ISSN 1828-5961

Beniamino Polimeni
È specialista in Restauro dei Monumenti (Università degli studi di Genova) e dottore di ricerca in Rilievo e rappresentazione dell'architettura mediterranea (Università degli studi Mediterranea di Reggio Calabria). Dal 2004 partecipa a campagne di rilievo strumentale ed analisi del costruito in Italia e all'estero. Nel 2008 vince il *Premio Nazionale di Architettura Digitale.*

Le città del Jabal Nafusah Libico: strutture insediative e spazi abitativi.
The Cities of the Libyan Nafusah Mountain: Type of Dwellings and Urban Settlements.

L'interesse verso la zona del Jabal Nafusah, nella Libia nord occidentale, nasce dalla volontà di studiare un sistema di insediamenti e di trasformazioni del paesaggio che per caratteristiche ed esiti formali rappresentano un *unicum* all'interno del Maghreb.
Il lavoro presentato, diviso in quattro sezioni, si propone come un possibile *metodo di lettura* delle forme urbane e delle architetture che le hanno generate, attraverso lo studio delle tre città berbere di Nalut, Cabao, Ulad Mahmud. Tre casi di studio significativi analizzati mediante gli strumenti del disegno e dell'analisi grafica con lo scopo di comprenderne l'organizzazione logica delle configurazioni e verificarne la continuità territoriale. L'obiettivo è quello di creare una sequenza storico/analitica che partendo dagli oggetti architettonici più minuti, i più vicini alla scala umana per struttura e dimensione, proceda fino all'estensione urbana e territoriale. Un metodo di analisi induttivo che seppur limitato ad una porzione circoscritta dà vita ad un valido processo di interpretazione formale.

Interest in the Jabal Nafusah Mountain, in the north-eastern part of Libya, arises from the desire to study a system of settlements and landscape transformations which are unique to the Maghreb territory characteristics. The goal of this research is to propose a reading method for the urban structure and architectural forms, by the analysis of three models of settlement: Nalut, Cabao, Ulad Mahamud. These three significant study cases are analyzed by graphic and historical instruments with the purpose of understanding and verifying configuration and territorial continuity. The aim is to create an analytic sequence which starts from the territory with minimal architectural objects and extends to those nearest to the human scale of structure and dimensions, allowing us to understand the relations among the landscape, the history and the city formation.

ISSN 1828-5961

INTERPRETING THE URBAN ORGANISMS

Introduction

"Exploration of a city combines the pleasure of discovery and the joy of reflection. Going inside means understanding a logic structure made of elements, initially confused with one another, like words of a foreign language. And as with a foreign language, learning happens gradually, as the amount of the elements start to reveal the order that rules the full structure"[1].

This is the way Roberto Berardi explains the awareness process of the urban forms, explaining it like a linguistic learning path that proceeds by successive approximations, allowing us to test the flexibility and to study the mechanism. This linguistic metaphor recurs often in the thought of the theoreticians and invites us to consider human settlements like organisms. Organisms generated by different structures and functions reveal the expressions of the civilizations that produced them and the cultural identities that lived in these spaces, showing the connections that existed among physical spaces and the characteristics that determined these functions.

These aspects condition our knowledge process and determine a unified vision to which the word "city" refers and in the same breath, builds a space containing the community that lives there.

The nearer we come to discover the process that has originated the formal configuration of the settlement, the more we understand the rules of these organic structures. These rules are observable in several definitions of the physical spaces that allow their existence. Residing, covering, meeting, working are all activities inseparable from the places in which these happen; The essential requirement for their existence is the presence of places that are able to receive them.

Looking at the city like an open organism, we can understand, regardless of the different functions, the organic nature of the system that encloses them; without this structured system, every function would not be intelligible. Human spaces are products of human necessities, on the basis of the culture of every group that occupy them. If we accept as the origin of our "knowledge path" the cultural matrix of the built spaces, the city can be investigated like a single phenomenon, with analyses that allows us to recognize the stratified languages and to choose, among the knowledge schemes, the most useful for each of them.

Methodological approach

The analysis has focused on the possibility of determining the morphological configurations of the settlements through the instruments of 3-D modelling and cartographic analysis. To do so, the city organism has been initially considered as a collection of functions and spaces: everyone has a particular form and a specific language, which is related to specific spatial characteristics. Among the several activities included inside of the urban organism "dwelling" is that one which allows us to operate a complete analysis of the structural organization in each settlement.

The spatial domestic dimension, in fact, is the prevalent urban function: the element that in the Berber society allows us to examine the close connections existing between architectures, settlements, landscape[2]. House is, therefore, the most primitive unit, the element that develops through successive articulations in complex systems that goes ahead from the human scale to the territorial one[3].

Starting from the territorial scale, it's possible to trace the different settlements typology, analyzing the formal connection between settlement and territory through the study of traditional cartography and digital data.

After the analysis on the settlements at the territorial scale we can carry on our study with a typological approach, a method, described by Muratori and his school, useful to underline the basic buildings and the different processes of transformation.

The digital drawing, or to be more exact, the construction of digital *maquette*, has constituted the main instrument to communicate this research. In order to underline the essential attributes of our examples we have chosen to design digital 3-D models monochromatic, with simplified geometric characteristics.

To communicate efficiently the spatial characteristics of every model we have generated horizontal and vertical sections. The same method has been used for the images related to the territory. In this case, the digital drawing method has been thought to point out the peculiarities of geographic spaces in which similar human settlements are scattered in similar morphological conditions.

Case studies

Our case studies are the cities of Nalut, Cabao and Ulad Mahmud, three settlements that were born by the same cultural matrix and are inserted in a structure that shows different formal consequences related to different conditions.

The entirety of the cities located on the borders of Jabal Nafusah is a linear structure [fig. 1]: a network of elements linked by social connections among the human groups, by similar modality of land use and by similar historic origins. It is a cultural sphere defined throughout the ages by a clear hierarchy that is visible in the transformation processes and in the solid connections among the settlements[4].

Settlements are distributed predominantly on the border of the plateau [fig. 1, 2], with the biggest distribution on the east side, in the territory in which the Uadian, the dry valleys on the border, are rich in water and the territory allows a poor cultivation.

The advantages of this configuration are twofold: On the one hand, the morphological characteristics of the Jabal Nafusah are a privileged spot to control the territory by incursions from north and south; On the other hand, it allows maintenance of a strong connection with the Sahara desert, facilitating transports and trades[5].

There is, moreover, another cultural reason that can explain the highest density of settlements on the border: the Jabal Nafusah is a psychological border, the extreme edge of a region in which the oldest native commu-

ISSN 1828-5961

nities have resisted the expansion of other peoples coming from other parts of the Mediterranean area[6]. It is a territory that, at the same time, has protected and defined a civilization, becoming a physical limit and a sign for a peculiar social identity.
This strong identity that influences the different examples of vernacular architecture, arose from the adaptation of climatic conditions and in reply to the collective needs of the communities. It is a basic vocabulary that covers all the Maghreb and in its local variations, tends to evolve over time to reflect the environmental, cultural and historical context in which it exists.

