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**The organisation of port space at *Iol- Caesarea Mauretania*:
A reconstruction through archaeology and environmental history
L'organisation de l'espace portuaire de *Caesarea Mauretania* :
Une reconstitution entre archéologie et histoire environnementale**

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Abstract

The most emblematic of Algeria's ancient cities, *Caesarea Mauretania*, saw its port area develop from a simple maritime nucleus of the *Iol* agglomeration into an imposing architectural entity, an economic, cultural and political converge for the royal capital of Mauretania, then a Roman province, and later a Byzantine one, before falling into ruin and being reclaimed by nature. The location of this major port on such a challenging site, on a cliff overlooking an exposed bay to north and north-west wind, raises questions about the choice made by ancient societies to build and maintain such a complex, despite the predominantly steep and hostile Algerian coastline. This study aims to understand the interaction between human activity and the natural environment, as well as highlighting their architectural and conceptual adaptation, but also to analyse the adjustment strategies deployed to reconcile the economic imperatives inherent in the status of the ancient city with the challenges of an unstable environment, identifying the technical and structural responses, such as the use of roman hydraulic concrete jetties and systematic dredging practices, that have enabled it to continue its activity despite natural, climatic and historical hazards.

This article offers a reconstruction of the organisation and evolution of this port area, through an approach combining archaeology, geography and environmental history, drawing on archaeological analysis of port structures identified since the XIXth century, including basins, jetties and the Hellenistic-style lighthouse, as well as its landward extension, through Military Engineering studies and excavation reports, as well as rare, but valuable, underwater observations made with the introduction of the scuba diving apparatus, and spatial archaeology initiated by Jean BARADEZ, featuring the aerial identification and organisation of the structures. On the other hand, geomorphological studies provide insight into coastal transformations, including the reformation of the medieval tombolo, and bathymetric evolution based on ancient sediment cores taken in the 1990's and historical Hydrology Services maps from 1871 to 2024. Finally, historical contextualisation using ancient sources such as Pseudo-Scylax, Strabo and Pomponius Mela, allows us to appreciate the topographical potential, that the site of Cherchel held in the eyes of the ancient community, and to place it back in its historical environment.

The results demonstrate that the expansion of the port, from its initial core at *Iol* to its Roman monumental scale, was a response to a process of continuous adaptation. The Roman piers, oriented to counter the prevailing currents, reduced silting in the channels and provided a safe berthing area for ships, while regular dredging maintained a functional depth in the western basin. The gradual abandonment of the site marked the end of this symbiosis between technical innovation and environmental resilience.

Keywords: *Caesarea Mauretania*, Harbour Space, Environnement, Archaeology

Résumé :

La plus emblématique des cités antiques de l'Algérie *Caesarea Mauretania*, voit son espace portuaire se développer, passant d'un simple noyau maritime de l'agglomération d'Iol, à une imposante entité architecturale, espace de convergence économique, culturelle et politique, de la capitale royale de Maurétanie, puis d'une province romaine, ensuite Byzantine, avant qu'il ne retombe en ruine, reconquis par la nature. L'implantation de ce port majeur sur un site aussi contraignant qu'une falaise, dominant une baie exposée aux vents du nord et du nord-ouest, interroge le choix des sociétés antiques sur l'implantation et le maintien d'un tel complexe, malgré un littoral algérien majoritairement abrupt et hostile.

Cette étude vise à comprendre l'interaction entre l'activité humaine et le milieu naturel, ainsi que leur adaptation architecturale et conceptuelle, mais aussi à analyser les stratégies d'ajustement déployées pour concilier les impératifs économiques inhérents au statut de l'antique cité, avec les défis d'un environnement instable, en identifiant les réponses techniques et structurelle qui ont permis de pérenniser son activité malgré les aléas naturels, climatiques et historiques.

Cet article propose une reconstitution de l'organisation et de l'évolution de cet espace portuaire à travers une approche croisant archéologie, géographie et histoire environnementale, qui mobilise l'analyse archéologique des structures portuaires identifiées depuis le XIX^e siècle, dont les bassins, les jetées et le phare hellénistique mais aussi son extension terrestre, à travers les études du génie militaire et des rapports de fouilles, mais aussi avec les rares, mais précieuses, observations sous-marines effectuée avec l'introduction du scaphandre autonome, et de l'archéologie spatiale initiée par Jean BARADEZ, qui étudia l'identification aérienne et l'organisation des structures. D'un autre côté, l'étude géomorphologique apporte une vision sur les transformations littorales, dont la reformation du tombolo médiéval, ainsi que l'évolution bathymétrique à partir de carottages sédimentaires anciens effectuées dans les années 90 et de cartes historiques des services hydrologiques entre 1871 et 2024. Enfin la contextualisation historique via les sources antiques dont le Pseudo-Scylax, Strabon et Pomponius Mela, permet d'apprécier le potentiel topographique que présentait le site de Cherchel aux yeux de la communauté antique, et de le remettre dans son environnement historique.

Les résultats démontrent que l'expansion du port, depuis le noyau initial d'Iol jusqu'à la monumentalité romaine, a répondu à une logique d'adaptation continue. Les jetées romaines, orientées pour contrer les courants dominants, réduisaient l'ensablement des chenaux et offrent un espace d'accostage sécurisé pour les navires, tandis que des dragages réguliers maintenaient une profondeur fonctionnelle dans le bassin ouest. L'abandon progressif du site, marque la fin de cette symbiose entre innovation technique et résilience environnementale.

Mots clés : *Caesarea Mauretania*, Espace portuaire, Environnement, Archéologie

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Introduction

The study of the ancient port of Iol-Caesarea Mauretania and its space, offers an opportunity to explore the interaction between society and its natural environment, focusing both on the perception of a place in perpetual motion, and on the adaptation of facilities to various natural constraints and economic needs. However, intensive coastal development and climate changes, often initiated in ancient times, complicate the study of these remains, forcing us to retrace the evolution of the coastline under both anthropogenic and natural influences, of which the site of Caesarea offers a typical example.

