

Altarpieces Constructive Systems and Material Characterization, SC, Brazil

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ABSTRACT: In the preservation of the cultural heritage, the systematic study of the historical and constructive aspects is essential for their comprehension and perpetuation to future generations. This paper intends to identify the structural wooden system of some selected altarpieces, considered the ornamental structure located in the altars posterior part. High-altarpieces pertaining to the churches of Nossa Senhora das Necessidades and of Nossa Senhora da Lapa, located in the city of Florianopolis, in the State of Santa Catarina, Brazil, have been selected. The methods applied are bibliographical survey and characterization of the altarpieces constitutive materials. From the results obtained, the identification of different structural systems applied in both case studied, as well as the wood species used, allows to recognize and to consider that the region has had its own system of execution of altarpieces in comparison to the know techniques. The results of this research aided to recognize their original system alterations.

1 ALTARPIECE AND PRESERVATION

The cultural heritage is composed by form and matter, of organic and inorganic origin, and liable to be decayed. Thus, for their preservation, the systematic study of the historical and constitutive aspects is fundamental, together with the study of the causes of degradation and the existing defects, enabling their comprehension and consequent perpetuating for future generations.

According to Ávila et al. (1996) the altarpieces are considered the ornamental structure located in the altar posterior part. They are characterized as property integrated to religious architecture with aesthetics and didactic functions. Their structure is composed by a set of interconnected components, among which there are the structural framework and the polychromatic carving cut.

It is necessary to have knowledge and comprehension of specific particularities of altarpieces including constructive materials and techniques, and causes of their degradation. This, in order to be able to implant a database that will enable the connection of the altarpiece data with the information about the site where it is placed allowing an improvement in the management of a conservation plan. Souza (1996) considers of a great importance the knowledge of technique and materials utilized in the construction of cultural heritage. This affirmation is based on the idea that having information is a starting point to characterize the evolution of the object production technology. The data associated to the study of degradation causes would aid the adoption of steps to keep permanence and authenticity of cultural heritage.

Degradation of the altarpiece may be associated to lack of maintenance, weathering or inadequate interventions. Feilden (1994) declares that negligence and ignorance are possibly the main causes of heritage destruction provoked by man, besides vandalism and fire.

The good performance of the roofs, by maintaining the collection and destination of pluvial waters working perfectly, and the replacement of damaged tiles, is emphasized as it favors the conservation of the building, of its integrated property, and of other goods existing in the inte-

rior of the construction. We consider that every site is significant to the conservation state of the object, and that strategic actions should be developed in order to lessen its decline, among which we point out periodic monitoring and maintenance, that should count on the community collaboration.

2 ALTARPIECES' CONSTRUCTIVE SYSTEMS

2.1 *Transformations in the altarpiece constructive systems*

Historical, ideological and religious events have influenced the transformations occurred in the altarpiece constructive systems along the centuries, and have produced systems innovations. Thus, the altarpiece constructive system has been modified from simple panels with painting that represent a narrative sequence during the Middle Age, to elaborate golden and polychromatic carving, with three-dimensional effect during the Renaissance, presenting baroque and rococo styles as a consequence.

As artwork, the result obtained along the centuries is a result of the wish of obtaining long lasting quality works, guaranteed by the artisan's ability and knowledge about material use and techniques. For Uzielli (1998) among those ancient manuals on artistic techniques, one of the most valuable is considered to be the one written by Cennino d'Andrea Cennini, in his book *Il libro dell'art*, written in the XV century, which contains detailed information and recommendations about the necessary care regarding the use of wood and the preparation of the layers applied on the base. It is important to emphasize that during creation, the technique and material choice are many times associated to chronological and geographical aspects.

The recognition of altarpieces' constructive systems presupposes an analysis of material composition, a study of anchorage systems, support structure, reinforcement elements, connection pieces and polychrome techniques applied to. In this paper the structural system identified in the altarpieces selected as case-study are approached.

2.2 *Structural system classification*

The assemblage of wood pieces that compounds the support structure of altarpiece has the purpose of guarantee the system equilibrium of the constructive elements, in order to avoid structure displacements. According to Aguilar (2003), the anchorage system classification could be divided in: wall dependent system; wall independent system and merged system. In the wall dependent system, the altarpiece structure is supported by mean of embedding wood supports that are projected from the walls, see Fig. 1.



