American-Eurasian Journal of Scientific Research 15 (4): 170-182, 2020
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2020.170.182

Cleaning and Consolidation of Damaged Plasters, Writings and Drawings on the Walls of the Pilgrims' Room in the Monastery Anba Hadra Aswan, Egypt

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Abstract: The Aswan governorate, in Egypt, contains a wealth of rich and varied cultural heritage. These rare monuments suffer from factors of deterioration that cause numerous damages that may finally lead to the complete loss of these important buildings, including the monastery of St. Hydra, which is located on the West Bank of the Aswan Nile. This study aims to conduct investigations using an electron microscope (SEM) with an EDX module. Studying the markings and decorations on monuments and the walls of Coptic churches and monasteries became one of the most crucial things for archaeologists and researchers to accomplish as a result of certain mortar layer samples that had fallen. So that it will last over time and make the restoration process appear simple and easy to understand, the conservators must preserve it and keep it clean. Then, this study suggests the use of the following materials: a cobalt-ferrite nanoparticle with a technique for cleaning plaster layers. It showed satisfactory results during its experiment on prepared samples that simulated the part to be cleaned. In addition, tests were conducted to use Nano graphene oxide to improve the properties of adobe bricks used as supports, which showed good results. The results also showed that the use of nanoparticles of calcium carbonate was useful in improving the properties. In further studies, these materials will be mentioned in more detail. But this research is concerned with studying damage in the monastery and giving treatment suggestions for consolidation and cleaning.

Key words: Plasters · Monastery of Anba Hydra · Nanoparticles · SEM–EDS

INTRODUCTION

The monastery of St. Simeon was built like a castle in Aswan in the seventh century and it had been for St. Anba Hydra since the early fifth century AD, after which he became a monk. Then it was rebuilt in the tenth century and dedicated to Saint Simon. After that, the Coptic monks came to practice their rituals in the calm of the desert, which provided them with tranquilly and meditation. It was surrounded by walls to protect the monk from dangers and threats and inside it there are the remains of a church, stables and simple buildings to suit daily life without luxury [1, 2]. Archaeologists called this place Saint Simeon, but Arab and Coptic sources called it the Anba. Hatre (Hidra, Hadri, Hadra) [3]. It is built on two levels. The lower one is commonly made of stone and the upper one is made of mud bricks; about the walls are about 10 meters high [4]. It is partially destroyed. We find that the last room on the upper floor at the end of the right contains writings and drawings on the walls and these writings belong to the Muslim travelers who passed on their way to Makkah and then relaxed and lived in this room inside the monastery.

Vitruvius [5] and by Pliny [6] describe painted plasters finished with covering coats in the following order: a render coat made of lime as the binder with coarse sand; a finish coat made of lime as the binder with fine powder; and a painted coat as the top layer. Mentioned only using clay earth for covering and using plaster as a render coat [7].

Deterioration of Plaster, Writings, Drawings and Walls: The impact of the natural environment was great on Coptic buildings when they were built in the past, so that we find it in many forms, including the choice of sites, building materials, climatic conditions, etc.

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Fig. 1: (from a to r): Location and status of the Anba Hydra monastery. a: Map showing the location of the monastery of Anba Hydra. www.google.com/maps/. b: shows the plan of the monastery. c: shows the construction of the Anba Hydra monastery on two levels. d : An overhead view of the church Ruins of a church on the lower level, with plaster and painting details. e: shows the desert surrounding the monastery. f: shows the vaulted arch and salts on the surface of the bricks in Al-Haniyah. Photograph taken in 2019. g : shows the remains of a painting of haloed figures seated and shows the loss of mortar. Photograph taken in 2019. h : showing the effect of wind on the main structure. Photograph taken in 2020. i: shows the color peeling, falling layers of plaster and the final disappearance of drawings from the vaulted arch and walls of the monastery. Photograph taken in 2019. j: shows the separation of the surface layer from the support. and damage from the Hajj's room k: shows the deep cracks caused by the loads at the inlet of the fryer. l: depicts a detail of the semidome and the separation of the colour crust due to temperature differences. Photograph taken in 2020. m: shows a fall in the plaster layers, which are to be completed from the inner walls of the room. We also see rust on the walls. n: Falling of plaster and cracks in building materials. o: Ceiling of cave at the west end. It served as an ancient Egyptian rock tomb that was used by monks. Paintings are dated to 600 or 700 AD. p: Murals and paintings in arched rooms beside the northeastern corner display the cracks resulting from the loads in the Anba p : Murals and paintings in arched rooms beside the northeastern corner display the cracks resulting from the loads in the Anba. q: shows the previous restoration on the walls while preserving the integrity of the wall below the beehive and not scratching the surface. r: Illustration of the concentration of fossilised hives on the walls.

