

Digital survey and architectural representation of a Genoese tower for the Museum of the city and territory of Galata

Original

Digital survey and architectural representation of a Genoese tower for the Museum of the city and territory of Galata / Camiz, Alessandro; Peker, Doruk; Spallone, Roberta; Verdiani, Giorgio; Vitali, Marco. - STAMPA. - 13:(2023), pp. 425-432. (International conference on fortifications of the Mediterranean coast FORTMED 2023 Pisa 23, 24 and 25 March 2023) [10.12871/978883339794854].

Availability:

This version is available at: 11583/2977556 since: 2023-03-28T17:03:51Z

Publisher:

Pisa University Press - edUPV

Published

DOI:10.12871/978883339794854

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)

13 DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN

Marco Giorgio BEVILACQUA, Denise ULIVIERI (Eds.)



DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN
Vol. XIII

PROCEEDINGS of the International Conference on Fortifications of the Mediterranean Coast
FORTMED 2023

DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN
Vol. XIII

Editors
Marco Giorgio Bevilacqua, Denise Olivieri
Università di Pisa

PISA
UNIVERSITY
PRESS

 edUPV
Universidad Politécnica de Valencia

International conference on fortifications of the Mediterranean coast FORTMED 2023, 6. <2023 ; Pisa>
Defensive architecture of the Mediterranean, vol. XIII-XV : proceedings of the International conference on fortifications of the Mediterranean coast FORTMED 2023 : Pisa, 23, 24 and 25 March 2023 / editors Marco Giorgio Bevilacqua, Denise Ulivieri. - 3 volumi. - Pisa : Pisa university press, 2023.

Contiene:

[Vol. 1]: Defensive architecture of the Mediterranean, vol. XIII / editors Marco Giorgio Bevilacqua, Denise Ulivieri

[Vol. 2]: Defensive architecture of the Mediterranean, vol. XIV / editors Marco Giorgio Bevilacqua, Denise Ulivieri

[Vol. 3]: Defensive architecture of the Mediterranean, vol. XV / editors Marco Giorgio Bevilacqua, Denise Ulivieri

725.18091638 (23.)

I. Bevilacqua, Marco Giorgio II. Ulivieri, Denise I. Architettura militare - Fortificazioni - Mar Mediterraneo - Coste - Congressi

CIP a cura del Sistema bibliotecario dell'Università di Pisa

UPI

UNIVERSITY
PRESS ITALIANE

Membro Coordinamento
University Press Italiane

Series *Defensive Architecture of the Mediterranean*

General editor: Pablo Rodriguez-Navarro

The papers published in this volume have been peer-reviewed by the Scientific Committee of FORTMED2023_Pisa

© editors: Marco Giorgio Bevilacqua, Denise Ulivieri

© editorial team: Iole Branca, Valeria Croce, Laura Marchionne, Giammarco Montalbano, Piergiuseppe Rechichi

© cover picture: Giammarco Montalbano, Piergiuseppe Rechichi

© papers: the authors

© publishers: Pisa University Press (CIDIC), edUPV (Universitat Politècnica de València)

Published with the contribution of the University of Pisa

© Copyright 2023

Pisa University Press

Polo editoriale - Centro per l'innovazione e la diffusione della cultura

Università di Pisa

Piazza Torricelli 4 · 56126 Pisa

P. IVA 00286820501 · Codice Fiscale 80003670504

Tel. +39 050 2212056 · Fax +39 050 2212945

E-mail press@unipi.it · PEC cidic@pec.unipi.it

www.pisauniversitypress.it

ISBN 978-88-3339-794-8 (three-volume collection)

ISBN 978-88-3339-795-5 (vol. 13 and electronic version)

© Copyright edUPV (Universitat Politècnica de València) 2023

ISBN: 978-84-1396-125-5 (three-volume collection)

ISBN: 978-84-1396-129-3 (electronic version)

ISBN: 978-84-1396-126-2 (vol. 13)

PROCEEDINGS of the International Conference on Fortifications of the Mediterranean Coast FORTMED 2023

Pisa, 23, 24 and 25 March 2023

L'opera è rilasciata nei termini della licenza Creative Commons: Attribuzione - Non commerciale - Non opere derivate 4.0 Internazionale (CC BY-NC-ND 4.0).

Legal Code: <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode.it>



L'Editore resta a disposizione degli aventi diritto con i quali non è stato possibile comunicare, per le eventuali omissioni o richieste di soggetti o enti che possano vantare dimostrati diritti sulle immagini riprodotte.

L'opera è disponibile in modalità Open Access a questo link: www.pisauniversitypress.it

Organization and committees

Organizing Committee

Chairs:

Marco Giorgio Bevilacqua. Università di Pisa
Denise Olivieri. Università di Pisa

Secretary:

Lucia Giorgetti. Università di Pisa
Stefania Landi. Università di Pisa

Members:

Iole Branca. Università di Pisa
Laura Marchionne. Università di Firenze
Massimo Casalini. Università di Pisa
Valeria Croce. Università di Pisa
Andrea Crudeli. Università di Pisa
Monica Petternella. Università di Pisa
Piergiuseppe Rechichi. Università di Pisa
Giammarco Montalbano. Università di Pisa

