e-conservation

the online magazine no. 25, spring 2013

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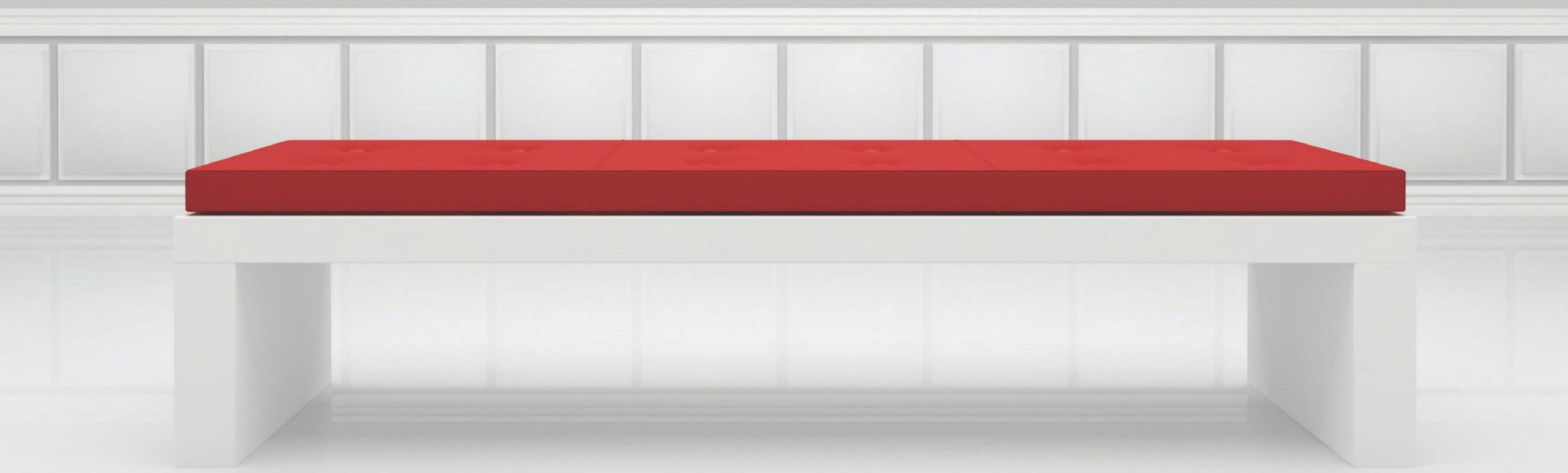

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On Innovation in Conservation

Creativity consists largely of rearranging what we know in order to find out what we do not know…
Hence, to think creatively we must be able to look afresh at what we normally take for granted.
Robert Fisher

Fifteen years ago when I was studying conservation at university one of the things I enjoyed most was to discover new gadgets and gizmos and figure out how they could be useful in my work. I used to anxiously search catalogues of equipment in various fields, trying to find new uses for those 'odd looking tools'. Looking back, I realize now that I basically use the same old tools as before and I can't help but feel a bit of a disappointment for the lack of innovation in our field.

I'm not saying that nothing has changed in conservation. I'm well aware of the enormous advance science has brought to our field such as better analytical techniques and digital imaging. However, these have been, as always, borrowed from other fields such as physics and the chemical industry. When we think of innovation in conservation, the latest scientific equipment comes to mind but in fact, for our practical and immediate work, the tools we need are much more simple.

In our day to day practice we find ourselves employing the most familiar methodologies because we feel they are the safest. We may be working against the clock, stuck in a daily routine, just moving along without giving it much thought. I think it's mostly a cultural issue of our own, being users instead of makers, and as in all cultural matters, this also may be changed. See the example of Jeff Peachey, bookbinder and conservator in private practice, who is one of the few professionals I know that likes inventing. If the practicing conservator will change its mindset to find a better way of doing the same job, then we have set the path to innovation. Innovation does not depend on the latest technological fad or on the access to expensive scientific equipment. Innovation does not have to be high-tech. It just has to serve a purpose in a better way than before.

A reference example for our field could be that of the Makers Movement. This movement is emerging from the do-it-yourself culture, but far from simple amateurs, these makers turn their ideas into reality, sometimes with a commercial purpose but most often for the fun of bringing into the physical world something they envisioned. They can literally build any object, from the most ridiculous to the most interesting. A clear advantage of this culture is that they are driven by creativity and objectives, not just by what they learnt like we conservators often are.

This movement has been recently called a "new industrial revolution" because it has empowered the individual with the capacity to produce what until very recently was only in the power of factories. Take, for example, the case of 3D printers: as 2D printers revolutionized desktop publishing, so will 3D printers change forever the way we create objects. Have you already imagined their potential for conservation? Or look at far less complex technologies such as the Dino-Lite, the famous digital handheld microscope. Despite its limitations, it is very useful in our field but if you think about it, you come to realize that technologically it is quite basic, not far from a simple toy: a webcam, a plastic lens and a few LEDs. All these are cheap off-the-shelf pieces that can be easily assembled to become a tool of great utility.

Of course, I don't expect that we should all come up with great inventions but merely pay a little bit more attention to the things we do on a daily basis and try to improve them. Not all inventions are necessarily technological: find a way to reduce waste, to make conservation more environmentally friendly, to develop better scalpels or better mortars would already be of great help. Last but not least, when you discover something, make sure you share it with the world and take that step that helps to the advancement of our field.

And just imagine, we could adopt and implement this innovative way of thinking in our universities, starting with the earliest stage of our careers. Can you think of a better way to revolutionize conservation?

Rui Bordalo
Editor-in-Chief

TURNING THE PAGE: E-CONSERVATION JOURNAL

The end of a magazine, the beginning of a journal

The present issue of e-conservation magazine, at its 25th edition in spring 2013, is marking a milestone in our existence. After 6 years of continuous online presence we celebrate today not the end, but the beginning of a new stage in our existence: e-conservation magazine becomes a scientific journal. We started in 2007 as the first online conservation magazine released in open access and turned during the years into one of the most popular and world-wide read publications of our field. We have hoped but not anticipated this success. We are thankful to you, our faithful reader who made us grow and became better by the day. We are undoubted to our authors who contributed valuable content and worked closely with us, many times against the pressing deadlines. We are grateful to those people who stood by us since the beginning: our collaborators and reviewing committee, the team behind the scenes whose efforts remain invisible most of the time. Last but not least, we owe the existence of this magazine to those who had the courage to establish it and the dedication to continue on a volunteering basis, donating their free time and expertise to provide the best publishing experience.

The success of this publication is due to all of you. So it is with enthusiasm and renewed hopes that we announce this transformation. For us it represents the step forward that will allow us to continue in a better, more sustainable way.

The format that is known to you today, that of a magazine, enabled us to include a wide range of articles, including news, projects, case studies, book reviews. Our intention all the way was to remain accessible to anyone. We have achieved this goal but even though the articles are available worldwide, easily spread and referenced, as magazine our indexing is limited. In practice, and taking into consideration the best interest of our authors, we need to go a step forward and turn into a journal starting from September 2013.

To make this happen, e-conservation has teamed up with HERCULES, a research center of excellence from the University of Évora, Portugal. HERCULES is one of the most advanced research centers of cultural heritage in Europe and a wel-comed addition to the e-conservation team. On the practical side, a new editorial board as well as an enlarged scientific committee will be established. Nevertheless, these changes will be mostly felt in the administration since on the frontend the publication will continue in the same way you are already familiar with.

e-conservation journal will be available from a new website - www.e-conservation.org - while the archives of e-conservation magazine will always remain available from www.e-conservationline.com

CENTRO HERCULES

HERANÇA CULTURAL, ESTUDOS E SALVAGUARDA

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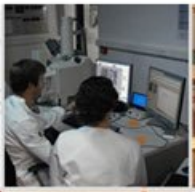
investigação



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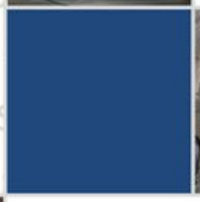

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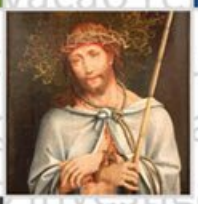

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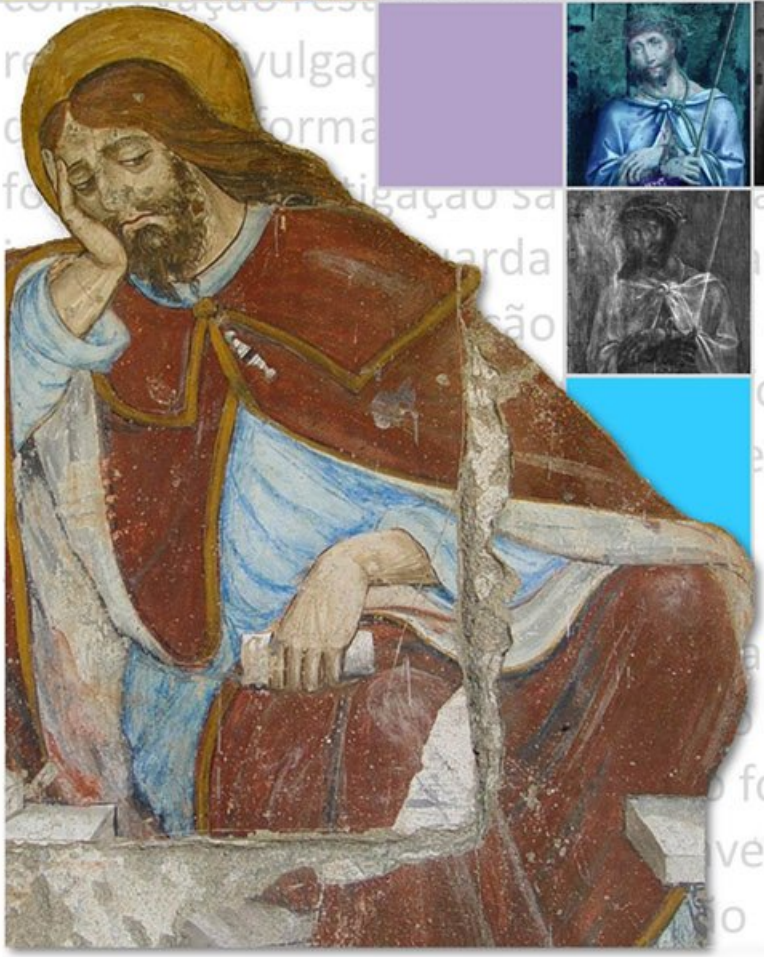

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A NEW NAME, FOR A NEW AGE?

By Daniel Cull

"DID YOU HEAR IT? It's the sound of their world ending.
It's that of ours resurging."
Subcomandante Insurgente Marcos [1]

Conservators, and fellow museum professionals, have long struggled with the legacy of colonialism. Museums that house material drawn from indigenous peoples are "haunted by the collections and the coloniality that they represent" [2]. The fact remains that our collections, and our societies, were built upon colonialism; that is to say social relationships of oppression. If we cannot exorcise the past, how can we, as conservators and as people, live with our ghosts in the present? The solution I believe can be found in Gustav Landauer's famous words "by creating new social relationships; i.e., by people relating to one another differently" [3]. A while ago I discussed the developing conversation within the *ICOM-CC Working Group on Ethnographic Collections* concerning the name of the group [4]; such discussions are a direct attempt to develop new ways of relating to one another. The working group recently announced the results of the third (and final) consultation regarding the proposed name change, 85% of members agreed that the name of the working group should be changed. The suggested new name is *ICOM-CC Working Group on Objects from Indigenous and World Cultures* [5]. Now we wait to see if the decision by the working group will be accepted by the board.

The legacy of colonialism dominated several recent news headlines. In September, Evo Morales Ayma, President of Bolivia, gave a speech at the United Nations, in which referring to the apparent end of the world predicted by the Mayan calendar, he said "the 21st of December is the end of the non-time and the beginning of time. It is the end of the Macha and the beginning of the Pacha, the end of selfishness and the beginning of brotherhood, it is the end of individualism and the beginning of collectivism [...] It is the end of sadness and the beginning of happiness, it is the end of division and the beginning of unity". After more end or beginning of comparisons, he invited the world to "an international meeting on the 21st of December [...] a virtual debate, and also in person" [6]. A meeting that would discuss amongst other things: the crisis of capitalism, the relationship of the human being with nature, the recovery of ancestral uses and customs, food sovereignty, the end of patriarchy, awakening of self-knowledge, and health. As December 21st arrived the world kept turning and out of the Mexican jungles 21st Century Mayans came "their faces covered with the legendary Zapatista pasamontañas and paliacates around their necks [...] marching in silence, in perfect formation, entering the cities of San Cristóbal de las Casas, Ocosingo, Las Margaritas, Comitan, and Altamirano, and occupying their central squares" [7], their silent march the

View of the Mayan ruins of Tikalas. Photo by Shark.

physical embodiment of their communiqué; "DID YOU HEAR IT?" On the same day in Canada, and across the Globe, another social movement came to worldwide attention; known as Idle No More. Born in opposition to Bill C-45, perceived to be a treaty violation, the movement continued to grow, and Canada's Christmas shopping season was regularly interrupted by round dance flash mobs [8], and news of the ongoing fast by Attawapiskat Chief Theresa Spence, which she intends to keep until granted an audience with Canadian Prime Minister Stephen Harper, who seems to believe that he can wait it out. It seems the Indigenous social movements manifested the predictions of the Mayan calendar.

These social movements of indigenous peoples, rather than the academy, are the true context for the debate over the name change within ICOM-CC. My view remains that the proposed new name achieves the immediate goals but doesn't take us beyond dualist concepts of otherness inherent in definitions built on classification systems. Greater consideration of the root of the problem might elicit a longer lasting and more far reaching change. By which I mean that strictly speaking the word "ethnographic" is simply a symbol, symbolizing the real issue; the legacy and continuation of colonialism. The question we must ask ourselves is whether we can "heal our colonial wounds, if the 'right' information is in the catalogues and on the labels, and the 'right' person has contributed with it?" [2]. Indeed an argument I sympathize with believes that the conflicts raised by the competing layers of meaning embedded within an object are necessary as they "contribute to the uncovering of the way coloniality works today" [2]. We have witnessed a growing community of indigenous museum workers, a network of indigenous museums, and more than a decade of collaborative work between indigenous communities and museums.

This background might allow us to explore these competing layers of meaning, to explain, support, critique, and develop, contemporary political movements in our communities, and use the collections our institutions hold to help build collective knowledge of past struggles. Amongst the discussions surrounding the ICOM-CC name change, the *United Nations Declaration on the Rights of Indigenous Peoples* [9] was widely cited as an inspiration. The declaration describes the responsibilities signatory states have pertaining to each article; although several key states have yet to ratify the agreement. Ultimately, of course, we have a personal responsibility to consider what we can do to ensure these rights are upheld, and to de-colonize our own lives and minds; no small feat. It has been suggested that the most effective means of healing pain and moving forward so we can all live together in the here-and-now is to "stay with the pain instead of hurrying to get away from it" [2] in doing so we might find that a new truly post-colonial understanding will find the necessary spaces to grow; perhaps one of those spaces might be a museum.

Notes:

[1] Subcomandante Insurgente Marcos, *Communique: DID YOU HEAR IT?*, December of 2012, L. Oikonomakis (transl.), ROAR Collective on December 22, 2012, URL (accessed 5 January 2013)

[2] L. K. Blom and M. Lundahl, *Haunted Museums: Ethnography, Coloniality, and Sore Points*, Eurozine, URL (accessed 5 January 2013)

[3] G. Landauer, "Weak Statesmen, Weaker People!", in G. Kuhn (ed.), *Revolution and Other Writings: A Political Reader*, PM Press, 2010, p. 214

[4] D. Cull, "O, Ethnographic Conservation, Be Some Other Name!", *e-conservation magazine* 19, 2011, pp. 6-8, URL (accessed 5 January 2013)

[5] ICOM-CC Forum, URL (accessed 5 January 2013)

[6] Evo Morales Ayma, President of the Plurinational State of Bolivia, General Assembly of the United Nations on September 26, 2012, transcription by S. Shahriari, URL (accessed 5 January 2013)

[7] L. Oikonomakis, "Zapatistas: 'to be heard, we march in silence'", *ROAR Magazine*, URL (accessed 5 January 2013)

[8] *Idle No More*, URL (accessed 5 January 2012)

[9] *United Nations Declaration on the Rights of Indigenous Peoples*, [PDF] (accessed 5 January 2012)

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Daniel Cull is a board member of e-conservation, he has also served on the board of the Western Association for Art Conservation. As a conservator he specializes in ethnographic materials and has worked at institutions in the UK and USA, including: the Musical Instrument Museum, the National Museum of the American Indian/Smithsonian Institution, and the Royal Albert Memorial Museum. Daniel trained at the Institute of Archaeology, University College London, where he received an MSc in Conservation for Archaeology and Museums, an MA in Principles of Conservation, and a BSc in Archaeology. His recent research interests have focused around Web 2.0, Wikipedia, and the ethical implications of the emerging social media landscape for conservators.

THE DECORATIVE: CONSERVATION AND THE APPLIED ARTS

24th biennial IIC Congress

Review by Sandi Mitchell

September 10-14, 2012
Vienna, Austria

Organised by:
International Institute for Conservation of Historic and Artistic Works

With its heritage of exceptional achievement in the applied and decorative arts, its history of the Jugendstil period and the c. 1900 Vienna Secession, the city of Vienna was a most fitting setting for "The Decorative: Conservation and the Applied Arts", the 24th biennial IIC Congress. To top it all off, 2012 also happened to be the 150th anniversary of the birth of Gustav Klimt.

The Congress was held at the New University of Vienna and was spread over five days from the 10th to the 14th of September 2012. The first two days of the Congress were dedicated to the Technical Programme, the third to excursions to various cultural venues in and around Vienna and the last two to the second half of the Technical Programme. Each paper and poster presented as part of the Technical Programme was significant and interesting, exploring the breadth of issues associated with the conservation of the applied and decorative arts from a myriad of perspectives. Subsequently, it would be an impossible task to review and discuss each paper in depth. Instead, this review will mention the seven thematic groups the papers were presented in over the four days of the Congress, and will provide more detail into selected papers as an example of the diversity and depth of the papers selected for presentation at the Congress.

Prior to the presentation of the papers and posters, the Congress was officially opened by IIC President Jerry Podany, followed by The Forbes Prize Lecture delivered by Prof. Dr. Manfred Koller, who set the mood for the audience by providing great contextual insight into the history, architecture and applied arts of Vienna.

The first group was titled *Objects and collections under the lens*. The presentations within this group ranged from analysis of surface coatings on metal sarcophagi of the Hapsburg imperial crypt to how collection quality and accessibility can be enhanced and improved through the use of clever design and digitization. Material and technical analysis of decorative glass objects were the focus of a few presentations within this group. For example, Ivana Kopecká presented "Zwischengoldglas: Technology of production, material analyses and conservation". These objects reached their production peak in eighteenth century Bohemia and are a category of glass decorative objects with the decoration (often gold leaf) placed between two or more layers of glass. While it is unfortunate that the deterioration processes started very soon after the objects were made, the paper highlighted that sometimes production flaws in objects are important as they allow conservators to learn about the materials, structure and technology of the objects production.

Examining a collection from a different angle was Dinah Eastop who, in her paper "Design, digitization, discovery: Enhancing collection quality"

First day of the congress.

discussed the decision making process involved in allowing full digital access to the *UK Board of Trade Representations and Registers of Designs*, *1839-1991* while still maintaining the significance and integrity of the information contained within the collection. This process demonstrated the difficult task that arises when digitizing a collection in order to preserve it, and emphasized that each collection manager will need to evaluate what characteristics of a collection are significant or valuable to the large range of people who may access them, which will vary case by case with every collection.

Decorated surfaces and spaces was the theme of the second large group of papers, and covered topics ranging from Egyptian wall paintings, the technical analysis of a fifteenth-century northern European parade shield and the conservation of seventeenth century French and Flemish harpsichord soundboards. Within this group, Lori Wong presented her interesting research (with Stephen Rickerby, Amarilli Rava, Alan Phenix, Joy Mazurek and Rasha Kamel) titled "Examination of the wall paintings in Tutankhamen's tomb: Inconsistencies in original technology" which provided an in-depth reassessment of the wall paintings within the burial chamber of the Pharaoh Tutankhamen's tomb. According to Wong, the conservation of the wall paintings should be approached with awareness that the deterioration and current condition of the paintings are linked to the fact that the untimely death of the Boy King influenced the original methods, materials and techniques employed. On the similar issue of degradation of painted spaces, Ferenc Mihály (in association with Márta Guttmann) presented "The Umling painter-carpenter workshop in Transylvania" and discussed the culturally significant painted carpentry work found in sacred interiors of Transylvania. The paper described the history, materials and techniques of the beautiful painted coffered ceilings and also discussed the most significant painter-carpenter workshop of the 18th century, the Umling family. Conservation approaches and challenges were also discussed. To date, treatment is conducted when funds allowed, and the approach has centered more on the documentation, inventory and survey of painted carpentry work in Transylvania. Challenges to the conservation of painted carpentry were stated as being biodeterioration of

Presentation of "Ceramic rivet repair: History, technology and conservation approaches" by Kasi Alberts.

Presentation of "Examination of the wall paintings in Tutankhamen's tomb: Inconsistencies in original technology" by Lori Wong.

the wood and painted surface as well as damage due to human intervention. A lack of financial resources and awareness by owners (mainly historic churches) regarding conservation strategies were also stated as significant factors contributing to the endangered status of these significant and valuable Transylvanian cultural objects.

Approaches to understanding and conserving decorative arts was the third group of presentations. This group contained strong presentations that often used treatments and projects as a platform to launch discussion into the larger issues of situations, circumstances and challenges conservators face when dealing with decorative arts. Subsequently, this group generated good discussion and dialogue amongst the audience. In the paper "A 'once in a lifetime' experience: 'Conservation in Action' for Thornhill's wall paintings at Hanbury Hall, Worcestershire, UK" Katy Lithgow (research conducted with Nicky Bowden, Michelle Hill, Richard Lithgow and Kate Measures), discussed the results of surveys quantifying visitor responses to being engaged with the conservation treatment of Baroque wall paintings decorating the staircase of Hanbury Hall via tours and open communication. Subsequently, the paper encouraged attendees to consider the methods and benefits of engaging the public with conservation. In her paper titled "Ceramic rivet repair: History, technology and conservation approaches", Kasi Albert raised interesting issues regarding the removal of past interventions versus the information repairs may contain in regards to the history and past value of the object. The challenges conservators face regarding the ownership, management, responsibility and conservation of public art was also explored in this group via the presentation of Karin Hermeren and Henrik Orrjes' paper titled "Exposed and unseen: Management of public immovable art". This paper used case studies to explore the 2011 project *Management of Public Building-Related Art in Public and Private Ownership* in Sweden and the factors leading to the formation of the project.

The important role of technical analysis to better understand the techniques, materials and production of decorative art objects was explored in the next group, fittingly titled *Understanding the decorative by means of technical analysis*.

Presentations ranged from technical analysis of enamels from the Botkin collection, Indigo carmine, silver hollow wares and glazed ceramics. Jennifer Mass and Catherine Matsen presented their research into non-destructive attainment of useful and reproducible quantitative XRF data of English and American silver hollow wares. This data is often important when investigating condition, provenance, manufacture and authenticity. The presentation discussed the problems often encountered when trying to record accurate quantitative XRF data and provided practical advice by suggesting that these problems can be mitigated in a number of ways, including polishing silver enriched surfaces, tarnish and firescale from the area to be analysed, recording multiple measurements and averaging results in order to mitigate surface inhomogeneities and quantifying error due to the surface curvature of the objects.

Woven threads, feathers and enamels are prevalent materials within the decorative and applied arts, and therefore were the focus of the next group of presentations. This was another strong group of diverse and fascinating presentation topics ranging from metal thread embroidery found on 16th and 17th Hungarian textiles to the tangible and intangible values attributed to feathers by certain cultural groups. Of particular note was the examination of the role the decorative arts play as an important barometer of socio-cultural identity. This concept was addressed in the paper "Decorative art or art practice? The conservation of textiles in the Kurdish Autonomous Region of Iraq" by Anne-Marie Deisser and Lolan Sipan and presented on the day by Dinah Eastop. This paper provided fascinating insight into how traditional materials, techniques, design and usage of Kurdish decorative textiles have been influenced by, altered and endured through a range of socio-economic, geo-political and environmental changes. Also discussed was

During "Conservators talk to Conservators" tour of the Painting Conservation of the Kunsthistorisches Museum.

the role the Kurdish Textile Museum plays in preserving and representing the decorative arts of the Kurdish nomadic tribes. Since 2004 the Kurdish Textile Museum has documented, conserved and displayed a collection of 2000 textiles. They have also fostered a relationship between representatives of the nomadic tribes and KTM staff by encouraging dialogue, sharing knowledge and information as well as supporting continuity of practice.

Decorated surfaces and spaces 2 carried on from the earlier group with exploration into both the technical analysis and conservation of decorated surfaces. Several large-scale projects were discussed in this group, ranging from the conservation of Edvard Munch's monumental sketches for the Aula of Oslo University (Norway) to the

Congress attendees on excursion to historic Klosterneuburg Abbey.

Wien Museum Karlsplatz, another site of one of the "backstage" tours.

research and ongoing treatment of a built-in kitchen unit from the *Unité d'Habitation* (France). A project of interest was "The Ermlitz project: the conservation and mounting of 310 square metres of painted wallhangings", presented by Ursula Haller (in association with Stephanie Hilden and Karin Krüger). This paper presented the results of the first stage of their long term conservation project - the surface cleaning, consolidation, canvas repair and remounting of the c. 1770s painted textile wall hangings within five parlours of The Ermlitz manor house. Of particular note was the use of a newly-developed mounting system based on neodymium-iron-boron (NdFeB) permanent magnets and a hook and loop fastening system. The development of this system allowed the conservation team to keep the intervention to a minimum, avoid lining the previously unstretched textile hangings and provide both a remountable and detachable easy system that was invisible and maintained an original, untouched atmosphere within the historic parlour.

The last group of papers was titled *The decorative: Understanding it and using it*. "Use it or lose it: The opportunities and challenges of bringing historic places to life" was presented by Sarah Staniforth (in association with Helen Lloyd) and discussed methods used by the National Trust UK to balance preservation with an accessible and rewarding visitor experience of decorative art collections, specifically as many of these collections contain functional objects. These methods included allowing visitors to use objects within the collections, such as chairs and books, for the original purpose in which they were produced; sitting and reading. In this way, the paper proposed that the visitor achieves a better understanding and appreciation for the history and function of the object, which subsequently ensures that historic buildings remain sustainable and relevant cultural organizations. The careful planning and decision-making process involved in this approach was discussed. It revolved around the theoretical mindset that objects and places can evolve and be finite, but experiences of those objects can be preserved through education of visitors and in-house staff, monitoring of condition and use, as well as supplementation of original objects with replicas when necessary. This paper was a good note to end the Congress presentations on, as it allowed attendees to

ponder the future of decorative art collections, and the ways in which conservation can facilitate a balance between preservation and access.

As mentioned, the third day of the conference was dedicated to "Backstage Tours", excursions and a Round Table Discussion. The excursion program was promoted as allowing "Conservators to talk to Conservators" and allowed attendees to choose their tour according to their area of specialization or interest. For the "Backstage Tours" a number of important Viennese cultural venues, such as the Kunsthistoriches Museum Vienna, Burgtheatre, Wien Museum, the Austrian State Archives, the Austrian National Library, Museum of Natural History Vienna allowed access to their usually restricted areas to view collections, institutions and venues close up and "behind the scenes". One of the great benefits of the tours and excursions was the opportunity to engage with staff, who generously gave their time to impart information and knowledge that only comes with working intimately with a particular collection or place.

The Round Table Discussion, titled *Not Your Grandmother's Chair* was held in the evening of the third day in the historic Klosterneuburg Abbey. The focus of this discussion was the conservation of contemporary applied and decorative arts. The panel was made up of conservators Tim Bechthold, Denise Domergue and Friederike Waentig, curator Ginger Gregg Duggan, artist Tomáš Libertíny and museum director Carl Aigner. Panelists asked questions such as "how does one conserve a table made of 22 thousand strips of newspaper or a chandelier made of Gummy Bears?" and provoked the audience to consider the conservation implications of Assemblage and ephemeral objects as well as those made from disposable and non traditional materials. The issue of conserving the technology behind the production of contemporary applied and decorative arts was also raised, as was the extent of influence both artist and the conservator should have upon one another's field of practice (general consensus being that the conservator must tread the fine line between providing artists with information regarding their choice of materials and impinging on the creative decision making process). Although many of the questions raised during this Round Table Discussion may not be resolved for some time to come, it was a worthwhile dialogue to explore within a group of international conservators. It also complemented the Technical Programme, which understandably tended to be focused more on the conservation of more historic decorative art objects.

The 24th biennial IIC Congress in Vienna successfully addressed a wide range of research avenues leading from the theme of *The Decorative: Conservation and the Applied Arts*. The Congress papers and posters explored the history, materials, techniques of the applied arts through research, technical analysis and documentation while also discussing the conservation and management of the expansive and diverse area of the decorative and applied arts.

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1st INTERNATIONAL SEMINAR AND WORKSHOP ON EMERGING TECHNOLOGY AND INNOVATION FOR CULTURAL HERITAGE

Preservation of Parchment, Leather and Textiles

Review by Irina Petroviciu and Cristina Carsote

September 24-26, 2012, Bucharest, Romania

Organised by: The National Research Institute for Textile and Leather (INCDTP) – Bucharest, the National Museum of Romanian History, the National Village Museum "Dimitrie Gusti" and the University of Craiova, with financial support of the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), Romania

The 1st International Seminar and Workshop on Emerging Technology and Innovation for Cultural Heritage "Preservation of Parchment, Leather and Textiles" took place on 24th-26th September 2012 in Bucharest, Romania. The event, chaired by Dr. Elena Badea (University of Craiova and University of Turin) and Dr. Lucretia Miu (National Research Institute for Textile and Leather, Bucharest), was hosted by the National Museum of Romanian History.

Dedicated to the innovative technologies applied to parchment, leather and textile museum objects, the meeting brought together well-known specialists from European institutions with tradition in museum objects conservation as well as Romanian researchers, conservators and curators from various museums, libraries and archives. Eleven lecturers from six European countries and fourteen Romanian specialists were invited to share their experience over the three days scientific program including five Plenary Sessions, a Demonstrative Workshop and a Round Table. An exhibition of textiles and parchments manuscripts restored in the laboratories of the National Museum of Romanian History was especially organized for the Seminar and Workshop attendees. More than 80 conservation professionals, students, and conservation scientists from the main national museums, conservation laboratories and workshops, as well as from research and academia institutions, joined this event organised in cooperation with the Romanian Association Science and Cultural Heritage in Connection (i-CON), while 22 young conservators participated to the Workshop.

The Seminar and Workshop provided an excellent forum for conservation scientists and conservation-restoration professionals to interact, exchange ideas and initiate collaborations. It showcased some of the latest technical developments in the field of micro- and non-destructive testing for the diagnosis and conservation of historical parchment, leather and textiles, as well as innovative ICT technologies for an improved exploitation and fruition of cultural heritage.

The seminar was opened by the lecture of Dr. Jan Wouters, conservation scientist with a particular interest in the analysis of natural organic materials used in works of art and culture. Jan Wouters, past Chairman of the Conservation Committee of the International Council of Museums (ICOM-CC) and visiting scientist and consultant at the Getty Conservation Institute in Los Angeles, USA, presented "Leather analysis for conservation

General view of the seminar.

purposes". He showed how to evaluate the deterioration of historic leather using very small amounts or even micro samples and how to assess the suitability of commercially available leather for conservation purposes.

Within the Seminar, Plenary Sessions dedicated to specific topics were organized to allow a debate among the European and local experiences. In *Materials Analysis and Response to Environmental Damage* session, Prof. Manfred Schreiner (Academy of Fine Arts, Vienna, Austria) explained the use of non-destructive analytical techniques in pigment and ink analyses in manuscripts and miniature paintings on parchment, with an emphasize on the capabilities and limits of in situ reflexion FTIR analysis in the evaluation of parchment degradation. In a complementary talk, Dr. Marta Ursescu ("Moldova" National Complex of Museums Iasi, Romania) undertook a review of the materials used for making illuminated manuscripts and discussed the influence of iron-gall inks composition on parchment stability.

In the following section, dedicated to *Preventive Conservation*, two case studies were illustrated by Dr. Marie Vest (The Royal Library, Copenhagen, Denmark) with "Directions in book conservation–materials, methods and training", and by Dr. Marta Guttmann (Transylvanian Museum Society, Cluj-Napoca, Romania) with "Preventive conservation issues in parchment, textile and leather conservation". According to the Danish experience, cold or cool storage should be used to slow down the deterioration process of all unstable materials and digitization should be considered as a priority solution in conservation.

The *Research and Education for Conservation* session was approached as an overview of the experience and expertise on textile investigation and restoration of three national museums, two of which from Germany and one from Romania. Dr. Christine Müller-Radloff reviewed her 30 years of work in the restoration of ethnographic textiles at both the Staatliche Kunstsammlungen and Staatliche Ethnographische Sammlungen Sachsen

Practical demonstration during the workshop.

Museum für Völkerkunde, Dresden. Dr. Ileana Creţu introduced the audience to the history of textile conservation in the oldest textile conservation workshop in Romania. In her talk "National Museum of Art of Romania - 50 years of practice and science in textile conservation and restoration", Dr. Creţu illustrated the evolution from the former definition "restoration means to bring the object to an image as much similar to the original" to the new philosophy of textile conservation based on "the principle of minimum intervention". Recent advances in technical investigation, research and archives organization, as result of the facilities offered by the ARTECH, COST G8 and CHARISMA EU projects, were emphasized and acknowledged. The connection between Romanian and European institutions as result of the joint research projects was illustrated by the presentation of Ioana Cova ("Bucovina" Museum, Suceava, Romania) on "Mounting a cap, at the National Museum of World Culture, Gothenburg, Sweden". The section was closed with an overview on the Romanian education system in conservation and restoration presented by Octaviana Marincaş from "George Enescu" University of Arts, Iasi.

In the last two sessions, dedicated to *Innovative Technologies for Sustainable Preservation* and *Materials Characterization and Damage Assessment*, the outcomes of some ongoing European and national research projects were presented.

Prof. Alessandro Vitale Brovarone (University of Turin, Italy) gave an exciting interpretation of "Reading problems and chromatic variability" of manuscripts of the Royal Library of Turin, while Dr. Paola Iacomussi (National Research Institute for Metrological Research, Turin, Italy) explained how to "Enhance the perception of works of arts with innovative lighting" and illustrated the benefits obtained in the case of lighting the Holy Shroud of Turin.

Prof. Robert Sablatnig (Institute of Computer Aided Automation, Computer Vision Lab, Vienna University of Technology, Austria) presented a

Visit at Stavropoleos Monastery.

very interesting application of "Multispectral image acquisition, image enhancement and layout detection of the Sinaitic Glagolitic documents". Following on, Oana Miu (Mira Telecom, Bucharest, Romania) illustrated the "Use of Σ-Δ filtering for automatic detection of shrinkage temperature of collagen fibres". Her presentation was complemented by Valentin Velican (University "Politehnica" of Bucharest, Romania) who presented the objectives, benefits and impact of the project "Intelligent system for analysis and diagnostic of collagen-based artefacts".

Nikifor Haralampliev ("Ivan Duichev" Center for Slavo-Byzantine Studies, Sofia, Bulgaria) talked about the experience gained from the "Recreation of medieval recipes related to parchment making in Byzantyum".

Dr. Petru Budrugeac (INCDIE ICPE-CA Bucharest) discussed about the "DSC analysis of historical leathers and parchments for damage assessment and certification". Dr. Irina Petroviciu (National Museum of Romanian History, Bucharest, Romania) presented a very useful overview on "Flavonoid dyes in textiles from Romanian collections". The final presentation of the Seminar was Dr. Ioana Stanculescu who presented "Physical chemical tests, gamma irradiation and augmented reality technology for the conservation of textile and leather heritage artefacts" developed at the "Horia Hulubei" National Institute of Physics and Nuclear Engineering, Romania.

The half-day demonstrative workshop was organized in two modules: Multispectral characterisation of historical parchments (tutors: Paola Iacomussi and Michela Radis, National Research Institute for Metrological Research, Turin, Italy) and Damage ranking of collagen artefacts by Micro Hot Table (MHT) Method (tutors: Cristina Carşote, National Museum of Romanian History, Bucharest, and Oana Miu, Mira Telecom, Bucharest). In each module, the theoretical introduction was followed

by a practical demonstration. Dr. Elena Badea discussed the results provided by micro-invasive thermal analysis techniques such as Micro Hot Table Method and micro Differential Scanning Calorimetry (micro DSC) and their ability to "Identify environmentally sensitive artefacts". During the practical demonstration, the participants had the opportunity to also perform measurements by themselves.

The last day of the meeting was reserved to a Round Table discussion dedicated to Advances in Practice on Ethnographical Objects hosted by the National Village Museum "Dimitrie Gusti", one of the biggest and the oldest outdoors museum in Europe. The Round Table was focused on textile and leather heritage preservation and exhibition in ethnographic open air museums. The discussions offered many interesting insights into how conservators in Romania and Europe are confronted with such challenging issues and continued in a varied natural way during the visits to the museum depots and restoration workshops. Then, participants greatly enjoyed the guided tour of some of the peasant farms and houses, among the most representative for the Romanian popular architecture and techniques.

The Seminar and Workshop ended with a visit to the Romanian Medieval Art Collection of the National Museum of Art where Ileana Creţu spoke about the most valuable embroideries and textiles on display. In order to show the specificity of the Romanian cultural heritage, other visits were organized at the National Cotroceni Museum, the former royal residence, the Romanian Peasant Museum and Stavropoleos Monastery.

The papers presented in the Seminar were published in the book of extended abstracts (ISBN-978-973-1716-81-7).

This first edition of the Seminar and Workshop can be concluded with the Jan Wouters' words during the press conference: "despite having internet, email and, whether we like it or not, Twitter or Facebook, face to face discussions are unavoidable nowadays and in the near future".

The local organizers are hoping to continue this series of events at two-year intervals.

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Irina Petroviciu is presently senior researcher at the National Museum of Romanian History/ Centre of Research and Scientific Investigation. She obtained her PhD in analytical chemistry at the University of Bucharest on the use of LC-DAD-MS in characterisation and identification of natural dyes in historical textiles. She has more than 15 years of expertise in analytical chemistry applied to cultural heritage.

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Cristina Carşote is conservation scientist at the National Museum of Romanian History/ Centre of Research and Scientific Investigation. She received her education in chemistry at the University of Bucharest and is currently following a PhD programme on damage assessment in historical collagen-based materials. She has been involved in several projects dedicated to organic materials in museum objects.

WESTERN ASSOCIATION FOR ART CONSERVATION (WAAC) ANNUAL MEETING

Review by Rose Cull

October 22-26, 2012
Palm Springs, California, USA

Organised by:
Western Association for Art Conservation (WAAC)

The Western Association for Art Conservation (WAAC) annual meeting was held this year in Palm Springs, California. Palm Springs is only a 2-hour drive from Los Angeles, and the meeting was well attended with around 66 attendees and 24 lectures.

Before the meeting an 'Angels Project' was scheduled. This is a WAAC tradition, because so many conservators will be in one place for the week, they coordinate a volunteer project at a local cultural site to help in conservation or collections. On Monday, October 22nd, I participated in the Angels Project at the Agua Caliente Cultural Museum storage facility. The museum collects materials to tell visitors about the Agua Caliente Band of Cahuilla Indians. The Angels project was to inspect the basketry collection to determine the presence of mold on a few of the baskets. The conservators shared 2 ultraviolet lights to examine the baskets. Mold is not always easily visible in under normal lighting conditions but will often show a faint yellow fluorescence in ultraviolet light. Mold was successfully identified on some baskets, and it was determined that other baskets were free of mold and could be displayed and handled. The conservators offered more information to the museum about integrated pest management and housekeeping practices. It was interesting for the conservators who participated to see a collection of historical and contemporary artifacts from that area, I enjoyed learning more about the Cahuilla Indians and the history of basketry in that part of California.

We kicked off two-and-a-half days of lectures on Tuesday, October 23rd at the Palm Springs Art Museum auditorium. The lectures covered a variety of topics and included: education, recent research among PhD and Master's students, treatment case studies, disaster planning and management, and personal experiences using new materials and technologies. I found all of the lectures really engaging, I really enjoyed the opportunity to hear about a variety of materials and current research topics.

Two lectures that stood out to me concerned the earthquake and related aftershocks' in 2010 and 2011 in Christchurch, New Zealand. The first lecture was by Lynn Campbell who walked us through the first earthquake on September 4th, 2010 the subsequent aftershock on December 26th and the devastating aftershock on February 22nd, 2011. It was striking that the most damage was caused by the second aftershock, mainly because the focal depth of the earthquake was only 5 kilometers. The details of the destruction caused by the earthquakes complicated communications, transportation, security, and health and safety. I could see the situation in Christchurch was very serious. After the second aftershock responders and residents living in the area had no power, water, or sewage services. It was also difficult to

Conservators examining basketry under UV light.

encourage salvaging structures and collections, which was in conflict with the wants of property developers and the needs from the local government that wanted to raise revenue through rebuilding. The lecture highlighted the issues around disaster management and the need for preparedness.

The second lecture was by Sasha Stollman and focused on the successful quakeproofing at the Canterbury Museum. The building was built between 1870 and 1882 and extensively strengthened for potential earthquake damage in the 1980s and 90s. Sasha pointed out that the earthquake strengthening was very intrusive to the historic structure, but ultimately this is what saved the building from sustaining serious structural damage during the 2010-2011 earthquakes. Other earthquake prevention the museum used effectively were sticky dots of Rhoplex N-580 which were placed on the bases of ceramics installed on platforms under vitrines. Only one ceramic was damaged in an entire gallery, which seemed amazing after witnessing the structural damage that occurred in some buildings.

What I really took away from these lectures is that conservation and preservation do not mean buildings should never change, but for good preservation there should always be a dialogue weighing the benefits or dangers involved in any modification to an artifact (including a building). The lectures also pointed out how important it is to understand collection risks to best understand how to preserve a collection.

WAAC is a fun conference, other activities included: a silent auction, a chance to talk to friends in colleagues, tours of local cultural sites, and Palm Springs had many options for food and entertainment. WAAC was held in conjunction with the Western Museums Association meeting and there

Daniel Cull introducing the conference.

was an evening event that included attendees from both conferences. I ended the conference week by going for a hike with two conference attendees in Indian Canyons, an oasis in the desert.

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Rose Cull is a board member of e-conservation. Rose specializes in the conservation of sculpture and contemporary art. Rose trained at the Winterthur/University of Delaware Program in Art Conservation where she received an MS in Art Conservation. Her recent research interests have focused on the role of the artists interview, and the conservation of electronic dance music. She has previously published on the legal rights of artists and conservators under VARA, issues of sustainability in conservation, and the changing views of preventive conservation. Rose is the assistant coordinator the ICOM-CC Theory and History of Conservation working group, and the American Institute for Conservation (AIC) Electronic Media Group.

THE CHINA FROM CHINA

Third Chinese Heritage Conference

Review by Anne-Cecilia Orr

November 2, 2012
London, United Kingdom

Organised by:
China Culture Connect, Artability Art & Collection Ltd in association with Royal Museums Greenwich

The conference focused on the export trade of Chinese Porcelain, to which the setting of the National Maritime Museum lent itself nicely. The day's events were presented within the context of Chinese tradition and culture. It featured some of the most eminent speakers in the field of ceramics conservation including collectors and academics prompting discussions on export, cultural heritage and how to keep traditions alive.

Conservation treatments on the various materials: glass, ceramics and pottery were discussed. This was my original reason for attending; however, I was also delighted with the additional discussions that complemented the day's program. We heard interesting stories about the trade routes between China and the West; the development of Chinese porcelain art from a contemporary porcelain collector; and a Heritage Award Winning film (March 2012) detailing the technology of pot making in a remote province of China.

Amy Miller, Curator of Decorative Arts and Material Culture at the National Maritime Museum, lead a discussion on the acquisition of their collections, specifically, the interpretation and association of highly prized china as well as copies and fakes. These indicate how objects were commissioned and how markets catered for colonial expansion. A trader's gallery opened in 2011 demonstrating association through consumption with the East India Company as the central focus. Part of the display, exhibit souvenirs collected by travellers, not only represent culture but also show a pattern of consumption and taste. This is epitomised by the museum's china punch bowl depicting scenes of ship manufacture.

Punch itself is a trade commodity, being a drink comprising brandy, oranges, lemons, sugar, green tea and champagne. The punchbowl is therefore used to consume trade products as well as being a trade product. Two examples of 18th century Chinese export porcelain depicting the Gough and Hynde interlocking coat of arms have been acquired by the museum and were briefly touched on in the presentation. The Gough and Hynde family were Chinese traders and chairman to the East India Company providing direct association links and literal interpretation.

Kate Newnham from Bristol Museum was the second speaker. Together with Jenny Gosling she researched and conserved the Chinese Qing Dynasty (1644-1911) glass acquired by Bristol Museum during the 1950's with the help of the National Art Collections fund. The acquisition reinforced Bristol's association with glass manufacturing in the early 1800 when it was known for producing a blue glass known as Bristol-blue. The 300 articles of Chinese glass were acquired and conservation work was carried out between

National Maritime Museum Greenwich, main entrance.

2004 and 2006. Research showed signs of inherent corrosion probably due to the unstable product of liquid flux. Kate gave a frank assessment of the conservation treatment, the problems encountered with the extent of the corrosion, and maintaining stable environmental conditions which required the purchase of new display cases. An XRF machine was used to carry out experiments on some of the glass objects providing interesting results in pigment analysis, and further testing will be carried out to investigate the pigments and to determine some of their true identity.

In the third presentation we learned about the Guangdong Shiwan Pottery Ridge Decoration given by Haiyan Huang, curator at the Guangdong Folk Art Museum in Guangzhou since 1995. Haiyan explained the origins of the Ridge Decoration commonly used to decorate large public buildings from the 1850's to the early 20th century and the agencies of decay, which have caused the destruction of so many buildings. Following this, she took us through the conservation plan and subsequent restoration of the Ridge Decoration on the museum where she works. Acid rain, air pollution, and fluctuating temperatures all contribute to its degradation. Interestingly, particle analysis showed the heaviest dust deposits were from south-east direction correlating to the direction of monsoon storms in the summer. The conservation treatment included recreating missing sections, areas where delamination occurred were consolidated, the removal of vegetation and biological growth was carried out and lightning rods were fitted. A professional restorer was commissioned to work on recreating the missing sections, and to remain in keeping with the traditional style of decoration, it was decided that a Dragon Kiln would be built. This traditional method of manufacture would produce figures of a similar firing colours and shrinkage rate. It was successfully achieved and future restoration will be carried out using traditional means. However, the style, construction and manufacture of this traditional kiln used are a dying art and these skills require the interest from a younger generation to keep it alive.

Before breaking for lunch we were shown a short film which brought together the ethos of the day's events, 'keeping tradition alive'. The film centred around an elderly Chinese lady from the Hainan province and her struggle to provide for her family in the remote village where she now lives with her remaining daughters. The harsh realities of maintaining the traditions of pot making lie with her determination to teach the skills to the next generation as they had been taught to her, but a lack of interest and saleable goods pose risks to their livelihood. Industrial manufacturing means traditionally made pottery is no longer sought after and the younger generation finds more prosperous jobs in inner cities. The only way to keep these skills alive is by adding economic value to the pottery which will allow sustainability. It is only with necessity and interest in the pots that the villagers would be able to continue their traditions. The film makers captured the vulnerability of progress but only by bringing awareness

Punch Bowl depicting scenes of ship manufacture. Courtesy of the National Maritime Museum Greenwich.

of their skills can we help to support the tradition and keep it going. The film producers, who attended the conference, brought with them some examples of the pots as seen created on the film and there was an opportunity to purchase the DVD entitled 'Being with Clay'. (http://www.cinemalumiere.com/Being-With-Clay/)

After a chance to catch up with delegates from around the world and meet those working in the UK, we returned to the second half of the day which started with a dual language presentation. Chunming Yu, professor in the School of Art and Design at Nanchang University and Head of the Nanchang University Museum, was the first to speak. His talk focused on the new Museums display on Chinese export porcelain, specifically between the west and China, including the story behind the various export routes. As with the theme of the day, lessons need to be passed down to the next generation detailing the functions of trade and Chinese export porcelain. This can be done in a number of ways: new publications to guide collectors on what and how to collect relevant artefacts, the availability of online resources as well as image databases documenting the story of Chinese export porcelain. The addition of an International Conference organised every two years by Nanchang University Museum will bring together professional knowledge from scholars and collectors from the west and China contributing further export research. We were all cordially invited to the next conference in Nanchang on 15th of November 2014.

The enthusiasm of collector Humphrey K.F. Hui, our next presenter, was infectious. He began by reminding us that all the slides we were about to see were all from his own private collection of contemporary porcelains. He was clearly passionate about his collection and was keen to educate us with stories of each artist, their signature marks, symbolisms used and calligraphy markings from which a collector with a trained eye would be able to detect a forgery. The remarkable images seen on the fine porcelain were originally scenes painted

Ronald Pile and Velson Horie, conference organiser.

Humphrey K.F. Hui, Min Qui Society Hong Kong, and wife.

on canvas. In 1929 a society was formed called the 'Full Moon Society', which aimed to replicate works of art on paper onto ceramics. Commissions started with images such as traditionally painted scenes and poems. These ceramic artists, by then masters, passed on their skill and techniques to their children from which commercial family businesses developed.

Our final presenter hit stardom by being the conservator whom won the bid to restore the famous Qing Dynasty vases at the Fitzwilliam Museum in 2006 after a disastrous accident involving a member of the public falling into them. Penny Bendall's talk was divided into two parts. One half was dedicated to the theory based procedures encountered while restoring the three Qing vases. The second half was a live demonstration of a practical restoration lesson. A fitting end to a conference focused on transferable skills. Her work is based on discreet restoration using hxtal nyl-1 epoxy as the main adhesive. Also used as the filler it is tinted and a bulking agent is mixed into the paste at the preparation stage, this is applied in stages and finished off by polishing with low grade abrasive paper. This modern epoxy can be less intrusive than previous restoration techniques due to its qualities such as strength, fluidity, and compatible refractive index. However, it is nonetheless still a subject of discussion as it remains a modern product with little historical evidence of degradation.

Culture and tradition was in abundance while remaining focused on the export heritage of Chinese porcelain and glass. The conference delighted all with its educational programme and informative discussion of future desires to inspire the next generation, forming links between the east and west on common ground where a transfer of knowledge was gained between museum professionals, collectors and academics. The celebrated theme was clearly emitted 'keep tradition alive'.

A warm welcome was received by all and the organisers Xuhua Zhan and Velson Horie led the smooth running of the conference with absolute precision.

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Anne-Cecilia is in her final year at Cardiff University studying a BSc in Conservation of Objects in Museums and Archaeology. As a mature student with past experience as a porcelain restorer, she now wants to focus on working as a conservator.

DIAGNOSIS FOR THE CONSERVATION AND VALORIZATION OF CULTURAL HERITAGE

Review by Luciano D'Alessio

December 13-14, 2012
Naples, Italy

Organised by:
Associazione Italiana Esperti Scientifici and
Centro Interdisciplinare di Ricerca per le Scienze Applicate alla Protezione dell'Ambiente e dei Beni Culturali

The international conference *Diagnosis for the conservation and valorization of cultural heritage* came to its third edition. It took place last 13th and 14th of December in the NH Ambassador hotel, a 30-storey building at via Medina, in the historical center of Naples. Previous editions also took place in the same hotel in 2011 and 2012. The aim of this last edition was to shed new light on problems relating to Italian cultural heritage, and to explore new topics and new tools applied in the field of conservation and restoration.

The diagnosis of our cultural heritage, said in the foreword the conference organizers Ciro Piccioli and Luigi Campanella, is a fundamental prerequisite to knowledge and a strong support to the political and administrative effort of valorization, which is the only way to lead our country to recover from the economical crisis.

In the opening session, the author of this review presented a keynote lecture "Knowledge and valorization of cultural heritage: a new challenge to complexity" where it was pointed out that every artwork is a complex system, both in space and in time. The spatial complexity refers to the multiplicity of geometrical elements and constituting materials, each of them has its own morphological and physical-chemical properties. The temporal complexity is related to the transformations that the artwork undergoes during time due to interactions with the environment, interventions of restoring and conservation, and spontaneous modifications. Moreover, the artwork intrinsic complexity is accompanied by an extrinsic complexity that is linked to the interactions with the observer, which is another complex object. Therefore every valorization intervention requires an integrated approach and a new language appear to be indispensable, leading to the long awaited dialog between cultures necessary for a reciprocal understanding and enrichment.

The conference was essentially subdivided in 12 sessions: *Security, Valorization, Materials, Research and Development, Mathematical models, Applied Informatics, Wooden Materials, Musical Instruments, Diagnostics, Restoration Technologies, Case Studies*, and *Posters*. Given the overall number of presentations, between two and five per session, we will focus only on some examples of each session. This report is in no sense exhaustive but just a taste of the flavor we have experienced in Naples, except for the pizza, of course.

In the first session, *Security*, Erminia Attianese, from the University of Naples Federico II, pointed out the importance of usability of hand tools and work instruments in order to grant the safety both of the worker and the artwork. Ergonomic

requirements must be defined for the most commonly employed tools, and suitably handbooks for their use are to be made. Another important issue is the injury prevention in the construction sites, where a number of risks coming from chemistry, biology and physics are possible, as explained in the paper of Paola Marone and Ciro Nappo from the Comitato Paritetico Territoriale per la Prevenzione Infortuni della Provincia di Napoli.

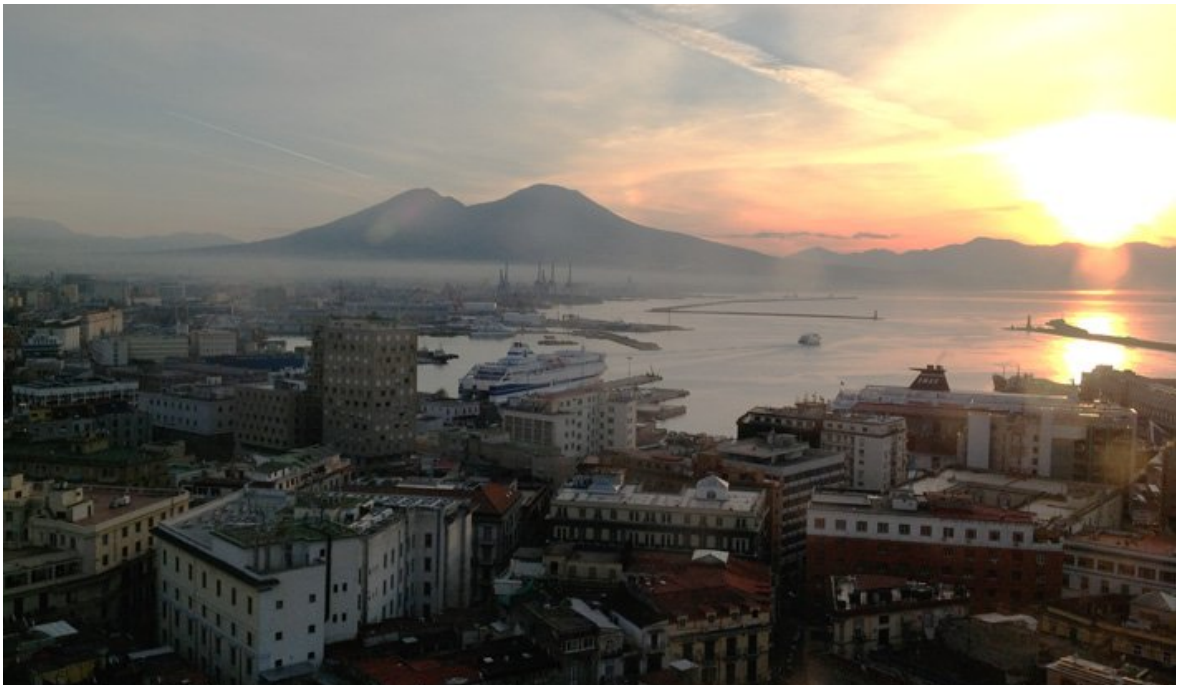
In the *Valorization* session, freelance archaeologist Sergio Cascella showed a little known archaeological site, the Theatre of Sessa Aurunca, and the long sequence of transformations undergone by its beautiful colored marble.

