
conservation

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Introduction

By Loh Heng Noi
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We are grateful for the constructive feedback and comments on the first issue of *On Conservation*. Launched in 2010, this biennial publication is an avenue for practitioners in the heritage or cultural material preservation field to share their knowledge, insights and best practices. For some readers, information gleaned from each article can serve as departure points for further discussions and conversations on specific topics.

This second issue of *On Conservation* gathers a selection of work carried out by the team at the Heritage Conservation Centre (HCC) between 2011 and 2012. The article in this issue on mould is based on a new initiative to look into mould management. Preventive conservation has always been core to the Centre's preservation efforts. For more than a decade, the robust process for integrated pest and environment management had helped to contain many potential risk factors. Our attention is now on mould management as mould has been identified as a potential risk. Two articles are specific case studies of typical interventive conservation treatment work carried out on an old map and a leather puppet.

The article on the Indian trade cloth exhibition is an example of a project which required extensive and major involvement of conservators and collections managers against tight timelines and limited resources. The process of negotiation, problem-solving and resource management underscores the complex nature of making an exhibition involving many stakeholders, including curators and exhibition designers.

Some of the major conservation challenges posed by contemporary artworks that are made up of modern and unusual materials can be gathered from the article on the treatment of the artwork by artist Jane Lee. The response can be deemed as unconventional and drastic by some. Discussions on approaches to conserving such artworks continue within the international conservation community. The general consensus points to the critical need for a decision-making and documentation framework to apply to such works. This requires new skill sets on the part of the conservator to bring about adaptive and creative responses to these materials. The Centre has initiated a multi-disciplinary work group of conservators and collections managers to work together with the curators on such a framework.

HCC was privileged to be invited by the Rudolf Bonnet Foundation to assist in conserving a selection of works of art on paper in the collection of Puri Lukisan in Bali. The sharing of skills and technical know-how is a key component of this project. This interaction has enriched both sides. Finally, an article in this issue presents an idea as to how the collection can be curated digitally to create new content on the virtual platform.

To enable greater access to this publication, we are pleased to announce that a Web version will be launched of each issue. The website is www.hcc.sg.


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From Arrival to Exhibition: The Indian Trade Cloth Collection

By Miki Komatsu,
Conservator (Textiles)[1]

Figure 1. ACM Exhibition Gallery, ***Patterns of Trade: Indian textiles for export, 1490-1900***

Introduction

In 2009 the Asian Civilisations Museum (ACM) acquired an important collection of Indian trade cloths, consisting of 304 pieces of textile. Seventy pieces of the collection were selected for display in a special exhibition, *Patterns of Trade: Indian textiles for export, 1400-1900*, held at ACM[2] (Figure 1).

Indian textiles have a long and distinguished history. By the most conservative estimate, India had more than two millennia of experience in the growing, handling and processing of cotton. Beyond the proficiency in making cotton textiles, India's crowning textile accomplishment was the patterning of this cloth with brilliant fast dyes[3]. They were traded from production and distribution centres in Gujarat and along the Coromandel Coast. India was a great entrepot for early international trade, due to its axial geographical position, through which the east-west commerce in spices and other luxuries passed[4]. The following article describes how a large collection of Indian textiles has been cared for at the Heritage Conservation Centre (HCC), including a behind-the scenes insight to its preparation for exhibition.

Phase 1: Initial Condition Survey and Storage

A verification check of the newly acquired collection was conducted following a period of acclimatisation at HCC. The Textiles Conservation Section assisted in this process of inspection, which included handling some of the more delicate textiles and a brief preliminary assessment of future storage and conservation requirements. It was noted at this stage that a significant number of the textiles had been conserved with a localised or full support using stitching (Figure 3) and/or an in-painting technique (Figure 4). Interestingly, some of the modern repairs used a digital print technique for patch support.

[1] The conservation treatment for this project was undertaken by Jacinta Loh Boon Nee, Chuance Chen, Elsie Wong, Geraldine Sim, Michelle Oh, Siti Suhailah Salim (Textiles Section) and Poppy Singer (HCC Fellow).
[2] The textiles were acquired in 2009 from the American collector Roger Hollander's private collection, and were seen publicly for the first time. The exhibition ran from 12 Nov 2011-17 July 2012 at ACM, Singapore.
[3] GITTINGER, M., *Master Dyers to the World*. The Textile Museum, 1982, pp 16.
[4] GUY, J., *Woven Cargoes Indian Textiles in the East*. New York: Thames and Hudson Inc., 1998, pp 7.

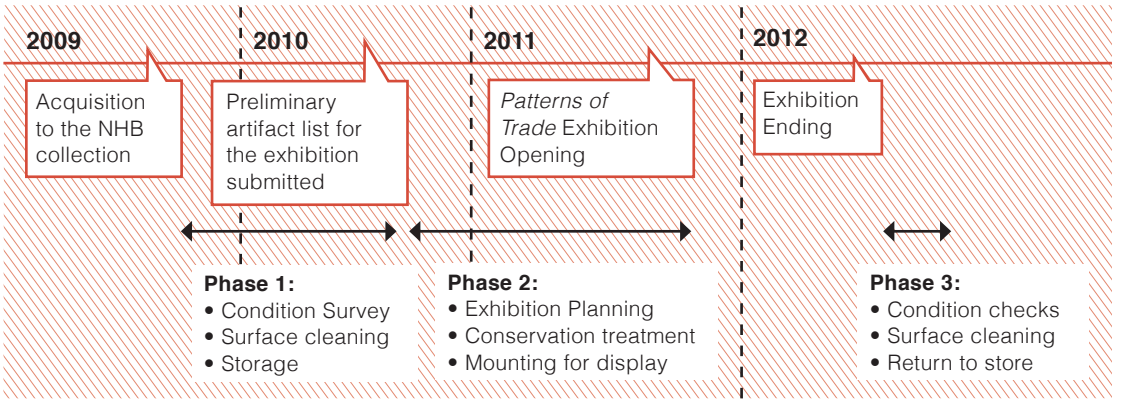


*Figure 2. Timeline for the **Patterns of Trade** Exhibition*

As part of the process of acquisition, a series of more detailed condition checks were undertaken to examine the textiles and prepare them for storage. This process comprised condition assessment, inspection for insects and mould, surface cleaning with gentle vacuum suction, and rolling on tailor-made archival storage rollers with a Tyvek[5] cover, prepared by the Collection Services Department. A total of nine months (592 hours in total) was spent on this task.

Phase 2: Exhibition Planning and Preparation

It is important for a conservator to understand how an exhibition is managed, the length of time needed for organisation and planning, as well as the parameters within which to work. Typical parameters for conserving large textiles include space, resources and time for conservation and exhibition mounting. The submission of a preliminary artefact list in mid-2010 contained nearly one hundred pieces of Indian textiles, including a substantial number from the recently acquired Hollander collection. Additional Indian trade textiles were also selected from NHB's collection. Conservators began to estimate the amount of time needed for conservation and mounting work. The acquisition condition reports of the Hollander collection provided a valuable insight to the condition of the textiles selected for exhibition and their specific conservation requirements. A series of meetings with the Exhibition Project Team narrowed down the original list to approximately 70 pieces of Indian trade cloth, based on their condition and suitability for display.

Figure 3. Stitched patches

Figure 4. Stitched patch with in-painting

[5] Non-woven fabric made from 100% polyethylene fibers.

Figure 5 & 6. Ritual Hanging (2009-02117). Front (left), Back (right). [Before Conservation] Coromandel Coast, India, 18th Century, Cotton; drawn resist, painted mordants, dyed, red, blue and black (222.7 cm x 442.0 cm)

In order to maximise gallery space, approximately 50% of the textiles were selected for hanging display, whilst the remainder was displayed flat on sloping plinths within showcases. An important concern for both the curatorial and conservation teams was the physical safety of the textiles during display.

Conservation Treatment

A total of 11 months (approximately 2,400 hours) of conservation work was allocated for the exhibition. Seven conservators, an external conservator, and three seamstresses were engaged in this project. Of immediate concern was the structural stability of some of the larger textiles and the development of a mounting system for their display. A minimal approach to conservation treatment was developed to prioritise time and resources for specific individual requirements. Each of the textiles was photographed and documented, before being surface cleaned with a low-suction museum vacuum, soft-haired brushes and nylon net screen. Treatment proposals were then discussed with the curator to determine the extent and nature of conservation work. The conservation decision-making process is often influenced by a variety of factors, such as the artefact's condition, proposed method of exhibition display, cultural and historical context, as well as technical expertise and logistical resources. Therefore, there is no single approach to conserve an artefact or collection. Various creative solutions and techniques, both simple and complex, can be developed to achieve this objective. Examples of some of these issues and treatment challenges are highlighted below.

1. Full support

A total of 34 textiles were selected for vertical display with strainers. Each was given a stitched/adhesive support to ensure their stability for hanging display. A broad definition of support in conservation terms would be to strengthen and stabilise areas of physical damage, deterioration or weakness. Conservation treatments were specifically devised for the exhibition to stabilise the condition of the textiles and make them safe for vertical display.

Figure 7. Five pieces of dyed support fabrics sewn together

Figure 8. Textile placed on the support fabric before the grid system of stitching given

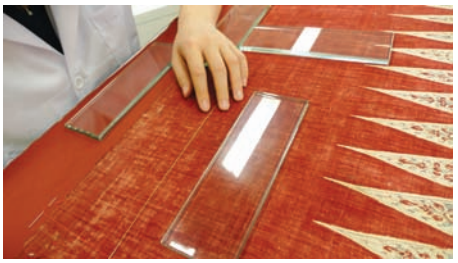


Figure 9. Yellow and orange threads laid on the textile as guiding lines

Figure 10. Close up of staggered running stitches on support fabric

Case Study 1. Ritual Hanging (2009-02117)

Kain lelehur, or Ceremonial canopy, of tabby woven cotton cloth has a *tambal* motif (patchwork pattern) in a rectangular field with *tumpal* boarders. The textile is constructed of two loom width cloths that are hand-stitched together horizontally (Figures 5 & 6).

The textile was assessed to be in fair condition with numerous previous stitched patches and in-painting repairs. The hanging also had many small holes, most likely caused by a previous insect infestation. The majority of holes was not supported and required some form of structural treatment. The main conservation priority was to stabilise the condition of the textile, making it safe for vertical display. Documentation, surface cleaning and humidification were undertaken before the hanging was given a full stitched support.

A fabric was selected that had sufficient weight to support the textile, but that was not too heavy to prevent, or resist, the textile's natural drape characteristics. Cotton voile was chosen for the full support and dyed with solophenyl dyes[6] to visually infill the holes and losses (Figures 7 & 8). A grid system of stitching was planned that provided an even distribution of support throughout the textile (Figures 9 & 10). The width, length and spacing of the grid were determined by the weight of the textile, its size and overall condition. Of principal importance was the textile's overall level of contact and drape with the support fabric when on vertical display. Remedial couch stitching was also undertaken around fragile areas of holes and losses. Finally, the textile was given a test hang in the conservation laboratory, allowing the textile to stretch naturally and for conservators to assess the tension of the stitching.

2. Adhesive treatment

In textile conservation, adhesives are generally used for objects that are very brittle, where stitching is not felt to be appropriate, or where access for stitching is restricted. This also applies to certain painted textiles and non-textile materials (e.g. bark cloth, felt, paper, etc.). They are often described as being a last resort and they raise the issue of re-treatability as a factor in determining the suitability of a conservation treatment[7].

Figure 11. Skirt Cloth (1994-00515). Front. [Before Conservation] Cotton, drawn and stamped resist and mordants, dyed red, blue, yellow, green, purple and black (422 cm x 205 cm)

[6] Direct dyes for cellulose fibers; water-soluble dyes applied from a dye bath. Proved to have high light and wash fastness.

[7] TEXTILE CONSERVATION CENTRE. *Introduction to the Use of Adhesive in Textile Conservation*. (Unpublish notes from a series of lectures given by Advanced Conservation texhniques at the Textile Conservation Centre) 2006; Conservation research on adhesives has revealed that many early adhesive treatments show signs of yellowing, dirt pick-up, stiffening and increased rigidity. Long-term effects to the object and its degradation process are yet to be fully studied.

