Study of The Processes of Loss - Completion and Reconstruction of the Archaeological Stone Statues on The Rams Road - Luxor - Egypt, Applying on Selected Models

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Abstract

The Rams Road is one of Luxor's most important tourist attractions, and it connects the temples of Luxor and Karnak with a length of 2,700 m. The number of statues on both sides of the road is more than 1200 statues, which are statues of rams and sphinxes.

In the recent period, attention has been paid to restoring these statues, most of which were lost as a result of damage and the lack of periodic preservation, the statue consists of a base consisting of three courses next to the foundation course in addition to the body of the statue.

Some of the statues were removed from their places, and therefore it was necessary to reconstruct these statues, as well as to complete the missing parts. Two statues were chosen on the road, one of which was not in its original position, and thus the reconstruction was carried out in the original position of the statue, and the other suffered from breaking into several parts and therefore it was installed on the base and carrying out various restorations, including assembly and completion.

Samples were taken from these statues and analyzed by X-ray diffraction in addition to examination by polarizing microscope and scanning electron microscope. A soil sample was also taken to determine its components and type, it was found that the type of stone is a Nubian sandstone and that the soil type is a sandy soil, the soil containing halite as a result of the presence of ground water on the site.

The two statues have undergone many restoration processes , such as: mechanical and chemical cleaning, consolidation, reconstruction, assembly and completion.

Key Words:

Loss- Completion, Reconstruction, Rams road, Restoration, Analysis and Examination.

1. Introduction:

The Sphinx Road (The Rams) is one of the largest ancient sacred roads built by the ancient civilization to connect the two largest holy areas on the eastern mainland of Luxor **(Weeks, K.R.,2005)**.

The thought of revealing this sacred road began during the revolution of July 23, 1952 AD, when the President Gamal Abdel Nasser issued a decision No. (441) considering the route of the Rams Road as one of the sites of public benefit, as this road vanished and disappeared throughout the ages, especially in the Roman era, when the landmarks of the road disappeared

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below Layers of silt and dirt, and many buildings were built on it, whether houses or places of worship, mosques and churches.

This road was dedicated to the religious celebrations and processions, and was used on religious holidays, especially the Opet festival, in which the anniversary of the marriage of the god (Amun) with his wife, the goddess (Mut), was celebrated. Luxor Temple was celebrated in the month of Baba (A month in the Coptic Calendar).

The length of the road from Karnak Temple to Luxor Temple is about 2,700 m and contains more than 1,200 statues on both sides.

The actual project to discover and restore the road began on December 25, 2009. The Road of Rams is the road that connects Luxor Temple to Karnak Temple. A wide street started from the beach, surrounded by statues of sphinxes. We find them in Karnak temples, they are in the form of a sphinx with a ram's head, the ram here symbolizes the god Amun, perhaps to protect the temple and highlight its axis. The ancient Egyptian called this road "Wat-nTr",it means the way of the god, as for the way of rams in the Karnak temples, it was known as "Ta-Mate-Arhant" and translated by rams also **(Boraik, M., 2013)** - Fig(1).

1.1. Statues description:

A sandstone statue in the form of a lion sitting with a ram's head below this head is a statue of King Ramses, holding in his two hands the sign of the key to life (ankh), and its length is about 1 meter, The statue is located on a sandstone base with a length of 3.85 meters, a width of 1.40 meters and a height of 0.95 cm. The base has a cornice from the top, below which is a stick- Fig (2-3).

Fig (1). The path of the road from Karnak Temple to Luxor Temple (By Satellite imaging - Reports of the Supreme Council of Antiquities –Upper Egypt Antiquities Authority)

