

The Use and Restoration of Papers for Archival Preservation—Case Study of National Taiwan Library

Mei-Wen Hsu, Chiao-Min Lin

National Chengchi University, Taipei, Republic of China (Taiwan)

Background. There is significant progress in preservation and restoration of archives in various countries worldwide. And associated management technology specifications had been established. Archives Act of Taiwan (R.O.C.) was issued on 25th Dec. 1999. It was a very important event for preservation and restoration of archives. The word “Preservation” denotes activity with respect to collection of library, archives, and museum. Workers of cultural relic preservation and restoration must realize the threat regarding the damage and deterioration of data from which library and archives are suffering.

Objectives. (1) Realize the importance to know the characteristics and specifications of papers for preservation and restoration of archives; (2) Realize the types and properties of papers for preservation and restoration of archives in Taiwan; (3) Realize the papers and properties used by National Taiwan Library for preservation and restoration of archives.

Methods. The research design of this paper adopted literature analysis and case study methods. Book Hospital, National Taiwan Library was chosen as object of study in an attempt to finding out the most eligible papers and their characteristics for preservation and restoration of archives. Two steps of literature discussion and sample selection (non-random) were included. Selection of papers was made between two systems of conventional papermaking industry in Taiwan and imported acid-free papers, and samples of study were found. Last, a data preservation theory was established according to properties of papers. The theory was compared with existing documents to find similarities and differences as the basis to modify the initial theory established. In the end of paper, conclusion and suggestion were proposed.

Results. (1) Use acid-free papers with low lignin content; (2) Use bast fiber papers with longer fibers; (3) Use papers made from virgin pulp instead of recycled papers made from recycled pulp to restore archives; (4) Appropriately use alkaline papers to neutralize acid archives papers.

Contributions. Urge archives personnel to conduct preventive operation of archival preservation in order to maintain the storability and durability of paper archives. This research also provides various units with paper conditions used for preservation and restoration of archives.

Keywords: archival preservation, archival repair, paper condition, paper selection, archival mounting, paper restoration, acid-free paper

Mei-Wen Hsu, Ph.D. student, Graduate Institute of Library, Information and Archival Studies, National Chengchi University, Republic of China (Taiwan).

Chiao-Min Lin, Professor, Graduate Institute of Library, Information and Archival Studies, National Chengchi University, Republic of China (Taiwan).

Introduction

There is significant progress in preservation and restoration of archives in various countries worldwide. And associated management technology specifications had been established. *Archives Act of Taiwan (R.O.C.)* was issued on 25th Dec. 1999. It was a very important event for preservation and restoration of archives. The word “preservation” denotes activity with respect to collection of library, archives, and museum. Workers of cultural relic preservation and restoration must realize the threat regarding the damage and deterioration of data from which library and archives are suffering including reinforcement and deacidification of book papers, restoration, framing, and mounting of books, protection of handwritings of book, control and adjustment of humidity of stack room, prevention and cure of noxious gas hazards from books, prevention and cure of organism and microorganism from books, dust-proof and dust-free, light rays and light-tight, fireproofing and firefighting, water-proof, theft-proof, and development of durable book materials etc. In modern times, material protection of microfilms and magnetic tapes has become an important content to be maintained by above mentioned collection units due to availability of technologies of miniaturization, recording, computing, and disk. Therefore, the pursuit of above information is getting important.

Formation of archives in modern times was almost papers. These archives may have not been preserved in good hands, and the quantity of them is enormous. It takes continual and gradual improvements on current preservation conditions of archives. Besides timely advancement in cultivation of talents, appropriate materials for preservation and restoration of papers must be found. And associated, domestic specification of papers for preservation and restoration of archives shall be summarized, especially the informative requirements of papers for preservation and restoration of archives which is essential to personnel conducting preservation, framing, and mounting of archives. As a result, this paper tried to summarize all kinds of domestic papers for preservation and restoration of archives and took National Taiwan Library as an example in an attempt to summarizing the papers used in the library for preservation and restoration of archives.

