

RESTORATION AND CONSERVATION OF THE STONE TOMB OF PRINCESS ELENA (1799-1867)

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Abstract

In St. Petersburg, the Alexander Nevsky Trinity Lavra, and the Tudor Church in Novgorod, there is a group of historic stone tombs that have been destroyed by war and the weather conditions that surround them over time. All this is part of Russia's cultural heritage, civilization and history. This study focuses on the restoration and preservation of the tombstones of Princess Elena (1799-1867), which were destroyed. Many of these stone monuments have been lost, and those that are preserved suffer from evolutionary effects of deterioration of structural elements (change in physical condition) and degradation of component materials (change in chemical nature). This cultural heritage must be valorized, through urgent preservation and restoration interventions, in order to pass it on to future generations.

Keywords: *Conservation; Stone tomb; Assembly; Adhesives; Filling missing parts; Polyester resin; Stains; Erosion; Restoration.*

Introduction

The importance of conservation science is due to the interest in preserving cultural heritage and protect it from damage and extinction. Therefore, the importance of this research paper is related to the restoration and preservation of the stone tomb of Princess Elena (1799-1867) the The Nikol Fyodorovsky Cathedral in the Holy Trinity Alexander Nevsky Lavra in Saint Petersburg, Russia [1]. Among the restored planks, is an interesting object which is a marble slab installed fixed at the burial place of Princess Elena The object was set under restoration in a form of (32 fragments, the largest of which is 51 × 60cm). Through a laboratory examination, it became clear that the slab was made in 1867 and it was the stone tomb of the daughter of the Georgian prince Farnavaz - Princess Elena, who died at the age of 69 in Tsarskoe Selo. About 15 percent of the slab marble under investigation has been completely lost. Chips, cracks, foci of erosion and granulation of stone, stains of rust, cement, soil, and soot dust were visible on the entire surface. as a result for that , the text on the slab was lost, the slab was poorly recognizable [2, 3].

Then carry out the process of collecting, pasting and gathering the pieces of broken stone. The stone is coated with one another using adhesives, after which the processes of filling the missing parts of the stone are completed with polyester resin. the condition of the object was well studied, based on the results, treatment and restoration plan was drawn up, it started with archaeological documentation and photographic processes for all manifestations of damage.

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The restoration process started with cleaning operations to remove dirt, stains, and rust, whether by mechanical cleaning or chemical cleaning, it follows by a process of bringing the broken and separate stone pieces together using adhesives. Then the processes of filling the missing parts of the stone were followed using a polyester resin together with stone powder. In this way, the text written on the surface of the stone slab can be clearly identified and interpreted in addition to preserve it from loss and extinction for the new generations.

Experimental part

Old stone artifacts extracted from archaeological sites, before cleaning, restoration and preservation, the interventions must be scientifically investigated in order to determine the component materials and their state of conservation, by identifying the effects of damage and frostbite under the influence of environmental factors and those of anthropogenic or natural risk [4-6], then an experimental protocol is made for the selection of materials and procedures compatible with the old traditional techniques [7-10]. In parallel, in addition to the archeological, photographic and colorimetric documentation, it is performed [7, 11].

Archaeological documentation (photography)

The process of archaeological documentation of the manifestations of damage from which the object suffers is considered the first and most important steps through which to identify the types and forms of damage, this kind of documentation supplies us with important information that helps in setting up a successful restoration and treatment plan. The photographic archaeological documentation process gives us an accurate identification of the places of damage and the most vulnerable places. It is also considered one of the important steps because we could gain a valuable document through the photos which represent restoration and completion (before and after) to make a comparison [12].

The effect object is photographed as a full image, followed by focusing on the places of damage, the manifestations of damage are photographed very accurately because these photos are the only evidence that show the state of the object and the smallest depiction of details and recording them. By using Photo Shop program, will be transformed as maps to show the manifestations of damage (using a variety of colors), as in figure 1 and Table 1 [13, 14].

