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Michele RUSSO, Marta ACIERNO (Eds.)

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Editors
Michele Russo, Marta Acierno
Sapienza Università di Roma

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Preface

Fortifications constitute one of the most complex and stratified expressions of the built heritage, in which technical knowledge, political structures, territorial strategies and cultural representations are closely intertwined. Their understanding necessarily rests on an interdisciplinary approach, capable of bringing into dialogue historical, architectural, engineering, archaeological and landscape perspectives. Within this framework, the historiographical reflection of Marc Bloch appears particularly pertinent and fruitful, as it highlights how historical knowledge is grounded in the crossing of perspectives and in the capacity to interrogate the traces of the past through multiple viewpoints; a principle that finds in fortified architectures a particularly productive field of application, given their systemic nature and their long duration over time (Bloch, M., *Apologie pour l'histoire ou Métier d'historien*, Paris, 1949). As a matter of fact, fortifications are not merely military artefacts, but complex devices that have structured cities and territories, contributing decisively to the definition of their forms and spatial hierarchies. They are situated at the intersection of different scales, ranging from the territorial and urban dimensions to the level of construction and material detail. Within this multiscalar articulation, architecture assumes the role of a hinge, capable of connecting urban design with knowledge of construction techniques, and the overall layout of defensive systems with the material reality of structural solutions. To understand fortifications therefore means recognizing and interpreting the relationships between these different scales, avoiding reductive approaches and fragmented readings.

The international conference FORTMED, conceived as a space for encounter and exchange among different disciplines and research traditions, offering a qualified forum for discussion on issues related to the knowledge, conservation, and enhancement of fortifications. In a context marked by profound social, environmental, and technological transformations, the conference aims to contribute to the construction of a shared culture of fortified heritage, grounded in a critical awareness of its historical, architectural, and landscape values, as well as of its role in the present.

The idea for FORTMED was born in 2014 from the brilliant initiative of a research group at the Polytechnic University of Valencia, coordinated by Pablo Rodríguez-Navarro, who gathered international researchers on this topic with the primary objective of exchanging and sharing knowledge on fortifications to understand better, evaluate, manage, and enhance them. On this basis, the FORTMED 2015 conference, organised at the Instituto Universitario de Restauración del Patrimonio of the Universitat Politècnica de València on 15, 16 and 17 October 2015, was proposed with the hope of starting a new tradition and making FORTMED a consolidated reality. Since then, eight other institutions have taken up the tradition. The second edition of FORTMED 2016 was organised by the Department of Architecture of the University of Florence and chaired by Giorgio Verdiani on 10, 11 and 12 November 2016. The third edition of FORTMED 2017 was curated by Víctor Echarri Iribarren and held on 26, 27, and 28 October 2017 at the Escuela Técnica Superior de Arquitectura of the Universitat d'Alacant. The fourth edition of FORTMED 2018 was organised by the Department of Architecture and Design of the Politecnico di Torino on 18, 19 and 20 October 2018, chaired by Anna Marotta and Roberta Spallone. The fifth edition of FORTMED 2020, organised by the Escuela de Estudios Árabes in Granada under the coordination of Julio Navarro Palazón and Luis José García-Pulido, suffered several setbacks due to the outbreak of the COVID-19 pandemic, moving from an in-person conference scheduled for 26, 27 and 28 March 2020 in Granada to an online conference on 4, 5 and 6 November 2020.

Precisely because of these difficult circumstances and the “slow return to normality”, there was a time jump that led to the sixth edition of FORTMED 2023, organised by the Department of Energy, Systems, Territory and Construction Engineering (DESTEC) of the University of Pisa under the coordination of Marco Giorgio Bevilacqua and Denise Ulivieri on 23 and 24 and 25 March 2023. Since then, conferences have been held annually, with the seventh edition, FORTMED 2024, organised by Gjergji Islami and Denada Veizaj with the support of the Polytechnic University of Tirana, taking place on 18, 19 and 20 April 2024. The eighth edition, FORTMED 2025, was hosted by the University of Campania Luigi Vanvitelli in Caserta and chaired by Ornella Zerlenga and Vincenzo Cirillo on 10, 11 and 12 April 2025.

Looking at this sequence of events, we can appreciate some aspects that make this conference unique. On the one hand, international venues demonstrate a desire to build and grow a large community around the domain of fortifications. On the other hand, there is the incredible quantitative and qualitative richness contained in the macro-theme of fortifications, which is developed through a huge number of theoretical and existing case studies scattered across territories and expressed in multiple forms of study and analysis aimed at knowledge, conservation, and promotion. A complex and rich ecosystem, represented by FORTMED over the years with great care, and perfectly represented by the collection of open-access conference proceedings, which guarantees excellent visibility and accessibility. With the ninth edition of the Rome conference, the FORTMED series of publications reaches 24 volumes in 2026, with more than 10,000 pages dedicated to research on the macro-theme of fortifications, a heritage to be preserved and promoted. The comprehensive overview of such a rich and diverse system of knowledge is certainly a harbinger of future developments, confirming the valuable insight gained in 2015. The same evidence is provided by the fact that the annual event always attracts a large number of scholars, showing that this subject is constantly evolving and offers new nutrition for thought, while increasingly consolidating a community built over time. The FORTMED 2026 Conference, now reaching its 9th edition, will be in Rome from 19th to 21st of February, 2026, hosted by Sapienza University of Rome, with the support of the Department of History, Representation and Restoration of Architecture and the Faculty of Architecture. The conference, following the past format, is structured around seven thematic areas, designed to cover the full spectrum of research and practice in the field of fortified heritage: Historical and Documentary, Theoretical Concepts, Research on Built Heritage, Characterization of Geomaterials; Digital Heritage, Culture and Management of Cultural Heritage, Miscellaneous.

