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Conservation in South and South-East Asia

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Conservation in South and South-East Asia

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To our readers

Under its programme for 1975–76, Unesco is to carry out a study on the methods of publication of *Museum*. Such a study appeared necessary, not only in light of the difficulties with which the publishing world in general is currently faced but also because it is a good thing for any journal to assess and ask itself some hard questions from time to time.

It goes without saying that such a study could not be carried out without eliciting the views of those who are most directly concerned—the journal's readers. This is why you are requested to fill out the accompanying questionnaire.

Since many of our subscribers are institutions, the journal is in fact read by several persons who may not all have the same opinions. It would be most useful to know the views of all the readers and it is suggested therefore that replies be filled in on photocopies of the questionnaire, or separately in the form of a letter.

On a previous occasion, we asked for the views of the readers and many of them were kind enough to reply.[1]

This is encouraging, but is far from being enough. Great importance is attached to widening considerably the participation of the readers in this way, regardless of whether their comments deal with museology or museography, or whether they are positive or negative.

1. 'Some Points of View on Museums of Exact and Natural Sciences', by A. J. Rose, A. Bose, G. McCann Morley, J. Kuba, J. Arnold, *Museum*, Vol. XXVII, No. 2, p. 94-6, Paris, Unesco.

Editorial

We have always provided information to our readers about the conservation of different types of museum objects, but usually in terms of objects and materials found in the West.[1] In many other parts of the world, however, the materials from which works of art are made are often quite different from those employed by the Western artist; and sometimes they are used in a manner that imparts a special character of its own to the final product. For instance, oil for painting, so popular with the Western artist, has seldom been used in the East. Parchment and vellum were fairly common in mediaeval Europe, but hardly known in South and South-East Asia, palm-leaves and paper serving instead. Techniques differed too: a person trained and brought up in the Western traditions of art may not realize that a painting or a canvas need not always be stretched rigidly on a frame; some cultures preferred it to be flexible and hung as a scroll.

Ignorance of these matters has often been disastrous. For instance, borders and margins of *tankas* (Tibetan paintings)[2] have been discarded at the time of relining the painting by people who did not realize that they were an integral part of it, with an iconographical interest and purpose of their own; without them, the painting diminishes greatly in significance.

Miniatures,[3] which normally have a matt surface, have often been so heavily varnished as to look like oil paintings. Many an Indian or Persian miniature has been damaged because of faulty treatment in restoration or cleaning. And so on.

It is natural, therefore, that an international magazine such as this should discuss these problems. Clearly, they do not concern South and South-East Asia alone, since the material discussed here is not confined today to that region, but is found in many Western museums, particularly in Europe and North America. It is of equal importance to the custodians of such collections to understand the particular methods and materials which went into these works of art as an essential background to their proper conservation.

This issue, of course, is not intended to provide a treatise on the subject. Its limited purpose is to show various aspects of conservation peculiar to this region: special materials and techniques of production characteristic of Asia, the climate, and the rarity or sometimes almost total absence of conservation facilities.

The chapter below will set out first the meaning of conservation in the Asian world view of yesterday and today, and second, some aspects of the regional ecological context—climate and natural conditions—in which cultural objects must be preserved. This general background will be followed by a series of descriptions of Asian art and craft forms and techniques. Although most of the examples are drawn from the author's own experience in India—his home country—they illustrate identical or closely similar problems encountered with respect to the cultural objects of all Asia.

1. For a full list of articles on conservation included in Vols. I to XXIV of *Museum* (1948 to 1974) see Usha Agrawal, 'Abstracts of Conservation Articles in *Museum*, Vols. I–XXIV', *Conservation of Cultural Property in India*, Vol. VII, 1974, p. 77–87.
2. See discussion on Tibetan *tankas* below, page 181.
3. See discussion on miniatures below, pages 198–202.

1

An Asian view of conservation

Mankind has always tried to preserve its past in the form of oral traditions and written literature,[1] monuments, sculpture and paintings. This is as true for Asian countries as for any other. Museums as such are relatively new in Asia, but institutions have long existed which served much the same purpose as a modern museum. For example, ancient India had *chitrashalas*[2] (painting galleries), sometimes located in the centre of a town and destined for both public and private use. These were as much a means of education as a source of enjoyment, the paintings and sculpture providing lessons in history, religion and art.

Paintings and sculpture have had a definite role to play in presenting different aspects of the cultural heritage to the people. The rock paintings in the caves of Ajanta and Ellora,[3] for instance, and the paintings and carvings on the walls of monasteries and temples illustrated the life and previous incarnations of the Buddha, who by his constant sacrifice and compassion for human suffering, had earned the right to become the Buddha. They were meant to instruct the people in righteousness and to prepare them for a path towards the final aim of life according to the Buddhist teachings, i.e. *Nirvana* (salvation from all worldly sufferings). The sequence of paintings and sculptures had a message to deliver, combining visual teaching with enjoyment.

The temple of Borobudur,[4] in Java, with thousands of scenes carved in friezes on its walls, is another example. The story of Buddha's many lives is graphically told. The carvings bear a spiritual message and a meaning beyond their artistic content (Fig. *1*). The people who visited the stupa no doubt appreciated the art form, but were probably even more conscious of the stories it told.

The carved panels of Prambanan[5] (a group of temples in Java), depict stories from the *Ramayana* epic arranged in sequence around the periphery wall. The visitor who came here to pay reverence to the gods learnt the lessons of mythology as he went around the temple. Here also, art was entwined with the propagation of teachings, those of the *Ramayana*.

The long scroll paintings, illustrating moral and religious stories, which were hung on the walls of temples, also simultaneously provided education and entertainment. They were sometimes used for the audio-visual presentation of religious literature. The paintings, wrapped around a rod at each end, were unrolled gradually, exposing one portion at a time, and thus revealing scene by scene the story depicted. The narrator sat near by, explaining the significance of what was being shown.[6]

In ancient times, the village temple or the village monastery served not only as a place of worship, but as a real community centre. Paintings were shown,

1
Borobudur: a detail. Hundreds of carved panels in this stupa depict the lives of the Buddha.

1. The *Vedas* in India, for instance, were transmitted orally from generation to generation and were not written down until a very late period.

2. C. Sivaramamurti, *South Indian Paintings*, New Delhi, National Museum, 1968, gives a very vivid description of *chitrashalas* in ancient India. It is interesting to note that there also were mobile *chitrashalas*, like mobile museums, which enabled more people to see and enjoy the arts.

3. The Ajanta Caves, carved and painted between the second and the sixth century A.D., are located in Maharashtra State, India. The Ellora caves, also in Maharashtra, are of a later period (eighth to tenth century). The caves of Ajanta and Ellora are not natural caves; they were excavated by man as temples and monasteries, with big halls for meditation and residential cells for monks. See A. Ghosh, *Ajanta Murals*, New Delhi, Archaeological Survey of India, 1967; Sivaramamurti, op. cit.; R. S. Gupta and B. D. Mahajan, *Ajanta, Ellora and Aurangabad Caves* (D. B. Taraporevala Sons & Co., Private Ltd., Bombay, 1962).

4. Borobudur, a huge Buddhist stupa situated in Central Java, Indonesia, near Jogjakarta, was built in the tenth century. It has nine storeys. The walls of each storey are covered with carved stone panels. The stupa is in a very bad state of preservation and a Unesco project is now working on its restoration.

5. Prambanan is a group of temples in Central Java, Indonesia, dedicated to the Hindu gods Shiva, Vishnu and Brahma.

6. This tradition still continues in some parts of Asia.

stories were recited, puppet shows were arranged, dances were held. The community took part fully in the activities and were not simply observers or an audience in the European sense. The changes which took place in Europe after the Renaissance and during the Industrial Revolution are only now occurring in Asian countries, and even at that, mostly in cities and towns, which are expanding and being rapidly modernized. The urban community, unlike the rural community, is no longer closed in, but people in it, by and large, still retain much of the traditional outlook. The small towns and villages still use their temples and monasteries as cultural centres, so that their attitude towards conservation and the arts is governed mainly by prior considerations of religion.

Painting was also used for secular, but didactic purposes: to illustrate literature, poetry, history, geography and so on. In many Indian miniatures, couplets were added on the front or back, and illustration was often an integral part of a literary composition. The main purpose of art was to present in visual form what was being expressed in words (Fig. 2).

It is not always realized that one important function of temples and monasteries was to take care of the preservation of ancient manuscripts and works of art. Most temples and monasteries acted as repositories of religious manuscripts.

2
An Indian miniature representing *Basant Ragini*; the painting illustrates the couplet which is written at the top.

They were, in a sense, real seats of learning, affording facilities for study and the safeguarding of literature and the arts. This is true of many of the ancient monasteries and temples in Japan, Korea, Thailand, Indonesia and other countries. The Horyu-ji, the Chugu-ji and the Horin-ji in Nara, and the Koryu-ji in Kyoto, and many others in Japan, for example, are famous treasure-houses of ancient objects. In India, temples had libraries attached to them which acted as repositories (*Gyana-bhandaras*) of manuscripts and art, veritable store-houses of knowledge. But for these temples, many works of art would have long ago been destroyed for ever.

According to certain Indian beliefs and scriptures, *Jirnodhar* (the repair or restoration) of damaged temples was an act of merit, and the repair of an ancient temple was much more meritorious than even the construction of a new one. This does not mean of course that the making of new works of art or new religious buildings was discouraged; on the contrary, artistic activity was always encouraged. In Thailand and in some other countries, images of the Buddha were made on important occasions during a lifetime (birth, marriage anniversaries, birthdays and so on) and donated to the temple. This tradition is still alive.

It will thus be seen that, in almost all forms of artistic activity, the works of art produced had a special significance and purpose, and religion always played a large role in their creation and preservation. To the oriental artist, not only the product of his labour (e.g. the image which would serve for worship and meditation), but even the very act of painting or carving was a form of meditation. The artist, therefore, approached his act of creation with detachment, but with a full sense of religious participation. He did not consider himself as a creator, but painted or carved as a mission or as an act of worship. During this time it was enjoined upon him to be pure in body and in thought.[7] Art was not for art's sake, but had a deep inner purpose. An image, and sometimes a painting, was not complete unless life was breathed into it by consecration. During the ceremony of consecration of a statue, for example, various objects were enshrined in cavities specially made within it for the purpose. Religious formulae were written at appropriate places in paintings or sometimes hidden inside the mounting.

The Asian countries have thus always been concerned about the preservation of cultural property, but in a way that differed greatly from the modern philosophy of conservation. Art in Asia usually had a religious purpose; the meaning of the art as such, and its physical form, did not have much importance. Because of this basically different psychological approach towards art forms, it hardly mattered to the ordinary man if a broken image was replaced by a new one; in fact, if broken, it could not continue to occupy the main sanctum of the temple. An image or a religious work of art was not considered as a piece of decoration or something intended for specifically aesthetic enjoyment. Hence, there was no objection to a painted sculpure being repainted, and this was indeed done year after year without in any way offending the aesthetic feelings of the people. It was not that they lacked aesthetic sensibility, it was simply that they had a different conception of works of art. They simply did not see why it should be necessary to preserve and maintain decaying paintings on the walls of temples, feeling that it would be just as well or even better if the old paintings were scraped off and the work done anew. Hence the problem of gaining acceptance for conservation in the sense that we understand it today.

The modern approach is concerned primarily with the archaeological and historical interest of an ancient object as a relic of history and a clue to the artistic achievements of the past. Moreover, such objects justify a country's pride in its own past. The nineteenth-century form of the scientific approach and a nationalist revival of concern for monuments were combined in the theory of conservation propounded by Viollet-le-Duc in France. In most nineteenth-century conservation work in Europe, this view is clearly evident. Many

7. Priyabala Shah (ed.), *Vishnudharmottara Purana*, Third Khanda, 1958.

Asian countries were influenced by it and, since it continues to coincide at least partly with their own concept of the arts, the influence still continues. In view of the traditional Asian approach to restoration, and of strongly nationalistic feelings, natural in newly independent nations, it is not easy to convince people that the complete restoration or reconstruction of an object or monument is not the best solution, and that each creation is unique in its own right and as an irreplaceable witness to the past, so that any tampering with it will not only change the quality of the work of art but also obliterate, for all time to come, the mark of history. According to modern art criticism and aesthetics, each work of art, each piece of decoration, each historical document is unique and cannot be repeated without faking. This being so, conservation must operate in such a manner that any retouching or substitution is easily recognizable as a modern addition; it should not be passed on as something from the past. In Asian countries, people have only just started to accept the truth of this proposition, and it will be some time before it can be translated fully into practice.

For conservation programmes to be effective, therefore, people must be made conscious of the modern approach to conservation. In some Asian countries, restoration is still considered to depend on the continuity of craftsmen's traditions, i.e. if a painting is to be restored or a sculpture repaired, it is given to a traditional artist who tries to make it look as new and fresh as possible; if a carved window is damaged it will be replaced by a window which is new, though carved in the same style. This basic difference in the approach to conservation often constitutes the greatest stumbling-block to the proper preservation of cultural property. It is not always easy to convince the owners of art objects, especially if they are religious institutions, of the need for conservation. The sense of involvement and the natural instinct to ensure the preservation of the cultural and natural heritage must be stimulated and directed according to the respect for and curiosity about the artistic past that characterize contemporary analytical conceptions.

Conservation: the regional climatic and natural conditions

After having considered some of the psychological—indeed philosophical—factors involved in conservation, we can now take up various practical aspects of the safeguard of cultural objects in Asia. Deterioration of an object or a monument is not due to one single agency; rather, it is due to the combined effect of several factors working simultaneously that cause, for example, metal to corrode, or paper to become brittle or stone to disintegrate. Conservators know that it is a complex phenomenon, whose rate and extent depend on the nature of the material and on the severity of the damaging agencies to which it is subjected. The interaction between the two—the object and the agent or agents of deterioration—determines the condition of the object.

The most common causes of deterioration of cultural objects are: climate, micro-biological organisms, insects, light and atmospheric pollution. To this list can also be added another factor of very great importance, but often overlooked, which is physical damage due to mishandling and faulty storage techniques, due mainly to ignorance or neglect on the part of the personnel responsible for museum collections.

These problems are, of course, present all over the world, but there are distinct regional variations. For example, the tropical climatic conditions prevailing in South and South-East Asia are extreme conditions and are probably much more severe than in the temperate climate of Europe. These include very high temperatures and relative humidity throughout the year in countries such as Bangladesh, Sri Lanka, Burma, Thailand, Malaysia and Indonesia. On the other hand, the western parts of India, Afghanistan and Iran are comparatively dry. The monsoon type of climate, which prevails in most parts of India, is characterized by alternating dry and wet seasons (see Table 1).

Such extremes of temperature, relative humidity and rainfall are bound to have damaging effects on cultural property. Excessive humidity accelerates the growth of micro-organisms and insects. On the other hand, extreme dryness makes objects in leather and palm-leaves very brittle. Organic material is known to deteriorate faster in conditions of high temperature. The alternately dry and wet conditions and fluctuation of temperature produce unnecessary strain on objects, particularly paintings, scrolls and lacquer-ware.

Fluctuations in temperature and relative humidity inside a museum may represent a great danger to certain fragile types of objects. All hygroscopic materials such as wood, paper, cardboard, etc., expand in a moist atmosphere and shrink in a dry atmosphere. This is one of the main reasons for the flaking of paint in miniature paintings, which are executed on paper or on board made up of several layers of paper. The board expands with high humidity but the

TABLE 1. Average climatic conditions

Town and country		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Baghdad (Iran)	°F	49	53	59	71	82	89	93	93	87	76	64	53
	°C	10	12	15	21	28	31	34	34	30	24	18	12
	Rainfall[1]	1.0	1.0	1.1	0.4	0.1	0.05	0.05	0.05	0.05	0.1	0.8	1.0
Bangkok (Thailand)	°F	78	82	84	86	85	82	82	82	82	82	79	77
	°C	25	28	29	30	29	28	28	28	28	28	26	25
	Rainfall	0.4	0.8	1.3	2.9	7.1	6.2	6.3	6.6	12.1	8.3	2.6	0.3
Bombay (India)	°F	75	75	79	82	85	84	81	81	81	83	81	78
	°C	24	24	26	28	29	29	27	27	27	28	27	26
	Rainfall	0.1	0.1	0.1	0.1	0.7	19.1	24.3	13.4	10.4	2.5	0.5	0.1
Boston (United States)	°F	28	29	35	46	57	67	72	70	63	54	42	33
	°C	2	2	2	7	14	19	22	21	17	12	5	1
	Rainfall	3.6	3.3	3.8	3.5	3.1	3.2	3.3	3.6	3.2	3.3	3.6	3.4
Brisbane (Australia)	°F	77	77	74	70	65	60	59	60	65	70	73	76
	°C	25	25	23	21	18	16	15	16	18	19	23	24
	Rainfall	6.4	6.3	5.7	3.7	2.8	2.6	2.2	1.9	2.9	2.5	3.7	5.0
Chicago (United States)	°F	25	27	37	48	59	69	74	72	65	54	39	38
	°C	4	3	3	9	15	20	23	22	18	12	4	3
	Rainfall	1.8	1.4	2.9	2.8	3.7	4.1	2.7	3.2	3.2	2.6	2.3	1.9
Colombo (Sri Lanka)	°F	79	79	81	82	82	81	81	81	81	80	79	78
	°C	26	26	27	28	28	27	27	27	27	27	26	25
	Rainfall	4.0	2.2	4.9	8.9	15.0	9.0	6.0	2.6	7.0	13.3	12.3	5.6
Delhi (India)	°F	59	65	76	86	92	96	89	86	85	81	70	62
	°C	15	18	24	30	34	35	31	30	29	27	21	16
	Rainfall	0.9	0.7	0.5	0.3	0.5	2.9	7.1	6.8	4.6	0.4	0.1	0.4
Detroit (United States)	°F	25	25	35	46	57	68	73	71	64	52	40	30
	°C	4	4	2	8	14	20	23	22	18	11	4	1
	Rainfall	2.1	2.1	2.5	2.5	3.3	3.6	3.3	2.7	2.8	2.4	2.4	2.3
Frankfurt (Federal Republic of Germany)	°F	33	35	42	50	57	62	66	65	59	50	41	35
	°C	2	3	5	10	14	16	19	18	15	10	5	3
	Rainfall	1.7	1.3	1.6	1.5	2.0	2.5	2.8	2.6	1.9	2.2	2.0	2.0
Glasgow (Scotland)	°F	39	40	42	45	50	55	59	58	54	49	42	39
	°C	4	4	5	7	10	13	15	15	12	9	5	4
	Rainfall	4.7	3.1	2.5	2.5	2.6	2.4	3.2	3.5	3.7	4.7	4.0	4.1
Hong Kong	°F	60	59	63	71	78	81	82	82	81	77	70	63
	°C	16	15	17	21	25	27	28	28	27	25	21	17
	Rainfall	1.3	1.8	2.9	5.4	11.3	15.3	15.2	14.3	10.4	4.3	1.7	1.0
Honolulu (Hawaii)	°F	72	72	72	73	75	77	77	78	78	77	75	73
	°C	22	22	22	23	24	25	25	26	26	25	24	23
	Rainfall	4.1	2.6	3.1	1.9	1.0	0.7	0.9	1.1	1.4	1.9	2.5	4.1
Ibadan (Iran)	°F	54	59	65	76	88	93	97	97	90	81	69	58
	°C	12	15	18	24	31	34	36	36	32	27	20	14
	Rainfall	1.5	1.7	0.6	0.8	0.1	0	0	0	0.1	0.1	1.0	1.8
Karachi (Pakistan)	°F	67	69	75	79	84	87	84	81	81	80	76	68
	°C	19	20	24	26	29	30	29	27	27	27	24	20
	Rainfall	0.5	0.4	0.3	0.2	0.05	0.9	2.9	1.7	0.4	0.05	0.05	0.1
Kuala Lumpur (Malaysia)	°F	81	82	82	82	82	82	81	82	82	81	81	81
	°C	27	28	28	28	28	28	27	28	28	27	27	27
	Rainfall	6.2	7.9	10.2	11.5	8.8	5.1	3.9	6.4	8.6	9.8	10.2	7.5
London (England)	°F	40	40	43	48	54	60	64	63	58	57	44	41
	°C	4	4	6	9	12	16	18	17	14	14	6	5
	Rainfall	1.8	1.5	1.7	1.5	1.7	2.2	2.2	2.2	1.9	2.7	2.2	2.3
Montreal (Canada)	°F	15	15	28	42	55	65	70	68	60	49	36	19
	°C	9	9	4	5	13	18	21	20	16	10	3	7
	Rainfall	0.9	0.5	1.8	2.6	3.0	3.2	3.6	2.8	3.2	3.0	3.0	2.8
New York (United States)	°F	32	31	39	49	60	69	74	73	67	56	45	34
	°C	0	0	4	10	16	20	23	23	19	13	7	3
	Rainfall	3.6	3.5	3.8	3.3	3.3	3.4	4.3	4.3	3.5	3.4	3.2	3.3
Rangoon (Burma)	°F	77	79	83	86	84	81	80	80	81	82	80	77
	°C	25	26	28	30	29	27	27	27	27	28	27	25
	Rainfall	0.2	0.2	0.3	1.6	12.0	18.0	21.4	19.9	15.3	6.9	2.9	0.4
Rome (Italy)	°F	45	47	51	56	64	71	76	75	69	62	53	47
	°C	7	8	11	13	18	21	24	24	20	16	12	8
	Rainfall	3.1	2.5	2.7	2.7	2.3	1.6	0.7	1.1	2.8	4.7	4.6	3.5
Singapore	°F	80	80	81	82	81	82	82	81	81	81	80	80
	°C	27	27	27	28	27	28	28	27	27	27	27	27
	Rainfall	9.9	6.9	7.6	7.4	6.8	6.8	6.7	7.7	7.0	8.2	10.0	10.2
Tehran (Iran)	°F	36	41	49	60	70	79	85	84	77	64	53	42
	°C	3	5	10	16	21	26	29	29	25	18	12	5
	Rainfall	1.8	1.8	1.8	1.4	0.5	0.1	0.1	0.1	0.1	0.3	0.8	1.2
Tokyo (Japan)	°F	38	39	44	55	62	70	77	79	72	60	52	43
	°C	3	4	6	13	16	21	25	26	22	16	11	6
	Rainfall	1.9	2.9	2.2	5.3	5.8	6.5	5.6	6.0	9.2	8.2	3.8	2.3

1. In inches.

overlying paint which, unlike water-colours, has a certain thickness, remains of the same size, with the result that strain is produced between the paint and the board. During the dry season on the other hand, the board becomes smaller while the paint does not contract at all. Such a continuous expansion and contraction, repeated over the years, ultimately harms the paintings.

For proper conservation of objects, the control of the internal climate of the museum building is, therefore, always recommended. Air-conditioning is undoubtedly the best way of achieving this. However, the high cost of air-conditioning—not only the capital investment, but also the maintenance and running costs—makes it too expensive for museums in South and South-East Asia. As an alternative some of them may install individual room air-conditioners for their collections. These unit air-conditioners do bring down the temperature but it should not be forgotten that the air-conditioning of museum buildings is recommended not only for the control of temperature, but of relative humidity as well. Individual air-conditioning units, however, are normally meant for human comfort and not for the control of relative humidity. Moreover, they have to be switched off at night or after office hours because they are not meant for continuous use. Hence the installation of room air-conditioners may do more harm than having no air-conditioners at all. For the museums of this region, therefore, some other means of minimizing the effect of climate will have to be found.[1]

One such means is the suitable use of principles of architecture for control of climate. Through suitable orientation of the building, protection of the walls and the roofs from direct and reflective solar radiation, control of the sizes of the window openings, provision of ventilators, etc., this aim can be achieved to a certain extent.[2] There certainly is a very close relationship between the design of the museum building and the climate prevailing inside. This idea must be utilized to the full in South and South-East Asia, because present conditions do not permit the use of mechanical means in the majority of cases.

Conditions of high humidity also accelerate the growth of micro-organisms. The relative humidity in parts of South India, Sri Lanka, Bangladesh, Malaysia and Indonesia is always high. It rarely falls below 65 per cent. In this region, therefore, there is a constant danger of deterioration due to various micro-organisms.

Damage to cultural property brought about by micro-organisms can take very serious forms indeed. It is almost impossible, for example, to remove fungus stains from the Indian *pata* paintings or miniatures. Excessive use of fungicide may not be desirable, because of its possible ill-effect upon the material and its toxic properties for museum workers.

Like fungi and other micro-organisms, insects also seem to thrive in the type of climate prevailing in the region. Termites, cockroaches, silver fish and various species of beetles proliferate very rapidly in tropical climates. The damage due to insects in climates where humidity and temperatures are high is enormous in comparison to the damage caused by them in temperate climates.[3] Again, as with fungicides, insecticides cannot be used indiscriminately and in large doses.

Another important factor of deterioration of objects is light, which has a profound effect on paper, paintings and dyed textiles. Studies show that the effect of light is much more intense on water-colour paintings and miniatures, common in the Asian countries, than on oil paintings. Further, since the fading of dyed materials, textiles or paper, is quicker at high humidity, the effect of light is aggravated in tropical countries.

Light is much more intense in the tropical countries than in temperate climates. Table 2 will give a comparative idea of light intensities in various parts of the world. It is natural that the destructive effect of light, if uncontrolled, will be much more harmful in the tropics than elsewhere.

The danger to cultural property due to atmospheric pollution, though it has so far not been serious in this region, is increasing rapidly. New industries are

1. G. Thomson, 'Climate and the Museum in the Tropics', *Conservation in the Tropics*, p. 37–52, Rome, International Centre for Conservation, 1974.
2. O. P. Agrawal and Smita J. Baxi, 'Climate and Museum Architecture in South and South-East Asia', *Museum*, Vol. XXVI, No. 3/4, 1974, p. 269–73.
3. S. M. Nair, 'Biodeterioration of Museum Material in Tropical Countries', *Conservation in the Tropics*, Rome, International Centre for Conservation, 1974.

