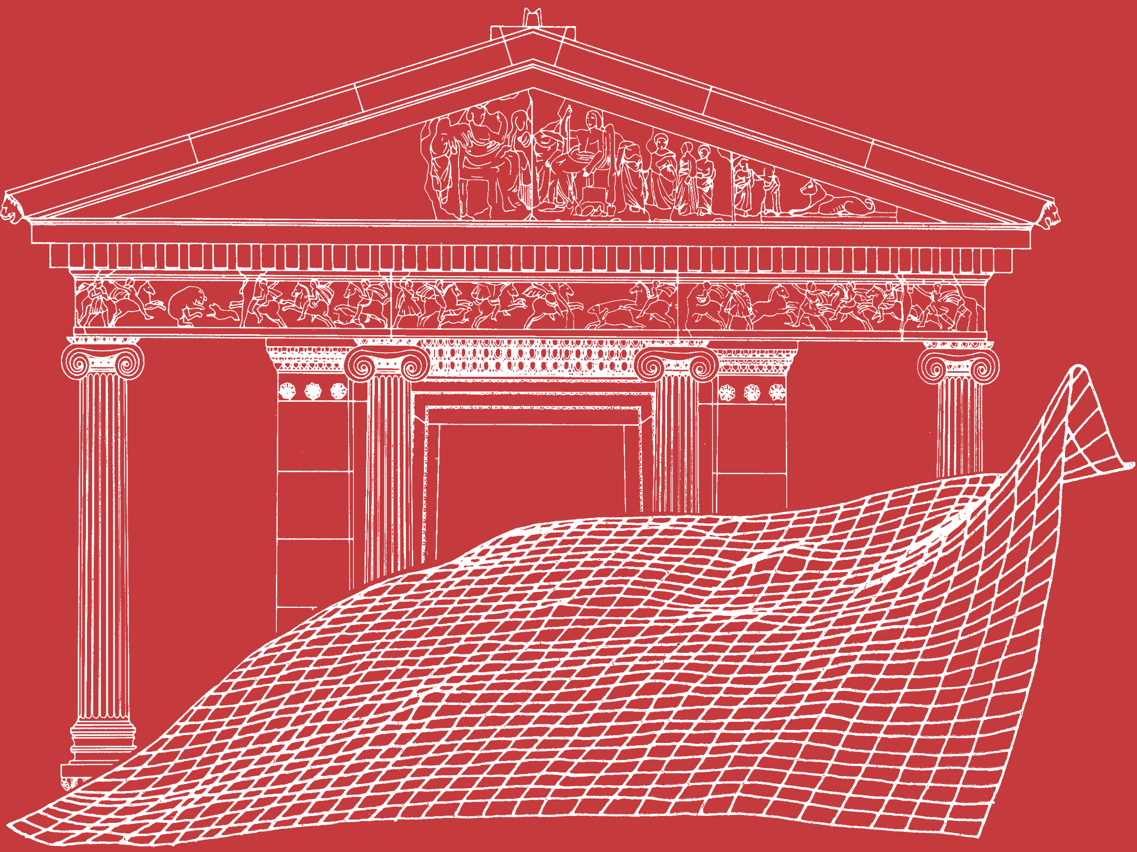

ARCHEOLOGIA E CALCOLATORI

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ARCHAEOLOGICAL DATA MANAGEMENT AND SPATIAL ANALYSIS TOOLS IN THE STUDY OF NECROPOLISES: CASE STUDIES FROM BOLOGNA AND SPINA (6TH-3RD CENT. BC)

1. Introduction

The preponderant funerary nature of archaeological documentation of the Po Valley Etruria is well-known. Between the late 6th and 3rd centuries BC, vast and articulated funerary areas developed in the cities of Bologna, Spina and Adria, as well as other minor centres in the territory. In later periods, only Adria continued its lifestyle in a completely altered historical context. Over the last several years, the Chair of Etruscology of Bologna has been carrying out research that has employed the most effective methodologies for data management and funerary landscape reconstruction. The research first looked at several sectors of Bologna's western necropolis from the Certosa phase (see *infra* § 2), and then the necropolis of Valle Trebba in Spina (see *infra* § 3) and other minor locations in the Bologna area (Kainua-Marzabotto: Pizzirani 2023a, 2023b; Castelvetro: Pizzirani 2009b), and finally in Adria (Gaucci 2021a; Antoniazzi, Cappello, Serra in press) (Fig. 1).

The excavations of these necropolises mostly took place between the second half of the 19th century and the first decades of the 20th century. Scarce graphic and photographic documentation remains, often with inaccurate topographical references. In some cases, however, the excavation journals are rich in data, useful for the philological reconstruction of grave goods and sometimes even the funerary landscape. Although each context requires a detailed analysis and has its own particularities, recurring challenges[1] have led us to develop a consolidated line of research on funerary rituals involving the recovery and management of data for each tomb and its grave goods, and a general view focused on the reconstruction of funerary plans on the city scale. The subsequent step of the analysis is the georeferencing of these plans, in order to formulate hypotheses regarding the geomorphology of these locations and consequently of the funerary landscape. The funerary landscape is crucial in understanding the strategies of occupation of necropolises, as well as the social relations and representation that took form through the exploitation and modification of an environment that has

[1] The reflections developed at the 2008 Conference in Fisciano (*Tra Etruria, Lazio e Magna Grecia: indagini sulle necropoli*) on the problems of management and use of archival data on necropolises excavated in the past remain fundamental (Bonaudo, Cerchiai, Pellegrino 2009); see also Rondini, Zamboni 2016.

