

Roman Open Data: a data visualization & exploratory interface for the academic training of university students

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Abstract- Within the framework of the Archeology degree course at the University of Barcelona, a series of practical activities are proposed to provide students with a series of techniques and knowledge that they can apply in future work and research. It was Antonio Aguilera, one of the original developers of the CEIPAC amphoric epigraphy database, who promoted its use as part of a hypothetical activity where university students were faced with the discovery of an inscription on ceramics in an archaeological excavation. This would give them experience of managing the digital corpus that is essential to read and understand the Latin epigraphic texts, as well as knowledge of where to find parallels related to the inscription. This concomitance would enable them to date the archaeological strata, to understand the type of product that reaches the excavation, as well as the distribution of the food containers. Here the practice is transferred to the Roman Open Data portal (<https://romanopendata.eu>), an exploratory interface developed within the framework of the European EPNet project, which allows geolocation of epigraphic searches on a map, consulting – through the use of computational tools to be able to analyze epigraphic data on amphorae – members of the academic community, while promoting the principles and practices of Open Science in the context of Digital Humanities.

Keywords: *teaching innovation, archeology, epigraphy, ancient history, software, digital humanities, open science.*

1. INTRODUCTION

The Epigraphy subject of the Archeology degree at the University of Barcelona has a high degree of practical content. Its main objectives include providing students with the essential knowledge and techniques to read and understand Latin epigraphic texts. This concomitance would allow them to date the archaeological layer, to understand the type of product that reaches the excavation, and the distribution of the food containers. Among the various works developed during the course, students are set the task of practicing one of the most common forms of epigraphy in archaeological excavations, namely that found on ceramics. This epigraphy concerns the various phases of ceramic traceability, and in the case of amphorae, it is divided between *ante cocturam* inscriptions

(made before the piece is fired), where graffiti and stamps dominate (in relation to the stamps and their meaning, see Remesal 1986 and Moros 2019; Moros 2021; on the graffiti Rodríguez 1993 and Ozcáriz et al. 2020), and the *post cocturam* inscriptions (made after firing the piece), among which are graffiti and the painted marks known as *tituli picti* (concerning the *tituli picti*, see Aguilera 2001; 2007 and Remesal, Aguilera 2014). The case study presented to the students arises from the discovery of some of these inscriptions in a hypothetical excavation and how, thanks to the use of CEIPAC's amphoric epigraphy database, they can find parallels that relate to the inscription analyzed. The CEIPAC Latin amphoric epigraphy database consists of more than 50,000 inscriptions and has close to two million pieces of data (<http://ceipac.ub.edu>). Thanks to the virtual compilation of a large number of catalogs, the researcher benefits from a large mass of information being reduced to a single point – where to organize the exploration of amphorae epigraphy (Remesal et al. 2000, 2008 and 2015a; Remesal 2012; Aguilera, Berni 2001; Aguilera 2004; Pérez 2014).

We will take as a reference one of the ceramic containers best known for its prolific production during the first three centuries AD along the Genil and Guadalquivir rivers in present-day Andalusia, the Dressel 20 type olive oil amphora (Remesal 2018). Thanks to the epigraphic study, we can detail its specific place of production, as well as its manufacturing and shipment chronology. In the first phase, in the graffiti prior to the firing of the container, we would find the owner of the pottery or the craftsman specialized in the manufacture of the container represented, after which the stamp would show, by means of an abbreviated message to the owner of the pottery, the producer of the container or the owner of the bottled olive oil. Finally, the *tituli picti* would announce the tare of the container, the weight in Roman pounds of the bottled olive oil, the place of fiscal control exercised, the consular year of the container, and the private agents that own the olive oil and are in charge of its distribution under the protection of the Roman State (Fig. 1).

