

# Conservation & Restoration of Paper Records\*

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### <국문초록>

급변하는 정보화시대 속에서 우리가 잊고 있는 중대한 사실이 있다. 이는 우리가 많은 양의 정보를 가장 빠르고 작고 편리하게 담고자 치중하고 있는 지금, 그 주체가 되는 기록물, 즉 종이에 적혀있는 과거의 역사는 조금씩 우리 곁에서 사라져 가고 있다는 사실이다. 다시 말하자면, 우리가 막대한 예산을 들여 이 기록물을 보존하는 목적으로 다른 매체로 전환시키는데 총력을 기울이면서도, 실제로 보존 대상인 이 기록물들에 대해서는 예산부족을 핑계로 삼아 등한시하고 있는 것이다. 기록물의 보존은 과거에도 중요하게 여겨졌고, 현재와 미래에도 계속 중요하게 여겨질 것이다. 그럼으로 우리는 과거의 기록이라는 메시지를 우리의 선조들로부터 전해 받아 우리의 다음세대에게 전해주는 메시지에 불과하므로 이 메시지의 역할에 대하여 정확하게 알아야 할 것이다. 또한 우리가 전해 받은 과거의 유물을 그대로 물려주기 위해서 우리가 이 시대에 할 수 있는 최선의 일은 그 원형을 잘 보존시키는 일이다. 이러한 기록물의 소실은 그 기록물에 적혀 있는 과거 역사의 소실을 뜻한다. 따라서 앞으로의 보존과학은 과거에 대한 우리의 탐험을 뒷받침할 많은 정보들을 제시하여 줄 것이며 이러한 정보들이 체계적으로 분류되어 정리될 때 한국 종이 기록물의 보존·복원이 발전을 거듭할 것이다.

## I. Introduction

Rapid development in IT technology is fundamentally changing our society at an amazing speed. People are now increasingly interested in finding an answer to the question: How can we store larger amount of information in a smaller and more convenient medium that allows for swift recording and retrieval? This question has not arisen in the 21st century but can be traced back to the time when mankind first tried

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to express and preserve its thoughts using external objects. One medium has replaced another and the incessant quest for a better container of our thoughts led to the invention of paper.

The 20th century witnessed the advent of human reading records (HRRs) as well as machine reading records (MRRs). HRRs refer to records that allow for a direct reading by humans as is the case with photographs and microfilms while MRRs refer to those that require a special device for reading such as magnetic tapes and optical discs. The two types of recording media have brought about a far-reaching influence on the course of human history and immensely accelerated the pace of mankind's record making. In particular, the Korean government is now investing massive financial and human resources on developing MRRs and MRR-related industries are playing an increasingly important role in our society. What are the ramifications of this for our future? In fact, the speed at which MRR is developing is so fast that probably much of what we hail as "state-of-the-art" today will most likely have become obsolete one year from now.

However, there is something conspicuously missing in all this hurly-burly of IT revolution: awareness of the need to preserve our past. In a sad irony, the current enthusiasm in preserving records by moving them from one medium to another does not apply to our past records preserved on paper, the very things that need to be preserved. They are being forgotten and lost piece by piece. While huge sums are spent to move data from old media to more advanced ones for conservation, historical records are overlooked because of "budgetary constraints."

Conservation and restoration of historical records has been one of the constant preoccupations of mankind. Whether it be East or West, there have been experts specializing in making and preserving books, which account for most of written records, and their efforts, combined with the force of modern science, gave birth in the 20th century to a discipline called "conservation science." In the following I will describe how we have and are trying to preserve and restore paper records in Korea.

## II. Materials for Paper Records

Most of existing records are those written on paper. Many other types of media have preceded it but they all have fallen into disuse as people have moved toward new recording media that were more versatile, easier and cheaper to use and store. Ever since its appearance, paper—one of China's four greatest inventions—has been the medium of choice for keeping records. We live surrounded by paper documents and life without paper is now unimaginable. Wherever we turn our eyes, it is there whether it be toilet paper, newspaper, books and calendar. Then it would be worthwhile to look at how these things are made and from what materials.

