Pegem Journal of Education and Instruction, Vol. 15, No. 4, 2025 (pp. 3534-3546)

RESEARCH ARTICLE WWW.PEGEGOG.NET

The preservation environment of mosaic at Djemila museum

Mediene nour el Houda [1], Naouelle khechab [2]

[1] Abou Bakr Belkaid University of Tlemcen (Algeria). Email: norelhouda.mediene@univ-tlemcen.dz; https://orcid.org/0009-0005-6236-4461

[2] University of Algiers 2 ABA El Kassim Saadallah; Email: naouelle.khechab@univ-alger2.dz

Received: 22/07/2025 Accepted: 01/10/2025 Published: 17/12/2025

Abstract:

Preventive conservation is one of the strategic approaches that seeks to preserve museum collections by controlling the appropriate conservation environment and improving the conditions surrounding works of art, including mosaic panels, which are the focus of our research. This research centres on the conservation environment for mosaics in Algerian museums, and we have chosen Djemila museum.

the focus has been placed on a set of key points underlying preventive conservation,such as studing the preservation environment, the means and equipment specific to each museum,and highlighting the conservation state of the mosaics in the studied museums through the analysis and diagnosis of selected mosaic samples preserves within them.

In the context,the essential role of preventive conservation can be highlighted,as it involeves creating a set of preventive measures aimed at ensuring and improving preservation conditions in museums to guarantee the survival and continuity of this type of tangible cultural heritage.

Keyswords:
Conservation space, mosaics, Djemila museum, conditions of preservation.

Introduction:

One of the most difficult tasks of a museum is preservation, which involves several processes, such as maintenance of various kinds and restoration. This role is considered more complex than other museum roles because the condition of museum collections varies from one artefact to another, whether in terms of material (organic or inorganic) or condition. Some artefacts are in very poor condition and require immediate treatment, There are also cases of moderate condition, which may require cleaning, restoration and reinforcement, and cases of good condition, which may require preventive conservation measures.

This is one of the modern strategic approaches aimed at intervening in the environment of the artefact or archaeological collection without directly affecting or interfering with it. This is achieved by taking into account many factors, such as the climatic environment, including temperature, humidity and light, and even the level of pollution in the environment where the artefact is located, in addition to the equipment and resources available to the museum, such as lighting, display methods and the necessary devices to ensure the safety of the artefacts from various dangers, such as surveillance and security devices.

All of this depends on specialists or a competent team to achieve the basic points in the preventive conservation process. Therefore, it is considered one of the difficult challenges that modern museums seek to achieve in order to preserve various museum collections.

Among the important museum collections preserved by our museums are mosaics, which were one of the techniques used in flooring and wall cladding, depicting images on their surface with interlocking cubes. Its inorganic composition helped it withstand the ravages of time to some extent, enabling excavation missions to find it and present it to museums, and thus to the public. This is the case with many Algerian museums, which have housed numerous mosaics in their exhibition halls and storerooms.

Undoubtedly, the new environment that has embraced it plays a major role in preserving it, providing it with a suitable climate to restore its splendour and maintain its authenticity.

Mosaics are transferred from archaeological sites to museums to ensure their preservation and provide a suitable storage environment. However, museums lack the necessary preservation conditions**. What is the current state of mosaic preservation in Algerian museums? To what extent do environmental conditions affect the preservation of mosaics? What are the preservation methods and preventive measures that ensure the protection and longevity of mosaics?**

This study was divided into a theoretical part to define the research concepts and an applied part that included fieldwork consisting of studying the conditions for preserving mosaics at the Jemila Museum.

1-Glossary of terms:

1-1 Preservation:

It means protecting archaeological materials from deterioration. Preservation involves taking appropriate measures to maintain the artistic and cultural value of the artefact[1]. It requires a cautious approach with regard to interventions and the materials used, and is based on the principle of changing as little as possible, but with as little intervention as possible, and aims to preserve the original elements and their value and meaning, not just restore them to their previous condition[2]. We also find another term that is very similar in linguistic structure and concept to the term preservation, which is the term conservation.

