

Accidental Archaeological Findings Revealed by Forest Fires in Aïn Maimoun (Khenchela, Northeast Algeria)

F. Tout, N. Rebouh, H. Dinar, Y. Benzid, Z. Zouak, Y. N. Benzagouta, M. Seghiri*

Research Center for Territorial Planning, Constantine, Algeria

Abstract. Fires significantly alter the characteristics of natural environments worldwide, impacting forest cover and surface soil properties. In the Aïn Maimoun area of northeastern Algeria, wildfires have uncovered an archaeological site. This research, conducted through field surveys as part of a damage assessment and rehabilitation evaluation by the Territory Planning Research Center, utilized Geographic Information Systems (GIS), including Google Earth Engine and ArcGIS, to identify areas affected by fires in 2014 and 2021. An initial analysis of archaeological signals and remains at the site was also performed. The results indicate that the area was a Roman cemetery, meeting typical archaeological and geographical conditions. Evidence includes the nature and shape of the rocks, ancient pottery, and illegal excavation activities related to treasure hunting. The findings also suggest traces of an olive press structure. The significance of this discovery is still under evaluation, as the exact boundaries of the site remain unknown. Additionally, many nearby and distant areas with similar characteristics could potentially be ancient fortifications. One of the most important implications of this discovery is identifying the archaeological area representing the population related to this cemetery. The research underscores the necessity of expediting appropriate measures and expanding the understanding of the site's boundaries and nature. It emphasizes the importance of incorporating archaeological research in fire-affected areas and aims to draw authorities' attention to protecting these areas. Furthermore, it encourages stakeholders to consider preserving forest heritage and mitigating destructive activities. Lastly, it highlights the significance of using Geographic Information Systems in archaeological research.

Keywords: Algeria, Tamza, geographic information systems, archaeology, wildfires, vegetation cover.

For citation: Tout F., Rebouh N., Dinar H., Benzid Y., Zouak Z., Benzagouta Y. N., Seghiri M. Accidental Archaeological Findings Revealed by Forest Fires in Aïn Maimoun (Khenchela, Northeast Algeria). *Bulletin of the Irkutsk State University. Geoarchaeology, Ethnology, and Anthropology Series*. 2025, Vol. 51, pp. 49–62. <https://doi.org/10.26516/2227-2380.2025.51.49>

Случайные археологические находки, обнаруженные в результате лесных пожаров в Айн-Маймуне (Хеншела, Северо-Восточный Алжир)

Ф. Ту, Н. Ребу, Х. Динар, Ю. Бензид, З. Зуак, Ю. Н. Бензагута, М. Сегири*

Исследовательский центр территориального планирования, г. Константина, Алжир

Аннотация. Представлены результаты исследований, проведенных в целях выявления районов, пострадавших от пожаров в 2014 и 2021 гг. в районе Айн Маймун на северо-востоке Алжира. В результате работ выявлен участок с археологическими памятниками, где располагалось римское кладбище (об этом свидетельствуют природа и форма камней, находки древней керамики, а также следы незаконных раскопок, связанных с охотой за сокровищами; также обнаружены остатки пресса для получения оливкового масла). Выдвинуто предположение, что другие близлежащие и отдаленные районы с аналогичными характеристиками также могут представлять собой древние укрепления. Сделан вывод о том, что исследование подчеркивает важность проведения археологических исследований на территориях, пострадавших от пожаров, и призвано привлечь внимание властей к защите этих территорий.

Ключевые слова: Алжир, Тамза, географические информационные системы, археология, лесные пожары, растительный покров.

Для цитирования: Accidental Archaeological Findings Revealed by Forest Fires in Aïn Maimoun (Khenchela, Northeast Algeria) / F. Tout, N. Rebouh, H. Dinar, Y. Benzid, Z. Zouak, Y. N. Benzagouta, M. Seghiri // Известия Иркутского государственного университета. Серия Геоархеология. Этнология. Антропология. 2025. Т. 51. С. 49–62. <https://doi.org/10.26516/2227-2380.2025.51.49>

* See the last page of the article for full authors information.
Полные сведения об авторах см. на последней странице статьи.

Introduction

Wildfires are significant hazards that impact natural environments [Avila et al., 2024]. These fires, caused by various factors [Tout, 2023], have altered the characteristics of landscapes and natural features worldwide [Guehaz, Sivakumar, 2023; Jodhani et al., 2024; Kreider et al., 2024; Tout, 2023]. In recent years, their increasing frequency and intensity especially due to climate change have garnered greater attention [Kreider et al., 2024]. In Algeria, efforts primarily focus on implementing suitable pre-

vention measures to mitigate these impacts [Belgherbi et al., 2018; Zahira, Hadj, 2017]. At more advanced stages, efforts may include replanting damaged areas or utilizing the resulting timber, though other aspects often receive less attention.

The municipality of Tamza, part of the Khencela district in northeastern Algeria, frequently experiences wildfires [Guehaz, Sivakumar, 2023]. While the causes of these fires involve several factors [Ganteaume et al., 2013; Meddour-Sahar et al., 2012] still under investigation, there is significant focus on assessing the current conditions of the forested area. The state, through various agencies and forest services, has initiated several procedures to conduct effective damage assessments and identify impacted areas. This includes determining the plant and animal species harmed by these fires [Meddour-Sahar et al., 2012].

