DIACHRONIC URBAN MORPHOLOGY: THE FORMATION PROCESS OF AIT BEN HADDOU, MOROCCO.

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DIACHRONIC URBAN MORPHOLOGY: THE FORMATION PROCESS OF AIT BEN HADDOU, MOROCCO.

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To my parents, and the dearest people to my heart, my father, my mother, my brother Zakaria, and my sisters.

ABSTRACT

This study focuses on the Ksar Ait Ben Haddou as an outstanding example of a well-preserved earth settlement in southern Morocco. The fortified town is located in a semi-desert basin within the Draa region and stands on the side of a hill constructed primarily of rammed earth. The site was inscribed on the UNESCO World Heritage List in 1987, indicating that the oldest constructions do not date before the 17th century. However, the fortified town conveys ancient construction materials and techniques. Interestingly, Al-Wazzan [1], mentions the existence of fortified castles along the Drâa valley in the 15th century.

In this respect, the research explores the formation process of Ait Benhaddou by comparing available fragmentary historical data through geographers' and travellers' records and oral history with the results of the typo-morphological analysis based on the Caniggian school of thought.

The application of the Caniggian theoretical framework demonstrates the role of urban attractors in forging the urban tissue and the urban grid, and the results reveal that the village originated from the hilltop and gradually expanded downhill from east to west (valley). The typo-morphological study explains a transformation of the urban pattern assisted by the development of building types following the growth direction while maintaining the notion of enclosure. Furthermore, the inspection of social, religious, economic, and commercial local attributes offered valuable insights into the logic of urban growth and the building form as an outcome of local contextual factors that characterize the village in its territory.

ÖZETÇE

Bu çalışma, Güney Fas'ta iyi korunmuş bir toprak yerleşiminin olağanüstü bir örneği olarak Ksar Ait Ben Haddou'ya odaklanmaktadır. Müstahkem kasaba, Draa bölgesindeki yarı çöl bir havzada yer alır ve sıkıştırılmış topraktan inşa edilmiş bir tepenin kenarında durur. Alan, 1987'de UNESCO Dünya Mirası Listesi'ne kaydedildi, bu da en eski yapıların 17. yüzyıldan önce tarihlenmediğini gösteriyor. Ancak müstahkem kasaba kadim inşaat malzemelerini ve tekniklerini taşıyor. İlginçtir ki, Al-Wazzan, 15. yüzyılda Drâa vadisi boyunca müstahkem kalelerin varlığından bahsediyor [1].

Bu bağlamda araştırma, Ait Benhaddou'nun oluşum sürecini, coğrafyacıların ve gezginlerin kayıtları ve sözlü tarih aracılığıyla mevcut parçalı tarihsel verileri Caniggian düşünce okuluna dayalı tipo-morfolojik analizin sonuçlarıyla karşılaştırarak araştırıyor.

Caniggian teorik çerçevesinin uygulanması, kentsel dokuyu ve kentselleşme ağının yapımında kentsel çekicilerinin rolünü gösteriyor. Sonuçlar, köyün tepesinden kaynaklandığını ve yavaş yavaş yokuş aşağı doğudan batıya (vadi) genişlediğini ortaya koyuyor. Tipo-morfolojik çalışma, kentsel modelin değişimini, bina türlerinin büyüme yönünü izlerken, kapsama kavramını koruyarak gelişmesi yardımıyla açıklanmıştır. Ayrıca, sosyal, dini, ekonomik ve ticari yerel özelliklerin incelenmesi, bölgeyi karakterize eden yerel bağlam faktörlerinin bir sonucu olarak kentsel büyümenin mantığı ve bina şekli hakkında değerli fikirler sundu.

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CHAPTER I

INTRODUCTION

The settlement of Ait Ben Haddou is an example of earthen architecture spread across Sub-Saharan Morocco, located by the edge of the Atlas Mountains along the Ounila valley. The fortified village is distinguished by its earthwork building technique of adobe construction, spread across the Drâa, Toudgha, Dades, and Sous regions. These regions are supported by sets of oases ecosystems, which mark the boundary between the northern Mediterranean climate and the sub-Saharan climate. Agriculture gloves are thus a vital part of the valleys in which the settlement rests and a crucial component in Ait Ben Haddou's construction and similar buildings in South Morocco.

The Drâa region has been notable for centuries with its unique architectural design and the Ksour that stems from earlier times, as reported by Al-Wazzan in the 15th century. The region of Draa, according to Ibn Khordadbeh, was linked by several trade routes that connected African countries such as ancient Sudan with Marrakesh and Sijilmassa and linked countries passing through the Sahara Desert region on their way to Egypt through the valleys of southern Morocco [2]. The Ighrem of Ait Ben Haddou has witnessed several historical and socio-economic events, many of which have contributed to its development. At the junction of the Ounila and Draa valleys lies Ait Ben Haddou, along the Oued El Maleh River, in a trail that passes several earthen settlements called Ksour, which we estimate to date back to ancient history.

1.1 Hypothesis

Ait Benhaddou, one of the prominent settlements in southern Morocco, holds an exceptional record of historical events and legends transmitted through oral traditions, making it one of the most known settlements in the region. The fame of the settlement started with the introduction of foreign cinematographers to the area and its inscription on UNESCO as a world heritage site. The town's history remains unknown due to the lack of written historical sources. Yet, building technology communicates ancient techniques and a rooted culture across a large geographical area, including some of the most ancient habitations.

Fortification walls surround the hilltop and a remaining building of a previous Berber bank, suggesting the foundation of the original town of Ait Benhaddou, as the collective memory of residents recognizes the current form of the settlement to be an enlargement of an earlier town that began at the hilltop.

The region of Draa was a flourishing territory throughout history and home to one of the most ancient tribal communities in Northern Africa, where the Ksar Ait Benhaddou stood. The history of the region incorporates several attributes that make Ait Benhaddou a rich and organized town that conveys the development of building types in adaptation to the local context, identifies progression in building techniques and technology, and embraces a multi-religious milieu within a fortified setting, reflecting adaptation in a conflict zone while sustaining the continuity of the town. The urban tissue presents religious diversity, implying a relationship between the social, economic, and religious instruments in forging the Ksar and establishing the settlement as an urban organism.

1.1.1 Research method and nature

This research is a case study that addresses Ksar Ait Benhaddou as an illustrious earth settlement in the region. The intricacy of this case study demands a thorough, multifaceted comprehension of several components that include a historical search, the application of theoretical guidelines, and an analytical investigation that assesses and describes the findings; thus, it presents a qualitative approach with an exploratory and descriptive nature supported by a quantitative survey.

Initially, the search begins with the historical context, which provides a compilation of written available materials that explain the circumstances that gave birth to the Ait Benhaddou and allowed it to endure for a long time. The lack of a written historical record in this region imposes the analysis of data from expeditions, travellers, cartographers, historians, and geographers, along with the local oral tradition, to form an integrative examination and achieve coherent research.

Secondly, we conducted an exploratory study to examine the application of earlier theories in urban morphology and gain insight on the formation process of Ait Benhaddou. The Caniggian theoretical framework is the principal tool in dealing with the research aim, which offers an understanding of the historical process of the built form within a universal explanation of human settlements.

The territorial organism is analyzed to determine the settlement location within the geographical area using Caniggia's method of nomadic route evolution in establishing historical settlements. The theory articulates an evaluation of the historical-geographical nature of ancient towns across the globe and presents a coherent assessment of the typo-

morphological development following a set of principles, such as the ridge-top theory and attractors theory, that are fundamental in addressing the urban growth process, revealing a conscious synthesis of structure, urban spatial arrangement, and plan compositional layouts that identify the architectural organism.

The descriptive nature of the research is a tool to strengthen the built-form analysis of the case study and communicate observations, on-site investigations, and documentation of the settlement's state, along with several crucial elements found in the urban environment, to ensure a coherent analysis of the available data.

Historical search, oral history, typo-morphological analysis, and site surveys contribute to transdisciplinary research expressed in a descriptive manner that delivers a lucid evaluation of the research findings and connects all the components. Further, the quantitative survey is employed to create the plan drawings of the urban tissue and examine the building form on a closer scale for an in-depth understanding of the urban context, using:

- Measurements
- Plan drawings
- Interviews
- Site observation and investigation
- Photography

The oral historical data is collected on-site along with available data, including social, economic, and religious history. In this regard, the oral tradition is considered an effective

tool for verifying the general interpretation of the formation process. It elaborates on the understanding of the forces that impacted the local culture, which then significantly influenced the form of the fortified village.

1.1.2 Research approach

Due to the insufficient literature about the history of the vernacular architecture of the desert, it was crucial to set up a background platform to cover the history of the studied region to analyze the principal aspects and characteristics of the Ksour architecture and unveil the morphological urban layout of Ait Benhaddou in this research. The case study follows a deductive approach by implementing the Caniggian school of thought, which originated from the Muratorian school of urban morphology and is the primary theory utilized to explore urban growth. Finally, the study infers an analysis of the urban form within a historical context, supported by an inspection of the territorial scale, linking geography to architecture and the past with the present.

1.2 Research Structure

The thesis consists of six chapters, starting with the introduction, which includes an initial step into the target study area, introduces the research question, research method, and nature, the adopted methodology of the research approach, and highlights the importance of the study.

Chapter II delves into the history of the region of Draa, home to Ait Benhaddou, and delivers a historiographical inquiry, an exploration of the territory of Draa, and the vital contextual characteristics that aided in its recognition through records of travellers' and geographers' accounts. Following that comes a brief introduction to the terminology

of the Ksour and the properties of the Ait Benhaddou habitat, addressing its significance within the geographical and cultural context and highlighting the crucial adoption of the local tradition as a considerable tool in the study.

Chapter III initially explores the history of the Ksar name by combining oral history and written sources. The chapter emphasizes the associations between toponymy and geography before targeting the theoretical framework of the formation process and investigating the territorial organism and urban fabric. This chapter also describes the town's geographical setting in the territorial organism and its general urban properties and characteristics.

Chapter IV presents an application of Caniggian's theorem of small towns to Ait Benhaddou, indicating four critical development phases, outlining the urban analysis of the street network and spatial configuration, and indicating some of the main influential factors in urban growth. This chapter demonstrates economic, social, and religious factors as principal stimulants for urban form. Finally, the chapter articulates an introduction to the building typology of the Ksar to formulate the following chapter.

Chapter V explores the building typologies of the Berber village (Ighreman) through the lens of climate, construction techniques, and geometry. The building types of Ait Benhaddou are then juxtaposed with examples of Berber towns in Mauritania that belong to the Berber geographical area. In this chapter, the reference to the geometrical features is due to the repetition of geometrical motifs and forms across the built form in various arrangements and conveying notew orthy attributes found repetitive across the built environment in Ait Benhaddou and the Berber towns across North Africa.

This chapter briefly explores the connection between the Ksar Ait Benhaddou and several North African Berber cities, which identifies a noteworthy connection that supports the urban morphological investigation, which aims to gain insight into the diachronic formation of the settlement.

Chapter VI discusses the state of the settlement from the beginning of its inscription on UNESCO's heritage list and sheds light on the restoration works conducted in response to the fragility and abandonment of the town and the intrusive powers that shifted its environment from an oasis habitat to a tourist destination. This chapter also focuses on paying attention to the heritage as an organism and provides suggestive proposals by different authors that align with the overall analytical outcomes of the study.

Chapter VII concludes the outcome of this study through a brief discussion of the historical data, performs analysis, and identifies the town's origin and distinguishable characteristics concerning its ancient identity. This chapter ends with a short suggestion for future research and highlights the importance of the study in this regard.

1.3 Importance of the study

The importance of looking into the formation process of the Ksar Ait Benhaddou lies in uncovering the history of ancient settlements in the semi-desert and desert regions, where little historical information is recorded. The conventional idea of the Ksour as nomadic towns shifts the focus towards other building types in Morocco, placing the traditional ancient Berber Ksour in a state of neglect and causing a gradual disregard for its heritage and architecture. The history of Berber architecture is highly crucial for historical heritage that reflects the mastermind of the local culture that assembles a natural lifestyle to

originate a highly independent sustainable environment, which can also add to the architectural sustainable design field.

Ksour are human settlements embodying an immediate expression of a way of life that is a highly rich study prototype. Another significant aspect in this respect is the need for studies to explore the Ksour and similar structures in Northern Africa and other influential cultures that had their share of impact on the local architecture. This way, a comparative analysis can facilitate comparing several habitats and gaining more knowledge about the Ksar patterns within a geographical context. The lack of research on the formation of Ksour, including all the aspects of social life within their environment, creates a necessity to bring research that assembles several attributes that have a hand in Ksour's growth. Understanding many aspects of life within the Berber towns contributes significantly to composing a larger picture of their growth. The description of Ksour settlements entails more than just a set of fortification walls. Instead, it reflects cities formed in distinctive locations, remarkably rooted in their environment.

In this work, we aim to lay the groundwork for an interdisciplinary investigation using the theoretical analysis of the urban tissue and fragmentary collected data to comprehend the urban form as a part of the larger organism in the Draa region and south Moroccan Berber architecture.

CHAPTER II

HISTORY OF DRAA REGION

In the case of historical cities, historical inquiry becomes a critical component in building clarity and understanding the urban fabric. The history of Draa provides a base for the upcoming chapters in this study. Hence, it breaks down several significant aspects of life in the area and communicates the social, political, and economic attributes that define the environment of the Berber communities. These attributes are tools for understanding the local traditions that assisted in establishing the Ksar as an urban complex and a living organism within the territory, as well as the connection of the urban settlements with their land.

North Africa stood as a significant station and a linking ground for different civilizations, connecting the African continent to the European continent and serving as a terminal for several trade routes, particularly in the regions of Draa, which was a well-known territory across the records of geographers and travellers. The region stands in the Sub-Saharan area along a rich network of commercial routes connecting several nations. Draa is home to Berber tribes who lived in the southern Moroccan lands for centuries, and it represents a significant and prominent territory where Ethiopian tribes lived and traded with Phoenicians in the 4th century before the Christian era [3]. The area is home to the Ksar Ait Benhaddou, south of the Atlas Mountains, known for earthen fortified cities by the Draa River, located in an environment of distinct climate, traditions, and lifestyles (Fig. 1).

In this research, it is critical to present the environment in which Ksar Ait Benhaddou resides. By connecting the past to the present, it is possible to comprehend the palace's contemporary setting and how it evolved in proportion to temporal changes to identify the urban morphological development in parallel with the historical context.

Ait Benhaddou in the lower Atlas Mountains series occupies a significantly prosperous area that has witnessed prehistoric civilizations and is home to numerous engravings and Libyco-Berber inscriptions like Fumm ash-Shanna in Tinzouline and Azib N'Ikkis [4] in the Draa province, scattered throughout the territories of the Atlas Mountains (Fig. 2.)

In this regard, it is necessary to note that the local language of the Draa region and Morocco historically has been the Berber language (Tamazight), a language of oral transmission of knowledge. Therefore, it is essential to scrutinize historical records through manuscripts, inscriptions, travel accounts, oral tradition, and available historical data. From that, inquiring about the earliest inhabitants of Draa province points to one of the earliest figures, the Roman poet Horace, who refers to the Berber tribes living in the Moroccan Atlas as Gaetulians.

2.1 Berbers of Draa during the Roman era

The term Gaeulians was a widely used name in Western ancient texts to refer to the inhabitants of the Draa regions. Historically, Libya indicated the area stretching from Morocco to Egypt. According to Strabo, the Gaetulians were one of the largest Libyan tribes in the west of Libya and lived in tribal communities parallel to Maurasia, in territory limited by the Atlas Mountains series (Fig. 4), and he explains that the Gaetulians spread

across the Atlas and towards the Sahara [5]. Significantly, this zone persists as the Berber territory of the tribal Amazigh communities, beginning in the Atlas Mountains or the Dyris Mountains and extending from northern to southern Draa.

The Draa River is another popular feature in the region, present in several ancient sources, particularly to indicate a prosperous life in the area and signify its importance to the locals, which resulted in its recognition. Pliny the Elder mentions the region of Draa and explicitly references the people of Draa as the *Darian Gaetulians*, indicating the Gaetulian tribes of Dara, located by a river lively with animals, full of crocodiles and hippos [6]. Likewise, the coin of the Mauretanian king in the first century BC, King Juba II, shows a Crocodile symbol engraving (Fig. 3).

Several accounts regarding the location of Gaetulians and Draa represent an area at the borders of the Atlas Mountains that indicates a natural geographical limit. The name Atlas was given by the Greeks when the Geatulians called it Mount *Dyris*, which is commensurate with the Dyras River, referring to the current-day Draa River [5].

The region was a well-known territory for centuries, as several geographers, including Strabo and Pliny the Elder, point out that the Dara River held considerable fame and was a source of a prosperous life in the region, which included different types of animals that once lived along the rivers. The historical accounts regarding the rich animal life verify a particular climate that reigned in the region thousands of years ago and the fertile oasis land where ancient settlements merged.

Nowadays, this area is considered a sub-Saharan region, and the river is dry all year long, while it flows occasionally during the winter. Accordingly, Lipiński [7]

explains that it is highly possible that around 400 AD, the climate condition in Draa started changing and reached its peak at 700 AD, when the dryness was notably evident. Thereupon, the oasis habitat served in the maintenance of the settlement and Ksour life to this day.



Figure 1: Topographical map generated from Mapcarta, presenting the location of the Ksar Ait Benhaddou along the Draa river.

Source: [8]

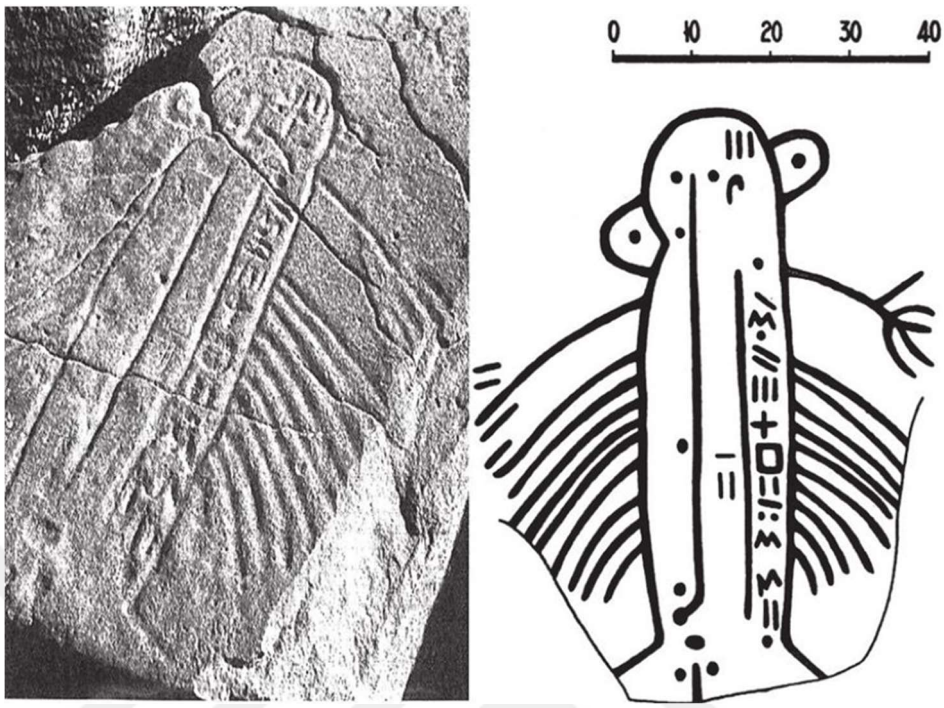


Figure 2: The man of Azib n'Ikkis inscription in the High-Atlas Mountains.

Source: [4]



Figure 3: The Mauretanian King Juba II coin with a crocodile symbol.

Source: [9]



Figure 4: The region of the Atlas Mountains the land of Gaetulia according to Ptolemy.

Source: [10]

2.1.1 Draa during in the Islamic period (7th century)

After the introduction of Islam, written Arabic sources were produced and made a significant contribution to the unveiling of the history of this area by providing invaluable explanatory illustrations through Muslim travellers' and geographers' narratives.

The Islamic golden age produced several geographers and scholars who progressed in creating written sources and mapping places and regions. One of the best-known geographers of the 9th century AD was Ibn Khordadbeh, who narrates and describes Draa as a large city inhabited by many people and a homeland for silver production [2]. In the 11th century, Al-Bakri described Draa as a large city inhabited by a large population, with separate buildings across its territories [11]. Additionally, Al-Idrissi states that Draa is not a single village but a group of small towns distinguished by agriculture [12] and depicts its location by the riverbanks in (Fig. 5). Several years later, in the 15th century, Al-Wazzan gives a precise account of the buildings in Draa and describes them as being constructed from mud and raw brick [1], as he describes the state of the Draa River that overflows during winter until it becomes like an ocean and dries during summer [1]. Consistently, the description given by Al-Wazzan corresponds to the current condition of the Draa and Ait Benhddou, which sustained their identity regardless of the fragile nature of the rammed earth material that required constant maintenance and repair [13].

Jezula, 'جزولة' is a place in Draa, a land of livestock known for its production of barley, spices, iron, and copper mines where copper vessels were made and traded along with other necessities [1]. Along the Draa valley spread numerous fortified settlements, or Ksour, separated by a distance ranging from 3 to 4 miles from one town to another and made of stone and adobe. As they sat along fertile lands and agricultural holdings spread

in the distance between the valley and the settlements, where palm trees grow an excellent kind of date if stored on the ground floors of the Ksour, they could keep the dates conserved for seven years [1]. In the 16th century, Carvajal Marmol states that Draa is known for spices, dates, and the Indigofera plant that serves as an indigo dye and describes the building types and technology as fortified buildings of stone and adobe material with ceilings made of palm tree trunks [14]. Likewise, John Ogilby described the region as the kingdom of Draa, home to many towns, forts, and castles that stand near the banks of the rivers [15].

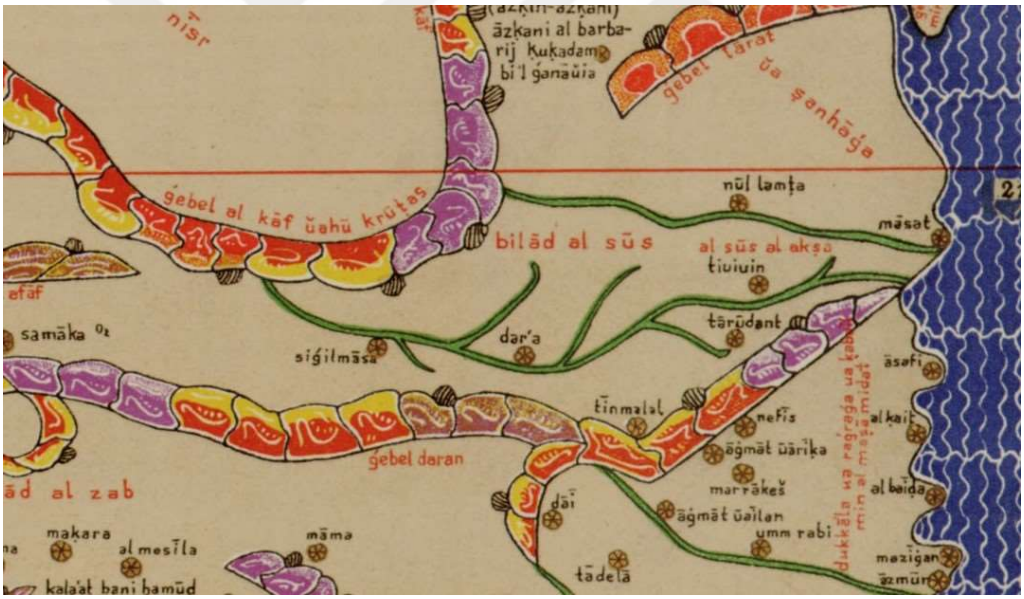


Figure 5: The location of Draa (dar'a) by the valley route, reported by Al Idrissi in the 12th century.

Source: [16]

2.1.2 The Jewish presence in Draa

The history of the Jews in Morocco is vague and present through the urban fabric and the built form that depict the cultural heritage of the Jewish communities. According to oral tradition, Jews arrived at the Ksar Ait Benhaddou in the 16th century after fleeing Andalusia, lived with the Berbers in Draa until 1956, and left the last family to exit the settlement in 1960. The sequence of migrations of the Jews has established several habitations across North Africa. Southern Morocco has witnessed multiple tribal and ethical communities for diverse migratory and interacting tribal cultures since it was home to one of the world's most prosperous trades, including animal skin, herbs, gold, salt, silver, and other natural resources that enriched commerce and links with numerous civilizations. Draa was home to Jews and Muslims, who sustained the liveliness of the region through an active trade network. In the 15th century, the commercial activity in Draa was not limited to one religious group, as the Berber Jews were renowned as smiths and artisans [1] and cooperated with Muslims, as both groups played a significant role in the trade flourishment and maintained an interreligious life that helped the endurance of trade movement across the regions.

In Ksar Ait Benhaddou, a synagogue and a mosque stand within a single fortified frame. To this day, the ruins of the Jewish Quarter reveal a compact building cluster among the urban tissue. On the other hand, the Muslim neighborhood remains active and functioning. The trade continued with an alliance between the two religious groups, and Jewish tradesmen participated in trade and were well-known in the Dra Valley [17].

To this present day, Jewish quarters exist across Morocco, notably in the Ksour of Draa regions, such as Tamnugalt, Qasbat al-Makhzan, Tinzulin, Arumiyat, Mansuriya, Amzru, Alhammid, Mhamid, and Ait Benhaddou. Abandoned, they stood after the mass

emigration of Jews outside of Morocco and Draa, which added to the deterioration and abandonment factors of some Ksour. The multi-religious neighborhoods in Ait Benhaddou are expressed noticeably through the urban pattern and testify to an evolutionary morphological urban development.

2.1.3 Draa within a historical trade route network

Throughout history, Draa has been a main stop for traders traveling from the south to the north and vice versa. Gold and salt trade routes were significant trade routes in the 7th century. However, the history of commerce and exchange in Draa is estimated to be older. Pliny the Elder explains that the Romans searched for ivory and purple dye in the mountains of Gaetulia. Horace speaks of the well-known purple paint derived from the Murex shells called Gaetulico Murice [6]. Maurice indicates a purple colour dye in Latin, and the word Getulico refers to the Gaetuli tribes [18].

Moreover, the most significant trans-Saharan trade was the gold trade that began with the Ghana Empire, also called Wadagu, which dates back to the third century AD, according to the Tarikh Al Fattash chronicles [19]. The gold trade route connected the Ghana Empire with northern and eastern Africa, and the gold coins became an exchange element between Berbers and Timbuktu.

The Draa region included Sijilmassa city, known for pottery and utensils. Due to the soil quality, pottery depicting pots with animal and plant prints and ornaments was made in Draa and Sijilmassa for trade across West African territories [20]. Al-Wazzan explains that the road between Draa and Timbuktu was used by trading merchants and letter carriers that established a link between the kings of Timbuktu and the rulers of Draa [1].

The trans-Saharan commercial route included the salt trade route that crossed Timbuktu, stopping by Taghaza city of salt mines, arriving at the Draa territories, and continuing towards Marrakesh (Fig. 6). The trans-Saharan route links the settlements across a large territory in the desert, and according to Al-Wazzan, the connection between these territories was essential for the survival of mine workers from Taghaza, which was a salt mine city, where workers had to bring food from Draa or Timbuktu [1]. Likewise, Ibn Battuta spoke about the salt trade connecting the Berber cities of Sijilmassa and Draa with Taghaza and Walata and described Taghaza as a salt city that supplied salt to Malian regions and exchanged it for gold and silver [21].

Several goods were exchanged through this commerce trail, which created a network between eminent towns. One of the significant routes was the Timbuktu-Draa route. As Berbers traded animals and transported horses in exchange for gold coins from the Malian territories, they exchanged books and other manuscripts, knowing that Timbuktu was a city of literature, scholars, imams, and lawyers [1]. The commercial activity along the desert interestingly spread along oasis settlements crossing the desert, creating a guideline of stations highlighted by several Berber towns towards the west and northern Africa, like Walata and Aoudaghost in Mauritania, Draa territories in Morocco, and Tuat in Algeria (Fig. 6) and (Fig. 7).

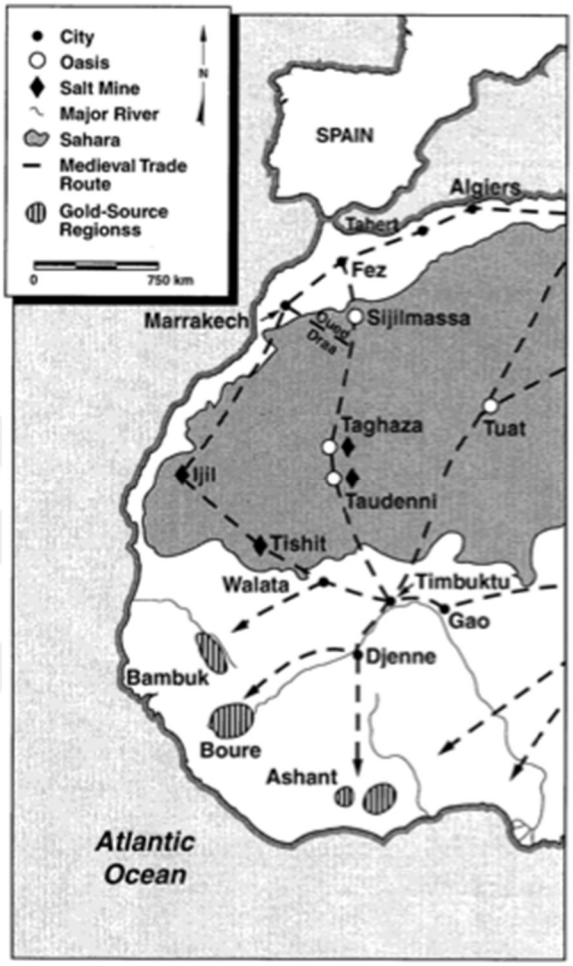


Figure 6: Medieval TransSahara gold trade routes, indicating the Oued Draa connecting Timbuktu-Walata and Timbuktu-Taghaza to Marrakech.