Under the theme of *Materials*, a very interesting study of colored maiolica domes was presented by Caterina Gattuso, from the University of Calabria. Maiolica plates were used to cover domes of churches and cusps of bell towers in many places of southern Italy, typically in Campania and Calabria. Remarkable examples can be found in the Amalfi Coast. The pigments of the plates have been studied from the colorimetric points of view, with the purpose to quantitatively characterize the artwork, and to carry out comparison between buildings checking for different authors. Another paper by Giuseppe Chididimo, from the University of Calabria, introduced us in the world of textiles talking about a quasi completely unknown fiber: the bisso, or sea silk. It is produced by the great bivalve mollusk Pinna Nobilis and it can be defined as blonde protein or mermaid hair. It was employed in ancient time to manufacture royal and ecclesiastic dresses, embroideries and decoration. Today is gathered only by a single woman in Italy. The study focused on the distribution of the mollusk in the Mediterranean sea, and gave a new vision of sea bottom as innovative site of cultural fruition.

Furthermore, in the *Research and Development* section, we can mention the microwave-induced heating of stones and woods to eradicate the biological infestations. On this issue, one paper deserves special interest, by Bruno Bisceglia from the University of Salerno, regarding the treatment of the statue of San Leone Magno and the stone wall of Paestum. They employed microwaves for heating in the same way we do every day in our kitchen. In the same section Ilaria Catapano, from the Institute for Electromagnetic Sensing of the Environment in Naples, discussed the holographic radar inspections for cultural heritage monitoring, with reference to the Musmeci bridge in Potenza, an important architecture masterpiece with interesting geometrical features. And remaining in the field of geometry, a study of the spiral in ionic capitals was presented by Caterina Gattuso and Annarosa Serpe, both from University of Calabria, for the Mathematical Models section.

The session on *Applied Informatics* gave us a new vision of architectonic structures thanks to virtual reconstruction. You can navigate inside a building sitting in your armchair or going on-site with your iPAD reading information about the paintings you have in front of you, as described by Ulderico Sicilia from Risviel in Rome. 3D modeling is also important for Wooden Materials restoring and conservation, as explained by Giuseppe Amoruso from the Polytechnic of Milan, regarding the funerary statue of a famous puppeteer in Parma.

The musical tradition in Naples is well known all over the world, but only recently the ancient *Musical Instruments* are considered as subject of protection and conservation. The Neapolitan mandolin was invented in 17th century and got a sudden success due its simple use, small size and low cost. The work of Luciana Festa, from Istituto Superiore per la Conservazione e il Restauro in



View of the gulf of Naples seen from the 20th floor of the conference venue.

Rome, provide for the first time several scientific analyses performed on micro-samples from 11 mandolins produced in the second half of the 18th century. A multidisciplinary approach has been followed to characterize the materials, including optical microscopy, SEM-EDS, FT-IR, Raman and Py-GC. The study gave a detailed characterization of the materials employed in the constructions of the instruments and an insight into the fabrication processes.

The section *Diagnosis* included Infrared Light Photography as an inexpensive and non-invasive tool for paintings characterization (Filomena Parisi, student at the University of Naples), LED Multispectral Imaging for monitoring the conservation of frescoes (Marcello Manfredi, University of Eastern Piedmont) and μ-EDXRF for paintings dating purposes (Giovanni Cavallo, Istituto Materiali e Costruzioni (SUPSI), Switzerland). The *Restoration Technique* session has been focused on the problems regarding interventions on a wooden statue (Michela Rossi, Polytechnic of Milan) and on the inlaid floor of a Roman church (Ylenia Rubino, from Istituto Superiore per la Conservazione e il Restauro in Rome).

An interesting *Case Study* was presented by Francesca Larcinese and Silvia Moretta, both from Cultural Association Akedà in Pescara, regarding a new way of popularization of the historic and artistic heritage. The two young authors, both art historians, have designed a project named Mirabilia d'Abruzzo, placed in the middle between travels and scientific literature exploiting a modern frame: an up to date web site (www.mirabiliadabruzzo.it) synchronized with two mobile applications freely downloadable from smartphones and Android or IOS tablets. The web site is organized at various levels of focalization, from an overview of the monuments of Abruzzo through more detailed information as history, opening time, accommodation, gastronomy, nature, folklore, important people, legends, handicraft, and, last

but not least, the bibliography section which is a very innovative presence in works of this kind. All of this is enriched by a rich photo gallery.

Finally, in the Poster session some less known archaeological sites were shown, namely the Roman villa of Sava (Salerno), the imperial thermal baths of Baia (Naples), and the restoration of a nice etching of Lipinski and the Cathedral of Sessa Aurunca (Caserta).

In conclusion, as stated by the organizers, this conference helped to build a meta-language to achieve an integration between scientific, artistic, historical, psychological languages spoken by different cultural heritage operators, which, in our opinion, was achieved with success. The next meeting is scheduled for December 12-13, 2013 in Naples, Italy.

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Luciano D'Alessio graduated in Chemistry in 1975 from the University of Rome La Sapienza where he worked in the fields of molecular spectroscopy and solar energy conversion. Since 1992 he is Associate Professor of Physical Chemistry at the University of Basilicata, Potenza, where he gives courses on classical physics, statistical thermodynamics, quantum mechanics, and chemistry applied to archaeology and cultural heritage. His research interests span from thin film deposition by pulsed laser ablation to chaos, fractals, dynamic systems, cellular automata and elastic properties of macromolecules. In recent years, he studied complexity in paintings and architecture, and its applications to the valorization of art works.

The News section is bringing up-to-date information on cultural heritage topics such as on-site conservation projects reports, reviews of conferences, lectures or workshops and any other kind of appropriate announcements.

If you are involved in interesting projects and you want to share your experience with everybody else, please send us your news or announcements.

For more details, such as deadlines and publication guidelines, please visit www.e-conservationline.com

TECHNOLOGY IN THE ARCHITECTURE OF MODERNISM THE ARCHITECTURAL HERITAGE

10th anniversary conference in Karlsruhe on architecture – theory and practice

Review by Maria Bostenaru

Organised by: DOCOMOMO Germany

January 25-26, 2013
Karlsruhe, Germany

On 25th and 26th of January 2013 the anniversary conference "The architectural heritage" of the Modern Movement took place at the Karlsruhe Institute of Technology, in Germany being at the same time DOCOMOMO (the international committee for DOcumentation and COnservation of buildings, sites and neighbourhoods of the MOdern MOvement) International technology seminar was also organised. The conference was recognised by the architecture chamber as continued learning for architects, but it was also open to the general public. As such, a day of presentations was followed by a day of site visits to EZB Frankfurt or to Dammerstock Siedlung Karlsruhe. Organiser was architect Alex Dill, academic councilor at KIT, together with colleagues Uta Pottgiesser and Jos Tomlow from DOCOMOMO Germany. Through generous support of the Getty Research Institute it was also possible to involve the related ICOMOS International Scientific Committee ISC20C. Both committees held meetings related to the conference.

Different from the previous conferences, this time the focus was the influence of material on what is called in German "Baukonstruktion", the constructive scaffold of a building including its details. This conference featured both contributions of today's interventions on historic buildings, as well as studies on the history itself and the employment of construction materials in the past.

The first lecture introduced the Großmarkthalle Frankfurt, today transformed in the Europäische Zentralbank. Under the motto "syntheses", Horst Pesecke presented the view of an engineering company and talked on the history of reinforced concrete, from the view of codes, journals and other ways of interaction between research and practice. The development of shell structures in reinforced concrete at the Großmarkthalle was put in the context of the Jahrhunderthalle in Wrocklaw, built at the same time, and of a new building of today in Lausanne. As the closing discussion showed, the most important aspect was the role of actors from different disciplines in the design process.

The second lecture focused instead on "innovations". Wolfgang Thöner, an expert in the history of the Bauhaus Dessau talked about the influence of industry on the experimental teaching at that site.

Jan Molema from Netherlands was the next speaker. On the topic of "limits" he returned to the role of concrete, presenting the Zonnenstraal sanatorium restoration, but he also went on to detailing other materials, such as the transformation in Maison de Verre in Paris. This was part of his ongoing research on the work of Bernhard Bijvoet, Johannes Duiker and Jan Gerko Wiebenga.

Conference room, 2013.

Anke Zalivako from Berlin talked about Russian Avantgarde and the relationship of Constructivism to technology. Although her detailed studies served the Narkomfin building, the research presented was much wider and included the relationship between building material, "Baukonstruktion" and preservation in the Russian constructivist buildings in Moscow between 1919 and 1934.

Vanessa Fernandez, doctoral candidate, and Emmanuelle Gallo presented the relationship between façade technology and interior comfort in case of Le Corbusier's building for the Salvation Army. While a full glasing to the side of the house turned towards the sun lead in winter to costs savings in heating, in summer, for preventing the negative effects, brise-soleil had to be attached.

The next three lectures were dedicated to architecture from overseas, a new element in the series of conferences.

Under the motto "Nonchalance", Danilo Matoso Macedo presented the contribution of the engineer, in this case Joachim Cardoso, to Oscar Niemeyer's architecture. The lecture was therewith a hommage to the recently deceased architect. Oscar Niemeyer worked with several engineers, including a graduate from Karlsruhe University, but the special contribution of Cardoso, this time to architecture in concrete, was on the shape of the elements. A rectangle becomes slightly ellipsoidal to mathematically optimize these shapes in the pillars designed by the architect. Parabols were defining the arcades. In the view of the speaker, the dialogue between the actors can be seen as a successful teamwork.

The chair of ICOMOS ISC20C presented the Los Angeles "case study house" programme, an example of "Standardisation": 25 houses built from 1948 till 1960s, an example of the power of a journal such as Arts&Architecture. Kyle Normandin, now project manager at the Getty Research Institute, went into detail for the houses designed by Neutra, Eames and Koenig, from timber to steel prefabrication. Images of these buildings by the renowned photographer Julius Shulman helped to the perception of the buildings by the public. Protection of Modernist heritage is seen differently in the USA and in this case the houses can be better preserved thanks to the collaborative partnership with Escher GuneWardena Architecture, represented at the conference by Frank Escher who was also the next speaker. His talk was dedicated

Walter Gropius building in Dammerstock, 2013.

to "Futuristic living", presenting the ideosyncratic architecture of John Lautner, the archive of which he served as administrator until 2007, when it was moved to Getty. Now he serves on the Board of Directors of the Lautner foundation. John Lautner is best known for his works in concrete, but which he started only conjuncturally in the 1960s, after having worked mainly in timber.

Iveta Cerna, director of the Museum Villa Tugendhat in Brno talked on "Visions" becoming reality in case of the villa. She presented its history, from building to its decay and today's new glance. There is a close connection between these conference series and the villa, DOCOMOMO Germany holding some of its meetings at that location and a number of its members being also in the THICOM – International Commission of Experts for the Tugendhat House. The restoration of the villa had not taken place yet when it was first presented to the public and the photoalbum made in frame of the research performed within the conference series. The villa was recently opened to the public.

A lecture which explicitely mentioned digital technology was that of Colin Davies on Foster and Rogers and the start of British hightech. Now hightech means digital technology, but the hightech in architecture was predigital. Prefabricated detailing in miesian tradition was shown, and the beauty of the exposed structure.

The closing lecture was given by Christina Kanstiger-Otto, the daughter and partner of Frei Otto. In a chronological overview of his most important works, including the Multihalle at the Bundesgartenschau in Mannheim, the wandering of the university institute in Stuttgart, and the work in Montreal, she showed how the free forms were developed from model to reality, and the importance of yet another material: the textile.

The closing discussion concentrated on two points: the question of "function follows form" and the importance of today's actors. Such issue did not exist in the Middle Ages, when the architect, engineer and even investor were one and the same – so collaboration between actors was considered an important aspect, and more precisely, how development of technology is influenced by it.

Returning to the topic of the conference series, it was concluded that preservation also needs innovation in relation to technology, and accordingly, regular inspection is needed. Preservation depends on how people are looking to all these buildings, not only to the iconic ones.

In the second day of the conference we participated to the excursion in Dammerstock. The Dammerstock Siedlung was built following a competition won by Walter Gropius in 1929 under the name exhibition "Die Gebrauchswohnung" (the usage house). The second prize was of Otto Haessler, who designed both a multistory and a single storey rowhouse. The Dammerstock Siedlung is characterized by these rows, called "Zeile" in German. Today the Siedlung is administrated by a society, die Hardtwaldsiedlung, together with other sites in Karlsruhe.

Walter Gropius building in Dammerstock, 2013.

We had the occasion to discuss the urban planning models from the competition, included in an info pavilion, and to see from inside and outside two reference apartments for which is proposed preservation in order to be more energy efficienty (especially relating water usage). The first one, the building of Otto Haessler, just at the entrance in the Siedlung, is connected to a washing room, on which we could see the damaged caused by the lack of isolation of the structural parts in the metal. Otto Haessler proposed for this building a metal skeleton as at the buildings in Celle, about which we wrote in the World Housing Encyclopedia (http://www.world-housing.net/category/europe/germany). The intervention proposed among others to ensure the way the staircase connects to the main building, replacing the rollos through glazing. The second one was a building by Walter Gropius next to a copy of it from the 1950s. Later interventions on the Siedlung also filled the gap between them with a connection building now used as exhibition place.

In conclusion, the conference "dealt with the question on how technology was perceived by designing architects and how those were collaborating with engineers and found adequate building material and systems as a part of the design process". Although numerous presentations dealt with concrete, we saw also the relationship to timber, to which we dedicated some research. Attendance to the conference was made possible in the frame of a short visit grant from the Network of Digital Methods in Arts and Humanities on the topic "Architectural heritage protection of the central area of Bucharest – mapping ways of visualisation in GIS and archives", with the aim to make visible to the general public the early reinforced concrete heritage in Bucharest. Although the aim of the network is to make available research materials through digital means for remote consulting, the site visits after the conference showed again the importance of perceiving in reality a building, and the meetings at the conference showed the importance of networking through personal contacts. A digital infrastructure shall be the starting point for that important part in the education of an architect which is the study trip.

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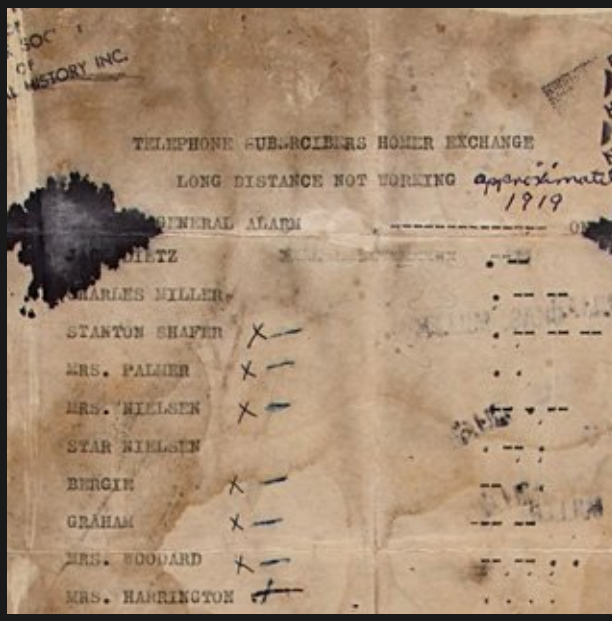
projects

PAPER CONSERVATION IN THE FAR NORTH A PROJECT SUMMARY FROM ALASKA



By
Seth Irwin

This paper will explain how a 14-month paper conservation project functioned, as well as discussing the methods of conducting treatments in the most remote of conditions. Alaska is home to numerous indigenous groups including Inupiaq, Yupik, Aleut, Tlingit, Haida, Tsimshian, and Northern Athabascan. Alaska is also a state of extremes and beauty. In addition to Alaska's stunning natural beauty, the state also has a very rich history. Alaska was first visited by Europeans when Russian fur traders arrived in the 18th century, and adopted to statehood within the United States of America in 1959. The state has some of the oldest paper artifacts in the United States, and houses many archives and collections depicting Alaskan history. Many of these collections have not been assessed creating a state of concern relating to the stability of the overall collections. Paper conservation in Alaska presents difficulties: limited accessibility, small staff sizes, limited training, and no paper conservators within the state. Throughout 2010 and 2011, organized through the Alaska State Museum, 15 Alaskan institutions were visited to address the conservation concerns for their paper collections. This project, funded primarily through generous grants from the Rasmuson Foundation and several other institutions, had three primary objectives; assessment of the collections, training in basic paper conservation techniques, and treatment of each institution's high-priority paper artifacts.

Introduction

Alaska is a state of vast land and extreme beauty from the Inside Passage with its fishing and glaciers, to the interior with people traveling by sled-dog teams of huskies and bush planes. At times during the year one can see the Aurora Borealis, and the days can range from the summer's midnight sun to long periods of darkness during the winter. Alaska is also known for its wildlife, from its moose population to bison, and all three types of bears. Alaska is also the second youngest state in the United States of America, and it's the biggest and most remote; being three times the size of France with a population less than the city of Athens. However, Alaska by no means has a young history, nor does it lack in historical paper artifacts. While many of Alaska's historical artifacts such as paintings and three-dimensional artifacts have been documented and even conserved, there are mountains of historical paper artifacts throughout the state that have yet to be assessed. Although a large portion of the state's paper artifacts can be found in Alaska's eighty or so museums and institutions, many artifacts still reside in private hands.

As Alaska is a young state, so is its introduction to the field of conservation. At present, Alaska is fortunate to have three object conservators to handle the state's many valuable three-dimensional artifacts. Ellen Carrlee and Scott Carrlee are employed by the Alaska State Museum, Juneau, and Monica Shah is employed by the Anchorage Museum at the Rasmuson Center, Anchorage. The state currently has no permanent conservator that is able to offer advice on paintings, paper or textiles. While the lack of a full-time paper conservator is an issue, Alaska's problems with its paper collections go far beyond this vacancy. In the last few years, many of the institutions in Alaska have sustained serious damage to their collections in catastrophic events including floods, volcanic eruptions, and fires. Staffing levels in many institutions are limited to one or two people, and while they have good intentions, many are not trained in proper handling or preservation issues for paper artifacts. This inability to deal

with preservation problems on-site, as well as the inability of sending material to a conservator, has forced custodians caring for collections and exhibits to choose between conducting short-term potentially destructive repairs or exhibiting damaged artifacts. Many collections also contain artifacts composed of inherently unstable materials that pose risks to themselves as well as nearby artifacts.

Discussion for the project began in April 2009 with Scott Carrlee, who wanted to bring a paper conservator to Alaska in order to assess paper collection issues throughout the state. Since no paper conservation lab or equipment existed in the state, whoever committed to this project would need to be well-equipped, have sufficient mobility to relocate to the various institutions, and work in virtual isolation in remote and harsh conditions.

Project Overview

At the planning stage for this project only four institutions had asked to be involved, but as word spread and the project began, more institutions sought to participate. As the project concluded almost 14 months later, 15 institutions had participated in some form. For most of the institutions the format was a one-month time frame to specifically focus on whatever the institution needed for the preservation of their paper collection. This meant, conducting a general assessment of the paper-based collection, training of the staff in conservation techniques, and conducting treatment of several 'high priority' paper artifacts in each collection. Of the 15 institutions, five asked explicitly for only treatment work, two institutions only required an assessment of their collections, and one only participated in training. The remaining six institutions requested treatment, training, and assessment.

Table I. Participating institutions.

Participating Institutions	Locations	Dates
Valdez Museum And Historical Archive	Valdez	March of 2010
Clausen Memorial Museum	Petersburg	April of 2010
Eagle Historical Society	Juneau	May of 2010
Alaska State Museum	Juneau	*Project coordinator: not directly visited*
Anchorage Museum at The Rasmuson Center	Anchorage	June of 2010
Alaska Aviation Heritage Museum	Anchorage	July and December of 2010 February / March of 2011
Kenai Visitor And Cultural Center	Kenai	August and September of 2010
Russian Orthodox Church Of The Holy Assumption	Kenai	
Soldatna Historical Society	Soldatna and Kenai	
Dorothy Page Museum	Wasilla	October of 2010
The Duncan Cottage Museum	Metlakatla	December of 2010
Seldovia Museum And Visitor Center	Seldovia	January of 2011
The Pratt Museum	Homer	
The Baranov Museum	Kodiak	April of 2011
The Alutiiq Museum	Kodiak	May of 2011

Figure 1. Float plane taken to the Island of Metlakatla for the Duncan Cottage Museum.

For the six institutions that required collection assessment, staff training, and artifact treatment, the month was scheduled in the following manner. The collection assessment was the first priority. It would take about a week, and would normally be conducted box by box. Throughout the process of going through the collection, any paper artifacts of greater importance to the institution that were in need of repair were selected for possible treatment. The second week of each month would be devoted to training. The third and fourth week were left for the treatment of paper artifacts that were selected during the first week of collection assessment. The number of artifacts selected for treatment ranged from two to twelve artifacts, depending on the complexity of the repairs.

The first institution visited was the Valdez Museum and Historical Archive, Valdez, in March of 2010. Following the Valdez Museum was the Clausen Memorial Museum, Petersburg, in April 2010. To travel from Valdez to Petersburg required an 18-hour car drive through Canada to a town in Alaska called Haines, a several hour ferry ride to Juneau, followed by a twelve-hour ferry ride to Petersburg. Following the Clausen Memorial Museum, in May, was a one month treatment specific project in Juneau. In June and July, I went to the Anchorage Museum at the Rasmuson Center followed by the Alaska Aviation Heritage Museum, Anchorage, and another several hour ferry from Juneau followed by a two-day drive. I then went to Kenai for two months to the Kenai Visitor and Cultural Center, the Russian Orthodox Church of the Holy Assumption, and the Soldotna Historical Society. I spent one-month at the Dorothy Page Museum, founded to commemorate the 'Mother' of the Iditarod Dog Sled Race. Following this, I returned to the Alaska Aviation Heritage Museum. I then took a float plane flight to the remote native island community of Metlakatla in the Inside Passage to conduct an assessment of the Duncan Cottage Museum (Figure 1). A second assessment was conducted at the Seldovia Museum and Visitor Center in the remote village of Seldovia. Like Metlakatla, this village is only accessible by air or water and I traveled to Seldovia in a small plane. In January 2011, I went to the Pratt Museum, Homer, and returned to Anchorage to the Alaska Aviation Heritage Museum for most of February and March. In April and May 2011, I was on Kodiak Island at the Baranov Museum and the Alutiiq Museum (Figure 2).

Throughout the 14 months, with the exception of two institutions where air transportation was necessary, all of the equipment was transported via a single automobile to each location. The only equipment that any institution could generally provide would be several tables and a chair. As short-term lodging is difficult to attain, participating institutions were required to provide lodging.

Assessment

Most of the institutions are small museums dedicated to the history of the local communities. This was the case with museums such as the Clausen Memorial Museum and the Valdez Museum and

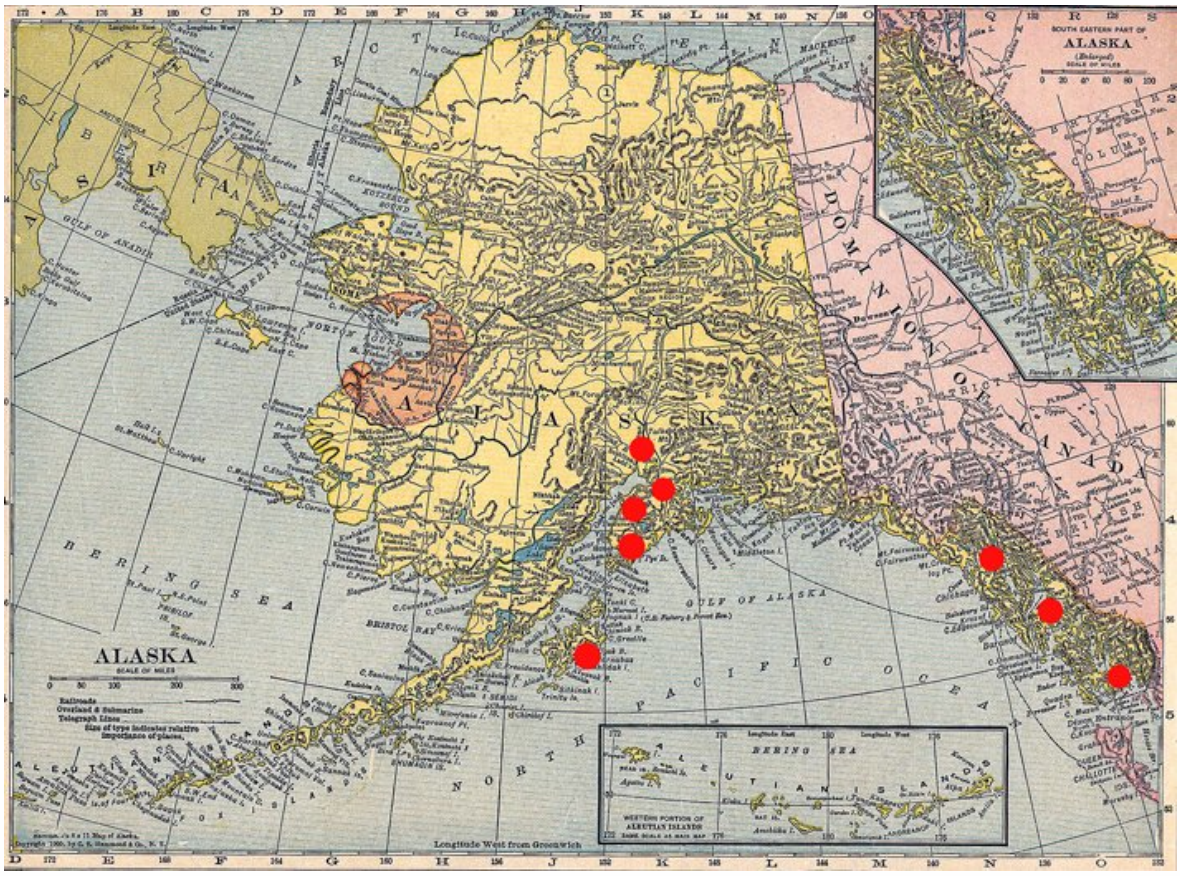


Figure 2. Locations of the institutions on Hammond's Map of Alaska. Copyright 1906, by C.S. Hammond & Co., NY.

Figure 3. The new compact collection storage for the Valdez Museum and Historical Archive.

Historical Archive. For communities such as the Clausen Memorial Museum, the history of their community is largely based on the fish cannery that brought revenue to the town for decades and employed most of the town's residents. A significant portion of the collection is dedicated to the history of the cannery including: can labels, cannery advertisements, and business invoices typed on cannery letterhead; all are of significance and value to the community. The Baranov Museum, Kodiak, and the Russian Orthodox Church of the Holy Assumption, Kenai, also had collections that were very specific to these locations. These communities have a deep and rich history associated with Russian trading and missionary work. This history is mirrored in their collections with significant quantities of Russian Orthodox religious texts, and artifacts used by Russian fur traders.

The condition of the collections that were assessed revealed varied preservation concerns. As with all institutions, budgetary issues are involved in the decisions surround the short-term and long-term preservation management of collections. In many cases, institutions have a far more restrictive budgetary state due to the remoteness of the communities. For these small communities cultural heritage institutions do not receive the attention and traffic that a similar size institution in a more populated area might receive. Their budgets are heavily depended on the admission fees and whatever budget is allocated to them by the local governments. Much of this money is received from local taxes. For many of the ocean based communities along the Inside Passage such as the Clausen Memorial Museum, the amount of traffic their institutions receive is heavily depended on the frequency of the Cruise Liners that come seasonally.

It is not uncommon for an institution in Alaska to be asked to run a preservation program, with a collection of thousands of artifacts, on an annually budget of a few hundred dollars a year. Often with a staff comprised of one or two members who are responsible for: collection care, education programs, running a front desk, and sometimes even acting as museum director, while being hundreds of miles off a road system, often isolated, in arctic conditions half the year. There is also frequent staff turnover at many of the smaller institutions for reasons such as termination, retirement, or even a change of scenery. While this is generally not considered a major problem in regions where there is a large population of qualified applicants ready to jump into a vacant position, finding qualified replacements for a vacant staff position in Alaska can be a tremendous challenge. For an institution residing in a town with a population of a few hundred people, such as that of the Seldovia or Metlakatla, finding someone interested in changing the fast past life of city for a remote Alaskan town is not an easy prospect.

Collection acquisition policies are varied and each institution manages their accession policies differently. While many institutions have a collection's committee to deal with the frequent acquisition of new artifacts into the collection, some do not and practice an open acquisition policy that allows any donor to essentially drop off whatever they want at any time to be accessioned into the collection. This often leads to severe backlogs in records management as well as collections littered with artifacts that are unrelated to an institution’s mission or goals. The backlog prevents an institution from properly caring for all of the artifacts and conducting a long-term preservation program.

While many larger collecting institutions of cultural heritage approach their preservation challenges with certain standards, applying those same standards to all cultural heritage institutions would be neither appropriate nor possible. While some of the larger, better-funded institutions, have been able to create and develop collection policies and long-term preservation plans, this has not been the case for many of the smaller institutions with limited budgets and staff. Larger institutions such as Valdez Museum and the Alaska Aviation Heritage Museum were found, during the collections assessment, to have secure, climate-controlled, collection storage. Preservation issues were limited to secondary storage concerns such as inappropriate boxes and folders (Figures 3 and 4). Collection maintenance issues like an organized registration system and long-term preservation strategies were also a problem. Other institutions like the Dorothy Page Museum, the Clausen Memorial Museum, the Duncan Cottage Museum, and the

Seldovia Museum have limited staffs and small annual supply budgets. The progress that they have made in areas like collection organization, acquisitions, and even collection maintenance with so little is both admirable and amazing. These institutions are also often housed in historic structures where precise climate control is impossible (Figure 5). Collections at these smaller institutions were still in relatively good condition. Excluding climate control, most of the preservation problems found while assessing their collections were related to housing and collection management (Figure 6).

Training

The remoteness of these institutions makes the transport of damaged paper artifacts to a paper conservation lab difficult, and alternatively, having a paper conservator come every time something needs treatment is prohibitively expensive. Therefore, providing training at as many institutions as possible in practical paper conservation skills was essential. In addition, due to the high turnover at many of these institutions, it was also important that any skills learned during each month be capable of being passed down to newer staff. The choice of what training was needed was based either on an institutional request or the prior assessment.

Up to down:
Figure 4. Inappropriate acidic tissue paper found at the Valdez Museum and Historical Archive.
Figure 5. The Clausen Memorial Museum of Petersburg Alaska.
Figure 6. Problematic housing for invoices and receipts in the Clausen Memorial Museum.
Figure 7. Tear repair workshop being conducted for the Kenai Visitor and Cultural Center, and members of the Soldatna Historical Society. Photograph by Laura Forbes.

Tear Repair

Training in the repair of tears in paper was based on the goal of eliminating or reducing the use of pressure sensitive tape, by providing an alternative. This skill could also be adapted for a hinging technique during the framing of an artwork. Two methods of tear repair were taught, the first was the traditional method involving cooking wheat starch paste and using Japanese tissue, and the second was creating a ready-to-go repair tissue impregnated with methyl-cellulose as the adhesive. This tissue would simply be remoistened with a small amount of water and applied (Figure 7).

Humidification and Dry Cleaning

Teaching staff how to create and use humidification chambers was necessary because the collections at most of the institutions contain significant quantities of rolled panoramic photographs that the staff all wanted to know how to unroll and display. For the construction of the chamber it was important that all materials be locally available for purchase. It was also decided that the 'traditional' method of creating a humidification chamber with a pool of water in a tray was too dangerous for non-experienced staff to use. For these reasons a chamber was devised using painter's plastic, plastic crating, polyester interfacing fabric, and unbleached cotton muslin. A wet bath towel would be the source for the water-vapor (Figures 8-10). All of the materials could be purchased at the local hardware store and local quilting shop.

The choice to conduct training in the safe method of dry-cleaning paper was a collection maintenance choice, and this training was conducted at the same time as the humidification training. All of the participants were instructed to dry-clean the artifacts before humidification so as to prevent surface soiling from becoming entrenched in the paper fibers. It involved grinding PVC erasures and locally applying them to a paper's surface.

Box Making and Folders

Training for making boxes and enclosures allowed an alternative to the expense of purchasing and shipping boxes. Two styles of enclosures were taught, the construction of cloth-covered clam-shell boxes and the various constructions of pamphlet bindings. Due to the inability for PVA glue to thaw follow freezing, it had to be frequently shipped via overnight freight by the supplier.

Treatment

The treatment and repair of over 30 artifacts was conducted over the 14-month period. One of the most important things that I learned during these projects was what each institution valued as its most important paper artifacts; these were given the highest priority for treatment. This stresses the lesson to recognize that what might be considered an insignificant piece of paper and easily overlooked could possible be the most important paper artifact in an institution's collection.

As has been mentioned the State of Alaska has no paper conservation lab, no equipment, and no conservation-specific suppliers. If a treatment required a specific chemical it would need to be ordered. For most of the remote communities anything that is ordered has a transit time of at least a week. With a one-month window to complete all treatments, all necessary supplies would need to be ordered by the end of the first week to arrive with enough time to complete a treatment. The best that could be hoped for in terms of local supplies would be that most communities would

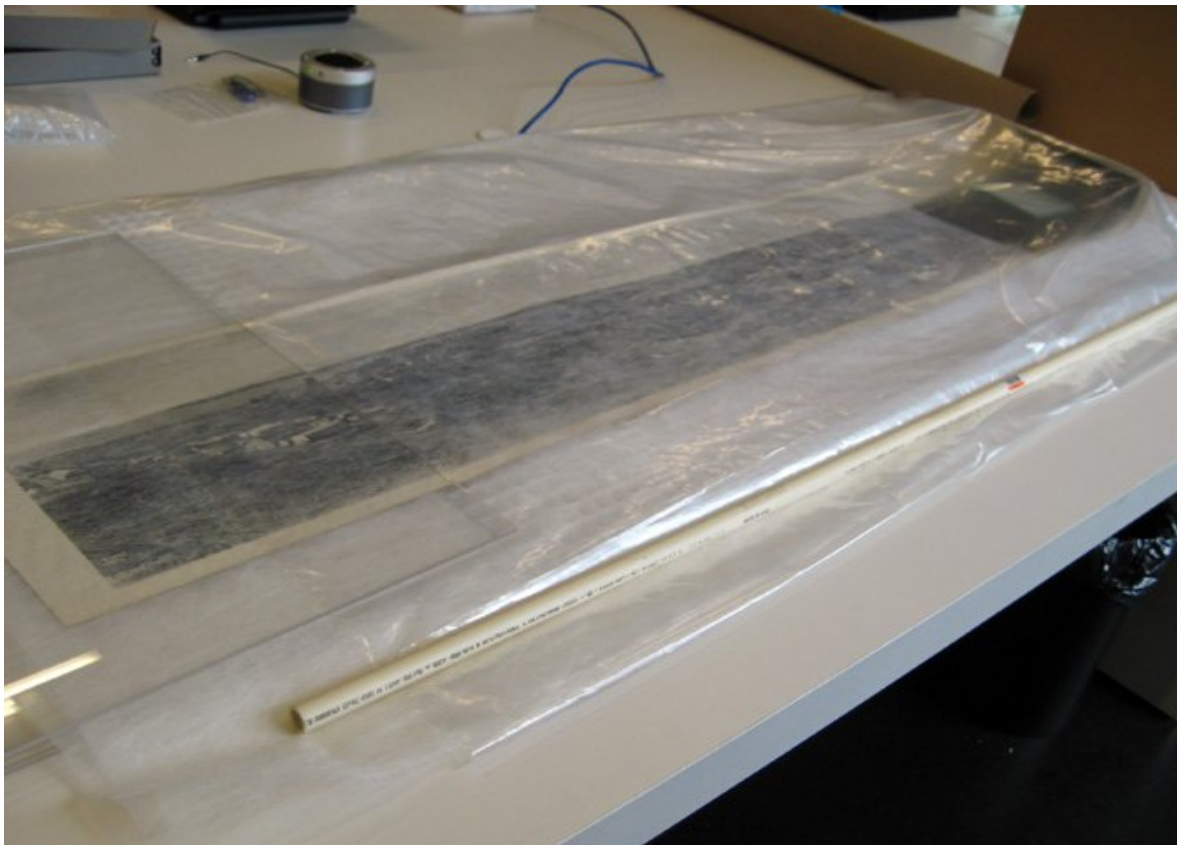


Figure 8 (top left). Cross section layout for humidification chamber.
Figure 9 (top right). A box of rolled panoramic photographs unrolled for the Anchorage Museum at the Rasmuson Center.
Figure 10 (bottom). Humidification chamber setup used for the unrolling of the panoramic photographs. Several of the photographs measured close to six feet long when unrolled.

have, at minimum, a quilting supply shop and a hardware store. The toxicity of all chemicals would need to be carefully thought about in advance as no institution had a fume hood, and working outside was generally prohibitive because of the extreme weather conditions.

While many treatments took place over the 14-month period, several were noteworthy due to how common both the type of artifact and its condition were found in the collections.

Homer Telephone Exchange, c. 1919

The Pratt Museum, Homer, had asked that their town's oldest telephone directory page be repaired; dating from 1919 the year that the town installed telephone lines. As many of the people listed on the page were distant relatives of some of the community's current residents, this single page was very important to the town's history. This document was important because of the extreme historical value of the material. It was also a well-used artifact. The page had apparently hung above a phone for many years, and showed evidence of smoke damage, adhesive residue, physical damage, and severe staining. The back of the page had been stamped several times with a black ink stamp from a prior employee, and black ink

Up to down:

Figure 11. Paper being light bleached with the use of a 400 watt metal halide fixture suspended between two tables.

Figure 12. The removal of the spilled black ink with the use of steam generated from a clothing steamer with a garden hose spigot attached to the hose. Underneath the paper was a suction disk made from an electrical gang box and the screen from a car stereo speaker. Photograph by Holly Cusack-Mcveigh.

Figure 13. The homemade suction disk fabricated out of an outside electrical gang box and a screen from a car stereo speaker.

had also been spilled on the page covering sections of the text. In order to remove much of the staining, the paper required light bleaching. This task could not be conducted outside, due to the cold, therefore a 400 watt metal halide lamp was suspended between two tables and the wash tray was placed on the floor (Figure 11). The spilled black ink required steam for its removal, so a metal garden hose spigot was attached to a clothing steamer (Figure 12). The steam was focused over a suction disk fabricated out of an electrical gang box and the screen from a car stereo speaker (Figure 13). The resulting treatment was considered a success and the page can now be read (Figures 13 and 14).

The Devil's Thumb Climbing Log, c. 1946

The climbing log, in the Clausen Memorial Museum, was recovered from a nearby mountain, called Devils Thumb, on the Canadian side of the border in British Columbia. It had been placed on the mountain in 1946 in a tin can by a 20th century mountain climber named Fred Becky, and was a record of every person who had climbed the peak. The paper had been severely damaged by rust from the can due to sitting on a snow covered mountain for 65 years. The recommended treatment would have called for the use of Sodium Dithionite as a powerful reducing agent to remove the rust. Due to the lack of a fume hood, the expense of the chemical, and the time required for the shipment of a hazardous material to Petersburg, it was decided that this was not a viable treatment. For this reason an alternative reducing agent was chosen with a similar molecular structure, called sodium metabisulfite. While this chemical was still not able to be purchased locally, it did not require shipping via hazardous materials freight and therefore was far less expensive and faster to obtain. The use of this chemical resulted in a successful treatment removing almost all of the rust staining. This log, a single sheet of paper with graphite inscriptions, is an extremely important artifact to the Museum and can now be handled and displayed [1] (Figures 15 and 16).

Eagle Alaska Shipping Ledger, early 20th Century

The leather and cloth bound shipping ledger, dating from the early 20th century, was one of the earliest records for the remote town of Eagle, and located approximately 350 Kilometers east of Fairbanks along the border of Alaska and the province of Yukon in Canada. This ledger was damaged under very unfortunate, but all too common circumstance. On 7th of May 2009, a large ice jam developed and sent blocks of ice the size of houses along with over ten feet of water into the Old Town section of Eagle. This was the worst flood on record, and the power of the ice and water was enough to destroy structures. An emergency was declared by the Governor and residents had to be airlifted to safety. During the flood there was an attempt by town's people at the Custom House Building to save artifacts from destruction (Figure 17). One of these artifacts was the town's oldest shipping ledger. The ledger was immediately bagged and frozen, then shipped to the Alaska State Museum in Juneau until treatment was possible. The treatment repair of this ledger was made possible by a generous grant from the Alaska State Museum Grant-In-Aid program.

Once the ledger was safely thawed, it was discovered that all of the pages were covered with thick coatings of mud and the cover was completely detached (Figure 18). Fortunately, due to strange twist of fate, the text in the ledger was written using iron gall ink. Under most circumstances iron gall ink would have been detrimental and damaging, but in this case actually saved the ledger from being a total loss.

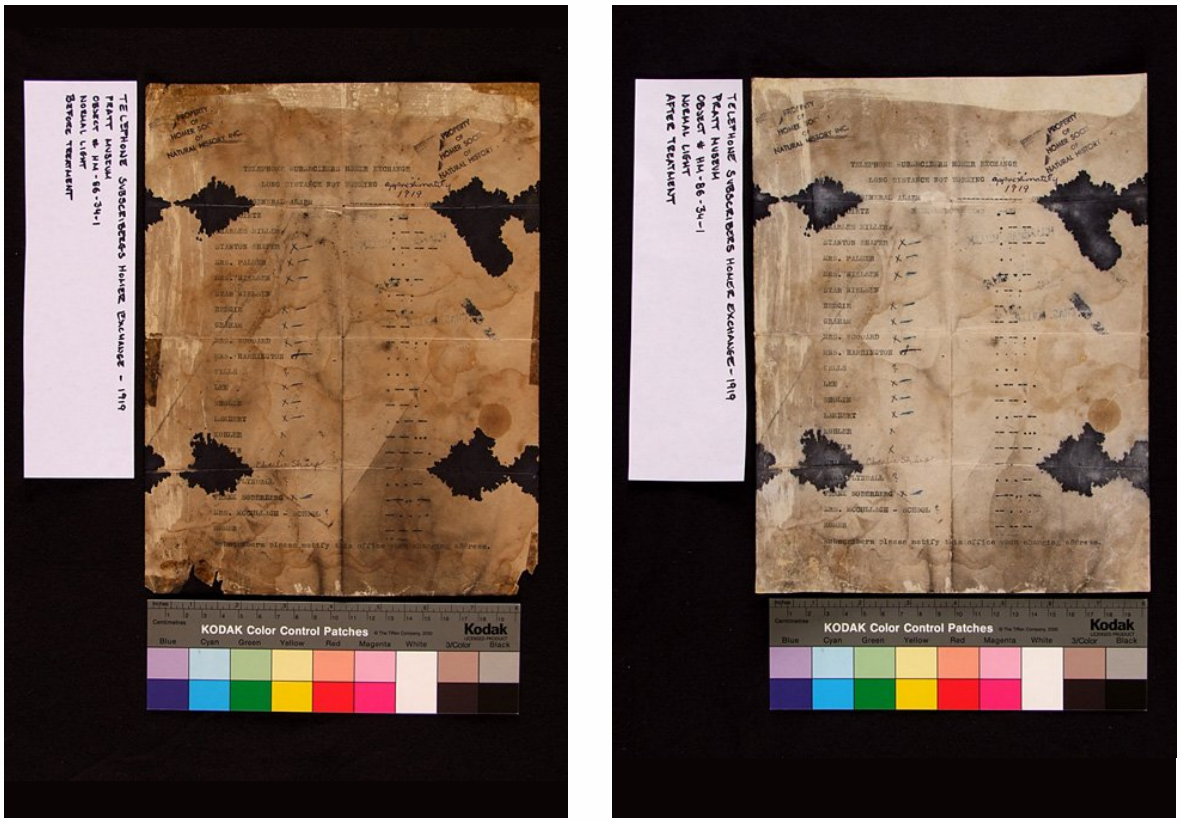


Figure 14. The Homer Telephone Exchange before (left) and after (right) treatment.

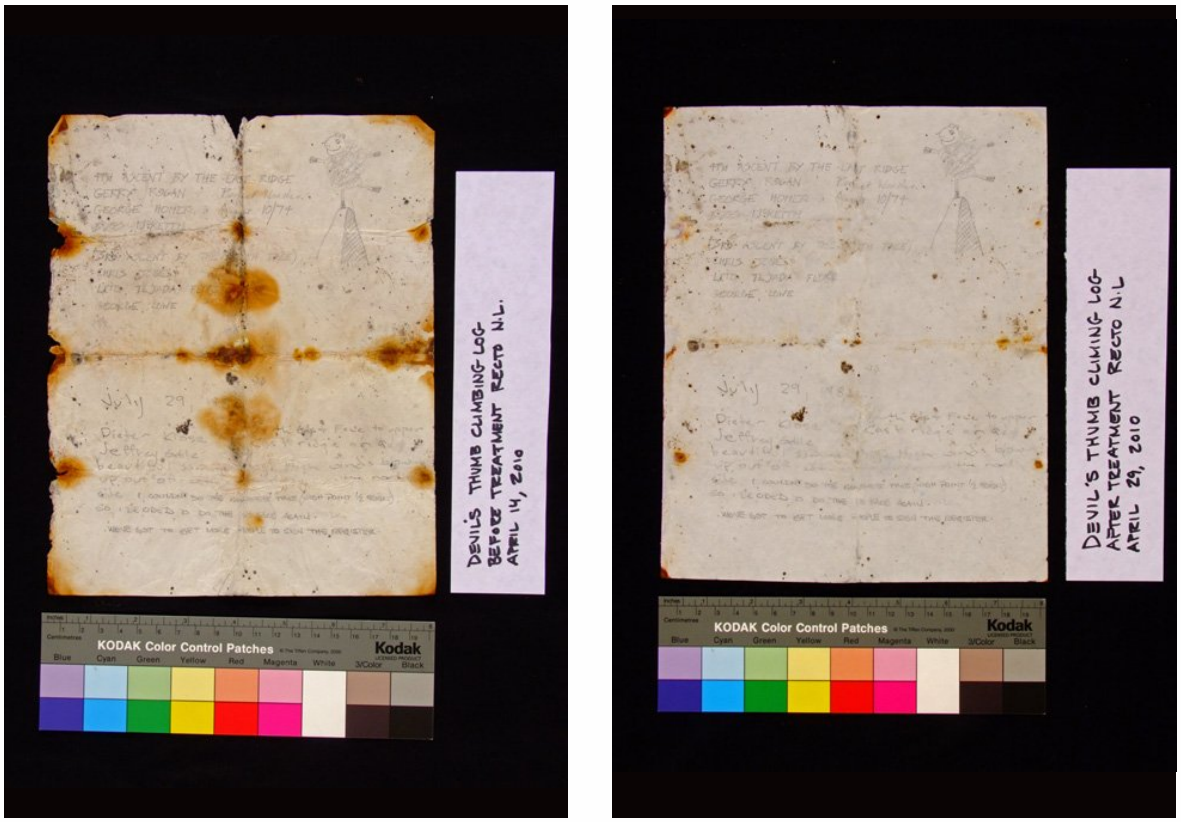


Figure 15. Devil's Thumb Climbing log before (left) and after (right) treatment.

From up to down:
Figure 16. Residents of Eagle removing artifacts from the second story window of the Custom House Building after a disastrous flood of 2009. Photograph by Jean Turner.
Figure 17. Page from the text block, containing significant quantities of mud.
Figure 18. Washing the text block of the Eagle Ledger suspended in a 5 gallon fish tank.

Iron gall ink will not generally dissolve by water and almost any other ink would surely have been washed away from the water damage. It was also discovered that the sewing structure was still intact. A standard treatment in this case would be to dis-bind the sections of the text block, treat all of the pages and re-sew them, repair the cover, and re-case the ledger. Unfortunately, due to time-shortage this approach was not possible. Therefore, based on an approach pioneered by book conservator William Minter [2], it was decided that the entire text block could be washed still sewn together. This approach was considered safe since the sewing structure was still intact and could be washed along with the pages. The entire text block was first thoroughly dry-cleaned using PVC erasure crumbs in order to remove all of the mud. The text block was suspended in a five gallon fish tank by running fishing line underneath the sunken cords, between the signatures, and then tied to a broom stick (Figure 19). The fish tank was filled up with water to immerse the pages. Several washes were conducted until the water was clear indicating that the pages had been cleaned. In order to dry the text block, the text block was divided into three sections. The outer two sections were dried completely using a hair drier and the entire text block was then placed under pressure in a book press. This process allowed the exterior portions of the text block to act as its own blotter wicking the moisture from the center section outwards. This process was repeated several times for several hours until the text block was completely dry. The cover was then repaired and the ledger was re-cased. This alternative approach, using virtually no specialized equipment, allowed for a treatment that would have taken over a week to be conducted in only two days. The ledger has now been returned to the city of Eagle and can be handled and displayed (Figures 20 and 21).

Figure 19. The cover of the Eagle Ledger after treatment and re-casing.

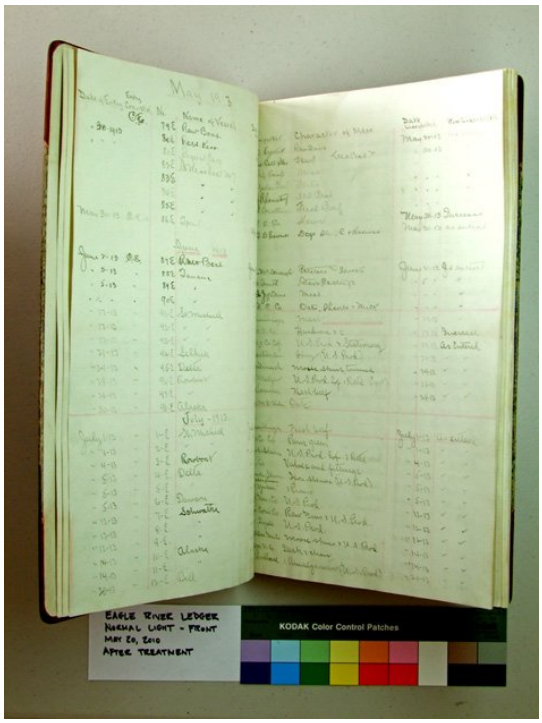


Figure 20. The text block of the Eagle Ledger after treatment and re-casing.

Conclusions

During the 14-month period, over a dozen public workshops were conducted, multiple conservation clinics were staged, and several public lectures were given. The project received a positive media response. There were two public TV news segments, two public radio interviews, and three newspaper articles, focused on the paper conservation performed at these institutions. For communities with little knowledge about paper conservation, this was a tremendous educational opportunity.

When the project is considered as a whole, it is possible to realize the successes and the setbacks. For the institutions that had their collections assessed, they are now able to use those assessments to identify their risks and threats and develop a long-term preservation plan. Institutions that requested treatment services for some of their most important artifacts, while this will not have the strongest impact on the overall preservation of the entire collection, the public attention generated after seeing artifacts repaired was immense. This can re-energize a small community institution. Finally, for me, the most significant and the most important part of these projects was the training. While this proved to be a wonderful component, it also ended up for several institutions a disappointment. Although many of the institutional staff took their new skills and implemented them immediately, unfortunately, for whatever reason, some that took part in the training are no longer with their institutions. Unfortunately, the skills they derived to aid in the preservation of their collections were also not passed down. Due to the lack of an in-state paper conservator to continue with refresher workshops and in order for the skills to remain an effective tool for the institution staff, the skills must be re-taught again and again. Staff training should not exist on a singular level.

It is important to note the exceptional devotion these institutional staffs have toward their collections. Most of these community institutions exist in the most extreme conditions and in the most remote areas of the United States. The heroic efforts of their staffs should not be underrated. Their desire to participate in these projects shows a commitment to excellence in museum practices, and their desire to learn better preservation techniques for their collections should be both commended and rewarded.

Acknowledgments

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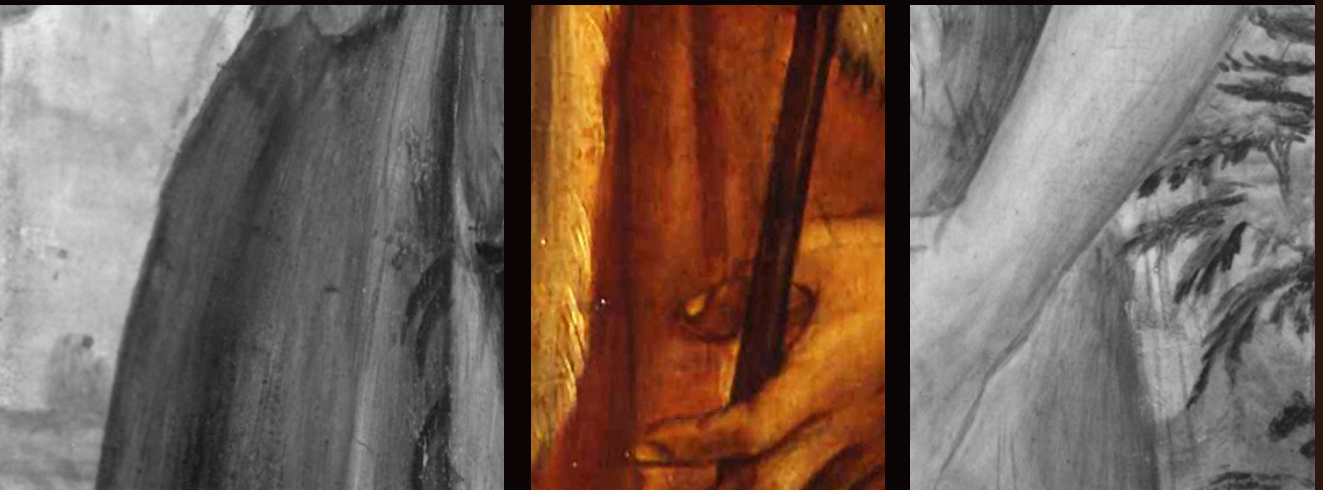
INFRARED REFLECTOGRAPHY: TEST OF A PANORAMIC SCANNING TECHNIQUE

By

Marco Gargano and Duilio Bertani



science

Infrared reflectography is an imaging technique used to visualize the underdrawing of ancient paintings. An underdrawing is a preparatory drawing sketched by the artist on the preparation layer before the painting is made. Pigment layers are quite transparent to infrared radiation in the spectral band between 0.8 and 2.5 microns. The preparation layer normally reflects the infrared radiation except where it is adsorbed by the underdrawing made with a carbon-base material. Infrared sensitive devices can therefore record the reflected radiation and store an image of the underdrawings. InGaAs sensor cameras are nowadays the most used devices to visualize the underdrawing. Due to the small size of InGaAs detectors, these are usually mounted on image plane scanning systems to record high resolution reflectograms. This article describes a portable scanning system based on a motorized panoramic-head which can be built at a lower cost than commercial reflectographic systems. The system performance is comparable with that of other reflectographic devices with the advantage to extend the scanned area up to 1x1 m.

Introduction

Most ancient painting materials are quite transparent to near-infrared radiation in the 0.8-2.5 micron spectral band [1-3]. On the contrary, white gesso preparation layers reflect these radiations except where they are absorbed by a drawing sketched with an infrared opaque material, like a charcoal stick which is a carbon-base compound. Infrared sensitive InGaAs cameras are the perfect portable devices for routine in situ infrared reflectography [4]. Their sensors have good spectral sensitivity, linearity and dynamic range despite their low number of pixels (640 x 512 the largest) and small element size (20 microns square the smallest). Professional photographic cameras with silicon-digital backs records high resolution images in the infrared band up to about 1 micron. These images are hardly satisfactory because in this band penetration through the pigment is rather poor [5]. The limit of the very low number of pixels of InGaAs sensors can only be bypassed mounting these sensors in a scanning system.

Only high-resolution reflectograms can properly visualize the underdrawing strokes, since they depend on the painter's style and tools [6, 7], and vary from the large strokes of a brush dipped in a liquid solution to the quite thin and faint lines of a soft metal point. Even thinner can be the engravings made with a sharp blade, often used to draw architectural features. In order to record these details, high precision mechanical scanners equipped with InGaAs sensor cameras must be used to record hundreds of sub-images which are then mosaiced to obtain the final high-resolution composite. Commercial InGaAs scanners designed specifically for IR reflectography cost around €50,000 [8].

