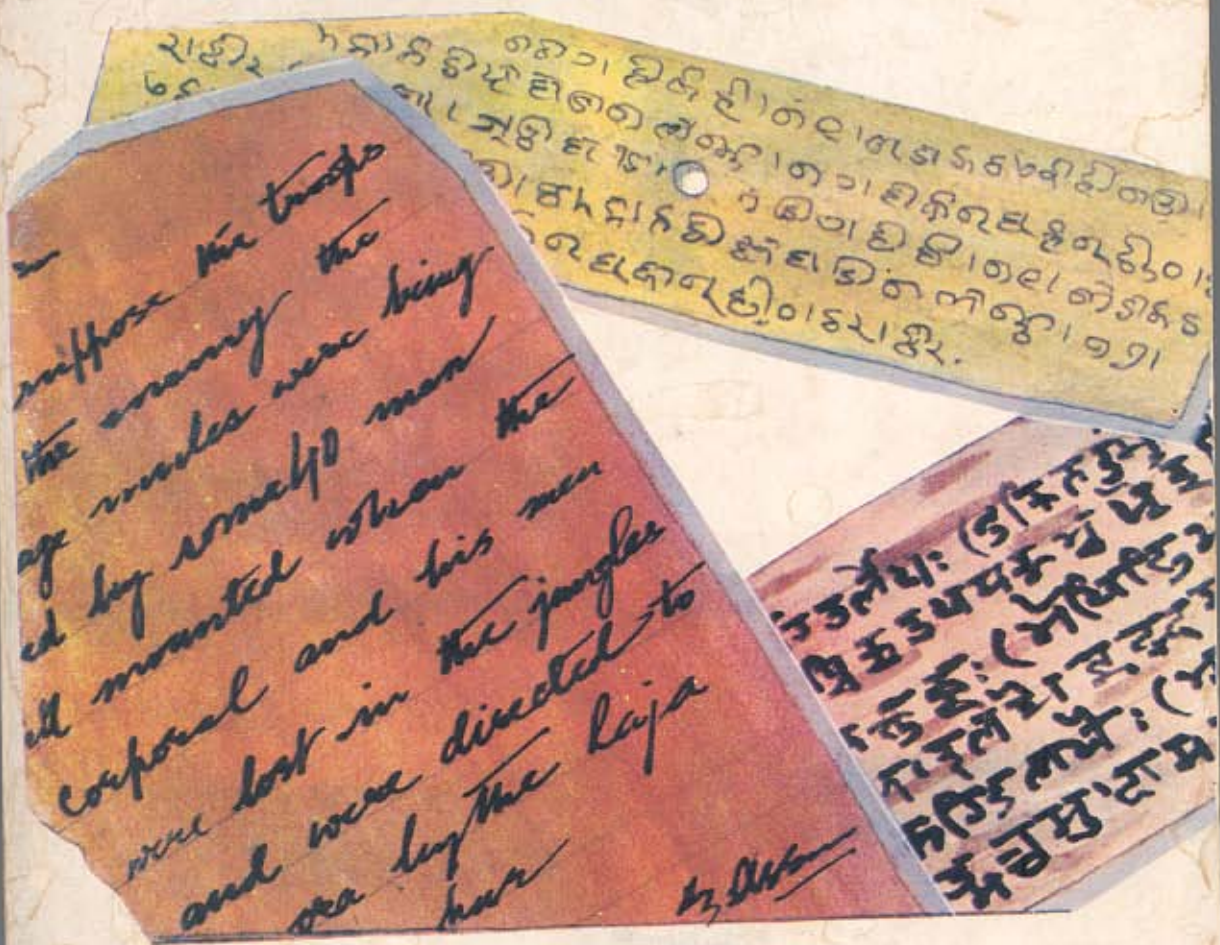
CONSERVATION OF TRADITIONAL RECORDS
PAPER AND ALLIED MATERIALS



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Contents

Preface	..	v
Schedule of the Seminar	..	vii
List of Participants	..	xi
Welcome Address *by* DR. R.K. PERTI	..	1
Inaugural Address *by* Y.S. DAS	..	3
Vote of Thanks *by* G.P.S.H. DE SILVA	..	5
Proceedings of the International Seminar	..	9
Papers read at the Seminar :	..	35
Some Problems in Conservation of Documentary Heritage in Indian Repositories *by* R.K. PERTI	..	37
Conservation Problems of the National Archives of Nepal *by* MRS. S.M. RANA	..	43
Some Conservation Problems in the Archives of Sri Lanka *by* MISS. S. WETTASINGHE	..	47
Conservation Problems in the Archives of Iran *by* IRAJ AMERI	..	52
Conservation Problems in the Archives of the Region (Pakistan) *by* ASHRAF ALI	..	53
Role of Climate and Environment in Deterioration of Paper and other Allied Materials *by* Y.P. KATHPALIA	..	60
Chemical Composition of Paper and its role in Preservation of Paper *by* V.V. TALWAR	..	65

Preventive Conservation of Archives *by* JOHN DAVIES .. 71

Housing Requirement for Conservation of Archives *by* RANBIR KISHORE .. 78

Bio-deterioration of paper and other Allied Materials *by* S.M. NAIR .. 81

Fumigation Equipment and Techniques for Sterilisation of Records *by* V.V. TALWAR .. 87

Sterilisation of Records against Fungus, Insects and Rodents *by* Y.P. KATHPALIA .. 94

Guarding and Filing of Archives *by* JOHN DAVIES .. 98

Materials and Equipments for Restoration of Documents *by* Y.P. KATHPALIA .. 106

Restoration of fragile Documents *by* AVINASHI LAL .. 111

Polyester Film Encapsulation—A Restoration Technique *by* JOHN DAVIES .. 166

Restoration of Palm Leaf Manuscripts *by* RANBIR KISHORE .. 123

Repair and Restoration of Illuminated Manuscripts and Miniatures *by* A.S. BISHT .. 125

Training Requirements for Conservation Personnel *by* JOHN DAVIES .. 132

Training Requirements and Presentation of RAMP Study *by* Y.P. KATHPALIA .. 138

Training for skilled Craftsmen *by* AVINASHI LAL .. 139

Microfilming-Essentials and Products *by* V. KOTNALA .. 144

Microfilming as an Aid to Conservation *by* Y.P. KATHPALIA .. 159

Microfilming as an Aid to Conservation *by* O.P. BHUGRA .. 162

Resolutions .. 166

Preface

I have great pleasure in bringing out the publication "Conservation of Traditional Records—Paper and Allied Materials" being the Proceedings of the International Seminar held at Vigyan Bhavan, New Delhi from December 16-19, 1985 under the joint auspices of the South and West Asian Regional Branch of the International Council on Archives and the National Archives of India. The Seminar was inaugurated by Y.S. Das, Secretary, Department of Culture, Government of India.

Besides National Archives of India, representatives from Iran, Nepal, Pakistan, Sri Lanka and various State Archives in India participated in the Seminar. Specialists in the field of conservation of documents and manuscripts, who contributed papers and participated in the discussions, were drawn from National Library, Calcutta; National Research Laboratory for Conservation of Cultural Property, Lucknow; Forest Research Institute, Dehradun; National Museum, New Delhi; National Museum of Natural History, New Delhi; and National Archives of India, New Delhi. Mr. John Davies of Australia and Mr. Y.P. Kathpalia of India acted as Resource Persons, while Mr. Ranbir Kishore, former Chief of Repair and Conservation, National Archives of India, acted as Technical Co-ordinator.

The Seminar discussed the conservation problems presently faced by the Archives and manuscript libraries of the region, causes of deterioration, deterioration prevention, restoration techniques, housing requirements and training of conservation personnel. The use of microfilming as an aid for conserving the informational contents of documents and manuscripts was also discussed.

The publication includes the papers presented at the Seminar, an account of the discussions that followed and the recommendations made at the concluding session. It thus gives a comprehensive insight into the various aspects of conservation of paper records and allied materials. It is hoped that it will be of great interest and use to those engaged in conservation work.

I will take this opportunity to thank the Department of Culture, Government of India and the International Council on Archives for their co-operation and financial assistance in organising this Seminar. I must also put on record my appreciation of the ungrudging assistance given to me by the institutions named above and by a number of my colleagues.

R.K. PERTI
Director of Archives,
National Archives of India.
and
Chairman, SWARBICA

New Delhi.
10th April, 1987

Schedule of the Seminar

Monday, 16 December, 1985.

9.30 a.m.	Registration	(Vigyan Bhawan)
10.00 a.m.	Inauguration	
	Welcome Address by Dr. R.K. Perti. Inaugural Address by Mr. Y.S. Das, Secretary, Deptt. of Culture, Government of India.	
	Vote of Thanks by Mr. G.P.S.H. de Silva	
	Technical Papers and Discussions.	
First Session	Chairman : DR. R.K. PERTI (INDIA)	
11.30 a.m. to 1.00 p.m.	Conservation Problems in the Archives of the Region. Speakers : India, Nepal, Sri Lanka.	
Second Session	Chairman : MR. R.C. GUPTA (INDIA)	
2.30 p.m. to 4.00 p.m.	Continuation of first session. Speakers : Iran, Pakistan.	
4.15 p.m.	Visit to National Archives of India.	

Tuesday, 17 December, 1985 Preventive Conservation

Third Session	Chairman : MR. A.Z. SHEIKH (PAKISTAN)
9.00 a.m. to 10.45 a.m.	Physical and Chemical Agents of deterioration and Control Measures. Speakers : Mr. Y.P. Kathpalia, Mr. V.V. Talwar.

Fourth Session Chairman : MR. IRAJ AMERI (IRAN)

11.00 a.m. to 12.30 p.m.	Preventive Conservation and Housing Requirement for Archives. Speakers : Mr. John Davies, Mr. Ranbir Kishore

Fifth Session Chairman : MR. G.P.S.H. DE SILVA (SRI LANKA)

2.00 p.m. to 3.30 p.m.	Bio-deterioration of Records, Sterilisation of Records against fungus, insects and rodents. Speakers : Dr. S.M. Nair, Mr. V.V. Talwar, Mr. Y.P. Kathpalia.
3.45 p.m.	Visit to National Museum of Natural History.

Wednesday, 18th December, 1985

Treatment of weak and fragile Materials.

Sixth Session Chairman : DR. R.K. PERTI (India)

9.00 a.m. to 10.45 a.m.	1. De-acidification and Restoration Techniques : Traditional Methods and Recent Developments. 2. Materials and Equipments Speakers : Mr. John Davies, Mr. Y.P. Kathpalia, Mr. Avinashi Lal.

Seventh Session Chairman : MR. A.Z. SHEIKH (Pakistan).

11.00 a.m. to 12.30 p.m.	Continuation of Sixth Session: Demonstration of Restoration Techniques. Speakers : Mr. John Davies, Mr. Y.P. Kathpalia, Mr. Avinashi Lal.

Eighth Session Chairperson : MRS. S.M. RANA (Nepal).

2.00 p.m. to 3.30 p.m.	Problems in Restoration of Palm leaf, Birch Bark Manuscripts, Illustrated Manuscripts and Miniatures. Speakers : Mr. Ranbir Kishore, Mr. A.S. Bisht, Mr. John Davies.
3.45 p.m.	Visit to National Museum.

List of Participants

FOREIGN PARTICIPANTS

1.	Mr. John Davies	State Archives, New South Wales, Sydney, Australia.
2.	Mr. Golam Ali Sanati	
3.	Mr. Iraj Ameri	Iran Archives.
4.	Mrs. Sani Maiya Rana	
5.	Miss Sanunani Kausakar	Nepal Archives.
6.	Mr. Atique Zafar Sheikh	
7.	Mr. Ashraf Ali	Pakistan Archives.
8.	Mr. G.P.S.H. de Silva	
9.	Miss S. Wettasinghe	Sri Lanka Archives.

INDIAN PARTICIPANTS

10.	Dr. R.K. Perti	Chairman, SWARBICA Director of Archives, National Archives of India.
11.	Mr. N.R.R. Chari	Deputy Director of Archives, National Archives of India.
12.	Mr. C.P. Mehra	Scientific Officer, National Archives of India.
13.	Dr. R.P. Malik	Do
14.	Mr. C.L. Prajapati	Scientific Officer, National Archives of India, Record Centre, Jaipur.
15.	Mr. Shoorvir Singh	Scientific Officer, National Archives of India, Regional Office, Bhopal.
16.	Mr. O.P. Bhugra	Microphotographist, National Archives of India.
17.	Mr. R.C. Gupta	Former Deputy Director of Archives, National Archives of India.
18.	Dr. N.H. Kulkarnee	Do
19.	Mr. Ranbir Kishore	Former Chief of Repair and Conservation, National Archives of India, Senior Fellow, School of Archival Studies.

20. Mr. V.V. Talwar	Former Asstt. Director of Archives, National Archives of India, Fellow, School of Archival Studies.
21. Mr. Y.P. Kathpalia	Former Asstt. Director of Archives, National Archives of India, Conservation Consultant, 11A/33 W.E.A. Karol Bagh, New Delhi.
22. Mr. M.V.S. Prasada Rau	Director, Andhra Pradesh State Archives, Hyderabad.
23. Mr. C.B. Pandya	Director, Gujarat State Archives, Gandhinagar.
24. Mr. R. Muniswamy	Director, Karnataka State Archives, Bangalore.
25. Dr. S.N. Sinha	Director, U.P. State Archives, Lucknow.
26. Mr. V.K. Sharma	Under Secretary (Archives) Union Territory of Delhi, Delhi.
27. Dr. N. Rajendran	Director, Kerala State Archives, Trivandrum.
28. Mr. B.D. Dhatavakar	Director, Maharashtra State Archives, Bombay.
29. Mr. J.K. Jain	Director, Rajasthan State Archives, Bikaner.
30. Mr. S.D. Guru	Director, M.P. State Archives, Bhopal.
31. Mr. Harvansh Garg	Language, Arts and Culture Deptt. Himachal Pradesh Govt., Shimla.
32. Mr. Harcharan Singh	Panjab State Archives, Patiala.
33. Miss V. Lalitha	Tamil Nadu State Archives, Madras.
34. Dr. S.M. Nair	Director, National Museum of Natural History, New Delhi.
35. Mr. A.S. Bisht	Chief Conservator, National Museum, New Delhi.
36. Dr. T.R. Sareen	Director, Indian Council of Historical Research, New Delhi.
37. Mr. O.P. Agarwal	Director, National Research Laboratory for Conservation, Lucknow.
38. Dr. (Miss) Shashi Dhawan	National Research Laboratory for Conservation, Lucknow.
39. Mr. Avinashi Lal	Dy. Librarian, National Library, Calcutta.
40. Mr. V. Kotnala	Microphotographer, National Library, Calcutta.
41. Mr. Y.K. Sharma	
42. Dr. K.S. Bhandari	Forest Research Institute, Dehra Dun.

SCHOOL OF ARCHIVAL STUDIES, NATIONAL ARCHIVES OF INDIA

FACULTY MEMBERS

43.	Mr. Hardeo Singh	Asstt. Director of Archives.
44.	Dr. (Mrs.) Meena Gautam	Archivist.
45.	Mr. A.K. Sharma	Microphotographist
46.	Dr. Gurmeet Singh	Scientific Officer

TRAINEES

47. Miss Amarjeet Kaur
48. Mr. Azimah Mohd. Ali
49. Shri Babu Lal Verma
50. Miss Deepta Sharma
51. Mrs. Faduma Sheikh Ibrahim
52. Miss Habibah Ismail
53. Mr. John L. Ogolla
54. Mr. Misbahul Islam Siddiqui
55. Miss Nor Janati Ibrahim
56. Miss Priyamvada Mukherjee
57. Miss Renee Ghosh

INAUGURAL SESSION

Welcome Address
Dr. R.K. Perti welcoming the participants. On his right is Mr. Y.S. Das

Welcome Address

DR. R.K. PERTI

DISTINGUISHED chief guest Mr. Y.S. Das, members of the executive board of SWARBICA, delegates to the seminar, ladies and gentlemen:

It is my privilege to welcome you all this morning to this International Seminar on 'Conservation of Traditional Records: Paper and Allied Materials' that is being held under the joint auspices of SWARBICA and the National Archives of India.

SWARBICA, as you all perhaps know, was established 9 years ago to promote co-operation amongst the Archives and the Archivists of the Southern and Western parts of Asia. It was to provide a forum to them to discuss their mutual problems and pool up their resources in overcoming them and safeguarding the documentary heritage of the region. It is a non-political, non-governmental organisation, which is affiliated to the Unesco through its parent body, i.e. the International Council on Archives. This SWARBICA region has been the cradle of one of the ancient and the highly developed civilisations of the world. It is also proud of having a continuous history of many a millenium now—a fact unparalleled in the history of mankind. It is our responsibility, nay, I may say, obligation, to conserve all that has come to us in different forms and formats. Although 'Archives' in the modern sense of the term has come in this region only towards the close of the last century, yet certain rudimentary methods to preserve paper, birch bark and palm leaves, etc. did exist. Conscientious people preserved their scriptures and the like materials with the help of certain dyes and insect repellants, but their use was rather restricted. Consequently, a large body of materials, which had been created and ought to have come to us as our heritage and useful for reconstructing our past has got destroyed and we are faced with the problem of paucity of materials. Most of the materials available in the Archives in the countries of the region provide us with information about the different facets of our society, and the functioning of the Government in a succinct manner only from the period of coming of the Europeans in this region, i.e. 17th century. Should we not learn from our past mistakes and take steps to

Inaugural Address

Mr. Y.S. Das inaugurating the session. On his right is Mr. Iraj Ameri and on his left Dr. R.K. Perti

Inaugural Address

Y.S. Das

Distinguished archivists and friends,

It is indeed a favour to me to be called upon to associate myself with the community of archivists from neighbouring countries in the South Asia, West Asia and South East Asia. Having been associated with Government administration for quite many years I consider myself as one of the users of archives, and this is perhaps a link that brings me nearer to you.

Archival institutions in our countries have to play a vital role in helping the scholars in synthesizing and interpreting administrative, political and cultural history of not only of the past, but of contemporary times as well. Therefore, archivists, as custodians of the valuable national treasure, have a very heavy duty and an obligation to preserve it for posterity.

During the past few decades there has been a good deal of awakening and consciousness about conserving the archival wealth in our region, but the problems that we face are very many. Hot and humid climate that prevails in the tropical belt in which our countries lie, not only has an adverse bearing on the long life of paper, which forms the major bulk in our repositories, but is also conducive to breeding of biological pests. Many an important collection have been reduced to powder by insect pests, while many others have been defaced by microbiological decay. Treatment of paper for prolonging its life as well as to safeguard it from deteriorative influence is very necessary. Scientific innovations made in the developing countries have made available techniques and processes that help preserving paper. Special techniques, materials, and chemicals are needed to treat paper and safeguard it from injurious pests. One of the problems that we face is the non-availability of special materials required for restoration of weak and fragile documents and manuscripts. Further, there is a need to examine how best these techniques could be adopted with full advantage. It seems that the problems confronting the archives in our region require examination in depth and efforts are needed to develop our

own know-how so that we could find repair materials in the region itself rather than look for the ones available in the developed countries. From the programme of the seminar I observe that the seminar will be pooling its technical expertise to find solutions to the very many problems that our archives face.

We have made a modest beginning by providing indigenous hand made paper, chiffon as well as tissue paper to meet the demands of our conservation laboratories. Recently our Forest Research Institute has developed a leaf casting machine for restoration of weak and fragile documents, which is a welcome step for meeting the requirements of the Indian Archives and manuscripts libraries.

Another vital problem that we face is the need of trained and skilled craftsmen to man the conservation workshop. The School of Archival Studies of the National Archives of India is doing its best to train the professional and skilled conservation specialist. This school is also catering to the needs of the Archives of the neighbouring countries as also other parts of Asia and Africa in training their personnel, though on a limited scale. I hope the seminar will also pay its attention as to whether the training programme in vogue here needs further improvement to make it more meaningful.

During the course of your stay at New Delhi I am sure you will have an occasion to visit the National Archives, National Museum and other allied Institutions where conservation tasks of all sorts are being attended to.

I am sure that experts assembled here will provide adequate guidelines for the preservation of our documentary heritage well within the limited resources available in a developing economy.

I wish the seminar all success.

Y.S. DAS,
Secretary, Deptt. of Culture, Govt. of India.

Vote of Thanks

G.P.S.H. DE SILVA

DISTINGUISHED chief guest Mr. Y.S. Das, chairman and members of the executive board of SWARBICA, delegates, participants, ladies and gentlemen.

It is my pleasure and privilege to thank the Government of India for the facilities to hold the present Seminar on "Conservation of traditional records", which form an important part of our cultural heritage. Since the problems of conservation are comon to the region, I am sure the deliberations of the Seminar will be of great interest and use to all of us. I would also appeal for greater regional collaboration in this field.

G.P.S.H. DE SILVA,
Director, National Archives of Sri Lanka and Secretary General, SWARBICA

PROCEEDINGS OF THE SEMINAR

Proceedings of the Seminar

FIRST SESSION

The first session of the Seminar was held on 16th December, 1985 at 11.30 a.m. In the absence of Mrs. Carmen Crespo, the ICA representative, the session was chaired by Dr. R.K. Perti. At the beginning Dr. Perti presented a paper 'Some Problems in the Conservation of Documentary Heritage in Indian Repositories', which broadly outlined the problems faced by archival repositories in India. The other two papers presented were:

1. 'Problems of Conservation in National Archives of Nepal' by Mrs. S.M. Rana.
2. 'Some Conservation Problems in the Archives of Sri Lanka' by Miss S. Wettasinghe.

Thanking the speakers, the Chairman threw open the papers for discussion.

Commenting on the aforesaid papers, and dwelling on the detrimental elements present in the atmosphere affecting the records adversely, Mr. N.R.R. Chari made a reference to the presence of salt in the air in areas close to the sea and its ill-effects on film, tapes etc. He maintained that mere air-conditioning would not solve the problem and pointed out the need for special steps to ward off the danger. Agreeing with Mr. Chari, Mr. John Davies suggested that the fool-proof answer to that problem rested in providing facilities for washing/filtering of air, besides air-conditioning. In this context he referred to a recent survey conducted in the United Kingdom wherein it was brought out that salt moisture travelled 40 to 50 kilometres inland.

Mr. R.C. Gupta maintained that air washing was necessary to remove the salt effect. He, however, had certain doubts about the efficacy of normal washing in removing salt from the moisture. On the contrary, he felt that development of a green belt around archives could help in diverting/diluting salt effect and drew the attention of the members to

the experience of the archaeologists in this field and the successful attempts made by them in preserving moment by resorting to the foliage system. Mr. Y.P. Kathpalia was of the view that besides washing, filtering of air was very important to overcome that problem. He also emphasised the need for running the air-conditioning plant for all the 24 hours and providing a conditioned air for the proper health of records. He also added that laying of ducts for an effective air-conditioning system was a job of supreme importance. But while doing so the role of plants and foliage in diverting salts and sulphur dioxide could not be minimised. Mr. Ranbir Kishore, however, felt that air-conditioning was a very expensive proposition and most countries of the region could ill-afford it. He further held that as the concentration of salts was a variable factor even air-conditioning was not helpful in combating the danger. He therefore, urged if the deliberations in the Seminar could lead to some feasible and practical compromise solutions, and in that context he referred to the alternatives suggested in Dr. Perti's paper. Miss V. Lalitha drew the attention of the members to the Nilgiris Library in Ootacamund which has in its custody a book dating back to 1584. She further pointed out that even the 19th centry documents at the Collector's office in that city were in good condition. She therefore, pointed out that proper location for an archival building was a factor of immense significance. The need for a study of ecology while constructing buildings for Archives was yet another facet that engaged the attention of the participants. Dr. (Miss) Shashi Dhawan pointed out that the Department of Environment, Government of India had taken up planting of trees etc. outside temples to control pollution. Such steps were also equally beneficial to preserve the buildings Dr. N.H. Kulkarnee opined that there was a likelihood that the adverse effect of salf breeze depended on the quality of stones used in a particular building and to prove his contention he drew the attention of the participants to the Konark Temple which had been affected by salt breeze more then the temple at Mahabalipuram. He further wondered if the phenomenon of salt breeze, as applicable to the monuments, did not hold good for the paper as well. Intervening Mr. Kathpalia pointed out that no study had so far been conducted on the subject insofar as archives were concerned and mentioned that ill-effects of salty breeze could be rectified through de-acidification of documents. Mr. R. Muniswamy, stated that the presence of salt in the air did not always effect in a uniform way. Mr. de Silva was of the view that saltiness was a factor observed mainly near the seacoast and if the archival buildings could be located far away from the coasts, and were also sheltered by providing proper foliage, the problem would be cut down to a sizeable extent. He, however, suggested that how far the saltiness travelled needed to be studied in depth.

Commenting on the role of fungus, Mr. R.C. Gupta felt that investigation into the causes of growth of fungus even in air-conditioned buildings/stack areas was desirable. He pointed out that cleaning of documents in an air-conditioned area was of little help as absorption of acid liberated by fungus damaged the documents. Clarifying the position Dr. Shashi Dhawan mentioned that fungus was sometimes showing up even under conditioned atmosphere and stated that the ideal temperature and relative humidity for the purpose should be maintained at 15-20°C and 45-50% respectively. In case those ideal conditions were not rigorously enforced the chances of fungus taking root, could not be ruled out. She further mentioned that certain kinds of fungus needed salt to grow.

Mr. Chari suggested that pending the accomplishment of a long term plan for air-conditioning, the learned members attending this Seminar should consider seriously some practical interim measures which would help achieving certain optimum conditions for proper storage of records.

Mr. Kathpalia reiterated that proper storage conditions played a very vital role in fighting out the deleterious influence of environmental conditions and thereby, contributing towards the longevity of records. And to accomplish this task the documents should be stored in acid free conditions.

Mr. J.K. Jain, felt that the problem of conservation was two-fold. One was the bulk of records in hand and the other was that of bulk being created. He stressed that the records which were to be transferred should as well be in good condition. He further felt that use of a synthetic gauze would be better than the silk gauze, presently being used in repair of records.

Summing up the discussion, the Chairman remarked that the discussions provided a glimpse into the problems of conservation faced by India, Nepal and Sri Lanka. He hoped that the problem of salt in the air, which had been discussed in depth, would be still further discussed over the next few days and some suitable remedial measures might emerge. He further added that the high grade tissue paper as also the leaf casting machine could be used with advantage for strengthening a document.

The meeting concluded with a vote of thanks to the Chair.

Third Session in progress
From left to right are Mr. Ranbir Kishore, Mr. A.Z. Sheikh (Chairman), Dr. R.K. Perti, Mr. G.P.S.H. de Silva

given in Iran by Mrs. Zaidi of Pakistan and sought information from Mr. Ameri about the recent offer of Iran to provide training facilities to archives personnel of Afghanistan.

Mr. Ameri referring to this query observed that in addition to its own documents Iran National Archives had been repairing documents of outside agencies as well, but unfortunately war had changed the situation. He, however, mentioned that Iran would like to seek help from India for training its personnel.

The meeting ended with a vote of thanks to the Chair.

THIRD SESSION

The third session was held on 17th December, 1985 at 9.00 a.m. with Mr. Atique Zafar Sheikh, Director, National Archives of Pakistan in the Chair. Mr. Ranbir Kishore, former Chief of Repair and Conservation, National Archives of India, acted as Technical Coordinator.

Two papers were presented in the session, viz:

1. 'Role of Climate and Environment in Deterioration of Paper and other Allied Materials' by Mr. Y.P. Kathpalia.
2. 'Chemical Composition of Paper and its Role in Preservation of Paper by Mr. V.V. Talwar.

There were no interventions on the paper presented by Mr. Kathpalia.

Initiating the discussion on Mr. Talwar's paper, Mr. Y.K. Sharma drew the attention of the members to the depleting stock of wood and the consequent increase in reliance on secondary fibres, and pointed out that the depletion of natural wood would adversely affect the quality of paper. He as well doubted the efficacy of sodium silicate in the manufacture of paper, since it was corrosive in nature. Mr. Sharma also felt that there was need for modifying the specifications for permanent paper and that there was need for developing a suitably sized paper having netural pH. He felt this could be taken up as a research project to be pursued with full vigour.

Taking up from Mr. Sharma, Dr. K.S. Bhandari referred to constituents found mixed with cellulose and observed that cellulose was not chemically but physically bounded with lignin. He further explained that during chlorination and bleaching, it was not chlorine which was of utmost importance but the pH. He felt that pulp containing more than 80% cel-

lulose could be made from wood, such as rayon grade pulp. He further stressed that pH should be kept on the alkaline side as far as possible. In view of the suggestions made, Mr. V.V. Talwar agreed to re-examine this aspect. Replying to the query raised by Mr. Avinashi Lal of the National Library, Calcutta about the use of dimers as sizing for neutral paper, Mr. Sharma observed that because of their cost use of dimers is not preferable. Mr. Y.P. Kathpalia expressed the view that there was need to have paper of very good quality i.e. neutral paper with long fibres which contribute to its durability. Mr. Sharma intervened to add that while neutral paper was ideal, even small fibres could produce paper of good quality. He further felt that paper could be made from eucalyptus, which is neutral. He also referred to a paper by Mr. A.S. Watson on paper making which dealt with this subject at length. The technical coordinator Mr. Kishore, intervening at this stage, stated that specifications for permanent paper were formulated by the Indian Standards Institution (ISI) in 1961 in consultation with the paper manufacturers, but the quality of paper conforming to the above standard was not manufactured/available. The specifications thus could be revised and the problem could be referred to ISI as desired. He felt that Mr. Sharma could offer expertise in laying down suitable specifications for paper manufacture so that the desired quality could be produced and made available for use in Government Offices. He also felt that deacidification techniques, using sodium hydroxide as practiced in West Germany could also be tried. Mr. Kishore further referred to the effects of ink on paper and felt that this problem also needed consideration.

Joining in the discussion Mr. J.K. Jain drew the members' attention to the poor quality of paper being supplied to the creating agencies and maintained that it was obviously posing a problem to the Archivists. Quoting figures, Mr. Kathpalia observed that the cost-wise difference between good quality and poor quality paper was only Rs. 1.729 per tonne which was very nominal. The matter could therefore, be taken up with the respective Governments stressing upon them the expediency of buying better quality paper. Mr. Sharma fully agreed with Mr. Kathpalia on this point. Mr. de Silva enquired about the constraints in use of good quality neutral paper in the Government sector. Mr. Sharma explained that very often the main problem was the non-availability of raw material and lack of facilities for quality control. Mr. Kathpalia also referred to good quality hand made paper being manufactured by the Khadi and Village Industries Commission, which was also being exported. He, however, added that the Alum content in that paper was on the higher side and urged that this factor should be impressed upon the authorities so that production quality could further improve. Intervening at this stage, Dr. R.K. Perti, Director of Archives, National Archives of India, informed the members that standard quality paper was presently being manufactured on demand

from the Central Government for use in various Government Departments. And if State Governments could also be persuaded to put in their indents for the same, the cost of manufacture could certainly be cut down. Mr. Chari wondered if cost of raw materials would go up in future with the increase in demand to which Mr. Sharma replied that the cost of paper had actually gone down by Rs. 2,000 per tonne and that the production was in excess of the present demand.

Summing up the discussions, the Chairman agreed that there was urgent need for environmental control and preventive steps to be taken by all concerned, and there should be proper standardisation of materials like ink and paper etc. used in Government offices. He further suggested that there was urgent need to evolve ways and means for restoration of archival material on scientific lines at moderate rates, and for imparting training for the technical personnel to staff the archives offices in the country.

The meeting ended with a vote of thanks to the Chair.

FOURTH SESSION

The Fourth Session was held on 17th December at 11.30 a.m. under the Chairmanship of Mr. Iraj Ameri of the Iran National Archives, with Mr. Ranbir Kishore acting as Technical Coordinator. The first paper entitled 'Preventive Conservation of Archives' was presented by Mr. John Davies.

Opening that discussion, Mr. Harbans Garg of Himachal Pradesh Archives, drew the attention of the members to the pollution in Shimla on account of burning of coal and coke in Government Offices during the cold season. He wondered whether to save the archival material there could be any preventive measures against such pollution. Mr. John Davies replied that the practice should be stopped and instead heater/radiators could be used. Mr. Ranbir Kishore agreed with Mr. Davies and emphasized that the only solution to the problem of pollution in environment was to discontinue burning of coal etc. and switch over to alternative source of heating. Dr. Kulkarnee intervened to add that some enactment should be brought about to enforce the suggestion prohibiting the practice of coal burning in Government Offices which had a deterimental effect on records. Mr. Chari sounded a word of caution and suggested that certain necessary safeguards must be taken by the archives administrators to prevent damage to their records by any unforeseen disaster e.g. fire, flood, war etc Mr. de Silva wanted to know the practices adopted to safeguard the records in Australia from such an eventuality. Mr. Davies replied that security

microfilming with mostly 35mm films was being used in Archives for this purpose while 16 mm films were being used only in the case of certain special projects. He also explained the procedure of preparing master negative and third generation copy and the methods for their preservation and use. The master copy was stored away from the original for security reasons. Intervening at this stage, Mr. J.K. Jain observed that most of the problems were created by the creating agencies who handled records shabbily. He urged that there should be a set of rules for the creating agencies for safe handling of records in their Record Rooms.

