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The Significance and Functionality of the Conservation Science Institute of Cultural Heritage in South Korea

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Abstract

Conservation science, as a multidisciplinary field, encompasses various activities such as conditioning, analysis, conservation processing, environmental monitoring and materials research. Of particular significance is the conservation science room which assumes a central role within museum settings and facilitates the preservation and safeguarding of diverse cultural collections. The purpose of this paper is to explore the pivotal role of the Conservation Science Institute of Cultural Heritage in the preservation and scientific study of cultural assets with a specific focus on preventing damage. By investigating the background, developmental trajectory, distinguishing characteristics and objectives of the Korean Cultural Heritage Conservation Science Room, this paper provides a comprehensive analysis of the methodologies employed in cultural heritage conservation science and presents valuable insights into effective preservation strategies that uphold the integrity of the original cultural heritage.

Keyword : Conservation Science, Cultural Heritage, Conservation Science Room, Cultural Heritage Preservation

1. Introduction

Conservation science as an academic field originated from the analysis of ancient Greek and Roman currency and underwent further advancements by the German chemist M. H. Klaproth during the late 18th century. Its significance is evident in the establishment of dedicated conservation science departments in European and American museums during the late 19th and early 20th centuries. These departments were primarily created to scientifically protect cultural heritage. In similar way, a series of noteworthy archaeological discoveries led to the exploration of numerous cultural heritage sites in South Korea, starting with the Seokguram conservation investigation in 1958 followed by the excavation of King Muryeong's tomb in 1973, and Shinan underwater relics in 1976. In response to these historical events and the increasing recognition of the crucial importance of conserving cultural heritage, the Conservation Science Department was established in 1969 within the National Research Institute of Cultural Heritage under the auspices of the Cultural Heritage Administration. To further strengthen this institutional framework, the Conservation Science Division was introduced within the same organization

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in 1975. At present, the field of conservation science is undergoing gradual expansion and attracting qualified experts to actively engage in its endeavors.

Some research has been conducted to assess the conservation strategies or any influence in conservation in South Korea [1][2]. Chung et al. emphasizes the even distribution of cultural ecosystem services throughout South Korea's coastal areas and suggests that decision-makers can leverage these services to improve conditions in coastal wetlands outside of protected areas [1]. More focus on the conservation technologies or system has been studies [3][4]. However, conservation science represents a systematic framework grounded in scientific inquiry and conservation strategies with the primary aim of safeguarding cultural heritage against deterioration. Thus, the domain of conservation science activities is congruent with the responsibilities undertaken by the Conservation Science Division. In addition, it encompasses diverse undertakings such as condition assessments, analytical investigations, preservation interventions, environmental and material research and related pursuits. This specialized division assumes a central role in advancing the overarching objectives of the broader conservation science discipline by directly engaging in the conservation and treatment of endangered cultural heritage.

In this regard, the paper critically examines the historical foundations, evolutionary trajectory, distinctive attributes and overarching objectives of our Cultural Heritage Conservation Science Division. Furthermore, it conducts a comprehensive analysis of the methodologies employed in the field of cultural heritage conservation science. In this paper, an innovative approach is proposed to the preservation of cultural heritage with a specific emphasis on conserving its intrinsic authenticity.

2. Cultural Heritage Conservation Division in South Korea

The primary purpose of the Conservation Science Division is to safeguard and conserve cultural heritage through the establishment and maintenance of optimal environmental conditions. This endeavor involves creating an environment conducive to the permanent preservation of cultural heritage collections. Moreover, the division engages in continuous investigation and research to enhance these environmental conditions, thereby proactively proposing improvement measures when deemed necessary. Also, the division directs its efforts towards the advancement of safer and more efficient treatment methodologies and materials. Considering the extensive array of traditional technologies employed in the preservation of cultural heritage, including textile production, hardwood furniture, and lacquerware adorned with mother-of-pearl, it becomes imperative to acquire a comprehensive understanding of these traditional materials. Consequently, rigorous investigations are undertaken to discern the inherent advantages and

disadvantages associated with such materials, ultimately leading to the development and application of superior alternatives.

