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Altinum: discovering a hidden municipium through GIS, historical research and new excavations

Keywords: archaeology, survey, dig, Altinum, cartography, GIS

Summary: The history and understanding of the ancient *municipium* of *Altinum* is lately drawing attention of an increasing number of scholars. In 2016 the Department of Humanities of Ca' Foscari University started a campaign of archaeological excavations, intended to investigate the urban area of this Roman site. We were able to identify this area through a comparative study between recent and historical cartography: ancient planimetries, cadastral maps, interpretation of old and recent aerial photographs combined with the study of archaeological documents and – in some cases unpublished – manuscripts represent the core of this project. Integrating different types of data is crucial for the aims of our research, and it made possible to identify traces of the archaeological record still hidden under the ground, that have been inserted in a GIS system. We created an archaeological digital map inclusive of data from old and new field works, photo-interpretations, archives, and surveys (such as those conducted by Ca' Foscari University in 2012 and 2014); this resulted in a simple and interactive tool on cartographic base, collecting all we know about *Altinum*.

The Altinum project 2012-2016: survey and excavation[1]

In 2012 the Ca' Foscari University of Venice launched a project on the site of *Altinum*, in collaboration with the 'Soprintendenza archeologia, belle arti e paesaggio per il Comune di Venezia e laguna'. The research was focused on the area called Ghiacciaia, in the northern part of the Roman city.

In 2007 an aerial photographical survey undertaken by the University of Padua allowed to appreciate for the first time the monuments of the Roman city (Ninfo et al. 2009). The plan, which derived from aerial photographs and was supplemented with data from archaeological surveys and aerial photography archives, shows the main buildings of Roman Altinum: the city is surrounded by a ring of water and it is crossed by a large canal. In this map the Ghiacciaia area is clouded and provides little data: it is possible to see part of the road, the network, and scattered structures (Fig. 1).

In 1989 - 1990 this area underwent a geophysical survey (Veronese 2000), which contributed to identifying in the eastern sector some structures and a series of plinths along the main canal that borders the city to the North and along a north-south sub-channel that is connected to it. In 1972 the undertaking of archaeological soundings on the east bank of the secondary channel foundations led to the discovery of a brickwork quay erected on a wooden palisade, seven quadrangular plinths, and structures related to a large building: it is possible to hypothesize a large commercial area with porches piers and warehouses (Tirelli 2011: 64). Among the areas subjected to geographical surveys, the Ca' Foscari project focused on the Western sector. The latter yielded evidence of various blocks, oriented Northeast / Southwest, and a structure, probably a road or a ditch, which divides the area into two parts, and is oriented Northwest / Southeast, curving slightly to the West (Fig. 2).

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During the first stage of the survey (2012-2015) a 10x10 meters GPS grid was created, connected to the previous one that had already been positioned on the ground during the geophysical survey campaign led by Sandro Veronese. The area was systematically surveyed according to parallel lines at 5 m intervals. The discovery of special finds (coins, ceramic, architectural fragments, etc.), and the presence of structures or concentrations of materials have been consistently positioned with a GPS device and photographed; all data was entered in the specifically created GIS platform (see following paragraphs). Significant concentrations of plaster, mosaic *tesserae*, and architectural fragments indicate the presence of public and private buildings.