Scientific Committee

Almagro Gorbea, Antonio. Real Academia de Bellas Artes de San Fernando. Spain
Bertocci, Stefano. Università degli Studi di Firenze. Italy
Bevilacqua, Marco Giorgio. Università di Pisa. Italy
Bragard, Philippe. Université Catholique de Louvain. Belgium
Bouزيد, Boutheina. École Nationale d'Architecture. Tunisia
Bru Castro, Miguel Ángel. Instituto de Estudios de las Fortificaciones – AEAC. Spain
Cámara Muñoz, Alicia. UNED. Spain
Camiz, Alessandro. Özyeğin University. Turkey
Campos, João. Centro de Estudos de Arquitectura Militar de Almeida. Portugal
Castrorao Barba, Angelo. The Polish Academy of Sciences, Institute of Archaeology and Ethnology.
Poland – Università degli Studi di Palermo. Italy
Croce, Valeria. Università di Pisa. Italy
Cherradi, Faissal. Ministère de la Culture du Royaume du Maroc. Morocco
Cobos Guerra, Fernando. Arquitecto. Spain
Columbu, Stefano. Università di Cagliari. Italy
Coppola, Giovanni. Università degli Studi Suor Orsola Benincasa di Napoli. Italy
Córdoba de la Llave, Ricardo. Universidad de Córdoba. Spain
Cornell, Per. University of Gothenburg. Sweden
Dameri, Annalisa. Politecnico di Torino. Italy
Di Turi, Silvia. ITC-CNR. Italy
Eppich, Rand. Universidad Politécnica de Madrid. Spain
Fairchild Ruggles, Dorothy. University of Illinois at Urbana-Champaign. USA
Faucherre, Nicolas. Aix-Marseille Université – CNRS. France
García Porras, Alberto. Universidad de Granada. Spain
García-Pulido, Luis José. Escuela de Estudios Árabes, CSIC. Spain
Georgopoulos, Andreas. Nat. Tec. University of Athens. Greece
Gil Crespo, Ignacio Javier. Asociación Española de Amigos de los Castillos. Spain

Gil Piqueras, Teresa. Universitat Politècnica de València. Spain
 Giorgetti, Lucia. Università di Pisa. Italy
 Guarducci, Anna. Università di Siena. Italy
 Guidi, Gabriele. Politecnico di Milano. Italy
 González Avilés, Ángel Benigno. Universitat d'Alacant. Spain
 Hadda, Lamia. Università degli Studi di Firenze. Italy
 Harris, John. Fortress Study Group. United Kingdom
 Islami, Gjergji. Universiteti Politeknik i Tiranës. Albania
 Jiménez Castillo, Pedro. Escuela de Estudios Árabes, CSIC. Spain
 Landi, Stefania. Università di Pisa. Italy
 León Muñoz, Alberto. Universidad de Córdoba. Spain
 López González, Concepción. Universitat Politècnica de València. Spain
 Marotta, Anna. Politecnico di Torino. Italy
 Martín Civantos, José María. Universidad de Granada. Spain
 Martínez Medina, Andrés. Universitat d'Alacant. Spain
 Maurici, Ferdinando. Regione Siciliana-Assessorato Beni Culturali. Italy
 Mazzoli-Guintard, Christine. Université de Nantes. France
 Mira Rico, Juan Antonio. Universitat Oberta de Catalunya. Spain
 Navarro Palazón, Julio. Escuela de Estudios Árabes, CSIC. Spain
 Orihuela Uzal, Antonio. Escuela de Estudios Árabes, CSIC. Spain
 Parrinello, Sandro. Università di Pavia. Italy
 Pirinu, Andrea. Università di Cagliari. Italy
 Quesada García, Santiago. Universidad de Sevilla. Spain
 Rodríguez Domingo, José Manuel. Universidad de Granada. Spain
 Rodríguez-Navarro, Pablo. Universitat Politècnica de València. Spain
 Romagnoli, Giuseppe. Università degli Studi della Toscana. Italy
 Ruiz-Jaramillo, Jonathan. Universidad de Málaga. Spain
 Santiago Zaragoza, Juan Manuel. Universidad de Granada. Spain
 Sarr Marroco, Bilal. Universidad de Granada. Spain
 Spallone, Roberta. Politecnico di Torino. Italy
 Toscano, Maurizio. Universidad de Granada. Spain
 Ulivieri, Denise. Università di Pisa. Italy
 Varela Gomes, Rosa. Universidade Nova de Lisboa. Portugal
 Verdiani, Giorgio. Università degli Studi di Firenze. Italy
 Vitali, Marco. Politecnico di Torino. Italy
 Zaragoza, Catalán Arturo. Generalitat Valenciana. Spain
 Zerlenga, Ornella. Università degli Studi della Campania Luigi Vanvitelli. Italy

Advisory Committee

Pablo Rodríguez-Navarro. President of FORTMED. Universitat Politècnica de València
 Giorgio Verdiani. Università degli Studi di Firenze
 Teresa Gil Piqueras. Secretary of FORTMED. Universitat Politècnica de València
 Roberta Spallone. FORTMED advisor. Politecnico di Torino
 Julio Navarro Palazón. LAAC, Escuela de Estudios Árabes, CSIC
 Luis José García Pulido. LAAC, Escuela de Estudios Árabes, CSIC
 Ángel Benigno González Avilés. Departamento de Construcciones Arquitectónicas. Escuela Politécnica Superior Universidad de Alicante

Organized by:



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA
DELL'ENERGIA, DEI SISTEMI,
DEL TERRITORIO E DELLE COSTRUZIONI

**With the collaboration
and the contribution of:**



**With the patronage
and the contribution of:**



With the patronage of:



Partnership:



With the patronage of:



Table of contents

Preface..... XV

Contributions

HISTORICAL RESEARCH

Le vestigia della Grande Guerra: il contributo della manualistica militare per il riconoscimento delle caratteristiche costruttive delle permanenze..... 5
J. Aldrighettoni

Le fonti archivistiche per la storia di un bastione e delle sue molteplici vicende (secc. XVI-XX)..... 13
L. Bedino

Lo scenario difensivo umbro-marchigiano nel primo Seicento: note dalla relazione dell'ingegnere militare Giulio Buratti a papa Urbano VIII 21
M. A. Bertini

