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THE WOODEN DOOR IN THE EX-ABBEY OF SAINT SECONDO IDENTIFICATION OF THE BOTANICAL SPECIES

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Abstract

A lot of objects with historical and artistic significance in cultural heritage assets are made of wood. This is due not only to the availability of raw material and its easy processing, but also to the natural beauty and durability of wood against biological degradation and weathering. For these characteristics, wood has been widely used for musical instruments, furniture, paintings, sculptures, etc. In this context, the study of wooden doors in historic buildings plays a primary role when the ancient town centres are investigated. The doors can be considered artefacts expressing historical, aesthetic and technological values of historical buildings, revealing at the same time a great durability in regards to the most relevant degradation agents. Their importance, therefore, is crucial in the analysis of historical events and problems related to their conservation.
In this contribution, the wooden door of the ex-Abbey of Saint Secondo in Amelia (province of Terni, Italy) has been investigated with the main objective to gather information of its state of conservation to supply information for the restoration process. After restoration, samples from replaced boards were also examined. The investigation was performed through direct observation and analysis of wood micro-samples in the laboratory for characterising the species.

Keywords: abbey, wooden door, demo-ethno-anthropological, heritage, preservation

1. Introduction

This work deals with the contribution of diagnostic investigations to identify the botanical species constituting the wooden door of the orphanage,

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previously ex-Abbey, of Saint Secondo in Amelia, a town in Central Italy, under the district of Terni.

Figure 1. The door in the ex-Abbey of Saint Secondo: (a) before and (b) after the intervention. A smaller door is opened within the main one.

Figure 2. (a) Vertical board assembly in the inner side, after the intervention. (b) Detail of the conservation state before the intervention and (c) decayed boards in the lower zone, inner side, during restoration.

The modern approach to the cultural heritage study suggests the scientific analysis of materials to increase knowledge through objective data [1, 2]. In particular, concerning historical and artistic heritage made of wood, the identification of wood type, used in the construction of the artefact, is prerequisite for the planning and design of the conservation and restoration operations. The diagnosis also allows formulating hypotheses on the origin and choice of the original material [1, 2].

The wooden door of the ex-Abbey and then orphanage of St. Second in the town of Amelia is located in the framework of a portal made of stone ashlars. The portal constituted the main entrance of the old Abbey and probably it may be dated back to the first years of the 17th century, as can be derived from the incisions on the portal upper part. The Abbey was built in the 12th century, during the pontificate of Innocent the 3rd, on the ruins of a temple belonged to Silvestrini monks. During the Middle Age, the Abbey played a relevant political role, being seat of important historical events, such as the peace treaty signed by Amelia with Todi. In the second half of the seventeenth century, the entire complex was transformed and then used as orphanage [3, 4].

The door is characterised by a 'mercantile' style, with a double lining, which can be described as a medieval model of frame, still maintaining its features along the centuries. The door could be dated back to the same period of the portal. It consists of two major wings with transom window and grate in wrought-iron. Into the larger wings, two smaller wings are opened (Figure 1). On the internal side, the boards are vertically disposed (Figure 2a) while in the outer side they are arranged horizontally (Figure 1). The two layers are joined together with glue and nails ordered in staggered pitch and riveted on the inner side so as not to be removed.

The evaluation of the conservation state, which preceded the restoration, highlighted the presence of gaps in the outer part in correspondence of the joints.

The lower side appeared extremely deteriorated (Figure 2b and 2c), the left door was remarkably warped as well as some of the boards of the outer layer and the surface protection was missing. In the lower part new boards badly replaced the original ones to maintain the door functionality.

In the case of the door of ex-Abbey of St. Secondo, a preliminary characterisation of wood species was performed to supply useful information to the conservator. As a consequence, microscopic and macroscopic observations were performed to support the conservator during the restoration phases. Sample from replaced boards were examined after restoration.

2. Experimental

The restoration started with the removal of dust and debris accumulated on the whole surface by using detergents, water and delicate metal brushes. Subsequently, the removal of the double lining in the lower part was followed by the delicate stage of reconstruction of the deteriorated parts.