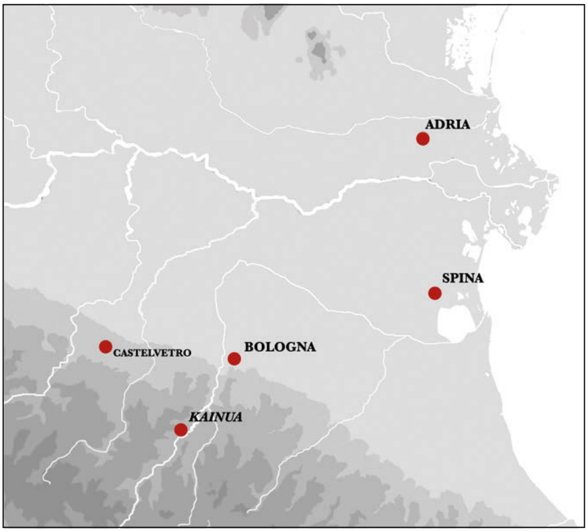

Fig. 1 – The sites of the Po Valley Etruria mentioned in the paper.

contributed over time to the construction of a collective memory shared by the community that buried their dead there (Assmann 1997).

The two selected case studies of Bologna and Spina are not only the most complex sites, but they also represent two distinct phases of research: the first started in the 1990s, when Information Technology was confidently applied to archaeology, leading to the first computerised data management systems used in experimental analyses of large funerary sites in Italy (Gottarelli 1997, 2009; D'Andrea 1999; Cuozzo, D'Andrea, Pellegrino 2004); the second, launched in 2008, was able to take advantage of a different and decidedly more advanced theoretical framework thanks to many years of methodological reflection. One of the most challenging problems to be faced today is updating previously used systems and creating a dialogue between these older systems and the newer ones. For example, an initial pioneering attempt to support research on large funerary complexes was developed by A. Gottarelli in the 1990s as part of a joint project between the Archaeological Museum of Bologna and the Chair of Etruscology of the University of Bologna centred on the study of the Benacci and Certosa necropolises in Bologna. A software named 'Necropolis' was developed for the project, and it offered researchers the possibility of correlating the dataset of each tomb, filled up in a database based on FileMaker, with the general plans of the relative funerary area. The subsequent and rapid development of Geographic Information System convinced researchers to abandon *Necropolis*. Nonetheless, this software strongly conditioned initial methods of recording data, constraining all the information of each tomb to a unique record of the database and to specific codes for the different classes of materials.

The study of these funerary contexts, following an approach driven by abovementioned objectives and issues is still ongoing, but the analysis and some of the research outcomes have been discussed for some years now. In 2008, the presentation and analysis of the general planimetry of the western necropolis of Bologna (ca. 800 tombs) became possible thanks to the unexpected discovery of the plan of the De Luca funerary area in the archives of the Archaeological Museum in Bologna (Govi 2009; Morpurgo 2018). The plan, however, still lacked a geomorphological characterisation, which was later achieved thanks to the publication of the Bologna Geological Cartography (see *infra* § 2). This research saw renewed momentum thanks to the virtual reconstruction of the Etruscan Bologna, of which the Certosa funerary area was an important part[2].

An even more significant effort was made in reconstructing the funerary landscape of Spina (see *infra* § 3), of which only a partial plan of the Valle Trebba necropolis with no references to tomb numbers was edited (Berti, Guzzo 1993). The reconstruction of the necropolis required the long and careful recovery of topographic (Romagnoli 2017) and altimetric data (Gaucci, Mancuso 2016). We now have a plan, completed between 2015 and 2017, that offers extraordinary points for investigation, as we will discuss in the following sections.

Alongside the issues of producing accurate and reliable cartographies, we have also had to deal with the complexity of funerary rituals that presuppose large quantities of heterogeneous data (see *infra* § 3.1). The informative value of these data does not rely solely on the class and/or function of the objects found, but also on various other important aspects such as iconography, whose hermeneutic potential in the social, political and cultural reconstruction of communities is now well known (see *infra* § 3.2). Another pivotal issue, in addition to the philological reconstruction of the funerary assemblages, often altered in the passages between the excavation and their final destination (deposit or display), is the problem of recording and managing a large amount of data from both a quantitative and qualitative point of view.

Apart from the selection of the system and software used, the choices made have led to the decision of not making use of statistical and computational analyses, which were carried out in the past on a specific category of tombs in Valle Trebba di Spina, but with negligible results (Berti, Bisi,

[2] A virtual model of the necropolis was created in collaboration with CINECA (https://www.cineca.it/progetti/museo-virtuale-della-certosa-ricostruzione-del-paesaggio-della-necropoli-etrusca), then merged into the 3D animation produced in 2013 for the Museum of the History of Bologna.

Camerin 1993). Indeed, it is rather difficult to categorize the data of grave goods into a univocal, repeatable and effective coding system, given the countless variables in terms of classes and forms, iconography, position etc.

E.G.

2. The western 'Certosa phase' necropolis of Bologna

The topographical organisation of the western necropolises of Bologna during the so-called 'Certosa Phase' (late 6th-early 4th cent. BC) was first addressed at the beginning of the 20th century (see Ducati 1928). Afterwards, a more scientific approach to this problem was adopted by G. Sassatelli (1988; Sassatelli, Donati 2005, 235- 257) and E. Govi (*ibid.*, 264-281, 282-290; Govi 2009).

