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Preventive Conservation of the Archaeological Site of Siga in Ain Temouchent

الحفظ الوقائي للموقع الأثري سيقا بعين تموشنت

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Abstract:

The ancient site of Siga, renowned for its rich heritage and historical significance, bears a wealth of cultural and archaeological legacies in the domains of heritage and architecture. These legacies, spanning from prehistoric times to the Islamic period, were left behind by the region's local inhabitants.

We have focused our study on one of the archaeological sites that takes us back to a historical period in which the local inhabitants demonstrated their ability to keep pace with and adapt to the prevailing civilization of that time. The site in question is the archaeological site of Siga in Aïn Témouchent. Accordingly, our research is titled "Preventive Conservation of the Archaeological Site of Siga in Aïn Témouchent."

Regardless of differing perspectives on methods to safeguard and conserve the archaeological remains of Siga, this endeavor transcends mere procedural activities. It is a specialized practice rooted in principles and traditions, requiring extensive expertise and an in-depth understanding of the unique characteristics of archaeological sites.

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Regrettably, despite the significant archaeological remains of Siga, the authorities' acknowledgment of its importance, and their initiatives to establish institutions and enact protective legislation, the site remains vulnerable to destruction, vandalism, and neglect. Consequently, it faces the risk of permanent disappearance.

Keywords : Archaeological heritage; preservation; prevention; management; laws, cultural institutions; archaeological sites; Siga.

الملخص:

سيقا العريقة بتراثها وتاريخها الحافل بالإنجازات الكبرى، بما تحويه من إرث حضاري غني في ميدان الآثار والعمران، ممّا خلّفه الإنسان المحلّي لتلك المنطقة منذ عصور ما قبل التّاريخ إلى الفترة الإسلامية.

لقد سلطنا دراستنا على واحد من المواقع الأثرية، والذي يعود بنا إلى إحدى الفترات الزمنية التي أكد فيها السكان المحليون على جدارتهم في مجارات ومسايرة الركب الحضاري المعاش آنذاك، وهو الموقع الأثري سيقا بعين تموشنت، فكان بحثنا موسوماً بـ"الحفظ الوقائي للموقع الأثري سيقا بعين تموشنت."

مهما اختلفت وجهات النظر في كيفية حفظ ووقاية المواقع الأثرية بالموقع الأثري سيقا، فإن هذه العملية ليست على أية حال مجرد عمليات مجرّدة، بل هي عمليات ذات طبيعة خاصة لها أصولها وتقاليدها، لا بد أن تمارس من منطلق الخبرة الواسعة والدراية الكاملة بطبيعة وخصائص النوعيات المختلفة من المواقع الأثرية.

لكن الأمر المؤسف فرغم إمتلاكنا لهذا الزّخم المتبقّي والمتمثّل في المواقع الأثرية (سيقا)، وشعور السلطات المعنية بأهميّة الآثار، والمحافظة عليها، وعملها على إنشاء المؤسسات وسنّ التشريعات التي تضمن الحفاظ على هذا الإرث، وتمنحه الحماية اللاّزمة، ورغم تصنيف المنطقة وطنيا فإنه ما زال عرضة للضّياع والهدم والتخريب وبالتالي الإندثار والزوال إلى غير رجعة.

الكلمات المفتاحية: التراث الأثري؛ الحفظ؛ الوقاية؛ التسيير؛ القوانين؛ المؤسسات الثقافية؛ المواقع الأثرية؛ سيقا.

Introduction:

There is hardly a region within the borders of Algeria devoid of archaeological remains left behind by successive civilizations throughout history. The nature and significance of these remains vary based on the geographical characteristics of different regions and the diverse cultural, social, and temporal contexts of the civilizations that shaped them.

The diversity of these archaeological remnants, spanning the country's east to west and north to south, underscores the breadth of the ancient cultural legacy that left its imprint on Algeria. This legacy comprises a rich array of cultural, religious, and social elements, some of which are visible on the surface, while others remain buried beneath the ground. These findings solidify the notion that North Africa, in general, was both a cradle of ancient civilizations and a stage for the demonstration of the cultural advancements of those who arrived later.

Our study focuses on one particular archaeological site that reflects a historical era during which local inhabitants demonstrated their ability to keep pace with the prevailing cultural advancements of the time: the archaeological site of Siga in Ain Temouchent. Specifically, we examine the field of preventive conservation of archaeological sites, applying it to this landmark. Our research, titled "Preventive Conservation of the Archaeological Site of Siga in Ain Temouchent," seeks to apply the latest methods and theories in the preservation and maintenance of heritage sites, tailored to the current state of this specific location.

