

Re-evaluation of the existence of the ancient harbour of *Iomnium* (Tigzirt): Contribution of spatial and underwater archaeology

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• Abstract:

The existence of ancient ports in Algeria remains a topic of contention among archaeologists. The site of Tigzirt, which is often regarded as lacking a port, serves to illustrate how our understanding of the commercial dynamics of antiquity can remain partial without an in-depth study of its possible port infrastructure. Researchers have long described Tigzirt as a simple natural harbor with no significant port structure.

This study aims to reassess this perspective by adopting a multidisciplinary approach, combining spatial archaeology and underwater surveys. The combination of these methods allows for a more comprehensive exploration of the site's potential material remains and a deeper understanding of its interactions with the maritime environment, which may provide insights into the presence of port activities at Tigzirt.

Keywords:

Tigzirt, Iomnium, Underwater archaeology, Spatial archaeology, ancient harbours

• Introduction

Notwithstanding its considerable archaeological riches, the city of Tigzirt, formerly known as *Iomnium*, is frequently regarded as lacking a port. These assertions are not based on solid archaeological data but rather on a biased interpretation by early researchers, who paid limited attention to the maritime aspects of archaeological sites in general. This resulted in the neglect of the complementary importance of the maritime landscape to the terrestrial landscape.

Our study of the ancient port of Tigzirt is based on a non-destructive, multidisciplinary approach that has two significant implications. Firstly, it opens up a vast field of

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investigation by integrating spatial archaeology and the study of the natural landscape. Secondly, it addresses the time and resource constraints that any archaeological research must contend with. Additionally, underwater surveys assist in corroborating the initial data gathered during the preliminary research phase.

The objective of this study is to demonstrate the existence of port infrastructures in Tizirt and to enhance our understanding of the urban expansion and city territory. Moreover, our objective is to contribute to the preservation of both terrestrial and submerged cultural heritage. By integrating modern investigative methods, our objective is to establish a new vision of the significance of Tizirt in the context of maritime exchanges in antiquity.

1. Geographical and Historical context

Tizirt is situated between the hills of Kabylia and the Mediterranean coastline. The city is situated approximately 40 kilometers from the administrative capital of the wilaya of Tizi Ouzou and approximately 130 kilometers east of Algiers and Béjaïa. Tizirt is also the name of the commune and administrative center of the daïra of the same name, which includes the communes of Mizrana and Iflissen. The daïra encompasses a 36-kilometer stretch of Mediterranean coastline.

The region is distinguished by its mountainous topography, with undulating hillsides descending gradually towards the coastline. The town of Tizirt developed in this geographical setting, with its initial urban nucleus constructed on a plateau that extends into the sea, forming a peninsula. The name *Tizirt* derives from *Tagzert*, a term borrowed from Arabic whose root *JZR* means «island» or «islet». The initial *T* a marker of the feminine gender in Berber¹, is followed by the *i*, used in Kabyle to indicate the possessive relationship (that of), while the final *t* forms an integral part of the root of the word². The name *Tizirt* thus translates as «that of the islet», referring specifically to the islet located around 200 meters from the shore.

An alternative etymological hypothesis is proposed by Lipiński, who suggests that the toponym originated from the Kabyle term *Tighzert*, meaning «little stream», in reference to the two wadis bordering the ancient site.³.

Tizirt is a town in the Kabylia region, notable for its pronounced topographical diversity, which has profoundly impacted the establishment and evolution of ancient human settlements. The town is located on a narrow and precipitous coastal plain, with a distinct coastline to the north, bordered by the sea.

¹ Imarazen, M, Manuel de Synthaxe Berbère, Haut-Commissariat de l'Amazighité, Alger, 2007, p.10.

² Ibid.

³ Lipiński, E., Itineraria Phoenicia, Studia Phoenicia, XVIII(127), Leuven: Peeters, 2004, p. 397.

The terrain to the south of the study area can be described as ascending into gently sloping hills. The elevation of the shoreline is approximately 4 meters, while the highest elevations in the town reach approximately 175 meters. In the southern region, the topography becomes increasingly rugged, with the coastal mountain range known as the «Kabylie Maritime» exerting a dominant influence. The range's highest peak, *Tamgout*, reaches an elevation of 1,278 meters⁴.

The region's geomorphology is distinguished by a topography of rugged terrain, comprising alternating coastal rock formations and deep valleys. This landscape has been shaped by the Alpine orogeny, which has had a significant influence on northern Algeria⁵. Tizirt is situated within the flysch domain, which is characterized by Quaternary slopes and Cretaceous marls⁶. The ancient city was constructed on a rocky promontory, with Cape Tedles to the east, where the ancient town of Russipissir was previously situated. The promontory is bordered to the north by an islet, situated approximately 200 meters offshore. Collectively, this formation creates a substantial bay, which is susceptible to the influence of northern winds. The bay provides shelter for two sandy shorelines, which are separated by a hill. To the west of the promontory, the landscape is characterized by the presence of elevated, precipitous hills, which border another sandy shore.

Tizirt is situated in a Mediterranean climate, characterized by precipitation during the winter months and a lack thereof during the summer. Two minor, semi-permanent wadis provide irrigation for the town. To the east is Oued Feraoun and to the west is Oued Tassalast. These streams are intimately associated with precipitation patterns, flowing from the south to the north and receiving input from minor tributaries⁷.