Literature Review

In aspect of archival preservation, in accordance with “*Archives Act*”—*Principle of Archive Management* Article 6:2 principles namely “Management of archives shall regard unified rules and centralized management as principle. Any archives which can be displayed for appreciation, research, preservation, and implement of secular enlightenment shall be handed in to the authority for preservation.” Preparation office, National Archives Administration expressly stated the criteria of management and preservation of archives. The general specification of archival preservation technology expressly stated the safety maintenance operation is achieved through control of collection environment in order to benefit the preservation of archives and prevent them from damage or deterioration for archives to retain their original appearances. Thus *Draft of Technical Specification of Archival preservation* was stipulated. The Article 3 of this draft states: “Paper archives shall be preserved within polyester film protecting bag with stable chemical property, or archival clip, or protection box made from acid-free materials.” Item 2 of Article 3 states:

Preservation methods of archives can be chosen by various properties. Take permanent preservation of archives as an example, acid-free paper board can be used for framing. Otherwise archives can be stored within four-wing-folding acid-free protection box, vertical alkaline archival box, or flatwise alkaline painting box. General archives can be

preserved within polyester film protecting cover (bag) or acid-free archive clip, or to be separated with acid-free interleaf. (National Archives Administration, 2001b)

Due to the fact that the above papers for archival preservation as well as acid-free paperboards or board papers produced by domestic manufacturers have not been produced or sold domestically, in general imported acid-free paperboards by domestic manufacturers are used. The denoting acid-free paperboards here shall be acid-free or alkaline paperboards imported from abroad with certain thicknesses to be made into protection boxes or archival clips.

The following statements are the general confidentiality of Item 76 of *Administrative Manual of Archival Processing* published by Secretariat, Executive Yuan:

(1) Staff of each institution shall keep confidentiality of archives of this institution without revealing except for those allowed to go public.

(2) Processing of archives shall not be interspersed at will or be shown to others.

(3) Job secrets of cases being handled by personnel at each level shall not be discussed in private at any time. Those non-handling personnel shall not inquire about any official incidents beyond their business scope.

(4) Approval decisions, countersignatures, and meeting drafts of archives shall not be handled by any outsiders of this institution or even to be handed in to relevant parties of this case.

(5) Placement of archives shall be inside archival clip to prevent any glances by others.

(6) Official documents shall be kept inside locked drawers or cabinets after work or during temporary absence in office.

(7) Any official documental data which are not one's belonging shall not be ascertained or held. Any confidential official documents shall be preserved in offices to be checked at any time. Those without any continued necessity to be kept shall be returned to original unit. Those that cannot be returned shall be destroyed.

(8) Personnel in charge of confidential documents shall report to immediate supervisors for investigation and further processing when any handling or preserving confidential documents was found to be revealed, lost, or being judged to have possible disclosure.

In accordance with Article 4 of *Draft of Technical Specification of Archival Preservation*: "Any breakage of paper archives shall be restored at all times. The methods of restoration can be mounting and framing, inlaying, or other eligible means" (National Archives Administration, 2001b). Item 1 of Article 4 expressly states the principle of restoration of paper archives. Item 2¹ referred to Item 75 and 76 of *Administrative Manual of Archival Processing* published by Secretariat, Executive Yuan regarding documentation. The above personnel indicated persons in charge of collection, archival mounting, and framing. Due to the fact that framing personnel shall see the content of archive delivered by collection personnel to mounting and framing personnel, thus archival confidentiality items shall be followed as well without any disclosures.

Item 3 of Article 4 of *Draft of Technical Specification of Archival Preservation* states: "Broken archives shall be restored by mounting method. Archives with writing on one side shall be mounted with white paper on reverse side of the archive, and then the archives shall be mounted and framed with cellophane paper." Item 4 states "Broken or rimous archives shall be pasted with papers for one-sided written archives of mounting method.

¹ In accordance with Item 76 of "Administrative Manual of Archival Processing" published by Secretariat, Executive Yuan. Items of general confidentiality are listed as follow: by Secretariat, Executive Yuan.

Those with writing on both sides shall be pasted with cellophane papers” (National Archives Administration, 2001b). In accordance with Article 5 of *Draft of Technical Specification of Archival Preservation*: “In case paper archives get yellowed and embrittled, or deteriorated and damaged due to own property or influence by exterior environment, mounting processes shall be conducted” (National Archives Administration, 2001b). From above we concluded mounting can be done by using white paper, cellophane paper, or scrip. But no clear indication on acid-free paper, hand-made paper, or any paper name is given. Thus hand-made paper is speculated for mounting of domestic archives. Besides, Pi-Ling Hung (2011) mentioned in her thesis about interview with masters of restoration and mounting that various poundage of bark papers are used for restoration and mounting. But masters of restoration and mounting still considered the diversity of papers shall be pursued to handle papers required for original copies of archival literatures.

