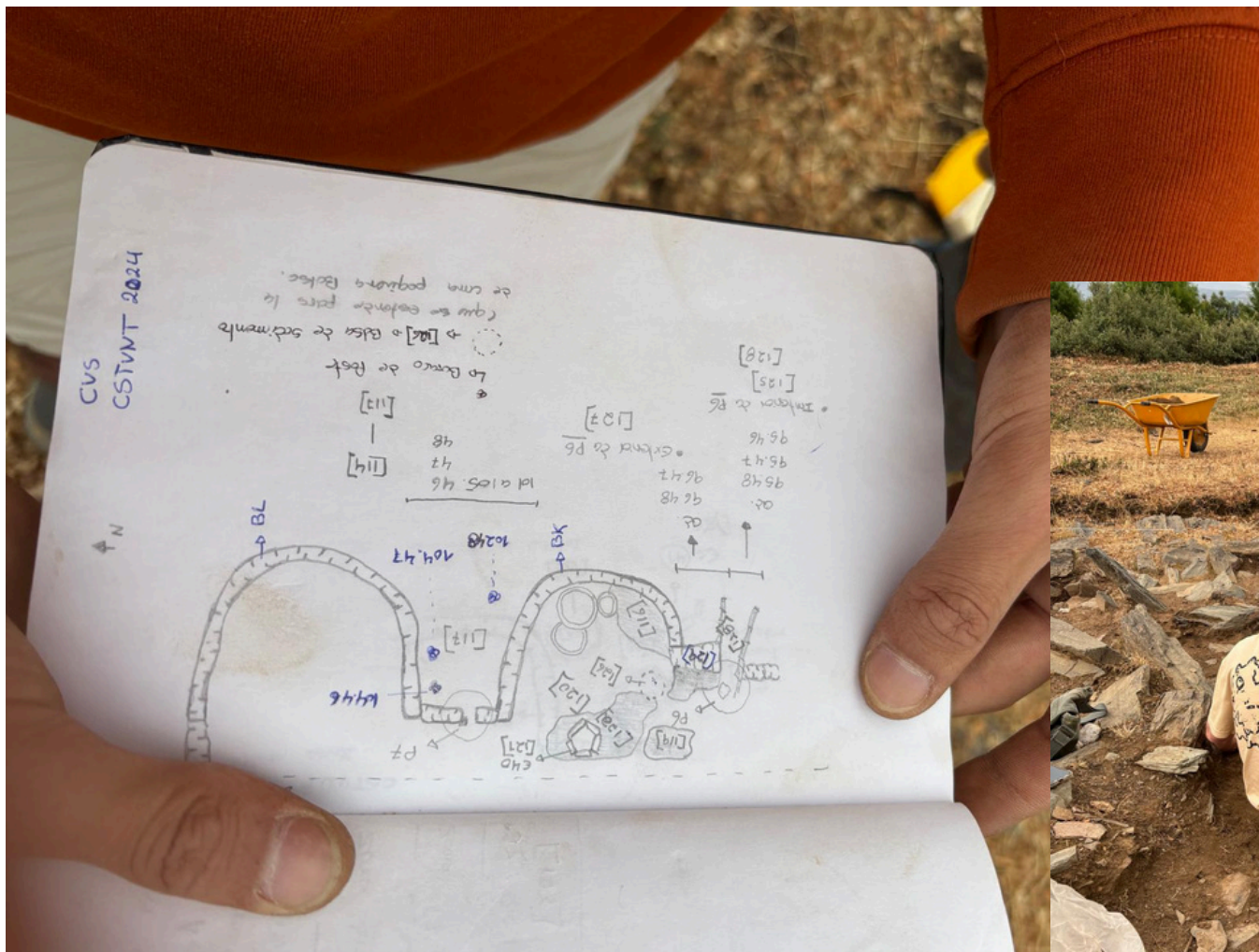
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Motivation

- Passion for past civilizations
- Friendship
  (with a colleague, an Archaeologist at the Univ. Nova de Lisboa)

- Archaeological Excavation in Castanheiro do Vento (Foz Côa, Portugal)

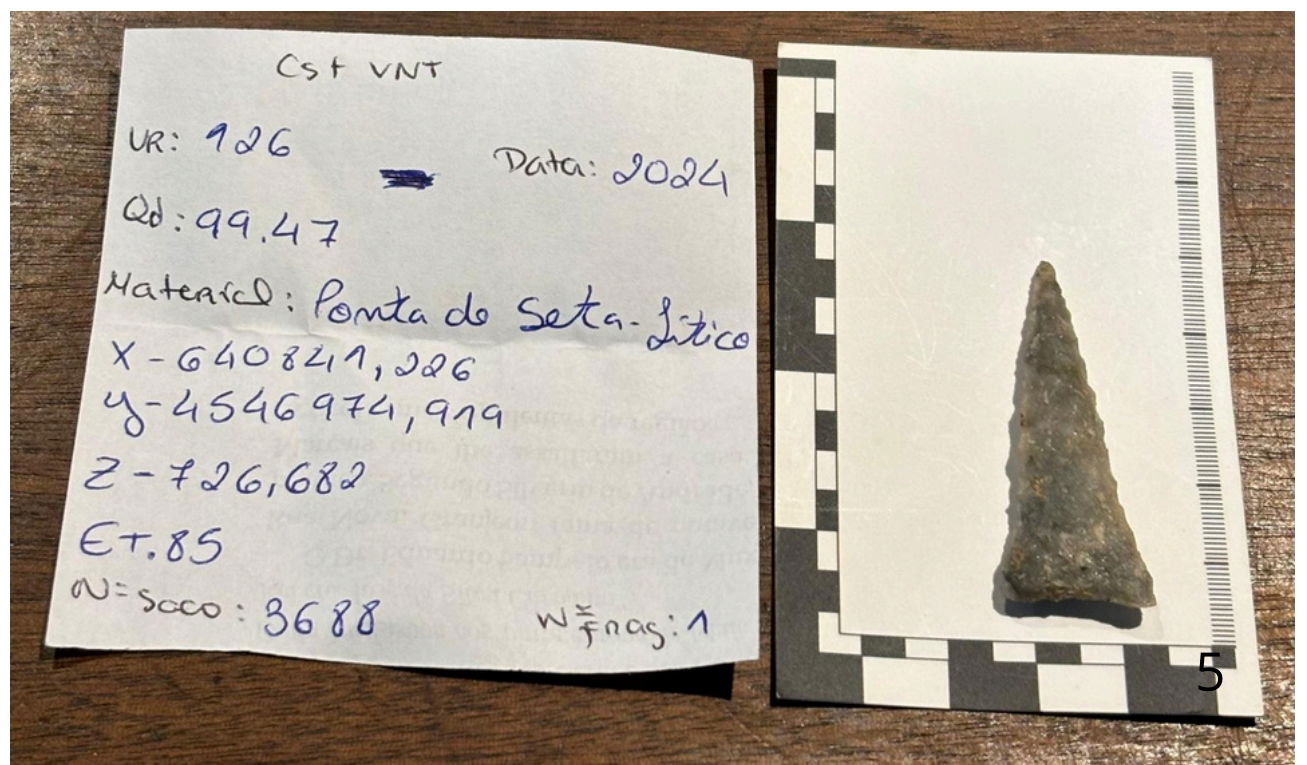# Where all this started

How to describe an arrowhead Data | Metadata

There are so many types of arrowheads and all over the world!

