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ECHOES FROM THE SEA. DEFENSIVE ARCHITECTURES OF THE MEDITERRANEAN

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Abstract

The project explores the historical and geopolitical interactions between Italy, Spain, and Turkey during the Ottoman and Saracen incursions into the Mediterranean, focusing on defensive responses like watchtowers and coastal fortifications. It aims to analyze these structures as "imprints of memory" of the Mediterranean, particularly the architectural heritage linked to defense systems, promoting their value as part of a shared history among diverse cultures, religions, and societies.

The methodology includes actions to enhance the architectural heritage of watchtowers and fortifications built along Italian, Spanish, and Turkish coasts between the Early Middle Ages and the 17th century. This will be done through a scientific approach using new digital techniques for representing historical sites, cities, monuments, and cultural landmarks. The creation of a digital twin will allow for virtual simulations of different stresses and performance responses of these structures.

The research highlights the importance of these fortifications as symbols of interreligious cooperation and architectural heritage to be preserved. It reveals that the watchtowers were not only responses to raids but also the result of political alliances between European powers and the Ottoman Empire. These fortifications tell a story of resilience, cooperation, and conflict, emphasizing the need for their preservation to deepen understanding of Mediterranean history and culture.

The project reinterprets the relationship between Christians and Muslims, challenging the "clash of civilizations" narrative. By promoting the watchtowers as symbols of shared history, it fosters a more complex and inclusive understanding of the past and encourages heritage preservation across borders.

Keywords: Defensive architecture; Mediterranean routes; Tangible and intangible heritage; Digital representation.

1. Introduction

The point of view is the sea. The surface of the Mediterranean apparently does not retain the traces of the routes that have sailed it. The trails of ships, shipwrecks, the stories of sailors, brigands and travellers, seem to disappear swallowed up in the depths of the sea. The Arabs called the Mediterranean the 'white sea', meaning that it was often calm and that its surface, smooth as oil, reflected the glow of the sky. On that surface, as on a large vinyl record, we can hear again the echoes of past routes: the pencil, like a phonograph head, retraces the signs of the ancient charts and releases the related sounds and images. Redrawing the routes is equivalent to making a journey by eliminating the time component and condensing, in a few moments, the months spent at sea. Drawing, once again, decodes encrypted messages and frees us from the *hic et nunc*, from the subjectivity of our existence in present space and time.

In this sea of relationships, of echoes of the past, of memories and immaterial traces, some elements, like lithoid sentinels, traverse the unfolding of time and come down to us unchanged to testify to the persistence of persistent gazes. These are the coastal watchtowers. They are fixed, punctual, and visible elements, contrasting with the invisibility and fluctuation of sea routes. The research attempts to compare permanences through the filter of history, morphology, and the relationship with the sea and the territory.

The phenomenon of coastal towers is very ancient. The Mediterranean saw the development of this system of defence and control of the sea in ancient times. The network of coastal towers, however, suddenly became stronger as the phenomenon of plundering advanced. These are not real fortresses designed to systematically defend cities and territory from invasions by foreign peoples. The watchtowers were intended to monitor the sea and prevent rapid incursions that brought destruction and poverty. They formed an effective system to detect the enemy early and to communicate with the hinterland and with small coastal towns. They were placed at the mouth of rivers to protect ports, or near small businesses to defend production and trade. The pirate routes are closely intertwined with the trade routes of the time. In fact, by following trade routes it is possible to reconstruct not only the spread of goods but also the contiguity between different peoples, and the spread of building techniques and traditions. For instance, the commercial and banking penetration of the Republic of Genoa gave rise to emporiums and trading colonies in ancient Byzantium: Pera and Galata. The permanence of place names and defensive structures, the tower of Galata, testify to the extent to which trade exchanges were able to change the morphology of places and penetrate the culture of foreign lands.

Watchtowers in the Mediterranean underwent a strong development around the 16th century. During this period, Spain was at the height of its economic and political power. The discovery of America and the Reconquista, culminating in the defeat of the Muslim invaders in 1492, reaffirmed the success of the Spanish Empire. That same year, Spain expelled the Jews from its territory and, a few years later, did the same with the Muslims. This was probably the spark that triggered an increase in Saracen incursions into Spain and southern Italy, then under Spanish control. The theme of this research is linked to a suggestion: visualising the relationships that have taken place in the Mediterranean Sea starting from the coastal watchtowers. Pivoting on the medial part of the Mediterranean, the Strait of Sicily, some links are unravelled, graphically, some elements that can tell and condense centuries of history in a few evocative images.

