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Wellington Congress Posters

Conservation and Change: Response, Adaptation and Leadership

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Forward

As we look back on IIC's 29th Biennial Congress in Wellington, Aotearoa New Zealand in 2022, we are now pleased to present this special issue of *News in Conservation* featuring the event's professional posters. While IIC has always published the papers presented at each congress, this is the first time we have created a publication for the posters, which offer an impressive calibre and breadth of subjects from our colleagues across the globe; they do indeed deserve to be preserved and shared beyond the event week.

With the announcement of the next congress theme, *Sustainable Solutions for Conservation: New Strategies for New Times*, it is clear that seeds of change explored in Wellington will lead and inspire the papers and posters to be presented at the Lima, Peru congress in 2024. While we look forward to our next congress in Lima, it is perhaps inevitable to look back at congresses of the past. Some have a particular nuance brought about by their location or theme, with Vienna 2012, London 2008 and Melbourne 2000 (in which I had a hand) all bringing back memories of happy collaborative moments as a profession. Then there are those congresses which, for their subject, can be seen as important milestones for the profession: Baltimore 2002 for paper, Los Angeles 2016 for contemporary art, and Ottawa 1994 and Turin 2018 for preventive conservation all spring to mind.

Our 28th Biennial Congress in 2020, slated for Edinburgh, had to pivot to an entirely online conference due to the Covid-19 pandemic. We had hoped when we announced the 29th Biennial Congress in Wellington that, by 2022, we would be meeting in person again. Whilst that was not fully the case, we landed on a hybrid model providing maximum accessibility including those who could physically reach Wellington and those who participated online—a format we intend to continue.

Aotearoa New Zealand has a vibrantly diverse culture shaped by European and Māori influences, some of the complexities of which were explored in the conference theme of *Conservation and Change: Response, Adaptation and Leadership*. Anchored around this theme, but reflecting experiences and learnings from around the world, the selected papers and posters delivered a picture of the diverse work that conservators are involved with. If there was a common theme, it was indeed change. With this near constant change has come opportunities for innovation including the importance of sustainability being woven throughout the work we do and the world we live in.

What has not changed is the quality and depth of the papers and posters. Under the expert eyes of the Technical Committee assembled for 2022, a rigorous process of peer review and editing has once again been employed. One author has commented that they have never been through such an intense review and how fruitful it has ultimately been for her paper. My thanks to the Technical Committee for the hours and hours of work involved and, in particular, to Committee Chair Isobel Griffin and to the Editorial Committee, chaired by Joyce Townsend, for editing the papers and overseeing the content of the posters.

Julian Bickersteth
President, IIC

Preface

This congress and its proceedings, including this special issue of *News in Conservation* which features the congress posters, have the ambition to address change in a fast-changing world, and where better to locate that discussion than Aotearoa New Zealand, a country which has opened the doors to a more inclusive heritage experience. Time and again, in discussions on a global stage, it has been voices from Aotearoa New Zealand that have spoken carefully and kindly, offering a challenge and raising questions to help the heritage sector recalibrate, to rethink and—I hope—to begin to re-form.

The papers and posters offer the perspectives of conservators, heritage scientists, curators, community activists and academics. Many of the authors hold multiple roles, and such multiplicity is essential to our practice. As the world looks back at the pandemic years and looks forward to how we can do better, we are emerging from our lockdown lives. What have we all learnt from these years, and what can we change? I believe that we can find optimism in new voices and perspectives taking centre stage in conservation. Whether those voices belong to people new to a career in conservation or those being given voice after generations of exclusion, they emerge to offer the community a chance to build something new, something better, and something unique that can only be created by interactions across place, class, sex, race, gender, ability or age. This is the prize and the gauntlet. Will we all stop to listen and to learn, to hear what others say and to use that to recalibrate and test our own approaches?

IIC has used the last three years to adapt and to challenge its own structures and practices. We aim to carry forward all that was wise, graceful and supportive of the past and to bring in the vibrancy, excitement and energy on offer from our members and supporters worldwide. The potential to do better developed during the pandemic, and the need to do better has been illustrated on the world stage with destruction, hatred and sadness impinging on all our lives. We know that cultural heritage can take its place in community building and restitution. In these proceedings we want to celebrate what the conservation community can do to share our passion for the things that people value, how we can guide and lead each other, develop new knowledge and make old wisdom available. We have a unique focus on re-using the past to build a better today. That is our contribution to sustainability, and I hope you enjoy reading the posters within.

Professor Jane Henderson FIIC ACR
Secretary-General, IIC

Acknowledgement

On behalf of IIC Council, I would like to extend a heartfelt thank you to our local organising partners for supporting this first major international hybrid congress.

We are grateful to Tru Vue Inc. as our headline sponsor and to the Getty Foundation for their unwavering support in helping to provide opportunities that help connect and bring together the conservation community globally and that promote more equitable access to professional development and knowledge exchange. Through this kind support, and alongside donations from members to the IIC Brommelle Memorial Fund, we have been able to fund online attendance internationally for so many students and colleagues from previously under-represented regions globally.

Conservation of cultural heritage is crucial to society, it is an enabler for social cohesion, environmental justice, inclusive growth and disaster resilience. And so, we must pay a special tribute to our global conservation community: thank you for your contribution in helping advance our profession during this time of great change and to the important role you have in helping to create a more sustainable and resilient world.

Sarah Stannage FRSA
Executive Director, IIC

Contents

Aiming at the characterisation of the anti-microbial protection effect of a chitosan-based layer enriched with essential oils applied to mural paintings' surfaces

By Alexandra Marco[1,2], Nádia Silva[2], Sandra Santos[3], Bruno Campos[1,2], Eduarda Vieira[1], Manuela Pintado[2] and Patrícia R. Moreira[1,2]

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Mural painting in Portugal had its peak activity between the 15th and 16th centuries. The environmental conditions for these ensembles, with high relative humidity and wide temperature variations throughout the year, concentration of water and salts along with biological contamination, are the main reasons for the degradation of these murals. To minimize that degradation, focusing on a preventive conservation approach, a protective layer is being developed and tested.

The anti-fungal and anti-bacterial activity of chitosan is recognized in literature for other applications (Caldeira et al., 2015). It has high biocompatibility, biodegradability, no toxicity (Costa et al., 2017), good film forming properties and low permeability of oxygen (Kanatt et al., 2012). Although its application in cultural heritage is still new, its use is already being reported in literature on wood (El-Gamal et al., 2016), archaeological wood (Walsh et al., 2014; Walsh et al., 2017), metals (de Luna et al., 2016; Silva et al., 2018), paper (Ciolacu et al., 2016) and stone (Silva et al., 2018).

Physicochemical properties of chitosan films were assessed by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and contact angle measurement (CAM). SEM analysis was performed before and after the application of one, two and three chitosan layers and showed no visible differences between them; chitosan films are transparent and colourless. Four bands are visible with FTIR analysis at 516, 712, 872 and 1406. Bands at 872 cm^{-1} and 712 cm^{-1} suggest the presence of calcite but no chitosan elements, not even with a three-layer application. CAM was carried out, showing that three-layer application slows down absorption of water, increasing hydrophobicity.

The anti-fungal activity of several essential oils (EO) regarding *Aspergillus versicolor, Aspergillus niger* and *Penicillium chrysogenum* (fungi species commonly encountered on mural paintings) was determined by a serial agar dilution method as described previously (Marco et al., 2020). PDA plates were prepared using 90 mm diameter Petri dishes. To each PDA plate containing 20 ml of autoclaved agar, an EO (basil, oregano or clove) was added in a volume range between 1.56 to 200µl. After four days the minimum inhibitory concentration was determined by the lowest concentration of biocide that inhibited visible growth of the inoculated microorganisms. All three EOs inhibited all strains, but oregano EO proved to be effective against all strains with the lowest concentrations. The growth of the three fungi was completely inhibited by oregano EO at 0.16 µl/ml.

Prototypes of mural paintings were made with pigments detected in case studies – calcium carbonate, light yellow ochre, English red, burnt umber and vine black. Three layers of 400 µl of chitosan were pipetted in a batch of prototypes while controls had no chitosan. *Penicillium chrysogenum* was chosen to inoculate the prototypes. This assay for the evaluation of antimicrobial activity of chitosan is ongoing. The next part of this assay will be to incorporate the essential oils in chitosan films, to further extend its anti-fungal activity.

This work was supported by the Foundation for Science and Technology (FCT) through POCH, co-participation by the Social European Fund and MCTES National Fund [SFRH/BD/125596/2016]; the BIO4MURAL was funded by FEDER through POCI-01-0145-FEDER-029157 and by National Funds from FCT [PTDC/HAR-ARQ/29157/2017]; and FCT for funding through the Strategic Projects CITAR [UID/EAT/0622/2016] and CBQF [UID/Multi/50016/2013].

Alexandra Marco graduated in conservation and restoration of cultural heritage and has a master's degree with specialization in painting from the Portuguese Catholic University in characterization of microbial colonization and removal of black stains from mural painting of the 15th and 16th century in granite religious buildings in northern Portugal. She is a FCT Ph.D. grant research student in conservation of cultural heritage at the same university. She is an integrated member of the Centre for Research in Science and Technology of the Arts (CITAR) and author of several scientific publications as well as co-founder of YOCOCU Portugal (Youth in Conservation of Cultural Heritage).

Nádia Silva has a degree in biology from Faculdade de Ciências-Universidade do Porto and a master's degree in microbiology from Escola Superior de Biotecnologia-Universidade Católica Portuguesa (ESB-UCP) where she began working with chitosan to develop novel nanomaterials and drug delivery systems with antimicrobial properties. Recently, she has been involved in the characterisation of microbiological contamination of outdoor stone and metal artworks through project BIONANOSCULP. She is currently a PhD student at ESB-UCP working on the development of new nanomaterials to prevent biodeterioration of cultural heritage. Her main areas of interest are microbiology, natural polymers and antimicrobial coatings and nanoparticles.

Sandra Santos has a BSc and MSc in food engineering, postgraduate studies in biochemical engineering, in herbal medicines and health products (University of Coimbra). She is completing a PhD in biotechnology-engineering and food science at Escola Superior de Biotecnologia, Universidade Católica Portuguesa (ESB–UCP). Sandra participates in national and international R&D projects, is author of scientific papers and book chapters and presented national and international oral communications. She was awarded with three regional prizes for food products and food technology (aromatic, medicinal and spice plants extracts, essential oils extraction, nanoencapsulation). She has supervised several internships, graduate work and has collaborated on several doctoral projects.

Bruno Campos earned a PhD in chemistry from the University of Porto-Faculty of Sciences. He is affiliated with CITAR and CBQF and has worked in subjects related to the development of new materials able to mitigate and solve weathering problems associated with historic buildings and mural paintings. Bruno was a postdoctoral researcher of the Bio4Mural project and lecturer of green chemistry applied to conservation and restoration at School of Arts-UCP. He is a regular reviewer of the *Studies in Conservation and Restoration* journal and was a member of the organizing committee responsible for the 3rd International Conference-Green Conservation of Cultural Heritage.

Eduarda Vieira holds a PhD in conservation and restoration of historic and artistic heritage from the Polytechnic University of Valencia (Spain), and a master's degree in architectonic conservation from Évora University (Portugal). She is currently assistant professor at School of Arts of the Portuguese Catholic University (Conservation of Inorganic Materials), where she coordinates the PhD programme of Conservation and Restoration of Cultural Heritage. Eduarda is director of the Research Centre of Science and Technology of the Arts (CITAR) and editor of *Studies in Conservation and Restoration* ECR journal. She is also a member of ICOMOS and ICOM and a researcher on projects related to preventive conservation and green conservation besides supervising several PhD and master theses.
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Maria Manuela Estevez Pintado has a PhD in biotechnology and is currently associate professor at the College of Biotechnology of the Portuguese Catholic University (ESB-UCP), associate director for the School of Biotechnology from Universidade Católica Portuguesa (ESB-UCP, Porto, Portugal) and the director of CBQF (Chemistry and Biotechnology Center – State Associate Laboratory), an ESB-UCP research unit and associate laboratory. In the research field she is the head of the Bioactive and Bioproducts Research Laboratory.

Patrícia Moreira holds a PhD in biotechnology with specialization in biochemical engineering from Universidade Católica Portuguesa (UCP). She is an assistant professor at the School of Arts – UCP, an integrated member of the Research Centre for Science and Technology of the Arts (CITAR), and coordinates the Heritage, Conservation and Restoration Focus Area of CITAR as well as being a collaborator with the Centre for Biotechnology and Fine Chemistry (CBQF), both UCP. Her main research area is in innovation in biotechnology and nanotechnology for cultural heritage with emphasis on biodeterioration, sustainability, circular economy and citizen science. She co-represents the green conservation movement in Portugal and co-ordinates the RESEARCH PROJECT HAC4CG funded by CCDRN. Patrícia supervised several doctoral and master's theses and is author/co-author of numerous articles in impact journals in her research area.

IIC 29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Aiming at the characterisation of the anti-microbial protection applied to mural paintings' surfaces

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Introduction

The environmental conditions of mural painting (MP) ensemble surroundings, with high relative humidity and wide temperature variations throughout the year, concentration of water and salts in the murals along with biological contamination are the main reasons for the degradation that these murals endure. To minimize that degradation, and focusing on a preventive conservation approach, a protective layer is being developed and tested.
The anti-fungal and anti-bacterial activity of chitosan is recognized in literature for other applications (Caldeira et al., 2015). It has high biocompatibility, biodegradability, no toxicity (Costa et al., 2017), good film forming properties and low permeability to oxygen (Kanatt et al., 2012).

Methods and Results

Physicochemical properties of chitosan films were assessed by SEM, FTIR and contact angle measurement (CAM). The chitosan protective layer formulation (Silva *et al.*, 2018) was tested in mural painting prototypes in a volume of 400 µl in one, two and three layers.

- Scanning Electron Microscope (SEM after application of each layer, and s them. It was visually impossible to diff prototypes coated with one, two or t are transparent and colourless;
- By Fourier transform infrared spect 516, 712, 872 and 1406. It showed the cm^{-1} but no chitosan elements, not ev The contact angle measurement evide prototypes with one < two < and three that three-layer application slows d hydrophobicity (figs. 2 and 3);
- Antimicrobial assays: To each Petr Potato dextrose agar (PDA) (VWR) was 1.56 to 200 µl. Two replicas were mad at room temperature (~22ºC). The co measurements (mm) per fungus, at in inhibitory concentration (MIC) valu concentration of biocide that inhibited plates with no biocide were used as co

Figure 2. CAM of MP with calcium carbonate pigment prototype (CC12) at 100s.

Prototypes	CAM	SD
CC10	96,8	9,8
CC11.1	92,2	0,7
CC11.2	69,4	9,7
CC12	89,3	6,7

Figure 3. CAM of 4 calcium carbonate MP prototypes at 3s with 3 measurement average and standard deviation (SD). CC10 uncoated; CC11.1 one layer; CC11.2 two layers; CC12 three layers of 400 µl of chitosan.

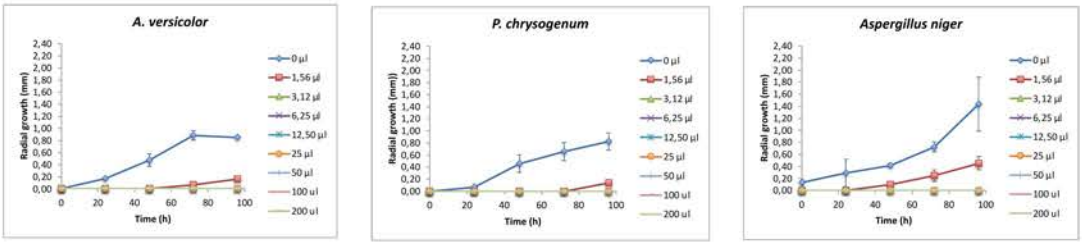

Figure 4. Graphics of the oregano EO in all three strains of fungi at all concentrations.

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This work was supported by Foundation for Science and Technology (FCT) through POCH – Operational Human Capital Program, co-pa
Biotechnology innovative solutions for the removal of pigmentation and preventive conservation of cultural and historically relevant m
029157] and by National Funds from FCT [grant number PTDC/HAR-ARQ/29157/2017]; and FCT for funding through the Strategic Projects

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n effect of a chitosan-based layer enriched with essential oils

uela Pintado [3], Patrícia R. Moreira [1,2]

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M) analysis was performed before and showed no visible differences between erentiate a prototype uncoated, and the hree layers of chitosan. Chitosan films

troscopy (FTIR) four bands are visible at presence of calcite at 872 cm^{-1} and 712 en with a three-layer application (fig. 1). enced the absorption ratio between the e applications of chitosan. CAM showed lown absorption of water, increasing

i dish of Ø 9 mm, 20ml of autoclaved added with EO in a volume range from e for each concentration, and incubated olonies' growth was calculated from 3 tervals of 24h for 4 days. The minimum es were determined by the lowest l visible growth of microorganisms. PDA ntrols (fig. 4).

- The results showed that the one that has proven to be effective against all the various strains at a lowest concentration was oregano EO. The mycelial growth of the fungi was completely inhibited at 3.12 µl per 20 ml of medium (fig. 5);
- Prototypes of MP were made with colour pigments detected in the practical case studies – calcium carbonate, light yellow ochre, English red, burnt umber, and vine black;
- Three layers of chitosan were applied in a batch of prototypes and the other batch with no chitosan were the controls. *Penicillium chrysogenum* fungi was inoculated in all plates with 15 ml of water at the bottom and in sterile Petri dishes (fig. 6). After 27 days, no growth can be accounted.

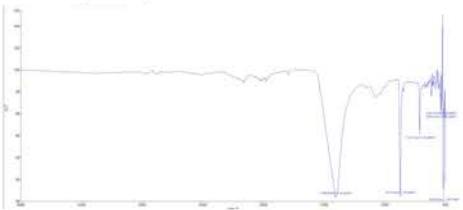

Figure 1. FTIR analyses of calcium carbonate mural painting prototype with three chitosan layers' application, showing only calcite.

Figure 5. Example of the antimicrobial assays of three EO with *Penicillium chrysogenum* and *Aspergillus versicolor*. Growth of fungi in controls and at 3.12 µl of each EO in 20 ml PDA.

Future work

To incorporate EO in chitosan films, to further extend its anti-fungal activity. Non-inoculated prototypes will be placed inside selected buildings (churches) with the studied murals paintings and subjected to the same environmental conditions as the original paintings to evaluate the antimicrobial activity in a long-term assay.

Artificial ageing will be performed as complement of the characterisation of the devised coating in MP prototypes, using colorimetric techniques with FTIR and optical microscopy.

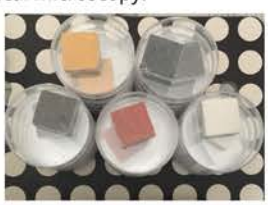

Figure 6. (a) Sealed petri dishes with mural painting prototypes in 15 ml of water on the bottom; (b) Vine black MP control prototype with a plug of *Penicillium chrysogenum and* growth after 27 days.

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10.1016/j.foodhyd.2012.03.005

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rticipated by the Social European Fund (FSE) and MCTES National Fund [Ph.D. grant number SFRH/BD/125596/2016]; the BIO4MURAL – ural painting was funded by FEDER – Operational Competitiveness and Internationalization Program [grant number POCI-01-0145-FEDER- CITAR [grant number UID/EAT/0622/2016] and CBQF [grant number UID/Multi/50016/2013.

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Analysis and Preservation of the Royal Family Embroidery Flags in the Korean Empire (1897-1910)

By Youngmee Baek

Hwang Sil Chuk Won Jang Eum Su (皇室祝願莊嚴繡) is a pair of embroidered flags bestowed in October 1902 by the Imperial House of the Korean Empire (1897-1910) in prayer for peace and prosperity of the Empire and the Imperial House, respectively. The items are under the custodianship of the Beomeosa Temple located in Busan, South Korea, and were designated as Busan Folklore Cultural Property No. 1 on September 3, 1999. This study presents the results of the analysis of materials and dyes and the preservation of these relics.

Similar to a Buddhist-style flag in shape, the items are composed of a head, body, arms, and tail; a Dharani pouch can be found in the head. On both sides, knotted decorations composed of five-colored knots and tassels are hung from the head and hung over the arms. Letters, lotus leaves, and vines are embroidered on the central red silk fabric. Gold threaded letters are embroidered in a prayer for each of the departed souls of Emperor Munjo and Empress Shinjeong. A lotus flower was embroidered on the green silk fabric below the red silk, and blue silk fabric was added on both sides. Embroidery employed couching stitch, matt stitch, satin stitch, and outline stitch techniques.

Signs of damage were present in the form of contamination, breakage, discoloration, and damage to the couching stitch. These artifacts underwent fabric analysis, gold yarn analysis, and dye analysis. Fabric analysis found that a satin fabric was used as the base fabric of the flag, and various silk fabrics, including silver thread fabrics, were used for the Dharani pouches. The fiber of the top knot was identified as silk, while the fiber used in knots draping the sides was identified as cellulosic. In addition, the tassel attached to the bottom of the knot was identified as silk.

Analysis found gold threaded letters to be an alloy of gold and silver, while the gold at the border was identified as pure gold. The metal threads used in the Dharani pouches were identified as silver and an alloy of gold and silver. In addition, dye analysis on the knot at the top of the flag for the Emperor revealed carminic acid, and the dye was cochineal. The head knot dye for the Empress revealed purpurin, and the dye was madder.

Preservative treatment for these artifacts was carried out including surface cleaning using a vacuum suction machine, brush, preservation eraser, air blower, stain removal, and adhesion of couching stitched gold thread.

This study is significant in that proper analysis and pertinent conservative treatment were performed on designated cultural heritage relics held by the Imperial House of the Korean Empire. Relics have been well preserved while replicas have been created to reflect the analysis results. They are currently stored in the Beomeosa Temple Seongbo Museum.

Youngmee Baek graduated from the doctoral course in the Department of Clothing and Textiles at Pusan National University (PNU) in Korea. She is currently working as a full-time researcher at the Cultural Heritage Preservation Research Institute affiliated with PNU researching preservation treatment and analysis of textile relics, including excavated clothing and textiles from Korea. Recently she conducted studies on dye analysis of fabrics and research into mechanisms of fiber degradation is in progress. In addition, she has been lecturing on subjects related to the history of Korean traditional clothing culture, the composition of hanbok, and the conservation of Korean textile cultural properties at the University.

Analysis and Preservation of the Royal Family Embroidery Flags in the Korean Empire (1897~1910)

Youngmee BAEK

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Introduction

Hwang Sil Chuk Won Jang Eum Su(皇室祝願莊嚴繡) is a pair of embroidered flags bestowed in October 1902 by the Imperial House of the Korean Empire (1897~1910) in prayer for peace and prosperity of the Empire and the Imperial House, respectively. The items are under the custodianship of the Beomeosa Temple and were designated as Busan Folklore Cultural Property No. 1 on September 3, 1999. This study presents the results of the analysis of materials and dyes, and the preservation of these relics.

Fig.1 Emperor's Jang Eum Su

Fig.2 Empress's Jang Eum Su

Characteristics

Similar to a Buddhist-style flag in shape, the items are composed of a head, body, arms, and tail; Dharani pouches can be found in the head. On both sides, knotted decorations composed of five-colored knots and tassels are hung from the head and hung over the arms. Letters, lotus leaves, and vines are embroidered on the central red silk fabric. Gold threaded letters are embroidered in prayer for each of the departed souls of Emperor Munjo and Empress Shinjeong. A lotus flower was embroidered on the green silk fabric below the red silk, and blue silk fabric was added on both sides. Embroidery employed couching stitch, matt stitch, satin stitch, and outline stitch techniques.

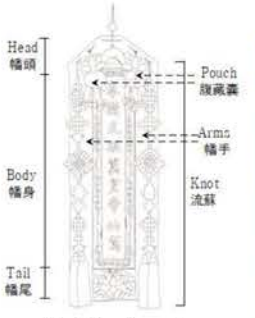

Fig.3 Structure of Jang Eum Su Flag.

Fig.4 Embroidery methods of each part

Analysis

Signs of damage were present, in the form of contamination, breakage, discoloration, and damage to the couching stitch. These artifacts underwent fabric analysis, gold yarn analysis, and dye analysis.

1. Textile

Fabric analysis found that a satin fabric was used as the base fabric of the flag, and various silk fabrics, including silver thread fabrics, were used for the Dharani pouches. The fiber of the top knot was identified as silk while the fiber used in knots draping the sides was identified as cellulosic. In addition, the tassel attached to the bottom of the knot was identified as silk.

Fig.5 Emperor's fabric (×50), (a) Arm, (b) Body, (c) Tail, (d) Back(cotton)

Fig.6 Various silk fabric of Emperor's Dharani pouch.

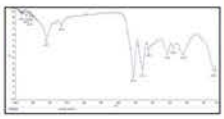

Fig.7 FT-IR graph of Empress's Dharani pouch fabric.

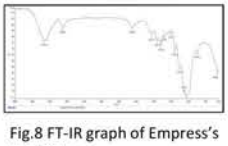

Fig.8 FT-IR graph of Empress's knot fiber

Fig.9 Photo of Empress's knot

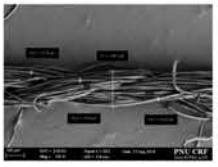

Fig.10 SEM of Empress's knot thread.

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2. Metal threads

Analysis found gold threaded letters to be an alloy of gold and silver, while the gold at the border to be pure gold. The metal threads used in the Dharani pouches were identified as silver and an alloy of gold and silver.

Table.1 Gold threads of the embroidery part

	Letter	Pattern	Border
Emperor			
Empress			

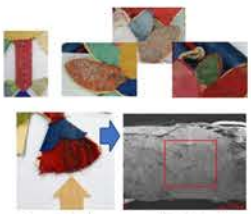

Fig.11 Photos and SEM of metal threads of the Dharani pouch.

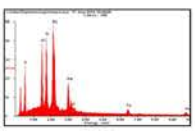

Fig.12 EDX of gold thread of emperor's letter.

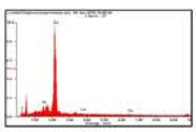

Fig.13 EDX of gold thread of emperor's border.

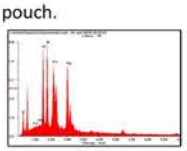

Fig.14 EDX of metal thread of emperor's Dharai pouch fabric.

3. Dye

Dye analysis on the knot at the top of the flag for the Emperor revealed carminic acid, and the dye was cochineal. And the head knot dye for the Empress revealed purpurin, and the dye was madder.

Fig.15 Emperor's knot

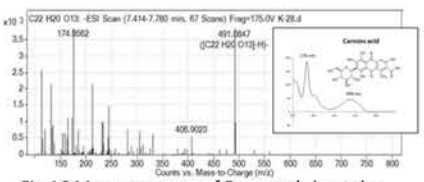

Fig.16 Mass spectrum of Emperor's knot dye

Fig.17 Empress's knot

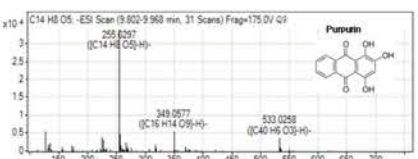

Fig.18 Mass spectrum of Empress's knot dye

Preservation treatment

The preservation treatment for these artifacts was carried out by surface washing using a vacuum suction machine, brush, preservation eraser, air blower, stain removal, and adhesion of couching stitched gold thread.

Fig.19 Preservation treatment process.

Fig.20 Before and after Preservation treatment.

Conclusion

In this study, the characteristics of flags for blessings used in the imperial house designated as cultural properties in Busan were investigated. The results of analysis of textiles, gold threads, dyes, and preservation were reported.

They are made of silk, the back is cotton, the decoration knots are made of silk and cotton, and various silk fabrics are used for the Dharani pouches. Dye analysis showed that the emperor's knot was dyed with cochineal and the empress's knot was dyed with madder. They have been preserved and replicas have been made to reflect the analysis results and are currently stored in the Beomeosa Temple Seongbo Museum.

Acknowledgements

This study was carried out with the support of the National Research Foundation of Korea with funding from the government (Ministry of Education) in 2015 (NRF-2015R1D1A1A02061580).

Antimicrobial potential of chitosan-based coatings for the preventive conservation of urban outdoor stone sculptures

By Nádia C. Silva[a], Raquel Madureira[a], Manuela Pintado[a] and Patrícia R. Moreira[a, b]
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The proliferation of microorganisms in stone sculptures carries an increased risk of deterioration of the materials composing the stone which, over time, has a significant impact on the conservation of the artworks. This situation is particularly relevant for outdoor sculptures in urban areas that are continuously exposed to environmental elements and pollution. The combination of these factors enhances the degradation of the sculptures through direct physical and chemical actions and favours the colonisation and propagation of microorganisms with deteriorative potential. The impact of the action of microorganisms on stone sculptures brings negative consequences to the structure and aesthetics of the artworks and is a fundamental aspect to consider in their preventive conservation plans. Therefore, developing new solutions that prevent or delay the uncontrolled colonisation of sculptures by microorganisms is important, especially considering the level of toxicity of many products currently available.

We propose using chitosan-based coatings to be applied on the surface of stone sculptures as an antimicrobial protective layer to slow down the growth of microorganisms with potential degradative action. This research is intended to be a link between science and art conservation as a contribution to the development of less toxic alternatives for the prevention of biocontamination and biodeterioration of art objects, namely outdoor stone sculptures. This work is in line with the United Nations sustainable development goals, particularly goals 11 and 12, which convey the efforts to preserve the world's cultural heritage and achieve sustainable production patterns.

The coating was prepared with chitosan as the base polymer due to its interesting properties that can be explored in the context of art conservation, such as its non-toxicity and antimicrobial activity. An initial screening was performed to test different molecular weight chitosans and various combinations and concentrations of cross-linking agents to create an insoluble coating able to support outdoor conditions. The chosen coating was tested for its ability to prevent the growth of *Staphylococcus aureus*, *Bacillus cereus* and *Rhodotorula spp.* by incubating these microorganisms with the coating after drying to the solid state. The liquid coating was also tested and applied on marble samples either by brushing or by direct deposition of the liquid using a micropipette, allowing it to spread and absorb naturally without further action, and then analysing the area using scanning electron microscopy (SEM). After applying the chitosan coating on marble, antimicrobial assays were also performed for *B. cereus*.

The antimicrobial assays of the chitosan coating, after 24 hours of incubation with the tested strains, revealed a reduction in the growth of all microorganisms. Growth reduction of c.a. 1.3 to 2.7 log was observed for the three tested strains compared to the initial concentration of the microorganisms. The direct application of the chitosan coating on marble resulted in the deposition of a protective layer on its surface, as observed by SEM. However, this layer was not uniform at the microscopic level, even though no aesthetic changes were observed with the naked eye. The coating application by brush led to its total absorption by the stone pores, and no protective layer was observed on

the stone surface. Nevertheless, the growth of *B. cereus* was inhibited 24 hours after inoculation on chitosan-coated marble samples compared to un-coated marble inoculated with the same strain.

The tested chitosan coating inhibited the growth of bacterial and yeast strains that may be involved in the biodeterioration of stone sculptures. When the coating was applied on a marble surface, its antimicrobial activity was maintained, at least for *B. cereus,* for 24 hours. Antimicrobial testing of other strains and other stone types to simulate natural exposure conditions to outdoor settings is underway.

Nádia Silva has a degree in biology from Faculdade de Ciências-Universidade do Porto and a master's degree in microbiology from Escola Superior de Biotecnologia-Universidade Católica Portuguesa (ESB-UCP), where she began working with chitosan to develop novel nanomaterials and drug delivery systems with antimicrobial properties. Recently, she has been involved in the characterisation of microbiological contamination of outdoor stone and metal artworks through project BIONANOSCULP. She is currently a PhD student at ESB-UCP working on the development of new nanomaterials to prevent biodeterioration of cultural heritage. Her main areas of interest are microbiology, natural polymers, antimicrobial coatings and nanoparticles.

Raquel Madureira holds a degree in microbiology and a PhD in biotechnology from UCP (2010). She is a senior researcher at Alchemy Project and an invited assistant professor at UCP, where she teaches industrial microbiology. Her research career has involved participation in several industry-led projects, for the establishment of by-products integrated valorisation strategies and new product development for human nutrition, animal feed and skincare. She has special research interest in *in vitro* model development for biological phenomena simulation and microbiome modulation (gut-skin) for bioactive compounds testing. Raquel is an evaluation panel member for European projects, a member of three scientific journal editorial panels, and is author of more than 70 publications and 20 oral presentations.

Maria Manuela Estevez Pintado, Ph.D. in biotechnology, is currently associate professor of the College of Biotechnology of the Portuguese Catholic University (ESB-UCP), associate director of School of Biotechnology from Universidade Católica Portuguesa (ESB-UCP, Porto, Portugal) and the director of CBQF (Chemistry and Biotechnology Center – State Associate Laboratory), a ESB-UCP research unit and associate laboratory. In the research field she is the head of the Bioactive and Bioproducts Research Laboratory.

Patrícia Moreira holds a PhD in biotechnology with a specialization in biochemical engineering from the Universidade Católica Portuguesa (Portugal). She is an assistant professor at the School of Arts of the Universidade Católica Portuguesa (UCP). She is an integrated member of the Center for Research in Science and Technology of the Arts (CITAR) and coordinates the area-focus heritage, conservation and restoration of CITAR and is also a collaborator at the Center for Biotechnology and Fine Chemistry (CBQF) both at UCP. Her main research area is in innovation in biotechnology and nanotechnology for cultural heritage, with emphasis on biodeterioration, sustainability, circular economy, citizen science and co-represents the green conservation movement in Portugal. She is currently co-coordinating the RESEARCH PROJECT HAC4CG (NORTE-01-0145-FEDER-000067), funded by CCDRN. She supervised several doctoral theses and master's theses and is author and co-author of numerous articles in impact journals in her area of research. http://orcid.org/0000-0002-0004-851X

Antimicrobial potential of chitosan-base conservation of urban outdoor stone scu

Nádia C. Silva[a], Raquel Madureira[a], Manuela Pintado[a], Patrícia R. Moreira[a, b]

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Introduction

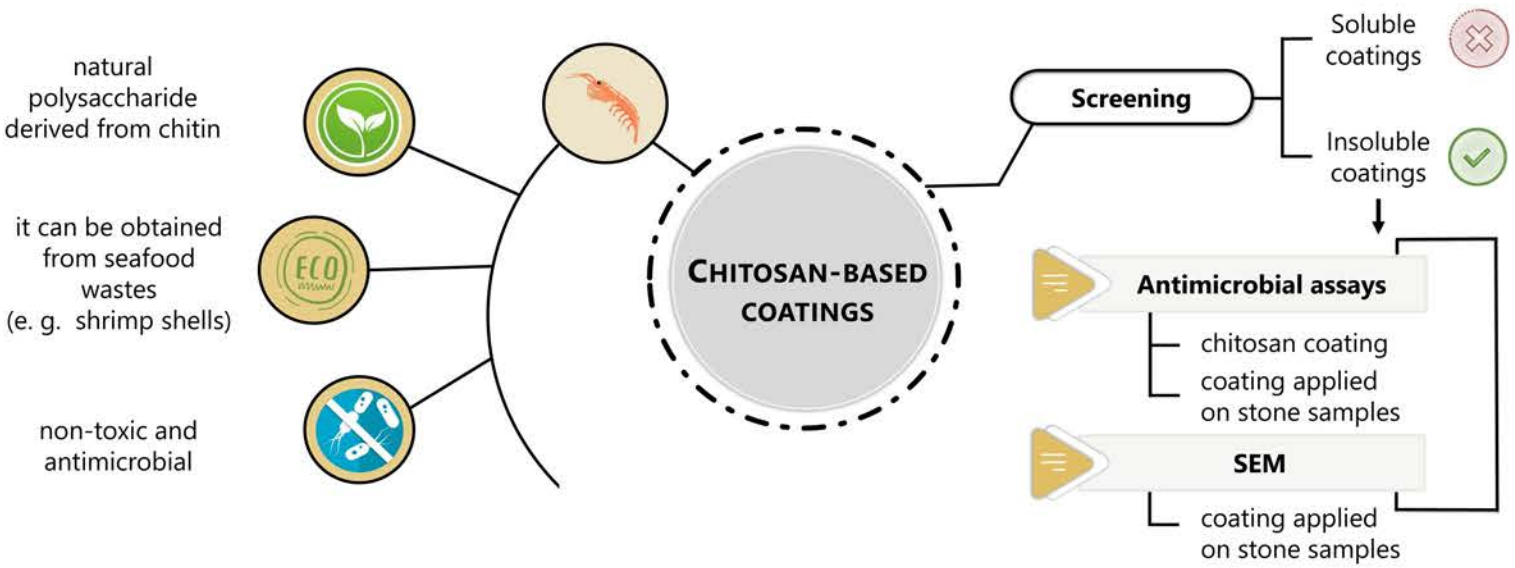
Proliferation of microorganisms in stone sculptures carries an increased risk of deterioration

- significant impact on the conservation of the artworks
- especially relevant in sculptures that are outdoors in urban areas

Action of microorganisms c

- negative consequences t of the artworks
- fundamental aspect to co conservation plans

Methods



Conclusions

- The tested chitosan coating inhibited the growth of bacterial and yeast strains that may be involved in the biodeterioration of stone sculptures
- When applied on a activity was maintaine

Acknowledgements

This study was funded by National Funds from FCT – Fundação para a Ciência e a Tecnologia through the research project BIONANOSCULP [grant number PTDC/EPH-PAT Europeu through Programa Operacional Regional Norte for the financial support [grant number SFRH/BD/138935/2018]. The authors thank the scientific collaboration under

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PORTO

ON STONE SCULPTURES

o the structure and aesthetics

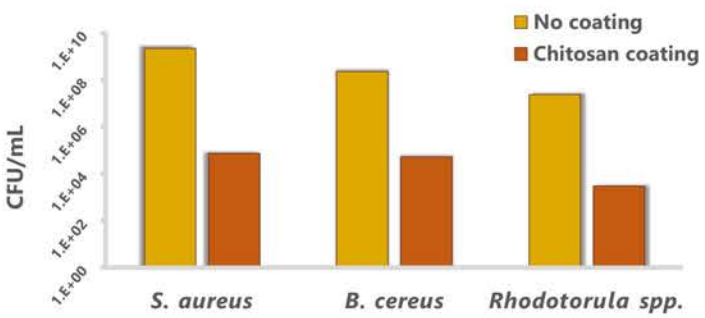
onsider in preventive

DEVELOPMENT OF NEW SOLUTIONS

prevent or delay the uncontrolled colonisation of sculptures by microorganisms

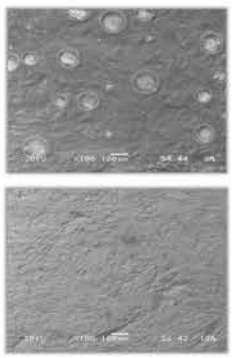
Results

Antimicrobial activity of the chitosan coating after 24 h of incubation with bacterial and yeast strains



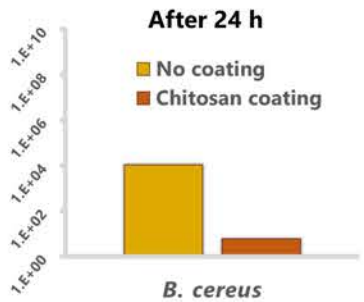
- *S. aureus*: 1.5 log cycle growth reduction
- *B. cereus*: 1.3 log cycle growth reduction
- *Rhodotorula spp.*: 2.7 log cycle growth reduction

Application of the chitosan coating on marble



Direct application on the marble surface: the coating forms a layer on the marble surface but it is not uniform

Application with a brush: the coating is not visible on the surface due to total absorption by the stone pores after homogeneous application



marble surface, its antimicrobial
d, at least for *B. cereus*, for 24 h.

Antimicrobial testing of other strains and other stone types to simulate natural exposure conditions to outdoor settings is underway.

T/6281/2014]. Nádia C. Silva would like to thank FCT and FSE - Fundo Social
the FCT projects UID/Multi/50016/2013 and UID/Multi/50016/2019.

Assessing the Er:YAG laser interaction on commercial varnishes used throughout the mid-twentieth century

By Chiara Chillé and Dr Charis Theodorakopoulos

In recent decades, viable alternatives to traditional cleaning methods for paintings have been established. Since the cleaning of paintings is an irreversible treatment, physical methods (e.g., laser treatments) rather than chemical methods are frequently employed to reduce side effects to underlying layers. Traditional cleaning methods may lead to unpredictable results, which are intrinsically related to excessive use of solutions and poorly controlled mechanical tools. Free-running Er:YAG lasers (2940 nm) are considered suitable for cleaning, even though the physicochemical mechanisms have not been thoroughly understood. The strong absorption of 2940 nm photons from the hydroxides in varnishes, pigments and binders leads to diverse photo-thermal and mechanical effects on the surface of artworks. To maximise the laser absorption at the surface, it is common to pre-wet the area with OH-containing solutions. The established approach is to thin varnishes first instead of attempting their total removal.

This work aimed at an enhanced understanding of the physicochemical effects induced by Er:YAG laser on commercial mid-twentieth-century varnishes (dammar, Ketone N and MS2A and Paraloid B67) through systematic examination. Dammar, Ketone N, MS2A and Paraloid B67 resins were chosen due to their wide use by conservators throughout the mid-twentieth century. Corresponding varnishes were applied on glass slides with a film applicator and were light and hydrothermally aged.

An Er:YAG laser was employed in Very Short Pulse (VSP @ 100 µs) and Short Pulse (SP @ 300 µs) modes. The laser beam was set at 4 mm diameter and delivered to the substrates by the R11 titanium handpiece keeping the working distance stable at 20 cm. Single laser pulses with fluences ranging between 0.5 and 2.7 J/cm2 were fired onto dry and pre-wetted varnishes. The pre-wetting solution used was 1% (v/v) non-ionic surfactant (Tween 20) in deionised water (DI-W + TW20) applied on the substrate at the beginning of each laser test.

Since the efficacy of the Er:YAG laser-varnish interaction is directly proportional to the concentration of hydroxides in the substrate, and as there are no hydroxides in poly(isobutyl acrylates) resins, Paraloid B67 films did not absorb at 2940 nm. Even pre-wetted Paraloid B67 films did not display detectable spots regardless of the fluence tested (up to 2.5 J/cm2).

Transmission studies on the aged Ketone N, MS2A and dammar varnishes in real time upon laser irradiation showed that the energy transmitted upon single laser pulses in VSP and SP modes increased almost linearly with fluence, apart for the B67 resin where no significant modification was recorded. However, pre-wetting led to reduced beam penetration into the irradiated varnish films.