How to describe an arrowhead
Data | Metadata

- **There are so many diferent types of arrowheads**
- **All over the world!**

- **Dream about putting an intelligent system reasoning about these different arrowheads**

Cst VNT

UR: 926   Data: 2024

Qd: 99.47

Material: Ponta de Seta - Lítico

X - 640821,226

Y - 4546974,919

Z - 726,682

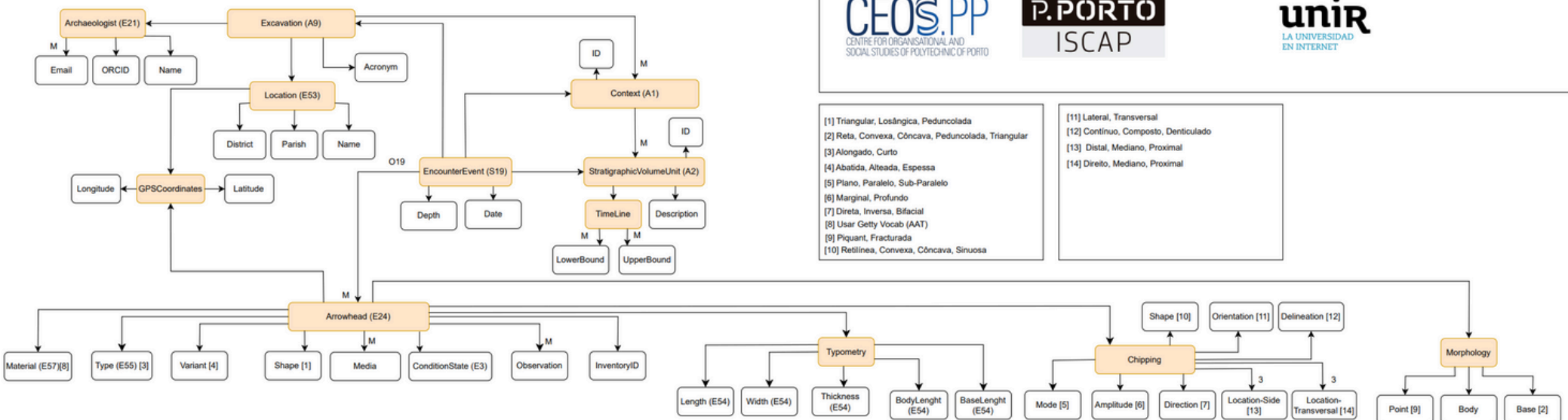Et. 85

N=5000: 3688   W≠ frag: 1

How to describe an arrowhead
Data | Metadata

- **There are so many arrowheads all over the world!**

- **Dream about putting an intelligent system reasoning about these different arrowheads**