2. . The Network of the Towers of Calabria Ultra

2.1. The Romano Carratelli Code

The research on the towers started a few years ago and is connected to the project PNRR, Tech4You Technologies For Climate Change Adaptation And Quality Of Life Improvement, Spoke 4, PP.4.5.3 On-site dissemination of the monumental heritage of the Calabrian Coast.

The project takes as its starting point the towers depicted in the *Codice Romano Carratelli*, produced in the 16th century during the Spanish rule in Calabria. The Codex consists of 99 watercolours representing the fortified system of *Calabria Ultra*. It documents the existing towers, shaded in pink, and the plans for those yet to be built, coloured in blue. The codex is a valuable testimony to the strategies the Spanish Empire was implementing at the time for its territories. Spain had set up a technical structure to control the coasts: in the Kingdom of Sardinia, the Royal Administration of Towers; in the Kingdom of Sicily, the Deputation of the Kingdom of Sicily; and in the Kingdom of Naples, two ordinances were issued thirty years apart—the first by *Vicerè* Peter of Toledo in 1532, the second by the Duke of Alcalà, Pedro Afan de Ribera, in 1563. The ordinances required individual universities to protect themselves from possible Saracen attacks by building maritime watchtowers at their own expense. In this context, the *Romano Carratelli Codex* was created, offering an insight into the situation of Calabria Ultra using mixed systems of representation, between perspective views and axonometric diagrams. The territory is shown from a bird's eye view, while the towers are represented semi-axonometric, framed from below. The view is always oriented from the sea towards the coast. The formal qualities of the architectures are necessarily rarefied. The towers are defined by few elements: overall morphology (circular or quadrilateral); presence or absence of the scarp; the *redondone*, a curb with defensive function; walkways and *bertesche*, small projections often with machicolations; blind arches supporting the eaves walkway; and battlements—either straight-profile Guelph merlons or curvilinear Ghibelline merlons. The mixture of these elements, like a combinatory game, makes the Codex turrets identifiable.

2.2. From context to hypotheses for a new cultural landscape

The research conducted as part of the PNRR project, Tech4You, On-site dissemination of the monumental heritage of the Calabrian Coast involves several steps including the documental cataloguing of all still existing towers. As part of this, 18 integrated instrumental surveys were conducted. The research data certainly has a double value: on the one hand, it contributes to documenting an architectural heritage that is often forgotten by institutions, in serious disrepair and close to complete destruction. On the other hand, the data obtained form the basis of multimedia processing for the construction of an innovative App. The latter will offer augmented reality experiences capable of implementing knowledge of the architectural heritage and visualising the complex network of relationships connecting the towers to the landscape. It will be possible to observe the remains of the towers and to superimpose a digital reconstruction, to see the landscape from the top of the tower and to locate the neighbouring towers in a geometry of gazes that returns, in an explicit and visual way, the functionality of these “mechanisms for communication and defence”. Finally, the app plans to point out new itineraries, land routes, for the exploration of the architectural heritage of the coastal towers and surrounding territories. The research attempts to reconnect the threads of the relationships that brought the fortifications of all the successive peoples to the Mediterranean coasts. It is useful to note that the first fortifications on the Mediterranean coast of Spain's Maghreb and Turkish coasts were built by the Byzantine Empire. Over the centuries, the decline of the Byzantine Empire gave way to the Islamic invasions that occupied Spain in the 8th century and Sicily between the 9th and 12th centuries. The rise of the Spanish Empire coincides with the fall of Byzantium, Sicily is under

Aragonese influence but from the east the Ottomans attack the western Mediterranean coast. The towers define both the natural and cultural landscapes: the routes connecting them signify intangible links and traditions that bring different cultures closer together.

2.3. Hypotheses for the classification and comparison of towers in the Strait of Messina area

The towers analysed in this study were surveyed with terrestrial laser scanners and aerial photogrammetry. The data obtained gives us digital twins to investigate. It is interesting then to try to carry out a transition from the exemplified drawing of the towers in the Codex to the 3D modelling of only the details shown in the watercolours. The cataloguing of the examples, ordered according to type, and the details present gives an initial comparative view (Fig. 1-2), while the modelling and analysis of the components present in the surviving architectures can provide information on the morphology of the architectural elements that did not always find a place in the Codex's representation. (Fig.3)