The excavation documentation of the funerary areas was uneven, old and at times unedited (Morpurgo 2018, 8), therefore making the reconstruction of the topography of the western necropolises a rigorous task. The georeferencing of the funerary areas and the recovery of the topographical and dimensional data of the individual burials – about 765 – was necessary in obtaining a precise spatial distribution using modern cartography (Vanzini 2014-2015).

The first step was resolving the topographical issues related to the available documentation, namely the georeferencing of the excavation plans with urban planning documentation and establishing the spatial relationships among the graves.

Georeferencing involves dealing with Bologna's nineteenth-century cartography, and the Certosa necropolis is a prime example of the maps from this period. The excavation plans drawn up by A. Zannoni used the plan of the Certosa cemetery of that time as a cartographic basis (Zannoni 1876), which has undergone numerous structural changes over the past 150 years. Therefore, it was necessary to superimpose post-unification cartography on the modern one in order to georeference the original excavation plans. For other contexts, as in the case of the Aureli necropolis, the excavation plans did not have cartographic data providing insight about their positioning. Fortunately, the distance of the trenches from known points in the urban context of Bologna at the time was documented, allowing us to georeference the graves starting from the nineteenth-century cartography.

Regarding the distribution of the individual graves, the nodal points used in the reconstruction are geometric, i.e. based on the accuracy of the dimensions of each grave, and spatial, i.e. based on the accuracy of the positioning of the graves relative to one another. The first aspect is closely related to the quality of the excavation plans, which are rarely homogeneous, even within the same documentation. For example, as far as the necropolises of Certosa, Aureli and De Luca are concerned, the drawings by Zannoni are often considerably

Necropolis	No of tombs	Scaled tombs	Scaled tombs (%)	Georeferenced tombs	Georeferenced tombs (%)
Certosa	418	206	49.4	161	38.6
Aureli/Balli	41	33	80.5	41	100
Battistini	19	3	15.8	9	47.3
De Luca	111	27	24.3	108	97.3
Arnoaldi	166	84	50.6	75	48.4
Polisportivo	9	2	22.2	9	100
Total	765	356	46.5	404	52.9

Tab. 1 – Scaled and georeferenced tombs of the western necropolises of Bologna.

larger than the documented size of the graves. The comparison between the cartographic and documented metric data has allowed us to redraw each grave at the correct scale, keeping the centroid of the excavation plan as a reference. In general, 46.5% of the 765 graves of the western necropolises of Bologna were able to be traced according to their correct dimensions (Tab. 1).

The second aspect, i.e. the accuracy of the relative positioning of the graves, is strongly affected by the quality of the documentation. In the case of Certosa, where only 40% of the burials were correctly positioned, the graves with a higher degree of accuracy are those that partially overlap with the modern plan of the cemetery's structures. In other cases, such as for Aureli and De Luca, other data collected during excavations, particularly the distances between the corners of the graves and those between those corners and the limits of the trenches, allowed us to accurately place a higher number of graves (97%). Overall, 53% of the graves in the western necropolises have been correctly repositioned (Tab. 1).

Despite the heterogeneous documentation, it has been possible to quite accurately relocate all the funerary areas on the city's contemporary topography using nineteenth-century planimetric and descriptive data. The accuracy of the georeferencing and scaling of each grave was less successful, with around 50% of the total number of graves being accurately repositioned. The results of this work can provide a solid basis for integrating the developed maps with other data, from grave goods and anthropological information at the grave scale, to geomorphological elements at the scale of the funerary landscape. Indeed, the superimposition of the Bologna Geological Cartography (Pignone 2013) has allowed us to observe that the palaeo-channels flowed differently from the present ones. For example, the Meloncello canal, previously thought to have divided the Arnoaldi and the De Luca areas, must have flowed much further W (Fig. 2), between the De Luca and Certosa funerary areas. This partly explains why the westernmost graves of the Arnoaldi area are so close to the easternmost De Luca graves, as they must have formed a single burial complex.

R.V.

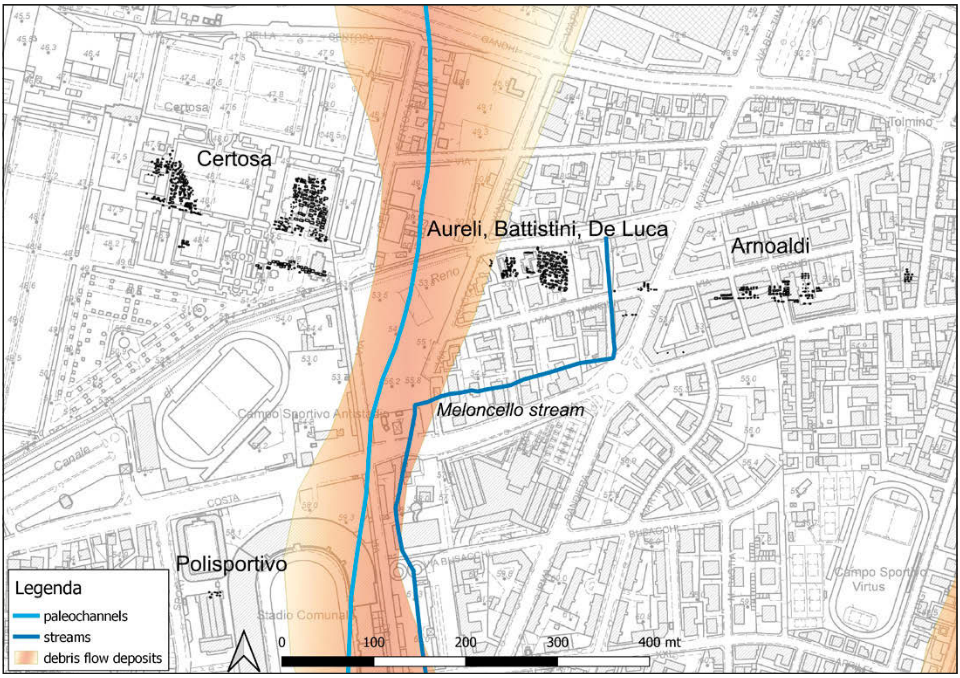

Fig. 2 – Superimposition of the Geoarchaeological Map of Bologna (after Pignone 2013) and the western necropolises of Bologna.