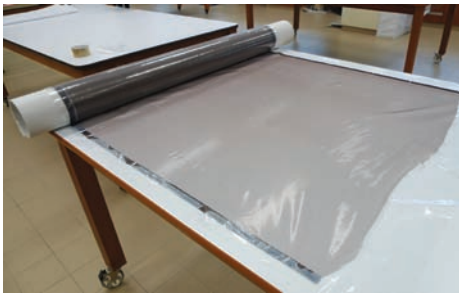


Figure 12. Brown polyester support fabric coated with Lascaux adhesive on a plastic sheet

Figure 13. Support fabric carefully peeled away from the plastic to ensure the alignment of its fibres

Figure 14. All four borders supported with adhesive coated brown support

Case Study 2. Skirt Cloth (1994-00515)

The textile has a central field of a blue background, decorated with small rosettes that are arranged to form an overall lattice design (Figure 11). The cloth would have originally been calendared[8], showing a smooth and shiny surface. It is constructed of one loom width of cloth with selvedge, and shorter ends finished with hand stitches. It was used as wraps in different styles by men and women, as well as room dividers, curtains, coverings for altars, floors and seats for the nobility. The textile was made in the 18th century for export to the Thai court.

The skirt cloth was in fair condition with distortion and creases along the edges. The cloth also had numerous small holes, most likely resulting from a previous insect infestation. The holes are bigger along both sides of selvage, possibly due to how it was previously used or hung. There was also an L-shape tear on the top left hand side.

After documentation, surface cleaning and humidification to reduce the creases, a localised stitched patch support was undertaken on the L-shape tear. For the numerous tears distributed along the four edges, an adhesive support was considered. For the treatment of the skirt cloth, adhesive was applied in strips along the four outer edges. The surface of the cloth had a polished appearance that would have been disfigured had a traditional stitched method of repair been undertaken.

A thin open-weave brown fabric, made of 100% polyester multifilament, was chosen for the support because of the strength and flexibility of its woven structure. The support fabric was stretched over a plastic sheet to help align the stabiltex grain with the aid of sprayed water. After removing the excess water, a low concentration solution of Lascaux 360HV and 498HV[9] in deionised water was applied twice with a roller. The support fabric was then left over night to dry to form an adhesive fabric on the plastic film (Figure 12). This support that was cast with Lascaux solution was placed at the back of the textile, adhesive side facing down. The plastic sheet was slowly removed, whilst ensuring that the weave structure remained aligned (Figure 13). The dimensions of the support fabric had been extended by 2.0 cm in order to encase the edges of the textile. The adhesive was re-activated with a travelling iron at low temperature (Figure 14).

[8] Calendaring is a process to smooth and shine a surface of the fabric with hard pressure. The textile would have been polished with cowrie shells.
[9] A thermoplastic copolymer Butyl-methacrylate dispersion thickened with acrylic butyl-ester.

Mounting and Display

Textiles selected for exhibition require special mounting work in preparation for their display. The often-conflicting demands of conservation and public access need to be carefully balanced. Another challenge is the handling and installation of large textiles within a limited space with several conservators and art handlers. Therefore, planning and organisation of packing, delivery and installation requires advanced planning for efficient and safe installation. The following are some examples of textile mounting prepared for the *Patterns of Trade* exhibition.

Flat Display

A total of 28 textiles were deemed to be in a relatively poor condition and suitable only for flat display, where the textile is supported throughout its length without risk to its structure. Each of the textiles were laid flat directly onto a fabric wrapped plinth with 30° slope inside the showcase[10]. A polyester fabric was used to wrap the base of the plinth, and provided a grip to keep the textiles in position and to prevent them from sliding down (Figure 15). Fine entomological pins were used where necessary.

Another group of textiles that was assessed to be in better condition was also displayed flat. Due to limited exhibition space, only a section of the textile was fully revealed for display. The textiles were wrapped around a square cushion (soft sculpture) that is made of polyester wadding and cotton calico (Figure 16). This gives soft and even support to the textiles. Each textile was pre-mounted at HCC before delivery to the museum, which helped speed up the exhibition installation process and minimise unnecessary handling. The soft sculptures were individually made to fit to the textiles by trained seamstresses. Tiny loops made of cotton tape were stitched at the top of the soft sculptures, which enabled them to be pinned down to the fabric-wrapped plinth to secure the objects (Figure 17).

Hanging Display on Strainers

A total of 37 textiles were selected for vertical display to maximise the special exhibition space at ACM, surrounding the visitor with rich textiles. More than half of the textiles chosen for this method of display are mounted on padded strainers for vertical support against a wall. Each strainer is made of a wooden framework, coated with three layers of sealant[11] and a layer of sturdy archival board stapled into position. Polyester wadding was then stretched over the frame and archival board, followed by the exhibition display fabric tensioned across the board. A Velcro

Figure 15. Textile displayed flat on fabric-wrapped plinth

Figure 16. Textile displayed wrapped around a supporting cushion

Figure 17. Detail of loop made of cotton tape stitched at the top of a cushion, allowing pinning of the mount without touching the artefact

[10] BARKER, K. *Reducing the Strain*. In UKIC Conservation News, Issue 80, 2002, pp 30; She studied the effects on tilting a support board to reduce the strain. According to her research, 30° slope could reduce a 50% of the strain on the textile.

[11] Water-borne acrylic copolymer to seal/glaze organic acids from natural woods, and to protect an artefact from off-gassing.

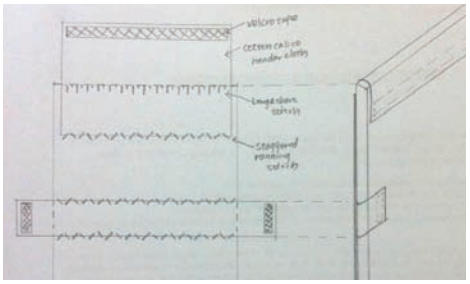


Figure 18. Diagram of header cloth and horizontal strip for mounting the strainer

Figure 19. Cotton header cloth stitched to the rear side of the textile. A Velcro strip stitched at the top of the header cloth goes over the back of the strainer

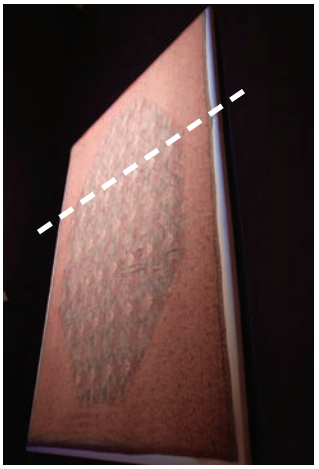


Figure 20. Join line of a two-part strainer, positioned two-thirds up from the bottom of the textile

strip was then stapled to the back of the strainer, married with matching Velcro stitched at the back of the textile. Additional strips were stitched horizontally along the middle and near the bottom of the textile where necessary (Figure 18). To mount the textiles to the strainers, a header cloth (cotton calico) was used for most of the textiles. A piece of calico that is the width of textile and 15-20 cm longer extends to the top of the textile (Figure 19). Velcro strips were machine-stitched at the top of the header cloth. This extended header cloth then goes over the top of the strainer to the back, where the matching Velcro is stapled.

The majority of strainers consists of two parts, due to the large size of the textiles and logistical problems of access to both the exhibition cargo lift and gallery entrance. Therefore, installation work and assembly of the two-part strainer joinery were carried out inside the exhibition space (Figure 20).

Phase 3: During and After the Exhibition

During the exhibition, various precautions were taken to safeguard the textiles on open display. At least 3-4 Gallery sitters were deployed at all times to avoid the visitor from touching the textiles. “Do Not Touch” signs and barricades were also used to deter curious fingers. A routine walkthrough to monitor display conditions was carried out once a month by a conservator.

The final stage of the exhibition was to de-install the textiles and return them to their respective stores at HCC. All of the textiles were condition checked, noting any changes in condition. Surface cleaning was carried out for the open display pieces as dust accumulation was observed at the upper part of the strainer, due to the prolonged exhibition period. The textiles were then carefully rolled for storage.

Conclusion

Despite constraints of time and the physical difficulties of the treating for large textiles, the conservation team was able to develop and refine their treatment and mounting skills. This resulted in building up confidence of stitching skills and adhesive treatments in particular. The project also widened our understanding of Indian textile history and material techniques, essential information for conservation decision-making.

The exhibition has provided an excellent starting point for further research and conservation of these beautiful textiles. Additional documentation and classification of the materials and techniques would greatly enhance our understanding and interpretation of the collection. Conservation can contribute to this process through scientific analysis of textile fibers, dyes and mordants, as well as dating techniques.


02
SINGAPORE
Surveyed in the year 1843
BY
J. T. THOMSON
Govt Surveyor.
Battery N° 3.
N° 2.
1 Mile
Battery N° 6.
NOTE
REMARKS

Conservation of a 1843 Town Plan of Singapore

By Lee Siew Wah,
Senior Conservator (Paper)

Introduction

The original town plan referred to in this article was possibly drawn by Captain Samuel Best of Madras Engineers[1]. His signature was faintly printed on the right-hand edge of the plan. London Mission Press[2] printed it in 1842 using a method known as lithography[3]. It was later hand-copied and published in 1843 by John Turnbull Thomson, the first Government Surveyor of Singapore from 1841 to 1844. It is one of the earliest detail town plans of Singapore in the collection of the National Heritage Board.

Condition

Originally printed in black ink, this plan was later hand-coloured with watercolour and inscribed with iron gall ink. The printing and watercolour media had remained in stable and good condition. The iron gall ink inscription at the bottom edge had suffered cracks and minor losses, indicating the end stages of the iron gall ink deterioration. At this point, the risk of further ink deterioration would be low with proper storage and display environment. Treatment should target the cracks and losses that resulted from ink deterioration.

Executed on thin cotton paper, the plan had become severely discoloured and brittle. The cause of this condition was probably due to an unstable sizing or coating layer that had turned acidic with age. Holes and some losses were noted on the paper support, with a large loss on its top right-hand corner (Figure 1). Evidence of a previous treatment included adhesion of the plan onto a card support, which had over time caused the plan to bow at the top and bottom edges. Air bubbles trapped likely during the adhesion of the plan to the card had created areas of weakness, where the brittle paper support above the air bubbles could be easily damaged through handling or fluctuations in relative humidity.

The card, made from wood pulp, was discoloured and brittle from acid deterioration due to the presence of lignin and other impurities. There was also evidence of insect damage on the surface at the back. The advanced level of acidic degradation of the support board threatened the future physical stability of the map, with any distortion risking breakage of the card together with its paper support. Therefore, any proposed conservation treatment needed to consider the merits of replacing the acidic card with a more stable support material.

[1] A regiment in the Indian Army under the East India Company.
[2] London Mission Press was the first printing service provider in Singapore, set up by London Missionary Society in 1823.
[3] Lithography is a printing method invented by Aloys Senefelder in 1798. It was a common method of printing used in reproducing drawings and paintings in the 18th century. The printing involved creating the design on a smooth, wet lithographic stone with an oil-based medium. When the oil-based printing was applied, it was repelled by the water on the stone and attracted to the oil-based medium. An image was printed by pressing a paper through a press.

Figure 1. Front of plan before treatment

Figure 2. Back of plan before treatment

Conservation Treatment

The condition of the plan, coupled with its historical significance, meant that conservation treatment was considered necessary to remove the card backing and stabilise its support. Without treatment the plan could not be safely used for display or research, with high risks of further breakage of the paper support from further handling and/or fluctuations in relative humidity.

Due to the extremely brittle condition of the card support, a method of treatment was devised to minimise any risk to the plan during the delicate process of its separation with water. A facing technique to protect the plan's surface on the front was chosen to provide support for the plan while the card was removed from its back. The plan was then repaired and lined with alkaline Japanese paper[4] to reinforce the primary support. The lining treatment with alkaline paper could also reduce the acidity[5] of the plan since it was too fragile to be washed. Following this treatment the facing was removed and the plan dried.

Prior to commencing treatment, the stability of the printing and colouring media was tested to determine their solubility characteristics in deionised water and ethanol. The tests demonstrated that both water and ethanol had no discernible effect on the plan's media and could be considered for use in its treatment. The starch-based adhesive used in attaching the plan to the card support was identified by an iodine test[6]. The known solubility of starch-based adhesives to water prompted the choice of deionised water as a treatment solvent for separating the map from its card support.