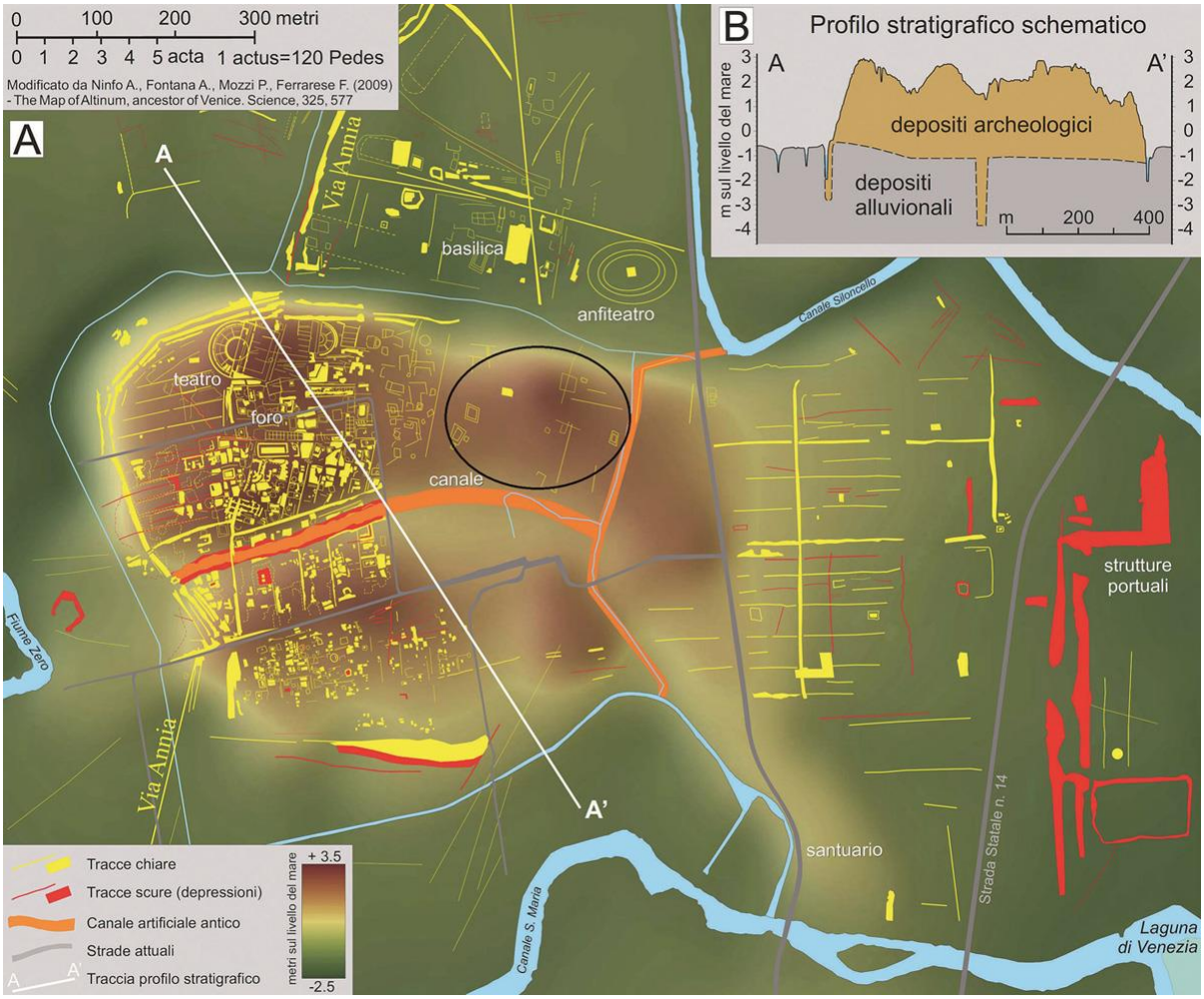

Figure 1. Altinum plan, derived from aerial photographs. In the black circle the so-called Ghiacciaia area is visible (Mozzi et al. 2011, tab. 1).

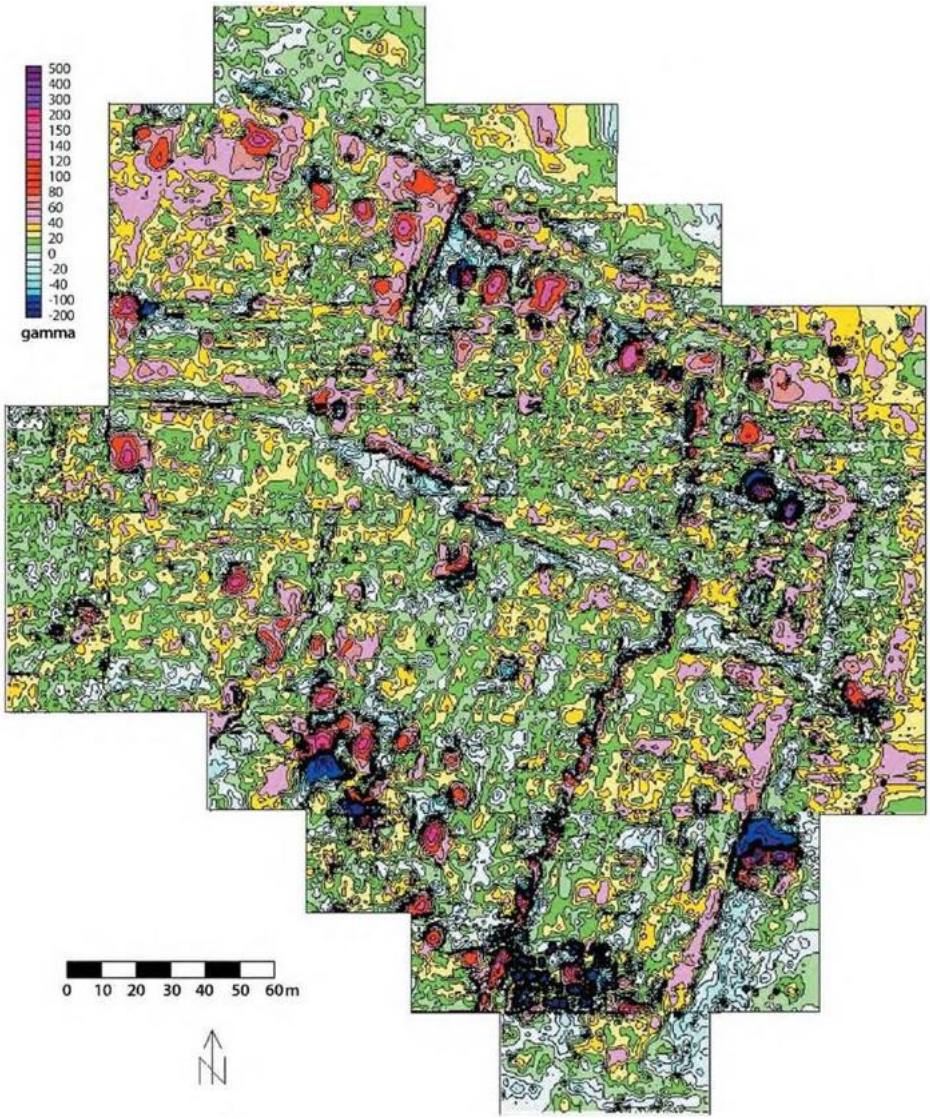

Figure 2. Map of the anomalies derived from the geophysical survey campaign (Veronese 2000).

Meanwhile, we started inventorying and studying the abundant material found during the survey campaigns; the archaeological finds of 2012, spanning from Mesolithic to the modern age, will be published soon (Sperti et al., in press). The statistical approach to the data, based on the GIS platform, and edited by Angela Paveggio and Eleonora Delpozzo, is expected to define the function of the different areas.

The survey campaigns allowed to investigate in a short time a vast portion of territory, and made it possible to identify buildings and infrastructures. The discovery of glass slags and the fragment of a melting pot possibly suggest the presence of specialised workshops for the fabrication of glass in this area. Such evidence is of fundamental relevance, as it would corroborate the role of Altinum in the glass industry during the Roman period, so far only supposed but never really attested by archaeological findings in context.