Figure 1 : Nossa Senhora das Conceição altarpiece anchorage system, Florianopolis-SC, Brazil.

The independent system is composed by struts supported by the floor and by beams usually placed at entablature position of each element of the altarpieces, without connection with walls and, the merged or semi wall system presents the struts carried by the floor in order to sustain the altarpiece structure, while the beams are supported by the walls in the height of the entablatures and inserted to the struts, see Fig. 2.



Figure 2 : High-altarpiece back of São Francisco da Penitência Church, Florianópolis-SC, Brazil.

It also should be considered, in the altarpiece structural analysis, the secondary system of anchorage composed by iron or wood elements, fixed to the grid and embedded to masonry wall or to a proper system of anchorage. These secondary elements act as ties keeping the altarpiece structure in place. If necessary, the secondary system of anchorage could be straight or bended.

2.3 Material composition - Wood

Wood has been used for centuries for different purposes, among which, as physical support to the artwork. As an organic, heterogeneous, non-isotropic, and hygroscopic material, wood undergoes environmental effects that may alter its conformation. Thus, in high relative humidity atmospheric conditions, the material absorbs environment humidity until reaching equilibrium. These variations can cause faults such as cracks and fissures, often affecting polychrome surface.

We know that the choice of the wood species is related to the function to be performed, and according to Fioravanti (1994), to some of its technologic characteristics, such as dimensional stability, permeability and durability. Uzielli (1998) points out that a the selection of the wood employed in work execution containing artwork, is associated to technology, economic and practical factors, associated to the artist's tradition, that is, the wood choice is influenced by issues of viability and costs, usually utilizing local woods from the region.

We emphasize that, referring to the species of wood used in structural pieces in historical buildings in Santa Catarina, Terezo (2004) mentions that, almost exclusively Brazilian tropical species are found, particularly, in the roof and floor structures. In the execution of the carving cut the use of the cedar is frequent in Brazil.

In Brazil, for instance, perhaps because of its territorial dimension, it is common to hesitate during wood identification due to the adoption of ordinary denomination that generates doubts in its use and origin. Among several possible actions, in order to preserve cultural heritage, the wood specie identification is an important tool. Burger and Richer (1991) point out the anatomic identification aims at correct specification of the wood in case of rehabilitation, as well as facilitates to distinguish apparently identical kinds of wood and to comprehend its behavior when in use. During microscopic analysis the transverse, radial and tangential section characteristics, necessary for the anatomic identification, were observed.

3 CASE-STUDY

3.1 Nossa Senhora das Necessidades Church high-altarpiece

This high-altarpiece is part of patrimony of Nossa Senhora das Necessidades Church, built around 1750 and located in Santo Antônio de Lisboa, Florianópolis, SC, Brazil. In this altarpiece, built in polychrome wood, is predominant the verticality and it fulfills the space limited

by ceiling, floor and lateral walls. Although it has some elements of the baroque period, is characterized as a rococo style.

According to historical sources the altarpiece was built in 1759, and its authorship is unknown. However, through written documentation, local inspection, and results of laboratory analysis, it was verified that various interventions have modified its appearance. It is supposed that its present aspect is the result of a remodelling partially occurred between 1856 and 1862, and completed later in 1956, see Fig. 3.



Figure 3 : Nossa Senhora das Necessidades church high-altarpiece.

3.2 *Nossa Senhora da Lapa Church's high-altarpiece*

The Nossa Senhora da Lapa Church was consecrated in 1806, situated in Ribeirão da Ilha, Florianópolis and protected by Municipal and State legislation. Its altarpiece is built in polychrome gilding wood and is characterized by presenting simplified carving cut according to the rococo style. During historical files research, data execution and authorship references have not been found. Through inspections in the polychrome layer, it was verified that it has been repainted in the past, see Fig. 4.



Figure 4 : Nossa Senhora da Lapa church high-altarpiece.

4 METHODS

4.1 Structural system identification

The structural and anchorage system of the altarpieces have been identified, as well as the reinforcement elements and the joint geometry through local inspection. Also was done a comparison with other specimens in Florianopolis and from specific reviewed literature such as architecture dictionary and academic researches about applicable methodologies to study altarpieces and to identify construction materials. It was measured the dimensions and the cross sections of all components and of the joints between structural elements. The manufacture techniques applied to the construction were observed too.

