

## WATER CISTERNS IN HISTORICAL HOUSES - GJIROKASTËR

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### ABSTRACT

Gjirokastra features 1200 stone buildings, making it one of the most important cultural heritage sites in Albania. In 1961 Gjirokastra was declared a Museum City, and in 2005 it became part of the World Heritage List (UNESCO).

Born in a period of turmoil, the ‘City of Stone’ was first mentioned in a chronicle on the uprising against the Byzantine Empire in 1336. In these difficult periods people were forced to balance defensive concerns with other life needs, such as water, food, etc. The defensive needs prevailed, and the people chose to establish the town in the most protected, but also the driest, part of the Drinos Valley. Given these conditions, the provision of water was a problem that required an urgent solution. For this, people devised an ingenious method of collecting rainwater in private cisterns, a technique we still find in all kinds of homes built in Gjirokastra from the end of the 18<sup>th</sup> century until World War II.

Water collection was such an integral part of life for the people of Gjirokastra that it shaped even the design of their homes, as well as their daily routine, such as cleaning/treating the cisterns and distributing the rainwater.

Water cisterns contribute to our understanding of sustainable architecture and the way people throughout history have creatively used natural resources. We are dealing with organic architecture strongly related to local characteristics, materials, topography, geography and particular needs of that place, as well as the technical skills of that time. Today the efficient use of natural resources is of main interest, and the maintenance and restoration of these monuments is urgently needed. Such studies, therefore, help us understand the nature and technique of these buildings increase the effectiveness of restoration interventions and teach us more about our heritage.

**KEYWORDS:** *Cultural heritage, Architecture, Sustainability, water, Restoration, Building materials, Traditions.*

### 1 INTRODUCTION

The way of collecting water through roofs into water cisterns was firstly mentioned in the 17<sup>th</sup> century, when the Ottoman chronicler Evliya Çelebi, described how the castle residents used to collect water.

After the city was declared a “Museum City” in 1961, systematic and scientific studies started. The first article about Gjirokastra’s water supply was conducted by Th. Kamberi (1975). Later on E. Riza (1981) published a monograph entitled “The Museum City of Gjirokastra”, which contains a general explanation about the city and an analysis of Ottoman residential buildings. Water cisterns are an integral part of this explanation, but a clear typology on their construction and maintenance is missing. Shtylla (1980) published a study on the town’s water supply, dealing especially with the castle’s aqueduct.

In 1984, local authorities started to identify, classify and restore all city wells and water cisterns for military reasons. They revealed a large number of wells, washstands and cisterns (about 500-700). This was part of the communist mentality to secure water supply for the citizens in case of an attack or war. Furthermore, because of their strong stony structure and vault coverage they could also be used as dwelling-places. This valuable evidence was never published as it was a state secret. The National Institute on Projects in Tirana (ISP, *Instituti i Studimeve Projektuese*) has published several design booklets such as “Design Elements, Humidity”, with a chapter about humidity in popular architecture and Gjirokastra as an illustration example. They contain an explanation about water cisterns, but there isn’t any new detail from previous editions. Somehow, this is the current situation of information about the water cisterns in Gjirokastra’s residential buildings, regarding their number typologies and building techniques.

There has not yet been a study that considers the development of this element during the time, its distribution in space and its construction techniques. There is also no information about their usage and maintenance.

## 2 INFLUENCIAL ELEMENTS ON THE ARCHITECTURE OF CISTERNS

Even if the city is placed in the driest part of the valley, some places with water can be found there, e.g. in the neighbourhoods Teqe (Partizani), Bazaar, Varosh and Meçite. In these areas the houses are taking water from wells, which are built in their yards.

In the past there were also two aqueducts bringing water to the city from the Sopot mountain spring, 12 km far from the city. The oldest of them was supplying not only the castle but also different parts of the city. Its origin cannot be found today. Well-known today is the aqueduct that was built by Ali Pasha in 1811-1812, a great structure supplying the castle.

Most of the city was using rainwater, which was collected in special chambers (cisterns) in the neighbourhoods. To build a water cistern was very costly for a family and not all the residents had the possibility to realize this. For this reason beside private ones, some families shared their cisterns with their neighbours. A special case was the so called Baboçi cistern in Manalat, which was a public cistern.