In this context, the challenges and opportunities offered by digitalization assume a central role. Digital technologies now allow the collection, organization and interrelation of large quantities of heterogeneous data, making it possible to construct complex knowledge systems capable of reflecting the multilayered nature of fortifications. However, such tools cannot be regarded as mere technical support: they entail methodological and interpretative choices that profoundly affect the way heritage is understood and, consequently, transformed. The availability of integrated information systems represents a fundamental resource for guiding more informed restoration projects, founded on critical and shared knowledge, and capable of reconciling conservation, use, and transformation. Alongside the established presence of a large number of research projects in the fields of history, design, modelling and representation, diagnostics, it is therefore unsurprising that the Rome edition of FORTMED 2026 features a significant number of contributions devoted to restoration, understood not as an exclusively technical practice or as an isolated specialized field, but as a privileged space of synthesis between historical knowledge, critical interpretation, and design. The restoration of fortifications, given their complex and stratified nature, indeed requires constant engagement with historical reading, material analysis, structural assessment, and interpretation of cultural values, placing design at the centre of an articulate and reflective knowledge process. The prominence of these studies reflects a widespread sensitivity towards design as a critical act, capable of engaging with the long-term endurance, incompleteness, and heterogeneity of fortified systems, while avoiding standardized approaches and one-dimensional solutions. An expression of a shared epistemological stance, which recognizes in restoration design a space of mediation between memory and contemporaneity, between permanence and change. This cultural orientation finds particularly fertile ground in Rome and connects with the well-established tradition of the Roman school of restoration, which has always emphasized the inseparable relationship between reading the work, recognizing its stratifications, and assuming responsibility for contemporary intervention.

Within this framework, the decision to invite Donatella Fiorani as a keynote speaker for the conference is particularly pertinent for the role her research has played in developing a restoration approach founded on critical knowledge and design responsibility, as well as for her specific contributions to the study of fortified architectures, approached as complex systems where constructional, historical, territorial, and landscape dimensions are intertwined. Her work feeds the debate on restoration not merely as a tool of preservation, but as a field of theoretical elaboration capable of guiding the transformation of fortified heritage in the present. Besides, the choice of Pilar Chias Navarro as keynote speaker lies in her interest on the documentation and dissemination of cultural heritage, in particular on the analysis of architecture, cities and landscapes as essential cultural resources. She also specialises in the study of ancient cartography as an essential tool for understanding the evolution of landscapes, as well as in the use of GIS and remote sensing tools for impact assessment. The multidisciplinary and multiscalar research applications of these two invited speakers are representative of the complexity of the fortifications.

Reflection on knowledge is inevitably intertwined with consideration of the processes of heritagization of fortifications and city walls. As Françoise Choay has emphasised, heritage is not a fixed category, but the result of a cultural process that attributes value to certain objects, places, or systems, selecting them within a broader built reality (Choay, F., *L'allégorie du patrimoine*, Paris, 1992). In the case of fortifications, heritagization has involved a profound transformation of status: from functional military infrastructures to elements recognized as carriers of historical, identity-based, and symbolic values. This transition is not without ambiguity, as Choay observes, since the risk lies in reducing heritage to a museumized object or an iconic image, separated from its functional dimension and everyday life. The challenge, therefore, is to consciously manage these processes, recognizing fortifications as active agents in the present, as cultural devices capable of balancing between memory, design, and social practices.

It is no coincidence that this dialogue takes place in Rome, a city where the relationship between walls and urban fabric is particularly evident. The Roman walls, in their various historical phases, do not merely define a defensive perimeter, but rather constitute a threshold—a porous limit that is at once deeply lived. They continue to accompany and shape the experience of the contemporary city, functioning as a spatial and symbolic device that links past and present. Rome thus provides an emblematic context for reflecting on the role of fortifications in the modern city: not as isolated relics, but as cultural infrastructures capable of generating new relationships, practices, and meanings.

Within this perspective, FORTMED 2026 is conceived not only as a moment for presenting the state of the art in research, but also as an opportunity to envision future scenarios, promoting a vision of fortified heritage founded on critical knowledge, design responsibility, and an awareness of the equal and relational value of all its components.