4.2 Wood identification

Due to uncertainties about wood species used in the altarpieces, small samples were collected in order to be identified in laboratory. A photographic registration was performed before and after sample extraction. After this, samples have been catalogued and packed. This phase of the work was developed in the Inter-disciplinary Wood Study Group (GIEM) Laboratory, associated to Civil Engineering Department (ECV), in the Federal University of Santa Catarina (UFSC). Aspects related to wood anatomic structure were analyzed.

The analysis was performed on an optical microscope with a color video camera coupled to it. This tool allowed photographing images obtained by this process. The confirmation of identified species was responsibility of the Vegetal Anatomy Laboratory in Biologic Sciences Center (CCB) of the Federal University of Santa Catarina (UFSC).

5 RESULTS

5.1 Structural system identification

5.1.1 Nossa Senhora das Necessidades Church high-altarpiece

The Nossa Senhora das Necessidades high-altarpiece front part is separated from the back by a masonry wall. This disposition is classified as an anchorage system wall dependent, since the entablature is fixed at the beam grid and the latter is embedded in the masonry. The ornamental elements are fixed through metallic dowels to the main structure and by means of "L" profiles or wood elements to secondary structural system. Analyzing the tribune anchorage, it could be classified as a merged system since the floor beams extremity is supported by consoles embedded to the wall while the beam middle is carried by struts connected to the floor structure. The extremities beams are supported by the walls, see Fig. 5 and Fig. 6.



Figure 5 : Nossa Senhora das Necessidade Church altarpiece back.

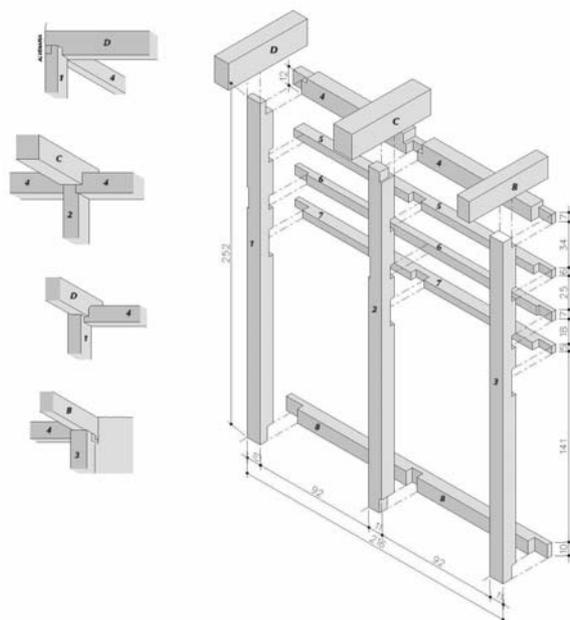


Figure 6 : Partial graphic representation of the anchorage system of the wooden floor of the high-altarpiece of the Nsª Srª das Necessidades Church, Santo António de Lisboa.

During the process of evaluation of the state of conservation of the structural parts of the high-altarpiece, it was found evidence that some parts of it have been attacked by termites. However, no termites were found. It is important to emphasize that there was no loss of mechanical properties of these woods since the attack of termite was superficial.

Also it was verified that specific boards and bars of the wooden floor of the tribune had been attacked by xylophages' microorganisms, causing the appearance of superficial spots, without damaging greatly the structure of the wood. This situation suggests the necessity of periodic maintenance of the roofing and draining system, together with cleanness of the monument and of the spaces, both external and internal. These factors, frequently, may compromise the integrity, security, and authenticity of the cultural heritage.

5.1.2 Nossa Senhora da Lapa Church high-altarpiece

The back part of the high-altarpiece is supported by a merged anchorage system. The entablature and the ornamental elements are connected to the main structural system. The main upper beam is sustained by the walls and by the struts supported by the floor system. Further that, the structural system was modified during interventions carried out in the past. It is possible to notice some elements superposition, replacement of original struts and beams, some carried out carelessly, see Fig. 7.



Figure 7 : Nossa Senhora da Lapa altarpiece's anchorage system embedded in the masonry wall.

The tribune floor anchorage system is a masonry independent system. The beams are supported by the struts and this subsequently by the ground, in a different way of the tribune structure of Nossa Senhora das Necessidades Church. It is important to note that interventions carried out in the altarpiece reduce the historical good security and integrity.

