

*The role of water in economic life in Algeria
during the Roman period*

دور المياه في الحياة الاقتصادية في الجزائر خلال الفترة الرومانية

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• **Abstract:**

This research addresses the topic of water and its role in economic life during the Roman period as a vital element and considerable driver of this sector. Water is a fundamental resource required for various purposes (drinking, irrigation, bathing etc...). Its importance extended however during the Roman period to various crafts and industries, where it was used to supply both the internal and external markets, in addition to its significant role in transportation. Water was a significant financial asset as well, contributing to revitalizing the economy by enabling the acquisition of various raw materials and the creation of job opportunities, as well as a water exploitation tax, referred to as *Vectigal Aquae*, imposed by the Roman authorities and applicable to the use of both public and private water sources, as well as for delivery services. This research aims to highlight the role of water in economic life, both in urban and rural settings as well as its contribution to their development and prosperity. It also seeks to examine its impact across all economic fields, such as agriculture (through irrigation), industry (through craft and industrial activities), as well as water transportation, and finally to address the tax policy implementation or financial charges on water consumption and delivery service. The key issue of this research revolves around the role of water in promoting the economy, requiring a range of water facilities for collection and distribution, and the use of water in both natural environments and various craft activities, as well as water taxation and transport.

Keywords:

water, economy, irrigation, crafts, water taxation.

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● الملخص:

يتناول هذا البحث موضوع الماء ودوره في الحياة الاقتصادية خلال العصر الروماني، لكونه عنصراً حيوياً ومحركاً مهماً لهذا القطاع. فالماء مورد أساسي نحتاج إليه لأغراض متعددة (الشرب، الري، الاستحمام، وغيرها). غير أن أهميته اتسعت في الفترة الرومانية لتشمل مختلف الحرف والصناعات، حيث استُخدم لتلبية حاجات الأسواق الداخلية والخارجية، إضافةً إلى دوره البارز في النقل. كان الماء كذلك مصدراً مالياً مهماً، إذ ساهم في تنشيط الاقتصاد من خلال تمكين الحصول على مختلف المواد الأولية وخلق فرص العمل، فضلاً عن ضريبة استغلال المياه المعروفة باسم "Vectigal Aquae" التي فرضتها السلطات الرومانية، والتي كانت تُطبق على استخدام المياه العامة والخاصة، وكذلك على خدمات توصيل المياه.

يهدف هذا البحث إلى إبراز دور الماء في الحياة الاقتصادية، سواء في البيئات الحضرية أو الريفية، وإسهامه في تطويرها وازدهارها. كما يسعى إلى دراسة دوره في مختلف المجالات الاقتصادية مثل الزراعة (عبر الري)، والصناعة (من خلال الأنشطة الحرفية والصناعية)، وكذلك النقل المائي، وصولاً إلى معالجة سياسة الضرائب أو الرسوم المالية على استهلاك المياه وخدمات توصيلها.

تتمحور الإشكالية الرئيسة لهذا البحث حول دور الماء في تعزيز الاقتصاد، وما يتطلبه ذلك من منشآت مائية لجمع المياه وتوزيعها، واستعمالها في البيئات الطبيعية ومختلف الأنشطة الحرفية، إضافةً إلى مسألة ضرائب المياه ووسائل نقلها.

● كلمات مفتاحية: الماء، الاقتصاد، ضريبة الماء، الجزائر، الفترة الرومانية.

● Introduction

The early populations of North Africa were closely linked to water sources establishing their communities in coastal and inland locations, a factor regarded as crucial for their subsequent development and prosperity¹, especially in the field of agricultural development. Consequently, the Numidian period witnessed significant economic growth, characterized by the export of substantial amounts of wheat and barley to Rome, which constituted only a fraction of the total production. Furthermore, trade agreements were established with Delos and various other Greek islands and cities². As for the Roman period, it witnessed great development in the field of water exploitation through the establishment of various water facilities with sophisticated technologies.

Investigating the subject of water and its role in economic life during the Roman period is crucial if we consider its considerable impact on economic activity in its various fields, as a basic element in the prosperity of agriculture and the improvement of products through irrigation, as well as its

¹ - Samir Ait Oumghar, Water and Stability in North Africa during the Ancient Era, Astour Magazine, Qatar 2020, P.107.

² - Mohamed Elhadi Harech, The Kingdom of Numidia (Civilization Study) from the Ninth to the First Century BC, Algeria, 2013, P.150.

use in various crafts and industries. The Romans also used water to transport people and goods across seas and valleys, not to mention its importance in the daily consumption, as it contributed greatly to the stability of the people in some areas rather than others according to the availability of water.

This study seeks to highlight the importance of water in the revival of economic activity in Algeria during the Roman period, by exploring the various methods employed for the exploitation of water in various basic fields of agriculture, industry and trade, alongside the various financial implications involving a special tax on water consumption. We will also present the most important infrastructures established by the Roman Empire in order to ensure water supply to cities and villages, including residential properties and public and private structures such as baths and fountains.

The problematic of this research revolves around how water affected economic activity in Algeria during the Roman period in various fields and how it contributed to its development.

1. Uses of water:

Water has many uses in daily life, but the Roman administration combined three main tasks in its management, which are as follows:

1.1 USUS:

It refers to the various benefits of daily used water, relevant to individuals or private and public municipalities, and is reflected in the consumption of potable water as well as washing and bathing activities.

1.2 SALUBRITAS:

This term refers to water, its cleanliness and purity, through its flow and not stagnation, so that it is suitable for drinking. It also refers to the cleanliness of individuals and their environments. For example, the excess of reservoirs was used to clean roads and sewage channels so that stagnant water and waste would not accumulate, which helps improve the appearance of the streets and the purity of the air.

1.3 SECURITAS:

It provides security for the city by making use of water, which allows it to place water infrastructures in various places in order to facilitate the process of fighting fires³.

³ - Michael Vannesse, Les usages de l'eau courante dans les villes romaines, Le témoignage de l'épigraphie, in, Latomus 71, 2012, PP. 469-470.

Water is used extensively in irrigation to secure the produce. It is also used to serve more specific functions such as: purification (*LUSTRATIO*), sacrifice (*SACRIFICIO*), baths (*BALNEUM*), and washing or bleaching clothes (*FULLO*)⁴.

2. Water installations and the economy:

The Roman authorities established several systems to ensure reliable water supply in all residential areas, whether urban or rural, by exploiting groundwater, surface water and rainwater. These systems were notable by their specific architectural features and precise construction techniques that allowed for the collection, transport and storage of the largest possible amount of water. Certainly, these installations were allocated substantial funding, and served as a crucial economic catalyst, as raw materials such as stones and marble were requested from quarries, and building materials, made of clay, from pottery and lead workshops. Furthermore, a considerable labor force was mobilized, including qualified workers from remote areas (the engineer who built the Saldae Canal for instance) using various means of transportation. Here lies the significance of water installations from an economic perspective, as they may provide jobs in various fields, thereby stimulating the economy.

Establishing water facilities targeted two main issues: on the one hand, ensuring access to potable water and daily household consumption in urban residential centers, and on the other hand, facilitating rural agricultural irrigation, which attracted particular attention from the Romans. The water was sourced from rain, which was collected and stored, or from springs that were exploited through fountains and water transport channels⁵.

In areas characterized by a clear shortage of rainwater, scarcity of sources and dryness of valleys, various facilities as such as water basins, reservoirs and wells were constructed, all designed to supply water for the consumption of both humans and animals, especially in irrigating agricultural lands. Rainwater has thus become precious and could not be neglected, wasted or used for inappropriate purposes⁶.

