

Restaurator

1980. VOL. 4. NO. 2

A
2: 885 ml, N6976

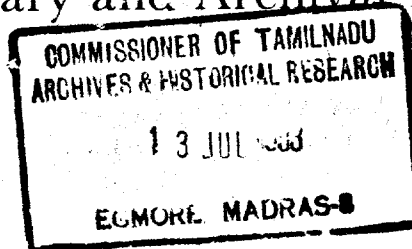
N80.4.2

49969

S.no. 61/2

RESTAURATOR

International Journal for the Preservation
of Library and Archival Material



Volume 4 • Number 2 • 1980

MUNKSGAARD • COPENHAGEN

2: 885ml, 1980
N80-4.2
49969

Board of Editors

EDITOR:

POUL A. CHRISTIANSEN, Librarian. University Library: Scientific and Medical Dept. DK-2200 Copenhagen N, Denmark.

ASSOCIATE EDITORS:

N. S. BAER, Professor. New York University, Institute of Fine Arts: Conservation Center. 1 East 78th Street, New York, NY 10021, U.S.A.

GÜNTER BRANNAHL, Conservator. University Library. Prinzenstr. 1, D-3400 Göttingen, FR Germany.

RICHARD D. SMITH, President. Wei T'o Associates, Inc. 224 Early Street, Park Forest, IL 60466, U.S.A.

CONSULTANT EDITORS:

ARIE ARAD, B.Sc., Chief of Restoration Section. Israel State Archives. Jerusalem, Israel.

TOM COLLINGS, Senior Lecturer. Camberwell School of Art and Crafts. Peckham Road, London SE5 8 UF, England.

IAN COOK, Principal Conservator. National Library of Australia, Canberra ACT 2600, Australia.

FRANÇOISE FLIEDER, Directeur du Centre de Recherches sur la Conservation des Documents Graphiques. 36 rue Geoffroy-Saint-Hilaire, F-75005 Paris, France.

TOMOKICHI IWASAKI, Director. 1-13-4 Ueno Sakuraghi, Taito-ku, Tokyo, Japan.

Y. P. KATHPALIA, M.Sc., Scientific Officer. National Archives of India. New Delhi 5, India.

ROMUALD KOWALIK, Professor, Head of Microbiological Laboratory. Institute of Industrial Organic Chemistry. PL-03-236 Warsaw, Poland.

HELGA LAURENSZKY, Chem. Eng., Chief of Restoration Department, Hungarian National Archives. H-1014 Budapest, Hungary.

FRAN MOKRENI, Chief of the Department for Conservation and Restoration of Archival Materials. Archiv v Praze. Karmelitská 2, 11801 Praha 1 - Malá Strana, Czechoslovakia.

FRAN MOKRENI, VNIIR. 10, Krestyanskaya pl. SU-109172 Moscow, U.S.S.R.

ROBERT C. MORRIS, Lecturer. Canberra College of Advanced Education, School of Applied Science, Materials Conservation, P.O. Box 1, Belconnen ACT 2616, Australia.

YULIA PETROVNA NYKISHA, Dr. (biol.sc.), Chief of the Department of Hygiene and Restoration of Books. M. E. Saltykova-Shchedrin State Public Library of Leningrad, SU-191069 Leningrad, U.S.S.R.

ENRICA ORMANNI, Direttore. Centro di fotoproduzione, legatoria e restauro degli Archivi de Stato. Via Constanza Baudar 14, I-00153 Rome, Italy.

JAN PIDEK, Head of Records Conservation Section. Public Archives. 395 Wellington Street, Ottawa K1A 0N3, Canada.

GALINA S. ROŽKOVA, Dr. (biol.sc.), Chief of the Department of Hygiene and Restoration of Books. State V. I. Lenin Library of the U.S.S.R., SU-101000 Moscow, U.S.S.R.

ANDRÉE SCHIEFFELIN, Dr. Phil. L., Conservateur. Archives Générales du Royaume, B-1000 Brussels, Belgium.

NORMAN J. SHAFFER, Chief of Photoduplication Service. Library of Congress. Washington, DC 20540, U.S.A.

CHANDRU J. SHAHANI, Ph.D., Chief of Document Preservation Branch. National Archives and Records Service. Washington, DC 20408, U.S.A.

RESTAURATOR, *International Journal for the Preservation of Library and Archival Material* is published quarterly. Annual subscription price is D.kr. 260.00 plus postage D.kr. 16.00 (total US\$ 49.70, £ 20.50, DM 95.25) payable in advance. Prices are subject to exchange rate fluctuation.

Subscription orders should be sent to MUNKSGAARD International Publishers, 35 Nørre Søgade, DK-1370 Copenhagen K, Denmark, or to any bookseller.

Storability of Film Sound Records

22.6.1980 69
by A. M. POLISHKO AND G. K. KLIMENKO

The objective of this paper is to present some grounds to prove the expedience of recording the sound accompaniment on 35-mm magnetic tapes with the view of obtaining sound records for storage purposes. The paper also describes the existing procedures of storing the sound records in film libraries and discusses the ways of perfecting these procedures.

Sound cinematography was introduced at the end of the nineteen twenties. An optical (photographic) method was used at that time for sound recording. This made it possible to most effectively solve the problem of composite filming and to avoid difficulties in synchronizing the sound and image during the projection of sound films in film theatres.

From the first years of its development, sound cinematography employed two types of photographic sound records, namely: a variable-density sound record and a variable-width sound record. Due to a number of technological advantages the variable-width sound record has found a wide-spread application and is now in use for 16- and 35-mm sound films.

From the beginning of the 'fifties' the photographic method gave way to a most effective magnetic method which makes it possible to obtain better qualitative parameters of the sound records in a studio process of sound recording. Nowadays, the sound components, such as dialogue, music, murmurs and other sound effects are recorded on separate magnetic tapes, edited in conjunction with the image, and finally blended to form a resultant sound signal in the process of magnetic re-recording. The original thus obtained is further employed for producing a sound photographic negative intended for copying the 16- and 35-mm films. For the final release copy of a magnetic sound film, the magnetically stripped sound tracks are obtained by re-recording from a master tape by a magnetic method.

The quality of sound records is being perfected continuously. Fig. 1 shows the increase of the frequency (curve 1) and dynamic (curve 2) ranges of the sound records with time. Nowadays, the frequency range amounts to 16 kHz and is adjacent to the audio band. Therefore, increase of the frequency range is apparently impractical.

The first great increase (from 35-40 to 55-60 dB) of the sound record dynamic range has been achieved due to the transition from the photographic

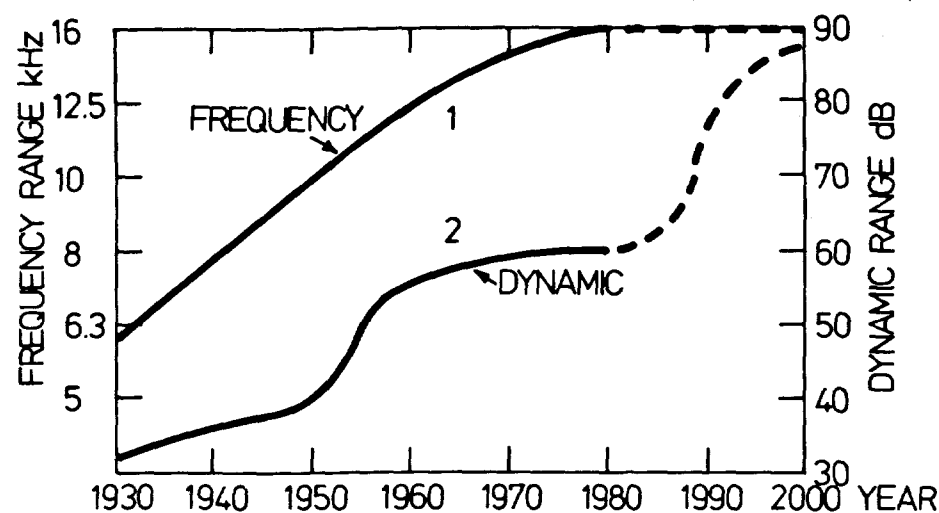


Fig. 1. Improvement of sound quality with year of manufacture.

Fig. 1. Amélioration de la qualité du son au cours des années.

Abb. 1. Verbesserung der Tonqualität mit dem Herstellungsjahr.

method of sound recording to the magnetic method. Transition from the analogue to digital method of sound recording is expected to increase the dynamic range up to 80 to 90 dB. Table 1 gives the values of the parameters that determine the quality of the various sound records. The sound records based on 35-mm magnetic tapes feature the highest quality. From usage, the signal-to-noise ratio of photographic sound records is liable to decrease by a value anywhere between 5 and 7 dB due to various contaminations and scratches. Splices on the photographic sound records give rise to clicks in reproduction and the shrinkage of the film base increases the perforation effects (96-Hz noise). In addition to these drawbacks, further making of a print of the photographic record may result in the appearance of considerable nonlinear distortions due to the violation of the conditions pertaining to the compensation mode of recording and printing the sound records: difference in time of recording and printing, use of different printers and of raw films of new grades, etc. Therefore, it is found expedient to store magnetic sound records since they feature better storability and higher qualitative parameters. Another advantage is that it is always possible to produce a magnetic sound record of films which have a photographic sound record.¹ Also, the electrical printing makes it possible to decrease the noise of the sound record by using various frequency-selective noise suppressors and frequency filters: cutoff, rejection, graphic filters, etc. Such re-recording makes it possible to restore the sound record or, in

Table 1. Values of parameters determining the quality of various sound records.

Table 1. Valeurs des paramètres déterminant la qualité de divers enregistrements sonores.

Tabelle 1. Werte der Parameter, die die Qualität der unterschiedlichen Tonbänder bestimmen.

Type of sound record	Tape width, mm	Track width, mm	Sound record speed, cm/s	Frequency range, Hz	Signal-to-noise ratio, dB	Nonlinear distortion coefficient, %	Wow and + flutter coefficient, %
Studio, magnetic	35	5.0	45.6	31.5 to 16,000	60	1	0.04
Magnetic, on film print	70	1.6	57.0	40 to 12,500	55	2	0.20
	16	2.2	18.3	40 to 12,500	50	2	0.35
Photographic, on film print	35	1.95	45.6	50 to 8,000	40	3	0.25
	16	1.5	18.3	100 to 6,000	36	4	0.35

other words, to remove the noises that have appeared from usage and storage as well as noises that have been introduced in the sound record during production of the film (noises of operating picture cameras and lighting equipment, various clicks, cracklings, etc.)^{2,3,4}

The experience gained in work with sound records stored under specified conditions shows that the basic parameters of such records remain unchanged for a long time. In the process of storage it is the mechanical properties of magnetic tapes that are most liable to impairment due to aging of the tape bases. Practically, the working magnetic layer does not affect the strength of the tape. Deformations, poor elasticity and curling of the tape worsen the conditions of interaction between the sound record and magnetic sound-reproducing head and dislocate the working gap of the head relative to the direction of the sound record movement which downs the level of the high frequencies in the sound being reproduced. Loss of high frequencies in reproduction may also occur due to accumulation of dust and effects of wear of the tape working layer, cores of magnetic head and parts of tape transport mechanisms of sound recording and reproducing machines on the surface of a magnetic sound record. The rate of accumulation of dust and above particles depends upon the response of the sound to the electrolyzing effects.

Long-term storage of magnetic sound records may give rise to appearance of a copying or print-through effect, i.e. to magnetization of some areas of a rolled magnetic tape due to the effect of adjacent turns which will result in appearance

of leading and lagging echo signals. This print-through effect had not manifested itself under any storage conditions until very recently, due to the fact that magnetic sound records were based on perforated magnetic tapes featuring a triacetate base of up to 150 μm thick. Even thinner perforated tapes with a polyester base of 85 to 90 μm thick, now finding a more extensive application, give a print-through effect of about 60 dB which is not high enough to produce appreciably large leading and lagging signals.

Magnetic sound records lose their original properties in response to the action of external magnetic fields and strong ionizing radiations.⁵ Strong magnetic fields can introduce into a magnetic sound record additional noise and increase the printing effect. Since the tape magnetic layer features a strong coercive force, in practice the magnetic sound records do not yield to demagnetization. The magnetic fields with an intensity of up to 800 A/m are thought in general not to be detrimental to magnetic sound records. To protect the 35-mm magnetic sound records against the effects of external magnetic fields in storage, the records are placed in steel boxes to screen them against such fields.

The basic factors affecting the magnetic sound records in storage are temperature and humidity. Unfavourable storage conditions can make the sound records fully unsuitable for further use.^{6,7} Therefore, it is recommended to maintain the temperature within $21 \pm 3^\circ\text{C}$ in the rooms intended for work with magnetic sound records and within 5 to 15°C in the rooms selected for storage of such records. In all cases of storage and application of magnetic sound records, the relative humidity of the atmosphere should lie between 50 and 60%. For long-term storage of magnetic sound records, use should be made of specially equipped rooms with air-conditioning and diffused outdoor lighting.

Sound records improperly wound up on their cores are liable to suffer from physical defects. The winding process should provide for uniform pull of a tape irrespective of the variation of the roll diameter. Projections of separate turns beyond the end faces of the rolls and roll concavity should not be tolerated.

Protection of sound records against dust and moisture is an important requirement of packing containers. For packing the records, it is recommended to use packets fabricated of polyethylene film at least 0.12 mm thick, since a thinner film is hygroscopic.⁷ The rolls are placed into boxes and the space between the covers sealed by an adhesive tape.

Prior to placing a magnetic sound record in store, clean it thoroughly to remove any contamination. For this purpose various devices and appliances are used, including a sapphire tool.⁸ Dust and magnetic layer particles accumulated on the surface of a magnetic sound record should be removed by air-suction. Archival materials are permitted to be handled by fingers only when cotton gloves are worn.

A magnetic tape shelf-life appraisal study has shown that magnetic tapes can be stored, serviceable, for a period of 20 to 25 years. However, sound records placed in storage should be periodically inspected, (at least once every 3 to 5 years). Detection of any defect during such inspections requires that respective preventive and restoration measures, such as repair of perforations, strengthening of splices, rewinding of sound records, cleaning of surfaces, etc., be taken. In some exceptional cases, when a sound record reveals a noticeable impairment of its quality (decrease of its output by 1.5 to 2 dB, for instance) it is good practice to re-record the sound on a new magnetic tape. To evaluate the extent of impairment of the parameters of the sound records in storage, it is recommended to place in store (simultaneously with the records) reference tests, i.e. identical magnetic tapes bearing, for instance, the measuring signals of the average frequency of 400 Hz and high frequency of 12.5 kHz. Where a reference record is not available, the quality of the stored sound record is evaluated by means of a test monitoring with a simultaneous viewing of the film.

It should be noted that frequent re-recordings may bring about a noticeable impairment of sound record parameters. Fig. 2 shows variation of the magnetic sound record parameters with the rise of numbers of successive re-recordings. As is seen from the diagram of Fig. 2, the noise level in pauses N becomes higher and nonlinear third harmonic distortion coefficient K_3 and wow and flutter coefficient k_d increase. It is not recommended, as a rule, to make more than four re-recordings.⁸ The curves of Fig. 2 are valid for the re-recordings obtained with the use of identical equipment and for magnetic tapes of the same quality. As was mentioned above, the recording equipment and information carriers are continually improving. Therefore, it is quite natural to assume that in 20 to 25 years the equipment will be so perfect that any re-recording of magnetic sound records, even if kept under storage for 20 to 25 years, will not worsen the quality of such records. Moreover, the new equipment, as experience shows, makes it possible to better the technical quality of sound records in restoration.