The archaeological excavations of the so-called Ghiacciaia area, never previously excavated, began in 2016. The excavation, carried out in an area of about 200 square meters, has unearthed some structures related to the urban housing district: more specifically, these structures probably belong to two different *domus*, of which masonry foundations, part of the floor substrates (Fig. 3), and a fragment of the pavement in *opus caementicium* with geometrical patterning in black and

white mosaic tiles are still preserved. In the same area, a sewer, sacked and *spoliata* by a large trench, has also been unearthed. These structures can be dated between the first century BC and the beginning of the first century AD.

Figure. 3. A portion of the excavated area, with foundations of walls and floors.

Researches and GIS[2]

Historical sources

The historical research concerning Altinum inevitably starts from the ancient authors, who occasionally mention the city in their works. This occurs, in particular, whenever Altinum is related to broader historical events; moreover, the healthiness of the Roman city and its great fortune in trade, favoured by its location at the crossroad between both land and sea trade routes, appear to be especially appealing to these authors. Although the Paduan historian Titius Livy unusually neglects to mention Altinum and its history, Velleius Paterculus profusely discusses the events related to Gaius Asinius Pollio, a Roman commander of seven legions, who resided temporarily in the region (*circa Altinum*)[3]. The facts reported by Paterculus seem to concern the period during which the Roman city became a *municipium*, between 42 and 49 B.C. Altinum is later mentioned again in connection with the brutal events that interested the Italian region after the Julio-Claudian dynasty came to an end.

After about a century, the *municipium* reemerges in the ancient chronicles related to the invasion of the Germanic Quadi and Marcomanni, who destroyed *Opitergium*, another Roman city close to Altinum, in 166 A.D. Furthermore, the *Historia Augusta*[4] mentions Altinum with regards to the death of Lucius Verus, which occurred nearby. At that moment, the city must have been

[2] *Co-authored by:* Angela Paveggio, Eleonora Delpozzo

[3] VELL. 2, 76, 2: *«nam Pollio Asinius com septem legionibus, diu retenta in potestate Antonii Venetia, magnis spe- ciosisque rebus circa Altinum aliasque eius regionis urbes editis, Antonio petens, vagum adhuc Domitium, quem di- gressum e Brutianis castris post caedem eius praediximus et propriae classis factum ducem, consiliis sius illectum ac fide data iunxit Antonio».*

[4] HIST. AUG. Ver. 9, 2.: *«Sed non longe ab Altino subito in vehiculo morbo, quem apoplexin vocat, correptus Lu- cius depositus e vehiculo detracto sanguine Altinum perductus cum triduo mutus vixisset, apud Altinum perit».*

necessarily involved in the campaigns on the Danubian front, since it is from Altinum that the Via Claudia Augusta originates, which represents the direct connection of the Roman Empire to Europe.

The name of Altinum disappears once more from the historical sources, until Attila mentions it again in later texts that recall its conquest and destruction in 452 A.D.[5], when all the local inhabitants were forced to move to the nearby lagoon islands.

Nevertheless, numerous legislative documents included in the *Codex Theodosianus*,[6] provide evidence of the significant number of constitutions issued by the emperors in Altinum and prove that not only did the emperor often stay in the city, but also that the imperial chancellery regularly worked there between the 364 and the 406 A.D.; this indicates that the city was actively involved in the political dynamics. It is not surprising, then, that the *Tabula Peutingeriana*, an illustrated *itinerarium* depicting the Roman road network, yielded a symbolic image of Altinum as a city with two towers, thus represented as an important and populous city (Fig. 4).

Figure 4. Altinum as a city with walls and two towers, depicted in the Tabula Peutingeriana (in digital form, https://upload.wikimedia.org/ wikipedia/commons/3/36/Tabula_Peutingeriana_-_Altino.jpg).

The architectural aesthetic of the city of Altinum and its urban topography, as well as how it changes over the centuries, are the major focus of this research. On this note, ancient sources often emphasize the intense relationship of the city with water, as described in the *descriptio Italiae* by Pliny the Elder.[7] In addition, in his comparison between Altinum and Ravenna Strabo mentions how they were *"built entirely on piles, and traversed by canals, which you cross by bridges or ferry-boats"*.[8]

[5] ANON. RAVENN. 4, 30: *«Item in regione Venetiarum sunt civitates, id est Vicentia, Patavium, Altinum, quae et Altilia quondam dicebatur, antequam ab Attila esset capta...».* PAUL. DIAC. hist. 14, 11: *«Plura preaterea eiusdem regionis castella immanis hostis extinctis vel captivitatis civibus, succedi ac diruit: Concordiam, Altinum, sive Patavium, vicinas Aquileiae civitates, illius instar demoliens solo coequavit».*

[6] *Cod.Theod.9,30,1;15,15,1;9,30,2;9,40,7;11,36,16;14,3,7;14,21,1;11,31,5;11,1,18;14,15,5;1,12,* 7, 6; 11, 7, 15; 14, 15, 6; 9, 42, 16; 14, 23, 1; 1, 15, 17, 5; 11, 1, 30.

[7] PLIN. *nat.* 3, 126: *«Sequitur decima regio Italiae, Hadriatico mari adposita, cuius Venetia, fluvius Silis ex monti- bus Tarvisanis, oppidum Altinum, flumen Liquentiaa...».*

[8] STRAB. 5, 1, 7, 213-214. English translation by H.C. Hamilton.

Overall, the sources agree about the general wellness and prosperity of the city, whose trade routes both by land and by sea allowed trades in summer as well as in winter.[9]

Cartography and archaeology studies

Altinum may be referred to as a hidden city, because it was not occupied after its destruction in the Late Antiquity; nowadays, the ancient site is located in the countryside at circa 6 kms from the urban area, and it is known as the town of Quarto d'Altino. This unique archaeological condition allows us to study the city as it was, not only through archaeological excavations, but also by means of aerial photography and cartographic studies in general. Everything that was monumentalized, such as walls, bridges, buildings, roads, and so on, was dismantled during the centuries to be reused as building material for other lagoon settlements, Venice among all, but the urban structure is still *in situ* and recognizable, covered and protected underground.