- **And then there are other things important to know**

- **Like the context of the finding**

Domain Model

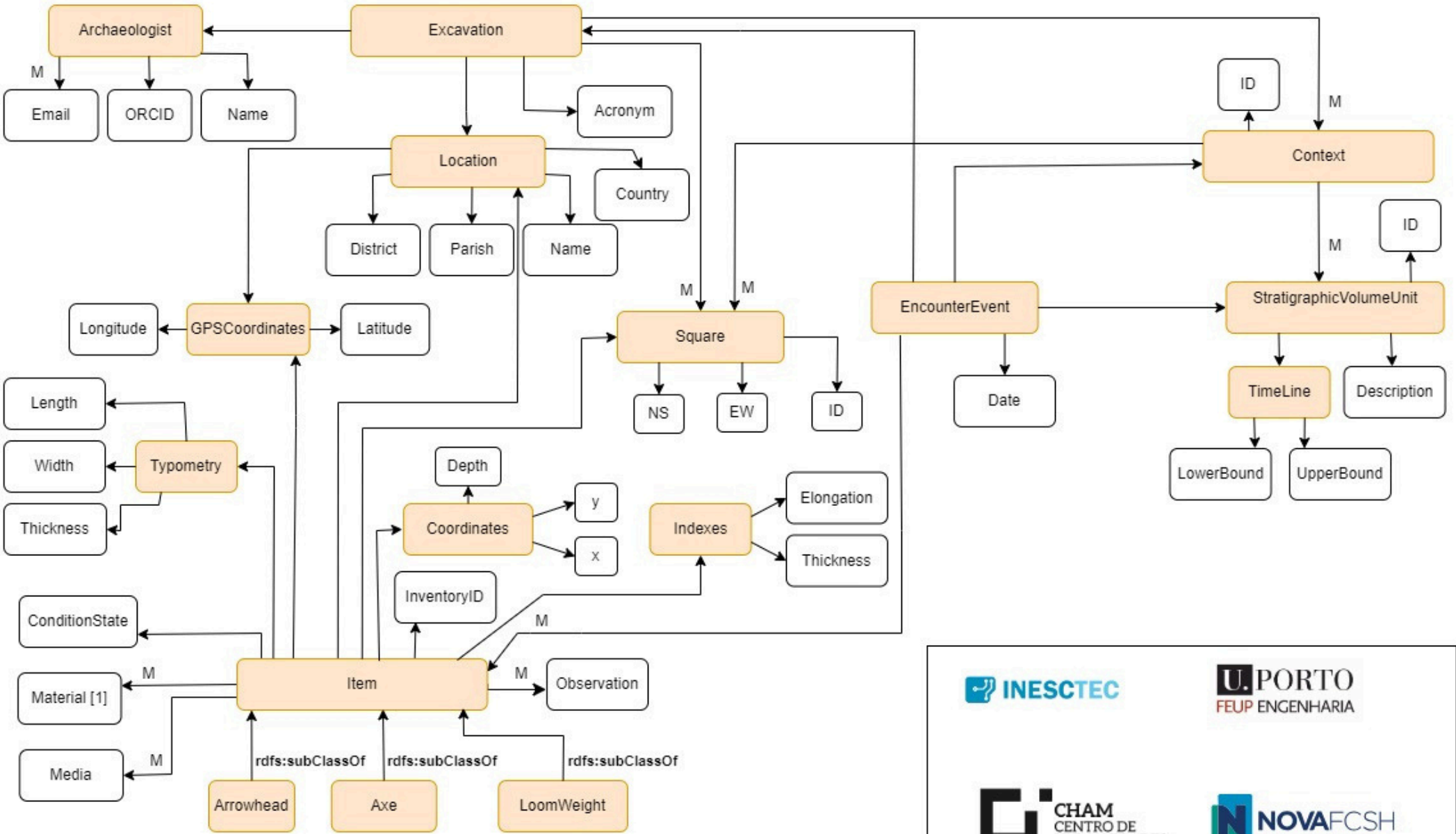ARROWHEAD PROJECT | DOMAIN MODEL - V1.0

Curado-Malta, M., Diez-Platas, M.L., Araújo, A., Muralha, J., Oliveira, M. (2024). Promoting Interoperability on the Datasets of the Arrowheads Findings of the Chalcolithic