PROCEEDINGS OF THE 1ST TIR-FOR SYMPOSIUM. FROM TERRITORY STUDIES TO DIGITAL CARTOGRAPHY

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TABULA IMPERII ROMANI / FORMA ORBIS ROMANI
TIR-FOR INTERNATIONAL COMMISSION

PROCEEDINGS OF THE 1ST TIR-FOR SYMPOSIUM. FROM TERRITORY STUDIES TO DIGITAL CARTOGRAPHY

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The digital *Tabula Imperii Romani – Forma Orbis Romani* project

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Abstract

The TIR-FOR International Commission, within the International Union of Academies, is developing an online map of the Roman world based on the documentation accumulated during the project's one hundred years of history. The article explains this digital application, consisting of a database with a map viewer, a public website, an administrator website and a powerful advanced search facility. It will be indispensable as a research and outreach infrastructure for the Roman world intended as a large-scale collaboration between countries.

Keywords: Digital map, mapping, Roman Empire, LOD, archaeology, online database.

1. Introduction

The TIR-FOR International Commission, within the International Union of Academies, includes all countries that wish to take part in the project to create a digital map of the Roman Empire. It's the online evolution of the paper map started in the 1920s. The Institute for Catalan Studies (*Institut d'Estudis Catalans*, IEC), which currently holds the presidency of the Commission[6], has produced the application we present here (https://tir-for.iec.cat/). The IEC is developing this project together with the Catalan Institute of Classical Archaeology.

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We should stress that we've created this application as a contribution to the project carried out by the aforementioned institutes. However, we believe the application belongs to all the teams working on the TIR-FOR project because it has been produced under the guidelines of the Commission's agreements. Our desire is not only that the application be available to all the project teams but that everyone should feel it is theirs. We would therefore like everyone working on the TIR-FOR project to be as proactive as possible in proposing improvements and in using the application, making the most of all its potential. (Fig. 1)

2. The aim of the project

The main aim of the project is to share an online map of the Roman Empire. The project is

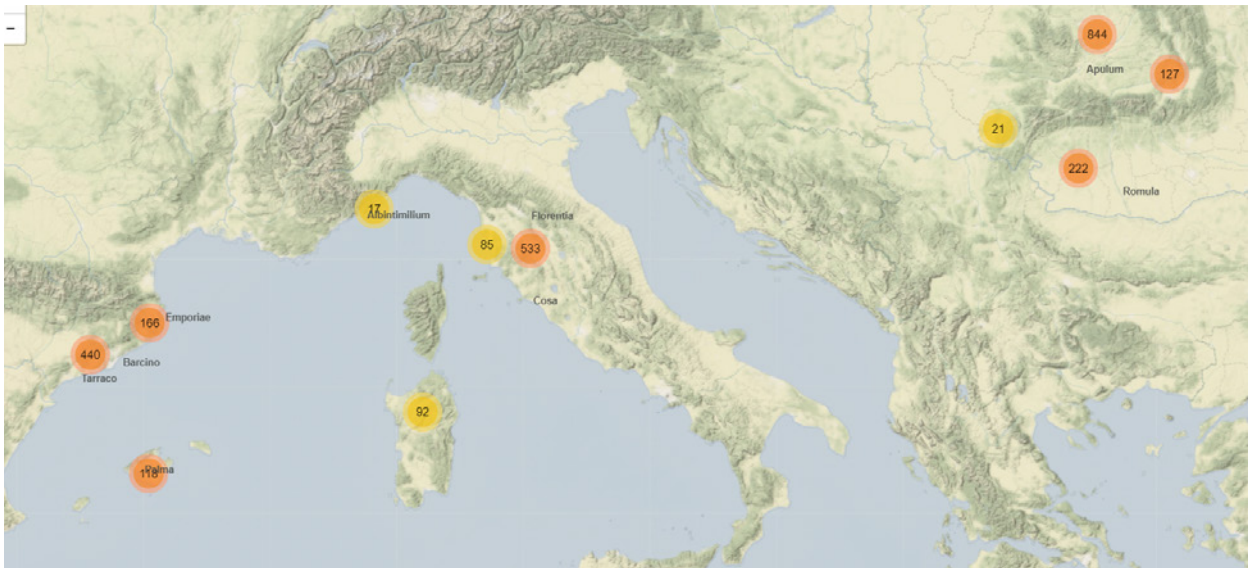

FIGURE 1. The TIR map with the sites currently entered in the application.

creating a huge online digital application, cataloguing and mapping all the information available on sites, toponyms and landforms in the Roman Empire based on precise, reliable and first-hand archaeological data provided by specialists from each of the regions we're working on. The Commission's goal is to globalise and systematise all this information via an online portal shared by all the teams involved in the project. Technologically, the current basis of the project is the combination of an SQL Server database, a geoportal or map viewer and a public website with a powerful search tool. The IEC provides the server and maintains the application.

One fundamental objective is to link this application with other maps and databases of the Roman world to enrich their capacity and help build up an extensive network of information and analysis related to the Roman world. (Fig. 2)

For almost 100 years the TIR-FOR project has been the basic topographic study for the Roman Empire. Given the recent emergence of a large number of other projects on Roman topography that are highly specialised in various subjects, the TIR-FOR project may seem to have become less relevant. However, our proposal will help to rejuvenate this project. It's an innovative proposal, possible due to the structure created by TIR-FOR within the UAI and thanks to the huge amount of information generated by it.

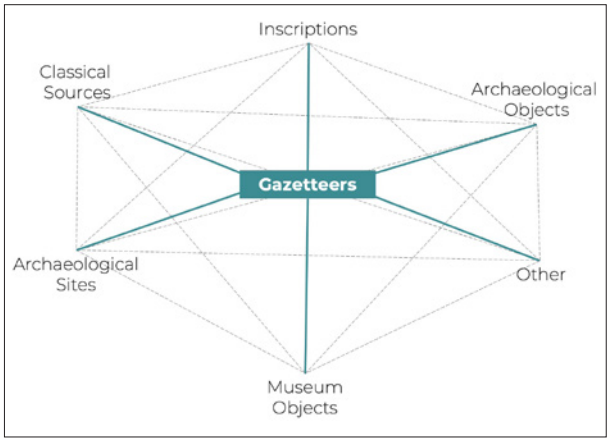

FIGURE 2. Diagram of the function of gazetteers as connectors of Linked Open Data projects.