InGaAs detectors are acknowledged the best for IR reflectography but the investment required is, indeed, significant. It is also possible to perform IR reflectography with cheaper systems (€500-€10.000) as those that come from commercial photography (professional digital backs or modified DSLR digital cameras) that mount silicon detectors although the results are not the same of those obtained with InGaAs cameras in terms of penetration through the chromatic layer (e.g. malachite, azurite, ochre are opaque in the 800-1000 nm band).

In the past years, several types of scanners have been proposed although for the purpose of this article, we will only briefly remind the working principles of the Image Plane Scanner (IPS) [9, 10] and of the Moving Lens Scanner (MLS) [11].

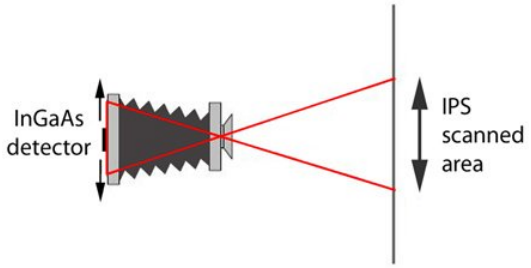
In an IPS scanner, the detector array explores the image plane of a lens for large size photography, automatically driven by a mechanical precise XY axes system. As showed in Figure 1, the sensor is moved along rows and columns by steps equal to the width and height of the sensor respectively, and at each step an image is stored. The movement is so precise that these images can be easily juxtaposed and mosaiced.

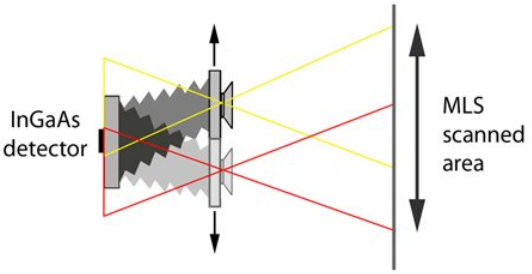
A MLS device (Figure 2) works similarly to the IPS except that here the lens moves instead of the sensor. The advantage of a MLS is that, for a given magnification, a larger area of the painting can be inspected at once [11]. This area is directly proportional to its magnification.

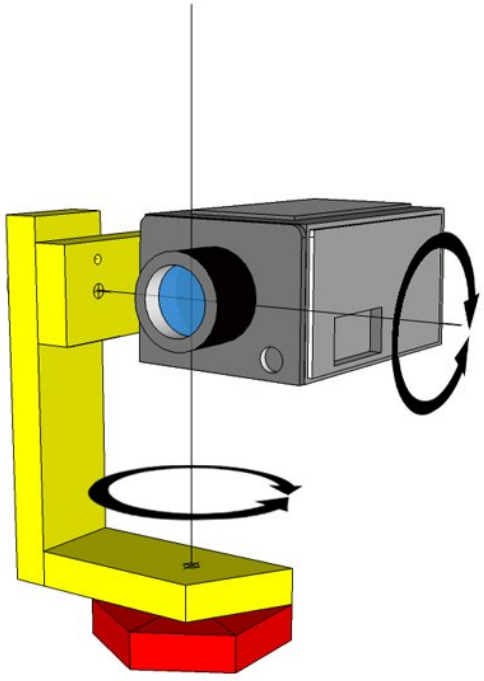
The Panoramic-Head Scanner

A panoramic-head is a photographic accessory that moves the camera with a rotation around its no-parallax point (Figure 3).

Super wide angle scenes and even 360° panoramas are captured in this way. For a given type of panorama, single or multi-raw, and its angular span, a motorized panoramic-head computes the number of images to shoot, their amount of overlap and the necessary horizontal and vertical displacements according to the sensor dimension and lens type. Images are then shot and stitched automatically. Since the camera rotates around a point, an image of a sphere is recorded and the correct visualization of this panorama should require its projection on a spherical screen, as it happens in a planetarium (Figure 4).







From up to down:

Figure 1. Schematic representation of an Image Plane Scanner, the sensor explores the image plane.

Figure 2. Schematic representation of a moving lens scanner, scanning is performed moving the lens.

Figure 3. A panoramic head. The camera rotates around its no-parallax point.

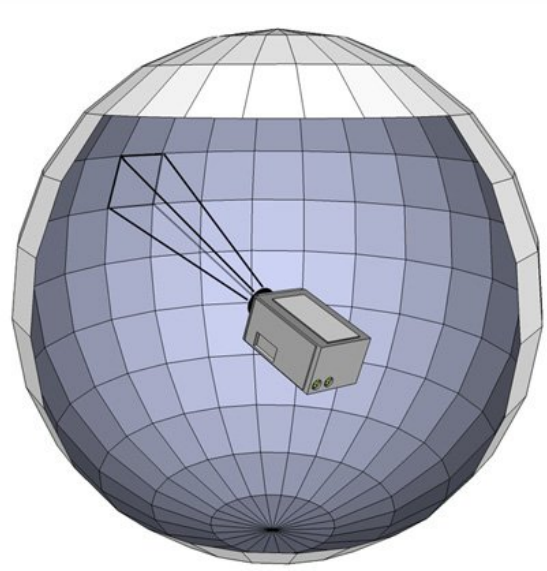
In order to assemble a flat "realistic" image, the stitching software must therefore be fed with the shooting parameters and the most appropriate projection type to compensate any distortions.

Since this automatic hardware and corresponding driving software are now commercially available at a reasonable cost, a panoramic shooting technique seems an appealing possibility for infrared reflectography. Unfortunately, these systems cannot be used simply by equipping them with an InGaAs camera and modifying the driving software accordingly.

In fact, these devices and stitching software work quite well for distant landscapes but it is very difficult when imaging a painting at short range. In theory, the limited depth of field of photographic lenses enables recording of an acceptable image only for a small area around the point where the panoramic object sphere is tangent to the painting, as shown in Figure 5.

To verify if and up to which extent a panoramic system can be used for infrared reflectography, a simple scanning system was assembled in our Department workshop with a goniometric cradle and a small rotating table, both motorized with stepping motors. The system is driven by a dedicated software written in LabVIEW.

This "off-the-shelf" scanner moves a XenICs Xeva-1.7-320 InGaAs camera (spectral sensitivity 0.9 to 1.7 µm, 320 x 256 elements, 30 µm square). The camera was equipped with a Tamron 500mm f/8 SP macro-tele lens. This lens is quite compact for its focal length, has few glass elements and a minimum focal distance of about 1.7 m. At this distance the optical magnification is about 3:1 which means that the painting would be sampled at 280 pixels/inch at the center of the scanned area. Dioptric lenses were not considered because of their remarkable weight and high number of infrared absorbing glass elements. On top of this, the antireflection coating of each element is optimized for the visible spectral range.



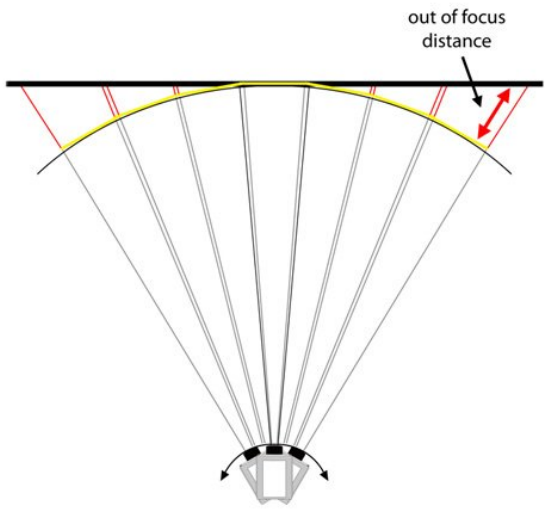


Figure 4. For a panoramic scanning all images lay on a sphere. The camera shoots from a fixed position moving around its non-parallax point.

Figure 5. Equatorial section of figure 4. The yellow band represents the in focus zone (depth of field). In red the out of focus for the spherical object plane to the painting is represented.

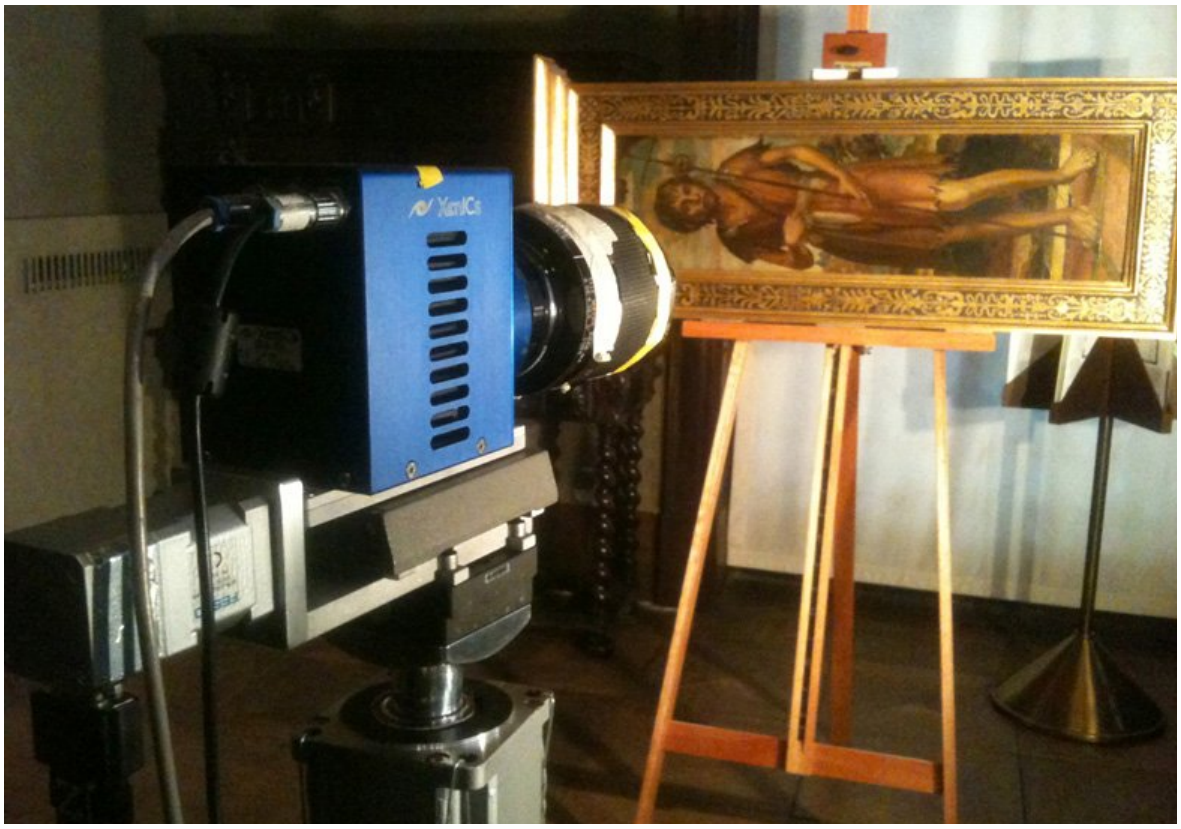


Figure 6. Panoramic scanner in the Bagatti Valsecchi Museum in Milan.

The system was tested on the panel painting of St John the Baptist (1502-1507) by Bernardino Zenale in the Bagatti Valsecchi Museum in Milan, as shown in Figure 6.

In a first test, the camera was set perpendicular to the painting at a minimum shooting distance (2 m) to scan an area of about 26 x 90 cm. The final composite reflectogram was stitched with Microsoft's Image Composite Editor and rectified with Adobe Photoshop, as shown in Figure 8.

A visual inspection of the reflectogram confirmed that the image was acceptably in focus within a circle of about 20 cm radius and that, as expected, the sharpness rapidly decayed outside this circle. The spatial resolution was 230 pixels/inches and details of the central and boundary parts of this reflectogram are shown in Figure 9.

Though the reflectograms, which were obtained with a simple panoramic scanner, can be considered acceptable in most cases, especially for routine inspections, we have investigated which improvements could be implemented to considerably extend the scanned area of the painting. The goal is to demonstrate the feasibility of a prototype performing as well as an IPS or a MLS scanner.

Camera Refocusing

IPS and MLS scanners are designed to shoot reflectograms orthogonally pointing to the painting. For large paintings a certain number of reflectograms must be recorded, moving the scanner along an XY path in front of the painting. Each of these images is first corrected to compensate any lens distortions and then stitched using

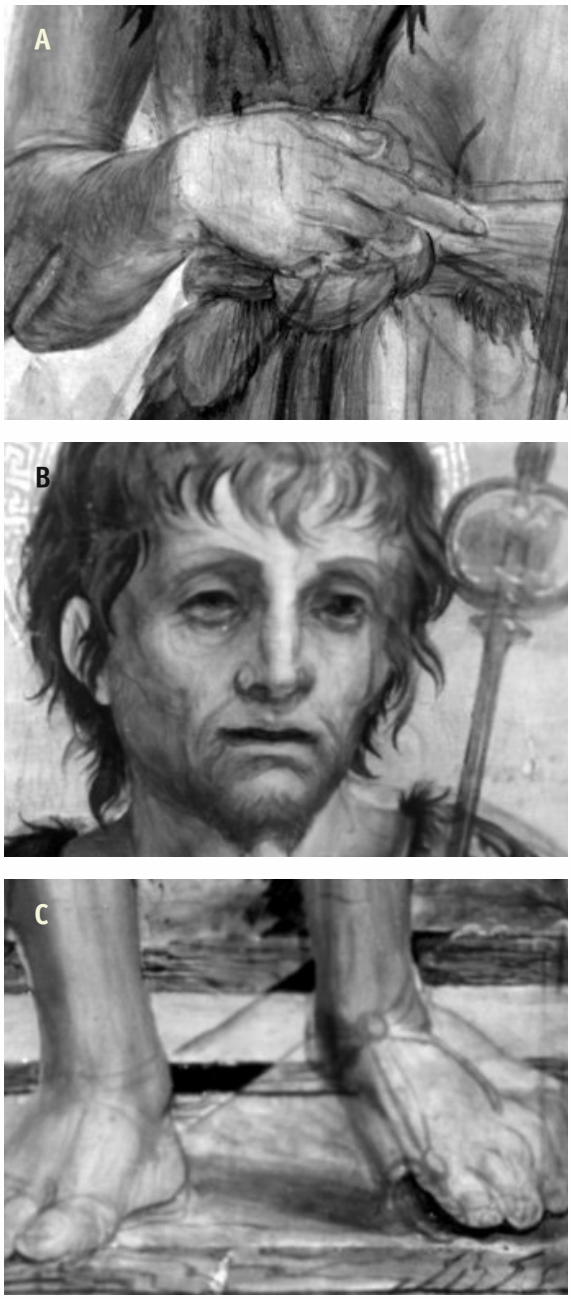


Figure 9. Details of the central (a) and boundary parts (b,c) of the reflectogram. The sharpness rapidly decay moving to the boundary parts of the scanned area.

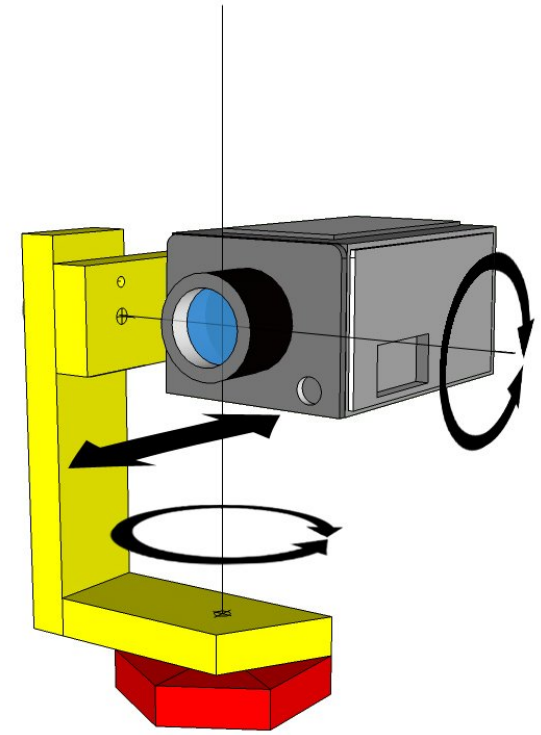


Figure 10 (upper). Scheme of a panoramic head: a linear refocusing movement is added.

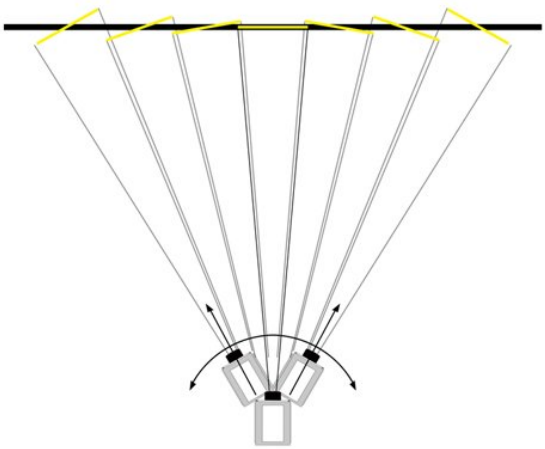
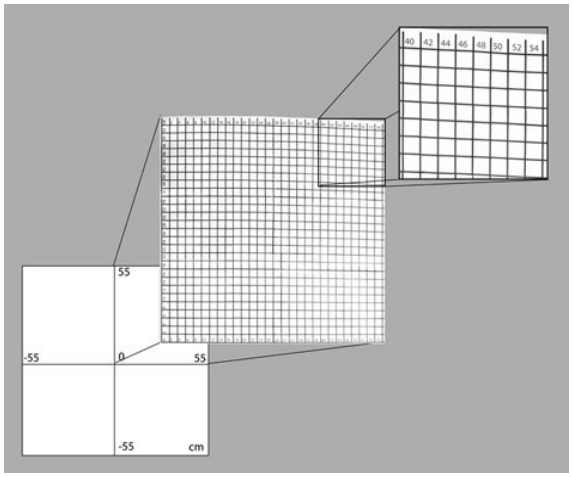


Figure 11 (lower). After each rotation around its no parallax point, the camera is moved along its optical axis to obtain an in focus image all over the scanned area without affecting the magnification.

Previous page:
Figure 7 (left). St John the Baptist, Bernardino Zenale, 1502-1507, tempera and oil on panel, courtesy of the Bagatti Valsecchi Museum in Milan.
Figure 8 (right). Reflectogram of the panel painting recorded with the panoramic scanning technique.



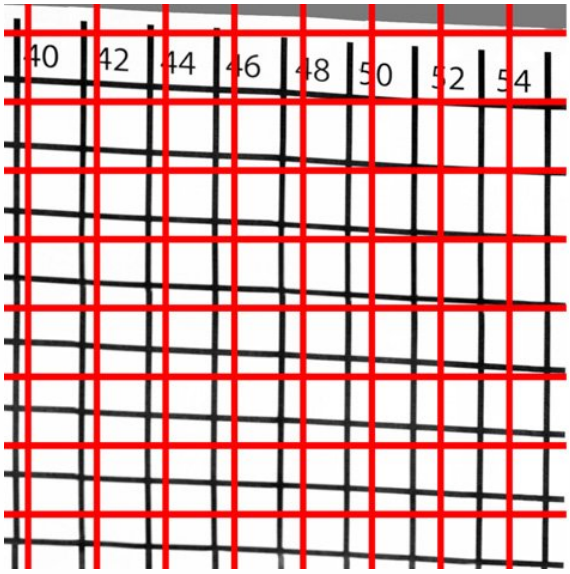


Figure 12 (upper). A reference regular grid is placed in the upper right quadrant of the considered area. Distortions increase from the center outward as shown in the enlarged detail.

Figure 13 (lower). To visualize the distortions, the detail of figure 12 is overlaid with the reference grid, in red.

the traditional orthogonal-stitching-mode to get a composite reflectogram of the entire painting. IPS scanner and MLS scanner are both well performing systems but rather big and heavy.

In order to get a result comparable with an MLS or IPS system, a panoramic scanner should examine an area much larger than that allowed by the shallow depth of field. To solve this problem we added a small linear translation stage to refocus the camera on the painting after each displacement. In order to leave the magnification unaltered, refocusing was done moving the entire camera along its optical axis of the exact local distance from the sphere to the panel.

Preliminary tests to simulate this technique were carried out mounting a photographic camera on a Manfrotto QTVR spherical panoramic head, equipped with a linear stage. The scanning movements are schematically shown in Figure 10.

The scheme of the refocusing method is shown in Figure 10. As the camera rotates around the non parallax point, a calibrated displacement is applied by the linear translation stage. In this way, the optical magnification does not change as it would for refocusing by moving the lens.

To evaluate the amount of the distortions of the final mosaic, intrinsic in this type of scanning, a regular grid pattern was printed and shot.

Since the scanning method has a circular symmetry, to simplify the test we placed this grid as shown in Figure 12 to examine only one quadrant of the entire area. As expected, the distortions are larger in the boundary regions, as can be seen in Figure 12 where an enlarged detail of upper right corner is shown.

As an example, the local amount of these distortions is visualized in Figure 13 where the same detail of Figure 12 is overlaid to the reference grid, in red. This calibration should be carried out for any of the shooting distance. Since the resolution decreases as this distance increases, it is advisable to always shoot at the minimum distance and therefore calibrate the system for this maximum resolution. An alternative method is the image-to-image registration of the reflec-

Figure 15 (above). Details of the central (A) and boundary parts (B, C) of the reflectogram. With the refocusing technique the sharpness cover the whole scanned area.

Figure 14 (left). Reflectogram recorded with the panoramic scanning with the refocusing technique.

togram with a high resolution photograph of the painting as a reference. This post processing can be done with a geospatial image processing software such as Erdas Imagine.

Since the distance panel-camera changes after each displacement, in order to keep this distance unaltered, the camera was mounted on a linear translation stage to move back to the correct focus distance. The driving software was updated with an automatic refocusing algorithm.

The system was tested on the St John the Baptist panting and a sharp reflectogram of 90 x 26 cm was successfully recorded (Figure 14). Details of the central and boundary parts of this reflectogram are shown in Figure 15.

Conclusions

The preliminary tests carried out in laboratory and in situ proved that a panoramic scanning technique is a reliable method for infrared reflectography, provided that the infrared camera is mounted on a linear stage for refocusing. With such a device a reflectogram up to 1 x 1 m with a resolution of 280 pixels/inch can be recorded.

The system is comparable with other high resolution scanning devices, with the advantage of a better portability and a lower cost. The complete reflectographic system weights about 6 kg and can be built with less than €20,000.

In the near future, we plan to consider commercial mechanical scanning systems such as gimbals, U-fork mount, goniometric cradle/rotary table to find the best set-up in terms of cost and performance. A dedicated shooting and stitching software will be written taking into account the mechanical characteristics of the chosen approach.

Nevertheless the successful outcome of this approach, this refocusing panoramic shooting technique requires further testing with different cameras for other diagnostic imaging techniques such as infrared False Color, UV photography and thermography.

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A PRACTICAL GUIDE TO PANORAMIC MULTISPECTRAL IMAGING

By
Antonino Cosentino

Panoramic Multispectral Imaging is a fast and mobile methodology to perform high resolution imaging (up to about 25 pixel/mm) with budget equipment and it is targeted to institutions or private professionals that cannot invest in costly dedicated equipment and/or need a mobile and lightweight setup. This method is based on panoramic photography that uses a panoramic head to precisely rotate a camera and shoot a sequence of images around the entrance pupil of the lens, eliminating parallax error. The proposed system is made of consumer level panoramic photography tools and can accommodate any imaging device, such as a modified digital camera, an InGaAs camera for infrared reflectography and a thermal camera for examination of historical architecture.

Introduction

This paper describes a fast and mobile methodology to perform high resolution multispectral imaging with budget equipment. This method can be appreciated by institutions or private professionals that cannot invest in more costly dedicated equipment and/or need a mobile (lightweight) and fast setup. There are already excellent medium and large format infrared (IR) modified digital cameras on the market, as well as scanners for high resolution Infrared Reflectography, but both are expensive. Also, scanners must be arranged for the dimensions of the painting being documented, while panoramic photography has virtually no size limits. Furthermore, self-assembled equipment can be modified for specific tasks and upgraded with comparatively little incremental funding, following technical and scientific developments in the consumer market, e.g. upgrading to a new digital camera with higher pixel count. The economical, fast and mobile system suggested in this paper is composed of tools used in consumer level panoramic photography. Essentially, represented here in a down-scaled form, is the method employed by Google Art Project to produce gigapixel images of artworks in museums around the world, and it can be applied to any other imaging device, such as thermal cameras for diagnostics of historical architecture. This article focuses on paintings, but the method remains valid for the documentation of any 2D object such as prints and drawings. Panoramic photography consists of taking a series of photo of a scene with a precise rotating head and then using special software to align and seamlessly stitch those images into one panorama.

Multispectral Imaging with a Digital Camera

A digital camera can be modified for "full spectrum", infrared-visible-ultraviolet photography. There are companies that provide the modification of commercial cameras for a small fee. It is recommended to use a Digital Single-Lens Reflex (DSLR) camera which can be tethered to a computer since this feature allows the user to achieve sharp focusing in non-visible modes (IR and UV) using live view mode. A strongly recommended reading is the AIC guide to digital photography [1] which provides plenty of information on photography practices for museum professionals and it has a valuable section on multispectral imaging. However, it must be mentioned that this article uses a different terminology and set of acronyms than those employed in the AIC guide. Here it is

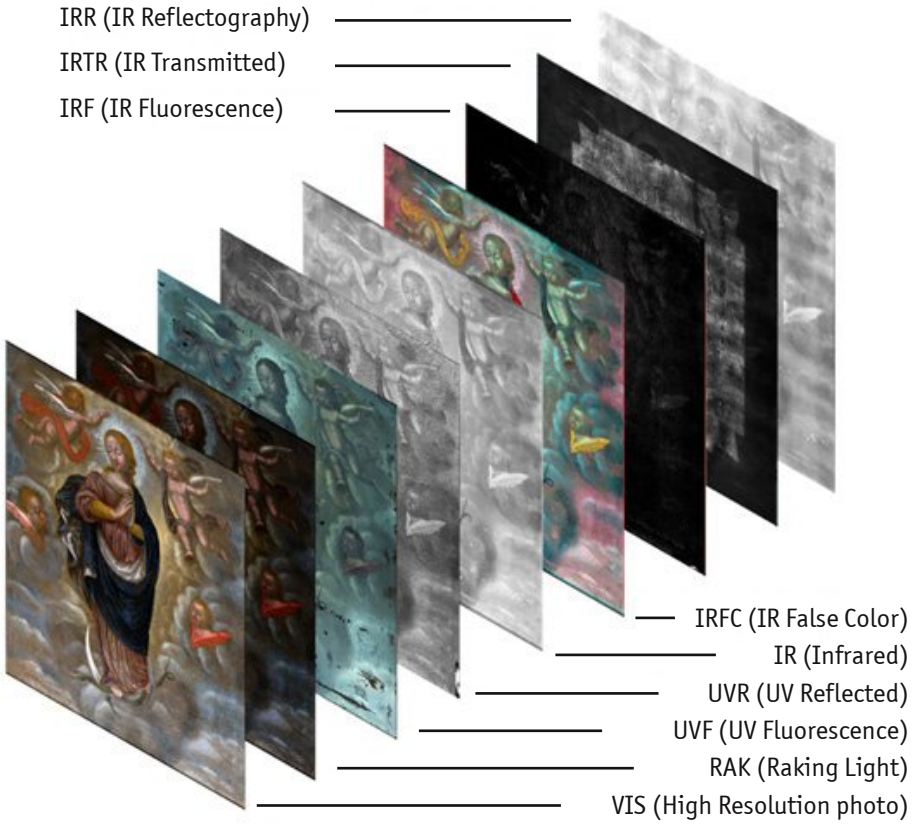


Figure 1. Multispectral imaging terminology and acronyms adopted in this article. Early 1900 Sicilian devotional art, oil on canvas, 80x66 cm, private collector.

preferred to highlight first the spectral range, followed by R (Reflected), F (Fluorescence), FC (False Color), TR (Transmitted) (Figure 1). The multispectral (MSI) images in Figure 1 have a pixel dimension of 12000x1000 and have been collected with a modified Nikon D800 (36 MP, CMOS sensor) with a Nikon Nikkor 200 mm F4 AI telephoto lens, and are composed of a total of 12 stitched shots for each image. The same set of multispectral images can be viewed on IIPImage server [2].

Panoramic Head

A motorized panoramic head such as the lightweight Gigapan EPIC Pro makes high resolution imaging fast. The head can be programmed to automatically rotate the camera around the entrance pupil of its lens and release the shutter in order to take pictures without parallax error. It works with all the major brands of digital cameras. No risk anymore to forget to shoot a picture in whatever complex panorama. There are lighter panoramic head models but it is recommended to choose a model that can accommodate heavy lenses. As a note, Google Art Project team uses panoramic heads CLAUSS RODEON VR Head HD and CLAUSS VR Head ST [3]. These have the same concept but are much more sturdy and expensive. Google Art Project gigapixel images of paintings represent the cutting edge of panoramic photography for art documentation in the visible

range of the spectrum and they provide a macro documentation of the entire artwork with extraordinary details. However, the goal of this article is to suggest a version which is both affordable and specifically meant for multispectral imaging (MSI) to suit the actual workflow of professionals involved in art documentation. This article will highlight the specifics of the components necessary to achieve resolution on the order of 20 pixel/ mm for a medium size painting about 1x1 m in dimension, such as the one in Figure 1. Indeed, it must be kept into account that an MSI documentation of a painting, both front and back, could result in around 12 images. In order to allow a comparative examination through the different spectral ranges, those images are uploaded on the layers of a single document file in an image editing software such as Adobe Photoshop or GIMP.

This image file would be too big to allow agile manipulation by a consumer level computer if the size of each MSI image was on the order of gigabytes. Actually, a solution to this problem is an IIPImage server [4] which delivers the images over the internet and doesn't overload the user's computer. Streaming from the image server is tile-based, the same method used by Google maps for satellite view, which allows the user to navigate and zoom gigapixel size images without downloading them to the computer being used.

Camera

The recommended camera to achieve the desired resolution of about 20 pixels/mm is the Nikon D800, 36 MP (image size 7360x4912 pixels). The mirror up function in the camera must be activated for sharper images since it is necessary to eliminate any vibration due to the relatively long exposure time required by the telephoto lens. A sturdy tripod will complete the set-up. Focus and exposure must be set in manual mode and the images can be saved in RAW format for further editing, but eventually the images must be exported into a compressed format such as TIFF or JPEG in order to be uploaded by a stitching software.

Lens

The Gigapan Epic Pro supports camera and lens combinations up to 4,5 Kg (10 lbs) but for MSI we would not use such a heavy, extreme telephoto lens. There are a number of reasons to keep the telephoto lens within a 200 mm range (zoom lenses are slower and must definitely be avoided): ultraviolet and infrared fluorescence have low intensity; complex lenses are likely to give flares in the infrared and ultraviolet photography; and telephoto lenses over 200 mm only accommodate filters with diameter greater than the common and affordable 52 mm. The cost of filters used for scientific MSI can grow considerably with their diameter. For this article, a Nikon Nikkor 200 mm f/4 AI manual focus lens was tested. At its minimal focus distance of 2 m and coupled with Nikon D800, it delivers a considerably good resolution of about 27 pixel/mm. In Figure 2, the 2 cm scale bar in the AIC Photo Documentation (PhD) Target [5] represents 540 pixels in the image.

For smaller paintings, it is possible to use a faster telephoto lens with a shorter focal length, which will shorten exposure times. This is a valuable property for dim illumination techniques such as UV Fluorescence and IR Fluorescence. The Nikon Nikkor 85 mm H f/1.8 has minimum focus at 1 m and delivers (coupled with Nikon D800) images with resolution of about 20 pixel/mm, as calculated above with the AIC PhD Target.

Other issues to take into account are lens distortion and infrared hot spot. Lens distortion can be

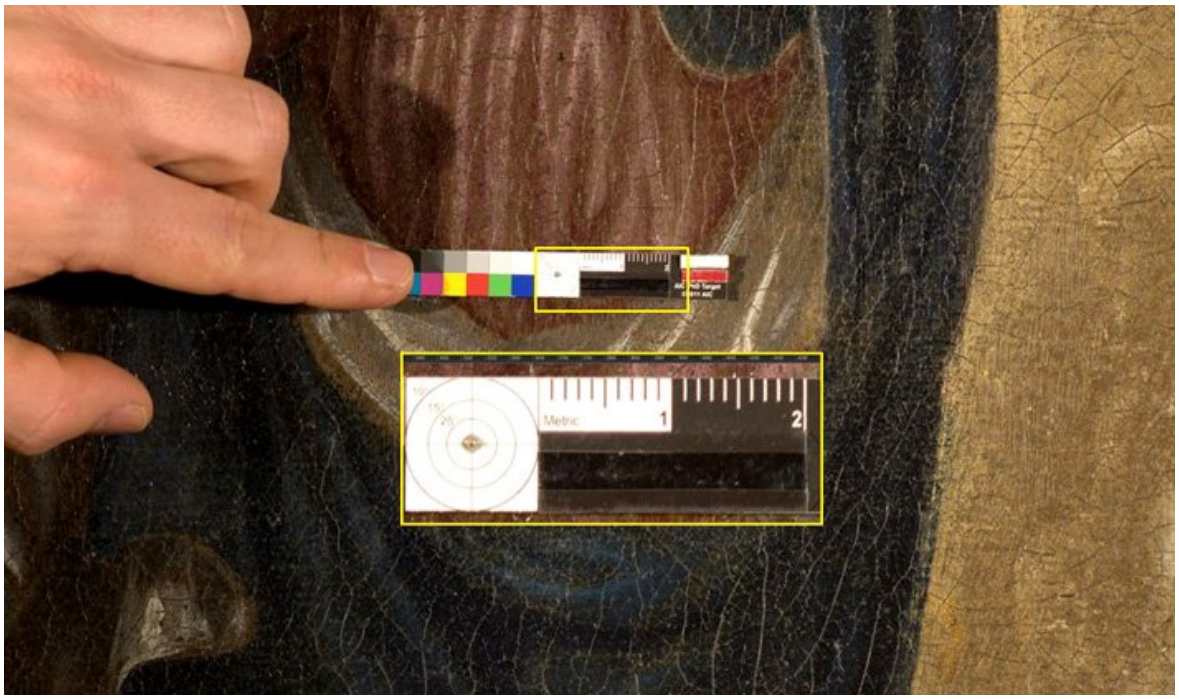
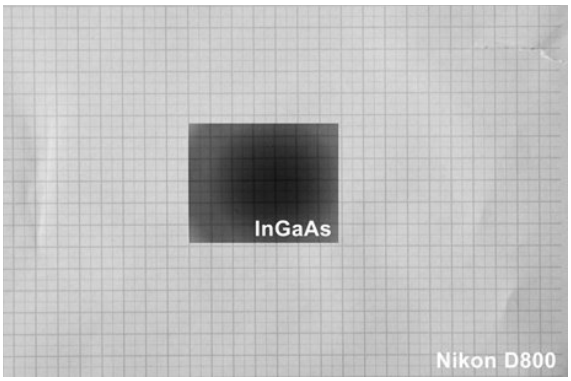


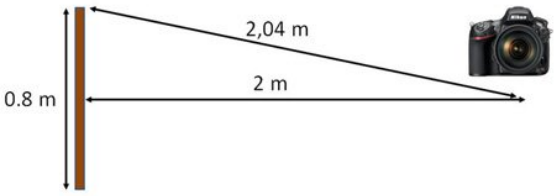
Figure 2. AIC PhD target photographed with Nikon D800 from 2m (minimum distance) with a Nikon Nikkor 200 mm lens. A resolution of 27 pixels/mm is delivered.

minimal or remarkable depending on the lens. Figure 3 shows a picture of a paper grid taken with the Nikon Nikkor 200 mm, which is renowned to have great mechanical and optical performance and, indeed, no distortion is observable. If a lens has geometrical distortion there are tools in Photoshop to correct it before attempting the stitching. Infrared hot spot is a bright circle in the center of the image that becomes more evident when increasing f-stop number. Hot spots are caused mostly by the coatings inside the lens barrel and on the lens elements or, rarely, by the interaction between the lens elements and the imaging sensor. The only solution is to use a different lens. Lists of lenses tested for hot spots are available for consultation online [6].

Set-up camera-painting

The camera should face the painting perpendicularly at its center. The actual distance from the painting depends on its dimension. The shorter the distance, the greater the magnification afforded. But, on the other hand, the depth of field decreases and the focus could become soft on the borders. It's necessary to compromise in order to get the highest resolution possible and keep the center and borders of the object into the depth of field near and far limits. There are a number of online sources that provide these values for a specified lens and a given distance and aperture [7]. In our case (lens 200 mm, distance 2 m, aperture f/7.1) the total depth of field was 4 cm. This is just enough to keep this painting, with a maximum dimension of 80 cm, on focus. Indeed, while the distance from the camera to the center of the painting is 2 m, the distance from the camera to the border of the painting is 2,04 m as can be immediately calculated with the Pythagorean theorem on the three sides of a right triangle (Figure 4). The picture of the AIC PhD target hold on the top





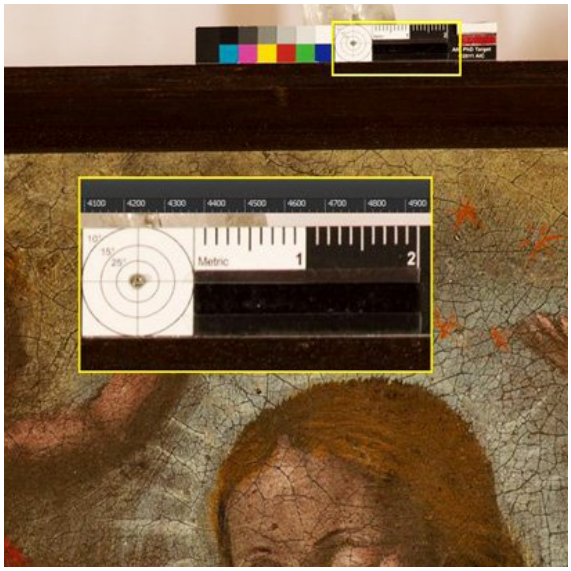


Figure 3 (upper). Overlapped images of a paper grid (1 cm) taken at 2 meters with the Nikon Nikkor 200 mm lens mounted on Nikon D800 and on InGaAs camera 320x256 pixels. There is no deformation pattern observable.in both cameras but InGaAs picture shows vignetting.

Figure 4 (middle). It is necessary to estimate the difference between the distance from the camera to the painting at the center and again at the higher border and be sure it falls within the lower and upper limits for the depth of field. This is immediately calculated with the Pythagorean Theorem using the right triangle shown above.

Figure 5 (lower). AIC PhD target photographed with Nikon D800 at distance camera-painting's center 2 meters and lens focused on the painting's center (200 mm lens, f/7.1).

border it's indeed still on focus (Figure 5) even if the lens was focused on the painting's center.

Pre-editing

It can be necessary to edit the set of panoramic images before attempting to stitch them, in order to correct for chromatic aberration, geometric distortion and vignetting. Photoshop scripts such as Actions and Droplets make this editing fast, even if there are a large number of images.

Stitching

Chosen from an array of available panorama stitching software, PTGui [8] allows a great deal of control onto the stitching process. Once the pictures are uploaded, PTGui attempts a total automatic stitching after being given the focal length of the lens, the crop factor of camera, and in the Align to Grid function, the number of rows and columns shot. The preliminary result could be refined, if necessary, with manual addition of control points. Some typical issues in panoramic photography are vignetting and panorama file size. Vignetting refers to a reduction in brightness near the corners of an image that depends on the lens. This effect is more evident with wide-angle lens, and less for telephoto lens. PTGui has automatic color and exposure adjustment for the correction of vignetting and flares that is performed by the analysis of the contents of overlapping images. Concerning the Panorama File Size, PTGui blends the panoramic images into a Photoshop file up to 300,000x300,000 pixels. For a painting 1x1 m, using the 200 mm lens at 2 m, image resolution is 25 pixels/mm and the total panorama pixel size will be around 25,000x25,000 pixels. To handle files this big, it is recommended to use a computer with at least 8 GB of RAM and a new

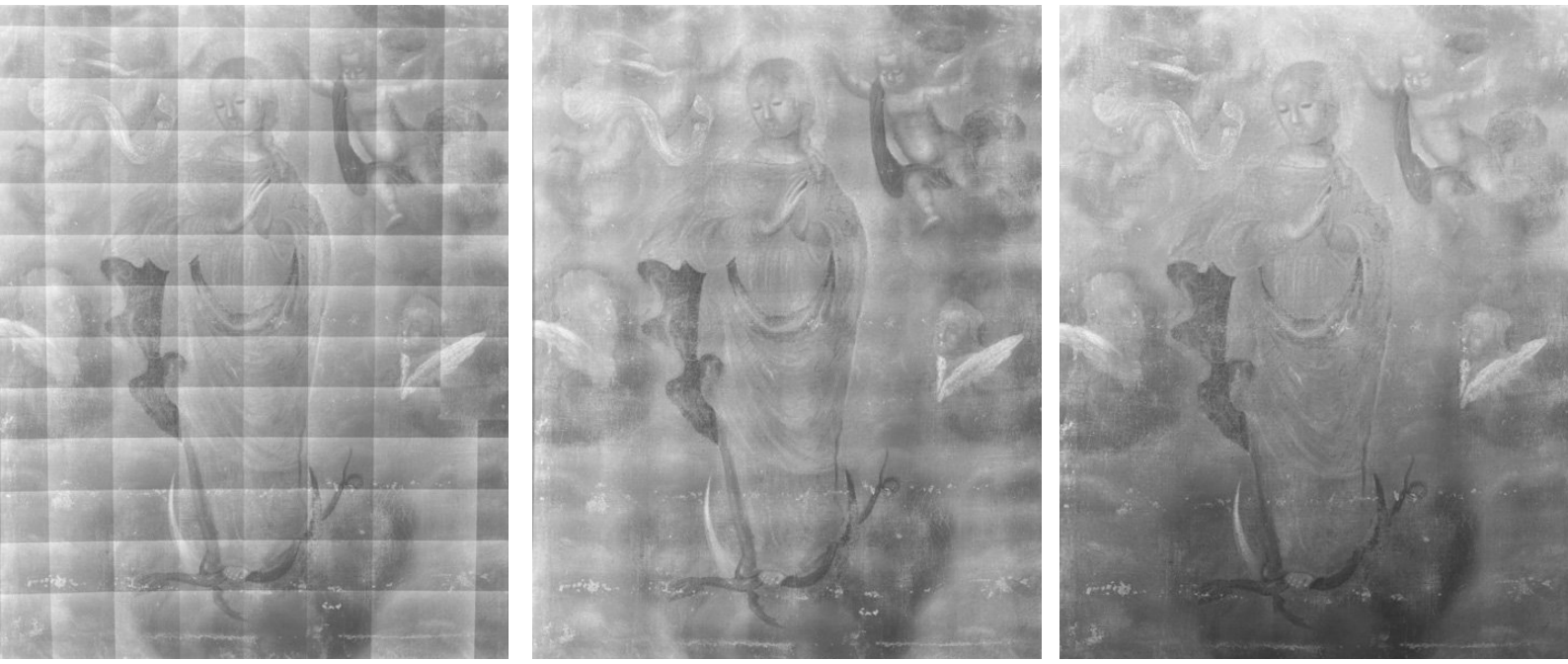


Figure 6. a) 104 images tiled (overlapped) without any blending; b) PTGui panorama without vignetting correction; c) PTGui panorama with PTGui vignetting correction.

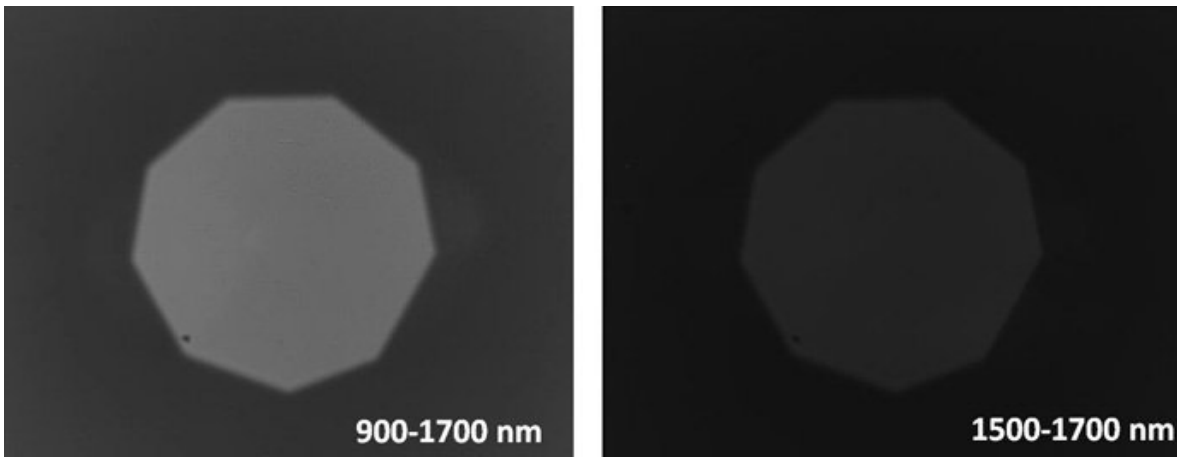


Figure 7. Left, InGaAs image of the bare halogen spot light. Right, the same spotlight pictured with the 1500 nm filter on. The lens transmits infrared in the 1500-1700 nm spectral range and permits to use the full capabilities of the InGaAs camera.

SSD (Solid State Disk) drive that is faster than the common Hard Disk Drive (HDD).

High Dynamic Range (HDR) photography

This photographic technique can be useful to document paintings with a dynamic range so high that a digital camera cannot reproduce it, such as ones including bright whites and pitch dark blacks. In these areas there is always a loss of detail and it's necessary to compromise between information lost in the brightest or darkest areas. HDR allows the user to capture all those details. PTGui provides extensive support for HDR imaging such as stitching bracketed exposures into an HDR panorama.

Infrared Reflectography with InGaAs camera

The Gigapan EPIC Pro motorized pan head allows the user to automatically take all the shots in sequence, since it can trigger a DSLR camera. Though, this head can be still used in automatic mode with any imaging device connected to a computer since a USB trigger adapter can be implemented. At the moment these USB adapters are not yet available commercially. In any case, pictures can still be shot manually while the Gigapan runs in a step-by-step mode. As an example, an InGaAs camera (320x256 pixels) Merlin NIR by Indigo Systems (Figure 8) was plugged to a Gigapan Pro head to produce the Infrared Reflectography [9] images in Figure 1 and Figure 6. A total of 104 images were shot with the same 200 mm lens (an adapter Nikon to C-mount was used for the lens). Infrared Reflectography between 900 and 1700 nm and Infrared photography with a modified DSLR are complementary methods [10] and Panoramic Infrared Reflectography is the budget alternative to high-resolution infrared scanners [11, 12]. The main issue with an InGaAs camera is its drastically lower pixel count. Currently these cameras are available at 640x512 pixels and there are even bigger detectors of 1024x1024 on the market, though they are much more expensive. At any rate, the pixel count of an InGaAs camera is much less than that of a digital camera. This means that particular care must be exercised to meet the minimum resolution needed to resolve the finest marks in the underdrawing, which is 5 pixel/mm [11, 13]. The InGaAs image of the grid paper shown in Figure 3 was acquired using the same set-up as the imaging with the Nikon D800, distance 2 m and lens 200 mm.

It's now necessary to introduce the Crop Factor, which we define as the ratio of the diagonal in the 35 mm film format (24x36 mm, diagonal 43.4 mm) to the diagonal of the specific camera's imaging area. The Nikon D800 has an imaging area the same size of a 35 mm film so its crop factor is 1. The crop factor for a DSLR camera is indicated in the manual under technical specifications. The size of the imaging area of an InGaAs camera or any other imaging device used for panoramic photography is often not provided. In this case, Figure 3 is useful to estimate the crop factor of the InGaAs camera used in this article. Indeed, an immediate method is to calculate the diagonals of the pictures of the paper grid taken with the D800, which is a 35 mm equivalent sensor, and then repeat the same shot using the inGaAs camera. We recall that both images were taken at the same 2 m distance. These diagonals are about 31 cm and 9 cm, respectively, for the pictures taken with the Nikon D800 and the InGaAs camera. The ratio of the diagonals of the actual pictures the cameras take is the same as that of the diagonals of the imaging areas of their sensors. Therefore, the crop factor of the InGaAs camera is identifies as 31:9 =3.4. This is a simple method to figure out the crop factor for imaging devices when dimensions are not available.

Since the detector is smaller (crop factor 3.4), the lens works now as a 200x3.4= 680 mm. Indeed, multiplying the focal length of a lens by the crop factor gives the focal length of the lens that would yield the same field of view if used with the 35 mm reference camera format. In the conditions mentioned above, a minimum resolution of about 5 pixel/mm is achieved. The resolution could be greatly improved (roughly doubled) with a new 640x512 pixel model, thus becoming comparable with high-resolution scanners. The InGaAs image of the paper grid in Figure 3 shows that while there is no noticeable geometrical deformation, vignetting is much more evident and needs editing. Indeed, the 104 images of the painting stitched without any vignetting

Figure 8. Gigapan EPIC Pro Panoramic head with Nikon D800 (left) for multispectral imaging and with InGaAs camera Merlin Indigo Systems (right) for Infrared Reflectography, both mounted with a Nikon Nikkor 200mm lens.

correction show the characteristics tiled effect (Figure 6B). PTGui has a new function to automatically correct for the vignetting (Figure 6C).

Lens

As for the modified DSLR setup, it is necessary to verify the occurrence of hot spots for the specific lens and InGaAs camera. Another problem, which was overlooked while discussing modified DSLR is the lens transmittance in the infrared. Commercial photographic lenses show a decrease in transmittance moving from visible to infrared light [14]. While this is not noticeable before 1100 nm, from thereon to 1700 nm, the upper limit of InGaAs cameras, it could be significant. To quickly test if a lens does actually allow transmission of light in that range, a Thorlabs FEL1500 1" Long pass Filter with Cut-On Wavelength centered at 1500 nm can be used. The filter can be positioned over a spotlight halogen lamp which will provide a source of infrared light with wavelength higher than 1500 nm. Figure 7 shows an InGaAs image of the bare halogen spot light and of the same spotlight with the 1500 nm filter on.

Conclusions

Panoramic Multispectral Imaging is a valid alternative to more costly equipment for high resolution imaging. It can be implemented with consumer panoramic imaging tools and can deliver images with resolution up to 25 pixel/mm which is more than art examination and documentation requires. The stitching software is easy to use, the overall panoramic method does not require specialized personnel or intensive training and is, therefore, appealing to medium-small museums and private conservators who want to implement an affordable method to professionally document their collections.

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STUDY OF ANCIENT GREEK AND ROMAN COINS USING REFLECTANCE TRANSFORMATION IMAGING

By Eleni Kotoula and Maria Kyranoudi

Previous work on Reflectance Transformation Imaging (RTI) in the field of antiquities and works of art demonstrated the potential advantages of this technique in many areas of archaeological research and conservation. This paper presents a study on the use of RTI as a tool for visual analysis, conservation documentation and monitoring of remedial conservation operations. Tests were performed on a selection of roman or ancient copper alloy and silver coins before, during and after mechanical cleaning. The results indicated that RTI not only assists coin identification but also enables advanced conservation documentation and monitoring of cleaning operations. Moreover, RTI's use in the field of preventive conservation, as well as its significance for providing access to cultural heritage collections and in particular in the case of coin, is discussed.

Introduction

There is no doubt that coins pose challenges to conservators, archaeologists and historians. From an archaeological perspective, the study of coinage reveals important information related to dating, social structure, economy and politics [1]. From the conservators' perspective, the double post-excavation function of coins as resources for archaeological information and as displayable objects should be examined. Critiques towards the underestimation of the latter exist in literature [2]. However, the conservation treatment should reveal the surface morphology of coins to be legible, identified and dated, while simultaneously it is an ethical requirement to undertake all the necessary actions to preserve coins for the future and to gain maximum information from and for them. This information is not restricted in providing chronological evidence but includes information related to coins manufacture and corrosion studies. The present article discusses conservation and numismatics issues related to examination, documentation, identification and preventive conservation and proposes an affordable and easy alternative methodology, Reflectance Transformation Imaging (RTI).

RTI is a computational photography technique that enables the virtual examination of objects in front of a computer monitor. Conservators and archaeologists can observe minor details, unseen with the naked eye, holding the mouse or a tablet rather than the coin. Hence, it meets the conservation needs for limited human-object interaction, high quality and affordable visual analysis and documentation. For the purposes of the present project, a collection of ancient Greek and Roman coins was used as a case study to test RTI's efficacy in the field of coin identification, conservation documentation and examination.

Conservation, Numismatics and RTI

Conservation and Numismatics

Documentation, the accurate pictorial and written record of all procedures carried out, including analysis, examination and intervention as well as the rationale behind them, is a fundamental part of contemporary conservation as dictated by international charters. Also, guides for good practice emphasize the importance of documentation, which is an ethical obligation as it implies accessibility, one of the main objectives of conservation [3]. It is more likely for the broad scientific community to access the record of the coin rather than the coin itself. Worth mentioning is that this is also preferable from a conservation point

of view, taking into consideration preventive conservation and security measures. Traditional numismatics documentation methodologies, such as photography, proved to be insufficient in recording fine surface details and visualizing the materials' optical properties. One of the most usual problems is the surface reflectivity which produces undesirable results such as distortions, reflections and shadows. This, in turn, can lead to misunderstandings for the photographed coin. Because of this, and also due to the fact that coins include thorough details, advanced recording is a necessity [4].

The identification of coins can be extremely laborious or even impossible using traditional means such as photographs, plaster casts and drawings. The most common parameters that affect coin identification are related to the coins' condition, manufacture and use. The materials' degradation, either acting additively or subtractive, can alter significantly the appearance of coins introducing changes in geometry, colour and texture. Therefore, the comparative study of coins in different states of preservation may be unsuccessful. Distortions created during their manufacture may lead to great variation, as the penetration and strike angle varies. Also, the central positioning of the figure is not certain because the procedure is performed manually. Any die damage or break adds another level of complexity in coins identification. Also, over striking is difficult to recognise and interpret [5]. Furthermore, the coins use and possibly re-use leave marks such as holes, scratches and cuts. These alterations affect coins' appearance and act as a drawback for identification purposes.

Cleaning methodologies for coins can make use of mechanical, chemical and/or electrolytic means [6]. In case of copper alloy coins, the strongest advantage of mechanical cleaning is its ability to preserve details of design, tool marks and surface finishes [7]. Taking into consideration the importance of the revelation of representations and legends on coins, it is understandable why mechanical cleaning is considered the most acceptable method for cleaning copper alloy coins: it is easy, selective and enables patina preservation [8].

Reflectance Transformation Imaging

Reflectance Transformation Imaging [9], including one of its subdivisions Polynomial Texture Mapping (PTM), invented in 2001 by Hewlett-Packard researcher Tom Malzbender [10], is a group of technologies for surface characterisation. According to Cultural Heritage Imaging (CHI), RTI is a computational photography tool that captures surface shape and colour and represents 3D reflectance properties of objects. It is an interactive re-lighting technique, further enhanced by mathematical transformations of the subject's surface shape and colour attributes [11].

Polynomial Texture Maps (PTMs) and RTIs can be created by the dome method or the Highlight-based method. Highlight RTI captures a series of raking light images of a static object, accompanied with one or two glossy balls with a static digital camera at constant exposure. The necessary equipment includes a digital SLR camera, a tripod, a light source and a glossy sphere, whose dimension is relative to the size of the object under examination. The accurate execution of the procedure, as described in detail in the Guide to Highlight Image capture [12], assures the successful completion of data acquisition. A typical scene set up for Highlight RTI data capture is presented in Figure 1.

