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***A Study of Earthen Architecture Models in the
Amour Mountains Region: The Cases of the
Ksars of El-Houita and "El-Ghicha as
Examples of Construction Techniques and
Materials"***

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ABSTRACT

Traditional earthen ksour in the Algerian Sahara clearly demonstrate the advanced development of earthen architecture and ancient construction techniques. Built using locally available materials, these structures have proven their effectiveness and efficiency over time, while offering architectural and design solutions well adapted to local environmental and climatic conditions and responsive to the needs of the resident communities.

Despite the numerous advantages of earthen materials, they are not without limitations and shortcomings that must be carefully considered and addressed. These include the need to enhance their resistance to moisture, erosion, and other natural factors. In this context, this study examines the principal construction materials employed in the earthen architecture and urban fabric of Ksar El-Ghicha and Ksar El-Houita, highlighting their main characteristics within the Amour Mountains region of Laghouat, as well as identifying points of similarity and difference in comparison with other regions. The study further explores the role of local building traditions in the adaptation, development, and consolidation of innovative construction techniques used in the erection of these traditional fortified settlements, commonly referred to as Saharan ksour.

Keywords :Moisture; Erosion factors; Ancient construction techniques; Ksar El-Ghicha; Amour Mountains.

1.Introduction

1.1. General Overview of the Topic

Ksar El-Ghicha and Ksar El-Houita, located in the Amour Mountains region (Laghouat Province and the delegated province of Aflou), constitute an architectural model that reflects a profound interaction between humans and their Saharan environment. Clay and stone remain among the most important primary materials used in the construction of these ksour, particularly since Ksar El-Ghicha is predominantly built of stone, whereas Ksar El-Houita is largely constructed of adobe bricks. This choice is attributable to several factors, foremost among them the availability of these materials in the local environment and their capacity to adapt to the extreme thermal conditions of the desert—high daytime temperatures and cold nights. These ksour also represent a living expression of local culture, as communities seek to preserve their traditions by maintaining the use of the same materials and construction techniques while gradually developing building methods over time ¹

1.2. Importance of the Topic

The significance of this study—centered on the analysis and understanding of construction techniques and materials—lies in its contribution to comprehending the evolution of architecture under harsh desert climatic conditions. Despite the advent of modern construction techniques, these ksour continue to exhibit remarkable quality, solidity, and durability over time, while embodying substantial architectural and historical value. This reflects both natural and human adaptation to environmental challenges.

The study aims to highlight the architectural and urban value of the ksour of the Laghouat region by examining the construction materials employed and the methods of their use within specific building systems as realized in practice. This approach seeks to contribute to the revival of this cultural heritage and its promotion as a tourism asset, with the objective of integrating it into sustainable development strategies and creating tourist destinations that benefit local populations and improve their living conditions (ELTAKHI.belkacem, 2018) Several questions arise in this context: What distinguishes the ksour of the Amour Mountains from those of other Saharan regions? What types of construction techniques and traditional building skills were employed in the construction of the Saharan ksour of the Amour Mountains? What are the urban layouts and spatial organizations of these ksour? Accordingly, the main research

¹ Ayache, M. (2022). *Saharan Ksour and Their Military Fortifications in Southern Algeria*. Maghreb Journal of Historical and Social Studies.

question may be formulated as follows: **What are the construction materials and architectural techniques used in the building of the ksour of the Amour Mountains region?**

To address these questions, the study adopts a structured approach beginning with a definition of the Amour Mountains region, to which Ksar El-Ghicha and Ksar El-Houita belong. This is followed by a geographical and historical overview of each ksar, an analysis of the construction materials used—selected on the basis of both formal and functional comparison—and an examination of the construction techniques applied. Ksar El-Ghicha, like Ksar Ain Madhi, is predominantly built of stone and is located in the eastern part of the Amour Mountains, whereas Ksar El-Houita, similar to the well-known Ksar Tajmout, exhibits a mixed construction of stone and adobe and lies in the western part of the region. The study concludes with key findings and recommendations.

