

Preservation, Protection and Utilization of Ancient Woodblocks of Yangzhou Block Printing Museum

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<Summary>

Woodblock printing has a long history of use in China, and is among the important components of tangible cultural heritage. Since wooden cultural assets, made of organic materials, can be very easily putrefied or vermin-damaged, special care has to be taken in their preservation and protection. This article, based on comprehensive investigation of vermin in the Yangzhou Museum-kept woodblocks, proposes certain preservation and restoration methods and thereby hopes to play an active role of contributing to protection of wooden cultural assets.

Keywords: Collections of Yangzhou Museum (or kept by Yangzhou Museum), wooden cultural assets, woodblock, vermin, protection

1. Introduction

Yangzhou, with a history of 2,500 years, has experienced prosperity and extreme changes of China's past dynasties and accumulated a rich history and culture for a long time. Publishing of books in Yangzhou began in the Mid-Tang period, not long after invention of printing in China. During the Song dynasty, Yangzhou's publishing industry earned a notable status nationwide. The earliest woodblock-printed version of the book 『Dream Pool Essays (몽계필담 夢溪筆談)』 - a masterpiece by *Shen Kuo* (심괄 沈括) - was published in none other than Yangzhou.

During the Qing dynasty, book publishing became a fashion across various regions, and not only the number of books published or the scale but excellency of the quality far exceeded those of previous dynasties. In the 44th year of the Qing dynasty's Kangxi Emperor (1705), *Cao Yin* (조인 曹寅), implementing the emperor's order, published in Yangzhou the book 『*Quan Tangshi* (Collection of Poetry from Tang Dynasty)』 (전당시 全唐詩), which not only had meticulous, fine engraving but very exquisite book-binding. The book 『*The Scholars* (유림외사 儒林外史)』, a masterpiece, was first published in Yangzhou. In addition, classics published in Yangzhou had a certain degree of fame in China and overseas, dubbed 'Woodblock-printed in Yangzhou (양주각본 揚州刻本).'

In August 2003, Yangzhou Block Printing Museum was established upon permit of the State Council of the People's Republic of China. Woodblocks in the museum previously used to be kept in Guangling Publishing in Yangzhou (양주광릉서사 揚州廣陵書社), and wood, not to mention being highly inflammable as it is organic compound, is easily putrefied or vermin-damaged. Thus, as a result of deterioration by insects and microorganism, it is not easy to preserve wooden cultural assets for a long time. Also, under the influence of climatic environment, wooden cultural assets are cracked, deformed or bent very easily.

Yangzhou Block Printing Museum, based on the Ministry of Culture of the People's Republic of China's opinion on protection of the museum's woodblocks and the experts' and engineers' investigation of basic information on cultural assets and their measurement and analysis, continuously conducted on-site experiments, thus allowing its woodblocks to enjoy protection and restoration and satisfying the demand for their preservation and display.

2. Types and analysis of vermin in woodblocks in the museum

Since woodblocks, being organic fiber materials and hydrophile, expands when absorbing moisture and contracts when deprived of moisture, their surrounding environment's humidity tends to have relatively big impact on cultural assets made of fiber material, and if temperature and humidity of the surrounding environment suddenly rises or falls, the damage to such cultural assets becomes

even greater. Hot, humid environment provides conditions favorable to growth and reproduction of mold and vermin, and in such environment, it also becomes easier for woodblocks to be eroded by harmful organisms.

Wooden instruments generally have water content of 12 to 13%, and at lower water content, show distortion. And since wood is actually affected by outside temperature and humidity, its water content can be deemed to vary from time to time. To prevent erosion and deformation by mold and insects, we need to be able to control water content during storage of wood, which content should not exceed 20% at the highest. The woodblocks in Yangzhou Block Printing Museum, before being kept in the museum storage therein, used to be kept in Guangling Publishing, and at the time the woodblocks were made, not only was the wood not completely dried but in the process of its use and preservation, no additional systematic insecticide and mold prevention were conducted despite being exposed to moisture, so they were damaged, were imperfect, or suffered very serious problems such as putrefaction and mold.

