


ECO-INTEGRATIVE TERRITORIAL EVOCATION BY EMERGING NEW ARCHITECTURAL ECO-CLIMATIC STYLE

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Received 08 November 2022; accepted 04 May 2023

Abstract. In this research work, the interest is directed towards the evocation of innovative neo-architectural dynamics in the Tunisian south-east territory, through an eco-integrative approach and the production of new eco-climatic architectural styles, based on the natural and cultural wealth of the Tunisian territory, authentic and revolutionary, yet marginalized and restricted, giving rise to reactions to the question that arises:

“Is the situation of the vernacular heritage in the Tunisian south-east the direct result of a lack of vernacular heritage potential knowledge lack or of a modernist, restricted and reductive architectural production?”

A multi-scale architectural study of rustic heritage has been developed, including a morpho-metric study, the analysis of hygrothermal diagrams produced in situ as well as the measurement of temperature and humidity inside the spaces. Neo-troglodytic architecture, allows to highlight the intelligible integration of this new architectural mode in the mineral and arid desert landscape and to detect the aspect of an ecological and sustainable architecture, offering a humble, comfortable and welcoming intra-spatial atmosphere. Otherwise, in southeastern Tunisia, diagnostics have shown that rural villages, partially occupied and exploited in an anarchic manner, are subject to real dangers that threaten their survival in the Saharan territory, considered a difficult area. Direct consequences of an unsuitable development process, these historic works are perceived as static in the face of a dynamic social process, which has led to the gradual increase in their abandonment rates. Similarly, a disfigurement of the rustic landscape results from poor adaptation due to the standardized reproduction of architectural styles “in search of modernity”. The new troglodyte modes present a versatile and capacitive cultural potential. The manifestation of cultural and spatial wealth thus emerges, with the lasting potential of constituting a vector of cultural transition for the territorial development of southeastern Tunisia.

Keywords: neo-rustic concept, architectural innovation, spatial dynamics, eco-integrative approach, troglodytism evocation, territorial development.

Introduction

Troglodyte is an ancient civilization, distributed in several regions and in several territories in the world. This is a particular style of integration into the landscape, considered in particular by specific locations. The construction of troglodytism is remarkable. It is closely linked to the natural reliefs of occupied sites.

The attraction for historical-cultural landscapes is increasingly accentuated during this last decade (Toumi et al., 2017). Troglodyte has inspired a multitude of artists and master workers, especially through ancient literary

treaties and productions. Particularly, the architect Bernard Palissy is quoted, who has reproduced the rustic cave.

Various treaties were interested in troglodyte on a global scale. Bertholon and Huet (2005), in their “dug habitat: the troglodytic heritage and its catering” claim that “the troglodyte houses are more numerous than their great ignorance suggests”. The geological variety of France offers, from north to south and east to west, rocky contexts conducive to their establishment, and they are found in many departments. Cavities grouped around a well in well, invisible for the passer-by, with the pieces nestled in

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the heart of a wall dominating the landscape, these dug spaces offer extreme diversity. Their restoration requires a good knowledge of the legal, geological and architectural specificities of the troglodytic phenomenon.

Similarly, Rewerski (1991), evokes the Nabatean troglodyte kingdom of Jordan in his treaty "Pétra, the site in its environment" (Rewerski, 1991). In Turkey, Triolet and Triolet (1993), speak of troglodyte works of the Otmommane civilization in their treaty "The underground cities of Cappadocia" (Triolet & Triolet, 1993).

Long considered too complex by the ambiguity of the concept, the notion of historical landscape has now become a transversal and operational concept. The landscape is mentioned in various discourses: tourist, political, scientific, etc., to approach space with a new vision. Landscape changes have reached a speed and magnitude never observed before following the effect of urbanization, the rationalization of agriculture and the development of infrastructure. These developments brought the landscapes to a loss or alteration of their specificities, leading to a reduction in their diversity (Jacobs & Mann, 2000; Ermischer, 2003).

The troglodytic natural-cultural works are unique and constitute the imprint deposited by the civilization which generated them. They offer authentic and lasting landscapes due to their optimal integration mode and adapted to reliefs. The interior atmospheres are of an extraordinary aesthetic insofar as it is a question of sculpting the work in the mass of the relief and not of producing standardized volumes and placing them on a flat ground (Toumi et al., 2018, p. 12).

Historical-cultural landscapes generally occupy territories in difficulty (Zaïed, 2006, p. 25), and join observable phenomena in the fragile areas (Morelli & Sghaïer, 2012, p. 74). The Southeast Tunisian, area of our research, is considered to be "fragile zone".

This landscape suffers from the absence of a coherent policy and a classification, protection and enhancement regulations. The return or renewed interest in troglodyte is useful for the requalification of territorial natural-cultural heritage and its transmission to future generations. The interest in historical landscapes should not be limited to folk aspects in the name of the search for precarious socio-economic development.