Unlike most Algerian coastal sites, the port of Cherchell was the subject of early scientific attention from the XIXth century. Its historiography can be divided into three distinct phases. The first phase, marked by the pioneering work of Amable Ravoisié (1851), provides surveys of the port's original configuration, before modern transformations, although these are limited to a purely descriptive approach. At the beginning of the XXth century, a second phase emerged with the research of CAGNAT (1931), who proposed an initial historical contextualisation and distinguished

between a commercial basin and a military basin, an interpretation biased by systematic comparisons with the Carthaginian model. Finally, the advent of the scuba diving apparatus in the 1960s, opened a third phase of underwater exploration, represented by the work of Stawski (1962). The methodology remained rudimentary and the conclusions limited, yet, the observations provided details on construction techniques.

These incomplete studies provide a partial and chronologically unbalanced view of the relationship between the port and its coastal environment. They raise questions about the extent of the influence of natural and technical factors on the development, organisation and use of this port area during antiquity. To do this, we need to understand to what extent the ancient perception of the landscape shaped the port's location? how society adapted to natural constraints? and finally, how this port area served as a showcase for power?

To answer these questions, our approach combines four complementary methods: Literature and archaeological study, environmental, and geographical analysis. The few classical (Pseudo-Scylax, Strabo) and medieval literary sources provide information on the evolution of the port of Cherchell, from antiquity to the critical period of its ruin. Although allusive, they nevertheless clarify certain archaeological and historical data. Nineteenth-century reports by the military engineering and public works departments, provide systematic descriptions of the various ancient port structures (MEUNIER, 1847), before their destruction by contemporary development work. Although they remain utilitarian, they provided a basis for reflection in the 1900s on the functional organisation of the port area (QUEMARD and LACOSTE, 1932). Underwater surveys from 1951 onwards, although lacking methodological rigour, compensated for the land-centric view and enabled mapping. Finally, analysis of satellite images and studies of sediment dynamics in port basins in the 1990s, as well as the study of coastal geomorphology, has provided an understanding of the silting process of the ancient port.

1. The Historical, Geographical, and Environmental Context of *Caesarea Mauretania*

Cherchell, the ancient *Caesarea*, is a coastal town located in the wilaya of Tipasa, on the Mediterranean coast of Algeria. It is located about 100 km west of Algiers and 20 km northwest of the wilaya capital, Tipasa. The first recorded name of Cherchell dates back to the Libyan-Punic period, when the city was known as *Iol* (Pliny, *Natural History* : V, I.20). The locality retained this name until the Ist c. AD, when it was renamed *Iulia Caesarea* by King Juba II (CAT, 1891 : 127), and kept it until the Xth century, where it became *Cherchell* (MOKRANTA, 2013 : 1087). *Ibn Hawqal* refers to it as *Šaršal* (*Ibn Hawqal, Šūrat al-Ard* : 78), a name with a Berber connotation (MOKRANTA, 2013 : 1087). Subsequently, this place name underwent various transformations under the influence of foreign interpretations, often carried out without an in-depth knowledge of the indigenous language. These variations include forms such as *Sersseli*, *Zarzel* and *Sargel* (PHILIBERT, 1973: 5), which are very far removed from its ancient place name.

1.1. Historical Context

From Cap Rouge in the west to *Ras el Meskhouta* in the east, the Cherchell coastline is dotted with prehistoric sites dating back to the Middle Palaeolithic (MARCHAND, 1932 : 474-479). According to H. MARCHAND: "A dense population already existed at that time and remained there until the Neolithic period" (MARCHAND, 1932: 480). And it was undoubtedly this population that founded the first settlement of the city of *Iol* and interacted with the first navigators from the Levant. The status of *Iol* remains uncertain, in relation to Carthage or to the powers of the local kingdoms, but in the IIIrd c. BC, the Punic influence is noticeable, particularly through the cult of Baal Hammon and a necropolis of Punic funeral traditions (LEVEAU, 1984: 11). *Iol* was part of

the Masaessyles kingdom, then of the Massyles, as evidenced by the cult dedicated to Micipsa (LEVEAU, 1984: 11). Its port, like Siga's, belonged to the local rulers (Titus Livius, *The history of Rome*: XXVIII, 17). *Iol* was thus successively integrated into the Numidian kingdom, before joining the domain of Mauretania of Bocchus II (LEVEAU, 1984: 12).

At the end of the Ist c. BC, following the death of Bocchus II, Augustus inherited the Maure kingdom and appointed Juba II, son of the Numidian king Juba I, to govern this vast territory (Dion Cassius, *Roman History*: 1. 53, 2). During his reign, *Iol* became *Caesarea* (Pomponius Mela, *Description of the world*: I, 6, 30), and seems to have undergone a significant transformation, changing from a relatively modest status to a prestigious city. Prior to this period it was still « obscure », despite its strategic position "by the sea" (Pomponius Mela, *Geography* : I, 4).

The kingdom continued to enjoy peace and prosperity with the reign of Ptolemy, and this was one of the reasons for his assassination by the emperor Caligula (Leveau, 2024, p. 25). The kingdom of Mauretania was annexed to the Roman Empire, and the city was granted the status of colony shortly afterwards (Pliny, *Hist. Nat*: V, 2, 20). Throughout the Roman period, Caesarea continued to establish itself as one of the largest metropolises in the Roman Empire. Then in 371, the city was damaged during the revolts of Firmus (Ammianus Marcellinus, *History of Rome* : XXIX, IV, 18). However, the archaeological evidences show rich *Domūs* from the late IVth c. AD (LEVEAU, 1984: 209), proving the city recovering, yet Caesarea fell to the Vandals, thirty years later (GSELL, 1952 : 28).

