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Practical Aspects of Conservation of Archaeological Metal Artifacts: A Case Study

Heena Naz[1], Danish Mahmood[2], Nawazish Raza[3]
MSC, Department of Museology, Aligarh Muslim University, Aligarh, India[1]
Assistant Professor, Department of Museology, Aligarh Muslim University, Aligarh, India[2]
Junior Research Fellow, Department of Museology, Aligarh Muslim University, Aligarh, India[3]

Abstract: *The "material culture of a people or age in history" is what archaeology refers to as being established through artifacts. One of a museum's most crucial roles is conservation. Environmental factors can affect how quickly museum items decay. Metal objects are stabilized by using the electrochemical reduction technique, which can even reverse the oxidation process. Despite not being in use, the item has been long neglected and is severely rusted in several parts. For the Samovar's chemical treatment process, 10% sodium hydroxide solution was created. If our artifacts are stored correctly, corrosion and the formation of the patina won't be a problem. A metal object's surface could be lost via excessive cleaning, resulting in an uneven surface. This study would surely be useful to the curators and conservators who work in various museums and deal with metal artifacts.*

Keywords: Metal objects, Conservation, Artifact

I. INTRODUCTION

Conservation and preservation are one of the most essential functions of a museum. Metals and alloys form a significant portion of the museum collection. They are primarily archaeological collections, are exposed to air from the ground, and are found to be corroded primarily. Artifact is likely the most basic and inclusive one used in both contemporary and historical archaeological practice. It is commonly understood to refer to any "thing" produced or altered by human culture. It is the outcome of the fieldwork project. Artifacts establish what archaeology refers to as the "material culture of a people or era in history" when they are examined in conjunction with one another. A patina is a green or brown layer that forms over the surface of bronze or other comparable metals as a result of prolonged oxidation. Noble patina and malignant patina are the two varieties. Corrosion is the degradation or breakdown of metals and alloys caused by chemical or electrochemical processes when they are exposed to an environment.

1.1 Atmospheric Factors Affecting Museum Objects

The environment has virtually little influence on how museum artifacts deteriorate. Light, heat, pollution, sulphur oxides, nitrogen and carbon, ozone, and other substances make up the atmosphere. Moisture in the air is what is referred to as humidity. Scaling occurs when the absorbed salt crystallizes on inorganic objects like metals. Generally speaking, the RH for any kind of museum object should be between 45% and 60%. The many contaminants that pose a threat to museum and archaeological artifacts include oxides of carbon, sulphur, nitrogen, and nitrogen oxide, ozone, salt spray, and various organic gases that have an impact on massive metal artifacts.

1.2 Conservation

Conservation is defined as any action taken to determine the nature of the material used in handling and treatment.

A. Preventive Conservation

Even while an object may occasionally need to be treated, treatment by alone is insufficient to safeguard the collection for the long term. Inevitably, things deteriorate, but it is our job as guardians of material culture to slow this deterioration as much as we can. By enhancing the ecology around collections, preventive conservation aims to lessen harm and deterioration.

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B. Curative Conservation

Aims to stop destructive processes and, where possible, stabilise the status of an object or group of objects against future deterioration. It includes any activities that are directly applied to an object or group of objects.

C. Restoration

When conservation fails to uncover the artefact's original surface, restoration is the next step. It aims to replicate an ancient object's original appearance as precisely as possible and creates an environment in which the artefact can be displayed.

II. CONDITION OF SAMOVAR

It is constructed of fixed components. Brass makes up the pedestal drum and handle while tin makes up the outer chimney. The object has been long neglected and is highly rusted in both places despite not being in use. The tap and brass pedestal both display cuprite that has been deposited in slits. The vessel used to boil the liquid was filthy and covered in numerous dried leaves and bushes.

III. ELECTROCHEMICAL REDUCTION METHOD

The most frequent method used to slow, stabilise, and even reverse the oxidation of the metal is the electrochemical cleaning procedure. It has long been standard procedure in the field of conservation to differentiate between electrochemical and electrolytic cleaning. Without the need of an external electromotive force, an electrochemical reaction is based on the association of two metals occupying distinct locations on the galvanic or electromotive series of the metals.