1.1. Historical context

The city of Tizirt has presented a challenge to archaeologists working in the region since the 19th century due to inconsistencies between ancient geographical texts and the epigraphic data bearing the toponym Rusuccuru. Nevertheless, the discovery of an epigraphic document (C.I.L. VIII. 20716) has corroborated the ancient name of Tizirt, Iomnium⁸.

Tizirt, previously designated as Iomnium, is referenced in the Itinerary of Antoninus, a document dating from the 5th century BC⁹. The term appears in the Pseudo-Skylax under the designation *Ιουλίου*, likely referring to *Ιομνίο*¹⁰. Following the

⁴ Lacoste-Dujardin, C, « Grande Kabylie : du danger des traditions montagnardes », Hérodote (107), 2004, p. 122.

⁵ Girous, L., & Melbouci, B., « Caractérisation du glissement affectant le versant côtier de Tizirt (Algérie) », Algérie équipement (63), Juin, 2020, p 972.

⁶ Djerbal, L., Khoudi, I., Alimrina, N., Melbouci, B., & Bahar, R., « Assessment and mapping of earthquake-induced landslides in Tizirt City, Algeria », Nat Hazards, 87, 2017. 87, 1861.

⁷ Girous, L., Melbouci, B, Op., Cit, p 36

⁸ Pallu de Lessert, « Nouvelles inscriptions romaines du Cap Tedlès (Tizirt et Taksebt) », Bulletin de la société nationale des antiquaires de France, 1889, p. 178.

⁹ Lipiński, E., Op., Cit, p.398.

¹⁰ Gsell, S., Histoire ancienne de l'Afrique du Nord, Paris, Hachette, 1918, p.162.

implementation of corrections to the distances outlined in the Table of Peutinger, Iomnium is now associated with the ruins of Tizirt, which were previously identified as a polis. This site is situated in close proximity to the city of Sida (modern Béjaïa) and is notable for its adjoining port¹¹.

The region of Tizirt offers tangible proof of the initial settlement through the presence of a well-established local culture, as evidenced by the discovery of a Punic stele at Taksebt.¹² The site of Ait R'Houna has yielded evidence of indigenous burials, which have yielded ceramics that reflect both local and overseas trade from the protohistoric era¹³. This culture endured under the Numidian kingdoms and during the Roman period, during which a heterogeneous Libyco-Punic population was evident¹⁴. By 44 AD, Iomnium had been incorporated into the two pagi of the municipality of Rusuccuru¹⁵. From the end of the 1st century to the beginning of the 2nd century, the remains of the initial urban settlement of Iomnium have survived, providing evidence of its military function. Two notable inscriptions from this era have been identified, one of which is linked to a soldier from the III Legion of Augustus (CIL, VIII, 20713).

At the beginning of the 3rd century, Iomnium received municipal status under Septimius Severus, distinguishing it from the colony of Rusuccuru, with a temple dedicated to the Genius of Rusuccuru¹⁶. In the aftermath of the Quinquentani uprisings, the city of Tizirt was devastated, with an estimated 270 casualties. Similarly, Iomnium, like Rapidum, was also destroyed around 270-280 CE.¹⁷

The Christian period at Iomnium is distinguished by the construction of a substantial basilica, erected on the foundations of a pagan temple, incorporating the reuse of votive offerings. Iomnium provided support to Rusuccuru during the revolt of Firmus (Saint Augustine, Letter LXXXVII). During the Vandal period, the basilica was destroyed by fire in the 5th century, which resulted in a decline of coastal cities and the rise of small principalities inland. A garrison was established at Iomnium under Byzantine rule, situated on the promontory in a manner reminiscent of Caesarea in Mauretania. This

¹¹ Lipiński, E., Op., Cit, p.397.

¹² Gavault, P. (1887). Étude sur les ruines romaines de Tizirt. Paris: Ernest Leroux, 1887, p.123.

¹³ Laporte, J.-P., « Kabylie : La Kabylie antique », Encyclopédie Berbère (26), 2004, Seen the 09-09-2024, <https://journals.openedition.org/encyclopedieberbere/1400>

¹⁴ Euzennat, M., « L'histoire municipale de Tizirt : Rusuccuru colonia et municipium », Mélanges d'archéologie et d'histoire, 67, 1955, pp.131-132.

¹⁵ Gascou, J., « Sur le statut de quelques villes de Numidie et de Maurétanie Césarienne », Antiquités Africaines, (40-41), 2004, pp. 226.

¹⁶ Euzennat, M., Op., Cit, p 140

¹⁷ Laporte, J.-P., « Quinquentani (ou quinquegentiani) : Une confédération du Mons Ferratus (Djurdjura) au cours des révoltes berbères du IIIe siècle », Encyclopédie berbère (39), 2015, pp. 6686-6703, Seen the 09-11-2024, <http://journals.openedition.org/encyclopedieberbere/4047>

location was similarly landlocked, as access to the surrounding area was restricted by the Moors (Procopé, Book IV, XX, 05).

2. Historiography of Research on the Ancient Port of Tizirt

The site of Tizirt has been the subject of scholarly interest since the early nineteenth century. Systematic excavations commenced only towards the end of the century, and none were specifically focused on the ancient port of *Iomnium*.