First, testing of moth holes on woodblocks, of shells from metamorphosis of moth, and of its excretion and corpse showed that the main types of moth included mulberry longhorn beetle, long moth, 도둑 좀 (역어를 찾지 못함: 역자), and wood moth. Long moth drills holes into the wood, leaves moth pieces in the shape of fine powder, and, together with flour moth, are collectively called powder moth. When the imago drills holes into the wood, powder falls at the opening of the holes, which have diameters of 1.6 to 2.1 mm. Inside the woodblock criss-cross moth-trodden paths, and in extreme cases, almost all of the inside is in the state of powder and thus crumbles even by contact.

<1. Vermin damage in woodblocks>

<2. Long moth>

Second, we extracted mold samples on the site and then cultured, separated and examined them in the laboratory, discovering that molds discovered in the woodblocks were those mostly found in southern China including *Mucor mucedo*, *Stachybotrys atra*, *Penicillium Chrysogenum* and *alternaria alternate*. Molds are all

the more rampant.

<3. Woodblocks infested with mold>

<4. Mucor mucedo>

Third, as for rotten woodblocks, in the case of woodblocks for the book 『*Un-ja-jae-gam-chong-seo* (운자재감총서 雲自在龕叢書)』, they had a volume of 876.65m³ and a mass of 196.6g, although the mass ought to have been about 412.0g given the jujube wood's density of 0.47g/m³ at natural dry state. The actual mass was only 47.7% of the theoretical value. And in the case of the book 『*Ye-pung-dang-mun-man-jon* (예풍당문만존 藝風堂文漫存)』, it was only 54.4% of the theoretical value (원문인 “이론상 수치는 54.4%였다”는 “이론상 수치의 54.4%였다”의 오타로 이해: 역자). Most of the woodblocks were already empty inside due to moth and significantly putrefied, only the surface layer barely remaining, to the point of crumbling with just a little bit of strength being applied.

<5. Basic condition of woodblocks for the book 『*Un-ja-jae-gam-chong-seo*』>

3. Preservation of woodblocks kept in the museum

After learning, from the types and analysis of damage in museum-kept woodblocks, that damage by moth and damage by mold were the most important causes of woodblocks' damage and that change in environment was the most important element affecting woodblocks, we conducted preservation of woodblocks mainly in the following areas.

1) Insect prevention

Generally, traditional measures against vermin damage include insecticide and sterilization using fumigation chemicals, and chemicals used for fumigation include ethylene oxide (C₂H₄O), methyl bromide (CH₃Br), and carbon

tetrachloride (CCL₄). These fumigation chemicals have relatively strong toxicity and thus, in consideration of environmental elements, are being used less and less, and instead nitrogen gas is being used for insecticide and sterilization of woodblocks.

Earlier, in September 2007, Yangzhou Block Printing Museum, as emergency measures for its woodblocks, conducted insect and mold prevention. Based on the woodblocks' vermin damage and on-site conditions, the museum mixed Empenthrin, also called vaporthrin, with NMF-1 insect and mold prevention chemicals (key ingredient being C₉H₇BrO) in its emergency measures for woodblocks. Initially, it sprayed the resulting chemicals on the entire woodblock and then injected chemicals into moth holes with syringe. Empenthrin, a kind of integrated insecticide chemicals, kills insects when contacted, but due to its generally low toxicity, has always been broadly used in the fields of sanitation or medicine.

Nearly 5 years of observation after the insect and mold prevention in woodblocks showed that mold did not keep reproducing or spreading, so one could say that mold control here already is effective. And close observation of the woodblocks showed no damage thereof by chemicals. Currently, nitrogen gas is being used for that purpose.