Under Byzantine rule, Belisarius sent one of his officers to retake the city, which then became the capital of the province (Procopé. *History of the Vandal war*, II, 5 and II, 20). This status as provincial capital remained largely symbolic. In reality, Caesarea remained isolated, reduced to its urban perimeter and its port, a city without its territory.

1.2. Geographical Context

The town of Cherrhell is situated in the wilaya of Tipasa, approximately 92 kilometers east of the country's capital, Algiers, and 105 kilometers west of the town of Ténès. It is bordered to the south by Miliana and to the north by the Mediterranean Sea. The city is located on a narrow, gently sloping coastal strip, bordered by the Mediterranean Sea and overlooked by the foothills of the Dahra massif. This unique geographical configuration, combining the advantages of the littoral, and the mountainous hinterland dominated by Mount Zaccar, gave the city a naturally defensive position, and enabled it to be an active link in the economic, maritime and land-based exchanges of the territory. Overlooking a bay, the city benefited from a rocky coastline, alternating between cliffs and sandy beaches to the east. Despite difficult access, the ancients were able to exploit these natural constraints to establish a port there, thanks to the islet in the bay, although it was difficult to access the promontory.

The Cherrhell region's coastline is characterised by the presence of five wadis, fed by the Dahra and Chenoua heights. These waterways, which are often seasonal, have a marked hydrological regime during the rainy season, where wadis el Hachem and el Bellaa are the main sources of the sediments yields (MOULFI, PAUC, & MOULFI, 2012 : 29), flowing, respectively, into El Hamdania beach, located about 6 km east of the city, and east Cap Tizirine. During the medieval period, the Oued el Bellaa was used to power mills and irrigate farmland (MARMOL, 1989: 356).

1.3. Environmental Context

1.3.1. Coastal Geomorphological Setting

The city of Cherrhell is located on a semi-peninsula, dominated by the rocky promontory of Cap Tizirine that divides the coastline into two distinct bays, each with its own specific

geomorphological and environmental characteristics, limits direct access to the sea and shapes the organisation of the city, thus influencing the location of the port and maritime infrastructures.

The larger western bay, is bounded by Cap Rouge (MEUNIER, 1890: 01), and edged by a steep cliff, which rises to 22 metres and is subject to heavy erosion. The boulders that litter its base bear witness to this dynamic (BENCHAOU & TATAI, 1998: 13). Meanwhile, the eastern bay has relative protection from the prevailing north-east to eastern wind and swell during the winter, and from the northern to north-western during summer (LEM, 2007 : 10-14), creating a natural shelter conducive to the establishment of port and commercial activities. The cliff overlooking this bay is made up of soft, crumbly marl and limestone (AMARNI, FERNANE, & BELKESSA, 2021 : 56), and the architectural remains, still visible on the seafront, bear witness to the concerns of the inhabitants of Antiquity, about the stability of this coastal sector. These elements suggest that, from the very first settlements, the issues related to erosion and the solidity of the land occupied a central place in the city's development choices.

1.3.2. The Bathymetry

The bathymetric data of the European Marine Observation and Data Network (EMODnet) shows that the port area of Cherchell, in a global image, has a depth of less than 10 m (EMODnet, 2025¹). In a micro-perspective, the bathymetry of the port area of Cherchell is linked to its geomorphology. The seabed level of the commercial basin gradually increasing offshore (fig.01). Near the coastline, measurements rarely exceed 1 meter, a vessel would navigate over 150 meters seaward to reach just 3 meters draft. A comparison between data from the Hydrographic and Oceanographic Service of the Navy² (Shom) of 1929, and the one of royal ADMIRALTY CHART of 1871, shows that the eastern harbour has remained largely unchanged over the last two centuries. Though, the depth was increased over 1.5 meters since 1991 (Navionics Maritime Charts³, 2024).

For the supposedly military port, the depth for modern surveys is 3 metres near the three quays, compared to 1.5 metres in 1871 (ADMIRALTY CHART, 1871). A comparative study was carried out in 1997 by Mr Benchaou and Mr Tata, who realised that the bottom of the basin had risen by 0.4m, going from 4.7m in 1990 to 4.4m in 1997 (BENCHAOU & TATAI, 1998 : 33).

¹ EMODnet, E. (2025). EMODNet Map Viewer. Consulted on 11/21/2024. EMODnet : <https://emodnet.ec.europa.eu/geoviewer/>

² Shom. (1933). Port de Tipaza et Baie de Chenoua 1:10000. Shom 5699. Ministère de la défense. Consulted on 15/10/2024. <https://www.nvcharts.fr/32645/shom-5699-port-de-tipaza-et-baie-de-chenoua/>

³ NAVIONICS MARINE CHARTS. (s.d.). Bathymetric Map consulted via SaSPlanet. 242808.10624 Nightly, on 11/21/2024

