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AN INVESTIGATION OF ARTWORKS CONSISTING OF WOOD MATERIAL AND EVALUATION OF THE INVENTORY INFORMATION

Göksel Ulay[1], *Mustafa Yıldırım*[1]

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Abstract

Wood, due to its superior properties, has been influenced by cultural and technological developments throughout human history and has found a place in people's life. When the valuable works of art that have been revealed throughout history are examined, it is seen that wood materials are used in many wood products that have survived to the present day. The purpose of this study is to reveal the process of defining the properties of wood artworks and the evaluation of inventory information. In the study, descriptive information about the wooden artworks in the current academic literature and inventory records in the museums where the works are studied were examined. Whether the information given about wooden artworks is based on scientific evidence and data of the works will be discussed. The use of scientific and evidence-based methods in the process of producing reliable information of the works will be discussed. As a result, it is thought that the real values of artworks will be understood and, identification by revealing the properties of wooden artworks with correct and reliable methods and techniques. This process requires interdisciplinary work and collaboration of experts. In this way, it can contribute to providing reliable information to the public who are interested in wooden artworks.

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Corresponding Author

Göksel Ulay
gokselulay@gmail.com

[1] Van Yuzuncu Yil University, Van Vocational School, Dept. of Furniture and Decoration, Van, Turkey

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Göksel Ulay
gokselulay@gmail.com
ORCID : 0000-0003-4080-8816

Mustafa Yıldırım
mustafayildirim@yyu.edu.tr
ORCID : 0000-0002-1436-6359

1. Introduction

One of the most valuable resources that nature offers us is wood material. Due to its characteristics, it has found an important place in people's lives by being affected by cultural and technological developments throughout history (Sanivar, 1978).

Wood, which has been used in the construction of movable or immovable works from ancient times to the present, has been used extensively in many areas due to its ease of processing, its easy and abundant growth due to the climate in some regions. In the formation of the way of society's lives, their beliefs, as well as the environmental conditions they live in, have been determinant. Studies have shown that the societies that use wood materials have taken the tradition and technique of using wood with them in every region they go (Oney,1970).

In the historical process, it is known that the number of wooden artifacts used is quite high. However, the number of cultural assets made of wooden material that can survive today is less than expected. There are two important reasons for this situation. Firstly, wood is the material that is mostly affected by external factors such as climate conditions, harmful microorganisms and moisture, and sometimes by disasters such as a fire. Secondly, the destruction caused by the people damages, sometimes deliberately or unintentionally, and the aging caused by the use of the material from the destruction of wooden artifacts, which have an important place in the cultural heritage (Bozer, 2006).

Artworks made of wood material, which have a long history and a very rich variety of species, are the most valuable documents of cultural existence. Cultural assets created by humanity throughout the ages are constantly transferred to the future in development and change. These products, which were initially made with simple tools to meet human needs, gradually became an art (Arikan, 2009).

Some of the wooden works of art are collected, preserved, and exhibited in museums today. Some valuable wooden works are kept in warehouses according to the classical museology understanding for location, but even though they are kept in warehouses, wooden works are damaged by microorganisms and moisture, and they cannot survive for a long time. Many of the works that are not preserved in museums do not reach today in their original form. The wooden artifacts in the warehouses of the museums should be preserved with contemporary museology methods, their restorations should be done faithfully, and the necessary definitions about the work should be made in detail during the inventory records of the works (Altunbas and Ozdemir, 2012).

This study aims to reveal the identification method based on current and scientific evidence by addressing the methods of defining the type and species characteristics of wood material and the process of evaluating inventory information.

1.1. Definition of wood

The root of the word wood is originated from the plural word of hasebi (khashabiin) in Arabic. It also means "building material, timber cut from the tree to use it in a random production" (Web-1, 2020). It is a natural material formed by gathering the cells that look like wooden thin tubes. Since wood is a material taken from a living organism, its structure and chemical components constitute the properties of the material. Due to its organic structure, defects such as splitting, distortion, and cracking may occur. It is very difficult to examine and define the appearance properties of wood. Physical strength increases in direct proportion to the density of the wood. When the wood material is cut, not all pores die and the material does not lose its water immediately. As the water decreases over time, its volume also shrinks; However, when the dried wood material absorbs moisture again, its volume expands and swells. The deformation of wood with these events is called the work of wood material (swelling and shrink). This change in size is not the same all over the wood material but also varies according to the type of the tree. Therefore, some precautions are taken to eliminate the possible drawbacks that may arise as a result of the work of the wood material. The most important of these measures is to use natural or unnaturally dried wood materials (Hasol, 1997).

