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3D LASER SCANNING AS A CRITICAL ARCHIVE: A MORPHOSTRUCTURAL REASSESSMENT OF THE MOSQUE OF THE DEY IN ALGIERS

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ABSTRACT

This article offers a critical reassessment of the Mosque of the Dey in Algiers, based on the cross-analysis of three sources: a three-dimensional survey conducted by terrestrial laser scanning (TLS) in 2019, direct in situ material observations, and Ottoman legal records transcribed by Albert Devoulx. Situated within a building archaeology framework, the study reconstructs the processes of assembly, reuse, and adaptation that governed the construction of this monument, regarded as the last major architectural achievement of Ottoman authority in Algiers. Three key areas are analysed in detail: the north-east wall, the qibla wall, and the minaret. The TLS survey reveals an asymmetry between the base and the upper section of the north-east wall, with irregular over-thicknesses and misalignments pointing to the integration of an earlier substructure. The qibla wall displays a subtle yet significant outward inclination in its upper masonry, while the minaret, visually perceived as hexagonal, is in fact affected by a torsional distortion of its plan, reflecting the cumulative impact of time, use, and structural contingencies. These material singularities, imperceptible to the naked eye, directly resonate with historical sources: the geometric anomalies confirm the rapid expropriations and partial reuse of earlier structures mentioned in legal deeds. The TLS survey, employed as a critical archive, not only exposes hidden morphological anomalies but also clarifies structural discontinuities and contributes to the assessment of seismic vulnerability. By combining 3D digitisation, historical documentation, and architectural analysis, this research advances an interdisciplinary methodology that refines the morphostructural understanding of the monument and promotes a preventive approach to the conservation of architectural heritage.

KEYWORDS

3D Laser Scanning, Building Archaeology, Ottoman Architecture, Mosque of The Dey, Morphostructural Analysis, Architectural Heritage

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Introduction:

A thorough understanding of a building is an essential prerequisite for any well-founded heritage intervention. Knowing its load-bearing structures, identifying the original constructive logics, and recognizing the transformations it has undergone over time are fundamental for characterizing its vulnerabilities, anticipating its mechanical behavior, and guiding conservation decisions in an informed manner. In contexts exposed to seismic risks, this preliminary reading of the building—material, morphological, and historical—becomes a strategic concern, not only to ensure the durability of the structure but also to support the design of appropriate interventions [3] [17] [13] [12].