3. THE PAST AND PRESENT OF THE *TABULA IMPERII ROMANI* (TIR) AND THE *FORMA ORBIS ROMANI* (FOR)

In fact, this application is the sum of two historic centenary projects: the TIR and the FOR. The TIR project focused on summary maps with record sheets and reviews of all the Roman toponyms appearing in the classical sources and the archaeological research carried out in countries formerly occupied by the Roman Empire. It was designed to create maps to the scale of 1:1,000,000. The objective of the

TIR project was therefore to create a scientific map with a gazetteer summarising the Roman world (Gardiner, 1973; Migliorati, 2014).

The FOR project, on the other hand, was designed to produce more detailed maps. It was set up as a large-scale collaboration between countries in order to create a detailed cartography of the Roman world with maps to the scale of 1:25,000 or 1:50,000, accompanied by site catalogues (gazetteers) on all the features that appear on the maps themselves, as well as scientific analysis with conclusions regarding the corresponding territories[7]. The ultimate goal of the FOR project was to produce an exhaustive collection of all the evidence available from sources, epigraphy and archaeology that can be included on a map. The online FOR will therefore have great research potential as it's based on information from either excavations or direct surveys and reports in the archives.

The current online project is actually an enlargement of the TIR project with the FOR project, producing even more detailed mapping. It's like zooming in on specific regions. Both objectives have been maintained, namely to produce a general map and also a detailed map. Consequently, when a general (or TIR) map is being created for an area, we enter only the most significant and well-known archaeological sites and the toponyms. When a detailed (or FOR) map is being created for an area, however, all the toponyms and also all the sites and finds known must be entered (including small, doubtful and/or relatively unknown sites and finds).

On digitising the projects and given the current data model, it was decided that each site should have a unique record sheet containing different levels of information: basic information, which in the original project was associated with TIR maps, and more detailed and exhaustive information, traditionally displayed on the FOR maps. As a result, in the current application basic information (TIR) can be provided as well as more detailed information (FOR) for any site or toponym, whether a more general or detailed map of the area is being created. The record sheet can therefore contain more basic information fields (which are obligatory, both for the TIR and for the FOR map), and other, more detailed information fields, compulsory only for the FOR map. These later fields are optional in areas for which the TIR map is being produced but obligatory for areas where the FOR map is being produced.

Which sites should be included and which not? Following the criteria observed in the published volumes of the TIR, which selected all the toponyms that appear in the sources, epigraphy and numismatics, as well as all the cities, the most representative Roman villas and the rest of the most representative and well-preserved sites, we have established a dictionary of toponyms and elements eligible to appear on TIR maps. It's important to constantly focus on the end result; the aim of the TIR is to create a scientific summary map of the Roman world on a large scale to provide an overall cartographic picture and outline. The FOR project, on the other hand, provides a detailed view of specific zones on the TIR map, as an extension and more detailed version of the TIR for those regions that have been studied more thoroughly and are particularly rich in terms of their documented archaeological evidence. The application allows detailed information to be available for some sites even when these were originally part of the TIR project. When moving from managing data to viewing these data on the public website, since zones with sites from the TIR project are now being managed together with zones from the FOR project, the origin of the sites must be indicated so that the desired view can be chosen. Otherwise, some areas on the map could appear with a very high concentration of sites but the reason for this concentration would not be evident.

4. TIR-FOR, THE ONLINE APPLICATION

We've created a complex geodatabase to digitise the TIR-FOR data and disseminate it online. The Postgre SQL online relational database allows us to apply spatial treatment tools to the project's archaeological data and the application is equipped with a map viewer, a public website, an administrator website and a powerful advanced search facility.

7. For example, Marchi, 2010; Ebanista, 2017.

This system has been created following strict security protocols and creating an independent multi-user environment. Each country has its own workspace within the database system in order to enter, edit and search information. In the management application, each team can only see and manage its own data whereas, on the public website, all the information from all the countries can be seen, albeit only information that has been classified as public.[8]

As mentioned above, the database encompasses both levels of content covered by the TIR and the FOR projects. This means that each site has a unique record sheet where the necessary fields are provided to enable general information about the sites and toponyms, as in the TIR project, as well as fields for the more detailed information, previously only included in the sites included on the FOR map.

The current project is driven by a new unified methodology. The database is used as an integrated system to store the data generated by each country's archaeological team and is the result of considerable systematic work regarding all the concepts concerned. Unified criteria enable the data to be compared, as well as producing chronological-typological maps of the whole Empire or extensive parts of it.

We're currently fine-tuning the TIR-FOR methodology, adapting it to the needs of all the countries that once belonged to the Roman world. Our aim is for regional teams to work in parallel with each other, performance testing and adjusting the database to produce a fully-integrated online system. By working together we can refine and optimise the system and ensure it's suitable for all the countries within the Roman Empire. We also run constant checks to ensure the system works properly for everybody.

The main database tables are those for sites, chronologies, typologies, elements and ancient sources. (Fig. 3)

8. The database record contains information on the author and how to cite the record. This work comes under the terms and conditions of the public Creative Commons licence.

5. The record sheet

The record sheet is divided into the following sections: 1. Site information to provide data that identify and locate the site on the map; 2. Coordinates; 3. Chronology; 4. Typology and elements; 5. Ancient sources (literary, epigraphic, numismatic and iconographic sources); 6. Juridical status; 6. Bibliography; 7. Images; 8. Text (description); 9. Author. (Fig. 4) Each of these sections have been worked on to ensure advanced searches can be carried out based on all the fields or a combination of them.