The promotion of historical-cultural landscapes becomes a local, regional or even global conscience. Indeed, today, the rural vernacular architecture of fragile areas is found at the heart of different projects, linked to the conservation and enhancement of local and regional cultural and historical heritage. These projects go hand in hand with the enhancement of an alternative form of tourism, which could be described as agritourism, ecotourism or even tourism on the farm. Prigent (2016) says that "this strategy is carried, accompanied, and even encouraged by public, departmental and regional actors, which have posed different objectives for all tourist countries.

The need to reconsider or rebuild the troglodytic heritage, according to a development policy is essential. Indeed, in the book "Aménagement du territoire" Demazière (2008) spoke of "competitiveness and territorial attractiveness", which appeared in recent years in public debate, which express a Return of efficiency and an eclipse of equity among the objectives of regional planning. On the other hand, Rejeb, in his work "Landscape geomeditation" (2009) in collaboration with Donadieu, encourages landscaping as an effective and innovative solution to conciliation with the weakened space (Donadieu & Rejeb, 2009).

1. Materials and methods

1.1. Restriction of the study area to typical landscapes

The study area includes the authentic landscapes of the governorates of Gabes, Medenine and Tataouine in south-eastern Tunisia. Given that southern Tunisia is rich in heritage heritage, typical landscapes are targeted, chosen according to the proximity to large cities (airports, stations, ports, etc.), the criterion of representation of the diversified typologies of vernacular works that can be reclassified, the state of the remains to be studied and their media coverage. The Berber villages selected are: Oued elKhil, Governorate of Gabes; Old Matmata, Governorate of Gabes; KsarMetameur, Governorate of Medenine. The villages chosen occupy natural landscapes with reliefs varying from plains to mountains of more than 70 m in altitude of the Dhaher and Djefara zone presenting differentiated vernacular typologies.

1.2. Methodology

This work has three major components: (1) the diagnosis of the potential of eco-integrative architecture activities (workshops, training workshops, etc.) in relation to the socio-cultural environment; (2) the study of the multipurpose potential of vernacular modes of occupation of the differentiated landscape, (3) the characterization of the spatial and social dynamics resulting from eco-integrative architecture as well as the media coverage and the perception of a communicational approach for the integration in the territorial development process in south-eastern Tunisia. The approach used is consolidated by the answers of the respondents in the field to understand their way of understanding the heritage and cultural wealth of the territory and its evolution with the succession of generations.

2. Troglodytic heritage potential apprehension

2.1. Contextualities of architectural cultural landscapes in Tunisia

In Tunisia, the natural-cultural heritage has largely been marked by French colonization. Indeed, the contextual study of the heritage, troglodytic in particular, shows

globally three main periods: precolonial, colonial and postcolonial. Before the French colonies settled in Tunisia in 1881, the communities living in the south-east of Tunisia led a nomadic life, seeking to survive the harsh natural conditions and the repetitive invasions of invaders (Romans and Hilalians).

In this context, the populations seeking shelter created refuges in the rock (terrestrial and mountain), thus producing troglodytic architectural spaces and gradually, the tribes began to settle. During the colonial period, the social system mutates towards an aspect of diversity and little by little the populations of south-eastern Tunisia began to leave their living spaces perched on the mountains and those dug in the ground, after discovering a new way of life. of life from a new culture. After independence, the new republic founded the concept of new villages to replace the old troglodytic villages deemed ill-suited to contemporary life (the new Matmata, the new Guermessa, the new Zraoua, etc.) with architectural works that want to be modernist and offering a way of life more compatible with the new postcolonial culture influenced by the French protectorate. As a result, the troglodytic heritage has been gradually abandoned and the old Berber villages have been marginalized and deserted. The need to reconsider or rebuild the troglodytic heritage, following a planning policy is essential. Indeed, in the book “Aménagement du territoire” by Demazière (2008) spoke of “competitiveness and territorial attractiveness”, which have appeared in recent years in public debate, which express a return of efficiency and an eclipse of equity among the objectives of regional planning. On the other hand, Rejeb, in his work “Géomédiation paysagiste” (2009) in collaboration with Donadieu, encourages landscaping as an effective and innovative solution for reconciling with weakened space (Donadieu & Rejeb, 2009).

2.2. Characterization of the current troglodytism socio-cultural situation in southern Tunisia

The in situ diagnosis in the Tunisian south-east has made it possible to affirm that, generally, the rustic villages are well served by good quality road networks (coated roads), in order to maintain tourist visits of a restricted seasonal nature. Despite the short distances that separate the troglodytic villages and their proximity to the capitals of the governorates of Gabès, Tataouine and Médenine, the development and exploitation programs are almost reductive and citizen intervention remains very limited and insignificant.