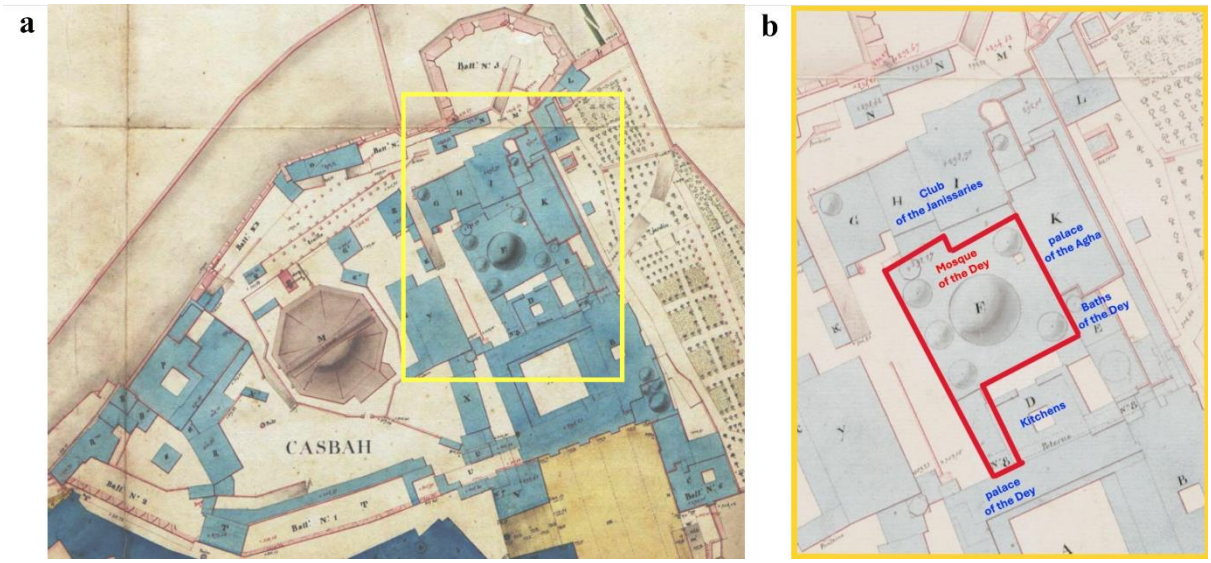

***Fig. 1**. The citadel in 1831 with a yellow frame indicating the zoom on the mosque (a), Zoom on the mosque and its integration within the palatial complex (b). (SHD Génie, Project for the Casbah, 1831, document 13/5 1VH60)*

The Dey Mosque, located in the upper part of the Algiers medina at the heart of the Ottoman citadel (Qasaba al-jadida), fully illustrates this complexity. Constructed at the end of the Ottoman Regency within a pre-existing urban fabric, it is integrated into a palatial complex combining spaces of power, residences, and places of worship (Figure 1a). The superimposition of construction phases, the inheritance of earlier structures, and successive transformations of the building make it an exemplary case for critically examining interpretative methods in architectural heritage.

The research presented here is part of a broader project on the mosque as a whole; however, this article focuses on three specific areas: the north-east wall, the qibla wall, and the minaret. These areas were selected for the richness of the evidence they provide and for the way in which they demonstrate the potential of 3D surveying, combined with material observation and the Ottoman legal records transcribed by Albert Devoulx, to reveal the underlying logics of architectural transformation. The TLS survey reveals several anomalies: an asymmetry between the base and the upper section of the north-east wall, characterized by irregular over-thicknesses and misalignments suggesting the integration of an earlier substructure; a subtle yet significant outward inclination of the upper masonry of the qibla wall; and, in the case of the minaret, a torsional distortion of its plan, contrasting with its visually perceived hexagonal regularity.

These singularities, imperceptible to direct observation, are clarified through the cross-analysis of three sources. The TLS survey emerges as a high-resolution diagnostic tool: it allows precise reading of thicknesses, geometric ruptures, deformations, and formal discontinuities, revealing elements invisible in situ [16]. Beyond immediate modeling, it constitutes an autonomous geometric archive that is objectifiable, reproducible, and transferable over time. Historical documentation provides a decisive dimension: the geometric anomalies highlighted by the survey directly correspond to rapid expropriations and partial reuse of earlier structures mentioned in the Ottoman legal records. The strength of this approach lies in its ability to cross-reference geometric, visual, material, and textual data, thereby constructing a building archaeology of high interpretative

value, capable of reconstructing construction sequences, highlighting adaptation logics, and supporting structural modeling more faithful to field realities [1], [14].

Finally, it remains essential to situate these findings within the mosque's founding context. Consulting historical, legal, and topographical sources allows survey data to be interpreted in light of the political logics, land constraints, and construction practices of the late Ottoman Regency. The built fabric, as revealed by the point cloud, is neither homogeneous nor fixed: it bears the traces of political recomposition, strategic spatial appropriation, and successive construction operations that only a cross-referenced reading can fully reconstruct [15].

This article therefore aims to demonstrate, through the analysis of these three case studies, how the combination of 3D laser scanning, material observation, and historical documentation allows the complex genesis of the mosque to be reconstructed, while refining the understanding of its structural vulnerabilities. The study is organized in three complementary stages: a critical analysis of the morphological singularities revealed by the TLS survey, their correlation with available historical and legal data, and finally an examination of their implications for the structural interpretation of the building, with the aim of shedding light on stability and conservation issues.

1. The Dey Mosque: Cross-Readings of a Political and Architectural Project

1.1. A Late Mosque at the Heart of a Declining Ottoman Power

The Dey Mosque, also known as Djamaʿ Dakhil al-Qasaba (mosque within the citadel), stands as a unique example within the Ottoman religious landscape of Algiers. Built between 1818 and 1819, it was established within the very core of the newly reinforced Ottoman citadel, making it simultaneously a religious, military, and political structure. This citadel was the most complex of all the military constructions in the city of Algiers[2]. This unprecedented choice of location in Algiers reflects an explicit intent to re-center power within a closed and defensive space, shielded from the urban tensions of the city[9].

