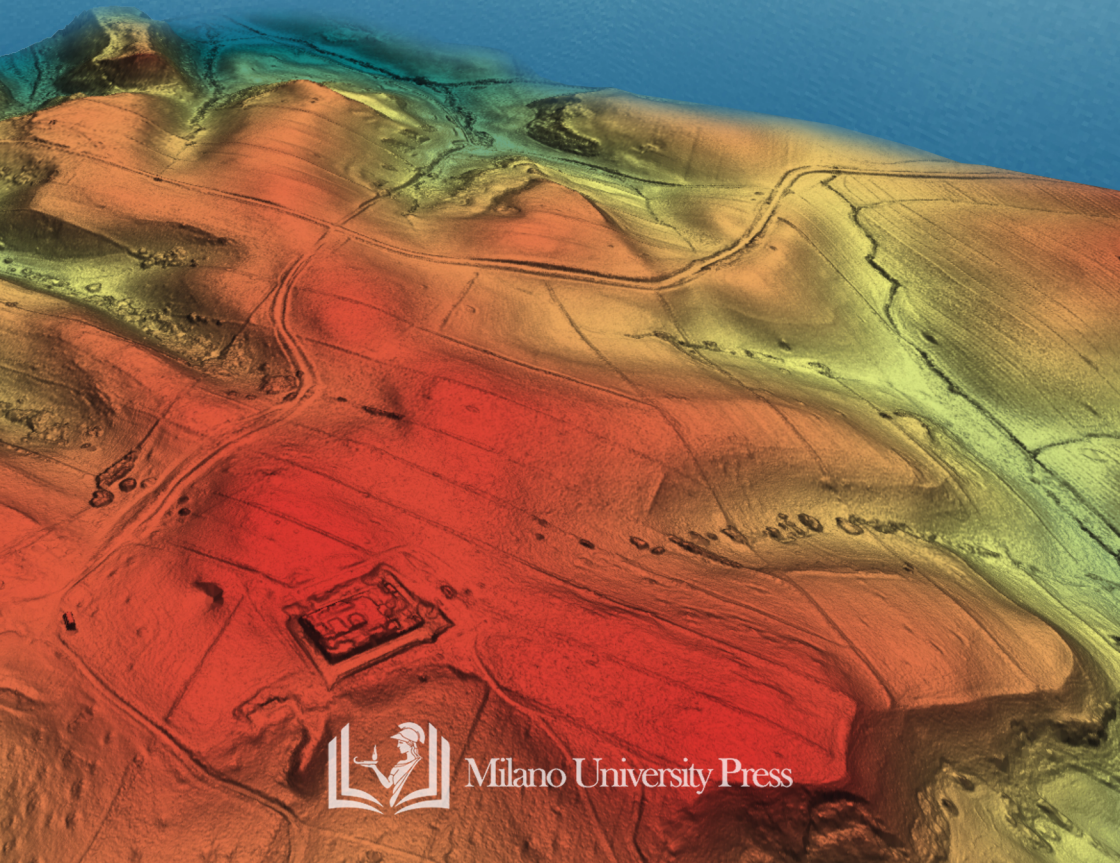


# TARQUINIA

TARCHNA / QUADERNI 3 2022

## TRACING SPACES AT THE ARA DELLA REGINA SANCTUARY OF TARQUINIA THEMES OF URBANISATION THROUGH GEOPHYSICAL RESEARCH

*Matilde Marzullo & Andrea Garzulino*



Milano University Press



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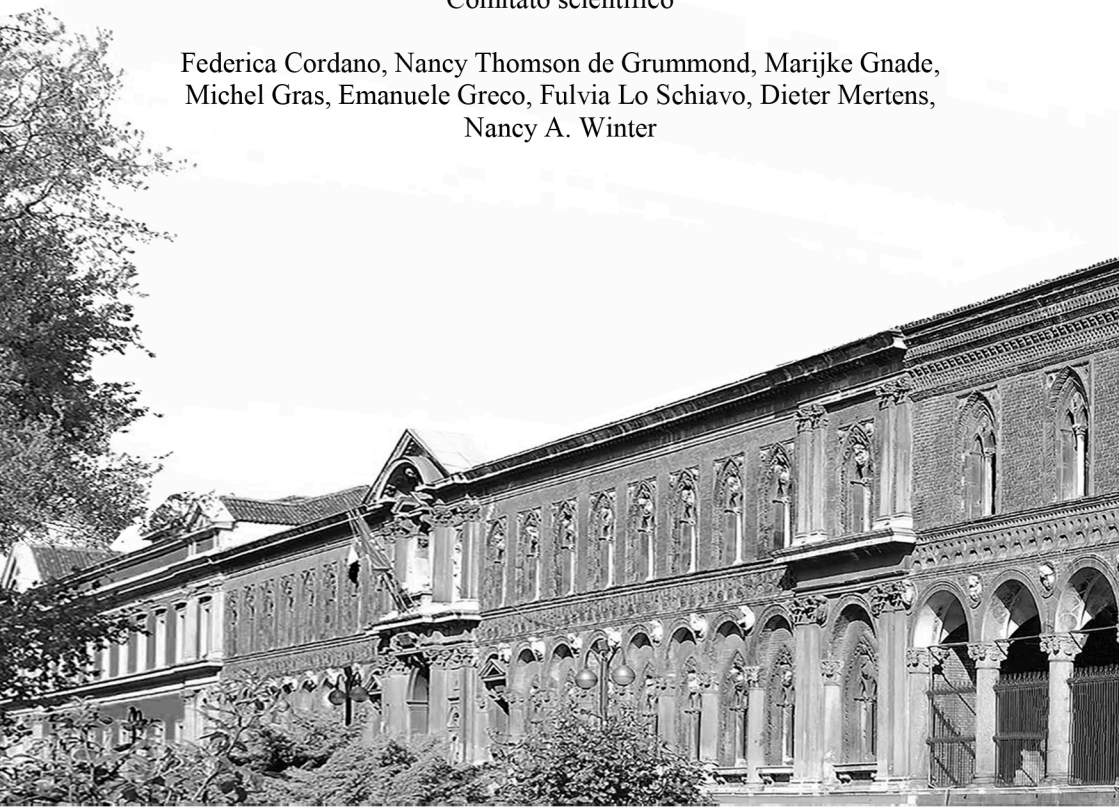
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## FOREWORD

*Margherita Eichberg*

Nei quasi cinque anni trascorsi dall'inizio del mio incarico a Soprintendente Archeologia, Belle Arti e Paesaggio per l'area metropolitana di Roma, la provincia di Viterbo e l'Etruria meridionale, a causa dei tanti impegni istituzionali non ho ancora avuto l'occasione di visitare il Pianoro della Civita. Non lo feci neppure quando, poco più di un anno fa, trovandomi a Tarquinia per un convegno nel periodo degli scavi, la professoressa Giovanna Bagnasco Gianni dell'Università Statale degli Studi di Milano che li dirigeva mi rivolse un cortese invito informale.

Nonostante ciò, la risonanza dei risultati delle ricerche del gruppo milanese mi è arrivata chiara e forte.

Nell'area tarquiniese ha preso vita, ormai da tempo, la collaborazione dei due poli universitari di Milano, la Statale e il Politecnico; e di questa compresenza non posso che apprezzare la positiva sinergia, sfociata nelle tante dimostrazioni dei risultati conseguiti, fornite nelle sedi di confronto scientifico. Un esempio fra tutti, il Convegno milanese tenutosi nel marzo del 2019, i cui atti sono usciti nel volume 31.2 della Rivista Archeologia e Calcolatori (2020). Dal titolo parlante "Milano internazionale: la fragilità territoriale dei contesti archeologici", l'incontro ha dedicato un ampio spazio alla ricerca che si svolge a Tarquinia sui temi della fragilità territoriale. In essa colpisce la completezza degli intenti e dei risultati, che devono necessariamente trovarsi nella conoscenza, base essenziale per la tutela, attività principale tra quelle esercitate dalla Soprintendenza.

Di questi risultati, pertanto, non posso che essere grata a tutta l'équipe coinvolta.

Fin dagli esordi il "Progetto Tarquinia" - del quale sono stati appena celebrati i quaranta anni di attività - si è caratterizzato per una strategia precisa, nella quale il tema dell'antica città nel suo



complesso, con il suo sistema viario, le sue porte e il suo rapporto con il territorio circostante era obiettivo primario, data anche la risorsa di poter contare sulle indagini e le prospezioni condotte sul Pianoro della Civita dalla Fondazione Lerici in tredici campagne, condotte fra il 1954 e il 1981. Tali prospezioni rappresentano ad oggi un patrimonio prezioso e irripetibile. Svoltesi in un'epoca in cui l'inquinamento metallico era pressoché assente, le loro acquisizioni conoscitive sarebbero infatti impossibili al giorno d'oggi, con le condizioni ambientali ben diverse che si sono determinate negli anni. Il lavoro che è stato svolto dall'Università in collaborazione con la British School at Rome, volta a verificare la possibilità di sovrapporre le mappature delle prospezioni Lerici di quegli anni pionieristici con le più moderne mappe georeferenziate ottenute con il modello tridimensionale del Pianoro della Civita ottenuto con tecnologia LiDAR, dimostrano quanto esse siano state utili. Anche quest'ultimo è stato un esperimento che Statale e Politecnico hanno effettuato insieme, con la relativa elaborazione dei dati, e per la prima volta su una città etrusca.

Su questa base, solida per tradizione e competenza, poggia il lavoro di Matilde Marzullo e Andrea Garzulino esposto in questo nuovo Quaderno, che ha potuto contare sulla Carta Archeologica del Pianoro della Civita già redatta dalla stessa Marzullo nel corso di una collaborazione con la Soprintendenza, dove sono stati acquisiti i risultati inerenti alla situazione delle mura rilevati per la ricerca PRIN ed illustrati nel suo volume del 2018 "Tarquinia, l'abitato e le sue mura: indagini di topografia storica".

A soli sette anni dalla pubblicazione degli scavi di P. Romanelli, che confermavano definitivamente l'ubicazione dell'antica città etrusca, nel 1955 iniziarono gli interventi dei tecnici e degli ingegneri della Fondazione C.M. Lerici a Tarquinia. Questi interventi, dapprima concentrati principalmente sulle tombe, passarono ben presto all'antica città. Le indagini geofisiche sulla Civita iniziarono nel 1964, e da allora furono eseguiti lavori per esaminare sistematicamente l'intera superficie dell'altopiano. Il programma non sempre fu rispettato ed incontrò notevoli ostacoli, ma nonostante tutto continuò fino al 1981.

Indagini magnetometriche, misurazioni elettriche, carotaggi e sondaggi hanno raccolto una quantità incredibile di dati. E nel tempo, nell'ambito del CRC 'Tarquinia Project' diretto dall'Università degli Studi di Milano, sono stati effettuati ulteriori rilievi georadar (ITABC - CNR) e rilievi gradiometrici (British School at Rome).

Oggi il progetto si occupa dell'elaborazione di questa enorme mole di dati per la pubblicazione della Carta Archeologica della Civita di Tarquinia, che si vuole il più esaustiva possibile.

Il volume che qui presento si incastona dunque in un'ampia strategia di ricerca che utilizzerà l'area Sud-Est del Santuario dell'Ara della Regina come progetto pilota. Il volume mostra che solo con lo studio comparato dei risultati delle diverse discipline (dalle fonti letterarie alla ricerca d'archivio, dallo scavo allo studio delle fonti cartografiche), attraverso l'ottica dell'archeologia, della topografia, della speleologia, dell'architettura, coadiuvato dall'informatica e dalla gestione dei dati ICT, è possibile fare luce nel sottosuolo e porre le basi per lo studio complessivo della città e del suo sviluppo.

Secondo il Codice dei Beni Culturali e del Paesaggio (D. Lgs. 42/2004 e s.m.i., art. 3), "La tutela consiste nell'esercizio delle funzioni e nella disciplina delle attività dirette, sulla base di un'adeguata attività conoscitiva, ad individuare i beni costituenti il patrimonio culturale ed a garantirne la protezione e la conservazione per fini di pubblica fruizione". Il punto di partenza, pertanto, è l'attività conoscitiva che, in un sito di rilevanza globale come la città etrusca (e poi romana e medievale) di Tarquinia, non può che coincidere con la ricerca scientifica in tutte le sue declinazioni.

La collaborazione istituita tra l'Università di Milano e la Soprintendenza - con particolare riguardo al 'Tarquinia Project' - è pertanto la base sulla quale si può progettare la tutela futura di un sito come la Civita di Tarquinia, che costituisce un osservatorio privilegiato per innumerevoli discipline: dalla storia dell'urbanistica all'interazione tra paesaggio antico e moderno, e dalle applicazioni di tecnologie innovative all'archeologia all'utilizzo agro-pastorale delle aree di interesse archeologico.

Un patrimonio culturale che anche l'UNESCO ha segnalato come meritevole di protezione e attenzione a livello mondiale, inserendo

nel 2004 Tarquinia e la sua necropoli nella Lista del Patrimonio dell'Umanità e la cui fruizione, fine ultimo della tutela secondo la legge italiana, passa necessariamente attraverso la promozione della conoscenza.

Un ulteriore tassello di questa filiera continua, dalla tutela alla valorizzazione, viene presentato oggi in questo volume, che mette insieme informazioni provenienti da diversi ambiti disciplinari, in un rinnovato connubio tra scienza e storia.

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## FOREWORD

*Christopher Smith*

Tarquinia has always been one of the most enthralling Etruscan sites, with its stunning paintings and the evocative ruins of the Ara della Regina complex. It is also now one of the most intriguing as the density of information increases generation by generation.

Maria Bonghi Jovino and Giovanna Bagnasco Gianni have led an innovative and highly productive series of interventions on the site which have transformed our understanding of this powerful Etruscan city, revealing the grandeur of its architecture, but also and increasingly, the complexity of its urban form.

The combination of the unique record of exploration by the Lerici Foundation, whose value and validity was confirmed by the British School at Rome (BSR), and a recent LIDAR survey, gives us now a deep site wide knowledge which can be explored furtherly and give context to specific excavation. This is a huge advance methodologically and although many sites are now using multiple techniques to confirm and amplify findings, the scale of the work at Tarquinia and the favourable conditions, now lost, under which the Lerici Foundation operated, make this a uniquely intriguing dossier.

The state of our knowledge of Tarquinia is now easily comparable with Veii, which has benefited from the BSR field survey initiated by Ward-Perkins and a campaign of aerial photography by Guaitoli, and Vulci which is becoming rapidly better known through a series of interventions. The rarity of large plateau sites in Etruria without subsequent destruction (compare Caere for instance) makes this a vital test case.

This volume shows the value of these overlapping techniques. Garzulino describes the LIDAR techniques and their value, and Marzullo looks in detail at the results of the combined work of stratified surveys, research and excavation to the south-east of the Ara della Regina.

If this area is indeed the site of the Roman forum as Bonghi Jovino and Torelli have suggested or an architectural space left open over a long period, we see the work of commemoration and preservation as indeed we see at Rome, where too the important monuments under the Lapis Niger are maintained and marked.

This parallelism will not be fortuitous. The intersecting histories of Tarquinia and Rome leave traces in space and over time. The rhythms of monument and piazza, of *templum* and *forum*, are also the rhythms of a dialogue between political and religious conceptions of space and time and we are privileged to glimpse this as clearly as we do in Tarquinia.

It is immensely to the credit of the “Tarquinia Project” that the team continues to bring innovative techniques to explore this extraordinarily significant site.

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TRACING SPACES AND PLACES: THE AREA SURROUNDING  
THE ARA DELLA REGINA SANCTUARY IN ITS LONG WAY  
FROM ETRUSCAN TO ROMAN TIMES

*Matilde Marzullo*

**The context of the investigation in the framework of the territorial researches of the 'Tarquinia project'**

In the last fifteen years, the 'Tarquinia Project' has been extended to the whole plateau in order to deepen the knowledge of the Etruscan settlement. This has allowed contextualising the archaeological sites in which the Università degli Studi di Milano worked directly as well as previous research work in a broader topographical context. The project is embracing the surrounding territory and is developed in continuity with the systematic and interdisciplinary research carried out by the University of Milan for almost forty years: inaugurated by Maria Bonghi Jovino in 1982, since 2004 research activities have continued under the direction of Giovanna Bagnasco Gianni. The solid interdisciplinary vocation led to the creation of the Coordinated Research Centre (CRC) "Tarquinia project" in 2015. This is directed by G. Bagnasco Gianni and involves six departments of the University of Milan and numerous Italian and foreign Universities and Research Institutes<sup>1</sup>. The common goal is to reconstruct the cultural and historical dimension of the ancient city, from the tangible archaeological records to the intangible forms of life,

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<sup>1</sup> For the University of Milan: Dept. of Cultural Heritage and Environment; Dept. of Environmental Science and Policy; Dept. of Chemistry; Dept. of Biomedical Sciences for Health; Dept. of Computer Science; Dept. of Earth Sciences. For the other Universities and Research Institutes: Politecnico di Milano (Dept. of Architecture and Urban Studies (Techniques for the Conservation and Management of Architectural Heritage Lab.); Fondazione Ing. C.M. Lerici; Geotechnos srl; British School at Rome; University of St Andrews; University of Oxford; Florida State University; University of Cambridge (in this regard see: BAGNASCO GIANNI *et alii* 2011).



without resorting to pre-established theoretical models or literary sources. The data processing is based on recurring associations and aims to identify the function and role of objects and monuments through examining their contexts<sup>2</sup>.

Many results have already been acquired through this collaboration. From the territorial point of view, we can mention the researches aimed at ascertaining the relationship between the two major sanctuaries and the urban fabric at different chronological levels. These are the 'monumental complex' (excavations by the University of Milan from 1982 to date) and the Ara della Regina sanctuary (excavations by the University of Milan in the period 1983-2002)<sup>3</sup>. The systematic nature and continuity of these research activities have guaranteed the contextualisation of evidence and findings during the entire evolution process of the community. This allowed us to clearly define facts and events characterising the life, apogee and decline of the ancient Etruscan metropolis.

The investigations on the historical topography of the perimeter walls (*Tarchna* suppl. 8)<sup>4</sup> and the inner core of the inhabited area (*GIS Archaeological Map of the Civita di Tarquinia*)<sup>5</sup> are set in this

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<sup>2</sup> For further details about this method see *Research at Tarquinia* 2017.

<sup>3</sup> The *Tarchna Series* host the dissemination of the results of the systematic excavations. Four main volumes (1991, 1999, 2001, 2012) and eight additional volumes (2005, 2008, 2015, 2016, 2017 1-3, 2018) have been published so far. For the latest acquisitions and the main references about the 'monumental complex', see: *Research at Tarquinia* 2017, BAGNASCO GIANNI *et alii* 2019. For the Ara della Regina sanctuary, see: BONGHI JOVINO 2019. For the latest details on the themes of urbanization, see *Ricerche nell'area urbana di Tarquinia* 2018 and *Scavo e Scuola a Tarquinia* 2020.

