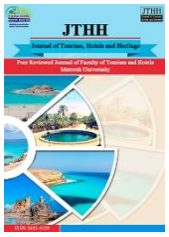

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Preserving Tell Atrib: Analysing Human Risks and Applying Protective Measures

الحفاظ على تل أتريب: تحليل المخاطر البشرية وتطبيق التدابير الوقائية

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Abstract

Tell Atrib, an archaeologically significant site in Egypt, is under threat from a range of human-induced risks. This research aims to identify, analyse, and propose solutions to these threats, focusing on issues such as vandalism, urban encroachment, pollution, neglect, and illicit activities. Utilizing a quantitative risk assessment model, the study systematically evaluates the impact of these risks. Key findings reveal that frequent vandalism and theft, unchecked urban development, and widespread pollution significantly degrade the site's integrity. Preventive measures recommended include enhanced site security, stricter urban zoning laws, comprehensive waste management, and community education programs. These strategies are designed to mitigate the immediate risks and ensure long-term preservation. The research emphasizes the necessity of a multi-faceted approach, involving local communities, governmental agencies, and international organizations, to safeguard Tell Atrib. The proposed framework not only addresses the specific threats to Tell Atrib but also provides a model for the preservation of other endangered heritage sites in Egypt. This study underscores the importance of sustainable conservation practices and community involvement in heritage preservation.

Keywords: Heritage site; Risk Analysis; Conservation Strategies.

الملخص

تل أتريب، موقع أثري ذو أهمية كبيرة في مصر، يواجه تهديدات متعددة ناتجة عن الأنشطة البشرية. تهدف هذه الدراسة إلى تحديد وتحليل واقتراح حلول لهذه التهديدات، مع التركيز على قضايا مثل التخريب، التوسع العمراني، التلوث، الإهمال، والأنشطة غير المشروعة. باستخدام نموذج تقييم المخاطر الكمي، تقوم الدراسة بتقييم تأثير هذه المخاطر بشكل منهجي. تكشف النتائج الرئيسية أن التخريب والسرقة المتكررة، والتوسع العمراني غير المنضبط، والتلوث الواسع النطاق تضر بشكل كبير بسلامة الموقع. تشمل التدابير الوقائية الموصي بها تعزيز أمن الموقع، وتطبيق قوانين تنظيم عمراني أكثر صرامة، وإدارة شاملة للنفايات، وبرامج تعليمية للمجتمع. تم تصميم هذه الاستراتيجيات للتخفيف من المخاطر وضمان الحفاظ على الموقع على المدى الطويل. تؤكد الدراسة على ضرورة اتباع نهج متعدد الجوانب، يشمل المجتمعات المحلية والمؤسسات الحكومية والمنظمات الدولية، لحماية تل أتريب. لا يقتصر الإطار المقترح على معالجة التهديدات الخاصة بتل أتريب فقط، بل يوفر أيضًا نموذجًا للحفاظ على المواقع التراثية الأخرى المهددة في مصر. وتؤكد هذه الدراسة على أهمية ممارسات الحفاظ المستدامة وإشراك المجتمع في الحفاظ على التراث.

الكلمات الدالة: مواقع التراث؛ تحليل المخاطر؛ استراتيجيات الحفظ.

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Introduction

Tell Atrib, historically known as Athribis (Greek: Ἄθλιβις) and originally named Hut-hery-ib  in ancient Egyptian, is an archaeological site of great significance located in Lower Egypt (Gauthier, 1927). Positioned northeast of modern Banha on the hill of Kom Sidi Yusuf, about 40 km north of Cairo (Welc, 2014). The city of Athribis served as the capital of the tenth Lower Egyptian nome (Kem-Wer  which means the black bull) during various periods, including the Ptolemaic, Roman, and Byzantine eras (Ezz Ali, 2022). Although some historical texts suggest that the city might date back to the Old Kingdom (Rowland, 2011), the earliest confirmed occupation dates to the 12th Dynasty (Petrie, Walker, & Knobel, 1908). A small brick pyramid, which was initially documented by Napoleon's expedition and remained visible at the site throughout the nineteenth century, has now completely disappeared (Mynářová, 2012). Significant contributions to the site include the construction and enhancement of local temples by pharaohs such as Amenhotep III, who rebuilt a temple during the 18th Dynasty (Amer, 2021), and Ramesses II, who expanded this temple and erected two black granite obelisks, now housed in the Cairo Museum (Ćwiek, 2014). Additionally, Athribis is notable as the birthplace of Amenhotep son of Hapu, a distinguished official and architect during the reign of Amenhotep III (Al-Kurdi, 2023). The 26th Dynasty also saw the construction of a temple by Ahmose II (Michałowski, 1961), and local texts reference a temple dedicated to Horus Khenty-khety (Leitz, 2002). Excavations have unearthed significant findings from various eras, including a large bathhouse, villas, and industrial buildings from the Ptolemaic period, and early Byzantine structures (Myśliwiec, 2013). The city's importance continued through the early Christian period, as evidenced by the discovery of an early Christian basilica (Myśliwiec, 2008). The site's rich history is further highlighted by its use as a significant pottery production centre during the early Ptolemaic period, with numerous kilns and a large collection of stored pottery uncovered (Welc, 2013; Zaremba et al., 2020).

Athribis, historically recognized as a significant centre of cultural and national diversity within the Mediterranean region, boasted a rich tapestry of inhabitants from various backgrounds. The city's population included Egyptians, Greeks, and individuals from the Near East, all of whom coexisted in close proximity to the temple dedicated to Horus-Khenty-khety (Leitz, 2002). This temple served as a focal point for the community, reflecting the city's role as a melting pot of different cultures and traditions. The multicultural nature of Athribis is further underscored by historical texts, which suggest the presence of a Jewish colony within the city. This indicates that Athribis was not only a hub for Egyptian and Greek residents but also a welcoming environment for people of diverse ethnic and religious backgrounds. The coexistence of these varied communities within Athribis highlights its importance as a cosmopolitan centre in the ancient world, where cultural exchange and interaction were commonplace. This blend of cultures would have contributed to a vibrant and dynamic society, influencing various aspects of daily life, including trade, religious practices, and social customs. The presence of different cultural groups likely fostered a rich exchange of ideas and traditions, making Athribis a microcosm of the broader Mediterranean world's diversity (Mynářová, 2012).