Far from being a long-term religious project, the construction of this mosque responded to the immediate need to legitimize the authority of Ali Khodja, a short-lived yet decisive Dey in the history of Algiers. The belated character of the building, at the very end of the Ottoman Regency, reinforces this strategic dimension: it was not merely a place of prayer, but also an act of spatial appropriation, a sacralization of power, and a symbolic reconfiguration of the command center.

The writings of Samia Chergui[4], through the examination of the *habous* register, confirm this distinctive position: the mosque is explicitly referred to as "located inside the citadel," which underlines its singularity within the urban fabric of Algiers. This location reflects a transformation of the defensive space into the nerve center of the Ottoman government, initiated under urgent circumstances and consolidated through architecture (Figure 1b).

1.2. Ottoman Legal Sources: The Decisive Insight of the Acts Translated by Devoulx

One of the foundations of this study lies in the critical analysis of a corpus of Ottoman legal documents, translated by Albert Devoulx in 1876 in his manuscript, which is well preserved in the National Library of Algiers. Although often mentioned on the margins of historical studies, these acts have rarely been used to inform an architectural reading of the built fabric. Yet they prove decisive for understanding the concrete conditions of the construction of the Dey Mosque and the logics of spatial appropriation implemented in the context of a declining Ottoman power.

1.2.1. Three Acts for a Strategy of Appropriation

The three acts reported by Devoulx are dated to the year 1233–1234 of the Hijra (1817–1819)[7]. They recount a series of land disputes related to expropriations ordered by Ali Khodja, as part of the major development works for the new center of power.

- The first act refers to the appropriation of a house, half of which was incorporated into the ramparts of the new Casbah.
- The second act records the demolition of a *habous* house, located "near the new Casbah," to allow for the construction of the palace. It specifies that an exchange with another property was granted only a posteriori, under Hussein Pasha.
- The third act, particularly significant, mentions a house located "facing a bathhouse" (probably the present-day Janissaries' hammam), which the Dey sought to incorporate into a mosque under construction within the palace itself. Since a fair exchange was proposed, the act was deemed legally acceptable by the Medjelès.

- Beyond their legal scope, these documents reveal the haste of the construction campaign, the spatial constraints within which it was carried out, and the authorities' determination to impose a new urban order at the heart of the fortress.

1.2.2. Spatial Evidence and Morphological Implications

The cross-reading of these documents leads to a fundamental observation: the mosque was not built on an empty plot, but rather on a pre-existing urban fabric, partially demolished or integrated. This stratification gave rise to several architectural anomalies still visible today—misaligned walls, uneven thicknesses, divergent orientations—all clear signs of a composite construction. These morphological irregularities, which will be detailed in the analysis of the north-east wall, find here their documentary grounding. They reflect the entanglement of urgent political decisions, property compromises, and the pragmatic use of existing structures.

1.2.3. Archival Complements: Vincennes and PKZ

Since the Ottoman deeds cover only a fragment of the narrative, they must be supplemented by other sources. The military archives of Vincennes, although primarily oriented toward a strategic reading of the citadel after 1830, provide insights into the transformation of the site, even though they remain silent about the mosque itself.

By contrast, the surveys produced in the 1980s by the Polish Atelier for the Restoration of Historic Monuments (PKZ), as part of a restoration campaign, provide valuable technical documentation. Plans, sections, and elevations make it possible to visualize elements that have since disappeared, such as the elevated tribune (*seda*) in the prayer hall reserved for the Dey. Some graphical hypotheses, not included in the final reports, suggest intermediate reconstructions that are useful for understanding the original design. These documents constitute a hybrid archive, situated between survey, restitution, and interpretation—at the intersection of memory and reconstruction.

Yet to fully grasp the conditions that presided over the very emergence of this atypical mosque, one must look beyond the building itself, to the unstable political context that precipitated its construction. For the Ottoman legal sources, valuable as they are, acquire their full significance only when set within the logic of power that produced them. The genesis of the Dey Mosque did not stem from a carefully elaborated religious project, but from a strategic gesture, carried out in urgency by a ruler seeking legitimacy.