UNDERSTANDING THE HISTORIC WAYS OF THE HUMAN SETTLEMENTS

Introduction

Interest towards the awareness of places invites us, almost inevitably, to a comparison of their histories, enlightening the aspects that connect the structure of settlements with the characteristics of their social organizations. During its history, the North part of Africa has been an earth of cities. "The Punic settlements and the Roman occupation have consolidated a structure of urban points made of trades, connections, contacts and exchanges on the borderline of a territory marked by a tradition of ancient nomadic"[7].
The geographic, cultural, and human base of North Africa never has been historically uniform: on an ancient Berber structure, endowed of an autonomous language and of a specific political articulation, the Roman, Punic, Vandal and Byzantine contributions have never altered the original habits of life. Only the Islamic conquest and the invasion of the tribes coming from the East succeeded in modifying the social structure of the ancient people of Maghreb, defining a new system of urban structures and creating new organizational models, of rights and coexistence based on Koranic doctrine .
Islam spread in North Africa, arriving into areas that had not been involved in previous occupations. The consequences of the diffusion of this new religion were the aban-

1. The Jabal Nafusah and the urban system.

ISSN 1828-5961

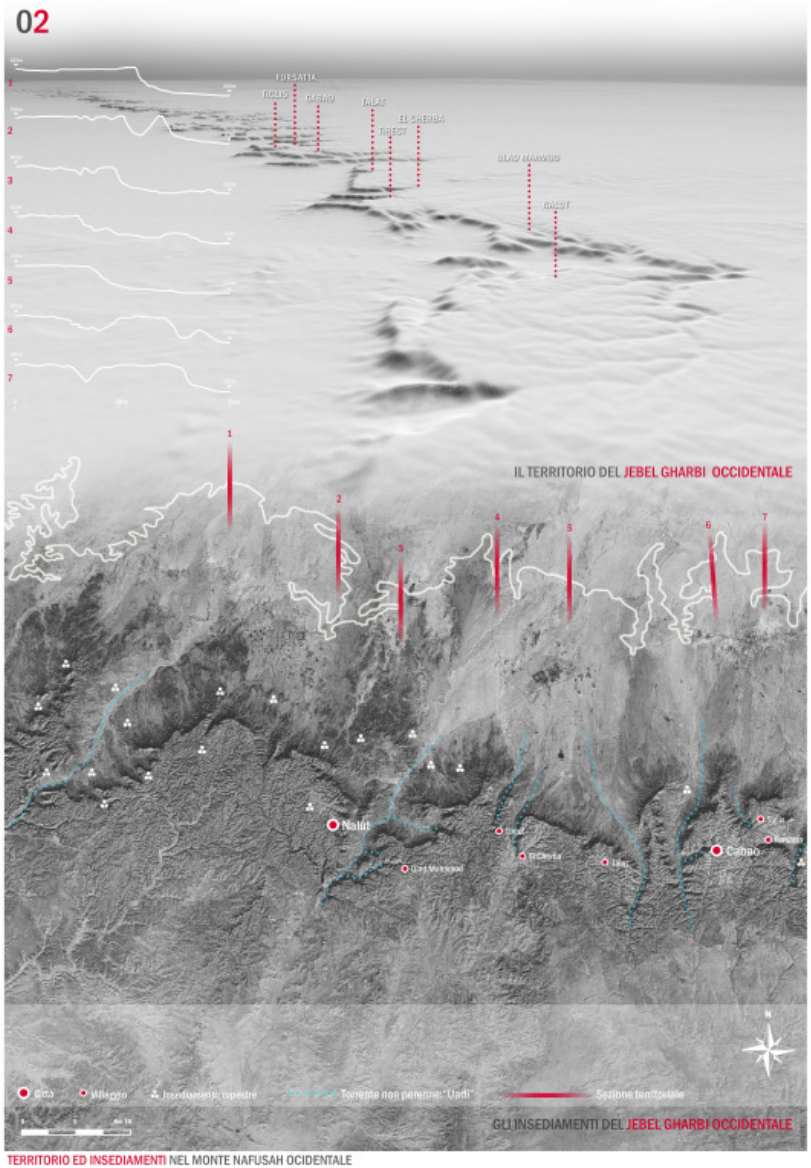
donment of the plains of the Berber groups and their progressive displacement in the internal and less accessible zones[9]. These new conditions deeply influenced the social structures of the nomadic groups, generating the birth of peculiar urban organisms.

The structure of the settlements in the Jabal Nafusah: Distribution and evolution

The migratory process consequent to Arab invasion influenced the configuration of the settlements located in the north and south part of the Jabal border. The progressive displacements of the Berber people from the Jifarah plain and from the south part aided the creation of several villages on the border of the plateau and, for the first time, in the southern limit of the plain, which was still the economic engine for the communities of that part.

According to Despois[10], the first configuration of the settlements, before the Hilalian invasion, was related to a semi nomadic condition relative to the activities of breeding and cereal cultivation. The climatic conditions of the Jabal border were favorable when compared to the south plateau, the so-called Dahar, and the particularly territorial morphology allowed the control of the territory. Although this was a compact occupation of the plateau, there existed some differences between the Eastern and Western parts. These differences arose from the origins of the different tribal groups: in the Eastern part the tribal groups were mainly farmers, while in the Western part lived communities that had never been sedentary and were more influenced by the Arab culture[11]. At the end of 12th century, new historical events created a new and slow change in the structure of the cities, with a transformation that went on for three centuries[12]. It's possible to describe schematically this transformation in four phases referring to the historical sources and on the system of signs that the territory analyzed suggests [fig. 3]:

1. Seasonal land settlement: the first way of settlement, before the Arab invasion, was a seasonal occupation of the territory. This



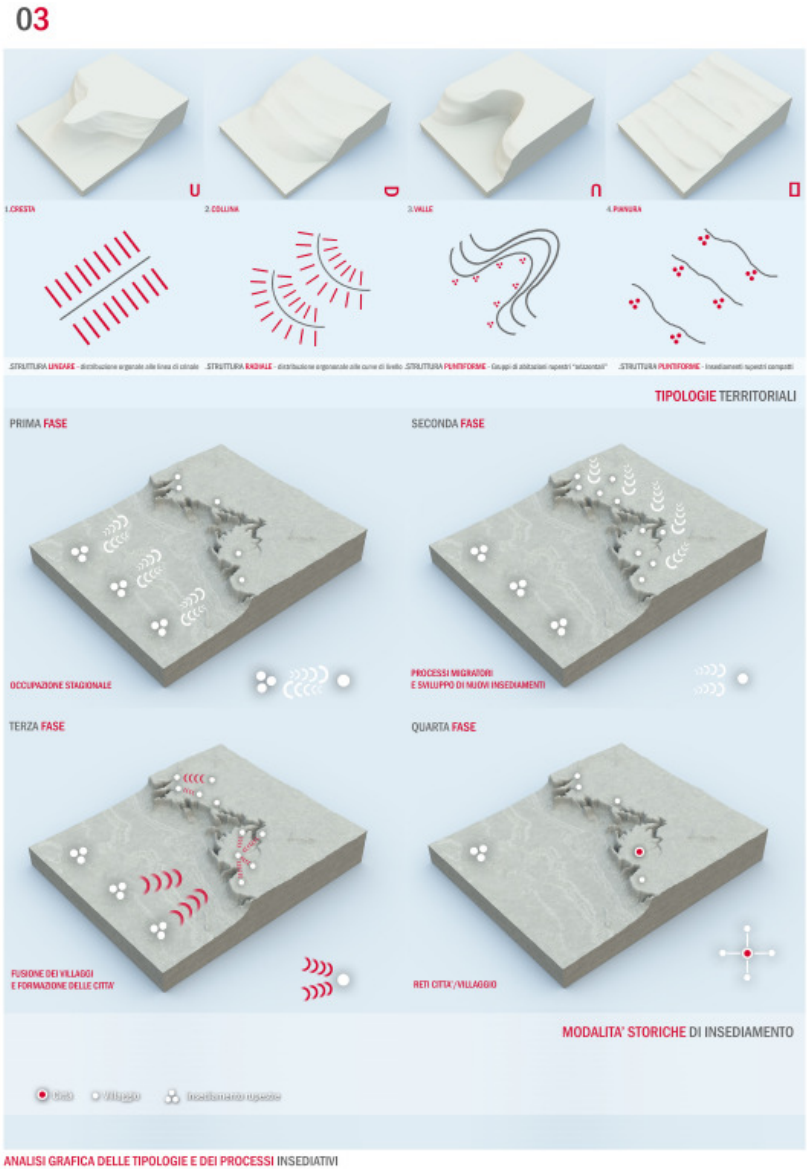
2. Morphological aspects and settlement's conditions.