According to the International Council of Museums (ICOM) operating under the auspices of UNESCO, cultural heritage conservation encompasses a broad spectrum of measures aimed at prolonging the lifespan of cultural heritage. In this context, the Conservation Science Division assumes a pivotal role by encompassing both preventive conservation which centers on the creation of appropriate conservation environments as well as direct conservation treatments. The maintenance of an adequate conservation environment for cultural heritage necessitates conducting comprehensive examinations of the materials employed and the facilities utilized. Furthermore, it involves a thorough investigation of external factors that have the potential to impact cultural heritage including temperature, humidity, light, air pollutants, insects, molds and other relevant parameters. The complexity inherent in this examination process underscores its significance in guaranteeing the preservation and enduring legacy of cultural heritage.

3. Conservation of Relics in Cultural Heritage Conservation Science Division

Cultural heritage constitutes a wide spectrum of materials and manifestations, spanning diverse categories including metal, stone, earthenware, ceramics, painting, paper and timber. The incorporation of each material imparts unique attributes to the cultural heritage objects, demanding a comprehensive comprehension of their intrinsic properties and behavior [5][6]. Consequently, the identification of foundational materials constituting cultural heritage, the exploration of the techniques employed in their creation and the application of suitable conservation methodologies all assume utmost significance in the effective governance of cultural heritage as shown in [Fig. 1].

[Fig. 1] Cultural Heritage Restoration Process

3.1 Conservation Method and Scientific Investigation of Cultural Heritage

Preservation treatment is a crucial process aimed at safeguarding cultural heritage from damage and stabilizing its vulnerable condition [7]. The sequential steps involved in preservation treatment encompass several key procedures:

① Investigation of condition before preservation treatment: This initial step involves assessing the extent of damage and identifying the materials comprising the vulnerable parts of the cultural heritage. Various methods such as visual inspection, on-site surveys, photography, radiation irradiation, infrared and ultraviolet irradiation and component analysis are employed to evaluate the condition of the cultural heritage.

② Removal of foreign material: Foreign materials, although unrelated to the cultural heritage, can significantly impact its integrity. Mechanical techniques like ultrasonic cleaning and scalpel usage as well as chemical dissolution or bleaching are utilized to eliminate these materials. Historical significance or the absence of potential harm may warrant the retention of certain foreign materials. However, in cases where damage could occur, they are separated and stored separately.

③ Stabilizing treatment: This treatment addresses continuous corrosion or damage caused by materials present within the cultural heritage. A commonly employed approach involves immersing the cultural heritage in a solution to extract factors contributing to corrosion.

④ Strengthening treatment: The objective of this treatment is to enhance the structural integrity of vulnerable cultural heritage by employing additional materials. Synthetic resins are commonly utilized for metals and ceramics while layering techniques are employed for written and painted artifacts, textiles and similar items.

⑤ Adhesion and restoration: Adhesion refers to the reattachment of separated parts of the cultural heritage using appropriate adhesives. Preference is given to adhesives that are removable and less durable than the cultural heritage itself. The selection of specific adhesives depends on the material of the cultural heritage including synthetic adhesives, glue, fish glue or starch. Restoration involves filling in missing or damaged parts restricted to cases where the original form can be inferred.

⑥ Finishing: Colored pigments are applied to areas where adhesion or restoration has taken place to match the original appearance of the cultural heritage. From a distance, these colored areas may appear similar to the original cultural heritage. However, close inspection reveals noticeable distinctions.

Following preservation treatment, meticulous documentation of the entire process and the materials employed is crucial on a preservation treatment card. These records serve as primary reference data for future condition assessments or instances where preservation treatment needs to be repeated, thereby warranting their careful management as research materials.