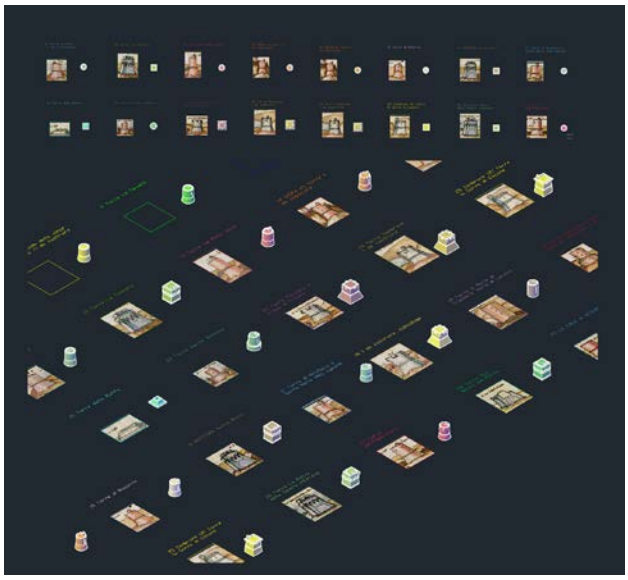


Fig. 1. (Left) 3D models of the towers of Calabria Ultra, as depicted in the Romano Carratelli Codex.

Fig. 2. (Right) The towers of the Romano Carratelli Codex

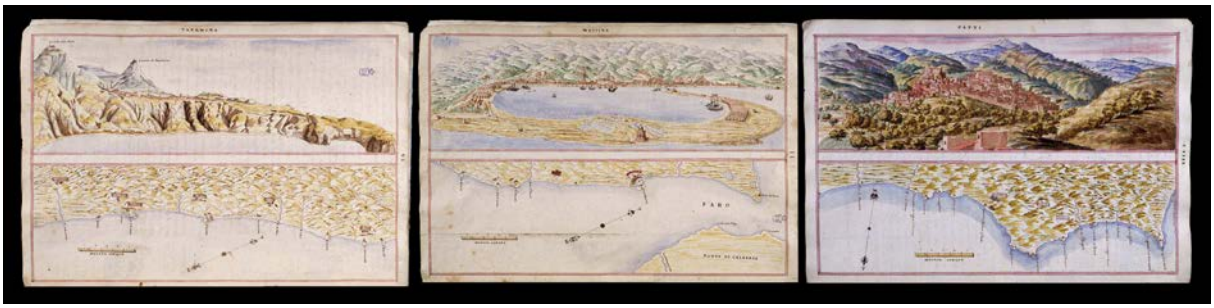


Fig. 3. Spannocchi, Marines of the Kingdom of Sicily. Northeastern cusp: Taormina, Messina and Patti.

The research is still in progress and foresees sinkings on the Ionian coast of Sicily with further surveys and comparisons with the representations made by Spannocchi in his text: Marine del

Regno di Sicilia (Fig.3). he towers of the Straits area were analysed and some that can be compared due to their consistency and morphology. The towers in figure 4 (Fig.4) show the instrumental surveys and the modelling of some detailed elements.

In fact, most of the towers surveyed in the Romano Carratelli codex do not show the corbels or the morphology of the *redondone*. The comparison of the surveys also highlights the scale ratios of the towers and can provide detailed information on the morphology of the shoes and wall texture.

Fig. 4: Off-scale abacus: instrumental investigations and modelling of some detailed elements. The numbers, if any, are those that the Romani Carratelli Code gives.

3. An overview of the distribution of Turkish coast watchtowers

Turkish cost extends over 4 different seas, the Black, Mediterranean, Aegean, and Marmara sea, where many consider the last two as part of the Mediterranean Sea too. Coastal fortifications were not merely built for the base purpose of defence but were also expensive structures that conveyed to the enemies' domination over extremely important trading locations of the Aegean Sea and Mediterranean Sea. These fortresses now stand as magnificent relics, offering panoramic views and an insight into ancient maritime strategies.

Since the area of modern Türkiye was under the control of different civilizations in different historic eras, like the Roman, Byzantine, Arabs, Selcuk and Ottoman. Moreover, we will find testaments of each of these civilizations in the fortresses and watchtowers spread along the coasts of Türkiye, which also were sometimes established by a civilization, then conquered by other, added, modified, or sometimes destroyed those watchtowers. The fifteenth and sixteenth centuries in the Mediterranean are associated with major political changes and territorial alterations (Nicolle, 2010). Regions and cities which had been subordinate to one power suddenly became part of another. These changes were the product of long-term political interests, but violent changes such as the Ottoman conquest (firstly Constantinople in 1453 and later of Rhodes in 1522) opened new horizons to expand into the lands of the former Byzantine empire and the West. If we focus on that era, the Ottoman coastal fortresses and watchtowers, called *Burj* in Arabic and *Kule* in Old Turkish, will spread from the Balkans to modern-day Turkey, Syria and North African countries on the Mediterranean, including those that were conquered and those that were newly established. Since the war of the Turkish Republic, castles have lost their defensive role and many monuments have been neglected or abandoned. There are no research or documentation projects to map or create a database, only a few well-preserved projects have survived (Anonim, 2006). One of the attempts to document and present the ottoman fortifications was prepared by Davide Nicolle, in his book of (Ottoman Fortifications 1300-1700) where the illustrations were prepared by Adam Hook, some maps were prepared in figure 5 (Fig. 5).