The next paper entitled 'Housing Requirements for Conservation of Archives' was presented by Mr. Ranbir Kishore. Initiating the discussion, Mr. Kathpalia urged that soda-acid fire extinguisher should not be used in the Archives offices. Mr. J.K. Jain drew the attention of members to the construction of underground store rooms, fitted with exhaust fans and air-circulators which maintained low temperature and could serve as an alternative to air-conditioning. Mr. Avinashi Lal also observed that books in the newly constructed annexe building of the National Library were more prone to deterioration than those kept in the basement of their earlier store room. Miss V. Lalitha, however, cautioned that destruction by floods should be taken into account while keeping records in basements. Dr. Rajendran referred to the problem in Kerala where humidity posed a grave threat to records and suggested that a flexible approach be adopted towards airconditioning taking into account the climatic conditions etc. Mr. Muniswamy reverted to the suggestion of basements for storing records and felt that this could be a boon to archives. Dr. Kulkarnee suggested an enquiry by the experts to investigate into the phenomena as to why certain records deteriorated fast and others maintained fairly good health, though both these were stored under similar climatic and other house keeping conditions. Mr. Harbans Garg agreed with Mr. Kishore that a Committee of Archivists, Architects and Engineers should be set up to go into the question of an alternative to air-conditioning. Referring to Dr. Kulkarnee's suggestion, Mr. C.P. Mehra of National Archives of India explained that the documents may have survived all these ages on account of their good quality paper and good house-keeping. Mr. Avinashi Lal observed that in the air-conditioned stacks of the National Library, incidence of dust has been observed. The Chairman felt that humidity and other climatic conditions had a lot to do with the life of a document. Commenting on Dr. Kulkarnee's observations about the good condition of ancient paper, Dr. Bhandari felt that this could be due to the mild pulping process then used. Modern techniques, he added, were different and perhaps not fully conducive to durability of paper. Mr. Ranbir Kishore added that the basements could serve useful purpose provided air-circulators were adequately installed and dampness checked. Dr. R.K. Perti drew

A view of the audience

the attention of members to the experience of the Public Record Office in U.K. where members of the staff fell sick after the air-conditioning plant broke down. He urged that some alternative was necessary. He agreed that basements were a good alternative proposal but these need not be used in flood prone areas. He also suggested the use of carbon dioxide sprinklers for fire-fighting even though these needed much space and called for a study on the subject.

The meeting ended with a vote of thanks to the Chair.

FIFTH SESSION

The Fifth Session of the Seminar was held in the afternoon of 17th December 1985 at 2.00 p.m. and was chaired by Mr. G.P.S.H. de Silva, Director, National Archives of Sri Lanka. Mr. Ranbir Kishore acted as Technical Coordinator.

The Chairman invited the speakers to present their respective papers which were as follows:-

1. 'Bio-deterioration of Paper and other allied naterials" by Dr. S.M. Nair.
2. 'Fumigation Equipment and Techniques for Sterilisation of Records' by Mr. V.V. Talwar.
3. 'Sterilisation of Records against Fungus, Insects and Rodents' by Mr. Y.P. Kathpalia.

The Chairman thanked the speakers for the useful data provided by them in their respective papers and invited discussion thereupon.

Initiating the discussion, Mr. C.P. Mehra referred to the paper presented by Mr. Kathpalia and desired to know the agencies engaged in conducting experiments by using laser beams in eradicating fungus stains in paper etc. He further enquired whether there was any published literature available on the eradication of fungus growth by exposure to microwaves. Mr. Kathpalia stated that the Tata Institute of Fundamental Research and Bhabha Atomic Research Centre were working on this area and added that an article on eradication of fungus growth by exposure to microwaves had also been published in the 1980 issue of the UNESCO bulletin for Libraries and Archives Administration. Dr. Shashi Dhawan stated that laser beam experiments on paper were also being conducted at the National Research Laboratory for Conservation, Lucknow.

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Mr. Kathpalia further informed the house that Indian red rose possessed preservative qualities and it helped in fighting out the termites. Mr. Avinashi Lal observed that air-circulation at a low speed helped in controlling the insects. Dr. Nair, however, felt this could help only to a limited extent.

Mr. Muniswamy referred to the use of neem leaves dried up in shade as an effective insect repellent. He also referred to inherent preservative qualities of indigo and turmeric and suggested the use of zinc paste in binding as an effective guard against insects and fungus. He further observed that documents on paper with blue colour were found in better shape and wondered if some medicinal values were attached to this particular colour.

Mr. Ranbir Kishore, while referring to the use of indigenous herbs as insect repellants, intervened and observed that Neem oil was an effective insecticide. However, he felt that there was need for a study to find out as to what was the ingredient in neem which actually safeguarded the paper against insects. He, however, issued a note of caution in using neem oil and stated that it should be used only after purification, as it was likely to leave stains. Referring to the sterilisation of infested materials in a repository, he suggested that segregation of the affected materials should generally be resorted to, otherwise infestation could spread further. He was of the opinion that some guidelines for sterilisation of records should be formulated.

Mr. Kathpalia, while agreeing with Mr. Kishore's observations on the use of neem oil referred to the investigations being conducted by the American scientists and Khadi and Village Industries Commission (KVIC) in India.

Mr. Atiqua Zafar Sheikh referred to the 'Deep Freeze Techniques' being used in USA for sterilisation and desired to know more details. Dr. Nair also lauded the deep freeze system in bringing down the damage wrought by such infestation. He, however, admitted that there was a tremendous drive to find out new methods using indigenous material in controlling insect infestation and he suggested that conservationists should enlist the support of various agencies like Bhabha Atomic Research Centre and Defence Research Laboratories to find out as to how far the traditional Indian methods could he improved upon.

The Chairman, Mr. de Silva intervened and wanted to know more about the use of paradichlorobenzene in the sterilisation process. Mr. Talwar in reply stated that concentration of chemical as well as duration

of fumigation depended greatly on ambient temperature and the extent of infestation. Howevei, Dr. Nair felt that some experiments were required to be conducted in order to find out the exact duration for the chemicals to be applied to kill the insects.

Mr. J.K. Jain pointed out that the present system of fumigation in vogue for sterilising the records involved shifting of record from the muniment room with the result that it took care of only a small bulk of records. To expedite the job, he wondered if some technique could be devised to cover the entire bulk of records on the spot without shifting it.

Mr. Y.P. Kathpalia stated that some researches were being conducted in this area in U.K.

Dr. Nair felt the use of gama-radiation might be a solution to Mr. Jain's query. At this juncture, Mr. Kathpalia however, stated that the studies had shown that the use of gama-radiation had been rather harmful.

Miss V. Lalitha referred to the practice of keeping black pepper wrapped in muslin cloth used at the Nawab's Library, Mylapore, Madras and said that records preserved there were found in satisfactory condition, free from any infestation.

The Chairman felt that there were many possibilities for national/international research in the field of use of the very many preservative chemicals and further investigations were required.

The Session ended with a vote of thanks to the Chair.

SIXTH SESSION

The Sixth Session was held on 18th December, 1985 at 9.00 a.m. In the absence of Dr. K.M Karim of Bangladesh, the Session was chaired by Dr. R.K. Perti, Director of Archives, National Archives of India. The theme of the Session was 'Treatment of weak and fragile Materials'. Three papers were presented in the session, viz.:-

1. Guarding and Filing Archives' by Mr. John Davies,
2. 'Materials and Equipments for Restoration of Documents' by Mr. Y.P. Kathpalia; and
3. 'Restoration of Fragile Documents' by Mr. Avinashi Lal.

The Chairman then threw the papers open for discussion. Opening

the discussion, Dr. Y.K. Sharma referred to Mr. Kathpalia's remark regarding use of fibres in restoration and pointed out that the machine developed at the Forest Research Institute, Dehra Dun was being used for reinforcement by preparing a thin layer of pure cellulose on both sides of the paper, so that readability was not affected. This, he maintained, was different from the leaf casting. He further informed that ancient paper was made from rags, while wood pulping was comparatively a new technique: Similarly rosin sizing also began only around 1800 and acidic nature of ancient documents should not be attributed to rosin and alum or other additives. Dr. S.N. Sinha enquired about the differences between the leaf casting machines being used at the National Archives of India and the one referred to by Mr. Kathpalia. This was duly explained by Mr Kathpalia who said that the one at the National Archives of India was prototype model similar to the sheet-casting machine used for paper manufacture. This method was capable of reinforcing documents on both sides, while the leaf casting machine used in European countries was suitable for filling up of gaps and holes in paper. He added that cellulose acetate film in use for conservation was specially formulated for document restoration purpose. Dr. K.S. Bhandari then enquired about the effect on the pH of the paper reinforced by using cellulose acetate foil. He further wanted to know whether cellulose acetate underwent polymerisation during ageing as mentioned by Mr. Avinashi Lal in his paper, and also wished to know the effect of ammonia on the strength of paper. Replying to Dr. Bhandari, Mr. Ranbir Kishore explained that the cellulose acetate foil which was used for lamination was of special quality whose properties have been evaluated and therefore it did not pose any sort of danger to records. Referring to the deterioration of papers in USA, he felt that this was probably due to the high degree of loading or filling materials. He elaborated that use of tissue paper alongwith cellulose acetate foil was very essential and said that no trace of acetic acid was detected in the documents thus treated and which were stored over 30 years ago. Explaining the use of ammonia for deacidification, it was observed that only diluted ammonia fumes were being used. This was corroborated by Mr. Kathpalia.

At this stage the Chairman adjourned the meeting for the tea break and said that discussion would continue in the 7th Session.

SEVENTH SESSION

The Seventh Session of the Seminar was held on 18 h December at 11.00 a.m. In the absence of Mr. Nilab Rahibi of Afghanistan, Mr. Atique Zafar Sheikh, Director, National Archives of Pakistan chaired the session. This session was, in fact, a continuation of the Sixth Session.

Mr. Kathpalia displayed documents repaired by solvent lamination and polymer lamination and pointed out that the document repaired by solvent lamination was in perfect condition, whereas documents repaired by polymer sheet showed sign of wear and tear.

Mr. de Silva referred to Mr. Davies' paper 'Guarding and Filing Archives' and sought clarification on binding of cocuments of various sizes in one volume as enumerated in his paper and also sought information on various types of deacidification methods and its efficacy as detailed out in the paper presented by Mr. Avinashi Lal.

Mr. Davies clarified that in the process of 'guarding and filing,' packing strips were used to even up the sheets for binding. In this process different sizes of documents were staggered in position with guards to keep the formation of filed paper at a level. Mr. Avinashi Lal explained the different processes of deacidification and stated that simple washing of paper by water at 40°C-50°C would remove 90% of acidity. He also referred to the non-aqueous deacidification process which was possible with the help of barium hydroxide octahydrate in methyl alcohol and referred to gaseous deacidification which was done with th application of ammonia in closed chamber for 72 hours.

Dr. R.P. Malik raised some doubts about the formula prescribed for deacidification in Mr. Davies' paper. He stated that when carbon dioxide gas was passed through a solution of calcium carbonate and magnesium carbonate, both the chemicals would undergo a change and calcium bicarbonate and magnesium bicarbonate would thus be formed. Calcium carbonate would undergo a chemical change. He added that pH of the deacidification solution was not indicated which should have been greater than 9.

Mr. Kathpalia intervened at this juncture and stated that deacidification solution of calcium bicarbonate and magnesium bicarbonate was prepared from calcium carbonate and magnesium carbonate mixture after carbon dioxide was passed for 2 hours. He stated that pH of the solution and the document must be kept under control. He further stated that in aqueous deacidification involving the use of calcium hydroxide and calcium bicarbonate solutions, documents should not be kept immersed in solution for more than 20 minutes in each of the solutions mentioned, otherwise these might disintegrate. He issued a note of caution against the use of di-ethyl zinc advocated by Library of Congress for deacidification of documents. He added that di-ethyl zinc had explosive tendencies when coming into contact with the atmosphere.

Mr. Chari referred to the deterioration of cellulose acetate base in

microfilms as smell of acetic acid had been felt in some of the films prepared and in which free hypo was eliminated. He also pointed out the disintegration of the above mentioned films over a period of long storage.

Mr. Mehra while referring to the probable disintegration of cellulose acetate foil on paper records stated that regular tests on cellulose acetate film were being conducted by the Conservation Research Laboratory of the National Archives of India. He also referred to condensation of moisture on processed microfilms and attributed this to storage conditions and defective processing of films. Deterioration could also be due to inherent manufacturing defects.

Mr. Avinashi Lal stated that decay of acetate based microfilms could be due to presence of chemical ingredients as a result of faulty processing.

Mr. Jain observed that in view of fast changing needs, and use of multiple type of gadgets/chemicals in restoring the materials, the doubts occasionally came up regarding their efficacy, and therefore, some sort of standardisation of procedures etc. was called for.

Mr. Mehra referred to a booklet 'Repair and Preservation of Records' published by the National Archives of India which could serve as a guideline in this respect.

Mr. Chari referred to health hazards emanating from the increased and indiscriminate handling of preservative chemicals in conservation of archives.

Mr. Muniswamy observed that polyester based film was more suitable for long term preservation and also stressed the need for automation in handling various chemicals as a safeguard against toxicity of chemicals posing health hazard.

Mr. O.P. Agarwal felt that there was a need for re-examining the issue of deteriorative effects of cellulose acetate/cellulose tri-acetate foil on paper especially in tropical climate. Referring to manuscripts housed in the Asiatic Society, Calcutta, and Viswa Bharati, Santiniketan, he stated that manuscripts which had been laminated had shown signs of deterioration. He, however, wondered if this might be due to the non-deacidification of documents prior to lamination. He added that such deterioration could also be due to degradation of cellulose acetate foil.

With regard to time required for deacidification Mr. Agarwal stated that it would depend on several factors, like bulk of paper to be deacidified, acidity contents, temperature etc.

Referring to the health hazards arising out of indiscriminate handling of chemicals, he mentioned about a book published in U.K. and another one on 'Museum Insects' published in the United States. He felt that there was a need for a booklet on preservation techniques which could be followed by the archivists of small repositories.

Mr. Jain observed that there was an urgent need to revise the booklet on 'Repair and Preservation of Records' published long back by the National Archives of India.

The Chairman thanked Mr. Agarwal for providing informative data during the course of his observat ons and requested Mr. Davies to present his paper on 'Demonstration of Restoration Techniques—polyester Film Encapsulation'.

Mr. Davies after presenting the above mentioned paper demonstrated the encapsulation process on documents. The chairman invited discussion on his paper.

Miss Saroja Wettasinghe enquired whether adhesive used in encapsulation of a document had any effect on documents stored in tropical countries with high humidity.

Mr. Muniswamy was of the view that the process of encapsulation was not advantageous for rehabilitation of fragile documents and palm leaf manuscripts, and was of the view that this process could be used for preserving and rehabilitating individual documents for display and not for mass collections. Dr. Kulkarnee was also of the same view and remarked that this process, if practised on a large scale, would considerably add to the bulk.

Mr. Ashraf Ali was also of the view that encapsulation process suggested by Mr. Davies was not suitable for major record collections and could only be adopted for individual documents which were fragile. He observed that encapsulated documents would add to the bulk of the collection.

Mr. Davies, however, clarified that findings and experiments made by the Library of Congress on encapsulation process have been very successful and it had been confirmed that the process was very durable. However, he clarified that this process should be used with great discretion and only documents frequently handled should be repaired by means of this process and it could be useful only on documents which were not brittle.

Mr. Agarwal referred to the introduction of a machine by the Library

of Congress for binding polyester films, thus replacing the adhesive tape and stated that this technique had a great potential for rehabilitating fragile palm-leaf manuscripts and miniature paintings.

Mr. Kathpalia stated that polyester film used for encapsulation should be of standard quality as per specifications laid down by the American National Standards Institute. He also cited the practice prevalent in the United States where sealing in encapsulation was being done by ultrasonic waves.

The meeting ended with a vote of thanks to the Chair.

EIGHTH SESSION

The Eighth Session was held in the afternoon of 18th December 1985 at 2.00 p.m. under the Chairpersonship of Mrs. S.M. Rana of Nepal. The theme of the session was Restoration of Palm Leaf Manuscripts, Birch Bark Manuscripts, Illustrated Manuscripts and Miniatures. Two papers were presented in this session viz:

1. 'Restoration of Palm-leaf Manuscripts' by Mr. Ranbir Kishore.
2. 'Repair and Restoration of Illuminated Manuscripts and Miniatures' by Mr. A.S. Bisht.

The paper was followed by a demonstration through slides.

The Chairperson then threw the papers open for discussion.

Initiating the discussion, Mr. de Silva suggested that a joint research project should be undertaken on the conservation and preservation of palm leaf manuscripts as large number of such manuscripts were available in the countries of the region.

Mr. Kathpalia drew the attention of the house to Mr. Bisht's paper and suggested that lamination should be affected only when the document had become completely dry after deacidification otherwise it would degenerate. He also informed that use of Vitamin E oil for oil paints and Vitamin A oil for water paints produced good results but these should be evaluated further. Mr. Agarwal referred to two types of palm leaf manuscripts, namely stylus engraved leaves and surface written leaves and added that repair techniques for these two would be different. He added that the treatment of leaves differed from region to region. He cited the example of the heating process in Thailand, and rubbing with sand and the use of rosin oil in

Eigth Session in progress
From left to right are Mr. John Davies, Mr. Ranbir Kishore, Mrs. S.M. Rana (Chair-person), Dr. R.K. Perti and Mr. G.P.S.H. de Silva.

Sri Lanka and reiterated that some joint research was needed. Dr. N. Rajendran informed the house of the large collection of palm leaf manuscripts in the Kerala State Archives. These, he said, were treated with the juice of a creeper plant and felt that further investigation should be done. He was supported by Shri Muniswamy. Talking of the collection of records housed at Bikaner in Rajasthan, Mr. Jain pointed out that these were written with ink having gum base. And so, while determining any set line of treatment for the documents, all such factors had to be taken into consideration so as to ensure that no adverse results appeared. Mr. Bisht, however, clarified that a systematic and scientific case study should also be a pre-requisite before finally prescribing a suitable line of treatment.

The meeting ended with a vote of thanks to the Chair.

NINTH SESSION

The Ninth Session of the Seminar was held on 19th December 1985, at 9.00 a.m. The session was devoted to Training for Conservation Personnel. This Session was chaired by Mr. O.P. Agarwal, Director, National Research Laboratory for Conservation jointly with Dr. R.K. Perti, the Conference Chairman.

The Chairman invited speakers to present their respective papers.

The following papers were presented:-

1. 'Training Requirements for Conservation Personnel' by Mr. John Davies,
2. 'Training Requirements and Presentation of RAMP study on Model Curriculum for Preservation and Restoration of Documents for Developing Countries' by Mr. Y.P. Kathpalia,
3. 'Training for Skilled Craftsmen' by Mr. Avinashi Lal.

The Chairman then invited discussion on the papers.

Opening the discussions, Mr. Y.P. Kathpalia pleaded for the setting up of a regional documentation centre on the subject of Archives Administration/Archives Conservation for the benefit of SWARBICA countries.

Mr. Ranbir Kishore referred to the paper presented by Mr. R.C. Gupta at the SWARBICA Seminar held at Colombo in 1979 and said that experience of UNESCO and ICA following the establishment of UNESCO Regional Centre for training Archivists in Ghana had not been encourag-

ing. It was therefore, then decided that instead of establishing a regional centre entirely funded by the UNESCO or for that matter any outside agency, it would be advisable if an existing national institution could be linked up with the UNESCO and the latter could provide the institution with some sort of grants in equipment/literature or fellowships. Accordingly the School of Archival Studies, National Archives of India, New Delhi had been getting UNESCO aid to enlarge its teaching and training facilities. This School is presently meeting the training needs of the countries of the region and also of a few countries from Africa. Mr. Ranbir Kishore was of the view that a separate traning centre was not feasible in the region at this stage.

Mr. Y.P. Kathpalia thereupon suggested that since the Library of the School of Archival Studies at the National Archives of India had developed with aid received from UNESCO, this could be further developed to provide a nucleus for a Documentation Centre for Archival Studies which should be established for the benefit of member countries of SWARBICA.

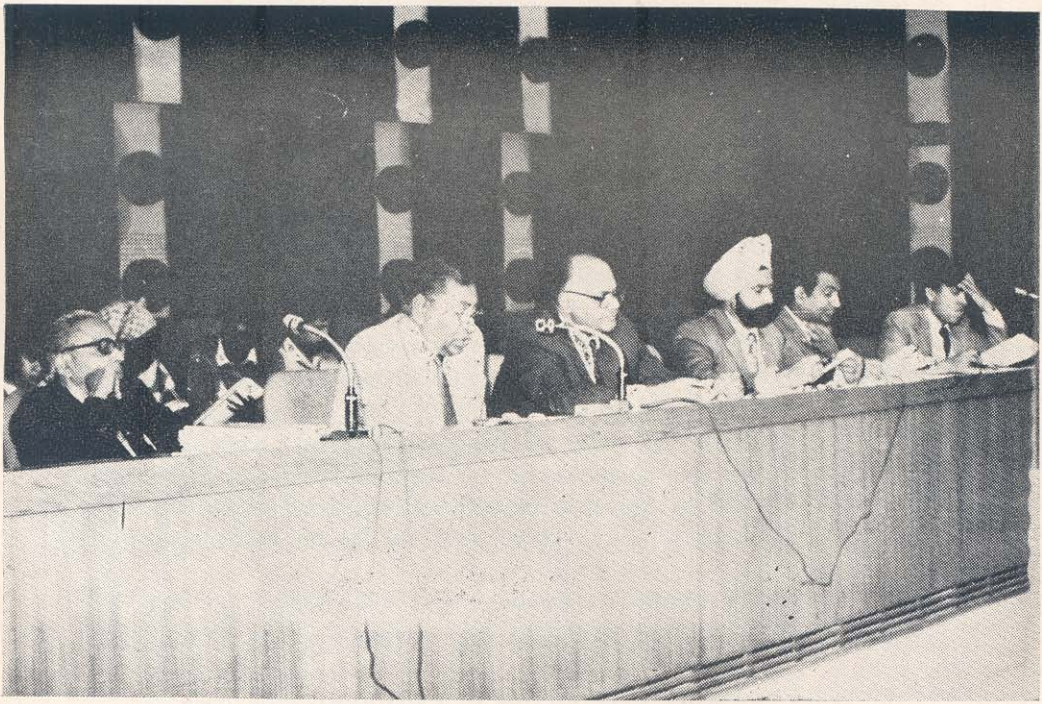
Mr. G.P.S.H. de Silva informed that a Seminar had been recently organised at Manila (Phillipines) wherein the feasibility of establishing a regional training centre for Asia and Pacific region with the assistance of UNESCO and ICA was also discussed.

Dr. R.K. Perti referring to the Seminar mentioned by Mr. de Silva clarified that the said centre would cater to the training needs of the countries of SWARBICA only.

The Chairman Mr. O.P. Agarwal felt that it would have been perhaps in the fitness of things if SWARBICA could have been consulted into the matter before discussing the issue at the aforesaid Seminar. Endorsing the view held out by Mr. Ranbir Kishore, he affirmed that experience had shown that such an institution to be really successful and purposeful must have some national linkage and must not be established afresh in vacuum and in this context quoted sad examples of Schools at Ghana and Baghdad.

Mr. R. Muniswamy referred to practical difficulties in sponsoring archives personnel for the training programme for longer duration. He was of the view that a refresher course for in-service employees of the Archives along with 3 to 4 months practical training should be introduced.

At this stage Mr. John Davies also veered round to the views held by Mr. Kishore and Mr. Agarwal and felt that if the School of Archival Studies was already getting the UNESCO subsidy and the countries in the region



Ninth Session in progress
From left to right are Mr. N.H. Kulkarnee, Mr. John Davies. Mr. Y.P. Kathpalia, Mr. Harcharan Singh and Mr. V.K. Sharma.

were feeling satisfied, he saw no need for a separate regional centre. All that really mattered was to ensure update training. Perhaps, the present School of Archival Studies, National Archives of India could be upgraded to meet the requirements for specialised training in conservation.

Mr. Atique Zafar Sheikh then enquired about the details of the different courses offered by the School of Archival Studies, National Archives of India and the facilities available for overseas archivists. The detailed information on the subject was readily provided to the house by Dr. R.K. Perti.

Referring to the papers presented by Mr. John Davies and Mr. Kathpalia on training requirements and the syllabus suggested therein, Mr. R.C. Gupta maintained that present courses run by the National Archives of India more or less, met the suggested requirements. He further stated that these courses were constantly monitored and the syllabi updated.

Commenting on the papers read, Dr. S.N. Sinha, observed that these lacked in giving out any details regarding entrance qualifications for the different courses. He was of the opinion that the training courses should be of two types viz. for freshers and the other for inservice candidates. He also added that the U.P. State Archives imparted a two weeks' training course in conservation and records management to the personnel working in the record rooms of the offices of the U.P. Government.

Mr. John Davies felt that knowledge of science at college level was desirable for persons desirous of undergoing a course in conservation.

In reply to a query made by Mr. de Silva wanting to know the level at which the School of Archival Studies was being operated, Dr. Perti informed that the School of Archival Studies was established under the aegis of the Government of India and had been running courses for the last 40 years. The School was not run in accordance with the guidelines prescribed by the University Grants Commission which is basically concerned with University education.

Mr. Avinashi Lal referred to his paper wherein he had pleaded for training at grass root level i.e. training should be imparted in book craft and then intensive training could be given.

The Chairman at this stage observed that there should be three different courses viz. for Archivists, Restorers and those working in Research Laboratory. Further, emphasising the need of a refresher course for updating their knowledge and awareness about conservation techniques, he suggest-

ed that there should also be some sort of orientation courses for the staff working in the archives offices.

Mr. Atique Zafar Sheikh referred to the 12 weeks training course organised by the Campbell School of Arts and Crafts, London designed for inservice personnel. He informed that the course was designed for overseas conservators.

Mr. Kathpalia, however, felt that there should be two courses in conservation: one for supervisory level, and the other for craftsmen, conducted by the School of Archival Studies of National Archives of India. He observed that two short-term courses run by the School of Archival Studies, i.e. Records Management and Archives Administration also impart appreciative training in conservation.

Looking at the limitations and constraints under which the School at the National Archives of India worked, Mr. Ranbir Kishore referred to the difficulty of imparting training to fresh candidates from the open market as the limited staff of the School of Archival Studies was kept fully engaged in attending to the candidates sponsored by various institutions.

Mr. M.V.S. Prasada Rau at this stage remarked that while certain universities (e.g. Osmania University at Hyderabad) had already introduced Diploma Course in Archives Keeping, there were a few others contemplating to do so. He added that Andhra Pradesh State Archives was approached for imparting practical training by some Universities. Considering that the Universities had already started making a move in the direction, he pleaded for 'Open door' policy and felt that perhaps Archives offices could extend them a helping hand by taking care of the practical training to the course students, since the universities had no such infrastructure. He also informed that Andhra Pradesh State Institute of Administration was also organising training courses for record keepers and record managers at district, divisional and State level.

Mr. J.K. Jain was of the view that training should be basically for those who were either already in the profession, or else were genuinely interested in it, and as such only a very limited number could be taken from outside. He proposed that different training programmes should be so designed that most of the personnel in service at different levels of archival administration were benefitted. He was of the view that young people should be trained in archives keeping and importance for the profession should be instilled into them. Mr. Jain recommended creation of an integrated National/State Archives and Record Services.

The Chairman at this stage adjourned the Session for tea-break.

TENTH SESSION

The Tenth Session, being continuation of the 9th Session, commenced at 11.00 a.m. on 19th December 1985 under the Chairmanship of Mr. O.P. Agarwal. Discussions on the papers presented at the Ninth Session were continued.

Resuming the discussions, Mr. Y.P. Kathpalia referred to the course in Archives-Keeping offered by Gujarat Vidyapith and other Universities and stated that they did not have adequately qualified professionals in the faculty for imparting training in this discipline, but were inviting Archivists and other visiting fellows to deliver lectures. He added that there was no provision for practical work.

Mr. Ranbir Kishore referred to the courses initiated by the Universities in archival science and stated that funds originally sanctioned for the creation of Archival Cell were being diverted for starting new courses in archival science. He expressed his doubts about the teaching facilities in such institutions and wondered how they were able to train personnel in archives in the absence of adequate facilities and any infrastructure for practical training. He informed that the matter is being examined in consultation with the University Grants Commission.

Mr. N.R.R. Chari while referring to the courses of study offered in archival science in Universities stated that this could result in a large numnumber of persons with so-called academic qualifications and without adequate employment opportunities and professional competence.

Supporting the apprehensions held out by various members, the chairman also expressed his doubts about the efficacy of courses in archival science being offered by various Universities without any proper infrastructure for training facilities, and exhorted the members to stand together in taking some necessary counter measures to check it. In this context, he cited the example of successful steps taken by the Museums' Association to counter the scheme nursed by certain Universities to start a course in Museology without proper facilities. He suggested that there should be a proper evaluation of the courses being run by the Universities and that this Seminar should adopt a recommendation that any institution proposing to introduce a course in archives administration/conservation should necessarily be asked to first fulfil the basic pre-requisite to provide the required facilities before aspiring for accredition.

Dr. N.H. Kulkarnee at this stage observed that considering the very nature and title of this Seminar, it was only proper if the discussions could

be confined only to training in conservation and not archival training in general. He felt that there was a need to upgrade the School of Archival Studies with the help of UNESCO and International Council on Archives in order to further strengthen existing training facilities in Conservation in the SWARBICA region. As far the move recently made by certain Universities to encroach on the field of archives, he stated that National Archives of India had already taken up the matter with the University Grants Commission.

Mr. S.D. Guru referred to proliferation of training courses introduced by the Universities and felt that imparting of sub-standard training should not be encouraged or tolerated as it would do more harm than good. He also pleaded for inservice training to archives personnel.

Mr. Atique Zafar Sheikh was in favour of training of technicians as there was no course available for paper conservation in the SWARBICA region. He felt that there was an urgent need for a training centre and suggested that the proposal of Mr. John Davies should form part of the recommendations.

Dr. R.K. Perti clarified that such training facilities were available at the School of Archival Studies, National Archives of India and added that the UNESCO after due consideration of this vital need, had preferred to upgrade the School of Archival Studies and it was presently catering to the training needs of the region.

Mr. Sheikh, however, commented that information about such facilities should have been brought to the notice of other countries of the region as well. Dr. N.H. Kulkarnee said that information about the training facilities available in the National Archives of India was highlighted in the very first issue of SWARBICA Journal published in 1976. Dr. R.K. Perti further added that the facilities available at School of Archival Studies, National Archivies of India had been circulated and Sri Lankan Government had been sponsoring its candidates.

Intervening in the discussions the Chairman felt that there certainly appeared to be a genuine need for a training centre in the region. And with a view to improving the existing standards of training courses and to provide adequate facilities, he suggested that some existing national institution could be designated as regional training centre. And further that for the centre to work satisfactorily and successfully in the long run too, he reiterated the need for the centre to have some sort of national linkage, as the new centres started in absolute vacuum had proved a failure. In this connection he cited the examples of centres in Conservation of

Cultural Property set up in Ghana, Iraq and Peru which, were initially funded by UNESCO but ran into trouble thereafter for lack of financial support. But on the other hand, the institute set up in Mexcio and the one at Lucknow (India) were doing well since these were attached to respective national institutions and were being duly reinforced in their mission by the UNESCO by providing with regular funds.

At this juncture, Mr. G.P.S.H. de Silva intervened and stated that the House should confine the discussion to curriculum in conservation techniques rather than unncessarily deliberating on establishment of a centre for training in the region.

The Chairman was of view that a sub-committee be set up by SWARBICA for a deeper study into the subject which could recommend the curriculum for the courses to be run by such centre and suggested that terms of reference of the committee could also include the question of assistance to the existing/proposed centres. Mr. de Silva, however, was of the opinion that the question of monetary assistance from the UNESCO could better wait till the detailed curriculum was finalised.

Mr. John Davies was of the view that the short term courses for in-service training should be supervised by a trained conservationist otherwise training received by the technicians would not be complete and thorough. Mr. Ranbir Kishore informed the assembly that Conservation and Restoration Committee of ICA had discussed this problem and Miss Carmen Crespo has been collecting detailed data on the subject for a study. He was, however, of the view that SWARBICA should maintain a regular liaison with the said Committee and the two must work in cooperation. The Chairman agreed to the suggestion.

Mr. Y.P. Kathpalia remarked that training in conservation could be profitable in an archival institution if facilities for the work are available there and there must be a follow-up action to ensure continuation of work on proper lines and motivation.