3. Valle Trebba in Spina

3.1 *Data management*

The Valle Trebba necropolis (end of the 6th-3rd cent. BC; on the study project, see Govi 2017), was excavated from 1922 to 1935 leading to the discovery of 1,215 graves. The recently completed analysis of this context has posed the problem of data management, requiring the development of a system to study the entire complex in its evolution. In this regard, it was necessary to identify a single solution allowing for the collection of different typologies of data (i.e. descriptions, archival documents, photographs, grave sketches, object information and anthropological data), with varying degrees of completeness and accuracy.

The preliminary step was the development of a Relational Database (RDB). FileMaker, already used by the Bologna team, was chosen as the Relational Database Management System (RDBMS). The availability of intuitive and user-friendly masks for consulting made it possible to structure a system that was easy to use within a large team, and also speed up data entry. The use of a unique RDBMS for several projects introduced the possibility of connecting all

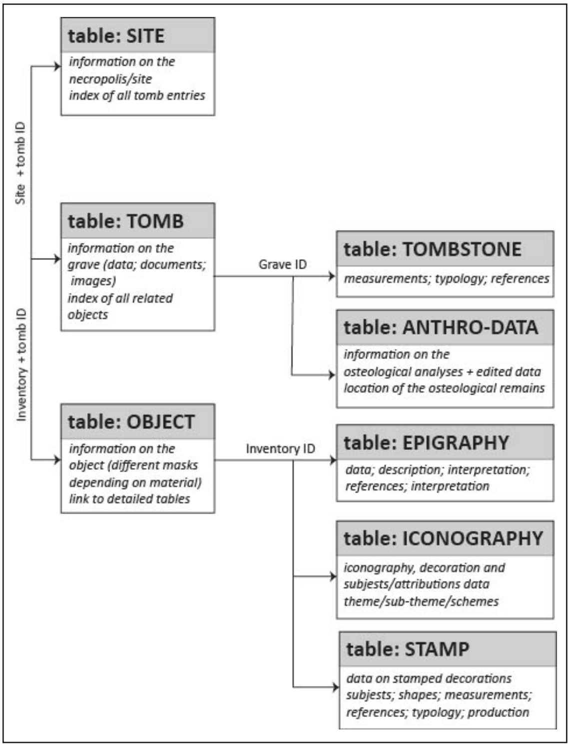

Fig. 3 – Structure of the RDB used in the analysis of Valle Trebba.

the data and making the RDB structure replicable; the system was thus designed, as much as possible, for the sharing and interpolation of data from different contexts, a necessary requisite for the analysis of funerary rituals in the region.

The database has been progressively implemented (Fig. 3). The main structure hinges on the 'tomb table', designed to collect information on each tomb context, and the 'object table', which contains the object data (more than twelve thousand items to date). Information was then organised in different fields, fostering a structure employing trees that broke the data down into primary elements and well-established codes (e.g. types and shapes) and providing implementable lists of values to reduce errors and limit variability (Madsen 1999, 126-127; more recently Mancinelli 2015). The two tables are related to each other through the grave number, while the inventory number of each object is the key linking it to secondary tables, which delve into more detailed aspects.

A.S.

3.2 *The qualitative issue in data management: Iconography*

An 'iconography and decoration table' was created to facilitate the mapping of the iconography of the Attic vases found in the funerary contexts. This table was divided into five sections (Fig. 4): the first two present the general data of the tomb and the object, necessary for the correlation of the tables and the framing of the object itself; the last three are focused on iconography, decoration and the subjects/attributes represented. We decided to break the data on the iconographic subjects and accessory decoration down into different fields according to their position on the vase and the subject/motif depicted. In