One of the primary interests of the Research Center for Territorial Planning, within an environmental and geographical context, is to understand the changes in the characteristics that define regions. This involves first comprehending the factors that led to these changes and assessing the current conditions, and second, proposing alternatives for rehabilitation and recovery. The ultimate goal is to establish a flexible framework for addressing and anticipating various hazards, aiming to prevent them when possible.

In the context of researching the wildfires that impacted the Aïn Maimoun area in the municipality of Tamza, which resulted in the destruction of large forested areas [Guehaz, Sivakumar, 2023], multiple signs indicating a previously invisible archaeological site have been revealed. The recent wildfires affecting the region, particularly over the past decade, have led to the removal of vegetation cover and impacted the surface soil, allowing for the identification of new characteristics of the area.

Study Area

The Aïn Maimoun area (Fig. 1) is part of the municipality of Tamza in the Khencela Province of northeastern Algeria. Located within the Aurès Mountains, it is known for its natural characteristics, particularly its mountainous and forested landscapes. The region falls within a semi-arid climate zone, characterized by hot, dry summers and cold, rainy winters [Guehaz, Sivakumar, 2023]. This climate supports the growth of various plant species, especially pine, oak, and some shrubbery. However, this diverse vegetation also makes the area particularly susceptible to wildfires [Llopis et al., 2024]. The average annual rainfall ranges from 400 to 500 mm, necessitating specific water excavation practices in agricultural activities, especially given the recent water scarcity. The region's distinctive topographical characteristics provide suitable conditions for human settlement in various locations.

From an archaeological perspective, the area is not well-known and has not been previously researched, nor has any archaeological inventory been conducted by official authorities. Tables 1 and 2 refer to the archaeological properties registered in the province at both the local and national levels. Therefore, aside from occasional statements made by residents about finding remains of ancient civilizations, such as pottery fragments on their agricultural lands or at the start of constructing their rural homes, the area does not receive any attention in this regard.

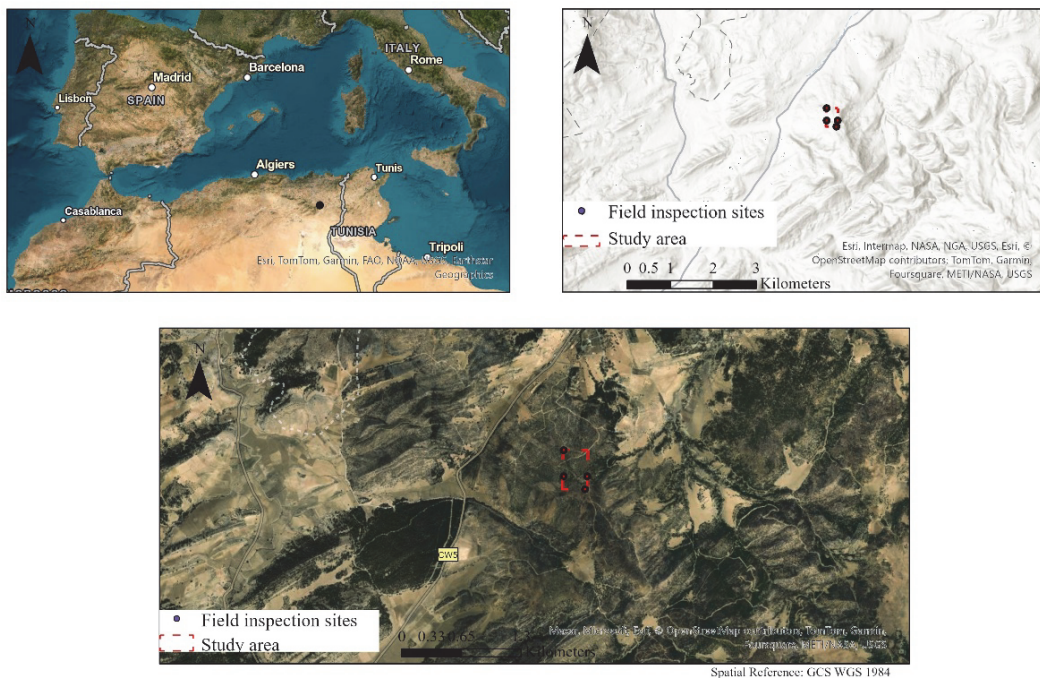


Fig. 1. Study area

Рис. 1. Район исследований

Locally designated archaeological sites
(Source: Directorate of Culture of Khenchela Province)

Table 1

Археологические памятники местного значения
(источник: Управление культуры провинции Хеншела)

Табл. 1

N	Cultural Property Designation	Municipality	District	Historical Period
1	Tibaliyeen	Khiran	Shashar	Roman Period
2	Laktef	Baghai	Hamma	Prehistoric
3	Kadiyat al-Qamh	Ain Touila	Ain Touila	Prehistoric
4	Foris	Oulad Rachash	Oulad Rachash	Ancient (Roman)
5	Tabrouri	Al-Mohammal	Oulad Rachash	Ancient (Roman)
6	Zawiya Mosque	Zawiya Village	Shashar	Islamic Period
7	Old Premises of the Provincial Intelligence Department in the Municipality of Khenchela, formerly a “French Gendarmerie Barracks” during the colonial period	Khenchela	Khenchela	Liberation Revolution Era
8	Military Barracks hosting the so-called "Second Office" now the Internal Urban Security Headquarters in the Municipality of Qais	Qais	Qais	Liberation Revolution Era