<sup>4</sup> MARZULLO 2018. For the aspects concerning the relation between the fortifications and the inhabited area, see also BAGNASCO GIANNI 2018; MARZULLO 2018b and *Themes of urbanization* 2021.

<sup>5</sup> The *Archaeological Map of the Civita di Tarquinia* was completed in its GIS version in 2018 and is now under elaboration for traditional publication. This dynamic and open GIS environment was created to be an excellent system for territorial control, to more easily see, analyse and understand patterns and relationships between elements. Even if the GIS version was completed in 2018, the GIS open structure can always host new materials and updates and permit to compare them together with the legacy of data already acquired. This happened,

direction. This research led to the first complete revision of the topographical documentation on the entire settlement and allowed to study the urban organisation diachronically for the first time, considering all possible archaeological emergencies.

In this context, in 2010 the first pioneering LiDAR survey of an Etruscan metropolis was also carried out. With its extreme geometric accuracy, versatility and completeness, this kind of survey produced the most innovative cartography suitable for effectively investigate every topographical aspect<sup>6</sup>.

Thanks to a GIS environment, a comparative study was carried out of the signs and elements contained in every cartographic threshold. This highlighted the stratifications that nowadays compose the palimpsest of the Civita plateau. In this regard, we should remember that these results are raw data from the archaeological point of view, as they are potentially non-related to the chronological context under consideration. For this reason, it was decided to follow a philological method of analysis that could guarantee hypotheses based on concrete data. All the historical information and the thematic representations concerning the Civita plateau from the sixteenth century to date were thus systematically analysed and entered into the GIS system<sup>7</sup>. This operation was carried out from 2011 to 2016 and was crucial to understand the chronological setting of the signs and elements and at the same time extend the available information.

All the information and results were organised and processed in the GIS environment, based on the results of the LiDAR survey. In

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e.g., with structures and building revealed by the heavy rains in the winter of 2019. For the *Archaeological Map* see MARZULLO 2018, pp. 18-19; *Research at Tarquinia* 2017; *Ricerche nell'area urbana di Tarquinia* 2018.

<sup>6</sup> About this, see GARZULINO - MARZULLO 2019 for the latest details and previous bibliography.

<sup>7</sup> The complete asset of the analysed data consists of about 70 historical and modern cartographic and aero-photogrammetric thresholds, ranging from 1816 to date. To these, they should be added the approximately 50 thematic maps considered from an archaeological point of view. The result is a total amount of approximately 140 different layers of spatial data infrastructure. For further details see *Research at Tarquinia* 2017.

this way, the positioning of the archaeological elements found on the Civita plateau from the sixteenth century was obtained with a good level of reliability. This list also includes monuments and structures no longer visible but clearly identified in the past.

Thanks to the collaboration with the Lerici Foundation, the Politecnico di Milano and the British School at Rome, the work could consider the results of the geophysical surveys conducted by the Foundation on the whole plateau. The more than 600,000 magnetometry measurements acquired in about thirty years have been entirely systematised, digitised and georeferenced for the first time<sup>8</sup>. This is an enormous, precious and no longer repeatable legacy of data, because it reflects the condition of soil before it being polluted by highly magnetic and disturbing modern residue. In any case, we should remember that despite the great usefulness and reliability of the data, these are only predictive models that need verification through parallel testimonial series. Moreover, if the presence of strong anomalies can be linked to a considerably-sized building, this does not mean that no buried anthropic structures can be found where there are no anomalies. This could happen because these structures are poorly reactive to this type of stress, as is the case, for instance, of the local calcareous stone *macco*<sup>9</sup>.

All the historical information and cartographic issues have been used to overcome this problem, and thanks to the collaboration with the Soprintendenza, the research produced the first *GIS Archaeological Map of the Civita di Tarquinia*<sup>10</sup>. It collects more than 220 sites effectively verified, including unpublished and poorly known areas, never considered in a topographical overview so far. Every site has been examined in a systematic way, considering information about the location, chronology, description, graphic documentation and bibliography, focusing on its level of reliability.

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<sup>8</sup> For the process, the potential and the main results of this method, see *Civita di Tarquinia* 2018.

<sup>9</sup> See MARZULLO - PIAZZI 2017 for some case studies of application.

<sup>10</sup> For further details see *Ricerche nell'area urbana di Tarquinia* 2018 and MARZULLO 2018b.

The first goal of the interpretative reading of the signs was the recognition of the numerous overlapping activities, phases and structures. Then we focused on creating several diachronic phase plans to follow the development of the urban fabric from the Bronze Age to the modern age. This work is actually in progress. It will allow to deepen the analysis of the 220 contexts collected in the *Archaeological Map* and to grasp the entire development of the settlement over time.

The stratigraphic excavations carried out by the University of Milan in key points of the city through its fourteen centuries of life are the pivot from which changes in customs, traditions, beliefs and production choices can be observed. This is crucial to verify and better clarify the numerous events occurred.

Specific analyses were also carried out on the modern landscape with reference to the regulatory framework. As highlighted by the Soprintendenza, they integrate the *GIS Archaeological Map* with current data in order to better manage, organise and protect the territory<sup>11</sup>. This solution is particularly useful for identifying problems, monitoring changes, managing and responding to events, performing forecasting, and setting intervention priorities. In addition to the implications at the archaeological level, these results are particularly relevant in the framework of the UNESCO master plan of the necropolis in its relationship with the buffer zone represented by the Civita plateau. For this reason, an agreement between Soprintendenza and the University of Milan has been set to plan the reunification of the two areas. It is vital for the success and durability of the UNESCO site as a whole<sup>12</sup>. In this regard, the disciplines that converge in the CRC 'Tarquinia Project' (Archaeology, Paleo-anthropology, History, Informatics, Communication, Geoarchaeology, Agri-environmental Systems, Architectural Restoration, Topography) will be particularly useful for developing new strategies and innovative systems for the management of wide-ranging archaeological research, for the

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<sup>11</sup> RUSSO - TRUCCO 2015, pp. 76-79.

<sup>12</sup> For these aspects, see *Scavo e Scuola a Tarquinia* 2020, MARZULLO - PIAZZI 2020.

dissemination of the results and the protection and enhancement of the heritage<sup>13</sup>.

The collaboration with the University of Verona and Duke University is the most recent step of this long lasting research. It started effectively in 2019 and consists in a complementary investigation, with a different method and background, of a sample area that can act as a test bench for subsequent and wide-range operations. The common aim is merging the historical, archival, documentary, archaeological, geophysical and spatial data already collected by the ‘Tarquinia Project’ with additional geophysical and digital data, in order to highlight the territorial aspects of the urban development, as it will be further explained.

This paper represents the knowledge base shared by the University of Milan in the winter of 2020 and acted as a knowledge-centred support for the subsequent research carried out at the Pian della Regina. The Records of the *Archaeological Map* presented here reflect the situation known in 2018, therefore they do not consider the subsequent acquisitions of the University of Verona occurred in recent years at the sample area south-east of the Ara della Regina.

### **The sample area south-east of the Ara della Regina sanctuary**

In the area under investigation (**Fig. 1**), archaeological researches have come in succession with great intensity since the centuries of the first documented investigations on the Civita Plateau<sup>14</sup>. The structures and the results that have emerged, especially over the last three centuries of research, involve aspects of great historical and archaeological complexity that concern the entire city in its spatial framework and its evolution during the delicate transition from the Etruscan to the Roman age.

The archaeological and chronological context under consideration is given by the set of previous data: they are contained and organised

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<sup>13</sup> BAGNASCO GIANNI 2017; *Scavo e Scuola a Tarquinia* 2020 with references to previous works.

<sup>14</sup> For a summary see MARZULLO 2018, pp. 1-18.

in the *GIS Archaeological Map of the Civita di Tarquinia*. The following exposition will proceed with reference to its sheets and from north to south (**Fig. 2**). Since it is impossible to present here all the records of the *Archaeological Map* in their entirety, only the files directly connected to the current research will be reported, in order to facilitate the understanding of this paper. The sheets contain information that is partly the result of compiling and partly of analysis and interpretation. In this regard, it is important to specify that the field "Description" always contains information derived from publications and the sources reported in the bibliography, whereas the "Observations" field contains data produced by research or the results of analysis and further elaborations. The level of reliability is based on that which can be seen nowadays on the territory or was seen in the past. This level will be uncertain if the evidence is identified only through geophysical methods or through research hypotheses.

**From Record P01 of the Archaeological Map - Street or paved walkway**

**Location:** In front of the entrance to the terrace of the Ara della Regina (**Figs. 2**).

**Chronology:** Certainly from the 4th century BC.

**Description:** The researches of P. Romanelli in 1938 brought to light for the first time an area in front of the terrace of the temple, 4.68 m wide and paved with large slabs of nenfro (**Figs. 3-4**). This structure shows diversity and greater accuracy of preparation compared to the street that runs along the south side of the sanctuary (see Record 17 below). The stairway leading to the temple moved from this area (**Fig. 4**), which was closed to the east by a row of nenfro blocks (**Fig. 4**, structure 45). Considering the geomorphology of the hill, the southern part of this area is higher than the level of the street flanking the south side of the sanctuary (**Fig. 7**). The two floors were probably connected by some steps. Further investigations carried out by the University of Milan showed that the raised area was contained by a small wall (**Fig. 4**, in green): the structures identified showed the number according to P. Romanelli's system. It therefore seemed that a number of structures were used to

create specific external, raised, open and flat areas at the entrance of the sanctuary which were respected for centuries (to deepen this area see [Record 85](#) below).

The paved area in nenfro slabs continues northwards, assuming a triangular profile due to the pre-existence of some walls. These were subsequently named *delta wall* or walls 36+37 by the systematic explorations of the University of Milan (**Fig. 4**). The “Fountain of Cossuzio”, dated to the early Augustan age, was placed on this pavement. According to recent studies, the current position of the Fountain may not coincide with the original arrangement. P. Romanelli considered it to be ancient the circular base built in rough masonry of fragments and tuff blocks, on which the marble basin now rests. G. Baratti, M. Cataldi and L. Mordeglia, followed by M. Bonghi Jovino, believe it to be more likely this stand base was not the original laying surface, due to its precarious and rough structure, and therefore believe it to represent a subsequent relocation of the monumental basin.

The "Tarquinia Acropolis" map<sup>15</sup> shows traces of roads that move from the city walls towards the front of the temple. The segment that proceeds from the crossroad near the southern city gate (Record 02 of the *Archaeological Map*) (here Fig. 2) is very evident. From this point, it continues towards the temple, then it bends north-east towards Castellina (Record 111+66 of the *Archaeological Map*) and reaches the gate near Casale Ruggeri (Record 62 of the *Archaeological Map*). During the excavation carried out by the University of Milan at the sanctuary in the 1980s (Record 15 of the *Archaeological Map*), a test pit was opened at the south-east corner of the sanctuary (**Fig. 4**, A, C1-C2 sectors). Here three different structures appeared: the paved street that runs along the south side of the temple (see [Record 17](#) below) (**Fig. 4**, structure 29), the paved walkway, or street, described by P. Romanelli along the front of the temple (this one in consideration), and an area in macco gravel in front of the temple (**Fig. 4**, structure 26). They can be referred to the Hellenistic period but were still in use during the Roman Imperial Age. The wall 45 in nenfro slabs with a north-south direction dates back to the same Hellenistic period. It was built with increasing

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<sup>15</sup> For this cartography see MARZULLO 2018, pp. 33-34, tav. 13.

heights according to the evolution of the hill. This wall contains various remakes of macco floors that left part of the *gamma wall* exposed. In the south area of the terrace, a paved floor in white stones 47 was realised. It leans on the terrace and the *alpha altar*, leaving part of the *gamma wall* visible in this area as well. Altar 27 is raised. Subsequently, in Roman times, the paved street 29 was built (see Record 17 below). It leans on a part of the paved area in white stones 47 and the altar 27. The anomaly of high magnetism found next to the low magnetism area visible in the maps produced by the Lerici Foundation in the 1980s<sup>16</sup> corresponds to this arrangement. The macco floor 26 was built at a later time. It leans on wall 45, altar 27 and the paved street 29. A containment wall C59 (**Fig. 4**, in green) was built to delimit the area in which the *gamma wall* was still visible. This area was raised again with respect to the paved street 29. Finally, a preparation 28 was built above the paved street 29. This consists of an alignment of eight squared limestone blocks arranged on the sides of a slab (threshold). The western part of this structure did not lie directly on the street but on an accumulation of earth that obliterates the paved street. Unfortunately, the exiguity of the rest does not allow to reconstruct the function of this wall nor its dating. Nevertheless, the study of the materials found in the more superficial layers has brought to light a long frequentation of the area, with findings dating back to the 6th and 9th centuries AD.

In this same area, the Soprintendenza uncovered a part of a paved street in excellent condition during restoration works in 1990. This segment branches out from the paved street 29 that runs along the south side of the temple (see Record 17 below) and heads towards the south. This is probably the road axis that connected the temple area to the route running along the city walls. The probable intersection near the walls is the crossroad discovered by Romanelli (Record 02 of the *Archaeological Map*) (here visible in **Fig. 2**, P02). The route of the north-south street is clearly visible in the elaboration of the magnetometry measurements processed by the Lerici Foundation (**Fig. 5**).

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<sup>16</sup> For this graphic information see MARZULLO 2018, pp. 37-39, tav. 16.



The interpretation of the georadar measurements recorded at 80 cm depth from the surface area in 2000 immediately east of the excavation area (**Fig. 6**, area A) shows some anomalies with a roughly linear trend as evidence of possible parallel walls. Some anomalies of limited size were noticed in front of the temple (**Fig. 6**, zone F), while several irregular anomalies were observed outside the paved walkway or street (**Fig. 6**, zone C).

**Observations:** The data analysis for the *Archaeological Map of the Civita di Tarquinia* has shown that the georadar elaborations have some problems in the geometry of the restitution that unfortunately do not allow the results to be used without first proceeding with their dimensional and proportional remodelling. This means that the anomalies presented in the graphic documentation in figure 6 do not reflect that which is actually buried in that particular place.

**Level of reliability:** Good.

**Bibliographical references:** ROMANELLI 1948, p. 244, tav. I; ROMANELLI 1948b, p. 56; G. Bagnasco Gianni, in *Etruschi di Tarquinia 1986*, pp. 364-365; CAVAGNARO VANONI 1989, p. 344, fig. 4; MASTROCINQUE 1993, pp. 93-97; CATALDI 1994, p. 62; G. Bagnasco Gianni, in *Tarquinia Etrusca 2001*, pp. 50-51; CUCARZI *et alii* 2001, fig. 70; PIRO 2001, pp. 65-67, fig. 72; CATALDI - BARATTI - MORDEGLIA 2009, pp. 52-53; G. Bagnasco Gianni, in *Tarchna IV* (2012), pp. 69-77; CASOCAVALLO - MAGGIORE 2018, pp. 137-138; MARZULLO 2018, pp. 40-44, tab. 45; BONGHI JOVINO 2019, p. 168.

### **From Record P85 of the *Archaeological Map* - gamma wall**

**Location:** South-eastern side of the Ara della Regina (**Fig. 2**).

**Chronology:** From the 7th century BC to the Roman Imperial age.

**Description:** In front of the stairway to the temple (Record 15 of the *Archaeological Map*), the excavations directed by P. Romanelli have brought to light an area accurately paved with nenfro slabs (see Record 01 above). The southern part of this area was clearly higher than the level of the street flanking the south side of the sanctuary (see Record 17 below). Further investigations carried out by the University of Milan showed that the raised area was contained by a number of walls (see Record 01 above). The deepest wall, called *gamma*, is a strong structure with a north-east/south-west direction (**Fig. 4**, in pink). The wall is polychrome, of considerable length and

runs according to the orientation of the *alpha* and *beta* altars, founding on layers approximately dating to the late 7th - early 6th century BC. The excavations of the University of Milan, the magnetometry prospecting and the core sampling carried out by the Lerici Foundation demonstrate that the structure runs for about 40-50 m in the same direction: the base level was at the height of 167.14 m above sea level and the maximum summit preserved was at 169.59 m at east.

The beauty and the accuracy of the southern face could find a reasonable explanation in the hypothesis that this was the wall that marked the sacred enclosure of the area, with the simultaneous function of containing the thrust of the hill behind and delimiting the sanctuary. In this perspective, the coloured and accurate face had to be visible to those who reached the temple from the southern side. It ends at the northeast, where it leaned against the natural slope of the ground. The *gamma wall* still emerged at the time of Temple III (or of the Winged Horses) and was partially obliterated when Temple IV was built (Record 15 of the *Archaeological Map* and Record 01 above). The excavations have shown that the Classical and Hellenistic floors in macco gravel had always left the wall in the area in front of the temple exposed (see Record 01 above). On the other hand, in the southern area of the terrace, the structure was completely covered (see Record 17 below). Both to the east and south of the temple terrace, the *gamma wall* covers unexplored situations. This is represented by the irregular macco stones A71 in the southern sector and by the aligned stones of macco, red tuff and nenfro C147 (**Fig. 4**, structure 46) in the eastern sector.

**Level of reliability:** Good.

**Bibliographical references:** ROMANELLI 1948, p. 244 e fig. 30; G. Bagnasco Gianni, in *Tarquinia Etrusca 2001*, pp. 50-51; PIRO 2001, pp. 65-67, fig. 72; PIRO *et alii* 2007, pp. 200-201, figs. 7-8; M. Bonghi Jovino, in *Tarchna IV* (2012), pp. 29-30, 40; G. Bagnasco Gianni, *ivi* pp. 69-77; MARZULLO 2018, pp. 40-44, tab. 45.

### **From Record P17 of the *Archaeological Map* - Street**

**Location:** Along the south side of the Ara della Regina (**Fig. 2**).

**Chronology:** It was paved during the Hellenistic and Roman periods, but it is probably older.

**Description:** It was probably discovered during the first excavations at the beginning of the 19th century. We know that in the winter of 1875-76 a paved street just over 3 m wide was unearthed for its entire width. It was composed of stone slabs arranged diagonally and was covered at the end of the excavations, as the other structures discovered in that occasion. According to G. Fiorelli, it was paved later than the Ara della Regina, and probably in the same period of the Tullian Baths (Record 39 of the *Archaeological Map*). On the other hand, according to L. Dasti, the street had an average width of 3m and in some points would have been composed of large slabs only at the borders and of gravel inside.

The investigations by P. Romanelli provide more precise data: a paved street composed of irregular stones carelessly connected extends alongside the base of the temple. It is 4 m wide, with a 1.60 m wide unpaved footpath running along it near the temple (**Fig. 7**). The street rises significantly from west to east, i.e., towards the front of the sanctuary. Its height difference from one end to the other corresponds to a row of blocks of the platform of the temple, which is about 50 cm.

The paved street was connected to the floors discovered by the University of Milan in the sample area opened in front of the terrace of the temple (see Record 01 above). Here many floors have been brought to light: they attest several activities from the Roman Imperial period to 4th-3rd century BC, chronological level at which the excavation stopped. The excavations have also shown the extraordinary correspondence between the magnetic anomalies highlighted by the Lericci Foundation in front of the temple (**Fig. 5**) and the archaeological equivalents identified by the University of Milan. They correspond to the paved street 29 and the extensive macco gravel areas 26 and 46 in front of the temple (**Fig. 4**).