Fig. 2: (from a to I): The status of Pilgrims' Room in the Monastery. a: Murals and paintings in arched rooms along the northeastern corner layers of dirt and dust. Photograph taken in 2019. b: shows a large fragmentation and collapse in the plaster and the writings that are important for the dating of historical events. c: The hives of wild bees are dotted abundantly on the walls. Photograph taken in 2020. d: shows significant fragmentation and collapse in the plaster layers. Photograph taken in 2020. e: shows the inscriptions and writings that will be placed on the entrance walls. Photograph taken in 2019. f: shows the metal supports installed on the walls. With these existing supports, we need to treat the rusty iron left on the walls. g: The corridor goes north-south and contains the monks' rooms.Photograph taken in 2020. h: shows soot spots on the surface and a blood spot from bats. Photograph taken in 2020. i: shows the salts on the surface of the preparation layer, fungal growth in many areas and biological residues.

As with geological aspects, the availability of bricks influences the construction of Coptic buildings and churches. There is also an easy-to-dig earth option, which is naturally fortified [8].

This means that the sites for building churches or monasteries were not chosen at random, but rather based on certain criteria, the most important of which are the presence of a well or a water source near the site, the presence of bunkers and so on. However, when building monasteries, the impact of the natural environment was not limited to the selection of sites, but also appeared in other features such as building materials, so the building materials for churches and monasteries were chosen based on the natural environment. The walls were made of rough bricks and the roofs of palm trees were covered with a layer of mud [9]. Nubian sandstone may be a poor building material because it is coarse in grain, soft and full of hard veins and pebbles. However, Christian builders in Nubia often used monolithic columns of sandstone or gneiss that came from nearby quarries. In the southern part of the Nuba Valley, silt from neighboring regions is the most accessible and abundant material [10]. Figure 1 (from a to r).

So we found bricks from the material that was at hand everywhere. The raw plaster bricks are mainly made of Nile mud. The nature of these church buildings makes them vulnerable to the salts found in these places, which feed heavily on the raw bricks, consuming low cycles of the walls and turning them into a powder that we see the stone may disintegrate. The Egyptian hot weather played an important role in saving those Coptic buildings, as they were preserved for a long time, even though they were not built of durable materials and without this climate, only remnants of existing ruins would be left.

In most Nubian churches, when it rains, we find that the northwest wind causes damage to the bricks and therefore some layers of the lower walls are built of stone [11]. Temperatures mostly affect adobe buildings. And due to increased loads, micro cracks appear and plasters often weaken and disintegrate. Due to structural conditions, winds and the effects of simple raw materials, we find that there are clear destructive effects on heritage buildings. According to [12] usually the mortar was based on the same formulation as the mud bricks. However, whereas each brick was composed of about 80% bentonite clay, the mortar was composed of 65% clay and 15% hydrated lime. The composition of the plaster finish coat is almost identical to that of the base coat. The only difference is that 3% sand and 47% clay were used. The remaining 50%comprised hydrated lime.

Hydra, Deir al-Anba, contains a large number of plaster walls. These original materials for archaeological architecture, made of materials such as mud brick, were subjected to continuous weathering. As a result, its architectural surfaces were subjected to severe damage and deterioration phenomena. Coptic monasteries in desert areas, such as Deir Anba Hydra, are subjected to the effects of sand-laden winds, which cause cracking and fragmentation of the mineral granules that make up the mud brick blocks, as well as mechanisms on the falling of the bricks and the separation of the plaster layer. Plaster is a soft material that can be spread on a wall, ceiling, or other surface, where it then hardens. In the context of architecture, plaster is a mixture of water, lime and sand, often combined with other materials, such as animal hair, to give the resulting material the required strength and porosity [13].

One of the main problems that we face in order to be able to preserve the fragments of the plaster layers is that we find exposure, cracking and cracks in the remains of the walls of the building on which the plaster, drawings and historical writings are important to us. Among the external factors that have a significant impact on damage (rain, humidity, wind, sun and heat). And the presence of decomposition and damage between the plaster layers and the walls appears to us in the form of a powder between the layers with the passage of time due to the destructive effect of water (liquid and/or steam) [14] and if the needed measures are not taken, this finally leads to great destruction and damage that cannot be restored and the final loss of this The important archaeological heritage of these types of writings and drawings on the plaster walls inside the room that was designated for Muslim pilgrims. Fig. 2 (from a to i).