We have all heard, on many occasions from childhood, that Hanji, or Korean paper, is the best paper in the world and has many superb qualities. However it appears that most people's knowledge about Hanji is limited to the fact that it is made from mulberry tree. Throughout the period from Shilla to Choson, Koreans produced high-quality Hanji and left all their records on it. However the production method underwent a major change during Japanese occupation and, as a result, there remain only a few now who know how to make Hanji using the original method. Before turning to how Korean Hanji is produced and how ancient documents written on Hanji are preserved, let's have an overview of paper in general.

### 1. Paper in East and West

Until recently the generally accepted view was that paper as we know it was invented by Ts'ai Lun, a Chinese court official in the 1st century A.D. However archaeologists have discovered paper specimens produced before Christ was born, so a different view is now gaining support. It suggests that Ts'ai Lun is mentioned as the inventor of paper in the ancient Chinese history book not because he actually invented

paper but because he made a major improvement to make paper a more convenient medium for writing. A common dictionary defines paper as plant-derived cellulose fibers brought together in water through hydrogen bonding. According to this definition, papyrus and parchment are not paper though they can be used for roughly the same purpose. It appears that paper production was introduced to Koreans not long after its invention in China. Probably it was introduced at the same time as Buddhism—or earlier, which is quite likely based on the extant Hanji records. For example, Dharani Sutra from Seokgatop Pagoda (est. mid 8th century, National Treasure No. 126) and Avatamsaka Sutra (754 A.D., National Treasure No. 196, Ho Am Art Museum) show that Korea's traditional papermaking was perfected in as early as mid 8th century. Notably, the epilogue at the end of Avatamsaka Sutra mentions about papermaking and the quality of the paper on which it is written is superior to that of Buddhist scriptures of China of similar periods. Papermaking art was perfected on the Korean peninsula and transferred by Dam Jing, a monk of Koguryo, to Japan in the early 7th century. Then Japan modifies and develops its own papermaking technique. As for historical records regarding papermaking in Japan, massive amount of paper was needed in AD 673, when there was a major project to copy Buddhist scriptures at 'Senganji Temple' and the 53-year 'Shosoin Repository' record (from 727 to 780) names 233 kinds of paper.

Papermaking had taken firm root in Asia by 8th century but it was introduced in West much later because China kept its papermaking technology secret. But, according to tradition, Chinese (Tang Dynasty) papermakers were captured by the Arabs in a battle in AD 751, thus spreading the art westwards. Papermaking was introduced to Europe in the 13th century and spread widely in the 15th century. The technology used by Europeans at the time was basically the same as the one initially employed by the Chinese. They made paper from recycled materials from fish nets and other flax items using "Gadumddeugy" technology. So early European paper was mostly made from flax clothes collected by ragmen and later papermakers in the region started to use cotton too. Papermaking in the West then underwent a revolutionary change in the early 19th

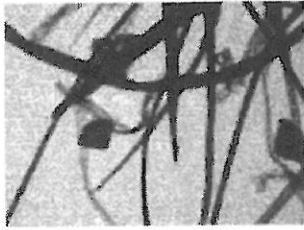
century as a result of the introduction of machines, new sizing agents and bleaching chemicals. A major breakthrough in printing was made when mass production of paper became possible thanks to technological innovations such as fourdrinier machines on which paper can be formed on a continuous sheet; rosin sizing; and the use of wood pulp. But, as people was to learn later, this type of mass-produced paper can scarcely last a century, which has raised a serious question about how to preserve the huge amounts of written records made on it. The biggest problem is the destructive effect that residual acid has on paper.

This is a serious problem both in the East and West because the West's papermaking, as is the case with other industrial technology, was exported to the East and, since then, most of Asia's written records have been made on industrially produced paper. Therefore when there is a problem concerning the conservation of a paper record, one of the first questions to be asked is what is the qualitative characteristics of the paper.