1-2Preventive conservation:

The concept of preventive conservation defined by ICOM refers to measures and procedures aimed at avoiding and reducing future deterioration and losses. These measures concern the environment or external surroundings of the artefact, regardless of its history and condition, and are indirect, i.e. they do not involve direct intervention on the artefact itself[3]. We can say is a set of proactive measures and procedures aimed at securing museum collections from various human and natural hazards that threaten them in the museum, such as inappropriate display or storage conditions, fires, earthquakes and other events. It is based on an accurate diagnosis of the various hazards and incidents that are likely to occur inside the museum itself or in its immediate vicinity and the damage and harm that may result to the collections. providing display and storage furniture for the collections and equipping the various museum maintenance wings with means of protection against these various hazards, and ending with the daily activities of technicians in the field of conservation climate control and monitoring any undesirable changes in the appearance of the collections in order to address them in a timely manner.

1-3 mosaique:

Mosaic can be defined as the joining or assembling of pieces of various materials, such

[1] The burra charter,the Australia,ICOMOS charter for places of culture significance2013,Adopted 31-10-2013 article 3-7-12-22-25.

[2] Phillipe Bromblet,Guide technique de conservation de la pierre, l'association medistone,2010,p. 02

[3] Floreal Daniel, conservation préventive pratiques et recherches pour une écologie du patrimoine,2011,researchgate,net,publication, université bordeaux Montaigne, p.47.

as marble and glass paste of different colours, to form designs[4]. It was used to decorate floors, walls, domes and palaces, and mosaics of various sizes formed floors or murals in houses, temples, palaces, churches and mosques. According to most books, the first signs of the emergence of mosaic art can be traced back to Mesopotamia in southern Iraq, specifically in the city of Al-Warka, in the third millennium BC[5].

1-4museum:

The International Council of Museums (ICOM) first defined a museum in 1948 as a permanent, non-profit institution working in the service of society and its development, open to the public, that acquires, preserves, studies, makes available and displays the tangible and intangible heritage of humankind and the surrounding environment for the purpose of study, education This definition was amended in 2022 at the last ICOM conference in Prague, Czech Republic, where the ICOM President acknowledged that this new definition corresponds to some major changes in the role of museums today and the definition was as follows: A museum is a permanent, not-for-profit institution working in the service of society that researches, collects, preserves, interprets and exhibits tangible and intangible heritage, museums are open to the public, accessible, inclusive and promote diversity and sustainability, they work ethically, professionally and in partnership with communities and offer diverse experiences to educate, enjoy, reflect and share knowledge[6].

2-A historical overview of the Jameela archaeological site and museum:

There are many types of museums, including the museum of the archaeological site, which is the place where the finds and discoveries found at the archaeological site are kept and displayed, and it is the same for the archaeological site and museum of Jamila, before learning about the museum, it is necessary to mention the site of Jamila, which is closely related to the museum, as the site is considered one of the most important Algerian archaeological sites due to its abundance of archaeological discoveries. Thus, France paid great attention to it after entering Algeria in 1938, trying to transfer the arch dedicated to Emperor Caracalla dated 216 to Paris, where its attempt failed[7], followed by excavations and excavations, the first of which was in 1909, and thus the first hall was built, which was initially in the form of a warehouse in which the archaeological finds were placed The first hall was built in 1910 with an area of 60 m. Most of its exhibits are mosaics discovered in the houses and the southern church of the site, while the second hall was built in 1915 with an area of 273 m. Both halls were built by the architect Albert Palmer, and the first hall was built in 1915 with an area of 273 m(photo01). The third hall was built in 1930 to commemorate the centenary of the occupation of Algeria[8]. The area of mosaics displayed in this hall was estimated at 519 m, which is the largest hall of the museum(plan01), after the independence of Algeria, the front facade was covered with a glass pyramid roof and was adopted as a fourth hall that displayed a collection of finds, including 5 mosaics.

[4] Dictionnaire la rousse ,paris,2007,p644

[5] Katherine(M) ,Dunbabin,mosaics of the Greek and roman world,united kingdom,1999,p5

[6] ICOM international concil of museums,museum new dedinition,paragues,2022.

[7] Albert Ballu, Guide illustré de Djémila, Alger 1926, pp. 8-9.