Rounding up the discussions the Chairman observed the training in various disciplines in archives was very important and lauded Mr. Kathpalia's suggestion regarding standardisation of training courses. While referring to Mr. Davies paper which advocated both theoretical and practical management of conservation, he added that training should be linked with the conservation laboratory. He also extolled the idea of training requirements of the grass-root workers, i.e. book-binders, book-menders and repairers advocated by Mr. Avinashi Lal in his paper. He concluded that since conservation was mainly a practical subject, it was necessary to

hold frequent workshops and orientation courses. He also laid great stress on the close ties to be maintained between the Conservation Training Centre and an Archival Restoration Unit.

The Session ended with a vote of thanks to the Chair.

ELEVENTH SESSION

The Eleventh Session was held in the afternoon of 19th December 1985 under the Chairmanship of Shri R.C. Gupta. The theme of the Session was 'Microfilming as an aid to Conservation'. Three papers were presented viz:

1. 'Microfilming Essentials and Products by Mr. V. Kotnala.
2. 'Microfilming as an Aid to Conservation' by Mr. Y.P. Kathpalia.
3. 'Microfilming as an Aid to Conservation' by Mr. O.P. Bhugra.

The Chairman thanked the members for their useful papers and opened them for discussion.

Initiating the debate, Mr. Ranbir Kishore informed the members that SWARBICA had already planned to organise another seminar on non-traditional records where this subject was to be thrashed out in great details. The only purpose, therefore, of including the subject in the present Seminar was to discuss as to how best microfilming could be useful as an aid to conservation and to take up the other relevant aspect of the same in the next seminar. Mr. de Silva then drawing attention to Mr. Kotnala's paper wanted to know as to how cans were better for storage of microfilms than boxes. In reply Mr. Kotnala informed that it was observed in USA during 1962 that microfilms stored in boxes had developed brown spots. Upon investigation it was attributed to the presence of hydrogen peroxide in carton boxes. The National Bureau of Standards consequently recommended the use of cans for storage purpose. Elucidating, he added that in the 70's, the National Bureau of Standards further advised that microfilms should be washed in potassium iodide solution before final storage. Mr. Kathpalia added that storage in cans helped in removing humidity. The Chairman intervened to enquire that if microfilms were stored under controlled temperature and humidity, why should boxes be considered unsafe. Mr. Kathpalia then explained that electromagnetic waves could pose problems and the microfilms should therefore, be kept in cans or cabinets of non-magnetic type. Mr. Chari then solicited more details about effect of electromagnetism and felt that this could be further investigated. He confirmed that static electricity posed problems for raw films. Mr. Kathpalia corroborated this view. Mr. Chari continued and added that in view of the experience

Eleventh Session in progress
From left to right are Mr. S.V. Singh, Mr. V.V. Talwar, Mr. Avinashi Lal, Mr. N.R.R. Chari (Standing), Mr. Irai Ameri, Mr. G.A. Sanati, Mr. R.C. Gupta and Mr. A.Z. Sheikh.

with cellulose tri-acetate films, only polyester based films should be used. He felt that members should take note of the Round Table Conference recommendations mentioned in Mr. Bhugra's paper and felt that microfilming should be taken up by all Archives urgently since this was a very important field. Dr. Kulkarnee intervened and added that since most institutions did not possess adequate storage facilities, it may not be possible to adopt all the Round Table Conference recommendations. He suggested a study of adequate storage conditions so that it could come up at the next Seminar. Mr. Davies mainly dwelling on his experience in New South Wales Archives added that the microfilms originally prepared and maintained by the creating agencies were subsequently transferred to archives for permanent storage and this caused a major problem. These microfilms prepared without expertise often deteriorated. The State Archives had taken up a publicity programme through seminars and booklets to make the creating agencies aware of the need for quality control.

Winding up the discussions, the Chairman thanked the members for their useful suggestions and emphasised that in his opinion there was no need to undertake the microfilming of all records transferred to an Archives. He stressed upon the need to evolve suitable and specific microfilming programmes. He also felt that archivists must be associated with all purchases of record material for creating agencies, since this was the only way to control the quality of material coming to Archives.

The meeting ended with a vote of thanks to the Chair.

TWELFTH SESSION

The Twelfth Session was held in the afternoon of 19th December, 1985 under the Chairmanship of Mr. A.Z. Sheikh, Director, National Archives of Pakistan. After a discussion of the deliberations of the seminar in its eleven sessions a series of resolutions were adopted which are given as a separate item at the end of the papers read.

The Chairman thanked the participants for evincing keen interest in the proceedings of the Seminar. The meeting ended with a vote of thanks to the Chair.

PAPERS PRESENTED

Some Problems in Conservation of Documentary Heritage in Indian Repositories

Dr. R.K. Perti

Introduction

Remnants of our past in the form of documents, which constitute the integral personality of India as a nation, are amassed in the National and State Archives, Oriental Libraries and Manuscript Repositories. However, lack of awareness and understanding of the causes that are responsible for the decay of organic materials, which constitute the bulk of these collections, combined with inadequacy of resources needed for their proper preservation and maintenance have adversely affected their well being. And, wherever these collections have survived, it has been perhaps due to the personal zeal and care of their custodians.

Conservation Studies in India

Concerned with the preservation of cultural and literary wealth in the libraries in this country, Sudborough and Mehta of the Indian Institute of Sciences, Bangalore, undertook the first study of its type into the causes that lead to the early decay of paper in the 1920s with a suitable grant from the Government of India. Their study revealed that the proportion of perished paper in the Indian Libraries exceeded anything that had been observed in the European or American Libraries. Accelerated ageing of paper with high degree of impure cellulose and high acid contents; and (ii) hot and humid climate. It was also then observed that the method of treating paper with arsenical preparations and corrosive sublimate (like mercuric chloride), which had been frequently used as a preservative to prevent insect damage, was no less harmful. This study also revealed that in some cases while the paper had been quite strong, the acidic substances in the ink had produced serious corrosion and the paper under the text had been cut right through. Further, such corrosion did not spread very

far from the actual ink marks. But this condition could be remedied if all rag, acid-free paper was used for creating records of permanent value, and for preparing standard editions of works of famous authors, and by keeping all such materials in libraries which had air-conditioned areas.

Recommendations of Indian Historical Records Commission

These observations and recommendations, valuable as they were, however, could not be implemented due to the all round economic depression of the 1930s and the subsequent outbreak of the World War II. The Indian Historical Records Commission, which was set up by the Government of India in 1919, showed its no less concern for this problem in its deliberations and passed a number of resolutions at its various sessions. It called upon the authorities to improve upon the existing ill-devised conditions and storage facilities available for preservation of records of permanent value, manuscripts and other similar documentary evidences of historical importance. Nevertheless, need for introducing scientific techniques available and being used in the British, French, German and American archives was constantly being felt. But it was only in the 1940s that steps to implement an important recommendation of the Commission regarding adoption of a programme for scientific preservation of such materials could be put into practice. Under this programme of investigating the reasons of decay and methods for proper rehabilitation and restoration of paper and allied materials, a Research Laboratory was established in the then Imperial Record Department, which was subsequently rechristened as the National Archives of India.

Development of National Archives

Subsequent to India attaining independence in 1947, the Indian Historical Records Commission prepared a Post War Development Programme for the National Archives of India in 1948, and being the Secretary of this Commission, I feel it as my duty to inform this august body that this programme besides other things included air-conditioning of the muniment rooms, introduction of scientific fumigation technique of vacuum fumigation and adoption of lamination for restoration of weak and fragile documents. Thus equipped with a laminating hydraulic press vacuum fumigation vault and air-cleaning unit (imported from USA and Canada), the National Archives of India introduced a mechanical document-restoration programme in 1950. Introduction of this programme necessitated further development of the Research Laboratory, which during the course of years was equipped well to take up the investigation and studies of the problems of conservation confronted by the National and the State Archives, Oriental libraries and manuscript repositories. The first major

breakthrough in the scientific restoration techniques suited to the Indian repositories came by way of development of a solvent lamination technique by this research laboratory. This process being essentially a cold technique did away with high pressure and heat, which were the essential features of the mechanised lamination process. In course of years this technique, as all of us are now aware, came to be recognised as one of the standard reinforcement techniques for paper documents all over the world.

Standard materials for repair and restoration

Further, it launched a programme for formulating Standards for 'Paper for Permanent Records', 'Permanent Writing Inks' and other connected subjects in collaboration with the Indian Standards Institution.

Small institutions had, however, been facing great difficulty in taking up a programme for repair and restoration of their documents on a regular basis because of non-availability of materials like high grade handmade paper, tissue paper, chiffon, cellulose acetate foil, that were vitally needed for such an endeavour. This laboratory consequently started looking for the materials, which could be suitable for the purpose and was successful in developing handmade paper and the silk gauze for repairing the documents. Continuing further with its earlier successes in the field, it has just very recently been possible for it to get a high grade tissue paper fabricated at the Forest Research Institute, Dehra Dun, and the experimental trials in this field are still in progress. I hope that this variety of tissue paper would soon start getting manufactured in the country and thereby provide an indigenous substitute for the document-restoration programme.

In recent years the price of cellulose acetate foil has escalated very heavily and its use for document conservation is consequently becoming increasingly uneconomical. Steps have, therefore, been initiated to manufacture this material indigenously and make it readily available. Alternative techniques for repair of fragile documents are as well being developed and I hope that we might succeed in our endeavours before long. Learning from the experience of the Jewish National Library, Israel as also that of the Archives in Austria and the Federal Republic of Germany in reinforcing documents through the leaf casting process, efforts are as well being made to fabricate a similar type of machine. Initial experiments on the prototype machine (now on display) have shown encouraging results and it is hoped that this technique, with experience, would much facilitate the document conservation programme in Indian repositories. We are also making experiments for developing techniques which could be applied with ease to documents written with water soluble inks.

Preventive conservation programme

Nevertheless, there is a vital need for launching a preventive conservation programme, as the methods used for the upkeep of weak, damaged and fragile manuscripts and documents are not only slow, but also need resources both of materials and trained and skilled craftsmen that are becoming more and more expensive. It obviously once again emphasises the need to provide optimum storage climate and environment for ensuring preservation of paper, palm leaf, birch bark and the like organic materials. Housed in ill-devised and improvised buildings with no proper security against dampness, heat, high humidity, dust, insects etc., most of the Indian repositories are struggling hard to preserve their collections. Air-conditioning of these repositories though desirable, is both un-economical and beyond their means. I may here mention that even the muniment rooms of the National Archives of India, though a principal repository in the country, could not be air-conditioned during the last 40 years, inspite of the fact that it had been on the cards. Happily this proposal has now come through and it is hoped that the new stack wings under construction would be fully air-conditioned in the course of the next few years.

However, in many cases the places or buildings in which our libraries or repositories are located provide only makeshift arrangements. Gratis, as they have been provided by patrons of learning, they are generally in need of repair and renovation and effective air-conditioning of these buildings is sure to present innumerable difficulties. Scientifically planned functional building, which could satisfy the requirements of a healthy and systematic storage environment would, therefore, appear to be their first requirement, and to facilitate this, the National Archives of India, in collaboration with the Indian Standards Institution, has provided basic guidelines for designing a suitable building: "Indian Standards IS : 2663 : 1977— Code of Practice Relating to Primary Elements in the Design of Buildings for Archives."

Though air-conditioning of such buildings may not be feasible, yet recent developments and advances in the building material sciences, and architectural designing have now made it possible to modify their climatic conditions. Mechanical dehumidifying devices could as well be of great help in checking and controlling the incidence of high humidity. Besides, air-circulators combined with coolers could be helpful in reducing high temperature in the muniment rooms. These are perhaps the problems which need in-depth study because only such an approach could provide an alternative to an air-conditioning plant, which is not only expensive to instal, but also needs high operational expenditure, not to say of the prob-

lem posed by mechanical breakdown and electric failure at centres where adequate facilities for attending to such situations might not be available.

There is yet another problem that is facing many of the repositories in India and it emerges out of inadequate safety measures against fire, flood and other natural calamities. Taking of adequate and early steps for ensuring security of documentary collections against these hazards can hardly be over-emphasised. Indigenously developed smoke detection alarm system coupled with automatic gas sprinklers (Halon or Carbon Dioxide) could be provided; but it is a field where an expert advice, and study of the individual needs is highly desirable.

Necessity of insect control measures

It is rather unfortunate that repositories in this part of the world face a serious problem caused by a variety of insect, pests and fungi, who thrive on paper and other organic components of documentary collections. Many a precious collections have been reduced to dust by these pests. Whereas maintenance of tidy storage environment helps in overcoming the susceptibility of damage being done to these collections by pests, precautionary measures could be reinforced by using repellent chemicals, with spray of insecticidal solutions, and adoption of well evaluated fumigants for infested materials. It may be here mentioned that a wide variety of fumigating equipment, chemicals and accessories are now readily available. Fumigation in wooden vault with thymol and steel vault with Para Dichlorobenzene are mostly in use in many repositories. A vacuum fumigation chamber, wherein Ethylene Dioxide and Carbon Dioxide mixture is used, is installed in the National Archives of India. However, as recent studies have revealed that exposure of working personnel to Ethylene Oxide is harmful, investigations are under way to find out another suitable chemical toxicant for the purpose. Methyl Bromide is another fumigant which has potential use. But this chemical too needs to be handled with great care. There is, therefore, a great need to find out a suitable chemical that is toxic yet inert, and can be worked with simple safety measures well within the means of small establishments. Quite a large number of pest control agencies, which operate mostly for agricultural products, recommend a variety of chemical pesticides and fumigants. Nevertheless, a line of caution is to be adopted by the custodian of books, manuscripts and archives since very many chemicals affect durability and permanency of paper and other book/records components.

Restoration of fragile materials

Though paper forms the chief component of most of the archives and

investigations into its decay, re-strengthening etc., have been conducted, yet very many repositories in our SWARBICA, and SARBICA region have documents on palm leaf and birch bark as well. Unfortunately, very little attention has been paid to study the physio-chemical changes that have taken place in the composition of these materials as also to their ageing in warm and humid climate. Restoration of these materials with processes that are in vogue for paper documents are not applicable here. Smearing the palm leaves with natural/synthetic oils has no doubt been tried, but there is a need for systematic experimentation and study of various aspects of the problem confronted in conservation of these materials. The Research Laboratory of the National Archives of India have undertaken some studies in this respect and we hope that we may soon be able to adopt a suitable formulation which would add flexibility to old, dried and brittle palm leaves.

Training of skilled and professional conservator

There is still another problem of locating professionals and skilled craftsmen, who could man the laboratories and workshops for undertaking systematic and planned conservation programme. Since there is an acute shortage of trained manpower in this field the School of Archival Studies of the National Archives of India had introduced courses in 'Conservation of Documentary Archives and Library materials' as also in 'Servicing and Repair of Records' in 1980. These courses are of 8 weeks duration. The syllabi of the conservation courses being run by the National Research Laboratory for Conservation of Cultural Property and the National Museum in our country provide general instruction in the field of conservation of paper manuscripts, illustrated documents etc. The training in this field is rather diversified and to ensure its effectiveness and pragmatic approach, it is essential that the syllabi of these courses is standardised. This would encourage a more practical approach and ensure effective utilisation of the trained personnel. Happily a RAMP study on this subject is now available. It is hoped that our discussion of the subject with the coordinated efforts of the UNESCO and the International Council on Archives would help in reaching a consensus for resolving the various issues that have been agitating our minds.

Dr. R.K. Perti, Director of Archives, National Archives of India, New Delhi.

Conservation Probiems of the National Archives of Nepal

MRS. S.M. RANA

Introduction

WITH the creation of a record, proper care must be given for its maintenance. However this aspect of maintenance be it preventive or restorative, is highly neglected in the developing countries. The subject conservation needs a high priority especially in a tropical country like ours, where the deterioration percentage is higher in comparison with countries of the west. This state of affairs is sure in the SWARBICA Region and Nepal is no exception to it.

The National Archives of Nepal, although established as late as 1967. conserves a cultural treasure which is vast, consisting of materials, both of historical and literary value. In the custody of the National Archives are some 30,000 volumes of manuscripts written on palm-leaf, blue paper, ordinary hand-made paper as well as on mill paper. These manuscripts cover different periods ranging from the 11th to the 19th century. Besides these manuscripts, the National Archives also possess although in less number modern documents in the form of chitthi-patra, istihar, ekchappe Duichappe, Khadga Nissan, Lalmohar etc. Also in possession with the National Archives, is a collection of legal transaction deeds of the medieval period on palm-leaf.

Most of the above mentioned manuscripts and documents are written on hand-made paper. Each leaf of a manuscript or document is made of two or three layers of Nepali paper pasted together with rice starch. For the purpose of conservation of the manuscript, or document, they are coated with starch paste mixed with yellow arsenical compound locally known as "Harital" and the surface smoothened out with either a stone, hard wood or glass in order to protect them from moths and rodents. In some cases, they are coated with copper sulphate to make a blue paper known as "Nila patra". Several of the manuscripts are beautifully decorat-

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ed with colourful picture and designs, while some are written with ink prepared from gold and silver dust.

The paper manuscripts are wrapped in cloth for protection against dust and bookworms, some generally being placed between wooden covers before wrapping, while the documents are enclosed in insecticide envelopes before both of them are stored in steel shelves.

Due to the fact that the manuscripts cover different periods, they were kept in numerous buildings under most unsuitable conditions without any preventive or restorative treatment and then they were finally forwarded for storage in the stack hall of the National Archives.

Two major types of deterioration have been observed namely :

(A) Natural Deterioration
(B) Bio-deterioration.

A. *Natural Deterioration* has led to two major damages, namely the brittling of the paper which is caused mainly by the mishandling of the documents by man himself, besides the influence of the three main agents of deterioration which are humidity, temperature and atmospheric pollution. (2) The fading of the ink which is mainly due to the lack of technical knowledge, the exposition of the manuscripts to the sun and the use of commercial ink.

B. *Bio-deterioration:* (A) A recent study of the manuscripts of the National Archives by a student from the Zoology department of the Tribhuvan University for his Masters Degree dissertation works, has shown that the papers are being attacked by silver fish, termites, beetles and moths. The student took a sampling of 300 manuscripts and discovered that 24 per cent of the documents were damaged and out of this 24 percent, 20 percent damage was caused by beetles boring tunnels into the leaves of the manuscripts. This beetle was identified by the Entomology division as 'lasi-odarma'. During the summer months with ambient temperature around 24 degrees centigrade, the infestation by this beetle is high, while during the winter months with temperature around 11.95 degrees centigrade, the infestation is low.

At present the National Archives has no other restoration means to control the above mentioned deterioration. Then to adopt a few preventive measures on checks against further damages, the preventive measures are as follows:

(1) Thick window curtains have been used to check the damaging influences of sunlight.
(2) To attain the desirable humidity of 40 to 60 per cent and temperature range between 20 to 25 degree centigrade, two sets of dehumidifiers, received under UNESCO assistance are being used.
(3) The manuscripts are wrapped in cloth to protect against dust.
(4) Further, naphthalene balls are kept both in the shelves and documents before wrapping of the documents by clean cloth.
(5) Regular checks of the manuscripts are made and infested manuscripts if any, are removed from the stacks hall.
(6) The above infested manuscripts undergo fumigation treatment in a small wooden box, as no fumigation 'chamber' is at hand.
(7) A primitive form of lamination of the documents or manuscripts is also done.

The National Archives faces a number of serious problems and these are dealt with below:

(1) *Lack of Restoration Laboratory:* Restoration and conservation of documents are the supplementary wings of any archives and a modern restoration and conservation unit is needed with the assistance of UNESCO. A small restoration unit has been set up but this small unit cannot cope with the large demand of restoration required. Hence the establishment of a large modern restoration unit is a pressing problem of the National Archives. Nepal Archives finds it very difficult to undertake the work of restoration and conservation effectively because of the lack of funds and lack of trained and experienced personnel to handle the job.

(2) *Lack of Trained Personnel :* In the field of restoration currently there are only three personnel working and only one is of Officer rank. This small work force cannot definitely cope with the volume of work at hand and request to our Government has been made to increase the work force. The recent Seminar on Archives services held in October at Kathmandu has brought about an archival awareness in my country and I sincerely hope it will be helpful to get the sanction for the essential personnel.

Besides, the above mentioned problems in the conservation of traditional records, the problem has been enhanced by the requirement of the conservation of non-traditional records, such as magnetic tapes, audio-visual materials, microforms, etc. We are making efforts to raise the priority in this new field, with the help of 'Nepal-German Manuscripts Preser-

vation Project'. We have been successful to microfilm nearly 56,000 manuscripts from numerous private and institutional collections. Film also being a man made device, needs proper care for its conservation, but what are the measures to be adopted to be check the deterioration of microfilms, we have limited idea.

Mr. Chairman, the Archives of Nepal is the youngest organisation, and the older organisations present here might have already come across and over come such problems. The sharing of views and experiences in the seminar on conservation aspect will definitely contribute to improving the conservation aspect of the National Archives of Nepal.

Thanking you.

Mrs. S.M. Rana, National Archives of Nepal.

Some Conservation Problems in the Archives of Sri Lanka

SAROJA WETTASINGHE

Introduction

THE National Archives of Sri Lanka has come across a number of problems, in the course of conservation of its documents which commence from the 17th century. The holding presently extends to about 9000 linear meters, around 600 microfilms and some tapes. In addition the Presidential Archives, where the records of His Excellency the President are housed, contain paper documents, films, cassettes, tapes, photographs, paintings and objects in various metals and other materials: all these face a number of conservation problems, as they are housed in buildings very close to the sea.

The above mentioned archival materials face hazards from the environment and also biological and chemical attack.

Environmental Influences

Light: It is a very important factor to be considered in conservation, because light transmits energy that turns into heat, when absorbed at the surface, and this in turn produces a rise of surface temperature. Artificial electric light does not transmit energy to the degree required to cause a troublesome temperature rise on the surface, unless it is very directional in nature. In Sri Lanka we attempt to control natural light upto certain limits by curtains, and thus protect the archival material. In any case the intensity of light should not be higher than 50 Lux.

Humidity: Being a tropical country, high humidity is always a problem in Sri Lanka (more than 70%). The ideal condition to be maintained is 40%-60% RH for paper materials. At present, the ideal conditions are not available as the present areas of the building used as 'repositories' have not been air-conditioned. The repositories, which are

now being built will be air-conditioned and dehumidifiers too will be fitted. In the Presidential Archives proper temperatures are maintained and humidity control is effected as it is air-conditioned.

Temperature: Though Colombo has the same climatic conditions throughout the year, temperature varies from 26°C to 33°C. The optimum temperature for the storage of paper is between 15°C-20°C. In the new building, it is expected to maintain this ideal condition, with air-conditioning facility made available. If the temperature is reduced by 10°C, it is expected that the life of paper can be increased at least two fold.

Air-pollution: Pollutant gases like SO_2 can be present in the air and it is known that its concentration should not exceed 10 micrograms in one cubic metre of air. Further, to have a clean environment, it is said that the particle count should not exceed 3000 particles in one cubic metre of air. Particle size limit is from 0.5 microns to 5 microns with no particles larger than five microns. However, in Sri Lanka we expect to deal with this problem too with central air-conditioning where the air will be filtered. It is of interest to note that in the archives division, sited close to the sea, though it has been air-conditioned, some deterioration in the photographs and documents has been seen, due to the saltiness in the air.

Accidents (fire and water): Archival materials are susceptible to damage by fire and water. Hence necessary action should be taken before hand to prevent any such hazards taking place.

In Sri Lanka water-hose system and soda-acid extinguishers have been used along with smoke and heat detector alarm for fire protection system; the building does not face flooding by water.

Biological Attack: The conservation of books, papers and other archival materials from attacks of insects, mould or fungi is the most difficult and serious problem faced by the archives in Sri Lanka.

Insects : Termites, silverfish, white ants, cockroaches, austroids and rats are very common in the island. Though precautions have been taken against these insects, we come across certain problems.

For preventive conservation, paradichlorobenzene (PDCB) crystals have been used. These are kept in perforated envelopes in between books in the almirahs and paradichlorobenzene was also used as a fumigant. However, it has also been noted that PDCB may have been responsible for slight discoloration of ultramarine, slight yellowing of paper and also fading of ink. These effects could be attributed to the chlorine compo-

nents of the paradichlorobenzene. A further set back to the use of this chemical is the recent finding that PDCB has carcinogenicity and matagenicity effects. Due to these findings we are programming to stop using paradichlorobenzene, as a fumigant and repellant.

To protect books from insect attack, archives has used Canadabalsam and vegetable turpentine (1 : 2 by weight) on book covers: This mixture has proved strong enough to prevent insect attacks on books.

For termite attack on book shelves—not at the Archives—an application of a mixture of Baygon (major component is methyl carbamates) and Citranella oil 3 : 1 (by weight) has been tried with success. This application is allowed to dry for 24 hrs. and the books are replaced on the shelves. Also, as a preventive against insect attack, Thymol and Phenylmercury acetate is added to the wheat flour paste made in the repair branch for conservation work.

Mould or Fungi: It has been observed that fungi appear specially on newspapers covered with rexine: but it must also be stated that humidity is not yet under control. Since Colombo has a very high relative humidity and high temperature, it would be difficult to arrest fungi growth without proper control of relative humidity and temperature. In the repository close to the sea, even with air-conditioners, fungus and foxing on photographic prints have been observed mostly due to the salty breeze.

Another fumigant used against fungi is thymol. Here too the problems that have been reported and observed with the use of thymol have been yellowing of paper, softening of paints, varnishes and animal glue and discolouring of some types of prints.

Thymol is considered to be slightly toxic to humans, but no permanent health problems have been reported. However, it has been reported that prolonged exposure may result in vomitting, dizziness and drowsiness If due to this uncertainty of the safe use of thymbol, it too is to be avoided. as a fumigant in archives, some chemicals other than PDCB and Thymol which are not harmful to human beings and is efficient in killing insects and fungi, has to be found.

Chemical Attacks : Chemical attacks on paper can occur due to light, humidity, temperature and pollutant air.

One of the major chemical attacks is acidity. This can be caused due to lignin of the unpurified wood pulp and alum process of manufacture,

and also other acid materials (paste, cardboard etc.) and sulphur dioxide in polluted air.

Ground wood pulp contains lignin and complex organic compounds which decompose to form a number of components some of which are acidic. In turn, these components cause darkening and embrittlement of the paper. At present, ground wood pulps, have found their way increasingly into book and general printing papers, which causes alarm to archival conservationists. Paper industry uses alum and rosin as they are more economical in use. However the paper thus made, when in combination with atmospheric moisture, produces sulphuric acid. It is this, that in its turn, results in the deterioration, discolouration and embrittlement of book paper and other papers that find their way into archives.

The oxidation catalysts, i.e. iron and copper speed molecular scission of cellulose and produce discolouration and embrittlement in paper. The degradation of paper is essentially a chemical process. Acid paper deteriorates much more rapidly in a humid environment than in a dry environment.

In Sri Lanka deacidification is done with Ca $(OH)_2$ prior to repairing, a document. At present it is being considered to introduce a non-aqueous deacidification process, but it has not been possible to locate a suitable media which is economical for wide scale use. An elementary action against environmental biological and chemical damage is proper and regular cleaning of documents. Cleaning documents containing dust, soot etc., not only improves the appearance of the sheet, but it does remove compounds which may be acidic and injurious to the paper fibres. If these materials are allowed to remain on the paper, there is danger that they may become fixed to the fibres by water, very high humidity, or by oils in the fingers of users etc. Additionally, dust generally contains particles of silica, which may have an abrasive action on the fibres when the sheets are handled.

For the preservation of documents in the archives, it is also very necessary to focus attention on storage and restoration facilities.

Storage Facilities : At present, the areas used as repositories in Colombo have no air-conditioning facility, and therefore, it is out of question to maintain ideal conditions of RH and temperature. At present it is only the reprography division in the archives that has air conditioning where microfilms and tapes, are also housed.

However, when the facilities of the new building would be available

it would provide central air-conditioning and dehumidifiers for the repositories.

Restoration Facilities : For the maintenance of a good restoration workshop in an archives, modern equipment and trained people are necessary. At present we do not have scientific laboratory facilities but a unit would be soon established in the new building, and should be in operation in the very near future.

Conservation of archival materials in a science. As scientific knowledge in the field of preservation has increased, it has become clear that different documents could vary in their reactions to a given treatment. Thus the treatment which preserves one document, may damage the next or may do it little good. The untrained person of the half-trained conservationist may with all the best intentions some-time do more harm to a collection than the good effect that is expected of a treatment. Therefore a proper training is a must for people working in the technical division of an archives.

Although the great bulk of materials held by most archives are paper documents such as books, manuscripts, maps, prints, drawings, photographs, there is also a wide variety of materials, such as motion picture films, magnetic tapes, microfilms and colour transparencies, each having its own peculiar preservation problems, all traceable to the basic nature of the material used and to the environment in which they are stored and used.

Sri Lanka faces, many problems in conservation of archival materials as noted above, and being aware of them, steps have been taken and are being taken, within various constraints to preserve this aspect of the valuable cultural heritage of our nation.

Miss Saroja Wettasinghe,
Asstt. Archivist (Technical),
Deptt. of National Archives, Sri Lanka.

Conservation Problems in the National Archives of Iran

Iraj Ameri

THE National Archives of Iran has only recently been set up and is a comparatively new organisation. Since my country has been engulfed in throes of war for a number of years now, no significant programme for the development of archives could be formulated.

The climate in Iran is generally dry. As such there have been no problems connected with humidity. The records have been kept on metallic shelves with adequate measures for fire protection.

In view of acute dearth of technical personnel we have not yet taken up appraisal/conservation programme and for the present the Archives has taken up accessioning of 40 years old records. However, to overcome lack of trained personnel, the Tehran University has recently started a training course in Archives. Iran would also like to seek help from India for training its personnel.

IRAJ AMERI,
National Archives of Iran.

Conservation Problems in the Archives of the Region

ASHRAF ALI

Introduction

REGARDLESS of the different forms of written materials Archivists and Librarians have always had the problems of preservation of their records. Deterioration of manuscripts and books is not unique to this twentieth century. The man from his early days of civilization was facing various problems for protecting the records of his achievements from insects, water, fire and other natural calamities.

As recorded knowledge increased, the problems of preservation increased in proportion. Specially after the invention of printing there was a corresponding increase in the problems of paper preservation. Now the Librarians and books lovers were well aware of the disastrous effects of dampness and the importance of regular cleaning, airing and drying by limited exposure to sunlight. But the causes of deterioration of the records were more than the remedies practiced at that time. The technique of hand made paper reached this part of the world in 1420 and the books written on this paper are still in good condition and does not pose problems of restoration for the archivists. The problems of conservation of records have been identified from the papers made in 1678 when alum was used in the paper manufacturing. The use of alum was not good for the paper fibres.

In 1774 Karl William Scheele a Swedish, discovered chlorine which was popularly used for bleaching the paper. This made possible the use in high cost paper of dirty rags that previously could only be used for cheap stock. The use of chlorine actually weakened the fibres of the cotton rag badly, whereas previous rag paper which was hand-made and used for writing was durable and acid free.

In early 1840's some paper makers added resin size to paper pulp,

but it added nothing to paper strength but would cause brown stain on the paper with the passage of time.

Because of the ever increasing requirement for paper, it was seen necessary to find and use fibres other than linen and cotton for paper pulp. Ground-wood, because of its low cost and abundance, was in general use. It was a disastrous development. Paper made from "Ground Wood" pulp has a high lignin content. This complex organic acid soon attacks paper, causing it to darken and become exceedingly brittle. This paper is used generally for newspaper prints and other paper-back cheap editions, etc.

These are the main problems and I may be permitted to explain some of them before this learned gathering.

Adverse effects of Light

This is a common observation that light causes fading of colours.

Light can only damage where it reaches and since most objects are opaque to light its major effect is on surface. But surface is the very essence of many exhibits specially paintings and drawings.

It must be remembered that light can cause not only colour changes but strength change, as in the weakening of textiles and the destruction of paper. Archival repositories, museums and libraries in our region display their objects in the direct light which ultimately damages the tissue of the paper and other object exposed to light. It is, therefore, suggested that we should educate curators and archivists about the bad effects of light and heat produced in the show cases or galleries.

Importance of humidity

Since plants and animals contain a great deal of water, it is not surprising that products made from them retain moisture. If moisture is taken away from wood, ivory or bone they contract, split and warp. Organic products such as paper, parchment, leather and natural textile become less flexible so that their fibres become weak and brittle.

In contrast direct physical damage is less likely to occur in very damp condition which suits the growth of the moulds and fungus.

The absorption of moisture makes objects swell and in changing size they may also change shape. The change in relative humidity is,

therefore, potentially disastrous in the repositories. We must, therefore, study how to control it. And it is as well to realize at the outset that control of relative humidity is a great deal more important than control of temperature.