An Architectural model is a multi-component system. It is one of the various possible responses to a set of needs and uses. These needs are predefined according to practices (traditions and mores), the standard of living and the environment that will host the project in question (geography, bioclimate, accessibility, availability of materials, availability of equipment, etc.). Vernacular architecture constantly reminds us that this form of appropriation of

space is an inseparable part of the landscape. Where the landscape is omnipresent, thus encouraging us to bring out all the landscape rules, which gave rise to this way of apprehending space and integrating into the site, so as to have created a authentic work of occupying the territory. It is about Living in the landscape: Creation of an architectural landscape, or architecture, landscape, par excellence.

In addition to eco-architecture in southern Tunisia, this research aims to evoke new tourist activities that can boost the territorial transition in southern Tunisia. Eco-integrative architecture is based on the implementation, in situ, of national and international programs, thematic workshops, workshops, training stays for, on the one hand, the design and construction of new architectural styles. ecological, sustainable, with optimal integration in the environment and in the occupied landscape, in a contemporary setting and on the other hand, to propose redevelopment and requalifications of the troglodytic remains keeping a resilient state. In addition, this typology of architecture in southern Tunisia allows visitors, simple consumers, to become consumer-actors and to satisfy their ambitions to handle innovative materials and build their living environments, meeting qualitative, eco-climatic requirements and techniques, by themselves.

In support of the above, the socio-economic survey (Figure 1) carried out in southeastern Tunisia with local actors, tourists and visitors at different scales (national, regional, etc.) showed that most respondents opt for the valuation material and immaterial cultural heritage in southern Tunisia despite the fact that they do not really know the characteristics of the potential (Architectural, landscape, historical, eco-climatic, etc.) of this revolutionary mode. This fact is as well palpable at the level of the foreigners (tourists) as at the level of the citizens of the Tunisian south-east, especially on the part of the new generations, due to the non-transmission of the historical wealth from generation to generation and to the absence of approaches to immortalization and consolidation of cultural transmissibility.

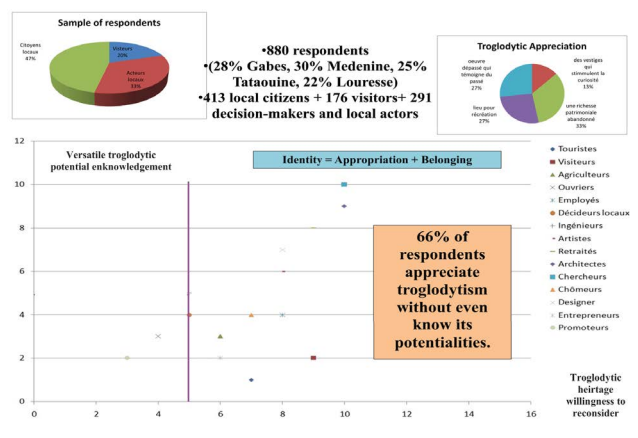


Figure 1. Summary of data from the southern Tunisian survey (Toumi, 2018)

2.3. Apprehension of the versatile potential of the neo-vernacular mode in southeastern Tunisia

Vernacular architecture has various specificities, namely landscape, architectural and cultural. Indeed, the vernacular troglodytic heritage is based on a sustainable and stable optimal integration party with the occupied natural relief (Toumi, 2019b). It is a question of sculpting the existing natural mass without structural or constructive constraint. The relief constitutes the support and the frame at the same time (Toumi, 2019b). In southeastern Tunisia, there is a regression in the spatial occupation of Berber villages. Despite this regression, the in situ diagnosis revealed that only 10% of the rustic troglodytic works are in ruins while 90% are abandoned, which expresses a stability of the vernacular works despite their abandonment. In addition, the vernacular concept shows an authentic landscape harmony. From the above, the vernacular landscape architectural style forms the imprint that reflects the cultural identity of the people of the southeast. The practical challenge of this research is to enhance the multipurpose potential of historic cultural landscapes, through a landscape mediation approach. This aims to provide decision support elements for the requalification of the vernacular potential of southeastern Tunisia (Figure 2). The inventory of mountain troglodytic works in southeastern Tunisia revealed an architectural and landscape richness of old Berber villages and a morphological and functional differentiation. In addition, operations to restore and enhance rustic vernacular works have proven to be limited and absent in most cases (limited craft and tourist activities). The visit of all the mountain troglodytic villages in the south-east of Tunisia revealed a low permanent occupation of the old Berber villages (limited seasonal activities dedicated to tourism). The populations tend to occupy the new villages in the plain. The troglodytic heritage is a production of the Amazigh civilization to occupy the natural landscape. Therefore, the study of this heritage in the territory of southeastern Tunisia encompasses the natural framework and the cultural anthropogenic framework.