In 1856, Jules Barbier provided a detailed account of the remains on the promontory of Tizirt (Fig. 01). He identified an eastern jetty that extended into the sea, forming a small port supplied by a cistern. Additionally, a 200-meter jetty linked the peninsula to an islet, while a mole extended 120 meters north from the islet, with a subsequent return of 50 meters oriented south-southwest, thereby completing the port structure¹⁸.

In 1856, General Charles Devaux provided an account of the ruins of Tizirt, erroneously identifying them as Sidi Khaled¹⁹. In contrast, General Thomas, although he deemed these remains of little interest, posited that the islet may have once been connected to the mainland²⁰.

Regarding the port, Devaux stated:

«...jetty, connecting the town to a small islet approximately 200 metres in length, along with two other jetties – one extending from the western part of the islet and the other from the mainland – together formed a port covering an area of 3 to 4 hectares»²¹

In 1868, Christian de Vigneral provided a detailed account of the ruins of Tizirt in his seminal work, *Study on the Roman Ruins of Algeria*. The Kabyles of Djurdjura provided corrections to the erroneous identifications of certain structures made by their predecessors. In his observations, he noted:

«...The beginning of a jetty, formed of three rows of slabs; today, two fragments remain, approximately 40 metres long, now covered by the sea. At the shore, where the jetty connects to the plateau, there is still an imposing mass of ten courses of enormous blocks forming a wall about 3 metres thick, which the waves have not been able to displace»²².

Vigneral characterizes the peninsula as a "narrow strip of land," suggesting a potential connection to the promontory. While Barbier notes the presence of a jetty linking the

¹⁸ Vigneral, C., *Les ruines romaines de l'Algérie*. Paris, Imprimerie de J. Clay, 1868, pp. 23-24.

¹⁹ Devaux, C., *Les kebail du Djurdjura : Etude nouvelle sur les pays vulgairement appelés la Grande Kabylie*, Camoins frères, Marseille, 1859, 338.

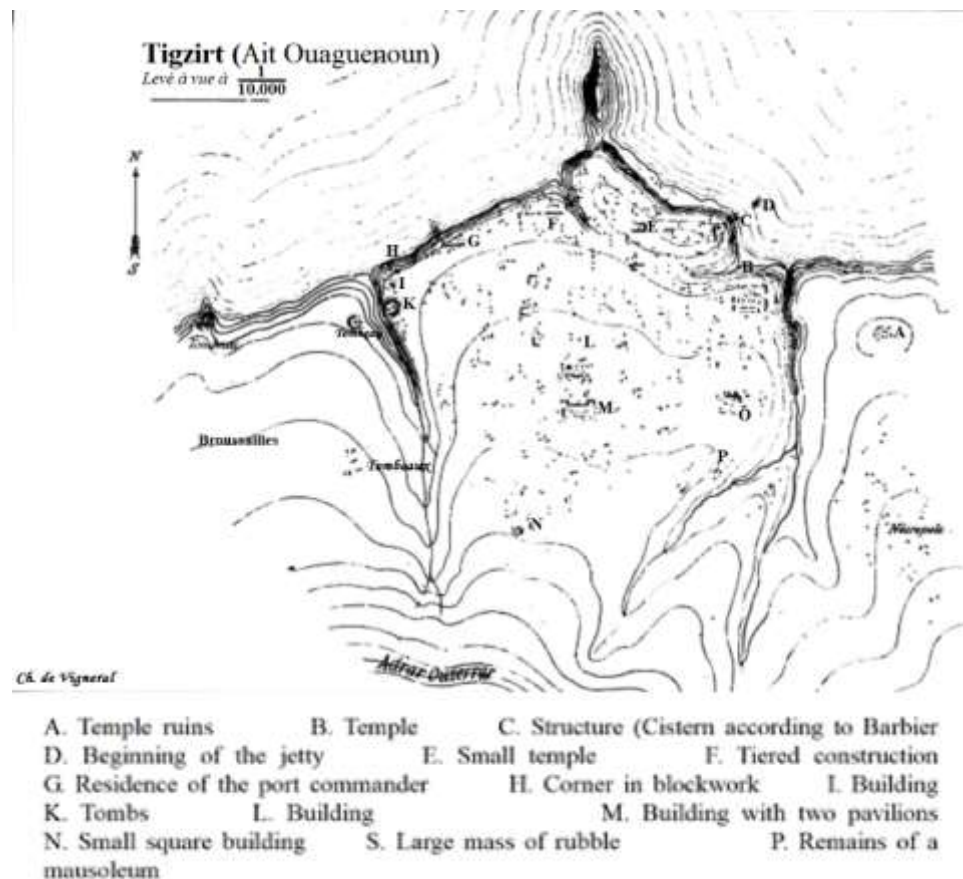
²⁰ Gle Thomas, « Ruines romaines de Zeffoun. », *Revue Africaine*, II (12), Août 1858, p.444.

²¹ Devaux, C., *Op.*, Cit, 339.

²² Vigneral, C., *Op.*, Cit, p.23.

peninsula to the islet, Vigneral did not identify any remaining structures and did not comment on the other jetties. He did, however, identify the ruins of a building above the jetty as possibly the port commander's residence²³.