It is also reasonable to believe that in the next 20 to 25 years the methods of film projection in film theatres and on television will remain the same as now. In film production, the image will be recorded on cine films and magnetic tapes, and the sound on magnetic tapes only. This will call for revision of the procedures dealing with the storage of sound records to meet the requirements of saving storage space. Nowadays, only one seventh of the surface of a 35-mm magnetic tape is effectively used for various recordings. In addition to the main sound record of a film (monophonic master tape) a film library stores, as a rule, music records, sound effects records and (for some films) special records (re-

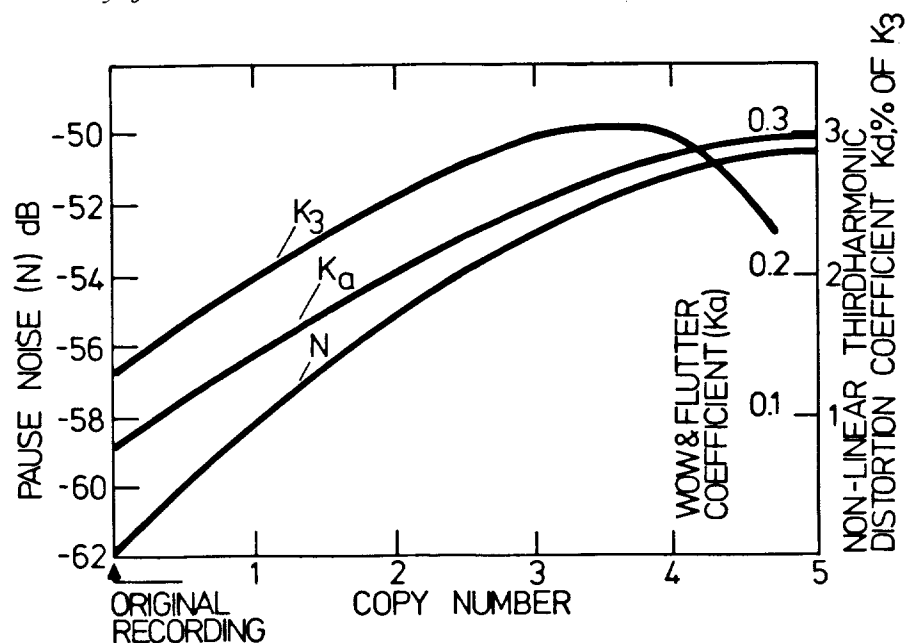


Fig. 2. Dependence of magnetic sound record parameters on the number of successive re-recordings.

Fig. 2. Dépendance des paramètres d'enregistrement sonore magnétique vis à vis du nombre de réenregistrements successifs.

Abb. 2 Abhängigkeit der magnetischen Tonband-Parameter von der Anzahl der aufeinanderfolgenden Überspielungen.

marks in a foreign language, musical accompaniment) usually based on single-track tapes. These records are intended for subsequent dubbing of the film. It would be solid practice to store the sound materials in the form of multitrack sound records carrying all the sound components.⁹ Fig. 3 presents a four-track original carrying separately recorded film dialogue D, special components SC, sound effects E and music M. In reproduction of such a record, the signals taken from tracks 1, 3 and 4 are summed up to obtain a resultant signal including all the components of the sound accompaniment ($\Sigma + D + E + M$). The signals recorded on tracks 2, 3 and 4 are used in film dubbing.

Use of four-track sound records as storage items reduces the volume of storage requirements by a factor of three. Besides, separate presentation of sound components make it possible to obtain more favourable conditions for restoration of archive sound records. If, for instance, a record is too noisy in dialogue (track D), it is required to clear the noise only from one of the four signals during re-recording of such a sound record.

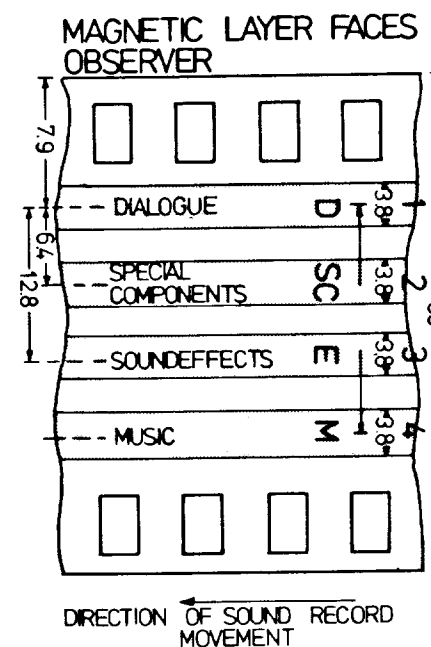


Fig. 3. Distribution of film sound components on four track re-recorded master tape.

Fig. 3. Répartition des composantes d'un film sonore sur une bande principale de réenregistrement à 4 pistes.

Abb. 3 Verteilung von Film-Ton-Komponenten auf einem vierspürigen überspielten Master-Tape.

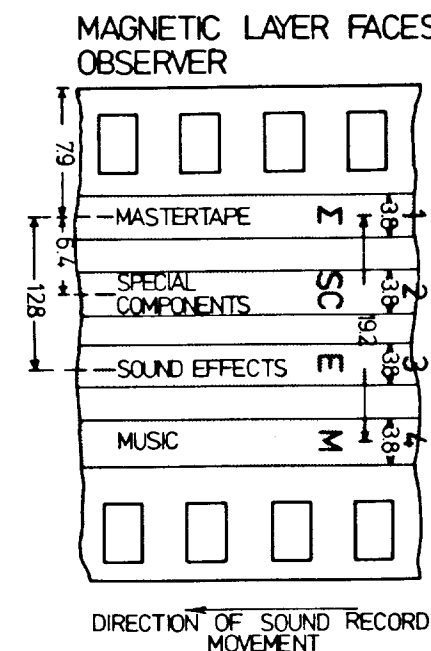


Fig. 4. Recommended distribution of film sound components in replacing the stored single track sound records by four-track sound records.

Fig. 4. Répartition recommandée des composantes d'un film sonore en remplaçant les enregistrements sonores monopistes par des enregistrements quadri-pistes.

Abb. 4 Empfohlene Verteilung der Film-Ton-Komponenten beim Ersatz der gelagerten einspurigen Tonbänder durch vierspürige Tonbänder.

At present, the film libraries store, as a rule, many separate sound records per each film. Therefore, in such libraries it is expedient to take certain measures to replace these records by four-track ones, the arrangement of the sound components being taken as that shown in Fig. 4.

Storage of a cheaper unperforated magnetic tape 6.25 mm wide as a sound media accompaniment has been found impractical since such tape is more sensitive to mechanical actions and to the phenomena causing the print-through effect. Besides, use of this tape will offer certain difficulties in synchronizing the sound and image.

ABSTRACTS

Storability of Film Sound Records

The expedience of storing the sound accompaniment of motion picture film on 35-mm magnetic tape is discussed. The current technology of sound records storage in film libraries is described and the trends of its development are considered.

Conservation et stockage des bandes sonores de film

L'expérience acquise dans le stockage de l'accompagnement sonore des films de 35 mm sur bandes magnétiques fait l'objet d'une discussion. La technique habituelle de stockage des enregistrements sonores dans des filmothèques est décrite et les tendances de développement sont abordées.

Die Aufbewahrung von Film-Tonbändern

Die Zweckmässigkeit der Aufbewahrung von Filmtongleitung in Form von 35-mm-Magnettonbändern wird diskutiert. Die z.Zt. praktizierte Technologie, die Tonbänder in Filmarchiven zu lagern, wird beschrieben und die Entwicklungstrends werden in Erwägung gezogen.

References

1. Polishko, A. M.: *Preservation of sound in films*. F.I.A.F. The preservation and restoration of colour and sound in films. 1977, pp 105-27.
2. Orlov, Ju. M.: [Noise reduction of sound records in the process of film production.] *Technika kino i televidenija* (1976: 9): 30-32.
3. Orlov, Ju. M.: [Reduction of level of noise introduced in sound records during filming.] *Technika kino i televidenija* (1978: 2): 64-67.
4. Doronina, L. A., Ionina, E. M., Klimenko, G. K., Rosinkina, T. Ju. i Trusova, N. K.: [Spectral analysis of noise of synchronous sound records.] *Technika kino i televidenija* (1978: 1): 36-42.
5. Madden, W. H.: *Handling and storage of videotape*. *Broadcast Journal* 7: 5 (1970): 10-15.
6. Kushnarev, V. K.: [Methods and some results of researching the magnetic sound records staying under long-term storage.] *Trudy NIKFI* 90 (1978): 35-69.
7. Knight, G. A.: *Factor relating to long term storage of magnetic tape*. *Recorded Sound* (1977: 66-67): 681-692.
8. Maso, A. Ja. i Ustinov, V. A.: [Storage of magnetic tape sound records] *Technika kino i televidenija* (1974: 1): 20-25.
9. Musaeljan, E. A., Visotzkii, M. S., Klimenko, G. K., Makartzev, V. V., Marsov, S. V. i Makhnovskii, E. G.: [Multitrack magnetic rerecorded original.] *Technika kino i televidenija* (1972: 8): 5-9.

Anatolij M. Polishko, *Engineer*
Chief of the Sound Department of Gosfilmofond USSR
Stancija Belye Stolby
Moskovskaja oblast'
U.S.S.R.

Gennadij K. Klimenko, * *M. Tech. Sc.*
Deputy Chief of NIKFI
Leningradskij prospekt 47
Moscow
U.S.S.R.

*The Editor regrets to inform you of the death of Mr. Klimenko on May 18th, 1980. Till his death he was the Deputy Chief of the Sound Recording Laboratory of the Research Institute of Film-Photo in Moscow [NIKFI].

Disinfection and Straightening of Parchment Damaged by Microorganisms

by L. I. VORONINA, O. N. NAZAROVA & YU. P. PETUSHKOVA

It is known that many bacteria and micellar fungi cause the destruction of parchment.^{1,2,3,4} Under inappropriate storage of manuscripts the parchment damage by microorganisms consists essentially in extensive destruction of collagen, the main constituent component of parchment. In addition to collagen decay the destruction process also involves some other proteins of parchment, as well as lipids and carbohydrates. As a result, the parchment loses its original properties: it becomes hard and brittle and is covered with differently stained spots. In many a case the destruction processes also cause deformation of parchment.

According to the literary data, thymol, *p*-chloro-*m*-cresol and ethylene oxide are widely used to disinfect parchment.^{3,5,6,7} However, all these substances are either inefficient disinfectants or they exert subsidiary effects on the parchment, which can affect its properties.

The present work was aimed at a search for new approaches, which might be effectively used for disinfection and simultaneous straightening of deformed parchment.

MATERIALS AND METHODS

In our investigations we examined several parchment manuscripts with traces of microbiological damage.

The samples were collected from the damaged parts of the parchment, using routine techniques. Beef-extract agar (BEA), 3% parchment agar, beef-extract gelatine and beerwort agar were used as nutrient media for the bacteria and micellar fungi. The cultivation was carried out in a thermostat at 25°C.

A preparation of a quaternary ammonia compound – alkyl-dimethylbenzylammonium chloride – conventionally termed as Catamin AB, was used as a possible disinfectant.

The physico-mechanical and physico-chemical trials of the parchment were carried out in accordance with the standard procedures for leather.

RESULTS

Isolation of microorganisms: A microbiological analysis of the majority of ancient parchment samples revealed spore-forming bacteria, which in their morphologi-

cal characteristics and peculiar shapes of colonies can be referred to genus *Bacillus*. In addition, non-spore forming wide and short rods and smaller mobile ones were detected. In order to reveal bacterial growth at the expense of nutrient substances of parchment, the bacteria were inoculated onto a parchment agar. Of all the strains obtained the most rapid growth was observed in some *Bacillus* species. This fact determined our choice in selecting for further analysis a spore bacterial strain, which in terms of its colony shape was described as *Bacillus mesentericus*.

We also isolated from some strains of micellar fungi, of which the most frequently occurring ones were *Trichoderma viride*, *Penicillium chrysogenum* and *Aspergillus versicolor* and used them as test organisms for further examination.

Choice of disinfectant: The choice of Catamin AB as a possible disinfectant was not a random one. This substance had already been used for disinfection of paintings; some of its properties, in particular the antifungal activity, had been

tested.⁸ Catamin AB was found to be especially effective as a protective means against micellar fungi.

Our studies have demonstrated that Catamin AB also reveals some antibacterial properties. Therefore, our final choice was made in favour of this possible disinfectant.

Choice of disinfection conditions: The experiments were carried out on models, representing fragments of new parchment, 1 × 1 cm in size. The samples were infected with a spore suspension of the test fungi and a bacterial suspension and then placed in a desiccator kept at a constant temperature of 25°C and relative humidity of 100%. Under these conditions the samples were stored for 1 month. Then the samples with the grown microorganisms were processed with 3% water-alcohol solutions of Catamin AB. Water and alcohol were chosen on the grounds that they are widely used for restoration of parchment and, consequently, their harmlessness for parchment leaves no doubt. Water and alcohol were taken at a ratio of 1:3, which was experimentally found to be the optimal one. The percentage of Catamin AB in the solution was determined in accordance with the requirements for its application for disinfection of paintings and tissues.



Fig. 1. Medieval parchment charter before treatment with Catamin.

Fig. 1. Charte médiévale sur parchemin avant traitement à la Catamine.

Abb. 1. Mittelalterliche Pergament-Urkunde vor der Behandlung mit Catamin.

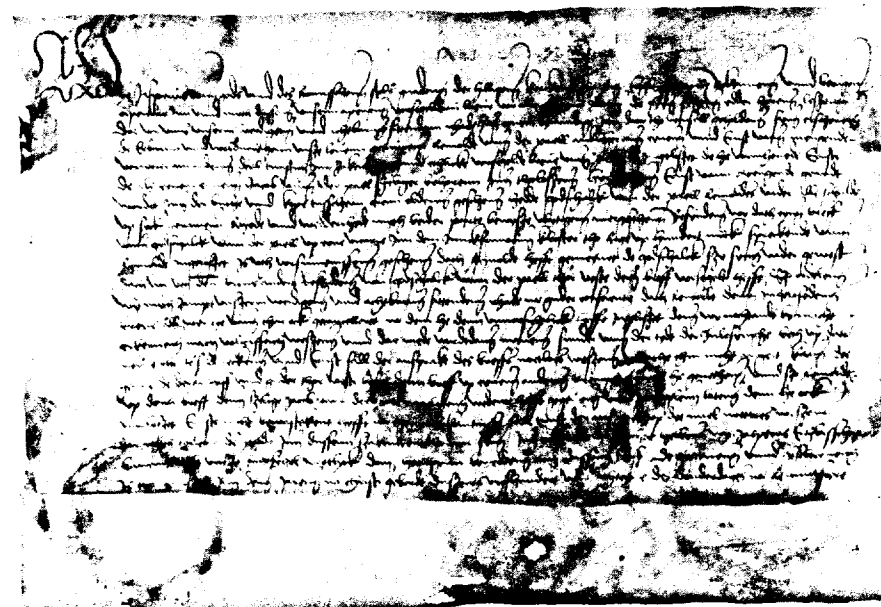


Fig. 2. The same charter after treatment.