Chemical changes were monitored with attenuated total reflection/Fourier transform infrared (ATR/FTIR) spectroscopy, registering a reduction of hydroxides and carbon-hydrogen bonding as a function of fluence for dammar and Ketone N films and almost no change for the dry and pre-wetted MS2A film. The decrease in hydroxides confirmed that the dominating mechanism of Er:YAG laser is directly related to the maximum absorption of the laser wavelength from the hydroxides in the irradiated surface. The decrease in carbonyls in the bulk is in line with the presence of depth-wise oxidative gradients.

Scanning Electron Microscopy (SEM) Imaging in the Backscattered Electron (BSE) mode revealed that the laser spots were less marked in the pre-wetted varnishes in comparison to the dry-irradiated films.

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Dr Chiara Chillé was awarded her PhD at Northumbria University (2021). She investigated the potential of Er:YAG lasers for the treatment of varnished paintings. During her research fellow position at the Institute of Applied Physics (IFAC) at the National Research Council (CNR) Italy, she explored the feasibility of using lasers as an alternative to traditional cleaning methods. She is a paintings conservator with an MRes degree in nanotechnologies and nanomaterials for cultural heritage (2016) and two MSc degrees in the conservation of paintings on canvas and wooden supports and polychrome wooden sculptures from the University of Palermo. Currently she is a conservator involved in the Getty Conserving Canvas initiative at the National Gallery of Ireland.

Dr Charis Theodorakopoulos is the programme leader of the MA Conservation of Fine Art, and the conservation science lead at Northumbria University, Newcastle. His work focuses on the interaction of soft resins, polymers and drying oil media with lasers and gels and the evaluation of conservation treatments. He has led several research projects, doctoral studentships and partnerships with the V&A Museum, the Tate, the private sector and with conservation technology enterprises. He is a member of several conservation and heritage science professional bodies and has published in peer-review journals and conference proceedings.

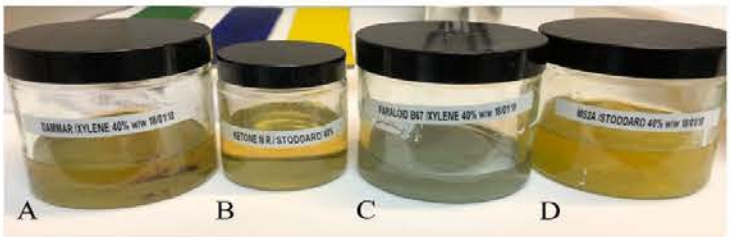
Assessing the Er:YAG laser interaction on commercial varn

C. Chillè[1] and C. Theodorakopoulos[2]

[1]*Institute of applied physics ''Nello Carrara'' (IFAC-CNR), Florence, Italy*
[2]*Department of Arts, Science in Conservation of Fine Art, Northumbria University, Newcastle upon Tyn*

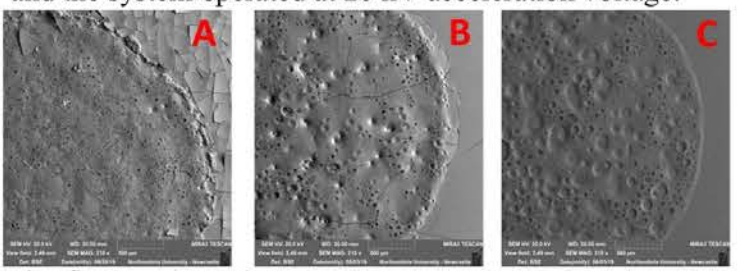
Sample preparation

Dammar, Ketone N, MS2A and Paraloid B67 resins were placed into a gauze bag and dissolved in their suitable solvent.



BSE-SEM

The surfaces were analysed in low vacuum at 0.2 mbar, and the system operated at 20 kV acceleration voltage.



The figures show dammar (A), Ketone N (B) and MS2A (C) upon dry Er:YAG laser irradiation at 2.5 J/cm^2.

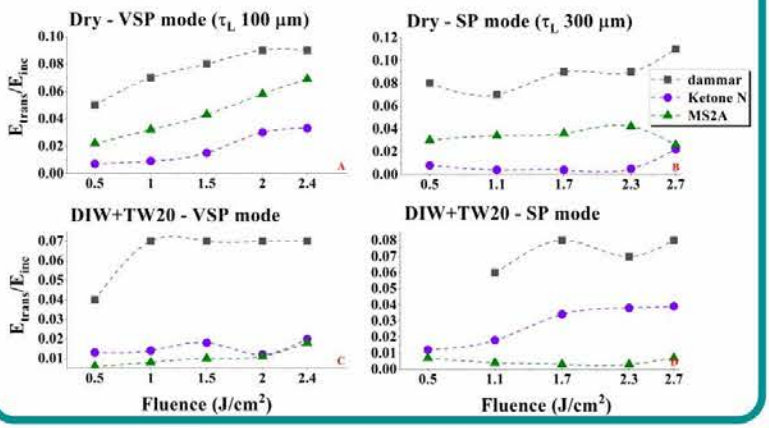
Laser tests

An Er:YAG laser was employed in Very Short Pulse (VSP ≅ 100 µs) and Short Pulse (SP ≅ 300 µs) modes. The laser beam was set at 4 mm diameter and delivered to the substrates by the R11 titanium handpiece keeping the working distance at 20 cm.

Single laser pulses with fluences ranging between 0.5 and 2.7 J/cm^2 were fired onto dry and pre-wetted varnishes. The pre-wetting solution used was 1% (v/v) non-ionic surfactant (Tween 20) in deionised water (DI-W+TW20) applied on the substrate at the beginning of each laser test.

Transmission study

A Pyroelectric Detector was used to record transmission upon laser irradiation. The samples were tested using a single shot shuttered exposure per site, increasing fluence within a range of 0.5 to 2.7 J/cm^2.



Conclusion

Since the efficacy of the Er:YAG laser-varnish interaction is directly proportional t films did not absorb at 2940 nm. Transmission studies on the aged Ketone N, MS2A increased almost linearly with fluence. However, pre-wetting led to reduced beam hydroxides and carbon-hydrogen bonding as a function of fluence for dammar and hydroxides confirmed that the dominating mechanism of Er:YAG laser is directly r surface. The decrease in carbonyls in the bulk is in line with the presence of depth-wi

Acknowledgments The authors acknowledge Ed Teppo (founder and president of former Enterprise Big Sky Laser Technologies) and Anne Tepp Conservation Laboratory and for the transmission studies.

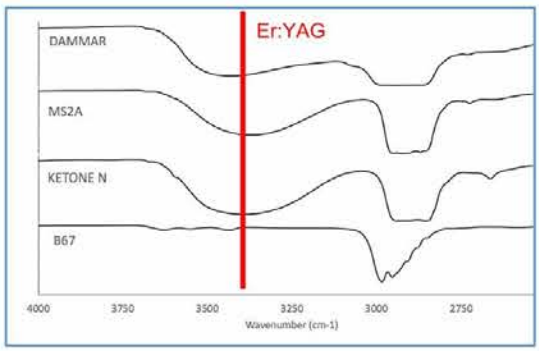
nishes used throughout the mid-twentieth century

Abstract

This work aimed at an enhanced understanding of the physicochemical effects induced by Er:YAG laser on commercial mid-twentieth-century varnishes (dammar, Ketone N and MS2A and Paraloid B67) through systematic examination.

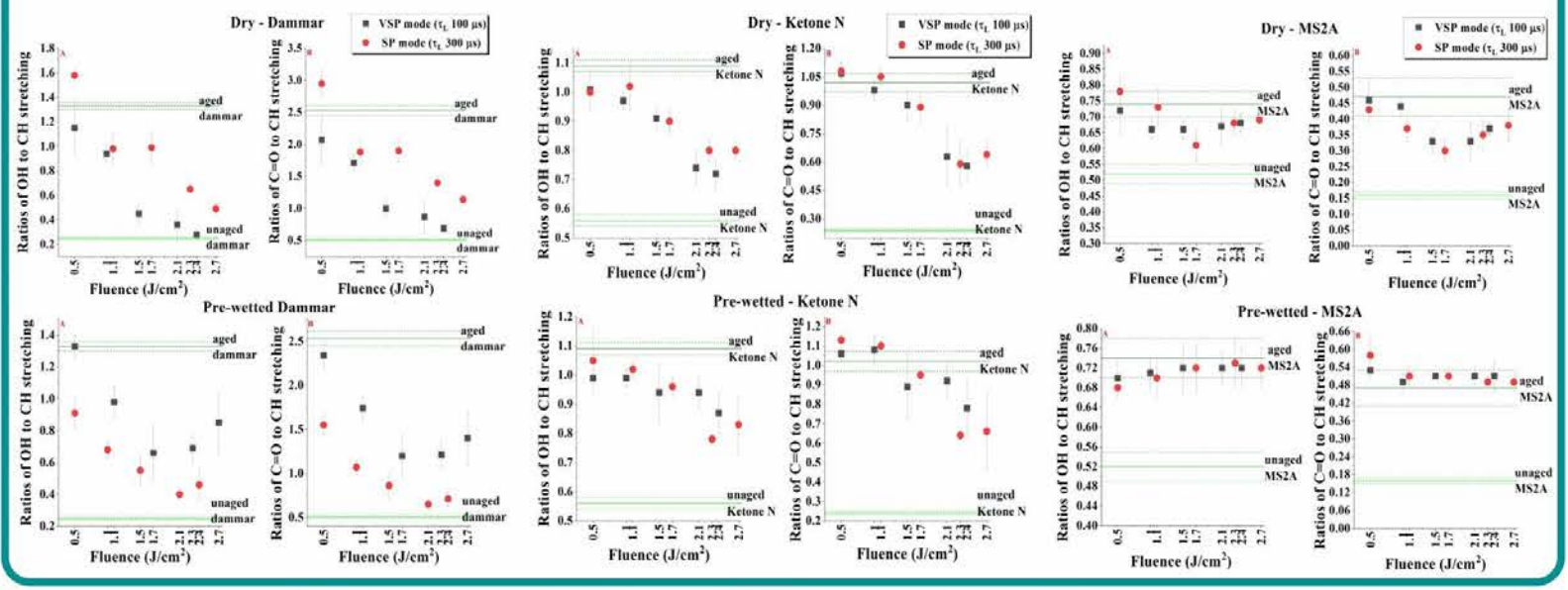
ne, UK

ATR/FT-IR spectroscopy



Chemical changes were monitored with Attenuated Total Reflection/Fourier Transform Infrared spectroscopy and aimed to assess the laser-induced modifications upon Er:YAG irradiation. The laser-irradiated varnish films received five consecutive laser pulses released in the same place. The glass-coated non-irradiated and irradiated varnish films were placed directly on the diamond window and pressed (up to a pressure gauge of 100). The wave-number range was set from 4000 to 380 cm^{-1} and the spectra were acquired over 16 scans at 4 cm^{-1} resolution.

Ratios of the integrated areas of the –OH/CH and the –C=O/CH bands as acquired by ATR/FT-IR vs fluence of the dry and pre-wetted irradiated varnish films in VSP and SP modes.



to the concentration of hydroxides in the substrate, and as there are no hydroxides in P B67, the A and dammar showed that the energy transmitted upon single laser pulses in VSP and SP modes penetration into the irradiated varnish films. ATR/FT-IR spectroscopy registered a reduction of Ketone N films and almost no change for the dry and pre-wetted MS2A film. The decrease in related to the maximum absorption of the laser wavelength from the hydroxides on the irradiated ise oxidative gradients.

po for lending the Fotona Fidelis^{XS} Er:YAG laser to the Northumbria University Art

Cleaning paint on stone surfaces with ultrashort pulse lasers

Julie Brand[1,2]*, Steve Madden[2], Alison Wain[1], Andrei V. Rode[2] and Dr Ludovic Rapp[2]
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Lasers have been used successfully in the conservation of historic stonework to remove contaminants from stone surfaces, ranging from sculptures to entire building facades. A wide variety of stone substrates have been investigated around the world including the most common limestone, marble, sandstone and granite. Many of those types of stone, however, are heterogenous bodies which vary in composition due to their processes of formation. This makes it complex to determine a laser fluence regime that is safe for all the mineral phases present in a single stone feature.

The current commercially available generation of lasers used in conservation are based on nanosecond or longer pulses of light which generate heat and shockwaves that either vaporize dirt layers or explosively dislodge them from the underlying surfaces. This is effective but can induce changes of the morphology, chemistry, and internal structure of the materials making it problematic to accurately control the depth and precision of the cleaning procedure. It is particularly complex in the treatment of stones, such as granite, which contain a mixture of minerals with different sensitivities.

In this study we investigated the use of ultrashort pulse lasers to remove paint from granite surfaces. Ultrashort lasers use pulses in the picosecond and femtosecond range and break molecular bonds with minimal heat-related effects using a process known as cold ablation. After determining the safe range of laser energy that can be applied without detrimental effects to the most vulnerable minerals, we studied the removal of paint to determine if an efficient cleaning can be reached.

We used multiple analytical techniques including optical and scanning electron microscopy, spectroscopy (infrared or Raman), and profilometry to evaluate the efficiency of the ultrashort pulse cleaning method and to assess the effects of the laser on the morphology, internal structure and composition of the stone.

We demonstrated that the granite treated with femtosecond lasers does not show signs of melting or other morphological and compositional damage under the safe threshold of energy. We showed that paint can be removed, returning the stone to a clean state as defined beforehand.

Ultrashort pulse lasers are capable and versatile tools to remove contaminants from stonework surfaces while safely preserving the underlying substrate. This type of laser offers important benefits for the conservation of heterogenous and sensitive stone materials. We are confident that this research will pave the way to a more widespread use of ultrashort lasers to clean heritage stonework.

Julia Brand is a third-year PhD student at the Faculty of Art and Design at the University of Canberra. She is working on the Sydney Harbour Bridge conservation project. Her research interests include lasers applied to conservation, analytical science, cultural heritage and art. She graduated with a master's degree in materials science and nanoengineering from the University of Strasbourg, France.
*Corresponding author's email address: julia.brand@canberra.edu.au

Assistant professor **Steve Madden** currently leads research on chalcogenide, tellurite and polysiloxane integrated optical devices at the Laser Physics Centre. His research career in fibre and integrated optics spans much of the period from 1984 to the present in start-ups, multi-nationals and academia covering a diverse range of areas including liquid crystals, seven different materials systems for planar devices, all fibre devices, hybrid integration, Bragg gratings and devices, planar tuneable lasers, optical transmission systems and all optical networking, and non-linear effects in SOAs and planar waveguide devices.

Alison Wain specialises in the conservation of large technology heritage and is currently assistant professor in cultural heritage and materials conservation at the University of Canberra. Her research is focused on the challenges of preserving and interpreting engineering, industrial and science heritage, and on the importance of recognising the intangible heritage of culture, skills and changeability connected with and embodied in machinery heritage.

Andrei Rode is currently emeritus professor at the Australian National University. Research interests are in short-pulse laser-matter interaction, laser-induced phase transitions and transient states of matter, laser-produced nanoclusters and their properties, laser ablation and deposition of nonlinear optical films for photonics applications, laser trapping of particles in air and related phenomena.

Dr Ludovic Rapp is a senior research fellow at the Laser Physics group of the Department of Quantum Science and Technology (DQST) at the Australian National University (ANU). Ludovic has a strong background in short and ultrashort pulse laser interaction with matter. His research work is focused on the use of laser technologies for advanced research and industrial applications. He is currently leading the development of laser cleaning solutions for the preservation and restoration of heritage and cultural monuments, buildings and infrastructure such as the Sydney Harbour Bridge conservation project.

Cleaning paint with ultras

J. Brand*, S. Madd

Introduction

Short pulsed lasers, using nanosecond (ns) pulses are most common for cleaning contaminants from stone surfaces

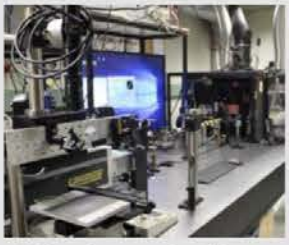
BUT: ns pulses cause removal of material through melting, vaporization and shock waves, which can induce morphological and structural damage

Ultrashort pulsed lasers, using femtosecond (fs) pulses offer a promising alternative, removing contaminants in a non-thermal, electrostatic process.

→ No heat-related damage

Method

Short pulsed laser Compact Phoenix (Lynton Conservation)



Ultrashort pulsed laser Carbide CB3-40W (Light Conversion)

Paint and granite

λ Wavelength 1064 nm	Wavelength 1029 nm	Montana Colours® spray paints Cadmium yellow, Blood Red, Europe Blue, and Natura Green
Power 1.15 W	Power 40 W	
Repetition rate 25 Hz	Repetition rate 100 kHz	Applied on diamond-sawn billets of Moruya granodiorite (sourced from Moruya, New South Wales, Australia)
Pulse duration 5 ns	Pulse duration 275 fs	
Max. pulse energy 150mJ	Max. pulse energy 400µJ	

Cleaning with ns

Ns laser cleaned

Partial cleaning only with safe energy (green)

Complete cleaning with damage (orange, red)

Fs laser cleaned

Complete cleaning with no damage to stone. Laser energy is below damage threshold of stone (black).

Corresponding number of scans in white b

Laser fluence used (boxes color): Green: 0.5 J
Black: 1.0 J/cm², for the fs

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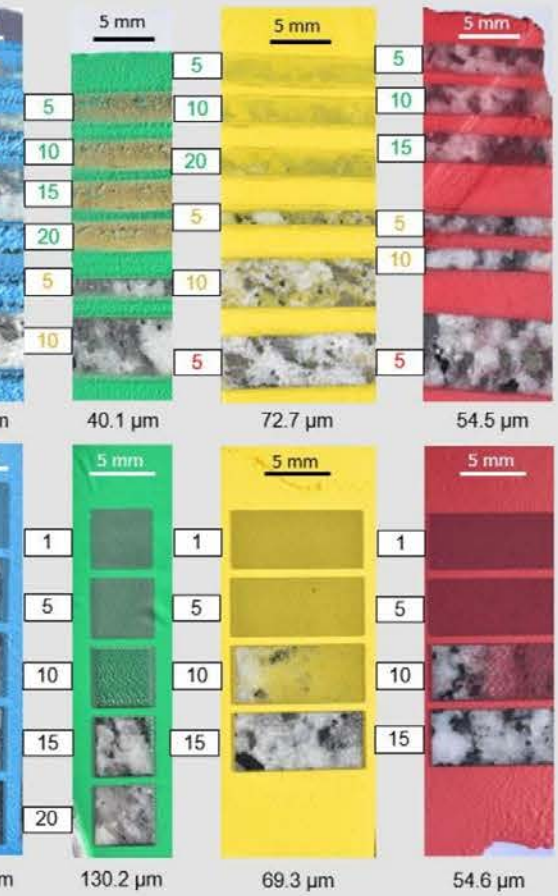
t on stone surfaces
short pulsed lasers

UNIVERSITY OF CANBERRA
Australian National University

en, A. Wain, A. V. Rode, L. Rapp

* Corresponding author: julia.brand@canberra.edu.au

vs. fs pulsed lasers

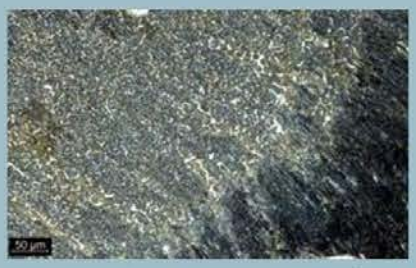


oxes, paint thickness at the bottom

/cm² ;Orange: 0.8 J/cm²; Red: 1.5 J/cm², for the ns laser
s laser

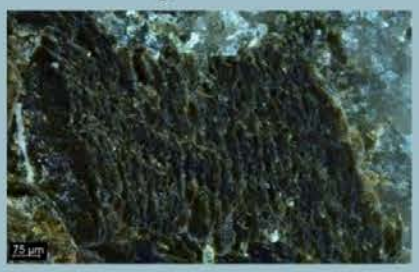
Effects on minerals in granite

Ns laser – melts the biotite at 0.8 J/cm²



Paint is not removed below this fluence

Fs laser – granite undamaged at 1.0 J/cm²



Safe and efficient removal of paints at 1.0 J/cm²

Benefits of fs laser

- No heat: eliminates compromise between keeping stone intact and achieving complete cleaning
- Selective cleaning due to difference in damage thresholds of stone and contaminants
- Quicker process than with ns laser (<10min for 10x10cm² for thicknesses between 50-150µm)

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Acknowledgements: The research was funded by the Australian Research Council and Transport for New South Wales through the Linkage Project LP180100276

Community leadership in conservation of table tombs in the churchyards of Gloucestershire, UK

By Adam Klups and Graham O'Hare

The table or chest tomb is a unique, very typical feature of churchyards in the southwest of England. They are especially common in Gloucestershire and the neighbouring counties, and here they show the greatest variety and richness of decoration. They flourished due to the combination of wealth, availability of suitable stone, the craftsmen to carve it and the need or desire to commemorate individuals as well as their position and standing in local society. Most date to the late 17th, 18th and early 19th centuries.

This poster focuses on table tomb conservation projects as an interesting example of community leadership in conservation of local architectural heritage of special interest. Many successful projects have been possible in recent years in Gloucestershire's churchyards thanks to the efforts of keen volunteers and their readiness to positively engage with conservation advisers and conservators.

The authors offer an overview of the significance of table tombs and their conservation challenges. They also investigate, through two case studies, the motivation of local community custodians and what they have learned on the job, as "accidental" conservation leaders. The poster draws on the volunteers' personal accounts as well as the authors' own experience over the past decade, gained through supporting local communities on their journey to preserve unique examples of tangible heritage of Gloucestershire. The poster contributes to the limited literature on the significance and practical conservation treatment of table tombs. The poster discusses examples of positive non-expert involvement in the planning of conservation projects concerning local heritage and reflects on the changing role of conservation in rural communities.

Adam Klups is Care of Churches & DAC team leader and senior church buildings officer at the Diocese of Gloucester, UK. He is passionate about conservation management, building conservation and adaptive reuse of historic buildings. He holds a BA in history of art with material studies, and an MA in principles of conservation, both from UCL. Adam is a Fellow of IIC and a full member of the Institute of Historic Building Conservation (IHBC). He is also sits on council of the Gloucestershire Historic Churches Trust.

Graham O'Hare is a stone conservator based in Gloucestershire. After a ten-year career as a field archaeologist in Italy, he retrained as a conservator at Salisbury (Wiltshire) and Asti (Piemonte, Italy) Cathedrals before attending the diploma course in architectural stonework conservation at Bournemouth University in 1994. Since then he has conserved numerous churchyard and internal monuments and stonework on many fine buildings including Wells and Winchester Cathedrals, Tewkesbury Abbey and the Eltz Palace in Vukovar, Croatia. He has a particular interest in churchyard monuments and their conservation and has conserved over one hundred in the last twenty years.

Community leadership in conservation of table

Adam Klup

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INTRODUCTION

The poster focuses on table tomb conservation projects as an interesting example of community leadership in conservation of local architectural heritage of special interest. Many successful projects have been possible in recent years in Gloucestershire's churchyards, thanks to the efforts of keen volunteers and their readiness to positively engage with conservation advisers and conservators.

The authors offer an overview of the significance of table tombs and their conservation challenges. They also investigate, through two cases studies, the motivation of local community custodians and what they have learned "on the job", as "accidental" conservation leaders. The poster draws on the volunteers' personal accounts, as well as the authors' own experience gained through supporting local communities on their journey to preserve unique examples of tangible heritage of Gloucestershire over the past decade. The poster discusses examples of positive non-expert involvement in the planning of conservation projects concerning local heritage and reflects on the changing role of conservation in rural communities.

SIGNIFICANCE OF TABLE TOMBS

The table or chest tomb is a unique, very typical feature of churchyards in the South West of England. They are especially common in Gloucestershire and the neighbouring counties, and here they show the greatest variety and richness of decoration. They flourished due to the combination of wealth, availability of suitable stone and craftsmen to carve it, and a need or desire to commemorate individuals, but also their position and standing in local society. Most date to the later 17th, 18th and early 19th centuries. They tell stories from the past of local communities, providing an invaluable local history resource. Each monument is significant in its own right. Its design, position and inscriptions tell us much about the families that built them. A group of monuments together in a churchyard speaks of the society that created them, as well as the individuals commemorated on them.

FIGURE 1. Churchyard of St Cyr, Stinchcombe. Graham O'Hare (right) with a member of his team, reinstating the lid of the table tomb of Mary Manning. Image: Adam Klups

DETERIORATION MECHANISMS AND CONSERVATION TREATMENT

Deterioration mechanisms relevant to table tombs are well understood and can be managed successfully by an experienced stone conservator. They include the usual water, air, and frost-related stone deterioration. Carved stone inevitably weathers away, and while this process can be slowed, it cannot be stopped. In addition, the iron cramps used in their construction rust and expand, causing cracks and lifting stones out of alinement. Many of the problems encountered in work on table tombs are caused by structural issues

They are often built over a brick-lined shaft designed to contain multiple burials and these can deteriorate due t material failure, tree roots and burrowing animals. If their structural stability is compromised, table tombs can pose safety risk. Typical conservation treatment involves dismantling unstable parts, reattaching broken elements replacing iron fixings with non-ferrous ones, repointing with lime-based mortar, repairs to the tops of burial shafts and rebuilding. Although most table tombs are built in a similar way, each monument is unique, with its own set o challenges requiring individual solutions. It is this subtle variety that makes them so interesting to conserve.

The authors' experience and contribution to table tombs conservation projects

Adam Klups works for the Diocese of Gloucester supporting parish volunteers planning building repair, conservatio and development projects. He is passionate about educating local volunteers about the significance of table tombs. He supports volunteers with practical advice on project planning, accessing conservation expertise and finding fundin opportunities, and assists them with securing permissions under the Faculty Jurisdiction Rules, which Church of Englan churches and churchyards are subject to.

Graham O'Hare's involvement as a freelance conservator usually begins when he is contacted by a parish voluntee asking for his professional assistance. They might be concerned about the condition of their monuments, often becaus at least one is a safety issue. That often leads to a request to carry out a condition survey. Each monument is examined photographed, and documented, its condition assessed, and where appropriate, treatment suggested. Priorities ar suggested too; some tombs might be in imminent danger of collapse, others in good condition. The conservator' condition survey provides the client with a comprehensive record of the table tombs, their significance historically an artistically, their condition, what conservation problems they experience, how these can be addressed, and how much might cost to treat them. Thus, the condition survey becomes a useful tool for the management of the churchyard an its monuments in the long term. Parishes often decide to act on the condition survey's recommendations, as long a funds can be raised. This can be a one-off intervention on one or more tombs, or an involvement over several years with tombs treated one by one as more funding becomes available. Graham's involvement creates opportunities t raise the community's awareness of the importance of conservation and significance of table tombs.

Importantly, the role both authors play is providing volunteer conservation leaders with encouragement and motivation

WHO IS RESPONSIBLE?

Although the majority of table tombs are found in churchyards managed by volunteer members of local worshippi congregations, the question of who should be responsible for conservation planning, commissioning, and fundi conservation treatment is not always clear. While legally any churchyard memorial remains in ownership of the hei in law of those it commemorates, in practice tracing those liable for older memorials is close to impossible. Th burden of custodianship, ongoing maintenance, as well as ensuring safety of churchyard users most often rests wi Parochial Church Councils (PCCs), formed by worshipping communities from their membership. An exception to th rule are churchyards which have been closed for burials and where the maintenance responsibility has been formal passed to the relevant tier of local government i.e. the Parish, Town, City or District Council.

The conservation wellbeing and ultimately the survival of table tombs depend largely on the success of calls for actio on the local level, and volunteers' willingness to effectively step in as conservation project managers and work wi conservators, even if they have little or no prior experience of conservation. With church congregation numbers a resources required to keep up with maintenance and repair of the church building and not just the churchya dwindling, planning a table tomb conservation project can seem a daunting and costly prospect. Yet, faced with th choice between taking action to conserve significant local heritage or letting table tombs gradually deteriorate a perish, many communities take it upon themselves to obtain conservation advice, fundraise and commission work b experienced conservators.

CASE STUDIES

St Cyr's, Stinchcombe

The monuments were first examined in summer 2018 because of concerns over stability and safety issues of one of the monuments. There had been two collapses prior to this. Subsequent visual inspection of other monuments in the churchyard as a whole showed that others too needed attention due to rusting iron fixings.

e tombs in the churchyards of Gloucestershire, UK

s[1] and Graham O'Hare[2]

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FIGURE 2. Churchyard of St Bartholomew, Nympsfield. A 'tea caddy' style tomb in the state of near collapse. Image: Graham O'Hare

Six monuments were identified as needing attention. The condition survey was completed in January 2019. The report aided the PCC's decision making and raising of funding. It became a management tool. It was realised that savings could be made through the greater efficiency of working on all six monuments at the same time, rather than dealing with them individually, as the equipment needed to do one could be used on all the others.

Treatment was carried out between August and October 2019. It included the complete reinstatement of the monument commemorating Mary Manning dated 1715, from a collapsed pile of pieces to a standing chest tomb. The conservation project led to an increased interest in the churchyard and local history in the village, and a greater sense of the continuity of village life and death represented physically by the churchyard and its memorials. This was followed up and encouraged by an informal talk on churchyard monument conservation, using the churches own monuments as examples. Due to the Covid-19 pandemic this had to be delayed until August 2021, but interest had not waned in the meantime!

The Revd Fiona Crocker, Vicar of St Cyr's, Stinchcombe said:

At St Cyr's, Stinchcombe, we are fortunate to have a number of table tombs. With the passage of time sadly many of these had deteriorated, but thanks to the extraordinary knowledge and work of Graham O'Hare, they have been beautifully conserved. Whilst raising funds to have our table tombs repaired was part of a larger picture of maintaining our village history, it provided a focus for all in the village who were interested in local history to get involved when Mr O'Hare spoke about his work. This took place as the work happened and at a special evening gathering.

It was heartening to see the interest generated in the preservation and understanding of this aspect of the history of our village. History allows us to be placed as human beings in the context of time and allows us to have that sense of belonging to something which is so much bigger than ourselves. The work of preserving our tombs was an important and enlightening process and enabled a part of the history of this village to be preserved.

St Peter's, Little Barrington

The condition survey of seven chest tombs, including a late Mediaeval one was commissioned by the PCC and carried out in Autumn 2020, due to concerns raised after an architect's quinquennial survey of the church and churchyard. Conservation treatment is ongoing as this poster is being finalised (April 2022). Further involvement with and within the local community is planned in the form of a talk and guided tour by the conservator. This will combine the celebration of the completion of this project with celebration of the local community, and its place in the national community at the time of the Queen's Platinum Jubilee.

Jacky King of Little Barrington PCC reflected:

When chest tombs were identified in our architect's report as needing attention, the PCC's initial reaction was to question if it was really necessary to preserve them, or whether there were more important things to spend our limited time and money on. Graham O'Hare's report transformed our thinking: we understood the importance of the tombs as part of our heritage, and were convinced that we should make every effort to conserve them.

As I had recently retired, I volunteered to lead the project and raise funds for the necessary work. I admit to being tiresomely meticulous when it comes to completing forms so applying for necessary permissions played to my strengths in that regard. However, as it was my maiden voyage into this process, I was helped enormously by Adam Klups and his team, who were incredibly patient in helping me through each stage. Through this process, I moved from "not understanding the question" to really challenging myself to justify why the conservation project was so important – so the first person I truly persuaded of this was myself! In particular, reflecting on the "living churchyard" made me see things from a completely new perspective, and the ancestry angle revealed a clear route for channelling the residents' interest in local history into a stronger interest in the church. For many years, I have walked through the churchyard into church, barely noticing the tombs on either side of the path. Working on this project has opened my eyes to a whole treasure-trove of fascinating facts about their construction and symbolism and awakened my interest in all the people who have been buried here through the ages. Having read the amazingly well-researched condition report by our conservator, the whole PCC is now hugely well-informed and inspired by the project, and the excitement is beginning to ripple through the whole community.

CONCLUSION

It is hoped that this poster will contribute to the limited literature concerning the significance of table tombs and the challenges involved in conserving them. The poster celebrates the leadership and successes of volunteer conservation leaders; both those mentioned above and many others, whose initiative helped to save hundreds of Gloucestershire's table tombs from perishing.

The authors recognise that further efforts are needed to encourage rural communities to positively engage with their local heritage.

FIGURE 3. Churchyard of St Peter's, Little Barrington. Graham O'Hare (right) discussing the progress of works with Jacky King and Jan De Haldevang. Image: Adam Klups

Acknowledgements

The authors would like to thank The Revd Fiona Crocker and Jacky King for their insightful comments and the inspiration their conservation projects provided.

Conservation of a Blue Whale Flipper from the Waitomo District, Aotearoa New Zealand

By Susanne Rawson, Megan Wells and Ron Lambert

In 1975 a 26-metre blue whale washed up on the shoreline of the beach north of Awakino in the Waitomo District of the Waikato Region. The remains were subjected to wave action and exposure on the beach before being removed and prepared by burying them on a rural farm for three years. They were then restored using metal dowels, plaster, epoxy and acrylic paint. They remained on display at the Taranaki Museum through the transition to Puke Ariki—the current modern-day research and cultural centre as a main feature for visitors—until 2021. The lower mandible was also collected by the then cetacean curator from the Dominion Museum, which became the present Museum of New Zealand Te Papa Tongarewa, making the remains nationally significant.

During the dismounting from display for a gallery renewal at Puke Ariki, museum staff noted that there were sticky, brown secretions and an unidentified white powder that had accumulated on the surface of several bones. Additionally, some of the plaster repairs had cracked, and the remains needed a cleaning. The overall goals were to investigate and remove the brown surface secretion and white powder, examine the previous plaster repairs (addressing the restoration paint), reintegrate a new repair and in-paint.

The new conservation treatment included removal of the overpaint, retaining the previous plaster repairs where possible and filling with an epoxy putty, Milliput®, to bridge existing gaps. Reattachment of loose plaster or separated bone was completed with 40% Paraloid B-72 in acetone. These were then in-painted with HWC® watercolours over a barrier layer of 10% Paraloid B-72 in acetone. Due to the spongy layer being exposed in some places, it was not possible to remove all of the plaster or overpaint; these were left in situ. Several solvent tests were conducted on the fatty substance based on other whale bone conservation projects. The most successful was a solvent extraction using boiled ethanol for the surface fats and 25% (aq) ammonia applied with lint-free wipes used by nail salons. The white powdered substance was revealed as primarily calcium based but retained a fatty consistency. Mechanical cleaning techniques had very little effect on removing the powder, seemingly causing it to regenerate. Successful chemical cleaning included a 1:1:1 (acetone:ethanol:water) solution and a separate 10% (aq) hydrogen peroxide solution.

This project is unique and contributes to conservation practices by:

· Acknowledging the role of non-traditional natural specimen preparation practices and the effects of time
· Discussing changing approaches towards consultation with Māori communities in Taranaki
· Introducing new materials for conservation of prepared whale remains

Susanne Rawson is shaped by serving in many roles related to cultural heritage preservation, material culture and archaeology including non-profit, education and private practice environments with a variety of materials and in locations from the Arctic to the Antarctic, South America and across the Near East and Africa. She believes that more open, wide-reaching and transparent communication with realistic goals and resources can lead to better understandings of the past and finding future directions for the preservation of significant heritage sites and objects. Susanne currently lives in Taranaki, New Zealand and is principal for Heritage Preservation and Field Support Solutions.

Megan Wells is the Poutiaki Hītori-a-Papori, Social History Curator at Puke Ariki Museum in New Plymouth, Aotearoa New Zealand. With over a decade working in regional and national museums in Aotearoa, she loves the challenge diverse collections provide and sharing the community stories that are hidden in collections, waiting to be discovered. Her previous roles at the National Army Museum Te Mata Toa, Nelson Provincial Museum and Founders Heritage Park have provided this diversity which she has shared through both exhibitions and published research. Her publications include a chapter in Annabel Cooper, Angela Wanhalla and Lachlan Paterson's *The Lives of Objects* (Otago University Press).

Ron Lambert was born and raised in Taranaki. He obtained a BSC (Hons) from Victoria University in Wellington then worked as a scientist at Forest Research Institute in Canterbury for five years from 1967, working on population dynamics and distribution of chamois in South Island. He was then appointed as deputy director at Taranaki Museum and became director in 1975. On the establishment of Puke Ariki in 1999, he was appointed senior researcher, a position he held until his retirement in 2016. His published works include *Taranaki - An Illustrated History* and *In Crude State - The Moturoa Oilfield* as well as articles in *NZ Geographic*, *Historic Places Trust News*, etc.

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CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

CONSERVATION OF A
FROM THE WAITOMO DISTRIC

INTRODUCTION

Located in the middle of the west coast of the North Island of Aotearoa New Zealand, Taranaki has a renowned role in shaping the historical cultural narrative of the nation's development. Additionally, the extensive coastline and prominent dormant volcano are cornerstones to the natural history of the region. In 1975, a 26-metre-long blue whale (Balaenoptera musculus) washed onshore in the neighbouring Waikato region. The distal pectoral flipper was recovered from the badly-decayed carcass and prepared for display. At the time, there was a strong recording programme in place for cetaceans through the New Plymouth Underwater Club supported by then Taranaki Museum (now Puke Ariki) and then Dominion Museum (now Museum of New Zealand Te Papa Tongarewa).

Blue whale remains after washing up on the beach. Source: Taranaki Daily News. December 1975. Taranaki Newspapers Limited. Supplied by Puke Ariki.

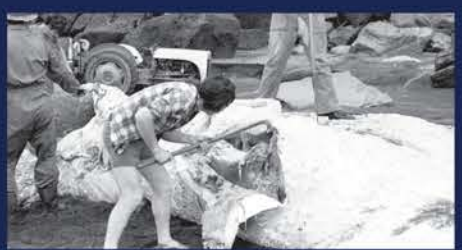
CHANGING CONTEXT OF WHALES IN TARANAKI

This blue whale flipper is representative of the changing role of natural history collections in New Zealand's museuological past. Māori, the indigenous peoples of Aotearoa, have a long history with whales and consider them taonga (sacred). Whereas early collecting practices separated taonga from Māori; today many museums in Aotearoa actively work to increase consultation and to reunite iwi with their taonga. While Puke Ariki is working to strengthen relationships with Māori communities, the museum also serves as a whare taonga (place to store sacred things). This includes a mandible from a later stranding which is under iwi ownership and on loan to the museum.

Today, the Department of Conservation Te Papa Atawhai work with iwi and hapū (tribes and sub-tribes) to manage cetacean strandings and ensure appropriate cultural protocols occur. However, in the 1970s, the recording and collection of such specimens were scientifically rather than culturally driven. Both then and today, there are very few people recording the natural history of the region using Western science approaches and currently there is no specialist natural sciences curator at Puke Ariki.

SPECIMEN PREPARATION IN THE 1970

The flipper was removed from the beach to a farm. Once a large enou was placed on the ground to ensure the remains could be excavated e years, the bones were removed, washed and dried in the sun. Some o from the movement in the tidal zone and these only became visible af The bones were restored using metal dowels, epoxy, plaster and pain placed on display.



Removing the flesh from the remains. Source: Taranaki Daily News. 1 Taranaki Newspapers Limited. Supplied by Puke Ariki.

Flipper being revealed after three years burial. Source: Source: Taranaki Daily N 21 July 1979. Taranaki Newspapers Lim Supplied by Puke Ariki.

BLUE WHALE FLIPPER
T, AOTEAROA NEW ZEALAND

21ST CENTURY CONSERVATION

The preparation of the whale flipper used non-traditional practices influenced by the resources available at the time. During deinstallation for gallery renovations, the curator noted several concerns. There was an oily brown substance that was emitting an odour, a white powdery substance on the surface and the cracks in the joins in the phalanges were visible. The main goal in the restoration was to remove the oily substance and white powder residues while also removing the original overpaint. This revealed cracks and fragmentation in the original plaster repairs. The bone was reattached to the original plaster and dowels using 40% Paraloid B-72 in acetone with 10% Paraloid B-72 in acetone base layers, the cracks were filled with Superfine White Milliput® and inpainted with Holbien HWC® watercolours over a barrier layer of 10% Paraloid B-72 in acetone. The oily substance was removed using boiled ethanol and 25% (aq) ammonia applied with lint-free cloths. The white powdery substance was analysed using Elemental Dispersive Spectroscopy (EDS) and revealed to be a largely calcium-based substance with a fatty consistency. Chemical removal was successful using a 1:1:1 acetone:ethanol:water solution on some areas and a 10% (aq) hydrogen peroxide solution on others. The surface formations are likely a result of an incomplete fat-removal process where the oils continue to leech out of the bone. The result of conservation has led to a cleaned, stabilised surface with more detailed inpainting that can be monitored for future changes.

Before and after treatment images of a metacarpal. Source: HPFS Solutions.

Radius of the flipper showing the formation of a sticky brown substance. Source: Puke Ariki.

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gh hole was dug, chicken netting asily. After approximately three f the phalanges had been broken ter the recovery of the bones. t then mounted to a board and

1 January 1976.

of ews. ited.

ON DISPLAY AT PUKE ARIKI

The blue whale flipper became iconic in the collective memory of the Taranaki community due to its size (bigger than dinosaurs!), the captivating similarity to human hand and finger bones, and the lengthy display time that lasted over 30 years, through generations of visitors. Recent redevelopment of the gallery spaces has meant that the flipper was removed from display. The conservation treatment therefore prioritised stabilisation and treatment for storage.

Flipper on display at Puke Ariki. Source: Puek Ariki.

Puke Ariki
MUSEUM • LIBRARIES • VISITOR INFORMATION

Mountain to Sea
Te Kaunihera-ā-Rohe o Ngāmotu
NEW PLYMOUTH DISTRICT COUNCIL
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Heritage Preservation × Field Support Solutions

Contamination in Repatriated Objects in African Museums?

A call for Safety Measures in the Handling and Display of the Objects

By Davison Chiwara, Siona O'Connell and Maggi Loubser

Repatriation of looted artefacts from countries in the global north to Africa is a topical issue which has seen African countries demanding the return of artefacts looted by countries in the global north during the colonisation of the continent. Some countries in the global north have responded to the demands of African countries by agreeing to return the looted artefacts back to Africa. Against this background, the aim of this study was to propose safety protocols for the protection of staff and various users of artefacts in African museums and preventing cross-contamination of local artefacts from repatriated ones that are potentially contaminated with harmful pesticides.