1.2. Wooden Artworks Description

Artworks are valuable artifacts that emerged as a result of creativity and mastery (Web-2, 2020). Wooden works have an important place in people's lives in every period. When looking back to the historical process, people have used wood in architecture and household goods, based on needs (Ozen, 1985). The decoration together led to the emergence of the concept of wooden artwork. The data obtained from the excavations show that the art of wood decoration on portable objects has advanced. For example; tables and horse harnesses belonging to Asian funnels excavated in Pazirik and Noin Ula excavations can be given (Ersoy, 1993).

1.3. The Use of Wooden Materials in Artworks Production

Wood has been one of the most widely used materials in human history for the production of artworks (Altun, 2020). The characterization of wood as a work of art is not only related to its usability quality but also its natural aesthetic features such as brightness, color, texture, line (Ors and Keskin, 2008). The structural properties of wood, which is the most important raw material with renewable resources in the world, has enabled it to be used as a versatile material. (Erdin and Bozkurt, 2013).

Mankind has made many items that he uses daily from wooden materials and started to use them for decoration purposes in time. The first examples of wooden decorations that form the expression of different cultures are seen in Central Asia. Since prehistoric times, wood has been a material that shows the continuity of use with its durability, warmth, and texture. Especially the pulpit, mihrab, lectern, sermon lectern, sarcophagus, courtship guard, jewelry box, balustrades, and wood depending on the architecture; it was used in door-window wings, ceiling hubs, columns, and column heads. Wooden artworks, which we come across with various examples, have spectacular examples that reflect the general temperament of the period. To make wooden artworks long-lasting, fiber-free, and hard-textured wood types were generally preferred and different methods were applied to them (Bozer, 2006). Walnut, oak, ebony, cedar, pine, rose, apple, and pear trees were used as wood species (Oney, 1970).

2. Materials and Methods

In the study, descriptive information about wooden works of art in the current academic literature and the inventory records of the museums were examined. The issue of whether the information given about wooden works of art is based on scientific evidence and data was discussed. While recording the wooden works of art in the inventory, it was examined whether the identification methods of the material were made by scientific methods (Figure 1.).

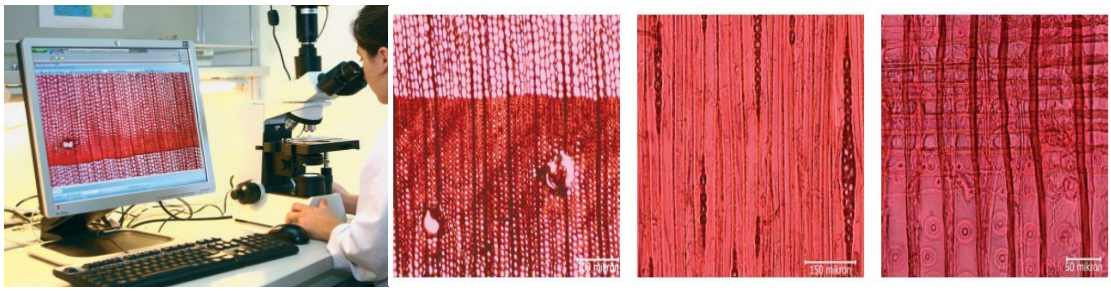

Figure 1: Microscopic examination sections of wood material (Web-5, 2020).

Evaluations were made by presenting the current analysis methods: HLPC (High-Performance Liquid Chromatography) and Figure 2. SEM-EDS (Scanning Electron Microscope and Energy Dispersion X-Ray Diffraction) and the methods used were discussed.

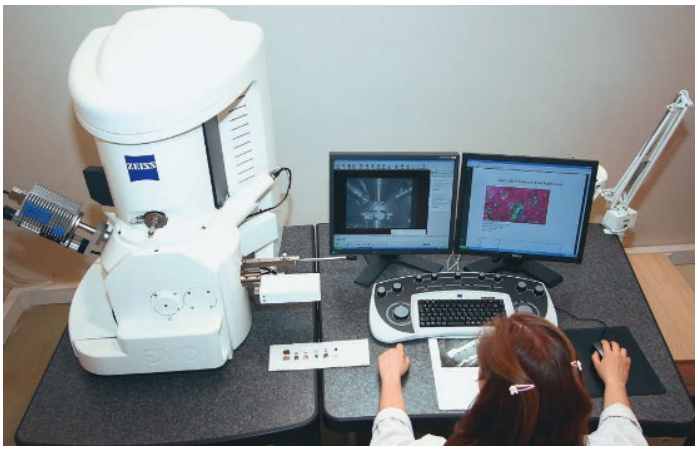

Figure 2: SEM examination sections of wood material (Web-5, 2020).