Fig. 2. Môme charte après traitement.

Abb. 2. Die gleiche Urkunde nach der Behandlung.

Among the other disinfectant procedures the most effective ones were the following:

- 1) immersion of a parchment sample into a disinfectant solution for 5 min;
- 2) application of solution onto the parchment surface with a brush;
- 3) placement of the parchment sample between the sheets of filter-paper impregnated with the disinfectant solution for 30–40 min.

After the treatment by one of the above procedures, the parchment samples were placed under a press for 3 days to dry. The parchment samples treated with water and alcohol were used as controls. The efficiency of disinfection was evaluated after the placement of the samples onto the nutrient media. The results obtained demonstrated that all three methods eventually resulted in disinfection of parchment damaged by microorganisms.

Similar experiments with samples of medieval parchment confirmed the above-mentioned conclusions.

The third method, which is a modification of a method of distant moistening, was used for disinfection of the deformed sheets of manuscripts with traces of microbiological damage. After processing and pressing, the parchment samples were subjected to microbiological analysis for determination of efficiency of disinfection and a visual examination of the straightened sheets.

The selection of samples for microbiological analysis was done using routine microbiological methods. Non-processed parchment sheets served as controls. The control dishes with BEA contained a multitude of pinpoint colonies of different bacterial species and three colonies of micellar fungi. Contrastly, in all experimental dishes with BEA only singular (1–2) bacterial colonies were detected; the fungal growth was altogether absent. It can be thus supposed that the bacterial invasion on the surface of the disinfected parchment occurred from the environment, since the treatment was performed under non-sterile conditions.

It was also found that after treatment the deformed parts of the parchment sheets straightened out and the sheets resumed their softness and elasticity. However, before this method can be recommended for practical use, its harmlessness to the material should be proved. For this purpose we examined some physico-mechanical (e.g. limit of strength at stretching, elongation at rupture, hardness, elasticity) and physico-chemical (e.g. hygroscopicity, moisture absorption, acidity) properties of the parchment. The experimental results expressed as ratios of the values obtained before and after processing are summarized in Table 1. The samples of parchment treated with a solvent were used as controls. The effect of the disinfectant on the physico-chemical proper-

Table 1. Effect of Disinfection by Catamin AB on the Physico-Mechanical and Physico-Chemical Properties of Parchment.

Table 1. Effet de la desinfection a la catamine AB sur les proprietes physico-mecaniques et physico-chimiques du parchemin.

Tabelle 1. Die Wirkung der Desinfektion mit Catemin AB auf die physikalisch-mechanischen und die physikalisch-chemischen Eigenschaften von Pergament.

Treatment	P/P_0	δ/δ_0	$\Delta L/\Delta L_0$	H/H_0	RH/RH_0	E/E_0	H_g/H_{g0}	W_1/W_0			
								Parchment			
								New	Ancient	New	Ancient
Distant moistening with disinfectant solution	0,9	0,9	0,5	1,3	1,2	1,0	1,0	1,4	1,1	1,0	
Distant moistening with solvent	1,1	1,3	0,8	1,3	1,5	1,0	1,0	1,2	1,0	1,0	
Application of disinfectant solution with a brush	1,0	1,1	1,0	0,8	1,0	1,0	1,1	1,3	1,0	1,0	
Application of solvent with a brush	0,8	0,9	0,9	1,1	1,2	1,0	1,1	1,2	1,0	0,8	

Note: Results of tests expressed as ratios of the values obtained before and after treatment. The index $_0$ is for before and $_1$ for after.

P: load; δ : limit of strength; ΔL : relative elongation; H: hardness; RH: relative hardness; E: elasticity; H_g : hygroscopicity; W: moisture desorption.

ties of parchment is masked due to anisotropy of the latter. The structural heterogeneity of collagen determines the degree of mechanical strength of different parts of the parchment. Nevertheless, the results obtained (Tables 1 and 2) suggest that Catamin AB does not have any destructive action on the physical and chemical properties of parchment*.

Thus, the experimental results allow recommendation for practical purposes two methods of treatment of deformed parchment sheets damaged by microorganisms, i.e. application of the disinfectant solution onto the surface of the parchment sheet with a brush and placement of the parchment between the

*The efficiency of the first method was not studied because of the limitations in its application.

Table 2. Effect of Disinfection by Catamin AB on pH of Parchment

Table 2. Effet de la désinfection à la catamine AB sur le pH du parchemin

Tabelle 2. Die Wirkung der Desinfektion mit Catamin AB auf pH von Pergament

Processing	Parchment	
	New	Ancient
Distant moistening with disinfectant solution	7,8	6,8
Distant moistening with solvent	7,8	6,8
Application of disinfectant solution with a brush	7,8	– 1.
Application of solvent with a brush	7,8	– 1.
Non-processed parchment	7,8	6,7

1. Tests were not carried out due to shortage of material.

sheets of filter-paper impregnated with a disinfectant solution for 30–40 min. In both cases the deformation of parchment sheets disappeared and the parchment became disinfected. However, the application of the disinfectant solution is limited for particular cases only, e.g. when a small part of the sheet is subject to processing, and its choice in this case is determined by concrete aims of restoration.

SUMMARIES

Disinfection and Straightening of Parchment Damaged by Microorganisms.

Bacteria and micellar fungi were isolated from the damaged parts of ancient manuscripts on parchment and investigated. The spore-forming bacteria (*Bacillus mesentericus*) and fungi (*Trichoderma viride*, *Penicillium chrysogenum*, *Aspergillus versicolor*) were used as test organisms capable of destroying parchment. Catamin AB was found to be a highly efficient antiseptic agent against microorganisms causing parchment destruction. The disinfectant techniques for parchment were developed, which also allow straightening out the deformed parchment sheets. It was found that Catamin AB has no destructive effect on the physico-mechanical and physico-chemical properties of parchment.

Desinfection et redressage de parchemins endommagés par des microorganismes

Des bactéries et des champignons mycéliens ont été isolés sur les parties endommagées de manuscrits anciens écrits sur du parchemin, puis fait l'objet d'investigation. Les bactéries sporigènes (*Bacillus mesentericus*) et les champignons (*Trichoderma viride*, *Penicillium chrysogenum*, *Aspergillus versicolor*) ont été utilisés comme organismes d'essai capables de conduire à la destruction du parchemin. La Catamine AB s'est avérée être un agent antiseptique très puissant à l'égard des microorganismes causant la destruction du parchemin. Des techniques d'application de désinfectants de parchemins ont été mises au point permettant le redressage des feuilles de parchemin déformées. La Catamine AB s'est avérée être exempte d'effet dégradant sur les propriétés physico-mécaniques et-chimiques des parchemins.

Desinfektion und Glättung von Pergament, da von Mikroorganismen beschädigt worden ist

Bakterien und micellare Pilze wurden aus den beschädigten Teilen alter Pergamentmanuskripte isoliert und untersucht. Die sporenbildenden Bakterien (*Bacillus mesentericus*) und Pilze (*Trichoderma viride*, *Penicillium chrysogenum*, *Aspergillus versicolor*) wurden als Testorganismen eingesetzt, die in der Lage sind, Pergament zu zerstören. Es wurde festgestellt, dass Catamin AB ein hocheffektives Antiseptikum gegen Mikroorganismen ist, die die Zerstörung von Pergament verursachen. Die Desinfektions-Verfahren für Pergament wurden untersucht, die auch eine Glättung der deformierten Pergamentseiten ermöglichen. Es wurde festgestellt, dass Catamin AB keine zerstörende Wirkung auf die physikalisch-mechanischen sowie die physikalisch-chemischen Eigenschaften von Pergament hat.

References

- Smirnova, B. I.: [On Microflora of Parchment]. In [Problems of Conservation and Restoration of Paper and Parchment]. Leningrad 1962 49–59. (In Russian).
- Gallo, F. & Strzelczyk, A.: Indagine preliminari sulle alterazioni microbiche della pergamena. Bollettino dell'Istituto di Patologia del Libro 30 (1971): 71–87.
- Sadurska, I.: Ochrona pergaminu przed mikroflora. Biblioteka muzealnictwa i ochrony zabytkow. Ser. B 24 (1969): 84–93.
- Tardieux, P., Moussin, M.-H., Flieder, F. & Pochon, J.: Altération biologique des parchemins. Comptes rendus hebdomadaires des séances de l'Académie des Sciences. Ser. D 272 (1971): 1817–18.
- Subbotina, T. M.: [State of Manuscripts and Restoration Procedure]. In [Unknown Monuments of Book Art. Experience in Restoration of the French "Legendarium" (XIII century)]. Ed. V. S. Lyublinskij. Moskva, Leningrad, USSR Academy of Sciences, 1963 5–26 (In Russian).
- Plenderleith, H. J. & Werner, A. E.: The Conservation of Antiquities and Works of Art. London, Oxford University Press, 1971.
- Stambolov, T.: Manufacture, Deterioration and Preservation of Leather. A Literature Survey of Theoretical Aspects and Ancient Techniques. ICOM Plenary Meeting, Amsterdam, September 1969.
- Voronina, L. I.: [The Use of Antifungal Techniques in Preservation of Paintings]. Soobshcheniya VZNILKR 20 (1968): 57–65. (In Russian).

L. I. Voronina
O. N. Nazarova
Yu. P. Petushkova
All-Union Institute for Restoration, USSR
10, Krestyanskaya pl.
SU-109172 Moscow
U.S.S.R.

Microbiodeterioration of Library Materials

Part 1, chapters 1–3

By ROMUALD KOWALIK

CONTENTS

- | | |
|---|---|
| 1. Introduction | 3. Microbiocorrosion of Inorganic Writing Grounds: Stone, Clay Tablets. |
| 1.1 Abstracts | 3.1 Abstracts |
| 1.2 References | 3.2 References |
| 2. General Characteristics of Microflora Damaging or Decomposing to Library Materials | 4. Microbiodecomposition of Basic Organic Library Materials. |
| 2.1 Bacteria – Schizomycetes | 5. Microbiodecomposition of Auxiliary Library Materials |
| 2.2 Actinomycetes | 6. Methods of Testing the Microbioresistance of Particular Library Materials |
| 2.3 Fungi | 7. Methods of Testing Fungi- and Bactericides |
| 2.4 Yeasts | 8. The Problems of Toxicity of the Biocides used in Document Protection |
| 2.5 Algae | 9. The Problems of Toxicity of Microorganisms Causing Damage to Library Materials |
| 2.6 Abstracts | |
| 2.7 References | |

“Aurum, argentum, gemmae, purpureae vestis, marmoreae domus, cultur ager, pictae tabulae, phaleratus sonipes, caeteraque id genus mutam habent et superficiariam voluptatem; libri medullitus delectant, colloquuntur, consulunt, et vita quadam nobis atque arguta familiaritate iunguntur.” Francesco Petrarca: Epistolae de rebus familiaribus III, 18; De Remediis 40/I.

1. INTRODUCTION

Microorganisms, in particular bacteria and bacteria-like organisms, are almost certainly the oldest inhabitants of the earth. It seems likely that microorganisms originated some 3.5–4 billion years ago.² Owing to the simplicity of structure and rapidity of absorbing the nutrients, microorganisms multiply exceedingly fast. Therefore the number of mutations may occur with greater frequency and may easily acquire a high resistance. In addition, the spores, especially of fungi, can be carried long distances by air currents or water and in this way they may find better possibilities for germination. Thus microorganisms may be found in all kinds of conditions, from very dry to cold and

Editor's note: Chapters 1–3 form Part 1, chapters 4–5 will form Part 2, and chapters 6–9 will form Part 3. Part 2 and 3 will be published in later issues.

thermophilic ones and not only on different depths of earth, but also down to the bottom of the ocean.⁵ The adaptability of microorganisms gives them potential to readily develop populations to utilize not only cellulose, collagen, but also different hard decomposing materials and even chemicals toxic for other organisms. It is not surprising then, that they had played and continue to play a great part in the decomposition or corrosion of materials, among others library and archive materials.

Library materials are as a rule organic products, but conservators are also interested in inorganic writing grounds, such as small flat pieces of limestone utilized by Egyptians; columns and monuments used by Aztecs; bronzes, coins, medals in Phoenicia, Syria, Palestine, Egypt, Cyprus; stone inscriptions on sarcophagae in Phoenicia; writings on stone, rocks and seals made of stone by the Hittite culture and in Crete, Syria, Palestine, Greece, Etruria; Mayan hieroglyphics on stelae, columns and stone altars, building walls and ceramics.^{1,3,4,8} Moreover, curators and conservators are interested above all in clay tablets from the oldest in the world: Sumerian libraries, such as Kish, Nippur, and Sippar in present-day Iraq. Clay tablets were also uncovered in Iran, Syria, Egypt, Asia Minor, Crete and Greece. These inorganic materials, used from about 4,000 to 1,000 years B.C., may be vulnerable to microbial agents. Therefore considering only visual impressions, remedies had been used by the oldest inhabitants of Mesopotamia.

Out of very varied organic materials, shoulder blades of a camel in Egypt⁴ and bone scapula of an ox and turtle shells have been used for prophetic writings in China, as well as the use of ivory in Mesopotamia and Egypt.^{3,4}

Afterwards wood and some parts of plants and textiles were used for writing on.

Wood, both plain and coated with a thin coating plaster, has been used as writing grounds by ancient Egypt^{4,7} and by China¹ about 3,000 years ago. For books the Chinese used thin bamboo or wooden planks.³ The Aztecs wrote on long bands made out of palm fibers.³ Sometimes wood was used for recording organ music, as can be observed in the Polish National Library-Warsaw recording on an organ music stand, from the beginning of the 16th century, which comes from the Saint Catherina Church-Casimir near Cracow. It is probably the oldest recording of organ music in Poland. From vegetable fibres, palm leaves "talipot" in India and bast cultivated rubber plant "copo" by the Mayas have been used for writing on.³

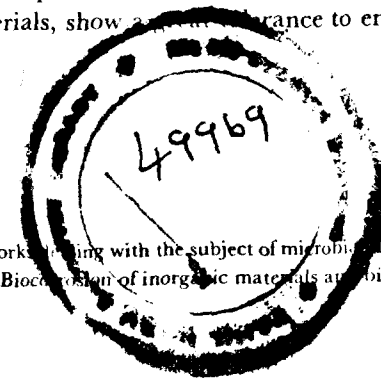
Considering textiles, linen was used as writing ground in ancient Egypt⁴ and silk in China before the invention of paper.¹ Textiles as library and archive materials are utilized continually for bookbinding and other purposes.

All mentioned organic materials are often deteriorated by microorganisms.

Library materials introduced successively: papyrus, leather, parchment and paper are much more conducive to prolific growth and decomposition caused by microflora.

Contrary to physical deterioration of materials caused by animals, the damage of library and archive materials due to the activity of microflora is almost the consequence of a more compounded process. Hence quick microbiodeterioration of these materials (particularly modern paper) and materials used in the conservation field (for instance adhesives, plastics and others) makes the aid to technologists urgent not only for the manufacture of materials destined for durable manuscripts and books or needed in conservation, but also at different stages of their preservation. From the microbiological point of view, infected materials used in restoration and inappropriate selection of products for conservation purposes may cause irreversible damages in cultural collections. It is required, then, to devise international standards relating the tests of microbial resistance to materials used in libraries and to preservation of books and manuscripts, because our essential task seems to be the necessity to introduce, in practice, methods to preserve the documents of our era indefinitely.

