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الخزانة

مجلة علمية نصف سنوية تعنى بالتراث المخطوط والوثائق

تصدر عن مركز إحياء التراث التابع لدار مخطوطات العتبة العباسية المقدسة

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دراسات تراثية

Preventive Conservation Of Muanuscripts

الحفظ الوقائيّ للمخطوطات

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الملخص

إنَّ كلمة المخطوطة Manuscript مشتقّة من المصطلح اللاتيني manuscriptum الذي يعني الوثائق المدونة باليد. تُعد المخطوطات أغنى مجموعة وثائق مدوّنة؛ إذ تؤرّخ معلومات عن وجود حضارات مختلفة، ووجود نتاج ثقافي للأُمّة. وقد انتشرت هذه المخطوطات المدوّنة بلغات مختلفة في كافّة أنحاء العالم، في كنائس ومعابد ومكتبات ومتاحف مختلفة منفردة، وفي عدّة جمعيات خاصّة.

حُفظ تراثنا الموثّق على صخور، وأحجار، وألواح طينية وخشبية، وأوراق أشجار، وقماش، وزجاج، وعاج، وعظام، وورق.

تُحفظ المخطوطات والتراث المؤرشَف في المكتبات وأقسام الأرشفة، والمتاحف، والعتبات. وقد تدهور معظم التراث المؤرشَف بسبب الغبار، والعوامل البيولوجية، والتلوّث الجوّي، والحرارة، والضوء، والحشرات، والأحياء المجهرية، وقلّة الاهتمام، والإهمال. والسبب الرئيس وراء تدهور التراث الخطي هو قلّة الوعي. ولهذا فإنّ التحكّم بالتلوّث الجوّي، والرطوبة النسبية، ودرجات الحرارة، والغبار يمكن أن يتم بتهوية المخزن واستخدام تنظيف ميكانيكي للمخطوطات. إنَّ هذا الاستعمال يحفظ المخطوطات من الدمار الذي تسببه الحشرات والأحياء المجهرية. كما أنَّ من الضروري التحكّم بمصدر الضوء؛ لأنّ أشعّة الضوء يمكن أن تكون مؤذية للمخطوطات والمواد العضويّة.

Abstract

The word 'manuscript' is derived from the Medieval Latin term 'manuscriptum' that means hand written documents. Manuscripts are the richest collection of written documents that provide information on the existence of different civilizations and the cultural affluence of the nation. Written in different languages, these manuscripts are spread all over the world in-different monasteries, temples, libraries, museums, with individuals and in several private institutions.

Our documentary heritage is preserved in the form of Rocks, Slab of Stones, Clay Tablet, Parchment, Metal Plaque, Wooden Panel, Barks of Tree and Leaves, Cloth, Glass, Ivory, Bone, and Paper. In the early period, the documentary heritage was in the form of rock paintings and inscriptions, the stone slabs and clay tablets are housed at various museums, but these materials were very heavy and un-transferable hence, before the 3rd and 2ndCentury B.C., Birch bark and Palm leaves and Parchment were used as writing substance. Later The Ivory, Bones, Glass and Metal Sheet, Textile and Paper were used as writing substances. The Manuscript and archival heritage are mostly preserved in Libraries, Archives, Museums and Shrine. The most of the Archival Heritage is deteriorated due to dust, biological factors, atmospheric pollution, temperature, relative humidity, light, insects, micro-organism, improper care, human vandalism and negligence. The main cause of deterioration is lack of awareness in custodians and readers.

Bhoj Patra or Birch bark Manuscript

Alberuni mentioned that in the Northern & Central India, barks of the trees were used as a writing material. To use the bark as writing material oil was applied to the bark to make smooth, strong, and used to scribe, each folio was given a number. The complete book was bound under two wooden boards of same size and wrapped in a cloth such books are called Panthi.

Textile Manuscript

Textile was rarely used as writing substance. To use the textile as a writing substance, a starch paste made from rice or wheat applied on the texture to make a smooth surface. When dried, rubbed by a polished stone and used for writing. The first reference of textile manuscript referred by Nirucus in the Smruthi. A 300 years old fragment is available at Sirangir Mutt. Recently one Textile manuscript has been restored by Dr.P.Suresh at Chowmahalla Palace Hyderabad, which is on a textile of 9 feet height and 4.5 feet width, belongs to the early 19th Century with Naskh script is a rare codex.

Bone Manuscript

The bones were also used as writing substance. Some Islamic codices were found on the bones of camels etc., the fragment is available in the Tope Qapi Palace Museum, Istanbul, Turkey.

Ivory Manuscript

The ivory was rarely used as a writing substance, number of Miniature paintings also found on the ivory. Some fragments are showcased in the Odisha State Museum, Bhubaneshwar and Salar Jung Museum, Hyderabad.

Manuscript on Wood

The wood was used as writing substance from early times, writing was done by engraving or relief work. A huge collection of calligraphic panels on wood is housed in different repositories of Iran and Turkey.

Incising of Calligraphy on Glass

Glass is rarely used as writing substance, after scribing some chemicals were applied on the writing parts and mercury was on the surface. It will not stick to the writing parts and beautiful script appears. Such fragments are available in the Salar Jung Museum, Hyderabad, India.

Parchment Manuscript

In the Europe and Islamic world, parchment was mostly used as writing substance; number of Islamic Manuscripts on the Qumash of Camel, Deer and Vellum are housed in the different repositories.

Manuscript on Metal Sheet

Documentary Heritage on metal sheet is found on Gold, Silver, Bronze and copper known as Tamarasa. The technique of Tanmarasa was by moulding process or engraving. The Tamarasa are generally made to preserve the revenue documents. The silver and gold were in royal use. Such fragments are available in Indian Libraries and museums.