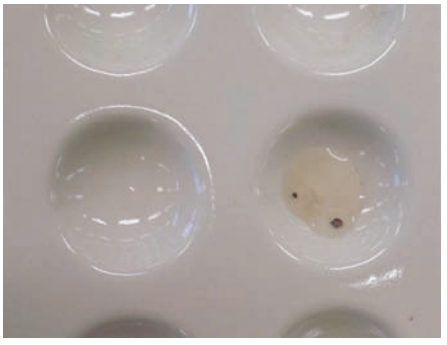


Figure 3. Detail of Iodine test showing the presence of starch

[4] Refers to traditional handmade papers from Japan, consisted of mainly mulberry fibres that are pH neutral or slightly alkaline. They are widely used for paper conservation treatments.
[5] AIC Paper Conservation Catalog, Section 20 Neutralization and Alkalization, pp 13.
[6] This test is done by extracting some samples from the exposed area of the card backing onto a spot plate, followed by applying a drop of iodine and potassium iodide solution. A blue colouration indicates the presence of starch.

In order to select a suitable adhesive for the facing process, a series of potential water-based conservation adhesives (e.g. Klucel G, Tylose 300 and Methylcellulose) of different percentages, were tested at the edge of the plan to evaluate their physical properties and visual characteristics. A 2% solution of Methylcellulose was judged to be the most suitable of the adhesives tested for attaching the facing material. Factors such as adhesive strength and surface gloss were carefully studied during the selection process.

Rayon, a material made from a mixture of paper and polyethylene fibres, was chosen as the facing material. The paper-like properties of Rayon enable it to adhere easily to compatible surfaces and allow for its future removal without leaving any residual paper fibres. Three strips of Rayon were adhered to the map's surface with a 2% solution of Methylcellulose and dried under the light pressure of glass weights (Figure 4).

Figure 4. Plan faced with strips of Rayon paper

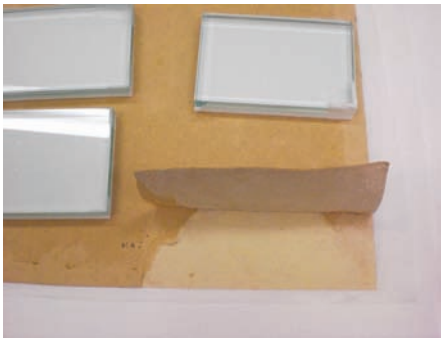


Figure 5. First stage of removing the card backing

After the Rayon facing had dried, the process of removing the card backing commenced. First, the card was thinned down mechanically from behind using a scalpel and spatula (Figure 5). A thin layer of card was left attached to the plan, due to the risk of damage from the process of mechanical removal. The plan was then placed in a plastic tray for humidification through a layer of Gore-Tex[7], followed by spraying with deionised water to ensure that the artefact was thoroughly wet. A selective or partial wetting of the map would have contributed to the formation of a wet-dry interface, an area where the plan and its backing would distort due to differences in moisture content, risking cracking of the plan's support. The last layer of the backing was then removed (Figure 6). Extreme care was taken during this final stage of the process.

Holes and losses on the map were repaired with dyed[8] Japanese paper, adhered with wheat starch paste[9] (Figure 7). After the repairs had dried,

[7] Gore-Tex is an expanded polytetrafluoroethylene laminate that only allows the vapour of a liquid to pass through.
[8] Dyed Japanese papers are ready-dyed Japanese papers by master dyesmen in Japan using natural plant dyes.
[9] Wheat starch paste is an adhesive made by cooking wheat starch powder in water, and then diluted with water to a suitable consistency.

Figure 6. Removal of the remaining layer of the card backing after wetting with deionised water

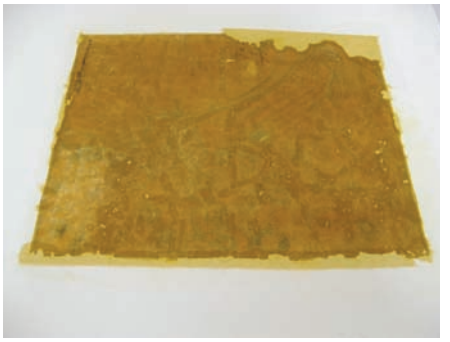


Figure 7. Back of plan showing Japanese paper repairs

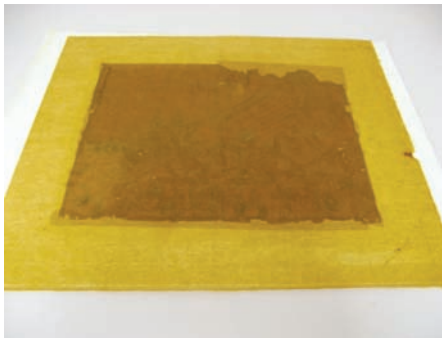


Figure 8. After the first lining of the plan

Figure 9. Removal of the Rayon facing paper

the plan was prepared for the application of its new lining. First, the plan was humidified through Gore-Tex and sprayed wet with deionised water. Then a piece of dyed Japanese paper, larger in size than the plan, was adhered to the back of the plan with wheat starch paste (Figure 8). The plan was then placed face-up and its Rayon facing was removed (Figure 9). Two pieces of a spun bound polyester fabric, Hollytex[10], were then used to interleave the lined plan, before drying between sheets of thick felt for one week (Figure 10).

Lining with just one thin layer of Japanese paper was considered insufficient to support the brittle map. The application of a thicker piece of Japanese paper was also judged to be inappropriate, due to the increased risk of dimensional expansion and contraction forces caused between wet and dry conditions. The thick Japanese paper would be much thicker than two pieces of thin Japanese paper. This characteristic of thick Japanese paper could lead to an opening up of tears and cracks, especially in areas with iron gall ink corrosion.

Figure 10. Drying of the plan between sheets of thick felt

[10] Hollytex is a spun bound polyester fabric that is used in paper conservation as an auxiliary support to handle or drying wet paper artefacts.

Figure 11. Tension drying of plan on laminated board

Figure 12. Plan after treatment

After the plan had dried, the excess lining paper was trimmed off. Another layer of Japanese paper was lined onto the map, using the same procedure as before. The plan was then tension-dried[11], where it was laid on a laminated wooden board with the edges of the new lining paper attached with strips of Japanese paper and wheat starch paste. It was then left to dry for two weeks.

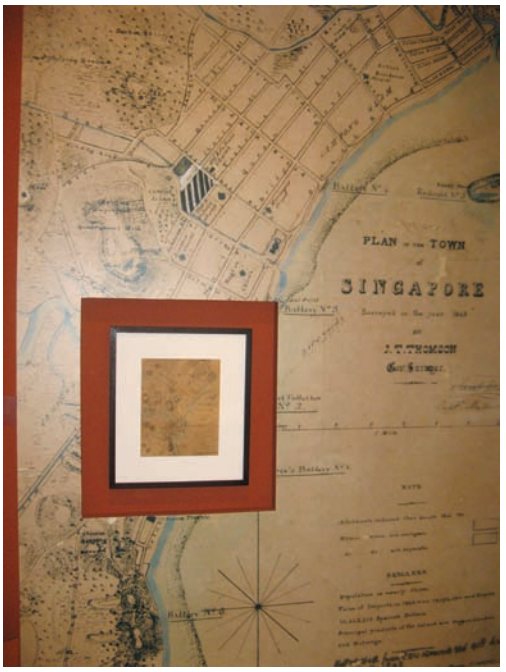


Figure 13. Plan on display

Conclusion

The conservation treatment of this plan provided several technical challenges that are not routinely encountered during the course of regular work. The removal of the backing and facing materials required a high level of practical skill and great precision, so as not to damage the brittle support of the map.

The support structure of the map was significantly stabilised following its conservation treatment, providing a flatter map surface without air bubbles. The visual appearance of the map also improved, with former holes and losses becoming less intrusive after their repair using dyed Japanese papers matching the colour of its support. The new flatness of the map also means it can be mounted and framed more easily for display and appreciation.

[11] Tension drying is a process of drying paper by making use of the tension created when the paper was restricted at its expanded stage while it was wet and contracted when it was drying.


03

Conservation of a Javanese *Wayang Kulit*

By Cindy Lau,
Assistant Conservator (Objects)

Introduction

The Army *wayang kulit* (XX-5457), was sent for conservation treatment following a collection-in-storage inspection project in August 2011. Dating from the 20th century, the object is of Javanese origin. This *wayang kulit*, which depicts a troop of soldiers, is also known in Javanese as *ampjak, prampogan* or *rampogan*, The Marching Army puppet[1].

The theatre of *wayang kulit* has played an influential role in Indonesian society. It was first recognised and utilised as a political instrument by the Japanese government during its occupation of Indonesia in World War II (1942-1945), where it was used to communicate nationalist Japanese propaganda[2]. After the return of the Dutch in 1945, Indonesia went through a period of struggle for independence from colonial rule. It was during this period that unique puppets were created for "*Wayang Revolusie*". These puppets fused with political ideologies were crafted to motivate Indonesians to rise against the Dutch, to inspire patriotism, and to fight for freedom (1945-1949)[3].

Construction and Materials of *Wayang Kulit*

In Javanese, *wayang* literally means "shadow" and *kulit* means "skin", the material used for fabrication of the puppets. *Wayang kulit* is made from water buffalo hide that is two to three years old. The hide is first dried in the sun by stretching or pegging it over a frame. After drying, the hide is then soaked in lime water, calcium hydroxide, to act as a depilant (hair remover) for two to three days. Once the hide is swollen, it is scraped with a knife to remove the hair, epidermis and fatty substances of the adipose layer. It is stretched and dried in the sun again. The hide is repetitively scraped and polished with a rag until it has an even thickness and a smooth finish on both sides in preparation for painted decoration. The thickness of the hide is usually estimated to be 1.0 to 1.5 mm in relation to the size of the puppet[4]. As the hide undergoes a smoking process, *wayang kulit* is considered to be a semi-tanned skin.

[1] BRANDON, J.R., *Theatre in South East Asia*. Cambridge: Harvard University Press, 1967, pp 23.
[2] BRANDON, op. cit., pp 285.
[3] LEITER, S.L, *Encyclopedia of Asian Theatre: O-Z*. West port: Greenwood, 2007, pp 578.
[4] GOWERS, H., *The Conservation of Javanese Shadow Puppets*. In ICOM Committee for Conservation 4th Triennial Meeting, Venice 13-18 October 1975, Preprints. Paris: International Council of Museums, 1975, pp 75/3/1-75/3/7.

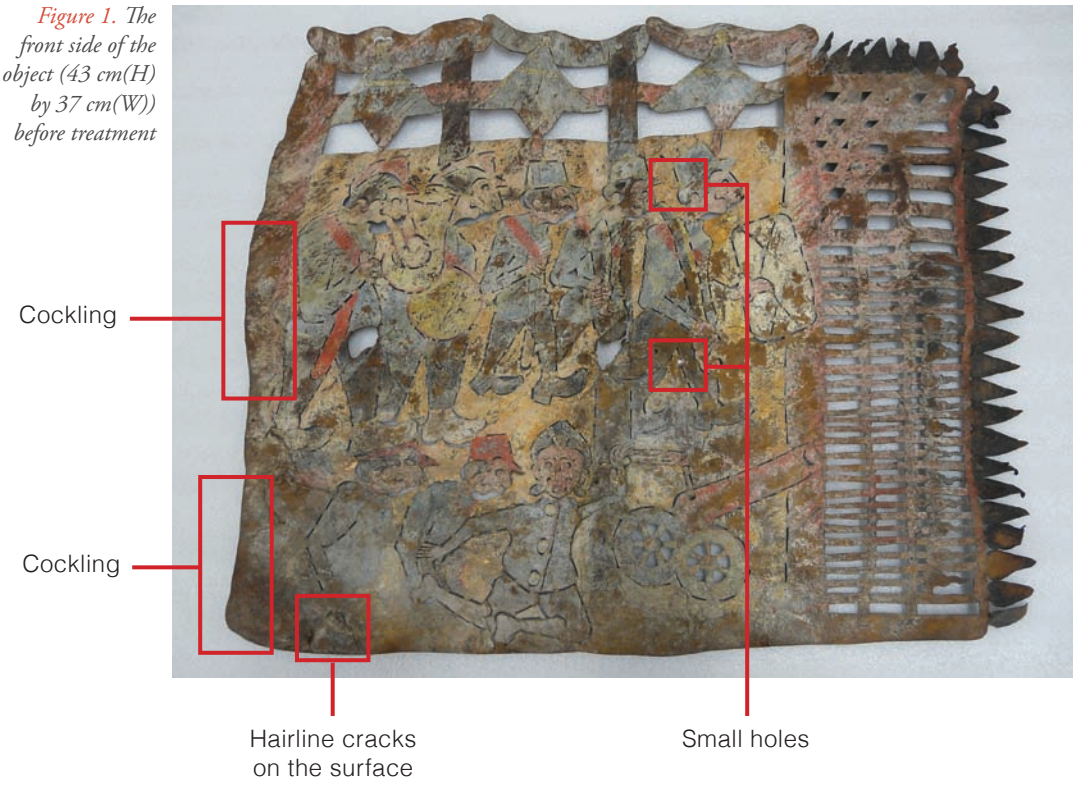


Figure 1. The front side of the object (43 cm(H) by 37 cm(W)) before treatment

Description

Both sides of this *wayang kulit* are painted with the same scene of an army in blue and red uniform, marching and playing musical instruments. The lower proper left corner of the object depicts a man with a joyous expression trying to light the cannon. The piece is framed with rectangular blocks and flame-like motifs, and black triangle designs on the proper left of the object (Figure 1). The top of the object is decorated with an irregular motif on top of a triangular, bell-like design. The overall scene of the object is that of a victory celebration by the army.