Figure 01. Plan of the ruins of the ancient city of *Iomnium*



Source. Charles de Vigneral, 1868

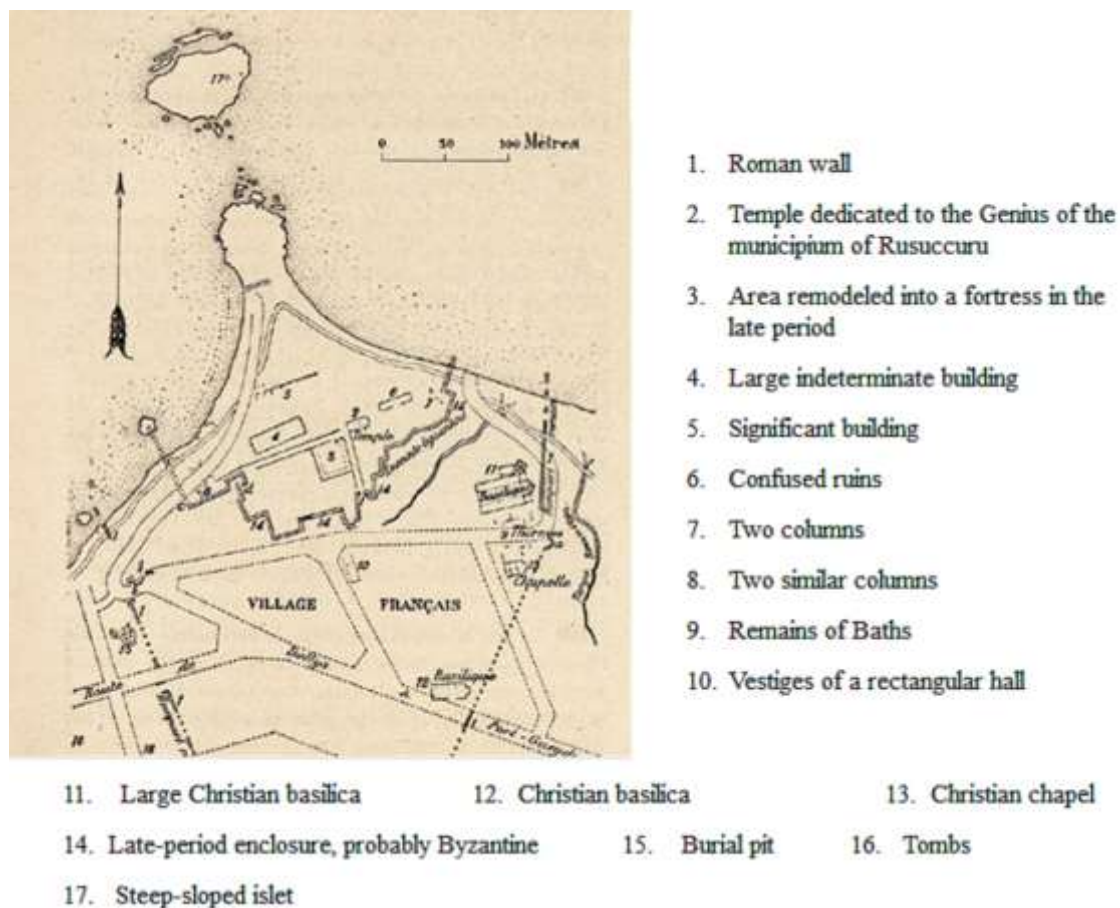
The descriptions of the port facilities at the ancient site of Iomnium are largely based on the findings presented in Barbier's writings. This highlights a significant gap in the archaeological record, indicating a lack of comprehensive investigations into the ancient port of Tigzirt. In 1897, Pierre Gavault conducted excavations at the site, with a primary accent on the large basilica and its surrounding remains. The maritime area was largely neglected in this process.

According to Gavault, the village did not have a port (fig.02); instead, it was located about 6 km to the east, at the base of Cape Tedless in the locality of Sidi Khaled. He noted:

²³ Vigneral, Op., Cit, p.24.

«...The islet facing the peninsula, which has given it its modern name, was certainly connected to the coast by a jetty or rather by a masonry causeway, as clearly indicated by the traces of cut stones visible on both shores. However, the sea, constantly eroding the cliffs, has destroyed this structure. The channel remains shallow enough today to allow access to the island without losing footing. This jetty could have sufficiently sheltered ships during the fair season for them to unload their cargo, either to the east or west, depending on the prevailing winds. However, it should be noted that there has never been a port in Tigzirt in the strict sense. Previous authors mistook the ramparts on one side and natural rocks on the other as remnants of jetties and the remains of a harbour, which they described with complacency. The stratified rocks rising to the north and west of the island, similar to those of Cap Bengut and Tedlès, seem to explain this illusion »²⁴.

Figure 02 : Plan of the city of the city of Tigzirt and the remains of *Iomnium* in 1895



Source: Stephan Gsell, page 05 of text 05, sheet 06, 1895

Following the untimely death of Pierre Gavault at the end of the 19th century, Stephan Gsell resumed his research, compiling it in his *Atlas Archéologique de l'Algérie*. In this work, he describes the islet and some of the remains found there for the first time:

²⁴ Gavault, P., p.110-111.

«...The islet has steep slopes and contains a small vaulted chamber. It was connected to the mainland by a masonry causeway, which was intended to serve as a landing quay, either to the west or to the east. There was no true port at Tizirt »²⁵

Between 1900 and 1960, several excavations were carried out, notably by Deroche in 1949, Frézouls in 1950, Hus in 1951 and 1953, and finally Euzennat in 1959. However, none of these researchers focused on the ancient port of Iomnium.