and the Early/Middle Bronze Age. In: Antonacopoulos, A., et al. Linking Theory and Practice of Digital Libraries. TPDL 2024. Lecture Notes in Computer Science, vol 15177. Springer, Cham. https://doi.org/10.1007/978-3-031-72437-4_6
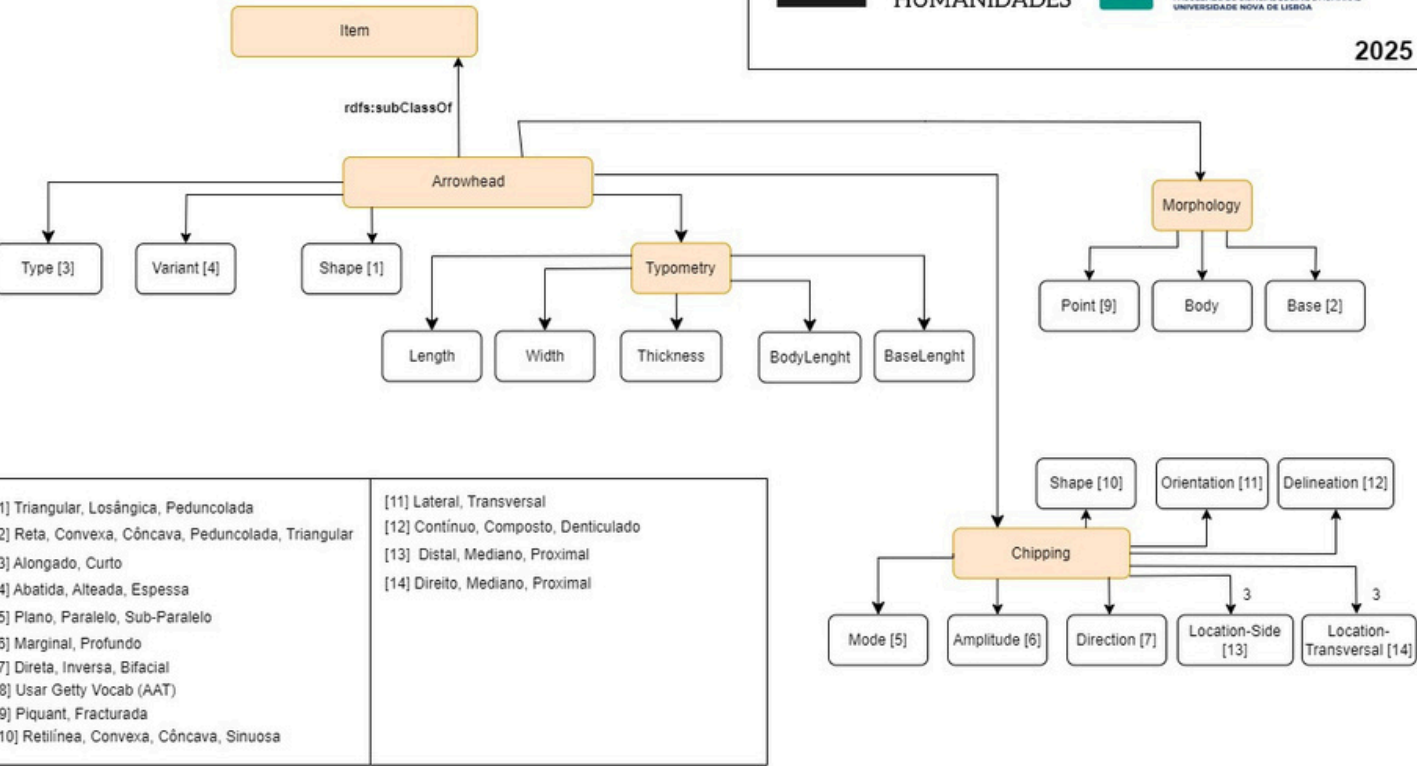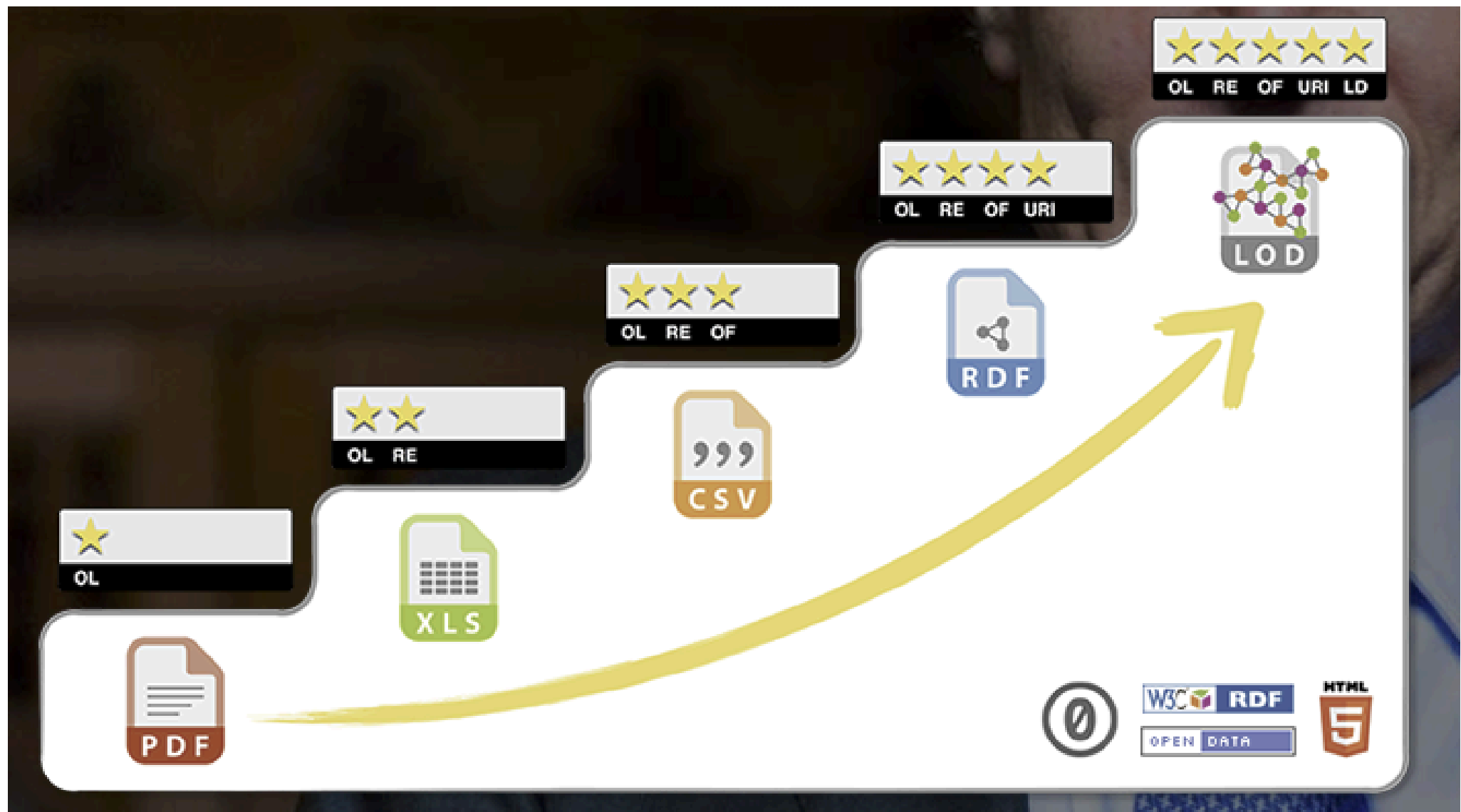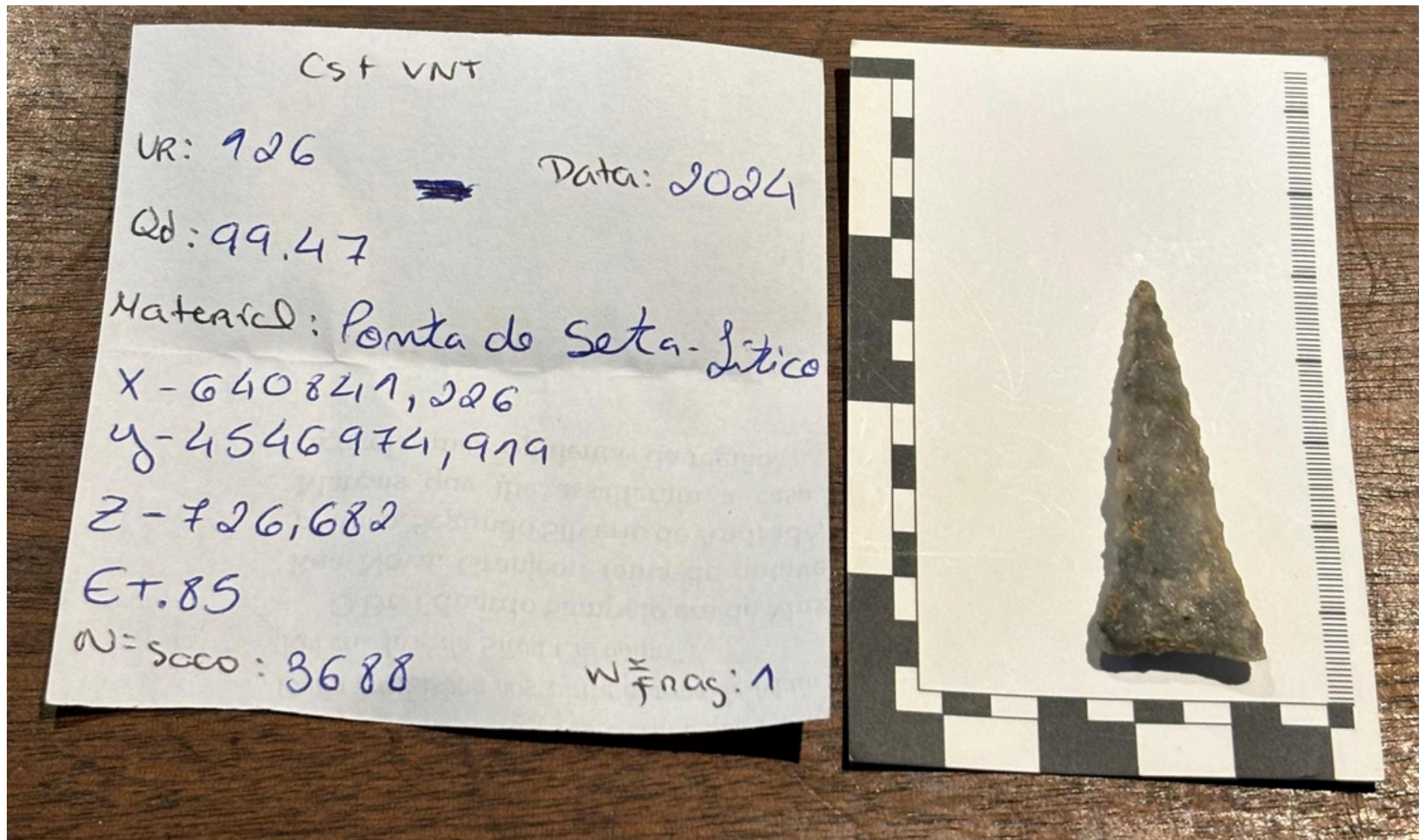
But then …