There were two types of water facilities, classified according to their characteristics and functions. The first type encompasses collection facilities which consist of dams, wells and tanks. The second type is distribution facilities which include transport, reservoir and distribution channels. We will examine the various types of facilities, providing examples from our various sites in order to highlight their construction technology and their architectural beauty.

2.1 Aggregation constructors:

4 - M.M. Ch. Daremberg et Edm. Saglio, Dictionnaire des Antiquités grecques et romaines d'après les textes et les monuments, librairie Hachette, Paris, 1900. P.331.

⁵ - M, Du Coudray La Blanchère, L'aménagement de l'eau et l'installation rurale dans l'Afrique Ancienne, Nouvelles archives des missions scientifiques, SD, P.9.

⁶ - Stephane Gsell, Histoire Ancienne de l'Afrique du Nord, Librairie Hachette, Paris, T.1, 1972. P. 98.

These facilities collected rainwater and exploited groundwater by digging wells and building dams, reservoirs, cisterns and fountains. They spread throughout most cities, thereby indicating a shortage of water, which forced the authorities and population to build them, to collect and provide this vital resource.

2.1.1 Hydro dams:

These systems were designed for capturing, collecting and storing surface water (rain) and were generally built in valley gorges or at the bottom of mountain slopes, at the point where the mountain meets the plain⁷. Numerous instances of this process, which was built by the Romans, were recorded on the valleys descending from the heights of the Aures, Belezma and El Hodna towards the south. Numerous traces of dams were also discovered on the slopes of the Boutaleb Mountains heading towards El Hodna, including four dams in Oued Lakman (Fakis, Jassassia, Roman and Lamzoria Dam), the Djir on Oued El Lahm and the Oued El Qasab⁸ and two traces of a Roman dam in the vicinity of the “Khamissa” region (Thubursicu Numidarum) in the “Ain El Said” Valley, from which a canal extends to transport water towards this city⁹.

2.1.2 The Wells:

Managing groundwater was and still a persistent issue, yet the Romans embraced this arduous challenge with limited means, as long as it provided access to this vital resource¹⁰, as plains, high plateaus, farms and Roman villages were supplied with abundant well water¹¹. Archaeological investigations have also revealed the existence of a large network of wells in the southern region, demonstrating an advanced level of technical expertise, and where the drilling reached about 59 m¹². The wells were similar and differed only in depth which was related to the nearness or distance of the water level. The orifice could be circular, square or rectangular, with a side length or diameter ranging between 0.80 m and 1.50 m. The latter two shapes were the most common¹³, but the diameter could reach up to three meters¹⁴.

The wells were often crowned with a covering above the ground called *Margelle* and placed on wide slabs, the purpose of which was to protect the well from water pollution factors¹⁵. A representative example of this can be observed in a well discovered within the house of frescos at the archaeological site of "Tipaza"(picture N° 01). The city of Timgad is another example and alone

⁷ - Mohamed El Arbi Aggoun, *Economy and Society in Ancient North Africa*, Dar Al-Huda, Ain Mlila, Algeria, 2008. p. 106.

⁸ - Mohamed El Bachir Chenniti, *Numidia and Imperial Rome, Economic and Social Transformations under Occupation*, Algeria 2012, PP.138-139.

⁹ - Stéphane Gsell, *Atlas Archéologique de l'Algérie*, 2nd edition, Algiers 1997, F. 18, N°. 308.

¹⁰ - Mohamed El Bachir Chenniti, op-cit, P.140.

¹¹ - Jean Birebent, *Aquae Romanae, Recherche D'hydraulique Romaine Dans L'est Algérien*, service des Antiquités de l'Algérie, 1962, P.494.

¹² - Mohamed El Arbi Aggoun, op-cit, P. 107.

¹³ - J. Birebent, *Aquae Romanae*, op-cit, P.494.

¹⁴ - Mohamed El Bachir Chenniti, op-cit, P.140.

¹⁵ - J. Birebent, *Aquae Romanae*, op-cit, P.495.

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northeastern part, where there are numerous dyeing workshops as well (*Fullonica*) (picture N° 02)¹⁶.

Picture N°02 of a well
- Timgad site

Picture N°01 of a well - Garden
House - Tipaza site

2.1.3 Reservoir

The reservoirs often received water from the transport canals near the cities and residential complexes, in order to preserve it and use it when needed. From there, a network of underground canals in the form of lead or clay pipes extended towards the public fountains or towards the baths and even towards some of the private homes of the wealthy. These reservoirs were large, with a capacity of up to 30,000 m³ in Cirta for instance and 12,000 m³ for Hippone¹⁷.

The remains of these structures appear in large numbers at the site of Tipaza and most of them are in a good state of preservation, especially two of them. The first is located in the far east of the city and the other, on the plateau of the temples¹⁸. Reservoirs are also widely spread in the southern regions, and their density increases as we head south, where they are distributed parallel to surface sources and groundwater, and with the channels that transport dam water, springs and rainwater. The most particular of them can be found in the Hodna region and the southern Aures¹⁹.

During the excavations conducted in 1907 in the city of Sétif, important remains of a large rectangular water reservoir were uncovered. It features three sides comprising a curved, paved

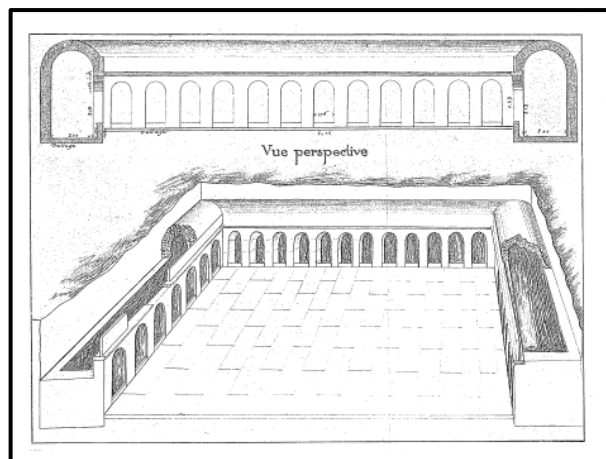
¹⁶ - Bahlou Guerbabi F.Z., Farhi A. La gestion de l'eau à Timgad de la source aux thermes antiques, in, Larhyss Journal, n°23, Septembre 2015, P. 262.

¹⁷ - François Decret, Mohamed Fantar, L'Afrique du Nord dans l'Antiquité, Histoire et civilisation des origines au Ve siècle, édition Payot et Rivage, Paris VI, 1998, P.218.

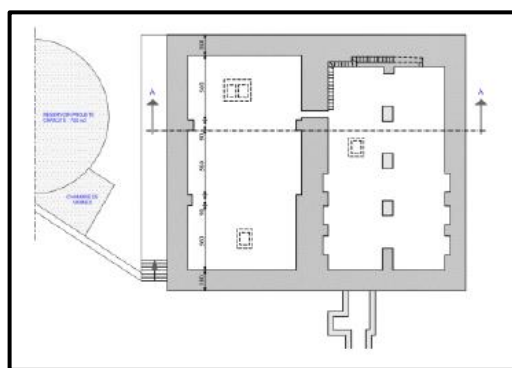
¹⁸ - Stéphane Gsell, Tipasa, ville de la Maurétanie Césarienne, in, Mélanges d'archéologie et d'histoire, t.14, 1894. P. 377.