A macroscopic accurate recognition of each wooden element of the door has been conducted for the diagnosis of the botanical species on the basis of the anatomical features evident to the naked eye or with the aid of low-magnification lenses, after the first cleaning of the artefact.

The botanical species of each wooden element were macroscopically identified, except in the outer side board that remained unidentified. For this reason, the University staff was asked to perform a microscopic identification. A small sample was collected for laboratory analysis. After the restoration, five boards were subjected to xylological investigation to understand which botanical species were chosen, during time, to maintain the functionality of the door.

Stereomicroscope Wild M420 was used for a first macroscopic examination of xylem characteristics on the samples, identifying the anatomical features on the three fundamental sections namely transverse, radial and tangential. Thin sections (15-20 mμ) were examined by Polivar 100 light microscopy. The anatomical features were compared with the descriptions of Nardi Berti [5], Schweingruber [6] and with the data base Insidewood [InsideWood, 2004-onwards, http://insidewood.lib.ncsu.edu/search, accessed in 2016 and 2017].

3. Results and discussion

The poor conservation state of the inner side required intervention aimed at restoring the door functionality. The reconstruction of the lower part has been made by jointing the vertical boards of the original part with the new ones in elm wood (Figure 2a). The outer layer showed a very critical situation due to chemical and physical degradation processes but also to the lack of correct ordinary and planned maintenance. The deterioration of the surface was caused above all by light sun exposure without any wood protection. The original colour of wood was turned to a silver-grey one, due to the surface photo-degradation [7-10]. The external layer of horizontal boards has been restored, with the care to preserve the original materials and to maintain the aesthetic appearance. Subsequently, the two door wings were aligned and consolidated by applying, in the upper part, two iron bars secured by screws. Finally, where necessary, plugs were inserted made of elm wood, vinyl glue and wood powder. The puttying was carried out with Balsite, un-shrinking resin-based filler. It can be coloured with earths and oxides and easily sanded. The final stage was to restore colour and make uniform the new parts with the originals. This goal was reached by three applications of boiled linseed oil diluted with petroleum in the volume ratio 3:1.

Wooden doors, located in outdoor conditions, are generally and continually exposed to several intense different degradation factors, abiotic and biotic, which often play synergistically degradative actions. In the case of the exterior doors of buildings the degradative action of the solar radiation is favoured by the runoff of rainwater [11]. Moreover, the presence of persistent humidity in the lower part favours the fungal decay. As in the present case study, the degradation progresses are often accentuated by poor or absent maintenance

that should be a regular practice in cultural heritage assets, especially in those with higher sensitivity. In case of outer door side, the progressive degradation is due also to the vicinity of the road surface, particularly subject to the action of anthropogenic and meteoric agents. The wear and tear of the wings is favoured by their function of passage, their conditions of use, the perishability of the materials in some components. The greatest danger is the loss of prestigious elements due to the substitutions or transformations that could occur over time [12-14]. Timely and programmed maintenance surely may reduce the necessity of invasive intervention in case of restoration actions. These considerations determine the need to multiply studies on these artefacts, in order to ensure their valorisation and therefore the development of specific protection instruments.

The preliminary macroscopic characterization of the door elements allowed revealing the presence of hardwood. Specifically, the observation of macroscopic characteristics of the vertical internal boards of the two original panels revealed the main use of chestnut wood (*Castanea sativa* Mill.), while those of the two smaller wings were in elm wood (*Ulmus* sp.). The chestnut wood identification features were the porous rings and the rays, invisible at naked eyes. The elm wood was identified for the porous rings and for the waving arrangement of the pores in latewood (ulmiform arrangement), rays indistinct.

Chestnut and elm are coarse textured wood, due to the ring porous earlywood. They have coloured heartwood which gives them high durability, both have good nailing and mechanical properties [15]. The elm wood was probably chosen as the material for the two smaller wings due to its better hardness properties.