ISSN 1828-5961

was characterized by a distribution of dwellings perpendicular to the borderline of the *plateau*, following a scheme in which the cave dwellings were located along the Jifarah plain and several little villages overtopped by a fortified granary along the border of Jabal. This spread structure was related to the main activity of the Berber tribes which lived and farmed in the Jifarah Plan during most of the year and stored the harvest in the fortified granary on the border of the mountain[13].

2. Migratory processes and new settlements: the violent incursions of the Arab tribes that more than once defeated the Berber opposition changed the original scheme, creating a rapid migratory process of the Berber populations. They came from the East, towards the borderline of the western Jabal and as a consequence, abandoned the cave dwellings located on the plain. The instant consequence of this change was the proliferation of several new little villages, from east to west, on the border of the plateau. For instance, according to Jean Despois, the villages of Tamzin and Iefren, on the eastern part, were originated by the migratory movements of the Berber communities coming from the east. Instead, the zone of Tamzin was occupied by the community of the region of Rojeban, near the little village of Zarizera in the west, and by other tribes that came from the south of Tunisia. New villages were built from this fragmentation as well as from the union of communities nearby. Iefren, for example, was built by tribes coming from the region of Fassato, a zone near the city of Giado[14].

3. Fusion of the villages and birth of the cities: after the gathering and the segmentation of the people in new little villages, there followed an opposite process that originated from the fusion of some villages, creating the first fortified cities. Cabao and Giado, for example, originated by this kind of mutation, and the signs are visible in the structure of several abandoned villages[15]. This process influenced the movement of some little cave villages from the Jifarah plain to



3. Historical ways of settlement.

ISSN 1828-5961

the north border of the Plateau, especially in the zones richest in water.
4. Network city/villages: the structure of these new cities, and several economic changes that encouraged the populations toward the border of the plateau, reinforced the relations of interdependency among cities and adjacent villages. This solid network defined a geographical homogeneous system, articulated on the territory through a rule of occupation always similar case by case. A design of source sharing in which, the villages, the paths, the water sources and the technical skills became part of a common vision[16].

DESCRIBING THE CHARACTERS OF THE TERRITORY

Introduction

If the understanding of human events is useful to outline the social reasons of the land's occupation, the study of formal characteristics of the territory can help us to understand the relation between sites and buildings and, consequently, between nature and culture.
The analysis of these relations is essential to describe the ways in which the territory in its morphological aspects has influenced the settlement's disposition, suggesting possibilities of occupation and defining several processes in which the modification of the physical support are expressions of the condition in which these happen.
The Jabal Nafusah Mountain is, indeed, a geographical portion in which morphological conditions are repeated along the line that separates the plain below; a land stripe that contains several anthropic elements related to the landscape through specific rules, inserted in balance in the surrounding environment. Therefore, the natural component is an element that directs the anthropic action: it is not only limited to the passive role of the physical presence, but through its sensible manifestations, enters into the relationship between nature and culture.
To understand this manifestation and outlining the rules of land occupation, we can use some different representation instruments,

4. Territorial types.

ISSN 1828-5961

diverse for scale and accuracy, but useful to describe the territorial and anthropic elements [figg. 3, 4].

Instruments and analysis criteria

A basic role for our study is related to the use of different type of cartographic maps. The study of the historical and traditional maps and the analysis of the digital elevation model from satellite and topographic survey campaigns, allowed us to put together qualitative and quantitative information useful to create new territorial and urban representations. On this scale, this study was carried out in three different phases. The first phase was oriented on the geometric and morphological aspects of the territory.

The goal has been to define the morphological quality of territory, analyzing the form, the structure and the orhography, independent of the anthropic elements, so that it has been possible to reduce the complexity of the environment, as a whole, of signs that are useful to communicate the basic attributes. To carry on this initial analysis, we have used the srtm DEM (Digital Elevation Model) elaborated with freeware GIS mapping software. The study of these supports and the use of CAD traditional instruments, allowed us to create perpendicular sections to the borderline of the plateau, outlining the different geometric aspects in every zone of the border.

After this first phase relating to a topographic study, we have compared the DEM data with a repertory of historical maps. The Italian I.G.M. (*Istituto Geografico Militare*) maps, produced in the period of the Italian occupation, have been very useful to individualize the disposition of the historic villages, the cave dwellings, the fortified granaries and the landscape transformation hardly recognizable in the modern maps. A census of the Italian maps compared with other historical sources and maps, has suggested the rules and the settlements modality peculiar of our area[17].

In the last phase of the study, our interest concentrates on the urban scale and on the formal analysis of the three case studies. Due to the absence of topographical survey in a proper scale, we have referred to the satellite images, geographically referred to the context and used it as base for the survey of our architectural examples (Ikonos and SPOT images with different resolution).

Territorial types

The comparison between cultural and natural aspects, operated through graphic and cartographic instruments, help us to carry out our analysis on the settlements' structure. These, in their totality, have originated an organism that nowadays, with the limit of modernization, reflects the ancient rules. Following the plateau from east to the west, the modern cities of Nalut, Cabao, Giado, Iefren and Garian appear like spot elements that interrupt the line of the plateau. Generally, these settlements are characterized by a process of expansion behind the old nucleus, in parallel with the construction of a modern road system that crosses the Plateau, ending in Tripoli. This point scheme can be described as a structure of principal fortified settlements, located on the border of the plateau, and other little villages located around these, that extend the physical presence of the first ones on the territory. This rule is constant along the border, even if some minor differences in housing density exist between the western (Nalut-Cabao-Giado) part and the eastern part (Iefren-Garian), due to the dissimilar geological conditions and different Arab cultural penetration.

We can try to classify the different urban episodes through the Muratori and subsequent Caniggia[18] theory at the territorial scale [figg. 3, 4]. Using a general criterion that links the morphological aspects, in their more evident signs, to the settlements displacement, we can define four conditions: Ridge, Hill, Valley and Plain:

Ridge: belonging to this category are the cities and the above-ground villages located on the extreme boundaries of the convex parts of the plateau. The urban structure generally restrained in the morphologic limits is arranged with a grid perpendicular to the lines of the ridge, which almost always define the main viability.

Hill: that part in which the plateau presents a border less strong, especially in the east part, the cities configurations is characterized by a "radial" compact structure; in this geometric matrix the location of every dwelling is perpendicular to the contour lines. In this disposition, we can find a hierarchic rule between buildings of different dimensions.

Valley: in the convex parts of the plateau, there are little groups of cave villages located following the geometry of horizontal rock face. More frequently we can find single dwellings with two or more rooms.

