

# Cities in Evolution. Diachronic Transformations of Urban and Rural Settlements, II

VIII AACCP Symposium, Proceedings

Edited by Z. Ceylanlı, P. Günay and E. Çiçek



Dynamic Research on Urban Morphology books - 4

**CITIES IN EVOLUTION  
DIACHRONIC TRANSFORMATIONS OF URBAN AND RURAL  
SETTLEMENTS  
Proceedings Volume II**

VIII AACCP (Architecture, Archaeology and Contemporary City Planning)  
symposium, Istanbul 2021

Edited by

**Zeynep Ceylanlı, Pelin Günay and Ezgi Çiçek**

DRUM Press  
Istanbul, 2023

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Proceedings, Volume II**

VIII AACCP (Architecture, Archaeology and Contemporary City Planning) symposium, Özyeğin University, Istanbul, April 26<sup>th</sup> May 2<sup>nd</sup> 26 2021

Edited by:

**Zeynep Ceylanlı, Pelin Günay and Ezgi Çiçek**

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**VIII AACCP (Architecture, Archaeology and Contemporary City Planning) Symposium  
CITIES IN EVOLUTION. DIACHRONIC TRANSFORMATIONS OF URBAN AND RURAL SETTLEMENTS**

Organized by the Dynamic Research on Urban Morphology-DRUM laboratory, Özyeğin University, Istanbul, Turkey, April 26th-May 2nd, 2021

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## **The remains of the Horrea Agrippiana in the Roman Forum, from survey to virtual reconstruction**

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Keywords: Rome, Digital Survey, Virtual Reconstruction

### **Abstract**

The digital survey at the base of this research was originally taken during “The Roman Forum: Architecture and Archaeology” ISAR summer school in 2020, the very specific situation at that time, just in between the first and second pandemic waves, pushed the teams participating to the workshop to operate from the distance, basing all the communication on online platform, sharing the digital survey data taken in place by a specific survey group. The digital survey turned out to be very versatile for this task, even if in its huge amount of data, it allowed both a virtual exploration than a perfect base for supporting all the activities in the online classes. The area of the survey was the “Horrea Agrippiana” a sector of the Roman Forum characterized by a very variable level of details, with both large and massive remains but even thin walls, mosaics, and complex overlaid structures. The fascinating shape of the remains, strongly altered, were a difficult challenge to any interpretation of the past phases and states of the buildings before their state of ruin. After the completion of the summer school, mainly aimed to enhance the fruition of the area using new architectural interventions, the digital survey was used as a base reference for applying the procedures for an accurate reconstruction: the area was represented in its present state, interpreted, analysed, and then developed into a virtual reconstruction capable to present in a more coherent way the development of the building and their relationships through their various phases. This contribution will present the various phases from the infield survey to the data treatment, to the various post-processing, to the making of the digital reconstruction and its use for creating new contents to better understand this part of the Roman Forum.

### **Introduction**

The awareness of the passage of time, also happens through the analysis of architectural typologies and their evolution over time. The case study is the complex of the Horrea Agrippiana, a typical warehouse in the ancient Rome. For this aim, support provided by today's computer technology during the phase of the purchase of data gives excellent results in terms of both accuracy and time. Representative of this technology is the 3D laser scanner with which it is possible to sample millions of points of the object and, thus, obtain an accurate copy apt of providing a real-time 3dimensional representation of the heritage surveyed. The outcome is a digital model which documents the dimensional, material and characteristics of the heritage itself, thus representing a support to be examined. The survey is the preliminary step in a larger effort aimed at developing recommendations for a coordinated strategy to sustain and strengthen digital cultural heritage initiatives. After the survey and analysis of the complex, the second step is a proposal for the reconstruction of it. Reconstruction is defined as method used in cases that a building or a group of structure is lost partially or completely due to natural or man-made reasons. In this case the remains are very few of the original building.

### **Historical process of the examined building**

The Horrea Agrippiana are in the North-West of the Roman Forum, between the church of Santa Maria antiqua, the church of San Teodoro, and near the so-called *Clivus Victoriae* and the *Vicus Tuscus*, an ancient Etruscan Road, one of the most important streets for merchants that connect the Tiber River to the Roman Forum. The original construction belongs to the period of the Augustan age during the I century B.C., done

by Marco Vipsiano Agrippa, friend, and supporter of the emperor. The remains of this period are the tufa dividing and perimetral walls in the South-East side, and only the dividing wall in the West-Side and the travertine pavement of the central courtyard. The major change arriving during Domitian emperor, in the North-West the brick wall replaced the previous tufa one that was probably damaged by Neronian Fire in 64 A.D. In third phase, during the Antoninus age, the *Sacello* was built and dedicated to the *Genius Horreorum Agrippianorum*. We can find the signs of this celebration in the interior, where there are remains of a votive statue. A mosaic floor with plants and marine motifs was also added during the third century. During the III century in the courtyard, we can find a set of cells built with double face masonry and vaulted cover. These are very simple spaces for commercial purposes or used as animal shelter. In the last phase the apse fountain was built but it is the starting of a progressive abandonment of the area. The building techniques change progressively with the passing of the time. The original wall and partition of the *cellae* are made in Aniena tufa blocks, assembled with the technique called *Opus Quadratum*, used in Rome since the sixth century B.C. The Domitian Wall is made in *Opus Testaceum* with a typical course in the Domitian age of *bipedalis* each 60 cm. There are two other types of *Opus Testaceum*: in the *Sacellum* and in the *Pillars*. In the courtyard few walls are made in *Opus Vittatum*. The buildings in the courtyard are double faced walls composed by undercooked yellow bricks, on the exterior side, three different type of *Opus Vittatum*, the most used is composed by irregular small blocks of tufa interrupted by a three brick courses on the interior side. Others evidence in the masonry is the various types of restorations in different periods with different materials.

