Searching and Analyzing Coin Finds with a Linked Data Based Web Application

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Abstract. This paper presents the CoinSampo demonstrator, a web application and data service created to open data on numismatic citizen finds reported in Finland between 2013 and 2023. The data has been converted to Linked Open Data (LOD) using light weight ontologies that were based on the data. The CoinSampo web application queries a knowledge graph with SPARQL, and offers users faceted search and various visualization options for data analysis. The application is aimed at researchers, heritage professionals, citizen scientists, amateur archaeologists, educators and the general public. We will also show how the underlying user interface framework can be applied to other similar data such as the finds data of the British Museum.

1 Introduction and Related Work

The amount of reported metal-detected objects in Finland has considerably increased in the recent years [13,7]. Coin finds are usually the most numerous of the object type reported by the public and can be identified more precisely than other common finds, producing higher quality data and making them specially suitable for describing semantically. Coin movement has also been historically international, and therefore creating Linked Open Data LOD resources that enable transnational comparison and data harmonization has wide relevance in numismatics and in digital Cultural Heritage (CH) more generally [5].

CoinSampo was created as part of the *DigiNUMA – Digital Solutions for European Numismatic Heritage* [6,5,11,10][4] research project, in response to the new needs in Finnish and international CH data management, research, and dissemination. The CoinSampo web application[5] and data service[6] were opened

[4] This paper has been partially extended in [10].
[5] https://coinsampo.ldf.fi
[6] https://www.ldf.fi/dataset/coinsampo

to public on February 28th, 2024. The underlying data was collected in the National Museum of Finland between 2013 and 2023 based on the reports made by the objects' finders, mostly recreational metal-detectorists, and includes data of some 18 000 objects.

CoinSampo builds upon the Sampo model[7] [2] and the FindSampo framework [3] and web service [9]. FindSampo opens data about archaeological citizen finds of all types that have been catalogued and redeemed in to the national collections of the Finnish Heritage Agency (FHA). However, only prehistoric and medieval finds are consistently redeemed and recorded by the FHA. In contrast CoinSampo opens data about all reported numismatic finds, including thousands of Early Modern coins.

Our work was influenced by Nomisma.org[8] [1], a collaborative international project that aims to provide necessary ontologies for representing numismatic concepts as Linked Data. CoinSampo is also inspired by the ARIADNEplus[9] [12] project. ARIADNEplus is a pan-European research infrastructure and aggregation project of archaeological data including coin finds.

In addition to the demonstrator for Finnish data, we are also developing a more generic version of the CoinSampo web application, one that could be used to search and visualize any data that uses the Nomisma.org ontology. We have also applied the user interface framework to analyzing the citizen finds data of the Portable Antiquities Scheme (PAS)[10] of the British Museum, which includes around 500 000[11] coin finds.

2 CoinSampo Web Application

The CoinSampo KG was created using existing tabular CSV data collected by the National Museum of Finland. The data was converted to RDF format using light weight ontologies created from the data. The ontologies are linked to external resources, mainly to Wikidata[12], where possible. The conversion process was done largely by reusing as much as possible the existing Python script for converting FindSampo data. However, there was only limited opportunity to reuse FindSampo ontologies because the main ontological work there concerned object types, which wasn't relevant in data consisting completely of coins. The data[13] is served openly from a SPAQRL endpoint and data service hosted by the Linked Data Finland platform.

The CoinSampo web application [14] is based on the Sampo-UIframework [4,8]. The application works by querying the data using SPARQL queries created based

[7] Cf. Sampo series of systems: https://seco.cs.aalto.fi/applications/sampo/
[8] http://Nomisma.org
[9] https://ariadne-infrastructure.eu
[10] https://finds.org.uk/
[11] Data export obtained in early 2023.
[12] https://www.wikidata.org/
[13] https://www.ldf.fi/dataset/coinsampo
[14] See source code at https://github.com/SemanticComputing/coinsampo-web-app.

on selections made by the user and then presenting the data to the user using various JavaScript libraries. The user can refine the search using various facets, view and browse coin finds individually or as a table, or analyze the data by selecting one of the available visualization tabs. For example in Fig.1 a user has limited the search to coins from the Viking Age (here defined as AD 800–1150) that were found in the municipality of Nousiainen. The visualization shows arcs on a map[15] starting from the minting place of the coin and ending at the findsite municipality. It is easy to see that coins found in Finland were minted in many places around Europe, and also arrived from further afield such as from modern Uzbekistan. The mint concepts have been mapped to Wikidata and their coordinates have been extracted from there. Similarly, find municipalities are mapped to the place ontology YSO (General Finnish Ontology) Places. The CoinSampo web application also offers perspectives for searching and visualizing authorities (such as rulers) and mints.