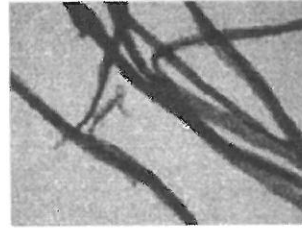
## **2. Paper in China, Korea and Japan**

As mentioned above, we here quite often that Hanji is the best paper in the world. A question that naturally follows would be: What is it about Hanji that makes it the best? Paper was invented in China and transferred to Korea and Japan. But the three countries have different natural and cultural characteristics and papermaking took different paths of development among them. At first, Chinese made paper from flax fibers but later used short fibers such as bamboo and Quin-tan. This switch in materials appears to have been for the purpose of improving the efficiency of production process and lowering raw material cost. For example, Japan's Engisiki dated AD 927 says that using flax, the first in the series of raw materials for making paper, took three times as long as mulberry. This appears to have been a key reason that flax was replaced by other materials in all three countries. There is a common saying that the

most economical raw material is something that one can obtain within 10 li ("li" is an old Korean unit of length and 1 li is the same as 393 meters). In China, Bamboo and Quin-tan satisfy this condition and in Korea and Japan mulberry. (Figure 1, Figure 2)

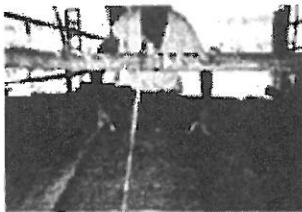


【Figure 1】 Bamboo fiber

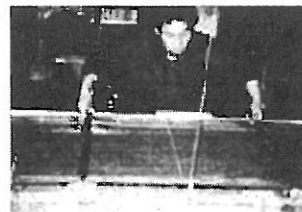


【Figure 2】 Mulberry fiber

The papermaking technique that was introduced to Korea was Gadumddeugi. Improving on this, the Koreans later established Heulimddeugi and Woebalddeugi and the Japanese made further changes and developed Sangbalddeugi. Of particular importance is Korean Woebalddeugi, which, as suggested by its name, was used only in Korea. In Woebalddeugi, which has disappeared even in Korea, paper is skimmed in the opposite direction to that in Japanese Sangbalddeugi and even the flow of water is also quite different. (Figure 3 and Figure 4)



【Figure 3】 Korean Woebalddeugi

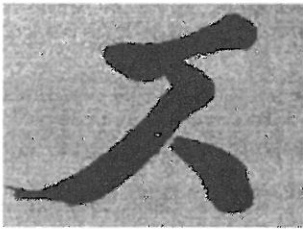


【Figure 4】 Japanese Sangbalddeugi

In Woebalddeugi, one end of a sheet is bound have a different thickness from the

opposite end. In order to produce an evenly thick sheet, one has to put together two sheets forcing the formation of hydrogen bonding between plant cellulose fibers in water. Therefore Korean paper is invariably made by putting together multiple sheets—two or four depending on the desired thickness. This method makes paper tougher.

Korean mulberry also possesses superb qualities as raw material for paper as Korea has more distinct seasons in comparison with China and Japan. This appears to be the reason that Korean mulberry paper has more sheen than its counterparts in China and Japan. Mulberry fibers are long and they are arranged in random directions in Woebalddeugi because there is no wood fences in this method, which causes water to flow away faster compared with Sangbalddeugi. In order to address this problem, one has to shake the rack swiftly in multiple directions in contrast to Sangbalddeugi, in which the rack is shaken in one direction. Shaking in multiple directions adds to the paper's cohesiveness. These are the factors behind the toughness of Korean mulberry paper. In addition, a process called "Pounding the sheets with a wooden block" also adds to Korean paper's quality. In "pounding" one adds a small amount of moisture to the paper and pound it, in order to remove empty spaces between fibers and make the paper thinner. This process also makes the surface of paper smoother, which makes it easier to write on it. (Figure 5, Figure 6) It serves the same purpose as sizing in European papermaking.



【Figure 5】 Before "pounding"



【Figure 6】 After "pounding"

As seen above, Hanji is made from the mulberry tree, which produces long fibers—

and the mulberry tree grown in Korea with its distinct seasons—using Woebalddeugi. As a result, it is suitable not only for writing but also for many other everyday purposes due to its toughness. However Woebalddeugi disappeared during Japanese colonial rule giving its place to Japan’s Sangbalddeugi. This was because Woebalddeugi, as it requires adjoining multiple sheets, takes more than twice as much time and labor and is more difficult to learn than Sangbalddeugi, which makes it less attractive from an economic point of view. Economic consideration was also behind the replacement of mulberry paper by Western paper made from wood pulp.

