Pegem Journal of Education and Instruction, Vol. 16, No. 1, 2026 (pp. 1518-1542)

RESEARCH ARTICLE WWW.PEGEGOG.NET

Granaries in North Africa During the Roman Period: The Province of Numidia as a Case Study

Dr. Nacer Benmessaoud [1], PhD. Benkacir Boubaker [2]

[1] Algiers 2 university - Abou EL Kacem Saâdallah, Algeria. Institute of Archaeology,
Email : nacer.benmessaoud@univ-alger2.dz.
[2] Institute of Archaeology, Algiers 2 university - Abou EL Kacem Saâdallah, Algeria.
The Laboratory of Civilizational Construction of the Central Maghreb (Algeria).
Email : **benkacir.boubaker@univ-alger2.dz**

Received: 14/01/2025 ; Accepted:10/04/2025 ; Published: 28/01/2026

Abstract

The construction and operation of granaries (horrea) in Roman cities, particularly in the province of Numidia in North Africa, remain insufficiently explored in archaeological and historical research. These granaries, which formed an essential component of the Roman imperial food supply system, played a strategic role in storing and distributing agricultural products, especially grain, whether for meeting local population needs or for shipment to Rome itself. Major cities in Numidia, such as Cuicul (modern Djemila), Lambaesis, Timgad, Cirta, Milev (modern Mila), and Skikda, were equipped with advanced storage infrastructure. Latin inscriptions serve as vital sources for understanding these installations, offering detailed information about their establishment and administration, as well as the individuals or institutions responsible for their construction. Key references, such as *Corpus Inscriptionum Latinarum* (Volume 8), along with the works of Rickman (1971), Allais (1933), and Papi & Martorella, provide valuable insight into the architectural and administrative significance of these public buildings.

This study aims to present a comprehensive analysis of the architectural typology, geographical distribution, and functional mechanisms of granaries in Numidia during the Roman period. It also investigates the role of these facilities within the imperial logistical system and local governance, particularly in the context of the Annona state-controlled supply network responsible for provisioning Rome and the military with grain and other essential goods. The research further examines how these structures reflected imperial economic priorities and were employed as tools for administrative and symbolic control.

Methodologically, the study relies primarily on Latin epigraphic sources, many of which record dedications by provincial governors to emperors, reflecting the close relationship between local initiatives and imperial authority. Archaeological evidence, including excavation reports and architectural surveys, supports this analysis. Inscriptions often describe these structures as *horrea publica* or *horrea sacra*, indicating their official and communal status. Architectural features such as raised floors (*suspensurae*), massive stone thresholds, and sloping corridors demonstrate a high level of engineering adapted to diverse climatic and topographic conditions.

The findings indicate that the financing and management of granaries in Numidia were undertaken through a combination of public resources (including *pecunia publica*), imperial patronage

(*indulgentia*), and, at times, private contributions (*pecunia sua*). These installations were frequently located near forums, city gates, or military zones, highlighting their importance in urban planning and logistical strategy. Thus, they were not only centers for food security but also expressions of local elites' loyalty to imperial power and manifestations of Roman prestige in provincial contexts.

Ultimately, this study offers new perspectives on the intersection of infrastructure, agriculture, and imperial policy. It contributes to a broader understanding of how Rome supported its regional cities and how local communities participated in the logistical fabric of the empire. The granaries of Numidia exemplify the integration of local initiative and centralized imperial planning in the Roman world.

Keywords: Numidia, granaries, agricultural products, storage.

Les greniers à grains en Afrique du Nord à l'époque romaine : Le cas de la province de Numidie

Résumé:

La construction et le fonctionnement des greniers à grains (*horrea*) dans les villes romaines, en particulier dans la province de Numidie en Afrique du Nord, demeurent insuffisamment étudiés dans les recherches archéologiques et historiques. Ces structures, éléments essentiels du système impérial romain d'approvisionnement alimentaire, jouaient un rôle stratégique dans le stockage et la distribution des produits agricoles, notamment les céréales, tant pour les besoins locaux que pour les expéditions vers Rome. Les grandes cités de Numidie, telles que Cuicul (actuelle Djemila), Lambaesis, Timgad, Cirta, Milev (Mila) et Skikda, étaient dotées d'infrastructures de stockage sophistiquées. Les inscriptions latines constituent des sources clés pour comprendre ces installations, fournissant des informations détaillées sur leur fondation, leur gestion, ainsi que sur les personnes ou institutions impliquées dans leur construction. Des références essentielles, telles que le *Corpus Inscriptionum Latinarum* (volume 8), ainsi que les travaux de Rickman (1971), Allais (1933) et Papi & Martorella, apportent un éclairage précieux sur l'importance architecturale et administrative de ces bâtiments publics.

Cette étude vise à présenter une analyse approfondie de la typologie architecturale, de la répartition géographique et des mécanismes fonctionnels des greniers de la Numidie à l'époque romaine. Elle examine également le rôle de ces installations dans le système logistique impérial et la gouvernance provinciale, notamment dans le cadre de l'*annona* — un réseau d'approvisionnement contrôlé par l'État, chargé d'alimenter Rome et l'armée. La recherche explore en outre comment ces structures reflétaient les priorités économiques de l'Empire et servaient d'outils de contrôle administratif et symbolique.

Méthodologiquement, l'étude repose principalement sur des sources épigraphiques latines, dont beaucoup documentent des dédicaces de gouverneurs provinciaux aux empereurs, illustrant la relation étroite entre initiatives locales et autorité impériale. Les données archéologiques, y compris les rapports de fouilles et les relevés architecturaux, étayent cette analyse. Les inscriptions désignent fréquemment ces bâtiments comme *horrea publica* ou *horrea sacra*, soulignant leur caractère officiel et collectif. Des éléments architecturaux tels que les planchers surélevés (*suspensurae*), les seuils en

pierre massifs et les couloirs inclinés révèlent des solutions techniques adaptées aux conditions climatiques et topographiques locales.

Les résultats montrent que le financement et la gestion des greniers en Numidie relevaient d'un mélange de ressources publiques (*pecunia publica*), de patronage impérial (*indulgentia*), et parfois de contributions privées (*pecunia sua*). Souvent implantées à proximité des forums, des portes urbaines ou des zones militaires, ces structures occupaient une place stratégique dans la planification urbaine et les logiques de défense. Elles constituaient à la fois des centres de sécurité alimentaire et des marques de loyauté des élites locales envers le pouvoir impérial, participant au rayonnement de Rome dans les provinces.

En définitive, cette étude apporte un éclairage nouveau sur l'interaction entre infrastructures, agriculture et politique impériale. Elle contribue à une meilleure compréhension du soutien de Rome à ses cités provinciales et de l'implication des communautés locales dans le tissu logistique de l'Empire. Les greniers de Numidie illustrent l'intégration des initiatives locales dans une planification centralisée propre au monde romain.

Mots-clés : Numidie, greniers, produits agricoles, stockage.

1. Introduction

North Africa was once prosperous region of Roman Empire, referred to as "granary of world." Today, much of it is desert. Roman Empire encompassed some of the most fertile lands in Earth (Rathbone, 2014). Asia Minor, Syria, and Palestine thrived economically during the first Christian century (Koon, 2012). Egypt supplied vast quantities of food for population of Rome, while France and Spain were also highly productive. With its rich agricultural land and high-quality food production, North Africa was unparalleled in its abundance.

During the Roman period, North Africa, particularly province of Numidia, experienced significant economic development in agricultural sector, which formed backbone of both local and imperial economies (Cheung, 2021). Roman administration emphasized improving storage methods for agricultural products, particularly grains and liquids, due to their crucial role in ensuring food supplies for the population and military forces in Rome and supporting trade across the Mediterranean (Bevan, 2020). Among key structures that played a pivotal role in this context were granaries, designed using advanced architectural and engineering techniques to ensure long-term storage and minimize losses caused by environmental factors and spoilage.

Granaries of Numidia during Roman period exhibited various forms, including underground silos, which were used to store grains beneath the surface, protecting from weather conditions and deterioration (Rathbone, 2014; Beattie, 2011). Above-ground granaries, known as horrea, represented more advanced storage facilities (Monfort, 2002). These structures were built with durable architectural designs allowed for proper ventilation and ensured enhanced protection against humidity and rodents. These were focused throughout the province, in urban centers and major agricultural regions, which discussed Numidia's strategic role in securing food supplies for the Roman Empire (Bevan, 2020; Rickman, 1980). Rome relied heavily on grain shipments from North Africa.

Study examines Roman granaries' significance in Numidia's province by analyzing their locations, architectural styles, and economic and administrative functions. It aims to highlight the impact of these storage facilities on agricultural activities and their role in integrating Numidia into the broader Roman economic system. Investigating historical and archaeological sources, this research explores how these infrastructures contributed to stabilizing agricultural production and

meeting the growing demands of empire. Analysis positions Roman granaries as integral to North Africa's economic history, particularly in Numidia. Main research question guiding this study is: What were the most significant granaries in the province of Numidia during Roman period, and how did they contribute to the economy of the Roman Empire?

1. The Historical and Geographical Framework of the Province of Numidia:

Civil war between Julius Caesar and Pompey had significant repercussions on Numidia. After Pompey was defeated, the king of Numidia, Juba I, who had been his ally, met his death in 46 BC, and most of his kingdom became a Roman province under the name *Africa Nova*. His son, Juba II, was granted the kingdom of Mauretania in 25 BC (Ghambou, 2010).

Under Emperor Septimius Severus in 193 AD, Numidia was separated from province of Africa Proconsularis and was governed by an imperial procurator. In 4th century, reorganization of the empire ordered by Diocletian made Numidia one of the seven provinces of Africa under the name *Numidia Cirtensis*. Over the centuries, Numidia underwent strong Romanization, marked by the construction of many cities, province of Numidia was created as Roman territory during the reign of Emperor Septimius Severus, around the end of the 2nd century AD (Beattie, 2011). According to research and archaeological inscriptions, it is believed that the establishment of the province dates to the year 198 AD, The texts and inscriptions discovered, like those found in Lambaesis, indicate that the military commander who headed the Third Augustan Legion (*legio III Augusta*), Quintus Anicius Faustus (*legatus Augusti legionis III Augustae*), was promoted to the position of the first governor of the province, indicates its transformation into an official administrative unit under Roman control (Pflaum, 1959, p. 26), Another inscription mentions the governor of the province and his position, and the name of this African province is explicitly mentioned in the text of the inscription (mhjubi, 2001:108).