¹⁹ - Mohamed El Bachir Chenniti, op-cit, P.151.

water channel, measuring 2 m wide. The reservoir measures 20.15 m in length, with the width at both ends measuring 11.19 m and one end remaining open and unconstructed. Its floor is tiled and there are 26 arched openings visible along its three sides, measuring 2.50 m high and 1.05 m wide (12 of them are located on the longitudinal axis and 7 on each transverse axis). This reservoir is supplied from its left side by water from nearby reservoirs (picture N°03)²⁰.



picture N°03 of a plan for a water reservoir - Sétif, in: J. Maguelonne, 1907, P.184.



picture N°04 of a plan for a water reservoir- Sidi Touati- Bejaia, in: H. Djermoune, 2018, P.309)

Saldae (Bejaia) is known for its significant water wealth. In addition to its canal known as “Toudja”, traces of important reservoirs called “Sidi Touati” were also observed (picture N°04). It is rectangular in shape, 18.80 m wide and 29.80 m long and divided into two reservoirs: the first, on the western side, appears as a single piece connected to the eastern side (the second reservoir), which is divided by columns into four parts. It is slightly lower than the first to enable water collection. The capacity of these reservoirs reaches about 5000 m³ (1000 m³ for reservoir 1 and 3700 for reservoir 2)²¹

The water was extracted from wells to be stored in reservoirs of varying sizes, some of which were built with a technology that allowed them to receive rainwater. The most important example of this type are the “Hadrian” reservoirs of the city of “Hippone”, named after Emperor “Hadrian”, located at the outlet of the water transfer canal (picture N°05). This massive structure has a substantial storage capacity, consisting of a hall 40.25 m long and 17.40 m wide, 10 m high, with two rows of columns, each measuring 1.60 m per side, supporting three



Picture N°05 of the Hadrian's reservoirs - Hippone Site

²⁰ - J. Maguelonne, Découverte à Sétif d'un château d'eau et de citernes remontant à l'époque romaine, in, Recueil des Notices et Mémoires de la Société Archéologique du Département de Constantine, 1907, PP. 183-184.

²¹ - H. Djermoune, M. E. Filah, Le dispositif d'approvisionnement en eau de la colonie romaine de *Saldae* (actuelle ville de Bejaia) de la fin du 1^{er} siècle avant à la fin du 2^{ème} après. In : Revue des études archéologiques, N°01, 2018, PP.308-309.

domed axes. There are numerous other reservoirs in this city, such as the one located in the Christian quarter near the basilica, which is large and rectangular in shape (4.20 m / 1.14 m) with a depth of 4 m, as well as additional tanks at the foot of the "Gharaf al-Atran" hill opposite a villa near the seashore. Excavations yielded results in the *Dii Consentes* monument and one of the walls of its facade yielded another rectangular réservoir (16 m/5m)²²

In most of the prominent houses of the city of Cuicul, water reservoirs are commonly found, such as the stucco house, which contains a considerable tank (3.70 m long and 2.50 m wide). The most important water facility in this city is the basins designed for the storage of large quantities of water transported from the mountain, built at the same time as the building of the great baths in the southern district under the rule of Emperor Commodus (picture N°06)²³. These reservoirs consist of six interconnected open basins on the northern side of the baths, allowing water to flow from one basin to another, in addition to a seventh basin

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Picture N°06 of the six reservoirs
of Commodus- Cuicul site

Picture N°07 of underground
water reserve - Cuicul site

The city of Tiddis is distinguished from other cities by its distinctive geographical features, as it is built on a high rocky plateau. At an elevated point of this plateau, the city houses a large water tank

²² - Xavier Delestre, *Aqueduc, châteaux d'eau, fontaines...L'eau, une richesse antique menace aujourd'hui les vestiges*, in, Hippone, Edisud, Aix- en- Provence, 2005, PP.122-123.

²³ - Y. Allais, *Le quartier occidental de Djemila (Cuicul)*, in : *Antiquités Africaines*. 1971, T. 5, PP. 110- 112.

²⁴ - *Année Epigraphique*, 1920, 15.

(picture N°08)²⁵ consisting of three rectangular basins interconnected through a filling system. The entire city was supplied by a transmission channel to individual tanks, resulting in a significant number of water tanks in almost every house, thereby reflecting the ongoing water crisis in the city, which forced the residents to equip their homes with tanks.



Picture N° 08 of water réservoir- Tiddis site



Picture N° 09 of a model of a private water reservoir - Teddis site-

We present a model of the private tanks that were found inside the houses (picture N°09). They vary in size from one house to another and were designed with arched roofs, tiled flooring, and their walls still bear a layer of mortar that maintains the purity of the water and the porosity of the floor to prevent any water loss. Given the water's scarcity, the establishment of these private tanks in the city was an absolute necessity.

2.1.4 Cisterns:

Cisterns are simple dams built at the bottom of slopes to collect the water running on the surface and direct it towards open reservoirs. These structures are prevalent in the southern regions, which experience sudden and heavy thunderstorms. They were built in areas characterized by mild slopes, thus ensuring stability against the currents of running water. These dams are generally designed as trenches or low-height walls that extend over long distances to collect the largest possible amount of water²⁶.

2.1.5 Water sources:

The Romans showed a remarkable ability to exploit the groundwater that flows from the springs. The city of Tazoult (Lambese) for instance houses a significant number of them, such as “Ain Drin” located south of the city's heights. The importance of this spring is underscored by the construction nearby of a temple devoted to the God “Neptune”, or “Ain Boubnana” about 1 km southwest of “Ain Drin”²⁷. Another example is the city of “Timgad” which collects its abundant water resources

²⁵ - Gilbert Charles- Picard, *La civilisation de l'Afrique romaine*, Librairie Plon, Paris 1959, P. 194.

²⁶ - Mohamed El Bachir Chenniti, *op-cit*, P.141.

²⁷ - Stéphane Gsell, *Atlas Archéologique de l'Algérie*, 2nd edition, Algiers 1997, F. 27, N°. 224, 27.

from the "Ain El Meri" spring to primarily supply its public fountains, then private houses and baths with water. The exploitation of this spring dates back to the second century AD²⁸.

The city of "Khamissa" contains a very important water source called "Ain Al-Youdi" (picture N°10) which springs from the "Khamissa" plateau. Its waters are characterized by low salinity. Its course is called "Oued Khamis" and heads north to reach "Majrada". Its waters reach the site of Khamissa and are collected in two important basins. The first is rectangular, measuring approximately 50 m in length, 20 m in width, and 1.40 m in depth. The second is larger and is divided into two sections. The first is rectangular in shape, 18.50 m long and 24.80 m wide. The second is curved in shape, with a diameter of about 26.50 m. A double dividing wall separates the two basins. The two basins contain a conveying channel underneath them, as well as a stop valve that closes when they are filled to capacity. From here, the Bagrađa stream starts heading towards the city of "Souk Ahras"²⁹.



picture N°10 of the Ain al-Yudi basins - Khamissa - 2nd century AD

2.2 Distribution constructors:

The vast number of wells and local sources was insufficient to supply the residential centers that were constantly expanding, which prompted them to source water from neighboring areas and even from distant highlands that were part of the water transport and distribution network. This network enhanced the functionality of the collection facilities and ensured its transfer to the consumer.

2.2.1 Aqueducts:

Aqueducts are significant structures consisting of large channels supported by interconnected arches allowing them to cross valleys and depressions. Tunnels may be excavated when facing hills

²⁸ - J. Birebent, *Aquae Romanae*, op-cit, PP.325-328.

²⁹ - St. Gsell, Ch-A. Joly, Khamissa, Mdaourouch, Announa, fouilles exécutées par le service des monuments historiques de l'Algérie, 1914, PP. 85-98.

or elevations. These channels are mainly designed to supply cities with potable water and recreational and health facilities such as bathrooms, while the surplus is allocated for agricultural irrigation³⁰.