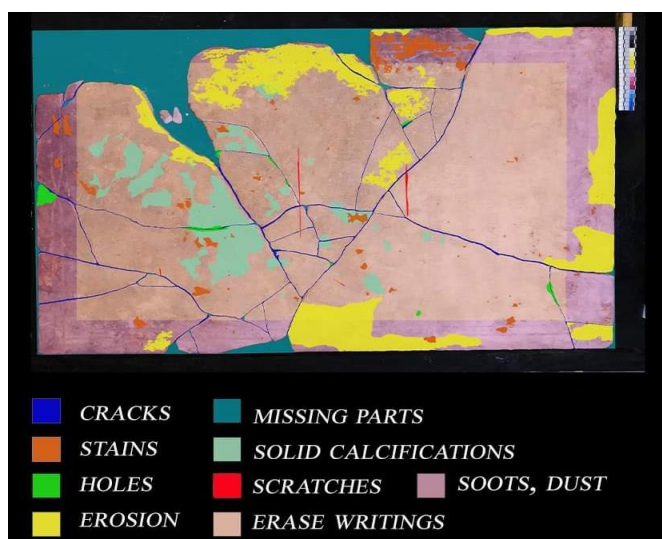


Fig. 1. Map of the manifestations of damage

Cleaning process

The purpose of the cleaning process is to remove dirt stuck on the surface of the stone to show the historical, cultural, and philosophical value in terms of decorations, inscriptions, and drawings on the surface of the stone and to preserve the integrity of the stone from decay and damage. Cleaning is the first step in restoration and conservation. Dirt hides the historical, cultural, and philosophical value of the monument, covering the inscriptions, drawings, and motifs in the monument with mud [15, 16]. Mechanical cleaning is the first of the practical steps that must be performed when cleaning (if the condition of the stone allows).

Table 1. The manifestations of damage oin Stone tomb of Princess Elena

Phenomenon 1 - Cracks



Large cracks in the stone slab, because of destruction, they turned into pieces of stone that were shattered and separated from each other

Phenomenon 2 - Erosion



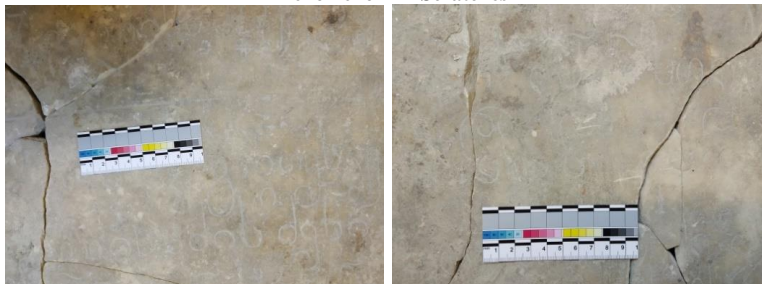
The disintegration and separation of some pieces of stone from the surface layers of the stone

Phenomenon 3 - Missing Parts - Loss



Missing parts in a stone slab that are missing due to destruction, corrosion, and stone slab handling operations

Phenomenon 4 - Scratches



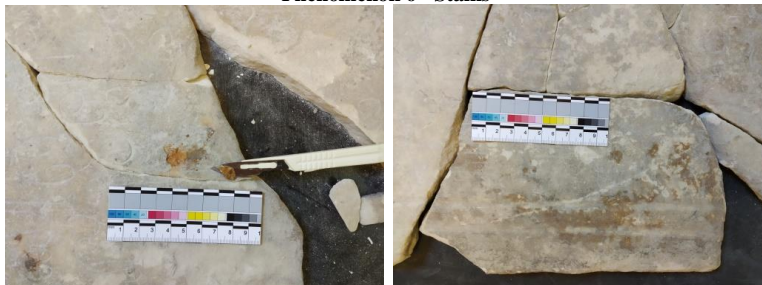
Scratches When using a sharp tool or rubbing against the surface of the stone, the stone is scratched and deformed

Phenomenon 5 – Holes



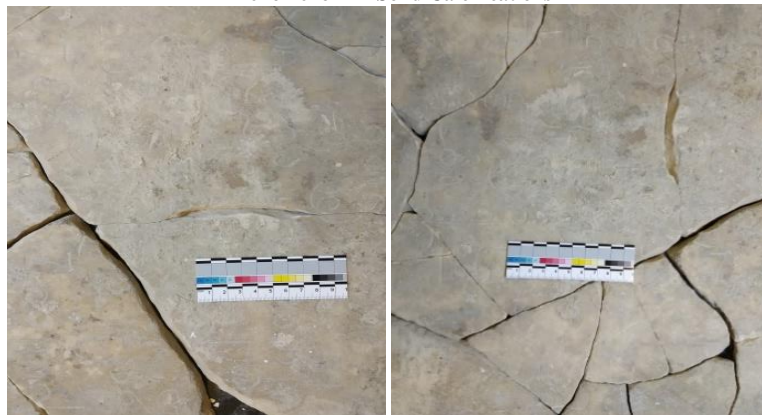
Holes are the weakest spots on the stone surface that fall off and separate from the stone