Incription text:

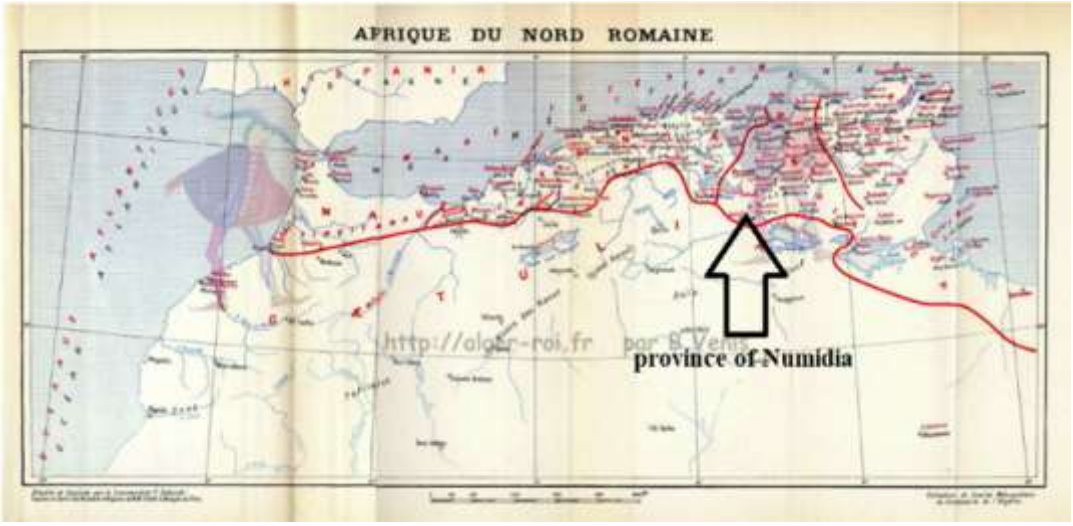
Disciplinae / militari / Augustor(um) aram d(e)d(icaverunt) Q(uinto) Anicio Fausto / co(n)s(ulari) eq(uites) sing(ulares) pr(ovinciae) Af(rica (AE 1957, 00122, AE 1971, 00507 , AE 1973, 00629).(*see figure01*).

Figure No 01: Image of the inscription.
Source : https://db.edcs.eu/epigr.

It included group of cities that played significant role in the Roman Empire's control over province of Numidia, whether militarily, religiously, economically, or culturally. These cities include Lambaesis, Timgad, Cuicul, Thubilis, Tiddis, Cirta, (Ployer, 2017: 34).

There was considerable debate among researchers regarding the geographical boundaries of the province of Numidia, due to the varying information found in ancient historical sources that address region's borders. However, it is generally accepted boundaries of province of Numidia, based on its establishment during the reign of Emperor Septimius Severus, extended from western border of the province of Africa Proconsular is to the east, bordering the province of Mauretania Caesariensis, specifically the area of Zarai (Christian, 2011: 64).

In the north, the borders of Numidia reached the Mediterranean coast, including coastal cities like Skikda (*Rusicade*), the city of El-Kala (*Chullu*), To the east, the province bordered the proconsular province and reached the city of Slaua Announa (*Thibilis*). To the west, it extended to the city of Zarai (*Zarai*) and Timgad (Cuicul) colony, bordering Mauretania Caesariensis. In the south, on edges of desert, furthest point considered is Messaâd (*Castellum Dimmidi*) (Berthier, 1981: 141).



Map No01.: Showing the Boundaries of the Province of Numidia and Its Cities During the Roman Period.
http://alger-roi.fr./ Source :

2. Grain Storage Methods in the Roman World:

Various grain storage techniques were employed throughout the Roman world, spreading across the provinces under Roman rule. These methods differed between rural and urban environments, adapting to the specific needs and conditions of each setting.

1.2. Large Storage Jars (Dolium) :

One of the most common storage methods was using large ceramic containers known as *dolium*. These were sizeable earthenware vessels with flat bases, specific thicknesses, and heights generally exceeding 30 cm, with a wall thickness of more than 2 cm. They were made from carefully selected clay mixed with stabilizing agents to ensure proper firing quality (Dominique, 1997: 98) (*see figure 2*).

According to researchers, the origins of the *dolium* traced back to Greeks, emerging as early as sixth century BCE. As agricultural production expanded, their use became more widespread in ancient world, particularly due to their effectiveness in preserving goods over long periods. These vessels varied in form depending on the regions where they were produced. Initially used for maritime transport, *dolia* became extensively utilized by the Romans for both transportation and storage, for liquid commodities like oil and wine transported from the provinces (Michel, 1993 p. 402). Their

controlled capacity made them particularly practical for storage and transport. Archaeological evidence has revealed their presence in numerous Rome and Roman provinces sites, particularly in domestic settings, oil and wine presses, farms, and ports.

In rural agricultural estates known as *oppida*, where production was relatively modest, *dolium* vessels were commonly used to store grains or liquids for individual households. Excavations in the Mediterranean basin have uncovered storage facilities containing remnants of these ceramic jars. Over time, *amphorae succeeded dolia*, which served similar functions in transport and storage but differed in shape, size, and manufacturing techniques (Dominique, 1997 p. 100).

In the African provinces, *dolium* vessels were particularly abundant, in regions with high agricultural productivity. They have been found in both rural estates and urban centers. In urban areas, they were placed in front of houses, assigned dedicated storage rooms, or buried partially in the ground, leaving only the opening visible. They were also commonly stored in granaries. One of the main advantages of these vessels was their ease of storage and accessibility, allowing for convenient retrieval of stored goods (Fichti, 2007: 15).

figure No. 02: Jars found in the storage facilities of the city of Ostia, Italy.
Source: Stephan Fichti, p. 12.

2.2. Silos:

Silos were one of the oldest methods used for grain storage, with evidence of their use found across several Roman provinces as well as in the Italian peninsula (*figures 03,04*).

A silo consists of a pit with a narrow opening, excavated into the ground. This method was particularly suitable for storing grains in a sealed environment. Once filled, the pit was tightly sealed with soil or clay, effectively isolating its contents from air and moisture to ensure long-term preservation. Some researchers suggest that silos emerged alongsideadvent of agriculture itself. One of their key advantages was their ability to preserve grain effectively. These storage pits appeared in various forms, and in some cases, grains were not stored directly in the silo but placed inside ceramic jars before being stored within the pit (Fantar, 2007, p. 213).

Not all regions were suitable for the construction of silos, as they required careful site selection. Factors like firm soil composition, proximity to farmlands, and accessibility from harvesting areas were crucial in determining the viability of this storage method (Baajami, 2012, p. 163).

Silo openings were typically circular or semi-circular and were securely sealed after grain was deposited inside. Walls were carefully prepared to prevent moisture infiltration, ensuring proper preservation of stored grain. Shape of the storage pit varied and circular, cylindrical, or concave, with depths ranging from 1 to 3 meters (Guirado & Bianchi, 2012, p. 38).

There were two main types of silos: those carved into rocks and those dug into soil. The primary advantages of this storage method included long-term preservation, large storage capacity, and ease

of preparation. However, silos had drawbacks, like risk of collapse during unloading and the limited accessibility, which made frequent retrieval of stored grain impractical (Fichti,*2007*: 9).

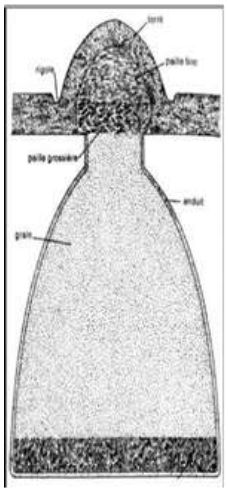
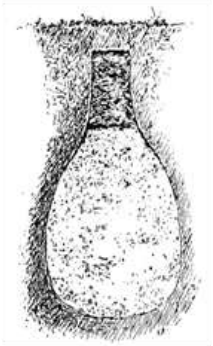


Figure No. 04: Model of silos (*silos*) and their components.
Source: Stephan Fichti, p. 11.



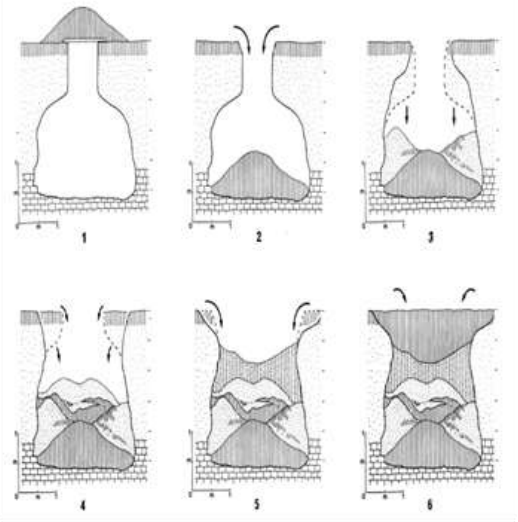


Figure No. 03: Stages of preparing silos (*silos les*) and placing materials inside them.
Source: Stephan Fichti, p. 11.

3.2. Built Granaries (Horrea):

Latin term *Horrea* refers to storage buildings or warehouses used primarily for preserving and storing foodstuffs, particularly grains and liquids. However, these structures were also used to store marble and textiles (Ginouves, 2006: 122).

As form of storage infrastructure in Roman period, *horrea* were used to store grain and other goods, exist as standalone buildings or be integrated within urban setting. Layout varied; some were single-unit structures, while others consisted of multiple rooms and spaces (Guirado & Bianchi, 2012, p. 11). Storage within these facilities is either short-term or long-term, with goods stored in heaps, wooden crates, sacks, or ceramic jars and amphorae. A key feature of *horrea* was their ability to provide optimal protection against pests and humidity, ensuring the preservation of stored commodities (Albert, 2015, p. 221).

Architecturally, *horrea* appeared in various designs, including single-story and multi-story buildings, which are used to optimize space and protect stored materials from deterioration (Pigment, 2008: 34). These storage facilities are either public or private, serving civilian or military purposes. Typically isolated from other structures and strategically positioned in markets, ports, and rural enclosures, highlighting their role in commercial and agricultural activities and in large-scale storage. Economic significance of these granaries in Roman Empire was considerable, attracting scholarly attention. One of the most notable studies on these structures was conducted by the English researcher Geoffrey Rickman, who examined Latin inscriptions and analyzed the presence of *horrea* across various Roman provinces (Dominguez, 2014, p. 203).