## Methodology

The reality-based digital model, generated through laser scanning of the ruins, had a double purpose in this project. On the one hand it allowed an accurate documentation of the current site status, a valuable source of information for interpreting Horrea architectural structures and the possibility to analyze it with a great level of detail on a PC, possibly far from the site or in a different time. On the other hand, it was a starting point for a digital reconstruction. It was utilized the Laser scanner 3D Z+F Imager 5016 combined with Autodesk Recap and AutoCad. To increase and accelerate the survey process we used photogrammetry and a technique which utilizes a series of 2-dimensional images to reconstruct the 3-dimensional structure of a scene or object called Structure from Motion (SfM). It was utilized a camera Nikon 850D with a total 1899 pics with the accurate results of 3D meshes, processed in Reality Capture and later refined with Adobe Photoshop. With this process a plan and elevations of the complex was produced.

## Hypothetical reconstruction

Architectural reconstructions start from different clues, which can be ruins, drawings, photographs. The whole of these remnants can help, but if you are faced with parts completely disappeared, you will have to get to deductions through logical procedures and certainly a deep knowledge and historical research. The approach to this reconstruction process has been focused on the previously studies on the Horrea Agrippiana, and the analysis of the remains. During the 20th century two excavation campaigns carried out by Giacomo Boni, in 1904 and 1911, were revealed that brought to light much of the complex. The depth of the investigation reached the floor level of the northeast and southeast sides, and many architectural fragments were found, fragments of statues, epigraphs, coins of different eras. Later the monument was restored several times and only in 2003-2005 in the project *Post aedem Castoris (PAC)* were polls in the northwest corner of the building. In 2016, the ISAR conducted a first excavation campaign planned by the *Signum Vortumni* project in which it evidence of the layout of the area in the periods previous the construction of the Horrea Agrippiana. Some documents have been found in which horrea are mentioned, which are among the best documented storage facilities. There are three epigraphs that mention the *vestiarii*:

CIL VI, 9972

C(aius) Iulius Lucifer / vestiarius de horreis / Agrippianis;

CIL VI, 10026

Ius Nectareus / [3]us de horreis Agrippia/[nis sibi et sui]s libertis libertabusq(ue) / [poste]risque eorum / [hoc monu]mentum exterum heredem / [ne sequat]ur neve de nomine nostro / [3] exsiat(!);

CIL XIV, 3958

Dis [Manibus] sacr(um)] / M(arco) Li[vio Herm]eroti / vestiario de horreis / Agrippinianis / Claudia Ti(beri)  
f(ilia) Moschis / viro carissimo,

Another epigraph source is represented in the interior of the *Sacello* dedicated to the *Genius Horreorum Agrippianorum*:

AE 1915, 97

pro] salut(e) Genium horreor(um) / [A]grippianorum negotiantib(us) / L(ucius) Arrius Hermes / C(aius) Varius Polycarpus / C(aius) Paconius Chrysanthus / immunes s(ua) p(ecunia) d(onum) d(ederunt) // Posit(um) dedic(atum) V Idus Iun(ias) / Cn(aeo) Cossutio Eustropho / L(ucio) Manlio Philadelpho // Cur(atores) ann(ii) III.

An important support for this study, are the analysis made by H. Bauer in 1978 when we can see still in his sketch the remains of the three pillars in the South corner. With this, we can assume the wheelbase that is 5,50 m in this corner. It's the half width of the same *tabernae*. The only remain *in situ*, visible today, is the base of the pillar of the courtyard in the South, with it and other two bases previously studied is possible to recreate the porch. The porch is typical in these architecture typologies, it means composed by a central courtyard surrounded by rows of rooms opening in on to an arcade around it. They tried to consider other *Horrea* who could help rebuild those *Agrippians*. The main problem in the research was finding that the *Horrea* identified in the *Forma Urbis Severiana* and therefore of which one could be sure of their existence, they no longer exist in marble. So, in order to have more feedback and comparison, the attention is fall towards the near ancient *Ostia*. We find more details and also the stands of several *Horrea* in different eras.

In this case, three main types are analysed:

- *Horrea* of Hortensius (I Century B.C.), the building composed by a rectangular courtyard with colonnade, with rooms on four sides. The storage cells are arranged along the four sides of a quadrangular court and are made in *Opus reticulatum*.