TABLE 2. Approximate annual exposure of an unobstructed horizontal surface to light from sun, sky and cloud, in million luxhours (Mlxh)

City	Mlxh		Mlxh
London, Stockholm, Leningrad	100	Bangkok, Madrid	170
Paris, Warsaw, Moscow	110	Athens, Peking, Sydney, Lagos	180
Munich, Vienna, Tokyo	125	Brasilia, Lima	190
Rome, Boston, Chicago	150	Mexico City, Kano, Capetown	200
New York, Naples, Washington	160	Delhi, Karachi	230
		Aswan	280

developing, more automobiles can be seen on the roads, chemical refineries are being set up, sometimes very near to museums or national monuments. The sulphurous acids in the atmosphere, given out by industrial units or automobiles can have a deadly effect on museum objects. Luckily, this problem is not as acute as in the industrially developed countries. But if suitable preventive measures are not taken now, the time is not far off when Asia will find itself in the same situation.

Dust is another type of polluting agent present in the atmosphere, especially in the dry areas and in the summer months of monsoon climate lands. Since, in the absence of air-conditioning, doors and windows have to be kept open for proper ventilation, it is next to impossible to put a stop to the inroads of dust.

Damage due to physical factors can largely be averted through proper training and creation of awareness of such dangers among curators. Unfortunately, this training is severely lacking in most countries of South and South-East Asia. There have been occasional seminars and training camps, but the shortage of trained personnel is far more serious than it appears to be on the surface. The situation is worsened by a lack of literature on the subject in the local languages of the countries concerned. English, French, Russian or German are understood by very few in these countries. Besides such specific problems of preservation, one should also mention the lack of conservation facilities in this part of the world, which has a very serious effect on the maintenance of the cultural heritage. Very few countries in the region have fully equipped conservation departments. This situation, I believe, is partly due to lack of awareness on the part of the authorities and partly due to lack of financial resources. Most countries in the area are obliged to devote a major part of their budget to other essential expenditure on agriculture, industry, education, health and so on. Conservation of cultural property even when very much desired by the government does not get, and possibly can never get, as high a priority in the national budget as it needs.

Even more serious is the staff situation in most existing conservation laboratories. Many of them have on their staff untrained or semi-trained conservators. Such semi-trained persons can do more harm to cultural objects than none at all. Two training centres have been started in this area, on the initiative of Unesco, but this is only a very modest beginning. One can only hope that ultimately enough trained persons will be available for saving the vast cultural heritage of Asia.

As has been said earlier, the degradation of an object is the outcome of interaction between the factors of deterioration and the material. The problems of conservation of cultural property in South and South-East Asia are also distinctive because of the nature of the objects and their construction. Besides metal objects, wooden objects, stone sculptures and paper manuscripts, there also are objects like palm-leaf manuscripts and paintings, birch-bark manuscripts, cloth paintings executed in a mixed technique of dyeing and painting, lacquer objects, shadow puppets, etc., which are more or less specific to this region, as will be shown in the following pages. Their deterioration and methods required to treat them have specific characteristics of their own. The alterations caused by climate and by the other agencies of deterioration

prevalent in tropical climates are not quite the same as in temperate climates. The materials used for these objects may not differ markedly from those used elsewhere, but techniques of construction are peculiar to the region. A brief account of these techniques is given below in order not only to focus attention systematically on the various problems involved and to bring them to the attention of all art-lovers, but also with the hope that intensive research will be undertaken in order to solve them. Research on this subject, with particular focus on the needs of South and South-East Asia, is very limited. Most conservation centres have to depend on the methods applicable in the West, which sometimes yield results but more often than not prove to be inappropriate. The problems to be solved are major ones and the survival of cultural property in the area will depend upon whether effective solutions to them are found.

Conservation of Asian cultural objects: Asian materials and techniques

Birch-bark manuscripts

In India, before paper was introduced, sometime in the twelfth century, the main materials used for writing were birch bark (*bhojapatra*) and palm leaves. There are large collections of manuscripts on palm leaves in various museums and oriental institutes, and some on birch bark. These materials ceased to be used after the introduction of paper (Fig. 3).

The birch is a moderate-sized deciduous tree, growing at an altitude of about 14,000 feet (4,600 metres) in the Himalayas. The inner bark was used for writing. It was slowly dried, then oil was applied and it was polished. The leaves were cut to size, and holes were pierced in the centre to allow a cord to pass through and hold them together. There were two wooden covers around which the cord was wrapped.[1]

Deterioration and conservation

Birch bark has several layers, each of which is as thin as tissue paper. They are joined together by natural gums, and by knots and streaks in the texture. Deterioration can occur in two ways: (a) separation of individual layers from each other; (b) deterioration of the sheet itself.

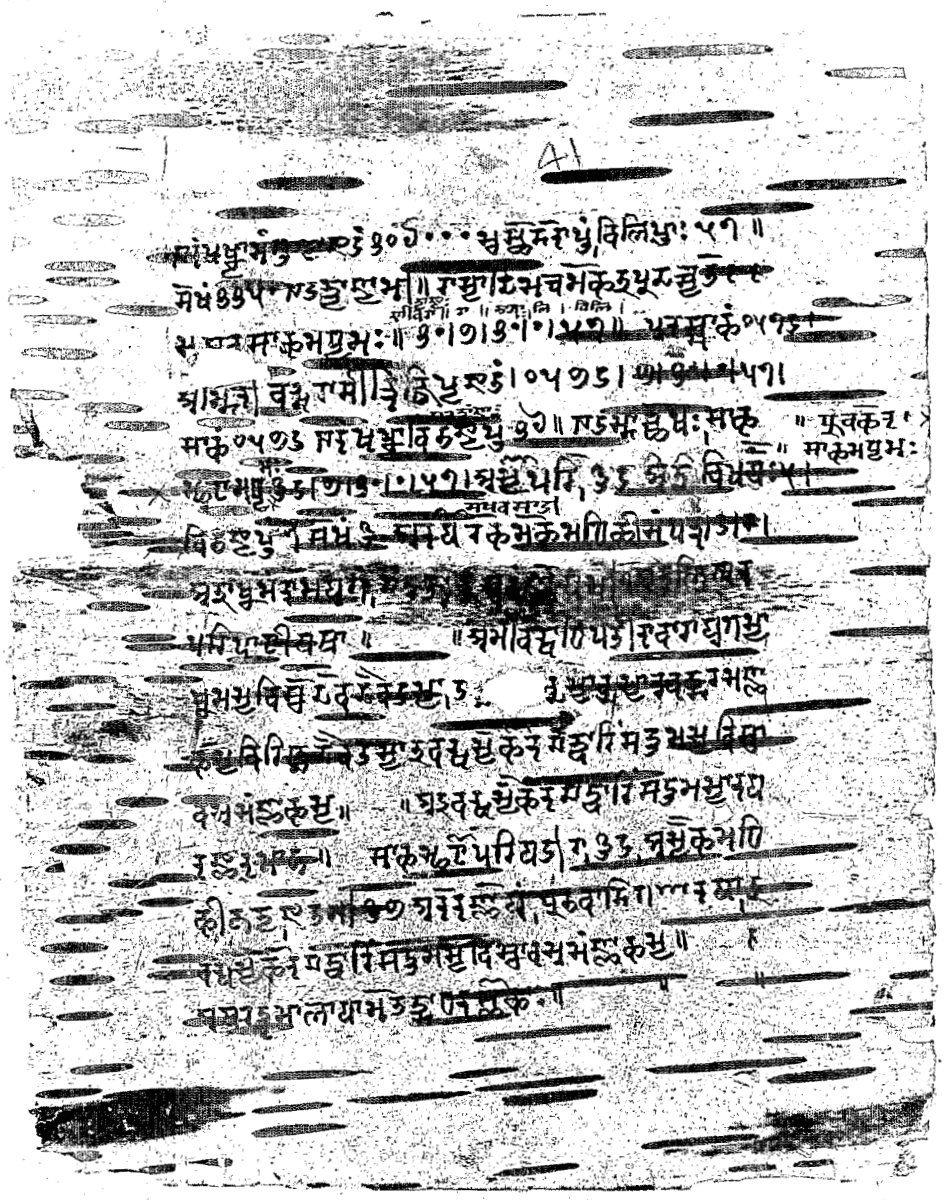
It is difficult to deal with separation, mainly because of the knots which often defeat any attempt to apply an adhesive uniformly to all parts of the sheet, even with a thin brush. There is always a likelihood of breakage at the spots where the knots occur.

Birch bark weakens considerably with age. The sheet becomes stiff and brittle and gradually disintegrates. As with paper, acidity seems to damage the birch. The solution of keeping brittle birch between two sheets of glass is not possible with big collections. Lamination between cellulose acetate foils after deacidification seems to be the only remedy currently available.

Palm-leaf manuscripts

Paper was invented in China towards 105 A.D. by a man named Tsai-Lun, but the method of producing it remained a closely guarded secret within that country for many centuries. Knowledge of paper-making was acquired by the Arabs in the eighth century from a Chinese prisoner and paper factories were opened at Samarkand and Baghdad in 794.[2] Before this time, in Arab

1. O. P. Agrawal, 'A Study of the Technique and Materials of Indian Illustrated Manuscripts', *Bulletin National Museum, New Delhi*, 1972, p. 22–33.
2. Basil Gray, *Persian Miniatures*, p. 23, London, 1930.



3
A leaf from a birch-bark manuscript. The birch bark is composed of several layers, joined together by knots and streaks. The edges of the leaves are generally fragile.

countries, Persia and neighbouring areas, parchment and leather were the main materials for writing and painting, and continued to be used for a long time afterwards because paper was expensive. In India, Ceylon,[3] Burma, Thailand, Indonesia, Cambodia and other Eastern countries, palm leaf was extensively used for writing purposes, as well as for painting. It remained by far the most important writing material, and today we come across sizeable collections of palm-leaf manuscripts, with or without painting, in most of the museums and libraries. In India palm leaf and birch bark ceased to be used after the introduction of paper. However, even today, they are employed for certain religious writings, because of the character attributed to them.

The palm trees which produce palm leaves for manuscripts are of two types—the palmyra palm (*Borassus flabellifer*) and the talipot palm (*Corypha umbraculifera L.*). The talipot palm is by far the more important of the two. It grows abundantly in humid climates in the coastal areas of India, Ceylon, Burma, Thailand and Indonesia. Talipot palm leaves are smooth, delicate and supple, while the palmyra palm, growing in comparatively drier climates, has rough, coarse leaves. The fibres of talipot do not easily get damaged and are more resistant to decay. In India and Nepal both varieties were in use, while in Ceylon, Thailand and Indonesia talipot was more common.

3. Now Sri Lanka.

4
Bundle of palm leaves being cut to even size with a sharp knife.

Palm leaves had to be processed in a special manner. In India and Ceylon fresh palm leaves were first dried, boiled in water (in some places in lime water) for a few hours, dried again, and then cut as needed. Palm leaves come in varying sizes, sometimes as long as 1 m. However, the widest would measure not more than 8–10 cm. Sometimes two or more leaves were stitched together to make a broader writing surface.

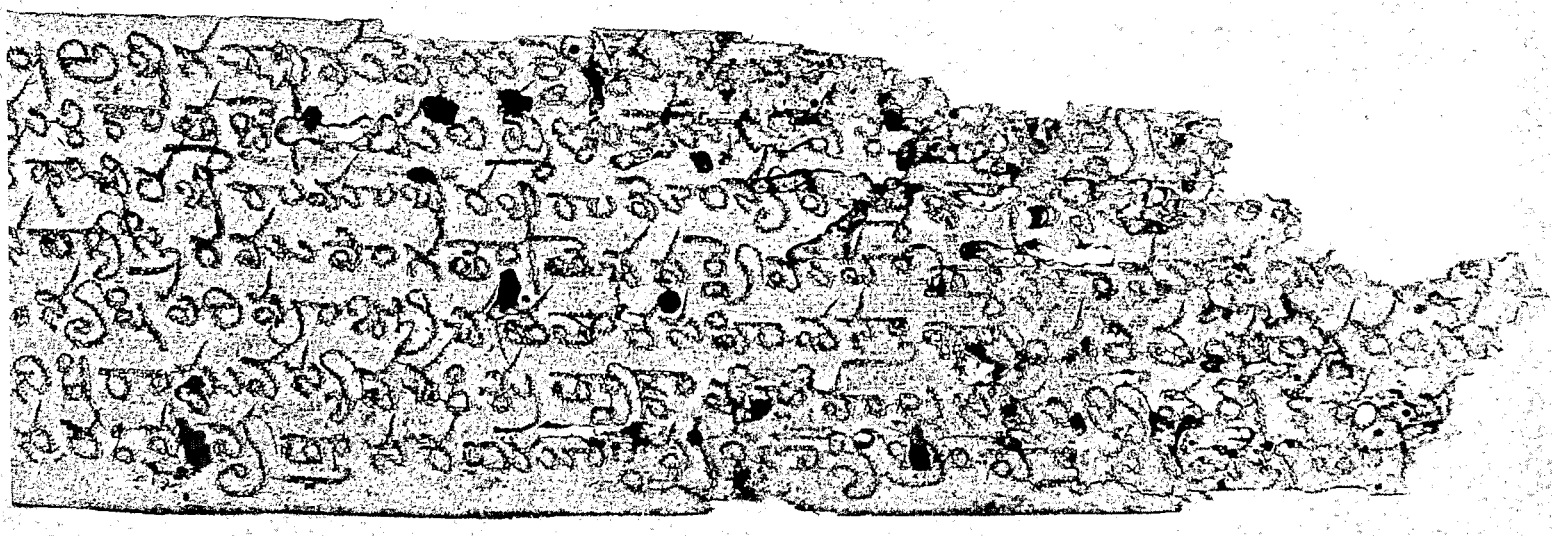
In Thailand, the method of processing palm leaves (known as *Bai-larn* in the Thai language, the palm tree being called *larn*) differs considerably. The palm leaf is found throughout the Thai forests, but the most famous comes from the forests near Lopburi. The leaves are slightly golden-cream in colour. After being cut from the tree, they are dried and the stiff rib of the pinnate leaves is removed. They are collected in bundles of about fifty, put between two wooden boards of the size needed, and cut to size with a sharp knife (Fig. *4*). The next step is steaming, used in Thailand only. The leaves are fastened together in dark, heavy frames and kept for a whole day in a wood-heated kiln. A kind of black oil exudes from the leaves. It is believed that this process was introduced to 'ripen' the leaves, and was considered crucial for their conservation. Only the leaves used for writing or printing were treated in this way; it was not necessary for the rest, which were used for making hats and other objects. The leaves were taken out of the kiln and wiped with a cloth to remove all exudations. They were held over an open fire for a few minutes and then polished. The leaf, at this stage, is absolutely dry and ready for writing upon.[4]

Method of writing

Writing was done in two main ways: (a) by incising (Fig. *5*); and (b) by writing with a pen or brush (Fig. *6*).

Incising was the more common. Letters were incised in the leaf with a pointed stylus (Fig. *7*). Lamp black or charcoal powder mixed with oil was then rubbed on to make the writing visible. The excess was wiped off with a cloth. In India, mustard oil or *til* oil was used for the purpose. In Ceylon, two types of oils were used for mixing the blackening—one is called *du-du tel* and the other, *dummala-tel*. *Du-du tel* is prepared by pressing the fruits of the heart-peak (*Cardiospermim halicacabum*). Dummala oil is obtained by distillation of a fossil resin found in the soil in certain localities. The oil is brownish in colour. In Thailand, an oil sold under the name of 'wood-oil' was mixed with black for application on incised palm leaves. The leaves were then rubbed with hot

4. Information collected from Mrs Siri Sithisoradej of the Larn-Thong (golden palm) palm-leaf shop in Bangkok.



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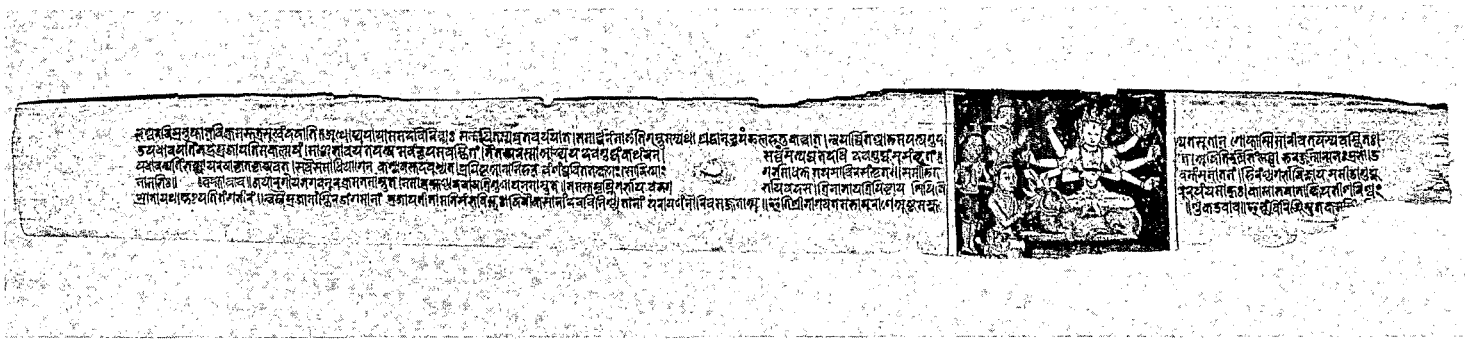


6

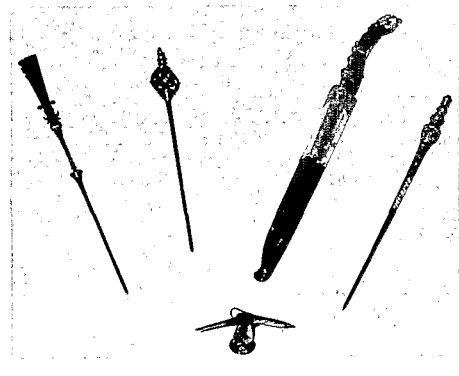
sand to reveal the writing. I have not come across hot sand being used for this purpose in any other country.

Besides these habitual practices, various innovations were introduced. For instance, in certain parts of India a paste of turmeric powder applied to the leaf gave it a slightly yellowish colour. Possibly the greatest variations are found in Thailand. Palm leaves were coated with a red vermilion dye, and written upon with gold ink. Black lacquer was sometimes applied on the leaf which was then inscribed and illuminated with gold. Black or blue dye was also applied, and the leaves were written upon with white ink, prepared by mixing chalk with gum. However, the leaf was used most commonly without any coating, but was sometimes lacquered black or red, or tinted blue, black or red. Gold, black, red or white inks were used. In a few examples, the palm leaf was gilded and then written upon with black lacquer. These various treatments are not found in other countries.

I have noticed that the edges of the Thai palm-leaf manuscripts are almost invariably gilded with lacquer mixed with gold powder or vermilion. This process binds the fibres of the edges of the leaves, at least to a certain extent, and does not allow them to break easily, besides saving the leaves from getting stained or soiled.

The texts on palm leaves usually had illustrations—either incised (Fig. 8) or painted with a brush (Fig. 9). In the incised illustrations the use of colours was restricted, to black usually, or sometimes red. In brush paintings, the palette is wider—yellow, red, blue, green, white, black and mixtures of these colours.

Palm leaves could not be bound like a book; they were stored between two wooden boards, slightly bigger in size than the leaves, often painted or decorated with inlay work. Covers for palm-leaf manuscripts are often themselves



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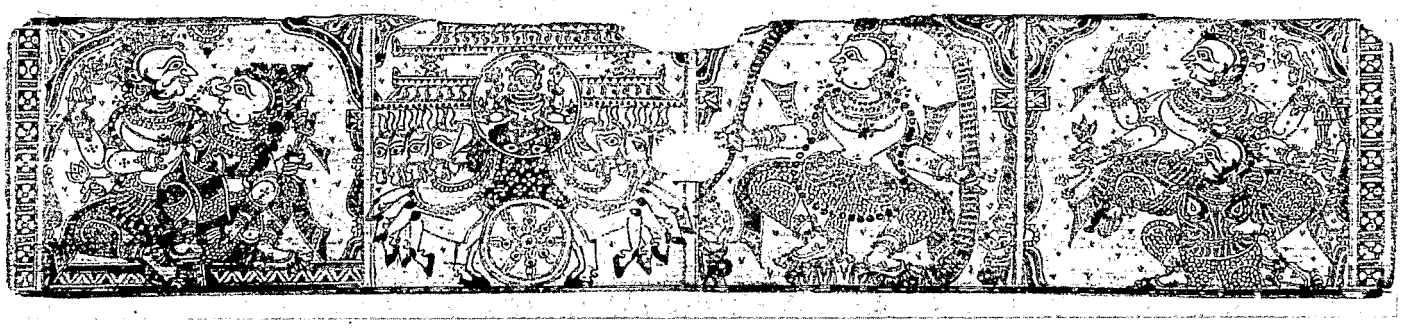
5
A leaf from a palm-leaf manuscript, incised with a pointed stylus. The writing is cut deep into the leaf and is made legible by rubbing in black ink which fills in the incisions.

6
Writing done with pen and ink. The painting was done with a brush and paint. The ink remains on the smooth surface of the leaf and is therefore less durable.

7
Iron styli used for incising on palm leaf.

8



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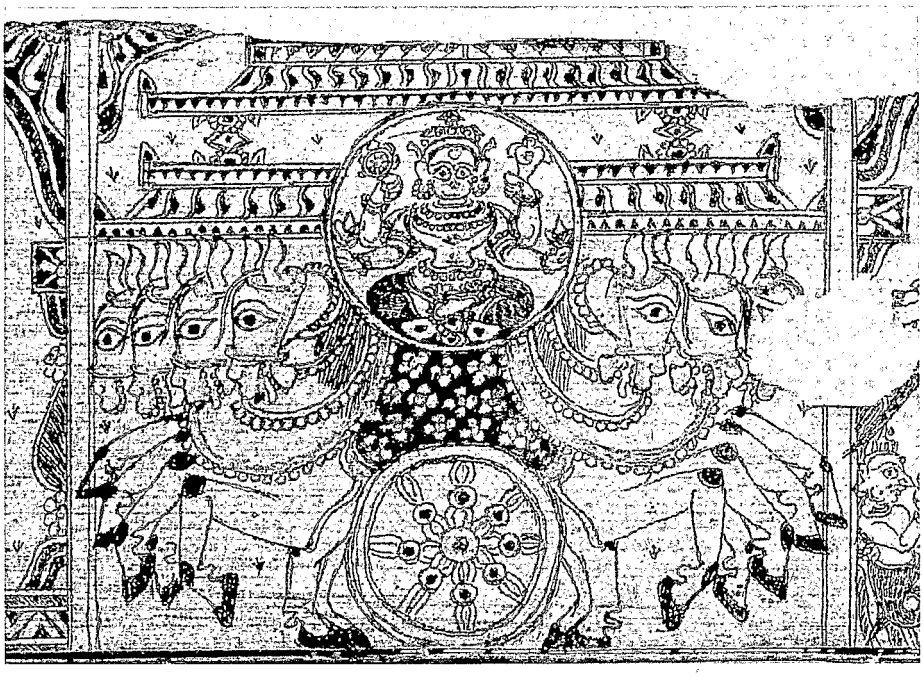


8
An illustrated palm leaf. The drawing has been done with a pointed stylus. Black ink is rubbed over the incision to make it visible. Sometimes paint is also filled in with a brush.

9
Detail of one of the panels of Figure *8*. It depicts the sun-god on a chariot driven by seven horses.

10
A palm-leaf manuscript kept between two wooden boards and bound with cord. An inscribed leaf on top contains the title. The covers are decorated with mother-of-pearl inlay. The manuscript edges are gilded.

11
A damaged inscribed palm leaf. The upper layers of the palm leaf have got stuck to the adjacent leaf of the manuscript.

12
The layer of the inscribed palm leaf sticking to the next leaf is being separated in the laboratory. This layer will then be fixed in position of the leaf shown in Figure *11*.

works of art and should be treated as such. They served the double purpose of protecting the leaves and of portraying scenes from religious stories. Holes were punched in the palm leaves, in the centre if the leaf was small, otherwise on either side of it. Cords were passed through the holes and wound around the manuscript to keep the leaves in position (Fig. *10*). A slip, also of palm leaf, sometimes of ivory or wood, carrying the title of the work, was placed over the book's cover for identification. The manuscript was always wrapped in cloth to keep it free of dust.

Deterioration of palm leaf

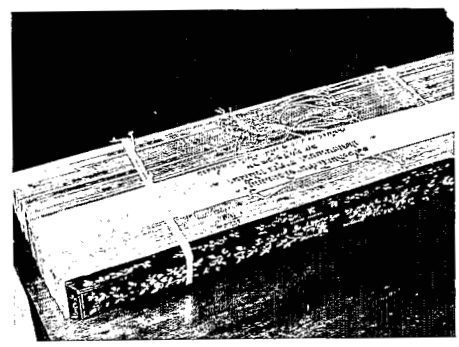
With time, several defects occur in palm leaves, of which the main ones are fading of ink, brittleness and consequent breaks and friability, insect damage and stains.

Dirt and stains can often be removed with a mixture of glycerine and water. In this respect, palm leaf is better than paper in the sense that cleaning with wet swabs, if not prolonged unduly, will not harm the leaf. However, if it is soaked in water for a long time, distortion and breaking may take place. Organic solutions can be used when the stains are of an organic nature or when the ink is soluble in water.

Sometimes the blackening element is lost from the incisions and the writing fades. In such cases it is necessary to re-blacken by rubbing carbon black, mixed with a suitable oil, on the faded leaf.