Chronology is divided into epochs, periods and sub-periods. The periods have been established by the Italian team and approved by the Commission and are based on the history of Rome as a reference point for all the provinces in the Roman Empire. Sub-periods are century by century. It's important for all countries to adapt their data to these chronological periods to be able to create consistent chronological maps of the whole Empire. (Fig. 5)

Unified criteria have been important in establishing the chronological periods but they have been even more important in creating the typologies and elements. It's fundamental for the typology assigned to a site to specify well-defined characteristics recognised and shared by all the teams involved. That's why substantial systematic work has been carried out, agreed by all the teams. The application has a drop-down dictionary of typologies with definitions of the different concepts. The dictionary also includes the criteria used to justify a site appearing on the TIR. (Fig. 6)

Different elements can often be defined within one site (for example, within a city there might be a forum, city walls, baths, etc.). To be able to define these, a drop-down dictionary of elements has also been created, with their definitions and defining characteristics.

The ancient sources have also been defined and systemised (literary, epigraphic, numismatic and iconographic). A drop-down dictionary has been created for the ancient literary sources and each team can ask to add the sources that are missing for their particular geographic area. (Fig. 7) The juridical status section is also the result of considering all possible statuses and how they

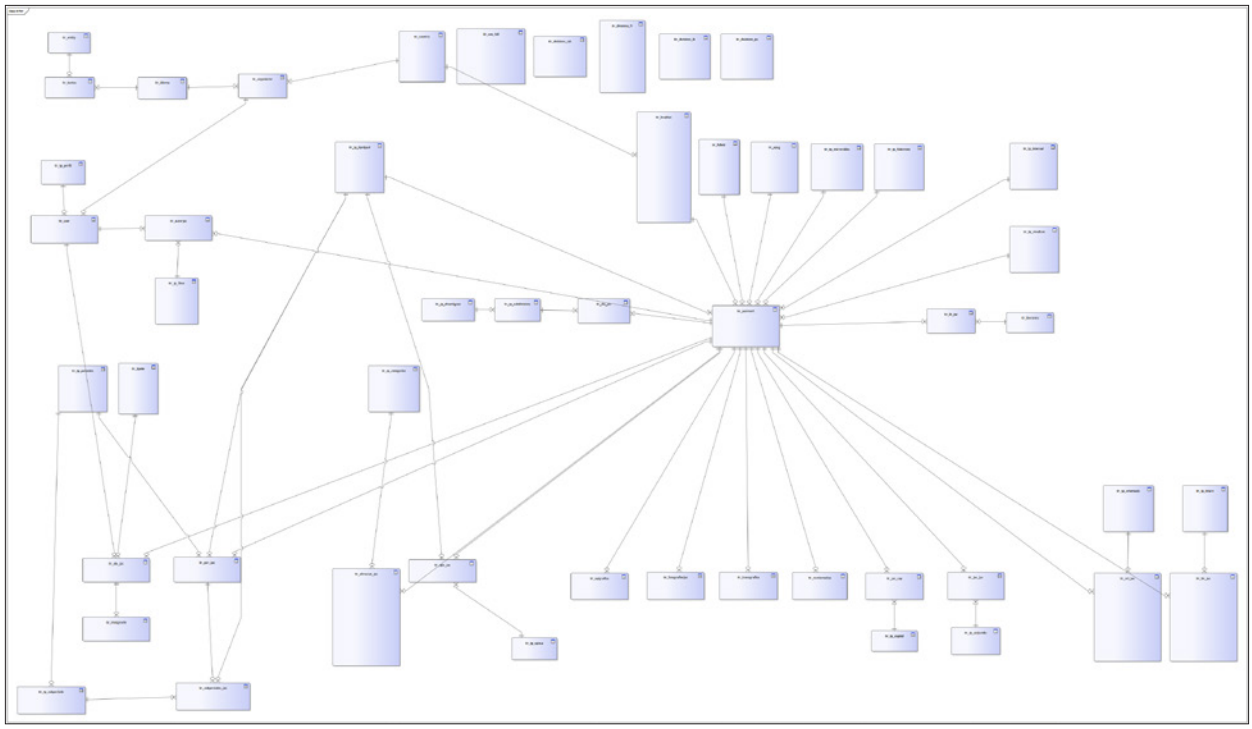

FIGURE 3. TIR-FOR application database tables.

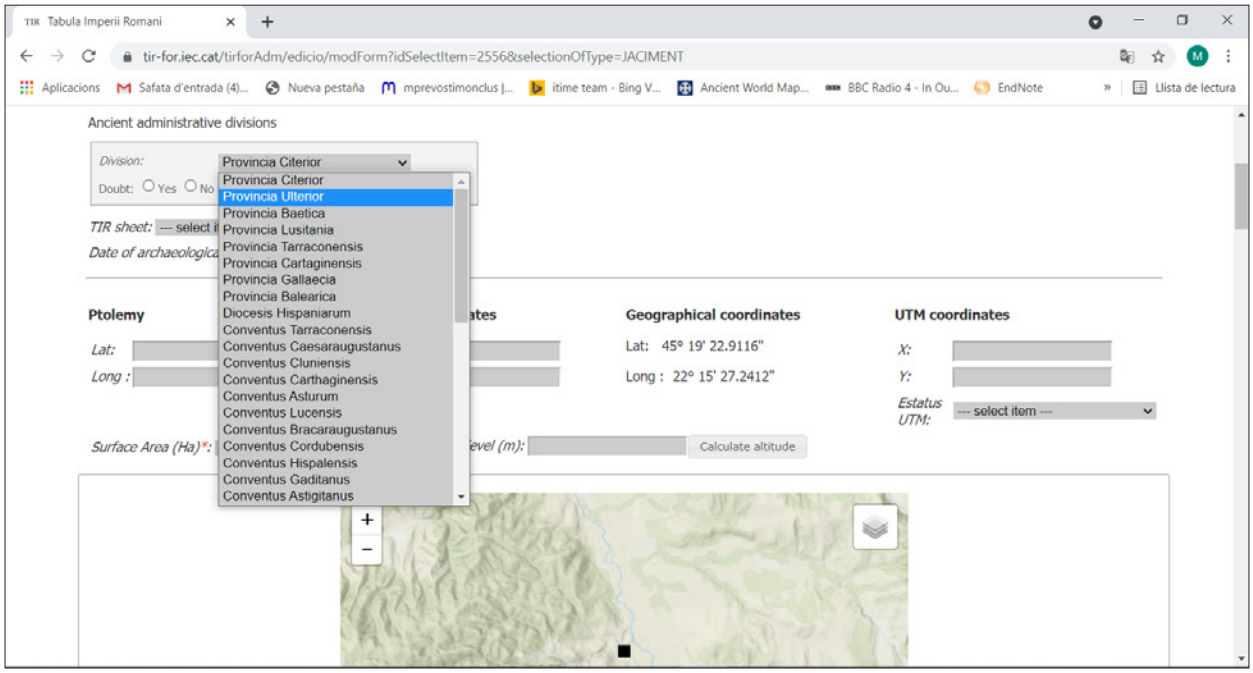

FIGURE 4. TIR-FOR record sheet with the drop-down list of ancient administrative divisions.