IV. REVIEW OF LITERATURE

In their investigation, Mereu, M. et al. (2011) came to the conclusion that the object's preservation was being harmed by the constituent materials' state of conservation. It was constructed by layering a number of thin embossed copper alloy sheets. The sheets range in thickness from 0.5 to 1.2 mm. The flask was discovered in pieces during the 1915–1916 Veio cemetery excavations. They currently had two pieces of the flask's sides, a sizable section of the back face covered in gaps, several pieces of the lateral portions, and the neck. All of those components were adhered on a paperboard that was shaped like the original form. The flask's state of conservation was quite precarious. The sheet had many cracks and was mineralized. There was a lot of debris and remnants of the prior renovation on its surface. Additionally, there were distorted areas of the base, which led to the separation of sheeting pieces.

According to Kulkarni, S. J. (2015), corrosion control was essential from a technical, economic, environmental, and aesthetically speaking perspective. The rates of pitting corrosion were considerably higher than the rates of general corrosion. The corrosion rate of mild steel in sulphuric acid media was higher than that of aluminium and copper. Additionally, it was discovered that copper and iron corroded more quickly when oxygen or carbon was present in the aerating air. Galvanizing and other common corrosion control techniques, like as coatings, can be useful. There is potential to reduce the loss caused by corrosion by altering current procedures or substituting new ones, such as the use of green inhibitors.

No perfect coating for indoor brass objects was found among those tested there, according to Heginbotham, A. et al. (2014). None of the evaluated coatings even came close to meeting the visual quality of typically polished brass. Even the most attractive layers typically fall short when it comes to corrosion prevention. The majority of coatings that offer the best corrosion protection lack naturally attractive features.

V. CONSERVATION OF SAMOVAR

5.1 Mechanical Cleaning

With the use of a brush, we first cleaned the Samovar to get rid of all the debris and dust. To get rid of the solid particles stuck to the thing, we also utilised a knife. Finally, use a brush to clear away any leftover dust and grime.

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5.2 Chemical Cleaning

To get rid of any remaining corrosive contaminants, the items treated with chemicals must always be cleaned with distilled water thereafter. Chemicals must be used with caution for removing concretions. It is advised to first remove large concretions before administering basic treatments; often, sodium hydroxide is employed in this procedure.

VI. STEPS UNDERTAKEN

1. Take a container filled with 20 liter of distilled water and heat it to the boiling point using a metallic heating rod. Distilled water takes around 50 to 60 minutes to reach the boiling point. We created a 10% sodium hydroxide solution and added zinc granules to the distilled water that had been heated in order to speed up the reaction.
2. For around 24 hours, we submerged the Samovar in the NaOH solution. We took the item out of the solution after 24 hours and used a metallic brush to wash it under running water. But the piece still had rust and patina on it. For the following 24 hours, we once more immersed the Samovar in the NaOH solution. The Samovar was once more taken out of the solution after 24 hours, and washed in running water with the aid of a metallic brush. Corrosion and patina were totally eliminated at that point.
3. The object was exposed to sunlight to warm and dry.

VII. STABILIZATION OF THE SURFACE

We melted paraffin/bee wax and mustard oil in a 1:1 ratio to appropriately mix them together to create the wax-oil solutionthen we applied a wax layer in front of the heating blower to create a consistent covering that can shield the object against future corrosion caused by ambient moisture. The object's superfluous wax was simply removed.

Fig.1 Tap of Samovar Before Conservation

Fig.2 Tap of Samovar After Conservation

Fig.3 Pedestal of Samovar Before Conservation

Fig.4 Pedestal of Samovar After Conservation

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Fig.5 Handle of Samovar Before Conservation

Fig.6 Handle of Samovar After Conservation

Fig.7 Interior of Pedestal Before Conservation

Fig.8 Interior of Pedestal After Conservation

Fig.9 Samovar Before Conservation

Fig.10 Samovar After Conservation

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VIII. CONCLUSION

We came to the conclusion from our investigation that Samovar must be conserved and preserved. Corrosion and the development of the patina are not an issue if our artifacts are stored properly. Because they weren't put on exhibit in the showcase, the objects we preserved don't store properly. It was exposed, which is why corrosion happened. We preserved the artifact through the electrochemical reduction procedure, although it takes longer because the corrosion layer is so thick. Over-cleaning could cause the metal object's surface to be lost, creating an uneven surface. By maintaining the goods in an environment that isn't overly damp, cold, or hot, corrosion can be prevented. The curators and conservators working in various museums and dealing with metal artifacts would undoubtedly benefit from this study.

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