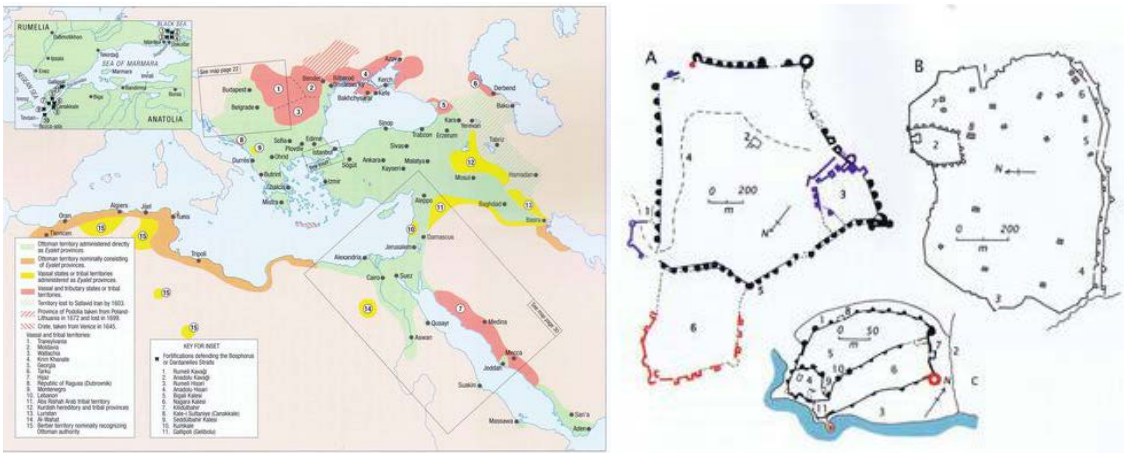


Fig. 4. (Left) Map of the ottoman fortifications by Davide Nicolle

Fig. 5. (Right) A: Kutahya (after Foss), Byzantine fortifications in black, Germiyan repairs and additions; in blue, Ottoman repairs and lower city wall in red. B: Bursa (after Turkish Antiquities Authorities). Main Islamic religious buildings in grey. C: Anamur (after Fedden), Karamanid coastal castle with probable Ottoman additions in red.

Using some of the drawing from the famous ottoman captain and cartographer (Piri Reis) who prepared many detailed maps of the Mediterranean in 16th century, also from the description, many plans and perspectives were presented in the book (Fig. 6).

Fig. 6. Anatolian Fortress (left), Rumeli Fortress (Middle) and Yedikule Fortress (Right)

In Istanbul alone there are three main fortresses from the ottoman era (Fig. 7). Anatolian Fortress is the oldest fortress among them. It is located on Anatolian side of the Bosphorus and was built in 1395 under the command of Ottoman ruler, Yıldırım Bayezid. The fortress was used as a place of Ottoman army right before the battle of Varna in 1444. It has three parts: an inner castle, inner and outer castle walls. Both Anatolian and Rumeli Fortresses played an important role during the conquest of Istanbul. The second fortress of Istanbul is Rumeli Fortress. It is located on the narrowest point of Bosphorus, opposite of Anatolian Fortress. It was built under the command of Ottoman ruler, Fatih Sultan Mehmed (Mehmed the Conqueror) in 1452, during the preparation process of the conquest of Istanbul. After the conquest, the fortress lost its military purpose and served as a prison until 19th century. Today, it is an open-air museum which is open to the public (Savvides , 1997).

The third fortress is Yedikule Fortress (also known as Fortress of Seven Towers and Seven Tower Dungeons). This historic structure is located in Yedikule neighbourhood of Fatih. It was built in 1458 under the command of Ottoman Sultan Mehmed II (Mehmed the Conqueror). You can see the mixture of architectural features of Byzantine and Ottoman in this structure.

Ofcourse those castles are from the few survived and conserved to be used with new functions, but if we want to list all the watchtowers and castles of modern Turkiye coast on the mediterranean , we will find a lot which vanished or disapperead and only parts of the traces of the towers or the walls remain, for example Yoros Castle, from the Byzantium era, views the Bosporus in Istanbul. Also, Ginolu Castle is believed to have been built between the ninth and 11th centuries in today's Kastamonu province, and Ayas Castle in the ancient city of Ayas in the Yumurtalık district of Adana province.