Source: [22]

2.2 The geographical distribution of Berber towns (Ksour)

The basin of Draa incorporates the Draa valley that established the oasis environment, as water tributaries develop through the valley route and create a guideline for the earthen compact settlement that lies along agricultural lands (Fig. 7) and (Fig.8). Ounila Oued is a narrow river that streams from the high atlas down to Ait Benhaddou and is a tributary of the Draa River that represents a pivotal attribute for the endurance of the built heritage, agriculture, and commerce. The climate in this area is semi-arid, as the precipitation depends on the elevation of nearby mountains that support the river flow during snowy seasons, regulating the scarcity and availability of water [23].

The palm grove at Ksar Ait Benhaddou presents the ground for the agricultural harvest occupation. Agriculture fields are irrigated mainly through surface water, establishing the habitat for the Berber tribes, which require management and assistance using the development of water management practices through Seguias and traditional knowledge to construct and sustain the Ksour architecture.

The Berber towns display a sturdy tie to their territory, regardless of the climatic change. As fertile lands became a semi-arid region in sub-Saharan Morocco, towns relied on rivers and adapted to the climate. The concentration of the settlement by the river was a response to the climate change from the fertile savannah biome to an arid area, leaving the gradual effect of desertification to identify the territories of local communities [24].

In consequence, Ksour towns face environmental issues like floodplains, heavy rainfall, and extreme drought. Yet, the survival of the Ksour settlements in hostile habitats communicates signs of a deeply rooted culture that fought against nature's challenges,

only feasible through successful management to ensure the continuity of the towns as living organisms. These sub-Saharan towns present an enigmatic character that renders them within their environment elaborative of the exceptional bond to the land.

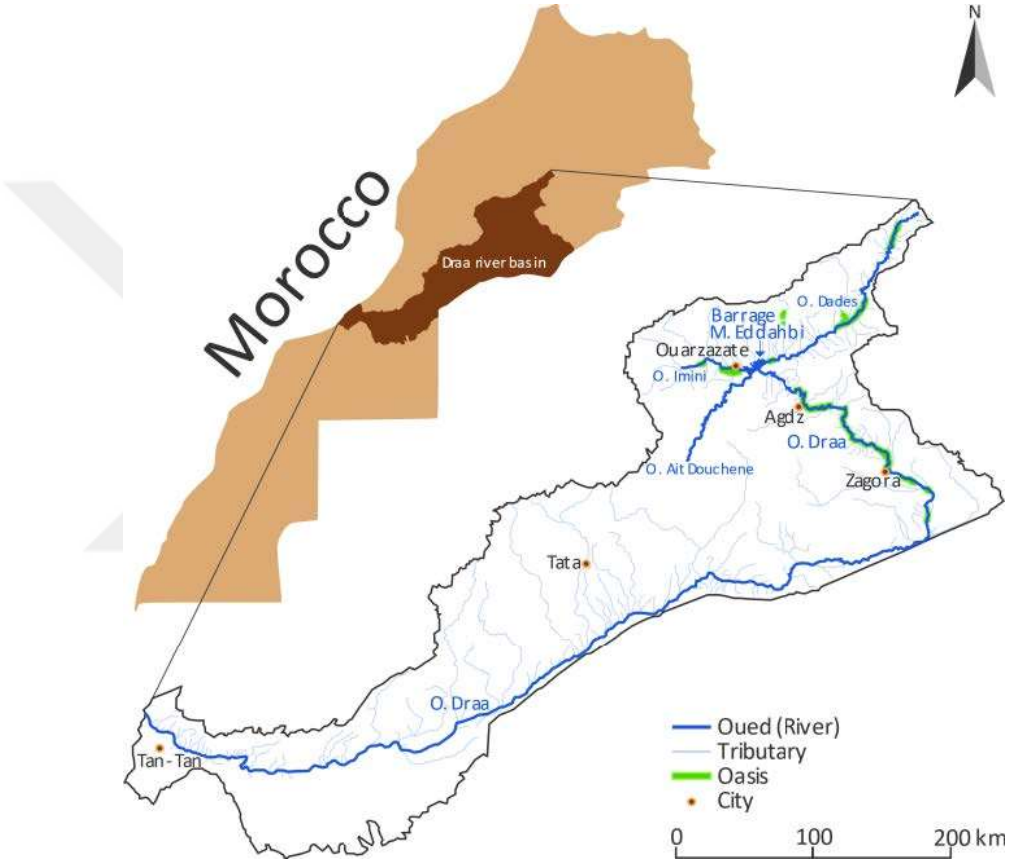


Figure 7: The Draa basin and the water tributaries.

Source: [25]

2.2.1 The Ksour settlements and the oasis habitat

This nature of the land in Middle Eastern geography offers a series of rivers across an enormous plateau that led to the formation of ideal habitats for major human civilizations [26]. Along the Ounila valley, several fortified settlements appear along tributary streams, demonstrating a coherent architectural style, like the famous Kasbah of Tamdakht and Telouet.

The oasis agroecosystems supply various crop productions in Draa, like wheat, barley, and dates, along with varieties of vegetables regulated by climatic conditions. Palm groves are the most prevalent and ubiquitous plants that inspire the architecture language and constitute the local building technology.

The variety of crops contributed to the commercial and economic richness of the settlement. The spread of the Ksour by the Ounila Valley conveys settlements that seem to be an integral part of the Wadi oasis system within the territory, as indicated in (Fig.8) and (Fig.9). The oases are part of the wealth of the southern Moroccan region, as they represent the world's largest oases and are an essential attribute for desert dwellers and thriving urban organisms.

Notably, the relationship between the agricultural environment and animals is ancient. The Atlas region was known for the richness of several animal species that have gone nonextant through the years. Animal trade has been recorded since the time of the Carthaginians, who traded along the Moroccan coast and brought animals like lions, leopards, and elephants [27]. The region was historically known for its richness of animals, which has substantially influenced the territorial town's arrangement. Inevitably, sheep farming is a common occupation within sub-Saharan culture, as it has an

enormously crucial link to the survival of the Oasis milieu and the continuity of the Ksour environments.

As the Berber towns stand by the riverbanks, they rely on agriculture, cultivation, and animal husbandry. The Wadi oasis represents the foundation of the Ksar Ait Benhaddou, setting up an environment rich in materials like earth, water, palm trees, and fruit crops that institute the formation and growth of Ait Benhaddou. Consequently, the agricultural grove supplies and sustains the livelihood of the settlement and provides a distinctive character to its identity (Fig. 9) and (Fig. 10).

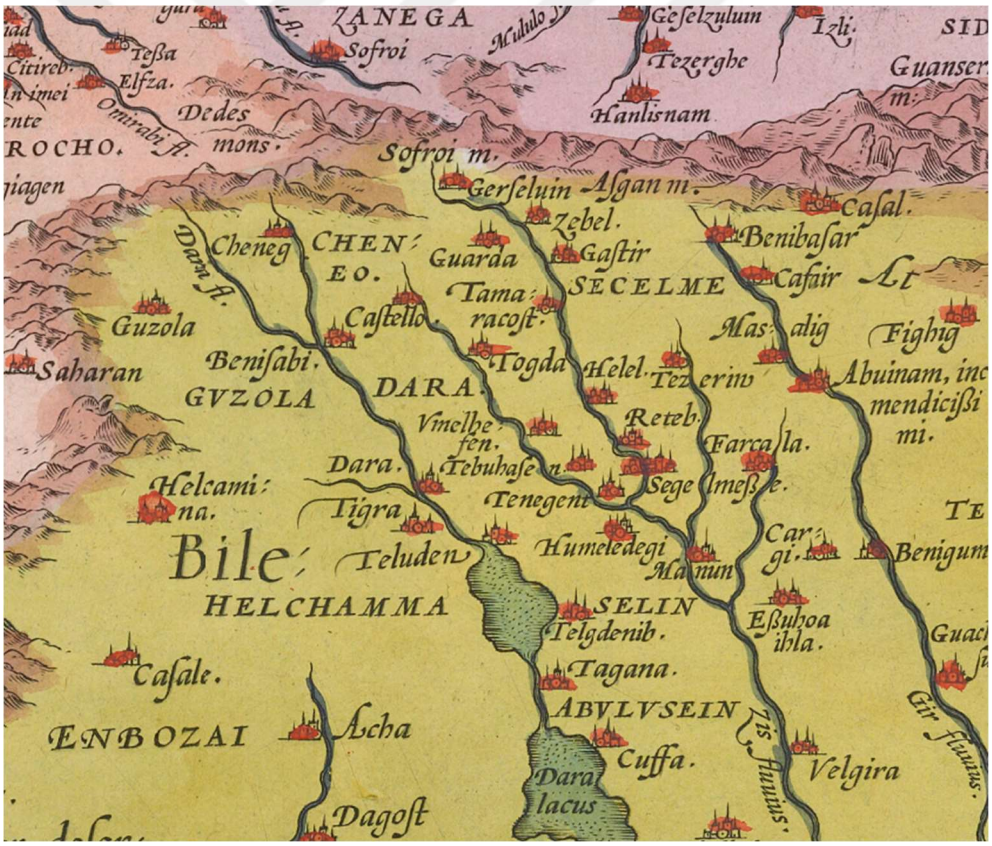


Figure 8: Map of Draa territories and Ksour by the riverbanks in the16th century.

Source: [28]



Figure 9: Ksar Ait Benhaddou seen from above with the view of Oued Ounila.

Source: [29]



Figure 10: Photo of the Ksar Ait Benhaddou near the agricultural grove and palm trees.

Source: [30]

2.2.1.2 The architecture of Berber fortified towns (Ksour)

Ait Benhaddou is located at the edges of the Atlas Mountains, along the Ounila River, where earth-building technology exemplifies the area's architectural language. The settlements represent a habitat that follows an organic flow of life shaped by human needs that developed in southern Morocco under the name Ksour. The Ksour presents an organism of brilliant natural architecture design principles projecting the local values and traditional lifestyle within its geographical context.

2.2.1.2 The definition of Ksour settlements

The Ksour spread across the Saharan Atlas of Morocco in a region that witnessed many linguistic intrusions. The word Ksour is a North African term for the Arabic قصور, plural of Ksar قصر, which refers to the walled settlements and is also a reference to the Latin word Castrum. The Berbers (Amazigh) call it Ighrem and Igherman in the plural. The influence of different cultures in this region explains the use of various expressions to name the settlements within this area. While Ksour is originally called Igherman, Berbers refer to the Ksar Ait Benhaddou as Ighrem N' Ait Benhaddou. After the introduction of Arabic around the 8th century, it merged with the local language, and it became common to use Arabic words to refer to elements in the region, including the fortified settlements.

Ksour or Igherman are self-adapted fortified cities in the oasis habitat of southern Morocco and convey a lively response to their environment. They are fortresses erected on the caravan routes through several Saharan trade trails and known for the various defensive structural devices that express the historical setting in which they survived.

Caniggia defines the settlement as a living complex that might be a single home or a collection of dwellings, as well as a housing complex that simultaneously serves as a manufacturing facility where each building aggregation is cohesive and interacts cooperatively to form an urban organism [31].

The urban form of the Ksar Ait Benhaddou molds within its geographic setting to form an organism in which every attribute operates with one another. Each urban feature inside the Ksar expresses an interconnectedness with the surrounding building aggregates to form a coherent organism that permits the Ksar to grow and distinguish itself as a settlement organism.

2.2.1.3 Properties of Ksour settlements

The ksour are fortified settlements that are traditionally compact in nature. They represent a reproduction of the natural conditions within the Saharan Atlas. Built using local materials, they project earth colours that blend with the environment of nature. Some Ksour are found at higher altitudes, while others stand by the lower valley. Ait Benhaddou is an example of a fortified ksar on a hill. The urban properties of the Ksar represent similar language to the physical building properties within the Ksar. Everything in the tradition and nature of the Ksar speaks of defence, protection, and privacy, from urban scale and building scale to street layout. The Ksar reflects traditionally compact building aggregations of residential aggregates, religious centres, and squares. The Ksour are generally fortified, isolated, and separated from their surroundings.

In this context, cartographic maps were examined to detect the earliest illustrative portraiture of the building types identified in the region. The following maps

communicate some of the earliest descriptive depictions of the building typology and date to the 14th and 16th centuries.

The Atlas Catalan map in (Fig. 11) and (Fig. 12) demonstrates the Atlas Mountains and the proximity of the Draa region in the 14th century within the African network of gold trade, depicting the exchange between King Mansa Musa and nomadic tribes.

(Fig. 12) illustrates a fortified hill city near Sijilmassa, displaying a Muslim castle situated between Taghaza, Sijilmassa, and the Atlas Mountains, designating the environs of Draa.

Moreover, Abraham Ortelius's map illustrates the Ksour of Draa in the 16th century via compelling details, including village names, rivers, and buildings in rammed earth colour symbolized as fortified castles on lower land (Fig. 8). The geographical elements present determining attributes for the survival of urban organisms. The connection between the settlements and the river is strong and endures despite the harsh climate. The palm groves and agricultural lands make Draa a fertile habitat, where the river awakens the semi-deserted environment and enriches the agricultural landscape, establishing an oasis structure that sustains and contributes to the survival of Ksour settlements. As a result of its geographical location, Draa inherited an enormous network of commercial activities that lasted for centuries.

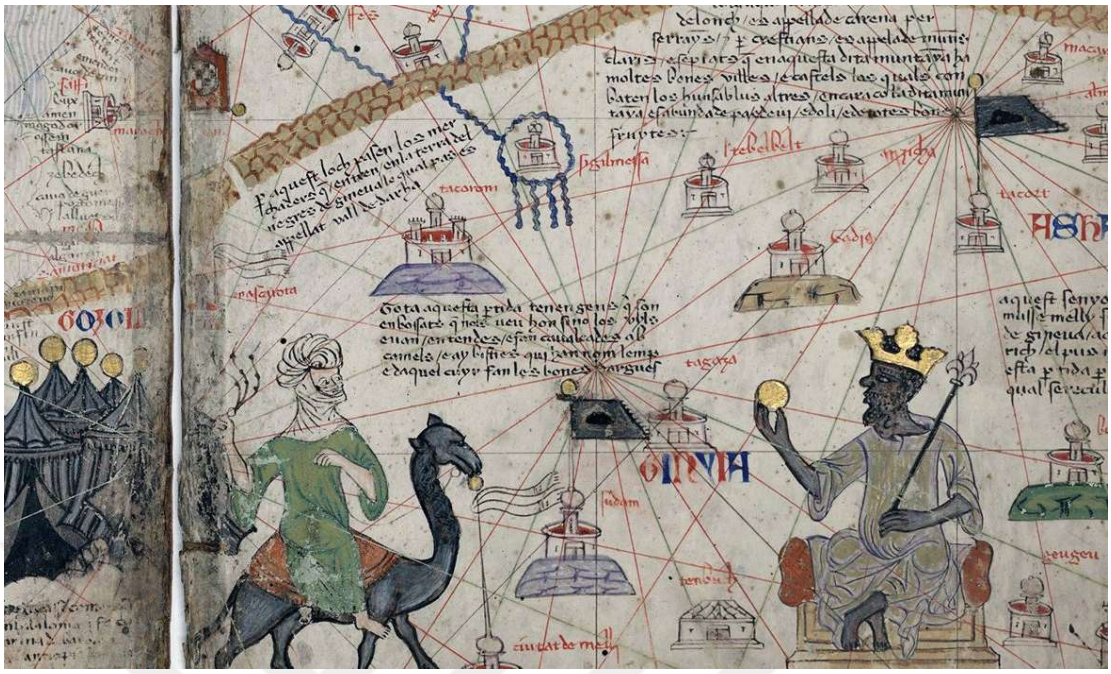


Figure 11: The Atlas Catalan manuscript depicts the gold trade between nomads and the king of Mali, city of Taghaza and Sijilmassa and the territories within.

Source: [32]

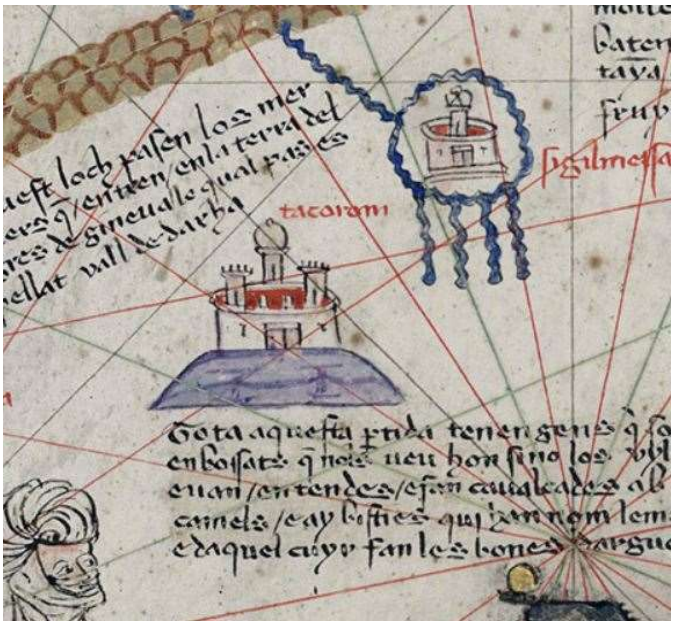


Figure 12: A fortified hill town in the estimated region of Draa, near Sijilmassa city, is limited by the Atlas Mountains.

Source: [32]

2.3 The language and cultural area of Draa

(Fig. 13) depicts the region of Draa occupying the Tachelhit cultural area, home to indigenous Berber tribes and Ksour settlements. Tachelhit is a Berber dialect derived from the ancient Libyco-Berber script dating to the first Millennium BC and used by the indigenous tribes of North Africa. In the Tachelhit dialect, the name of the High Atlas Mountains translates to Adrar N Draren or Adrar N Deren, meaning the mountain of mountains or the mountain of life. The Deren Mountains stand as the limiting border of this cultural area and the defining element of several tribal communities. Within this territory, the famous Tizi N' Tichka route is considered a defining segment in the Draa territory and a significant segment in historical trade that connected the Draa to Marrakech and is also referred to by cartographers by the door of Deren [33].

2.3.1 Geographical distribution of the Berber tribes

The purpose of pointing out the origin of the Berbers and their ancient identity is enunciated in this part of the research to reveal conspicuous and repeated features found in the architectural history, geometric language, and ornamental design of the Berber villages, as well as identification of the historical context that established their settlements. Ait Benhaddou, the central target in our study, is part of the large Berber cultural and geographical area in which settlements employ a consistent geometrical formula, characterizing examples of some of the oldest building types and building technology that prevails across North African cities.

Ancient Egyptian records speak of Libyan tribes as one of the predominant groups alongside Egyptians and depict a substantial connection to the Berber tribes of North Africa. Temehu or Tenehu represent ancient Libyan tribes, referred to as the Westerners,

who lived west of the Nile and were the ancestors of modern-day North African Berbers [34]. Moreover, the Egyptians referred to the territory of Temehu as 'the land of Oasis dwellers' [34]. Temehu, or Tmh, appears analogous to the words Tamasheq and Tamazight, which represent the spoken language of Berber tribes. Throughout history, the indigenous people of North Africa were called Libyans, Mauri, or Gaetulains, while Berbers called themselves *Imazighen* or *Mazigh*. To this day, Berber-speaking communities exist in most North African countries, including Morocco, Libya, Tunisia, Algeria, Mauritania, Niger, Nigeria, Mali, Burkina Faso, and Egypt. Accordingly, archaeological studies elaborate on the connection between East and West through a distribution of the descendants' languages of the Proto-Amazigh spread widely through the Sahara Desert [35].

This connection is perceived in the architectural design, regardless of climate factors that are crucial components in shaping the built heritage. The spread of Berber towns across the Oasis system across North Africa is vastly pronounced and delivers a link between language and conscious building methods.

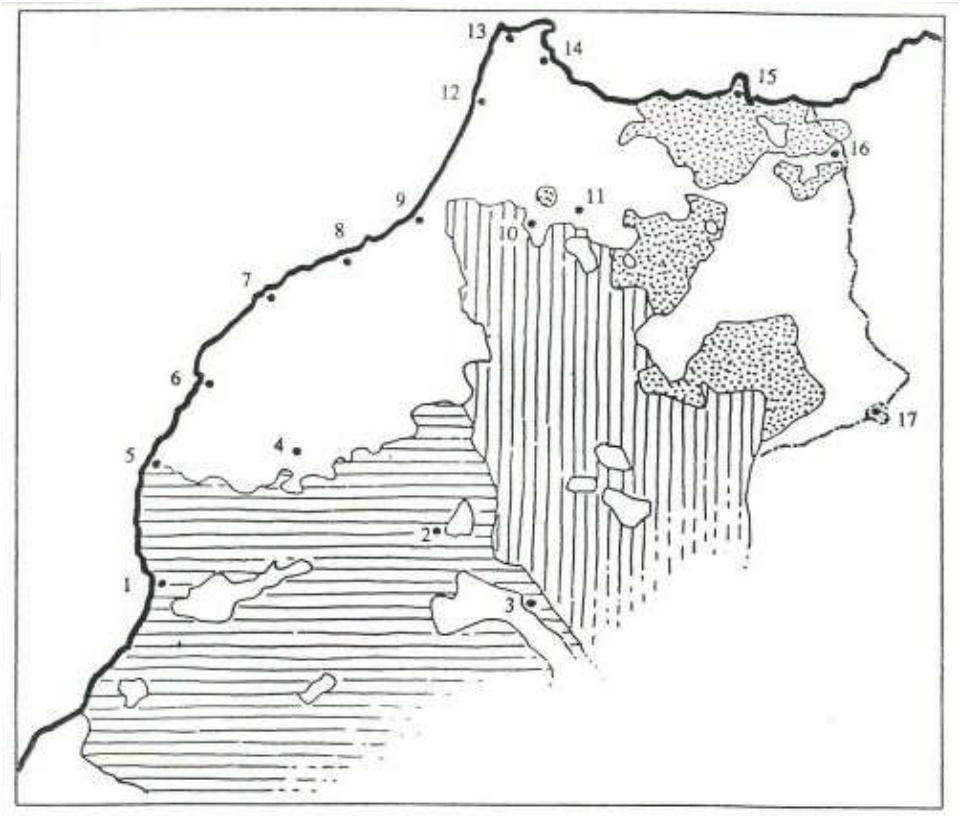


Figure 13: Map of the languages of Morocco, (Number 2 indicating the city of Ouarzazate home to Ait Benhaddou) under the Tashlhiyt cultural area.

Source: [36]

2.3.2 Knowledge transmission and the oral tradition

In the Berber tribes of Morocco, oral tradition represents a dominant part of the culture and a custom that shaped the civilization's heritage, using rich poetic language to elicit emotional responses as a tool to revive historical events through traditional spoken performances.

The term memory is associated with history and anthropology. In this context, it refers to the ability of individuals or groups to establish ways to store prior acts or knowledge to recall it for whatever reason. In psychology, the relationship between language and memory is an effective tool to recall past actions and practices. Pierre Nora [37] identifies the notion of collective memory as the remains of the past through the experiences of living groups or communities that retain past feelings as an integral part of their identity, which develops to become a form of historiography. The collective memory evolves with cultural groups and can be both inalienable and manipulable, an instrument of struggle or power.

According to Le Goff [38], memory is an essential element of individual or collective identity. While history allows understanding the past through the present and the knowledge of the eternal present, its purpose is to clarify the present. The quest for collective memory is inaccessible via texts but in words, gestures, rituals, celebrations, and images that create a historical perspective. He explains that forgery exists in historical sources and can be a valuable testimony as texts undergo manipulation, and sincerity must be determined and verified by other testimonies. Therefore, no document is innocent. In this regard, history must enlighten the memory and help it rectify its errors [38].

The collective memory and the oral tradition are indispensable elements of the indigenous African cultures. Berber culture is known for the oral transmission of past stories and momentous incidents via singing and poetry, as the language functions as a principal tool for pronouncing history through expressive forms. Oral history in indigenous African cultures is not a historical record but a commentary on artistic, rhythmic, visible, and sensory activity performance [39].

In this regard, I interviewed Mr. Malik, a resident and descendant of Ait Benhaddou and a self-taught historian who embarked on a journey of collecting historical data and registering some of the well-known myths of the village. After the abandonment of the Ksar, the residents moved to nearby settlements, and it was necessary to connect with qualified individuals who retained the town's history to reinforce the research approach in dealing with historical context.

2.4 Brief conclusion

This chapter sets out to explore the history of the region where Ait Benhaddou resides and situate it within its historical context, providing initial data about the general geographical conditions of the Draa territory and highlighting the role of oral tradition in the cultural area as a beneficial tool in this study. The historical inquiry indicates the presence of ancient Berber communities that occupied the land for centuries and were known for agriculture and harvest skills. The descriptions given by the earliest figures indicate the rich natural resources that allowed the flourishing of a robust trade system. Moreover, revealing the persistence of the Berber civilization throughout climate change and their acclimation to the territory, they model habitations along a natural system that allows the prosperity of the settlement habitat from an early age.

This expresses the survival of local communities through the changes occurring in the area and their evolving adaptability to the land, allowing the continuity of the groups to become the present home to the Ksour Berber towns across the Draa region.

The following chapter focuses on the history of Ait Benhaddou in particular, from a cultural setting and through the lens of oral tradition. Ait Benhaddou stood as a well-known settlement in the Ounila valley, along a significant trade route that linked southern territories to some central Moroccan cities like Marrakech. Its location communicates a rich history that survived through several changes, and such events and incidents are transmitted via spoken words. Thus, it is crucial to document and obtain the history through the locals' memories to support the historical search.

CHAPTER III

INTERPRETING THE CONNECTION BETWEEN THE TOPONYMY AND GEOGRAPHICAL HISTORY

3.1 The toponomastic analyses of Ait Benhaddou

The tradition of historical recollection is conveyed through spoken legends and communicated via oral traditions. In the Berber culture, oral heritage is a fundamental tool of the historical record and remains rooted in the Berber Ksour historical reality and memory. In this chapter, historical sources combined with oral sources are displayed to deliver an inquiry about the origin of the name Ait Benhaddou, along with an inspection of the Ksar's urban tissue to gain insight into the village's history, its name origin, its physical properties, and lay the groundwork for the analytical investigation of the urban formation process.

Targeting the cultural area, language, oral tradition, and travellers accounts is required to detect the history of the toponym Ait Benhaddou. The name of Ait Benhaddou does not seem to appear in any sources concerning the Draa province. While the memory of the town residents maintains the title of Ait Aissa, implying the descendants of Aissa.

The name Ait Aissa recurred in adjacent areas, sparking an intense hunt for this name. A key source came from Charles de Foucauld's book Renaissance au Maroc, in which the French priest embarked on a journey of exploration in Morocco, where he obtained and documented significant information about the unstable region trekking towards the south of the Ounila Valley and indicating every village along the valley route,

from Tamakhoucht to Tazentout at the end of Ounila [40]. The attestation made by Foucault is expressed through the map in (Fig. 14) and indicates the accuracy of the order mentioned by the author through his passage south of Ounila, notably the location of Ait Ben Haddou, which suggests Ait Aissa.

Similarly, (Fig. 15) indicates a document presented by Jablowski and Baabbouz [41] that conveys an 18th-century inheritance document of one of the Ksar's households by the west side of the Ait Benhaddou and reveals a tribal name of Ait Aissa. The document declares the name of the buyer as علي بن محمد نيت حدوا أو عيسى بأيت عيسى, denoting Ali Ben Mohamed N 'Ait Haddou O-Aissa in Ait Aissa and revealing the place of issue to be Ait Aissa, designating the descendant lineage of Aissa, confirming the testimony of Foucauld.

The settlement's urban form, built form, and cultural, social, and religious attributes provide an understanding of urban growth and the progression of the urban fabric. In Ait Benhaddou, the urban tissue illustrates legible separation within the urban layout, reflecting a visible intercultural and interreligious fusion of many groups inside this hamlet that corresponds to urban development within the Ksar's neighborhoods. Jablowski and Baabbouz portray Ait Benhaddou's descendant families throughout the nineteenth century, illustrating the existing ethnic groups that resided in the Ksar (Fig. 16).

The lively region of Draa is home to numerous tribes from the Atlas region to the Saharan territories and has witnessed a political history of constant wars. Draa valleys attested to vital military movements during the Almohad era in the 12th century to take

control over Tzakourt, Toundoute, and Ouzline in northern Draa through the Ounila valley [42].