Moreover, on Sep. 26th 1986 Bureau of Standards, Metrology & Inspection, M.O.E.A. published *Permanence of Paper for Publications and Documents in Libraries and Archives* (CNS-13776) to become Taiwan national standards of high storability of coated papers and non-coated papers which focused on the long-term preservation of non-coated and coated papers to indicate the specification on elements of PH compliances, tear resistance strengths calcium carbonates, lignin contents, etc. Additionally Item 87 of documental processing handbook *10. Stationery Supplies & Processing Standards* specified the paper materials (cream-colored (white) simile papers or recycled papers at 70-80 GSM (g/m^2) or above), dimensions, and formats of official documents for each institution. And National Archives Administration expressly stated on its website² that archival administration is the continuation of documental operation. Use of paper for related kinds of official documents such as various draft letters shall refer to above protocols. Besides, it is also stated that recycled papers may have differences in durability due to different additives, lignin, and PH values. Durability gets worse with pulp containing poor oxidative resistance or acidic materials. In terms of long-term preservation, recycled papers do not belong to materials for long durability. Thus it is recommended for institution to consider expenditures, manpower, and time in choosing papers for official documents by archival values or expiry requirements in order to save the costs of future archival preservation. And base material is only a factor of archival preservation. Carefully preventive operations for archival preservation are still needed to prevent any damages of archival materials.

Archival Preservation and Papers for Restoration

In modern times, archives were made from diversified materials. But most of them were papers with usually three kinds of component elements including papers, inks, printing inks, etc. Research, Development, and Evaluation Commission, Executive Yuan published the book *Research on Technical Specification of Archival Preservation* and in accordance with Article 8 of *Rules of Implementation of Archives Act*: “Locations, machines, and tools for archival collections shall proceed according to regulations on dispositions of archival collecting environments and facilities stipulated by National Archives Administration.” Each kind of archives shall be stipulated with the same technical specification of preservation (Executive Yuan, 2015). According to Chapter 4 of that book saying archival formation materials were mostly papers, which are subject to influences of

² Referred to reply as follow: <http://www.archives.gov.tw/Faq/Default.aspx?cnid=534&p=42> No. FQ29042.

environment and own organic materials during preservation process. If preservation environment is unfavorable, there will be circumstances such as yellowing, embrittlement or deterioration resulting from acidification.

Archival preservation and restoration papers are very important. Selection of papers shall be acid-free or alkaline papers by property, and durability is a must. Conventional handmade papers from Mainland China have a good reputation of “Longevity of Paper for Thousand Years”, and are usually preferred by archival mounting personnel. Besides, papers are popular in foreign countries which are mostly acid-free paperboards, acid-free corrugated papers, or thin acid-free papers so as to benefit the preservation and restoration of paper archives. In terms of Taiwan, papers from home and abroad are usually integrated for application on archival preservation and restoration.

Material of paper is plant fiber. Main ingredients of plant fibers for papermaking are, cellulose, semi-cellulose, and lignin. The contents of these ingredients within papermaking will directly affect durability of paper. Cellulose is high-molecular compound of carbon, hydrogen, and oxygen. The longer molecular chain within cellulose, the stronger strength of fiber gets. And the paper becomes more durable. But papers with more lignin content easily get oxidized and paper will get yellowed and embrittled with worst durability. Therefore, understanding property of paper materials and their component elements to find out the most appropriate kinds of papers for preservation and restoration is the only way to extend longevity of archives. Table 1 was summarized by author about current status of papers used by restoration personnel in each unit of northern Taiwan.