Michele Russo, Marta Acierno
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Contributions

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The Kasbah of Mehdiya, the early historical development of a Moroccan fortress

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Abstract

Kasbah Mehdiya is a historic military citadel at the mouth of the Sebou River on Morocco's Atlantic coast, about 12 km from Kenitra. Its strategic location made it a key outpost for logistics, military, and commerce. Despite its importance, historical research has mainly focused on the Spanish and Alaouite periods, while its Almohad origins remain underexplored. This study offers an interdisciplinary analysis aimed at critically reconstructing the site's earliest construction phases. Through a comparative study of ten Almohad fortresses in Morocco, Spain, and Algeria, the research combines historical and architectural analysis with systematic documentation of the surviving structures. Surveying employed drone-based photogrammetry and SLAM technologies, providing a reliable metric basis for interpretation. Rather than advancing digital data workflows, the project emphasizes a historically grounded reading of the Kasbah's origins and early transformations. References to HBIM and heritage ontologies are limited, pointing to future strategies for semantic data integration and conservation planning. Supported by the Italian Ministry of Foreign Affairs and International Cooperation (MAECI), the project offers a new interpretation of the Almohad phase of Kasbah Mehdiya and contributes to its integrated conservation and enhancement.

Keywords: Almohad fortifications, architectural heritage, historical evolution, digital survey, photogrammetry SLAM.

1. Introduction

Located at the mouth of the Sebou River on Morocco's Atlantic coast, the Kasbah of Mehdiya holds a strategically important place in the historical and geopolitical landscape of the western Maghreb. The Sebou, Morocco's main navigable river, connects the coastal zone with the agricultural Gharb and cities like Fez and Meknes, forming a natural commercial corridor

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since antiquity. Mehdiya exemplifies a coastal river fortification with deep historical layers involving Phoenicians, Carthaginians, Romans, and notably Islamic dynasties such as the Almoravids and Almohads, who settled in the region in the 12th century. The kasbah, controlling access to the river, was part of a wider Atlantic defensive network, including fortified ports like Salé, Rabat, and Larache—crucial for maritime defense and trade regulation. A key development occurred with the Portuguese in the late 16th century and the Spanish in the 17th century, who built the fortress San Miguel de Ultramar, incorporated into the current structure. Reclaimed by the Alaouites, the site later saw periods of abandonment until recent times. This study reconstructs the kasbah's settlement and construction phases through stratigraphic and comparative analysis, focusing on Almohad-era documentation and its relationship to ten contemporary sites in Morocco and Andalusia.

2. The Kasbah of Mehdiya: historical stratification and settlement dynamics between Sebou estuary and Moroccan atlantic

The earliest evidence of a settlement in the Mehdiya area dates to the 5th century BCE in classical sources such as the *Periplus of Hanno* and that attributed to Scylax, which mention the toponym *Thymiaterion*—a port beyond the Pillars of Hercules, on a plain crossed by the river *Crabis*, likely the Sebou. In Roman times, the area fell within the province of Mauretania Tingitana (est. 42 CE under Claudius). The lower Sebou valley underwent urbanization with trade and military functions, as shown by nearby sites like Banasa and Thamusida. While imperial sources don't mention the kasbah, the strategic need to control the delta suggests port and defense structures likely existed. The kasbah's original foundation is debated. Alaouite historian Az-Zayani attributes it to the 10th-century Banu Ifran principality active in Salé and Mehdiya. Later sources credit Almohad Sultan Yaʿqūb al-Manṣūr in the late 12th century, under the name *Mehdiya al-Mamūra*. Under the Almoravids, Mehdiya appears as a meeting point between Yūsuf Ibn Tāshfīn and Andalusian ruler al-Muʿtamid ibn ʿAbbād, showing its strategic role in Maghreb–al-Andalus relations. Sources like al-Idrīsī and Leo Africanus note that, under Almohad rule, *Al Mamora* became the focus of major planning under Caliph ʿAbd al-Muʾmin, including a naval arsenal and shipyard that produced over 100 vessels for campaigns in Andalusia.

2.1. The Kasbah of Mehdiya: from historiographical marginality to a strategic node in contemporary archaeology

Despite its strategic position at the Sebou River's mouth and its symbolic and topographic relevance, the Kasbah of Mehdiya long remained marginal in historiographical and archaeological studies. Until the early 20th century, scholarly interest was sporadic and mostly tied to military or administrative concerns, in a broader context where Moroccan archaeology wavered between amateur activity and colonial objectives. Early research focused mainly on Roman sites largely neglecting Islamic-era legacies. Only recently, with the reassessment of colonial paradigms and the rise of interdisciplinary approaches, has the significance of Almoravid and Almohad material contexts gained recognition, especially regarding fortified and military architecture (Pradines, 2018). One of the first detailed descriptions of the kasbah is in M.H. Saladin's *Les Monuments de Mehedhia* (1911), which, despite its orientalist perspective, remains a key reference for architectural documentation and construction techniques. An additional, though unconventional, source is *La toma de La Mamora relatada por Tirso de Molina*, edited by Guastavino Gallent (1939). Framed as historical comedy, it reflects Spain's imperial narrative while providing indirect insights into the 1614 occupation and the building of the San Miguel de Ultramar fortress.