Palm leaf Manuscript

There are number of palm trees, but only three types of palm leaf are being used as writing substances. They are Tala, Sritala and Corypha Talira Palms. The leaf processed (seasoning) by various methods to use as writing substance, after seasoning the leaf written with a Qalam or incised by stylus, the incised leaf are invisible so inking is done by carbon Black or Bean leaves. The Palm leaf manuscript tradition is alive in different states of India.

Paper Manuscript

Paper was introduced in China in 607 A.D. by T.Sailun and from the China paper making technology reach to Arab in 725 A.D. the Chinese war prisoners at Samarkhand trained to the Arabs. Gradually the Arabs used the paper as writing substance from 9 th Century. In India paper being used as a writing substance since 11th century. During the Mughal reign India was famous all over the world for paper manufacturing. Paper was made by Rice, Bamboo, Old Cloth, Cotton, Jute, Wheat, Grass and Fruits etc., and exported to various countries. A number of manuscripts were written on handmade paper. After the invention of machinery, paper was manufactured by machines and hence called machine-made paper.

To scribe the manuscripts different types of Ink, Dyes and Pigments are used and each creates an individual effect on the writing substance. Hence, we will discuss each substance separately in detail.

Factors of Deterioration

Various deterioration are found in manuscripts by different factors such as atmospheric pollution, temperature and relative humidity, insects, micro-orgasm and light. The dust and dirt are highly dangerous, if exists on surface of paper for long period abrades and forms stains in high humidity. Actually, the dust contains iron oxide, moisture and fungal spores, which deteriorate the manuscript.

Insects such as silver fish, bookworms, termites, cockroaches are other factors, which damage the paper material. The silver fish grows quickly in dark and moist places, particularly behind the bookshelves and extremely fond of sizing material. The book worms deposited on the surface lays the eggs, after hatching, larvae eats the manuscripts and produces a sort of channel on the paper. The termite grows at tropical and subtropical climates and damages the book in no time.

The cockroaches eat and discolor the paper. The sizing material attracts

fungus. Improper lighting is also a reason for deterioration and encourages the growth of fungus. Natural and artificial both lights enhance the presence of acidity and lade to dyes and ink. Sometimes erase the entire script. Unnecessary heat gives aging effects and paper discolored and become fragile. Acetic gases and smoke present in atmosphere also effects. The dust particle contains acidic and metallic ions, moisture also deteriorates the manuscripts. The manuscripts, printed books and archival documents not preserved automatically, requires proper care and preventive measures. It must be ensured that, we provide sufficient equipments, infrastructure and skilled manpower for proper care to protect our manuscripts and heritage.

Generally manuscripts are deteriorated by following factors

1. Atmospheric Pollution.
2. Dust.
3. Temperature and Relative Humidity.
4. Insects.
5. Microorganism.
6. Light .
7. Human Vandalism.

Atmospheric Pollution

The environment consists of the atmosphere, i.e., hydrosphere and lithosphere. The atmosphere is a mixture of gases. Hydrospheres are ocean, lake and rivers, the lithosphere are the mixture of soil mantle that wraps the core of earth. Together with hydrosphere are all biospheres, which provide substance to all living organism. Air, food, water are withdrawn from the biosphere waste products in gaseous, liquid and solid forms discharged into biosphere. The industries and polluted water passing through open drainage degrade the environment. Sulphur dioxide, carbon dioxide and oxides of nitrogen emitted from various industries like cement, oil refineries, stone crushing units, fertilizer plants and coal based thermal power plants pollute the air. Sulphur dioxide is converted into sulphuric acid by

action of iron and copper which present in paper.

The smoke emitted from motor vehicles like carbon monoxide, sulphur dioxide also degrades the environment, by which the paper and other archival material deteriorate. The Sulphur dioxide, hydrogen sulphide, Ammonia and Nitrogen oxides, which present in air, also responsible for the deterioration and major hazard for the manuscripts.

Sulphur dioxide is converted into sulphuric acid by action of iron and copper present in the paper. The acid is absorbed by the fibers of paper and destroys the cellulose bonds and weakens the paper, so paper becomes brittle and crumble.

Hydrogen Sulphide acts on silver and lead pigments and changes them to a dark brown colour by chemical reactions.

Ammonia Ammonia Combines with moisture and sulphur dioxide formed ammonium sulphate, because it is hygroscopic, hence absorbs moisture due to which paper became brittle.

Nitrogen oxides Emitted from motor vehicles and very harmful to archival material, this gas effect on the dyestuff which is used on the manuscripts.

Dust

Dust is one of the components of atmospheric pollution, it contains sharp particles such as silicon, which causes abrasions and chemical reaction. Dust contains acidic and metallic ions, which may cause degradation of atmosphere. Dust attracts moisture, which in turn give rise to chemical reaction. It is hygroscopic in nature, if not paid attention highly dangerous for the manuscripts heritage. There are various sources of dust and necessary to control. The main source of dust are

1. Atmosphere/ Air/ Winds.
2. Traffic on roads.
3. Shoes and garments of staff and visitors.

4. Hands.
5. Carpet.
6. Construction material.

Atmospheric dust particles mixed with dirt like textile fibers and organic matter settled on the manuscripts. Because of organic residue, dust becomes excellent food for microbes such as fungi and helps in growth. Dust also contains metallic ions like potassium, sodium, iron that acts essential nutrients for fungi and bacteria. Humidity with such dust particles multiplies the growth of fungus in manifold. Therefore clean and dust free atmosphere should be maintained for the display and storage of manuscripts. Staff responsible for manuscripts should not be allowed to take food in the display and storage area. As far as possible, such areas should be made air-conditioned, visitor and staff may be asked to remove their footwear before entering such rooms.