3.1. Typologies of coastal castles and watchtowers

Apart from the historic classification, and the building era, the coastal towers can be classified into watchtowers (Burj)alone like Galata Tower in Istanbul, or fortresses (hisar) which usually include multiple towers for different functions as the case of yedikule, or castles (Kale in Turkish) which is a complete furtified complex like Mersin Kale (Yılmaz, 2022). Some of the most interesting watchtowers were built on some islets in the Mediterranean, which present unique examples of this defensive maritime architecture, such as Şile Castle, which was built by the Byzantines, was used to resist attacks from the sea, or Maiden's Castle was built on an islet in today's Mersin province in 1199. Beside the aforementioned Ayas Castle (Fig. 8).

Fig. 7. Şile Castle (left), Maiden's Castle (Middle), Ayas Castle (right)

3.2. Conservation and protection requirements

According to Article 16/c of the Cadastre Law No. 3402, which was accepted on October 10, 1987, "rocks, hills, mountains, unclaimed lands not suitable for agriculture and sea, lake and river shores are under the sovereignty and disposal of the state." These places are not subject to registration and delimitation. However, according to Article 18 of the same law, if it is possible to transform these places into agricultural lands or provide economic benefits, they are determined and registered in the name of the treasury.

With the Law No. 3348 dated 1987 on the Organization and Duties of the Ministry of Transport; The Ministry of Transport is authorized to prepare plans and programs of "Ports, shelters and related equipment and facilities, coastal protection structures, coastal structures and facilities" to be built by the state, in cooperation with relevant institutions, to take necessary measures and provide opportunities for their realization, to conduct or have conducted research, study, project, survey, specification, and construction, maintenance and repair, to transfer those whose

construction is defined to relevant institutions, to prepare principles for the organization of maintenance and repair of those that have been built, to examine and approve the projects and specifications of those to be built by all kinds of public institutions and organizations, municipalities, special provincial administrations, legal entities and real persons.

Since many of these structures belongs to different authorities, and the responsibility of preserving them are distributed under different offices and directorate, the abandonment and neglect caused a severe damage, and the loss of many of these monuments which were witnesses of a rich heritage not only of war and battels but also trade and cultural exchange across centuries. It is essential to start a project of documenting and mapping all these ruins and structures, assessing their status and damage suffered, structural integrity, at least with creating database through 3D models by photogrammetry and laser scanning, as the project in Reggio Calabria, and East Spain coasts. even with drones due to the difficult accessibility to the sites. This will enrich the archive and enables proposals for the restoration and conservation through different strategies, including adaptive reuse as have been done in the castles of Istanbul where they became centres of art and cultural events, preserving their heritage and continuing one of their historical functions as cultural exchange hub in the mediterranean basin.

4. The muslim presence and the need for defensive architecture

In the context of Muslim rule in the Iberian Peninsula, the term "Eastern Spain" refers specifically to the eastern coast of *Al-Andalus*, a region known at the time as *Sharq al-Andalus*. This area encompassed territories that today correspond to the provinces of Valencia, Alicante, and Murcia.Its fertility and strategic coastal location made this area a top priority for early Arab settlements following their conquest of the peninsula. The region of Murcia, known as the Cora of Tudmir, maintained a vassal kingdom from 713 AD until its integration into the Crown of Castile between 1243 and 1266. The Valencian territory, on the other hand, remained under Islamic rule until it was conquered by the Christian king James I in 1238.

The political evolution of Al-Andalus had a direct impact on the scale and main features of its defensive architecture. Periods of strong centralized authority, such as the Caliphate (929–1031 AD) and especially the Almohad Empire (1147–1228 AD), allowed for the implementation of ambitious fortification programs with highly standardized characteristics. In contrast, the fragmentation into *taifa* kingdoms led to much more localized and consequently less robust defensive constructions, as survival depended on each small kingdom's ability to finance its own troops or, alternatively, buy peace with money. This correlation between political stability and architectural sophistication is a fundamental aspect for understanding the development of its network of defensive towers.

4.1. Architectural characteristics of the watchtower network in *Sharq al-Andalus*

Islamic fortifications in eastern Spain were not merely isolated defensive structures, but essential components of a complex territorial and administrative organization. This system divided *Al-Andalus* into provinces or *coras*, some of which, due to their frontier location, had a distinctly military character. In addition, Muslims have promoted intensive agricultural development, which has generated substantial surpluses for urban markets. The interconnection between defensive structures and agricultural settlements reveals a very advanced form of land management; the system extends beyond military defence to include protection of agricultural resources and dispersed rural population. Thus, the network of towers across the Iberian Peninsula reflects an integrated approach to state security and resource control; consequently, military architecture was deeply embedded in the economic and social fabric of *Al-Andalus*. This manifested in a notable diversity of typologies, each designed to fulfil specific functions within this system: 1) The

