

ISSN 1512 - 5769

**RADOVI**  
**Šumarskog fakulteta Univerziteta u Sarajevu**

**WORKS**  
*of the Faculty of Forestry of the University of Sarajevo*

**Volume 40, broj 1**

**Sarajevo, 2010. godina**

UDK 674.5:595.7(496.5 Berati)

## IDENTIFICATION OF WOOD AND WOOD - BORING INSECTS OF THE ICONS OF BERATT'S MIDDLE - AGE MUSEUM IN ALBANIA: FIRST STEPS OF THEIR RESTORATION AND CONSERVATION\*

Identifikacija drveta i insekata drveta na ikonama Muzeja srednjeg vijeka u  
Beratiju, Albanija: Prvi koraci restauracije i konzervacije

Entela L<sup>1</sup>., Ajdinaj D<sup>1</sup>., Kuku D<sup>1</sup>., Thoma H<sup>1</sup>.

### Izvod

Muzej srednjeg vijeka u Beratiju, u svom skladištu, sadrži oko 350 ikona, od ukupno 4500 uzoraka izuzetno vrijednih artefakata od drveta, koliko ih je konstatovano u Albaniji. U stvari, četiri ikone su u fazi restauracije, a naša prva naučna aktivnost u ovom procesu sastoji se od identifikacije drveta i insekata drveta.

Tehnika koja se koristi za izučavanje anatomije drvenih ikona je inkluzija smole. Nakon hemijske obrade malih uzoraka smole (baza butila), te toplotne obrade u termostatu (temperatura 60°C tokom 12 sati), mikrotomom su pripremljeni anatomski isjeći. Posmatranje kroz mikroskop je pokazalo da je za tri ikone korišteno drvo vrste *Juglans regia* L. (tipična vrsta šuma ovih prostora), a za jednu ikonu drvo vrste *Populus sp.*, vjerovatno *Populus alba* L., budući da je to jedina vrsta čije je prirodno stanište u dolini Osumi, na jugu Albanije.

Izvršena su precizna posmatranja i mjerenja u cilju utvrđivanja stepena propadanja drveta, koje je bilo znatno nagriženo gljivicama i insektima, naročito insektom *Anobium punctatum*. Za čišćenje ikona od insekata korištena je vakumska metoda.

U toku je proces identifikacije drveta za druge ikone u postupku restauracije.

**Ključne riječi:** Albanija, *Anobium punctatum*, identifikacija drveta, ikone, restauracija, konzervacija.

### Abstract

There are about 350 icons at the deposit of the Middle Age Museum of Berati, among 4500 items of very precious wooden artwork heritage, all over Albania, Actually four of these icons are under restoration process and our first scientific collaboration in this process consisted in identification of wood and wood-boring insects.

---

\* Rad je prezentiran na Međunarodnoj naučnoj konferenciji: «Forestry Science Between Economy and Society Demands», Sarajevo, Bosnia and Herzegovina, October 8-10, 2008.

<sup>1</sup> Faculty Forestry Sciences, Department of Wood Industry, Agricultural University of Tirana.

The technique used for the anatomic study of the icons wood was the resin inclusion. After chemical treating of small samples in resin (butyl based) and their thermal treating in thermostat (temperature 60°C for 12 hours), anatomic sections were prepared by microtome. The microscope observations showed that three icons belong to *Juglans regia L.* (very typical specie of the forests of that area) and only one belongs to *Populus sp.*, probably *Populus alba L.*, because it is the only one specie naturally grown in Osuni valley in the south of Albania.

Accurate observations and measurements have been done for the inspection of wood deterioration, which showed considerable fungi decay and insect damages, especially from *Anobium punctatum*. The method of vacuum was used for insect disinfection of icons. The process of wood identification is going on for the other icons in the restoration process.