2) Dust prevention

Dusts sometimes contains acidic or alkaline minute chemical particles, metal dusts, micro-organism spores, etc. Accumulation of dusts on cultural assets not only alters exterior colors or forms contaminants but even causes chemical corrosion or mechanical damage. Microorganism spores, floating in and falling on cultural assets, reproduce or propagate under the right conditions. When cultural assets are on display or kept in the museum storage, one ought to maintain not only a clean environment but good ventilation for them with attention to the following matters, and must wear gloves when touching cultural assets, because contaminants and perspiration, when in contact with the surface of cultural assets, becomes nutrient for molds, thus making it easier for molds to form.

3) Preventive protection of woodblocks

By endeavoring to suppress various environmental factors harming woodblocks through effective quality control, monitoring, evaluation and adjustment and thereby create an environment wherein cultural assets can safely be preserved in stable and cleanly environment, one has to prevent or delay, as much as possible, situations wherein woodblocks' physical or chemical properties change and ultimately deterioration occurs, thus achieving the purpose of long-term preservation. Although there are lots of elements affecting changes in cultural assets, since change in humidity has the biggest effect on preservation of woodblock itself and since effective control of humidity can have favorable effect on prevention of mold or vermin damage, priority must be placed in its control. And then, in-flow of hazardous air including temperature and light has to be controlled. The museum storage for woodblocks already has temperature & humidity chamber (원문은 “**항온항습 설비**”: 역자), and has installed temperature & humidity meter so that it can control and monitor the museum storage's environment and refer to the measured values.

4. Restoration of woodblocks

1) Maintaining cleanliness

Woodblocks, in the process of their preservation, accumulate a great amount of dusts and are damaged by vermin, resulting in wood scraps and excretion residues, and also, due to dirt and mold stains occurring, measures to maintain cleanliness have to be taken.

(1) Mechanical method

We mechanically remove dusts, wood scraps, vermin excretion, etc. on the woodblocks using tools such as soft towel, bamboo chisel, and bull's horn knife, and suck up dusts using small vacuum cleaner as supplementary instrument.

(2) Cleansing with aqueous solution

We use aqueous solution to cleanse dusts and contaminants fastened onto the woodblocks. We mix OP surfactant (APEO) with water-soluble mold preventives (preventive agent) to make aqueous cleansing agent. As regards cleansing method, we pick cleansing agent-soaked cotton with tweezers, softly rub out the dusts and contaminants, and for hard, solid contaminants, we soak cotton swab with cleansing agent, apply sufficient amount thereof on the woodblocks, and then when the contaminants become soft, remove them by also using the mechanical method.

(3) Cleansing with organic solution

We cleanse mold stains on the woodblocks by using organic solution. We make cleansing agent out of mold preventives (preventive agent) diluted to 1‰ (1 per mille, 1/1,000), and remove mold stains by softly rubbing them with cleansing agent-soaked cotton swabs.

2) Insecticide and mold prevention

(1) Fumigation insecticide

Most woodblocks have been damaged by vermin, so in order to prevent cross-contamination between woodblocks, we conduct fumigation insecticide.

In consideration of elements such as environmental protection and human body safety, we use nitrogen gas in insecticide. Long-term insecticide using the circulation-type nitrogen gas method based on actual situation is a relatively acceptable method which ensures not only moisture control by the woodblocks themselves but the wood's inherent liveliness. Although the nitrogen gas-using method might be able to avoid such variability, it can continuously decrease moisture (drying) within and thereby cause putrefaction.

(2) Insect and mold prevention

The insecticide equipment using fumigation method could treat about 500

woodblocks at a time and since the treating session was relatively long, untreated woodblocks on the shelves needed preventive measures of continuously spraying insect and mold prevention chemicals prior to treatment. As for woodblocks on the shelves, since mold could reproduce or propagate due to high humidity in the museum storage, we placed insect repellents and mold prevention chemicals on each floor of the shelves.