The initial excavation of Athribis was undertaken by French archaeologist Auguste Mariette in 1852, but major systematic excavations began post-World War II, led by Professor Kazimierz Michałowski and his team from the Polish Centre of Mediterranean Archaeology University of Warsaw, in collaboration with various institutions. These excavations revealed foundational structures from the reigns of Taharqa and Amasis, a large Roman bath complex, and provided comprehensive insights into the site’s historical layers (Mysliwiec & Południkiewicz, 2003).

Fig 1. Archival photos of the discovery of the site by the Polish mission in 1957@ https://pcma.uw.edu.pl/en/2019/01/18/tell-atrib-2/

Preserving Tell Atrib is of paramount importance due to its extensive historical and cultural value. As a site that encapsulates key periods of Egyptian history, including the Ptolemaic, Roman, and Byzantine eras, Tell Atrib provides crucial insights into the architectural, religious, and social practices of these times. The site's archaeological remains, such as temples, bathhouses, and pottery workshops, highlight a unique blend of Egyptian and Greco-Roman influences, underscoring the significance of cultural exchange in ancient societies. Moreover, conserving Tell Atrib not only preserves its historical essence but also enhances educational and tourism opportunities, fostering greater public awareness and appreciation of Egypt's rich cultural legacy.

Historically, the issue of encroachments and violations at Tell Atrib and its ancient artifacts can be traced back to the time of the site's discovery. Flinders Petrie noted this in his writing on *"Atribis," stating, "Today, much of the pre-existing artifacts are being lost every year because local farmers like to use the sebakh, fertilizer from the ancient mudbrick blocks that were used for most of the buildings."* (Mysliwiec & Południkiewicz, 2003). This practice has been a significant cause of the site's deterioration over the years. Unfortunately, today the historical site of Tell Atrib is facing critical threats from various human activities. Once a flourishing ancient city, Tell Atrib has devolved into a garbage dump and a refuge for criminals and drug users. Urban encroachment has further exacerbated the situation, with influential individuals exploiting the area for residential development. Despite the Ministry of Antiquities' decision to erect a protective wall around the site, no concrete actions have been taken to safeguard this valuable heritage. Local residents report that the 3-acre site has been subjected to looting and unauthorized excavations, leading to the extraction of numerous artifacts and coins. Only scattered hills, fragmented archaeological pieces, columns, a limestone sarcophagus, and a single intact cemetery remain. The urban growth surrounding Tell Atrib has nearly engulfed the site, isolating it and making it increasingly vulnerable. Acts of vandalism, such as graffiti on monuments and fires set to burn garbage, further degrade the site. The most significant threat remains the random digging by treasure hunters, compromising the site's archaeological integrity.

The objectives of this research are to comprehensively identify and analyse the human risks threatening Tell Atrib then analysis the threat rate to each risk and to develop and recommend effective risk management strategies aimed at mitigating these threats and preserving the site's historical and cultural value. The research will address the following questions: What are the primary human risks to Tell Atrib? How can these risks be assessed and mitigated?

By systematically evaluating the severity and impact of the identified risks and proposing actionable strategies to mitigate these threats, this research aims to ensure the long-term preservation and protection of Tell Atrib, contributing to the broader effort of safeguarding our global cultural heritage.

Literature review

Although there are no direct references addressing risk management at the Tell Atrib site, several sources discuss the archaeological and historical significance of the site, as well as the history of the excavations and investigation in the site. These sources provide a solid foundation for understanding the cultural and historical value of the site, which in turn underscores the necessity for effective risk management strategies. **Michalowski's** work in 1961, "Les Constructions Ptolémaïques et Romaines À Tell-Atrib," delves into the architectural developments during the Ptolemaic and Roman periods at Tell Atrib. By examining the construction techniques and architectural features of the site's structures, Michalowski provides crucial context for understanding the cultural landscape and urban development of Tell Atrib during this period (Michałowski, 1961). **Myśliwiec's** study on "Polish-Egyptian Excavations at Tell Atrib" in 1989 presents detailed findings from joint Polish-Egyptian excavations, shedding light on the site's ancient history and material culture. Through careful analysis of artifacts, architectural remains, and stratigraphic layers, Myśliwiec contributes significant data to our understanding of settlement patterns, socio-economic activities, and cultural interactions at Tell Atrib throughout different historical periods (Myśliwiec, 2008). **Szymańska's** excavation reports in "Tell Atrib: Excavations" (1998, 1999) provide comprehensive documentation of archaeological findings and stratigraphic sequences uncovered during excavations at Tell Atrib. These reports offer detailed descriptions of pottery assemblages, architectural features, and burial practices, enriching our understanding of the site's material culture, social organization, and religious beliefs over time (Szymanska, 1998). In her work "Athribis, Tell Atrib" (2012), **Mynářová** offers a holistic overview of the site's historical significance, emphasizing its role as a prominent administrative center and religious hub in ancient Egypt. Through analysis of textual sources, iconographic representations, and archaeological evidence, Mynářová provides insights into the political, religious, and economic dynamics that shaped life at Tell Atrib throughout its history (Mynářová, 2012). Welc's work "Tell Atrib 1985-1995 IV. Faience Objects" in 2014 provides a detailed analysis of faience objects uncovered during excavations at Tell Atrib. By examining manufacturing techniques, stylistic attributes, and contextual associations of faience artifacts, Welc contributes to our understanding of artisanal practices, trade networks, and cultural exchange at Tell Atrib during the specified period (Welc, 2014). **Górecki's** study in 2017, "Remnants of a Byzantine church at Athribis," explores the religious landscape of Tell Atrib during the Byzantine period. By documenting the architectural remains and material culture associated with a Byzantine church found at the site, Górecki sheds light on the religious practices, beliefs, and social dynamics of the Byzantine community inhabiting Tell Atrib (Górecki, 2017). **Islam Amer's** work "Three Blocks of the King Ramesses III from Tell Atrib (Benha)" in 2021 focuses on specific architectural elements associated with the reign of King Ramesses III at Tell Atrib. Through detailed analysis of inscriptions, architectural fragments, and spatial distribution patterns, Amer provides insights into the monumental architecture, royal propaganda, and political ideologies of the New Kingdom period in ancient Egypt (Amer, 2021). **Mona Ezz Ali**'s paper in 2022 examines the religious significance of Tell Atrib, with a particular focus on the worship of the local deity Khenty khety. By analyzing textual sources, iconographic representations, and archaeological evidence, Ali elucidates the cultic practices, religious beliefs, and socio-political roles of Khenty khety within the religious landscape of Tell Atrib (Ezz Ali, 2022).