Table 1

Papers Used for Archival Restoration by Each Unit of Northern Taiwan

Unit	Names of papers	Sources of manufacturers	Remarks
National Archives Administration	Bark Paper, Tengushi, Other Tissue Papers for Mounting, Bibulous Papers, etc.	Fu Lung, KuangHsing Paper House, Ta Chang, Suho Tien, and Shang Yi	
Archives, NTU	Fine Paper, Bark Paper, Tengushi, Artificial Fiber Paper, and Other Acid-Free Board Papers	Suho	
National Taiwan Library	Bark Paper, Bamboo Paper, China Calligraphy & Painting Paper, Color Xuan, Ganpishi, Tengushi, Fengshui Xuan, Chemical Fiber Paper, Non-Woven Fabric, Other Acid-Free Paperboard, Art Papers, etc.	Fu Lung Cotton Paper, Suho, Chang Chun Paper House, KuangHsing Paper House, Shang Yi Paper Business, Other Imports Companies, etc.	
Academia Historica	Bark Paper, Tengushi, Fengshui Xuan, and Chemical Fiber Paper	Unknown	
Painting & Calligraphy Restoration Room, NPM	Japan Minowashi Japan Meixi Paper Japan Udagami Bark Paper Xuan Papers (China Red Star Cotton Paper, Fine-Quality Writing Paper, and Wingceltis Paper)	Fu Lung Xuan Papers are associated with budgets. Shipment are from HsinYa in Sanchong District (Owner imports books from China), and Hsiu-Hsiung Chen, Teacher of NTNU owns a batch of Chinese papers, too.	
Huan-Sheng Lin Restorer Studio	Suho, Japanese Tengushi, Suho Bark Paper, and Other Auxiliary Papers	Use Suho or Japanese Papers	
Restoration Room, Ssu-Nien Fu Library	Bark Paper, Color Xuan, Tengushi, Bamboo Material Paper (DongDong Books), and Chemical Fiber Paper	Use Bamboo Material Paper from Zhejiang, China (Shipped directly from China. Now Owner of DongDong Books is helping to send it), KuangHsing, Fu Lung, Chang Chun, and Suho (Tengushi)	

Archival Preservation and Restoration Paper at National Taiwan Library

Historical Evolution

National Taiwan Library originated from “Library of Taiwan Governor’s Palace” during Japanese Occupation and it has been more than nine decades since opening which is the oldest public library in Taiwan region. During this period, R.O.C. Pavilion 34 had been burnt down by war and moved for four times with part of early archives destroyed. But plentiful and precious historical data had still been preserved. Book literature is now preserved, managed, and utilized by specialty collection business unit in that library. Associated archival segment is organized and stored by archives. That library is working hard to collect literature data about Taiwan in many ways so as to enrich the content of collection. Digital collecting techniques are used to reinforce promotion. Focusing on archives, forms are also created for society public to access to, research, utilize, and refer to the data. Meanwhile, themed exhibitions focusing on library’s history are conducted.

Organization of Archives and Manpower Allocation

Ever since the publishing and execution of Archives Act, archival administration in every institution has gradually moved towards professionalization and institutionalization. With limited manpower and budget, the library is working hard to cooperate and promote appropriate archival preservation with simplified operating procedure of information system and books restoration techniques in hope that future archival administrative operation can be more consolidated and comprehensive to move gradually towards standardization. Archives administration business belongs to Secretariat on organization chart with one member allocated to handle documentation, archives, and storeroom management. There are paper documents under administration of archives. The collections of archives are total 71,102 pieces with confidential ones for 115 pieces by end of Dec. 2008. In terms of training for archival personnel, they not only proactively participated in all kinds of training courses of archival management held by Ministry of Education and National Archives Administration but also joined membership of education study center of virtual archives of National Archives Administration to go to digital class on-line of archival administration after work.

Archival Storeroom

The archival storeroom of that library is located in 7/F administration zone for an area of about 50 level grounds. A single passageway was adopted. Originally it was an independent space. Based on work requirements and conformity with regulations of *Archival Storeroom Facility Standards*, fire-proof plates were used to partition in order to separate with work zone. The related facilities are listed as follow:

- (a) Intensive bookshelves (Movable, double-sided 155 sets and fixed, double-sided for 21 sets).
- (b) 24-hour central air-conditioning and hygrothermograph.
- (c) Inductive door access card swiping system and central surveillance system.
- (d) Firefighting apparatus (1-hour fire doors, dry-powder extinguishers, sprinkles, and smoke dampers) and emergency lightings.
- (e) Low ultra-violet ray illumination.
- (f) Dust-proof curtains.
- (g) one set of telephone.

Archival Preservation

After checking and organizing, archives shall be listed with item numbers before being placed into archival clips. Table of contents shall be placed on front page with clear indication marked on the back cover to be organized in order by file numbers before being placed onto shelves from left to right. That library passed Key Administrative Points of Archival Storeroom in Library Affairs Meeting on Dec. 15th 2008 as a basis of storeroom administration. In order to consolidate administration of storeroom, *Record Lists of Personnel Turnover in Storeroom* and *Record Sheets of Humiture of Storeroom* were created for detail record and further improvement.