Condition

The structural condition of the object was fair as it was still relatively intact. It was observed that the object was constructed from one piece of leather. Severe cockling of the object was observed on the corner and proper right side edge (Figure 1). This was most probably due to shrinkage caused by the desiccated condition of the leather. Minor embrittlement was observed at the corners of the object, with some areas of the connecting joints of the puppet broken off. Some small splitting had occurred at the sharp edges of the triangular motif and the supporting stick for the puppet was missing.

Figure 2. Rear of object before treatment

The overall surface condition was poor with the majority of the surface suffering from paint loss and flaking, due to abrasion, cockling, shrinkage and also natural deterioration of the object (Figure 1). The surface of the object was observed to be covered in dust and dirt. The painted surface of the object consists of five main colours: red, blue, yellow, black, and white, with the last used for the primer. The colours near the center, where the skin was relatively flat, were still in fairly good condition (Figure 1). However, patches of the white primer layer and yellowish-brown skin substrate were revealed from the flaking and loss of paint layers. Two large holes were seen along the center and proper right edge of the front surface; it was possible that the hole in the center was the original position of the missing supporting stick. Two small holes were detected, one on the shoulder of the soldier marching in the center and the other near the raised arm of the soldier lighting the cannon. Scratches and hairline cracks were distributed randomly along the surface of the object and abrasion was usually detected on the cockling areas. Under microscopic examination at magnification 15x, miniature paint cracks were observed on the paint surface. Colours had been dulled by the accumulation of dirt, and minor spots of shiny hardened accretion were detected. A mild pungent leather smell was detected on close examination of the object, but no mould was detected.

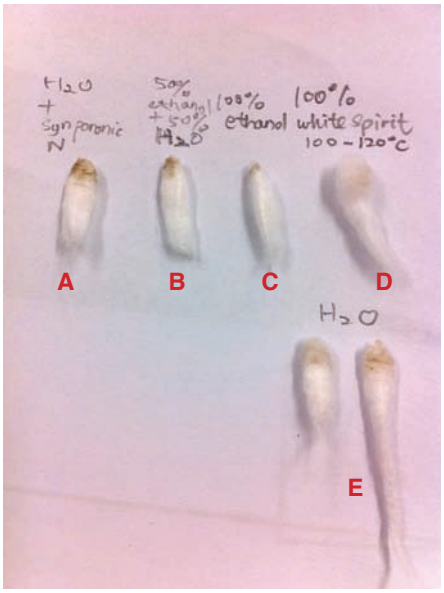
Conservation was required to stabilise the object and minimise the effects of deterioration. Thus, the objectives of the treatment proposal were to prevent further flaking and deterioration of the painted surface which was aggravated by the cockling and shrinkage of the object, through humidification, flattening and application of surface consolidants and adhesion of the splitting edges.

Analysis

pH test

A pH test was conducted to determine the acidic content of the leather. A measurement below pH4 often indicates an acidic condition that can result in the structural deterioration of the leather, particularly if exposed to high levels of relative humidity[5]. The pH level of three different locations gave consistent results of pH 5-6, which is considered a stable range for leather objects.

[5] SULLY, D., 'Humidification: the reshaping of leather, skin and gut objects for display'. In Hallebeek, P. et al (eds.), *Conservation of Leathercraft and Related Objects*, Group Interim Symposium, ICOM-CC, London, 1993, pp 50-54.



A: DI water + a drop of Syperonic N

B: 50% DI water

C: Ethanol

D: Petroleum spirit (100°C-120°C)

E: Deionised water

Figure 3. Cleaning results with different solvents can be observed on the dirt collected on the cotton swabs

Testing of Different Cleaning Methods

Dry cleaning test

After confirming the level of acidity within the leather, the conventional mechanical method of dry cleaning using a chemical sponge was tested on a discreet part of the object's surface. The chemical sponge[6] was pressed very lightly on the object's surface so as to avoid further damage to the cracked paint layer. The method was effective in removing dirt although some tiny paint fragments were detached in the process.

Wet cleaning and spot tests of different cleaning solvents

A variety of cleaning solvents was tested to find a suitable cleaning agent for the areas of flaking paint. The object was subjected to spot tests with a range of solvents: deionised (DI) water, ethanol, petroleum spirits, a solution of deionised water with a drop of Synperonic N[7] and a solution of 50% ethanol and 50% water. The solution of deionised water with Synperonic N was found to give the best cleaning results (Figure 3). The spot tests also highlighted the sensitivity of the different paint colours to wet cleaning methods. It was noted that both the black and red paints bled severely with polar solvents, whereas the blue and yellow were less affected. Conversely, petroleum spirits also caused the black paint to bleed.

The results and risks of using wet cleaning and conventional dry cleaning methods were compared. Wet cleaning posed a greater risk to the paint medium through irreparable colour loss, bleeding and staining. Dry cleaning with a chemical sponge caused minor loss of paint fragments but this risk could be minimised with exercised care. Thus, dry cleaning with a chemical sponge, followed with a soft brush and low-suction vacuuming was the method chosen to clean the surface of the object.

[6] Chemical sponge are vulcanised rubber dry-cleaning sponges, that are not abrasive and do not contain solvents or cleaning agents.

[7] Synperonic N: It is an aqueous solution of a condensate of nonylphenol with ethylene oxide, which can be used as a wetting agent, an emulsifying agent, a dispersing agent, and as a non-ionic detergent in conservation.

Table 1. Adhesive strength test for consolidants

Consolidant	Adhesive strength rating: (from 1/10 being the weakest to 10/10 being the strongest)	Observations
0.5% Klucel G in ethanol	4/10	Considerable strength was needed to peel the Japanese paper off.
1% Kucel G in deionised water	7/10	Considerable strength was needed to peel the Japanese paper off.
1% Mowilith in acetone	1/10	Very little strength was needed to pull the Japanese paper off. No staining on the paper.
5% Butvar B98 in acetone and propanol (4:6)	7/10	Considerable strength was needed to peel the Japanese paper off.
Lascaux Hydro-Sealer 750 in DI water (1:1)	10/10	Very great strength was needed to peel the Japanese paper off.

Selection of consolidants

A range of consolidation materials were tested to determine properties of adhesion, method of application and potential staining effects on the leather. These included Klucel G[8] (Hydroxypropyl cellulose), Mowilith50[9] (Poly vinyl acetate), Butvar B98[10] (polyvinyl butyral resin) and Lascaux Hydro-Sealer 750[11] (Acrylic solution)[12]. The consolidants were applied to discreet areas of the object in small spots to check if there was any saturation of colour, staining or gloss after drying. An adhesive strength test involving peeling strips of Japanese paper coated with the different consolidants was also conducted (Table 1). This test is derived from the principle of the standard Peel test which is approved by the American Society for Testing and Materials (ASTM D903, D1876, D3167). The substrate with the adhesive is peeled off the support board using a universal tensile testing machine. In this case, due to the lack of device, the test was conducted manually by pulling the Japanese paper away at 90 degrees from the plane. A numerical scale of 1 (weakest) to 10 (strongest) (see Table 1) is used to estimate the strength of each consolidant. This helped to determine the most appropriate consolidant for the *wayang kulit*.

[8] Klucel G: is a hydroxypropyl cellulose, non-ionic compound that is used as leather consolidation.
[9] Mowilith 50 is a poly vinyl acetate compound with thermoplastic property, it has excellent light fastness and high transparency.
[10] Butvar B98 is a polyvinyl butyral resin that imparts adhesion, toughness, and flexibility for either applications as coating or adhesive.
[11] Lascaux Hydro-Sealer 750 is a 30% aqueous dispersion of pure acrylic, that has thermoplastic property. It can be used for consolidation of sanding, crumbling, or non consolidated grounds, as well as loss paint layer, cracking or cuppings.
[12] Horie C.V., *Materials for Conservation: Organic Consolidants, Adhesives and Coatings*. London: Butterworth Heinemann, 2010.

Figure 4. 1% Klucel G in deionized water showed no evidence of surface gloss and visual changed

The results obtained during testing showed that 1% Klucel G in deionised water was the most suitable consolidant for the the painted decoration. It did not result in any visual change of the surface after drying and had good adhesive strength. Lascaux Hydro-Sealer 750 and Butvar B98 gave very strong adhesion, but both showed colour saturation and surface gloss respectively in the staining tests and so were judged unsuitable for the object.

Treatment

The *wayang kulit* was first surface-cleaned with a chemical sponge, followed by cleaning using a soft brush and low-suction vacuuming. This was carried out with care so as not to aggravate the flaking and loss of paint layers. Cleaning was carried out before consolidation as the object had to undergo humidification and flattening processes to reshape the object. If the object had been consolidated first, the differential rates of expansion and shrinkage between the leather and the consolidant during humidification might have resulted in further damage to the paint medium.

The object was placed inside a constant climate chamber[13] for humidification, to help flatten the cockled leather prior to consolidation of the painted decoration. The chamber allowed the control of temperature and humidity of the internal environment. The constant climatic chamber was set at a controlled temperature of 24°C and relative humidity of 90%. Although it is generally recommended that a level of 95% relative humidity would provide the best results for the humidification of semi-tanned skin materials for reshaping[14], due to the limitation of the machine (set relative humidity range to maximum of 90%), the relative humidity was set at 90%.

After four hours of humidification, once the surface of the object was slightly damp to the touch, it was removed from the chamber. It was then interlaid with two thin layers of Bondina[15], before being sandwiched between blotting papers. It was used in this context to prevent further flaking of paint layers from catching on rough surfaces. A flat medium density fiberboard (MDF) was placed on top and the set-up was weighed down with books to flatten the leather. The flattening process was allowed to proceed for two days before the books were removed.

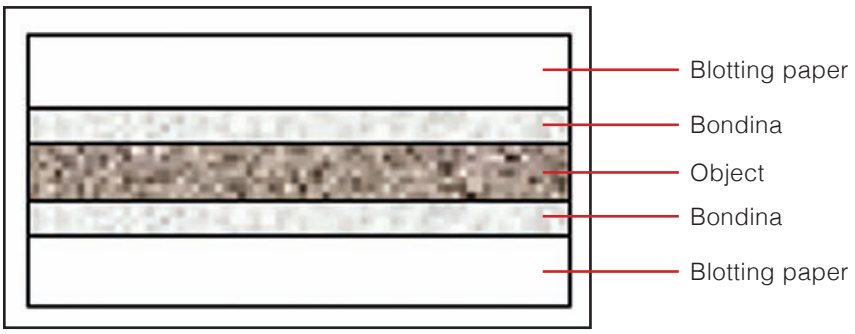


Figure 5. Layout for flattening of object after humidification

[13] Binder-Constant climate chamber, model KBF 115 (E2).
[14] SULLY, D., 'Humidification: the reshaping of leather, skin and gut objects for display'. In Hallebeek, P. et al (eds.), *Conservation of Leathercraft and Related Objects*, Group Interim Symposium, ICOM-CC, London, 1993, pp 50-54.
[15] Bondina: Non-woven, 100% polyester material with a smooth surface. It is used in pressing to prevent changing the surface quality of the object.