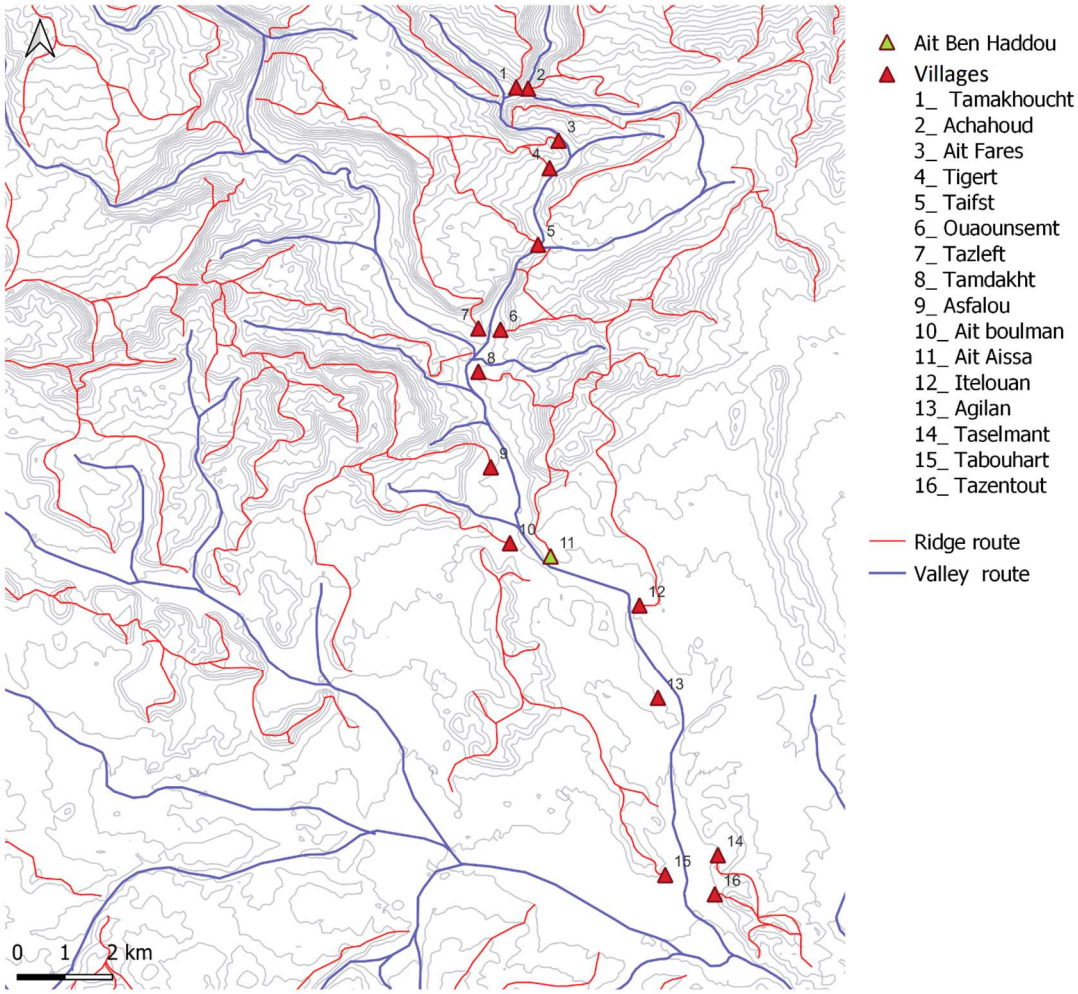


Figure 14: Map created using QGIS, indicating the placement of villages mentioned by Foucauld from his trail across the Ounila Oued along valley and ridge routes.

Source: [43]

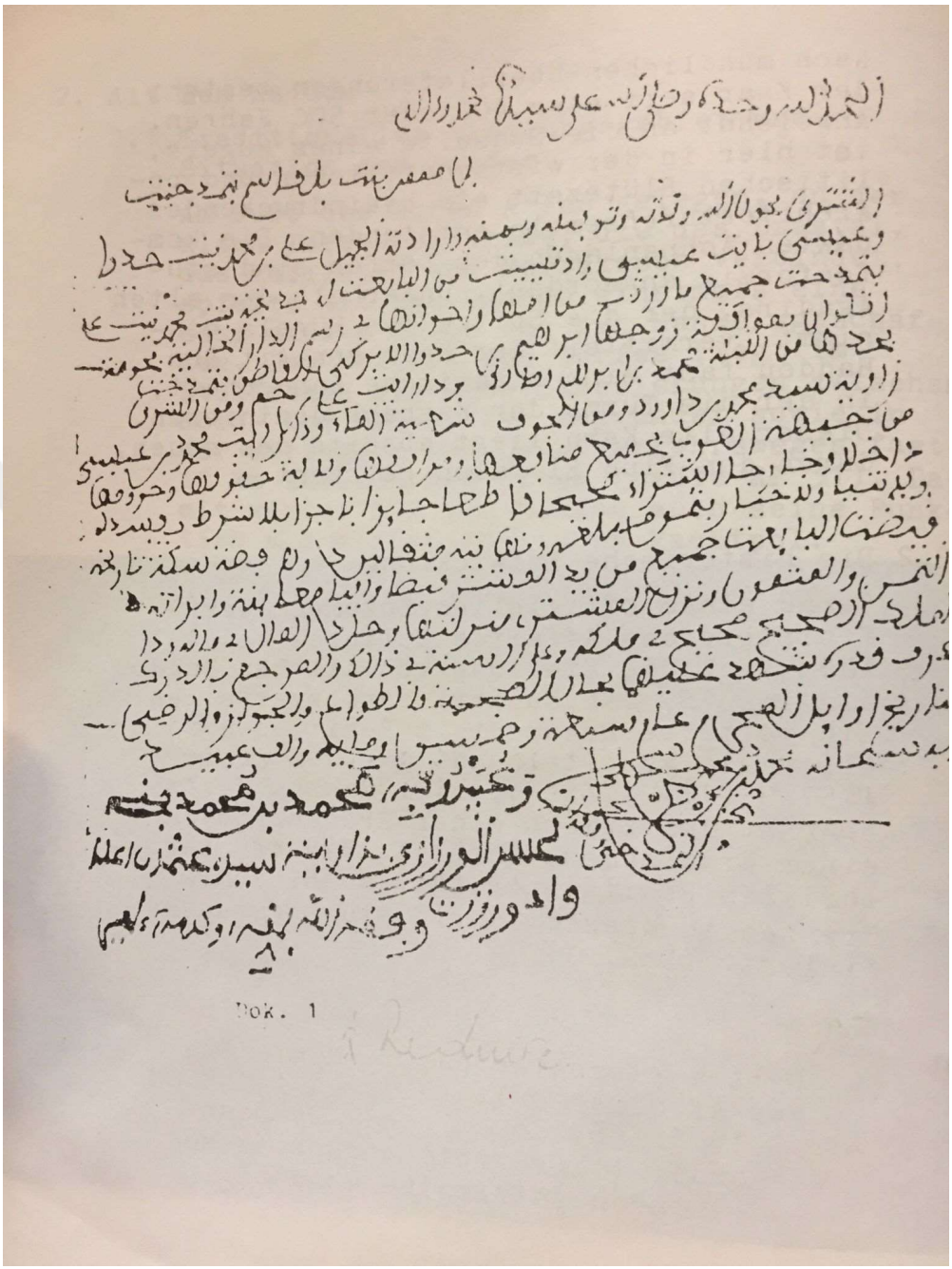


Figure 15: Document of property inheritance of an Ait Benhaddou resident.

Source: [41]

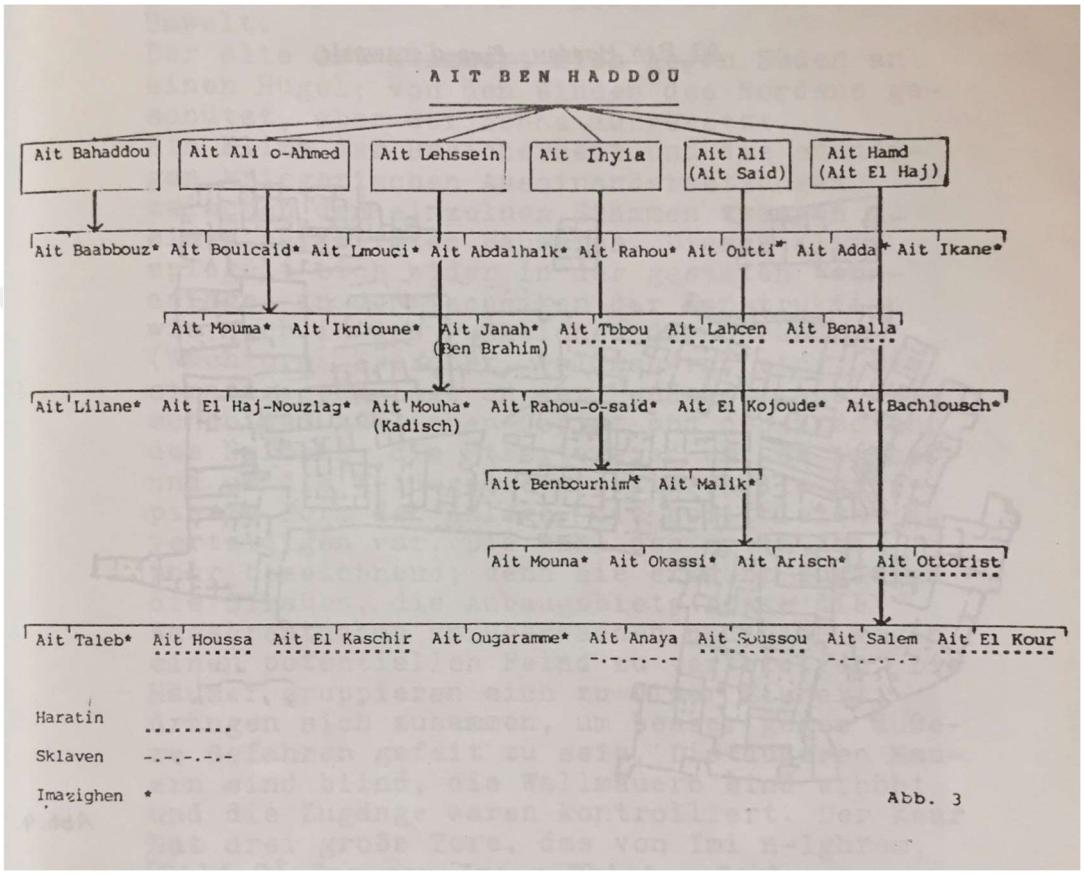


Figure 16: Families of the Ksar in the 19th century, indicating different ethnic and social groups.

Source: [41]

3.1.1 The origin of Ait Benhaddou's title according to the oral history

One of the well-known legends in Ait Benhaddou reported by Mr. Ait Malik speaks of a king called Ouad who lived in the region. The king had five daughters named Assata, Sergata, Telouata, Zelfata, and Doulata, and each of the daughters reigned in one of the Ksour in the region. Correspondingly, the names indicate Ksour settlements near Ait Benhaddou. Assata, which designates Ait Aissa or Ait Benhaddou, and Sergata denote Tessergate; Telouata stands for Telouet; Zelfata for Tazelaft; and Doulata for Tadoula.

The map in (Fig. 17) identifies the location of settlements described by the oral tradition, which seem to be connected by the valley routes. As the oral tradition stands in the memories of the locals, the placement of these villages displays a coherent relationship and proximity to one another. (Fig. 20) and (Fig. 21) illustrate the Ksar of Ait Benhaddou and Telouet as the only standing villages today due to restoration efforts, while Tazlaft and Tadoula are deteriorating and have been abandoned and relocated towards contemporary accommodation (Fig. 18) and (Fig. 19).

The history of the Ksour is unknown. Yet the structural resistance of the Ksour that requires constant maintenance for the survival of these sub-Saharan settlements indicates an elongated process that survived for many years. The Ksar's expansion and development into sustaining security and protection in a battle zone area expresses the ingrained continuity of the persistence of locals in adapting to the circumstances.

Oral traditions suggest that during the Almoravid period, a chieftain named Benhaddou controlled the town in the 11th century and subsequently was attached to the

name Ait Benhaddou [44]. Meunié made the first direct reference to the name Ait Benhaddou, referring to it as one of the well-known Ksour North of Draa [45].

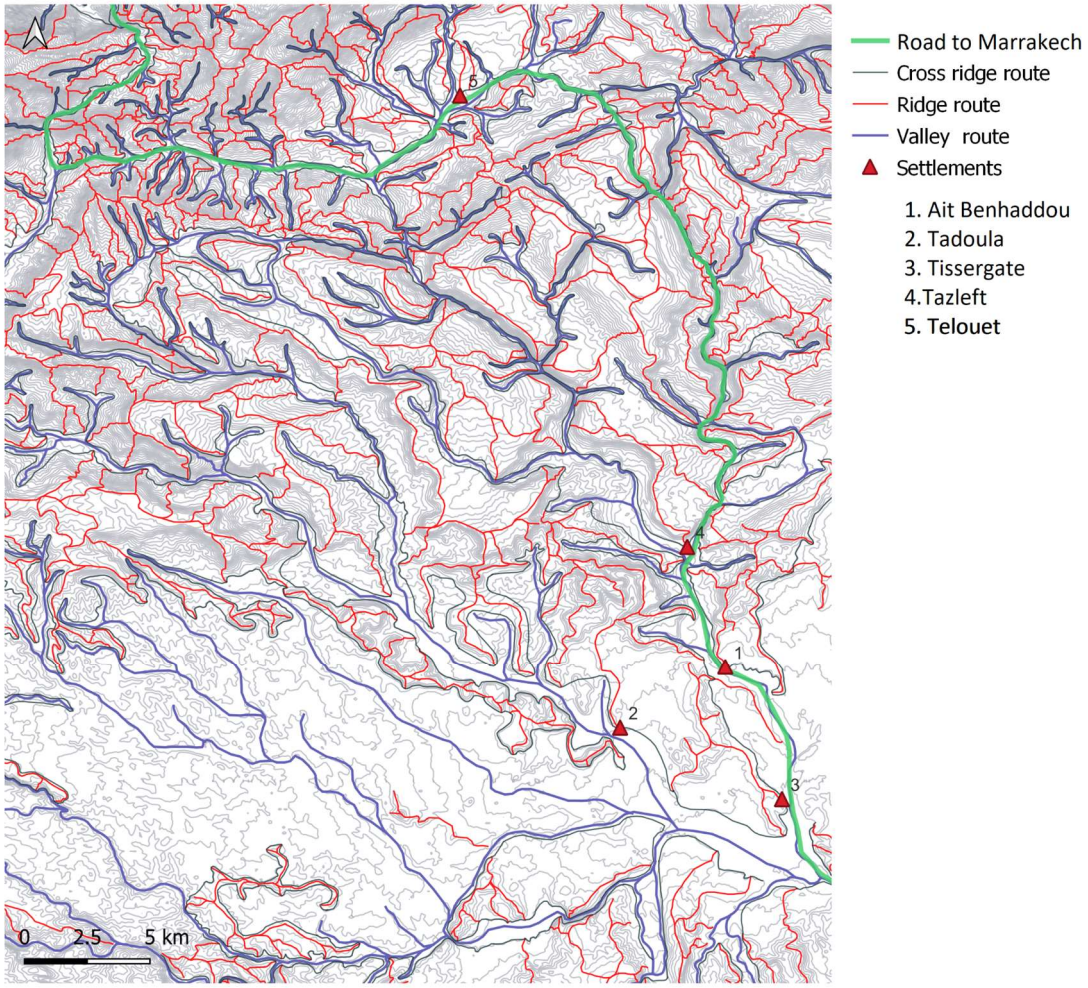


Figure 17: Map of the territorial organism created using QGIS, indicates the placement of the villages according to the myth in oral history.

Source: [46]



Figure 18: Photo of the ruins of Tazleft town.

Source: [47]



Figure 19: photo of the ruins of Tadoula Ighrem.

Source: [48]



Figure 20: Photo of the Ksar Ait Ben Haddou taken from across the river.

Source: [49]



Figure 21: Photo of the Ksar of Telouet and residence of the Glaoui family.

Source: [50]

3.2 Ait Benhaddou under a military and conflict zone

The location of Ait Benhaddou indicates its eminence along the trade route as a neighbouring village to the Kasbah of Telouet, home to the leader Glaoui, and a witness to military action and historical events. The Ounila River was a paramount route because of the chieftain Glaoui, who was given control of southern Morocco and lived there throughout the 19th century, making the Ounila trail a popular route for traders. The Telouet Kasbah signifies one of the strong ksour and fortresses in southern Morocco, as the residence of the leader of the South. The Ksar of Telouet and Ait Benhaddou define the trail that connects puissant cities with central Moroccan cities and southern territories (Fig. 22).

The power of the Glaoui chieftain prospered, expanded in wealth and influence, and gained recognition and power throughout his lifetime, making the route passing by Ait Benhaddou a significant one during his ruling time. One of the major battles occurred in 1901, initiated by Berber tribes under the leader Ali N'Ait Haddou in resistance to the Glaoui family [51]. It arose in the Kasbah of Tamdakht, about 5 kilometres from Ait Ben Haddou. The war history continued until the French colonial era, like the battle of Bougafer in northern Draa in 1933 that took place near the Ouarzazate region.

Mr. Malk further reveals that at the beginning of the 20th century, the leader Glaoui brought his army to conquer Ait Benhaddou, and Sheikh Haddou felt defeated when facing the Glaoui army. The two leading families married within each other, and the Ait Benhaddou became the name of the settlement, indicating the descendants of Haddou.

The military history of Ait Benhaddou reveals the context in which the fortified town stood, reflecting the building language and urban distribution shaped by the military

actions that modeled its form. According to oral history, Ait Benhaddou was abandoned for several years following destruction caused by military action in the region.

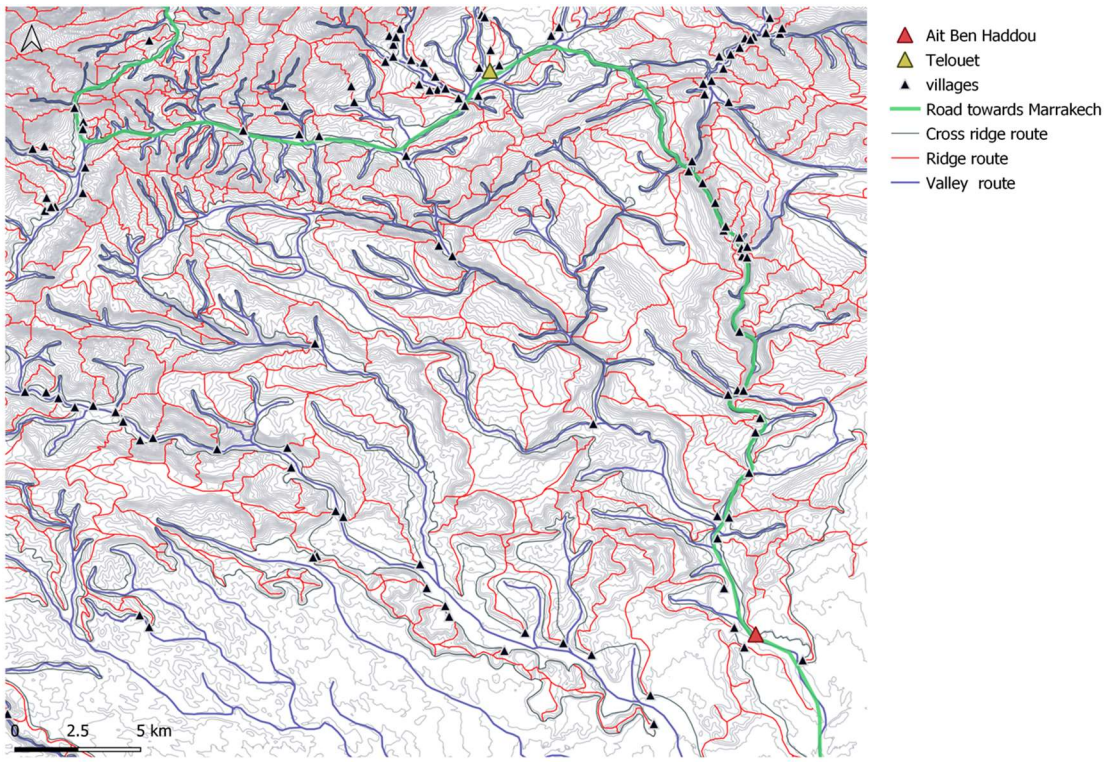


Figure 22: Territorial map created using QGIS representing the location of Ait Benhaddou and Telouet along the Marrakesh route.

Source: [52]

3.3 Urban Morphology

Urban morphology is the study of urban form, which connects geography with human settlements to provide an understanding of their formation and progression in the territory. As a result, it combines a range of domains of different scales, from human interaction with the environment to a building block. With human development comes various components, including social, economic, environmental, and technological progress. These components play a role in the evolution of urban form.

Urban morphology is then the study of the urban form and its components that explain the formation and transformation of cities. It tackles multiple layers of the built form from different scales to demonstrate the synthesis structure of the urban spatial layout with its physical characteristics. Through analyzing the urban form of the Ksar Ait Benhaddou, we aim to deliver an adequate acquaintance with its birth and growth and explain the formation process of the settlement.

3.3.1 Architectural approaches within urban morphology

The term urban morphology indicates the terms of human settlement and morphology, which is the study of shape or form and distinctly the formation process of an urban domain. It requires a look at the landscape, geography, and natural environment. The commencement of this field began in Germany. As influential as German cartographer Otto Schlüter (1872–1959) was, he first dealt with the city in the broader scope of the landscape. Fifty years later, Günter Conzen (1907–2000) became an important figure throughout the mid-20th century. He contributed immensely to understanding urban landscapes and morphogenetic methods through cartographic representation and terminological precision. Conzen is regarded as one of the early established figures of

urban morphology, forming the British school of urban morphology. On the other hand, the Italian school incorporates Saverio Muratori, Gianfranco Caniggia, and Aldo Rossi. This school was founded under the leadership of a group of architects who were the first to connect urban morphology to urban design and architecture [53]. However, the British and Italian schools share a communal concept of comprehending the urban environment by addressing attributes of time, form, and scale.

3.3.1.1 Conzen Approach

Günter Conzen (1907–2000) emerged from a geographical field, where he dealt with urban morphology as an approach to examine the structural condition of the existing town plans and their historical development. Conzen's morphological measures aim to analyze and describe the physical landscape using a two-dimensional cartographic representation [54]. The British school aimed to answer the question of how the built landscape was produced through a focus on cartographic representations, building fabric, and land use patterns.

3.3.1.2 Caniggian approach

The Italian architect Gianfranco Caniggia (1933–1997) was a devoted student of the architect Saverio Muratori (1910–1973), who developed his work from an architectural perspective within urban morphology, producing significant milestones in the field by establishing what is now called the Caniggian method of morphological analysis. Caniggia worked on developing Muratori's work throughout his lifetime, establishing a methodological approach to understanding urban territory and typo-morphological analytical studies. He developed a concept that focused on the building typological process in Italian cities, and as a result of reading the history of the city and its urban traces, he was able to recognize past urban structures [55]. This morphological approach

vitalized the urban morphological approach regarding architectural design and aimed to unravel the meanings of the city and reveal the intelligent progression and formation process it undergoes.

The Italian school focuses on human settlements and the built environment, which started initially as a response to the failure of modern architectural design and turned to a conscious theory of understanding the older imprints of the ancient cities and their urban tissue by making a classification of various building mutations that evolved through history.

3. 4 The Territorial Organism: The Ridge-top routes theory

The territorial organism communicates a result of a movement experience brought about by displacement through a route system that reveals its diachronicity and relationship with the land and the geographical elements and conveys the morphological and geographical characteristics of its propensity to be inhabited, linked to production zones suitable for development [56].

The territorial organism identifies route connections between the territory, settlements, and the urban organism. A methodological analysis that allows an understanding of the region on an urban scale and offers a conscious comprehension of the urban fabric and its growth. It is the groundwork for the ridge-route theory by Gianfranco Caniggia in 1976 that unravels the interconnection between early ancient towns and settlements and their natural geographical locations. Orographic conditions have always influenced human settlements that formed through stages within a geographical location and evolved throughout time to develop within an urban

transformation into contemporary urban settlements shaped by several environmental and natural factors. The Ridge-top Routes Theory traces the prehistoric human migration movement and settlement locations along ridges to form a territory, and this establishes a theoretical understanding of cities' origin and their foundation and growth as urban organisms. Caniggia and Maffei proposed the theoretical model for central Italy that depicts the progression of nomadic routes along ridges into permanent settlement [57], yet the model applies to the prehistoric migratory paths via ridge routes across the globe and serves as a universal example, as demonstrated by Palazzo [58] in its application to the Mediterranean city of Bethlehem in Palestine.

The territorial organism map in (Fig. 23) shows the settlements along geographical characteristics over various territory levels. Several villages indicate low promontory settlements towards the mountainous region, while most settlements south of the Atlas region, like Ait Benhaddou, present valley settlements. The link between villages shows the displacement and movement pattern parallel to the valley route, marking a crucial trail for human movement.

3.4.1 Ait Benhaddou within the territorial organism

Certain geographical features attract human settlements. It is where the ridge-top theory comes into play, where ridges act as territorial and urban attractors on a geographical scale. The Ksar Ait-Benhaddou sits on a hilltop that stands by the edges of a ridge route, where the urban structure shows a strong identification of urban expansion, primarily through two sets of fortifications: a semi-deteriorated fortification on the summit and another wall surrounding the urban tissue downhill. Based on Gianfranco Caniggia's ridge-route theory and the settlement's urban morphology, it is possible that the settlement

initially emerged as a hill settlement, which provides a natural geographical attribute of boundary that people have taken as a refuge in establishing urban organisms throughout history.

The hill stands secluded at the end of a rich ridge route trail and makes a natural protection shelter for locals against possible danger. The Ksar Ait Benhaddou sits in an area historically known for its instability and military actions, elevated from the ground, and demonstrates an urban form that spreads alongside the hill, enclosed within a fortification wall, along the river Oued Ounila, making a natural barrier and a channel for trade and communication among different tribes.

The ksar is situated in a zone along countless settlements in northern Draa, along a range of topographical features varying from low-lying to hilly and mountainous territories. Regardless of the location or climate, the territorial organism reveals a distinct pattern and communicates a singular language of urban settlement.

Natural determinants and environmental factors contribute to the attraction of urban settlements, like the water, which is an essential factor for survival in such a climate, and the development of the Ksour. A water source is a vital element in the progress of agriculture and survival in general and a natural border feature.

At the highest point in Ait Benhaddou, the ruins of a collective granary take place, indicating the presence of order and structure inside the village and raising the prospect of an urban genesis on a hill, as corroborated by oral traditions.

The urban expansion along the riverbanks shows an organic growth process that recollects all of the natural qualities of the environment and reflects the development of

building techniques and technologies that rely exclusively on naturally accessible components.

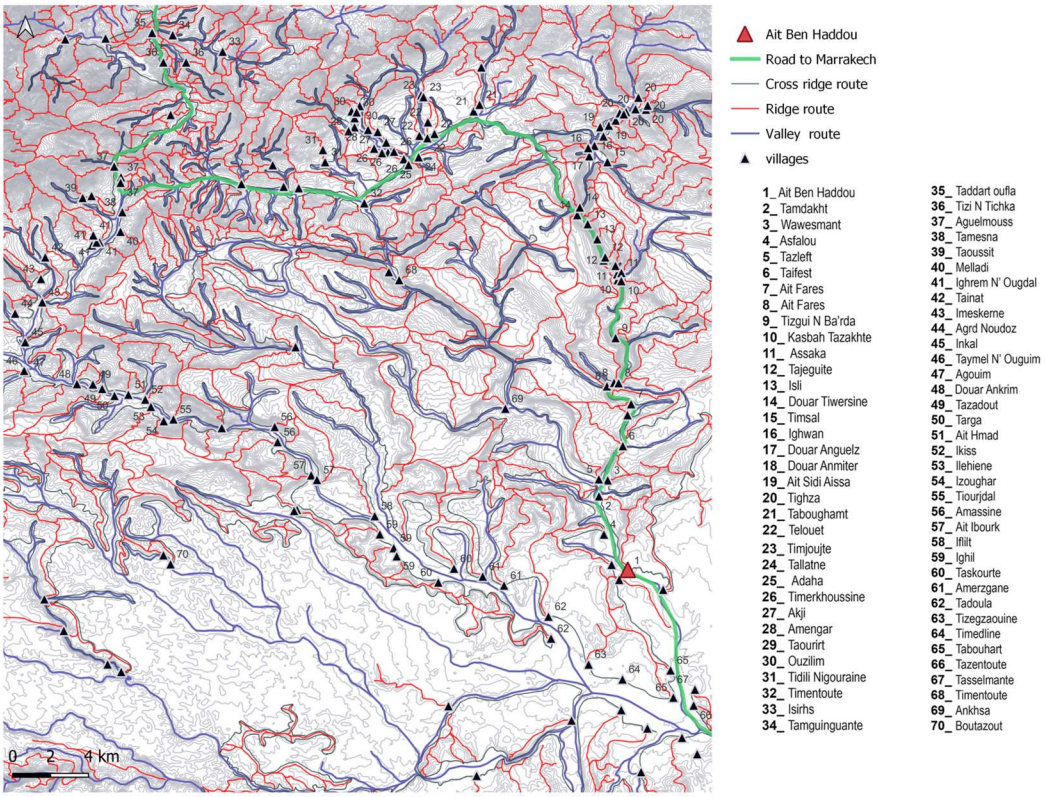


Figure 23: The territorial organism map, created using QGIS, indicating Ait Ben Haddou's location within the territory along the list of neighbouring villages.