The objectives of the study included: the assessment of international, regional and national legislations on the repatriation of looted artefacts to their countries of origin and evaluation of safety protocols on handling, use, storage and exhibition of repatriated artefacts in selected African museums. Data collection methods included desktop survey, observations and interviews with museum staff.

Research findings showed that international conventions and heritage laws in Africa do not address the issue of pesticide analysis of repatriated artefacts. The research findings also showed that in some cases there is lack of awareness, particularly among museum staff in Africa, of contamination of artefacts, which can be a health hazard to them if safety protocols are not followed in the handling and use of the artefacts.

The research recommends that all repatriated artefacts to Africa be tested for pesticide contaminants, that those that have not been tested for chemical contamination be treated as suspicious artefacts, and that conservation measures must be instituted in the museums to prevent cross-contamination with other collections. These measures include quarantining of the artefacts and exhibiting them in sealed exhibition cases. Additionally, safety equipment such as nitrile gloves, respirators, goggles and protective overalls should be worn when handling repatriated artefacts to protect humans from harmful effects of possibly contaminated repatriated artefacts.

Davison Chiwara received his PhD from the University of Pretoria, South Africa. His PhD focused on the scientific investigation of pesticide contaminants on organic collections at the Natural History Museum, Zimbabwe, with the aim of establishing safety protocols for their handling and use and to prevent further deterioration of the collections from pesticide use. He is also a lecturer in the Department of Archaeology, Cultural Heritage and Museum Studies at the Midlands State University, Zimbabwe. His research interests lie in the conservation of heritage and museum and gallery practice.

Professor Siona O'Connell, from the Faculty of Humanities at the University of Pretoria, is widely respected for her work on restorative justice in South Africa. Her co-edited book *Hanging on a Wire* won the 2018 National Institute for the Humanities and Social Sciences (HSS) award for the best non-fiction edited volume, and her monograph on forced removals in Cape Town, *An Impossible Return: Cape Town's Forced Removals*, continues to garner broad recommendations. O'Connell is a Brown International Advanced Research Institutes (BIARI) alumnus and was the NEH Distinguished Visiting Professor of the Humanities at Colgate University in the USA in 2018-19.

Maggi Loubser: In a career as an analytical chemist spanning three decades in the mining and manufacturing industry, Maggi worked in government, academia and industry and ran her own consulting company. At the beginning of 2019, she was appointed by the University of Pretoria to run the new Masters Programme in Tangible Heritage Conservation. Currently she is teaching science to students with a humanities background to equip them to better understand the materials they work with in conservation and research of cultural heritage objects.

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Abstract

Repatriation of looted artefacts from countries in the global north to Africa is a topical issue which has global north have responded to the demands of African countries by agreeing to return the looted Museums and to prevent cross-contamination of local artefacts from repatriated ones that are potent of looted artefacts to their countries of origin; and the evaluation of safety protocols for handling, use, with museum staff. Research findings showed that international conventions and heritage laws in Afr contamination of artefacts particularly those repatriated to Africa among museum staff in Africa, whi artefacts to Africa be tested for pesticide contaminants and that those that have not been tested for ch other collections. These include quarantining the artefacts and exhibiting them in sealed exhibition c protect humans from the harmful effects of possibly contaminated repatriated artefacts.

Keywords

Chemical contamination, Artefact repatriation, Safety Protocols

Introduction

This poster addresses the issue of pesticide contamination of artefacts in African museums, particul cultural heritage laws in Africa, as well as during repatriation negotiations between museums in the shown that some pesticides such as arsenic, mercury, lead, naphthalene and malathion are harmful t

The Return of African Artefacts from Museums in the Global North

Countries from the global north such as France and Germany have responded to calls for repatriation of African artefacts by agreeing to return the artefacts looted from Africa. France has returned 26 artefacts to Benin, which had been pillaged in 1892. Germany has agreed to return many bronze artefacts held in its museum collections (Bakare2021; Mcgreevy 2021). However, what is missing from repatriation discussions and literature is the issue of testing for possibly contaminated artefacts that are being returned to Africa. This is further worsened by the fact that international conventions, guidelines, African charters, protocols and heritage laws do not address the issue of testing for contamination on repatriated artefacts and the safety measures for the protection of museum staff and museum visitors (See table 1).

- Operational guidelines of the UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property
- The 1977 United Nations General Assembly Secretary General's report on the Restitution of Works of Art to Countries Victims of Expropriation
- Intergovernmental Committee for Promoting the Return of Cultural Property to its Countries of Origin 1986 Guidelines
- The 1995 UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects
- The 2006 Charter for African Cultural Renaissance
- The Southern AfricanDevelopment Community (SADC) Protocol on Culture, Information, and Sport
- South Africa's National Heritage Resources Act Number (SAHRA) 25 of 1999
- Zimbabwe's National Museums and Monuments Act [Chapter 25:11]; National Gallery of Zimbabwe Act [Chapter25:09]; and National Archivesof Zimbabwe Act [Chapter 25:06]

Table 1. Conventions, Charters and Selected Laws Impacting Repatriation of Artefacts to Africa.

Contaminated Artefacts in Museums in the Global North

Analysis has shown that some artefacts in museums in the global north ar contaminated with harmful pesticides such as arsenic, mercury and lea (Falkenberg 2015; Hahn and Krug 2015; Lang and Zimmer 2015 Caldararo et al 2001; Odegaard and Sadongei 2001; Purewal 2001; Siroi 2001). A wide variety of pesticides have been used consistently for over century ago to prevent, destroy, repel or mitigate pests to preserv museum artefacts (Goldberg 1996). An estimated 95% of artefacts fro sub-Saharan Africa are kept outside the African continent (Godonou 200 cited in Gofswald 2009). This is quite a huge number of artefacts lost b Africa to countries in the global north. Possibly some of these artefact could have been treated with harmful pesticides as a way of preservin them and they could be repatriated back to Africa. This is an importan issue that deserves urgent attention to safeguard museum staff and user of the artefacts in African museums, as well as prevent cross contaminating artefacts in local museums.

Analysis of Pesticide Contaminants in Artefacts

Interviews with selected staff from museums in Zimbabwe showed tha most of them are not aware of pesticide contamination of artefact including those repatriated from the global north. Against this backgroun there is a need for analysis of the artefacts within African museums t determine the pesticide contaminants and institute safety measures fo the handling, use, display and storage of the artefacts, as is currentl happening at the Natural History Museum of Zimbabwe, courtesy o sponsorship by the Department of Tangible Heritage Conservation, at th University of Pretoria (See Figures 1-4). However, many African museum cannot afford the costs of analysis as the equipment and materials neede are beyond the reach of many museums in Africa. Thus African museum need to be capacitated for the analysis of pesticide contaminants.

ted Objects in African Museums? n the Handling and Display of the Objects.

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s seen African countries demanding the return of artefacts looted by countries in the global north during the colonisation of the continent. Some countries in the artefacts to Africa. Against this background, the study aimed to propose safety protocols for the protection of staff and various users of artefacts in African ially contaminated with harmful pesticides. The objectives of the study included: the assessment of international, regional and national laws on the repatriation , storage and exhibition of repatriated artefacts in selected African museums. Data collection methods included desktop surveys, observations and interviews ica do not address the issue of pesticide analysis of repatriated artefacts. The research findings also showed that in some cases there is a lack of awareness of ch can be a health hazard to them if safety protocols are not followed in the handling and use of the artefacts. The research recommends that all repatriated hemical contamination be treated as suspicious artefacts, and conservation measures must be instituted in the museums to prevent cross-contamination with ases. Additionally, safety equipment such as nitrile gloves, respirators, goggles and protective overalls should be worn when handling repatriated artefacts to

arly those that are being repatriated from countries in the global north. We argue that this issue is not given enough attention in international conventions and global north and African museums. This issue must be urgently addressed to ensure the safety of recipients of repatriated artefacts in Africa. Research has o human health and they cause cancer and kidney, lung, liver and heart failures (Dawson 1992).

Figure 1: XRF Analysis of Specimens at the Natural History Museum of Zimbabwe

Figure 2. Collections of Samples at the Natural History Museum of Zimbabwe for Chromatographic Analysis of Pesticide Contaminants

Figure 3. Condition Assessment of Specimens for Pesticide Contaminants at the Natural History Museum of Zimbabwe

Figure 4: Powder Residues of Pesticide Contaminants at the Natural History Museum of Zimbabwe

Conclusion

Pesticide contamination of artefacts in African museums, particularly those that are being repatriated to Africa needs to be urgently addressed. International conventions, charters, and protocols on repatriation, as well as heritage laws in Africa, must be reviewed to provide a legal basis for the enforcement of testing of repatriated artefacts to Africa. The artefacts must be tested for pesticide contaminants. In the absence of testing, safety measures must be instituted in African museums to protect museum staff and users of the artefacts in Africa. These include quarantining artefacts that are suspected of being contaminated, displaying and storing contaminated artefacts in sealed cases, and wearing safety equipment such as nitrile gloves, goggles, respirator masks and dust coats when working with contaminated artefacts as well as working in contaminated environments.

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Developing Cultural Sustainability through Revival of Traditional Craftsmanship: Rescue Role of the City Palace Museum, Udaipur, India

By Dr Vandana Singh and Dr Hansmukh Seth

India, a diverse country with rich cultures, art forms, and traditions, has long recognized the importance of sustainability. The traditional handicraft industry, which has been a source of livelihood for craftsmen since ancient times, embodies the essence of sustainable practices. These craftsmen employ antique techniques and age-old traditions to create eco-friendly products that are not only unique but also contribute to the preservation of ecosystems and natural resources vital for our existence. However, the rapid growth of mass-scale production methods poses a threat to these traditional practices, jeopardizing their survival. Moreover, the COVID-19 pandemic has further impacted the livelihoods of these craftsmen, highlighting the urgent need to protect and value their invaluable skills.

To rescue and revive traditional craftsmanship, the author suggests three crucial steps. Firstly, recognizing that it is an arduous task that requires collective effort, focus should be placed on preserving a single form of craft at a time. Secondly, patronage of artisans and their products is essential. Cultural organizations can play a pivotal role by organizing exhibitions that provide platforms and marketing opportunities for craftsmen to showcase their talent and craftsmanship to a wider audience. Lastly, fostering self-reliance and promoting sustainable practices among artisans is crucial for preserving arts and handicrafts. Educating customers about the value and significance of traditional craftsmanship is also integral to revitalizing the industry.

The City Palace Museum in Udaipur, administered by the Maharana of Mewar Charitable Foundation (MMCF) under the custodianship of Chairman and Managing Trustee Shriji Arvind Singh Mewar of Udaipur, has played a significant role in reviving traditional craftsmanship in Mewar, Rajasthan. Since 1983, Shriji has honoured craftsmen at the MMCF Annual Awards Distribution Ceremony, providing them with much-needed support to sustain their culture. Additionally, since 2012, MMCF has been organizing the World Living Heritage Festival (WLHF) to promote and support local craftsmen who lack access to regional and national markets. The festival has fostered direct interaction between craftsmen and museum visitors, generating renewed interest in traditional craftsmanship. Moreover, the

museum's arms and armour conservation project has incorporated the skills of traditional craftsmen, enabling the transfer of these skills to young conservators and empowering the next generation. These initiatives have not only contributed to cultural sustainability but have also stimulated economic progress and improved the lives of local craftsmen.

By examining the benefits of the City Palace Museum's initiatives, we can observe their positive impact on both the cultural landscape and the craftsmen's well-being. Similar craftsmen exist worldwide, and it is crucial to motivate and support them by enhancing their quality of life and creating economic opportunities, thus promoting sustainable development.

Dr Vandana Singh is a metal conservator, educator and scholar. Since 2018, she has been serving as a conservator at the Arms and Armour Conservation Laboratory at the City Palace Museum in Udaipur. In addition to her conservation work, Dr Singh also shares her expertise as a guest faculty member, teaching metal conservation to aspiring professionals. Moreover, Dr Singh actively engages in conducting capacity building training programs for museum professionals across India, contributing to the development of the field. Dr Vandana Singh has dedicated over a decade of her career to uniting traditional knowledge, conservation practices and sciences. She has a profound interest in exploring and understanding the remarkable material culture of the traditional metal craftsmen community in South Asia. Her work is driven by a passion for preserving and celebrating the rich heritage and craftsmanship of the region.

Dr Hansmukh Seth has been serving as an associate curator at The City Palace Museum in Udaipur since 2013. In this capacity, he brings his expertise and insights to the Museum, contributing to the curation and preservation of its valuable artifacts and historical collections. With a strong academic background, Dr Seth has presented his research findings at over 40 conferences, making significant contributions to the field. In addition, Dr Seth's scholarly work extends to publication of research papers and articles. Dr Seth's passion for sharing knowledge extends to academia, where he has been actively involved in teaching ancient Indian history, museology, and history of Indian science and technology at regional universities.

Eternal Mewar
Custodianship unbroken since 734 AD
Maharana of Mewar Charitable Foundation

Developing Cultural Sustainability through Rescue Role of the City Palace Museum, Uda

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Sustainability in Traditional craftsmanship

Sustainability is mainstream in India since ancient times when the traditional handicraft industry has been providing livelihood opportunities to our craftsmen. The speciality of their crafts also dwells on the use of antique technique and age-old traditions with the potential to churn out various eco-friendly products that can be distinctly unique based on their utility and quality. Thus, they are preserving the areas of the ecosystem and natural resources, required for the continuation of life.

The dilemma of Traditional craftsmanship

With the onslaught of fast-paced mass-scale production methods, survival of the traditional practices is at stake. Secondly, these craftsmen paid heavily with the loss of livelihoods during the pandemic. This is because they have no choice. The one thing they do have, which we must recognise, protect and value, is their skills, which no one else could replace in their absence. The challenge is to maintain and pass on these traditional skills to the future generations.

Key steps

The author suggests three key steps to rescue and revive traditional craftsmanship

1. Concentrate on one or single form of art or craft
2. Patronage Artisans and their products
3. Artisans are exposed to self-reliance and sustainable practices.

Further information

The synergy of craft, conservation, and cutting-edge technology: Conservation of arms and armour at the City Palace Museum, Udaipur, India. In Transcending Boundaries: Integrated Approaches to Conservation. ICOM-CC 19th Triennial Conference Preprints, Beijing, 17–21 May 2021.

The City Palace Museum Initiatives

The City Palace Museum, Udaipur under the custodianship of Maharana of Udaipur, Shriji Arvind Singh Mewar provided the infuse the support for the revival of traditional craftsmanship Cultural sustainability as a concept is place-specific. Each loca its own needs, rights, and responsibilities for more sustainabl has preserved the rich legacy by facilitating the following initi

Annual award ceremony fo craftsman

Since 1983 craftsmen have beer MMCF Annual Awards Distributi Udaipur, which made big differe ability to sustain their culture.

Promotion of hereditary c World Living Heritage Fes

Since 2012, MMCF has initiated Heritage Festival, with the Inten craftsmen who are great in thei access to the regional and natio direct interaction with craftsme in museum visitors.

Incorporation of traditiona Arms and armor conservat

Since 2018, traditional Mewari s working together with conserva involvement of craftsmen in suc boosting their economic progre lives.

Passing on traditional kno and skill

Learning traditional skills and a conservation is an influential m cultural sustainability. During th conservators were upskilled an working together with craftsme

n Revival of Traditional Craftsmanship: aipur, India

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In Summary

By improving the quality of life and creating various economic benefits, heritage organizations can contribute to the sustainable development of craftsmen. Initiatives taken by the City Palace museum impact the bottom line of the culture field and the craftsman's benefits. Each activity has added value to the lives of traditional craftsmen. Many such craftsmen exist in the world. They merely require the recognition and encouragement. We need to grow them by promotion and development of their traditional craft. It would be great service to the hard working artisans.

Experimental treatment for black dyed textiles using Japanese traditional adhesives funori and nikawa

By Ajla Redzic[1], Moe Sato[2], Hisae Watanabe[1] and Noriko Hayakawa[1]
[1] *Tokyo University of the Arts,* [2] *Tokyo National Museum*

Significant degradation of black textile dyed using a natural colorant involving tannic acid and iron mordant has long concerned conservators and has been one of the most difficult issues to solve in the conservation field. The metal salt, known as green vitriol in the Middle Ages, has been used in textile dyeing for the fixation of colour to the dyed substrate. However, iron ions act as an initiator of fibre deterioration, causing extreme chemical and structural modifications to the fibres. Effective conservation treatments have not been established to date. This degradation process is manifested as excessive divalent iron ions in the fibres reacting with oxygen to produce hydrogen peroxide and hydroxyl radicals, inducing iron-catalysed oxidation and acid hydrolysis.

Current studies have suggested the ability of funori and nikawa, traditional Japanese adhesives, to capture the iron ions. This study shows evidence that nikawa (a traditional Japanese cowhide adhesive of B-type gelatine glue) and funori (consolidant and adhesive made from a Japanese cultivated *Gloiopeltis* genus seaweed—sulphated polysaccharide) demonstrate capability in absorbing the metal ions. Based on the study results, this research aims to examine the application of funori and nikawa on iron-mordant deteriorated fibres.

The test silk and cotton fabrics were dyed with iron-tannate dye (1 wt% tannic acid aq., followed by 2 wt% $FeSO_4$ aq.). The dyeing process was repeated three times. Sample preparation consisted of accelerated ageing (1-3 days for cotton samples, 14-28 days for silk samples) in conditions of 80°C/65%RH and subsequent treatment with funori (1.4 wt%, 0.6 wt%, and 0.2 wt%) and nikawa (1 wt%) solutions in deionised water. Bathophenanthroline, surface pH and tensile tests were used to characterise the dyed, undyed, artificially aged and unaged samples.

The Bathophenanthroline test performed on dyed cotton samples (an iron ion detection test in the form of an indicator test paper) enabled the identification of soluble iron (II) ions (the indicator paper turns from white to magenta when iron ions are detected). A higher detection rate of iron (II) ions was exhibited on samples that underwent accelerated ageing. The highest level (the strongest magenta hue) was identified in the samples treated with funori which were artificially aged before and after the treatment.

The surface pH of dyed cotton samples displayed increased acidity when artificially aged. Compared to the samples without the treatment, samples treated with funori and nikawa, especially in higher funori percentages, exhibited lower acidity levels.

Tensile strength of cotton samples (under 23°C/50%RH conditions) showed differentiation in force due to the processes of iron-tannate dyeing and accelerated ageing. The tensile strength was lower in dyed and artificially aged samples than in undyed and unaged samples. The highest tensile strength in the group of undyed, unaged and artificially aged (1 day/3 days) samples was exhibited in the sample with funori treatment, artificially aged for 3 days. A similar condition was displayed in the group of dyed cotton samples.

Iron-tannate dyed samples exhibited low tenacity, significantly enhanced after accelerated ageing, causing loss of colourfastness and increased fragility. The ageing process increases the presence of free iron ions. Samples treated with funori exhibited a higher iron ion detection rate; however, the pH of those samples was higher than the pH of untreated and artificially aged samples. It is suggested that funori, by increasing the pH value of the samples, prevented the formation of hydroxyl radicals thus preventing acid hydrolysis. Funori also affected the tenacity of the samples by acting in the form of a fibre strength enhancer.

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Ajla Redžić is a doctoral student at the Department of Conservation Science, Graduate School of Fine Arts of the Tokyo University of the Arts. She graduated from the integrated interdisciplinary study programme in conservation and restoration organized by the Academy of Fine Arts and the Faculty of Natural Sciences and Mathematics of the University of Sarajevo. She founded and ran an independent conservation studio, Reparera, specializing in the restoration of paper materials. She also worked as an expert advisor for the Protection of the Cultural Heritage of National Minorities in the Sarajevo Canton. Her principal interest is preventive conservation.

Noriko Hayakawa studied polymer science at the Tokyo Institute of Technology, Japan and obtained her master of engineering degree in 1998. She has been working as a conservation scientist at the Tokyo National Research Institute for Cultural Properties since 1998. She received a PhD in conservation science from the Department of Conservation Science, Graduate School of Fine Arts, Tokyo University of the Arts, in 2018. Her principal interests are the characterisation of conservation materials, especially traditional Japanese organic materials, and the development of conservation methods for artefacts. Since 2016 she has been the head of the Material Science Section. She has also taught at the graduate school of Fine Arts of the Tokyo University of the Arts as a professor since 2012.

Hisae Watanabe is an assistant in education and research at the Graduate School of Fine Arts, Tokyo University of the Arts. She received a master's degree in cultural property conservation from Tokyo University of the Arts in 2009. Her specialty is cultural property buildings, and she is interested in the preservation of historic townscapes and repair techniques for buildings. Her previous employers have been City Hall, National Research Institute for Cultural Properties, Tokyo and Tokyo University of the Arts. Hisae has held her current position (at the Preventive Conservation Lab) since 2020.

Moe Sato is textile conservator at the Tokyo National Museum (TNM) in Japan. She received her PhD in conservation science in 2012 from the Kyoto Institute of Technology, Japan. After completing an MPhil programme in textile conservation at the University of Glasgow in 2014, she trained at the Abegg-Stiftung textile conservation workshop in Switzerland as a postgraduate intern and at the Arts of Africa, Oceania, and the Americas, the Metropolitan Museum of Art, New York as a senior research intern. From 2016 she was assistant conservator at the Kyoto Costume Institute in Japan before joining the TNM in 2020.

Experimental treatment for black dyed textiles traditional adhesives funori and nikawa

Ajla Redzic, Noriko Hayakawa, Hisae Watanabe (Tokyo University of the Arts) and Moe Sato (Tokyo

Introduction

Significant degradation of black dyed textile by natural dye involving tannic acid and iron mordant is one of the most difficult to so
This metal salt, in Middle Ages, known as green vitriol, has been used in textile dyeing for the fixation of colour to the dyed substr
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adhesive, made from a Japan cultivated *Gloiopeltis* genus seaweed (by chemical composition sulphated polysaccharide), demonstr
nikawa on iron-mordant deteriorated fibres.

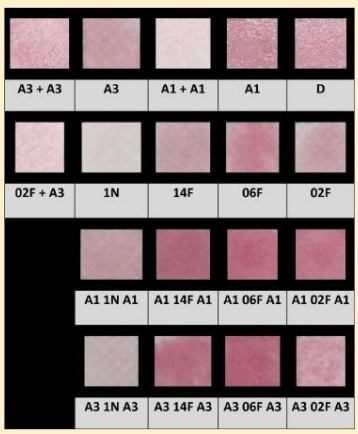
Experiments

- The model silk and cotton fabric were dyed with iron-tannate dye (1 wt% tannic acid aq., followed by 2 wt% $FeSO_4$ aq.).
- The dyeing/mordanting process was repeated three times.
- Sample preparation consisted of accelerated ageing (1-3 days for cotton samples, 14-28 days for silk samples) in conditions of 80°C/65%RH, and treatment with funori (1.4 wt%, 0.6 wt%, and 0.2 wt%) and nikawa (1 wt%) solutions in deionised water.
- Bathophenanthroline, surface pH, and tensile tests were conducted to characterise model dyed and undyed, artificially aged, and unaged samples.

Results

- **The Bathophenanthroline test** of dyed cotton samples (an iron ions detection test in the form of an indicator test paper) enabled the identification of soluble iron (II) ions (turns from white to magenta when iron ions are detected).
- A higher detection rate of iron (II) ions was exhibited on samples induced by accelerated ageing.
- In contrast, the highest level (the strongest magenta hue) was identified in the samples treated with funori and two times artificially aged (before and after the treatment) compared to the samples artificially aged for the same amount of time without funori treatment.

D = Unaged/untreated
A1 = 1 day aged A3 = 3 days aged
02F = 0.2% funori 06F = 0.6% funori 14F = 1.4% funori 1N = 1% nikawa



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Conclusions

- Iron-tannate dyed samples exhibited low tenacity, significantly enhanced after accelerated ageing, causing loss of colourfastne
- The ageing process increases the presence of free iron ions.
- Samples treated with funori exhibited a higher iron ions detection rate; however, the pH value of those samples was higher th
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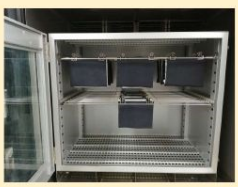
t oxidation and acid hydrolysis.
udy signifies the evidence that nikawa, a traditional Japanese cowhide adhesive (B-type gelatin glue) and funori, consolidant and
rated capability in absorbing the metal ion. Based on the above results, this research aims to examine the application of funori and

cial ageing I

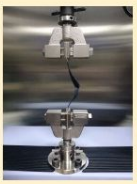
Funori preparation

Funori/nikawa treatment

Artificial ageing II



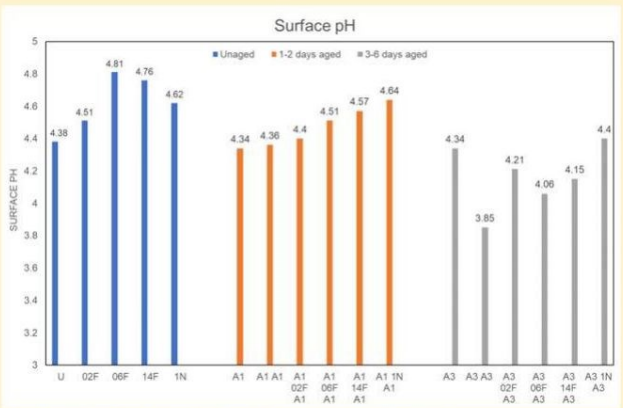
Tensile test



Tensile tested samples

rface pH test of
otton samples
ed increased
when artificially

red to the
s without the
ent, samples
with funori and
especially in
funori
ages, exhibited
cidity levels.



U = Untreated A1 = 1 day aged A3 = 3 days aged
02F = 0.2% funori 06F = 0.6% funori 14F = 1.4% funori 1N = 1% nikawa

- **Tensile strength** of cotton samples (under 23°C/50%RH conditions) showed differentiation in force due to the processes of iron-tannate dyeing and accelerated ageing.
- The tensile strength was lower in dyed and artificially aged samples than in undyed and unaged.
- The highest tensile strength in the group of undyed, unaged, and artificially aged (1 day/3 days) samples was exhibited in the sample with funori treatment, artificially aged for 3 days.
- A similar condition was displayed in the group of dyed cotton samples.

ess, and fragileness.

an the pH of funori untreated and artificially aged samples.
enting acid hydrolysis.

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GIS Technology for Documentation of Wall Paintings in Northern Portugal with a Dark Stain Phenomenon

By Alexandra Marco[1,2], Frederico Henriques[1], Eduarda Vieira[1], Manuela Pintado[3] and Patrícia R. Moreira[1,2]

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We often come across a problem of deterioration in some 15th- and 16th-century mural painting ensembles covering the inner walls of granitic Romanesque religious buildings in northern Portugal. This degradation is manifested in the production of a dark pigmentation that stains both the granite supports and the mural paintings (Marco, 2016). It is difficult to ascertain the origin of this phenomenon, and it may be due to several conjugated factors such as microbiological and chemical attack.

Through the gathering of relevant data associated with geographical issues, a database in a Geographic Information System (GIS) was created to understand and uncover spatial analysis correlations between the potential factors of the deterioration (Burroughs & McDonnel, 1998; Huisman & Rolf, 2009).

A map is being created on open-source software (QGIS®) to pinpoint the location of each case study along with its relevant information that will allow the characterization of this phenomenon. The fire hazard regions map and the hydrographic pathways map have been added as a tool for a preventive conservation viewpoint. The data was collected to determine the mural paintings' common features and to connect them to the appearance of chromatic alterations with information necessary to obtain further insights. This data organization allows for reasonable access and ease of retrieval of information which can then be transferred to important stakeholders such as city councils.

This project is an ongoing investigation that requires information gathering from heritage documentation sources and *in situ* verification. For that purpose, 67 mural paintings in northern Portugal and, currently, five in northern Galicia are being surveyed; data is collected, organised and assembled into categories based on geography, monument characteristics and wall painting characteristics. Geographical information includes church orientation, environmental surroundings, proximity to graveyards and waterways. Data regarding monument characteristics includes the type of protection, construction date, construction materials and number of openings, among others. Data concerning mural paintings comprises their manufacturing date, materials, technique, painter or guild (if known), restoration interventions and whether they are exposed to the environment or covered by mortar and/or altars, among others (Marco *et al.*, 2019).

The study of georeferenced data is a complement to the research in progress such as the characterisation of the microbiological species responsible for the degradation as well as the characterisation of mural painting pigments, granite, mortar and so on (Campos, 2021).

Mapping these case studies and their chromatic alterations will support conservator-restorers in their conservation activities and will serve as a strategy for preventive conservation guidelines.

To comprehend and substantiate the common characteristics of wall paintings in religious buildings in northern Portugal, a multidisciplinary investigation has taken place. With this project we aim to find a solution for the chromatic alterations of the frescoes, minimising their visual impact without damaging the 500-year-old paintings. This phenomenon, occurring in the Iberian Peninsula, promotes collaboration and co-designed conservation treatments between Portuguese and Spanish investigators.

Funding: This work was supported by the Foundation for Science and Technology (FCT) through POCH (Operational Human Capital Program), co-participated by the Social European Fund (FSE) and MCTES National Fund [Ph.D. grant number SFRH/BD/125596/2016]; the BIO4MURAL – Biotechnology innovative solutions for the removal of pigmentation and preventive conservation of cultural and historically relevant mural painting was funded by FEDER through project reference POCI-01-0145-FEDER-029157 – Operational Competitiveness and Internationalisation Program and by National Funds from FCT – Foundation for Science and Technology [grant number PTDC/HAR-ARQ/29157/2017]; and FCT for funding through the Strategic Projects CITAR [grant number UID/EAT/0622/2016] and CBQF [grant number UID/Multi/50016/2013.

Alexandra Marco graduated in conservation and restoration of cultural heritage and has a master's degree in painting from the Portuguese Catholic University, her thesis on characterization of microbial colonization and removal of black stains from mural painting of the 15th and 16th century in granite religious buildings in northern Portugal. She is an FCT PhD grant research student in conservation of cultural heritage at the same university. She is an integrated member of the Research Centre of Science and Technology of the Arts (CITAR), the author of several scientific publications and co-founder of YOCOCU Portugal—Youth in Conservation of Cultural Heritage.

Frederico Henriques's interests cross over several areas of cultural heritage conservation. His work is focused mainly on computer applications, such as 3D modelling, virtual reconstruction, photogrammetry and geographic information systems. Frederic's leading professional activities include a post-doc program from 2014 to 2018, during which he participated in several academic projects with students and researchers from CITAR (Universidade Católica Portuguesa), HERCULES Laboratory (Universidade de Évora), and CIEBA (Faculdade de Belas Artes da Universidade de Lisboa). In December 2018 he received a contract with Universidade Católica Portuguesa to develop scientific activities in heritage documentation.

Eduarda Vieira holds a PhD in conservation and restoration of historic and artistic heritage from Polytechnic University of Valencia (Spain) and a master's degree in architectonic conservation from Évora University (Portugal). Eduarda is currently assistant professor at the School of Arts of the Portuguese Catholic University (conservation of inorganic materials), where she coordinates the PhD of Conservation and Restoration of Cultural Heritage Programme. She is director of the Research Centre of Science and Technology of the Arts (CITAR) and editor of *Studies in Conservation and Restoration* ECR journal. Eduarda is also a member of ICOMOS and ICOM and a researcher in projects related to preventive conservation and green conservation besides supervising several PhD and master theses. ORCID: ORCID: 0000-0002-0620-080X E-mail: evieira@porto.ucp.pt

Maria Manuela Estevez Pintado has a PhD in biotechnology, is currently associate professor at the College of Biotechnology of the Portuguese Catholic University (ESB-UCP), associate director of the School of Biotechnology from Universidade Católica Portuguesa (ESB-UCP, Porto, Portugal) and the director of CBQF (Centre for Biotechnology and Fine Chemistry – State Associate Laboratory), an ESB-UCP research unit and Associate Laboratory. In the research field she is the head of Bioactive and Bioproducts Research Laboratory.

Patrícia Moreira holds a PhD in biotechnology with specialization in biochemical engineering from Universidade Católica Portuguesa (UCP). She is an assistant professor at the School of Arts – UCP, an integrated member of the Research Centre for Science and Technology of the Arts (CITAR), and coordinates the Heritage, Conservation and Restoration Focus Area of CITAR as well as being a collaborator with the Centre for Biotechnology and Fine Chemistry (CBQF), both UCP. Her main research area is in innovation in biotechnology and nanotechnology for cultural heritage with emphasis on biodeterioration, sustainability, circular economy and citizen science. She co-represents the green conservation movement in Portugal and co-ordinates the RESEARCH PROJECT HAC4CG funded by CCDRN. Patrícia supervised several doctoral and master's theses and is author/co-author of numerous articles in impact journals in her research area.

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CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

GIS Technology for Documentation of Wall Paintings

Alexandra Marco [1,2], Frederico Henriques [1], Eduarda Vieira [1], Manuela Pintado [3], Patrícia R. M

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Introduction

We often come across a problem of deterioration in some 15th and 16th century mural painting (MP) ensembles on the inner walls of granitic Romanesque religious buildings in the north of Portugal (fig. 1). It is manifested by the presence of dark pigmentation staining both granite supports and mural paintings (Marco, 2016 and 2019). The origin of this phenomenon is unknown and may be due to synergy of factors such as microbiological and chemical attacks.

Figure 1. 1. N. Sra. da Azinheira Church (Chaves); 2. Sta. Leocádia Parish Church (Chaves); 3. S. João Baptista da Comenda Church (Arcos de Valdevez); 4. S. Salvador de Ceivães Church (Monção); 5. Sta. Maria Madalena Church (Melgaço); 6. S. Julião de Montenegro Parish Church (Chaves); 7. S. Brás Chapel (Vila Real); 8. Mouçós Parish Church / N. Sra da Guadalupe Church (Vila Real); 9. Cimo Vila Castanheira Parish Church / S. João Baptista Church (Chaves); 10. Sta. Cristina Church (Guimarães); 11. Sta. Maria de Negrelos Church (Sto. Tirso); 12. Sta. Marinha Church (Vila Real).

Objectives

- Gathering of relevant data associated to geographical issues and elaboration of a database in a Geographic Information System (GIS) (Burroughs & McDonnel, 1998; Huisman & Rolf, 2009) to understand and uncover spatial analysis correlations between potential factors of the deterioration;
- Study of georeferenced data to c
the microbiological species responsib
material characterisation of the mura
- Mapping these case studies and t
conservator-restorers in their conser
strategy for a preventive conservation

Methods

A map was created on open-sourc
location of each case study a
characterization of this phenomenon
such the lithology of the region (fig. 2
temperature, i.e.). A fire hazard regio
map have been added as a tool for
All maps were obtained from the "
Environment Agency (APA) (SNIAmb, s
The algorithm used to associate the
maps was the "Count Points in Polyg
Count Point in Polygon).

Figure 2. Lithologic map

Results and discussion

The processing results were observe
attribute tables quantitatively. An ex
taken and 64 were observed *in situ* w
degradation was observed, and 5 n
churches are in the second high-leve
(12,5-15ºC) and also 33 in the
observation of the lithologic map sh
stains are located in granite and simil

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s in Northern Portugal with a Dark Stain Phenomenon

oreira (1,2)

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complement the characterisation of
le for the degradation, as well as the
l paintings (Campos, 2021);
heir chromatic alterations, supports
rvation activities, and will serve as a
n guideline.

e software (QGIS®) to pinpoint the
and its relevant information for
with the incorporation of other maps
2) and climatic variables (precipitation,
ns map, and a hydrographic pathways
a preventive conservation viewpoint.
SNIAmb platform" of the Portuguese
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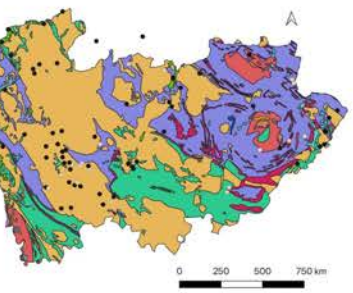
e churches to each class of thematic
on": (QGIS > Vector > Analysis Tools >



d in a new file (shapefile) and in the
haustive survey of 90 churches was
ith dark stain phenomenon. In 21 no
eed further inspection. Thirty-three
l interval of the temperature (T) map
previous interval (10-12,5°C). The
ows that 57% of churches with dark
ar rocks region soil (fig. 2).

In Fig. 3, the selected churches are located mainly in the range of 1200-1400 mm (8 of 13 classes). The analysis suggest that conditions such as high-temperature associated with precipitation in medium-range intervals on specific rock regions may be associated with the dark stain phenomenon, although other variables must still be considered to fully grasp its origin. The database created with the geographical information and church characterization including church's cardinal orientation, environment surroundings (graveyards, waterways, etc.), construction date, as well as date, materials, painter, or guild (if possible) of mural paintings, and whether they are exposed to the environment or covered by mortar and or altars, will constitute a base for further studies.

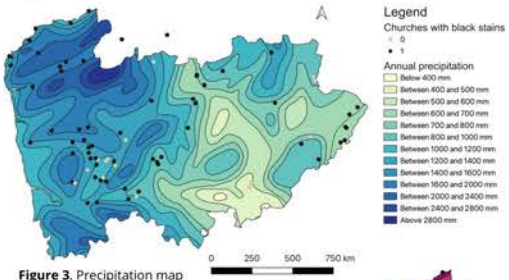


Figure 3. Precipitation map

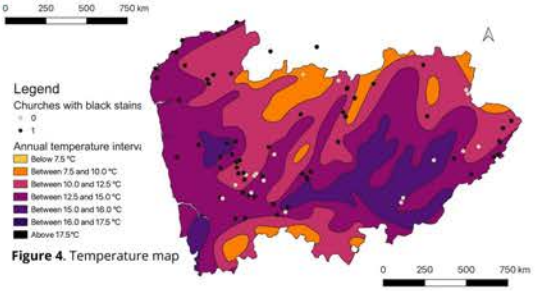


Figure 4. Temperature map

Conclusions

Ninety mural paintings of northern Portugal and five in the north of Galicia were surveyed, and maps related to specific climate and geological variables were constructed that might indicate a relation between these variables and the black stain phenomenon. However, this relation must be further validated as well as expanded with other variables to help clarify the origin of this deterioration problem.

Acknowledgements

This work was supported by Foundation for Science and Technology (FCT) through POCH – Operational Human Capital Program, co-participated by the Social European Fund (FSE) and MCTES National Fund [Ph.D. grant number SFRH/BD/125596/2016]; the BIO4MURAL – Biotechnology innovative solutions for the removal of pigmentation and preventive conservation of cultural and historically relevant mural painting was funded by FEDER – Operational Competitiveness and Internationalization Program [grant number POCI-01-0145-FEDER-029157] and by National Funds from FCT [grant number PTDC/HAR-ARQ/29157/2017]; and FCT for funding through the Strategic Projects CITAR [grant number UID/EAT/0622/2016] and CBQF [grant number UID/Multi/50016/2013.

Identification of Mother-of-Pearl Shell Decorations and Substrates

By Reo Kurashima, Noriko Hayakawa and Koji Kobayashi
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Raden is the practice of decorating substrates with thin pieces of shell or using it for substrates which are then decorated. In Asia, mother-of-pearl shells, such as abalone (*Haliotis sorenseni*), green turban (*Turbo marmoratus*) and South Sea pearl shell (*Pinctada maxima*), have been historically used for making *raden*. However, the first two are difficult to distinguish with the naked eye because of the size of the fragments used to form fine images or patterns and their dull color due to deterioration over time. In this study we attempted to identify shell type through microscale observation and characterization of surface appearance in order to understand the trade routes for shell at the time the artifacts were made and to select methods for conservation treatment of *raden*.

This study was conducted through microscale observation using a scanning electron microscope (SEM), and a multi-angle spectrophotometer (MAS). MAS can detect scattered light at six acceptance angles, which can be useful for determining structural or metallic color. The conditions used were:

· SEM (Hitachi S3700-N), low vacuum (30 Pa), applied voltage 15 kV, and backscattered electron imaging
· MAS (Konica Minolta CM-M6), acceptance angle: -15°, 15°, 30°, 45°, 75°, and 105°, tilt detector off, 10° observer, illuminant D65, CIELAB1976 color system, light direction: double path, automatic averaging of 3 measurements, and 5 measuring points

To avoid the effects of background color during use of the MAS, measurements were performed by placing each sample on the apparatus. Care was taken to ensure that ambient lighting did not affect the results.

The samples were prepared from thin (0.1 and 0.2 mm) and thick (1 mm) films cut from shells (abalone, *T. marmoratus*, and *P. maxima*), which were purchased from two suppliers. Fragments of both abalone and *T. marmoratus* show structural color, but this is not very prominent in *P. maxima*.

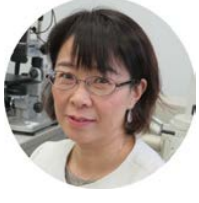
Obtaining high quality images using an optical microscope was difficult because shell fragments have glossy structural color owing to microscopically structured surfaces that cause interference effects in visible light. Therefore, SEM observation was conducted which revealed that abalone and green turban, which is a species of conch, had similar repeating micro-structures (less than 1 μm) whereas *P. maxima*, a species of clam, only showed partially similar structures.

In MAS results, as the acceptance angle increased, the values of a* and b* were low in all samples. Shell layers are considered to show structural color at small acceptance angles whereas their unique color becomes apparent at large acceptance angles.

Focusing on these properties, plotting a* versus b* of each sample at acceptance angle 110°, revealed a trend. The distribution of a* and b* on thin films of abalone, *T. marmoratus* and *P. maxima* showed distinct differences between samples. A similar trend was observed for other samples purchased from different suppliers. For thick films of abalone and *T. marmoratus*, the values of a* and b* differed between samples and shifted in the b* plus direction compared to that of the thin layers. Thick layers had unique colors in comparison to the thin layers. However, regardless of the measuring direction and whether the direction of the shell growth lines was parallel or at a right angle to this, similar results were obtained.

Identification of shell species in shell inlay was attempted by microscale surface observation and the use of a multi-angle spectrometer. As a result, it was possible to distinguish *Pinctada maxima* from abalone and *Turbo marmoratus* by using SEM. It is possible to distinguish between abalone and *Turbo marmoratus* by using both MAS and SEM.

Reo Kurashima received his BA and MA in engineering from the Department of Organic and Polymeric Materials, Tokyo Institute of Technology. He joined the Department of Restoration, Center for Conservation Science, Tokyo National Research Institute for Cultural Properties, as a researcher in 2017. His current research interests are the physical properties of oriental lacquer and materials used in lacquerware.