- *Piccolo Mercato* (120 A.D.) The main entrance is in the north. It is lined with shops and stairs behind a deep brick porch. The interior is arranged around two rectangular courtyards, surrounded by a portico with brick pillars. To the west, south and east of the courtyards there are 28 rooms. They were closed with two doors, testify the thresholds. Above the doors there were windows square and in the back walls louvered windows, for light and ventilation. The rooms were about high 7 meters and covered by barrel vaults.

- *Horrea Epagathiana et Epaphroditiana* (150 AD.) the only visible remains that we can enjoy today in good condition.

In the examples gathered around a courtyard the *horrea* usually had two floors, of which the second was to be used for the most delicate and valuable goods and for the administration offices and staff quarters. At the ends of each side and at the centre of the porch were arranged access stairs. The portico continued the second floor with a kind of long loggia covered. On the ground floor of the buildings, it was very frequent that there were rows of *tabernae* or shops, rented to shopkeepers of various types. In the South-East elevation there is the original partition wall that show the 5<sup>th</sup> and 7<sup>th</sup> row are more prominent because they had to support a mezzanine probably made of wood, and vaulted cover. At the bottom of the cell, leaning against the perimeter wall there was a staircase (in wood) leading to the mezzanine, space used for storage of goods, for overnight stay or for any other possible use. It is possible to identify with the help of thresholds and partition walls, about 18 rooms on the ground floor. The side towards the Forum consists of 7 rooms open to the central courtyard, excluding the angular spaces. In the east corner, two rooms are articulated in such a way that to have access to the second, one must necessarily pass from the first. A series of eight environments, excluding also here the angular zones form the south-eastern part of the *horrea*.

Many rooms in contact with the ground retain travertine thresholds with the furrows of guidance for the accommodation and the sliding of wooden boards that fit between the threshold and the lintel, a recurrent mode in commercial environments. It is possible to deduce that the cells of the upper floor were of the same width as the ground floor. The main remain as a reference point is the brick wall although it is not of the original complex. In this wall there are the traces of the hypothetical levels. For another confirmation we utilize the *pes*, the basic unit of Roman linear measurement. Metrologists have come to different conclusions

concerning its exact length, varying between 29,1-29,7 cm in this study the value used is 29,47 cm like in other studies of this complex, by Heinrich Bauer.

The complex starts at 13.30 m a.s.l. and this is the reference altitude starting point of 0.00 m and rise for a total of 22,40 m in height. The ground floor is about 7,07 m in height The first floor is probably 7,37 m in height and the last floors are about 4.00 m in height. Thanks to these traces we can presume the original structure of the complex of *Horrea Agrippiana*, composed by 4 level and probably with a trussed roof and tiles. And the courtyard composed by Corinthian semi-columns. As for the last two floors, we cannot know what they are really like because we don't have enough remains and evidence to lead us towards something certain. So, it is assumed that they were plans for administrative lodgings or that they vaguely recall the *insulae* (ancient Roman apartment building). Other clues for this reconstruction are the plan of the other *Horrea* in Ostia.

### Virtual Reconstruction

The proposal of reconstruction it was elaborated by different software, the first 3D model was produced in Rhinoceros but for the elaboration in Virtual Reality it was exported in Maxon Cinema 4D to convert 3D faces from NURBS (Non Uniform Rational Basis-Splines) to mesh (is a collection of vertices, edges and faces that defines the shape of a polyhedral object) and then contextualized by inserting it within the 3D model obtained from Reality Capture.

The last and the most important phase is the exporting in Unreal Engine 4, an Open-Source software created by Epic Games for the creation of the Virtual spaces. Thanks to the support of the LXR laboratory of the University of Florence, the approach to virtual reality began. Using Unreal Engine 4 software it was created two types of virtual tour: Virtual Immersive Tour and a 360 Interactive Tour. After exporting the model In Unreal Engine has carried out a job of shading and lighting so as to have the right colors, and the environment that seemed ideal to us for the immersive visit. The virtual environment is visualized through the use of headsets, in this case an Htc Vive PRO has been used. The second tour always involves the export of the model to Unreal, but in this case the cameras are set to 360° imported then in the program Pano2vr that converts the various shots in interactive experiences.

<https://www.didalxr.it/2021FMHorrea/index.html>

In this link there is the interactive tour when we can see the entire *Horrea Agrippiana* complex, and we have the information panels that will guide your visit.

### Conclusions

The aim of this work was to investigate some of the new techniques of representation of architecture combining everything with the extensive historical research that has allowed to deepen the knowledge of the building, showing its metric characteristics, technical, formal, and graphic, has made possible the reconstruction of its constructive vicissitudes. The aim was to use some of the new techniques of representation, using digital information processing, creating an immersive space.