3) Restoration

(1) Preparations

In restoration, we used traditionally-used tools and materials (e.g., water-soluble adhesives, bull's horn, and bamboo skewer) as much as possible, and thus endeavored to make the restored color and gloss as similar as possible to the original ones so that the original condition could be restored. For materials which are absolutely necessary, we used those which were soft in nature, had no color or gloss, and had no poison (toxicity) or adverse effect.

(2) Binding broken parts

In the case of a broken woodblock, we initially combine them, compare between the broken side (face) (원문인 “깨진 단면”을 “깨진 면” 의미로 이해: 역자) and the serial number and then at locations where such broken sides meet each other, make a hole with gimlet, penetrate one broken side with pre-cut bamboo skewer (bamboo skewer's length being the sum of depths of two holes) and cover it with the other broken side, and then observe the match. If there is no problem, we remove the bamboo skewer and then drop water-soluble adhesives in the hole and apply the same on the broken sides, insert the bamboo skewer therein, and place the woodblock on top of that and thus bind the broken area. In the case of a woodblock's cracks, we bind the same by dropping water-soluble adhesives therein with bamboo skewer.

In the use of water-soluble adhesives, one has to be careful so that the amount of water-soluble adhesives is not too much or little, thus preventing them from overflowing or becoming insufficient in amount. After binding by use

of water-soluble adhesives, we temporarily fasten the relevant part with pre-designed, plate-fastening tool and after the adhesives dry, have to check the condition of the bound part. We add water-soluble adhesives if they are insufficient in amount, and cleanse the runny water-soluble adhesives with bull's horn knife.

(3) Mixture of hole-filling materials

In parts or areas suffering from vermin damage (moth), we select different materials according to the woodblock's type of material, turn old hardwood into powder, mix the same with water-soluble adhesives, and use the foregoing to fill up empty holes. Considering that the woodblock and the hole-filling materials have to match each other, we used wood powder. As for adhesives, we generally used water-soluble adhesives or epoxy resin because we considered whether the woodblock had become relatively weak and thus could handle the weight or not. And the reason why we chose water-soluble adhesives of somewhat low strength was because we were concerned that excessive strength of the epoxy might damage the woodblock.

The ideal method is to fill the hole a little low and then flatly insert the surface with same-material piece of wood, which is a method which has actually been used in woodblock restoration for a long time. In addition, to ensure use of natural materials for restoration, we sometimes use mixture between wood powder and raw lacquer as hole-filling materials, but due to Chinese lacquer tree's physical properties, drying takes a long time and handling is more difficult.

(4) Internal reinforcement

Putrefied parts or areas need internal reinforcement by injecting low-concentration water-soluble epoxy resin with syringe. Water-soluble epoxy resin can also be used on the surface.

(5) Reviving the color

Since the bound part or the hole-filled part shows clear difference from the original woodblock, after the aforesaid process is completed, we have to conduct color-matching treatment. Since the museum-kept woodblocks have been used for printing or print-out, the surface layer's color has turned to black due to printing ink. So, in the museum, we evenly painted the restored part with printing-purpose printing ink, making the overall color basically match that of the original woodblocks.

4) Reproduction

Woodblocks having undergone protection and restoration processes, under the right conditions, can be preserved and displayed for a long time. Since woodblocks' material itself still tends to be relatively weak, however, they are not suitable for continuous printing. Thus, we reproduce the woodblocks, which enables to supplement missing woodblocks. Currently, the reproduction process is entirely conducted in traditional methods, in the areas of wood selection, soaking in salt water, drying, 제판하기 (바로 다음에 열거되는 “판목 제작하기(block wood production)”와 같은 의미로 이해: 역자), block wood production, carving woodblocks, inspection, revision, etc.