Soot: is absorbent, the Sulphur-dioxide in the air forms sulphuric acid, which is absorbed by the soot and a type of acid compress. This means the acid acting on the object over which soot is deposited. Soot sticks to objects and becomes very difficult to remove.

Iron oxide cause small brown rust spots on the paper manuscripts. Iron oxide also helps in the formation of acids by acting as a catalyst for chemical reaction between sulphur dioxide and moisture in the air.

Fungal spores as soon as find favorable conditions grow and spread all over the object and make colonies. Fungus discolors the manuscripts and releases acids, which is harmful for the manuscripts.

Moisture Dust contains sharp particles and metallic ions which deteriorate the manuscripts. Apart from these dusts also acts as a nucleus around which water/moisture collected. This moisture provides the necessary humidity for growth of fungus and chemical reactions, which lead to formation of acids.

Temperature and Relative Humidity (RH)

Temperature is a measurement of hot and cold, high temperature gives aging affect to paper and palm leaf manuscript, the paper becomes yellow and then brittle in a short period of exposure to high temperature and looses the natural moisture which is present in the paper, due to the chemical reaction, acidity increase in a long time. When the temperature is low, paper becomes soggy and limp and attracts the fungus.

The fluctuations in temperature are cause mechanical damage because of expansion and contraction of material. Therefore, the temperature should be maintained at 22 degree centigrade. Air conditioning of galleries and storage area is the only remedy for controlling the temperature.

Relative Humidity means the moisture present in the air. The moisture is also a factor in deterioration of manuscripts. Temperature fluctuation causes mechanical damage if moisture increase it causes to expansion of material, if moisture decrease it causes contraction, by low humidity makes the paper become dry, brittle and the high humidity makes the paper limp and soggy and encourages the growth of microorganism. Maintenance of Relative Humidity between 45% to 55% is most effective way of preservation of paper and palm leaf manuscripts.

Relative Humidity can be measured by dry and wet bulb thermometer, whirling hygrometer and thermo hygrographs. The dry and wet thermometer is consisting of two bulbs one is covered by cotton wick and another dipped in water. First note the reading of wet bulb and then note the reading of dry bulb subtract dry reading from wet reading, note the difference, and efer to the plot chart. Now the Thermo hygrographs and other measuring instruments introduced.

Preventive measure for Relative Humidity and Temperature

1. Maintain temperature and relative humidity as constant as possible and keep the manuscripts by wrapping in thick cotton cloth in an

inner room. Use moisture absorbent materials such as cotton curtains and wooden furniture around the collection. These material are buffers absorb the moisture quickly and release slowly thus decreasing the harmful effect of fluctuations.

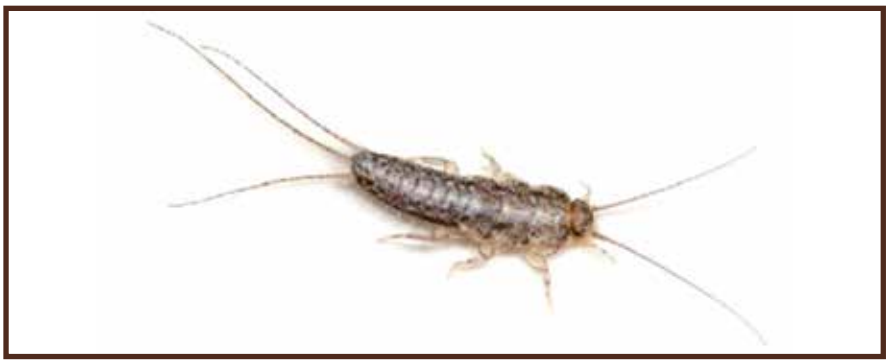
2. In tropical area, temperature and relative humidity will be high, if air conditioner is installed it should continuously have to work 365 days a year. Constantly switching off / on causes sharp fluctuations hence it is better to preserve the manuscripts without air conditioning.
3. Keep tissue papers between illustrated folios as buffer to avoid flaking and abrasion.
4. Maintain a record of temperature and relative humidity for at least one year, to plan about fluctuations and to take proper steps for control.
5. Regulate un-even movement of visitors.
6. Avoid water accumulation near the repositories.
7. Relative humidity can be controlled by placing silica gel in the showcases.
8. When the relative humidity falls to level lower than 45%, there is danger to the manuscripts, folios become brittle due to loss of natural moisture. Hence, use the humidifier.
9. Maintain a temperature 21 to 23 degree centigrade.
10. The collection area should be good air circulation in high humidity; otherwise, fungus may grow in darkness and stagnant air.
11. Damp air should be exhausted from the room by using exhaust fan.
12. If a manuscript becomes wet, do not dry in the sun light, dry in a shaded room with a fan gently blowing and keep blotters between the folios.
13. Do not use heaters in the manuscripts store and gallery.
14. Do not use air cooler in the manuscript store and galleries.
15. Do not use the high watts bulb.
16. Do not keep the almarah at the walls on which direct sun light expose.