2. Geographical and Historical Framework

2.1. Geographical Location

Ksar El-Ghicha and Ksar El-Houita, the focus of this study, are situated in the Amour Mountains region of Laghouat Province, approximately 448 km south of Algiers. The region is bordered to the north by Tiaret Province, to the southwest by El-Bayadh, to the east and northeast by Djelfa, and to the south by Ghardaïa, which constitutes the gateway to the Algerian Sahara and marks the southern limit of the Saharan Atlas. The area lies between longitudes 2° and 5°2' and latitudes 33° and 48° (see Figure 01).

The Amour Mountains lie between the Ouled Naïl Mountains to the east and the Ksour Mountains to the west and form part of the Saharan Atlas range. They extend over approximately 130 km in length and 60 km in width, with elevations reaching about 2,008 m above sea level. The region serves as a transitional zone between the High Plateaus and the Sahara. It is characterized by a harsh desert climate, with high summer temperatures and sharply cold winters, and receives annual rainfall ranging between 300 and 500 mm. This contributes to environmental diversity, including springs, wadis, and forests that shelter rare species of birds of prey.

The region represents a clear model of traditional Saharan architecture based on local materials that enable adaptation to severe climatic conditions, thereby requiring specific and exceptional construction techniques that enhance thermal insulation and environmental integration.

Despite the general harshness of the Saharan climate, the Amour Mountains exhibit certain climatic particularities due to their elevation above sea level, which facilitates natural ventilation. The region is also distinguished by its rock art heritage, reflecting prehistoric life and local culture.

Clay and stone are among the most important traditional materials used in the construction of ksour in the region. Clay, whether in the form of adobe bricks or as a mixture of clay and sand, is valued for its thermal insulation properties in hot desert environments. Local stones, such as limestone, are used in foundations and walls, while tamarisk wood and other local vegetation are employed in roofing and columns, with reeds serving as structural reinforcement in earthen roofs².

2.2. Differences between the Amour Mountains and Adjacent Regions

The Amour Mountains differ from neighboring regions in their geological composition, notably the abundance of local stone materials such as limestone and even hard granite. In contrast, regions such as Ouargla and Oued Souf possess fewer stone resources, which compels inhabitants to rely on sun-dried bricks or imported materials. Nevertheless, the use of reeds and stones for reinforcing walls and providing protection against heat and aridity is common across these regions, including Ouargla and Timimoun, reflecting a shared traditional architectural culture.

Overall, the Amour Mountains are distinguished by geographical characteristics that make them a prominent example of the use of local materials—clay, stone, reeds, and even granite—in construction. While neighboring regions share certain architectural traits, they differ in the materials available. Through these traditional materials and techniques, the inhabitants of the Amour Mountains have sought to adapt effectively to their harsh desert environment.

2.3. Historical Framework

The origins of traditional earthen ksour in Algeria are generally attributed to the Islamic periods, during which the Fatimids and Zirids introduced architectural techniques such as domes and arches, which later spread into Saharan regions. Ksar El-Ghicha and Ksar El-Houita form part of this architectural tradition. They were constructed over different phases and

² Cote, M. (1996). *Media-Plus K Guide d'Algérie*. Algiers.

influenced by various historical periods, including Ottoman rule and colonial occupation.

The desert environment is marked by significant thermal variation, with extremely hot days and cold nights. Consequently, the architectural techniques employed in Ksar El-Ghicha and Ksar El-Houita focused on adaptation to this contrast, relying on local materials—particularly clay—which provides excellent thermal insulation and mitigates the effects of extreme heat.

.3. Ksar El-Ghicha and Its History

The ancient Ksar El-Ghicha is located northeast of the town of El-Ghicha. According to oral traditions, its foundation dates back to the 15th century CE, and it covers an area exceeding approximately 4 hectares. Like other ksour, it occupies a strategic location near water sources and wadis, surrounded by fertile gardens. At its center stands a mosque located at the highest point of the ksar.

Local accounts describe Ksar El-Ghicha as a witness to various historical periods, including colonial and pre-Islamic eras. Notable structures include the House of the Al-Allash family, located in a spacious square and dating back to the establishment of the ksar, as well as the House of the Ouifat family, formerly known as Dar Al-Fawatih, which dates to the 15th century and comprises eight rooms with arches that served as centers of learning for prominent scholars such as Ouifat Mohamed and Ben Shohra.