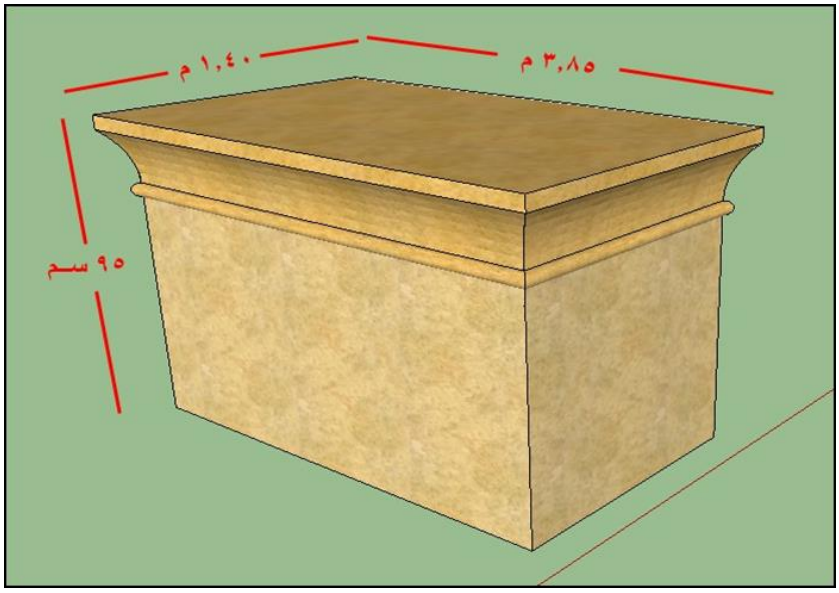


Fig (2). The dimensions of the base on which the rams are placed

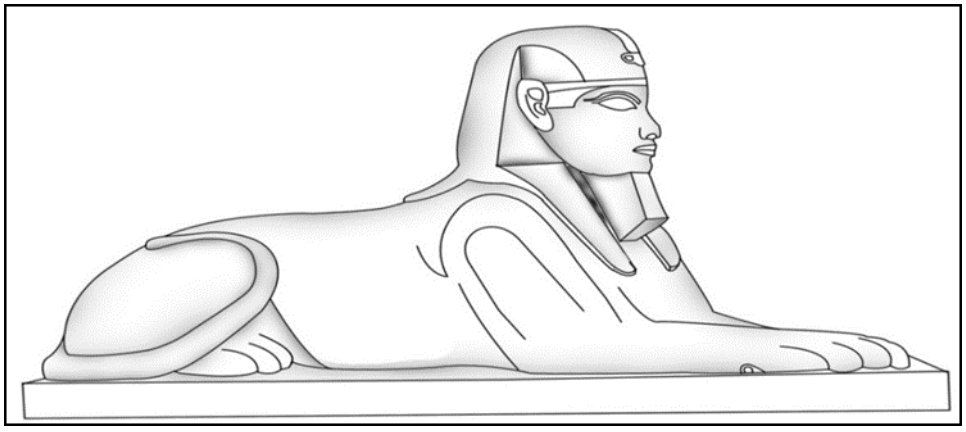


Fig (3). The position of the statue while sitting on the base (The right side of the statue)

1.2. The current state of the statues:

The statues and bases show some deterioration phenomena, the most important of which are:

A. Some floors fell below the bases, which led to the landing of some statues.

B. The presence of cracks in some of the bodies of the statues and the bases in different places with different shapes.

C. Some parts separated in the statues' body and are still in their places.

D. It has been lost in several places in the bases, including what is completed with an old mortar, and some of it is not completed.

E. A loss - Completion in some of the bases and the body of the statues.

F. Some statues have a complete separation in the upper part, except for a small part.

G. The presence of an intentional damage to the bases and bodies, as well as the pavement.

H. A lost in most rams' heads and statues of gods.

I. The presence of many plants and weeds in some places on the road.

J. The presence of ground water in a large extent in some places of the road.

K. The disappearance of many bases and statues, especially in the sanctuary behind and under the church.

L. The presence of many worn-out and scattered parts that are not in their original place – Fig (4-7).

Fig (4). Shows the condition of some of the bases that were found and the effect of the various deterioration factors on them, only a course or two of its stones remain, and a great loss has occurred in them

Fig (5). The presence of ground water in the site

Fig (6). The loss of some statues bodies

Fig (7). The condition of some of the bases of the road, which are destroyed and weeds spread, and the presence of cracks and many separations is noted

1.3. Previous Restoration processes on the statues:

Some of the sandstones that make up the bases were cleaned using soft brushes and fine scalpels to remove dust, dirt and clay calcifications very carefully to preserve them, then use a solution of ethyl alcohol diluted with water in a ratio (1:1) to remove the remnants of dust and clay calcifications that are difficult to remove mechanically.