The choice to focus this research project on the area northwest of the old museum is the result of a precise cartographic study aimed to identify the area, or areas, of highest archaeological interest. The purpose was to investigate aspects of the urban design, the organization of roads and, eventually, canals, the daily life of people living in the city, and the different environments where they lived.

All the available data regarding this territory, acquired mostly through remote sensing techniques, provide a general overview of the area, although visible marks cannot be interpreted from a chronological point of view. This is the major challenge in this project: to reconstruct the history of the city in its different phases through archaeological excavations and the study of the different materials found during the investigations.

In the primary stages of this work, a heterogeneous set of maps was collected and examined.

The most important of them all is probably represented by the archaeological map, which was created on paper and based on the CTR – "Carta Tecnica Regionale" (Technical and Regional Map of given towns and areas) by the former illustrator of the National Archaeological Museum of Altinum, Elena De Poli. Primary alignments of the ancient city and its macro-structures appear on this map: urban boundaries, canals, roads, *domus*, mosaics, bridges, warehouses, villas, the monumental harbour entrance – as they were hypothesized from aerial photographs, electromagnetic surveys, and archaeological excavations. This map, updated until 2005 and realized in two versions (one at scale of 1:1000 and the other one at scale of 1:2000), was digitized in 2007 thanks to a grant from Regione Veneto. The digitized version is the base map we now use in the Altinum GIS.

The cadastral maps of Quarto d'Altino are also preserved in the archives of the Archaeological Museum. From the Fifties to the Seventies, these maps were used to position findings, structures and any archaeological evidence discovered either accidentally or during excavations and surveys. These planimetries are often accompanied by handwritten notes, particularly important are the ones by Bianca Maria Scarfì, former manager of the museum, Mario Soncin, a worker in charge of the excavations, and Giovan Battista Frescura, an official of the Soprintendenza.[10]

The sheets of the cadastral map taken into consideration are numbered 3, 7, 8, 9, 10, 18, 19, 19B, 19C, 20, 20A, 20B, 25A, 25B, 25C, 26A and 26B, pertaining to the territory of ancient Altinum, the city and the areas nearby (Fig. 5).

[9] Recent studies about Altinum: Tirelli 2011; Cresci Marrone, Tirelli 2011. On economy and trade: Cresci Marrone, Tirelli 2003.

[10] Some difficulties arise when one tries to correctly read such writings.

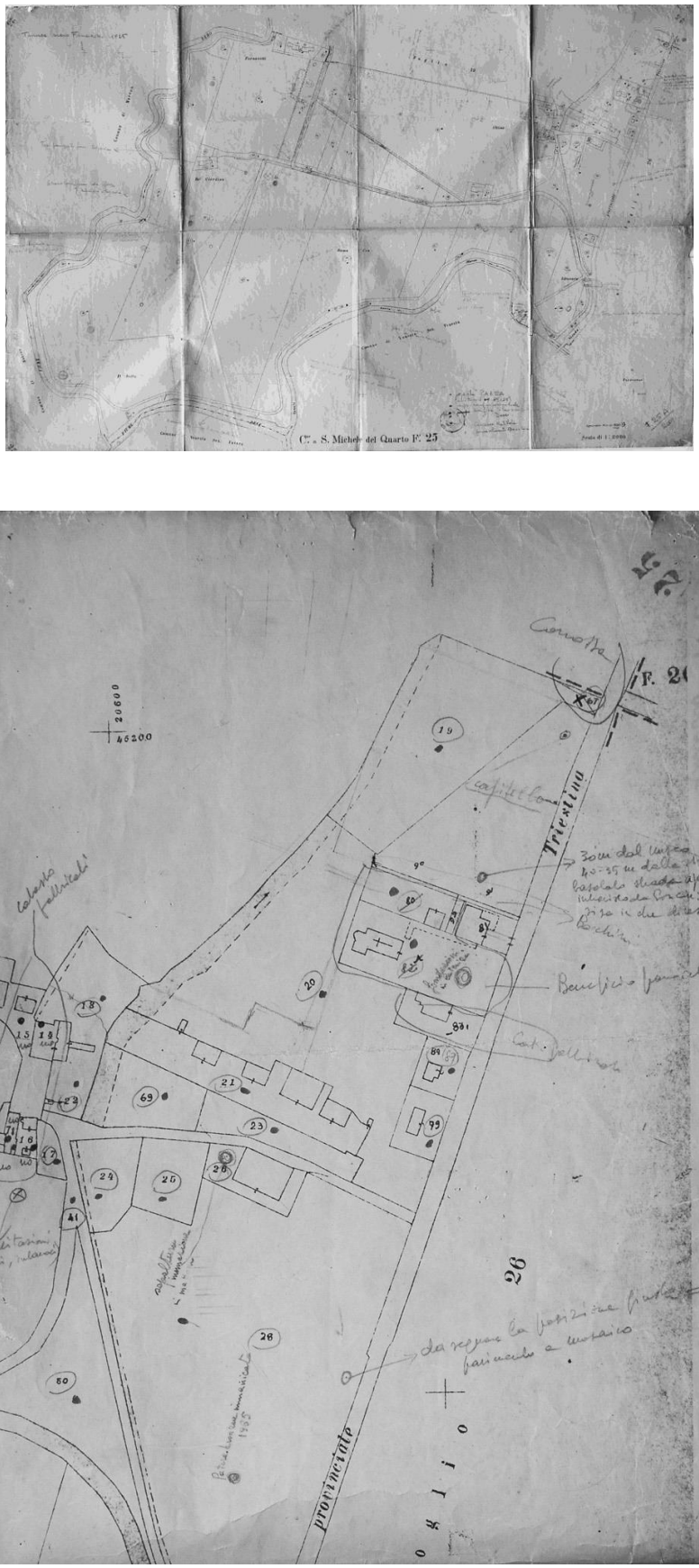

Figure 5. Cadastral map (A); S. Michele del Quarto sheet 25 (B) (Paveggio 2011: 171, figs. 2a – 2b).