Muzio Oddi architetto di fortificazioni nell'Italia del Seicento 29
P. Bertoncini Sabatini

Santa Magdalena: una villa de nueva planta para el sistema defensivo de la Horta d'Alacant (Alacant, España)..... 37
M. Bevià i Garcia, J. A. Mira Rico, J. M. Giner Martínez

La strada di soccorso e gli interventi veneziani a Sebenico nel '400..... 45
D. Bilić, K. Majer Jurišić, J. Pavić

Il disegno delle architetture militari sulle coste mediterranee nella raccolta di Michel Angelo Morello.. 53
C. Boido, P. Davico

L'opera di Francesco di Giorgio Martini in Abruzzo: alcune aggiunte e riflessioni 61
F. Bulfone Gransinigh

Fortified architecture in the name of the octagonal cross. Echo and criticism of the Cottonera bastioned line in Malta 69
V. Burgassi

Le tecniche costruttive del castello di Oriolo in Calabria 77
C. A. Cacciavillani

Il castello di Ischia e l'*insula minor*. Architettura militare, città e paesaggio (XV-XIX)..... 85
F. Capano

I Tosetti di Castagnola (Lugano): ruoli e gerarchie professionali nei cantieri delle difese sabaude nel corso del Seicento	93
<i>M. V. Cattaneo</i>	
Le motte e i dongioni de <i>La Tapisserie de Bayeux</i> . Materiali sulla storia e l'iconografia dell'architettura fortificata normanna dell'XI secolo	101
<i>G. Coppola</i>	
Al soldo di Richelieu: un frate spia e i lavori di potenziamento alla piazzaforte spagnola di Breme	109
<i>A. Dameri</i>	
Il forte di Santa Maria nel Golfo della Spezia. Materiali per la ricostruzione virtuale del manufatto storico andato distrutto	117
<i>V. De Santi, C. A. Gemignani, L. Rossi</i>	
Castel Gonzaga di Messina.....	123
<i>G. Di Gregorio</i>	
Notas investigativas sobre el legado de los Antonelli en el Caribe; Reformas al Sistema de Defensa de la ciudad de San Juan de Puerto Rico siglos XVI-XVII.....	131
<i>M. Flores Román</i>	
“Fora les muralles!” la excavación de la muralla renacentista de Cullera durante las obras de peatonalización del Paseo del Dr. Alemany	139
<i>E. Gandía Álvarez</i>	
Polyorcetic adaptations of the fortifications of the Order of Calatrava: the case of the Castle of La Peña (Spain).....	145
<i>L. J. García-Pulido, J. Navarro Palazón</i>	
Disegni di città e fortezze. Gli interessi politici e culturali dei granduchi Medici di Toscana per le fortificazioni di terra e di mare tra '500 e '600	153
<i>A. Guarducci</i>	
Le fortificazioni di Mahdiya nel <i>Kitab Ghara'ib al-funun wa-mulah al-'uyun</i> (X-XII secolo).....	161
<i>L. Hadda</i>	
La propuesta de fortificación del castillo de Bellver realizada en el siglo XVIII	171
<i>M. C. López González, J. García Valldecabres, M. T. de Arnaiz Martín</i>	
Nuovi documenti per la conoscenza delle fortezze delle isole di Candia e Cipro (XVI sec.).....	179
<i>E. Maglio</i>	
El alzamiento de la isla Plana (o de Santa Pola) para su fortificación, hoy Nueva Tabarca.....	187
<i>A. Martínez-Medina, A. Pirinu</i>	
The Torre chica: Reconstruction of the history of Sidi Fredj (Algeria).....	195
<i>O. Menouer</i>	
El modelo defensivo del presidio de la ciudad de San Agustín de la Florida-USA, entre los siglos XVI y XVIII.	201
<i>Y. Morales Hidalgo, J.C. Piquer Cases, E. Capilla Tamborero</i>	

“Sit obligatus artem docere omnes querentes et volentes discere”: seguaci ed allievi di Baldassarre Peruzzi, architetto militare senese	209
<i>B. Mussari</i>	
Fortification Inventories in the Early Modern eastern Adriatic as Research Tools	217
<i>K. Papeš</i>	
Il castello-palazzo della ‘Rocca’ dei Valdina nella Sicilia orientale	223
<i>F. Passalacqua</i>	
The uncovering of forgotten fortifications and other findings from recent field surveys and archival research of the frontiers of Šibenik district (2018-2021)	231
<i>J. Pavić, A. Nakić</i>	
Leggere e rappresentare l’architettura militare. Forma e progetto della cinta muraria di Castelsardo in epoca moderna	239
<i>A. Pirinu, G. Sanna</i>	
Torino, Borgo nuovo (1800-1839). Bastioni vs crescita urbana	247
<i>A. Pozzati</i>	
Cronaca e propaganda. Immagini di fortificazioni anatoliche nel primo decennio del XVII secolo.....	255
<i>G. Scamardi</i>	
L’ampliamento del fronte bastionato orientale di Cagliari e la demolizione del convento di Nostra Signora di Gesù (1717-1732)	263
<i>M. Schirru</i>	
La lunga pianificazione del sistema di difesa costiera del Regno di Sardegna	271
<i>G. Serreli</i>	
Livorno vista dal mare. L’evoluzione fortificatoria del waterfront portuale	279
<i>D. Ulivieri, O. Vaccari, I. Branca, L. Giorgetti</i>	
THEORETICAL CONCEPTS	
Castel Nuovo: un castello-fortezza sul waterfront di Napoli	289
<i>C. Aveta</i>	
Le cittadelle pentagonali: dalle rive del Po alle coste dello Stato dei Presidi	295
<i>F. Brogna</i>	
Dos fortificaciones de campaña en los Andes colombianos (s. XIX)	303
<i>J. Galindo-Díaz, C. Salazar-Ocampo, R. Tolosa-Correa</i>	
“...Per non entrare in spesa de’ baloardi...” Il progetto della fortificazione ibrida di Gaspare Beretta per Domodossola	311
<i>P. Negri</i>	
Comprehensive typomorphological approach to the studies on the bastion castle phenomenon in the former Polish lands	321
<i>O. Tikhonova</i>	