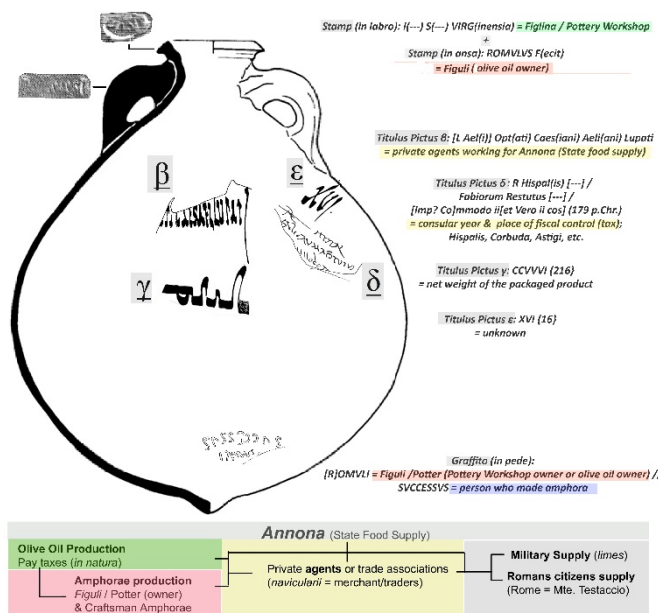


Figure 1 Epigraphic distribution on Dressel 20 amphora.

2. CONTEXT

Next, different epigraphic cases are proposed to the students to start the practice. The exercise consists of offering the students a photograph of the epigraph and guiding them in the search for other examples among the tangle of data in the CEIPAC epigraphic database. These teaching activities are part of the last step designed by the CEIPAC group, with the first phases dedicated to the accumulation of data and its analysis, and which currently dedicates part of its time to the teaching and social transfer of its research. Thus, the objective of this communication is to outline the steps that students must follow in using the CEIPAC digital corpus and its future applicability in real-world findings of these materials.

It is normal that at the beginning of the course the database sees an increase in visits, caused by 30 or 40 new users. Thus, taking the years 2018 and 2019 as an example, and capturing their use through a visualization, we see an increase in visits from the months of September to October, a fact largely attributable to the incorporation of users from university courses.

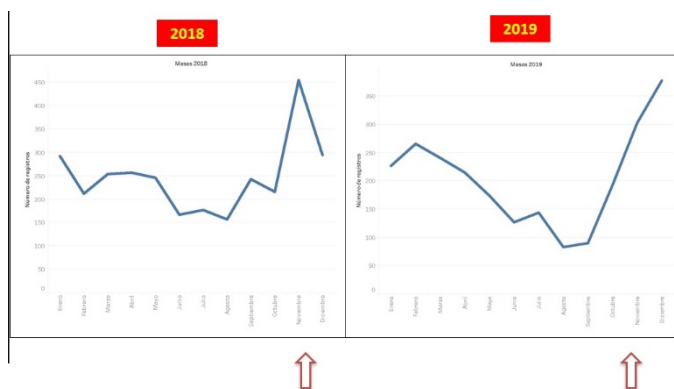


Figure 2. Monthly frequency of use of the CEIPAC database during the years 2018 and 2019.

In order to have this information available internally from CEIPAC, the user is asked to register in the database. Once access to the database has been requested, the latest publications emptied into the database are made known, as well as the latest additions to the bibliographic database. At this point it is proposed to cite the epigraphic files by reference to the CEIPAC number. In parallel, a visit to the geographic browser allows us to gain an idea of the magnitude of the data cleared; geolocating stamps, graffiti and *tituli picti* in different modern countries, cities and other specific locations. In this line, the epigraphic search tool also allows searches according to their typology, either in general or in more detail, and is able to combine different fields in the same query, making it easier to obtain more specific results.

Next, students are proposed various epigraphic cases that they could find in a fictitious excavation or an unpublished material review, and whose search they will be able to carry out in the traditional CEIPAC database or in its exploratory extension Roman Open Data.



Figure 3. Epigraphic study proposals: Stamp I[IVNIM]JELISS[I]/E[T]MELISSE (CEIPAC 41498).

Let's say the student finds a two-line stamp whose state of conservation only permits us to read the complete letters ...*e.* *elisse*. If, for example, we search for the proposed heading in the database with the following text '%e% elisee' we would obtain more than 240 results from the stamp found in Las Delicias (Écija, Sevilla) with the full form IIVNIMELISSEETMELISSE; a joint production of amphorae by a certain *Iunius Melissus* close to *Iunia Melissa* (Berni 2008). These results can be viewed in text format or through images. Next, the detailed file for each heading can be consulted, enabling users to know the development of all its fields, from the place of conservation, to the amphoric type, through to its dating and other interesting information such as available literature. (Fig 4). There is also an option for the user to report errors and download the information from the file for their own use.