Temperature and relative humidity should be within the ranges of 21°—24° C and 50% to 65% respectively. Higher figure for relative humidity relates to India, Pakistan, Sri Lanka and Bangladesh etc.

Air pollution

Air pollution is associated with towns and industry and is almost entirely caused by burning of fuels. It is a big problem for archivists who should think to check it. Air conditioning is a remedy for it but it is difficult for small repositories to install an air-conditioning plant or even providing window air-conditioners since it involves a lot of energy and money.

Dust

Dust on archival objects, becomes unsightly as it accumulates but sooner or later necessitates the operation of cleaning. During the last fifty years various gaseous pollutants have become a world wide hazard for the health and safety of archival materials and the archivist. The only complete answer to check dust and humidity is air-conditioning.

Fumigation

Every Archives service should have facilities for fumigation. It is preferable to have a separate room specially for the purpose. It should be air-tight, be fitted with an inlet and outlet valve and also have shelves. The same room can be used for fumigation with thymol, paradichlorobenzene or methyl bromide or for the drying of wet documents, as well as for deacidification with ammonia or other gaseous processes. This type of room should be constructed in all big archives. The other simple method is to have a separate cabinet for fumigation with thymol or para-dichlorobenzene and a vacuum chamber for fumigation against insects. There are certain countries in our region who do not know the chemical effects of keeping leaves of some trees and untested chemicals as insecticides. The knowledge of the chemical effects of these primitive methods alongwith the knowledge of modern fumigation and insecticides is very necessary for conservators.

Deacidification

Process for deacidification are many and varied and differ from region to region. The deacidifying agent most commonly in use in the United Kindgom is lime-water (calcuim hydroxide) which is also widely used in those countries whose conservators have been trained in the United Kingdom. Besides lime-water, other materials used for aqueous deacidification are : (a) calcium hydroxide and calcium bicarbonate solutions; (b) magnesium bicarbonate solution and (c) a mixture of bicarbonate and magnesium bicarbonate solution.

Non-aqueous methods involve the use of: (a) barium hydroxide in the methyl alcohol; (b) magnesium acetate in alcohol.

Counteracting acidity in documents is a particular problem in this region which has tropical and sub-tropical climates. Most countries that have facilities for restoration, deacidify their documents with these two above mentioned methods.

Restoration

Every Archives service should have a fully-equipped restoration workshop and laboratory. The staff which should be technically qualified and trained, need not be large but should certainly be sufficient to meet the immediate requirements. Their number will depend upon the quantity and nature of the materials, and the extent of their potential deterioration.

For cleaning dusty records soft brushes and vacuum cleaners may be used. However, there should be facilities for cleaning with organic solvents. The solvents should be used with care and the work carried out by qualified persons. Bleaching solvent like chloromine "T" is recommended for such documents which have oil stains. For cleaning with organic chemicals, a fume cupboard, fitted with an exhaust fan, is necessary. The laboratory or the workshop should have adequate ventilation and exhaust fans to draw out fumes and gases. Such fume Cupboards are now being used in most of the conservation laboratories of United Kindgom and in some Asian countries like Pakistan & India. A fume cupboard has been installed in National Museum at Karachi recently, whereas archival respositories generally in provinces are not fully aware of the benefits of documents cleaning by this method. This method is safe but needs basic knowledge of chemistry.

However, in both the methods ink used in documents is tested and if it is found fugitive it is fixed by 2-5% solution of Marylene Nylon

(trade name Calaton C.B.) in methylated spirit or paraloid mixed in Acetone. The preparation of ink fixer is a bit difficult job for common restorer. Sometime the stamp pad ink used for stamp seal is not fixed with the above ink fixers and it runs with water. There is a need to find out some more effective ink fixers for red and blue pad ink.

Repair

In order to carry out repairs, there are three essentials—materials, equipments and skilled men. Archives repair section should have trained staff to carry out repairs by traditional processes. The well-known Florentine method is an improvement on the ordinary traditional processes. The other method in which the staff should be skilled, is the lamination process, which laminates the documents with speed and ease.

For restoring newspapers in the custody of Archives, lamination by flatbed or rotary type machine is done. The equipment is, however, costly and lack of funds may well delay its acquisition. Until such time, traditional methods and the solvent lamination process developed by India would be feasible. The other method for repair is leaf casting developed in Israel and is now used in many European countries. The process of leaf casting is becoming popular and effective for repairing documents. It is believed that more countries will adopt this process of repair in the near future, provided the equipment is available locally on reasonable cost.

The handling of this machine is not so simple as it has been stated. It is, therefore, necessary that the manufacturers of this equipment should arrange practical demonstration before they suggest its use in the developing countries.

Conflict between bulk and preservation

We are very well aware that the restoration of archival material is a slow process and the volume of archival material to be preserved in our archival repositories is increasing day by day. This has led to a common problem faced by all i.e. conflict between bulk and preservation. Although advancement and improvements have been made in restoration techniques yet the techniques are slow and time consuming. The traditional method of repair of documents using hand-made paper, silk, or Japanese tissue is very slow. Dry repair methods using heat-set tissue and adhesives is also very slow and requires expert hands to execute the job. The output of one expert restorer is six to eight documents per day working for eight hours. Lamination process using lamination

machine was a step forward in resolving the conflict between bulk and preservation. However, this process has many limitations. It could not be applied to manuscripts. Very serious objections were raised against this process even when it was used on printed material. It was reported as early as 1978 in UNESCO's survey of facilities in conservation and restoration of Archives that the U.S. Library of Congress have given up lamination of documents completely. Heat, high pressure and the stiff look of the restored documents are some of the serious objections against machine lamination. Another development in restoration technique came in the shape of Leaf Casting machine. The machine has speeded up the restoration work but its cost is prohibitive. Moreover, many advanced countries have discouraged its use. In this machine paper pulp is used for restoring the document. The Leaf Casting Machine has not been able to win universal acceptance. This state of affairs again leaves the Archivist facing the problem of preserving the bulk of Archival material in his custody. The lack of conservation facilities have aggravated the situation further. The archival material is fast deteriorating. Can we arrest the deteriorating bulk of records? We can only reduce the rate of deterioration and cannot stop it.

Education and training in archives

Another important problem in preserving the archival material is the lack of adequate number of trained persons in conservation and restoration techniques.

The non-availability of suitably trained persons poses a problem to the administrators and heads of archival repositories. With the exception of India, there is no satisfactory arrangement for training in the field of archives, conservation and restoration in other member countries of SWARBICA. For Pakistan, National Archives of Pakistan is contributing its share in imparting training to fresh hands by organizing short term courses and by providing in-service training through attachment to the technical members of its own staff and of other archival repositories. However, for thorough and more advanced training in Archives conservation and restoration, National Archives has to depend on foreign training. So far U.K., U.S.A. and West Germany have provided training to six officers of the National Archives. An important factor responsible for the non-availability of trained persons in our country is the fact that archival education has not been included in any of the syllabi of the universities within the country. Library Education has place in the curriculum of many universities but no place has been preserved for the Archival Education. There is no training school or institution for the training of Archivists, Restorers and Conservators. It is high time that

now attention should be given to include archival education in the syllabi of the universities. This matter should receive a serious thought in the member countries of SWARBICA. The problems faced in restoring the increasing volume of records can only be tackled by providing free and extensive archival education to the people. There is a need for concerted effort in this direction and it is here that we need to co-operate and assist each other.

Ashraf Ali,
Deputy Director,
National Archives of Pakistan

Role of Climate and Environment in Deterioration of Paper and Other Allied Materials

Y.P. KATHPALIA

Introduction

Deterioration of paper is a universal phenomenon which is natural. It is accelerated by carelessness on the part of we humans, climate of the region, and environment around it, during use and storage.

Climatic factors

The two important factors in tropical and sub-tropical climatic countries are variations in (i) day and night temperatures and (ii) relative humidity almost throughout the year. If these are not checked and countered by means of methods and techniques that are now available, such as, central air-conditioning and constant monitoring, control of relative humidity in non-conditioned area, selection of storage rooms or areas, air-circulation and use of room air-coolers to name a few, then these create silent havoc amongst the stored documents. More often than not damage caused by these two variables i.e. temperature and relative humidity is detected when papers are either requisitioned and consulted by a scholar or by an inspection team if an archive has. The latter is one sphere of activity which is sadly ignored by most of the archives in the region.

Naturally the regions which have cold and temperate climate are better placed from the deterioration point of view than the regions that have tropical or sub-tropical climate. Paper and other archive material has survived better in the former regions and deteriorated fast or even disintegrated or disappeared in tropical climatic regions, where these two factors, variations in temperature and relative humidity are prominent.

Sunlight

Another factor that is prominent in the tropical and sub-tropical regions is the intensity of sunlight which is rich in two components radiant energy and ultra-violet rays. Both of these are active deteriorating agents specially in the presence of moisture which acts to catalyse reactions in paper and disintegrate cellulose, its main component. The paper becomes so brittle that it literally falls apart on mere handling. In case of these papers which contain alum—used for sizing of paper during its manufacture—it gets scotched and turns deep brown or black.

Behaviour of paper

There are many instances of the material on the same type of paper behaving in a different way in a tropical country such as either India or Sri Lanka or Bangladesh or Malaysia or Indonesia and in a temperate cold country such as England or Denmark or Sweden to name a few. The paper in the latter is still white and in good condition, while its counterpart and similar in all aspects in tropical countries has turned brown or black. In our country instances of such deteriorative changes can be seen in Calcutta, Madras, Pondicherry and Trivandrum to name a few which have hot and humid climatic conditions during most of the year.

Some problems

Such damaged papers pose problems of preservation and restoration unknown to the conservators in the cold and temperate regions. For instance, if documents that have turned deep brown and black, are deacidified by any of the conventional methods, they break up on drying into pieces, just as a toughened glass breaks up on impact. I had an occasion to work with such papers in Indonesia, where I was invited by the National Archives of Indonesia to train the staff and help set up a conservation laboratory. Similar problem was posed to me by the conservators of the Aurobindo Ashram in Pondicherry.

A process developed by Kathpalia working with his associates, involving the use of ammonia enable one to deacidify such affected documents without any damage to them. According to the work done in Federal Republic of Germany and presented at the Cambridge 1980 Seminar on conservation, papers exposed/treated with ammonia at sub-zero temperature came out better after the treatment. It is because that cellulose gets regenerated in ammonia, a phenomenon well known in textile industry.

The tropical climate, besides damage referred to earlier, leads to development of conditions necessary for the growth of insects and fungi. These cause damage to the nearly 90% of the holdings in the region. In fact a combination of high humidity, temperature, dust—which is abundant in the region specially during the hot summer days, fungi and insects leads to physical and chemical changes in paper and allied materials. The chemical reactions result in high acidity in paper—a potent cause of disintegration of paper and break up of the cellulose molecule.

Climate thus plays a major role in deterioration of paper in the region where we are meeting today and deliberating on the problems of conservation. Nevertheless the role of environmental conditions is no less significant.

Environmental factors

Environmental conditions in this region have undergone changes for the worse. It is because of our urge to develop at a quicker rate, to attain self-sufficiency or attain a decent level of living and growth in population. The changes in environment are proportionate to the level of development achieved but are detrimental to archive materials and art objects.

In fact development has resulted in increase of pollution in the environment around us. The falling of trees and pollution of rivers by industries have resulted in change of ecology of the region and hence in climatic conditions. We have witnessed seasonal changes hitherto not experienced.

Pollution

As far as the conservators are concerned, it is the resultant pollution and more and more of it that is a big danger. Pollution in the form of industrial gases, automobile fumes, lead in the atmosphere because of its use as anti-knock agent in petrol. improper disposal of human and animal excreta, burning of coal and furnace oil is resulting in the generation of sulphuretted hydrogen gas, grime, oily impurities and acidic gases. In fact it may be said that all the potent acids such as sulphuric acid, nitric acid, carbonic acid and hydrochloric acid, known to man are being found in the environment around the objects of arts. Their action is visible all around us, be it in the archives on paper, micro-films, tapes, discs and videos, museums, paintings, monuments or the health of we humans. Some regions in the world are witnessing acidic rain.

Preventive measures

The action of changes in climate and environment are amenable to control by modern methods at our disposal such as, air-conditioning, air-wash, proper and controlled deacidification and proper storage and diaplay. Herein lies the importance of designing proper buildings for housing art objects.

Some of these methods we will be discussing during the deliberations in the course of this Seminar. It is the pollution control which needs care and attention, not only by the conservators of art objects but at the national level also. It is the bureaucrat who has to be made aware of the finer and cultural value of archives and art objects and their importance to the nation both morally and spiritually.

Exercise of proper control in the concerned industries and units is the simplest and surest way of controlling such emission and hence pollution. The alternative like the restoration of deteriorated materials in archives, libraries, museums and art galleries, besides being costly is unthinkable.

In many cases pollution is because of apathy of the authorities. If measures for its control are included while drawing plans for our industrial unit and in other sphere of activities, the problem and its nuisance value can be eliminated. Yes, pollution is controllable, what is required is will and farsight on the part of the authorities.

Huge expenditure, which can be saved, is required otherwise to provide for equipment, materials, chemicals, manpower and expertise to counteract the action of pollution and save the national heritage. Here usually archives are the losers. Because, archives unlike archaeological sites or museums are not seen by the public. They are consulted by the scholars and researchers. They, therefore, get lesser allocation of budgets than public libraries, museums or archaeology.

Thank you.

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Y.P. Kathpalia, Assistant Director of Archives (Retd),
Presently: Conservation Consultant.

Chemical Composition of Paper & its Role in Preservation of Paper

V.V. TALWAR

Introduction

Paper is chiefly made of fibres matted together and sized to provide mechanical strength and requisite surface characteristics capable of registering writing/printing and other coloured mediums. In addition, mineral fillers and colours are added to increase opacity and improve printing quality. The keeping qualities and initial strength of paper will thus depend upon the nature and length of fibres, sizing and fillers used.

The variety of fibrous materials available may be divided into several categories viz.

Animal fibres	..	Wool, fur, hair, silk etc.
Synthetic fibres	..	rayon, nylon, glass etc.
Mineral fibres	..	asbestos
Plant fibres	..	cotton, linen, esparto, straw, bamboo, wood etc.

The last group requires particular attention as these fibres are the most commonly used raw material for paper making The main chemical constituent of fibres is cellulose which is in loose chemical combination with lignins, pectins, gums, resins and various colouring matters present in plants. The purer the cellulose, the greater is the durability and strength of paper.

Manufacturing technique

Whatever raw material is used for making paper, it has to pass through the following stages of preparation: removal of all foreign matter and dirt, reduction to fibrous state either by mechanical and/or chemical methods, chlorination, bleaching, beating to a pulp with water and lastly

converting pulp into paper. Chlorination and bleaching are carefully regulated as any excess bleaching causes degradation of cellulose.

Purified cotton cellulose contains 98-100% alpha Cellulose whereas normally purified wood pulps contain not more than 88%. A cellulosic material produces a paper with higher degree of durability and performance according to the amount of alpha-cellulose it contains.

Sizing

The term sizing covers a number of paper making operations which make paper resistant to penetration by water or other liquids or by their vapour. The basis of modern sizing methods is the intimate coating of the individual fibres with a material which is insoluble in and repellent towards water. Its main functions are:-

(a) to prevent the spreading of writing ink on paper.
(b) to render paper more resistant to penetration by moisture.
(c) to consolidate and harden the sheet.
(d) to increase the retention of fibres, loading and colouring matters added.

The sizing processes and materials in use in paper industry are:

Rosin sizing: Rosin is the solid residue of gums or juices of coniferous trees and is at present largely used as a sizing material for paper. It is added to the beater in the form of a fine emulsion free rosin in water or as a solution in alkali. In order that rosin may exert its full water-proofing effect, it must be rendered insoluble by adding a solution of alum (i.e. aluminium sulphate). It precipitates rosin as aluminium rosinate in intimate contact with the fibres, with the result that these are coated and impregnated with a solid water resistant material.

The quantity of alum should be strictly regulated, taking into account the hardness of water used in paper making. This is because alum being a relatively acidic product, residual acidity is detrimental to the permanence of paper.

When exposed to light and air, rosin changes into a crystalline substance. This explains why rosin sized papers gradually deteriorate, losing colour and ink resistance.

Starch sizing: In very ancient times starch was the only material

known for the sizing of paper. It is now used in addition to other sizing agents to give a hard rattle and improved finish to paper. A slight increase in strength may also be obtained by its use. It increases transparency.

Sodium silicate sizing: The use of silicate as an auxiliary sizing agent is gradually becoming more general and excellent results may be obtained by using it either alone or in conjuction with rosin size and starch. Alum is used as a precipitating agent.

As it is very resistant to oils, the silicate sizing may be used to great advantage in the making of printing papers and posters which have to resist coloured and oily inks. It also has the effect of assisting the paper to resist the deteriorating action of sunlight. The cementing action of the silicate on the fibres keeps down fluff and gives increased rattle and firm handle to all papers.

Gelatin sizing: The best writing and typewriting papers are always coated and impregnated with a solution of gelatin in order that the surface may be more even and more resistant to ink.

Gelatin sized papers are much more durable, as the fibres are protected by the thin film from the oxidising agents of the atmosphere. They are also rendered more tough and will stand folding and rough handling.

It may be stated that the process of sizing has to be strictly controlled as any increase in degree of sizing will increase the tendency to curl.

Loadings/Fillings

All machine made papers are non-uniform in structure and have different strengths in machine and cross directions. It is, therefore, necessary to supplement the natural surface texture by coating with certain minerals to provide a smooth surface. The use of loadings or mineral fillers also provides dimensional stability to papers, improves opacity, brightness and the receptivity of the surface to printing. It also reduces the cost of paper by substituting loadings for fibres.

Some of the most commonly used loadings are:

(i) China clay or Kaolin which consists mainly of Aluminium Silicate.
(ii) Gypsum or Calcium Sulphate.

(iii) Barytes and blanc fixe are forms of Barium Sulphate.
(iv) Titanium Oxide.
(v) Zinc loadings .... Zinc Oxide
Zinc Sulphate
Lithopone ($ZnS + Ba\ So_4$).
(vi) Talc-Hyderated magnesium silicate.

Almost every paper of any substance, except hand-made paper and some very expensive all—rag papers, contain mineral loadings. The retention of loadings in the paper varies according to the degree of fibrillation of the pulp, the nature of the fibres and loadings, the sizing material and the amount of water used.

Loadings in suspension form may be added to the pulp either in the beater or in a thin continuous stream to the stock before it goes on to the machine. The later method results in saving of loading and its quantity can be easily regulated.

Undesirable effects produced in paper as a result of excessive loadings are:

(1) Decrease in the bonding properties of the sheet, resulting in loss of strength.
(2) Loss of rigidity, with a marked tendency to become flabby and dusty, together with lowered erasing properties.
(3) Papers become abrasive on the surface and sizing becomes difficult.

Thus the factors that play contributory and important part in determining permanence are:

(i) The constitutents of paper i.e. fibres, loading and sizing materials.
(ii) The care taken in preparation of pulp or paper i.e. digestion, chlorination, bleaching, fibrillation etc.
(iii) Physical and chemical differences between pure cellulose from plants of different origins. The fibres may also be classified as under in order of permanence.

(a) Cotton, flax, hamp (Linen)
(b) Wood (i) Sulphite pulp; (ii) Soda & Sulphate.
(c) Esparto & Straw
(d) Ground Wood

Chemical and physical tests of paper give us:

(i) the amount of acidity i.e. pH
(ii) Alpha cellulose content
(iii) Copper number
(iv) Sizing materials
(v) Loadings (Ash content)
(vi) Tensile strength
(vii) Folding Endurance
(viii) Bursting strength
(ix) Tearing strength

From a comparative study of the results of the above tests before and after accelerated ageing on different types of papers, it is possible to find as to which papers is comparatively more durable and permanent.

A careful study of the above points has helped in making the following important conclusions:

1. Preference should be given to papers made from unbleached rags i.e. high alpha Cellulose content.
2. Harmful effects may arise from colouring matter, loading, size and acidity which should be avoided as far as possible.
3. Good quality of ink should be used.
4. As far as possible, documents should be bound at once.
5. Precautions should be taken to protect books and documents from harmful effects of atmospheric pollution, heat, light, humidity, dryness, insects, bad binding and stitching.

Specification for permanent papers: The following specifications have been prescribed by the Indian Standards Institution IS: 1774. 1961: Specifications for paper for permanent Records.

A. Chemical Requirements

1. Rag, Content-Cotton and linen, single or mixed	100%
2. Alpha Cellulose Content	85% minimum
3. Copper number	2 maximum
4. Ash Content	2% maximum
5. Rosin Content	1.5% maximum
6. pH	5.5 minimum

B. Physical requirements

1. Burst factor	25

2. Folding Endurance	250 double folds minimum average in each direction at 1 Kgm. tension under ISI test conditions. (Methods of sampling and Test for paper and Allied Products Part I, IS: 1060-1956)

C. Ageing Test (Heating for 72 hours at 103±2°C)

1. Retention of Alpha Cellulose	98% minimum
2. Increase in Copper Number	Not more than 0.5
3. Percentage of the un-aged folding strength retained by the sample after ageing	70% minimum

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Preventive Conservation of Archives

JOHN DAVIES

Introduction

THERE are many uncertainties in preservation of documents and it is not always possible to judge how long a document will remain in usable condition. Although historic documents of the past that escaped the ravages of floods, fire and other calamities, have survived for centuries and longer, whether or not modern records, which are being created in ever increasing numbers will remain as long is uncertain.

Paper like any other organic matter, will not remain intact forever. Alteration in its appearance and structure is inevitable with the passage of time. This natural ageing process in paper is slow and its effects go undetected until the damage has reached a stage beyond repair. Nonetheless, documents in a fair state of preservation will continue to remain for an indefinite period without perceptible deterioration if suitably stored and carefully handled.

Considering the uncertainties involved, it is only realistic to assume that paper has a limited life. Although natural aging in paper is a relatively slow process, it may be accelerated by careless handling and inadequate storage conditions. They are also affected by several other causes and some of the factors involved are:

(a) Changing weather conditions,
(b) High temperature and humidity and light,
(c) Micro-organisms,
(d) Foreign substances in the air, such as sulphur dioxide, dust, mould spores, etc., and
(e) Acid in paper.

Maintenance of storage environment

High humidity in storage area will support growth of mould. In exces-

sively dry conditions paper and related materials and notably adhesive used in bound volumes of books suffer damage by desiccation. Dryness also causes severe physical deterioration of bookbindings. Insect pests and micro-organisms thrive in a hot and humid climate and may cause damage to paper and related materials.

Acidic documents

The most important single item in the permanence of paper is the absence of acid. Scientific studies and observations made by practicing paper chemists indicate that acid is the main cause of deterioration in paper. Richard Smith, in one of his recent articles observes that:

> "Over 75 percent, perhaps even 90 percent, of paper deterioration in library book collections is caused by acid hydrolysis. The remaining 10 to 25 percent is caused primarily by oxidative degradation (reactions involving oxygen) assisted by fungi, insects and rodents, photochemical attack and normal use."

The problem of acid damage of documents and related materials is particularly serious in industrial areas where the atmosphere is polluted with noxious gases. In paper making processes alum is extensively used to disperse the fibres in water and also to precipitate rosin size on the fibres. But when too much alum is used, the acidity of the paper will be higher than is consistent with good aging qualities. Again ultraviolet rays in sunlight and fluorescent light weaken and degrade cellulosic materials.

Shelving equipment

The manner in which archival materials are shelved and used also has a significant impact on the need for physical treatment or repair. Untidy shelves, rough handling of the materials will lead to damage and are a needless waste of resources. Moreover the everpresent possibilities of damage through natural causes, such as flooding, fire etc., cannot be overlooked but the continuous loss of valuable archival materials through ignorance and negligence is most deplorable.

For example, it was common practice in most Government agencies, in the past, to relegate the older or non-current records to basements or attics of the office buildings when space was required for current records. The characteristic feature was that when an office could no longer house its older records in the registry, it was an accepted practice to move them out into a nearby storeroom in which the office stationery was kept. At times, when the first storeroom was full, the dead or non-current records were

cast into some remoter storeroom, where, amongst old tyres and scrap iron, they would lie forgotten and neglected in filthy and decaying heaps on the ground. Records salvaged from the store are now found in archival institutions where large sums of money and energy are being spent to rehabilitate them so as to make them available for research and reference.

Preventive conservation measures

Preventive conservation is the creation of an environment in which the enemies of archival materials or factors deterimental to them cannot exist. Environmental control, proper shelving and handling practices and more active maintenance procedures of timely repairs, deacidification and proper storage containers for the materials are the basic requirements.

Accommodation

Ideally there should be no windows in a storage area. It should be constructed of fire-resistant materials and airconditioned with low wattage bulbs for lighting. Where such a facility is difficult to come by in an existing building, the accommodation chosen should be at least dry, weatherproof, adequately lighted and ventilated. The doors and windows if any should be protected with frames of mesh wire-netting. Direct sunlight on stored materials must be avoided and there should be no possibility of flooding, e.g., from burst tanks or blocked gutters or drains and preferably no water pipes running through the rooms. Electrical wires should be concealed in conduits.

Air-conditioning eliminates extremes of heat and humidity and thus inhibits mould growth and the effects of prolonged exposure of the documents to high or fluctuating temperatures and humidity. Even the simplest air-conditioner removes most of the aerosols in polluted air and the more elaborate systems are also able to remove most of the noxious gases. The ambient temperature and humidity should be kept as constant as possible and ideally the temperature should be maintained between 20°-22°C and the relative humidity between 50%-55%.

Consumption of food should be prohibited in and near the storage area. As a precaution against accidental fire smoking should be strictly prohibited and lighting of match-sticks or carrying an open flame should be banned.

Equipment and storage of records

A great variety of storage equipment is manufactured today by a

large number of firms and it is essential to choose the type most suitable for each operation. The selection of a suitable equipment for a particular type of work can only be determined by a thorough examination of the need and purpose, in relation to the existing, facilities for its installation and operation in the office concerned. The base material of the equipment is also important from the preservation point of view. Storage equipment is available in either wood or steel. Wood is prone to attack by insects and liable to damage from several other causes. Steel storage equipment, because of its greater strength in comparison with its bulk, allows not only the maximum use to be made of available storage space but it is also immune from attack by vermin or fungus and there can be no warping or splitting as can happen with wood. Open steel rack of the adjustable type is preferable to closed cabinet or cupboard as it permits adjustment of the shelves to suit the size and bulk of items. The rack should be stacked and arranged to stand clear of the walls and the bottom shelves in all bays should be at least 6 inches from the floor. Storage racks arranged in this manner not only allow free circulation of air but facilitate cleaning.

Maps, plans and larger items need special care in storage. Small maps and plans should preferably be stored flat in ordinary plan filing cabinets, but they may also be rolled and kept on shelves, securely wrapped with strong paper. Large or oversized maps andplans must be kept in rolls, which should be covered with strong wrappers and stored on shelves.

Bound volumes of books should be shelved upright on shelves. Shelving the books vertically saves space and at the same time facilitates retrieval. However, the weight of the pages in a book shelved upright pulls away from the spine of the book thus causing damage to the binding and it is therefore, essential to ensure that the books are supported by one another on shelves reasonably filled, or by means of book supports or book-ends. However, large and oversized volumes should be shelved flat on their sides

Various types of boxes of cardboard or acid free boards are used in archival institutions as document storage containers. The acid free boxes are expensive and if the cost of such special boxes make them impracticable, any ordinary strong cardboard boxes may be used, though the documents should not be placed in them without some preliminary wrapping, preferably acid free wrappers. Also boxes should be comfortably filled with documents and neither over nor under-packed.

Documents should be cleaned before being put away. Corrosive metal clips, pins and rubber bands should be removed and replaced by non-rusting brass or plastic clips or wide white tapes. If the corners of documents have been 'dog-eared' they should be lifted and flattened. Loose enclosures

should be re-inserted in their correct position. The materials affected by mildew, which spreads rapidly, should be segregated and treated. Slightly mildewed items must be dried out thoroughly and the mildew spores brushed off. Heavily infested materials should be chemically treated with methyl bromide or ethylene oxide in a vacuum fumigation chamber. If facilities for vacuum fumigation are not available, commercial pest control agents should be invited to treat the materials. Similarly, any small tear in documents should be mended promptly to prevent it from tearing further into the writing or print.

In spite of dust proof doors and air-conditioning, dust somehow finds its way into records repositories and onto the materials. Organised periodical cleaning of the materials and the storage racks and the floor with the aid of a vacuum cleaner is desirable. The materials themselves should be cleaned with a low-powered vacuum cleaner. A reasonably high degree of protection from insects can be secured by spraying the storage area periodically with insecticide mixtures. Care should be taken, however, to ensure that the spray is directed to the walls, dark corners and crevices, but not on to the materials themselves.

Disaster prevention and preparedness

Storage areas should be provided with adequate fire fighting equipment. It is imperative that every archival institution should be prepared to act quickly to salvage irreplaceable materials in the event of a major or minor disaster.

The disasters that occur in archives are more often the result of misplaced water: plumbing leaks, roof leaks, burst tanks, rupture in steam lines, floods or water used to quench fire.

Although we know that only good luck can protect the archives for all time from all potential disasters, we even mistakenly assume that we know what to do about it when it occurs. When it does strike however one is shocked and found unprepared. This is especially true when destruction and damage is caused on a large scale affecting rare and sometimes irreplaceable materials.

Disaster preparedness includes an assessment of existing building to determine potential hazards. Alarm systems and fire extinguishing systems should be examined and problem areas noted. Areas such as roof, physical plant, duct-work can present special hazards. A schedule for periodic inspection and monitoring should be instituted,

Development of a written disaster preparedness plan will enable the staff members to act expediently and react appropriately to a disaster. The disaster plan should include the designation of key staff members who would authorize and supervise salvage operations; the identification of priority collections for immediate protection and salvage: lists of necessary services, equipment and supplies; and a step-by-step procedure for salvage operations.

There are now available scores of studies and reports about fire protection and prevention. There are also booklets and articles on salvage operation and procedures which should be available to staff members for consultation and reference. One of the most informative publication on the subject is Procedures for Salvage of Water-Damaged Library Materials by Peter Waters of the Library of Congress of the USA. This publication is available from the source and it is free.

Microfilming alternative to repair

Apart from chemical, physical and biological damage suffered by paper and related materials for which suitable repair, deacidification and proper storage can provide remedial measures, there remains a large number of documents written in washable or acid inks which fades in time. The fugitive nature of modern print, particularly in newspapers and certain journals also poses problems and shortens the 'readable' life of these documents. All newsprints are manufactured from mechanical wood pulp in which a good deal of non-cellulose material is retained with the result that papers made from this stock lack strength and deteriorate quickly, neither can newspapers, which are printed on newsprint be economically repaired once deterioration has set in. This problem has long been recognized by archival institutions but it was not until the beginning of the present century with the development of microfilm technology that an alternative to repair became available.

Microfilm is also the answer, in many situations: saving on storage space and securing the information against disasters from calamities such as fire, flood and war. For each of these hazards, the security of archival materials is provided for by having microfilm copies at separate locations or by providing extra microfilm copies at protected locations. It also provides protection for the original materials especially those items in brittle condition and which no longer can be used by readers with safety from a variety of normal use hazards such as wear and tear, mutilation and loss, by making available only microfilm copy rather than the original for reference and consultation.

Thus an effective conservation programme should include facilities not only for repair but also microfilming so as to ensure that the intellectual contents of the materials are preserved for posterity in one form or another.

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Housing Requirements for Conservation of Archives

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Introduction

AMONG the very many responsibilities and obligations that an archivist has to share the preservation of archival wealth entrusted to his custody is quite a major one. All the basic components that go to create archives are organic and suffer constant deleterious changes due to climate viz., variation in temperature and relative humidity, as also by the pollutions being released in the atmosphere in urban areas. In tropical countries where there are extreme variations from hot and humid climate to dry and cold one the diverse organic media, chief among them being paper, suffer degradation to a great extent. Therefore, the primary need of an archives is to provide proper housing for its collection, which besides meeting all its functional requirements would also satisfy the need of physical safety from climate, biological pests, as well as ensure safety from hazards like fire and flood.

Planning a building

Most of the archivists assembled here are from countries which have only a few decades ago started paying due attention to their archives. Some of them have already planned their new buildings to house their National Archives fulfilling scientific storage requirements. The National Archives of India has planned its new building which is under construction. The essential requirements of providing an environment suitable for long range preservation viz., Air-conditioning is an essential component of these archival buildings. For effective air-conditioning, ventilation is to be so planned as to permit no leakage or minimum of the conditioned air. It is preferable to have blind construction, but in such a case if there is a plant failure, and the same takes time to attend to, the environment within the repository becomes stagnant and congested. While planning for air-conditioning and calculating conditioning load bulk of shelving equipment, record

material, the number of persons working, movement of man or material, heating load of electrical equipment, light etc. should be taken into acount. In tropical colimate the ambient conditions desirable are temperature 22-25°C and relative humidity 45-50%.