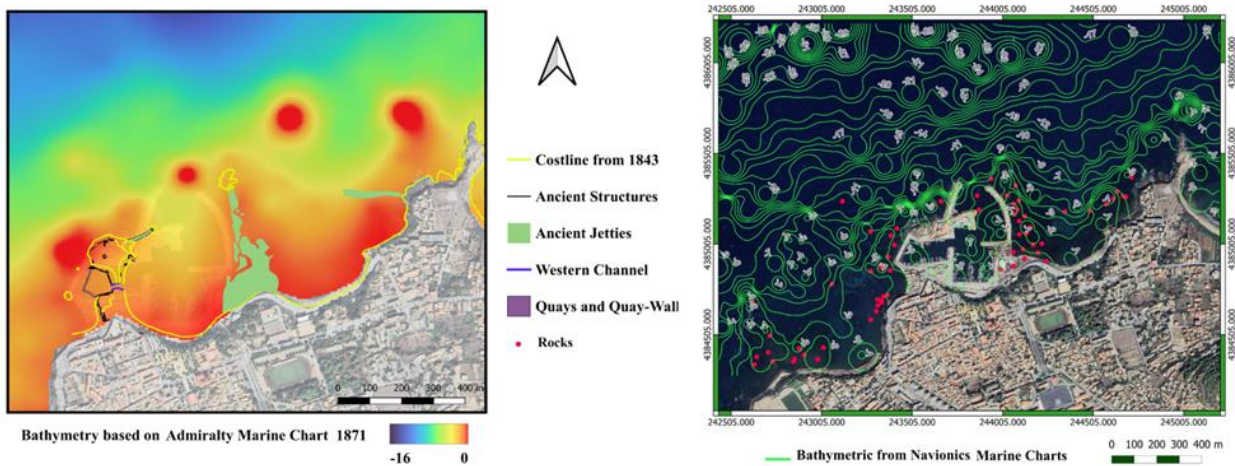


Figure 01: Bathymetric Map of the Marine Area of Cherchell Port and the repartition of the ancient port's structures

Source: Bourai. D. (2025). Processed Bathymetric map based on Admiralty Marine Charts (1871) (left) and Contours from Navionics Maritime Charts, basemap Google satellite 2024 (right)

2. Archaeology of the Port Area

The Reflections on the ancient port of Cherchell and its surroundings reveal the special attention it has received, over other Algerian coast sites. This is due, on the one hand, to its historical status as a historical capital, and on the other hand, to the need to create a sheltered port from 1842, following the creation of a colony for 100 families in 1840, after the sinking of several ships (MEUNIER, 1890: 18) due to the poor quality of the shelter provided by its then state.

The dredging and expansion of the Roman port that took place following the decision of 15 October 1843 (ANOM : GGA, 3F, 12, p247), provided an opportunity to document the spatial organisation of the ancient port, as well as to point up certain port facilities, that are still in place. This work formed the basis of the hypotheses on the existence of a functional duality of the ancient port, distinguishing between its military and commercial dimensions.

2.1. Maritime Infrastructures and Spatial Organisation

2.1.1. The Basins

The development work on the modern port of Cherchell, has provided an insight into the functional organisation of the ancient port, to meet the military and commercial needs of Caesarea (CAGNAT, 1913: 280-284). The ancient port had three functionally distinct harbour basins (LACOSTE & QUÉMARD, 1933: 33).

The commercial basin was bounded to the east by Cape Tizirine and to the west by the Pointe des Marabout's jetty (LACOSTE & QUÉMARD, 1933: 33). It was used for the berthing of merchant ships and for maritime trade. The central basin was a harbour entrance, with the access channel formed by the tip of the El Hammame rock and the eastern tip of Joinville islet (LACOSTE & QUÉMARD, 1933: 33) (fig.02). The western port, for its part, was located to the south of the Joinville islet. It had the shape of an irregular hexahedron, with a 0.7 hectare surface area, and a depth of approximately 2.40 meter.

DIOLÉ had hypothesised the presence of a fourth basin. A series of stone blocks that lined up from the islet to the west created another basin with the exterior façade of the military port, the function of which remained unknown (DIOLÉ, 1952: 161).

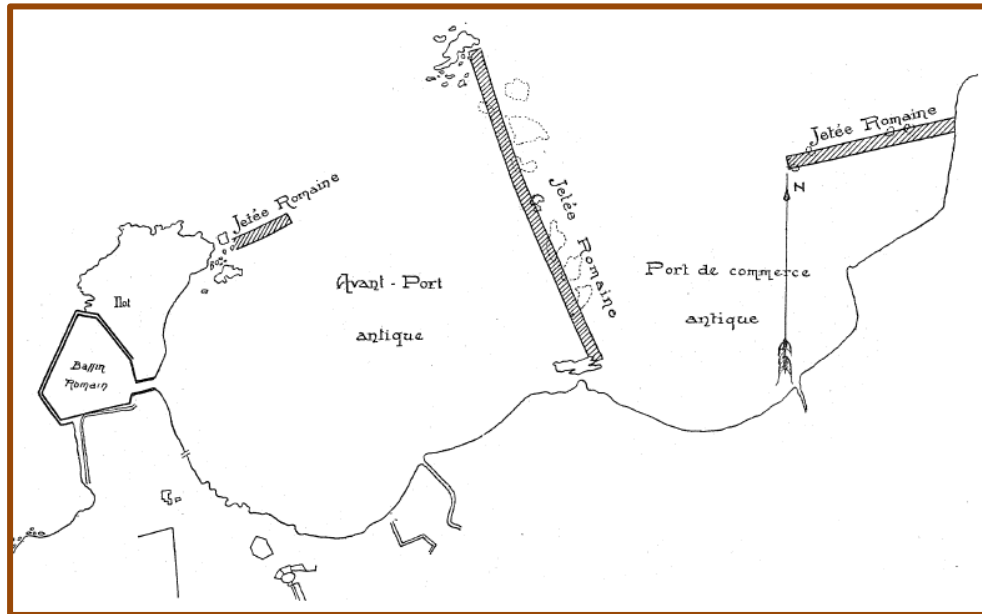


Figure 02: Plan of the ancient harbour of Caesarea Mauretania (Scale 1/5000)
Source: QUEMARD & LACOSTE, 1933: p 26

2.1.2 The Jetties

Two jetties have been observed in the ancient port of Caesarea, forming what would be considered an outer harbour. The central jetty (fig.03), the most impressive, is oriented from south to north and measured approximately 300m, and it extended from the Pointe des Marabouts to the small islet of El Hammam, with a structure that seemed to narrow towards its end. DIOLÉ had noted an interruption in its centre, but no other source confirms this observation (DIOLÉ, 1952: 157).

On the aerial photographs, another jetty can be seen, offset by about 45° from the line of the central jetty. This structure is a modern construction built during the development of the French port (fig.03). Though, it is proven that it rests partially on the ancient pier, whose foundations are anchored in a natural substrate (BARADEZ, 1930-1960: 1-5).