The interpretation of the georadar measurements recorded at 80 cm depth from the surface area in 2000 shows that this paved street covered some portions of mutually perpendicular wall, south of the terrace of the temple (**Fig. 8**, zones H, L). Of these, the northernmost could correspond to the *gamma wall* (see Record 85 above). These surveys also show farther linear anomalies crossing the *gamma wall* in the south-west sector which seem to suggest the presence of additional structures.

**Observations:** Unfortunately (see Record 01 above), the georadar measurements cannot be used without first proceeding with their dimensional and proportional remodelling.

It seems that the width of the street is greater than the 4 metres detected by Romanelli: at the moment, the paving stones can be seen for about 6 metres, to the point where they begin to be covered by the debris of the previous excavations, which today is piled up along the southern edge of the open area.

**Level of reliability:** Good.

**Bibliographical references:** P. Manzi - M. Fossati, in *BullInst* 1831, p. 4; DENNIS 1878, p. 427; G. Fiorelli, *NSc* 1876, p. 3; DASTI 1878, p. 69; ROMANELLI 1948, p. 240-243; *Carta MODUS* 1985; M. Bonghi Jovino, in *Etruschi di Tarquinia* 1986, p. 356; G. Bagnasco Gianni, *ivi* pp. 364-365; L. Cavagnaro Vanoni, in *Tarchna 1* (1997), pp. 3-4; PIRO 2001, pp. 65-67, fig. 72; *Carta Mura Tarquiniesi 2014*; MARZULLO 2018, pp. 40-47, tab. 45.

### **From Record P150 of the *Archaeological Map* - Possible street**

**Location:** East-southeast of the Ara della Regina (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** Already in the Eighties, the analysis of magnetic prospecting by the Lericci Foundation suggested the existence of a street with a south-east/north-west direction, east of the Ara della Regina. The interpretations occurred in 2001 (**Fig. 5**) continue to highlight the same anomaly, interpreted as a road axis, probably in clay court.

**Observations:** This route crosses the path highlighted in the *Archaeological Map* of 1885-1879 (Record 109 of the *Archaeological Map*). To date, in the absence of excavation tests, other data or sources that can ascertain the nature of the anomaly, the hypothesis that it may refer to a road remains to be verified. Nevertheless, this anomaly is part of a regular pattern composed of similar signs, parallel and perpendicular, that supports its interpretation as a street.

**Level of reliability:** Uncertain.

**Bibliographical references:** CAVAGNARO VANONI 1989, fig. 2, fig. 4; CUCARZI *et alii* 2001, fig. 70.; MARZULLO 2018, pp. 37-41, tab. 45.

**From Record P152 of the Archaeological Map - Possible street**

**Location:** Southeast of the Ara della Regina (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** The interpretations of the geophysical measurements carried out by the Lerici Foundation in 2001 (**Fig. 5**) highlighted an anomaly with a south-east/north-west direction, interpreted as a road axis, probably in clay court.

**Observations:** To date, in the absence of excavation tests, other data or sources that can ascertain the nature of the anomaly, the hypothesis that it may refer to a road remains to be verified. Nevertheless, this anomaly is part of a regular pattern composed of similar signs, parallel and perpendicular, that supports its interpretation as a street.

**Level of reliability:** Uncertain.

**Bibliographical references:** CUCARZI *et alii* 2001, fig. 70; MARZULLO 2018, pp. 37-41, tab. 45.

**From Record P197 of the Archaeological Map - Spina di Pesce well**

**Location:** South of the Ara della Regina (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** The speleological explorations carried out in the 1990s revealed a structure called CA 01021 LA VT: Pozzo Spina di Pesce (Pian della Regina). It consists of a truncated cone-shaped cavity with a vertical axis, completely coated with stones. The mouth had a diameter of 1.10 m and a curb in nenfro, which at the time of the exploration had fallen into the well. The coating is made with stones arranged in a herringbone pattern in fairly regular courses. The structure was explored for a depth of 3.9 m, at this point the diameter was 2.60 m. About 60 cm from the mouth, a clay pipe (diameter 11 cm external, 9 cm internal, inclination of about 10°) was discovered. It could be a cistern.

**Observations:** It corresponds to the structure 21 in the Map of Artificial Cavities dated back to 1999. It is currently visible on the surface of the plateau.

**Level of reliability:** Good.

**Bibliographical references:** *Acque Profonde* 1999, p. 11; PADOVAN 2002, pp. 76-77; MARZULLO 2018, pp. 39-43.

### **From Record P153 of the Archaeological Map - Possible street**

**Location:** Southeast of the Ara della Regina (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** The interpretations of the geophysical measurements carried out by the Lerici Foundation in 2001 (**Fig. 5**) highlighted an anomaly with a south-east/north-west direction, interpreted as a road axis, probably in clay court.

**Observations:** To date, in the absence of excavation tests, other data or sources that can ascertain the nature of the anomaly, the hypothesis that it may refer to a road remains to be verified. Nevertheless, this anomaly is inserted in a regular pattern composed of similar signs, parallel and perpendicular, which supports its interpretation as a street.

**Level of reliability:** Uncertain.

**Bibliographical references:** CUCARZI *et alii* 2001, fig. 70; MARZULLO 2018, pp. 37-41, tab. 45.

### **From Record P158 of the Archaeological Map - Square-shaped anomaly, buildings and streets**

**Location:** Southeast of the Ara della Regina (**Fig. 2**).

**Chronology:** Not determinable with certainty: probably from the Roman period.

**Description:** The interpretations of the geophysical measurements carried out by the Lerici Foundation in 2001 (**Fig. 5**) highlighted a large square-shaped anomaly dated back to the Roman period. A linear alignment interpreted as a road axis probably in clay court was recognised on the western side of the structure (see Record 169 below). The linear anomaly intercepts and partially overlaps the square-shaped element.

**Observations:** Analysing the Lerici elaborations published in 2001 by means of geolocalisation in the *Archaeological Map's* GIS, a building is identified. It has a roughly squared plan with a series of anomalies of the same shape but smaller in size and located inside the bigger and external one (**Fig. 9** in light grey). The south-eastern

corner is particularly evident, as well as a localised linear anomaly of about 30 metres in the centre of the eastern side and perpendicular to the structure. The linear anomaly observed by the Lericci Foundation and referred to a road can be recognised on the western side (see [Record 169](#) below). Here a circular anomaly within the structure can be seen. An additional linear anomaly is identified just outside the southern side of the squared area and seems to follow the direction of the latter. A possible north-south road axis (see [Record 154](#) below) appears to end on it.

Further geophysical investigations carried out within the 'Tarquinia Project' by the British School at Rome in 2016 found another building appearing at the south-west end of the biggest squared structure (**Fig. 10** in green). It is composed of a series of small squared rooms of about 7-8 m per side and seems to lean against, or open on, the larger quadrangular space.

The further elaborations carried out on the Lericci measurements for the *Archaeological Map* in 2017 allow to add other details (**Fig. 11** in dark grey). The largest square-shaped building is about 100 m on the north-south axis by 90 m on the east-west axis. These measurements do not include the second building with several cells. All these small rooms together seem to form a rectangular structure arranged with the long side in the north-south direction. An area of approximately the same size characterised by high magnetism and partially included within the quadrangular structure is identified nearby.

If we assumed that the anomaly discussed at [Record 169](#) is a street (see [Record 169](#) below), it would pass precisely between these two buildings and could be considered the route on which they were opened. Further east, the latest elaborations show other linear anomalies that can be related to additional structures located within the eastern front of the squared space. In the south, a regular, highly magnetic anomaly seems to lean against the southern side of the building with many cells. It could be interpreted as a structure or an open area, paved with a very reactive material. The western side of the building seems to be served by a street that runs north-south from the city walls towards the Ara della Regina (see [Record 211](#) below).

Considering the extension and the position on the south-east side of the Ara della Regina, it may be hypothesised that all or a part of these structures probably coincides with some of the remains of Etruscan and Roman buildings unearthed at the beginning of the nineteenth century in this area (Record 81, 86, 25 of the *Archaeological Map*)<sup>17</sup>. All the hypotheses remain in any case to be verified in the absence of excavation tests, other data, sources or testimonial series that can ascertain the direction and the nature of the anomalies identified.

**Level of reliability:** Uncertain.

**Bibliographical references:** CUCARZI *et alii* 2001, fig. 70; MARZULLO 2018, pp. 37-41, tab. 45; *Civita di Tarquinia* 2018.

### **From Record P177 of the Archaeological Map - Alignments of squared blocks**

**Location:** On the top of the hillock south-east of the Ara della Regina (Fig. 2).

**Chronology:** Non determinable.

**Description:** The surveys conducted on behalf of the Soprintendenza between the 1990s and 2000s led to recognising some alignments of squared blocks and several isolated squared blocks.

**Observations:** They are still visible on the surface of the plateau and could be read in connection with the series of buildings discussed at Record 158 (see Record 158 above).

**Level of reliability:** Good.

**Bibliographical references:** *Carta Pelletti* 2005; CATALDI *et alii* 2010-2011, tab. 1; MARZULLO 2018, pp. 40-45.

### **From Record P169 of the Archaeological Map - Possible street and alignments of squared blocks**

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<sup>17</sup> These records discuss a number of findings whose exact location is not specified. The *Archaeological Map* shows that the results of these investigations can be placed in a rather large area along the southern slope of the Ara della Regina. The sampled area currently under investigation could be a part of in this wider space. For further information about those findings see below next chapter.



**Location:** South of the Ara della Regina and up to the edge of the plateau (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** The interpretations of the geophysical measurements carried out by the Lerici Foundation in 2001 (**Fig. 5**) highlighted an anomaly with a north-south direction, interpreted as a road axis, probably in clay court.

**Observations:** We can reasonably believe that this evidence coincides with the street observed by P. Romanelli near the edge of the plateau (Record 2 of the *Archaeological Map*). In the vicinity of this route, the surveys conducted by the University of Milan led to the recognition of some rows of squared blocks. Numerous other squared blocks have been noticed not very far away. Sometimes they were in connection, but they were often laid with divergent alignments and directions, conditions that prevent the recognition of any structure. The places of the outcroppings have been georeferenced and correspond to the points called "PT141", "PT142" in the GPS survey<sup>18</sup>. Considering the topographical location and the geophysical data, we can hypothesise some building facing the eastern side of the road headed to the Ara della Regina. As in any observation based only on the geophysical results, the hypothesis remains to be verified. In any case, the connection with the Romanelli's discoveries described at Record 02 of the *Archaeological Map* and the location of the anomalies in a regular pattern composed by similar signs, parallel and perpendicular, seem to support its interpretation as a street. The sign passes through and intersects the structures discussed at Record 154 (below), suggesting the possibility that the road had different phases.

**Level of reliability:** Average.

**Bibliographical references:** CUCARZI *et alii* 2001, fig. 70; MARZULLO 2018, pp. 39-47, 72-73, tab. 45.

### **From Record P154 of the *Archaeological Map* - Possible street and alignments of squared blocks**

**Location:** South of the Ara della Regina (**Fig. 2**).

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<sup>18</sup> On these surveys see MARZULLO 2018, pp. 17, 71-74, tabs. 31, 43.

**Chronology:** Non determinable.

**Description:** The interpretations of the geophysical measurements carried out by the Lerici Foundation in 2001 (**Fig. 5**) highlighted an anomaly with a north-south direction, interpreted as a road axis, probably in clay court.

**Observations:** As with any consideration based only on the geophysical results, the hypothesis remains to be verified. In any case, the coincidence with that found on the surface by the University of Milan and the location of the anomaly in a regular pattern composed of similar signs, parallel and perpendicular, seem to support its interpretation as a street.

During the GPS surveys carried out by the University of Milan<sup>19</sup>, several blocks and structures were recognised in this area. The presence of two walls forming an angle was noticed: their position was acquired with the GPS and called "AA1-AA6". The angle consists of two large squared blocks of macco, hypothetically belonging to a structure whose limits are currently not recognisable. The point of the outcropping also stands out in the elaborations of the magnetometry measurements of 2001 (**Fig. 5**). Here a sharp alternation between anomalies of different nature can be clearly recognised. There were also some slabs of macco juxtaposed farther east next to some large squared blocks. They form the sides of a canal with a north-south direction which runs from the top of the plateau towards the valley. Their location was registered and georeferenced (points "AC1-AC2" in the GPS survey).

An alignment of squared blocks was recognisable farther south. It was running perpendicular to the channel, reaching its southern edge (points "AD1-AD3" in the GPS survey). At the point of contact, the blocks of the wall showed a rectangular recess, functional to accommodate one of the slabs of the eastern side of the channel.

Another series of slabs was slightly farther east. They formed a second channel in combination with several squared blocks shaped with a central recess. Although of composite construction, it had a north-south orientation headed from the edge of the plateau towards the valley as the previous channel. Its location was acquired and georeferenced (points "U1-U2" in the GPS survey).

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<sup>19</sup> For these surveys, see MARZULLO 2018, pp. 17, 71-74, tabs. 31, 43.

An alignment of medium-sized squared blocks was recognised in line with the AC channel but about 10 m northerly. It intersected a second alignment of blocks, forming a right angle. The location of the intersection was acquired and georeferenced (point "AA7" in the GPS survey). Approximately at the centre of these structures, the elaborations of the magnetometry measurements of 2001 (**Fig. 5**) highlighted a linear anomaly interpreted as a road axis, probably in clay court. This starts from the point of the AC channel and heads northwards, ending about 40 metres farther, in correspondence with a large squared anomaly (see Record 158 above). Not too far away, some road paving stones were noticed at the point "AB" of the GPS survey. They seem to provide greater consistency to the interpretation of the linear anomaly as a street.

Other alignments of blocks have been noticed in the space between these structures and the city walls. Their nature cannot be better clarified at the moment. Their location has been acquired and georeferenced (points "V1-V4" in the GPS survey). All these elements can be inserted in the phases of intense activity at the edge of the plateau where the city walls were built (Record 02, 101 of the *Archaeological Map*).

**Level of reliability:** sufficient.

**Bibliographical references:** CUCARZI *et alii* 2001, fig. 70; MARZULLO 2018, pp. 39-47, 71-72, tab. 45.

### **From Record P211 of the *Archaeological Map* - Possible street**

**Location:** South of the Ara della Regina (**Fig. 2**).

**Chronology:** Non determinable.

**Description:** The most recent processing of the geophysical measurements acquired by Lericci and developed within the 'Tarquinia Project' led to the recognition of a linear anomaly with a north-south direction. It starts from the edge of the plateau and heads towards the Ara della Regina. A small part of it is also visible in the prospecting carried out in 2016 by the British School at Rome within the 'Tarquinia Project' for the *Archaeological Map*. The anomaly appears tangential to the western side of a squared anomaly (see Record 158 above).

**Level of reliability:** Uncertain.

**Bibliographical references:** *Civita di Tarquinia* 2018.

## Some considerations about the area south-east of the Ara della Regina

Following the topographical order, these considerations proceed from north to south. The area next to the great sanctuary of the Ara della Regina (see Records 01, 17, 85 above) is very complex due to the dense and continuous stratigraphy and the numerous, more or less regulated excavation activities that have occurred over the centuries<sup>20</sup>. The emerging structures and the research carried out so far are particularly important for the issues currently under discussion about open spaces, city squares or *fora*.

According to a number of scholars, the large space opened in front of the sanctuary corresponds to the *forum of the ancient city*. Recent articles concerning the divinities of the Ara della Regina discuss this possibility in-depth<sup>21</sup>. According to M. Torelli, there are numerous evidence that would make the Ara della Regina the great forensic sanctuary in a significantly enlarged space compared to the limits of the ancient square of the archaic temples<sup>22</sup>. Crucial to this definition would be the isolated altar 27 (**Fig. 4**, below), the well-known "Fountain of Cossuzio" (**Fig. 4**, above), and some epigraphic texts from the age of Tiberius<sup>23</sup>. Combining these proposals with the results of the stratigraphic research on the temples, edited fully and in detail, according to M. Bonghi Jovino the identification of the space in front of the sanctuary as the *forum* would be confirmed by the passage –with no substantial modifications– from the square of Temple I to that of the Temple II and finally, to the square of Temple III, with no reason to doubt that the *forum* also respected this trend<sup>24</sup>. This would therefore confirm this square to have had a highly

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<sup>20</sup> For a summary see MARZULLO 2018, pp. 1-18.

<sup>21</sup> See specifically TORELLI 2018; BONGHI JOVINO 2019 with references to the previous bibliography.

<sup>22</sup> TORELLI 2018, p. 128.

<sup>23</sup> Idem, pp. 128-132.

<sup>24</sup> See Record 01 above and BONGHI JOVINO 2019, p. 166.

political and social function from the archaic era to the Roman Imperial age<sup>25</sup>.

From the topographical point of view, as M. Bonghi also pointed out, the thematic map of the walls, gates and roads of ancient Tarquinia (**Fig. 1**) specifically showed the direction of the roads converging towards this square. In this context, the *Archaeological Map* introduces several other structures now buried around the remains of the sanctuary. They are mostly unknown in the literature<sup>26</sup>, and as far as we can anticipate today, they consist of streets and buildings that are structured according to a regular network of routes centred around the sanctuary and respecting an extensive open area located in front of the temple.

In this framework, the study of the recent phases of the sanctuary of the Ara della Regina, currently in progress and part of the “Tarquinia Project”<sup>27</sup>, aims at publishing the materials brought to light by the excavations of the University of Milan. This will certainly support the understanding of the phases of the complex and especially the relationship of the monument with the urban fabric of the ancient city. This operation is carried out essentially as an integration to the *Archaeological Map*. As a consequence, it is expected that the areas detected by the excavation in front of the temple entrance will be more properly connected to the rest of the structures unearthed so far.

Therefore, the set of data considered so far suggests that a large open area, interpreted by some as a *forum*, probably extended from the front of the sanctuary towards the east<sup>28</sup>.

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<sup>25</sup> BONGHI JOVINO 2019. For the role of this area, see specifically M. Bonghi Jovino, in *Tarchna IV* (2012), pp. 30, 61-64, 91; G. Bagnasco Gianni, *ivi* pp. 73-77.

<sup>26</sup> For some structures with a possible artisanal character found near the Ara della Regina, see MARZULLO - PIAZZI 2017.

<sup>27</sup> J. Tulipano's PhD candidate project: “Il Santuario dell’Ara della Regina di Tarquinia: le fasi recenti”, Sapienza Università di Roma, XXXVI ciclo.

<sup>28</sup> For a summary of the information and about the latest research perspectives on this area, see BRIQUEL 2012, pp. 94-97, 106-107; TORELLI 2018, p. 128; BONGHI JOVINO 2019, p. 167.