Brittleness or loss of flexibility is largely due to desiccation. Brittle palm leaves easily break—the slightest bend is enough. A dry climate is dangerous for them: they get distorted and cracked. The tension is released in a humid

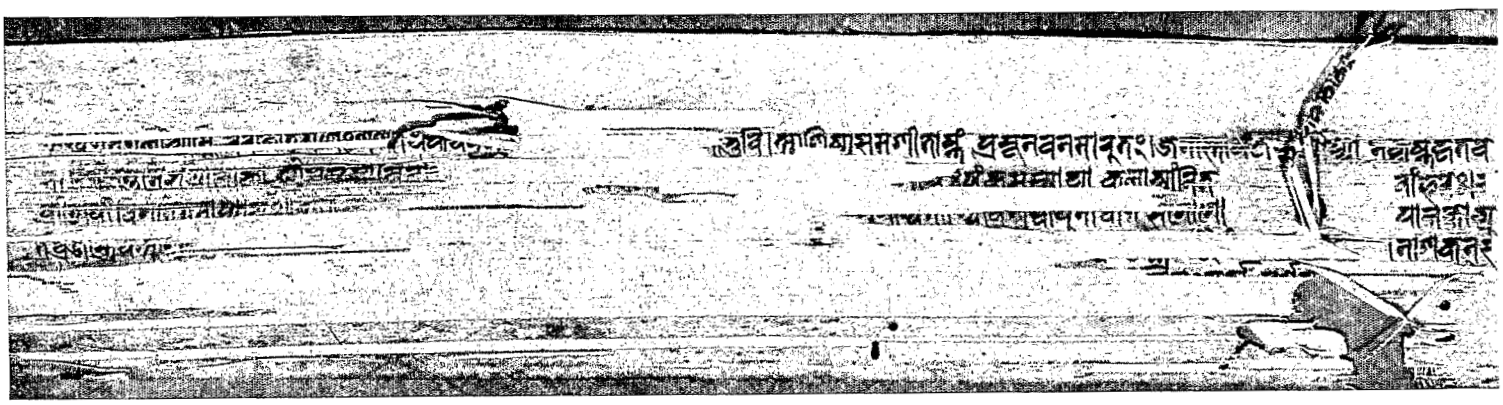
climate. An alternating dry and humid climate also produces strain and breaking.



10

Flexibility can be restored to a certain extent by the application of oil. Citronella oil, camphor oil and walnut oil can be used. In Ceylon, dummala oil is periodically applied to keep leaves supple. The edges of brittle palm leaves are especially weak and friable. In handling also, pressure is exerted mostly on the edges, which get broken. Hence the leaves must always be stored between stiff boards, slightly bigger in size than the leaves, as was the practice in early times.

Broken leaves are repaired by lamination with silk net, using starch paste,



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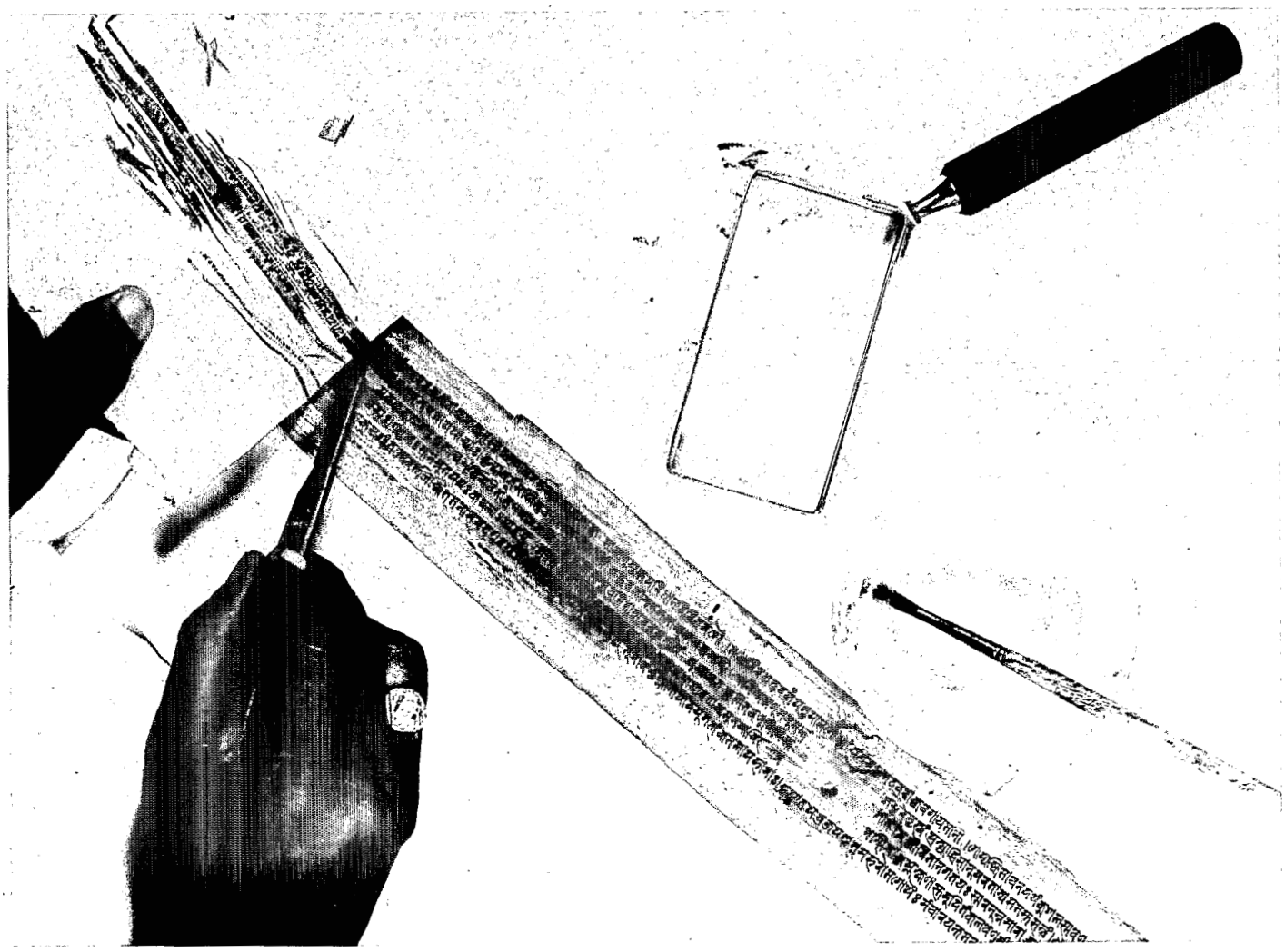


12

or by cellulose acetate foil. In some libraries, palm leaves are placed between glass sheets, but this is possible only when there are only a few leaves in the collection.

Layers of palm leaves quite often get split and separated, especially when

leaves get stuck to one another. Re-fixing the cleavages is a delicate task, but possible (Figs. *11* and *12*). A solution of alcohol and water is used to soften the palm leaves which have got stuck together. The layers are separated with the help of needles and tweezers. Each separated layer is then affixed to the original with polyvinyl acetate emulsion.

Deterioration of paintings and decoration

Painting on palm leaf was very similar in technique to painting on paper. A thin white coating was applied to the leaf and burnished. An outline was drawn and colours filled in. The colours used were mostly pure red, yellow, blue, green, black and white.

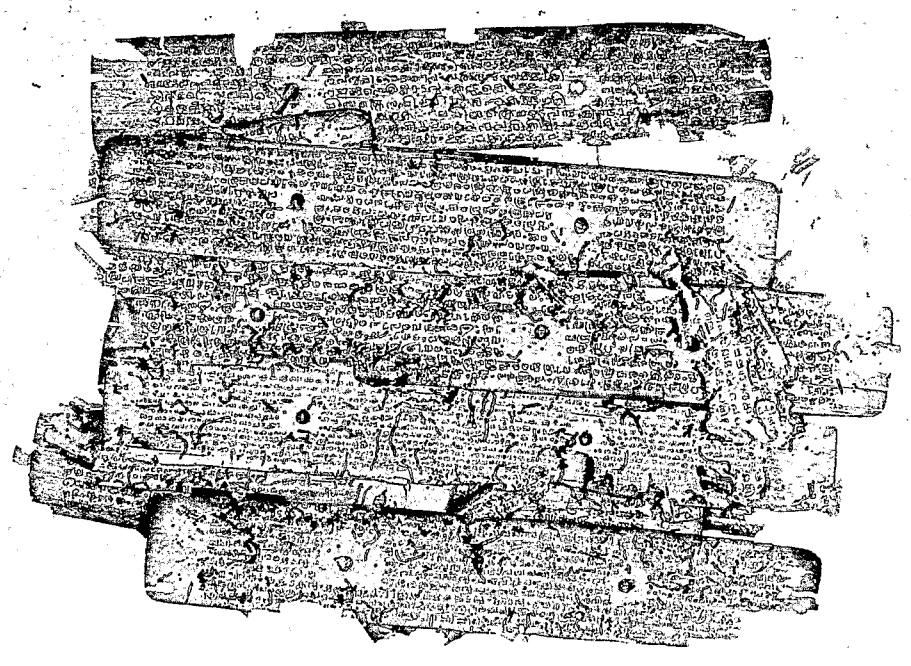
Flaking of pigment, because of lack of binding power in the medium, is the most common defect in palm-leaf manuscripts. This is not surprising, as the bond between the paint and the leaf is never very strong. A fresh protective coating is helpful.

In Thailand, palm leaves are sometimes decorated with lacquer. Extensive flaking occurs in lacquered palm leaves (but not in lacquered wooden boxes); it is mainly due to the flexible nature of the leaf, which bends, while the stiff resin layer is not able to do so to the same degree.

Insects are great enemies of palm leaves, especially those of the palmyra palm (Fig. *13*). Whole bundles of palm-leaf manuscripts have been destroyed by insects (especially *Castrallus* larvae). Holes are tunnelled from one end to the other. The strength of the leaf is naturally much reduced; it gradually falls to bits or is reduced to powder. Periodic fumigation and the regular application of insecticides are therefore absolutely essential.

Storage

As stated earlier, the ancient practice was to keep palm leaves between stiff boards which saved them from physical damage. This was an excellent practice (palm-leaf manuscripts, even if only one or two sheets, should always be kept between rigid boards). The bundles were then wrapped in cloth. The cloth wrapping saved the manuscript from dust and also from any other pollution present in the atmosphere. Bundles of manuscripts should not be stacked one over the other. Libraries, or *Granth-bhandaras,* as they were called in India, sometimes had storage cupboards with a pigeon-hole system for the individual bundles.



13
Palm-leaf manuscript damaged by insect larvae (*Gastrallus indicus reitter*).

Indian pata *paintings*

Indian *pata* paintings are paintings on cloth. Because of the perishable nature of cloth in a humid climate like that of India, very early specimens of pata paintings are not available, but there are references to them in early Sanskrit literature, evidence of the antiquity of their use and popularity.[5] Whole books were sometimes written on cloth. The *Jain-Chitra Kalpadruma*[6] mentions the possession by a Gyan Bhandara in a religious town of India, Vakhatijiniseri at Patan, of a cloth manuscript dating from A.D. 1351 or 1353.[7] Numerous examples from the fourteenth to the sixteenth century survive. The painting was done on long scrolls and, even after paper was introduced, cloth continued to be a popular support. The scrolls were used for various purposes, e.g. for teaching religious texts to the people and for explaining scenes from mythological stories in illustrated form.

In one form of *pata* painting, paint was used on the surface only. In a second form, dyes were used in the painting; they were applied by brush (*kalam*—hence the name *kalam-karis*), and became an integral part of the fabric. There were numerous centres in the country where painting on cloth was done to produce hangings for the walls of temples, on themes taken from epics and religious texts and stories.

Surface-painted patas

Cotton cloth, coarse or fine, was used. It was first sized with a paste of wheat flour or rice flour to make it non-absorbent and fill up pores and irregularities. The surface was next thoroughly burnished with agate stone to make it smooth and polished. In certain centres white priming (a mixture of glue and chalk) was applied and also burnished thoroughly. Burnishing and polishing were an important step in most painting techniques in India, and allowed the artist to execute fine brush work. In the cloth paintings from Bengal and Orissa, a thin layer of clay, fine and well-powdered, and mixed with cow-dung also finely pulverized, was applied. It was burnished until it became very smooth.

Paint was prepared by mixing various pigments with gums and glue. In certain religious centres, the use of glue was prohibited, and a gum or starch paste was used as binding medium.

In most cases, no varnish was applied. Sometimes the cloth was first dyed black to provide a background. Different colours and gold produced a most charming effect.

Deterioration and conservation

Deterioration takes two main forms: weakening of the support (Fig. *14 (a), (b)*); and flaking or chipping of the paint (Fig. *15*). The thinly applied paint may flake off because of the constant rolling and unrolling of the *pata*.

Weak supports must be relined on a new cloth. Wax, oil, resin or some such material likely to impart an 'oily' look to the painting can never be used for the relining of Indian *patas*.

There are two main methods of relining:

Starch paste.[8] A properly desized new cloth is backed with tissue paper and then fixed to the cloth painting with starch paste. This method has the advantage of not changing the matt-surface appearance of the painting, but it does unfortunately make the painting stiff.

Synthetic resin and nylon net.[9] A nylon or terylene net impregnated with polyvinyl acetate emulsion and dried previously is applied with heat. The scroll remains flexible but sometimes the resin 'creeps' to the surface, making it look oily.

After relining by the first method, the painting is put on a stretcher. In

5. C. Sivaramamurti, 'Sanskrit Literature and Art—Mirrors of Indian Culture', *Memoirs of the Archaeological Survey of India*, No. 73, 1955.

6. A sixteenth-century text of the Jain sect.

7. Motichandra, *Jain Miniature Paintings from Western India*, p. 70, Ahmedabad, Sarabhai Manilal Nawab, 1949.

8. T. R. Gairola, 'Pastes and Adhesives for Paper and Textiles', *Journal of Indian Museums*, Vol. VIII, 1952, p. 36–42.

9. E. R. Beecher, 'The Treatment of Weakened Fabrics', *Museums Journal*, Vol. 58, January 1959, p. 234.

India a special stretcher, like that used for Japanese screens, is used. It is prepared by fixing cross batons at a distance of 12 in (30 cm) from each other. Wet Japanese or Nepalese tissue paper is pasted on both sides of the stretcher with starch paste. When dry, the tissue paper becomes tight. The stretcher is lightweight but remarkably free from distortions. The size of the new support of the painting is slightly greater than that of the stretcher, and the edges of the support are folded and fixed on the back of the stretcher.

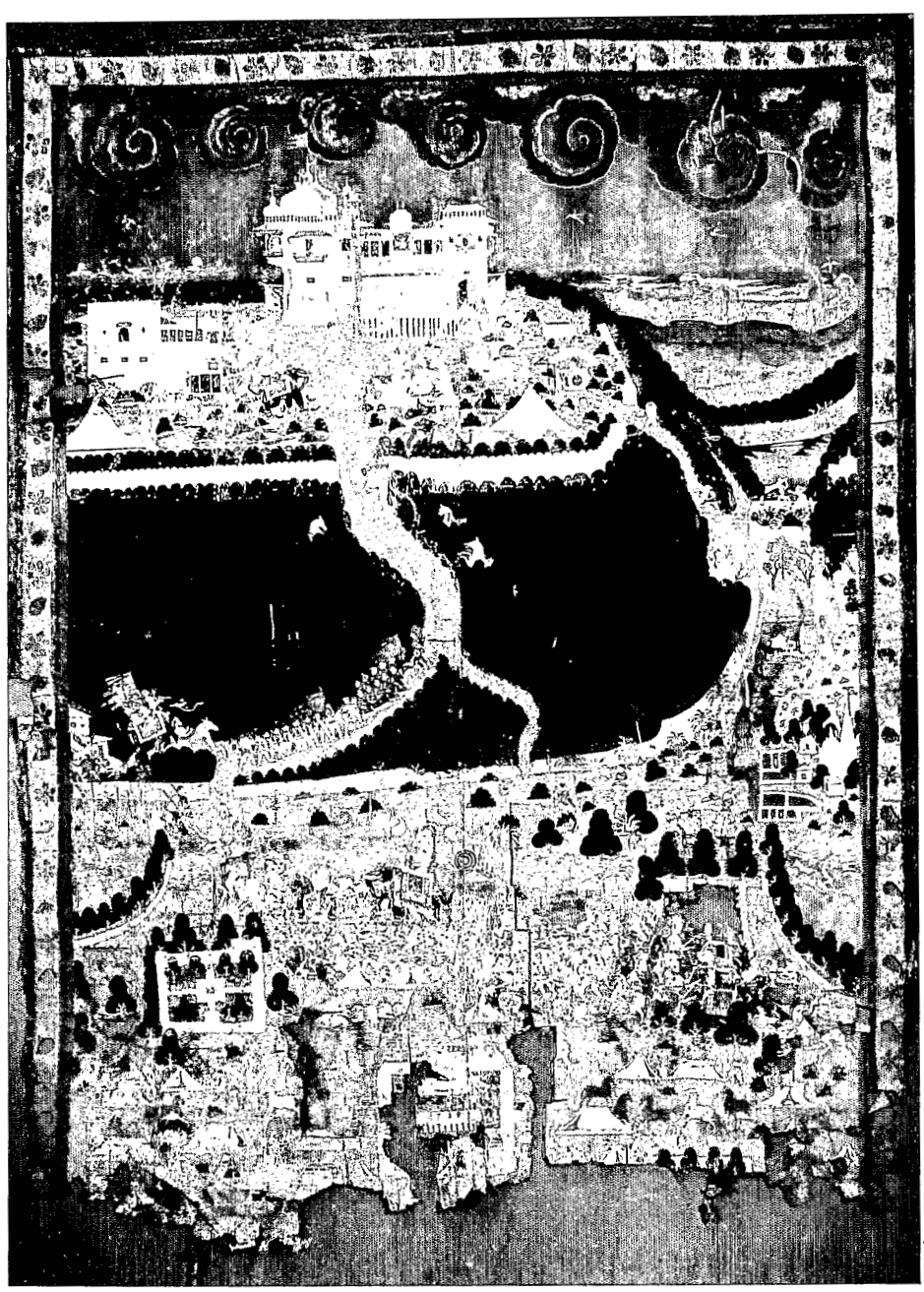
Flaking of the paint is often taken care of by the relining adhesive. If relining is not done, a dilute synthetic adhesive, such as soluble nylon or polyvinyl acetate, is applied on the painting from the back.

The paintings should be stored flat, but storing scrolls 20–30 ft (7–10 m) flat for a long time is a great problem. Space in most Indian museums is seldom sufficient even for a proper exhibition; many scroll-paintings are lying in the *gyan-bhandara*[10] attached to various temples.

Pata *painting with dyes*

Large paintings have been done by the *kalam-kari* technique (Fig. *16 (a), (b)*). Thick unbleached cotton cloth of the required size is used. Silk is not suitable.

14 (a), (b)
Deterioration of textile support of Rajasthani cloth painting.



14 (a)

10. *Gyan-bhandars:* Literally meaning store-house of knowledge; they were attached to most temples and housed religious manuscripts, paintings and other items. These *bhandars* served a very useful purpose in the preservation of art objects. See Kastoor Chand Kalsiwal, *Jaina Grantha Bhandars in Rajasthan*, Jaipur, Shri Digambar Jain Atishaway Kshetra Shri Mahavirji, Mahavir Bhawan, November 1967.

14 (b)

The first step is to wash the cloth thoroughly in flowing river water. In this process no other washing material is used. The cloth is soaked overnight in a solution of myrobalan (*Phyllanthus emblica*) and dried. This pre-treatment with myrobalan solution, which acts as a mordant, allows the black dye, applied later, to be fixed properly.

The artist then draws his design free-hand on the cloth, using a burnt twig as a charcoal pencil. Over this rough outline he draws the final drawing with a special black dye,[11] using a pen.[12] In some centres, the outline is prepared by means of engraved wooden blocks, instead of by free-hand drawing.

The next step is to give to the cloth its general background, which is normally reddened with vegetable dyes. Another brush is used to coat, with an alum solution, those portions which are to become permanently red. The other parts get slightly coloured in the process. Areas which should have remained white are bleached, by a very interesting method. The partly painted cloth is dipped in a solution of sheep's dung overnight and then rinsed in flowing water for some time. The cloth is spread on the river bank and exposed to the sun. Water is continuously sprinkled on the painting. Dipping in the sheep-dung solution and exposure to sun continues every day for a week. At the end, the painting retains the colour only in those portions where alum was applied.

It is amazing to see how the tonal value of the colour, ranging from pink to deep red, can be controlled by the artisan. By changing the strength of the alum solution, he obtains a graded colour. By experience and practice, he knows how many applications of alum solution are needed to produce a particular result.

Other colours are next filled in. The bleached cloth is dipped first in milk, to prevent one dye from running into another later. Other dyes are fixed with alum as mordant. The areas to be painted yellow or blue, for instance, are coated with an alum solution mixed with a tannin prepared from the bark of certain trees. The yellow or blue dye, also vegetable, is applied with a bamboo brush. After each colouring the painting is washed in running water.

When the whole process is complete, the cloth is finally washed in running water and dried.

The *kalam-kari* technique follows this sequence more or less in various centres. Variations depend upon individual taste and necessity.[13]

In dyed paintings, gold outlines are sometimes used. They are of course added on the surface as a paint, and are prepared by mixing gold dust with glue.

A combination of dyeing and surface painting techniques may be used in the same picture; body colours, hair, and so on are imparted by the dye techniques, and the other portions are painted (Fig. *17*).

It would seem to one not acquainted with *kalam-kari* painting that the whole process consisted of dyeing rather than painting, but such is not the case. In India, dyeing was modified by the controlled use of dyes and mordants to produce surprisingly brilliant works of art of great simplicity and directness of expression.

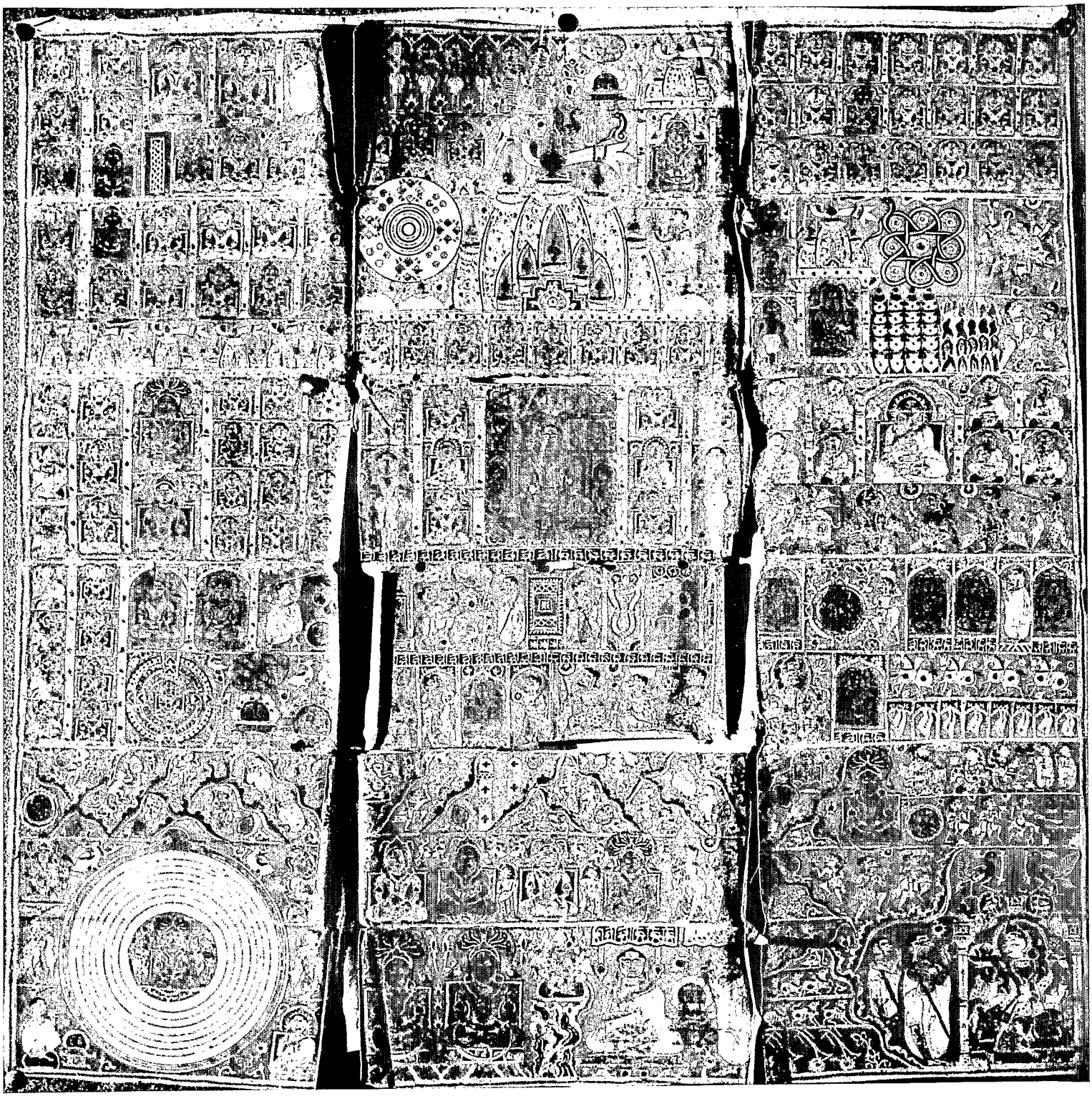
Deterioration

The deterioration problems of *kalam-kari* paintings are entirely different from those of a multi-layered painting with ground and paint on the surface. In surface-layered paintings, the various layers may separate or may flake. In *kalam-kari* or dyed paintings, there is no question of flaking or separation since there are no layers. Differently coloured dyes are absorbed into the fibres of the cloth and become part of them. However, there are deterioration problems. Weakening of the cloth support is the first. Continuous exposure to the sun during the bleaching process, and the use of alum and tannins as mordants tend to render the cloth fragile and weak. The painting then obviously needs to be relined.

11. The black dye is normally prepared as follows: Jaggery (unrefined sugar) is dissolved in water and iron filings are put into it and allowed to react. The resultant liquid is greyish, which turns black on reacting with myrobalam.

12. The pen is also made indigenously by sharpening a bamboo stick to a point. The centre of the stick is covered with felt which is soaked with the dye or the mordant solution, as need be. By pressing the felt the artisan is able to apply the solution to the cloth. The use of the pen needs a great control of fingers and knowledge of the dyes.