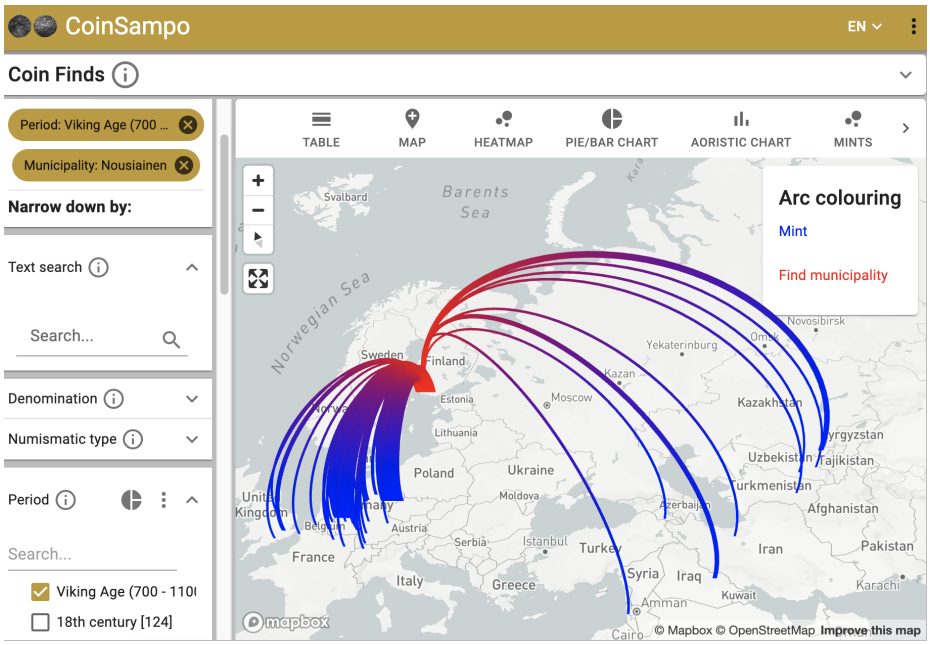

Fig. 1. An example of a visualization created with CoinSampo application showing the identified mint sites of Viking Age coins found in municipality of Nousiainen.

We have also applied the user interface framework to PAS finds data from England. The data was first converted to simple RDF using a CSV export from PAS data, and then a simple portal was created for it. We call this new applica-

[15] The map is rendered using Mapbox (https://www.mapbox.com/about/maps/) service which is based on OpenStreetMap (http://www.openstreetmap.org/copyright.

tion PASampo. As of 2024, it is still a work in progress and unavailable online, but it can already be used to analyze the PAS data and to make comparisons with the Finnish data. For example, in Fig. 2 a statistical Sampo tool has been used to create pie charts comparing the relative proportions of various materials of manufacture among PAS and Finnish coin finds. At over 80 percent (Finland) and 60 percent (PAS) copper is clearly the most common material in both cases, but there are significant differences among other materials (e.g., silver and gold), indicating very different numismatic histories between these two regions.

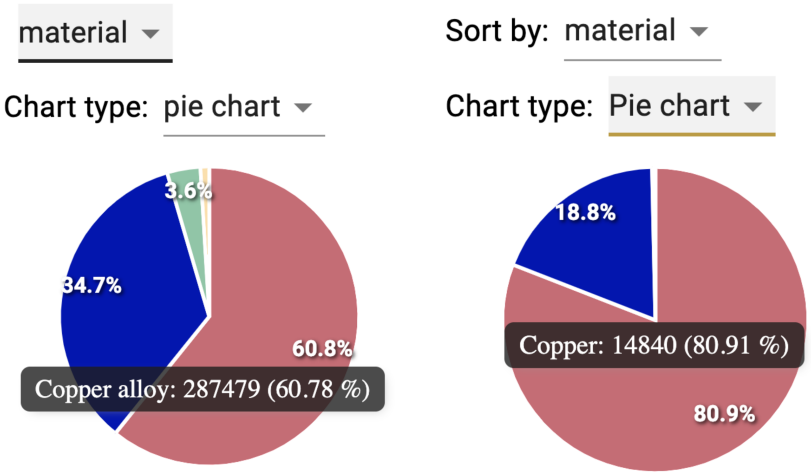

Fig. 2. Comparing relative numbers of different materials in coin finds from England (chart on the left) and Finland (on the right) with pie charts generated using Sampo portals.

3 Conclusion

The CoinSampo demonstrator is an example of how practical applications can be build on top of SPARQL endpoints, and how ontologies mapped to external resources can be used to enrich the data and make it easier to search and analyze. The web application framework is easy to modify so that it can be applied to other similar data as show by the PAS example. However, some of the visualizations would require specific semantic information such as coordinates for mints. Comparing different sets of data meaningfully in more complex cases would also require harmonizing the data which may require significant effort.

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