Plain: in the plain on front of the Jabal border, the cave dwellings are compact and structured, with groups of complex settlements, oil-mills and mosques as described by Warfalli[19]. These spaces are scattered on the Jifarah as a point system that follows rules connected to the water presence and productive possibilities of the surrounding territory.

Formal aspects of the settlements: Nalut, Cabao, Ulad Mahamud

After having defined the macroscopic criteria that relate the territory to the settlements' typology, we are able to understand the formal characteristics of the above-ground cities. We can start from the three case studies analysing the elements that in every city have a collective function. After this first phase we can focus our attention on the housing dimension looking through the construction process and the spatial articulation [figg. 5, 6].

Nalut

The old center of Nalut, an example of "ridge settlement", arose by the migratory processes, which involved the movements of many dwellings and settlements from the Jifarah plain to Jabal as described in Despois[20]. The city is located on a rock ridge 200 meters above the plain, in a privileged point to control the territory. This morphological condition influences the rules of the urban development that reflects the necessity of defence of the city. The gasr, the fortified

ISSN 1828-5961

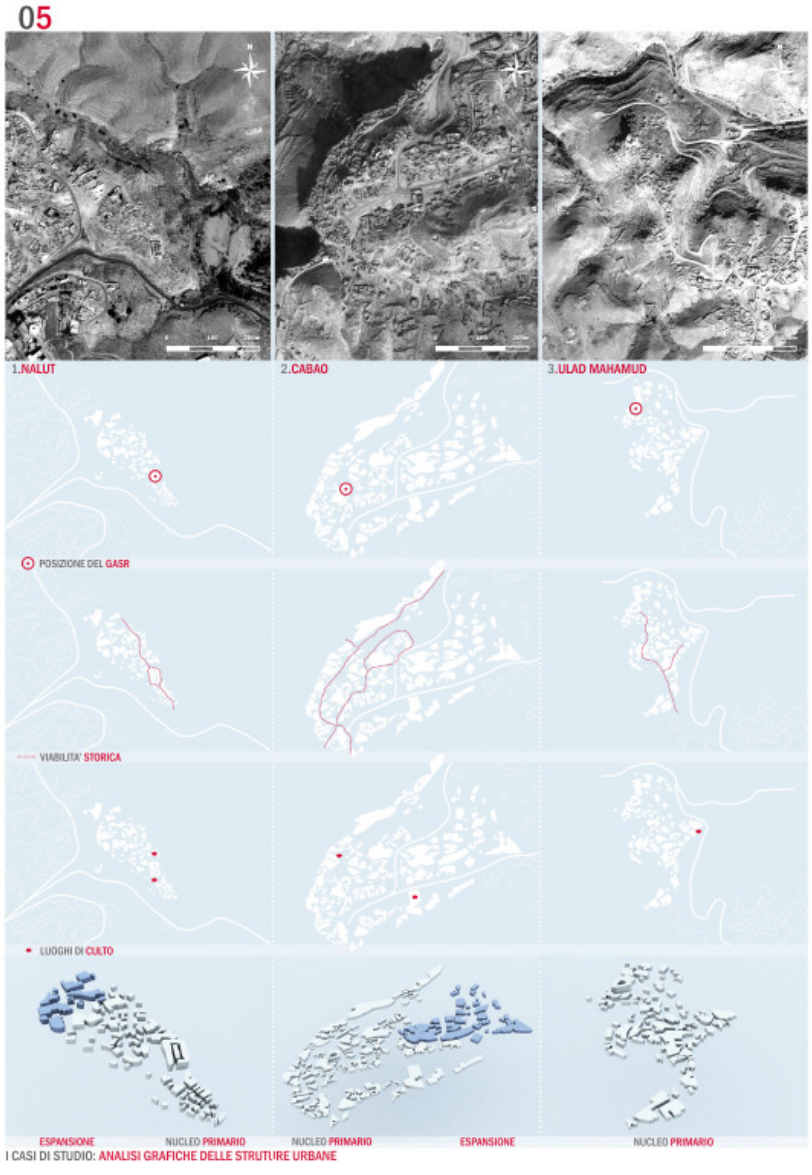
granary located in the center, shows the most important collective form. The equilibrium of the settlement is related to the position of the gasr; dwellings are in fact located in the North and in the South part of the gasr, creating a geometry signed by a road that cuts in two halves the ridge following the line of the crest. The position of the Ibadi mosques, in the center of the city, reflects the necessity to concentrate the collective functions in a single block, determining conditions that we find constantly in many settlements in the border of the plateau. In the south of this central area, the housing structure has a geometry of monocellular and bi-cellular dwellings perpendicular to the road; the north part the plain nucleus is characterized by a scattered matrix, originated by modern typological processes of fusion and transformation of the original dwellings.

Cabao

Cabao is a fortified city located on a little cliff above the plain. The formal and structural aspects represent the typical urban settlement generated by the fusion of several scattered settlements into one. Like other examples of the Nafusah Mountain, the city arose by the confluence of different tribes and human groups that joined together in a new territory to find new sources[21]. As in most of the main settlements of the plateau, the urban structure is distributed around the gasr that stands out from the urban tissue becoming the main generator element. Its position, on the highest point of the cliff, is also on the center of an urban nucleus with a structure of dwellings that follows in parallel the contour line. The historic viability follows the natural limits of the plateau in the northwest with a semicircular path and in the east part, a little road cuts the city with an orientation of south west-north east.

