Department of Architectural Engineering

Seminar Title :

The Underground houses in Libya

(Gharyan houses)

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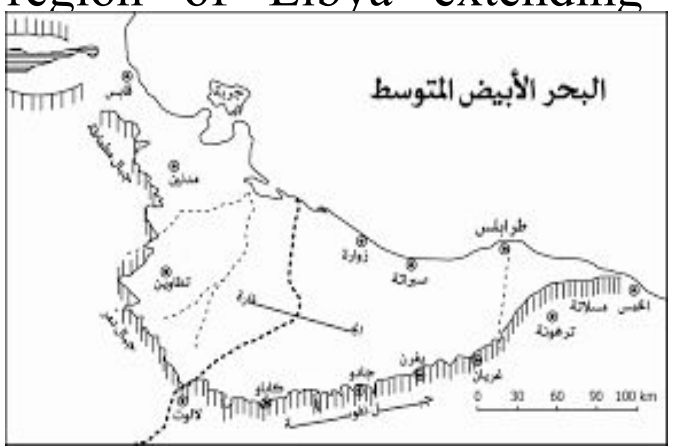
Subterranean Architecture

Since the beginning of humankind, what is called subterranean architecture, exists. It is, **in fact, finding shelter in the underground**. This concept was once used in order to create caves, refuges, tunnels; as an answer for the most primitive needs.

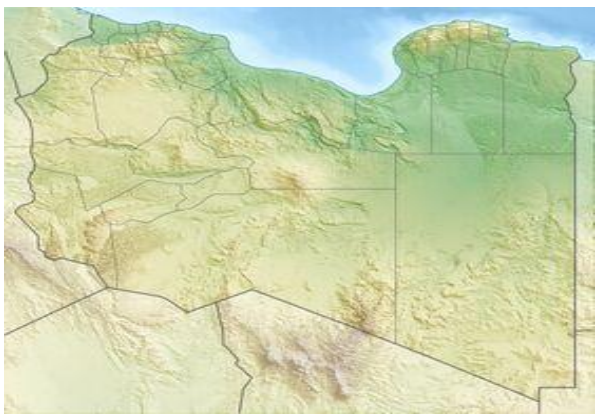
Architecture styles in Libya

The mountain region in Libya

Libya consists of two mountainous areas, one of them being the Mountains of ***Nafusa*** Mountain which are located in the north-western region of Libya extending

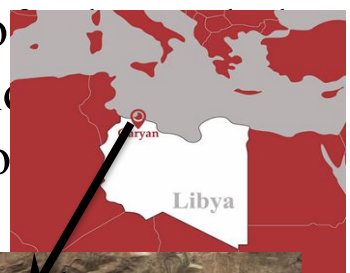


Nafusa Mountain

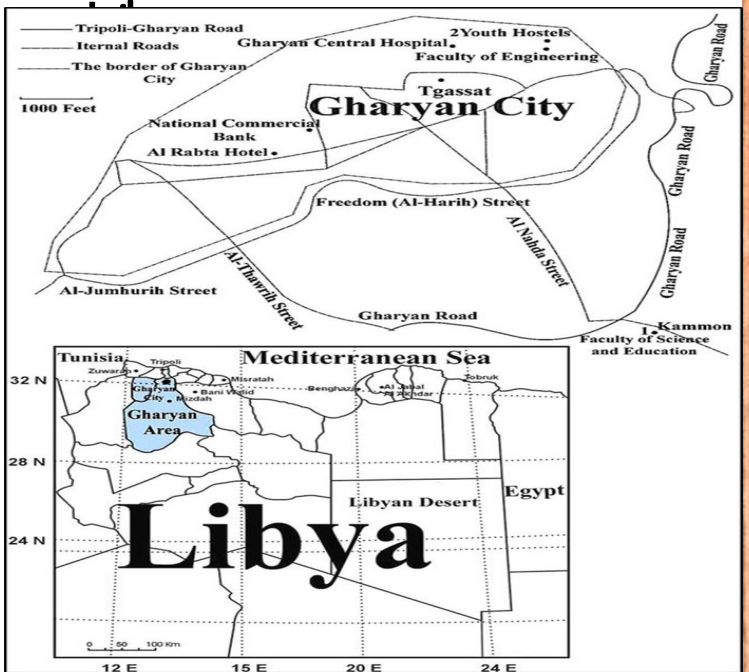


Location of Gharyan City

Gharyan is a city located in northwest of Libya. Gharyan is the largest city in Mount Nafusa region. **Gharyan region** extend across the top of the plateau at the end o Nafusa. It is l 85 km south o Tripoli.