The macroscopic investigation on the outer side highlighted another botanical species belonging to hardwood. The small sample collected for laboratory analysis showed silvery-grey surface colour, caused by photo-degradation of the surface, due to exposure to solar radiation for a long time without any protection. After the mechanic removal of the altered layer, the underlying surface showed a light colour, typical of natural wood. The growth rings were easily detected. The rays were thin and numerous, giving a silky appearance to the longitudinal surfaces. The texture was fine and the grain almost irregular.

The sample was cut to obtain thin section to perform the microscopic observation of the anatomical feature. In transversal section (Figure 3a), presence of distinct growth rings; diffuse porous wood; scattered vessels, solitary or in radial rows of 2-3 elements, with constant diameter in the transition from early wood to late wood; apotracheal parenchyma widespread were observed. In radial section, simple perforation plates, presence of spiral thickenings on vessels walls, homogenous rays were detected. In tangential section, multiseriate rays up to 6 rows of parenchymatic cells were observed.

Macroscopic and microscopic analyses of the anatomical structure of the sample showed that the examined wood belongs to the genus *Acer*. The number of rows of the ray cells up to 6 (a significant diagnostic feature for the species identification [6, p. 70]) makes evidence to the hypothesis that the wood

examined was *Acer pseudoplatanus* L. The genus *Acer* belongs to the *Aceraceae* family. It includes more than 200 spontaneous species in Europe, Asia and North America. The geographical distribution of the maple comprises the whole northern hemisphere. It grows in the lowlands, in hilly areas and sub-mountain contributing to mixed forests.