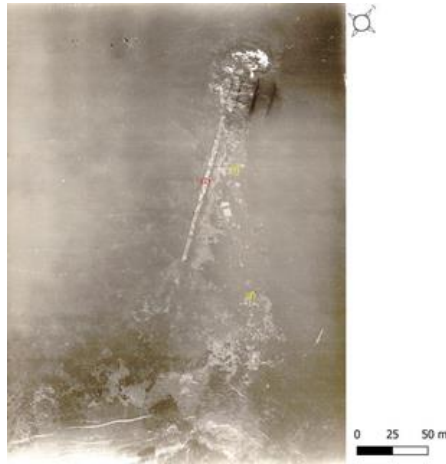


Figure 03: Aerial image of the roman central Jetty (01) and the french jetty (02)

Source The Jean BARADEZ fonds, ANOM: 129 APOM 02. By Bourai Donia

The second jetty connected the tip of Joinville islet to a rocky outcrop to the east (MEUNIER, 1890: 16), and it clearly appears on Ravoisié's surveys carried out at the beginning of the XIXth century (fig.04). It measured around one hundred metres and ran from the south-west to the north-east. This jetty has completely disappeared under the modern port developments.



Figure 04: A view on the city of Cherchell from the western jetty

1. The western jetty 2. Outport 3. Tombolo 4. Public Building

Source: Ravoisié. A, 1851, Pl 25

Other protective structures have been observed underwater. The first is located upstream, about ten metres to the north-east of Joinville islet. It consists of a series of several mortar blocks aligned parallel to the western pier and evenly spaced (BARADEZ, 1930-1960: 07). This type of structure can be found in several Mediterranean ports, including *Portus Iulius* in Italy (BRANDON, 2021: 13-19). Another example of these submerged blocks can be found to the west of the military basin, to the south-west of Joinville Islet, a remarkable alignment of large structures, whose regular spacing and shape undeniably bear witness to human intervention (BARADEZ, 1930-1960: 10).

2.1.3 The Channels

The main channel is between the central and western jetty (fig.02). The central jetty, further out to sea, projects its end about 100 metres downstream of the latter. The current depth of the channel is about 4 metres (Navionics Marine Charts, 2024), although it is difficult to know whether this data can be extrapolated to the ancient times conditions. By this organisation, the main pier offered protection from the waves and swell from the north and east, still, the offset between the

two jetties and their orientation can cause eddies, making entry relatively uncertain, thus, the western one was inaccessible in heavy seas (MEUNIER, 1890 : 25).

As for the channel leading to the military port, it was uncovered during the construction work on the modern port from 1843 onwards. Located to the south of Joinville islet, it crossed a clay bank and was 10.24 metres wide. Its banks were lined with quay walls (MEUNIER, 1890: 17)

2.1.4 The Quays and Quay Walls

The harbour basin to the south of the islet was used as a military port, but it is the only building with structures related to the unloading and loading of goods. This basin was lined with quays and retaining walls, built almost entirely from cut stone. Traces of a continuous portico were still visible along the southern edge in 1843 (MEUNIER, 1890: 17). Nevertheless, they did not rest directly on the bottom of the basin, but on bases located at different depths, depending on their location.

The foundations of the south side were two metres deep, they were built 0.4 metre above the bottom of the basin (MEUNIER, 1890: 17). This may suggest that the structure rested on a platform which no longer exist at the time of the observations, or the seabed was higher than recorded. The quays on the south side, consisted of three tiers, each with a recess of about 0.20 m (fig.05), and measured almost 1.85m, for the still visible part, in the mid- XIXth century (OGECB : Bt N°03 Wilaya 42, Fd AR).

The quay wall on the eastern side was built on the edge of a trench 1 to 1.8 metres high. The foundations were built above the bottom, and consisted of two layers of cut blocks. The anchoring depth of the stone in the wall structure was 0.4m (MEUNIER, 1890: 17). Unfortunately, apart from the two structures on the south and east facades of the port, the others were completely dislocated and destroyed.

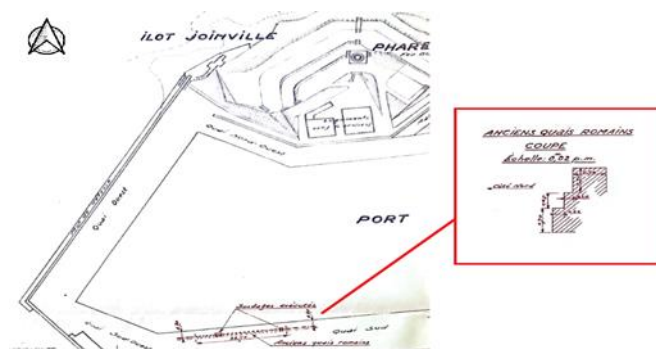


Figure 05: Transverse profile of the Roman quay along the southern front of the ancient port of Caesarea Mauretania, on a scale of 1/1000m

Source: OGECB, Archaive department (2025): F.MN, bx 42.02. By Bourai. Donia

2.2. The Auxiliary Facilities

At the end of the XVIth century, MARMOL Carvajal, a Spanish chronicler, described the state of abandonment of the port of Cherchel. The bottom of the port was littered with « buildings... some still whole, with cracked roofs', visible in calm seas...» (MARMOL, 1667 : 382). Two centuries later, during his visit to the city, Ms Thomas SHAW gave a detailed description of the ancient port of Cherchell, as well as some of the structures in its surroundings. In calm seas, it was

still possible to see the ruins under the sea, including columns and fragments of walls, and the remains of the arsenal and warehouses. The *Cothon*, as he called the western harbour basin, was supplied with fresh water from a cistern on the rocky island, which the ships used to protect themselves from the north and north-easterly winds (SHAW, 1830 : 270).