### References

- Pronti A.; Astolfi F.; and Guidobaldi F. (1978) *Horrea Agrippiana: Archeologia classica : rivista del dipartimento di scienze storiche archeologiche e antropologiche dell'antichità : XXX, 1978*
- Geoffrey R. : (1972) *Roman granaries and store buildings* Cambridge: University Press
- Bauer H. (1978) *Un tentativo di ricostruzione degli Horrea Agrippiana. Archeologia Classica Vol. 30 (1978), pp. 132-146 (23 pages)*
- Insolera, I., Perego, F. (1999), *Storia moderna dei Fori di Roma: archeologia e città*, Bari, Laterza, Italy.
- Adam, J.P.(1988), *L'arte di costruire presso i romani*, Longanesi, Italy.
- Giuliani, C.F. (2018), *L'edilizia nell'antichità*, Carocci, Italy.
- Verdiani, G. (2017), *Retroprogettazione. Metodologie ed esperienze di ricostruzione 3D digitale per il Patrimonio Costruito*, Firenze: Dida Press, Italy



Fig. 1. Francesca Montanaro, Vicus Tuscus and Horrea Agrippiana



Fig. 2. Francesca Montanaro, Horrea Agrippiana today, panoramic photo

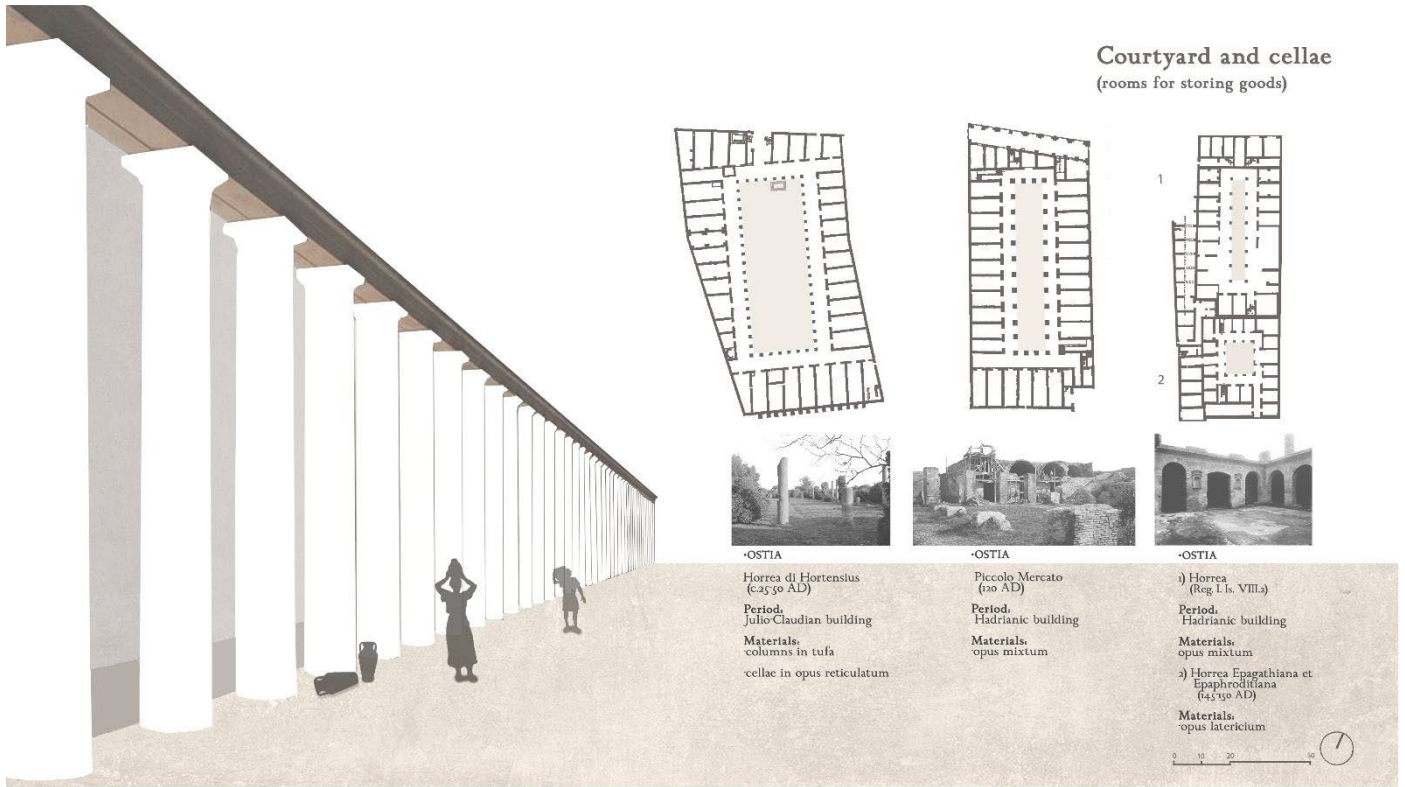


Fig. 3. Francesca Montanaro, Horrea Ostia, Courtyard and cellae

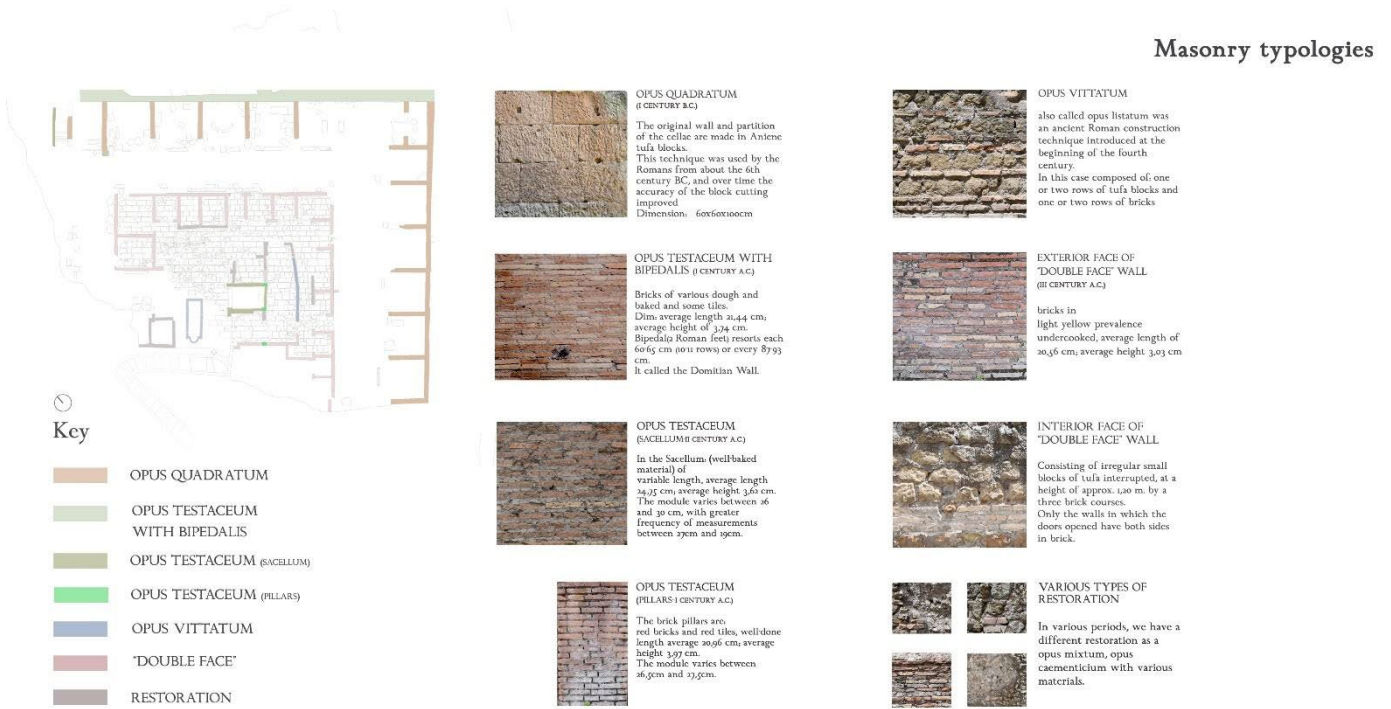


Fig. 4. Francesca Montanaro, Mansory typologies

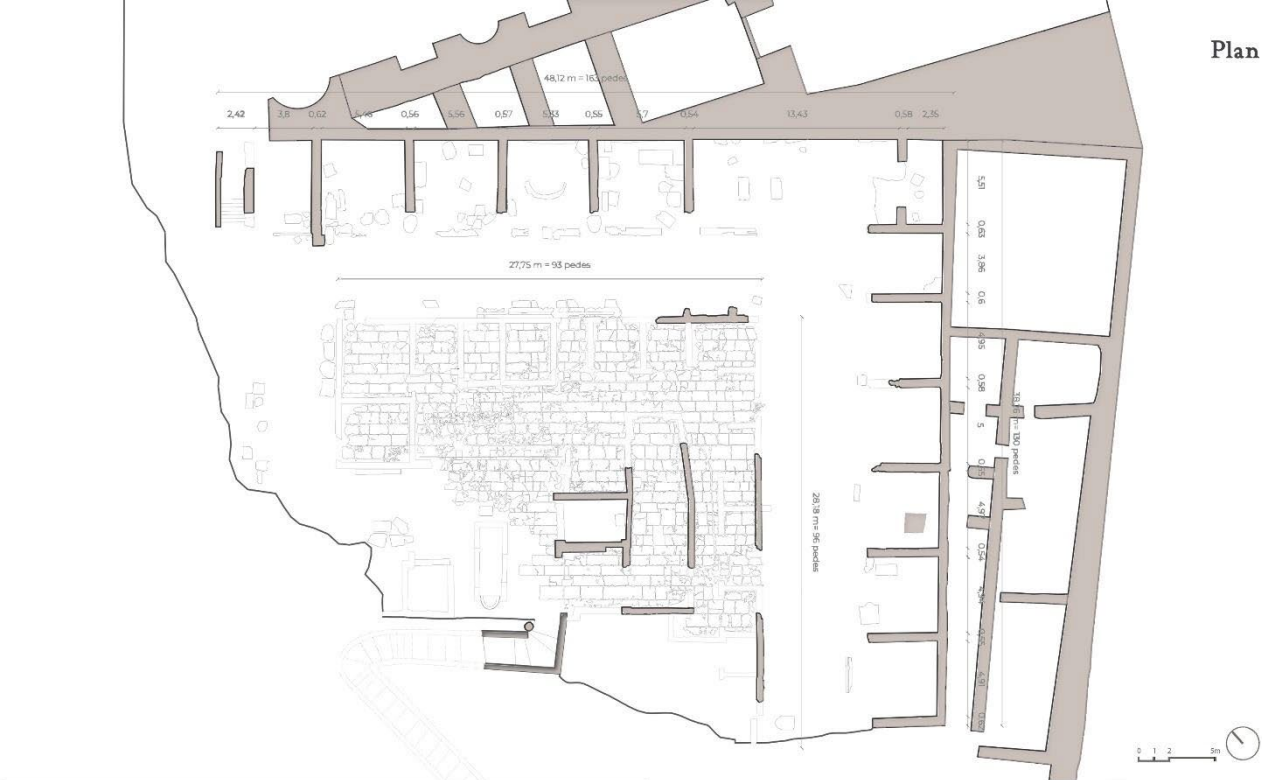


Fig. 5. Francesca Montanaro, Plan



Fig. 6. Francesca Montanaro, Plan photogrammetry

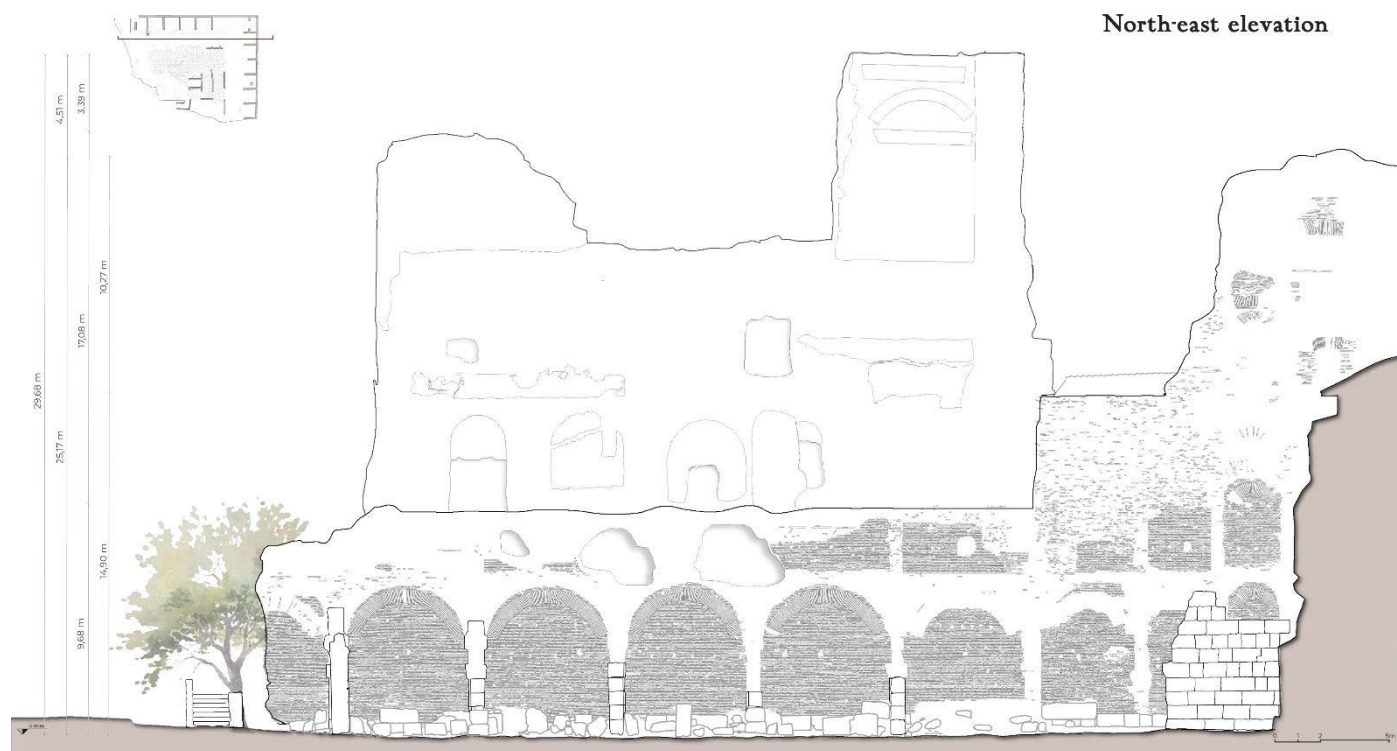


Fig. 7. Francesca Montanaro, North-east elevation