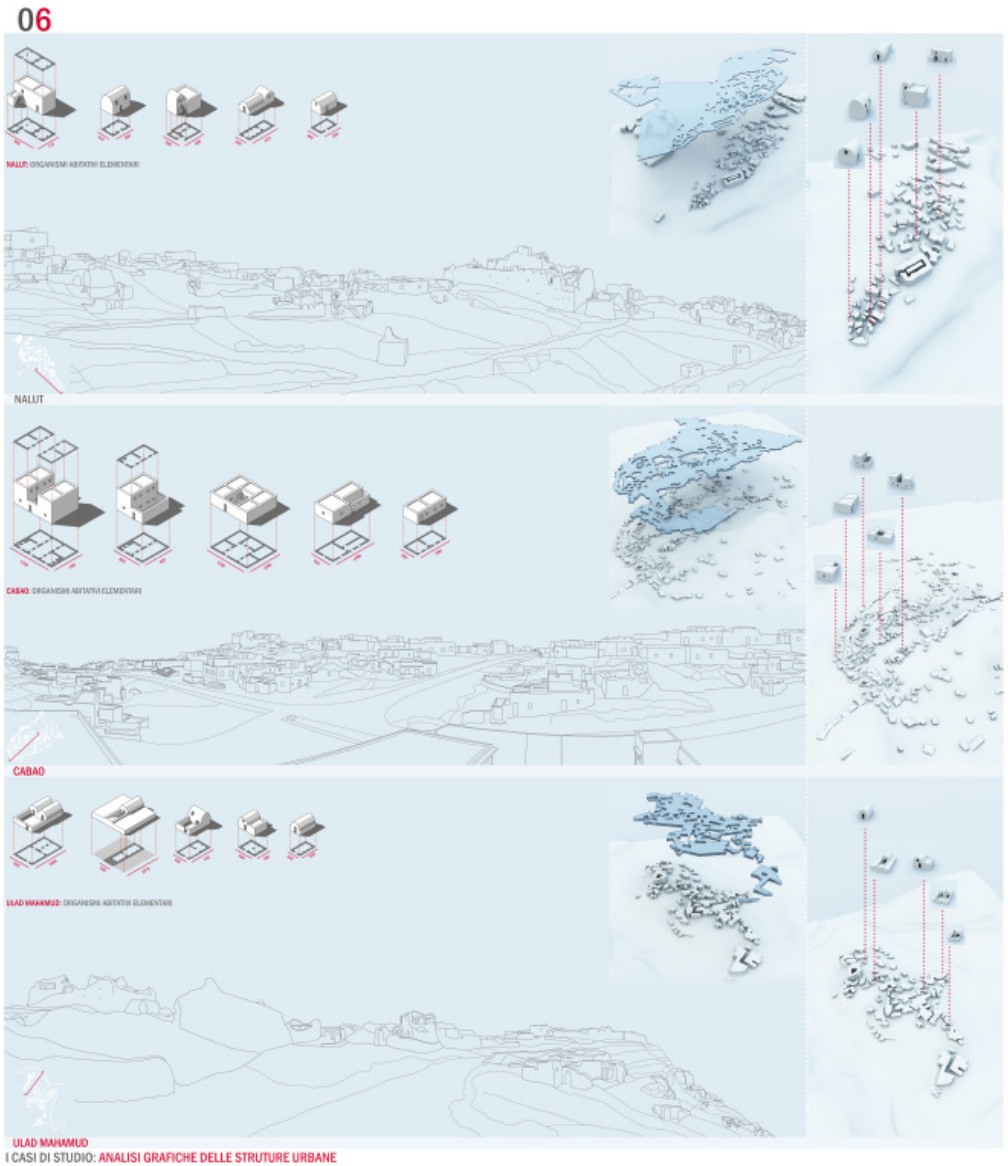
Ulad Mahamud

The old village of Ulad Mahamud is located on a flat riff, at the end of a deep wadi that crosses the Jabal from west to east for five kilometres. The morphological asset has influenced the urban form on the territory,



5. Formal aspects of the settlements: Nalut, Cabao, Ulad Mahamud.

[nella pagina seguente]
6. Formal aspects of the settlements: Nalut, Cabao, Ulad Mahamud.



conditioning the different dwelling types that are displaced and aggregated following the different slopes. The fortified granary, in the northwest part of the riff, has a triangular shape. The only mosque of the settlement is positioned in the eastern limit of the settlement. The road system crosses the cliff from north to south with a twisting shape.

DESCRIBING THE MINIMAL DWELLINGS

To analyse the minimal dwellings it has been necessary to choose and survey the most understandable and best preserved examples, reducing the complexity of the urban form to three typologies: mono-cellular units, bi-cellular units and courtyard houses. The fusions and the transformations of these three elementary types generate the complex aggregations that we can find now in our settlements, becoming the alphabet of the urban form. For the mono-cellular and bi-cellular type we use the Berber name, Taqsipt, Taddart, Tmiddilt referring to the linguistic code that is still in use in our zone of research [figg. 7, 8, 9, 10].

Mono-cellular units

The mono-cellular unit is the primitive model of the family life and, in the hierarchy of the urban organism, is the basic element for all the evolutionary processes. The definition of this unit allows us to define the transformations that have generated further basic units, showing that in a society intrinsically tied to the traditions, the building types are never totally static entities. In our area the mono-cellular unit usually consists in a quadrangular room 20 to 25 m^2 with a ratio of its two side of 1:2, the room is covered by a vault and less frequently by a plain roof. A single opening simultaneously serves to ventilate, illuminate and provide access.

Bi-cellular units

The first modification of the basic units is the transition from the mono-cellular to the bi-cellular type based on increased housing needs. Generally this transition takes place vertically, horizontally or on the slope; it involves the separation of work-related activities (stables, storage area) from dome-

ISSN 1828-5961

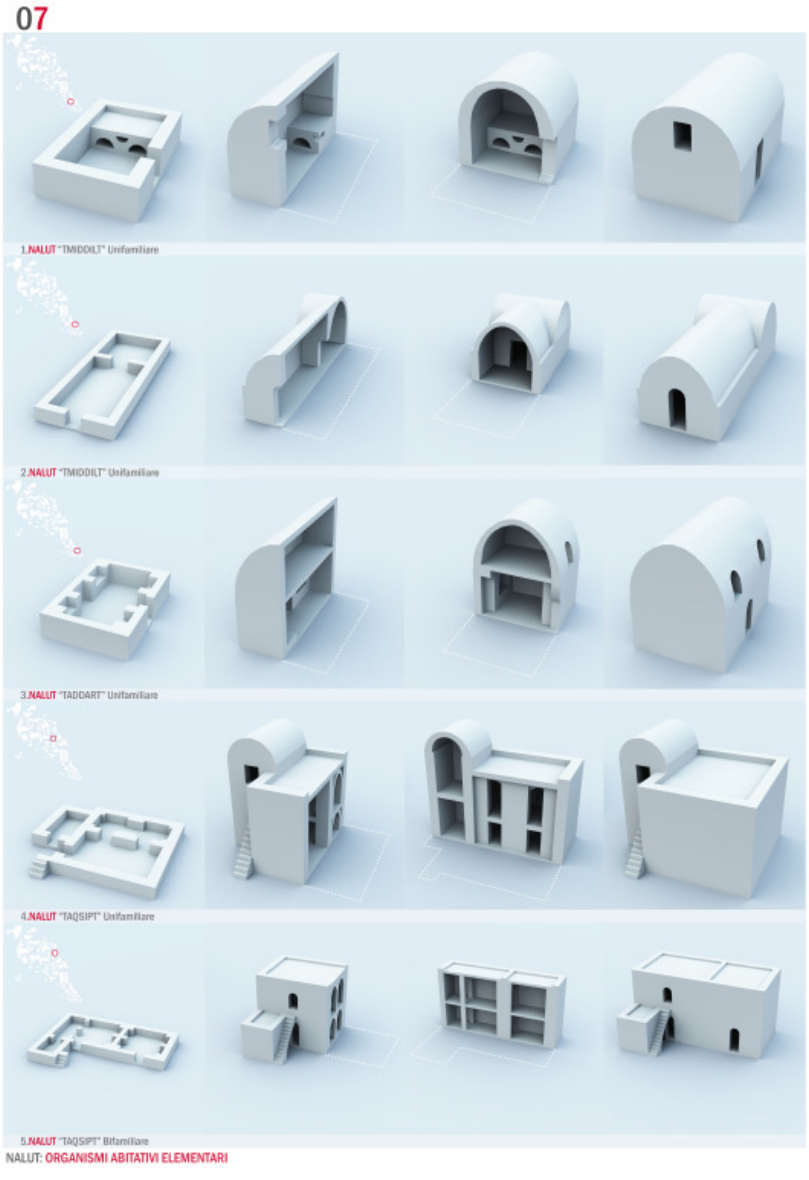
stic activities. The simplest modality in the composition of the double cell is originated by the doubling of a square room on the short side of the main vain, generally used like a little granary. After this first process follows, generally, a process of vertical duplication of the first vain with a little space vaulted or covered with a plain roof accessible by external stairs.

Courtyard houses

The great tradition of the studies on the courtyard house have been carried out in different ways by architectural historic geographers aiming to describe a typology originated by the climatic conditions of the desert territories and the need of a private space. The work of the Orientalists and Arabists celebrates the courtyard as the heart of the Islamic family, in a form that often seems frozen in time, as described in Petruccioli[22]. Rarely do these studies evaluate the formal construction and the typological components of the courtyard house, nor follow its phases of change nor evaluate its geographical differences. Studying the examples of many urban or pre-urban realities of Maghreb it's possible to understand the courtyard house is a part of a typological process that originated by the fusion of basic units around a central space. We can find some examples of this transformation in our case as processes that start when a little space in front of a mono-cellular unit is limited by a wall, defining an open courtyard. This element becomes a reference for the union of different units around a space, creating, at the end of this process, a system that is totally closed.