3.1. Historical Overview

El-Ghicha contains the Ksar of the Zanakhra, dating to the early Christian centuries; however, the existing ksar built by Arab populations dates to a later period, following the departure of the Zanakhra tribe. Arabs initially settled in Ksar Al-Tarifiya, which predates the foundation of Ain Madhi.

During this period, El-Ghicha emerged as a major center of influence in the Amour Mountains and the Laghouat region, serving as the capital of Jebel Amour. The city flourished through trade exchanges (wheat and barley in exchange for fruits and vegetables) and artisanal activities such as blacksmithing, weapon making, and wool weaving. Alongside Tawiella and Ain Madhi, El-Ghicha formed one of the three principal urban centers of the region. It was also renowned for its Qur'anic schools and scholars and for the Tijaniyya Sufi order led by Sheikh El-Hadj Mbarek Ben Toumi.

El-Ghicha is further honored as the birthplace of the revolutionary hero Cherif Mohamed Ben Toumi Bouchoucha Al-Mansouri Al-Idrissi Al-Ghichawi. The town and its surroundings suffered severe repression, displacement, and

massacres during the colonial period. Major battles include the Battle of Al-Shawabir (north of El-Ghicha) on 4 October 1956, resulting in 1,375 casualties and 25 martyrs, and the Battle of Khenq Abdelrahmane (southwest of El-Ghicha) on 15 May 1957, with approximately 50 killed, 50 wounded, and 70 martyrs.

El-Ghicha contains numerous archaeological sites that unfortunately remain neglected and endangered, including remnants of the walls of Ksar Zanakhra, the ruins of Ksar Al-Raddada, the ancient Ksar El-Ghicha, and rock engravings at Al-Rahya and Al-Safsafa—the latter adopted by UNICEF as a symbol depicting an elephant protecting its calf. The region is also known for its scenic landscapes, waterfalls, flowing waters, irrigation channels, and traditional garden irrigation systems.

3.2. The City of El-Houita and Its Ancient Ksar

Ksar El-Houita is located approximately 40 km west of Laghouat. Oral traditions extensively recount its history, including its mosque and architectural features. The ksar is praised by Dr. Hamlawi in his work *Models of Ksour on the Southern Slopes of the Amour Mountains*, and it is also mentioned by travelers such as Ibn Hattal Al-Tlemceni in *The Journey of Mohamed the Great* and El-Aghwati El-Hadj Ibn El-Din in *The Journey of El-Aghwati*, dating to the 16th century CE, which is generally accepted as the period of its foundation.

The name “El-Houita” refers to a circular enclosure or fortified wall, reflecting the ksar’s circular layout and defensive nature. The site is naturally protected by a wadi and an elevated mound.

In the mid-17th century (circa 1650 CE), members of the Ouled Yaacoub tribe settled at a site known as “Al-Tafza” and constructed a surrounding wall to protect their dwellings, thereby establishing the nucleus of the ksar, later named El-Houita after this enclosing wall. As the population increased, the ksar came to comprise three groups: Ouled El-Hadj, Ouled Mahsar, and Ouled Sidi Aref.

4. Building Materials in Ksar El-Ghicha and Ksar El-Houita

4.1. Adobe (Sun-Dried Brick)

Adobe refers to bricks dried by exposure to sunlight and constitutes the primary construction material for most dwellings in the ksour of the Laghouat region, particularly in the Amour Mountains. Adobe possesses notable properties in terms of thermal and acoustic insulation and can preserve wall integrity over extended periods when protected by suitable coatings against natural factors such as rain, wind, and snow.

Adobe bricks are prepared in gardens or nearby forests surrounding the ksar, where cohesive soil is available. A large basin—often approximately one arm’s length—is prepared according to the desired quantity of bricks. Water is added at a ratio of about 80%, and the mixture is thoroughly blended with straw or animal waste. The mixture is left to ferment for a period that may exceed one month, after which it is repeatedly kneaded by foot until it becomes moldable. Bricks are then shaped using a wooden mold locally known as *al-farda* (see Figure 01).