The weak parts of the sandstones constituting these bases, as well as the bodies of the rams, were consolidated using a solution of Paraloid B-72 dissolved in acetone at a concentration of 3%. After that, some of the bases were reconstructed in their original place, with the completion

of the missing parts with new sandstone, and then some parts separated from the bodies of the statues are assembled to each other, and with regard to the bodies of the rams, these parts were strengthened using stainless steel skewers or bars with Araldite 1306 to stick these parts in their original place. The cracks and small gaps in the statues' bodies were filled using lining mortar, then the statues were lifted and fixed on their bases using a suitable lifting machine.

1.4. Treatment and Restoration processes (Loss – completion and Reconstruction):

This stage is one of the most important stages in which the treatment and restoration plan is developed, as the archaeological material carries artistic, historical and cultural values, even if it is free of any decorations, inscriptions or writings, but it represents a scientific value, where the aim of its restoration is to discover and protect these values in accordance with what is approved by the law and recommended by international conventions for the protection of antiquities, where the restoration process is considered a highly specialized operation, and this all shows that the restoration work of antiquities is procedures related to the material of the antiquity that should be well understood and the method of its design and analysis of those elements.

Through the field study of the statues of rams, it was found that there was a large loss in the bases and bodies of the statues, which necessitates the presence of completion operations for the missing parts with stone and mortar, as well as the presence of many dilapidated stones, especially in the bases of the statues, which must be replaced with other intact parts of the same type of the sandstone, and there are some statues that suffer from subsidence of the soil below due to the groundwater effect , which requires dismantling and reconstruction of these statues, with the presence of international regulated standards in this regard.

- Criteria for reconstruction and loss - completion of the archaeological landmarks:

1- The process of reconstruction and loss- completion the archaeological landmark becomes necessary in order to lead to a more comprehensive understanding of the archaeological and historical value of the archaeological landmark, provided that there are sources and documents that can be relied upon in restoring the original image, **(El-Banna, ElS.M., 2002)**.

2- Reconstruction and completion of the missing and worn out parts using new materials, provided that they are homogeneous in design, color, texture and all other visual appearances, and this must be done according to confirmed historical images or elements, **(Moustafa, B.M.,2000),(El-Sayed, SSM., 2021)**.

3- The process of reconstruction must be accompanied by putting in place all controls to preserve any underground foundations or elements, **(Salman, A.F., 2007)**.

4- Reconstruction of missing parts must be done in a way or manner that does not harm the integrity and general appearance of the original existing elements, **(Moustafa, S, L., 2010)**.

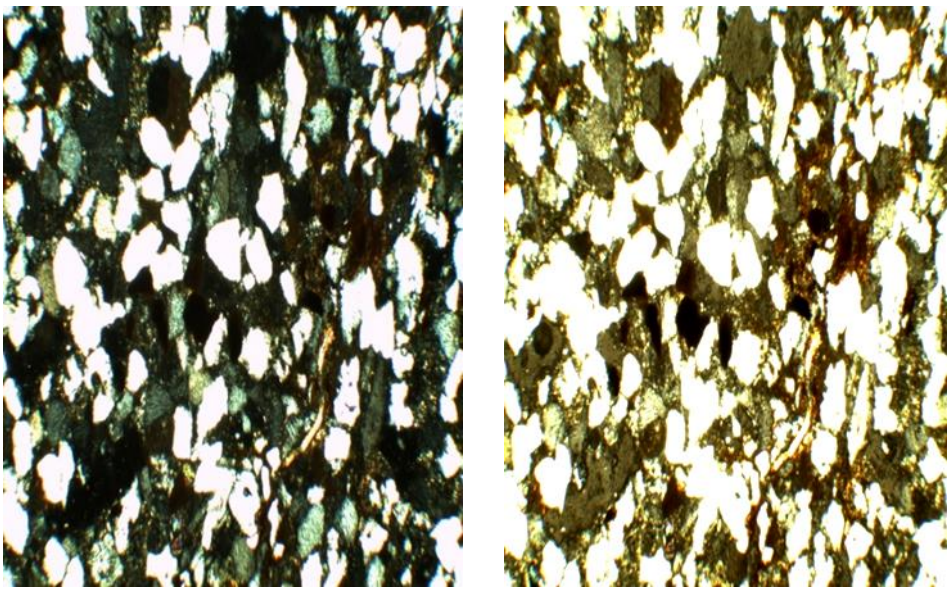
5- Items of sculpture, painting or decoration which form an integral part of a monument may only be removed from it if this is the sole means of ensuring their preservation **(Article 8- Venice Charter 1964)**.

6- Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence **(Article 12- Venice Charter 1964)**.

2. Materials and Methods:

One of the statues which needed for the reconstruction processes as a result of soil problems, also needed operations to complete the lost parts after installation, where samples of soil and sandstone were taken from the base to identify their components, damage causes and develop a restoration plan to preserve this important cultural heritage.

Samples were subjected to analysis by x-ray diffraction (XRD) – (Model : Philips Analytical X- Ray B.V - Housing and Building Research Center – Dokki – Giza – Egypt), examined with polarizing microscope (PLM) – (Model : 40X-1000X AmScope - Petrography Laboratory – Faculty of Science – Cairo university – Giza- Egypt) and scanning electron microscope (SEM) – (Model: XTM.1999-2007-Housing and Building Research Center – Dokki – Giza – Egypt) - Fig (8 -11).



(A) **(B)**

Fig (8), (A-B). Examination of a sandstone sample using a polarizing microscope (PLM)

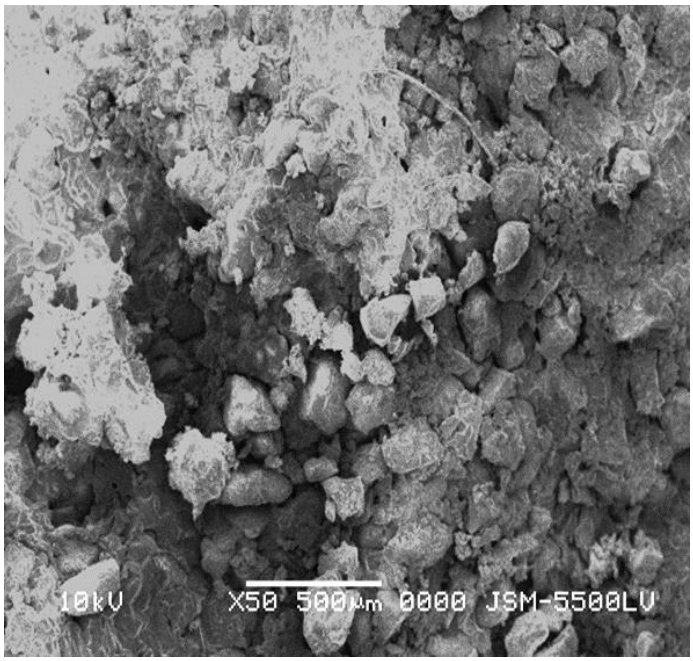


Fig (9). Examination of a sandstone sample using Scanning Electron Microscope (SEM) – 50X