Territorial potential can be broken down into three dimensions: landscape, architecture and heritage. Each dimension of potentiality is divided into components, themselves divided into markers, which present the identifiable elements on the ground. The sum of each of the dimensions of potentiality will ultimately correspond to

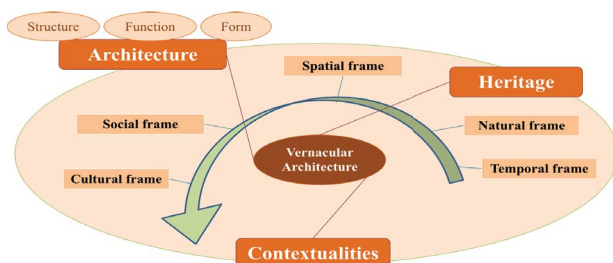


Figure 2. Different components of the troglodytic territory (Toumi, 2019b)

vernacular potentiality. The vernacular concept of landscape occupation is characterized by optimal integration into the occupied natural relief. In the Tunisian south-east, there are mainly three troglodytic typologies according to the forms of different reliefs (full of Djefara, Mounds and mountains). The village of Old Matmata, which comes under the governorate of Gabès, as well as the village of Beni Khdeche, which comes under the governorate of Médenine, occupy mounds and present a troglodytic typology based on a mixed vertical and horizontal excavation (underground troglodytics). The villages of old Guermessa, Chenini, Douiret, under the governorate of Tataouine, are integrated into the mountains and present a troglodytic typology based on horizontal digging (troglodytic climbers).

The troglodytic underground typologies identified can be summarized at the level of the following synthetic section (Figure 3).

The landscape analysis and diagnosis, of troglodytic works, by means of a morpho-functional differentiation, due to the difference in culture as well as to the nature of the site occupied (tuffeau rock and falun rock), globally show a homology with troglodytic works, from the Amazigh culture in Tunisia.

Within the scope of a comprehensive and in-depth architectural study, many various types of troglodytic houses are visited to conduct a set of measurements that were influenced by conducting a taxonomic study of the dense and diverse troglodytic product after a total inventory of the troglodytic Amazigh villages in the southeastern Tunisian region and inventing a special mechanism to measure the dimensions of these unusual architectural products.

Field visits in the southeast of Tunisia also enabled us to conduct talks and numerous interviews with the indigenous people and with the foreign tourists present on the spot, who at times proved to be familiar with the characteristics of the troglodytic style more than the new generations in the southeast of Tunisia.

The combination of field data and analysis of the results of conversations with residents and others enabled us to form a clearer idea of the troglodytic pattern by studying its heritage and analyzing its identity. It turns out that these excavated houses reflect a deep knowledge and skill of the

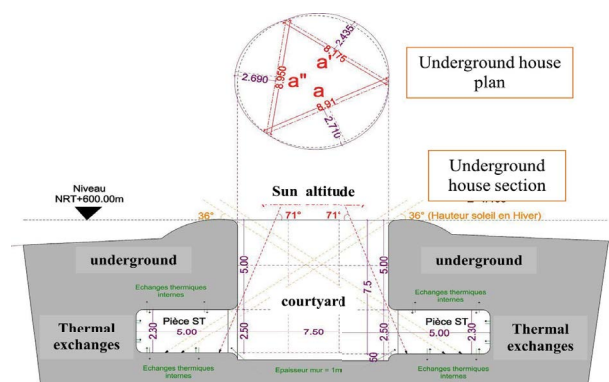


Figure 3. Synthetic draw explaining underground troglodytic house design based parameters (Toumi, 2020)

Berbers who carefully dug them into the rocks using traditional techniques (the takoura), based on natural data and in an ideal respect for the environment. The dimensions and depth of the s/court yard pony and the troglodytic chambers and the way they are distributed around the plow and the way they are located in the hill or in the inhabited mountain depend on the solar path and on the dominant winds and precipitations in that area, and this troglodytic product that being study continuously is a successful result and balanced for the various experiences carried out by the Berbers in order to understand their medium of life.

In the study of each architectural product, it is indispensable to study the development of two basic factors in the health and well-being of the users of the place, namely, the perceptible temperatures and humidity levels (the amount of water in the air). Evaluating the architectural space by comparing the evolution of its temperature and humidity with the agreed upon defined sanitary comfort zone. On this basis, an approach was devised to combine the factors of temperature and humidity in one equation to facilitate the assessment of the architectural place by extracting a unified graphic curve, given that these two factors are interrelated, it is not correct to study one without the other, otherwise the significance will be incomplete and erroneous. This factor is the hygrothermal value (HTV).

In a field experiment to compare the quality of the internal atmosphere of the excavation with the quality of the internal atmosphere of a non-excavated building in the same area at the same time, taking into account that the places are naturally air-conditioned only and uninhabited to avoid inaccuracies in the measurements of temperature and humidity, over the 12 months and four seasons, Identical electronic tools was placed to record for each specific period of time temperature and humidity inside these different architectural places.

Finally, after 12 months, temperature and humidity data downloaded from the measurement tools was entered into an Excel file where they will be combined into the exact equation to obtain the graphical curves of the evolution of the hygrothermal value for the three different geometric places over the course of four seasons compared to the specified thermal wet comfort zone, as shown on the second graph (Figure 4).