Aqueducts indicate the extent of the Romans' keenness to consume pure and healthy water. They sometimes travel long distances from water sources to important cities that may have nearby sources, but their water may not be suitable for drinking or sufficient to meet the needs of dense population centers. These aqueducts also indicate the scarcity or lack of rain, which causes a deficit in agricultural irrigation.



Picture N° 11 of the aqueduct of Cirta - Roman period

Their water is directed towards agricultural fields, whether to irrigate vegetable and fruit fields in the summer, or during winter droughts. Notable among these canals are the Cirta aqueduct, which is 35 km long (picture N°11), Caesarea, at 28 km, Rusicade at 22 km long, and Hippone at 18 km³¹.

In order to supply the reservoirs of the old city of Cherchell (Caesarea) with water which is then delivered to the public baths, fountains and residential buildings, aqueducts are sourced from three different directions: the southern plateau or “Manasser Plateau”, the “Morso” area and the “Chenoua” mountain. The “Morso” aqueduct is considered one of the largest aqueduct, with a total length of 40 km, and its traces remain to this day visible and appear near the modern road (picture N°12)³².



Picture N° 12 of the aqueduct of Cherchell - Roman period

Saldaie (Bejaia) was supplied with water from the main source of Todja, 17 km to the west. The water was transported on a 21 km long aqueduct to reach important reservoirs in the city of Saldae. A Latin inscription, found in the city of Tazoult, reveals the story of its construction, when a military engineer, Nonius Datus, was appointed by the governor of the province of Numidia to the governor of the province of Mauretania Caesarea in order to evaluate the project, which began in 137 AD and ended in 152 AD³³. In the camp of Tazoult, another Latin inscription mentions an aqueduct which was restored by the Emperor Diocletian and that supplied the camp, in addition to other inscriptions mentioning the foundation or restoration of aqueducts found near the temple

³⁰ - Mohamed El Arbi Aggoun, op-cit, P. 107.

³¹ - F. Decret, M. Fantar, op-cit, P.218.

³² - Jean Berard, Note sur les Aqueducs Antique de Cherchel, in, Revue Africaine, Volume 75,1934, PP.418-419.

³³ - J. Birebent, Aquae Romanae, op-cit, PP. 467-469.

of Aesculapius³⁴, two of which belong to two governors³⁵, two to the Emperor Severus Alexander³⁶, and one to both emperors Diocletian and Maximian³⁷.

The aqueducts were the responsibility of either the emperor, the governor of a province or even the local councils of the cities, as mentioned in an inscription from Lemellef in Mauritania Setifensis, which states that this locality was supplied with drinking water during the reign of Emperor “Philip Arab” between 247 and 249 AD³⁸.

2.2.2 Distribution Conduit:

While other water facilities supplied cities and villages for daily consumption, the distribution channels were specifically designed for agricultural irrigation purposes. The Romans fought nature and climate in areas with limited water resources. They established an important water network in order to control the available supply and ensure its effective distribution across agricultural lands. The observable outcome points to the fact that it was executed according to a comprehensive plan by the state and embodied by military engineers, as most of the distribution channels were located in military areas and managed by the army, which was accountable to the emperor for their safeguarding and for providing optimal conditions for their effective exploitation to benefit economy³⁹. The most significant example of these conduits are the important facilities located in the southern foothills of the Saharan Atlas, including the “Bades” region near the Aurasian foothills⁴⁰. An important underground conduit was also discovered in the Lamasba region, built and covered with stones⁴¹.



We present a model of a lead water conduit, which substantiates the activity of special mining workshops in order to provide special equipment for water conduits. The model is from the Timgad Museum (picture N°13).

2.2.3 Public fountains:

Picture N°13 part of a lead aqueduct - Timgad

³⁴ - Stéphane Gsell, Atlas Archéologique de l'Algérie, op-cit, F.27, N°. 224, 18.

³⁵ - G. Wilmans, Corpus Inscriptionum Latinarum, VIII, 2661, 2657.

³⁶ - C. I. L. VIII, 2658, 2659.

³⁷ - C. I. L. VIII, 2660.

³⁸ - Michael Vannesse, Les usages de l'eau courante dans les villes romaines : témoignage de l'épigraphie, in, Latomus 71, 2012, P.474.

³⁹ - Mohamed El Bachir Chenniti, op-cit, PP.152-154.

⁴⁰ - Mohamed El Arbi Aggoun, op-cit, P. 108.

⁴¹ - Pavis d'Escurac Henriette. Irrigation et vie paysanne dans l'Afrique du Nord antique. In: Ktéma : civilisations de l'Orient, de la Grèce et de Rome antiques, N°5, 1980, P. 181.

Fountains are widespread in Algeria, most of them are found in cities, and most of their shapes are semicircular while others are polygonal⁴². The most beautiful examples can be found in both “Djemila” and “Timgad”⁴³. Timgad for instance features four astonishing models of public fountains spread along the main road, supplied with water sourced from a nearby plateau, and transported by a stone channel⁴⁴. The most significant of the four structures and the largest as well, is the octagonal fountain, founded by “P. Julius. Liberalis”, a municipal governor, who invested 32,348 sesterces from his private funds, (picture N°14)⁴⁵. Timgad houses 16 public fountains in total⁴⁶.



Picture N°15 Fountain -
Cuicul site

The fountain of the site of Cuicul is distinguished by its conical shape. It is one of the most beautiful fountains in African cities and is located in a strategic location, which is the main *Cardo* road, near the baths. It consists of a circular basin topped by an outlet stone. The water rises through a vertical pipe carved into the stone⁴⁷, and the water returns and descends gradually and elegantly over the stone before pouring into the basin (picture N°15)⁴⁸.

Excavations in the city of Hippone yielded important traces of several public fountains as well, placed along a road passing over a high reservoir. Traces of three of them were found, all of which are important, including the Gorgon fountain, additionally to other evidence represented by masks in the shape of fountain mouths made of bronze and stone, currently preserved in the Annaba Museum⁴⁹.

One significant piece of archaeological evidence that underscores the connection of fountains to the water supply network, is an inscription (picture N°16) found near a fountain which reveals that the fountain was incorporated into the water network in 172 AD under the rule of the governor



the fountain to the water network- Timgad

⁴² - Corinne Boulinguez, Joëlle Napoli, Hippone, port de l'annonne : la contribution de l'iconographie, in, L'Africa romana XVII, Sevilla 2006, Roma 2008, P. 719.

⁴³ - J. Birebent, Op-cit, P.502.

⁴⁴ - Albert Ballu, Monuments antiques de l'Algérie, Tebessa, Lambèse, Timgad, conférence faite au palais du Trocadéro, le 11 Décembre 1893, Paris, 1894.P. 30.

⁴⁵ - Stéphane Gsell, Atlas Archéologique de l'Algérie, op-cit, F.27, N°255, 54.

⁴⁶ - Bahloul Guerbabi F.Z., Farhi A.La gestion de l'eau à Timgad, de la source aux thermes antiques, in, Larhyss Journal, 23 (2015) P. 267.

⁴⁷ - M. Paul, Martyrs de Djemila, in : comptes rendus des séances de l'académie des inscriptions et belles-lettres, 1920, 64-4, P. 290.

⁴⁸ - L. Leschi, Djemila Cuicul de Numidie, toute une cité de l'Afrique romaine, gouvernement général de l'Algérie, 1938, P.26.