Table 2

Nationally classified archaeological sites
(Source: Directorate of Culture of Khenchela Province)

Таблица 2

Национальные археологические памятники
(источник: Управление культуры провинции Хеншела)

Inventory Number	Designation of Cultural Property	Municipality	District	Legal Status	Date of Classification	Type of Classification	Official Gazette Number	Historical Period
01	Baghai Palace	Baghai	Hamma	State-Owned	1999/11/03	National	87dated 1999/12/08	Various Historical Periods
02	SidiAs Tomb	Al-Mohamma	Oulad Rachash	State-Owned	1999/11/03	National	87dated 08/12/1999	Roman Period
03	Hammam Al-Salcheen	Hamma	Hamma	State-Owned	2010/03/17	National	27dated 25/04/2010	Roman Period
04	Tibaliyeen	Khiran	Shashar	State-Owned	–	National	July 2023	Roman Period
05	Ras Matousa (Qadiyat Al-Fath)	Ain Touila	Ain Touila	State-Owned	–	National	2024	Prehistoric Period

Methodology

The scientific field excursions conducted to assess the effects of the wildfires that affected the Ain Maimoun area in the municipality of Tamza, northeastern Algeria, between May 5, 2024, and July 19, 2024, significantly contributed to understanding the nature of the site. These excursions helped clarify ambiguities and highlight the differences that characterize the region in terms of the natural forms of rocks and their distribution.

The fieldwork aimed to provide a broader understanding of the impacts resulting from the fires of 2014 and 2021. Initially, we relied on Geographic Information Systems (GIS) to identify the areas affected by these wildfires. These tools have proven highly effective in analyzing spatial information [Epstein et al., 2024; Fekir et al., 2022; Khader et al., 2009; Pelletier et al., 2024]. This part of the study specifically utilized Google Earth Engine and ArcGIS, relying on Landsat 8 satellite imagery from the periods before and after the fires to calculate the Normalized Burn Ratio (NBR) and identify areas of vegetation cover that were affected.

The Burn Severity Index, known as dNBR (Differenced Normalized Burn Ratio), is used to determine the severity of burning [Crockett, Hurteau, 2024] and is calculated based on the following equation:

$$dNBR = NBR_{PreFire} - NBR_{PostFire}$$

Regarding the Use of Landsat 8 Data:

$$NBR = \frac{Band\ 5 - Band\ 7}{Band\ 5 + Band\ 7}$$

Where:

Band 5: Near Infrared (NIR) (0.851–0.879 μm)
Band 7: Shortwave Infrared (SWIR) (2.107–2.294 μm)

The positive values for both maps indicate high burn severity within the area, while the severity of damage to vegetation decreases as we approach the value of 0. Negative values signify an increase or improvement in vegetation cover (Fig. 2, 3).

Field inspection is of utmost importance [Celebrezze et al., 2024; Lahiri et al., 2022] to uncover details that remote sensing techniques cannot reach (Hendel, Ross, 2020). After observing the site's characteristics and reviewing some details, archaeological features became evident. This was confirmed by the nature, location, and unusual distribution of the rocks, the presence of pottery remnants, and some illegal excavation activities likely conducted in search of treasures. All of this contributed to forming a picture of the site that appears unnatural.

Although obtaining an actual assessment of this archaeological site and determining its true boundaries and components, thus understanding its value, requires significant technical expertise [Walker et al., 2023] in various scientific fields, we attempted to provide additional insights through a geographic perspective. This involved the use of satellite imagery and the Shuttle Radar Topography Mission (SRTM) digital elevation model with a resolution of 30 meters, along with one of its derivatives slopes which greatly aids in understanding the region's topography [Tout, 2023] and identifying the logical reasons for the previous users' selection of this site.