### III. Conservation and Restoration of Paper Records

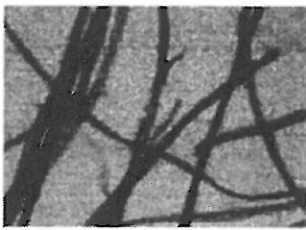
Korea’s oldest extant paper records are Dharani Sutra of Seokgatop Pagoda, Avatamsaka Sutra held by Ho Am Art Museum, Dharani Sutra of Hwaom Temple and Dharani Sutra of Nawon-ri. The author published a study on their paper quality and conservation issues in 1998. The four specimens all were “pounding” processed as is the case with all the Buddhist scripture and other paper documents of the Koryo and Choson periods. They all display a shining, smooth surface characteristic of “pounding”-processed paper and one can see that writing material—Chinese ink, gold powder or silver powder—have not penetrated their surface. In addition, thanks to the superb chemical characteristics of mulberry fibers, Korea’s ancient paper documents have a longevity that far surpasses that of the records made on Western paper. And they are less prone to damages caused by environmental factors such as bugs and mold compared with Japanese paper documents. However, when it comes to damages caused by poor handling or conservation, Korea’s cultural assets are in worse states.

Conservation and restoration methods vary from region to region and from one period to another. In Korea, the task fell to the experts called “traditional mounters” in the past

and, since the Japanese occupation, to “professional mounters”. However, recently a systematic approach is attempted by specialists armed with modern science. They employ tools such as follows.

### 1. Investigation and Photographing

One should make a thorough record of all the information related to the specimen before it undergoes any conservation treatment. This includes photographing and, for the parts that cannot be reached by a naked eye, microscope photographing. For example, if one wants to determine the type of the fiber, he can stain it with C dye and then observe the result under microscope. This forms the basis for producing paper of the same quality as the original that will be used in restoration. For example, in the restoration of “Roster of Slaves” of Songgwang-sa Temple (Treasure No. 572), fiber photographing showed that it was made of mulberry fibers which were cut into smaller pieces. So researchers could produce the same kind of paper for restoration. (Figure 7, Figure 8)



【Figure 7】 Mulberry Fibers of “Roster of Slaves” of Songgwang-sa Temple



【Figure 8】 Mulberry Fibers Used in Restoration

In order to produce paper more approximating the original, one needs to know not

only the fiber type but also the thickness, weight per unit area and density of the original paper. These pieces of information are gathered before restoration treatments and form the basis for them. In addition to ordinary photographs of the whole and parts, one sometimes needs to take infrared pictures of the original. As for features that cannot be photographed, one can turn to hand drawing.

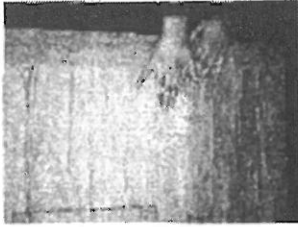
## 2. Dismantling

Records that are in the form of bound books, lengthily folded books or hand scroll) should be dismantled to allow for conservation treatments. The sequence of dismantling should be recorded without fail so that the pieces can be restored after the treatments in the same arrangement as the original. In addition, all the new information obtained during dismantling should be recorded so that the post-restoration specimen is as close to the original as possible.

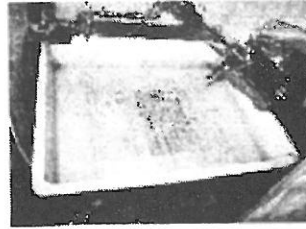
If there is a backing paper, it should be removed. This process often follows the cleaning process.

## 3. Cleaning

There are two types of cleaning: dry and wet. Dry cleaning is the removal of dust and dirt from surface with brushes. In wet cleaning, the dry-cleaned specimen is submerged in filtered neutral water to get rid of contaminants that ooze out. (Figure 9, Figure 10). For a simple example, if one subjects a newspaper that has been severely acid damaged and darkened to the wet cleaning process, he can see it recover elasticity and brightness. But wet cleaning can be performed on records that do not involve water-soluble materials.