ḥusūn, or rural castles that emerged within peasant communities, whose difficult access made them ideal as temporary refuges for the population in times of danger. Each was generally associated with several *qurà* or *alquerías*, the main residential settlements for agricultural and livestock production, which in some cases included a tower adjacent to the *albacar* or fortified enclosure. 2) Isolated towers typically built using tapial (rammed earth), which served purposes beyond mere military surveillance: they acted as communication elements, agricultural storage units (*silos* or granaries), or as fiscal checkpoints and/or irrigation control points. 3) Urban towers and walls, forming robust and sophisticated defensive systems that protected major cities like Valencia and Murcia, which were the economic and administrative centers.

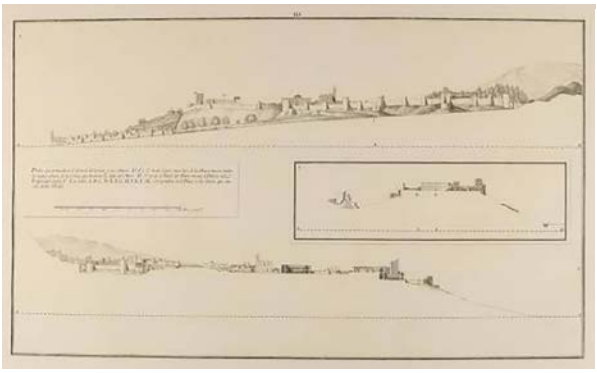
Our understanding of these Islamic fortifications and their significant functions is based on medieval Arabic chronicles, which provide valuable insights into their construction and use. Authors such as Ibn Hayyan (11th century) in his "Muqtabis", Al-Idrisi (12th century) in his "Geography", and other contemporary works offer detailed descriptions of walled cities, castles, and military events involving fortified structures, emphasizing the importance of urban centres and the rulers' determination to ensure their defence. To understand the network as a whole, the distribution map of rural structures from the 12th and 13th centuries in the former territory of *Al-Andalus* (including Garb al-Andalus and Sharq al-Andalus) is fundamental. This map (Fig. 9), published by Quesada-García & Romero-Vergara (2019), was developed within the framework of project HAR2014-53866-R titled "The System of Medieval Islamic-Origin Towers in Segura de la Sierra: Implementation, Construction Techniques, and Restoration of Rammed Earth". It displays all known Muslim architectural elements supported by archaeological evidence, distinguishing between *ḥusūn* or rural castles, towers, alquerías, alquerías with towers, and archaeological sites. From the distribution, the striking proliferation of these constructions in the eastern region—especially along the coastal strip—is readily apparent.

Fig. 8. Distribution of 12th- and 13th-century rural structures in the former territory of *al-Andalus*, of which some remains are still preserved today. Source: Quesada-García & Romero-Vergara (2019).

4.2. The representation of peninsular levantine watchtowers and their sources

The historical graphic documentation of Arab fortifications in Spain has its roots in pioneering initiatives such as those of the Royal Academy of Fine Arts of San Fernando, which, since the mid-18th century, promoted the compilation and reproduction—through sketches, drawings, and plans—of the Andalusi architectural legacy in projects such as "Arab Antiquities in Spain" and "Architectural Monuments".Unfortunately, these early drawings were mostly limited to first-order monuments like the *Alhambra* in Granada and the Mosque of Córdoba. However, drawings such as those by José de Hermosilla (fig. 10), produced as part of an expedition sent by the Academy, represent a significant and accurate attempt to document these works with a graphic quality that would not be surpassed until well into the 20th century (Almagro-Gorbea, 2015). Both historical and contemporary photographs help document the current state of preservation of the towers

and their integration into the landscape, as in the case of the watchtowers along the Málaga coastline or the urban towers of Valencia.



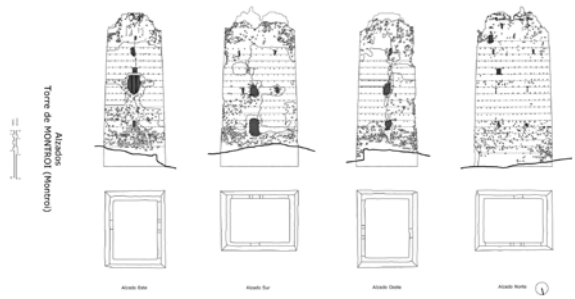


Fig. 9. (Left) Side view of the Alhambra. José de Hermosilla, 1766-1767. Source: Almagro-Gorbea (2015).

Fig. 10. (Right) Elevations of the Montroi Tower (Valencia). Source: Rodríguez-Navarro (2018).