Studies of this nature demand meticulous attention, given their role in prolonging the lifespan of archaeological landmarks, ensuring their transfer to future generations in the best possible condition. This necessity is amplified by the unique architecture and engineering of sites such as Siga, which calls for particular care. To achieve the objectives of this research, we posed the primary question: What are the preventive conservation measures required for the archaeological site of Siga? This central inquiry is broken down into secondary questions, including:

- What is the historical significance of the site?
- What is its current preservation status?
- What legal frameworks and technical approaches can be utilized to protect it?

The nature of this subject requires the adoption of specific research methodologies. These include site-specific diagnostic methods based on field observations, a historical approach to track the various historical phases of the Siga site, and comparative and analytical methods to assess its current state and future preservation prospects.

The ancient city of Siga, with its rich heritage and history of remarkable achievements, embodies a cultural legacy rooted in archaeology and architecture. This legacy has been passed down through the ages, from prehistoric times to the Islamic period.

Nevertheless, despite the site's significant historical value, the efforts of authorities to recognize its importance, and the establishment of institutions and enactment of legislation to ensure its preservation, Siga remains under threat. Acts of destruction, vandalism, and neglect continue to jeopardize the site, placing it at risk of irreversible disappearance.

1- The Natural Context Of The Archaeological Site Of Siga:

Siga is located in western Algeria, along the Oranian coast, at a bend of the Tafna River—historically referred to as the Siga River. The site lies approximately 40 km from Ain Temouchent Province and 12 km west of the town of Beni Saf, facing the island of Rachgoun on the northwestern bank of the Tafna River, about 4 km from its mouth. Its coordinates are 23°40′ W longitude and 22°38′ N latitude, with an elevation of 19 meters above sea level (Algerian Ministry of Interior.Wilaya of Ain Temouchent . 2025).

The area surrounding the site belongs to the coastal mass of the southern Mediterranean Sea, near a maritime headland known as Cape Akra, located west of Beni Saf. Opposite the site lies Rachgoun Island, one of the most prominent islands in the region. Adjacent to the site, the Tafna River flows, originating from northern Sebdou in the Tlemcen

Province and emptying into the sea at Rachgoun Beach. Spanning a length of 177 km, the rive (Raqiq. 2010: 25) r's middle and lower courses form a narrow alluvial plain flanked by the Skouna mountain range to the east and the Wlaa Sila range to the west, both of which are linked to the Trara Mountains. This plain is one of the richest in fertile alluvial soils.

The climate of the region is consistent with other coastal or near-coastal areas, characterized by warm summers and mild winters. Influenced by the high-pressure systems of the Azores in the Atlantic Ocean, the area experiences northwesterly winds during winter, often accompanied by rainfall. The rainy season typically begins in the second half of September and extends until late June, followed by a dry season from June to late August. During the dry season, the Sirocco winds cause a significant rise in temperature. Meteorological records for the region indicate that prevailing winds from the northwest rarely exceed 100 km/h, except in rare cases.



Image 01: An aerial photo showing the environment surrounding the archaeological site of Siga in Ain Temouchent, from Google Earth.

2- The Historical Context Of The Archaeological Site Of Siga:

Siga occupies a strategically important location that has rendered it one of the key settlements for humans since ancient times. Its unique natural features positioned it as one of the most vital trade hubs connecting the eastern and western Mediterranean. Political and economic circumstances along the eastern Mediterranean coasts

contributed directly to the emergence of active maritime trade along the western coast, primarily facilitated by the Phoenicians. These traders interacted with the indigenous populations, particularly in the commercial domain, gradually giving rise to a cultural blend known as the "Punic" peoples. The Punics established themselves in several sites across the western Mediterranean, including Akra Island (modern-day Rachgoun), which became closely associated with the city of Siga. Excavations have revealed Phoenician presence in the area dating back to the mid-7th century BCE. Greek geographer Scylax mentioned Siga as a city situated along a river of the same name, opposite Akra Island.

During the Numidian period, towards the end of the 3rd century BCE, Siga rose to prominence as the capital of the Massylii Kingdom, which extended from the Moulouya River to Cape Carton, under the leadership of King Syphax. The city benefited from its Mediterranean location, with fertile lands and the navigable Tafna River providing a robust agricultural and trade base. Historian Strabo classified the Kingdom of Syphax as a prosperous region, noting its capacity to produce two harvests annually (Muhammad Al-Saghir Ghanem. 2003: 62).