In 1955, Maurice Euzennat published an article on the municipal history of Tizirt, in which he explained the reasons why Tizirt was a wise choice for the Phoenician accommodations, based on the Punic scales established by Cintas. Despite the absence of any reference to Phoenician or Punic activity in Iomnium, the latter offers optimal conditions for cabotage, a practice highly valued by these navigators²⁶.

«...The Punics do not seek deep-water ports; they prefer the sheltered beach where ships can easily land: the bay of Tizirt offered them exceptionally favorable conditions, close to a stream of fresh water. The peninsula and the islet create, to the east and west, two anchorages that can be used depending on the prevailing wind »²⁷.

In Roman times, the characteristics of Tizirt's port were less suited to Roman criteria. The site, once ideal for Punic sailors, no longer met the standards for Roman ports, especially due to the increasing size of ships and its exposure to northern winds. Without proper development, Tizirt was seen as merely an anchorage, not a true deep-water port»²⁸

In 1968 a more detailed survey of the ancient port of Tizirt was undertaken as part of the project, led by the Cambridge research team (Fig.03), and concentrated on 17 sites along the Algerian coast²⁹. Researchers used geophysical techniques, in particular the echo sounder, to map underwater structures by emitting acoustic signals to detect underwater shapes and depths. This method provided detailed seabed profiles (fig.03), which aided the analysis of submerged Roman harbour remains.

« ... There is a distinct bank between the island and the headland. About a dozen cut blocks were found on this bank, which is only 1.5m below the surface at shallow point. Its profile shows well on the echosounder trace... The area is thickly covered with Posidonia weed, making underwater search very difficult. On the island itself there is a cistern whose vaulted roof has collapsed, a column and numerous blocks and shreds. Perhaps there is more, but nothing else could be seen because of the dense prickly pear.

²⁵ Gsell, S., Atlas Archéologique de l'Algérie, Ed. Adolphe Jourdan, Algiers, p.5 of Text 05- Sheet 06

²⁶ Bouchenaki, M., « Algérie », L'Espansione fenicia nel Mediterraneo : relazioni del colloquio in Roma, 4-5 maggio 1970, Roma : Consiglio Nazionale delle Ricerche, Roma, 1971

²⁷ Euzennat, M., Op., Cit, p. 130

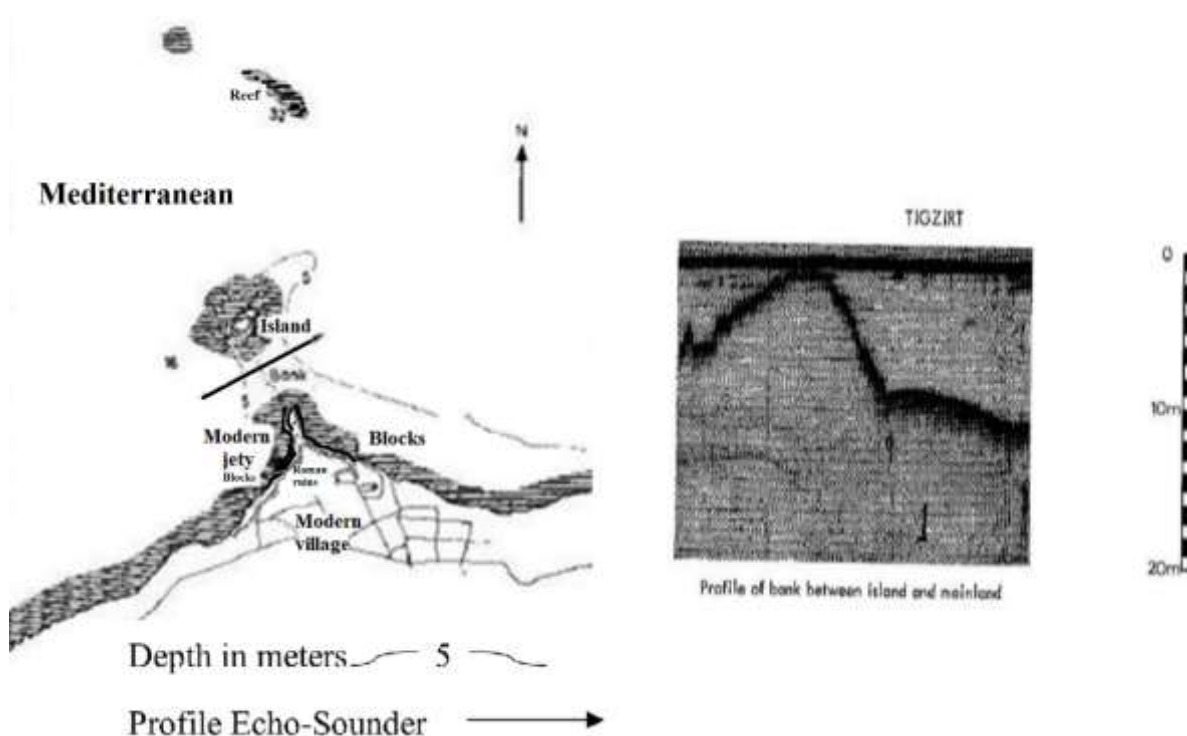
²⁸ Euzennat, M., Op., Cit, p.130-131.