Regarding urban planning, *horrea* were usually located in isolated areas near the city's protective walls. Faced streets and gates to facilitate security and the movement of goods in and out of facility. Due to the variation in their architectural forms, identifying their specific functions and distinguishing their types was challenging. However, researchers have relied on construction techniques and inscriptions to determine their purposes. Structurally, these granaries typically consisted of

rectangular rooms with slightly elevated floors to prevent water infiltration and moisture damage. Walls were built using specialized construction techniques, and they featured central courtyard to facilitate movement and loading and unloading of goods (Dominguez, 2014, p. 210).

Two primary types of *horrea* have been identified: public and private. Public granaries serve military garrisons or civilian populations, while private granaries were commonly found in urban and rural homes.

3.2.1. Public and Military Granaries

Public and military granaries were classified into two main types: civilian and military storage facilities.

Public Granaries (Civic Storage):

Public granaries simple or complex structures,consisting of multiple storage rooms, colonnades, and courtyards. These facilities typically included measuring table for weighing and standardizing grain quantities. They were located within Roman cities and primarily used for storing tax grain or annual provisions. Storage in these granaries temporary or long-term until the supplies were distributed to population or transported to ports for shipment to Rome. These granaries were managed by specialized administrative body responsible for their supervision and operations within the Roman city (Gettouche, 2004: 33).

Military Granaries:

On the other hand, military granaries were specifically designed for military use. Geoffrey Rickman extensively studied these structures, particularly those found in Britain. These granaries were commonly located within military forts and along strategic roads to ensure sufficient protection (Rob Collins, Matthew Symonds and Meike Weber, *2015: 20*). According to Rickman, military granaries were typically rectangular or square. However, their design varied depending on the size and location of the fortifications in which they were situated. These granaries served as essential storage facilities for provisions, clothing, and sometimes weapons. Its widely distributed across Roman provinces, including Asia, Africa, and Northern Europe. Britain and Germany had huge military granaries, categorized into two main types: stone-built granaries for permanent storage and elevated wooden granaries (Rickman, 1971, p. 201).

In Africa, examples of military granaries have been discovered at sites like *Haïdra* camp in Tunisia and the *Lambaesis* fortress, which served as the headquarters of the Third Augustan Legion in Algeria. In the Asian provinces, notable granaries include *Hadrian's* granaries in Petra, Jordan. The variations in granary designs depended on the nature of the military fortifications and their strategic importance (Rickman, 1971 p. 209).

3.2.2. Strategic Placement of Roman Military Granaries:

Security considerations determined the placement of Roman military granaries. Grain and food storage facilities were among the last buildings constructed within fortresses and military settlements, as their positioning required careful planning. Typically, they were located near the command center, oriented towards the north to minimize exposure to strong winds and excessive sunlight. Their central positioning ensured optimal protection. For instance, the military granaries of Rome featured an internal courtyard (Rickman, 1971 p. 233). The same design was observed at *Lambaesis*, where the Third Augustan Legion's storage facilities included a courtyard surrounded by rooms, the largest of which measured up to 10 meters long. The entrances to these storage rooms were unusually wide, with openings measuring approximately 2 meters in width (Cagnat, 1913, p. 510). The stationed army directly managed these military granaries, which oversaw their maintenance and distribution of supplies within forts and strongholds (Rickman, 1971: 204).

One of the key examples that allow us to study this type of Roman economic architecture is the **granary complex of the city of Ostia**. This complex was strategically located near the Tiber River and was major hub for receiving shipments from other Roman provinces. According to the researcher **Geoffrey Rickman**, this granary complex consisted of **eleven storage facilities**, classified as follows:

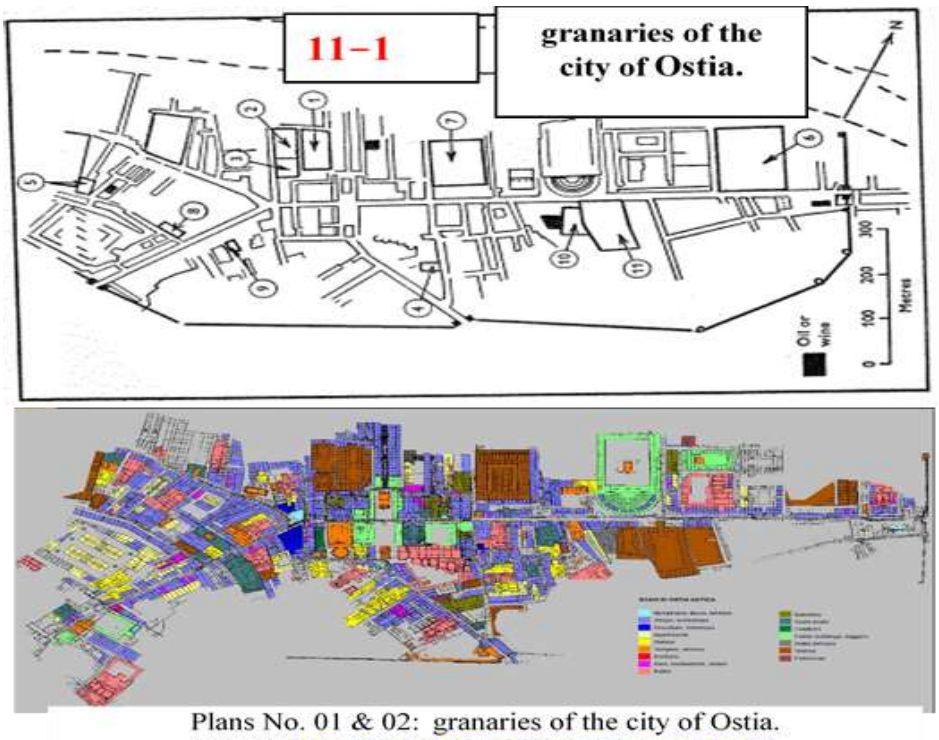
1. **Piccolo Mercato** *(Reg. I, Is. VIII. 1)*
2. **Horrea** *(Reg. I, Is. VIII. 2)*
3. **Horrea Epagathiana et Epaphroditiana** *(Reg. I, Is. VIII. 3)*
4. **Horrea** *(Reg. I, Is. XIII. 1)*
5. **Horrea** *(Reg. III, Is. XVII. 1)*
6. **Horrea Antoniniani** *(Reg. II, Is. 11.7)*
7. **Grandi Horrea** *(Reg. II, Is. IX. 7)*
8. **Horrea** *(Reg. II, Is. II. 6)*
9. **Horrea** *(Reg. IV, Is. V. 12)*
10. **Horrea dell'Artemide** *(Reg. V, Is. XL. 8)*
11. **Horrea di Hortensius** *(Reg. V, Is. XII. T)* (Rickman, 1971: 25). (*figure05*).

Classification highlights the diversity and significance of **Ostia's storage infrastructure**, which play crucial role in the **supply chain of Rome**, ensuring the steady flow of goods, particularly grain, from the provinces to the capital.

The Ostia granaries were in southwestern Italy and underwent multiple phases of renovation and restructuring over time. They were reconstructed during the reign of Emperor Hadrian and later modified during the Severan dynasty. However, scholars suggest that their original construction dates to the reign of Emperor Claudius. Each subsequent emperor contributed to the expansion of the complex, gradually transforming it into the primary hub for receiving shipments and goods from various Roman provinces.

A key characteristic of these granaries is their uniform architectural design, featuring central courtyard and a consistent construction technique. According to Geoffrey Rickman, their structures were elevated on small terracotta supports, isolating stored goods from moisture and potential water infiltration. Granaries were equipped with ventilation openings and porticoes, facilitating air circulation and storing materials easily.

The wWalls of the granaries were constructed using insulating materials, designed to protect the stored grain from humidity, pests, and even fires. Moreover, inscriptions found within the granaries have provided valuable historical insights, enabling researchers to date their construction and uncover critical information about their function and usage (Rickman, 1971 p. 43) *(plans 01,02)*.



Plans No. 01 & 02: granaries of the city of Ostia.
Source: http://digitalmapsoftheancientworld.com

Grandi Horrea stands out as the largest granary in Ostia, dating back to the Roman period, among the structures within this complex. It primarily functioned as a storage facility for foodstuffs, particularly grain, and remains the largest known granary in Ostia. The structure has a quasi-square layout, measuring 100 meters in length and 72 meters in width, and features large central courtyard, surrounded on all four sides by porticoes. Numerous rooms and storage spaces are distributed around this central area, and its floors were supported by hypocaust system, suggesting that it stored perishable goods that required protection from moisture and water infiltration (Boetto, Bukowieck, 2016: 179).

Excavations of the Grandi Horrea began between 1885 and 1886 and continued intermittently until 1914 and 1918, led by the scholar G. Calza. His research determined that the granary was constructed under Emperor Claudius in the late 2nd century and the first half of the 3rd century AD. The structure underwent several modifications, particularly during the reigns of Commodus and the Severan dynasty, to expand the storage rooms in response to increased agricultural production in the Roman provinces. As Ostia functioned as major hub for incoming shipments, its strategic location allowed it to facilitate the storage and transportation of goods efficiently. The complex was situated at the intersection of maritime, land, and river trade routes connecting Ostia to Rome. It also contained water reservoirs for washing goods before storage, and numerous shops opening onto the main streets. The structure was built using large, regularly cut stone blocks (Opus Quadratum), covering an area of 7,000 square meters, with walls reaching a height of 3 meters. The site's topography influenced its layout, and it was surrounded by roads to facilitate the movement of goods (Boetto, Bukowieck, 2016: 180).

Several construction techniques were used, including mixed masonry, brickwork, rubble stone, and ashlar masonry. The walls contained large supporting piers, and during the Flavian period, an eastern portico with shops was added. At the end of the 2nd century, structural changes were made to the northern section, where the ground level was raised to improve storage conditions. In the early 3rd century, new platforms were installed in the northeastern corner to facilitate warehouse workers' handling and stacking of bags and merchandise.

Regarding the type of goods stored, absence of amphorae and jars suggests that the granary primarily stored solid commodities, like grain and legumes. At the same time, liquids like oil and wine were likely excluded. The construction materials and techniques used indicate a strong emphasis on moisture insulation. Multiple rooms, central courtyard, and surrounding porticoes allowed efficient loading, unloading, and periodic store goods inspections (Boetto, Bukowieck, 2016: 182).

Transporting goods from the provinces was conducted by sea, with cargo shipped in vessels and carefully secured during the journey. Upon unloading, conditions had to be optimized for storage. The floors were elevated on ceramic supports, ranging from 30 to 50 cm in height, and were constructed using concrete or hydraulic mortar. According to Geoffrey Rickman, storage methods varied: grain was stored in sacks, large heaps, or within wooden crates. The total storage capacity of the granary is estimated to have been between 1,695 and 2,430 tons of grain (Rickman, 1971: 50).