But then …

[1] A good practice is to use the Getty Vocab (AAT) if possible

MegaLOD Project | Domain Model
V1.1
Class Arrowhead

http://purl.org/megalod/

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UNIVERSIDADE NOVA DE LISBOA

2025

Item

rdfs:subClassOf

Arrowhead

Type [3] Variant [4] Shape [1]

Typometry

Length Width Thickness BodyLenght BaseLenght

Morphology

Point [9] Body Base [2]

Chipping

Shape [10] Orientation [11] Delineation [12]

Mode [5] Amplitude [6] Direction [7] Location-Side [13] Location-Transversal [14]

[1] Triangular, Losângica, Peduncolada
[2] Reta, Convexa, Côncava, Peduncolada, Triangular
[3] Alongado, Curto
[4] Abatida, Alteada, Espessa
[5] Plano, Paralelo, Sub-Paralelo
[6] Marginal, Profundo
[7] Direta, Inversa, Bifacial
[8] Usar Getty Vocab (AAT)
[9] Piquant, Fracturada
[10] Retilínea, Convexa, Côncava, Sinuosa

[11] Lateral, Transversal
[12] Contínuo, Composto, Denticulado
[13] Distal, Mediano, Proximal
[14] Direito, Mediano, Proximal

Paradigm: Linked Open Data (5* data)

Metadata Application Profile

The domain model (and the semantic model) comes from the data

It is a different process from the one we are used to (as software developers - Functional and non-functional req)

In fact, here we have informational requirements....

Metadata Application Profile

- Identify the terms (in the RDF vocabs) that can express what we need
- Identify the constraints

→ HAVING AS DRIVE SEMANTIC INTEROPERABILITY

- CIDOC CRM + extensions → why?

STANDARD

Vocabularies used

NameSpaces

Prefix	URI
dct	http://purl.org/dc/terms/
dul	http://www.ontologydesignpatterns.org/ont/dul/DUL.owl
foaf	http://xmlns.com/foaf/0.1/
dbo	http://dbpedia.org/ontology/
crm	http://www.cidoc-crm.org/cidoc-crm/
crmsci	https://cidoc-crm.org/extensions/crmsci/
crmarchaeo	http://www.cidoc-crm.org/extensions/crmarchaeo/
edm	http://www.europeana.eu/schemas/edm
geo	http://www.w3.org/2003/01/geo/wgs84_pos#
time	http://www.w3.org/2006/time#
ah	https://purl.org/megalod/ms/ah/
excav	https://purl.org/megalod/ms/excavation/
axe	https://purl.org/megalod/ms/axe/
lw	https://purl.org/megalod/ms/loomWeight/

MegaLOD MAP & CIDOC CRM + extensions

In the RDF vocabulary (owl:equivalentClass, Domain & Range)

https//purl.org/megalod/ms/excavation/

excav:Archaeologist owl:equivalentClass crm:E21_Person

excav:Archaeologist
rdfs:domain crmarchaeo: A9_Archaeological_Excavation
rdfs:range excav:Archaeologist

excav:hasSVU
rdfs:domain crmarchaeo:A1_Excavation_Processing_Unit
rdfs:range crmarchaeo:A2_Stratigraphic_Volume_Unit

excav:hasTimeline
rdfs:domain crmarchaeo:A2_Stratigraphic_Volume_Unit

excav:foundInSVU
rdfs:domain crmsci:S19_Encounter_Event
rdfs:range crmarchaeo:A2_Stratigraphic_Volume_Unit

MegaLOD MAP & CIDOC CRM + extensions

In the RDF vocabulary (owl:equivalentClass, Domain & Range)

https//purl.org/megalod/ms/excavation/

excav:foundInAContext

rdfs:domain crmsci:S19_Encounter_Event
rdfs:range crmarchaeo:A1_Excavation_Processing_Unit

excav:foundInAExcavation
rdfs:domain crmsci:S19_Encounter_Event
rdfs:range crmarchaeo:A9_Archaeological_Excavation

```
#==========  #------<>-------------------------------<>-----#  ==========#
#==========  #------<>         CLASSES                <>-----#  ==========#
#==========  #------<>-------------------------------<>-----#  ==========#
            #======<>===============================<>=====#

excav:Archaeologist
    a rdfs:Class;
    rdfs:comment "This Class represents the Archaeologist in charge of the excavation."@en;
    rdfs:isDefinedBy <https://purl.org/ah/ms/excavationMS>;
    rdfs:label "Location - has GPS Coordinates"@en;
   owl:equivalentClass crm:E21_Person;
   rdfs:SubClassOf foaf:Person;
    vann:usageNote "Non-mandatory Property - 0..1"@en .


            #======<>===============================<>=====#
#==========  #------<>-------------------------------<>-----#  ==========#
#==========  #------<>         Properties              <>-----#  ==========#
#==========  #------<>-------------------------------<>-----#  ==========#
            #======<>===============================<>=====#


#>-------------------------------------<#
#>         Data Properties             <#
#>-------------------------------------<#
excav:bc
    a rdf:Property, owl:DataProperty;
    rdfs:comment "This property informs if the date in the bound of the timeline is before christ (true) or After christ (
```

MegaLOD MAP and CIDOC CRM + sci

In the Metadata Application Profile

https://purl.org/megalod/map

crmsci:O19_encountered_object

crm:E3_Condition_State

crm:E57_Material

crm:E55_Type

crm:E54_Dimension

Some Triples

Left navigation:
- Graphs overview
- Class hierarchy
- Class relationships
- Visual graph
- Similarity
- {...} SPARQL
- Setup
- Lab
- Help

```
3   PREFIX crmarchaeo: <http://www.cidoc-crm.org/extensions/crmarchaeo/>
4
5   SELECT DISTINCT ?subject
6       (REPLACE(STR(?predicate), "^.*/([^/]+)$", "$1") AS ?property)
7       ?object ?context
8   WHERE {
9     GRAPH ?context {
10      ?subject ?predicate ?object .
11      FILTER (
12        STRSTARTS(STR(?predicate), "http://www.cidoc-crm.org/cidoc-crm/") ||
```

Table | Raw response | Pivot Table | Google Chart

Filter query results   Compact view ○ Hide row numbers ○

Showing results from 0 to 53 of 53. Query took 0.1s, moments ago.