²⁹ Yorke, R., & Davidson, D. (1969). Roman harbours of Algeria. Report of the Maghreb Project, 1969.

To the east and west of the island, natural reefs extend some way underwater. On the east the water is shallow, and nothing artificial could be seen. To the south west, 40 m from the island, there are a few small regular blocks among a huge boulder wick from the reef on this side.

...Firm evidence today is slight, but it would seem highly likely that the island was connected to the mainland by a causeway in ancient times. The echosounder profile, the blocks and the signs of habitation on the island help to substantiate this. The harbour would not have been large, simply a quay of blocks offering protection from east and west³⁰»

Figure 03. Plan of the echosounder survey made at the ancient port of *Iomnium*



Source. Yorke and Davidson, 1968

3. Spatial survey on the *Iomnium*'s harbour site

Three main methods have been used for this part of the study, which covers the area of the presumed site of the ancient port of Iomnium. Aerial photography provides topographical detail and an overview of the spatial organization of the site. In parallel, satellite imagery provides a broad perspective of the region³¹, while multispectral analysis allows the extraction of specific information on soil composition and land

³⁰Yorke, R., & Davidson, Op., Cit, p. 17

³¹ Pande, C.B., Kadam, S.A., Jayaraman, R., Gorantiwar, S., Shinde, M., «Prediction of soil chemical properties using multispectral satellite images and wavelet transforms methods», Journal of the Saudi Society of Agricultural Sciences, Volume 21, Issue 1, January 2022.

cover³². Together, these techniques provide an integrated approach to better understand the archaeological environment and identify submerged remains.

3.1. Aerial imagery

The use of aerial photographs taken from low-flying aircraft provides a panoramic perspective of the archaeological site of Iomnium, revealing spatial organization and topographical relationships that may not be visible from the ground. This type of imagery also makes it possible to study the evolution of the landscape, urbanization and degradation of the site over time by comparing different chronological sources.

The image, taken during a flight by R. Henrard, captures the south-eastern area of the ancient site, including the promontory and its two beaches facing east and west, as well as a glimpse of the islet (Fig. 04). Although the topographical variations in the area are difficult to discern, a well-established road network can be observed. The development of the urban fabric within the ancient city of Iomnium appears to be well advanced, while the coastline retains its natural authenticity.

Figure 04. Oblique aerial imagery on the promontory of Tigzirt



Source. R. Henrard, ed, Kac, 1955

The area to the east of the promontory highlights various elements, including boulders and areas of dark and light colors. The dark areas show the presence of marine biodiversity, while the light areas indicate submerged structures that will be explained

³² Pande, C.B., Kadam, S.A., Jayaraman, R., Gorantiwar, S., Shinde, M, Op. Cit.

later. The clear rectangular shape (n°01 in Fig.05) corresponds to the Byzantine wall, which extends under water for about 50 metres. A grey band, visible at the interface seaboard (n°2 in fig.05), is devoid of any biological presence and illustrates the variations in tidal levels. The beach to the west of the promontory exhibits color variations similar to those of the eastern beach. The immediate surface near the small landing stage constructed in 1940 is devoid of rocks, likely due to the remediation associated with its construction. However, blocks become apparent when moving southwards.

Figure 05. Oblique aerial imagery on the promontory of Tigzirt with clear submarine structures



Source. R. Henrard, ed Kac, 1955

3.2.Satellite Imagery

The methodological approach is based on the differentiation of underwater variations observed on satellite images from two periods: 1985 and 2024. Initially, the identification of potential geological or man-made structures is based on variations in color and shape. This preliminary identification will then be verified in the field during dives.

Analysis of satellite images from Airbus 2024 (fig.06) reveals several notable anomalies in the area studied, particularly around the supposed site of the ancient port of *Iomnium*. The images show distinct light and dark areas. The light areas may correspond to sandy surfaces, submerged structures or rock formations, while the dark areas refer to marine

biodiversity. This difference in color suggests a heterogeneity of materials present on the seabed, which justifies the need for field verification by diving.

Figure 06. Satellite imagery on the site of Tigzirt's harbour in 2024



Source. Airbus 2024

The clear spots run north to south-east for 142 m, then extend from the islet to the promontory over an area of 1.32 ha, with a maximum width of around 40 m. This configuration forms polygons that could indicate features of a geological process or previous human intervention. Further analysis is required to determine their origin.

Between 1985 and 2024, significant changes to the coastline were observed, largely due to the construction of the Tigzirt marina in 2006 (Fig. 07). This infrastructure is likely to have had an impact on coastal dynamics, leading to changes in natural habitats and influencing sedimentation patterns. Landsat/Copernicus images dated 31 December 1985 show marked progradation of the sea between the promontory and the Grande Plage, with an emerging platform visible in the area currently covered by the sea (fig. 07).

Figure 07. Satellite imagery on Tigzirt from 1985 (on the left) and from 2016 (on the right)



Source.. Landsat Copernicus (on the left) CNEST/Airbus (on the right)

3.3.Multispectral Analysis

The primary objective of this analysis is to identify and map potential structures that will require field validation, particularly through underwater dives. By integrating these results with previous data and visual observations, we aim to provide an in-depth understanding of coastal dynamics and the underlying archaeological remains.