Giacomo De Lanteri. Il ruolo del disegno nell'architettura della difesa tardo-cinquecentesca 329
O. Zerlenga, V. Cirillo

RESEARCH ON BUILT HERITAGE

On the Fort of Granatello, to keep its memory alive 339
R. Amore

Le mura romane di Aosta: le prime attività di Alfredo D'Andrade all'azione di tutela della Soprintendenza 349
L. Appolonia, B. Scala

Construction and development of the castle of Molyvos, Lesbos..... 359
K. Aslanidis

Conservazione e manutenzione all'interno di una città patrimonio UNESCO: il caso studio delle mura difensive di Urbino 367
L. Baratin, A. Cattaneo

Integrated use of ground penetrating radar and time domain reflection for volumetric water content evaluation in wood structures inside the castle of Carosino (Taranto, Italy)..... 375
D. F. Barbolla, L. De Giorgi, L. Longhitano, C. Torre, G. Leucci

Il tema dei siti fortificati in Sardegna tra perdita, restauro e riuso 383
B. Billeci

La Torre degli Upezzinghi a Caprona: analisi storico-archivistica e rilievo digitale per la documentazione dell'evoluzione temporale 391
D. Billi, V. Croce, G. Montalbano, P. Rechichi

La torre di Tabbiano e il sistema di difesa dei confini della Repubblica Pisana in età medioevale: analisi storica finalizzata alla conservazione ed alla valorizzazione 401
I. Branca

Evolución del frente murario más destacado y simbólico del recinto de la Alhambra: la muralla norte 409
V. C. Brazille Naulet, A. Orihuela Uzal, L. J. García-Pulido

Nicosia Venetian Walls. Common conservation strategies for a divided palimpsest 417
G. Bressan, A. Evangelisti, P. Martire, L. Shamir

Digital survey and architectural representation of a Genoese tower for the Museum of the city and territory of Galata..... 425
A. Camiz, D. Peker, R. Spallone, G. Verdiani, M. Vitali

Il castello di Francavilla di Sicilia. Un presidio fortificato sulla Valle dell'Alcantara. Dall'epoca medievale alla guerra austro-spagnola 433
M. T. Campisi

Le fortificazioni come elementi di reti difensive a scala territoriale. La Fortezza di Agrò nel territorio della costa jonica messinese 441
M. T. Campisi, M. Turnaturi

The pioneering intercontinental framework of Portuguese fortification in the Expansion 449
J. Campos

Le Casematte in Calabria. Architetture di un sistema difensivo del Novecento.....	457
<i>M. R. Caniglia</i>	
Architetture difensive nella Piana di Sibari in Calabria. Scenari per la conservazione e la valorizzazione.....	465
<i>B. Canonaco</i>	

Digital survey and architectural representation of a Genoese tower for the Museum of the city and territory of Galata

Alessandro Camiz^a, Doruk Peker^b, Roberta Spallone^c, Giorgio Verdiani^d, Marco Vitali^e

^a Özyeğin University, Istanbul, Turkey, alessandro.camiz@ozyegin.edu.tr, ^b Pekerler İnşaat, Istanbul, Turkey, dorukpeker@gmail.com, ^c Politecnico di Torino, Torino, Italy, roberta.spallone@polito.it, ^d Università degli Studi di Firenze, Firenze, Italy, giorgio.verdiani@unifi.it, ^e Politecnico di Torino, Torino, Italy, marco.vitali@polito.it

Abstract

Galata, one of the oldest districts in Istanbul, still shows a historical and multi-layered urban texture. In 2019, within the “Urban Facade-Istanbul Waterfront” international workshop, a 3D laser scanner survey of Galata’s city walls was carried out. The raw data therein collected became the basis for a thesis in Architecture, as part of a joint research (Politecnico di Torino, Özyeğin University, Università di Firenze) on the fortified systems in the Mediterranean area. The multidisciplinary research comprised the historical study of the transformation of the urban tissue in the considered area, and the relationships between the city, the walls, and the towers. We processed the digital survey with the aim of realizing 3D models and orthophotos of a sector of the walls characterized by a Genoese semicircular tower, which today is abandoned. The final drawings are aimed at recognizing the building’s transformations, the different materials, and the relationship between the monument and the context. The research also outlined the damages, underlining the urgency of restoration works.

Keywords: digital survey, 3D modeling and representation, open-air museum, Galata.

1. Introduction

Galata, one of the oldest districts in Istanbul, still shows an historical and multi-layered urban texture. In 2019, within the “Urban Facade-Istanbul Waterfront” international workshop, (Özyeğin University), a team led by G. Verdiani carried out a 3D laser scanner survey of Galata’s city walls. The raw data therein collected became the basis for Doruk Peker’s thesis in Science of Architecture at Politecnico di Torino, supervisors R. Spallone, A. Camiz, M. Vitali, as part of a joint research (Politecnico di Torino, Özyeğin University, Università di Firenze) on the fortified systems in the Mediterranean area. The multidisciplinary research comprised the historical study of the transformation of the urban tissue in the considered area, the relationships between the city and the walls, and the construction of the walls and the towers (1).