The data processing methodology uses the RTI builder software, developed by University of

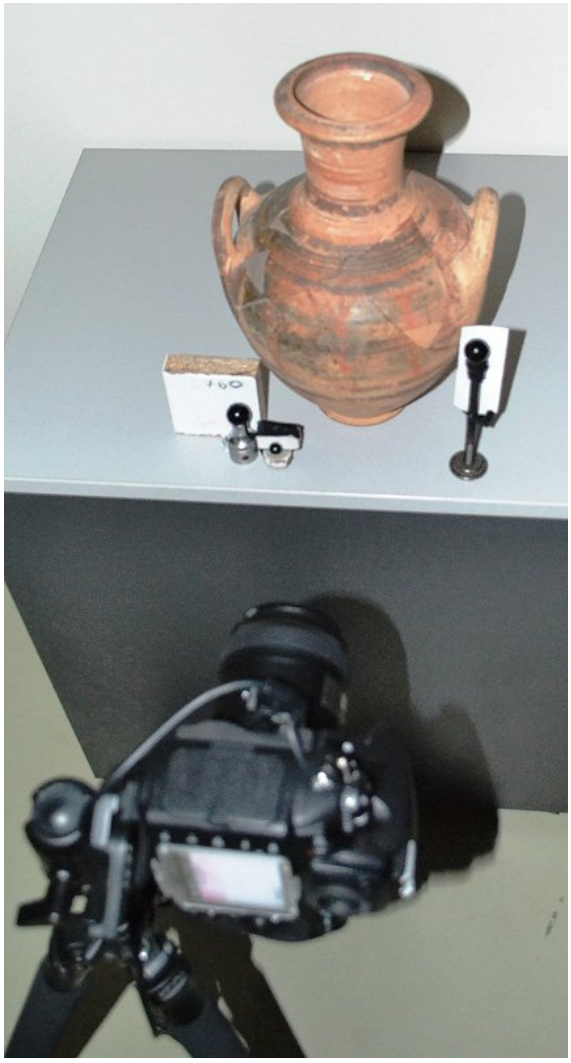

Figure 1. Highlight RTI data capture scene.

Minho in collaboration with CHI [13]. In case of Highlight RTI, images are loaded and saved, the sphere is selected and added by the user, and then the program executes sphere and highlight detection. Finally, the PTM or the Hemispherical Harmonics (HSH) fitter completes fitting) and results in artefacts visualised in polynomial texture map or reflectance transformation imaging format (*.ptm or *.rti), using either the polynomial texture map, developed by HP researchers [14], or the hemispherical harmonics fitter, developed at the University of California, in collaboration with CHI and T. Malzbender [13].

The other available option for RTI visualization is the dome method (Figure 2). In the case of dome RTI, data capture and processing is different because each dome has a pre-build lighting position file. There is no need to add spheres in the scene in data acquisition stage. During processing the builder uses the pre-build lighting position file and continues with fitting. More details can be found in the guide to highlight image processing, provided by CHI [13] and in the Hewlett Packard website [14]. The dome method provides automatisation, decreases time for capture - processing, and leads to better, more precise results while the highlight method is able to capture data regardless of the size of the objects, without any special instrumentation. A compromise between these two methods is the use of rotation rings or mechanical arms for the automatic moving of light (Figure 3).

PTM and RTI files can be viewed via specialized software. The RTI viewer (ISTI-CNR/CHI RTIViewer) (Figure 4A) is compatible with both .ptm and .rti files, while the PTM viewer (HP Labs PTM Viewer) (Figure 4) supports only .ptm files. Both programs enable interactive manipulation of the lighting position and enhancement of the final outcomes through different rendering modes. More details on viewers are provided by Cultural Heritage Imaging Guide to RTI Viewer and [15] and the Hewlett Packard website [14]. The technique contributes significantly in analysis, conservation and representation [16]. Microscopic RTI, using the microscopic highlight or the minidome method, offers interesting results leading to its broader application in the cultural heritage sector and, particularly, in conservation practice [17].

One of the most in depth analysis of RTI in numismatics is the study of coins from the Hospice of the Grand St. Bernard [9]. Not only was the superiority of PTMs over traditional documentation

Figure 2. RTI data capture, minidome.

Figure 3. RTI data capture, mechanical arm.

methodologies proved but also its significance in numismatic studies, communication and dissemination was discussed. Also the Diniacopoulos Collection coins RTI workshop, held in the departments of Classics and Conservation of Queen's University (RTIiCAN), Kingston, Canada in 2011, included coins from the Hellenistic to the Byzantine period [18]. Promising for the future of numismatics research is the Selby hoard project of the University of Southampton [19, 20].

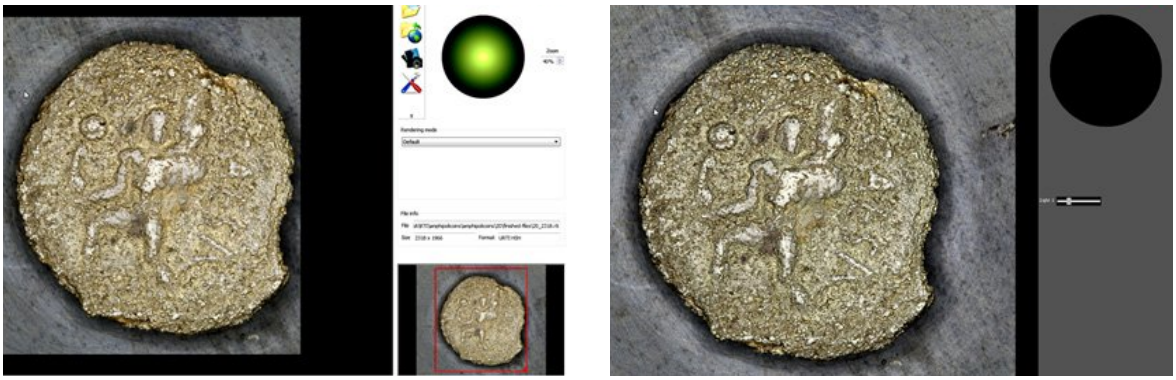

Figure 4. Snapshots of the RTI viewer (left) and PTM viewer (right).

Although the RTI community is increasing in number as well as in expertise, the application of RTI is limited to representations after conservation operations, without taking into consideration previous stages of its biography and 'non-static' nature of artefacts.

Selection of Study Set

The 25 ancient a roman coins used for the purposes of the present study are lacking provenance information. These coins were selected for further investigation in an attempt to include coins that presented interesting surface phenomena and form a representative sample of the whole collection's condition. The cleaning operations and the experimental dome and highlight RTI tests using macroscopic means were carried out in the conservation laboratory of the Archaeological Museum of Amphipolis in Serres, Macedonia, Greece.

Results and Discussion

This project resulted in 50 .ptm and .rti files which visualise coins pre-, during and post-cleaning operations. However, for the purposes of the present paper, only few characteristic examples will be presented to demonstrate the efficacy and the limitations of the technique. The following examples aim to describe the surface effects seen on the selected coins and to outline RTI contribution.

RTI's ability to emphasize surface variation proved to be extremely important for coin identification, even in cases of minor low relief details and/or highly corroded coins. The technique proved particularly interesting in cases of unidentified coins before conservation treatment such as the one shown in Figure 5. After cleaning, the human standing figure in the copper alloy coin becomes discernible (Figure 5D), although the coin surface is covered by corrosion products.

RTI not only assists identification and dating but also enhances examination and condition reporting. For example, it can emphasize surface effects due to conservation treatment. A silver roman imperatorial denarius of Julius Caesar minted in North Africa in 47–46 BC was chemically cleaned prior to acquisition by the Amphipolis Museum (Figure 6). As a result, it presents a stripped, porous, rough surface. Moreover, the scene represented on the reverse, Aeneas advancing to front,

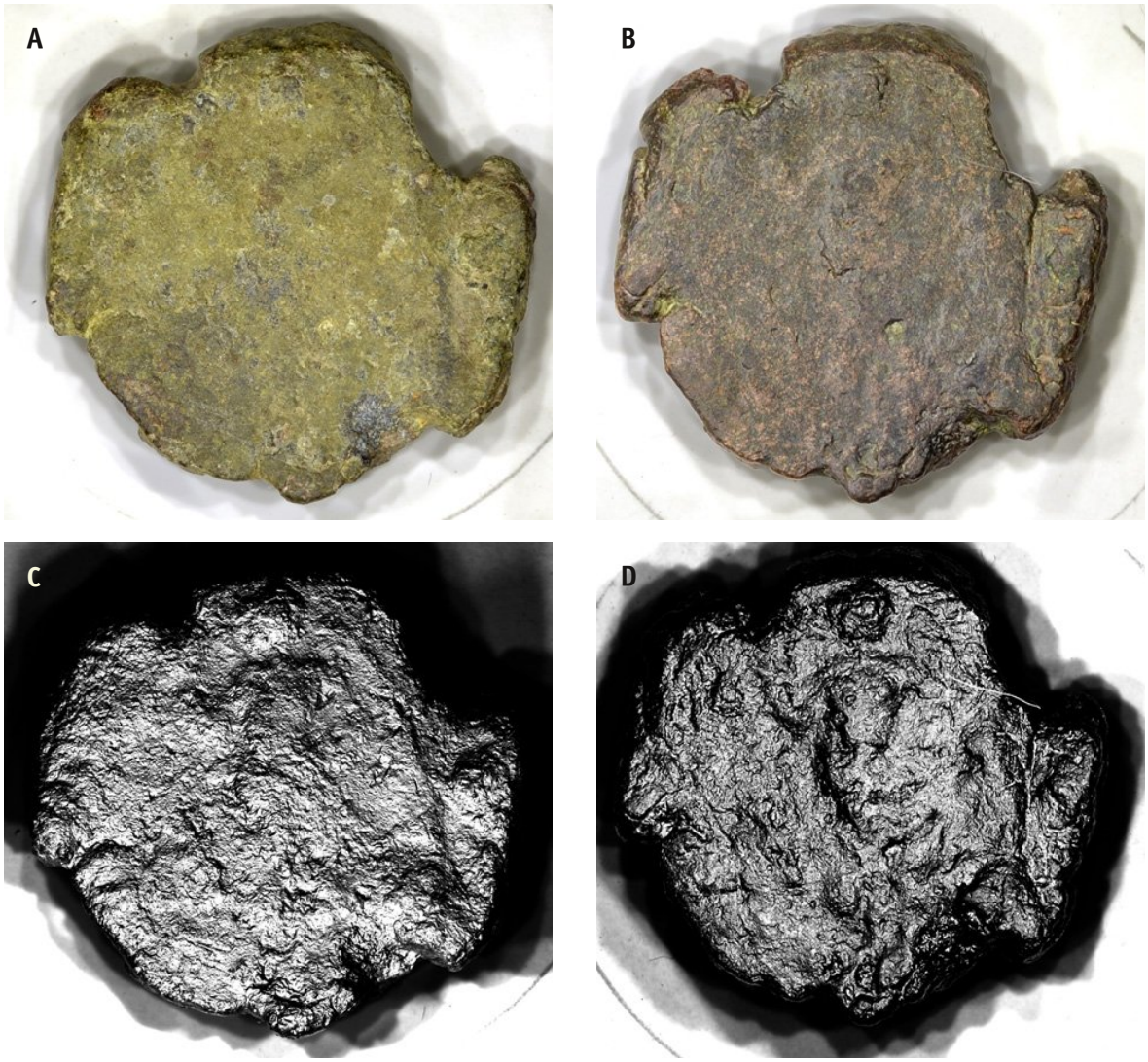

Figure 5. Human figure representation on copper alloy coin (unidentifiable, Ø 18 mm): digital image before (5A) and after (5B) mechanical cleaning; and RTI visualizations in specular enhancement mode before (5C) and after (5D) mechanical cleaning (right).

holding Palladium in the palm of his right hand and carrying his father Anchises on his left shoulder, as well as the legend "CAESAR" is hardly legible. The legend and the scene appear more vivid in the RTI snapshots than in digital image (Figure 6).

Also, surface effects such as corrosion, pitted surface, scratches, depositions and surface loss can be easily documented using RTI (Figures 7 and 8). But apart from condition reporting, a complete conservation record should narrate the objects biography or "life cycle", referred as 'treatment history' by Scott [7]. Taking into consideration that RTI viewing is comparable to the original artefact examination experience, the object visualization in relation to time and change before, after and during conservation intervention is recommended. This approach befits archaeological and conservation ethics and succeeds in capturing the objects "non-static" nature [21]. For example, the RTI visualization of

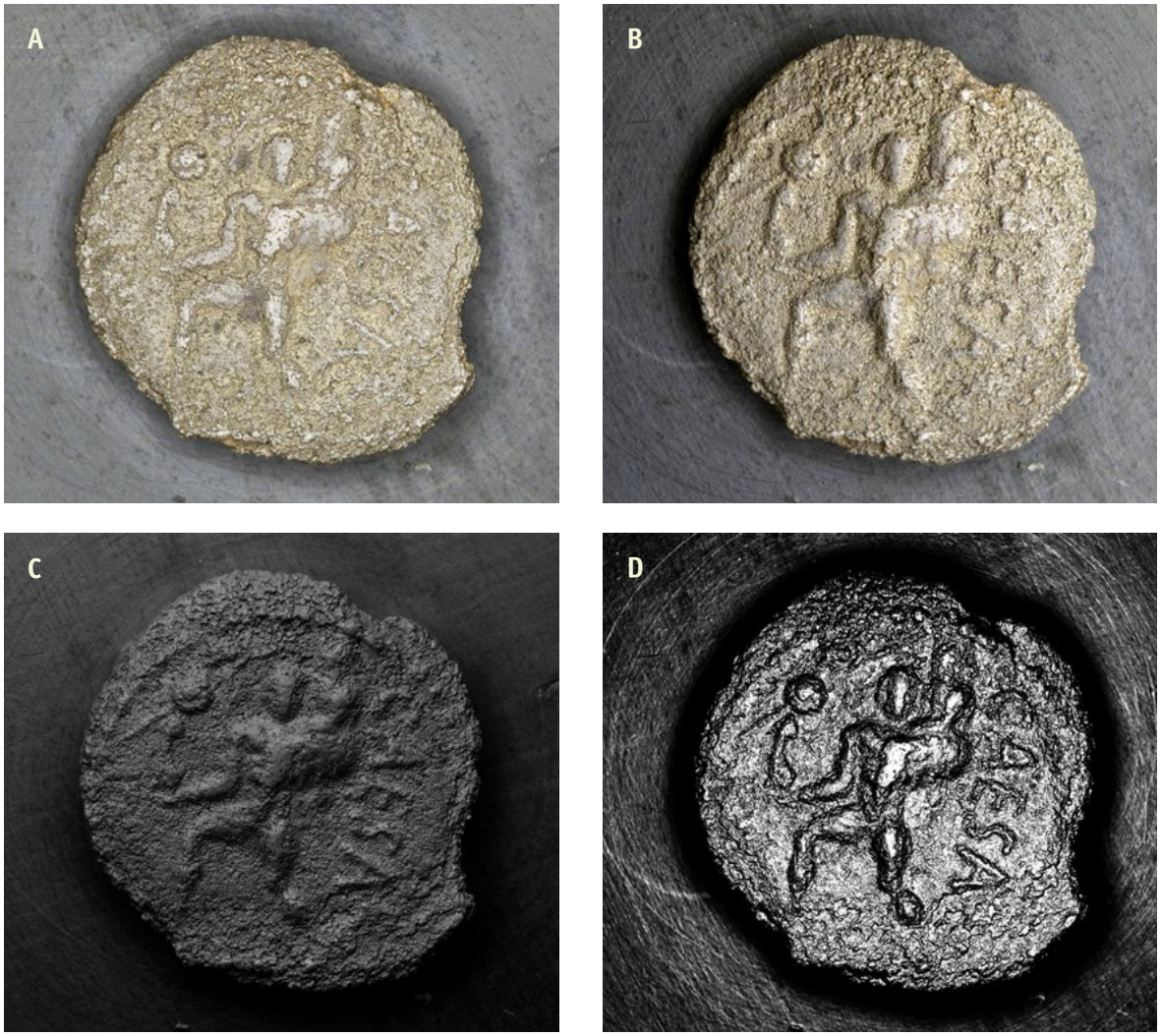

Figure 6. Silver roman imperatorial denarius of Julius Caesar, CAESAR /Aeneas advancing to front, holding Palladium in palm of right hand and carrying father Anchises on left shoulder (Ø 19 mm): digital image (A) and RTI visualization in default (B) and specular enhancement mode (C, D).

a copper alloy coin before, during and after conservation (Figure 9) captures the coin's "museum life", an inseparable part of its biography, or it can be used as means for cleaning monitoring. The copper alloy coin representing Salus standing right, holding out a patera in her left hand to feed a snake held in her right arm (Figure 10) required partial cleaning. RTI visualizations of the coin before cleaning documented the state of conservation while those visualizations executed after cleaning can be used for the evaluation of success of the conservation operation. The relatively smooth surface obtained indicates that no further action was required, neither for preservation, identification or aesthetic reasons.

The conservation process may lead to interesting conclusions about the various aspects of the coin under examination such as its manufacture and use. For example, it is known that surface cracking is strongly connected to minting. According to the bibliography, radial cracking indicates

Figure 7. Silver coin not identified, possibly denarious of the family of Repousias (Ø 17 mm): digital image (A) and RTI visualizations in specular enhancement rendering mode (B, C, D).

Figure 8. Coin (Ø 17 mm): digital image (left) and RTI visualization in specular enhancement mode (right).

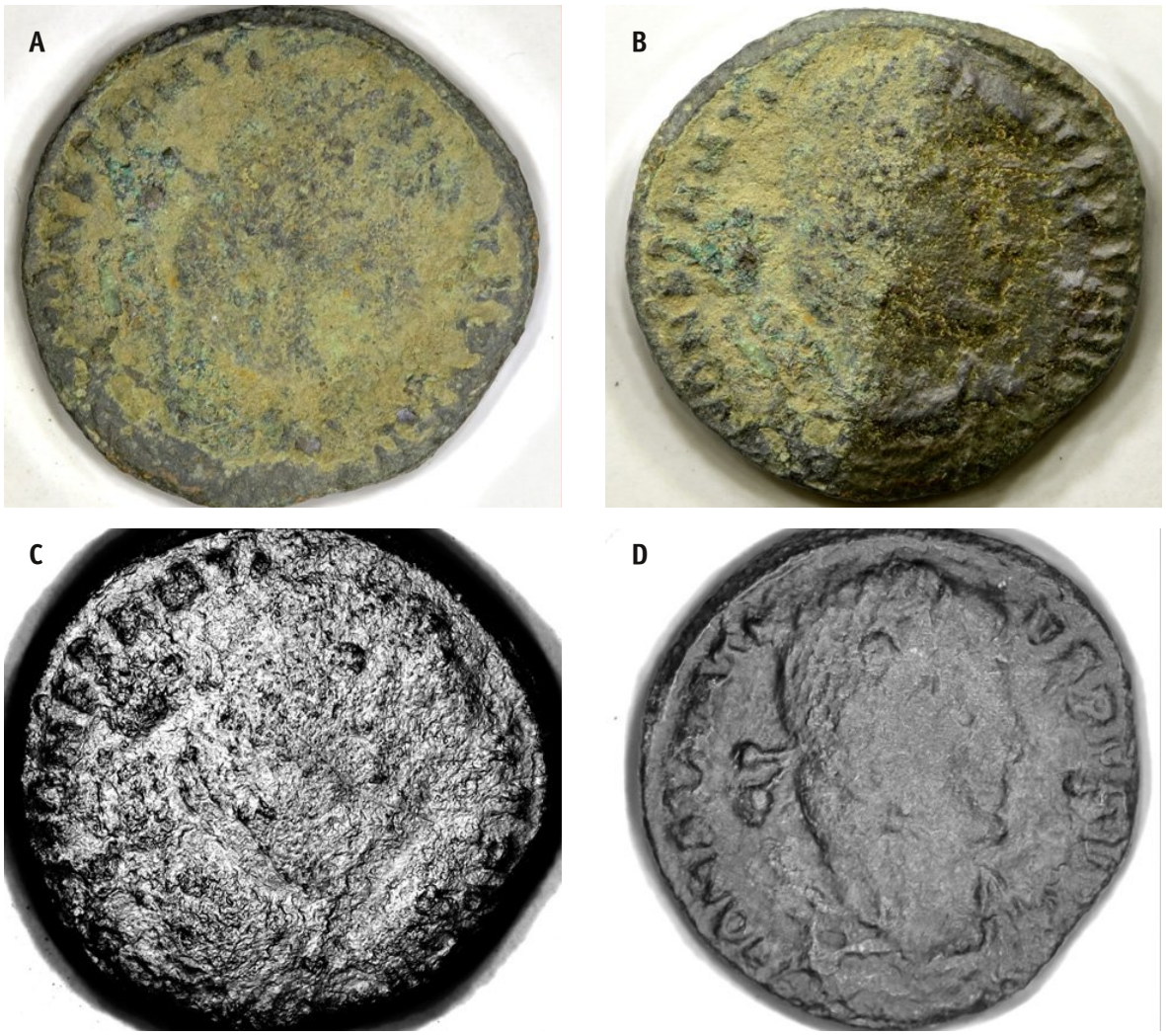

Figure 9. Copper alloy coin, obverse, male bust (Ø 22 mm): digital images before (A) and during (B) conservation and RTI visualizations before (C) and after (D) conservation.

coins hammered to shape, while crack irregularities, such as those on Figure 11, are considered a result of striking [22]. RTI ability to underline surface variations can be helpful to distinguish cracks among other defects, study their form and potentially reach conclusions for coins manufacture.

As far as the protection and the stability of artefacts are concerned, RTI visualization is an action of high respect towards the remnants of the past. It can play a crucial role as a preventive conservation measure as RTI limits the contact with the original material considerably [17]. According to Hoge, minimal handling of coins is recommended since contact with human skin encourages corrosion due to the presence of fatty acids from the skin and humidity from human breath, as well as mishandling, an action which may result in physical damage [23].

RTI Critique

RTI is a powerful technique. It takes digital photography to the next level of analysis. A comparison


A
B
C
D
E
F
G
H

Figure 11. Copper alloy (unidentifiable, Ø 15 mm): digital image (left) and RTI visualization (right).

of the outcomes of RTI and digital photography methodologies demonstrate the impressing capabilities of RTI. No single captured image can demonstrate the characteristic features of archaeological objects, especially coins, such as three-dimensionality and geometric complexity, in addition to the surface topography of deteriorated material. Also, specular enhancement capability of RTI viewers can be compared to specular axial or oblique illumination imaging. Moreover, the ability to change the specular parameters in the viewer enables the enhanced recording and examination. RTI combines successfully raking and specular illumination imaging techniques. Not only has it record surface anomalies, traditionally captured by specular illumination, but also the surface texture, usually documented with RTI. The latter is flexible enough to implement different photographic set ups according to the needs of the photographed object. Consequently, RTI is a more holistic approach than other techniques.

RTI is an affordable technique for documentation, monitoring and examination. The economic cost does not raise a barrier at all because of the standard commercial photographic equipment needed for data acquisition and the free software employed in processing and viewing.

There is no doubt that the time and expertise needed for the execution of RTI is not comparable to traditional techniques such as regular digital photography. RTI data capture and processing is more laborious and time consuming. Although the RTI process is rather simple, familiarising with the technique requires time. Also worth mentioning is that RTI training is not included in the programme of the vast majority of educational institutions as the other photographic techniques (multispectral imaging, raking light etc.), which are well disseminated. However, the time needed for data capture and processing as well as for training is worthy, as RTI encapsulates in a single file the data provided by other imaging methodologies.

Previous page:
Figure 10. Copper alloy coin, SALUSAVGG/ Salus standing right, holding out a patera in her left hand to feed a snake held in her right (Ø 22 mm): digital image before (A) and after (B) treatment, and RTI visualizations before (C, D, E) and after (F, G, H) treatment.

RTI visualisations of artefacts can be furthered processed making use of the various rendering modes available within the viewers' software. The result of such processing may be visualizations that present features different to the common digital images. Although this phenomenon is the power of the technique it does not come without its limitations. It is recommended for RTI users to address critically features which appear strange based on previous knowledge about artefacts, materials' optical properties, damage or alteration. The interpretation of such features requires special attention and, if possible, implementation of other techniques to avoid misleading conclusions about the artefact under examination. It is obvious that the wise use of the technique is an imperative need.

There are no restrictions in the manipulation of RTI files and every user can make its own discoveries, exploring the various components of artefacts. The crucial point in the whole process is to keep metadata for the visualizations produced by the software, including the *ptm and *rti general files and the single renderings (snapshots) from each lighting condition under each rendering mode employed. This approach is the logical and sophisticated manner of experiencing RTIs. If the metadata process is overlooked, the visualised digital artefact will display neither a useful nor a trustworthy version of the original, with limited research potential for the scientific community.

Conclusions

The results indicated that RTI not only assists coin identification but also enables advanced conservation documentation and monitoring of cleaning operations. Moreover, RTI's use in the field of preventive conservation, as well as its significance for providing access to cultural heritage collections is advantageous, in particular in the case of coins, regarding problems of small size and low relief detail.

Thanks to the recent developments of RTI technology, the application of such an advanced digital technique is not restricted to major museums and research institutions but can be part of the everyday mainstream conservation activities. It is obviously of great importance for the conservators to be aware of the potential advantages and limitations of new technological developments.

Considering the above, the conservation community can take advantage of the new possibilities for enhanced coins identification, examination and documentation. In the future computer vision and other computational photography techniques, such as algorithmic rendering, will provide even more powerful techniques for lab recording.

Questions arise whether the development of new digital tools may affect our attitude towards remedial conservation. In this sense preventive conservation measures would assure the safeguarding of material integrity, while coins visualised in *ptm and *rti form would provide an easily accessible and legible digital analogue.

Acknowledgments

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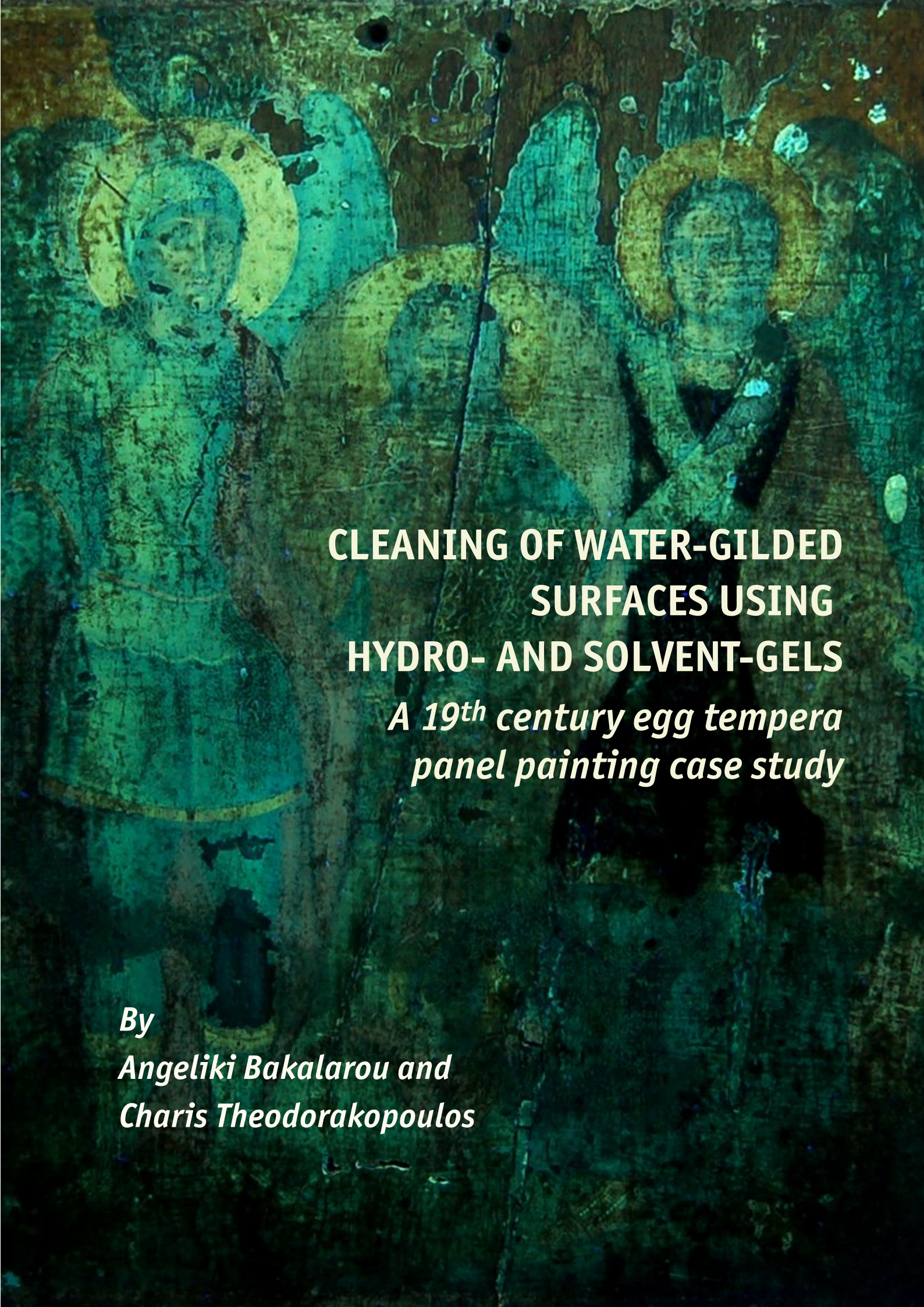

CLEANING OF WATER-GILDED SURFACES USING HYDRO- AND SOLVENT-GELS

A 19th century egg tempera panel painting case study

By
Angeliki Bakalarou and
Charis Theodorakopoulos

This paper describes the implementation of three customized gels on a 19th century panel painting for the removal of its degraded natural resin varnish from a water-gilded surface and a complex solvent-sensitive stratigraphic construction over the gilded substrate. At first, the varnish was unsoiled with a typical hydrogel that was composed of an aqueous phase buffered at pH 5.5 with sodium acetate, poly(ethylene glycol) p-(1,1,3,3-tetramethylbutyl)-phenyl ether surfactant and hydroxy-prorylmethyl cellulose. The removal of the entire aged varnish was facilitated with a microemulsion of an aqueous phase buffered at pH 8.5 with triethanolaminate, a fatty phase of a mineral spirit - benzyl alcohol solution and a polyoxy-ethylene(23)lauryl ether surfactant, altogether incorporated in a viscous gel generated from the dissolution of a polyacrylic acid in poly(oxy-1,2-ethanediyl) cocoalkylamine surfactant. The third gel, which was based on a polyacrylic acid of higher viscosity and incorporating a microemulsion of the same aqueous phase (pH 8.5) as in the second gel, and a fatty phase made of benzyl alcohol and a polyoxyethylene(23)lauryl ether surfactant, enabled the selective removal of the degraded varnish over the elaborate gilded area with a composite stratigraphy over the golden leaf. Fourier transform infrared spectroscopy and UV fluorescence imaging were employed for the analysis of the aged varnish and the monitoring of the cleaning procedure, respectively. The conservation procedure determined the effectiveness of the customized gels employed for this special implementation. The fine preservation of the water-gildings and of the complex solvent-sensitive stratigraphic construction of the painted surface was a satisfactory outcome.

Introduction

Interaction with the environment normally leads to aging and decay of the materials constituting diverse surfaces, including coatings and paints of cultural heritage masterpieces. Aging leads to discoloration of coatings, which sometimes may utterly obscure owing to deposition of soils and pollutants [1-3]. Therefore, when aged coatings begin to have a destructive impact on the appearance and the surface chemistry of an artwork, they should be removed. Removal of aged coatings may be realized upon dissolution in organic solvent blends [4,5] and/or micellar solutions [6] that should keep abuse of the underlying paints, such as swelling and leaching of volatile components from binding media, to a minimum degree [4,7-9]. In case permeation of the liquid solvents is not efficiently controlled the physical integrity of the painted surface is seriously compromised [7-9]. However, the depthwise gradients in polymerization, condensation, oxidation and consequently in the formation of insoluble matter and in polarity of aged varnishes [10-12], which are directly associated with corresponding gradients in dissolution properties [13], impede the control of liquids on varnished paints. In particular, liquid diffusion into the bulk of aged varnishes cannot be terminated once the upper and most degraded varnish layers are dissolved [13], thereby fostering permeation of the cleaning agents in the interface with the varnish substrate. Thus, cleaning procedures become precarious in case of chemical similarity of coatings and diverse components in the underlying layers.

In the presence of gilded layers, permeation of liquids during the removal of aged coatings may deteriorate both the composition of the metal alloy leafs of the gilding and the adhesives that keep the latter in place [14]. In traditional paintings, murals and icons, gilding is typically applied on a substrate, made of a mixture of hydrated aluminium silicate with various organic

sediments and iron oxides (bolo), water and egg white [15, 16]. Upon construction, this special insulating layer prevents the original ground from absorbing the adhesive of the gilding. The adhesive for joining thin metal alloy leafs with such priming layers can be either hydrophilic, made of water gelatin or natural distillation spirits, such as the polysaccharide rich 'raki' [15-17], or hydrophobic, such as linseed oil that has been treated with a siccative, traditionally lead acetate (sugar of lead) [18]. According to traditional treatises, the use of hydrophilic adhesives was typical for the gilding of original Byzantine and Post-Byzantine panel paintings [17, 19, 20]. Depending on the water or oil gilding substrates, permeation of polar or hydrocarbon liquid solutions respectively should have devastating effects given that these solvents will react with the gilding adhesive.

The use of gellants into the cleaning solutions reduces permeation into the underlying layers since all liquids are confined onto the targeted layer. The active solution within the gel network is gradually released over the surface, reducing thus the risk of swelling of the paint [21] and/or dissolution of the gilding adhesive. In addition, gels are quite versatile, provided that a great variety of aqueous solutions and/or non-polar solvents [22], microemulsions, as well as highly selective cleaning agents, such as chelators and enzymes [6, 18] can be incorporated. The increased viscosity of the gel reduces bulk diffusion of solubilized molecules within the gel liquid, while slowing the kinetics of solubilization [21]. This particular characteristic may facilitate the selective removal of a coating from a chemically similar substrate, which may be another coating, resinous paint, diverse paint media and/or gilding adhesives.

This paper presents the removal of a degraded varnish from the painted surface of a 19th century

Figure 1. The 19th century panel painting "Assembly of Archangel Michael" as received in the conservation studio. The varnish was aged and discolored and soiling deposits were scattered accross the surface of the artwork.

egg-tempera panel painting "Assembly of Archangel Michael" (Figure 1) with diverse means performed in the framework of a diploma dissertation at the Conservation Department of the Technological Educational Institute of Athens, Greece [23]. The painting, which belongs to a private collection, was a post-Byzantine icon made in egg tempera with water-gildings and a thick mastic varnish and was a subject of study, documentation and conservation treatments, from which cleaning was just a part. Cleaning of the painted surface followed an elaborate conservation treatment of the wooden panel and diverse implementations of adhesion and consolidation [23].

The painting was coated with an aged, discolored and soiled varnish, contributing to the overall obscurity of the underlying painted and gilded

surface. Moreover, there were surface scratches and losses that were in particular concentrated over the upper part of the painting. The discoloration and obscurity effects on the appearance of the underlying paint and gilding, the poor preservation state and the apparent chemical and physical damages of the varnish led to the decision to remove both the soiling and the aged varnish. Initially, the varnish over the largest part of the painting, in particular over the paints, was dissolved in organic solvents.

The cleaning procedure of the varnish over the gilded areas was implemented with customized gels. In the beginning, a hydrogel was employed to remove the soiling material from the varnish surface and a second gel to actually remove the varnish from the gilded substrate. A particular part of the gilded area with successive vulnerable layers of translucent paint and transverse brushstrokes was potentially susceptible to the cleaning agents in the former gel. Therefore, solvent-gels were synthesized with the intention of removing the degraded resin layers at the surface of the varnish and, at the same time, to protect the composite stratigraphy over the gilded substrate. Prior to the cleaning procedure, the varnish was analyzed using Fourier Transform Infrared Spectroscopy. UV fluorescence was employed to monitor the cleaning procedure.

Materials and Methods

Solvent Cleaning

The aged varnish over the painted surfaces of the painting was removed using organic solvents. At first, successive cleaning tests were performed using the following solvents and solutions: (a) low aromatic white spirit (MERCK); (b) acetone (99,5% pure, MERCK); (c) ethanol (MERCK); (d) ethanol-white spirit 1:1 solution; and (e) benzyl alcohol (puriss, Riedel-de Haën)-white spirit 1:3 solution. As shown in Figures 2 and 3, the ethanol-white spirit 1:1 blend (d) and the benzyl alcohol-white spirit 1:3 solution (e) had the best result in that they removed the coating and had the minimum visually assessed effect on the underlying paint. For the final solvent cleaning procedure, the ethanol-white spirit 1:1 solution (d) was employed to remove the aged coating from selected areas of the painted surface.

Gel Cleaning

For the comparative cleaning study of the sensitive gilded areas of the painted surface three customized gels were synthesized using the following materials: deionized water, low aromatic white spirit, benzyl alcohol, sodium hydroxide (NaOH) 1N, poly(ethylene glycol) p-(1,1,3,3-tetramethylbutyl)-phenyl ether (Triton X-100), hydroxyproryl methyl cellulose (HPMC), glacial acetic acid (CH_3COOH), triethanolamine (TEA), hydrochloric acid (HCl) 1N, a polyacrylic acid (PAA) with 416 acrylic monomers (Carbopol 934), poly(oxy-1,2-ethanediyl) cocoalkylamine (Ethomeen C/25) and polyoxyethylene(23)lauryl ether (Brij 35). All the materials were supplied by Acros Organics except for sodium hydroxide, supplied by MERCK. The materials were weighted with an OHAUS Scout Pro SPU202 analytical scale and the solutions were stirred at room temperature with a VELP SCIENTIFICA ARE Heating Magnetic Stirrer. The pH of buffer solutions was measured with a XENON portable PH 122E pH-meter.

Gel A was a hydrogel composed of an aqueous phase, Triton X-100 and HPMC (95.60% v/v, 0.57% v/v and 3.83% w/v respectively in a solution of 100 ml). The aqueous phase was glacial CH_3COOH in deionized water (0.50% v/v), which was buffered to pH 5.5 with the dropwise addition of 1N

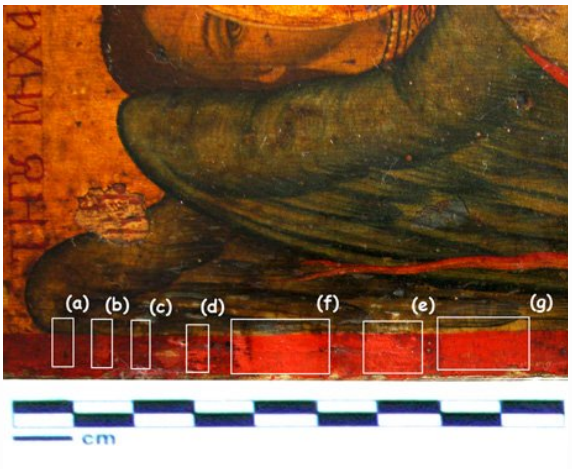

Figure 2. The dissolution tests employed at the surface of the painting indicate that solution (d) (ethyl alcohol-white spirit 1:1) was able to remove the coating with minimal effects on the underlying paint. This solution was employed to remove the aged coating from selected areas of the painted surface. The areas marked (f) and (g) are the dissolution tests for gels B and C, respectively.

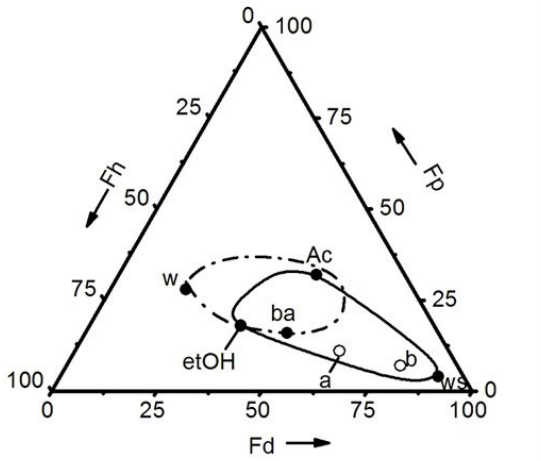

Figure 3. The ternary Teas solubility plot showing all the tested solvents (●): acetone (Ac), benzyl alcohol (ba), white spirit (ws), ethanol (etOH), distilled water (w), and the solutions (○): (a) etOH-ws 1:1, (b) ba-ws (1:3), with the solubilization limits of both resin mastic (--) and proteinaceous materials (-·-), including egg yolk and polysaccharides [34]. The graph indicates that neither of the solutions would affect the water gilding of the panel painting.

NaOH solution. Gel A was employed to remove the soiling material from the surface of the coating. After use, rinsing was performed with the buffer solution.

Gel B was based on a microemulsion that was synthesized of an aqueous phase, a viscous PAA gel and a fatty phase (1.4%, 70.6% and 28.0% v/v, respectively in a solution of 50 ml). The aqueous phase was TEA in deionized water (3.33% v/v), which was buffered to pH 8.5 with the dropwise addition of 1N HCl solution. The PAA gel was a mixture of Carbopol 934 in Ethomeen C/25 (5.0% w/v), deionized water and white spirit (17.8%, 10.7% and 71.5% v/v respectively). The fatty phase, which was a 10% w/v blend of Brij 35 in a white spirit - benzyl alcohol 3:1 solution, and the aqueous phase were vigorously shaken together until complete homogeneity. The solution was left to calm and form two separate phases. The upper phase was collected and added to the viscous PAA gel to form gel B.

Gel C was another solvent-gel based on a microemulsion that was composed of the same aqueous phase and the same viscous PAA gel as in gel B and an altered fatty phase, which was 20% w/v Brij 35 in benzyl alcohol, (1.6%, 82.0% and 16.4% v/v, respectively in a solution of 50 ml). These components were brought into homogeneity by first mixing both the aqueous and fatty phases before the addition of the PAA gel. Solvent-gels B and C were employed to remove the aged coating from the gilded areas of the painted surface. All gels were applied to the painted surface using a 00 brush. They were allowed to remain for a few seconds (5-10 sec) and removed from the surface using a dry cotton swab. Clearing of the surface after implementation of gels B and C was performed using low aromatic white spirit as suggested elsewhere [6].

Fourier Transform Infrared Spectroscopy

The absorption infrared spectrum of the coating of the panel painting was recorded with a Perkin

Elmer Spectrum GX Fourier Transform Infrared (FTIR) spectroscopy system. A small sample of the coating was taken with the aid of a scalpel blade. The sample was then mixed (c. 10% w/w) with potassium bromide (KBr) and pulverized in an agate mortar. The powdered sample was accordingly inserted in a standard cylinder die system (SpecAc) and pressed (SpecAc pressing apparatus) with 10 tons/cm^2 for approximately 60 seconds into a KBr disc. The spectra were obtained in the transmission mode within the mid-IR range (4000-400 cm^{-1}) after 20 scans at a resolution of 4 cm^{-1}. Spectral analysis was carried out using the Spectrum software package by Perkin-Elmer.

UV Fluorescence Imaging

The surface was examined with a Waldmann W Diagnosis Light TypHLL 264 device equipped with two ultraviolet fluorescent lamps (Philips TL 4W/08 F4T5/BLB), emitting between 315-408 nm (peak at 368 nm). The surface was photographed with a digital Nikon D50 camera, with 6.24 Megapixels analysis (6.1 effective Megapixels) and 18-55 mm normal type lens AF-SDX Nikkor 18-55 mm f/3.5-5.6 GEDII (Ø 52 mm). A circular polarizer Cinko (Cinko Circular Polarizing Filter) and a UV Kodak Wratten 2E (75 mm) filter were employed to cut off reflectance and the corresponding UV wavelengths, respectively. The camera was adjusted with the following parameters: f/5.6 aperture, 25 seconds shutter speed and 100 ISO sensor sensitivity. The camera was fitted on a tripod in order to keep the lens parallel to the painted surface during the shooting procedure.

Figure 4. UV fluorescent image of the coated surface showed a green-yellow emission that indicated the presence of an aged natural resin varnish. The non-fluorescent dark areas and back spots indicated the presence of soiling depositions.

Results

Under UV fluorescent irradiation, the varnish of the painting had a green-yellow emission (Figure 4), indicating the presence of an aged natural resin film on the surface of the painting [24]. FTIR analysis (Figure 5) confirmed the presence of aged resin mastic as the main component of the varnish [25, 26]. The evident intense absorbance around 1710 cm^{-1}, where the C=O carbonyl stretching vibration of aldehydes, ketones, and carboxylic acids of the triterpenoid molecules is detected, demonstrated the rather advanced oxidation state of the varnish. In addition, UV fluorescence provided evidence for the presence of the deposited soils across the surface that blocked the efficient absorbance of the UV light from the underlying varnish and appeared as non-fluorescent dark areas and black spots (Figure 4).

The principal cleaning procedure that was designed to liven up the painted surface was the solvent-based removal of the aged varnish over the painted surface (Figure 6) and the selective removal of

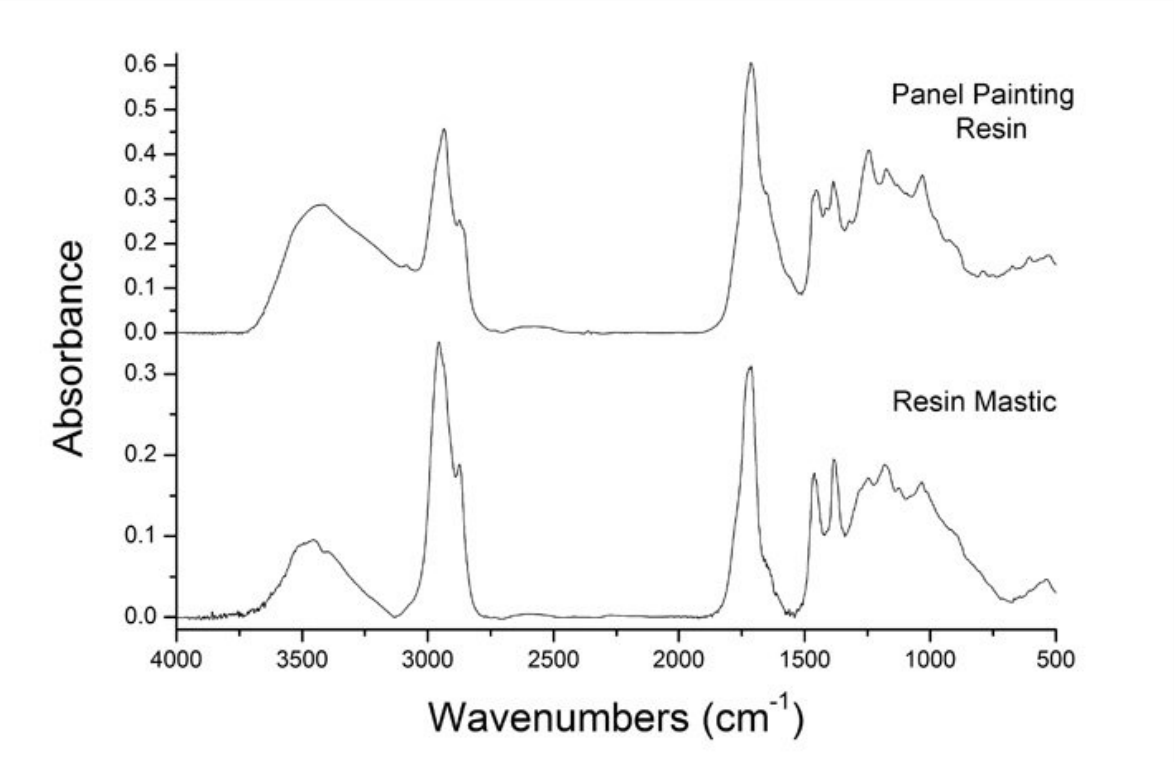

Figure 5. The FTIR absorbance of the varnish of the panel painting compares well with that of resin mastic.

pollutants and varnish using customized gels over the gilded surface. At first, a few dissolution tests were performed using a short list of solvents, which were capable to dissolve resin mastic with negligible or no swelling effects on the underlying paint [26], which according to traditional treatises was expected to be egg tempera [17]. These tests demonstrated that a 50% (v/v) solution of ethanol in mineral spirits was efficient for the cleaning process (Figures 2 and 3). Indeed, the varnish was readily dissolved over the painted surface that was left in a visually-assessed satisfactory preservation state (Figure 7). The same solution was tested for the cleaning of a selected area over the gilded surface at the upper right corner of the painting (Figure 8a). Observation of the former surface showed a general dimness, microcracks, localized detachments and some minute losses of the golden alloy leaf (Figure 8b), possibly due to both partial dissolution of the gilding adhesive and/or stress cracking effects [27].

In conclusion, there was a great risk of deteriorating the painting after solvent cleaning, in particular of the gilded areas. Additionally, some finest and elaborate parts of the surface, such as the area of the clothing of the right figure, depicting Archangel Gabriel, which was constructed using an elaborate stratigraphy over a gilded area, was considered to be quite sensitive for solvent cleaning. Definitely, the fine and translucent paint brushstrokes over the golden leaf were to be preserved. Therefore, varnish removal from the remaining gilded areas was performed with customized gels, which provide advanced selectivity during the cleaning procedure [6].

Gel cleaning of the gilded areas was attempted in two stages, by the synthesis of two types of gels to selectively remove the soiling depositions at first and then the aged varnish respectively. In particular, soiling removal from the surface of the coating was enabled with gel A that was a

Figure 6. The blue-stripped pattern demonstrates the areas of the painted surface where the aged varnish was removed with the ethyl alcohol-white spirit (1:1) solution.

Figure 7. The painted surface after solvent cleaning.

Figure 8. Detail of the gilded area (a) where the ethyl alcohol-white spirit (1:1) solution was tested before cleaning. Solvent cleaning resulted in a general dimness, microcracks, localized detachments and some minute losses of the golden leaf (b).

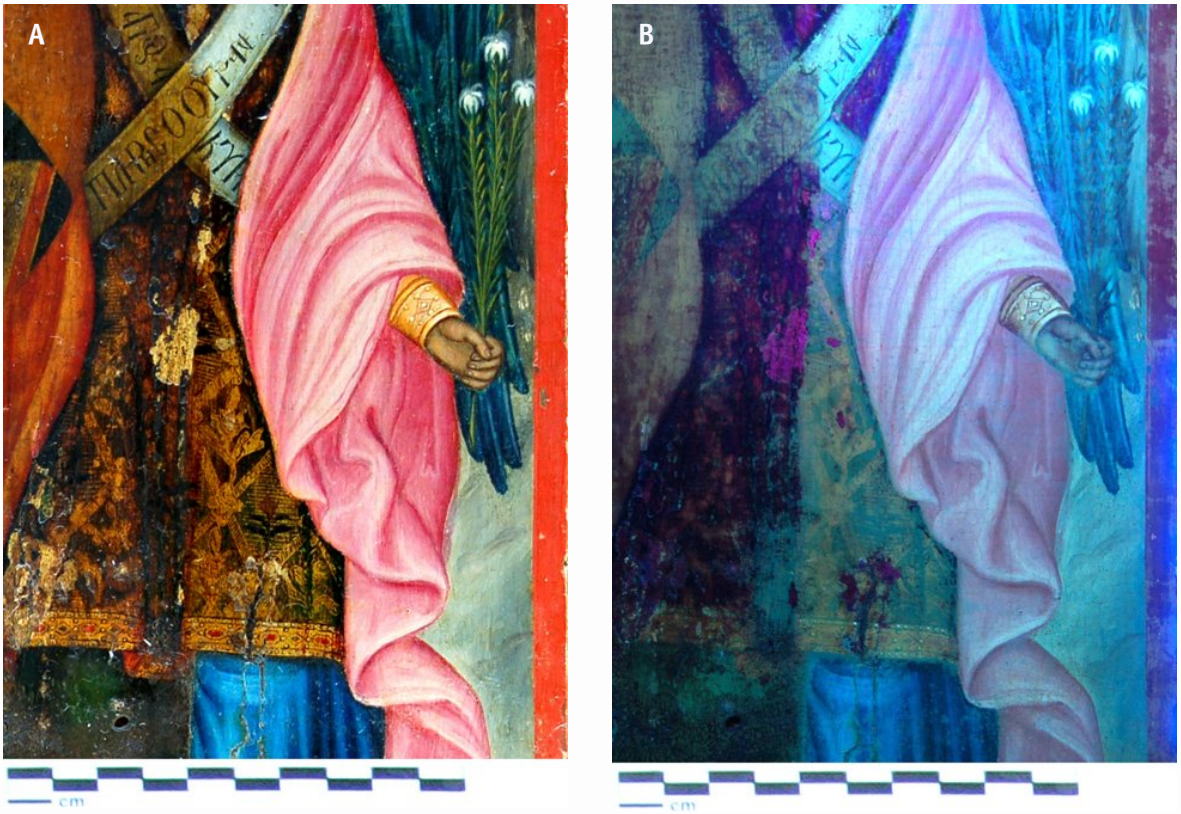

Figure 9. Visible (a) and UV fluorescence (b) images of the gilded part of the clothing of Archangel Gabriel as unsoiling with the HPMC hydrogel (gel A) was in progress. The left part of the gilded surface demonstrates the obscurity problems introduced by the soiled and discolored varnish, while at the right part the improvement of the area appearance is obvious. The successful soiling removal is confirmed by UV fluorescence (b). Note that varnish of the surrounding painted surface was removed earlier with organic solvents.

hydrogel buffered to pH 5.5. This gel enabled the removal of the depositions that obscured both varnish and paint (Figure 9). It is possible that the cleaning procedure might have had some minimal hydrolytic effects on the varnish. Nevertheless, the revealed varnish remained discolored and affected the aesthetical homogeneity between the underlying gilded surface and the cleaned painted surface, which in the largest extent was uncoated after the solvent-based varnish removal.

Therefore, it was decided to selectively remove the aged and discolored varnish over the gilded areas of the painting. A viscous PAA microemulsion solvent-gel (gel B) was employed to minimize diffusion of the cleaning agents into the bulk of the aged varnish [6]. The pH of the aqueous phase of the microemulsion was raised to 8.5 to breakdown via ionization the majority of the oxidized triterpenic acids of the mastic coating [28] and to encapsulate the varnish fragments into micelles [6, 18]. As shown in Figure 2, gel B (test area f) did not have the expected selectivity and entirely removed the aged varnish. Possibly, implementation of the rather low-selective gel B on the finest and elaborate gilded parts at the clothing of Archangel Gabriel would have had devastating effects.

Therefore, a more viscous and more polar PAA microemulsion solvent-gel (gel C) was composed. As demonstrated in Figures 2 (test area g), 10 and 11, gel C removed the surface layers of the

Figure 10. Detail of a selected gilded area during the partial removal of the varnish layer: a) implementation of the highly viscous PAA solvent-gel (gel C) on the area; b) the same area after cleaning with gel C.

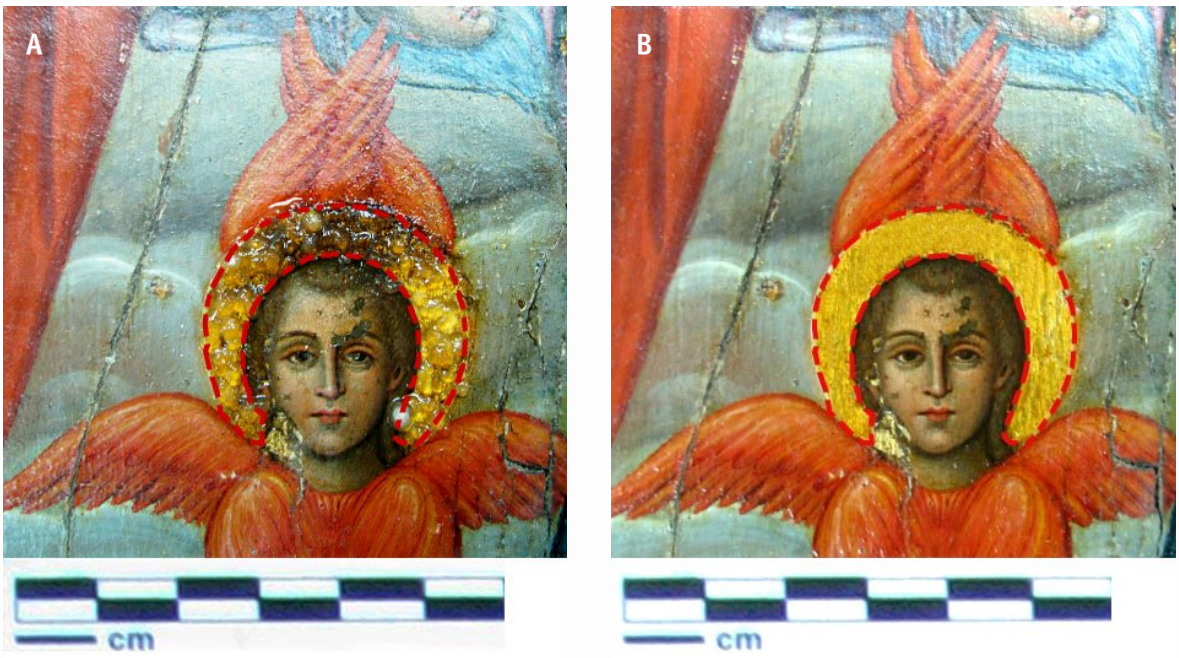

Figure 11. Detail of a selected gilded area during the partial removal of the varnish layer: a) implementation of the highly viscous PAA solvent-gel (gel C) on the area; b) the same area after cleaning with gel C.