Besides financial reasons, another factor for the location and the type of a cistern, was the terrain. The craftsmen were in charge for finding places in the house, where the terrain was steep enough in order to be able to build a cistern.

Considering these factors, the following general classification of water cisterns can be made:

### A) Filling-method of cisterns:

#### 1. *Filled by rain water*

This is the most usual type of water cistern in the city.

#### 2. *Filled by the town’s aqueducts*

In rare cases, cisterns (e.g. in the Kokalari house) were filled by water coming from the old aqueduct<sup>1</sup>.

#### 3. *Cisterns filled from groundwater springs, supported by rainwater*

This is a hybrid of a well and cistern. This category is rare, too. They were filled by water from underground springs but helped also with rainwater collected from the houses next to them (Cistern in the yard of Çani house).

### B) Ownership:

#### 1. *Family ownership and usage only for family needs*

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<sup>1</sup> As the aqueduct was later destroyed, this is a theoretical approach and still needs to be proofed.

The water was used only from the family who owned the house, where the cistern was placed.  
(e.g. Zekate, Fico, Reso)

2. *Family ownership but also shared with the neighbors*

These cisterns can be accessed from outside walls of the house (inside the court yard) and sometimes also from inside the house (e.g. Kabili, Babaramo, Skenduli).

3. *Public property*

A completely public cistern. The only example is the so called Baboçi cistern, which was a donation of the family to the community.

**C) Cistern related to the house:**

1. *Cistern as part of the house*

Common form; filled by rainwater.

2. *Cistern as separate building in the yard*

Filled by rainwater collected from the roof of the house. (E.g. Çani, Pone, Çenko)

**D) Position inside the building (house):**

1. *Perimetral*

Adjacent to two or more outside walls

2. *Cental*

Adjacent to maximum one outside wall

**E) The way of water supply from cistern:**

1. *With “muslluk”*

Water taken by tap at the side wall of the cistern (Alb.: “fiti”).

2. *With “kokerdhok”*

Water taken with a bucket from a cylinder, located above the ground on the upper part of the cistern.

3. *With both ways*

Rare examples provide muslluk and kokerdhok. (E.g. Braja house).

**F) Relation with the terrain :**

1. *Built underground (2/3 of the cistern)*

This is the most common way of building cisterns.

2. *Built above-ground*

This type of cistern is a rare case. The cistern is reinforced with elements from the outside walls in order to carry the water pressure (e.g. Muhedini house).

### 3 ELEMENTS OF THE WATER COLLECTION SYSTEM

The collection of rainwater from the roof till the tap was realized through several elements:

1. *Roof:*

The roofs of Gjirokastra were covered by thin stone plates positioned one above the other, starting from the biggest ones in the eaves and followed by smaller ones up to the top. The reason for this is that the stone plates on the eaves had to collect also water coming from the top. The different sloped sides oriented the rain water to the gutters, while the eaves protected the walls from water damage.

## 2. *Gutters:*

The gutters were not placed all around the roof (as it was not necessary) but only in the part, which are close to the water cistern. The reason was to have the shortest possible way to take the water inside, as the metal gutters were expensive and difficult to find. The horizontal gutters were positioned around the eaves of the roof, just under the first stone slate and were supported by metal hooks called “ganxha”. If the eaves were too short the gutters were supported by stone elements called “kokosh”.

The connection of vertical pipes with horizontal or diagonal ones was realised by metal elements in conic shape, allowing the collection of a large amounts of water. The vertical gutter-pipe was movable. (Photo 1)When it was necessary to clean the stone slates from dust, the vertical pipe was pushed aside, so the water could pour out. After two or three rains, the roof was considered clean so the vertical pipe was connected again and the water was taken with diagonal pipes to the water cistern. Diagonal pipes were used to direct water into the water cistern. In some cases, horizontal stones were used to support the diagonal pipes in case the water passing into the cistern became too heavy for them.