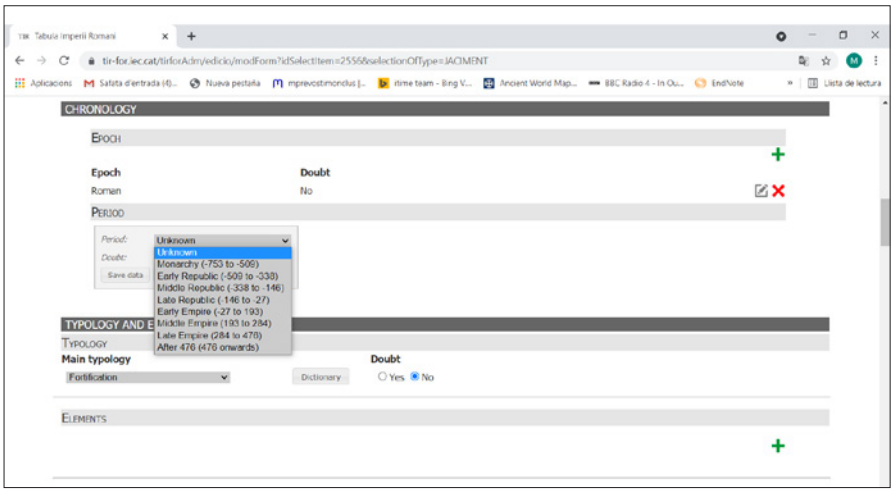

FIGURE 5. TIR-FOR record sheet with the drop-down list of periods.

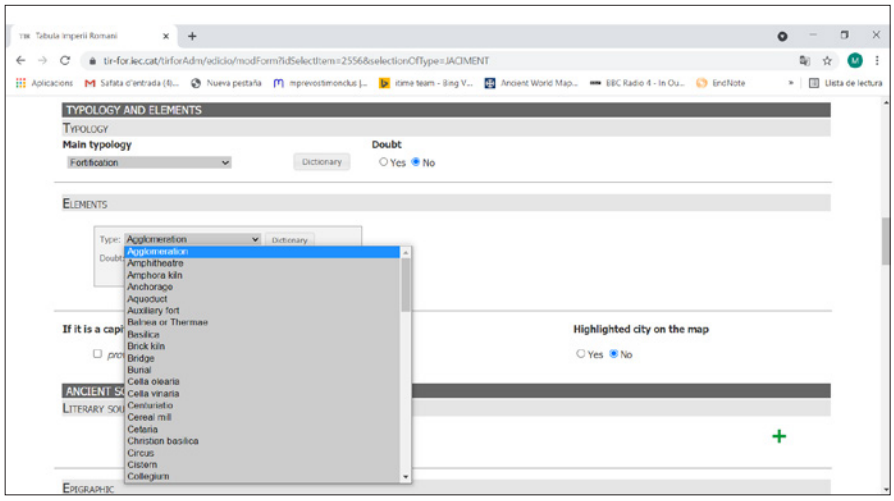

FIGURE 6. The TIR-FOR application has a drop-down list of typologies and elements as well as a dictionary of typologies and elements with definitions of the different concepts, criteria to identify them and TIR criteria to include them in the database so that they appear on the map.

should appear on the maps to ensure they are useful and informative.

A text field allows the author of the record sheet to explain any fundamental features of the site. Particularly relevant aspects are the data used to define the typology, the elements found within it and which data justify them, as well as the data used to date the site (pottery, other finds, etc.).

Each sheet created in the application's database must represent a point on the map. The record sheet may contain a lot of information and even links to other websites but it's represented by a single dot on the map or a symbol of its typological classification. A link can be entered in any text field, whether intra-project from one record sheet to another, or to an element outside the project.

A user's guide to completing the record sheet can be downloaded from the home page of the data management site. The TIR-FOR record sheet, the list of symbols that appear on the map and the typology and elements dictionary, with the definition and criteria used to identify the typologies and/or elements as well as the requirements to appear on TIR maps, can be downloaded from the public website (methodology section). The typologies and elements have been highlighted as key fields on the record sheet.

For several fields contained in the record sheet (i.e. Ancient administrative division, Typology,

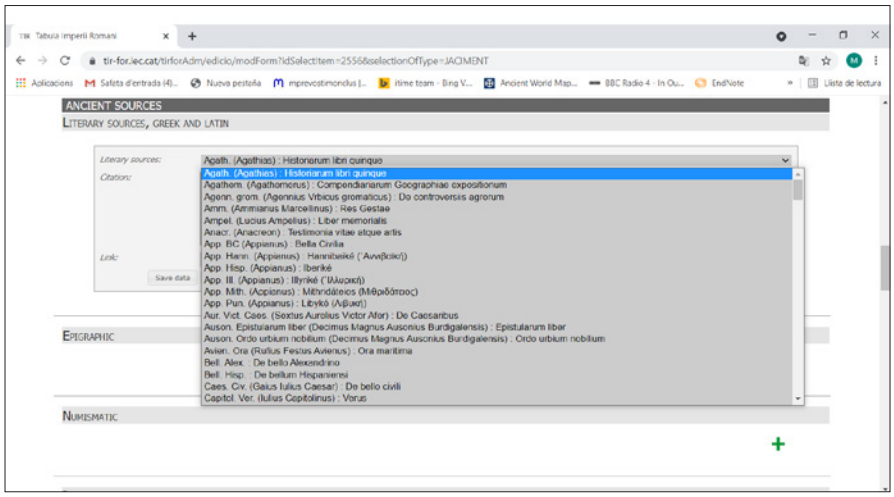

FIGURE 7. Ancient literary sources should be selected from a drop-down list.