Fig 8. Francesca Montanaro, North-east elevation photogrammetry



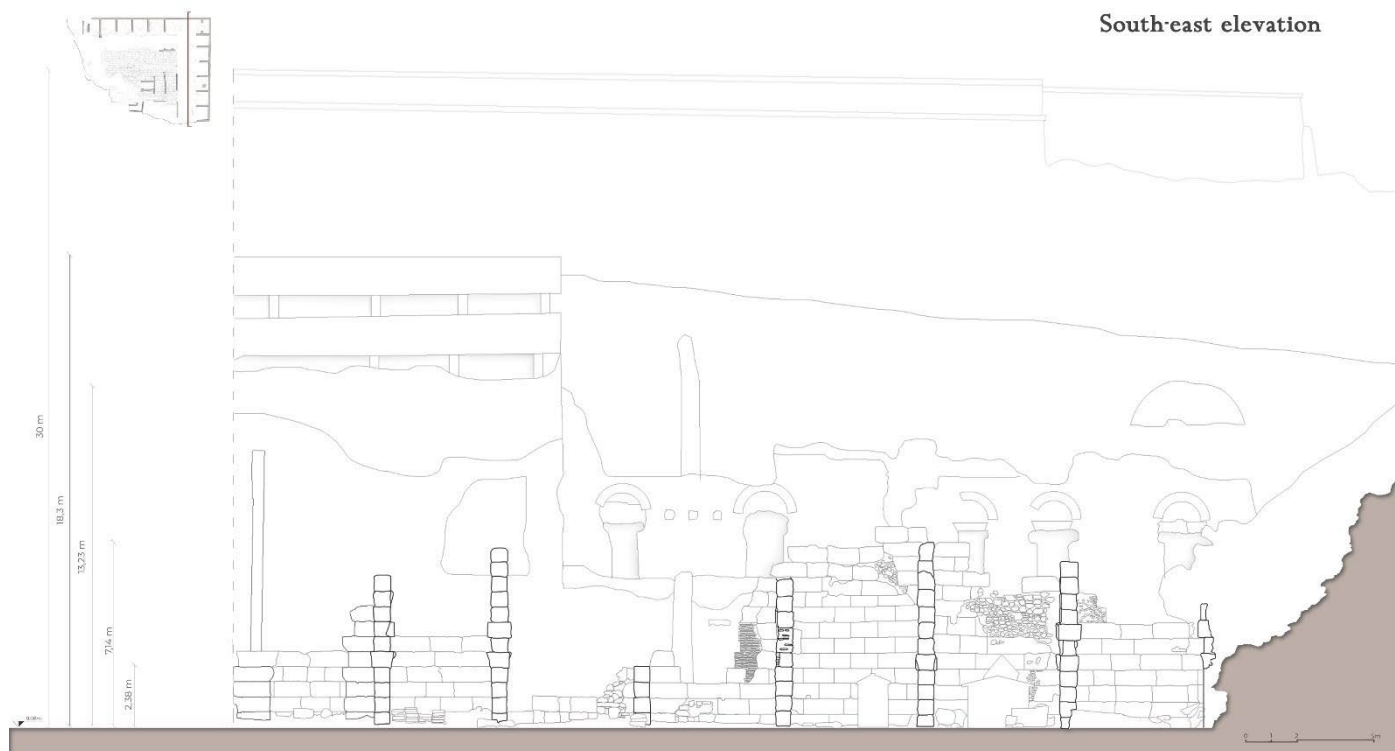


Fig. 9. Francesca Montanaro, South-east elevation



Fig. 10. Francesca Montanaro, South-east elevation photogrammetry

Archaeological remains



Corintian half-capitals.



Pillars of the porch.

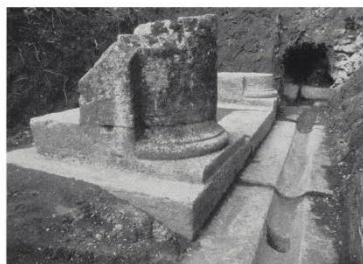


Fig. 11. Nash, Ernest, Archeological remains, semi-capitals, photos

Archaeological remains



Threshold.

Mezzanine.