The mountain region in

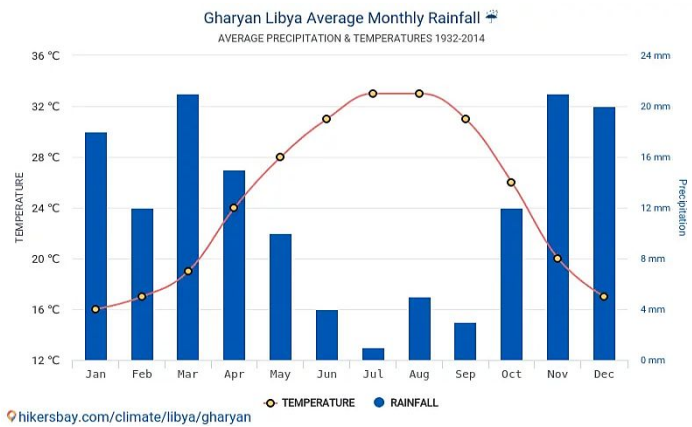


The administrative boundaries of the city of Gharyan (National Consulting

The height of Gharyan is about 700 meters from sea level.

The Climate in Gharyan

Gharyan city is generally cool. In winter, the temperatures sometimes fall below freezing, snow falls occasionally. The coldest month is December.

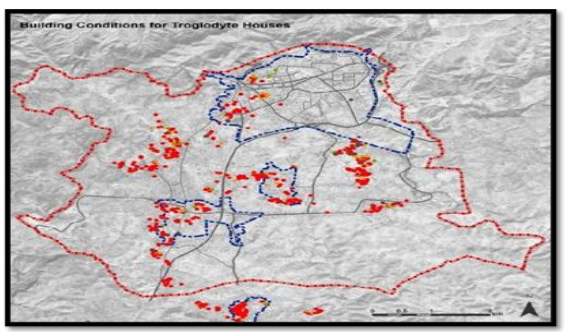


What are the underground houses?

"Earth sheltered, or underground, houses lie mostly beneath the ground surface. The surrounding soil provides natural insulation, making these houses inexpensive to heat and cool. The best location for an earth sheltered house is on a well-drained hillside."

Underground Houses in Gharyan

The underground houses in Gharyan are integrated with the modern settlement. New houses were built by owners over the underground houses or next to their old houses using the old house as a storage zone. Underground houses spread all over the southwest side of the new center, from south-east to south-west of the city, and there are also a few located outside the settlement to the north-east.

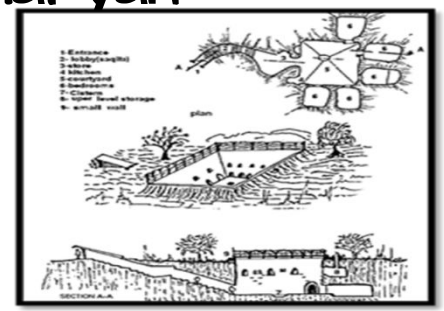


The compact grouping of underground houses

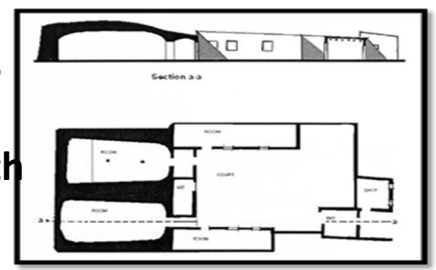
Relatives usually live together or live as near neighbors. Families usually extended their dwelling by excavating a new dwelling next to their old one, such that five houses together or more can be found, creating a group of houses for brothers and their extended families.

Types of underground architecture in Gharyan

First type: (Aboskefa) this is completely underground without any elevation.