Source: [59]

3.4.2 The urban fabric of Ait Benhaddou

The urban fabric depicts a dense building assemblage bordered by an enclosure setting. There are two sets of defensive walls at Ait Benhaddou, one on the hilltop encircling the *Ighrem N' Iqddarn* structure, which designates the remaining monument of the Berber bank (Fig. 20) and fortification walls along the lower valley route protecting the city.

Berber Banks are ancient constructions in Morocco that exist either as caves or buildings over elevated mountainous and hilly areas. The Agadir Itourhaine in Taroudant province is an example of a fortified Berber Bank, which is said to be an 800-year-old granary [60]. Similarly, Ait Benhaddou retains traces of the collective granary encircled by observation towers. With time, collective granaries lost their functions after the decline of military activities in the area and eventually quit service.

The city walls surround the urban tissue of Ksar Ait Benhaddou, incorporating three gates and several castles with observation towers within the peripheries of the fort. The image in (Fig. 24) illustrates one of the earliest pictures of the Ksar Ait Benhaddou in 1906 by Gentil, indicating the granary building on top of the hill. Gentil, who followed the trail of Charles de Foucauld, similarly describes the towns along his trip toward the south of Draa. Gentil takes the route of Ounila Valley following the trail traversed by Foucauld and refers to Ait Ben Haddou as 'Bou-Rehim' [61].



Figure 24: Image of Ait Benhaddou by Gentil from his expedition through Ounila valley.

Source: [61]

3.4.3 The Urban pattern in Ait Ben Haddou

The urban tissue depicts a dense building aggregation bounded within an enclosure-fortified setting. The city walls mark the Ksar boundaries and carry the main gates that signify connecting points between locals and foreigners.

Each gate indicates a name, referring to its purpose or activities held in its proximity. *Imi N' Ighrem* denotes the south-eastern entrance and the main gate to the settlement. Through this gate, ruins of a Jewish neighborhood stand in an irregular and highly compact building pattern next to ruins outside of the border of the Ksar (Fig. 25).

Outside of the Jewish corner, the settlement identifies a semi-regular urban pattern, indicating the development process of the Ksar and its expansion through a discernible separation of regular and semi-regular patterns highlighted by two different religious groups, the Jewish and the Muslim. Muslim and Jewish cemeteries sit near the Ksar and attest to the multi-religious identity shown in (Fig. 26) and (Fig. 28).

Towards the southwest, a semi-regular urban pattern holds the affluent houses called Kasbahs in a segment parallel to the valley route that connects to the new village of *Issiwid* through a bridge crossing the Oued Ounila (Fig. 27).

Many influential factors managed to shape the present form of the settlement. The Jewish neighborhood exhibits a portion of the village predominantly destroyed after the departure of the Jews, adjusted near building ruins outside the Ksar's borders, implying an absent part of the urban tissue (Fig. 27). The building ruins by the eastern limits of the Ksar refer to the consequences of military history, or its neglect and abandonment that retain the collective memory.



Figure 25: Photo of the main gate path and the Jewish neighborhood taken from the Orality house.

Source: [62]

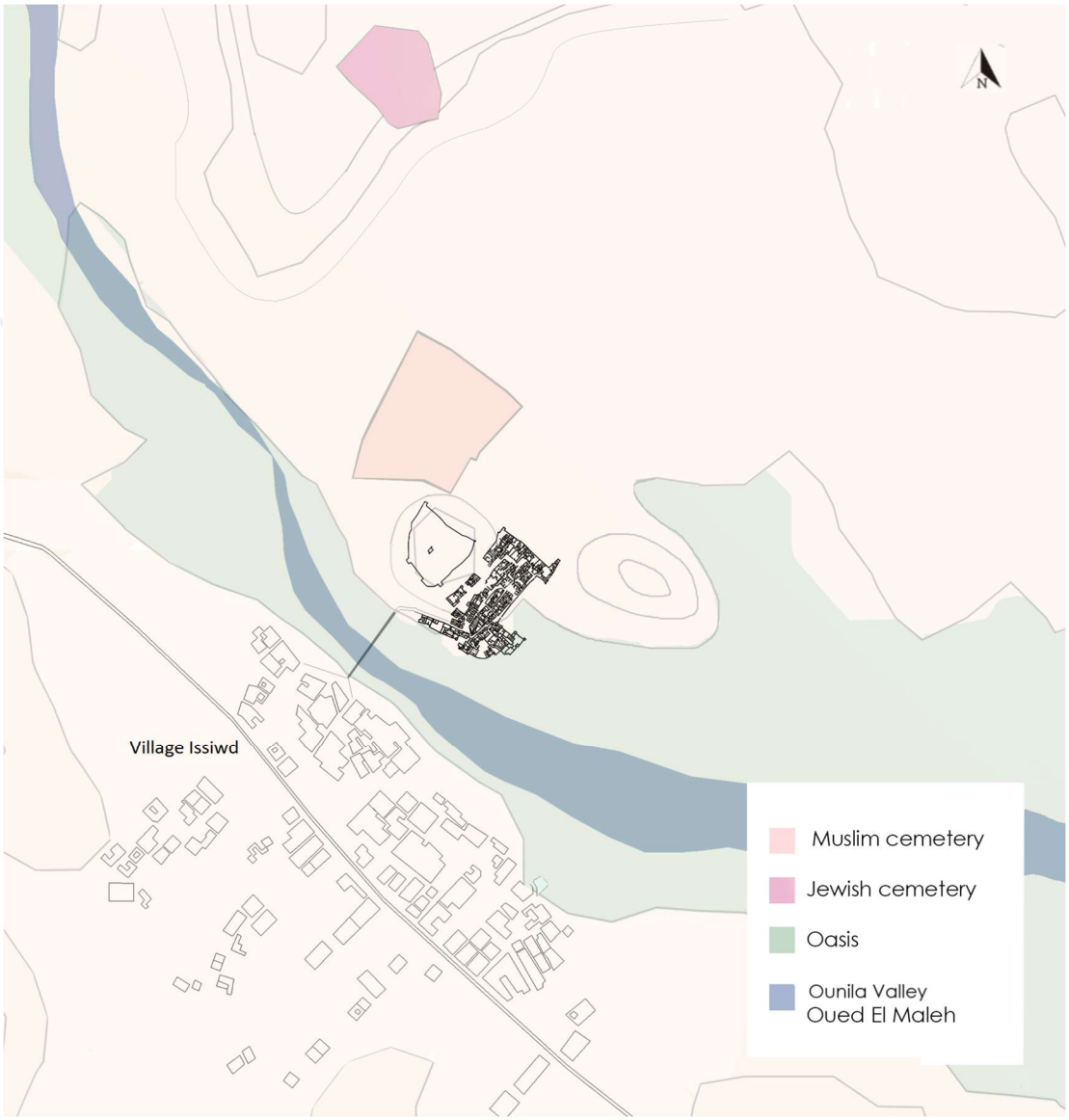


Figure 26: Schematic map of Ait Benhaddou and surrounding territory, cemeteries and Issiwid village.

Source: [63]



Figure 27: Map of Ait Benhaddou master plan, including nearby ruins, Issiwid village across the valley, and the surrounding territory.

Source: [64]

3.4.4 Physical properties of Ait Benhaddou

Reading the city with the inclusion of its historical context is a powerful tool in comprehending the urban form, as attested by Camiz [65], who emphasizes that urban design must combine familiarity with its environment's historical and typological knowledge by recalling the study of antiquity, the fragment, and characteristics of the city that elaborate the significance of the site. Reading pathways, urban fabrics, agricultural dividers, and building typologies can lead to a new contextual grounding of architecture, providing it with the required life [65].

In Ait Benhaddou, the urban fabric exhibits a social classification of building types, from south-west to east-west. By the valley, dwellings of powerful families align, forming a singular district that protects the inner residential modest area that holds a mosque and a synagogue. Towards the east, the house of the tribal Chief Amghar Brahim Haddou stands as the orality house (Maison de l'oralité), located at the highest point of the Jewish neighborhood, where he resided in the late 19th century and is now devoted to being a cultural centre that documents the oral history and the heritage of the region. Moreover, the village sits on a hilly topography limited by the agricultural fence and the valley (Fig. 27), where the urban tissue lies on the natural slope of the hill and creates a unique street network characterized by a narrow and snaky nature.

The urban tissue displays components that allow an understanding of the formation process of the settlement through a set of guidelines emphasized by attraction points that generate the urban grid. Initially, the street network reveals a connection between the gates on the lower land and *Ighrem N 'Iqddarn* building uphill. The noticeable distinction is delivered through the urban layout, indicating different zones

within the settlement that express growth patterns and reveal recognizable elements within the tissue used to comprehend the phases of the village formation.



Figure 28: Map indicating the religious buildings in Ait Benhaddou.

Source: [66]

3.5 Brief conclusion

The chapter emphasizes the effectiveness of looking at oral history, which helps strengthen the historical search. The local memory preserves significant data regarding political events and the significance of Ait Benhaddou in the region as a crucial part of Ounila Oued's military history. The inspection of the history of Ait Benhaddou on account of the collective memory indicates the significance of such intervention, as it conveys a strong alliance with the reality of the town and reinforces the reports presented by textual sources. It elaborates on a better perception of the general circumstances and conditions that shaped the Ksar and influenced its present form.

The name change correlates to past political affairs in the region, broadening the scope of the fort's historical setting. Although the name Ait Ben Haddou does not appear in written documents, the name Ait Aissa reflects more extensive historical growth.

The inspection of the territorial organism expresses the local mechanism of human movement in such a way that it correlates massively with the properties of the land and its characteristics. Introducing the territorial organism is intended to deliver an overview of the coming chapter. One that will address the formation process of Ait Benhaddou's settlement through the application of Muratori and Caniggia theoretical guidelines in reading the urban tissue connecting larger-scale territory to an urban scale anticipates a continuous and conscious outgrowth in conformity with the theory of progression of small towns.

CHAPTER IV

THE FORMATION PROCESS AND URBAN ANALYSIS

4.1 Typo-Morphological analysis of the Ksar Ait Benhaddou

Processual evolution occurs within bounded lots that extend its meaning to form linkages with the surrounding buildings, infrastructural networks, archeology, and the landscape. The significance of the location is revealed by reading the urban fabric, paths, agricultural partitions, and building types [65], and its characteristics define a significant grounding of architecture in the region.

The territorial organism introduces a large-scale inspection that explores a ridge and valley route system as the structuring phase to understand the nature of the place and the formation of settlements, hence demonstrating Ksar Ait Benhaddou in its geographical context as a hilltop settlement.

The progression from a territorial organism to an urban organism elaborates the acclimation of local people to the geographical, climatic, and general nature structure of the hill and its surroundings. The urban nucleus is born through an adaptive cycle, producing a route system elaborative of the unique characteristics of its land.

The formation of historical towns is studied through the analysis of a typo-morphological process that articulates the connections between routes and the building form that shapes the urban grid [31]. Therefore, reading the urban tissue and the built form reveals clarity on the sequential formation of the Ksar Ait Benhaddou.

The scarcity of documented and archeological research makes it challenging to formulate a diachronic analytical understanding of the evolution of historical towns. However, urban analysis grants a departure from reading the urban tissue by analyzing

the movement and the polarities that are driven by forces of direction leading to symbolic areas called nodes and poles [67].

The attractor theory allows a diachronic analytical approach to the urban tissue, and the routing system serves as a tool for detecting several attractor points within the urban tissue that explain the organization of the street network. Its application across several historical towns delivers substantial analytical findings [68].

Significantly, the urban pattern displays substantial order and sequence exhibited through the street network and the spatial setting inside the Ksar, as the building orientation suggests expansion phases through an axis system launching from the hilltop. The development of the Ksar is driven by attractors or polar points that establish axis lines serving as a guideline to the built environment, eventually defining the urban form that implies growth direction from east to west through four discernible growth sequences, starting from the top of the hill represented by the building of *Ighrem N' Iqddarn* towards the agriculture fields and valley limits.

The village is oriented towards the southeast and lies in a compact urban configuration beside visible remnants of previous residential blocks recognized through a sequence of damaged walls, signifying a broader plan configuration towards the east (Fig. 27) and (Fig. 28). The local memory mentions a partial destruction of the Ksar under the leader Azeroual, which led inhabitants to abandon the town for seven years, and this demolition occurred before the arrival of Saint Sidi Ali Ouamar to the Ksar [42]. For this, the south-eastern district could have been larger than its current state, hence its irregularity that expresses its earlier birth compared to the rest of the village.

The urban tissue is formed via elementary routes that begin through the hilltop by the ruins of the Berber bank and formulate an evolutionary street network expressed

through the urban form and urban pattern. Various elements contribute to the genesis of the Sub-Saharan Ksour, illustrating an association between geographical and morphological features and the genius of traditional adaptive techniques. Every feature of the urban tissue is explored in this chapter to unravel and explain the process of urban growth and identify the many stages and influences involved in the construction of the settlement.

4.2 The formation process of Ait Benhaddou

4.2.1 The initial Phase

The location of the sedentary early human communities indicates habitats along the ridge route, as presented by the model of human evolution of nomadic roads over ridge routes leading to settlements along the Mediterranean [57]. This model introduced a conscientious investigation method for dismantling the elements of the urban organism to fathom its development. When speaking of sedentism, protection is essential. This protection takes form in the geographical topography of the territory, serving as a natural boundary of protection from outsider interventions. The hill is of natural defence ground; similarly, the Berber bank at the hilltop suggests an original hill settlement on the hill that retains fortification walls in the present day. This wall maintains five observation towers across 360 degrees around the village's highest point, allowing complete surveillance over the territory.

The ruins of the fortification walls uphill and the building of *Ighrem N' Iqddarn* indicate the base of a previous urban structure. The purpose of this building is said to be a collective granary functioning as a bank to collect goods owned by locals of the Ksar and controlled by a Pasha. However, narrations differ regarding the original size of the granary. Nevertheless, *Ighrem N' Iqddarn* stands to indicate the founding-built

environment on top of the hill, supported by the oral tradition as the location of the first village (Fig. 29). Therefore, according to the ridge route theory, together with the oral tradition, it is reasonable to suggest that the original foundation of the Ksar began at the hilltop.

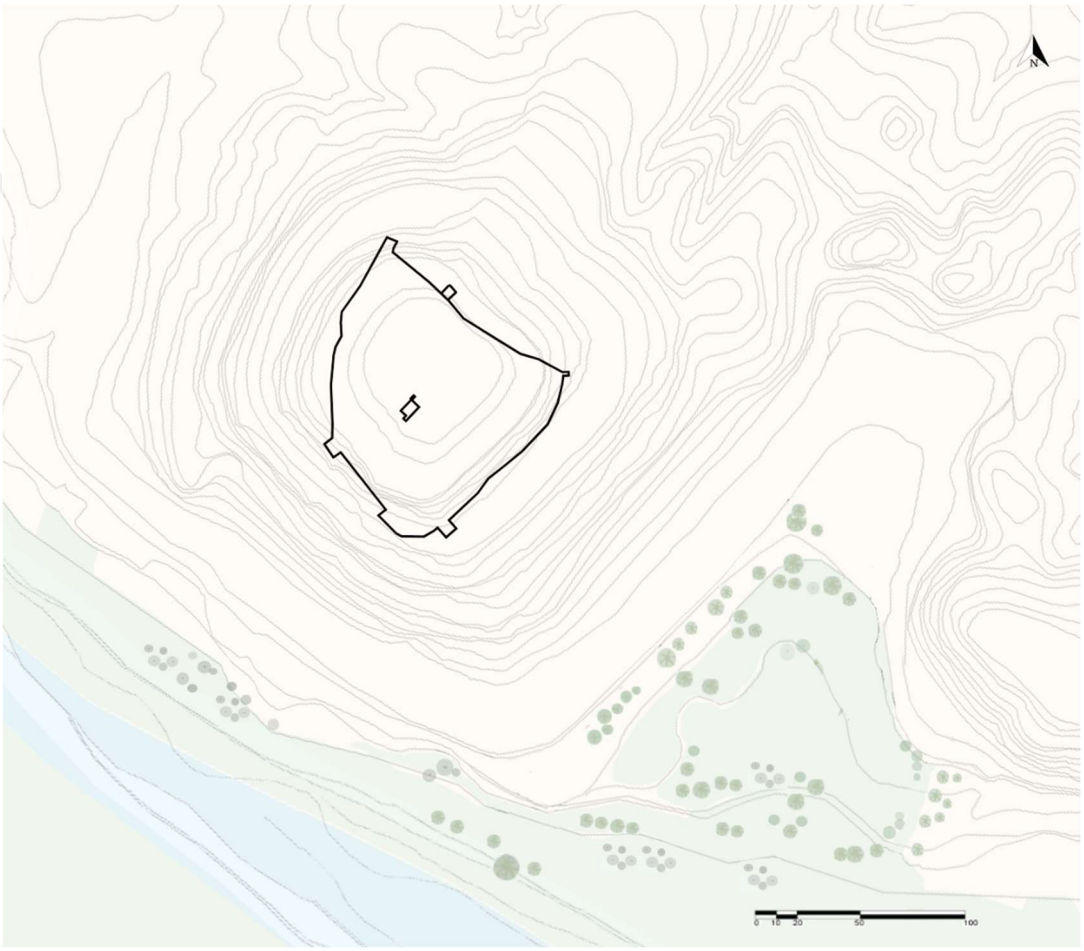


Figure 29: Map of the hillfort and the initial location of the town.

Source: [69]

4.2.2 The Second phase

The analysis of the urban organism is processed by adopting the scheme of progressive growth of small towns by Caniggia and Maffei, addressing the development of urban planning guidelines and formative laws based on a matrix route in different geomorphological settings [31]. The urban organism begins with a matrix route that starts from a polarity point at the hilltop to another point downhill, along which buildings develop, creating the genesis of settlement.

In this phase, the spatial arrangement exhibits building aggregation by the east in a compactly structured manner, assembling along a route connecting the hill to the main gate, indicating a matrix route (Fig. 30). The Matrix route sets from the initial location in the initial formation phase of the settlement and descends downhill to connect with the main gate, instituting an expansion of the building aggregation along an axis that adjusts to the topographical nature of the hill and creates a winding path.

Camiz [70] explains the diachronic evolution of urban routes within the attractor theory and points out another example of a point attractor, which is city gates. Likewise, in Ait Benhaddou, the link between the hilltop and the gate communicates the birth of an additional attractor point, the city gate. This gate presents the main gate of the settlement, exhibits a significant attractor in the urban environment, and reveals a principal point in relation to the route network expansion.

Along the Matrix route, the Jewish neighborhood conveys singular properties of a united urban character in an irregular urban pattern. Notably, houses show orientation facing each other along the matrix route, which shape the building language of the neighborhood and result in a highly compact and connected district, united towards a central path and enclosed towards itself, penetrated through shaded alleys that conceal

the street within the built tissue (Fig. 34). The southeast gate is the main entrance of the village and indicates the name *Imi N' Ighrem*, a literal translation of the mouth of the village. It is customary for Berber towns to place main entries facing east as a symbol of welcoming the blessings of light at sunrise, and gates are named according to a function or a particular description they are associated with. Correspondingly, other gates in the Ksar carry names *like Imi N Talat N Tigoura* and *Imi N'ou Azerg*, meaning the door to the Frog water canal and the door to the mill.

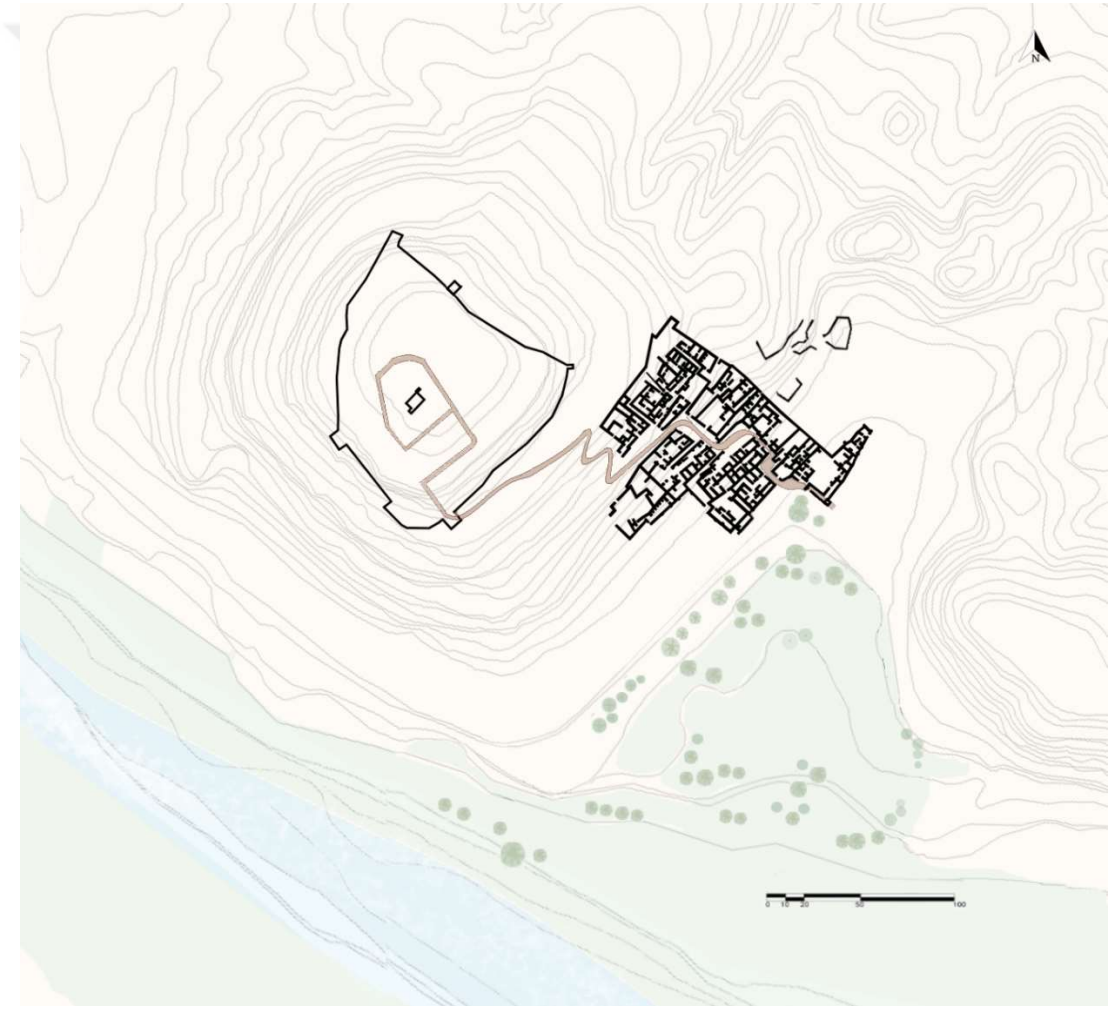


Figure 30: Map indicating the second phase of urban development.

Source: [71]

4.2.3 The third phase

After the formation of the eastern neighborhood along the matrix route, new urban tissue grows and forms an extension of building aggregation, developing towards the west in a semi-regular urban pattern.

Caniggia and Maffei [31] express the notion of pole and anti-pole attractors that determine the origin or destination of a route within a territory, producing new routes that foster the urban form of the settlement.

The settlement's core section features two religious structures that indicate a growth period defined by a semi-regular layout, with the mosque facing the west gate. It is a constant feature of Berber settlements to install mosques in locations accessible to outsiders. Thus, its placement is considered an attraction point in the territory.

The nodal attractor determines a branching between two or more routes [72]. Likewise, the conversion of paths at the hinge point of the mosque represents a nodal attractor in the village, denoting an attraction point and an intersection point, where the mosque's structure is shaped by the destination routes and aligns with the street network (Fig. 31).

The mosque at the edges of this expansion communicates a form and plan arrangement that indicate the process of growth as a result of the intersection of nodal and polar points, producing a guideline of routes shaping the mosque (Fig. 32). Finally, as urban growth initiates from the hill, the built environment is navigated by various roads of different widths, slopes, and types that run from the lowest point of the village to its

highest point to establish a rich street network offering a meandering movement via narrow alleys connecting the main streets with secondary streets.

To clearly understand the third expansion phase, a conscious realization of the buildings on a closer scale is required, and the mosque standing at the intersection of the street network exemplifies a perfect testimony to the urban growth that occurs on a smaller scale and shapes the urban form as well as guides the urban growth.



Figure 31: Map indicating the third development phase of Ait Benhaddou.

Source: [73]

4.2.3.1 The mosque's development as a symbol of the urban growth

The form and organization of the mosque express a development process that established its final shape. Traditionally, the Berber Mosque is a modest building that progresses from a prayer hall that initially served as a teaching space. The prayer hall is oriented towards the *Qibla*, denoting the direction of Mecca towards the east, alongside the *Wudu* area or ablution rooms that align with the street network and the water heating room analogous to the main street coming from the eastern gate (Fig. 32). The mosque's arrangement expresses separate development through street deviation and movement.

In (Fig. 32), the Quranic School (4) articulates an extension phase of the mosque that does not resemble the form and configuration of other rooms (prayer hall, ablution area, and water heating room). The Quranic rooms are shaped from one side by a route pointing out to the vicinity of the gate, indicating the deviation of the street orientation through attractor points, resulting in the final shape of the mosque. In Berber societies, the quality of the mosque and its ability to accommodate extra spaces and rooms reflect economic growth. The plan organization presents a clear development based on the street network commensurate with urban growth guided by economic and social prosperity.

The same norm applies to residential housing, which is communicated via the urban tissue, as the property boundaries show the development and extension of the structures. Homes begin with modest proportions, and as financial and familial status develop, dwellings reflect this change, resulting in organic growth guided by local requirements and traditional practices.

The mosque reveals a direct illustration of the built form as a result of a street deviation driven by the economic and social expansion that characterizes the final urban growth.

(Fig. 32) reveals the Quranic school directed towards the gate (6), identifying the process of urban attractors leading towards further urban expansion. The direction towards the valley gate as a new deviation point directs the final phase of urban growth towards the valley and shapes a new district distinguished by military and protection characteristics.



Figure 32: Map indicating the plan organization of the mosque and the surrounding buildings.

Source: [74]

4.2.4 The fourth phase

The fourth and final phase is represented from a broader scope to explain the development of the urban tissue according to the existing built form and to reveal its logic. Camiz [68] clarifies that an existing urban attractor stimulates change in the urban network configuration, where routes take further deviation from their former position. Likewise, from the urban attractor point of the mosque, the route system deviates towards a new attractor point, the valley gate (Fig. 32).

The map in (Fig. 32) indicates the city gate (6) by the valley side and presents a principal element in the final formation phase of Ait Benhaddou. Consequently, urban growth develops along the valley route and surrounds the town from two sides with a set of fortified castles that stand parallel to the valley route. The fortified castles with similar physical characteristics execute along the intersection of two axis lines, establishing the final urban district and presenting buildings identified as typological variants compared to the rest of the town.

In this phase, Kasbah buildings are defined as a synchronic variant of simultaneous existence with similar characteristics emerging contemporaneously [31], arranged along the latest route leading to the valley gate to suggest that the buildings resulted as a formation due to a prior road.

According to Caniggia and Maffei, buildings are established according to the prior existence of a route system that defines and guides the institution of buildings, making the streets a guideline for the kasbah formation.

Equally, (Fig. 33) presents the latest phase of the town towards the valley as an outcome of territorial attractor points, where the valley gate (1) and the bridge (3) stimulate the village's growth towards a cross-valley route and create the street paths and guidelines for the Kasbah execution.

The institution of Kasbah district delivers the image of the power of the village leaders, conveyed through the military characteristics of fortified castles, distinguished by observation towers that merge with the fortification walls. This execution reflects the authority of leading families and symbolizes their role in protection. Thus, Kasbahs signify wealthy households and military castles that shield the town from the riverside and establish security across the village. The observation towers on each side of the Kasbah provide high security and monitoring of the narrow street network.

Through the expansion of the Ksar Ait Benhaddou and the need for security, the creation of fortified castles as a final stage expressed in a singular placement allowed advanced observation over the inner and outer territories (Fig. 33) and (Fig. 42). The need for protection from intruders was essential, knowing that the Ounila Valley was a vital passage of trade in a conflict zone, supported by the appearance of Kasbah's casting power.

Finally, (Fig. 33) identifies the convergence of the street network at the hilltop, making the hill a principal source of street deviation, supporting the overall investigation of urban growth and clarifying its role for Berber communities, where the Berber bank acts as a collective bank that reflects the social and economic order but also a refuge in critical times.



Figure 33: Map indicating the final growth phase of the Ksar with the road network system.

Source: [75]

4.3 The street network

The street pattern demonstrates a spatial layout that discloses the boundaries of the urban form, establishing navigation segments that allow the reading of the settlement's formation process. The hilltop generates the origin of the street network that extends downhill, assembling various street types adjusted to the nature of the hill.