Microorganisms-bacteria, actinomycetes, fungi, yeasts and sometimes even algae play a very important role in decomposition and deterioration of nearly all natural and man-made synthetic materials. Therefore it is necessary to understand what kind of organisms they are, how they reproduce and the conditions under which they can grow and flourish in libraries and archives. The process of intensive microbiodeterioration of materials depends greatly upon relative humidity and moisture content of books and archives and they belong to more critical agents than temperature. Fungi, on the other hand, occurring abundantly on library materials, show a certain resistance to environment.



1.1 Abstract

The survey besides literature data covers the work dealing with the subject of microbiodeterioration of different library and archive materials: Biocorrosion of inorganic materials and biodecomposition of organic ones.

1.1 Résumé

En plus des données bibliographiques, cette étude traite des travaux effectués sur les détériorations survenues à divers matériels de bibliothèques et d'archives, à savoir la biocorrosion des matières inorganiques et la décomposition des matières organiques.

1.1 Zusammenfassung

Der Bericht umfasst, ausser Literaturangaben, die Arbeiten, die sich mit dem Problem der Mikrobiodeterioration von verschiedenen Bücherei- und Archivbeständen beschäftigen:

Biokorrosion von anorganischen Materialien und Biodekomposition von organischen Materialien.

1.2 References

1. Cunha, G. M. & Cunha, D. G.: *Conservation of Library Materials*. Metuchen, NJ: The Scarecrow Press Inc. 1971.
2. De Ley, J. & Kersters, K.: *Biochemical Evolution in Bacteria*. Eds. Florkin, M., Stotz, E. H.: *Comprehensive Biochemistry*. Amsterdam, New-York, London: Elsevier Sci. Publ. Co. vol. 29 B. 1975: 1-77.
3. *Encyclopedia Wiedzy o Książce*. Wrocław: Ossolineum 1971.
4. Lucas, A. & Harris, J. R.: *Ancient Egyptian Materials and Industries*. London 1962: E. Arnold Publishers Ltd.
5. Miller, J. D. A. (Edit.): *Microbial Aspects of Metallurgy*. Chiltern House, Aylesbury, England: MTP Medical and Technical Publ. Co., Ltd. 1971.
6. Petrarca, F.: *Epistolae de rebus familiaribus* III, 18; *De Remedii* I: 40.
7. Pietschmann, R.: *Leder und Holz als Schreibmaterialien bei den Aegyptern*. Beiträge zur Kenntnis des Schrift-, Buch-, und Bibliothekswesens 5 (1897): 51.
8. Plenderleith, H. J. & Werner, A. E.: *The Conservation of Antiquities and Works of Art*. London: Oxford University Press 1974.

2. GENERAL CHARACTERISTICS OF MICROFLORA DAMAGING OR DECOMPOSING TO LIBRARY MATERIALS

2.1 Bacteria - Schizomycetes

Bacteria are morphologically simple unicellular organisms, which may be considered as the lowest forms of plant life; sometimes a special place in the biological system is ascribed to bacteria and they are classified neither as plants nor as animals. Bacterial cells are shaped as spherical, cylindrical, comma shaped, spiral or filamentous. Morphological features of bacterial cells, which exhibit their own mobility, are generally delicate protoplasm-flagella, sometimes several times longer than bacterial cells. They act as locomotory organs. Spherical bacteria (cocci) are as a rule nonmotile.

An important feature of bacteria is their propagation. In suitable conditions they multiply with great rapidity and division may occur every half hour so that one individual may soon produce by simple binary fission several millions of new organisms. Although bacteria do not require as rigorous conditions

as higher organisms for their reproduction and metabolism, nevertheless definite factors are necessary, particularly a limited temperature range of from 0 to 45°C, depending upon the species.

Bacteria tolerate persistent coolness, even temperatures near absolute zero (-273°C). However, they are sensitive to high temperature and some organisms are killed above 40°C. Some species of saprophytic (contrary to pathogenic) bacteria grow best at the remarkably high temperature of 60-70°C. These are termed thermophilic and, recently, bacteria were isolated from hot springs, tolerating even the temperature of boiling water. Further important requirements for bacterial growth are the moisture content of the materials on which they live and the relative humidity of the atmosphere. For growth, all microorganisms require at least a trace of water, although many will survive for years in a completely dry state. Indeed, one of the best ways of preserving bacteria in a viable form is to freeze-dry them and store them under high vacuum. Below a relative humidity of 65%, the metabolism of bacteria is impossible and the optimum for bacteria lies near 100% of relative humidity. The more hygroscopic the materials, the lower the R.H. needs to be in order to permit bacterial growth. At a R.H. of 65%, the moisture content of a book, for instance, or a collection of archival papers varies between 6 and 9.5%.

A great amount of bacteria are able to survive dryness for a long time owing to the production of spores, which may also tolerate high temperatures in dry conditions better than in a humid state. The pH (H-ion concentrations) of the substrate is also essential to the growth of bacteria. Its range, depending on the species of bacteria, may vary from about 1.0 to 12.5. Generally speaking however, the majority of bacteria develop best in weak alkaline conditions, i.e. when the pH is about 7.2 to 7.5.

Due to the variability of enzyme systems, greater than in the case of higher organisms, bacteria may grow in the absence of atmospheric oxygen; others may live either in the presence or in the absence of air. Others can survive only in the presence of atmospheric oxygen.

When considering food, bacteria may be divided into two groups: The first group, that of autotrophic bacteria, are able to take up mineral salts and oxidized carbon compounds, such as carbon dioxide and carbonic acid. In this process they use, as external source of energy, light energy (for bacteria that contain a substance similar to that of chlorophyll) and chemical energy (by oxidation of sulphur compounds and ammonium salts, nitrates, ferric compounds by such bacteria as Thiobacilli, Nitrobacter and Ferrobacilli, which can destroy stone, metals and hard to decompose synthetic materials).

Bacteria that decompose the basic components of papyrus and paper, cellulose, as well as that of starch, hemicelluloses and other organic compounds,

belong to a heterotrophic category of organisms, which use macromolecular compounds as a food.^{1,5}

2.2 Actinomycetales

Actinomycetales take an active part in the deterioration of papyrus, paper, parchment, leather, wax seals and plastics. They are a group of branching unicellular organisms, closely related to bacteria, which reproduce either by fission or by means of special spores of conidia. The chemical composition of their cell walls is similar to that of Gram Positive bacteria (they stain when treated with one of para-rosaniline dyes-gentian violet and they do not decolorize with ethanol after treating with iodine to fix the stain). They are distinguished from bacteria by their ability to form mycelium (composed of individual filament-hyphae). The hyphae of Actinomycetales are narrower than fungal hyphae; their diameter seldom exceeding 2 microns. Ability to hydrolyze cellulose, hemicelluloses in paper and papyrus, lipids in leather bookbindings and in parchment is an important attribute of many of these organisms. These organisms require more alkaline media (pH from 7.0 to 8.0) than do bacteria. They grow on agar media as leathery or more often as powdery aerial mycelia of white, grey, yellow, green, orange, red, blue and even black colour. They grow in the presence of atmospheric oxygen (excluding *Streptomyces* pathogenic to man) of temperatures from 18–37°C, optimum 28–32°C and in a range of RH from 65–80%. They do not grow as vigorously as fungi and bacteria, but they are difficult to control with chemical and physicochemical methods and therefore play an important role when penetrating different materials. Their presence can be detected by a characteristic odour of soil.⁸

2.3 Fungi

Fungi popularly called mould or mildew are considered as the most primitive character of the Plant Kingdom owing to the cooccurrence of chitin in fungi and in the animal kingdom.^{4,7} They participate in decomposition of nearly all natural and even man-made synthetic materials such as plastics.

Fungi are generally regarded as a highly specialized class of plant. Fungi, however, differ fundamentally from plants. They do not contain any chlorophyll, which enables green plants to build up complex organic compounds from carbon dioxide and water in the presence of sunlight. As a consequence, fungi are dependent on other organic living or dead matter for their

food. Thus they possess, as bacteria and Actinomycetes do, a destructive metabolism.

The name fungus is now used to designate a large and variable group of plant organisms. Fungi are classified almost entirely on the basis of their morphology and life histories. They are divided into four groups and a taxonomic variety, the Fungi Imperfecti. Many important wood destroying fungi belong to the group known as Basidiomycetes which, to a lesser degree, also decompose textiles and paper and papyrus. Basidiomycetes bear their spores on the structure called basidium. An important role in deterioration of various materials is played by the Ascomycetes, another form of higher fungi. In these fungi the spores are formed inside a club-shaped bag known as an ascus. Most of the fungi which cause the troublesome dark stains in light coloured wood and cellulosic materials belong to this group. The next group, Fungi Imperfecti, are probably the most harmful to cellulose and other organic materials, and many synthetic products, sometimes even works of art, composed of inorganic constituents.

The vegetative body of fungi is composed of branching threads, hyphae, collectively called mycelium. The growth of fungi may take place after transferring any part of the mycelium upon the substrate; as a rule, however, development arises from the germination of a spore or conidium. If the spores of fungi fall on a suitable substratum they germinate when moistened. The spore wall bursts and a germ tube grows out. This germ tube elongates and becomes a hyphae.

The spores or conidia of fungi are very resistant, particularly to dry conditions. A great amount of them may tolerate a temperature of 100°C for as long as 25 years.

The most suitable conditions for the growth of fungi are: temperature of 24–30°C, a RH of 65–80%, and pH slightly acid, i.e. about 5.5.

Fungi show, however, a great tolerance of environment⁶ and curators of museums, libraries and archives are more familiar with them than with other biological agents. This is understandable, because the conditions in museums, libraries and archives favour the growth of fungi more than the growth of bacteria; because fungi can vegetate at the pH range 1.4 to 10.0 owing to a buffering system which can neutralize conditions that are neither too acidic nor too alkaline for growth. Moreover, a great many fungi require for their growth a lower moisture content of the materials than other microorganisms. Representatives of the *Aspergillus* and *Penicillium*, for example, can germinate even where there is a 7.8–9.0% moisture content and may act as a harbinger for other groups or genres of microorganisms, which are better endowed en-

zymatically, thus allowing the accompanying microorganisms to decompose cellulose, protein compounds and others. The beginning of germination depends to a large degree on the relative humidity, and the conidia of the genus *Aspergillus* and of *Penicillium* both exhibit low requirements in this respect. Germination of spores of *Aspergillus chevalieri* begins at 65–73% and growth at 65%, and the growth of *Aspergillus echinulatus* occurs at 62% R.H.⁵ *Aspergilli* and *Penicillia* as a rule begin to germinate at 70% R.H. Other genera of fungi develop in R.H. above 80%. In conditions of R.H. close to 75% the process of intensive deterioration of materials does not appear, but even short periods in which the R.H. ranges up to 90%, as during rainy days or short periods above 90%, are very dangerous.

During the growth and reproduction of microorganisms on writing materials, temperature plays a very important part and fungi show a significant tolerance in this respect. The representatives of the fungi class may begin to grow at temperatures below zero. *Cladosporium herbarum*, for example, at –7°C, *Penicillium* at –4°C and optimum temperatures for microorganisms deteriorating particular products oscillate from 14 to beyond 50°C. It is worth noting that deterioration is more quickly caused on land than on sea, due to greater daily changes in the temperature and R.H., greater amounts of dust and better possibilities to attack the materials by conidia of fungi. Therefore the prescriptions in the same geographical area should be more fastidious on the land than on the sea.

Light intensity has also an essential influence on the rate of growth of microorganisms and UV-radiation in the range of 3.100–4.000Å stimulates the appearance of conidia of some species of fungi, for instance *Alternaria*, *Aureobasidium*, *Fusarium* and others. Numerous species of fungi, owing to the dark coloured cell walls of their spores, show a great resistance to the activity of sun rays, for example, *Stemphylium*, *Helminthosporium*. As a rule however, the rays of the sun have a harmful effect on the life of fungi.

The nutrient requirements of fungi are the following: carbon, hydrogen, oxygen, nitrogen, sulphur, potassium, magnesium, phosphorous and traces of such elements as iron, zinc, copper, manganese and sometimes calcium. It is difficult to find a carbon-containing compound which some fungus cannot utilize. Certain fluorine plastics and a few detergents whose carbon cannot be used by microorganisms may be the only examples.

For fungi the best source of carbon are all carbohydrates such as cellulose, starch and other compounds which under the influence of enzymes are decomposed to simple organic compounds soluble in water. Decomposition of some materials may be brought down to carbon dioxide and water, and the fungi can be self sufficient given the necessary requirements of moisture. The rapidity of

deterioration and the amount of losses depend then on a complex of agents: moisture content and R.H., temperature, light intensity, chemical composition and reactivity of particular inorganic and organic library materials, and upon air composition.

The fungi may be destroyed by heat, but the exposure of antiquities and, especially, books to excessive heat may cause them to crack or to flake. Materials that are particularly susceptible to this trouble include desiccated and brittle leather. All organic materials should be maintained at a R.H. between 50 and 63% unless they have already become desiccated because of display for many years (in a heated library, for instance). In this event 50% R.H. will be satisfactory.

The above mentioned conditions are not always possible to maintain and therefore fungi-and bactericides are often used to protect library and other valuable materials (Table 1).

2.4 Yeasts

Yeasts also play some role in the deterioration of library materials, to which classes belong the Ascomycetes that are typically not filamentous but unicellular, ovoid or sphaeroid. They are larger than bacterial cells ranging to 5 microns diameter by 8 microns in length. Some yeast cells have a volume hundreds of times that of *Staphylococcus aureus*, bacteria pathogenic to man. Yeast cell walls contain, like fungi, chitin as well as large quantities of commercially used fat. One group of *Torula* (*Rhodotorula*) may cause reddish discolouration of cellulosic materials. Other ones (as *Candida*) destroy collagenic materials, proteinaceous adhesives and so on. It is worth mentioning that *Candida albicans* was isolated the most often from crew members of Apollo.

2.5 Algae

Although not frequently implicated as causal agents of deterioration, algae are nevertheless sufficiently common occurrences on the upper surface of articles exposed to receive maximum solar radiation.

Algae belong to the Division Protophyta, or typically primitive microscopic plants, each of which consists of a single undifferentiated cell or of unorganized groups of such cells. The first class of Protophyta comprises the photosynthetic blue-green algae.

Like all higher plants (but unlike all bacteria) the blue-green algae contain the green pigment chlorophyll. Cyanophyceae require sunlight or another source of radiant energy for growth and give off oxygen during photosynthesis.

No simple description would suffice to convey an accurate impression of the structure and reproduction mechanisms of the algae. Extreme diversity is characteristic of the group. Under the microscope some of the algae are among the most beautiful and fascinating of all living things. They have morphologically and functionally distinct rigid cell walls. Like bacteria, the fibers of the cell walls of typical Cyanophyceae consist not of cellulose but of a complex heteropolymer of mucocomplex.

In nature they are found on the surface of soils, rocks, trees and in water. Some types have been observed frequently on fabrics in Queensland, Australia which receive maximum solar radiation and which are at temperatures of 17°C. Another species, *Tolypothrix byssoidea*, was recorded growing profusely on tents in New-Guinea.² They have been rarely observed on library materials except during river floods, but they may be seen very often on stone and other inorganic materials.