Second type: (Al-Feseal) this is partially underground with some elevation.



Third type: (Al-Mgara) is a "hanging" house i. e., it is cave-like excavation in a vertical cliff face.

Why people use this type of houses?

*Readily available and accessible space.

* Protection from climate and weather.

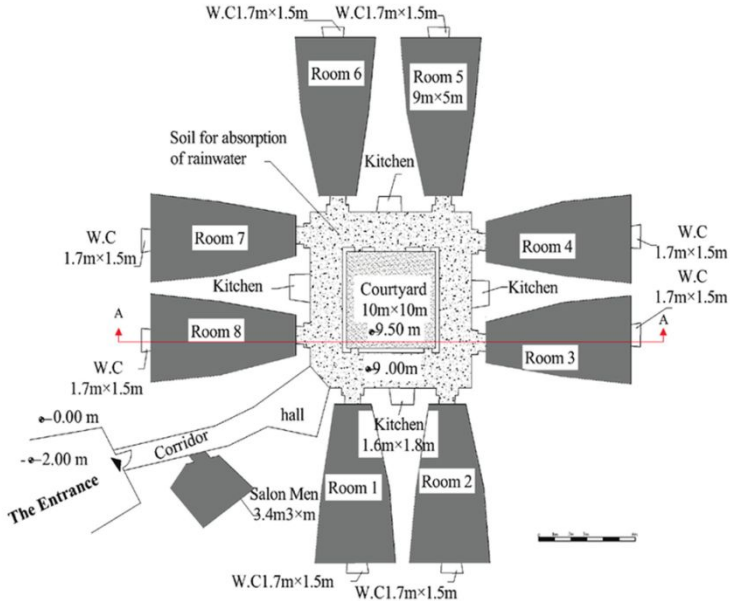
* Protection from enemies.

* Favorable geology and topography.

* Religious and ceremonial purposes.