3. Result and Discussions

In this section, the methods currently used in the identification process of works of art made of wood material have been investigated. The inventory information of the studied artworks in the Turkish literature and the methods used in the creation of these documents are given below.

3.1. The Process of Including Wooden Art Works in the Inventory

Wood has been one of the main materials preferred in daily use and artistic activities throughout the history of humanity in terms of its easy processing, warmth, durability, and aesthetic properties. In the period when wooden works are produced, depending on where they are used by their intended use, when they lose their function, as a movable cultural asset; It can be found in different environmental conditions as a museum display, warehouse or as a building element in architecture (Eskici and Arikan, 2019).

It is a monumental and materials in civil architectural buildings, quality, and content, originality, problems and problem cause KUDEB, which was established to diagnose, provide services throughout in Turkey. The process, which starts with the application made to the KUDEB laboratory for the identification of the wooden work, ends with the sampling within the scope of planning, the preparation of the samples taken and the planning of the necessary analyzes, the analysis and finally the reporting of the results of the relevant analyzes (Web-5, 2020). The workflow is arranged according to the material, and it consists of the stages in Figure 3.

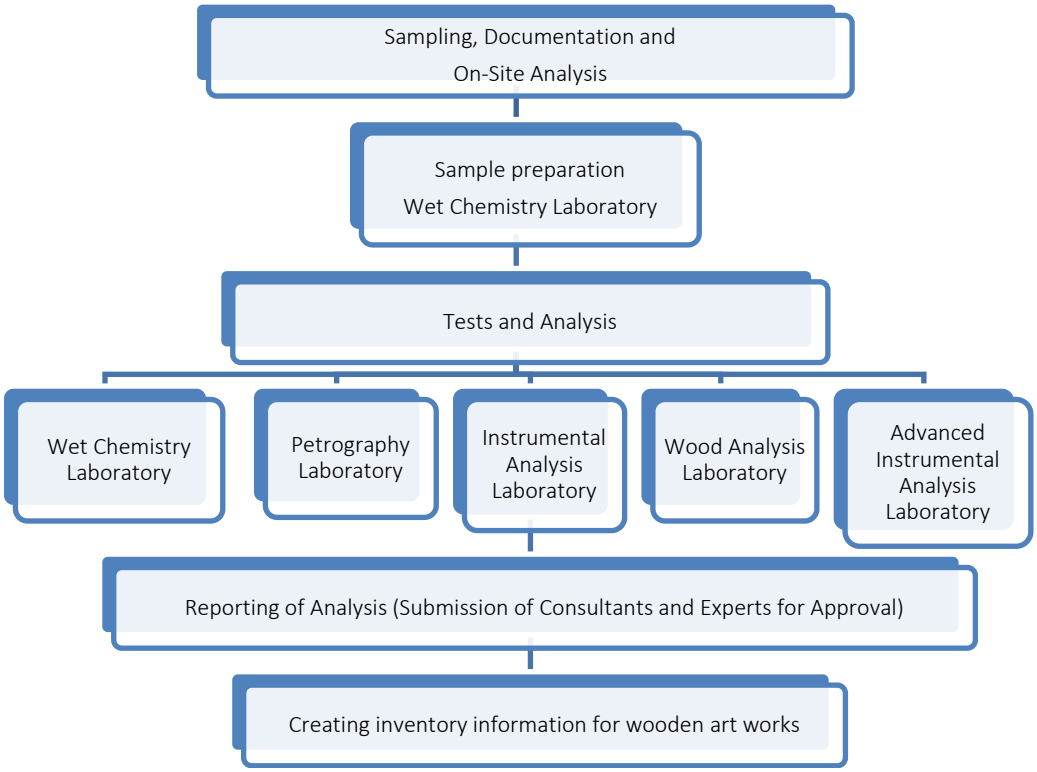

Figure 3: The process of defining the material of a wooden work of art. (Web-5, 2020).

It is aimed to investigate the history of wooden works, which are an element of our culture, and to examine their place and importance in Anatolian geography with scientific research, and present them for the benefit of the scientific world and society. For this purpose, taking the inventory of the works kept in museums and warehouses for many years, analyzing them, and adding them to our culture and society is a responsibility of societies against human history (Yildirim, 2019).