Furthermore, we studied a significant number of historical maps. One emerges for its importance: a portion of the *Kriegskarte* of Anton von Zach (1798-1805), at a scale of 1:27,000, which includes the city (Fig. 6).

In this map, the city centre is depicted clearly and stands above from the marshy territory surrounding it, circumscribed by what seems an embankment. In total, five buildings are represented, four of which are probably part of the same complex. The areas all around the city are depicted with different colours in dark shades so as to give the idea of a marshy land. This difference in soil use should be attributed to the fact that the urban centre was more elevated than the rest of the countryside, and it is also related to the differences in the geology, and the permeable character of the soil, due to the presence of artificial materials, such as bricks, pottery, and rocks.

Figure 6. Historical map, Kriegskarte, A. Von Zach XIII, 15 (Paveggio 2011: 171, fig. 3).

Among other relevant cadastral maps that were considered to reconstruct the ancient image of the Roman *municipium* are included the Austrian Cadastre of 1845 and the Austrian-Italian one, 1845 as well (Fig. 7).

Moreover, in order to study relevant environmental changes (see especially the problem regarding the boundaries of the ancient city), the IGMI[11] sheets were examined, in particular Sheet. N. 51, at a scale of 1:25,000 (Fig. 8).

The entire set of historical maps has been digitized and georeferenced on the current CTR.[12] Thus, visualizing the ancient territory was more effective as we could observe the differences with the current image of the same area.

[11] IGMI – Istituto Geografico Militare Italiano

Figure 7. Historical map, Austrian Cadastre (Paveggio 2011: 172, fig. 4).

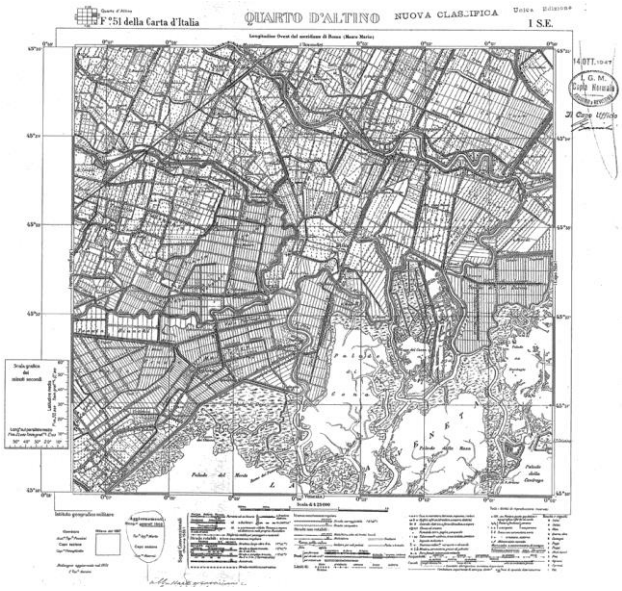

Figure 8. IGMI map, sheet 51 (Paveggio 2011: 173, fig. 5).

The information obtained from these maps were combined with the data from a core of planimetries edited by Alessio De Bon in the Thirties, some of which are still unpublished and preserved within the archive of the National Archaeological Museum of Altinum. There are at least four of these archaeological maps and at different scales. Some of them report several archaeological findings (often different from one map to the other), positioned and illustrated with notes (every finding is identified with a letter and every map is provided with a legend). Other maps only report the names regarding land ownership, while others represent the ancient road network (Fig. 9).

[12] CTR – Carta Tecnica Regionale

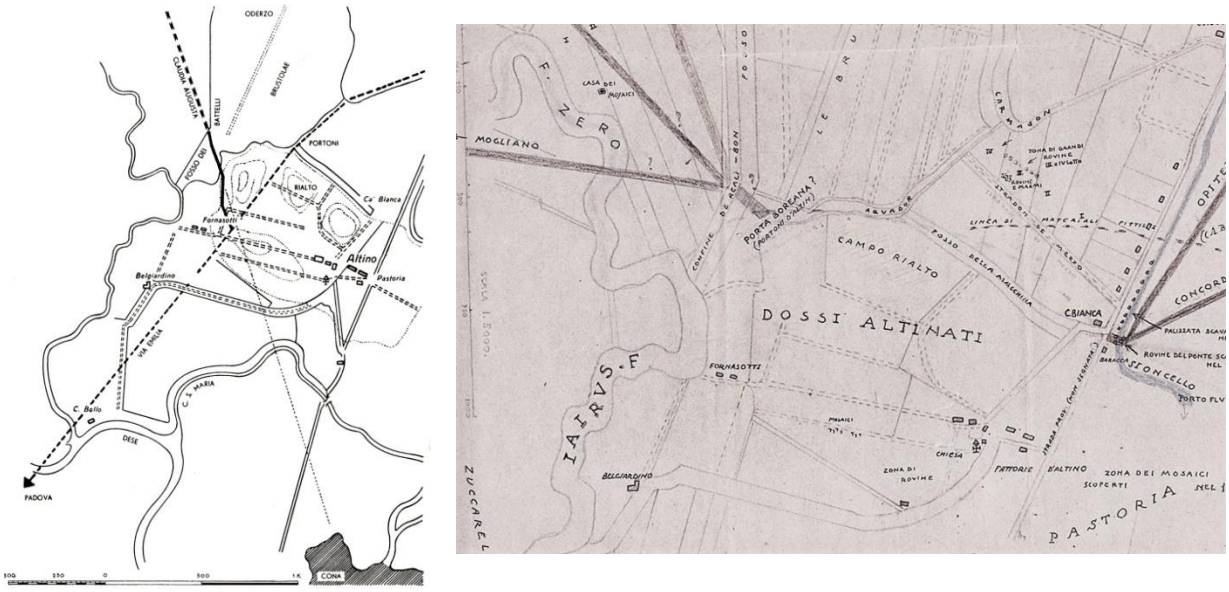

Figure 9. Altinum plan as drawn up by A. De Bon (De Bon 1938) (*Left*). A detail of De Bon's plan (National Archaeological Museum of Altinum; Paveggio 2011: 173, fig. 6) (*Right*).