Among the pathological problems detected one gives credit that, beyond the attack of termites, the substitution of improper form of structural parts compromises the integrity and the security of the Nossa Senhora da Lapa high-altarpiece. Some joints do not fulfill the function of linking between the parts, meet dimensioned badly and they had not respected the original model.

5.2 Wood species identification

The results of laboratory analysis of anatomic structure involving species of wood found in both altarpieces, identifies the use of six wood species, which are: the Canela-preta (*Ocotea catharinensis*), the Canela-sassafras (*Ocotea odorifera*), and the Pinho-do-Paraná (*Araucaria angustifolia*) endangered in conformity to a governmental regulation (Edict nr. 37-N, 1992, Brazilian Institute of Environment Natural Renewable Recourse-IBAMA).

Of the 27 analyzed samples, the more frequent occurrences were Peroba (*Aspidosperma pycnollum*) and Canela-preta (*Ocotea catharinensis*) both with 25.92%, followed by Capororoca (*Rapanea* sp) and Cedro (*Cedrela fissilis*) with 18.52%. Finally the Pinho-do-Paraná (*Araucaria angustifolia*) with 7.41%, and Canela-sassafras (*Ocotea odorifera*) 3.71% appear. All of them can be found in the State of Santa Catarina.

According to Silva and Medeiros (2000), the Canela-preta is exclusive from the Pluvial Forest of the Atlantic Coast and although being heavy it is easy to manipulate. Thus, the Peroba was found in structural pieces on both altarpieces. Nowadays, its trading is forbidden. For Mainieri and Chimelo (1989) the Peroba has demonstrated to have low durability to wood degrading organisms in laboratory. The Peroba is considered a rare specie, and although it is not in the list of endangered species, its conservation is necessary.

6 CONCLUSIONS

The assemblage of wood pieces that compounds the altarpiece structure should guarantee the system equilibrium of the constructive elements, in order to avoid structure displacements. The anchorage system classification could be grouped in three categories: wall dependent system; wall independent system and merged system. The structural systems of Nossa Senhora das Necessidades and Nossa Senhora da Lapa high-altarpieces are identified according these classes and it was verified that both present diverse characteristics.

The Nossa Senhora das Necessidades high-altarpiece could be classified as wall dependent system, since the structural beam grid is embedded in the masonry walls. But the tribune anchorage structure could be classified as merged system, since the floor beams are supported by walls and ground structure.

The Nossa Senhora da Lapa high-altarpiece system is classified as merged because the main structure is carried by the walls and at the same time supported indirectly by the ground foundations. Beyond this, it was observed, during the inspection, that the structural system was not the original anymore. The interventions were done in a careless way and resulted in elements superposition and incorrect replacement of struts and beams. The tribune anchorage system is classified as wall independent. The floor structure is supported by the ground. It is important to notice that the interventions carried out during the interventions reduced the historical good security and integrity.

The wood utilized in the original pieces of the Nossa Senhora das Necessidades and Nossa Senhora da Lapa high-altarpieces is found in the region where the churches are located. For instance, the Peroba (*Aspidosperma pycnollum*) and the Canela-preta (*Ocotea catharinensis*) are predominant in the structural pieces and the Cedro (*Cedrela fissilis*) was found in ornamental elements.

The supply decrease of Canela and Peroba species in the South Region has stimulated the use of another species, for example Capororoca (*Rapanea*) and Pinho-do-Paraná. The criteria util-

ized along the years for selecting wood species to replace degraded pieces may have been based firstly on the use of existing woods in the region and secondly on species available in the market at that period. Both Peroba and Canela-preta were plentiful in the Island of Santa Catarina in the past. However the intense use of those species almost caused the complete exhaustion of their supplies, causing an increasing difficulty of finding them since the 70s in the 20th century. Based on this fact, is possible to deduce that both altarpiece constructive system have their own system of execution, according to wood species applied.

Some of the species found have average natural durability and the deterioration detected in the altarpieces are due possibly the bad conditions of the site, such as lack of maintenance, high humidity level, defective ventilation and accumulation of dirt.

The results of this research will aid in the characterization of altarpiece constructive systems as well as for recognizing some original system alterations. Such knowledge is an important parcel of the fundamental aspects to preserve these heritage buildings.

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