2.6 Abstract

In chapter 2 the general characteristics of various microorganisms was given: bacteria, actinomycetes, fungi, yeasts and algae, which damage or decompose library and archives basic and auxiliary materials.

2.6 Résumé

Au chapitre 2, les caractéristiques générales de divers microorganismes ont été traitées, à savoir bactéries, actinomycètes, moisissures, levures, algues qui conduisent à l'endommagement et à la décomposition des matériels de base et des matériels auxiliaires de bibliothèques et d'archives.

2.6 Zusammenfassung

In Kapitel 2 wurden die allgemeinen charakteristischen Eigenschaften von verschiedenen Mikroorganismen beschrieben (Bakterien, Actinomycetes, Pilze, Hefe, Algen), die die Grund- und Hilfsmaterialien von Büchereien und Archiven zerstören, bzw. dekomponieren.

2.7 References

1. Haldenwanger, H. H. M.: *Biologische Zerstörung der Makromolekularen Werkstoffe*. Berlin, Heidelberg, New York: Springer Verlag 1971.
2. Heim, R., Flieder, F. & Nicot: *The Conservation of Cultural Property*. Lausanne: UNESCO 1968.
3. Hudson, H. J.: *Fungal Saprophytism*. London: E. Arnold Ltd. 1972.
4. Jeuniaux, Ch.: *Chitine et chitinolyse*. Paris: Masson et cie 1963.
5. Kowalik, R. & Czerwińska, E.: *Wybrane Zagadnienia Mikrobiologii Technicznej*. Podstawowe Problemy Współczesnej Techniki. Warszawa: Państwowe Wydawnictwa Naukowe 1971.

6. Panasenko, V. T.: *Ecology of Microfungi*. The Botanical Review 33 (1967): 189-215.
7. Swain, T.: *Biochemical Evolution in Plants* (Eds. Florkin M. & Stotz, E. H.): *Comprehensive Biochemistry*. Amsterdam, New York, London: Elsevier Sci. Publ. Co. 29A (1974): 125-302.
8. Williams, S. T.: *Role of Actinomycetes in Biodeterioration*. International Biodeterioration Bulletin 2:2 (1966): 125-133.

3. MICROBIOCORROSION OF INORGANIC WRITING GROUNDS

Library materials are as a rule organic products, but sometimes we have to do with inorganic writing grounds, much more less deteriorated by microorganisms, than organic materials. Microbial damage extends to such inorganic materials as stone, clay tablets and others. Of all the materials of works of art, limestone and sandstone were the most often used, also as writing grounds. Prehistoric caves, Roman settlements and grottoes of the Black Sea zone, great antique buildings on the Mediterranean Sea, stone objects from Egyptian, Greek, Roman and ancient civilizations of the Near and Far East and South America all have been preserved through the ages and as a rule they are not susceptible to attack by microorganisms. The occurrence of stone's aging and corrosion of different degrees of intensification, however, have been observed upon various buildings and monuments. The damages to stone in great cities are undoubtedly due to chemical agents and especially polluted with acidic atmosphere. The surface of stone swells and black scales, which crumble away, occur.

Microorganisms do not decompose inorganic materials; their activity is attributed to metabolic products, as a rule the acids, such as inorganic ones (sulphuric and nitric acids) and organic ones (acetic and oxalic acids and others). The whole process we call *biological corrosion*. Microflora do not take a great part in deterioration of different inorganic materials, but we cannot underestimate their role when considering works of art and writing materials. Contrary to the above mentioned processes, organic materials, for instance paper, can be destroyed completely by carbon dioxide and water. Here we have to do with real *decomposition* of valuable materials and therefore only some of them have lasted until our times.

Ubiquitous corrosion agents are, particularly, sulphates, developed by bacterial action and we know that sulphate reducing microbes are among the most ancient of living organisms on earth.¹⁶ Sulphur compounds deriving from the soil penetrate with water by capillary action and they are reduced on sulphides by anaerobes *Desulfovibrio desulfuricans*.^{4,6} According to Bourcart and others⁴ the mechanism of deterioration is the following:

Sulphur compounds deriving from the soil penetrate with water by capillary

action below the level of postument, and they are reduced to sulphide by anaerobes. Then sulphides are oxidized to sulphates by aerobic bacteria. The organism responsible for oxidation of sulphides is *Thiobacillus thiooxidans*, which may produce 10% of sulphuric acid and withstand pH 0.6.³ Affected surface layers of monuments or buildings become detached, exposing a surface of crystalline gypsum. Methods are available for the detection of sulphate reducers and sulphides oxidizers.^{3,13,21}

It was also found that solubilization of silicates may cause the corrosion of sandstone, marble and others. Silicon is the second most abundant element and we cannot underestimate at the present time its evolutionary importance. Igneous granite rocks composed of leachable silica could have yielded the ingredients for early life: diatoms, foraminifera, sponges. Silicates are dissolved by the activity of microorganisms and the highest degradation is caused by *Pseudomonas extorquens*.¹ It evidently can destroy marble, the crystalline form of limestone. Other *Pseudomonas*, for instance, *Pseudomonas fluorescens*, can form organic acids during growth.²³ Marble may be damaged by the fungi and bacteria from pigeon excrement, both mechanically and by secretion of acidic products from *Aspergilli*, for example.² Selected rock specimens were found to be heavily colonized with different microorganisms, which solubilize silicates.²² Bacteria are the most abundant and fungi, *Actinomycetes* and lichens occur successively. Clay tablets composed mostly of aluminosilicates as well as of lime, oxide of iron, potash, soda, magnesia and carbon and sulphur dioxides seem to be also soluble by the activity of microflora such as different bacteria and, according to our laboratory, some fungi: *Spicaria*, *Aspergillus niger*, *Alternaria* sp. and *Fusarium* sp. (unpublished data). Clay tablets not sufficiently kiln hardened or merely sun-dried may be solubilized through microbial action.

Kaufmann¹⁴ and Kaufmann and Toussaint¹⁵ attribute the principal role in biocorrosion of stone to nitrifying bacteria. Kaufmann¹⁴ has investigated different buildings: Notre Dame and the Church of St. Severin in Paris and two cathedrals in the valley of the Rhone. On the specimens of damaged stones an abundance of nitrates has been produced. The nitrifying bacteria grow profusely on the places exposed to air and rainwater having an especially sufficient amount of mineral elements. They use calcium carbonate as a carbon source and convert it into soluble calcium nitrate by nitric and nitrous acids, produced by bacteria from atmospheric nitrogen. Calcium nitrites and nitrates are washed away by rainwater and stone presents some form of powder, consisting of loose siliceous particles. In the monolith church of Auberre¹³ carved out of a calcareous hillside, the natural place of cult, the encrustments and deposits of calcium carbonate, an abundance of bacteria belonging to *Nitrosomonas* and

Thiobacilli were determined by Jaton. Therefore the author concluded that deterioration is due to the production of nitrate and sulphate and has found in the rock the oxidation of marcasite nodules by *Thiobacilli*.

Sometimes atrophied biocorrosion may be seen. Rich media at the beginning may lose the nutrients progressively and nitrifying bacteria cannot develop. Biocorrosion is characteristic for these bacteria, but they do not actually live, probably due to the absence of water and other agents.

In the tombs of clay, autotrophic aerobes have been observed by Gromow²⁵ on the surface of damaged marble.

Fusey and Hyvert,⁹ analyzing rainwater from the temple of Angkor Vat, could determine the conditions for the development of *Thiobacilli* and nitrifying bacteria. These authors attribute some role in the deterioration of stone to *Actinomycetes*, which reduce nitrates and sulphates. It seems to me that these slow growing microorganisms have not such a sharp water requirement and they may be more dangerous than other bacteria. Fusey and Hyvert⁹ found some species of Algae and these species particularly play some part in the fixation of atmospheric nitrogen, such as *Tolypothrix* and *Scytonema*, in damaging stone monuments.

The type of growth of Algae, lichen and moss depend upon the nature of the stone, but above all upon the climatic conditions and the degree of pollution. Relatively unpolluted and humid atmosphere allow Algae to develop. The lichens (symbiotic organisms of fungi and Algae) develop in dryer conditions. Mosses, however, occur in the presence of humus deposits, for example, accumulations of dead Algae. A 4% solution of boric acid may be suitable to inhibit the growth of all these organisms for 2–3 years. The monuments in cemeteries and elsewhere may be protected against lichen by using tri/n-butyltin/oxide, and Algae can be killed with less expensive and less permanent quaternary ammonium compounds.¹⁹ Excellent results against Algae are achieved by tetramine copper sulphate/ $\text{SO}_4\text{Cu}/\text{NH}_3/4$ together with the cleaning agent attapulgit. Copper fluoroborate⁸ is also satisfactory. Richardson¹⁸ advises the use of a 4% Polybor (borax + boric acid) solution for monumental purposes on reasonably porous stone. This concentration was found to be active for two and a half years against Algae, and a longer period against mosses and lichens. It is worth mentioning that mosses rarely develop on stone without organic deposits. The source of deposits are dead Algae. Lichen symbiosis of *Ascomycetes* and *Basidiomycetes* with Algae grow very slowly (in Northern Europe 1 mm diameter per annum). On building structures where moss and lichen are the most important, the effective life of Polybor ranges from 10–20 years. Sometimes tri/n-butyltin/oxide with quaternary

amines as emulsifier may be used against Algae and other organisms. This is effective for 2–3 years.

Problems of deterioration of palaces and other buildings in Venice seem to be connected with the activity of anaerobic sulphate reducers, *Desulfovibrio desulfuricans* (author's experiments 1974) existing in the canals in abundant amounts.

From manganese and iron oxide layers of stone Fusey and Hyvert⁹ isolated two fungi: *Cladosporium herbarum* and *Curvularia lunata*, which may also play a role in decaying the stone. Although fungi as heterotrophic organisms cannot grow on inorganic materials, they may live on very small amounts of organic substances as admixtures and we know that some fungi as *Merulius lacrymans* and *Poria vaporaria*, which destroy wood, may overgrow the concrete.

Fungi, when they exist together with Algae *Gloecocypsa kützingianum*, may attack stone.^{7,11,12,18} Species of *Spicaria*, *Penicillium*, *Botrytis*, *Cephalosporium*, *Fusarium*, *Hormodendron*, *Mucor*, *Trichoderma* and *Aspergillus* decompose silicate-containing compounds^{10,24} by citric and oxalic acids, which causes active release of metallic ions and silica from rocks. Earlier, some protective compounds for stone monuments were proposed.^{11,21}

3.1 Abstract

Chapter 3 deals with the causes of microbiocorrosion of inorganic library and archive materials attributed to bacterial and other microorganisms metabolic products, as inorganic acids (sulphuric and nitric) and organic acids (oxalic and others). Special attention is paid to the protection of inorganic materials by means of bacteri-, fungi-, and algicides, as tin, quaternary ammonium and boron compounds.

3.1 Résumé

Le chapitre 3 traite des causes de corrosion microbienne des matières inorganiques de bibliothèque et d'archives attribuées à des produits du métabolisme de bactéries et d'autres types de microorganismes, ces produits étant du genre acides minéraux tels que l'acide sulfurique et l'acide nitrique, des acides organiques tels que l'acide oxalique et divers autres acides. Une attention spéciale est prêtée à la protection des matières inorganiques à l'aide de bactéricides, de fongicides et d'algicides tels que l'étain, les ammoniums quaternaires et les composés à base de bore.

3.1 Zusammenfassung

Kapitel 3 beschäftigt sich mit der Ursache für die Mikrobiokorrosion von anorganischen Bücherei- und Archivbeständen auf Grund der Stoffwechselprodukte von Bakterien und anderen Mikroorganismen, wie z.B. anorganische Schwefelsäuren und Stickstoffsäuren sowie organische Oxalsäure

und andere. Besondere Aufmerksamkeit wird dem Schutz von anorganischen Materialien mit Hilfe von Bakteriziden, Fungiziden und Algiziden wie Zinn, Viertelammoniak und Borverbindungen gewidmet.

3.2 References

1. Bassalik, K.: *Silicate Decomposition by Soil Bacteria*. Zeitschrift für Gärungsphysiologie. I: 2 (1914): 1–30; I: 3 (1914): 15–42.
2. Bassi, M. & Chiatante, D.: *The Role of Pigeon Excrement in Stone Biodeterioration*. International Biodeterioration Bulletin 12: 3 (1976): 73–79.
3. Booth, G. H.: *Microbiological Corrosion*. London. Mills and Boon Ltd. 1971.
4. Bourcart, J., Noetzelin, J., Pochon, J. & Bertheliet, S.: *Études des détériorations des pierres des monuments historiques*. Annales Institute Technique Bâtiments et Travaux Publique 108 (1949): 1–16.
5. Butlin, K. R. & Postgate, J. R.: *Economic Importance of Autotrophs*. Autotrophic micro-organisms. Cambridge 1954.
6. Dillon, C. P.: *Corrosion of Concrete by Sulfate Ions*. Materials Protection and Performance. 12: 8 (1973): 23.
7. Degelius, G.: *Über Verwitterung von Kalk und Dolomitstein durch Algen, und Flechten* (Edit. U. A. Hedval): Chemie im Dienst der Archäologie, Bautechnik und Denkmalpflege. Göteborg (1962): 156–163.
8. Dupuy, P., Trotet, G. & Grossin, F.: *Protection des Monuments contre les Cyanophycées en Milieu Aride et Humide* (Edit. by E. Rossi-Manaresi): The Conservation of Stone, Bologna 1976: 205–219, Centro per la Conservazione dell' Scultura all' Aperto.
9. Fusey, P. & Hyvert, G.: *Biological Deterioration of Stone Monuments in Cambodia*. London. Microbiological Deterioration in the Tropics, Society of Chemical Industry Monograph No 23.
10. Henderson, M. E. K. & Duff, R. B.: *The Release of Metallic and Silicate Ions from Minerals, Rocks and Soils by Fungal Activity*. Journal of Soil Science 17 (1963): 236–246.
11. Hueck van der Plas, E. H.: *The Microbiological Deterioration of Porous Building Materials*. International Biodeterioration Bulletin 4: 1 (1968) 11–28.
12. Jaag, O.: *Untersuchungen über die Vegetation und Biologie der Algen des nackten Gesteins in den Alpen, im Jure und im Schweizerischen Mittelland*. Beiträge zur Kryptogamenflora der Schweiz 9: 3 (1945).
13. Jaton, C.: *Altérations microbiologiques de l'église monolithe d'Aubeterre sur Dronne*. Revue Écologique Biologie de Sol. 9: 3 (1972) 471–477.
14. Kaufmann, J. M.: *Rôle des bactéries nitrifiantes dans l'altération des pierres calcaires des monuments*. Comptes rendus de l'Académie des Sciences 234 (1952): 2395–2397.
15. Kaufmann, J. & Toussaint, P.: *Corrosion des pierres: nouvelle expériences montrant le rôle des bactéries nitrifiantes dans l'altération des pierres calcaires des monuments*. Corrosion et Anticorrosion 2 (1954): 240–244.
16. Kobrin, G.: *Corrosion by Microbiological Organisms in Natural Waters*. Materials Performances 15: 7 (1976): 38–43.
17. Pochon, J., Coppier, O. & Tchan, Y. T.: *Rôle des bactéries dans certaines altérations des pierres des monuments*. Chimie et Industrie 65 (1951): 496–500.
18. Richardson, B. A.: *Control of Biological Growths*. Stone Industries 8: 2 (1973): 1–6.