One of the most significant maps that we have studied was drawn up in unknown years for the "Istituto Veneto di Scienze, Lettere ed Arti" (Roman roads commission), and updated with altitude measurements by engineer Pianetti (Fig. 10).

Figure 10. Historical map representing the city of Altinum by engineer Pianetti, based on De Bon's notes and maps (Paveggio 2011: 173, fig. 7).

A recent discovery in the archives of the Institute brought to light an unpublished manuscript written by Alessio De Bon for the former "Reale Istituto Veneto di Scienze, Lettere ed Arti". It is composed of two notebooks, which contain an entire chapter dedicated to Altinum and its territory, exceeding in details than what had been later published in the book *La via Claudia Augusta* (De Bon, 1938). Attached to the notebooks was a photographic album, hand bound and with original notes, which also include pastel drawings made by Alessio De Bon, accompanied by evocative descriptions of the ancient Altinum. The photographs show various subjects: from landscapes to archaeological findings and, in particular, funerary monuments, some of which have now gone lost or of unknown location and were not known until this discovery.

The aerial photographs were equally essential to this study, as much as the maps. The area of Altinum and its surroundings was examined through significant aerial photographs downloaded from Regione Veneto WebGIS.[13] The flights considered are: 1978, flight ReVen, b/w; 1983, flight ReVen, b/w; 1987, flight ReVen, colours; 1994, flight Comune di Venezia, b/w; 1999, flight ReVen - Veneto Centrale, colours; 2005, flight ReVen, colours. Every image has been georeferenced to integrate with cartographic data.

In 2000 a geophysical survey campaign led by Sandro Veronese highlighted the existence of a dense maze of perpendicular traces northwest of the museum. The density of the lines suggested the existence of an urban structure, and the survey confirmed also the presence of several buildings, one of them probably with an apse.

Finally, in July 2007 the scholars from the geosciences department at the University of Padova conducted a remote sensing campaign all over the territory, using visible and multispectral sensors (Ninfo et al. 2009). The photographs acquired confirmed some of the proposed hypotheses and brought new data to the study. The images highlighted a large number of still unearthed traces, showing even the smallest details of the topography of the city. It was possible to precisely identify the major buildings and public complexes such as the *forum*, the theatre, an *odeon*, the basilica, the amphitheatre, and buildings connected to the harbour (Fig. 11). Although these structures were already known by the scholars thanks to the historical relevance of the city and allusions in epigraphic sources, they were not able to locate these buildings and complexes, except for the amphitheatre, known by its trace since 2007 thanks to Google Earth satellite images.

This was a turning point for the scholars, as it gave a detailed image of the city and it confirmed what was conjectured during the years, in particular for what concerned roads, watercourses, and the urban subdivision.

[13] The photographs are property of Regione Veneto.

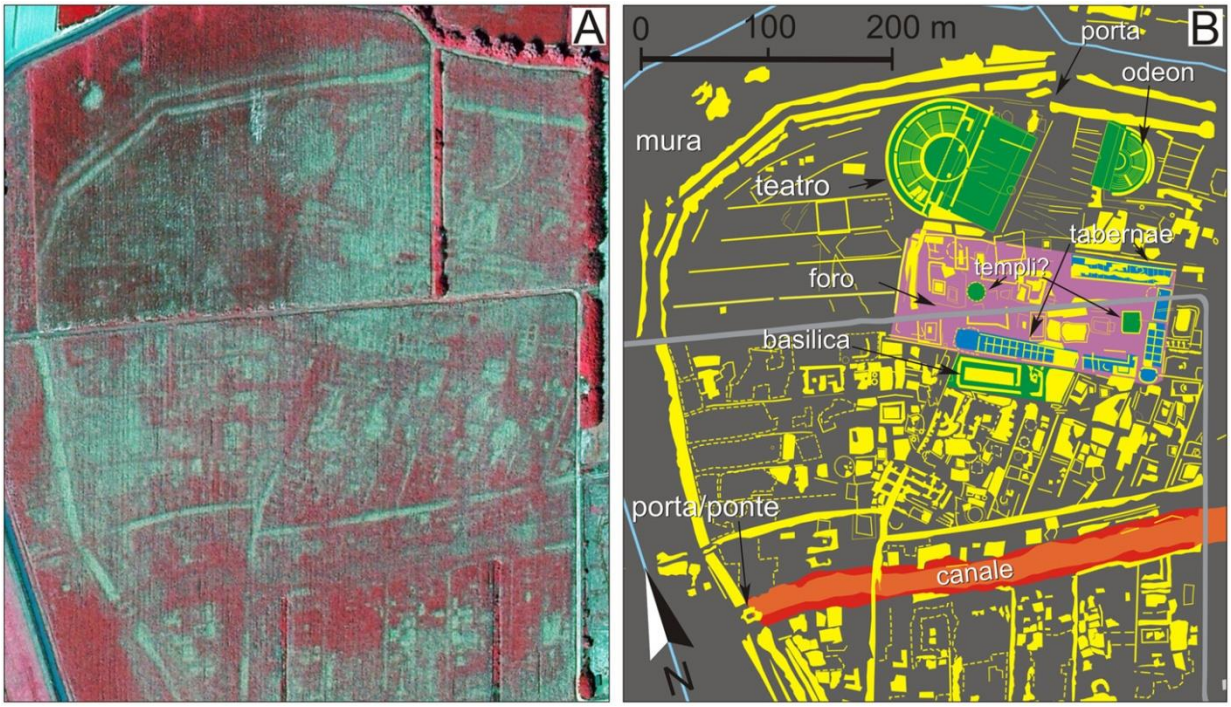

Figure 11. North-western area of the city of Altinum (A) and interpretation of cropmarks (B) (Mozzi et al. 2011: 200, fig. 2).