Element, Epoch, Period, Sub-period, Juridical status documented, Other categories documented), a doubt can be added to the choice made for each field. For example, in the specific case of typology and elements, the doubt should be marked if there is evidence, but not *in situ*, that might indicate the type of site chosen or the elements indicated for the site.

A two-stage system has been created for completing the record sheet. First, users must enter the more general data of the site corresponding to TIR data. When the sheet is being edited, the basic information fields (TIR fields) become available. When the user needs to enter more detailed information (FOR fields), the command "Detailed data" is activated and the FOR fields appear against a cream background. For each of the chronological periods selected in the TIR fields, the option to detail sub-periods, century by century, will become available. These periods and sub-periods can also be related to different typologies as a site may have evolved over time, for example from a rural settlement to a villa. The elements selected in the basic information fields produce a sub-sheet in the detailed information fields, with its own decimal coordinates, where more data can be entered, as well as illustrations, specific bibliography and a description of the element. The text of the FOR sheet is expected to be more detailed and the bibliography more exhaustive. Both the author field of the TIR sheet and the author field of the FOR sheet must be completed.

6. ENTERING TIR AND FOR DATA

The Catalan team has been preparing the TIR for Catalonia. At present, 551 entries have been uploaded for the K/J-31 record sheet that was published on paper in 1997. Half the territory has been revised, with 134 new entries uploaded and the existing records updated. The rest are now being revised. The TIR map for Catalonia is therefore relatively complete and gives us a good idea of the desired result in general (Fig. 8). It provides a very solid, informative global view of the distribution of Roman settlements, their greater concentration along the coast with the most notable clusters being around *Barcino*, *Baetulo* and *Iluro* (Fig. 9), although the density is also quite high around *Emporiae* and *Gerunda* in the northern coastal area (Fig. 10) and around *Tarraco* in the south (Fig. 11). Further inland, beyond the line of hills that run along the coast known as the Serralada Litoral, Catalonia was less densely populated. We can see that the Pyrenees were also populated, albeit less densely. Essentially, settlement was concentrated along the roads, both major and secondary, undoubtedly playing a key role in spreading Roman culture. It also shows how the Romans introduced a pattern of settlement that has lasted up to the present day, this being its initial development. In other words, the cities —a fundamental factor in the Romanisation process— are essentially the same today as they were in Roman times. The pattern

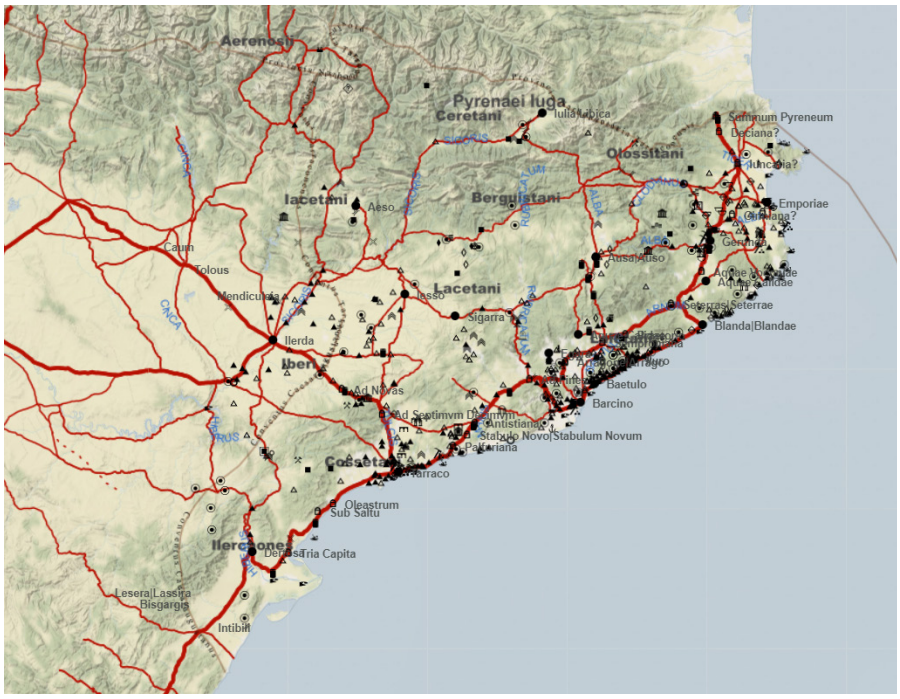

FIGURE 8. The TIR map of Catalonia.