<6. Process of treating woodblock materials>

<7. Process of treating woodblock materials>

5. Display and utilization of woodblocks

In contemporary museums, based on the fundamentals of protection and management, display and utilization of collections are becoming more and more important. Yangzhou Block Printing Museum possesses over 100,000 woodblocks, which were mostly engraved in the Qing dynasty, are rich in content, and boast of great historic and literary value. But how to display and utilize woodblocks, a rather special collection, is becoming an issue which museums have to continuously study and explore.

Display of the woodblocks adopts, first, the ‘museum storage-type display,’ wherein we built museum storage for the woodblocks inside the exhibition hall and placed over 100,000 ancient woodblocks in the display shelves, and although they are tightly placed there because the shelves are divided based on catalog of books, there is an order there. The museum storage for woodblocks has outer walls with transparent glass on all sides, so not only can visitors clearly view inside the museum storage from the outside but can come close to the woodblocks, thus directly observing them and feeling a sense of realism or immediacy and thereby feeling like swimming in a giant sea of woodblocks. The visitors can sometimes see what kind of job the museum personnel are doing inside to protect ancient woodblocks, which also constitutes a part of the display. This display method could be called a very novel method not only based on the premise of protecting woodblocks but satisfying the requirement of display. The second may be the planning of <Woodblock Printing in China>, a special exhibition, and the activities with the theme of woodblock printing.

<8. Museum storage-type woodblock display>

<9. 『*Du-reung-si-sa* (두릉시사 杜陵詩史)』, newly printed with ancient woodblocks>

Since woodblocks can be deemed a storage device for printing technology, conducting printing at an appropriate level can be an act of protecting woodblocks to some degree. Our museum has formulated a plan based on the principles of protection of cultural assets and utilization of cultural assets, select woodblocks in relatively good condition as verified by experts, conduct printing, and publish woodblock-using books in collaboration with Zhonghua Book Company (중화서국 中華書局) and other reputable publishers, thus doing a very good job of promoting woodblock printing, designated as world intangible cultural heritage.

For example, the book 『*Du-reung-si-sa*』, whose original or base version was kept by *Yu Se-hyeong* (유세형 劉世珩), a famous bibliophile, is a chronological history of poetry for Du Fu’s poetry which is not only whole in its entirety but whose woodblock printed version is highly exquisite. A ‘history of poetry’ refers

to a collection of poems related to past historic facts and of detailed footnotes added to the foregoing. This book has been a collection of the *Museok Hwa* Clan (무석화씨 無錫華氏) in the Ming dynasty, *Gonsan Seo* Clan (곤산서씨 昆山徐氏) and *Sangu Song* Clan (상구송씨 商丘宋氏) in the Qing dynasty, and *Gye Han* (계한 季漢) of Taixian (태현 泰縣), at one time finding its way into Japan, and having been greatly valued by past bibliophiles. *Yu Se-hyeong*, after acquiring the original copy, himself conducted collation and authored 'collation notes' thereof, and invited *Do Ja-rin* (도자린 陶子麟) of Huanggang (황강 黃岡), an excellent woodblock engraver, to single-heartedly, meticulously engrave the woodblocks, and then re-published the Song dynasty's woodblock printed version in such perfection as the original one and without defects, deserving the reputation as the sole 'rare book' of Du Fu's poems.

Those involved in the aforesaid work, after completing cleansing and repairing the woodblocks, conducted printing with pine soot ink on the Xuan paper from Jing County, Anhui. Then, they made the book cover with *neung* (능 綾) [referring to thin, patterned silk], wrote the book's title not on the book cover but on another paper or silk and attached the same to the cover with *gyeon* (견 絹) [referring to raw silk]) and then bound the book with silk-thread and made *pogap* (포갑 包匣) with silk fabrics, thus using traditional printing methods. A total of 37 processes were used, all in handicraft, deserving to be called a masterpiece. Yangzhou Block Printing Museum also printed 『*Cho-sa-jip-ju* (초사집주 楚辭集注)』 and 『*Li-han-lim-jip* (이한림집 李翰林集)』 by the same method.