17. Direct sun light should not enter in the storage or gallery, because the sunrays affect the ink and paper.

Insects

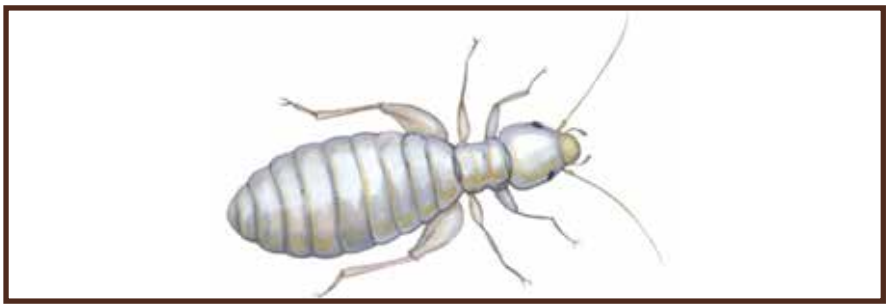
Insects are the most important biological agents, which deteriorate the paper and palm leaf manuscripts. The body of insects is consists of three divisions, head, thorax and abdomen and normally has six legs, most of them have two pair of wings, and some have one pair. The mouth parts consist of one pair of jaws and two pairs of maxillae. Their habits include chewing, sucking or lapping. The young are almost always quite different from the adults. Usually the larvae under go at different stages either an incomplete or compete before assuming the adult form destroy to the Manuscripts. Insects are in different group but only one percent of insects are harmful to manuscripts. The common insect such as silverfish, cockroach, moth, book lice, beetle and termite damage the paper, palm leaf and wooden plank of binding.

Silver Fish is a wingless fast moving nocturnal insect, grows in moist and dark atmosphere very quickly, like behind the bookshelves or cabinet. It has chewing mouthparts and long antennae. Silver fish is extremely found of sizing material, normally eating glue, and paste, starch causing surface damage to paper, palm leaf and photographs. Presence of silver fish is alarming for fungal attack because the fungus attracts the silver fish and damage the paper.



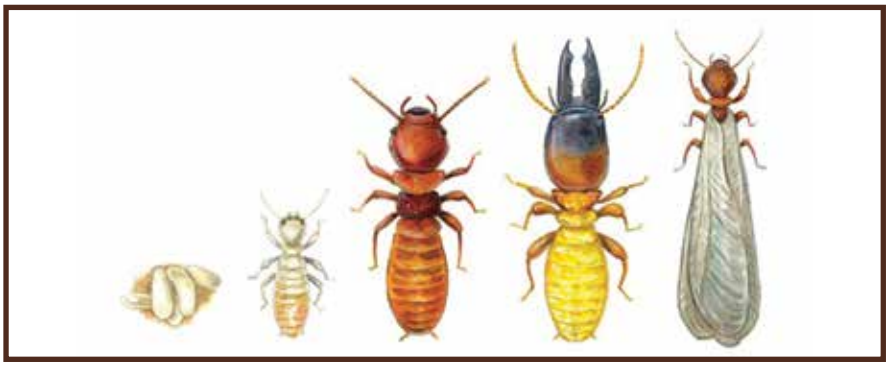
Silverfish

Book Lice Book lice are found everywhere they are pale tiny insects with very small soft body, mostly found on manuscripts and archival material, which remain un-used for long period. They eat sizing material and plant matter, they produce very tiny holes on paper and palm leaf manuscripts. Book lice damage the surface of paper / palm leaf, and destroy the books, photos, leather and parchment, the booklice feed leather, glue and gum of bookbinding.



Booklouse

Termite Termites are found in Tropical and Sub tropical climate, among the winged insects, they live in nests of wood, underground or ground surface nests, including architectural parts of building, wooden cabinets' doors etc. and come out for food through tunnels. Termites damage wood, paper, books, palm leaf and cellulose materials, if the manuscripts infected by termite they destroy within a short time.



Different caste members of termite colony

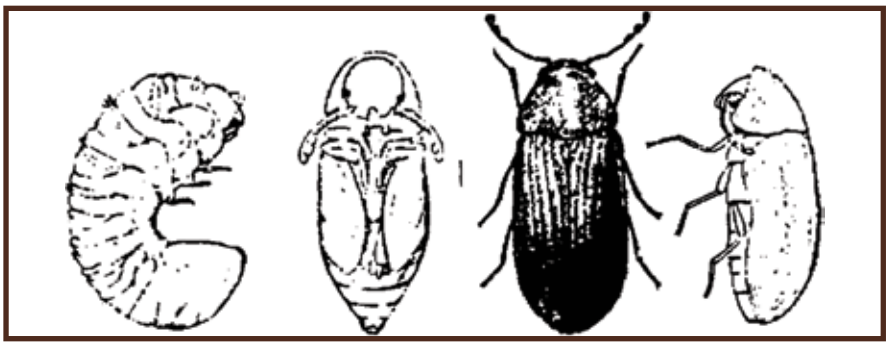
Moths The larvae of moth feed on cloth, fur, wood etc. Moreover, form neat round holes and tunnels in wooden objects, paper and palm leaf manuscripts. They produce holes, round tunnels from first to last folio if not seen moths converted the paper like a mesh. Moths are generally formed in humid and darkness and destroy the manuscripts.

Moths

Cockroaches are common household pests frequently found in Libraries, Archives and Museums. Cockroaches damage the manuscripts and archival material, bookbinding, leather and fabric. The black coloured cockroaches are grow/accumulate on the Manuscripts, discolour, and change the appearance.

Cockroach

Bookworms the bookworms feed on paper and damage profusely. They eat the sizing materials and digest cellulose, they lay eggs on surface of binding or on the edges of leaves. When eggs hatched, the larvae eat the book and produce sort of channels in entire manuscript.



A "bookworm" whose larva and adult damage books

Insect deterioration to the Manuscripts is a serious problem in tropical humid areas. The affected manuscripts were have to examine carefully, the study shown larvae cause the nature of damage. The larval activity was found to be more predominant within the bookbinding, though this was not revealed by surface examination alone. The bindings were composed of cardboard made up of unbleached wood pulp. They also possessed thin leather layers pasted on the outer cover sides. The adhesives used seemed to be starch paste. The leather surface shows a number of small round holes. Inside the binding & leather layer, a large number of tunnels made by the larvae were visible; the larvae had made parallel-sided tunnels of about 1 to l.5 mm wide running in all directions.