MATERIALS AND METHODS

Investigation using a USB portable microscope, using analytical techniques Scanning electron microscopy with an EDS microanalysis detector (SEM) and cleaning with magnetic Nano gel. Examinations and studies with a digital USB portable microscope are one of the simple, easy and non-damaging methods of observing antiques and they help in identifying the condition of the antiquities and the damage that appears on the surfaces which is difficult to see with the eye without microscopes, imaging and examination were carried out with a variety of magnifications up to 1000X. the type of microphone used: Electronic Digital Wi-Fi Portable Chulovs. Microscope, 1080p, 50x-1000x, FT-XF9F-4Q9V.

Analytical techniques: scanning electron microscopy with an EDS microanalysis detector (SEM) [15]. The morphological characteristics of the archaeological and laboratory samples were determined by a JEOL JSM-840A scanning electron microscope. The accelerating voltage is 20 kV, the probe current is 45 na, the working distance is 20 mm and the real-time counting time is 60 seconds. ZAF correction was the matrix correction protocol. The samples were coated with carbon. The tests were carried out at the National Research Center in Cairo. The preparation layer was examined using a scanning electron microscope equipped with an EDX unit, with a magnification power ranging from 7, 000 to 30, 000 x, to find out the elements that make it up.

Using Magnetic Nano Gel for Cleaning: (50 gm) [Carpabol 2%, PH 7, $CoFe_2O_3$ 10%]. The gel material is prepared by simply adding water and its viscosity can differ depending on the additional amount of water, ranging from 0.5% to 4% weight of carbogel in water [16]. To achieve a high viscosity gel, mixing is done at room temperature [17]. The ability of carbogel to clean a surface and remove distant material has been established and discussed in previous studies [18]. According to the works, cleaning was carried out by using a gel poultice to remove dust from surfaces; it was effective in removing nitrate spots and by adding silica, respectable cleaning effects were obtained [19, 20].

RESULTS

The use of a USB portable microscope for investigation is a simple and advanced technique, which can magnify objects up to 1000 times their original size [21]. Figure 3 show the surface details of these building materials, which have a great quantity of sand combined

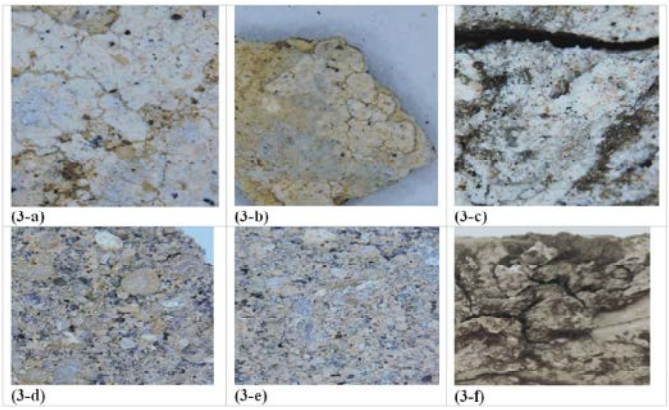
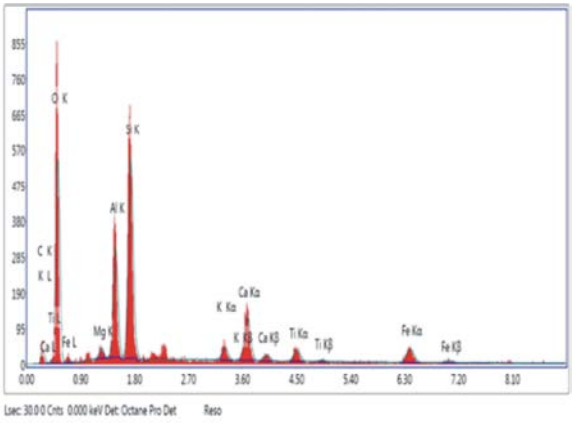


Fig. 3: (from a to f): Portable USB microscope results. a: Wall cracks and separation of plaster. X400. b: shows a high hygroscopic property that crystallizes and re-crystallizes the salts. X500. c: Cracks and holes because of internal pressures. d: shows Background sample compounds are shown for residual rock and sand. X600. e: The background of the sample shows the carrier compounds of the sand grains. X600. f: shows the precise surface details: a large amount of sand in micro cracks, mud and dirt



(4-a)