Noriko Hayakawa studied polymer science at the Tokyo Institute of Technology, Japan and obtained her master of engineering degree in 1998. She has been working as a conservation scientist at the Tokyo National Research Institute for Cultural Properties since 1998. She received a PhD in conservation science from the Department of Conservation Science, Graduate School of Fine Arts, Tokyo University of the Arts, in 2018. Her principal interests are the characterization of conservation materials, especially traditional Japanese organic materials, and the development of conservation methods for artifacts. Since 2016, she has been the head of the Material Science Section.

Koji Kobayashi is a senior fellow at the Tokyo National Research Institute for Cultural Properties (Tobunken). He completed his PhD at the Graduate School of History (Archaeology), Waseda University and has specialized in material and cultural history. Starting with the investigation of Vietnamese mother-of-pearl decoration in 2007, Mr. Kobayashi has been continuously engaged in the study of the history of mother-of-pearl decoration and various objects multiculturally exchanged in Asia. Publications in this field include "Turban Snails and Abalone Shells: The Technique of Mother-of-Pearl Inlay on the Korean Peninsula," *Korean Lacquer Art -Aesthetic Perfection*, 2012; "A Consideration of Namban Lacquer Lecterns and Their Dating", *Bijutsu Kenkyu* No.417, 2016; International Symposium Proceedings, Revised Edition, *In Search of the Multiple Origins of Namban Lacquer*, 2017; "Emergence of Goryeo Dynasty Mother-of-Pearl Decoration from East Asian Perspective", *Misul Jaryo* No.95, 2019 and others.

Identification of Mother-of-Pearl Shell Inlays and Substrates

Reo KURASHIMA, Noriko HAYAKAWA and Koji KOBAYASHI
Tokyo National Research Institute for Cultural Properties, Tokyo, Japan

Introduction

Raden (mother-of-pearl decoration) is a technique used to decorate substrates with shell fragments or to make the decorated object itself (Figure 1 and Figure 2). Relatively large shells with iridescence, such as abalone (*Haliotis sorenseni*), green turban (*Turbo marmoratus*) and South Sea pearl shell (*Pinctada maxima*), have been used as a material for making *raden* in Asia. However, it has been difficult to identify them by visual inspection because of the dull color caused by deterioration over time, or for other reasons. In this study, we attempted identification of shell species by micro-scale surface observation and characterization of surface appearance. The results will be useful for planning conservation treatment and to understand the historical use of shell fragments as an artistic material, and their trade routes.

Methods

Shell fragments were prepared as shown in Table 1 and Figure 3. This study was conducted using surface observation with a scanning electron microscope (SEM) and a multi-angle spectrophotometer (MAS). The MAS can receive scattered light at 6 acceptance angles, which is useful for measuring structural or metallic colors (Figure 4 and Figure 5). The conditions used were:

- SEM (Hitachi S3700-N), in low vacuum mode (30Pa), applied voltage 15kV, and backscattered electron imaging
- MAS (Konica Minolta CM-M6), with acceptance angles -15˚, 15˚, 30˚, 45˚, 75˚ and 105˚, tilt detector off, 10° observer, illuminant D65, the CIELAB1976 color system, double path, automatic averaging of 3 measurements, and 5 measuring points.

Discussion

It was found from SEM imaging that abalone and *T. marmoratus*, a species of conch shell, have similar microstructures whereas *P. maxima*, clams, are distinct (Figure 6).

From the MAS measurements, as the acceptance angle increases, a^* and b^* showed less variation in all samples (Figure 7). Plotting a^* *versus* b^* for each samples at acceptance angle 110˚ revealed a trend. In particular, the values for a^* and b^* on thinner films of abalone and *T. marmoratus* were distinct (Figure 8). *P. maxima* which has no distinguishing features when MAS alone is used, but it was possible to distinguish between abalone and *T. marmoratus* by using both SEM and MAS together (Figure 7).

Conclusions

Identification of shell species in shell inlay was attempted by microscale surface observation and the use of a multi-angle spectrometer. As a result, it was possible to distinguish South Sea pearl (*Pinctada maxima*) from abalone (*Haliotis sorenseni*) and green turban shell (*Turbo marmoratus)* by using SEM. It is possible to distinguish between abalone and *Turbo marmoratus* by using both MAS and SEM.

This work was supported by JSPS KAKENHI Grant Number 20H00037.

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Figure 1 A
Turbo ma

Figure 2 *P*
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Figure 4

Figu
appa

Abalone (left) and
armoratus (right)

Pinctada
from
mmons.
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47.JPG?
a)

Table 1. Samples

No.	Shell	Thickness	Agencies
1	*Turbo marmoratus,*	0.1 mm	A
2		0.1 mm	B
3		0.2 mm	A
4		1 mm	B
5	Abalone	0.1 mm	A
6		0.1 mm	B
7		0.2 mm	A
8		1 mm	B
9	*Pinctada maxima*	0.1 mm	A
10		0.2 mm	A

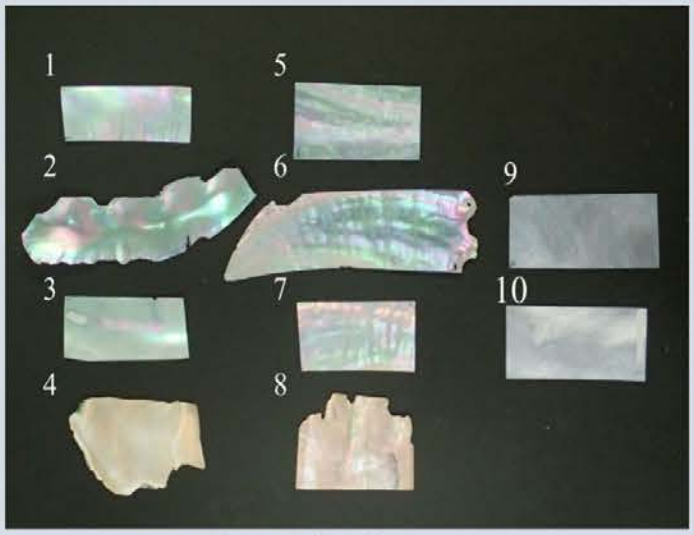
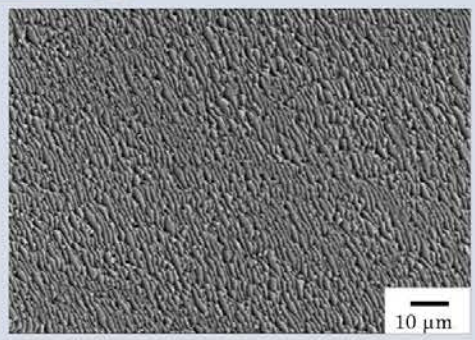
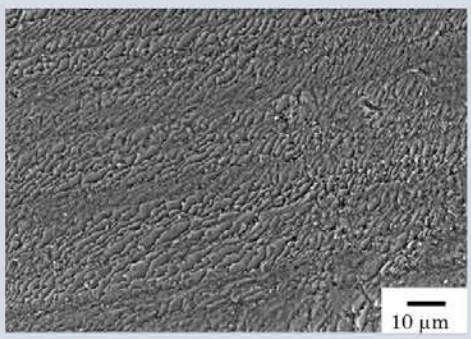


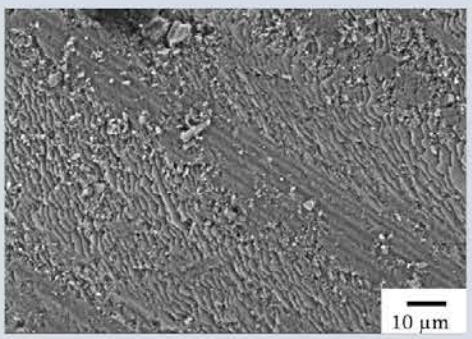
Figure 3 Samples



(a)Abalone

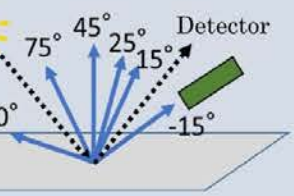


(b) *Turbo marmoratus*



(c) *Pinctada maxima*

Figure 6 SEM images



4 Acceptance angle in MAS

ure 5 The MAS
aratus and a sample

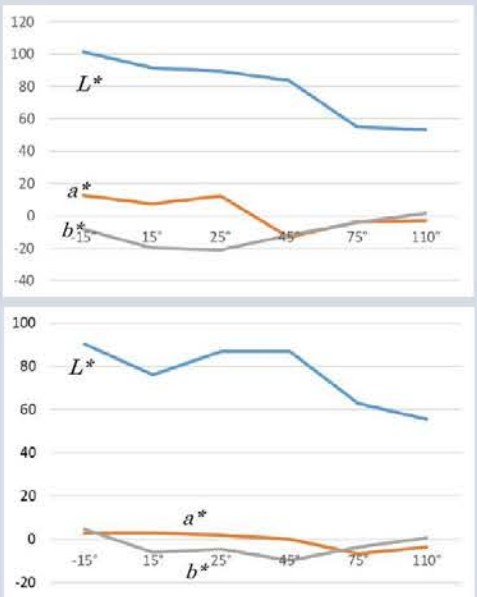


Figure 7 Relationship of $L^*a^*b^*$ to acceptance angle (No.4)

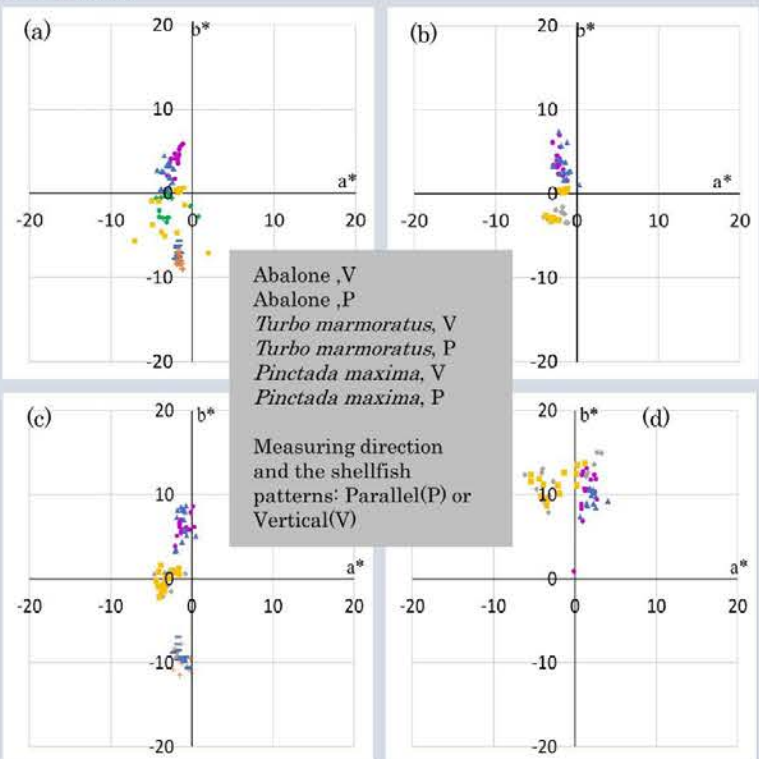


Figure 8 MAS results of (a)No.1, 5, 9, (b)No.2, 6, (c) No.3, 7, 10, and (d)No.4, 8

Identification of Pollutants in Portable Fresco Paintings

By Jessica Bondarczuk and Dr Marilene Maia

In this poster we present the methodology and results of the pollutant analysis done as part of the scientific examination and study of deterioration of a fresco painting. These analyses are part of a broader project entitled Technoscientific Exams in Fresco Painting Restoration Projects in which many other analyses were done to give a complete diagnosis of all deterioration found in the painting.

The analyses were done on a portable fresco made by the students of the famous professor Edson Motta in the 1970s. He was also one of the forerunners in the field of conservation based on the scientific method in Brazil. The studied painting was located in his former office on the seventh floor of Rio de Janeiro's Federal University (UFRJ) School of Fine Arts. With Modern style architecture, the building has wide windows and a facade of mitred glass. The painting was exhibited under those conditions for years, exposed to the weather and adverse conditions including high levels of RH coming from the Guanabara Bay, lack of regular cleaning and maintenance and exposure to air pollution due to its proximity to big highways.

The inside and outside pollutants are especially important factors to consider for preventive conservation and the investigation into the causes of deterioration. According to Jean Tétrault, author in the *CCI Technical Bulletin 37*, a pollutant can be a gas, an aerosol, a liquid or a solid that causes deterioration in a certain material such as corroding, acidifying, weakening of the structure and discolouring. Pollutants can originate outdoors (for example airborne pollutants) or indoors (coming from the material inside the room or enclosures that emit gases).

This study was made in collaboration with the analytical chemistry lab of CETEM – Center for Mineral Technology. For the analysis, samples of dirt were gathered from the front and back surface of the painting with sterilized gauze pads. With the assistance of the lab, the samples were quantified and weighed, then immersed in a solution of hydrochloric and nitric acid, centrifugated and then filtered. The material obtained from the centrifugation was analysed using ICP-OES (industrial coupled plasma optical emission spectrometry) to detect the presence of lead, sodium, manganese, magnesium, calcium, copper, chromium, sulphur and potassium.

The most abundantly found elements were calcium and sulphur: the first one associated with the mortar used; and the second one with the typical airborne pollution from urban environments and burning fossil fuels. The elements

present in lesser quantities were associated with the mineral pigments used in the painting which had migrated to the support by the capillarity of the material and the high humidity of the environment. A possible union of calcium with sulphur can also be implied, forming gypsum, weakening the structure of the fresco, making it more fragile and resulting in the loss of cohesion of the pictorial layer, craquelure and the loss of small fragments.

It was concluded that sulphur, as the main pollutant, had a singular role in the deterioration of the work associated with the abundant moisture present both in the construction technique and in the storage environment.

The results, along with the other analyses, will allow us to make a complete evaluation of the deterioration and its causes, and to formulate a proposal for preventive conservation.

Jessica Bondarczuk is an emerging conservator who graduated from Rio de Janeiro Federal University (2020), worked as a monitor for painting conservation class and developed research on fresco paintings. She recently participated in the conservation project on the National Museum's Pompeiian frescos in partnership with Centro Conservazione e Restauro La Venaria Reale, Italy.

Dr Marilene Maia is a conservator with a PhD in anthropology from the Université Paris X - Nanterre, France (2009), a master's degree in conservation préventive du patrimoine from Université Paris 1 - Sorbonne, France (2003) and a specialization in conservation and restoration of cultural movable properties from the Federal University of Minas Gerais (1993). She currently holds the position of professor of paintings conservation and preventive conservation at the Federal University of Rio de Janeiro as part of the Arts and Preservation Department at the School of Fine Arts.

Identification of Pollutants in Portable Fresco Pain

Bondarczuk, Jessica (jessbondarczuk@gmail.com) - Federal University of Rio de Janeiro; Corrêa Maia, Marilene (marilene
Fine Arts school - Federal University of Rio de Janeiro; da Conceição Ribeiro, Roberto Carlos (RCARLOS@cetem.gov.br) - C

Introduction

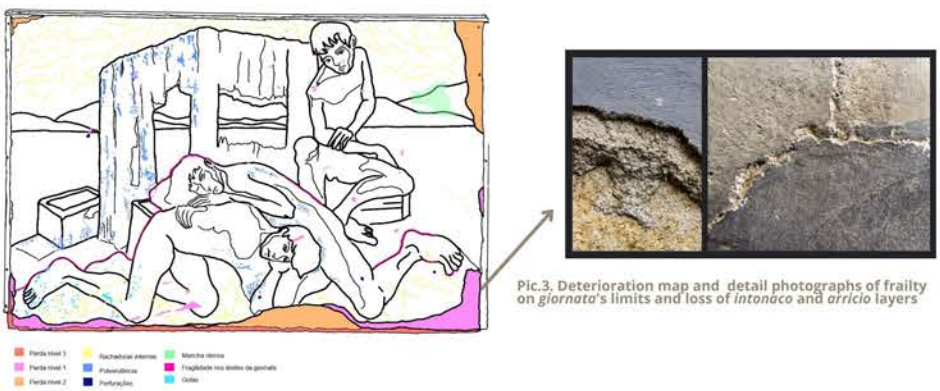
Pic. 1 - Fresco painting by Edson Motta's students

During our Painting Conservation classes of 2018, this curious painting came to our attention. Apparently discarded, this mobile fresco (pic. 1) was found to be a class exercise from the students of Edson Motta: one of the forerunners in the field of Conservation in Brazil, being the co-founder of the first Conservation lab at SPHAN (National Service of Historic and Artistic Heritage) in 1947 (pic. 2).

Pic 2 - Edson Motta at the Setor de Recuperação de Obras de Arte no IPHAN lab. source : Arquivo Noronha Santos, Rio de Janeiro.

We decided to work on analyzing this painting for its peculiar technique of the Italian *vero fresco* since we don't have many fresco paintings in Brazil (especially in Rio), and also because of the importance of researching the methodology used in class by Edson, which combined the teaching of traditional techniques along with its conservation and restoration methods.

The painting was in a "regular" condition, presenting fragility and losses along its *giornata*'s lines and several *intonaco* and *arriccio* parts along its borders near the wooden frame (pic.3). Among all the deteriorations studied in our broader project called ""Technoscientific Exams in Fresco Painting Restoration Projects", here we show our investigation of the influence of the environment and pollutants on the fraglity of the painting.



Pic.3. Deterioration map and detail photographs of frailty on *giornata*'s limits and loss of *intonaco* and *arricio* layers

Surroundings

Pic. 4 - Back view of the awarded Fine Arts school building "Jorge Machado Moreira" named after its architect

The painting was first located in the pro former office on the seventh floor of the Fi school building and after that relocated Painting Conservation Lab on the second floor The painting remained for several years in a room (though the rooms have wide windows almost entirely glass façade) with a lack of cleaning and little air circulation, thus provid perfect environment for the deterioration painting materials (especially the organic o wooden frame and MDF back panel) and blu colors.

Pic. 5 - picture from Google earth with blue arrows showing humidity sources from the bay and red arrows showing the nearness of the highways.-

As for the outside and surroundings, the campus is on an island in the Guanabara Ba also encircled by the city's three main hig Linha Vermelha, Linha Amarela e Avenida Bra DNIT- National Department of Infrastructu Transportation estimate traffic of 600 thousan day, being the main cause of airborne polluta suspended particulate materials.

References: MORA, P., MORA, L. e PHILIPPOT, P. (1984) Conservation of Wall Paintings. Butterworths Series in Conservation and Museology. London : Boston : Butterworths. - SILVA, R. E. C., RIBEIRO, R. C. C. Metodologias disponíveis para cálculo do traço das argamassas históricas - Available methodologies for calculating the trace of historical mortars. In: Jornada do Proj de Janeiro. Rio de Janeiro- CETEM/MCTIC, 2019. - JÚNIOR, A.C. S.O., BRANDÃO, A.M.P.M. O Sistema Clima Urbano da Ilha do Fundão (RJ): Subsídio para o Planejamento Urbano. In: Revista Brasileira de Geografia Física V. 08 N. 01 (2015). - TÉTREAULT, J., Control of Pollutants in Museums and Archives – Technical Bulletin 32. Government of Canada, Canadian (2015). Contatos e intercâmbio americanos no IPHAN: O Setor de Recuperação de Obras de Arte (1947 – 1976). Tese de Doutoramento apresentada à faculdade de Arquitetura e Urbanismo da Universidade de São Paulo.
Pic. 2 - Pintores no Instituto do Patrimônio Histórico e Artístico Nacional: a preservação dos "bens móveis e integrados" no Brasil entre 1937 e 1976. in:-http://caiana.caia.org.ar/template/caiana.php?pag=articles/article_2.php&obj=281&vol=11#_ednref88-

tings: A Case Study

_maia@gmail.com) - Art and Preservation Department -
CETEM - Center for Mineral Technology.

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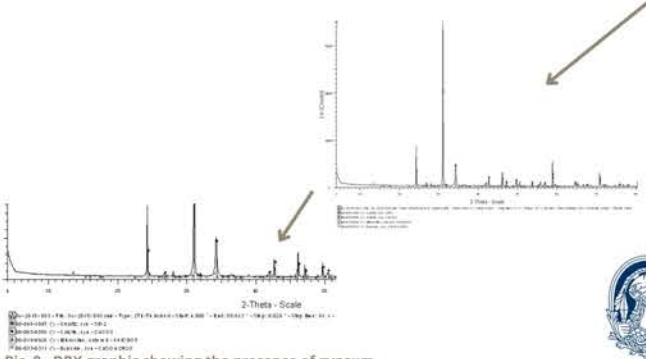
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Methodology

Our analyses were made in cooperation with CETEM – Center for Mineral Technology, our neighbor-building inside the campus. Samples of dirt were gathered from the front and back surface of the paintings with sterilized gauze pads. We chose not to use any system with water due to the fragility of the surface.
So after being quantified and weighed, the samples were immersed in a solution of hydrochloric and nitric acid and were centrifugated and filtered.

Pic. 6 - gathering of dust samples and its centrifgated and filtered solutions

The material obtained from the centrifugation was analyzed in a ICP-OEs (Industrial Coupled Plasma Optical Emission spectrometry) to detect the presence of lead, sodium, manganese, magnesium, calcium, copper, chromium, sulfur, and potassium.



Pic. 8 - DRX graphic showing the presence of gypsum

Results

Elements mg/kg	Ca	Cr	Cu	K	Mg	Mn	Na	Pb	S	Al
Front	1.177,0	0,4	2,5	11,0	74,0	4,6	3,0	8,2	391,0	83,1
Back	2,150,0	1,4	5,4	458,0	117,0	9,3	2,0	41,7	983,0	158,0
Front blank	564,0	--	0,1	265,0	319,0	4,2	164,0	--	263,0	12,1
Back blank	627,0	--	0,4	126,0	354,0	4,5	102,0	--	169,0	11,1

Pic. 7 Result table by elements

The most abundantly found elements were calcium and sulfur: the first one associated with the mortar used; and the second one with the typical airborne pollution from urban environments and burning fossil fuels. The elements in lesser quantity were associated with the mineral pigments used in the painting that migrated to the support by the capillarity of the material and the high humidity of the environment.

Discussion and Conclusion

The sulfur, as the main pollutant, had a singular role in the deterioration of the work associated with the abundant moisture present both in the construction technique and in the storage environment as expected. Also, there was a possible union of calcium with sulfur, forming gypsum, weakening the structure of the fresco making it more fragile, resulting in the loss of cohesion of the pictorial layer, craquelure, and loss of small fragments. The gypsum was not expected to be present in the making of the painting, but it was detected in some samples analyzed through DRX.

Acknowledgments:

I'd like to thank the CETEM labs, the LACON - Conservation and Alterability of Construction Materials Lab, the LARP - Painting Restoration Lab, the biologist Bárbara Tasca, Daniel Barbutti for the pictures, and all the people involved in this project.

UFRJ LaRP CETEM CENTRO DE TECNOLOGIA MINERAL ESCOLA DE BELAS ARTES

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Conservation Institute, 2021. URIBARREN, M. S.

Influence of Silk Production Methods on East Asian Painting Expression and Conservation: Fibre Shape and Durability

By Noriko Hayakawa, Michiko Okabe, Midori Hamada, Riyo Kikuchi, Shigeko Akimoto and Akira Simura

Silk has been used as a substrate of East Asian paintings since ancient times. Traditionally, the silk thread produced from cocoons was reeled by hand in Japan. In the 17th and 19th centuries, simple mechanical instruments were introduced to improve this method, and during the latter half of the 19th century, an auto-reeling system was imported from the West. In this study we examined the differences between traditional silk and the current commercially available silk used for painting from the perspective of fibre shape. The shape influences fibre expression and durability which influences the conservation of silk textiles and silk paintings. Microscopic observation of silk thread shape was conducted using scanning electron microscopy (SEM) and digital microscopy, and durability was evaluated using acceleration ageing tests.

The SEM observations showed that traditional silk, which is hand-reeled, has a thinner and looser fibroin bundle cross-section than commercial silk, which is manufactured using auto-reeling machines. In East Asian paintings, colourants have been applied to both the recto and the verso. However, this painting technique has rarely been applied ever since silk preparation shifted to the industrial method. We determined that the transparency of silk, which is influenced by the fibre shape, is related to the painting expression, especially the verso painting technique. The digital microscope observations also showed that the pigment exhibited a more even adhering state in traditional silk fibres than in commercial, industrial silk. This difference may be attributed to the SEM observation that the cross-section of the traditional silk fibre shape is flatter than that of commercial silk.

In Japan infilling silk for the conservation of paintings is prepared using electron irradiation to imitate the natural ageing of silk. Accordingly, we prepared cocoons (via stifling and dry-heat) and exposed them to UV and moist heating to accelerate ageing. The cocoons stifled with salt showed a lower variation in their tensile strength. In addition, we monitored the temperature, humidity and CO_2 concentration in a sealed jar to clarify the effect of salt in the stifling method. The CO_2 concentration increased rapidly and was off the scale after only one hour of sealing. The temperature reached its highest point nine hours after being sealed after which it decreased to room temperature, and the humidity was maintained at 76–78% RH. This shows that although pupae die quickly due to a lack of oxygen, the purpose of using salt is not to kill pupae but to maintain the 76–78% RH, which is the equilibrium relative humidity of common salt, and microorganisms tend not to grow at this humidity inside the jars.

Based on these results, we prepared artificially aged silk using traditional silk (stifled with salt) and industrial silk (heat-dried silk) using three different methods: electron irradiation, UV-C irradiation and moist heating. All the prepared silk samples were tested to simulate ageing conditions by conducting an ageing test at 80°C and 65% RH. As a result fewer colour changes were observed in traditional silk than in commercial silk for all the samples, which may be attributed to the effect of the pupa killing method. It is suggested that cocoon proteins are denatured by heat treatment at 110° C for two hours using the commercial method.

These results suggested that as the pigment on industrial silk tends not to be fixed evenly; the verso colouring is rarely used today. The results of durability tests indicated that the conservation of industrial silk must be considered because of its tendency to change over time.

Noriko Hayakawa studied polymer science at the Tokyo Institute of Technology, Japan and obtained her master's of engineering in 1998. She has been working as a conservation scientist at the Tokyo National Research Institute for Cultural Properties since 1998. She received a PhD in conservation science from the Department of Conservation Science, Graduate School of Fine Arts, Tokyo University of the Arts in 2018. Her principal interests are the characterisation of conservation materials, especially traditional Japanese organic materials, and the development of conservation methods for artifacts. Since 2016 she has been the head of the Material Science Section.

Michiko Okabe received a master's degree in cultural properties from the Tokyo University of the Arts in 2018. During her graduate studies, she conducted research and analysis on the Zumi, a natural dye which has played a more minor role since the modern period in Japan. She was a research assistant at the Center for Conservation Science at the Tokyo National Research Institute for Cultural Properties(TNRICP), Japan from 2018 to 2023. In TNRICP, she researched on traditional Japanese materials to apply for restoration, and surveyed museum environments, especially microbial environments.

Midori Hamada worked as a curator specialising in conservation science at the Saitama Prefectural Museum of History and Folklore after working as a research assistant at the Tokyo National Research Institute for Cultural Properties. Her main duties include maintaining the temperature, humidity and air environment of the storehouse and checking the condition of the stored materials. The collection stored in the Museum covers diverse materials including historical, artistic and folklore materials, and she strives to better preserve various materials in the same storeroom. She obtained her master's degree at Tokyo Gakugei University.

Riyo Kikuchi is a senior researcher in the Department of Intangible Cultural Heritage at the Tokyo National Research Institute for Cultural Properties. In 2008, she started working as a researcher in the department, and in 2020 she transferred to the Agency for Cultural Affairs as a senior cultural properties specialist. Her main research focuses on traditional textile craft techniques and conservation techniques for cultural properties through the study of their actual conditions and historical changes. In 2022 she started working again at the Tokyo National Research Institute for Cultural Properties.

Shigeko Akimoto has been a technical expert at the Institute of Silk Fabric KATSUYAMA Co. ltd. since 2018. In 2000 she began studying and working on silk fabrics under the guidance of Mr. Shimura Akira. Her principal work includes the production of silk for the conservation of cultural properties that use silk fabric and textile.

Akira Shimura has held the role of principal at the Institute of Silk Fabric, KATSUYAMA Co. ltd since 2004. He engages in traditional silk manufacturing including the cultivation of mulberry, raising silkworms, reeling silk thread and weaving by handloom. His life's work revolves around conducting research to clarify the traditional techniques for producing silk material in Japan and China.

Influence of Silk Production Methods on East Asian Painting Expression and Conservation: Fibre Shape and Durability

IIC 29TH BIENNIAL CONGRESS 2022 CONSERVATION AND CHANGE: RESPONSE, ADAPTATION AND LEADERSHIP

Introduction

Silk has been used as a substrate of East Asian paintings since ancient times, although the method of manufacturing silk changed before and after the industrial revolution in Japan. This study aims to clarify the differences between traditional silk and current industrial silk in terms of their shapes' effect on painting technique and effect of durability on conservation.

	reeling	pupa killing
Traditional silk	hand-reeling	raw/stifled
Industrial silk	auto-reeling	heat-dried

Reflecting on → shape | durability

Effect on → painting techniques | conservation

Evaluation → Microscopic observation | Accelerated ageing test

Materials

1) Commercial silk : auto-reeling, heat-dried (110℃, 2h)
2) Traditional silk : hand-reeling, stifled with salt (maintaining 76-78% RH)

Comparison of tensile strength in different pupa killing silk

Materials: Stifled silk and heat-dried silk
Ageing: UV-V and heating (80° C, 65% RH)
Evaluation: tensile strength

Method of Accelerated Ageing Test

Artificially ageing silk → Accelerated ageing → Evaluation (colour changes)

electron beam2.0MeV × 2, UV3h, moist heating 22 days

80° C, 65% RH

Microscopic Ob

Scanning Electron Microsc

commercial silk

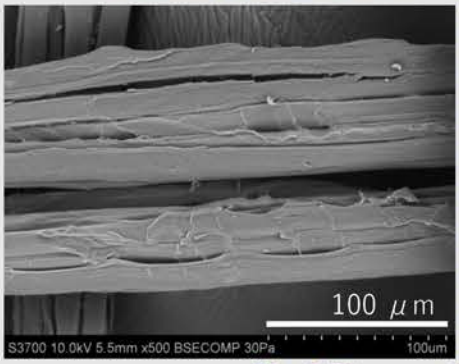

Fig.1 fibrous direc

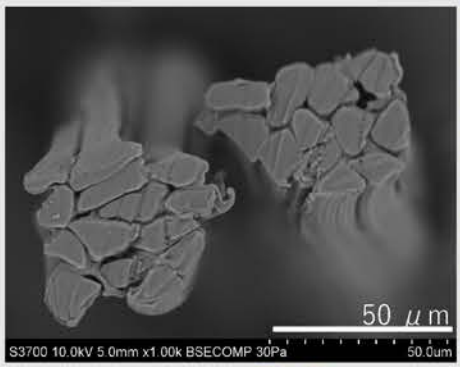

Fig.2 cross sectio

Digital Microscopy (KE

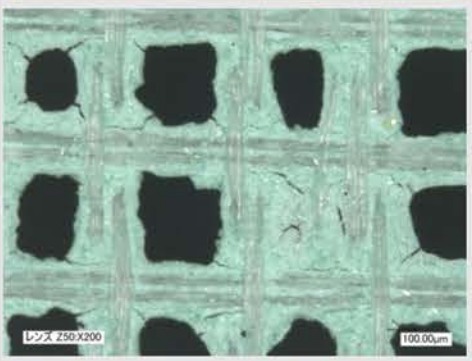

Fig.3 painted malachite green from uneven

HAYAKAWA Noriko[1)], OKABE Michiko[1)], HAMADA Mirdori[2)], KIKUCHI Riyo[1)], AKIMOTO Shigeko[3)], and SHIMURA Akira[3)],

1) Tokyo National Institute for Cultural Properties,
2) Saitama Prefectural Museum of History and Folklore, 3) KATSUYAMA CO., LTD.

東京文化財研究所
Tokyo National Research Institute for Cultural Properties

bservation

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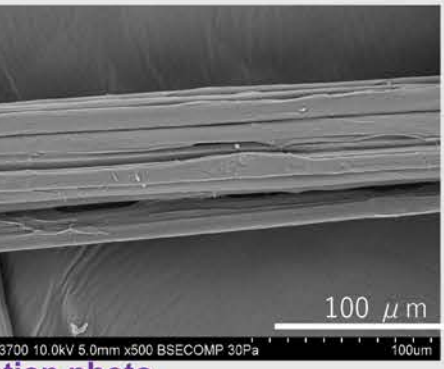
traditional silk



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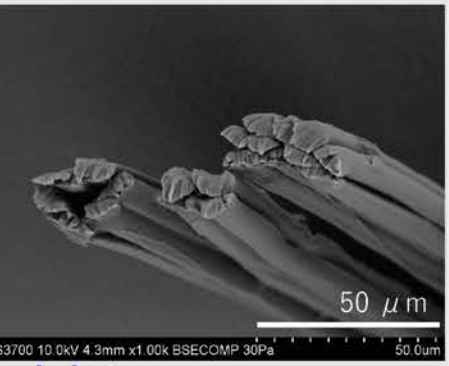

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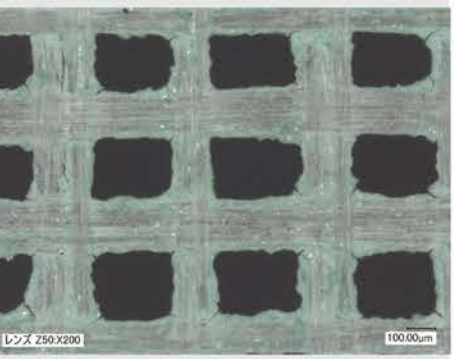
YENCE: VHX-1000)



the recto and the verso

even

Comparison of tensile strength in different pupa killing silk

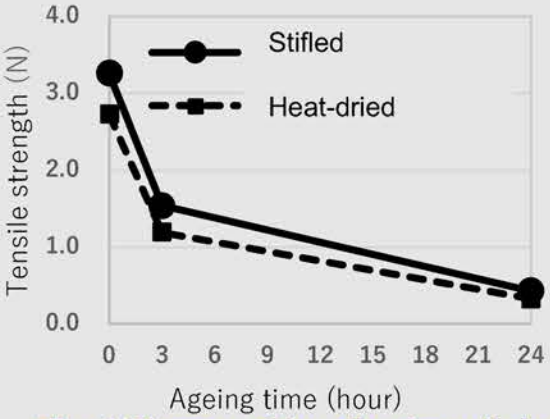


Fig. 4 Change of tensile strength by UV ageing

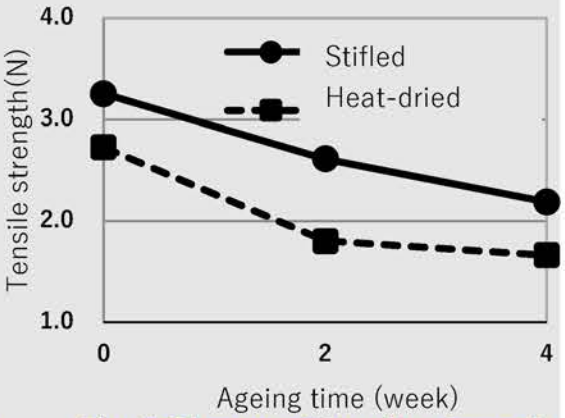


Fig. 5 Change of tensile strength by moist heating

Accelerated Ageing Test for artificially ageing silk

Simulating for silk durability after conservation treatment.

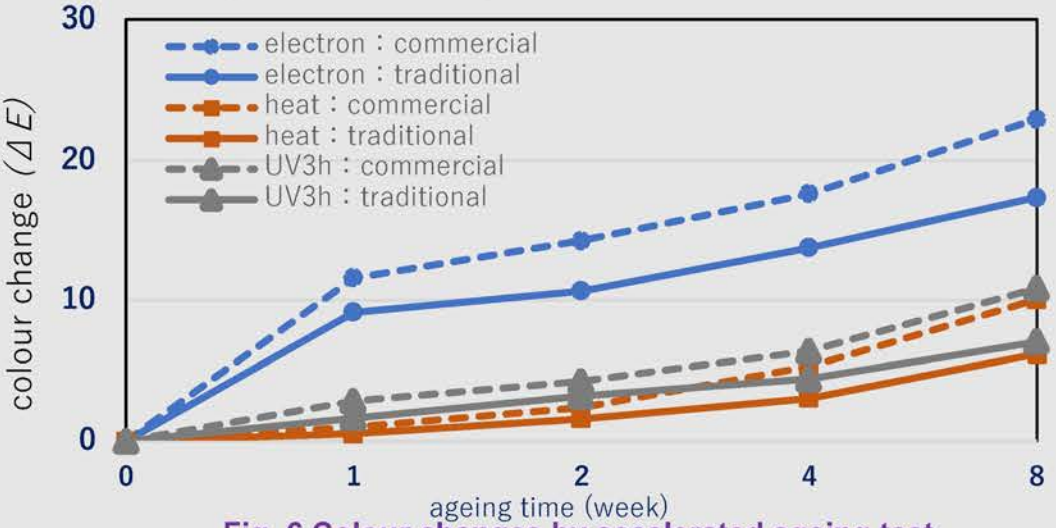


Fig. 6 Colour changes by accelerated ageing test

Conclusion

Traditional silk and industrial silk showed different fibre shapes and durability. It is suggested that the pigment on industrial silk not being fixed evenly effected on the verso colouring is rarely used today. Traditional silk showed higher durability than industrial silk. This means that the conservation of industrial silk must be considered based on its greater fragility than traditional silk.

This work was supported by JSPS KAKENHI Grant Number 19H01365.

Integrating Conservation and Collection Care at Auckland's Museum of Transport and Technology

By Kristie Short-Traxler

In 1960 the Old Time Transport Preservation League, the Royal Aeronautical Society (New Zealand) and the Historic Auckland Society banded together with the aim of establishing a museum to house transport heritage. The Museum of Transport and Technology (MOTAT) opened to the public in 1964. Most museums start with local or national government backing, professional staff and already established collections. This was not the case for MOTAT whose existence was wholly predicated on the passion and enthusiasm of volunteers.

In 2000 the MOTAT Act was passed to recognise the significance of the MOTAT mission, the collections and to underpin the governance of operations as a museum. By 2017 MOTAT had made significant headway in providing a wider museum framework but still lacked professional conservators and suffered from a reputation of poor restoration and collection care. Held over challenges with available professional resources, context of the collections and organisational structure still hampered wholistic effective collection care.

The MOTAT leadership and board made a commitment to provide improved preservation systems across the museum. The author took up the challenge to lead this goal in 2017 and set out to create a conservation team and structure for the Museum.

This poster looks at the journey over the past five years to establish conservation and collection care on a scale that would be both realistic and sustainable within a museum that strives to provide interactive experiences with New Zealand's transport and technology heritage.

Kristie Short-Traxler is a conservator-restorer with 20 years of experience across archaeology, natural history, fine art, industrial and library & archive collections with a preventive and object conservation focus. She is passionate about advocacy, training and development with specific interest in environmental monitoring, colour theory and measurement, display case design and emergency planning. Kristie has degrees in studio art (AA), chemistry (AS), history (BA) and conservation for archaeology and museums (MA and MSc). She has been accredited with Icon (Institute for Conservation, UK) since 2010 and volunteers with them as a CPD reader and student mentor. She is also vice president of NZCCM (New Zealand Conservators of Cultural Materials – Pū Manaaki Kahurangi) and chair of the membership committee. After five years at MOTAT, Kristie has started her own company, The Collection Care Company Ltd. In Auckland, New Zealand.

29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Integrating Conservation & Collection

Kristie Short-Traxler MA MSc

ABSTRACT

In 1960, the Old Time Transport Preservation League, the Royal Aeronautical Society (New Zealand) & the Historic Auckland Society banded together to establish a museum to house transport heritage. The Museum of Transport & Technology (MOTAT) opened to the public in 1964. The MOTAT Act was passed in 2000 to recognise the significance of the collections & it underpins the governance of operations & the importance of collection care in the museum mission.

This poster looks at the journey to establish conservation & collection care on a scale that would be both obtainable & sustainable within a museum that strives to provide interactive experiences with New Zealand's technology heritage.

CONSERVATION FRAMEWORK

1. Lab Space & Infrastructure
2. Permanent Roles
3. Budget
4. Policy
5. Preventive Conservation Programs
6. Interventive Conservation Programs
7. Hazmat Collection Management
8. Analysis & Research
9. CPD (Continuing Professional Development)
10. Benchmarking

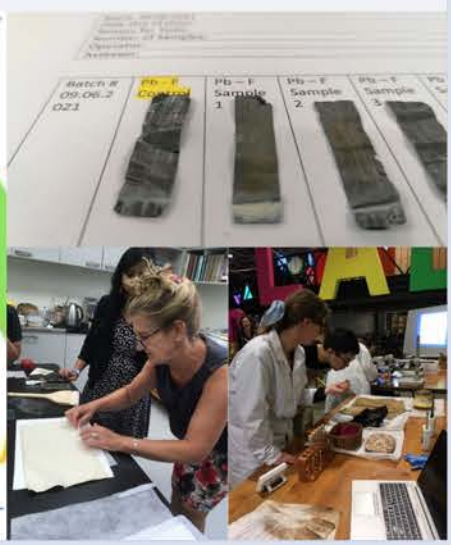
RESULTS

Care at Auckland's Museum of Transport & Technology

c ACR Conservation & Collection Care Manager

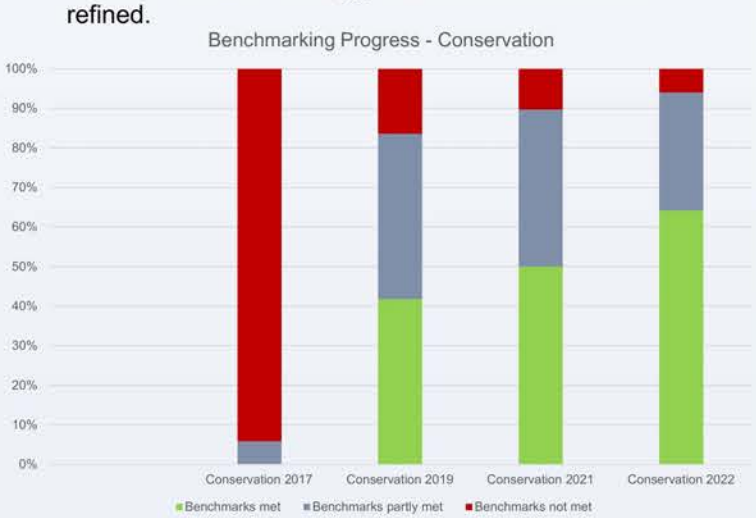
RESULTS

- Established lab & working spaces with budget, equipment, inventory & maintenance schedules
- Robust health & safety systems in place for lab
- Permanent roles filled by qualified, trained conservators
- Established hazmat management programs for radiation, asbestos & other hazardous collections
- Established preventive programs (environmental monitoring, IPM, emergency planning)
- Established treatment programs to support acquisitions, exhibitions & public programs
- Established analysis & identification processes
- Established CPD network through NZCCM



CONCLUSIONS

- Conservation has a firm foundation at MOTAT
- Significant improvement in the way that the museum views conservation as an integrated part of the whole organisation; not as a separate function
- Conservation at MOTAT allows for change & variation over time, while preserving an environment that is beneficial to the preservation of the objects
- Less about absolute standards & more about decisions, balance, cost/benefits & risks
- Wider museum teams have a better understanding that the impact of decisions in one area (workshops, exhibitions) have effect on care of collections
- Museum board & leadership understand the economic & ethical value of conservation
- Within the framework are metrics for the museum to gauge its best practice & the flexibility for changes to be made as museum strategy, collections & access are refined.