Maintenance of storage environment

For optimum efficiency the air-conditioning system must also take into consideration at least 5-6 air change per hour with at least 20-25% fresh air intake for each cycle to eliminate or minimize the effect of contaminants added by personnel or materials to the circulating air. It is also advantageous to couple an air wash system with airconditioning to remove the acidic gases like oxide of sulphur. sulphuretted hydrogen and ozone which accelerates the rate of decomposition of paper and like materials.

However, as all of us are well aware, the archival wealth of our countries does not lie concentrated in one National centre only. In India besides National Archives there are State Archives, some of them being still in development stage. Our developing economy does not ensure due priority for being able to provide scientifically planned air-conditioned repository for each of our archival centres. With limited resources being provided for archives it seems that for the present our State Archives and other like agencies have to think of planning their buildings or devising ways and means to modify their present buildings in a manner that at least adequate safeguards be provided against vagaries of nature.

Necessity of guidelines

Keeping in view the basic requirements of an Archives, a Committee of archivists, building experts, and standards engineers combined for a collaborative effort to lay down recommendations relating to primary element in the Design of Buildings for Archives described in IS : 2663-1977, issued by the Indian Standards Institution. These recommendations besides enumerating some considerations for location, site and design also describe minimum essential requirements needed for functioning of an archival repository. Desirable parameters for the respective areas viz. Repository, Record Receiving Room, Research Room, Administrative and Technical Wings etc. have been also discussed. While guidelines for planning new buildings are now available to the archivists it seems that for the present some consideration is yet desirable to think as to what alternatives could be devised for maintaining an environment conducive to providing long life to paper archives, which form a major bulk of our collections.

Orientation and design

In the first instance it is desirable that a thorough study be made of

geographical climate of the particular location so as to provide a natural air in-take, its circulation and passage with postive pressure. Orientation of the building ventilation in keeping with the wind direction, and using building materials which provide insulation against external heat is helpful in maintaining a congenial storage environment. Further by adopting an architectural design which would be in keeping with this objective will further aid maintenance of such an environment. A study of the designs of some of the monuments with Rajput or Moghul architecture could perhaps help in this effort. Similarly the effect of high humidity could be reduced by using dehumidifying machines or chemicals. In buildings with damp walls or floor the effect can be reduced by applying acrylic water proof paint on the walls and by covering the floor with water resistance plastic tiles, linoleum or a cheap material like jute matting which will need drying/replacement more frequently than the former materials.

Though incidence of dust in air-conditioned building is much less than in buildings provided with natural ventilation openings, yet even with the best filtering devices, particulate matter could find its way into the storage area. Regular cleaning operations with a vacuum cleaner is helpful. In buildings with natural ventilation the incidence of dust could be also reduced by planting trees, plants, grassy lawns round the building and laying a few fountains which besides providing an aesthetic view will also help filtering dust, as also absorb the acid gases.

Security against hazards

Besides the above, adequate built-in security system for safeguarding against fire hazards are necessary. Building By-laws of the District Municipal Authorities or other like bodies take care of this aspect while approving the plans for a new building, but for buildings which are old, fitting of a fire alarm system coupled with automatic or manual fire fighting appliances is an essential requirements. For adequacy of such measures expert advice of the District Fire Adviser could be sought. However, since one of the cómmon causes of an accidental fire is electric short circuiting, safety could be ensured by periodic check on electric lines, and equipments, laying all the electric wiring in conduit, providing automatic cut-off device with the main circuit to break the electric supply in case of short circuiting. All these and other measures which will be beneficial for proper housing of archives could be perhaps specified as a separate guideline for archives with limited financial resources.

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Biodeterioration of Paper and Other Allied Materials

DR. S.M. NAIR

Introduction

ARCHIVAL materials generally consists of paper, palm leaf, birch bark, parchment etc. in the form of books, manuscripts and documents. The care and preservation of these materials not only call for protection from physical and chemical causes of damage but also from deterioration brought about by living organisms because of their organic contents which provide a rich source of nutrition to these organisms. Such deterioration brought about by biological agents is generally referred to as 'biodeterioration'. The problem of biodeterioration is a matter of considerable significance in countries characterised by a tropical humid climate, such as in India.

In the case of books, apart from paper, there are other materials used such as bindings of cardboard, leather or cloth; glues or resins all of which add to their nutritive content. Because of its cellulosic composition, paper is susceptible to a wide range of biological attack. Some paper is made from wood pulp while others are made from cotton and linen rags, straw, waste paper etc. all containing cellulose.

Biological agents of deterioration

The most common biological agents of deterioration of paper are bacteria, fungi and insects. Of these bacteria are of much less importance, though certain species of aerobic bacteria may be involved in the deterioration of paper. They, however, do not play as predominent a role as the fungi or insects.

Fungus attack:— Fungi constitute a major threat to the preservation of archival material comprising paper. More than a hundred species of fungi attack paper and paper materials. These fungi have a remarkable

cellulose dissolving capacity. It is well known that cellulose provides a satisfactory medium for mould growth. Staining and weakening of paper are the obvious results of fungal activity. The fungi growing on paper usually produce black, brown, yellow and green spots and some may even be colourless. Chromatic alterations on paper on account of fungus growth may depend upon several factors, such as the composition of paper, the level of acidity and the species of fungi that is responsible for the damage.

Foxing, a characteristic rusty-brown spotted discolouration of paper is said to be associated with fungus growth. Beckwith *et. al* (1940) observe that foxing or brownspotting of paper is associated at least partly with fungus growth, but points out that it may also be due to the presence of iron. According to him the organic acids secreted by the fungi in the course of their metabolic processes react with the traces of iron present in paper forming salts that decompose into oxides and hydroxides of iron which are responsible for this rusty-brown discolouration. Ambler and Finney (1957) have shown that micro-organisms are directly responsible for foxing. They develop because of the presence of glue and starch, forming hygroscopic areas on paper on which the water soluble products of the decomposition of cellulose accumulate. These assume brown-red colour in damp surroundings. Opinions are varied on the causes, nature and mechanisms of foxing and the available information is inadequate for making any definite statements in this respect.

Studies conducted by the author on the isolation, culture and identification of fungi from old paper manuscripts in India showed the presence of the following fungi : *Aspergillus niger, Aspergillus glaucus, Aspergillus flavus, Aspergillus restrictus, Alternaria humicola, Alternaria malvae, Pencillium ruburum, Pencillium funicolosum, Pencillium chrysogenum, Curvularia tetramera, Trichoderma album, Fusarium moniliformae, Cladosporium herbarum.*

Insect attack :— The most common insects that attack paper are Silver fish, Book-lice, Cockroaches, Termites, Book-Worm Beetles, Crickets etc. A brief account of their characteristics are given below:

Silver fish (*Lepisma saccharina*) :— The adult is a wingless, silvery or pearly gray, carrot shaped insect, measuring 8 to 10 mm in length. Temperatures varying between 16 degrees C. to 24 degrees C. and humidity above 55% are ideal conditions for their growth. Silver fishes are mostly surface feeders. They show a particular affinity for flour, glue, photographic gelatine, sizes and pastes. They eat away the surface of book-bindings, papers, cards etc. making irregular patches. These insects penetrate the books through the back, which offers them glue and starch. They also

destroy wall paper and disfigure miniature paintings and illustrated manuscripts.

Cockroaches :— Brown, brownish black or tan coloured, shiny, flat bodied and foul smelling cockroaches are common throughout the world. Several species of them are known to feed on many kinds of materials including book-bindings, leaves of books, magazines, paper boxes and other kinds of paper products. This insect is usually a nuisance in museum storage where old books, documents and manuscripts are kept. The characteristics of cockroaches are so well known that a description here would only be superfluous.

Book-lice (*Psocoptera*) :— Annoying, but harmless, psocids are those tiny white or frayish white to brown, book lice scarcely as long as the width of an ordinary pin head (1 mm to 2.5 mm). These little nuisances do not really damage books, paper and fabrics (silver fish and cockroaches are the real culprits). Psocids are of little importance as far as biodeterioration of paper is concerned, except that their presence in large swarming numbers can be bad. The author has observed more cases of book lice attack among leather objects, herbaria etc. than among books.

There are several kinds of psocids, some with wings and some without Their body is almost semi-transport and they have long thread like antennae and chewing mouth parts. The occurrence of psocids was also noted on old books and manuscripts on which fungus growth has taken place. Dampness and warmth are the essential requirements for their rapid growth.

Termites :— Books and papers are some times attacked by termites. Archival material, if neglected to the extent of being attacked by termites, the results will no doubt be disastrous. The other pests mentioned above do not devastate the collections to such an extent, but termites, given a chance would obliterate paper materials in no time. They have ruined more books than any other group of book insects.

Book-worms :— Book-worm infection of archival materials has been recorded from many parts of the world. The larvae of some beetles belonging to the family Anobiidae are the true book-worms, though many other insects have been described as book-worms by several authors. There are several species of them each of which have a limited geographical distribution. Most of the serious damages to books due to book-worm infections are reported from the tropical regions of the world. The Indian Book-worm Beetle has been identified as *Gastrallus indicus Reitter*. It has been recorded from many parts of India and Burma. Punjab, Dehra Dun and New Delhi in India and Mundalay in Burma were the places from where

Gastrallus infection of paper has been recorded in the past (Roonwal and Chatterjee, 1952). During a survey of biodeterioration of museum materials in India, serious infection of this insect in books in libraries and museums has been observed by the author in Hyderabad, Baroda and Dehra Dun whereas old palm-leaf manuscripts were found attacked in Trivandrum. This indicates the probability that *Gastrallus indicus* has an almost all-India distribution.

The book-worm beetle larvae make parallel sided tunnels of about 1 to 1.5mm in width running in all directions, during the course of their feeding activity within book bindings. These galleries get filled with irregular shaped feecal pellets. Occasionally, the larvae also tunnel into the pages of the book. The concentration of the galleries is seen on the edges of the cover and the pages.

Crickets :— The House Cricket, *Acheta domesticus* is also found as a pest of books and manuscripts in India. This black or brown jumping insect is capable of feeding both plant and animal matter indiscriminately. It is known to attack clothing and other household belongings. Considerable damage and destruction brought about to books and manuscripts by this insect was noticed in India.

Control measures

Fungus attack :— Fungi vary enormously in their response to toxic chemicals. It was found that some types of fungi can tolerate surprisingly high concentrations of certain fungicides which will inhibit other types of fungi at quite low concentrations. Low percentages of thymol and saffrol were found to inhibit the growth of Aspergillus Niger, whereas they had little effect on certain pencillium species. Paranitrophenol and Zinc sillico fluoride were found effective against Penicillium but not against Aspergillus. The implications of such variations in tolerance to poisons is that it is essential to use as many test fungi as possible in carrying out laboratory estimations of toxicity. It is obvious that effective use of fungicides calls for an understanding of the identity of the species of fungi so that appropriate use of fungicides could be recommended. The optimum percentages of the fungicides required to be used may also vary depending on the fungi toxicity of the chemical and the fungistaticity of the species in question. While using fungicides on library materials one has to consider the possible chemical effects of the toxic material on the material and any damaging effect has to be avoided. From this point of view, it is always necessary to use the lowest concentration of the chemical that would impart

fungicidal property. Studies conducted on the effectiveness of various fungicides gave the following results (Nair, 1974):-

(i) Mercuric chloride and pentachlorophenol are effective at very low concentrations of 0.2 and 0.25 percentage respectively.
(ii) Paranitrophenol is effective only at 3% and above 5%.
(iii) Thymol and sodium flouride are effective at and above 5%.
(iv) Sodium salicylate and sodium pentachlorophenate are effective at 10% or above.
(v) Other chemicals tested require much higher percentages that are beyond the limits of safety as far as books are concerned.

Insect attack :— The following insecticides are generally found to be effective against the species mentioned:

Silver fishes :— Sprays or dusts containing 5% D.D.T., B.H.C. or Pyrethrum. A mixture of equal quantities of Paradichlorobenzene, Benzene and Creosote (P.B.C) is an effective repellent.

Cockroaches :— Sprays or dusts containing 5% D.D.T., B.H.C. of Pyrethrum, Sodium fluoride and Gypsum (1 : 1) as a poison powder; P.B.C. as a repellent.

Termites :— General termite proofing of buildings, timber work and storage areas.

Book-lice :— Pyrethrum sprays; P.B.C. or Paradichlorobenzene as repellents.

Book-worm Beetles :— Exposure to P.B.C. vapour, fumigation with Ethyl or Methyl Bromide or Carbon-di-sulphide.

Specific considerations while using biocides in an archive

It has to be kept in mind that Archives are to be used by people and therefore, use of chemicals can be undertaken only with extreme caution. Most of the treatments specified above should be undertaken after the books and documents are isolated from the reading areas and stacks. Books which are to be handled by people are best treated with volatile chemicals which do not leave any residues after the biocidal action has taken place.

Prevention is always better than cure. Preventive measures to safeguard archival materials from biodeterioration primarily consists of cont-

rolling the temperature and humidity in storage areas. Temperature between 20 to 25°C and a relative humidity between 40 and 50% are ideal for preservation. This can be attained by a successful air-conditioning system. But when technical or economic considerations make it difficult to have air-conditioning, other methods, both physical and chemical should be resorted to.

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Fumigation Equipment and Techniques for Sterilisation of Records

V.V. TALWAR

Introduction

INSECT and fungoid infestation is a serious problem in any record office or library in a tropical country. A number of chemicals either alone or in combination, are used to control these insect pests.

Insecticides have been classified, according to the manner in which they are administered to insects and their mode of entry into the body.

Stomach Poison :— Application to the food and entry through the mouth, alimentary canal and mid-gut e.g. arsenicals and flourine compounds.

Contact Poisons :— Application to the body surface and entry through the cuticle and trachae e.g. (1) pyrethrins, rotenone (2) Sulphur-organic and inorganic compounds (3) oils-petroleum oils, kerosene oil, tar oils.

These can be used as sprays in liquid or dust form.

Fumigants :— Application as a vapour and entry through the trachae e.g. Hydrocyanic acid gas, chloropicrin, methyl bromide, carbon disulphide, carbon tetrachloride etc.

Residual :— Application to surfaces and subsequent uptake through the cuticle e.g. D.D.T., chlordane.

This is, however, not a true classification since any given insecticide will be found to have several types of toxicity. Nicotine which is primarily a contact insecticide, is also a stomach poison and a fumigant. Chlordane is capable of showing all types of toxicity.

Fumigation :— To control insect and fungoid infestation, fumigation

of records with a suitable insecticide, at regular intervals is essential. Any fresh accessions to the records should also be fumigated and cleaned be-before being sent for storage. Care should be taken not to use any insecticide without first ascertaining its effect on the durability of paper. Since fumigants are of a poisonous nature, they must be handled under expert supervision.

Characteristics of a fumigant

In order that a chemical can be effective as a fumigant it must be volatile enough to produce a toxic concentration and uniform distribution of vapour in an enclosed space. Except in vacuum fumigation molecular diffusion must be relied upon to bring about gas penetration of material to be fumigated. The rate of diffusion depends upon the molecular weight of the gas, size of the openings through which the gas has to pass and the absorptive capacity of the material. Density influences fumigant distribution. Some fumigants are heavier than air and tend to sink to the floor and must be artificially stirred with a fan. To ensure uniform distribution such fumigants are often applied through several openings or nozzles at the top of the space to be fumigated.

Physical state of the fumigant at ordinary temperature is also of importance. Some chemicals like methyl bromide, ethylene oxide etc. which are gaseous at or immediately above ordinary fumigation temperature must be confined under pressure in heavy metal cylinders and introduced preferably through a system of pipes from outside. Such chemicals must be handled by experienced persons. Other chemicals like carbon tetrachloride, ethylene dichloride, carbon disulphide that are liquid at ordinary temperature and solids like para-dichlorobenzene, are volatile enough to vaporise within a reasonable time to produce concentration necessary for fumigation in an enclosed space. Thymol and naphthalene, however, require heating for volatilisation.

Temperature is highly important in determining the effectiveness of a fumigant. Insects are not active at temperatures below 15°C (60°F) and they become more or less dormant at 10°C (50°F) or below. In the dormant state it is extremely difficult to kill them with fumigants. At 25°C (75°F) they are active and their susceptibility to gases is good. The effect of atmospheric moisture upon the toxic action of fumigants is much less than that of temperature.

The quantity of a fumigant to be used will vary according to the length of exposure, the temperature, the tightness of the room, the amount of adsorption and absorption by the material to be fumigated and to the

specific immunity of the insects to be exterminated. Fumigants act on the insects chiefly by penetration of the respiratory system. Carbon dioxide accelerates the toxic action of a number of fumigants by inducing openings of the breathing pores of the insects while reducing the inflammability of some of these insecticides.

The following fumigants at the concentrations stated below are very effective in killing all storage insect pests within 24 hours and have no deleterious effect on paper, ink and other record components.

Fumigants	*Concentration per 1000 cu. ft.*
1. Carbon disulphide & Carbon Tetrachloride (1:4)	6 lbs
2. Ethylene dichloride & carbon tetrachloride (3:1)	14 lbs
3. Ethylene oxide and carbon dioxide (1:9) known as Carboxide	30 lbs
4. Ethylene oxide	2 lbs
5. Methyl bromide	2 lbs
6. Methyl formate-Carbon dioxide (2:5)	28 lbs

Thymol Fumigation :— Thymol fumigation can be used as an immediate preventive against mildew growth whose incidence increases rapidly during the rainy season. Records infested with mildew should be first fumigated and then cleaned. The fluffy surface growths can be cleaned with soft cotton wool. Care should be taken to prevent scattering of spores in the process of cleaning.

An air-tight wooden cup-board can be used for this purpose. The volumes or files to be fumigated are opened in an inverted 'V' form on a framework of wire net supported about 6" from the bottom of the cupboard. A 60-100 Watt electric bulb depending upon outside temperature is installed at the base of the cupboard to vaporise thymol crystals placed above the bulb in a dish. Heating of thymol crystals is necessary for 2-3 hours every day. A concentration of 1-2 ozs. of thymol vapour per 10 cu. ft. is sufficient and the time of fumigation is about 7 days. The process of thymol fumigation should be repeated at intervals to check fresh growth of mildew. Thymol fumigation however, should not be used in case of paintings with oils or varnishes which become softened under this treatment.

A 5% solution of thymol in methylated spirit can be sprayed in a room to check the growth of spores.

Fumigation with Paradichlorobenzene and Killoptera:— Fumigation with these chemicals may be carried out in an airtight steel almirah, the shelves of which are perforated. Records for fumigation are kept on shelves and bound books, volumes or files are opened and kept in inverted "V" form. One lb. of P.D.B. is provided for 10 cu. ft. of space and Killoptera (a mixture of carbon tetrachloride and ethylene dichloride 1: 3) in the concentration of 14 lbs/1000 cu ft. The chemicals volatalise at ordinary temperature. The vapour of paradichlorobenzene and of killoptera are heavy and flow downwards and are placed in the uppermost shelf. The fumigation period is about a week.

Vacuum Fumigation :— While the above two methods destroy mildew, living larvae and active beetles, the eggs laid in furrows near the binding joints and in boards of volumes are not affected. These eggs may hatch and produce fresh infestation. Vacuum fumigation of records with "Carboxide" (a mixture of ethylene oxide and carbon dioxide 1 : 9 by weight) is the most effective process of exterminating insects, larvae or eggs as this ensures speedy penetration of the lethal gas into the interstices of books and papers thus making it unnecessary to spread out the material under treatment.

Other liquid insecticides like Killoptera or Pip can also be used as fumigants under vacuum. This process, however, involves installation of costly equipment.

Fumigation with methyl bromide

Methyl Bromide which is extensively used as a fumigant for grains in storage, can be effectively used for fumigation of books and documents.

This is a colourless liquid boiling at 3.6.C. Its low boiling point makes it suitable for fumigation at low temperature. The gas is almost odourless, at concentrations which are toxic. Therefore, tear gas (chloropicrin) is added to it as a warning agent at the rate of 2% by weight of the mixture.

The gas is about 3 times as heavy as air and is very slightly soluble in water. It is not flammable. It can penetrate most materials quickly and leave them as quickly on conclusion of fumigation. It also escapes very quickly from structures that are not completely airtight. The presence of methyl bromide in air is detected by using a halide detector lamp. The normally invisible flame of a spirit lamp turns light green to deep blue depending upon the concentration of methyl bromide in the atmosphere.

The chemical is supplied in steel cylinders of 5—100 lbs. or more of fumigant under natural vapour pressure reinforced by addition of air at a pressure of 60 pounds per square inch. The liquid can, therefore, be discharged through outlets when required at normal temperature. For small scale fumigation, cans containing 1 lb of methyl bromide are available. For domestic use the chemical is available in 20 cc glass ampules wrapped in cotton wool and muslin bag.

Concentration required is 25 gms. per cubic meter of space at normal temperature (25°C) and duration of fumigation is 24 hours at atmospheric pressure.

Fumigation with methyl bromide can be carried out in a vault or under gas-tight covers. This can also be used as a fumigant in vacuum fumigation chamber.

Vault Fumigation

An air-tight room which provides for adequate ventilation can be used for fumigation. The room should be well plastered and provided with well-gasketed fitting doors/windows openable from outside and with leaves opening outwards in all the four walls. Alternately, it is advisable to fit one or more exhaust fans for quick degassing. Since most of the fumigants are heavier than air the windows/exhaust fans should be located near the floor level. The inside surface of the room should be painted or tiled in order to prevent absorption of the fumigant. The crevices between the door/window leaves and their frames should be sealed with mud mortar or gummed paper during fumigation. If the fumigation chamber is set up inside a building, the ventilating stack must extend outside the building and preferably above the roof.

Fumigation under gas-tight covers

Fumigation can also be carried out in the open in suitable gas-tight covers made from rubber proofed double texture fabric with aluminium finish, available from Central Ordnance Depot, Kanpur. One cover can be used for 100-125 fumigations or for about 2 years whichever is less. The covers are available in two sizes of 1.00 and 2000 cu. ft. capacity.

The cover should be of a size that will allow the stack of records to be fully enveloped leaving about 12" of all edges to lie flat on the floor. The edges are sealed to the floor by means of mud plaster when in operation. It should be ensured that the cover is not torn or punctured. Punctures can be repaired with rubber patches applied by means

of rubber solution on fabric side of the cover. Covers can be examined against light to detect hopes or punctures. When fumigation is in progress a danger sign should be put up.

Method of fumigation

The gas cylinder kept outside the fumigation cover/vault is placed on a spring balance. The cylinder valve is connected to a piece of pressure rubber tubing. The free end of the tube is led to the top of the fumigation stack/vault and is joined to a T or Y shaped glass/copper tube. Two or more branches of tubes may be laid for uniform distribution of the fumigant. In case of vault fumigation the effect of fumigation is enhanced by keeping the inside gaseous atmosphere of a vault, stirred.

The cover is draped over the stack and sealed with mud mortar. In case of the vault, the room is closed and sealed. Requisite weight of the fumigant is then released and the cylinder valve is closed. The outer end of the delivery tube is closed with a stop cock and disconnected from the gas cylinder. Halide detector lamp should be used to check leaks and immediate action taken.

Since fumigants are poisonous, at the end of the specific period of fumigation the cover or chamber should be opened and no one should be allowed within 10 metres on the leeward side of the stack or the chamber for an hour.

Cover: The sealing mud should be removed and the edges of the cover on the leeward side should be lifted and raised to the top of the stack. Then the edge on the windward side should be similarly raised to the top of the stack. Work may be started in the fumigated stack after an hour of the opening up.

Chamber: The doors/windows on the leeward side should be opened and then those on the adjacent side followed by those on the windward side.

If the exhaust fans are provided, no one should be allowed in front of the exhaust fans within a distance of 10 metres for an hour. Workers may enter the chamber only after about 2 hours of opening of the doors/windows.

If the fumigation chamber is set up inside a building, the ventilating stack must extend outside the building and preferably above the roof.

Scope of Fumigation: Fumigation is preferable to any process involving impregnation or other method of treatment with protecting substances. Its only disadvantage is lack of permanenu but it can always be repeated at intervals. Moreover, if the paper is thoroughly sterilised in the first instance and then stored under good conditions, it should remain free of infestation and the necessity of frequent repetition of fumigation is lessened.

Fumigation Hazard: The fumigants used are poisonous not only to insects but also to human beings. Most of them are toxic by ingestion, inhalation and skin absorption. Hence necesary safety precautions must be observed when working with them.

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Sterilisation of Records Against Fungus, Insects and Rodents

Y.P. KATHPALIA

Introduction

STERILIZATION is the first requisite and essential step for any archival agency concerned with storage and safe custody of records. It is all the more so because an archivist has no role or control over the creation of a record or its storage by the creating agency except that of an advisory capacity. This realization has resulted in the development of a new concept of preservation, i.e. Records Management, which enables custodians or authorities concerned to a say in such matters.

This aspect is relatively less developed in SWARBICA region or even in SEARBICA, ARBICA, CARBICA, ECARBICA and ALA regions than in the other regions of the archive world. The tempo has, however, increased in the last decade specially in the PARBICA, SEARBICA and SWARBICA regions.

All records that get converted into archives through the various stages of evaluation, technically called appraisal by the authorities and archivists, are sterilized on receipt at an archive to prevent access to any microorganism into the archival vault.

Process

There are a number of techniques and methods for sterilisation ranging from the use of herbs to chemicals and lethal gases.

A number of processes are in use. For insects the wellknown and well-developed processes are fumigation with:

(a) para-dichlorobenzene;
(b) killoptra—a mixture of ethylene dichloride and carbon tetrachloride in the ratio 3 : 1;

(c) formaldehyde;
(d) methyl bromide, and
(e) ethoxide in vacuum; ethoxide is a mixture of ethylene oxide and carbon dioxide in the ratio of 1 : 9.

For fungus the various processes in use are fumigation with:

(a) thymol, and
(b) a mixture of ethylene oxide and air in the ratio of 1 : 1.

Besides this a 10% solution of thymol in methylated spirit is effective in storage areas to inhibit the growth of fungus.

All these techniques you will see during the course of your visit to the National Archives of India, which has the necessary equipment, facilities and expertise for the work.

Other techniques

There has been significant research in use of these and other techniques for sterilisation of archive materials. Notable are (1) the use of less quantity of chemicals than mentioned in the literature and (2) development of new techniques.

Some of the newer techniques are use of microwaves, deep freeze, treatment with carbon dioxide and use of laser.

A. Microwaves

It has been observed that when documents are exposed to heat in a microwave oven at 60°C to 63°C the insects and fungi die. An exposure of one and a half to two hours is essential depending upon the intensity of infestation and growth of fungus. No damage is caused to the documents because heat till 70°C has very little effect on the keeping qualities of paper. Of course the documents are conditioned under normal temperature and relative humidity prior to cleaning and storage. This technique is promising and I hope to publish data and details of this in the near future.

B. Deep-freeze technique

It has been observed that insects and fungi die when documents are deep-freezed. Work on this has been done in the United States of America and equipment for the purpose is likeiy to be available in the near future.

C. Carbon Dioxide

This process is a by-product of the research in space technology. It has been observed that if carbon-dioxide is pumped into a chamber to a pressure of 7 atmospheres it kills insects and possibly fungi. This technique is significant as it does not have any after effect nor it uses chemicals that can be or are objected to by some countries.

Laser

It is well-known that laser can remove pencil marks from the document without affecting paper or its keeping qualities. Work on it has proved that fungus stains too can be removed and that insect infestation can be countered. Work on this is progressing and we i.e. myself and my colleagues hope to have some positive findings and results in not too distant a future.

All the newer techniques are multifunctional in that they eliminate insects and fungus. But have yet to withstand the evaluative test of time. Meanwhile the use of techniques in use presently is recommended with lesser quantities of chemicals.

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Guarding and Filing Archives

JOHN DAVIES

Introduction

LOOSE papers have always presented the archivist with a problem. If they are left loose, they can too easily be lost, damaged, or mislaid. If they are bound into volumes, it is hard to change their order, or make insertions or removals, without destroying the binding; while a series of papers of varying sizes, makes a very unsatisfactory binding.

This awareness has brought to the fore the need for a process of filling loose documents which will meet with the requirements of custodial institutions. The process of "Guarding and Filing" has therefore, been developed to avoid not only the disadvantages encountered in keeping papers in loose form or bound into volumes but also to give an aesthetic appearance to the finished product.

Archival institutions hold large collections of loose papers of the early period. Most of these papers are kept folded and some of them have been bound into volumes. Many of them are in varying conditions of repair.

Background

During the early days it was customary to assemble groups of related papers and have them bound into volumes of uniform size. In some instances the individual papers were mounted on pages of blank books, or pasted into 'guard books'. 'Guard books' are bound volumes with short stubs of stout paper instead of leaves. The loose papers are pasted to the stubs along the left-hand edge. The material that was bound in this way is generally found in good condition. As time went on, it was found that the bulk of the accumulating files of paper was increasing at a tremendous rate, and the adoption of some quicker and less expensive method of treating loose papers became of the utmost importance.

This led to the scheme of folding and filing the records that were created. It offered many advantages; it took considerably less time and was an inexpensive way of tackling the ever increasing accumulation of papers. It was therefore widely accepted by the records creating agencies. The method involved folding the papers individually or in bundles. In some instances they were placed in some form of containers and labelled. This form of filing was satisfactory from several view-points. as the papers pertinent to one subject were folded and kept together conveniently. Over-size or large papers, like maps, plans, etc., presented no special packing problems since they were folded to the standard size and filed in proper sequence in the series.

What was evidently not foreseen by the records creating agencies was the inevitable physical damage to the papers that would be incurred by the periodic unfolding and refolding of the documents as they were used. Added to this there were the problems of the natural aging of paper, its exposure to polluted air and the lack of properly controlled humidity and temperature in storage. As a result the papers gradually dried out, deteriorated and became brittle. Breakage along the folded lines of papers became inevitable.

It is, therefore, these early records which are worthy of preservation that now require the major portion of the custodian's thought, insofar as the physical handling is concerned.

Filing loose papers

There are, of course, several methods of treating loose papers. Individual papers which have accumulated in series but without any physical attachment or make-up, can, after repair or flattening be kept in acid-free folders or preservation boxes. Security for the papers can be provided by numbering the papers and the total number clearly noted on the label affixed to the folder or box, so that the papers can be checked after use by researchers. Theoretically, security can be maintained in this way. The drawback is that the documents are likely to get out of order, not to mention loss, damage or misplacement. Furthermore, the degree of security provided by numbering is not as great as the custodians would like to achieve and some form of filing attachment is desirable.

It is objectionable in principle to punch filing holes in papers or documents to secure them together, as this would obviously be very damaging to such documents as personal correspondence on notepaper written close to the edges, in which case punch-holes may obliterate writing.

On the other hand, assembling groups of related papers and having them bound would provide adequate protection and security. But it is an expensive exercise considering the amount of papers involved. Moreover most custodial institutions may not have the funds nor the personnel with the necessary expertise to carry out the work.

Guarding and filing

Guarding and filing has been developed to avoid the disadvantages of either extreme. It is a method of protecting collections of repaired papers of varying sizes. This process consists essentially of attaching each separate paper or gathering of papers, to a guard, piercing the guards with the holes and fastening them together with a lacing of cord through the holes. The system offers several advantages; the papers are held firmly in order and position; yet should it be necessary to add or remove any, or to change the order, they can be separated in a moment by untying the cord, and as easily reassembled. The strain of turning the pages or items is taken by the guards. The guard also provides sufficient clearance for photocopies to be made deep into the back of the document without risk of damage. Thus it provides a secure and practical method of making-up loose papers and present the papers in a form very convenient for the user.

The process is not difficult to learn and requires less skill and experience than binding and it is worthwhile considering it in some detail.

A manageable size for the file is about 200-250 leaves or 3-4cm. thick including the cover boards. If a bundle of papers exceeds this number or thickness, it should be split into two or three equal parts or nearly as possible without splitting items or groups of related material.

Guarding and filing is effected as follows: The *first* step in the process is examining all the papers to be filed. They are unfolded to their full size and repaired where necessary.

The *second* step is to consider the size of the papers to be filed. If they are of uniform size, they will present no difficulty. If not, there are four courses of action that may be taken:

(a) where the variation is not extensive, the file will be made up to the size of the largest of the papers.
(b) where the papers are in groups of varying sizes, the papers may be made up into several files corresponding to these groups.
(c) where a few documents only are very much larger than the others (e.g. large maps, plans etc.) the larger papers may be removed

and made up separately, a slip must be inserted in its former place to explain its removal; and another slip will be attached to the document explaining where it came from.

(d) where one or two papers only are considerably larger than the others, and it is not considered desirable to separate the items, then consideration may be given to have the larger paper or papers folded and filed within the group. It must be ensured, however, that the folded edge is kept well within the outer edges of other papers.

The *third* step is to have the papers knocked to head and fore-edge. This is best done by placing papers in between two slightly over-size and pre-squared boards and firmly held by both hands for knocking the papers to lie flush with the boards.