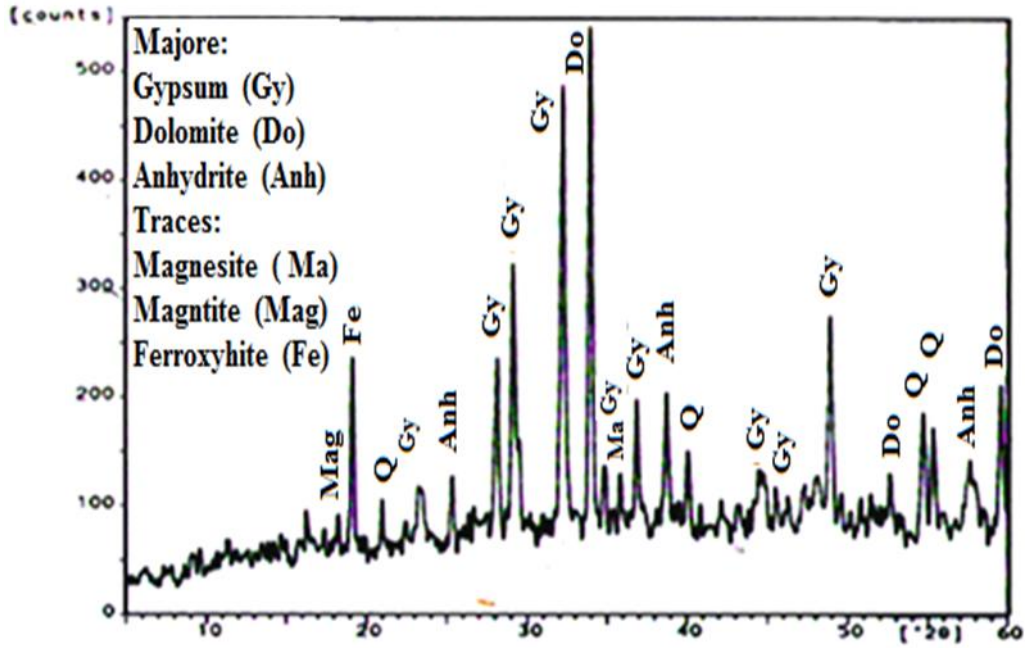


Fig (10). Analysis of a sandstone sample using X-Ray Diffraction (XRD)

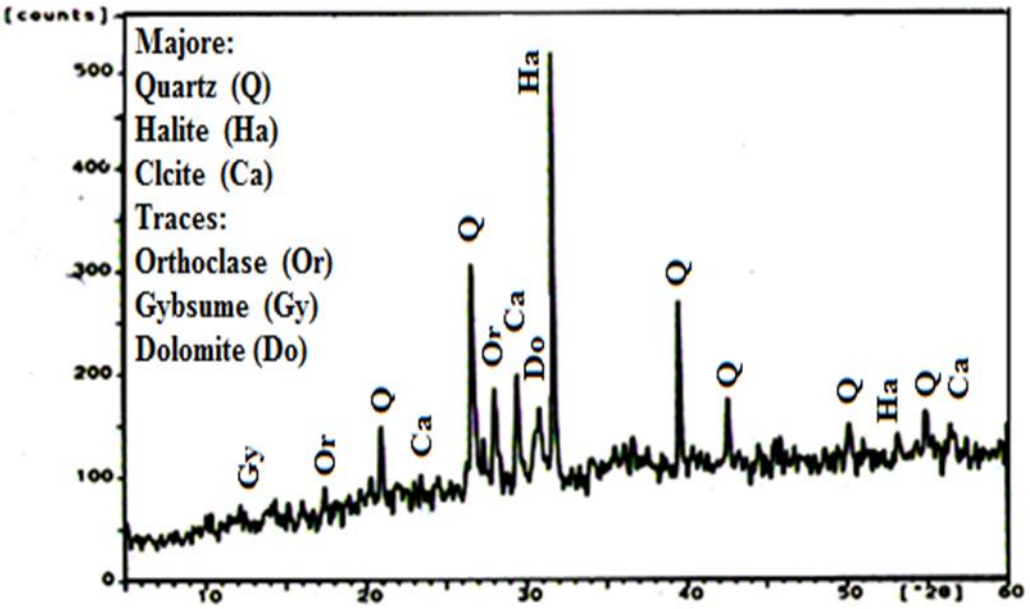


Fig (11). Analysis of a soil sample (under a statue) using X-Ray Diffraction (XRD)

3. Results:

3.1. Polarizing Microscope examination (PLM):

Through the polarizing microscope examination of a sandstone sample taken from one of the deteriorated statues which is located in the third sector of the four sectors of the Rams Road, and it begins with the road connecting from Al-Matahn street to the airport bridge, with a length of about (625) m and is symbolized by the symbol (Y), it was found that it consists of a Nubian sandstone, which consists mainly of quartz grains, which are linked to each other by iron oxides, quartz and a small percentage of calcite. Quartz grains range from fine to medium-coarse, most of which are classified as having semi-sharp to sharp edges, as it appears from the examination that the quartz grains are subjected to mechanical distortion, which is represented by some very

fine cracks, which express the stresses to which the stone is exposed **(Abdel Kader, R.R., etal., 2019)**.