Examples of basic units on the case of studies. Nalut

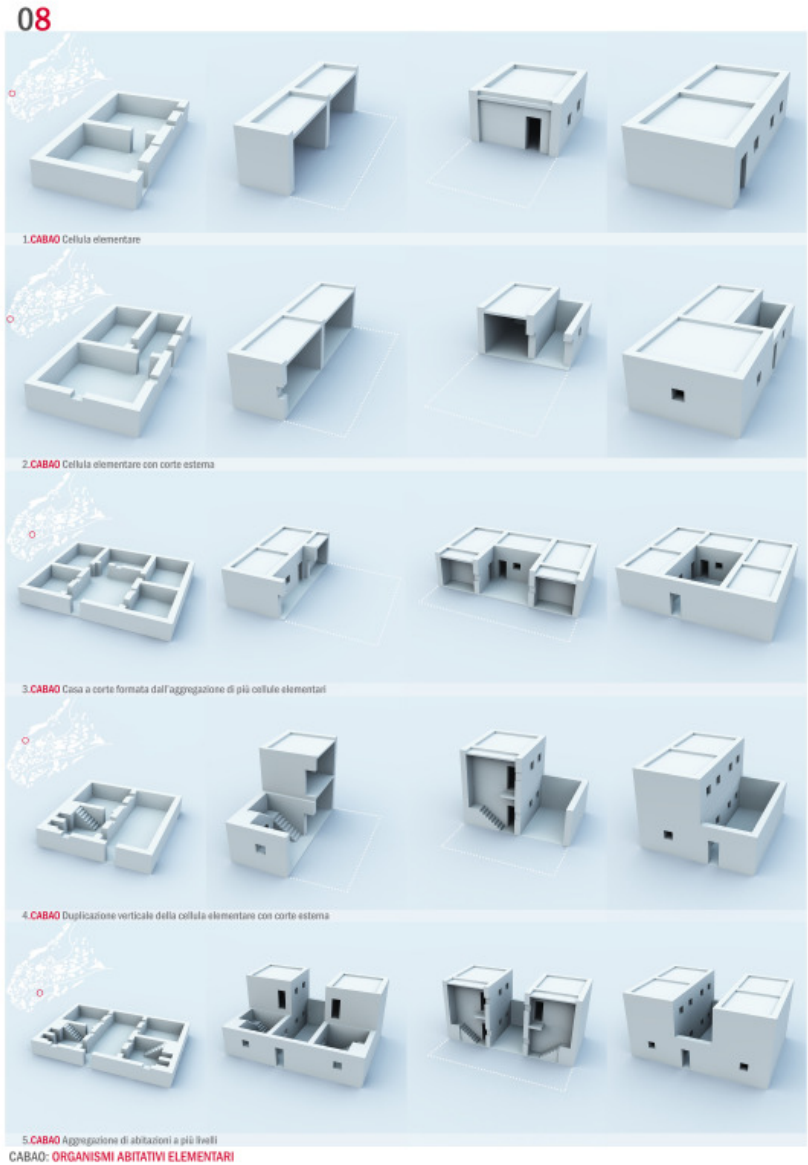
Tmiddilt: the basic unit of in the cities of Nalut is called Tmiddilt, a Berber Word that indicates a quadrangular room that defines the singular familiar dwelling and is the main module of a process of duplication and expansion. In its simplest kind, the cell has a ratio of 1:2. The position of the entrance depends on the disposition of the cell: when this one is perpendicular to the



7. Nalut: basic units.

ISSN 1828-5961

road, the entrance is located on the shorter side; when the house is parallel to the road, the entrance is located in the longer side. The roof is generally constituted by a semi-circular vault. This simple type can be associated with a little squared granary on the short side [fig. 7].
Taddart: the Berber word "taddart", in different parts of the Maghreb, indicates generally, a house for a single family. In the Jabal Nafusah, the "taddart" is a two-floor building. The first floor is the family space; the second floor, generally covered with a vault, is used to store the food. The second floor is characterized by one or two little openings in a roof accessible by external stairs. Due to a modern process of transformation, this type is rarely covered by a plain floor [fig. 7].
Taqsipt: in the city of Nalut this type, called a Taqsipt, is generally originated by the aggregation of two quadrangular cells duplicated vertically. In its characteristic form, the Taqsipt is a two-floor organism divided in three sections. The first section, the most extensive one, is the family space. The others can become alternatively, parts of the house or a work zone. Another two-floor space is used only for the storage of the food and the harvest and is located on the long side of the main cell. When the Taqsipt is used by more families, this configuration can be duplicated, generating a building that shows the most complex evolution state in the house [fig. 7].
Ulad Mahamud
Tmiddilt: as in the case of Nalut, in Ulad Mahamud, the "tmiddilt" is the basic unit too. The cell generally consists of a quadrangular room with a ratio of its two sides 1:2. A small door located on the short side simultaneously serves to ventilate, illuminate and provide access. In several cases this cell is located underground with a shape that leaves above only the vaulted part. The entrance is preceded by a ramp delimited by two lateral walls [fig. 9].
Taddart: in Ulad Mahamud, there are two types of "Taddart", and both are characterized by the duplication of the basic cell on two floors as well, as we can see in the case of



8. Cabao: basic units.

ISSN 1828-5961

Nalut. The first type consists of a square building divided by a succession of two arches supported by columns and semi-columns. One of these two cells is covered by another cell that is generally used as granary. The second type is characterized by a two-roof building with an open courtyard in front of the main side of the room. In this case, the process of duplication of the cell is vertical with a vaulted room at the second floor [fig. 9].

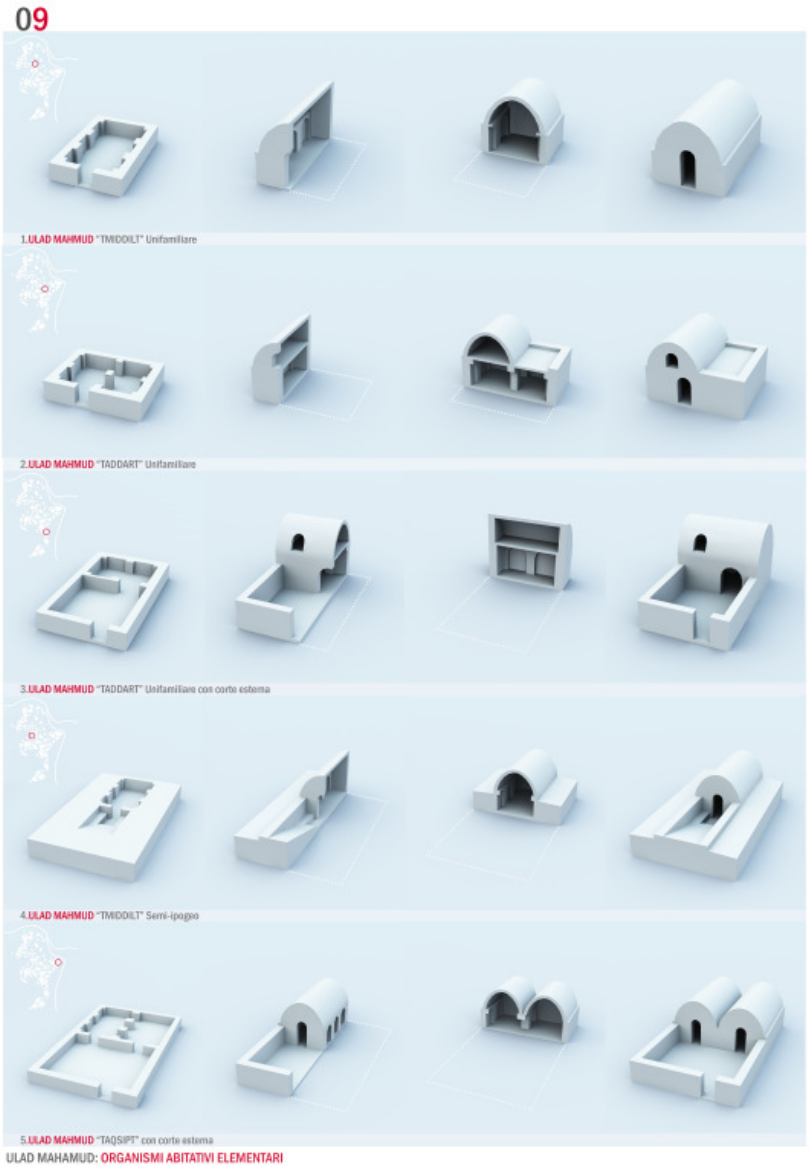
Taqsipt: this type is a bi-cellular building with a squared shape, originated by the duplication of a single cell on the longer edge. In this case, the external courtyard, equal to the area of the double cell, defines the domestic space, characterizing the building in the urban structure [fig. 9].