**Key words:** Albanija, *Anobium punctatum*, identification of wood, icons, restoration, conservation.

### **Introduction – Uvod**

Medieval picture in Albania is represented by a considerable number of works. Many of them have an artistic quality which passes the border of the national interest. These pictures are in general Byzantine icons, conserved in churches and monasteries of south and mid of Albania, where the Byzantine religion is diffused. There are more than 4500 icons. A considerable part of them are conserved in National Museum of Tirana (about 700) and in Middle Age Museums of Berati (about 350) and Korça.

The structure of icons is composed by some layers; wooden support, ground layer, canvas and in the end the painting. In some rare cases, the painting is applied directly on wooden supports.

According to dimensions, Albanian icons can be classified in three categories, small, medium and large.

The small ones are mainly placed in the upper part of iconostases and are composed by a single board. This type of icon was commonly used in Albania. The medium ones are composed by two boards and in large icons (over 100x70 cm) the wood support has three boards.

The jointing of boards was made using animal glue. Most of supports of Albanian icons of the XIV–XVI centuries are realised by this kind of joint. In the XVII–XIX centuries, where icons started to be painted in larger supports, glued jointing was reinforced with butterfly keys.

Crossbeams are elements which maintain the support continuity and insure the planarity of the surface. Until the XVI century the connection between crossbeams and boards was made using wrought-iron nails. In the later centuries the dovetailed crossbeams were used.

The actual situation related to the study, conservation and restoration of icons in Albania is not satisfactory. The elements leading to such conclusions include:

- documentation; is partial. Icons are described only by the artistic viewpoint. There is a lack of the accurate information about wood species, structure and supports, the biodegradation and used paints. At the same time the chronological information about the restorations is completely lacking.
- conditions of conservation; problematic ones, especially in museum of Berati. The storage room of icons in Berati is exposed to inappropriate environment hygrometric parameters.
- performed restoration interventions; until now the interventions have consisted only of cleaning and restoration of the painting layer

The aim of this paper is to present the work in progress in the framework of the cooperation between the Department of Wood Technology, Faculty of Forestry Sciences and the Institute of Monuments.

This cooperation consists of:

- (i) identification of the wood species of the icons;  
(Four icons are identified and are in process of restoration under the direction of the Centre of Restoration of Berati. As for fifteen other icons, which are foreseen for restoration, the identification is in process).
- (ii) inspection of the state of conservation of the whole wooden supports;  
(Four icons mentioned above are inspected)
- (iii) monitoring of deformations.

Icons which actually are in process of restoration are:

*Christ Pantocrator* – anonymous;

*Deesis* – anonymous;

*Christ Crucifying* and *Source of Life Givens* – 18<sup>th</sup> century, Çetiri brothers.

### **Material and methods – *Materijal i metode***

#### **- *Wood identification - Identifikacija drveta***

For wood identification of icons small samples were taken very carefully using a sharp cutter. The location where the samples were extracted was the back corner edge of the panel, in a way that the object of art is not damaged. The size of fragment ranged from 1 to 3 mm in width, and several millimeters in length up to 1 cm (ROMAGNOLI & the others, 2007).

The first step was the verification by stereomicroscope for choosing the good parts of samples which will be treated later.

The technique used for anatomic study was the resin inclusion. After the resin was prepared (based in butyl), the samples were put in glass containers filled with mixture of resin and absolute alcohol in equal amounts. The samples stayed in these containers for one hour. The same procedure was repeated by passing the samples in pure resin staying there for 1.5 hour. In the end, the samples were placed in capsules filled with resin, which were placed in thermostat in a temperature of 60°C for 12 hours.



Figure 1. Inclusion of samples in resin  
*Slika 1. Tretiranje uzoraka u smoli*

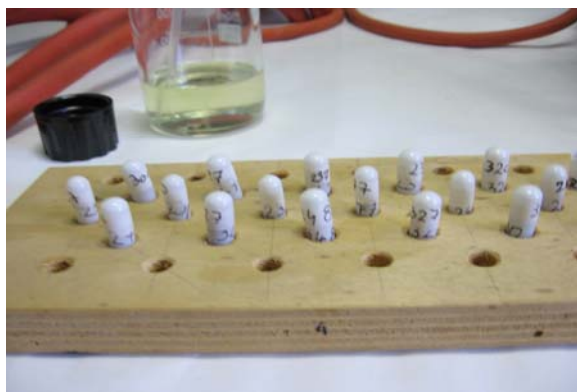


Figure 2. Samples in capsules after thermal treatment  
*Slika 2. Uzorci u kapsulama nakon termičkog tretmana*

After the resin polymerization in thermostat and the equilibration in the environmental temperature for two days, the capsules were open and the resin, together with the samples, was cut by microtome and fixed in microscopic glasses using glycerol, ready for anatomical observation.