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Thanks to the following MOTAT Teams: Conservation & Collection Care, Library, MEST, Registry, Curatorial Research & Workshop volunteers. A special thank you to the NZCCM community of conservators in Aotearoa, for skills sharing & support.

Laser cleaning of heritage steel: preserving structure, removing contamination

Julie Brand[1,2,*], Steve Madden[2], Alison Wain[1], Andrei V. Rode[2] and Ludovic Rapp[2]
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[2] Laser Physics Centre, Research School of Physics, The Australian National University, Canberra ACT 2601, Australia

Lead has been used as an ingredient in paint for centuries, both for the colours that lead oxides can provide and for the physical properties conferred by lead—it makes paint dry more quickly, it makes paint durable and it provides corrosion protection for iron and iron alloys. These applications mean that lead-based paints are commonly found as both primers and top coats on movable and built heritage and are especially prevalent as primers on large-scale structural steel works.

Removal of lead-contaminated paint and corrosion layers from large metal heritage structures is often done by sandblasting. The effects of sandblasting, however, can be aggressive, and the use of sand in the process causes major problems with restricted operating spaces, restricted visibility, the creation of large quantities of contaminated sand waste and transport of the sand to and from the treatment area. Laser cleaning, by contrast, uses only light energy, and therefore has minimal environmental impact, dust and visibility problems. New ultrashort pulse lasers also offer critical improvements in control over the treatment of metal surfaces.

Current heritage laser cleaning systems use nanosecond pulses of light which allow energy to be transferred to the metal substrate as heat, potentially causing melting, the formation of cracks, exfoliation of flakes from the surface and annealing or softening of thinner sections of the bulk material. Ultrashort (pico and femto second) lasers avoid these problems as the pulse duration is so short that the ablation proceeds from the skin layer without heat transfer into the bulk of the material, a process called cold ablation.

We compared the removal of lead-contaminated paint and corrosion layers from aged steel samples using nanosecond and femtosecond pulse regimes and used electron microscopy to evaluate the impact of the different regimes on the metallurgy of the steel.

Lasers offer an effective way to remove lead-contaminated layers from steel surfaces, so it is important to ensure the treatment does not inadvertently damage the structure of the metal. This work demonstrates that the cold ablation process of femtosecond lasers does not cause micro-cracking in the steel surface and therefore has important implications for the treatment of structural steel, as microcracking at the surface is known to initiate further cracking and rusting that reduces the strength and life of the steel.

The ultrashort pulse laser technology enables removal of lead-contaminated paint and corrosion layers from large structural heritage steel components without detrimental thermal and shockwave effects on the underlying material and with significantly improved environmental, work health and safety impacts compared with sandblasting. The precision of the cold ablation laser process presents significant advantages for maintaining safety and integrity and preserving the original strength of steel in built and movable heritage around the world.

Julia Brand is a third-year PhD student at the Faculty of Art and Design at the University of Canberra. She is working on the Sydney Harbour Bridge conservation project. Her research interests include lasers applied to conservation, analytical science, cultural heritage and art. She graduated with a master's degree in materials science and nanoengineering from the University of Strasbourg, France. * Corresponding author's email address: julia.brand@canberra.edu.au

Assistant Professor **Steve Madden** currently leads research on chalcogenide, tellurite and polysiloxane integrated optical devices at the Laser Physics Centre. His research career in fibre and integrated optics spans much of the period from 1984 to the present in start-ups, multi-nationals and academia covering a diverse range of areas including liquid crystals, seven different materials systems for planar devices, all fibre devices, hybrid integration, Bragg gratings and devices, planar tuneable lasers, optical transmission systems and all optical networking, and non-linear effects in SOAs and planar waveguide devices.

Alison Wain specialises in the conservation of large technology heritage and is currently assistant professor in cultural heritage and materials conservation at the University of Canberra. Her research is focused on the challenges of preserving and interpreting engineering, industrial and science heritage and on the importance of recognising the intangible heritage of culture, skills and changeability connected with and embodied in machinery heritage.

Andrei Rode is currently emeritus professor at the Australian National University. His research interests are in short-pulse laser-matter interaction, laser-induced phase transitions and transient states of matter, laser-produced nanoclusters and their properties, laser ablation and deposition of nonlinear optical films for photonics applications, laser trapping of particles in air and related phenomena.

Dr Ludovic Rapp is a senior research fellow at the Laser Physics Group of the Department of Quantum Science and Technology (DQST) at the Australian National University (ANU). Ludovic has a strong background in short and ultrashort pulse laser interaction with matter. His research is focused on the use of laser technologies for advanced research and industrial applications. He is currently leading the development of laser cleaning solutions for the preservation and restoration of heritage and cultural monuments, buildings and infrastructure such as the Sydney Harbour Bridge conservation project.

Laser cleaning of heritage steel: pre
structure, removing contamination

J. Brand[1,2,*], S. Madden[1], A. Wain[2], A. V. Rode[1], L. Rap

Introduction

- Lead used in paint both as primer and top coat on movable and built heritage
- Concentration of lead in paint was high in Australia until the 1970s
- Removal of lead paint often done by sandblasting (causing abrasion)
- Lead paint waste collection and management is problematic for the environment
- Laser cleaning offers a promising solution with minimal environmental impact
- New ultrashort pulse lasers offer **critical improvements** in control over the processing of metal surfaces

Method

Short pulsed laser Compact Phoenix (Lynton Conservation)

- Wavelength 1064nm
- Power 1.15W
- Pulse duration 5ns
- Repetition rate 25Hz
- Max. pulse energy 150mJ

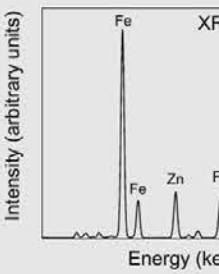
Ultrashort pulsed laser Carbide CB3-40W (Light Conversion)

- Wavelength 1029nm
- Power 40W
- Pulse duration 275fs
- Repetition rate 100kHz
- Max. pulse energy 400µJ

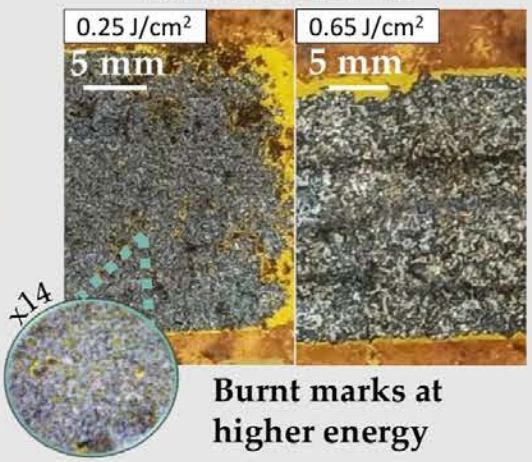
Cleaning with ns vs. fs lase

Steel cog wheel from early agricultural machinery

Covered in lead paint and rust



Ns-laser cleaned



Burnt marks at higher energy

Darker appearance due to residual rust

Most lead paint removed (microscopic residues)

Fs-laser cleaned

No damage to steel

Complete remova of lead paint

No burnt marks

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[2]Research School of Physics, Australian National University, ACT 2601, Austr
*corresponding author's email: julia.brand@canberra.edu.au

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CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

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RF spectrum

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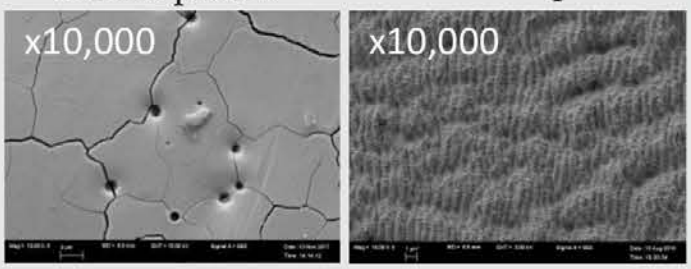
Effects on steel

Network of cracks with ns pulses

No cracks with fs pulses



Cracks on the surface can cause further deterioration of the steel and decrease the lifespan of heritage steel structures

Benefits of fs laser

No heat-related damage (melting) as fs laser rely on non-thermal, electrostatic removal**

No cracks – preservation of the steel's structure

Better cleaning results

** *see* Rode, A. V., Baldwin, K. G. H., Wain, A., Madsen, N. R., Freeman, D., Delaporte, P., and Luther-Davies, B., Appl. Sur. Sci. **254** 10, 3137-3146 (2008) https://doi.org/10.1016/j.apsusc.2007.10.106.

Open questions

Laser processing inside fume hood, and removal of fumes with HEPA filter

How to improve extraction of lead fumes in order to:

Better protect the users entrusted with conservation

How to improve waste collection in order to:

Better protect the environment

Acknowledgements

The research was funded by the Australian Research Council and Transport for New South Wales through the Linkage Project LP180100276
The authors would like to thank Mark Lintermans for loaning items from his collection of early agricultural machinery for analysis

UNIVERSITY OF CANBERRA

Australian National University

Leading Conservation: Adaptation, Confidence & Impact

By Julie Hutchison and Susan Bradshaw

In an ever-competitive environment, the threat to conservation is real if the conservation profession is not seen as valid, valuable and vital in the minds of those that provide the resources to create meaningful outcomes which meet the standards required. Our purpose with this paper is to provide insight into how changing needs of the profession have brought about a need to transform the way conservators respond and adapt their leadership style to make an impact.

At the Institute of Conservation (Icon) conference in 2016, there was an eager debate about leadership in conservation. The opinions generated showed that there was a need to develop more confidence, collaboration and impact for conservators. In response, we collaborated on a project to design an accessible leadership programme that meets those needs. Over the last five years, we have observed evidence of how over 50 delegates have successfully and wholeheartedly engaged in the programme achieving promotions, new roles, better clients and more impact.

Evidence was sourced from this leadership programme delegate pool, and we compared where each delegate started to where they are now in terms of what they have achieved, the key components of their success as leaders and what has hindered their progress.

We intend to compare our findings with the Icon Labour Market Intelligence surveys (2013 and 2021), COVID surveys, other published surveys applicable to the heritage sector and other leadership programmes provided for this sector.

We want to inspire conservators to grow their impact, invite them to review their conservator toolkit and understand what's in it for them when they apply leadership skills to achieve their goals. We want them to grow more confident, resilient, more strategic and become more valid, valuable and vital as the landscape changes. We want to encourage conservators to develop a growth mindset regarding the behaviours needed to create wider impact and leadership and to create a culture of leading their own destiny.

We want conservators to understand that they are no longer seen solely as working at the bench—they have to be part and parcel of the whole picture in order to influence the sustainability of conservation within the heritage sector.

We anticipate that the evidence will demonstrate what can be achieved with the right mindset, behaviours and tools, proving that conservators can be leaders whilst being who they want to be and can stand out from the crowd to make a real impact. We will show how creating confidence in knowing themselves, their values, beliefs and goals provides inspiration to lead themselves and others around them. By linking a leadership mindset to the strategic goals of conservation, they can influence change and take control.

Julie Hutchison is an award-winning leadership & impact coach helping technical experts and professionals to develop impact, leadership skills and the mindset to create business performance. She is the creator of the Leaders Launchpad, an accessible, online leadership training and coaching programme for conservation professionals and believes in developing down-to-earth leadership skills that are practical and easy to implement. Julie has worked with a wide variety of clients, including public sector (policing, NHS, DWP, councils); technical IT, manufacturing, private medical and science-based businesses plus arts-based and heritage businesses such as Icon, National Trust, British Museum, British Library and others.

Susan Bradshaw's career started in a hot glass studio, and 32 years later she is working as a freelance mentor/coach to support people with their personal and professional development. She worked on her transferable skills to transition between the roles. In 1984 she trained in-house as an archive conservator and worked in the profession for 13 years. From 2003 she was fully involved with the development of the Professional Accreditation of Conservator Restorers (PACR). She worked for the Institute of Conservation (Icon) from its inception in 2005 to 2021, and her remit included professional accreditation, continuing professional development and internships.

LEADING CO

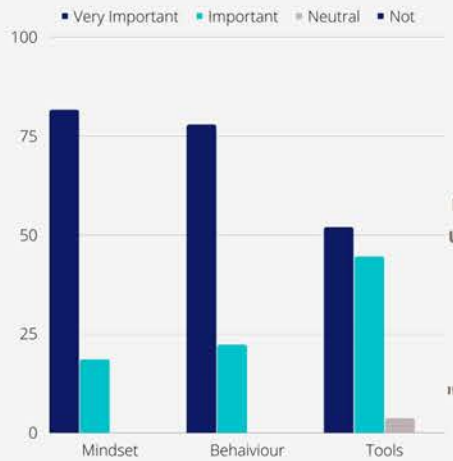
ADAPTATION, CON

CONSERVATORS AS LEADI
BY JULIE HUTCHISO

Our purpose is to show how cha
necessity to transform the way in w
lead

We asked 50 graduates of the Lead
important in growing as a leader,
Confidence, **Ability to Collaborat**

THE IMPORTANCE IN GROWING AS A LEADER



Our research shows 100% of those surveyed believe growing our mindset, behaviours, and the tools we use as leaders are either Very Important or Important.

"Without the mindset you ultimately have nothing. If you can't think like a leader, and understand how you work, and those around you, it doesn't matter how many tools you have, you will never use them appropriately."(1)

"Mindset to me is being aware of myself, but not be afraid of perceived/feared judgement of others." (1)

I CAN BE A LEADER AND BE ME

93% of respondents felt that they could be themselves, and did not have to try to be someone they are not

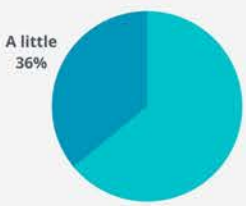
"You can't be anyone/anything authentically if you're not being yourself." (1)

I HAVE MORE CONFIDENCE

89 % of respondents feel more confident from developing their leadership & Impact skills

"I now believe in myself, I don't doubt my abilities. I see myself as a strong professional person who contributes fully to the profession and has a lot to offer. I now like and appreciate myself and understand that others will feel the same way if I just show up and be me." (1)

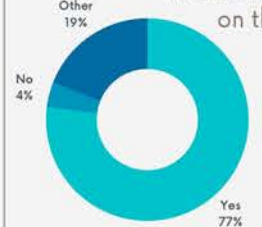
I AM APPLYING TOOLS



64% are actively applying the tools. they have learned, whilst 36% are using them somewhat.

"I am now solution oriented rather than worrying about whether I'm doing the right thing." (1)

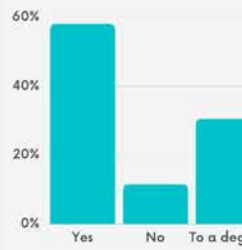
I HAVE MORE IMPACT



77% of respondents feel they have more impact after working on their leadership skills

"I have expanded my own business and set up a not for profit company that has received is currently working on its first arts council funded project.." (1)

I HAVE



58% of respondents
clear strategic goals,
30% agreed to a de

IIC 29TH BIENNIAL CONGRESS 2022 CONSERVATION AND CHANGE: RESPONSE, ADAPTATION AND LEADERSHIP

THINK BE DO Leadership™

References & Notes: (1) Think Be Do Leadership, Leaders Launchpad Delegate Survey, Feb 2022; (2) Coronavirus & Conservations Impact Study, icon, Feb 2021; (3) Scop

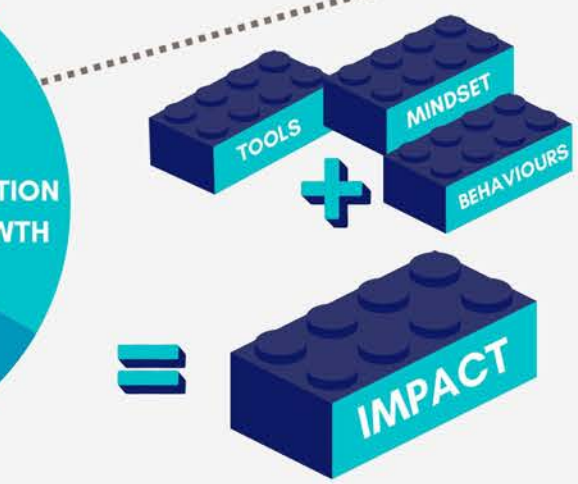
ONSERVATION

IFIDENCE & IMPACT

ERS IN A CHANGING WORLD
N & SUSAN BRADSHAW

nging needs in the sector have made it a which conservators respond and adapt their ership style.

lers Launchpad Programme what they felt is and what changes they have seen in their te and their level of **Impact and Influence.**



SB Coaching

I AM A LEADER

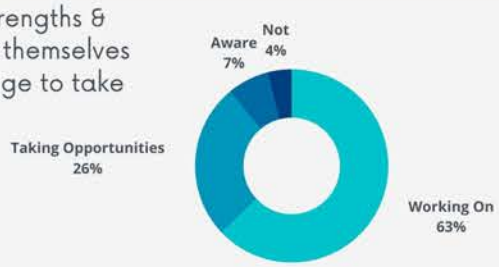
Leadership is practiced at all levels within an organisation; it is defined as the ability to conceive and articulate a direction and purpose, and to work with others to achieve that purpose in both benign and hostile circumstances." (3)

"I understand myself better & know my strengths & weaknesses. I have learnt to be able to read others better, and to know how to approach someone I want to influence. It has shown me the value of collaboration, compromise and working together to achieve a goal. I am just generally more confident in making the ask, or steering others to see problems from my perspective, while being mindful of their priorities at the same time." (1)

I AM AWARE OF MY STRENGTHS

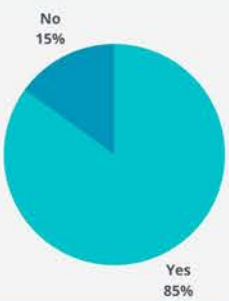
96% are more aware of their strengths & weaknesses, with 63% working on themselves & 26% actively using this knowledge to take up opportunities

Actively working on our strengths is imperative to our growth and therefore our ability to be resilient and to thrive



"It has supported me in recognising and acknowledging leadership qualities." (1)

I AM MORE COLLABORATIVE



85% of respondents are more collaborative since developing their leadership skills. This appears as a key skill for creating a sustainable future for conservation.

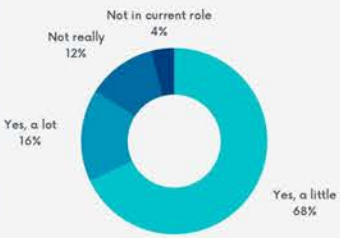
"The ability to bring people together and with you on the journey is key in productivity, effectiveness and growth."

"By delegating and enabling junior colleagues to have more responsibility, I have been able to concentrate on the things that interest me more, and they feel more free to discuss and share their ideas and questions." (1)

STRATEGIC GOALS

"Having a strong visions for the future for myself & the business, enjoying engaging & working with others & genuinely wanting to move forward with others collaboratively. Feeling connected to the bigger picture, the procession generally." (1)

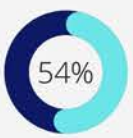
I AM AN INFLUENCER



68% of respondents felt able to influence somewhat and only 16% felt able to influence a lot

"I am much better at explaining the 'why, what and how' to everyone I work with, above & below me in the organisation." (1)

I HAVE OPPORTUNITIES



54% of respondents have achieved a promotion or a new role, either in their current or a new establishment

"Growing & enabling talent is so important but it is also imporant to belive in oneself & one's own talents." (1)

ing the leadership development needs of the cultural sector in England, TBR, Dec 2013

Lost In Transmission? The Interdisciplinary Dialogue Challenge to Managing Change and Significance

By Ann-Cathrin Rothlind

This paper discusses how the role of conservation knowledge has managed change in works of art from a historical, ethical and science philosophical perspective. The interdisciplinary nature of conservation, with roots in the natural sciences and the humanities, is embodied in the conservation decision-making process. Regardless of directing, deferring or deterring conservation-restoration to manage change, and secure optimal transmission of significance to the future, consequently, omittance of critical conservation knowledge in management may, in time, result in values lost. Hence the question for each generation of stakeholders remains the same: how do we sustain non-renewable cultural heritage assets put in our care while retaining significance and value? Consulting conservation decisions require a common language and perceptions for a shared understanding of the why, what and for whom conservation-restoration is done. In complex environments, such as historic house museum settings, conservation decision-making risks becoming crucial if communication fails or goals are not understood.

To illuminate the role of conservation knowledge in decision-making, and the impact of decisions made on collection condition, I present a historical case-study and discuss examples of the decision-making processes. I analyze and deconstruct half a century of written sources regarding conservation-restoration decision-making processes in the management of the painting collection of Skokloster Castle. I have analyzed the processes in an experimental research design using a Foucauldian discourse analysis using a conservation knowledge framework together with quantified collection condition survey data to assess unacceptable change.

The role of documentation is emphasized as an auxiliary science of conservation to evaluate rate of change and assess transmission of significance. Acknowledging the interdisciplinary epistemological and ontological nature of conservation knowledge is imperative to understand the risks and benefits of strategies to solve the recently defined interdisciplinary decision-making problem in interdisciplinary science philosophy research. Assessing the presence of an interdisciplinary problem in decision-making may help avoiding errors recognized in science as type I or type II errors, where a type I error occurs when interventions made are unnecessary, thus wasting time and resources. The consequences of making a type II error, that is, not acting when intervention is needed, will affect cultural heritage negatively. The preservation perspective of acting conditionally on unacceptable change may need decision-making to cut across the borders of any subject matter or discipline. The broadening influence of stakeholders neither removes the burden of responsibility from the conservator nor does it remove the use of conservation-restoration knowledge from being central in sustaining cultural heritage as expressed in the texts, professional guidelines and ethical codes of conservation-restoration.

For future stewardship, managing change via a decision-making dialogue needs further research on knowledge modelling based on the ontology of the discipline to bridge existing knowledge gaps in conservation decision-making.

Ann-Cathrin Rothlind has been a paintings conservator at the National Historical Museums Collections The Royal Armoury, Skokloster Castle and the Hallwyl Museum since 2011. She holds a BA in paintings conservation (2004) from EVTEK Institute of Arts and Science and an MA from Metropolia University of Arts and Sciences, Helsinki (2021). She is a certified psychologist and holds an MSc in psychology from the University of Tampere (1992). In 2019 she was project manager for an international workshop supported by The Getty Foundation´s Conserving Canvas Initiative. Her master´s thesis interrogates interdisciplinary communication challenges in conservation-restoration decision-making for stewardship ethics and sustainability in collection management.

Lost in Transmission? – The Interdisciplinary Dialo

Ann-Cathrin Roth

National Historical Museu

1 INTRODUCTION

Long recognized a challenge for the Heritage field conservation decision-making need systematic research to make sustainable scientific progress. Based on a master´s thesis the use of an ontology-based conservation-restoration knowledge-model[4] is presented for assessing inter-disciplinary consulting impact focusing on managing change and significance of the collection of 16th, 17th, and 18th century paintings on canvas at the historic house museum, Skokloster Castle, during five decades as a Swedish public museum.

2 OBJECTIVES

The experimental study setting aimed to analyze conservation knowledge present in inter-disciplinary stakeholder conservation decision-making discourse from a theoretical, ethical and social perspective. Focusing on views on object condition, representation and use the cause was foresight analyzing perspectives and perceptions managing change to test the hypothesis of the symbiotic relationship between value, conservation, and representation.[1]

3 MATERIALS & METHODS

Language, identified by the philosophers Hans-Georg Gadamer, and Michel Foucault as the main means to study knowledge in a science philosophical, hermeneutic and discipline framework, was analyzed by performing a Foucauldian qualitative discourse analysis (FDA) on sampled "corpus of statements" in documentation and written archival material.[2 3]. Conservation examples were analyzed using an ontology-based conservation knowledge framework, the E.C.C.O. concept conservation-restoration process map as a "key" to visually recognize areas of knowledge involved or omitted consulting conservation decisions (See **Figure 1**).[4]

Originally developed by the E.C.C.O. working group for mapping taxonomy of a knowledge and skills framework for conservation education the concept map was experimentally used as a discourse interpretation "key" in collection management context to interrogate1) areas of knowledge used in interdisciplinary consulting, and 2) ethical and social aspects in retrospective managing change.[5] To assess unacceptable change quantified collection condition survey data was used. The preservation state of Skokloster Castle collection was studied with reference to collection condition survey data for the National Portrait Gallery, Gripsholm Castle.

3 MATERIALS & METHODS cont.

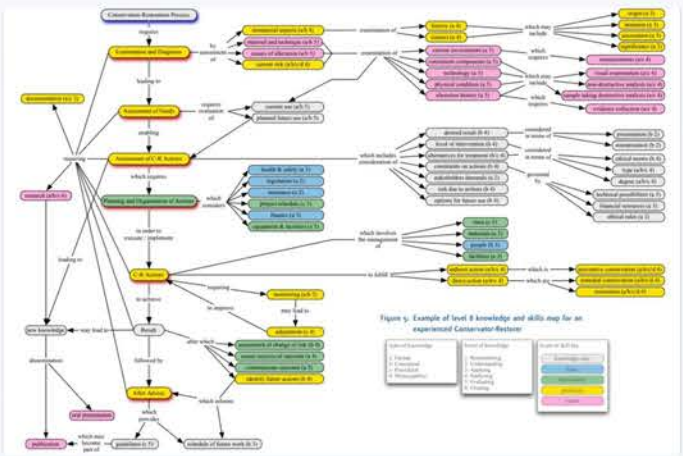


Figure 1.The expanded conceptual model of conservation-restoration decision-making process for an experienced conservator. (E.C.C.O. Competencies 2011)

4 RESULTS

During the five decades the dichotomy of the `hard´ and `soft´ sciences and different cultures of practice in collection management would show as areas of knowledge considered or left unaddressed consulting conservation decisions. Conflicting views reflecting different institutional traditions and objectives, disciplinary experience and knowledge backgrounds would result in important causal links become overlooked (Type II error).[6] Risks present for paintings on canvas kept in wrong climate were dismissed promoting the historic building structure.

To overcome the Type II error a Type I error was created (implying a causal link where there is none) by explaining unacceptable damage in paintings a result of using wrong conservation methods. In time the unresolved interdisciplinary decision problems[6] would evolve into bespoke ethics[7] and myths. Efforts finding "safe" remedial conservation methods for wrong climate would after generational change lead management to adopt a conservation policy phenomena described as "doing nothing".[7]

After acquisition by the Swedish state in 1967, the 1968 collection condition survey found two thirds of the painting collection in need of remedial conservation. The 2011 collection condition survey indicated a status quo, including need of retreatment of paintings conserved during the first decade state conservation campaign. The preservation state of the reference collection kept in a controlled climate for a century would show remarkably lower numbers indicating need of remedial conservation. Also, damage type such as mold related to wrong climate would not be reported in the reference collection data (See **Table 1**).

ogue Challenge Managing Change and Significance

lind, Conservator

ums, Stockholm, Sweden

4 RESULTS cont.

Skokloster Castle Collection of paintings on canvas - Condition survey 2011															
	Picture carrier			Picture layer					Varnish layer			Particle deposition		
Period	N= Canvas	Deform	Def lining	Cupping	Microflaking	Flaking	Losses 1	Losses 2	Yellowed	Blinded	Crazed	Surface dirt	Dust	Mold
16th c	6	3	0	5	5	6	6	0	5	5	5	5	6	1
17th c	390	251	35	296	104	229	216	87	315	319	278	245	329	134
18th c	21	12	2	14	7	15	14	1	21	18	14	17	17	3
Sum	**417**	**266**	**37**	**315**	**116**	**250**	**236**	**88**	**341**	**342**	**297**	**267**	**352**	**138**
16th c	1,4%	50,0%	0,0%	83,3%	83,3%	100%	100%	0%	83%	83%	83%	83%	100%	2%
17th c	80,9%	64,3%	0,9%	75,9%	26,6%	58,7%	66,6%	22,3%	97,8%	81,8%	71,2%	95,0%	84,3%	34,3%
18th c	7,0%	57,1%	0,9%	66,6%	33,3%	71,4%	66,6%	0,5%	100,0%	85,7%	66,7%	91,6%	80,9%	14,3%
All periods	100,0%	57,1%	19,0%	75,3%	8,6%	76,7%	77,7%	7,6%	93,7%	83,5%	73,6%	89,9%	88,4%	16,8%

National Portrait Gallery, Gripsholm Castle, paintings on canvas - Condition survey 1993														
	Picture carrier			Picture layer					Varnish layer			Particle deposition		
Period	N= Canvas	Deform	Def lining	Cupping	Microflaking	Flaking 2	Losses 1	Losses 2	Yellowed	Blinded	Crazed	Surface dirt	Dust	Mold
16th c	157	7	5			9	15	3	0	5	3	24		
17th c	239	6	11			4	5	2	1	1	5	25		
18th c	57	2	0			0	5	0	0	0	0	3		
Sum	**453**	**15**	**16**			**13**	**25**	**5**	**1**	**6**	**8**	**52**		
16th c	34,7%	0,4%	0,3%			1%	9,50%	2%	0%	3%	0,2%	15%		
17th c	52,8%	0,2%	0,4%			1,7%	2,1%	0,1%	0,0%	0,0%	0,2%	10,4%		
18th c	12,5%	0,4%	0,0%			0,0%	0,9%	0,0%	0,0%	0,0%	0,0%	5,3%		
All periods	100,0%	0,3%	0,2%			1%	4,16%	0,046	0,00%	1%	0,1%	10%		

Table 1. Reference collection condition survey comparison for Skokloster Castle 2011 and Gripsholm Castle 1993.

Figure 2. Skokloster Castle. Photo: Jens Mohr/SHM (CC BY)

Figure 3. Gripsholm Castle. Photo: Alexis Daflos/The Royal Court of Sweden

5 CONCLUSIONS

The ontology-based conservation concept map enabled encoding decision-making discourses thus unveiling knowledge gaps indicating interdisciplinary decision problems.[6] Acknowledging the error risk may prevent the Heritage field from making unnecessary interventions thus wasting time and resources (Type I error) or not acting when intervention is needed (Type II error) thus affecting cultural heritage negatively, respectively. The preservation of significance by acting conditionally on unacceptable change may need decision-making to cut right across the borders of any subject matter or discipline.

To prevent errors due to interdisciplinary decision problems the study underlines decision rely on experience and shared knowledge of primary documentation on damage functions. The role of documentation is emphasized as an auxiliary science of conservation to evaluate rate of change and assess transmission of significance. Broadening requirements on stakeholder influence does not remove the burden of responsibility of the conservator and the use of conservation-restoration knowledge from being central in sustaining cultural heritage as expressed in the doctrinal texts, professional guidelines, and ethical codes of conservation.

RECOMMENDATIONS FOR FUTURE RESEARCH

For future stewardship decision-making discourse need research on knowledge modelling based on the ontology of the discipline to bridge existing knowledge gaps in conservation decision-making. For the development of conservation as an inter-disciplinary science the discipline need study mechanisms creating inter-disciplinary decision problems to prevent Heritage values being lost in transmission managing change and significance.

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IIC 29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Museum As a Cultural Hub: Maintenance and Renovation Program for The Flinders Island Butterfactory, Whitemark, Tasmania

By Joanna Lang

Flinders Island is a very special place known for its outstanding natural beauty as well as for the epic history of its residents and their endeavours. Many travellers visit the Island for its beaches, mountains, flora and fauna. https://www.flinders.tas.gov.au/; https://visitflindersisland.com.au/

The island community (about 1,000 residents) care a lot about its historical heritage, which can be proudly seen at the impressive Furneaux Museum, operated by FHRA volunteers and through involvement with historical associations including FHRA and FMHA.

The dairy industry wasn't easy to organise on Flinders Island. However, a group of enthusiasts drew up a memorandum and Articles of Association of the Flinders Island Co-operative Cheese, Butter and Bacon Farm Company, with the first shareholders meeting in 1918.

The important site, worthy of preservation as an industrial museum, is The Flinders Island Butterfactory, Whitemark, Tasmania. Alfred Trueman built this factory and home in 1920; the local museum provides some information. From its peak of 150 tons of butter in 1950, production gradually declined with the factory closing down in 1974. However, a very interesting new chapter of history for this place began in the 1990s, thanks to the efforts of new owners and friends. The Butterfactory buildings and some of the original machinery were renovated, the original butter churn was restored and a winery was established.

There are many photos documenting the factory workings and musical performances held on site. Aside from producing award-winning wine, it is now known as a living venue, famous for its music—an inclusive place where visitors are always welcome. Jimmy Murphy maintains a small workshop making musical instruments, such as ukuleles, from unique local timbers. Inside the engine room we can see interesting old machinery and many original artefacts; wooden tools, metal forms, butter moulds, glass bottles, sieves and cartons bearing the Flinders brand logo. All this leaves an amazing, lasting impression. https://www.facebook.com/butterfactoryboys/

My case study refers to conservation approaches in response to historical, social and environmental challenges and the changing role of conservation in communities. Due to their profession, conservators look at monuments in a broader perspective, perceiving value where many would not. It's also a matter of professional passion to be able to protect history, whether it be a beautiful work of art or an old factory.

The purpose of this project is to make use of conservation methods to create a professional museum on site. Our aim is to protect both the tangible and intangible assets of the Butterfactory. The first stage is to establish a precise inventory and description of all historical elements: from buildings and machines to small artefacts. This allows conservators to extract the original objects, creating a tangible collection of exhibits. The next step is photographic documentation.

Based on this documentation, the conservation programs will be prepared, including condition assessment and preservation planning, along with a knowledge of conservation treatments for various types of materials (e.g. metal, wood, paper and glass). The Butterfactory wine-making and musical traditions should also be well documented on video, including recorded interviews. A collection of photographs from the '90s urgently needs to be digitised.

Co-operation with volunteers from the local community will bring a better understanding of the site's historical value. Informative exhibitions can be designed, and various museum workshops could also be developed. In light of the new ICOM definition of a museum, as well as the use of conservation tools, such places can be protected and turned into professional museums, bringing new value to local communities and to visitors.

This project will promote Flinders Island, not only as a place of natural beauty but also for its story of human lives and courage on this distant island.

Joanna Lang earned a master's degree in art conservation from Nicolaus Copernicus University, Torun, Poland and completed post-graduate studies in museology at the University of Warsaw, Poland. She has worked on wall paintings by Vincenzo Brenna at the Natolin Palace, Warsaw; Sgraffito elevation at the Broniszów Castle, Lubuskie; and on a Banksy mural in Somerset, UK. She has worked at The Warsaw Rising Museum, Warsaw, Poland and is currently a committee member at the Polish Museum and Archive in Australia. Joanna is a member of ICOM, Icon, AICCM and IIC. She presented at the ICOM 25th General Conference (Kyoto, Japan) and received the Medal for Merit to Polish Culture in 2014.

Museum As A Cultural Hub - Maintenance And
For The Flinders Island Butterfactory, Whitema

Flinders Island is a very special place of outstanding natural beauty as well as its e

The factory was built in 1920, with the peak production of 150 tons in 1950s, closed d

Alfred and Mrs Trueman first owners, 1946 / FHRA inc. Museum

BF workers packing Flinders Island Butter

PROGRAM

Protection of the tangible and intangible assets of the Butterfactory

Creation of conservation documentation

- Inventory and descriptions of historical elements and original artefacts
- Photographic documentation
- Assetment of phisical condition
- Conservation programs
- Preservation plan
- Digitalisation of photo – collection from the 90s

- Project of Informative exhibition
- Records of events: musical performaces and wine-making traditions
- Interviews with the BF members and friends
- Workshops program

View from Strzelec Point Beach / photo J. Lang

The Furneaux Mus / J. Lang

Vineyard 2021/ J. L

IIC 29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Joanna Lan

Renovation Program
ark, Tasmania

pic history of the residents and their endeavours
own in 1974. The new chapter started in the 1990s.

ki Peaks, Trousers

eum 2022

The Butter Factory painted by B. Robinson

Original Butter churn restored in 1990s / J. Lang

Original machinery inside the engine room 2018
/ photo Naomi Creek

Collection of artefacts: wooden tools, metal forms, glass bottles, sieves, cartons with Flinders Brand logo
/ J. Lang

One of many tableux of photos documenting renovation of buildings and machines , planting vinyard and music events in the 90s

Lang

Bottling 2021/ J. Lang

Jimmy Murphy 2022/ J. Lang

Jimmy Murphy's ukulele workshop 2022/ J. Lang

g Art& Conservation joannalealang@gmail.com +61405764800

https://www.facebook.com/butterfactoryboys/

Preliminary study on deterioration patterns and conservation approach for ancient Chinese jade

By Huang Xi

Chinese jade culture has a long history. Since the 1980s, a large number of jade objects of different types and ages have been excavated from various regions of China, which has greatly enriched the possibilities for research.

These jade artifacts, especially those dating from the Neolithic period and excavated in southern China, have undergone tremendous changes. The condition and deterioration patterns of these jade artifacts are very different from the bulk of the heirloom jades existing in both domestic and international collections. The compact mineral aggregates have transformed into loose white powders with a substantial decline in mechanical strength. Ancient jade artifacts with severe deterioration were hard to extract completely during archaeological excavation, and further damages like disintegration and peeling can occur during handling and moving. Recently, ancient jade in storage was observed to have discoloration and loss of the surface decoration affecting both long-term exhibition and future research; the conservation of ancient jade is now urgently needed.

This research mainly focused on silicates: tremolite and serpentine jade artifacts. The deterioration patterns and process during the thousand years of burial were summarized after participating in archaeological excavations, interviewing experienced archaeologists and extensive investigation into the jade artifacts unearthed in various regions of China. Alterations can be organised into four categories: mechanical, chemical, biological and previous restoration.

The whitening of jade does not always lead to disintegration, and the whitening develops from the exterior to the interior. Disintegration is the major problem for jade conservation.

On the basis of the previous study, a glossy hyaline layer composed of inorganic colloids can be observed on some jade surfaces which exhibit a more compact structure compared to the whitened powders beneath it. This formed an interior colloidal silica stemming from corrosion, and the electropositive alumina sol from the burial soil flocculated on the interface through chemical bonding and electrostatic interaction. Due to this dense surface layer, weathered jades can maintain the integrity of their surface morphology and retain their exquisite carving. Consolidants synthesized by chemical precipitation of charged inorganic colloidal particles could be a promising solution for jade conservation. Aluminum sol and silica sol have been used to consolidate some unearthed powdery pieces from the Zhongchuming site and were successful in improving their mechanical strength with minimal application. This kind of material has great natural compatibility with jade and ensures good retreatability, as it can fill the etching pits and intergranular pores while retaining the pores with dimensions at the micron level.

Huang Xi recieved a BSc in materials chemistry from the Faculty of Science, Harbin Institute of Technology (2011-2015) and a PhD in History (Outstanding PhD Thesis Award) from the School of Archaeology and Museology, Peking University (2015–2020). Huang Xi is mainly engaged in the study of corrosion and conservation of ancient Chinese jade and glass and has participated in dozens of on-site conservation projects at important archaeological excavations in China. Huang Xi is able to deal with conservation and restoration of bronze, iron, gold and silver objects. 1270141223@qq.com (Institute of Archaeology, Chinese Academy of Social Sciences, Beijing, China)

INSTITUTE OF ARCHAEOLOGY
CHINESE ACADEMY OF SOCIAL SCIENCES
(IA CASS)

Preliminary Study on Dete
Conservation Approach fo

Huang Xi, Institute of Archaeology, Chi
email:127014122

1.Deterioration Patterns

Jade is one of the most symbolic marks of the ancient Chinese culture, but very few studies have paid attention to the degradation and conservation of weathered jades. Jade artifacts, especially those from the Neolithic perio and excavated in southern China, have undergone tremendous changes.The condition and deterioration pattern of these jade artifacts are very different from the bulk of the heirloom jades existing in both domestic and international collections. The compact mineral aggregates have transformed into loose white powders, with a substantial decline in mechanical strength.


original state

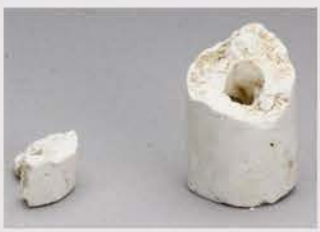
powdering


colouration

Biological Colonization


zonal whitenning


erosion


fracture

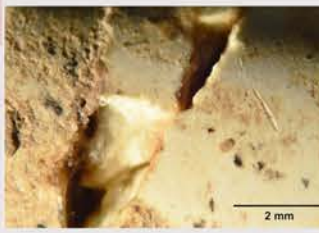
Previous Restoration

previous restoration (intergration)


whitenning

perforation


delamination



previous restoration (adhesion)

Chemical

Mechanical

Alteration can organized into four categories: Mechanical, Chemical, Biological and Previous restoratio
The whitening of jade dose not always lead to disintegration, and the whitening had developed from the exterio to the interior. Disintegration is the major problem for jade conservation.