Architectural plans are essential tools for the detailed study of this type of construction. Recent academic publications and archaeological studies have enabled their graphic documentation through orthographic elevations, floor plans, and sections, which reveal their internal layout, dimensions, and construction techniques. In this regard, studies such as Rodríguez-Navarro (2018) provide a major contribution to the graphic documentation of Islamic towers (fig. 11), in this case focused on the province of Valencia. The combination of various forms of graphic representation — from photographs that capture visual reality to plans that document architectural complexity—is essential for understanding the network of Muslim towers. This multidisciplinary approach not only documents this heritage but also helps reconstruct its original function and its impact on the territorial organization of *al-Andalus*.

5. Echoes from the sea. ECHOES – Eternal Coastal Heritage: Observation, Evocation, Signal

5.1. A Network of Coastal Sentinels

The turreted system dotting the shores of the Mediterranean determines a network of observation and defence that, far from being static, reflects a profound stratification of historical and cultural phenomena. Although geographically distant, many of these structures share common characteristics: the era of their construction, their cultural or political affiliation, and their strategic role along established maritime routes. Starting from the Strait of Sicily, the hinge between the western and eastern Mediterranean, one can trace invisible but significant relationships that become the focus of a new visual narrative. These towers, born for defensive or signalling/seeing purposes, formed a strategic network of visual communication between the shores of the *mare nostrum*; these artefacts, to this day, largely lie abandoned or unknown to a non-specialist public, even though they possess a strong symbolic, cultural and identity potential.It is necessary, therefore, to propose a reflection on the architectural heritage of coastal towers erected between the Middle Ages and the modern age, with reference to those that prop up the shores of the Mediterranean, in the lands that today belong to Spain, Italy and Turkey.

5.2. A Digital Narrative Atlas: Enhancement Strategies Through Augmented Reality

Starting from these premises, the project aims at enhancing the value of these structures using digital tools of architectural representation, mapping and storytelling, with the objective of visually reconstructing the historical, cultural and geopolitical connections that link these apparently distant elements and making them perceptible through a digital medium. A sort of dynamic atlas that does not limit itself to locating the towers, but reconnects them through lines, flows and thematic routes, changing the point of view from an archive of stone to a system of shared memories. The research therefore translates into an experimental attempt that is still in the development phase, which follows the path of a valorisation that is implemented through the visibility of relationships: links of use, function, epoch and position, finally made explorable through contemporary visualisation and storytelling tools.

'ECHOES', in fact, is a system based on a geo-localised AR mobile app, which enables the real-time visualisation of historical routes and points of interest superimposed on the real environment. The AR engine exploits plane detection, motion tracking and lighting estimation technologies - e.g. ARCore and ARKit - to integrate historical data with interactive elements. This will allow the modelling of an explorable dynamic map of selected coastal towers in the three countries, bringing the ancient visual communication network back to life, defining a veritable chain of views covering vast coastal and maritime areas. The system involves the design of the installation of smart LED projectors at the selected towers, more precisely low-impact devices that reminiscent of light signalling, restoring a nocturnal dialogue between the structures, observable from certain strategic points (Fig.12). The system stores complex data on a cloud platform for cultural content management, synchronisation between structures and integration with special events, such as night narratives or light shows. The smartphone, used as a visor, will allow the user to 'see' virtual navigation routes, both historical and modern, and watch simulations of communications between towers, as if they were still the lithoid sentinels of yesteryear. An acronym that sings the echoes of the towers, suspended between stone and sea, where every light turned back on is a returning memory: 'Eternal', recalling the timeless duration of historical and cultural memory; 'Coastal Heritage', maintaining the focus on coastal heritage; 'Observation', representing the act of looking, observing the towers and routes; 'Evocation', a poetic keyword for 'calling to mind' or 'reviving' emotions and stories; 'Signal', combining the past of fire and smoke signals between towers with the present of augmented reality digital signals. It is in the redundant rustle of the sea that 'ECHOES' wants to recreate an integrated system of augmented reality, intelligent lighting technology and geolocalised storytelling, aimed at rediscovering and symbolically connecting the coastal towers and lighthouses of the Mediterranean. A project that makes the past dialogue with the present, places with travellers, and peoples with each other through light and technology. Coastal defence heritage is here interpreted according to the notion of 'trace', as a material imprint of collective memory, but also as a trigger point for new transmedia narratives (Ricoeur, 2004, p. 180).