2.2. The Kasbah of Mehdiya: key archaeological studies and challenges

Roger Coindreau's *La Casbah de Mehdiya* (1943) was the first archaeological analysis of the site, examining the stratifications of the Spanish fortress San Miguel de Ultramar and later Almohad and Alaouite interventions. Notably, Coindreau focused on Moulay Ismāʿīl's construction and pisé structures likely dating to the medieval period. Samir Raoui's "Casbah de Mahdiya": une fortification espagnole au cœur de l'Atlantique (2010) provided the first comprehensive interpretation of the fortress, surpassing previous fragmented studies. Using 17th-century plans by engineers such as Juan de Medicis and Chardelou, Raoui offered a

stratigraphic reading of the walls, identifying three zones: Spanish, Islamic, and a hybrid area modified over time. His study was the first to conceptualize the kasbah's defenses as a cohesive system. Francisco Javier Bueno Soto (2010) further contributed by reconstructing the design and construction phases of the Spanish fortress, from Cristóbal de Rojas's initial plan to Cristóbal Lechuga's technical updates. Despite these advances, the lack of systematic archaeological excavations limits a full integration of material and documentary sources. Many uncertainties remain about the kasbah's origin and evolution. However, its rich stratigraphy and convergence of construction cultures make Mehdiya a key site for studying architectural and military transformations from the medieval to early modern periods. A critical recovery of this layered heritage is now more urgent than ever, especially amid current debates on conserving Western Mediterranean coastal fortifications.

3. Methodology: a multidisciplinary workflow for the study of historic built heritage

In recent decades, the multidisciplinary study of historic monuments has evolved through the integration of humanistic approaches, digital tools, and applied sciences. Current frameworks emphasize a structured workflow made of synergistic phases, from defining research objectives to the architectural-historical reconstruction of the asset. Scholars stress the need for a solid preliminary stage—critically gathering historical, iconographic, cartographic, and narrative sources—to trace a monument's evolution and guide research (Avrami et al., 2019; Cessari & Gigliarelli, 2006). Typological and stratigraphic analysis of wall structures is now a well-established practice in archaeology and architecture, especially in contexts with layered construction phases. Studies by Gil-Crespo and Maldonado-Ramos (2015) on fortified architecture in the western Islamic world show how masonry technique analysis, paired with typological comparisons, can provide chronological insights even without direct records. Similarly, recent Mediterranean research demonstrates the effectiveness of stratigraphic surveys and close readings of masonry to reconstruct building sequences (Domínguez Martínez, García Hermida & Moreno Adán, 2014; Van Staëvel, Fili & Gaime, 2021). The final, integrative phase is architectural-historical interpretation, where data from physical surveys and historical research converge into a comprehensive understanding of the site.

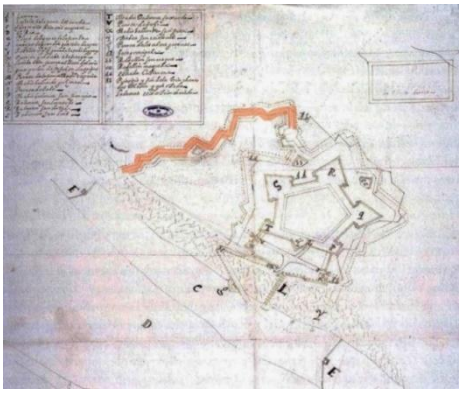

Fig. 1- Plan of the fortress of La Mamora. Sent by Captain Cristóbal Lechuga to His Majesty on 18 December 1614 (Bueno Soto, 2010). The sections of existing masonry that pre-date the Spanish fortification are highlighted in yellow

Recent literature calls for moving beyond fragmented readings of isolated building phases, advocating instead a systemic interpretation of architectural transformations through comparative and interpretive models. Identifying successive historical layers requires integrating material evidence, archival sources, and stratigraphic analysis, as seen in studies on Ibero-Maghrebian fortifications (Gil-Crespo, 2016; Fauvelle et al., 2018). The methodology developed for reconstructing the Kasbah of Mehdiya includes five integrated phases for a coherent reading of its transformations over time. The first phase defined research objectives, especially concerning conservation and knowledge of the site. It relied on critically collecting historical, narrative, iconographic, and cartographic sources, particularly from the Spanish occupation in the 17th century. Spanish military plans and reports (1614–1681) were analyzed philologically and comparatively to identify architectural layers and possible remnants of Almohad structures. The second phase involved typological and stratigraphic analysis of masonry, using direct surveys, photogrammetry, and wall stratigraphy sheets. This helped identify construction techniques—Almohad *tabīya*, Spanish stone and lime masonry, or Moroccan mixed systems—and distinguish phases.

