

# **Rural environment, aridity and engineering**

## The aghlabide basins in Kairouan : An engineering lesson

*I Think, o Muslims ! to found a city to be used as a parade ground for Islam until the end of time. Snakes and ferocious animals, we are the prophet's faithful companions. So leave this place, we are going to dwell here ».*

Snakes and ferocious animals left with their progeny. At such a sight, a lot of Berbers converted to Islam. This is how Arab chroniclers reported the founding of Kairoun, the first Muslim city in the Maghreb region, in 670 by Uqba ibn Nafi.

The Arab conquest was not an easy one. Berbers, headed by Kusayla then by Kahena, rose up against Kairouan's governors and even managed to occupy the city.

Harun ar-Rachid, the khalife of Bagdad entrusted Ibrahim ibn al-Aghleb, one of his greatest commanders, with the governing of Ifriqiya (the first Islamic name of the Maghreb). He restored the situation in no time and was, therefore, awarded the right to pass his title down to his descendants and set up the Aghlabide dynasty in 800. A century later, it collapsed under the Fatimide attacks led by Mahdi.

Kairouan, the political and religion capital, developed and grew in size with several dazzling residences such as Qasr el-Qadim and Raggada. Within a short period of time, it became a centre of the Arab and Muslim civilization.

Arts, sciences and humanities grew dramatically in Kairouan. Looking for water was one of the Aghlabide's concerns in Ifriqiya. Whereas Romans were excellent in catching underground waters, the Aghlabide tried their best to mobilize, derive and store surface waters. They looked for water far away to supply cities as shown by the 33-kilometer Bir el-Adine aqueduct which drains water from Ouslet mountain and pour it in the Aghlabide basins in Kairouan. Its remains are still visible today.

The Aghlabide basins were built under the reign of Abu Ibrahim Ahmad Ibn Muhammad, sixth prince of the Aghlabide dynasty, between 859 and 863.

The small basin or decantation basin has a polygonal shape with seventeen equal sides. The depth down till the apron is 4,87 m, whereas walls are supported by 28 external buttress and 17 internal buttress. The inner wall is occupied by sixteen boxes. The basin receives the floods of Merguellil wadi through an opening topped by a vaulting between two quarters of a cone . On the top of one of these quarters of cone, we can see a part of a terracotta duct having an internal diameter of 0,25 m which is mounted in a masonry block adjoining the small basin; It seems that this was the channel's mouth bringing water from Bir el-Adine.

The big basin or pondage basin has also a polygonal shape with 64 equal sides. The internal diameter is 129,67 m. Walls are supported by 64 internal buttress (el-Fersiyat) ; 58 external simple buttress on angle apexes and 61 simple external buttress in the middle. The apron is 0,50 m thick and the depth is 4,35 m. In the middle of the basin, there is a central pillar which height is 4,68 m. Today, there is only a part left of this octagonal pilaster which was once set on circular steps resting on the basin's apron. The junction of both basins was carried out with a one block masonry which does not show brutal marks of any attached elements.

There is a double system to pour the small basin's water : It is the Sarh (outflow) with two terracotta pipes which are 0,60 m below said outflow; as soon as the water reaches the level of 0,83 in the small basin, pipes start the discharge.

As for drawing tanks, they are made up of two independent arched tunnels adjoining the big basin.

Drawing water is carried out in the terrace from a double row of chimneys with a square section into two groups of six which are 2,70 m apart, whereas the distance between each orifice, within each group, is only 1,40 m. The link between each tank and the big basin is made through two arched openings located at the level of the same apron.

One of the most important structures is the catchment system of Bir el Adine. It is a water tower supplying, through an aqueduct, the Aghlabide basin and then, under the Fatimide reign, Sabra-Mansuryya city. The tower is made up of several catchments and Aghlabide and Fatimide water distribution systems in close connection with older Roman hydraulic structures.

Roman structures include a water catchment system made up of two filter tunnels. The first one supplies the oriental network and the second supplies the occidental network. There is also an underground tank grouping two juxtaposed buildings. Roger Gresse and Louis Chatelain considered them as a temple and basilica. Later, lieutenant Lamotte described them as two tanks. The whole set contains an adduction system and another for the collecting, storage and distribution of water. The oriental network includes a decantation rectangular and arched basin but the occidental network operates thanks to a small storage basin and a drain.

Nonetheless, it seems that the hydraulic facilities of this system had a regional importance only. The Aghlabide used again the Roman facilities of the oriental network after some repairs and after replacing some mechanisms and equipment. Effectively, the initial nymphaeum, which was in ruins, was replaced by an Aghlabide building which is a large circular basin concentric to the Roman nymphaeum. It is built in block masonry with an inner coating in pantile mortar like all Aghlabide basins. The basin's walls are 1,30-m thick supported from outside by 12 reinforced buttress. The total height is 3,70 m and the external diameter is 41,85 m. This basin was supplied through a roman pipeline starting from the decantation basin and pouring water into the nymphaeum.

This pipeline was restored and a gutter was juxtaposed to it. The gutter, coming from an apse of the nymphaeum, crosses, in a straight line, the annular space comprised between the nymphaeum and the basin, then flows into this latter.

Two water intakes occupying the location of missing butterness were meant to discharge the water exceeding in height 1,20 m, for the first, and to discharge the whole stored water (drainoff and draining sewer) for the second. Finally, a device was provided to discharge the possible small floods in the basin. It was fit out on top of a butterness.

In order to mobilize more water, the Fatimide built a quadrilateral large basin adjoining the small Roman storage basin from the occidental network. It is a sub-aerial basin without internal butterness. Its walls are 1,32 m thick. There are 20 external butterness spaced by 4,50 m over the long sides and 4,00 m over the short sides of the quadrilateral. A small basin, located on the transversal axis and a butterness of this structure play the double role of pouring convergent flows from crest channels and discharging a given flow. The southern wall of the big basin includes an intake which supplies a tank, probably for local use. Near this intake, a channel starts ending up in a square well. At right angles to said canal, two other channels start from the same well.

One of them represents Kairouan aqueduct. The second, having an opposite slope, is the drainoff channel.

This way, a connection between the oriental network and the occidental network was carried out by the Fatimide through a perched channel. This channel made it possible to discharge caught waters, which are not used for the local supply, into the Aghlabide pipeline heading for Kairouan.

Aghlabide adductions between Bir el Adine and Kairouan are located downstream Bir El-Adine catchment points. An initially Roman pipeline supplies several centres located at a few kilometers downstream Bir el-Adine. It was extended during the Aghlabide era. Near Cherichia and Jerouila confluence, there was probably a water tower where come not only the Aghlabide aqueduct but also two other lateral pipes: the first pipe drains the oligocene limestone layer of the right shore of Cherichia wadi ; the second drains Bou Zellouma massive of the left shore.

Under the Fatimide, the main adduction underwent restorations and was completed starting from the water tower, a bigger pipeline was stacked up the old one. Up till the mountainous area of Cherichia, Aghlabide and Fatimide adductions are carried out through distinct and superimposed aqueducts. This double pipeline crosses the depressions of Mouta wadi and el-Brel wadi over a bridge.

The 1,70 m long aqueduct of Mouta wadi made of a solid wall which height starts at 2 m and reaches 10 m at the beginning of arches, does not follow the architectural rules of Roman aqueducts. Actually, this aqueduct which became a specific model for North Africa was inspired from a similar structure in Morocco in terms of architectural characteristics and use.