2. Historical contextualization – Ali Khodja, power, and the urgency to build

The Khutba mosque of the citadel of Algiers, often referred to as the Dey Mosque, cannot be separated from the singular political trajectory of its founder: Ali Khodja (also known as Ali Pasha), a short-lived yet decisive ruler of Algiers, whose reign lasted only from September 1817 to March 1818. In a context of profound political instability, he decided to transfer the center of power to the Casbah, a strategic decision tied to topography, security, and the need for defensive retreat[10].

2.1. The retreat to the Casbah: political rupture and material foundation

On the night of November 1, 1817, Ali Khodja hastily abandoned the Jenina palace, located in the lower town, to take refuge in the citadel, under the mounting pressure of military factions and urban elites. This move was not merely a strategic retreat, but signaled a symbolic reconfiguration of power: the Casbah, until then a military stronghold, became the nerve center of Ottoman executive authority in Algiers. This shift triggered a profound reconfiguration of the urban fabric[8]. Barely settled in power, Ali Khodja initiated a series of major works: the extension of the fortified perimeter, the annexation of private dwellings, and above all, the launching of the construction of a mosque within the very enclosure of the palace. Conducted under urgent circumstances, this building project expressed a clear intent to sacralize authority in a context of profound institutional instability. By bringing together in a single site the palace, the fortress, and the place of worship, the project articulated a logic of territorial rootedness and political centralization[5]

2.2. Acts of Spoliation and Accelerated Temporality

The Ottoman deeds of 1818, translated by Devoulx, confirm this historical reality. They bear witness to the expropriation of at least three *habous* houses, one of which is explicitly mentioned as having been incorporated into the mosque under construction. The legal tone, at times accusatory (Ali Pasha is designated therein as "the despoiler"), reveals that these deeds were not mere expropriations but visible ruptures within the Islamic land tenure system.

The fact that these documents were drafted only a few months after the death of Ali Khodja (March 1818) demonstrates that the mosque was constructed within an extremely short time span.

This constrained temporality, documented in the deeds, sheds light on the presence of morphological irregularities and discontinuities, which the geometric analysis will confirm in the following sections. This accounts for certain heterogeneous architectural choices: the partial reuse of pre-existing walls and the juxtaposition of earlier elements, which will be examined in the subsequent analysis.

2.3. A Composite Construction

The composite character of the mosque is fundamental to understanding its present morphology. Unlike other Ottoman mosques in Algeria, it does not follow a canonical plan. The structure was superimposed upon pre-existing buildings, partially demolished or incorporated, as confirmed by wall anomalies revealed through 3D scanning (irregular wall shapes, misalignments, variable thicknesses). This heterogeneous composition is the precise reflection of an unstable political situation. Here, the built fabric becomes the material testimony of a historical turning point, where the desire to construct a sacralized power collided with spatial constraints, pre-existing land tenure, and a temporality dictated by urgency.

2.4. A Work Shared Between Two Successive Sovereignties

Although the decision to construct a mosque within the citadel indisputably belonged to Ali Pasha, his premature death left the work unfinished. It was therefore his successor, Hussein Pasha, the last Dey of Algiers, who oversaw its completion, institutionalization, and probably the epigraphic inscription that still adorns the building today[6].

This transition between two reigns is clearly documented in the legal deeds translated by Albert Devoulx, in which Hussein Pasha appears as the legal arbiter of the land expropriations carried out by his predecessor, and as the guarantor of religious orthodoxy through adherence to habous law. The mosque thus becomes a collaborative work, an architectural and political expression of the last two Deys in the history of Algiers. Ali Pasha conceived it as a defensive strategy and a means of sacralizing power, in the urgency of the moment. Hussein Pasha, more cautious, incorporated it into a process of regularization, legal recognition, and probably heritage enhancement upon its completion.

As the final architectural gesture of Ottoman power in Algiers, the citadel mosque embodies in its materiality the political tensions of the late regency. The anomalies revealed by 3D scanning – breaks, misalignments, excessive thicknesses – correspond to the expropriations and forced adjustments described in the Ottoman deeds. Here, the built fabric becomes the direct imprint of a hasty spatial reconfiguration.