3.2. Classical Methods Used in Creating Inventory Information

It is understood that the wooden works of art brought to the classical museum's function to be collected and preserved in warehouses. In the classical museums, which have the function of preservation, the creation of the inventory information of the wooden artifacts in the warehouses that make up the kitchen of the exhibition areas is done through observation, which is a classical method. For example; In the Inventory Book of the Konya Ince Minaret Stone and Wooden Works Museum (Inventory No: 8, 144, 149, 151, 152, 153, 157, 260), it was written that the material from which the works were made was wood or wood, and the technical characteristics of the material were not included. The type of wood material cannot always be determined by observation. For the wooden artifacts in Sanliurfa Museum (Inventory No: 235, 236, 238, 239, 672, 799, 800, 801, 802, 985, 986, 1135, 1136, 1169, 1322, 1323, 2341, 2342, 2416, 2585) it was stated as the material of which it was made determined by observation (Erdemir 2015; Yildirim, 2019) defined it as Inventory No: 3217 Material of the Work: White Tree (Erdemir, 2015).

Registered in the inventory book of the Turkish Islamic Arts Museum (Inventory No: 3, 5, 6, 10, 12, 74, 78, 116, 127, 130, 145, 147, 191, 195, 196A, 196B, 197,198, 199, 208, 244, 246, 247) defining the raw materials of the works (Uysal, 1991; Bozer 1992; Disoren 1993; Ozkul 2001; Unludil, 2005; Bayrakal 2007; Agyar 2007; Arikan 2009; Pamuk 2010; Taskan 2011; Kurttap 2015; Aktug 2016; Kosif 2017; Akinay 2019; Katildi 2019) and in the determination of material type in studies it has been determined that the traditional method of observation is used. In the inventory document of the wooden work no 1322 given in Figure 4, only pine, walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done. In the inventory document of the wooden work number 1169 given in Figure 5, only the walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done.

Figure 4: Inventory number 1322 (Yildirim, 2019).

Figure 5: Inventory number 1169 (Yildirim, 2019).

In the inventory document of the wooden work number 145 and 244 given in Figures 6 and 7, only the walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done.

Figure 6: Inventory number 145 (Akinay, 2019).

Figure 7: Inventory number 244 (Akinay, 2019).

Kandemir (2010), although the results of the applications vary according to the individual, it does not provide a completely objective evaluation, it is still a method used to provide preliminary information about the material (Kandemir, 2010).

In the inventory document of the wooden works number 119 and 139 given in Figures 8 and 9, only the walnut information about the material is included. Because it is thought that a single type of wood material is not used even when a surface evaluation is made by observation.

Figure 8: Inventory number 119 (Katildi, 2019).

Figure 9. Inventory number 139 (Katildi, 2019).

Kurtisoglu (2015) in his evaluation regarding the material in his study; "it is stated in the sources that it is made of ebony wood, but it is seen that it is a tree species that is lighter than the worn surfaces". he reported (Kurtisoglu, 2015).

It is one of the oldest methods to determine the type and classification of the material without damaging the work. However, the visual evaluation is completely subjective and is evaluated by the analyzer (Icel and Beram, 2016). It has been determined that the descriptions of the type of material from which the works are made are entirely made by observation in all the studies subject to the study. In definitions where traditional methods are used, it is considered that erroneous determinations can be made depending on the knowledge and experience of the person.

3.3. Examination Detection and Documentation Methods

Tree type diagnosis in wooden materials or objects is of great importance in terms of art history. In this context, determining the type of wood used in the production of wooden works that are of interest in art history can explain many issues. The period to which the work belongs, where it was produced, whether it is original, whether it underwent any repairs is very important in terms of art history. Modern methods are used to determine the type of materials that have become antiquities of wooden works that have reached today in laboratories, handicrafts, and architecture.

The academic literature in Turkey; Ph.D. and master thesis, leaflets, catalogs, and books defining the details of the woodworks of art in the inventory information of the works belonging to the museum have been identified which assessed through observation of the conventional method. But some experts have reported that traditional methods are subjective and may differ depending on the person (Icel and Beram, 2016).

The material to be tested or in the group of materials to represent the whole sample needs to be taken. Destructive traditional methods require specific laboratory infrastructure and equipment to perform tests. These methods are also possible to evaluate the material on site does not provide. The disadvantages of traditional destructive testing methods have led to the development of alternative methods, which is a

new method Non-Destructive Testing, the material its integrity and availability in any way defects on the surface and internal structure without damaging and It is defined as determining the status (Icel and Beram, 2016). Development of non-destructive methods, scientifically elasticity in the 20th century and with the development of instrumentation methods in measuring wood properties (Bucur, 2003).