3.2. Scanning Electron Microscope examination (SEM):

By examining the sandstone sample using a scanning electron microscope, it was found that there was erosion in the grains and the presence of cracks and gaps, as well as a weakness in the internal tissue of the surface of the sample **(El-Sayed, SSM., 2016)**.

3.3. X-Ray Diffraction analysis (XRD):

The result of the analysis of sandstone sample showed that it is mainly composed of gypsum, dolomite and anhydrite in addition to magnetite, magnesite and ferroxite, which indicates the displacement of the binding materials of the quartz grains that make up the sandstone and their deposition on the surface in the form of a dark solid layer as a result of the impact of ground water **(El-Sayed, SSM & Maky, A.Y., 2022)**.

The result of soil sample analysis showed that it consists of quartz, halite and calcite, in addition to orthoclase, gypsum, and dolomite, which indicates the presence of halite in a high percentage in the soil due to the ground water existence.

4.The Restoration processes of the chosen statue (Reconstruction and loss-completing):

A. The Reconstruction process:

The process of reconstruction of the selected statue includes several steps as follows:

1- The original location of the base to be rebuilt is determined and the original dimensions are determined (120 cm width & 330 cm length & 118 cm height).

2- A hole is made in the original base place with a depth of 50 cm and an increase in the sides of the original dimensions by 10 cm.

3- 20 cm of the hole is filled with gravel and sand (replacement) - Fig (12).

4- 25 cm of the hole is filled with reinforced concrete of sand, gravel and cement.

5- Distilled burlap is placed on concrete and bitumen is placed on it in order to isolate and protect it from ground water - Fig (13).

6- The stone blocks that will be used in reconstructing the base shall be prepared, taking into account that they are of the same type of stone used (Nubian sandstone), as well as refining the dimensions of each block used in building the base on the same dimensions and sizes of the stone blocks that were in the base in the past, as well as taking into account the directions of all block and put it in each course of the base- Fig (14).

7- The foundation course, which is more than 5 cm in sides on each side, is laid, taking into account the height of its mass, according to the stone pavement facing it - Fig (15).

8- A mortar consisting of (lime + sand + white cement + stone powder + Addibond) is used and mixed with lime water in proportions (1: 3: 1: 1: 15%) - Fig (16).

9- The rest of the blocks (first, second, and third) are then completed and connected using the previous mortar, and the gaps and joints are filled with the same mortar – Fig (17- 19).

10- A composition known as Al-Dahara is used. It consists of (silt, primal and colored oxide) dissolved in distilled water. Modern stones are painted with it in order to give a color similar to the color of the old bases.
11- The body of the statue is raised on the base after its restoration, using a silk rope so as not to scratch the body from the force of the load, since it is sandstone, and by using an appropriate lifting machine, it is installed on the base.
12- The body is fixed to the base with the same mortar used to connect the base courses to each other – Fig (20).

Fig (12). The shape, depth and dimensions of the hole on which the base is built and the replacement of sand and fine gravel is placed in it