The streets link to a track outside the town's limits, utilized to reach nearby villages. Tracks around the eastern limits encircle building ruins, distinguishing a broader street network that once belonged to the Ksar and a bridge towards the west that connects the settlement to Issiwid village (Fig. 34).

The paths within the town adapt to the hilly inclination and are formed with local materials and stones to mark the road and create natural stairs. Regardless of the street types, the narrowness of the street network remains a common trait due to the defence and security needs of the time. Tunnel streets exist through the urban tissue and represent shaded passages that penetrate through housing blocks and are seen mainly in areas where houses extend over existing pathways and connect several buildings (Fig. 34).

4.3.1 The generation of public spaces and urban growth

The streets are a significant social space in the Moroccan Berber communities, as each family has its share in the agriculture fields. Locals spend considerable time inside the town, traversing its hallways, making it one of the most used places and a social interaction space.

Initially, urban growth serves as an engine for the street network, establishing the social-interactive spaces inside the Ksar. Hallways serve as a principal public space for social interaction and generate networks shaped by the conversion of agricultural and cultural traditions (Fig. 35). The tunnel alleys serve as a meeting place for gathering and communication between neighbours, protected from the summer heat and rain in winter (Fig. 65).

In this regard, religious structures serve as urban spaces, with social and cultural interaction defining everyday social behaviour in Middle Eastern cities [76]. Likewise, the expansion of the urban tissue produces the mosque as an attractor point with substantial social, religious, scholarly, and humanitarian attributes. It stands as a merging point of the street network, shaping the everyday movement and activities of the inhabitants. Finally, the communal space operates as a social public space of significant social and economic value to the evolution of the settlement.

The social spaces exist on a ground level and an elevated level. The nature of the hill allows social interaction between families through roof terraces, which present a private zone, allowing a broader social interaction standard and expressing the importance of communication through the built environment. On the other hand, the street network conveys the establishment of public spaces according to traditional customs incorporated with influential religious and economic attributes established by the town development.

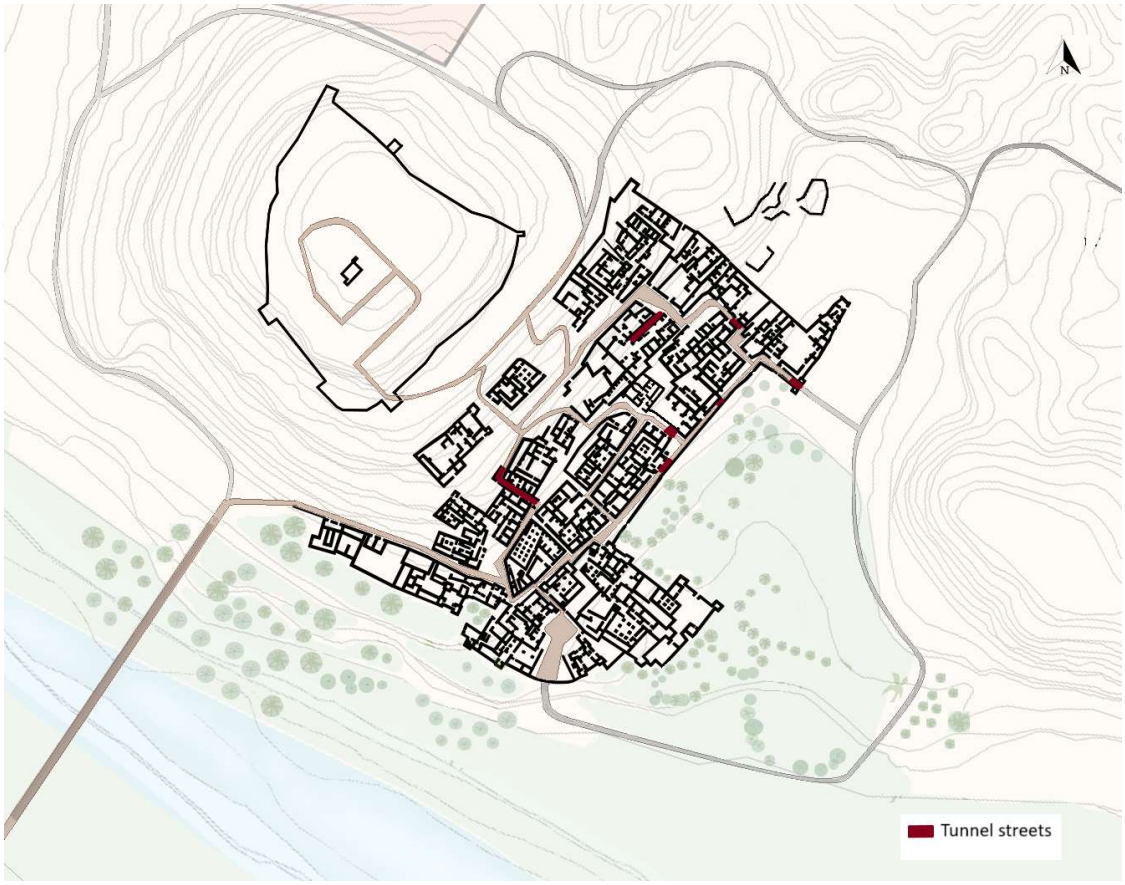


Figure 34: Schematic map indicating the location of tunnel streets and the surrounding track.

Source: [77]



Figure 35: Photo depicting the social behaviour driven by agriculture harvest in interacting with the street network in the Ksour of Draa.

Source: [78]

4.4 The collective granary

The collective granary, or the Berber bank, is a landmark in southern Morocco, also called *Agadir* and *Igoudar* in the plural of Tamazight. The local Berber banks endure across the Atlas Mountains and Draa Valley. They are collective banks for village families situated on hilltops, where each family possesses a crop storage cell. Igoudar are fortified granaries with surrounding towers and appointed personnel responsible for control. Likewise, *Ighrem N' Iqddarn*, stationed at the hilltop of the Ksar, exhibits the remains of an Agadir structure (Fig. 37). The fortified granary was once a shelter for goods, food, and household tools, and according to Jacques Meunié, they served to store items like jewellery, clothes, carpets, and traditional weapons [79]. It also served as a community house, where the village leaders kept religious inscriptions and various documents [79]. The granary at Ait Benhaddou exhibits a single building at the centre of the hill, surrounded by the remains of fortification walls and five towers (Fig. 36).



Figure 36: Photo of the hilltop fortification wall with the remains of a tower structure.

Source: [81]



Figure 37: Photos of the granary building at Ait Benhaddou.

Source: [82]

4.5 Influential factors in Ait Benhaddou's morphology

4.5.1 Spiritual factors

Economic, social, religious, and political factors have helped shape urban growth. However, another commonly prominent aspect of the semi-nomadic and nomadic tribal communities of southern Morocco is the spiritual lifestyle. The vastness of the desert and the calm it holds naturally bring one closer to reaching God and push one to contemplate the essence of existence.

Traditionally, the main gates of Igherman face east to welcome the blessings and prosperity of the sunrise. Similarly, the main gate in Ait Benhaddou, *Imi N' Ighrem*, faces the southeast, favouring the settlement with morning sunshine and blessings.

The oral tradition reposted by Mr. Malk speaks of a ruler from the Almoravid dynasty in the 11th century who came from the east accompanied by a saint from the Zaouia Naciria (Nasiriyya Sufi order) of Tamegroute. The saint questioned the residents of Ait Ben Haddou why they live uphill rather than along the river, and the residents responded that it is due to their dread of the rough nature of the hill as well as the presence of deadly animals and snakes. The history of wild animals in the Atlas is not far back. In fact, the Atlas lion was considered extinct in the wild by the 1920s [83]. The myth narrates that until the saint came to the land and gave his blessing, people started to extend their properties and build downward the hill. Draa is known for the historical hermit figures (Igurramen) that had an influential share in the development of the Ksour. The impact of saints in the Atlas and southern Atlas regions is profound, as they take on agropastoral,

social, and political roles in Berber societies and symbolize spiritual protection and guidance; consequently, their sanctuaries become pilgrimage places [84].

Oral tradition narrates that the Sufi saint Sidi Ali ou Amer sought refuge through times of anguish and tribal conflict in Ait Benhaddou, and as part of his martyrdom, locals built a Marabout in his honour (Fig. 38).

Djeradi [85] explains the misapprehension that the Ksour architecture can seem to be influenced solely by local environmental factors and natural attributes. The concept of spontaneous architecture is not as potent as the spiritual impact on Ksour's cosmogony, and it is the architecture of the sacred, as it holds the burial of ancestral memories in many cases [85]. The collective memory recalls the history of Saints and their influence on urban expansion. All these attributes remain in the memory of the locals nowadays, expressing a language of spirituality that prevailed for centuries and strengthened with religious influence as symbolized in sacred buildings represented by the synagogue and the mosque within the Ksar.

The Ksour architecture revolves around agriculture, harvesting, and local natural resources, an essential part of its growth, and reflects glimpses of the morphological expansion expressed through the raw building material. However, it might not be the only guideline for its urban development and formation. The Ksour belongs to the geography of the sacred, which does not concentrate on a singular region but has its own vision; unlike the necessity-driven placement of the utilitarian approach, it is an environment symbolic of human activity. The rational ecosystem and technological constraints are insufficient to explain the entity of the overall morphology of the Ksour sites, as spiritual factors can be more decisive. [86]. The spiritual aspect is, in fact, persistent in every house

within the settlement in a way that is recognized internally, and it is only inside the Ksar environment and inside the buildings where one can taste the feel of the architectural details and the fragrance of the spiritual. The windows are one prominent element in this matter. The play of light inside the buildings is an example that reflects a glimpse of the spiritual through geometrical forms and openings. The small windows on the facades allow minimal, sufficient light within the houses, creating the atmosphere of a traditional Berber house.



Figure 38: The Marabout of Saint Sidi Ali ou Amer by the Muslim cemetery at the Ksar Ait Benhaddou.

Source: [87]

4.5.1.1 Openings as a symbol of the sacred architecture

The humble and modest living spaces strengthen this experience. Light penetrates through the patios, which are bigger openings within the buildings. Ventilation is made through courtyards, wall openings, and ceiling openings and realizes the perfect climatic atmosphere within the houses (Fig. 39) and (Fig. 40).

The two religious buildings and societies collide in one fortified settlement within Berber traditional conditions, which requires a strong connection between its entire population, verifying the importance of religious peace and alliance and the spiritual significance of the Ksar. In Islam, houses can be a place of worship for women, as it is traditionally requested for men to pray in the mosque. On the other hand, women aren't obliged to obey such an order. Therefore, they get to practice their prayers indoors. On that account, every single element of the traditional house creates pristine conditions that stress the importance of privacy for women. Likewise, the synagogue is a religious and communal space for the Jewish communities that retains the same architectural language as the rest of the built environment. The window grills presented in (Fig. 41) are a symbolic shade element that permits inhabitants to look through without being noticed. Windows have wooden shutters to control light accessibility and maintain privacy. The courtyard is a similar operation that provides a space solely for house inhabitants, a space for socializing, and a location to perform several household tasks requiring sunlight while remaining unexposed.



Figure 39: Photo of the roof light apertures in the Ksar residential buildings.

Source: [88]



Figure 40: Photo of the inner illumination through openings.

Source: [89]



Figure 41: Window view from the Haj Mohammed kasbah.

Source: [90]

4.5.2 Religious influence and morphology

Mosques in the Ksour settlements represent public spaces and are positioned near the village gates for travellers to perform daily prayer without accessing the rest of the village [91]. Through the formation of the settlement, the mosque stood at the periphery of town before the Kasbah district establishment.

With the evolution of the settlement and its movement towards the riverside, maintaining the identity of the mosque as a public building was considered by creating an alley amid a couple of Kasbahs by one of the western gates. By doing so, traders can access the village and place their merchandise in the communal area, surrounded and guarded by the leader's families' households under high surveillance through observation towers.

(Fig. 42) displays the placement of the gate (1) next to the market space (2), and through this marketplace, a small alley leads directly to the mosque (3), which operates as a shelter for the poor and passersby, a place for the sick to rest, and could even serve as a hospital.

The fortified castles create an enclosure around the communal space and the mosque, with observation towers providing a 360-degree view of the inner street network, the mosque, the communal area, the valley, and nearby territories. Consequently, urban growth demonstrates calculated expansion while sustaining security, trade, religious values, and local customs.

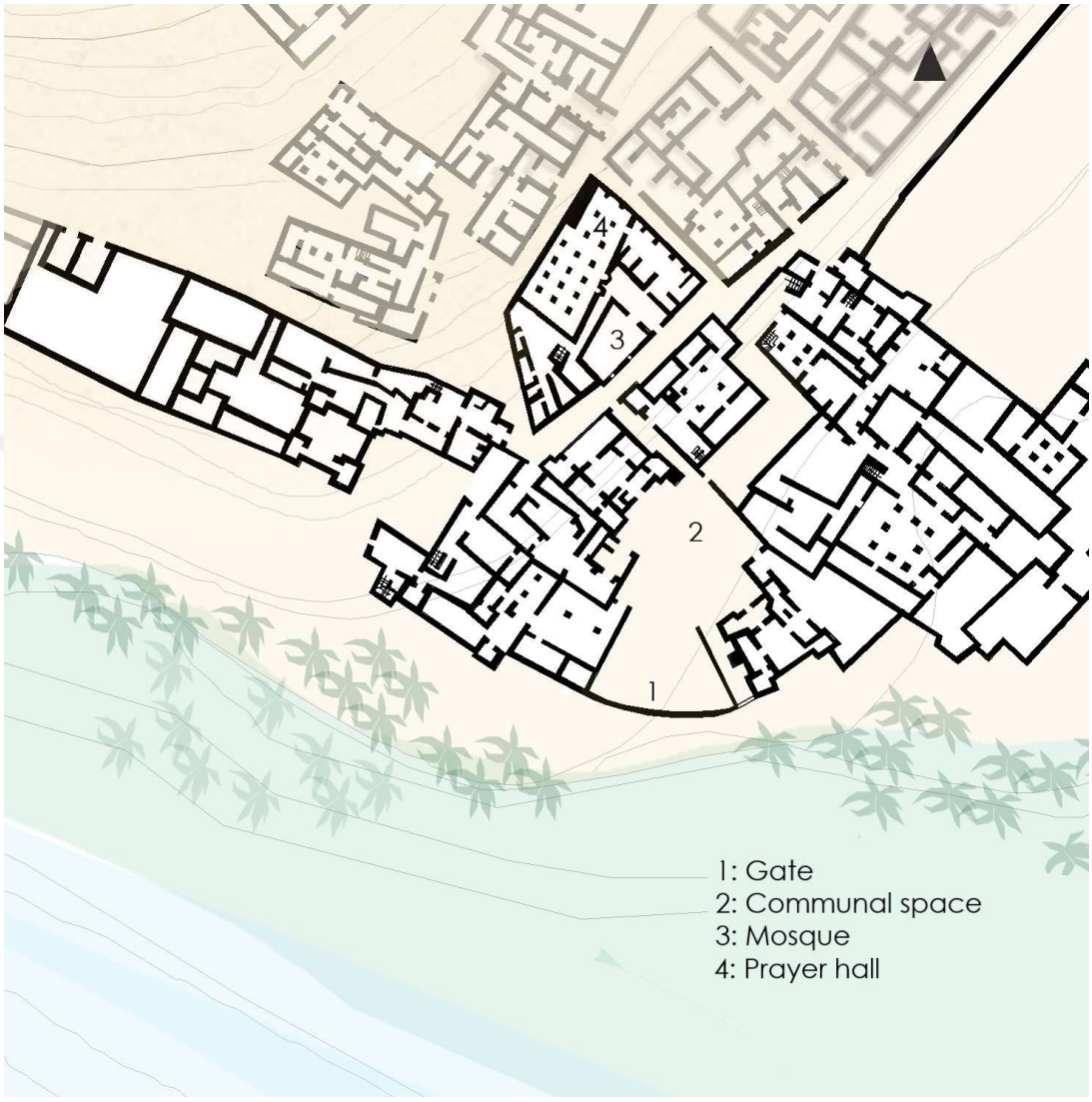


Figure 42: Schematic plan drawing of the mosque and its surrounding built environment, indicating the formation of the Kasbah district in accordance with religious structure.

Source: [92]

4.5.3 Commercial and social factors

Trade was a prominent feature in Draa for centuries. It linked Berber tribes with neighbouring civilizations and contributed to the growth of the cities along the commerce trail, increasing economic flourishing and the prosperity of different towns. Fortified cities by the valleys trace tracks of some of the most prominent trade routes, signifying an interrelationship between the notion of trade and the concept of Ksour.

The Timbuktu-Draa route passed through the Mauretanian Ksour of Tichitt, Oualata, and Ouadane, which stood as crucial trade stations during the 11th century. Today, countless Ksour survive in Morocco across the southern Moroccan region, Mauritania, and Algeria.

Ksour in Morocco are independent towns and retain a history of craftsmanship and self-sufficient building anatomy, relying on the familial organism as a quintessential element of the Ksour urban expansion.

In Ait Benhaddou, familial unity is crucial for the Ksar's development. Berber social relationships centre on the oneness of family members. The Ksar is both the home and workplace, and every member is appointed a role in the household centered around the agricultural harvest, sheep farming, and commercial activities. Traditionally, houses are prone to expanding space with population growth to accommodate more inhabitants. With time, building continuation becomes a family task to preserve and develop the built environment as needs arise.

The Ksour convey a highly independent living organism, where the family is the gist of its entity and an essential contributor to the construction and expansion of the

village. At the same time, they live in an alliance with ruling families and have respect for one another. Each family participates in the Ksar's creation, making social integration a crucial attribute of urban expansion. Sociocultural symbiosis is a significant factor in the development and maintenance of the Ksour [93]. It also represents the strength of social and traditional values in response to the evolution of the village based on respect for local needs. The development of social and cultural traditions is then mirrored through the buildings and design methods, eventually impacting the urban tissue.

4.5.3.1 Animal husbandry and architecture

Due to the prominent role of animal husbandry, animal care in the Ksar tradition is essential, as it takes part in ecological, economic, and social growth, as reflected in the presence of animal rooms within the residential housing (Fig. 43). Animals are necessary for transportation, water extraction, tillage, composting, fertilizing the soil with manure, and feeding on the fodder growing in the oasis [94]. Their importance in the Ksour's growth reveals their inclusion in the plan configuration of the dwellings, where animal shelter chambers stand as a permanent fixture in the homes, an indication of the significance of cattle in this sub-Saharan culture for the persistence of its communities and its rooted existence in the culture, which has established the inclusion of animals in the vision of the urban form and building aggregations. The partition plan of the houses of the Ksar comprises animal shelter rooms located on the ground floor.

Thus, the ground floor is distinguished as the main area for the animal shelter and consists of two spaces for animals. The first is an enclosed room used during the winter and an open-air space used in the summer. The local members of each family carry out the sheep-care process. Locals maintain a lifestyle that intertwines daily social life with

the economic and traditional oasis lifestyle by taking the animals out during the day and back to their shelters before sunset.

In the same manner, each family works as a unified entity, and families work and help one another in different roles when needed. The narrow connecting passages seen across the Ksar allow an easy connection between residential houses. Roof terraces serve as a communicating medium, are a crucial component of the Berber dwelling, and serve to dry agricultural harvests like figs and other goods.

Locals have a principal role in the enduring and survival of the buildings, as they take on the responsibility of maintenance and repair, which produces the integration of the building process with local traditions and contributes to the persistence and liveliness of the village (Fig. 44). The building procedure is, therefore, a permanently integrated practice in the family's daily life, where they take care of the revival and birth of many parts of the settlement and remain in constant interaction with the built environment.



Figure 43: Photo of the animal shelter room in one of the houses in the Jewish district.

Source: [95]



Figure 44: Photo depicting home repairs conducted by the house owners.

Source: [96]

4.6 Protection and defence in the Ksar

The Ksour nest within a regional identity of self-defence. Historically, they stood in environments marked by insecurity where the survival of groups depended on remarkable structural social organization. Therefore, the defence system was crucial.

Ait Benhaddou presents and highlights the characteristics and symbols of the defensive history of this region. The three gates of Ait Benhaddou represent the principal entrances of access, indicating different purposes. *Imi N' Ighrem*, located east of the village, determines the main gate that welcomes locals, and other gates have eponyms according to their purpose and role in allowing different groups to access Ait Benhaddou. The existing gates reflect the history of organization and protection in the Ksar.

The example in (Fig. 46) shows a tower by the western gate that merges with the city walls and strengthens the appearance of defence from the valley route. The valley route identifies the trade route; it is the main trail for foreigners and traders to enter the settlement; therefore, numerous high towers stand along this trail and project the powerful status of the settlement.

Naturally, historical cities stand in elevated areas for refuge and are highlighted by defence walls, illustrating the obligation for protection. Similarly, (Fig. 45) indicates the towers of the hillfort, which include five discernible observation towers surrounding the hill from each side, permitting high protection and surveillance.



Figure 45: Photo of the fortification wall and the watchtowers surrounding the hilltop.

Source: [97]



Figure 46: Photo of a tower structure attached to the fortification walls of the Ksar Ait Benhaddou.

Source: [98]

4.7 Building typologies in Ait Benhaddou

To understand the building typology and terminologies of the Ksour architecture, one needs to be familiar with two Berber words, Tighremt and Tiguemi, which refer respectively to the multi-towered castles occupied by village headmen and the modest village housing. The urban tissue of the Ksar displays Tiguemi houses and Kasbahs, characterized by distinct attributes. While Tiguemi houses have a central distribution within the settlement, Kasbahs exist along the boundaries along the fortification walls in the southwest.

To comprehend the typological process, Maffei's guideline for the processual typology method delivers a study of the fundamental structure stage, called the base type, as a guideline and foundation for specialized typology [99]. The form of the buildings in the village displays a basic structure identified as a quadrilateral form that describes the essence of the typological process and the base type guideline by which the buildings develop. The housing system in the Ksour progresses through a framework based on one cellular family unit that gradually groups to carry out different functions based on need [100].

Tiguemi is a modest house that symbolizes traditional housing derived from a rectangular cellular unit base type and influenced by various factors defining its final design. The example of the mosque exhibits the typological process of the base type through the prayer hall and the ablution spaces as the principal rooms. However, Tighremt, also known as the Kasbah, exemplifies the specialization of the basic quadrilateral structure and indicates a conscientious typological process influenced by typological components. As the house takes on an administrative function that isn't

residential, it becomes specialized, and this is visible in the proportional language and ornamental elements in the Kasbah.

4.7.1 Tigemi (Dar)

Tiguemi, also called Dar دار in Arabic, is a traditional one- to two-story courtyard house belonging to modest families. It is centered on a patio, permitting a well of light to penetrate the entire house, as seen in the examples in (Fig. 47) and (Fig. 48), and conveys minimal living spaces on the ground floor. In Tiguemi, floor levels designate specific functions that can sometimes be interconnected. The ground floors are appointed to contain animal shelters and storage rooms to conserve fresh animal fodder and agriculture equipment. Traditionally, locals prefer cooler and damper ground levels as storage rooms due to the ease of access to these rooms and the ground levels being the pristine climatic zone for preserving goods. The animal shelter rooms can be within the house territory or, at other times, outside or near the house. The kitchen, or cooking zone, is another area constantly found on the ground floor because of the use of tree branches as materials for making fire and the use of the kitchen area as a storage place for the branches and palm cane for daily use.

Other rooms within Tiguemi are multi-usage spaces that do not retain a singular function due to the climatic conditions that produce a shift in air quality during different times of the day, causing residents to move from one room to another to escape the midday and night heat. This way, rooftops become a sleeping place at night, and ground-floor courtyards are perfect locations in the daylight.

Tiguemi of the Oukassi family is one example of the several houses in Ait Benhaddou, standing at the highest fringe belt of the built environment of the Ksar. The Oukassi house plan shows an example of a Tiguemi encompassing a living zone with a central courtyard and a small patio around 5.6 meters square. (Fig. 49) indicates the columns of the light shell that are about 1 meter wide. The ground floor includes a kitchen, bathroom, and storage rooms in more dam and chill zones, while the living spaces take up the upper floor space.

A distinctive component within the region of Draa is caves. Similarly, the House of El Houssein family includes the only cave seemingly discovered in the settlement. The properties of this cave create a unique atmosphere within the house—a significantly chill room in the Saharan heat. (Fig. 50) and (Fig.51) demonstrate the placement of the cave on the ground floor and its function as a living room is used at certain times during the day as its cooling properties change.

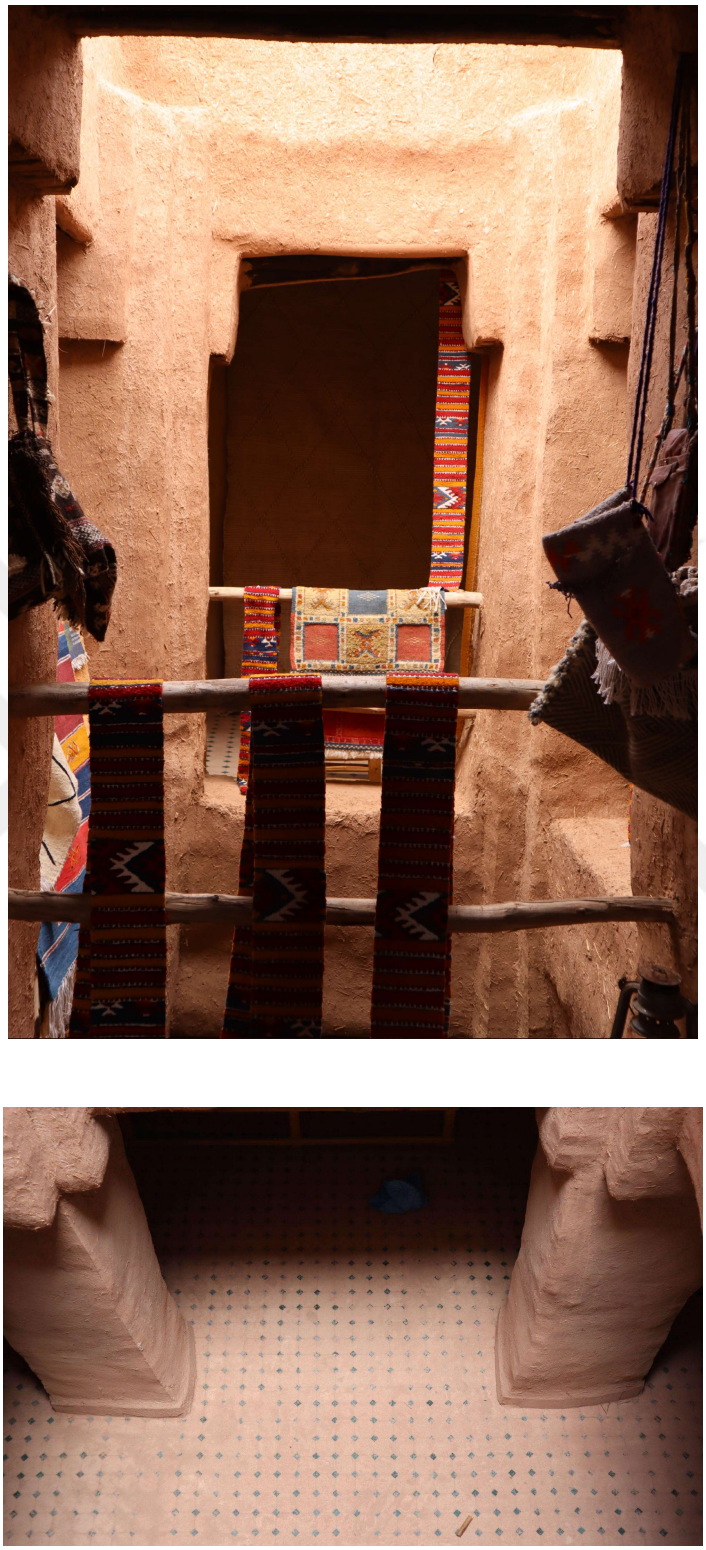


Figure 47: Photos of the Oukassi house courtyard and column structures.

Source: [101]



Figure 48: Photos of the ground floor structure and the stairs at Oukassi Tiguemi.

Source: [102]

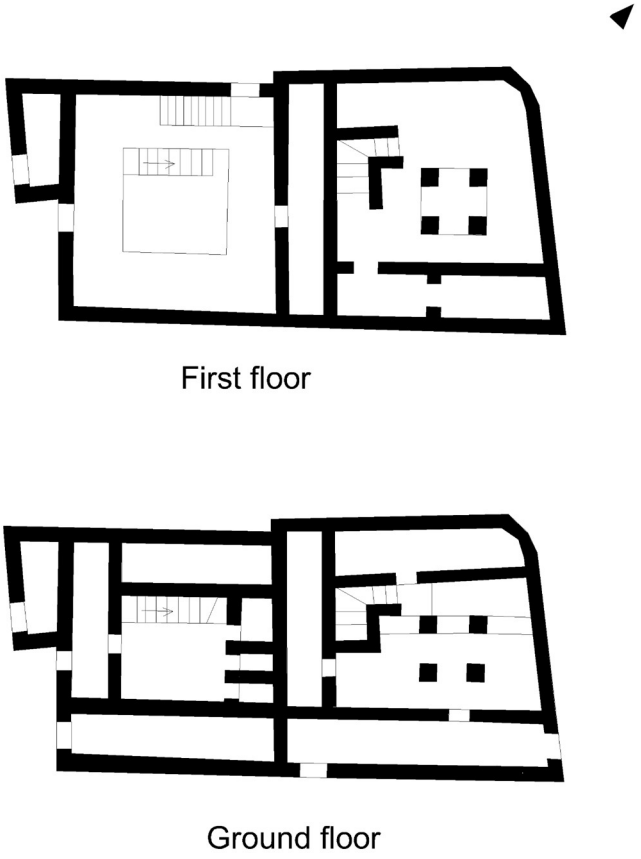


Figure 49: The Oukassi family house plan drawing created using AutoCAD.