3. The Silence of the Archives, the Voice of the Built Fabric: 3D Scanning as a Critical Archive

While the written sources on the citadel mosque remain fragmentary, sometimes contradictory or biased, the use of 3D scanning provides a major methodological shift: instead of waiting for the archives to reveal the shape of the building, it is the material itself that speaks, in three dimensions. It thus becomes possible to access the geometric objectivity of the existing structure, revealing dysfunctions, discontinuities, or the re-emergence of ancient strata that neither the naked eye nor conventional surveys can detect.

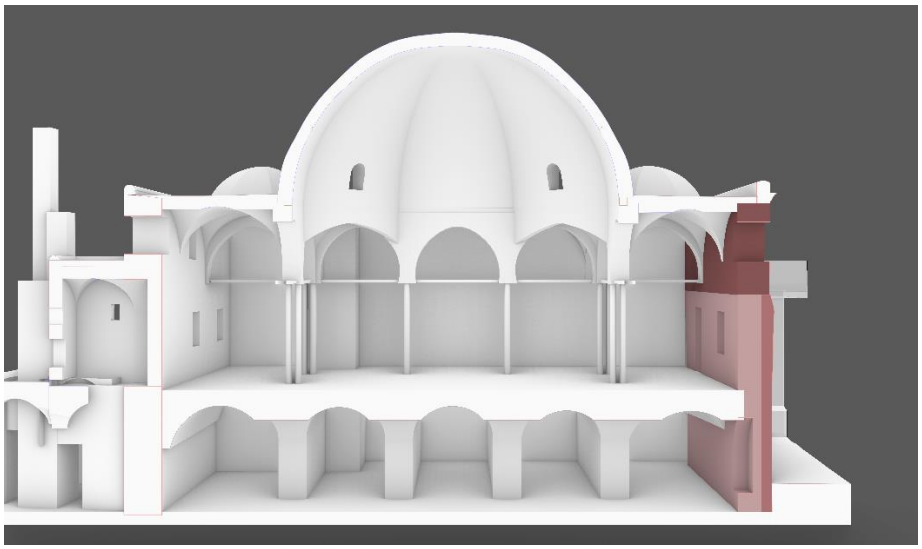

Fig. 2. *Reconstruction of the north-east wall: the interior wall (in pink) and the upper-storey wall (in dark garnet) date from 1818. The exterior wall (in light garnet) predates this construction.*

3.1. The North-East Wall as an Archaeological Witness of an Architectural Palimpsest

One of the most complex and revealing areas of the Dey Mosque is located at the north-east wall, which defines an open patio (as observed during the 2019 scanning campaign) and forms a direct connection with the former kitchen of the Dey's palace. Cross-analysis of the 3D point cloud, photographs from the emergency works (2008–2010), and in situ observations allows for an accurate reconstruction of its singular configuration.

This wall exhibits, on the patio side, a clear geometric offset between its lower and upper sections. Up to approximately 5.75 meters in height, its exterior face follows an oblique inclination, resulting in a slightly trapezoidal base. Above this height, the wall resumes a strict verticality, in accordance with the overall orthogonality of the mosque's elevations. The interior facing, by contrast, remains vertical along its entire height, except for a slight 0.062 m offset between the lower verticality and that of the prayer hall, perceptible only through the point cloud. This indicates that the asymmetry affects only the exterior face. These observations suggest that the mosque wall was partially constructed on a pre-existing substructure, integrated into new masonry (Figure 2).

Fig. 3*. 360° panoramic image from the FARO 350^s scan at the patio level: at the center, exposed wooden beams on the palace kitchen wall; on either side, the north-east wall.*

This hypothesis is supported by several material indicators: the wall thickness is noticeably greater here than on other façades; textures, masonry patterns, and mortars vary between the lower and upper levels; the

stone courses show a clear discontinuity between the interior and exterior faces. All of these anomalies, perceptible since 2008, are clearly confirmed by the point cloud, which highlights geometric irregularities previously inaccessible through morphological analysis alone. The spatial relationship with the neighboring palace building provides valuable insight. The two structures, parallel along their entire length, display elements of an ancient connection: on the kitchen side, aligned cavities are visible, remnants of wooden beam anchors, still partially observable (Figure3).