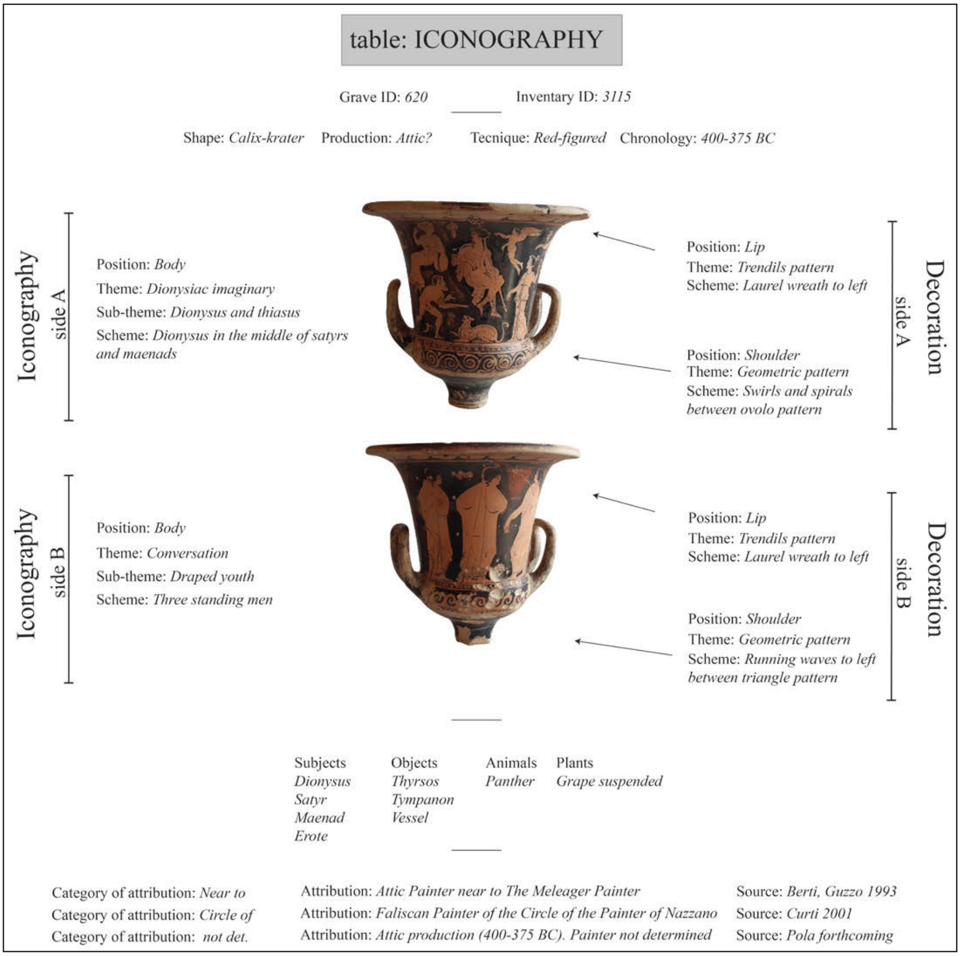

Fig. 4 – Structure of the Iconography table of the RDB used in the analysis of Valle Trebba necropolis.

particular, the main iconographic elements are structured into three groups, 'theme', 'sub-theme' and 'scheme', allowing recurring elements or specificities in the scheme of certain iconographic themes to emerge during the study phase, following the approach adopted by C. Pizzirani as a starting point (Gaucci, Govi, Pizzirani 2020, 176-180). The iconographic fields were duplicated in order to observe if the subjects depicted were distributed on both sides of the vascular support (side A and side B). Finally, special lists were drawn up and the subjects depicted on the vases were sorted into categories identified in the literature (Giudice 1999; Batino 2002; for mythological subjects, Mugione 2000, with evidence from the Spina necropolises).

The section addressed to workshops is also structured in three parts: the first allows us to specify who produced the iconography (Painter, Group, Circle, Workshop); the second to enter the name of the artist (e.g. Meleager Painter; Fat Boy Group); the third concerns the bibliographic source of the attribution. Each field has been duplicated because, although somewhat rare (around 20 cases), some vases contain iconography attributed to different artists whose style has been distinguished by scholars (e.g. Curti 2001, for the workshop of the Meleager Painter).

C.T.

Together with the analysis of funeral rituals, the iconographic analysis of the object within the tomb context is certainly one of the most challenging aspects of data management. The table elaborated and refined over the years attempts to cover all possible identifications of an image in terms of schemes, themes, identities, attributes, accessory decorations and painters. However, it is often the slightest variation within a well-established tradition – or of the ceramographers' workshop itself – that constitutes the interpretative key to the semantic value of the scene, and consequently the entire object and its vascular form and, by extension, the iconographic associations made between various objects within a single tomb context, and sometimes within a necropolis sector. The study of iconography within the spatial organisation of necropolises has, moreover, revealed its great hermeneutic value in terms of social groups and family traditions, both in Bologna and Spina (Govi 2009; Pizzirani 2009a; Govi, Pizzirani in press).

This process, well known in theoretical terms since Warburg's lesson (Mastroianni 2000; Cieri Via 2018, 33, 116), proved to be pivotal during the study of the Bologna and Spina contexts on several occasions, particularly in tomb contexts of the highest rank, and it also had a considerable impact on the spatial organisation of the necropolis. For instance, one thinks of the well-known kraters of tombs 128 and 311 of Valle Trebba, included in every handbook dedicated to Attic pottery and difficult to schematise in terms of theme or identity. Indeed, they have extremely powerful images from a visual point of view, capable of evoking – once adequately contextualised from every possible perspective – multiple meanings (Isler-Kerényi 2002, 2003; Pizzirani 2017).

By and large, the 'iconography and decoration table' is a starting point for more in-depth research that keeps a watchful eye on the analysis of each tomb and the funerary ritual reflected in the grave goods. This is certainly a challenging aim, but this approach has already yielded significant results and can hopefully also be applied to other funerary contexts in which images play a prominent role, as they do in Po Valley Etruria.

C.P.

3.3 *GIS, spatial analysis and the ancient landscape*

Due to the complexity of the studied areas, it became necessary to create a platform capable of correlating the spatial data relative to each grave with the data contained in an articulated database such as the one designed for Valle Trebba.

The choice of software for dealing with the planimetric component would naturally fall in a well-established one such as QGIS. However, the management of a database structured on multiple tables in a GIS environment is quite problematic. Specifically, in order to conduct a large-scale spatial analysis (e.g. to investigate the distribution of specific classes of materials or particularities of the ritual), it is necessary to establish not only a 'one-to-one' relationship between the vectorised tomb geometries and the records in the funerary structures table, but also a 'one-to-many' relationship between the geometry of the tomb and the records created for each object belonging to it.