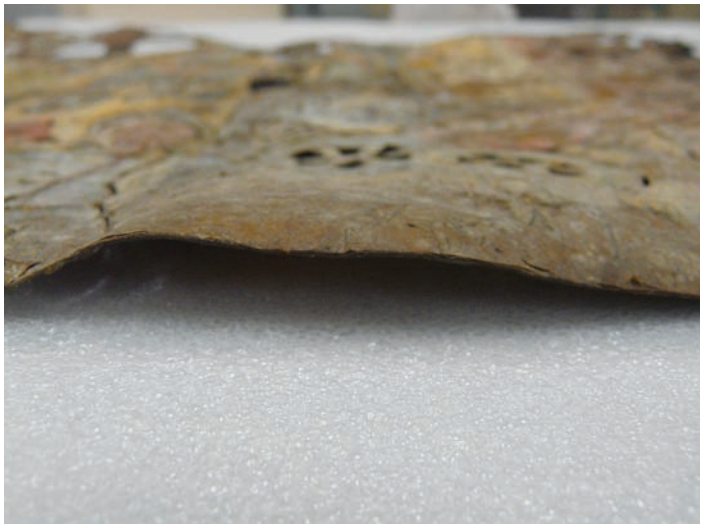


Figure 6. *Cockling on the mid-section before treatment*

Figure 7. *Mid-section of the object after humidification and flattening*

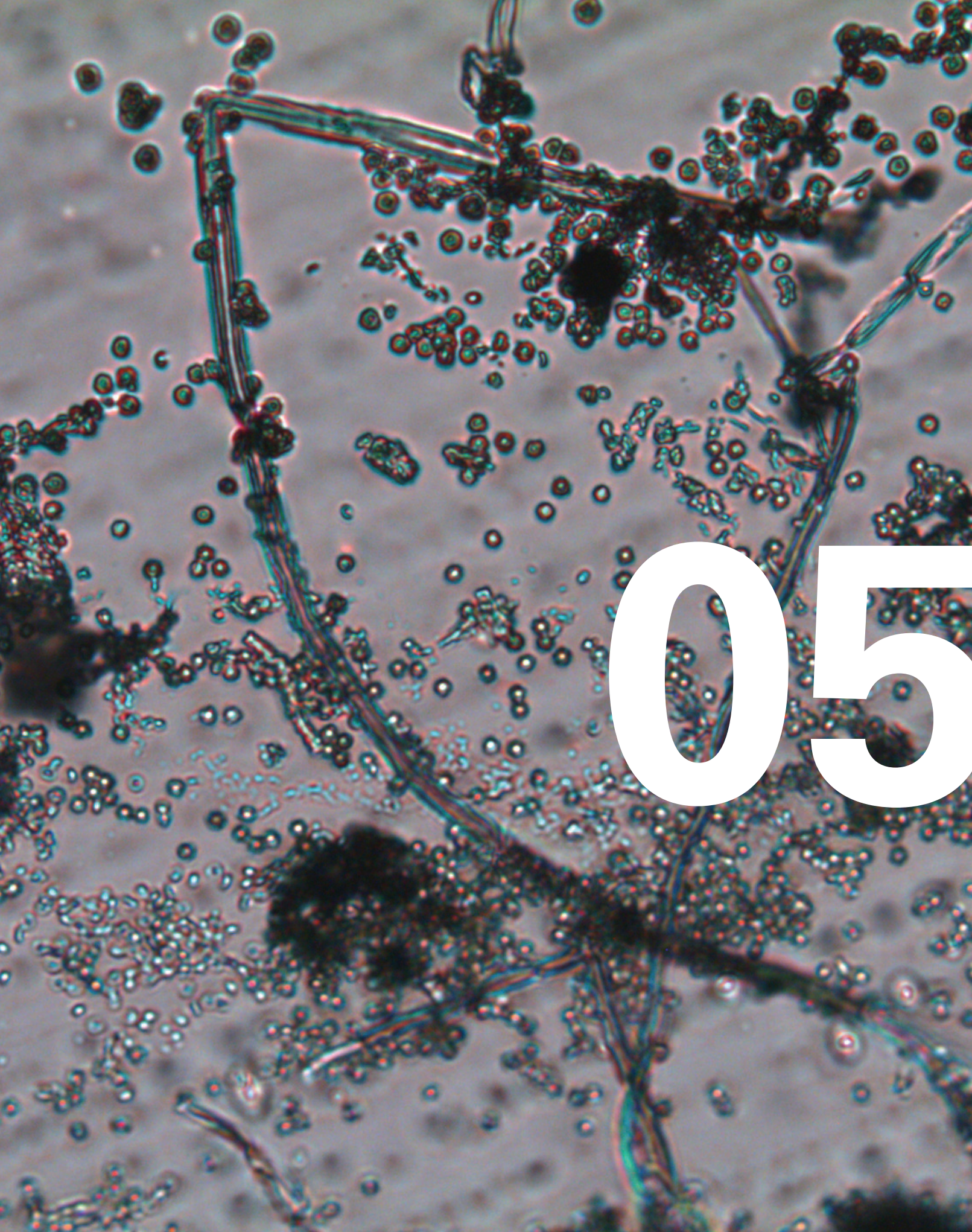
Figure 8. *The front side of the object after conservation treatment*

After flattening, the surface condition of the object was inspected to ensure that there was no staining and that the leather had dried. Consolidation with a solution of 1% Klucel G in deionised water was then applied on both sides of the object and left to dry in laboratory conditions of around 25°C and 55% RH. The splitting of the skin layers at the sharp edges of the triangular motif was then adhered together with Jade 403[16].

Conclusion

After completing the treatment, it was observed that the paint layers had adhered firmly to the surface and no paint flakes or fragments had detached from the surface. The stable painted surface will now be strong enough to allow handling and storage. However, it was also observed that although the object had flattened out significantly after the humidification and flattening treatment, the old memory in the skin structure caused the object to return to some degree of its initial cockled state after the consolidant had dried. The cockling was accepted as part of the leather's natural aging process, as the paint layers were not affected by it. Although the cockling of the object was observed to have reduced as compared to its initial state before treatment, further research and experiments can be conducted for the improvement of future conservation treatments and storage of *wayang kulit*.

[16] Jade 403 is a white aqueous adhesive emulsion containing ethylene vinyl acetate (20/80) copolymer, which is fast drying, pH neutral and will form a transparent flexible film. On drying. It also has thermoplastic property.


05

The Study Of
Metatin 906 (Rocima 603) in Inhibiting Mould Growth

by Lynn Chua,
Assistant Conservator (Paintings)

Figure 1. Close-up image of cream coloured mould on bronze sculpture – identified as a Penicillium variable

PAINTINGS CONSERVATION

Introduction

Mould growth is commonly experienced in the tropical climate of Singapore and is a major concern when it develops on the collections at Heritage Conservation Centre (HCC). While HCC is looking into preventive measures to keep artworks safe from such outbreaks, it is also concerned with how best to treat infested works safely and effectively.

Metatin (now known as Rocima 603) was used by HCC to treat mouldy paintings. According to the manufacturer Lascaux[1], Metatin 906 is a basic liquid combination of benzisothiazolinon (BIT) and octylisothiazolinon (OIT) in butyldiglycol. It claims to be a broad spectrum product effective against mould growth[2]. As a general guideline, the manufacturers recommend that Metatin be used at 0.1% – 0.3% concentration[3] in solution form. However, when applying on a surface, a swab may require a higher concentration. Paintings conservators at HCC have been using 5% – 10% swabs of Metatin 906 on mouldy paint surfaces, followed by clearance swabs of deionised water. This treatment was introduced by former Paintings Conservator, Lim Chong Quek, who encountered Metatin during her studies in New York in 1989. It was used on ethnographic collections and was effective for a period of about 3-4 months[4].

This study project was devised to better understand the application of Metatin (MET) in inhibiting mould growth, targeting on surfaces of PDA (potato dextrose agar) and mock-up paint samples. Although it is important to find out if residual MET has a detrimental effect on painted surfaces, this is not the focus in this study.

[1] Lascaux, Metatin 906 (now known as Rocima) MSDS dated 6 September 2010.
[2] Gram positive and gram negative, aerobic and anaerobic bacteria as well as mould and yeast fungi.
[3] This result was proven true from collaboration with Singapore Poly. Agar broth was prepared with different concentrations of Metatin from 0.0% to 10%. 0.0% to 0.3% showed growth after day four. From 0.4% onward, no subsequent growth was observed even after incubation of one week.
[4] Personal communication with Lim Chong Quek (previous HCC Paintings Senior Conservator), 7 September 2010 and Lawrence Chin (previous HCC Paintings Senior Conservator), 25 August 2010.

Table 1.

PDA culture	Description	MSQPCR Results	Interpretation of Results
1	Cream coloured mould from bronze sculpture: After five days, it developed into green coloured mould.	Pencillium variable	**Occurrence:** Widespread – found everywhere in the air and soil. Commonly found in carpet, wallpaper, interior fiberglass duct insulation, house dust, damp wall-paper. **Water activity required for mould growth:** 0.78-0.86

Figure 2. Example of a "Failed" swab – M3: 0.1% MET swab. From left to right: (i) before treatment (ii) after treatment (iii) after four days

Figure 3. Example of a "Passed" swab – M8: 10% MET dropper. From left to right: (i) before treatment (ii) after treatment (iii) after four days

Methods and results

This study consists of three experimental phases:

Phase 1 – Germination of mould

Dry cotton swabs were used to transfer mould from a mouldy sculpture onto a potato dextrose agar (PDA) plate. Within a week, mould colonies were visible. This was identified as mould via microscopic examination and was sent for MSQPCR analysis[5] for further identification (Table 1).

Phase 2 – Control of mould growth on PDA

In Phase 2, the aim was to find out the effective concentration range of MET in inhibiting mould growth on the surface of PDA under extreme conditions of relative humidity RH (at least 100% RH). Seven new PDA plates were allowed to germinate via a swab transfer from PDA plate 1. After one week, significant mould colonies were observed on all plates. Next, different concentrations of MET (0.1%, 1%, 10%) were applied onto the mouldy plates using either (i) a dropper or (ii) cotton wool swabs. For (i), drops of MET were applied onto the agar surface until fully covered. For (ii), a cotton swab immersed in MET was rolled onto the agar surface to pick up surface mould (Table 2).

Phase 3 – Control of mould growth on mock-up paint samples

In Phase 3, a mock-up oil on canvas painting prepared one year before the tests[6] was chosen as the test substrate.

[5] MSQPCR or mould specific qualitative polymerase chain reaction is an identification method designed and analysed by Vivien Goh, Research Officer of the National Environment Agency in Singapore.

[6] Painting construction: Oil paint on cotton canvas sized with rabbit skin glue and champagne chalk.