The *fourth* step is to cut a board for the preparation of a template. The height of the template will be the same height as the largest document. The width will be determined by the widest document plus 3cm., required for the minimum swing on the guards, and a further 3cm., for the placement of the packing strips and binding edge. The template is marked accordingly, and used as a guide for cutting the guards and for the placement of the packing strips.

The *fifth* step is to cut guards to the appropriate size or sizes. The guards will all be of the same height, the width will vary according to the width of the papers. The guards are then stuck on the papers and any portion of the guard that projects below the foot of the paper is tapered off.

The *sixth* step. When the guarding and trimming are completed the papers are placed in a filing-frame, beginning with the last paper in the series to be filed, one by one, remembering to stagger the papers to avoid a build-up of double thickness. Nonetheless there will be a slight swelling and therefore packing strips are cut and added to compensate, so that the building of the file could end with a compact even mass. Holes are then drilled through the guards and the packing strips for a temporary sewing. The surplus material on the guards that project beyond the binding edge and the packing strips are then cut in a guillotine.

The *seventh* and the final step in the process is the preparation of the cover boards and drilling holes on to them corresponding to the holes on the book block for the final sewing.

Guarding and filing of the Norfolk Island papers

The following case history describes the treatment of one of the volumes of the Norfolk Island Papers in the holdings of the State Archives of New South Wales, Sydney, Australia.

The Norfolk Island Papers comprise of letters, papers and returns of settlers, convicts and other inhabitants showing the ships they came by, date and place of their conviction and their sentences; and an account of land in cultivation and stock and grain in their possession. Because of the value and importance of these papers, they were secured by having them mounted on to a blank book made up of cartridge papers.

However, most of the papers in the volume were found to be in need of treatment and the cartridge paper, on which the papers were mounted, was itself acidic and the pages were in varying conditions of repair. In order to prevent further damage to these papers, it was decided to remove them from the volume and have them treated and preserved by guarding and filing.

Fourtunately, most of the papers in the volume were held to the cartridge paper supports by narrow thin paper hinges affixed to the left hand edge of the reverse side of each item so that there was no difficulty in removing them from their supports. Each sheet was held firmly with the hand and was pulled out. Any remaining portion of the hinge adhering to the edge of the paper was sponged out lightly with warm water and removed.

Nonetheless, there were some papers which had undergone previous repair and as a result the text was obscured. These repairs were easily undone as flour paste had been used to effect them. There were also a few papers which had been repaired with cellulose adhesive tapes. The tapes were dislodged using toluene and the surface traces of adhesive were swabbed off with the solvent.

The extraneous materials from the papers having been removed, the papers were photocopied to provide a reference copy for use in the Search Room.

The papers were then checked for pH since the value of the papers indicated that it should receive maximum protective treatment. A number of sheets were subjected to the test using Metrohm pH Meter with a flat-head combination electrode. The pH Meter was standardized with pH buffer and although the pH readings for the papers varied, they were all

below pH 5.5. This confirmed our suspicion that the papers were in need of deacidification.

In spite of age, the sheets were in fairly good condition. The ink was also fast and it was therefore, decided to have them deacidified in an aqueous deacidification solution of calcium bicarbonate and magnesium bicarbonate.

A solution of calcium bicarbonate and magnesium bicarbonate is prepared by passing carbon dioxide for two hours through a mixture of calcium carbonate and magnesium carbonate in water. When the undissolved particles have settled, the clear solution is decanted for use.

The sheets were soaked in the solution overnight. The next morning they were removed and air dried by hanging them on cloth lines. This effectively neutralizes the acid in paper which then becomes alkaline. The treated papers were checked again for pH and the recording of pH 8.5 to 8.7 confirmed that the acid had been neutralized.

The papers were then gathered and checked for order. Tears, lacunae and weakened fold and edges were repaired by the traditional method, using handmade paper and methyl cellulose as adhesive. The papers were pressed after repairs. A paper with writing on both sides and requiring extensive repair is normally lined up with gossamer nylon on one side, laid down on a terylene covered perspex sheet and repaired. The papers repaired in this manner would dry flat and no pressing would be required.

After repairs, the papers were re-gathered, they were knocked to head and fore-edge in order to determine the size of the file and also the guards to be cut. The longest and the widest papers indicated that a file measuring 51 cm. x 41 cm., be required.

A template was then cut 51 cm. x 41 cm., wide and marked with the distances for the widest document, the minimum swing required for the guard and the positioning of the packing strips for drilling sewing holes.

For guards, 32 lbs. Handmade Paper was used. They were cut to appropriate sizes, using the template as a guide, and applied to the papers. Guards projecting below the foot of the paper and also those projecting above the head of the paper were tapered off.

The template was then aligned in the filing frame and the papers were placed in it one by one. The papers were staggered as necessary and packing strips 3 cm. wide with the same length of the guards were cut from

acid-free bristle boards and positioned within the area marked on the template. This is essential to even-up any swelling that may build up in the centre because of too many papers of double thickness. On completion, the packing is checked to see it has not moved during filing. A board was laid on the top, marked and seven holes were drilled and a temporary sewing was applied. The surplus materials of the guards were then marked and cut by a guillotine.

A buckram covered file cover was then made. The buckram used is Red Bridge Arbelave Buckram and the boards were cut from acid-free Archivart Supreme Binding Boards. Mowilith acid-free adhesive was used for coveri g the boards.

The oards were cut 5mm. larger than the book block at the head, foot an fore-edge. Two strips, 3 cm. wide were then cut from the back edge of the boards to form the flanges. A further two 5 mm wide strips were then cut away from the boards. These narrow strips were used as a guide in order to form a joint between the main boards and the flanges. These two strips were removed after aligning the boards.

The buckram for covering was cut 3 cm. larger than the board at the head, the foot and the fore-edge but 10cm. larger at the back over the flange. The buckram was pasted down and the boards were then covered. This done, the inside of the boards were lined with acid-free end papers. They were boned and nipped in the press.

For the spine, a 3cm. wide strip of board, the same length as the main boards, was cut separately. A piece of buckram was cut 3 cm. larger at the top and bottom of the board and 3 cm. wider at its sides. The strip was pasted and laid in the centre of the piece of buckram. The buckram at the top and bottom was pasted and folded over the board, boned and nipped in a press.

The cover boards and the spine, after gold blocking with the title, were marked, and holes were drilled corresponding to the holes in the book block. The coverboards and spine were then attached to form the file.

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Materials and Equipments for Restoration of Documents

Y. P. KATHPALIA

Introduction

A number of processes for restoration of documents are in use in Archives all over the world. I had conducted a survey of facilities in Archives on behalf of the International Council on Archives (ICA) and UNESCO which was published by UNESCO in 1978

RESTORATION PROCESSES

The various processes in use can be classified under two broad categories:

(a) Traditional processes, and
(b) Modern processes

Traditional methods

The traditional processes viz repair with (i) tissue paper, (2) chiffon (Silk) and (3) hand-made paper respectively have withstood the test of time. Their efficacy depends upon the experience and expertise of the restorer. Some of the restorers working manually indeed turn out work which are exquisite and can be described as pieces of art. It is a joy to see them work. I have had the privilege to see such work in a number of countries

These processes, however, are laborious and timeconsuming. As such they cannot meet the requirements of the present-day Archives where most of the holdings need attention In some cases as much as 60% to 70% of the entire collection is in an advanced stage of deterioration and require urgent treatment

Lamination

To quicken the pace and also to improve the permanency and dur bility of a document, newer processes have been developed. Notable these have been the lamination techniques both mechanical and manua The latter is popularly called solvent lamination or the Indian proce of lamination, is a contribution of Indian expertise. The present speak is proud and privileged to be associated with its development and use ov the years and has successfully introduced it in a number of countr right from Latin American countries in the West to Indonesia in the Ea Fiftysix institutions in 34 countries use this process of restoration documents.

Machine lamination during the past few years has come into disrep mainly because of the observation in the Library of Congress in the Unit States of America. In some documents they have noticed that the writi has become unreadable because of the cracking of cellulose acetate fil This, in my opinion, is due to the improper use of the techniques of la nation and deacidification and also use of inferior quality of cellul acetate films. There is no documentation regarding the deacidificati done or the process used for the same as well as of pH of the paper pr to or after deacidification. It is well known that deacidification is a m and that it should be controlled. Higher values of pH are as destruct of paper as the lower ones.

It is thus essential, not only to use deacidification techniques with c and under controlled conditions but also to standardize them and k a complete documentation of the work done and procedure adopted. A it needs evaluation over the years.

All these aspects one feels are neglected in almost all the Archi the world over. Those institutions who have technically qualified pers manning the laboratory should be the ones to conduct such studies a maintain data/documentation. For this it may be necessary to consi reallocation of duties. Such persons i.e., chemists and others having scie qualifications should be entrusted with these jobs and relieved of rout administrative work which can be handled more efficiently otherwise.

Encapsulation

Besides lamination, other processes that have come into use encapsulation and leaf-casting. Encapsulation is dangerous at least countries having tropical and subtropical climate. Here the documen sealed by static electricity. So if the deacidification is not proper and

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It is thus essential, not only to use deacidification techniques with care and under controlled conditions but also to standardize them and keep a complete documentation of the work done and procedure adopted. Also it needs evaluation over the years.

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Encapsulation

Besides lamination, other processes that have come into use are encapsulation and leaf-casting. Encapsulation is dangerous at least in countries having tropical and subtropical climate. Here the document is sealed by static electricity. So if the deacidification is not proper and also

the storage facilities are not as required, it can lead to disintegration of the documents Such fears are not false. I had voiced them as back as 1980. A second thought is being given in U S.A.

Leaf casting

Leaf-casting is based upon the techniques of the manufacture of paper. It is a process that strengthens a document. Its use is, however, limited to documents that are printed or are in ink which is not labile. It is not suitable for documents in an advanced state of deterioration, due to pollution and fungus attack. There are instances of documents restored by this process, where the reinforced fibres have come off from the lacuna filled portion of the document because of improper sizing.

This process requires thorough knowledge of the restoration work knowledge of chemistry and mathematics to achieve proper backing.' Besides, pulp of highest purity is required for the purpose. It is here that future restorers can look to the use and help of computers

To sum up, each archival unit should have facilities for traditional work and an open mind to use the modern techniques, specially the one I advocate, the solvent lamination technique because of its proved efficacy and limitless use and variation of application.

Role of chemist

Also such a unit must have a chemist for preparation of solutions. This work looks easy and the tendency is to entrust such work to assistants. Other techniques that require attention are deacidification and fumigation. These must be conducted by the chemist under controlled conditions. He should also maintain complete documentation. Constant monitoring should be done to notice any change in behaviour pattern of the restored document and also of paper in custody. Herein lies the importance of training in an archival institution having modern facilities for conservation and testing.

Materials

Some of the materials required have become standard because of use over the years.

For traditional processes these, besides restorers and binders' tables, hand or nipping presses are:

Tissue paper,
Chiffon (silk) very costly these days,
Handmade paper,
Paste flour/starch or the one made from C M C and modified for tackiness.
Cellulose acetate film.

For modern techniques the materials required are:
Tissue paper,
Acetone for the solvent lamination technique,
Pulp for leaf-casting,
Poly-vinyl acetate emulsion; and leaf-caster.

For deacidification with aqueous, non-aqueous and gaseous (ammonia process):

Universal pH indicating solution, a paper for measuring pH and monitoring the same. A pH meter should be had only if facilities for research are available or desired and also persons with post-graduate degree of chemistry i.e, science are available

I would be happy to help those who wish to have specialized equipment to meet their individual needs Most of the equipments and materials can be seen while you visit the National Archives of India, who have a set of specifications of the materials used therein.

Caution

A word of caution. The materials used for restoration work must be durable and permanent. They must not harm the keeping qualities of the document or interfere with its originality. I have come across instances of use of substandard materials for restoration work in a number of countries. Among such materials used are cellulose acetate film, tissue paper, hand-made paper, adhesives and chemicals which are not what is on the labels fixed on the containers.

The efforts of each Archives should be to use standard materials for which specifications have been laid and not to be tempted by newer and untested materials. Remember archives are unique and more often than not, only single copies are available.

Finally developing conservation facilities require thoughtful planning and expertise based upon practical experience Restoring documents is not be all and end all. Their behaviour under use and storage and keeping qualities have to be constantly monitored.

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Restoration of Fragile Documents

AVINASHI LAL

Introduction

REPOSITORIES are faced with the country's most astounding problem—the fragility of their collections. A document on paper is hardly to last for the next century if produced somewhere in the middle of this century. An examination conducted by W J Barrow's Laboratory of the publications between 1900-1949 indicated that by 1960, 57% had reached restoration category i.e. folding strength less than 10, and pH about 5. We thus come across the gigantic problem of their restoration.

The basic cause of brittleness of paper is due to high acidity, use of short-fibre impure mechanical wood pulp, bleaching, loading and filling materials, all adopted during the manufacturing process, over which a restorer has no control. He has thus to fight and correct the imbalances created to kill the paper at the time of its birth. Paper, however, also develops brittleness due to environmental pollution.

Preventive restoration

While dealing with the fragile documents the first and foremost consideration is the state of brittleness a document has reached. We know that the acid of the paper hydrolyses the cellulose molecule at the glucosidic linkages making the fibre length shorter and consequent brittleness. Papers which are reasonably strong and whose pH is about 5 5 can be washed in warm water. This removes about 90% of the acid and also degradation products. The process makes the hydrolysed glucosidic linkages free. These free ends of the partially damaged cellulose molecule, while drying develop cross linking and re-establish a longer molecule than before. The process imparts permanency to paper. It is more suitable to papers which are relatively strong, apparently not decayed and have pH between 5.5 and 6. Papers which have high mechanical wood pulp, highly decayed and have water soluble ink cannot be treated in this way. The above treatment if

followed with alkaline treatment will enable the paper to combat with the residual acid and atmospheric pollution.

Slightly more weak paper, but preferably not the newsprint, treated in the above way, deacidified with calcium hydroxide and calcium bicarbonate can be further strengthened by sizing with gelatin, starch, carboxy-methyl cellulose, polymethyl acrylate or any other suitable sizing material. Sizing consolidates the fibres

In case the documents have water soluble ink the restorer has to use his skill and knowledge for deacidification Examination and prior documentation of each document are essential, and a photograph of its original condition before treatment may be kept

Pre-restoration considerations

Restoration is a process aimed at adding permanency and durability to any document. It is the ingenuity of the restorer to adopt or even invent a suitable technique for restoration. In fact each document is a different individual and its problems should be cared accordingly. Several methods have been evolved, but the restorer has to choose and even modify them according to the need of the document, quantity of material to be restored, and use of the document and available resources

Removal of the degradation products and cause of decay i.e. the acid, is the primary concern and a restorer has to choose a proper method of deacidification (e.g. calcium hydroxide and calcium bicarbonate, magnesium bicarbonate, magnesium hydroxide; magnesium methoxide, barium hydroxide tetra-hydrate, ammonia and diethyl-zinc) The latest technique to deacidify the document in bulk with diethyl zinc, as soon as cleared by the researchers will go a long way to combat this problem. The substitution of the diethyl zinc at the hydrolysed bond positions blocks further breaking down of the cellulose molecule and creates permanency with the bridging up of its broken link

Selection of materials

Choosing the right type of material for reinforcement is vital to restoration. Apparently it may appear that any paper, adhesive, board, cloth, film, chemicals or even the thread etc may be used in restoration, but their intrinsic properties may be harmful or not compatible with the paper or the type of use a document will be put to or the method of its storage. Standardization of materials to be used for restoration has been done and recommended, still it needs care and insight in their selection and use

Restoration's another very important consideration is the maintenance of the originality. In fact it is an illusion, that anything will become original after treatment or restoration. In fact it never happens, but we may make it or rather imitate it to look like original. Here it is always the consideration of a conscientious restorer to adopt reversible processes.

Orthodox methods of restoration

Restoration is not a new innovation. The need has always been felt and several methods have been adopted according to the need of the documents. These methods have stood the test of time, if the selection of repairing material has been done judiciously. Some common processes may be mentioned as, full-pasting, inlaying, photo-mounting, repairing with fine tissue paper, repairs with chiffon, and guarding etc. In all these methods, the reinforcing materials should have permanency and should not be acidic. Their properties should have compatibility with the properties of paper, to avoid strains during natural expansion and contraction.

Recent developments in restoration

Our present knowledge of the nature of paper and related materials and also the modern technology has helped to evolve new methods of restoration during the past fifty years. These are now used extensively for restoration. Some of these are discussed below:-

Lamination:- Fragile documents after deacidification are heat sealed in flat bed or roller press lamination machine with thermoplastic films, with or without tissue paper. Most commonly used films are cellulose triacetate film or polythene film. Cellulose acetate film in combination with tissue paper is preferred because its properties are more close to the paper. It is soluble in acetone and thus the process is reversible. It is colourless and transparent and is available in very thin film. The lamination is done at 300-F temperature at a pressure of about 1000 lb. per square inch. The film melts and goes into the fibres and also binds the tissue paper with the document. The resultant product is clear, strong and also impervious to the detrimental atmospheric pollutions. It also has the advantage that water soluble ink is not affected.

National Archives of India, New Delhi, modified the above process by use of acetone as solvent process which does not require cumbersome machine and equipment and can be adopted in any situation if the ink is not affected by acetone.

Transparent polythene film of about .03 cm thicknesss are also used

for lamination by heat and pressure with or without tissue paper. The reversibility in case of polythene film is a bit difficult. Polythene softens at about 100°C to 120°C and therefore, delamination can be done only at that temperature in decalyne or mineral turpentine. Polythene is lighter than cellulose acetate and the product is more flexible. It is more abundantly available and is cheaper by about ten times than cellulose acetate film.

Encapsulation: In case of heat lamination the desirability of high temperature and pressure to which a document is subjected is questioned. It has, therefore, been suggested that wrinkle resistant inert, transparent and having high tensile strength polysterene film be used. This film is made to adhere electrostatically on both the sides of a document. The air is eliminated by applying pressure over it moving side ways. The document is sealed from all sides with double adhesive tape. It has been found that document with folding strength less than even one can be strengthened and even rolled. The reversibility of the document is complete. Process does not require any machinery or equipment and is easily adoptable.

Leaf Casting :- Leaf Casting is miniature paper manufacturing. In a small machine cellulose fibres in suspension with some sizing material is used. Document desired to be strengthened is placed at the bottom over which the suspension is stored. A vacuum is created below the document which makes the fibres to settle in the holes, broken corners and edges. The method although simple needs elaborate machine and is more suited to the documents where edges are broken. Matching of the colour of the suspension with paper gives good finish.

Splitting the document :- In case where damaged paper can be split into two in thickness, a strengthening leaf can be introduced in between In this case the originality of the printed or written material is not disturbed and adequate strength is imparted to the document.

Special problems

Although a general outline of restoration can be prepared for most of the documents, some cases by virtue of their special format or nature of decay need special considerations.

Old repairs :- The documents which have earlier received restoration after a lapse of time require rectification. The documents in such cases are extremely individual and need to be examined about the nature of earlier restoration and the decay it produced. Various types of tapes, adhesives, stains, preservative mixture and chemicals, acidic papers and even storage

conditions need to be considered and examined. Treatment to rectify their effects precedes the actual restoration.

Maps and prints :- Use of maps and prints makes the approach of their restoration quite different. It has been found that large maps have invariably been treated with shellac to protect their surfaces. Shellac, however, imparts brittleness to the paper and therefore, it must be washed off with a solvent. Maps and prints should be deacidified and should be mounted flat to store them like that. Fine muslin cloth may be used for mounting. A specially prepared nylon-web coated with polyvinyl alcohol is also in use for mounting. This material can be laminated on the back at 60°C.

Damage due to water :- Water soaked document is extremely weak and breaks easily. Water damage which is mostly due to leaking roof, fittings or fire fighting should immediately be attended. The document should be separated while wet and allowed to dry. Restoration should follow as soon as the document gets dry and is free from infestation after treatment with a suitable fungicide

Burnt or Charred Document : Charred paper is very brittle and must be handled very cautiously In case it can withstand some pressure it should be laminated immediately by solvent process. If the paper has become too dark that it cannot be read, photographic reproduction in infrared radiation is the only alternative

Conclusion:- Restoration is not simply a technique or science, but it is also a way of perception of feeling the pains of the decaying documents which must be taken as adopted children for proper care. It will never be possible to attend to restoration if we cannot realize the needs of the documents and how they can be salvaged

I owe my gratitude to the Director, National Library, Calcutta, who so kindly gave me this opportunity to present this paper before you.

AVINASHI LAL, Deputy Librarian,
National Library, Calcutta

Polyester Film Encapsulation— A Restoration Technique

JOHN DAVIES

Introduction

ONE of the recent developments in conservation of records is polyester film encapsulation. The technique was first developed in the Library of Congress of the United States of America in the early 1970s. It was developed as an alternative to cellulose acetate lamination because polyester film would seem to provide greater and more permanent protection to documents than cellulose acetate lamination.

In encapsulation, the document is held in a sandwich of clear, inert polyester film. The edges of the sandwich are held together by double-coated pressure sensitive tape. No adhesive touches the document which is held in place by static electricity. Unlike lamination, no heat or pressure or solvent is applied, and the process is immediately and completely reversible.

Materials for encapsulation

Polyester film is sold in rolls of various widths and lengths. The film may also be purchased in sheets, cut to required dimensions. It can be obtained also in various thicknesses and the most popular thicknesses being 3 mil, 4 mil and 5 mil. The film has a certain degree of static charge, especially the thinner film, which helps to hold the document in place within the enclosure. Thus prior repair to documents with minor tears is not called for unless fragments of a document are to be put together in encapsulation or when large tears are present in the document. However, the static charge that accompanies the film has certain disadvantages with documents characterized by flaking layers of paints, pastels, charcoal and other loosely bonded media. The film has a tendency to lift off particles of loosely bonded matter within the enclosure.

The double-coated pressure sensitive tape, used for sealing the edges of the sandwich, consists of an acrylic resin coated on both sides of 0.5 mil polyester film. 3M Scotch Brand Double-coated Tape No. 415, 6 mm wide by 33m long, is widely used in conservation laboratories. The tape is stable and although there is no evidence of any migration between tape and the encapsulated paper, care should be taken to ensure that the adhesive does not come into contact with the document. The tape should be applied leaving at least a margin of 4mm wide on each side of the document. Machines have recently been developed that join the polyester film sandwich without tape. These machines are expensive and therefore, not widely used. They are more likely to be purchased and used by larger institutions.

Polyester encapsulation should not be performed on a document unless there is a specific reason to do so. In large quantities, the film can add considerable bulk to a collection and its glossy appearance might be objectionable. However a document that is in need of physical protection because it is fragile, brittle or is subject to heavy use may be encapsulated.

It has been firmly established that for permanent preservation, it is essential to neutralize the existing acidity in paper documents and leave an alkaline buffer on it to prolong its life, regardless of whether it is encapsulated, laminated, boxed or put in a folder. Therefore, documents which are designed for indefinite retention should be deacidified and alkalized before encapsulation.

Encapsulation is a widely applied simple conservation technique requring only inexpensive materials and tools. Moreover, encapsulation can be carried out by relatively inexperienced personnel. Its use can range from phased protection to more permanent archival preservation.

Encapsulation procedures

The following instructions are general directions only and should be modified to meet specific requirements:

Equipment and Supplies:

1. A large piece of plate glass with a graph paper taped underneath it.
2. Document trimmer.
3. Scissors.
4. Scalpel or knife.
5. Blotting paper.
6. Window cleaning squeegee.

7. Corner rounder.
8. Lint free dust cloth.
9. Polyester film (3mil, 4 mil and 5 mil).
10. Double-coated Tape (3M Scotch Brand Doublecoated Tape No. 415).
11. Weight.

Operating Procedures—Typical Sequence

Documents which are designed for indefinite retention should be deacidified and alkalized before encapsulation.

1. Place the document on a clean surface or on a piece of blotting paper and remove loose dirt and dust with a lintfree dust cloth.

2. Cut two sheets of polyester film at least 3cm larger than the document on all four sides.

3. Place one sheet film on the glass or flat hard work surface and wipe over it with a lint-free dust cloth to remove dust. This will create a static charge which will adhere the film to the work surface.

4. Place the document on the film, and centre it leaving an adequate border on all four sides of the document for the double-coated tape and weight it down to keep the document in position. See Figure 1.

5. Put down the double-coated tape to the film, leaving a 3mm margin on each side of the document. The ends of the tape should be cut square and butted on three corners with no overlap. A gap of at least 2mm should be left at the fourth corner for air escape. Leave the brown protective paper on the tape. See Figure 2.

6. Wipe the second sheet of film with the lint-free dust cloth.

7. Remove the weight from the document and place the second sheet of film over the document with the cleaned side facing down on the document.

8. Replace the weight on the centre of the pack.

9. Remove the paper backing from the tape. Reach under to top sheet of film and carefully peel the brown protective paper from the tape on two sides of the sandwich. See Figure 3.

10. Repeat step 9 on the other two sides. See Figure 4.

11. Use the squeegee to seal the tape and remove air from the sandwich, working towards the air gap left in one corner of the tape border. See Figure 5

12. Roll the brayer over the tape to bond it firmly to the film. See Figure 6.

13. Trim the sandwich, leaving a margin of 3mm outside the tape on all four sides of the sandwich. This will prevent the edges of the tape from picking up dirt. See Figure 7.

14. Round the corners of the sandwich. This will help prevent scratching or cutting during handling. See Figure 8.

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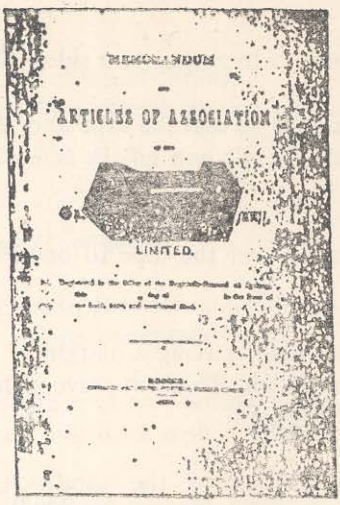

Figure 1 : Positioning document in the centre of the film with weight on top of it to prevent movement

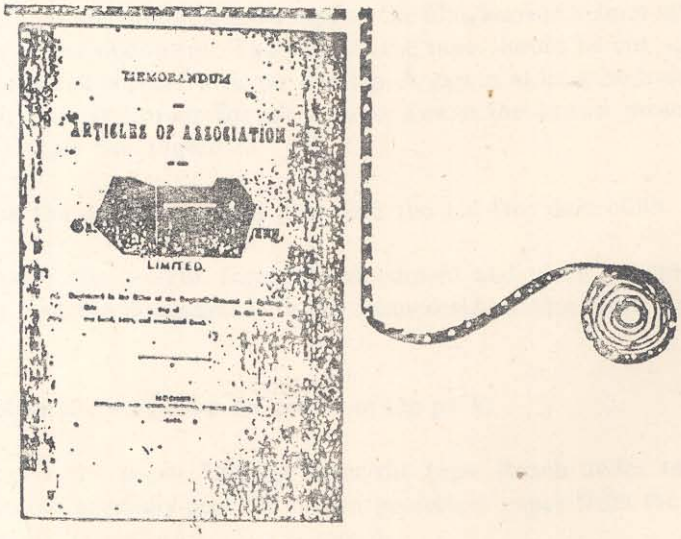

Figure 2 : Placing tape leaving 3 mm distance between the document and the tape.

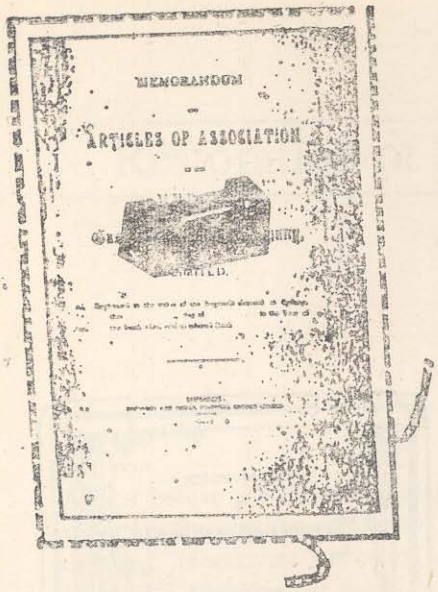

Fig. 3 : Removing backing from the tape on two sides of the document

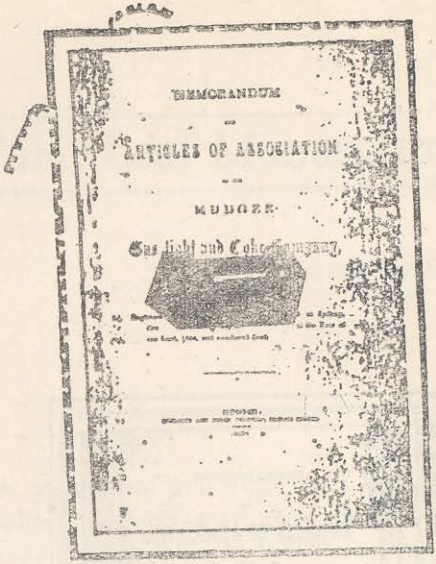

Fig. 4 : Removing the backing from the tape on diagonally opposite corner

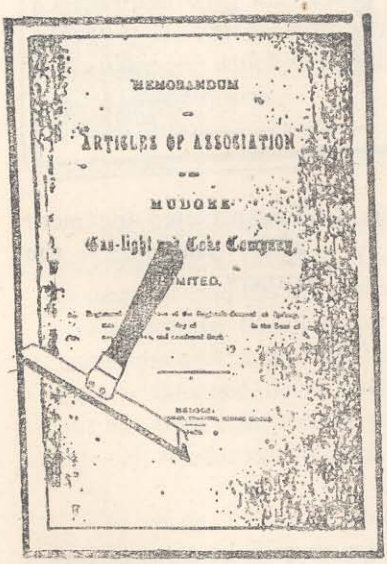

Fig. 5 : Removing air from the sandwich using a squeegee

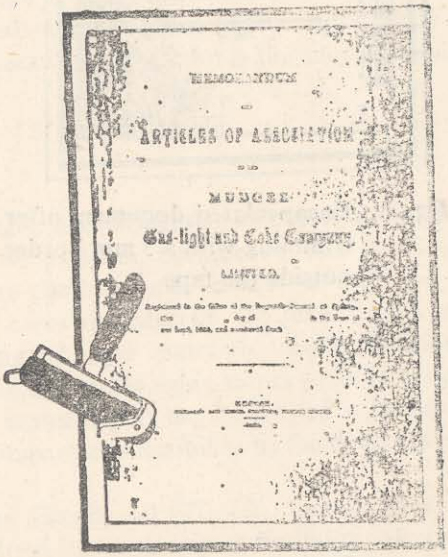

Fig. 6 : Rolling the brayer over the sandwich for affixing the tape firmly to the film

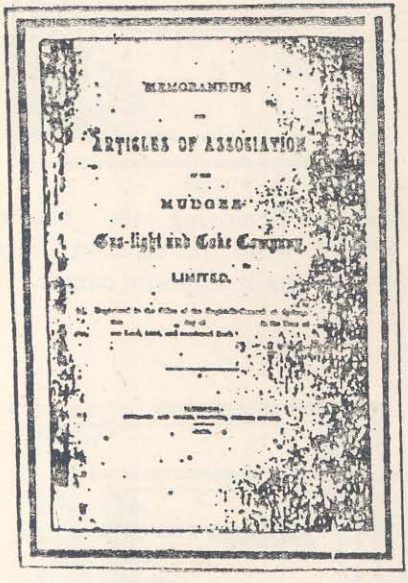

Fig. 7 : Encapsulated document after trimming with a 3 mm border outside the tape

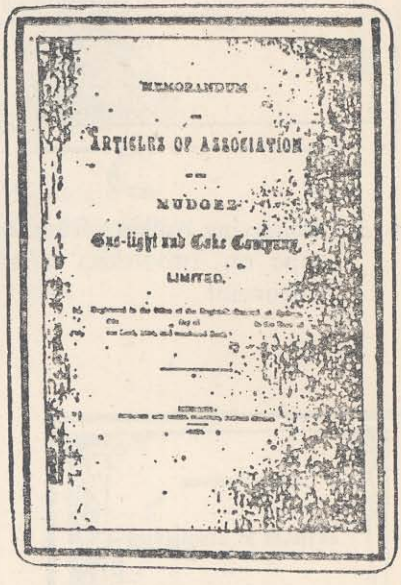

Fig. 8 : Encapsulated document after rounding the corners

Restoration of Palm Leaf Manuscripts

RANBIR KISHORE

Introduction

MUCH before the advent of paper, palm Leaf and birch bark had found their use for writing, and a vast collection of manuscripts of historical and cultural importance on palm leaves are available in Indian repositories, museums, libraries, as well as in many like organisations/monasteries in South East Asia (Thailand, Sri Lanka, India, etc.).