Then, the digital survey has been assumed and processed with the aim to realize 3D models and orthophotos of a sector of the walls characterized by a Genoese semicircular tower today in state of abandon and obsolescence. The detailed drawings testified the superfetation occurred in the building as well as the constructive materials and unified the different information for an integrated communication declaring the data accuracy through a codified system of graphic conventions. The final plans, elevations, and sections, aimed at recognizing the building’s transformations, the different materials, and the relationship between the monument and the context. The research also outlined the damages, underlined the urgency of restoration works and suggested the design of an open-air museum, entitled “Museum of the city and territory of Galata”.

2. Urban Transformations of Galata and the walls

The topographical knowledge of Constantinople is generally fragmentary, but the formation process of Pera, also referred as *Regio tertiadecima* in the *Notitia Urbis Constantinopolitana*, is barely known. The Ottoman period of Galata has been widely studied and documented (Cuneo, 1987), but for the earlier phases, besides Dallegio D'Alessio's (1946) detailed reconstruction, the research of Paolo Cuneo (1983-1987) and the recent studies on the Genoese period (Sağlam, 2018), the knowledge about this part of the city is almost a *tabula rasa*. Wolfgang Müller (1993) published plans where the only topographic feature in Byzantine Pera are the Genoese walls, even the most recent plans of the Byzantine phase of the Polis (Dewing, 2015), show only the Galata Tower, which is known to have been built by the Genoese administration in 1348.

Within this knowledge of the Topography of Pera (today Karaköy), we attempted the application of the Caniggian (Caniggia, 1979) morphological analysis of the cyclical inversion of centers and limits, in strict correlation with the opposite shore of the Kryson Keras, where the growth process is known from sources and archaeological evidences. This comparative approach derived from the diachronic evolution of Byzantium and its Roman transformations, with particular focus on the changing positions of city walls and the different central *forum*, the parallel hypothetical evolution of Pera, starting from the first Megarean



Fig. 1- Map of Constantinople in the VI century, Procopius. The Anecdota or Secret History. Translated by H. B. Dewing. Loeb Classical Library 290. Cambridge, MA: Harvard University Press, 1935, p. 361

colony, through two subsequent Roman additions (Constantine/Honorius and Justinian). The results of this hypothetical diachronic reconstruction were confirmed by the scarce documentary sources, the archaeological evidence of Roman hydraulic infrastructures, as well as the results of the orientation analysis of the contemporary urban tissue, establishing, therefore, a topographical

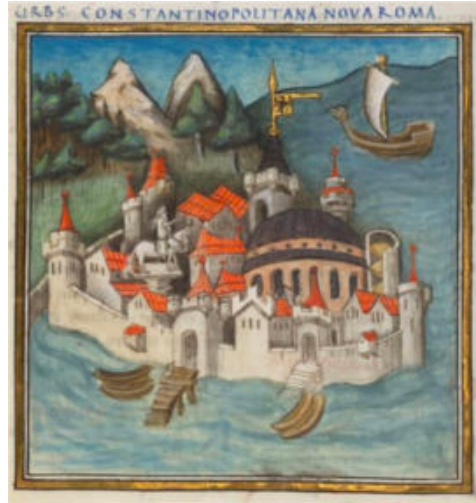


Fig. 2- *Urbs Constantinopolitana. Nova Roma*, MS canon. misc. 378 f. 84r, 1436 (© Bodleian Libraries, University of Oxford)



Fig. 3- *Liber insularum Archipelagi*, Cristoforo Buondelmonti, 1470 ca. (Biblioteca Medicea Laurenziana, MS. Plur. 29, 25)

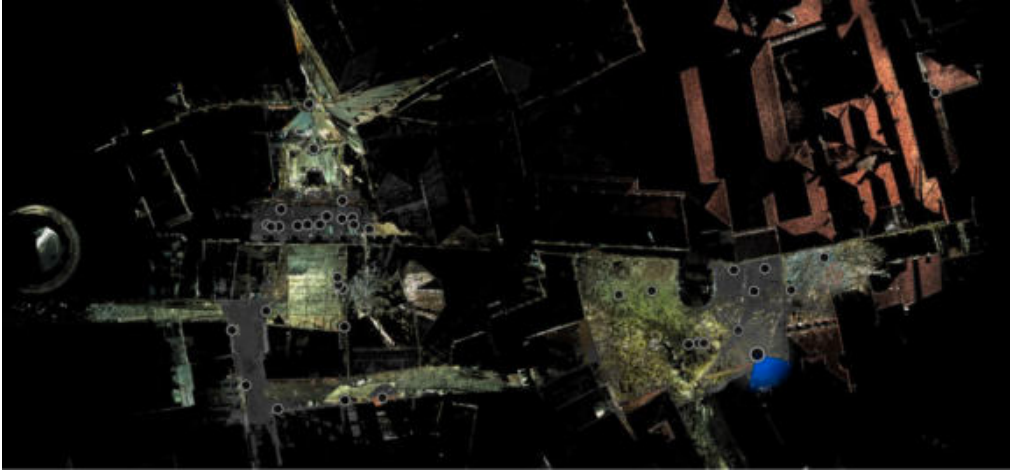


Fig. 4- The whole set of scan stations from a top orthographic view, on the left of the Galata Tower

plan localizing the main features of the Roman and Byzantine settlement of Pera, Sykai, Galata.

3. Digital Survey of the fortifications

Documenting a fragmented architecture needs accuracy, accessibility, and correct positioning. Each piece of built history needs a proper level of details to allow efficient reading, the most complete coverage of all its parts, and the certainty of having it well aligned in the present urban tissue. The digital survey of the towers and their surrounding areas was based on one single 3D Laser Scanner unit (3DLS), with a working range up to the distance of 300 meters. The model in use was a well-known and not that recent unit, a Leica Geosystems ScanStation C10, a 3DLS based on 'time of flight' measurement (Bini & Bertocci, 2012). It has the features of gathering points in a panoramic field of 360° on the horizontal and 270° on the vertical. Each gathered point got a measurement accuracy of about four millimeters at ten meters on standard reflective materials (Bianchi et al. 2016).