These granaries were semi-temporary storage facilities since grain was eventually transported to Rome after designated period. The shipments were transferred via boats to Port of Portus, which then redirected them to the port of Puteoli, where another storage complex was located. After being stored for certain duration, the grain was either distributed to the population of Rome or sent to markets for commercial sale.

The Ostia granaries, including the Grandi Horrea, supplied approximately 70% of Rome's annual grain and food requirements. Recognizing the vital role of these storage facilities, Roman emperors took active measures to maintain and expand them. Ostia served as primary hub for food shipments, particularly those from Africa and Asia's Roman provinces (Rickman, 1971: 73).

3.Cereal Cultivation (Wheat and Barley):

Wheat was one of North Africa's primary agricultural products, receiving significant attention before and during the Roman period due to the region's favorable climate, abundant water sources, and fertile land. Even during the Carthaginian era, numerous storage facilities and depicting wheat and barley ears on Carthaginian coinage highlight its importance. The Carthaginian agronomist Mago compiled an encyclopedia of 28 volumes, later translated into Latin and Greek (Andisheh, 2018: 435). North Africa supplied wheat and barley to Rome from the kingdoms of Numidia and Mauretania, continuing into later periods. Focusing on grain cultivation in both Carthage and the Numidian kingdoms made North Africa a target of Roman expansion (Andisheh, 2018 p. 439).

The demand for North African grain increased due to several factors. First, Rome's growing population requires reliable food supply, particularly wheat and barley. Punic Wars devastated Roman agriculture, as fires destroyed farmland, and many Roman farmers, exhausted by war, abandoned cultivation. The use of slave labor in Roman estates in Spain and Italy, further weakened agricultural productivity. These conditions led Rome to turn to North Africa as a strategic agricultural hub, developing extensive transport networks, storage facilities, trade routes, and ports to facilitate grain exports (Al-Bishari, 2007 p. 205).

One of the defining characteristics of African wheat was its hard, dense nature, making it ideal for producing semolina. It was also highly durable, allowing for long-term storage without spoilage—crucial advantage given the long transport times to Rome, where grains deteriorated. Recognizing North Africa's importance as primary supplier of staple crops, Roman emperors—beginning with Augustus—implemented laws and policies to regulate grain production and distribution. Archaeological evidence, including grain mills, storage facilities, and transport infrastructure, further supports the scale of this agricultural system (Al-Bishari, 2007: 206).

Historical sources confirm that North Africa played a central role in sustaining Rome's food supply, particularly after the decline of Italian agriculture. As a result, the region became Rome's primary grain supplier, earning it the title "Rome's Granary" (Al-Bishari, 2007:238).

North Africa provided one-third of the wheat consumed in Rome, with Egypt supplying another third, and both Sicily and Sardinia contributing the remaining third. This is confirmed by Julius Caesar, who stated, "I brought to Rome a country capable of supplying 840,000 quintals of wheat," following his victory in Africa and the conquest of the Kingdom of Numidia in 46 BCE. This led the Roman government to organize and direct the African agricultural economy, making wheat and barley the most important crops in the Roman Empire. The value of grain grew exponentially over time, accompanied by the expansion of agricultural land in the African province, particularly in the Numidia region and the High Plateaus. The African province played a crucial role in alleviating food shortages during economic crises in Rome, aftersecond century AD, alongside Egypt and Sardinia. Additionally, the "Hadrianic Law" is one of the laws that encouraged the acquisition and reclamation of new lands to ensure the continuous supply of provisions to Rome (Al-Bishari, 2007: 187).

1.3.**Olive Cultivation and Oil Production:**

Inhabitants of Ancient Maghreb were familiar with cultivating and grafting olive trees, as evidenced in historical sources. Olive cultivation preceded the arrival of the Romans in the region, in agricultural estates of Carthage, with numerous oil presses found that date back to this period. After the Romans arrived, they expanded olive cultivation to dominate all regions of North Africa (Camps, 2014 p. 3).

Olive trees were among the key crops the Romans focused on in the Maghreb, primarily producing oil to supply Rome. They employed various techniques, including grafting wild olive trees to make them productive and planting new olive orchards. This practice emerged at the end of the Republican period and into the Imperial era. Notable areas where archaeological remains testify to olive cultivation during the Roman period include "Haydra" in Tunisia, " **Tebessa** "Theveste" in Algeria, and "Mador" in Algeria (Camps, 2014: 6).

Julius Caesar imposed oil taxes on inhabitants of Numidia and Tunisia. "Manichaean Law" was one of the regulations allowed the transformation of forested and steppe lands into olive and vineyard orchards. The reclamation of agricultural lands continued under the Julio-Claudian and Flavian emperors, and olive presses became widespread across regions where olives were cultivated (Camps, 2014: 7).

Olive oil was a highly sought-after agricultural product in internal and external trade. Evidence of this can be found in the many markets across the African province, like famous Kosinos market in the ancient city of " Cuicul " in Algeria. This market featured tables with carved basins used for measuring liquids like wine and oil. Some of the oil produced in Africa was consumed locally, while part of it was paid to the Roman state as a tax known as the "annona" and stored in designated warehouses. Emperor Hadrian notably encouraged olive cultivation, which led to large quantities of oil being produced and sent to Rome, particularly from Numidia and the African continent (Camps, 2014: 10).

Extraction of olive oil was carried out using various types of presses. For example, primitive presses consisted of two stones, one fixed and the other movable, with the lower stone carved into basin. This stone was rotated by a transverse handle with a central beam that allowed for adjustments based on the amount of olives. A space was left between the stone and the fixed wall to prevent crushing the pits. A more advanced olive press was found in **Madauros**, which allowed for smoother flow and higher quality oil (Camps, 2014: 38).

Olive presses required substantial equipment, and large facilities for oil extraction have been discovered. These varied between private mills, like those found in the ruins of "Al-Aqoub" in Setif, and public mills located in cities with significant production, like those in Cuicul," " **Madauros** " and various cities in Tunisia. African oil was of excellent quality, determined by the type of olive and its ripeness, as well as conditions of the milling process. Interest in olive cultivation and oil production grew significantly in the second century AD, particularly following decline in grain production, exacerbated by period of drought in the region. This led Roman authorities to seek alternatives, promoting olive cultivation instead of grain in fields, with climate conditions playing a critical role in oil production. Roman emperors also actively encouraged olive farming (Sheniti, 1980 p. 132).

2.3.Vineyard Cultivation and Wine Production:

Agriculture in Roman Africa was not limited to grains and olives but also included the cultivation of vineyards aimed at wine and alcohol production. Vineyards were an ancient agricultural practice in Africa, initially with wild vines. However, with the arrival of the Phoenicians, grafting techniques were introduced, transforming viticulture into significant agricultural activity. The Carthaginians, Numidians, and Romans further developed this practice. Roman attention to viticulture in North Africa led to the widespread cultivation of vineyards, in second century AD. Harvesting of grapes was depicted in mosaic scenes and coins from Numidian kings. Special vineyards were established for this purpose, and wine and spirits became key exports to Rome and Italy across the Mediterranean (Al-Bishari, 2007: 152).

Roman emperors were deeply interested in viticulture due to profitability of wine trade. Vineyards and orchards spread throughout the African provinces, particularly in wet coastal areas. Legislative texts from the region mention the development of vineyards, which evolved alongside Roman occupation. African vines were noted for their unique qualities, and due to local interest and encouragement from Roman authorities, viticulture flourished across almost all of the ancient Maghreb, in coastal and humid regions (Al-Bishari, 2007: 115).

Wine was transported in amphorae to coastal ports for export to Rome and stored in jars for preservation. Remains of wine presses, used to extract the wine, were found, indicating the active production of this agricultural product. Numerous jar and amphora remain were discovered at sites like "Ostia" and "Pozzolos," which served as storage locations for exports from Africa (Al-Bishari, 2007: 312). While wheat, barley, oil, and wine were among the primary exports to Rome, there were also smaller quantities of vegetables and dried fruits exported (Al-Bishari, 2007 p. 532).

4.Granary Storage in Numidia:

Numidia provided the Roman army with grains, wheat, practice continued by King Massinissa until later stages of the region's development. Numidia produced surplus of grains for export to Rome, which were stored in either granaries or fortified warehouses, like those in "Cuicul," "Stora" in Rusicade, "Lambesis," "Tiddis," "Timgad," and the city of Hippone, among others. These storage facilities were scattered across the Numidian region .

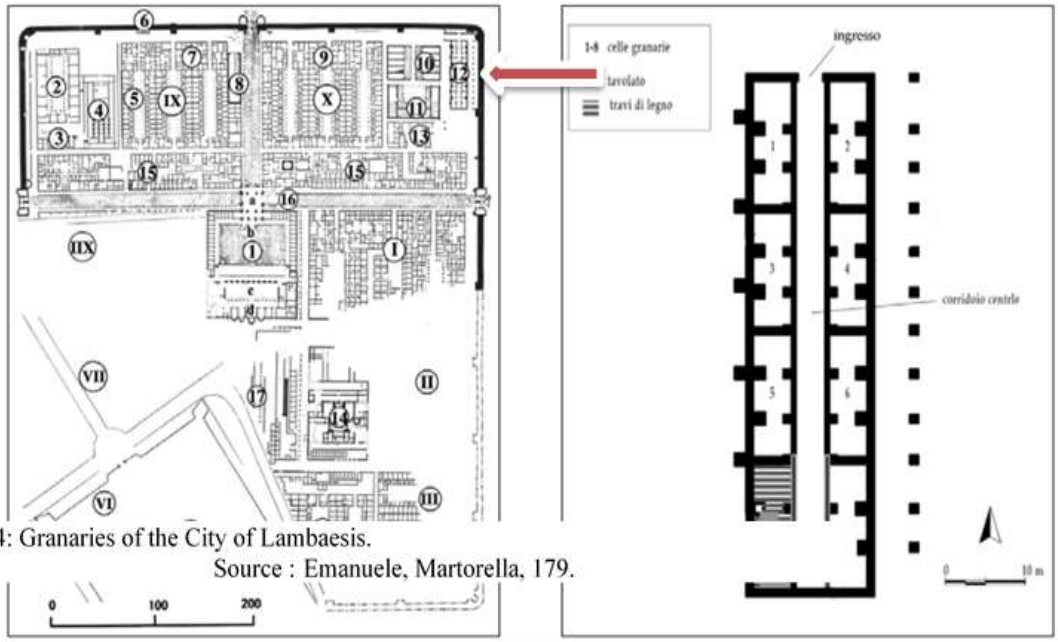
1.4.**Military Granaries of Lambesis (Lambesis):**

Lambesis camp was constructed to house the Third Augusta Legion after its transfer from Tebessa. Lambesis contained various facilities, including granaries in the eastern part of the command center. These granaries were accessible through the northern gate. The discovery of the granaries was made by the French researcher "Courmontagne agli," and they were identified as granaries by the French scholar A. Ballu in 1905. This identification was further elaborated by Gsell and R. Cangnat (Emanuele, Martorella, 2007: 174).