⁴⁹ - Xavier Delestre, Aqueduc, châteaux d'eau, fontaines...L'eau, une richesse antique menace aujourd'hui les vestiges, in, Hippone, Edisud, Aix- en- Provence, 2005, PP.121-123.

Aemilius Macer Saturninus using the municipality's funds⁵⁰.

3. Roman baths:

Baths were among the most profitable investments in the Roman period due to the frequent visits of population. They were among the most important and largest landmarks in the cities. As with any structure, both construction and upkeep require a cost as well as savoir-faire. Baths served as an important economic catalyst; as they provided a workforce by recruiting teams to erect the building, ensure the constant heating in the bath, as well as supervise the process of running water, whether for supply or sanitation. Baths also foster commercial activity as they require special building materials such as volcanic stones (from which most African baths were built) that are searched for and brought from distant areas. Baths also rely on other industries such as pottery, which they need in substantial amounts⁵¹.

All baths were designed following the same principle: a cold, a medium and a hot hall. The city of Timgad is known for its plentiful water resources, and it had the fortune and financial means to live in luxury by building 14 large and small baths, the large ones for the wealthy and the small ones for the common people. Additionally, there were baths reserved exclusively for women. These significant structures also held a significant societal role as places for meeting, talking and exchanging ideas⁵².

Baths were also divided into two categories, public (built by the local authorities) and private that could be rent by the owner. The city of Cuicul illustrates both types. The great southern baths were built around 183-184 AD by the local council known as *Respublica Cuiculitanorum*. There were many private baths as well, including the baths of the House of Castorius and the House of Europa. Among the most beautiful landmarks that this ancient city has preserved are the symmetrical baths on the western side, which were built by the emperor Commodus (picture N°17).



Picture N° 17 Public baths - Cuicul site - reign of emperor Commodus

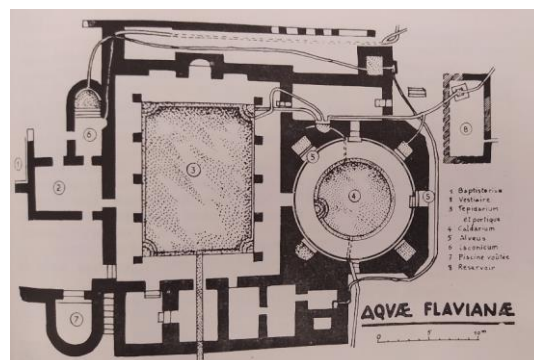
⁵⁰ - CIL.VIII.17869.

⁵¹ - Yvon Thébert, *Thermes romains d'Afrique du Nord et leur contexte méditerranéen*, nouvelle édition, Publication de l'école française de Rome, Rome, 2003, PP.465-470.

⁵² - J. Birebent, *Aquae Romanae*, op-cit, P. 330.

The city of Tazoult has two different types of private baths, one allocated for the army, which had the privilege of owning private baths, and another for the fishers. Their architecture had no specific features compared to other baths except that circular bricks instead of square bricks were privileged. These baths were all marked with the insignia of the Third Augustan Legion⁵³, thus suggesting that they were built with army funds.

The Romans used natural hot mineral baths, as indicated by traces of conduits designed to transport hot water to the large baths. Their affinity for warm water led them to transport it to their private homes⁵⁴. These baths were also very popular among people battling an illness and seeking therapeutic benefit, thus serving as a significant source of income. The most famous Roman mineral bath is the “Hammam Al-Salihin or Aquae Flavianae” (picture N°18) located about 6 km west of the city of “Khenchela” (Mascula)⁵⁵.



Picture N° 18 of a plan of the Aquae Flavianae bath. in: J. Birebent, P.339.

This bath was a destination for the Roman military armies, especially those who had been wounded in battle. Members of the Third Augustan Legion restored it in 208 AD, and it became known as Septimianae in honor of the initiator after his healing⁵⁶.

3.1. Sewer channels:

The economic importance of these conduits was the financial budget allocated to them by the authorities, who paid large amounts of money to establish, restore and repair them, as they were included in the general plan of cities, and were built with various materials such as polished stones or baked clay bricks, or even lead, and tightly covered drains, as illustrated by various examples from our ancient cities. These materials come from quarries, pottery and mining workshops, and were installed by workers and employees who were compensated for their labor (draining water created jobs opportunities and enhanced mobility in various fields)

Toilets occupied an important place in Roman society as well, as evidenced by their prevalence in all cities, whether private or public. The ancient city of Timgad houses toilets consisting of 28 seats. Those of Tazoult, which have the same drainage system, were instead equipped with simple perforated tiles⁵⁷. Additionally, two varieties of toilets can be observed, one originating from the site of Cuicul (picture N°19) and the other from that of Timgad (picture N°20).

⁵³ - J. Birebent, *Aquae Romanae*, op-cit, P. 324.

⁵⁴ - A. Berbrugger, *Hammam Righa, Aquae Caldae*, in, *Revue Africaine*, V.08, 1864, PP.347-353.

⁵⁵ - S. Gsell, H. Graillot, *Exploration archéologique dans le département de Constantine (Algérie) Ruines romaines au nord de l'Aurès Mélange de l'école française de Rome*, V. 13, 1893, PP. 507-508.

⁵⁶ - J. P. Laporte, *Henchir el Hammam (Antique Aquae Flavianae)*, in, *Aouras, Société d'études et de recherches sur l'Aures antique*, N°3, Paris, 2006, PP.285- 287.

⁵⁷ - M.M. Ch. Daremberg et Edm. Saglio, *Dictionnaire des Antiquités grecques et romaines d'après les textes et les monuments*, librairie Hachette, Paris, 1900, PP.989-990.



Picture N°20 Public toilets- Timgad site



Picture N°19 Public toilets- Cuicul site

4. Structure monitoring and maintenance:

As we can see, the Romans showed a specific interest in water, using various methods and techniques to prevent any loss, thus appointing a qualified employee, the *aquarius*, to monitor the distribution of water and the maintenance of fountains as well as water channels. The *aquarius* was responsible for all construction and maintenance work related to water structures, especially monitoring the smooth running of the distribution process, and ensuring that individuals and various public institutions did not take a larger quantity of water than the amount granted by the law. This type of employee formed several teams and worked under the supervision of an administrative official, the “*Aedilus*.”⁵⁸

5. water and agriculture:

Water is one of the most important natural factors that affect various sectors of the economy, especially agriculture, which is closely linked to irrigation. North Africa had diverse sources of this vital substance, whether surface water or groundwater⁵⁹.

Therefore, the search for compensation for the lack of rain through irrigation was an important solution that was taken care of by those in charge of agriculture during the Roman period. The establishment of irrigation facilities to benefit from rainwater and springs went with agricultural expansion⁶⁰. The management of agriculture as well as that of the various requirements of their daily lives were not left to chance. Rather, they actively sought to control rainwater by building dams, connecting water channels, digging wells, and building reservoirs, thus overcoming the phenomenon of drought that the country was suffering from by completing the largest water facilities, the effects of which are visible to this day⁶¹

58 - G. Goyou, *Lexique des Antiquités Romaines*, Librairie Thorin et Fils, Deuxième tirage, Paris, 1896, P.20.

59 - J. B. Robert, A propos de l'évolution du climat en Afrique du Nord depuis le début de la période historique, in, *Revue de géographie jointe au bulletin de la société de géographie de Lyon et de la région Lyonnaise*, V.25, N°1, 1950, P.8.

60 - Mohamed El Arbi Aggoun, op-cit, P.105.

61 - H. Camps. Fabrer, L'Olivier et l'Huile dans l'Afrique romaine, Imprimerie officielle, Alger, 1953. P. 10.