19. Richardson, B. A.: *Control of Moss, Lichen and Algae on Stone* (Edit. E. Rossi-Manaresi). The Conservation of Stone. Bologna. Centro per la Conservazione della Scultura all'Aperto (1976): 225-231.
20. Quispel, A.: *The Mutual Relations Between Algae and Fungi in Lichens*. Leiden. Thesis 1943.
21. Sadurska, I. & Kowalik, R.: *Experiments on Control of Sulphur Bacteria Active in Biological Corrosion of Stone*. Acta Microbiologica Polonica 15 (1966): 199-202.
22. Webley, D. M., Henderson, M. E. K. & Taylor, I. F.: *The Microbiology of Rocks and Weathered Stones*. Journal of Soil Science 14 (1963): 102-112.
23. Wood, P. A. & MacRae, I. C.: *Microbial Activity in Sandstone Deterioration*. International Biodeterioration Bulletin 8: 1 (1972): 25-27.
24. Zajic, J. E.: *Microbial Biogeochemistry*. New York. Academic Press 1969.
25. Gromow, B. W.: *Mikroflora razruszajuszczaja kirpicza, sztukaturki i mramora*. Wiestnik Lenin-gradskowo Uniwersiteta. Seria Biol. 18 (1963): 69-74.

Dr. Romuald Kowalik
Microbiological Laboratory
Institute of Industrial Organic Chemistry
03-236 Warsaw
Annopol 6
Poland

American Architectural Records: Creating Order and Organization

by CATHA GRACE RAMBUSCH & CAROL HIERSELLE KRINSKY

Architectural records are written as well as graphic documents which record the development of the built environment. In the United States, such documents are found in many locations, including architectural offices, libraries, archives, museums, historical societies, private collections, agencies of the city, state and national government – they also languish neglected in attics or cellars.

Unfortunately, many important architectural records have been lost, destroyed or ruined by neglect. Others have been preserved, but their location was unknown to everyone except the owner. Scholars and architects, museum curators and laymen were unable to learn which records still existed and where they were preserved.

In 1973, the *Committee for the Preservation of Architectural Records* was organized in New York City to bring order to this disorderly situation. The Committee members include architects, architectural historians, librarians, museum curators, preservationists, archivists, other professionals and interested laymen. The Committee was organized at first as a group of friends and colleagues, with each member of the group seeking others who wished to address this problem. Later, the Committee became more formal, and became a legally incorporated organization, able to receive public funds and charitable donations.

The methods used by this Committee to establish order in the field of architectural records will be the subject of this article.

The Committee decided to collect information about the location of architectural records. It also decided not to collect original material, but only to assist in the placement of original material in suitable existing repositories. By not competing for possession of architectural records, the Committee could remain neutral, and could ask for everyone's cooperation in accumulating information which might later be useful to many people. In retrospect, we find this decision to have been a wise one.

At first, the Committee's scope was local. Believing that setting an example is the best way to teach, the Committee began to locate and describe architectural records collections in New York City repositories. After identifying the repositories, we sent an introductory letter to the person in charge, defining in

detail the types of records that we wished to survey. At a mutually convenient time, a Committee representative went to the repository to ask questions, to inspect the materials, and to take detailed notes. The information obtained during the visit was transferred in the Committee office to an information sheet describing the collection in the repository. Each sheet gave the repository's name, address, telephone number, admission policy, hours of opening, general outline of the collection, a list of major holdings, information on photography and duplicating processes available, lists of finding aids, and travel directions via public transportation facilities. These sheets were then returned to the person in charge of the repository for reviewing or editing. The Committee examined more than ninety collections.

In order to make all this information available quickly and cheaply, we followed this procedure: We obtained 12 labels on special wax-backed paper; they were supplied by a typographer. The labels stated: Name, Address, Scope of Collection, etc. The labels were printed in conspicuous, bold-faced type. The information from each repository was typed on ordinary paper with space left for the label at the top of each section of information. The label was applied by pressure; the warmth of one's hand made the label adhere to the typed sheet. The original typed and labeled sheets were then taken to the printer in groups of 12, to be offset-printed on mylar-reinforced three-holed looseleaf paper. The originals were then returned to our office, where the labels were lifted off and applied to the next group of original sheets. This was done repeatedly. The method provided a uniform format, and at the same time allowed complete flexibility to type entries of varying lengths. The looseleaf paper allowed for the gradual completion of the research and survey phase because the information did not all have to be printed and bound together at one time. The looseleaf format also allowed the easy insertion of additional notes made later by the person using this publication. The looseleaf format made the publication cheaper and easier to mail, because we asked the recipients to provide their own looseleaf notebook covers. A copy of our *Guide* was distributed at the first International Conference of Museums of Architecture where the format gained quick acceptance as a means of organizing and publishing information of this kind. Of course, refinements can be made in this procedure, but initial control of a great deal of material can be gained by this method.

Having produced the *Guide* to architectural resources in New York City, we then conducted a mail survey of over six hundred repositories in the State of New York. The first mailing included an explanatory letter stating in great detail the types of documents we wanted to identify. We also included a simple form to be completed, and a 6-page pamphlet containing a bibliography concerning preservation of materials. (This pamphlet, "Selected References in the

Literature of Conservation" is available gratis from the Library of Congress, Washington, D.C. 20540 U.S.A.; it is part of their Preservation Leaflet series). Even though the institution might not have any materials pertinent to the survey, the Committee provided a service by distributing the pamphlet. This service may have caused some people to respond to our questionnaire who might not have done so otherwise. The initial response was 18%. A reminder memo brought a total return of 43%. We published the information in *Architectural Records in New York State: An Exploratory Survey*. The information was arranged alphabetically by geographic location, with additional indices of repository name and name of architects represented. Although the information is useful, its accuracy depended upon the care exercised by the person who answered our letter. It was not possible to check the answers with an on-site surveyor, as in the New York City survey.

To stimulate local activity and to gain specific kinds of information, the Committee conducted several national surveys. One survey of State Archives was to determine their collection policy and to find what records they actually held. Another survey was made of all the accredited schools of architecture to determine the existence and extent of their holdings. As a result of this survey, several architectural schools began to give serious thought to ordering their collections, starting a collection, or seeking the records of past graduates. Still another survey was made of all American architectural firms in continuous practice since before World War I. The results of this survey have been published in the *Directory of Historic American Architectural Firms*, which is available from the American Institute of Architects Foundation, 1799 New York Avenue, NW Washington, D.C. 20006.

The New York City *Guide*, the New York State survey, and a *Guide* to architectural records in Philadelphia (like the New York City guide) are available from the Committee, c/o AIA, 457 Madison Avenue, New York City 10022.

Our early survey work stimulated latent interest in architectural records. We received requests, inquiries, and information from all areas in the U.S.A. and abroad. A grant proposal to enlarge the scope of the Committee was presented to the National Endowment for the Humanities (Research Collections). We received funding for a two-year (1976-1978) project enabling the Committee to assume national responsibilities. The New York office became the national clearing house of information on all aspects of American architectural records — their discovery, placement, arrangement, and conservation. The task was to create a nationwide information network. Hoping to unify people with a common interest, and not wishing to compete with anyone, the Committee asked existing organizations to circulate news of our national efforts; these organizations graciously consented. To alert individuals, we prepared a clear

and simple statement of our purposes and goals and started a Newsletter. Within a surprisingly short time, a group was drawn from various academic and professional disciplines, and from interested laymen. We made contacts with people in all fifty states of the U.S.A. We designed and distributed guidelines and information packets to people who wished to organize local groups in their state. Activity on the local level to locate, save, and organize architectural records has been responsible for the growth of the Committee. The 1100 persons on the mailing list, some of whom are active participants, are all volunteers. Volunteers are actually doing survey work in Connecticut, Indiana, and Alabama, to mention a few examples.

This volunteer reporting system is the basis for the newly established *National Catalog of American Architectural Records*. All the activities of the Committee directly or indirectly relate to the amassing of information for this catalog. The National Catalog is the central reference source where people in the U.S.A. and abroad may ask for the location of American architectural records. The National Catalog has been transferred from the Committee's office to the Library of Congress, Prints and Photographs Division, Washington, D.C. 20540, U.S.A. A firm institutional setting is needed for the increasing volume of information and to coordinate the increasing number of studies being made about the U.S.A. The Committee itself had no institutional setting and no permanent funding. The National Endowment for the Humanities provided funds for another year (1979) during which institutional affiliation was sought. In early 1980, the Committee signed a formal agreement with the Library, authorizing the transfer of the Committee's national activities, its files, and its existing National Catalog entirely to the Library of Congress. The Library's assumption of this responsibility is an assurance that the Committee's work will continue.

The National Catalog describes architectural records under eleven headings, arranged thus on a sample card:

- 1) Name of architect
- 2) Name of firm
- 3) Name of designer, renderer, and/or builder
- 4) Original name of building: subsequent name, client's name
- 5) Address of building
- 6) Date of building or project (indicate if never built)
- 7) Type of building
- 8) Location of record
- 9) Type of records
- 10) Number of records
- 11) Comments

Under the heading "type of building" a building can be listed in one of ten categories: - residential; ecclesiastical; theater; educational institution; commercial; public; transportation; military; other (out-building, monument, cemetery, etc.). There are eight categories under "type of records." They are drawings (floor plan, elevation, section, presentation, interior, detail, mechanical, electrical, structural); photographs (print, negative, transparency, contact sheet); models; blueprints; specifications; files (personal, office and job files); correspondence (personal, office); other (travel, sketchbook, patternbook, diary, etc.).

These headings reflect the Committee's understanding that the headings had to systematize a wide variety of information, ranging from a detailed scholarly entry to a casual remark about a room full of drawings by a specific architect. The headings allow for addition of new or more detailed information about a building or record. The headings are suited to eventual computerization.

The information is typed on a 4-sheet non-carbon release archival quality ledger paper, 4 × 6 inches. An electric typewriter can produce four legible copies at one time. After the information is typed, the sheets are separated and filed separately under these headings: Name of architect; Location of building; Type of building; Building name. There are now several thousand entries. Some single entry cards may refer to thousands of individual records, grouped under a single name or may be for a single drawing. This system has worked well.

The existing entries in the National Catalog include information sent to the Committee by people in the U.S.A. and abroad. It is essential to continue the collaboration of those who are cataloguing architectural records in individual collections. They must understand the importance of continuing to report their old and new holdings to the central national unit. People who work in repositories in Delaware, New Mexico, and Oregon have already sent duplicates of their catalog cards for inclusion in the National Catalog. For the National Catalog, we examined entries in the only existing survey of American architectural records, whose purpose was to locate individual drawings of importance created before 1917. This typewritten work is entitled *American Architectural Drawings*, 1969, compiled and edited by George S. Koyl, FAIA, and Moira Mathieson, Assistant Editor; it was funded by the Philadelphia Chapter of the American Institute of Architects. We also examined relevant entries in the *National Union Catalog of Manuscripts*, in a *Guide to Archives and Manuscripts in the United States*, Philip M. Hamer, Editor, 1961, and *Index of American Architectural Drawings Before 1900*, American Association of Architectural Bibliographers, 1957. We collaborated with the National Historic Publications and Records Commission in preparation for its recent publication, *Directory of Archives and Manuscript Repositories*, 1978.

The *National Catalog of American Architectural Records* is an information resource of increasing value. Critical to the whole effort is the encouragement of activity at the local level – finding, sorting, arranging, and placing architectural records and the reporting of this information for inclusion in the National Catalog. The Committee has begun the task, provided an example, created a network, and devised a system to receive the information. Now it is necessary for others to organize their own collections and to inform the public at large of the treasures they have found. Although it is a task that will never be completed, the job of establishing order has been initiated by the *Committee for the Preservation of Architectural Records*.

In the Spring of 1980 the Committee was awarded a silver medal. The citation reads, "The American Institute of Architects is honored to confer this AIA medal on the Committee for the Preservation of Architectural Records, a national clearinghouse of information on this nation's accomplishments in Architecture and the Building Arts. Their endeavor promotes an understanding and public concern for architecture – while providing a reserve for scholars and maintaining records that will aid future generations."

SUMMARIES

American Architectural Records: Creating Order and Organization

A description of initiatives taken by a small group in the USA to locate and record the nation's architectural records, this article traces the formation of an interdisciplinary Committee in New York, its local activities, and due to government sponsorship, its national growth. Survey methods, recording techniques, and the formation of a National Catalog of American Architectural Records are also described.

Registres américains du domaine de l'architecture : synonyme d'ordre et d'organisation

Description des initiatives prises aux Etats-Unis par un petit groupe en vue de localiser et d'enregistrer les diverses archives nationales traitant d'architecture. Cet article passe en revue la formation d'un comité interdisciplinaire à New York, ses activités locales et, grâce au patronage du gouvernement, son extension à l'échelon national. Les méthodes de relevé, les techniques d'enregistrement et la formation d'un Catalogue National des Registres Américains du domaine de l'Architecture font aussi l'objet d'une description.

Amerikanische architektonische Berichte: Für Ordnung und eine bessere Organisation

Eine Beschreibung von Initiativen, die von einer kleinen Gruppe in den USA ergriffen worden sind, um die nationalen architektonischen Berichte zu finden und zu registrieren. Dieser Artikel verfolgt die Bildung eines Ausschusses in New York, der verschiedene Disziplinen verbindet, seinen örtlichen Aktivitäten und, auf Grund der Sponsortätigkeit der Regierung, seinem nationalen Wachstum. Darüberhinaus werden Untersuchungsmethoden, Registrierungsverfahren und der Aufbau eines Nationalen Kataloges über Amerikanische Architektonische Berichte beschrieben.

Catha Grace Rambusch
Executive Director
N.Y. Committee for the Preservation of Architectural Records
c/o American Institute of Architects, New York City Chapter
457 Madison Avenue
New York, NY 10022
U.S.A.

Carol Hierselle Krinsky
Professor of Fine Arts
College of Arts and Science
New York University
New York, New York 10003
U.S.A.

On Preservation of Library Holdings

The State Policy in the Field of Library Collection Conservation in the USSR

by GALINA S. ROZHKOVA

Preservation of manuscript and book wealth in the USSR has always been a matter of state importance. It is not accidental that the first decrees concerning culture and art and issued on V.I. Lenin's direct instructions were directed at preserving the country's extremely rich cultural heritage. Only in the first year of the existence of the Soviet Republic the Council of People's Commissars issued over 20 decrees and instructions concerning this question.

Fresh convincing testimony of the tireless concern shown by the Communist Party and the Soviet State for the preservation and augmentation of the country's spiritual wealth was the 1976 Law "On the Preservation and Use of Monuments of History and Culture," the first All-Union legislative act of this kind based on Leninist principles of treating historical and cultural heritage, and on the extremely rich experience of Soviet power. Lastly, Article 27 of the 1977 Constitution of the USSR decreed the increased significance of culture in Communist construction. It reads: *"The state concerns itself with protecting, augmenting and making extensive use of society's cultural wealth for the moral and aesthetic education of the Soviet people, for raising their cultural level."*

Monuments include documentary, manuscript and printed materials, which is stipulated by the USSR Law "On Protection and Use of Monuments of History and Culture": *"In the USSR monuments serve the goals of the development of science, public education and culture, of the moulding of the lofty ideal of Soviet patriotism, and of ideological and moral, internationalist and aesthetic education of the working people."* This provision of the Law fully conforms to the tasks set before state libraries as national book depositories.