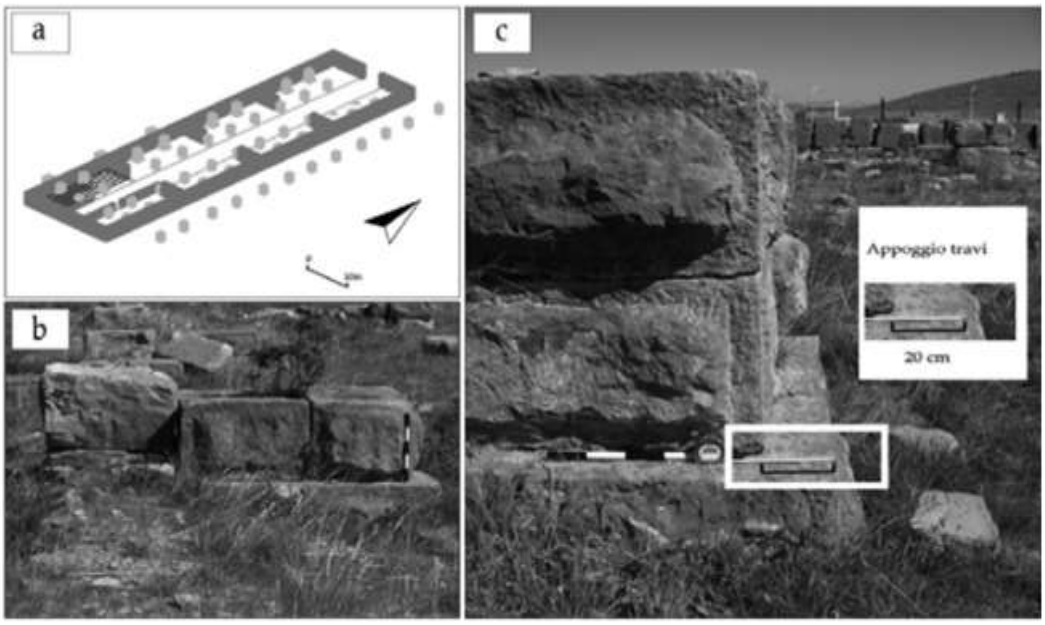
Structure of the building is oriented from north to south with a single entrance facing north. This was common feature in ancient structures designed to facilitate the ventilation of stored grains or materials, ensuring sufficient heat would enter to prevent the growth of fungi and pests. The granaries were in isolated area, with 10-meter-wide space left around them to allow for airflow and to reduce the risk of fires reaching the storage areas. This also helped in the loading and unloading of goods. The building was supported by strong pillars to provide stability, with an elevated platform (Emanuele, Martorella, 2007: 175).

Regarding the dating of the structure, it remains uncertain, but it is believed to have been built between 115-117 CE or sometime shortly thereafter. The building spans an area of 1000 square meters and consists of eight rooms. The rooms measure 2 meters in width and 4 meters in length, with walls that are 90 cm thick. The walls are reinforced with embedded columns. The floors of the granaries were raised on clay supports that are 20 cm high to prevent moisture and water from affecting the stored goods.

As for the nature of the building, it is considered military granary due to its location within military compound. It was used for storing military taxes, particularly wheat and barley, intended for the Roman army. The total area of the rooms is 550 square meters. The grains were likely stored in bags on wooden planks, though they may have been stacked in piles, as the thickness of the walls would prevent excessive pressure from damaging the storage (Emanuele, Martorella, 2007: 179) (Plan04).



Plan 04: Granaries of the City of Lambaesis.
Source : Emanuele, Martorella, 179.



Plan 05: Granaries of the City of Lambaesis.
Source : Francesco Martorella, 146.

2.4.Granaries of the City of Cuicul:

Public granaries of the city of **Cuicul** are considered one of the important landmarks in the city. They are located on the eastern side of the **Cuicul** archaeological site, covering an area of approximately 500 square meters. These granaries are positioned east of the house of Castorius, south of the main street, north of small road, and west of another small road. To the east, they are bordered by the city wall. The granaries are situated on an elevated spot, overlooking the eastern baths. They are connected to several roads, which allowed for easy surveillance and facilitated the transport and entry of goods or stored materials (Miloud, 1998: 221).

In 1910, inscription was discovered near the southern large baths of the city, commemorating the establishment of granaries in the municipal area of **Cuicul**. However, the exact location of these granaries was initially unknown. In 1926, excavations were carried out on the eastern side of the road, revealing part of the inscription near the southern baths, and identifying the location as the public granaries. Researcher Yvonne Allais conducted excavation. The granaries, known in Latin as *horrea*, were found to consist of several elongated, rectangular rooms. These spaces were bordered by roads on three sides, forming right angles (Allais, 1933: 268).

Granaries taketrapezoidal shape, with the walls of the building having varying measurements: the southern wall is 21 meters long, the northern wall is 28 meters, the eastern wall measures 11.8 meters, and the western wall is 23 meters. Access to the granaries is via the eastern gate, which has a double arch. This gate leads to a secondary *cardo* road, which is 3.13 meters wide and stretches 26.35 meters from the gate to the end of the granary wall. To the east is the "Saveria Square," while to the south lies the road separating the granaries from the city wall. This road measures between 21.5 meters in length and 3 meters in width. To the north is *Decumanus* road, which is 3.10 meters wide and 28 meters long. A small road on the eastern side separates the granaries from other unidentified structures (Allais, 1933: 260).

longest length of the granaries is 28 meters, and the shortest length is 11.28 meters. The structure is divided into seven spaces, with a corridor connecting all the rooms except the last one. The corridor measures 12.60 meters in length and 3.12 meters in width. These rooms and spaces vary in shape,

area, and dimensions. The corridor is rectangular, while the first two rooms are rectangular, the third room is semi-rectangular, the fourth is triangular, the fifth and sixth rooms are semi-rectangular, and there is a square space connecting the corridor, the sixth room, and the gate (Allais, 1933: 261).
These granaries were built by order of the Roman Empire's administration in the region and were inaugurated on December 8-9, 199 CE, during the reign of Emperor Septimius Severus. The local authority of Cuicul oversaw the construction. They were used to store the *annona* tax on agricultural produce, managed by the imperial official Flavius Nebos Marcianus (ROMANIS, 2007: 191). (Plan05).

The inscription text:

Imp(eratore) Caes(are) L(ucio) Septimio Se[vero Pio] / Pertinace Aug(usto) Arabico A[diabeni]/co Part(hico) max(imo) fortissimo felicis[simo] / pont(ifice) max(imo) tr(i)b(unicia) pot(estate) VII imp(eratore) XI co(n)s(ule) II p[roco(n)s(ule)] / divi M(arci) Antonini Pii fil(io) divi Commodi fr[atre divi] / Pii Antonini nep(ote) divi Hadriani pronep(ote) div[i Tra]/iani Part(hici) abnep(ote) divi Nervae adnep(ote) et / Imp(eratore) Caes(are) M(arco) Aurelio Antonino Aug(usto) trib(unicia) pot(estate) II proco(n)s(ule) / ⟦P(ublio) Septimio Geta Caes(are) [Augusti nostri]⟧ M(arci) Aureli / Antonini Aug(usti) fratre et Iulia Domna Aug(usta) matre / castrorum res p(ublica) Cuiculitanorum horrea a solo / extruxit dedicante / Q(uinto) Anicio Fausto / leg(ato) Augg⟦g(ustorum)⟧ / pr(o) pr(aetore) viro (!) amp(lissimo) consular<i=E> pat(rono) coloniae(AE 1911, 0106). (*figure06*).

inscription:

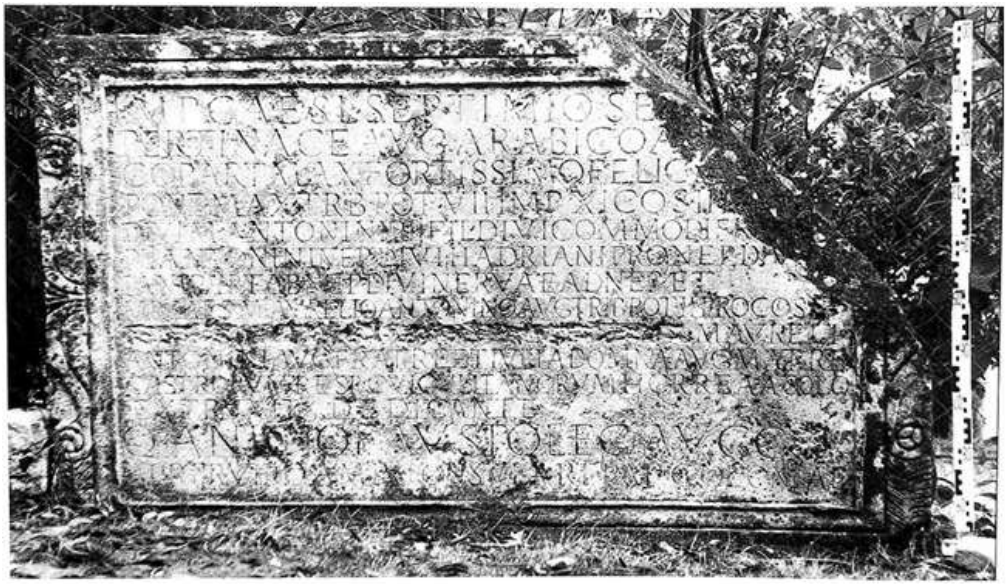
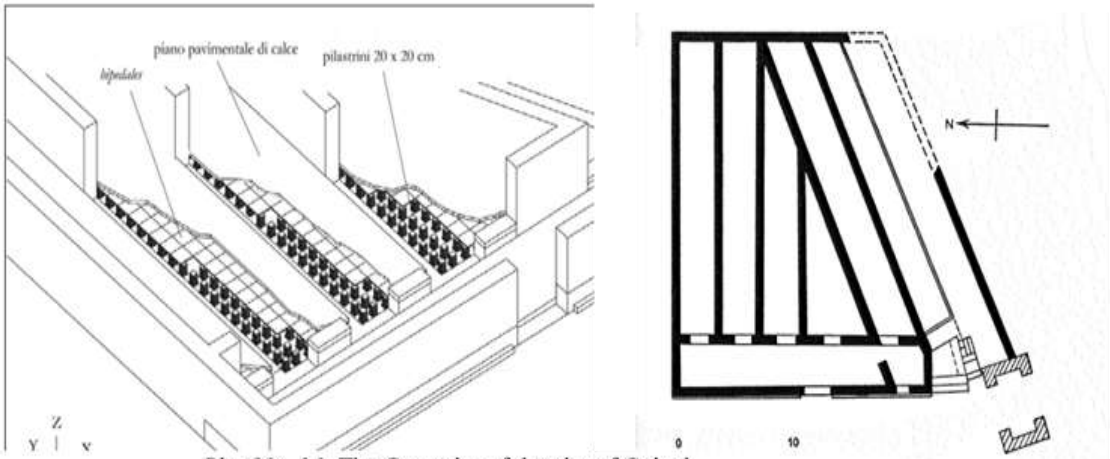


Figure No. 06: The inscription found near the Great South Baths.
Source : AE 1911, 0106.