Fig. 12. Francesca Montanaro, photo

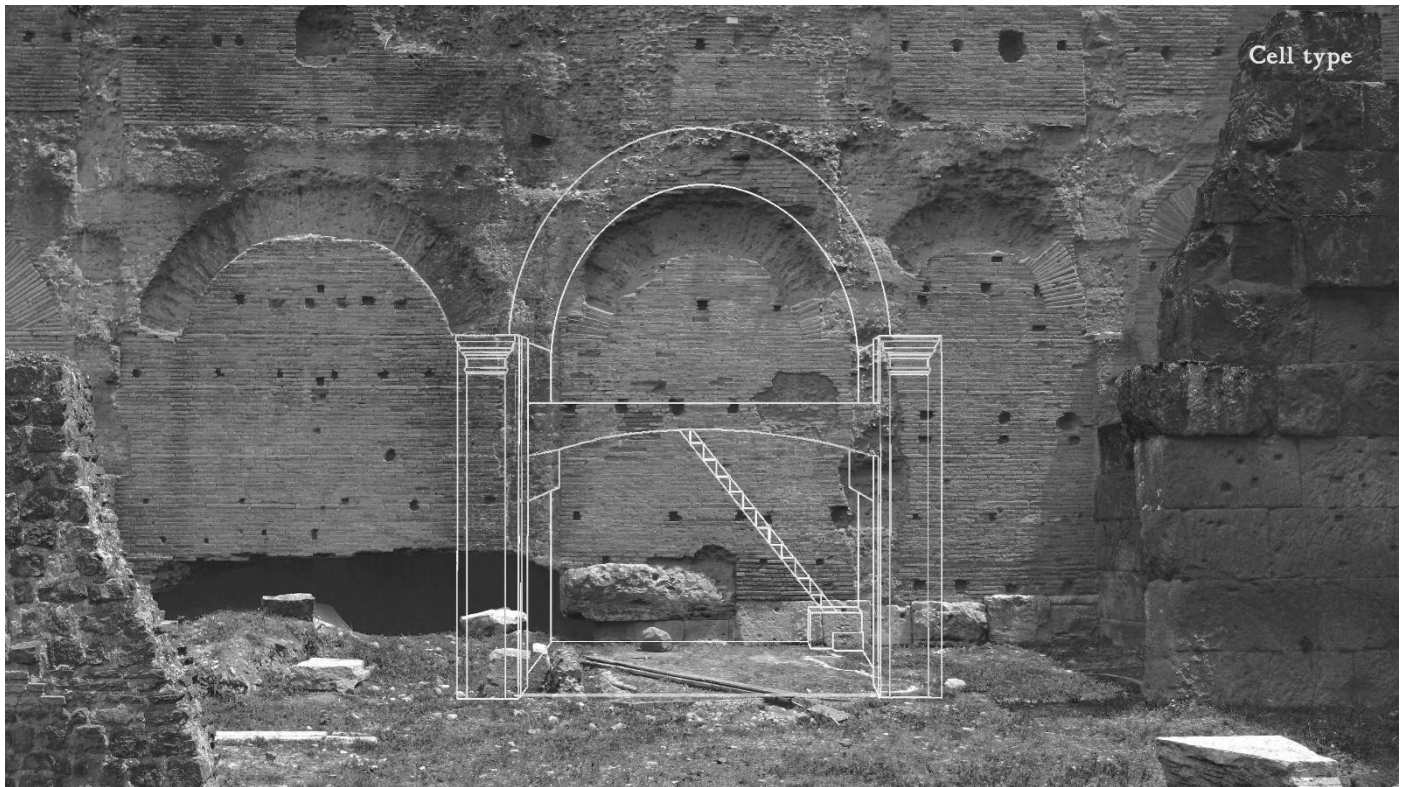


Fig. 13. Francesca Montanaro, Cellae type

Historical traces

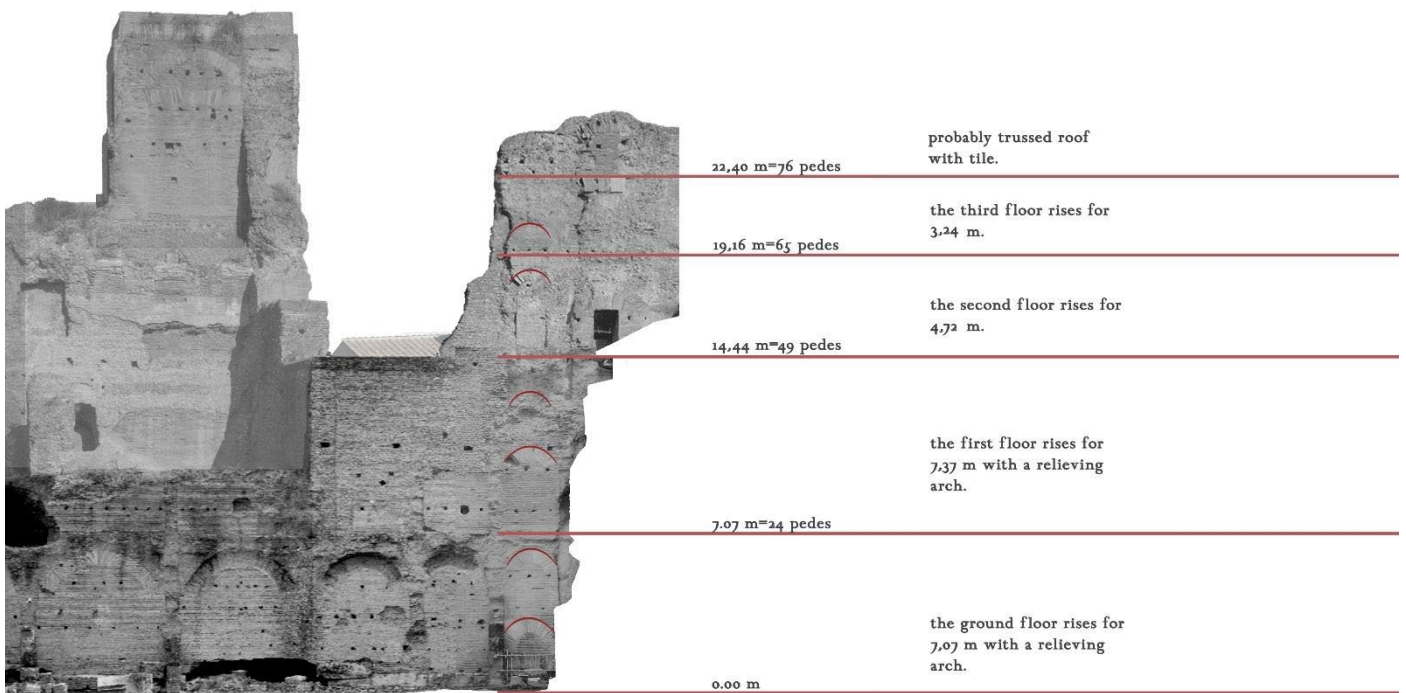


Fig. 14. Francesca Montanaro, historical traces, Domitian wall

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