#### *- Inspection of wood deterioration*

By an accurate observation performed on the panel paintings it was found that the major part of them show decay by fungi attack, especially in external sides (figure 6).

Considerable damages by wood-boring insects were also verified (in many of panel paintings the tunnels were extended to the paint layer). To identify the wood-boring insects, the process was as follows:

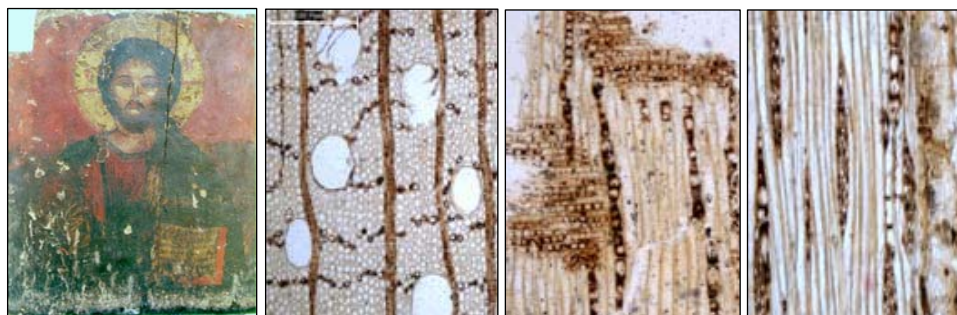
- measurement of holes diameter and observation of the tunnel form;
- observation of tunnels orientation according to the direction of grain;
- analysis of the color and pellets characteristic of insect frass (BLANCHETTE, 1995).

After this, for insect disinfection, icons were treated with vacuum. This non chemical method is an alternative to heating and fumigation methods and is used in museums for wood artifacts, which are sensitive to heat or chemicals. The value of vacuum was -0.9 atmospheres. According to the moisture content of wooden supports (about 20 %) the duration of vacuum treatment was 7 days (CHEN & the others, 2006).

### **Results and discussions – Rezultati i diskusija**

#### *- Wood identification*

For four panel paintings which actually are under restoration, the identification of wood species (NARDI BERTI, 2006) showed that three of them (*Christ Pantocrator*, *Deesis*, *Christ Crucifying*) belong to *Juglans Regia* L. and the other one (*Source of Life Givens*) belongs to *Populus* spp.



*Christ Pantocrator*      Transversal section      Radial section      Tangential section  
*Poprečni presjek*      *Radijalni presjek*      *Tangencijalni presjek*

Figure 3. Anatomical sections (*Christ Pantocrator*)

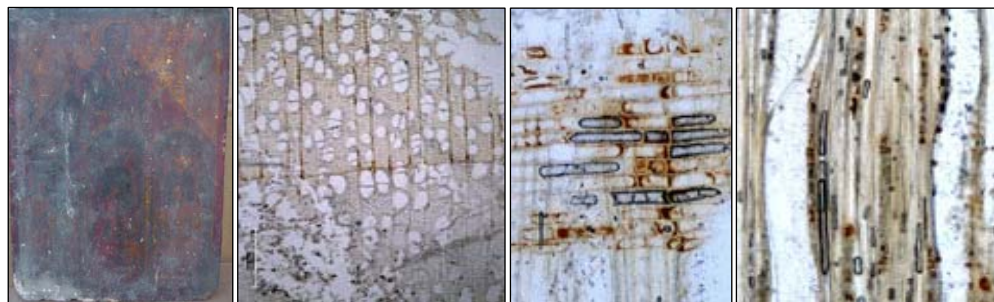
Slika 3. Anatomske presjeci (*Christ Pantocrator*)

Anatomic description:

- Transversal section : Diffuse porous. Isolated large pores. Apotracheal parenchyma in layers and diffuse. Tyloses present.
- Radial section: Heterogeneous and homogenous rays.
- Tangential section: Simple perforation plate. Rays most often 2-4 cells wide, occasionally uniseriate. Average ray height 15-30 cells.