Granaries were built for Quintus Anicius Faustus, commander of the Augustan cohort and pro-praetor, and protector of the colony, in honor of the Severan emperors.



Plan No. 06: The Granaries of the city of Cuicul.
Source : Geoffrey Rickman, P 141.

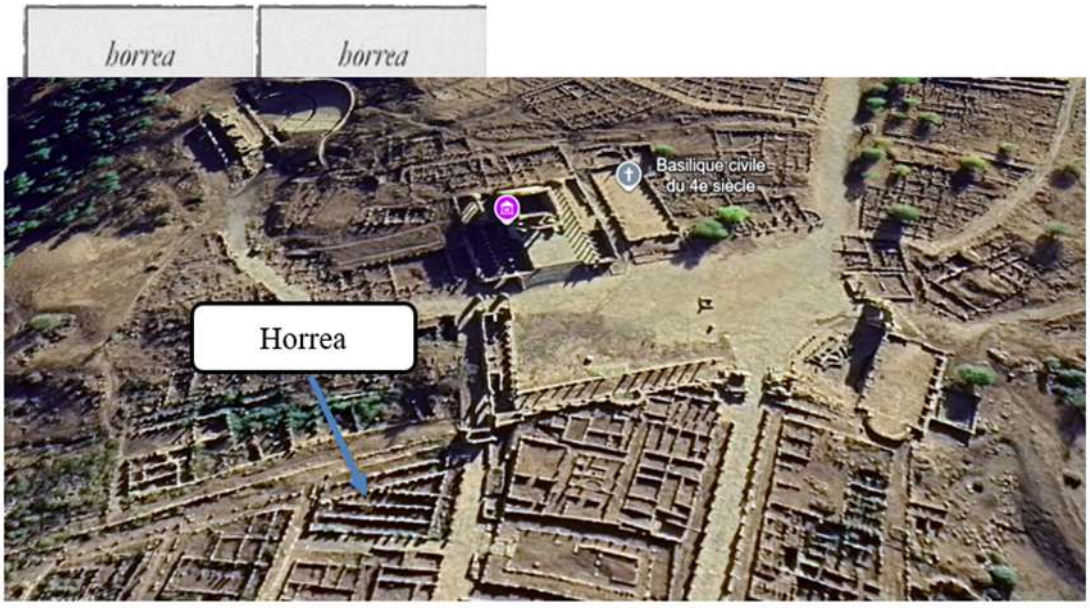


Figure No. 07: The Granaries of the city of Cuicul.
Source: https://earth.google.com

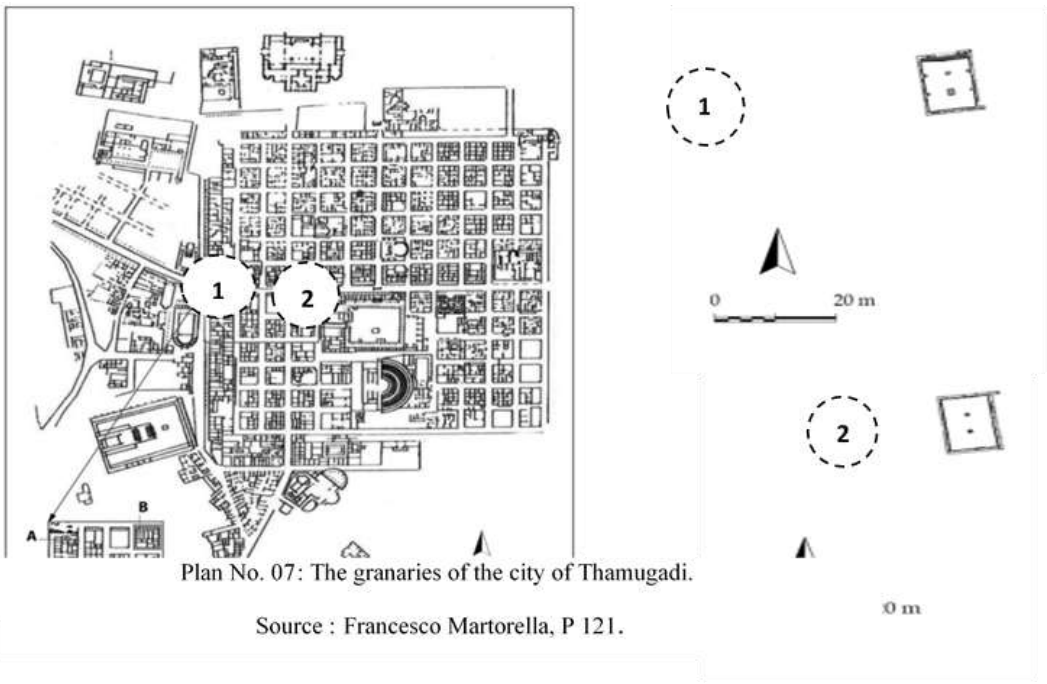
3.4. Granaries of Thamugadi (Marciana Traiana Thamugadi):

Colony of Thamugadi (Marciana Traiana Thamugadi) was established by Emperor Trajan in 100 AD. It is characterized by two granaries in the city, which is understandable given its geographical location. The city is situated amid vast agricultural lands and served as one of the regions that supplied the Roman authority with various agricultural products, particularly from the Aurès region. Additionally, the granaries stored local products and goods from Caesarean Mauretania and neighboring areas (Martorella, 2007: 121).

Granary 1: This granary is located west of the Trajan Arch, in the northwestern area. It has a rectangular shape and is surrounded by several buildings. It is independent and was discovered in 1930 by researcher Christofle. It occupies an area of 60 square meters. The southern walls are 1.21 meters high, the northern walls are 1.39 meters, and the wall thickness is around 0.50 meters. Its walls are built in the African technique (Opus africanum). The entrance is located on the northern side with dimensions of 1.20 meters in length and 0.50 meters in width. The northern wall is approximately 8.07 meters long, while the southern wall is about 7.44 meters. The eastern and western walls are

approximately 9.50 meters long. The granary has moisture-insulating floor using the hypocaust technique and contains two ventilation openings (Martorella, 2022: 122).

Granary 2: This granary is located north along Decumanus Maximus street, near the intersection of the two main streets. It was discovered in 1905. The building consists of interconnected rooms, except for one rectangular room located within the granaries, measuring around 20 square meters, possibly for the workers and overseers stationed there. This granary occupies an area of 90.50 square meters, with walls approximately 0.50 meters thick. Its walls are also built in the African technique (Opus africanum). The entrance to the granary is located on the Decumanus street, with dimensions of 2.80 meters in length and 0.50 meters in width (Martorella, 2022: 123). (Plan06).



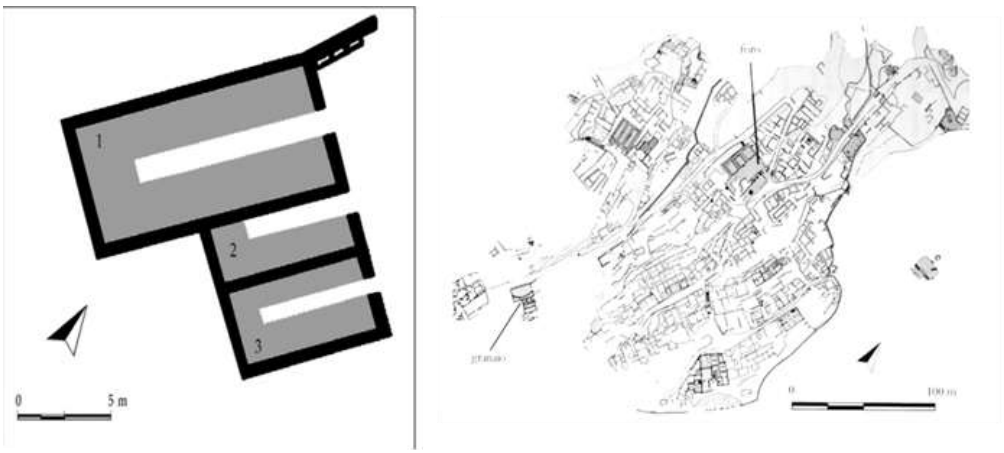
Plan No. 07: The granaries of the city of Thamugadi.

Source : Francesco Martorella, P 121.

4.4. Granaries of Tiddis (Castellum Tidditanorum):

These granaries are located on the southern side of the ancient city of Tiddis. They are carved into limestone rocks and consist of three rooms, surrounded by roads on all sides. The largest room has an area of 105 square meters and features a central entrance. The smallest room has an area of 18.75 square meters, and the third room has an area of 37.5 square meters. The total area of the granaries is 161.25 square meters. Initially, it was believed that these were altars due to the remains of pigs found during excavations led by the French researcher André Berthe (Emanuele, Martorella, 2007: 176).

However, these structures were determined to be granaries for storing grains, based on the building technique that insulates against moisture, their separation from other buildings, and their alignment from north to south. Additionally, there is a large opening on the western side of the granaries, allowing for an elevated floor, which increased the storage space. These granaries were likely used for storing military and civilian grain taxes. It is assumed that they were built during the Severan period, as they are located outside the city walls (Emanuele, Martorella, 2007: 177). (Plan07).



Plan No. 08: The Granaries of the city of Tiddis.

Source : Papi Emanuele, Martorella Francesco, p177.