Fig. 2- The 1633 plan attributed to C. Lechuga highlights the pentagonal bastioned system and the extensions of the defensive walls towards Fez (Bueno Soto, 2010)

Fig. 3- Extract from Chardelou's 1681 plan of the kasbah: the yellow shading highlights the remains of the Spanish fortification complex after the Alaouite attack (Raoui, 2010)

The third phase verified early structures via comparative models, cross-analyzed with similar fortifications in Morocco and the Ibero-Maghreb region. Notably, irregular wall segments in the 1614 Spanish plan, combined with Almohad construction techniques, suggest that parts of the kasbah's eastern wall may date to the original Almohad fortifications. This hypothesis aligns with medieval geographic and historical sources (e.g., al-Idrīsī, Leo Africanus), which refer to a naval arsenal and shipyard at the site. The fourth phase focused on historical-architectural interpretation by integrating survey data, stratigraphy, and typology with documentary sources. This approach helped define the site's main building phases, identifying three key stages: the 12th-century Almohad foundation, the 17th-century Spanish reorganization with the pentagonal fortress, and the post-1681 Alaouite reconstruction. The final phase delivered a revised stratigraphic framework and interpretative reconstruction of the kasbah's evolution, based on cross-verification of material evidence, masonry chronology, and historical records. This process offers a model workflow applicable to similar heritage contexts.

4. Historic stratigraphy and construction phases of the Kasbah of Mehdiya: from the Almohad foundation to the Colonial period

The structural stratigraphy of the Kasbah of Mehdiya is analyzed through a diachronic, multidisciplinary lens to identify its main construction phases from the Islamic medieval period to the modern era. While no material evidence confirms Phoenician or Roman occupations, a critical reading of Arabic medieval sources and post-conquest maps supports the hypothesis of a 12th-century Almohad fortress, later transformed by Iberian military engineering and reworked during the Alaouite period (Cuneo, 1986).

4.1 The Almohad Phase (12th Century)

Medieval geographers like al-Idrīsī and later sources such as Leo Africanus mention a fortified settlement at al-Ma'mūra with an arsenal and dockyard, indicating a coastal military base under Almohad rule, likely protecting maritime routes along the Sebou. Though no visible remains survive, the hypothesis of an Almohad enceinte is pursued through two strategies: analysis of early modern Spanish cartography and a typological-stratigraphic reading of embedded masonry in existing walls. The 1614 Spanish military plan (Fig. 1), drawn during the early construction phase, shows a regular pentagonal bastioned layout. However, its eastern segment features an irregular outer wall, disconnected from the geometry of the bastioned system. This anomaly, inconsistent with Spanish standards of the time, might indicate a remnant of an earlier Almohad enclosure. Ongoing stratigraphic and constructional analysis aims to clarify its chronology and potential medieval origin.

4.2 Portuguese and Spanish phases (1515-1681)

The brief 1515 Portuguese occupation resulted in the citadel São João da Mamora, though no remains have been confirmed. A more substantial transformation occurred during the Spanish occupation (1614–1681), when the fortress of San Miguel de Ultramar was established. Initial Spanish works (1614–1616) involved trenches and earthworks around a central core. A second phase, shown in Cristóbal Lechuga's 1633 plan (Fig. 2), introduced a compact pentagonal bastioned system with three main bastions—Sandoval, San Luis, and San Leonardo—facing inland, and a riverfront base defended by a ravelin and demi-bastions. The internal layout included barracks and magazines for optimized defense. In the same plan, a third phase added river curtain walls, artillery towers (San José and San Cristóbal), and a gate toward Fez—later replaced by a residence, reflecting new site uses. The final Spanish stage is documented in Chardelou's 1681 plan (Fig. 3), after the Alaouite reconquest by Moulay Ismāʿīl. It depicts a transitional fortress: remnants like Guzmán bastion and curtain walls with walkways and ditches coexist and new Moroccan elements—unfinished walls with gunports, a mosque, lime kilns, and a new gate system. This hybrid configuration signals the start of new political-architectural phase at Mehdiya.

4.3. The Alaouite Phase and Modern Transformations (1681–20th Century)

After the 1681 reconquest, the Alaouites renamed the site al-Mehdya. In the 18th century, under Sīdī Muḥammad Ibn ʿAbdallāh, the kasbah was restored as a military stronghold. During Moulay al-Yazīd's reign, it served as a detention center for political dissidents. From 1911, French colonial forces used the site as a military base. It sustained damage during the 1942 Allied landings (Operation Torch), and by 1959 was evacuated and designated a national heritage site. This layered history, reconstructed via historical, cartographic, and architectural sources, illustrates the value of integrating archival and fieldwork research in complex fortified contexts in North Africa.

5. Stratigraphy of the Fortress Wall

A full survey was carried out during fieldwork in May 2025, using direct measurement and photogrammetry of both interior and most exterior walls (some exterior areas remained inaccessible due to terrain and vegetation). The initial results reveal notable variation in construction techniques and materials, identifying over 20 distinct masonry units in the perimeter walls alone. The primary sections—most of the eastern, southern, and parts of the northern and western fronts—are built using *tapial,* the Spanish term for *tabīya* (Arabic) or *pisé* (French), a rammed earth method. This technique is recognizable by horizontal layering and small holes left by the removed formwork ties (Fauvelle et al., 2018). Widely used in North Africa and the Iberian Peninsula since antiquity, *tapial* presents challenges in dating due to its long usage, minimal stylistic clues, and limited documentation, complicating chronological attribution (Gil-Crespo & Maldonado-Ramos, 2015).