[8] Blanchard Lemée,le musée de Djemila(Algérie)historique et problemes actuals,Bulletin de la socieété nationale des Antiquaires de France,1994,1996p88

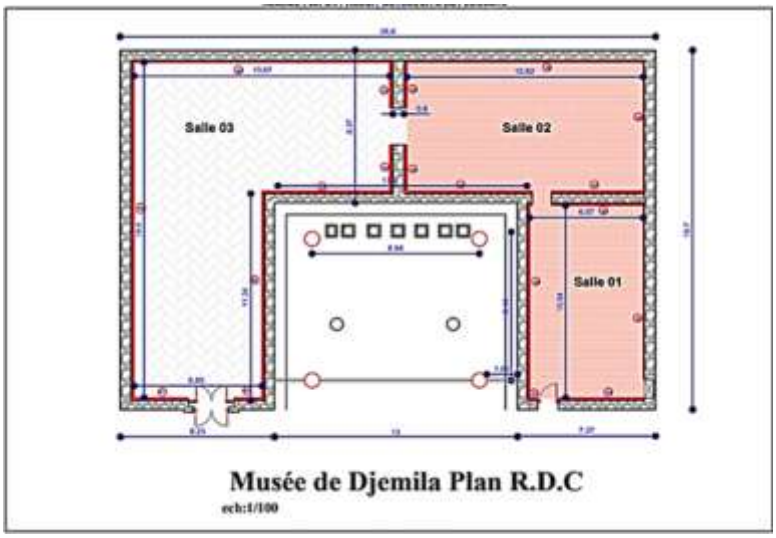


Diagram No. (01): Diagram showing Djemila museum halls

Photo NO 01 showing galleries of Djemila museum

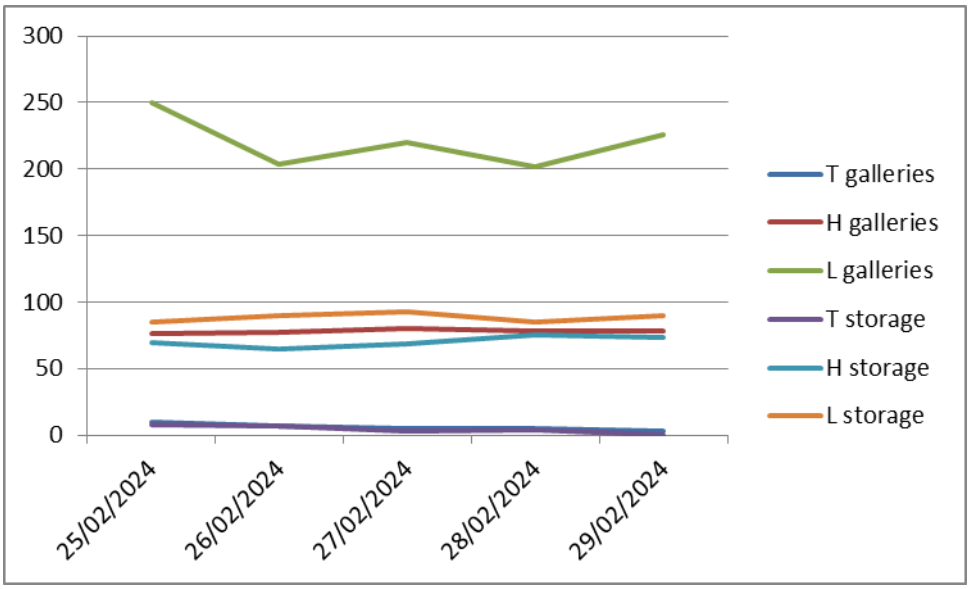
-2 Study the preservation environment of Djemila Museum: 2-1 study of the climate conditions in the preservation environment:

To study the climate of the mosaic preservation medium in the Jemima Museum, we used special equipment to measure humidity, temperature and light inside the museum halls and storage (table 01), the results of which were as follows:

date	storage			galleries		
	L	H	T	L	H	T
25/02/2024	85	70	8	250	76	10
26/02/2024	90	65	7	204	77	7
27/02/2024	93	69	3	220	80	5