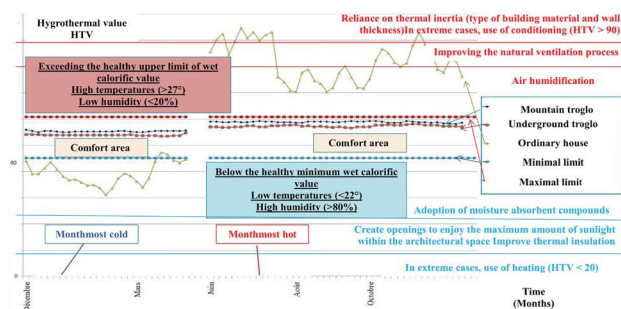


Figure 4. Synthetic diagram comparing hygrothermal value variations in troglo houses and ordinary houses in south-east of Tunisia and architectural evaluating internal comfort general model (Toumi, 2020)

It's clearly noticed that the graphs of the pit house (dark red on the graph, Figure 4) during the coldest month and during the hottest month of the year are regular and symmetrical within the specified thermal-humid comfort zone. It's also noticed that the same regularity for the hygrothermal value curve of the mountain troglodytic house (in blue on the drawing) with a slight difference in the resulting value (the hygrothermal value is almost constant for the two troglodytic houses). From here, it is concluded that there is a natural temperature and humidity adjustment mechanism in the troglodytic houses. While it's noted that the graph of the wet heat value of the non-excavated house (in green on the figure) is irregular and exceeds the limits of the wet thermal comfort zone, especially in the hottest month and in the coldest month of the year. It can be asserted with certainty that the atmosphere of the interior spaces of the troglodytic homes, whether mountainous or underground, guarantees the health and quality of life of the inhabitants more than the ordinary buildings, and here the unique troglodytic ecological characteristics emerge.

Troglodytic architecture is an ecological product means that it is designed based on natural data and a good understanding of it to exploit it as a strength and not as a difficulty and a hindrance to architectural production a link is done between the dimensions of the excavated houses and the solar path to obtain the largest possible amount of sunlight inside the house with the longest duration, by choosing the appropriate location (Figure 5).

Here another factor is mentioned that was adopted in how to choose the way and direction of the location of the Berber troglo villages in the desert center, which is the wind. In order to understand this Amazigh choice, Tools for analyzing the direction and changes of the winds is used, the dominant ones in particular, is the wind flower (Figure 6).

The field visits to the majority of villages in the south-east of Tunisia allow us to understand the relationship established over time between the inhabitants of the new cities and their tangible and immaterial heritage. strong implicit popular demand for valuing the troglo architectural heritage and integrating it into the regional development

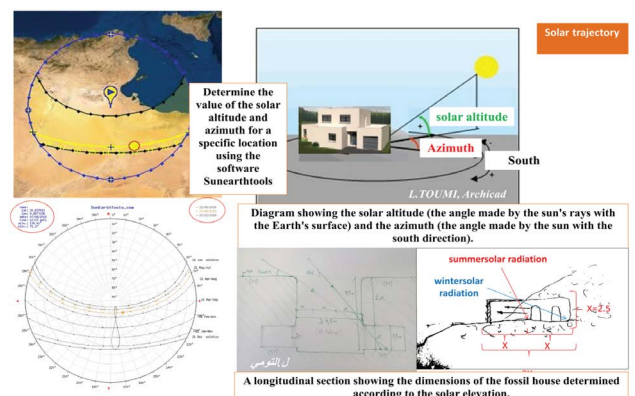


Figure 5. Analyzing the ecological criteria and how to adopt them in the architectural design: Solar trajectory (Toumi, 2020)

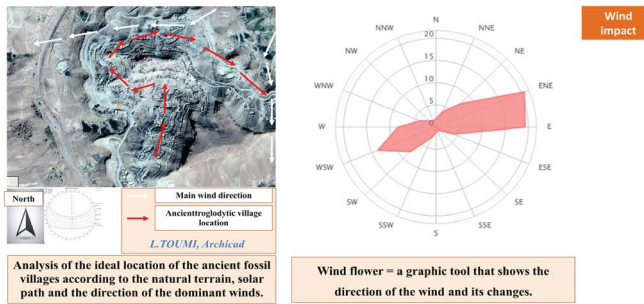


Figure 6. Analyzing the ecological criteria and how to adopt them in the architectural design: Wind impact (Toumi, 2020)

system is noticed. On the other hand, the emergence of initiatives on the part of local citizens to search for a new architectural product is an important fact. These construction initiatives derives its resources and components from the fossil architectural style using local materials and raw materials (ecodom of sand and mud, a thatched guest house, etc.). This indicates the failure of the new modern cities to meet the needs of the residents, and that reconsidering the fossil style with contemporary modifications is the guarantee to establish an appropriate quality of life and appropriate with the cultural, social and environmental environment.