#	subject	property	object	context
1	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3983	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-001	https://purl.org/megalod/3937/
2	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3983	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-002	https://purl.org/megalod/3937/
3	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3986	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-003	https://purl.org/megalod/3937/
4	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3988	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-005	https://purl.org/megalod/3937/
5	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3990	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-006	https://purl.org/megalod/3937/
6	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3992	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-010	https://purl.org/megalod/3937/
7	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3994	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-014	https://purl.org/megalod/3937/
8	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3996	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-015	https://purl.org/megalod/3937/
9	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3998	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-017	https://purl.org/megalod/3937/
10	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4000	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-018	https://purl.org/megalod/3937/
11	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4002	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-020	https://purl.org/megalod/3937/
12	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4004	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-023	https://purl.org/megalod/3937/
13	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4006	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-022	https://purl.org/megalod/3937/
14	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4009	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-029	https://purl.org/megalod/3937/
15	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4011	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-038	https://purl.org/megalod/3937/
16	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4029	"O19_encountered_object"	http://localhost/megalod/3937/item/ah-40	https://purl.org/megalod/3937/
17	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4038	"O19_encountered_object"	http://localhost/megalod/3937/item/AH-34f	https://purl.org/megalod/3937/
18	http://localhost/megalod/3937/item/ah-001	"E57_Material"	http://vocab.getty.edu/page/aat/300011443	https://purl.org/megalod/3937/
19	http://localhost/megalod/3937/item/ah-002	"E57_Material"	http://vocab.getty.edu/page/aat/300011443	https://purl.org/megalod/3937/
20	http://localhost/megalod/3937/item/ah-003	"E57_Material"	http://vocab.getty.edu/page/aat/300011175	https://purl.org/megalod/3937/
21	http://localhost/megalod/3937/item/ah-005	"E57_Material"	http://vocab.getty.edu/page/aat/300011173	https://purl.org/megalod/3937/
22	http://localhost/megalod/3937/item/ah-006	"E57_Material"	http://vocab.getty.edu/page/aat/300011173	https://purl.org/megalod/3937/
23	http://localhost/megalod/3937/item/ah-010	"E57_Material"	http://vocab.getty.edu/page/aat/300011173	https://purl.org/megalod/3937/
24	http://localhost/megalod/3937/item/ah-014	"E57_Material"	http://vocab.getty.edu/page/aat/300011173	https://purl.org/megalod/3937/
25	http://localhost/megalod/3937/item/ah-015	"E57_Material"	http://vocab.getty.edu/page/aat/300011173	https://purl.org/megalod/3937/
26	http://localhost/megalod/3937/item/ah-017	"E57_Material"	http://vocab.getty.edu/page/aat/300011175	https://purl.org/megalod/3937/
27	http://localhost/megalod/3937/item/ah-018	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
28	http://localhost/megalod/3937/item/ah-020	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
29	http://localhost/megalod/3937/item/ah-022	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
30	http://localhost/megalod/3937/item/ah-023	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
31	http://localhost/megalod/3937/item/ah-029	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
32	http://localhost/megalod/3937/item/ah-038	"E57_Material"	http://vocab.getty.edu/page/aat/300011171	https://purl.org/megalod/3937/
33	http://localhost/megalod/3937/item/ah-40	"E3_Condition_State"	"false"^^xsd:boolean	https://purl.org/megalod/3937/
34	http://localhost/megalod/4032/excavation/auxd/encounter/encounter-4036	"O19_encountered_object"	http://localhost/megalod/4032/item/2713222	https://purl.org/megalod/4032/
35	http://localhost/megalod/4040/excavation/esxcav-11/encounter/encounter-4045	"O19_encountered_object"	http://localhost/megalod/4040/item/ah-44	https://purl.org/megalod/4040/
36	http://localhost/megalod/4047/excavation/Excav-teste/encounter/encounter-4052	"O19_encountered_object"	http://localhost/megalod/4047/item/teste1-ponta	https://purl.org/megalod/4047/
37	http://localhost/megalod/4061/excavation/Excavation-example/encounter/encounter-4066	"O19_encountered_object"	http://localhost/megalod/4061/item/AH-22	https://purl.org/megalod/4061/
38	http://localhost/megalod/4061/item/AH-22	"E3_Condition_State"	"true"^^xsd:boolean	https://purl.org/megalod/4061/
39	http://localhost/megalod/4061/item/AH-22	"E55_Type"	"true"^^xsd:boolean	https://purl.org/megalod/4061/
40	http://localhost/megalod/4061/item/AH-22	"E57_Material"	http://vocab.getty.edu/page/aat/300011175	https://purl.org/megalod/4061/
41	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4077	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-01-TEST	https://purl.org/megalod/4069/
42	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4079	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-002	https://purl.org/megalod/4069/
43	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4081	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-teste-2	https://purl.org/megalod/4069/
44	http://localhost/megalod/4069/item/AH-002	"E3_Condition_State"	"true"^^xsd:boolean	https://purl.org/megalod/4069/
45	http://localhost/megalod/4069/item/AH-002	"E55_Type"	"true"^^xsd:boolean	https://purl.org/megalod/4069/
46	http://localhost/megalod/4069/item/AH-002	"E57_Material"	https://purl.org/megalod/material/flint	https://purl.org/megalod/4069/
47	http://localhost/megalod/4069/item/AH-teste-2	"E3_Condition_State"	"true"^^xsd:boolean	https://purl.org/megalod/4069/
48	http://localhost/megalod/4069/item/AH-teste-2	"E55_Type"	"false"^^xsd:boolean	https://purl.org/megalod/4069/
49	http://localhost/megalod/4069/item/AH-teste-2	"E57_Material"	http://collection.britishmuseum.org/id/thesaurus/material/wood	https://purl.org/megalod/4069/

Run
keyboard shortcuts

Download as

Some Triples

|	subject	property	object
1	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3983	"019_encountered_object"	http://localhost/megalod/3937/item/ah-001
2	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3983	"019_encountered_object"	http://localhost/megalod/3937/item/ah-002
3	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3986	"019_encountered_object"	http://localhost/megalod/3937/item/ah-003
4	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3988	"019_encountered_object"	http://localhost/megalod/3937/item/ah-005
5	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3990	"019_encountered_object"	http://localhost/megalod/3937/item/ah-006
6	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3992	"019_encountered_object"	http://localhost/megalod/3937/item/ah-010
7	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3994	"019_encountered_object"	http://localhost/megalod/3937/item/ah-014
8	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3996	"019_encountered_object"	http://localhost/megalod/3937/item/ah-015
9	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-3998	"019_encountered_object"	http://localhost/megalod/3937/item/ah-017
10	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4000	"019_encountered_object"	http://localhost/megalod/3937/item/ah-018
11	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4002	"019_encountered_object"	http://localhost/megalod/3937/item/ah-020
12	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4004	"019_encountered_object"	http://localhost/megalod/3937/item/ah-023
13	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4006	"019_encountered_object"	http://localhost/megalod/3937/item/ah-022
14	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4009	"019_encountered_object"	http://localhost/megalod/3937/item/ah-029
15	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4011	"019_encountered_object"	http://localhost/megalod/3937/item/ah-038
16	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4029	"019_encountered_object"	http://localhost/megalod/3937/item/ah-40
17	http://localhost/megalod/3937/excavation/CSTVNT/encounter/encounter-4038	"019_encountered_object"	http://localhost/megalod/3937/item/AH-34f