Table 2. Results of different application methods of MET on PDA plates

Method	Description	Results	Pass/Fail[7]
M1	0% MET (Control)	Substantial new growth, uninhibited	Good Control
M2	0.1% MET swab	Substantial re-growth and new growth	Fail
M3	1% MET swab	Substantial re-growth and new growth	Fail
M4	10% MET swab	Substantial regrowth. No new growth	Pass
M5	0.1% MET dropper	Substantial re-growth and new growth	Fail
M6	1% MET dropper	Substantial regrowth. No new growth	Pass
M7	10% MET dropper	Substantial re-growth. No new growth	Pass

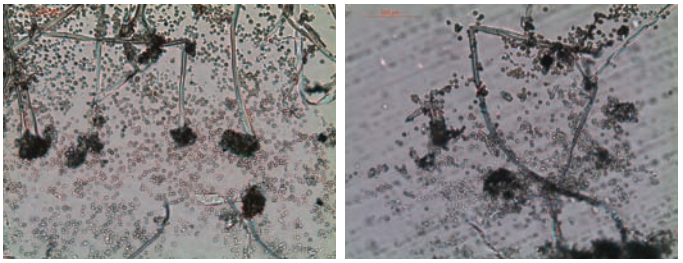


Figure 4. Magnified image of under 200x optical light (S1) (i) mould on paint front (ii) mould on canvas back

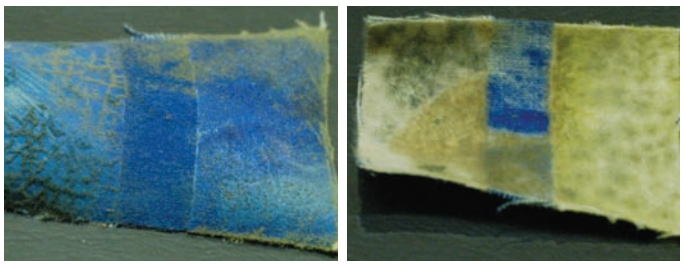


Figure 5. Mould colonisation of Oil on Canvas mock-up paint sample with accumulated dust. From left to right: (i) paint front after growth (ii) canvas back after growth

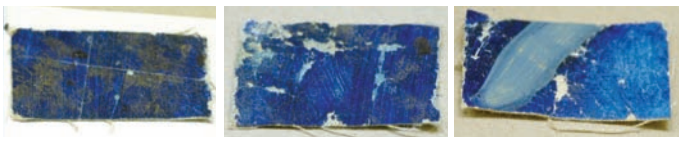


Figure 6. Example of rating in different degrees – (S15) Intense; (S14) moderate (S13) slight or almost no visible growth

Phase 3(i)
This Phase was carried out to evaluate the effectiveness of MET on a mock-up painting. The painting was cut into strips of 4.0 cm by 6.0 cm and allowed to germinate via a swab transfer from PDA 1. A tinytag[8] was included in the set-up to monitor and record the levels of RH during the experiment. After two weeks, significant mould colonies were observed on the paint front and canvas back (Figure 5). A microscopic examination confirmed the presence of mould (Figure 4).

These samples were cleaned with selected methods (Table 3). They were then left at extreme RH for further observation. After 10 days, the paint samples showed different intensities of new mould growth (Figure 6).

Phase 3(ii)
To compare which treated surface is more susceptible to mould growth, Phase 3(ii) was carried out. Paint samples cut to 2.0 cm by 5.0 cm were immediately treated with different cleaning methods (Table 4) before being placed in two completely sealed vessels at 50% – 60% RH and 100% RH. They were then left undisturbed for further observation.

Without transfer of mould spores, germination in the vessels is slower but not impossible within a reasonable timeframe. After two months, the

[7] Pass is rated when the PDA showed no signs of new growth in previously unaffected areas. The opposite is rated as Fail. Regrowth in previously affected areas are not taken into account in the rating.
[8] Tinytag refers to a type of datalogger that measures temperature and relative humidity in real time .

Table 3. Observation of new mould re-growth on paint mock-up samples after cleaning

Sample	Method of cleaning	After 10 days
S11	Vacuum only[9]	Moderate growth
S12	Vacuum, followed by 10% MET swab, DI water swabs	Moderate growth
S13	Vacuum, followed by 10% MET swabs	Almost no visible growth
S14	Vacuum, followed by 1% MET swab	Moderate growth
S15	Vacuum, followed by 1% MET swabs, DI water swabs	Intense growth
S16	Vacuum, followed by 0.01% lysing[10] solution	Slight growth

Table 4. Observation of new mould growth on paint mock up samples in 100% RH and 50% - 60% RH

Vessel / RH	Method	Result after 2 months
V1: >100%	Cleaned with 2% MET, followed by DI water swabs	Very densely populated with mould throughout the strip
	Cleaned with 2% MET	Almost clean with few mould spots
	Brush vacuum only	Several mould spots sparsely spread out
	No cleaning	Dense mould spots concentrated at the top
V2: 50-60% (store conditions)	Cleaned with 2% MET, followed by DI water swabs	No change
	Cleaned with 2% MET	No change
	Brush vacuum only	No change
	No cleaning	No change

vessel with 100% RH showed various degrees of growth. On the other hand, the samples in the vessel at 50% – 60% RH showed no change seven months following its set-up.

Discussion

Numerous studies have shown that for mould colonisation to occur, three contributing factors are required: (i) availability of a food source (ii) access to moisture (iii) adherence of mould spores onto substrate. If any of these factors can be eliminated, mould growth can be prevented. The experiments were designed in extreme conditions to find out how effective Metatin inhibits mould growth in a series of worst case scenarios.

In Phase 1, Penicillium was identified as one of the common fungi causing discoloration of paints. Consequently this PDA culture acted as a suitable mother plate for Phase 2 and 3.

In Phase 2, three methods, namely M4: 10% swab, M6: 1% dropper and M7: 10% dropper, were rated “pass”. This implies that a range of 1% to 10% MET has the potential to inhibit surface mould growth when conditions are extremely favourable. However, when

[9] Brush vacuuming: a process using a soft brush to sweep surface mould and spores towards a vacuum nozzle.
[10] Lysing is a mix of enzymes that targets mainly cellulose cell walls in yeast.

Figure 7. Result of treated samples in Tube 1 of 100% RH after four months. From left to right: Cleaned with (i) 2% MET, followed by DI water (ii) 2% MET (iii) Brush vacuum only (iv) no cleaning

applying via the swab method, 1% is not effective and 10% MET is preferred. A higher concentration is likely to provide a larger area of coverage over the cleaned surface, and hence more effective.

This is confirmed in Phase 3(i), where S13 (10% swab) showed almost no visible growth whereas S14 (1% swab) showed moderate growth. Samples with DI water swabs added for clearance showed the most extensive mould growth (Table 3). DI water swabs introduced moisture on the paint front and canvas back, and were only air-dried for a few hours before placing in the chamber. As such, organic cotton retained the moisture and accelerated mould growth. Also, lysing enzyme may prove to be another alternative to Metatin as 0.01% lysing and 10% MET both showed similar inhibition.

In Phase 3(ii), paint samples showed various degrees of growth within two months at 100% RH. From here, we can compare the effectiveness of the methods (Table 4). Applying only MET is most effective in controlling growth. The next in line is brush vacuuming. If left as it is with surface dirt, the paint sample has a higher risk of mould growth. The least effective of all is applying MET, followed by DI water swabs. When water swab is applied, mould growth is more extensive than when left untreated. This time, the water swabs were only applied to the paint surface and were left completely air-dried for a day before placing into the glass vessel. This is possibly due to insufficient drying time or condensation of water on the insides of the glass, thereby promoting mould growth.

The above results clearly showed that moisture is a dominant factor in controlling mould growth.

Conclusion

Above observations suggest that the application of 10% MET without water swab clearance is able to inhibit mould growth in the worst case scenario. However, it is not conclusive whether this treatment will be adopted in HCC. Firstly, it is unlikely that the paintings will be exposed to 100% RH in real storage and display conditions. Secondly, we do not know if leaving Metatin on the surface without clearance will lead to any deterioration of the paint. The relationship of RH and Metatin effectiveness, as well as the side effects of Metatin, can be considered for further studies.

Clearly, the importance of relative humidity in the control of mould growth is demonstrated. In fact, the use of a fungicide like Metatin is not necessary as long as the level of relative humidity is correctly controlled. However, it is not always possible to predict the future environmental conditions that a painting will be exposed (eg. loans to non NHB exhibition venues). While these results improve our knowledge of Metatin, it is ultimately up to the judgement of a conservator to decide what materials and methods of application they should select for an affected artwork.

06

An Idea and Exploration in Using Collections for Content Development

By Zaki Razak,
Assistant Researcher

Introduction

Heritage is essential for the enrichment of life. The legacy of past generations is transmitted through intangible or tangible sources such as folklore, language, oral history and, most notably, physical artefacts. Physical artefacts, as tangible representations of history, and resources that can be used to tell stories to the public and future generations.

The Museums under the National Heritage Board (NHB) collects a variety of heritage materials such as artefacts of civilisation, social ephemera of Singapore's history and culture, modern paintings, and installations of contemporary art. The Heritage Conservation Centre (HCC) manages and preserves the collection. As the custodian of the collection, HCC facilitates access to the collections via its virtual tool – The Singapore Collections Online (SGCOOL). SGCOOL was a project developed from HCC's digital database, Museum Collection System (MCS). A resource for art enthusiasts, SGCOOL is an online database that provides virtual artefacts and digitised collections for visitors to view in the comfort of their own homes.

HCC has been exploring ways to tap into the rich collection to reach a wider public through more creative avenues.

The Singapore Collections Online (SGCOOL)

Since SGCOOL was launched in 2007, it has progressed from a data-verification initiative to include a written caption (label text) describing the significance of each artwork or artefact. The conversion from analogue photography to digitisation and its distribution has allowed museum staff and the public to gain access to NHB's collections for either research purposes or to merely obtain basic information (Figures 1 & 2). Over the past few years, images along with descriptions, have been uploaded to SGCOOL with the aim of providing the public with information on NHB's permanent collection.

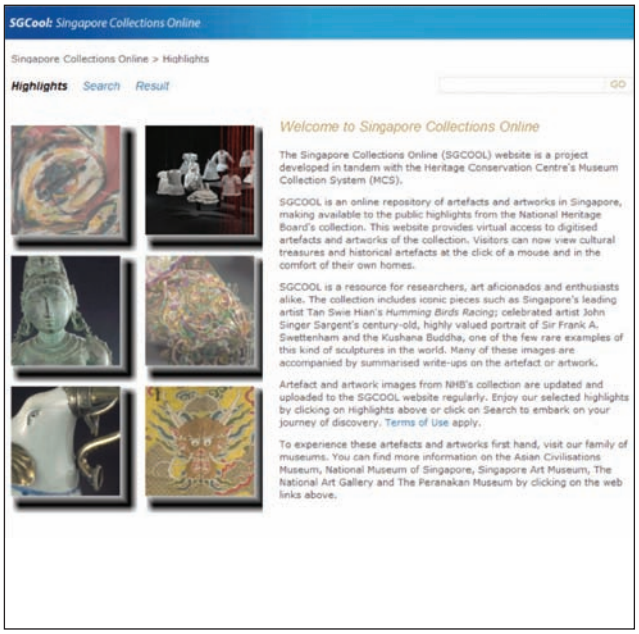


Figure 1. Existing screenshot of SGCOOL website (home page)

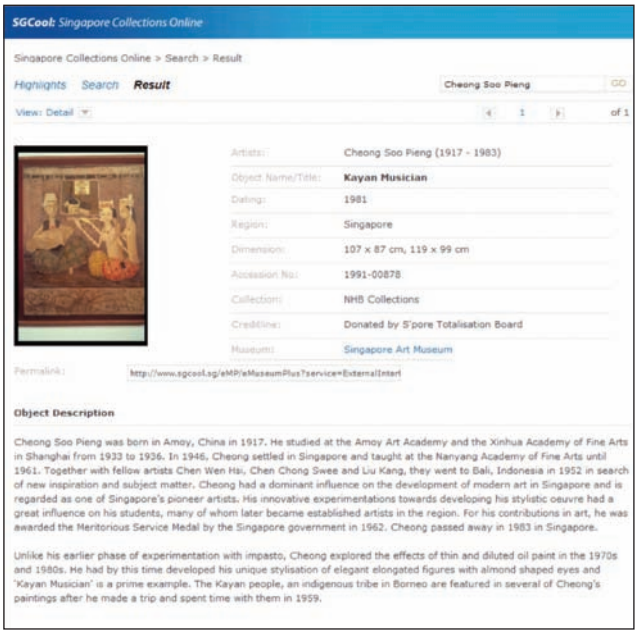


Figure 2. Existing screenshot of SGCOOL website (object description page)

However, SGCOOL's non-interactive interface and the conciseness of information might be cause for concern in terms of its usefulness and relevance for more computer-literate and tech-savvy users. It can better engage the public if it can be enhanced into a comprehensive online portal which accommodates public acknowledgment and participation. As an example, the Tate, an institution that houses the United Kingdom's national collection of British Art as well as International Modern and Contemporary Art, presents its collection on a user-friendly platform with a navigation tool, accompanied with learning and media channels. Online resources for diverse age groups and research papers serve as supplements to the basic information of the artworks and artefacts. The Tate's emphasis on public participation via interactive elements provides ample and easy access to its collection and significantly widens its appeal to all age groups. The Tate's extensive online serving of its collections information, the media channels and the learning resources are helpful references in HCC's desire to bring knowledge of the collections to a wider audience by means of a more socially-interactive interface.