Phenomenon 6 - Stains



Rust spots on the surface of a stone are brownish spots that penetrate the subsurface layers and pores of the stone

Phenomenon 7 - Solid Calcifications



In the past, cement mortar was used to anchor and fix the slab in place, resulting in stains of cement on the surface of the stone, the edges, and the back of the slab

Phenomenon 8 - Erased Writings



With the passage of time and environmental conditions, inscriptions and drawings wear off the surface of the stone slab, making them difficult to be recognized

Phenomenon No. 9 - Soiling -Dust - Soots



A thin layer of particles (dust from the air) covers the surface of the stone.
This dirt adheres to the surface layers of the stone in different shapes

The cleaning process was carried out using brushes of different sizes [17]. After removing the dust from the surface of the stone, hard calcifications (continuous layers on the surface of the stone) had been appeared. Hard layers were removed from the surface of the stone by using medical scalpels, this process had been carried out slowly, and the restorer must take care to protect the stone from scratches, as in figure 2 [18].



Fig. 2. Mechanical cleaning

Chemical cleaning is used in the least limits in the case of tough spots dirt and colored stains that are difficult to remove by mechanical cleaning. The restorer must take the necessary care when cleaning with chemicals, as chemicals cause reducing the proportions of the stone to avoid damaging it. Chemical cleaning includes wet cleaning using water or aqueous solutions, it is used in a form of organic solvents such as acetone and ethyl alcohol [17].

Cleaning with water was used as a preliminary step to chemical cleaning which has been proven by many studies to be one of the best detergents for many types of dirt, especially for clay calcifications and plankton such as dust and color stains. An attempt was made to clean with water, the results were good, the calcification of dust and dirt was removed from the surface of the stone specimen, but no good result was achieved in brown spots [19] another attempt was made in cleaning using acetone and ethyl alcohol at a concentration of 5:10% to remove hard calcifications and colored spots, but it was not able to remove completely the dirt.

Removing the hard layer: use a 1:1:1 solution of a mixture of white ethyl alcohol + water + acetone as a cotton cloth compress, which is left on the surface for a few minutes, this process was repeated several times [19] However, this method did not remove the sticky dirt well, so the following mixture was used:

250mL of mild soap + 1000mL of Distilled water + 250mL of ammonium hydroxide. Using such mixture in cleaning showed very good results in removing calcified hard layers on the stone surface. After the cleaning process was completely finished, in which the dirt, hard layers and concrete stains were removed, the cleaning process was successful and the patterns appeared as in figure 3[20].



Fig. 3. Chemical cleaning

Collecting pieces and gathering together process

The process of collecting pieces of stone is one of the most difficult processes of restoration. The restorer must be of a high degree of efficacy in case of gathering process. The stone slab was separated into three parts they were gathered as a one stone.

The stone pieces were gathered by using 6mm stainless steel nails that were cut to different lengths depending on the size of the stone, holes were drilled, and stainless-steel nails were inserted into them. An experiment was carried out to gather pieces of stone together to make sure that the cracks were perfectly closed, while the level of the stone surface remained the same. use the adhesive, Before the step of using the adhesive each piece of stone is prepared separately, so it will be easier to gather and together, as in figure 4.



Fig. 4. Experimental gathering of stone pieces

First, the process of cleaning stone pieces and preparing them for the gathering and gluing process is carried out using a sharp tool wrapped with processed cotton, moistened with an organic solvent "white spirit" - solvent 646, then need to Dry stone pieces for 5-10 minutes. After ensuring good cleaning and drying, the glue should be prepared with TENAX SOLIDO TRASPARENTE (THICK HONEY) in the appropriate amount, according to the area required for gathering, and glue (3: 1: 1), (Glue "3" + stone powder "1" + catalyst "1") [21].