Contemporary preservation methods heavily rely on scientific investigations and highlight the vital role of scientific material analysis. Various non-destructive analysis techniques, such as X-ray fluorescence analysis, X-ray diffraction analysis, scanning electron microscopy and X-ray imaging systems are applied to excavated relics. In addition, medical imaging devices such as X-CT have found successful application in cultural heritage studies. Given the variation in analysis methods depending on the material, uniform classification of the employed equipment poses a challenge. Nevertheless, commonly used analysis tools for cultural heritage can be categorized as follows:

① Shape observation: optical microscopy, scanning electron microscopy and transmission electron microscopy.

② Component and material analysis: x-ray fluorescence analysis, X-ray diffraction analysis, energy-dispersive spectroscopy, electron backscatter diffraction and Raman spectroscopy.

③ Origin determination and dating: lead isotope ratio analysis, carbon isotope ratio analysis, thermoluminescence analysis, dendrochronology and related techniques.

④ Organic matter analysis: infrared spectroscopic analysis, fatty acid analysis, DNA analysis and similar approaches.

3.2 Conservation Treatment Norm and Preservation Environment

In the realm of cultural heritage preservation, there exist specific practices, ethics and norms that must be diligently upheld during repair and restoration processes. The ethical standards pertaining to the conservation of cultural heritage demand particularly stringent adherence [8]. Given the relatively short history of cultural heritage conservation in South Korea, we do not have separate regulations in place, and instead we follow the ethical standards prescribed by international organizations and academic associations. The following are some common conservation treatment rules for cultural heritage:

① Thoroughly document conservation endeavors by recording comprehensive information on the initial state of the cultural heritage, the employed treatment methodologies, pertinent historical context, and the materials used.

② Avoid making arbitrary modifications or alterations to the original form of the cultural heritage, as well as refrain from removing any constituent elements.

③ Restrict conservation treatments to the extent justified by the specific needs of the cultural heritage.

④ As a general principle, preserve the original shape of the cultural heritage to the extent that its aesthetic and historical characteristics remain intact.

⑤ When evaluating a conservator's work, place greater emphasis on the applied methods and their execution, rather than solely on the objects under treatment.

⑥ While the quantity of cultural heritage entrusted to a conservator may diminish over time, the quality of treatment should continuously improve.

⑦ Conservators are expected to embrace transparency by openly sharing their treatment methodologies and all pertinent research findings to foster collaboration and knowledge exchange among fellow conservation practitioners

Adherence to these conservation treatment rules infuses new life and vitality into cultural heritage. Moreover, the conservation environment encompassing artifacts constitutes one of the various approaches employed in cultural heritage preservation, actively shielding them from detrimental external influences. Environmental factors encompass temperature, humidity, light and harmful gases. To ensure accurate monitoring and management of these factors, devices such as hygrothermographs, illuminometers and gas indicators are employed to record prevailing conditions.

[Table 1] Temperature and humidity standard by material

Material of Artifact	Temperature	Moisture	Illumination	Amount of UV rays
Metal and Stone	20±2℃	45% or under	1500~750lux	
Ceramics and Glasses	20±2℃	45% or under	300lux	
Woods and Papers	20±2℃	55~65%	750~300lux	10㎼/㎡
Oil Painting	20±2℃	50~55%	150lux or under	10㎼/㎡
Dyed Products (including engraving)	20±2℃	55~65%	80lux or under	10㎼/㎡
Oriental Painting and Water Color Painting	20±2℃	55~65%	100lux or under	10㎼/㎡
Natural Material such as Leather, etc.	20±2℃	55~65%	100lux or under	10㎼/㎡
Films				
-Black-and-white Film	10℃ or under	30% or under	150lux or under	10㎼/㎡
-Color Film	2℃ or under	30% or under	150lux or under	10㎼/㎡

First, to achieve the desired environmental conditions, adjustments are made to temperature, humidity,

illumination and ventilation, guided by a comparison between recorded values and recommended reference values. Second, biological factors including mold and harmful insects play a significant role as well. Regular inspections and the use of insect monitoring traps aid in detecting and monitoring these biological agents. If any harmful elements be identified, appropriate measures such as fumigation are implemented to eradicate them. Third, different materials are employed for storage and exhibition purposes. Prior to their usage in exhibitions, materials undergo the Oddy test to assess their potential impact on the cultural heritage.