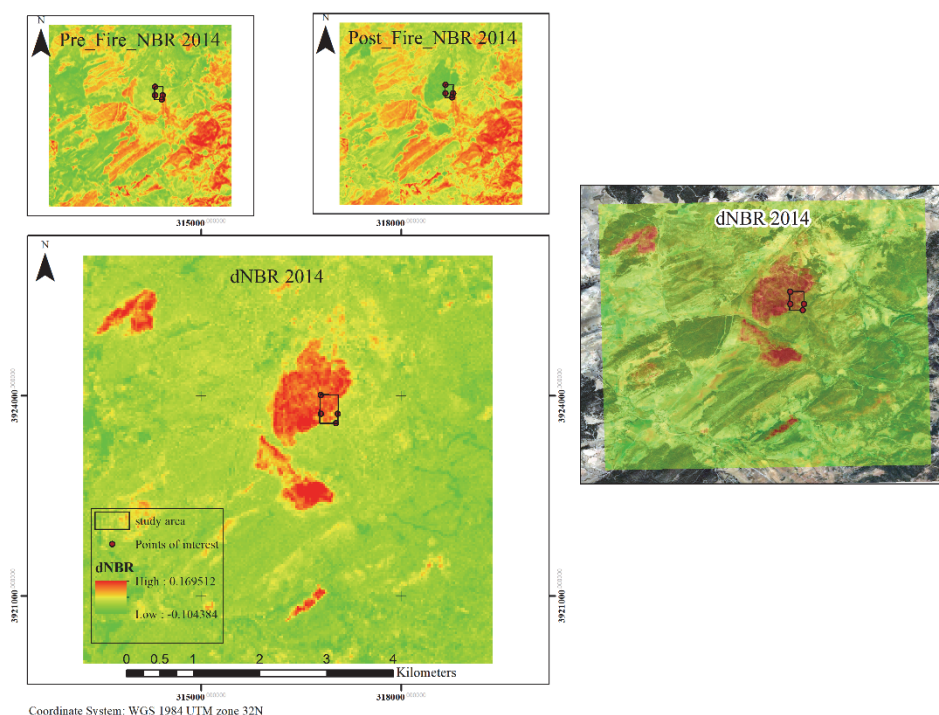


Fig. 2. Differenced Normalized Burn Ratio (2014)

Рис. 2. Дифференцированный нормализованный коэффициент горения (2014 г.)

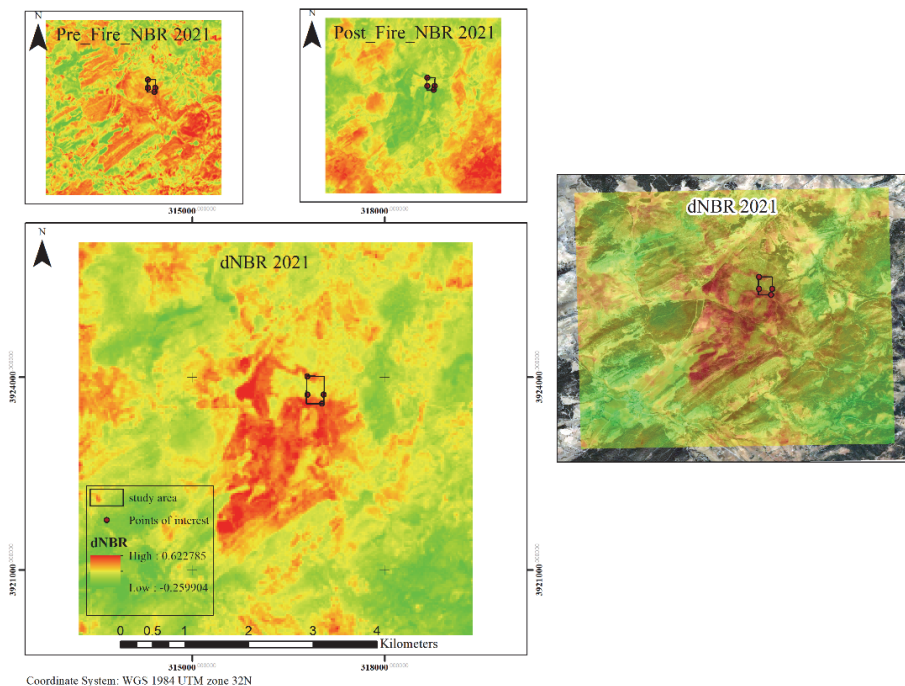


Fig. 3. Differenced Normalized Burn Ratio (2021)

Рис. 3. Дифференцированный нормализованный коэффициент горения (2021 г.)

Results and Discussion

Compared to archaeological remains found in urban areas and open regions, research into forest archaeology is often neglected [Lahiri et al., 2022; Mustoe, Eberl, 2020] due to the complex environments in which these remains are located. These environments provide ideal cover either from vegetation or from processes affecting the surface soil. This complexity makes it extremely challenging to uncover or predict such remains using currently available methods and conditions [Walker et al., 2023].

In the forested area under study, which had not been affected by any fires prior to 2014, as evidenced by old satellite images and statements from nearby residents, the dense vegetation that characterized the region before the 2014 fire prevented even livestock herders from detecting unnatural formations and the interrelations between the rocks present at the site. This obscured their understanding of the complete picture of the site and its boundaries. Additionally, the site's distance from paved roads and unpaved forest paths contributed to its isolation. The region's topography further complicated the cleaning operations conducted by forest services after the 2014 fires, making access to the site extremely difficult, as it necessitated the creation of new pathways. All these factors contributed to the site's continued concealment.

The fires that affected the region in 2021 extended to broader areas, likely exacerbated by the conditions created by the 2014 fires, as their remnants produced more extreme conditions [Kreider et al., 2024]. As a result, these recent fires have drawn greater attention to this area and have helped uncover adjacent regions with similar characteristics to the main site. This has led us to hypothesize that large portions of these areas fall within the boundaries of the current study site.

From a geographical perspective, the site characteristics in the study area align with Dr. Mohamed Ali's description of Roman cemeteries [Ali, 2016]. The site is somewhat sloped and located away from watercourses and areas prone to flooding (Fig. 4). Additionally, the stones that form the site do not resemble natural rock formations; they are carefully arranged, with some being large and rectangular in shape, and others forming walls that extend for dozens of meters.