Fig. 5. Gathering and pasting stone pieces

Place the adhesive in a mixing bowl and apply stone powder to it. Mixing is done thoroughly to ensure that the mixture is homogeneous. The catalyst is placed at the end because it is dried quickly and become sticky. After that, the glue (mixture) is placed in the holes and along the edges of the pieces of stone. The glue is polymerized for 10-20 minutes, after which the surface of the stone is cleaned by removing the remnants of the glue by using the organic solvent 646. The stone pieces are gathered by using 6mm stainless steel nails cut to different lengths, depending on the size of the stone. stainless steel nails have already been inserted into the drilled holes, and the pieces of stone have been tried on together to make sure that the cracks are completely closed, and the surface level of the stone is the same level, as in figure 5.

The process of completing the missing parts

The process of filling in the missing parts is one of the important steps of the restoration process, therefore Article 12 of the 1964 Venice Charter stipulated that to complete the missing parts of the monument, they must be harmoniously integrated into the archaeological group, and distinguished from the original parts so that restoration was a forgery of the monument, and thus the Philosophical, cultural, aesthetic, and historical value of the monument was taken into account. "Aesthetic and historical values are important qualities in a work of art".

After finishing the completion process filling and reparation of the stone slab process is started Materials used in the process of completing the missing parts: Polyester Resin 440 501 + Marble dust - calcite (in a 2:1 ratio) - Peroxide (Catalyst) (1:20 ratio) [22, 23].

Polyester resin is the most common type of resin because it is much tougher than epoxy. The process of preparing the additional material (artificial stone) was carried out by adding polyester resin to a large bowl and gradually adding calcite marble dust in a ratio of 2:1 with continuously stirring until the mixture was completely mixed. In addition, some colored oxides are added to achieve the desired degree of coloration of the mixture, which is identical or like the original color of the stone, as some oil paints were added to the white and darker yellow color to bring the mixture to the desired degree [24].

The required amount of the mixture is determined accordance to the missing parts needed, the methyl ethyl ketone peroxide catalyst is added as a catalyst and as a reaction activator. In the ratio of 1 catalyst peroxide to 20 mixtures of polyester resin and calcite marble dust, the rate of drying of the mixture after the filling process depends on this. After pouring, this will cause a reaction that increases the temperature due to the internal friction of the resin mixture. The casting process is carried out and the missing parts are gradually filled with thin layers on the top of each other, and fabric strips of linen fibers are placed between each layer of resin to support and give strength and durability to the stone after hardening, as in figure 6[25].



Fig. 6. Filling the missing parts with polyester resin mortar.

After drying and hardening, the surface of the finished parts with the original surface of the stone slab is smoothed with emery paper, so the desired result is achieved, as in figures 7 and 8. As a result, after the completion process had been finished, it became easy to recognize

the inscriptions in the Georgian and Russian languages, we were able to read the text written on the stone slab:

"In this place rests the ashes / of the Georgian Tsarevich Farnavaz Iraklievich / His Holiness Princess Elena / Who died in 69 in Tsarskoye Selo / 1867 July 7 days"

ამ ადგილზე განისვენებს ასული ქართველი მეფის შვილისა ფარნავაზისა ელენესი, რომელიც გარდაიცვალა 69 წლის ასაკში 1867 წლის 7 ივლისს ცარსკოე სელოში.



Fig. 7. Sanding the stone surface with sandpaper.



Fig. 8. Stone slab before and after restoration

Conclusion

The preservation of the cultural and civilizational heritage of peoples is one of the most important and noble goals of the science of restoration. The aim of the restoration, conservation, cultural, and aesthetic values is to preserve these objects for future generations. Based on the study of cultural and historical monuments, you can get an idea of the life of the people and their traditions. Throughout the study it is proved that it is useful to use a neutral soap mixture, distilled water, acetone, ammonium hydroxide and other organic solvents to remove dirties and hard stains calcified on the surface of the stone was proven, as well as the success of using Tenax glue (Solido Trasparente (Dense)) for gluing and gathering stone pieces. In the course of the work, an example of the use of polyester resin and calcite marble powder to fill the missing parts of a stone slab and supplies it with a better strength and durability to preserve and protect it as a cultural and civilizational heritage.

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