	4038		
18	http://localhost/megalod/3937/item/ah-001	"E57_Material"	http://vocab.getty.edu/page/aat/300011443
19	http://localhost/megalod/3937/item/ah-002	"E57_Material"	http://vocab.getty.edu/page/aat/300011443
20	http://localhost/megalod/3937/item/ah-003	"E57_Material"	http://vocab.getty.edu/page/aat/300011175
21	http://localhost/megalod/3937/item/ah-005	"E57_Material"	http://vocab.getty.edu/page/aat/300011173
22	http://localhost/megalod/3937/item/ah-006	"E57_Material"	http://vocab.getty.edu/page/aat/300011173
23	http://localhost/megalod/3937/item/ah-010	"E57_Material"	http://vocab.getty.edu/page/aat/300011173
24	http://localhost/megalod/3937/item/ah-014	"E57_Material"	http://vocab.getty.edu/page/aat/300011173
25	http://localhost/megalod/3937/item/ah-015	"E57_Material"	http://vocab.getty.edu/page/aat/300011173
26	http://localhost/megalod/3937/item/ah-017	"E57_Material"	http://vocab.getty.edu/page/aat/300011175
27	http://localhost/megalod/3937/item/ah-018	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
28	http://localhost/megalod/3937/item/ah-020	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
29	http://localhost/megalod/3937/item/ah-022	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
30	http://localhost/megalod/3937/item/ah-023	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
31	http://localhost/megalod/3937/item/ah-029	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
32	http://localhost/megalod/3937/item/ah-038	"E57_Material"	http://vocab.getty.edu/page/aat/300011171
33	http://localhost/megalod/3937/item/ah-40	"E3_Condition_State"	"false"^^xsd:boolean
34	http://localhost/megalod/4032/excavation/auxd/encounter/encounter-4036🔗	"O19_encountered_object"	http://localhost/megalod/4032/item/2713222
35	http://localhost/megalod/4040/excavation/esxcav-11/encounter/encounter-4045	"O19_encountered_object"	http://localhost/megalod/4040/item/ah-44
36	http://localhost/megalod/4047/excavation/Excav-teste/encounter/encounter-4052	"O19_encountered_object"	http://localhost/megalod/4047/item/teste1-ponta
37	http://localhost/megalod/4061/excavation/Excavation-example/encounter/encounter-4066	"O19_encountered_object"	http://localhost/megalod/4061/item/AH-22
38	http://localhost/megalod/4061/item/AH-22	"E3_Condition_State"	"true"^^xsd:boolean
39	http://localhost/megalod/4061/item/AH-22	"E55_Type"	"true"^^xsd:boolean
40	http://localhost/megalod/4061/item/AH-22	"E57_Material"	http://vocab.getty.edu/page/aat/300011175
41	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4077	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-01-TEST
42	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4079	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-002
43	http://localhost/megalod/4069/excavation/EXC-PRESENTATION/encounter/encounter-4081	"O19_encountered_object"	http://localhost/megalod/4069/item/AH-teste-2
44	http://localhost/megalod/4069/item/AH-002	"E3_Condition_State"	"true"^^xsd:boolean
45	http://localhost/megalod/4069/item/AH-002	"E55_Type"	"true"^^xsd:boolean
46	http://localhost/megalod/4069/item/AH-002	"E57_Material"	https://purl.org/megalod/material/flint
47	http://localhost/megalod/4069/item/AH-teste-2	"E3_Condition_State"	"true"^^xsd:boolean
48	http://localhost/megalod/4069/item/AH-teste-2	"E55_Type"	"false"^^xsd:boolean
49	http://localhost/megalod/4069/item/AH-teste-2	"E57_Material"	http://collection.britishmuseum.org/id/thesaurus/m
50	http://localhost/megalod/4095/excavation/EXC-PRESENTATION-2/encounter/encounter-4101	"O19_encountered_object"	http://localhost/megalod/4095/item/AH-002
51	http://localhost/megalod/4095/item/AH-002	"E3_Condition_State"	"true"^^xsd:boolean
52	http://localhost/megalod/4095/item/AH-002	"E55_Type"	"true"^^xsd:boolean