All the scanning work was planned to obtain a point cloud with a level of definition between the architectural and the urban scale. For this, the settings of the 3DLS and its positioning were set with the aim of producing a grid of about one point each centimeter at ten meters of distance for almost each scan station. The C10 unit has also the feature of taking panoramic pictures for coloring the resulting point cloud, with its internal camera taking a sequence of shots immediately

used to remap the colors of the gathered point cloud without causing any parallax error because its position and field of view are exactly the same of the laser measurement system. This function, even if time-consuming (about four minutes for each scan station, which means adding an equal time to the point-cloud scanning itself), is very useful in the documentation of the remains of these fortifications, making it easier to recognize the complex stratigraphy of the phases, from the original parts to the various reuses with all their weird elements, describing with plenty of details in a complete 3D model all the masonry works, iron elements, cracks, holes, fallen pieces. For covering all the areas accessible in safety conditions, a total of 40 scans were operated in the turn of one afternoon. The scanner positioning was planned in a classic logic of having sufficient overlapping between scanned areas. The intervention was brought on in the main space around the first tower (for a period occupied by industrial uses); then with a specific intervention for the second tower (in extremely bad conditions and not directly accessible) which was surveyed from the distance positioning the scanner along the nearby roads and lots; in the end, a large portion of masonry work from the original walls was surveyed from the inside of recent building growth against the fortification and now used as a restaurant. The results were then quite fragmentary, but it was possible to align them in a single model exploiting the long-range capability of the scanner and targeting quite far elements like the Galata Tower itself and various tall buildings

and roofs. The area with the first tower was covered with 14 scans, the area with the second tower was covered with 10 scans, the portion of walls in the restaurant was covered with 15 scans, and one extra scan was taken from the roofs in a nearby area to allow a more efficient alignment of all the sectors. The bad conditions of the interiors of the towers blocked access for taking scans from the inside, thus the various openings allowed to gather a certain amount of metric information for estimating the thickness of the walls and the main aspects of the masonry work

4. The Genoese tower: Artifact reading and raw data integration

The tower on which the work of analysis and graphic interpretation focused is the second tower on the surveyed portion of the wall, which extends southwest of the Galata Tower.

The U-shaped tower measures approximately 9.80 x 7.70 m in plan and about 16 m in height: the circular facade faces a courtyard to the north, which is currently used as a parking lot; to the south, it passes the city walls, which in turn are adjacent to St. Peter's Church.

Direct observation clearly shows how the building is founded on the rock (the ground level has decreased over time, gradually uncovering the foundations, which to this day emerge above ground), and the numerous traces of artifacts

and plaster suggest the presence of buildings that were built over time adjacent to the tower and subsequently collapsed or demolished. Today, between these pre-existing buildings, a warehouse structure remains, adjacent to the southwestern facade of the tower. The building is currently empty and unused.

Due to uses unsuitable for the building's function, architectural elements have been added over time that is not appropriate to the original nature of the building and its structural characteristics (holes, intermediate floors, facade cladding, etc.), which have resulted in a general weakening of the structure: cracks and projecting girders are distributed on all exterior wall surfaces. At present, the tower also lacks a roof, which considerably accelerates its deterioration process.

In an example such as this, interpretation of the raw data is particularly important, since the information derived from each survey method is incomplete and requires significant work of interpretation and integration.

The laser scanner survey comprehensively rendered all the exterior surfaces of the artifact, but for numerous reasons, it was not possible to carry it out on the interior of the structure as well: for the interior parts, the restitution work had to make use of the information derived from direct survey and observation, since the interior floors are missing. The drawings were made from thin,



Fig. 5- View of Tower one from the point cloud, colored map mode, panoramic view

horizontal, and vertical point cloud slices: the information from these slices was supplemented by direct surveys of interiors. The elevations were drawn thanks to the photoplanes obtained by projecting the point cloud on planes parallel to the main layout of each elevation.

The entire data integration and restitution work were done in the AutoCAD environment, after appropriate operations necessary to manage the point clouds in the Recap environment.

5. Graphic restitution

The graphic restitution of the digital survey aims to constitute a documentary basis useful as a testimony to the state of conservation of the remains and as a means for the elaboration of conservation and enhancement proposals. Hence the choice of the scale of reduction is 1:50, a scale that entails the representation of the textures of materials, door and window frames (when present), and the main signs of degradation related to structures (fractures, lacunae,...), materials (washouts, detachments,...), and vegetation infestation.

The choice of horizontal section planes was guided by the recognition of the openings, including the filled ones, and the placement of the thin interior slabs, directly surveyed due to the impossibility of scanning the interiors. Six plans, at different levels, were considered adequate to

provide a comprehensive representation of the artifact. Four vertical sections were considered useful for the representation of the main masonry discontinuities and back elevations. These are the drawings in which the integration of survey techniques proved most effective, allowing the geometric and material characteristics of the interiors to be defined.

Finally, the three elevations, were drawn based on the ortho-photoplanes obtained from the point cloud and supplemented with numerous detailed eidotypes performed on-site and directly measured.

Therefore, the drawings condense the peculiarities of geometric, architectural, and thematic surveying, the latter dedicated to the representation of materials. For this representation, conventional hatches prescribed by the graphic standards (UNI 3972/1981 and UNI ISO 128-50) have been selected and integrated with those consolidated in international manuals.

In conclusion, the detailed drawings testify to the stratifications that affected the building as well as the construction materials.