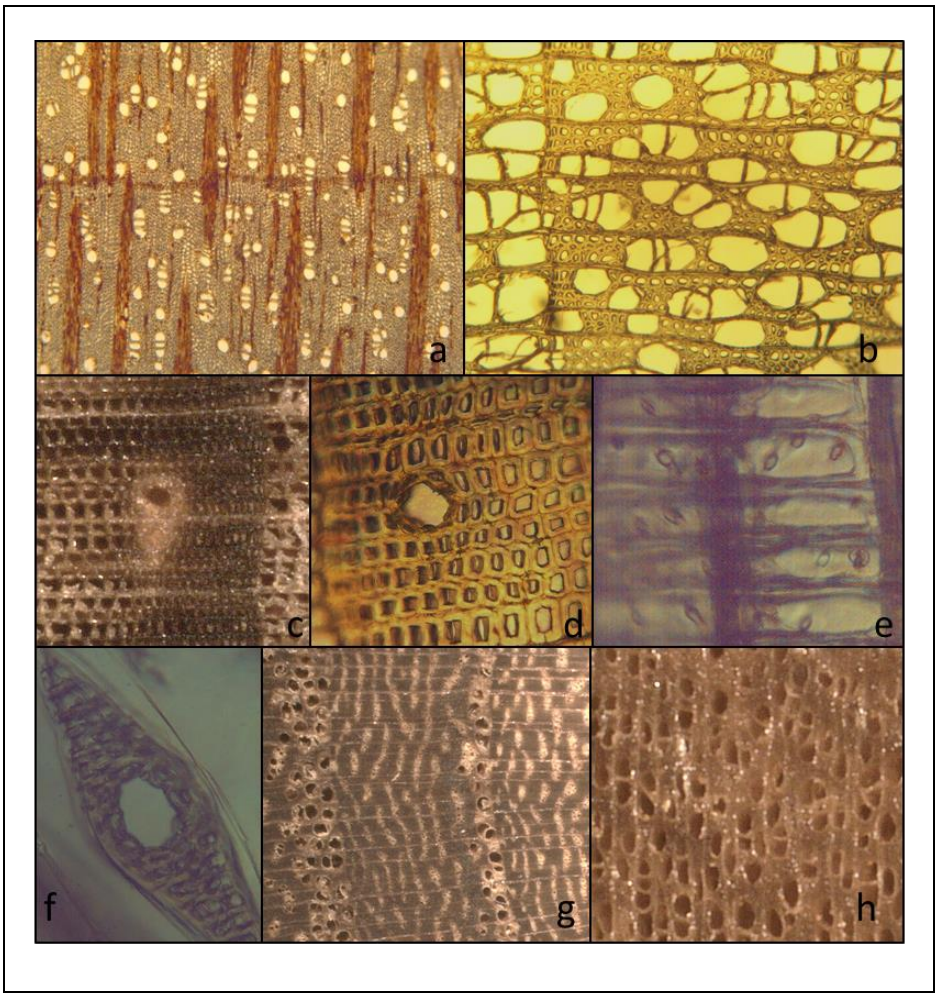

Figure 3. Anatomical features of the examined wood samples: (a) Maple: transversal section (microscopy magnification 40x); diffuse porous wood with a distinct growth ring and pluriseriate rays up to 6 rows of parenchymatic cells. (b) Poplar: transversal section (10x); diffuse porous wood with a distinct growth ring and uniseriate rays. (c, d) Spruce: softwood with resin canal, thin-walled epithelial cells (stereoscope imagine 32x), optic microscope imagine 25x). (e) Spruce: radial section (40x); pits in cross-field small, 2-3 per cross-field. (f) Spruce: resin canal in tangential section (40x). (g) Elm: transversal section (12,5x); porous rings in early wood, latewood pores in wavy (ulmiform) tangential bands. (h) Poplar: transversal section (11x); diffuse porous with uniseriate rays.

In central Italy there are the following species of maple: Sycamore (*Acer pseudoplatanus* L.), Norway maple (*Acer platanoides* L.), Field Maple *(Acer campestre* L.), Montpellier Maple (*Acer monspessulanum* L.), Opalus maple (*Acer opalus* Mill), and the *Acer lobelii* Ten. as the vicarious of the northern *Acer platanoides* L.

Sycamore tree can reach large dimension in diameter and height. The wood colour is light; the texture is fine, sometimes the grain is irregular or wavy, appreciated for the violin backs and decorative veneers. It is not durable in a moist environment without a preservative treatment. It is easy to be worked and a good finishing can be obtained. It is used for turning, carving, furniture, flooring and, as it has no odour or unpleasant taste, for kitchen objects. It has been used for cabinets, fine inlaid boxes, flooring, musical instruments and sculptures [16].

The removed boards were found decayed and insect attacked. Two boards belonged to species of the genus *Ulmus* (Elm) (Figure 3g), two to the *Picea abies* (L.) Karst. species (Spruce) (Figure 3c, d, e, f). A sample of the outside layer, studied in the second diagnostic campaign, belongs to genus *Populus* (Figure 3b) (Poplar).

The choice and heterogeneity of materials and intervention modalities suggest that the main purpose was to maintain the functionality of the door. The presence of spruce indicates a non-local wood supply [17]. This species spontaneously grows only in the Alpine region, while its wood is commercialised throughout the national territory.

4. Conclusions

The study of wooden artefacts underlines the importance of xylological analysis for determining the tree species used for the realization of works of art. The diagnosis of botanical species is fundamental in the study of a wooden artefact, allowing to collect information also on the operational choices and methods of the past craftsmen, to know the technological properties of the used wood and the natural durability guaranteed by the materials. The diagnosis of botanical species further permits to define the physical and mechanical characteristics of the wood and its workability, and can provide information about the historical and artistic context, as well as indications to support the restoration choices. At any time and in any region, the use of a specific type of wood depended on habits, on empirical knowledge, on availability and sometimes on the symbolic meanings of the materials. Therefore, there is a strong link between the artefact, its location and the constituting wood.

The choice of different wood species in various parts of the door in the ex-Abbey of Saint Secondo in Amelia, suggests, at the light of the previous considerations, that the craftsmen were awareness of the properties of each wood and chose them to satisfy their specific technological requirements.

We think that this study demonstrated as depth knowledge of the works of historical and artistic importance, obtained by scientific methods, allows assessing the state of conservation, to know the constitutive materials and the technological aspects, and to support the choice of the most appropriate methods of intervention for the restoration and maintenance.

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