The material type can be determined by preparing transversal, radial, and tangential sections (Figure 1.) and examining them under a polarizing microscope to determine the material type of the samples that can be taken. The analysis of valuable decorative materials, which cannot be taken as a sample in terms of quantity and quality, is only made visually. However, definitions made only by examining physical properties visually may not always give reliable results. HLPC (High-Performance Liquid Chromatography) and SEM-EDS (Scanning Electron Microscope and Energy Dispersion X-Ray Diffraction) analyzes are used in the laboratory environment of wood material (Gulec, 2014; Web-3 2020; Web-4 2020).

Macroscopic structure of the material by analyzing the wood material; Information about anatomical features such as annual rings, self-rays, traces, and physical properties such as color, brightness, and smell are obtained using a stereomicroscope. In the Microscopic Analysis performed under the microscope; the material type of the wooden material can be determined using a polarizing microscope and electron microscope.

Species identification is performed by microscopic examination of the cell order and sequence of wood samples. Identifying the type of wood used in wood materials and determining the reason for biological and physical deterioration caused by insects, fungi, or external factors in its structures by macroscopic and microscopic methods and determines the cleaning and treatment methods. In the Wood Laboratory of the KUDEB institution in the Istanbul metropolitan municipality (IBB), the type of wood material, its preservation status, the degree of deterioration, and protection methods are determined using up-to-date methods. (Web-5, 2020). The tests performed for wood material within the KUDEB laboratory are given in Table 1. Erdem (2007) researched the effects of the "university-industry cooperation, which was conducted in the field of science and technology, on the administrative and financial autonomy and academic freedom of universities.

Table.1: Tests and Analysis Applied to Wooden Building Materials (Web-5, 2020).

<table>
<tr><th colspan="3">Analysis of wood material</th></tr>
<tr><th>Analyzes</th><th>Purpose</th><th>Analyzes and Devices</th></tr>
<tr><td>Physicmechanics</td><td>Physical of wood specimens such as porosity, water absorption, density; It is the determination of mechanical properties such as adhesion, compression, tensile, and bending strength.</td><td>• Universal Test Device
• Adherence Device
• Non-Destructive Testing Device</td></tr>
<tr><td>Chemical</td><td>If it is in the sample, paint, etc. determination of the type and chemical properties of the coating layers.

It is the determination of materials and binders if impregnated.</td><td>• Spot Tests
• Thin Layer Chromatography
• HPLC
• SEM - EDX</td></tr>
<tr><td>Microscopic</td><td>It is the determination of the species and species by examining the anatomical structure of the wood material and the determination of any deterioration.

It is to determine the cause of biological deterioration in wood, cleaning, and treatment methods.</td><td>• Texture analysis
• Stratigraphy (layer) analysis
• Thin Section Preparation Set or Microtome
• Biological Microscope
• Stereo Microscope
• Polarizing Microscope
• SEM</td></tr>
<tr><td colspan="3">All analyzes are made by the experts of the relevant discipline.</td></tr>
</table>

The determination of the type of wood material is done in two stages as macroscopic and microscopic. Macroscopic structure, anatomical features such as annual rings, core rays, traches, which are diagnosed using a stereo microscope, and physical properties such as color, brightness and smell are obtained from the relevant institutions, and inventory information is created based on evidence.

4. Conclusion

Wood art wood species just by visual assessment of the work done in Turkey for nearly all the works done and it was determined that breed identification. Scientific methods and techniques should now be used by determining new approaches in the definition of wooden works of art. In the creation of inventory documents of artifacts in museums, to determine the technological properties of wood materials, they should be examined in detail in the relevant laboratories of universities and research centers, and precise information should be presented by experts with reports according to the evidence and test results. Inventory documents, based on observations made alone, may cause erroneous determinations and may not be sufficient to reflect the true value of the wooden artworks.

Descriptive information about wooden materials belonging to works of art should be created and recorded as a result of tests and analysis with modern test equipment (Table 1). It is considered appropriate to reveal accurate information about artworks passed down from generation to generation, with the cooperation of art historians and woodworking material engineers, and other relevant experts with a multidisciplinary approach.

Besides, there are art historians, architects, restorers, archaeologists, etc., who will examine and study artworks related to wood materials. It is recommended that experts take specialized courses in wood materials science.

As a result, the advancement of science and technology enables to reveal reliable data with modern analysis and test methods in material identification. The possibilities recognized by these methods, known as non-destructive testing methods, should be used to the fullest, and scientific methods and techniques should now replace traditional methods.

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Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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