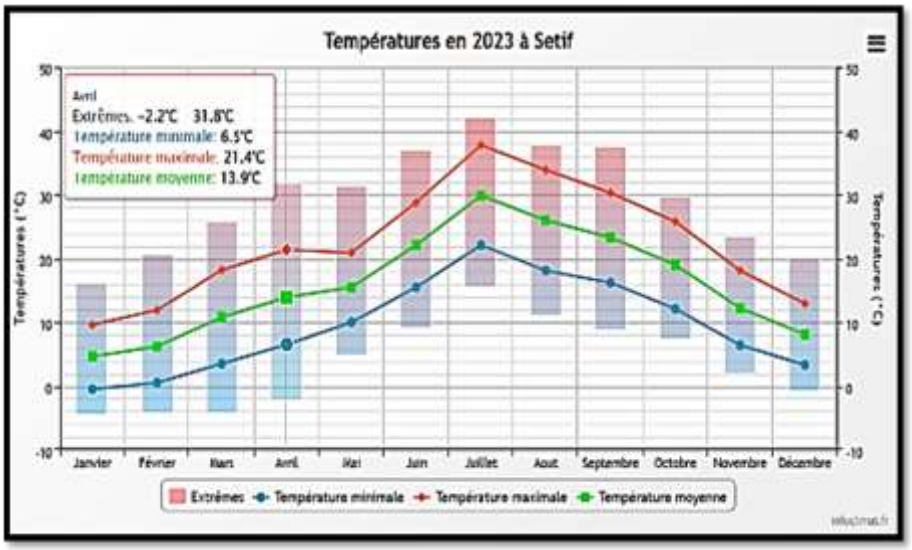
28/02/2024	**85**	**75**	**4**	**202**	**78**	**5**
29/02/2024	**99**	**73**	**0**	**226**	**78**	**3**

Table NO 01 showing temperature,relative humidity,and light levels in Djemila Museum(prepared by the researcher)



The curved graph 01 represents the temperature,relative humidity,and light levels of Djemila museum(prepared by the researcher)

Since some specimens were studied in the museum's outdoor space, whose climate is definitely different from the indoor environment, we decided to study the outdoor climate of the city of Jemila by contacting the Meteorological Department, which informed us of the temperature changes and their daily, monthly and even annual averages, in addition to representing the amount of precipitation that the city of Setif, including Jemila, witnesses, which has a direct impact on the mosaic specimens displayed outside.



Graph 02 showing the annual temperature for 2023 in the city of Setif, according to the Meteorological Service.

2-2 tools and way of display:

The display is a way of presenting samples or artefacts to attract the interest of the public, in order to achieve material gain, for temporary commercial exhibitions, or to achieve scientific or recreational benefit for permanent exhibitions held by museums The display is one of the prominent functions of the museum institution, and it is the only link between the institution and the public, and through this research will address the display method What we noticed in the display process is that it has many shortcomings that detract from the importance of the mosaic and even the tasks of the human staff in charge of this process. The first thing we notice in the presentation of the mosaic in the three halls of the museum is the great overcrowding of the number of mosaic paintings and their display next to each other without frames and dividers, which makes it difficult for the visitor to distinguish between those paintings and where the boundaries of the painting end from another In addition to the display of all the mosaics directly attached to the walls of the halls and even on the floor of the first and second halls, after the museum administrators were unable to provide more space for the discovered mosaics during the excavation work, they were displayed directly on the floor with carpets placed on them in the form of corridors for visitors (Photo No. 35) and the mosaics were displayed on the floor in the form of corridors for visitors (Photo No. 36). No. 36), however, glass facades with metal legs were placed in the second hall and glass facades on wooden tables in the first hall, which led to the legs of the facades sinking into the layer of cubes and thus uprooting them from their place (Photo No. 37).Another negative point that can be mentioned in the presentation method is the display of all the mosaics without explanatory cards with information about the mosaics on display, so the visitor becomes lost between the mosaics of the three halls without any clear idea of the mosaic he sees, as the card is the identity of the painting and even its translator if more than one language is used, as it gives an idea to the visitor about the name and type of the masterpiece he sees, where it was discovered and for the mosaic even a brief description of its subject because not all visitors are specialists because not all visitors are specialists Also, one of the negative points that take on the presentation method in the Jameela Museum is the placement of metal barriers in the first and second hall directly on the floor mosaic, which is rather heavy, which will undoubtedly affect the level of the cubes placed on top of it, so the overall statement about the presentation method in the Jameela Museum was just a process of gluing the mosaics to the museum halls without prior study or taking into account the presentation method and the conditions that must be available.

Images 02 showing the way of display in Djemila museum

2-3 Lighting:

As for the lighting method adopted in the Djemila Museum, it relied more on natural lighting through small circular glass openings covering the entire ceiling, some of which are covered with plastic material to break some openings, in addition to the presence of rather large side openings in the form of windows in the ceiling of the three halls (Photo 37), but in different numbers depending on the size of the hall. but in different numbers depending on the size of the hall. As for artificial lighting, there are several Florentine lamps installed on the ceiling of the museum halls and even outside it, but almost all of them are broken and have not been repaired.