Following a series of historical events, Siga was incorporated into the Mauritanian Kingdom around 105 BCE, experiencing significant economic decline. The city’s prominence in ancient historical records is largely associated with internal conflicts and power struggles. This situation persisted until the death of King Bocchus II in 33 BCE, after which the Mauritanian territories fell under Roman control, marking the beginning of Roman hegemony in North Africa. Siga thus became a Romanized territory(Jamal Masarhi: 42).



Image 02: The Mausoleum of Sifaqs in the archaeological site of Siga, in Ain Temouchent.

3- The Legal Framework Of The Archaeological Site Of Siga:

The archaeological site of Siga is officially registered in the General Inventory of National Cultural Properties, pursuant to the decree signed on July 14, 2007, published in Official Gazette No. 60 on September 26, 2007. This registration followed an earlier decree initiating its classification and listing in the Additional Inventory, which was announced in Official Gazette No. 22 in 1992(Official Gazette of the People's Democratic Republic of Algeria. 2007: 20).

4- Components Of The Archaeological Site Of Siga:

The site of Siga has undergone several excavation campaigns beginning in 1936 by Grimal, followed by others in 1952 and 1961 by Villemot, and later in 1977–1978 by Rakob and Bouchnaki. Artifacts discovered during these excavations were distributed among museums in Beni Saf, Ain Temouchent, Tlemcen, Oran, and Algiers.

These excavations have helped uncover the features, layout, and essential elements of the site, particularly during Grimal's initial investigations. According to his findings, the visible remains of the site are divided into two elevated areas separated by a gap. The first is the western elevation, which gently slopes toward the Beni Zahana area in the form of a plateau. The second elevation extends toward the bend formed by the Tafna River, standing at 46 meters above sea level. At this elevated point lies the acropolis ("l'acropole"), with its southwest corner marked by a rocky platform covering an area of 16 square meters, which is believed to have been the base of a corner tower. On the opposite side

of the gap, the western hill contains another similarly structured large building.

Moving 50 meters northwest of the acropolis, a complex structure begins, featuring walls made of rocks of various sizes, polished stonework, and remnants of a column constructed using the quadratum building technique. Beneath this structure, Roman sigillata pottery fragments were discovered, along with a rectangular cistern measuring 2.5 by 6 meters and a depth of 3 meters. The interior of the cistern was lined with well-preserved hydraulic mortar. Upon discovery, the cistern was filled with burned beverage containers. Behind this cistern, wall remnants were found, possibly belonging to a fortress. Approximately 37 meters from the front wall, a simple line of polished stones and a circular dome-shaped stone structure were identified, although the middle section had collapsed, leaving only the remaining walls visible on other sides.

In the western section of the site, Grimal uncovered a water reservoir connected to a channel. The reservoir was a rectangular room with a collapsed dome, measuring 28 by 6 meters, with solid stone walls coated internally with hydraulic mortar. The channel, which originated from the reservoir, was rectangular in shape (30 to 50 cm wide) and ran along the northern wall toward the mountains. Approximately 500 meters from the reservoir, the channel splits into two branches—one leading to Oued Ferd el-Maa and the other climbing the slope toward the mountain.

Through his examination of the city's water supply systems, Grimal was able to estimate the population size of ancient Siga. Based on the discovered cistern and water channels, he calculated that Siga required approximately 13,720 cubic meters of water daily, suggesting a population of about 8,000 inhabitants(Pierre Grimal. 1937: 141).

In addition to these findings, Grimal and subsequent researchers, such as Villemot, unearthed several artifacts and inscriptions at the site. These discoveries included capitals, inscriptions, ceramic vessels, and oil lamps. Villemot's excavations focused on the riverside area, where foundational remains such as polished stones, concrete bases, and capitals indicated the presence of Roman structures. Upon clearing the

soil covering the area, Villemot uncovered a network of walls that he described as intricate. Near the excavation's perimeter, he discovered two lime-plastered walls, which he identified as Roman due to their construction techniques and associated finds, including wall drawings, marble fragments, and tiled flooring. Villemot concluded that the walls were unlikely to have been residential structures, as they lacked tiled floors, water drainage systems, or plastered interiors.

Villemot also identified burial sites at the site, including a large necropolis located at the far northwest end and a smaller burial area near the Numidian river port at the site's center. The large necropolis contained four distinct types of tombs (George vuillemot.1971: 39).