An experiment was started in 2015 within the study of the Valle Trebba necropolis in Spina using the vectorial plan elaborated by S. Romagnoli, easily georeferenced using the existing drainage canals in the area (Romagnoli 2017). At the time, the RDB created in FileMaker was already very rich in data. Although we were aware of the difficulties in integrating it with QGIS, changing a software that has proved to be decidedly effective in previous studies was deemed impractical. This is also true because the software is more functional compared to GIS for many analyses (e.g. typological studies, or the management of images or long texts), as well as being more user-friendly overall.

Therefore, we chose the open-source software PostgreSQL, implemented with the PostGIS spatial extension, because the program allows users to convert tables from the original database into a new PostgreSQL database through automated processes, meaning it was possible to continue using FileMaker as a frontend (Fig. 5). Once the software is calibrated, it is possible to relate tables to each other and query them directly in the GIS environment through specific SQL queries that can be launched via special plug-ins. The

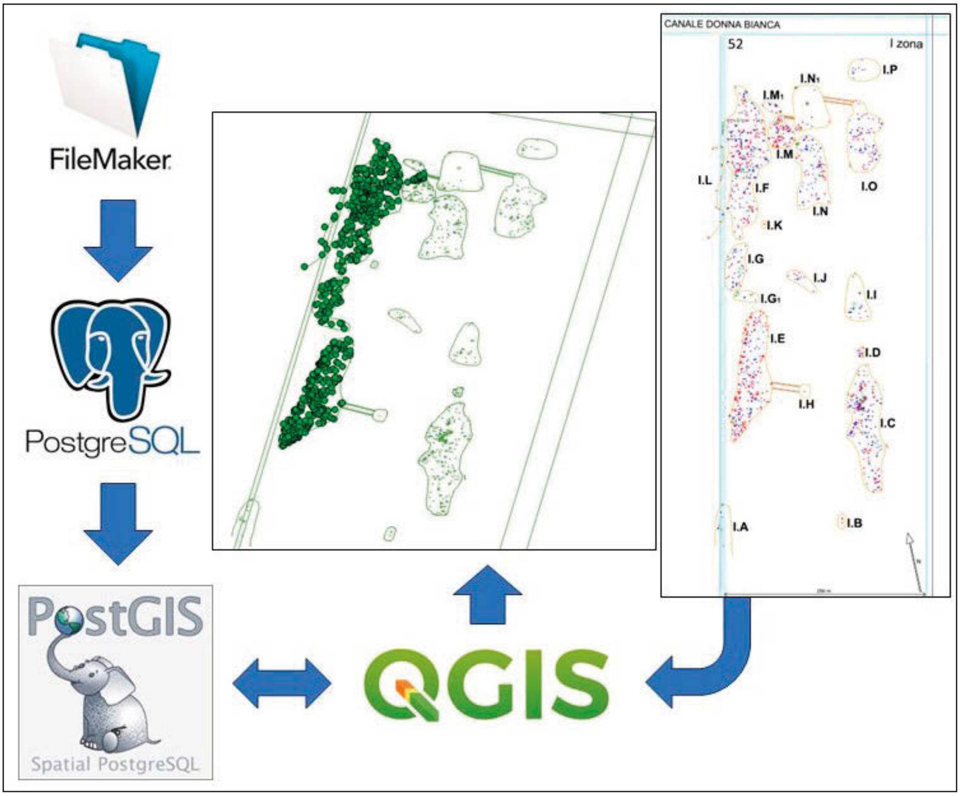

Fig. 5 – Workflow diagram implemented for the Valle Trebba GIS platform.

results of such queries can be visualised in real time through the automated creation of new layers. Thus, it is possible to quickly visualise, for instance, the occurrence of specific pottery productions in the graves of the necropolis and to analyse them in spatial and diachronic perspectives (i.e. verifying the distribution of a ceramic class in the funerary area and easily identifying clusters, then categorising the layer based on the graves' chronology).

This structure is also highly functional for consulting data: the dynamic connection created between the tables allows us to make hypotheses about the plan directly in the GIS environment and to view (and possibly even modify) all the elements relevant to each grave. This functionality is even more useful in the presence of detailed plans for each grave, which was unfortunately not possible for Valle Trebba (the sketches in the excavation journals, however detailed and well executed, were not suitable for georeferencing). This procedure has been implemented in a similar study project of the University of

Bologna (the Picenian necropolis Quagliotti-Davanzali in Sirolo/Numana: Baldoni 2021, 17-62): in the presence of a correctly georeferenced scaled plan, it is possible to consult all the information related to the grave structure and ritual in a single display (Zampieri 2021).

This system, based on the PostgreSQL/PostGIS binomial, has its limitations, above all in the complexity of configuring PostgreSQL, a software that requires somewhat advanced computer skills. However, it is worth emphasising how once the database has been configured, its use can be significantly facilitated through a more common database as a frontend. However, the adoption of other applications that in recent years have proven to be increasingly functional in the management of archaeological data, such as pyArchInit, is still a definite possibility for future studies.