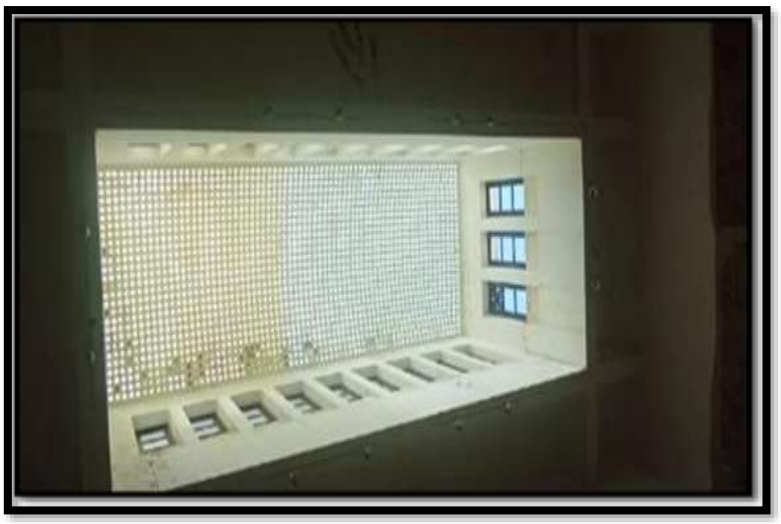


Image 03 showing natural lighting that use it in Djemila museum

2-4 Security:

The process of protecting the museum as an architectural structure containing an important cultural heritage is a necessary and heavy responsibility on the shoulders of the human staff working in the museum and this task is facilitated by the availability of the necessary capabilities and devices to ensure the successful conduct of this process, while what was observed in the Jemila Museum is the presence of surveillance cameras that were located at the level of the ceiling of the three halls and even outside the museum (Photo No. 38), from the external facade of the store to the archaeological site near the museum and is connected to a large screen located in the office of the director and the first responsible for the museum and the site and is in service, through that screen, the director is aware of everything that is going on in the museum halls and even outside the museum because the camera positioning points are numerous. In addition to the service of the camera with security devices, there is a radio communication device between the director and the rest of the workers, which facilitates the process of communication, especially during the occurrence of issues in the museum and thus solving them in a short time, which was confirmed by the director of the museum through the violations committed by some people sometimes, whether in the museum or the site, through his constant monitoring of the surveillance cameras in his office, he communicates directly with security officers and museum workers through the radio communication device, this is all the devices and tools for security provided by the Jemila Museum.

-3.4Measurement and climate control devices:

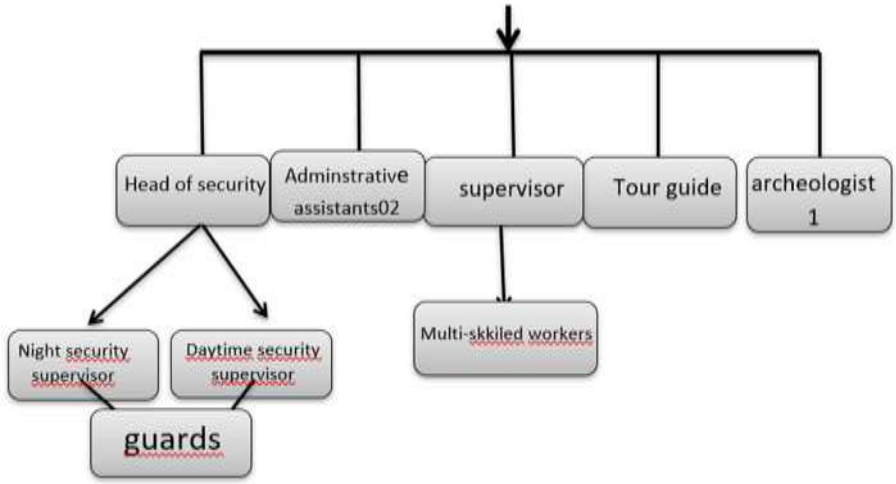
The process of setting a suitable climate for the preservation of archaeological artefacts in general and mosaics in particular is one of the difficult processes that advanced museums seek to work on by providing advanced devices and tools that help provide the optimal preservation conditions that the artefacts need to ensure their survival for as long as possible, and through doing our fieldwork and trying to search for climate and environmental control devices available in the Jameela Museum, we

noticed a complete lack of any such device, and no measurements of temperature and humidity are taken daily, weekly or even annually because the museum does not have such devices such as thermometers or luxometers, nor even modifying devices for temperature and humidity.