The chief constituent of the leaves and bark is unmodified cellulose, which is coupled with glucosides, gums, resins, pigments and essential oils. With the passage of time these non-cellulosic constituents evaporate or degrade with the result that the leaves/bark material becomes brittle and fragile. Further these materials are also damaged or eaten away by insects among which Gastrallus Indcus (Book beetle) is the most voracious feeder of cellulose.

Restoration

Restoration of the weak, fragile and disfigured manuscripts on palm leaf/birch bark presents a difficult problem, because of their thickness, presence of nodules etc. which are characteristic features in such raw natural materials. In most of the cases the edge of the manuscripts start crumpling and make the handling of these materials unsafe. Reinforcement of damaged, dried leaves with silk gauze using starch paste (a process that has been adopted for paper manuscripts) has been tried with success but such reinforcement does not impart any flexibility to the dried leaves.

In many Indian repositories Gingili oil (Til oil), Lemon grass oil had been used for smearing the dried leaves to impart flexibility. However, there seemed to be no regular study to confirm if such treatment could achieve the desired objectives. Polyethylene Glycols were tried with success in some European repositories, but such treatment was observed to leave a tarnishing effect on the leaves and impaired the visibility of the writing.

In preliminary experiment undertaken in the National Archives of India it has been observed that the use of diethylene glycol, glycerine, saffrol, olive oil, lemon grass oil, as also dried Linseed oil diluted with alcohol add satisfactory flexibility to the dried leaves since the absorption of these various formulations vary from 42% to 67% and the treated samples initially show a very high folding endurance. (over 500 d'lb. folds at 1 Kg.) It was, however, observed that on drying for over 30 to 45 minutes at room temperature again show a gradual fall in folding endurance Though the investigations are still in progress yet it seems that before reinforcement of dried palm leaf manuscripts is taken up, it may be desirable that they be given an immersion/brush treatment either in a solution of glycerine, or diethylene glycol, to induce flexibility. Silk gauze with starch paste or tissue paper with C.M.C. paste or an acrylic adhesive could satisfactorily be adopted for such reinforcement. Tissue paper coated with 5 to 10% poly-vinyl acetate in benzene has been also found satisfactory for reinforcement of palm leaf manuscripts. Enveloping the palm leaf in polythylene/ polypropelene film after it has been treated with diethylene glycol or glycerine has also been tried with satisfactory performance. While applying these treatments only those manuscripts where the ink is not smudged or smeared in the respective chemical could be safely processed. In other cases ink/pigment etc. may need protection with a suitable emulsion (methamethycrylate has been satisfactory for this purpose).

Conclusion

Recently some experiments were also tried to reinforce brittle palm leaves by giving them a fine cellulose layer in a Leaf Casting machine. The initial results have been encouraging though further work continues.

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Repair and Restoration of Illuminated Manuscripts and Miniatures

A.S. BISHT

Introduction

A large number of illustrated manuscripts and miniatures are housed in museums and manuscript repositories in India. Illuminated manuscript is not only a mere written document on paper but it is a painting in addition. Miniature paintings are a stratified structure of one layer over another and therefore, the paint has some thickness. In case of a simple document or a manuscript, the ink is partly absorbed by the paper carrier and to some extent we may state that it becomes part of the whole assembly. There is, therefore, a difference in the structure of a simple document and an illustrated document or a miniature and consequently their deterioration differs in nature. Methods of repair and restoration suitable for a simple document may, therefore, not be fully applicable to an illustrated document or minature and vice versa.

Technique

Broadly speaking, most of the illuminated documents and miniatures have a structure mentioned below with slight modifications and changes here and there depending on the period and school they belong to:-

1. Paper or paper board,
2. Rough drawing in Indian red or Indian ink,
3. Ground mixed with a vehicle, though this layer is sometimes not present in some early miniatures and illustrated documents,
4. Final drawing,
5. Paint layer,
6. Final outlines and decorations to highlight the details,
7. Painting of the borders and calligraphy.

Thus, the miniatures and illustrated documents, have a structure of

complex nature in which the layers of different material stay in position due to some inter-relationship or adhesion between the various component layers. Hence the defects also vary in nature and these could be in any of the layers.

Defects

(a) *Defects in the support or carrier* :- The paper support develops acidity, it becomes yellowish brown and brittle due to atmospheric pollution in conjunction with humidity or due to poor quality of paper itself. Perforations may occur at places where the colour used develops acidity because of some inherent compositional defect. It has been studied that wherever *Verdigris* has been used, such a deterioration has been noticed. Paper is also affected by biological agencies like fungus, mold and insects making it more porous, spongy and disfigured as it provides enough food for insects. Different layers of paper support, in case of miniatures, may become loose due to weakening of adhesion as the binding qualities of the adhesives used to hold the layers together are affected.

Paper also develops foxing marks, stains of various nature and water stains. Accidental wear and tear and at times use of faulty materials for repair aggravate the situation further. All these defects make the old paper miniatures and illustrated documents difficult to handle for study purposes or for display because a slight rough handling would be fatal for their survival. Hence, mostly such objects of art are found in a poor physical state and many of them have been lost in the process in the past.

(b) *Defects in the ground layer* :- The defect in the ground layer may result into loss of adhesion with the paper on one hand and the paint on the other. Due to this, the detachment of the various layers either in patches or on a large scale happens. The medium in the ground being water soluble is affected by the variations of the relative humidity and temperature.

(c) *Defects in the paint* :- In the paint layer defects like fading of colours, loosening of colours, cracking and flaking of colours and detachment of the entire paint layer either in parts or as a whole occurs mainly because of the changes of the relative humidity of the environment in which these objects are kept. Frequent high and low humidity affects the adhesion power of the medium in the colours. Because of the layerified structure of the paintings the movement of the various layers, due to the changes of relative humidity, is not the same in the different layers and therefore, the paintings suffer a rupture in the structure resulting into loosening of decorations and even of the various components of the paint layer.

From this it would be seen that the deterioration of illustrated documents and miniatures is a complex problem and needs all possible care while deciding for their conservation or even for their proper handling.

Treatment

Because of the defects detailed above these paintings and illustrated documents need continuous repair and restoration in order to keep them in good state of conservation. Before attempting the actual repair or restoration these are subjected to scientific examination and the findings are recorded in the form of a conservation report. Next step is to chalk out a scheme for their repair and restoration. The undermentioned steps are taken up to achieve this task.

Preservative Coatings :- Due to high humidity and other physico-chemical degradation the colours become loose as the adhesion power of the binding medium or vehicle is reduced and it cannot hold the pigment particles with the same adhesion as earlier. Hence the material like 0.5% to 1% Methylmethacrylate or 1% to 3% polyvinylacetate in a suitable solvent are introduced by brushing or spraying in most of the cases. These preservatives impart binding power to the partly loose colours and also make them moisture resistant for future.

However in the case of the lac dye used in some early manuscripts which could not be fixed by the above usual preservatives, the fixing is done with a 1% solution of sandofix, a product of calico Industries. In addition to the above mentioned fixative, a solution of sodium chloride is also being used to fix some dyes. Weak solution of acetic acid is also used for this purpose at times.

Neutralization of Acidity :- The deterioration due to acidity is two-fold. First is the general acidity of paper and the second is the acidity due to the use of some pigments which turn acidic with time. In such cases deacidification is done. The procedures are of two types—Aqueous or non-aqueous. Basically for deacidification presence of moisture is necessary and the question is whether it is to be used liberally or on a restrictive basis. Sometimes only plain water and at other times solution of 5 to 10% calcium hydroxide or magnesium bicarbonate or calcium bicarbonates is used. These methods are useful if these do not have any loosening effect on the pigments even after fixation. These solutions may be used either by a brush or as a spray and they prove effective. But at times it is not possible to use them and non-aqueous method using 0.5% barium hydroxide in methanol is used or fumigation with ammonia is done.

Removal of Stains :- The stains are either of organic nature or inorganic in composition. Sometimes these are micro-biological. Methods are adopted by which the stains can be removed or minimised without affecting the paint. Water stains can be reduced by using mixture of water and alcohol. Stains of grease-oil can be removed by organic chemicals like benzene, trilene, cellosolve, ethylene di-chloride, etc. The treatment for removal of stains is always local and it is necessary to know when to stop. For removal of foxing and other such stains some bleaching materials are used. Hydrogen peroxide, sodium hypochlorite, sodium perioxide are used with skill and care. As these solutions are aqueous in nature, methods are adopted when these are used alongwith rectified spirit. The action is slow but may be controlled and a skilful worker knows how far to go. It is also seen that these chemicals are completely removed after their use and do not have any effect on the paint or the dye on one hand and the medium on the other.

Removal of old ugly Repairs :- Very often, it is found that the paintings have been repaired by giving paper patches cellotape and other similar material just to keep the painting in a manageable condition without much knowledge about their deteriorating effect on the original paintings. Harmful adhesives have also been used. According to the modern science of repair we should not introduce or use any material unless we are able to undo it, if needed, without damaging the art objects and it should not have any harmful effect on them or the chemicals used to remove the repairs should not have any effect on them. First of all it is necessary to know the nature of these adhesives that have been used and their solubility and also the effect of these products on the paint. The nature of the softening agent would depend on the adhesive used which are either water soluble or soluble in organic chemicals. The best is to use chemical-mechanical method by which we soften the adhesive and then easily remove the old repairs. Glue and gum are soluble in hot and cold water respectively. The modern plastic emulsions would be soluble in alcohol, ethylene dichloride, cellosolve, acetone, etc. The cellotape can be softened with trilene. Some adhesives with cellulosic base are removed with acetone.

After the removal of the old repairs it is necessary to use the material of known composition and maintain their record for the benefit of the future restorers. Care has to be taken in selecting repair material. Tissue paper (Nepalese or Japanese) with long fibres can be used using starch paste or carboxy-methyl cellulose as adhesive as an aqueous method or tissue paper coated with calilak or mowicoll could be used as dry method taking advantage of heat from a small electric spatula or iron.

Mounting on another paper support for strengthening:- Mainly two

methods are available. First is the use of aqueous soluble adhesive like starch paste, carboxymethyl cellulose, etc. Second method is the dry method using polyvinyl-acetate emulsions, polyvinylacetate (Calilak). Nepalese or Japanese tissue paper or chiffon are used for giving a support depending on the individual case. Mostly one layer of this paper is enough or two layers are given and care has to be taken of the text at the back or other details. In such cases either a window is cut in the paper layers or transparent chiffon is used as a relining fabric.

(i) *Wet Process* :- Processes described in the preceding paras are first done, i.e. fixation of pigments, removal of stains, removal of old repairs, removal of acidity, etc. are completed. If the painting needs strengthening, it is kept flat, face down on a glass sheet covered with an alkathene sheet and is flattened by slightly moistening it. The new support is in the meantime prepared separately, of a single sheet or two sheets joined together one over the other with an adhesive. Adhesives like starch paste or C.M.C. are now applied on the back of the paintings with a soft or flat painting brush or on the newly prepared support. This newly prepared assembly is now joined with the back of the painting again using flat soft painting brushes for smoothening and flattening so that there are no ai pockets in between the various layers of paper and the old support. The assembly is now allowed to dry after putting it upside down and the alkathene is removed so that the face of the painting is now exposed and is on the top. The supporting paper layers are fixed by pasting the back of the new support to the smooth unpolished table about an inch all around. The assembly is cut from the table after it has dried completely after 24 hours.

In case there is some text at the back a window is cut on the supporting paper layers before fixing them on at the back. The damaged edges, gaps, etc. are filled by making them with the same tissue paper as used for the back. In cases where chiffon has to be given at the back of the painting, paper strips are used to keep the chiffon and the back of the painting fixed in position. Care has to be taken to keep alkathene sheet in between chiffon and the table when such an assembly has to be dried as described earlier. Even if it is a wet process, yet the wetting has to be minimum as far as possible.

(ii) *Dry Process* :- In the dry process the new support of tissue paper or chiffon has to be prepared first. Adhesives that are used are mowicoll (Poly Vinyl Acetate emulsion) and calilak (Poly Vinyl Acetate). These adhesives upto 5% dilutions can be used for coating on the tissue paper or chiffon to be given as a support and is allowed to dry. It is the advantage of these adhesives that a film is formed on the paper which would

later melt and the precoated paper or chiffon should stick to the back of the painting. This method is very useful on cases where the colours cannot be properly fixed with any of the present day available preservatives or fixatives and a non-aqueous method is the only remedy.

Repair by strips :- Sometimes if there is warping in the *vasli*, it can be stretched by giving paper strips on all the four sides at the back of the warped painting using aqueous adhesives. Very often it is found that the edges of the paintings an damaged and are likely to get damaged further while handling. In such a case special method of providing tissue paper windows on both sides is done using dry method of mounting using Mowicoll or calilak, as adhesives. Tears are also mended by giving tissue paper strips either by dry or wet method.

Retouching :- This is a very delicate point. In the west retoutching of the damaged portions is invariably done in case of oil paintings keeping the medium of the colours to be added different than oil so that these could be located and removed easily if need be. In the case of the Indian miniatures the advantages of not retouching seem to be more than the disadvantages. We, therefore, usually do not retouch except damaged borders or tears and gaps in the centre are tinted to match with the ground showing that the details have been lost and are not reproduced but the damaged areas do not show prominently in the painting. Water colours are used for retouching. The gaps are filled with a thin layer of gosso before retouching.

Keeping in mounts :- It is well known that originally these paintings were either being stored in albums or inside the books as illustrations which now are being kept as loose paintings by the collectors or museums. All sorts of sub-standard materials were used in the past and faulty methods of their storage are being followed. In the National Museum, New Delhi we have devised a special method of keeping each of these paintings in between two mount board sheets one of which has a window to show the painting. The painting is fixed to the inside of the back mount board with paper hinges using mowicoll or photo mounting paste, to keep it in position. A tisue paper is kept over the painting to protect it from dust, etc. and the painting thus remains flat in between these two mounts. The mount board of high quality (all cellulose) is used which is resistant to the biological agencies and the climatic changes.

Preservation by Curators :- All the foregoing methods of preservation can only help in eradicating the past deterioration of these valuable works of art, but their ultimate survival would depend mainly on their proper storage and control of the environmental conditions in future. In fact,

if I may say so, their future would depend on the curators themselves, which they can ensure by adopting proper storage methods, careful handling, periodic inspection of their collections and by the control of the environmental conditions of light, humidity and temperature.

The relative humidity and temperature may be kept at 50% to 55% and temperature at 75°F respectively. The painting would remain safe under these conditions. Same painting should not be kept on display for a long duration and the paintings should be exhibited by rotation. While in display the lighting condition should be just enough or as minimum as possible (50 lux) so as to see the paintings. They should not be brightly illuminated. Colours are affected by the ultraviolet portion of the daylight or fluorescent light and the mediums of the colours are affected by heat that these lights produce.

While in storage the paintings may be kept in between mounts as mentioned earlier and should be stored flat, one above the other in wooden boxes made of seasoned deodar wood. Wooden almirahs are better than the metallic ones as these absorb humidity from the environment under the dry atmospheric conditions inside them and pass on this humidity to the mounts containing paintings which in turn keep the paintings not too dry and *vice versa*. In the metallic almirahs sometimes condensation of moisture also happens which is trapped inside and would damage the paintings stored in them.

A.S. Bisht, Chief Restorer,
National Museum, New Delhi.

Training Requirements for Conservation Personnel

JOHN DAVIES

Introduction

THERE has been a growing awareness in archival institutions for a number of years of the need for training of conservation personnel. The vast collections of earlier records already in varying conditions of repair and the ever increasing bulk of modern records, which are invariably on poor quality paper, make it necessary, if they are to be preserved for future generations, to protect them not only from the changeable weather conditions, chemical and biological deterioration but also from wear and tear they receive at the hands of untrained and incompetent users and from time itself. The condition of materials in the heavily-used archival institutions suggest that time is running out for a significant portion of the collections. However there has been no way of fully satisfying this need from within the existing facilities.

Conservation of archival materials is such a complex and mammoth task that continuing basic and applied research is vital to elucidate the causes of deterioration and to test new methods and materials. The development of standards for treatment and for materials is also essential to promote consistent, high quality work.

Requirements of a conservator

The requirements of a conservator are therefore rather specialised; it is partly academic as well as partly practical or manual. These requirements call for a specialised training course which can combine science and technology. We need many conservators equipped with such qualifications and every archival institution should make an effort to have at least one on its establishment to meet the needs of preservation and restoration of its collection.

There is a dire shortage of qualified people. Few countries are blessed

with capable and devoted conservators who make this their career. The few qualified conservators are highly motivated people who are to a large extent self-trained. We are beginning to be aware of the massive scope and complexity of the task and it is increasingly becoming clear that the few qualified people, who now exist, cannot cope with the problems neither can they take on the immense task of training the next generation of paper conservators.

Existing educational opportunities in preservation

There are special programmes and workshops which are being frequently sponsored by international, regional and national organisations and local societies of archivists and library associations These seminars and workshops cover a wide range of topics, including causes of deterioration, preventive measures such as environmental control, maintenance and house-keeping; preservation management and administration; disaster prevention and preparedness; mass treatments, simple repairs and protective measures; preservation microfilming and ethical considerations in the treatment of rare materials. These seminars and workshops are mainly aimed at Archives Administrators to alert them to preservation problems and administrative and managerial solutions.

There are also continuing courses to provide more intensive training for conservation personnel. For example, for years, the Public Records Office, London, the National Archives of France, the National Archives of India, the National Archives of Malaysia, to mention a few, accepted interns from other countries and helped fill a gap in conservation education and training. The National Archives of India also runs courses and the training programme teaches hands-on techniques over a two month period in addition to more general preservation topics. These hands-on training opportunities stop short of formal apprenticeship training and cannot be considered a suitable substitute for extensive on-the-job training under a competent conservator that is required of conservation technicians.

Again there are major conferences for conservation professionals, in addition to regular conferences and preconferences of professional associations, which are being periodically held. They are often focussed on a broad topic and the papers presented examine different viewpoints as a preliminary to discussion issues. The Cambridge International Conference on Conservation of Library and Archive Materials and Graphic Arts, sponsored by the Society of Archivists and the Institute of Paper Conservation in 1980 was attended by well over 450 book, manuscript and paper conservators, painting restorers and conservation scientists. The four days tightly organised sessions were devoted to special topics such as scientific

developments in paper conservation, leaf-casting, repair and relaxation of vellum and parchment, priorities in conservation of rare materials, etc. Conferences such as these offer an opportunity for the field to examine itself and engage in intensive professional dialogue. Workshops, seminars and conferences on professional conservation are useful and enlightening experiences for conservators, but the complexity of the preservation problem and breadth of knowledge and skills needed to apply solutions are best taught through a formal academic programme.

Academic Programmes

At present, full-scale academic programmes, specifically in the field of conservation of books and documents are conducted in four institutions: the Columbia University School of Library Services in the USA, The Canberra College of Advanced Education Australia, the Flemish Guild of Handbookbinders Belgium and the Camperwell School of Art and Crafts, Great Britain.

Few institutions are fortunate to have generous provisions of funds and take advantage of the training offered in these institutions. Many archival institutions, however, operate on limited budgets and will find it difficult to make available funds for training of conservation personnel in overseas teaching institutions.

Regional Training centre for paper conservation

There appears to be a real need for a conservation training centre in the region, if possible, a Regional Training Centre for Paper Conservation, similar to the UNESCO/UNDP Regional Training Centre for Archivists in Accra and Dakar. The centre when established could provide a long awaited opportunity to many young and aspiring university graduates to further their studies in this field. The centre could offer also regular courses for practicing technicians and conservators or courses especially designed to enable them to specialize in selected aspects of conservation technology. As such, the courses should vary in length as appropriate for awarding certificates and diplomas.

Such a centre should have close ties with a restoration laboratory of an archival institution working to high standards so that the trainees can be provided with practical training—both by observation and by participation in all aspects of document repair and preservation. As part of the training would involve work with scientists, the centre should have close ties also with a fundamental research laboratory and it should have its own applied research laboratory within the centre.

The courses should include conservation and material science, history of paper making and book technology, non-destructive testing methods, documentation, the causes of deterioration of archive materials, housekeeping and care of materials, the technique of surveying collections to establish priorities for preservation programmes and designing preventive preservation programmes, environment control, emergency measures and after-treatment and storage of fire and water damaged materials. Restoration or repair of books and paper documents, palm leaves, parchment, vellum, seals and maps. The care and preservation of photographic prints and negatives, microfilms, videotapes and sound tapes should be included also in the course.

The selection of candidates would be of prime importance. The type of student envisaged here for selection is the one who already had a fairly good scientific grounding at school or college. In addition, he should have manual as well as mental dexterity, patience, curiosity and dedication. Although scientific educational background is important there should always be room for a person with exceptional ability and previous experience in the field.

In my opinion it would be inadvisable to begin a regional training centre within an existing facility however tempting it might be as this might create practical and political problems. The training centre would need to be independent with its own organisational structure and secretariat. It should be adquately funded by contributions from participating countries or grants from UNESCO and other funding agencies to provide for housing, administrative staff, a small permanent teaching staff and visiting lecturers. At the moment, the usual rewards in terms of money and fame are not yet evident in this field and in order to make the profession attractive to young people, the centre should include means for providing fellowships for students admitted to follow the course.

In closing, I should like to present this paper together with a suggested syllabus for organising a training programme for specialists in document repair a nd preservation for discussion.

SUGGESTED SYLLABUS FOR ORGANISING A TRAINING PROGRAMME FOR SPECIALIST IN DOCUMENT REPAIR AND PRESERVATION

Background knowledge:

(a) The importance of preservation
(b) Literature of conservation, research centres, conservation centres

(c) The nature of archive material
(d) The history of paper making
(e) Synthetic materials for repair of documents
(f) The deterioration of archive material (chemical, physical and biological)
(g) Acid in paper and leather.

Preservative conservation

(a) The concept of preventive preservation,
(b) Environment control (temperature and humidity),
(c) Environment control (control of light),
(d) Housekeeping and storage.

Routine care of archive material

(a) Care of manuscripts, books, pamphlets,
(b) Care of prints, maps, drawings, plans and photographic prints,
(c) Care of non-paper materials such as audio-visual records, microfilm, etc.

Security

(a) Housing and fire protection,
(b) Housekeeping and storage,
(c) Theft and vandalism.

Testing

(a) Testing new materials for quality,
(b) Testing manuscripts and other items for acidity.

Repair and binding

(a) Economics of repairs or restoration,
(b) The techniques of repair,
(c) The repair of paper (sterilization, deacidification, cleaning) and stain reduction,
(d) The repair of paper (mending and reinforcement, leafcasting, lamination, encapsulation)
(e) The repair of seals, parchment, vellum, palm leaf,
(f) The repair of maps,
(g) Guarding and filing archives and binding and rebinding.

General

(a) Disaster and disaster control,
(b) Recovery from disaster,
(c) New developments in preservation and restoration techniques,
(d) Current research programmes,
(e) Future trends in conservation.

Conservation Surveys

(a) How to make a survey of building and its contents,
(b) Evaluating the collected data,
(c) Planning specific conservation programme using the evaluated data.

JOHN DAVIES, Curator of Conservation,
State Archives of New South Wales, Sydney, Australia.

Training Requirements

Y.P. KATHPALIA

Introduction

IN training the stress should be on practical work and strict evaluation of the same. I know a number of cases where the trainees did not pay much attention to such work and still passed the examination on evalution tests. Such trainees on return to their respective institutions either get stuck in their work or adopt wrong technique and produce sub-standard work. This brings bad name to the profession, the institutions and all like. Let us teach them less, but ensure practice and perfection. No lowering of standards should be allowed.

RAMP Study

With these words I introduce the study 'Model Curriculum for Preservation and Restoration of Documents for Developing Countries' which I prepared for UNESCO in 1984. This study covers training programme for Technicians and Specialists i.e. professionals. There is no need for me to reproduce the study here, which I am given to understand would form a basis for discussion in this seminar.

SOURCE MATERIAL

1. KATHPALIA, Y.P.: A Model curriculum for the Training of Specialists in Document Preservation and Restoration : A RAMP Study with Guidelines. PGI-84/WS/2, UNESCO, Paris, 1984.

Y.P. KATHPALIA,
Assistant Director of Archives (Retd.),
Present, Conservation Consultant.

Training for Skilled Craftsmen

AVINASHI LAL

Introduction

PRESERVATION of written document as an applied science is probably as old as the creation of records itself. We have evidence of use of insecticidal solutions in ancient China, and have evidence of proper maintenance, involving good house keeping and wrapping in cloth, during medieval ages. Use of book binding, one of the primary means of protecting the book, is as old as the history of book, and can be traced back to the 1st century A.D. The problem took new dimensions with the industrialisation of paper and book industry during the middle of 19th century. The entire art of creative book binding which is synonymous with conservation, came under economic pressure at this time.

The traditional training of a book binder was and is by an apprenticeship, starting at an early stage, which limits the formal education. Today neither the master nor the apprentice have an opportunity to study the conspicuously sound structures of early bindings. The technical changes of binding, restoring and preserving new materials made the conservation of records quite a different science and craft during the preceding half century.

Condition of paper-based material in repositories

As early as in 1919 A.D., J.A. Chapman, Librarian, Imperial Library, Calcutta felt aggrieved of the condition of books in this country. He, in his article, "An enquiry into the causes of perishing paper" in *Calcutta Review* of July 1919 wrote "All the enquiries stopped short at the very point at which it is so important (In India), for the tendency for paper to perish is so intensifed in this country that thousands of existing books will be lost unless measures are discovered in time to ensure their preservation". We, therefore, need well-trained class of technical persons to assist the conservation. Hardly there is a respository which is not crying for conservation but there is complete eclipse of personnel to handle it.

The load of work of preservation has never been estimated, especially in SWARBICA region. As estimate of Peter Walters will give an idea of the enormity of the job. He estimated in 1981, that 11,500 work years will be required just to deal with present problem of rare books in the Library of Congress with the available facilities. Can Asian countries afford to neglect their richer heritage? So we need competent team of skilled workers.

Education in conservation

The large scale destruction of cultural heritage in Europe during the 2nd World War, brought out the needs of their conservation. In case of Libraries and Archives, it was the Florence disaster which brought to light the total unpreparedness and helpless ignorance. Conservation was binding and that, to all extent and purpose was all that needed to be said. It has been an augury of fate that even this art has suffered miserably. Our experience of Calcutta, where there was a fine cluster of binders in early 20th century is now desolate and studded with poor workmanship. This has been true for the West too. There has been decline since World War I and at the time of disaster, not only Florence, but also Italy and West as a whole lacked the persons to do the job.

The revelation made the governments, archivists and librarians, think of training in conservation. Preservation simultaneously came to be concerned as an important ingredient of the libraries and record repositories. Training in conservation was therefore, gradually introduced in many of the leading countries of the world. Columbia University introduced two years training programme in 1981. British Library, London, established National Preservation Office to meet the demand. British Library, in view of the special needs maintained a special training programme "Craft Training Scheme" for its personnel. Candidates as apprentice are recruited by the British Library through interview with emphasis on craft and art interest. The apprentice personnel are provided with log books for their assessment, at the commencement of the course, which lasts for 4 years. Skill and speed both are judged for successful completion of the course. Besides training in, on the job of restoration and binding they also learn about paper technology, some chemistry and related aspects. British Library thus creates a strong craft cum conservation base.

In England again there is Campbell School of Paper Conservation. This school is training fresh students with general education (secondary). They have got Diploma Course for two years. The training is imparted

in practical handling of cases besides theory. As per facilities provided in Britain, the candidates for two-year course have to bear the cost of training only marginally. This college conducts a Higher Diploma Course in paper conservation which aims at specialisation.

Public Record Office in London also imparts training on the line of British Library. All trainees are taught how to repair and bind the public records as a distinct method of restoration and binding. The conservators have a more varied training as the department expands e.g. map restoration, care of seals, etc.

The Eurupean scene presents a view which has a sincere approach to training in conservation. The training facilities in SWARBICA region are few. The foremost institution in India which imparts practical and theoretical training in Conservation is National Archives of India, New Delhi. National Archives of India has established a School of Archival Studies, which conducts two types of courses to suit the different needs. The courses are meant mostly for persons already employed. The two months course is a short abridged and condensed course to give an understanding into the problems of conservation. The one year post-graduate course is more elaborate and also lays emphasis on practical training. It is, however, a part of general archival training and therefore, not so intensive from the point of preservation.

National Library, Calcutta has also run two courses in conservation of library materials of two months duration each for two consecutive years. The curriculum was entirely meant for conservation activities. It laid emphasis on 200 hours of practical working with assessment of work on the job itself, and 100 hours of theoretical tutelage.

The trainings of the National Archives of India and the National Library, Calcutta are essentially meant for the staff working in Libraries or Archives, irrespective of their nature of duties as practical conservators. They, therefore, lack the essence of creating grass root workers in conservation which mainly come from the craft as envisaged in the training of the British Library, London.

All the Universities which run Library Science Courses/Museology Courses undertake the teaching of the broad principles of conservation of paper based material in theory. They, however, fail to prepare the grassroot workers who actually execute the conservation work.

India being the third in the category of scientific and technical manpower has no dearth of scientific personnel with research orientation

in the field of paper conservation, which is also true for the rest of the SWARBICA region. India as well as other countries of this region have complete lack of the grass root workers and therefore, the work of conservation is miserably poor and often negative due to faulty notions.

It may not be out of place to mention that the persons engaged in preservation work are paid very poorly and thus there is a flight of skilled workers to other trades. It does not provide any attraction for the newer generation also. There is thus not only decline in conservation activities but also lack of availability of skilled manpower.

Conclusion

UNESCO who are also responsible for saving the cultural heritage should take upon themselves to establish a proper atmosphere of conservation and should therefore, undertake the following work.

(1) Establish a training centre for grass root workers in India for SWARBICA region, funded by UNESCO.
(2) The Training Centre should train at least 200 persons each year from different parts of the region.
(3) Training Course should be of at least two years duration with more emphasis on practical work.
(4) Trainees should be provided with suitable scholarships by UNESCO or the respective Governments or both to meet their entire expenses.
(5) This centre should be able to get indigenously available materials and foreign materials required for conservation freely.
(6) The Centre may be allowed to work against payment for repair, restoration and other activities of conservation for institutions and individuals who want the help. This will also subsidise the expenditure of the Institute to some extent.
(7) The trainees should preferably be drafted from the persons with Certificates or Diploma in book craft.
(8) The trained personnels should be absorbed in proper scale immediately to prevent fall out and loss to the profession. The pay scale should be commensurate with the scale of a science graduate working as junior scientist.
(9) Training Centres should work in liaison with other training centres.
(10) Teaching Staff ot the training centre besides conservation scientists should also include demonstrators and lecturers of high precision and calibre in practical working.
(11) The training should be recognised as equivalent to a graduate degree.

I made the suggestion for the training centre to be established in India not because of any regional sympathy. India has vast potentialities and resources. In some respect it is a developed country amongst the developing ones and moreover, it is the pivot of cultural revolution. Geographically too, India is more centrally located and easily approachable.

I owe my gratitude to the Director, National Library, Calcutta, who so kindly gave me this opportunity to present this paper before you.

AVINASHI LAL,
Deputy Librarian,
National Library,
Calcutta.

Microfilming : Essentials and Products

V. KOTNALA

Introduction

MICROPHOTOGRAPHY constitutes an activity of great importance to our material civilization. In practice it is a specialized branch of photography in which details are reduced to minute or even microscopic scale. It is a process for making minute, precision photographs of an object and best described by the phrase 'photocopy at extreme resolution'. Application of microphotography exists in (i) Microfilm ng, (ii) Microphotofabrication and (iii) High-Density storage.