5.4. Granaries of Rusicada:

Granaries were among the most important in the province of Numidia, playing a key role during the Roman period. They served as one of the economic centers responsible for sending food supplies to Rome. The port of Rusicade was a vital commercial hub for the city, and goods were stored in these granaries before being shipped to the port and granaries of Ostia. These granaries handled products from regions of Numidia like "lambase "Mons," "Lamabsa," and " **Cuicul**." Their external trade activity focused on export and import, particularly with the ports of Italy, including Ostia and Pozzuoli. Some of the most important products exported from Rusicada's port were olive oil and fish oil. Remains of jars and amphorae bearing the seal of "Rusicade" have been found at the port of Ostia. Latin inscription in Skikda mentions the city's granaries, who built them, and who oversaw their construction (Emanuele, Martorella, 2007: 180).

The granaries of Rusicade served as a "hybrid logistical link" or an administrative transit zone, where the provincial jurisdiction of Numidia's inland administration converged with the authority of the imperial fleet and the central grain supply office (*Annona*). Unlike the inland *horrea* in cities such as *Cirta* or *Thamugadi*, which primarily focused on the terrestrial collection and aggregation of tax grain from local farmers, the warehouses at Rusicade specifically those located in the sheltered bay of Stora managed a far more complex "logistical temporality" (Papi & Martorella, 2007: 182). This required precise coordination between the arrival of land caravans via the consular road and the schedules of the large maritime vessels, creating a dense bureaucratic environment where provincial officials interacted directly with maritime administrative personnel (Virlouvet, 2007: 167). This complexity is evidenced by specialized functional groups such as the *mensores portuenses* (harbor measurers), who acted as essential third-party guarantors to ensure that the volumes loaded onto ships matched the imperial ledgers, a role far more critical than that of their inland counterparts (France, 2008:11).

Furthermore, at this transit point, the grain underwent a significant legal transformation: once it entered the warehouses of Rusicade, it moved from being a provincial tax levy to a "strategic sovereign commodity" (*fiscus*) ready for export, necessitating advanced architectural features such as sub-floor ventilation (*suspensa horrea*) to safeguard Rome's food supply from the corrosive effects of maritime humidity (Papi & Martorella, 2007:183). Consequently, Rusicade functioned as a strategic buffer that did not merely store surplus but ensured the seamless conversion of Numidia's

agricultural labor into political stability for the heart of the Empire through rigorous accounting and logistical synchronization (Bonifay, 2007:256).

the Inscription Text:

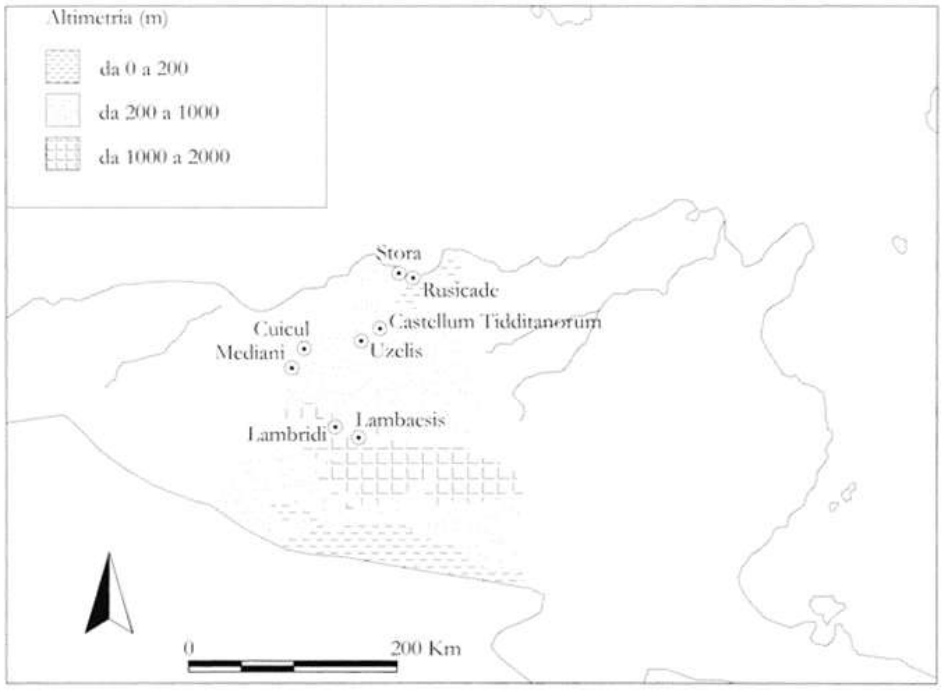
Pro magnificentia temporum / principum maximorum domi/norum orb[i]s Valentiniani et / Valenti[s] semper Augg(ustorum) horrea / ad securitatem populi Romani / pariter ac provincialium con/structa omni maturitate / dedicavit Publilius C{a}eionius / Caec[i]na Albinus v(ir) c(larissimus) cons(ularis) / sexf(ascalis) p(rovinciae) N(umidiae) Cons(tantinae)(CIL 08, 07975)

Granaries were built as gift for the emperors Valentinian and Valens by Publilius Caecionius Caecina Albinus, senator and consul who governed the province of Numidia.

6.4. Granaries of Uzelis (UDJEL):

Granaries are located 37 km west of Constantine (Cirta), near the Milev (Mila) road. In 1881, milestone bearing the law under which these granaries were constructed was discovered. The structure is square in shape and open, designed to store agricultural products harvested from the region. They served as temporary storage, transit station, or permanent storage for reserves and local crafts, particularly for collecting grain (Emanuele, Martorella, 2007: 180).

There are also other warehouses, like Granaries at port of Stora in Skikda, which an inscription mentions were built at the port in 364 and 367 AD. Warehouses of Lambridi are located in Aurès region near the city of Timgad (Carre, 2011, 27).



Map No. 02: Locations of the major Granaries of the province of Numidia. Source : Papi Emanuele, Martorella Francesco, p172.

The Administration and Management of Grain Granaries in the Province of Numidia: Functional Structures and Storage Patterns

The grain granaries (*horrea*) in the province of Numidia represented the backbone of the Roman fiscal and logistical system (Papi & Martorella, 2007: 171). They were not merely warehouses for surplus preservation, but "sovereign institutions" managed through a strict administrative hierarchy, ensuring the conversion of Numidian agricultural production into a vital tool for supplying Rome and the military (Virlouvet, 2007:166-167). Archaeological and epigraphic evidence in cities such as *Lambaesis*, *Thamugadi*, *Cuicul*, and *Tiddis* reveals a dual administrative system that combined technical efficiency with direct imperial oversight (Papi & Martorella, 2007: 180-181).

1. Bureaucratic Administration and the Imperial Civil Service in Numidia The management of imperial granaries in Numidia relied on the "Imperial Household" (*familia Caesaris*). At the apex of the administrative pyramid were the imperial procurators (*procuratores*), who oversaw the logistical planning for transporting harvests from the inland plains to the ports (France, 2008, p. 10). On the ground, executive tasks were entrusted to the "granary treasurers" (*dispensatores horrei*); these were imperial slaves endowed with broad powers to receive tax grain (*annona*) from Numidian farmers and issue official receipts (France, 2008: 12). The selection of slaves for these sensitive positions served as a legal guarantee for the Emperor, as their actions directly bound their master (*dominus*) and did not grant them an independent legal personality that might allow for the manipulation of stock (Virlouvet, 2007:167). Alongside them were the "overseers" (*vilici*), responsible for the physical management of the buildings, and the "counter-writers" (*contrascriptores*), tasked with reconciling accounting ledgers with the actual content of the silos to ensure financial transparency (France, 2008: 13-14).

2. Military and Technical Specificities of Numidian Granaries Due to the presence of the *Legio III Augusta* in Numidia, the pattern of military granaries emerged, as seen in the camp of *Lambaesis* (Papi & Martorella, 2007:175). These were managed by specialized personnel such as "granary clerks" (*librarii horreorum*) and "measurers" (*mensores*). Their mission was highly precise, requiring the measurement of grain using official scales to ensure the equitable distribution of military rations and quality control (France, 2008:11). Architecturally, the Numidian administration adopted the pillar-granary system (*Pfeilerhorreum*), equipped with sub-floor ventilation systems (*suspensa horrea*) to protect the grain from moisture. This technical evolution transitioned the province from the traditional "silos" used by Numidians in the Massylian era described by Sallust and Appian as fortified sites (*loca munita*)—to monumental architectural structures expressing the prestige of the State (Fantar, 2007: 231-232).

3. Geographical Distribution and Logistical Connectivity The administration of granaries was not isolated; rather, it was a link in a chain beginning at collection centers in the high plateaus, such as *Theveste* and *Madaurus*, and extending to port warehouses in *Rusicade* and *Hippo Regius* (Papi & Martorella, 2007:182). Estimates indicate that Numidia was capable of pumping vast quantities exceeding 1,200,000 *modii* of wheat annually (Papi & Martorella, 2007:171). This necessitated a complex logistical administration to oversee the shipment of these grains in vessels whose wrecks in the Mediterranean have revealed amphorae of Numidian origin, confirming the success of the Roman administration in transforming Numidia’s geography into a permanent strategic reservoir (Bonifay, 2007:256-258).

The intersection between military and civilian personnel, advanced technical systems, and imperial oversight proves that the management of Numidian granaries was the instrument that enabled Rome’s absolute economic control over North Africa, transforming Numidian wheat from a mere commodity into the "lifeline" for the survival and social stability of the Empire (Papi & Martorella, 2007:183).

5. The Role of the Warehouses of the Province of Numidia in Supplying Rome:

Province of Numidia played central role as primary source of agricultural products for the city of Rome. These products included grains like wheat, barley, and liquids like oil and wine. Roman Empire's administration managed to secure these goods by building warehouses in cities and along major roads, establishing special teams to manage and protect these facilities (Garcia, 1987: 96).

Main objective of constructing these warehouses was to preserve supplies for as long as possible to ensure their transport to Rome. Agricultural products were stored in these warehouses before being transferred to ports, like those in Skikda, Skikda, and Annaba, which also contained warehouses. From there, the goods were loaded onto ships bound for the Italian ports of Ostia and Pozzolos (Garcia, 1987: 97).

Grains were stored in wooden crates and water-resistant bags to protect them from moisture during sea transport. Liquids like oil and wine were transported in amphorae and small jars. Remnants of these amphorae have been found at the port of Ostia, bearing seals from North African cities like Annaba and Skikda. Suggests that there were workshops in these cities dedicated to producing amphorae for shipping, reflecting the Romanization policies in North Africa, which affected economic sphere. These policies resulted in noticeable economic and technical transformation, in Numidia, including advancements in agricultural techniques, land-use laws, and local industries like aslike pottery and amphorae production for wine and oil. New grain storage systems were also introduced (Garcia, 1987 p. 98).