This approach relies on the use of multispectral imagery provided by the Sentinel-2 satellite, which has a spatial resolution of 10 to 60 metres depending on the band and a varied spectral coverage. In order to detect underwater structures and analyze the dynamics of marine habitats, the Normalized Difference Water Index (NDWI), which is usually a remotely sensed index related to liquid water. In the case of our study, this index will be restricted to shallow areas and particularly clear water in order to monitor any anomalies related to reflectance variations of the seabed, calculated using Sentinel-2's green (B3) and near-infrared (B8) bands.

The results show a number of distinct areas, in particular emergent structures to the east of the promontory (Fig 08), in an area that was once within the ancient ramparts. Furthermore, this model suggests that the depth in this area is not very significant. A clear contrast can be observed at the level of the islet, indicating significant variations in depth.

The section obtained between the islet and the promontory clearly shows a continuous structure between the two formations.

Figure 08. Use of the NDWI (Normalized Difference Water Index) fot the identification of Submerged Structures on the harbour site of *Iomnium*



Source. Sentinel-2 imagery, 2023

4. Underwater survey on *Iomnium*'s harbour site

On the basis of the primary data obtained from bibliographical research and the promising results of the multispectral analysis, several underwater surveys were planned to validate and complete our observations in the maritime area between the islet and the promontory, which we divided into three zones (Fig. 09).

Figure 09. Designation of the zones of interest (01, 02 and 03) during the underwater surey



Source. Airbus Sat, 2023

The zone 1 corresponds to the immediate western coast of the islet. The depth does not exceed 180 cm and gradually increases towards the south, gently touching the surface along the length of the islet. The seabed is littered with heterogeneous stone blocks, most of which have irregular geometric shapes, although some have more defined contours, suggesting the reuse of materials (Fig. 10).

Figure 10. Seabed near the islet strewn with heterogeneous stone blocks



Source. Donia Bourai, 2024

While zone 1 displays heterogeneous stone blocks that hint at potential reused materials, zone 2 offers more structured remnants, possibly indicating distinct stages or types of human intervention. It is characterized by a depth ranging from 10m in the west to 2m in the east. This zone is covered with *Posidonia* whose roots, on closer inspection, are anchored in a stony substrate made up of boulders with an average diameter of 25 to 30 cm, which take on various geometric shapes, some of which are vaguely spherical. These beds of *Posidonia* interrupt segments of built structures (Fig. 11), the lower layer of which consists of mortar on which rubble foundations rest.

Figure 11. Close view of one segment of the constructed harbour's structure of *Iomnium*



Source. Donia Bourai, 2024

These segments correspond to the clearly visible bright areas on the satellite images. During our survey we also observed the presence of large sections of mortar without rubble, resting on a rocky substrate scattered with irregular rubble. These mortar blocks have perforations of 21 cm in diameter, with a margin of error of ± 3 cm.

The zone 3, is characterized by larger boulders than those observed in zones 1 and 2. These blocks do not have a clear orientation, but form a mass that significantly dissipates wave energy, as confirmed by the helmsman of our vessel.

5. Discussion

The geomorphology of the Tizirt region has strategic features that were particularly attractive to ancient navigators. Although partially sheltered by Cape Tedles, the bay is exposed to constant northerly and prevailing westerly winds, especially in autumn and winter. These conditions, combined with the presence of offshore shoals, increase the risk to navigation in heavy swells. However, the peninsula itself provides an area of relative calm for boats. Cape Tedles provides a protective barrier against the prevailing easterly and northeasterly winds during the rest of the year, and the adjacent islet provides shelter for boats in certain conditions. These conditions make it necessary to reinforce these natural shelters with additional structures. This will provide better protection and facilitate access.

A collection of photographs taken in the 19th century provides an overview of the site of Tigzirt at the time of the foundation of the French village in 1888. These images allow us to follow the evolution of the coastline and the presumed location of the ancient port over more than a century, as well as the surrounding area.

Although aerial photographs taken in the 1950s do not clearly show any underwater remains, they do show a formation at the front of the peninsula (fig04, fig05), corresponding to the presumed location of the masonry dam mentioned by Barbier³³.

To the east of the promontory, satellite data show a platform that indicates the ancient coastline. If a harbour existed here, as Barbier suggested, it would have been at the same level as the peninsula. However, multispectral analysis of the Sentinel 2 images shows that what Barbier identified as a harbour is actually just the outline of the Byzantine and Roman walls. The variety of large dressed stone blocks found in the area suggests a built structure whose purpose remains unclear. The foundations appear to have been removed from this part of the coast, where the natural rocky substrate can be clearly seen with the ebb and flow of the waves (fig.12).