For the purpose of appropriately restoration or bookbinding of broken archival data, *Restoration Specification of Archival Collection* was created on Feb. 26th 2008. The priority of books restoration are listed as follow: Data with urgency of restoration or bookbinding, Data of Taiwan during Japanese Occupation, Good Editions and Specialty Collection of Data, General Data of Taiwan, and General Library Collection.

Manpower Training for Archival Restoration in Book Hospital, N.T.L.

A book-making room (namely book-binding room) was established in National Taiwan Library since opening during Japanese Occupation. In 80s, the room developed and had specialty personnel with restoration skills. Bookbinding Room was handling books maintenance and bookbinding of library periodicals. At that time, that library was doing with the most plentiful techniques, personnel, and resources. In Dec. 2004, that library moved to Chunggho City. Bookbinding room moved to 5/F along with the move. In 2007, integration of massive deacidification system, freezing deinsectization, and bookbinding techniques was conducted to establish "Book Hospital, National Taiwan Library". On June 27th, an opening ceremony of Taiwan first "Taiwan Book Hospital" was held in 7/F administrative zone of that library so as to promote healthcare concept of book literature and its medical restoration techniques. Since Jan. 2007, interested volunteers and library staff have started to be recruited and coached to learn basic restoration techniques of mounting and bookbinding in order to rush to repair those aging, broken, or acidified and yellowed archives and book literatures. Colleagues of Secretariat in charge of archival administration are learning diligently in hope that, from maintenance concept to restoration skills, profound skills can be obtained for operation of archival administration of the library. On Dec. 22nd 2008, associated personnel and volunteers of maintenance visited Academia Historica to view and learn. They viewed the techniques of mounting, storeroom collection regarding archives of two former presidents of Chiang, freezing for deinsectization, fire prevention apparatus, digitalization, door access safety control system, promotion of archival exhibition, etc. To continue the legacy of books restoration techniques, retired personnel with familiarity and proficiency in books maintenance are specially recruited to work as counseling committees for pre-scheduled training courses of restoration theory and practice. Since Jan. 14th 2009, lecturers have come to library for lectures twice every week in order to cultivate bookbinding and restoration personnel. Due to the fact that archives before 1949 had been completely filed for archival directories to be transferred to National Archives Administration, the archives being restored are archival literatures after 1950.

Archives of that library combined resources of Book Hospital to reinforce restoration and deacidification capabilities of archives. Volunteers of Book Hospital are trained to help restoration and mounting businesses. Their restoration techniques of archival literature and book are affirmed by foreign industry. Frequently there are

foreign maintenance personnel coming from distance to learn library's techniques of book maintenance and bookbinding which indicates the demands of restoring archives, literatures, and books are very high. Reception of domestic institutions and communities are conducted for visit and tutorial of restoration techniques of archives, literatures, and books of the library.

Archival Preservation and Papers for Restoration in National Taiwan Library

Hometown of Taiwan papermaking is "Puli". In 1940 when Japanese conducted water quality investigation, Puli was found with excellent water quality with iron content and less other mineral substances. Therefore most of sugar factories, wineries, and paper mills were established here. Hand-made paper culture of Taiwan started to thrive since 1895 when worshipping of Mazu and burning of joss papers became popular island-wide. At that time, factories of hand-made bamboo papers were numerous with comprehensive distribution range. Since 1898, Baihe of Chiayi started to introduce simple machinery to process papermaking materials. Japanese hand-made papermaking methods and mechanical papermaking methods were both introduced into Taiwan at this time. After Taiwan's Recovery in 1945, papermaking industry was destroyed by bombings of war. Most of machinery and plants were ruined. Fortunately many retired technique personnel used old and wasted materials to replace raw materials to barely make papers. Although paper quality was poor, it was necessary article of daily use. Thus prices and profits were both very high. After few years as economy had gradually developed when there were no communications between Taiwan Strait, many intellectuals retreated from Mainland China with exquisite calligraphic and painting skills desperately required papers for writing and painting. As a result, after recovery paper mills in Puli had increased a lot with significant progress of production equipment and techniques of paper types and quality. This trend of papermaking had become descending system from father to son and master to apprentice. But they were all home-made production industry. At that time, the yield increased too much to generate surplus for exports to Japan after 1968. After 1974, massive quantities of papers had been exported to Japan. At that time Japan also imported plentiful papers from South Korea, Mainland China, and Taiwan. Taiwan papermaking industry reached its peak in around 1981 which had also improved living standard of Taiwanese.