Source: [103]

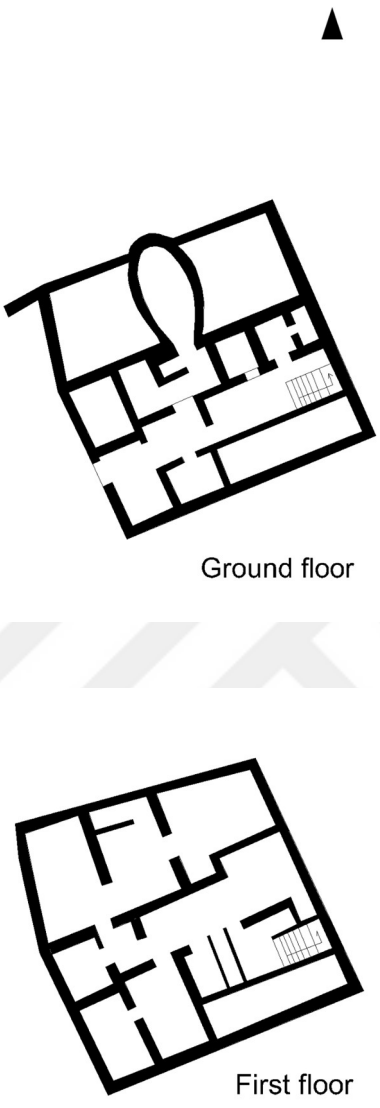


Figure 50: El Houssein family house plan drawing created using AutoCAD.

Source: [104]



Figure 51: Photo of the cave room at El Houssein family house.

Source: [105]

4.7.2 Tighremt (Kasbah)

Tighremt indicates the Kasbah in Arabic, a multi-story residence characterized by a more embellished architectural appearance that embodies a dwelling of power and protection. The use of the spaces within the Kasbah is similar to Tiguemi, as the ground floor remains an animal shelter and storage zone due to the ease of animal allocation and the cooler and damper atmosphere provided by the ground-level rooms. However, the Kasbah shelter zones can stand outside of their perimeters.

Due to the climatic circumstances, the Kasbah shares the same multi-purpose room layout as Tiguemi, with rooms flexible for use during different seasons with changing functions depending on the need.

The courtyard is a significant element of the identity of the Kasbah. The rooms surround the patio and create a sequence of adobe pillars designed in arcades that carry the lintels and the courtyard arches. This patio provides a space for airflow and cools down the building. It also provides privacy, which signifies one of the essential notions of the Ksour architecture (Fig. 52).

The Kasbah is organized differently from one building to another, with different courtyard and shaft dimensions. However, the overall dwelling structure is the same, with a quadrangle layout and four surrounding towers. Watchtower walls reflect the Kasbah's defensive quality and the insecurity that once prevailed, and its structure portrays a military defence (Fig. 53) and (Fig. 55). This explains the importance of watchtowers right next to city walls, as they set out to monitor the surrounding territory and make the Kasbahs supportive dwellings to emancipate power and defence.

The observation towers have small windows from the exterior, yet, from the interior, the wall shaft creates a place suitable for sitting and observing the surrounding area (Fig. 56).

Montagne Robert explains that the Kasbah originated as a military protective dwelling that hosted the wealthy social class with appointed security and control [106]. Accordingly, within the urban layout of Ait Benhaddou, the Kasbahs stand in an outstanding manner that makes the definition of their perimeters harsh to discern as they merge with fortification walls due to continuous growth that led to the merging and sharing of party walls.

The architecture of the Kasbah, similar to a regular Tiguemi house, is a courtyard house with maximum inner illumination and the utmost outer window opening. Since Kasbahs are forts for observation and control, almost no windows exist on the ground floor, as most windows exist on upper levels at staircases and areas that lack light access, as well as the *Broj* at the highest level of the Kasbah. Passages surround the courtyard, where several rooms stand along alleys of large openings that allow ventilation to pass through the Kasbah (Fig. 54). Moreover, the courtyard alleys permit inner communication throughout the different levels of the Kasbah.

The Kasbah identifies a typological model symbolic of urban growth and reflects a specialized systematic dwelling module that includes multifunctional and flexible organization and the evolution of the Tiguemi dwelling building type.

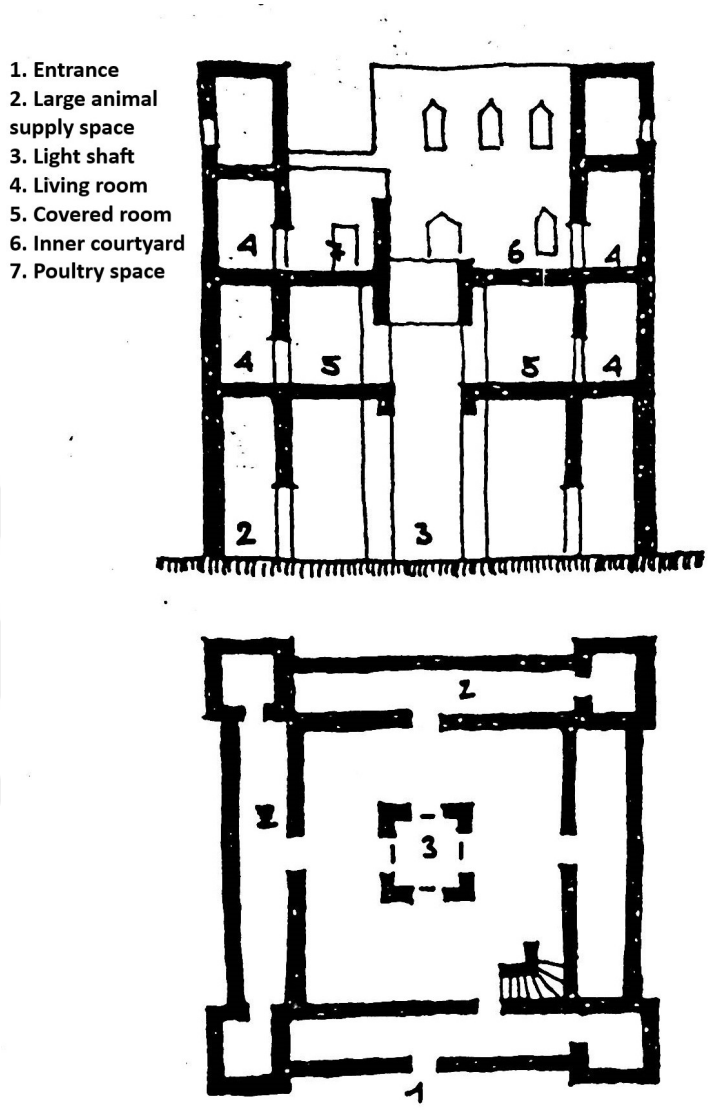


Figure 52: Schematic representation of the Kasbah at Ait Benhaddou.

Source: [41] (edited)



Figure 53: Photo of Kasbah's towers at Ait Benhaddou.

Source: [107]



Figure 54: Archades supported by wooden beams at the Haj Mohammed Kasbah.

Source: [108]



Figure 55: Photos indicating the *Broj* (towers) at the Haj Mohammed Kasbah.

Source: [109]



Figure 56: Photo of inside the Kasbah towers at Haj Mohammed Kasbah.

Source: [110]

4.8 Typological process

Tighmi and Taghrimet (Kasbah) represent two types of buildings within the perimeter of Ait Benhaddou, characterized by the concept of enclosure and the identical logic of plan organization and geometric composition and form. Nonetheless, they are differentiated by the contrast in height and exterior appearance, which marks the Kasbah as a high-rise building embellished with four observation towers, unlike Tiguemi.

The urban tissue demonstrates the dominance of Tiguemi in the southeast and Tighermatin (Kasbahs) towards the southwest. Their placement aligns with the direction of urban growth, where Tighremt functions as a military castle and possibly a developing building type from the Tigumeni house as a result of defence needs along with social and military evolution.

4.9 Brief conclusion

This chapter formulates the stages of development of the Ksar Ait Benhaddou through the implementation of Caniggia's theoretical structure in reading the city and the application of the attractor theory. It introduces an analytical investigation of the route system and delivers a lucid understanding of urban growth in the case of the Sub-Saharan town of Ait Benhaddou. Results of the theory application suggest the genesis of the Ksar at the hilltop and its continuity downhill, which later advances from east to west and ends by the valley route. This urban expansion is intelligible through a conscious spatial arrangement and urban development driven by cultural, social, and religious factors.

The case of the mosque shows a close-up representation of urban growth as a highly interdependent organism. The distribution of building types from southeast to

southwest and in selective areas reveals the formation of the town according to territorial conditions, amplifying the purposeful integration of each element within the urban territory.

The integrated organism further indicates a unified building method communicated through a geometrical pattern of progressive building types seen in Tiguemi. The typo-morphological investigation reveals that urban growth is consistent with a progression of building types, following geometrical guidelines of a square and quadrilateral form, representing the notion of enclosure, where buildings expand following the consistent geometrical rule.

This geometrical language is pronounced in its built form across Ait Benhaddou and suggests a connection to the Berber cultural area of proximate geography. The coming chapter discusses building characteristics and technology in an attempt to set the town within the architecture of the Berber geographical area that extends across North Africa and elaborates on the use of ancient traditional building technology and materials as a sign of its old and adaptive nature.

CHAPTER V

TRACING THE BUILDING TECHNOLOGY OF THE BERBER IGHREM

This chapter delves into the construction techniques used in Ait Benhaddou and reveals the building characteristics that produce a town in complete harmony with climate, land, and territory. Ancient building techniques are used in making walls, ceilings, and roofs, reflecting the absolute reliance on available materials where agricultural lands contribute to this process.

Agriculture provides construction material supply, from earth to tree branches, reeds, and wood panels used in doors and windows. Agriculture is the principal occupation of the residents, which not only defines the economic and social behaviour in Ait Benhaddou but also supplies the construction, nourishment, and animal husbandry roles, all of which exist within the singular building configuration.

The building techniques are significant in this matter, as they allow a profound comprehension of the formation process on a building level and the resident's role in the building process.

The chapter presents conventional building methods and materials that institute the formation of the buildings and reveals significant geometric patterns perceived in the built form that reflect a deep interconnectedness between all elements in establishing the town, communicating a highly organized social organism with ancient building technologies that reflect the genius of the historical city.

5.1 Climate and building technology

The hot and dry climate of the Ounila region marks its building characteristics. While the temperature changes seasonally and diurnally, the houses offer modest but remarkable design principles. The climate can reach 37 °C and a minimum of 6 °C in the winter. Therefore, the buildings in this region have thick walls made of adobe, which provides thermal insulation in winter and protects from the summer heat. Moreover, the winds can be strong and carry dust. Annual precipitation is low, ranging from 50 to 800 mm, and is unpredictable, with droughts interspersed with major floods [111].

Thus, most Ksour houses feature small-sized windows that allow limited ventilation flow through the houses and create a shield against strong winds. Other widespread features are flat roofs and courtyards that provide constant ventilation and sunlight. The Ksour architectural language represents a convenient living habitat for their environment and response to climatic circumstances, needs, social life, and many other aspects.

The building technology is a natural human genius response to human needs, incorporating the need for security in an unstable zone. It encompasses a holistic view that aims to establish a peaceful life within the walls of a fortress, protecting multi-religious groups and maintaining stability that was resisted with the help of the *Qaids* and the Amazigh culture, based on a unified community force. The community of Ait Benhaddou functions as one alive organism that established a settlement merging within the Oasis with a reddish mud earth colour and blends gracefully with nature while keeping a militant and majestically powerful presence.

5.2 Construction techniques and materials

5.2.1. walls

Construction techniques are regional and made of local earth materials, including the preparation process for manufacturing Tabut and Adobe bricks, which takes place inside the town, as presented in (Fig. 58) and (Fig. 59), which illustrate Adobe brick preparation and building techniques inside Ait Benhaddou. Buildings are built on stone foundations, with load-bearing walls made of wet rammed earth and chopped straw, and range in width from approximately 44.5 cm to 60 cm in wall thickness, corresponding to the forearm length and the ancient Egyptian cubit. Rammed earth is used for structural and partition walls, as demonstrated in (Fig. 57). Meanwhile, adobe bricks are utilized in forming Kasbah's upper floors, which are subject to minor load and allow the finishing and decorative capacity in the design of arches in the patio [112].

The Tabut technique is a famous construction technique in Draa, and it is a process of placing adobe mixture within Louh, which is a wooden panel structure that holds the material together and is secured to the straighteners with ropes to guarantee stability. To confirm the balance of the walls, the worker ensures straightness to avoid defects that may cause the building to buckle or fall apart and ultimately achieve a dense and solid monolithic wall (Fig. 60).

Building structures comprise rammed earth consisting of chopped straw mixed with moistened earth material, called pisé. It is a common practice to mix pisé with adobe bricks, as adobe bricks provide stability when the Tabut technique becomes challenging. Moreover, the construction of the walls requires meticulous logistic planning, a principal

conventional constitution method of adobe architecture in sub-Saharan Morocco, where manpower signifies the fundamental and sole tool to execute the structure entities. Different Maalems take charge of each step in the construction of the walls, from extracting the earth to making the pisé mixture, stabilizing the wooden panels, and finishing the walls. The building process happens from March to November, before the rainy season, because the walls require drying to ensure completion [113].

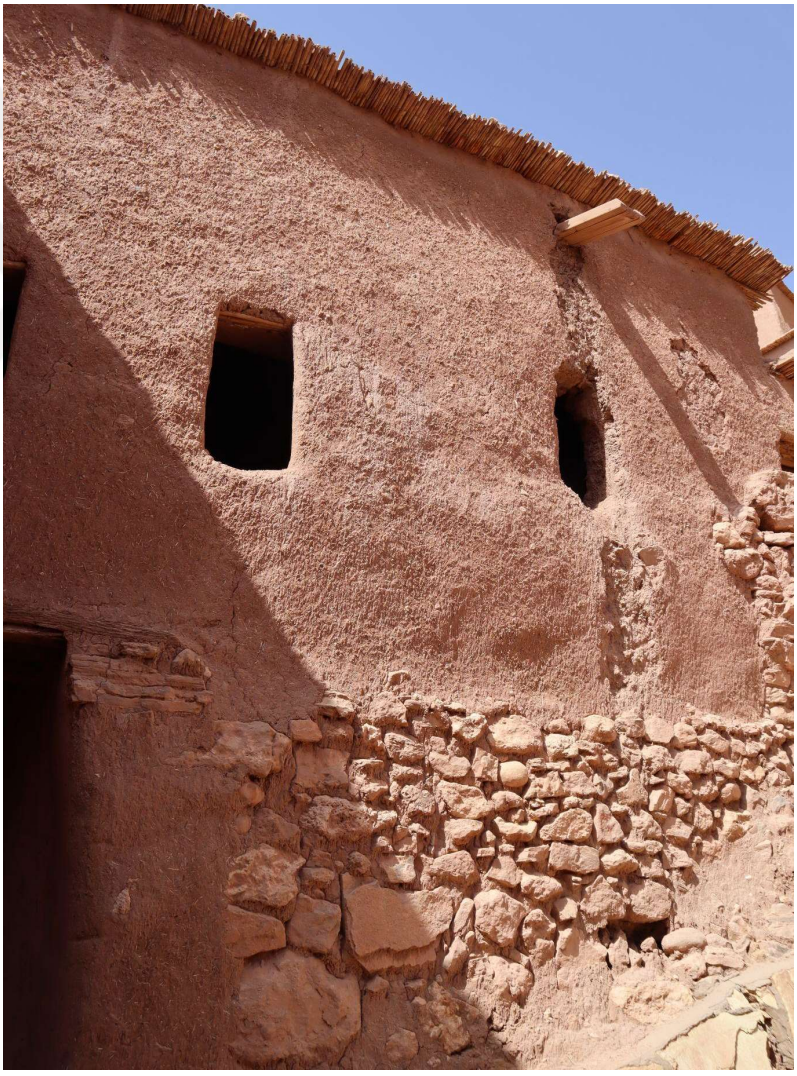


Figure 57: Photo of the stone base wall structure.

Source: [114]



Figure 58: Photo of adobe bricks prepared in the Ksar of Ait Benhaddou.

Source: [115]



Figure 59: Photo of wall construction panels in Ait Benhaddou.

Source: [116]

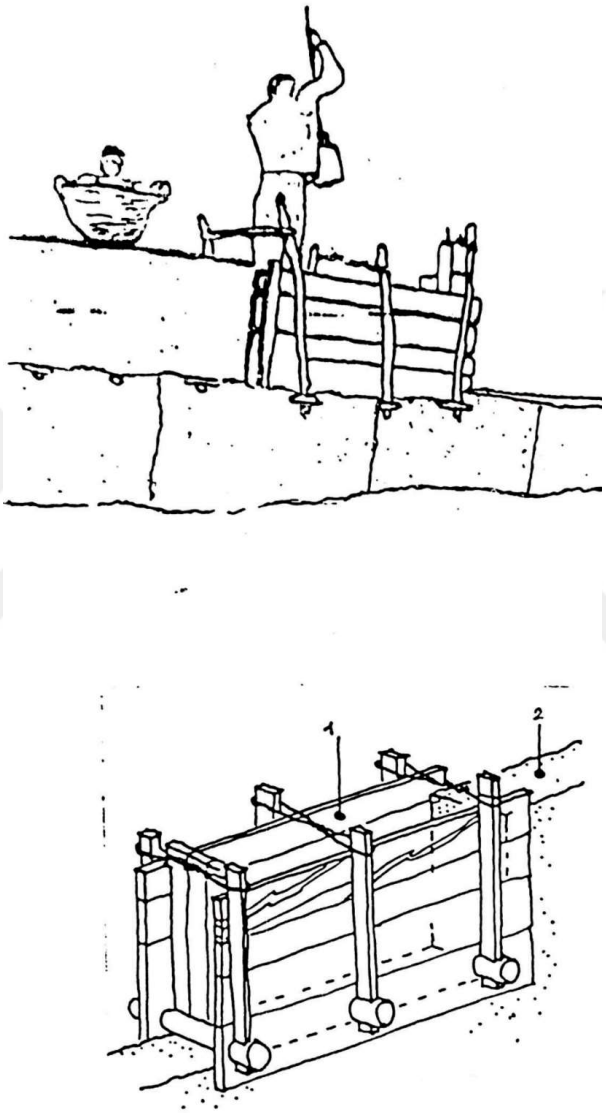


Figure 60: Representation of the wall construction technique in Ait Benhaddou.

Source: [41] (edited)

5.2.2 The gates of the Ksar

The arches are particular to the gates of the Ksar and the Kasbahs. Gates represent the most significant features of the village and are part of the city walls. The entrances possess large wooden gates that express the essence of protection, are around 3.5 meters in height, and are vast and spacious doorways intended to welcome ancient merchants and camels to the village (Fig. 63).

The gates are part of the city walls and reflect local materials, such as the example of *Imi N'Ighrem* in (Fig. 61), which designates the main gate, which's embellished with a monochromatic scene of light and dark rammed earth colours, established using a technique called Tadelakt, a typical method in Morocco.

Tadelakt is a waterproof plaster surface used in Moroccan architecture to make baths, walls, ceilings, roofs, and floors. This type of plaster comes from lime plaster that has been rammed, polished, and treated with soap to be water-repellent. Tadelakt can be combined with rammed earth to establish a strong composition, which results in a range of earth colours. This technique makes the gate arched since it allows the curvature in the walls to create a smooth arch design.

With time, additional modifications took place to restore the gates and preserve local heritage. Significantly, *Imi N'Ighrem* gate was given a new shape with an elongated path, while the original gate was located right at the entrance to the Jewish Quarter (Fig. 62).



Figure 61: Photo of *Imi N' Ighrem*, designating the main gate of the Village.

Source: [117]



Figure 62: Photo of the path from the main gate leading inside the village.

Source: [118]

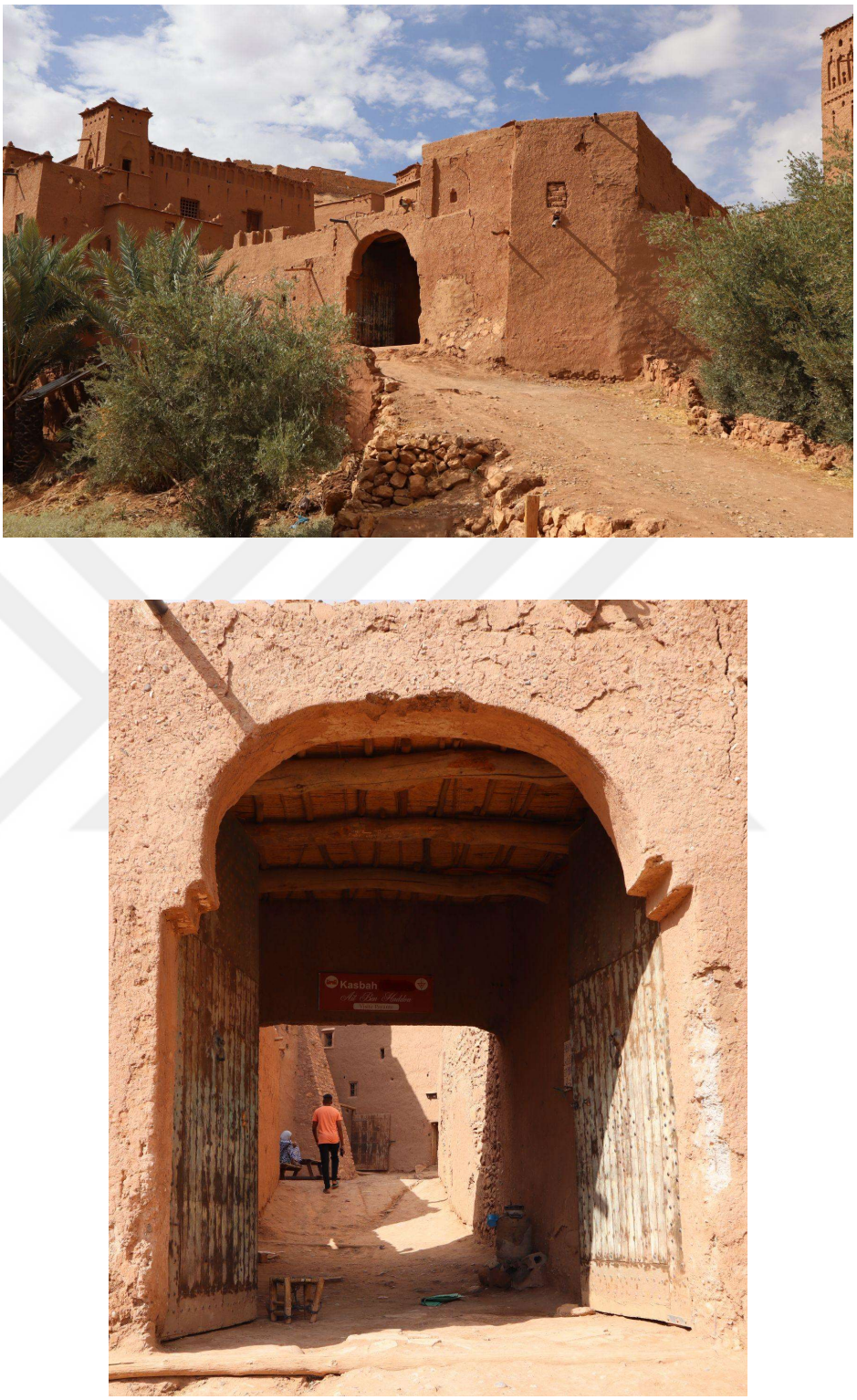


Figure 63: Photos of the valley gate leading out to the communal area.

Source: [119]

5.2.3 Street network and construction

The available natural material defines the local construction medium across the region. The foundation land of the Ksar is earth, as stone and wooden branches make the local material of street steps over an inclined topography. Stones and boulders across the Ksar identify delimiter materials in the settlement. The stone forms the base of the wall structure and shapes the urban grid, while boulders make the limit on agricultural lands.

The street network contains two types of streets: covered ones, which function as tunnels, and others, which are not (Fig. 64) and (Fig. 65). The shaded streets allow air circulation to flow and cool the atmosphere, becoming a shelter from the heat of the Saharan sun. Likewise, it serves as a shield from the sandy winds and is used to seal off coordinated attacks and advances over the city.

(Fig. 65) illustrates an example of a tunnel street with steps aligning with the land. Considering the hilly nature of the Ksar, a few pathways can be steep, with steps made of stone or earth fringed by wood at the edges of every tread. As stone and earth tend to be slippery during rainy seasons, wooden branches are placed at the edge of every step to ensure safety.



Figure 64: Photo of one of the streets in the Ksar.

Source: [120]



Figure 65: Photo of a tunnel street in Ait Benhaddou.

Source: [121]

5.2.4 Windows and openings

House openings follow proportions that align with the entire village's privacy rules. These openings must be square or rectangular, following the traditional typology of small windows [122]. The openings are apertures that permit rated light permission, and their size varies from room to room according to the functions; the example in (Fig. 66) shows variation in proportions.

Windows are earth crown openings with concealed wooden lintels, enveloped by grilles (Fig. 67). Protective grilles are made of wood or round iron and follow traditional patterns that reflect geometrical design language across the Ksar. In addition, it is inadmissible to position new openings opposite existing windows or doors, nor can they be adjacent to any terrace. Thus, they must comply with the neighborhood rules.



Figure 66: Photo showcasing the openings of a Jewish neighborhood home.

Source: [123]



Figure 67: Photos of the traditional window grilles made of wood and iron.

Source: [124]

5.2.5 Ceilings and horizontal structures

Wood is the primary material for horizontal structures, and it comes mainly from local trees and is used in door construction, windows, floors, and ceilings (Fig. 68). The ceiling structure is similar across the entire village, with a saba wooden base coated with rammed earth and oleanders, palm trees, or reeds [122]. The ceiling composition takes a cross-shaped design created by weaving reeds (Fig. 70).

Several layers of reed are placed next to one another and cover the rammed earth ceiling, while wooden beams are added to solidify and hold together the entity of the ceiling structure (Fig. 69).

The mechanical performance of the used trees can be poor, as their trunks are composed of bundles of parallel fibres that do not cooperate effectively with one another under load and undergo a great deal of inflection when subjected to tension [125]. The cross technique is, therefore, a way to gain more endurance. However, maintenance is always required. Some ceilings have traditional designs represented by a combination of quadrilateral shapes, mainly rhombus, that make the cane structure. Larger wooden branches are added over the cane design in a criss-cross manner for reinforcement and the final design creates a standard Berber ceiling design that extends over the whole village, including the streets, and the fabrication of the pieces occurs within the settlement.



Figure 68: Photo of the horizontal structure and roof supplies ready for usage placed in the community area.

Source: [126]



Figure 69: Photo of the traditional ceiling structure of cane and wood.

Source: [127]



Figure 70: Photo of traditional ceiling design at the main gate.

Source: [128]

5.2.6 Doors

Doors are made of wood throughout the entire Ksar, whether in the main gates, Kasbah, or house doors. Wood is utilized in the horizontal construction technique across the settlement, in ceilings, roofs, floors, doors, and windows. The door's dimensions vary by use and location. The gates to the Ksar are large, heavier, and thicker than the regular doors found indoors. The door frame is a wooden structure. Panels are placed across, horizontally, and vertically to create a wooden door lining.

The distinction between the various doors is in their size. The storage zone, for instance, possesses doors uniquely sized at around 1 meter in height. The height's dimension is due to the function of the room. Preserving goods in the necessary opaque environment supports the use of smaller doors. Storage units across southern Morocco are dim areas that protect various types of goods, like olive oil and other commodities. Therefore, smaller doors prevent maximum light from infiltrating into rooms, and the openings preserve the atmosphere requisite for these to produce conservation (Fig. 71).

Doors like Bab El Khoukha (باب الخوخة) are present in the Ksar and consist of a small door embraced by a larger one, also called the wicket gate, which measures around two meters in height (Fig. 73). The larger door allows cattle to enter the ground floor and deposit goods into storage units.

This type of door is found in the houses of affluent families (Kasbahs), ornamented with iron symbols, and incorporates a traditional wooden lock key, which is a wooden structure that is famous in the Berber regions and indicates the continuity of ancient techniques in the Berber towns (Fig. 72).



Figure 71: Photo of one of the storage room doors at the Haj Mohammed Kasbah.

