FACTORS THAT CAUSED THE WARP OF THE WOODBLOCKS – COUNTERMEASURES

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1. Identifying the issues

Woodblocks for printing first appeared in Vietnam in Ly Dynasty (1010-1225) and their popularity exploded during Hau Le Dynasty (1428-1527). However, nowadays, most of the woodblocks that remain are from Nguyen Dynasty.

The National Archives Center IV is currently preserving 34.619 Nguyen Dynasty woodblocks. These are documents in Chinese characters or Chữ Nôm (Southern characters) that were carved in reverse on the woodblocks, which were then used for book printing in Vietnam in the XIX century and in the early XX century. According to research documents, the woods that were used to make the carving board for Nguyen Dynasty woodblock documents were mostly from the plants Diospyros decandra, Pyrus, Rhamnaceae and Firmiana simplex.

Due to many reasons involving many technical and historical factors, at present, a large number of Nguyen dynasty woodblocks are suffering damages, such as: bent, warped, cracked, fractured, termite, decayed and the character-engraved sides are dust-covered, encrusted with ink, and not able to meet the woodblocks quality criteria. According to the data reported by The National Archive Center IV, the number of bent woodblocks is 3.332, accounting for 9,62% of the archived woodblocks.

In order to enhance the quality of the woodblocks, to restrain the bendiness, and warp of the woodblocks, we must identify the causes of the woodblocks' defects, to set the basis on which we could develop the countermeasures and create the condition ideal to preserve the woodblocks.

2. Factors that caused the woodblocks to bend or wrap

2.1. Different forms of bent/warped condition

According to the research of Mr. Hoang Trung Hieu and Mrs. Hoang Thi Tam (Research and develop solutions to restrain the degradation rate of Nguyen Dynasty woodblock documents - 2017), most of the 3.332 bent woodblocks are U-shape bent, while very few woodblocks suffer from surficial bent and the latter condition has little impact on the woodblocks' quality.

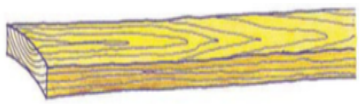
a)  b) 

Illustration 1. Main forms of bent/warp conditions of the woodblocks

a) U-shape bent b) surficial bent

Illustration 2. U-shape bent woodblocks

2.2. Factors that caused the woodblocks to bent/wrap

2.2.1. The process of wood-sawing for the woodblock's core

Wood is a biological material that has ununiformed structure and characteristic throughout the diameter and the length of the trunk. The lack of uniformity could be demonstrated with the 3 dimensional perspective planes: Transverse plane, Tangential plane and Radial plane (illustration 3).

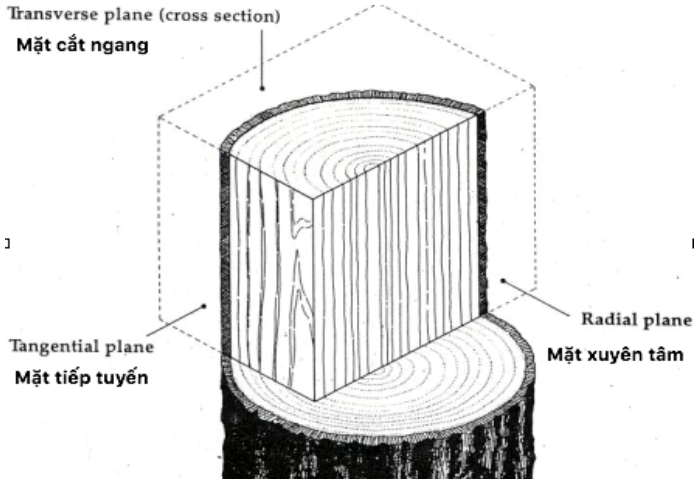


Illustration 3. Transverse plane, Tangential plane and radial plane

One of the primary cause of the woodblock's warp (bent, warped, fractured) is the uneven shrinkage of the wood in the different dimensions. The highest shrinkage appears on the tangential dimension (tangential plane) and the lowest on the transverse dimension (transverse plane).

When the ambient humidity is lower than the humidity enough to saturate the wood, the wood would begin to shrink. The uneven shrinkage over the different dimensions will cause the woodblocks to bend, warp, or twisted; the different pulling forces and pressure forces (inner forces) will form. If the gravity of the inner forces exceed the durability limit of the wood, it will crack or fracture.

On the other hand, the wood always has its growth stress. The gravity of the wood stresses depends on the type of wood, the structure of the wood, and the location of the board… During and after the process of sawing for the wood core, the growth stress would reduce to a balance state, causing the bending phenomenon after sawing.