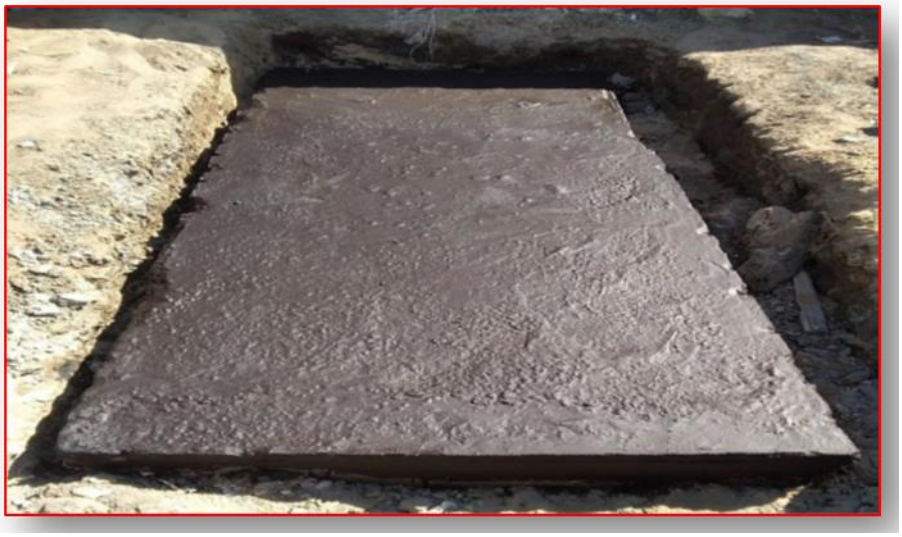
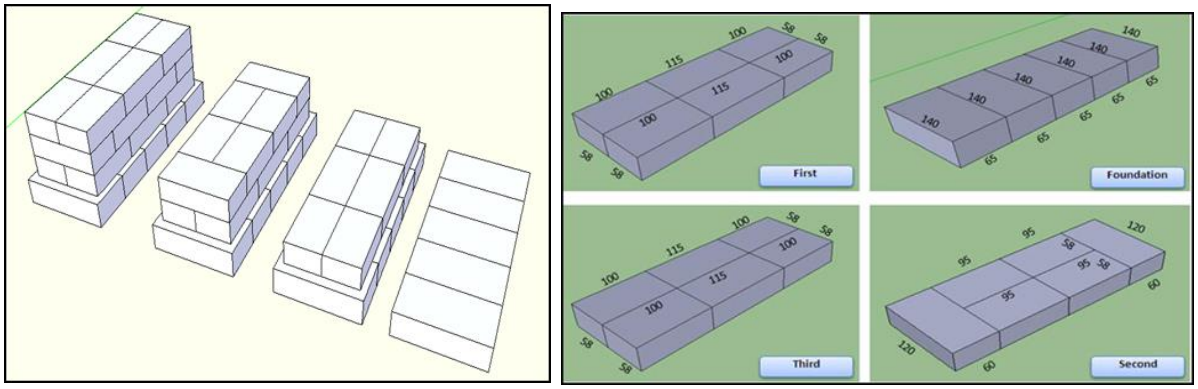


Fig (13). Shows the concrete and the dripping burlap placed on the bitumen material to protect the base from ground water



(A) (B)

Fig (14), (A-B). Shows how to build the base of the statue and its dimensions

Fig (15). The work of sculptors while refining the stone blocks used in building the base (which are Nubian sandstone blocks) and determining the dimensions and sizes of each block

Fig (16). Placing the foundation course in the base and placing the mortar on it to connect it to the rest of the other courses

Fig (17). Shows the shape of the direction of each stone block during the construction process and its dimensions

Fig (18). The shape of the first course, and the second after installation on the base and filling the gaps and joints between the stone blocks with mortar

(A) (B)

Fig (19), (A-B). Shows the shape of the base after reconstruction process, and the other figure shows some of the bases that were built in the same way in the same section of the road

(A) (B) (C)

Fig (20), (A-B-C). Shows the process of raising and fixing one of the statues' bodies on the base after reconstruction process

B. Loss – completion or (Loss- Compensation):

Many statues suffer from significant loss in the body of the statue; one of these statues has undergone the following restoration processes -Fig (21-22):

1- Mechanical and chemical cleaning processes were carried out for it, and all the various dirt and calcifications were removed, using poultices of ethyl alcohol and water in a ratio of 1: 1 and covering them with polyethylene to remove dirt and calcifications.

2- The body was consolidated with Wacker (OH)100 in the concentration of 3% and using brushes in the consolidation **(Horie, C.V., 1998)**.