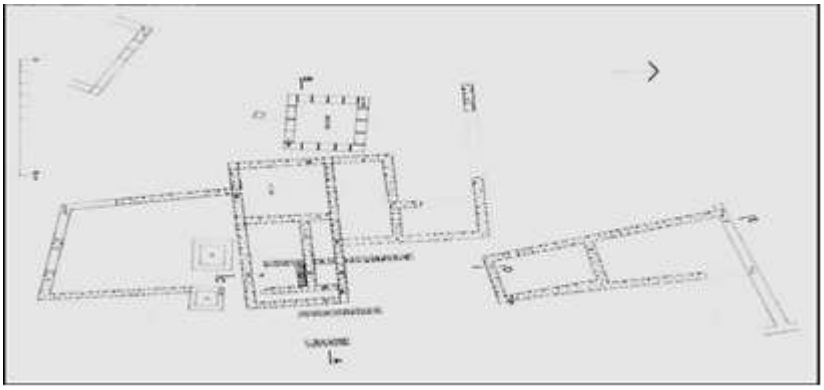


Figure 01: The plan completed by Filmo for the archaeological site "Siga". By George Vuillemot, 1971.

5- Factors Contributing To The Deterioration Of The Archaeological Site Of Siga:

The various signs of deterioration observed, diagnosed, and documented at the site are attributable to a range of natural, mechanical, biological, and human factors. Each has played a significant role in the site's current degraded condition, with varying degrees of severity and environmental impact.



Image 03: The effect of damage factors on archaeological materials, the archaeological site "Siga." in Ain Temouchent.

6-1- Physicochemical Factors:

Among the most critical physicochemical factors threatening the site is high humidity, as the site is located in a coastal area. The materials used in the site's construction, including stones and lime mortar, are particularly sensitive to moisture.

- Impact on Stones: Humidity affects stones based on their internal structure, mineral composition, and physicochemical properties, such as hardness, resistance, and permeability. Moisture directly influences the movement of gases (e.g., smoke, pollution), including SiO_2, NO_2, and CO_2, particularly in porous stone surfaces, exacerbating deterioration.
- Impact on Mortar: The lime mortar is especially prone to moisture-induced damage. Prolonged exposure to humidity leads to swelling, internal expansion, and subsequent cracking, rendering the mortar brittle and accelerating the overall degradation of the structure.
- Salt Effects: The impact of salts is closely linked to that of humidity. High humidity levels cause salts to crystallize on mortar surfaces, where water movement through capillary action draws the salts to the surface. In stones, salt migration—whether originating from the stone itself or from surrounding materials like mortar or the ground—leads to cracking and fracturing.

6-2- Mechanical Factors:

The site's Mediterranean climate, characterized by fluctuations in temperature between day and night and across seasons, contributes to the mechanical deterioration of its construction materials, including stones and mortar. Thermal expansion and contraction due to temperature changes cause stress within the materials, weakening their structural integrity(Masoud Hamian. 2009: 89).

Erosion: Erosion is a significant factor in the degradation of the site, particularly due to wind and sandstorms. Sand-laden winds act as natural abrasive tools, accelerating the wear and removal of exposed surfaces(Izzat Zaki Hamed Qadous. 2014: 205).

Seepage Water Damage: Seepage water poses one of the most severe threats to archaeological sites, particularly those located near rivers or coastlines, such as Siga. Seepage around the foundation raises water through capillary action, dissolving binding materials like lime in stones and mortar. Over time, this process transforms solid materials into weak, friable structures, prone to collapse when combined with other deterioration factors (Abdel Moez Shaheen. 1994: 189).



Figure 02: An approximate drawing showing the effect of mechanical factors and their manifestations on the archaeological site of Siga in Ain Temouchent.

6-3- Biological Factors:

A- Plants:

Given that the site is located on a wooded plateau covered with shrubs, plants are not considered a primary factor in its degradation. However, their impact on the site is dual:

- Chemical Impact:

Plants contribute to the production of acids that break down calcium carbonate (limestone), forming water-soluble compounds. These compounds infiltrate the structure, and, when combined with algae, form a dense, impermeable layer over the surface.

- Mechanical Impact:

The large roots of plants penetrate stones, causing cracks and fissures. Climbing plants, in particular, form a complete covering over the stone surfaces, which prevents evaporation and traps moisture within the walls, especially during periods of intense heat (Hazar Omran and George Daboura. 1997: 79).