Figure 1: The owner of Skenduli House, turning aside the vertical pipe in order to avoid the water to go to the cistern. September, 2012

## 3. *Cistern:*

The water cistern space has rectangular plan and is covered by stone vault. The size of the space differs from house to house depending from the size of the house and from the territory where it is placed. The floors of all water cisterns are typically sloped in the direction of the tap where the water was taken out. There is always a small window in the upper part of the walls from where you can enter to clean the space or to control it if it is necessary. The place from where the water was taken out(muslluk) was either inside the space of the house, when it was only for family usage, or in the outside wall in the cases where the water of the cistern was used also from the neighbours.

## 4. *Muslluk:*

“Muslluk” refers to the space where you take the water.(Photo 2) It is positioned in a lower level than the ground floor with a staircase leading in and out. Along the wall there is traditionally a small hole covered by an arch that was used to place light (mostly a candle). The tap is positioned roughly 30 cm from the level of the floor in order to reduce the amount of dirt that passes through the tap. The tap (Alb.: “fiti”), is made by bronze or brass material and is connected to the cistern with a pipe that goes through the wall. It has a diameter of 4-5 cm and is composed by two pieces, the tap itself and the pipe.

Beneath the tap was a hole, covered by a carved stone and laid with mortar. This hole was positioned on the same level as the lower part of the inside floor and was used to clean the cistern from accumulated dirt and grime in order to clear the passage of the pipe. Stone channels were built under the floor to take the water from the “muslluk”. These channels were called “llagëme”.



Figure 2: Muslluk, Skenduli house

#### 5. *Llagëme (Channels):*

Llagëme are made from stones along the three sides and are covered by stone plates. They are used to take the potentially poured out waters outside the ground. They were passing under the ground floor and the yard and were connected with the channels of the general water system of the city.

## 4 TECHNIQUES AND BUILDING MATERIALS:

### 1. *Walls*

The walls of the water cistern are always built by the same local lime stones as all the houses in Gjirokastra. As binding material a mixture of sand and lime in the ratio of 2:1 is used. The thickness of the cistern walls is between 1 and 1.2 m<sup>1</sup>. This thickness is not only to keep the weight of the floors above them, but also the pressure of water inside.

### 2. *Vault*

The cisterns are covered with vaults, which are also made from the local lime stones. Lime mortar is used as binding material (Kamberi, 1975) (Figure 3).



Figure 3: Interior of water cistern space, timber ties, Beja house

### 3. *Timber Ties*

The construction of the vault is reinforced with wooden ties in its springer point. They are 10-12cm thick and made from oak or chestnut<sup>1</sup> because of their characteristics as strong and resistant wood. These ties are part of a bigger reinforcement system, used in the entire house. They are supported by and connected to a wooden ring, build around the walls. The whole construction increase the resistance to horizontal forces, created from the water inside the room. (Photo 3)

### 4. *Plaster*

The vertical walls of the water cistern are usually plastered until 1m above the maximum water level. Cases can be found, where also the entire vault is plastered. The plaster of the vault is made from lime and sand<sup>1</sup>, while the vertical walls are plastered with a special hydraulic mixture called “horasan”. Horasan is made by the mixture of very fine crashed brick with lime in a 1:1 mixture. As final layer, a mixture of egg-shells and olive oil is applied in 3-4 layers<sup>2</sup>.

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### 5. *Floor*

The floor of the water cistern is build with the same technique as the cobbled streets in the town, where stones are vertically put next each other. This structure is covered with the same layer of plaster as the one applied in the vertical walls.

## 5 MAINTENANCE AND USAGE

### 1. *The ritual of collecting water*

A very strict ritual was followed for the collection of the water. It started each fall, when the stone slates were covered from the summer dust, leaves and other pollutions. Then they needed to be washed,

so that the first rainwater was left out of the cistern. Then the vertical, movable part of the gutter-pipe was opened. After the roof was cleaned the pipe was connected to take the water inside. When the cistern was filled with water the vertical pipe was moved back again.

## 2. *Monitoring*

In the upper level of the side walls of the cistern is a small window. It could be inside the house or on the outside walls. It was used as an entrance to clean the room as well as for checking the level of the water. If the water was exceeding the allowed level, through a hole in the wall with a diameter of 7-10 cm, water could be taken out. This was also a sign to move the vertical pipe so that no more water could go inside the cistern.