From this point of view, the materials from the *Archaeological Map* proposed here seem to add further details. The Records presented above clearly show the role that walls 36 and 37 to the north and the *gamma wall* to the south (**Fig. 4**) must have played in relation to the monument and the way to access it. According to a south-west/north-east orientation, their function of containment and general organisation of the open space in front of the temple had already been highlighted some time ago<sup>29</sup>. In addition, by examining the set of data proposed today, it can be seen that their direction, set since the archaic age, is reflected in the road network and has remained substantially unchanged over time. The several buildings and streets from the Roman period identified in the areas adjacent to the Ara della Regina<sup>30</sup> confirm that this arrangement was respected and survived until the most advanced periods<sup>31</sup> (**Fig. 12**). In this regard, the latest elaborations carried out on the Lerici acquisitions within the 'Tarquinia Project' show a further series of linear anomalies. They appear to continue the previous ones and can be interpreted as roads. The routes seem to isolate a roughly trapezoidal space in front of the temple, open to the north-east, in line with that which was hypothesised for the square (**Fig. 13**). The latest representations also clearly show the Hellenistic floor at the temple entrance expanding towards the north-east. It respects the direction previously set by the archaic 36+37 and *gamma* walls (**Fig. 4**) and has a roughly trapezoidal shape that perfectly fits the road network. In the elaborations, altar 27, at the time not yet revealed by the excavations, and paved road 17 can be clearly seen.

Therefore, these observations would suggest the existence of a large open space in front of the Ara della Regina which had been

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<sup>29</sup> M. Bonghi Jovino, in *Tarchna IV* (2012), p. 30; G. Bagnasco Gianni, *ivi* pp. 69-77.

<sup>30</sup> MARZULLO 2018, tab. 45; MARZULLO - PIAZZI 2017.

<sup>31</sup> Other significant proofs of this respectful conservation are the *altar alpha* and the *gamma wall* at the Ara della Regina. Through these structure, left at sight for centuries, the most ancient supremacy of Tarquinia upon the whole Etruria would have been preserved as long-lasting memory through time (see above Record 01, 85; BAGNASCO GIANNI 2011)

clearly qualified, defined and respected since at least the Archaic period.

The very persistence of this area over the centuries brings further solid clues for identifying its undeniable political, religious and social values, shaped in the urbanistic forms and frozen in the deepest frame of the urban structure. According to M. Bonghi Jovino and M. Torelli, this area could correspond to the *Roman Forum*.

This, of course, does not exclude the possibility of finding other open areas used for similar functions outside these structures. In this regard, we can mention the example of the well-known and well-defined space of about 9000 square metres that overlooks the northern side of the sanctuary (Record 117 of the *Archaeological Map*), in which the recorded anomalies are rarer than in any other explored area (**Fig. 5a** for the determination in magnetometry). This area will be discussed in-depth in another occasion. The first interpretations already spoke of point-shaped anomalies related to artefacts of limited extension scattered in an area that was mostly free from buildings<sup>32</sup>. This area was also indicated as a possible *forum*<sup>33</sup>. Today, thanks to the *Archaeological Map*, it can be more effectively framed in the urban context, perfectly integrated into the road network centred on the great temple (**Fig. 1** for the integration into the road network). As in the square in front of the sanctuary, the limited presence of anomalies indicates that the structuring and use of this space followed those of the sacred building and were respected over time until the abandonment of the inhabited area. In this case, the geomorphological evolution of the terrain, clearly visible from the LiDAR digital model without vegetation (**Figs. 20, 22**), shows that the area without anomalies is located on a flat, well-defined and perfectly levelled surface higher than the surrounding areas<sup>34</sup>. The other buildings identified by prospecting, which will be discussed in the complete edition of the *Archaeological Map*, are

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<sup>32</sup> CAVAGNARO VANONI - LININGTON 1980, p. 52.; CAVAGNARO VANONI 1989, p. 344, fig. 4.

<sup>33</sup> TORELLI 1975, pp. 101, 195.

<sup>34</sup> See Garzulino in this volume about the geomorphological conditions of the area around the Ara della Regina.

arranged around this summit area. They contribute to better isolate the surface at the top, flat and clear over the rest. Therefore, the temple, placed in this context, appears wisely arranged as a scenographic architectural setting for those who came from the northern side of the city. This shows a reasoned design of open and closed spaces, planned from the very beginning.

The sanctuary was also accessible from the south: determining factors in this sense are the roads and gates highlighted by the thematic map (**Fig. 1**). As suggested by M. Bonghi Jovino, those structures gave access to the sacred building even to people coming from the coast<sup>35</sup>. From this perspective, the *gamma wall* with its beautiful polychrome stones of fine craft in isodomic masonry, as has always been affirmed<sup>36</sup>, marked a part of the path around the sacred enclosure. It appears to the sight of those reaching the sanctuary from the southern side. In this context and within the area currently under investigation, the itinerary Record 169 (**Fig. 2**) which directly connected the front of the great temple with the gate identified further south, undoubtedly played an important role<sup>37</sup>.

Proceeding in this direction, the new elaborations show a poorly magnetic dark area flanked by a strongly magnetic white area not far from the base of the temple. The first is located approximately at the same height level of the Ara della Regina (**Fig. 13a**). The second, very reactive (**Fig. 13b**), is set along the slope and could be associated with the earth dumped here by excavations over time<sup>38</sup>.

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<sup>35</sup> BONGHI JOVINO 2019, p. 168.

<sup>36</sup> M. Bonghi Jovino, in *Tarchna IV* (2012), p. 31; G. Bagnasco Gianni, *ivi* p. 70 with references.

<sup>37</sup> MARZULLO 2018, pp. 72-73, tab. 45. BONGHI JOVINO 2019, p. 168.

<sup>38</sup> The poorly magnetic dark part marked with the letter a in figure 13 is roughly at the same height level as the base of the southern wall of the Ara della Regina, and therefore on the same walking level. The very reactive white part instead is sloping along the valley, and therefore it is not in flat (**Fig. 1**). According to similar situations identified at the Civita so far (CUCARZI *et alii* 2001, pp. 63-64), and as far as we can suppose, it can correspond to the debris poured along the slope over time. This two areas as a whole occupy about 3600 square metres (almost half an hectare), and continue outside the sample analysed by the prospecting.



The data considered so far show that numerous streets served the dark flat area (**Fig. 13a**): to the north the route that runs along the base of the temple (see Records 17, 01 above); to the east the route coming from the eastern side of the plateau (see Record 152 above) together with the route directed towards the gate along the southern edge of the hill (see Record 169 above). This latter route seems to connect this flat space with the rest of the structures examined in this article. The magnetometries do not show with sufficient clarity what happens at the connection between the flat area (**Fig. 13a**), where all these roads converge, the linear anomaly Record 169 and the square space Record 158. In this regard there are no precise archaeological finds that can offer indications in this sense, and also the other geophysical data do not seem particularly useful. The square structure (Record 158) and the linear anomaly (Record 169) overlap. This can be linked to a different height level, connected to different phases and chronology. This seems to be confirmed by historical data that tell us that this whole area south of the Ara della Regina has been heavily used for a long period of time. From the literature we know that this entire slope immediately south of the sanctuary and within a radius of 100 metres from its base had intense human activity. This is proved by the significant findings that occurred in this broad area over time. There are short reports testifying to activities related to the temple, both from the Etruscan and the Roman era. The votive deposit connected to the discovery of large *simae* with galloping knights can be referred to the first one, whereas the buildings for both public and private use highlighted in the first mid-19th century can be linked to the second. These structures also hosted successive burials which testify to continuous and stratified use of the same spaces, as it also happened at the Ara della Regina<sup>39</sup>.

Coming therefore to the squared magnetic irregularity highlighted by the Lerici Foundation (Record 158), the further elaborations carried out within the 'Tarquinia Project' show other details. A limited and poorly magnetic area (**Fig. 13c**) flanked by a more

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<sup>39</sup> All the above mentioned findings, which cannot be discussed exhaustively here, are systematically examined in Records 15, 25, 81 and 86 of the *Archaeological Map*.

reactive area (**Fig. 13d**) can be seen at the north-east side of the structure. These two areas are set between the squared building and the just mentioned streets (Records 169 and 152). At the moment their nature and definitive organisation is unclear, it is possible that they served as a link between structure 158 and the road network on its northern side. These hypotheses are exclusively based on geophysical data and therefore need to be verified through other test series. However, the frequentation of the entire area is guaranteed by the presence of the well Record 197, clearly visible also in the magnetometry (**Fig. 13e**). It is located within the squared anomaly, near the north side. Farther east, the surveys for the *Archaeological Map* recognised an erratic part of a column (**Fig. 13f**). It could be related to the squared anomaly 158, suggesting the presence of a colonnade in at least one of its phases.

No archaeological data comes specifically from this area, therefore the geophysical data are the only source that describes this important complex of buildings. As we have seen (see Record 158 above), it is composed of a series of square-based anomalies concentric each other. A circular anomaly of about 6-7 m in diameter seems to be recognisable on the inner west side, while further linear anomalies seem to compose other rooms and spaces on the east side. It is difficult to establish the relationship between this largest squared space and the smallest area with many cells at the south-western corner. As we have seen, this latter is characterised by a rectangular structure arranged with the long side in a north-south direction, near to a high magnetism area of approximately the same size and partially included within the larger squared structure. The building with many cells could be leaned against, or opened, on the square-based structure. In this perspective, if the interpretation of the anomaly Record 169 as a street is correct, we could think that it could pass precisely between these two buildings in one of its phases, representing the route at their service. The building with many cells seems to be served also by the road Record 211 on the west side. This headed towards the Ara della Regina climbing back the slope from the urban perimeter.

Moving south, an additional linear anomaly is recognisable just outside the south side of the larger structure. It approximately follows its direction. A north-south road axis appears to end on it, as described in Record 154. In this same area, the most recent geophysical data processing shows another anomaly of regular shape with high magnetism that seems to lean against the south side of the building with many cells. It can be interpreted as a structure or an open area paved with very reactive material on which the hypothetical road axis Record 169 converges. In any case without any further investigation we cannot exclude that it can correspond to the debris poured along the slope during some works on the top.

In conclusion, this legacy of data shows a rich and complex area: an orographically independent hillock that opens to the south-east of the Ara della Regina, on which numerous roads are leading to the front of the great temple<sup>40</sup>. Here probably a wide open space was set. It was characterised by specific political, religious and social values recognisable since the archaic period and transmitted from generation to generation until the Roman age.

The road network appears regular and well planned, as the road axes are located at a constant distance of about 40-50 metres from each other. This can be compared explicitly with the western plateau, where it was recognised the same road organisation, set on routes arranged at intervals of about 40 metres<sup>41</sup>.

A structured complex of buildings has been inserted within this network on the small hillock at the south-east of the Ara della Regina probably during the Roman period. It is characterised by many structures with probably many phases. There is a larger squared-plan space with several naves, probably partly colonnaded. A second regular building composed of many tiny sectors was set at the south-western end of it. While the largest space is almost entirely on the flat top of the hillock, the smaller building is located along the steep

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<sup>40</sup> See Garzulino in this volume to deepen the geomorphological aspects in relation to the archaeological results.

<sup>41</sup> MARZULLO 2018, p. 84; *Ricerche nell'area urbana di Tarquinia* 2018, pp. 302-303.

slope, perfectly opposed to the contour lines (**Figs. 24-25**). The characterisation with many cells could also serve as a substructure to ensure the holding of the larger quadrangular space at height<sup>42</sup>. On this regard we can mention the function of the Tabularium in the Roman Forum<sup>43</sup>.

Despite the isolated location on the small hillock, both buildings were closely connected to the area of the great polyadic sanctuary and well served by roads coming from the circuit along the walls. Here many structures and buildings prove the great activity near the city gate<sup>44</sup>. It gave access to this sector connecting the Ara della Regina sanctuary and the small hill with the squared building, with the main extra-urban routes that connected Tarquinia with its necropolis and with the sea.

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<sup>42</sup> For this, see Garzulino below in this volume.

<sup>43</sup> For the functional aspects of the Tabularium, see COARELLI 1983, pp. 32-33.

<sup>44</sup> For this complex area, see MARZULLO 2018, pp. 70-74.



# THE ROLE OF TOPOGRAPHIC MAPPING, MORPHOLOGICAL ANALYSIS AND REMOTE SENSING THROUGH UAVS FOR THE KNOWLEDGE OF BURIED ARCHAEOLOGICAL AREAS

*Andrea Garzulino*

## **The LiDAR topographic map for the Civita Plateau in Tarquinia**

Thanks to the set of data collected within the 'Tarquinia Project'<sup>45</sup> for the research regarding the perimeter walls of the ancient city and for the GIS Archaeological Map of the Civita di Tarquinia<sup>46</sup>, some territorial and geomorphological aspects that characterise the plateau can be explored here. The survey with LiDAR technology carried out in 2010 allowed interesting uses during the different phases of the research work. The primary purpose was to structure an adequate and reliable cartographic basis to ground the comparative study of signs and information and allow the identification of archaeological remains on the surface. The acquired territorial topographical dataset has also made it possible to deepen the morphological aspects that characterise the Civita Plateau by relating them to the data and the elaborations coming from the studies and research works<sup>47</sup>. This technology was tested in Tarquinia to overcome problems common to archaeological areas, especially in the Mediterranean zone: the large extension of the area, the particular territorial conformation with sudden non-linear changes in altitude and the dense obscuring vegetation. Despite these criticisms, it was possible to recover all the data considered useful and valid for giving a complete representation of the terrain and structures by making use of semi-automatic algorithms of geometric selection (such as maximum permissible

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<sup>45</sup> BAGNASCO GIANNI 2012.

<sup>46</sup> MARZULLO 2018.

<sup>47</sup> For this, see Marzullo above in this volume.

gradient and acceptable height differences)<sup>48</sup> and classification of the wave shapes and the laser pulses number of returns (**Fig. 14**).

The in-depth analysis of the laser pulse has, in fact, made it possible to implement the geometric database through all the information necessary for the description of areas characterised by a massive presence of vegetation or partially obscuring elements. The light pulse<sup>49</sup> that propagates in space heading towards the object to be detected, occupies an increasing acquisition diameter as it spreads in the environment due to the beam's divergence. For this reason, the laser pulse is characterised by an impact area and not by a single point at the time of contact with the surfaces. When the impact area of the impulse encounters an obstacle (such as leaves, branches or suspended wires), this is reflected at different times, thus generating more than one return signal (up to a maximum of 4). Thanks to the new sensors and data processing software, it is possible to investigate the complete shape of the wave generated by the reflected laser signal in such a way as to recover and separately calculate all the distances corresponding to the wave discontinuities.

The analysis criteria of the geometries and the return signals have also been calibrated in such a way as to optimise and exploit all the information recorded<sup>50</sup>, considering the complexity of the area and the uniqueness of the elements that characterise the plateau. In this way, the acquired points were recovered, verified and categorised, obtaining two fundamental representations to describe the morphology of the territory, the digital terrain model (DTM) and the digital surface model (DSM)<sup>51</sup>. These digital models have been further elaborated thanks to their insertion in environments with variable lighting capable of bringing out the concavity and convexity

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<sup>48</sup> See COWLEY - OPITZ 2012; DONEUS - BRIESE 2011 for detailed studies on semi-automatic criteria of geometry selection.

<sup>49</sup> Emitted by the laser scanner equipped on the airplane.

<sup>50</sup> See CRUTCHLEY - CROW 2009; DE LAET *et alii* 2009; KRAUS - PFIEFER 1998 for in-depth analysis on the calibration of the classification of the geometries and the return signals.

<sup>51</sup> GARZULINO *et alii* 2014; GARZULINO 2019.

of the ground and the structures with greater clarity<sup>52</sup>. To complete the purely morphological aspects, the aircraft used for the laser scanner acquisitions was also equipped with a photogrammetric camera that allowed to perform numerous aerial photos merged in an orthomosaic of the entire archaeological area (**Fig. 15**).

### **Analysis of the morphology and signs in the area southeast of the Ara della Regina Sanctuary**

The sample area is located southeast of the Ara della Regina Sanctuary in one of the highest portions of the Civita Plateau and occupies just over 4 hectares (**Fig. 16**). The area is mostly flat in the central-eastern sector with a maximum altitude of 176 metres above sea level (masl). On the other hand, the western portion is characterised by a strong slope towards the valley, passing from 171 to 164 masl in just 35 linear metres of space, with an average angle of 11° (**Fig. 16** in blue).

Observing the digital model of the terrain (DTM) with zenith lighting (**Fig. 17**), it is possible to notice some distinguishable signs on the ground: the path that moves south from the southeast corner of the sanctuary (in blue); three agricultural subdivisions with north-west/southeast inclination and one with south-west/north-east direction (in cyan); a land depression (a slight landslide caused by the rains and the slippage of the soil layers) in the southern portion of the area (in yellow); some accumulations of soil and stones (in purple). By varying the angle of incidence of the lighting source without modifying its intensity, the previously detected signs become more consistent (**Fig. 18**), making it possible to identify the fence near the sanctuary and the one with a north-west/southeast direction (in green) in the southern section of the investigation area. It was preferred to analyse the DTM as it represents the ground's surface without any noise conferred by vegetation, unlike the DSM (**Fig. 19**). The latter is complete in terms of geometric and territorial information; however, it does not allow clear recognition of the

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<sup>52</sup> See KOKALJ *et alii* 2010 for detailed studies on the advanced visualization techniques.



elements listed above and adds little except for the arboreal components and the birdwatching enclosure at the centre of the sample area. The DSM can represent an alternative by excluding the vegetation category (high, medium and low). Nevertheless, this model is still less effective due to the disturbances conferred by the ferula plants, which make the processing more complex to interpret, not being categorised as vegetation and thus generating pyramidal surfaces.

The sections of the terrain (**Figs. 20-21**) contribute to the analysis and confirm that which is identified in the planimetric views. In fact, the north-south profile highlights the flat course of the survey area close to the slope south of the sanctuary, probably attributable both to ancient and modern humans. It should be remembered that the Civita Plateau was involved in agricultural work and ploughing operations until the 1960s. The west-east section plan shows a similar trend and meets some elevations corresponding to the accumulations of earth and stones and the agrarian subdivisions. The inspection of the model in a three-dimensional environment (**Figs. 22-23**) confirms the indications and characteristics found. The area has no visible archaeological surface structures (apart from the Ara della Regina Sanctuary), and the model alone does not add further information other than to help in the perception of spaces and morphological relationships.

The advantage of having a single and reliable map that can be queried from the morphological point of view in the three dimensions and on which to anchor all the graphic, cartographic materials and data is undoubtedly an aspect of great value both for archaeological research and analysis of the modern landscape<sup>53</sup>. In this case, the superimposition of the results of the archaeological analysis conducted for this area<sup>54</sup> to the digital LiDAR model (**Fig. 24**) allows for further considerations and insights. It is interesting to note how some signs of the modern conformation of the territory derive from the historical landscape and have adapted their morphology to the shapes existing at that time. An example is

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<sup>53</sup> MARZULLO 2018.

<sup>54</sup> For this, see Marzullo above in this volume.

provided by the current agricultural subdivision of the land that follows the direction of an ancient path (south of the sample area; **Fig. 24**, the path is highlighted in a white circle).