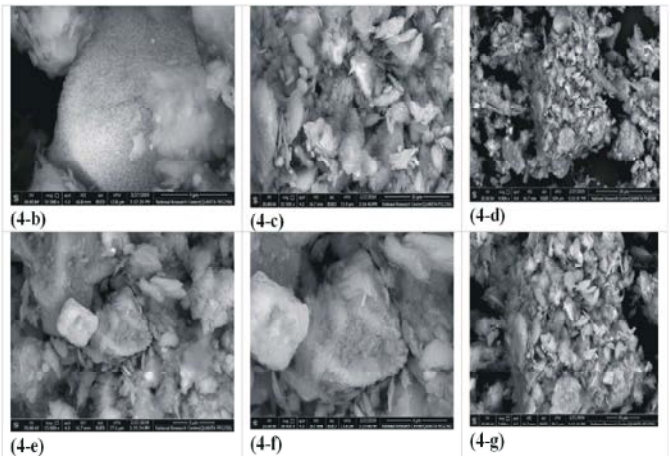


Fig. 4: (from a to g): SEM – edx microscope results. a: shows SEM of the damaged sample from plaster wall. b: shows collapse of the plaster. X3000. c: shows some weathered surfaces, internal cracks and the presence of salt crystals. X1300. d: shows weathered surfaces and increase of dirt. X4000. e: shows the presence of salt crystals. X1500.f: shows Damage and collapse of the plaster layer. X3000. g: shows Obvious deterioration and increase of dirt. X7000

Table 1: EDX element and Weight%

Element	C	O	Mg	Al	Si	K	Ca	Ti	Fe	Total
Weight%	10.46	51.69	0.86	8.28	14.67	1.4	5.95	1.97	4.71	100

with red and brown colors. There are many cracks. Investigation of the types of dirt and damage in the plaster. Figure 3 (from a to f).

Analytical Techniques: Scanning electron microscopy with an EDS microanalysis detector (SEM). The results at Figure 4 (from a to i) showed that the preparation layer consists of: quartz grains of different sizes, most of which are semicircular; a heterogeneous and coarse texture; calcium carbonate, as the binding is calcium carbonate and a small percentage of iron oxides. Potassium carbonate salts, calcium sulphate salts, halite salt, sodium chloride and calcium carbonate were discovered. Salts formed on the preparation layer, potassium feldspar (Kalsi3O8) and a small percentage of gypsum. Figure 4 shows the SEM of the presence and percentages of Ca, C and O for calcium carbonate, while the small peaks of Si, Fe and Al. as The USB digital microscopy investigation revealed some degradation in the samples, such as minor cracks and cracking of mud plaster caused by physical and weathering factors. The results of the SEM examination presented the morphology of the surface of the studied samples, which seem to be weathered. Figure 4 (from a to g).

Applications for Restoration and Conservation: The structure and the building in which the paintings and drawings are located on the walls require first a historical study, followed by a study of the technique of painting on the walls and then identification of the conditions of their preservation. During this time, an analytical study is carried out to detect and accurately identify the deterioration, identify the sources of deterioration and work to stop it and deal with it urgently.

Cleaning: If the condition of the object allows, the cleaning should be carried out by washing with water using brushes selected according to the resistance of the original surface. The choice of cleaning materials and methods will depend upon the nature of the substance to be removed and essentially upon the resistance of the wall painting. It occurs when organic solvents are used to clean antique works. This use of organic solvents leads to swelling of the original bonding media and damage to the layers and it is difficult to control their penetration during cleaning [22]. The cleaning of the wall and plaster faces many difficulties due to the physical and chemical properties of the components of the basic building that represent the support, which usually have a complex layered structure, both in terms of porosity and chemical composition. As a result, removing dirt and modifiers requires extreme selectivity and minimal interactions with the layers beneath the dirt and plaster, namely the coated layer [23].

For this reason, it is often undesirable to use the traditional solvent technique, which requires the use of pure (or mixed) organic liquids. Because it is difficult to control the action of organic solvents because of their surface tension and the high wettability common to the treated surface, which leads to the dissolution of the soil material and its spread in the interior and on the other side, the porosity of the basic support, Currently, gels are used and show a high level of cleaning efficiency [24]. After conducting the analysis and investigation of the fragments of archaeological samples, a choice is made between traditional cleaning techniques and the use of some nanomaterial's. In addition to testing the possibility of cleaning using different methods, including the laser, which is applied to prepared laboratory samples and then used at specific points, it has shown optimistic effects, according to studies, in its applications in the field of archeology [25].