These galleries were filled with irregular shaped. Occasionally the larva also tunneled into the folios of the manuscripts as revealed by the galleries, is seen on the edges of the cover as well as of the pages. This is because the eggs are laid near the surface of the bookbinding or on the edge of the leaves. The freshly hatched larvae eat their way into the interior of the bookbinding and the book. The heavily infected book binding with a number of galleries inside, with a surface cover that shows only a few circular holes.

Microorganism

In tropical countries, biological agents cause great damage to paper materials. The problem, although less serious in countries of temperate climate. The most important biological organisms are fungi and yeast both damage the paper materials, even synthetic materials.

Microorganisms grow in high resistance and multiply very fast. Another important property of microorganisms is the capacity of their spores to travel long distances in air or water. They can survive in all kinds of environments like in atmosphere, on earth and under water. To destroy the microorganism, we should first know the nature and reproductive habits. Microorganisms such as Fungi and Yeast etc.,

Fungi are the most common Microorganism damages the organic materials including paper. Paper is very weak and hygroscopic, so deteriorates easily. Fungus, popularly known as mould or mildew, can grow on all types of archival material in varied environmental conditions. Fungi are considered a class of plant. It cannot produce their own food and depend on other organic materials, living or dead for their survival. So they are harmful to the material on which they grow.

The Fungi germinate in wet conditions, temperature below 18˚C and relative humidity above 60% is most suitable for the growth of fungi. The fungal spores after 25 years of killing can regenerate when they get wet condition. Dark atmosphere also influences the rate of growth of microorganism. The fungal spores as soon as find favorable conditions spread all over the objects, make colonies, and discolor the manuscripts and release acid, which is harmful to the manuscripts.

Fungi usually require carbon, hydrogen, oxygen, nitrogen, sulphur, potassium, manganese and calcium. Sizing or other finishing materials, which are used on paper, also influence the development of fungus and rapidly in moist places. The action of fungi is rather very slow and depends on several factors. Actually, the dust also contains fungal spores and acts as

nucleus around which water / moisture collects, the moisture provides the necessary humidity for growth of fungus and by chemical reactions, which leads to formation of acids.

A Fungus formed book

The silver fish grows in dark and moist places particularly behind the bookshelf. The silver fish are extremely found of sizing material. When the temperature is low, the paper becomes soggy and limp and attracts the fungi. Therefore, the temperature should be maintained 22˚C. Air Conditioning of galleries and storage area is the only remedy for controlling the temperature.

Yeast is another microorganism, which can damage the manuscripts. They usually cause reddish coloration to the paper manuscripts.

Yeast colonies

Foxing: Foxing is another type of deterioration by which brown spots are formed on paper. This is the result of chemical action of iron impurities in the paper.

Control on insects and microorganism, variety of chemicals, herbals and oil has been used to prevent insect and microorganism. The materials used over the last four centuries for preservation of manuscripts and books are Alum, Thymol, Oil of Anis (Alsi), Beeswax, Camphor, Borax, Benzene, Cloves, Clove Oil, Oil of Eucalyptus, Lac varnish, Mercuric Chloride, Lemongrass, Tulsi (Rehan), Neem leaves, Tobacco, Paraffin, Sandalwood, Snuff and Turpentine.

A Foxing attacked paper

In India, various indigenous plant products were used as insecticides from very early times. Leaves of the Neem Tree (Azadirachta indica), Leaves of Tulsi (Rehan) and Tobacco (Nicotinum tabacum) were used to preserve the manuscripts, Powdered rhizomes of Sweet flag (Acorus Calamus) Camphor, Sandalwood oil, Cloves, Citronella and Deodar oils is being used as insect repellent. Palm leaf manuscripts used to be hung above the cooking fire in kitchens is also a preservative method in Odisha, but it is harmful for the manuscripts.

Preventive measures are necessary for the manuscripts longevity. To avoid insect and fungus attack in the manuscripts, ensure cleanliness of the surroundings, proper circulation of air, control of humidity and temperature, and periodical use of insecticide and Fungicide.

Interaction of Light

Light is an important source dealing with the manuscripts and archival material. It brings photochemical changes or oxidative changes in the paper by which the colour of paper becomes yellow and strength is lost due to loss of moisture, thereby paper becomes brittle and breaks by touching. The effect of exposure of light on paper is enhanced in the presence of acidity so the paper becomes brittle. The other writing material such as ink, pigments and dyes fade due to effect of light, after prolonged exposure writing can completely disappear.

There are two main sources of light one is Natural and another artificial, the source of natural light is sun, and the source of artificial light is by various processes, but mainly by electricity. Both the sources of light are emitted six types of rays.

(1) Infrared rays (2) Radio waves (3) X- rays

(4) Cosmic rays (5) Ultraviolet rays (6) Gamma rays

The infrared rays, ultraviolet rays and X-rays are invisible where the other rays are visible. The infrared rays and ultraviolet rays are harmful to our manuscripts heritage. All the visible rays are having destructive power. The infrared rays are with low energy and ultraviolet rays and X-rays are with high energy. The X-rays are yellow, orange, and red colours. The gamma rays are green and very harmful to manuscripts and organic material. The cosmic rays are violet, Indigo and blue.

The intensity of artificial light is low compared to natural source of light. The light from fluorescent tubes is harmful to our manuscripts and the deterioration is caused after long exposure.