Figure 12. Detail of the gilded part of the clothing of Archangel Gabriel after cleaning with gel C. Although there are no substantial changes captured in comparison with the same painted gildings after unsoiling with gel A (see Figure 9), the particular elaborate area appears brighter. Note that the varnish of the surrounding painted surface was removed earlier with organic solvents.

varnish successfully. This was quite obvious during the process, as the removed resin entities from the surface were yellowish. The cleaning result of the particular elaborate gilded area of the clothing of Archangel Gabriel is indicative of this observation, given that all layers above the gilding and below the aged varnish were efficiently preserved and the area appeared cleaner after gel implementation (Figures 12 and 13). Unfortunately, photographs did not capture substantial changes of the visual appearance in particular of the painted gildings, in comparison with the previous stage (after unsoiling), because both the aged varnish and the gilded surface were yellow.

Discussion

This document is an account of traditional and modern cleaning procedures employed on a typical 19th century hagiographic panel painting. The soiling material was removed from the varnish surface using custom-made gels. Solvents and gels were then employed to remove the aged varnish from the painting. Aiming at the optimum selectivity, the cleaning procedure was designed to remove the soiling material first and the aged varnish in a following step. This strategy would reduce precipitation of the hard soiling particulates onto the painted and gilded surfaces. Accordingly, the possibility of mechanical wear of the artwork surfaces due to creeping of and friction with the soils was eliminated.

The soiling material was removed from the varnish surface using an HPMC hydrogel (gel A) that contained an acetic acid/sodium acetate buffer (pH 5.5) and a non-ionic surfactant Triton X-100 (Figure 9). Similar hydrogels that have been employed to remove soils from varnish and paint surfaces are discussed elsewhere [6, 21, 22, 25, 29, 30]. HMPC increases the viscosity of aqueous solutions and converts them into hydrogels. In this case, the aqueous solution intended to ionize the polar groups of the triterpenic carboxyl acids in the aged mastic resin [4], leading to swelling of the cross-linked, condensed and polymerized network of the varnish [12]. This procedure facilitates the release of the embedded soiling particulates. Upon oxidative aging, natural resins like mastic form weakly acidic acids that exhibit a negative base-10 logarithm of their dissociation constants (pKas) in an approximate range of 6.5-7.5 [6, 31]. The ionization process of the carboxylic acid group of aged natural resins begins at a pH of a point lower and utterly completes at a pH of a point higher than their pKa values [6]. Thus, the acidity of gel A was adjusted at pH 5.5, which is a

Figure 13. The painting after completion of the cleaning procedures.

point lower than the pKa of most triterpenoid acids in mastic [6, 28]. The surfactant Triton X-100 was added into the solution in order to decrease the surface tension of the water, as well as to act as a detergent factor to the solution. The former property optimized wetting of the varnish surface from the hydrogel, while the latter aided at the encapsulation of the dispersed soils into micelles.

Removal of the aged varnish was carried out using two methods: at first solvent-based removal over the painted surfaces [23] and then gel-based

cleaning over the gilded areas which is discussed below. Typically, significant parts of 19th century Greek-Orthodox hagiographic panel paintings were water gilded, based on traditional treatises of the Byzantine era [15-17]. These treatises recommend adhesion of golden leaves on specially primed surfaces with "raki", which is composed of polysaccharides and promotes an effective although weak adhesion. In order to preserve the adhesion of the golden leaves on the surface, any cleaning agents must not dissolve the polysaccharide-based medium. Polysaccharides are very polar [18] and are therefore susceptible to polar solvents such as alcohols, ketones and water. The ternary Teas solubility plot [32] of polysaccharide supports this observation [33], although the limits of dissolution of such adhesives could be broader than that demonstrated by Horie [34]. As shown in Figure 3, it was expected that working on the gilded surface with a solvent blend of ethanol in white spirit (50% v/v) would be quite safe, but the actual implementation showed that the golden leaf surface was defected (Figure 8). Gel cleaning provided some confidence especially for minimizing the risks of defects in the gilded areas, provided that liquid permeation from the gel is eliminated.

A viscous microemulsion solvent-gel was composed based on the mixture of an aqueous phase (TEA, deionized water, HCl, pH 8.5), a viscous PAA gel (Carbopol 934 in Ethomeen C/25, deionized water and white spirit) and a fatty phase (Brij 35 in a white spirit - benzyl alcohol 1:3 solution) (gel B). The adjustment of the acidity of the solution to pH 8.5, which is at least one unit over the maximum pKa≈7.5 [6, 31] of most oxidized triterpenic acids in natural resins [28], intended the dissociation and encapsulation of the varnish fragments into micelles [6, 18]. The benzyl alcohol - white spirit 1:3 solution used in the fatty phase of gel B showed good results at the preliminary dissolution tests of the aged varnish over the painted surfaces of the painting (Figure 2). Also, benzyl alcohol as a solvent combines both alcohol and aromatic solvent properties and demonstrates a balance in polarity, making it quite effective on dissolving materials that combine both aromatic and hydrogen properties, like natural resins [6-8, 18]. The addition of the non-polar white spirit solvent provided some control of the polarity of the cleaning agents. Based on the Teas solubility diagram (Figure 3), gel B would not affect the gilding because the benzyl alcohol-white spirit 1:3 solution that was enclosed in the fatty phase appears outside the dissolution limits of polysaccharide media [33]. Brij 35, which was used in the fatty phase solution, is a non-ionic surfactant and therefore compatible with the weak polyacrylic acid Carbopol 934 and the weak base Ethomeen C/25, employed to increase the viscosity of the gel. Finally, Brij 35, benzyl alcohol, as well as the Carbopol 934/ Ethomeen C/25 gel are dissolved in white spirit and therefore can be rinsed off the surface [6]. Despite the high concentration of the viscous PAA polymer (70.6% v/v) in gel B, the concentration of the fatty phase (28% v/v), containing the benzyl alcohol-white spirit 1:3 blend, sufficed to unleash the solubility power of the solvent solution and to entirely dissolve the aged varnish (Figure 2). This is normally an acceptable result because of the exceptional cleaning efficiency but not for this particular case where sensitive fine and translucent paint layers over the water gilded surface were to be protected. For this case, the intention was to partially remove the aged varnish and hence an even more viscous solvent-gel (gel C) was synthesized.

Gel C was based on a microemulsion gel that was composed of the same aqueous phase and the same viscous PAA gel as in gel B and a different fatty phase (Brij 35 in benzyl alcohol). Gel C had two important differences in comparison to gel B.

At first, the concentration of the PAA polymer was increased in gel C (82.0% v/v vs 70.6% v/v in gel B), which made it more viscous than gel B and therefore allowed the former to remain longer on the surface of the varnish. Secondly, white spirit was not included into the fatty phase as in gel B. Thus, the microemulsion in gel C had an increased polarity providing a more drastic dissolution of the polar groups at the surface of the aged varnish. Given the aging-induced oxidation and polarity gradients [10-12], both degrees of polarity and oxidation are higher at the surface and reduced at the bulk of the aged coating. Subsequently, it was assumed that the aforementioned properties of gel C would suffice to both restrict diffusion of the limited cleaning agents into the bulk of the aged coating and efficiently dissolve the highly degraded surface layers of the varnish. As demonstrated in Figures 10 to 12, gel C was able to successfully remove the surface layers of the varnish.

A Comment on Gel Residues

Recently, a lot of concern has been expressed with regards to the residues of cleaning gels on painted surfaces [35]. Residues may vary depending on the variety and the concentration of the diverse polymers and cleaning agents employed. In accordance with the materials used for the gel formulations described herein, there are specific warnings on the residues of PAA-Ethomeen gels, which may leave Ethomeen surfactant and polyacrylate fragments heterogeneously distributed across the surface [35]. In case a surface is left uncoated after gel implementation, Ethomeen residues degrade to acetaldehyde and glyoxal by UV-initiated decomposition that in the long ran evaporate, although a lightly cross-linked layer of stable polyacrylates may remain on the surface [35]. These concerns may be compromised by the fact that in the case described herein, the gilded substrate was hydrophilic due to polysaccharide-based adhesive of the golden alloy leaf. This suggests that attraction of water gildings with particular entities such as long hydrocarbon chains of polyacrylates and hydrocarbon tails of surfactants, is minimal compared to that of lipophilic paint media. In addition, highly concentrated gel residues have been observed in areas with relatively high porosity and pronounced surface micro-topography, as is the case of paint [35]. In contrast, gildings, which are smooth and non-porous surfaces, should normally retain fewer residues, in particular at limited areas with microcracks and fissures of the golden leaf. The contribution of such residues as they age on the surface is a matter of future research. Despite these concerns, the selectivity obtained with the implementation of gels must not be overlooked.

Conclusions

The implementation of three customized gels for the cleaning of a 19th century panel painting was described in the present article. After identifying the varnish by FTIR as being mastic, three gels were developed to interact with it. The varnish was first unsoiled with a typical HPMC hydrogel with a non-ionic surfactant Triton X-100 and sodium acetate buffer to regulate acidity at pH 5.5. The removal of the entire aged varnish down to the interface with the gilded surface was facilitated with an Ethomeen (C/25)-PAA (Carbopol 934) solvent-gel that contained a microemulsion of an aqueous phase buffered at pH 8.5 with triethanolaminate and a fatty phase of a mineral spirit - benzyl alcohol solution and Brij 35. A third PAA solvent-gel of a higher viscosity incorporating a microemulsion of the same aqueous phase (pH 8.5), as in the second gel, and a fatty phase made of benzyl alcohol and Brij 35 enabled the selective removal of the upper parts of the degraded varnish

over an elaborate solvent-sensitive gilded area. FTIR spectroscopy and UV fluorescence imaging were employed for the analysis of the aged varnish and the monitoring of the cleaning procedure respectively. The experience gained herein demonstrated that the interaction between the surface layers of a resin varnish and a strong solvent is possible through viscous gels, with minimal risks since diffusion of the solvents through the layers is limited. The effectiveness of the customized gels was demonstrated by the fine preservation state of both paint and gilded surfaces after the cleaning processes. Conservators are advised to pay attention to the case-specific character of the surfaces to be cleaned, in terms of constituent materials and their degradation state. A sound scientific support is highly recommended in order to optimize the interaction of such surfaces with the diverse materials that are employed to synthesize a gel.

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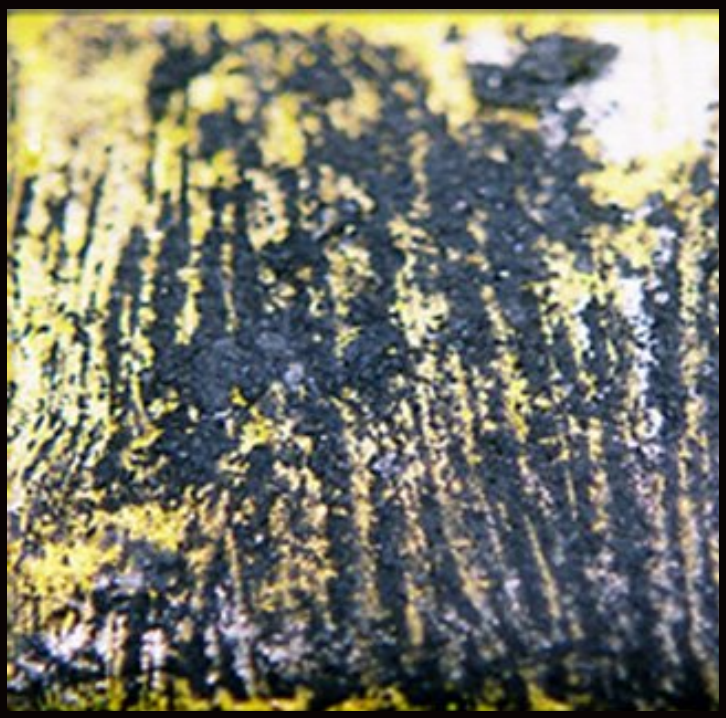

A NEW METHOD FOR CLEANING OIL PAINTINGS USING ZINC OXIDE NANOPARTICLES

By Osama El-Feky and Mohammad Hassan

The cleaning of oil paintings using traditional methods, namely mechanical and chemical cleaning, is a critical process that presents serious risks to the painting such as chemical reactions with the paint and ground layer compounds. These cleaning techniques require a high level of training and experience. A new method for cleaning and removal of stains from oil paintings based on laboratory prepared zinc oxide nanoparticles suspended in distilled water at 0.5% concentration (w/v %) was investigated to overcome the disadvantages of the traditional methods. The nanoparticles suspension can be used for removal of soot, grease, wax, and house fly specks from oil paintings by covering the stains with the suspension and then subjecting it to UV radiation at 365 nm for a certain period of time. The stains can then be easily removed using a cotton swab. This new method allows a high control of the areas to be cleaned with no secondary effects.

Introduction

Traditional oil paintings consist of several layers. Usually, the support was first coated with animal glue to make the surface impermeable and to receive the ground layer. The paint was then applied over the ground layer to form the painting. Oil paint has been the most used paint until the 20th century and it consists of a mixture of organic and/or inorganic pigments and drying oils such as linseed or poppy seed oil. After finishing the painting, varnish was usually applied to protect the surface from environmental conditions and physical damage [1].

With time, different types of dirt accumulate on the paint surface such as soot, grease, wax, and even house fly specks, which exist in many Egyptian museums as a result of improper exhibition and storage methods due to insufficient means. The presence of dirt may lead to degradation of the painting surface as result of the reaction between the dirt and the varnish or paint layer, and it may affect the painting visibility. Thus, cleaning is essential to prevent degradation.

The cleaning of oil paintings includes the removal of all dirt from the paint surface or the complete removal of the varnish layer using mechanical and/or chemical methods, avoiding any damage to the painting. Cleaning is the most risky intervention requiring a high level of training and experience and should only be carried out by experts.

Usually, dust can be easily removed by a soft brush or a piece of cotton although soot, grease, wax, and house fly specks are removed using chemicals after mechanical cleaning. However, chemicals can react with the paint and ground layer compounds resulting in unwanted effects. In addition, when solvents are used, softening or even partial removal of varnish and color layers can occur during cleaning. Therefore, choosing the proper solvent or solvent mixture is very important to avoid any unwanted effect on the surface. In addition, using scalpels or other instruments can also scratch the paint or varnish layers.

To ensure the highest possible level of safety and protection of oil paintings over time, especially during cleaning of colored surfaces, it was felt necessary to develop a new method for their cleaning and for the removal of the strongly-adhered dirt. The new method presented in this work allows safe cleaning and overcomes the drawbacks of conventional methods. The development of

more efficient methodologies by using nanotechnology is considered an important issue in the conservation field because it has many advantages such as easy application, safety and potential low cost.

Nanotechnology is the study of matter on an atomic and molecular scale, dealing with structures of the size of up to 100 nanometers [2]. As a result of their small dimensions, and consequently their large surface area to volume ratio, they possess different properties than its corresponding bulk material which strongly influence their physical, chemical, optical, electronic, magnetic and mechanical properties [3-5]. Recently, nanotechnology has been used in a wide range of applications including medicine, electronics and energy production [2]. The application of nanoparticles in conservation is a relatively new approach but has already been applied with success in several different materials [6].

In this new method, an aqueous suspension of zinc oxide nanoparticles was used to remove soot, grease, wax, and house fly specks from the surface of historical oil paintings. One of the important properties of zinc oxide nanoparticles is their self-cleaning effect on the surfaces they are applied onto in the presence of UV radiation [7, 8]. This phenomenon is explained by the fact that zinc oxide particles, especially as its size decreases, can absorb UV radiation and use that energy to disintegrate the dirt on the surface [9]. In addition, zinc oxide nanoparticles prevent the accumulation of dust or dirt on the surface of different materials by what is known as "lotus effect" [9]. Studies have reported the use of zinc oxide nanoparticles in chemical and physical methods of nanoscale impregnation or coatings for functional applications of protection, barriers, portable energy, sensors, wallpaper and films with antibacterial activity [10, 11]. In addition, zinc oxide nanoparticles are safe to use since they are not toxic to human cells [12, 13].

The new method allows the accurate control of the areas to be cleaned without effects on the rest of the surface. The new method does not require long experience or special training. The method is also safe for the protective varnish layer, either natural or synthetic, for the painting surface, and for the color layer in case of non-varnished oil paintings.

Experimental

Sample Preparation

In order to verify the effectiveness of this method, a series of mock-up samples (2 x 3 cm) were made. They were prepared with linseed oil mixed with lemon yellow (barium chromate, $BaCrO_4$) and painted over cardboard. Two of the samples were varnished with mastic and an acrylic varnish (Paraloid B-66, 20% in toluene). After drying for a year, a control sample was kept apart and the remnant samples were subjected to normal environmental conditions for three months during which large amounts of dirt and house fly specks formed on its surface. Afterwards, soot, grease and wax were added to the painting surface (Figure 1). The samples were divided into five main groups: soot, grease, wax, house fly specks, and combined stains. The last group was also subdivided in combined stains on mastic varnish and combined stains on acrylic varnish.

Aside, an oil painting (35 x 50 cm) was especially prepared. The ground layer, made of calcium carbonate mixed with animal glue, was painted over a canvas support and painted with pigments agglutinated in linseed oil. Soot was later applied to its surface (Figure 2).

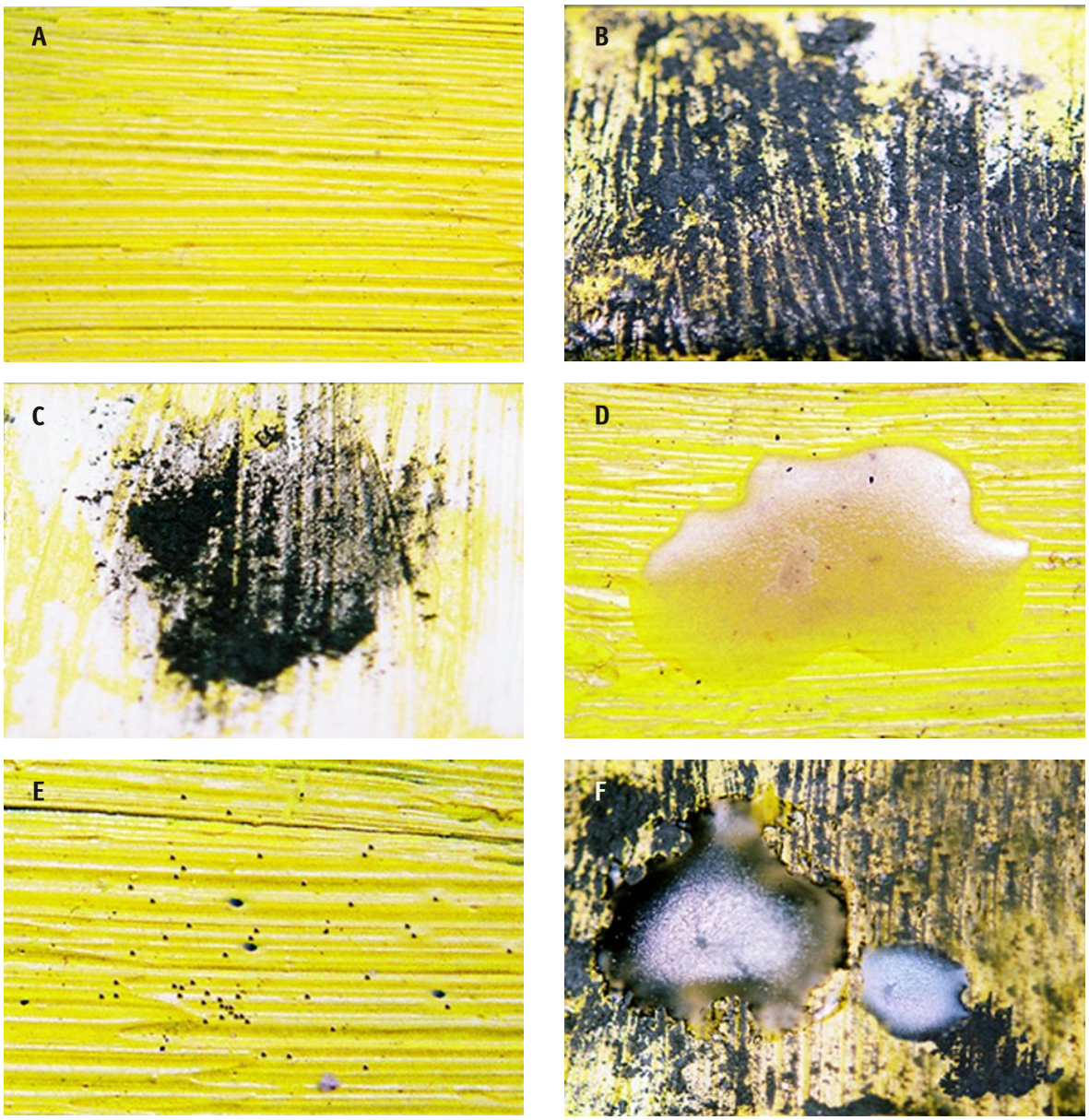

Figure 1. a) Oil painting sample; b) Soot; c) Grease; d) Wax; e) Housefly specks; f) Combined stains.

Preparation of the Nanoparticles Solution

Zinc oxide nanoparticles were prepared in laboratory using sodium sulfide (0.1 N) and zinc chloride (0.1 N) in the presence of polyethyleneimine aqueous solution (2% wt) according to the methodology described by Hassan and Ali [14]. The resulting zinc sulfide nanoparticles were separated by centrifugation several times with changing water and finally dialyzed against water to remove non-reacted chemicals. Then, zinc sulfide was dried at 105° C and thermally treated at 500° C for 4 hours to obtain zinc oxide nanoparticles. The nanoparticles obtained were observed by a transmission electron microscope JEOL 1230 with an acceleration voltage 100 kV (Japan) (Figure 3).

On an earlier stage, several concentrations of zinc oxide nanoparticles were tested at 0.1, 0.3,

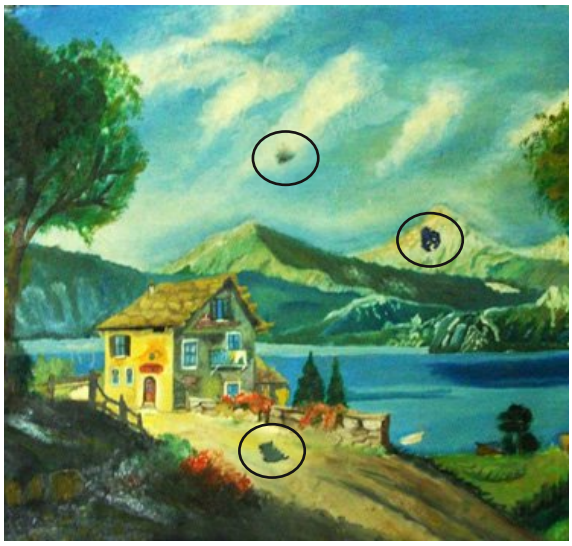

Figure 2. The oil painting model after applying three soot specks on its surface, namely in the central cloud, in the right mountain and in the road.

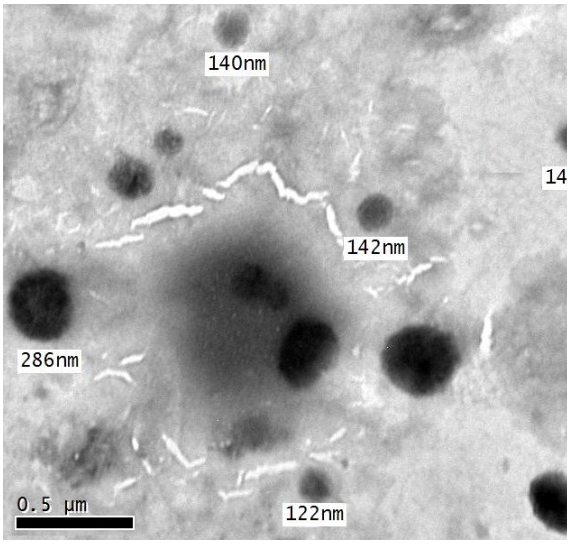

Figure 3. TEM image of the prepared zinc oxide nanoparticles.

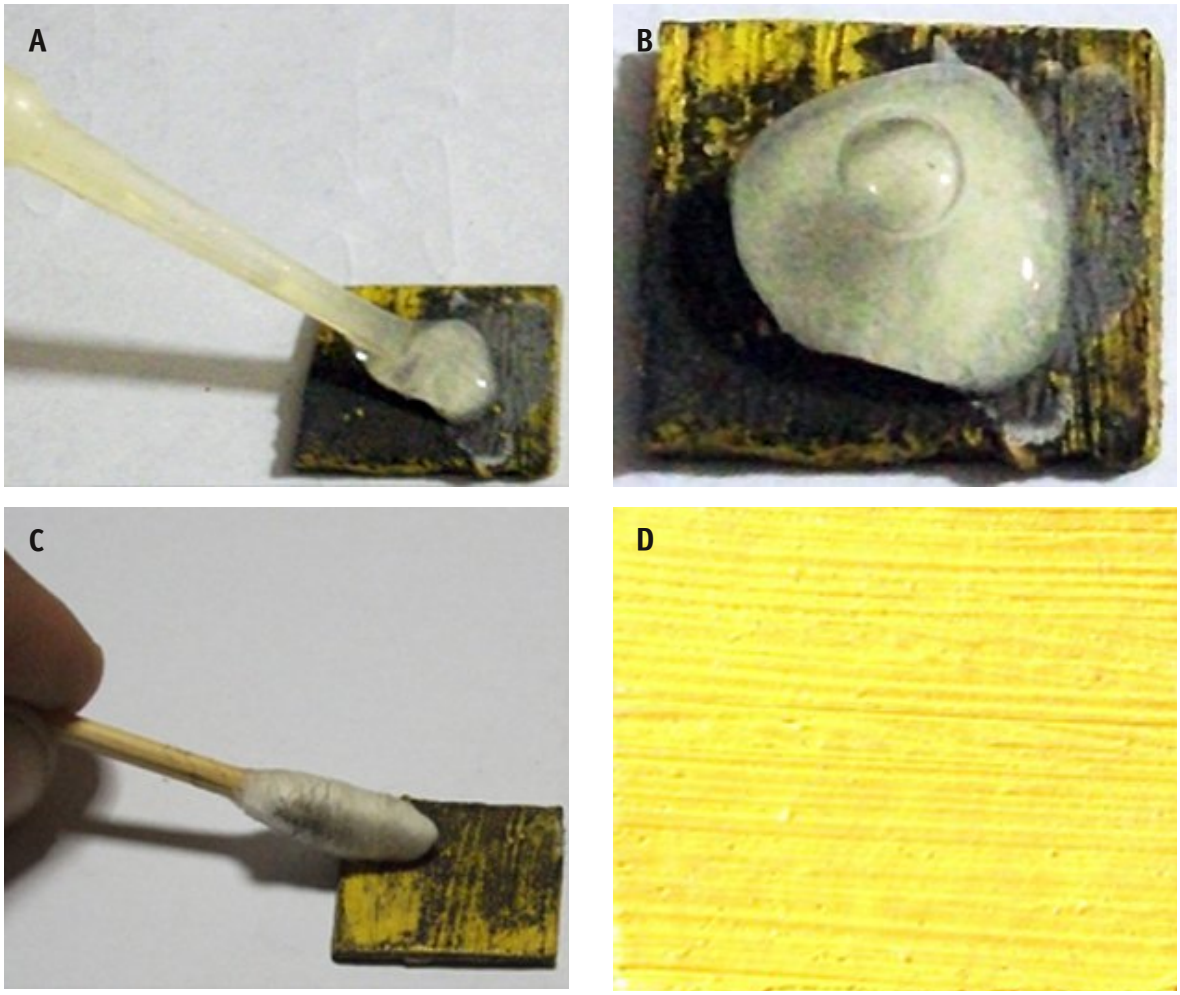

Figure 4. Cleaning of soot speck: a) depositing the zinc oxide solution with a dropper; b) detail of the solution applied to the area; c) cleaning with a cotton swab; d) final aspect of the area after cleaning.

0.5, 0.7 and 1% (w/v %) against pure water. The pure water and the solutions at 0.1% and 0.3% showed no effects whatsoever. The solution at 0.5% showed to have a maximum effect without any secondary effects. On the other hand, the solutions at 0.7% and 1% revealed no increase of cleaning efficiency than that of 0.5%. Therefore, this particular concentration was selected since it was the minimum concentration to have a maximum effect.

To prepare the nanoparticles aqueous suspension, zinc oxide was added to distilled water at 0.5% and the mixture was sonified for five minutes using an ultrasonic processor (Sonix, USA) at 500 Watt power obtaining a stable suspension of zinc oxide nanoparticles in water.

Cleaning with the Nanoparticle Suspension

To clean the surface of oil painting samples from different dirt, the following method was used. The areas of dirt were covered with the aqueous solution containing zinc oxide nanoparticles previously prepared using a syringe or a dropper, which were considered more suitable than brushes in the cleaning of small areas, according to the area of the dirt (Figure 4). For example, a syringe was used in the case of house fly specks while a dropper was used in the case of soot. Then, those particular areas were subjected to UV radiation at 365 nm for 45 to 120 minutes using a UV lamp (Vilber Lourmat VL-6LC) placed at 20 cm distance to accelerate the disintegration process. In a real painting, the other areas can be protected from this radiation during the cleaning intervention.

After the UV exposure, the dirt could be easily removed with a cotton swab. House fly specks could be easily removed using a fine pin since they were no longer strongly adhered to the surface, and finally cleaned with a cotton swab.

In the case of the specially prepared oil painting model, a sheet of white paper was put over the painting and cuts were made in the areas to be cleaned to avoid any adverse effects on the rest of the painting. Drops of zinc oxide solution at 0.5% were applied to the dirty areas and then subjected to UV radiation at 365 nm.

Discussion

In the present work, the removal of dirt and fly specks from the surface of oil painting samples using zinc oxide nanoparticles has been investigated. Upon the application of the zinc oxide nanoparticles solution, UV radiation was applied to those areas. The results of this process are

Table I. Degradation time of dirt from the oil painting models using a ZnO solution at 0.5%.

Dirt Samples	Degradation time (mn)	
	Start	End
House fly specks	25	45
Soot	30	60
Grease	30	90
Mixed dirt	30	120
Wax	100	120

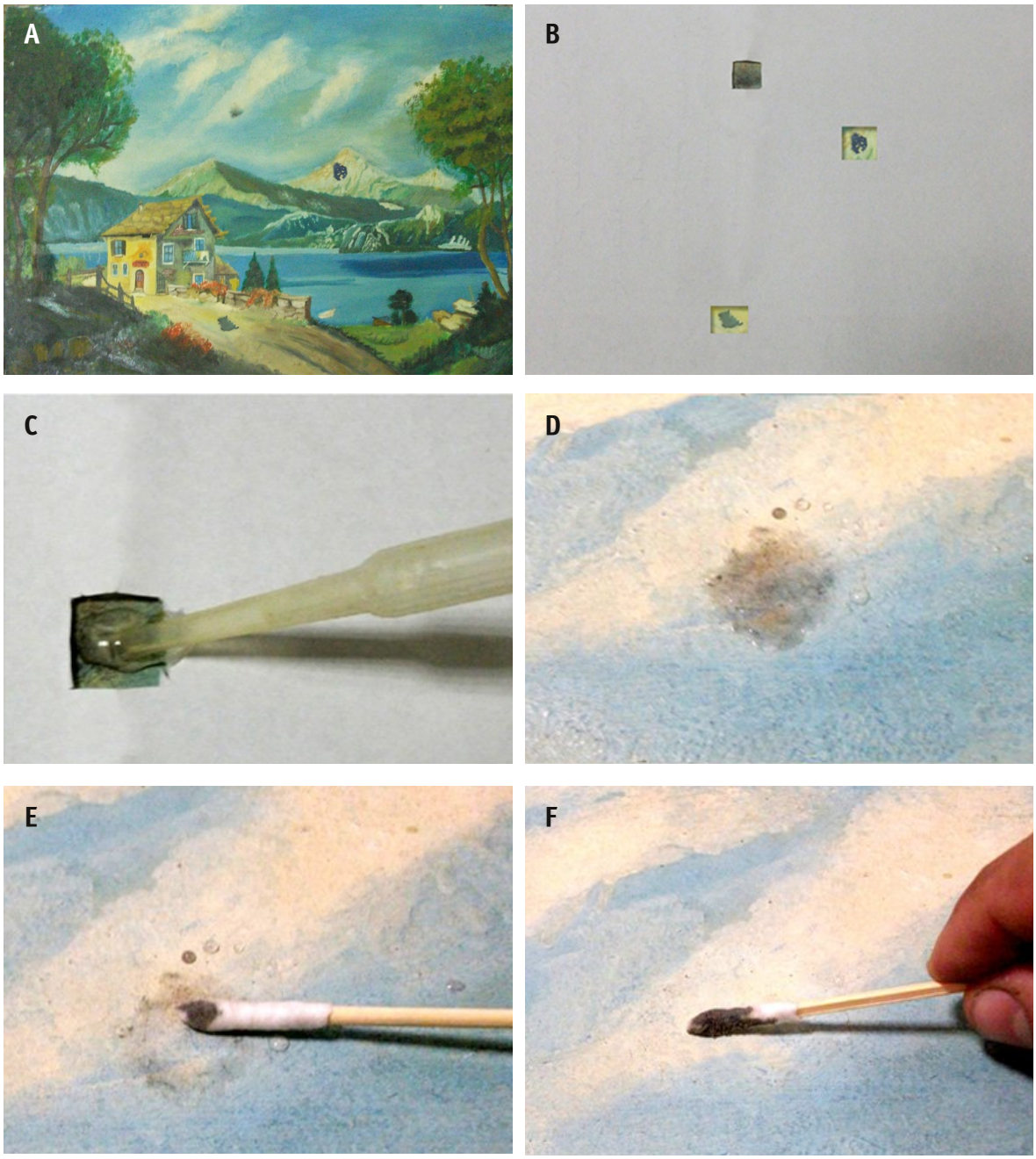

Figure 5. a) Oil painting with soot speck; b) Covering the oil painting with white sheet of paper and cut was made only at the areas of the specks; c) Drops of zinc oxide solution (0.5 % solution) were applied to the specks area then subjected to UV light at 365 nm; d) The specks were started to disintigrade after about 30 minutes and complete disintigrated after 60 minutes; e) The specks could be easily removed by white cotton wool swab; f) Complete cleaning for the specks.

summarized in table I. It was observed that the different types of dirt start to disintegrate after 25-30 minutes of the suspension application, which was also clear visually. However, they were not easy to remove completely and thus the solution was left until the complete removal could be easily performed with a cotton swab. Among the dirt, the most easily degraded were the house fly specks, followed by soot, grease, wax, and mixed dirt, which consisted of a mixture of the previous. Figure 5 illustrates the cleaning procedure of different types of dirt.

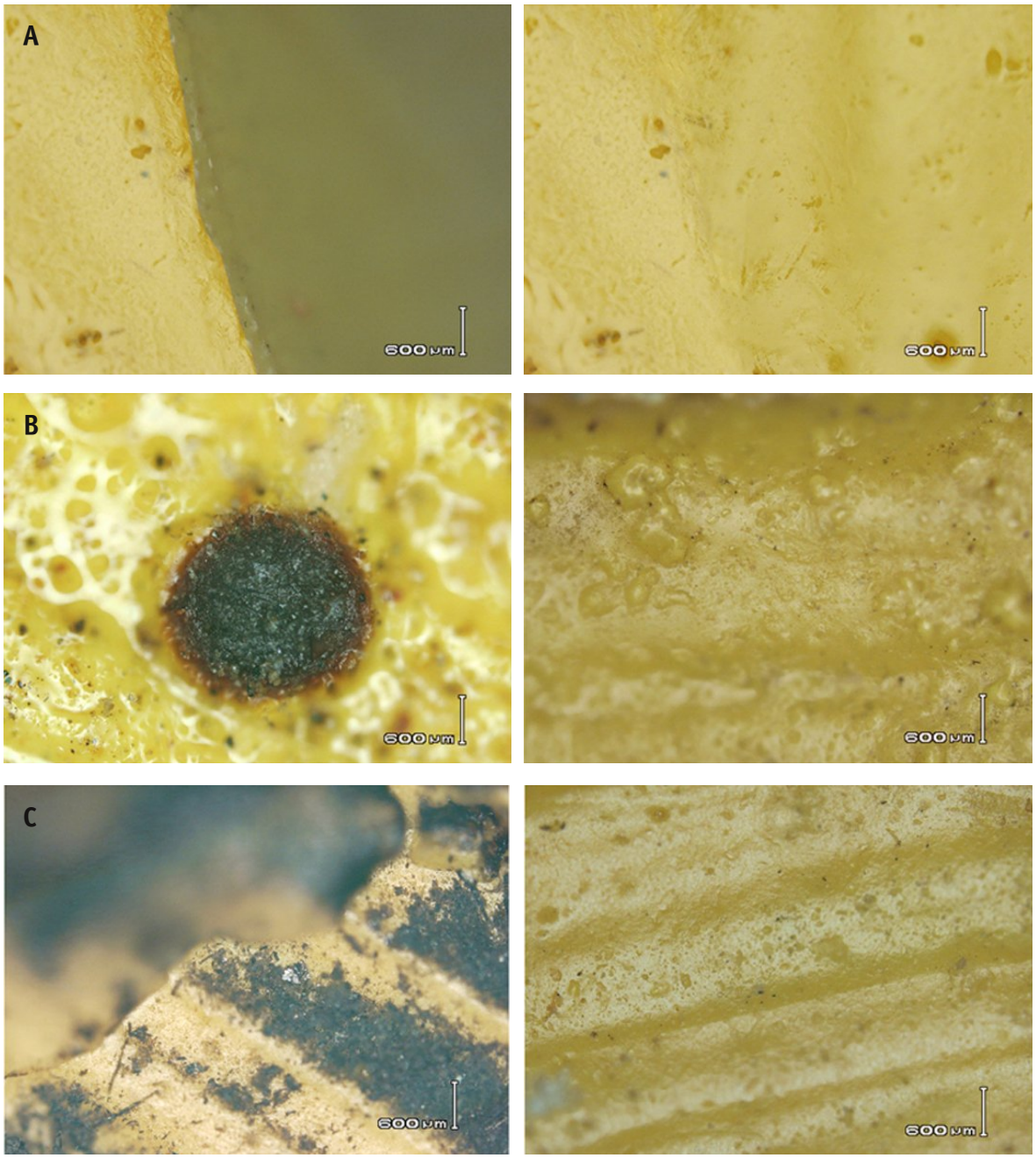

Figure 6. Examples of dirty spots (left column) and the respective cleaned spots (right column): a) wax; b) housefly specks; c) combined stains on Mastic varnish.

In the case of the specially prepared oil painting, the dirt started to disintegrate after about 30 minutes and completely disintegrated after 60 minutes. The dirt was then easily removed with a cotton swab.

Furthermore, to examine the effectiveness of this method on natural and synthetic varnishes, the dirt of two varnished samples with mastic and acrylic varnish was cleaned. Again, the dirt could be easily removed from the surface of both samples without damaging the varnishes. The

photos taken on an optical microscope Olympus BX51 TRF to the surfaces before and after cleaning showed the method effectiveness without noticeable damaging the surface (Figure 6).

Conclusions

A new method for removing different types of dirt (soot, grease, wax, and house fly specks) from the surface of oil paintings was shown. This method consists on the application of an aqueous solution containing 0.5% zinc oxide nanoparticles on several oil painting mockup samples covered with large amounts of dirt (soot, grease, wax, house fly specks and mixed dirt) and then subjecting them to UV radiation at 365 nm for 30 to 120 minutes in order to accelerate the disintegration process. Afterwards, the dirt could be easily removed using a cotton swab. When applying this method, a sheet of white paper should cover the painting areas not to be cleaned to protect them against the UV radiation. The method is simple, easy to apply, and does not cause damage to the colors or varnish layers since it seems to attack specifically the dirt. This method overcomes the disadvantages of the traditional methods such as softening or removal of colors and varnishes, and scratching of the surface. However, further research is required to study more in detail the exact interaction between the materials and the cleaning mechanisms in the paintings as well as its long-term effects. The method can be easily used in the laboratories of conservation and restoration without sophisticated equipment or especially trained personnel.

Note

The method used in this work was presented to the Egyptian Patent Office, a Performance-Based Organization of the Government of the Egypt, and Academy of Scientific Research and Technology, Ministry of High Education and Scientific Research under the No. 281/2011 in 21th February 2011.

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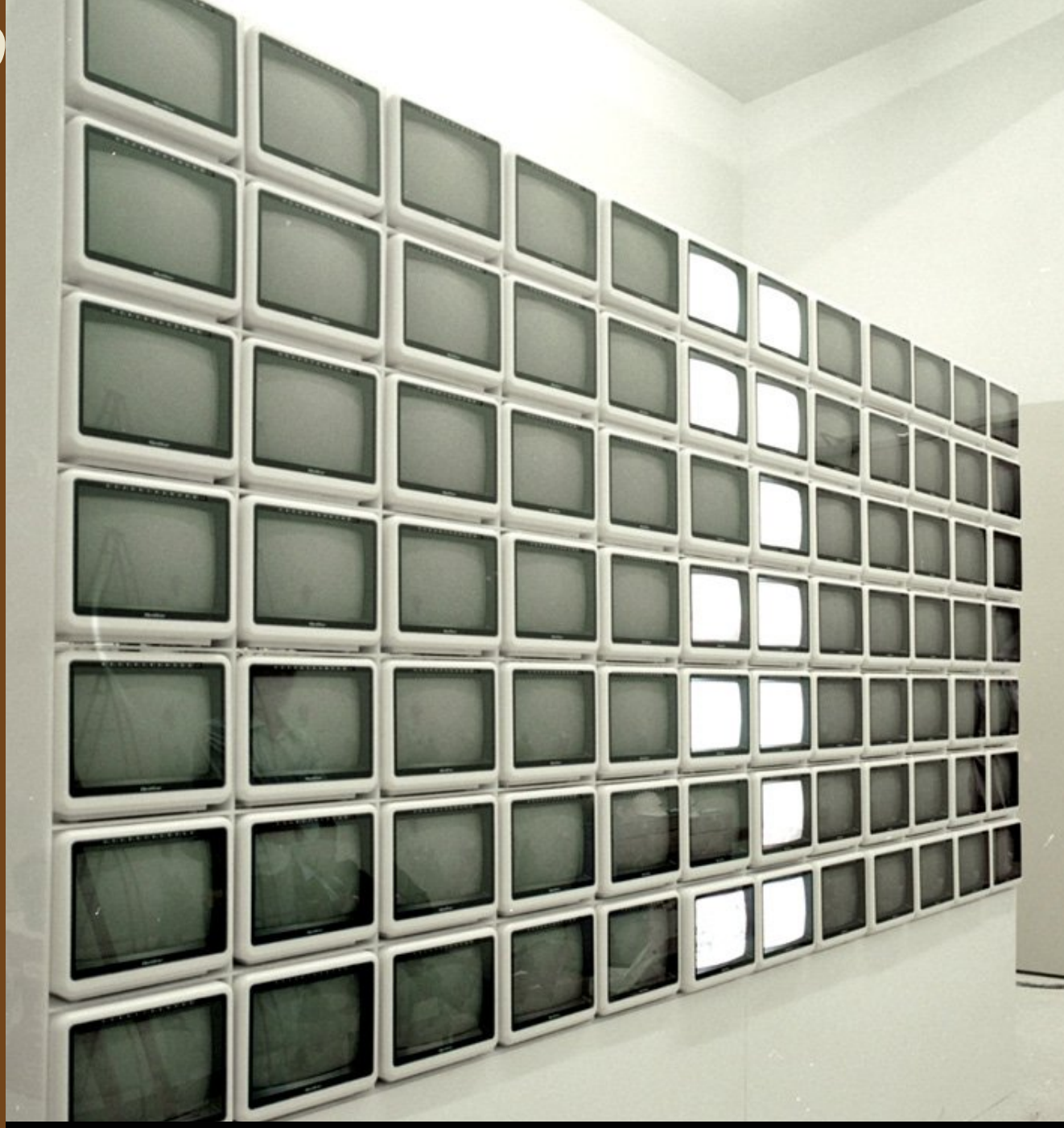
case study



THE RESURRECTION OF NAM JUNE PAIK'S VIDEO FLAG Z

By Mark Gilberg, Silviu Boariu, Steve Colton, John Hirx and Jeff Ono

In 1986 LACMA acquired Nam June Paik's Video Flag Z, a time-based media artwork consisting of 84 television monitors. Video Flag Z was operated almost continuously until the late 1980s when the original Quasar television sets developed a range of technical problems. Finally in 2000, the lack of spare parts rendered the artwork inoperable and it was taken off display. In 2006 the decision was made to restore Paik's Video Flag Z for the opening of the Broad Contemporary Art Museum. With the assistance of the Nam June Paik Studio in New York the process of restoring the artwork was put in motion. The results of this successful collaboration will be reviewed in an effort to illustrate some of the more problematic decisions and approaches that must be taken when undertaking the conservation of contemporary art and electronic art in particular.

Introduction

In 1986 LACMA acquired Nam June Paik's Video Flag Z, the third and final work in an edition of video sculptures, each comprised of 84 television monitors (Figure 1). Nam June Paik (1932-2006) is generally considered the father of video art. He was the first video artist to experiment with electronic media and played an important role in introducing the use of video as a form of artistic expression. In Video Flag Z, the arrangement of television sets mimics the format of the American flag. Through electronic programming, and the use of fast paced edits and psychedelic effects, the ever changing images flicker in a dazzling array across the zones of stars and stripes. The work is one of an edition of three video flags that Paik created. Video Flag Y is in the collection of the Detroit Institute of Arts and Video Flag X, originally purchased by the Chase Manhattan Bank Collection, is now owned by the Hirschhorn Museum and Sculpture Gallery. The physical structure and the stars and stripes format are similar on each example but the flickering images on the screen are unique to each flag. For this version, specifically commissioned by the museum, Paik included countless images borrowed from classic Hollywood films and other sources of popular American culture as a tribute to Los Angeles.

LACMA's Video Flag Z was constructed on site by the artist in 1986 where it was displayed in a prominent position in the modern and contemporary art galleries and operated almost continuously (Figure 2). In the late 1980s, the original Quasar television sets began to incur technical problems with wiring, switches, and "image burn" into the phosphorescent CRT's (picture tubes). Back-up Quasar televisions were deployed and repairs made as necessary. In the early 1990s, as more and more televisions began to require repairs, Video Flag Z was frequently shut down as local repair shops hunted for hard-to-find replacement parts for the Quasar model, which was no longer manufactured.

In 1996, Carl Solway Gallery, Paik's main U.S. representative and the vendor for Video Flag X, Y, and Z, made a gift to LACMA of six unused Quasar televisions that it held in reserve. The additional television sets made it possible to immediately reactivate the work, but in a matter of months more of the original televisions began to fail. From that time on Video Flag Z operated only sporadically between increasingly frequent shut-downs for repair. In 2000, the Santa Barbara Museum of Art organized a Nam June Paik exhibition which included prominent examples of his video constructions borrowed from collections throughout the U.S. and Europe. LACMA's Video Flag Z was

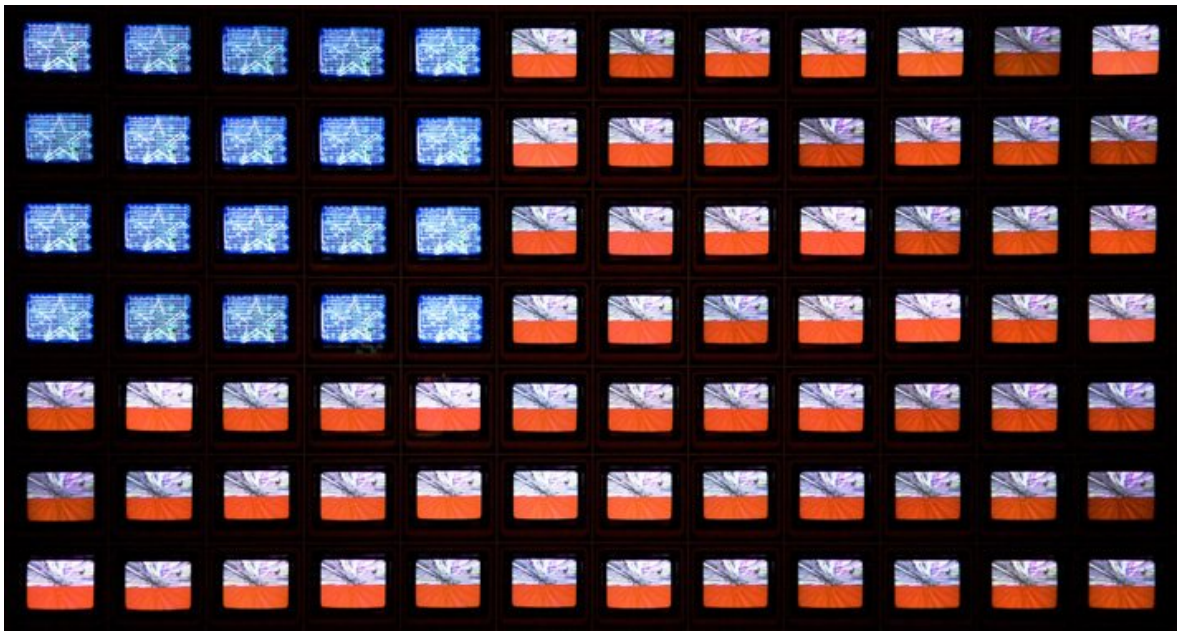


Figure 1. Nam June Paik's Video Flag Z (stop action photograph).

included, but technical problems and lack of spare parts continued to disrupt the successful display of the work. After the return of Video Flag Z to LACMA the decision was made not to return the work to public display. The components, many inoperable and beyond repair, were placed in storage.

In 2006, the decision was made to resurrect Video Flag Z for the opening of the Broad Contemporary Art Museum. With funding secured from the Samsung Foundation and the assistance of the Nam June Paik Studio in New York the process of restoring the artwork was put in motion. In 2011, the restoration was completed in time for the opening of the exhibition "Human Nature: Contemporary Art from the Collection" (March 13 to July 4, 2011). The results of this successful collaboration are described below in an effort to illustrate some of the more problematic decisions and approaches that must be taken when undertaking the conservation of contemporary art and electronic art in particular.

Televisions

In its original configuration, Video Flag Z consists of 84 television sets (Quasar Model WP2145H) placed inside a white polypropylene modular cabinet open at the front and back (Figure 3). The cabinet is divided into 84 equal sized square spaces to accommodate all of the televisions and consists of 12 horizontal and 7 vertical cubes. The cabinet measures 74 x 138 x 18.5 inches. The video disks and players along with the electronic connections are stored behind the televisions away from view. The original Quasar televisions were white in color with controls knobs situated flush with the top of the set (Figure 4). The television sets measured 18 x 18 x 20 inches. The sets were not perfectly square but possessing a rounded edge with a cathode ray tube with a true 10 inch diagonal screen.

Over time the once pliable ABS white plastic housing of the Quasar televisions yellowed and embrittled due to light exposure and heat

Figure 2. Original configuration of cabinet and televisions when installed in 1986 (front view).

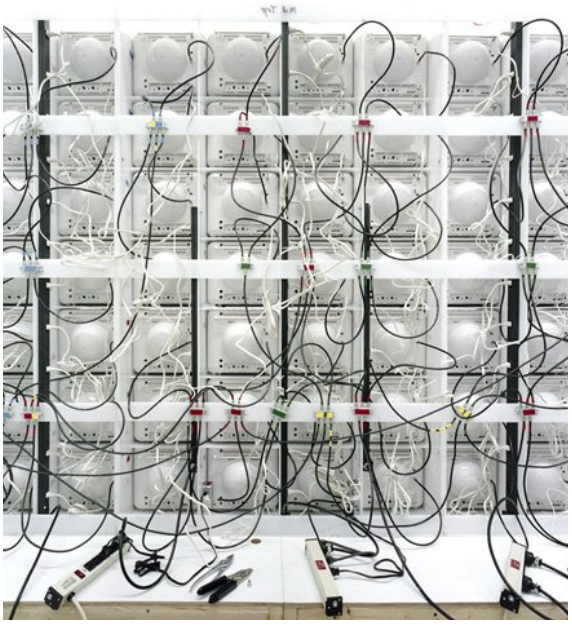


Figure 3. Original configuration of cabinet and televisions when installed in 1986 (back view).

generated by the continuous operation of the artwork (Figure 5). While the white, polypropylene cabinet maintained its original color, the heat and weight of the televisions caused the plastic to eventually sag and separate in areas rendering the cabinet unsuitable for future use (Figure 6). Given the overall condition of the artwork, it was decided to refabricate the entire artwork including the cabinet. This would provide an opportunity to address a number of long-standing issues involving the operation of the artwork. Fortunately, Nam June Paik had anticipated the need for such an event granting permission for LACMA to upgrade his existing artwork using current technology. Paik granted permission in writing for LACMA to make the following modifications to Video Flag Z to allow its continued operation in future years:

1. Television sets may be replaced with newer model hardware, by the same or different manufacturer, with substantially the same television screen size.
2. Laser disk players may be replaced with newer models or newer technology to play the software. The software may be converted to be compatible with any new technology.
3. Any supporting interior or exterior framework for the television sets may be modified, or refabricated, as required, to accommodate a replacement television set or sets, provided that the modification of framework does not substantially alter the visual design intention of the work.
4. If a television set is replaced in a work where the design intention requires matching identical screen size and cabinet appearance, then the replacement of one such television with a model of different dimension or appearance requires the replacement of all identical matching sets.

The restoration was also guided by various design criteria - both aesthetic and operational - developed in consultation with Nam June Paik Studios and LACMA's curators. These included the desire to maintain the original color and dimensions of the artwork including the size and shape of the televisions monitors and cabinet, and the desire to

maintain the original look and feel of the bank of televisions even when not in operation. From a practical standpoint, the new televisions must be robust and reliable and provide clear high resolution pictures under the most intense viewing application.

In selecting a suitable replacement for the original Quasar televisions, a number of different options were considered. These included: (1) replacing the Quasar televisions with a different but similar model of television; (2) fabricating a new shell to mimic the original Quasar shell and inserting a new monitor; and (3) reusing the existing shell of the original Quasar televisions by removing the old electronic components and substituting a new

Figure 4 (top left). White Quasar televisions in 1986.
Figure 5 (left). Quasar television set in 2010.
Figure 6 (below). Damaged area of embrittled plastic of the shelving system.