3- A sketch is made for the body of the statues, in which the missing parts to be completed are identified and the other parts are applied to know the location of each piece in the body.

4- The assembly and completion process is carried out directly on the base, as the missing parts are completed with mortar **(Doehne,E., & Price, A.C., 2010)**.

5- A mortar consisting of (lime + sand + white cement + stone powder + Addibond) is used and mixed with lime water in proportions (1: 3: 1: 1: 15%), taking into account the conditions for loss-completion, which are taking into account the differentiation and homogeneity.

6- Separate parts assembled by Araldite 1092 **(Abdel Kader, R.R., & El-Sayed, S.S.M.,2019).**

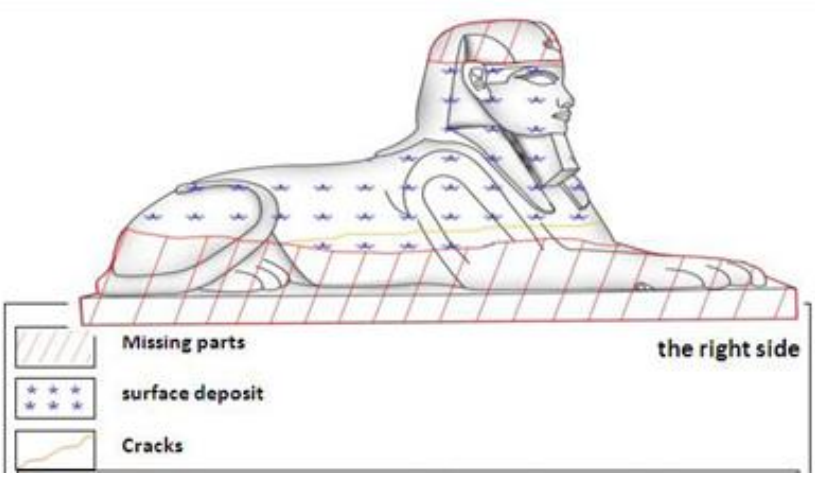


Fig (21).Shows the deterioration map of one of the statues' bodies

Fig (22),(A-F).Shows fixing , assembling and loss-completion processes of one of the road statues

5. Discussion:

Through a polarized microscope examination of the sandstone sample taken from one of the bases of the statues by means of rams, it was found that it consists of quartz grains linked to each other by iron oxides, and there is a small percentage of calcite, the grains range from small to medium grains with sharp angles as a result of exposure to sandstone to deterioration factors, the type of the sandstone is a Nubian sandstone, it is very weak and needed to be consolidated. The examination by scanning electron microscope (SEM) shows that the texture of the same sample full of cracks and gaps.

The results of the analysis of the sandstone sample by x-ray diffraction (XRD) confirmed the results of the examination by polarized microscope.

The soil type is a sandy soil which consists of quartz, halite and calcite, in addition to orthoclase, gypsum, and dolomite, and the presence of halite in the soil due to the groundwater effect.

6. Conclusion:

The Sphinx or Rams Road has previously suffered from deterioration and damage to many statues, which number more than 1, 200, as a result of the presence of ground water and the presence of a residential block in addition to deliberate vandalism and theft.

The Egyptian government has paid attention to this road by exposing and restoring many statues on the road extending from Luxor temple to Karnak temple. Luxor witnessed a global celebration of the opening of Rams Road on November 25, 2021 with the support of the political leadership and in the presence of His Excellency President / Abdel Fattah Al-Sisi.

The statues of the road have undergone many restoration processes, such as: mechanical and chemical cleaning processes, consolidation, reconstruction, assembly and loss - completion.

Two statues were selected, one of which underwent reconstructions for the base and body, and the other underwent cleaning, consolidation and reconstruction processes, then assembly and completion for the body.

The researchers recommend the need for a periodic maintenance of the road to detect any deterioration phenomena of statues and intervention immediately to treat them for this way of major local and international importance.

7. List of acronyms:

- **XRD:** X- Ray Diffraction.
- **SEM :** Scanning Electron Microscope.
- **PLM :** Polarizing Microscope examination.

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