The Geographic Information System of Altinum

As previously mentioned, the data collected have been integrated in our GIS platform to create a digital archaeological map of Altinum. The advantages of working with this tool are several, since, firstly, it allows us to work and manage different kinds of databases within the same software, and secondly because we can produce different types of thematic cartography. Since this project began, the system was designed with an open structure, to make it manageable and easy to update as new data becomes available; using this tool, it is possible to simultaneously interface the information regarding the ancient landscape and different databases regarding city planning, territory and environment. The first version of this archaeological map included only a portion of Altinum's district and it was presented in 2006 at the Computer Application in Archaeology Conference.[14]

The archaeological map of Altinum is based on an updated version of the CTR of Quarto d'Altino. All the historical maps and aerial photographs mentioned in the previous paragraphs were loaded in the GIS. Following this, different layers were created and used to draw the archaeological features, using mostly lines and polygons (most of the findings coincide with buildings or monuments).

The area taken into consideration is naturally quite extended, as it includes the ancient urban settlement of Altinum together with other marginal zones; ultimately, the territory is delimited to the North by the river Sile, to the South by S. Maria canal, to the East by the lagoon, and to West by the river Zero.

[14] The map was the result of Angela Paveggio's work for her Bachelor of Arts degree thesis: more specifically, she realized a database for archiving epigraphic data and successively implemented it in a GIS to manage the entire dataset regarding funeral monuments with inscriptions that come from the necropolis between the north-east segment of the Via Annia and the connecting road.

Through the application of different procedures (georeferencing, digitizing, etc.), we obtained an interactive and complex tool to collect geographic data, as well as the precise coordinates of where the findings were discovered in order to link with other related types of attribute information (descriptions, inventory numbers, chronologies, etc.); thus, the archaeological map is completed and serves as an integrative vehicle to access all types of different information. In conclusion, the GIS, through its internal database structure allows to link, visualize, and store data; we exploited this feature to analyze different datasets, their attributes and their positions.

In 2011, on the occasion of the conference "Altino dal cielo: la città telerilevata. Lineamenti di Forma Urbis", an analytic survey of the data inferable from the archives of the National Archaeological Museum of Altinum was undertaken. This project enabled the recording of the numerous manuscript notes in the cadastral maps from the Fifties, Sixties and Seventies, and, among them, different information regarding various accidental findings in the last century (as mentioned in the previous paragraph). A number of difficulties may arise while assembling all these different kinds of data and mainly regard sporadic findings that cannot be precisely located.

These data were hence implemented with those inferred from the comparative analysis of various planimetries, both printed and handwritten, preserved in the archive of the museum, among which the maps resulted from Alessio De Bon's researches in the Thirties are truly remarkable.

Likewise, the historical cartography was noteworthy. We studied and analyzed the Austrian Cadastre, the IGMI maps from the nineteenth century, and the aerial photographs preserved in the museum, starting from the Schmiedt Atlas.

The outcome of this work coincided with the development of the "Carta dei Rinvenimenti Sporadici di Altino" (CRSA 2011), in which every "new point" has been recorded and referenced to incorporate within the GIS project about Altinum. A decision was made to identify the new data with points in order to differentiate them from the buildings inserted on the map in a previous stage of the work. This also serves to distinguish data retrieved principally from archaeological excavations, represented by polygons, and sporadic findings, represented by points. Every point in the GIS comprises the following attributes: precise geographic coordinates of where they were found, an identification number (also used in the visualization of the map), a brief description of the artefact (and inventory number if known), and data source,[15] (Fig. 12).

The new findings, for a total of 109, refer both to individual findings and structures. This work allowed also the discovery of some significant contexts that were missing, as in the case of a block of decorated cornice (AL 39844), recovered in the Fifties in the so-called Campo Rialto area. This finding could be assigned to the *scaenae frons* of the theatre thanks to stylistic analysis; its dimensions also determined the size of the building that it belonged to (Figure 13).

Furthermore, the orientation of some of the minor decumani in the eastern district of Altinum is confirmed through these data: for example, the points 29, 52, 73, 99-103, known in the cadastral maps,[16] as "Basoli", "Strada basolata", "Strada selciata" or "Strada",[17] overlap with the linear marks distinctly recognizable in the aerial photographs, and already identified as roads.

In 2012 the Altinum GIS was further implemented with the data gathered during the survey's campaign lead by the research team of the Ca' Foscari University of Venice in the so-called Ghiacciaia area.[18] The entire area under investigation is particularly significant because, based on the photo interpretation and the geophysical surveys led by Veronese, the presence of roads and

[15] Cadastral map, Bianca Maria Scarfì's notes, Alessio De Bon's planimetry, etc.
[16] Cadastral map, sheet 26A.
[17] The terms refer to typologies and materials used for Roman roads (such as polygonal blocks of silex or lava).
[18] See the paragraph "The Altinum project 2012-2016: survey and excavations".

public buildings, including an apsidal plan, was suggested. Likewise, the data from the study of the University of Padova confirmed the presence of an urban rectangular grid to the northwest of the museum, in the area under investigation. The absence of specific information about this section of unequivocal role within the cityscape lies at the hearth of our choice to focus our attention on this particular area.