***Fig. 4**. Point cloud – view of the patio*

Their height corresponds to that of a former, now disappeared, floor. This level aligns with the offsets of the mosque wall, suggesting that a transverse floor once connected the two entities. The presence of openings in the mosque, located below this level, indicates that the space was then open, playing a fundamental role in the lighting and ventilation of the prayer hall from the north-east.

Another significant indicator reinforces this interpretation: a wall fragment oriented East-West, located above a vaulted passage and measuring 2.87 m in length with a thickness of 0.35 m, exhibits a dissonant orientation relative to the rest of the building. It forms an angle of 97.43° with the mosque's orthogonal wall, but 95.63° with the inclined fragment of the north-east wall. This angular configuration, combined with the repetition of its thickness at the patio entrance, suggests that it is a corner bond belonging to an earlier structure, partially preserved within the Ottoman project.

Photographs taken during the 2008–2010 restoration work show, on this fragment, a blocked window whose base exactly aligns with the floor of the imam's apartment corridor. Due to its position and dimensions, this opening cannot be attributed to the mosque's program, but rather to a prior state of the site, incorporated without complete erasure.

The totality of these indicators, which only 3D modeling allows to link and interpret in their full complexity, attests to the stratified and composite nature of this north-east wall. It is not a homogeneous wall, but rather a superposition of phases: a vestige of an earlier building, remodeled and then incorporated into an Ottoman project whose rapid execution—in 1818–1819, within a context of political tension—favored the partial reuse of existing structures (Figure 4). The wall thus becomes an archaeological document in itself, bearing superimposed temporalities and intertwined constructive logics.

3.2. Morphostructural analysis by 3D scanning: outward inclination of the qibla wall and torsion of the minaret of the Dey Mosque

The acquisition and processing of the point cloud generated from the 3D survey of the Dey Mosque revealed structural disorders that are scarcely perceptible to the naked eye. Two major anomalies warrant particular attention.

The first pertains to the qibla wall, whose upper section exhibits a pronounced outward inclination (Figure 5b). Measurements indicate a displacement of approximately 7 cm at a height of 9.92 m, originating from the prayer hall and affecting the entire wall, which gradually inclines outward (Figure 5c). This deformation, imperceptible to direct observation, becomes evident in the three-dimensional model derived from the point cloud. It points to a global imbalance of the masonry, potentially induced by differential foundation settlements, the thrust of interior vaults, or mechanical stresses accumulated over time[11].