Species of plant fibers for papermaking include bast fibers, silk fibers of seed coats, wood fibers, grass-family fibers, etc. Bast fibers include flax, marihuana, ramie, jute, wingceltis bark, mulberry bark, ganpishi fiber, paper mulberry, etc. And cotton belongs to silk fiber of seed coat. Grass-family fibers include bamboos, haulm, bagasse, sorghum stem, etc. Wood fibers include fir, aspen, birch, and larch. The above two kinds of fibers are good pulps for papermaking because of their massive content of cellulose. Paper is subject to influences of acid, light, oxygen, and inappropriate temperature and humidity which shall damage cellulose of paper at different levels and deteriorate permanence and durability and paper archives. Therefore, preservation work of paper archives must be done well. Thus we know the paper properties for restoration are: (1) No detection of any hazardous substances with stable paper quality and durability. (2) Must be neutral or slightly alkaline with PH value between 7 and 8.5. (3) No detection of any bleaching agents and fluorescent agents. (4) Fibers must be evenly woven. Thickness of paper must be consistent with long enough fiber length. Characteristics of light weight and softness are required. Pulling strength is required as well. (5) No detection of any greases, waxes, and alums. Hydrophile is a must. (6) Thickness, color, and ingredient of paper used must be as similar as possible with original copy (National Archives Administration, 2001b).

The generally mentioned Xuan Papers in Taiwan are not made from silk fibers of seed coats (cotton), instead they are bark papers³ made from bast fibers. The so-called Xuan Papers⁴ are different from those from Mainland China. Actually they are ganpishi⁵. Length of ganpishi fibers is only 4 mm and is not as long as tapa. But its fiber breadth is very thin. Paper made from it is delicate with gloss. Not to mention its low content of resin ingredient to be easily removed by resolving during cooking process. Thus its ink absorbency is better than bark papers and is suitable for paper of calligraphy and painting. Pulp for Xuan Papers of Taiwan are usually added with abundant bamboo pulps to increase ink color and ink rhyme. The best bark papers are made in Taiwan. Another saying is from interview data of thesis by Pi-Ling Hung (2011) which mentioned "Taiwan people said Minowashi belongs to Xuan Paper. Currently wood and other pulps are added. Its characteristic is similar to Minowashi with less ink absorbency compared to silk paper whose ink absorbency is stronger." Besides, control of ambient humidity in Archives of National Taiwan Library, Archives are integrated with resources of Book Hospital. Papers used for archival preservation and restoration are compliant with Technical Specification of Archival Preservation. Acid-free archival boxes are used for archives. Papers for restoration are acid-free, hand-made cotton papers made in Taiwan with types of acid-free, thick paperboards and acid-free, hand-made, thin cotton papers. Paper types for restoration include: Bark Papers, Ganpishi, Thin Minowashi, Cotton Paper, China Green Tanpizhi⁶, Tengushi⁷, Fengshui Xuan⁸, etc. There are also auxiliary paper materials for restoration to assist carrying of restoration papers during process such as acid-free, translucent, non-woven fabrics and chemical fiber papers. Or paper use for absorbing of excessive water during restoration such as neutral absorbent paper.

Experiment in 1950 on Dry Deacidification of Acid Paper Archives

Archives in National Taiwan Library are mostly created after 1950. Thus there are occurrences of yellowing or embrittlement resulting from acidification due to contemporary acid papermaking process. Tsang-Chi Hsia and Chun-Yu Chen (2011) had focused on a batch of acidified paper archives during 1946-1948 to conduct simple and feasible deacidification experiment. The process was to clip acid paper like a sandwich with two alkaline papers with calcium carbonate. By means of loading pressure and adjustment of related humidity of storage environment for aged and acidified paper archives to closely contact alkaline papers to achieve the goal of becoming neutral. In terms of archival preservation, besides preservation with acid-free archival boxes, alkaline papers such as Fengshui Xuan were used as interleaves of archives in order to neutralize the acidity of paper. This was a simple process similar to pressure method namely the Dry deacidification of paper archives. Author had conducted dry deacidification experiment on archives in that library. In 2014, Pineapple Xuan Papers were used

³ "Kozogami": Made from "Paper Mulberry" (also named Deer Tree, Money Tree, and Paper Mulberry. Scientific name is *Broussonetiapapyrifera*, which is a native species of Taiwan).