Key characteristic; Solitary pores sparsely scattered. Rays 2-4 cells wide. (*Juglans regia* L.).

The result of this anatomical description is also confirmed by the widespread of *Juglans regia* L in forests of Osumi's valley (MITRUSHI, 1956), South of Albania, where the churches of icons are located. This wood is determined as semi heavy (density over dried 520 kg/m<sup>3</sup>) and can be dried well. About the natural durability, it is classified in the middle rank (third class). It is not resistant against the insect attack, especially from anobium. *Juglans regia* L was appreciated by the local craftsmen to carry out their works due to its structure (fine texture), because is suitable for painting and gluing.



*Source of Life Givens*      Transversal section      Radial section      Tangential section  
*Poprečni presjek*      *Radijalni presjek*      *Tangencijalni presjek*

Figure 4. Anatomical sections (*Source of Life Givens*)

Slika 4. Anatomske presjeci (*Source of Life Givens*)

**Anatomic description:**

- Transversal section : Diffuse porous. Pores are solitary or in radial files of 2-3. Diffuse and terminal apotracheal parenchyma.
- Radial section: Homogenous rays. Large ray-vessel pits.
- Tangential section: Simple perforation plate. Uniseriate, homogenous rays. Ray height: 5-30 cells.

Key characteristic; Diffuse porous. Uniseriate homogenous rays. Large ray-vessel pits; *Populus* spp. (SCHWEINGRUBER, 1990)

In this case, it is most probably *Populus alba* L because it is the only popular specie grown naturally in the region of Myzeqe, South-West of Albania near of Berati (MARKU, 1999), where many Byzantine churches were also located. It is homogeneous wood with fine texture and low density. It is not resistant against biological and anobium attacks (fifth class), but is prepared and painted very well. This result is novelty for Albanian icons, because this wood was never appreciated in Albania for artifacts.

Except for these four icons which actually are under restoration, the wood identification process is going on for other icons. The latest interesting result belongs to the icon named *Over grave crying*.



*Over grave crying*

Trasversal section  
*Poprečni presjek*

Radial section  
*Radijalni presjek*

Tangential section  
*Tangencijalni presjek*

Figure 5. Anatomical sections (*Over grave crying*)

*Slika 5. Anatomski presjeci (Over grave crying)*

**Anatomic description**

- Transversal section: In general hartwood absent. No resin canal. In general a sharp transition from earlywood to latewood.
- Radial section: Rays without tracheids. Taxodioid pits in rays. Ray walls are thick and tooth shaped. Usually one, often two rows of pitting in radial tracheid walls.
- Tangential section: Average ray height : 9 – 25 cells.



Key characteristic : No resin canals. Rays without tracheids. Ray height 9 -25 cells. *Abies alba* Mill. (SCHWEINGRUBER, 1990)

The information about the use of softwoods in Albanian icons is not something new, but the detailed information about specific species did not exist. This specie has been rightly chosen by the author because of its characteristics of structure and properties. It is not heavy wood ( $d_{12}=441 \text{ kg/m}^3$ ) and can be dried well. The natural durability is not good (fourth class), but has a good resistance against the acid and basic solutions. Traditionally, it is known to craftsmen for good ability to be worked with. It seems, for painting purposes, that this wood is imported from Përmeti region, neighbor of Berati, where it is naturally widely grown.