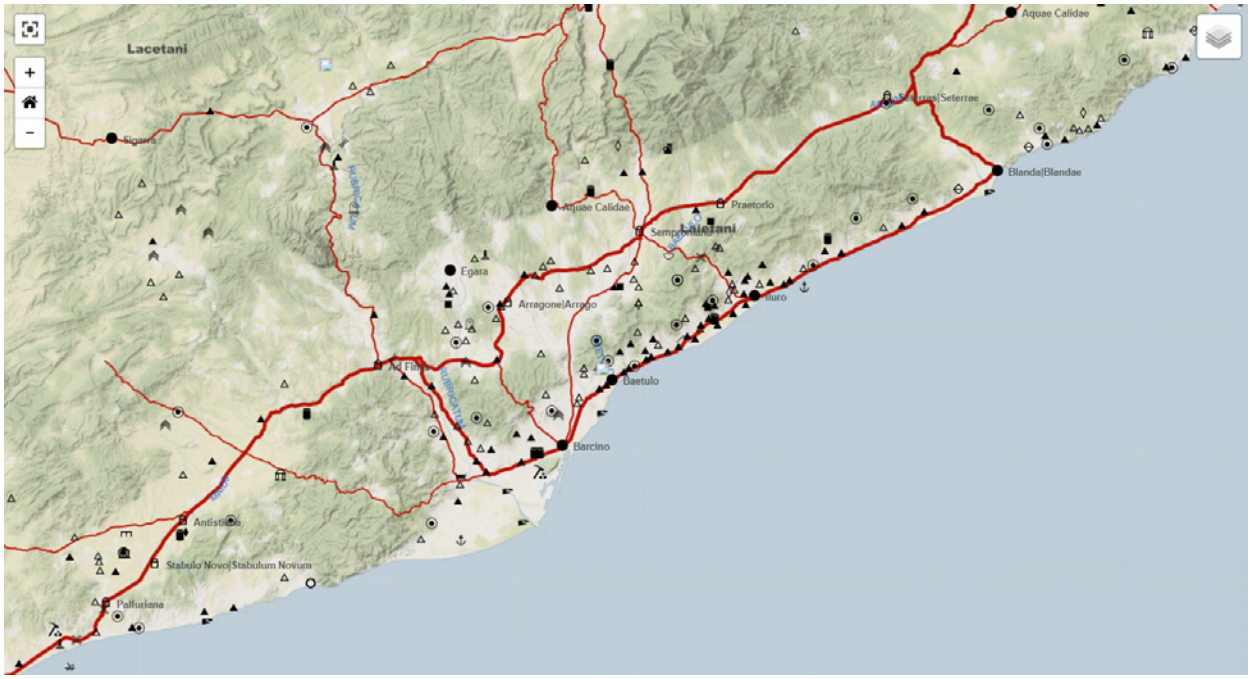

FIGURE 9. TIR map of the central coast of Catalonia.

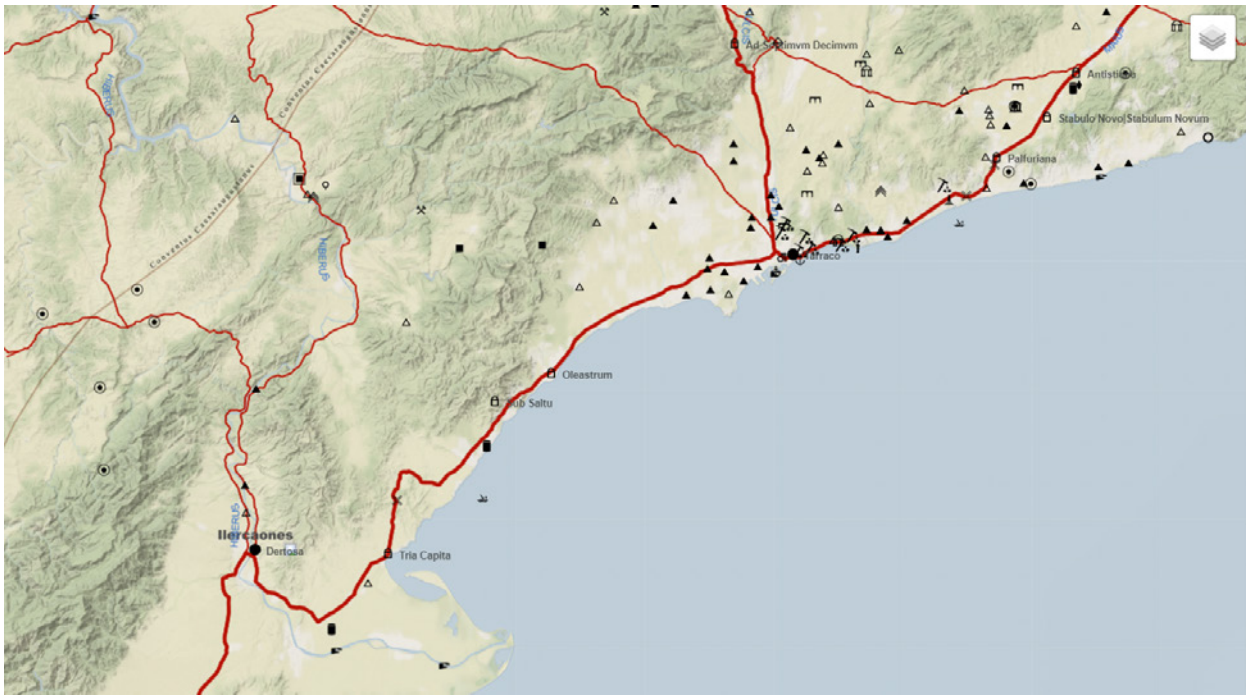

FIGURE 10. TIR map of the south coast of Catalonia.

FIGURE 11. TIR map of the north coast of Catalonia.

of Iberian settlement, on the other hand, is quite different.

The Balearic Islands have also joined the project and 121 entries which had already been published on paper in 1997 have been uploaded with some updates, while the area of Valencia already has 279 entries. (Fig. 12)

Regarding the FOR data, since 1997 the Catalan team has been working on the FOR sheet corresponding to Eastern *Cossetania* (Guitart, Palet, Prevosti, 2003) as well as the *ager Tarraconensis* area (Prevosti, Guitart, 2010; idem, 2011; Prevosti, López, Guitart, 2013), for which the corresponding databases have been made available. 372 FOR record sheets in the application have been created within this project.

We've already migrated data from the *ager Tarraconensis* project databases. This has been the first test of the system in terms of the FOR. In this case, we're migrating data from another database which obviously doesn't fit exactly with the fields in our TIR-FOR application but it's still a great advantage over having to enter all the data manually.

7. Searches

One of the main objectives established in the TIR-FOR online project was to create a powerful search and filtering system for data and archaeological sites. This element is essential to offer a really useful platform to society and researchers on the archaeological reality of the Roman era. The application is equipped with a "Search" tab and an "Advanced search" tab. On entering "Search", users can carry out a free search via multiple options such as the publication status, ancient or modern name, within the TIR sheets, within a location, by selecting a main typology or one or more elements. On entering "Advanced search", a multiple-choice menu becomes available to undertake more powerful and complex queries. This kind of search represents a detailed query system where users can combine all the fields from the database sheet and create personalised filters.