In the broader context of risk management at heritage sites, several studies have provided methodologies, assessments, and strategies that are crucial for preserving cultural heritage. **R. Jigyasu's** 2005 study, "Towards developing methodology for integrated risk management of cultural heritage sites and their settings," lays the groundwork for an integrated approach to managing risks at cultural heritage sites. Jigyasu emphasizes the need for a comprehensive methodology that includes both natural and human-induced risks, aiming to protect not just the sites themselves but also their

surrounding environments (Jigyasu, 2005). **PJ Matiz Lopez**, in 2016, developed "Integrated risk assessment for cultural heritage sites: a holistic support tool for decision-making," which provides a robust framework for assessing risks at cultural heritage sites. Lopez's holistic tool supports decision-making by integrating various risk factors, from environmental hazards to socio-economic pressures, thus enabling more informed and effective management strategies (Matiz Lopez, 2016). The book by **DC Stapp and J Longenecker**, "Avoiding archaeological disasters: Risk management for heritage professionals" (2016), offers practical guidance for heritage professionals on how to identify, assess, and mitigate risks at archaeological sites. Their work is essential for developing a proactive approach to risk management, ensuring that heritage professionals are equipped to prevent and respond to potential disasters (Stapp & Longenecker, 2016). **N. Masini and F. Soldovieri's** 2017 study, "Cultural heritage sites and sustainable management strategies," focuses on sustainable management practices for cultural heritage. Their research highlights the importance of integrating sustainability into risk management strategies to ensure the long-term preservation of heritage sites (Masini & Soldovieri, 2017). **A. Konsta's** 2018 work, "Risk management and built heritage: Experiences, reflections and perspectives," provides a reflective analysis on the challenges and experiences in managing risks at built heritage sites. Konsta offers perspectives on best practices and innovative approaches that can be applied to similar contexts, emphasizing the need for adaptive and resilient management strategies (Konsta, 2018).

In the Egyptian context, **S. Parcak's** 2015 study, "Archaeological looting in Egypt: A geospatial view," uses geospatial technologies to assess the extent and impact of looting on heritage sites. Parcak's case studies from Saqqara, Lisht, and el Hibeh provide crucial data for understanding the patterns of looting and inform strategies to mitigate this risk (Parcak, 2015). **Amany A. Ragheb, et al**.'s 2017 study, "Risk Management Strategy for Protecting Cultural Heritage: Case Study of the Institute of Egypt," outlines a specific risk management strategy tailored to the needs of the Institute of Egypt. Their work emphasizes the importance of localized strategies that address the unique risks faced by individual heritage sites (Ragheb, Ragheb, & Abd ElRahman, 2017). **Mohamed Faik**'s 2020 study, "Risk management in heritage sites: Case study Kharga oasis in Egypt," provides a detailed examination of risk management practices at the Kharga oasis. Faik's research highlights the challenges and solutions specific to managing risks in an arid environment, contributing valuable insights to the broader discourse on heritage site preservation (Faik, 2020). **HT Omar El-Shabrawy et al**.'s 2021 study, "Examine the role of the latest technology in risk management of conserving heritage buildings in Egypt: A Literature Review," investigates the application of modern technologies in managing risks at heritage sites. Their work underscores the potential of technological innovations to enhance risk assessment and mitigation efforts, offering a forward-looking perspective on heritage conservation (El-Shabrawy, Eid, & Khodeir, 2021).

While the existing literature provides robust methodologies, frameworks, and case studies for risk management at heritage sites, there is a notable gap in specific studies addressing these issues at Tell Atrib. This gap includes the lack of integrated risk management strategies that consider the unique environmental, cultural, and socio-political factors of the site. This paper aims to fill this gap by focusing specifically on examining human-induced risks, such as looting, vandalism, and urban encroachment, at Tell Atrib. The study will analyse how these human risks affect the ruins, contributing to their deterioration and loss of historical value. By highlighting the urgent need to address these risks, the paper will propose targeted mitigation strategies and preventive solutions tailored to the unique context of Tell Atrib

Methodology

The study will apply a comprehensive methodology employed to identify, analyse, and propose solutions for the human risks threatening the archaeological site of Tell Atrib. The methodology integrates qualitative and quantitative approaches, ensuring a robust and holistic analysis.

Data Collection

Site Visits and Observations

Direct observations and site visits are essential for understanding the current condition of Tell Atrib. Regular visits to the site will be conducted to document the extent of urban encroachment, instances of vandalism, and other human-induced damages. Photographic documentation and field notes will be taken during these visits to provide a visual and descriptive record of the site's state.

Surveys and Interviews with Local Stakeholders

Engaging with local stakeholders, including residents, local authorities, and site management personnel, is crucial for gathering first-hand information on the challenges facing Tell Atrib.

Review of Historical Records and Previous Studies

An extensive review of historical records and previous archaeological studies will be conducted to establish a baseline understanding of Tell Atrib's historical and cultural significance.

Data Analysis

Following the identification of human-induced risks at Tell Atrib, the next phase involves assessing their impact on the site's archaeological remains. This entails quantifying the probability of each risk occurring, its potential impact, and the resulting loss of value to the heritage assets. To accomplish this, the Canadian ABC tool is utilized to gauge the severity of these risks. This tool is composed of three scales: The A scale measures the frequency of risk events, ranging from annually (score 5) to once in 10,000 years (score 1); the B scale evaluates the degree of damage to heritage assets, from total loss (score 5) to insignificant loss (score 1); and the C scale determines the extent of affected items within the heritage asset, using the same scoring range. By summing the scores from these three components, the magnitude of risk (MR) is calculated, providing a clear indication of the risk level and aiding decision-makers in prioritizing mitigation efforts (Michalski & Pedersoli Jr, 2016; Pedersoli Jr, 2016).