The bricks are laid on a flat surface covered with a thin layer of sand to prevent adhesion and are exposed to sunlight throughout the day. They are turned on all four sides until fully dried, then stacked for use. Adobe was extensively used in Ksar El-Ghicha, with some dwellings entirely constructed of adobe, due to its lower cost compared to stone and its local availability. Both ksour employed adobe, albeit in different proportions: extensively in Ksar El-Ghicha, and more selectively in Ksar El-Houita, particularly in the lower sections of walls for reinforcement.

Stone was used primarily in foundations and extended up to one-third of the ground-level walls, especially in areas subject to moisture or rising groundwater, and to provide structural reinforcement capable of supporting upper floors. Stone was also employed in staircases connecting different levels. Entirely stone-built dwellings, though more expensive, were characteristic of Ksar El-Houita.

4.2. Stone

Stone has long been intrinsically associated with ksour architecture, particularly residential structures, and represents one of the earliest materials used by humans for shelter and settlement. The Amour Mountains are distinguished by diverse geological formations, and many ksour were constructed on elevated sites for security and protection against invasion. Stones were quarried from these elevations or collected near mountain bases beneath a soil layer locally known as *al-teef*. Stones are classified according to hardness into friable and hard types, with granite being among the most prominent.

4.3. Fired Brick

Fired brick has been known since ancient civilizations and was used in the construction of ksour, domes, and arches. It is characterized by its durability and decorative potential but is relatively costly in terms of production and labor. Consequently, its use in the Laghouat region was limited to distinctive structures

such as chimneys, bath walls, staircases, door frames, arches, and vaults (Belkacem, 2018)³.

Fired bricks were produced from clay collected from wadi banks during periods of low water flow or drying. After sun-drying, the clay was kneaded, molded using wooden frames, and fired in kilns. Common brick dimensions in the Laghouat region were 22 cm in length, 11 cm in width, and 5 cm in thickness. Fired bricks were more frequently used in Ksar El-Houita due to their compatibility with stone construction, whereas their use in Ksar El-Ghicha was limited.

4.4. Lime

Lime was produced in kilns by firing limestone at temperatures reaching approximately 1,000°C. The firing process involved a lower level for fuel combustion and an upper chamber filled with limestone. After about a week, the lime was extracted as white stones ready for slaking⁴. Slaked lime was used either as a whitewash or as mortar mixed with sand for masonry and plastering. Lime was widely used in both ksour due to its availability.

4.5. Tebshimite

This material is distinguished by its rapid drying and resistance to moisture, unlike gypsum. It was produced from limestone sourced from known quarries in the region and used primarily for finishing and decorative elements. Tebshimite was extensively used in both Ksar El-Ghicha and Ksar El-Houita, particularly for interior and exterior decoration.

4.6. Wood

The ksour of the Laghouat region are characterized by gardens and palm groves, providing materials such as juniper, willow, oleander, and halfa grass. Wood was used in roofing, staircases, lintels, and structural beams. Willow and juniper were commonly used in El-Ghicha, while juniper and oleander were prevalent in El-Houita.

5. Construction Techniques in Ksar El-Ghicha and Ksar El-Houita

Traditional adobe construction relied on deep stone foundations, protective stone coping at the top of walls to prevent rainwater infiltration, and dense layers

³ Eltakhi, B. (2018). *An Approach to the Restoration of Saharan Ksour in the Laghouat Region: A Case Study of Ksar Tawiella*.

⁴ Toracca, G. (2003). *Materials Technology and the Conservation of Historic Buildings*. Cairo: Al-Fajr Publishing and Distribution.

of tebshimite in roofing to prevent cracking and water penetration—particularly evident in Ksar El-Houita.

5.1. Foundations

Foundations were excavated to a depth of approximately one meter in non-rocky soils and constructed of stone and mortar, rising above ground level to prevent moisture infiltration and enhance structural stability.

5.2. Walls and Principal Construction Techniques

Adobe walls were erected on stone foundations, with thickness ranging from one to two brick lengths. In El-Houita, wall thickness averaged about 40 cm. Stone walls maintained uniform thickness throughout their height. Lime mortar was used in wet areas such as baths and kitchens. At wall tops, stone belts bonded with lime mortar supported wooden roof beams, while parapets (*al-laidoun*) protected walls from rainwater runoff.