Each search produces a map with the results, as well as a list of the sites resulting from the query, which can be downloaded in a csv file. This format is suitable for exporting data to GIS programs, including records with the selected archaeological and geographical information for each site. (Figs. 13 - 15)

8. Displaying TIR-FOR information

Another issue we're working on is how the map is visualised. When the user accesses the online application, a map with all the sites entered to date appears, large scale and in clusters, to provide an idea of the site density for the region in question. As we zoom in, these

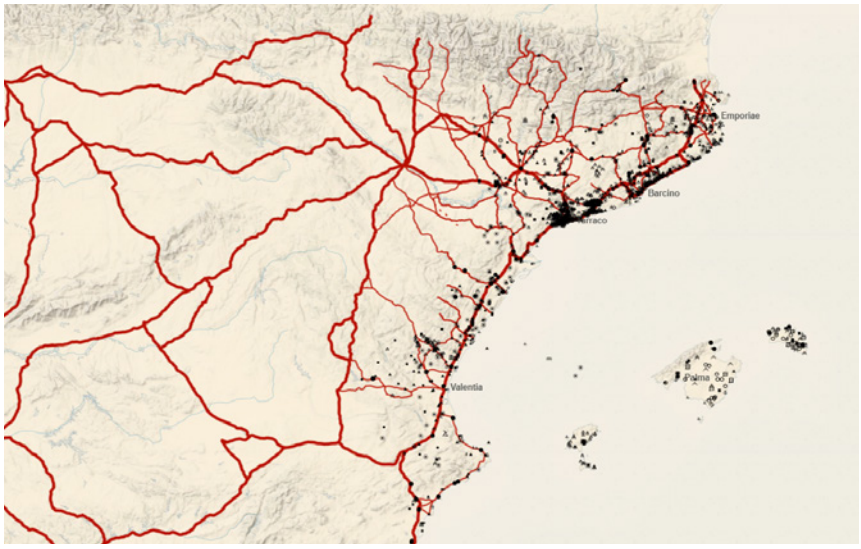

Figure 12. TIR and FOR work in progress map of Catalonia, the Balearic Islands and the region of Valencia. The black spot surrounding Tarraco corresponds to the FOR.

clusters are successively broken down into each of the territories. At the top right of the map is the option to view the sites in clusters or via Sites/Typology. When this option is selected using the most distant zoom, to avoid showing a black blob made up of all the sites, only the particularly important cities in each territory are shown with their corresponding ancient name.

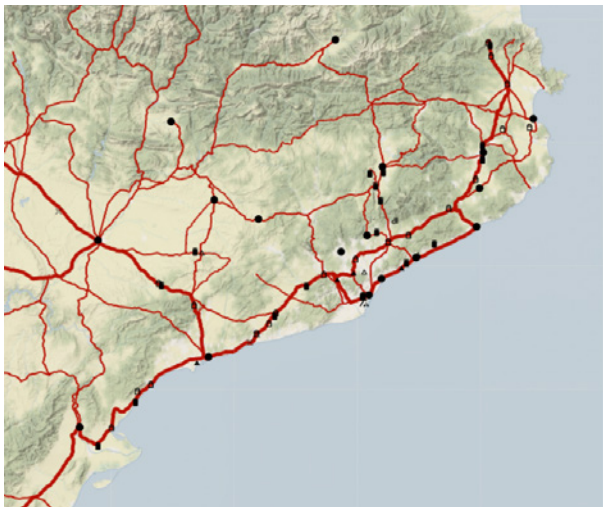

FIGURE 13. Search for Catalonia, city, *mansio*, milestone and roads.

It will also be necessary to study how the FOR is visualised. The FOR is actually a zoom-in on a specific area, studied in depth, where there's a lot of detail. But as you enter this view there should be a warning explaining why the area has so much detail. We cannot mislead the public into thinking the territory is necessarily more densely populated; we need to explain that there is so much information because it has been more thoroughly studied, an issue that has yet to be addressed and must be dealt with in the near future.

The list of eligible cartographic bases appears to the right of the map. The default map has very pale lines and colours; it's very neutral, without settlements and very few names, only geographical information ensuring the points and symbols of the TIR-FOR map stand out well. In order to facilitate navigation and geographical location of the sites, we have also included some open layers such as ESRI Roads, Google Roads, Google Satellite and the Digital Atlas of the Roman Empire.