Relational Content Development

The diverse museum collection of the NHB offers great potential to discover a rich web of relationships between seemingly unrelated objects. The 'uncovering' of the relationships offers a fresh look at the collection and can enrich its content for the public. An object is contextualised and threads of connections can be woven from objects collected by the Asian Civilisations Museum (ACM), Singapore Art Museum (SAM), The National Art Gallery, Singapore (NAGA), The Peranakan Museums (TPM) and National Museum of Singapore (NMS). What can be 'uncovered' can also serve in-house curators and external researchers, and offer new opportunities for educational initiatives shared with schools (Figures 3 & 4).

An Illustration – The 'Kayan Musician'

The 'Kayan Musician' (Figure 5) was painted by the late Singapore pioneer artist Cheong Soo Pieng. In NHB's permanent collection, there are approximately 1,600 artworks of Cheong's paintings, sculptures and sketches. This collection represents the richness and profundity of Cheong's artistic practice – his journey in exploring figurative subjects of Southeast Asia, techniques of abstraction and documentation of Singapore and its nationhood. The immense collection has provided museum curators and external researchers a comprehensive understanding of Cheong's artistic practice. How can we 'enrich' these artworks or artefacts by drawing from other parts of NHB's museum collection – to the public from the historical as well as contemporary perspectives – and offer new ways to explore NHB's permanent collection?

'Kayan Musician' is one of a series of paintings produced between the late 1970s and the early 1980s that bears testimony to Cheong's creativity. It is a refined and compelling display of his unique stylisation of elegant elongated figures with almond-shaped eyes. The series can be likened to a consolidation of his past creative enterprise, the conscientious exploration in abstract patterns of nature, the synthesis of the Eastern and Western painting techniques and the vivid incorporation of the region's significant motifs. The other aspect rarely discussed in the series is

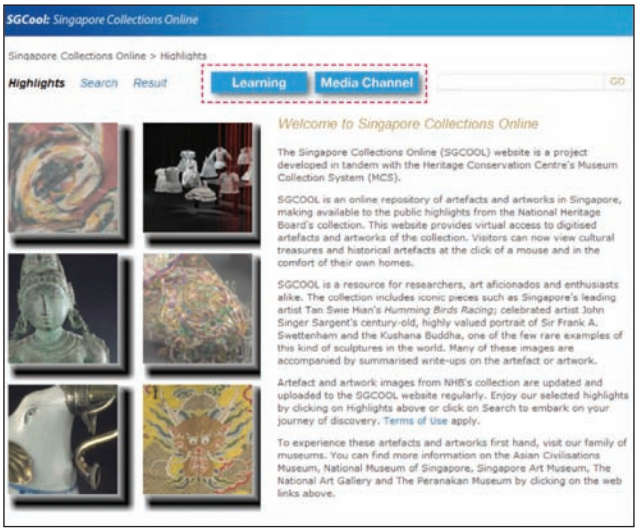


Figure 3. Suggested new educational content

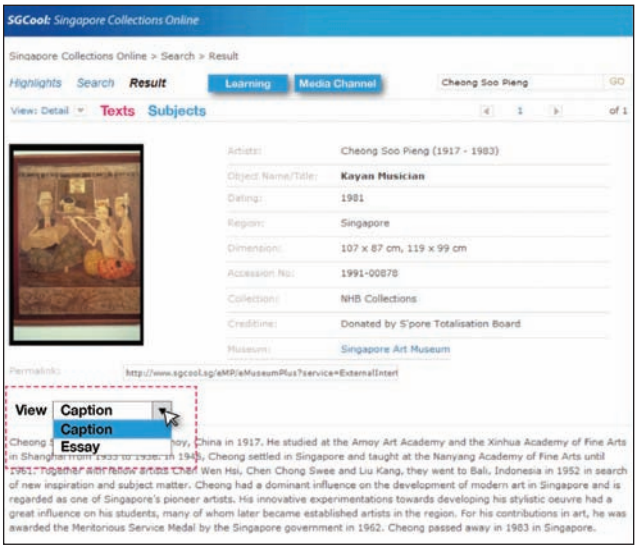


Figure 4. Additional content

Cheong's subjects. What made Cheong select this specific theme or signature for this swan song series completed a few years before he passed away, reverting to his affinity to the region, particularly to Bali and Borneo? Was it due to impulses of exoticism or merely the depth and intensity of Cheong's regionalist consciousness[1]?

We can draw connections from other artefacts in the collection to the 'Kayan Musician'. Some of these elements are highlighted below (Figure 6):

(a) The elongated bodily features of the Kayan characters resemble *wayang golek* puppet – *Lam Daoer*, one of a series of wooden doll puppets, from the collection of the Asian Civilisations Museum. Originated in Central Java, *wayang golek* contrasts vividly with *wayang kulit* due to its three dimensional structure that represents the versatility and expressiveness of human dance rather than the *wayang kulit's* function of shadow display.

(b) The Kayan, the subject of the painting, is an indigenous ethnic group from the island of Borneo, whose ancestors may have originated from along the Kayan river in Borneo. The ethnic group's culture is evident in *Scenery and Animated Life of Borneo*, a print in the collection of the National Museum of Singapore that portrays the river banks and the Kayans' mode of labour.

(c) The almond-shaped eyes of the Kayan characters are similar to the features found in Buddhism-related artefacts acquired by the Asian Civilisations Museum; particularly Buddha Head, which exudes a serene expression, suggestive of enlightenment.

(d) The vivid pattern and colours of the textiles worn by the Kayan characters is seen in the collection of textiles from Asian Civilisations Museums. The woven patterns and contrasting colours of the *ikat* technique of products of the traditional craft of Indonesia.

Figure 5. Kayan Musician (1981)

[1] *Reminiscence of Singapore's Pioneer Art Masters: Liu Kang, Cheong Soo Pieng, Chen Chong Swee, Chen Wen Hsi : 11 March-22 1994*, The Singapore Mint, Singapore, pp 7

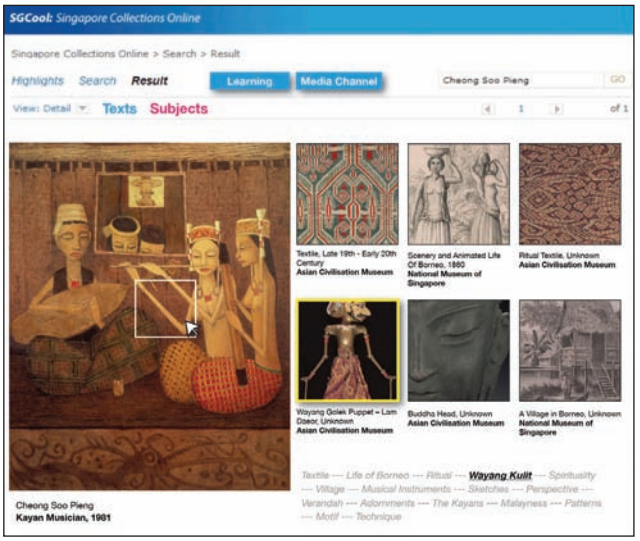


Figure 6. Additional content

With the 'Kayan Musician', we can construct an interesting and mulitfaceted exploration of connections between the main object, ie. the painting with multiple threads of information adding further layers of information from the collection, providing a better understanding of its context.

Conclusion

The 'Kayan Musician' offers the point of departure for an in-depth exploration of the collection. It is one way to revisit the collection using an object. There are many objects in NHB's museum collection that may be approached in a similar way to offer an alternative mode of interpreting objects in relation to others.

Exploring new ways of looking at objects can give new meaning and significance to them. The process can be refreshing, enriching the content that can be offered online and the educational experience of the virtual visitor.

07

Encountering Balinese Art, History and Material

By Lee Siew Wah,
Senior Conservator (Paper)
and Tay Jam Meng,
Assistant Conservator (Paper)

Introduction

In 2009, the Rudolf Bonnet Foundation (RBF) of the Netherlands invited the Heritage Conservation Centre (HCC) to assist in the conservation of works of art on paper in the collection of the Museum Puri Lukisan in Bali, Indonesia. This invitation followed an earlier successful collaboration in 2004 between HCC and the KIT Tropenmuseum of the Netherlands to survey, conduct training and conserve paintings from various museums in Indonesia. The Museum Puri Lukisan was officially opened in 1956 and is one of the earliest art museums established in Ubud, Bali. Its significant collection illustrates the early history and development of modern Balinese art. Discussions on this collaboration began in mid-2009 between HCC and RBF which was the main sponsor of the project. HCC was presented with this rare opportunity to work on the paper collection of this Museum. The main objectives of the project were to conduct a condition survey of the entire paper artwork collection, carry out conservation treatment of artworks in poor condition, and impart conservation knowledge and skills to the Museum staff.

Project Plan

The Heritage Conservation Centre, Museum Puri Lukisan and the Rudolf Bonnet Foundation divided the project into three stages: artwork survey, internship and treatment phase. The project was undertaken over 15 months.

1. Condition survey of collection at Museum Puri Lukisan in Bali (September 2010)
2. Basic conservation training for key Museum Puri Lukisan staff at HCC in Singapore (July-August 2011)
3. Conservation of artworks that were identified as being in poor condition at Museum Puri Lukisan (Phase 1 in August 2011 and Phase 2 in October 2011)

Condition Survey of the Works of Art on Paper

The condition survey was of the paper artwork collection took place in September 2010 (Figure 2). During the survey, each artwork was assessed and categorised according to their condition and treatment requirements (Table 1).

Figure 1. Museum Puri Lukisan

Figure 2. HCC conservator sharing preservation framing techniques with Museum staff

Training Museum Staff

One of the project objectives was to enhance the Museum staff's awareness in preventive conservation and impart basic knowledge and skills in paper preservation techniques to the Museum staff. The latter is intended to enable them to conduct simple treatment on selected artworks in the collection. To facilitate this process, a member of the Museum's senior staff, Mr. I. Wayan Sumadi, was sent to HCC for an internship in July 2011 (Figure 3). During the six-week period of intensive training, instruction was given in preventive conservation, basic conservation treatment, preservation mounting and framing. Sumadi would be an important bridge for communication between HCC's conservators and the rest of the Museum staff. The internship also provided an opportunity to work within a fully equipped conservation laboratory. This experience would later assist Sumadi in the setting-up of a conservation workspace at the Museum. Tools and materials that were not commonly found in Bali were also purchased in Singapore ahead for the treatment of the artworks at the Museum Puri Lukisan.

Table 1. Condition Survey Treatment Categories

Description	Condition	Definition	No. of artworks
Category 1	Poor Condition	Requires urgent and complex treatment	14
Category 2	Fair to Good condition	Artwork in stable condition, but in need of some conservation treatment by conservators	26
Category 3	Good Condition	Requiring minor treatment, which can be carried out by museum staff with basic training	37
Category 4	Excellent Condition	No conservation treatment needed	04
		Total	**81**

Figure 3. Mr. I. Wayan Sumadi during his internship at HCC

Setting Up of a New Conservation Laboratory

The condition survey of the artworks was undertaken in a workspace between the Museum's gallery and office (Figure 4). The artworks were unframed and examined on top of an old unused suction table. Prior to the final stage of the project, the Museum, with the support of the RBF, completed an expansion programme for one of its buildings. The office and collection store were enlarged and a new conservation workspace was created in the extension (Figure 5). Air-conditioning was installed in the new workspace, along with a sink large enough to undertake wet treatments of artworks. New furniture such as work tables and storage cabinets were also procured.

With a modest conservation materials budget, purchases of essential electrical equipment were limited to a hotplate cooker for making starch paste, adjustable magnification lamps for examining artworks, and a drill for art framing. A list of tools and materials had been proposed in the survey report for future use during the conservation treatment phase of the project. Some of these items were purchased from suppliers in Singapore, while others were sourced from an art material shop in Bali. Museum-quality mount boards were bought from this shop. Expensive and/or locally unavailable materials such as Gore-Tex[1], a material commonly used in the humidification and flattening of artworks, was replaced with low cost and readily available alternatives. A simple wooden frame with nylon netting was adapted for humidification treatments, using a damp cotton bath towel as the source of humidity. The simple setup was covered with a plastic sheet to enclose the artwork within a humid micro-environment (Figure 6 & Diagram 1).

Conservation Treatments

A total of 19 artworks, including all of the Category 1 and 5 pieces from Category 2 were treated during the interventive conservation phase between August and October 2011. A total of six working weeks were spent in treating the works.