Cabao

In Ulad Mahamud and Nalut, understanding the building processes appears simple by the presence of unchanged modular elements, whereas in Cabao, this procedure shows complex aspects. In fact, different transformations dating back probably to the last seventy years, have modified the original cells creating a new typological sequence influenced by new domestic needs and modern material and technologies. Considering the impossibility of reading the original models, we can try to study some recent mechanisms based on two types: the new basic cells and the courtyard houses [fig. 8].

Basic cells: the basic units recognizable inside the urban tissue of Cabao are probably the results of the fusion, expansion, and reconstruction of old original models, similar in the geometrical configuration to other cases in the Jabal Nafusah. The modern basic cell is a square room covered by a plain roof.

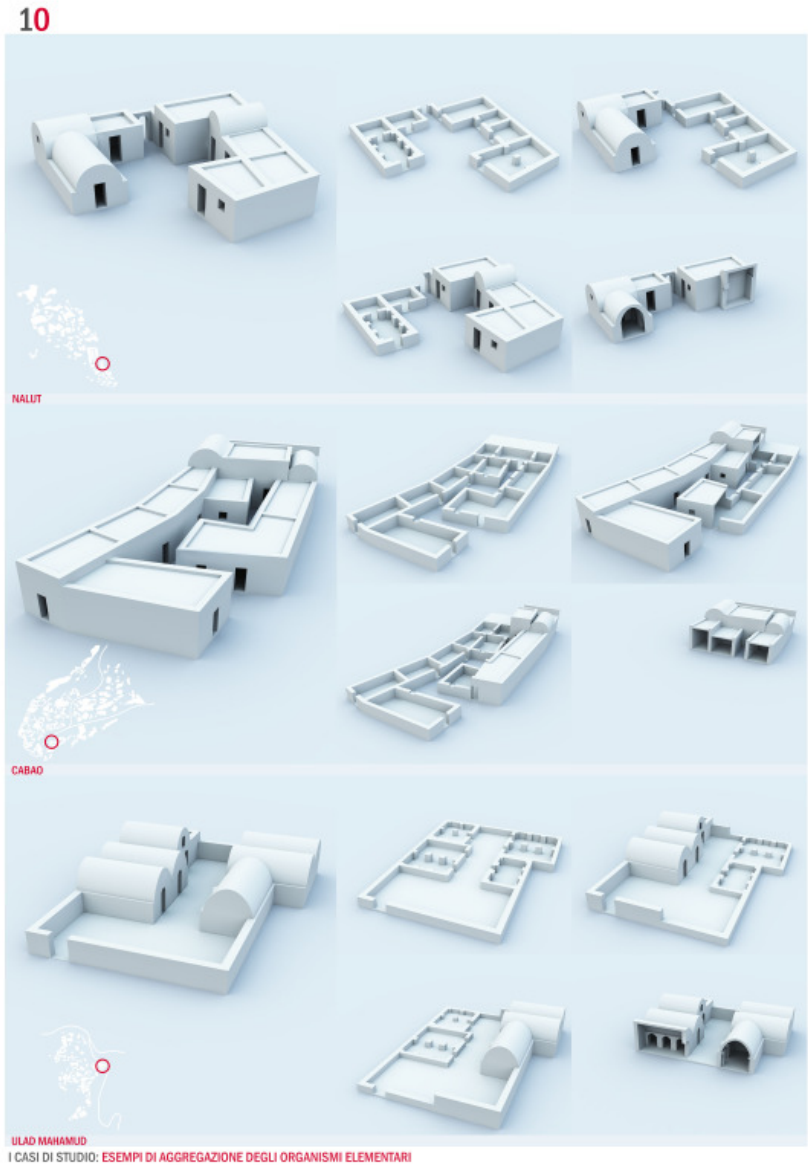
In the simplest version, the house consists of two square cells connected by a single door. The entrance is located in one of two long sides in relation to the road position. The position and number of windows on the facade is influenced by distributive reason and are in the center of every room, or connected to the specific location of the building in the urban tissue. In many cases, the position of a window can be explained with



9. Ulad Mahamud: basic units.

ISSN 1828-5961

the relation to the position of a little alley or a little square, in order to search for a more efficient climatic condition [fig. 8].
Courtyard Houses: through the analysis of the urban tissue of Cabao, it's possible to subdivide the courtyard houses in into four types related to different processes of growth. The first one is a square cell with an external rectangular courtyard that has an area of a quarter. This configuration is generally located perpendicular to the secondary road, or situated parallel to the northern border of the plateau. The second type consists of a connection of two quadrangular cells with another unit that creates an open courtyard. This building is delimited on the free side by a wall containing the main door. The windows are generally symmetrical and are opened toward the court, providing privacy and bioclimatic comfort. A third category shows many examples in which a rectangular cell is duplicated vertically. This type is characterized generally by an external courtyard that has the same area of the cell. A variation o f this two-floor type consists of three square rooms that creates a right-angle with a reduction of courtyard surface. Both of these cases have windows and doors facing the courtyard, though some little square windows can be located in the side of the facade that is in front of the road. A fourth model consists of a double enclosure of two units duplicated vertically and generally disposed in parallel. This is the most complex evolution of the house located in the zone where the topography allows its existence. As with the other cases, the openings and the windows are located towards the courtyard [fig. 8].



10. Examples of aggregation and composition.

ISSN 1828-5961

NOTE

[1] Berardi, R., *Saggi su città arabe del Mediterraneo sud-orientale*, Alinea, Firenze, 2005. p. 45.

[2] Brett, M., Fentress, E., *The Berbers*, Blackwell, Oxford, 1997. p.237.

[3] Petruccioli, A., *After amnesia: Learning from the Islamic Mediterranean Urban Fabric*, ICAR-Dep. of Civil Engineering and Architecture Polytechnic University of Bari, Bari, 2007. p.25.

[4] Despois, J., *Le Djebel Nefousa (tripolitaine), étude gèographique*, Larose Ed. Paris, 1935. p.219.