Source: [129]

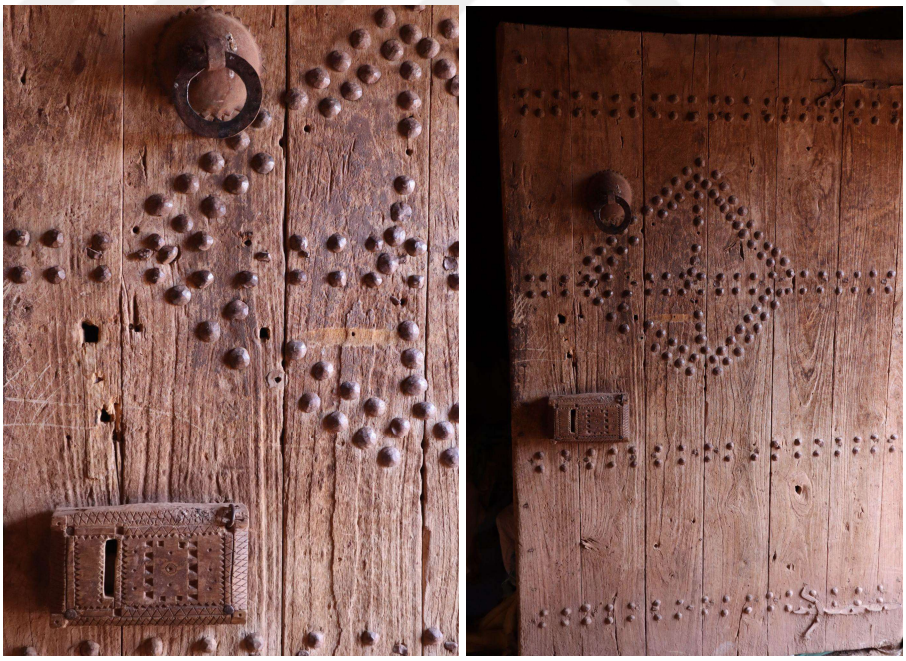


Figure 72: Photos of the Kasbah main door with details of the wooden lock.

Source: [130]



Figure 73: Photo of the entrance door (Wicket door) of Haj Mohammed's Kasbah.

Source: [131]

5.2.7 Roof

The houses have flat roofs, a common building attribute in Draa and sub-Saharan regions. The flat-roofed terraces serve different purposes as part of living space. They provide a drying area for grains and dates and a sleeping zone during summer nights (Fig. 74).

The roof structure is made of an adobe melange with canes or reeds to prevent moisture and rainwater from seeping into the walls and is built on palm beams, covered in branches, and then wrapped in rammed earth.

The first layer is a humid mixture, while the second layer is dry earth, designed to absorb any potential water infiltrations. The last layer is a damp combination of rammed earth and lime known as Tadelakt, or adobe and straw. These mixtures work as a waterproof layer to make the entire roof structure solid [125].

Throughout the years, roof structures have become subject to degradation due to rain, wind, and sandstorms. For that, they are limited by an inclined surface on each side containing straw to allow water to run off the wall structures (Fig. 75). However, maintenance is necessary for the buildings every 4 to 5 years, and layers of adobe mixed with straw are added to the roof to recover its thickness and solidity [125].



Figure 74: Photo overlooking roof terraces by the western side of the Ksar.

Source: [132]



Figure 75: Close up photo of the wall structure and the system for rainwater flow.

Source: [133]

5.3 Building properties and ecology

The Ksar environment connects society with its environment, as locals take charge of the Ksar's repair and maintenance. Ksar Ait Benhaddou, like all the Ksour of the region, represents a climatic adaptation of living with significant advantages in terms of energy efficiency and quality of life that provides a fresh and chilly atmosphere during hot seasons while protecting against the cold during the winter. The exterior walls have a slow heating rate during the day due to the thickness of the walls, and they radiate warmth inside at night when temperatures are chilly. As the midday heat increases, the high-ceilinged room's coolness gets restored by morning. The environment within the Ksar creates extremely chill living spaces within the heat of the semi-desert.

The Ksour have ample significant advantages, not solely because of the low-cost construction. The restoration and rehabilitation of the houses are feasible through reusable local materials and the mutual assistance that takes place in the local culture. Recycling within the construction is a standard of Ksour architecture. Adobe bricks can be recycled and reused whenever needed.

Regardless of the social status and the power of different families, the construction materials of the whole settlement are one. The traditions that unite the community of Ait Benhaddou permit the continuity of the life of a sustainable village that includes people of different ethnic, religious, and social groups within one fort, all able to maintain and restore the settlement while preserving their traditions.

5.3.1 The traditional art of Ornamental colouring and decoration

Natural materials are the source of the life of the oasis and the built environment, where the availability of resources defines the community's options in several aspects of life and directs the means of traditional and cultural expression.

Equally, natural colours establish the art of colouring using local plants. The famous colours in the region are blue, white, red, and brown, utilized as body paintings and writing tools. The blue colour is obtained from the Indigofera plant, النيلة, while henna plants make the brown colopurs, and saffron induces the reddish colour. Henna is widespread as a spiritual habit for occasions where men and women use the henna paste to decorate their hands and feet for blessing. Indigo paint is used in fabric colouring and has many other benefits. Saffron is famous for being a writing tool in the old inscriptions in the Berber culture (Fig. 76).

The use of local materials exists in many facets of life, not only in the construction field. The ancient art of writing on goat leather was the conventional way of registering, using natural indigo and saffron.

In buildings, white plaster is created in structures using the Tadelakt process, which combines lime plaster with earth to achieve several colours of white, and window grills manifest the raw colour of the material and deliver a colour palette and distinctiveness to the town that harmoniously mirrors its surrounding landscape.

Drawing techniques using plants have been a traditional heritage for centuries. Today, this art continues in the hands of local artists, introducing a new business by sketching drawings of the Berber heritage using natural techniques and promoting craftsmanship through artistic designs (Fig. 76).



Figure 76: Drawings made with saffron and Nila paint representing the local heritage and the name of the Ksar in Neo-Tifinagh indicating the name ‘Ait Benhaddou’.

Source: [134]

5.4 The Berber village 'Ighrem'

The case of Ighrem Ait Benhaddou expresses the vibrance of the cultural and religious richness of the South Moroccan regions. Several attributes of social life and local traditions are manifested in its architecture.

As trade survived for centuries, it linked Berbers with multiple communities and groups from Western Africa, the Arab Peninsula, and Southern Europe. The Berber housing in the middle ground separates numerous tribes and societies connected through historical trade trails through a valley system and present oasis settlements highly interconnected with land.

Moreover, the ancientness of the building techniques and styles is evident in the Berber villages. Caves are a widespread component in the Berber region that explains the continuity of Berber architecture as a natural adaptation to their environment.

The Berber bank, Agadir, is included in the settlement as evidence of a highly systematic and organizational community. The banks are appointed a chief with the task of the security of the banks. The organizational structure prevailing through the years is astonishing and has retained a harmonious relationship and organization within the local communities. Jewish corners, or Mellah, are another element among several Igherman of southern Morocco.

Ighrem is a harmonious habitat where social, religious, political, and economic prosperity is an enlivening organization within enclosed fortified settings, suggesting a decisive foundation of Ksour architecture.

5.4.1 The structure of fortified towns (Ksour)

Ksour exemplifies highly independent towns that are secluded and located by some prominent trade routes to guarantee continuity and connectedness with nearby towns. Trade is crucial in understanding the Ksour as cities, as merchants traverse the course of trade and bring merchandise into secluded villages, reflecting the history of an unstable conflict zone yet highly thriving and connected.

Several Ksour exist in regions surrounded by mountains or hills, yet they spread towards the desert and form highly adaptive, independent, and fortressed cities across Sub-Saharan Africa.

Significantly, the organism of Igherman (Ksour) is identical to the organism of Tighremt (Kasbah), as they represent integrated characteristics. In Ighrem, security, commerce, and the familial structure play significant roles in the flourishing of these towns. Families are a fundamental element in Ighrem, with the village's top families serving as the chiefs, administering decision-making and security.

In this sense, Tighremt is an architectural complex that reflects the Ighrem structure. Tighremt is a typical fortress built in a private place or neighborhood and stands near access to the valleys (Fig. 77). They serve as a control structure for the territory where they stand, facilitating the exchange of goods between tribes and nomads. In the same way that the communal area of Ighrem acts as a trade market and social ground for different tribes, the courtyard represents an identical communal area for Tighremt.



Figure 77: Photo depicting the fortified castle (Kasbah) and the street network near the city walls.

Source: [135]

5.4.2 *The Berber Mosque*

The mosque represents one of the religious edifices at the perimeter of Ksar Ait Benhaddou. It is a two-floor structure. The ground floor consists of a Quranic school called *Msid,* a place for abolition, a water heating room next to a wood storage room, and a main prayer hall with numerous large pillars with arches overlooking the Mihrab (Fig. 78). Similar with Tiguemi and Tighremt, terraces are a crucial part of the mosque.

(Fig. 79) reveals the mosque's roof that carries the Imam's corner and the terrace where the call to prayer is performed. Traditionally, Berber mosques do not have a minaret, and terraces serve as a part of the social configuration since terraces operate as a teaching location for students and a place to convey news to the village locals. The mosque's design is at one with the rest of the village, consisting of small openings and ceiling openings that bring light through the roof due to the flat roof layout.



Figure 78: Photo of the inside of the prayer hall, refurbished in 1992.

Source: [136]



Figure 79: Photo of the mosque's roof and the location of the call to prayer.

Source: [137]

5.4.3 The Jewish quarter

Urban expansion has been a calculated process that has identified social, economic, and political demands through the growth mechanism. In the same manner that the communal space embraces the residents for traditional occasions, the Jewish corner incorporates a gathering space called Tifrit N'Raha located at the principal alley of the Jewish district by the main gate (Fig. 84).

The separation of the social spaces of the two religious groups by two different gates notably communicates the progression of the fortress in embracing two religious communities with distinct features. The Ksar reflects a systematic growth with distinguishable urban patterns that evolved and developed a combined structural system of defence and cohabitation over time.

Moreover, as the Jewish quarter develops along a central axis that acts as a guideline for the housing plot, it produces a congested quarter. Notably, the houses indicate back doors towards a linear axis outside the village boundaries and reveal an alignment of doors with a course gazing outside the Ksar's confines, facing ruins of building aggregates (Fig. 80) and (Fig. 81). The building ruins confirm and advocate the possibility of a broader urban tissue towards the south-east (Fig. 85).

The synagogue stands outside the compact configuration of the Jewish neighborhood and the beginning of the Muslim district, indicating the expansion towards the west under a social and ruling order establishing a safe environment for the Mellah to exist (Fig. 84).

Mellahs stand in several Ksour in southern Morocco, like the synagogue at the Ksar of Amerzou, which incorporated a considerable Jewish community.

Due to the lack of renovation on this part, it was challenging to gather any data on its history. Likewise, the inaccessibility of several buildings and the locals' abandonment of the village have left numerous houses neglected and eventually destroyed (Fig. 82).

Presently, the Jewish neighborhood sits abandoned within a dense urban tissue, signifying a distinct language from the rest of the Ksar. Few families remain in the Ksar for commerce and touristic activities, as indicated in (Fig. 83) while most of the neighborhood is uninhabited.



Figure 80: Photo showing the Ksar bounds by the Jewish area, with a row of doors aligned along its boundaries facing building ruins.

Source: [138]



Figure 81: Photo of demolished walls outside of the Ksar's limits.

Source: [139]



Figure 82: Photos of the building ruins at the Jewish quarter.

Source: [140]



Figure 83: Photo of one of the active houses in the Jewish district.

Source: [141]



Figure 84: Schematic Plan demonstrating the synagogue outside of the compact Jewish quarter.

Source: [142]

5.5 Traditional motifs and symbols in the Berber architecture

Regarding the Berber Kasbahs and Ksour of Southeast Morocco, geometry is an indispensable part of the tangible heritage. The Kasbahs of Ait Benhaddou reflect the history of the design motifs seen throughout the towers of the Kasbahs. Decorative motifs on the Kasbah towers represent ancient characteristics of Tifinagh. The Tifinagh alphabet is a symbolic design for traditional tattoo art, rug-making designs, jewellery, and traditional artefacts of the Berber region. The symbolic significance is unknown; thus, Amazigh women wore various ornamentation themes to indicate their social and marital status. These customs have been transmitted via Berber tribes for centuries and remained until the 20th century. Tattooing and traditional adornment used similar symbols in numerous sections of Berber culture and architecture, demonstrating their importance and meanings within society and community.

Kasbah towers and facades may include decorative motifs inlaid by placing the motif shapes into the wall and establishing hollow symbols on the walls. These decorations are created by carving through the walls and planting symbolic characters into the rammed-earth walls. Moreover, the use of reeds in the roof structure of the towers significantly amalgamates with the ornamental design of the Kasbah towers, establishing another way of adornment used in the architectural language of the settlement (Fig. 85). The geometrical language delivered by the motif art is recognized through the lines and arches of the building tradition of the Kasbah structures, demonstrating a remarkable attribute of the Amazigh architecture and conveyed by the implanted geometrical organization fixed tradition, suggesting a considerable cognitive sophistication (Fig. 86) and (Fig. 87).



Figure 85: Photo of the Kasbah towers including the Berber symbols.

Source: [143]

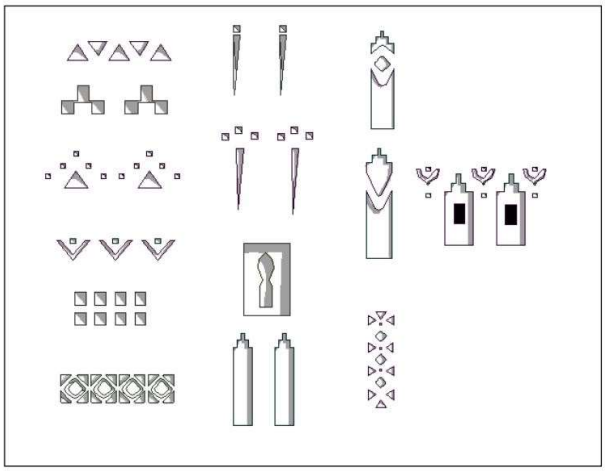


Figure 86: Image of the Motifs used in the architecture of Ait Benhaddou.

Source: [122]



Figure 87: Photos depicting a noticeable geometrical pattern inside Haj Mohammed Kasbah.

Source: [144]

5.5.1 The Berber house and the Tifinagh traditional art

The Berber civilization had an independent alphabet, as witnessed through several stone carvings in Zagora and the Oued of Draa dating to antiquity. Ancient Libyco-Berber inscriptions survive in Morocco, Algeria, Tunisia, Libya, and the Sahara. The Libyco-Berber scriptures were the local indigenous writing system before the Arabic scripts emerged in the 7th century in Morocco.

The emphasis on the history of the alphabet in this research is to emphasize the ancient history of the Ksour architecture and the geometry it carries, as well as its strong relationship with eastern cultures like the ancient Egyptian civilization. To trace the geometric structure of the Berber house and the essence of its traditional art, a brief etymological investigation of Tifinagh and the ancient Hieroglyphic alphabet was conducted.

5.5.1.1 Alphabetic history and origin

The origin of the Tifinagh alphabet remains controversial. Ancient Lybic engravings scattered across central and southern Morocco and North Africa dating to antiquity remain mostly undiscovered or non-assessed, and they indicate an early writing system across a large territory and a witness to a large ancient civilization. One example is the Azib N'Ikkis engraving, which includes libyco-Berber writings estimated to date to the 8th century before Christ [145]. The Berber cultural region extends from North Africa to Egypt, home to ancient tribal societies with a common language family that delivers illustrative symbolism that records vital information about their period. According to Antonio Loprieno, the Berber language has the closest relationship to the ancient Egyptians [146].

5.5.1.2 The Relationship between the Alphabetic Geometry and Architecture of North Africa

Anthropologist Frederick Wulsin suggests that the Berber language developed independently with Egyptian influence [147], and Tifinagh, like hieroglyphics, might have been ideographic and phonetic [148]. Overall, the two languages seem to have immense interconnection. By observing the hieroglyphic characters, Tifinagh demonstrates several shared alphabetical geometries. The geometry of the ancient Berber alphabet seems like frozen representations or shadows of ancient civilizations. The ancient Egyptian language depicts realistic figurative design, while Berber characters are geometric designs with dots, circles, and straight lines.

The emphasis on the similarities between ancient Tifinagh and hieroglyphics is discussed in this chapter to come close to the geographical linkage of the cultures and the linguistic correlation that allows an understanding of the several commonalities between these two cultures and civilizations. The written language of the Libyan Berbers that neighboured the ancient Egyptian civilization shows a symbolic analogy between two cultures that existed simultaneously.

In this regard, the symbol of the Ḥ letter in ancient Berber and Hieroglyphic shows interesting verification. The letter corresponds to *hasr* or *ḥaṣir* in Proto-Sinaitic, indicating a courtyard or an enclosure. Likewise, the letter Ḥ in Libyco-Berber and ancient Tuareg Tifinagh, considered two scripts of the most ancient Berber alphabet, symbolize four lines, four courtyard pillars, or four towers (Fig. 88). Montagne speaks about the origin of the Kasbahs, which derives from a primitive square enclosure flanked by two or four towers [149].

Equally, the word hasr in Arabic (حصر) refers to the act of surrounding something. Kasr and Hasr seem related and have similar meanings in the Arabic lexicon. Furthermore, the relationship between the alphabetic geometry and the symbolic meanings is noteworthy since it implies a rooted history and architecture. The geometrical form of letters in ancient languages indicates a written expression of their meaning. According to Gardiner's hieroglyphic grammar, the letter h indicates a courtyard with a wall and represents a shelter or room [150]. In Berber script, it symbolizes walls or columns that somewhat define the traditional shape of the Berber house (Fig, 88).

Camiz [151] indicates the importance of place names as an intangible heritage that links morphology and toponymy, suggesting an antonymic dyad illustrating the symbolic link between people and regions. Similarly, pointing out the linguistic heritage and the form of the Berber script indicates a symbolic form considerably implicative of the rectangular base type of the Ksour. The organization of the Ksar is primarily determined by the defensive nature demonstrated by the towers, emphasizing their value as enclosures. Similarly, this identity governs the Kasbah form, revealing a symbiotic habitat characterizing the distinct organization of the Ksour.

The case of the cities of the Maghreb indicates the evolution of specialized buildings through successive duplication based on population growth [67]. This development is communicated through the city as an interactive system between the city and the building's evolutions, expressed by Ginex in an analytical study of the diagram of enclosures and model of the planimetric morphological structure of Berber Ksour [152].

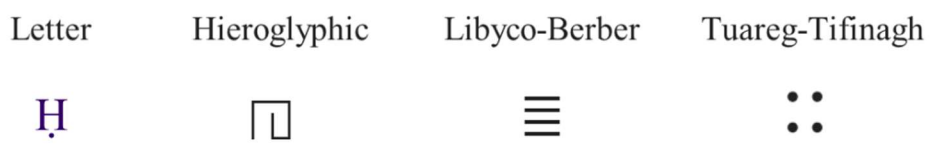


Figure 88: Table of letter Ḥ representing the notion of enclosure, in Libyco Berber and Tuareg alphabet obtained from Charles Fossey, and the Egyptian hieroglyphic according to Gardiner's code.

Source: [153]

In this prospect, the form of the Kasbah presents a geometric repetition of basic shapes, highlighted by the notion of a fence. Ginex [154] identifies it as both an independent structure and a city that is difficult to identify as a unique building because it overlaps with many aspects of the environment in which it stands.

A profound understanding of types is not solely a posteriori mental construct but an existing reality of the building forms in the city that begins with "the mental project" before the design stage. Types communicate formative elements of stylistic forms which reflect and contribute to their environment and culture, operating at the individual level while characterizing an entire school, age, and people [155].

The Ksar, fortified granaries, and Kasbah are fortified models of North African architecture that showcase a system of functional flexibility and an architectural continuum shaped by a geometrical pattern that becomes the model of the evolution of the archetype concept on an urban scale [154].

5.5.2 The architecture of Berbers of Egypt

A noticeable proximity links the symbolic expression of the Berber scripts and the ancient Egyptian languages. Geographically, both civilizations inhabited juxtaposing territories. The Berber cultural area shares a homogenous architectural language across North Africa, as Berber communities in Egypt still preserve their culture and maintain the Berber language to this day. Communities live in oasis cities in Western Egypt, like Siwa City and a couple of oasis cities by the Libyan border. Berber-speaking communities are a minority in Egypt, while predominantly Arabic is the spoken language of Egypt.

The table in (Fig. 88) presented an example of the influential association between the two civilizations, in which names provide a crucial part of cultural heritage, help preserve intangible heritage and the identity of a group [156], and thereby guide the comprehension of past heritage.

5.5.2.1 The example of Siwa's old city

Siwa's ancient fortress is built on a rock hill and constructed with adobe material and mud brick. The region of Siwa in the west of Egypt is a few kilometres from the Libyan borders. It represents a Berber oasis city with a compact built environment. Many scholars, like Al-Bakri and Al-Idrīsī, referred to this city as a Berber city. Al Maqrizi mentioned the connection between the Egyptian Berber dialect and the Zenata Berber dialect in Morocco and Algeria [157]. Likewise, Ilahiane [158] links the etymology of Siwah (*swh)* to Tachelhit. The Siwa Oasis settled on the trade and pilgrimage routes connecting the Maghreb to Mecca (Fig.85).

Shali Ghadi in Siwa exhibits a compact urban organization, a dense street network with tunneled alleys in a protected setting with varying degrees of accessibility and enclosure. The dry and arid desert climate and the water source establish the oasis settlement in Siwa, where climate and building technology are commensurate with Ait Benhaddou, and the use of local palm tree wood and reeds is principal in assembling the ceiling structures [159]. The unified language and building method joined the Berber villages across North Africa.

The development of these villages represents an exceptionally thriving environment of continuous evolution that evolves through a traditional process of self-correction and development through adapting to local needs. Likewise, the teaching process of building technology in Siwa is communicated in a person-to-person fashion with an emphasis on repetition. This tradition illustrates the fundamental traits of Berber culture in preserving tradition, which takes the form of poems, celebrations, or repetition to conserve intangible heritage.

The urban layout of the ancient city of Siwa Oasis exhibits an irregular urban pattern with a narrow street network [160], which is the case for the conventional Ksour in Morocco, particularly Ait Benhaddou. It is suggestive that this culture has survived through mud-brick buildings extending from western Egypt to the Atlas Mountains. Besides, the identification shared through language, culture, ethnic background, and geographical position of these settlements doubtless indicates an ancient homogenous civilization.

Historically, mud brick construction has been the oldest and most widely used form of vernacular construction [161]. The ancientness of the ways of life and the

construction material in the Berber communities preserved across different countries in North Africa prove an exceptional connection to ancestral traditions.

5.6 Vernacular Berber architecture

The common linguistic background, tradition, and heritage of the Berber culture in North Africa show the survival of an ancient civilization through the tangible history of mud brick buildings. Cultivation and agricultural harvest were essential for the settlement's formation, as the bond between the oasis, agriculture, and architecture is significantly the essence of the Berber settlements.

During antiquity, the northern Sahara was inhabited by the Gaetulians from the west and east, and according to Herodotus, they controlled the oases in the fifth century BC and cultivated palm trees and wheat [3]. Effectively, the caves are a known characteristic of Northern Draa that correspond to the most ancient forms of living that remain in the surrounding mountains of Ait Benhaddou, as well as in the Ksar, as a characteristic of the ancientness of the village, illustrating the first ever vernacular form of living historically.

The Berber tribes across North Africa in Algeria, Tunisia, Libya, Mauretania, and Egypt reflect some of the most ancient dwellings of vernacular architecture, particularly cave dwellings, that exist within the Berber communities, like the Ghyran Berber tribes in the Ghayran mountains in western Libya, the Berber cave dwellings in Qasr Tracine and Matmata in southern Tunisia, and the Gueldaman caves located at the mountain ridge route.

In addition, the shared attributes of the Berber towns across the North African terrain display an arrangement following the motion of the trade network, generating vibrant habitats against the harsh climate of the desert atmosphere.

The proliferation of Oasis cities along the historic Timbuktu-Draa trade route is an ideal example reflecting the agricultural knowledge of the Berber communities, resulting in a trans-Saharan settlement web defined by a cultural and geographical area and a thriving economy that reflects similar building attributes and architectural expression.

5.6.1 The connection between trans-Saharan settlements

The Draa-Timbuktu commerce route was one of the most prominent, that followed the paths of numerous vital cities and traversed Mauretania to reach Draa. (Fig. 90) presented adapted trade routes in Western Africa that highlight a particular network connection between Timbuktu, Oualata, Ouadane, and Draa. This route extends throughout several Oasis settlements, portraying noteworthy architectural similarities.

The example of the Ouadane Ksar displays comparable urban characteristics with Ait Benhaddou. According to ICOMOS, Ouadane was one of several stops that served the trans-Saharan route and stood by the ruins of an ancient settlement by the oasis, and its history dates to the 11th century [162]. Likewise, Al Bakri reports in the 11th century that the Ouadane settlement stood along the trade route between Aoudaghost in Mauretania and Akka City in Draa [11], thus implying the synchronous existence of the oasis cities.

Within this context, Ait Benhaddou, the Ksar of Ouadane, and Chingetti in Mauritania present a congruent architectural language seemingly shared by the trans-Saharan settlements. The Ouadane mosque incorporates a stone-arched prayer hall and a minaret that resemble fortified towers and the Berber Kasbahs of Draa (Fig. 91) and (Fig. 92).

Moreover, the mosque of Ouadane is situated at the peripheries of the urban tissue by the city walls and opposite the gates, following an identical organization system detected in Ait Benhaddou.

The example of Ouadane indicates an urban organization that testifies to the religious influence across a large geographical area, distinguished by resemblance in building design and united building principles.

Cultural areas link building features and differentiate them depending on the man-made structures of their location [86]. In this regard, Trans-Saharan Ksour communicates similar building designs, determined by the spread of the Berber tribal communities, and adapted by the availability of the material. This expanse of Berber communities throughout North Africa has left traces of a comparable building language for a single cultural area. The fortified towns express a pattern in adopting building technology and architectural properties, traversing a geographical area inhabited by the Berber tribal community from the Atlas Mountains to the west of Egypt, connected with an affluent trade network (Fig. 89).

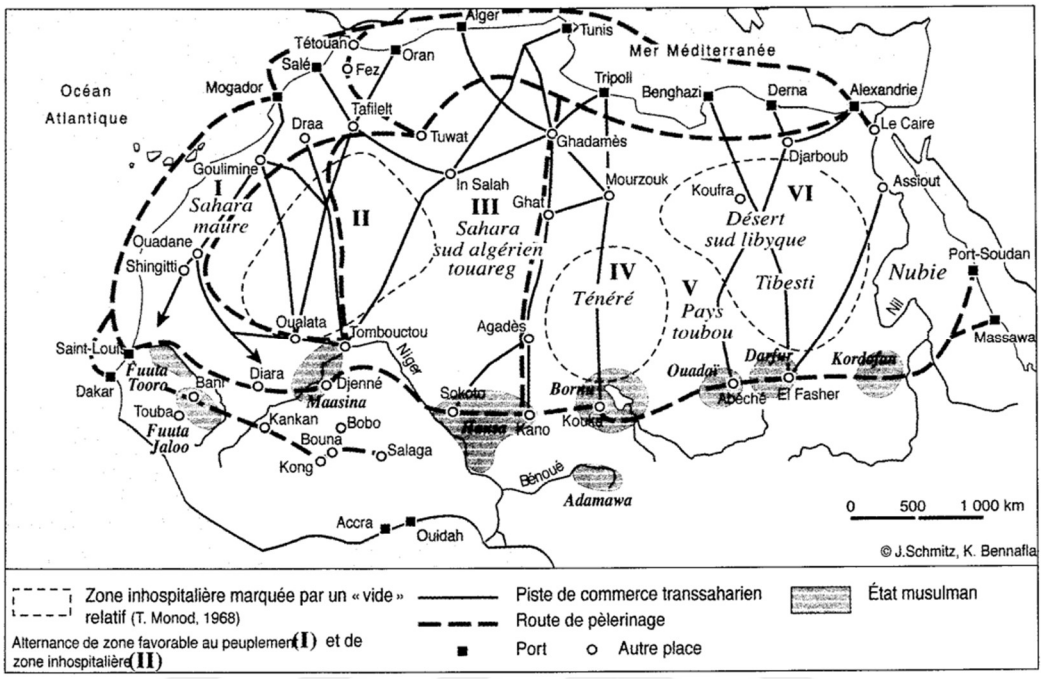


Figure 89: Meridian corridors and pilgrimage routes in the Sahara.

Source: [163]

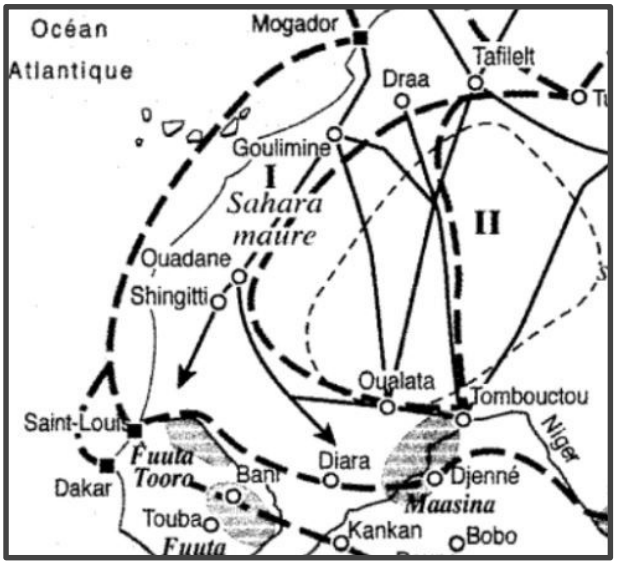


Figure 90: The trans-Saharan commerce routes connecting Draa with Ouadane Oualata, Shingitti and Timbuktu.

