



Preservation of Paper
and Textiles of Historical
and Artistic Value

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Preservation of Paper and Textiles of Historic and Artistic Value

John C. Williams, EDITOR

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of Historic and Artistic Value

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FOREWORD

ADVANCES IN CHEMISTRY SERIES was founded in 1949 by the American Chemical Society as an outlet for symposia and collections of data in special areas of topical interest that could not be accommodated in the Society's journals. It provides a medium for symposia that would otherwise be fragmented, their papers distributed among several journals or not published at all. Papers are refereed critically according to ACS editorial standards and receive the careful attention and processing characteristic of ACS publications. Papers published in ADVANCES IN CHEMISTRY SERIES are original contributions not published elsewhere in whole or major part and include reports of research as well as reviews since symposia may embrace both types of presentation.

PREFACE

The manufacture of paper and textiles has undergone extensive development in the past 200 years. Production rates have risen astronomically. Unfortunately, the permanence of the goods has not improved or even stayed the same. Rather it has gone down.

Paper in particular is a problem today; much of it is still being made on the acid side from the use of alum rosin sizes, and this limits its life. There are 150 years of similar bad paper on the shelves. Librarians are the custodians of millions of books which are too brittle to use. Often there is nothing to be done but to cut the books apart, microfilm the information, and discard them. Textiles too have been subjected to the exigencies of rapid machine production and mishandled so that their permanence has dropped. The artifacts of our present civilization are fragile, and much of our cultural heritage is slipping silently away.

The restorers, who are at work on the monumental tasks of preserving the remnants, need the advice of restoration scientists. How does one select the treatments which will make books and textiles last longer? A great many of the answers come from the extensive studies of cellulose fibers made over the past 100 years. Other information has been gained from accelerated-aging procedures. Materials and methods can be evaluated by subjecting an expendable article to high temperatures and monitoring the increased rate of degradation. If the logarithms of the rate of change of a selected property plotted against the reciprocal of the absolute temperatures give a straight line, the line may be extrapolated to find the rate of change at room temperature, and the permanence of the material may be calculated. This is the Arrhenius relation.

The determination of a complete Arrhenius relation is a long procedure. Even for quite unstable materials, degradation rates are low as room temperatures are approached, yet room temperature must be approached to minimize the errors of extrapolation. Once the slope of the line is established for a given material, the regression data from one oven-aging experiment can be translated to life at room temperature for other samples. Unfortunately, much of the Arrhenius data at hand for paper does not separate hydrolytic from oxidative degradation. The method will make more reliable predictions when such a separation is made.

For both paper and textiles made from cellulose fiber, permanence can be improved by bringing the pH to 7 or slightly higher. An alkaline

earth carbonate such as calcium carbonate or magnesium carbonate is deposited to protect the material against acid atmospheres or the acid generated in situ from oxidation. Strong bleaches or treatments that leave oxidizing residues are to be avoided. In this field there is a major place for the expertise and judgment of the conservator in the repair and display of books, documents, and textiles.

The papers contributed to the symposium and this book are divided into sections on paper and on textiles. There are discussions on how to care for each; treatments which slow degradation are described; and finally, there are a number of papers concerned with the prediction of permanence.

The symposium was suggested by Tyrone Vigo, who also is a contributor. It received the backing of Robert Read, Program Chairman of the Cellulose, Paper, and Textile Division of the American Chemical Society, as well as of Robert Gould, editor of the *Advances in Chemistry Series*.

I have been encouraged and advised by Frazer Poole, Assistant Director for Preservation at the Library of Congress, and Peter Waters, Restoration Officer. I also have been greatly helped by the staff of the Preservation Office. To all these, my grateful thanks.

Washington, D.C.
November 1976

JOHN C. WILLIAMS

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Care and Preservation of Books and Manuscripts

Book Preservation for the Librarian

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Vast numbers of books need to be restored, and they increase yearly, but there is no prospect that more than a small percentage can be treated professionally and competently. Limited funds and labor need to be incorporated effectively by using sound, economical binding structures and restoration techniques, by utilizing only chemically and mechanically good materials, and by making containers for fragile items. The provision of near-ideal environmental conditions will significantly slow down future deterioration and effect immense savings. Old books should perhaps be refurbished and be given very minor restorative treatment by responsible amateur-binder volunteers under supervision and by library technicians with limited duties. Both categories would also serve a vital conservation function in making protective boxes and folders.