The drawings unify the different information for an integrated communication declaring the data accuracy through a codified system of graphic conventions. The final plans, elevations, and cross sections achieve the goal of recognizing the



Fig. 6- The scanner unit at work from the buildings around tower two

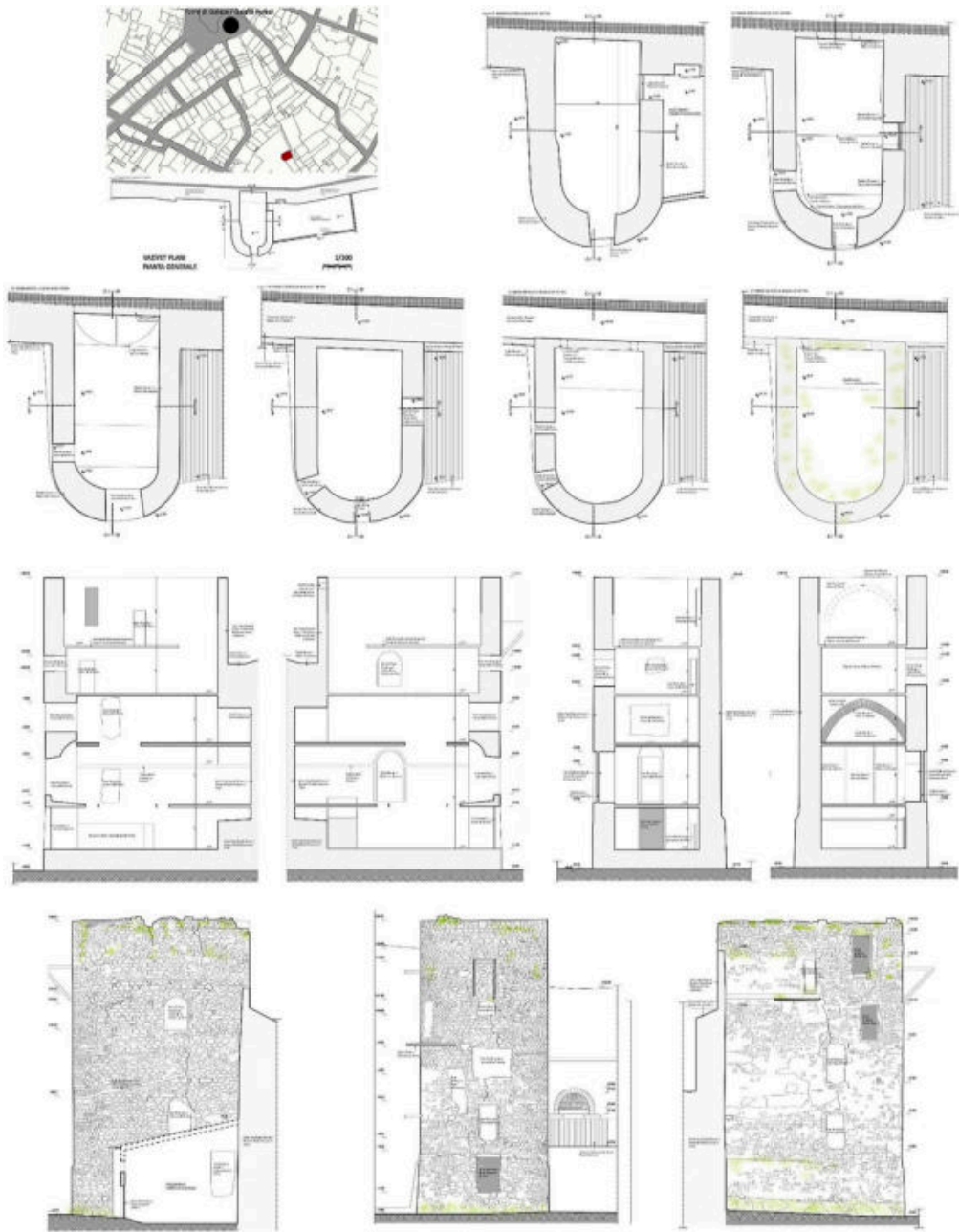


Fig. 7- Digital drawings of the Genoese tower. Plan view, plans, cross sections, and elevations, original scale 1:50 (editing by Doruk Peker)

building's transformations, the different materials, and the relationship between the monument and the context. They also outlined the damages, underlining the urgency of restoration works

aimed at the design of an open-air museum, entitled "Museum of the city and territory of Galata".

6. Conclusion

A neglected building will always benefit from a survey intervention, its documentation fixes the conditions and allows an easy sharing of a massive amount of data. Even in case of full loss, the detailed drawings may allow at least a virtual reconstruction of the built heritage, otherwise completely lost. Once more, the use and sharing of digital documentation allows many different competencies and uses to be applied to the architecture, promoting options for recovery and new ideas. The accurate description of the masonry works and of the shapes of architecture allows for a better understanding of periods and the logic of the original system, adding useful clues for a better knowledge of the building. In the case of the remains of the walls of Istanbul and their towers, the value of the constructions themselves is amplified by the high risk of loss, while at the same time, their specificity and unicity are elements worth to be enhanced and exploited in the overall recovery of the Galata neighborhood which is otherwise at risk of being gradually converted into an anonymous and a poorly 'globalized' collection of restaurants and temporary residence activities (Verdiani et al. 2019).