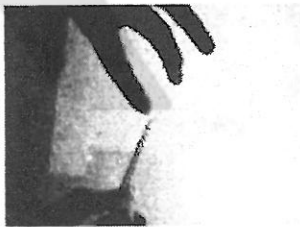
【Figure 9】



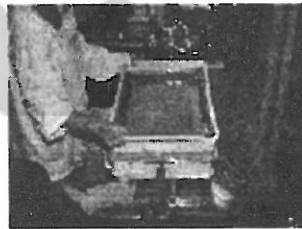
【Figure 10】

#### 4. Patching

In addition to traditional patching techniques in which damaged parts were manually patched with newly-produced counterparts, there is a method called “leaf-casting” developed in northern Europe and then recently spread to the East. (Pictures 11 and 12)



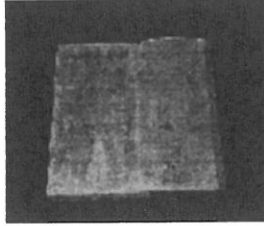
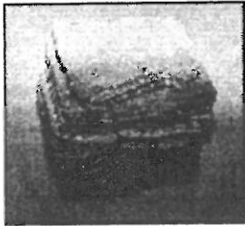
【Picture 11】 Patching



【Picture 12】 Leaf-casting

This method was designed to repair massive amounts of documents by recomposing paper by pouring water with dissolved fiber substances into the holes of the original paper whose nature was determined to be close to the fiber added. This method was derived from the observation that plant-derived cellulose forms paper through hydrogen bonds in water solution. It originally utilized wood pulp—a short fiber—so it has been unsuitable for traditional Oriental paper treatments which used mulberry fiber—a long fiber. However, newly emerging techniques such as cutting mulberry fiber into shorter

pieces have allowed for its applications in the East as well. (Pictures 13, 14 and 15)



【Picture 13】 Register - 【Picture 14】 After repair 【Picture 15】 After repair  
before repair

Though it was developed to address the labor-intensive and time-consuming aspects of manual patching, it also has its own limitations. A case in point is documents from ancient Korea that were often designed to have holes along the chain line. Leaf-casting such books would fill the holes as well as damaged portions. Besides, the fact that it requires lots of water makes it unfit for dyed records.

## 5. Backing or binding

Mulberry fiber is preserved relatively well that in many cases it does not require backing. Backing was once used almost unconditionally for reinforcement purposes. However, since it compromises the original shape its use should be reserved only for inevitable cases: restoration of badly damaged records and conservation of records made of poor-quality short fibers. Even in those cases, “thin” mulberry paper should be used to minimize distortions while it gives a reinforcing effect to the records. The records then should be bound or finished according to the original form.

## 6. Storage

Once records are fully treated for conservation, they should be kept in a storage box. If paulownia is not available for budgetary reasons, neutral mat paper or folder paper can be used. Stored records should be checked for their state of maintenance with meticulous care.

## 7. Writing a report

All the above steps should be documented and the resulting document should be stored together with the records in question. It can serve very usefully as a point of reference for future treatments of the records.

## IV. Conclusion

Conservation of records will always remain an undertaking of utmost significance. As to heritage, we are not its owners but merely messengers charged with receiving it from forebears and handing it down to generations to come. The best thing we can do about this task is to preserve its original shape as much as possible. However, in Korea no systemic research has ever been undertaken into paper, the very material used for documented heritage. Also lacking is serious research into how to preserve and restore paper records. Dynasty records and protocols from ancient Korea suggest that ancestors understood the characteristics of different papers and use them in a reasonable and effective way accordingly. We, however, have not still figured out what those papers really were.

This lack of our understanding of past records stands in stark contrast to spectacular

advancement of modern sciences. As suggested earlier, we should bear in mind the axiom that a loss of records is no less serious than a loss of history per se that they have stood witness to.

However, it is still true that since the dawning of the 20th century conservation of records has shifted away from empirical to more scientific approaches, demonstrating a lot of previously unknown materials and techniques as well as enabling development of new materials and techniques. It is in this context that conservation science is expected to play an increasingly important role in providing valuable information for our search for the past and taking conservation of paper records in Korea one big step further.

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