During fieldwork, various *tapial* characteristics were recorded to identify different masonry units and estimate their construction phases. Based on the taxonomy of I.J. Gil-Crespo and L. Maldonado-Ramos (2015), data included material type and texture, compaction level, dimensions of layers and forms, spacing of 'pigeon holes', and surface finishes. These details were cross-checked with archival and bibliographic sources. Survey findings only partially matched historical accounts, which described dry stone and earth-and-stone techniques in Spanish construction (Bueno Soto, 2010), revealing a more complex construction history.

The two surviving bastions of the Spanish pentagonal fort, though close in location, were built using distinct techniques. Baluarde San Leonardo (west) has outer walls of irregular, uncut stones (*mampostería*) in regular rows, with corners and base made of large cut white stones. Conversely, Baluarde Sandoval (east) features a *tapial* wall with a low plinth covered in terracotta shards and rubble. Outside the pentagonal fort, the walls—generally attributed to the Islamic (Alaouite) period (Raoui, 2010)—are mainly in *tapial*, but exhibit diverse materials and methods, including differences in wall thickness and deterioration. Two main *tapial* types were found on the eastern and southern fronts.

- Type A (central east) shows fine-grained reddish tapial with little gravel.

• Type B (northeast east) contains pinkish sediment with abundant white stones and gravel, with eroded surfaces and thinner walls (Zaidi et al., 2016).

• A similar unit (Type C) spans the southern wall to Sandoval Bastion, is also pinkish with high white aggregate and visible erosion. Small plastered repairs and one structural failure were noted.

Given visual similarities, the pinkish eastern and southern segments may belong to the same construction phase.

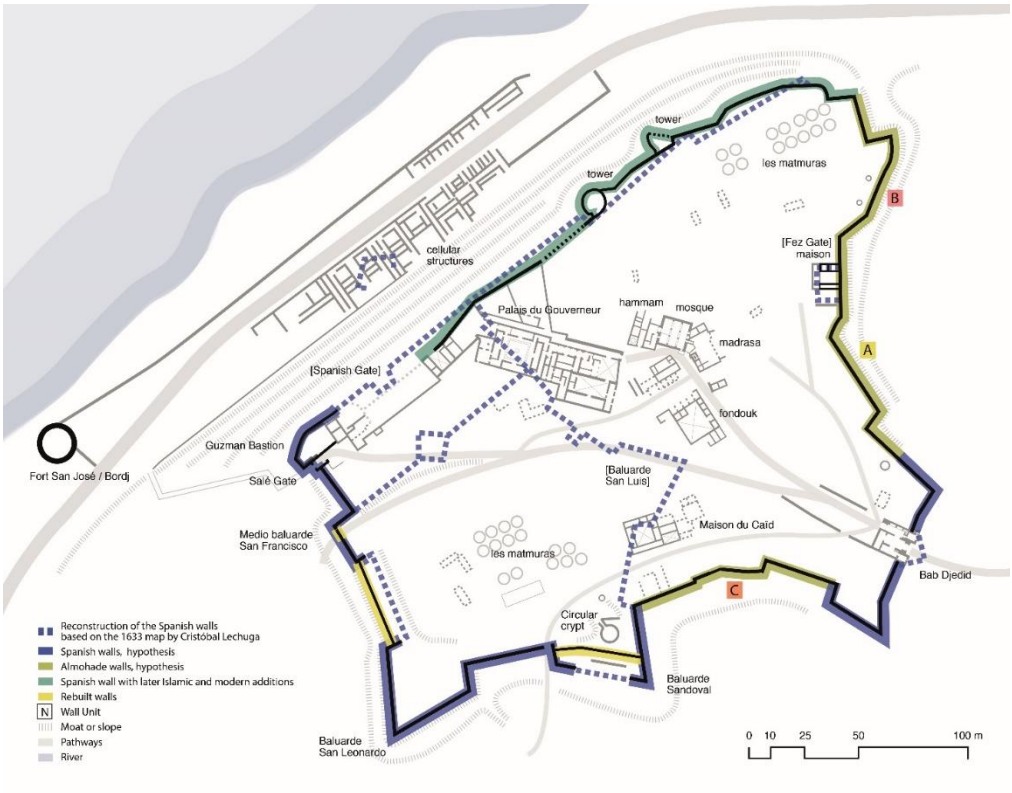

Fig. 4- Hypothesis historical phases of the fortification system (the authors, 2025)