The Ultra Violet rays: oxidize and destroy the cellulose bonds, and weaken the paper and palm leaf. It fades the ink, pigments, and activates the new chemical reaction in the paper. Ultra violet rays also deteriorate the binding material such as leather adhesives, cloth as it is with high energy. The artificial source of Ultra Violet rays is fluorescent tubes.

The infrared rays: are emitted by natural as well as artificial sources such as in-candescent bulbs. It generates heat thereby paper and manuscripts lose moisture and they become brittle, and due to photochemical reaction acidity increased.

Photoflash: Photo flash can be used for exposing the manuscripts but the source of light should be at least 3 meters away from the manuscripts because its power is high and the duration of exposure is very little so it is not harmful as compared to flood lights.

Preventive Measures from Light

1. Reduce the light intensity on manuscripts by using the filters.
2. Light bulbs inside the showcases produces heat and dries-up the natural moisture of paper, palm leaves and brick bark so it becomes brittle.
3. Manuscripts should be displayed at a light intensity of not more than 40 lux, . Lux meter shall be placed parallel to the manuscripts and do not stand against the light source and measure the intensity.
4. If light intensity is higher than 40 lux, bring it down to 40 lux by switching off extra light, by dimmer switch otherwise adjust the distance between the light source and the manuscripts on display.
5. Sunlight and tube lights weaken the manuscripts because the ultra-violet rays effect on paper and palm leaf manuscript. Hence, block the sunlight by closing windows or by putting curtains.
6. Ultra Violet filters can be placed over windows panes and tube lights to cut off the harmful rays.

7. Zinc Oxide or titanium dioxide, which absorbs ultraviolet rays, should be used to paint the walls and ceiling, the Ultraviolet rays from fluorescent tubes can be reflected off them.
8. Switch off the lights when there are no visitors in the galleries.
9. Don't use Incandescent bulbs while photography / reprography / digitization or scanning of manuscripts
10. Don't make the Xerox copy of manuscripts because the infrared rays of the bulb will deteriorate the manuscripts
11. While exposing through a photoflash, use filter on flash.
12. The flashgun should be away more than 3 meters from the manuscripts.

Preventive Measures to Control the Insects

1. Food should not be placed or eaten in the library, gallery, stock rooms and reading hall.
2. Close windows at night without fail.
3. Keep premises clean by use of damp cloth.
4. Install mesh/net on Door and window.
5. Insect Repellants should be used like Neem and Tulsi leaves and lemon grass.
6. Use red/yellow colour cotton cloth for wrapping the manuscripts.
7. To avoid termite attack, give anti termite treatment at the basement, by drilling the holes between 2 to 3 feet gap.
8. Borax powder should be sprinkled for silver fish.
9. Dust bin should be placed outside the room
10. Proper circulation of Air should be maintained.
11. Do not keep collection in open racks.
12. Keep insecticide such as turmeric powder at "Climbing points".
13. Keep the manuscript collection clean.

14. Proper record of insect attacks should be maintained for reference.
15. Avoid closed spaces around collection
16. Staff should have proper knowledge of chemicals, which can be used for preservation.
17. Insecticidal and Fungicidal paper should be placed between the collections.
18. Contact with experts to take suggestions.
19. Keep rare manuscripts in closed box or cupboards separately.
20. Newly acquired manuscripts should be fumigated.
21. Make sure the wooden boards of manuscripts are not infected.
22. The cloths used to wrap the Manuscripts should be made starch free by thorough washing otherwise the starch may attracts insects.
23. Regularly inspect the collection, if noticed any powder, indicates insect attack, report to the concerned authority.
24. Remove infected manuscripts and seek help for insect treatment.
25. Provide a fumigation chamber with appropriate chemicals and trained staff can help to remove insect infestation. But remember fumigation will only free the manuscripts from present insect attack. If precaution is not taken then manuscripts will get infected again and again.
26. Keep the collection away from wall and cupboard climbing points.
27. Termite proofing of the building at the time of construction will prevent from future termite attack.

Storage and Display of Manuscripts

Proper storage and display is very important for longevity of the manuscripts. It should be done on scientific lines. Preventive measures should be taken when reorganizing the gallery or storage. Wooden showcases or cupboards should be made by using the standard teakwood; insecticide repellent varnish should be applied for safeguarding the manuscripts & documents.

The un-bounded manuscripts, paper documents and miniature paintings must be kept in between two acid free hand made boards. For preservation of miniature painting or one side document, best method is preservation in window cut mount board, or preserved in a portfolio, made by acid-free board.

The unbounded manuscripts must be kept in a box made by acid free hand made board. For care, maintenance and storage of manuscripts and documents some principles are described below, by the practice manuscripts heritage can be saved from physical deterioration or damage as well as biological factors. Preventive care is the first step towards total conservation. It is the primary responsibility of librarian, Custodian and Curator to practice the principles.

Care & Maintenance

1. Whenever handle the Manuscripts, wash hands, otherwise sweating on hands will transfer in the manuscripts and deteriorate after some period.
2. Do not use the pen while referring the Manuscript.
3. Do not put hands and arms on Manuscripts nor move the fingers on lines.
4. Keep the books in almirah in vertical position with number slip on both sides i.e. binding title and spine.
5. Keep the palm leaf Manuscripts in red or yellow colour cotton cloth bag shelf by shelf, not bundle over the bundle.
6. Use wooden or steel almirah with doors for storage.
7. Tie up the palm leaf manuscripts with equal pressure.
8. If any document is found un-bound make a box or folder with Acid free hand made board.
9. If any alpine, jump clip, staple or flag of other than handmade paper is found, remove immediately.