An essential part of the preservation idea was the arrangement of the right conservation materials and methods. Only high-quality preservation materials and refined methods were tested and used for the treatments. It was necessary for the conservation materials to be water vapor permeable without forming surface films or sealing the porous structures. They should offer good ageing stability in the hot, dry Egyptian desert climate, as well as being consistent against insect infestation or microbiological growth. Therefore, no acrylic resins such as Primal or Paraloid, or harder gypsum or cement mortars, must be used [26]. Instead, a mixture of sensitive organic cellulose ethers and mineral silica binders was selected for the restoration of the adobe masonry surfaces, clay- and lime-based plasters, as well as their wall paintings. These resources meet the specified standards, are partially reversible, such as cellulose-bound conservation mortars and allow for additional preservation treatment of the original materials if necessary [27].

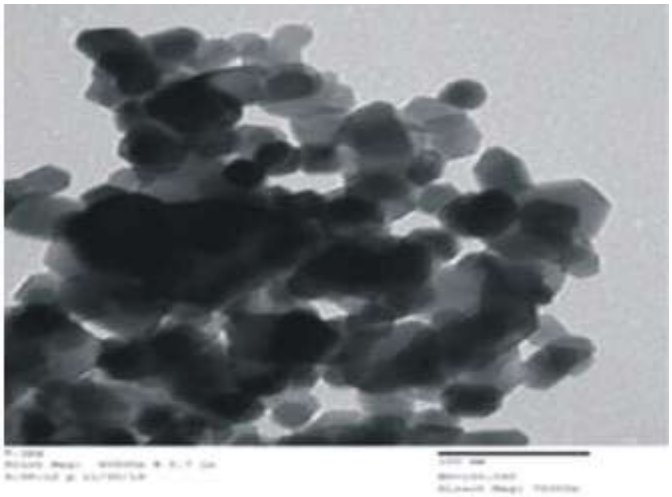


Fig. 5: Shows the TEM images of CoFe2O4 nanoparticles. according to Control Department Material Data Sheet

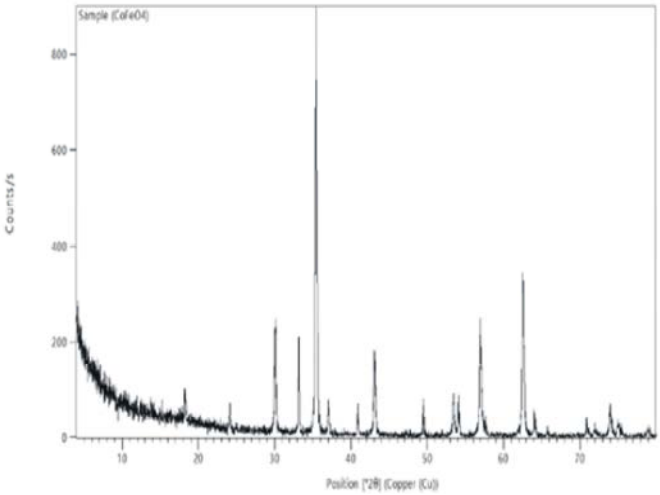


Fig. 6: Shows the XRD pattern of the prepared nanoparticles

Table 2: The Properties of Cobalt Ferrite Nanoparticles

Appearance (Color)	Black.
Appearance (Form)	Powder.
Avg. Size (TEM)	30 ±5 nm
Shape (TEM)	Spherical - like Shape

An extra-essential benefit is that these materials can be useful with reduced water content; the cellulose-ethers can even be purely dissolved in alcohol. Carbogel does not absorb cold water and it is essential to melt it in warm water at a temperature between 30 and 35°C. By slowly increasing the quantity of water, it grows in volume, indicating its ability to continue absorbing water.

Using Magnetic Nano Gel: (50 gm) Carpabol 2%, PH 7 and $CoFe_2O_3$ 10% The results (figures 5-7) showed that the Using Magnetic Nano Gel: (50 gm) [Carpabol 2%, PH 7, $CoFe_2O_3$ 10%]. Carbogel can be safely applied in the cleaning of artifacts, as its influence on plaster components is small and its color change is insignificant. Cobalt ferrite (CoFe2O4) is a famous solid magnetic material with great coactivity (Hc) and modest magnetization (Ms). These things, along with their great physical and chemical stability, make CoFe2O4 nanoparticles suitable for various uses [28]. Preparation Method according to Goldman [29].