Ksar El-Ghicha is predominantly adobe-built, whereas Ksar El-Houita exhibits mixed stone and adobe construction. These techniques reflect common practices in Saharan ksour, including those examined in this⁵.

5.2.1. The Herringbone (Sanbala) Technique

This construction technique involves arranging masonry units (stone or adobe bricks) diagonally and intersecting at regular angles, resembling wheat ears. It enhances structural cohesion and efficiently distributes vertical and horizontal loads, offering high resistance to cracking and sliding—particularly in arid environments with significant thermal variation. It was used in both ksour, especially in Ksar El-Houita, primarily in stone construction, either decoratively on wall surfaces or structurally within wall cores to prevent collapse.

5.2.2. The Regular Bonding (Tandhim) Technique

This technique consists of arranging masonry units in a regular horizontal or near-horizontal pattern, respecting joint alignment and course thickness to ensure uniform load distribution and long-term structural stability. It reflects refined craftsmanship and knowledge of material properties. It was predominantly used in Ksar El-Ghicha due to the lighter weight of adobe bricks, facilitating orderly construction and regular architectural patterns.

5.2.3. Mixed Construction Technique

⁵ Hamlawi, A. (2006). *Ksour of the Amour Mountains Region (Southern Slope): A Historical and Archaeological Study*. Algeria.

The mixed construction technique is a building approach that combines the use of natural stone and earthen bricks (adobe) within the same wall. Stone is generally employed in the foundations and lower sections exposed to moisture⁶, while adobe is used in the upper parts in order to reduce structural weight and enhance thermal insulation. This technique is present in almost all traditional ksour, as it represents the dominant and most widespread construction method for residential buildings, regardless of the topography or climatic conditions of the site.

5.2.4. Rubble Masonry Technique (Debsh)

This technique relies on the use of uncut or partially dressed stones, laid within walls with voids filled using earthen or lime mortar. It provides considerable wall thickness and a high level of thermal insulation. Its primary advantages lie in its low cost, ease of execution, and long-term structural durability. Although it is not widely used, it remains effective and economical. In Ksar El-Houita, this technique was employed more extensively, and due to its robustness, it was sometimes used decoratively in residential buildings.

5.2.5. Al-Adiya Technique

Al-Adiya is a traditional construction technique used in establishing load-bearing walls. It consists of forming a thick lower layer of natural stone or large rubble masonry, arranged in a relatively irregular manner, with voids filled using earthen or earthen-lime mortar. The primary objective is to isolate the wall from ground moisture and raise the building above ground level. This technique is applied in the lower part of the wall (foundations and initial elevation) and relies on relatively large stones, thereby increasing the structural lifespan of the upper earthen walls. Its main purpose is to protect earthen walls from deterioration caused by rising damp and erosion, particularly in oasis environments and former watercourses⁷.

5.2.6. Al-Shanawi Technique

Al-Shanawi is a traditional building method based on integrating horizontal or semi-horizontal stone courses within an earthen wall. These courses function as internal reinforcement elements that improve wall cohesion and reduce cracking caused by thermal shrinkage or vertical loads. This technique is executed within

⁶ Ayache, M. (2022). *Saharan Ksour and Their Military Fortifications in Southern Algeria*. Maghreb Journal of Historical and Social Studies.

⁷ Ben Abdallah, N. (2012). *Traditional Architecture in the Touat Region: The Ksar as a Model*. Kan Historical Journal – Digital Future of Historical Studies.

earthen walls through the insertion of stone bands separating layers of adobe. It contributes to load distribution, prevents buckling, and enhances horizontal structural bonding. Its primary objective is to increase the resistance of earthen walls to partial collapse and improve their performance under thermal and temporal stresses.

The last two techniques—Al-Adiya and Al-Shanawi—are often considered complementary aspects of a single constructive system. While Al-Shanawi relies on horizontal stone courses extending inward, Al-Adiya is based on a thick vertical stone base that reinforces and strengthens the wall to support upper construction. In practice, both techniques are frequently combined, demonstrating high structural efficiency. A clear example can be observed in Ksar El-Ghicha, where Al-Adiya is evident in the lower sections of both exterior and interior walls. The foundations were built using large rubble stones sourced from the surrounding mountainous environment and bonded with local earthen mortar. The choice of this technique is directly linked to the mountainous and semi-rocky nature of the site, as it elevates earthen walls above ground level, limits the effects of seasonal moisture, and ensures structural stability for thick walls.