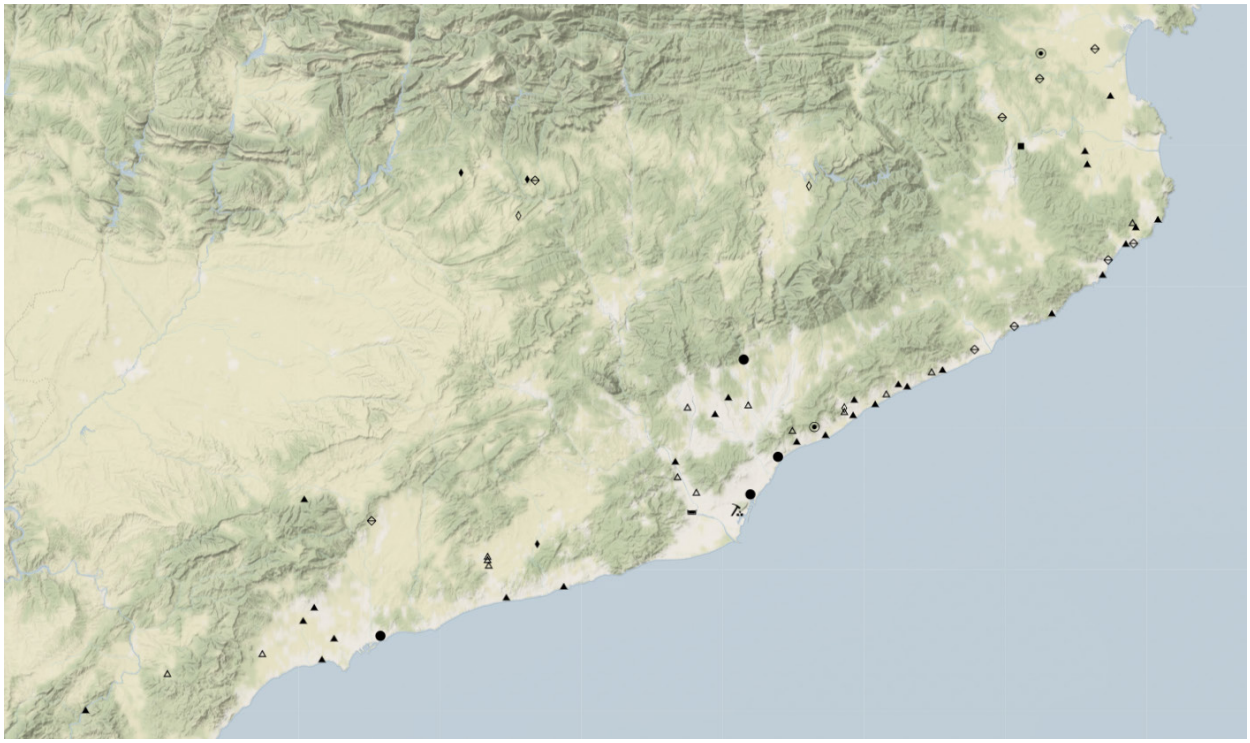

FIGURE 14. Search for Catalonia, pottery workshop, pottery kiln and pottery workshop dump.

FIGURE 15. Search for villa with aqueduct.

Users can enrich their view by adding some other information layers. We have included the possibility to visualise Roman roads, rivers, geographical features, Roman borders and *populi* names. For the time being, we've applied the easy and cheap solution of map layers to represent these elements on the map but, in the future, we'd like to prepare our database to also include records for the category of toponyms that can only be mapped as lines or polygons.

9. A RESEARCH TOOL

Once a region's information has been collected and entered, we'll have compiled information about all the Roman sites under unified criteria, providing us with a good quality tool to manage scientific data. This will become a key tool for historians and archaeologists to consult and carry out advanced searches, providing basic information about sites that's often difficult to obtain outside a researcher's own country of work. This tool will therefore help to advance many aspects of archaeological research, for instance comparisons between regions, cross-border issues and specific types of sites. It's also quick and easy to update, ensuring up-to-the-minute information that's nevertheless always based on agreed criteria.

Currently, there is a large number of historical gazetteers and international databases that include archaeological heritage information on different historical, epigraphic, numismatic and archaeological aspects. Our application can be networked with these using linked open data protocols. Our aim is for the different archaeological sites to be linked with online applications such as DARE, Pelagios, GAP, ORBIS, Epigraphische Datenbank Heidelberg and others. The value of our application lies in the fact that it's a tool created on a geographical basis that produces a map, so all data that meet certain criteria are included, without exception.

The system allows a team or individuals to work on entering information from a region before making this public. Such information can be disclosed once the data to be entered have been exploited scientifically, but it can also be treated as open research. With the TIR-FOR application, typological and chronological maps can be produced, advanced searches can be carried out, regions can be compared with each other and information can be extracted. The

application can also be used to download data for GIS programs. In other words, the application is ready to be used as an ideal research tool.

10. Disseminating and spreading information

This research tool can also be used as a tool for dissemination. We've created an online portal where users can access a large number of Roman sites with information on their typology, chronology and materials as well as graphic information, among other data, and make queries about archaeological sites on maps using a wide range of filtering options. Another priority is to create an innovative, user-friendly website whose usefulness and attractive design add value.

In the future, we expect the same system will connect the different archaeological sites with other online applications and provide additional information such as photographs, videos, classical texts, links to museum websites, information about sites open to the public, actions, activities and so on.

A freely available interactive map will be created with additional information and links, keeping Roman archaeological heritage alive and evolving. Open access, free at the point of use, is one of our priorities in promoting the dissemination of research into our Roman heritage. This tool will help us bring our Roman past closer to our Mediterranean present, thereby improving awareness of the past and fostering a shared identity.

The easy availability of data should help to encourage citizen involvement as part of the concept of citizen science. By making people more aware of our Roman past and heritage, we should be able to try out new approaches for dissemination.

In short, we hope this tool will become an essential resource for anyone interested in the Roman world and specifically in archaeological sites, since it combines open access, the backing offered by TIR-FOR and the scientific quality of its data. Combining our archaeological knowledge and historical heritage in an innovative, direct, entertaining and appealing way will engage the public at large. As a heritage dissemination and management tool, it can be used in teaching, museums, demos, tourism, outreach and entertainment. One consequence of this unification will be to promote a sense of a common Mediterranean origin based on classical culture. The ultimate aim is for it to become a fundamental tool for knowledge but also a way to enjoy the Roman world's archaeological heritage.

11. TIR-FOR's potential

In its current state, the TIR-FOR platform is proving to be an extraordinary tool for managing and analysing archaeological data from Roman times. The detailed scientific process required to collect and document such information takes time to produce new data, which is why the entire territory of the Roman Empire has not yet been covered. When the whole of the Roman Empire has been completed, this project will have even greater potential, enabling both extraordinarily detailed and global analyses.

However, another aim for this tool is to roll it out to other kinds of historical and prehistoric heritage, as well as other territories and cultures, thereby enabling greater chronological and thematic interaction, as well as helping to disseminate and manage information but always applying the level of scientific thoroughness achieved to date.

The FOR application aims to study a territory in-depth. This is a key perspective in landscape studies and the FOR application can therefore be a useful tool for studies with a long-term chronological view, providing an overview. For instance, the evolution from Roman to Byzantine times becomes relevant from the perspective of landscape studies, even though it's also of great interest per se.

12. Conclusions

We'd like to stress that the TIR-FOR project is a work in progress, open to all teams working in the territory that are interested in collaborating to produce a map of the Roman world and in extending its network of information, linked to

a range of databases and resources. We're building up a basic research and outreach infrastructure for the Roman world in which all countries are welcome. This project offers an up-and-running interface prepared for the introduction and storage of archaeological data. We've also created a study protocol with scientifically considered and debated parameters. Finally, this project also provides a remarkable viewer for the data documented. Consequently, our research team is interested in encouraging dialogue and contact with any other projects and teams that may be interested in using our platform and publishing their data within the framework of the project.

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