Characterization of Cobalt Ferrite Nanoparticles [30]: Size & Shape: TEM were done on JEOL JEM-2100 high resolution transmission electron microscope at an accelerating voltage of 200 kV, respectively. Figure 5 shows the TEM images of CoFe2O4 nanoparticles and Figure 6 shows the XRD pattern of the prepared

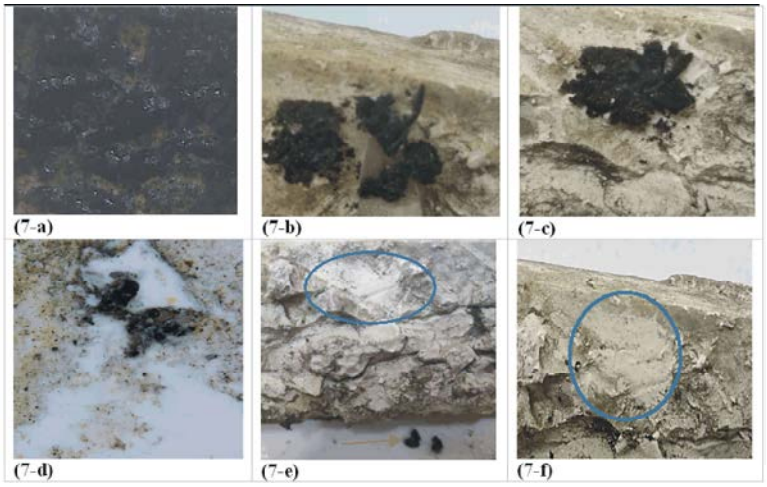


Fig. 7: (from a to f): Nano gel results. a: shows the use of Nano gel for the purpose of cleaning the surface. The Nano gel with magnetic nanoparticles has a black color. b: shows that the Nano gel, after being left for a while, has dried on the surface of the gypsum. c: shows that the Nano-gel, after being left for a while, has been separated from the surface of the gypsum. d: Shows the gelatinous appearance on the gypsum surface. e: The part becomes clear after the cleaning process and the gel falls off easily from the surface. f: showing after cleaning.

nanoparticles. Table (2) contains the properties. Experimentally, we find that the use of Nano-gel in cleaning and removing unwanted dust from surfaces showed success and efficiency in removing dirt as shown in Figures 7 (from a to f).

Consolidation: The consolidation process is one of the most important operations in the field of antiquities restoration, as parts of the building are strengthened to save them from extinction and we discover that there is great importance to strengthening the writings and inscriptions on the walls of the cell from the inside, as they contain important historical evidence of pilgrims' lives in the monastery. In addition, it proves that there was a good relationship between Muslim pilgrims and Christians in this period.

As a result, it is critical to preserve these inscriptions, writings and scribbles and these walls must be strengthened to do so. Materials that can be used at this stage, according to the study, include Nano-graphene oxide material to strengthen the mud bricks and Nano-calcium carbonate. According to The results displayed that the consolidation with $CaCO_3$-nanoparticles was valuable in improving the physical and mechanical properties of the models [31]. When using nanoparticles, it is important to obtain products with desirable properties such as high homogeneity, a higher melting point and higher strength. It appears that the dispersion of the nanoparticles is similar to a solution with a high concentration of lime water (up to 30% by volume), which is higher than the physico-chemical limit of the solubility of calcium hydroxide in water [32]. To evaluate the effectiveness of using calcium Nano carbonate To consolidate the internals of the old plaster, nano-$CaCO_3$ is applied several times by brushing on surface samples to confirm good application.

The restoration crew is responsible for consolidation; consolidation of the layers may be allowed in special cases before treating the foundation of the painting or before removing the wall paintings. Then Coming treatment is enabled by applying support using "facing" with gauze and consolidating, such as Paraloid B72 diluted in an organic-based agent. In positive cases, non-reversible materials may be used, such as lime water, lime-based mortar, or Nano lime, which will not affect handling. When a wall painting is exposed in situ, protective conservation actions must be taken, including shelter and cover as well as pre-consolidation of the walls and plaster. They also must support edges and consolidate spaces [33].

In some cases, applying the mortar or plaster layers to the plaster surface is the best solution. The cracks between the layers are usually filled by lime-based hydraulic injection plasters and the ratio of this mortar is determined according to the cracks and holes. This mortar is transferred with a wide tip that squeezes through the

cracks [34]. The material used for the purpose of consolidation must have a distinct strength suitable for the purposes of bonding the plaster. It is colorless, completely strong, must be decay-resistant and most importantly, it must not change the colors of the drawings or change the color of nature in general. Consolidate can be applied with a spray or a brush. The application concentration of the solution can range from 2–10%, according to the state of deterioration. The consolidate can be applied on the backside of the cut-out Japanese paper piece. Then the paper can be applied to the fragile surface with a soft brush [35]. Exemplary use of Japanese paper facings to protect endangered painting areas.