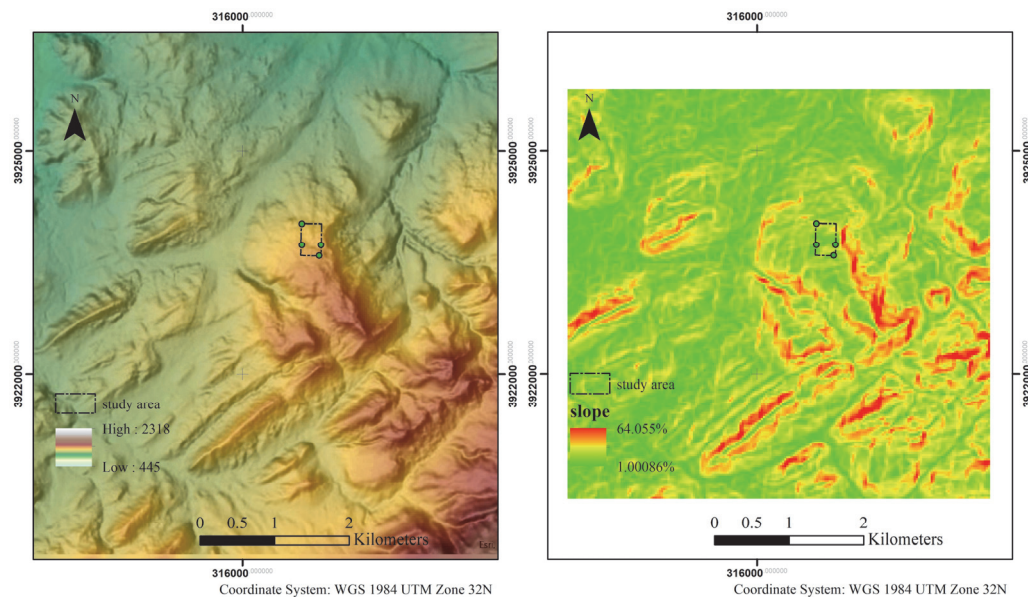


Fig. 4. Altitude and slope in the study area

Рис. 4. Высота и уклон в районе исследования

Field observations of the distribution and arrangement of rocks in many areas make it difficult to determine the boundaries of the site, especially since some rocks have become buried or covered by shrubs and small trees that have begun to grow after the fires.

Figure 5 illustrates some of the key locations that have been identified, which are only a few hundred meters apart. However, many similar sites, both nearby and farther away (some exceeding a kilometer in distance), are still under investigation. This leaves considerable room for hypotheses regarding the boundaries of the site and the overall significance of the region.

Figure 6 illustrates one of the sites containing a type of archaeological rock that appears to have been carefully carved. These rocks may represent part of a structure or monument, or they could be involved in the formation of buildings. The presence of these carved rock formations at multiple sites raises the hypothesis of numerous architectural structures existing in the area.

From the analysis of the site and the distribution of rocks, it is possible to identify some burial sites (Fig. 7) that appear in groups and may belong to specific families. These sites have unique characteristics, particularly regarding their orientation relative to the sunrise and sunset. As noted by Ali [2016], they are typically oriented toward the rising sun, allowing sunlight to shine on the heads of the deceased, while their feet are directed toward the setting sun.

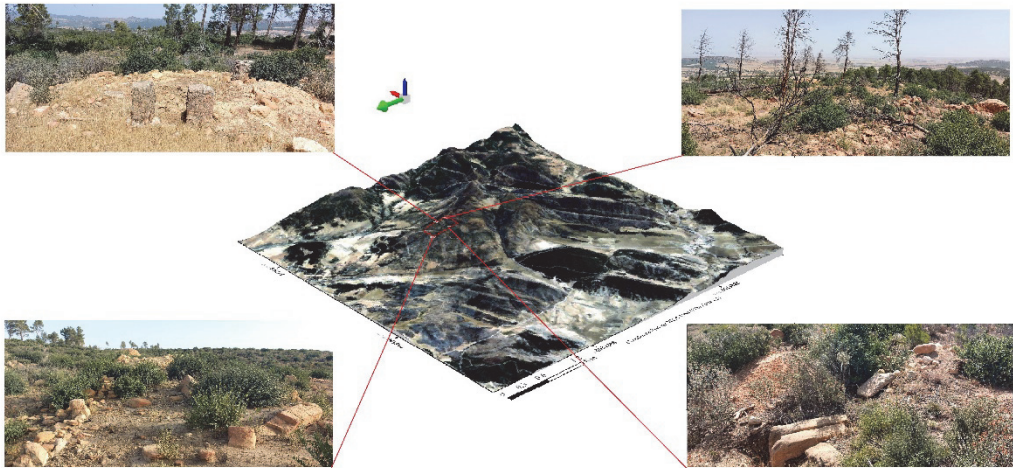


Fig. 5. The most important sites that have been identified

Рис. 5. Наиболее важные выявленные памятники



Fig. 6. Ancient rocks that have been carefully carved

Рис. 6. Тщательно обработанные древние камни

Our preliminary attempt to delineate the boundaries of the site, as shown in Figure 8, allowed us to gain a deeper understanding of the area. We identified distant zones located hundreds of meters away, occupying elevated positions in the existing topography. This aligns closely with constructions created for security purposes, such as watchtowers. However, it remains uncertain whether the main site was a cemetery intertwined with a residential area, as some remains are unrelated to burial rituals and do not exhibit the characteristics typical of cemeteries.