Acknowledgments

The samples in this study are mainly collected from Jiangjiashan Cemetery and the Zhongchuming site

erioration Patterns and
or Ancient Chinese Jade

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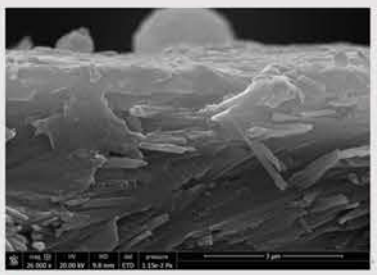
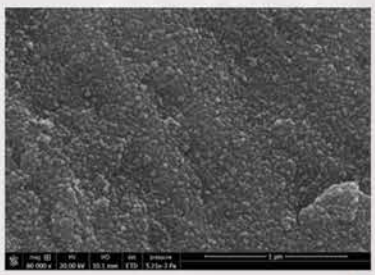



A: SEM image of spontaneous fracture of jade piece with the hyaline layer
B: the hyaline layer is composed of spherical nanoparticles of about 10-40nm in diameter

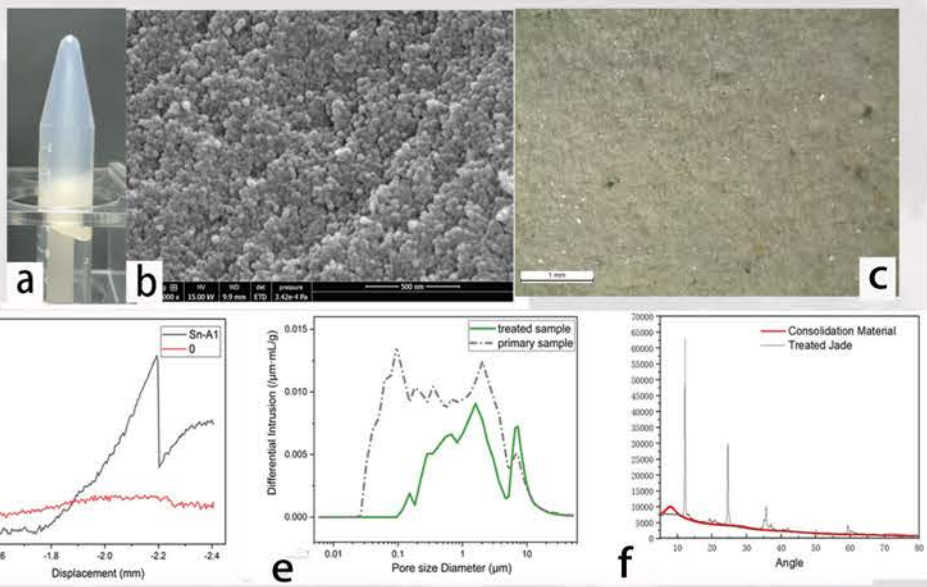
2.Natural Reinforcing Effect

By investigating the morphology and composition of natural reinforcing effect of inorganic colloids on some jade surface, revealing that the glassy layer is a kind of geopolymers with silica-alumina gels as the major component, which can also be found between grains of jade crystals closest to the surface.

3. Conservation Material

By using natural reinforcing effect of inorganic colloids as templates, consolidants synthesized by chemical precipitation of charged inorganic colloidal particles could be a promising solution for jade conservation. Aluminum sol and silica sol have been used to consolidate some unearthed powdery pieces from Zhongchuming site and were successful in improving mechanical strength with minimal application.

This kind of material has great natural compatibility with jade and ensures good retreatability, as it can fill the etching pits and intergranular pores while retaining the pores with dimensions at the micron level .



a: The consolidation material
b: SEM image of the consolidation material
c: Consolidated sample
d: Consolidation Strength of consolidants
e: The mercury intrusion pore size distribution of treated sample and primary sample
f: X-ray diffraction spectras of consolisation material and treated jade sample

of Liangzhu culture in Zhejiang province, provided by Research Institute of Cultural Relics and Archeology of Zhejiang, Hangzhou /China.

Preserving plastic book bindings: A response to changing collections

By Cancy Chu, Melanie Barrett, Sarah Bunn, Francesca Zilio and Petronella Nel

Some plastics in cultural materials are inherently unstable, displaying short lifespans and accelerating the degradation of neighbouring collection materials. While plastics are known to be common in museum settings, less information is available on conserving plastics found in paper-based collections. Surveys of three collections were conducted with the aim of identifying conservation strategies relevant to books containing plastic. This investigation identified plastic material types, binding structures and degradation patterns, indicating that books containing plastic may require improved storage methods.

Collection surveys were conducted as part of a collaborative Australian project focusing on plastics degradation in museums. Items were selected at the South Australian Museum (SAM) archive, the Art Gallery of New South Wales (AGNSW) collection, and the Grimwade Centre Thesis Archive (GCTA) at the University of Melbourne, to provide a representative sample of plastics in bound collections. Object details and condition were documented with a survey template in a Microsoft Excel spreadsheet for import into a relational database, and plastic polymers were identified with the aid of Fourier-transform infrared spectroscopy with attenuated total reflection (ATR-FTIR). Stylised book structure diagrams are illustrated in Microsoft PowerPoint.

A total of 160 bound items containing plastic components were surveyed across the three institutions, spanning the period from 1949 to 2019. Seven plastic polymers (PVC, PP, CN, PE, PMMA, PET and PUR) and 36 binding styles (collapsed into nine types) were identified, revealing the materials and structures of modern and contemporary book bindings. Three percent of plastic components could not be identified with ATR-FTIR. Items surveyed had an overall average condition rating of 2.29 on a 4-point scale, where 1 indicates good condition and 4 indicates severe condition. Bindings exhibited damage from four categories: physical damage, foreign material, ultraviolet (UV) radiation exposure and inherent vice. Suitable preservation methods for each degradation type are proposed: improved housing and environment, reduced handling, storage in low UV environments, low ventilation through containment or separation of plastic components depending on materials and structures.

As there is limited literature on books containing plastic, this paper is positioned to aid in the care of an increasingly common paper collection type. Results contrast and complement the traditional focus on plastics in museum objects and audio-visual settings. This study demonstrates the need for future research into conservation pathways specific to books containing plastic, highlighting the need for collaboration between plastics and paper conservators.

ACKNOWLEDGEMENTS

This research was supported by The University of Melbourne under the Melbourne Research Scholarship (Stipend); and by the Australian Government under the Research Training Program Scholarship (Fee Offset) and the Australian Research Council's Linkage Projects funding scheme (project LP160100160). The views expressed herein are those of the authors and are not necessarily those of The University of Melbourne, the Australian Government or the Australian Research Council.

Cancy Chu is a PhD candidate at the Grimwade Centre for Cultural Materials Conservation at the University of Melbourne, Australia. She is completing her dissertation on the conservation of plastics in paper-based collections. She holds a master's degree of cultural materials conservation specialising in works on paper from the University of Melbourne, Australia (2017) and a BA in studio art from Reed College, USA (2015). As an emerging conservator and researcher of books and paper, she hopes to build greater knowledge and awareness of modern book and paper materials.

Melanie Barrett is a conservator at the Singapore Art Museum and previously an objects conservator at the Art Gallery of New South Wales and the Museum of Contemporary Art Australia. She has a BSc In restoration and conservation of wood and metal decorative surfaces from London Metropolitan University and has an interest in the conservation of modern and contemporary art.

Sarah Bunn is currently an exhibitions and loans conservator at the Art Gallery of New South Wales (AGNSW), formerly conservator of works on paper at AGNSW and in private practice. She trained in Sydney and London and has worked with archive and rare book collections in Sydney and the United Kingdom and with works of art on paper at the Museum of Contemporary Art Australia and AGNSW.

Francesca Zilio has a BA and a master's degree in information management from Monash University. She had 15 years of experience working in both national and state government archives before transferring to the South Australian Museum. Her responsibilities include the archives, library and Australian polar collections.

Petronella Nel is a senior lecturer at the Grimwade Centre for Cultural Materials Conservation at the University of Melbourne, Australia. She has a BSc (Hons) in chemistry, a PhD in chemistry and an MA in cultural materials conservation (specialising in objects conservation) all obtained from the University of Melbourne. She is leading a collaborative Australian Research Council Linkage Project, "A national framework for managing malignant plastics in Museum Collections". She is interested in developing analytical techniques for characterising materials to inform their preservation.

Preserving Plastic Book Bindings

A Response to Changing Collections

IIC Wellington Congress, September 2022

Cancy Chu[1], Melanie Barrett[2], Sarah Bunn[3], Fran Zilio[4] & Petronella Nel[1]

[1]Grimwade Centre for Cultural Materials Conservation, The University of Melbourne, Melbourne; [2]Art Gallery of New South Wales, Sydney (currently Singapore Art Museum, Singapore); [3]Art Gallery of New South Wales, Sydney; [4]South Australian Museum, Adelaide, Australia

Contact: cancyc@student.unimelb.edu.au

Short Abstract: Plastics are known to be prevalent in twentieth century cultural collections. However, there is limited information available specific to books containing plastics. Surveys were conducted in three collections to determine plastic types, binding structures and types of degradation. Results from 160 surveyed books dating from 1949–2019 found 7 plastic polymers, 36 binding styles and 4 categories of degradation. Preservation methods are proposed in response to observed degradation trends. Results inform collection care decisions for modern and contemporary bound materials, and show the need for collaboration between plastics and paper conservators.

Keywords: book collections, modern materials, changing collections, storage, collection surveys, collaboration

Acknowledgements: This research was supported by The University of Melbourne under the Melbourne Research Scholarship (Stipend); and by the Australian Government under the Research Training Program Scholarship (Fee Offset) and the Australian Research Council's Linkage Projects funding scheme (project LP160100160). The views expressed herein are those of the authors and are not necessarily those of The University of Melbourne, the Australian Government, or the Australian Research Council.

PolyMuse
Conserving Polymers in Museum Collections

SAM South Australian Museum

Art Gallery NSW

IIC 29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

Australian Government
Australian Research Council

1. Context and Aim

- Although conservators are increasingly equipped to identify (2008; Plastic Identification Tool 2019), there is limited know
- Yet plastics are found in over 90% of Australian archives (Cl
- Therefore, collections were surveyed to propose preservatio

2. Methods

A representative sample of books containing plastics were survey

- Object materials and condition were documented in a sprea database (Bell et al. 2022).
- Plastic polymers were identified using Fourier-transform infr reflection (ATR-FTIR) (Bell, Nel & Stuart 2019). 3% of plastic

Table 1. Collections surveyed.

Institution	Collection type
South Australian Museum (SAM)	Manuscripts
Art Gallery of New South Wales (AGNSW)	Artwork *Chines*
Grimwade Centre Thesis Archive (GTCA)	Theses

3. Results

Summary

160 items surveyed

36 binding styles
9 overall types

7 plastic polymers
listed from most to least prevalent*

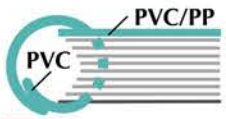
2.29 average condition
on 4-point condition scale where 1= good, 4 = severe

Key

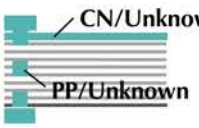
- **2.29** average condition rating
- adhesive
- plastic
- metal
- elements not visible from surface
- textblock
- paper-based cover

Binding Structure

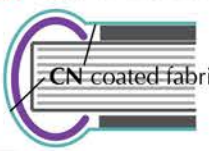
Materials and structures of 9 bindin representing 36 styles. Not shown t from severe to good condition.



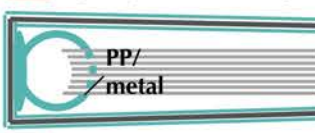
2.67 Comb binding



2.67 Strip or Velo binding



2.50 Spring-back binding



2.43 Ring binding

Enclosed: **PE/PP** bags or sleeves.

*PVC = poly(vinyl chloride), PP = polypropylene, CN = cellu

and conserve plastics (e.g. Shashoua
wledge of plastics in book bindings.
hu & Nel 2021).
n methods for books containing plastic.

yed in three collections (see Table 1).
adsheet for import into a relational

ared spectroscopy with attenuated total
c components could not be identified.

e	Collection period
	1980–2010
se Bible (2009)	1949–1999
	1982–2019

4. Conclusion

- An analysis of 160 post-1949 books containing plastic reveals that these materials are susceptible to a range of degradation.
- Damage from **physical forces** was most commonly observed, affecting all book structures.
- Plasticised **PVC** was the most unstable of the 7 polymers identified (PVC, PP, CN, PE, PMMA, PET, PUR).
- **Preservation strategies** proposed are improving housing and environment, reducing handling, storage in low UV environments, lowering ventilation through containment, or separation of plastic components, depending on material and structure.
- Future research into conservation pathways specific to books containing plastic is needed.

For more details, please see the forthcoming publication.

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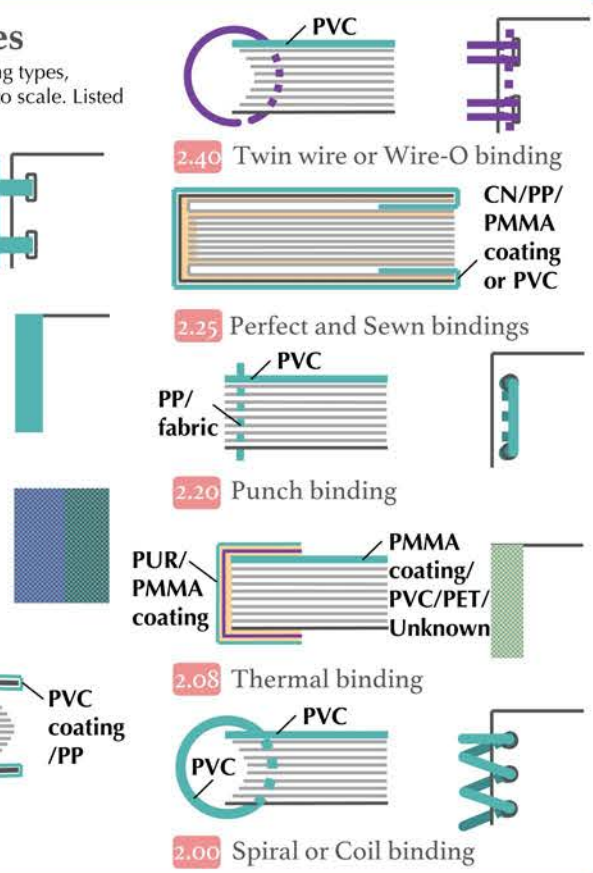


Damage and Preservation

Listed from severe to good condition.

I: Physical forces

- Degradation: Abrasion, cracks, deformation, etc., affecting all binding types.
- Solution: Improve housing and reduce handling.

II: Foreign material

- Degradation: Dust, dirt, staining or mould, affecting all binding types.
- Solution: Improve housing and environment to reduce contamination and risk of mould.

III: Inherent vice

- Degradation: Discolouration, shrinkage, cracking, embrittlement or media transfer affecting highly plasticised PVC covers of ring, perfect or sewn bindings.
- Solution: Separation or containment.

IV: Ultraviolet (UV) radiation

- Degradation: Colour fading or discolouration (yellowing) predominantly affecting lightly coloured or uncoloured PVC and coated fabrics.
- Solution: Storage in low UV environment.

ulose nitrate, **PE** = polyethylene, **PMMA** = poly(methyl methacrylate), **PET** = poly(ethylene terephthalate), **PUR** = polyurethane.

Sensor Materials for the Deterioration of Carbonates in a Changing Outdoor Environment

By Marija Milchin, Johannes Weber and Gabriela Krist

In this time of climate change and changing air quality, efforts must be made to increase our knowledge of the processes and rates at which materials deteriorate. In order to understand how the changes in climate and air quality influence the decay of materials, sensor materials as well as on-site monitoring can be implemented. In this poster, possible sensor materials for the surface recession of carbonate stones are proposed, tested and discussed.

It is expected that the recession rate of carbonate materials will increase in the near and far future in Europe, as suggested by Bonnaza, et al. (2009). In order to measure this phenomenon on site, sensor materials are proposed and evaluated in the following work. Polished samples of natural stones consisting of calcium carbonate and calcium sulphate (marble, limestone and different alabaster types) were compared and evaluated regarding their possible use as sensor materials for the wettability and surface recession of carbonate stones. For the evaluation, different methods of analysis including 3D microscopy, gloss and gravimetric measurements were used.

As a result the pros and cons of each of the sensor materials can be stated and typical situations and expositions defined in which one or the other sensor is indicated. Alabaster sensors seem to be very promising for the wetting of the surfaces while surface recession is best estimated with help from the sensors consisting of calcium carbonate. In order to monitor the sensors, gloss and weight measurements provide a simple but promising possibility; the measurement of the surface relief using a 3D digital microscope gives more insight to the morphology and development of the decay patterns.

Sensors can contribute to the decision-making process regarding possible conservation strategies and methods. Depending on the exposure and the rate of decay, traditional conservation measures like protective coatings and/or shelters (permanent or temporary) can be recommended. Similar to the Oddy tests for metals, standardized sensor materials for evaluating the decay rate of outdoor stone monuments can help towards sustainable conservation solutions and case specific interventions in the future. Sensors can become part of wider monitoring strategies offering a sustainable approach to the preservation of outdoor monuments or ensembles in times of frequent resource shortage.

Marija Milchin is a stone conservator who gained her degree in conservation at the University of Applied Arts Vienna in 2006. After two years at a private conservation company (Atelier Gurtner Wien), she started working at the Institute of Conservation in 2008 in the position of university assistant, teaching the theory and practice of stone conservation. At the Institute she is frequently involved in projects concerning cultural heritage in Austria and abroad (Nepal, India, Mongolia, Albania, Croatia, etc.). Since 2019 her research has focused on the possibilities for protection of outdoor stone monuments with regards to climate change in the frame of her doctoral thesis.

Johannes Weber, a petrologist who graduated from the University of Vienna, has been employed since the 1980s at the University of Applied Arts Vienna where he has been lecturing on mineral material sciences in respect to the characterization, decay diagnosis and principles of conservation to students of heritage conservation. His national and international research activities have focused on issues of stone deterioration and conservation as well as on ancient and historic mortar characterization. Retired from his position as professor in 2020, Johannes Weber is currently active as an honorary professor and lecturer and continues working in his fields of expertise.

Gabriela Krist has been university professor at the University of Applied Arts Vienna since 1999 and is head of the Institute of Conservation. Since 2019 she has been chair holder of the UNESCO Chair on Conservation and Preservation of Tangible Cultural Heritage. She studied conservation at the Academy of Fine Arts Vienna as well as art history and archaeology in Vienna and Salzburg. For many years she worked for ICCROM in Rome and at the Austrian Federal Office for the Care of Monuments (Bundesdenkmalamt). She leads education co-operation programmes, conservation campaigns and workshops in India, Nepal, Mongolia and Thailand.

SENSOR MATERIALS FOR THE DETERIORATION OF
IN A CHANGING OUTDOOR ENVIRONMENT

Marija Milchin, Johannes Weber and Gabriela Krist
Institute of Conservation, University of Applied Arts Vienna, Vienna, Austria

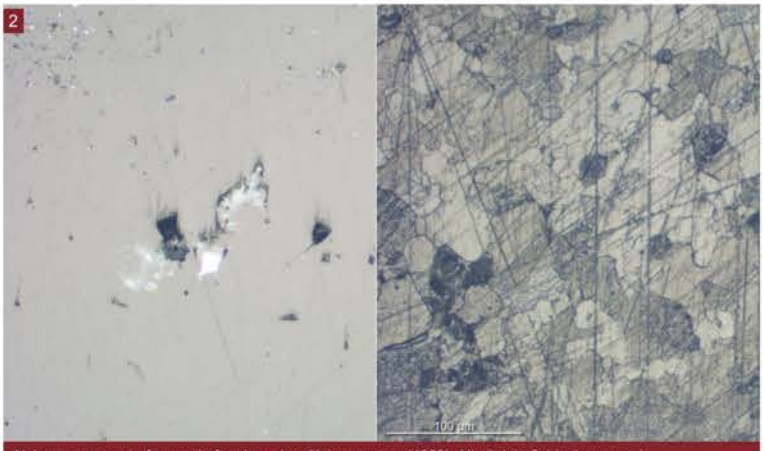
1. Introduction

In the time of climate change and changing air quality, efforts must be made to increase our knowledge of the processes and rate at which materials deteriorate. der to understand how these factors, affect the decay of hertitage materials, the exposure of sensors as well as on-site monitoring can be implemented.
It is expected that the recession rate of carbonate materials will increase in the near and far future in Europe, as suggested by Bonnaza et al. (2009). In order to sure this phenomenon on site, sensor materials are proposed and evaluated in this study. Different compact natural stone materials consisting of calcium carbon (compact limestone from Vraca, Bulgaria and Carrara marble from Italy) and calcium sulphate (different types of alabaster) were tested for their potential as mat sensors for the recession of carbonate surfaces. Preliminary testing in the lab was followed by field exposure (Fig.1). Varying types of surface polish were asses their suitability to monitor surface erosion under different environmental impact found on sites. Three different analytical approaches were used for the assessme surface alterations, namely gravimetry, gloss measurements and microscopy (3D digital and optical microscopy).

1

Polished stone sensors exposed in the outdoor environment. (winter 2021/22)

2



Alabaster sensor before and after 4 weeks of lab exposure (100% rH). (bright field microscopy)

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3. Methodology and Results: Field exposure tests

In the first field exposure test series, three alabaster types differing in transparency and colour and two carbonate stones (Carrara marble and Vraca compact limestone) were tested. The samples (4x4x1cm) were mounted facing NW in Lower Austria, placed on an exposure rack at an angle of approx. 45° (Fig.1). The surfaces before exposure were hand polished; back and sides of the sensors sealed. Gloss and weight were measured before as well as after exposure; microscopy was used for the detailed examination of the surface. After 3 months the first set of sensors was removed from the exposure rack and tested.

Results: Gloss and gravimetry

The results from the gloss measurements (20°, 60° and 85°) reveal a significant drop in the gloss value (drop of value between 26 and 97%) for all stones and all angles after three months, making the gloss measurement a promising testing method for the initial surface recession (Fig.3). However, it is expected that changes in surface gloss will flatten with increasing exposure time, as the surface recession produces a matt surface and the gloss approaches 0 GU. Although all sensors show weight reduction after 3 months, the loss is still under 1%; the alabaster samples have lost between 0,3 and 0,5%, the carbonate stones (Vraca and Carrara) under 0,1%.

Results: Microscopy

The use of incident light microscopy before and after the exposure enables a better understanding of microstructural effects of the weathering process as well as the assessment of initial changes in the surface morphology of the sensor materials. While the 3D microscopy before exposure could not trace any relief on the (polished) surfaces, it did reveal a partly strong surface relief after 3 months exposure (Fig. 4), especially with the alabaster samples. To which extent this can be used for the quantification of roughness as a measure of the recession, especially when applied in combination with the other two methods, has yet to be studied.

4. Conclusions and Outloo

The differences found between loss of gloss in this case, might (over 1 year), especially under data is expected to become mo

In order to understand the impa sors can be useful. The use of prolonged periods of exposure, tion of the sensors. Additional r in the preparation of polished m may prove useful if financial res have different starting points ar help in the process of conserva

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CARBONATES

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CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

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Universität für angewandte Kunst Wien
University of Applied Arts Vienna

2. Methodology and results: Laboratory tests

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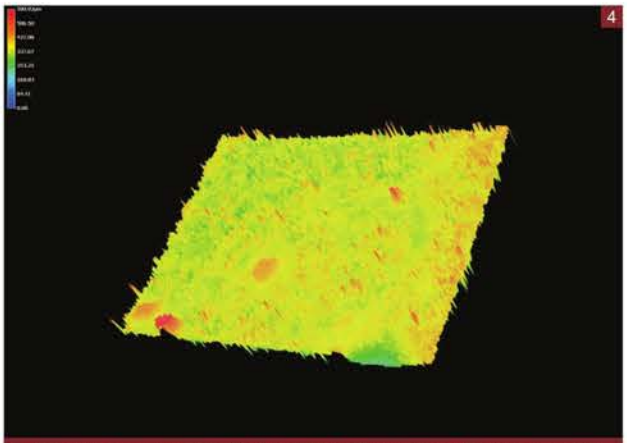
The tests in the lab were focussing on the optimal surface preparation of the sensors in view of standardized impact of moisture under lab conditions (water condensation and short-term contact of the surface with liquid water). The effects achieved in terms of surface etching were measured before and after the ageing tests, using the same analytical methods as for the field exposed samples (gravimetry, gloss measurements, microscopy). As expected, mechanical high gloss polish of the sensor materials showed the best results as it provides highly sensitive sensors which can be used both for outdoor and indoor exposure conditions. Thus, minute surface alterations as e.g. obtained due to indoor condensation or under sheltered outdoor conditions can be monitored. Alabaster proved to be very moisture sensitive material (Fig. 2) as compared to carbonate sensors. The latter ones are more useful for monitoring unprotected outdoor exposure conditions, where even hand polishing of sensor surfaces may yield satisfactory results achieved by decline in gloss and increase of microscopic roughness.

	Drop in gloss value after 3 months of exposure (%)		
material	for 20°	for 60°	for 85°
r I	78,6	63,64	92,1
r II	38,24	40,57	90,51
r III	26,32	50,51	97,06
mpact limestone	90,8	85,76	42,37
marble	91,33	89,21	55,9

p of gloss value for hand polished material sensors after 3 months of unsheltered outdoor exposure.



Surface relief of marble sensor after 3 months of outdoor exposure (3D digital microcop).

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the stone types were as expected. Alabaster revealed more soluble, therefore showing higher rates of weight loss as well as decline of gloss. However, the prove too fast for mid and long term sensoring. The carbonates on the contrary are expected to give good sensors for medium- and long-term monitoring unprotected exposure conditions outdoors. To verify this, an additional set of sensors is further exposed and will be evaluated in future. The gravimetrical set of ore relevant with longer exposure. The correlation of microscopy with the other two methods has to be studied more in depth.

act of the immediate surrounding at given conditions of exposure, including specific microclimatic situations under the effect of climate change, material sen- alabaster sensors for the indirect study of the surface recession of carbonate stones is a possibility, especially in situations where time is the limiting factor. For carbonate stones provide better sensors. The measurement of the surface gloss and the sensor´s weight give a good methodical combination for the evalua- microscopic analyses, help better understand the deterioration processes on a micro scale. Sensors with initial high gloss polish (machine preparation, as used nicroscopic sections), should be preferred over manual polishing due to their higher sensitivity in the initial phase. But also, sensors that are polished by hand sources are limited. It seems important to stress that the results of a sensor can only be compared to its initial values since each sample and each stone used, nd there is no standardized protocol for the use and the evaluation of such material sensors. Nevertheless, results from such material sensors can be of great ation and/or preservation of cultural assets made of stone, and provide a tool for informed decision-making.

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Shared guidelines for the conservation of public urban art: the CAPuS project

C. Ricci[1], A. Scarcella[1], P. Croveri[1], M. Gulmini[2] and D. Scalarone[2]
[1] *Center for Conservation and Restoration of Cultural Heritage "La Venaria Reale", Venaria Reale (Torino), Italy*
[2] *Department of Chemistry, University of Torino, Torino, Italy*

The preservation of contemporary urban art in public spaces poses several issues and challenges: the large variety of materials used, the impact of outdoor conditions, pollution and climate change, the need to involve many different stakeholders and professionals in the construction of a conservation project, the rise of awareness among local communities and citizens towards the shared responsibility related to the preservation of urban art, the lack of funds for maintenance plans and specific protocols for treatments and interventions. These were some of the topics addressed within the CAPuS project (Conservation of Art in Public Spaces), developed as part of the European Programme Erasmus+ Knowledge Alliances between 2018 and 2021, which involved 17 different partners from five member countries of the EU.

One of the main goals of the CAPuS project was the development of specific guidelines for the protection and conservation of contemporary urban artworks, particularly mural paintings and metal sculptures. These guidelines were created starting from the shared experience of all partners, each of which selected and studied some local artworks as representative case studies in order to test some specific treatments or products for conservation. Not only were the recommendations and expertise of conservators and conservation scientists taken into account but also the perspectives of artists, municipalities, companies in conservation and related sectors, citizens and other stakeholders involved.

The guidelines were created as an operative tool, aimed at outlining a shared approach and a multi-step protocol for the conservation of urban artworks. Designed like a road-map, the tool guides the users through an interdisciplinary path that includes the socio-cultural context in which the artwork was created; interviews with the artists; the analytical investigation of the constitutive materials and the artistic techniques; the identification of the deterioration phenomena and their possible causes; and finally leads to the construction of conservation projects and maintenance programmes.

Since each artwork has different conservation needs, the guidelines do not provide precise recommendations about the products or treatments to use but outlines a series of topics to take into account for the comprehension of the problems and the definition of methodologies. For each section, some tools or analytical techniques are suggested to address these questions as well as the criteria to follow for the choice of proper strategies, both for scientific campaign and conservation treatments. Some additional tools were defined within the project, such as a template for the condition report of the artwork and an illustrated multilingual glossary to help in the assessment and description of the artworks' conditions. A digital archive was also created in order to store, preserve and make available to scholars and the general public all materials related to the artworks examined within the project. Besides being intended as a dissemination tool, the repository could also serve as a reference for professionals by keeping track of different conservation methods and approaches. All documents and materials are available through the CAPuS official website (www.capusproject.eu).

Believing that there is no one-size-fits-all protocol that is universally suitable for conservation treatments, these guidelines represent a powerful operative and training tool both for students and professionals.

Chiara Ricci, a conservation scientist, graduated from the University of Turin in science for cultural heritage (2012) and in materials science for cultural heritage (2016). In 2020 she earned a PhD in protection of cultural heritage in collaboration with the University of Vigo, Spain. After graduation she had internship experiences at the Getty Conservation Institute (Los Angeles, USA) and the Instituto del Patrimonio Cultural de España (Madrid, Spain). She currently works as a technician at the University of Turin and at the scientific laboratories of the Centro Conservazione Restauro "La Venaria Reale" (CCR), where she carries out diagnostic and research activities. In recent years, she has mainly dealt with the issues of graffiti removal from ornamental stones and the conservation of public art, particularly street art works.

Arianna Scarcella is a conservator at the Centro Conservazione Restauro "La Venaria Reale"(CCR). She has participated in several conservation projects and interventions on wall paintings, stones and architectural surfaces in Pompei, Museo Egizio of Turin and on different artworks in Piedmont. She collaborates with the University of Turin including internships, workshops and an academic course of wall painting conservation (2020-2021). In 2016-2018 she joined the international cooperation project PMPS in Jerusalem (archaeological site of Bethany Tomb) as a stone and wall paintings conservation trainer. Since 2017 she has been involved as a researcher and trainer in different research projects on urban spaces and public art conservation, such the CAPuS European Project on Conservation of Art in Public Spaces. In 2020, she joined the Advanced Training School of CCR, developing and managing international training programmes on heritage conservation and capacity building. Her interest in research sprung up during her master's thesis on traditional and innovative biological systems for stone consolidation, through which she graduated in conservation and restoration of cultural heritage, at the University of Turin. Meanwhile, Arianna pursues her studies in contemporary society, science and human behaviour, attending classes on government and natural science at the Scuola di Studi Superiori "Ferdinando Rossi" of the University of Turin.

Paola Croveri attained a master's degree in chemistry from the University of Turin, and she obtained a PhD in science for the conservation of cultural heritage from the University of Florence. She worked for two years at the Scientific Laboratories at Malta Restoration Centre (Malta) as a researcher and assistant lecturer. Since 2004 she has been working as a technician researcher at University of Torino, Chemistry Department. In 2006 she began working at the Centro Conservazione Restauro "La Venaria Reale" (CCR), responsible for scientific laboratory activities and then as project manager for scientific research development and fundraising. Her main expertise concerns the conservation of natural and artificial stone, and her research activity focuses on porous building materials, paintings, glass and metals, their deterioration phenomena, the environmental causes producing their decay and the products and methodologies for their consolidation and protection. She specialized in scanning electron microscopy (VP-SEM-EDX technique) used in investigations of a wide range of works of art. Since 2007 she has been coordinating and developing the activities within national and international scientific research projects and international co-operation projects (Crosstexnet ERA, Erasmus + K2, PMSP projects, Central Europe Initiative projects) at CCR.

Monica Gulmini serves as an associate professor in the chemistry department of the University of Torino (Italy). She is a lecturer in chemical methods for the investigation of tangible cultural heritage for bachelor, master and PhD students. For her research activity, she employs several scientific techniques to investigate materials of artistic/archaeological relevance, particularly pottery, glass and textiles. She also develops instrumental analytical procedures to investigate the coating layers on historical musical instruments. She frequently contributes her chemical knowledge to interdisciplinary teams investigating the technology, provenance and degradation of ancient artefacts.

Dominique Scalarone obtained a PhD in chemistry in 2001. She is currently associate professor in the chemistry department of the University of Torino, where she lectures in the chemistry, conservation and restoration of cultural heritage curricula. Her research interests concern the chemical characterization of artistic organic materials and the analysis of their degradation, the study and development of polymeric materials and protocols for the conservation and protection of cultural heritage assets, also with a view of preventive conservation. Over the years she has developed the following research lines: i) identification and characterization of structure, properties and durability of organic materials in works of art; ii) development and characterization of polymer coatings for the protection of surfaces; iii) formulation and study of gels for the cleaning of works of art; iv) development of analytical protocols, conservation guidelines and educational resources for the conservation of urban art works; v) synthesis and characterization of functional polymeric materials for environmental applications. This research has so far led to over 80 peer-reviewed publications including research articles in international scientific journals and four book chapters.

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Shared guidelines for the
the CAPuS project

C. Ricci[1], A. Scarcella[1], P. Croveri[1], M. Gulmin

The CAPuS project (Conservation of Art in Public Spaces), developed as part of the European Programme Erasmus+ Knowledge Alliances between 2018 and 2021, started from the evidence that the conservation of street and urban art lacks of specific initiatives and is often underrepresented in academic programmes. The project involved 17 different partners from 5 EU countries.

Research team	Partner	Partner Country
1	University of Torino	IT
	Conservation Restoration Centre "La Venaria Reale"	IT
2	CESMAR7	IT
	AN.T.A.RES	IT
3	Cologne Inst. of Conserv. Sci.	DE
	Schmincke	DE
4	University of Split	HR
	METRIS	HR
	Sisak Municipal Museum	HR
5	Academy of Fine Arts in Warsaw	PL
6	University of Vigo	ES
7	Montana Colors	ES
8	University of Parma	IT
9	Medhiartis	IT
	Associated partner	
	Municipality of Torino	IT
	Municipality of Milan	IT
	Municipality of Reggio Emilia	IT

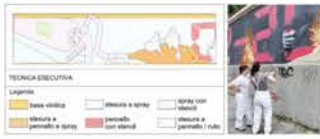
The CAPuS project envisaged several operational phases, organized into Work Packages (WPs):

- **WP 2** — Socio-cultural collocation of selected artworks (murals / metal sculptures)
- **WP 3** — Analytical characterization of the materials, technique and condition of the artwork
- **WP 4** — Testing of products for specific conservation treatments (both on mock-ups and on site)
- **WP 5** — Definition of a conservation methodology for public artworks
- **WP 6** — Implementation of formative modules based on the acquires knowledge and experience

One of the main goals of the CAPuS project was t development of an operational tool outlining a sh approach and a multi-step protocol for the conse of outdoor public artworks. The implementation o conservation guidelines has benefited from:

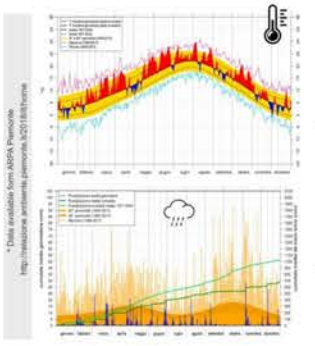
Knowledge

the study of the general context and the artwork, focusing on the constitutive materials, the technique of execution and the observation of the degradation phenomena



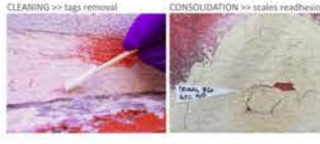
Evaluation / Research

the study of the outdoor environment and the urban context and the identification of the main causes of degradation; the comprehension of these factors is crucial to plan the following tests on products and treatments, first on mock-ups and then directly on site



Practice

the intervention (e.g., cleaning, consolidation, protection treatments) and maintenance recommendations



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e conservation of public urban art:

ni[2], D. Scalarone[2]

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[2] Department of Chemistry, University of Torino, Torino, Italy

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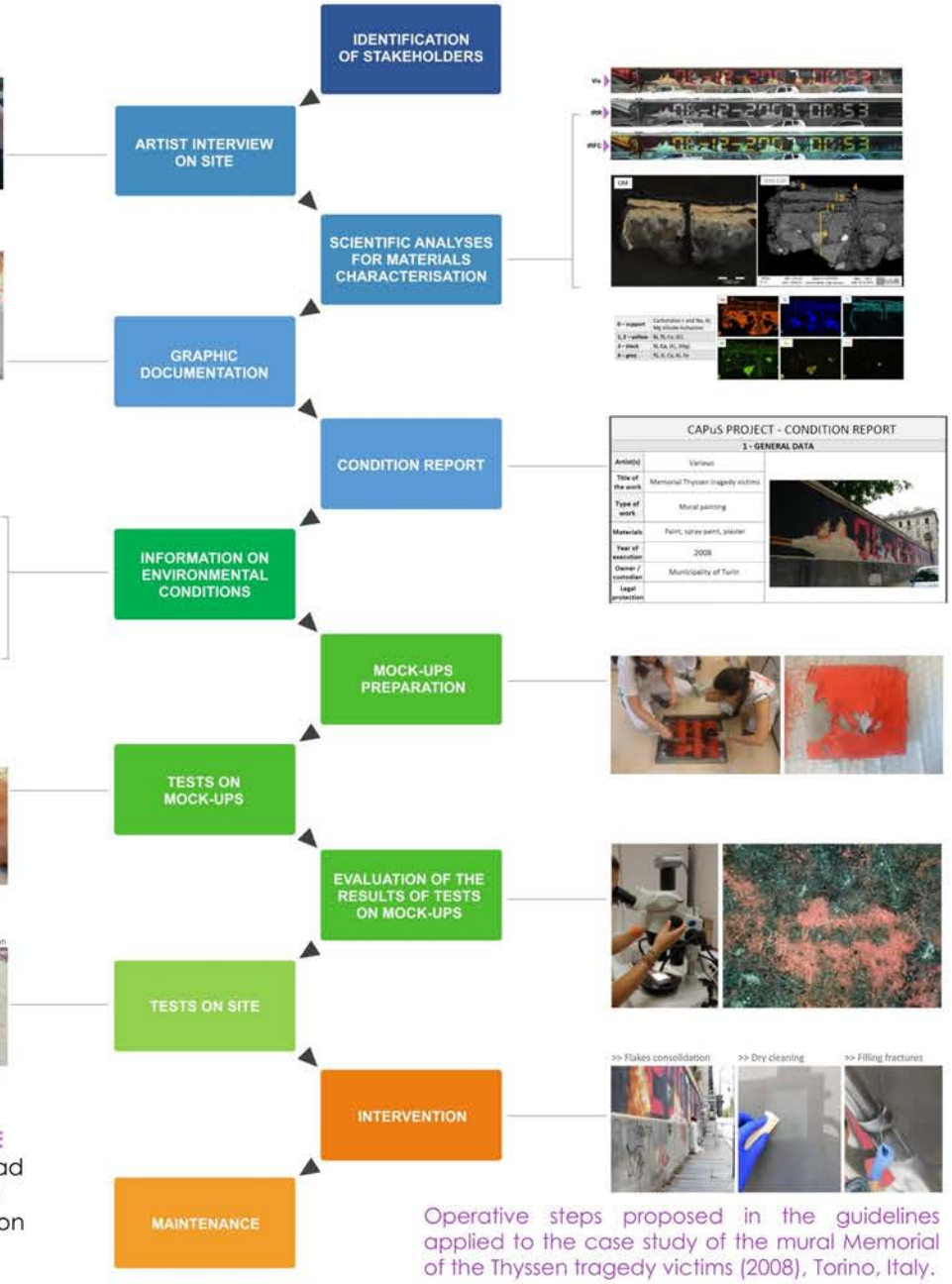
- the outcomes of WP2, WP3 and WP4
- the additional resources developed within the project (illustrated glossary, digital repository)
- a digital survey submitted to about 60 conservators around Europe with expertise in contemporary art



Operative steps proposed in the guidelines applied to the case study of the mural Memorial of the Thyssen tragedy victims (2008), Torino, Italy.

Final remarks

Although each artwork has different conservation needs and none single protocol for treatments may be universally suitable, the conservation guidelines can represent an operative road-map for professionals, guiding the decision-making step-by-step along the conservation process.

RESOURCES

Illustrated Glossary

A multilingual glossary to be used as a "working tool" by either students / non-expert users or specialists. It counts 141 definitions divided into two sections, respectively entitled "Street art & Graffiti" and "Conservation".

www.capusproject.eu/glossary/

CAPuS Digital repository

A digital archive which stores, preserves and provides access to information on the public artworks studied as a part of the CAPuS project: artist interviews, photographic documentation, archival records, analytical reports, conservation treatments documentation.

www.capusrepository.unito.it/

Co-funded by the Erasmus+ Programme of the European Commission, Project N° 588082-EPP-A-2017-1-IT-EPPKA2-KA.

Strength and Protest in Glass: Conservation of Ralph Hotere's leaded glass works *Mururoa* and *Black Rainbow* (1984)

By Peter Mackenzie

The deep, dark and saturating works of renowned New Zealand artist Ralph Hotere cross wide-ranging media; from glossy nitrocellulose lacquer, salvaged corroding metals and charred timber to glass, setting broad conservation challenges. The need to rehouse two large arched windows was an opportunity for a traditional stained-glass maker and conservator to explore local adaptations of modern materials and methods in New Zealand and, in collaboration with other tradespeople, share and revive old glazing techniques to support structural longevity while maintaining the artist's distinctive patina.

Gilded glass and sash windows became a consistent thread in Ralph Hotere's work. Distant from guild training, Hotere was free to innovate and utilise stained glass qualities of awe and quiet sustained observation with personal agenda, such as issues of nuclear testing in the Pacific, land confiscation, apartheid and environmental degradation. In his distinctive handwriting, he formed lettering with strap leads, cut striking bold shapes and used a limited vivid palette against graphic lead lines or even solid black glass. Over time structural issues arose: novel shapes prone to breaking, varying thicknesses of glass and lead, brittle weatherproofing cement, rot in salvaged wooden frames and lack of reinforcement.

Problems highlight the need to share traditional techniques: cement recipes; understanding joining; interlocking glass; load-bearing and architectural considerations; connecting artists with quality materials suppliers and expertise; building complementary trade relationships (masons, joiners) to deepen material understanding, e.g. silicones, cements, lime variants, drying oils and sensitive replacement techniques.

Conservation of *Mururoa and Black Rainbow* (1984) involved replacing deteriorated lead, matching and replacing glass, analysing and renewing weatherproofing cement and splicing matching wood into the old sash. Analysing sheet glass revealed Hotere's relationships with local New Zealand glass importers, the supply constraints then and the wider international glass provenance from the 1980s-2000s. German, French and English mouthblown glasses, American table-rolled mixtures, maritime signal glasses and salvaged residential glasses all form part of Hotere's contemporary glass context.