Strategies for risk mitigation

In the culmination of our risk analysis, we have meticulously evaluated the identified threats to the archaeological remains at Tell Atrib, categorizing them according to their potential impact and probability of occurrence. Building upon this foundational analysis, we have expanded our scope to examine comparable heritage sites globally that have faced analogous risks. Our objective has been to distill the strategies and measures implemented by these sites to mitigate and manage such threats. This comparative analysis not only enriches our understanding of the challenges faced by cultural heritage worldwide but also provides a robust framework for evaluating the feasibility of applying similar solutions within the Egyptian context. By critically assessing the transferability of these approaches, we aim to propose a suite of solutions that are not only grounded in international best practices but also sensitive to the unique cultural and environmental milieu of Tell Atrib. This methodical approach ensures that our recommendations are both practical and effective, contributing to the sustainable preservation of this invaluable archaeological site.

Description of Key Monuments at Tell Atrib

Tell Atrib is home to several significant unmovable monuments, each reflecting the rich historical and cultural legacy of the site. These monuments, spanning various historical periods, are crucial to our understanding of the ancient city's past and must be preserved from the numerous human risks currently threatening the site.

(Kom A)

Kom A features the remains of two ancient temples from the Late Period. The first temple dates back to the reign of Taharqa of the Twenty-fifth Dynasty, while the second is from the reign of Amasis of the Twenty-sixth Dynasty. These temples represent significant religious and architectural achievements of their time, providing insights into the ceremonial practices and structural design of the period (Mysliwiec & Południkiewicz, 2003). Another major discovery at Kom A is a large Roman bath complex from the Julio-Claudian period. This complex was later rebuilt during the reigns of Trajan and Hadrian (Trzciński, Zaremba, Nejbert, & Kaproń, 2022). Kom A also contains a unique set of several dozen lime-kilns. These kilns highlight the industrial activities that took place in Tell Atrib and are significant for understanding the technological advancements and economic activities of the ancient city (Mysliwiec & Południkiewicz, 2003).

Kom Sidi Youssuf

Kom Sidi Youssuf is distinguished by its baths from the early and middle Ptolemaic period. These baths reflect the influence of Greek culture on Egyptian society and are crucial for studying the daily life and social customs of the time (Myśliwiec, 2008; Welc, 2013). The site also includes workshops and a pottery kiln from the Ptolemaic period. These facilities were integral to the production of pottery and terracotta figurines, highlighting the craftsmanship and industrial activities of the era (Fig 2) (Szymańska, 1999; Welc, 2014).

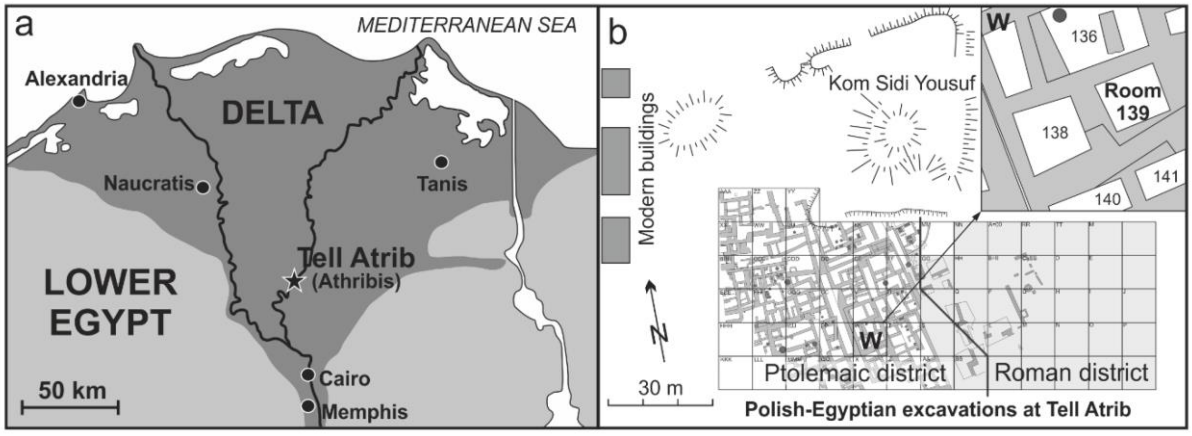


Fig 2.a. The location of Tell Atrib in the Nile Delta, b. the map of the site according to the polish excavation team. @ Małgorzata Zaremba et al.

A Roman villa found in Kom Sidi Youssuf illustrates the residential architecture and domestic life during the Roman occupation of Egypt. This villa, with its layout and construction, provides valuable insights into the living conditions and architectural styles of the period (Myśliwiec, 2013). One of the most historically significant monuments at Kom Sidi Youssuf is one of the oldest churches in Egypt. This early Christian church was partly constructed using fragments of earlier Roman buildings, such as columns. It stands as a testament to the religious transformation and architectural adaptation during the early Christian period (Myśliwiec, 2008).

Identification of human risks

The identification of these human risks was achieved through a combination of direct observations, structured interviews, and surveys with local stakeholders. Regular site visits provided first-hand insights into the physical state of Tell Atrib, while interviews with local residents, security personnel, and officials from the Ministry of Antiquities offered valuable qualitative data on the socio-cultural and economic factors contributing to these risks.

Fig 3. A satellite image showing the urban encroachment surrounding the site on all sides

Site Visits and Observations

During the site visits, detailed notes and photographic evidence were collected to document the condition of the monuments and the extent of human-induced damage. Observations included the presence of graffiti, signs of unauthorized excavations, and areas affected by urban encroachment and pollution.

Surveys and Interviews with Local Stakeholders

Structured interviews were conducted with a diverse group of stakeholders, including local residents, police officers, archaeologists, and community leaders. These interviews provided insights into the community's perception of Tell Atrib, the challenges faced in its preservation, and the socio-economic factors driving the human risks. Survey questionnaires were also distributed to gather quantitative data on the frequency and nature of the human activities affecting the site.

These methodologies and tools helped identify a group of human risks that greatly affect the site, which are as follows:

Vandalism and Theft

During several site visits, it was observed that vandalism is rampant throughout Tell Atrib. Graffiti defaces many of the remaining structures, and signs of forced entry into restricted areas are evident. For example, during a visit on May 12, 2023, numbers of graffiti have been observed on the limestone column, wall of roman bath. significantly diminishing their historical value. Additionally, there are numerous accounts of theft and unauthorized excavations, as reported by residents and local authorities. According to an interview with Mr. Ahmed El-Sayed, a local resident who lives adjacent to the site, "There are people who come at night to dig for treasures. They believe they can find valuable artifacts and sell them." This was corroborated by Officer Mahmoud Hassan from the local police department, who confirmed, "We have received several reports of illegal excavations and looting at Tell Atrib. Despite increased patrols, the vast area makes it challenging to secure entirely."