13. A. Chandrasekhar, articles on Kalamkari cloth printing in *Census of India, 1961*, Vol. II, New Delhi, 1964.



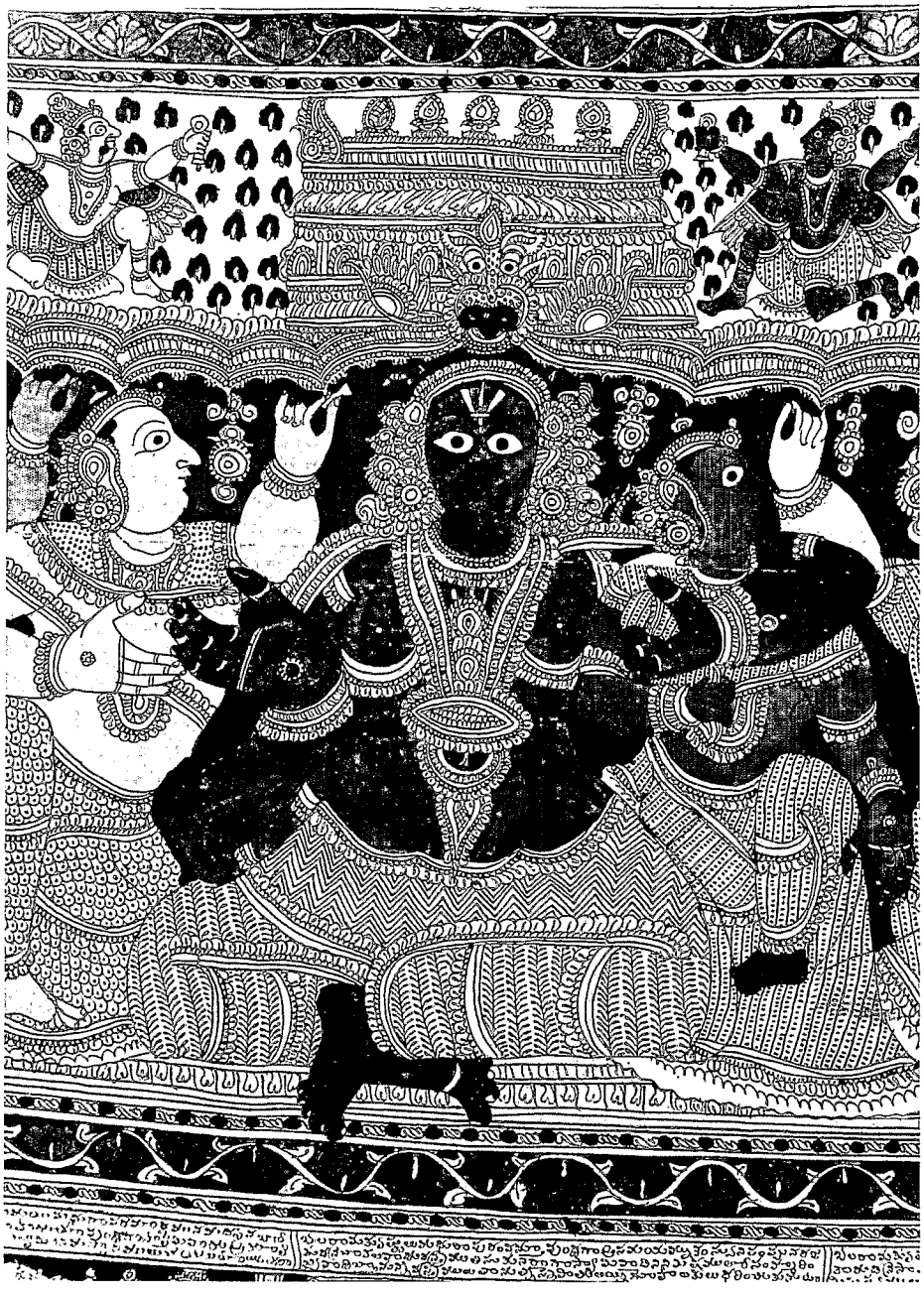
15
Western Indian Jain scrolls laid flat; curling of the edges has occurred.

Choosing a suitable process for the relining of Indian dyed cloth paintings is not easy. If a resinous medium is used for relining, and even if the synthetic resin-coated nylon net is applied with heat, the oily look it gives the surface contrasts with the normal matt surface. The wax and resin or glue paste used in the case of oil paintings are to be ruled out completely.

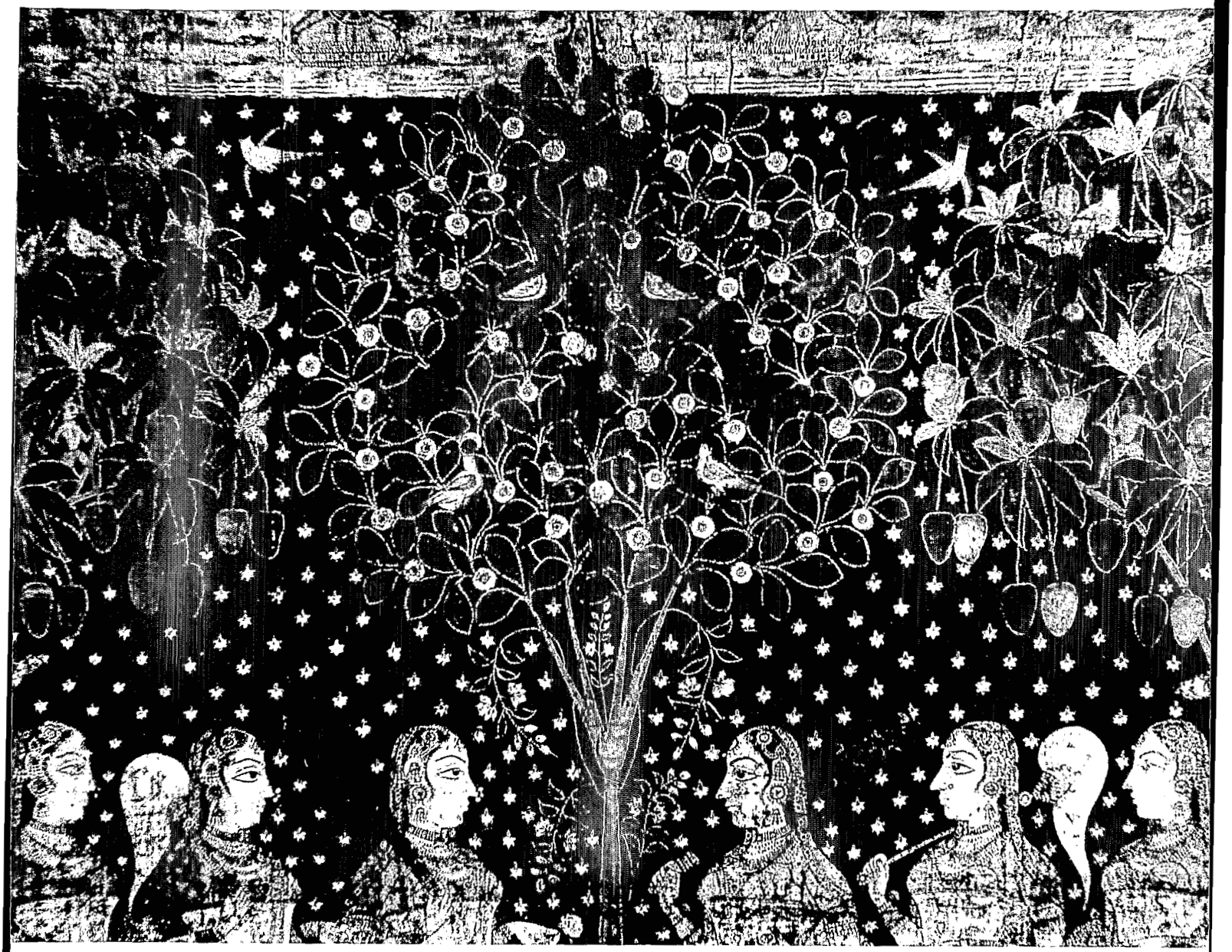
If the support is not too weak, a fresh support can be stitched on with a needle and thread. This does not transform a temple hanging into a framed

16 (a)

16
(a) *Kalamkari* painting from Andhra Pradesh, representing Krishna receiving the homage of the other gods.
(b) Detail: Krishna.



16 (b)



17
Detail of Rajasthani painting showing Gopis in search of Krishna: combination of surface painting and dyeing techniques.

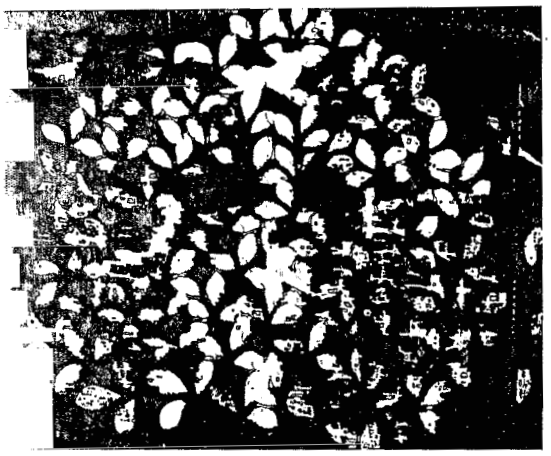
painting. But if the support is too weak, a new support must be pasted on. In our experience, thin starch paste works very well, better than other types of adhesive.

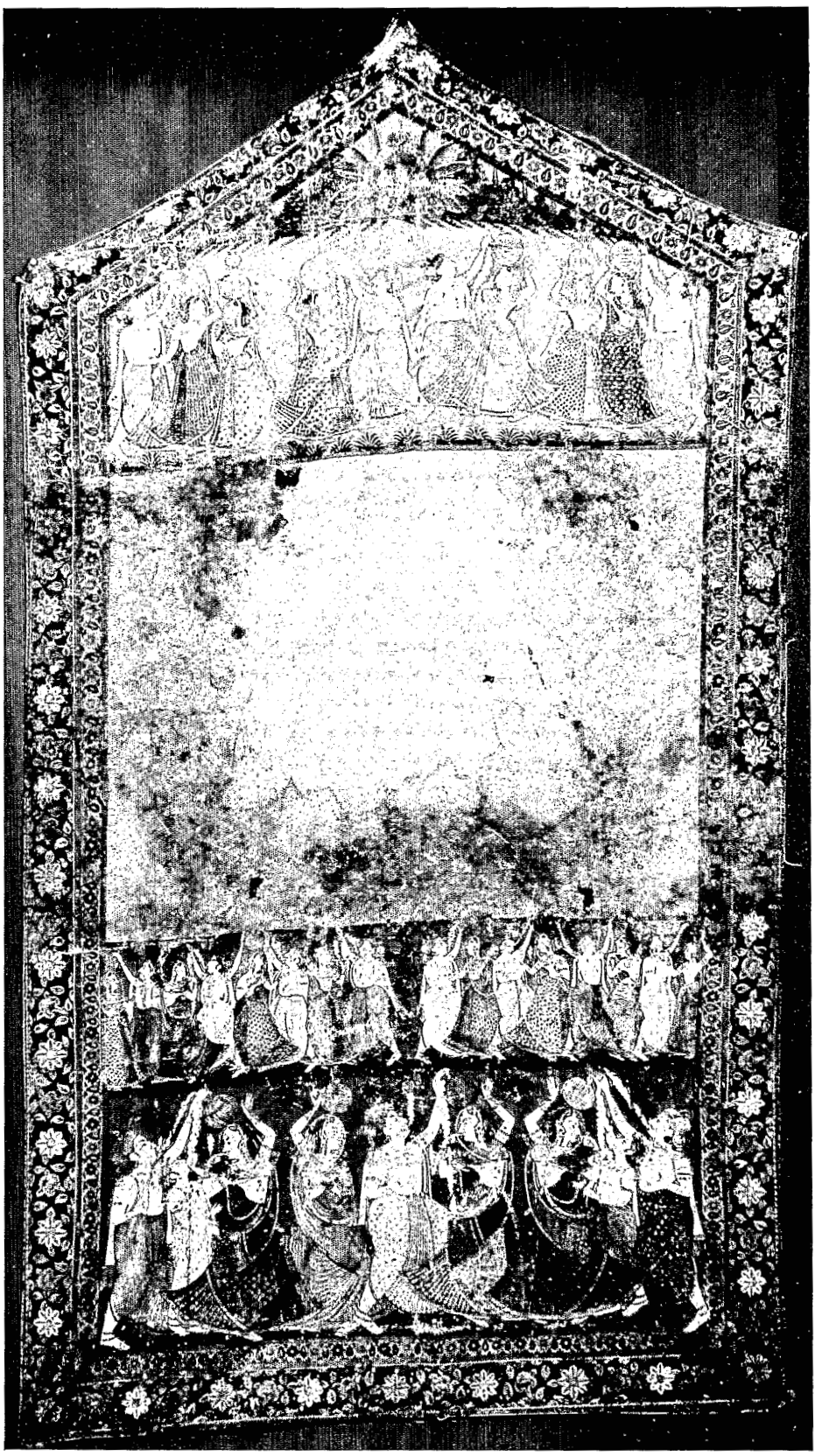
Another great problem is the loss of certain portions of a painting. For instance, the portions painted with one particular dye alone may be lost, the remaining portions remaining intact (Fig. *19*)—possibly the alum or other acid mordant used for that particular dye was not completely removed. Alum is known to disintegrate cellulose rather rapidly. The holes in the painted cloth sometimes produce an attractive uniform pattern (Fig. *18*).

The diminished strength of the fabric can be remedied by relining, but the main problem is to obtain the complete removal of the alum or other acid substances. When all the dyes are fast, it is possible to remove alum by washing (an alkali is not recommended, because it may have a fading effect on acid mordant dyes). But when all the dyes are not fast or when surface paint (which is normally aqueous) has been used, removal of the acids is tedious. Water cannot be used to wash off the mordants present. What is to be done? Will vapour phase neutralization be effective in arresting the decay? And if so, for how long? Is there any means of selective neutralization? These are some of the many questions which remain unanswered. Luckily for Western oil paintings they have no such acidity problem—one which almost invariably arises in the case of Indian cloth paintings.

Dyes in cloth paintings also fade at a much faster rate than do the oils in oil paintings. In this they resemble water-colour wash paintings, for which transparent dyes are also used (but on paper). The subject is not dwelt on here, as the effect of light on different types of materials has already been adequately studied elsewhere.[14]

18
Detail of cloth painting showing holes on portions painted with a particular dye.





19
Rajasthani painting, representing probably a scene of Krishna worship—the figure of Krishna has been removed by acidity in the centre portion.

14. Robert L. Feller, 'Control of Deteriorating Effects of Light upon Museum Objects', *Museum*, Vol. XVII, No. 2, 1964, p. 57–98 (a list of forty-nine references at the end of the article); Robert L. Feller, 'The Deteriorating Effect of Light on Museum Objects', *Museum News. Technical Supplement*, June 1964, No. 3, p. i–viii.

Tibetan tankas

The walls and pillars of Tibetan monasteries and temples were almost always embellished with colourful banners and scrolls. There were mural paintings too, but the removable banners and scrolls had their own special importance. To the outside world, the painting of Tibet is generally known through its scrolls, called *tanka* (*t'anka, tang-ka* or *tang-kha*) in the Tibetan language (Fig. *20*), because they have found their way to many Western museums and private collections. In technique and style, the *tanka* closely resembles to Indian *pata* painting on cloth.

Not much is known of the early history of painting in Tibet, the earliest available examples having been dated back to the ninth or tenth centuries.[15] In recent years interest in Tibetan *tankas* has grown considerably, and their history and importance have been studied in detail by many scholars.[16] The word *tanka* literally means 'something that is rolled up' i.e. a rolled-up image or a painted scroll. In Tibet, the *tanka* is always vertical in form. In this respect, it differs from the Indian *patas* and Chinese and Japanese scrolls which could be horizontal or vertical. It may also be of interest to note that the *tanka* was generally painted on cotton cloth, while the popular support for Chinese and Japanese scrolls was silk.

Construction

A *tanka* always has a mounting, and the word refers to picture and mounting together. In Tibetan, the mounting is called *tang-kahi-gos-sam* (the silk of the surface). The borders are indeed of silk. It is not always realized that the borders of a *tanka* are an integral part of the painting, and not simply an auxiliary as a frame is in the case of Western paintings. The *tanka* is not merely decorative, it is considered an aid to worship and meditation in order to attain the final goal of enlightenment. As such, the mounting has its own iconography and a symbolism which should not be ignored. Very often, in remounting a Tibetan scroll, the mounting is completely lost, and the pictorial part alone is mounted on a stretcher as if it were a Western painting. Rigid stretching changes not only the character of the *tanka* as a hanging scroll, but also its mystical significance. Several authors have discussed the symbolic significance of the mounting.[17] A fuller description will be found in Huntington's study on the iconography and structure of the mountings of Tibetan paintings.[18]

The pattern of borders is well established. The basic features remain more or less the same, but there are regional variations. Figure *21* shows the essential features of a *tanka*. All around the painting are stitched narrow strips of silk of different colours marked 1 in the figure. This part is called *ja* (rainbow), because it is of different colours and represents the spectrum of a rainbow. Red, yellow and gold are the colours most often used in the *ja*. Then on the two sides of the *ja*—right and left—marked 2 are stitched strips of cloth, generally dyed black or blue. The right strip is known as *gyas-pa* and the left, *gyan-pa*. On the bottom of the picture is a horizontal strip of cloth, 5, called *sa* (earth). A rectangular piece of cloth, generally gold brocade or embroidered silk, is stitched in the centre of the *sa* and is known as *rtsa-ba* (the root), 6. The horizontal strip at the top of the painting is called *gnam* (heaven), 4.

The two wooden or bamboo rods, marked 7, stitched at the top and base of the *tanka* are the *thang-rgyugs* or *thang-shing* (wood of the *tanka*). They are inserted tightly into the seams in the *sa* and the *rtsa-ba*. The top stick suspends the *tanka* and keeps it stretched laterally. A string is attached to its two ends, by which it is hung on the wall. The lower rod acts as a weight to keep the *tanka* hanging straight; over it, the *tanka* is rolled up for storage. The lower rod is always round and often has ornamental knobs on either side, made generally of brass, but sometimes of gold, silver or ivory.

The painting has a veil or cover, 8, and two ribbons. The cover is called

15. Pratapaditya Pal, *The Art of Tibet*, p. 34, New York, The Asia Society, 1969.

16. Giuseppe Tucci, *Tibetan Painted Scrolls*, Rome, ISMEO, 1950, 3 vols.

17. Tucci, op. cit.; G. de Roerich, *Tibetan Paintings*, Paris, 1925; Marco Pallis, *Peaks and Lamas*, London, A. A. Knopf, 1939—this study vividly describes the processes used by the artists of Tibet; A. B. Griswold, C. Kim and P. H. Pott, *The Art of Burma, Korea, Tibet*, London and New York, Methuen, 1964—contains a comprehensive bibliography.

18. John C. Huntington, 'The Iconography and Structure of the Mounting of Tibetan Paintings', *Studies in Conservation*, Vol. 15, 1970, p. 190–205.

thang-khebs (picture cover) or *jal-khebs* (cover of respect), which really is more appropriate, as one of its functions is to save the painting from the eyes of disrespectful viewers. It also protects the painting from smoke, oil and dirt. The cover hangs over the *tanka* and the ribbons hang over the cover. The ends of the ribbons are weighted with small quantities of sand to keep the veil straight and immobile on the painting.

The cover can be rolled up to expose the painting. Some important *tankas* are exposed only on special occasions. The rolled-up cover is held in position by the ribbons which are wound round it. The ribbons also serve to tie the scroll when it is stored.

An important difference between a *tanka* and a Chinese scroll is that all the constituent parts of the former are not pasted but stitched together and usually have no covering or lining at the back. Only the border has a lining, and it is attached by stitching it to the four sides of the picture and the ends of the border—possibly because the back of the painting nearly always carries some ritual words inscribed in black, red or gold, which are an important part of the *tanka* (Fig. 22). Without these words or religious formulae, the *tanka* will have no significance or value. Magic formulae are also written on thin tissue paper and kept below the golden patch of cloth *sa* stitched on the lower strip of the mounting. This forms part of the consecration of the painting, after which it becomes alive. In Tibet a painting is considered worthless unless it has been consecrated in a proper manner. In *Tibetan Painted Scrolls,* Tucci describes in detail the ceremony of consecrating a picture. Certain 'germ letters' are written at appropriate places of the design, either below the paint or at the back behind those places. Without these inscriptions, the picture is not a ritually correct image. It is prescribed that no image, earthen image, picture or the like will be the dwelling of a God if it is without the magic syllables.[19]

Thus, a Tibetan *tanka* is not an ordinary painting whose purpose is pleasure or art alone, but one which has a religious significance and symbolism. It was not hung on the walls of the monastery simply to decorate them: it played a vital part in ritual ceremonies.

Constituent materials

The material most commonly used as a support for a *tanka* is rough cotton cloth with an open weave. As such cloth is not manufactured in big widths, sometimes two pieces are joined together vertically to make a wider cloth. Linen and leather have been used, but only rarely. Silk *tankas* also exist.

The surface of the cloth is made smooth by applying a coating or ground on both sides, front and back. Normally the coating is white and composed of glue and kaolin or chalk. The ground is thoroughly worked into the cloth from both sides and finished by polishing. It is normally smooth and thin. Flexibility is a desired quality in the ground but is seldom achieved and cracks appear that are carried through to the paint, making it look damaged (Fig. 23). Continuous rolling and unrolling cause flaking and both horizontal and irregularly shaped vertical cracks (Fig. 24).

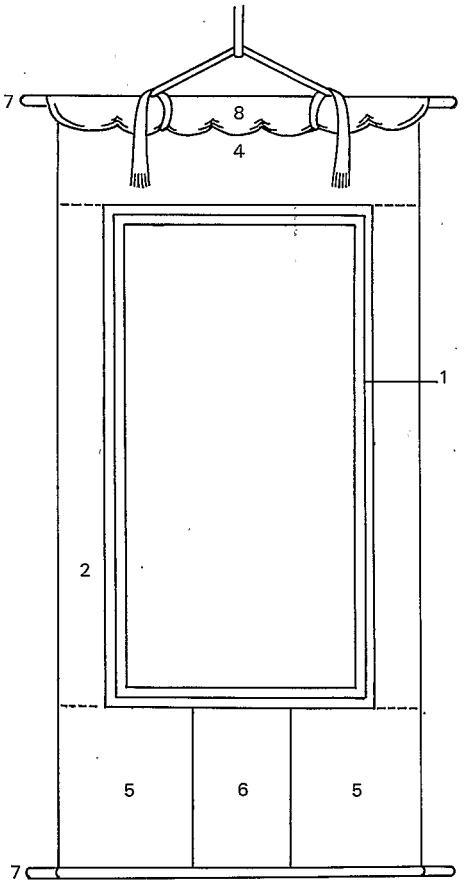
The pigments used were mostly mineral and were ground with glue. They included chalk, lead white, yellow ochre, orpiment, azurite, ultramarine, malachite, cinnabar and soot.[20]

Chemical analysis has revealed the following pigments: white (chalk, kaolin); blue (indigo, ultramarine); yellow (yellow ochre, orpiment); green (malachite, green earth, emerald green (copper aceto-arsenite) and scheeles green (copper hydro-arsenite)); red (vermilion, red ochre); black (soot, bone black, carbon black and bitumen).

For painting, the canvas is stretched on a bamboo or wooden frame with a thread running through its edges and passing over the stretcher to tighten the canvas.

The painting is first traced on the canvas from a drawing on paper. Tracing

20
A Tibetan *tanka*, showing its various parts, including the mounting.
21
A schematic drawing of a *tanka*.



21

19. J. Van Manen, 'On Making Earthen Images, Repairing Old Images and Drawing Scroll Pictures in Tibet', *Journal of the Indian Society of Oriental Art,* Vol. I, No. 2, 1933, p. 105–11.
20. R. Sankrityayana, *Marg,* Vol. XVI, No. 4, 1963 (special issue on Tibetan art).

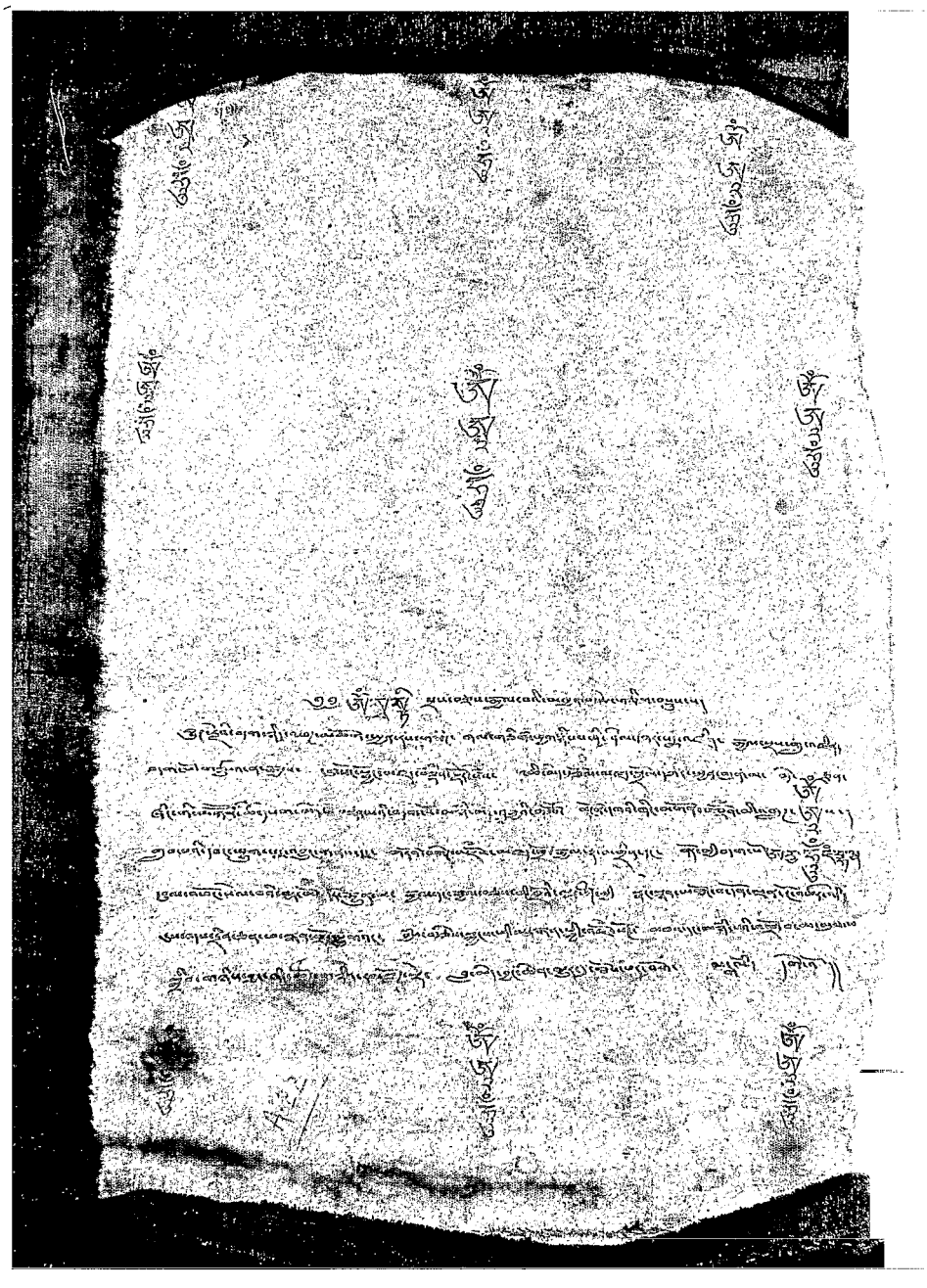
20

is done in black with ink or charcoal and sometimes in red. Paint is then applied to the drawing. Details and tonal values are filled in later. Gold is applied on the ornaments, crowns and so on. Gold is used in the form of paint, the golden leaves having been thoroughly ground with glue solution. This is a laborious process and sometimes takes hours of preparation. When the painting is complete, the threads stretching it are cut. It is then ready to be mounted with borders.