5.1 Irrigation:

Irrigation techniques in Algeria are not a product of the Roman period, but rather date back to the Punic period, when cities and even modest urban centers had water storage tanks with considerable capacities. The Moors implemented effective irrigation techniques in order to make better use of rainwater, especially in the Aures region⁶² but this technology developed and a significant irrigation network appeared during the Roman period, in order to cover the shortage of rainwater, using irrigation technology through wells in desert oases, as they exploited the groundwater levels that spread over vast areas located behind the southern slopes of the Atlas⁶³.



Picture N°21 of an inscription of Lamaspa
- (Merouana) Batna - 218-222 AD

The climate in North Africa was known for its aridity during the summer and substantial, yet not guaranteed, rains in the winter. This fluctuation forced farmers to establish a law to divide the quantities of stored water, as indicated by the Lamasba inscription (picture N°21)⁶⁴.

This text is considered one of the most important archaeological discoveries related to agricultural irrigation legislation, which introduces us to the irrigation system during the Roman period among farmers in a fair and equal manner. Here lies the importance of this document, which was found in 1877 AD by Masqueray, dating back to the reign of Emperor Marcus Aurelius⁶⁵.

This text holds significant value due to its valuable and diverse information about agricultural work and the irrigation system during the winter months⁶⁶. It appears from the first lines of this text, engraved on a piece of limestone, that the owners of these lands that benefit from irrigation were not satisfied with the method of dividing the waters that prevailed during the reign of Emperor Elagabalus (218-222 AD), as the text indicates that Valentinus and his assistant were the ones who formulated this system⁶⁷.

This register contains the names of the owners, the area of the land, and its tax value, in addition to the time period allocated for irrigation for each owner. This time was precisely specified, starting with the daily date on which the irrigation process begins (September 5) and the period (day or

⁶² - Antonio Ibba, Giusto Traina, *L'Afrique Romaine de l'Atlantique à la Tripolitaine* (69-439 ap.J.-C.), Bréal édition, Cedex, 2006, P.74.

⁶³ - M. Frédéric Lacroix, *Afrique Ancienne, Procédés agricoles*, in, *Revue Africaine*. V. 14, 1870, P.101.

⁶⁴ - Marguerite Ronin. *Réglementer l'accès à l'eau dans l'Empire romain*. Anthony Mergey; Frantz Mynard. *La police de l'eau. Réglementer les usages des eaux : un défi permanent*, Editions Johanet, 2017, pp.31-45.

⁶⁵ - E. Masqueray, *La Mission dans le sud de la province de Constantine*, in, *Revue Africaine*. V. 21, 1877, PP. 33-45.

⁶⁶ - M. F. G. De Pachtere, *Le règlement d'irrigation de Lamasba*, in : *Mélange d'Archéologie et d'Histoire*, T.28, 1908, PP. 374-376.

⁶⁷ - B. Shaw, *Lamasba: an ancient irrigation community*, in, *Antiquités Africaines*, V.18, 1982, PP.68-70.

night), in addition to the number of hours allocated for irrigation for each farmer, the beginning and end of which being precisely specified⁶⁸.

One of the characteristics of this inscription is that it testifies to the demand of the simple landowners in this region for a fair distribution of irrigation water. This demand was considered a collective behavior in which population entered into an association to demand their rights. They protested as if they were a "water union" without officially forming it, but their solidarity enabled them to distribute water in a way that satisfied everyone⁶⁹.

6. Water and Industry :

The Romans used water in both urban and rural craft as well as in industrial settings as an indispensable vital ingredient. It thus required the provision of both considerable and regular quantities, which prompted some workshop's managers to request the connection to the public⁷⁰ water distribution network, and this waste of water indicated to him a large body of Latin and legal texts that a certain amount of money must be paid for this loss to the public treasury⁷¹. some of the most important craft and service activities that involved the use of water were as follows:

6.1. Craft activities :

6.1.1. The Pottery Industry :

Water is as a basic and necessary material in the pottery industry where it is used by craft workshops in several stages : Initially, large basins are filled with water to immerse clay materials in order to get rid of impurities. During the fermentation stage, the clay is left for a certain period in large basins filled with water, exposed to sunlight⁷². Examples of these bassins have been excavated in the ancient city of Tiddis, in the neighborhood of the pottery craftsmen quarter⁷³.



Picture N° 22 Pottery Vats – Tiddis site –
The roman period

6.1.2. The Mineral Industry :

⁶⁸ - M. F. G. De Pachtere, *Le règlement d'irrigation de Lamasba*, Op-cit, P. 375.

⁶⁹ - D'Escurac-Doisy Henriette Doublon, *Note sur le phénomène associatif dans le monde paysan à l'époque du haut empire*, in, *Antiquités Africaines*, V1, 1967, P.60.

⁷⁰-Samir Ait Oumghar, op-cit, p.34

⁷¹- Ibid., p. 40.

⁷²-Dr. Bushra Hassan, *Pottery-making technique in Ancient Egypt (3100–1085 BC)*, Lark Journal of Philosophy, Linguistics and Social Sciences, Iraq, 2021, p.235

⁷³ -A. Berthier, *Tiddis antique "CASTELLVM TIDDITANORVM"*, Alegria, 1991, p.86

The archaeological excavation conducted in 1906 by the chief engineer of the Department of Historical Antiquities, Mr. Albert Ballu, resulted in a section with a triangular layout of the industrial district located southwest of the old city of Timgad, where a cluster of buildings featuring two courtyards were found. The exact function of the services associated with the buildings around the first yard are still to be determined, A. Ballu identified a facility for bronze plumbers around the second yard and on the edge of *Cardo Maximus*, with furnaces still loaded with combustible materials such as cedar and charcoal from this wood, working tools and heat-resistant roast clay bouquets, with a cooling basin for the immersion of the metal⁷⁴. Its sizes are about 2 m by 1.15 m and its depth has not been determined due to the poor condition of the lower part. Researcher Amraoui Touatia stated that it was not common to discover a basin of this size in a bronze plumber workshop as bronze does not require a high melting process and therefore does not require such processing either⁷⁵. The presence of several ovens in this workshop suggests that several artisans were likely working there, which makes of the presence of this large-sized bassin for communal use less surprising.

6.1.3. Food trade

- Bakeries

The bakery is one of the craft activities that is easily identified thanks to the presence of grinders and ovens. Furthermore, the bread preparation not only served economic interests but electoral purposes as well⁷⁶, which explains the involvement of the municipal elites in the establishment of bakeries. This craft, which consists in the transformation of grain into flour, was found in ancient cities in Algeria, where physical evidence was observed related to the practical chain of bread production, which follows three stages : primarily, the grinding stage, using hand mills, as observed in the bakeries. Hydraulic mills however that were found in other provinces of the Roman Empire, were not identified. Before the grain was milled it had to be washed with water, which also served to hydrate the flour into a paste. The ancient city of Djemila revealed the presence of a mechanical mixer featuring a cylindrical stone with a deep circular stone cavity at its center, a



Picture N° 23 Mechanical mixer –
Djemila site – The roman period

⁷⁴- A. Ballu , Rapport sur les travaux de fouille exécutés en 1906 en Algérie, France MD CCCC V III, P.40-41

⁷⁵- Touatia Amraoui, Le quartier industriel de Timgad : un état de la question, in *La ville au quotidien- Regard. Regards croisés sur l'habitat et l'artisanat antiques (Afrique du Nord, Gaule, Italie)*, France, 2011, P.225-226.