Figure 12. Coastal Landscape of Togzirt with a glimpse into the 1900's Shoreline

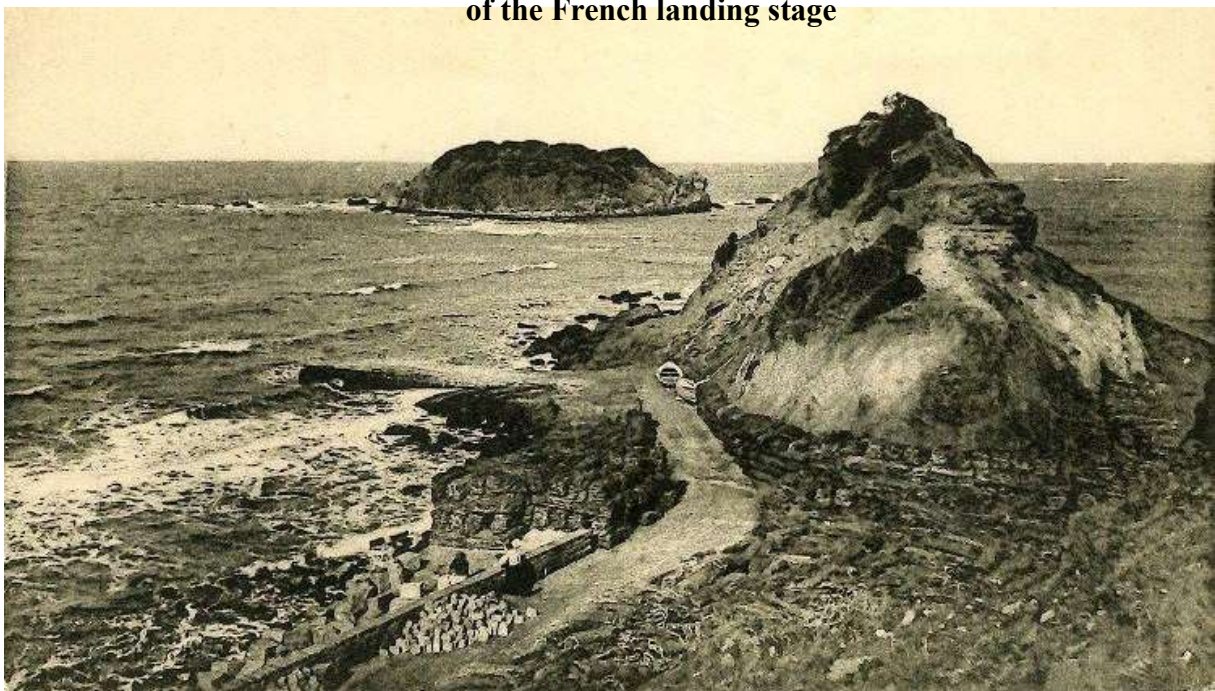


Source. www.lestizis.fr

³³ Vigneral, C., Op. Cit., p.23-24

On the western side of the headland there is a small sandy beach which could have served as a natural landing place, either by pulling boats onto the seashore or by the presence of a masonry jetty. However, with modern development, this seaside has completely disappeared, although old photographs show an abundance of large hewn blocks. Testimony from local residents supports this idea. In 2006, during the development of the new marina, a shipwreck was uncovered, revealing a dozen amphorae at the tip of what is now the western jetty, adjacent to the artificial shore (fig.13).

Figure 13. View on the Tigzirt peninsula and islet, showing dressed stone blocks to the south of the French landing stage



Source. Collection Jean de Crescenzo, between 20's and 40's)

Underwater surveys have confirmed that the dark areas visible on satellite images correspond to marine biodiversity formations, which appear to have expanded since 2016. In contrast, the lighter areas appear to be masonry structures, with a north-south-east orientation clearly indicating the presence of a 'masonry causeway', as suggested by the hypotheses formulated in the initial research. Although we do not have precise information on the type of structures built, it is clear that particular care was taken to protect them, as evidenced by the piles of stones scattered for about a hundred metres to the west of the built structure. Furthermore, the presence of mortar with holes indicates that these harbour structures were built with wooden reinforcements, as described by Vitruvius.

« In the area designated for the construction of the pier, cofferdams made of oak beams, securely fastened together, will be built in the sea, where they will be firmly

anchored. The gaps will then be filled with sturdy planks after the underwater bed has been cleaned and leveled; then, stones mixed with the mortar we just mentioned will be piled in until the space allocated within the cofferdams for the masonry is filled³⁴ »

The archaeological discoveries at the site, which is believed to be the ancient port of Iomnium, provide important data that challenge Gsell's claim that Iomnium did not have a port, but rather a natural harbour where ships docked on either side of the promontory, depending on the vagaries of the weather. According to Gsell, this harbour was only protected from the prevailing winds from the east and north-east by the geological formations of the site, which provided a shelter that may have attracted early sailors. However, the material elements found at the site indicate the existence of a port at Tigzirt in ancient times, suggesting a more sophisticated maritime infrastructure than previously thought.

Further investigations are underway to gain a full understanding of the site. The correlation between the presence of these underwater material infrastructures and the presence of warehouses from the ancient period indicates that there was active maritime transport. These additional investigations should provide a better understanding of the extent and functionality of this port, as well as its role in trade and maritime exchange at the time.

6. Conclusion:

In conclusion, this study demonstrates that the use of a multidisciplinary approach offers a new perspective on the study of ancient ports in Algeria and, more generally, on archaeology. The prospection work carried out at the Tigzirt site refutes claims about the absence of a port in the region and thus sheds new light on the commercial and economic motion of Tigzirt, which are often associated with those of Russipissir.

In addition, a non-destructive multidisciplinary approach to archaeological remains could greatly contribute to the preservation of both terrestrial and submerged cultural heritage, which is currently threatened by urbanization. These research strategies highlight the importance of continuing in-depth investigations to enrich our understanding of port infrastructures and maritime exchanges in antiquity.

³⁴ Vitruve, *Di Architectura*, Book V, Chapter X, text established and translated by Catherine Saliou, 2009.

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