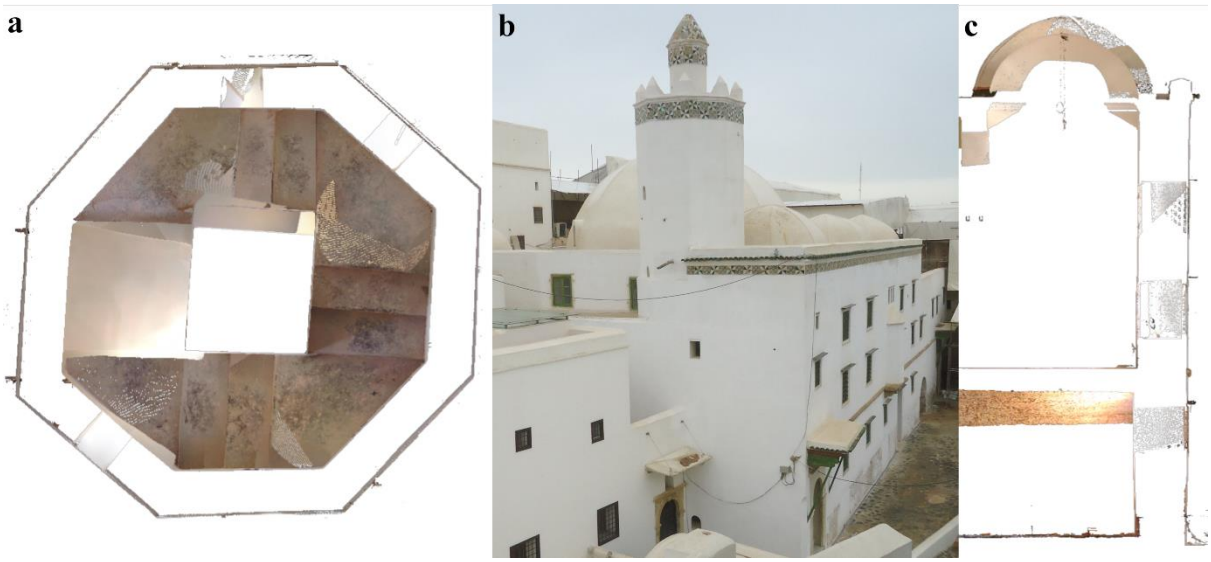

Fig. 5. *Horizontal section of the minaret point cloud showing apparent torsion (a); View towards the minaret (b); vertical section of the qibla wall point cloud showing an outward tilt in the upper part (c)*

The second anomaly is located at the minaret, whose morphology is commonly perceived as hexagonal (Figure 5b). However, a detailed analysis of the horizontal sections extracted from the point cloud reveals a marked geometric irregularity (Figure 5a). Rather than conforming to a regular hexagonal form, the structure displays a progressive torsion of its base, reflecting a cumulative displacement that failed to realign with its original axis. This distortion, imperceptible at the visual scale, underscores the critical contribution of 3D digitisation technologies in diagnosing architectural pathologies.

The minaret, positioned at the southern corner of the mosque above the south-western access stair, originates directly from the prayer hall. It initially adopts an octagonal form (1.30 m per side; overall width 3.15 m) and rises to a height of 14.33 m. Its volume is structured by a spiral staircase organised around a square core of approximately 0.86 m per side, providing access to the upper terrace. These observations highlight the significance of 3D laser scanning in detecting and quantifying structural deformations in historic monuments.

These morphological and structural observations were incorporated into the numerical model used for finite element analyses (FEM), as well as into the interpretation of ambient vibration tests (OMA). Accounting for geometric heterogeneities, continuity breaks, misalignments, and additional loads induced by later additions—such as the interstitial adjoining body or the patio covering—allowed the refinement of the simulated dynamic behavior of the building. This integration of architectural interpretation, 3D surveying, and structural modeling confirms the need for an interdisciplinary approach to address the historical and material complexity of the Dey Mosque.

4. Discussion and Conclusion

4.1. Discussion

The analysis derived from the three-dimensional scan reveals a reality far more complex than the apparent regularity of the Dey Mosque might suggest. What initially appeared to be a homogeneous composition, governed by a unified architectural logic, is in fact a stratified assemblage of heterogeneous built fragments, inherited from earlier phases and grafted under the urgency of a constrained construction process. The scan, by providing an accurate reading of geometries, vertical alignments, wall thicknesses, and breaks in continuity, emerges not merely as a tool of documentation but as a revealer of hidden layers, a catalyst for a renewed archaeology of the built fabric.

The identification of angular misalignments, facing discontinuities, material breaks, and localised wall thickening allows the mosque to be interpreted as an architectural palimpsest.

The case of the north-east Wall, with its inclined base and vertical upper section, or that of the qibla wall, whose upper section displays an outward inclination of approximately 7 cm at 9.92 m in height, illustrates this logic of insertion.

Similarly, the minaret, visually perceived as a regular hexagonal structure, reveals under point-cloud analysis a profoundly irregular geometry, marked by a progressive torsion of its basal form.

Such features are not the result of design flaws but of strategic choices: the reuse of pre-existing structures or the adaptation of construction to local constraints, even at the cost of imbalances perceptible only through three-dimensional surveying. These observations materially confirm what the administrative acts compiled and analysed by Devoulx had already suggested: the existence of a prior edifice upon which the new mosque was grafted. The texts do not indicate an intent to demolish entirely, but rather to establish the mosque "on the site of an older building," without specifying whether it was a palatial annex, a dwelling, or a service structure.

It is precisely this lack of precision in the written sources that the material trace helps to address. The walls themselves become documents, carriers of structural information that the archival record fails to disclose. One of the major contributions of this research lies in the articulation between visible traces, archaeological interpretation, and structural modelling.