Image 04 showing light meter and thermo hygrometer that use it in climate study

3.5 Human staff responsible for conservation:

The success of all the aforementioned processes of display, lighting, museum protection and climate control require workers and qualified human staff, each according to his field, to carry out the task assigned to him, while the Jemila Museum, in addition to the absence of some devices and tools, we notice a great lack, if not absence, of specialised expertise in the field of museums as a whole or mosaics, and even conservation workers or specialists and technicians in the field of maintenance and restoration All that was found in the Jemima Museum of workers, first the director or the first official in charge of the museum and the site with some who is an archaeologist, who does some periodic maintenance and conservation work but in a limited way such as placing medical gauze on some paintings affected by swelling to avoid their fall and filling some gaps with cotton material that is easy to remove according to the museum director because they are legal violations and not one of the tasks entrusted to him. The presence of one archaeologist in the museum as a whole with the presence of two tourist guides, as well as two administrative assistants from disciplines other than archaeology, with the presence of multi-service workers such as the ticket taker who sometimes collects the separate cubes because of their large number and puts them in plastic bags with numbering and stating the place of their removal, although he is outside the field of archaeology with a limited level and security officers The following chart represents the museum's administrative structure of the Jemila Museum.



Administrative hierachy prepared by the researcher

-4 Analyse the manifestations and factors of deterioration of the Jameela Museum mosaic:

3.4.1 Analysing the manifestations of damage:

Diagnosis is the first and most important stage of conservation and restoration, because proper restoration depends on proper diagnosis. The first and last goal of the diagnostic process is to identify the condition of the monument with the possibility of finding effective solutions to reduce the damage factors based on the manifestations of damage that have been examined, the diagnostic process is carried out in developed countries using advanced devices and means Such as X-ray, microscope and other advanced devices that give us good results in the diagnostic process and accurate information about the appearance of damage, but during our field work, the diagnostic process was limited to the naked eye through careful observation of clear manifestations of damage,that can be found in mosaics in general with diagnostic cards, which contained almost all manifestations of damage, the first of which was damage at the level of the surface layer of the cubes of cracks, separation of the cubes from the mortar, crumbling, crumbling, stains and peeling. Secondly, damage to the new support or damage to the structure on which the layer of cubes is placed, which in turn witnesses a range of types of damage represented by cracks, cracking, separation of layers, bulging and dome, with an attempt to mention some other types of damage that can be found in the mosaic in relation to the manifestations of damage that we have seen in the mosaic collection of the Jemima Museum in general.

Firstly, the cracks, which varied from one painting to another and in different forms, and we noticed the abundance of cracks in the same painting, whether at the level of the cubes or the walls bearing the paintings, which were at different levels, i.e. we noticed their presence at the top of the walls, in the centre and even at the bottom, and this appearance was repeated with all the studied paintings, in addition to that all the mosaics shared another damage

appearance, which is the separation of the cubes from their place and their disappearance, but This detachment varies from one panel to another, i.e. we may find one or two cubes detached in one part, which does not significantly affect the painting or the theme of the mosaic except with the passage of time and the continuation of the detachment process, while we find that some paintings have many squares detached from them, thus obliterating the theme of the painting or a large part of it, also a common damage manifestation among the mosaics of the Jameela Museum is the observation of stains on the level of some paintings, including black-coloured stains It is likely that they are the effects of fire, such as the animal geometric mosaic located on the northern wall of the third hall, and the difference in the colours of the original cubes that were present during the discovery, and there are other stains in white colour, which are likely to be paint stains resulting from the mistakes of the human factor during the work of painting the ceiling of the museum because these stains are abundant at the level of paintings at the top of the walls, especially in the third hall, in addition to the manifestations of damage We noticed two other manifestations, namely the hardening or bulging and the lowering of some cubes from the level of each other, and sometimes the hardening and lowering of whole parts from each other, and this we noticed a lot at the level of the mosaics displayed at the bottom of the walls, some of which reached the separation of the layers from each other, that is, the layer of the telatum and the layer of the walls bearing the mosaic We also noticed in most of the mosaic paintings a pallor in the colours and fading, which made it difficult for us to know the true colour of the cubes, largely due to old age and the lack of the necessary preservation conditions, in addition to the pallor of the colours there were some gaps in the surface layer that extended to the substrate or structure and these gaps were of different sizes. In addition to some hardened deposits on some of the paintings that made it difficult for us to diagnose and identify the type of hardened material, not forgetting some previous works resulting from the cutting, transporting and fixing of the mosaic on the walls, the effects of which are now negatively affecting some of the mosaics on display

.