Many studies mention after Rome crisis, Roman authorities turned to Numidia to cover the shortages, seeking to ensure food security in the capital, particularly given the frequency of these crises due to wars and periodic uprisings (Garcia, 1987 p. 98).

Research has revealed hierarchical structure for the grain storage facilities in the province of Numidia during Roman period. Their locations were strategically aligned with the reorganization of supply routes, responding to the increasing demand for grain in Rome. Although comprehensive data is lacking, Numidia is prominent area, one of Rome's key grain reserves. Several attempts have been made to estimate quantities of grain exported from Africa, particularly from Numidia, with figures ranging from 40,000 to 270,000 tons. Importance of organizing grain transport from Numidian plains to Rome, which was constant concern for Roman authorities, who worked to ensurea steady supply from this province (Carre, 2011: 27).

Many researchers have attempted to estimate the number of ships transporting grain to Italian ports, which was significant. Mosaic panels have provided insights into the types of ships that carried grain and various agricultural products to Rome (Carre, 2011: 28).

In mid-1st century AD, African grain accounted for only 10% of Rome's consumption. However, this percentage increased by the first half of the 2nd century, reflecting political and military developments in the 2nd and early 3rd centuries AD. This shift made the exploitation of Numidia and its fertile lands, known for their agricultural productivity, even more significant (Carre, 2011: 29).

Looking at storage capacities of warehouses built in the province of Numidia; it is evident that they stored considerable quantities of agricultural produce. In case of the warehouses in the city of Cuicul, the storage area was estimated at 115 square meters, with a capacity of 145 cubic meters of grain. The inscription related to "general distribution of imperial grain" highlights the importance of Cuicul as a primary storage center during the early imperial period. Since the colony of Cuicul was part of the Numidian province, the grain stored there was likely transported to the warehouses of Mila, then to the city of chulu, which had warehouses at its port, called the Port of Stora. Grain was transferred to the port of Rusicade. Port of Stora was the largest port for transporting supplies in the province of Numidia. Latin inscriptions indicate how these products were transported: from Cuicul, then to Mila, then to Cirta, followed by chulu, then Rusicade. Military grain storage warehouses in Lambesis,

possibly established between 115-117 AD, had final capacity ranging from 400 to 900 cubic meters (Carre, 2011: 30).
This extensive network of warehouses in the province of Numidia demonstrates the advanced Roman logistics system in North Africa and its crucial role in ensuring food supplies for the Roman Empire.

Conclusion:

Study of grain storage facilities in the province of Numidia during the Roman period reveals their central role in the economic and logistical system of the Roman Empire, particularly in supplying the capital, Rome, with grain. Since the 1st century AD, the province saw significant grain storage and transport infrastructure development. The creation of the network of warehouses was closely tied to expanding grain-growing areas and enhancing the Roman road network, which contributed to more efficient collection, storage, and transportation processes. Dynamic continued to grow during the 2nd and 3rd centuries AD, aligned with the increasing demand for grain, after the population of Rome grew and the needs of Roman armies stationed at frontier provinces expanded.
Analysis of the geographic distribution of storage facilities in Numidia shows that their locations were not random but resulted from careful planning, considering their proximity to major agricultural centers and key road networks linking inland areas to coastal ports, like Rusicade and Stora. Variety in the sizes and functions of these warehouses indicates a well-organized administrative system for managing storage and redistribution operations, as evidenced by inscriptions documenting the roles of overseers responsible for collecting and transporting in-kind taxes to export ports.
Direct intervention of imperial authorities, either through the construction of new infrastructure or the reorganization of local food supply administration, reflects the importance of this province in the broader strategy to supply Rome. While Egypt was traditionally known as primary source of grain, Numidia, along with other North African provinces, became key element in this system, particularly as demand for grain increased due to political and military changes, like founding of Constantinople and the diversion of some supplies to it.
Thus, the study of Numidian storage facilities not only contributes to understanding the economic role of this province in antiquity but also offers a broader perspective on the mechanisms of Roman control over its colonies. By developing integrated logistical networks, the Romans ensured the continuous flow of resources to major urban centers. This study highlights the complexity of the Roman economic structure, which was based not only on military strength but also on the effective management and control of resources to ensure the empire's stability in the long term.

Bibliography:

1. AE : L'Année épigraphique.
2. Albert, F. (2015). Cereals in the Ancient World. Editions.
3. Al-Bishari, M. H. (2000). Rome et l'agriculture des provinces africaines entre 146 av. J.-C. et 285 apr. J.-C. Dar Al-Huda pour l'Édition et la Distribution, Algérie.
4. Allais, Y. (1933). Les greniers publics de Djemila. Revue Africaine, 74, 260.
5. *derrate*. In E. Papi (Ed.), *Mediterranean Archaeology Studies* (Peer-reviewed series). Roma: Edizioni Quasar. ISBN 978-88-5491-281.
6. Papi, E., & Martorella, F. (2007). *I granai della Numidia*. Antiquités africaines, 43, 171–186.
8. Beattie, M. (2011). Just deserts: Roman military operations in arid environments (108 BC-AD 400) (Doctoral dissertation, Cardiff University).
9. Berthier, A. (1981). La Numide Rome Et Maghreb. Picard.

10. Bevan, A. (2020). A stored-products revolution in the 1st millennium BC. Archaeology international, 22(1), 127-144.
Bonifay, M. (2007). Cargaisons africaines: reflet des entrepôts? *Antiquités africaines*, 43, 253–260.
11. Boetto, G., & Bukowieck, E. (2016). The Large Granaries of Ostia: Warehouses and Trade in the Mediterranean from Antiquity to Modern Times. École Française de Rome.
12. Bouajimi Masoudi, A. (1994). Establishment and Development of the Basic Facilities of Roman Trade and the Maghreb during the Early Imperial Period. Ancient History, University of Algiers, 163.
13. Cagnat, R. (1913). L'armée romaine d'Afrique et l'occupation militaire de l'Afrique sous les empereurs (Parts 1 & 2). Imprimerie Nationale : E. Leroux.
14. Camps, J., & Fabrer, A. (n.d.). L'olivier et son importance économique dans l'Afrique antique. Maitre de recherche au CNRS, Aix-en-Provence.
15. Carre, M.-B. (2011). The Warehouse Networks in the Roman World. In J. Arce & B. Goffaux (Eds.), Horrea of Hispania and the Roman Mediterranean. Casa de Velazquez.
16. Cheung, C. (2021). Managing food storage in the Roman Empire. Quaternary International, 597, 63-75.
17. Collins, R., Symonds, M., & Weber, M. (2015). Roman military architecture on the frontiers: Armies and their architecture in late antiquity. Oxbow Books.
18. Fantar, M. (2007). Silos and Warehouses in Pre-Roman Africa: Historical and Archaeological Evidence. A. AF, 43, 231.
19. Fichti, S. (2007). Silos and Storage in the Gallic Period (6th–1st Century BC). Université François Rabelais de Tours, p. 9.
France, J. (2008). Personnel et gestion des horrea impériaux dans le monde romain. In *Les entrepôts dans le monde romain* pp. 8–15.
20. Garcia, D. (1987). Observations on the Production and Trade of Cereals in Mediterranean Languedoc during the Iron Age: Forms of Grain Storage. Revue Archéologique de Narbonnaise, 20, 96.
21. Ghambou, M. (2010). The Numidian Origins of North Africa. Berbers and Others: Beyond Tribe and Nation in the Maghrib, 153-170.
22. Ginouves, R., & others. (n.d.). Methodical Dictionary of Greek and Roman Architecture, Volume 11. École Française de Rome.
23. Koon, K. M. (2012). Granaries and the grain supply of Roman frontier forts: case studies in local grain production from Hauarra (Jordan), Vindolanda (Britain), and Vindonissa (Switzerland) (Doctoral dissertation).
24. Martín Viso, I. (Ed.). (n.d.). Horrea, Barns, and Silos: Storage and Incomes in Early Medieval Europe. Universidad de León.
25. Michelle. P. N. (1993). Doluims. Lattara6, 402.
26. Miloud, Z. (1998). Djemila et Sétif : L'urbanisme comparé de deux villes romaines d'Afrique du Nord (Doctoral dissertation, Université de Paris, Panthéon-Sorbonne, UFR d'Histoire).
27. mhjubi, A. (2001). "The Province of Africa from the Roman Occupation to the End of the Severan Period (146-235 AD). University Publishing Center.
28. Monfort, C. C. (2002). The Roman military supply during the Principate. Transportation and staples. In The Roman Army and the economy (pp. 70-89). Brill.
29. Obiang Nnang, N. C.-B. (2011). Les empereurs romains et les cités d'Afrique, du IIème au IIIème siècle ap. J.-C. L'Harmattan.
30. Ployer, R., & Polak, M. (2017). The Frontiers of the Roman Empire. Vienna.

31. Rathbone, D. (2014). Mediterranean grain prices c. 300 to 31 BC: the impact of Rome. Documentary Sources in Ancient Near Eastern and Greco-Roman Economic History, 289-312.
32. Rickman, G. (1971). Roman Granaries and Store Buildings. Cambridge University Press.
33. Rickman, G. (1980). The corn supply of ancient Rome. Oxford University Press.
34. Rickman, G. E. (1980). The grain trade under the Roman Empire. Memoirs of the American Academy in Rome, 36, 261-275.
35. Salah Addine, A., & Gettouche, A. E. (n.d.). Revaluation of the Roman City of Madaure and Its Legacy.
36. Shniti, M. B. (1980). Les changements économiques et sociaux au Maghreb pendant l'occupation romaine et leur rôle dans les événements du IVe siècle apr. J.-C. Institution du Livre National, Algérie.
37. Thomasson, B. E. (1996). Fasti Africani: Senatorische und ritterliche Amtsträger in den römischen Provinzen Nordafrikas von Augustus bis Diokletian. Stockholm.
38. Van Oyen, A. (2020). The socioeconomics of Roman storage: agriculture, trade, and family. Cambridge University Press.
39. Vigil-Escalera Guirado, A., Bianchi, G., & Quirós, J. A. (n.d.). Horrea, Barns, and Silos: Storage and Incomes in Early Medieval Europe. Universidad de León.
Virlouvet, C. (2007). Entrepôts de stockage, entrepôts et marchés: Pour une typologie des horrea dans l'Afrique du Nord antique. *Antiquités africaines*, 43, 165–169.

Websites:

1. https://db.edcs.eu/epigr.
2. http://digitalmapsoftheancientworld.com
3. http://alger-roi.fr./