Image 04: The spread of plants at the archaeological site of Siga in Ain Temouchent.

B- Animals:

The site, given its natural and secluded location, is vulnerable to damage from a variety of animal species.

- Wild Animals:

Wild animals significantly impact the site through mechanical damage, as they directly interact with its walls, foundations, and components. They also cause chemical degradation through their waste. Animals such as wild boars, foxes, snakes, and field mice, as well as local birds, use the site as a refuge, laying their eggs and building nests within its ruins.

7- Signs Of Deterioration At The Archaeological Site Of Siga:

Field visits to the archaeological site of Siga revealed advanced signs of deterioration, which are readily visible even to non-specialists. To identify the factors contributing to this degradation, we conducted direct field examinations and documented several features that indicate the site's deteriorated state.

Walls and structural elements have suffered extensive damage, with more than 70% of the site's structures having collapsed. Only remnants of walls remain, with no visible roofs, as they have entirely collapsed. Floor surfaces are either eroded due to environmental factors or buried beneath layers of soil.

The mortar binding the stones has also significantly deteriorated, and vegetation has overrun most of the site, including invasive woodland plants. These observations suggest that much of the site is buried beneath the soil, with only a few features visible, such as the water cistern and portions of the walls that rise just a few centimeters above ground level. As noted earlier, the site is situated on terraced terrain that gradually ascends to the south.

Furthermore, the encroachment of agricultural activities into the surrounding area has blurred the boundaries between the archaeological site and adjacent lands. The lack of clear demarcation exposes the site to additional human and environmental threats, exacerbating its vulnerability to degradation.




Image 05,06: Signs of Deterioration at the Archaeological Site of Siga in Ain Temouchent.

8- Preventive Conservation Of The Archaeological Site Of Siga:

To ensure the preservation and protection of archaeological sites, particularly the Siga site, several legislative and technical measures must be implemented.

8-1- Legal Framework For Preventive Conservation:

Given the significant attention international organizations and institutions have devoted to the preservation and maintenance of archaeological sites, Algerian legislators have not been left behind. In response to the urban expansion and demographic growth witnessed in the late 20th century, which contributed to the encroachment of residential developments on cultural heritage sites, the Algerian authorities introduced Law No. 98-04, dated June 15, 1998. This law addresses cultural heritage protection by outlining its definition, management, preservation, preventive measures, and restoration, while also including punitive measures against activities harmful to this legacy(Law No. 98-04, Pertaining to the Protection of Cultural Heritage. 1998: 04).

8-2- Technical Aspects Of Preventive Conservation At The Siga Site:

Regardless of differing views on how best to maintain archaeological buildings, conservation is not merely about prevention or repair of damaged architectural elements. It is a specialized process with established principles and traditions, requiring extensive expertise and a thorough understanding of the distinct characteristics of different types of heritage buildings.

8-2-1- Protection Against Physicochemical Deterioration:

Atmospheric humidity is one of the most critical challenges facing the Siga site. When moisture condenses and transforms into free water on cold surfaces, it penetrates walls and dissolves soluble salts. Upon drying, the salts crystallize, leading to cracking and fracturing of stones and walls due to the pressure exerted by the salts. Strategies to mitigate the risks of humidity, based on the site's current state, include(Izzat Zaki Hamed Qadous. 2014: 207):

- Implementing barriers to limit the infiltration of moisture.
- Using sealants to block porous areas.

8-2-2- Protection Against Mechanical Deterioration:

A- Protection From Winds And Storms:

Specialists in the field of archaeological conservation have developed methods to reduce the risks associated with winds and storms. The most effective approaches include(Abdel Moez Shaheen. 1994: 201):

- Removing sand accumulations around the site.
- Stabilizing the soil around the site by spraying it with resins and industrial polymers.
- Increasing afforestation efforts in the areas surrounding the site to act as natural windbreaks.

B- Protection From Rain And Floods:

Given the significant rainfall during winter, as previously discussed in the climate analysis of the region, certain preventive measures must be taken to mitigate the accompanying risks, such as:

- Constructing a drainage network to divert water away from the site.
- Strengthening walls and structures by sealing cracks and weak points.
- Reinforcing joints and corners with durable mortar resistant to water penetration.
- Treating existing mortar with resins and industrial polymers to enhance its resistance to water.
- Coating surfaces with waterproof layers to prevent water seepage.
- Covering the tops of exposed walls with insulating mortar layers, as experiments with resins and polymers have demonstrated high effectiveness for this purpose.