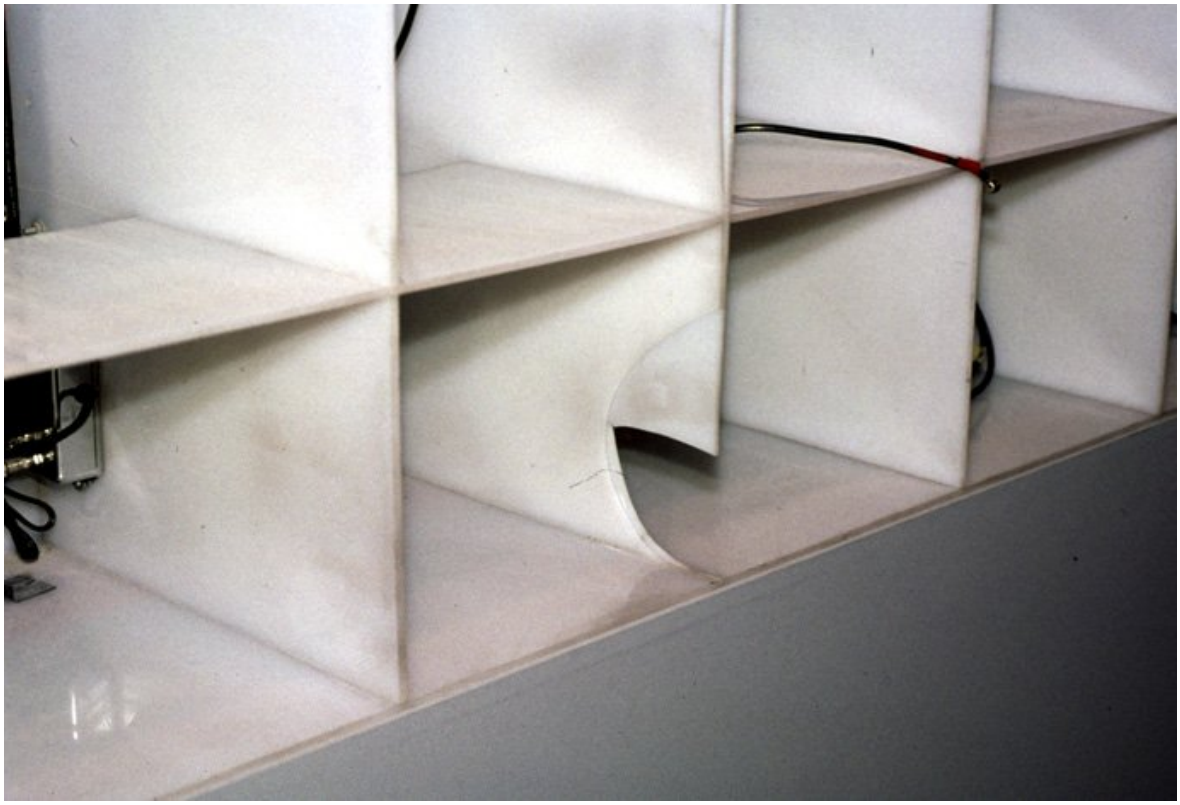
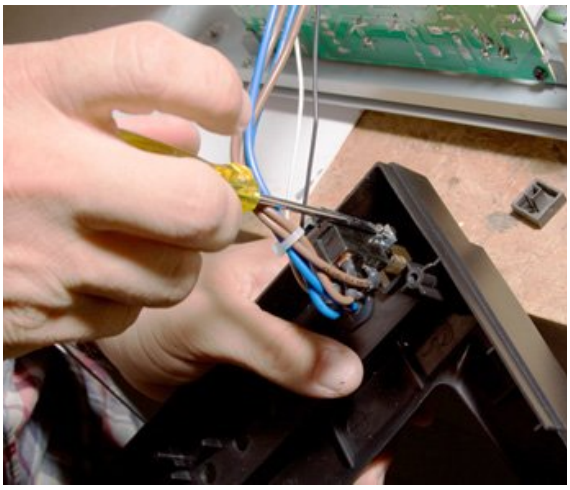
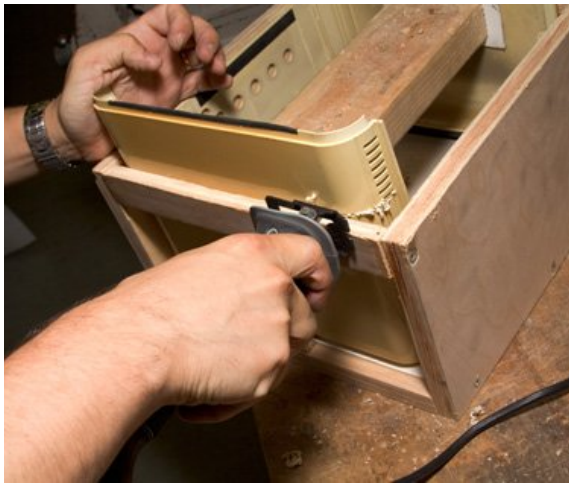


Figure 7 (above). First prototype (left) and original Quasar television (right).
Figure 8 (left). Triview TCM-1002.

monitor with a similarly sized picture tube to render the television operational. Replacement of the original Quasar televisions with a new off-the-shelf television proved impossible. All attempts to procure a television with a white colored housing or controls that were not in the front proved fruitless. Television sets with 10 inch picture tubes were almost impossible to locate and were being phased out by many manufacturers.

Nam June Paik's Studio had previously fabricated a custom made black shell for the Hirschorn Museum's Video Flag X which housed a new nine inch picture tube with an image size slightly smaller than the original which was deemed acceptable by Nam June Paik's Studio. A similar prototype was fabricated in white for LACMA's review but was almost immediately deemed unacceptable. The square box-like features of the shell failed to mimic the rounded, smooth edges of the original Quasars yielding a very sterile impression (Figure 7).

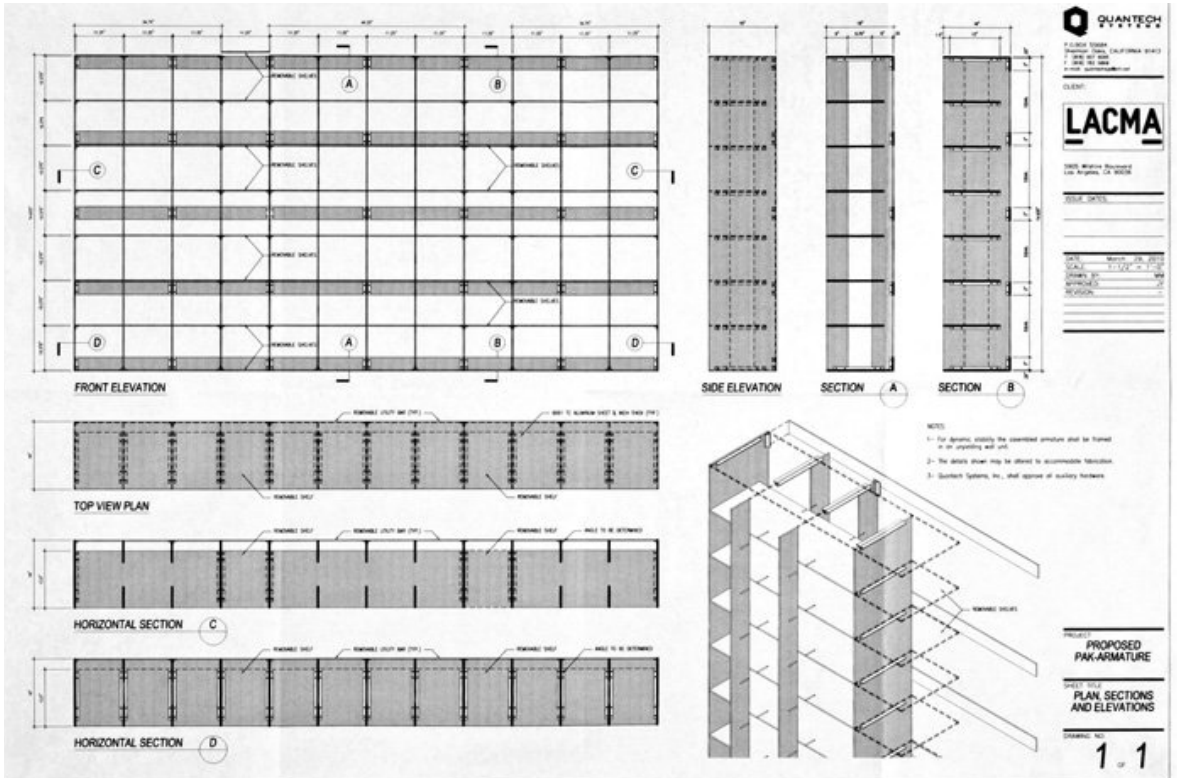
In the end, it was decided to attempt to reuse the original Quasar televisions despite the discoloration of their shells by removing all electrical components including the picture tube and then inserting a new, high-quality cathode ray tube (CRT) monitor. A feasibility study was conducted to determine if it was possible to disassemble and retrofit the old Quasar televisions to accommodate a new monitor with the desired dimensions, and if it was possible to identify and procure new


Up to down, left to right:
Figure 9. Disassembly of Quasar TV to salvage the front screen and housing.
Figure 10. Modification of Quasar TV to reduce depth of housing to accommodate Triview monitor.
Figure 11. Modified front housing of Quasar TV.
Figure 12. Disassembly of Triview TCM-1002.
Figure 13. Removal of on/off switch from front of Triview monitor for relocation to back.
Figure 14. Installing Quasar housing over the modified Triview monitor.

Figure 15. Final assembly.

Figure 16. Engineered drawing for shelving unit.



monitors which could be disassembled and rewired to operate within this new housing. A CCTV CRT monitor (Triview TCM-1002) with the desired power and operational specifications was found which proved ideal for the intended purpose (Figure 8). Triview's color professional monitors are designed for high-end industrial and security applications where high resolution and clear image quality are required. At the time, they were also the only commercially available monitor possessing a true 10 inch picture tube. Using a monitor (as opposed to a television set) also eliminated the need for a receiver and audio amplifier thus helping to reduce heat generation.

Though tedious and time-consuming, it proved possible to adapt the original Quasar televisions to receive a new monitor and to rewire the new monitors to operate within their new housing. In order to accommodate the new monitor, however, it was necessary to cut-down the original Quasar housing so that the new monitor would lie flush against the face of the Quasar and to fabricate new brackets to secure the two parts in place. Altogether, over 17 individual steps were involved in disassembling each Quasar television and making adaptations to each of the original shells to receive their new monitor. Over 40 individual steps were involved in disassembling each Triview monitor and installing it in the old Quasar shell including rewiring the electronics. Following final review and testing by the museum's audiovisual department, additional Triview monitors were purchased to allow the re-construction of 120 monitors. The fabrication process was completed in-house by various members of staff in the objects conservation laboratory over a period of several years. A selection of the various steps in fabricating the new monitors is shown in Figures 9-14. The final prototype is shown in Figure 15.

Figure 17. Three individual sections of cabinet prior to installation.

Figure 18. U-channel bars securing cabinet in place.

Cabinet

As previously mentioned, the original cabinet housing the television sets had deteriorated to the point where it was unusable due to the tremendous amount of heat generated by the television sets (Figure 6). Fabricated from polypropylene, the original cabinet had the advantage of being light weight and portable but was too weak to provide the necessary stability as a platform for the televisions. To avoid this in the future, a new cabinet was designed and fabricated from 3/8 inch aluminum with the same vertical and horizontal dimensions as the original (Figure 16). The depth of the new cabinet was slightly greater than the original to accommodate the newly re-fabricated "televisions", which were now considerably longer in depth. To facilitate the assembly, storage and transport of the artwork the cabinet was fabricated in three separate sections (Figure 17). This modular design and configuration required a system of fasteners to assemble and disassemble units to maintain the same dimensions at the joints as the original cabinet when viewed straight-on.

This design not only facilitated the transport and installation of the artwork, but provided the necessary strength and support for the televisions in the event of a seismic event. LACMA is in a seismic zone and all art installations require mounts to control the motion of the artwork during seismic activity. When first acquired, Video Flag Z was installed in a false wall to provide the necessary support which limited its placement in the gallery. The fabrication of a new aluminum cabinet provided an opportunity

to make a more effective mounting system without use of a false wall to mitigate against seismic activity. To this end the entire cabinet was surrounded with a steel U-channel bars which were then bolted to the platform of the installation as seen in Figure 18.

Video Source Format

When first acquired, videodisks and videodisk players were used to generate the images on the television screens. Three laser disk players and three amplifiers were used to feed the 84 televisions. One laser disk player was used for one set of stripes, a second for the other set of stripes, and the third for the stars. The video source format was ultimately changed. The code on the original digi-beta source was migrated to the server operated by the audio visual department, where a copy was maintained. The code was then copied to two compact flash cards and played on two DV-75H High Definition multimedia players (Technovision, Canada). The signal from the multimedia players was then routed through four SB-3702VNC distribution amplifiers (ShinyBow, USA). Upgrading the image generating equipment in this way rendered the artwork more compact, lighter, and thus less costly to transport if requested for loan. The amount of heat generated by the new video players was also significantly less than that of the older video equipment.

Conclusions

Though the conservation of Nam June Paik's Video Flag Z was certainly tedious and time-consuming, it ultimately proved worthwhile. While it would definitely have been simpler and less time-consuming to have replaced all the existing old quasar televisions sets with commercially available flat-screen televisions, our approach allowed us to retain the original dimensions and proportions of the overall artwork as well as its look and "feel". The conservation work enabled Video Flag Z to be placed on display after many years in storage. The artwork has run almost continuously now for over two years without interruption for repair or main-tenance. During this period of time the artwork was quickly installed and deinstalled in different locations in the museum with relative ease.

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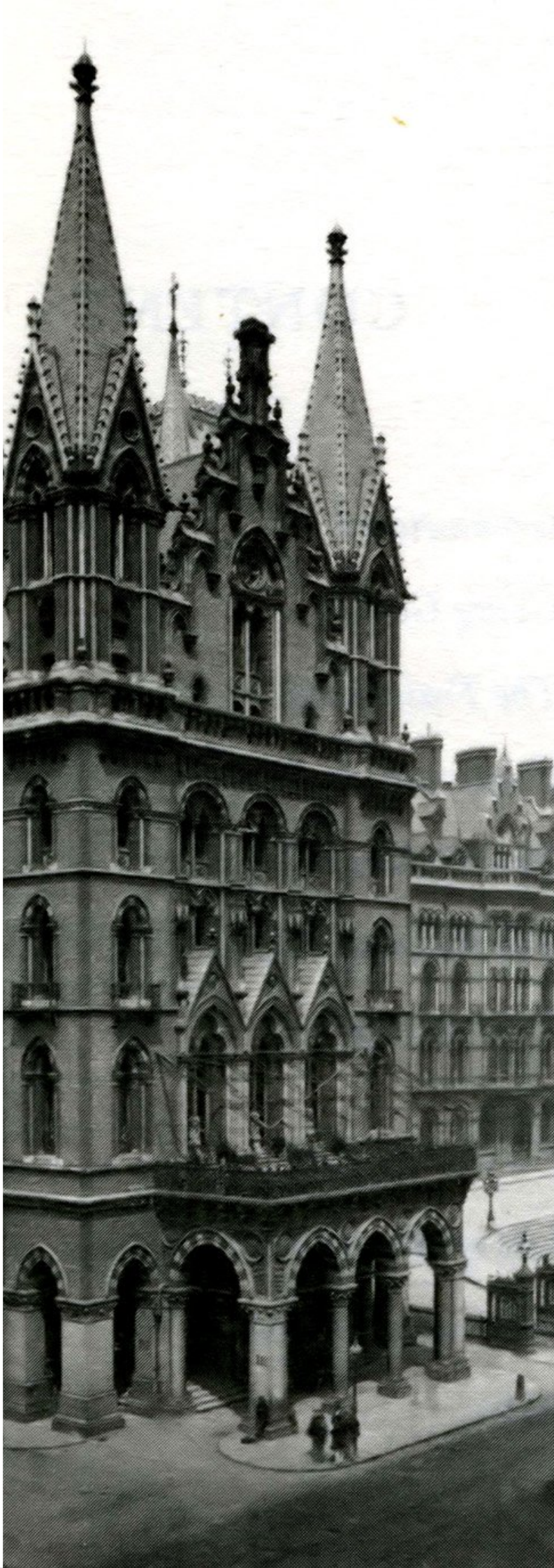
CONSERVATION OF WALLPAPERS FROM ST PANCRAS CHAMBERS

By
Lynda Skipper



The renovation of St Pancras Chambers (Midland Grand Hotel) in London provided an excellent opportunity for in-depth research into the wallpapers used in decorating this historic building. Initially a hotel owned by Midland Railway, the building was subsequently used as offices and staff accommodation by British Rail before it finally closed in the 1980s. During the restoration project, many wallpapers were uncovered from previously hidden areas, in addition to other papers that were still on view on the walls. All the wallpapers were at high risk from damage and loss during the extensive building works, and in order to keep a record of that evidence wallpapers were collected and removed from the site. Spanning just over 100 years of wallpaper from the 1870s to the 1980s, the papers were cleaned and conserved, and stored within Melinex pockets, acid free envelopes or rolled Melinex, as appropriate. They now comprise a historic wallpaper archive, available for access for researchers, students and other interested parties, held at the University of Lincoln.

Introduction

St Pancras Chambers, originally known as the Midland Grand Hotel (Figure 1) was designed by Sir George Gilbert Scott and opened in the 1870s in the St Pancras area of London. The building was commissioned by the Midland Railway Company, who also commissioned the neighbouring St Pancras Station, enabling Midland Railway to run their own rail route into London [1]. The hotel was in use until 1935, and was then converted to offices and staff accommodation, but then stood empty for over 20 years until a recent redevelopment project into a hotel and apartments by the Manhattan Loft Corporation [2]. The building reopened as a hotel in 2011. As part of this redevelopment, Crick Smith Conservation, a commercial arm of the University of Lincoln's Conservation Department, carried out in depth investigations to determine the historic paint schemes used in the building. When evidence of wallpapers was also found, this project was set up in conjunction with English Heritage to investigate, rescue and conserve wallpapers from the building.

St Pancras provided a unique opportunity to discover the decorative tastes of a commercial building in the gothic revival style, and the decorative choices of later occupiers, about which very little information has been previously recorded. This was a particularly unusual project as samples could be collected from the entire building, and the renovations revealed wallpapers that had been covered during earlier alterations, that would not otherwise be accessible. The decoration and furnishings of the hotel on the upper floors were much more modest than those on the lower floors [1], reflecting the hierarchy of uses of the building with servants rooms in the attic and the grandest rooms on the ground floor. Hence this project also provided a view of how different types of paper were used throughout the building, and how wallpapers were chosen to reflect this cost gradient.

This project was an emergency rescue attempt to remove examples of wallpapers that would otherwise have been lost during building works, and was also an opportunity to remove samples that would otherwise be covered during the redecoration. Suitable conservation treatments were used to clean and preserve the wallpapers, and storage methods were researched, in order to then establish a new archive at the University of Lincoln, allowing access to the collection for study and research purposes.

Figure 1. The Midland Grand Hotel at St Pancras Station, Euston Road, London, post 1874. © National Archive for Historic Decoration, University of Lincoln.

Figure 2. The author retrieving a fleur-de-lis style wallpaper from the 2nd floor of the building.

Retrieving the wallpapers from St Pancras

Four days were spent at St Pancras by the author, retrieving papers that had been found during building works (Figure 2). While the visits took place over 12 months (with a delay due to a fire which prevented access) it was necessary to act quickly as new wallpapers were uncovered, because these were areas that were actively being renovated by the building teams. Due to the short time frame and the large number of wallpapers (spread around more than 500 rooms) the wallpapers had to be removed from the walls as rapidly as possible. To illustrate the urgency of the task and need for a rapid removal, in one incident the author was surrounded by builders waiting to knock down a wall, but as the wallpaper was still attached, they were asked to wait until after the removal had taken place!

500 pieces were retrieved from corridors, stairwells and rooms throughout the hotel, with the majority of wallpapers coming from the bedrooms and corridors on the 2nd – 5th floors. Only three rooms on the top floor, which had been used as accommodation for staff in the hotel, contained any examples of wallpaper. As some pieces were fragments of the same design from one room, or samples of the same design found in multiple rooms, assessment after the visits showed 99 different designs were retrieved.

The first stage when any wallpapers were found was recording. Comprehensive photographs were taken to record the position of the paper in the room, and the size and design. On occasion it was not possible to remove the papers, either due to lack of scaffold access at short notice where the only remaining paper was high up on the walls, or where the wallpaper had been too badly damaged to remove, so the photographs are the only record of those pieces. However, it was possible to remove examples from the majority of wallpapers. Indeed, in some cases, such as the 3rd floor corridor

Figure 3 (above). Paper in the 3rd floor corridor, exposed by removal of ducting, is very poorly attached to the wall.
Figure 4 (left). Wallpaper from room 2.023 showing vertical staining pattern.

(Figure 3), the paper was already almost entirely detached from the wall and was easily removed dry, using only a scalpel where necessary.

A few wallpapers did not respond to the dry removal method and so were treated with water to aid removal. Steam was not practical for removal of the wallpapers in this project because of the lack of time and no suitable electrical connection.

Instead, after checking that the colours in the papers were not water soluble, direct water spray was used and allowed to soak into the paper, before removal with a scalpel.

In cases where water based removal was not possible, it was decided to remove the plaster and wallpaper together using a chisel, and separate them later. The hotel was replastered during renovation work so it was not critical to leave the plaster in situ. The weight of the plaster made it technically difficult to remove larger pieces, especially when combined with the inherent instability of a large plaster section when detached from a supporting wall. However, it was possible to remove small sections using this method.

The sizes of the wallpapers found ranged from tiny fragments to entire rooms. While the aim was to sample a pattern repeat for each of the designs, for the earliest papers there was not always enough

Figure 5. Schematic showing use of Gore-tex to separate layers via single sided humidification.

surviving wallpaper for this to be achievable, so in those cases as much as possible was kept.

Condition of the wallpapers

The main environmental factors causing deterioration to wallpapers within the hotel were light, humidity and dirt. The building had been neglected while it stood empty and there was evidence of many leaks. As well as water staining of the wallpaper, high humidity had caused problems. As a consequence of this mould growth was observed in many areas. Damage also occurred to the wallpapers from previous alterations within the building, such as iron staining and holes from pipework.

Dirt and discolouration was a common problem with the wallpapers. The building generally was very dirty and dusty, partly due to ongoing renovation work and partly due to years of neglect and lack of cleaning. An example of this is the wallpaper shown in Figure 4, where dirt has run down the wallpaper, carried by water. As the water dried, it left the dirt behind.

Conservation treatments

Papers were all condition surveyed following removal, which allowed a system of prioritising to be set up. Papers that were unstable due to plaster or paint layers, or those where the design was obscured by paint or other layers of wallpaper, were prioritised for conservation treatments carried out at the University of Lincoln. All pieces have been conserved and placed into archival storage materials using methods described below.

Removal of plaster

Plaster was removed using a preservation pencil with ultrasonic humidifier, plus mechanical scraping with a scalpel [3]. Tests over a range of temperatures showed that a high temperature setting was the most effective method and so 95° C was used. The humidity and mist levels were varied between 30% and 100% according to the paper treated. Although the most efficient method was to use high humidity, some of the pieces needing plaster removal had water sensitive pigments. Therefore low mist and humidity

Figure 6. Using a smoke sponge for dry cleaning of wallpaper. The area bottom left of the photograph has been cleaned with a smoke sponge. The remaining areas are uncleaned.

levels were used on the water sensitive pieces to prevent damage.

Separating layers of paper and paint

A progressive approach to separation of wallpaper layers was taken. A few layers could be removed dry, due to their separation when removed from the damp environment of St Pancras to a drier area. However, the most effective method of removing paint and paper layers with water resistant wallpapers was the application of water, in the form of steam provided by a preservation pencil and ultrasonic humidifier, which softened the adhesive holding the layers together [3].

Gore-tex was successfully used to introduce controlled levels of moisture to separate layered water sensitive papers, as shown in Figure 5 [4]. The wallpapers gradually became humidified and separated without damaging the papers or causing excessive bleeding of colours. The wallpapers were left in the Gore-tex for between 30 minutes and overnight, depending on the thickness of the layers and the amount of humidity needed to soften the adhesive.

Cleaning methods

After separation, cleaning was necessary. Loose dirt was removed with a brush unless friable pigments were present. A cleaning sponge (smoke sponge) was then used, which quickly removed the majority of the surface dirt on the papers (Figure 6).

Where further cleaning was needed, full immersion in water proved suitable in some cases particularly for the later, machine printed papers. If wet cleaning was necessary but immersion in water was not possible due to water soluble pigments, Gore-tex was used. A Gore-tex sandwich was therefore prepared using the method suggested by Dobrusskin [4]. Gore-tex provided a barrier

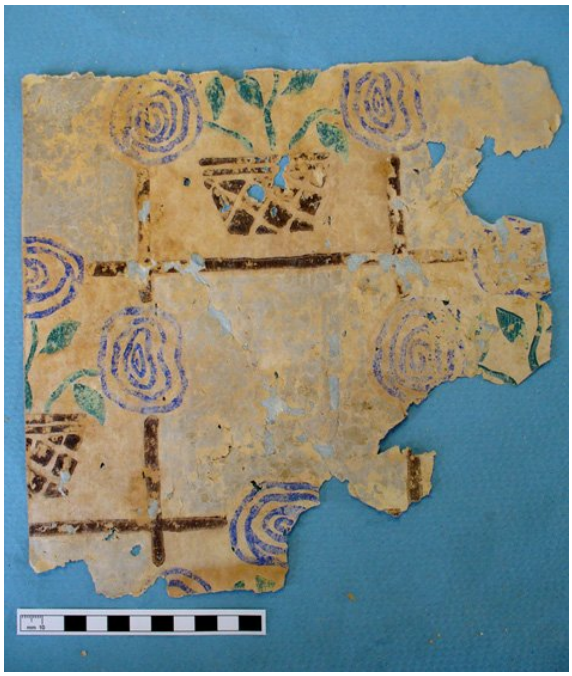


Figure 7. Wallpaper during conservation treatment. An example of a wallpaper from the ground floor with numerous tears and holes, which has been partially backed with Japanese tissue to support damaged areas.

through which moisture vapour could pass, but water itself was excluded. The sandwich method with blotting paper meant that dirt was drawn into the blotter and out of the wallpaper, along with the moisture. After two days of cleaning, a small amount of transference of the design both onto the back of the wallpaper and onto the Gore-tex occurred, but no significant bleeding of colour was observed. If this treatment had been continued longer it may have been even more successful, but it was felt that the risk of mould growth outweighed the benefits of further cleaning.

Gore-tex was also used in the application of solvents where necessary. For example, paper from room 4.024 (4^{th} floor) had a thick layer of paint applied to the surface. It was not possible to remove the paint without taking the top layer of varnish off the design. The design was slightly water sensitive, and dry removal of the paint removed the surface of the wallpaper as well. Acetone was an effective solvent to soften the varnish. In order to control the exposure to acetone, blotting paper was soaked in acetone and Gore-tex was laid between the blotter and the wallpaper. This was left for 15 minutes to soften the varnish and then the varnish and paint were removed mechanically. This was repeated 5 times in order to remove the whole surface layering. In order to remove any remaining solvent, the paper was washed by lightly spraying the verso with water and then quickly blotted dry. This prevented excessive moisture reaching the design area, and so the slightly water sensitive pigments were not affected.

Other conservation treatments carried out included consolidation of flaking pigments with carboxymethyl cellulose at 0.5% concentration, and paper repairs using Gampi and Minogami Japanese papers (Figure 7).

Storage of the wallpapers

The wallpapers vary in size from a few millimetres to over a metre in length. The most appropriate storage for papers is to leave them flat, as this prevents damage, and rolling papers may increase stress on the pigments and on the paper support. However, flat storage is not a practical option for the largest pieces due to space constraints. After visits to view methods of storage used in the Whitworth Art Gallery in Manchester and the Victoria and Albert Museum in London, it was decided that this wallpaper collection should be stored mainly in Melinex, but with acid free paper envelopes made for the papers with potential for pigment loss. The Melinex encapsulation was done using a heat sealer, which melts the edges of the Melinex sheet together. In order to avoid total sealing of the environment around the

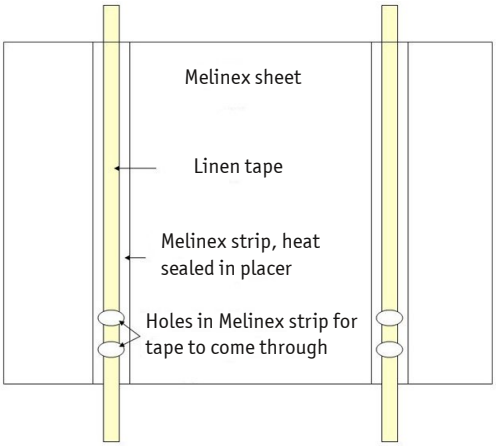


Figure 8 (above). Schematic of Melinex storage design for rolled wallpapers.

Figure 9 (right). An example of the wallpaper stored around a Melinex roll.

wallpaper one corner of the pocket was removed. This should allow some air circulation and prevent establishment of a microclimate.

Larger papers needed rolled storage. After a visit by the author to examine the Mylar rolls at the Whitworth Art Gallery in Manchester, this appeared to be a suitable storage solution for the St Pancras papers. The Whitworth needed a large number of these outer wrappers, so had them custom made, with the tapes able to be pulled through punched holes to adjust for the size of roll [5]. As a much smaller number were needed for this project, it was decided to make these in house, using two grades of Melinex sheet with linen ties. Thick Melinex was used for the main body of the roll, with thinner Melinex used to hold the linen ties in position. A plan of these rolls is shown in Figure 8.

Although this provided a suitable outer surface, the wallpapers needed an inner support around which they could be rolled. Therefore, the author decided to make a Melinex roll, as this material was inert, stable, strong and readily available. These central rolls were heat sealed to keep them circular, but this meant a fairly large diameter was needed in order to fit them onto the heat sealer. The advantage of heat sealing the inner roll was that no added chemicals or adhesives are involved, so there was no chance of any reaction with the wallpapers during storage. Figure 9 shows a completed storage roll in use.

Investigating the origins of the wallpaper

The earliest primary evidence of wallpaper being used in St Pancras is from a photograph depicting a 1st floor sitting room in 1876 (Figure 10). Previous investigations by Crick Smith Conservation found no trace of this original paper, except for traces of paste and lines on the wall where the dado used to be. This was probably stripped when electricity was installed around 1886 with just traces of paste remaining. Given

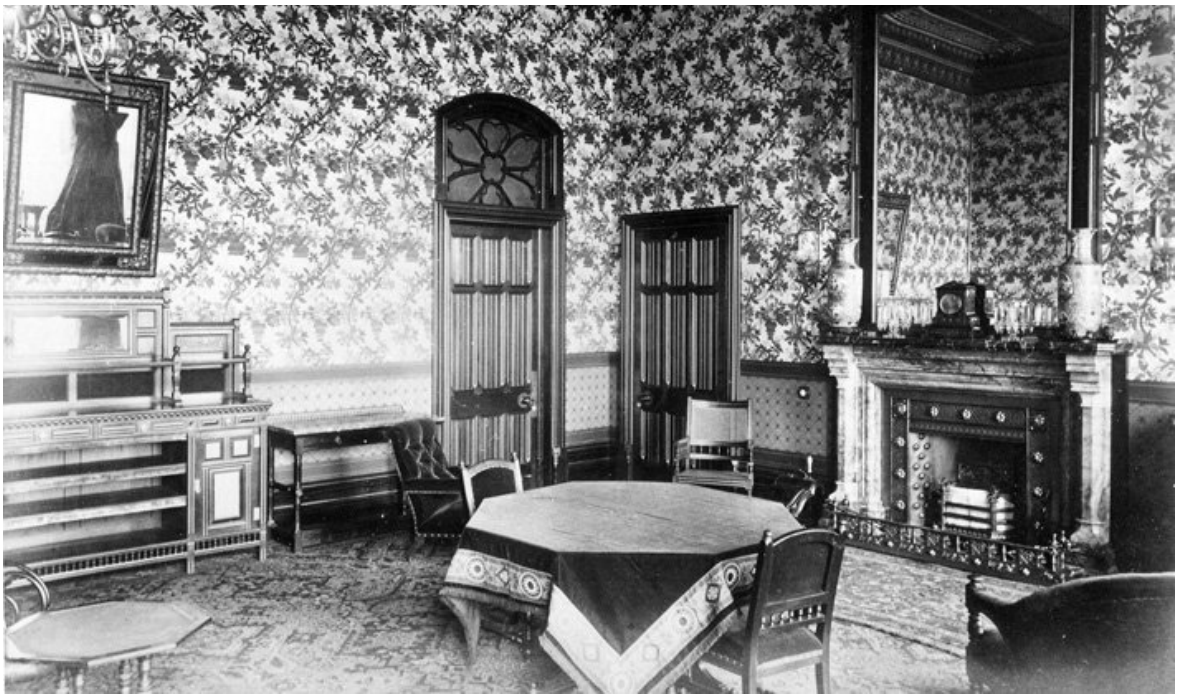


Figure 10. Sitting room, Midland Grand Hotel, St Pancras Station, c 1876. © National Archive for Historic Decoration, University of Lincoln.

the lack of very early papers found, it seems likely that this removal was employed throughout the building, with remaining papers generally quite fragmentary. An example of this is the wallpaper found in two of the 3rd floor bedrooms. This is a William Morris design, Venetian pattern, produced by Jeffrey and Co. [6] This dates the paper to c. 1871, and would have been part of the original scheme, used in the hotel in both blue and green.

Although it is difficult to confirm manufacturers and designers without locating an exact duplicate of that pattern with a known maker, Jeffrey and Co. seems to be a likely candidate for the manufacturer of many of the early papers. For a big project such as a hotel, the simplest option for interior decoration would be to have all the wallpapers supplied by one company. Jeffrey and Co. was renowned for its quality and produced wallpapers by many leading designers such as William Morris, Owen Jones and Charles Voysey [7]. Two of the slightly later papers (1900-1910) share strong similarities with wallpapers produced by Charles Knowles and Co. A later 1920s paper was most probably produced by Arthur Sanderson.

Conclusions

Through this project important new information has been found regarding the decoration of the hotel and the later offices and accommodation. All the samples have been fully documented, catalogued and recorded. It seems that the general decorative schemes of the hotel were of large floral patterns in the lower floors with cheaper, smaller floral pattern paper on the upper floors. It is likely that the wallpapers for the original scheme were provided by Jeffrey and Co, with later additions by companies such as Charles Knowles and Sanderson. Clearly the use of prestigious designers was important, as shown by the choice of papers by designers such as William Morris,

Owen Jones and Bruce Talbert. This highlights the significance of the wallpapers in the decoration of the hotel. In the areas with high usage more hard wearing wallpapers were often in use, either varnished or Lincrusta/Anaglypta based, though again mainly with a floral element to the design.

The use of Gore-tex to protect water-sensitive pigments on the wallpapers was a very useful resource for allowing cleaning and conservation of the papers to progress. The St Pancras project has led to the creation of an archive of historic wallpapers that will be preserved at the University of Lincoln, giving access to this collection for researchers, owners, students and other interested parties. All the 99 different wallpapers collected were historically valuable in terms of how the interiors of St Pancras developed over time, so it was important to treat them according to their conservation needs, irrespective of the sample age.

Acknowledgments

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EPITRACHELION, EPIGONATION, EPIMANIKIA

CONSERVATION AND DISPLAY OF THE MOST TREASURED ACCESSORIES OF THE CHRISTIAN ORTHODOX VESTMENTS

By
Tatiana Kousoulou

Among the Christian orthodox vestments used by clerics in the most important of the orthodox religion ceremonies, there are three textiles used from Byzantine times until today as symbols and integral part of the sacerdotal uniform for every grade of priesthood: the Epitrachelion is a vestment worn by all priests and bishops that symbolizes the grace of the Holy Spirit; the Epigonation is a stiff richly decorated textile in rhomboid shape that hangs on the right side of the body and it is worn only by high ranking clerics; and Epimanikia are cuffs made of heavily embroidered fabric that lace onto the wrists of all clerics. These liturgical textile accessories are extremely important display objects in the majority of Greek ecclesiastical collections. A series of case studies, selected from famous Greek monasteries, are used to illustrate the conservation methods, the current research and successful display solutions for these accessories. The practices presented here are applied by the textile conservation section of the Directorate of Conservation, Greek Ministry of Culture or/and by regional textile conservation groups in Greece under the supervision and guidance of the same office.

Introduction

Ecclesiastical vestments are worn by clerics during mass services and other ceremonies. They are also a distinguish mark of the ecclesiastical hierarchy and power. Each one of the three marks of rank of priesthood has one specific costume ensemble which corresponds to the mark of deacon, priest or bishop. In Greek, orthodox vestments are called “Amfia”, name originated from Byzantine writers that indicates precious and glorious textiles. Later, it characterized imperial clothing, while at the Byzantine era the term was used only for cleric’s dress [1].

According to literature, the use of vestments in the East began probably before the fourth century, without their full institution [2]. The use of hieratic costume in everyday practice was probably due to the need to differentiate the members of the Church from other social groups and to declare their status in the Empire, where dress code played the role of identity. Even later, with the entry of fine arts in liturgy and the influence of the Roman Empire, there are no changes on vestments as far as their shape, form and use is concerned. As the Byzantine Empire flourished, more valuable and richly decorated fabrics are used, often depicted in contemporary icons.

In the Orthodox Church, every vestment plays its particular role during liturgy and it is worn according to the hierarchy. For example, there are three forms of stole (Orarion, Epitrachelion, and Omophorion) which are worn by the deacon, priest and bishop respectively. The three garments (Sticharion, Phelonion, and Sakkos) are usually richly decorated and are used as distinguishing dress of the clergy. There are also some accessories to the sacerdotal costume such as the Zone and Epimanikia, holding the other vestments in place. Finally, there are vestments that work as awards of distinction worn only by high ranking clerics (Polos and Epigonation). Each vestment has also a symbolic meaning which is related to the specific prayer used by the priest at the time of wear [2].

Vestments are never thrown away or destroyed, even if they were much damaged due to extensive wear. On the contrary, they were usually given as presents to younger priests as it was always an honour to wear an old vestment. Also, when a

vestment was worn by an important person of high priesthood, and most normally richly decorated, it is placed in the temple or monastery sacristy. Often, these vestments are also in display at an ecclesiastical museum.

Almost every monastery in the Greek territory has its own museum exhibition, either organized and managed by the monks themselves or more scientifically assembled by the local Byzantine Archaeological Ephorate (BAE) and the Ministry of Culture.

The three "Epi" of the Greek Orthodox Vestments

Ecclesiastical textiles can be divided into two categories, the vestments (amfia) which dress the clerics of the Orthodox Church and the veils (pepla), which are liturgical or decorative textiles (eg. Epitafios, Podea, Aeras) [2]. Apart from the main basic vestments that work as dress, there are three "accessories" of the priest uniform that have a symbolic and liturgical meaning. Their name begins with the prefix epi which means "upon" in Greek. From their use and way of dress in the overall uniform, the three vestments are presented here:

The **Epitrachelion** (plural: *Epitrachelia*, "around the neck") is the stole worn by priests and bishops and is an indispensable piece of clothing since without it no priest can even approach the holy table. It is made of one fabric ribbon that is worn around the neck and goes down the chest in double row. It is buttoned together with little bells or buttons (Figure 1). It is usually made of brocade and/or gold embroidery with religious scenes or figures and quite often inscriptions. Frequently, *epitrachelia* are signed by their creators or their donors [3]. It symbolizes the yoke of Christ when he was taken to his tortures. It always ends with fringe or tufts that represent the souls of the faithful for whom the priest is responsible in the crack of doom [2].

The **Epigonation** (plural: *Epigonatia*, "upon the knee") was primary a soft kerchief hanged form the belt of the clerics, similar to those used by noblemen in Byzantium, or those originated by the roman mappa or mappula, the fabric used for the sign of break in the games by the consul. Later, the fabric was tightened to a stiff rhomboid cardboard and was decorated with gold embroidery. It is worn on the right side and upon the knee by priests and bishops (Figure 2). In the 12th century, it symbolised the piece of cloth that Christ used to wash his disciple's feet. In the 15th century, it gained a new meaning and it symbolised the resurrection and victory over death. Usual scenes found on the *epigonation* are relevant to its symbolization such as Christ washing, Descent into Hell and Resurrection [2].

Epimanikia (plural of *Epimanikion*, "around the sleeves") are long fabric cuffs that cover the lower side of the sleeves on *sticharion*. They symbolize the handcuffs of Christ when he was taken to the Romans. Very often, this scene is represented on the epimanikia at monasteries. Other usual scenes embroidered or appliquéd on epimanikia in the earliest years are the Annunciation (Figure 3), Christ and Profets, St. Peter and St. Paul, while in contemporary creations there is usually a cross in the center [2].

Use and Deterioration

The extensive use of these ecclesiastical textiles, long-term storage and display in non-controlled conditions caused damages to the objects. Mechanical stress and soiling are the most common forms of deterioration caused by their use.

Figure 1. 17th century Epitrachelion from Thera Cathedral (left). Detail (top right) and microscopic picture (bottom right) for the painted figures of the Evangelists and inscriptions.

Figure 2. 15th century Epigonation (left) from St. Dionysios Monastery, Mount Athos and microscopic picture (right) showing metal threads and ramma *threads visible in the gold embroidery detail.*

Figure 3. 18th century Epimanikia form Thera Cathedral, after conservation (below) and adjusted to a padded board for display (bottom).

Figure 4. Detail of 17th century Epitrachelion from Thera Cathedral, before (left) and after (right) conservation.

Epitrachelion, Epigonation and Epimanikia are never washed during their useful life due to their vulnerable and prestigious construction techniques and materials and, of course, their usage. The accumulation of soiling is therefore predictable due to ecclesiastical environment (smoke, dust, wax residues, wine spotting, etc.), storage and inappropriate display (dust, biological attack, mould, etc.) (Figure 4).

Since the majority of these textiles are decorated with gold embroidery techniques and is the result of mixed material construction (e.g. Epigonation is always given its shape by a cardboard placed in between two or more fabrics) (Figure 5), the interaction between the antagonistic construction materials, in combination with non-controlled environmental conditions (humidity, temperature and irradiation), has as result complex deterioration processes [4]. Most commonly, can be mentioned the corrosion of metal threads, the bleeding of dyes, fading and discoloration, biological deterioration, oxidation, disintegration and deformation of the weave and fibres.

Study and Research

The conservation of an object is a time for extensive research, as the conservator has the opportunity to investigate and collect information about the materials and techniques, and its changes due to deterioration and time. Furthermore, as objects are transferred to organized conservation

Figure 5. Conservation of paper inside an Epigonation.

Figure 6. Metal strips wound around a silk fibrous core. Microscopic picture from 15th century Epigonation from St. Dionysius Monastery, Mount Athos. Marks of the cutting tool are visible in the strips.

studios and are temporarily removed from the monastic environment, they have the chance to be studied in depth with analytical techniques. Simple investigation and documentation methods for all objects under conservation are normally used during the laboratory routine, but in the case of special and rare objects, more sophisticated analyses can be applied in collaboration with analytical laboratories and other scientists [5].

Stereomicroscopy and light microscopy is an excellent tool to study in detail the fibres and yarns used in embroideries and to obtain information about their size, shape and topography of the surface, pigmentation, imperfections, morphology and other visible properties. Optical microscopy is non-destructive for the objects, as there is no need of a sample [6]. Interesting observations on the aforementioned vestments are focused on the gold embroidery techniques as well as other forms of decoration such as painting. An example of this is the microscopic examination of the 15th century Epigonation from St. Dionysius Monastery of Mount Athos (Figure 2). Metal threads and fibres, during the execution of the embroidery are not passing through the fabric, but they are stabilized on the surface with the use of a cotton thread (ramma) which penetrates the textile. Ramma was chosen to be dyed yellow or beige, according to the metal threads in use, gold or silver respectively, so as to be as discreet as possible and waxed in order to facilitate the penetration [2] (Figure 2). Therefore, the front side of the embroidery was filled with metal threads and decorative material and the back side with ramma threads. The characteristic volume found in the gold embroidery is succeeded with the fillings, silk or thick cotton threads, embroidered in different layers, in order to create the desirable volume before the application of the metal threads [7].

The majority of the embroideries are made of solid metal or metal-coated strips. Solid metal strips have been manufactured either by cutting them from a sheet (foil/leaf) or by flattening (hammering) a wire. In the case of strips cut from a sheet, the edges of these strips preserve, in most cases, the marks of the cutting tool (Figure 6). To date there is insufficient information about the length of these strips or the methods of joining them. Short strips, cut from hammered

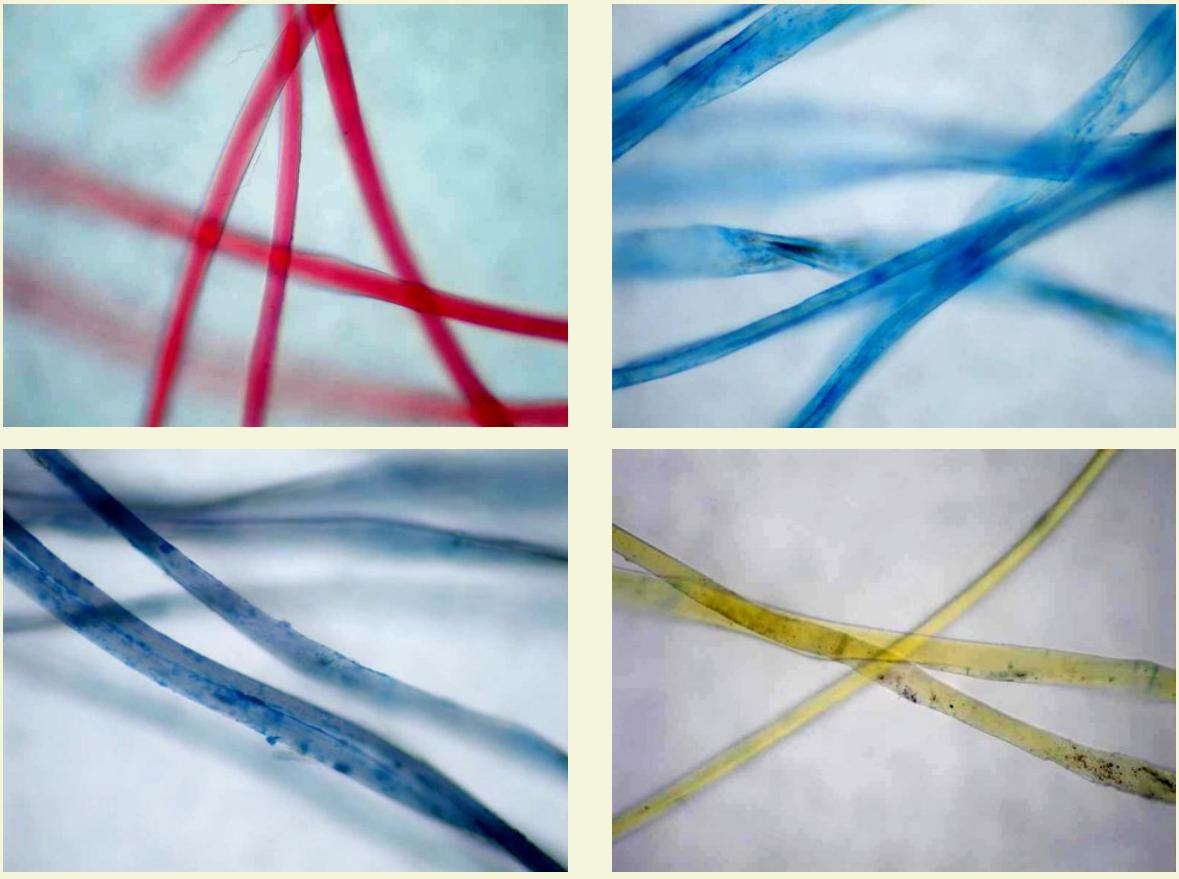
Figure 7. 15th century Epitrachelion (left) from Batopedi Monastery, Mount Athos and macroscopic picture (top) showing how silver gilded wire is used in the embroidery.

foil (approximately the size of the palm of a hand) were joined by overlapping them as they wound around a fibrous core [8]. A simpler and more practical method for making metal strips was discovered later. Drown wire was flattened into a strip by hammering it or passing it between rollers [6]. For finest result, a thin wire was used directly in the embroidery in the form of thin thread and this is the case on the 15th century Epitrachelion from Batopaidi Monastery of Mount Athos (Figure 7).

The winding of a strip or wire around a fibrous core was already a familiar technique in ancient times and was done with the twisting method of a twisted yarn. The twist is either on the left (Z twist) or on the right (S twist) at an angle to the fibrous core and the degree of twist reveals more or less the fibrous core [9], cotton or silk, in a

Figure 8. Gold embroidered and painted Epigonation from Arkadi Monastery, Crete.

Figure 9. Silk fibres, taken form Epitrachelion, Epimanikion and Epigonation from 15th- 18th centuries, identified under the light microscope.



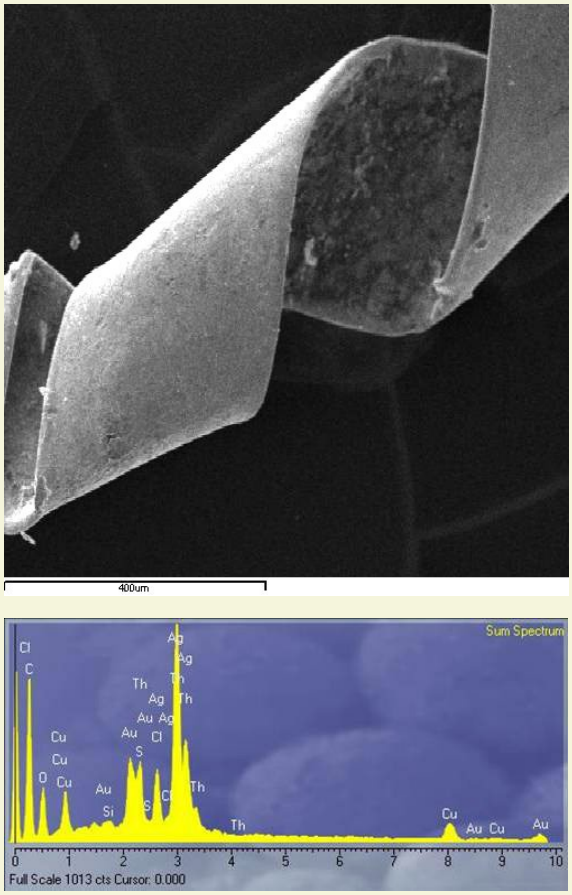


Figure 10. Metal strip (left) taken from gold embroidery and element analysis (top) under SEM-EDX.

way that the metal brightness is enhanced or supplemented by the coloured yarn (Figure 7).

There are cases where the decoration and iconography is made or supplemented by painting. In the case of the 17th century Epitrachelion from Thera Cathedral (Santorini), the Evangelists figures are depicted by painting with pigments and golden embellishment on the silk satin textile background (Figure 4). In the case of 18th century Epigonation from Arkadi Monastery in Crete, silk and gold embroidery is combined with oil painting on the silk satin (Figure 8).

Light microscopy was used to identify the fibres used to create 32 Epitrachelia, 24 Epigonatia and 18 couples of Epimanikia from 16th to 18th centuries examined at the conservation laboratory from Cretan monasteries (Arkadi, Preveli, Gonia, and Ag. Triada). In every case, the fibre used in the main fabric, in satin weave, was silk (Figure 9).

Scanning electron microscopy (SEM) provides information about the metal threads used, types of metals, gilding techniques and deterioration. The gilding or silvering of solid metal strip was done, most often, using gold or silver foils simply hammered on the prepared (polished) silver or copper foil, before cutting into strips. In the latter case, a relatively thick silver or copper rod was covered with gold or silver foil and heated. The gold or silver layer adhered to the surface of the base metal and after polishing, the rod could be hammered into a strip. When gilding copper, it was usually first silvered before being gilded [6]. An example of this can be considered a metal thread examined and analysed by SEM-EDX from the Epigonation of Batopaidi monastery. EDX analysis on the outer side of the metal strip showed the presence of gold (Au) and silver (Ag) while the inner side of the metal strip produced peaks of copper (Cu) (Figure 10).

Conservation and Preservation

Conservation treatments involve methods of cleaning, humidification and stabilization of the textiles in question, according to their specific needs and degree of deterioration. Because of their construction techniques and materials, wet cleaning is always avoided, although local cleaning using organic solvents and water may be attempted, after extensive spot tests. Mechanical cleaning using conservation sponges (e.g. chemical sponge) is preferred as far as gold embroidered and painted areas in concerned (Figures 4 and 11). Mechanical cleaning using controlled vacuum is performed in any case.

Figure 11. Mechanical cleaning with chemical sponge of a 15th century Epitrachelion from Batopedi Monastery, Mount Athos.

Figure 12. Microscopic picture of gold embroidered area covered with nylon net.

Figure 13. Enamel decorated metal button of an Epitrachelion.

Humidification is done in open systems and locally, using either ultrasonic steam or hygroscopic membranes (e.g Sympatex). Stabilization is done by hand sewing, using monofilament silk dyed in the laboratory in relevant colours. Minimum intervention and reinforcement of the gold embroidered areas is succeeded by the overlapping of the destroyed areas with nylon net, which is not visible by simple observation of the object and needs less sewing to keep it in place [7] (Figure 12).

There are cases where conservation needs to be made to other components that are not textile such as the inner paper of an *epigonation* (Figure 5) or the metal buttons of an *epitrachelion* (Figure 13).

In such case, advice and help is requested from other specialized conservators. A relevant example is that of an epigonation treated from Arkadi Monastery collection in the island of Crete, where the inner paper layers were made of pages taken from a book of conjuration, handwritten epistles, hieratic speeches and other printed material. The pages were removed and conserved separately while new acid free cardboard was inserted in the epigonation structure [10].

Much attention is given on protection of the objects after conservation, through packaging for transport or long term storage with acid free and inert material (Figure 14), as well as padding

Figure 14. Epigonation placed on custom-made box for transport to temporary exhibition.

Figure 15. Display case with Epitrachelia, Epigonatia and Epimanikia, at the ecclesiastical museum of Preveli Monasteri in Crete. Objects are mounted in specially made display mounts.

constructions when bigger objects, such as epitrachelia need to be folded in order to fit to an archival box [11]. Following preventive conservation rules, objects are protected from light sources and humidity, and pest control systems are used during transport and storage [5]. Finally, conservators deal with the preparation of the vestments for temporary or permanent display.

Display Solutions

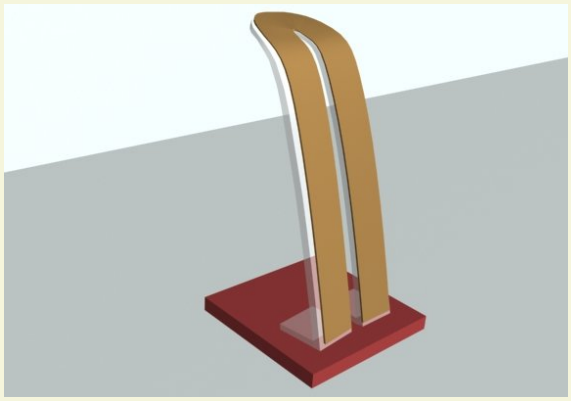
Display of these vestments as units is a difficult task as their use and function is abstruse, when not belonging to a complete ensemble. On the other hand, each one of them can be considered a separate work of art due to its precious materials, technique, symbolism and representation. Therefore, very often these three types of vestments are displayed alone in ecclesiastical museums and temporary thematic exhibitions (Figure 15).

The role of the conservator in the preparation of these objects for display is vital for the object's best handling and security, as well as better promotion in the display case environment. For each type of vestment special display mounts are prepared by conservators, adapted to their specific needs but also upon the museological design as well as the available space. Often, a conservator is working together with the exhibition designer, giving advice for the safe display of the objects. Some general ideas are presented below accompanied by successful examples.

Epitrachelion Display Mounts

This vestment, having the shape of a vertical band of fabric, should preferably be displayed in upright position, like it is worn by a human body (Figure 16). This includes the concave area of the neck, if the epitrachelion is made of a continuous band worn around the neck of the bishop (Figure 17). There are cases that epitrachelion is a flat textile with a round hole on the top; in such case there is no need to pad the neck area when preparing a mount (Figure 15).

Mounts are made of a core of acrylic sheeting of 1 cm thick, having the shape and size of the object and the form of an inclined platform. This way,



the object is clearly visible to the visitors and rests in the platform in an angle, so as its weigh (usually heavy due to gold embroidery) is equally shared. The mount is covered on the one side (the one in contact with the object) with archival polyethylene foam sheet, in order to create a soft and non-slip surface. Finally, the mount is covered with the selected for the exhibition fabric, linen, cotton or silk, which is either the same for all objects in the case, or is specially selected and prepared (material and colour) for the specific object. Epitrachelion is adjusted to the mount either with Velcro system or by simple seating (where a padded neck is present) while friction forces keep it in place (Figure 16).

Epigonation Display Mounts

The rhomboid and stiff form of the Epigonation determines the display mounts for this object. Its small size and important iconography needs its flat or incline position inside the display case, close to the viewer. Many times Epigonatia are placed vertically at the back or side of a showcase (Figure 15).

Several methods have been used for the display of Epigonation and most of them involve the creation of a padded board which hosts one or more similar objects and is usually placed in slope position (Figure 16). Boards are made of polycarbonate sheet, acid-free cardboard or acrylic sheet and covered with the selected fabric. In the case of vertical display, special acrylic holders are made in order to keep the objects in place (Figure 15). This method refers only to very stiff and stable

Figure 16. Design and application of custom made display mounts for Epitrachelion and Epigonation at the exhibition: Athos and the Byzantine Empire, Musée de Petit Palais, Paris 2009.

Figure 17. Detail of a mount prepared for an Epitrachelion, neck area.

Epigonatia, where the inner cardboard is capable to hold the weight of the object without deformation.