2.2.1. The Lighthouse

In 1840, a Ottoman fort was still standing on the islet, partially on what was the ancient lighthouse. The latter was built on the Hellenistic model, and reflected the lighthouse of Alexandria, and of Boulogne (LEVEAU, 2024: 53). It was probably made up of storeys, and measured 34 metres in height. It was built on a platform formed of cut stone aligned closely and oriented from west to east, placed on the rocky substrate of the islet that had to be reached by digging. On this base, two courses of cut stone were laid to form a regular octagon 18 metres in diameter (GIARDINA, 2010: 50-51).

The walls were 1.6 metres thick. Above the corners of this octagon, structures were carefully cut from blocks, measuring 2.15 metres on the outside. The intervening walls of 2.32 m length were built of rubble stone, set in regular courses bound with mortar, and were set back from the corner blocks (fig.06). They were covered by an *Opus reticulatum* to fill the space.

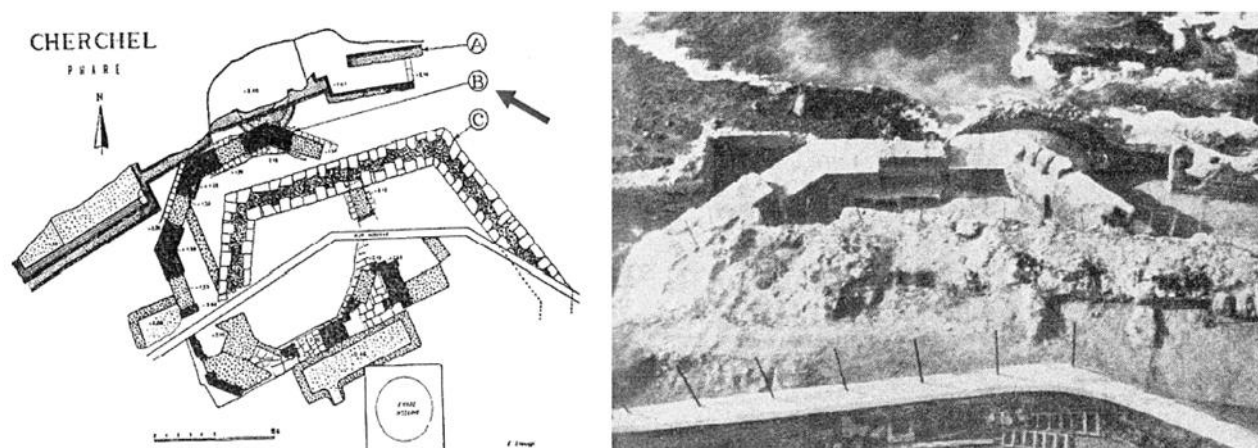


Figure 06: Plan of Juba II's lighthouse (left), with A. Remains of a wall in *Opus reticulatum*, B. lighthouse C. Turkish Fort, and view on the remains of it in 1950 (right)

Source: Plan, OGEBC, Department of archives, F.AR, Bte42-07, (1959), by Stawski. Picture: LASSUS. J, 1959

2.2.2. Sanctuaries and Cisterns

Immediately to the north of the lighthouse, is a group of buildings constructed between the Ist c. BC and the Ist c. AD. This complex consisted of a central building identified as a sanctuary, of which only the 4.4 metre diameter apse remains, the rest of the cliff having been eroded by the sea (LASSUS, 1959: 219).

On either side of this apse, the walls extended the building 2.50 metres. Beyond this monument to the east, an *Opus reticulatum* wall runs along the cliff, and shows the remains of a staircase that provided access to the sanctuary from the upper parts of the islet. Towards the west, a 6-metre-long wall ran along the cliff and ended at large cisterns (fig.07), most of which have also been eroded by the waves (LASSUS, 1959: 219).

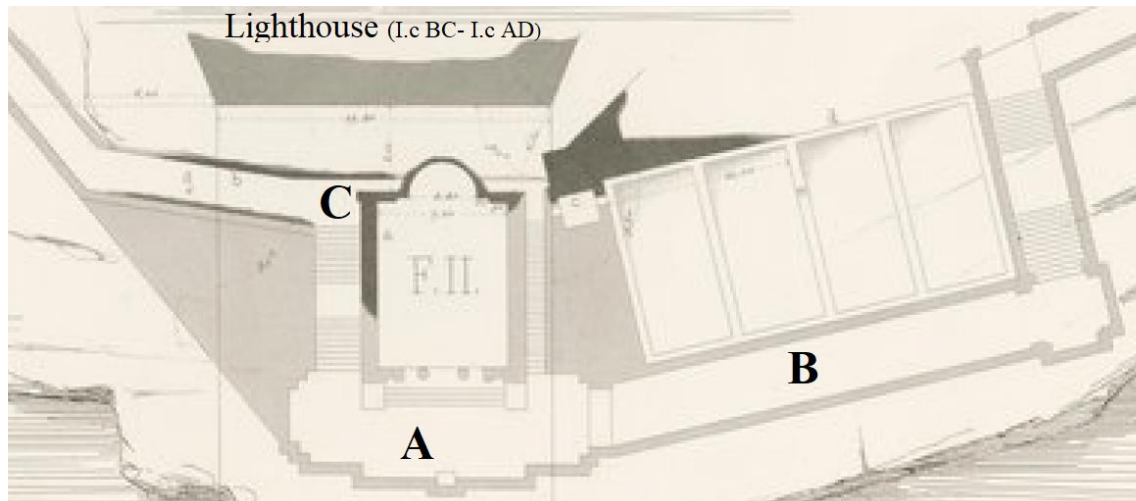


Figure 07: Plan of the northern façade of the islet of Joinville and the infrastructure developments from the Ist century BC to the Ist century AD

(A. Temple B. Cistern C. Stairs)

2.2.3. Other Constructions

The remains of buildings can be seen across the entire surface of the islet, spread over several archaeological levels. The southwest of the islet was occupied by a complexe, wich had an apse on its south side, paved with a mosaic representing a helmeted Minerva, edging another space with a hypocaust, and several pools to its north (LASSUS, 1959: 218). These, together with ovens, belonged to a craft quarter that could date back to the hellenistic era (LASSUS, 1965: FAR 42, Bte 02, 33, p 06).