Notes

(1) While the research is the result of the collaboration between the authors, paragraphs 1 and 6 were written by all authors, paragraph 2 by

A. Camiz, paragraph 3 by G. Verdiani, paragraph 4 by M. Vitali, paragraph 5 by R. Spallone.

Acknowledgements

All the original survey operations took place during the workshop "Urban Façade: Istanbul Waterfront" coordinated by prof. Alessandro Camiz in March 2019; the workshop was organized by the Özyeğin University and the University of Parma with the participation of Sapienza University of Rome, University of Naples "Federico II", DiDALabs System, Department of Architecture, University of Florence, Università degli Studi "Mediterranea" di Reggio Calabria. The survey workshop was coordinated by prof. Giorgio Verdiani and dr. Andrea Braghiroli from the University of Florence in collaboration with Bora Yavuz from the Litech Engineering Company, Istanbul, the teaching activities were tutored by Ezgi Çiçek, Elif Aktaş Yanaş, Emilia Valletta, Can Uzun, Chiara Alessi, Silvia Michelon, Anastasia Cottini. The participants were Ecem Boyacı, Aylin Erol, Aliyar Yıldırım, Olcay Yıldızgördü, Büşra Meriç, Valerio Musitwa, Enis Tan Ulman, Emine Şen. The architectural representation is part of the thesis in Science of Architecture discussed in 2020 at the Politecnico di Torino by Doruk Peker, "The architectural survey of the semicircular tower in Galata district – Istanbul", supervisor Roberta Spallone, advisors Alessandro Camiz and Marco Vitali.

References

- Bini, M. & Bertocci, S. (2012) *Manuale di rilievo architettonico e urbano*. Torino, CittàStudi.
- Bianchi, G., Bruno, N., Dall'Asta, E., Forlani, G., Re, C., Roncella, R., Santise, M., Vernizzi & C., Zerbi, A. (2016) Integrated Survey for Architectural Restoration: a Methodological Comparison of Two Case Studies. In: *Proceedings of the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLI-B5, XXIII ISPRS Congress, 12–19 July 2016, Prague, Czech Republic*.
- Camiz, A., Alessi, C. & Michelon, S. (2019) Integrated digital survey of the urban tissues in Galata waterfront, Istanbul. A typo-morphological approach. In: Conte, A. & Guida, A. (eds.) *Reuso Matera. Patrimonio in divenire, conoscere, valorizzare, abitare, VII International Conference Reuso 2019, October 23-26 2019, Matera, Italy*. Roma, Gangemi International, pp. 297-308.
- Camiz, A. (2020) *Galata waterfront: models, types, and the morphology of meaning in architecture*. In: Russo, A. (ed.) *Reggio Calabria Istanbul. Un progetto per Galata. A project for Galata. International Urban Design Workshop 2019. Urban Façade: Istanbul Waterfront* (International Urban Design Workshop 2019, Urban Façade: Istanbul Waterfront, Istanbul, 23-30 March 2019, Istanbul). Siracusa, Lettera Ventidue, pp. 8-9.
- Camiz, A. (2022) Cyclical inversion of limits and centres: the formation process of the Regio quartadecima, Constantinople. In: Feliciotti, A. & Fleischmann, M., (eds.) *ISUF Annual Conference Proceedings of the XXVIII International Seminar on Urban Form: "Urban Form and the Sustainable and Prosperous*

- City". Glasgow, University of Strathclyde Publishing, pp. 687-694.
- Caniggia, G. & Maffei, G. L. (1979) *Composizione architettonica e tipologia edilizia. 1: Lettura dell'edilizia di base*. Venezia, Marsilio.
- Cuneo, P. (1983-1987) Galata e Pera. Introduzione allo studio dei quartieri 'Latini' di Istanbul. *Quaderni dell'Istituto di storia dell'architettura*, n.s., fasc.1-10, 113-122.
- Cuneo, P. (1987) Sinan's Contribution to the Design of Galata Waterfront. *Environmental Design: Journal of the Islamic Environmental Design Research Centre*, 1-2, 210-215.
- Dallegio D'Alessio, E. (1946) Galata et ses environs dans l'antiquité. *Revue des études byzantines*, 4, 218-238.
- Dewing H. B. (2015) *Procopius Caesariensis*, Cambridge, Harvard University Press.
- Gottwald, J. (1907) *Die Stadtmauern von Galata: Deutsche Erinnerungen vom Bosphorus*. Konstantinople, A.D. Mordtmann.
- Müller-Wiener, W. (1977) *Bildlexikon zur topographie Istanbuls: Byzantion-Konstantinopolis-Istanbul bis zum Beginn des 17 Jahrhunderts*. Tübingen, Wasmuth.
- Notitia Urbis Constantinopolitanae*, Ms. canon. misc. 378, (1436), Bodleian Library, University of Oxford.
- Sağlam, H. S., (2018) *Urban Palimpsest At Galata & An Architectural Inventory Study For The Genoese Colonial Territories in Asia Minor*. [PhD Thesis]. Milano, Politecnico di Milano, Department of Architecture and Urban Studies.
- Sağlam, H. S., (2020) Transformation and Continuity of Sacred Places: The Case of Galata (Istanbul). *İdealKent*, 11 (31), 1832-1855.
- Sağlam, H. S., (2020) An interdisciplinary experiment for the urban morphology of Galata (Istanbul) and its surroundings during the Late Antiquity and Middle Ages. *A|Z ITU Journal of the Faculty of Architecture*, 17 (3), 13-30.
- Sağlam, H. S., (2021) A Reevaluation for the Genoese Period of the Galata Tower: Epigraphy and Architectural History. *In-Scriptio: revue en ligne d'études épigraphiques* 3, ISSN: 2553-5293.
- Schneider, A. M. & Nomidis, M.I. (1944) *Galata Topographisch-Archaologischer Plan*. Istanbul, Emel, Basimevi.
- Verdiani, G., Arslan, P. & Çiçek, E. (2019) Urban Transformation and Evolution of the Beyoglu Waterfront in Istanbul. In: Conte, A. & Guida, A. (eds.) *Re USO Matera Patrimonio in Divenire conoscere valorizzare abitare*. Roma, Gangemi, pp. 1215-1226.

Volume pubblicato nel mese di marzo 2023