⁴ The major ingredients of China Xuan Paper are bark of blue sandalwood and haulm.

⁵ Ganpishi and Wikstroemia belong to Genus Wikstroemia under Family Thymelaeaceae. The genus name Wikstroemia was in memory of a Swedish zoophytologist, Johan Emanuel Wikstroemia (1789-1956).

⁶ Bark and fiber forms of Blue sandalwood (Scientific name: *Pteroceltistatarinowii*) are between bark of paper mulberry and Ganpishi. It is an excellent raw material for papermaking. In Mainland China, only this paper can be called Xuan Paper. And "Jade Edition Xuan" which is honored as the highest level Xuan Paper is made primarily from bark of Blue sandalwood.

⁷ Thin papers are mainly made from fibers of Paper Mulberry with thickness from 2.5 g-10 g and are translucent for restoration of double-sided archives.

⁸ Fengshui Xuan is also named Pineapple Xuan, which was created by Professor of N.C.H.U., Mr. Feng-Chi Chang in 1970. Another name of it is Chung-Hsing Xuan. Major material is bast fibers of pineapple leaves thus another name of it is Pineapple Xuan with characteristics for alkaline paper and contains 8%-10% alkaline CaCO_3 content.

to wrap for one week to test the variation of PH values of archives dated 1950. The result of experiment indicated PH value of archives raised from originally 4.83 to 5.74 with an increment of 0.91 as shown below.



Figure 1. On Apr. 11th 2014, Pineapple Xuan Papers were used to wrap archives with interleaves inserted for one week to test the variation of PH value of archives dated 1950 before and after experiment.



Figure 2. On Apr. 16th 2014, Pineapple Xuan Papers were used to wrap archives with interleaves inserted for one week to test the variation of PH value of archives dated 1950 before and after experiment.

Conclusion

Once upon a time when Taiwan was in the phase of agricultural society, there was a booming period of hand-made papers. At that time, distribution of papermaking was in everywhere of Taiwan such as: Douliu, Zhushan, Hsinchu, Puli, etc. Many scrolls were exported to Japan from Taiwan during that period thus papers were needed for mounting. Thus hand-made papers were desperately needed by mounting dealers. Besides, sales volumes of Paper Moneys were huge. Not to mention there were huge demands of Taoist Magic Papers from temples or folk religion. As a result, distribution of hand-made papers was wide. After Taiwan migrated to industrial society, papermaking by machine got even quicker. Along with advance of printing techniques, paper mounting by machine replaced manual paper mounting. And the decline of Paper Moneys and Taoist Magic

Papers indicated replacement by printing patterns. After research and comparison, papers for preservation used by each unit come from few domestic distributors. Resources of restoration papers are more extensive. Some of them are made in Mainland China. Most of them are from few important manufacturers of hand-made papers in Puli, Nantou, Taiwan.

Work of archival preservation and restoration must specifically follow protocols of official document. Priority and routine items shall be stipulated to be executed literally by item. The reason why archives are very precious is their uniqueness. Therefore in terms of archival preservation, there are three major elements for archival preservation: (1) Preventive preservation measures; (2) Corrective preservation measures; (3) Use technology to research and develop preservation methods (Shih-Hsien Chang, 2000). This article tried to verify the characteristics and specification of papers for preservation and restoration so as to remind the importance of specification of papers for archival preservation and restoration. Besides, readers may have basic understanding of papers selected by large domestic units of archival preservation and restoration. Consequently, by means of summary of papers used for preservation and restoration in National Taiwan Library as well as the experiment of taking advantage of characteristic of Fengshui Xuan alkaline papers in how to easily neutralize acidity of paper by clipping acidified papers with alkaline ones for readers to clearly pick up the neutralization method of paper acidity.

Last, this article summarized a few recommended principles of papers used for archival preservation and restoration: (1) Use acid-free papers with low lignin content; (2) Use papers made from bast fibers with longer fiber length; (3) Use papers made from original pulps instead of recycled papers made from recycled pulps for restoration of archives; (4) Appropriately use alkaline papers to neutralize acidified archival papers. Besides, the above principles of papers used for restoration, archival personnel shall duly perform preventive operating of archival preservation in order to maintain the permanence and durability of paper archives.

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