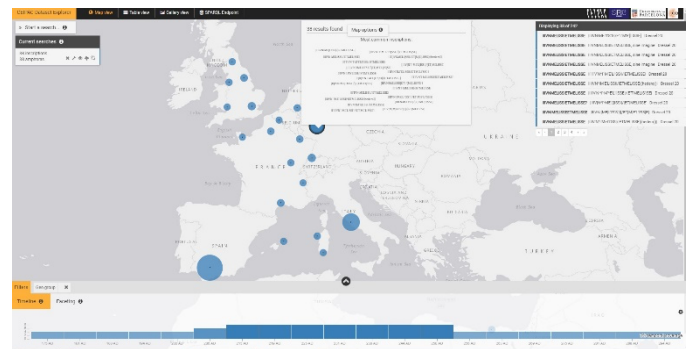


Figure 5. Text search *...elissi* in Roma Open Data (*II Ivni Melissi et Melisse*).

Roman Open Data offers multiple epigraphic, typological and even bibliographic search possibilities. Being able to link queries allows you to offer more complex results in a matter of seconds, speeding up the analysis of the data as we have never known before. The proposed query can be concatenated from others, whether epigraphic, typological or bibliographic. These results will be displayed in the same visualization, comparing the various queries and with the possibility of filtering any of the nodes. Likewise, these sums can always be hidden by clicking on the eye-shaped icon. In parallel, the possibility of a more detailed consultation is always offered through the classic tab system in the Tables and Gallery section. And as we have commented, by joining the Open Science movement, it is possible to download the consulted data in a .csv or .xls format, either in its entirety or filtered. To do this, just click on the cloud-shaped icon with an arrow. Another option allows you to download the resulting visualization by means of a screenshot, giving several options on the results to be displayed on the map, either through nodes, heat maps, whether based on a modern map or one of the Roman Empire. In addition, the user can select a known time slot in each of the epigraphic productions; by reducing the search field and also by using the Faceting tool, more specific queries can be defined, or new search fields proposed.

As an example, we can compare the distribution of the *Melissii* production with another production from the 3rd century AD that appears coded under the PNN text. In the following query, in addition to observing the general results of the search for the PNN stamp (which exceeds 500 results), we have added a third, more detailed query for a stamp of the same reading in order to observe the potential of the tool: filtering to find civil settlements in Italy, of direct reading, exact and on the handles of the amphora. In this line, the temporal results can be unified within the same chronological framework to better compare them.

Figure 4. Stamp epigraphic file IIVVNIMELISSI/ETMELISSE. CEIPAC 5652.

3. DESCRIPTION

Recently, within the framework of the European project *EPNet: Production and distribution of food during the Roman Empire: Economics and Political Dynamics* (ERC-2013-ADG 340828, Remesal et al. 2015b), an exploratory interface has been developed – Roman Open Data (<https://romanopendata.eu>) – the culmination of efforts to represent the knowledge accumulated over decades of CEIPAC projects (concerning its use, see Palacín et al. 2017 and 2020; Gimenez et al. 2018; Remesal, Rull 2021; see tutorials in Pérez 2020a and 2020b). The objective of the interface is to allow historians, through the use of computational tools, to analyze the epigraphic data on amphorae along with members of the scientific community, while promoting the principles and practices of Open Science in the context of the Digital Humanities. The information system used is based on an ontology-based data access and integration engine, called Ontop (Calvanese et al. 2015 and 2016; Mosca et al. 2015). The tool allows you to geolocate the answer on a map, enabling you to specify more through the Table or Gallery views, displaying the information on your files. The main interface is a virtual knowledge graph, presented in RDF, which conforms to the developed ontology and can be consulted through a SPARQL endpoint. Likewise, one of the successes of the interface lies in its ease of use, allowing a user without great technical knowledge to explore the data without having to worry about writing these queries in what we like to call ‘computer language’.

Next, if we ask a question about the inscription IIVVNIMELISSI/ETMELISSE, indicating the specific text to be displayed, in this case *...elisse* we would obtain the following result:

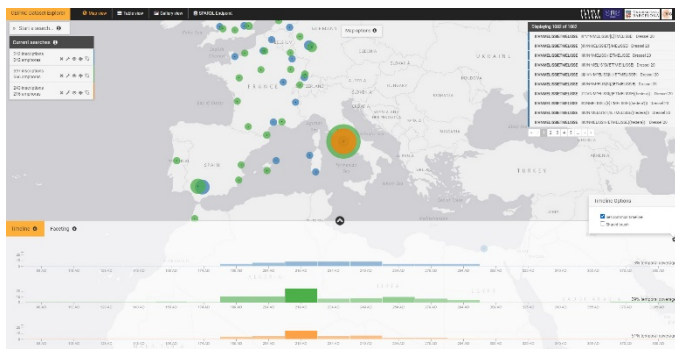


Figure 6. Search for the inscription... *elissi* in Rome Open Data (*II Ivni Melissi et Melisse*)-in blue. The search results of the PNN text are in green, while the results of filtered PNN text in an advanced search are in orange.