Deterioration

Tankas come to the laboratory in varying stages of deterioration, with oil, grease, smoke or dirt stains on the surface, back and borders. Such stains have been accumulated by the burning of incense and other substances inside the temples. A Tibetan lama stated that butter or oil was sometimes spread over the *tanka* to preserve it. In due course this oil darkens and obliterates the details under it.

Weakening of the support and of the borders is another common ailment. At times, parts of the fabric are lost, leaving big gaps in the painting. Portions



22
Tankas often have inscriptions and magic formulae written at the back. The back lining is stitched only at the edges so that such inscriptions can be read.

23

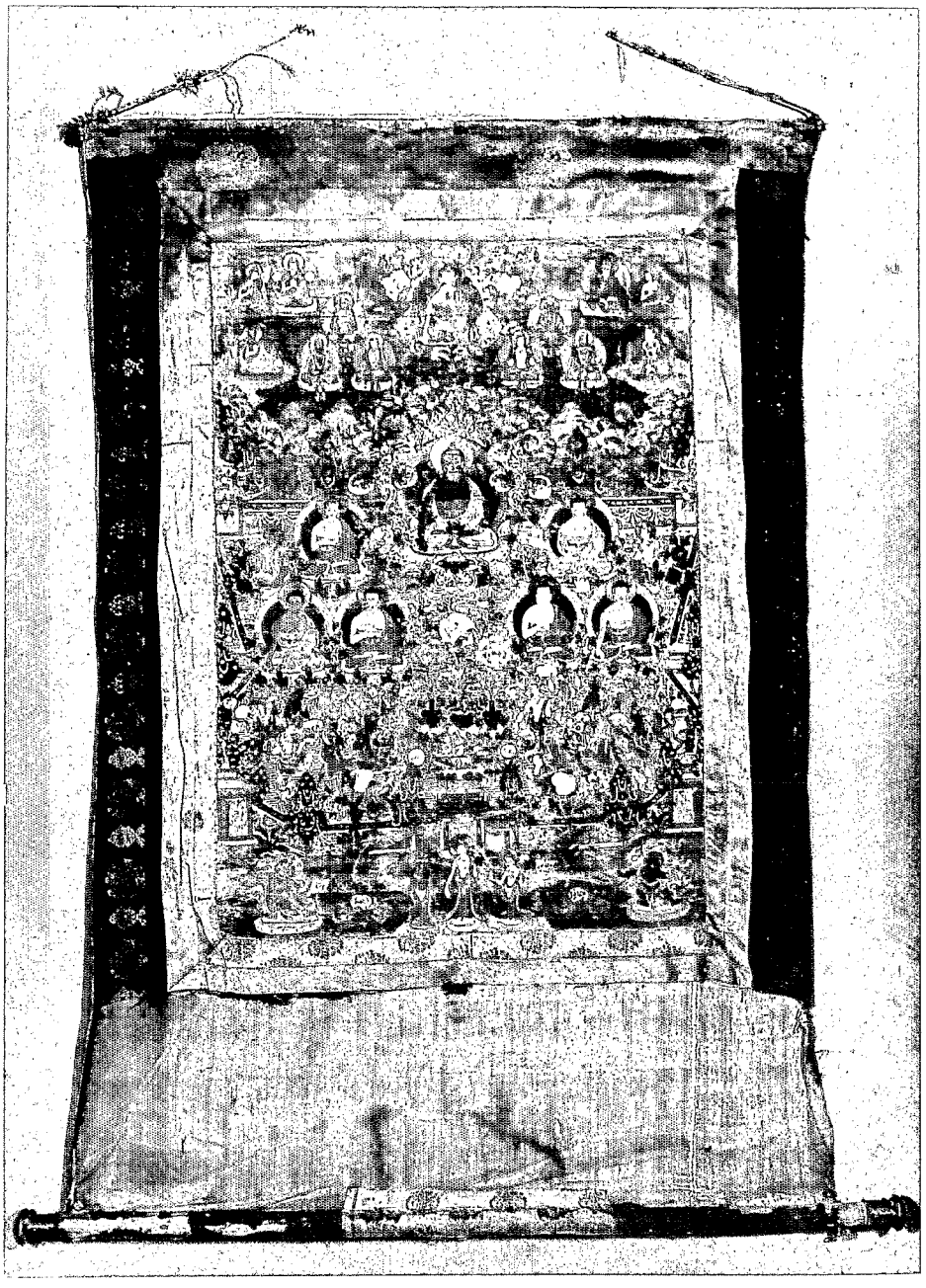
24

of borders are also lost (Fig. 23); in fact the strips and bands constituting it may have the same defects as textiles with woven designs. Each strip or band may present a different type of problem. For instance, a golden thread may have become tarnished or may have become brittle and got broken into small pieces. Similarly, the silk design may be broken and loose. Since the mounting is important both structurally and symbolically, an attempt is always made to save it.

The methods of treatment differ as the picture is a multi-layered complex structure of support, ground and paint, and the borders are strips of textiles with various designs. The textile strips can be dry-cleaned or even washed, while the painting must be cleaned and treated in the same manner as any other painting. All the parts must therefore be separated and cleaned or treated appropriately.

The removal of oil, soot and dirt from the surface of the painting is a delicate operation. Rough treatment can easily damage the paint, especially if it is brittle. Cleaning should not go beyond what is absolutely necessary. In all oriental paintings—*tankas*, miniatures, scrolls—the brush work is almost always fine. In cleaning, none of the fine details should be rubbed off or washed away. I have seen some people washing the painted portions of *tankas* by dipping them in trays full of solvents as if the painting was a piece of cloth. This practice can be extremely dangerous. The painting should be cleaned gradually, bit by bit. Water should be avoided unless it has been ascertained that it does not have any effect on the paint. Organic solvents such as xylene, tetrachlorethylene, ethyl alcohol, acetone can be used. To avoid rubbing the surface of the painting, blotting paper soaked in solutions can be kept on the dirty portion and covered with an alkathene sheet for a few minutes. The dissolved dirt is taken off with fresh blotting paper. Smoke marks are best removed with triethanolamine diluted in ethyl alcohol. To remove water stains, detergent solution can be used, but judiciously and cautiously. The choice of solvent will of course depend upon the nature of the film or stain.

23
Continuous rolling and unrolling produce horizontal damage marks.
24
Vertical and horizontal flaking of paint.



25
A damaged *tanka*. The lower strip of the mounting has disappeared except for some traces on the lower rod.

The strips of the border are cleaned in the same way as textiles. If strong enough, they can even be washed in a detergent solution, but care must be taken to ensure that the dye does not run. If the dye is not fast, dry-cleaning methods will have to be used.

If the support is too weak or torn, it may have to be relined on a fresh support. The new support must not impair its flexibility. The letters and symbols at the back must not be hidden in the relining. The use of glass fabric unfortunately makes the support rigid.

Another method is the attachment of terylene or nylon net impregnated with polyvinyl acetate emulsion by heat. In this process, the terylene net is put on a stretcher, bigger in size than the painting. Polyvinyl acetate emulsion is applied on the net and allowed to dry. The painting and the net are brought in contact and heat applied by a heating iron. The process is the same as is used to reinforce weakened textiles.[21]

Silk or thin cotton fabric can be attached using starch paste. Small windows are cut as appropriate in the new support to allow the inscriptions to be seen (Fig. *26*).

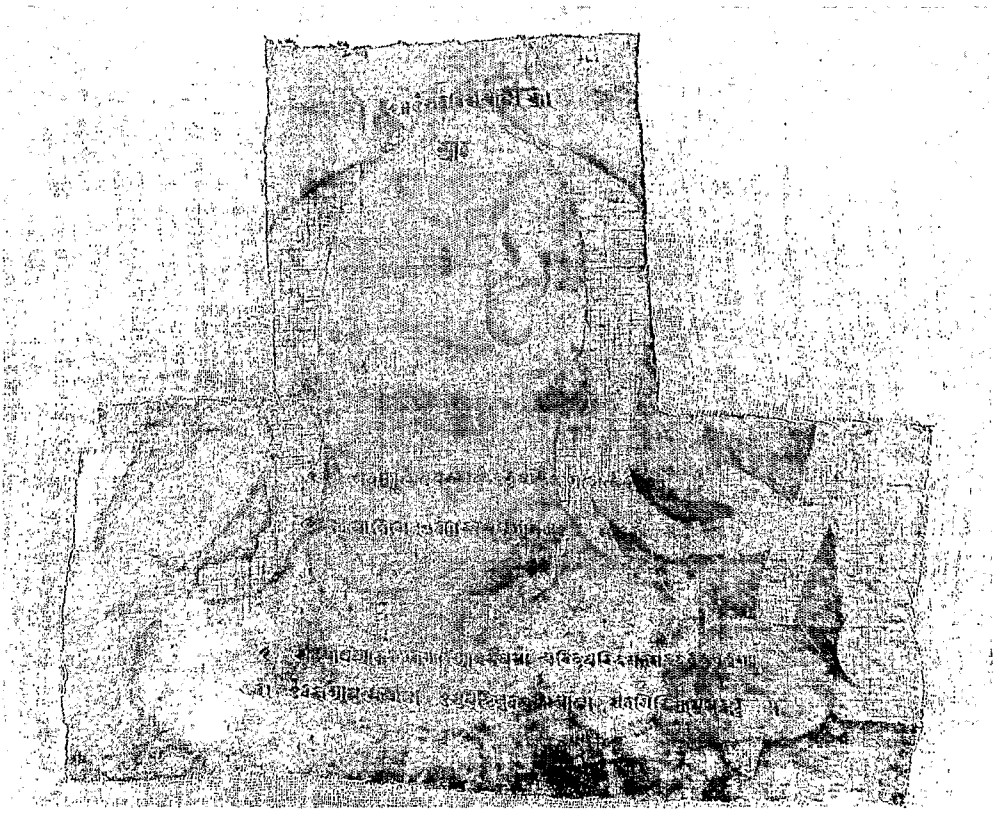
The problem of relining the borders is of a different nature. First the constituents of the border are separated, after a complete recording has been made

21. E. R. Beecher, 'Reinforcing Weakened Textiles with Synthetic Fibres Net', *Recent Advances in Conservation*, p. 195–6, ed. by G. Thomson, London, Butterworths, 1963.

of their position. Each unit is examined and its condition recorded. If the fabric is strong and there are only small holes, the holes are filled in by darning or patch-work. Strengthening can be done by attaching a new cloth, either by stitching with needle and thread or by pasting with an adhesive. Stitching is possible only when the old fabric is strong enough to take the thread. If an adhesive is used, a nylon net impregnated with polyvinyl acetate emulsion can be used.

After the painting and the border have been suitably strengthened, they are stitched together once again. The end rods are fixed in position after treating with an insecticide, and the front veil is added after repair if necessary.

To deal with flaking of paint, a 5 per cent solution of soluble nylon in ethyl alcohol or 3 per cent polyvinyl acetate in toluene has been found effective. However, *tankas* were never varnished originally, and the protective solution used should not produce a glossy surface.[22]



26
When a *tanka* is relined, a window is cut in the relining so that the inscription remains visible.

Lacquer

Lacquer has been in use for decoration and for painting in many Eastern countries, particularly China and Japan, since very early times.

The famous Chinese and Japanese lacquer is obtained by exudation from a species of the tree, *Rhus vernicifera*,[23] which grows all over Japan, especially north of Tokyo. The sap of the tree, in hot, humid conditions, solidifies and becomes hard, so much so that it can be polished, carved and moulded. The process of solidification is by polymerization and not by oxidation or by evaporation of the solvent.[23] A number of other trees, *Rhus succedanea, Melanorrhoea laccifera, Melanorrhoea usitata* also yield lacquer.

Wood is the main support for lacquer work, but other materials have also been used. Wooden objects were made by turning or by joining smaller boards or parts together. Small objects or vessels were sometimes made of thin cedar sheets.

22. V. R. Mehra, 'Note on the Technique and Conservation of some Tanka Paintings', *Studies in Conservation*, Vol. 15, 1970, p. 206–14.

23. To collect varnish, V-shaped incisions, about 9 in long are cut 6 in apart on the bark of the tree near the base. The apex of the cut points downwards. The front portion of the bark near the incision is raised up slightly and a bamboo container is inserted just below the cut. The resin exudes out and collects in the container. The flow of varnish continues for about ten days.

27 (a)

27 (b)

A fine layer of lacquer and clay or lacquer and sawdust is applied over a fabric-coated wooden support to serve as the ground; if no fabric is used, the ground of lacquer and clay is applied directly over the smooth surface of wood. Sometimes this ground is applied thickly like an *impasto*. The lacquer may be made black by mixing carbon black or iron compounds with it. The surface is polished and made smooth with whetstone and water. Fine lacquer is then applied layer by layer. If the object is to be finally carved, many layers are added one over the other. Pigments or fine powder of gold, silver or bronze may be added to lacquer to colour or to decorate it. The surface is repeatedly polished with hard charcoal and ashes of deer's horn.

If gold leaf is to be used, a very thin layer of lacquer is first applied, and when it is half dry, gold leaves are pasted on the viscous surface and pressed. The whole object may be covered by gold leaves in this way.

If gold is to be applied only in outline, or at a few points as dots, clear lacquer is applied over a hard, previously lacquered black surface with a brush and allowed to begin to dry. When it is half dry, gold powder is sprinkled over it and is thus fixed to the ground. Gold dust has sometimes been mixed with a solution of animal glue to make gold paint. However, because of the aqueous

27 (c)

27 (d)

27
A lacquered wooden image of the Buddha.
(a) The whole statue.
(b) The dried lacquer has a tendency to chip off from the wood.
(c) Flaking is often more pronounced at the back.
(d) Detail showing extent of the damage.

binding medium, such painting is less durable. Sometimes, a gold leaf was pasted all over the object, using lacquer as adhesive, and then fine lines or dots of gold were applied over the golden surface by the gold-dust technique described above. This gives a product having a dull gold background with shining dots and lines of gold. The result is extremely pleasing.[24]

Sometimes coloured designs have been produced by cutting incisions in the dried lacquer and filling them with lacquer of different colours. The surface was made smooth by grounding and polishing.[25]

We also find lacquer objects incrusted with mother of pearl. The dry-lacquer technique was another very interesting method of making images in Japan. A prototype core of the image, made of clay, was covered with cloth soaked in liquid lacquer. Layer after layer of lacquer was applied over the image until a thick coating was obtained. When the lacquer dried, the surface was polished with charcoal and ashes of deer's horn.[26] When the work was complete, the clay inside the image was removed.[27] What remained was a hollow sculpture of thick, dry lacquer, which was durable and hard, but light, immune from insects and the vagaries of climate. However, it was more susceptible to physical damage than hard-core objects.

Although wood was most popular in Japan and China, metal, leather, clay and other materials were also lacquered. Amalgamation was the usual method of gilding metal objects. The object was first treated with nitric acid to clean the surface. An amalgam of gold and mercury was then applied over the surface and the object was heated to a high temperature. This left gold on the surface. The gold film became an integral part of the bronze and the image can be polished, washed and treated with organic solvents if need be. In countries skilled in the use of lacquer, lacquer was often used as an adhesive for gold leaf. A red-coloured lacquer was first applied over the image. Before it was dry, gold leaves were applied using the same technique as with wood. This type of gilded image has to be treated with care. The use of organic solvent without a preliminary testing may result in complete dissolution of the resinous coating and the destruction of the gold film. Quite often damage is done to gilded antique objects by those who are not aware of the use of resin as a base for gilding.

Lacquer was used in Thailand for producing works of art, including the wooden cupboards and chests used for storing palm-leaf manuscripts.[28] We also find excellent examples of lacquer work in the form of doors, windows, glass vases, bowls and so on. The Thai lacquer known as *Lai rod nam* is obtained by exudation from the *Melanorrhoea usitate,* a large deciduous tree which grows in the open forests of Burma and Thailand. Lacquer work in Thailand uses the technique of washing with water (*Lai rod nam* actually means 'ornaments washed with water'). The base upon which the designs are executed is wooden or else prepared from a special type of thin, strong bamboo. Strips of this bamboo are interlaced and woven about solid core shapes (jigs) to provide an accurately contoured woven frame. A solution of *rak* (lacquer) applied over the wood or frame fills in the pores. When the articles are thoroughly dried, they are made smooth by rubbing with a flat stone or with the leaves of the *koi* tree, the surface of which is like sandpaper. Three coats of *smook* (a lacquer mixture made by mixing ashes of paddy husk with lacquer) are then applied. Between each coat the object is rubbed smooth.

When the lacquer is completely dried, the drawing is traced over the surface. The parts which have to remain black are coated with a gum paint, prepared by mixing realgar (*horadan* in Thai) and the gum prepared from the fruit of *feronia elephantum* (Thai: *makkwit*) and an acid extracted from the shells of *accacia rugata* (*som poi* in Thai). A thin coat of black lacquer is again applied over the surface and when it is slightly dried, gold leaves are applied. After twenty hours, when the lacquer has dried, the surface is washed with water. This washes off the gold leaves on the water-soluble gum, and the design in the other parts emerges in all its details.

24. K. Yamasaki and K. Nishikawa, 'Polychromed Sculptures in Japan', *Studies in Conservation,* Vol. 15, 1970, p. 278–93.
25. Sir Harry Garner, 'Technical Studies of Oriental Lacquer', *Studies in Conservation,* Vol. VIII, 1963, p. 84–98.
26. It is difficult to say why deer horn was preferred—quite often because of tradition and beliefs, but sometimes also because it is held to be sacred.
27. K. Herberts, *Oriental Lacquers,* London, Thames & Hudson, 1962; Sherwood F. Moran, 'Ashura, a Dry-lacquer Statue of the Nara Period', *Artibus Asiae,* Vol. XXVII, No. 1/2, p. 99–133.
28. Silpa Bhirasri, *Thai Lacquer Work,* Bangkok, The Fine Arts Department, 1963.

The National Library and the National Museum of Bangkok possess a large number of lacquer bookcases and other lacquered objects.

To conserve lacquered objects properly, it is essential to understand the techniques used in making them; and since there are many variations and combinations of the main procedures described above, it is also necessary to know which particular method was used.[29]

Deterioration

Lacquer is a very hard and durable substance. After its solidification by polymerization, it becomes inert, and is not affected by any solvent, or even acid, except hot nitric acid. Its coating on a wooden object therefore forms a very hard and durable film, protecting the wooden support below. However, for the same reason, once an object has been damaged, its repair or preservation becomes extremely difficult.

The main defect found in lacquered objects is the lifting or curling of the thick lacquer ground and paint. This mostly happens at the joints, which sometimes start opening up. Curling of the lacquer layers also occurs when climatic changes cause the wood to shrink (Fig. *27 (a), (b), (c), (d)*).

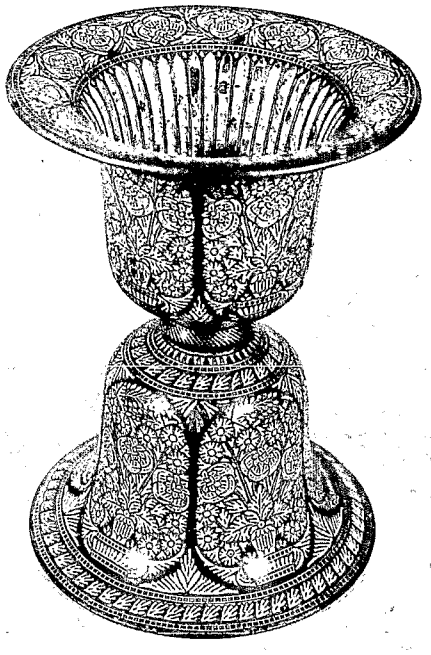
Fixing the curled and lifted resin is at times very difficult because the resin layer is hard and not being soluble in any solvent, is not easily softened. It can be reattached by injecting fresh liquid lacquer at the back of the curled layers and pressing them back. This is not feasible, however, if the brown coloured lacquer is likely to stain the gold decorations. If there is a likelihood of colour change, a modern synthetic resin such as polyvinyl butyral (10–15 per cent solution) is used as a fixative.

Another common defect in lacquer work is the loss of paint and gold, owing to flaking or peeling. When the binding medium used in the paint is glue, the loss is greater. Flaking is mostly caused by a lessening of the adhesive strength of the binding medium; to compensate, a coat of transparent solution of butyral resin is applied over the surface.

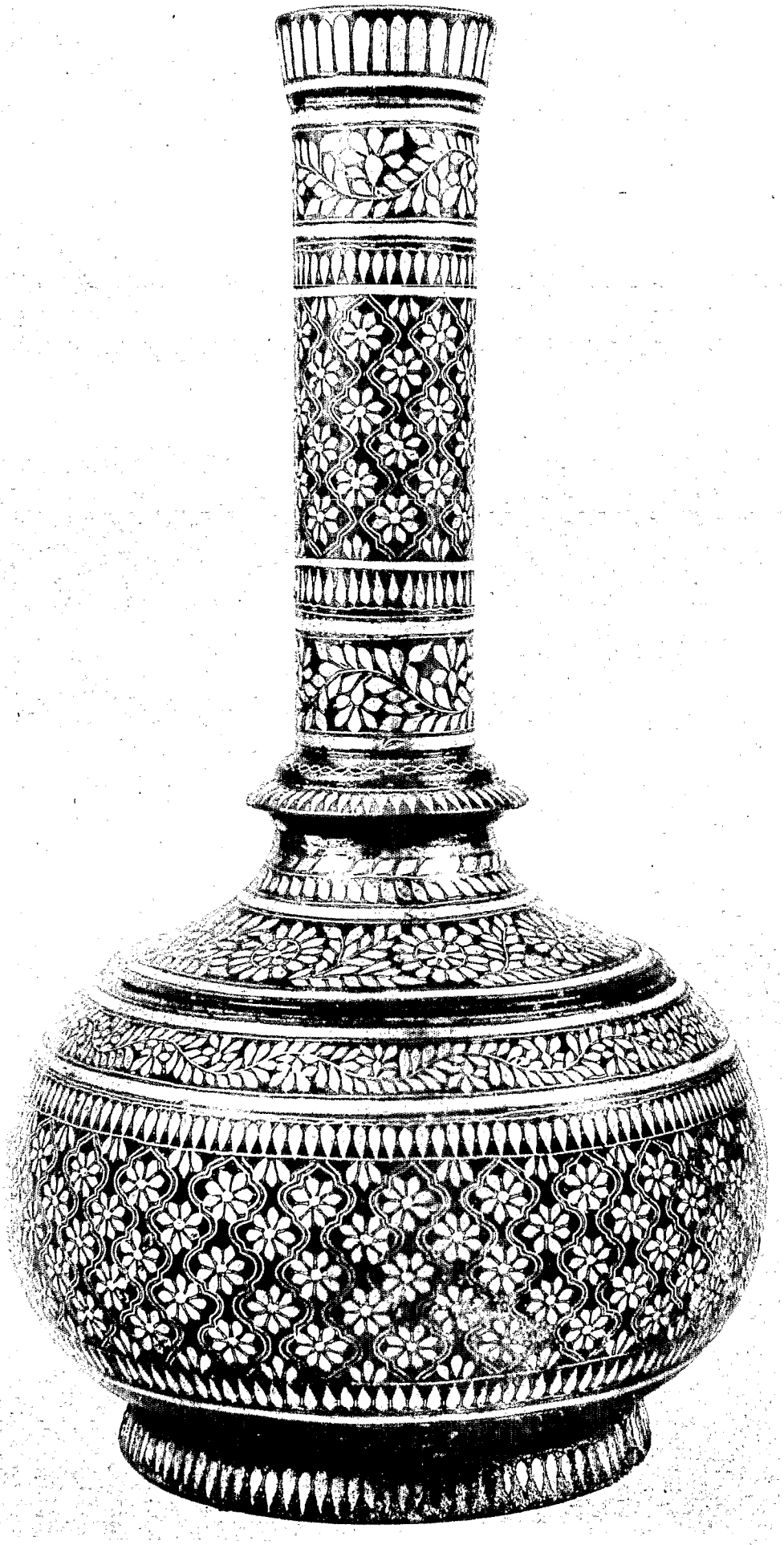
Although lacquer itself is quite durable and hard, the paint over it, and especially the gold decorations, are not equally strong. A decorated, lacquered object should, therefore, always be protected from abrasion and physical damage.

In many Eastern countries, it was customary to remove the damaged lacquer and lacquer the object afresh. New ideas and new values in regard to both repair and conservation are now producing a different approach.