3. Eco-integrative architectural approach for the territorial promotion in the south-east of Tunisia

Planning presupposes the presence of a territory, of a community expressed by a power or an authority that directs the action of transformation and ensures the necessary arbitration. The Council of Europe defines spatial planning as follows: "Spatial planning is the spatial expression of the economic, social, cultural and ecological policies of any society. It is at the same time a scientific discipline, an administrative technique and a policy conceived as an interdisciplinary and global approach tending to a balanced development of the regions and to the physical organization of space according to a guiding concept". This definition emphasizes the spatial dimension of development policy in all its aspects. On the other hand, it emphasizes the interdisciplinary approach to the planning process, the contribution of many disciplines at once. This definition highlights the importance of the social dimension in spatial planning, which then appears as a requirement for spatial justice: the correction of disparities. In Tunisia, heritage is no longer considered, today, only as a cultural value but also as a means of progress and development. Saving historical cores steeped in culture, steeped in history, the collective memory of an entire people, integrating them into a contemporary world, in full technological change, is not an easy task. According to the in situ analyzes and the contact of the various respondents in the Tunisian south-east, the rustic vernacular architectural concept has proven remarkable architectural, landscape and heritage performance.

Our approach is to meet the needs of requalification and exploitation of the troglodytic heritage in southern Tunisia and on the other hand, the needs to design, democratize and produce new eco-climatic architectural modes.

3.1. Production of neo-vernacular eco-climatic architectural concepts production

The search for a new architectural style draws its resources and its conceptual party, from the rustic vernacular mode, with local ecological materials is an innovative approach (ecodome/superadobe in clay at Oued elkhil, straw guest house, Governorate of Tataouine) (Figure 7). Local citizens' initiatives to create an innovative conceptual aspect, drawing its resources from troglodytism, subject to a few changes, clearly demonstrate the will of the population to enhance the vernacular potential, given its performance and its adaptation to the constraints of the arid environment.

The eco-dome, an architectural work of approximately 27 square meters, is a modernist architectural response referring to the rustic troglodytic concepts of southeastern Tunisia. This work is based on the use of local materials and has an organic morphology reminiscent of the shapes of ksours. The eco-dome includes a central room 4.50 m high, a bedroom and a bathroom. The central room includes a kitchen, a relaxation area and possibly a dining area.

The light openings are oriented due west to avoid sandstorms. A dome of light had been planned initially but abandoned in order to avoid the greenhouse effect, because in summer the temperature in southern Tunisia is around 50 degrees in the shade. A mezzanine had also been considered but the scarcity of wood made it impossible to create a second level. The red clay used comes from a local brickyard, the sand and lime are materials from the region. A cement mixer is used for this site which is not customary in the region, all masonry work is done mainly by hand (Figures 8, 9, 10, 11, 12, 13, 14, 15 and 16).



Figure 7. The eco-dom: Local attempts at design with vernacular bioclimatic references, Oued El Khil, Governorate of Tataouine (Toumi, 2018)

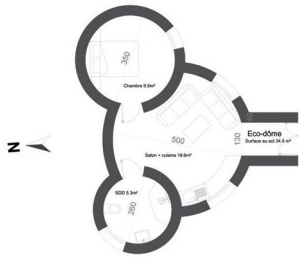


Figure 8. Eco-dome plan in Oued El Khil, Tataouine (Toumi, 2019a)

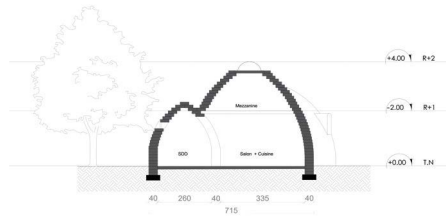


Figure 9. Eco-dome cross-section in Oued El Khil, Tataouine (Toumi, 2019a)



Figure 10. Earth test, 3 tests: 1/3 sand the rest in clay as well as lime (grey lime from locally). 50/50 clay sand/ 100% clay (Toumi, 2019c)



Figure 11. A few tons of red clay from a local brickyard and gray sand are available as well as everything needed to tackle the site (source: Toumi, 2019c)



Figure 12. After drying, the mixture of 1/3 sand and the rest clay and lime is extremely resistant. Volume of 4 shovels of lime, 6 shovels of sand, 12 shovels of clay as well as water (Toumi, 2019c)



Figure 13. Tracing the dome on the ground (Toumi, 2019c)



Figure 14. Digging of trenches (Toumi, 2019c)



Figure 15. Leveling the trench with a drywall's spirit level (Toumi, 2019c)

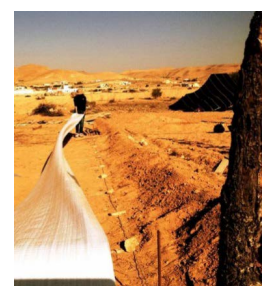


Figure 16. With the help of old branches dispenser for polypropylene was made (Toumi, 2019c)

The earth/air mixture of the neo-vernacular concept has reliable thermal and hygrometric properties to give a high-performance architectural space whose envelope has significant thermal inertia as well as optimal natural ventilation properties insofar as the earthen walls breathe. and offer humble and comfortable interior ambiances.