21

System developed by a Master Student

FrontOffice

<u>**Domingos Santos**</u>
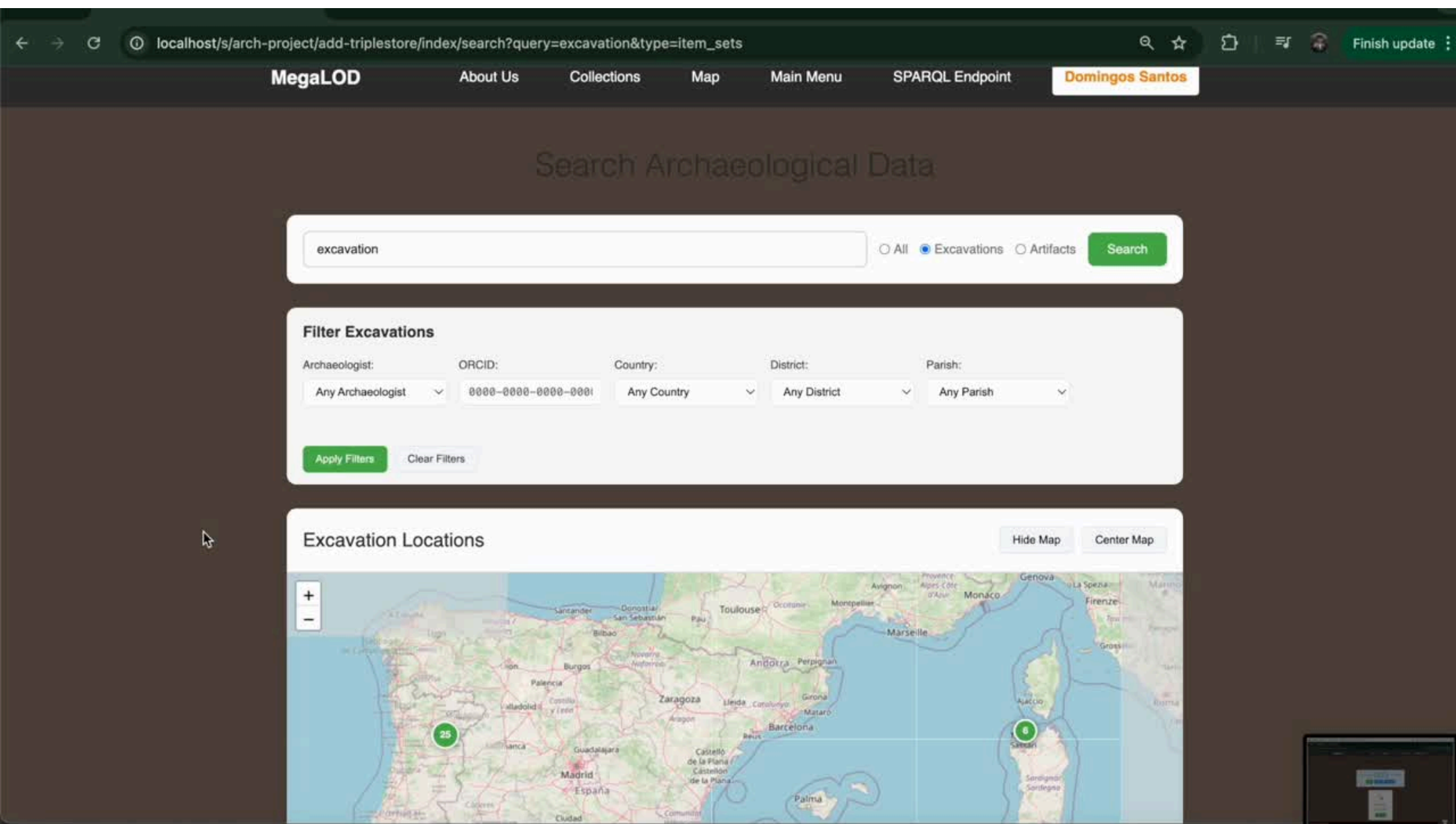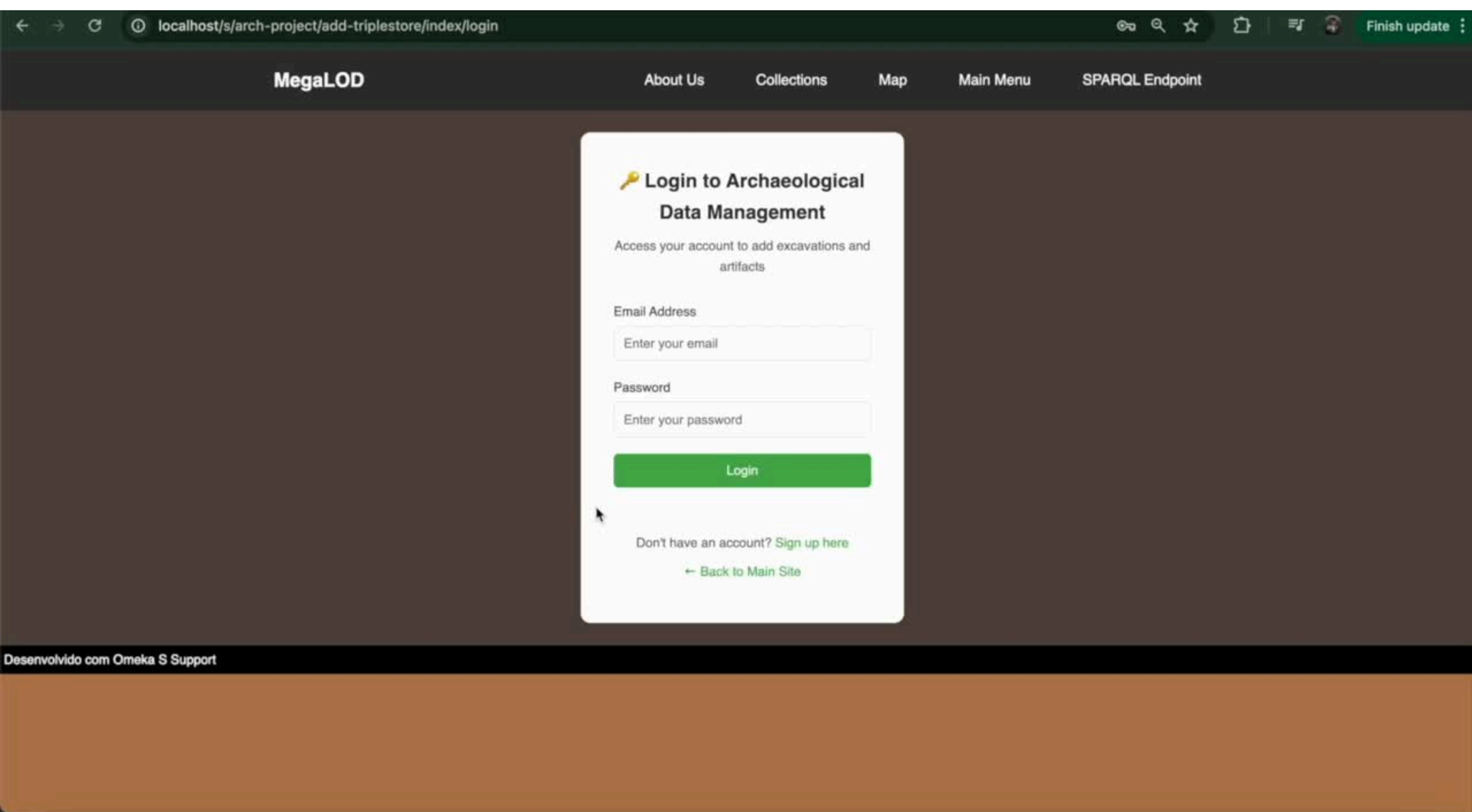
Using Omeka S

Upload data, manage data, sincronise it with RDF-store

System developed by a Master Student

BackOffice

Using OMeka S

System developed by a Master Student

SPARQL EndPoint with GraphDB

DATA MANAGEMENT IN PRACTICE

Applying CIDOC CRM in an Academic Research Data Management System

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Credits to Domingos Santos

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