The thought has occurred to most people at some time or other that certain industrial executives have heavy responsibility in the form of a complex and immensely expensive plant and that a wrong decision can be disastrous. Few, I suspect, give thought to the immensity of the burden carried by hundreds of librarians. The librarian of even a relatively obscure institution may well be responsible for a collection which in monetary terms is worth 10–20 million dollars and in cultural terms is of incalculable value. During a term of office of, say, 15 years, the librarian of a learned society containing 100,000 antiquarian books could cause the ruination of hundreds of fine volumes and, in the long term, place the rest in jeopardy.

The case must not be overstated, but the responsibility is considerable and the associated difficulties are immense. Unfortunately, few librarians have anything but the haziest notions of what is involved in a sound conservation program, a shortcoming they share, one fears, with

many trade binders and restorers. Antiquarian booksellers, too, have a heavy responsibility because many of them during a lifetime of dealing handle as many books as stock a substantial library, but that is another story and, in the main, a sad one.

In Britain, most libraries have no conservation program and no early prospect of one. For example, in London the libraries of the oldest learned societies have no air conditioning, expenditure is restricted to binding periodicals, and the restoration of old books is not contemplated, except on special occasions, because of the cost and the difficulty of finding skilled restorers to whom the work can be entrusted. One of the oldest learned societies in London, with one of the largest and finest libraries of its kind in the world, spends less than £1000 per annum on its maintenance. Every year of neglect involves increased costs in real terms, and each year creates extra demands for higher degrees of skill because of the poorer condition of the books. Such skill is not available and is not likely to be in the foreseeable future.

If the outlook in Britain is gloomy, it is no less so in the United States because although funds are more abundant, the number of books requiring attention is equally astronomical, and the extremes of climate to which most of the volumes have been subject over a fairly long period has rendered them in far worse condition than is usual in Britain.

In some ways it may be fortunate that the establishment of conservation departments and centers has been slow because much irreversible damage would otherwise have been done and much money would have been wasted through the use of chemically unsound materials and faulty structural techniques. Also, public sympathy would have been alienated. Clearly, much remains to be learned, but perhaps enough progress has been made to enable us to embark on conservation programs with a reasonable degree of confidence in the efficacy of our techniques until better ones have been developed. What a tragedy it is, though, that when first-rate craftsmen were abundant, materials were poor, and only a few thought intelligently about structure; science has now advanced excitingly, but craftsmanship has in general suffered a serious decline.

If the hard-pressed librarian is faced with the choice of establishing a conservation department or installing air conditioning with a humidity control and acid filtration, it is arguable that the latter should take precedence, though one would hope also for at least a small conservation unit which could be gradually built up. Dare one piously hope that both air conditioning and a conservation department would take precedence over nonessential acquisition of books, however prestigious?

The purpose of this paper is not to castigate library personnel, who have a difficult job and tend to be overworked, but to offer a few helpful hints which can extend the life of books and bindings and save money

in the long term. The following are generally accepted to be desirable environmental conditions for the storage of books and related material.

Air Conditioning

This is of paramount importance, and in conservation terms there can be no better investment. An air-conditioning unit should be installed which will provide book-stack temperatures of 60°–65°F with a relative humidity of 45–60%. Below this range, embrittlement of materials will occur, and covers may warp; above it, the growth of mold is encouraged. Deterioration of book materials is minimized when the temperature and the relative humidity are constant. The system should water-wash air free of sulfur dioxide, which is the most effective purifying method available, and it should eliminate ozone (1).

Lighting

Ultraviolet light causes serious chemical deterioration of organic materials and should therefore be eliminated or at least reduced. The simplest procedure is to curtain windows, but if this creates difficulties, plastic sheeting can be used. If walls and ceilings are painted white, nearly all the damaging radiation is removed from the reflected light. Ultraviolet ray-absorbent plastic sleeves should be fitted to fluorescent tubes. The sleeves are inexpensive, they filter out nearly all uv rays, and only slightly reduce lighting efficiency (2).

Pest Control

Insects of many kinds can do much damage in little-used sections of libraries, so the need for good housekeeping and frequent inspection is clear. Insects feed on dirt, and mold breaks down book materials thus providing more food as encouragement for their proliferation. It is possible to arrange monthly pest-control spray contracts relatively inexpensively, a valuable service in bad areas.