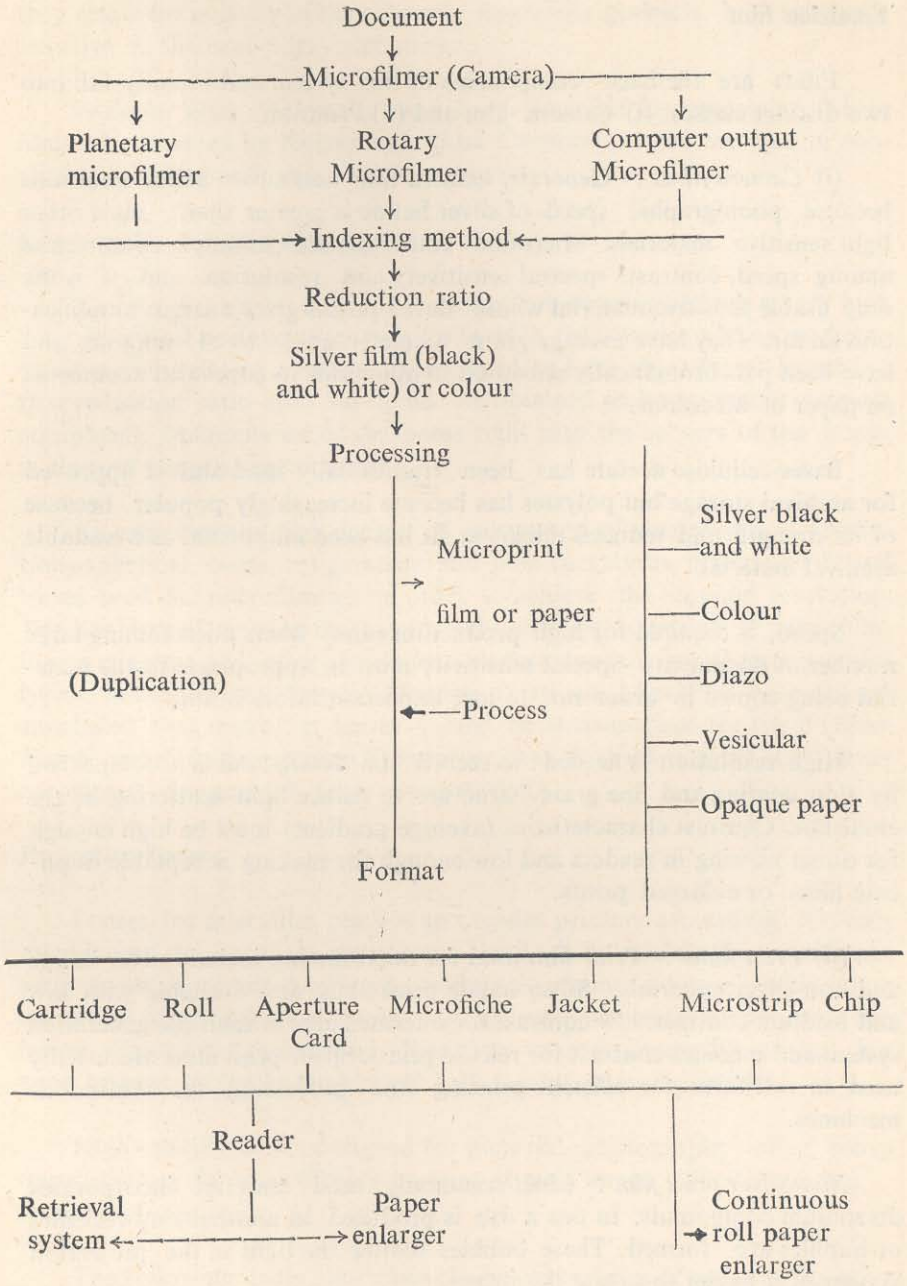
Microfilming is often referred to as document photocopy. The aim of any microfilm system is to provide a means to retrieve an image containing the same information as the original document. It permits storage of information in much reduced volume. With proper processing and storage, it is suitable for permanent, or archival, storage of records. It can be used as a publishing master from which additional film duplicates or enlarged paper prints can be made. With proper indexing system it can be used for manually or automatically retrieving and collating information. Microfilm is thus an information storage process and an important component of new instructional technology. The intended end use of the microform dictates many features of the system, reduction ratio, format, material quality level, recording, processing and retrieval equipment and container. Fig. on page 2 indicates the production flow in a typical microfilm system.

The paper, therefore, intends to present an overview of the basic essentials of the system as well as the description of equipments needed.

Three basic decisions namely choice of:

Emulsion (film)
Lens (Camera, Projection).

Reduction (format retrieval) are essential components for consideration when designing a microfilm system.



Production flow in a typical microfilm system.

Emulsion film

Films are the basic components of this system and broadly fall into two distinct classes: (i) Camera film and (ii) Printfilm.

(i) *Camera films* :- Generally camera film uses silver halide emulsions because photographic speed of silver halide is greater than most other light sensitive materials. Microfilm emulsions are usually a compromise among speed, contrast, spectral sensitivety and resolution and it is the only usable sensitive material whose development gives a large amplification factor. They have average grain diameter as .1 to .4 microns and have been panchromatically sensitised to allow this to cope with documents on paper of all colour.

Bases-cellulose acetate has been traditionally used and is approved for archival storage but polyster has become increasingly popular because of its strength and reduced thickness. It has been authorized as a suitable archival material.

Speed, is required for high production rates when microfilming large number of documents. Special sensitivity must be appropriate to the material being copied in order not to lose important information.

High resolution is needed to record film details and is accomplished by thin coating and fine grain structure to reduce light scattering in the emulsion. Contrast characteristics (average gradient) must be high enough for direct viewing in readers and low enough for making acceptable duplicate films or enlarged prints.

(ii) *Print films* :- Print film used for microfilming include silver halide and non-silver materials. Silver halide print films are available with low and medium contrast, low contrast for intermediates in multiple generation system and medium contrast for release prints. Silver print films are usually used in roll-form for efficient printing and processing in continuous machines.

Non-Silver print film :- Most commonly used material incorporates diazonium compounds. In one a dye is produced, in another tiny vesicules or bubbles are formed. These bubbles scatter the light in the projection system of a reader to create the image.

Dye-type Diazonium films are processed in an alkaline material usually ammonia. The gas is either at high temperature normal pressure or at room temperature and high pressure. They are direct duplicating (i.e.

they retain the polarity of the original), essentially grainless and spectrally sensitive in the near ultraviolet range.

Vesicular films : Normally only heat is needed for processing. These films are marketed by Kalvar and Xidex Corporation and are used in continuous roll film and unit record printers.

Lens : optics for microfilm system

Camera Lenses :- Lenses for microphotocopying require a very high level of optical performance over quite wide field angles and at moderate to quite high relative aperture. They need to have short forcal length so that reduction ratio upto 40 could be obtained with reasonably compact equipment. Maintenance of sharpness right into the corners of the image is also an essential requirement.

An exceptionally high degree of correction of several optical aberrations-spherical, coma, astigmatism and field curvatures, is required for all lenses used for microfilming in order to achieve the required resolution. The problem of meeting the increasingly stringent demands of microfilming programme and after going into performance of special response of a typical microfilm emulsion W. Mandler (National Microfilm Association) concluded that microfilm lenses should be achromatized for the F (Blue-Green) and C (red) spectrum lines rather than G (Violet) and C (red) lines considered for general lens computation.

Projection Lenses

Lenses for microfilm readers and reader printers are usually of short focal length to keep the equipment small. A flat field with maximum astigmatism is required with all projection systems and is probably more important in microfilming because of critical non-pictorial nature of the image. Colour correction and distortion are not unusually critical but good image contrast at moderately high resolution is important.

High quality lenses designed for pictorial photography often prove unsatisfactory for microfilming because of poor image definition in the corners of the field.

The following table illustrates the characteristics of camera lens as well as Microfilm Readers lens.

Typical Microfilm camera lens characteristics

	16*mm*	35*mm*
Focal length	22—37 mm	50—63 mm
Field coverage (Half angle)	20°	20°-26°
Reduction Ratios	18x-50x	8x-36x
Relative aperature	+f4-+f8	f/4-f/8
Resolving Power	120 at f/5.6	200 at f/8

Typical Microfilm reader lens characteristics

	16 *mm*	35 *mm*
Focal length	12.5-50 mm	50-75 mm
Field Coverage (1/2 angle)	15°-22°	15°-22°
Magnification	upto 50 x	Upto 20 x
Relative aperture	f/2.8-f/5.6	f/2.8-f/5.6
Resolving Power	Capable of procuring satisfactory 3 NBS chart on reader Screen.	

Reduction Ratio :

When embarking on a microfilm project, the choice of reduction ratio may be the most crucial decision of all. A microfilm process should be operated with the largest sized images consistent with the ultimate aims of the system.

A formula that assists in calculating the relationship of reduction ratio to the rest of the microfilm system is R-P/MO where R is the reduction ratio, P, the projection dimesion, M is the magnification ratio and O is the original dimension.

Reduction can be classified as :

Low reduction	Upto 15x
Medium ,,	15 x to 30 x
High ,,	30 x to 60 x
Very High ,,	60 x to 90 x
Ultra High ,,	90 x and up

Cameras

Whilst the choice of emulsions and lens has a critical effect on the quality achievable in microfilm copies, the choice of camera largely influences factors controlling the cost and convenience of the copying operation. Points to be considered are:

(i) Maximum size of document to be copied,
(ii) Single or multisheet documents,
(iii) Speed of operation
(iv) Skill demanded and hence labour cost,
(v) Provision for fixed or variable reduction,
(vi) Space and Power requirement of equipment,
(vii) Uniformity of quality of output,
(viii) Ability to stay in adjustment,
(ix) Automatic focussing,
(x) Warning of film end, lamp burnout or other malfunctions,
(xi) Exposure control by photo cells.

Apart from achieving the necessary image quality designers have concentrated their attention on three main aims of great commercial significance.

(i) Maximum efficiency in the use of the available area of film.
(ii) Great dependability,
(iii) Simplicity of operation.

Their efforts have led to the development of two quite different types of microfilming equipment. One type copies continuously moving single sheet documents on a moving film and the second can copy any type of document on stationary film.

Cameras are thus grouped into two categories namely.

(i) Rotary (Flow) Cameras and
(ii) Planetary (Flat-bed) Cameras.

Besides, cameras for special applications also exist.

Rotary cameras

Rotary camera photographs documents while they are in motion on some form of transport mechanism, such as a drum or conveyor belt. The document speed is synchronized with the film transport speed so that there is no relative movement between the film and the image of the document.

Most rotary cameras use 16 mm roll film and are ideal for rapid and economic microcopying. They are very simple to operate and will accept document almost as quickly as they can be fed in. Although flow microfilmer can only accept documents of limited width, they can deal with sheets of great length. This has proved valuable for the copying of the printed output from computers. The equipment is, however, limited in scope and flexibility even though accessories such as automatic feeding attachments, automatic exposure control systems and code indexing devices are available.

Planetary (flat-bed) cameras

In a planetary camera, the document being photographed and the film both remain stationary during exposure. The document is on a flat surface at right angles to the lens axis. The usual design includes a horizontal copy board with a vertical rigid column to which the camera head is affixed. The Camera head can be moved up or down the column to vary the reduction ratio.

The illumination system consists of lamps and reflectors mounted on both sides of the copy board and an appropriate Control unit. The camera head contains the film chamber and transport mechanism, the lens and its mount, the shutter, and film footage counters. Automatic focus mechanism is usually available with the microfilmers though manual focusing system is provided with some machines. The film is usually transported automatically frame by frame after each exposure so that the camera is always ready for the next exposure. Automatic exposure control system adjust the lights to the proper level or regulate the shutter speed. Planetary cameras produce the highest quality microimages.

Step and repeat cameras

A special type of planetary camera known as step and repeat camera, is primarily used for generating microfiche. In this Camera, a series of separate images is exposed on the film according to a predetermined format, usually in orderly rows and columns. The film can be in roll form, sheet form or plates can be used. A titling device may be included to produce an eye readable header.

Camera for computer generated information

In computer output microfilms (COM) images are recorded from cathode-ray tube displays, direct electron beams or a matrix of light emitting diodes. All types are relatively sophisticated and are typified by very high image recording rate.

Camera processor

Camera Processor combine a camera with a unit to process the film. Planetary cameras commonly use small chips of microfilm mounted in aperture cards called camera cards.

Some systems process each exposed frame as it comes out of the cameras in a small in-line processing unit. Other systems process strips or rolls of film at a unit adjacent to the exposure station but in a common threading path.

Processing methods and equipments

Processing of Microfilm images can be a major question for consideration by those deciding to organize their own processing and as the scale of operation may vary many different methods have been used for handling microfilm images. There are many different types of equipments depending on the film size, format and volume of production.

The following manual, semi-automatic and automatic methods are in use:

(i) Disc (Tray) processing particularly for step and repeat two dimensional array negative.
(ii) Tank processing which may be used with (nitrogen or an inert gas burst) proper agitation for optimum uniformity.
(iii) The process in which the film is wound backwards and forwards between two reels under the surface of the solution manually or motorized.
(iv) The spiral method in which the film is loaded into a metal or plastic spiral holding each layer apart, and is then developed in tanks as with processing of roll film or 35 mm film by amateurs.
(v) *Automatic film processors:* Density requirements for microfilm are extremely critical. Since microfilms are high and medium contrast materials, the process must be very carefully controlled to keep the densities within close tolerances.

It is customary in microfilm applications to keep the process constant and vary the exposure to avoid complication in a highly sensitive system. Because microfilm images are often intended for longterm or Archival storage, particular attention should be given to obtaining adequate fixing and washing. Care must be taken to avoid scratches and abrasions. The range of equipment varies from manually operated gadgets to semi-automatic and automatic processors.

Automatic processing machines

Automatic processing machines provide consistent high quality results with a minimum of operator time and skill. Some processing machines for black and white have much greater versatility, but usually some compromise in production rate or quality is necessary.

Automatic equipment is available in a wide range of size and cost depending on production rates, size and type of material, access time, and quality requirements. Because many automatic machines are expensive economic justifications may be necessary.

The film moves through various tanks (developer, water, fixer, washing tank with fresh water flow and drying chamber) with the help of pressure rollers and film guides which advance the film forward through a set path. The exposed film enters the processor at one end and is wound ready to use on reel outside the drying chamber.

Archival quality is maintained and the operational speed ranges from 45 m to 90 m per hour or so.

Duplication techniques and equipments

Once a satisfactory primary microfilm copy has been made, it is simpler and cheaper to make further copies from the microfilm than to re-film the original document. Microfilm duplication is required to:

(i) Provide multiple copies for wide distribution.
(ii) Provide an alternative copy so that the valuable original can be preserved.
(iii) Change of polarity of the original.

Duplicating material

Silver halide, diazo and vesicular materials are most frequently used. A small amount of opaque printing material is used for microduplication and these require special readers.

Printing: Continuous roll to roll printers are available for all three materials, speeds from 5 ft/minute to 350 ft/min. are possible with diazo or 150 ft/mm for vesicular film in the printer processors.

Since every optical projection inevitably leads to some image degradation, it is best to make the copies by contact printing by use of roll to roll

printers, in which film and unexposed film are brought into close contact by passing them under tension around a cylindrical drum. Exposure is effected by projecting an intense beam of light through a relatively narrow slit behind which the contracted film passes at a uniform rate.

The smooth surfaces and the intimate contact of film in the printer may cause Newtons' rings. Tension adjustment in the printer or matter film surface can minimise this problem.

Dust and dirt must be minimised and relative humidity must be high enough to prevent static build up on the film. Constant light and operating speed will help prevent fluctuations in density.

The production of prints from two dimensional array of images is more conveniently effected on flat-bed contact printers. Some printers produce duplicates in a single printer processor unit. These units accommodate microfiche, film in jacket, aperture cards and short strips of film. Diazo and Vesicular films are used almost exclusively because of their ease of processing.

Microfilm Readers (Viewers) Printers

A microfilm reader is a device for projecting and viewing a microfilm image. The reader should complement the total microfilm system which includes fast and accurate retrieval and comfortable viewing. Some microfilm readers can handle more than one film format (by adaptation, modification or accessories). To keep the readers' dimensions to a minimum, the light beam is folded by mirrors to image at a conveniently located reading surface.

Screens-Screen size : Screen range from 8" x 5" (half page display) upto 18" x 24" for newspapers or engineering documentation stored in aperture cards.

Screen type :- Screens may be either translucent rear-projection or opaque front projection. Rear projection screen are more common and are normally made of either green, blue or neutral coloured plastic or ground glass. Neutral screens are preferred for colour film.

An undesirable characteristic of rear projection screen is their scintillation or sparkle. Orbiting or oscillating screens can eliminate scintillation but they are expensive. Front projection screens have a matte finish and tend to get dirtier than rear-projection screens but can be cleaned with a mild detergent.

Brightness :- Uniform luminance (minimum fall of at the corners) is important and the illumination level should be sufficient to overcome the ambient light conditions in the viewing area.

Screen angle :- No standard for screen angle exists and the angle varies among manufacturers. Most readers are designed for viewing by a single person. Few readers provide for variable screen angle unless they are used in conjunction with stands, pedestals or mounts that allow for tilting or rotating the reader.

Screen angle is paramount to comfortable viewing, especially by people wearing bifocals or trifocals.

Magnifications :- The magnification ratio of a reader may be either fixed or variable depending on whether the reader has been designed for a simple projection lens or to accommodate interchangeable lenses. Several readers are available that provide for variable magnification ratios by using lens turrets, Zoom lenses or movable mirror nests to provide a Zoom effect.

Focus :- Most readers provide image focus. A mechanism is required to compensate for the various film generations and film thickness that are used. The reader should provide good corner to corner focus over the entire image and should also maintain focus as images are advanced.

Projection Lamp :- Readers projection lamps come in many types, sizes, shapes and prices. They range from automotive type of lamps to efficient tungsten halogen bulbs. Projection lamps are normally operated below their rated voltage to prolong their life.

Film handling-types :- Most microfilm readers accept silver, diazo, or vesicular film with positive or negative images.

Film Loading :- Most microfilm readers require that the microform be manually placed in the unit. Once placed there however, some readers (those which accept magazines-cartridges and some roll film readers) automatically thread the film. Some readers also retrieve and stop on the desired micromage selected. There are a few microfiche readers that are also designed to retrieve a specific image by key board input.

Film drive :- Film advance scanning or rewinding may be manual or motorized. Most unit record format readers are manual.

Film plane : Readers should be designed to hold the film in a rigid plane for good, overall, crisp focus. Some methods used are open film

gate (with crowned rollers), filmtracks or guides, fixed glass flats, rotating glass flats, or open close glass flats.

Film takeup :- (Roll Format Readers) Film may be taken up on a reel or fed into a frestoon chamber.

Image rotation :- Some readers provide a means to rotate the image on the screen.

Scanning:- Scanning is the ability to shift the film or the optical system to bring the film edges on to the viewing surface allowing different parts of the microfilm frame to be positioned for viewing.

Reader-printers

Reader printers combine the function of a reader with a device capable of making an enlarged hardcopy reproduction from the microfilm image. The printer may be either an integral part of the unit or designed as a modular conversion. Typical processing systems include:

1. Silver Stabilization,
2. Silver Monobath,
3. Silver Heat (Dry silver),
4. Electrolytic,
5. Electrostatic (Zn oxide and plain paper).

However, the Reader Printers of Electrostatic (both CPC + PPC) have replaced all others.

Focus for the prints is normally the same as for the screen image. A movable mirror is commonly used to allow switching from viewing to printing.

In addition to reader-printer, there are view printers or enlarger printers. These devices are primarily used to make hardcopy prints from microfilm. Small viewing screens properly position the image for printing.

Conclusion

In view of the realistic understanding of the role of microforms in archives and libraries, it will not be out of context to conclude the paper on a brief reference to their physical administration, especially storage requirements etc. The saving of space achievable by microfilming is by itself an incentive to employ this medium for the storage of records. It is

also natural to contrast the poor storage life of many papers (particularly some samples of newsprint) with the high stability of 'safety' film base and the long life of microforms.

Confidence in the use of microfilm for Archival storage has been fortified by many carefully conducted accelerated ageing tests and this is the type of data on which standard for processing and the properties of film for archival storage have been based.

It should be recognized that microfilm is highly vulnerable to high relative humidity and to water. Because of this, unsuitable storage condition can nullify the care lavished on the production and the quality control of the microfilms. If a microfilm operation has been conducted as the only defence against loss of information, accidental destruction of records can be quite disastrous. To avoid this contingency, proper preparation for storage should be made.

Many published standards (American, British and Indian) are specific on this point. As for microscopic spot occurrence detected in microfilms, temperature for archival storage preferably between 50°-60°F and RH 30-35% for inactive films was recommended and for the first time low relative humidity of 15% to 20% for archival storage was recommended by NBS in 1965, at least for new films, which were later modified upto 40% in 1970. The microfilm should be stored in closed containers such as cans rather than in the card board boxes previously used.

Many other aspects of storage need consideration such as:

Ventilation;
Control of dirt and chemical contaminants;
The risk of conditioning to high humidity during reading and before return to store;
Protection by lacquering;
Periodic inspection;
Re-copying if deterioration starts to show.

To summarize it is clear that long time storage of microfilm is a complex subject. In favourable circumstances where continuous air conditioning is already available, or is unnecessary because of ambient conditions, a minimum of special preparation may be necessary. The advisability of having a second copy stored in another place should not be overlooked.

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2. M/s. Afga Gevaert, 509, Leverkusen, West Germany.	Copex Microfilming System.
3. M/s. Iteck Business Products 1001, Jatterson Road, Rochester, N.Y. 14603.	Microfilming System.
4. M/s. Fuji Photo Film Co. Ltd. 26-30 Nishiazabu, 2, Chome, Minato-ku Tokyo-106, Japan.	Fuji Microfilming System.
5. Cannon Inc. 7-1, Nishi-Shinjuku, 2 Chome, Shinjuku-ku, Tokyo-160.	Cannon Microfilming System.
6. VEB CARL ZEISS JENA GDR.	CZ Microfilming System.
7. 3M Company, 3M Center St. Paul Minnesote.	3M-Microfilming System, Copiers.
8. Hirakawa Kogyo Sha Co. 2-23, Hirakawa Cho. Chiyoda-ku, Tokyo-Japan.	Hirakawa Portable Microfilmer.
9. Micro Record Corporation 487, Santa Ave, Beacon, N.Y. 06400.	For Semi automatic Processors.
10. Nikor Products, 179, New Bridge Street, West Sprinting Field Mass-D 1098.	For Manually Operated Processors.

11. Allen Products Inc. 180, Wampus Lane, Milford, Cown-66460.	For Processor & Duplicators
12. Eugene Dictzgn Co. 2425 N. Shefield AV, Cnicago, Illinois 60614.	For Readers.
13. Kalvar Corporation 907, South Broad St., New Orleans, Louisiano-70125.	For Kalvar Films & Printers.
14. Xidex Corporation, Sunnyvale California.	For Vesicular Film & Printers.
15. Rank Xerox Co. Singapore.	Copiers.
16. Imtec Equipment Ltd. United Kingdom.	Reader Printers.
17. Minolta Camera Co. Ltd. Business Equipment Div., 30, 2 Chome, Azuchi-Machi, Higashi-Ku, Osaka 541, Japan.	For Minolta Copiers', Reader Printer.
18. Konishiroku Photo Ind. Co. Ltd. Shinjuku Nemura Build'ng, No. 26-2 Nishishinjuku 1 Chome, Shiwuku-Ku-160 Japan.	For UBix Copier (PPC)

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Microfilming as an Aid to Conservation

Y.P. KATHPALIA

Introduction

MICROFILMING is the in thing in every Archives and even libraries and museums. Besides its advantages and disadvantages, which are many, its use for conservation purposes poses many problems and also possibilities.

To be an effective tool for conservation it is important to carry out every step properly right from exposure, processing and development. It is well known that variation in density and presence of residual chemicals in the processed film pose problems that could perhaps be avoided if care is taken in earlier stages.

There are instances of microfilms that have deteriorated in cans and also developed blemishes.

As effective tool for conservation a number of copies of microfilms are required. These are usually (a) Master copy or 1st generation copy, (b) a copy for security, (c) a copy for duplication, (d) a copy for scholars and so on. But each one is processed with utmost care. Usually it is the 4th generation copy that is given to scholars.

For preserving details or images on microfilms, it is necessary to ensure proper storage conditions, proper checking and evaluation i.e. monitoring and proper usage by the person handling and using them.

Condition of storage

The conditions for storage are different from that of documents on paper. The temperature and relative humidity required are lower than that for documents on paper. Temperature range is 18°C to 20°C and for relative humidity 45%±5%. These conditions are to be maintained day in and day out, i.e. for all the 24 hours every single day

of the year. Improper storage leads to fungus growth and stains. Also low temperatures are as deleterious as high range of relative humidities. Besides it is essential to use proper cans and proper shelves i.e. those which are non-corrosive and non-magnetic. In addition microfilms need rewash and duplication as soon as the first sign of change or deterioration are observed. Hence a constant watch is one thing that is absolutely essential. One should be on the lookout for any change in image sharpness, loss of details and scratches on the image.

The microfilms are used by scholars in reading rooms where the temperature and relative humidity are different than the ones in storge. It is, therefore, desirable to condition the microfilms to the storage conditions prior to returning them to their places in storage cabinets.

Permanence of microfilm

As is well known, the life of a microfilm under ideal conditions is as good as that of a good hand-made paper. It is, therefore, all the more necessary that precautions are taken at every stage of production, storage and usage. Otherwise the cost of duplication and reduplication becomes prohibitive for any institution. Nevertheless all institutions having microfilms either must have duplication facilities or must know from where to get the work done on urgent basis but without sacrificing the quality.

Conclusion

Documents as far as possible should be microfilmed in their nascent state i.e. prior to restoration. Such a step will ensure recording of all details and also the condition of the document, i.e. conform to originality of the document. At best, if necessary, minor repairs may be done to make the document fit for handling for microfilming.

Such images can help a conservator to check the restored work against the original and thus evaluate the restoration technique(s).

Microfilming, let us call it reprography, is a mode which is and can be of immense use to a conservator and for conservation.

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Microfilm as an Aid to Conservation

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Introduction

The maturity of a cultural age can be judged by the volume of the recorded material purposefully preserved for a future time. This simple statement has far reaching implications and deeper meaning concerning the nature of the recording process for preservation for posterity.

Recent technical developments in the field of the communication indicate that we are steadily moving forward at an increasingly rapid pace. We are producing larger and larger quantities of data daily. This is effected by the steady increase not only in the total quantity but also in the multiplicity of record materials consumed for recording purposes. In certain classes of such human communication, a large percentage of this recorded material is being preserved not only because of the desire of the librarians and archivists to preserve a copy for the cultural benefit of mankind but also to meet the legal necessities and reasons of accountability. The need for the preservation of the records is obvious. All of us as individuals cherish some items of interest ranging from the purely personal to items of professionals and business interest. We are aware that the difficulties in safegaurding vital records, original manuscripts, historical papers, biographies and genealogical records have long plagued mankind. We are also aware that apart from chemical, physical and biological damage suffered by original documents as earlier described in various papers prsented, there are a large number of documents written in washable and acidic ink which result in the loss of the text. Moreover, generally owing to increasing costs of production the quality of paper being manufactured is such that it cannot withstand heavy usage or handling and it disintegrates rather rapidly once deterioration has set in. Repair and rehabilitation of these materials is not only expensive but time consuming. One practical method of preserving the information recorded on such fragile and deteriorating documents is copying them on microfilm and to keep the film under conditions suitable for its long term preservation.

Advantages of microfilming

The loss of originals through fire, flood or other reasons can not also be overlooked. As a precautionary measure, the contents of the documents may be made secure by making copies in microfilm and storing them at a distant location. This will provide the best insurance against any of the above mentioned eventualities. This practice of preparing security microfilm copies and thereby preserving vital recorded information is in vogue in many of the archival institutions of the world particularly after World War II.

The importance and need of preparing and preserving micro-copies of vital records has already been stressed earlier. Archives by definition are documents intended to be preserved permanently. All progressive archives have therefore, taken up regular programmes of preparing microfilm copies as 'security copies' against loss of originals by fire, flood, war, the ravages of time and other enemies of records.

From the modest beginning of the use of the micrographics in 1929 as a photographic process when banks began to microfilm cheques before returning them to customers, the technique now combines the science, art and technology by which information can be quickly reauced to the medium of microfilm, stored conveniently and then easily retrieved for reference and use.

As a process microfilming is more than half a century old and its development has kept pace with the growth of other information management systems. Computer output Microfilm (COM) for example, uses technology that converts electronic impulses from computer into light beams that exposes the image of text, numbers and drawings on microfilms faster than they could be printed on paper. This compatibility of micrographics and data processing by computer is expected to broaden micrographics and data processing by computer is expected to broaden as more devices are perfected to input data directly from microfilm to the computers. (CIM).

Micrographics also has borrowed electronics for its own use. Mini-microcomputers are being installed as controls in cameras. COM recorders and retrieval terminals make the development of automated image retrieval methods possible.

Essentially microfilming offers speed of copying, convenience in handling, compactness and space saving advantages besides economy and permanence. Now even small offices can take advantages of micro-

film in low volume applications. The availability of inexpensive film cassettes for rotary microfilm cameras makes microfilming almost as convenient as making paper copies on a photocopying machine. These are only a few of the reasons why the use of micrographics is growing. Probably the greatest advantage of micrographics lies in its flexibility. Microfilming has also changed over the years. Its original format was in rolls but today microfilm is also available in Jackets, in aperture cards or as small sheets called Microfiche and in reduction ranging from 12 to over 100. Each microform has its own applications and each application serves to expand the usefulness of micrographics as a whole. However, the original microfilm format, i.e. the roll film still is one of the least expensive forms in which microfilm can be produced and duplicated.

Archival quality control

As stated earlier microfilms are now being increasingly used in archives, libraries, documentation centres, government, trade and industry As one of the most important application of microfilm especially for any archives, library or record centre is the preservation of the vital and valuable collection of records in their custody, they will be interested in producing a film of archival quality only. Without going into details of conservation techniques required to be adopted, as it is being dealt in a separate paper, I would like to emphasise that the success of the microfilm system depends on producing microfilm copies of good quality on a continuing basis. For this an understanding of the parameters that characterise a good image and quality control at every stage is most essential. Quality control is more than the inspection of finished negative films. It is the check that is required to be made at various steps of the negative production. It starts when the film is loaded in the camera and ends when the negative is finally filed away. The factors which contribute to the good quality image on microfilm are the condition of the document, the film, the camera, the operator's work, the quality of the film processing, the viewing apparatus, and the care in storage and handling. A weakness in any of the areas may cause the system to fail.

In conclusion we may recall some of the recommendations of the Round Table Conference of the International Council on Archives on Microfilm in Kuala Lumpur in 1982 which are as follows:-

(a) RTC recommends to all archives administrations to aim at a comprehensive programme which takes into account the essential role of microfilm for preservation purposes. In this context

attention should be given to the identification of priorities for all systematic actions of security and preservation microfilming, to make additional preservation copies from microfilm which are produced for other purposes, to provide search room copies in the form of microfilm, microfiche or hard copy in order to protect original documents from excessive use, to preserve deteriorating documents in the form of preservation microfilm and to maintain proper storage conditions and to provide periodical control of security and preservation microfilm.

(b) The RTC recommends to the Archives Administration to take care that substitution microfilming does not dispense Government agencies from statutory obligation to seek archival authorisation for the destruction of original documents, to attract the attention of business firms to the fact that wholesale destruction of records after substitution microfilming, may result in the loss of materials of permanent value.

Conclusion

Keeping in view the above recommendations, I would like to suggest that the archivists of the various countries participating in the Conference may take the following steps in the archives of their respective countries:-

(i) Promote the microfilming for the preservation purposes and also take steps to see that the precious and fragile documents are not allowed to be handled in original in the Research Room. Instead only microfilms are to be supplied for the use of the scholars.

(ii) Take steps in accordance with the recommendation of the Round Table Conference to ensure that the Government agencies which are considering substitution microfilming as a measure of space saving consult the archives of their respective countries before undertaking such programmes. They should also bring to the notice of the large business houses that in case they plan wholesale destruction of records after substitution microfilming, it may result in the loss of materials of permament value.

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Resolutions

The following resolutions were adopted at the concluding session of the Seminar:

(i) taking into account the varying climatic and other conditions of the region, it is suggested that standards required for the maintenance of records and record-rooms be specified;

(ii) having in mind the high cost of maintenance of air-conditioned buildings used as repositories, guidelines be provided for the construction of and maintenance of suitable repositories;

(iii) considering the varied quality of paper that constitutes the records that are transferred to Archives, steps be taken to make proposals to the Governments of the region, for the use of better quality materials in Government Offices;

(iv) in view of the hazardous nature of various chemicals used in Archives, this question be examined in detail for suggesting guidelines for their use and for the safety measures to be taken;

(v) as acidity constitutes one of the major causes for the deterioration of documents, further studies be made to recommend suitable and appropriate materials and processes for deacidifying documents;

(vi) considering the need for collaborative investigation in the conservation of palm leaf manuscripts, a research project be undertaken to examine and analyse such material and recommend restoration techniques, taking into special consideration the technology that is available in the region.

(vii) the necessity having been emphasised to have standard equipments, materials and procedures for conservation and restoration work in the Archives of the region, measures be taken to prepare standards.

(viii) in view of the importance of having in the region training facilities for archival conservationists, a study be undertaken of the present status and facilities available within and outside the region in such field, and for the type of demand of training facilities to be provided and the mode of providing such training be determined;

(ix) while drawing attention to the RTC recommendations of 1982 and while emphasising the use of microfilm as a means of conser-

vation, the Seminar wishes to stress the need for better dissemination of information on proper programmes for microfilming and the maintenance of production and storage standards;

(x) taking into consideration the need of having emergency measures for dealing with fire, flood and other disasters, guidelines be prepared and provided for the training of personnel in dealing with such emergencies.

(xi) the delegates to the SWARBICA Seminar, record their deep appreciation for the excellent arrangements made for the Seminar and the warm hospitality provided by the National Archives of India and to UNESCO/ICA for financial assistance.