8-2-3- Protection Against Biological Deterioration:

A- Plants:

Plants pose a significant challenge to the conservation of archaeological sites. At Siga, their widespread growth exacerbates deterioration. Simply uprooting these plants does not resolve the problem, as they tend to regrow. Burning them or using seed-killing chemicals is also ineffective. Prevention is the most effective solution, as

it hinders seeds from finding suitable growth conditions in the cracks and fissures between stones(Izzat Zaki Hamed Qadous. 2014: 209).

B- Animals:

Measures to mitigate the risks posed by animals include:

- Erecting fences around the site to prevent animal intrusion.
- Sealing holes and cracks that could serve as shelters for animals.
- Installing adequate traps throughout the site.
- Using chemical repellents and poisons to control animals.
- Ensuring regular cleaning and maintenance of the site to minimize animal attraction(Abdel Moez Shaheen. 1994: 117).

8-2-4- Protection Against Human-Induced Deterioration :

A- Intentional Or Accidental Human Damage:

Damage caused by human activity is often unintentional, stemming from ignorance, negligence, or indifference. However, deliberate vandalism also occurs. Preventing such damage involves implementing systematic monitoring, maintaining constant surveillance, enforcing strict legal penalties, and raising public awareness about the site's cultural and historical significance.

As the site is registered nationally, it falls under the supervision of the National Office for the Protection and Promotion of Cultural Properties, which is affiliated with the Ministry of Culture and Arts. Fieldwork has revealed that while the site is monitored and protected, its isolated location necessitates increased patrolling and stricter enforcement of legal protections to deter vandalism and deliberate harm(Abdel Moez Shaheen. 1994: 117).

B- Limiting Urban Encroachment:

Residential projects near the site pose a significant threat, as they may inadvertently disturb or destroy portions of the ancient city of Siga, most of which lies buried beneath the soil. To prevent such risks, it is essential to:

Conduct comprehensive archaeological and scientific studies of the area to identify and evaluate its cultural and historical assets, both visible and buried.

Enact and enforce relevant laws to protect the site(Abdel Moez Shaheen. 1994: 205).

Relocate nearby development projects as far from the site as possible.

If full protection of the site cannot be guaranteed, take rescue measures, including:

- Conducting excavations to uncover and document buried structures and artifacts.
- Cataloging and preserving decorative and architectural elements for museum storage.
- Relocating movable structures to environments resembling their original settings.

8-2-5- Excavations And Site Cleaning:

Given the current state of the site, where more than 80% of its structures remain buried, and the potential risks of exploiting nearby lands, coordinated excavations are essential. These should be undertaken in collaboration with the Ministry of Culture and its affiliated institutions to precisely determine the ancient city's extent. Excavations would significantly contribute to improving the site's condition.

Post-excavation, thorough cleaning is critical to remove signs of deterioration caused by various factors. Cleaning is not merely for aesthetic purposes but also to prevent further damage, as regular maintenance is among the most effective conservation measures. Since the site's primary construction material is stone, established and tested methods for cleaning stone structures should be applied.

- **CONCLUSION:**

Every archaeological field study grounded in objective scientific principles enables researchers to contextualize their subject within its historical and geographical framework. This allows for an accurate diagnosis of its current condition and realistic projections for its future. Based on these insights, practical solutions can be proposed to preserve the site's present state and ensure its stability for as long as possible.

Our study of the Siga archaeological site aimed to explore the most effective preventive conservation methods. By combining theoretical research with a field-based assessment, we identified the site's current condition and recorded visible signs of deterioration. The site's environmental and physical context is both an advantage and a challenge. While its wooded surroundings and isolation from urban development shield it from certain risks, they also expose it to other threats, such as dense vegetation and wildlife.

We documented the key factors causing deterioration, including physicochemical issues like humidity, mechanical factors like human activity and natural disasters, and biological threats like plants and animals. Based on these observations, we proposed preventive strategies to mitigate these risks, ranging from excavation and rehabilitation to cleaning and conservation efforts.

- Recommendations:

- Expedite preventive measures, beginning with constructing a durable protective fence around exposed areas.
- Finalize the delineation of the site's boundaries and true extent.
- Regularly remove invasive vegetation to prevent further encroachment.
- Involve the local community in preservation efforts through awareness campaigns while ensuring responsible participation.
- Consider conducting new excavation campaigns, as previous ones date back to colonial times and may reflect outdated ideologies.
- Preserve the site in its current state if excavations pose significant risks to its structural integrity.

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