- *Identification of wood-boring insect in panel paintings*



Figure 6. Fungal degradation and insect damage in panel paintings

*Slika 6. Gljivična razgradnja i štete od insekata na panelima za slikanje*

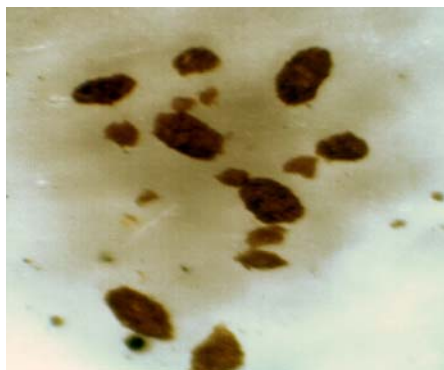


Figure 7. Pellets of *Anobium punctatum* frass

*Slika 7. Izmet Anobium punctatum*

The inspection of panel paintings show verified meandering tunnels 1-2 mm in diameter, often in direction of grain, filled with frass consisting of oval pellets and wood powder (figure 7). (There was fungal decay in peripheral zone of panel painting). According to the key for identification of wood-boring insect (BRAVERY & the others, 1992) this was done by common furniture beetle (*Anobium punctatum*).



### **Conclusions - Zaključci**

The identification of wood species carried out before the process of restoration of four icons of Berati's Museum, showed that the native wood was used. *Juglans regia* L was used in three icons and until today it has been very appreciated by local craftsmen who carry out their works. New thing is *Populus alba* L, which was identified in the fourth icon. This wood is spread in the region, but traditionally it has not been appreciated by the woodworker.

It was found that the major part of four icons show decay by fungi attack, especially in external sides. Considerable damages by wood-boring insects were also verified, made by common furniture beetle (*Anobium punctatum*). The tunnels were extended to the paint layer.

The work presented in this paper is novelty in Albania. Also, a part of information obtained in this work was unknown until now. The significance of interdisciplinary collaboration has reformed the restoration of icons in Albania in a process based on scientific methods. Given that the restoration of icons is a complex process which does not deal solely with painting, the future developments will be possible thanks to the identification of wood species in icons of Museums in Tirana and Berati.

The following cooperation in carrying out the work described in this paper is gratefully acknowledged by the Authors:

- preparation of anatomical samples is carried out in laboratory of DISTAF, Florence, Italy, in collaboration with Giusepina Di Guglio, under supervision of Prof. Marco Fioravanti.
- director and conservators of Museum of Berati for their positive predisposition for collaboration.
- Institute of Monuments which placed the collaboration with the Wood Department at institutional level.

### **References - Literatura**

- BLANCHETTE, R. A., (1995): A guide to wood deterioration caused by microorganisms and insects: The Structural Conservation of Panel Paintings (Proceedings of a symposium at the J. Paul Getty Museum).
- BRAVERY, A. E., BERRY R. W., CAREY J. K., COOPER D. E. (1987): Recognizing wood rot and insect damage in buildings. Building Research Establishment, Watford, England.
- CHEN, ZH., WHITE M. S., ROBINSON W.H. (2006): Preliminary evaluation of vacuum to control wood-boring insects in raw wood packing materials. Forest Products Journal, Volume 56, No. 7/8.
- FIORAVANTI, M., UZIELLI, L., (1992): Il supporto ligneo. La Maestà di Giotto restaurata. Gli Uffizi- studi e ricerche. Firenze.
- GIORDANO, G., (1981): Tecnologia del legno, Vol. 1, UTET, Torino.