⁷⁶- J. P. Brun, *L'artisanat urbain durant l'empire romain : Pompéi et les provinces occidentales de la méditerranée antique*, France, 2019, p.183

loader was installed at the bottom. Five mixers of this type have also been discovered in the city of Timgad and another one in the ancient city of Tiddis⁷⁷.

• Contemporary oil

The process of oil industry involves several stages. Primarily, large quantities of water are used to wash the olive fruits before placing them in specific grinding basins to be crushed until they achieve a paste-like texture. The dough is then placed in baskets stacked on top of each other and pressed by the stones. The oil liquid released falls into the first collection basin to collect impurities in the bottom. After that, water is added to the oil to facilitate its flow to other basins through a channel engraved on solid stones and then to a third basin where the oil, becoming less dense than water, floats and flows to the last collection basin⁷⁸.

Archaeological remains reveal that olive presses spread through urban and rural areas, as Setif, M'dawourouch, Cherchel, Tipasa, Tiddis and Timgad.

• Salted fish and whale broth factories

Due to the existence of an important fish resources along some of the coasts of the Ancient Maghreb, its inhabitants, besides consuming them fresh, preserved parts of certain species, for the purpose of salting and producing fish sauce⁷⁹, a fermented fish condiment that was favored the inhabitants of ancient Rome⁸⁰, prompting them to establish workshops to produce this popular commercial product in Rome as well as in the Mediterranean world where it gained considerable popularity⁸¹. The technique of salting fish and whale broth making was practiced in Algeria during the Roman period, where archaeological research resulted in urban and rural facilities including Tipasa, Cherchel, Betioua-Portus Magnus (situated between the cities of Oran and Mostaganem), Annaba, Al Guelta in the city of Chlef, Dellys⁸². A key requirement for processing fish was fresh water used for washing fish, preparing saline solution and cleaning the production facilities⁸³. It should however be noted, that no pipes designed for the water supply for the workshops were mentioned in the documentaion, despite many of them being adjacent to a water tank⁸⁴.

⁷⁷ - Touatia, Amraoui, L'artisanat dans les cités antiques de l'Algérie (I^{er} siècle avant notre ère - VII siècle après notre ère , Angleterre, 2017, p.113

⁷⁸ - Ali al-Fitni, Dr. Hussein Abu al-Atta, a contemporary of Roman oil through archaeological evidence northwest of Maslata in the city of Labda al-Kubra from the first to the fourth century, the scientific journal of the Faculty of Arts, Egypt, 2023, p.100

⁷⁹ - Chafia Charn, Ancient Marine Industries : Fishing methods, salting fish and whale broth, Journal of Heritage Studies, Algeria, 2008, p.39

⁸⁰ -Bahaman Hasiba, fish salting and purple dyeing workshops in the ancient Maghreb, Numiros Academic Journal, Algeria, p.8.

⁸¹ - Ibid., p. 12

⁸² - Touatia Amraoui, Les ateliers antiques de transformation de poissons en Algérie : typologie, localisation et échelle de production, in L'homme et l'animal au Maghreb de la préhistoire au Moyen Age, France, 2021, pp.234-239.

⁸³ - Heba Farouk Al-Nahhas, fish conservation factories during the Roman era in the areas of fish migration in the western Mediterranean and the Black Sea regions at the Bosphorus " Archaeological study", Journal of the General Union of Arab Archaeologists, 2021, p.371

⁸⁴ -Touatia Amraoui, Les ateliers antiques, op-cit, p.240.

6.1.4. Fabric dyeing

This activity, as any other associated with water, required its provision for the washing and the dyeing of fabric, whether cold or hot, clear or mixed with specific agents, for washing wool, clothing or textile. The washing of the wool required a preliminary removal of impurities attached to it. It was then placed in tubs filled with hot water to which a foaming agent (soap for instance) was added⁸⁵. Dyes were commonly extracted from murex mollusks, algae, clay soil and some plants such as Nile, saffron among others.

Dyeing workshops were distinguished from fabric washing workshops by the presence of Heating ovens underneath some basins, which were intended for the preparation of dyes and dyeing fabrics. Notable examples of these were found in the city of Cherchel. The preparation of the dyes, the dyeing fabrics and the ready-made clothes, large volumes of water were needed that the dyeing workshops' managers provided. Water was particularly crucial when preparing purple dyeing. Once the purple liquid extracted from the murex, it was soaked in salt for days before being heated in water-filled pools until it reached the desired color. If the dyers didn't want to dye parts of the fabric or clothing, these were covered it with beeswax, which could then be removed using hot water once the process was finished. Water was also used to clean the workshop.

In the ancient city of Djemila, the bathing area of a house, which contains four hot water basins and two waer bassins, was transformed into a dyeing workshop, supplied by a small water tank located next to the house⁸⁶.

6.1.5. Services craftsmanship " THE PROCESS OF Cleaning and whitening THE clothes and THE COVERINGs "

This activity is considered the most easily identified by archaeologists. The primary function of the "*Folonica*" was to clean and whiten clothes and coverings⁸⁷ through foot trampling⁸⁸ in aquariums filled with water to which essential salts were added, such as sodium carbonate or potassium carbonate⁸⁹. This service was mainly directed to city notables.⁹⁰

This craft was one of the most water-consuming economic activities, which explains the workshops' location near water channels and public watering. Frontinus pointed out that owners of textile and clothing washing workshops could have permission to use public water or what was left of it, in exchange of a royalty paid to the public treasury⁹¹.

Service-oriented facilities have been discovered in Algeria, specifically new and used clothes cleaning workshops. The ancient city of Timgad housed such workshops, which date back to the third century AD. These workshops consist of two or four rooms, and are located in the north-

⁸⁵- M.M. Ch. Daremberg et Edm. Saglio, op-cit, pp. 989-999.

⁸⁶- Samir Ait Oumghar, op-cit, p. 29-30

⁸⁷- J. P. Brun, L'artisanat urbain durant l'empire romain : Pompéi et les provinces occidentales de la méditerranée antique, France, 2019, p.184.

⁸⁸- N. Tran, Le procès des foulons- L'occupation litigieuse d'un espace vicinal par des artisans romains, in mélanges de l'école française de Rome, France, 2007, p.599.

⁸⁹- M.M. Ch. Daremberg et Edm. Saglio, op-cit, pp.998-999.

⁹⁰- J. P. Brun, op-cit, p.184

⁹¹- Samir Ait Oumghar, Water and handicraft activities in the cities of North Africa during the Roman period, Tunisia, 2021, p.13

eastern quater, possibly to benefit from the availability of wells for water supply, thus suggesting that they were not related to the public water distribution network and that water reservoirs were absent⁹².

In the ancient city of Tiddis, a small cluster can be observed under the retaining wall of the city in the northeast. It consists of two groups. The first, located on the fence, is the largest workshop on the site and is equipped with around ten washing basins and a central room as an annex. About ten meters to the south-east, is the second workshop, which contains two washing basins, while the remaining workshops are spread along the upper walkways *intra-muros*.

These workshops date back to the fourth and fifth centuries AD⁹³. To provide these facilities with water, water pipes made of pottery were imbedded in the wall and connected to a water tank featuring three units, or through water pipes that drew water from a water tank located in a house adjacent to the workshop⁹⁴.



Picture N° 24 Laundry workshop
– Tiddis site – 4th c. af.J.C



Picture N° 25 water basins–
Timgad site – 3th c. af.J.C

7. Water transport

When the Romans took control of the Mediterranean basin, they regarded it as an inseparable point of contact and named it " our sea " (*mare nostrum*)⁹⁵. In addition to maritime trade, maritime transport was the main maritime activity in this area. It reached its peak during the Roman period, due to its support to Rome's economy, mainly through the collection of taxes imposed on the Roman provinces (especially the wheat tax collected from Egypt and North Africa)⁹⁶.