Images 05 showing mosaics damage at Djemila Museum prepared by the researcher

-4.2 Analysing the deterioration factors of the mosaics of the Jemila Museum:

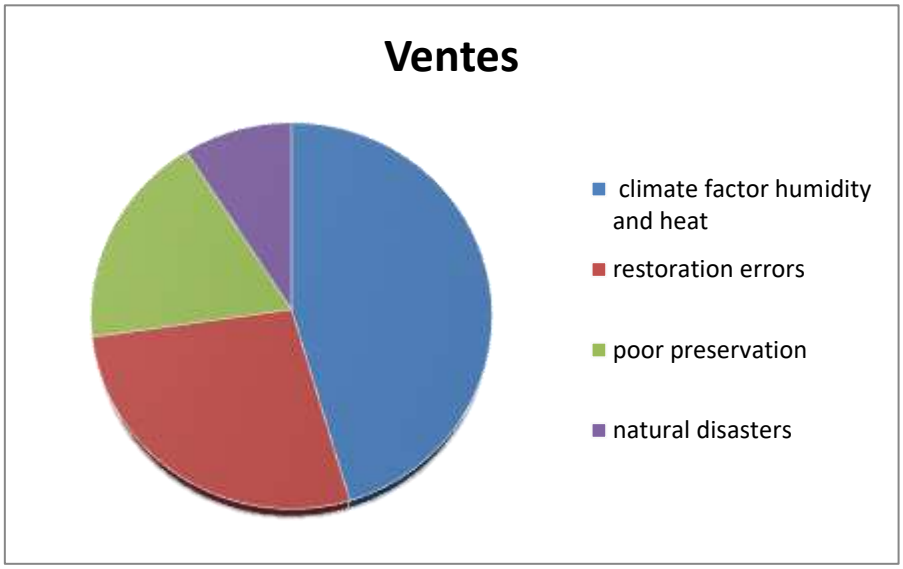
Through our last visit to the Jemila Museum and our study of the climate of the region, we noticed that it was not spared from weather damage factors, including humidity and heat, as the city of Jemila witnesses a significant increase in humidity during the winter season, with an increase in temperature in the summer season, cycles of humidity and drought in varying degrees and suddenly have a great impact on the mosaic There are many forms of humidity in the Jemila Museum, firstly humidity or water in its liquid state emitted by rainwater, especially since there are some specimens displayed on the exterior of the museum and will be exposed to rainwater, as well as ice and snow that the region witnesses abundant fall, and this is what we witnessed during our last visit in February 2024, as the region witnessed cold weather and a significant amount of snowfall A significant amount of snow, which will greatly affect the mosaics displayed in the open air and directly, and that water will penetrate all the materials that make up the mosaic, which resulted in the partial collapse of a large geometric mosaic due to rainwater, and the mosaic of the fourth hall is also vulnerable to this type of damage as it is protected by a glass roof only, without a wall for the entrance to the hall If the rain is sideways, it will reach those mosaics, and the mosaics of the hall are less affected by rain and snow because they are protected by the museum building, but some drops or small percentages of rainwater leak inside the hall, especially the first and third halls through the broken light openings in the ceiling of the halls, which are covered with plastic bags that are not sealed and allow rainwater to leak into the centre of the halls. We noticed that most of the mosaics displayed at the bottom of the walls and close to the foundations suffer greatly from dampness and swelling, and some of them have reached the separation of their layers, especially in the wall located to the left of the entrance to the third hall, where we noticed these manifestations mentioned above, and this is due to the water leaking from the water tank near this hall with the presence of a watercourse in the form of a staircase from the external side of the museum adjacent to this wall, and this type of moisture infiltration on a daily basis, especially in the winter The infiltration of this type of moisture on a daily basis, especially in the winter season, resulted in damage to the mosaics. According to the Jemila Museum official, some measures have been taken to reduce this factor by reinforcing the foundations of the museum and plastering some parts with cement and removing the water in the tank.