In the same ksar, the Al-Shanawi technique appears within thick earthen walls in the form of discontinuous horizontal stone courses separating layers of adobe. This method reduces cracking caused by thermal shrinkage, improves internal cohesion, and increases resistance to buckling and partial collapse.

Traditional ksour in the Laghouat region and the Amour Mountains, built using local stone and adobe, typically exhibit shared constructive features such as thick rammed-earth walls, stone bases integrated into foundations or wall outlets to protect against moisture and erosion, and the insertion of horizontal stone layers within walls to enhance internal bonding. These structural characteristics constitute the core principles of the Al-Adiya and Al-Shanawi techniques as practiced in the Amour Mountains region.

5.3. Mortar

Earthen mortar is prepared from a mixture of cohesive soil, fine sand, and water; in some cases, straw is added. It is used to bind wall elements together and to coat walls in two successive layers, either applied manually or using smoothing tools⁸.

⁸ Hamlawi, A. *Models of Ksour in the Laghouat Region: A Historical and Archaeological Study*.

Wall coating or plastering consists of applying a layer of earthen or lime mortar to protect walls externally from natural elements such as wind, rain, and cold, and internally to prevent insects and reptiles from nesting between adobe blocks, which could pose risks to inhabitants. Facade walls were treated with lime plaster, enhancing durability, protection, and aesthetic quality while contributing to the creation of shaded surfaces.

5.4. Roofs

Palm trunks, tree branches, reeds, fronds, and fibers were the primary materials used in roof construction. In both Ksar El-Ghicha and Ksar El-Houita, traditional roofs typically consist— from bottom to top—of wooden beams (palm trunks or branches such as willow, juniper, or almond) laid across load-bearing walls spaced no more than three meters apart, with approximately 40 cm between beams. Above these, reeds are interwoven to form a dense mat, followed by palm fronds, fibers, or alfa grass. A thick layer of earth mixed with water is then applied, reaching up to 40 cm in thickness⁹. Once dry, the surface is finished with a thick lime mortar or fired brick paving, forming an effective waterproof barrier. These roofing systems are present in both ksour, with slight variations in wood species—willow being more common in El-Ghicha, while oleander, retama, and juniper are more prevalent in El-Houita.

5.5. Staircases

Staircases are integral structural elements allowing vertical circulation between different levels, locally known as “*Derouj*”. Two main types are identified in the ksour of the Laghouat region, particularly in El-Ghicha and El-Houita:

5.5.1. Stone-Block Staircases

These staircases are built entirely from stone or adobe blocks and represent the oldest and most widely used type, especially in Ksar El-Ghicha, where many houses include two levels or underground floors.

5.5.2. Wooden-Beam Staircases

These staircases are constructed on wooden beams joined together, with steps made of dressed stone or fired brick. They are more common in certain houses in Ksar El-Houita.

⁹ Taskourt, Y. (2019). *Materials and Roofing Techniques of Ksour and Mosques in the Adrar Region*. University of M'sila.

6. Shared Structural and Aesthetic Features

6.1. Thick Walls

Thick walls—sometimes reaching up to one meter in thickness—are a defining feature of Saharan ksour, including El-Ghicha and El-Houita ¹⁰. Their primary function is thermal insulation, reducing heat transfer and maintaining moderate indoor temperatures .¹¹

6.2. Sloped Roofs

Steeply sloped roofs facilitate rapid rainwater drainage in regions with limited precipitation, reducing water accumulation and structural deterioration ¹².

6.3. Arches and Domes

Arches and domes are widely used for both structural and aesthetic purposes. They distribute loads evenly, expand interior spaces without columns, and enhance resistance to desert winds and climatic stress ¹³.

6.4. Environmental Techniques and Natural Conditioning

Natural ventilation and passive cooling are key features achieved through carefully positioned openings and windows that promote airflow, thereby reducing indoor temperatures during summer months ¹⁴. **Differences Between El-Ghicha and El-Houita and Other Saharan Ksour**

7.1. Material Differences

Compared to ksour in regions such as Touat or Béchar, those of Laghouat rely more extensively on lime as a binding material, whereas gypsum or limestone is more common elsewhere¹⁵.