Urban Development and Encroachment

Urban development and encroachment are among the most severe threats to Tell Atrib. Rapid urbanization has led to the construction of residential towers and other buildings dangerously close to the archaeological site (Fig 3). During a site visit on June 20, 2023, it was evident that new buildings were being constructed merely meters away from the ancient ruins. In an interview with

Dr. Mona Fathy, an archaeologist from the Ministry of Antiquities, she stated, “The urban sprawl is encroaching on the site at an alarming rate. We have little control over the surrounding private lands, and this has led to irreversible damage to some parts of the site.” Furthermore, Mr. Khaled Abdallah, a local real estate developer, mentioned, “There is a high demand for residential space in this area, and developers are keen to capitalize on it, often at the expense of preserving heritage sites.”

Littering and Pollution

Fig 4. The littering around the archaeological remains in the site

Tell Atrib has unfortunately become a dumping ground for local waste, severely affecting the site's environmental integrity. During multiple site visits, the presence of garbage piles was noted, particularly around the more secluded parts of the site. This pollution not only degrades the visual appeal of the site but also poses a threat to the physical preservation of the artifacts and structures. Mrs. Fatma Hassan, a local community leader, lamented, “People around here often dump their trash at the site because there are no adequate waste management systems in place. It’s heart-breaking to see such a historical place being treated like this.” Observations confirmed that waste disposal is a significant problem, with plastic, organic waste, and even construction debris scattered across the site. The accumulation of waste has also led to the proliferation of rodents and insects, which further endanger the archaeological remains. Many of the artifacts and structures at Tell Atrib are made of mudbrick, a fragile material that is particularly vulnerable to damage from pests. The rodents, attracted by the garbage, gnaw through the mudbrick, creating burrows and nests that can compromise the structural integrity of these ancient remnants. Similarly, insects thrive in the unsanitary conditions, exacerbating the decay and degradation of the site. The combination of pollution and pest infestation creates a cycle of deterioration that significantly undermines the preservation efforts at Tell Atrib.

Negligence and Lack of Awareness

A significant factor contributing to the site's degradation is the negligence and lack of awareness among both locals and authorities. Despite the site's historical importance, there has been minimal effort from the government to protect and promote awareness about its significance. During an interview, Mr. Youssef Ali, a security guard at Tell Atrib, revealed, “There is hardly any presence of officials or archaeologists on a regular basis. The site is mostly left unguarded, which invites trouble.” Additionally, many locals are unaware of the site's importance. As stated by Ms. Amina Rashad, a school teacher from a nearby town, “Many people in our community do not understand the value of Tell Atrib. To them, it’s just another piece of land.” This lack of awareness leads to neglect and improper use of the site, further exacerbating its decline.

Illicit activities

One of the most alarming risks to Tell Atrib is its use as a shelter for outlaws and drug dealers. According to interviews conducted with residents living near the site, such as Mr. Hossam El-Din, a shop owner, “At night, the site becomes a hotspot for illegal activities. We often see suspicious individuals entering the site, and its common knowledge that it’s being used for drug dealings.”

Visitors' Unregulated Access

The lack of regulated access and proper Visitors management has led to further damage to the site. Visitors often wander off designated paths, causing wear and tear on the ruins. Additionally, there are no proper facilities or guidelines for tourists, leading to littering and other forms of pollution. Moreover, the site is especially susceptible to cultural vandalism, such as unauthorized writing or drawing on historic buildings and sculptures. This can damage their surfaces and undermine their authenticity (Fig 5). During a site visit on July 15, 2023, it was noted that several Visitors were climbing over fragile structures and ignoring signs meant to protect the site. Mr. Mohamed Saeed, a tour guide, mentioned, “There are no proper facilities for Visitors here. People come, but there are no paths or guides, so they end up damaging the site unknowingly.”

Fig 5. Graffiti with Marker in the wall of one of the roman bath in the site.

Fire Hazards

The presence of flammable materials and the lack of fire safety measures pose a serious risk of fire hazards at Tell Atrib. During several site visits, evidence of fire damage was documented, with charred areas and burn marks visible on several archaeological remains (Fig 6). Local residents often set fires to clear garbage, inadvertently putting the site at risk. This issue is exacerbated by the widespread growth of wild plants and weeds throughout the site, which provides additional fuel for fires. Additionally, paper and plastic waste, discarded by nearby residents, is frequently set ablaze to dispose of it, leading to further destruction and defacement of the site. Photographs taken during these visits highlight the severity of the situation, showing burn marks on ancient walls and other structures. According to an interview with Mr. Hassan Ali, a local resident, “We sometimes burn our waste because there are no proper waste disposal services. Unfortunately, this sometimes gets out of control and affects the ancient ruins.” This was confirmed by Mr. Ibrahim Khalil, a firefighter from the local fire department, who stated, “We have responded to several fire incidents at Tell Atrib. Most are due to irresponsible garbage burning. There needs to be a clear policy and enforcement to prevent such activities.” The combined effect of flammable vegetation, improper waste disposal, and the lack of fire safety measures poses a continuous threat to the archaeological integrity of Tell Atrib, necessitating immediate intervention and the implementation of comprehensive fire prevention strategies.

Fig 6. The remain of the fire on the site and the impact of the smoke can still be seen on the column

Economic Exploitation

During a site visit, numerous makeshift stalls and small shops were observed operating along the edges of the archaeological site. Economic exploitation by local vendors and businesses has emerged as a significant issue at Tell Atrib. The encroachment of commercial activities on the site's periphery has resulted in several preservation and visual appeal problems. The structures contribute to the physical degradation of the area by increasing foot traffic and litter, and occasionally damaging ancient remains. The unchecked economic exploitation by local vendors disrupts the site's integrity and diminishes its historical and aesthetic significance. The accumulation of waste generated by these businesses further exacerbates the problem, with plastic wrappers, food containers, and other debris scattered around the site.