The Jemila region is experiencing a significant increase in temperature during the summer, especially in July and August, which will cause

the rapid and sudden drying of the moisture in the pores of the mosaic materials and change their chemical composition, which will cause brittleness and shrinkage of the materials and their effect will increase as the process is repeated several times.

Among the factors of damage that we have seen in the mosaics of the Jemima Museum are the bad interventions during the discovery. Due to the large number of discoveries, mainly mosaics on the site and the attempt to uproot them and transfer them to the halls available at the time, many mistakes were made in this aspect in the cutting process, such as cutting them according to the space available in the museum without taking into account their total area or the scene and the theme Some of them were destroyed, while those whose parts were moved were glued in an overcrowded and random manner and even glued the parts of the same mosaic in different walls and merged some parts together in one panel, in addition to the negative interventions made on the mosaics of the Jemima Museum is to install and integrate them into the walls and floor of the first and second hall directly, which will be difficult or impossible to remove in the future, in addition to the negative interventions made on the mosaics of the Jemima Museum.

In addition to the negative interventions mentioned, we also find the use of unsuitable materials in the restoration process, which is evident in the mosaic of the man displayed to the left of the museum entrance, which is in a poor state of preservation due to the use of a new glue that reflected negatively and exposed the mosaic to distortion. What we concluded through our study of the factors of damage to the mosaic of the Djemila Museum is its exposure to humidity and heat significantly and we don t forget the human factor since its discovery until now.



The pie chart 01 represents the factors of ;osqic deteriorqtion in the Djemila museum(prepared by the researcher)

Conclusion :

Preventive conservation is a new concept and approach adopted by modern museums, aimed at protecting archaeological artefacts from damage and deterioration in the long term. This approach is based on a set of preventive measures and procedures that provide a suitable conservation climate and a stable and safe environment for museum collections, including mosaics. This includes controlling climatic factors such as temperature, humidity, lighting and air pollution as much as possible, in addition to adopting appropriate display and storage methods and techniques. Preventive conservation also includes regular maintenance work, which can help reduce damage factors through periodic inspections and daily monitoring to detect various types of new damage.

Through our study and field visits to many national museums that preserve mosaics, not just study museums, we noticed a significant shortcoming in our museums, which have become mere warehouses, not to say storage facilities for archaeological collections. as they do not meet the required standards for preserving these collections in several respects. The first of these is museum architecture, as the architecture of all the museums studied does not comply with the model museum architecture that requires certain conditions for the construction of a museum. All of them were built during the colonial period, especially the Jamila Museum, which is an important museum and one of the most prominent archaeological sites and internationally recognised, attracting large numbers of visitors from different countries, including foreign dignitaries and ambassadors. This is what we observed during our field visit. However, the museum still lacks the minimum requirements to make visitors comfortable, foremost among which is the absence of toilets in the museum or a designated area near the museum for visitors to use, especially since the area is isolated and visitors will be coming from far away. The museum building is old and cannot accommodate the huge number of mosaic panels on display.

As for the conservation conditions in the museums we studied, unfortunately they do not meet the necessary conservation requirements and standards, whether in terms of controlling the environment suitable for conserving mosaic panels in the museum, as we noticed differences in seasonal and sudden temperature and humidity levels throughout the year, especially in the Jamila Museum.

It is essential to enrich this type of study on preventive conservation, which seeks to improve the conservation process by improving its environment and avoiding interference. The less we interfere with a masterpiece, the less damage we cause to it and the longer we extend its life, which is the goal we aim to achieve through our study of this field of maintenance and restoration.

References:

1. The burra charter,the Australia,ICOMOS charter for places of culture significance2013,Adopted 31-10-2013 article 3-7-12-22-25.
2. Phillipe Bromblet,Guide technique de conservation de la pierre, l'association medistone,2010.
3. Floreal Daniel, conservation préventive pratiques et recherches pour une écologie du patrimoine,2011,researchgate,net,publication, université bordeaux Montaigne.
4. Dictionnaire la rousse ,paris,2007.
5. Katherine(M) ,Dunbabin,mosaics of the Greek and roman world,united kingdom,1999
6. ICOM international concil of museums,museum new dedinition,parague,2022.
7. Albert Ballu, Guide illustré de Djémila, Alger 1926
8. Blanchard Lemée,le musée de Djemila(Algérie)historique et problemes actuals,Bulletin de la socieété nationale des Antiquaires de France,1994,1996