At the main site, there are remains of a Roman olive press (Fig. 9), which is consistent with what [Eid, 2023] described regarding ancient olive presses. This aligns with his observations about the Kharbat Saraydi press in Annaba, which is also located near funerary inscriptions. However, distinguishing the actual differences between an olive press and a wine press requires further research [Ibid.].



Fig. 7. A photo of what is supposed to be a grave group
Рис. 7. Фотография предполагаемой группы захоронений



Fig. 8. Some of the arranged rocks that were found in the area
Рис. 8. Некоторые из найденных в этом районе упорядоченных камней

The signs found in the study area are numerous. Some can be easily distinguished from natural rocks and remains resulting from natural factors, while others require experts to identify and analyze. Figure 10 shows a small portion of the signs discovered in the study area. It is worth noting that we found illegal excavation and digging activities near some of these signs.

The map in Figure 11 illustrates the coordinates of some of the most significant points in the region.

Site S1 is believed to contain a group of graves, as indicated in Figure 7. This site, whose archaeological nature is easily distinguishable, has been subjected to numerous illegal excavations.

In Site S2, according to the attached coordinates, there is a grave carved into a large rock, which has been emptied of its contents. Due to its location among the trees, it is difficult to detect. Several other archaeological remains are also found nearby.



Fig. 9. Part of the presumed olive press structure

Рис. 9. Часть предполагаемой конструкции оливкового пресса



Fig. 10. Some additional artifacts that were found in the area

Рис. 10. Некоторые дополнительные артефакты, найденные в этом районе

Site 3 contains an olive press along with other archaeological remnants. This site has also experienced extensive illegal excavations, and it is believed that a significant portion of its remains are still underground.

Site 4 represents one of the excavation activities carried out based on engravings, markings, and rock formations. It is not the only such site in the area.

Site 5 contains carefully carved rocks situated along an alignment of paved rocks, which may have once formed walls.

By observing the considerable distances between the selected sites, one can gain an understanding of the vast extent of the region.

Regarding the significance of this discovery, its boundaries are not yet clear for several reasons. First, the limits of the archaeological site remain ambiguous, as new boundaries are being discovered continuously. Additionally, there are other similar areas, both nearby and farther away, that have not yet been confirmed.

One of the most important outcomes of this discovery may be the identification of the population associated with this Roman cemetery (preliminary assessment), which could serve as a starting point for further research in this area, where many other archaeological signs have been reported by local residents.