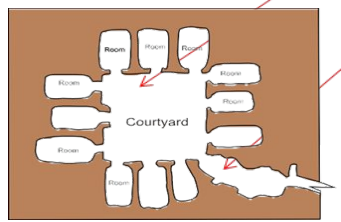
* Intensive land use of the surface

Characteristic and architectural features of Underaround houses

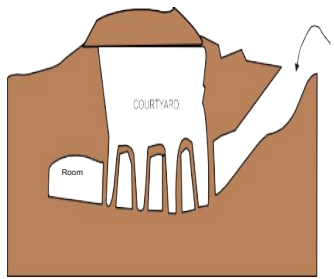


General layout of the underground dwelling in city of Gharyan

Characteristic and architectural features of Underground houses

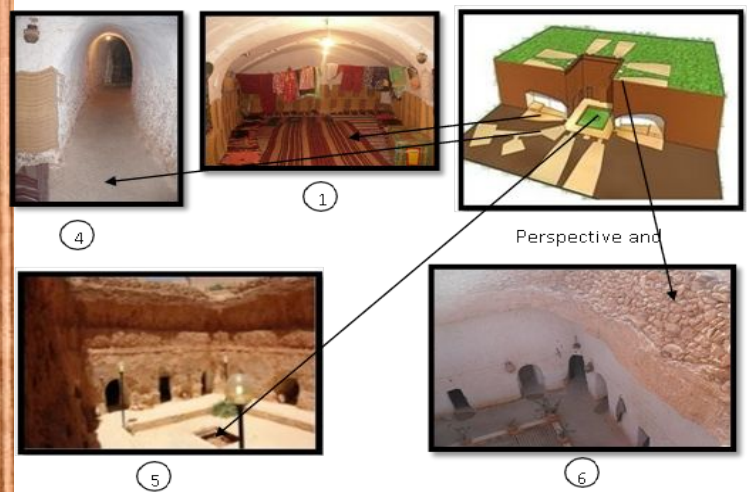


Plan



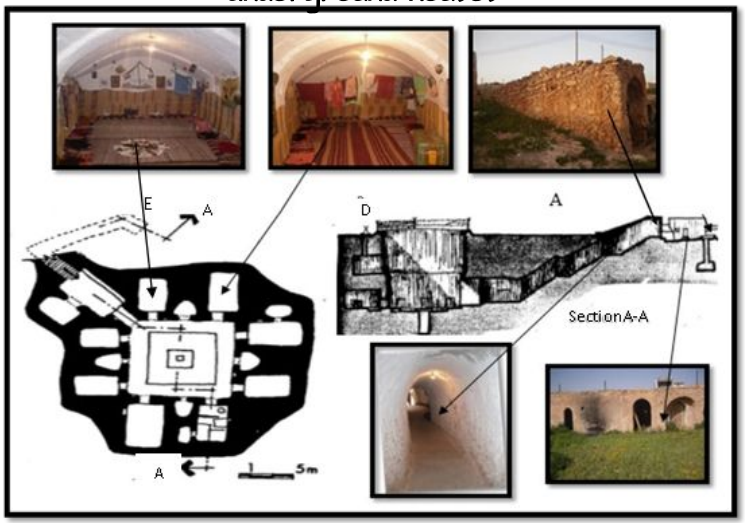
section

Characteristic and architectural features of Underground houses

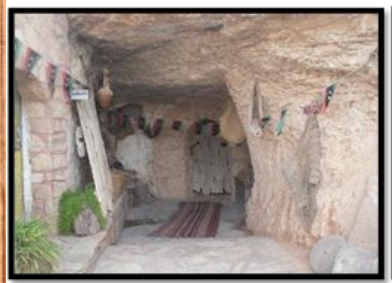


Perspective, section and photos for some design details

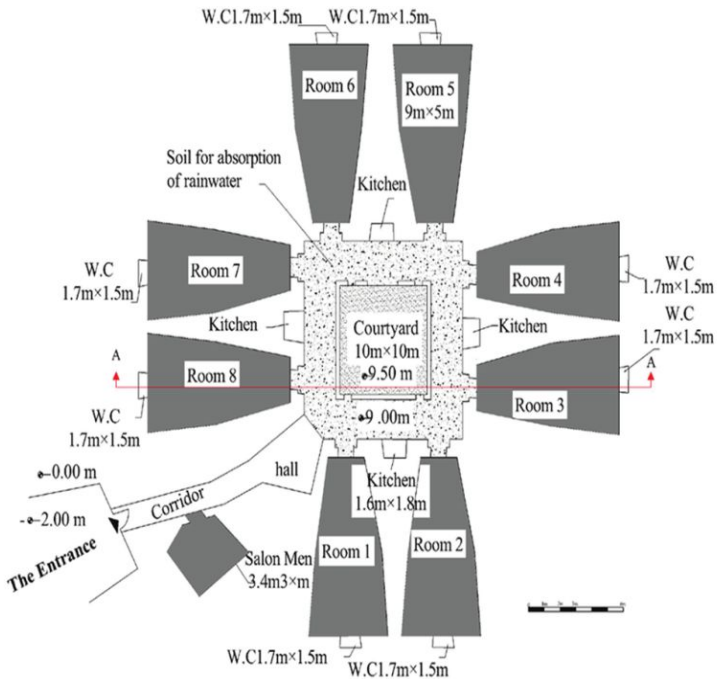
Characteristic and architectural features of Underground houses



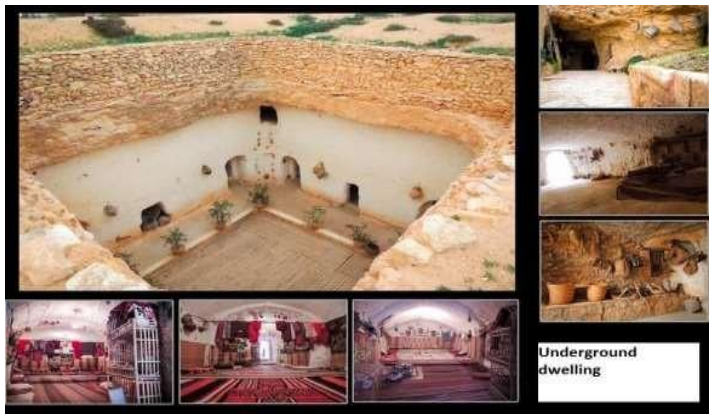
The main entrance and corridor of the underground house



The main entrance was built on the north western side, it is a long channel (corridor) with a length approximately 15 m and has a curved ceiling with a width of 1.2 m and height is up to of almost 2 m, there is a slope downwards where there is a difference gradually between the level of the entrance and the courtyard of the house approximately 7.60 m.