The conservation environment delineated above constitutes a crucial component of long-term cultural heritage preservation and must not be overlooked under any circumstances. The blow [Table 1] describes the regulations or standards in terms of temperature and humidity by material.

4. Discussion

Adherence to the conservation treatment rules serves as a catalyst for revitalizing cultural heritage, instilling it with renewed vibrancy and vitality. In light of this, it becomes imperative to introduce measures for enhancing conservation treatments. Nevertheless, the establishment and maintenance of an optimal environment for cultural heritage within museum settings necessitate substantial financial investments with the outcomes not readily perceptible, potentially engendering a perception of inefficacy [9].

Nonetheless, the creation of an environment conducive to the preservation of cultural heritage represents a commendable approach towards safeguarding their original condition and fostering their enduring appreciation [10][11]. Furthermore, for museums harboring extensive collections of artifacts, the establishment of such an environment assumes a foundational role in facilitating the proper storage of cultural heritage. Consequently, there exists an urgent imperative to implement diverse systems aimed at constructing an appropriate environment to ensure the preservation of cultural heritage. A paradigm shift is required in the mindset of individuals engaged in the custodianship of cultural heritage.

In addition, cultural heritage is often of global significance and its conservation can benefit from international cooperation. This can include sharing of resources and expertise as well as coordination of efforts to protect cultural heritage sites that cross national boundaries. For instance, Japan provides financial support to UNESCO for capacity-building projects related to cultural heritage preservation. It offers training programs and scholarships to professionals from developing countries and enables them to acquire knowledge and skills in heritage management and conservation. This collaboration aims to

strengthen global expertise and promote cultural exchange [12]. This partnership highlights Japan's commitment to preserving its own cultural heritage while actively contributing to the global efforts of safeguarding and promoting cultural diversity.

The involvement of local communities in conservation efforts can be a critical factor in their success. When local people are involved in and benefit from conservation, they are more likely to support these efforts [13]. This can also help to ensure that conservation efforts are sensitive to local cultural practices and beliefs. In particular, social media provides a platform for wider stakeholder participation in cultural heritage decision-making and should be widely utilized to engage citizens worldwide [14]. One successful example of cultural heritage conservation through social media is the 'Save Our Sounds' campaign by the British Library in the United Kingdom as shown in [Fig. 2]. The campaign utilized social networking sites (SNS) such as Twitter, Facebook, and YouTube to engage the public and raise awareness about the importance of preserving the world's endangered sounds.

[Fig. 2] British Library's programme called Save Our Sounds

5. Conclusion

In conclusion, the Conservation Science Institute of Cultural Heritage in South Korea plays a pivotal role in the preservation and scientific study of cultural assets to ensure their longevity and preventing damage. Despite requiring substantial financial investments, the establishment and maintenance of an optimal environment for cultural heritage within museum settings is crucial for safeguarding the original condition of these assets and fostering their enduring appreciation. The need for a paradigm shift in the mindset of individuals engaged in the custodianship of cultural heritage is also emphasized. In essence, the preservation of cultural heritage requires a multifaceted approach that combines scientific study, optimal environmental conditions, international cooperation, local community involvement and innovative

engagement strategies. These elements, when effectively integrated, can ensure the effective preservation of cultural heritage and uphold its integrity and promoting its enduring appreciation.

This paper undertakes an examination of the prevailing conservation treatment rules and environmental practices employed in the management of cultural heritage in South Korea. In addition, it suggests several factors to reconsider form making better conservation policies or strategies by exemplifying the international successful cases. It thus assumes this study expects to provide a basis for future research endeavors in the realm of cultural heritage preservation.

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