Consolidation of adobe brick masonry: We need to study mud brick as it is one of the cheapest construction materials in the world. In ancient Egyptian society, it was used by all classes in society for a variety of purposes [36]. Rossi [37] explained in a section on building materials and technology in ancient Egypt that one of the characteristics of ancient Egyptian architecture was that it was mainly built of mud bricks and various stones and that mud bricks were used to build houses and many structures, but stone was the main building material for most temples. Clay is one of the most commonly used building materials, but it is also one of the weakest and the heterogeneity of earthen materials and construction structures makes it problematic to order common deterioration processes and their related treatments [38].

Use Nano Graphene Oxide: according to Quality Control Department Material Data Sheet, experimenting with new materials provides opportunities for reconsideration and scientific challenges. Independent graphene was used in 2004 [39]. Graphene is a two-dimensional (2D) allotrope of crystalline carbon. Its intrinsic features and electronic properties are gaining a great deal of attention nowadays. Despite its short history in practical application, graphene has already yielded a large number of distinct physical and chemical properties to explore along with many potential applications in various fields [40]. Graphene oxide (GO) films with two-dimensional structure were successfully prepared via the modified Hummer method. It is proven that redox method is a promising way to synthesize GO films on a large scale. Comprehensive characterizations of the properties of GO films were conducted [41]. TEM and DFM analyses showed that GO sheets prepared in this study had single and double lamellar layer structure and a thickness of 2~3 nm. X-ray diffraction (XRD) was selected to measure the crystal structure of GO sheet.

Preparation of Graphene oxide; the synthesis of graphene was attained by chemical reduction of graphene oxide by means of two dissimilar reduction process, Sodium borohydride and hydrothermal reduction. The preliminary graphene oxide was prepared using improved Hummer's technique [42]. Characterization of Graphene Oxide: Size & Shape: TEM were performed on JEOL JEM-2100 high resolution transmission electron microscope at an accelerating voltage of 200 kV. Figure (8) Shows the TEM images of Graphene oxide nanoparticles, Figure (9) Shows the XRD analysis: pattern of the prepared nanoparticles. The Properties Graphene oxide in Table (3).

It has also been proved that graphene derivatives have a much higher corrosion resistance than traditional polymers [43]. However, there are almost no reports on graphene derivatives used as protective coatings for stone materials. But the vast majority of coatings, regardless of the target substrate, have not been studied. Only mixture or functionalized graphene nanostructures, that is, those combined with metal or metal alloys, have been studied oxide nanoparticles. Once this material was characterized, the focus was on ascertaining the potential and suitability of GO as a protective coating for monumental stones against wear. In order to address it, GO was applied to some stone specimens of different sizes that would subsequently undergo different simulations of rainfall and thermal changes, revealing the coating’s resistance to weather-induced damage [44]. The simple recipe of GO suspension over the stone's surface provides an affordable and extremely efficient way to preserve stone-based cultural goods exposed outdoors, preventing physical damage caused by weathering and finally resulting in a highly protective and durable coating. In fact, the incorporation of GO into commercial paints has been proposed as an additive, enhancing their protective effect [45].

recently, new nanomaterials have been developed to improve their compatibility with construction materials in historic masonry buildings. The majority of these studies mention stone and plaster strengthening; [46, 47] some rare applications on the strengthening of ancient mud bricks with nanomaterial's. This material still needs more applications, because preserving Egypt's wealth of clay is important for brick architecture. There is a need for specialists and specific studies in the preservation of mud-brick structures. Brick building conservation is a significant challenge due to the variety of conservation methods [48].