10. Clean the shelves of almirah periodically.
11. Do not use the polythene covers to keep the Manuscripts.
12. Treat the Manuscripts & documents frequently in the fumigation chamber.
13. Clean the Manuscripts frequently by mechanical process.
14. Folios should not be turned speedily. The folios will get damaged.
15. Corners should not get folded; a crease will be formed and may be torn at the fold.
16. Do not keep the water glass, teacups and eatables near the manuscripts.

Re-organization of Galleries and Store

For reorganization of galleries & storage, Practice following principles.

Preventive Measures

1. Use the quality teakwood, for making showcase and cupboard.
2. Do not use plywood because it is prone to insects attack.
3. Bind the Palm leaf manuscripts in the wooden panels or acid free handmade board of slightly larger than the manuscript, treated with insecticide & fungicides. The paper manuscripts also preserved in a folder of acid free hand made board.

Cupboard

1. Cupboard should be with closed door.
2. The shelves should be perforated or ventilated.
3. The height of showcase should not be excesses to 6 feet.
4. The lowest shelf should be 9 inches high from the floor.
5. Proper ventilation should be provided in the showcases and almirahs by perforation on the cupboard from door side.

Display Showcases

1. Display showcase should be made in slightly tilting positions.
2. Do not supply electricity in the showcase.
3. Do not fix bulb in the showcase.
4. Intensity of the light should not exceed to 40 Lux.

Precautionary Measures

1. Storage area should be neat, lighted and ventilated.
2. The manuscripts should be neatly arranged in the almirah or showcases.
3. Keep a space of 6" in between the wall and the cupboard or showcase.
4. The manuscripts should be well documented, to allow easy retrieval from the store
5. The manuscripts should be aired regularly and inspected at the same time.
6. Electricity controls and fuse box should preferably be kept outside the store along with dry type fire extinguishers.
7. Maintain a check and control the movement of visitors.
8. Do not store paints, chemical and other inflammable materials with manuscripts.
9. Smoking should not be allowed in stores and gallery.
10. Follow the essential procedure for control of light, dust, temperature and Relative humidity.
11. Frequently replace the manuscripts, which are on display with those in the store.

Handling, Packing & Transport

The handling packing and transportation, is an important aspect and require proper knowledge and training. In the Libraries archives and museums. Movement of manuscripts is routine for different purpose like

study, research, exhibition, photography shifting to other sections/or conservation work. For handling the manuscripts proper care and technique should be needed, otherwise during transportation, photography and digitization manuscripts may be damaged.

Handling

1. When handling the manuscripts, give support of alkaline acid-free handmade board, slightly bigger than the manuscript. The baseboard should be hard.
2. Tie the manuscript with flat ribbon in between the boards.
3. Hold the manuscripts carefully in both hands along with support.
4. Do not carry the manuscripts, like periodical or magazine, because if folios are loose fell down, manuscripts will be damaged, and sequences will be lost.
5. Carry the manuscripts single, if large number of manuscripts to be transfer use enamel tray, steel or wooden trunk or a trolley.
6. Keep the manuscripts properly in the tray, and use resilient material, for packing.
7. Don't use-staining materials like colour paper cuttings for packing.
8. Use trolley for shifting of manuscripts inside the building
9. Avail the security services for shifting inside the campus or outside.
10. Make a transfer record of manuscripts along with photographs in triplicate.
11. Affix the label on package of every book with photograph, and fix a detailed list on the container.

Packing

For transportation of manuscripts, remember the following points

1. Make a triplicate list of manuscripts along with small size photograph.
2. Wrap the manuscripts in alkaline handmade paper, paste a descrip-

tive label of manuscripts with photograph.

3. Always use flat ribbon for tying because thread damages the edges.
4. Use standard packing material.
5. Give thick insulation of Thermocol, around the packing area.
6. Kept the manuscripts one by one; use polyurethane in between the manuscripts.
7. Use wooden or steel trunk for transportation.
8. If space found in between manuscripts, fill with suitable packing material.
9. Use only lightweight material.
10. Lock the box and put seal, Now the material is ready for transportation.
11. Avail the services of Security personnel during transportation.

Transporting

1. Use standard transportation, having shock absorbers, gears, and movement control.
2. Before starting transportation check the risk involved during transportation like rain, sunlight, Road safety etc.,
3. Inform to the receiver of the manuscripts before transportation with an approximate time of arrival.
4. Handle the packed material carefully.
5. Do not keep the manuscripts box in the dickey or near the driver seat.
6. Keep the document container with the vehicle
7. The custodian and essential staff should travel along with the material for handling and security.
8. If transportation is by aircraft, or railway reach at least four hours before the departure.

9. Use Government vehicle for transportation.
10. Escort required in front and back if transportation through private vehicle.

Preventive Measures of Manuscripts

Manuscripts are deteriorated by various factors and damaged by mis-handling, improper care and negligence. So preventive care is necessary for the longevity of manuscripts and proper training is required to handle the manuscripts, otherwise manuscripts will be damaged. Some manuscripts are unbounded, if proper attention is not given, sequence of folios will be lost, corners will damaged due to abrasion pigments and dyes can flake. So following guidelines have to be practiced. In addition, prevent the manuscript from light, pollution, relative humidity and temperature. The concept of preventive measure is to avoid the curative conservation.

1. The unbounded paper manuscripts should be preserved in a folder or box made by acid free hand-made board with accurate size of manuscript.
2. The palm-leaf manuscripts, which are unbounded, pass a cord from the holes and use hand-made board on both sides to tie up with equal pressure. Then keep in the starch free cotton cloth of red or yellow color and fix a number slip on both sides.
3. The single paper document preserve in a folder of acid-free hand-made board.
4. Arrange the manuscript in closed-door almirah number wise, the number slip should be easily visible.
5. Don't store the Manuscripts in the shelf tightly, keep at least 3 inches gap in each shelf for easy movement.
6. To handle the fragile and brittle manuscripts give a support of hand-made board slightly bigger than the manuscript.