Transportation Infrastructure

Fig 7. Photo showing how close the road and cars are to the antiquities at the site

The infrastructure and transportation network around Tell Atrib present significant risks to the archaeological site. Notably, the site is flanked by major roads on multiple sides, which poses various threats to its preservation and integrity (Fig 7). During site visits, it was observed that the Faculty of Commerce road runs directly through the western part of the site, while the Canal road passes along the eastern boundary. Additionally, the site is separated from the Shaheed Farid Nada Road on the southern side by approximately 80 meters, occupied by residential towers. The close proximity of these roads to the archaeological site has several detrimental effects:

Vibration Damage: The constant traffic flow, including heavy vehicles, generates vibrations that can weaken the structural integrity of the ancient ruins. These vibrations, while often imperceptible to the human senses, accumulate over time, leading to cracks and potential collapse of fragile structures.

Pollution: Vehicular emissions contribute to air pollution, which accelerates the weathering of exposed artifacts and structures. The accumulation of soot and other pollutants can discolour stone surfaces and contribute to chemical reactions that degrade materials such as limestone and mudbrick.

Physical Wear and Tear: The presence of nearby roads increases foot traffic through the site, as people use it as a shortcut or a place to rest. This unregulated movement of pedestrians can lead to physical damage to the archaeological layers and artifacts.

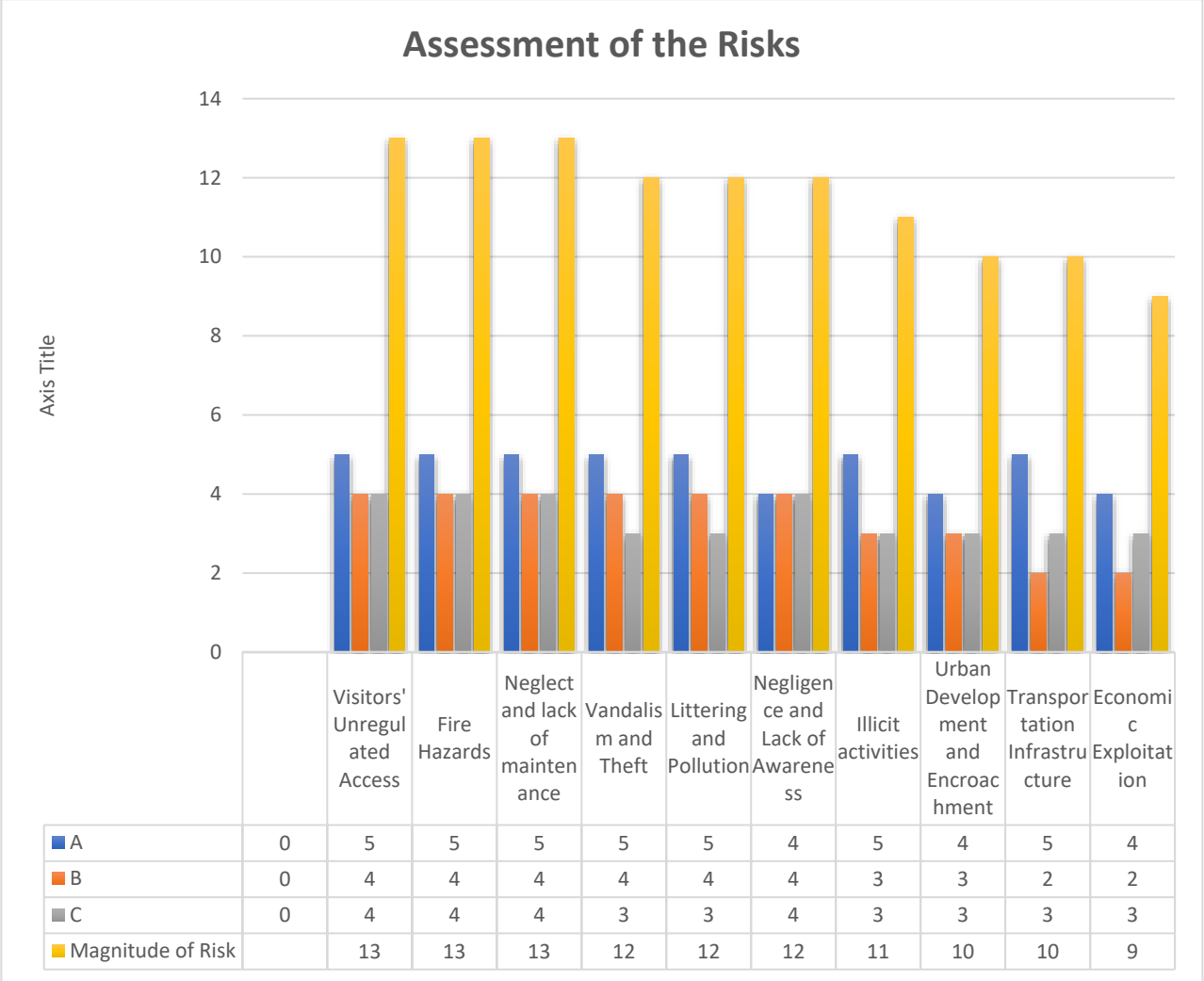
Accidental Damage: Proximity to busy roads raises the risk of accidental damage. For instance, vehicles could accidentally veer off the road and into the site, causing direct physical harm to the ruins.

Neglect and lack of maintenance

Neglect and lack of maintenance pose serious threats to the preservation and integrity of the archaeological site of Tell Atrib. These issues lead to the gradual deterioration of the site's structures and artifacts, making them more vulnerable to other risks. Without regular upkeep, ancient buildings and artifacts are exposed to significant hazards, such as weathering, erosion, and biological growth such as weeds, moss, and lichen, which can further destabilize the ruins by penetrating cracks and retaining moisture. The site's historical and cultural value diminishes as structures and artifacts degrade, impacting its potential as an educational resource and a tourist destination, which in turn affects local economies. During multiple site visits, the lack of maintenance was evident, with crumbling walls, overgrown vegetation, and exposed artifacts to hot sun rays and precipitation being common sights.

Risks analysis

As we delve into the specifics of the human-induced risks at Tell Atrib, the following chart presents a detailed analysis of each identified threat. Utilizing the data collected through our comprehensive methodology, which included site visits, surveys, interviews, and a review of historical records, the study applied the Canadian ABC tool to assess the probability, impact, and loss of value for each risk. The resulting magnitudes of risk (MR) are displayed to offer a clear prioritization for mitigation efforts. The next chart serves as a critical reference for understanding the multifaceted challenges facing Tell Atrib and guides the development of targeted conservation strategies (Fig 8).



