

A Study on Ancient Chinese Painting and Calligraphy Papers and Analytical Techniques for Modern Conservation Papers

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Keywords: Ancient Chinese Paper; Painting and Calligraphy; Conservation Paper; Paper Analysis; Restoration Science

Abstract: This paper examines the materials and techniques of paper used in ancient Chinese painting and calligraphy, alongside modern analytical methods for conservation papers. From the refined papermaking of the Ming and Qing imperial workshops to contemporary restoration science, paper has remained central to artistic creation and preservation. Traditional mounting emphasized matching paper properties to artworks, while modern conservation applies material analysis to evaluate physical, chemical, and optical performance. By integrating historical craftsmanship with scientific testing, this study outlines the evolution from experiential practice to standardized conservation, providing a foundation for data-based restoration and long-term preservation.

1. Introduction

Paper has long served as the primary support material for Chinese painting and calligraphy. Its material properties not only determine the artistic expression of a work but also profoundly influence its physical stability and long-term preservation. Since Cai Lun's improvement of papermaking in the Eastern Han dynasty, the technology of papermaking in China has undergone continuous refinement, forming a distinct material system characterized by diverse fiber sources, specialized papermaking processes, and refined surface treatments.

During the Ming and Qing dynasties, papermaking for court paintings and decorative purposes reached an unprecedented level of sophistication. A great variety of papers were produced, featuring exquisite craftsmanship, rich coloration, and refined texture, demonstrating the high aesthetic and technical achievements of the time.

In the field of painting conservation, the selection of repair paper is one of the most critical technical procedures. Conservation paper must fulfill multiple functions—supporting, backing, and reinforcing the original artwork—while meeting mechanical, optical, and chemical requirements. Traditional mounting masters developed an empirical system centered on the principle of “letting the paper follow the painting,” emphasizing the selection of suitable paper based on the nature,

thickness, and age of the original painting. However, this experiential approach, while effective, lacked quantitative standards. With the rise of conservation science, material analysis and testing techniques have been introduced into the restoration process. Systematic analysis of paper properties and the establishment of performance databases have enabled traditional experiences to be validated and transformed into scientific data.

This paper takes Ming–Qing court papers as historical exemplars and integrates them with recent studies on modern conservation papers. It aims to reveal the connection between traditional papermaking and modern analytical technology, exploring how empirical craftsmanship and scientific methodology converge in the protection of Chinese painting and calligraphy.

2. Court Papers of the Ming and Qing Dynasties: Systems and Craftsmanship

The court papers of the Ming and Qing dynasties represented both institutionalized production and the pinnacle of papermaking craftsmanship. Their sources can be divided into two major categories: (1) papers made by official papermaking bureaus or local tribute workshops under government supervision, and (2) papers collected or requisitioned directly by the imperial household from famous papermaking regions across China and its tributary states. Historical records show that tens or even hundreds of thousands of sheets were annually submitted to the imperial court, and the quality of these tribute papers was strictly monitored—substandard products could lead to official punishment.

In addition to domestic tribute papers, the Qing court also received papers from tributary and foreign regions. The Chunyou Suoji (Notes on Spring Outings) mentions the “Four Tributary Papers,” including Korean paper from the east, Ryukyuan snow paper, Western gold-edged paper, Islamic colored paper, and southern papers from Annam (Vietnam) and Burma. These papers varied in texture, color, thickness, and decorative patterns, reflecting extensive intercultural exchange in papermaking and decorative arts.

The craftsmanship of Ming–Qing court papers was highly sophisticated. Techniques such as sizing, alum treatment, coloring, waxing, polishing, embossing, gilding, and pattern printing were widely employed. During the Kangxi and Qianlong reigns, multi-layered decorative papers like powdered wax paper and jade-plate paper were developed, noted for their brilliant hues, elegant textures, and durability against insects and humidity. The imperial workshops also reproduced historical famous papers such as Jinsushan sutra paper, Xue Tao paper, Chengxintang paper, and Mingrengdian paper, marking them with red seals reading “Imitation of Chengxintang Paper, Made in the Qianlong Era,” to signify their authenticity and quality control[1-7].

In sum, court papers of the Ming and Qing dynasties demonstrate a systematized production process and refined aesthetic sensibility. Their controlled quality, complex processing, and ornamental elegance not only satisfied the functional and artistic needs of court painting and mounting but also provided invaluable references for later conservation research.

3. The Use of Traditional Papers in Mounting and Restoration

Since the Tang and Song dynasties, mounting and backing had become integral parts of Chinese painting and calligraphy practice. Paper served not only as the physical support of the artwork but also as the key structural element ensuring stability during rolling, hanging, and long-term storage. By the Song period, the choice and layering of papers in mounting had become systematized, and by the Ming and Qing dynasties, mounting technology reached a stage of remarkable maturity.