Epimanikia Display Mounts

Special attention should be given to these two textiles which are always displayed as pair, as the representation usually tells a story (eg. Annunciation). Therefore, they have to be put side by side in the correct order (left and right) in order to make the picture readable (Figure 3). As for Epigonation the usual method selected for this type of vestment is the padded board, either flat or in slope position (Figure 15). Exceptions must be considered epimanikia that have a stiff cylindrical shape that has to be supported by a special custom made soft mount, made of archival polyethylene foam (Ethafoam) (Figure 3).

Conclusions

Epitrachelion, Epigonation and Epimanikia are three vestments of the Greek Orthodox church that, apart form their liturgical, theological and symbolic meaning, are considered works of art and are treasured as special exhibits in ecclesiastical collections around the country and internationally. Their conservation, protection and preparation for safe display are important tasks for textile conservators in Greece and foreign collections. The role of the conservator is not only technical, since (s)he has to deal with religious objects that become exhibits. The conservator has to take advantage of the opportunity for research and detailed documentation of extraordinary objects, kept out of site for centuries, and at the same time to give the opportunity to the audience to admire them with minimum risk.

The promotion of the vestments through display solutions, after applied conservation, is also an important task for conservators. The applications presented here have had a successful feedback in Greece, in a way that has become a routine procedure for ecclesiastical collections in monasteries and cathedrals around the country. More and more requests from local ecclesiastical communities are coming to the central service of the Greek Ministry of Culture, giving us the gratification of communicating textile conservation services with success nationwide.

Acknowledgments

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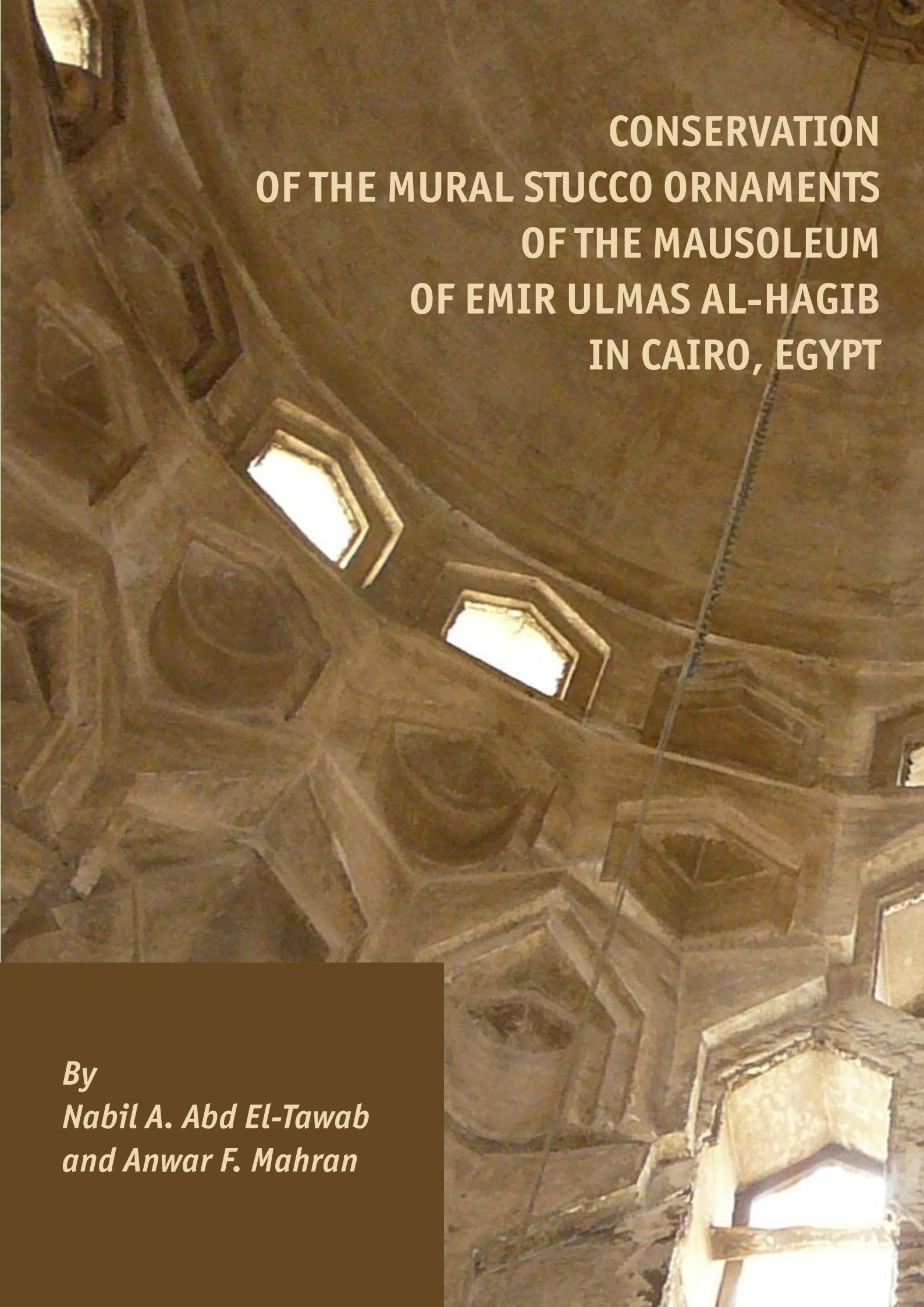

CONSERVATION OF THE MURAL STUCCO ORNAMENTS OF THE MAUSOLEUM OF EMIR ULMAS AL-HAGIB IN CAIRO, EGYPT

By
Nabil A. Abd El-Tawab
and Anwar F. Mahran

The Mosque of Emir Ulmas al-Hagib was built by Prince Sayf al-Din Ibn Ab-dallah in 1330 AD (730 H). The mosque mausoleum contains several stucco ornaments representing seven units (Sorra) with high and low reliefs executed with moulds. The transition zone of the mausoleum dome also contains stucco ornaments. The dome mural stucco was darkened and severely damaged due to the effects of the groundwater and the presence of salts which have caused significant detachments of the ornaments. It was also seriously affected by both acidic and alkaline environments due to rainfall, temperature, and moisture among others. Prior to the conservation intervention, the materials were characterized by optical microscopy, scanning electron microscopy with energy-dispersive X-ray spectroscopy, X-ray diffraction and X-ray fluorescence. After the material characterization, the conservation and restoration of the stucco ornaments, which included including cleaning, injection grouting, consolidation, restoration and completion of lost parts, were carried out.

Introduction

Historical and architectural background

The Mosque of Emir Ulmas al-Hagib (Figure 1) was built in 1330 AD (730 H) during the Bahri Mamluk period (1250–1382 AD). It was erected during the reign of Sultan El Nasir Mohamed ibn Qalawan [1] by Emir Seif El Din Ulmas, who was executed for unknown reasons and was buried in the mosque mausoleum [2]. The plan of this mosque (Figure 2) consists of an open courtyard (*Sahn*), surrounded by four arched chambers (*Riwaqs*), the largest being the *Qibla*[1] one. All the arches rest on marble columns, and those round the *Sahn* have borders of stucco ornament [3]. The mausoleum is in the northwestern corner of the mosque, the dome at the left corner and the minaret, which is later rebuilt, is at the right of the entrance [4].

The mausoleum and stucco ornaments

The mausoleum has a smooth plastered-brick dome decorated with stucco in seven units (*Sorra*) with high and low relief using casting methods. The stucco ornaments were executed around the windows (Figure 3) and in the transitional zones of the dome (Figure 4), and represents similar botanical and foliate elements (Figure 5). The aim of this research is to determine which materials were used in the construction of the mausoleum in order to characterize the construction techniques used in the XIV century and to proceed with its conservation.

Deterioration

The Mausoleum of Emir Ulmas al-Hagib is a cylindrical brick dome resting over cylindrical brick walls. The dome presented multiple cracks, some at the decoration level but others were deep penetrating into the red brick wall that supports the structure, likely resulting in loss of stability (Figure 6).

The stucco ornaments were in a very poor condition as result of different deterioration factors. These include physicochemical factors, changes in relative humidity and temperature, the effects of underground water and salts, air pollution, past

[1] Qibla is the direction that Muslim faces when they pray, heading towards the Kaaba in Mecca (Saudi Arabia).

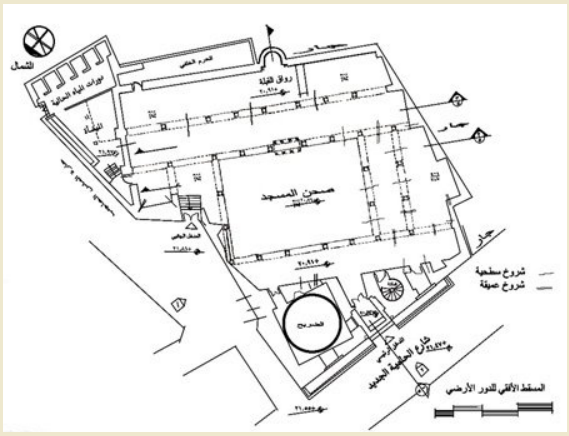

Figure 1 (top left). Minaret and dome of the mosque of Emir Ulmas al-Hagib in Cairo, Egypt.
Figure 2 (top right). Plan of the Mosque.
Figure 3 (left). Typical stucco carving that decorate the dome windows.

faulty restoration works and the great number of visitors and worshippers, human factors and their effects on archaeological sites.

The contamination of the stucco with soluble salts, mainly sodium chloride, calcium sulfate and nitrate, bears a considerable risk for its preservation (Figure 7) since their behavior is uncertain, remaining inert for long periods or becoming active and destroying the stone [5]. It is known that the crystallization and solubilization cycles of salts into the porous matrix causes damage to porous materials [6]. The salts in the stucco ornaments can originate from the lime mortars reacting with environmental pollution. Contaminating nitrates are brought through the water sewage. The brick support was also severely damaged by soluble salts transported by rising damp and groundwater.

The stucco ornaments were completely covered with a very concentrated layer of dirt (Figure 8), candle soot, stains, cobweb nests and bird excretions that caused color changes and deterioration of the stucco ornaments. The mural stucco also presented flaking. Furthermore, there were also other materials such as soot, grease and dust particles deposited from air or rain and fixed to the original material.

Microorganism's growth on the decorative stucco has interacted with the stucco substrate at different stages [7] and their metabolic products causing aesthetic and structural damage through chemical reactions. Furthermore, living and dead biological matter plays an important role in the blackening of surfaces, especially for black films growing on surfaces exposed to rain.

Figure 4. Mural stucco in transitional zones of the dome (stalactites).

Figure 5. Examples of botanical and foliate elements.

From up to down:
Figure 6. Cracks extended to the red brick supporting.
Figure 7. Contamination of the stucco with soluble salts.
Figure 8. The stucco ornaments covered with a very concentrated layer of dirt and presented flaking.

Materials and Methods

Since samples had to be collected for analysis, they were taken from selected areas that had no aesthetic value for future reconstruction or from deteriorated areas. Samples of stucco, plaster and red bricks were taken and were analyzed to identify their composition and the products of the different weathering forms such as which types of salt were present.

Thin sections of the samples were prepared to be analyzed by optical microscopy. The samples were first observed using an Olympus BX40 optical stereomicroscope, and recorded with digital camera under 40-60X magnification to study their surface. The samples were also analyzed using a JEOL JSM-5500 LV scanning electron microscope equipped with an Oxford Energy-Dispersive X-ray (EDX) system, detector model 6587. In order to be analyzed, the samples were coated with gold.

Selected samples were also analyzed by X-ray diffraction (XRD) using a Diffractometer Philips PW 1840 with Ni-filtered Cu Kα radiation (λ= 1.542 Å) at 40 KV, 25 mA and a scanning speed of 2° 2θ/min. Fourier transform infrared spectroscopy (FTIR) analysis was performed using a JASCO FTIR–460 plus spectrometer. The samples were grinded and mixed with potassium bromide (KBr) to be analyzed. The IR spectra were acquired between 1000 cm^{-1} and 4000 cm^{-1} at a 4 cm^{-1} resolution, representing averages of 64 scans.

Results

EDX-SEM Analysis

SEM was used for detailed investigation of the present conditions of the stucco ornaments. One of the main problems was the formation of micro-

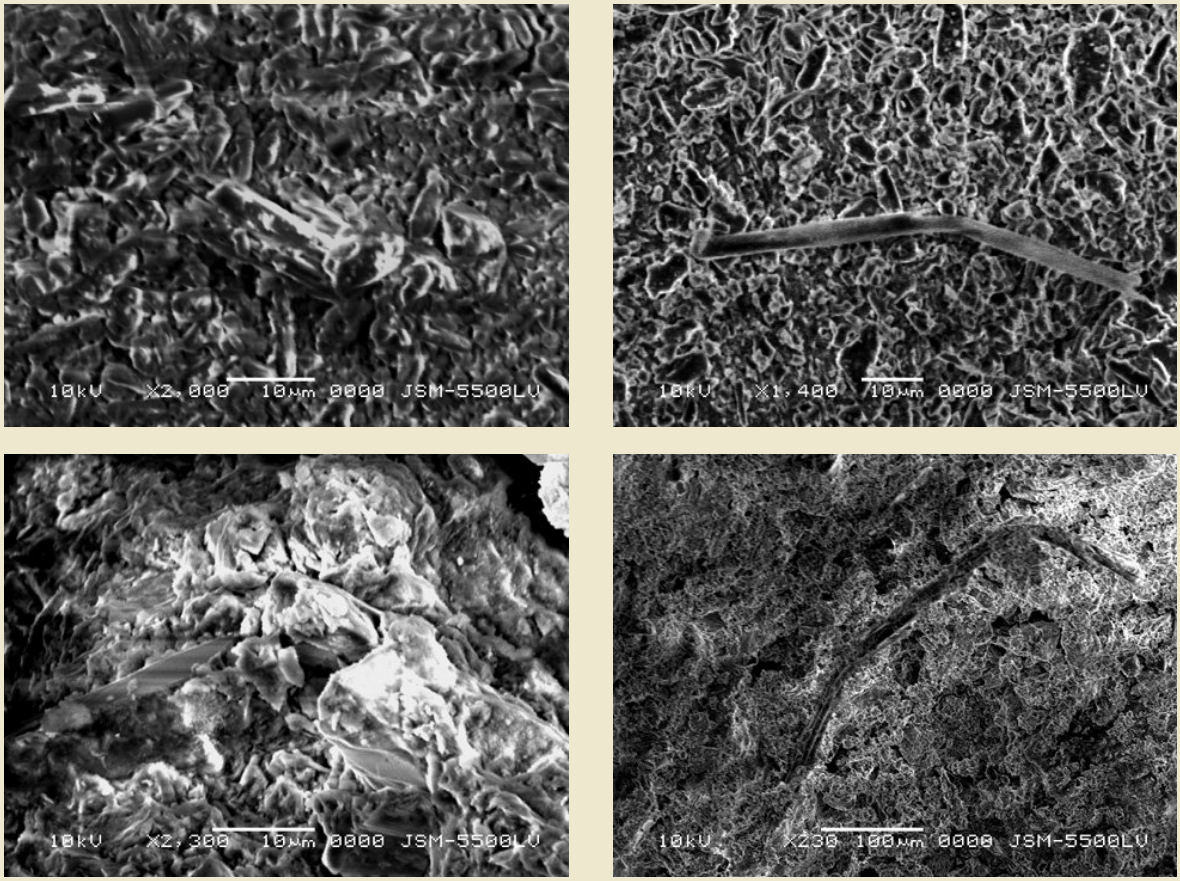

Figure 9. SEM photographs of the stucco ornaments samples

cracks, blistering, and clear disintegration between the fine lime plaster. The SEM microphotographies revealed that there was a wide range of deterioration features such as particle deposits, small fissures, smoothing in the outer surface of calcite and gypsum grains, eroded pits, and the presence of some salty crystals as halite and gypsum. In addition, the presence of fungi hyphae in the inner red brick structure was also detected (Figure 9).

Considering the EDX results, it can be concluded that mortar, plaster layer and ornaments of the mausoleum of Ulmas al-Hagib were prepared with lime and gypsum. The presence of chloride and sodium reflect the halite salts which play an active role in the deterioration of the stucco ornaments. The EDX analysis of the red brick indicated the presence of silicon, aluminum, potassium, calcium, magnesium, iron, and traces of titanium, the results are shown in table I.

X-Ray Diffraction (XRD)

Samples from the mortar, plaster, stucco and bricks were analyzed by XRD. The results are summarized in table I. According to the analysis, the mortar mineral composition consists mainly of calcite ($CaCO_3$), anhydrite ($CaSO_4$), quartz (SiO_2), orthoclase ($KAlSi_3O_8$) and halite (NaCl). The calcite can originate from limestone powder, quartz and orthoclase from aggregates and halite from salts. Anhydrite is the result of the transformation of gypsum ($CaSO_4.2H_2O$) by thermal weathering. The sample taken from the plaster

Table I. Results of the EDX analyses to the materials sampled from the Mausoleum dome of the Mosque of Emir Ulmas Al-Hagib.

Sample	Elements concentration (%)										
	Al	Si	Na	S	Cl	K	Ca	Ti	Sr	Fe	Pb
Mortar	1.4	5.4	-	1.9	8.7	1.2	67.1	0.9	0.7	12.6	0.9
Plaster	0.7	9.0	1.3	16.7	0.6	0.9	66.6	-	1.2	3.0	-
Plaster	1.0	2.0	3.3	20.2	4.5	0.6	67.3	-	-	1.2	-
Stucco	0.6	4.4	2.3	19.4	0.7	0.6	68.5	-	1.0	2.6	-
Brick	-	2.9	2.6	23.4	1.9	0.7	65.2	0.4	-	4.0	-

around the Sorra consists mainly of quartz, orthoclase, albite ($NaAlSi_3O_8$), halite, anhydrite and calcite. The sample from the stalactites shows that it consists mainly of calcite, gypsum, quartz and halite in similar proportions). The stucco from the Sorra), however, shows a higher concentration of calcite and gypsum, a lower concentration of halite and no traces of quartz than the other samples. The mineral composition of the brick is mainly of quartz, followed by orthoclase, magnetite (Fe_3O_4), hematite (Fe_2O_3), nitrate ($NaNO_3$) and anhydrite. All these results are shown in table II.

Fourier Transform-Infrared Spectroscopy (FTIR)

FTIR was used to determine the possible existence of organic materials that may have been used to bind the stucco. The FTIR results were compared with reference spectra of well known organic adhesives. The results showed the presence of a deteriorated protein-base material, suggesting the presence of animal glue that was used for binding. The characteristic absorption bands of the glue can be seen in table III. In the analyzed sample (taken from stalactite stucco ornaments), the stretching vibrations of calcium carbonate ($CaCO_3$) peaked at 1620, 779, and 672 cm^{-1}. The spectra also showed the presence of typical vibration bands of hydrated calcium sulfate, commonly called gypsum ($CaSO_4.2H_2O$), centered at 1073, 672, and 567 cm^{-1} as well as the stretching and deformation vibrations of the O–H bond of water at 3407 cm^{-1}.

Conservation Intervention

Conservation interventions have to be individually planned and conservation materials have to be well adapted to the material parameters of the building or decoration material in order to avoid further damages [8]. Prior to the intervention, documentation of the ensemble and of the stucco ornaments was performed. Conservation and restoration interventions need thorough planning and documentation. Since many of the interventions made today are due to damages caused by inappropriate interventions made in the past, proper documentation can help solving the problems being currently faced [9]. The restoration of the decorative elements was only started after the architectural restoration has completely done at the mausoleum.

Table II. Results of the analysis by X-ray diffraction of the Mausoleum of Ulmas El-Hageb.

Minerals	Samples (%)					
	Mortar	Plaster	Plaster	Stucco	Stucco	Brick
Gypsum ($CaSO_4.2H_2O$)	-	-	29.5	31.6	37.3	-
Calcite ($CaCO_3$)	55.2	12.0	35.6	39.7	52.7	-
Quartz (SiO_2)	27.5	65.1	15.5	9.8	-	46.7
Anhydrite ($CaSO_4.½H_2O$)	3.6	3.3	-	-	-	4.5
Orthoclase ($KAlSi_3O_8$)	5.3	7.7	-	-	-	16.2
Albite ($NaAlSi_3O_8$)	-	5.2	-	-	-	-
Hematite (Fe_2O_3)	-	-	-	-	-	10
Magnetite (Fe_3O_4)	-	-	-	-	-	29
Nitrate ($NaNO_3$)	-	-	-	-	-	8.8
Halite (NaCl)	8.8	6.5	19.4	18.9	10	-

Table III. Relation between functional groups of stucco elements and glue.

Function group	Glue (reference) (cm^{-1})	Stucco sample (cm^{-1})	Attribution
O-H	3400-3200	3672-34076	O-H stretching bands of both animal glue and gypsum
N-H stretch	3100-2800	2513-2237	N-H stretching band of animal glue is overlapped by O-H bands
C-H stretch	1600-1600	1685-1620	Asymmetric and symmetric C-H stretching bands of aliphatic groups of animal glue
C=O stretch	1565-1500	1685-1513	Very weak band due to C=O group of calcite (Calcite is present in low concentration)
O-C-O	-	873	O-C-O bending band of carbonate group of calcite
S-O	-	672	SO_4^{2-} bending band of gypsum

Cleaning

Before any other treatment could take place, a careful cleaning was performed to the stucco ornaments surface to remove the superficial salts that might remain on the surface. Also, the cleaning allowed removing disfigurements revealing the nature, color or details of the ornaments, unifying their appearance, remove harmful or undesirable deposits, expose concealed defects to establish the nature and extent of necessary repair, and preparation of the surface for other treatments such as improving the uptake of liquid conservation agents.

Mechanical cleaning was employed to remove friable dirt using soft brushes with different sizes (Figure 10). An air blower was also used in

Figure 10 (top left). Cleaning new plaster and removing friable dirt's by using different sizes of soft brushes.

Figure 11 (top right). Cleaning by poultices with an active ingredient.

Figure 12 (right). Using of chemical solution with cotton swab.

places with cracks to help removing the dirt unattached. Scalpels, spatula and different types of brushes were also used to remove the crust of bird droppings and other concretions. Overlying layers of lime wash were also removed.

Chemical cleaning was performed to remove what mechanical cleaning failed to remove from the soot, stains and other dirt. For this cleaning, poultices, which are constituted by an inert support mixed with an active ingredient, were used (Figure 11). Four different poultices were used: the first poultice used for soot was 3 parts Disogen 57 (with concentrate 5%) plus 1 part of solution of ammonia (with concentrate 5%); the second poultice mixture of alcohol and water (1:3) to remove the dust; the third was used for organic deposits and fats and consisted of Amyal acetate, dimythylformamide and Thinner L (supplied by Chemicals for Modern Buildings) (1:1:1); and the fourth poultice, used for the soot and dark spots, was prepared with pure acetone, ethyl alcohol, ammonia, and distilled water (3:1:1:1). In some places of the ornaments, poultices were not used but instead, the cleaning was carried out by rolling small cotton at wood swabs, dampened with the chemical solutions (Figure 12).

Desalination of the Stucco Ornaments

Since the principal cause of damage of the stucco ornaments was hygroscopic salts, they should be removed before other interventions such as consolidation. Mechanical cleaning was used to remove efflorescence salts by using scalpels, spatula and other different types of coarse brushes with different sizes. Afterwards, ethylenediaminetetraacetic acid (EDTA) was used because it forms a stable complex with Ca^{2+} ions making it particularly appropriate for gypsum crusts. Thus, gypsum is transformed into soluble sodium sulfate (Na_2SO_4) that is mobilized into the EDTA poultice as well as

Figure 13. The grouting process started by making very small holes.

Figure 14. Trichloroethylene was first injected into the rendering layers.

into the ornaments. For the determination of a suitable poultice, various tests were conducted. Several materials, including sepiolite, were considered but the best results were obtained with a cellulose pulp of beech wood, mixed with deionized water were applied to the stucco ornaments, to draw out the halite salts. The poultices completely covered the stucco ornaments to a uniform thickness of about 1 cm. They were allowed to dry over a period of about 48 hours. During this time, white salt crystals formed on the peaks of the sepiolite poultice. When these salts were removed and tested, they matched those that had been found in the water droplets. The poultice treatment was repeated ten times.

Injection Grouting

One of the main deterioration problems of the mausoleum is the crumbed and separated areas of the rendering layers which cover the red brick plaster inside the dome between the stucco stalactite and stucco sorra. Also, there were many cracks in the stucco stalactite. The grouting process aims at stabilize this rendering and their attachment to the underlying support and fill the big cracks. The grouting process started by making very small holes in free places from crumbed rendering (Figure 13). Trichloroethylene was first injected into the rendering layers as wetting agent to encourage the grouting mixture to fill the voids as shown in (Figure 14). Grouting was applied using primal AC33 emulsion applied with syringes. A mixture of gypsum and lime (1:2) with Primal AC33 in diluted form was injected into the cracks, being applied in highly viscous form with syringes.

Consolidation

Deterioration always causes a decrease in strength starting from the surface and progressing into the interior of building materials. The stucco ornaments were too fragile and its fragments too precious. Consolidating, therefore, aimed at equalizing this strength deficiency to attempt any form of desalination. In order to carry out this treatment, some problems had to be resolved: choice of a material for the consolidation and identification of a method for ensuring that the salts remained in solution during treatment; also the choice of a material for consolidation was conditioned by several factors. As with any consolidant, it is important it to have good penetration and that it do not reduce the material porosity, alter the color, or compromise future treatments. In addition, it was essential that the consolidant would not fixate the salts to the substrate or

prevent the passage of the liquid water. Given these criteria, it was decided that synthetic resins such as Paraloid B72 were unsuitable. The selected material was methyl silicate, a silicon ester (Tegovacone V) plus Acryloid B66, to give it greater strength and to seal it against moisture. Treatment began with the most threatened areas due to the powdering and flaking of the stucco ornaments. The initial consolidant application was made with a brush and injection. Subsequent applications were by spray. The consolidant was applied three to four times a day for four days at two-week intervals.

Conservation and Restoration Process

After stabilization of the layers, the deep cracks and voids between the stucco ornaments were filled with a lime-based mortar consisting of lime, gypsum, and wash fine (2:1:1). Linen rods impregnated in Primal AC33 were used to bind the restored parts with the thick mortar layer, (Figure 15). Every mortar layer was left to dry although its surface was scratched before complete dryness so it could easily accept the next mortar layer. The surface was finished with fine lime mortar at a lower level than the one of the existed original surface in order to differentiate this modern intervention.

Completion of Missing Parts

It was decided to proceed to complete the missing parts of the ornaments, especially if they were in

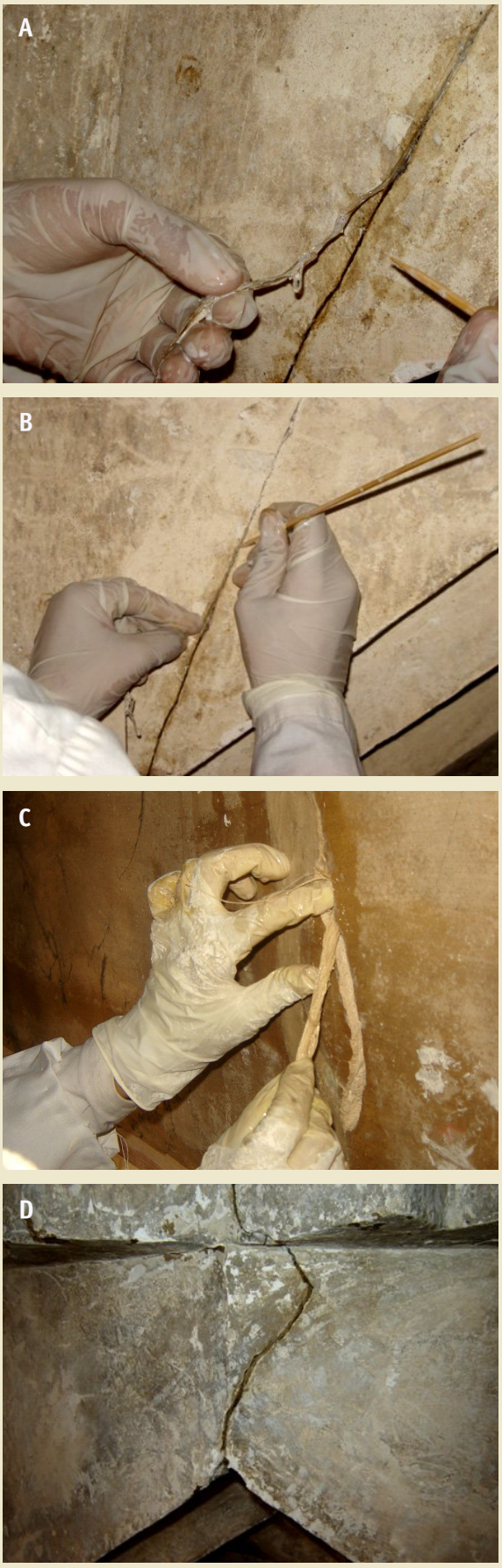

Figure 15. Restoration of the stalactite cracks: a) linen impregnated in primal AC33; b) compressed the linen rods inside the crack by spatula; c) linen inside the crack; and d) the surface covered by mortar layer.

poor condition and in need of rapid intervention to avoid future collapse. This works were carried out by conservators with lime mortar similar to the old preparation layer, which was prepared with lime, gypsum and sand (2:1:0.5) mixed with 15% of Primal AC33, in two types. The first completed the missing parts of the ornaments directly by engraving methods. The filling material was applied with a spatula to flatten the putty and smooth it out until it comes well to the edges of the ornament film. After finishing, iron oxide was used to approximate its color to the patina at the original parts. The second type was using reproduction parts using casting methods. The stage of completion was applied by reproduction because of the availability of benchmarks we have repeat units of decorative plant. The reproduction was applied by making clay mould which applied on the part to be reproduced to obtain a copy of the original ornaments (it is preferable to add talcum powder on the archaeological surface and rubbed it by dry piece of cotton, so do not stick to the clay on the archaeological surface). The work of the silicon rubber mold for these parts was done to reproduce and replicate by casting the corresponding components and then installed in the manner and place of work required by the frills (Figure 16). Figure 17 show the stucco ornaments in mausoleum of Emir Ulmas al-Hagib after the complete restoration.

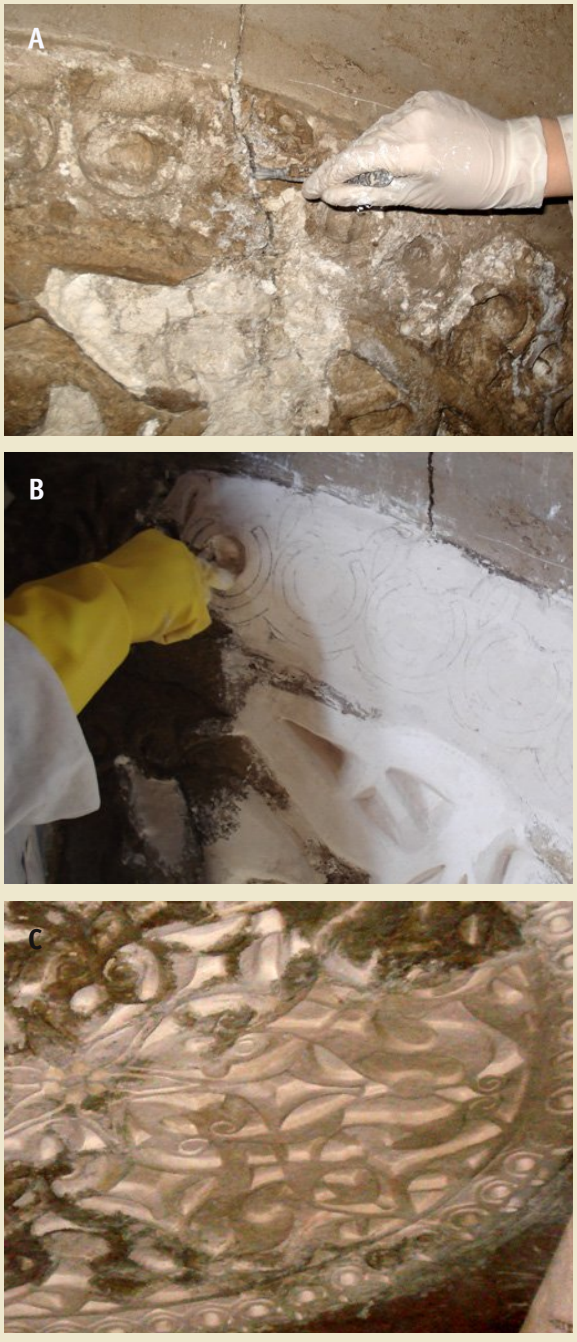

Figure 16. Different steps of the intervention of stucco ornaments: a) filling the crack with linen impregnated in primal AC33; b) volumetric reintegration; c) final aspect.

Figure 17 (next page). Stucco stalactite after the intervention.

Conclusions

This paper describes the material analysis and conservation intervention of the stucco ornaments at the mausoleum of Ulmas al-Hagib in Cairo, Egypt. The ornaments were in a very poor conservation condition and required urgent conservation. The ornaments were completely covered with a very thick dirt layer, black layer of lime plaster, soot, numerous cobwebs, and bird droppings that

caused color changes, the plaster layers lost its adhesion to the brick support in many places of the wall, and also micro cracks, flaking, crumbing were observed.

The materials were studied by optical and electronic microscopy while their composition was determined by EDX, XRD and FTIR. Calcite, gypsum, quartz and halite are the main compounds found in the stucco Sorra and stucco stalactite. The presence of sodium chloride in high ratios is mostly ascribed to direct effects salts crystallization transported, by rising damp, ground water, domestic waste water or relative humidity lead to dissolution of gypsum, so the stucco ornaments lost parts.

The SEM examination showed that there a weakness in the gesso due to deterioration factors as interference of sodium chloride between grains, and indicated the presence of fungi hyphae inside the red brick support which ascribed to direct effect of the biodeterioration. An organic binder, most likely animal glue as identified by FTIR, was also used as a binder for the stucco to make gesso.

The restoration and conservation work of the stucco ornaments included documentation, mechanical and chemical cleaning, desalination, grouting, consolidation, restoration process and volumetric reintegration.

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EFFECTS OF THE GROUNDWATER ON DETERIORATION OF THE CATACOMBS OF KOM EL-SHOQAFA, ALEXANDRIA, EGYPT

By
Ibrahim Mohamed Abdallah
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The Catacombs of Kom El-Shoqafa is one of Alexandria's most memorable monuments. The Catacombs are decorated with stone sculptures that have been exposed to severe ambient conditions. In particular, the rising groundwater level has caused intensive decay of stone, mortars and plasters. The aim of this paper is to study the effect of the groundwater on the minerals' deterioration of the Catacombs structural and decorative elements. Field inspection and analytical characterisation by X-ray diffraction (XRD) and X-ray fluorescence (XRF) of the stone, mortar and plaster samples were performed to determine the weathering mechanisms present in the Catacombs. Also, the mineral composition and its alteration were determined by petrographical examination using a polarizing microscope (PLM) and a scanning electron microscope (SEM) with energy dispersive X-ray analysis (EDX). Furthermore, chemical and biological analyses of the groundwater were also performed. The results showed that the dramatic increase in the groundwater salinity plays a major role in the chemical degradation and disintegration of the Catacombs' building materials.

Introduction

Kom El-Shoqafa is the Arab name given in recognition of the ancient Greek name of Lofus Kiramaikos which means "Mound of Shards" or "Potsherds". Kom El-Shoqafa is on the same site where once the village of Rhakotis was. It is the name by which it was known by the Romans as shown in hieroglyphic engravings from the time of Ptolemy I.

The Catacomb was discovered by chance in 1892. The necropolis corresponds to the type of tomb that was widespread during the first three centuries in Italy. Although catacombs were almost limited to the burial of deceased Christians, no trace of them were found in Kom El-Shoqafa. The most important buildings date from about the middle of the second century BC, but it extended to a longer period starting from the end of the first century and up to the fourth century AD, according to the architectural styles of sculpture and engravings that can be seen in the necropolis. This necropolis was constructed as a tomb for one single family, yet later it was used for the burial of many families as the burial of a group of heathens shows [1].

Down the spiral stairway there are three levels of burials from different periods cut in the rock on the southern slopes of a hill and which may have been the burial place of a particular religious community [2]. They are unique both for their plan and for its decoration, which represents a merging and mixing of the Egyptian, Greek and Roman cultures and traditions [3]. The catacombs are composed of a ground level construction that probably served as a funerary chapel, a deep spiral stairway and three underground levels for the funerary ritual and entombment, one of which was a banqueting hall where visiting relatives would dine (Figure 1).

The first level consists of a vestibule with a double exedra, a rotunda and a triclinium. In its original state, the second level was the main tomb. With various surrounding corridors, it was reached by a monumental staircase from the rotunda. The third level is currently submerged in groundwater.

Groundwater levels have been rising in Alexandria since 1980. They were affected by the development activities in the Nile Delta region after the establishment of the High Dam in 1970 and as

Figure 1. View of the catacomb main burial chamber (left) and deteriorated high-relief figures (right) from the tomb.

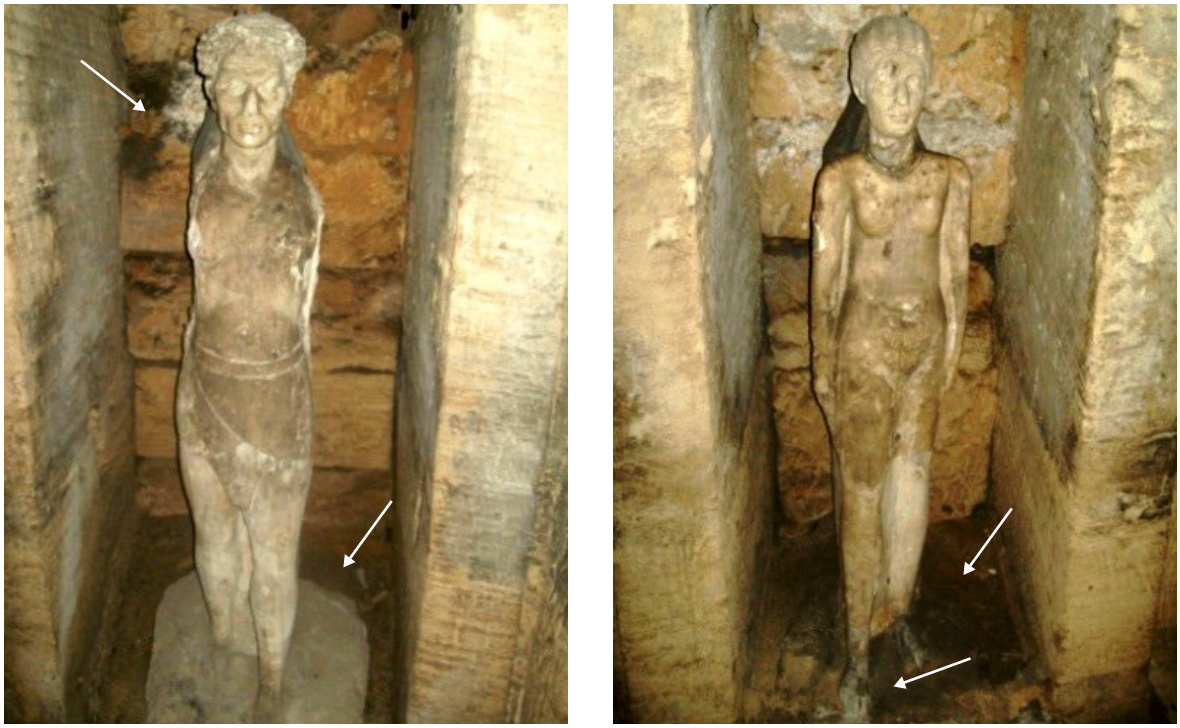

Figure 2. Male (left) and female (right) sculptures with signs of weathering and deterioration.

result of urban congestion and deterioration of the drainage systems. Also, the lack of modern irrigation systems in Alexandria's surroundings [4] is threatening to flood archaeological sites, particularly those with underground structures. The primary source of the water is the leakage from the old water supply and sewerage pipes [5].

The Mediterranean coastal ridges date from the Pleistocene period and are mainly composed of Oolitic limestone [6]. The Oolitic limestone forms the most important aquifer in the area and its surroundings covering an area of 660 km^2 (60 km long, 11 km wide). The saturated thickness rarely exceeds 10 meters due to combination of the relatively high rainfall (mean 170 mm/year) over the area and the limestone permeability, which enables the rainwater to be absorbed into the ground without large losses due to surface run-off. The Mediterranean Sea and Mariut depression

Figure 3. Presence of groundwater in the third level of the Catacomb tombs and its influence at the walls: algae growth and deterioration of plaster and limestone.

act as the main discharge area for the groundwater contained in the Oolitic limestone aquifer [3].

The water within this aquifer runs free, with a depth of 5 to 10 meters, under Oolitic limestone in the south of the coastal plain area [7]. The average depth of the groundwater varies from 3 to 21 meters below the ground surface and its salinity varies between 1100 and 2800 ppm.

The rising groundwater level is affecting archaeological sites [8]. The increasing groundwater salinity damages the structural and decorative elements like depositional soluble salts from the groundwater and high humidity that rises in the walls forming saline deposits causing blackening, roughening, plasterwork flaking [9], contour scaling and biodeterioration (Figures 1-3).

Materials and Methods

Chemical Study of the Groundwater

The water was analysed to determine its chemical composition. A water sample was taken from the third level in a sterile bottle to avoid contamination. The samples were analyzed for the major cations (K^+, Na^+, Mg^{2+} and Ca^{2+}) and anions (Cl^-, SO_4^{2-}, CO_3^{2-} and HCO_3^-) using chemical methods and an atomic absorption spectrometer model AAnalyst 100 (Perkin Elmer). The water temperature and pH were also measured.

Table I. Presence of ions of the groundwater from the Catacombs of Kom El-Shoqafa third level.

Ions		Ion Concentration (mol/L)
Cations	Na^+	115
	K^+	1.33
	Mg^{2+}	95
	Ca^{2+}	0.02
	Fe^+	0.004
Anions	Cl^-	126
	SO_4^{2-}	211
	HCO_3^-	89.2

X-ray Diffraction (XRD)

The composition of the Catacombs' building materials was made by X-Ray diffraction (XRD) using a Philips PW 1840 Diffractometer. The patterns were made with Ni-filtered Cu Kα radiation (λ= 1.54056 Å) at 40 kv and 10 mA. The scanning was limited to $2\theta = 1\text{-}80^o$.

Petrographic Examination

Samples were observed using different types of microscopes. Thin sections were prepared and optically analyzed using polarized transmitted light microscope model (Olympus BX51 TF Japan) with a digital camera attached under a magnification of 20x up to 40x to study the textural and mineralogical characteristics.

Scanning Electron Microscope (SEM-EDX)

A detailed mineralogical study of the stone was carried out. For that purpose, samples taken from the catacombs were analyzed by scanning electron microscopy (SEM). The analyses were made using a JSM-5500 (JEOL, Japan) coupled with an Oxford energy dispersive X-ray spectrometer (EDS) system with an X-ray detector (model 6587). The small limestone samples were coated with gold.

Biological Study

A study of the water biology and biodeterioration of the catacombs was performed to characterize the types of bacteria and fungi present in the limestone, plaster mortar and decorative elements. For the fungi identification, Czapek's agar medium was heated at 45°C, the plates were incubated at 28°C for 5-7 days and then counted. The same method was used to isolate the bacteria using nutrient agar medium and the plates were incubated at 37°C from 24 to 48 hours according to the methodology described by Bader and Al-Gharib [10].

Physical and Mechanical Properties

The physical and mechanical properties studied in the present work are essentially those specified in various international and Egyptian

Table II. Results of XRD analysis of the building materials samples from the Catacombs of Kom El-Shoqafa.

Nr.	Sample Type	Sample Location	Identified Minerals	Percentage (%)
1	Limestone	North of Rotunda	Calcite, $CaCO_3$ Sillimanite $Al_2Si_2O_6$ Mulite $Al_2Si_3O_{13}$ Quartz, SiO_2 Montmorillonite $Al_2O_3.4SiO_2.H_2O$	42 41.6 9.8 5.8 0.8
2	Limestone	Square shafts	Calcite, $CaCO_3$ Quartz, SiO_2 Gypsum $CaSO_4.2H_2O$ Silicone Oxide SiO_2 Biotite $KMg_3Al_2AlO_{10}(OH)_2$	41.1 38.9 13.9 2.6 3.7
3	Limestone	Vestibule	Calcite, $CaCO_3$ Calcium carbonate $CaCO_3$ Sillimanite $Al_2Si_2O_6$ Halite NaCl Microcline $KAlSi_3O_8$ Montmorillonite $Al_2O_3.4SiO_2.H_2O$	45.6 26.5 27.9 6.9 5.6 3.2
4	Mortar	Ground level	Calcite, $CaCO_3$ Halite NaCl Quartz, SiO_2	67.8 30.3 1.9
5	Mortar	Shaft	Calcite, $CaCO_3$ Quartz, SiO_2 Sillimanite $Al_2Si_2O_6$ Microcline $KAlSi_3O_8$ Halite NaCl	63.5 15.5 9.8 6.3 4.6
6	Plaster	Main tomb	Calcite, $CaCO_3$ Quartz, SiO_2 Sillimanite $Al_2Si_2O_6$ Gypsum $CaSO_4.2H_2O$ Kaolinite $Si_4\ Al_4\ O_{10}\ (OH)_8$	85.7 5.1 4.6 3.3 1.4
7	Plaster	Corridor of the 2nd circular stairwell	Calcite, $CaCO_3$ Quartz, SiO_2	95.8 4.2
8	Hard crust	Hall of Caracalla	Calcite, $CaCO_3$ Gypsum $CaSO_4.2H_2O$ Halite NaCl Quartz, SiO_2 Sillimanite $Al_2Si_2O_6$	42.8 26.3 13.4 10.1 7.9

standard specifications. They can be grouped in physical (bulk density, water absorption, apparent porosity) and mechanical properties (dry and wet compressive strength of the catacombs limestone).

Results

Chemical studies of the groundwater

A water sample taken from the catacombs' third level was analysed. Table I shows the analysis

results concerning the major cations and anions. The total dissolved solids (TDS) were 1004 mg/L. In situ measurements indicated the local water temperature being 24ºC and with a pH of 7.3. The microbiological studies indicate the presence of fecal coli bacteria. From two samples taken, the first contained 112x105 cell/g and the second 245x106 cell/g.

X-Ray Diffraction Analysis

Several stone, mortar and plaster samples where taken from the catacombs and analysed by XRD. Table II summarise the analyses results.

Petrography Analysis

The petrographic analysis using polarized light (PL) and crossed nicols (XN) prism showed that the main component of the limestone is micrite. Fossil fragments embedded in the micrite matrix, including bioclasts, are represented by *Pelecypoda*, *gastropod*, *echinoids*, remains of green algae, *Bryozoan* fragments, and *Foraminifera* (*Miliolida* and *Nummulitie*) [11]. Remains of micritized red algae were also observed. Fossiliferous fragments were replaced in some parts by sparry calcite crystals. Quartz grains forming the secondary components are medium to coarse-grained, and ferruginous material is probably responsible for the reddish colour of the limestone. The rock is an arenaceous bioclastic micrite according to Folks' classification [12] (Figure 4).

Scanning Electron Microscopy (SEM) Analysis

Table III shows the elements present in the limestone and plaster samples (Figure 5).

The SEM analysis showed that the Oolitic limestone in the catacombs consists mainly of calcite grains cemented with sparry calcite and clay minerals. It also showed weathering phenomena such as disintegration, exfoliation, pitting, and cracking. SEM observations showed that a heterotrophic micro flora, composed of algae [13], fungi, actinomycetes and bacteria, dominates the catacombs' stone surface (Figure 6).

Biological study

A biodeterioration study of the catacombs (Figure 6) was made to characterize and identify the present bacteria and fungi population. Samples were collected from different surfaces (decorative elements, stone, plaster and mortar) in eight locations consisting of room shafts and corridors. Sterile cotton swabs moistened with distilled water were used for sampling the surfaces. The samples were collected at 85 % RH and 19º C and were transferred immediately into sterilized Petri dishes to prevent contamination. For the counting, starch–casein agar was used for plate-counting bacteria and Czapek Dox agar, malt extract agar and potato dextrose agar (PDA) for fungi. The plates were incubated at 28 ºC. The results of microorganisms study are shown in table IV.

Table III. Results of XRF analysis of the limestone and plaster samples from the Catacombs of Kom El-Shoqafa.

Samples	Elements (%)										
	Ca	Si	Cl	Na	Fe	Mg	K	Al	S	Sr	Ti
Limestone	54.8	7.2	10.9	9.7	4.6	2.6	2.7	2.4	2.2	1.9	0.6
Plaster	92.1	3.5	0.2	1.6	0.6	1.5	-	-	0.6	-	-

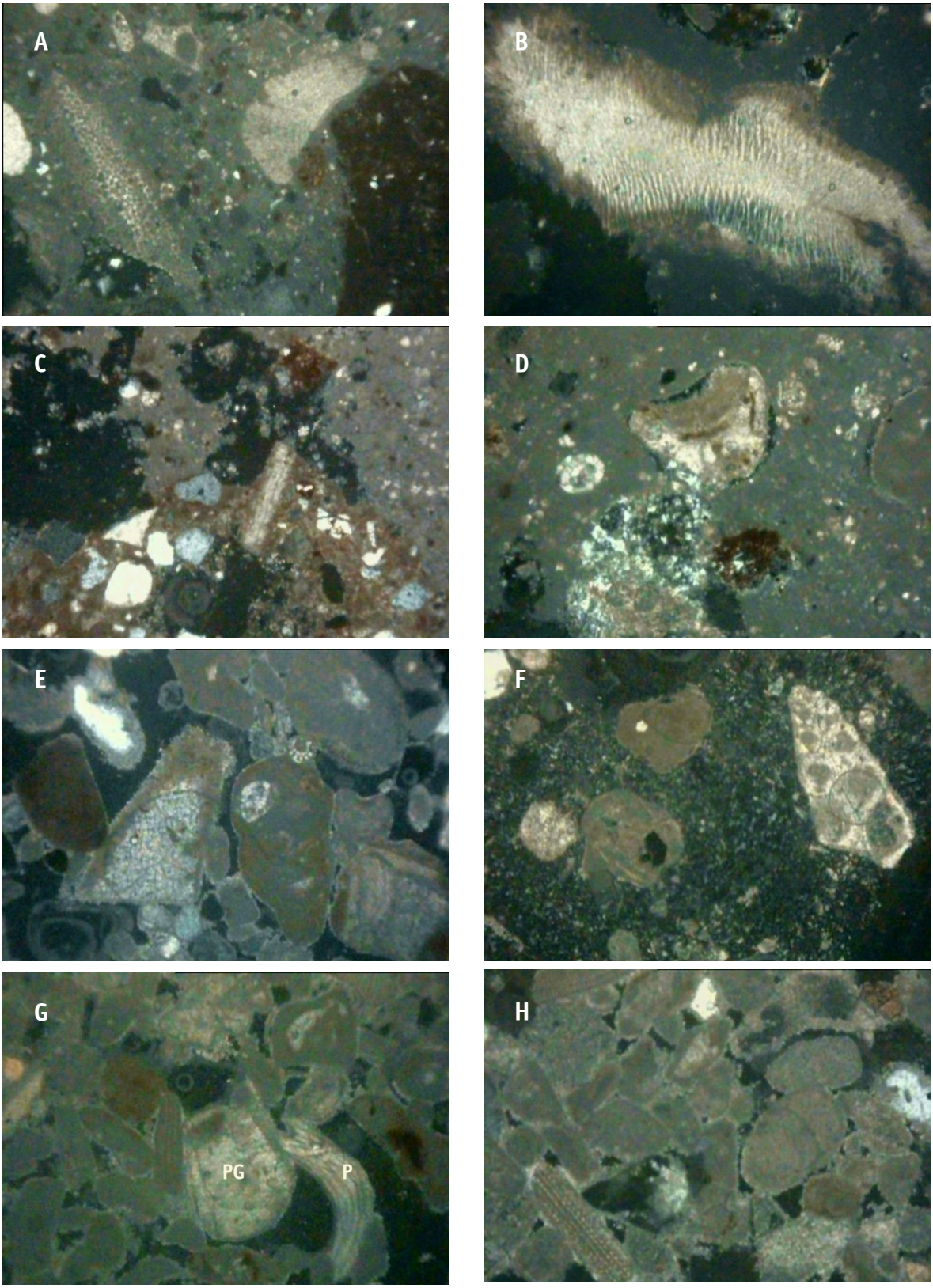

Figure 4. Polarized light micrographs of limestone samples: a) alga and quartz grains embedded in micrite matrix; b) remainder of micritized red alga; c) quartz grains embedded in micrite matrix; d) micrite with cavities filled by spray calcite crystals; e) coated grains embedded in micrite matrix, some grains are calcite and spray calcite crystals while the others are coated by ferruginous minerals; f) gastropod and quartz grains; g) Peloids grains (PG) and a fragment of Pelecypoda *(P); h) algae, quartz grains and iron oxide embedded in micrite.*

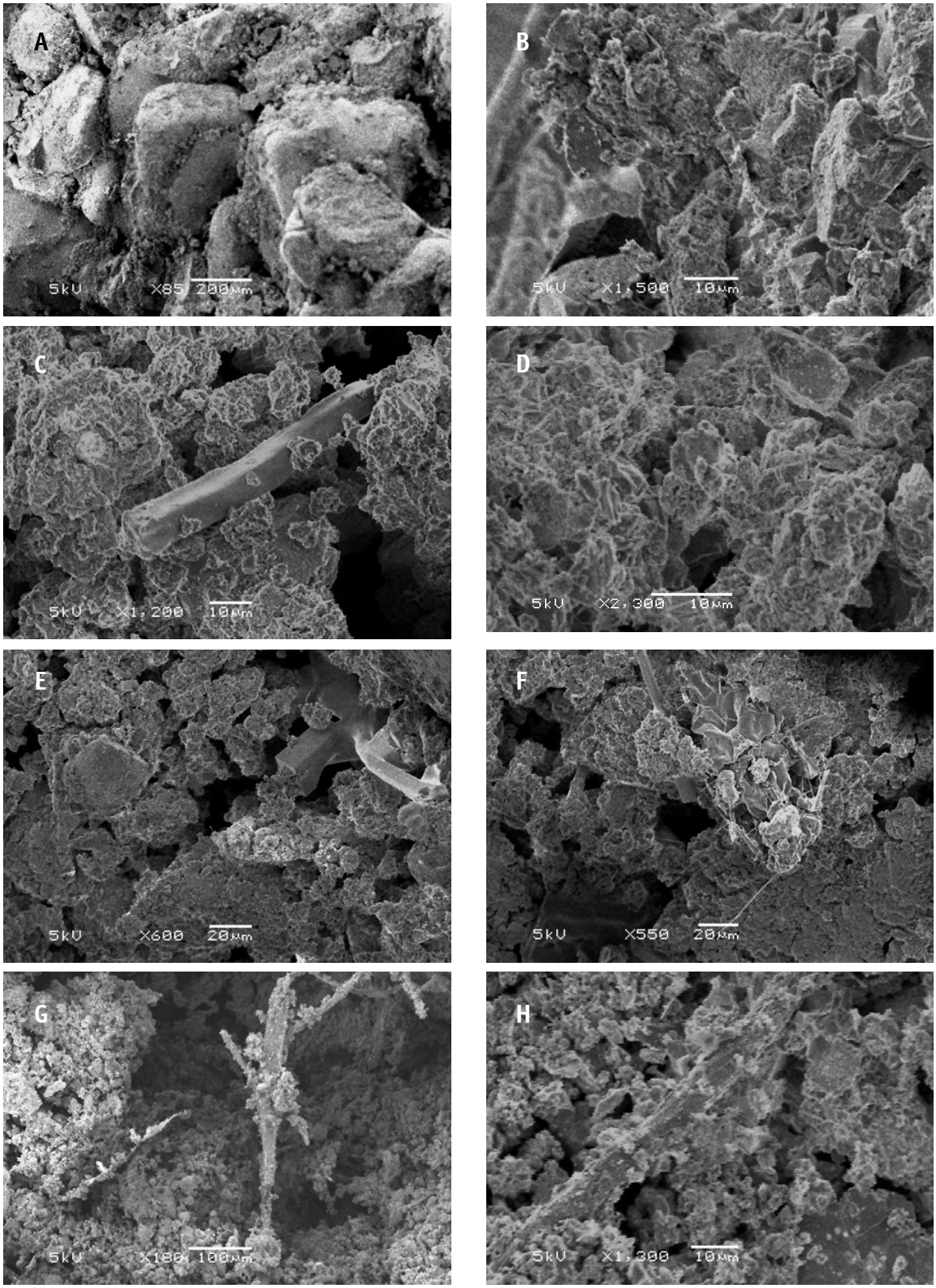

Figure 5. SEM microphotographs of oolitic limestone samples: a) micro pitting appears clearly, most of the oolites are removed and drusy calcite sparite crystals are noticeable; b) collapse of the limestone physical structure due to the effect water and growth of crystalline salts, micro pitting and micro-pores are noticeable, and Drusy spary calcite crystals are seen clearly; c) presence of clay minerals and salts grains; d) presence of gypsum and fossil fragment; e) sodium chloride and sulphates crystallized beneath the stone surface; f) growth between Oolitic limestone grains; g) algal growth; h) filamentous bacteria growth.