[5] Dell'Aquila, F., Fiorentino, G., Polimeni, B., Bencini, C., *Insediamenti rupestri nel Gebel Nefusa Occidentale*, in "Opera Ipogea", 2, 3-18, 2009.

[6] Camps, G., *I berberi. Dalle rive del Mediterraneo ai confini meridionali del Sahara*, Jacka Book, Milano 1997. p. 236.

[7] Berardi, R., *Saggi su città arabe del Mediterraneo sud-orientale*, Alinea, Firenze, 2005. p. 25.

[8] Sahli, O., *Nafousa. Berber Community in Western Libya*, B.A. University of Libya, 1959. p. 23.

[9] Camps, G., *I berberi. Dalle rive del Mediterraneo ai confini meridionali del Sahara*, Jacka Book, Milano 1997.

[10] Despois, J., *Types of native life in Tripolitania*, in Geographical Review, 35, 3-VII, 1945.

[11] Norris, H., *Cave Habitations and Granaries in Tripolitania and Tunisia*, in Man, 53, 1953, Royal Anthropological Institute of Great Britain and Ireland.

[12] Scarin, E., *L'insediamento umano nella Libia Occidentale*, in "Collezione Scientifica e documentaria dell'Africa Italiana", Ministero dell'Africa Italiana, 1940.

[13] Norris, H., *Cave Habitations and Granaries in Tripolitania and Tunisia*, in Man, 53, 1953, Royal Anthropological Institute of Great Britain and Ireland.

[14] Norris, H., *Cave Habitations and Granaries in Tripolitania and Tunisia*, in Man, 53, 1953, Royal Anthropological Institute of Great Britain and Ireland.

[15] Despois, J., *Le Djebel Nefousa (tripolitaine), étude gèographique*. Larose Ed. Paris, 1935. p. 299.

[16] Norris, H., *Cave Habitations and Granaries in Tripolitania and Tunisia*, in Man, 53, 1953, Royal Anthropological Institute of Great Britain and Ireland.

[17] Dell'Aquila, F., Fiorentino, G., Polimeni, B., Bencini, C., *Insediamenti rupestri nel Gebel Nefusa Occidentale*, in "Opera Ipogea", 2, 3-18, 2009.

[18] Caniggia, G., *Strutture dello spazio antropico*, Alinea, Firenze, 2007.

[19] Warfalli, M., *Some Islamic monuments in Jabal Nafusa*, University Press, London, 1981.

[20] Despois, J., *Le Djebel Nefousa (tripolitaine), étude gèographique*. Larose Ed. Paris, 1935. pp. 235-237.

[21] Bencini, C., Dell'Aquila, F., *Abitazioni rupestri a Nalut*, in "Grotte e Dintorni". 11, 2006.

[22] Petruccioli, A., *After amnesia: Learning from the Islamic Mediterranean Urban Fabric*, ICAR-Dep. of Civil Engineering and Architecture Polytechnic University of Bari, Bari, 2007. p. 73.

REFERENCES

AA VV, *Coutyard Housing. Past, Present & Future*, Taylor & Francis, New York, 2006.

Arecchi, A., *Abitare in Africa*, Mimesis, Milano, 1999.

Arecchi, A., *La casa nella roccia*, Mimesis, Milano, 1999.

Bencini, C., Dell'Aquila, F., *Abitazioni rupestri a Nalut*, in "Grotte e Dintorni". No. 11, 2006.

Bencini, C., Dell'Aquila, F., *Libia Sconosciuta: Nalut ed il Jebel Nafusah: le abitazioni rupestri dei Berberi i depositi di cereali, i granai fortificati, i frantoi e le tecniche di coltivazione secca*, in "L'Universo", n. 5, 2007.

Berardi, R., *Saggi su città arabe del Mediterraneo sud-orientale*, Alinea, Firenze, 2005.

Bianca, S., *Urban form in the Arab world. Past and present*, Thames & Hudson, London, 2000.

Bosa, D., *I Berberi: un popolo di uomini liberi*, in AFRICA, n. 1, 1999.

Brett, M., Fentress, E., *The Berbers*, Blackwell, Oxford, 1997.

Camps, G., *I berberi. Dalle rive del Mediterraneo ai confini meridionali del Sahara*, Jacka Book, Milano 1997.

Camps, G., *Les berberes, Memoire et identtite*, Edition Errance, Paris, 1987.

Caniggia, G., *Strutture dello spazio antropico*, Alinea, Firenze, 2007.

Caniggia, G., Maffei, G.L., *Lettura dell'edilizia di base*, Alinea, Firenze, 2008.

Chiaiuzzi, G., *Ricerche sui vari tipi di insediamenti trogloditici in uso sul Jebel Garian Libico*, in: "Attidell'Accademia ligure di Scienze e lettere", XXVI.

De Agostini, E., *Le popolazioni della Tripolitania*, "Governo della Tripolitania", Tripoli, 1917.

Dell'Aquila, F., Fiorentino, G., Polimeni, B., Bencini, C., *Insediamenti rupestri nel Gebel Nefusa Occidentale*, in "Opera Ipogea", 2, 3-18, 2009.

Despois, J., *Types of native life in Tripolitania*, in Geographical Review, Vol. 35, n. 3-VII, 1945.

Despois, J., *Le Djebel Nefousa (tripolitaine), étude gèographique*. Larose Ed. Paris, 1935.

Gazzola, L., *Architettura e tipologia*, Officina Edizioni, Roma, 1990.

Louis, A., Hallet, S., *Evolution d'un habitat du monde berbère du Sud tunisien*, in IBLA 144, 1979.

Merillis, A. H., *Vandals, Romans and Berbers: new perspectives on late antique North Africa*, Ashgate,2004.

De Calassanti-Motylinski, G. A., *Le Djebel Nelousa. Trascription, traduction française et notes con une Étude grammaticale*, Publications de l'École des Lettres d'Alger, Paris, 1898.

De Calassanti-Motylinski, G. A., *Le nom berbère de Dieu chez les Abadhites*, Revue Africaine, 59, 1906.

Lewicki, T., *Les subdivisions de l' Ibadiyya*, in Studia Islamica 9, 1958.

Nortbert-Schulz, C., *Architettura: presenza linguaggio e luogo*, Skira, Milano, 1996.

Norris, H., *Cave Habitations and Granaries in Tripolitania and Tunisia*, in Man Vol. 53, 1953, Published by: Royal Anthropological Institute of Great Britain and Ireland.

Oliver, P., *Dwellings, The vernacular House worldwide*, Phaidon, New York, 2003.

Petruccioli, A., *After amnesia: Learning from the Islamic Mediterranean Urban Fabric*, ICAR-Dep. of Civil Engineering and Architecture Polytechnic University of Bari, Bari, 2007.

Sahli, O., *Nafousa. Berber Community in Western Libya*, B.A. University of Libya, 1959.

Scarin, E., *Il movimento demografico della Libia orientale nel 1934*, Sansoni, Firenze, 1938.

Scarin, E., *L'insediamento umano nella Libia Occidentale*, in "Collezione Scientifica e documentaria dell'Africa Italiana", Ministero dell'Africa Italiana, 1940.

Turri, E., *Antropologia del paesaggio*, Edizioni di Comunità, Milano, 1974.

Turri, E., *Il paesaggio come teatro*, Marsilio, Milano, 1998.

Warfalli, M., *Some Islamic monuments in Jabal Nafusa*, University Press, London, 1981.