While personal research and analysis informs conservation processes, interviewing artists, family and craftspeople who assisted Hotere has been vital in understanding the practical, often simple, reasons behind the methods of the works and Hotere's personal practice. Working alongside the Hotere Foundation Trust and the Hocken Library collectively formed the path to collaboration for a sensitive conservation approach to stabilise and present the windows for exhibition and institutional guardianship.

Implications of this case study help to highlight potential deterioration issues and the need for early conservation of similar works. Dissemination of knowledge about sound materials, structural integrity and reinforcement practices can ensure transmission of skills and experience, supporting contemporary artists exploring the medium and advancing local contextual stained glass. As one of the most significant modern artists of New Zealand, Hotere's powerful and potent works cast reflections on our histories, with deep ramifications for other artists and conservators venturing into traditional techniques in modern media.

Peter Mackenzie uses non-destructive, reversible techniques to preserve windows forming part of New Zealand's architectural fabric. His practices are informed by master glass painter Charles Wetton from Luxford's Stained Glass, London. Peter believes understanding traditional studio culture is crucial to understanding historic windows. He surveys, plans, costs and delivers window conservation and long-term protection in tandem with New Zealand's established heritage architects. He works with manufacturers of mouth-blown, hand-mixed and hand-rolled glass across Europe and North America, also with lead and metals suppliers in trade since 1770, so as to match materials used in early NZ windows.

Strength and protest in glass: conservation of Ralph Hotere's leaded gl

AUTHOR: PETER MACKENZIE. OTAGO STAINED GLASS. PRINCIPAL STAINED GLASS MAKER AND CONSERVATOR. NZCCM

Summary

The deep, dark and saturating works of renowned New Zealand artist Ralph Hotere cross wide-ranging media; from glossy nitrocellulose lacquer, salvaged corroding metals and charred timber, to glass, setting broad conservation challenges. The need to rehouse two large arched windows was an opportunity for a traditional stained glass maker and conservator to explore local adaptations of modern materials and methods in New Zealand, and in collaboration with other tradespeople share and revive old glazing techniques to support structural longevity, while maintaining the artist's distinctive patina.

Local ingenuity with available materials

Gilded glass and sash windows became a consistent thread in Ralph Hotere's work. Distant from guild training, Hotere was free to innovate and utilise stained glass qualities of awe and quiet sustained observation with personal agenda, such as issues of nuclear testing in the Pacific, land confiscation, apartheid, and environmental degradation. In his distinctive handwriting he formed lettering with strap leads, cut striking bold shapes, and used a limited vivid palette against graphic leadlines, or even solid black glass. Over time structural issues arose: novel shapes prone to breaking, varying thicknesses of glass and lead, brittle weatherproofing cement, rot in salvaged wooden frames, lack of reinforcement.

Invaluable collaboration

Problems highlight the need to share traditional techniques: cement recipes, understanding jointing, interlocking glass, load-bearing and architectural considerations, connecting artists with quality materials suppliers and expertise, building complementary trade relationships (masons, joiners) to deepen material understanding, e.g. silicones, cements, lime variants, drying oils, sensitive replacement techniques.

Identifying materials

Conservation of *Mururoa* and *Black Rainbow* (1984) involved replacing deteriorated lead, matching and replacing glass, analysing and renewing weatherproofing cement, and splicing matching wood into the old sash. Analysing sheet glass revealed Hotere's relationships with local New Zealand glass importers, supply constraints then; wider international glass provenance from the 1980s-2000s. German, French and English mouthblown glasses, American table-rolled mixtures, maritime signal glasses, salvaged residential glasses all form part of Hotere's contemporary glass context.

Personal connections

While personal research and analysis informs conservation processes, interviewing artists, family and craftspeople who assisted Hotere has been vital in understanding the practical, often simple, reasons behind the methods of the works and Hotere's personal practice. Working alongside the Hotere Foundation Trust and the Hocken Library collectively formed the path to collaboration for a sensitive conservation approach, to stabilise and present the windows for exhibition and institutional guardianship.

Sharing insights

Implications of this case study help to highlight potential deterioration issues, and the need for early conservation of similar works. Dissemination of knowledge about sound materials, structural integrity and reinforcement practices can ensure transmission of skills and experience, supporting contemporary artists exploring the medium, and advancing local contextual stained glass. As one of the most significant modern artists of New Zealand, Hotere's powerful and potent works cast reflections on our histories, with deep ramifications for other artists and conservators venturing into traditional techniques in modern media.

Broken glass, some irreplaceable

- Several areas of the two leadlight artworks had suffered cracking and one smashed-out hole. Some rare glass had been cracked and was glued in situ with HXTAL.
- This strikingly vivid orange glass is of a type produced for only a short time by English sheet-glass makers Hartley-Woods, in Portobello Rd, Sunderland. Known for making the sought-after mouthblown "English Streakies", the company supplied glass for windows by the Pre-Raphaelites and Arts and Crafts exponents, plus for the prestigious James Powell and Co, (known as Whitefriars).
- For less than the decade before the Hotere windows were made, Hartley-Woods produced a leathery-surface-textured table-rolled streaky glass. An orange streaky sheet of this was used for the nuclear mushroom cloud.

Hartley-woods table glass was rare given its short production run. It proved so brittle it was often damaged during shipping

On and below surfaces: meaning in shadowy blacks

- Ralph Hotere developed a reputation for politically charged art that confronted misdi authority and notably challenged the arrogance and bigotry of colonial nations. A ma words, his forms of protest were in forms of art, and in shadow. War, sorrow, memor grief and reflection are mirrored in his masterful use of blacks. The glass works in qu exemplify this stance, calling to the fore the atrocities of French nuclear weapons tes Pacific: the bombing regimes and research to monitor radiation effects on fallout vict utter destruction of atolls and lives. *Black Rainbow* is grim, and to represent radiation spectre Hotere chose a rolled American glass with a wrought and strained texture (lo
- The artwork above this text, *Black Phoenix* (1984) rises from the ashes of a burnt ves palisades, and the smoke of retreat from Te Aupōuri. The transformation of materials subtleties of black surfaces deeply affected Hotere; charring and buckling, black, sha interplay, grief and loss.
- The panel on the lower right of the text is a classic ultra-sheen black work that is slas thin red cuts like wounds, in his quintessential cross series of work. The surface has depth of clear lacquer layers applied, showing Hotere's love of and knack for using a paints, making such a deep, saturated black, one feels they could almost fall into it. A significant element too is that the viewer can see, on the polished surface over the bla reflection of themselves, and the question could arise of what this wound represents, may have inflicted it on whom.
- The small sleeper work is at top right at distance seems dark and formless, but as you closer and waver in angles, much is revealed to a slower eye as the song reveals itsel black surface. It references a lament of Parihaka, of Taranaki, the land wars, confisca occupations, oppressions, and indignations, and the carrying of the land-loss, in Hote Whiti' series.
- Hotere never shied from speaking truth to power, and holding space in darkness and

Intervening as little as possible, doing the essential

- Breaks in irreplaceable glass were cleaned and glued, to ensure the original look of the glass the artist chose was kept consistent.
- Smashed annealed 3mm float glass was replaced with like glass but small cracks were glued, notably where they were under strap and sheet leads that spelled out the works' titles (see below and centre image at left.
- Lead came faces were carefully bent open and channels cleaned of weatherproofing material to accept replacement glass (top and middle images at right). Came faces were then bent back to cover the glass perimeter.
- Weatherproofing linseed oil putty, made dark grey with graphite, was then gently pressed in between lead cames and glass, on both sides.
- Original soldering of strap leads (below) and missed solder joins (arrowed) were left as is, to preserve process evidence (below). No attempt was made to adjust letter alignment or do any "tidying up" after the event.

Clear background glass (below)had to be glued with HXTAL so as not to disturb the artist's overlaid lettering formed with strap leads

Working with prem

- Ralph Hotere's art practice ofte producing powerful art to conv messages using readily availab Often this was was in prompt r political events he felt strongly
- These windows were made in repurposed from an early Dune warehouse. Their arched tops v shape of atomic explosion mus heads.
- Second-hand and weathered w is no surprise the sashes suffere the bottom that had to be made
- Using local tradespeople who Ralph and his partner, artist Ma meant these repairs could be m
- I gently tapped and machined then cautiously removed rotte the firmly braced frame with a its lowest setting. There was no lead. Rotten wood, repairs at ri

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CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

Acknowledgements:
This poster and conservation project were made possible and informed through the g his partner, artist Mary McFarlane. Also significant was the assistance, both technical Geology, University of Otago, Sophie White. I also acknowledge the guardianship and Collections, University of Otago, who has received and now looks after these artworks Photos of the author taken by Mary McFarlane and Sophie White. Images of gallery ar

ass works *Mururoa* and *Black Rainbow* (1984)

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.
rtworks by Sophie White. All other photos taken by the author.

Help from locals who worked with the artist

- Similar North American Douglas pine timber, here often called Oregon, was used to replace rotten sash corner material and braced with facing timber to match the original joinery. Having a local tradesperson with a feel for Hotere's work ensured appropriate care was taken and there was no damage to the windows when strengthening the frame.
- Before replacing glazing putty around the leadlight, the wood was sealed with an application of linseed oil to nourish the timber and give the fresh woodsash putty a sound surface to adhere to. The exposed perimeter lead was also treated with linseed to ensure a good seal. New joins are below and at right, and the image adjoining below and to the left of those shows linseed oil application.

Mururoa and *Black Rainbow*, in repaired frames, including the lead-head nails Hotere applied.

Cleaning glass, leaving work practice evident

- Glass surfaces were cleaned with distilled water and microfibre cloths, quite thoroughly. The panels were originally well cleaned and any oils absorbed with whiting powder, likely mixed with sawdust. Below left, the original weatherproofing (arrowed) has failed and fallen out.

- Glass surfaces were cleaned with distilled water and microfibre cloths, quite thoroughly, as the panels were originally well cleaned and any oils absorbed using whiting powder, likely mixed with sawdust. Metal surfaces were left unpolished, as that was their original finish, visible below.

Peter Mackenzie, of Otago Stained Glass, (right) uses non-destructive, reversible techniques to preserve windows forming part of New Zealand's architectural fabric. His practices are informed by master glass painter Charles Wetton, from Luxford's, London. Peter believes understanding traditional studio and guild culture is crucial to understanding historic windows. He surveys, plans, builds and delivers windows' conservation and long-term protection, in tandem with New Zealand's established heritage architects and masons He works with manufacturers of mouth-blown, hand-mixed and table-rolled glasses across Europe and North America, also with lead and metals suppliers, to match original materials used in heritage windows, and innovates with protective armouring strategies.

Email: stainedglassconservation@xtra.co.nz

Surviving and thriving: collaborative networks as a response to change

An innovative way of working adopted as a result of changes caused by the Covid-19 pandemic

By Nicola Walker

The 2020 Covid-19 pandemic caused unexpected changes on a global scale. For some these proved advantageous, for others it brought isolation and uncertainty. Many conservators in the UK, working in the public sector and large institutions, faced much time on furlough followed by unforeseen organisational re-structures and redundancy. For those in private practice, existing projects were cancelled, and new work evaporated.

Trusted Conservators, a network of eight conservation professionals with diverse specialist skills, experiences and work locations, grew out of these challenges and was launched in April 2021.

As former employees of the National Trust (a major UK conservation charity), we shared similar values and had a strong history of working collectively. The network provided an opportunity for continuity and generated a spirit of solidarity enabling us to come together for mutual support in a new world and to emerge with a positive outlook and renewed purpose.

Networks have long been established as a valuable way of spreading information and making connections to create new opportunities. Trusted Conservators began initially as a professional lifeline for individuals moving suddenly from employee to freelancer status, addressing a daunting and lonely prospect by providing an informal, yet structured, working relationship of professional and personal colleagues to debate ideas, news, questions and share advice and contacts.

The network of deeply embedded individuals became a platform that leveraged looser connections to build on established private practice, fill gaps, attract new clients and continue to work independently or collaboratively on wider projects.

Together we navigated the opportunities and (often IT) challenges of remote and home working; maintaining practical skills, often in reduced physical spaces and developing new competencies in business, finance and marketing. Via What's App and Zoom, we agreed on text and images, compiled contact lists, researched privacy policies and T&C's and debated promotional tools whilst group costs and the launch of our website were shared amongst us.

We are not a business, and network members mostly act independently, so the quantity and type of work has varied according to individual circumstances. However, without the extended support structures provided by a large organisation, a significant benefit of Trusted Conservators has been a reassuring environment in which to catch up and discuss things with peers, mitigating risks of isolation to which sole traders may be particularly susceptible.

Partnerships have resulted from working with organisations, such as providing training for a joint initiative between The Institute of Conservation and The Society for the Protection of Ancient Buildings.

We have observed other networks springing from recent challenges including groups of conservators who created community interest companies during the pandemic. More recently, in response to the Ukrainian conflict, several Trusted Conservators members have joined with others in Icon to support conservators seeking refuge in the UK. The past 18 months have shown the value of networks in providing new learning opportunities, making connections, supporting each other and wider conservation associates, sharing information, acting as a sounding board and bringing holistic solutions to projects through collaborative working and pragmatism.

Lockdown's impact on the heritage sector felt to some like the end of a hard-won career. For us, like others, collaboration in the face of this threat enabled a time of reflection, thinking differently, reviewing our working lives and developing alternative aspirations.

The pandemic was a challenging time to develop a new idea. However, the initiative provided a focus. To create and sustain the network has required our combined professional skills, leadership qualities, personal resilience, entrepreneurship, flexibility and, above all, collaboration. If it can survive that, then perhaps it can survive anything, and thriving will follow!

www.trustedconservators.com / contact@trustedconservators.com

Nicola Walker BA DipCons ACR is a paper conservator with 30 years of experience in the cultural sector. She works part-time for the National Trust as well as working as a freelance consultant for paper-based conservation and collections care projects.

In 2021 Nicola established Trusted Conservators, a network of highly skilled and experienced conservation professionals to support her own private practice and to provide a range of services to the heritage sector. This initiative grew out of huge challenges for institutional and private conservators and a recognition of the importance of collaboration in order to thrive in a changed world.

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Introduction:
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As former employees of the National Trust (a major UK conservation charity), we shared similar values and had a strong history of working collectively. The network provided an opportunity for continuity and generated a spirit of solidarity, enabling us to come together for mutual support in a new world and to emerge with a positive outlook and renewed purpose.

'Being part of the TC network has been a very positive and supportive collaboration. It turned a negative situation into a positive one and all via Zoom!'

Method:
Networks have long been established as a valuable way of spreading information and making connections to create new opportunities. Trusted Conservators began initially as a professional lifeline for individuals moving suddenly from employee to freelancer status, addressing a daunting and lonely prospect by providing an informal, yet structured working relationship of professional and personal colleagues to debate ideas, news and questions and share advice and contacts.

The network of deeply embedded individuals became a platform that leveraged looser connections to build on established private practice, fill gaps, attract new clients and continue to work independently, or else work collaboratively on wider projects.

Together we navigated the opportunities and (often IT) challenges of remote and home working; maintaining practical skills, often in reduced physical spaces and developing new competencies in business, finance and marketing. Via What's App and Zoom, we agreed text and images, compiled contact lists, researched privacy policies and T&C's, and debated promotional tools, whilst group costs and the launch of our website were shared amongst us.

www.trustedconservators.com / c

A steep learning curve - getting to grips with new technology, such media and business networking sites such as Instagram a

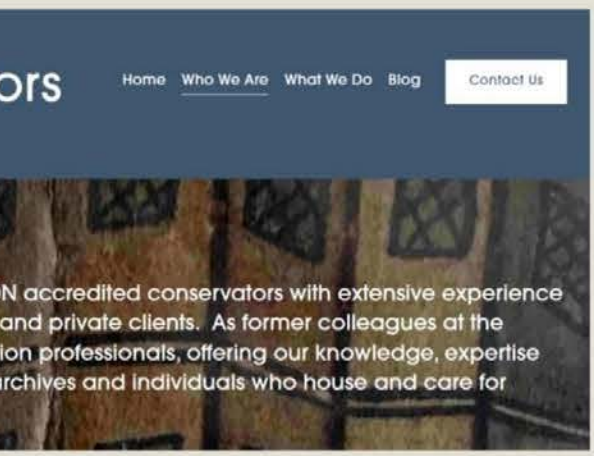
nd thriving:
as a response to change
lt of changes caused by the Covid-19 pandemic

Trusted Conservators

ontact@trustedconservators.com




as designing a shared website, and harnessing the power of social nd LinkedIn, in marketing the group and generating work



Implications and Impact:
We are not a business, and network members mostly act independently, so the quantity and type of work has varied according to individual circumstances. However, without the extended support structures provided by a large organisation, a significant benefit has been a reassuring environment in which to catch up and discuss things with peers, and which mitigates risks of isolation to which sole traders may be particularly susceptible.

Partnerships have resulted from working with organisations, such as providing training for a joint initiative between The Institute of Conservation and The Society for the Protection of Ancient Buildings.

We have observed other networks springing from recent challenge, including groups of conservators who created Community Interest Companies during the pandemic. More recently, in response to the Ukrainian conflict, several Trusted Conservators members have joined with others in ICON, to support conservators seeking refuge in the UK.

Widening our spheres of engagement through joint projects or passing on work through the network and other conservation associates - teamwork has included pitching to potential clients, practical partnerships, writing articles and delivering training

Conclusion:
The past 18 months have shown the value of networks in providing new learning opportunities, making connections, supporting each other and wider conservation associates, sharing information, acting as a sounding board and bringing holistic solutions to projects through collaborative working and pragmatism.

Lockdown's impact on the heritage sector felt to some like the end of a hard-won career. For us, like others, collaboration in the face of this threat enabled a time of reflection, thinking differently, reviewing our working lives and developing alternative aspirations.

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Sustainable Practices in Conservation: agar-agar gels for the cleaning of unvarnished paintings

By Leonardo Tavares and Dr Marilene Maia

Following the search to build new pathways towards sustainable practices in conservation, this poster explores a different approach on the formulation of a cleaning system for unvarnished oil paintings using agar-agar—a phycocolloid extracted from seaweeds like *Gracilaria spp* and *Gelidium amansii*. Usually present in modern and contemporary art, unvarnished paintings tend to be very sensitive to traditional water-cleaning systems, causing conservators around the globe to look for new materials and techniques in order to better preserve our heritage.

Already known by conservators for its gelification capability and syneresis effect, agar-agar is broadly used in gelled cleaning systems for stone, plaster and textiles and was used in an attempt to reproduce a similar system for the treatment of unvarnished paintings. With hopes of encouraging the search for natural, local and accessible materials used in conservation treatments—and due to the wide availability of agar-agar in Brazil—comparative tests were made using products from the food industry, the pharma-chemical industry and those accessible on the conservation specialized market.

A series of tests were made to compare different types of the gel loaded with deionized water regarding their cleaning efficiency and safety. The gels were tested on a 20th-century painting acquired at an antiques fair in downtown Rio. The work was chosen following a few parameters such as: being an oil painting, being unvarnished, exhibiting a priming layer and having a significant deposit of dirt. During the initial analysis it was confirmed that the paint was sensitive to the friction of swabs loaded with deionized water.

Three brands of agar-agar were chosen to perform the tests: Restaucon LDA, a specially designed conservation product acquired at the Portuguese store Restaurar & Conservar; Farmos LTDA, distributed in Rio de Janeiro by the pharma-chemical company Herzog; and Juventude Gracilária, a food industry material acquired at a local natural products store. Each gel was prepared in the same three concentrations of 1, 2 and 3% (w/v) in deionized water, applied on a selected area for five minutes and followed by a gentle mechanical removal of the residues with a cotton swab. All test areas were then registered using digital photography and microscopy with 500x magnification.

This research provides insight on the possibility of adapting commercial versions of agar-agar in cases where purer versions of the product are unreachable, making it possible to achieve a controlled dispersion of liquids during cleaning procedures and guarantying the safety of the treatment while still using a natural and green material.

Good cleaning efficiency was observed in all three products, with no solubilization of the paint. The gels could be safely used as long as the right concentration and time of contact with the surface was ensured. There seems to be a direct correlation between purity level and power of gelification. Further analysis with an electron microscope (SEM) is intended to better evaluate the results and confirm the lack of residues on the paint surface.

Leonardo Tavares is a conservator with a bachelor's degree in conservation and restoration of cultural heritage from the Federal University of Rio de Janeiro (2020) and a technical education degree in polymer science at the Macromolecules Institute (2021). Leonardo currently holds the position of conservator-restorer at the Center of Research, Collection Preservation and Diffusion of the History and Memory of the Regatta Club Vasco da Gama (CPAD-CRVG).

Dr Marilene Maia is a conservator with a PhD in anthropology from the Université Paris X, Nanterre, France (2009), a master's degree in conservation préventive du patrimoine from Université Paris 1, Sorbonne, France (2003) and a specialization in conservation and restoration of cultural movable properties from the Federal University of Minas Gerais (1993). Marliene was a professor at the Federal University of Minas Gerais for 19 years (1997-2016) and currently holds the position of professor of paintings conservation and preventive conservation at the Federal University of Rio de Janeiro as part of the Arts and Preservation Department at the School of Fine Arts.

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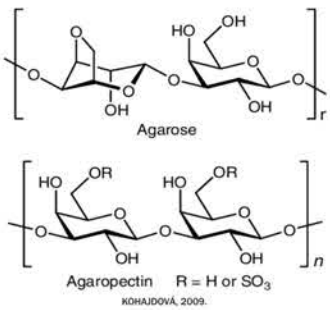
INTRODUCTION

In the pursuit of building new pathways towards sustainable practices in conservation, this poster explores a different approach to the formulation of a cleaning system for unvarnished oil paintings using agar-agar – a phycocolloid extracted from seaweeds like Gracilaria spp and Gelidium amansii. Usually present in modern and contemporary art, these paintings tend to be very sensitive to traditional water-cleaning systems, causing conservators around the globe to look for new materials and techniques in order to better preserve our heritage. Already known by conservators for its gelification capability and syneresis effect, agar-agar is broadly used in gelled cleaning systems for stone, plaster and textiles and was chosen for an attempt to reproduce a similar system for the treatment of unvarnished paintings.

Agar-agar is a polysaccharide copolymer composed by agarose and agaropectin, the first being the only responsible for the gelation of the system. It is commercialized as an insoluble powder, where all molecules are randomly tangled. After dispersion in hot water, at a temperature of at least 85ºC, the molecules reorganize themselves, forming linear chains that assume the form of a helicoidal helix after cooling. That creates the polymeric network responsible for the gelation of the system.

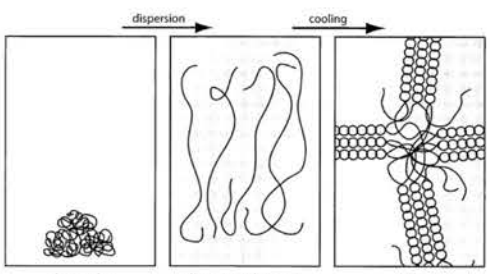
With hopes of encouraging the search for natural, local and accessible materials used in conservation treatments and due to the wide availability of agar-agar in Brazil, comparative tests were made using products from the food industry, the pharma-chemical industry and those accessible on the specialized conservation market.

Fig. 1 - The structure of Agarose and Agaropectin.



KOHAJDOVÁ, 2009.

Fig. 2 - Gel formation.



ARNOTT, S. et al. 1974.

MATERIALS AND METHODS

The painting used for the tests was acquired at a local antiques fair in downtown Rio and was chosen based on a few specific parameters, such as: being an unvarnished oil painting, having a ground layer and significant accumulation of surface dirt and/or grime.

Three brands of agar-agar were chosen to perform the tests: Restaucon LDA, a specially designed conservation product acquired at the Portuguese store Restaurar & Conservar; Farmos LDTA, distributed in Rio de Janeiro by the pharma-chemical company Chepplier; and Juventude Graciláriа, food industry material acquired at a local natural products store. All three gels were prepared in the same three concentrations of 1, 2.5 and 3% (w/v) with deionized water, applied on a selected area for five minutes and followed by a gentle removal and mechanical cleaning of the liquid residue on the surface with a cotton swab. All test areas were then registered by digital photography and microscopy with 500x magnification.

The test area was selected due to its chromatic uniformity, making it easier to observe the results. The area of application is highlighted on figure 3 by the red dotted line. Two test areas were selected for cleaning tests using only moisturized cotton swabs, attesting the expected water sensitivity of the painting. Only a gentle circular friction was necessary to observe pigment detachment.

Fig. 3 - Direct, reverse and UV light pho

Signed by "C. Prado", the piece chosen for the tests is a 55 x 4
tral background. This type of background allowed us to make the test or
ve the results. After the reverse light photography, it was evident that it
trait presenting water sensitivity was much higher. The UV light was used
unvarnished painting only by observation. No retouching or previous treatm

The photographs below show the cleaning results and how
trol of water dispersion. Gels at 5% concentration gave smoother
tact of the gel with the surface. That was confirmed on the digital mi
best results were achieved by the most rigid gels, the ones that gu

Fig. 4 - Moisturized swab cleaning.

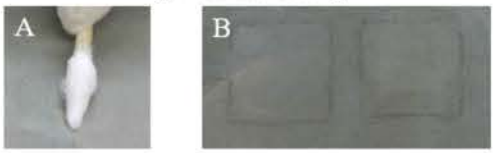


Fig. 5 - Restaucon LDA gels.

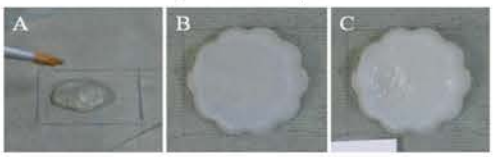


Fig. 6 - Farmos LDTA gels.

Fig. 7 - Juventude graciláriа gels.

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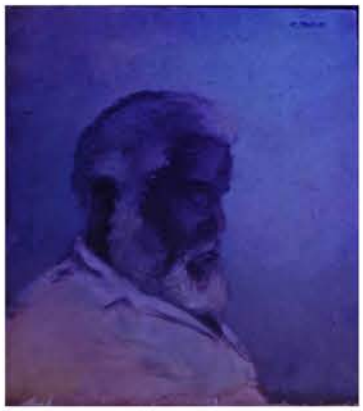
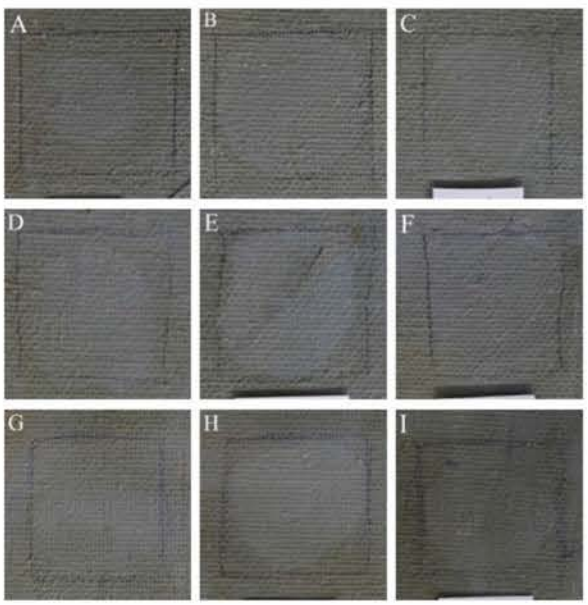
tography of painting used for the tests.



46 cm portrait, oil on canvas, showing the side view of a man on a neu-
n an area with a consistent regularity of colors, making it easier to obser-
was a really thin layered painting and therefore the chances of the por-
to attest the inexistence of varnish, even though it was clear that it was an
ents were observed, only some small paint losses, exposing the ground layer.
the higher gel concentration is directly associated with the con-
results and the cleaned area was equivalent to the area of con-
croscopy imagens on the right side as well, where we can see that the
aranteed the interaction of liquid with the upper most layer of grime.

Fig. 8 - Test areas after cleaning treatment.



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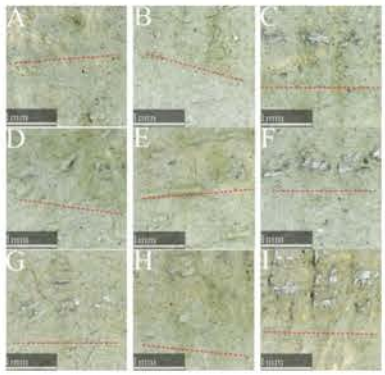
RESULTS

Good cleaning efficiency was observed in all three products and no pigment solubilization was attested. The gels could be safely used as long as the right concentration and time of contact with the surface is ensured. There seems to be a direct correlation between purity level and power of gelification. Therefore, the Juventude gracilária was definitely harder to manipulate in lower concentrations but at 5% (w/v) it was possible to create a maneuverable gel with good cleaning efficiency.

It is clear that the Restaucon gel presented the best water dispersion control among all products tested even at its lower concentration. The Farmos gel performed better at 2.5 and 5%, but it was evident that control of water dispersion was not as good as Restaucon's.

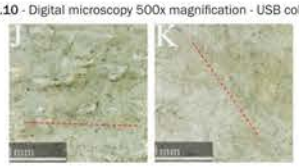
Fig. 9 - Digital microscopy 500x magnification - USB colemeter



On the left we can see the limit of the areas of contact of the gel with the surface and observe the difference between a cleaned area and an untreated area. Lower concentrations should be kept on the surface for shorter amounts of time so we can avoid migration of water to other layers of the painting, causing structural damages and whitening of the surface.

The images bellow shows the areas cleaned only with cotton swabs.

Fig.10 - Digital microscopy 500x magnification - USB colemeter.



DISCUSSION AND CONCLUSION

This research showed the possibility of adapting commercial versions of agar-agar in cases where purer versions of the product are unreachable, making it possible to achieve a controlled dispersion of liquids during cleaning procedures and guaranteeing the safety of treatment while still using a natural and green material. Further analysis with a scanning electron microscope (SEM) is intended to better evaluate the results and confirm the lack of residues remaining on the surface.

When using commercial versions of agar-agar, it is important to attest the level of purity of the product, since there's a large variety of brands available on the market. Without proper equipment to perform a deeper analysis, the color of the powder is a good parameter to start evaluating the quantity of algae residue on the final product.

All gels showed a better result than the swab cleaning. Besides the uneven cleaning results, pigment detachment was observed after gentle friction of the cotton swabs. It's clear that using a proper conservation product will provide better results, but is possible to adapt cleaning systems using higher concentrations to compose a maneuverable gel that allows the use of controlled dispersion of water, obtaining good cleaning results with cheaper and more accessible materials.

IIC 29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

The Conservation Challenges in Project Implementation at the National Heritage Site of Royal Belum Park, Grik, Perak, Malaysia: The Heritage Impact Assessment (HIA)

By Dr Mohd Sabere Sulaiman

The Royal Belum Park is a beautiful natural area of 117,500 hectares in Grik Perak, Malaysia. The park has been recognized for its significant global value and was gazetted as the Belum Forest Reserve in 1971 and later as a national heritage site under the National Heritage Act 2005 (Act 645) in 2012. The Royal Belum Park rainforest is believed to have existed for more than 130 million years, making it among the oldest in the world.

The aim of this study was to propose a suitable integrated solar LED road lighting system at Sungai Tiang Village and Sungai Kejar Village within the national heritage site of the Royal Belum Park, Grik Perak, Malaysia. Both sites were originally occupied by the indigenous people of northern Malaysia. The scope of this study focused on the conservation challenges of installing a total of 30 integrated solar LED lamp posts (20 at Sungai Tiang Village and 10 at Sungai Kejar Village) while preserving the national heritage site as approved by the National Heritage Department Malaysia. According to Act 645, a heritage impact assessment (HIA) report is required in order to protect and preserve the authenticity of a national heritage site and to maintain its identity while minimizing impact on the social and environmental aspects together with proper mitigation plans. These two cases were chosen to identify the challenges posed by the implementation process with the budget and time constraints in hand to comply with the Act 645 requirements.

Various methods were used to investigate and analyze the site including desktop study, on-site visual observations, photographic documentation and interviews with local communities and relevant local authorities in order to explore how the project would be implemented. The project was carried out during the Covid-19 pandemic, with the initial fieldwork conducted in April 2021. This gave participants a rough idea and overview of the site conditions. Both sites can be accessed only by boat via Banding Lake with a security permit from Perak State Parks Corporation. Initial findings showed some challenges and barriers that needed to be tackled comprehensively before the work could be started on the ground, especially when considering how to apply HIA requirements, awarding contractor B03 and appointing a conservator in accordance with the Act 645, ensuring the national heritage site will be protected and preserved for future generations.

Dr Mohd Sabere Sulaiman is a Superintendent Senior Architect in the Public Works Department Malaysia. He graduated with a bachelor's degree in Architecture (Hons.) from Universiti Teknologi Malaysia in 2000; received an MSc in Architectural Conservation from Edinburgh College of Art, 2009; and holds a PhD in Architecture (Building Conservation) from The University of Edinburgh, 2017. He is very passionate about building conservation and was acknowledged as Subject Matters Expert (SME) in 2018. He is also a Registered Conservator under the National Heritage Department Malaysia. Mohd's 21 years of experience have helped develop various skills related to sustainability including green building and building conservation.

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29TH BIENNIAL CONGRESS 2022
CONSERVATION AND CHANGE:
RESPONSE, ADAPTATION AND LEADERSHIP

THE CONSERVATION CHAL
NATIONAL HERITAGE SITE
MALAYSIA: THE HERITAGE

ABSTRACT

The Royal Belum Park is a beautiful natural area situated around 117,500 hectares in Grik Perak, Malaysia. The park has significantly an outstanding universal value where it was gazetted as Belum Forest Reserve in 1971 and later as National Heritage Site under National Heritage Act 2005 (Act 645) in 2012. The Royal Belum Park is believed to be existed more than 130 million years ago which amongst the oldest rainforest in the world. The aim of this study is to propose a suitable Integrated Solar LED Road Lighting System at Sungai Tiang Village and Sungai Kejar Village in the National Heritage Site of the Royal Belum, Grik Perak, Malaysia. Both sites were originally occupied by the aborigine's people in northern Malaysia. The scope of this study is focusing on the conservation challenges on installation of a total of 30 nos. Integrated Solar LED lamp posts (20 nos. at Sungai Tiang Village and 10 nos. at Sungai Kejar Village) while preserving the National Heritage Site as approved by National Heritage Department Malaysia. According to Act 645, the Heritage Impact Assessment (HIA) report is required in order to protect and preserve the authenticity of the National Heritage Site and to remain its significant identity besides minimizing the impact to the social and environment together with a proper mitigation plans. These two cases were chosen to identify the challenges posed by the implementation process with the budget and time constraints in hand in order to comply to the Act 645 requirements. Various methods were used to investigate and analyse the site including desktop study, on-site visual observations, photographing documentation, interviews with local communities and relevant local authorities in order to explore how the project implementation processes being carried out. Although the project was carried out in the pandemic covid-19 situation, the initial fieldwork was conducted in April 2021, to have rough idea and overview of the whole site conditions. Both sites can be accessed only by boat from Banding Lake and with an approved security permit by Perak State Parks Corporation. Initial findings show some challenges and barriers that need to be tackled comprehensively before the works can be started on the ground especially considering applying HIA requirements, awarding contractor B03 and appointing conservator in accordance with the Act 645 so that the National Heritage Site will be protected and preserved for future generation.

INTRODUCTION

Heritage site always require sensitive approach especially when dealing with its setting, nature and new additional objects or buildings. From complying the act to the holistic study of the impacts might affects the overall proposal while preserving the site and its surrounding. It also include the national treasure of biodiversity floras and faunas. These might be the challenges for this project in such unique location. As per Table 2 PLG04 (2013), the site is under Environmental zone (E2) Rural with Low district brightness (Sky Quality Measurements (SQM):15-20)


METHODOLOGY

Desktop study, on-site visual observations, photographing documentation, interviews with local communities and relevant local authorities.




















CONCLUSIONS

Prior to the site visit, the initial assumption on the proposed site was not suitable as it is located within the Royal Belum State Park National Heritage Site Area. After a fieldwork was done on site, preliminary observations found that the proposed development of LED solar light post could be considered and needed further study. The site environment is easily accessible as the village area is inhabited and has some basic amenities.

Overall, the significance value is considered fair enough to cared for, preserved as original and maintained its uniqueness through good planning as follows:

- Ensure that the operation before, during and after the installation does not have an impact, especially on the environment, flora and fauna.
- The proposed method done manually and does not involve large machinery that could damage the natural condition of the site in terms of traffic flow from the Banding Lake jetty to the two villages.
- The specified specifications does not disturb the flora and fauna. For example, the level of brightness and colour intensity of the lights not disturbing and attracting the attention of fauna such as elephants. The height of the post should be appropriate so as not to be at the height of the elephant's eye view.
- All the challenges and barriers need to be tackled comprehensively beforehand especially in complying all relevant requirement by the authorities at early stage. This include appointing registered conservator (physical) and B03 Contractor for the national heritage site like this Royal Belum Park. The project is considered successful and might be applied to another site/area but with more consideration on the Social Impact Assessment (SIA) requirement.

LLENGES IN THE PROJECT IMPLEMENTATION AT E OF THE ROYAL BELUM PARK, GRIK, PERAK, IMPACT ASSESSMENT (HIA)

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AIM OF STUDY

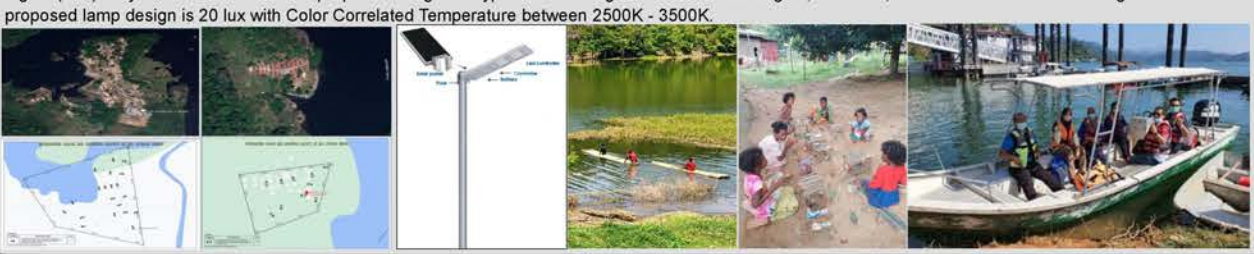
To propose a suitable Integrated Solar LED Road Lighting System at Sungai Tiang Village and Sungai Kejar Village in the National Heritage Site of the Royal Belum, Grik Perak, Malaysia.

OBJECTIVE OF STUDY

i. To identify conservation challenges on the installation of Integrated Solar LED lamp post in the National Heritage Site of the Royal Belum.
ii. To minimise impact to social and environment by establishing Heritage Impact Assessment (HIA) to protect the site.

SCOPE OF STUDY

Focus on the conservation challenges on installation of a total of 30 nos. Integrated Solar LED lamp posts (20 nos. at Sungai Tiang Village and 10 nos. at Sungai Kejar Village) in the National Heritage Site of the Royal Belum, Grik Perak, Malaysia while preserving the National Heritage Site.
The integrated type of road solar LED lighting were chosen from the Integrated Solar LED Road Lighting System specification under Specification for Road Lighting Installation (L-S20) at 8m height of lamp post and referring to Guidelines for the Implementation of the Installation and Maintenance of Village Street Lights (LJK) Project in Rural Areas. The proposed integrated type LED solar lights consist of LED Lights, Batteries, Solar Panels and Solar Charge Controller. The proposed lamp design is 20 lux with Color Correlated Temperature between 2500K - 3500K.



FINDINGS AND DISCUSSIONS

There are so many conservation challenges facing during the project was carried out. These includes:

i. Planning Stage: The requirements from Local Authorities (National Heritage Department (NHD) and Perak State Parks Corporation (PSPC)) especially the need to have the Heritage Impact Assessment (HIA) was only noticed by the project team later when they were referred to in-house registered conservator coincidentally. After the submission was submitted to the NHD, then they realized the need to submit the HIA and get approval from NHD before the work can start at site.
ii. Design Stage: Designing and mapping the location of the solar lamp post was not an easy job especially when the designer was not able to go to site during the restriction of movement during COVID-19 pandemic. The issue resolved when the permission was granted from the PSPC. The designer managed to propose conceptually before checking at the site directly to confirm the locations of the solar LED post for both *kampungs*.
iii. Procurement Stage: Awarding B03 Contractor registered with Construction Industry Development Board (CIDB) was also an issue raised by team because the scope of work for the project only involved electrical contractor where B03 Contractor only for civils work. The Registered Conservator (Physical)(NHD requirement) under the contractor was not appointed due to the limited of budget. The in-house Registered Conservator was appointed to advice the project.
iv. Construction Stage: During the implementation on site, a lot of constraints facing by the team includes transportation of materials and goods, equipment etc. where they must rent a boathouse which is quite expensive. Beside that, they are not allowed to bring in huge equipment such as backhoe or excavator tractors. They must do it manually with help by the local people. The site agent accommodation also another constraints where they have to rent a boathouse involves (MYR3000@NZD1000/day) for about 45 days approximately and it is quite pricy. The PSPC was not allowed many workers to enter the site.
v. Impact to local people: The aborigine's activities was aggressively and happening at night and it may affect or change the way of life (e.g.: late sleep, wake up late early morning for hunting – main activity). There is a need for further research on Social Impact Assessment (SIA) for this kind of project.
v. Low budget and time constraints: With budget constraints below MYR300,000.00 @NZD100,000.00 and time constraints to be completed within 75 days. At the end, the project was successfully managed to be completed within 45 days. It was a big achievement for such project where they have to carried out during the restriction movement of COVID-19 pandemic (early to mid 2021).

Beside that, the Royal Belum State Park is also identified as an Important Bird Area since 2004 by Birdlife International and Sungai Tiang has been designated as a Permanent Protected Zone for Malayan Tigers. This uniqueness will be affected if no strategic planning is done to preserve this National Heritage Site including:

- **Visual Impact**

The visual impact is clearly visible during the day and night not only to the original inhabitants but also to the flora and fauna. The level of brightness of the lamp light at night is believed to be appropriate to the site conditions besides considering the sensitivity to the flora and fauna, and to avoid any possibility of attracting insects, elephants etc. The height of the lamp post is also important to be kept higher. Although the natives reported less disturbance, precautions should be taken from time to time.