The fortress walls are interrupted at the southeast corner by the Alaouite Bab Djedid Gate. Restored between 2010 and 2012 by ALINSAP, the current plaster obscures construction details. However, historical photos show the gate's flanking walls made of uncut stone, marking a material and morphological break from the long southeast *tapial* wall. This supports the idea that this *tapial* section may be a surviving Almohad fragment, as also suggested by the 1614 Spanish plan (Fig. 1, Fig. 4). The east and north elevations are even more fragmented, comprising small units built with varying materials—stones, *tapial*, and mixed masonry. These often show vertical stratification, pointing to Spanish-period structures later modified, as per Cristóbal Lechuga's 1633 plan (Figs. 2, 4). To supplement the stratigraphic reading, a typo-morphological comparison was made with ten similar 12th-century Almohad fortresses (400–600 m in length): Cáceres, Albalat, Badajoz, Alcaudete (Spain), Ribat de Tit, Merja Zerga, Basra, Igiliz, Mehdiya (Morocco), and Honain (Algeria) (Fig. 5). Analysis (Fig. 6) shows that all were strategically located on hills or near coastlines and river mouths, like Mehdiya. Where terrain was flat, walls were elliptical or trapezoidal; in complex terrain, layouts were irregular—as in Merja Zerga, Igiliz, and Mehdiya, where southeastern segments follow the topography. Fortifications often had outerworks or used natural escarpments for defense, as seen at

Alcaudete, Igiliz, Honain, and Mehdiya's northern slope, which originally lacked walls (1614 plan). Construction techniques alternated between rough stone and tapial with local aggregates—both present at Mehdiya. No surviving Almohad towers or gates remain here, unlike other sites, which feature square towers, chicane entries, or tower-flanked gates. Notably, Mehdiya and Ribat de Tit share a similar layout: a long wall perpendicular to the water closed by a semi-circular enclosure extending inland.

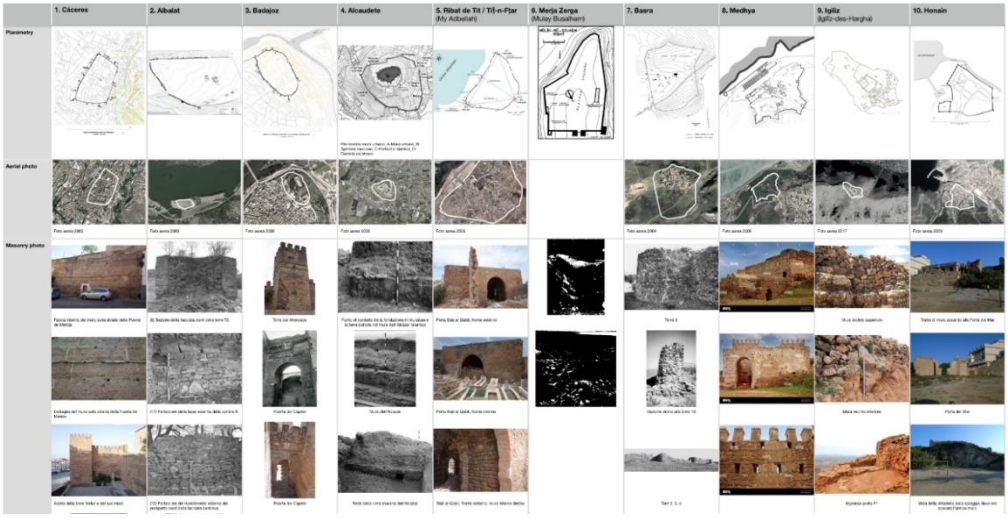

Fig. 5- Excerpt from the comparative study on Almohad fortresses (the authors, 2025)

	Case studies	State	Chronology						Location				Function	Architectural features of the walls					Settlement features		
			IX	X	XI	XII	XIII	...	Urban / Extra-urban / Remote	place: sea	place: river	place: hill	▼ defensive / ▼ military camp / ▼ commercial	Layout: Regular / Irregular	Wall type: Outerwall / Simple	Towers: □ square / ○ circular / rebuilt	Gates	Materials: ● tapial / ● stones	Dimensions: Major axis	Orientations	Spatial pattern: I unitary / II bipartite / III tripartite
1	Cáceres	ESP				■	■	■	U			✻	▼	R	O	□	straight	●	440 m	N/S	III
2	Albalat	ESP				■			R		✻		▼	R	S	□	straight	●	200 m	E/W	I
3	Badajoz	ESP				■	■	■	U			✻	▼▼	R elliptical	O	□ □	chicane	●	400 m	NW/SE	III
4	Alcaudete	ESP				■	■	■	U			✻	▼	IR	S orography	□	perpendi colar	●	300 m	centered	II
5	Ribat de Tit	MAR		■	■	■	■	■	U	✻			▼	R	S	□ ○	chicane	●	1000 m	NW/SE	I
6	Merja Zerga	MAR		■	■	■			R	✻			▼	IR	S	□	straight	●	100 m	N/S	I
7	Al-Basra	MAR	■	■	■	■			R			✻	▼	IR	S	○	straight	●	600 m	N/S	I
8	Medhia	MAR				■	■	■	EU	✻	✻		▼	R	S orography	irregular	–	● ●	400 m	NW/SE	I/II
9	Igiliz	MAR				■			R			✻	▼	IR	S orography	□	chicane	●	250 m	NW/SE	II
10	Honain	DZA			■	■	■	■	U	✻	✻		▼	IR	S orography	□	straight	●	450 m	NW/SE	II