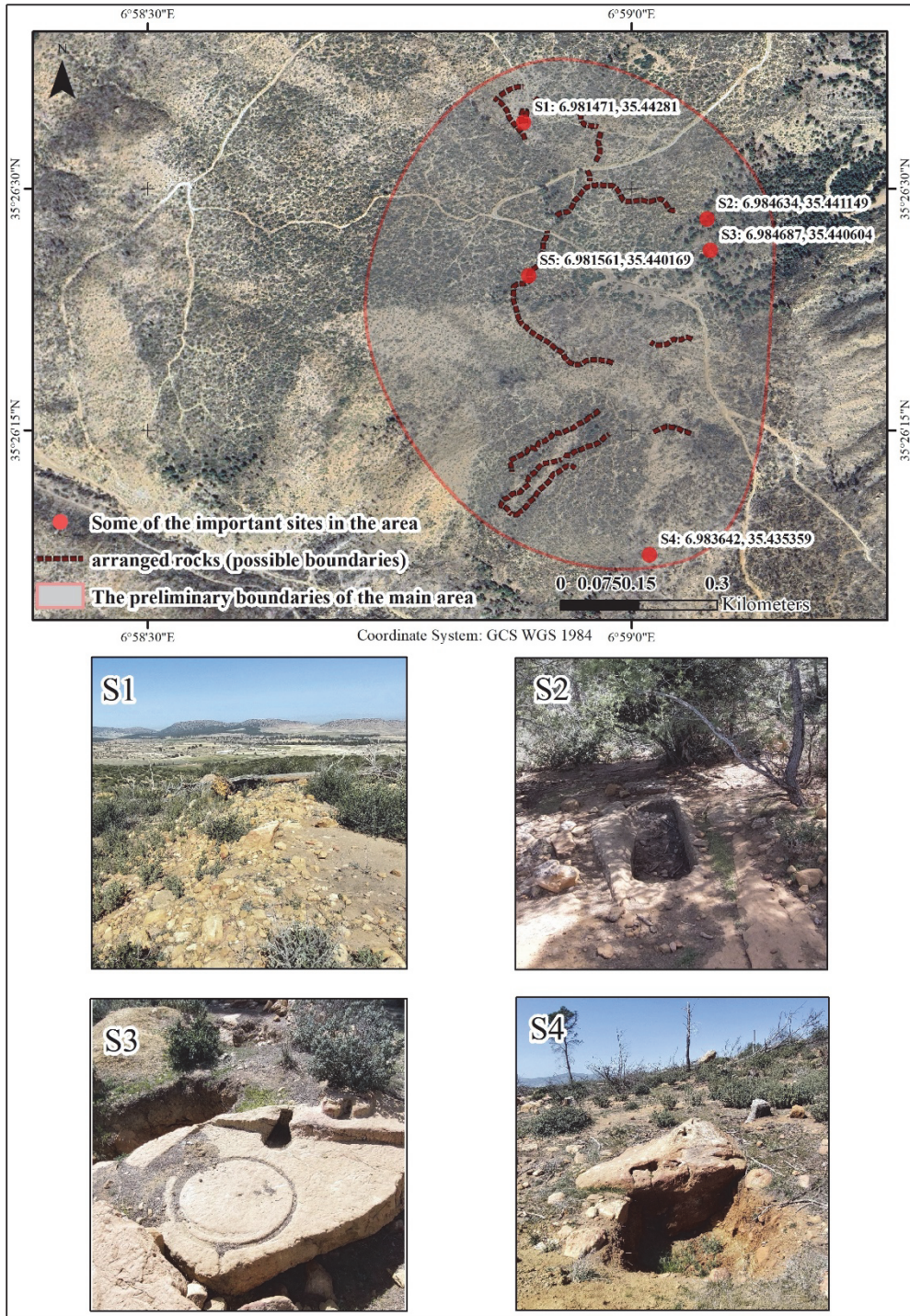


Fig. 11. Some of the important sites in the region
Рис. 11. Некоторые важные памятники региона

Furthermore, one of the objectives of this research is to find ways to protect this site and prevent its degradation [Seghiri Bendjaballah, 2018], thereby closing off opportunities for vandals and grave robbers. This research can contribute to a broader understanding of the local history of the Aïn Maimoun area, which is considered marginalized and often overlooked in terms of its historical significance, especially regarding ancient artifacts.

Analyzing the region and assessing its actual value may lead to the implementation of appropriate measures to prevent further fires that could cause additional deterioration of the site. This research could also serve as a starting point for guiding researchers and stakeholders in the field of archaeology to find and develop sustainable methods for uncovering forest archaeological sites. This may also represent a fundamental goal for those interested in remote sensing, potentially marking a turning point in understanding the history of many regions in Algeria and around the world.

Conclusion

The changes brought about by the fires in the Aïn Maimoun region, which also affected the surface soil, have resulted in a new image of the area. These changes have drawn attention to archaeological remains dating back to the Roman civilization (preliminary assessment of a cemetery), as the fires revealed unusual shapes and distributions of rocks in sites with unique characteristics. These rocks, which may be parts of various structural remains, also bear signs related to Roman civilization.

Although the significance of this discovery is currently unclear, this research can contribute to forming a new understanding of the region and raise many additional questions, especially concerning the boundaries of the site and the nature of similar neighboring areas, as well as somewhat distant regions with specific features that occupy carefully selected locations. A central question remains: Where is the population associated with this site?

The research emphasizes the urgency of taking appropriate measures and expanding the understanding of the boundaries and nature of the site, which could lead to a broader understanding of the local history of the area. Additionally, this research could serve as a starting point for guiding researchers and stakeholders in the field of archaeology towards finding sustainable methods for uncovering forest archaeological sites in Algeria and various regions around the world.

References

- Ali M. *Signs and symbols in archaeological excavation*. Al-Ward Island Library, 2016. (In Arabic)
- Belgherbi B., Benabdeli K., Mostefai K. Mapping the Risk of Forest Fires in Algeria: Application of the Forest of Guetarnia in Western Algeria. *Sciendo*. 2018, Vol. 37(3), pp. 289–300. <https://doi.org/10.2478/eko-2018-0022>
- Celebrezze J. V., Franz M. C., Andrus R. A., Stahl A. T., Adams M. S., Meddens A. J. H. A fast spectral recovery does not necessarily indicate post-fire forest recovery. *Fire Ecology*. 2024, Vol. 20, 54. <https://doi.org/10.1186/s42408-024-00288-6>
- Crockett J. L., Hurteau M. D. Climate limits vegetation green – up more than slope, soil erodibility, and immediate precipitation following high – severity wildfire. *Fire Ecology*. 2024, Vol. 20, 41. <https://doi.org/10.1186/s42408-024-00264-0>
- Eid A. H. New discoveries of Roman olive presses in Sitifis (in arabic). *Tributaries Journal for Studies and Scientific Research in Social and Human Sciences*. 2023, Vol. 03, pp. 575–598. <https://www.asjp.cerist.dz/en/article/233338> (In Arabic)
- Epstein M. D., Seielstad C. A., Moran C. J. Impact and recovery of forest cover following wildfire in the Northern Rocky Mountains of the United States. *Fire Ecology*. 2024, Vol. 20, 56. <https://doi.org/10.1186/s42408-024-00285-9>
- Fekir Y., Amine M., Djamel H. Integrated approach for the assessment of forest fire risk and burn severity mapping using GIS, AHP method, and Google Earth Engine in Western Algeria. *Euro-Mediterranean Journal for Environmental Integration*. 2022, 7(4), pp. 531–544. <https://doi.org/10.1007/s41207-022-00338-y>