		Visitors' Unregulated Access	Fire Hazards	Neglect and lack of maintenance	Vandalism and Theft	Littering and Pollution	Negligence and Lack of Awareness	Illicit activities	Urban Development and Encroachment	Transportation Infrastructure	Economic Exploitation
A	0	5	5	5	5	5	4	5	4	5	4
B	0	4	4	4	4	4	4	3	3	2	2
C	0	4	4	4	3	3	4	3	3	3	3
Magnitude of Risk		13	13	13	12	12	12	11	10	10	9

Fig 8. Chart indicate the analysis of the identified risks on the site by present of A, B and C factors of the Canadian equation.

Discussion

The archaeological site of Tell Atrib is an invaluable heritage asset that faces a multitude of human-induced risks, as outlined in our assessment. The analysis provided in this study employs a multifaceted approach to categorize and evaluate these risks based on three key criteria: frequency of occurrence (A), degree of damage to heritage assets (B), and extent of affected items within the heritage asset (C). This innovative risk assessment framework allows for a comprehensive understanding of the threats and informs strategic prioritization for preservation efforts.

High-Risk Categories

The analysis identifies several high-risk categories that demand immediate and concerted intervention. Visitors' Unregulated Access, Fire Hazards, and Neglect and Lack of Maintenance emerged as the most critical threats, each with a total risk magnitude score of 13. The high frequency of these risks indicates that they occur regularly, posing a persistent threat to the site. Visitors' Unregulated Access is particularly concerning, as the lack of proper visitor management leads to physical wear and tear on the ruins, littering, and unauthorized access to fragile areas. This issue necessitates the implementation of stringent visitor guidelines, improved signage, and the establishment of designated pathways to mitigate inadvertent damage. Fire Hazards are exacerbated by the presence of flammable materials, improper waste disposal practices, and the growth of wild vegetation. The risk of fire poses a direct and severe threat to the integrity of the site, necessitating

the introduction of comprehensive fire safety measures, regular site maintenance to remove flammable debris, and community awareness campaigns to prevent negligent behaviours. Neglect and Lack of Maintenance is a critical issue that reflects the broader challenges of resource allocation and institutional oversight. The deterioration of the site due to weathering, biological growth, and structural decay can be significantly mitigated through regular maintenance programs, dedicated funding for preservation, and increased professional oversight.

Moderate-Risk Categories

The categories of Vandalism and Theft and Pollution also present significant threats, with total risk scores of 12. These risks are characterized by their high frequency and substantial damage potential. Vandalism and Theft are particularly insidious as they not only damage physical structures but also compromise the historical and cultural integrity of the site. Enhanced security measures, community policing, and the promotion of local stewardship can help address these issues. Pollution poses a dual threat of environmental degradation and physical damage to the archaeological materials. The accumulation of garbage and the associated proliferation of pests create conditions that accelerate the deterioration of the site. Effective waste management systems, community education on the importance of site cleanliness, and regular clean-up initiatives are crucial for mitigating this risk. Negligence and Lack of Awareness and Illicit Activities were identified as moderate risks with scores of 11. These categories reflect broader social and cultural challenges that require targeted educational programs, community engagement, and stricter enforcement of regulations to foster a sense of collective responsibility for heritage preservation.

Lower-Risk Categories

Urban Development, Encroachment and Transportation Infrastructure (score of 10) pose notable risks due to their potential to cause structural damage through vibrations, pollution, and increased foot traffic. Strategic urban planning, buffer zones around the site, and traffic management can help mitigate these impacts. Economic Exploitation (score of 9), although the lowest among the assessed risks, still represents a significant threat through increased human activity and waste generation.

Preventive Measures and Conservation Strategies

1- Visitors' Unregulated Access

- Establish Designated Pathways: Develop and clearly mark designated pathways for visitors to follow. This can help minimize the physical wear and tear on the most vulnerable parts of the site (Ponsignon, Amiri-Aref, Lunardo, & Bouzdine-Chameeva, 2023).
- Install Informational Signage: Place informative signs throughout the site that guide visitors, provide historical context, and explain the importance of staying on designated paths to protect the site.
- Implement Controlled Access Points: Create controlled entry and exit points with staffed checkpoints to monitor and manage the flow of visitors. This helps in maintaining oversight and preventing unauthorized access (Jacques et al., 2023).
- Use Barriers and Fencing: Erect barriers and fencing around particularly sensitive or fragile areas to physically prevent access. This can include rope barriers, wooden fences, or even more permanent structures if needed.
- Develop Visitor Education Programs: Create educational programs and materials that inform visitors about the site's importance and the need to respect and protect it. This can include brochures, videos, and interactive exhibits at the entrance (Nowacki, 2012).

- Increase Surveillance and Security: Install surveillance cameras and increase the presence of security personnel to monitor visitor activity and deter vandalism or unauthorized access (Xia & Arrowsmith, 2008).
- Increased Staffing and Patrols: Increase the number of staff and security patrols to monitor visitor activities and enforce rules.

2- Fire Hazards

- Regular Vegetation Clearance: Regularly remove dry vegetation and overgrown plants around the site to reduce flammable material.
- Waste Management System: Implement a proper waste disposal system to prevent the accumulation of combustible materials such as paper and plastic waste.
- Fire Detection Systems: Install fire detection systems, such as smoke detectors and heat sensors, throughout the site to enable early detection of fire.
- Firefighting Equipment: Ensure that adequate firefighting equipment, such as fire extinguishers, hoses, and water tanks, are readily available at key locations within the site.
- Controlled Burning Regulations: Implement and enforce regulations on controlled burning activities in and around the site to prevent accidental fires.

3- Neglect and Lack of Maintenance

- Regular Site Inspections: Conduct frequent and systematic inspections to identify and address maintenance issues promptly.
- Scheduled Maintenance Plan: Develop and adhere to a detailed maintenance schedule for all structures and artifacts, ensuring regular upkeep.
- Funding Allocation: Secure and allocate funds specifically for the ongoing maintenance and conservation of the site.
- Training for Maintenance Staff: Provide specialized training for maintenance staff to ensure they are equipped with the necessary skills and knowledge.
- Community Involvement: Engage the local community in preservation efforts through awareness programs and volunteer opportunities (Abdul Aziz, Mohd Ariffin, Ismail, & Alias, 2023).
- Partnership with Academic Institutions: Collaborate with universities and research institutions to facilitate ongoing studies and preservation initiatives.
- Documentation and Monitoring: Maintain detailed records of the site's condition and monitor changes over time using modern technology.
- Emergency Preparedness: Develop and implement an emergency preparedness plan to address potential threats such as natural disasters or vandalism.