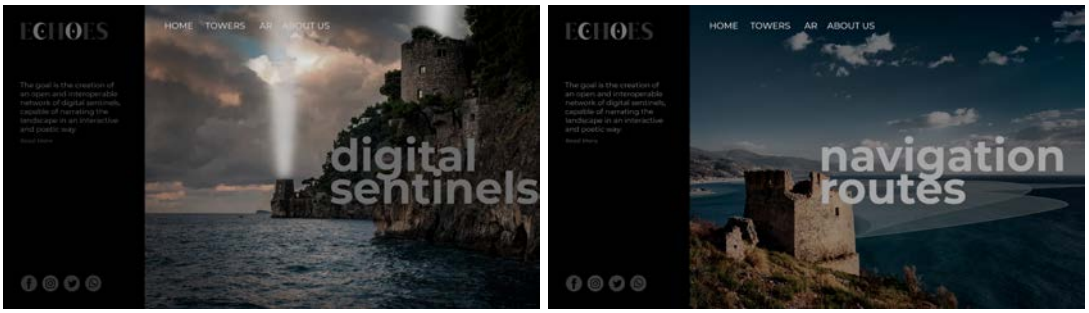


Fig. 11. (Left) Smart LED projectors recreate historic light signals, enabling a nocturnal dialogue between towers, managed via a cloud platform (towers of the Amalfi coast). Elaboration of the author.

Fig. 12. (Right) Narrative visualisations: interactive maps, augmented itineraries, and multimedia storytelling (Torre di Rienzo, Cetraro – CS). Elaboration of the author.

The project adopts an interdisciplinary methodological approach based on digital survey (photogrammetry, laser scanning, drone mapping), computer modelling (digital twin and parametric simulations) and the design of narrative visualisations (interactive maps, augmented itineraries, multimedia storytelling) (Fig. 13). Each tower is accompanied by a scientifically validated historical and architectural record, an interactive 3D in situ digital survey model, multilingual narrative content and thematic itineraries. The intention is not only to document, but to represent and communicate heritage, promoting active interaction between user, territory and memory (Manovich, 2013, p. 254). The project combines archaeology, immersive technology, interaction design and storytelling. Geolocated narratives are built through transmedia and user-centric approaches for a fluid, inclusive and multisensory experience (Koivisto et al., 2019). Each tower can become a "narrator" that tells local events, legends or episodes, in the first person or as part of a choral story. Visual reconstructions, based on archival and cartographic sources (fig. 14), are accessible through intuitive and multilingual interfaces. The expected impacts include: stimulation of tourism in small coastal villages, integrated exploitation of tangible and intangible assets, interregional and cross-border cooperation and strengthening of shared historical awareness among Mediterranean peoples. Prospects include the development of a prototype with local authorities, integration with regional routes and European networks (Cultural Pathways, Creative Europe), involvement of communities in content production. The aim is an open and interoperable network of digital sentinels capable of interactively and poetically narrating the landscape. The interactive representation allows an emotional and cognitive enjoyment, strengthening cultural belonging (Champion, 2015, p. 57). The towers thus become narrative devices that transmit a non-binary vision of Mediterranean history, overcoming the "clash of civilizations" and fostering a more complex and inclusive narration (Fabietti, 2002, p. 198).

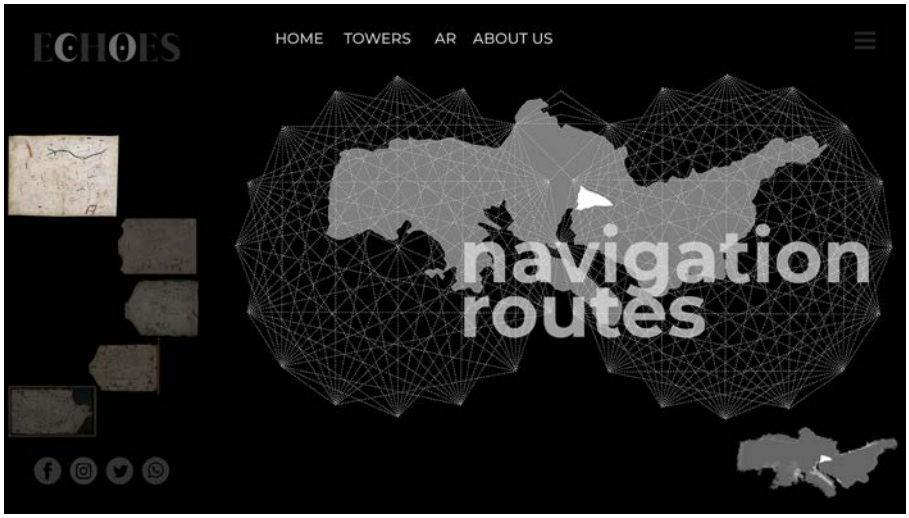


Fig. 13. Archival and cartographic sources, made accessible through intuitive interfaces.

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