The task of the present paper is to describe the major aspects of the work done by the country's libraries to preserve their book stock, namely, the problems dealing with their conservation and restoration. The recent years have seen an unprecedented interest in research in this field, and a wider range of

Editor's note: This report of the state-of-art of Russian library conservation was presented by Mr. N. S. Kartashov, Director of the Lenin State Library, to the 46th IFLA General Conference in Manila, Philippines, August 18-23, 1980: Conference of National Librarians.

organisational, scientific and practical work. New laboratories at institutions, as well as departments, groups and sectors at libraries and museums of the Union Republics are being set up; directions and scope of research are being expanded at the same time.

In the Soviet Union research and practical work are being conducted both at major libraries and in some laboratories, centres and institutes. Some lag in the development of scientifically grounded restoration methods, which took place in the post-war years, necessitated the establishment of special centres concerned with elaboration of modern scientifically grounded methods of conservation and restoration of library and museum collections.

It was necessary to set up a research organisation which would work according to a single scientific plan, possess modern equipment and instruments, employ scientific workers of different specialities and coordinate research into scientific restoration methods in the country. Thus, in 1958 the All-Union Central Research Laboratory for Restoration and Conservation of Museum and Artistic Values was established; on its basis the All-Union Research Institute of Restoration, the country's leading institution responsible for the preservation of all museum collections, was set up in 1979. Along with the Institute, research in restoration is being done by the All-Russia Scientific and Artistic Centre named after I. Grabar. The All-Union Research Institute of Document Management and Archival Work performs the function of a methodological centre responsible for the preservation of the collections of the state archives.

The Saltykov-Shchedrin State Public Library is the methodological centre for the libraries of the Russian Federation and carries out a great deal of research, methodological and practical work.

The laboratory for the conservation and restoration of documents of the USSR Academy of Sciences carries out many-sided research and restoration work only of ancient manuscript monuments, rare and valuable books from the holdings of academic libraries, and serves as the methodological centre for the libraries belonging to the Academy.

The library of Moscow State University is the methodological centre for the system of the country's university libraries.

State public scientific and technical libraries are headed by the State Public Scientific and Technical Library of the USSR.

The Lenin State Library of the USSR performs the functions of the methodological centre for all the libraries within the system of the Ministry of Culture of the USSR: it coordinates plans of scientific research, conducts All-Union seminar-conferences on topical problems of book-stock conservation, trains library personnel, conducts refresher courses for restorers and curators of libraries, issues methodological aids and conference transactions, and renders

practical assistance to all the libraries and museums of the country. Other methodological centres carry out work within their departments.

Research is done with a view to studying the reasons and processes of physico-chemical and biological factors destroying materials and investigating means and methods of conservation and restoration of documents based on paper, and parchment, of leather and writing facilities.

The ever faster process of the growth of library holdings made new demands on their conservation and restoration. Increased scope of book-publishing has led to a greater need for paper and to a decrease in its quality. Application of a considerable amount of wood and sulphite pulp obtained as a result of boiling wood in acidic medium and wide use of wood pulp considerably reduces durability of paper.

Libraries receive publications which by their physical and chemical properties are not intended for long keeping. Their volume is increasing with every passing year. In a particularly difficult position are big book depositories which receive an obligatory copy of every item of printed matter to be kept for centuries. These depositories have accumulated extensive files of very valuable literature, the possibility of its preservation being doubtful (different handbooks, dictionaries, abstracts, journals, newspapers, etc.). Therefore, recently of special urgency has been the question dealing with the design of the technology for the production of durable kinds of paper, i.e. of such paper which would for a long period of time retain its mechanical strength, as well as appearance and colour. The past few years have seen the investigation of the problem of aging of documents and the design of durable kinds of paper. (This work was carried out jointly by a number of institutions). Studies were conducted on a large assortment of specially designed paper specimens of different composition which made it possible to examine the effect of both separate factors and of their complex on the process of aging of paper. The results of the investigation established the dependence of the speed of aging of paper upon the kind of fibre and the composition of its components, and to outline ways of further research. Research should be continued so that paper for the publication of obligatory copies could be designed. As far as old manuscript holdings are concerned, they are guaranteed long-term preservation just as printed items of previous centuries issued on rag paper, unless they are exposed to the action of biological vermin because of violation of storage conditions.

With regard to the problem of preserving materials on a paper basis, work is being done to select and test new macromolecular compounds with a view to using them for strengthening and conserving decayed and fragile paper. The examination of the nature of interaction between chemical polymers and pulp fibres of a paper sheet makes a purposeful and rational use of polymers in order

to extend the service life of books. The effect of paper reinforcement as a result of impregnation with polymer solutions depends on the kind of fibres from which paper is made and, to a lesser extent, on the polymer compound and its functional groups. Research conducted by specialists of the Saltykov-Shchedrin State Public Library has shown that interaction between polymer compounds and paper from cotton fibres reveals the exclusive property of these fibres to form super tough compounds with polymers. The heavily broken-down paper can be strengthened by polymer solutions, cotton paper showing the most intensive growth of strength. Appropriate research has been conducted and many methods and ways have been applied in the restoration processes, such as:

- neutralization of acidity of papers;
 - removal of stains of different origin;
 - bleaching of dyes on paper;
 - strengthening of size paint on posters;
 - duplication of posters and maps;
 - unpasting of cemented unbacked books (as a result of accidents);
 - surface strengthening of paper with macromolecular film-formation compounds;
 - restoration of withered texts of manuscripts with chemical means;
 - investigation of the service life of modern dyes on paper;
 - strengthening of texts written in black lead pencil (manuscripts by A. N. Ostrovsky, A. P. Chekhov, N. V. Gogol, V. G. Belinsky, F. Dostoyevsky and the Maobit notebooks by M. Jalil have been strengthened);
 - strengthening of the colour layer of miniatures of illuminated manuscripts.
- The method has been developed and is partially used in laboratories, but is based on synthetic materials which is not desirable. At present research is being done into the selection of natural materials.

One of the interesting directions of research is the restoration of withered, obliterated and badly blotted texts. Numerous possibilities of photo restoration of texts and even of the very basis of paper can reveal the properties of the material, to obtain the complete characteristics of graphical, physical and chemical and textological features of a given document. The methods of restoring texts in ultra-violet and infrared rays are generally recognized.

A special field of research is the search for new effective methods of conserving and restoring leather bindings of ancient books and manuscripts on parchment. Earlier, the Lenin Library developed a conservation lubricant which functions as a conservation and prophylactic disinfection of leathers at the same time. By now investigation has been completed of new, longer term conservation systems, great attention having been paid to selection of the composition

varieties suitable for conserving not only dark but also coloured and light leathers. Optimal methods have been developed for softening old, breakable, heavily deformed and destroyed leathers with a view to preserving and restoring authentic bindings of ancient books.

A special direction of research concerns issues dealing with restoration of parchment, one of the most ancient materials to write on. This can be accounted for by the fact that in any big book repository of ancient manuscripts and documents on parchment there are some that belong, as a rule, to the most ancient and valuable part of the holdings. These are of the greatest scientific, cultural-historical and artistic value.

In restoring manuscripts on parchment and in pergamenous bindings special tasks stipulated by specific properties of this material are being tackled. As is known, parchment is undressed leather of special currying, chemically stable but very sensitive to fluctuations of atmospheric humidity. In preserving parchment in a building with relatively low humidity (40% and less) it becomes rigid and deformed; its area decreases considerably, and sometimes paints and inks crumble. Still greater deformations and shrivelling of sheets are caused by keeping parchment in a place with increased humidity (70% and more). In a bound manuscript kept in a damp place for some time the edges of pages, which absorb the atmospheric humidity to a greater extent, deform so much that the edge area increases considerably and it is sometimes impossible to close the book. Thus, it is obvious that the prime task in restoring parchment manuscripts is to soften and straighten them. In this connection the Lenin Library has developed methods which soften, straighten and unglue cemented parchment manuscripts. By using these methods specialists have restored manuscripts and rare books of the 7th–18th centuries, in particular, the "Ptolamaic Geography" published in 1511, which before restoration looked like a brick (the sheets were heavily deformed and stuck together). Now the book is in a good state and can be used.

Apart from deformation and sticking together, widespread damage of parchments includes stains made by microorganisms, atomization and crumbling of the dye layer of miniatures, tears, cuts, gaps under the text written in gallotannate inks and the appearance of brittleness and transparency. In research work much attention is paid to the removal and prevention of all kinds of damage. In particular, methods of removing pigment stains and transparency of parchments with print on both sides of a sheet have been developed. A possibility has been found for removing deformations of pergamenous bindings without removing the parchment from the covers of a binding (deformations are removed with the help of a water compress and in some cases by additional treatment with reagents).

Of great importance in restoring manuscripts on parchment is the strengthening of the dye layer of miniatures. In the course of aging, the dye layer undergoes physical and chemical changes causing its destruction (crumbling, peeling, swelling, coming off from base, etc.). To conserve such manuscripts it is necessary to use such substances which would strengthen the dye layer without changing the tone of colours, form a mat film, preserve the base of a document and interaction between the dye layer and base. This question is being studied jointly by the Lenin Library and the State Art Museum of the Estonian SSR, as the existing methods of strengthening the dye layer have some disadvantages. Biological issues involved in preserving book collections make up a special section of research distinguished for peculiarity of objects. Book repositories suffer heavy losses because of the simultaneous mass destruction of books by insects and fungi. The protection of books from biological damage and destruction is a very important element of the problem of conservation and restoration of library holdings.

Methods of protecting different objects and materials from biological destruction cannot be uniform, not only for different organisms but also for different conditions of the medium and microclimate. Therefore, the destruction of the biodestructors in libraries – insects and microorganisms – can rightfully be singled out as a special direction of science, i.e. entomology and mycology of book repositories, which has its own methods of biological research.

Since the scientific methods of preserving library holdings were formed, the USSR and foreign countries have introduced into practice the rule according to which each organised repository must take strict measures aimed at protecting the book-stock from insects, fungi, bacteria and rodents. This has been necessitated by librarians' experience, as they had witnessed more than once that in accidents and natural calamities the greatest amount of damage was caused by biological destruction. Besides, restoration of such materials encounters the greatest difficulties.

The main peculiarity of biological destruction of materials is that it is very active and dynamic, and that the destruction process which has begun is ever growing. Unfortunately, the initial stages of contamination and destructive activity are imperceptible. Moreover, according to their characteristics inherent in biological objects, only living organisms are active and, hence, form new foci of contamination. The spread of contamination in a closed space of the book repository may be very fast.

On the basis of research and observations in book repositories, which have taken many years, a methodology has been developed which ensures the provision of sufficient information on the contamination of books and library premises with insects and fungi.

It has been established that damage in book depositories of libraries can be caused by about 100 species of insects and over 300 species of fungi. Biological features and behavioural reactions of the most harmful species of insects have been investigated: optimal conditions of development, duration of each stage, as well as fecundity and the degree of harmfulness have been determined; species of fungi which are the strongest pulp destroyers have been identified; the relationship between storage conditions and the degree of contamination of library holdings has been established.

The comprehensive approach to measures against insects and fungi attaches great importance to prevention of contamination, to creation of specific storage conditions preventing the breeding and spread of vermin, to the production of new kinds of fungus-resistant paper, and to the development in the materials stored of resistance to microorganisms and insects by using different pesticides. The system of measures can only be based on a detailed study of biology, the life of vermin and their ability to damage the materials stored. The biology of most species of vermin in book repositories has been studied. But it should be borne in mind that the species variety of biological objects in book repositories constantly increases due to growing contacts between libraries, increasing numbers of species moving from living accommodations and all kinds of warehouses and adapting themselves to new habitation, and as a result of their transition from natural to *Sinanthropus* conditions.

Apart from deviations in temperatures and humidity, dust also facilitates the penetration of vermin into book repositories and their breeding there. Protection of book collections from dust is one of the main conditions ensuring their long-term preservation. There is a necessity to design mechanized systems of dust collection in the air and book-stock. Questions concerning the establishment of microclimate, air conditioning, illumination and some others should be thoroughly studied.

Stabilization of optimal conditions for the preservation of the book-stock can prevent or considerably reduce the physical and chemical destruction of library holdings. However, these temperature and humidity conditions are quite acceptable and sometimes optimal for most insects. Spores of fungi generally present in the air of book repositories begin to germinate even in the case of a short increase of air humidity and, hence, of moisture capacity of the book-stock to a level higher than the critical one; further growth and germination of fungi can take place then in ordinary conditions existing in book repositories.

The primary condition for the preservation of the book-stock in libraries is the provision of the necessary and constant (without sharp fluctuations) temperatures and humidity in book repositories.

Questions dealing with the protection of books from the effect of direct sunlight, removal of dust from books, proper transportation of books, as well as rules of using and scanning books require careful consideration.

The results of research are made direct use of in the work of restorers. Restoration work is an applied field of activity based on practical use of the achievements of science and technology, chemistry, physics, and biology. However, the skills and knowledge of a restorer and his intuition remain a most important factor in effective accomplishment of restoration work and an essential point in the practical implementation of the new scientifically grounded methods. All this helped to restore the Samaritanyanskaya manuscript of the 7th century, the Gospel Aprakos of the 15th century, Psalter of the 15th century, Karion Istomin's Primer, incunabula of the 14th-16th centuries, and many others.

Bonding agents are very important in restoring printed matter and ensuring their preservation. A correct choice of these agents is the main factor guaranteeing effective execution of the restoration process. Restoration glue should not destroy books, should produce transparent film, possess great adhesive capacity and be reversible (i.e. should be easily removed in case of necessity).

Restoration practice makes use of universally recognized methods and ways, the so-called classical and mechanized ones, but there are no universal methods suitable for all occasions. Classical restoration methods are constantly improved. It is necessary to take into account not only the variety of materials on which books are written, but also the materials from which they are made and the variety of damages. Special culture, tactfulness in dealing with a monument and the knowledge of the technology of its design, individual approach to each document are necessary in restoring all the materials and especially documents on parchment.

Widespread is the method of restoring the missing parts of a sheet with its simultaneous strengthening by means of paper mass. The method was developed by the Saltykov-Shchedrin Library. Earlier the Library designed a small sheet-casting machine and then a special facility (ROM-2) which has proved to be efficient. Specialists of the Library and those of other organisations received an inventor's certificate for their invention.

Methods of protecting paper by synthetic and artificial polymeric films have been known for decades. Film materials get stuck to paper by melting or dissolving, thus creating a surface or penetrating coating. Different modifications of this method have been called lamination or impregnation and have been mastered by many restoration laboratories to strengthen newspapers, super covers and library technology. The possibilities of mechanized (machine)

methods have not been exhausted. Therefore studies are being made of how to tackle new technological tasks with their help.

To render methodological and practical assistance to the country's libraries, All-Union seminars have been held in Moscow, Tartu, Leningrad and Alma-Ata. Such seminars help to sum up the results of the work done, to exchange practical experience, to share new methods and ways and to coordinate plans of further research.