4 – Vandalism, theft and illicit Activities.

- Enhanced Security Patrols: Increase the frequency of security patrols, especially during night-time, to deter vandalism and theft.
- Surveillance Systems: Install CCTV cameras throughout the site to monitor activities and capture evidence of unauthorized access.
- Secure Fencing: Erect secure fencing around the most vulnerable and significant areas of the site to prevent unauthorized entry.
- Guard Posts: Establish guard posts at strategic points around the site to provide a visible security presence.
- Lighting: Install adequate lighting around the site to increase visibility and deter criminal activities at night.

- Collaboration with Law Enforcement: Work closely with local law enforcement agencies to ensure prompt response to incidents of vandalism and theft.
- Reporting Hotlines: Establish hotlines or online platforms for anonymous reporting of criminal activities.
- The enforcement of the existing heritage protection law must be strengthened by imposing sanctions on the persons who undertake any kind of illegal excavation around the heritage sites.

5 - littering and Pollution

- Waste Management Infrastructure: Install sufficient waste bins and recycling stations throughout the site to encourage proper disposal of litter.
- Regular Clean-up Campaigns: Organize regular clean-up campaigns involving local volunteers, schools, and community groups to maintain site cleanliness.
- Signage and Information Boards: Place clear and informative signage around the site to educate visitors and local community about the importance of proper waste disposal and the impact of pollution on heritage conservation
- Environmental Awareness Programs: Conduct environmental awareness programs for local communities and visitors to highlight the significance of keeping the site clean.
- Eco-Friendly Packaging: Encourage the use of eco-friendly packaging materials among vendors and local businesses operating near the site (Khaledi Koure, Hajjarian, Hossein Zadeh, Alijanpour, & Mosadeghi, 2023).
- Penalties for Littering: Enforce strict penalties for littering and pollution, with fines or community service for offenders.

6 - Negligence and Lack of Awareness

- Public Awareness Campaigns: Launch campaigns to raise public awareness about the importance of the site and the need for its preservation.
- School Programs: Develop educational programs for schools to teach students about the importance of heritage conservation.
- Community Workshops: Conduct workshops for the local community to involve them in preservation efforts and increase their sense of ownership (Abdul Aziz et al., 2023).
- Cultural Events: Organize cultural events and activities at the site to attract visitors and raise awareness about its significance.
- Volunteer Programs: Establish volunteer programs where locals can actively participate in site maintenance and preservation (Holmes, 2007).
- Social Media Campaigns: Utilize social media platforms to share stories, images, and videos about the site’s history and the importance of its preservation (De Ascaniis, Della Monica, & Cantoni, 2017).

7 - Urban Development and Encroachment

- Buffer Zone Establishment: Create a protected buffer zone around the site to prevent direct encroachment by urban development.
- Zoning Laws and Regulations: Work with local authorities to enforce zoning laws that restrict incompatible development near the site.
- Sustainable Urban Planning: Collaborate with urban planners to integrate the site into the city's development plans in a sustainable manner.
- Infrastructure Development: Invest in infrastructure that supports the site's preservation, such as drainage systems to prevent erosion and damage from urban runoff.

- Incentives for Preservation: Offer incentives such as tax breaks or grants to property owners who engage in conservation-friendly practices.
- Legal Protection: Seek legal protection for the site at the national and international levels to safeguard it from unauthorized development.
- Lobbying and Advocacy: Lobby for stronger national and local heritage laws and advocate for the site's preservation in public forums.

8 - Transportation Infrastructure

- Traffic Diversion: Reroute heavy traffic away from the site to minimize vibration and pollution damage.
- Buffer Zones: Create buffer zones to keep roads at a safe distance from the archaeological remains.
- Speed Limits: Implement reduced speed limits on roads adjacent to the site to lessen vibration impacts.
- Road Surface Improvements: Use smoother road surfaces near the site to reduce vibrations caused by passing vehicles.
- Traffic Calming Measures: Implement traffic calming measures such as speed bumps and roundabouts to control vehicle speeds.
- Infrastructure Impact Studies: Conduct studies to understand the long-term impact of transportation infrastructure on the site and adjust plans accordingly.

9 - Economic Exploitation

- Designated Commercial Zones: Establish designated areas for vendors and small businesses to operate away from the core archaeological site to prevent damage and encroachment.
- Vendor Regulations: Implement strict regulations for vendors, including permits and guidelines to ensure their activities do not harm the site.
- Regular Monitoring: Conduct regular monitoring of commercial activities around the site to ensure compliance with regulations.
- Alternative Livelihood Programs: Provide alternative livelihood programs for those economically dependent on activities that harm the site.
- Limit Commercial Licenses: Limit the number of commercial licenses issued to prevent overcrowding and overexploitation.

Conclusion

The archaeological site of Tell Atrib, with its profound historical significance, faces a multitude of human-induced risks that threaten its preservation. This research has meticulously analysed these risks, including vandalism and theft, urban development and encroachment, pollution, negligence and lack of awareness, illicit activities, and economic exploitation, among others. By employing the Canadian ABC tool to risk analysis based on frequency, degree of damage, and extent of affected items, the study has quantitatively evaluated the impact of each risk, providing a clear and systematic understanding of the threats faced by Tell Atrib. The study proposed comprehensive preventive measures, including enhanced security, strict zoning laws, effective waste management, educational campaigns, regulated commercial activities, and fire safety protocols. These strategies are crucial for mitigating the identified risks and ensuring the site's long-term preservation. The research highlights the importance of coordinated efforts from local communities, governmental bodies, and international organizations. By adopting the proposed strategies, it is possible to safeguard this invaluable heritage site, ensuring its integrity for future generations. This research provides a framework for effective

heritage conservation that can be applied to similar endanger heritage sites in Egypt, emphasizing the importance of sustainable and community-inclusive approaches.

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