- Ganteaume A., Camia A., San-miguel-ayanz J., Jappiot M., Long-Fournel M., Lampin L. A Review of the Main Driving Factors of Forest Fire Ignition Over Europe. *Environmental Management*. 2013, Vol. 51, pp. 651–662. <https://doi.org/10.1007/s00267-012-9961-z>
- Guehaz R., Sivakumar V. A case study about the forest fire occurred on 05 July 2021 over Khenchela province, Algeria, using space-borne remote sensing. *Frontiers in Remote Sensing*. 2023, Vol. 4, pp. 1–14. <https://doi.org/10.3389/frsen.2023.1289963>
- Hendel I. G., Ross G. M. Efficacy of Remote Sensing in Early Forest Fire Detection: A Thermal Sensor Comparison. *Canadian Journal of Remote Sensing*. 2020, Vol. 46 (4), pp. 414–428. <https://doi.org/10.1080/07038992.2020.1776597>
- Jodhani K. H., Patel H., Soni U., Patel R., Valodara B., Gupta N., Patel A., Omar P. jee. Assessment of forest fire severity and land surface temperature using Google Earth Engine: a case study of Gujarat State, India. *Fire Ecology*. 2024, Vol. 20, 23. <https://doi.org/10.1186/s42408-024-00254-2>
- Khader M., Benabdeli K., Mederbal K., Fekir Y., Gueddim R., Mekkou B. Etude du risque incendie à l'aide de la géomatique: cas de la forêt de Nesmoth (Algérie). In: *G. U. Caravello, S. G. Conard, A. Farina, A. Ferchichi, L. Taiqu (Eds.). Mediterranea. Serie de estudios biológicos*. 2009, Vol. 20(2), 39 p.
- Kreider M. R., Higuera P. E., Parks S. A., White N., Larson A. J., Rice W. L. Fire suppression makes wild fires more severe and accentuates impacts of climate change and fuel accumulation. *Nature Communications*. 2024, Vol. 15, 2412. <https://doi.org/10.1038/s41467-024-46702-0>
- Lahiri N., Rajani M. B., Sanyal D., Banerjee S. Exploring the forest and mapping its archaeology: Bandhavgarh National Park and Tiger Reserve, India. *Current Science*. 2022, Vol. 123, 6, pp. 772–780.
- Llopis M. P., Yudego B. M., Berninger F., Gonzalo J. G., Ramón J., Olabarria G. Impact of species composition on fire – induced stand damage in Spanish forests. *Scientific Reports*. 2024, Vol. 14, 8594. <https://doi.org/10.1038/s41598-024-59210-4>
- Meddour-Sahar O., González-Cabán A., Meddour R., Derridj A. Wildfire management policies in Algeria: present and future needs. In: *A. González-Cabán (Ed.). Proceedings of the 4th International Symposium on Fire Economics, Planning and Policy: Climate Change and Wildfires*. Albany, CA, USA, Pacific Southwest Research Station, USDA Forest Service, 2020, pp. 245–382.
- Meddour-sahar O., Meddour R., Leone V. Analysis of Forest Fires Causes and Their Motivations in Northern Algeria: the Delphi Method. *IForest – Biogeosciences and Forestry*. 2013, Vol. 6, Is. 5, pp. 247–254. <https://doi.org/10.3832/ifer0098-006>
- Mustoe G. E., Eberl M. New discovery of neogene fossil forests in Guatemala. *Geosciences*. 2020, Vol. 10(2), pp. 1–16. <https://doi.org/10.3390/geosciences10020049>
- Pelletier F., Cardille J. A., Wulder M. A., White J. C. Science of Remote Sensing Revisiting the 2023 wildfire season in Canada. *Science of Remote Sensing*. 2024, Vol. 10, 100145. <https://doi.org/10.1016/j.srs.2024.100145>
- Seghiri Bendjaballah M. The funerary monuments in North Africa: Study and Presentation of numidian royal mausoleum Medracen. Phd Thesis, University of Paris Nanterre, 2018.
- Tout F. A model to predict the outbreak areas of forests arsons. *Geografická Revue*. 2023, Vol. 19 (1), pp. 62–75. <https://doi.org/10.24040/GR.2023.19.1.62-75>
- Walker R. S., Ferguson J. R., Olmeda A., Hamilton M. J., Elghammer J., Buchanan B. Predicting the geographic distribution of ancient Amazonian archaeological sites with machine learning. *PeerJ*. 2023, Vol. 11, 15137. <https://doi.org/10.7717/peerj.15137>
- Zahira S., Hadj B. L'algerie: Une Region Mediterraneene Tres Sensible Aux Incendies De Foret. *Territorium*. 2017, 24(1), pp. 177–186.

Information about the authors

Tout Faicel

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: faicel.tout@crat.dz

Rebouh Nouh

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: nouh.rebouh@crat.dz

Dinar Haythem

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: haythem.dinar@crat.dz

Benzid Yacine

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: yacine.benzid@crat.dz

Сведения об авторах

Ту Фесель

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: faicel.tout@crat.dz

Ребу Ну

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: nouh.rebouh@crat.dz

Динар Хайтем

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: haythem.dinar@crat.dz

Бензид Ясин

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: yacine.benzid@crat.dz

Zouak Zakaria

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: zakaria.zouak@crat.dz

Benzagouta Yasser Nassim

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: yasser.benzagouta@crat.dz

Seghiri Meriem

Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Route de Ain el Bey, 25000 Constantine, Algeria
e-mail: meriem.seghiri@crat.dz

Зуак Закария

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: zakaria.zouak@crat.dz

Бензагута Яссер Нассим

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: yasser.benzagouta@crat.dz

Сегхири Мерьем

Исследовательский центр территориального планирования, кампус Зуаги-Слиман, Рут-де-Айн-эль-Бей, 25000 Константина, Алжир
e-mail: meriem.seghiri@crat.dz