It is clear to note that the architectural aspects, trying to create, in synergy with the rustic vernacular vestiges, a new innovative modernist style, tend to introduce standardized materials and products, therefore, ill-suited to the vernacular rustic environments. It is therefore more appropriate to create new modernist images, based on local materials and personalized local products. It is a question of valuing the advantages of the rustic vernacular mode and of going beyond the limiting constraints. These local efforts, although limited, make it possible to affirm the will

of the citizens to reconsider and enhance their vernacular heritage and to draw on its key concepts, which proves to be effective with regard to the constraints of the sites. It is a question of founding the beginnings of a participative citizen approach, which amplifies a synergy between local actors and citizens in the projects of the territory.

3.2. Development of the neo-rustic architectural style

Following a study of topographic plans, maps, aerial views (topography and cadastre office) of urban development plans (PAU), sketches, manuscripts of technical documents and surveys carried out in situ following innovative and appropriate methods, designed for the vernacular works at the level of the vernacular villages in southeastern Tunisia, with the help of modern technics

of geographic information processing, generation of volumes and textures and photo-realistic visualization (BIM, 3Ds, Lumion, etc.), the digital models production of the south-eastern Tunisia reliefs is preceded by integrating vernacular works with different architectural typologies and by applying the local materials used (stone, trunks of palm trees, clay etc.). This graphic work makes it possible to create a paradigm that is easier to study and handle in order to study the concept of vernacular landscape integration and to detect the nature of the articulation between architecture and natural landscape. On the other hand, the creation of a graphic vernacular base allows the immortalization of the vernacular culture as well as the transmission of its original image of yesteryear to future generations.

The participation of qualified actors in territorial development through the enhancement of heritage resources and the creation of a new modernist, neo-rustic image of abandoned vernacular remains, adapted to the new way of life, constitute the foundations of a lever for sustainable territorial development.

The supports produced and distributed on the vernacular work (postcards, leaflets, guides, descriptive posters and posters) are dominated by photographs of the site and consist of long captions written in a nostalgic discourse. This is fueled by memories marking the collective memory of populations: images of community conviviality, feelings of traditional ceremonies, details of the organization of social structures, the atmosphere of popular markets and the enchantment of religious rituals. The privileged angles in the image capture relate to buildings, handicrafts, architectural motifs and decorations that remain authentic. The designers did not allow any presence of elements of modernity and no distorting transformations are visible. The documentation produced is imbued with two dominant ideas: the authenticity of places and the feeling of nostalgia. Respondents explain that their support for the defense of the heritage of the ksar comes after having acquired and developed knowledge of the history of the site and by becoming aware of the need to preserve it.

Discussion

The rustic troglo heritage have several points in common, including the orientation (generally southeast) and the use of local materials in the construction. This house also demonstrates a skilful bioclimatic design. The architectural analysis of the troglodytic architecture of southeastern Tunisia has shown that the rural architectural culture appears, in many cases, of marginalised situation. The disfiguration of the authentic landscape, by the reproduction of the same standard model of architecture, which aims to be modernist, on the whole, stigmatizes the place of buildings in the landscapes, while participating in their trivialization, erasing the characteristic features of each landscape entity. The modifications, undertaken in the forms and the architectural quality, contribute to the transformation of the sil-

houette, but also to the trivialization of the rural landscape and its performance. The trivialization of troglo heritage is also accentuated by the multiplication of architectural, exogenous and stereotyped models. Thus, any intervention on this rural heritage must strive to respect the troglodytic and landscape architectural value of the building, as well as the functional system of the rustic work, so as to contribute to its durability and to maintain or improve the comfort of the building, for its occupants. These atypical, well-typed, well-integrated architectural works are part of cultural heritage and constitute the troglodytic heritage of south-eastern Tunisia. Keeping them alive, by respecting them, is a duty. Any inappropriate or brutal intervention is a loss of their heritage value, which weakens and trivializes them. The troglodyte architecture demonstrates bioclimatic hygrothermal architectural properties. The thermal and hygrometric measurements, made on the models of troglodyte architectures of old Matmata and old Tamazret in comparison with a standard non-troglodyte architectural model, show that the interior temperature, during the summer, does not exceed 27 °C. This is the summer comfort temperature, referring to the thermal regulations RT 2012, France and, with reference to the ombrothermic diagram of B. Giovani. The thermal characteristics of the materials used (conductivity, density, capacity, opacity, porosity), the compactness, the organic architectural vocabulary and the optimal orientation of the troglodyte works and that of the openings (according to the solar geometry and the direction of the prevailing wind), played a major role in achieving these results. The multi-scale analysis, consolidated by the data of the surveys, carried out in the Tunisian south-east, demonstrated a landscape, architectural and heritage performance, superior, of the troglodyte works, compared to the standard architectural works. Hypothesis that the troglodytic natural-cultural heritage, perceived in a reductive folkloric framework, is endowed with other invisible, intrinsic aspects, constituting an authentic fabrication produced by ancient society respecting bioclimatic scales, is well verified. This heritage shows a versatile potential for landscape and planning requalification, through a reconciliation between modernity and tradition, is therefore verified. Thus, by proposing a scenario of reading and recognition of the troglodytic natural-cultural heritage, Understand and interpretate the troglodytic works, in a scientific context, will go beyond the reductive landscape gimmick of the versatile troglodytic potential. It is a repository of differential reading of historical landscapes, constituting a decision-making tool for planners and designers. In this case, the Berber villages studied are based on the same concept of landscape integration at the level of a rough relief, with rather difficult accessibility. These strategies apply to territories that have integration constraints in globalization because of their difficulties in being competitive in a globalized world with increasingly standardized productions. The vernacular heritage presented itself as static in the face of dynamic social evolution. Therefore, the modernization of historical vernacular works is required in order