## 3. *Cleaning of the cistern*

The water cistern usually was cleaned in the end of summer – beginning of autumn when almost all the water was spent. The remaining water was taken out from the tap and the hole under it. The walls and the floor were washed using woollen cloth and soap. After the cleaning, the hole was left open and the water of the first rains could wash away the remaining soap.

# 6 AUTHENTIC USAGE IN HISTORY AND NOWADAYS:

## 1. *How cisterns were used before*

*When it rained three or four days in a row, my father would push the gutter-pipe aside to keep the cistern from overflowing. It was a very large cistern, extending under most of our house and if it ever overflowed, it could flood the cellar and wreck the foundation.*

*Ismail Kadare "Chronical in stone"*

The water cisterns were an extremely important element of Gjirokastra's residential buildings and also an organic part of the spatial organization of the houses. The room next to the cistern was due to its tempering effect, used to keep perishable food such as cheese, butter, meat, etc.

A water cistern usually occupies about 20 % of the ground floor and sometimes also parts of the first floor, which is a considerable space of the whole building. Larger and richer families owned the biggest water cisterns. This also refers to a large number of people living in a house, which was occasionally between 25-35 people.

The cistern's rain water was clean and salt free. For this reason, it was applicable for washing clothes, to clean the floor, to cook and even to drink it. Another aspect was the usage for irrigation, as Gjirokastra's residential buildings have a two-yard system with two enclosures and inside this space, different trees were cultivated. This way, the system was sustainable and effectively exploited all opportunities that nature provided.

## 2. *The current usage*

Today most of the cisterns are not used anymore. The town's water supply network has marginalized these structures, so that today they are mainly filled with rubbish and are not being maintained. In other cases, their water is used for irrigation only. Their situation is constantly degrading and today, their conservation level is critical. Because of the lacking maintenance, the plaster is falling off and the wood ties and washstands are falling apart. Due to the very bad condition of some houses, also their cisterns are destroyed. In other cases, people have transformed them into warehouses or living rooms, by opening doors in the area where the washstand used to be.



## 7 CONCLUSION

Nowadays we see a deteriorating situation of water cisterns which has started many years ago with a newer water supply system in the city. It continued with the deterioration of historic buildings in general. Only in few cases cisterns are still functional. They used to be a very important element of the traditional lifestyle, when natural resources were used in a maximum amount. They contribute to our understanding of a sustainable architecture and the way people throughout history have creatively used natural resources.

Today the efficient use of natural resources is of main interest. The usage of rain water as a potential element in sustaining the renewable resources in architecture makes water cisterns more valuable, and their maintenance and restoration is urgently needed. On the other side, water cisterns are direct result of local historical conditions. By studying them, we can discover another dimension of the vernacular architecture of Gjirokastra and it increases the effectiveness of restoration interventions and teaches us more about our heritage in general.

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## REFERENCES

- Çelebi, E. (Ni Muhamet Dhil - Li Ibni Dervishi). 2000. "Shqipëria para tre shekujsh", botimet BESA, Tiranë.
- Elemente Projektimi, Lagështia; Dritaret, grup autorësh, botuar në ISP Nr.1
- Kamberi, Th. 1971. "Disa të dhëna mbi teknikën e ndërtimit të banesës gjirokastrite", Revista Monumentet (2), Pronë letrare e Institutit të Monumenteve të Kulturës pranë Ministrisë së Arsimit dhe Kulturës.
- Kamberi, Th. 1975. "Si furnizohej me ujë qyteti i Gjirokastrës, Monumente të Kulturës në Shqipëri", Shtëpia Botuese 8 Nëntori, Tiranë.
- Komiteti Ekzekutiv, Sektori Ushtarak. 1984. "Studim mbi gjendjen e burimeve të ujit në Qytetin e Gjirokastrës", Gjirokastrë.
- Riza, E. 1981. "Qyteti - Muze i Gjirokastrës (monografi)". Shtëpia Botuese 8 Nëntori, Tiranë.
- Riza, E. 1985. "Ndërtimet Fshatare në Labëri", Shtëpia Botuese 8 Nëntori, Tiranë.
- Shtylla, V. 1980. "Ujësellësi i vjetër i Kalasë së Gjirokastrës", Revista monumentet (20), Tiranë.