Fig. 6- Comparison table of the settlement and architectural characteristics of Almohad fortresses (the authors, 2025)

Results

The stratigraphic and comparative analysis of the Kasbah of Mehdiya has provided key insights into its architectural and defensive evolution. A wall segment on the northeastern side—built with irregular *tapial* (pisé) technique—closely aligns with Almohad masonry practices found at sites like Ceuta, Rabat, and Tinmel. Its deviation from the 17th-century Spanish bastioned layout supports the historical accounts of al-Idrīsī and Leo Africanus, which mention a fortified enclosure and naval arsenal at al-Ma'mūra in the 12th century. This evidence reveals three main construction phases: the Almohad period (12th century), the Spanish bastioned occupation (1614–1681), and the 18th-century Alawite reorganization. Data from photogrammetry, wall stratigraphy, and comparative studies confirm the coexistence of construction methods—*pisé*,

stone-and-lime masonry, and brickwork—highlighted by visible stratigraphic transitions. The Kasbah thus serves as a case study for examining medieval coastal fortifications and their transformation across Islamic and European regimes. The Almohad remnants embedded in later structures enhance the site's historical and archaeological relevance.

6. Conclusions

Mehdiya emerges as a crucial site for understanding military architecture from the Almohad period through the early modern era. The discovery of 12th-century elements within the current structure challenges prior narratives and confirms the site's strategic role in Maghrebi coastal defense. Evidence suggests that the Spanish occupation adapted rather than entirely replaced pre-existing medieval structures. The integrated methodology—field surveys, digital modeling, stratigraphy, and typological comparisons—shows how under-studied sites can reveal broader patterns in Maghreb coastal defense. Future excavations supported by advanced tools (HBIM, multispectral imaging, SLAM) could shed further light on the site's early phases and support its conservation. Mehdiya's layered fabric offers a model for analyzing other fortified Mediterranean sites with similar historical complexity.

Acknowledgement

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References

Avrami, E., Macdonald, S., Mason, R. & Myers, D. (2019). *Values in Heritage Management. Emerging Approaches and Research Direction*s. Los Angeles, Getty Conservation Institute.

Bueno Soto, F.J. (2010) Larache y La Mamora: dos fortificaciones españolas en tiempos de Felipe III. *Aldaba* (34), pp. 51-96.

Cessari, L. & Gigliarelli, E. (2006) *Il centro storico di Castellammare del Golfo. Analisi Urbana per il Recupero*. Roma, Gangemi Editore.

Coindreau, R. (1943) *La Casbah de Mehdia*. Rabat, Service des Antiquités du Maroc.

Cuneo, P. (1986) *Storia dell'urbanistica. Il mondo islamico*. Roma-Bari, Laterza, pp.403.

Domínguez Martínez, O., García Hermida, A. & Moreno Adán, C. (2014) Stratigraphic analysis of earthen architecture: The mosque of M'Hamid El Ghizlane. In Mileto, C., Vegas, F., García Sociano, L., Cristini V. (eds.) *Earthen Architecture: Past, Present and Future*. London, CRC Press, pp. 127-132.

Fauvelle, F.-X., Erbati, E., Mensan, R. & Daussy, A. (2018) The Periphery Walls of Sijilmāsa, a Medieval Islamic City in Morocco: Contribution to the Identification of Typological and Functional Variability of the Pisé Technique. In: Pradines, S. (ed.) *Earthen Architecture in Muslim Cultures*. Leiden, Brill, pp. 37-54.

Gil-Crespo, I. J. & Maldonado-Ramos, L. (2015) Hacia una taxonomía constructiva de las tapias de tierra y fábricas encofradas históricas. *Informes de la Construcción*, 67 (538), e086.

Gil-Crespo, I.J. (2016) Islamic fortifications in Spain built with rammed earth. *Construction History*, 31 (2), pp. 1–22.

Guastavino Gallent, G. (1939) *La toma de La Mamora relatada por Tirso de Molina*. Madrid, Real Academia Española.

Pradines, S. (2018) *Earthen Architecture in Muslim Cultures*. Leiden, Brill.

Raoui, S. (2010) "Casbah de Mahdiya": une fortification espagnole au coeur de l'atlantique. *Aldaba*, 34, 97-144.

Saladin, M.H. (1911) *Les Monuments de Méhédhiya*. Paris, Ernest Leroux.

Van Staëvel, J.P., Fili, A. & Gaime, S. (2021) Tit n Ftar (Moulay Abdallah Amghar): du ribât à la ville sainte tardomédiévale. Une approche archéogéographique et stratigraphique. *Hespéris-Tamuda*, 56, 181-212.

Zaidi, M., Baghdad, B., Chakiri, S. & Taleb, A. (2016) Characterization of the Biodegradation of Kasbahs of the Gharb Region (Mehdia and Kenitra Kasbahs, Morocco). *Open Journal of Ecology*, 6, 75.

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