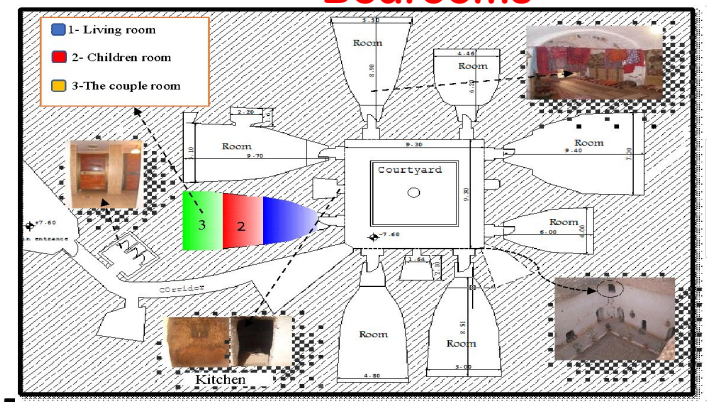


Courtyard



The vast majority of houses consists of a square courtyard of 6x6 m to 10x10 m with slight differences in terms of size, built into the ground from 7 to 10 m deep.

Bedrooms



The room is sectioned with curtains into three parts as follows:

1-The living room part was located next to the entrance.

2-The children's room part was located in the middle of the room.

3-This part of room was for a married couple. There are difference between these three parts is only in the ground level about 10 cm .The height of the rooms are between 2.25 to 2.60 m in the middle.

Kitchen

Location and section of the kitchen in the underground vernacular dwelling.

There are three small kitchens with different spaces, and almost 2 m high, between each two rooms is a kitchen shared by the two families, except for the North West aspect in order to provide to ventilation when cooking in past.

Store room

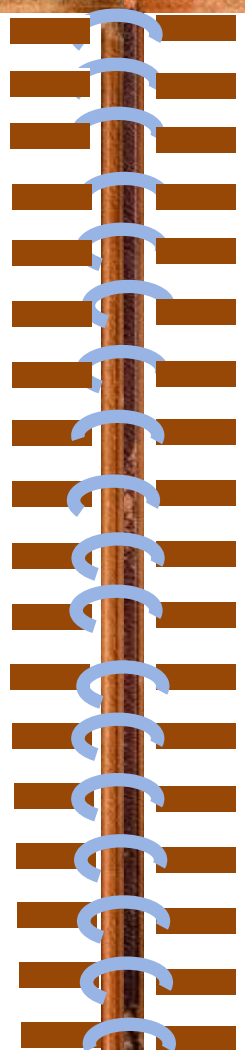
In about 3 m height upper level, there is a store space for crops built near one corner of the courtyard and extinction deeply 4-5 m and 2 m height in order to ensure that there are not rooms under it, causing it to collapse. This storage is reached using a ladder from the courtyard. A hole or opening (zimmer) is also built from land level, reaching up to the crop storage room and usually is secured by palm logs or olive wood