A great deal has been done to improve preservation of library holdings. Many questions have been solved, but a good many have still to be dealt with.

To solve such a multiaspect problem as document restoration it is necessary to focus the efforts of curators, restorers and technological services on the entire range of problems, above all, on the following ones:

- creation of optimal storage conditions, provision of better protection and fire safety;
- organisation of accurate stock-taking of library holdings and identification of documents that need restoration, conservation and hygiene;
- establishment of an insurance file (xeroxcopies, microfilms, microcopies);
- search for new scientifically grounded methods and ways of restoring and conserving book collections;
- coordination of research into the preservation of book collections, not only within a country, but also with specialists of other countries;
- wide exchange of experience, and workshops of specialists;
- organisation of regular planning work on conservation, restoration, preventive examination, dedusting and disinfection of all book collections;
- establishment of such a psychological climate in a library when all librarians would take care of the preservation of the book-stock.

SUMMARIES

Preservation of Library Holdings

Preservation of manuscript and book wealth in the USSR has always been matter of state importance. This state importance of preservation of library holdings today is testified by the 1976 Law "On the Preservation and Use of Monuments of History and Culture," which underlines that the State concerns itself with protecting historical and cultural monuments connected with the people's life, historic events, development of society and state, and having historical, scientific, artistic and spiritual values.

In the Soviet Union research and practical work are being conducted both at major libraries and in some laboratories, centres, and institutes. There is an All-Union research institute of restoration, the country's leading institution responsible for preservation of museum collections.

The V. I. Lenin State Library of the USSR performs functions of the methodological centre for all the libraries within the system of the Ministry of Culture of the USSR: it coordinates research plans, participates in international conferences, conducts All-Union seminars, conferences on topical problems of book-stock conservation, trains library personnel, conducts refresher courses for restorers and curators of libraries, issues methodological aids and conference transactions, and renders practical assistance to all the libraries and museums of the country. Other methodological centres carry out work within their departments.

Our mutual efforts enabled us to carry out a number of tasks. We have started and are successfully carrying on the training of restorers; there exist a committee on restorers matriculation; methodological and practical aids and collections of research works are published; while studying and restoring monuments, a complex method is used embracing the work of a restorer, historian, chemist, physicist, biologist, and climatologist. Today restoration goes beyond its traditional conception; it has reached a new quality stage of development. The advantage of the State policy is in the fact that all restoration activities are under the Restoration Boards control; that all enormous restoration/conservation work is being done according to plans with the assistance of the State restoration organizations.

Protection des Documents de Bibliothèques

La protection et la préservation du patrimoine tel que manuscrits et livres ont toujours fait en URSS l'objet d'un intérêt de la part de l'Etat. L'intérêt actuel apporté par l'Etat à la conservation des documents de bibliothèques se traduit par la loi de 1976 sur «La préservation et l'usage des monuments de l'histoire et de la culture», soulignant le fait que l'Etat s'engage à la protection des vestiges historiques et culturels en rapport avec la vie du peuple, les événements historiques, le développement de la société et de l'Etat et présentant une valeur historique, scientifique, artistique et spirituelle.

En Union Soviétique, la recherche et les travaux d'ordre pratique sont menés dans des bibliothèques importantes et dans des laboratoires, des centres et des instituts. Il existe un institut national de recherche en méthodes de restauration représentant l'organisme de point du pays, responsable de la préservation des collections de musée.

La Bibliothèque Nationale V. I. Lénine assume les fonctions de centre de méthodologie pour l'ensemble des bibliothèques dans le cadre du Ministère des Affaires Culturelles de l'URSS. Cette bibliothèque coordonne les plans de recherche, participe aux conférences internationales, mène les séminaires et les conférences à l'échelon de l'Union des Républiques Soviétiques sur les problèmes traitant de la conservation des stocks de livres, se charge de la formation du personnel de bibliothèque, conduit les cours de formation continue des restaurateurs et des conservateurs de bibliothèques, publie des auxiliaires méthodologiques et des compte-rendus de conférences en prête une assistance d'ordre pratique à toutes les bibliothèques et les musées du pays. D'autres centres de méthodologie mènent aussi des travaux dans le cadre de leurs départements.

Nos efforts mutuels nous ont permis de réaliser un certain nombre de tâches. L'entraînement des restaurateurs a été entrepris et il se poursuit avec succès. Une commission a été créée, chargée de l'immatriculation des restaurateurs, des auxiliaires méthodologiques et pratiques; des recueils de travaux de recherche sont aussi publiés. Durant la phase d'étude et de restauration d'un monument, une méthode compliquée est utilisée faisant appel au travail d'un restaurateur, d'un historien, d'un chimiste, d'un physicien, d'un biologiste et d'un climatologue. La restauration actuelle dépasse le cadre de sa conception traditionnelle, un nouveau niveau de développement qualitatif a été atteint.

L'avantage présenté par la politique d'Etat réside dans le fait que toutes les activités de restauration sont placées sous le contrôle de la commission de restauration, que tous les travaux extrêmement importants de restauration/conservation sont effectués conformément aux plans avec l'assistance des organisations d'Etat chargées de la restauration.

Die Bewahrung von Büchereibeständen

Der Bewahrung des Manuskript- und Bücherreichtums in der UdSSR ist schon immer staatlicherseits grosse Bedeutung beigemessen worden. Diese Bedeutung, der man von seiten des Staates der Bewahrung von Büchereibeständen heute entgegenbringt, wird durch das 1976 verabschiedete Gesetz »Über die Bewahrung und Verwendung der historischen und kulturellen Monumente« bewiesen, welches unterstreicht, dass sich der Staat selbst mit dem Schutz des historischen und kulturellen Erbes beschäftigt, das mit dem Leben des Volkes, den historischen Ereignissen, der Entwicklung von Gesellschaft und Staat in Verbindung steht das historische, wissenschaftliche, künstlerische und geistige Werte hat.

Die Forschung und die praktische Arbeit auf diesem Gebiet werden in der Sowjetunion sowohl in den grösseren Bibliotheken als auch in Labors, Zentren und Institutionen durchgeführt. Es gibt ein All-Unions-Forschungs-Institut für Restaurierung, das die führende Institution des Landes ist, die für die Bewahrung von Museumssammlungen verantwortlich ist.

Die Staatliche W.-I.-Lenin-Bibliothek der UdSSR hat die Funktion eines methodologischen Zentrums für alle Bibliotheken innerhalb des Systems des Kulturministeriums der UdSSR: sie koordiniert die Forschungspläne, nimmt an internationalen Konferenzen teil, sie führt All-Unions-Seminare sowie Konferenzen über die wichtigsten Probleme der Konservierung von buchsammlungen durch, sie führt Weiterbildungskurse für Restauratoren an Bibliotheken sowie Bibliotheksdirektoren durch, bildet Bibliothekspersonal aus, sie veröffentlicht methodologische Hilfsmittel und Berichte von Konferenzen und sie leistet allen Bibliotheken und Museen des Landes praktischen Beistand. Andere methodologische Zentren führen die Arbeit in ihren Bereichen aus.

Unsere gemeinsamen Anstrengungen haben es ermöglicht, dass wir eine Reihe von Aufgaben lösen konnten. Wir haben mit der Ausbildung von Restauratoren begonnen und führen diese erfolgreich fort. Es gibt ein Komitee für die Immatrikulation von Restauratoren. Methodologische und praktische Hilfsmittel sowie Sammlungen von Forschungsarbeiten werden veröffentlicht. Beim Studium und bei der Restaurierung der geschichtlichen und kulturellen Monumente wird nach einer komplexen Methode verfahren, die die Arbeit eines Restaurators, Geschichtswissenschaftlers, Chemikers, Physikers, Biologen und Klimatologen umfasst. Die Restaurierung geht heute über den Rahmen der traditionellen Auffassung hinaus, sie hat in ihrer Entwicklung eine neue qualitative Stufe erreicht. Der Vorteil der staatlichen Politik beruht auf der Tatsache, dass alle Restaurierungsarbeiten der Kontrolle des Restaurierungs-Ausschusses unterliegen und dass die gesamte Restaurierungs- und Konservierungsarbeit nach Plänen und mit Unterstützung der staatlichen Restaurierungs-Organisationen erfolgt.

Galina S. Rozhkova
Chief of the Department of Hygiene and Restoration
V.I. Lenin State Library of the USSR
Moscow
U.S.S.R.

2:885m1,1169
N80.4.2

Libri

INTERNATIONAL LIBRARY REVIEW

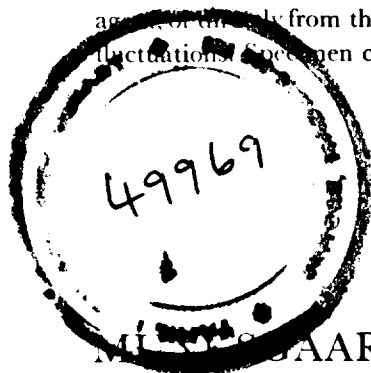
Libri was founded about 30 years ago as an international and independent forum for exchange of information about and discussion of important trends in library development all over the world.

Libri has played an important part in the efforts to promote the international relations between libraries and librarians throughout the world.

Libri is one of the significant periodicals within its field. On its pages you will find authoritative articles in English, French and German on the history of books, on bibliographical problems, on library research, and on all other aspects of librarianship throughout the world.

Libri should be read by every librarian wishing to keep abreast of the standards of his profession.

Libri is issued quarterly. Each issue has approximately 80 pages. The 1981 subscription price is D.kr. 370.00 plus postage D.kr. 28.00 (US \$60.50, £26.90, DM 137.30). Orders can be placed through your bookseller or agent or directly from the publisher. All prices are subject to exchange rate fluctuations. Free open copies can be sent upon request.



MILNE & BAARD International Publishers Ltd.
35 Nørre Søgade, DK-1370 Copenhagen K, Denmark

Editorial Notice

RESTAURATOR. *International Journal for the Preservation of Library and Archival Material*, will bring original papers on the subjects mentioned in the titles (including etchings and engravings), as well as reviews and news of interest to scientists, conservators, archivists, and librarians.

Contributions will be accepted in English, French, or German. Abstracts and figure legends will be printed in these languages. Contributors not writing in their mother tongue are particularly asked to have their manuscripts checked for linguistic and stylistic errors.

Manuscripts should be original typescripts (not carbon copies), in double spacing and on one side only of the paper. They must be carefully revised, as alterations in print are expensive. The paper used must be non-absorbent. Author's name should be accompanied by the title, position and working place of the author.

An abstract of no more than 200 words should be sent with the manuscript. The abstract should be in the same language as the article. The publisher will provide translation into the two other languages, of the abstract and the figure legends.

All graphs, drawings, or photographs are to be referred to as figures (abbr. Fig.) and should be numbered in sequence with Arabic numerals. Each figure should be identified with a figure number on the back. Any lines, numbers, or lettering that are to appear in the illustrations should be large enough for the necessary reduction. Line drawings should be drawn with black India ink on white paper and should be about twice the size of the finished blocks. Graphs can be plotted on plain white or blue squared paper; grid lines that are to show in the engraving should be inked in black. In general, photographs should be about 1 1/2 times the size of the final block and must be submitted as mounted glossy enlargements showing good detail and adequate, but not excessive, contrast. Authors should indicate in the manuscripts the approximate position of text figures.

Italics only are used for emphasis, especially for distinguishing titles of books and papers. It is marked in the manuscripts by underscoring.

References within the text should be indicated by numbers corresponding to those in the list of references. The list should be placed at the end of the paper and should contain no reading matter.

E.g.: 1. Barrow, William J.: *Restoration methods*. American Archivist 6 (1943): 151-54.

Authors alone are responsible for the opinions expressed in their papers.

50 offprints of each article will be sent to the author free of charge. Extra copies, if desired, will be supplied at a special rate.

© 1980 Munksgaard International Publishers Ltd. The appearance of the fee codes in this journal indicates the copyright owner's consent that copies or articles may be made for personal or internal use, or for the use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970 for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. All other rights, including microfilm, reserved.

Editor's Address

Manuscripts and review copies of books should be sent to the editor: Poul A. Christiansen, Librarian, University Library: Scientific and Medical Dept., 49 Nørre Allé, DK-2200 Copenhagen N, Denmark.

RESTAURATOR

Contents 4:2

- 81: A. M. POLISHKO & G. K. KLIMENKO: Storability of Film Sound Records.
- 91: L. I. VORONINA, O. N. NAZAROVA & YU. P. PETUSHKOVA: Disinfection and Straightening of Parchment Damaged by Microorganisms.
- 99: R. KOWALIK: Microbiodeterioration of Library Materials Part 1, chapters 1-3.
- 115: C. G. RAMBUSCH & C. H. KRINSKY: American Architectural Records: Creating Order and Organization.
- 123: G. S. ROZHKOVA: On Preservation of Library Holdings.

Indexed in:

Chemical Abstracts

Current Contents

Information Science Abstracts

Library Literature

Library Science

Social and Educational Science Citation Index

APPENDIX V-D

Archives Administration—VI Course (3 February—28 March 1986)

Sr. No.	Name	Sponsored by
1.	Shri F. J. Awosika . . .	National Petroleum Corporation, Lagos, Nigeria.
2.	Km. Nwe Nwe . . .	National Archives Department, Burma.
3.	Smt. Kyi Kyi Shwe . . .	Do.
4.	Shri S.Y. Saraf . . .	College of Agricultural Banking, Reserve Bank of India, Pune.
5.	Br. Saviour M.O. . . .	Carmelites of Mary Immaculate, St. John Ashram, Jalalabad, P.O. Nazibabad, Bijnor, U.P.

APPENDIX V-E

Reprography—XIII Course (7 April to 30 May 1986)

Sr. No.	Name	Sponsored by
1.	Shri P. K. Dobhal . . .	Geodetic and Research Branch, Survey of India, Dehradun.
2.	Shri A.K. Adhikari . . .	Department of Education, Government of Arunachal Pradesh, Itanagar.
3.	Shri Ram Shiromani Chourasia . . .	Rajkiya Public Library, Allahabad.
4.	Shri Shubh Narain Jha . . .	Kashi Prasad Jayswal Research Institute Museum, Patna.
5.	Shri Mahabir Singh . . .	Social Science Documentation Centre, I.C.S.S.R. New Delhi.

APPENDIX V-F

Reprography—XIV Course (8 September—31 October 1986)
(For Private Candidates)

Sr. No.	Name
1.	Shri Anil Kumar Sharma
2.	Shri Anil Kumar Jain
3.	Shri Budda Venkateshwara Reddy
4.	Shri Deep Raj Gupta
5.	Shri George A.V.
6.	Km. Madhu
7.	Shri Prayag Dutta Gautam
8.	Shri Shyam Bihari Upadhyaya
9.	Shri S.K. Bhaskar

APPENDIX V-G

Care & Conservation of Books, Manuscripts and Archives—XIV Course
(1 July—22 August 1986)

Sr. No.	Name	Sponsored by
1.	Shri Bhog Raj . . .	Defence Research Organisation Ministry of Defence, New Delhi.
2.	Shri Krishna Kumar Sharma . . .	Office of the Regional & Technical Development Centre, Ministry of Commerce, New Delhi.
3.	Shri P. Bala Gopal . . .	Kerala State Archives, Trivandrum.
4.	Shri L. G. F. Neilsen . . .	Department of Lands, New South Wales, Sydney Australia.