Affected books should be treated immediately, and of course newly acquired books which exhibit signs of infestation should be treated before being placed on the shelves or anywhere near other books. The number of volumes to be treated at one time is not likely to be great so a small fumigation chamber will suffice, and almost anything will do (even a large plastic bag) if it is air-tight. The books are put in together with a tray of *p*-dichlorobenzene crystals at a rate of 1 kg/m³ of air space at a minimum temperature of 68°F. Insects die quickly, but exposure to the vapor should last at least three weeks to cover the incubation period of the eggs. A watch should be kept on the books for some months to

ensure that the eggs have not matured into larvae after fumigation. The fumes irritate the eyes, so if a large chamber which lacks an extractor fan is opened, the windows of the room should be open and a fan set going to clear the atmosphere quickly.

Mold Control

If incoming books are found to be infected, they should be brushed clean in the open air. As soon as possible they should be sterilized, and this is vital if the temperature and the relative humidity in the library are usually high—i.e., in excess of 65°F and 60%, respectively.

Sterilization is easily accomplished by placing the books in an airtight container and supporting them in such a way that the leaves are fanned out—this is important because penetration between the leaves is essential. A tray of thymol crystals (50 g/m^3) is placed close to a 40-watt electric lamp, the heat from which is sufficient to vaporize the crystals. The lamp is switched on for about two hours daily for a week. The chamber should have a glass front so that the position of the books and the vaporization of the thymol can be checked. All materials are safe under this treatment with the exception of oil paints and varnishes and silk-screen printing inks, which are softened.

Alternatively, books can be sprayed with a 10% solution of thymol in industrial methylated spirit, but this process involves more labor and would not normally be used. It might, however, be necessary in an emergency when fumigating capacity is inadequate.

Maintenance

In many libraries, if deterioration of the collections is to be minimized, a certain amount of work must be done on them by specially recruited library technicians or even by assistant librarians, all of whom would be trained to carry out a few essential tasks. The reasons for this are: (a) it is inconvenient to have books away from the library, possibly for weeks or months, when all they need is minor attention; (b) the work costs more when sent out than when it is done on the premises, even allowing for the slowness of semiskilled staff; and (c) many librarians are not in touch with trustworthy binders to whom the work can be sent. If they do know a good binder or restorer, he is almost certainly already overburdened with work.

In addition to using suitable members of the staff on strictly limited maintenance work, it should be possible in some areas to enlist the services of one or two amateur binders who have retired from their professions and would enjoy working one or two days a week in the library, with or without remuneration, or possibly for a good lunch. Most amateur

binders reach only a modest level of attainment (as indeed do many professionals), and their experience in handling early books is likely to be minimal, so their activities would have to be very severely restricted and supervised. Herein lies a difficulty, for many amateurs will have ambitions beyond their ability. However, if the people concerned are carefully selected and can be trusted, their help could be extremely valuable; of course, it is essential that they be competently supervised.

Assuming that the foregoing policy is adopted and that some skilled and sympathetic labor is available, the following are some of the questions which need to be answered:

- Which books should be replaced rather than restored for economic reasons?

- Which, because of lack of use or importance, can safely be neglected in favor of more urgent items?

- Which should be given priority treatment to prevent extra damage, which in bindings tends to be at a compound rate?

- Which little-used books of special importance need to be boxed rather than restored because, for example, structural work would cover features which must be accessible—or which need to be boxed as a stop-gap measure until skilled treatment can be undertaken?

- Which books must be sent out to skilled binders or restorers?

- Which can be safely entrusted to the ministrations of library assistants?

Ideally, a conservator would be commissioned to go through the library and prescribe treatment for each book, but there are too many libraries and too few experienced conservators for this to be a feasible proposition, so the following observations may be of interest:

(1) The restoration of leather bindings calls for much skill, experience, and a feeling for the past—without this last attribute the skill is largely wasted. Bad work often permanently ruins bindings and at best is likely to be costly to rectify; so no structural restoration of important books should be attempted by untrained assistants or by professional restorers whose work is not known to be satisfactory.

(2) Many 19th century cloth bindings are as difficult, and in some cases more difficult, to restore as leather bindings because of the scarcity of matching repair materials and the fact that the grained cloths, patterned papers, and colored “surface” papers are easily stained by accident during the course of restoration. Generally speaking, the preservation of cloth bindings of this period is desirable, so here again unskilled labor should not be used except possibly for the reattachment of sound cases when, as often happens, the book has fallen out (*see* p. 12).

(3) The full-scale refurbishing of a leather binding by an experienced restorer involves thorough washing of all parts of the binding, cleaning of the book edges, consolidation of battered board corners, recoloring of rubbed areas of leather, restoration of missing gold tooling and onlays, fastening down of rucked up leather on the sides or board edges, reattachment of loose flyleaves, the mending of inner joints with matching