- MARKU, V., XHEKO, B. (1999): Dendrologia, Universiteti Bujqesor, Tirane
- MITRUSHI, I. (1966): Druret dhe shkurret e Shqiperise, Instituti Bujqesor, Tirane
- NARDI BERTI, R. (2006): La struttura anatomica del legno ed il riconoscimento del legnami italiani di piu corrente impiego, Amorth, Trento.
- ROMAGNOLI, SARLATTO, TERRANOVA, BIZZARI, CESETTI (2007): Wood identification in the Cappella Palatina ceiling in Palermo (Sicily, Italy), IAWA volume 28 (2).
- Schweingruber, H. F. (1990): Microscopic Wood Anatomy, Swiss Federal Institute for Forest.
- UZIELLI, L., CASAZZA, O. (1992): Conservazione dei dipinti su tavola, Nardini, Firenze.
- UZIELLI, L., (1995): Historical overview of panel making. Techniques in central Italy. The structural Conservation of Panel Paintings, Proceedings of a symposium at the Getty Museum. Los Angeles.
- UZIELLI, L., FIORAVANTI, M. (1999): Il comportamento fisico-meccanico del legno nei dipinti su tavola. Dipinti su tavola-la tecnica e la conservazione dei supporti, Firenze.
- WADUM, J. (1995): Historical overview of Panel-Making Techniques in the Northern Countries. The structural Conservation of Panel Paintings, Proceedings of a symposium at the Getty Museum. Los Angeles.

### Sažetak

Ova studija je vezana za konzervaciju i restauraciju ikona širom Albanije, i njome su obrađene četiri ikone (*Krist Pantokrator*, *Deisis*, *Krist na raspeću* i *Izvor života*) iz skladišta Muzeja srednjeg vijeka u Beratiju, koji posjeduje oko 350 ikona od ukupno 4500 ikona koje se nalaze širom zemlje.

Rad se sastoji od identifikacije vrste drveta od kojih su pravljene ikone; kontrole stanja konzervacije cjelokupne drvene podrške i praćenja deformacija.

Korištena je tehnika inkluzije smole za identifikaciju drveta. Prema ovoj tehnici, uzorci (uzorci drveta izvučeni iz jednog od uglova na zadnjoj strani ploče, kako se ne bi oštetio predmet) su smješteni u staklenu posudu napunjenu mješavinom smole i čistog alkohola, u jednakim omjerima. Uzorci su ostali jedan sat u ovoj mješavini. Ponovljen je isti postupak uranjanjem uzoraka u čistu smolu u kojoj su uzorci ostali 1,5 sati. Na kraju, uzorci su smješteni u kapsule napunjene smolom, koje su zatim smještene u termostat na temperaturi od 60 °C gdje su ostale 12 sati. Nakon polimerizacije smole u termostatu, te prilagođavanja sobnoj temperature tokom naredna dva dana, kapsule su otvorene, te su iz njih mokrotomom izrezani smola i uzorci koji su smješteni u mikroskopske čaše uz pomoć glicerola, čime je sve bilo spremno za anatomsko izučavanje.

Urađena je precizna kontrola, kako bi se utvrdio stepen propadanja drveta na ikonama. Tokom posmatranja je utvrđeno, da je najveći broj uzoraka pokazao oštećenja od gljivica, posebno na vanjskim dijelovima. Pronađena su i znatna oštećenja uzrokovana drvnim insektima (na mnogim obojenim plohama, hodnici su se

pružali do samog sloja boje). Da bi se spriječila dalja oštećenja uzrokovana insektima, ikone su tretirane vakumom. Pritisak vakuma je iznosio -0.9 atmosfera. Prema sadržaju vlage na drvenoj podršci (oko 20%), vakumski tretman je trajao 7 dana.

Identifikacija vrste drveta na četiri ikone iz muzeja u Beratiju pokazala je da je korišteno domicilno drvo. *Juglans regia* L je korišten za tri ikone, a njega i danas koriste lokalni drvodjeljci za svoj rad. Novinu predstavlja *Populus alba* L koja je konstatovana na četvrtoj ikoni. Ova vrsta je rasprostranjena širom zemlje, ali ga drvodjeljci ne koriste tradicionalno za svoj rad.

Utvrđeno je da su sve četiri ikone najvećim dijelom oštećene insektima drveta, naročito vrstom koja napada namještaj (*Anobium punctatum*).

Rad opisan u ovoj studiji predstavlja novinu u Albaniji. Također, dio informacija dobivenih tokom ovog rada je do sada bio nepoznat. Interdisciplinarna saradnja je izuzetno značajna u ovom radu jer je rezultirala reformom procesa restauracije ikona u Albaniji, koji je u cjelosti zasnovan na naučnim metodama.