4. RESULTS

Let us suppose that the work proposal to the students on the discovery of amphoric epigraph in a hypothetical excavation ends up materializing a real investigation, and that our students find themselves faced with the discovery of an amphora handle for the sample analyzed above. This case has already been raised to us internally within the CEIPAC group by researchers who request support in deciphering the meaning of the epigraphy they are studying, and who are also referred to use the designed tool, namely ‘What information would you get from your query on Roman Open Data?’

At this point, by comparing the images they will observe an incomplete copy of the stamp IIIVNMELISSIETMELISSE. Furthermore, 100% of the known samples in the CEIPAC digital corpus with more than 240 records only belong to this reading. They would see that it is a production recognised in up to 53 different places, and whose place of production was associated with the alfar de Las Delicias, near Écija in present-day Andalusia (Mauné et al. 2014). Indirectly, they would know the amphoric type to which it was associated, the Dressel 20 amphorae produced in the Roman province of *Baetica*; this would then allow them to know the product it contained, namely olive oil. With a query for copies of the same reading, they would obtain a list of the basic and specialized bibliography of the inscription, where to find the possible interpretations concerning the identity of the characters linked to the brand, in this case, perhaps a family company (brothers *Iunius Melissus*, close to *Iunia Melissa*, or that of the father with his daughter (Remesal 1986; Berni 2008 and 2017). They would also know that this stamp was combined with two other stamps, the FPATERNI and the VENERF, on another amphora in Worms and Wiesbaden, present-day Germany (CEIPAC 11 and 14588), and was also produced in the *fundus Paternus* - Los Villares, near the city of Alcolea del Río (Moros et al. 2010). The excavations in the Monte Testaccio (Rome) (Remesal 2019) may infer a dating from the 3rd century AD, where other copies of the same reading have been dated in the same download to the year 223 AD, especially in layer C 50-70 (Remesal 2010, n. 375, 375a1 and 375a2; CEIPAC 28721-28723), where the inscription n. 375a2 has appeared alongside a *titulus pictus* with consular dating [*R astigis*] *arca p(endo) ccxl[---]+ et euthyches/[ma]ximo ii [et] aeliano cos* (Remesal, Aguilera 2010, n. 81; CEIPAC 28977)

Finally, thanks to the mapping, you could observe its distribution throughout the western Mediterranean, with a large presence in Rome and on the Rhenish border.

5. CONCLUSIONS

The proposed teaching activity provides students with the necessary tools to be able to quickly and in detail learn about the information behind the epigraphic messages, some of which are encoded and widely represented and studied by CEIPAC.

This teaching practice has been developed since the 2015/2016 course within the Archeology degree, using the traditional scheme of the CEIPAC database. Classes consist of an average of 15/20 students and the work is proposed individually, after instruction on the operation of the databases. In all cases, the requested data is found by the students, proof of the proper use of the epigraphic base, which is valued in their evaluation. Consequently, students are provided with new analytical tools in the framework of Digital Humanities with an Epigraphy that is fully immersed in the digital age, thus enhancing processes that speed up future studies, capable of addressing large data sets. We do not know if the organizers of epigraphic content from other databases, such as the Epigraphic Database Heidelberg (<https://edh-www.adw.uni-heidelberg.de>), the Epigraphic-Datenbank Claus-Slaby (<http://www.manfredclaus.de>), or the Epigraphic Database Rome (<http://www.edr-edr.it>) promote its dissemination and use among university students.

Thanks to the typological link of the piece associated with the inscription, we can know the product contained, marketed and / or consumed in the location of the ceramic discovery. In this line, if the location where the product was produced is known, commercial routes for the consumption of these products can be elaborated. Finally, from the contextual or typological dating, they can infer a timeframe for the inscription studied and therefore propose chronologies for the area of the archaeological survey where the piece was found, many of which are as precise as the date of a consular year.

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