The final line of this research is the digital reconstruction of the funerary landscape, which is not at all accessible today for both of the cases studied. Scholars have dealt with this issue for decades (see Sassatelli 1988 for Bologna, and, more recently, Gaucci 2021b for a discussion on Virtual Archaeology). Even for the Spina site it has been hypothesised that the graves

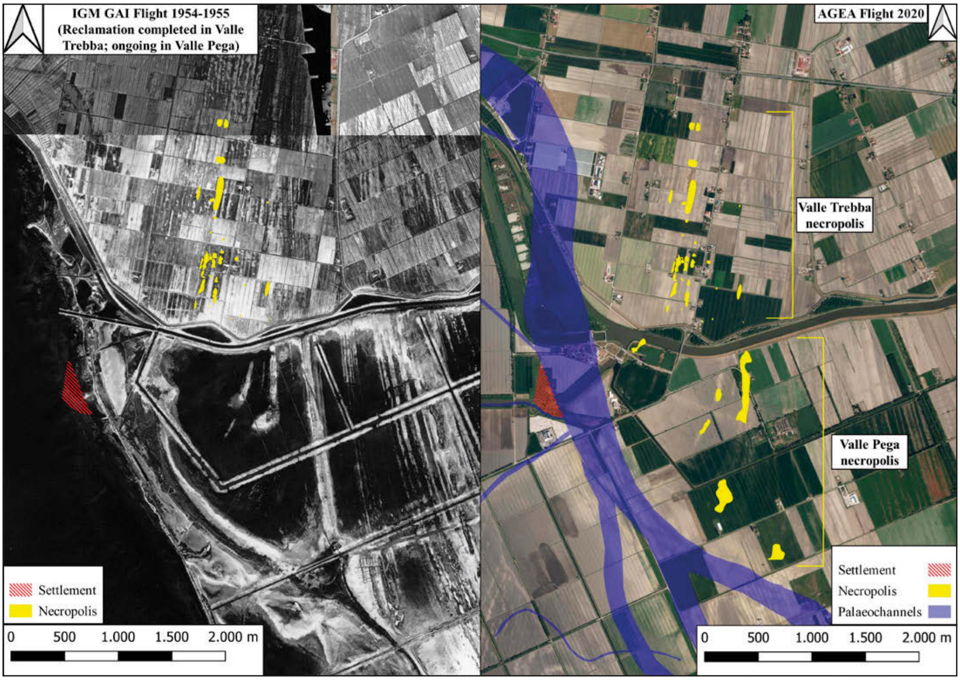

Fig. 6 – Localisation of Valle Trebba and Valle Pega necropolises on orthophotos from the 1950s (left) and in the contemporary landscape (right).

took advantage of the natural morphology of the beach ridges in order to give greater visibility to particular funerary plots (Romagnoli 2017, 118). While the interpretation of the ancient landscape of Bologna's western necropolis is complicated by progressive urbanisation (see *supra* § 2), the territory of Spina has undergone extraordinary modifications, both natural – due to the well-known phenomenon of deltaic progradation (Bondesan 2001) – and artificial – due to the reclamation of the deltaic lagoon environment during the 20th century (Visser Travagli, Vighi 1989).

Therefore, the reconstruction of the ancient geomorphology must necessarily pass through the documentation produced before or during land reclamation: for example, using the bathymetries carried out by the *Genio Civile* before the land reclamation of Valle Trebba or the aerial photographs taken before or during land reclamation processes (Gaucci, Mancuso 2016; Mancuso, Zampieri in press). These documents are certainly valuable today, useful for detailed geomorphological studies, as was already seen for some sectors of the Valle Trebba necropolis, yet not decisive for a large-scale reading of the landscape. Indeed, it is evident that the necropolises, which occupied a very large area nearby the settlement, must have been an integral part and constituent element of the ancient landscape (Fig. 6). This leads us to the consequent paradox that even refined reconstructions of the funerary areas hardly fit into an effective interpretation of the ancient lagoon environment. This issue goes beyond the thematic boundaries of this contribution and yet this is an aspect that must be considered in the study of these contexts and even more so in the reconstructions for dissemination. While a detailed analysis offers significant results from a purely archaeological point of view, the reconstructions that have been attempted on a larger scale, even very recently, show how the interpretation of the funerary landscape and its problematic aspects is subordinate to the understanding of the broader ancient landscape, particularly in a wet environment such as that where the city of Spina thrived.

E.Z.

4. Conclusion

Spatial analysis has a long tradition in archaeology (Gillings, Hacigüzeller, Lock 2020) and in this field of research GIS is still at the core of its practical applications (Verhagen 2017). As pointed out by P. Moscati in 1998 discussing a survey focused on GIS application in Italian archaeological research, at that time there was only one project dedicated to funerary contexts (Moscati 1998, 200 and 226-227, no. 23, Pontecagnano; see also Cuozzo, D'Andrea, Pellegrino 2004). If the use of GIS at the intra-site scale presents problems related to the representation of the third dimension of the archaeological context (Harris, Lock 1995, 356; Dell'Unto, Landeschi 2022), necropolises tend to be less subject to this problem (see *supra* § 3.3). Thus, this absence is rather surprising, as Moscati herself points out.

It is precisely the unpublished *Necropolis* project, mentioned above by E. Govi, that demonstrates the need to develop tools that are not simply forms of spatial representation, but «also and above all issues related – from a technical point of view – to the integration of data and systems, and – from an archaeological point of view – to the interpretation of archaeological processes» (Moscati 1998, 191). In this regard, it is worth recalling the observations of M. Goodchild (1996, 245-246), who emphasised that spatial analysis is «primarily analysis of form, whereas understanding requires analysis of process», i.e. «it is probably better to see spatial analysis as a source of possible hypotheses about cause rather than as a means of confirmation».

In large Iron Age funerary complexes, e.g. Pontecagnano or the Certosa necropolis in Bologna (certainly more contained but no less articulated in terms of data management), such an approach is only possible if all the data can be collected for each available grave. Given that the level of topographic data is not always satisfactory for an accurate georeferencing, the development of an RDB, primarily for the management of data (see Cristofani, Francovich 1990 for reflections on Italian research), is necessary to govern the quantitative and qualitative complexity of the data of these necropolises.