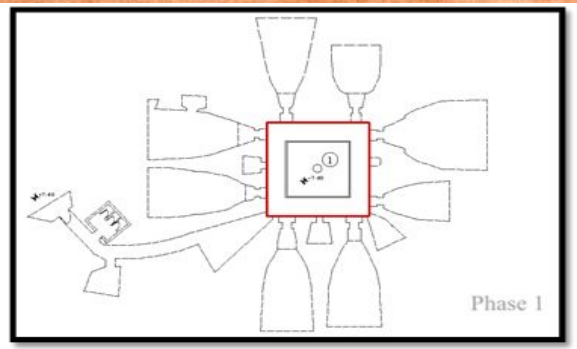
Phases of construction system

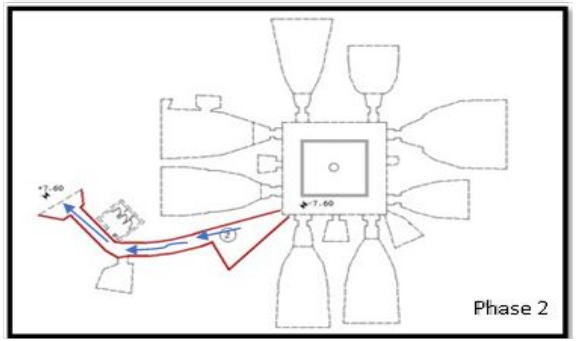
First phase is the digging of the courtyard by traditional tools (axe, shovel).

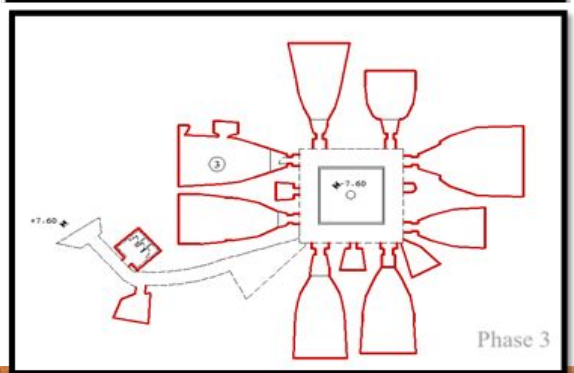
Second phase is the digging of the entrance from inside courtyard gradually up to the level of the outside ground.

Third phase the rooms are excavated on each side of courtyard









Construction materials

Types of materials

1-Walls , floors and roofs from clay soil.

2-Doors were made from palm and olive trunks.

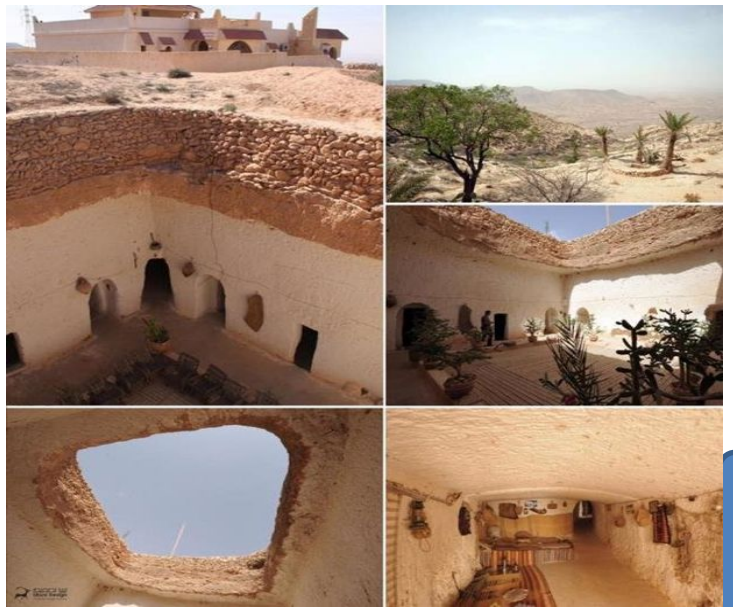
3-Windows: There are no windows in the room.

4-Finishes: The lime and sand, water were mixed for covering the rooms, for to eliminate insects and reflects light inside the rooms.

5-Decoration: gypsum and lime were used for decoration.

6- A hole of about 2 m is built into the courtyard, deep enough to collect the rainwater from the courtyard and filled up with salt and organic materials

7- Bathrooms and guest rooms are usually on the ground level.



Advantages

- lower construction costs compared to conventional one
- lower home maintenance costs
- Safe live environment in extreme weather conditions
- Fire resistance, High thermal efficiency; energy saving.

Disadvantages

- Psychical barriers - especially in constructions without windows
- In many cases, too small amount of day light.
- Problems with ventilation and air quality in individual rooms
- Need for a very good roof protection

References

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4-Brunskill, R. W. (1978). Vernacular Architecture of the Lake Counties: A Field Handbook. London: Faber and Faber.


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