7. Before handling the Manuscripts, wash hands properly, because the sweat of hands gets transferred to the manuscripts and enhances the acidity.
8. Mechanically remove the dust and other particles by long hair soft brush.
9. Do not keep water glasses/tea/edibles on the reading table.
10. Pen marks are found on the manuscripts due to irresponsible custodians and readers, these marks deface the manuscripts. Do not allow the pen while referring manuscripts.
11. Some readers that while turning the folios moisten the finger with spit, by which the sizing material stick to the folios. Instruct the reader not to practice.
12. While referring the book some readers put their arms on the half part of manuscripts or documents, due to which the manuscripts are damaged by various factors. The soluble ink bleeds by sweating of arms and sizing material lost, acidity is transferred to the manuscripts, or increase in the existing acidity.
13. The binding will be damaged, when the manuscripts are referred on flat tables, because at the beginning and at ending entire folios will be one side, only few folios will be on the other side, due to unequal level, the folios get loose from the stitches. So use a slanting bookstand to refer the manuscripts.
14. Keep the manuscripts in closed almirah in vertical position with number slip on both sides, for easy searching. If manuscripts are not kept with number slip, while searching repeatedly, the corner as well as binding will be damaged.
15. While consulting the manuscripts, some readers move fingers on the folios; it is harmful to the manuscripts, instruct the readers to avoid such habits.
16. If the palm-leaf manuscripts are not tie up properly by string with equal pressure, due to abrasion, paint of illustration will fade and

flake, the leaves also gets damaged, preserve the palm-leaf manuscripts in a bag of unstarched red or yellow cotton cloth.

17. Pins damage the paper & other archival materials. If found remove immediately
18. Some time the damaged folios are integrated by using the cello tape. It is very dangerous, because the cello tape causes lot of problems.
19. Clean the shelf of almirahs after removing the manuscripts to protect them from dirt and dust.
20. Do not use polythene bags to preserve the manuscripts.
21. If there is no circulation of air, the manuscripts will deteriorate.
22. While reading some readers fold the corners of the folios to make the notes, the folded corners will cause great loss to the manuscript, because if the paper is acidic the corner will be damaged or the folded portion it will be lost.
23. While referring to the manuscripts, readers keep the glass of water or teacup on reading table. By any mistake, it can fall down and damage the manuscript. So do not allow the eatables while referring the manuscripts.
24. Manuscripts should be aired regularly and inspected at same time.
25. The Manuscripts should be well documented, to allow easy retrieval from the storage.
26. Electricity control and fuse box should preferably be kept outside the storage area. Install dry type fire extinguishers at storage area and reading hall
27. Maintain a check and control the movement of visitors.
28. Do not store paints, chemicals and other inflammable materials with Manuscripts.
29. Smoking should not be allowed in store, gallery and reading hall.

30. Follow the essential norms for control of light, dust, temperature and relative humidity.
31. Frequently replace the manuscripts, which are on display with those in the Stores.
32. Keep insecticide & Fungicide in every four month in the almarah.
33. Maintain the temperature of storage area 21-23 degree centigrade.
34. Maintain the relative humidity 45% to 55%. Keep the silica gel in the almirah or show case when the Relative Humidity is more than 60%
35. If the storage area or gallery with compact unit or Air Conditioner, should continuously work for 24 hours. Switching off after office time because sharp fluctuation and may cause expansion and contraction of paper, hence manuscript may be damaged in long term.
36. Keep tissue paper between palm leafs which have illustrations to avoid abrasion.
37. Maintain a record of temperature and relative humidity at least for one year. It will give an idea of fluctuation and corrective steps can be taken.
38. The collection area should have good air circulation in high humidity otherwise; fungus grows in dark and stagnant air.
39. Damp air shall be exhausted out of the room by using exhaust fan.
40. Do not use heaters, stove, and cigarette in the library.
41. Do not use high power bulbs.
42. Do not keep the almirah at the walls on which direct sunlight falls.
43. Check seeping of walls, ceiling and take prompt action to redress.
44. Direct sunlight should not fall inside the store or gallery; it will fade the ink or disappear the writings.
45. When receive or acquire a manuscript do not include immediately with collection because the acquired Manuscript may infected with

fungus and insects, it will effect to the healthy manuscripts. First, do the mechanical cleaning and fumigation then keep in the almirah.

46. Wooden powder falling out from planks of palm leaf manuscripts indicates insect attack. Replace the board and seek specialist treatment.
47. Do not tie Palm Leaf manuscripts in centre; tie with equal pressure on entire manuscript.
48. Keep leave tightly between wooden planks by tying a cord with even pressure.
49. Store the manuscript bundles neatly if possible in closed boxes or cupboards.
50. Wrap the manuscript in a thick starch free cotton cloth of red or yellow colour.
51. Do not mark or under line on the original leaf.
52. People in charge of collection must document and publish the contents of manuscripts, instead of original manuscripts, copies or microfilms should be available to scholars for reference. Condition report should be prepared.
53. Most of the damage takes place in storage. Regular inspection is necessary, and damage should be immediately reported to the concerned authority who must take action to preserve the collection and its contents.
54. Responsibility should be placed on someone to look after the manuscripts.
55. Do not keep the manuscript in a dusty polluted area.
56. The area around the building should be made dust free by planting, grass and trees.
57. Air curtain should be provided at the entrance.
58. Store should be cleaned with a damp cloth or vacuum cleaner.

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