In addition to the bidimensional plan representation, the analyses are extended by means of combined three-dimensional views (**Fig. 25**) or vertical sections. It is possible to add information by crossing the results of the archaeological analysis with the morphological data, simulating the position of the identified remains. The structure with a roughly squared plan recognised through the magnetometry<sup>55</sup> can be easily placed in the space as well as the structure formed by many cells (**Fig. 26**). The quadrangular portion is placed almost entirely on the flat surface of the ground in the centre of the sample area. In contrast, the south-west corner is in the sloping portion of the land. The structure with many cells is located a slightly farther west, where the slope begins to drop in altitude with an 11° inclination. It is plausible that the many small cells had the function of containing the slope and the load (pressure strength) of the terrain by creating the limit of a built terracing on which to set the walking surfaces or other structures. Therefore, the building's position, its shape and the dense group of small partitions, support the hypothesis of the substructure that Marzullo indicated in her contribution<sup>56</sup>.

Some parts of the paths identified through magnetometry<sup>57</sup> are also located in the flat part of the investigation area, overcoming slight changes in altitude. The paths arising from the archaeological analysis of the other data and coming from different sources<sup>58</sup>, on the other hand, extend mainly in the southern and eastern portions of the sample area. To the west, the four tracks in the north-south direction are almost parallel to each other and overcome a considerable height difference (about 7 metres). The three paths to the east, on the other hand, overcome a minor difference in height (except the northern one), reaching the central portion of the sample area.

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<sup>55</sup> Ibidem.

<sup>56</sup> Ibidem.

<sup>57</sup> Ibidem.

<sup>58</sup> MARZULLO 2018.

## The LiDAR survey for archaeological research

The LiDAR data processing produced the most updated, accurate and comprehensive cartographic basis of the plateau. Thanks to its versatility, the capability to isolate the different materials that compose the surfaces and measure the height and extension of the geomorphological evidence, it was possible to rectify and shape all the graphic and cartographic information, accurately collected<sup>59</sup>. One of the most significant results is assessing structures and sites, including several almost unknown remains<sup>60</sup>. While the location and orientation of the remains could be generically indicated at the areal level, since they were only testified by archival documents such as sketches or excavation reports, the elaboration of the LIDAR data allowed a more significant deepening. In this regard, it is important to underline how the only modern cartographies (regional and provincial technical maps, municipal cartographies, aerial images) cannot be the only support for such elaborations, for two main reasons: first, because they primarily represent data already interpreted for a completely different purpose and a completely different definition level; the second reason, closely connected to the first one, concerns the criticisms on the metric reliability of these cartographies and the problems linked to the absolute positioning of the information contained therein. The GIS Archaeological Map containing all the maps and the reliable archaeological structures described above, combined with the precision and adaptability of the LiDAR processing output, was crucial in solving such a kind of problems. It was possible to compare signs clearly associated with buried archaeological remains to magnetometry results, verifying this data set by querying the LiDAR point cloud and obtaining their appropriate positioning.

In this context, the above-mentioned integrated system of tools developed at an interdisciplinary level provides a set of services for joining different existing data sources by defining a semantic network of relationships among landscapes, stratigraphic layers,

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<sup>59</sup> MARZULLO 2018.

<sup>60</sup> *Ibidem*.

structures and artefacts. Therefore, it allows switching from territorial scale to the scale of the structures within the archaeological sites, successfully managing examinations among all the topics identified in the archaeological thematic maps, thereby facilitating the comparison between different evidence within the same site. The archaeological analysis alone can reveal data and results useful for the reconstruction of the ancient landscape. Combining the examination and the elaborations of the LiDAR survey allows adding other considerations and reflections for a more appropriate interpretation of the historical landscape and the evolutionary phases of the territory. Indeed, the possibility of associating historical information with reliable and detailed geography facilitates interpretation operations for a full knowledge of the archaeological assets. This made it possible to create a unique information database and a flexible and appropriate tool for the analysis of ancient evidence and the protection of the historical landscape. A multilayer approach has been adopted to structure this system, making it easily upgradeable and implementable. In fact, the interpretation of the data passes through the analysis of multiple information levels that can be created or reworked from time to time to refine the research. Furthermore the possibility of adding the acquisitions and the results of the multispectral analysis and the data coming from remotely piloted aircraft systems to the methodological approach previously described would allow further reflections.

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The photographs, graphic reproductions and elaborations are kept in the graphic and photographic archive of Etruscology, University of Milan and are the work of the author unless other reference.

Fig. 1

Elaboration after MARZULLO 2018, tav. 45.

Fig. 2

Elaboration of the LiDAR aerophotogrammetry dated back to 2010.

Fig. 3

Archive of Etruscology, University of Milan.

Fig. 4

Elaboration after *Tarchna IV* (2012), tav. I ft.

Fig. 5

Elaboration after CUCARZI *et alii* 2001, fig. 70.

Fig. 6

After PIRO 2001, fig. 72.

Fig. 7

After ROMANELLI 1948, fig. 30.

Fig. 8

After PIRO 2001, fig. 72.

Fig. 9

Elaboration after CUCARZI *et alii* 2001, fig. 70.

Fig. 10

Elaboration after CUCARZI *et alii* 2001, fig. 70 and *Civita di Tarquinia* 2018, fig. 1d.

Fig. 11

Elaboration after CUCARZI *et alii* 2001, fig. 70; *Civita di Tarquinia* 2018, fig. 1d and the latest elaboration of the Lerici's acquisition processed by the 'Tarquinia Project'.

Fig. 12

Elaboration after CUCARZI *et alii* 2001, fig. 70.

Fig. 13

Elaboration after CUCARZI *et alii* 2001, fig. 70; *Civita di Tarquinia* 2018, fig. 1d and the latest elaboration of the Lerici's acquisition processed by the 'Tarquinia Project'.

Fig. 14

Elaboration of the LiDAR raw materials dated back to 2010.

Fig. 15

Elaboration of the LiDAR aerophotogrammetry dated back to 2010.

Fig. 16

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 17

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 18

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 19

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 20

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 21

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 22

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 23

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 24

Elaboration of the LiDAR morphologic data dated back to 2010.

Fig. 25

Elaboration of the LiDAR morphologic data dated back to 2010 and CUCARZI *et alii* 2001, fig. 70.

Fig. 26

Elaboration of the LiDAR morphologic data dated back to 2010.





## FIGURES



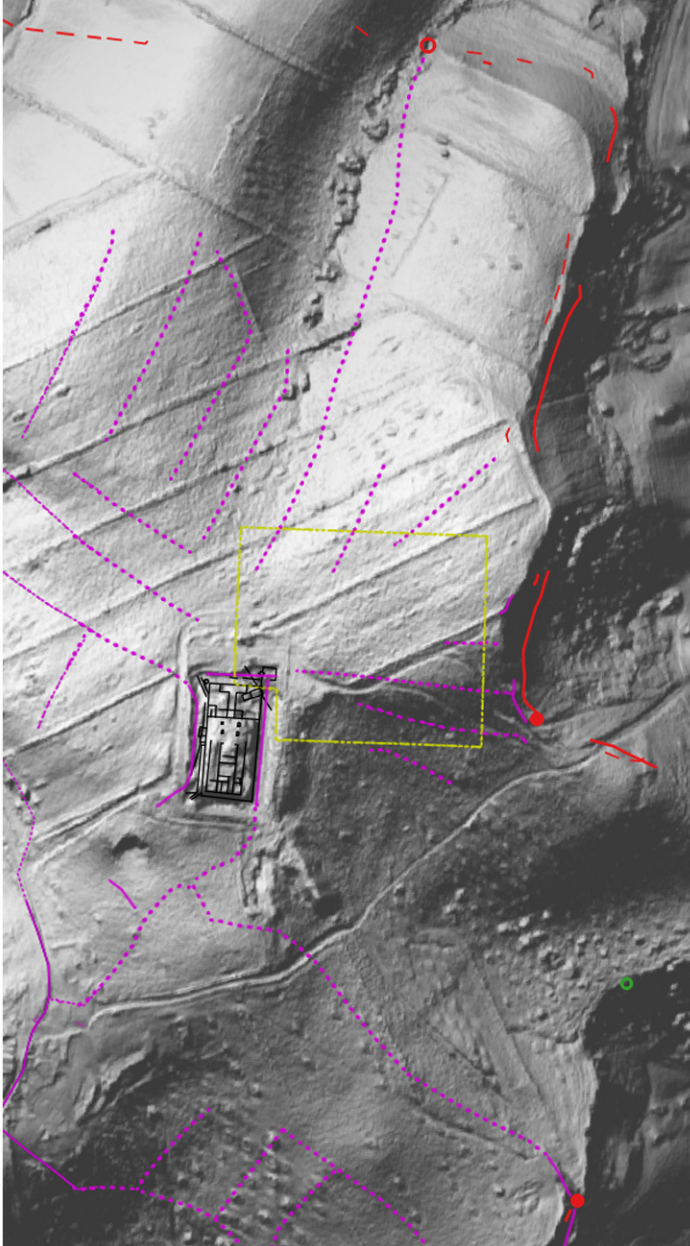
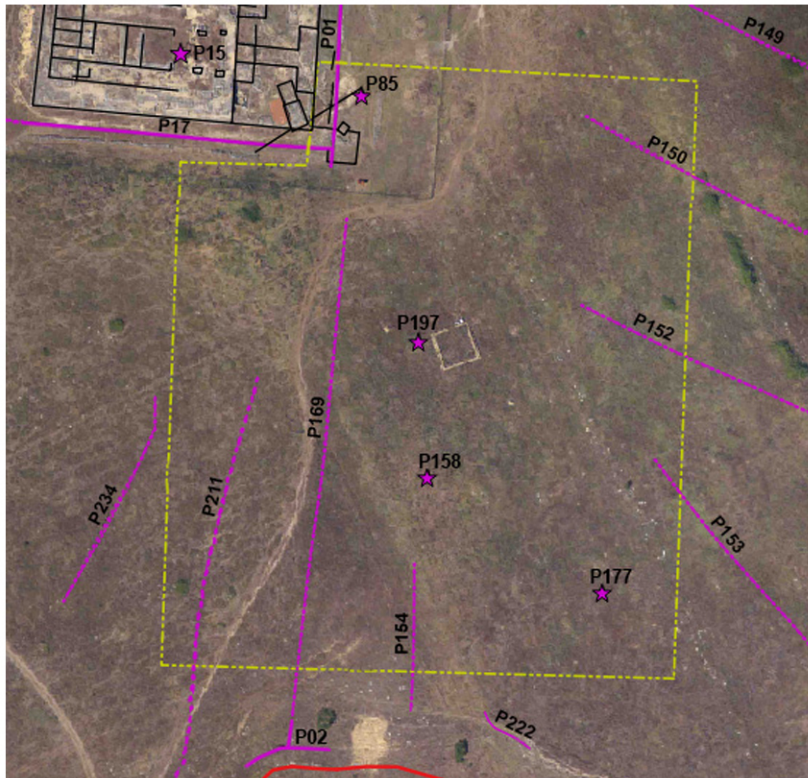
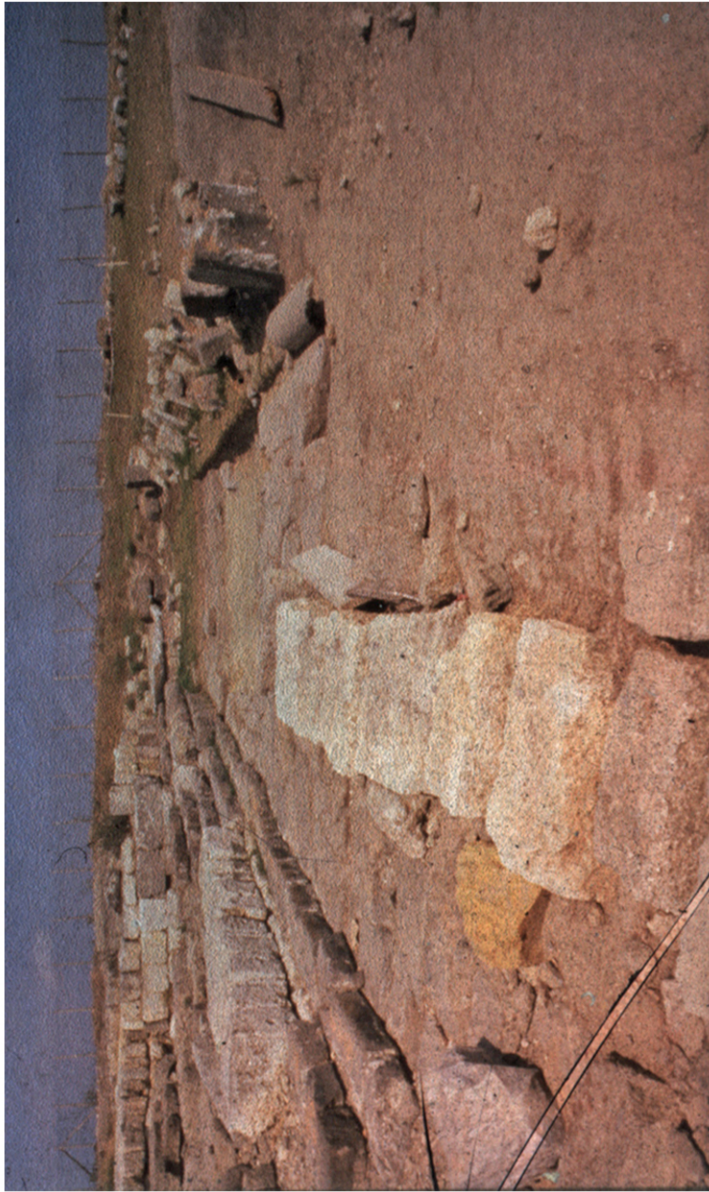


Fig. 01  
The sample area south-east of the Ara della Regina sanctuary on the 'Thematic map of the walls, gateways and roads of ancient Tarquinia'. The gateways and walls are highlighted in red, the streets in pink, the area under investigation in yellow. In this latter, the digital model of the LiDAR surfaces does not show significant signs on the ground, except for the agrarian boundaries that run from south-east to north-west.

Fig. 02

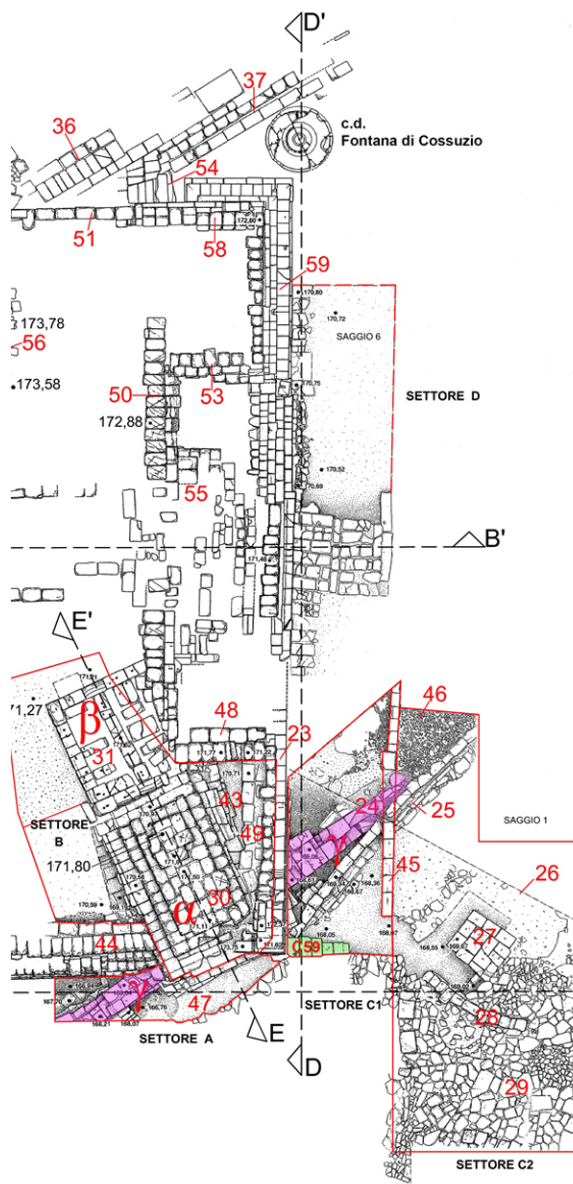


The sample area south-east of the Ara della Regina sanctuary on the LiDAR aerophotogrammetry (2010). The city walls are highlighted in red, the streets in pink, the area under investigation in yellow. The path of the ancient routes is after the 'Thematic map of the walls, gateways and roads of ancient Tarquinia' (MARZULLO 2018, pl. 45). The stars indicate specific sites of the *Archaeological Map of the Civita di Tarquinia* cited in this paper.



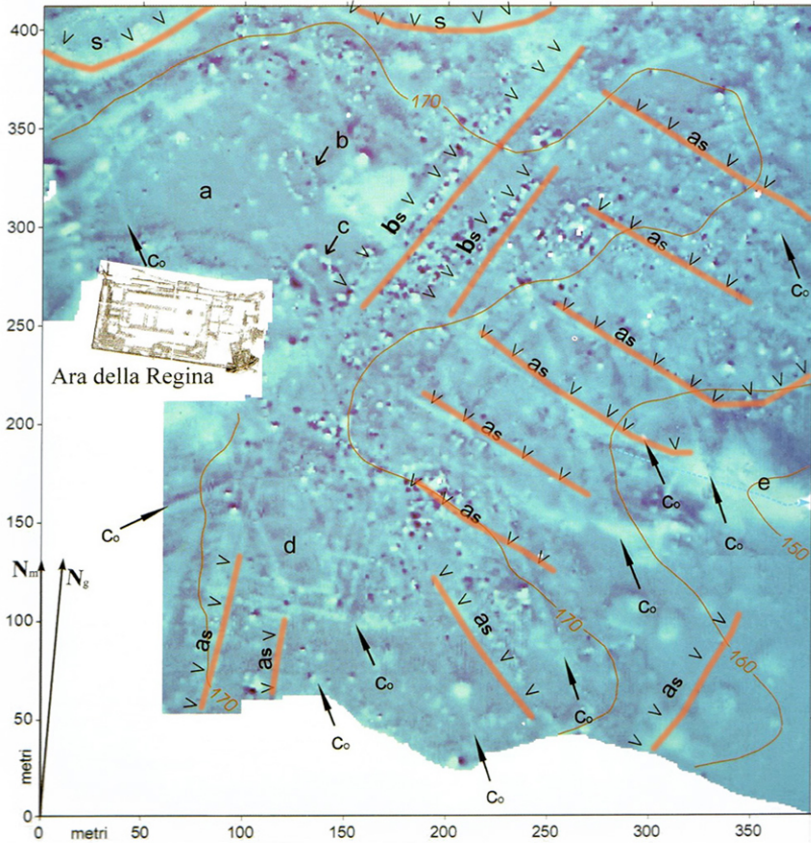
The area in front of the entrance stairway of the temple of the Ara della Regina as it appeared in 1983. A paved area with large slabs of nenfro is visible. It is closed to the east by a row of nenfro blocks and at the north it assumes a triangular profile due to the pre-existence of some walls in the south-west/north-east direction.