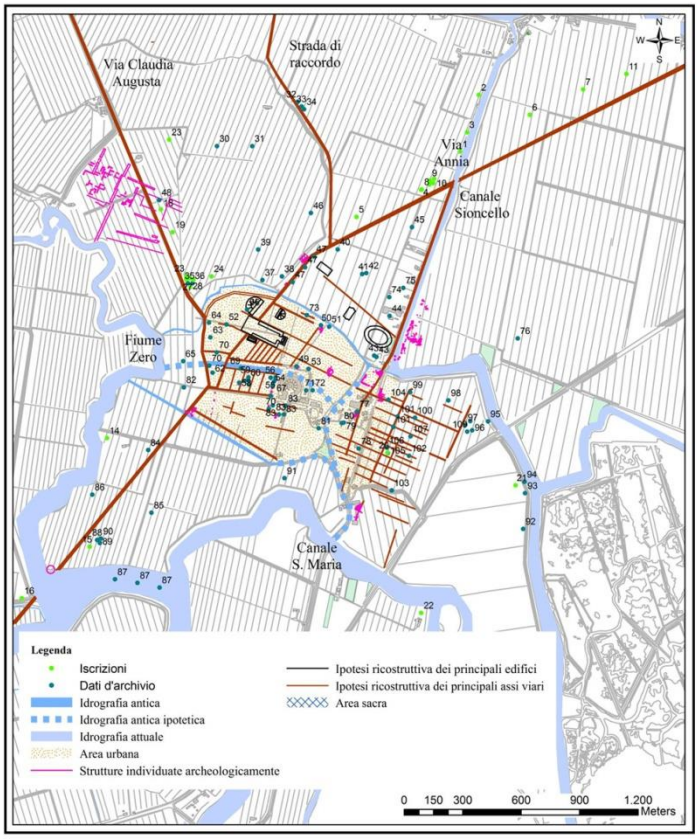

Figure 12. Carta dei Rinvenimenti Sporadici di Altino (Paveggio 2011: table 15).

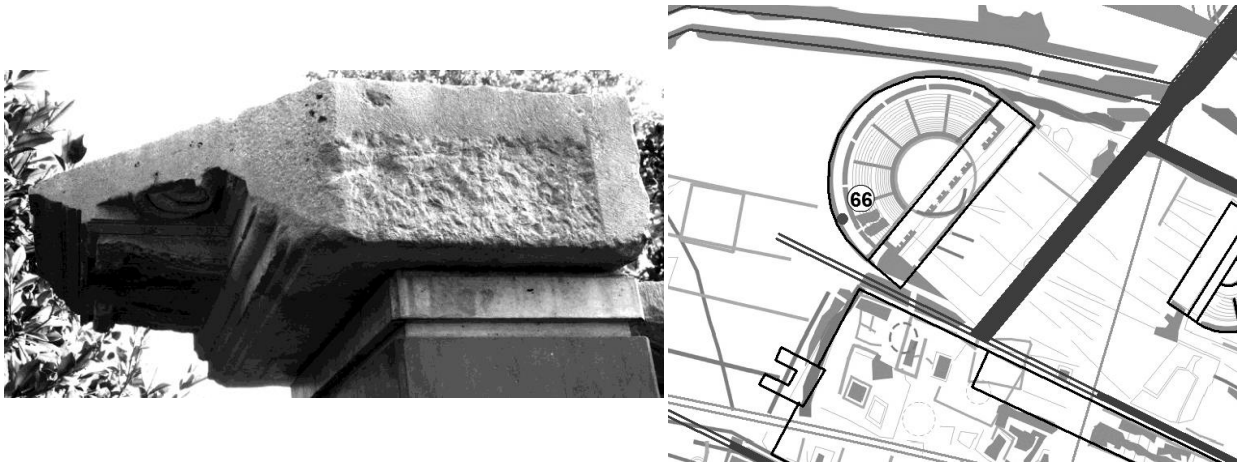

Figure 13. Decorated cornice (*Left*) and the plan of the center of Altinum (*Right)*, with reference of where the cornice was discovered (Sperti 2011: 115, figs. 14-15).

The data from the first survey campaign have been digitized on a specific layer and they are being integrated with the ones from the second, and final, survey campaign, done in 2014. A

preliminary study of the majority of these data prove the presence in this area of residential buildings, public structures, but also artisanal workshops: in fact, pottery sherds, glass fragments, production scraps, various mosaic *tesserae*, a fragment of inscription probably belonging to a public building, coins, different kinds of stone fragments were found.

At this stage of the project, we are working on a new version of Altinum GIS, to realize a complex database to manage the data coming from the archaeological excavations started in 2016. These data are more conspicuous and remarkably different from the ones managed previously. Thus far, the planimetries of what has been dig have been digitized in the GIS, connected with the data regarding stratigraphic units and the related findings. The system we are implementing is composed of a database aimed to record the different types of findings that are going to be found, with their pictures; moreover, every stratigraphic unit will be provided with geographical information, description and the relations with each other. In this way, all the data stored in the system can be efficiently consulted through queries and it is going to be possible to elaborate spatial analysis. One issue that would be deeply studied is chronology, because we want to store and organize the data in such a way that will result in a representation both synchronic and diachronic of the materials and the archaeological status.

Ultimately, the system should be simple in order that it can be used on the field, during the forthcoming campaigns, not only by the specialist but also by the students that are learning this tools.

From 2016, the survey activities are conducted in collaboration with IUAV Laboratory of Cartography & GIS, to assure accuracy and precision in the geographic data, and to georeference them in absolute coordinates. Thanks to their work, the excavation has been surveyed in details, producing a laser scanner 3D model, and a photogrammetric one from which an orthophoto has been elaborated and imported in the GIS.

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