Therefore, the first challenge concerns the development of an RDB (D'Andrea 2000 for Pontecagnano), which usually becomes sclerotic in information implementation processes that may last years or decades. The most recent case of Valle Trebba is illustrative: an articulated relational archiving system based on the proprietary software FileMaker has allowed us to not only collect the entirety of the information available for 1,215 tombs and over twelve thousand objects, but also the possibility of implementing its architecture. Over the years, we have created new related tables and further thematic insights that could not have been foreseen at the beginning of the project, but at the same time it has amplified the information and increased the complexity of the architecture of a system that is increasingly binding as a result.

The solutions adopted for overcoming the management approach and moving towards the use of data for spatial analysis in a GIS environment are not currently satisfactory since they do not respond to the principles of accessibility of such tools, nor to Open Data Standards. The hope is that future tools will be more suited to the needs expressed in the field of research focused on Iron Age necropolises, which is relatively limited in terms of case studies and could perhaps be adequately addressed through a collective project. In a geographical and diachronic landscape characterised by a strong cultural and ritual heterogeneity, such as that of the Iron Age of the Italian peninsula, such an objective would be challenging not only in providing adequate tools for spatial analysis, but also because it could be the stimulus to address the issues related to the processes of interpretation and the objectives that these tools should support.

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ABSTRACT

This contribution deals with the use of relational databases (RDB) and GIS for the spatial analysis of Iron Age funerary contexts in the Italian peninsula through two projects by the Chair of Etruscology at the University of Bologna. The two selected case studies of Bologna's western necropolis and Spina's Valle Trebba necropolis represent distinct phases of research and discuss the challenges in updating historic systems and creating dialogue between systems adopted at different times. The Bologna case provides the opportunity to discuss the quality of data from old excavations in reconstructing funerary landscapes using GIS. The case of Valle Trebba exemplifies the difficulties in planning and managing information on 1.215 tombs and over twelve thousand objects through an articulated relational archiving system. The iconography of Attic pottery allows us to understand the management of qualitative data. As far as spatial analysis in a GIS environment is concerned, we reassessed the solutions adopted for the Valle Trebba project, which are currently unsatisfactory, as they do not meet the principles of accessibility of such tools, nor Open Data Standards.

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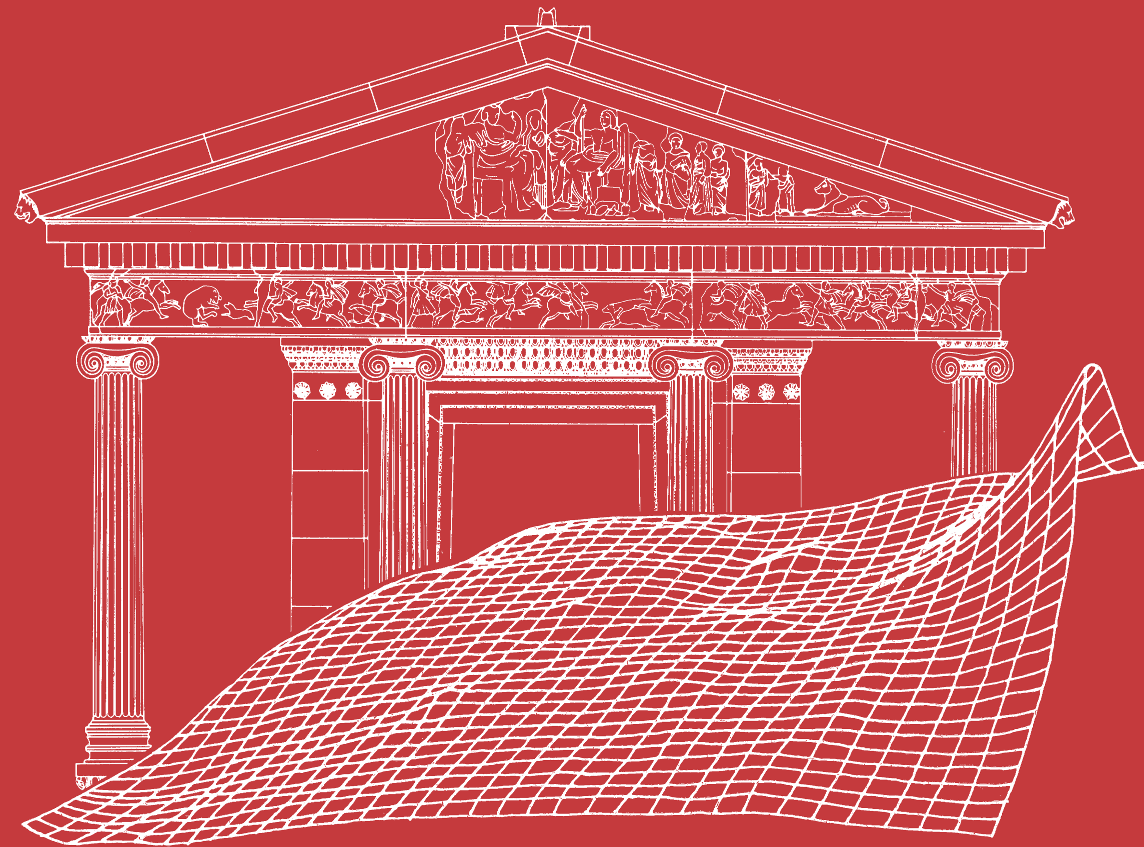

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