Fig. 04



The area in front of the entrance stairway of the temple of the Ara della Regina according to the investigations of the University of Milan (1983-2002).

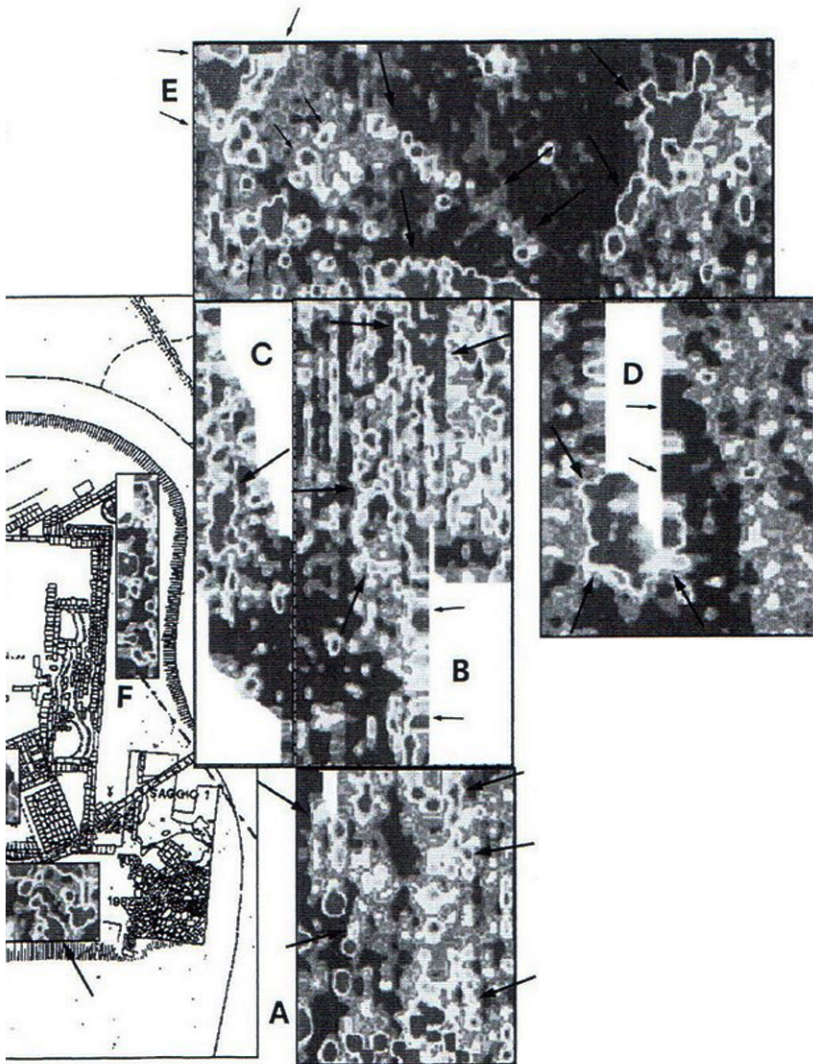
Fig. 05



The area east of the sanctuary of the Ara della Regina through the magnetometric surveys dated back to 2001. The possible streets (**as**, **bs**) are highlighted in orange. **Co** indicates the modern agrarian boundaries, letters **a-e** the ancient structures discussed in CUCARZI *et alii* 2001 and deepened in this paper. In the gradient scale, the white colour indicates very reactive materials, the blue non-magnetic materials.



Fig. 06



The area east of the Ara della Regina sanctuary through the georadar (GPR) surveys dated back to 2001. The GPR time-slices show the situation at the estimated depth of 80 cm and the black arrows indicate the most significant anomalies.

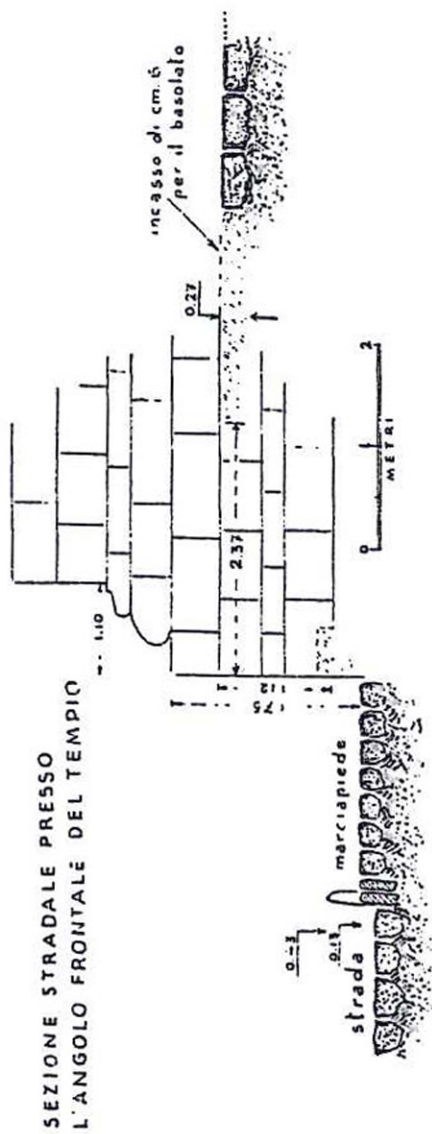
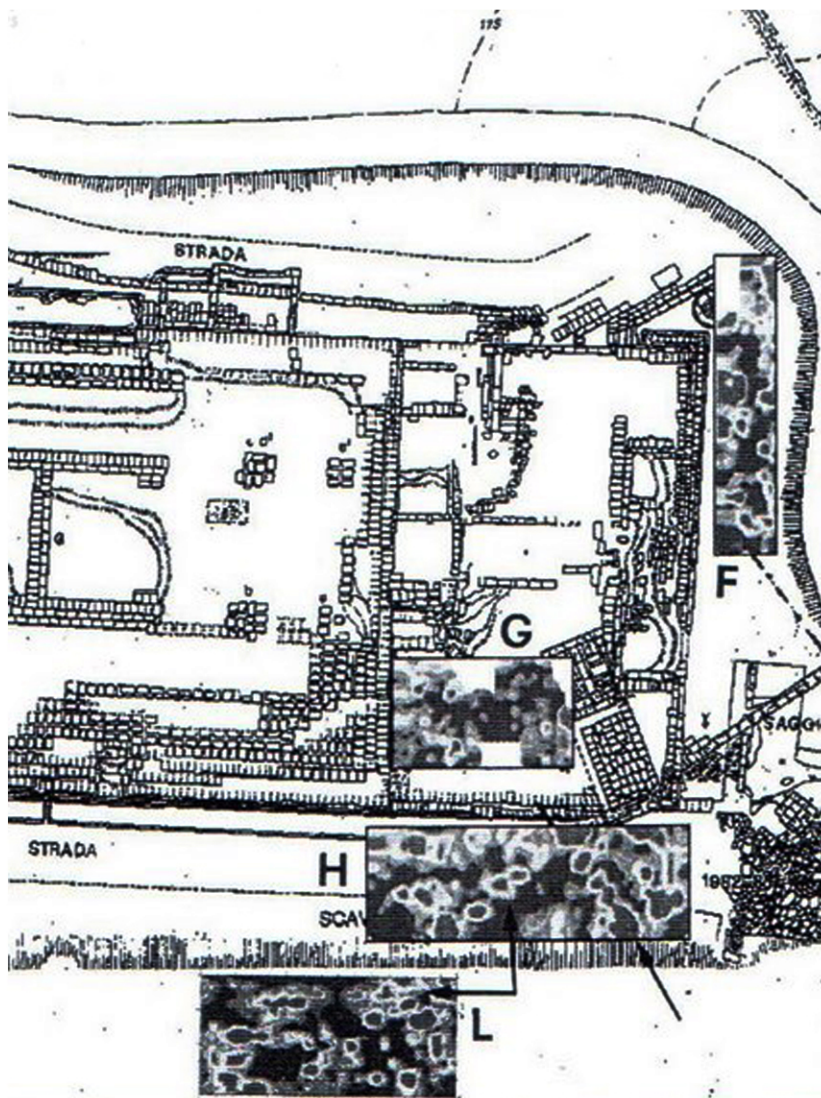


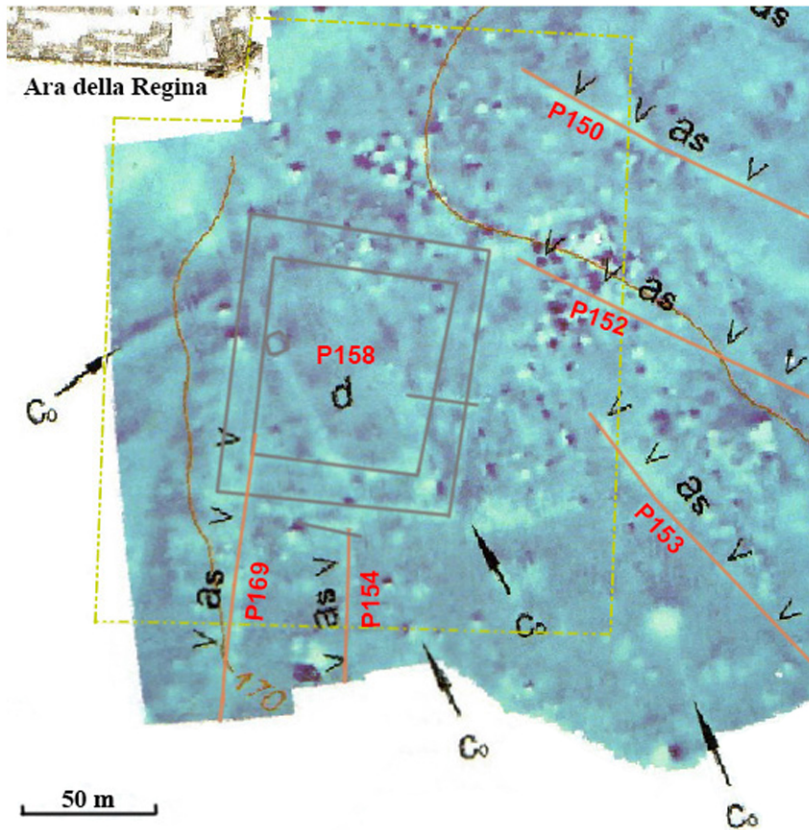
Fig. 07  
The section south-north across the south-eastern corner of the temple as appeared in 1948. It shows the street along the south side of the temple, the footway running along it, the basement of the temple and the paved area with large slabs of nenfro set at a remarkable high compared to the southern street.

Fig. 08



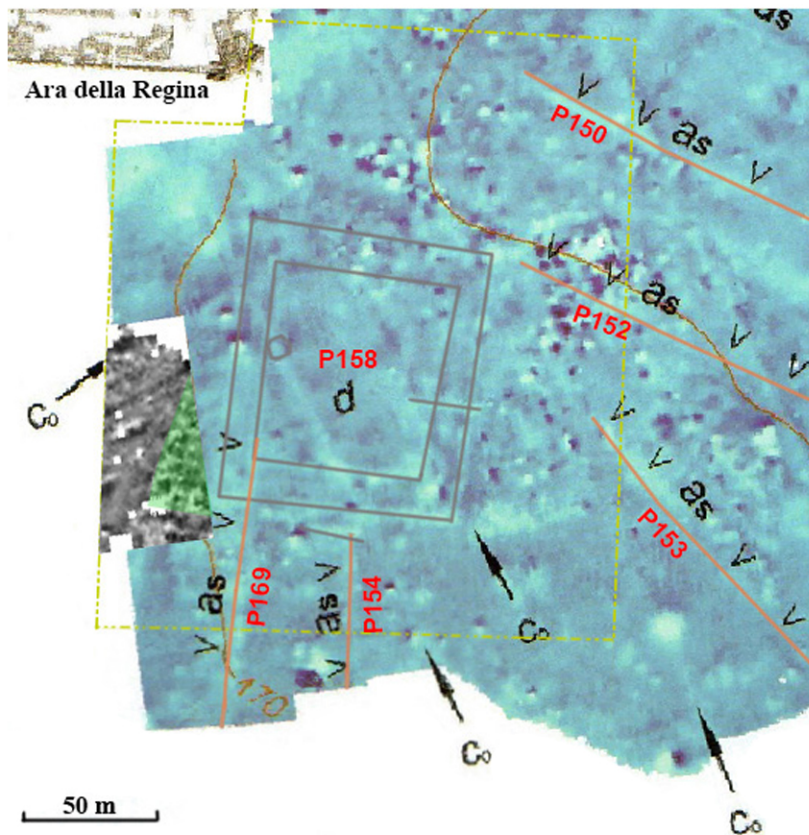
The southern area of the Ara della Regina sanctuary through the georadar (GPR) surveys dated back to 2001. The GPR time-slices show the situation at the estimated depth of 80 cm and the black arrows indicate the most significant anomalies.

Fig. 09



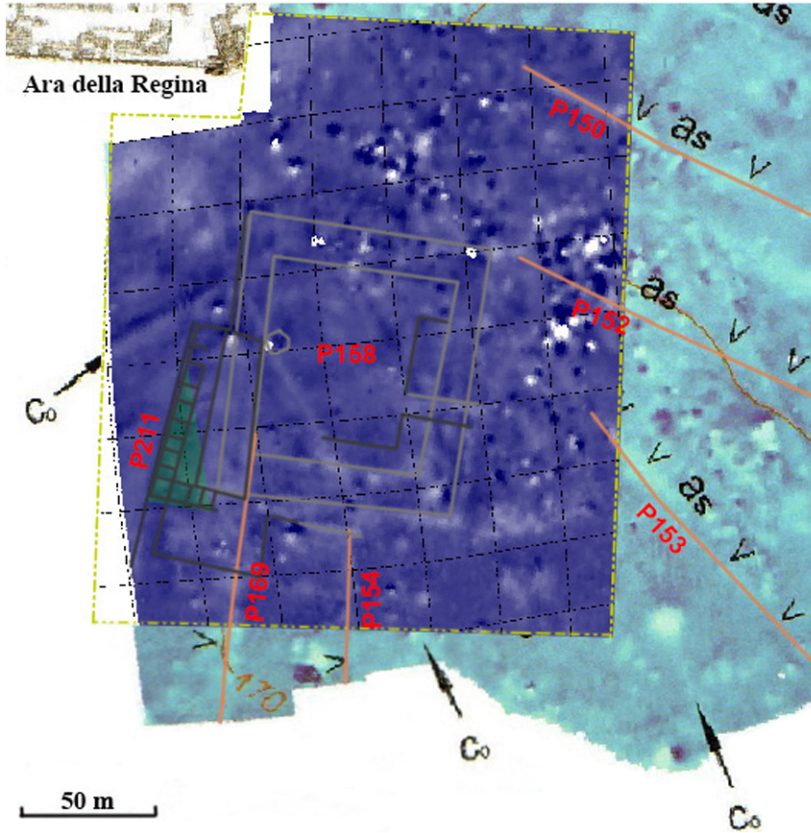
The area under investigation (defined in yellow) on the basis of the magnetometries dated back to 2001. The streets are highlighted in orange and labelled according to the records of the *Archeological Map of the Civita di Tarquinia*. The structures related to the squared area discussed in this paper are highlighted in grey.

Fig. 10



The area under investigation (defined in yellow) on the basis of the magnetometries dated back to 2001 and 2017. The streets are highlighted in orange and labelled according to the records of the *Archeological Map of the Civita di Tarquinia*. The structures related to the squared area discussed in this paper are highlighted in grey. The green area highlights the series of small squared spaces seated at the south-western corner of the squared area P158.

Fig. 11



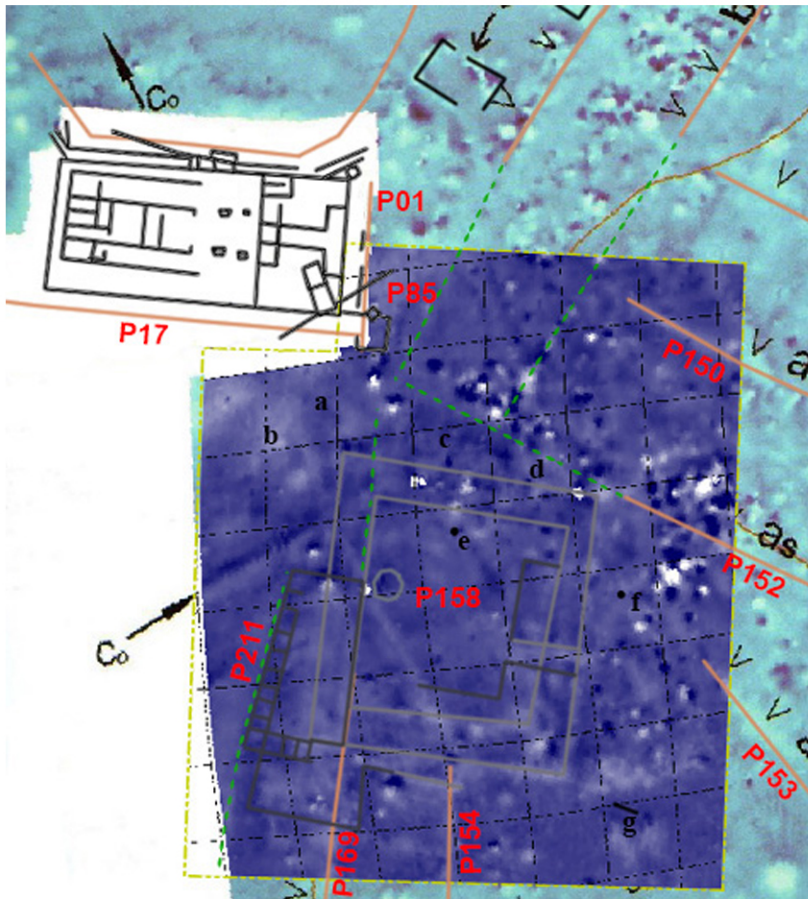
The area under investigation (defined in yellow) on the basis of the magnetometries dated back to 2001, 2017 and the latest elaboration of the Lerici's acquisition dated to 2018 (in the foreground). The streets are highlighted in orange and labelled according to the records of the *Archeological Map of the Civita di Tarquinia*. The structures related to the squared area visible in the 2001 threshold are highlighted in light grey; dark grey identifies those visible in the latest elaboration; the green area indicates the series of small rooms clearly visible in the 2017 threshold.

Fig. 12



The area surrounding the Ara della Regina Sanctuary and the area under investigation (defined in yellow) on the basis of the magnetometries dated back to 2001. The streets are highlighted in orange and labelled according to the records of the *Archeological Map of the Civita di Tarquinia*. The structures related to the squared area visible in the 2001 threshold are highlighted in light grey; dark grey identifies those visible in the latest elaboration processed by the ‘Tarquinia Project’ (2018).

