Aggregating coin find data to the ARIADNE+ portal

Challenges of a specialist domain

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Coin find data: what, where, how?

As a mass-produced medium, coins are one of the most common categories of archaeological finds, in particular of those made by metal detectorists: for example, they make up nearly half of all records in the database of the Portable Antiquities Scheme of England and Wales[1]. What is more, being more or less standardised, the core data that describes and defines coins is for the most part relatively simple to handle: e.g. issuer, mint, denomination, date, identification reference. Today, there is a wide range of substantial databases covering both coin collections and coin finds.

In spite of the structural similarities across databases, first international attempts nearly 40 years ago to agree on formats to enable data exchange between projects came to nothing, primarily because the various constraints to which individual institutions were subjected (e.g. by funding bodies, overarching requirements across institutions, etc.) inhibited the necessary flexibility of database structures, and placed the focus of work on aspects other than data sharing.

With the creation of the Linked Open Data initiative Nomisma in 2010[2], new possibilities were created to facilitate communication and exchange between databases. Nomisma provides stable digital representations of numismatic concepts in the form of a controlled vocabulary and an ontology[3]. Today 57 institutions and projects provide 353,837 Nomisma-conform records for ingestion into a range of virtual union catalogues based on the Nomisma architecture, such as Online Coins of the Roman Empire (OCRE) or the Inventory of Greek Coin Hoards[4].

[1] https://finds.org.uk/.

[2] http://nomisma.org/about/.

[3] http://nomisma.org/ontology.

[4] http://nomisma.org/datasets.

Current integration into the ARIADNE portal

Integration of data on coin finds into the ARIADNE portal presents a number of challenges, partly because the data is being provided not from primarily numismatic projects and institutions, but rather from disparate archaeological resources that integrate a wide range of artefacts and records. As a result, there is generally little focus on more specialised aspects of the numismatic data.

Granularity of numismatic data is affected by the Getty AAT, which has very patchy coverage of numismatic concepts. Thus, only five of the nine denominations of the Augustan coinage system of the early Roman Empire (*as coins* in Abb. 1) have a Getty entry, inevitably leading to a distortion of the representation of certain types of coins within the portal.

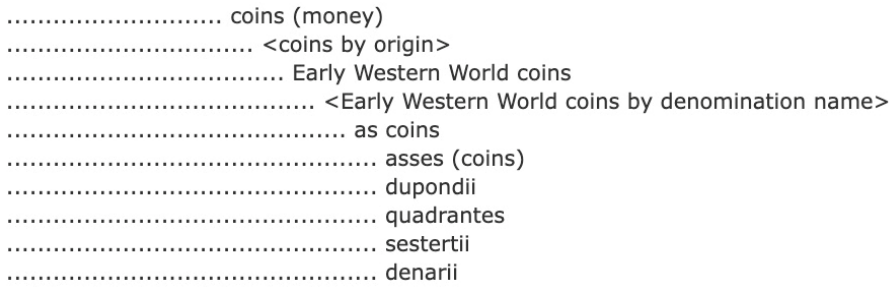

Fig. 1. The hierarchy of Getty AAT entries for the Augustan coinage system (screenshot).

AAT is also used inconsistently across, and sometimes even within, resources. Some contributors use *coins*, others *Early Western World coins* when modelling Roman coins in the portal. But since the hierarchy of AAT is not yet implemented in the ARIADNE portal, a search for *coins* will not produce coins modelled only as *Early Western World coins*. In one case a contributor models some Roman denarii as *denarii*, but not as *coins*, so that not all entries for their coins can be retrieved by a single search, whether one for *coin* or for *denarii*.

Problems also arise from using CIDOC-CRM for modelling numismatic data. CIDOC can rightly claim to contain a comprehensive ontology that maps all forms of cultural heritage, but the "problem" is precisely this requirement – in order to achieve a meaningful level of granularity for each discipline, the ontology must be highly specialized. Coins can be modelled with CIDOC, but this requires a thorough understanding of the ontology and has an impact on practical applicability. The event-based approach of CIDOC is in many ways counter-intuitive, and can lead to different, often rather circuitous ways of modelling, for example for the authority responsible for issuing a coin (fig. 2):

Fig. 2. The mapping of the issuing authority in the X3ML mapping tool for the ARIADNE portal for mapping 891 (screenshot).

As a result, models used to aggregate numismatic data can vary significantly, both in structure and granularity, thus reducing the ability to access data across resources.

Nomisma: an alternative?

Potentially, many of these problems can be mitigated by using the Nomisma vocabulary and ontology. For example, the vocabulary aims to provide persistent identifiers for all required concepts, such as all the denominations of the Augustan coinage system for which Getty is incomplete.

Both the vocabulary and the ontology have been developed in close cooperation with or by the numismatic community, and in particular the ontology reflects the ways in which numismatists work and conceptualise coins. The result is an intuitive system that can be implemented by a wider range of scholars, many of whom do not have the skills or knowledge to work with CIDOC. For example, the authority responsible for issuing a coin can be modelled as a single triple:

```
<https://ikmk.smb.museum/object?id=18221682>
nmo:hasAuthority
<http://nomisma.org/id/vespasian>
```

With highly standardised objects such as coins that are recorded in enormous numbers in a wide range of resources, under constraints of time pressure and by non-expert personnel, CIDOC generates avoidable sources of error. The application of the Nomisma ontology, on the other hand, has the potential to reduce inhibitions and avoid sources of error, thus encouraging more granular aggregation of data into the portal. However, both ontologies can be combined together, and this combination can be fruitful for both. While Nomisma provides the required level of granularity for the numismatic domain, CIDOC provides properties that are not numismatic specific and therefore are not on the agenda for Nomisma, a combination that is already implemented by Nomisma (fig. 3).

The way forward

Therefore, work is ongoing with colleagues from ARIADNEplus to investigate ways in which the Nomisma vocabulary and ontology can be integrated into the aggregation portal in order to provide more easily implemented and granular standardised modelling, thus increasing both the quantity and quality of accessible data.

Already, as an interim measure, building on pre-existing models in the ARIADNE portal, a CIDOC-based model has been developed that is being tested on datasets from a number of different data providers.

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All coins found in Northamptonshire, ordered chronologically by issue

This query uses property paths to look for children of (`crm:P89_falls_within`) of the Wikidata URI for Northamptonshire, England (http://www.wikidata.org/entity/Q23115).

```
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>
PREFIX dcmitype: <http://purl.org/dc/dcmitype/>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>
PREFIX nm: <http://nomisma.org/id/>
PREFIX nmo: <http://nomisma.org/ontology#>
PREFIX org: <http://www.w3.org/ns/org#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?coin ?type ?date ?place WHERE {
?coin nmo:hasFindspot/crm:P7_took_place_at/crm:P89_falls_within ?place ;
      nmo:hasTypeSeriesItem ?type ;
      a nmo:NumismaticObject .
?place crm:P89_falls_within+ <http://www.wikidata.org/entity/Q23115> .
?type nmo:hasEndDate ?date .
} ORDER BY ASC(?date) LIMIT 100
```

Fig. 3: A SPARQL query combining the ontologies of Nomisma and CIDOC presented as an example in the Nomisma documentation (http://nomisma.org/documentation/sparql/#geographic-hierarchy).

Author Contributions

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