Some of the Category 1 and 2 artworks were adhered onto recycled paper and mount board with synthetic glue. These

Figure 4. Old workspace for the condition survey phase of the project

Figure 5. New conservation workspace at Museum Puri Lukisan

[1] Gore-Tex is made up of laminates of polytetrafluoroethylene, or PTFE film and non woven fabrics. It allows water and organic solvents to penetrate as vapor but not as liquid. Therefore the artefact on top will be relaxed and humidified without being wet. It is commonly used in paper conservation for controlled application of moisture.

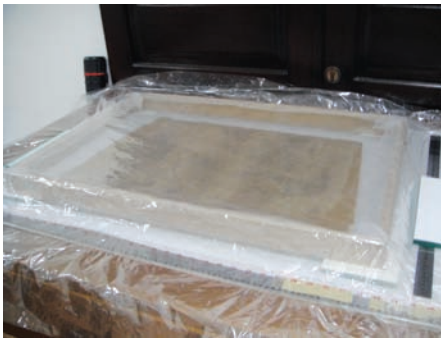


Figure 6. Humidification setup using a wooden frame and nylon netting

Diagram 1. Cross-section of the humidification chamber

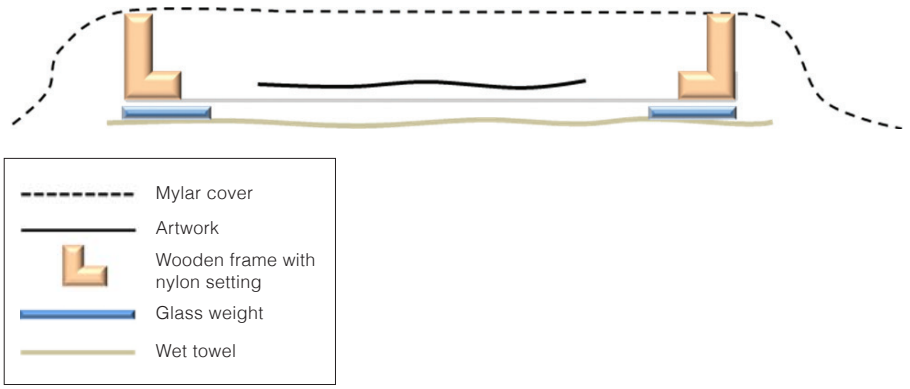


Figure 7 & 8. HCC conservators working on the collection of Museum Puri Lukisan

types of material are not suitable for the long-term preservation of artworks. Therefore, a programme of careful backing removal was carried out by the conservators (Figures 7 & 8). An example of treatment work done on a Category 1 artwork is elaborated below.

'Decoration' PL-67-L (33.9 cm x 42.6 cm)

'Decoration' (Figure 9) had been identified as being in poor condition and classified as a Category 1 artwork (Table 1). It required intensive treatment. The artwork had a thin and brittle support that was partially adhered to a backing board (Figure 10). There were tears and holes, some of which already had previous repairs. The support was severely discoloured, especially on areas where there were little or no adhesive; a condition that was most likely caused by direct contact with the acidic secondary support. An original label listing the names of each motif was adhered to the backing board.

Conservation Treatment

Before treatment, the tear and losses of the artwork were faced with Rayon[2] using 1% Methyl Cellulose solution[3]. This was applied to strengthen the damaged areas that might otherwise be prone to further loss or tears during backing removal (Figure 11). During removal, the artwork was placed facing downwards. The thick cardboard backing was removed mechanically, with ethanol and water (50:50) solution to aid in penetration and softening (Figure 12). Tear and loss repairs were undertaken after the complete removal of the cardboard backing.

Lining

Due to the artwork's inherent fragility, a lining treatment was deemed the most appropriate option to help strengthen the paper support, making it safer for handling. The artwork was first treated in a humidification chamber to fully relax the paper support. Once the artwork had been humidified, a handmade Japanese paper was prepared as a lining paper and wetted out with a brush. Thereafter, the lining paper was brushed evenly with runny wheat starch paste. Once ready, the artwork was lined onto the lining paper. Both the artwork and lining paper were supported by Mylar[4] during this process. After lining, the artwork was gently smoothened out with a Japanese smoothing brush with Mylar interleafed. The artwork was then tension dried on a piece of acrylic sheet.

[2] Rayon is a mixture of paper and polyethylene fibers which have smooth and translucent characteristics. Thin sheets of Rayon are often used as a facing material in paper conservation.
[3] Methyl Cellulose is a water-based adhesive which has many applications in paper conservation such as consolidation of paint media.
[4] Mylar, trade name of Dupont, is an archival clear polyester film which is chemically inert. It is commonly used in encapsulation of paper document in library or archives.

Figure 9. Before treatment (front)

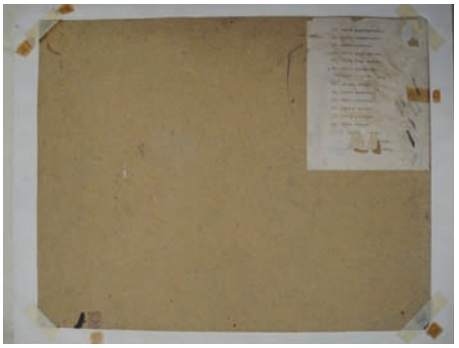


Figure 10. Before treatment, unframed (back)

Figure 11. Facing paper applied to weak areas

Figure 12. Backing removal using 1% Methyl cellulose solution

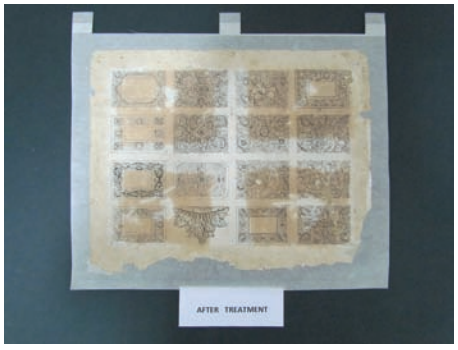


Figure 13. After conservation treatment (front)

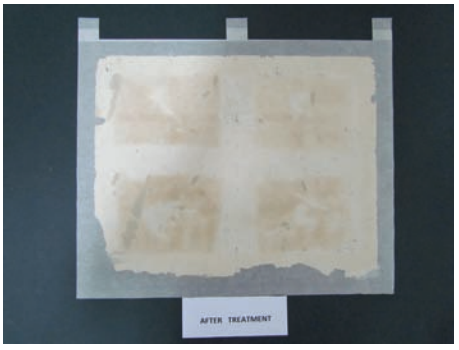


Figure 14. After conservation treatment (back)

Hinging and Framing

After drying, the artwork was removed from the acrylic sheet. Mounting hinges were incorporated as part of the lining paper for attachment to an archival quality mount board (Figures 13 & 14).

Conclusion

The project was successful in meeting its conservation targets of treating all of the artworks assessed to be in poor condition (Category 1), as well as five from the next group (Category 2). Each stage of the conservation work was shared with the staff of Museum Puri Lukisan. The staff also participated in less complex treatments, giving them hands-on experience for practical treatment work. The Museum Puri Lukisan and RBF also invited staff from other local museums to observe the work. Staff from the Neka Art Museum and Museum Rudana benefited from observing the various techniques and methods of condition assessment.

This project has enabled HCC conservators to gain a greater appreciation of Balinese art and also a deeper insight into the working culture and conditions at Museum Puri Lukisan. It was an invaluable experience to work with very limited resources in less-than-ideal conditions. The project required HCC conservators to develop and share low-tech solutions to enable the Museum staff to respond to common conservation problems. After the completion of HCC's involvement with this project, it is now the responsibility of the Museum's staff to follow-up and maintain basic standards of preservation and conservation for the collection. The knowledge gained by Sumadi during his internship played an important role in the transfer of knowledge and skills to his colleagues at the Museum Puri Lukisan, and hopefully to other museums in Bali. From the initial stage when HCC was first approached by the RBF for the project to the confirmation and agreement of the project by the various parties involved, the detail planning, resourcing, scheduling to co-ordination and logistics, and actual execution of the different stages till the completion of the project with all necessary documentation, took an estimated two years. This time period is not uncommon for a project of such a nature. More significantly however, the various stakeholders of this project were satisfied with the outcome of this project. HCC was also honoured to be able to play a part in conserving the collection of the Museum Puri Lukisan.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An Idea and Exploration in Using Collections for Content Development

Reminiscence of Singapore's Pioneer Art Masters: Liu Kang, Cheong Soo Pieng, Chen Chong Swee, Chen Wen Hsi : 11 March-22 March 1994 (Singapore: Singapore Mint, 1994) pp 7

BIODATA

Lynn Chua joined the Heritage Conservation Centre as an Assistant Conservator (Paintings). She graduated from the National University of Singapore with a Bachelor of Science (Honours) in Chemistry in 2009. Lynn is actively involved in Material Testing and Health & Safety. Her research interests are mould, Oddy testing (including effects of pollution) and using technical analyses (Ultra Violet, Infrared Reflectography, X-ray fluorescence, cross-section analysis) to investigate artworks. She completed an internship at the Victoria and Albert Museum, Science Section, concentrating on technical analyses and preventive conservation.

Miki Komatsu joined the Heritage Conservation Centre as a Conservator (Textiles) in 2008, and has headed the Textiles Conservation Section since 2009. She obtained her Master's in Textile Conservation from the Textile Conservation Centre, UK, through the sponsorship of the Japanese Government Overseas Study Programme for Artists; and a Master's in Domestic Science, Analytical Science in Textile, from the Kyoritsu Women's University, Tokyo, Japan. Miki completed an internship in textile conservation at the Metropolitan Museum of Art, New York; and has worked on conservation projects in various museums in Japan, such as the National Museum of Western Art, and the Ishibashi Foundation. She has published a paper on the identification of dyes and mordants used in 12th to 19th century Japanese armour. She was involved in the Patterns of Trade Exhibition held at the Asian Civilisations Museum.

Zaki Razak holds a Master's in Fine Arts from LASALLE College of the Arts. After receiving a Diploma in Visual Communication from the Nanyang Academy of Fine Arts in 2000, he worked as an artist and graphic designer. In 2004, his work was presented in the SENI exhibition at the Singapore Art Museum, and subsequently he has featured in many other local and overseas exhibitions, including those in Hong Kong, Thailand, Malaysia and Australia. Zaki has also made his mark as a curator of innovative art projects, including shows at Warung S. Nasir, the 2010 exhibition of Singapore street artists entitled 'Is This Home, Truly?' at Helutrans Artspace and 'Berita Harian 2: Utusan Melayu', an exhibition of Malay contemporary artists at

the Institute of Contemporary Art, Singapore. Zaki is currently an Assistant Researcher at the Heritage Conservation Centre, pursuing his keen interest in the in-depth study of modern and contemporary art in the region and beyond.

Tay Jam Meng graduated from the Nanyang Academy of Fine Arts in 1997. He joined the Heritage Conservation Centre in 2002, where he is currently an Assistant Conservator (Paper), specialising in paper and photographic material conservation. He was trained in the preservation and conservation of photographic materials by Ian and Angela Moor at The Centre for Photographic Conservation (UK) in 2004. Jam Meng worked as an intern with The British Library in 2005 and the Canadian Conservation Institute in 2010.

Lee Siew Wah has worked at the Heritage Conservation Centre since 1995. She is currently Senior Conservator (Paper). She recently received her professional accreditation from ICON, UK. Siew Wah obtained her Master's of Arts in Conservation in 1998 from Camberwell College of Arts, UK, and a Bachelor of Science (Merit) in Chemistry from the National University of Singapore. She has written several articles on her work in paper conservation.

Cindy Lau obtained her Bachelor of Science (Honours) in Materials Science from the National University of Singapore, followed by a Master's of Arts in Conservation from the University College of London. She joined the Heritage Conservation Centre in 2010 as Assistant Conservator (Objects).

Diana Tay is an Assistant Conservator (Paintings) at the Heritage Conservation Centre. She is an active member of the Centre's Contemporary Art Working Group, a working group that started in 2010 to study the challenges associated with preserving contemporary art. With her keen interest in contemporary art, she has been entrusted with overseeing several complex installation works as well as designing suitable storage and display methods to prolong the lifespan of such works. Diana completed a conservation internship with the Tate Britain in 2011.

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