Qing palace archives contain detailed records regarding the use of mounting papers. The Qing Palace Workshop Archives record several imperial orders, such as: “Use goose-yellow silk with four sheets of connecting paper as backing” (Yongzheng, Year 7); “For two large horizontal scrolls,

back with one layer of Gaoli (Korean) paper and one layer of connecting paper” (Qianlong, Year 6); and “Add magnetic-blue border paper and fine Hangzhou paper” (Qianlong, Year 9). These examples indicate that the imperial workshops employed carefully structured combinations of papers, selecting types according to the material, size, and format of each artwork.

Ming scholar Zhou Jiazhou, in his *Treatise on Mounting* (Zhuanghuangzhi), wrote that “Lian-si (Anhui) paper is used for all scrolls and albums—it is as soft and lustrous as silk.” Similarly, Zhou Erxue’s *Shangyan Suxinlu* from the Qing dynasty emphasized that “the backing paper should be even and delicate... not only durable and protective, but also easy to remove for future remounting”.[8-9] These statements highlight the essential considerations of thickness, toughness, fiber uniformity, and removability in traditional mounting—parameters that directly correspond to modern conservation standards.

Although traditional mounting lacked the quantitative precision of modern testing, its material logic was inherently scientific. Mounting masters evaluated fiber composition, tensile strength, and surface texture through observation and tactile experience, forming a practical system of empirical materials science. This experiential knowledge, passed down for centuries, provides a vital foundation for today’s quantitative conservation research.

4. Modern Analytical Techniques and the Study of Conservation Papers

Since the mid-twentieth century, conservation research has progressively incorporated modern scientific methods. The study of papers used in restoration has shifted from empirical observation to quantitative analysis, emphasizing the need for performance testing and database construction.

Modern conservation papers include a variety of fiber types—cotton paper, bast-fiber paper, kozo paper, bamboo paper, and mixed-fiber papers—each tailored for specific restoration functions such as backing, reinforcement, and infilling. Selecting the proper paper depends on the original artwork’s material, damage type, and mounting structure.

Performance analysis typically includes three categories of tests:

(1) **Physical properties**, such as tearing strength, tensile strength, delamination resistance, and folding endurance, which determine structural stability during handling;

(2) **Chemical properties**, including pH value and cellulose degree of polymerization, which indicate acidity and aging potential;

(3) **Optical properties**, such as brightness, transmittance, colorimetry, and yellowing index, which affect visual harmony and aging behavior.

Large-scale comparative testing allows the plotting of performance curves that reveal differences in fiber orientation, bonding strength, and durability across paper types. These data sets provide objective guidance for conservators, replacing purely experiential decision-making with measurable standards.

In recent years, several institutions in China have developed preliminary performance databases for conservation papers, cataloguing test results from different batches and sources. Such databases lay the groundwork for future standardization of paper selection and quality assessment. Integrating these data with cellulose degradation kinetics and environmental adaptability studies will further enable predictive modeling of paper longevity, marking a major step toward scientific, evidence-based conservation.

5. Conclusions

The history of Chinese painting and calligraphy papers reflects the evolution of both art and science. From Cai Lun’s early innovations in papermaking to the refined craft of Ming–Qing imperial papers, and from traditional mounting practices to modern analytical testing, paper has

remained the material cornerstone linking artistic creation and cultural preservation.

Traditional papers embodied a balance between technical control and aesthetic refinement, while the maxim “the paper must follow the painting” encapsulated an empirical understanding of material compatibility. Modern conservation science, through the introduction of analytical chemistry, fiber testing, and data modeling, has transformed these traditional insights into measurable, reproducible systems.

The establishment of conservation paper databases, the standardization of testing procedures, and research on environmental and aging behavior all signify a new paradigm of material-based cultural heritage protection. Future studies that combine materials science, conservation ethics, and digital technology will continue to advance the precision and sustainability of paper conservation.

Through the dialogue between tradition and science, the protection of Chinese painting and calligraphy will not only preserve material authenticity but also extend the living continuum of cultural memory.

Acknowledgements

The authors gratefully acknowledge the financial support from the following funding sources: the National Key R&D Program of China (Grant No. 2022YFF0904504); the ByteDance Ancient Books Preservation Special Fund under the China Cultural Relics Protection Foundation and the Palace Museum’s “Ancient Books Preservation and Revitalization Public Welfare Project”; and the 2024 National Social Science Fund Special Research Project on Cultural Heritage Protection and Inheritance: Research on Talent Team Development in Cultural Heritage Preservation (No. 24VWB028); Innovative Experimental Projects in Liberal Arts (LDWK202511). Their support has been invaluable for the completion of this work.

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