7.2. Functional and Infrastructural Comparison:

Element	Ksar El-Houita	Ksar El-Ghicha
Mosque	Solid structure with gypsum	Simple structure using earth and stone
Housing	Adobe and stone	Adobe mixed with straw
Storage	Polished stone walls	Straw-reinforced earthen walls

¹⁰ Dahmani, M., Qabqoub, L., & Salim, L. (2023). *Materials and Construction Techniques of the Archaeological Ksar of Tawiella in Laghouat*. Herodotus Journal of Humanities and Social Sciences, Vol. 7, No. 3.

¹¹ Shaker, R. *Traditional Architecture in Algeria: Principles and Criteria*.

¹² Bousna, F. *Saharan Architecture in Algeria: An Analytical Study*.

¹³ Ben Abdallah, N. *Architectural Art in North Africa*.

¹⁴ Najib, S. *Architectural Techniques in the Saharan Region*.

¹⁵ Al-Madyouni, A. *Saharan Ksour in Algeria: A Comparative Study*.

Table 01: Functional and infrastructural comparison between Ksar El-Ghicha and Ksar El-Houita

7.3. Architectural Design Differences

Both ksour display more complex layouts with well-defined internal courtyards separating private and public spaces, unlike some other Saharan ksour where such distinctions are less pronounced.

8. Similarities with Other Saharan Ksour

8.1. Emphasis on Privacy

Architectural design emphasizes privacy through the separation of public and private spaces, high perimeter walls, and interior zoning, reflecting social and religious norms similar to those observed in Touat, M'zab Valley, Ouargla, and other regions ¹⁶.

8.2. Use of Architectural Techniques

Arches and domes are common structural elements across Saharan ksour, enhancing load distribution, interior volume, ventilation, and resistance to harsh climatic conditions.

9. Cultural and Religious Influences

The architectural designs of Ksar El-Ghicha and Ksar El-Houita reflect strong local cultural and Islamic values emphasizing privacy, comfort, and gender separation. Interior spaces are carefully organized to accommodate worship, reception, and daily life in accordance with religious principles. Prayer areas typically include a mihrab oriented toward the qibla, underscoring the community's religious commitment¹⁷.

10. Conclusion:

The architecture of both ksour demonstrates advanced construction techniques, including arches, thick walls, and curved openings that facilitate airflow and thermal regulation. These features illustrate the effective adaptation of human settlement to the harsh Saharan environment. By relying on local materials and sustainable construction methods, these ksour preserve a distinctive architectural identity that embodies the region's cultural and historical heritage. It is therefore essential to safeguard these structures for future generations¹⁸.

This study highlights the critical role of local materials and innovative architectural techniques in ensuring the sustainability of Saharan ksour in

¹⁶ Ben Saad, M. *Architecture in Algeria: An Architectural Study*.

¹⁷ Jilali, M. *Islamic Architecture in Algeria*.

¹⁸ Ben Ali, R. *Saharan Architecture in Algeria*.

Algeria, revealing the dynamic interaction between vernacular construction, environment, and history. Future recommendations include the preservation and rehabilitation of these unique architectural forms in the Amour Mountains region, adapting them to contemporary environmental challenges¹⁹.

As future recommendations, it is strongly advised to preserve these unique architectural patterns in the Amour Mountains region, and Saharan ksour in general, and to undertake their rehabilitation and renewal in a manner that is consistent with contemporary environmental challenges and sustainability requirements



Figure 01: Remains of the Old Ksar of El-Houita



Figure 02: Interior view of the old mosque of El-Houita



Figure 03: Stone wall construction using various methods, including the herringbone technique and stacked masonry through reduced air voids in Ksar El-houita

¹⁹ Bouazza, M. Traditional Materials in Algerian Architecture.



Figure 04: Stone column supporting a wall in Ksar El-Houita, adapted from Eltakhi Belkacem, *An Approach to the Restoration of Saharan Ksour in the Laghouat Region: A Case Study of Ksar Tawiella*, Doctoral Dissertation, 2018



Figure 05: Adobe wall built on stone foundations in Ksar El-Houita.

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