Source: [163]



Figure 91: Photo of the Mosque of old Ouadane, minaret and arches

Source: [164]



Figure 92: Photo of the *Broj* at Lhaj Mohamed Kasbah.

Source: [165]

5.7 Brief conclusion

The comprehensive overview of the town's formation in terms of history, geographical concentration, urban development, and the building structure scale clarifies the intrusion of all the elements with one another, requiring a closer inspection of the building properties and techniques.

Construction materials and techniques present conscientious methods highly reliant on and adaptive to the oasis habitat, in total alliance with the land, in which residents adapt to the nature of the land and climate to establish resilient building design. Furthermore, buildings incorporate several elements that exist within the city, just as the fortified city is an urban organism; houses reflect an organism where architecture meets the sacred through small windows, and the design of shelter rooms conveys the well-thought-out design process that includes animal and agricultural roles.

The repetitive geometrical forms of the window openings link to the geometry of enclosure seen in the building types and the tower's plan, denoting a noteworthy feature in the settlement. The notion of enclosure is crucial in this regard, elaborated on by different authors, like Montagne, as a principal element of the oasis Ksour towns.

In this prospect, the linguistic investigation of the term Ksar aimed to briefly inspect the history of the enclosure geometrical form following the Berber cultural area, connect Ait Benhaddou with the large Berber scale, and place it within the historical trade network to briefly explore the commonalities between the Ksour within the context of trade that seems to be a crucial element in the formation of the Ksar Ait Benhaddou.

In parallel, the Berber tribes' historical movement and agricultural mastery reiterate the spatial organization of the built form and the building technology that requires ongoing maintenance. The continuity of the Ksour implies a fundamentally functioning society prevalent along the trans-Saharan trade, where architectural expression demonstrates analogous features that contribute to the model of this mechanism.

The following chapter discusses Ait Benhaddou in the 20th century, highlighting the evacuation of Ksar in the late 20th century and its impact on architectural heritage that gradually led to its deterioration, leaving the village mainly abandoned.

This chapter intends to shed light on the implications of historical inquiry elaborated on in previous chapters. Restoration tackles multi-disciplinary intervention programs that aim to fit with today’s standard of living; thus, referencing the past is crucial as a tool to preserve the identity and local heritage that sustained the continuity of these towns.

CHAPTER VI

AIT BENHADDOU IN THE TWENTIETH CENTURY

6.1 Fragility and Damage

Desert vernacular settlements are transforming due to fast technical, socio-economic, and socio-cultural development. The local communities suffer from urban decline because of economic deterioration and unsatisfactory living circumstances.

The accumulation of causative events in the oasis environment altered the social structure, causing an imbalance within the oasis milieu and starting its decline. Considering the fragility of the sub-Saharan building materials to be a known attribute recognized by the locals and coped with, the oasis habitat required a strong alliance within the communities to enable the continuity of local building traditions. However, after the gradual abandonment of the local families, the state of the built environment began to deteriorate, leading to a need to save the fortified oasis cities.

After the inclusion of the site in UNESCO's World Heritage List in 1987, the local and international organizations collaborated with the CERKAS Centre for Restoration and Rehabilitation of Heritage Conservation to prepare management plans for 2007–2012 and 2018–2023 to build promotion methods to resurrect the village. The initiative strategies concerned restoring elements of the built environment, creating marketing strategies for the site as a tourist attraction, generating revenue for local communities, and boosting life inside the Ksar, which began to become a tourist attraction in the late 1990s

due to the cinematic industry that took Ait Benhaddou as the suitable affordable set for their projects.

6.1.1 The intrusive powers and decline of the oasis habitat

With the decline of the trans-Saharan trade in the 18th century, the tribal communities became under the leadership of a central state under the French colonial regime that wanted to control the southern region by surrounding the Ksour settlement with military camps, leading to the introduction of new buildings and the decline of the oasis habitat and its architecture [166].

The French regime interrupted the sub-Saharan habitat through an encounter between two different cultures, causing a collapse of the Ksour environment and development. As a consequence, emigration occurred after the dismantlement of the social ties inside the Ksar. New buildings emerged when locals began working in other cities and returning to their home villages to support an easy life by establishing new structures across the river [166].

Ait Benhaddou suffered from neglect and the gradual abandonment of the local inhabitants to newer buildings, leaving the town in need of assistance and restoration. It was an initial step towards Ksar management and the creation of administrative and structural responsiveness regarding the state of degradation. With the locals' evacuation and movement to the other side of the valley in the 1940s [136], the number of families declined from 98 in 1940 to six in 1993 [167], and presently about four families remain in the Ksar.

The initiation of the film industry is among Ouarzazate City's most notable features of the 20th century. In 1962, Ait Benhaddou was home to the first film set of "Lawrence of Arabia," making the Ksar a suitable location for movie makers. Years later, Ait Ben Haddou produced a staggering twenty films, making it gain more recognition and consequently adding to its touristic value.

6.1.2 The abandonment of Ait Benhaddou

In a non-directive interview with Mr. Abdellah, a representative of the Ait Aissa association and a spokesperson for the conservation of Kasbahs and Ksour in the region, he revealed that additional concerns, such as the lack of power, drove inhabitants to abandon Ksar. Although management plans to provide electricity to the Ksar were carried out, obstacles facing the conservation of the built heritage stood in contrast to the suggestive integrations, leaving the Ksar without electricity. Therefore, locals were more motivated to look for a place with better and easier life conditions. Furthermore, the paved road became an essential function rather than the valley; locals had to get closer to the road to reach nearby provinces for education, hospital care, and other necessary facilities.

Moreover, the recurrence of floods along the Oued El Maleh has left residents of Ait Benhaddou secluded and disconnected from necessary help, which has increased the movement of Ksar abandonment, and encouraged residents to move to the new town because it provided water and electricity [168]. The lack of infrastructure and running water caused urban decay and distortion of the economic and social structure, inducing a breakdown in the communal system of the oasis settlements [167].

The 20th century was a time of evacuation of the Ksour and Berber settlements; despite their ancient nature, Berbers have inhabited the Ksour and Kasbahs until recent

history. The change within the global system has slowly leaked to the sub-Saharan region and left families searching for an easier life. The locals of sub-Saharan Morocco lost interest in agriculture because of the labor intensity and the separation of the family unit, which is essential in preserving these towns. With time, families started moving slowly to new concrete housing, which caused the culture to change and marked adobe housing as a symbol of poverty, as concrete houses symbolized prosperity and status.

Urbanization and globalization have altered a change in society, disrupting the Ksar's social and familial order and leading to a change in the usage of resources from the local environment to industrial ones, interrupting the flow of constructive tradition and leading to a shift from rural to urban living as profound urbanization ensued. The transition from adobe construction to concrete is seen through the landscape, conveying various building types in the evolving oasis environment following a genetic code [169]. The change in social class boosted the demand for concrete housing; though it was more expensive, it was faster than adobe construction, which requires a lengthy process. Consequently, concrete eased masons' jobs, enabled faster construction and easier maintenance of buildings, and caused a gradual loss of technical knowledge to design intervention and maintenance strategies for the urban fabric [167].

6.2 Revival and restoration of Ait Benhaddou

Intervention actions were developed to preserve the Ksar legacy, generate marketing and promotion tactics, and revitalize the site through plans such as electricity, fire hydrant installation, the development of Saguias in the agricultural lands, the requalification of health facilities, and upgrading the new Issiwid community to function as a close neighborhood acquiring necessary services.

The construction of the bridge set a link between the Ksar and the village of Issiwid, resulting in a satisfactory reaction that firmly supported the growth of the Ksar through the delivery of products and services throughout the winter months and during critical climatic periods, as well as sustained a connection between the two banks and brought safety from floods (Fig. 93).

The restoration projects on Ait Benhaddou's built heritage carried out by the Ministry of Culture, the National Agency for the Development of Oasis Zones and Argan, and the Ministry of Housing and Urban Policy mandated respect in managing cultural building techniques and local materials and prohibited the use of any contemporary material or design.

The conservation treatments included wall stability care and wall coatings, with respect for the indigenous aesthetic language and structural compositions, assessed and documented by the CERKAS rehabilitation centre [136]. Among the rehabilitation works were the restoration of the mosque, a renovation of the paving of narrow streets and tunnel passages, repairs of gabions made of stone masonry to mitigate erosion as a result of landslides and flooding caused by the river, and documenting the decorative typologies existing in the Ksar and the ornamental language of Kasbahs and their decorative motifs [122].

Notably, the management efforts reported successful outcomes in the Ksar appearance revival. As locals rely on tourist earnings, the agriculture culture is less represented in the present identity as a crucial part of historical heritage. In this prospect, conservation requires multidisciplinary approaches to address the essence of oasis settlement preservation [167]. In the case of the Saharan oasis cities, the importance of

strengthening the bond of locals to their heritage by generating income assets via the maintenance of the landscape as a significant part of the local heritage and encouraging locals to participate in the involvement of local traditions that require protection. In this prospect, Cimadomo [170] highlights the importance of inducting a new economic status that combines heritage, landscape, and tourism in the example of earth architecture heritage protection in the M'goun Valley of sub-Saharan Morocco, which can be used in Ait Benhaddou as well, and it presents the ideal approach to dealing with Ksour towns and bringing vitality to residents without giving away the local heritage.



Figure 93: Depiction of the bridge linking the Ksar Ait Benhaddou to Issiwid village.

Source: [171]

6.2.1 Construction material and sensitivity

The construction materials in the region are fragile, leaving the role of restoration a constant inquiry within the Ksour settlements. Rammed earth building technology is considered the most ancient building technology in the world because it requires manual labor and natural building measurements and equipment. The traditional techniques, therefore, create limitations in the construction process and rehabilitation. The sensitivity of materials to wind, rain, and temperature variance impacts the building's resistance [172]. Humidity is a significant cause of the weakening and gradual deterioration of the walls and ceilings and the erosion of the wall and exterior layers. Water leakage can aggravate the impact and cause grave damage as climatic conditions change drastically from winter to summer, from high rain to extreme drought.

(Fig. 94) indicates photographs captured from the exact street within a one-year difference, demonstrating the severe climatic impact on the walls and revealing one of the common issues facing the Berber Ksour: the disintegration and loss of the protective coating due to trapped moisture caused by rainwater [113].

The thermal properties of the local building techniques create a perfectly protected and shielded living environment throughout the year. The modest windows and openings on the façades make up the most essential portion of the building envelope in terms of energy savings. Upper floors make flexible spaces in terms of design and are made of adobe bricks, which allow feasible design patterns and openings for wind and ventilation control.



Figure 94: Photos showing the climatic impact on the wall structures over a one-year period.

Source: [173]

6.2.2 Natural disaster damage

The Ksar Ait Benhaddou exists under constant hazard threats of floods, heavy rains, and seismic activity. On September 8th, 2023, a fatal earthquake struck the Moroccan Atlas, inflicting damage to the architectural heritage in Ait Benhaddou. The damage seen in the Ksar varied according to the structural state of the built environment. The earthquake's impact has aggravated the condition of the weak and deteriorated structures with minor interventions. The damage indicates the importance of restoration work in reinforcing several residential buildings and kasbahs. Cracks manifest across residential blocks, especially in Kasbahs and towers. A couple of Kasbahs got afflicted, displaying dangerous fissures throughout the wall construction length, and the towers on the roof were partially ruined (Fig. 95) and (Fig. 96). The wall structures reveal cracks and place the building structures of the Ksar in fragile conditions.

(Fig. 97) shows the granary building on the hilltop that was massively affected and partially collapsed. Lack of seismic awareness and seismic responsive management in the renovation process is evident, as errors in renovation can include using heavy adobe bricks by the rammed earth structure, necessitating different techniques than the original methods [174]. Nevertheless, the resistant management and crack monitoring treatments implemented by Cerkas reveal the resilience of the settlement against such powerful earthquakes. Despite the destruction of a couple of towers, many houses resisted the shock after the stone consolidation works were conducted over the exterior angles to reinforce the structural ground settlement [172].



Figure 95: Photo manifesting the effects of the earthquake on the Kasbah structures and towers.

Source: [175]



Figure 96: Photo of the post-earthquake damage over a residential district.

Source: [176]



Figure 97: Photo of the earthquake impact on *the Ighrem N' Iqddarn*.

Source: [177]

6.3 The effects of tourism

Ksar Ait Benhaddou gained recognition as a touristic destination, and locals benefited from the notoriety to revive the economic life in the settlement through tourism, which brought new job opportunities but caused locals to neglect agricultural traditions, which are presently considered difficult labor requiring long work hours and effort. Unfortunately, the economic industry and the shift of sub-Saharan Morocco, in general, broke the ecosystem cycle of the oasis settlements that survived hundreds of years and distorted the traditional and social setting of the Ksar Ait Benhaddou. The Ksar now stands as a print of history abundant with tourists.

The Ksar shows a liaison between locals and their environment, which is evident through the urban investigation of the formation process, making the oasis habitat a lively milieu in the life of the Ksour.

In this respect, solutions that sustain the environmental setting and agriculture continuity are elaborated through the notion of sustainable tourism, a project that can be studied by analyzing the landscape and the social and urban development of the oasis settlements to protect the environment and heritage of sub-Saharan architecture in Morocco [170].

The beauty of the Saharan oasis cities lies in the landscape and the natural settings where the earthen dwellings reside, and it encourages a necessary alliance between the tourist sector and local human activities to preserve the cultural heritage [178]. Cimadomo [170] further reveals that targeting tourism models that include the locals also manages to awaken the value of the built heritage in the eyes of the locals, adds to

economic prosperity, and sustains the conservation of the built heritage and the touristic models.

6.3.1 Cinematographic impact over the Ksar environment

Some of the changes taking place in the building environment of Ait Benhaddou occurred due to the movie industry. The Ksar was the location for more than twenty films, with Gladiator being the last to be shot there in 2023. Consequently, this industrial introduction to the settlement has brought transitions economically, culturally, and socially, as well as impacted the urban context, resulting in positive and negative outcomes. Significantly, cinematographic history strongly influenced its present reputation in the 20th century.

Dozens of movies were shot in the Ksar from the early 1960s to the present day, including Sodom and Gomorrah, Oedipus Rex, The Man Who Would Be King (1975), The Message (1976), Jesus of Nazareth (1976), Time Bandits (1977), Marco Polo (1985), The Jewel of the Nile (1985), The Living Daylights (1987), The Last Temptation of Christ (1988), The Sheltering Sky (1990), Kundun (1997), The Mummy (1999), Gladiator (2000), Alexander (2004), Kingdom of Heaven (2004), Babel (2006), One Night with the King (2006), Prince of Persia (2010), Son of God (2014), Queen of the Desert (2015), A Life on Our Planet (2020), and lastly Gladiator II.

Consequently, this massive interest in Ksar as a movie destination has allowed a gradual and noticeable change in the town's cultural language, which has modified its historical value in the local heritage. On the other hand, it brought tourism and revenue flourishing to the residents, which was an essential part of the intervention and renovation plans discussed to enhance the quality of the tourist experience [179]. The focus on tourist

revenue has encouraged several residents to turn their residents into shops [180], and the tourist occupation has become a primary preoccupation for locals. As a result, the loss of cultural identity materializes, as locals' primary focus is directed towards tourism products, which is one of the management problems that expresses the challenge of maintaining the authenticity of the cultural product by promoting it as a mass tourism product, even though it is precisely this authenticity that provides it commercial worth [166].

The built heritage of Ait Benhaddou is gradually affected by the industry as nonnative elements are imposed on the Ksar, such as the wooden design at the main gate, executed by the Gladiator Cinema crews in 2023 (Fig. 98).

(Fig. 99) presents another foreign element to the architectural heritage: a concrete gate-like structure within the limits of the agricultural lands conducted for a movie set. The threats of the non-organized cinematographic activities in the Ksar are incorporated into the management plans of the Ksar to avoid distortion [181]. Unfortunately, such activities emerged after the Ksar became a well-known movie set for Western cinematographic industries.



Fi**gure 98:** Photo of the *Imi N' Ighrem* gate with an additional wooden structure made by Cinema crews.

Source: [182]



Figure 99: Photo of a gate-like structure by the Oued Ounila constructed by the movie crews, outside of the Ksar perimeter.

Source: [183]

CHAPTER VII

DISCUSSION AND CONCLUSION

This research aimed to investigate the chronological formation process of the Ksar Ait Benhaddou, detect its genesis and development phases mainly through the implementation guidelines of the Caniggia school of thought, and explore its implementation in the case of the sub-Saharan town.

The inquiry into the origin of the Ksar integrates a multidisciplinary approach that begins with an analytical investigation of the settlement's location inside the territory and its functionality as an oasis habitat, finally focusing on the settlement as a hillfort, revealing the possibility of an earlier fort from what is known. The cultural area, including religious and social attributes, was inspected to correlate with the results of the urban analysis and touch on the tangible and intangible aspects of the urban context to reflect the religious and local identity into the urban tissue, which demonstrated a substantial interconnectedness between local identity and urban growth. The analysis was performed on various scales to communicate a gradual understanding of the Ksar as an urban setting, clarify its significance within the territory, and explain its functionality, which defines its overall identity.

7.1 The origin of the Ksar Ait Benhaddou

The analytical investigation employing the Caniggian theoretical model of the formation of small towns offered an explanatory framework for understanding the human settlement movement, demonstrating that the earliest urban form in Ait Benhaddou began on the

hilltop where the Berber bank stands within a fortified setting. Likewise, the results of the typo-morphological study indicate that the urban expansion begins within the hilltop fort and ends by the valley side. Consequently, the street network initiates from the highest point of the hill and moves downhill to forge the urban grid, producing a route deviation system directed from the east towards the west that elaborates on socio-economic changes. The latest construction phase suggests the Kasbah (fortified castle) district aligns with the political and economic history of the territory where Ait Benhaddou was economically developing and the need for protection was necessary.

Further, the urban expansion occurred following urban attractor elements, where the building types develop according to urban growth, reflecting an organism in response to social, economic, and commercial activities that shape the urban tissue and the building form.

Ighrem N' Iqddarn, at the highest point of the town, symbolizes the remains of a broader urban tissue that was the source of forthcoming urban expansion, and it presents the primary attractor point of the entire street system that expands inside and outside of the Ksar limits.

The analytical investigation of urban growth parallel to social and economic history provided additional data that crystallized the development process and acknowledged a thriving society highly related to its land, supported by a flourishing, rich trade network that allowed the endurance of commercial links between Ksour and other civilizations.

7.2 Building types and characteristics

Building types and intelligent architecture in masterminding the community stand as tools to fathom its progression with time.

The micro-scale inspection of the building types identifies some of the most ancient building forms existing, such as caves, expressing the local conventional adaptation to the environmental conditions and communicating ancient building attributes of a prominent culture that spreads across a large geographical area in North Africa.

In addition, the monumental architectural language conveyed through the buildings and ornamental geometry recognizes a regulated system reflected through the outer wall designs and inner building language. Geometrical language leads to cultural heritage, which is an essential part of understanding the city.

Moreover, the progression of the building type from east to west evolves through keeping the sense of enclosure and adopting protection building attributes towards the west, expressing an organism connected to its land and soil, demonstrated by its functionality within a hostile zone, a sign of the resilience and integrity of the social groups within the community that testify to a systematic configuration permitting the town to thrive as a fortified city in a rich and cohesive environment.

The social organization required to adapt, endure, and create an urban environment with such a rich traditional, cultural, and agricultural system seemingly does not indicate a nomadic lifestyle. The historical presence of communities across the north African territory known for harvest and agriculture in the Saharan desert suggests inherited knowledge that implies that the constant mobility factor was the reason for early

writers to characterize Libyans as nomadic [32]. Ait Benhaddou likewise delivers characteristics of an older town that preceded the 17th century and shows the comparable language of the pre-Saharan valleys. According to Mimó [184], the structures of Ksour towns can be traced back to the third century AD.

7.3 The socio-spatial organization

The study operates at macro- and microscales, beginning with the territorial organism and the urban tissue to the residential housing and Kasbah organization, demonstrating that the fortified city works as an organism of a cyclic organization that connects the Ksar to its habitat and environment.

The fortified hill suggests the genesis of the street network and, thereby, the city. The conjunction of all paths towards the hill fort attests to its significance as an urban attractor and a root of urban formation and expansion.

The generation of public spaces illustrates a cooperative integration with agricultural activities and the leadership of the protection administration responsible for regulating the space over time. The expansion reflects a natural adaptation system to the geographical, social, economic, and commercial characteristics of the Berber lifestyle. Route deviation according to several points, such as gates, mosques, and valleys, indicates assurance of social comportment in the land required for such planning and is a natural response to the pre-existing notion of order. Throughout the formation process, the urban tissue communicates this notion, amplified with agricultural knowledge as a means of economic growth.

In this regard, the expansion of urban tissue occurs in response to traditional heritage and social behaviour. The case of historical cities pronounces the street network as not a simple void but rather a social place that denotes the formation of public squares, either in the form of buildings or voids becoming social spaces [185], such as the mosque.

The route deviation illustrates a well-thought-out process that follows urban attractors and develops in alliance with the natural setting, expressing the notion of the organism and shaping the urban tissue by means of human interactive conduct with the territory, driven by economic, religious, or social factors.

Moreover, the social order shown in the urban tissue and building typology emphasizes a gradual, coherent organization that coordinates with the organism's structure. The separation of social and economic classes and the roles of families within the fortified city highlight the division of labor and the liaison of territorial, urban, social, economic, religious, and cultural attributes in forming the fortified city system. It illustrates a deep-rooted culture possessing brilliant adaptive tools and knowledge to endure throughout history.

Ksar Ait Benhaddou presents a living organism distinguished by the notions of enclosure and fortification. Likewise, these notions identify the Kasbah (fortified castle), which functions just like the Ksar in terms of security, power, and surveillance, indicating an organism within an organism.

7.4 Recommendation for future studies

The study revealed the formation process of Ait Benhaddou through the application of the Caniggian urban morphological theory, which allows understanding and explaining urban growth in a conscious manner that aligns with oral history, social, and political culture. Moreover, it was possible to obtain a more precise understanding of urban development by taking into account the cultural and social milieu as well as the religious attributes of the Berber town.

Available studies on the architecture of the Ksour settlement, like that of Ait Benhaddou, appear to disregard numerous elements of the intangible history that reveal a significant portion of the genesis of these settlements. The formation process of the Ksar as an urban settlement shows a considerable integration of its cultural milieu, revealing the necessity of reading the past to fathom the present.

Little effort was made to comprehend the Ksour in a larger context, considering the large span of Berber societies throughout North Africa that established the so-called Ksour and Oasis settlements. This case study examines the identity of the Ksar Ait Benhaddou from a large scale to a microscale and implies the importance of an integrative historical search to understanding and reading the urban form of Ksour cities. Further research could, for instance, investigate the relationship between the several Ksour settlements in neighbouring countries and track their architectural language, as they are fundamentally architectural elements of one cultural area, expressing a similar lifestyle that reigned for centuries within ancient Berber (Amazigh) tribes.

APPENDIX A

Glossary of terms

Term	Berber Tamazight	Arabic	Definition
Amazigh	ⵎⵣⵎⵗⵅ	أمازِيغ	The name of indigenous people of North Africa, identified as Berber in latin sources, plural *Imazighen.*
Amghar	ⵎⵖⵅⵎⵇ	أمغار	The chief of the village in Berber language, also referred to as Qaid.
Berber	ⵎⵖⵎⵗⵅ	بربر	Latin term to refer to ethnic people of Morocco, called Amazigh.
Broj		البروج	Observation towers found in Ksour and Kasbahs.
Ighrem Igherman	ⵗⵅⵇⵖ ⵗⵅⵇⵖⵎⴰ	إغْرم إ غْرمان	village in Berber (Tamazight) language. plural of Ighrem, several villages.
Igurramen		إ جُرَّامن	Plural of Agurram, indicating the saints in Berber (Tachelhit dialect).
Imazighen		إيمازيغْنْ	The ethnic name of the Berber people.

Kasbah		قَصبة	Fortified house in North Africa.
Ksar Ksour		قصر قصور	Fortified village in North Africa. Plural of Ksar, several fortified villages.
Maalem		المْعلم	The artisan master in Morocco.
Marabouts		مُرابِط	Mausoleum or burial place of the Sufi saints in Morocco.
Qibla		القِبْلة	The direction of prayer for muslims towards the Kaaba in Mecca.
Saguias		الساقية	Water canal systems in Morocco.
Tachelhit	ⵜⴰⵛⵍⵃⵉⵜ	تَشْلْحِيتْ	The Berber dialect of the Middle Atlas and Draa region.
Tamazight	ⵜⴰⵎⴰⵣⵉⵖⵜ	تَمازِيغْتْ	The word which refers to the language of the indigenous peoples of North Africa.
Tighremt	ⵜⵉⵖⵔⵎⵜ	تِغْرْمْتْ	Fortified house in Berber language.

APPENDIX B

INTERVIEW

Unstructured Interview with Mr. Ali Ait Malk.

Date of the interview: 29.08.2022

Location: Hotel La Kasbah, Ait Ben Haddou, Ouarzazate.

Interviewer: Imane Saidi

Interviewee: Mr Ali Ait Malk (Descendant of the village Ait Ben Haddou and an Autodidact of history)

Mr. Malk: So, what are you really looking for?

Saidi I would like to start asking about the history of the Ksar first, then I will ask further questions, if that's fine with you.

Mr. Malk: The history of the town speaks of a king called Ouad Whole who lived in the region; he had five daughters, Assata, Sergata, Telouata, Zelfata, and Doulata, and these names refer to different settlements and Ksour in the region; that is, Assata ruled the Ksar before the Islamic introduction to the region. Assata, on the other hand, ruled until the Islamic introduction came to the place.

Saidi, I: Is there any reference to any timeframe in this information?

Mr. Malk: No, there isn't, but it dates to the pre-Muslim introduction to the region. In the 11th century, there was a king from the Almoravid dynasty who came from the east, accompanied by a saint from the "Zaouia Naciria" (the Nasiriyya Sufi order) of Tamegroute.

The saint asked the people of Ait Benhaddou, why don't you build your houses down the hill? People replied negatively because they were afraid that the rocky hill nature could become a danger to them due to the existence of snakes. The myth narrates that until the saint came and blessed the land, people began to extend their housing downward with no fear.

Saidi: What about the Jewish neighborhood in Ait Ben Haddou?

Mr. Malk: In the 16th century, the Jews came from Al-Andalus and lived along the Amazigh until 1956, and the last Jewish family departed in 1960. They have lived in the settlement for about 355 years.

Saidi: Regarding the name Ben Haddou, the son of Heddou, can you tell me more about the toponomy and its history?

Mr. Malk: Sheikh Haddou was the Amghar (leader) of the village at the beginning of the 20th century. The leader, Glaoui, was traveling from the east towards Marrakech through the Tichka route during the winter season, which is known for its snowstorms. Haddou stopped at Glaoui's house, and these two eventually created a trustworthy bond. Haddou was later given power in 1883.

The settlement was named Ait Aissa and was under the rule of Haddou until the 20th century when the Glaoui leader brought his army to conquer the settlement. Sheikh Haddou felt defeated when facing Galoui's army. Glaoui later married the daughter of Haddou, and the epitome of Haddou became the name of the settlement, Ait Ben Haddou.

Regarding the families within the Ksar, there were 74 families inside the Ksar, 60 Amazigh (Berber), and 14 Jewish families. These two did not marry within each other's

groups and had separate cemeteries. The latest buildings are the Kasbahs. They belonged to powerful families and had private exterior doors that took them out of the Ksar's fortification wall without the need to exit from the main gates.

Saidi: What were the famous trade products when the city was a thriving one?

Mr. Malk: The commerce included gold, salt, henna, silver, dates, and silk. The trade route did not continue across the end of the Ounila River but stopped at Tamdakht Kasbah. In 1954, the cinema industry was introduced in this region, which made the settlement of Ait Benhaddou a significant source of income for many locals. When it comes to the architecture, you can see that all the buildings have a stone base that prevents the water from disturbing the bottom structure, as the slope also allows the rainwater to descend smoothly.

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VITA

Imane Saidi graduated from Antalya Bilim University with a bachelor's degree in architecture; her interest in historical buildings led her to the discipline of sustainable architecture. As an early step in diving into the historical quest for ancient cities, she wrote academic research papers dealing with the architectural Saharan-built heritage and published articles like "The Formation Process of the Ksar Ait Benhaddou in Morocco" and "A Morphological Approach to Cities and Regions."

As a master's student at Ozyegin University, she tutored in the design studio and in various workshops and summer school programs dealing with archeological aspects and investigating the history of the past. She is also a member of Ozyein University's DRUM (Dynamic Research of Urban Morphology) laboratory. Imane has been a freelance architect and designer and has worked on architectural projects in Morocco, Turkey, and Oman, with an architectural design perspective of architecture as a quality of life that embraces the natural environment and heritage.