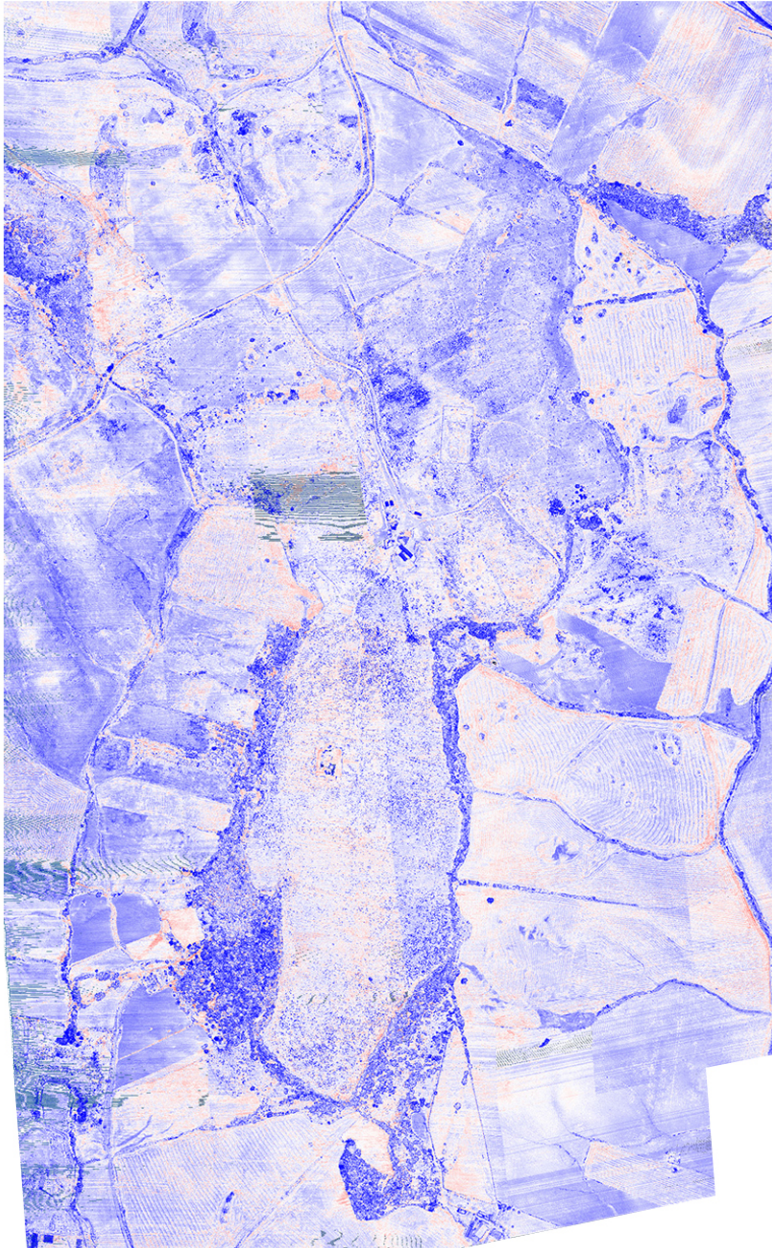
Fig. 13



The area surrounding the Ara della Regina Sanctuary and the area under investigation (defined in yellow) on the basis of the magnetometries dated back to 2001, 2017 and the latest elaboration of the Lerici's acquisition dated to 2018 (in the foreground). The streets referred to the 2001 threshold are highlighted in orange, those visible in the latest elaboration are in green dotted line. All the streets and structures are labelled according to the records of the *Archeological Map of the Civita di Tarquinia*. The structures related to the squared area visible in the 2001 threshold are highlighted in light grey; dark grey identifies those visible in the latest elaboration processed by the 'Tarquinia Project' (2018). Letters a-e mark specific structures discussed in this paper.



Fig. 14



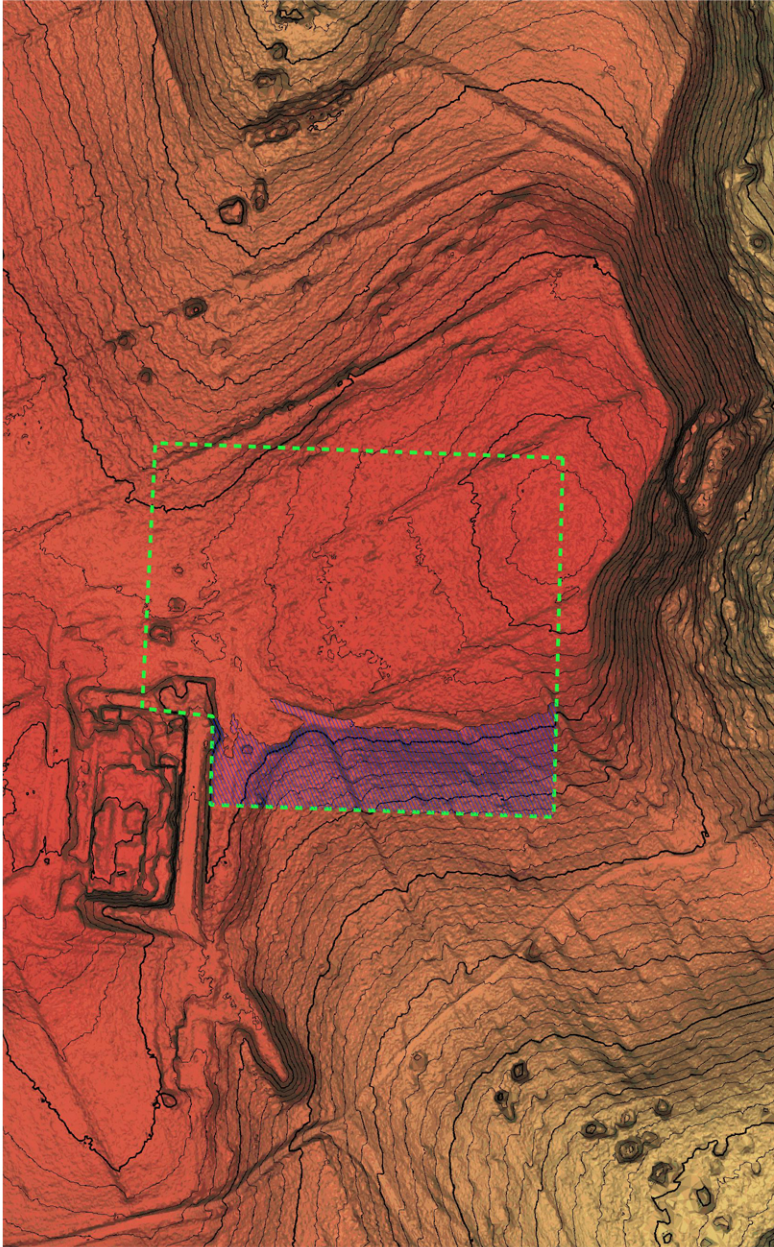
Representation of the intensity of the laser pulse all over the plateau.

Fig. 15



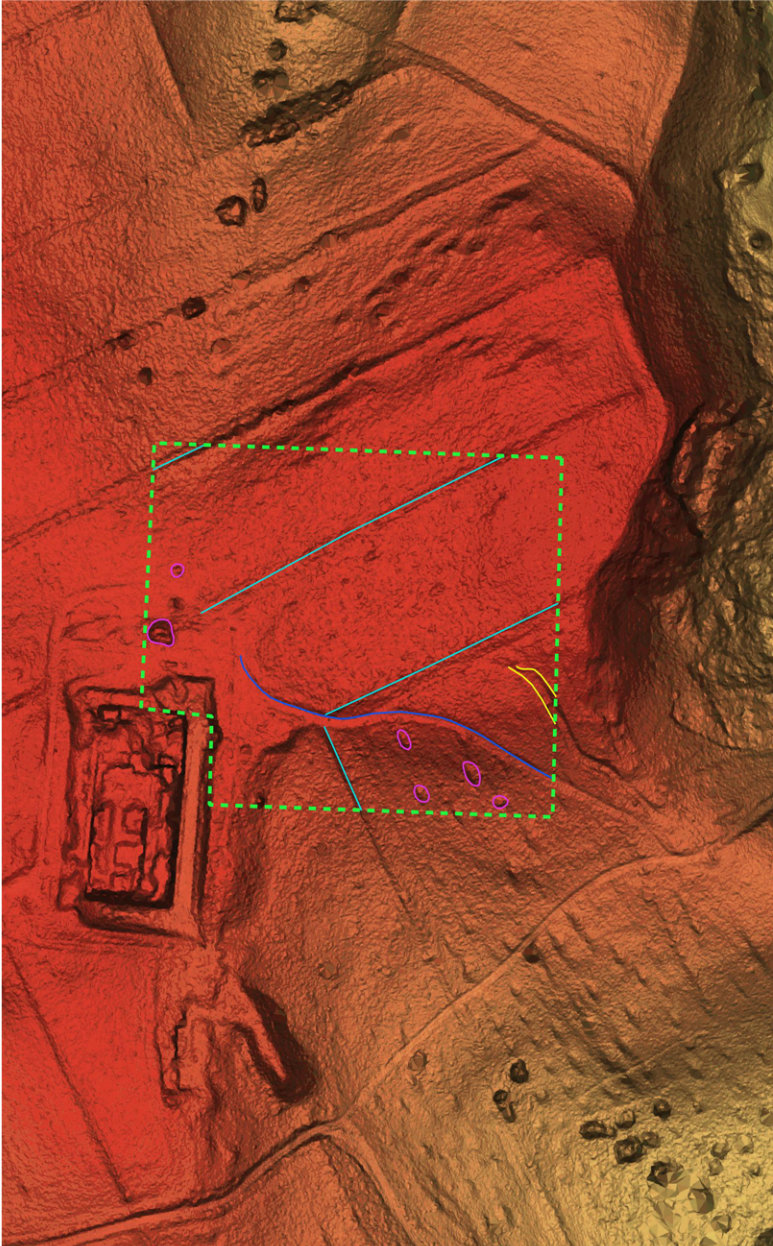
Orthomosaic of the Civita Plateau, 2010.

Fig. 16



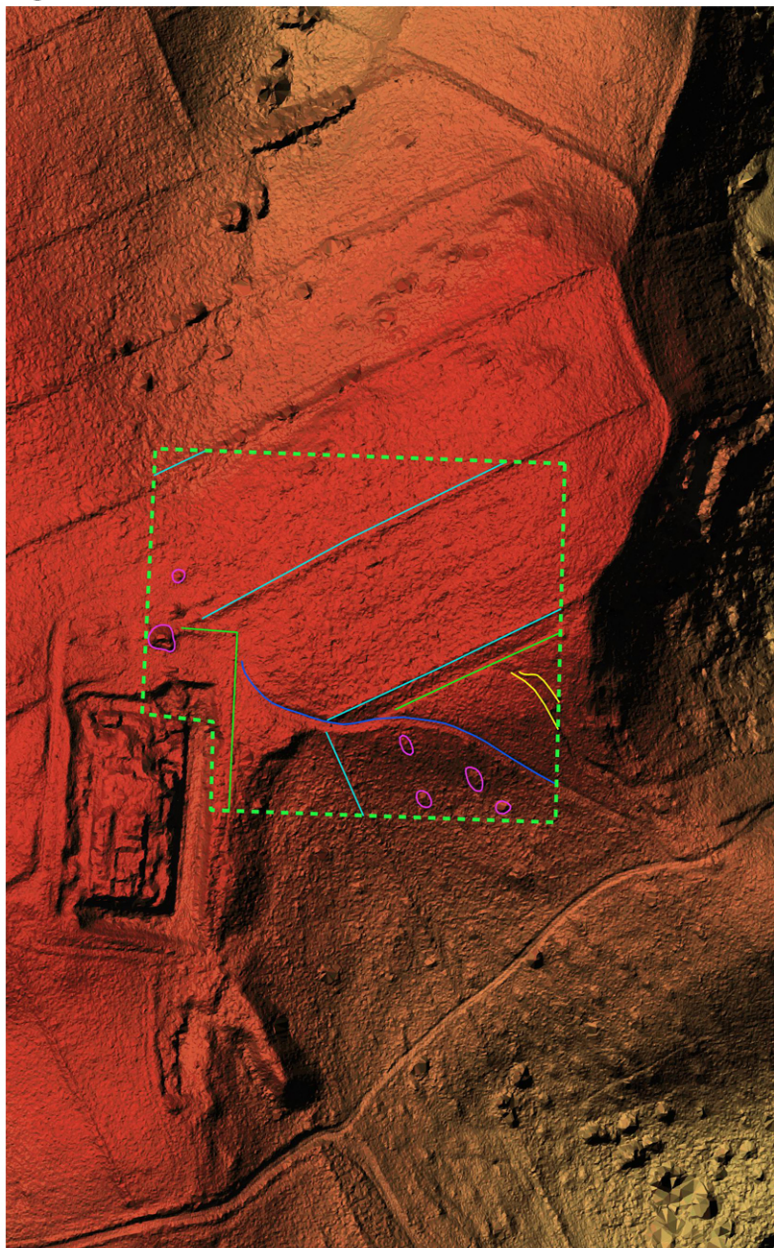
Levels of the terrain on the DTM; the portion characterised by a significant difference in altitude is highlighted in blue.

Fig. 17



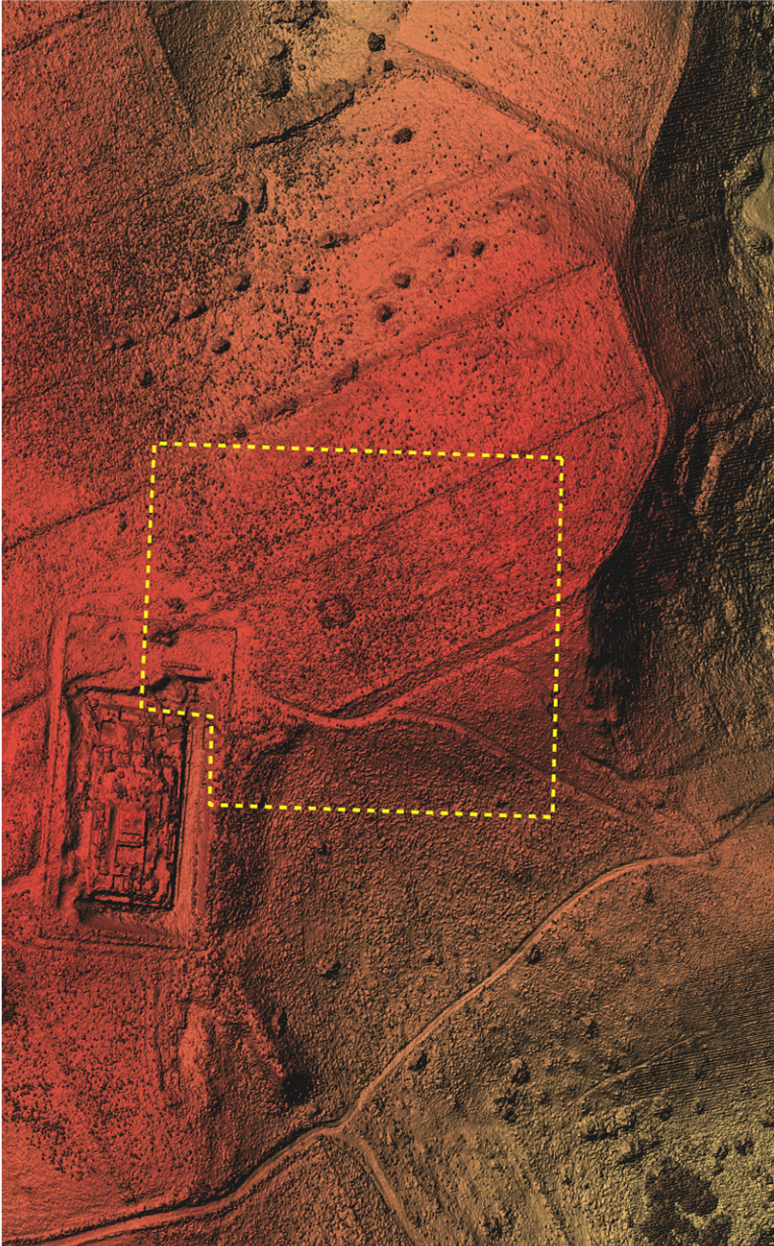
Analysis of morphological discontinuities on DTM with zenith lighting.

Fig. 18



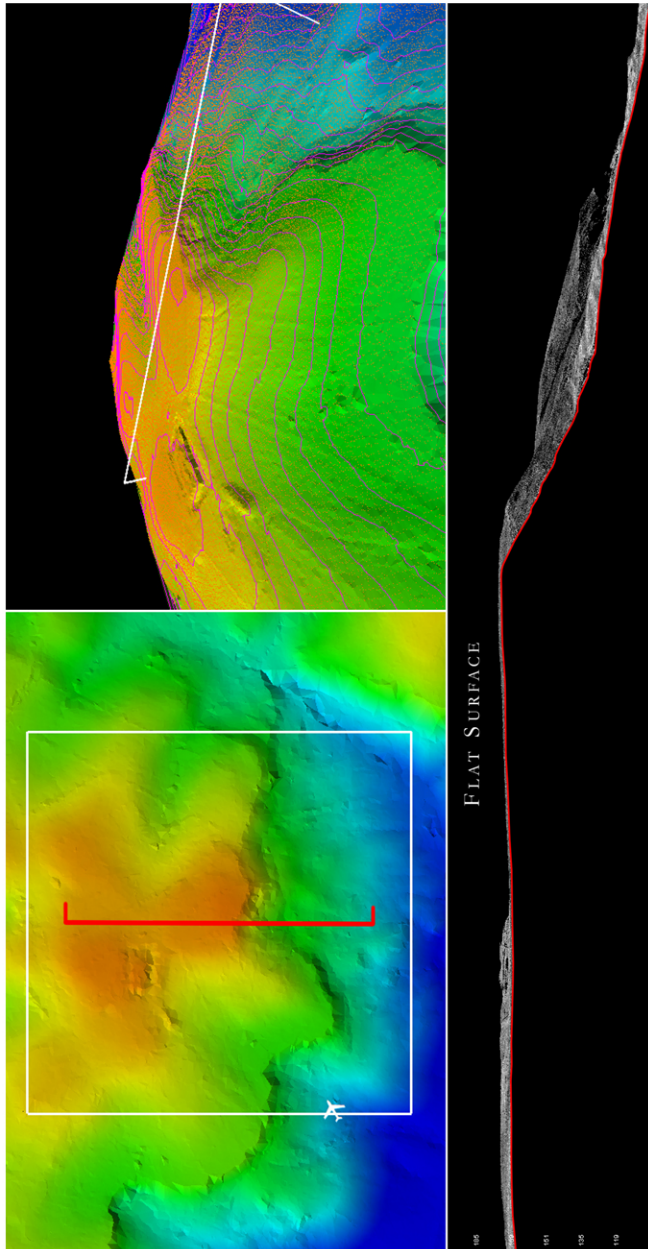
Analysis of morphological discontinuities on DTM with natural lighting (10.30 a.m. in May)

Fig. 19



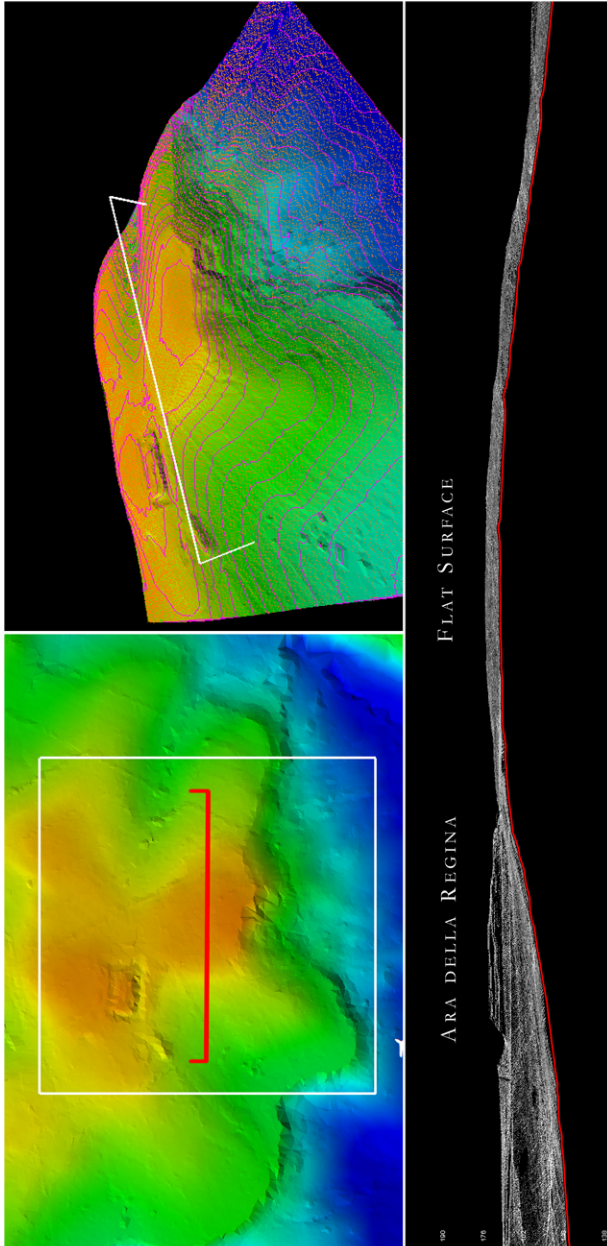
The digital surface model (DSM) with natural lighting (10.30 a.m. in May).