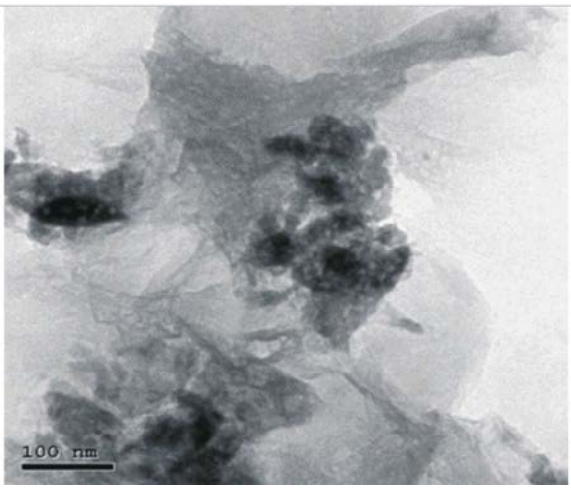


Fig. 8: Shows the TEM images of prepared Graphene oxide

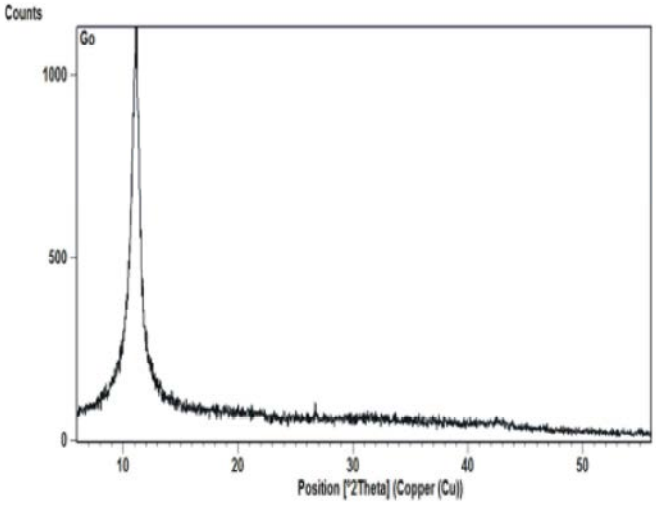


Fig. 9: Shows the XRD pattern of Graphene oxide

Table 3: The Properties of Graphene Oxide Nanoparticles

Appearance (Color)	deep brown.
Appearance (Form)	powder.
Avg. Size (TEM)	Length: 1-3 µm, Thickness: 1-5 nm
Shape (TEM)	Sheets

DISCUSSION

Restoration specialists have to make many efforts and develop different strategies to protect the monasteries under study. and setting up appropriate preservation methods so that archaeological and historical facilities are protected from distortion or loss according to foundations and standards to suit the nature and circumstances of each building and to achieve the necessary compatibility between the required objectives and the available capabilities. As a result, a large portion of this heritage is not only vulnerable to loss and extinction, but ultimately nothing but incomplete ruins remain.

This study proposal the examination and study of the appearances of damage revealed changes in the gypsum layer. The composition of the salts performed, the presence of internal micro cracks, crack gaps, weaknesses, losses and Gypsum turned into anhydrite and the resulting anhydrite is weaker than gypsum, which led to the loss of quartz grains and cracks and loss in the plaster layer, as well as high porosity, which led to cracking and loss of colors. Decomposition of the plaster layer, separation of layers due to fluctuations in temperature and relative humidity Through the results of the tests that were carried out on a sample of plaster, it was found that

it consists of: potassium chloride; quartz; calcite; minerals; salts such as sodium sulfate and magnesium sulfate; and some of these are sourced from the building materials. With the continuation of conducting scientific experiments in the field of restoration, it is necessary to study the physiochemical properties of mud brick and plaster before starting treatment operations and choosing treatment methods and materials. We find that strengthening the inside of the mud brick components using Nano graphene oxide gave satisfactory results, that the use of Nano gel in cleaning the plaster layer has shown good results and that the use of CaCO3 nanoparticles for the purpose of strengthening gives satisfactory results. Finally, we find that Carbogel can be practical plaster cleaning [49] and Nano graphene oxide is beneficial to consolidate mud brick.

CONCLUSION

In conclusion, the treatment processes of ancient buildings have gone through different stages of development and the concept of maintenance and restoration has clearly developed. As a result, numerous chemicals, resins, synthetic or synthetic polymers, or nanomaterial's are employed. However, it must take into account the use of a suitable material in each part to be restored so that it is suitable for the materials to be strengthened or cleaned. It is suggested that it be used to strengthen the plaster layer ($CaCO_3$-nanoparticles), for the purpose of cleaning (Nano Gel) and to strengthen the mud bricks (Nano Graphene Oxide). The preservation techniques that we define with their essentials should be qualified as serious preservation interventions for archaeological sites. In the end, a treatment plan for strengthening and cleaning is drawn up and the materials used are compatible with the original materials. All principles and conditions agreed upon must be observed in all treatments that will be carried out within the walls of the monastery. The preservation and restoration process is supposed to be carried out according to the needs and condition of each part of the wall inside the monastery.

ACKNOWLEDGEMENT

The author would like to declare support from Prof. Mona F. Ali, Head of the restoration department, Faculty of Archaeology, Cairo University, Egypt.

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