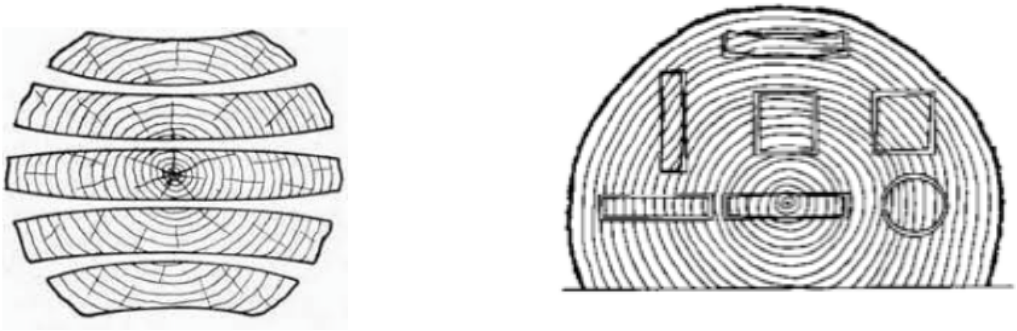


Illustration 4. Sawed wood is bent/warped due to the shrinkage and growth pressure

2.2.2. The different level of humidity on each sides of the woodblocks

During the usage and storage of the woodblocks, if there is a difference between the level of surficial humidity experienced by each sides, it caused the woodblocks to bend.

By nature, when the wood surface absorb more moisture, it would expand and be under growth pressure (convex side); the surface that absorb little humidity or incapable of absorbing humidity due to the lacquer coating would shrink and be under pulling force (concave side).

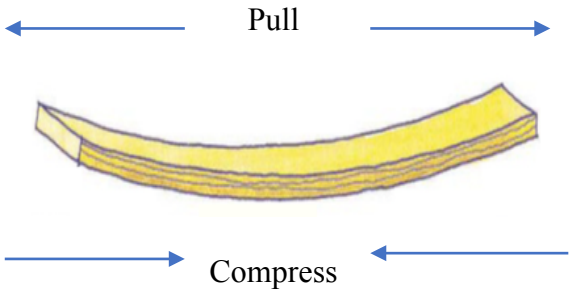


Illustration 5. The sawed wood is bent/warped as the underneath surface absorbs more moisture than the upper surface

The woodblocks are often character-engraved on the surface; during the printing process that engraved surface was painted on with a layer of (India ink). The Indian ink is made from the coal dust from some certain flora species mixed with resin or gelatin (gelatin). When the ink dried, it would encrust the surface, forming a layer that prevents mold and restrain the wood from absorbing moisture.

Thus, the intensive usage of the woodblocks thickened the ink layer and shifted the balance between the two side's moisture absorb capacity. The carved side, which absorbs little or no moisture would shrink (concave side), while the uncarved side, which has no protective ink layer, would absorb more moisture and would expand (convex side). The woodblocks would concave even further if the sawed wood core was on the tangential plane and the carved side is closer toward the tree's bark.

While archived, if the 2 sides of the woodblocks experienced ununiformed ambient conditions (humidity, temperature) the woodblocks would also bend in the same pattern and due to the same cause.

3. Countermeasures

- Woodblocks are bent due to the wood core producing process and growth pressure: It's tricky to fix this defect because the majority of the Nguyen Dynasty woodblocks are aged, the wood is dry and has little elasticity. Chemical and Physical solutions are out of question given the aged wood (Many woodblocks are decayed and have little wood core left).

- Woodblocks are bent due to the uneven level of moisture experienced by the sides: To minimize the effect on the woodblocks, physical measures could be employed (heat-humidity balance) to balance the humidity absorbing and releasing capacity of the two sides of.

Step 1: Clear the old ink layer from the woodblock surface.

Step 2: Paint Indian ink or other water-resistant substance (liquidized paraffin or PU clear paint) lon the uncarved side of the woodblock (convex side).

Step 3: Fix the concave by storing the woodblocks that went through step 2 for a duration dependent on the degree of concave, and the physical condition of the wood.

Step 4: Stabilization processing by clearing off the uncarved side and then apply the Indian Ink on both sides of the woodblocks, or apply the ink on the carved side and the water-resistant substance on the uncarved side.

Step 5: Store the processed woodblocks in 55-65% air humidity condition, perfectly air-ventilated (both sides get to access the air) and regularly flip the woodblocks./.

4. Conclusion

Bent, warped are the conditions often found on sawed wood in general and woodblocks in particular. This defect causes the quality to degrade, as it causes, the product to warp and later leads to the wood fractured, cracked and broken.

Nguyen Dynasty woodblock is an unique wooden products - the first World Documentary Herritage of Vietnam recognized by the UNESCO on July 31th 2009. Due to the carefulness that is required to fix the defects (bent, warped, cracked, fractured, mold, termite), it's much more labor intensive and costly than fixing normal wood product.

Fixing wood's concave using physical measure (heat – humidity balance) is the suitable method for Nguyen Dynasty woodblocks. However, this method takes long and does not guarantee to completely fix the defect./.