29. O. P. Agrawal, 'Conservation of Museum Objects in Thailand', *Museum Work*, Bangkok, Department of Fine Arts, 1974.



28
A Bidri *surahi* (water container).



29
Another example of Bidri.

Bidri

There is hardly any major museum in India which does not have a collection of Bidri ware, a special type of metal work with a deep black, smoothly polished background and shining silver inlay (Figs. *28* and *29*). Bidri ware, highly prized for its decorative value and craftsmanship, undoubtedly owes its origin to Persian influence on Indian artisans.[30] It is difficult to say when exactly it was introduced into India, but it was certainly as far back as the early sixteenth century when the Behmani and Baridi dynasties ruled in the area around Hyderabad. The name derives from Bidar, a town about 80 miles north-west of Hyderabad. The art reached its greatest perfection and beauty during the rule of the Behmani dynasty. Other centres in which Bidri ware was produced include Lucknow in Uttar Pradesh, Purniah in Bihar, and Murshibad in Bangalore.

Material

The basic material used in Bidri manufacture is an alloy of zinc, copper and lead. Zinc and copper are mixed in a ratio of 16 : 1. This alloy of zinc and copper takes a black colour when rubbed with a particular clay found in the Fort of Bidar[31] (which probably explains the Bidar origins). The proportion of zinc and copper differs from place to place. In some places lead is also added. Steel powder has been added in Lucknow to give additional strength to the alloy.

Production is in five stages: casting, polishing, engraving, inlaying and blackening.

The rough product obtained after casting is polished with a file. The designs for the inlays are engraved with a fine-pointed tool. Silver in the form of a flat sheet or wire is inserted into the engravings and hammered. The final polishing then takes place.

A suspension of the clay found in the Bidar Fort mixed with ammonium chloride is next rubbed over the object. The process immediately turns the metal black. The final effect is very pleasing. The surface has a black, lustrous appearance. Chemical analysis indicates that the active agent in Bidar earth which produces the black surface is an alkali nitrate mixed with an excess of ammonium chloride.[32]

A variety of techniques are used singly or in combination:[33] *tarkashi* (inlay of wire), *tahinishan* (inlay of sheet), *zarnishan* (low relief), *zarbuland* (high relief) and *aftabi* (cut-out designs in an overlaid metal sheet).

Deterioration

Bidri ware deteriorates in much the same ways as zinc, but the black polish patina almost precludes cleaning by any acid or alkaline solution. Accretions can be removed only with water, or mechanically. White spots and deposits often found on the surface are decomposition products of the zinc and copper alloy. High humidity has a deleterious effect on both the black polish and the material itself.

The silver inlay—sheet or wire—can chip off because of physical causes or corrosion beneath the silver wire which forces the inlay out. Tarnishing presents another major problem, as its removal demands a solvent or abrasive which may be dangerous to the black polish. Sometimes it can be polished out with soft cloth or chamois leather. An application of a 3 per cent polyvinyl acetate solution over the surface protects the silver from tarnish and the lustrous black surface from abrasion.

30. Persian artists normally used copper and iron for inlay work.
31. T. N. Mukharji, *Art Manufacturers of India*, Calcutta, 1888.
32. T. R. Gairola, 'Bidri Ware', *Ancient India*, No. 12, 1956, p. 116–18.
33. 'Bidri Ware', *Salarjung Museum*, p. 11, Hyderabad, 1961.

Shadow puppets

Puppets of different types and varieties always form an important part of museum collections in Asia. In ancient India they were used to teach spiritual values and relate them in an interesting manner to the great epics, the *Ramayana* and *Mahabharata*. Puppet-shows and puppet-making still survive in many parts of India, including Rajasthan, Orissa, Tamilnadu, Karnataka, Kerala and Andhra Pradesh. They constitute an even more powerful living force and widespread source of entertainment in Java and Bali than in India, from where they were originally introduced to these islands. The *Wayang Purwa* (shadow puppet) always was and still is a popular medium of artistic expression in Indonesian villages, and it is not surprising that superb specimens are found in the Central Museum in Jakarta and in other museums in Indonesia.

It is difficult to discover when and how the puppet play originated, but Indian literary sources point to its great antiquity, possibly predating conventional drama. It remained popular throughout Indian history until the beginning of the present century, when the village economy started to disintegrate, and new media of entertainment such as the cinema began to spread. Migrations and cultural diffusion from India to far-off places like Java led to an intermingling of cultures in art, architecture, literature and crafts. However, the Javanese artist did not simply follow foreign traditions, but evolved his own idiom and methods for making and using puppets.

The shadow puppet play is a unique art and is entirely different in conception and execution from other types in which the puppets are shown directly to the audience and manipulated from behind the scene. In the shadow plays, puppets and the manipulator are both behind a white screen and they are moved and animated by the performers. Light thrown from behind the flat multicoloured puppets throws beautiful silhouettes on the screen, creating a most attractive and spectacular effect.

Shadow puppets in Indonesia vary in style according to locality. They are found also in Malaysia, in Thailand and in Cambodia. Cambodian puppets resemble those of Thailand, where the shadow play is called *nag* (hide figures, referring to the material of which the puppets are made); big puppets are called *nang yai* (play with big figures). The hide is soaked in water until it is tender, and then dried in the sun. After smoothing with an iron, soot is applied to both sides. When dry, it is rubbed with a gourd. Figures are drawn on the surface, and the parts between the lines are cut out. In order to paint with colours the black surface is first rubbed in order to obtain a light colourless surface. The figures are then coloured. Indian museums contain string puppets, red puppets, glove puppets and shadow puppets. Here we are concerned with shadow puppets only because of the intricate conservation problems involved.

Construction

In India, Indonesia and elsewhere shadow puppets are made of animal skin: in Orissa, mostly goatskin; in Malabar, deerskin (which is considered holy); in Andhra Pradesh, goat, calf, cow or buffalo hide. Of the three layers of skin, only the epidermis and the dermis, are used. The skin is wetted in warm water and thoroughly cleaned with a sharp knife to remove the hair and any sticky matter. The thickness is made uniform, and the skin then resembles a membrane. The cleaned skin is dried and is then ready for making the puppet. As no tanning is involved, the skin is parchment and not leather (as it is often wrongly called); at no stage is the skin treated with the tannins or salts which turn skin into leather.

The figures are drawn on the parchment in outline and cut. The details are also drawn in and, with light touches of the chisel, picked out, leaving cuts and holes at appropriate places. They are coloured with vegetable dyes, the colour varying according to the character of the puppet (Fig. *30*).

Most types of shadow puppets are jointed at the knees, elbows, shoulders and so on (Fig. *31*), and are put together with thick string, knotted on two ends. A bamboo or palm stem stick, split in two, is fixed into the centre of the puppet for support and extends a few inches below the body to allow the puppet to be manipulated.[34]

Javanese puppet-making differs somewhat from the above in several respects. The art is highly regarded and requires years of practice before the puppet-maker can be called perfect. The puppets are much more delicately carved, and the costumes, ornaments, head-dress and so on are very elaborate and detailed. As there are more joints, there is more scope for animation than in the Indian counterparts.

The paint used is prepared by mixing glue and pigments: chalk or finely pulverized and charred bone for white; yellow ochre for yellow; indigo for blue; lampblack for black; red-ochre for red. A lye named *kopoh* (*Sterculia foetida L.*) from the fruit of the *djangkang* tree is used with the glue to dissolve it completely. It is believed that if no lye were used, the glue would not dissolve readily and would not stick strongly enough to the surface. The glue and lye are boiled in the case of all colours except white and black, for which unboiled glue is used. Boiled glue mixed with white pigment gives a brownish paint. An elaborate procedure is used in preparing the paint. After the glue solution, boiled or unboiled, is mixed with the pigment, the mixture is allowed to stand for a time to allow the coarse particles to settle. The upper portion of the paint is carefully and slowly decanted into another bowl.

Before painting the puppet, the surface is first smoothed with a stone or with rough leaves. This also removes any oil or fat, and allows the paint to take better. After rubbing, the puppet is coated thinly and evenly all over with white paint, which serves as a ground.

Painting starts when the ground is dry. The colour is identical on both sides. Gilding, done by applying gold leaves, is another interesting process. Glue of appropriate consistency is applied over the portions to be gilded. When the glue is half-dried, gold leaf is placed on the glued portions and pressed. The gold leaf sticks only to those portions which have been glued.

The puppet is then varnished with a thin solution of glue. This gives the surface a shine and makes the paint stick better.

When all the parts of a puppet are painted, gilded and varnished, they are joined together by means of bone pivots or cords. The central support is generally made of horn.

Deterioration

Shadow puppets involve some special conservation problems. As they are basically parchment, they behave like parchment sheets, and are subject to the same type of deterioration—buckling, curling of edges, distortion. The supporting sticks, cords and bone or ivory pivots prevent them from being stored flat. And they demand as much care as other forms of painting on parchment.

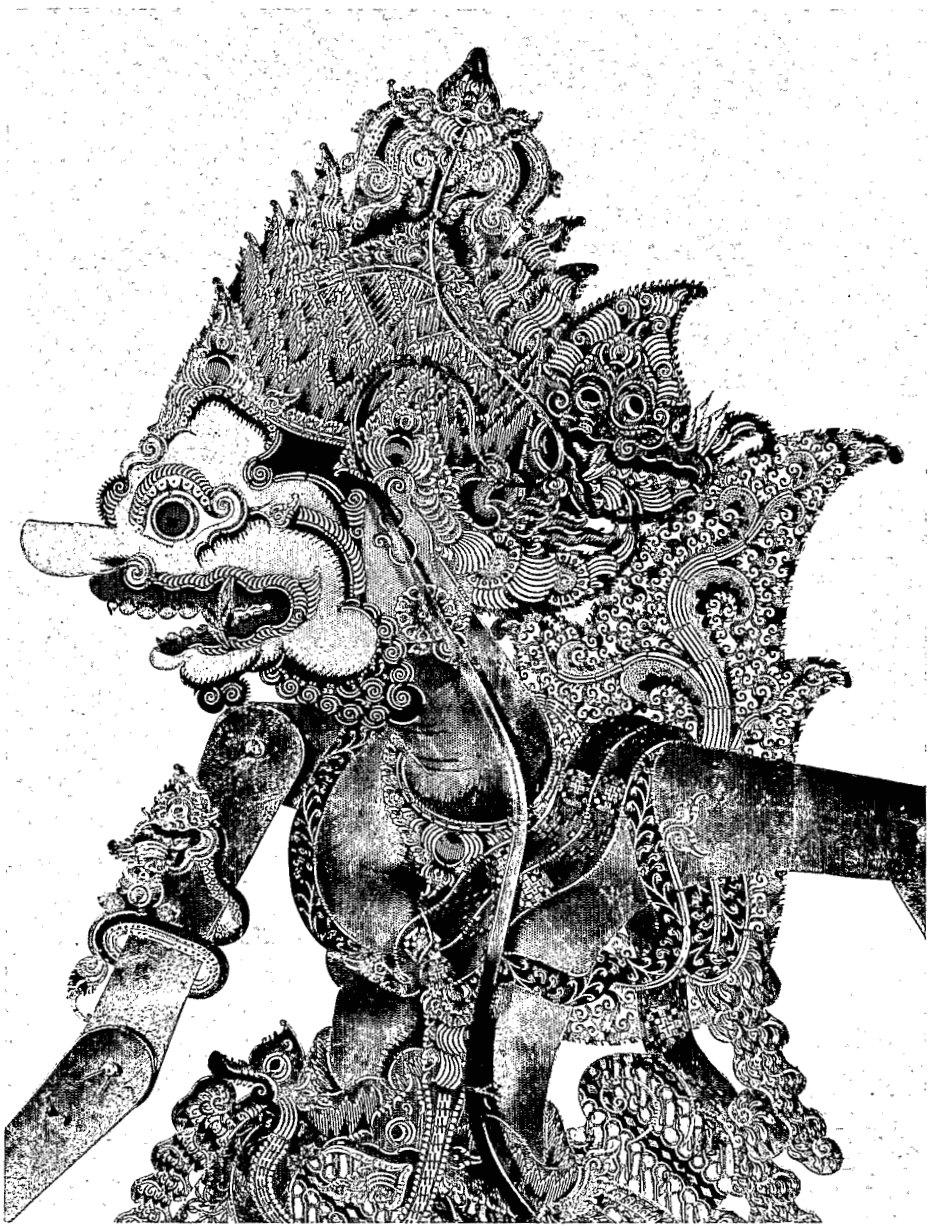
The most common problem is distortion. The edges curl and become stiff. The actual material of the puppet also eventually becomes brittle and fragile. Distortion occurs in the support which has thick paint on both the sides. Moreover, the bond between the paint and the parchment is not very strong. When the support is bent or buckles even slightly, cleavage occurs between the paint and the support, and flaking starts (Fig. *32*).

Because of the complexity of construction of the puppets, no conservation procedure is ever wholly satisfactory. The application of a dilute soluble nylon solution helps, but only temporarily. Because it is not possible to store the puppets completely pressed, it is very difficult to control distortion especially in dry climates. In the wet climate of Indonesia, parchment remains comparatively relaxed; but alternating wet and dry climates as in India cause

34. *Marg*, Vol. XXI, No. 3, June 1968 (special issue on shadow puppets); R. L. Mellema, *Wayang Puppets*, Amsterdam, Royal Tropical Institute, 1954; H. H. Bridhyakorn, 'Prince Dhaninivat Kromamun Didyalabh', *The Nang (Shadow Play)*, Bangkok, The Fine Arts Department.

30

30
Close-up of an Indonesian shadow-puppet; they are always delicately carved.
31
A puppet made of parchment. The elbow and shoulder joints and manipulating joints are made of horn.
32
If the support is bent or even slightly buckled, cleavage occurs between paint and support, and flaking starts. Here paint has started to flake off from the face.



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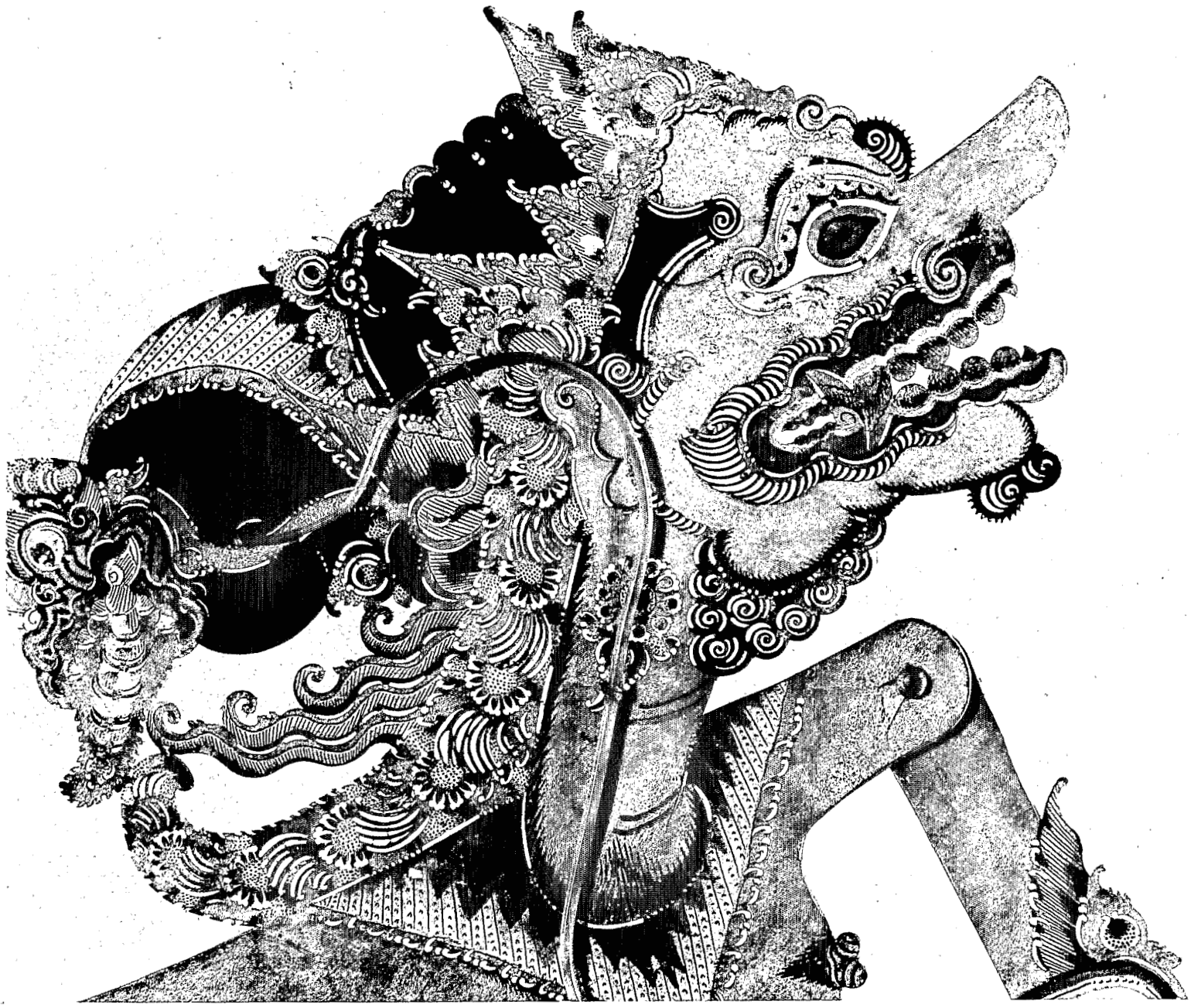

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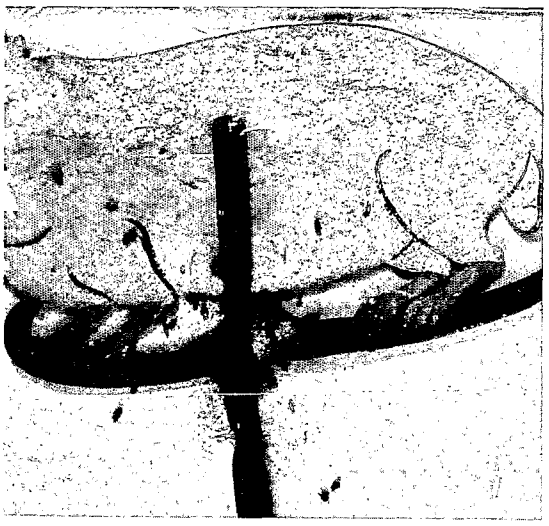
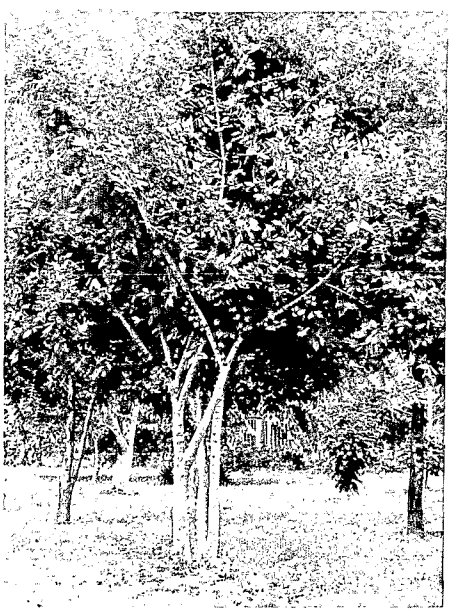


33
The component proteinous materials are liable to attack by insects.

trouble. In wet climates, however, the growth of micro-organisms tends to destroy both the paint and the support. The proteinous organic material of parchment is also liable to attack by insects (Fig. *33*). The importance of periodic inspections of collections and treatment with suitable insecticides cannot be overemphasized.

The art of puppet-making, like so many others, is dying out gradually. Puppets mass-produced for sale to tourists are naturally much inferior to the superb artistic creations of the past. Old puppets must be meticulously preserved. It is equally important to ensure that the skill of the manipulating performer is preserved, especially as his art is consistently losing ground as a main source of mass entertainment.



34
Koi tree (*Streblus aspera*) from the bark of which paper is made in Thailand.

Paintings on paper

For a long time after its discovery about A.D. 105, paper was known only in China. It came into use in the Arabic countries much later, and possibly from there spread East and West. In mediaeval times it was the chief supporting material for miniature paintings in Iran, Afghanistan, India and Nepal.

The raw materials used for its manufacture in India included bamboo, jute, flax, cotton, silk cocoons, old discarded fishing nets and so on. The raw material was cut into small pieces and soaked in water. After thorough pounding, the fibres were suspended in water and taken up on net screens. After drying, a coating of sizing (normally flour paste) was applied to make the surface non-absorbent. The surface was made smoother by burnishing.

In Thailand, the bark of the *koi* (*Streblus aspera*) tree (Fig. *34*) was used. The bark was cut into pieces, and washed in the flowing water of a river. It was then boiled with lime water and well pounded. The separated fibres were spread over silk screens stretched on frames, which were kept out in the sun for drying. Most manuscripts in Thailand were written on *koi* paper, which is very strong and durable. Sometimes the paper was blackened by rubbing soot over it, and white paint was then used to write on it. Black paper was also prepared by mixing black paint with the pulp of the paper. The paper was thoroughly polished and burnished to impart a smooth surface.

In India and Iran, several layers of paper were pasted together to prepare a thick board (*wasli*) for painting; this was almost always polished and burnished with *ghotli* (an agate stone).[35]

The artist first made a rough drawing on the paper with a fine brush or placed a perforated cartoon on the paper and rubbed black powder of charcoal on the perforations to prepare a tracing on the surface. The drawing or tracing was next gone over with a fine brush, and covered with a very thin layer of white priming. The priming was usually not applied over the whole painting at once but applied to a portion of the picture only. The priming was so thin that the black outline below remained visible. At this stage, the outline was redrawn and any necessary corrections made.

Burnishing with an agate stone produced an extremely smooth surface, suitable for very delicate and fine brush-work; burnishing was in fact repeated after every application of the priming. The painting was laid on a flat glass or smooth marble slab, with the primed or painted surface below. The other surface was rubbed with *ghotli* (burnisher). Pigments mixed with a medium

35. Y. K. Bukhari, 'Kinds of Paper', *Indo-Asian Culture*, No. 2, April 1969, p. 43–5.

like glue, gum or egg yolk, were then filled in. The outlines of the figures were then drawn more distinctly. Finally, the painting was again burnished to give it not only a smooth surface but also allow the paint to penetrate deep into the fibres of the paper. Several coats of paint were used to attain the desired result. Varnish was never used.

Gold and silver were frequently used in good quality paintings and were always applied last. For broad areas, gold leaf was used; for minute work, finely ground gold powder mixed with gum solution. In the Basohli and certain other schools of painting, the wings of green beetles were pasted over the ornamentation to produce the effect of a shining jewel.

Paintings to illustrate manuscripts were made on single sheets of paper or on thin paper and pasted into position.

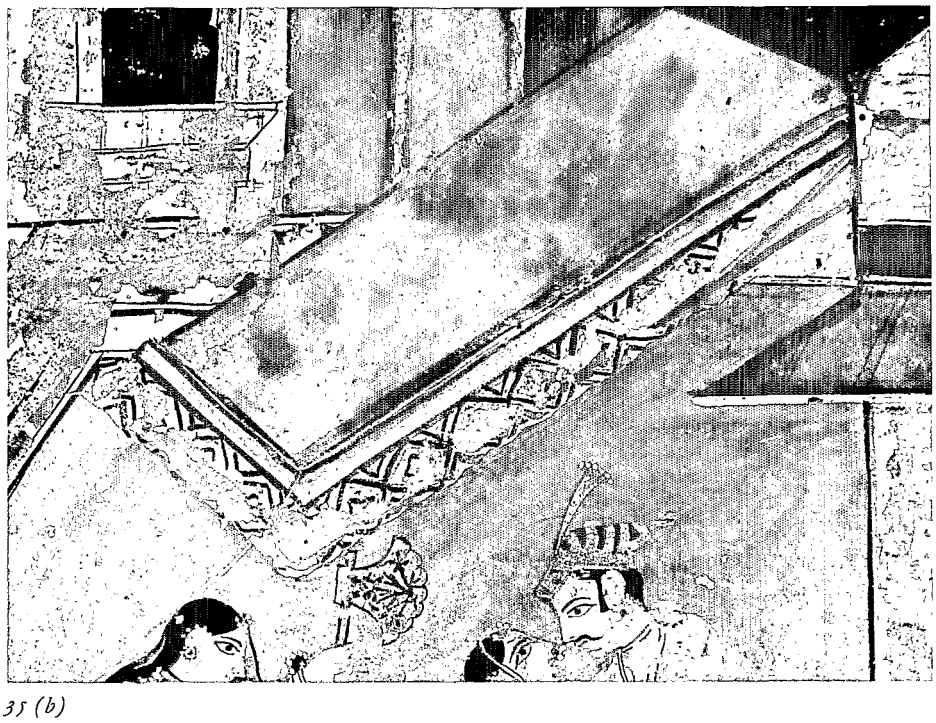
Deterioration and treatment

This type of painting on paper poses its own peculiar problems, quite different from those of watercolours done on paper, which have a thin transparent wash rather than a thick layer of paint. The thickness of the paint in Indian and Persian miniatures on paper means in effect that flaking and cleavage are constant dangers (Fig. *35 (a), (b)*).

Paintings on paper are subject to all the effects of paper deterioration. Depending on its quality, composition and method of manufacture, paper becomes increasingly brittle and yellow as it ages (Fig. *36*). Some types, e.g. all-cellulose paper, the *koi* paper of Thailand, and mulberry paper of Japan, are more durable than the woodpulp variety.

Painted paper that becomes weak because of ageing can be relined on fresh strong paper. But there may be illustrations on both the sides, or an illustration on one side and text on the other. In the case of a printed leaf, where the content is more important than the actual writing, the solution is easy enough. The leaf can be laminated with cellulose acetate foil or with silk gauge. But this is not possible with a painting, which must not be changed in its hue and in the tonal effect of the colour. If the edges are weak, the utmost that can be done it to strengthen them—the edges only—with strips of paper and starch paste, or with cellulose acetate foil.[36]

Acidity is another major problem (Fig. *37*), it degrades paper very quickly, and its removal has always been the concern of conservation experts. In a paper miniature, however, each line is important and each brush stroke unique.



35 (b)

35 (a)

35
(a) Flaking in an Indian miniature.
(b) Detail.

36. O. P. Agrawal, 'Problems of Preservation of Indian Miniatures', *Conservation in the Tropics*, Rome, International Centre for Conservation, 1974.