to adapt rustic spaces to the new requirements and needs of contemporary life. The optimal multiscale analysis and renewal management of the vernacular heritage within the framework of an awareness-raising, communication and exploitation approach will make it possible to disseminate the tangible and intangible vernacular heritage as well as to encourage the exploitation of their versatile potential and to draw profile from it with regard to contemporary architectural studies aimed at the eco-climatic approach. Insofar as heritage is a territorial wealth, refocusing the consideration of the vernacular heritage in the dynamics of socio-economic evocation allows the integration of this heritage in the process of territorial development and, on the other hand, to promote interculturality. In particular, contemporary neo-rustic troglo requalification makes it possible to generate spatial dynamics resulting in a dynamic and social mix and a cultural development for territorial influence, with a view to sharing neo-rustic know-how to multiply and extend it in addition to the influence of southern Tunisian culture and the increase in territorial competitiveness.

Conclusions

Each architectural style is a complex system with components that are constantly interacting. In order to adequately and comprehensively understand an architectural trend, it is necessary to define the components of an in-depth architectural study by adopting a scientific and analytical approach that links the reverse translation of the architectural product to understand its relationship to the various fields under which it was established (social, natural, cultural, etc.). Hence, the multiplicity of architectural languages with varied spatial morphological responses is seen. To highlight the relationship of the architectural product with its different mediums, it is recommended to adopt the multi-scale analysis approach to reading environmental, urban, social, etc. The lofty goal of every architectural design system is to establish a contemporary vision that merges in time as well as in space and in the middle to achieve a balance that lends to continuity and permanence for future generations.

In this study, interest is about the inherent renewal of the rustic troglo and then sculptural architectural styles. The reconsideration of the fossil heritage's multiple characteristics and possibilities will create various spatial, social (mixing of nationalities and knowledge), economic dynamics, conducive to pioneering regional development. On the other hand, taking inspiration from the ancient troglo pattern to create a sculptural modern architectural style, it is an evolutionary product that crystallizes in the optimum eco-climate adaptation of environmental projects with intelligent integration, characterized by stability and adapting to new needs and changing conditions. By taking care of the essential and basic quality of life and the well-being of the users of the architectural space (visual comfort, audio quality, etc.), relying on the use of local, innovative, sustainable and economic materials and compounds, stimulating the encouragement of participa-

tory demographic approaches. At the end of this research, the fact that the approach of researching new tourist attractions is emphasized, through a contemporary style in southern Tunisia, drawing its resources from troglodytism, constitutes an innovative vector of architectural transition and a demonstration of the citizen's will to adopt new planning approaches. The neo-rustic modernist concept deserves to be developed in a multi-scale research approach, reinterpreting the rustic vernacular principles of sustainable spatial planning. The emergence of an efficient participatory citizen approach is aimed through the creation of new local decision-making bodies adapted to the needs and regional constraints identified and mastered by the local populations. It is a question of reassigning marginalized local actors from the planning process within the framework of a participatory territorial project. On the other hand, Amazigh vernacular heritage communication approach proves to be an interesting and essential initiative as an interphase of tourist dynamics evocation process in the south-eastern Tunisian territory. It is a question of making known and radiating the Amazigh culture of the Tunisian South-East and its immortal potential through the reconsideration of the natural-cultural heritage that the Amazigh pioneers produced and which still persists today. In addition, it is a question of considering heritage resources as a territorial identity product, constituting the challenge of spatial dynamics in the context of sustainable architecture. The neo-rustic modernist concept deserves to be developed in a multi-scale research process, reinterpreting the rustic vernacular principles of sustainable land use planning. The emergence of an effective participatory citizen approach is thus aimed through the creation of new local decision-making bodies adapted to the regional needs and constraints identified and controlled by the local populations. It is about reassigning marginalized local actors from the planning process within the framework of a participatory territorial project.

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