- **Environmental Impact**

Based on the impact scale of the HIA ICOMOS guidelines, the impact on flora and fauna is small and very low in both areas of the village as these areas have been explored and inhabited by indigenous people (the existing environment has been cleared) compared to undisturbed dense forest areas. As stated in item 1.2 of the statement of values of universal excellence, all these aspects need to be preserved so as not to be lost. However, in this area of the village, no specific findings of unique flora and fauna are likely found due to the current environment that has changed. The real impact that needs to be considered is before the work start, during and after construction while complying to the Standards of Procedures (SOP) and practiced with care and caution.

- **Cultural Impact**

The installation of LED lamp has great potential of cultural impact on social activities especially at night. Study also need to be done on Social Impact Assessment.

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The mechanism for the wandering of objects and measures to prevent object movement

By W. (Bill) Wei
Vibmech.nl, Cultural Heritage Agency of the Netherlands (RCE), Amsterdam

The wandering and rattling of objects is a disconcerting vibration phenomenon often observed in museum exhibitions and storage facilities. It can be caused by visitors moving past particular kinds of exhibits on older, more flexible museum floors and also by construction work, loud music or heavy traffic in or near a collection. In most cases, wandering does not pose a physical threat to the objects unless, of course, they wander to the end of a shelf with no raised rims. Besides looking bad, repeated wandering in exhibits can create more work and object handling for curators and conservators as they constantly have to return objects to their proper positions. In storage facilities, wandering can also result in dissociation; for example, in natural history collections similar objects might wander among themselves or away from labels which are not attached to the objects.

Practical solutions for wandering in exhibitions include the use of strategically placed bits of museum putty or using special mounts to physically fix the object to its location. However, this is not always aesthetically desirable or physically possible. In order to develop less invasive solutions for the problem of wandering, an understanding of the wandering phenomenon is required.

An experimental programme was therefore conducted to determine the mechanism of wandering. Several types of objects—including ceramics, glass, plastics and metals—were placed on two different kinds of shelves: one made of glass and the other a consumer MDF shelf with fake wood veneer. The shelves were mounted freely on end supports, as is often the case in exhibitions. The entire construction was then mounted on a commercial vibration testing table followed by placing the objects, free-standing, at specific positions on the shelves. The object-shelf systems were first vibrated at frequencies from approximately 5 to 100 Hz in order to determine at what frequencies the objects and shelves begin to resonate, the assumption being that wandering would occur during resonance. They were then tested at increasing vibration levels at the resonant frequencies to determine the vibration levels at which they begin to wander.

It was found that wandering primarily occurs at the resonant frequency of the shelving system itself and not the resonant frequency of the objects. Wandering occurs due to the unweighting of objects as the shelves drop during a vibration cycle. Since no object-shelf contact is perfectly flat, this allows the object to overcome friction and move in the downward direction. Rattling occurs as the shelf moves upwards meeting the object falling downwards.

The lower vibration limit for wandering—as well as how far and where an object wanders on a particular type of shelf—depends on a number of factors including the weight, geometry and number of objects on the shelf and characteristics of the contact surface and friction between the object and the shelving. Based on these results, a number of additional practical and non-invasive measures are suggested for preventing wandering, ranging from relatively simple changes in exhibition shelf design and placement of objects, to more expensive damping solutions.

W. (Bill) Wei is senior conservation scientist at the Cultural Heritage Agency of the Netherlands (RCE). He has a BSE in mechanical engineering, Princeton University (1977) and a PhD in materials science, University of Illinois Urbana-Champaign (1983). For over 20 years, he has conducted research on the effects of vibrations and mechanical stresses on works of art and cultural heritage. He also studies the effects of cleaning and treatments on the appearance of objects and he moderates Socratic dialogues on conservation ethics. Before working at RCE, he spent twenty years in industrial R&D in mechanical properties, fracture mechanics, fatigue and corrosion.

The mechanism for the wandering of object

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

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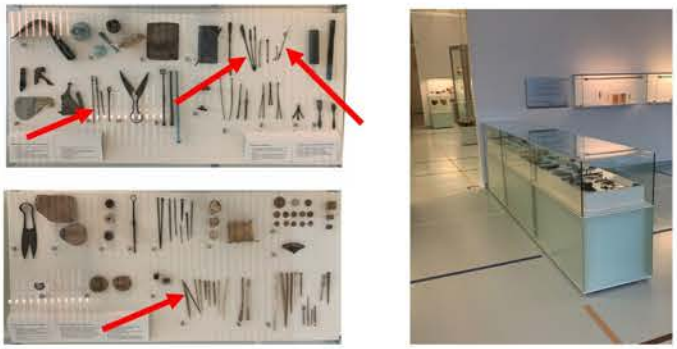

Fig. 1 Wandering of objects at Museum Valkhof, Nijmegen, The Netherlands

1. Introduction

The wandering, shaking or rattling of objects is a disconcerting phenomenon often observed in museum exhibitions and storage facilities. It is caused by vibrations due to e.g. visitor movement, construction work, rock concerts or heavy traffic. The effects of vibrations can include:

- Disturbance of exhibitions, see Fig. 1
- Shaking or falling over of top-heavy objects
- Dissociation, e.g. objects separated from labels
- Rattling of single or stacked objects
- Falling, if an object wanders off of a shelf.

2. Research objectives and procedure

A vibration testing project was carried out in order to determine the mechanism for wandering and rattling. A commercial vibration testing machine was used (Thales Nederland B.V., Hengelo), see Fig. 2. Various types and combinations of objects were tested on 80x20 cm glass or MDF shelves, see Fig. 3-4. The shelves rested on two roller supports, simulating common showcase conditions. Single objects or stacks were placed in the middle of the shelves, multiple objects were spaced evenly.

Based on previous results [1], first, the resonant frequency of the shelves was determined by conducting so-called ramp testing, increasing the frequency of the vibration table from 5 to 100 Hz at a constant vibration level. This was followed by further ramp testing to determine at which frequencies specific objects or combinations of objects began to wander or rattle. Finally, the input vibration level of vibrations at resonance was varied to determine at which levels objects begin to wander or rattle.

Fig. 2: Vibration testing system. The upper table (arrow) was used for this project.

Fig. 3: Glass shelf mounted on vibration table with a three test objects.

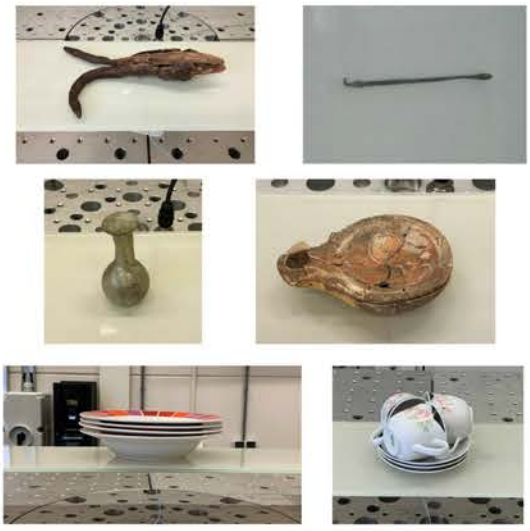

Fig. 4: Examples of other objects tested. Top 4 objects, Museum Valkhof Bottom 2 stacks, author's own objects

ts and measures to prevent object movement

(Bill) Wei FIIC
omech.nl
cy of the Netherlands (retired)

4. Mechanism

Wandering and rattling due to vibrations is due to the unweighting of an object as the shelf vibrates up and down. No shelf is perfectly flat, and no object sits perfectly flat on a shelf, even on a micro-level. Thus, in the moment the shelve moves down, the object is (partially) unweighted. For wandering, this reduces the force, F, needed to overcome friction due to the vertical force (F_N, essentially the weight of the object; $F = \mu \times F_N$) and slide the object towards the lower part of the shelf, in whichever direction that may be locally, see schematic diagram in Fig. 5. For rattling, the object will hit whatever it is stacked on/under when the shelf moves back up.

Whether an object wanders also depends on:

- Coefficient of friction, μ, between the object and the shelf.
- Micro-roughness of the shelf and the bottom of the object in contact with it.
- Geometry of the contact points/surface between the shelf and the object.

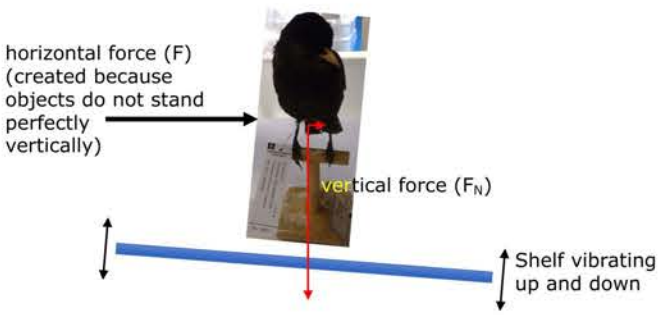

Fig. 5: Schematic diagram of the forces in play during wandering. Note that no shelf/-object contact is perfectly flat.

5. Main experimental results / rules of thumb

Wandering occurs at the resonant frequency of the shelf. (For geometry tested: glass 24 Hz, MDF 37 Hz) How fast and far an object wanders depends on how long the shelf resonates

Light objects wander starting at vibration levels around 1.5-2 mm/s

Heavier objects wander at higher levels

Results are only rules of thumb: depends on object/shelf geometry, contact points, friction coefficient, object location on shelf, etc.

6. Possible remedies

Each situation is different and requires a tailor-made solution. The following possible solutions are listed in order of ease of application and least to most cost. For some solutions, one will have to deal with questions of esthetics, i.e., "it's doesn't look good".

Object mounting and display (less expensive):

- Place objects on non-reactive padding (increase friction): not too soft or thick to avoid toppling
- Museum putty to inhibit movement
- Design supports
- Rims on edges of shelves to prevent falling due to wandering
- Attach labels to objects (in storage, see [1])
- Avoid stacking (light) objects too high
- Change visitor routing to slow visitors down

Change resonant frequency of displays (more expensive):

- Stiffen showcases
- Fix ends of shelves
- Change shelf dimensions
- Number of objects, total weight (also damping)
- Reduce "cantilever effect", e.g. objects displayed on slender vertical rods

Set vibration limits for activities:

- 2 mm/s for incoming vibrations remains a good guideline, see among others, refs. 1-3

Damping (very expensive):

- Stiffen floors
- Passive damping, e.g. carpeting to dampen visitor movement) or springs: note that springs require computer modelling, calculation and proper selection
- Active damping such as for computer chip manufacturers (extremely expensive)

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The perception of techniques used for retouching wall paintings in the Netherlands

By Jasmijn Krol and Dr W. (Bill) Wei

There are a wide variety of wall paintings in Western Europe which have survived the passage of time, in churches in particular. Most have suffered some loss varying from damage that is almost unnoticeable to large lacunae that cannot be ignored. The expertise of conservators in the restoration and conservation of such objects is invaluable. However, how conservators approach these problems differs from case to case.

Until a century ago, it was common to reconstruct missing parts to bring back the original image. Modern conservation theory and codes of ethics have led to reconstruction becoming a less common choice for the reintegration of lacunae in favour of more subtle retouching/infilling techniques or leaving lacunae untreated. The continued debate as to which techniques are appropriate revolves around the question of what one is supposed to see in the final result. It is not clear whether there is a consensus amongst conservators on which retouching/infilling techniques should be used and when. This also raises the question as to what the general viewing public actually sees and perceives of a retouched wall painting.

A study was therefore conducted on how professionals and the general public perceive lacunae in wall paintings. Originally, the use of so-called eye-tracking techniques was planned to determine what test subjects see and perceive of untreated and retouched wall paintings in historic churches in the Netherlands. However, the project timing fell within the corona pandemic. The decision was therefore made to conduct surveys of professional conservators and members of the general public in a manner simulating, to a limited degree, the use of eye-tracking.

Subjects were asked to consider possible solutions for retouching a wall painting of Maria Magdalena with the Vera icon in the Sint Agneskerk in Sint Truiden, Belgium. Professional conservators were shown a digital image of the untreated state of the painting and asked to select which retouching technique they would use for selected lacuna amongst a list of ten possible solutions, then explaining how and why. Members of the general public were shown the same image as well as several of the retouching solutions simulated using Photoshop techniques. They were asked which solution they preferred and why. The questions posed to the conservators and to the general public were intentionally different, reflecting the reality that conservation decisions are not normally made in consultation with the public.

The results provide a limited but interesting view on how professionals and the general public perceive lacunae and their treatment. Although many conservators chose neutral retouching as a solution for the various lacunae, roughly half of the conservators chose one of the other nine options, thus demonstrating that there was not a clear consensus. The training and field experience of the conservators appeared to influence their selection. The general public tended to prefer a realistic reconstruction or the use of tratteggio.

These results give pause for thought for future discussions on retouching. What role should public perception play in treatment decisions? Several reactions on the conservators' surveys mentioned "education". What does "education" mean for the choice of retouching techniques and for public perception of the results? How important is the choice of retouching techniques for lacunae in church wall paintings which are several metres to several stories above the viewer? And how does one deal with originality, authenticity, objectivity, subjectivity and taste in conservation decision making?

Jasmijn Krol MA, MSc is a Dutch trainee conservator at the University of Amsterdam. After obtaining a master's degree in fine arts, she worked as an independent visual artist for many years until she decided to enrich her career. She obtained a master's degree in conservation and restoration of cultural heritage at the University of Amsterdam in 2020, specializing in historic interiors, and is completing the last phase of the advanced professional programme in conservation and restoration. She has been working on a wide variety of 16th- to 20th-century historic interiors, focusing on retouching techniques for wall paintings.

Dr W. (Bill) Wei is a senior conservation scientist at the Cultural Heritage Agency of the Netherlands (RCE). He conducts research and consults on the effects of vibrations and mechanical stresses on the condition of fragile objects and the effects of cleaning and treatments of objects on their appearance. A major area of interest of his is how conservation decisions are influenced by the differing perception of objects by the cultural heritage profession. Dr. Wei has trained as a Socratic dialogue moderator and has organized and moderated over fifty dialogues in the past decade on issues in conservation ethics.

The perception of techniques used for reto

1. Introduction

There are a wide variety of ancient wall paintings in churches Western Europe, including in The Netherlands. How lacunae in such paintings should be treated continues to be a topic of (heated) debate in the conservation world, revolving around the question of what one accepts as the final result.

2. Research objectives and procedure

A pilot project was conducted to determine which techniques professional conservators and the general public prefer for retouching three lacunae in a wall painting in the Sint Agnes church, Sint Truiden, Belgium, see Fig. 1. Due to COVID, it was only possible to use digital surveys for the study. The subjects were mostly Dutch.

3. Survey questions

Conservators were shown the painting with the lacunae and asked how they would treat each of the three lacunae 1, 2, and 3 and why. They were also asked for background information (training and experience). The following options were given see examples below in Fig. 2:

- Abstract selection (crossed stripes in primary colors)
- Chromatic selection (stripes following the form)
- Defining form with black contour lines
- Reconstruction
- Infilling with neutral color
- No retouching
- Pointillism (small dots)
- Simulative technique (imitation of surrounding damage)
- Suggestive retouching with color and/or contours
- Tratteggio (rigatino: vertical stripes)
- Other

Members of the general public were asked to look at digital images of the wall painting which were virtually retouched using Photoshop and five of the techniques listed, see Fig. 3. They were then asked which version they preferred and why.

Abstract selection [1] | Chromatic selection [2] | Simulative technique [3]

Fig. 2: Examples of retouching techniques

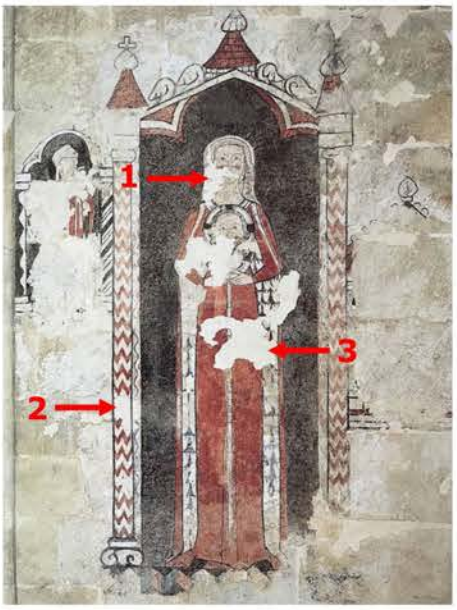


Fig. 1: Maria Magdalena with the Vera icon in Sint Agneskerk in Sint Truiden, Belgium

Trattegio | Suggestive color retouch | Define form with black contour lines

Imitative reconstruction | Infill with neutral color

Fig. 3: Five retouching techniques presented to the general public.

Jasmijn Krol

ouching wall paintings in the Netherlands

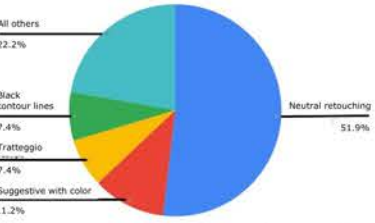
4. Main results

Table 1 – Conservators' preference for retouching technique

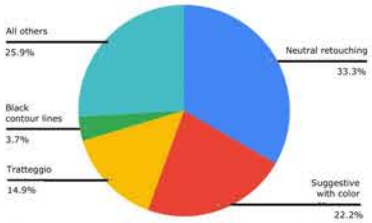
	Lac. 1 Face	Lac.2 Fabric	Lac. 3 Border
Neutral retouching	14	9	9
Suggestive with color	3	6	-
Tratteggio	2	4	4
Black contour lines	2	1	-
Reconstruction	-	-	2
Other	2	2	3
Chromatic selection	-	2	3
Camouflage	1	1	1
No retouching	1	-	3
Abstract selection	-	-	-
Pointillism	-	-	-
No answer	2	2	2
Total participants	27	27	27

Table 2 – General public's preference for retouching technique

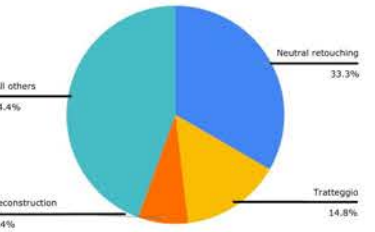
Technique	Number
Tratteggio	30
Reconstruction	28
Suggestive with color	9
Black contour lines	6
Neutral retouching	6
Total participants	79



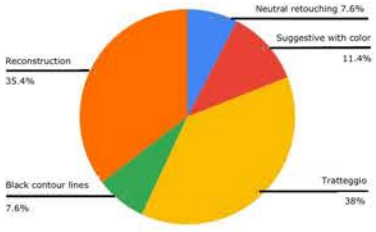
Conservators (lacuna 1: face)



Conservators (lacuna 2 fabric)



Conservators (lacuna 3 border)



General public (only 5 choices)

Fig. 5: Visual representation of data in percent in Tables 1-2. "All others" refers to the techniques not specifically named in the pie chart.

The main results from the surveys are summarized in Tables 1-2 and Fig. 4.

i. Conservators clearly show a preference for neutral infilling, suggestive retouching and tratteggio, Table 1.The reason was to maintain the current state of the painting and "calm" the lacunae.
ii. As a whole, academically trained conservators chose more of the options. Non-academically trained conservators only selected neutral or suggestive retouching, tratteggio, or no retouch.
iii. The general public preferred tratteggio and reconstruction, Table 2, that is, pictorial reconstructions, or at least seeing a distinct difference between the retouched areas and the original.

5. Pause for thought

These initial results give pause for thought for future discussions on the ethics of retouching lacunae.

- What role should public perception play in treatment decisions?
- What does "education" mean for the choice of retouching techniques, and for public perception of the results?
- How important is the choice of retouching techniques for lacunae in church wall paintings which are several meters to several stories above the viewer?
- How does one deal with originality, authenticity, objectivity, subjectivity and taste (!) in conservation decision making?[4]

6. Selected references

This poster is based on a Master's thesis with complete literature references was written by J. Krol and supervised by J. Hensel (University of Amsterdam). It is available on request.

[1] http://vecchiosito.dsa.unige.it/sla/marsc/pubblicazioni/guide/ic_astrazcrom.pdf
[2] http://vecchiosito.dsa.unige.it/sla/marsc/pubblicazioni/guide/ic_astrazcrom.pdf
[3] I. Brajer 2010. "The simulative retouching method on wall paintings: striving for authenticity or verisimilitude?" In BRK-APROA postprint Reflex or reflection?: actors and decision-making in conservation-restoration, 19-20 Nov. 2009, Brussels, 100-109, Brussels: BRK-APROA.
[4] W. Wei 2022. "Authenticity and Originality, Objectivity and Subjectivity in Conservation Decision-making – or is it Just a Matter of Taste?", *Studies in Conservation* 67 1-2 15-20.

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The sound exposure of Paintings during transport

By Dr Kerstin Kracht

When discussing stress impact on paintings caused by vibration and shock during transport, structure-borne noise is usually considered. However, only very few research projects pay attention to the effects of sound exposure on art and museum collections.

The only means of protecting these objects from exposure to structure and airborne sound during transport is their immediate packaging and shipping crates. In the recent past, tools such as the TURTLE® T+ holding system have been successfully developed to disconnect paintings from the structure-borne sound of transport crates. However, here we focus on the excitation of paintings due to airborne sound during transport and the resulting risk of possible damage by considering the question, "How does airborne sound affect works of art?"

The results of sound measurements in four different crates, following standard procedures for the measurement of sound insulation in buildings, are presented. Since the 1980s research investigating the effects of shock and vibrations on paintings and three-dimensional objects of museum collections has developed considerably, particularly taking off following innovations in measurement technology in the mid-2000s which enabled researchers to visualise the effects of vibrations on canvases with a high-resolution technique. This technique opened the door to exciting possibilities in the development of vibration-minimizing solutions for the transport, display and storage of artworks. The research presented on the poster shows case studies with experimental investigations and computational modelling in a bid to answer this question.

Dr Kerstin Kracht is a vibration technology and continuum mechanics engineer and has been applying and sharing her expertise in vibration and shock prevention in the field of art and cultural heritage preservation for over fifteen years. Kerstin studied physical engineering and completed her PhD at the Technische Universität Berlin in 2011 with an investigation into the vibration behaviour of oil paintings depending on their age. From 2020 to 2022 she held positions as guest professor for the Mechanics of Historical Artistic Artworks at the TU Berlin as well as at Bremen University, Germany. Here she lectured mixed groups of conservation and engineering students, whose aim was to develop solutions for the preservation of objects in museums together. In addition, Kerstin has been working since 2017 as a consultant on numerous high-profile projects in her capacity as one of the leading experts in designing vibration-reducing and shock-absorbing measures in a museum environment, including transport, display and museum storage.

The sound exposure of pa

Prof. Dr. Ing. Kerstin Kracht, Chair of Continuum Mechanics and M

Introduction

Various sound sources can be observed during art transport. In the case of trucks, the large walls and the floor can act as sound radiators. In airplanes sound amplified by the walls of the tube and the sound emitted from the turbines can impact on paintings. The only means of protection from the possible adverse effects of this exposure are the crates the paintings are packed in. Generally, it is distinguished between airborne sound and structure-borne sound. When sound waves travel through the air and reach the wall of a crate, the wall begins to vibrate. These vibrations travel through the crate structure and internal packing where the waves will eventually hit the artwork. Since the material structure of paintings and objects can be much denser, it is possible that the sound waves are converted into structure-borne sound and the objects itself begin to vibrate. This effect depends on the wave lengths. This is vibration in addition to the vibration generated by the motor of the transport vehicle.

Test objects

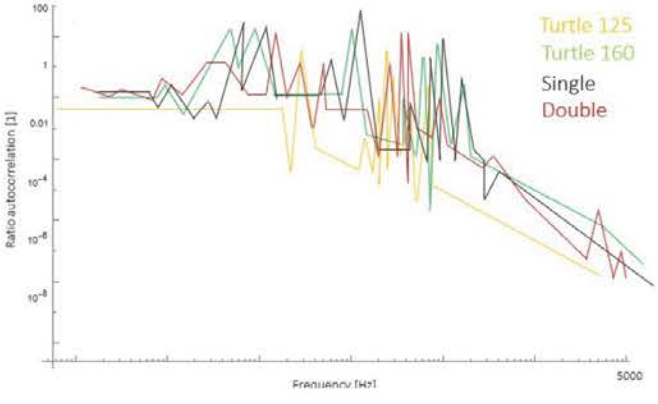
TURTLE 160

TURTLE 125

Double walled wooden crate

Single walled wooden crate

Results



The diagram shows the ratio between the measured and averaged sound pressure levels inside and outside the crates in the frequency domain.

Note: The gap between lid and corpus was plugged with sealant to ensure the wooden crates perform similar to the crates made of composite material (i.e. the green Turtle crates).

Sound Mea

In order to find out how effective transpor paintings from sound, experimental tests w chamber.

Excitation

Dodecahedron loudspeaker produced a diffuse sound field (white noise) over a wide frequency range up to 10.000 Hz. The amplitude distribution and frequency range were chosen according to [1].

aintings during transport

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RESPONSE, ADAPTATION AND LEADERSHIP

Material Theory, Einsteinufer 5, 10597 Berlin, k.kracht@tu-berlin.de

asurements

t crates currently available protect were carried out in a reverberation

Response

Inspired by standard methods for measuring sound insulation in buildings, the sound pressure level (SPL) was measured inside the box with 36 microphones and on the outside with two rotating microphones.

Effect of Sound on Paintings

The response of a painting to sound depends on its structure on micro, meso and macro scale. KOEHLER also shows that that plane sound waves, spherical waves and diffuse sound do excite plate structures like paintings at their natural vibration modes, which is potentially damaging [2].

Research by the author (of this poster) revealed that each painting, depending on size, stretching, materials, condition, etc., has a very specific vibration behaviour [3]. Restoration and conservation measures can also alter the natural frequencies and the natural vibration mode as the following images show.

Before restoration, 1st nat. freq. 1,6 Hz

After restoration, 1st nat. freq. 3,6 Hz

Summary and Conclusion

The results of this study show that crates made of composite material are quieter on the inside than the wooden crates. The gap between lid and body in wooden crates contributes significantly to a 'noisier' environment inside the crates. This increases the risk of additional structure-borne sound, i.e. resonance effects, impacting negatively on the painting.

This shows that the painting's response to sound is dependent on its specific vibration behaviour as well as its mechanical structure at different scales. Further investigation is required how sound affects paintings and if additional sound isolation is advisable.

Literature

[1] C. Thomas, H. Scheel: Kabinenakustik in der Luftfahrtforschung, DocumentID 480290, Deutscher Luft- und Raumfahrtkongress, 2018.
[2] I. Köhler.: Modellierung des Einflusses von Luft- und Körperschall auf die Anregung von Gemälden, BSc-thesis, TU Berlin, 2021.
[3] K. Kracht.: Die Untersuchung des Schwingungsverhaltens von Ölgemälden in Abhängigkeit der Alterung, Dissertation, TU Berlin, 2011.

Acknowledgement

The author would like to thank the Department of Engineering Acoustics at the TU Berlin for operating the sound tests of the transport boxes for paintings.

For providing the test crates the author is grateful to TURTLE.

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The Study of Carved Lacquerware Conservation Based on the Case of Carved Lacquerware with Red Dragon Pattern

By Wang Kaibiao and Cui Mingyuan
Palace Museum

As one of the main categories of lacquer techniques, lacquer carving plays a very important role in the history of lacquerware development in China. Its complex craftsmanship, excellent quality, rich variety and unique aesthetic value make it stand out from other kinds of lacquer techniques. Among numerous collections of the Palace Museum, the carved lacquerware collection is the largest and boasts the highest quality making it an important one in which to study and evaluate its conservation.

At present, the lacquer conservation team in the Palace Museum still uses the master-apprentice teaching method. There are many kinds of deterioration such as dust, warped and missing lacquer paint layers, loss of pattern elements and cracked lacquer body. This paper focuses on the details of restoration methods of different parts, materials and processes for the wooden body and the paint layers in order to provide a reference for lacquerware conservation.

Based on the conservation case of "Carved Lacquerware with Red Dragon Pattern" from the middle Qing Dynasty, this paper is divided into four parts meant to:

(1) Summarize the general situation, historical and artistic value of carved lacquer cultural relics through literature and documents;

(2) Analyze the internal structure of the cultural relics and identification of restoration plan through scientific instruments such as optical microscope, infrared spectroscopy (FTIR), pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) and X-ray CT scanning. According to the results, we inferred that the carved lacquerware was made following the sequence of these procedures: assembling wooden body, pasting linen, leveling lacquer putty, brushing raw lacquer and red coating lacquer, and polishing. The restoration plan was then carried out.

(3) Specify the procedures, tools and methods adopted during conservation process. It is noted that the restoring procedures must be in compliance with the manufacturing order.

(4) Summarize the difficulties and problems during restoration and put forward feasible suggestions including a notice for brushing the carved paint layer, the dusting methods and storing suggestions, wishing to offer advice for the implementation of the preventive protection and conservation plan for the carved lacquerware.

This report is the phased research result of the project of the Palace Museum "Research on Inheritance and Development of Carved Lacquer restoration techniques in the Palace Museum" (KT2020-27)".

Wang Kaibiao, associate researcher at the Palace Museum, graduated from Tsinghua University with master's and bachelor's degrees in lacquer crafts. He participated in several field investigations about Maki-e, carving or inlays in Fujian, Shanxi in China, and Tokyo, Kanazawa in Japan; attended many domestic and international exhibitions; and won awards. In 2016 he started to work at the Palace Museum as a conservator, learning traditional restoration skills and modern technology detection techniques from professionals. Over these years, he has restored artworks of various categories (lacquerware, ceramic, furniture, murals), deterioration (breakage, decay, mold, loss), and materials (wood, lacquer, metal, jade). To date, Wang Kaibiao has published five academic papers and is now leading a youth project—Inheritance and Development of Imperial Carved Lacquer Restoration Techniques.

Cui Mingyuan, associate researcher at the Palace Museum, graduated from Beijing International Studies University with master's and bachelor's degrees in translation and interpretation. She started work at the Palace Museum in 2016. During these years, she has translated passages introducing conservation for several cultural relic categories (lacquerware, imperial package box, wood furniture, paper mounting, clocks), wishing to increase people's awareness of Chinese conservation techniques in cross-cultural communication. In 2021 she attended the ICOM-CC Beijing conference with the poster "Documenting and translating Chinese clock conservation jargon based on the history of the Clock Conservation Studio", co-authored with a clock conservator.

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The Study of Carved Lacq

Carved Red Lacquer Vase with Dragon Pattern

Carved Red Lacquer Vase with Dragon Pattern

Period: Middle Qing Dynasty
Dimensions: height 60.5 cm, belly-diameter 47 cm, belly-perimeter 147 cm, mouth-diameter 15.8 cm, bottom-diameter 22.7 cm
Characteristic: The vase is black paint inside and red paint outside carved with pattern of nine dragons roaring on the sea. The bottom is painted in black without any inscription.
Deterioration: Full of dust, missed carved pieces, seriously deteriorated bottom.

1. Content Analysis

Sample 1: piece of red paint

Figure 1.1: section of red paints

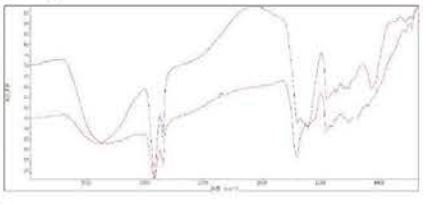


Figure 1.2: infrared spectrogram result

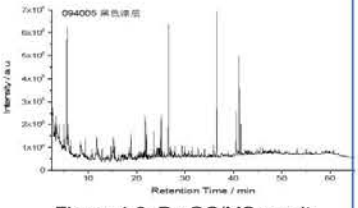


Figure 1.3: Py-GC/MS result

Clear red paint layer can be observed and the thickness of each layer is about 100 μ m.

According to the intensity absorption peak of 1710 cm-1 showed by the infrared spectroscopy, it can be asserted that the content of tung oil is relatively high.

The Py-GC/MS result shows that it includes Chinese lacquer, boiled tung oil and wax covering on the vase's surface.

Sample 2：piece of black paint of the bottom

Figure 1.4: section of black paints

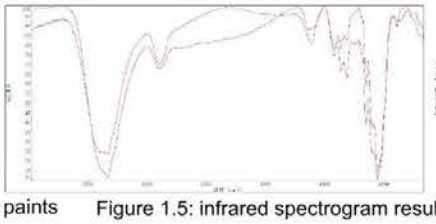


Figure 1.5: infrared spectrogram result

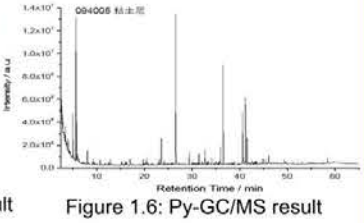


Figure 1.6: Py-GC/MS result

There are 2 layers. The upper black painted layer is about 80μm-thick, and the bottom layer is called the ground where clay particles are clearly seen. Fibrous objects can be observed on the back of the sample.

The result shows the fiber of the bottom is hemp fiber. Test for ground layer indicates that it may contains oil, protein, silicate and quartz, which the oil and protein are from clay cementitious materials, silicate and quartz are from clay.

Through Py-GC / MS analysis, the ground layer contains boiled tung oil and pig blood, which is 'Xue Liaohui', a commonly used material for ancient lacquerware.

Figure 2: X-ct

By using scientific and technological metho
materials and manufacturing processes of
linen, leveling lacquer putty, brushing raw l

3. Conclusion

Guided by the principle of minimum interv
technological result, and then carry out

When restoring the paint layer, conservato
filled the missed area with lacquer putty and
made it smooth and plain, then brushed the
area with black paint. Remember to keep
the surface color and gloss as same as the
original state.

Figure 3.2: procedures of restoring the re

Dedusting is not easy because dust, micro
narrow gullies. Thus, it is suggested to store

querware Conservation

Wang Kaibiao, Cui Mingyuan, Palace Museum

2. Structure Analysis

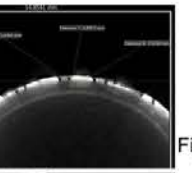


Figure 2.1

X-ct result of Figure 2.1 shows two rows of “lacquer ash nails" , which is used to connect the head and tail of rolling wood strips for bonding and reinforcement.

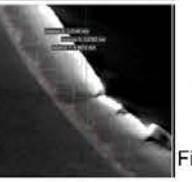


Figure 2.2

Figure 2.2 shows eight layers of ladder-shaped wood strips from the view of vase's neck. Each layer of wood strips is about 3mm-thick with clear boundary and discontinuous wood grain. Therefore, it is reckoned that the lacquer vase is assembled by eight layers of wood strips, and the adjacent wood strips are overlapped, spliced up and down respectively.

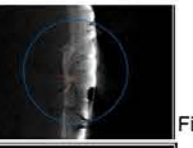


Figure 2.3

The assembling method can be discovered from the Figure 2.3 which indicates the belly part is composed by two bowl-shaped wood strips, bonded with each other.

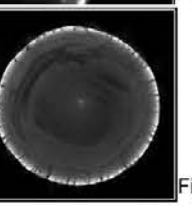


Figure 2.4

The bottom of the vase is a round wood plates with clear horizontal wood grain and a hole at the center. The hole is used for positioning the bottom round plate. See figure 2.4

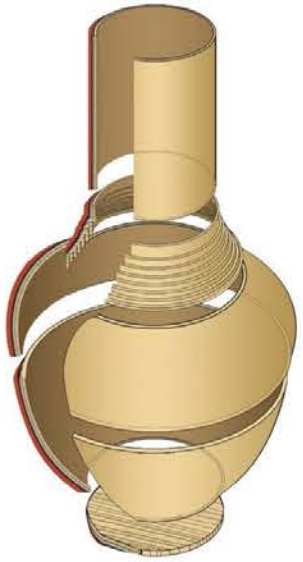


Figure 2.5: structure of wooden body

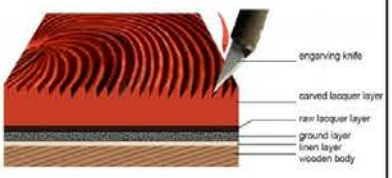


Figure 2.6: strucutre of layers

ods such as optical microscope, infrared spectrum and X-ray CT scanning, we found the original the vase. The vase was made in sequence of these procedures: assembling wooden body, pasting acquer and red coating lacquer, polishing and etc. Figure 2.5 & 2.6 shows its inner structure.

vention, conservators conduct customized restoring plan according to the scientific and restoration steps by steps by using its original material and manufacturing method.

Figure 3.1:procedures of restoring the ground layer and black painted area

d painted area

When restoring the carved paint layer, the paint layer must be repeatedly brushed to a certain thickness. If the two adjacent layers do not paste firmly, it is easy to separate in the late period. Conservators must finish the task of engraving within five months before the paint layers are completely dried out. Great skills of knife is required during engraving part.

oorganisms and other harmful substances are most likely to accumulate in many very e the lacquerware in a dust-free environment with constant temperature and humidity.

Figure 4: comparison

Turning to Green Conservation for the Preservation of Cultural Heritage

By Bianca de Souza Gonçalves

According to UNESCO, cultural diversity is just as necessary as biodiversity. The preservation of humanity's cultural heritage should thus be indissolubly linked to the preservation of the planet. Nonetheless, numerous current conservation-restoration practices are damaging to the environment: from high energy consumption to the use of toxic materials and treatments and the production of considerable amounts of waste. Conservation-restoration is thus a profession that is not yet suited to the most pressing ecological issues of our time. Fortunately, conservator-restorers are beginning to be aware of their environmental impact and to understand its causes. Thus, in the last few years, a desire has arisen to find solutions that can address both the needs of the objects and the urgency of reducing the negative impact of conservation practice on the environment. Indeed, sustainable research and alternative materials are being developed while platforms allowing the field to share good practices have appeared. This presentation will introduce these matters and show that enhancing sustainability in the cultural heritage sector may be a challenge, yet it is one we, as a professional community, must urgently tackle.

Bianca de Souza Gonçalves: Originally from Brazil, Bianca Gonçalves is currently an independent paintings conservator in the Netherlands and Brazil under the name of Atelier CurArte. She received a BA in conservation and restoration from the Polytechnic Institute of Tomar, Portugal, and she specialized in the conservation of easel and panel paintings through an MA at ENSAV La Cambre in Brussels. Her master's thesis on *Less toxic approaches to cleaning acrylics*, reinforces her interest in sustainability and green chemistry. Furthermore, she is currently active in the Amazon fight for social sustainability and indigenous rights in Brazil.

TURNING TO GREEN CONSERVATION FOR THE PRESERVATION OF CULTURAL HERITAGE

Towards a sustainable practice in paintings' conservation
Bianca Gonçalves

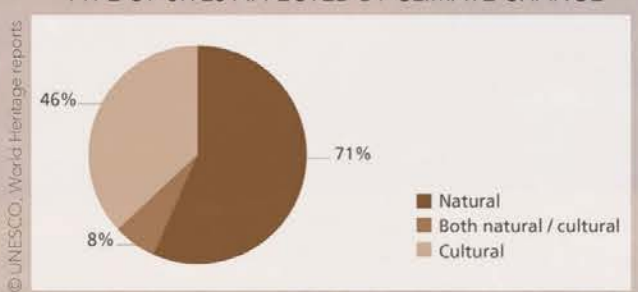
I. INTRODUCTION

According to UNESCO, cultural diversity is just as necessary as biodiversity[1]. The preservation of humanity's cultural heritage should thus be indissolubly linked to the preservation of the planet. Nonetheless, conservation-restoration is a profession that is not yet suited to the most pressing ecological issues of our time.

II. **WHY** MAKE CONSERVATION **MORE SUSTAINABLE**?

Have you ever thought that climate change can also affect our treatments and results? That we may need treatments for extreme weather situations?

TYPE OF SITES AFFECTED BY CLIMATE CHANGE



- **CR practices are damaging to the environment**: high energy consumption, toxic materials and/or treatments, waste production.
- **Regulations and restrictions** on materials and energy consumption are changing.
- Better for **our health**
- Sustainability = **better performance and less expences**[2]
- Our job is to **CONSERVE!**

III. **HOW** TO MAKE CONSERVATION **MORE SU**

Fortunatly, awareness has brought a desire to find so
the urgency of reducing the negative impact of con
research and alternative materials are being develop
appeared[3]. However green does not always have to
can do with what we already have.

THINK DIFFERENTLY. THINK TWICE.

Sometimes the solutions are right in front of us, we j
we arrive at a solution.

→ Could the material be more natural and less toxic?
→ Is toxicity for the environment a valid a criteria for t

Paintings shouldn't come first if our health is at risk, th
your self.

ADAPT

Research on cleaning contemporary art has been c
materials as they are an alternative/reduction of the
bio-cleaning, Nano-technologies, essential oils, enzy
best solutions in conservation and restoration to appr

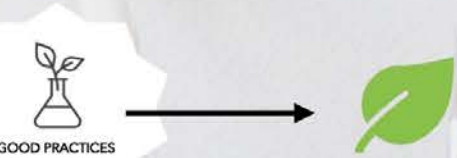
Even if we can't be green, we can
Reducing the toxicity in our professio
health too.

EDUCATE

It is important to emphasize our real role in the worl
opportunity, means and reliability to encourage proje
generations but, most of all, we are the history and on
It is time for our university programs to change. It is tim

? RESEARCH on alternative materia
disposal or recycling of used mat

USTAINABLE?



olutions that can address both the needs of the objects and servation practice on the environment. Indeed, sustainable ped, while platforms allowing to share good practices have be new. And most of the times there are small changes we

ust need to rethink and reformulate our approaches before

he selection of a material?

ink twice and check how toxic the product you're using is for

pening a panoply of "greener" methods, techniques, and use of solvents and other toxic products[4]. **Gels, emulsions me treatments, greener solvents**[5] are nowadays one of the oach green chemistry.

ALWAYS be greener.

n will directly reduce the toxicity for users and improve our

d as art keepers. In fact, universities and museums have the ct development, fund research, motivate and inspire younger e of the models of the world and we can show how to change. ne for sustainability to be addressed in education.

ls, sources, waste production, correct erials.

IIV. CONCLUSIONS

The shift to become more environmentally sustainable is already occurring, and the inherent duality between protecting cultural heritage and the planet is more palpable than ever. Sustainability in the Cultural Heritage sector needs to be a priority and it needs to be integrated in our discussions. We already have many ways and methods to improve, but as long as it is not a criteria it won't be adopted.

Enhancing sustainability in the cultural heritage sector may be a challenge, but it is an attainable one.

ART WORLD AS SOURCE OF INFORMATION → CLIMATE EMERGENCY IS A FACT

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