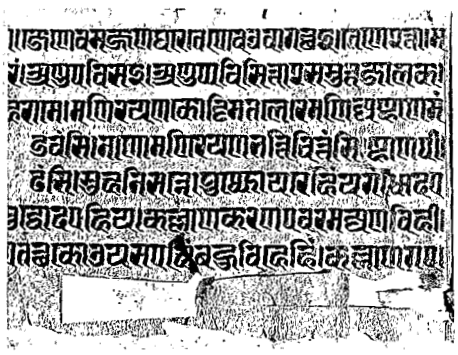
36
A fragile paper drawing.

Because of the aqueous nature of the paint, deacidification by washing is feasible only if the paint and ink are unaffected by water. Even then there is always the danger of losing minute particles of the paint and the fine lines.

Choice is thus limited to an organic solvent for deacidification—without being altogether sure that some of the dyes (e.g. the Indian yellow) will not be affected by the solvent.

In the deacidification of paper miniatures, a solution of barium hydroxide in methyl alcohol is used by many laboratories.[37] The method is satisfactory provided that the ink and dyes are not affected by the solvent. The vapour phase system of deacidification has also been used, but without much success. In another method, before neutralization of the acidity with the aqueous solutions, the ink or paint is coated with a solution of methylmethacrylate which renders it impervious to attack by water. This method cannot be used if the entire surface is painted, as the acidity would then get locked under the impervious coating of resin.[38]

Another problem in the preservation of miniature paintings is the separation of the paper layers of the *wasli* from one another. The back layers may weaken or lose their strength completely. The weak papers can be removed until only



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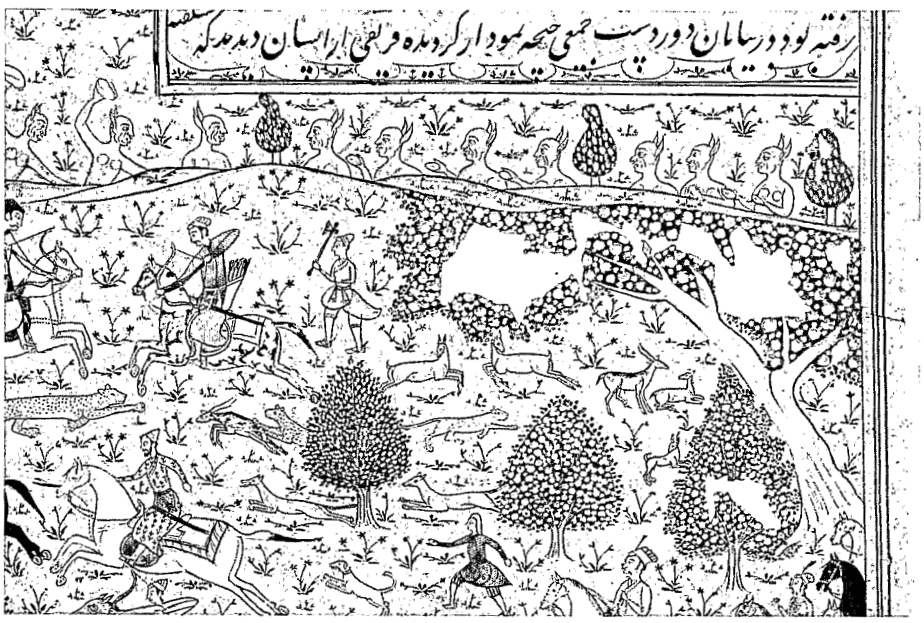
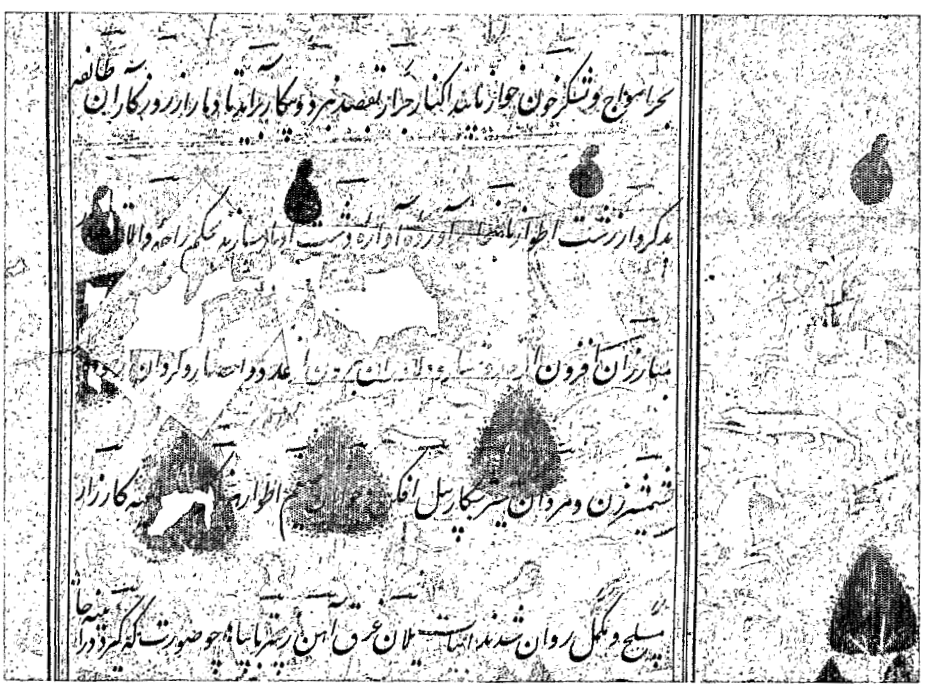


38 (a)



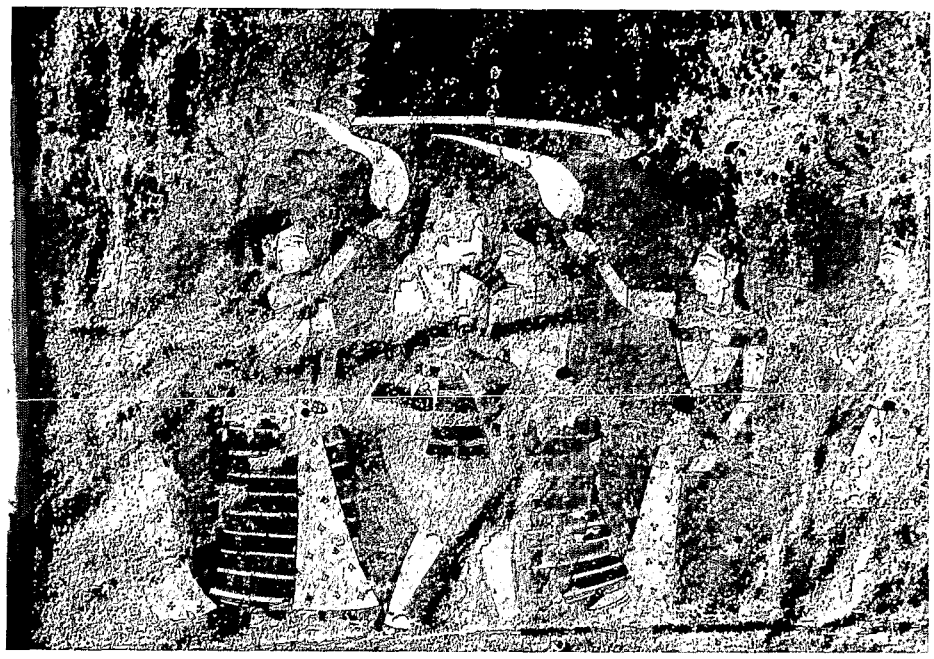
38 (b)

37
Paper manuscript damaged because of the high acidity of the paper.
38
Persian manuscript.
(a) Detail of a painting. The green pigment *zangar* is notoriously dangerous for paper which it chars and then gradually converts it into powder. The green leaves of the trees in this painting were destroyed in this way.
(b) Charring seen from the back of the painting.

37. 'Permanence/Durability of the Book—III', *Spray Deacidification,* Richmond, W. J. Burrow Research Laboratory, 1964.

38. O. P. Agrawal and A. S. Bisht, 'Non-Aqueous Deacidification and Preservation of an Illustrated Indian Manuscript Leaf', *Studies in Museology,* Vol. V, 1969, p. 34–7.

39 (a)



39 (b

39
(a) An Indian miniature stained at the two upper corners. Paint is flaking in many places.
(b) Detail seen in raking light.

the final layer bearing the painting remains. Sheets of new non-acidic tissue paper are then pasted on as backing.

Neutralizing the effect of acidic ink or acidic pigment on paper presents a much more difficult problem. Many miniature paintings and manuscripts are destroyed because the green pigment, verdigris,[39] is acidic and chars and weakens the paper wherever used (Fig. *38 (a)*). Charring is revealed on the back of the painting by the dark patches (Fig. *38 (b)*). At a more advanced stage of deterioration, the paper involved gets completely powdered and falls away, leaving holes.

The preservation of such paintings presents one of the most difficult of conservation problems. Deacidification is out of the question because the pigment itself is acidic, and any attempt to change its properties may lead to a change in colour. A similar problem arises when an acidic ink has been used. Sometimes only the portions written upon get destroyed and perforated.

Being organic in nature, paper is also attacked by various species of insects. If paintings remain for a long time without being cleaned and cared for, insects will attack. Insect damage is very common in such countries as India, Burma, Sri Lanka, Thailand and Indonesia, where the relative humidity of the atmosphere is generally very high, and provides optimum conditions for the proliferation of many varieties of insects. Insect control is largely a matter of good housekeeping: a regular supply of insecticides, periodic fumigation, and good ventilation.

As paper is highly absorbent it is easily stained. Oil or dirt stains appear on the surface of paper paintings (Fig. *39 (a), (b)*), or fly specks, rust, water stains, ink perspiration, or finger marks. The removal of such stains from a paper painting is a tedious matter. The stain affects the paper in the same manner as does a dye. It becomes embedded in the paper fibres. Bleaching can at most be used locally because of the danger of bleaching the paint itself. However, organic solvents will remove many types of stains.

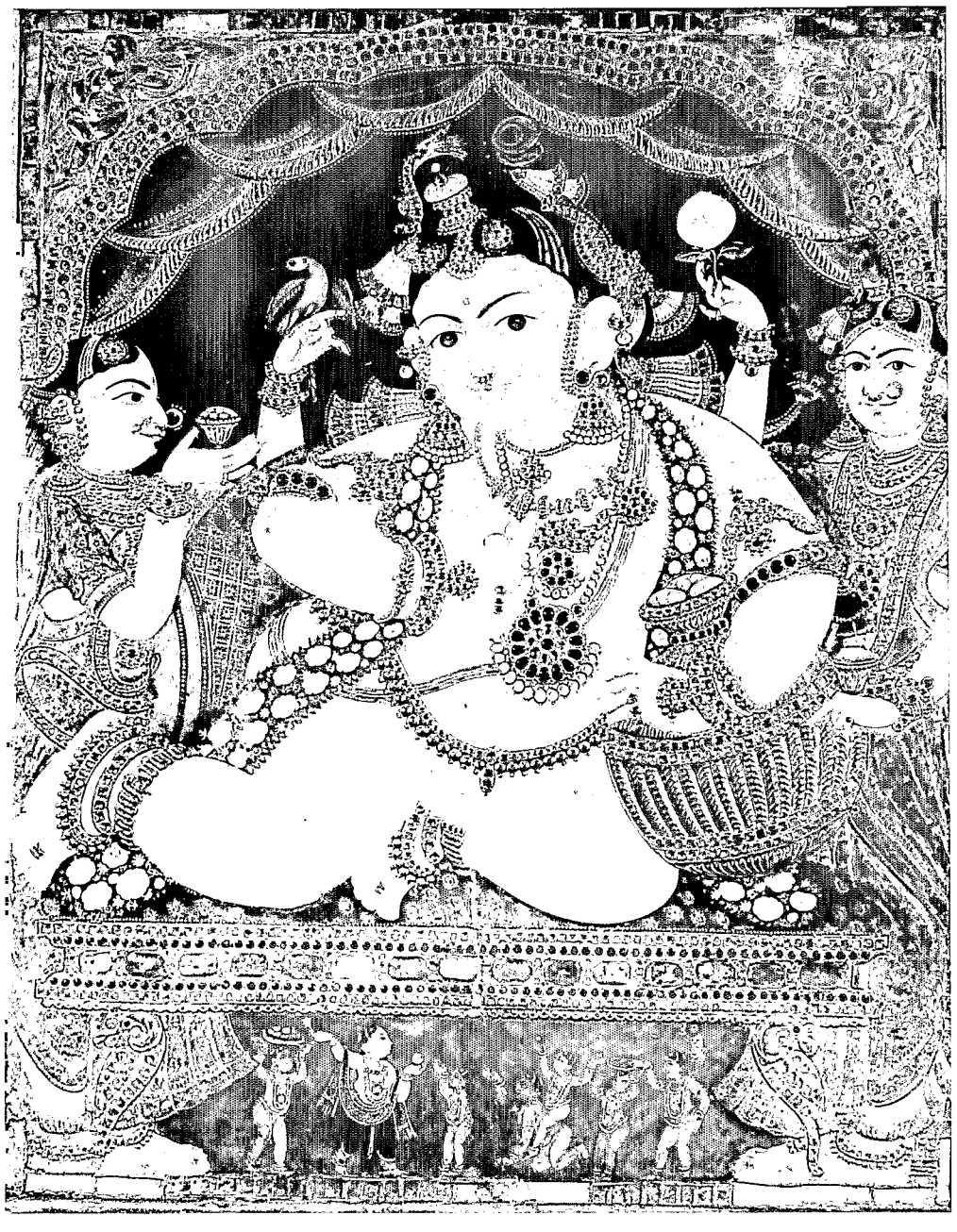
39. Verdigris (known in Persian and Urdu as *zangar*) was prepared by the action of vinegar and copper. The *Asrarul khat* (the secrets of calligraphy), a treatise on the techniques of calligraphy during the Mughal period, by Folw'llah Ansari wal Faruqi, written in 1102 A.H. (A.D. 1724) mentions the preparation of verdigris as follows: 'Take one *ratl* of *maushadar* [sal ammoniac] and half a *ratl* of copper scrap, put them in a pot and pour grape vinegar drop by drop into the vessel and with the help of a rod rotate the mixture in the pot till it becomes *zangar* [verdigris].' See also Y. K. Bukhari, 'Pigments', *Marg.*, Vol. XVI, No. 2, 1963 (supplement).

Tanjore paintings

During the eighteenth and nineteenth centuries, Tanjore in South India became a great centre of arts and crafts, and developed its own characteristic technique of painting. Clothes, ornaments and architectural details were painted in slight relief and covered with gold leaf; jewels, semi-precious stones of various hues, and pieces of mirror were fixed in the ornamental portions to produce a dazzling effect. The painting was done on wooden panels; sometimes several panels were joined together to make a large-scale picture.

A cotton cloth was pasted on the board with flour paste or gum produced from tamarind seeds.[40] A white or sometimes red coating, made by mixing chalk or red earth and glue, was applied over the cloth to form the ground.

The outline of the painting was drawn with a brush. Whenever a jewel was to be inserted, a small cavity was made with fine chisels. The jewel was fixed in position with a *gesso* paste. The colours were then filled in. After applying a suitable adhesive over the portion to be gilded, gold leaves were pasted over it and thoroughly burnished. The final effect was very striking (Fig. *40*).



40
A Tanjore painting depicting Balakrishna. All the ornaments and designs have stores embedded.

40. The gum of tamarind seeds was highly valued in India. After removing the brown shell, the seeds were pounded, and boiled in water until a thick, sticky solution was produced. This gum was also used as a binding medium for paint.

Deterioration and treatment

The most common problem is that the jewels or semi-precious stones loosen in their sockets, and sometimes get lost, leaving cavities in the painting.

Another problem is that dust may accumulate beneath, or in cracks in the jewels and pieces of mirror, dulling their brightness. The only remedy is to remove the stones carefully and to refix them after cleaning.

Cleavage of paint in Tanjore paintings, because of the relief in certain parts, is more frequent than in normal paintings. Flaking is also common, a normal result of the loss of adhesive power of the binding medium, or expansion and contraction of the support because of variations in the relative humidity of the atmosphere. The separating layers are fixed by injecting a thick glue solution with a syringe at the back of the paint.

As the painting is often on wooden panels joined together, any separation of the boards causes cracks in the painting. This problem is often much more serious than is realized. It is possible to bring the separated joints skilfully together but how long this will last in alternating dry and humid conditions is difficult to say.

Changes in the dimensions of the wooden support also cause the paint to flake, especially if, because of the tempera binding medium, the paint is not very strong. No sooner is there a stain on the paint than flaking starts. Gaps in the painted surface from which the pigment has flaked off can be filled in in the usual manner. But the real remedy is to ensure proper control of the ambient temperature.[41]

41. See: *Museum*, Vol. XXVI, No. 3/4, 1974 (special issue on museum architecture); and also *Museum*, Vol. XIII, No. 4, 1960 (on climatology and conservation in museums).

Appendixes

1 Conservation resources in South and South-East Asia

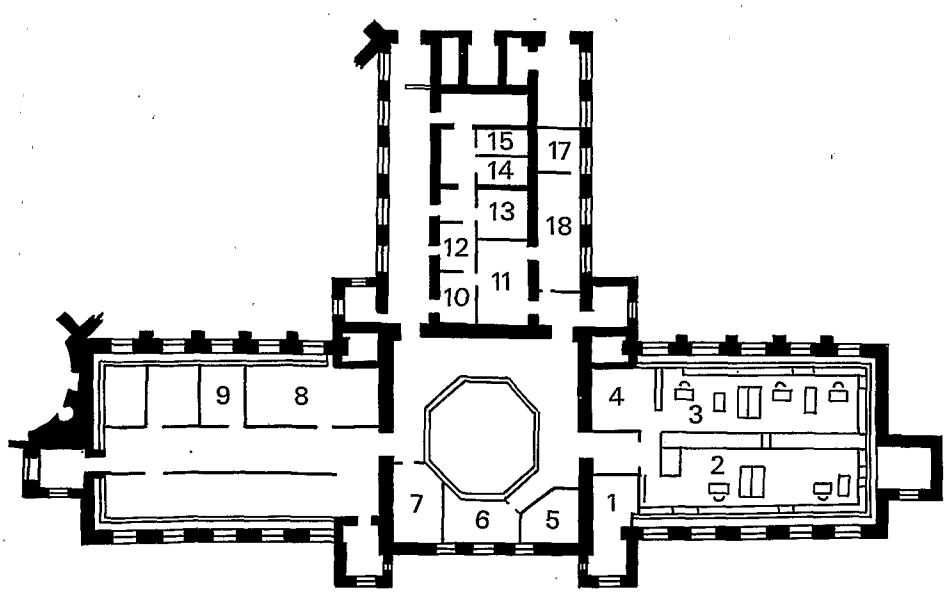
India

Conservation is handled by several specialized institutions. Responsibility for the conservation of nationally protected monuments and wall-paintings rests with the Archaeological Survey of India; and for archival and library material, with the National Archives of India. Several museums have their own conservation sections. The conservation laboratory of the National Museum in New Delhi is recognized by the Indian Government as the central conservation laboratory for museums. This laboratory also constitutes the regional training centre for the conservation of cultural property established in collaboration with Unesco, one of several so established in different parts of the world.[1]

Central conservation laboratory. The National Museum Conservation Laboratory in New Delhi started in 1957 with one chemist and two assistants. The initial difficulties of setting up a working laboratory were partly solved by the generous offer of the Director-General of the Archaeological Survey of India to transfer to the National Museum part of the equipment and staff from the conservation laboratory attached to the museums branch of his department. This laboratory has steadily improved the quality of its equipment and staff, and now engages in various types of research and the conservation of museum objects of almost every kind.

The laboratory staff includes scientists, conservators, textile repairers and assistants. They have been notably successful in the

41
CENTRAL CONSERVATION LABORATORY, National Museum, New Delhi. Plan.
1: Painting restoration room. 2, 3, 6: Conservation of wood, metals, ceramics, miniatures, leather, ivory and miscellaneous items. 4: Library. 5: Office of the Head. 7: Classroom. 8: Manuscripts and textiles repair. 9: Mounting of miniatures. 10: Office. 11: Microchemical analysis. 12: Microscopy. 14, 15: Dark rooms. 16: X-ray and photographic studio. 17: Office. 18: Chemical analysis.



1. The other centres are at Mexico for Latin America and the Caribbean; Baghdad for the Arab countries; Jos (Nigeria) for Africa; and Tokyo for Asia.

preservation of miniatures, palm leaves, Tibetan and Nepalese *tankas*, textiles, metal objects and polychrome and unpainted wooden sculptures. Wall-paintings have been transferred from several palaces to the National Museum (Fig. *41*).

The laboratory's equipment includes the usual instruments for chemical analysis and physical research, microscopes, photomicrographic equipment, ultra-violet lamps, paper testing machines, a spectrophotometer, a metal hardness tester, metallurgical equipment, fumigation chambers, impregnating equipment and ultrasonic generator.

The laboratory's nine-month training programme in practical conservation covers the study of materials, their structure and deterioration, and conservation techniques. It accepts students from all the countries of South and South-East Asia.

Archaeological survey of India. The laboratory of the Chief Chemist of the Archaeological Survey of India was established in 1917. It is concerned with the conservation of monuments, mural paintings, wood carvings on ancient temples, rock painting, terracottas, stuccos, plaster decorations, miniatures and other museum objects. It does research on pigments, plasters, alloys, ceramics, metal objects, building materials, and so on; and has a special section for the analysis of the soil profiles of ancient and excavated sites as a basis for chronological and prehistoric studies.

The main laboratory is located in Dehra Dun. Field-work is supervised by two regional offices—one for the north and the other for the south. Four zonal offices exist at Aurangabad (west), Bhubaneswar (east), Madras (south) and Dehra Dun (north).

The laboratory offers excellent facilities for the training of workers in the conservation of monuments and their documentation.[2]

Laboratory of the National Archives of India. The National Archives of India, New Delhi, has an excellent conservation department for the preservation of all types of paper material.

Its Research Section is specially concerned with conservation procedures for archival and library materials and has all types of equipment for testing paper and its properties. Two other departments are concerned with the actual preservation of material in the archives: the Machine Preservation Section uses heat lamination, while the Manual Preservation Section repairs by solvent lamination.

A six-week training course is offered in methods of preservation. There is also a one-year diploma course in archival keeping. *The Indian Archives* is published annually.

Baroda Museum and Picture Gallery. The Museum and Picture Gallery, Baroda, has two distinct conservation departments: the picture restoration studio, established in 1961, and the chemical conservation section, established in 1962.

The restoration studio works mainly on European oil paintings, of which the gallery has a good collection, and looks after the painting collections of all museums under the Department of Museums of Gujerat State.[3] It possesses a vacuum hot table, easels and the usual equipment.

The section for chemical conservation occupies a basement area of nearly 17 m². The staff includes one chemist and one chemical assistant. The laboratory treats all types of museum objects, organic and inorganic. Its equipment includes a microscope, electrolytic apparatus, a vacuum pump, ultra-violet lamps, a metallurgical microscope, ultrasonic equipment and the normal facilities.[4]

The museum brings out an annual publication: *Bulletin of the Museum and Picture Gallery, Baroda.*

Indian Museum, Calcutta. The conservation section of this museum works under a chemist who has three technical assistants. There are plans to develop it further. It has the normal equipment required for day-to-day conservation.

Chandradhari Museum, Darbhanga.[5] The Chandradhari Museum, Darbhanga, Bihar, started a conservation section in 1964 which handles metals, miniatures, paintings, textiles and so on.

Gaya Museum.[6] A small laboratory was started at the Gaya Museum, Gaya, in 1973, under the Director of Archaeology and Museums of Bihar. The chemist in charge received his training at the Regional Conservation Centre in New Delhi. The museum contains objects of metal, ceramics, stone, wood, miniatures, textiles, ivories and natural history specimens.

Salarjung Museum, Hyderabad.[7] The Salarjung Museum, Hyderabad, which is one of the National Museums maintained by the central government, started a laboratory in 1961 for the conservation of stone and ceramics under a junior chemical assistant. A chemist in charge was appointed in 1965 on contract for five years. The laboratory handles miniatures, manuscripts, textiles and various museum objects. The staff includes two scientists, six textile repairers, manuscript repairers and an artist. Occupying an area of nearly 300 m², it has microscopes, a photomicrographic camera and spectrophotometer, pH meter, and the normal equipment.

Department of Archaeology and Museums, Jaipur.[8] The department established a conservation laboratory in 1962, headed by one archaeological chemist who received training at the Regional Conservation Centre in New Delhi. It handles all types of museum objects, including miniatures, of which there is a large collection in Rajasthan Museums, textiles, ceramics, stone and metal objects and so on. It possesses simple equipment (microscope, chemical balances, hot-air ovens and so on).

State Museum, Lucknow.[9] With the construction of a new building for the State Museum, a conservation section was established in 1963. The post of chemist in charge was filled for some time but was largely unoccupied till 1973. The new incumbent is training at the Regional Conservation Centre at New Delhi. It also

2. Based on information provided by J. C. Nagpall, Chief Archaeological Chemist, Archaeological Survey of India, Dehra Dun.
3. Information sent by K. S. Natu, Restorer, Museum and Picture Gallery, Baroda.
4. Based on information supplied by Dr S. K. Bhowmik, Director, Museum and Picture Gallery, Baroda.
5. Information provided by B. N. Choudhary, Chemist, Chandradhari Museum, Darbhanga.
6. Based on information by the Curator, Gaya Museum, Gaya.
7. Information given by Dr Satya Prakash, Director, Salarjung Museum, Hyderabad.
8. Based on information sent by Dr Hot Chand, Chemist, Department of Archaeology and Museums, Jaipur.
9. Information by Dr N. P. Joshi, Director, State Museum, Lucknow.

has one chemical assistant and one laboratory assistant.

The laboratory occupies 70 m². The Director hopes to expand its scope so that it can also serve the other museums of Uttar Pradesh.