Fig. 20



The north-south section of the digital terrain model.

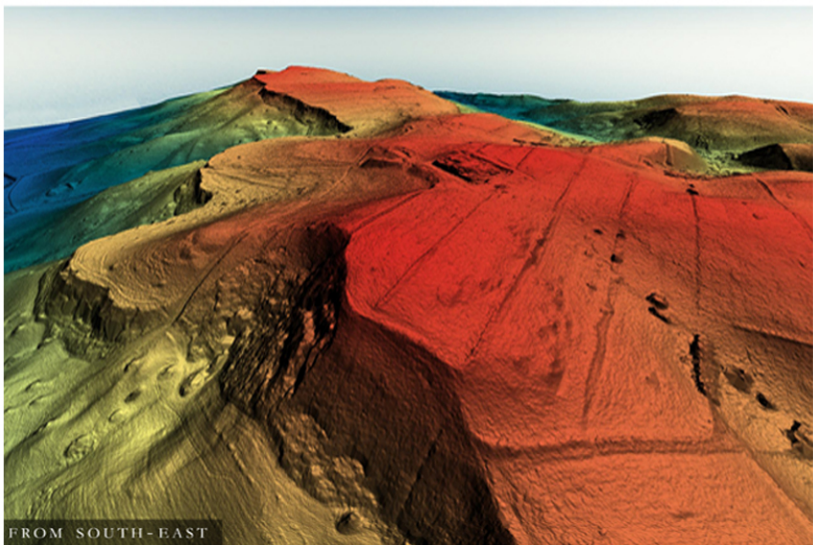
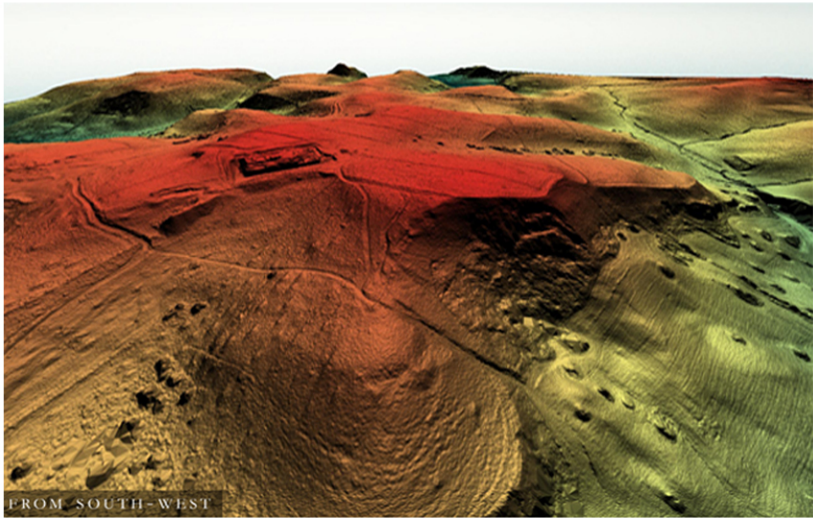
Fig. 21



The west-east section of the digital terrain model.

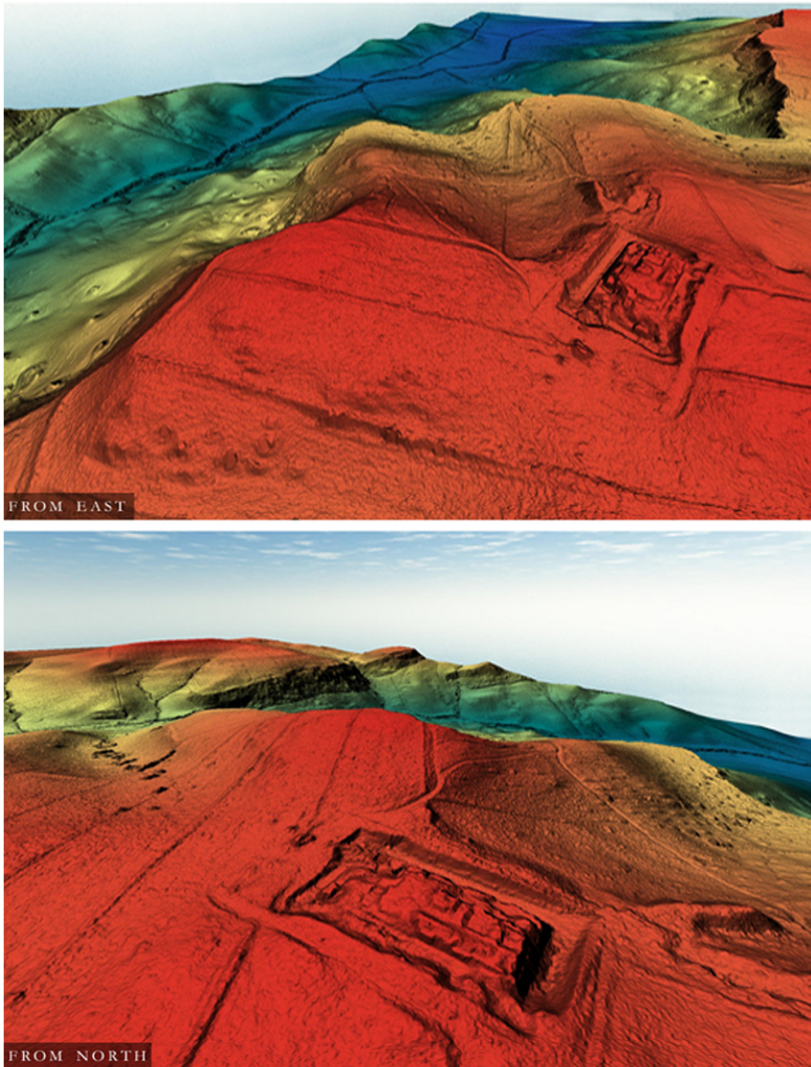


Fig. 22



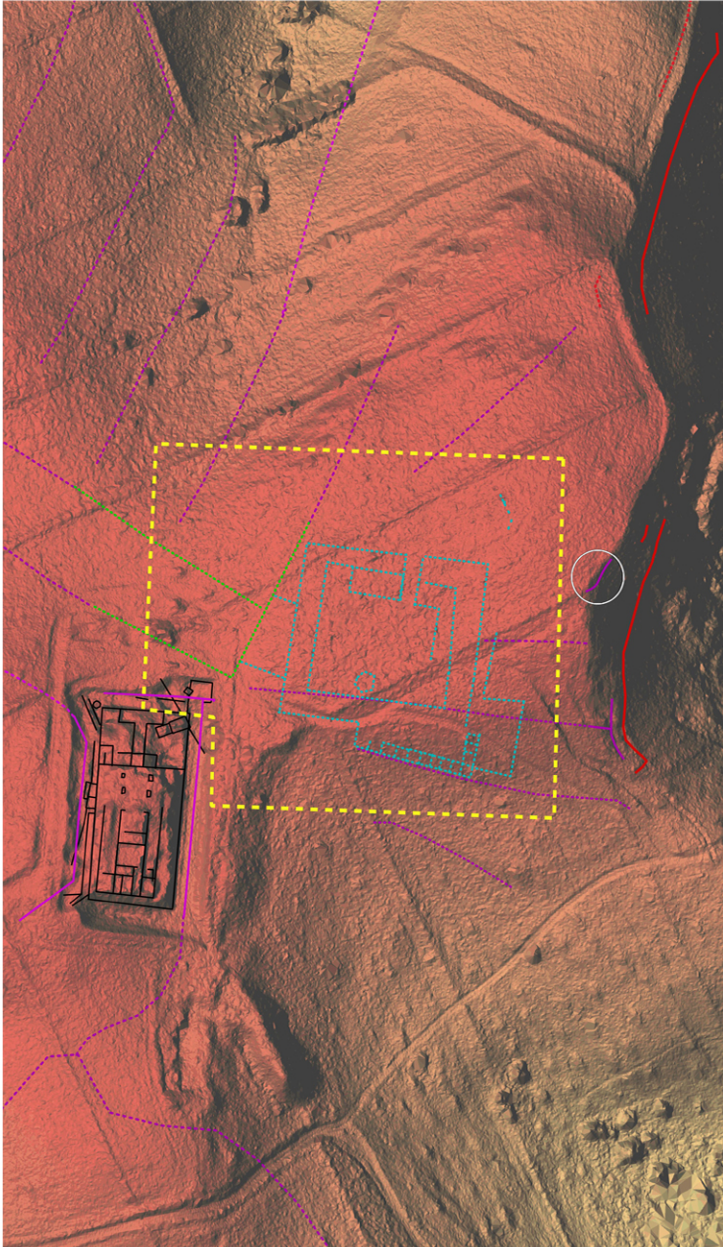
Three-dimensional perspective views of the digital terrain model.

Fig. 23



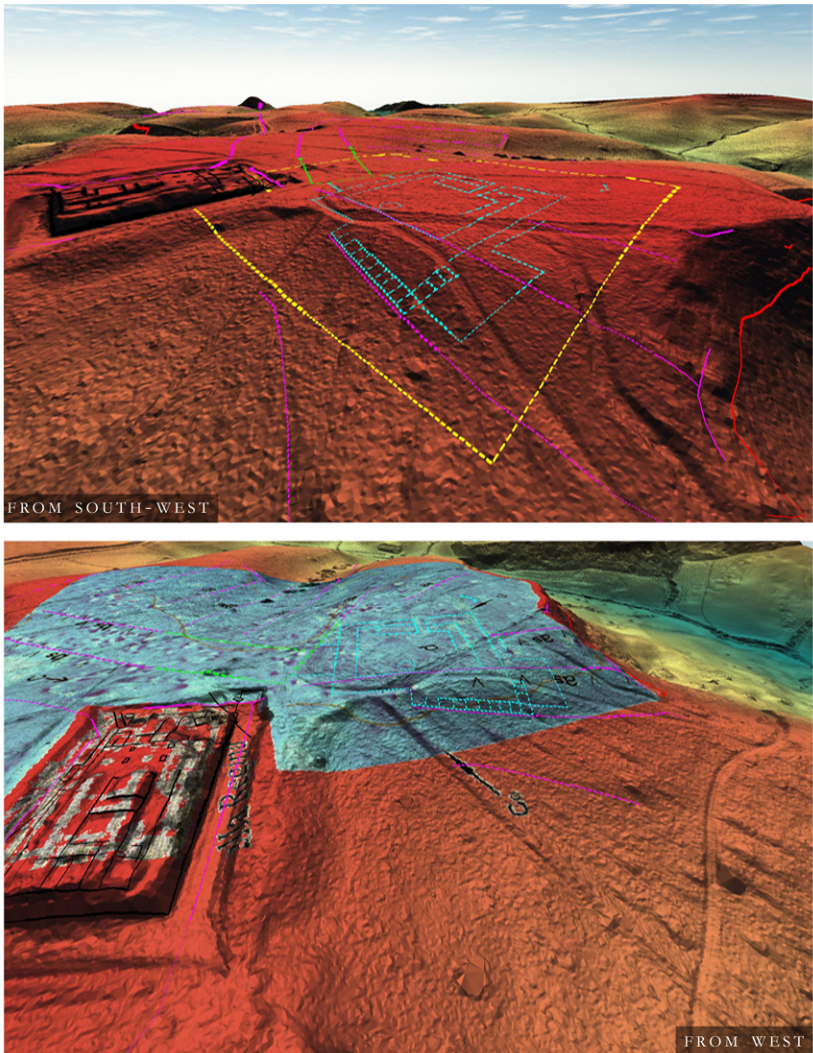
Three-dimensional perspective views of the digital terrain model.

Fig. 24



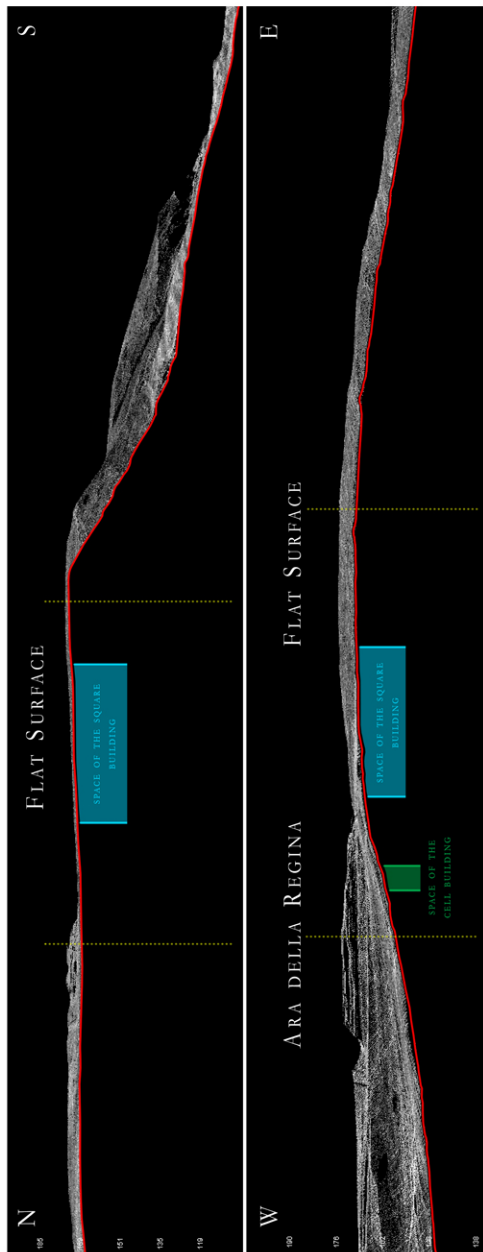
Superimposition of the archaeological analysis to the DTM: possible paths/roads deriving from the latest magnetometry in green; possible paths/roads deriving from previous sources in purple; visible structures in black; wall circuit in red. The white circle defines the current agrarian boundary following the direction of an ancient path.

Fig. 25



Overlay of the result of the archaeological analysis on the DTM in perspective view (above). Superposition of the results of the archaeological analysis on the DTM texturised with the 2001 magnetometry of the Lerici Foundation (below).

Fig. 26



Sections of the digital model and indication of the space occupied by the structures. The north-south section above, the west-east section below.





UNIVERSITÀ DEGLI STUDI DI MILANO

DIPARTIMENTO DI BENI CULTURALI E AMBIENTALI – SEZIONE DI  
ARCHEOLOGIA

ETRUSCOLOGIA

**TARCHNA**

Collana fondata da Maria Bonghi Jovino  
diretta da Maria Bonghi Jovino e Giovanna Bagnasco Gianni

M. BONGHI JOVINO - C. CHIARAMONTE TRERÉ

Tarquinia. Testimonianze archeologiche e ricostruzione storica. Scavi  
sistematici nell'abitato.

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I materiali 1

*(Tarchna II)*

M. BONGHI JOVINO

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I materiali 2

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M. BONGHI JOVINO – G. BAGNASCO GIANNI

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*(Tarchna IV)*



## TARCHNA / SUPPLEMENTI

M. BONGHI JOVINO - F. CHIESA

Offerte dal regno vegetale e dal regno animale nelle manifestazioni del sacro (a cura di). Roma, "L'Erma" di Bretschneider 2005.

*(Supplementi / 1)*

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Università degli Studi di Milano

Dipartimento di Beni Culturali e Ambientali - Sezione di Archeologia  
Etruscologia

Only seven years after the publication of the excavations by P. Romanelli, which definitively confirmed the location of the ancient Etruscan city, in 1955, the operations of the technicians and engineers of the Ing. C.M. Lericci Foundation began at Tarquinia. They focused primarily on the tombs, but soon they also switched to the ancient town. The geophysical investigations at Civita started in 1964. Since then, works were carried out to systematically examine the entire plateau surface: the program was not always respected and suffered considerable obstacles, but, despite this, it continued until 1981. An incredible amount of data was collected through magnetometry, electrical measurements, core samples and surveys. Over time, additional georadar (ITABC - CNR) and gradiometry surveys (British School at Rome) were also performed as part of the CRC 'Tarquinia Project' directed by the University of Milan. Today the project is dealing with processing this huge amount of data for the publication of the *Archaeological Map of the Civita di Tarquinia*.

In light of the recent collaboration with the University of Verona, this work will use the area South-East of the Ara della Regina sanctuary as a pilot project. The volume will show that only with the comparative study of the results of different disciplines (from literary sources to archive research, from the excavation to the study of cartographic sources) through the optics of archaeology, topography, speleology, architecture, paleoanthropology, paleobotany, chemical-physics, assisted by information technology and ICT data management, it is possible to shed light below the ground and to lay the foundations for the overall study of the city and its development.

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