⁹²- Ibid, p. 17

⁹³- Touatia Amraoui, L'évolution de l'urbanisme en Afrique et l'implantation des ateliers entre le 1^{er} s. avant notre ère et la fin de l'antiquité –Approche chronologique et spatiale à travers le cas de quelques villes antiques d'Algérie, in *antiquités africaines*, France, 2018, pp.100-101.

⁹⁴- Samir Ait Oumghar, *Water and handicraft activities*, op-cit, pp. 20-21

⁹⁵- Alia Ali Abbas, *Maritime Activity on Roman Mosaic paintings in the North African region*, Yearbook of the General Union of Arab Archaeologists, Egypt, 2021, p.12

⁹⁶- Ibid p. 21

The Romans were devoted to the development of ports and ships. These varied in purpose, military, commercial or for the transport of goods. A mosaic panel, discovered in a *caldarium* in the city of "Althiburos" (A. Proconsularis), dating back to the third century AD and the beginning of the fourth century AD, depicts the Roman maritime trade. The mosaic features twenty-five ships and boats, including warships, commercial ships⁹⁷, as well as the types of ships in the Roman merchant fleet, which could be identified through the Latin inscriptions as follows: " Ponto ", " Corbita " and " Hippoge " which was used to transport horses and animals⁹⁸. It was also represented on a mosaic discovered in 1886 in the baths of the city of Tebessa (Theveste)⁹⁹, which dates back to the late third century AD and the beginning of the fourth century AD¹⁰⁰. The mosaic depicts a transport ship loaded with amphoras¹⁰¹.



Picture N° 26 detail of a mosaic representing a transport ship loaded with amphoras – Tebessa –Late 3rd c. AD –Beginning of the 4th c. AD

In the province of Caesarea Mauretania, wine was produced in sufficient amounts for export. It originated from the remote areas of Tubusuptu and even from the region of Setifis and was exported to the Mediterranean between the late second and fourth centuries AD. For instance, the wine contained in 30 Dressel *amphorae* was possibly produced in Tubusuptu and Saldae, then exported from this port. The wreck of the Pointe de La Luque also revealed a fourth-century cargo containing a large number of oil lamps produced in Caesarea Mauretania as well as African *amphorae*¹⁰², most likely manufactured in the same province, more particularly in Cherchell and Tipasa.

8. Water tax

Since ancient times, water has been regarded as a public asset shared by the *communis Omnium*, especially seas, valleys and rivers of navigation, and was thus qualified as *aqua publica*. However,

⁹⁷ - Alia Ali Abbas, op-cit, p. 21-22

⁹⁸ - Ibid, p. 24

⁹⁹ - F. Baratte, Quelques remarques à propos de la mosaïque de « Fortuna Redux » de Tébessa, article in bulletin de la société nationale des antiquaires de France, France, 1975, p. 77

¹⁰⁰ - Ibid, p. 78

¹⁰¹ - Dondin – Payre (M.), Les thermes romains de Theveste – Tébessa et l'album de François –Maurice Allotte de la Fuye : Un document sur des vestiges méconnus, in comptes-rendus des séances de l'année Académie des inscriptions et belles –lettres, France, 2010, p.724

¹⁰² - T. Amraoui, L'artisanat dans les cités antiques de l'Algérie, op-cit, p.378.

private waters also existed such as less important streams (*Rivi*), lakes, ponds, piped water (*aquae ductuso*) stored in reservoirs (*Castellae*) or built ponds (*Laci*)¹⁰³.

Property owners controlled water resources, such as valleys and rivers, while still having access to public water. The municipalities also owned their own water, and did not only have the privilege of using it, but the authority of imposing water rights (*Ius Aquae*) as well and even selling it. This policy applied to water sources that were established at the time of the city's inception, and excluded any other inalienable public water that remained available for public use¹⁰⁴.

The state also imposed taxes on land and buildings near water installations such as water transmission channels, reservoirs and fountains. Property owners were expected to pay the public treasury an annual fee of 250 000 sesterces. The water of state-built facilities, such as transportation channels, was not distributed free of charge either. Instead, the beneficiaries were required to pay exorbitant annual financial rights called *Vectigal ex Aquaeductibus*, whether these were public institutions (such as baths) or private companies. In the city of "Rome" water was distributed free of charge to citizens, while in provincial cities, the distribution of water was based upon consumption fees, and inspectors were even appointed to prevent fraud. Furthermore, individuals had access to a certain amount of water according to their financial resources and for a specific period of time (hours, days, or season: *Aqua Quotidiana*, *Aestiva*)¹⁰⁵.

The Emperor granted the city the right to oversee its waters and to impose its authority, contingent upon building water installations which were judged essential for its resources. The fees paid would then go to the municipal treasury, and the municipality was granted full access to their management. It is worth noting that these funds, paid by individuals, were not taxes *per se* but rather a right paid for a service. Some researchers believe that the fees for using water were paid solely by craftsmen and industrialists¹⁰⁶.

The legal sources state that a tax had to be paid on water and not on the delivery service, and that it was used to ensure further restorations of the water transmission channels. "Vitruvius" (*Vitruve*), when describing water supply to an urban center, states that from a main reservoir water was transported through three pipes, one of which being transferred to the private individuals who paid the *Vectigal* to the public treasury. This fee will then be directed to the restoration of water facilities. The law also expected everyone who has benefited from water to contribute either financially or through labor to the maintenance and cleaning work in order to ensure the proper functioning of the water system, especially the cleaning of secondary channels. The quantities of water supplied varied from one person to another, depending on financial contributions and participation in maintenance operations. Those who failed to contribute were subject to a financial penalty of 100 sesterces, payable to the municipal treasury. It may seem a small value, but the collection of these fees allowed the municipality to build and maintain other facilities. These fees also varied from

¹⁰³- Raffaella Biundo, *Aqua Publica : Propriété et Gestion de l'eau dans l'économie des cités de l'empire*, in, *Le quotidien municipal dans l'occident romain*, presse universitaires Blaise- Pascal, Paris I, Panthéon- Sorbonne, 2008, P.365.

¹⁰⁴- Ibid, P. 366.

¹⁰⁵- MM. Ch. Daremberg et Edm. Saglio, op-cit, P.345.

¹⁰⁶- R. Biundo, *Aqua Publica*, op-cit, P. 367.

one city to another, which makes it difficult to assess or determine the financial and economic value of such business transactions¹⁰⁷.

The municipality's financial profits from duties or tax on water were however small, especially when compared to the costs of materials, transportation, labor and specialized personnel, but it remained a considerable source of income for the budget, as long as the municipality optimized its water resources and monitored its economic management¹⁰⁸.

• Conclusion

The study addressed a topic related to the role of water in the Roman economy of ancient Algeria, highlighting key elements, among which:

- Water played a key role in the stability of the population and society within an environment characterized by development, prosperity and well-being, both in the city and in the countryside.
- The availability of water contributed significantly to the prosperity of the Roman economy by enhancing agricultural production thanks to irrigation and the revival of artisanal activity.
- The marketing of products has ensured supply and demand, provided jobs, and created stability among families.
- Water was considered a significant financial source for the municipal treasury through the revenues of the water tax.
- The dependence of commercial traffic on maritime transport in the Mediterranean sea, which contributed to the diversification of the aspects of the Roman economy.

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¹⁰⁷- Ibid, PP. 368-372.

¹⁰⁸- R. Biundo, Aqua Publica, op-cit, P. 374.

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