Government Museum, Madras.[10] A conservation laboratory was set up in 1930. Its work on paintings and metal objects is well known. It at first dealt primarily with the electrolytic conservation of bronzes (the museum's bronze collection is justly famous). The laboratory was given a separate building in 1963 and more equipment: fumigation chambers, microscopes, an X-ray generator, ultra-violet lamps, a spectrophotometer, an ultrasonic generator besides the normal analytical laboratory facilities. Its future plans include the investigation of ancient techniques, the preservation of paintings in the temples of Tamilnadu, and the restoration of paintings and miniatures.

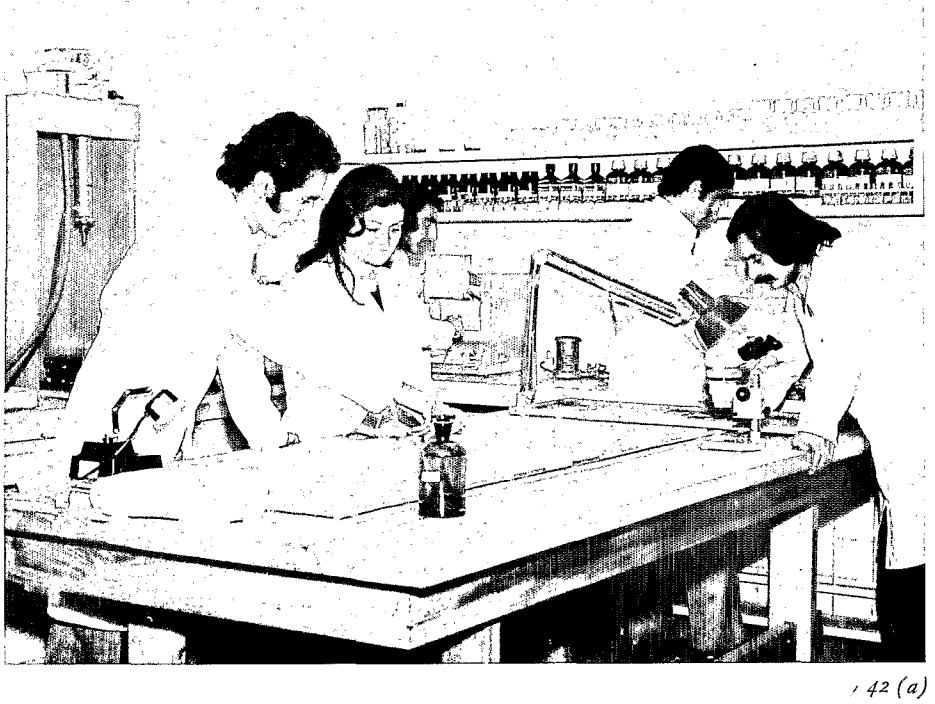
Nehru Memorial Museum, New Delhi. This important research institution for the study of modern Indian history has its own conservation department and a reprographic unit for micro-filming and copying documents. Newspapers and important documents are maintained on micro-film. The repair section uses the solvent lamination process for repairing documents.

National Gallery of Modern Art, New Delhi. The gallery, which has a large collection of oil paintings, has a restoration studio and a restorer who trained at the Istituto Centrale del Restauro, Rome. A vacuum hot table, stereo-microscope and other equipment are available.

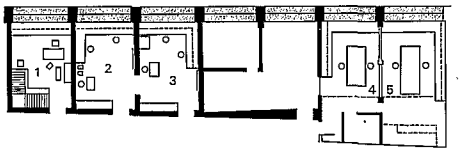
Patna Museum, Patna.[11] The Patna Museum, the State Museum of Bihar, established a laboratory in 1928. It operated on a small scale, and sometimes closed down, until its chemical assistant went for training to the Regional Conservation Centre in New Delhi in 1973. He is now trying to improve both the organization and the equipment. The museum's large collection of Tibetan *tankas* and palm-leaf manuscripts raises special conservation problems. The museum also has Natural History and Ethnological Sections. The laboratory occupies a space of 525 ft², with the normal equipment of a chemical laboratory.

Iran

National Research Centre for History of Art and Archaeology.[12] The centre, located in Tehran, is under the direction of Dr Firouz Bagherzadeh. It is establishing a first-rate conservation laboratory whose services will be available to other Iranian museums and archaeology departments. This is a purely national effort, organized by the Iranian Ministry of Culture and Arts. During the planning phase (March 1973 to March 1974), staff was trained abroad, notably at the Regional Conservation Centre in New Delhi and the Institut Royal du Patrimoine Artistique, Brussels. It has now on its staff two chemists, one physicist, one zoologist, one biologist and two conservators. It has also acquired important equipment, including a flame photometer, a stereo-microscope, a photomicrographic camera, moisture determination balances, an automatic furnace (Fig. *42 (a)*). It has excellent premises (Fig. *42 (b)*) near the National Research Centre and the Iran e Bastan Museum. When fully developed, it will be able to handle miniatures, textiles, metal and wooden objects, paintings on cloth, ceramics and so on. It is hoped that, under the fifth development plan, an extensive conservation laboratory will develop from this nucleus.



42 (a)



42 (b)

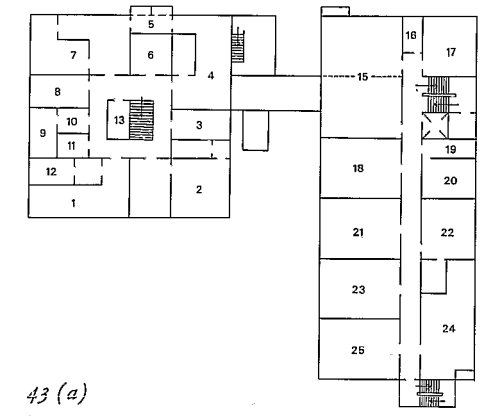
42
LABORATORY OF THE NATIONAL RESEARCH CENTRE FOR THE HISTORY OF ART AND ARCHAEOLOGY, Teheran: *(a)* preservation section working on textile.
(b) Plan: 1, 2, 3. Physical and chemical examinations. 4, 5. Preservation.

Japan[13]

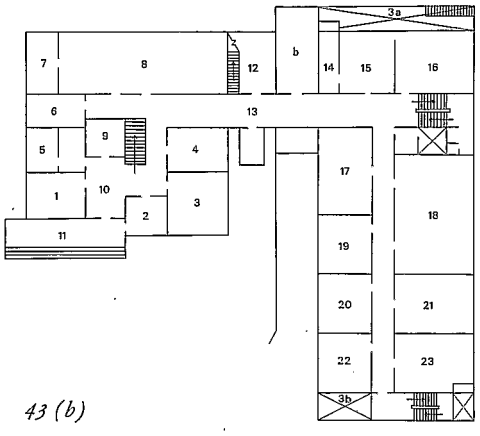
Under the Agency for Cultural Affairs, which is responsible for cultural property in Japan, three national museums have been established, at Nara, Kyoto and Tokyo, as well as the two national research institutes for cultural property, at Tokyo and Nara respectively. Each of the forty-seven prefectures has a cultural property department.

The National Research Institute for Cultural Property. This institute in Tokyo is by far Japan's most important institution for the preservation of cultural property. It makes a systematic study of preservation problems.

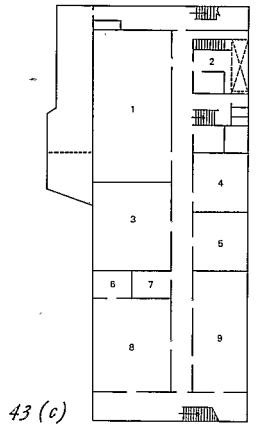
10. Information provided by Dr S. T. Satyamurti, Director, Government Museum, Madras.
11. Information given by Dr H. K. Prasad, Curator, Patna Museum, Patna.
12. Information given by A. Vatandoost, Chemist in charge of the laboratory.
13. Information obtained from Dr Kenzo Toichi, Chief, Scientific Department, National Research Institute for Cultural Property, Tokyo, and Dr Bunsaku Kuruta, Director, National Museum, Nara.



43 (a)



43 (b)



43 (c)

43
SCIENTIFIC DEPARTMENT OF THE NATIONAL RESEARCH INSTITUTE FOR CULTURAL PROPERTY, Tokyo. *(a)* Second-floor plan. 1: Biological research. 2: Physical research. 3: Dark room for physical research. 4: Chemical research. 5: Draft chamber. 6: Dark room for special experiments. 7: Analytical research. 8: Microscopy. 9: Photographic dark room. 10: Front room. 11: Cultivation room. 12: Germ-free room. 13: Balance room. 16: Hot-water service. 17: Head's room. 18: Library. 19: Preparation room. 20: Spectro-analysis. 21, 23, 25: Study rooms, Restoration section. 22: Electron microscope. 24: Non-destructive analysis. *(b)* First-floor plan. 1–13: General purposes. 14: Fumigation. 15: Sterilization (vacuum fumigation). 16: Biology laboratory. 17: Storage for art objects. 18: Atelier for scientific treatment. 19, 20, 23: Rooms for preparation. 21: Mounting. *(c)* Plan of the basement. 1: Air conditioning. 2: Radiography. 3: Electric power. 4: Special chamber with constant temperature and humidity. 5: Storage for chemicals. 6: Weather-meter. 7: Engineers. 8: Specially air-conditioned room for physical experiments. 9: Chemical laboratory.

When established in 1952, its conservation department disposed of a mere 66 m². Now its various sections (conservation; chemical, physical and biological research; restoration techniques) occupy almost 1,200 m² (Fig. *43 (a), (b), (c)*). Once or twice a year it publishes *Science and Conservation*, a periodical in Japanese with summaries in English.

Its activities include analytical studies of materials, research on art, studies of bronzes by radiography, environmental control studies, the restoration of wooden buildings, stabilization and treatment of exhibited metal and wooden objects.

The conservation laboratory has the usual and some advanced equipment: an electron microscope, a spectroradiometer, a spectrophotometer, an IR-spectrophotometer, X-ray generators, 60 CO gamma ray sources, fluorescent X-ray analysers, spectrographs. It is probably the best-equipped laboratory in Asia. There are no training courses at the institute, but it collaborates with the Asian Cultural Centre for Unesco in training programmes.

Other Japanese laboratories. The corresponding laboratory in Kyoto deals with the practical aspects of conservation, and has a staff of chemists, physicists and conservators who are mainly concerned with the conservation of archaeological and excavated materials.

Attached to one of the old temples of Nara is the Gokuraku-bo Institute for Research on Cultural Property. It takes a major interest in folklore. Its staff of ten conservators are engaged in the restoration of cultural property.

The private Bijutsuin Foundation, with premises in Kyoto National Museum, employs thirty sculptors, mainly for the restoration of sculpture. It deals only with registered antiquities.

Many private restorers and mounters of scroll paintings use traditional Japanese methods of restoration and repair and are highly skilled.

Japanese legislation for the protection of cultural property is among the most comprehensive of its kind. The Law for the Preservation of Ancient Shrines and Temples passed in March 1897 was superseded in 1929 by the Law of the Preservation of National Treasures, made more comprehensive in turn by the 1950 Law for the Protection of Cultural Properties. Under the latter, all cultural property in Japan had to be registered and the more important items designated as of national importance and protected. It refers to both nationally and privately owned objects, and tangible and intangible property. It defines cultural property to include buildings, paintings, sculptures, manuscripts, objects of folk culture, ancient sites, gardens, plants, animals, mountains of great importance, and so on.[14]

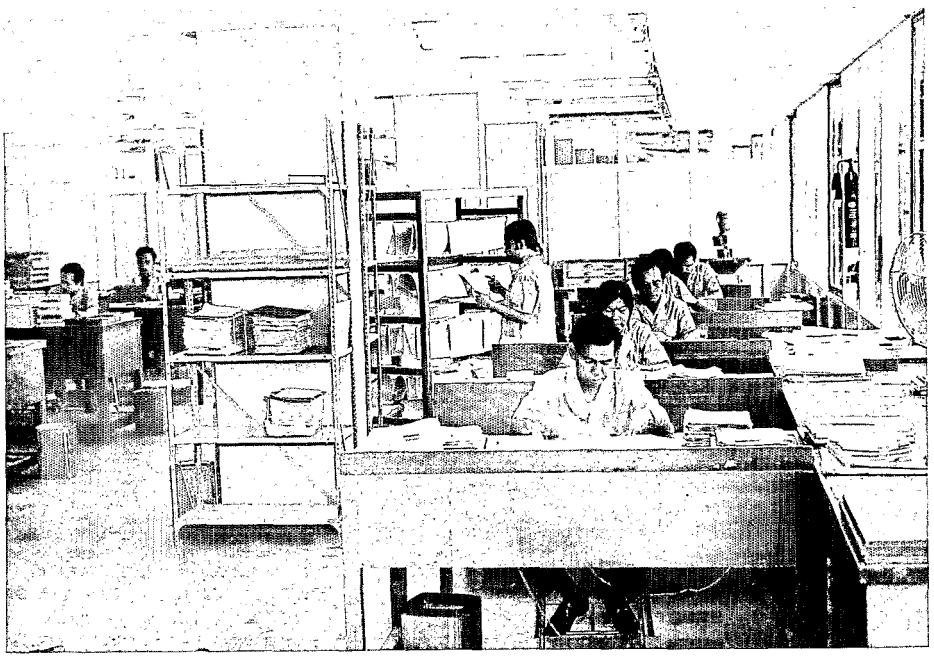
Malaysia

Since Independence, the Government of Malaysia has followed an enlightened cultural heritage policy. The Museums Department is responsible for the conservation and protection of the historical and cultural property of the nation. The National Museum at Kuala Lumpur has a small laboratory. Two technicians do the basic repair work on pottery, stone objects, and ethnographical and other material. There are plans to expand this service to form a national conservation laboratory.

The National Archives of Malaysia.[15] This has an excellent conservation department capable of handling all types of paper materials. It originated as a bindery in 1962 and so as to provide proper care for its collections the National Archives and Library established a preservation division (subsequently the repository and technical services) in 1965. The service is now fully operational and has a well-trained staff. The restoration laboratory undertakes a great variety of operations: protecting manuscripts and other documents by lamination with silk chiffon; cleaning the prints and photographs and mounting them; repairing maps; drawing plans and so on. It also has a micro-film unit attached (Fig. *44*).

14. *Administration for Protection of Cultural Properties in Japan*, Tokyo, National Commission for Protection of Cultural Properties, 1962.

15. Information obtained from the National Archives of Malaysia.



44
NATIONAL ARCHIVES, Kuala Lumpur. Conservation Department. General view of restoration and binding section.

Nepal

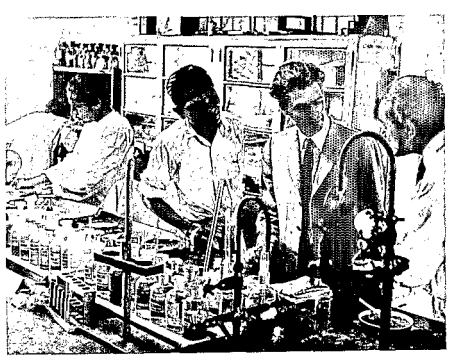
National Museum, Kathmandu.[16] The Department of Archaeology of His Majesty's Government of Nepal has set up a laboratory for the conservation of museum objects and monuments at the National Museum in Kathmandu. The laboratory started on a modest scale with Unesco assistance in 1971. It has the basic equipment and hopes to acquire other major items for research and conservation gradually. The staff (two scientists and seven others), have to deal with the conservation of wooden objects, Nepalese *tankas*, metal objects, palm-leaf and paper manuscripts, miniatures, textiles and so on. It hopes to get more of the staff trained for work that urgently needs to be done.

During 1974, the laboratory personnel tackled the treatment, cleaning and strengthening of wood carvings at Hanuman Dhoka (which was to be restored for the Royal Coronation in February 1975), and at some other sites.

Sri Lanka

National Museum, Colombo.[17] The museum eventually hopes to establish a conservation laboratory, but at present has only one small workshop in which a technician deals with simple repairs, the fumigation of books, and wooden objects. As and when needed, advice is sought from visiting scientists and the Archaeological Commissioner of Sri Lanka. The museum has a superb collection of manuscripts, palm leaves, metal objects, ethnographical material and leather objects which needs careful attention and treatment.

Archaeological Department, Colombo. The Archaeological Department, responsible for monuments and site museums, has a chemical conservation laboratory, equipped for the examination and conservation of wall-paintings, metal, wooden, stone and other articles, under the direction of an archaeological chemist (Fig. *45*).



45
ARCHAEOLOGICAL DEPARTMENT. Colombo. A view of the laboratory.

Thailand

Department of Fine Arts, Bangkok. The Fine Arts Department of the Ministry of Education is responsible for the preservation of Thai art, history, monuments and culture, and operates a modern conservation laboratory. The laboratory began modestly but today has its own two-storey building with several large rooms used for the treatment of metals, ceramics, textiles, wall-paintings, and so on (Fig. *46 (a),)b), (c)*). Much of the laboratory equipment was provided by Unesco. Two of the staff attended courses at the Institut Royal du Patrimoine Artistique in Brussels. Several of the staff of the Department of Fine Arts have taken training in the conservation of wall-paintings at the International Centre for Conservation in Rome, and another studied the preservation of paper and textile. Recently, responsibility for conservation has been entrusted to two main agencies: the National Museum (museum objects) and the Division of Archaeology (monuments and wall-paintings).

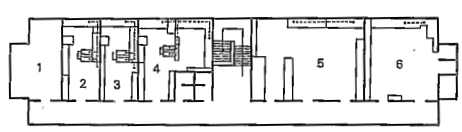
Because of the high level of ground water in many parts of Thailand, capillary action takes moisture up the walls of monuments to a considerable height. This is one of the main causes of the deterioration of wall-paintings. The Thai style of building, in which tiles are used on sloping roofs, also

16. Information sent by Miss Gisèle Hyvert, Unesco Consultant, Department of Archaeology, Kathmandu.

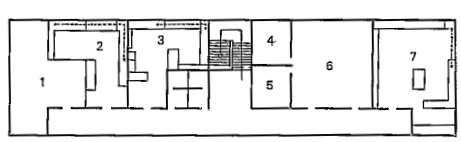
17. Based on information sent by Dr P. H. D. H. de Silva, Director of Museums (Sri Lanka).

46 (a)

46
DEPARTMENT OF FINE ARTS. Bangkok. Conservation laboratory.
(a) General view.



(b) First-floor plan. 1: Office of ICOM Regional Agency in Asia. 2: Biological laboratory. 3: Microchemical laboratory. 4: Physical laboratory. 5: Studio for easel paintings. 6: Ceramic and stone repair.



(c) Second-floor plan. 1: Secretariat library. 2: Repair of organic materials. 3: Repair of metallic objects. 4, 5: Dark rooms. 6: Photographic studios. 7: Wall-paintings room.

contributes; once the tiles break, rain water easily finds access to the walls, washing away the paintings with it. The Thai Department of Fine Arts has done a great deal to ensure the preservation of wall-paintings.

The department recently undertook a project to safeguard bronze collections. As the chloride content of the soil in most parts of Thailand is rather high, copper objects excavated from such soil get 'bronze disease'. The conditions of high humidity prevailing in Thailand cause the bronzes to deteriorate very quickly. The department, with assistance from the JDR 3rd Fund, New York, and technical guidance from the Feer Gallery of Art, Washington, D.C., ran a conservation project in the Bangkok National Museum from August 1974 to August 1975 for the treatment of objects infested with 'bronze disease' and to provide training for museum personnel in bronze conservation. The JDR 3rd Fund provided most of the financial support, and the Thai Government covered the local expenditure. An exhibition, *Bronze Disease and its Treatment,* was arranged as a part of the project.

2 Some regional organizations dealing with conservation

Asian Cultural Centre for Unesco, Tokyo

The Asian Cultural Centre for Unesco was inaugurated on 28 April 1971 in collaboration with the Unesco Member States in Asia.

The difficulties in the way of ensuring the preservation of the cultural heritage in the Asian countries were obvious from the outset. The centre therefore tries to strengthen ties of mutual interest in this connexion between the various countries involved and to encourage international exchanges. The centre receives assistance from the Japanese Government and from private institutions in Japan. It issues the *Unesco Bulletin of Asian Culture,* a monthly publication in Japanese, *Asian Culture,* a quarterly in English, and *Newsletter,* also a quarterly in English, giving information on book development activities in Asia. It also publishes annual reports, and reports of the various meetings held under its auspices. It has sponsored several seminars and conferences on subjects connected with museums and the protection of cultural property.

The centre organized a six-month course on conservation methods for four students from other Asian countries from January to June 1964.

ICOM Regional Agency in Asia

The International Council of Museums is deeply interested in museum development programmes throughout the world. Despite the work of national committees it has established in many countries, it found that not enough effective contact could be maintained outside the geographically favoured and increasingly experienced European zone; hence the establishment in New Delhi of the ICOM Regional Agency in Asia in December 1967 as a pilot project. A modest annual grant was obtained for a four-year period. The agency tries to provide effective liaison for museums and museum people of the region with ICOM and Unesco Headquarters in Paris, and to provide professional advice and services of various kinds, direct and indirect, for museums in South, South-East and East Asia. Its interests include conservation.

The New Delhi office has assembled reference material on museums and museum activities in the Asian countries, and on aspects of their culture that may affect or influence museums. Index cards are available on publications, systematically analysed and arranged. The Bangkok office, located in National Museum premises, also maintains a reference collection and indexes. The agency arranges visits from specialists to provide consultation and advice. It brings museum professionals together in meetings and conferences, and visits of the head of the agency help to maintain a personal contact with museums and their staffs.

The Indian Association for the Study of Conservation of Cultural Property

The Indian Association for the Study of Conservation of Cultural Property in New Delhi was founded following the Unesco Seminar on the Development of Museums held in that city in February 1966. It has since held nine annual seminars, publishing the proceedings in *Conservation of Cultural Property in India* which it publishes annually. The association welcomes participants from abroad, and especially from Asian countries where the problems are more or less similar to those in India.

New Delhi Regional Office of the Rome International Centre

The International Centre for the Study of the Preservation and the Restoration of Cultural Property, Rome, was set up by Unesco in 1959. It is an autonomous intergovernmental organization with a secretariat composed of specialized and administrative personnel. Many Asian countries are members. As the long distances involved constitute an obstacle to the maintenance of regular contacts and make it difficult to have an up-to-date first-hand knowledge of the situation and needs in its different countries, an honorary regional representative of the centre was nominated for Asia in 1974, with an office at the National Museum in New Delhi. This has enabled the centre to improve liaison, adapt programmes better to the needs of institutions and specialists in South and South-East Asia, and facilitated the arranging of training and missions for consultation and advice. The office also has a publication programme.

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Note. Regional organizations are important for museum development in South and South-East Asia. Their seminars and publications sometimes are concerned with conservation. They are:

ASIAN CULTURAL CENTRE FOR UNESCO (ACCU), TOKYO

Experts' meeting on 'Regional Co-operation in Unesco Cultural Activities in Asia', Tokyo, 26 February to 1 March 1973; Round-table conference on 'Modernization of Museum Activities in Asia', Tokyo, 13–17 November 1973; 'Traditional Forms of Culture in Japan', Tokyo, February 1975; Training course on 'Conservation and Restoration of Cultural Property in Asia', 19 January to 15 July 1974.

ICOM REGIONAL AGENCY IN ASIA (ICOMASIA), NEW DELHI AND BANGKOK

Museums in South, South-East and East Asia—Survey and Report, New Delhi, 1971; *Supplement to Survey and Report of 1971*, New Delhi, 1974; *Protection of Cultural Property in South-East Asia*, Report and Recommendations of the Meeting of Experts, held in Malacca, 12–13 December 1972, New Delhi, 1973; *The Role of Museums in Adult Education for Development*, Report and Recommendations of the symposium on the subject, organized for Unesco by ICOM, Malacca and Kuala Lumpur, 14–18 December 1972, New Delhi, 1973.

INDIAN ASSOCIATION FOR THE STUDY OF CONSERVATION (IASC), NEW DELHI

Conservation of Cultural Property in India. Annual (seven volumes published so far.)

REGIONAL OFFICE OF THE INTERNATIONAL CENTRE FOR THE STUDY OF THE PRESERVATION AND RESTORATION OF CULTURAL PROPERTY, NEW DELHI

Conservation in the Tropics, Proceedings of the Asia-Pacific Conference on Conservation of Cultural Property, New Delhi, 6–17 February 1972, New Delhi, 1974.

SOUTH-EAST ASIAN REGIONAL BRANCH OF THE INTERNATIONAL COUNCIL OF ARCHIVES (SARBICA), KUALA LUMPUR

Handbook: *South-East Asian Regional Branch International Council of Archives* (Inaugural conference in Kuala Lumpur, 9–11 July, Kuala Lumpur, 1968; *The Constitution of the South-East Asian Regional Branch of the International Council of Archives*; *The Constitution of the International Council of Archives.*

Picture credits

1, Unesco/David Davies; *21–40*, National Museum, New Delhi; *42 (b)*, National Research Centre for History of Art and Archaeology, Tehran; *44*, National Archives, Kuala Lumpur; *45*, Archaeological Department, Colombo; *46 (a)*, Department of Fine Arts, Bangkok.

Author

OM PRAKASH AGRAWAL

Born 1931. After obtaining a master's degree in chemistry, started his career in 1952 with the Chemical Branch of the Archaeological Survey of India. Studied at the Instituto Centrale del Restauro, Rome, in 1959 for one year. Now Head of the Central Conservation Laboratory, National Museum, New Delhi, and Director of the Unesco-sponsored Regional Conservation Training Centre. Specially interested in conservation of cultural property in Asia. Has carried out several consultant missions to Asian countries. In 1972, prepared for the International Centre for Conservation, Rome, a survey and report on the conservation needs of the region. Visiting lecturer at the murals course of the International Centre for Conservation, Rome, and at the Regional Conservation Centre, Baghdad. Secretary, Indian Association for Conservation, New Delhi, 1966–71; Secretary, Museums Association of India, 1967–72; Editor, *Conservation of Cultural Property in India*, 1966 to present; Editor, *Journal of Indian Museums* 1967 to present. Vice-President of the Council of International Centre for Conservation, Rome; Vice-President, Indian Association for Conservation, New Delhi. Member of the Executive Council, International Institute of Conservation, London. Author of many articles on conservation. Books edited: *Conservation in the Tropics* (1973); *Documentation in Museums* (1974); *The Small Museum* (1975).