This methodological cross-reading enables the linking of morphological anomalies with constructive and mechanical hypotheses. The example of the outward inclination observed on the qibla wall and the torsion detected in the minaret perfectly illustrates this approach: far from being trivial details, these deviations reflect adaptations to pre-existing constraints—reuse, differential settlements, or construction adjustments—and induce a redistribution of forces upon walls not originally designed to bear such loads. This finding is not merely descriptive; it profoundly reshapes the analysis of the building's weak points and vulnerability scenarios.

The consideration of these elements has moreover guided the choices in the finite element modelling (FEM) scenarios. Where a homogeneous interpretation would have led to the attribution of uniform stiffness, the scan-derived data allowed for the introduction of variations in mechanical properties, distinguishing homogeneous zones from composite areas, and original masonry from grafted sections. This level of detail is crucial for understanding the building's dynamic responses, particularly in the context of seismic exposure.

More fundamentally, this research questions our ways of seeing and interpreting the built heritage. It challenges the notion of a fixed, completed monument, inviting us instead to conceive of the edifice as an evolving organism, bearing contingent decisions, constructive compromises, and successive layers of appropriation. The Dey Mosque cannot be understood without reference to the palace that surrounds it, to the practices of reuse, and to the political urgencies that dictated its construction.

In this sense, the scan is not neutral: it grants access to architectural truths invisible to the eye, and thus becomes a tool of historical critique, on a par with archival records and archaeological surveys. Finally, this approach opens significant perspectives for preventive conservation. By making vulnerabilities visible—overloaded walls, rupture points, discontinuities—it not only enriches our historical understanding but also prepares the built fabric for future stresses, particularly seismic ones. It thereby creates a bridge between academic research, heritage engineering, and safeguarding policies.

5. Conclusions

A careful reading of the building through the lens of built-heritage archaeology and three-dimensional digitization technologies reveals a profoundly unexpected aspect of the Dey Mosque. Far from being a building designed homogeneously according to a canonical plan, the analysis reveals a composite construction, marked by successive integrations, subtle adjustments, and reuse logics often imperceptible to the naked eye.

The geometric anomalies revealed by the 3D scan—wall misalignments, plumb breaks, distinct facing fragments, interrupted alignments—outline a structural map in which each wall segment conveys a specific constructive narrative. These elements, cross-referenced with archival data from previous restoration photography campaigns and also confronted with the scarce historical sources available—particularly the land allocation deeds recorded by Devoulx—confirm the existence of a preexisting architectural substrate, partially incorporated into the Ottoman project of 1818–1819.

The strength of this approach lies in its ability to go beyond mere volumetric restitution. By revealing the constructive stratigraphy of the building, it allows the characterization of structural heterogeneities not as defects, but as material witnesses to a history of adaptation: adaptation to the existing fabric, to site constraints, to political urgency, as well as to strategies of rapid appropriation of a symbolic and strategic space. Each preserved wall, each setback or trace of a vanished floor, provides information as much about construction practices as about usages and the compromises adopted.

Moreover, this differentiated reading of the building, supported by geometric modeling and integrated into numerical simulations (FEM, OMA), enables the creation of a precise structural map, essential for any attempt at seismic assessment or long-term restoration. Indeed, understanding a wall's origins, its continuities and discontinuities, is to understand how it behaves, how it responds to loads, and how it may fail. In the case of a heritage building, such understanding is a sine qua non for any responsible conservation.

In this sense, the study presented here is not merely a retrospective analytical exercise: it lays the foundation for a forward-looking approach, in which an intimate understanding of the building fabric—its weaknesses, its additions, its tensions—enables better calibration of future interventions. It reintegrates architectural analysis into a perspective of knowledge transmission, where the memory of constructive gestures directly informs conservation strategies.

Ultimately, this rigorous and cross-disciplinary methodology provides the means to better delineate the mechanical characterization of each building segment, to refine the calibration of stiffness modules in numerical models, and to anticipate the actual seismic behavior of the structure. It opens a new avenue for conceiving restoration not as a fixed reconstruction, but as an informed act, grounded in a profound understanding of the material, and oriented toward durability.

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