Due to the remodelling of the lighthouse by the construction of Ottoman Fort, and later by the development of the various contemporary buildings, it is difficult to read the stratigraphy of the islet, but, the west of the lighthouse has revealed installations dating back to the IIIrd c. BC. To the north of these installations was a room containing a semi-circular basin, and below it, another older building, paved with a mosaic in *Opus incertum* (LASSUS, 1965: FAR 42, Bte 02, 33, p 01).

The modern place de la Pêcherie held multi-purpose buildings, undoubtedly linked to port activities, including, summarily and without descriptions, and often suppositions, warehouses, cisterns and swimming pools (DE VERNEUIL & BUGNOT, 1870 : 134).

3. Diccussion

3.1. Technical Adaptations and Structuring of the Port Area

In its original form, the bay of *Iol* was marked by an islet connected to the coast via a tombolo (MEUNIER, 1890 : 17), which, like other insular Mediterranean sites such as Alexandria and Appolonia Pontica, was formed over the last 6,000 years (GIAIME, MORHANGE, CARAYON, FLAUX and MARRINER, 2016 : 12). It provided sheltered docking on either side of the isthmus from the Vth c. BC, when the first Mediterranean trade with *Iol* began (LIPINSKI, 2004: 405).

From the Ist c. BC, the establishment of the royal city of Caesarea was accompanied by the development of the port, to transport the materials needed for urban construction. (LEVEAU, 2024: 46-47). This planning was reflected in the construction of the port of Caesarea Maritima, where

Herod built the first artificial port on a barren coast, a pioneering project in the Augustan period (BRANDON, 2021: 15).

The management of marine constraints then became technical, with the introduction of pozzolan powder (Vitruvius, *Di Architectura*, B XII : 98). They designed a basin enclosed by a central jetty. This structure, anchored on the shoals of the Marabouts' point, deflected the waves refracted by Cape Tizirine. A similar coastal structure can be seen at Tigzirt, where hydraulic concrete foundations extend from the coast towards the islet (BOURAI, 2024: 40). The port's capacity was then optimised by the construction of the western basin, which not only consolidated the isthmus against western breakers, but also ensured mobility with the promontory through a portico, warehouses and cisterns.

The Roman period marked a period of adaptive continuity in existing developments and consolidation of the coastline (Ravoisié, *Explorations Scientifiques de l'Algérie*, 1851: 56). On the seaward side, isolated Pilae are observed upstream of the main channel of the port, as well as to the west of the artificial basin (DIOLÉ, 1952; BARADEZ, 1930-1960). They do not follow a clear pattern, making it impossible to determine their purpose other than protection.

3.2. Siltation Problematic and Abandonment of the Port Area

The question of silting in port basins is a major concern in ancient port organisation and planning. However, due to the extensive restructuring of the port of Cherchell and its dredging in 1847, it is no longer possible to carry out studies on the ancient layers.

Analysis of a 1988 SPOT satellite image (fig. 8), without the extensive remodelling that has taken place since, processed using colour correction, superposition of the NDWI (*Normalized Difference Water Index*) and Turbidity, reveals dark areas corresponding to areas of Suspended particulate matter. This dynamic is verified by the Benchaou & Tata study conducted in 1997 (BENCHAOU & TATAI, 1998: 57) and observations from the 1947 work (MEUNIER, 1890: 17). The closed harbour basin has a muddy bottom, while the outer harbour has fine sand, suggesting its semi-closed nature. These results can be observed in ancient port sites with similar contexts and rapid sedimentation rates, such as *Portus* (MORHANGE & al., 2015: para.11). These results illustrate the need for regular dredging of port basins during antiquity.

During dredging work in 1847, two ancient shipwrecks were found in the basin fill, but they disintegrated when they were extracted (DE VERNEUIL & BUGNOT, 1870 : 134). However, the coexistence of artefacts dating from the IInd c. BC to the Ist c. AD suggests that the dredging of the harbour basin began in the Ist c. BC.

During the Byzantine period, the city of Caesarea was only accessible by sea. The ancient port landscape changed radically from this period onwards. The once flourishing port of Caesarea lay in ruins by the 10th c. (Ibn Hawqal, *Šūrat al-Ard* : 78). The earthquake mentioned by SHAW may have accelerated the destruction of the port (SHAW, 1830: 270), and thus the port was completely filled in by the XIth century. (El Bekri, *Description de l'Afrique Septentrional*, 1859: 190), and a tombolo had already formed. The western basin channel was filled in 1843 (Ravoisié, *Explorations Scientifiques de l'Algérie*, 1851 : 50) , and the sedimentary layers observed (clay-sand-gravel-pebbles) show gradual abandonment, accompanied by the deterioration of protective structures, turning the port area into an open space.

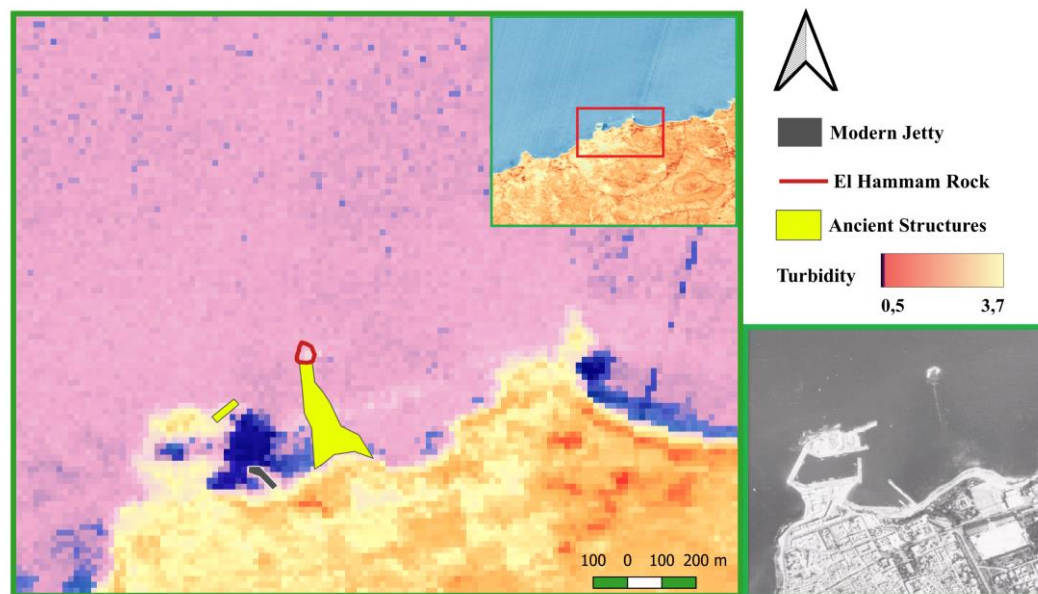


**Figure 08: Plan of the northern façade of the islet of Joinville and the infrastructure developments from the Ist century BC to the Ist century AD
(A. Temple B. Cistern C. Stairs)**

Source: Satellite imagery by Spot, 1988, Aerial Imagery I.N.C, 1980, ref. 778.35, scale 1/10000. virtuallibrary.enssmal.edu.dz/collection/item/8596-cherchell-port?offset=. by Bourai. D

3.3. The Functional and Symbolic Evolution of the port of Iol-Caesarea

The Joinville islet was a central and distinct geographical feature of *Iol*. Strabo describes *Iol-Caesarea* as a place that « has a port and an islet in front of it » (Strabo, Geography : XVII, 3, 12). This separation was in line with the functional and defensive spatial structure of the site. Its northern fortification in the IIIrd c. BC illustrates an adaptation to coastal constraints, while the development of a craft complex (LASSUS, 1965 : FAR 42, Box 02, 33, 05), built using local construction techniques adapted to the available materials, responding to economic imperatives rather than monumentality. *Iol* was therefore a port-focused urban centre, located on the sea route connecting Iberia to Carthage (LEVEAU, 1984).

The urbanisation of *Iol* was radically redesigned and remodelled during the Jubéenne period, transforming it into a Mediterranean display city. *Iol* became the illustrious *Caesarea* (Mela: I, 4), embodying Libyan dynastic legitimacy in the dynamics of imperial propaganda. The port area adopted a functional specialisation. The island was monumentalised by a lighthouse accompanied by a religious complex dedicated to *Isis Pelagia*, protector of sailors (LEVEAU, 2024: 50), based on a Hellenistic Ptolemaic model. Together with the royal palaces and gardens, as well as an *Iseum* overlooking the port on the promontory, this configuration is reminiscent of Alexandria and corresponds to a *Basileion* (LEVEAU, 2024: 51).

This organisation questions the military purpose of the closed occidental area (CAGNAT, 1913: 280-284), Reddé argues that the existence of a double basin did not necessarily indicate a specific function (Reddé, 1986: 246), therefor, LEVEAU sees it rather as « an artificial port that could be closed for the private use of the royal family » (LEVEAU, 2024: 51).

During the Roman period, the urban space was reorganised to assert its status as a provincial capital. Economic activity became fully integrated into the imperial networks, as evidenced by the presence of *Caesarea* in *Statio* 48 of the port of Ostia. A permanent fleet was established, although its precise organisation and home port remain uncertain. Inscriptions attest to its role in public

works projects, such as the construction of the *Saldae* aqueduct (*CIL VIII 2728*). The military aspect persisted during the Byzantine period, but its power remained symbolic, confined to the city itself (Procopé. *History of the Vandal war*, II, 5 and II, 20).

Conclusion

The study of the ancient port of Cherchell has allowed us to reconstruct the evolution and organisation of the port area from the maritime centre of Iol to its abandonment in the Xth century, highlighting the technical and environmental adaptation dynamics that shaped its development. The results demonstrate that the port, initially a simple natural shelter, taking advantage of its unique morphology, with an islet connected to the coast by a tombolo, was transformed into a monumental complex from the Ist c. AD onwards. The port was designed to accommodate the needs of a Roman provincial capital, with a compartmentalised layout. These achievements were made possible by the integration of a revolutionary construction techniques based on hydrolic concrete, which meant that the choice of coastal morphology was no longer a constraint. This approach enabled Caesarea to establish itself in the economic dynamic of the Mediterranean, but also to assert the legitimacy of a Libyan dynasty, with a Hellenic model, and then as a Roman provincial capital.

Geomorphological data nevertheless show that regular maintenance of the port structures helped to alleviate the problem of silting. Dredging carried out in 1847 shows that this practice had begun as early as the 1st century BC. However, the silting up of the port began in the Byzantine period and was complete by the Xth century. *Iol-Caesarea* reflects constant technical developments to adapt to a constantly changing natural environment. Exploiting the potential of the coastal landscape enabled the ancient city of Caesarea to cope with natural and historical constraints throughout the ancient period. A more in-depth study of the port area would be a key asset in understanding the ancient city, through a rigorous methodology that would circumvent the obstacles that accumulate in the modern context, with the profound reshaping of the landscape, and the degradation of the remaining installations under natural and anthropic dynamics, by paying increased attention to the protection and enhancement of an archaeological site in a port context, the legacy of a vision of grandeur and perpetuity.

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