Table IV. Microorganisms isolated in the Catacombs of Kom El-Shoqafa.

Microorganisms	Samples			
	Decorative Element	Stone	Mortar	Plaster
Fungi				
Alternaria alternate	✓	✓	✓	✓
Phoma sp.	✓	✓	-	✓
Aspergillus sp.	✓	✓	✓	✓
Fusarium	-	✓	-	✓
Mucor sp.	-	✓	-	✓
Ulocladium	✓	-	-	✓
Bacteria				
Bacillus subtilis	✓	-	✓	-
Bacillus cereus	✓	✓	-	✓
Bacillus pumilus	-	✓	✓	✓
Staphylococcus sp.	✓	-	✓	-
Streptoverticillium reticulum	✓	✓	-	✓

Identification of fungi

Light microscope with a magnification of 400x was used for preliminary identification of the fungi (including *Alternaria alternata, Aspergillus, Phoma sp., Fusarium* and *Mucor sp*) according to typical colonial and conidial morphology. The numbers of fungi in the stone samples ranged from 8.6×102 cell/g to 1.2×104 cell/g [14].

Identification of bacteria

The results showed that microbial groups analised were both aerobic and anaerobic bacteria. The stone surface was colonised by sulphur-oxidising bacteria, ranging from 112 to 114 cell/g.

Physical and Mechanical Properties

The physical and mechanical properties of the limestone of the catacombs tomb were determined as follows: apparent porosity, 24.6 %; water absorption, 19.4%; bulk density, 1.65 g/cm^3; and compressive strength, 63 kg/cm^2 (wet) and 70 kg/cm^2 (dry).

Discussion

Based in both the field investigation and laboratory analyses, the rock decay at the catacombs may be attributed to action of the groundwater with salt weathering processes and microorganisms

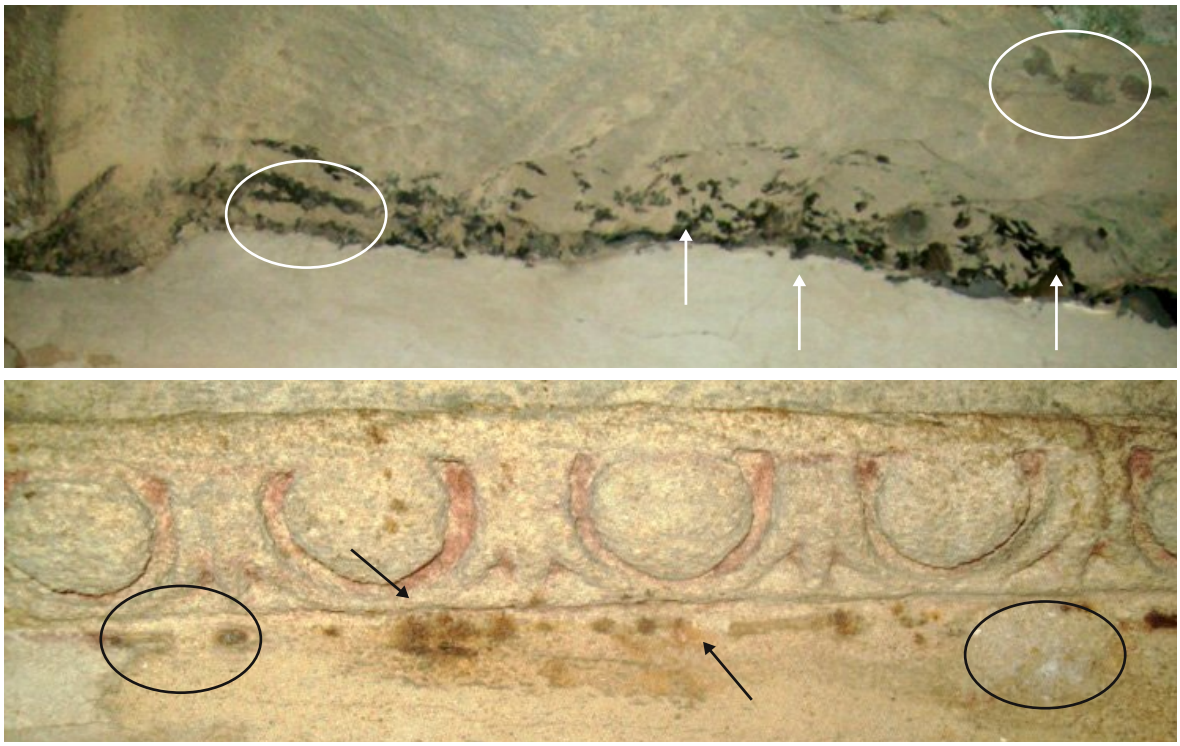

Figure 6. Locations where the microorganisms were collected inside the main tomb (top) and the third level (below).

in collaboration with the cyclic variation of air temperature and relative humidity.

The groundwater analysis identified the presence of several anions (mainly chlorine, sulphates and bicarbonates) and cations (magnesium, calcium and sodium) as shown in table I. The dominant anion and cation were chlorine and sodium, respectively. The total dissolved solids (TDS) were 1004 mg/L [15].

Salts within the limestone can cause it to break down by three mechanisms: the considerable contrasts in thermal expansion of salts in pores; the pressure produced by halite crystallization in small pores; and dehydration exerts an additional pressure that depends on the ambient temperature and the relative humidity [16]. The thermal expansion and the pressure produced during the crystallization of halite associated with the disaggregation process can explain the large decrease of strength. The resulting rupture occurs at a lower strength but with increased deformation of the sample.

SEM observations on Figure 6 show numerous small patches of salt on the rupture surface which may explain the weakness of mineral crystals made of halite (NaCl) [17]. The stone high porosity could result from different weathering, chemical reactions induced by groundwater rapid free-face dissolution of cement materials connecting the grains leading to mechanical failure and concomitant grain–grain sliding.

The petrography analysis of the Oolitic limestone indicated that the texture is the result of shallow, strongly agitated waters. According to Hugman and Friedman [18], sparitic limestone is less resistant to salt weathering than micritic limestone. Also, there is an inverse relationship between the quartz grain content and the hardness of the rock which may explain the low durability of Oolitic limestone.

The laboratory study indicated that there are several biological processes causing aging and damage to the limestone and decorative elements in the catacombs, a high groundwater level led to algae penetrating along the cementing material between the stones (Figure 7), and along fissures and cracks [19]. This type of biological growth provides a wet environment for chemical and biological interaction which increases the rate of weathering. The biological growths have several colours: green, brown and black. While green colour is the most common, mostly present in wet environments, other types of algae (brown and black) are present where less water is available. These microorganisms can deteriorate stone either chemically or mechanically due to their metabolic activities. Their presence is generally detected through the formation of patina or crusts. All this factors biological growth accelerated the catacombs' stone deterioration [20].

Conclusions

The aim of this paper was to study the deterioration induced by the groundwater in the Catacombs of Kom El-Shoqafa, Egypt. For this, a series of analyses were performed to identify the mineral composition of the building materials, the salts present, and the biologic growths in order to assess their influence on the stone physico-mechanical properties.

The petrographical examinations of the oolitic limestone indicated that, according to Folks' classification, the rock is an arenaceous bioclastic micrite and sparitic. XRD and SEM analyses confirmed the existence of clay minerals (hydrated sillimanite and montmorillonite) which causes both crystalline and osmotic swelling phenomena, characteristic when groundwater is present.

The high concentration of sodium, chloride and sulphate ions is the cause of the most serious damage to the limestone structure. The bacteriological analysis of the groundwater detected the presence of fecal coliform bacteria confirming that the water source is the bad sewerage systems from the surrounding populated areas.

The chemical composition of the mortars and plaster were studied by PM, SEM-EDX and XRD analysis. The results indicated that the main component of the plaster that covered the walls of the main tomb is calcite ($CaCO_3$), followed by quartz (SiO_2) and silicates with some gypsum (lime mortar).

Several biological processes caused damage to the limestone and decorative elements. The high groundwater level led to the development of algae (brown and black) colonies, fungi and bacteria that helped deteriorating the stone either chemically or mechanically.

Therefore, the decay of the catacombs' stone can be mainly attributed to the destructive action of the groundwater during the last decades. In order to help solving this, the groundwater level in Alexandria must be reduced through repair and maintenance of the sewage and water networks, and through other general methods such as the improvement in the use of water in agriculture by using modern methods of irrigation. A thorough conservation project of Catacombs must also be performed.

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theory

RETHINKING VANDALISM

ALTERNATIVE INTERPRETATIONS OF DELIBERATE DESTRUCTION OF CULTURAL HERITAGE

By
Dimitrios Chatzigiannis

The deliberate destruction of cultural heritage constitutes a common phenomenon throughout history. In this paper, different aspects of destruction are described and discussed. It is argued that the perception and the interpretation of an act of deliberate destruction are influenced by basic values of our society. The role of politics, the role of the past and the position of the person in modern western society are presented as key issues in the interpretation of vandalism. Conservation is a field entirely related with the society in which we live and its practice is determined by these issues. An alternative view is proposed, based on a more emotional and human centric approach, re-negotiating our current way of interpreting vandalism. Finally, some issues related with the actual conservation of vandalized objects are discussed.

Introduction

Vandalism or, in more neutral way, the "deliberate destruction of cultural heritage" constitutes a common phenomenon in society and one of the major causes of damage that conservators deal with. Iconoclastic activity, either as an organized massive action or as a spontaneous personal expression, marks important historic periods and events, influences our everyday life and transforms, permanently or temporally, the material social landscape. Various examples of deliberate destruction and iconoclastic behavior can be met throughout history, as exemplified below.

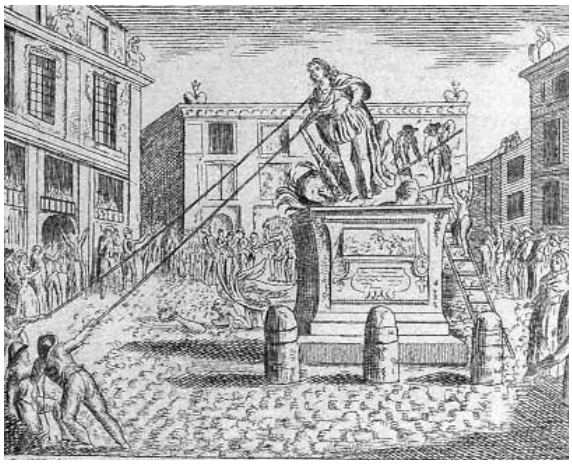
Aspects of Destruction

Deliberate destruction can be a form of political (Figures 1-5) or religious (Figures 6-9) activism during periods of war, revolutions, rebellions, changes of regime or periods of strong ideological struggle, but also even during periods of peace [1-3]. Ancient traces of vandalistic attitude often constitute great archaeological evidence (Figures 10-11), like the inscriptions written on the walls of Pompeii or in old churches, and offer invaluable information about politics, ethics or linguistics [4-7]. It also might have an artistic significance (Figures 12-13) such as modern graffiti [8-9] or other kinds of destruction auto-characterized as art [10, pp. 201-211], or even of literary value like poems and smart slogans written on walls [11, 12]. Of course, deliberate destruction constitutes, in almost all the cases, a criminal activity and is often perceived as an act of ignorance or stupidity [13].

These various aspects and significances that can be attributed to an iconoclastic behavior co-exist and constitute the complex character of an act of destruction [10, p. 11]. For example, the destruction of the Bamiyan Buddhas in 2001 was an act of religious iconoclasm but it certainly had a strong political dimension. Modern artistic graffiti is an act with an artistic motive but also characterized by political significance, while is considered as an act of stupidity by many. The final characterization of an act is the result of a struggle between all these significances and determines its actual future. Some of them are celebrated as important historical events, and others are studied and preserved as antiquities. On the contrary, others are neglected, ignored or criticized as stupid, anti-social acts or even as crimes against cultural heritage.

The Interpretation of the Act

An act of destruction can be interpreted differently by various viewers. Which are the social procedures behind the interpretation and the



Up to down, left to right:
Figure 1. The pulling down of the equestrian Statue of Luis XIV, 1792, Paris [published in P.P. Ferguson, Paris as Revolution: Writing the Nineteenth-Century City*, University of California Press, Berkeley, 1994, p. 198,* URL*]. Used with permission.*
Figure 2. Destruction of the statue of Joseph Stalin in Budapest, 1956. Picture by The American Hungarian Federation.
Figure 3. The pulling down of Sadam Hussein's statue, Iraq, 2003.
Figure 4. Contemporary political graffiti from Palestine. Picture by Victorgrigas.
Figure 5. Comparison of the effacement of an image of Christ with the Crucifixion, from the Chludov Psalter, mid-9th century, State Historical Museum, Moscow.
Figure 6. Destruction of religious art during the Protestant Reformation.

Figure 7. The Bamiyan Buddha in Afghanistan, before its destruction by the Taliban forces in 2001. Picture by Marco Bonavoglia.

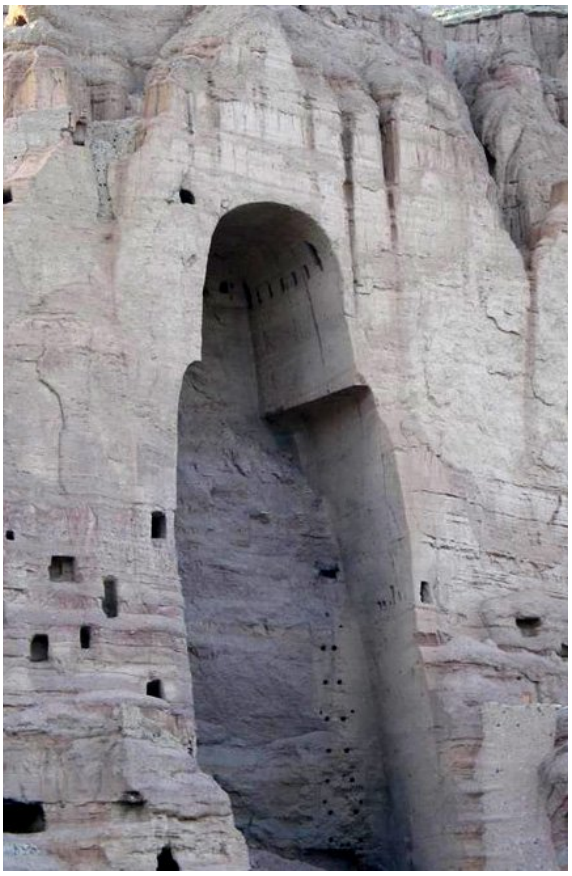


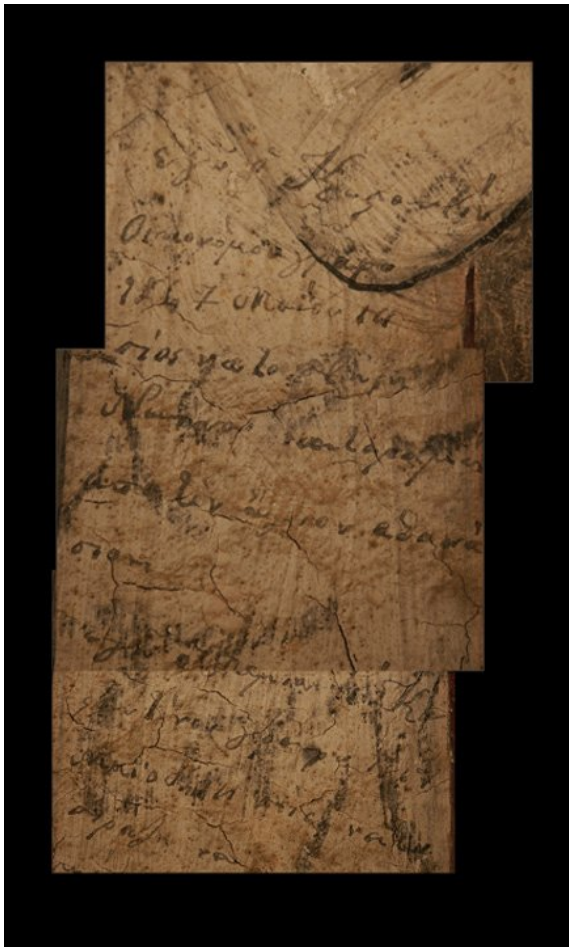
Figure 8. The Bamiyan Buddha in Afghanistan, after its destruction by the Taliban forces in 2001. Picture by Sqamarabbas.

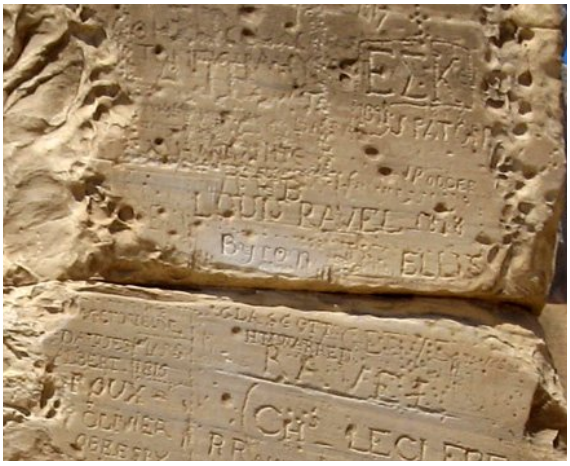
characterization of an act of destruction? It is here argued that the interpretation of the act does not constitute an objective and dry historic or social procedure. Instead, it is influenced by the socio-political background of the act and the sovereign socio-political ideas [10, p. 38; 13, p. 23]. By this point of view, the following issues will be discussed: the politics of destruction, the role of the past and the position of the minorities and the individual in the social network.

Vandalism and Society: the Act and its Context

The concept of context is crucial for the interpretation of a historical event [14; 15, pp. 170-172]. In the case of vandalism, the context embraces the socio-political circumstances under which the act took place. The context must be specified since it constitutes a key issue for the interpretation of the act.

Today's context is formed by the sovereign socio-political ideas of our society and constitutes a social web of common values, shared more or less by wide majorities. Art and cultural heritage are major values of our society. The western world has a long tradition for caring for the past, studying history and art, preserving and protecting monuments and antiquities. The value attributed to cultural heritage is supported by institutions and heritage agencies and accompanied with other significant and related social values: the respect to social order and the law, the respect of public and private property, the cleanliness.





Up to down, left to right:
Figure 9. Electoral inscriptions, Pompeii, Italy. Picture by Amadalvarez.
Figure 10. A curse written on a church's wall, St Athanasios church, Albania. Personal Archive of Maria Chatzidakis.
Figure 11. Graffiti in Thessaloniki, Greece, 2001. Used with permission.
Figure 12. An illegally executed graffiti by Banksy, UK. One of the most famous graffiti artists worldwide.
Figure 13. Lord Byron's name carved upon the Poseidon's temple in Sounio, Greece. Picture by Adam Sofen.

Within this context, conservation is taking place, serving society's values regarding cultural heritage. Thus, museum objects are protected with showcases and guards, graffiti on public monuments are cleaned off and vandalized sculptures are restored.

Politics of Destruction

Acts of destruction challenge these widely accepted values. The person who chooses to smash a public monument or smudge a work of art in a museum disturbs its aesthetic integrity, criticizes its political significance, disrespects current ethics regarding decent behavior, breaks the law, creates crime and dirt. Thus, all the social values expressed through cultural heritage are insulted.

Therefore, vandalistic behaviors are logically condemned. But not always, though. Are the American soldiers that pulled down Saddam Hussein's statues vandals? What about the citizens of Budapest that smashed Stalin's statues? Or, what about the ancient Pompeians who filled their city's walls with political inscriptions and vulgar slogans? Were they vandals too? Supposedly, the spontaneous answer is no, but if a today's anarchist or fascist would write a political slogan in a public place, he would be considered as such. What if he would smash a public statue? Worst for him. Teenagers that write their nick names on public or private property are condemned as well.

Behind these different perceptions and interpretations of destruction of cultural heritage, the role of the sovereign sociopolitical context is crucial. This context, formed throughout history, is more or less common and influences all the observers, independently from any individual beliefs. It embraces the basic ethics and politics that shape what we could call common sense, according to which people perceive history and respectively interpret contemporary acts. The sociopolitical context also determines what kind of behavior is accepted and what is not [16]. Law is formed according these socio-political ethics. This whole social context influences crucially the interpretive procedure of the act and it determines "why [an act of vandalism is] defined as bad, deviant or socially problematic in the first place" [17]. Thus, obviously, acts that turn against the dominant sociopolitical ethics are criticized and condemned.

The Role of the Past

Modern society loves the past. Monuments, museums and historic buildings are among us, reminding us of the past. The past is always present but it looks to be far. Usually it was glorious, heroic and perfect. However, history through monuments remembers the glory but forgets the violence.

Acts of destruction from the past are faced in a totally different way than those of today. An ancient graffiti is nowadays studied and preserved as an antiquity. It offers historic information of the politics or the ethics of an era and a rare chance for an insight into the ancient mind. But a modern graffiti does not merit the same fate since it is faced as a tasteless act of deviance. In modern society, it looks like there is no free space and no need for this kind of destructive expression. Why these different interpretations again?

Ancient vandalism is distant and harmless. It does not influence people's everyday life directly and it is easier to be perceived with neutrality or passiveness. Clear examples of this are the graffiti of Pompeii or Lord Byron's name scratched at the temple of Poseidon in Sounio, Greece (Figure 13). They can be easily perceived as romantic

expressions that happened long time ago rather than antisocial behavior. For this view, the patina of time and the fact that they do not harm our private property play a significant role.

In addition, there is a general feeling that the reasons that forced people to act violently in the past do not exist today. French Revolution's *sans culottes* fought for liberty, equality and fraternity. More recently, Hungarians and Iraqis smashed the statues of their former leaders celebrating their freedom. But in western democratic countries similar acts of destruction are condemned; there is nothing in common with the Ancien Regime, Stalin's USSR or Saddam's Iraq. Vandalism offends western values and turns against the democratic and ordered state.

Minorities in the Society

Even if a society, through its official mechanisms, serves the majority values and perspectives regarding vandalism, what if these acts express the feelings of a minority?

Often oppressed or marginalized minorities express themselves through destruction. Extreme political minorities, and or other groups such as immigrants and homosexuals, do not have other channels available to express their feelings and beliefs, through the established media, or they willfully choose to express through illegal means.

Thus, destruction is evidence of their existence and their ideas but also might constitute evidence of a real problem (racism, oppression, isolation, etc.). Simply erasing the traces of destruction, as usually happens, is like deleting the existence of these groups, ignoring the message they send and hiding a real problem under the carpet. Minorities express problems that majorities have not solved.

When considering minorities, other questions easily rise. What if the majority widely accepted values are not right? What if the minorities are right? History has proved that many ideas, widely accepted today, took a long time until they were embraced by extended majorities. Minorities were always the initial carrier of change. I strongly believe that any attempt for interpretation of vandalism should keep this feature in mind: people in one moment of history, acted illegally, against the sovereign social values and put the seed of change.

The Position of the Person in Society

Another important issue in the study of vandalism is related with the position of the person in the modern western society. As we saw, acts of destruction related with the great History, during revolutions, rebellions and wars, can be more easily accepted and become part of the official narrative. The fall of Bastille is celebrated with a national holiday in France and the demolition of Saddam Hussein's statues was transmitted live on television.

In addition, acts of destruction related with important historical figures are also somehow accepted. The graffiti with Lord Byron's name previously described is a good example. An act, which in any other case would be condemned and interpreted as an act of ignorance, is now highlighted and accepted as a romantic act of respect of the famous poet to the ancient world. And it is presented as a material evidence of the poet's spirit that still wanders through the ancient ruins. Similar acts, undertaken by anonymous individuals do not merit the same fate. In modern western society, the person is worth mentioned only as a celebrity or as the anonymous member of the mass.

Another View

Criticizing the points previously made, one could say that History is not something that belongs to the Past but that is still happening. Change is taking place today and we are all part of it. It is not related with kings and important personalities only. It depends on which part of the stage we choose to throw the light, and this is a matter of ideology. Every simple human has his merit and everybody deserves some space in the historical record.

Societies are not static structures and of course are not perfect. Things are changing. Values that are celebrated one day, are condemned the other and the traitors of yesterday are today's heroes.

I do not try to exaggerate. I do not mean that all acts of vandalism constitute progressive and revolutionary actions that are going to be justified in the future but that our approach on vandalism is not that objective as we often believe and that our conservation approach reflects (maybe to be rethinked) aspects of our general sociopolitical ethics. A calm and humanistic approach should keep an open ear to different voices. They might be an echo of the future or the cries from the past.

Beneficial Destruction

An act of destruction is an active intervention in the social network. It calls for our attention and it has the purpose of provoking. Society's general context of accepted behavior, the illegality and the contrast of any act of destruction with the widely accepted values of order and cleanliness, forms a more or less unfavorable climate for positive perception of acts of destruction. However, there are acts of destruction that are not mean or aggressive, but are able to renegotiate and redetermine widely accepted values regarding art, aesthetics, property, etc., and could be considered, under a certain point of view, as beneficial.

"Innocent" Vandalism

Small, innocent inscriptions written by children or teenagers upon public monuments or buildings, in places where they use to play or group, are considered in general as an act of ignorance and disrespect against cultural heritage and public property. Is not this perception a little bit monolithic?

In my view, that kind of destruction is an expression of familiarity with a place and helps people create sentimental bonds with it. It is not aggressive and is characterized by a sense of innocence: "this is the statue around which I used to play when I was a child!" or "I wrote my name and my friends' names on this wall when I was fifteen!". More or less we all have been in similar positions. And what a nostalgic emotion we feel when, after years, we see these graffiti still there [18, p. 71].

Often, the a priori perception of that kind of destruction as vandalism is characterized by a shortsighted logic ordered by the legal and social frame and a lack of a more human-centric and emotional approach. The widespread social values may work as a border for the interpreter to see some aspects of the act. In the case of Byron's graffiti at Sounio or others such as old graffiti in churches (Figure 10), we easily embrace a nostalgic or romantic approach of the act but we refuse to accept it in a modern context.

Re-giving Voice to a Monument

A case study of another form of 'beneficial' destruction is here examined. In Stadiou Street in

Figure 14. The slogan ''HELP, OLD MAN'', written on the statue of T. Kolokotronis, after its cleaning by the municipality's agencies, 2010, Athens, Greece. Personal Archive.

Athens, Greece, stands the equestrian statue of Theodoros Kolokotronis. He is probably the most respectful figure of the Greek Revolution of 1821 against the Ottoman Empire, which led to the independence of Greece and the foundation of the Greek state. The Old Man of Morias, as he is also known, was famous for his strategic mind, his wise thought and his suasion upon his men, which prevented many times civil conflicts between the Greeks. His statue in Athens is one of the most well known monuments of the city and a famous meeting point for Athenians. Nevertheless, during the last years, it did not escape the fate of almost all the public monuments, and slogans were sprayed on it. Some of the slogans that were found there say "OUT THE IMF, THODORIS'' [URL] or "HELP, OLD MAN" (Figure 14). Both of these recent slogans are related with the current political situation in Greece and the Greek government's recourse to the International Monetary Fund (IMF).

What is happening here? The statue of the great fighter, which remained a silent observer for decades, has voice again. And it takes a stand as well, participating actively in the political scenery. Having in mind the present political and economical situation and the phraseology used by many people about "ceding national sovereignty" [19], it is obvious why the actor chose Kolokotronis' statue, the fighter of independence, to speak for him and protest against the government's measures. This changing in the statues "behavior" is really interesting. Artistically speaking, the whole idea is great. As illustrated in Figure 16, the slogan fits perfectly with the statue's gesture while the use of the informal type ''Thodoris'', instead of the more formal "Theodoros", adds a sense of familiarity with the depicted person. Furthermore, the whole act is characterized by a very slight sense of humor. The second case is a desperate call for help for the "old man", the man who always helped Greeks to overpass difficult moments in history.

Despite being an illegal and violent act, these graffiti are expressing many people's beliefs [20, 21]. It is also interesting that they do not turn against the depicted person, as many other acts of political iconoclasm. On the contrary, they show sympathy and respect for him. This act regives voice to a monument which now participates actively in the social network. It is not aggressive and it does not insult anybody's feelings or beliefs. It also highlights a very vivid interaction between an individual, or even a group of individuals, with a monument and a historic figure.

Artistic Graffiti

Artistic graffiti is the most obvious kind of beneficial vandalism. I suppose that it is generally accepted that the cities where we live are not perfect, that there are too many ugly buildings, huge surfaces of grey, cold walls. Graffiti pieces painted on these surfaces are often aesthetically much more pleasant than the empty walls. Of course this is a subjective matter. Nevertheless, figures 15 to 17 speak for themselves.

There is also an apparent paradox here. In recent years, fabulous wall paintings were undertaken on public buildings under the authorities' permission. These events were advertized by the responsible authorities as a chance for the youth to express itself through this modern kind of art. However, if these graffiti were undertaken illegally, the aesthetic result would be the same but the actors would be hunted by the police and their work erased the next day. If graffiti is undertaken legally is art, if not it is vandalism. Does the law determine what is art and what is not?

Figure 15. The wall of the ''ELHAIS'' factory after the execution of a legal graffiti by the graffiti artist ''Bizare''. Used with permission.

The Actor

Usually, the actor of the destruction is considered as an outsider of society or as an individual who feels secluded from the general environment, while vandalism is for him an expression of this feeling of isolation [22].

However, in many cases, vandalistic acts reflect a totally different approach. For graffiti writers, for instance, public property belongs, not to anybody, but to them. They do not consider themselves as passive receivers of a public space that belongs to everybody, which is a very abstract statement anyway, but as active participants in it, with the right to form it as they wish, and usually with a white motive, to make it beautiful [23]. Their act declares their presence, not their absence [24].

If the active participation of the people in the social network is a basic element of a democratic society, does anybody have the right to intervene in it illegally and transform it? Should we keep an open ear to any kind of illegal interventions in society? In my perspective yes since the legal frame is not an absolute criterion of what is beneficial for a society and what is not.

In cases like those mentioned previously, vandalism is not mean, it is beautiful, creative, humorous,

Figures 16-17. Legal graffiti undertaken under the aegis of Ministry of Transportations and the municipality of Athens, 2005, Athens, Greece. Used with permission.

innocent and sometimes sweet. It can be argued that is also desirable. It is not insulting and this is a basic feature that could help the act to win a wider audience. Perhaps these acts of destruction could be renegotiated.

Engaging the Public

Heritage professionals call for a democratic management of cultural heritage, a management that allows people to participate actively in the preservation and the decision making of cultural heritage and be engaged in the archaeological procedure [15, p. 197]. But are we really honest when we ask that? I have the feeling that we wish the public's engagement as long as we are the one that draws the thin red line of what is accepted and what is not.

Acts of destruction of cultural heritage are a form of interactive relation between people and material culture that heritage professionals cannot control. Thus, it constitutes for the most of us an unaccepted behavior. But maybe we neglect the fact that as archaeologists and conservators can preserve and highlight the historic or aesthetic significance of a monument, an active iconoclast can bring to light, or even create other significances beyond the aspects predetermined by the professionals [14]. In the case of the statue of Kolokotronis, for example, the conservators of the municipality took care for the aesthetic integrity of the sculpture, but the unknown vandal underlined its significance as a symbol of resistance. "Innocent vandals" turn a public space into a "private" one, with extra significance for some people without excluding the general public. Artistic graffiti can create artistic value at a till now cold place. Moreover, slogans and poems, not to say literature, offer pleasure and joy, values that can very easily be ignored.

As a conservator, I believe that any intervention or non-intervention to an object adds and, at the same time, removes value. Which value will be preserved and presented is a matter of choice.

A Human-centric Approach

All the acts of destruction, constitute a form of expression; maybe undertaken by the extremes or by marginalized groups of people or even by a lumpenproletariat. However, these acts are often significant and even creative. Important or not, the knowledge that any kind of deliberate destruction offers must not be lost.

Studying vandalism means studying people. People that destroy a monument or a work of art are active subjects of history and society. Historians dedicated thousands of pages for the Byzantine or French revolution's iconoclasts. Modern iconoclasts or vandals do not merit this fate. They participate actively in history, they leave their visible traces upon material culture. Their acts are of course illegal, violent and not respected by many, but they exist. And it is certain that they deserve some space in the historical and archaeological record [18, p. 78].

A real human-centric approach of history, archaeology or conservation needs to have people in its core; all the people. Even if they are important personalities or unknown individuals. Byron's name scratched upon the temple of Poseidon is not necessarily more important than a simple name scratched on a park bench.

Conservators, very often believe that matter is the subject of our discipline. On the contrary, I believe that human and its interaction with material culture is the subject of conservation field. As we study how and why humidity and light damage

objects, in the same way we owe to study how and why human interacts with the material environment, even through the most humble and disrespectful ways.

This desirable human-centric approach of "vandalism", which tries to understand the deeper motivations of the actor, that pays extra attention to the sociopolitical context, shows respect even to the most simple expression of human behavior and calls for a democratic management of cultural heritage, is the one that can reveal all the aspects of the event and offer an holistic interpretation. An interpretation that might open the way to the next stage: the physical preservation of the destruction.

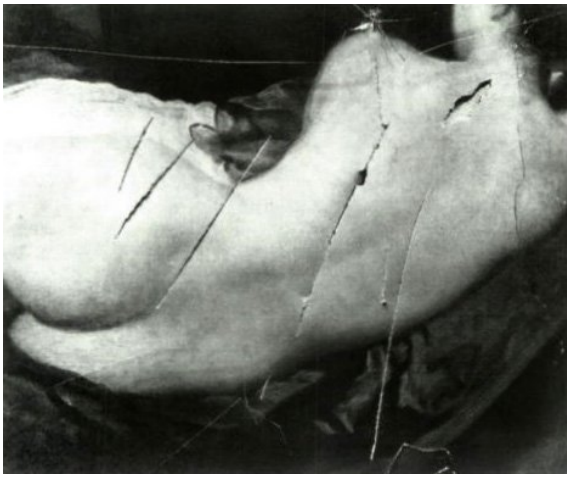


Figure 18. The Rokeby Venus of Velasquez after the attack by Mary Richardson in March 10, 1914, National Gallery, London.

Conserving Vandalism

What should be done with a vandalized object? Obviously it is not proposed that all the traces of destruction, in any case, should be preserved but as long as there are issues regarding vandalism that should be rethinked, some ideas could be proposed.

The beautiful Rokeby Venus by Velasquez at the National Gallery in London (Figure 18) was attacked in 1914 by Mary Richardson as an act of protest against the imprisonment of Mrs. Pankhurst, leader of the feminist movement in the early 20th century. After the attack, the painting was greatly retouched and is still on display. But, why there is no single information for the incident at the museum? This incident could present political issues that the painting once raised, despite its apparent non-political nature, to inform the visitor about a strange incident of the past which took place in a rather different sociopolitical context and also to communicate conservation by presenting a very impressive restoration. If all this information was offered just using a small label, the painting could be remembered and enjoyed in a more vivid and interesting way.

Acts of destruction are historical events and their traces are archaeological evidence. Since vandalism always existed and it will exist, different interpretations of it could be presented to the public. Exhibitions with attacked objects and monuments, either ancient or modern, even through pictures, that present vandalism as a part of the history of the object or its significance as archaeological evidence and making parallels with today, could work as an initial point for rethinking aspects of destruction.

Moreover, graffiti has fairly enough gained its place as an official form of art. There is a plenty amount of related serious and academic publications [9, 25, 26] and definitely much more place for others. Many issues regarding this interesting artistic idiom can be discussed. It already has its history and if we do not wish to lose the "old masters" pieces we have to hurry. I strongly believe that it is time for its actual scientific conservation.

However, the most important element that has to be highlighted and communicated to a wider audience is that acts of destruction are carriers of the sense of a place; traces of presence and life [18, p. 71]. They constitute evidence of human behavior once happened upon the material landscape related with society and history. Their study perhaps transfers the focus point from the great and noble to the simple and humble but offers a very vivid, emotional and experiential approach, something that is desirable.

Conclusion

Under the shadow of a political crisis in Europe, extreme ways of expression such as vandalism, are becoming a common phenomenon. Thus, their study by our point of view becomes imperative.

Today's crisis highlights social and cultural issues which our current ideology has not solved. Some of these issues, like the role of the past in modern society, the dominant politics, the position of the person and the status of minorities within the social matrix were presented. All these issues are reflected upon the way we practice our job. Rethinking our current approach on the preservation of cultural heritage, its role in the social network and its relation with our sociopolitical system is more challenging than ever.

If we conservators, as cultural heritage professionals, believe that the current sociopolitical and aesthetic context in which we practice our profession can be reconsidered, we have to be the carriers of this alternative by changing our shelves, our view and our practice.

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preventive conservation

ASSESSMENT OF PLASTICS IN THE NATIONAL TRUST – A CASE STUDY AT MR STRAWS HOUSE

By Lynda Skipper and Brenda Keneghan

The National Trust is a charity that cares for over 300 publically accessible historic buildings and their contents across England, Wales and Northern Ireland. There have been few previous studies on preservation of plastics within National Trust collections, which form a significant part of the more modern collections of objects. This paper describes the design of an assessment system which was successfully trialled at Mr Straws House, a National Trust property in Worksop, UK. This system can now be used for future plastic surveys at other National Trust properties. In addition, the survey gave valuable information about the state of the collection, demonstrating that the plastics that are deteriorating are those that are known to be vulnerable, namely cellulose nitrate/acetate, PVC and rubber. Verifying this knowledge of the most vulnerable plastics enables us to recommend to properties across the National Trust that these types should be seen as a priority for correct storage and in-depth recording.

Introduction

The National Trust is a charitable organisation that looks after over 300 historic buildings and their contents. Plastics form a significant but often forgotten part of the more modern collections cared for by the National Trust, and present some complex challenges for conservation. While most, if not all properties, contain at least a few plastic items, the bulk of the modern materials are found in the more recently acquired properties, such as Mr Straws, an Edwardian town house in Worksop, which came into National Trust care in 1990 (Figure 1). In order to explore some of the issues facing the National Trust in caring for their plastics, the authors visited this property to assess the condition of their plastic collection. This property was owned by the Straw family and is a typical family home. As the family rarely threw anything away, it contains a wide range of utilitarian household plastics providing a record of everyday life from the early 1900s through to the 1980s. Figures 2 and 3 shows two views of the interior of the property. The majority of drawers, cupboards and other storage areas are filled with the families' collections of household objects. Some are on display to visitors, such as the storage cupboard in Figure 2, whereas in other rooms the plastics are in a mixed collection of items as originally left by the family, in a variety of boxes and bags (Figure 3). A few items have been transferred to a small store room in conservation grade materials. Plastics within Mr Straws House ranged from kitchen spice jars to jewellery, as well as fixtures and fittings such as Bakelite light switches. There were also plastic false teeth, Christmas cake decorations (Figure 4) and even a bath plug!

There were two main aims for the survey of the plastics at Mr Straw house. The first aim was to devise and test a condition scoring system for plastics based on the existing National Trust system. Secondly, the aim was to provide an overview of the condition of the different types of plastic and their state of preservation in a collection, and to apply this information to collections care across the National Trust, by providing advice and guidance to other properties with plastics based on the findings at Mr Straws.

Condition Scoring Plastics

The National Trust uses a standardised condition scoring system for all objects, grading items into four categories based on their condition, stability

Figure 1. View of Mr Straws House. Mr Straws House is the righthand half of the semi-detached property, the property on the left is a visitor centre and exhibition space. ©National Trust Images/Rupert Truman

Figure 2.View of the store cupboard found on the second-floor landing of Mr Straw's House. ©National Trust Images/Geoffrey Frosh

Figure 3. View of The Lumbar Room, Mr Straws House. ©National Trust Images/Geoffrey Frosh

Figure 4. Christmas cake decoration, one of the typical domestic plastics found at Mr Straws House.

and treatment priority, with 1 being the best or most stable, and 4 relating to objects in the poorest condition or the most unstable [1, 2]. These ratings have been used for all condition surveys within the Trust for some time, but there was no specific wording relating to scoring for plastics. The first task before starting the survey was to agree the definitions for all of the category codes, to make sure the assessment of the condition of the different items was consistent. The wording of the assessments was agreed based on prior experience of plastics in collections. This was the first time the standards for assessment of plastics had been agreed, and so it can be now be applied across the Trust for looking at the condition of different plastics (Table I).

Previous work has identified the most vulnerable plastics in collections as cellulose nitrate and acetate, PVC, polyurethane and rubber [3]. All cellulose nitrate and cellulose acetate plastics were placed within category 3 for stability (1-5 years) when no deterioration was evident. While it's clearly not the case that all these types of plastic objects will show a change within this time, due to the inherent problems with this material, stability beyond this time scale could not be guaranteed. Putting them within this category gives NT house staff increased awareness of the potential vulnerability of these items, and highlights the need for regular monitoring. Items in category 3 should be checked annually, and more frequently in category 4.

Surveying the Collection at Mr Straws House

There were almost 200 objects at Mr Straws House that were entirely or partially plastic, a mixture of natural, semi-synthetic and synthetics. In many cases it is difficult to determine the exact type of plastics without doing in depth scientific testing, so due to time constraints, and the fact that the survey was carried out on site, the plastics were identified as best as possible by looking at the colour, style and age.

All items were photographed under artificial lighting conditions, and a condition survey carried out using the agreed definitions. The photographs will act as a record to highlight any future changes in condition. Buttons on clothing and synthetic fabrics were not surveyed, although PVC clothing items were included in the scope. Some collections of identical objects, such as bags of rubber rings, were surveyed as one item for speed and ease of recording.

Results of the Survey

The results of the survey are shown in Figure 5. The condition of the items surveyed was mainly good or fair, with 64% of objects falling into category 1 or 2. 71% of the items were not in need of treatment, or only a light cleaning, and so were graded as 1 for treatment priority (Figure 4). Only 6 (3%) were category 4, the lowest score possible, meaning they are in poor condition, unstable, and in need if urgent conservation treatment. If this is representative of collections of plastics across National Trust overall, this distribution is generally encouraging.

It is interesting to note that the results do not follow the expected normal distribution, with a higher number of objects in conditions 2 and 3. This is particularly notable in the case of treatment priority, where there are a high number of objects in condition 1 and relatively low number in categories 2-4. This is mainly due to the material type – all of the condition 4 items were made from either PVC, rubber or cellulose nitrate, which had either become sticky due to deterioration, or were

Table I. Generic and plastic specific definitions of stability, condition and treatment for use when assessing objects.

Stability code				
	I	**II**	**III**	**IV**
General Guidelines	Condition not expected to deteriorate within the next 10+ years	Condition not expected to deteriorate within next 5-10 years	Change in condition likely to be evident between 1-5 years	Change in condition likely to be evident within 1 year
Plastic Specific Guidelines	Modern stable plastic or bakelite in good condition, generally correctly stored with appropriate enviromental conditions	May be stable but with small chips/ cracks, may be stored in appropriate environment but may have less than ideal packing conditions	Cellulose Nitrate and acetate plastics showing no current sign of deterioration. Other types showing minor deterioration e.g embrittlement, hardening, cracking, or previous damage. Any plastics stored in inappropriate environment (>65% RH, >20ºC temperature)	Any plastics showing signs of deterioration, e.g stickiness, unpleasant or vinegar smell. Active mould growth. Cellulose Nitrate or Acetate showing signs of internal crazing or similar changes. Mixed material object with active deterioration of other parts e.g. metals
Condition code				
	A	**B**	**C**	**D**
General Guidelines	Excellent	Minor amount of damage and/or loss of original and added material, or with light discolouration or accretions	Noticeable damage and loss and appears disfigured with visible accretions	Considerable and/or significant loss or original or added material or major damage/ breakage or disfigurement. May be endangering other objects and surfaces
Plastic Specific Guidelines	Good, sound condition with virtually no damage	May have surface dirt or dust, minor chips/cracks/ scratches or slight fading	May include extensive scratches, large but stable cracks and chips, extensive dust/ dirt, large areas of fading or yellowing, minor embrittlement, evidence of previous mould growth but no longer active	May include active deterioration of Cellulose Nitrate and Acetate, PVC objects, smell, stickiness, hardening to the point where it is vulnerable to handling, active mould growth; could have large losses or damage
Treatment Priority Code				
	1	**2**	**3**	**4**
General Guidelines	Conservation treatment not required beyond routine maintenance	Conservation treatment desirable but not necessary to ensure the long term stability of the object. For instance, conservation treatment may be required for curatorial reasons	Conservation treatment necessary to avoid further deterioration, loss or undesirable strain on an object and/or loss of significance (evidential or artistic value)	Conservation treatment required to prevent significant deterioration in condition of object and/ or loss of significance (evidential or artistic value); this may include structural vulnerability, risk of total loss of entire object or part of object, or risk of accidents to visitors/users

potentially damaging to other items, due to their storage in boxes with mixed materials types. Some plastics were damaged or deteriorated but there was no treatment necessary, and so we classified as priority 1, for example rubber rings for jam jar lids that had hardened. Others were in need of a light clean but were otherwise in reasonable condition, such as kitchen spice containers, and these also generally came under category 1.

Comparing the results of the treatment priority section of the survey to previous surveys carried out at the British Museum (BM) and Victoria and Albert Museum (V&A), the percentage distributions between the categories are markedly different (Table II). Although the smaller survey size at Mr Straws is likely to have some effect, much of this variation is due to the category definitions themselves. The National Trust characterisation of treatment priority for category 1 stated that routine maintenance should be carried out. Objects in need of minor dusting or similar 'routine maintenance' were therefore placed within this category, in order to be consistent with the National Trust standards for other object surveys. In contrast, the definitions used by BM and V&A would suggest that some items classified as condition 1 under the National Trust system would have been placed into category 2, had we applied their definition of condition as listed in table II.

The other notable variation between the plastics at Mr Straws and within the museum results is a marked difference in the numbers of objects in category 4, those needing urgent treatment. One explanation for this could be that the plastics at Mr Straws are more likely to have been subjected to greater levels of use and handling in the past than museum objects, therefore leading to heightened deterioration. Items surveyed as priority 4 for treatment were in general due to storage issues, which are discussed in more detail below. This was due to a number of mixed plastic and non-plastics being stored in close proximity, either in boxes or in drawers. This is less likely to have been flagged as an issue at the museums listed.

Table II. Treatment priority comparison for the plastics at Mr Straws House with results from surveys carried out at other institutions. The treatment priority definitions are those used by the other institutions. Table adapted from [7].

Conservation Priority		**Victoria and Albert Museum 4500 objects [4]**	**British Museum 3032 objects [5, 6]**	**Mr Straws House National Trust 174 objects**
1	None: object in perfect condition	>50%	27.5%	68%
2	Low priority, slightly damaged but stable, needs cleaning, no immediate danger	24%	60%	6%
3	Essential work needed, damaged and unstable, no immediate danger	13%	12%	7%
4	High priority: extremely unstable, requiring urgent treatment	1%	0.6%	18%

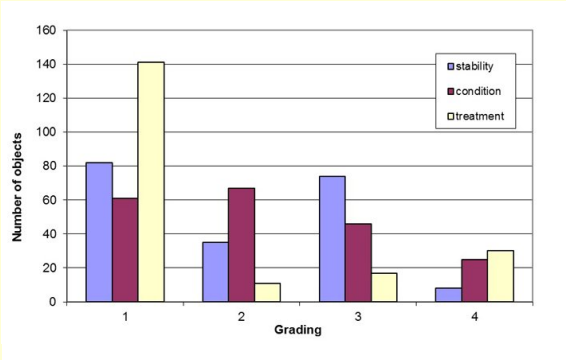

Figure 5. Graph showing the distribution of objects within the 4 grades for stability (blue), condition (maroon) and treatment priority (yellow).

Figure 6. Deteriorating cellulose nitrate brush, with characteristic crazing and discolouration.

Recommendations

The main suggestions for improvement were around packing and storage of some items. As deterioration of one plastic can affect others, it was recommended that all the stored plastics should be individually packed, and monitored regularly for any changes.

Thirty eight objects were identified during the survey as likely to be made from cellulose nitrate or acetate, of which only one cellulose nitrate item was actively deteriorating; the others appeared stable. The deteriorating cellulose nitrate brush (Figure 6) was placed in charcoal cloth, a product designed to absorb the nitric acid given off by the breakdown of the cellulose nitrate. Although this will slow the deterioration, total loss of the object at some point is inevitable, as once begun, the deterioration cannot be reversed or stopped. Other items that were actively deteriorating were those made from natural rubber, such as plimsolls where the soles had become very sticky. A PVC coat had also become yellowed and sticky in some areas. They are no longer on display, and will be stored in silicone release paper, which has a non-stick surface to stop them from sticking to their wrapping.

Other recommendations from the survey were to monitor for degradation of stored cellulose nitrate and acetate using A-D strips (paper strips that detect acetate film deterioration), and to ensure that plastics were not kept in mixed storage boxes with other materials.

Conclusions

We have successfully defined and tested a condition scoring system that works in situ for assessing plastics and plastic-containing objects. This can be used for future plastic surveys at other National Trust properties. The majority of plastics surveyed were in good condition. The plastics that are deteriorating are those that are known to be vulnerable, namely cellulose nitrate/acetate, PVC and rubber (no polyurethane was identified at Mr Straws). At the moment, there is no way of predicting how long plastics will stay in a stable condition, and there is limited knowledge of how to carry out conservation treatments on deteriorating plastics, though research in this area in ongoing. This means much of the work that can be done is preventive. Verifying this knowledge of the most vulnerable plastics has enabled us to recommend to properties across National Trust

that these should be seen as a priority for correct storage and in-depth recording. By ensuring the storage conditions and surrounding environment are as suitable as possible, it will increase the likelihood of the survival of the plastics in collections.

Acknowledgments

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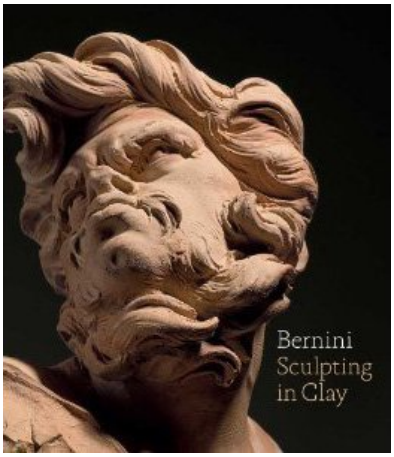
BERNINI: SCULPTING IN CLAY



Review by Carol Grissom

Editors: C. D. Dickerson III, Anthony Sigel and Ian Wardropper
Publisher: Metropolitan Museum of Art
Publication Year: 2012
Pages: 432
ISBN: 978-0300185003
Language: English

In the fall of 2012 I had the pleasure of seeing "Bernini Sculpting in Clay" at the Metropolitan Museum of Art in New York. Until April 14, 2013, it was possible to visit this exceptional exhibition at its current venue, the Kimbell Art Museum in Fort Worth, Texas. I admit to not having been a particular fan of the Baroque or Gian Lorenzo Bernini (1598-1680) before seeing the exhibition, but one of the pleasures of this field is the constant discovery of new areas of interest. What changed my mind about Bernini was the freshness of his clay sketches (*bozzetti*), which predominated in the exhibition. The sculptor is thought to have made thousands of them, working out ideas for a single commission with many *bozzetti*. Several for the same monument were presented in the exhibition for comparison, and fascinating evidence of Bernini's hand was made readily apparent by labels without onerous verbiage. A few more finished terracottas made for presentation (*modelli*) were also exhibited, such as one for the Fountain of the Moor in Piazza Navona (Figure 1). A wooden preparatory model for the Four Rivers Fountain provided a nice contrast to the omnipresence of fired clay (albeit with a terracotta figure of the Rio de la Plata and other elements in place), as did the sculptor's beautiful complementary drawings for the same commissions displayed nearby.

If you can't make it to the exhibition but are at all interested in sculpture, clay, Bernini, or technical art history, it is worth purchasing the exhibition's eponymous catalog, ably edited by C.D. Dickerson III, Anthony Sigel, and Steven F. Ostrow (Metropolitan Museum of Art, New York, 2012). Following six essays, entries for 52 terracottas are co-written by art historian Dickerson and objects and sculpture conservator Sigel. They are organized as in the exhibition around large-scale public projects in marble and bronze, mainly for Rome (fountains, chapels and saints,

Figure 1.Model for the Fountain of the Moor (1653), Kimbell Art Museum, Fort Worth.

Figure 2. Use of a buttress, tooling, and firing cracks characteristic of Bernini's bozzetti *can be seen on the back of the* Angel with the Superscription *(ca. 1667-68). Harvard Art Museums/ Fogg Museum, Cambridge, Massachusetts. Photograph by Anthony Sigel, © 2012 President and Fellows of Harvard College.*

Figure 3. Spiraling gaps resulting from Bernini's columnar wedging of clay can be seen on the bottom of Charity with Four Children *(1627-before 1634). Musei Vaticani, Vatican City. Photograph by Anthony Sigel, © 2012 Musei Vaticani.*

equestrian monuments, the Ponte Sant' Angelo angels, and Altar of the Blessed Sacrament), or patrons (the Barberini and Chigi). A checklist of 41 drawings (all illustrated in the book but not all exhibited at both venues) is supplemented by an essay by Ian Wardropper, who describes Bernini's use of preparatory drawings in tandem with models. Photographs in the book are many (nearly 500), excellent, and in color, including innumerable details.

I am hardly qualified to comment critically on the catalog's art historical essays on Bernini, and I am somewhat surprised to report that I enjoyed them. Dickerson begins with a discussion of Bernini's formation, initially by working with his father Pietro. Illustrated here is the marble *Bacchanal: A Faun Teased by Children*, carved by father and son, which greeted visitors to the exhibition in New York. It is a breathtaking display of marble carving. Based on similarities in style, however, Dickerson posits that Bernini learned terracotta modeling from Stefano Maderno. Andrea Bacchi discusses the role of Bernini's workshop, explaining differences between *bozzetti* and *modelli*. The latter were often made by or for copying by assistants in the sculptor's large studio, necessitated by the prodigious number and size of his commissions. Steve Ostrow's historiography of Bernini models provides useful background information, including references to seminal work by Rudolph Wittkower, Irving Lavin's 1955 dissertation, and even a work by Sherman Lee (who knew that he was interested in anything other than Asian art?).

Of the art historical chapters, I was most drawn to Tomaso Montanari's look at seventeenth and eighteenth century sculptor's use of models, attitudes of collectors toward terracottas, and discussion of the specific case of Bernini's terracottas. Bernini himself is thought not to have

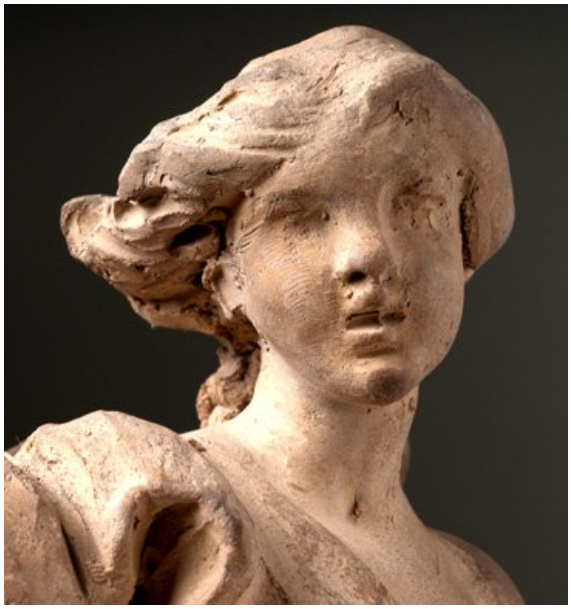


Figure 4. A fingerprint can be seen on the face of the Half-Kneeling Angel *(1672). Harvard Art Museums/Fogg Museum, Cambridge, Massachusetts. Photograph by Anthony Sigel, © 2012 President and Fellows of Harvard College.*

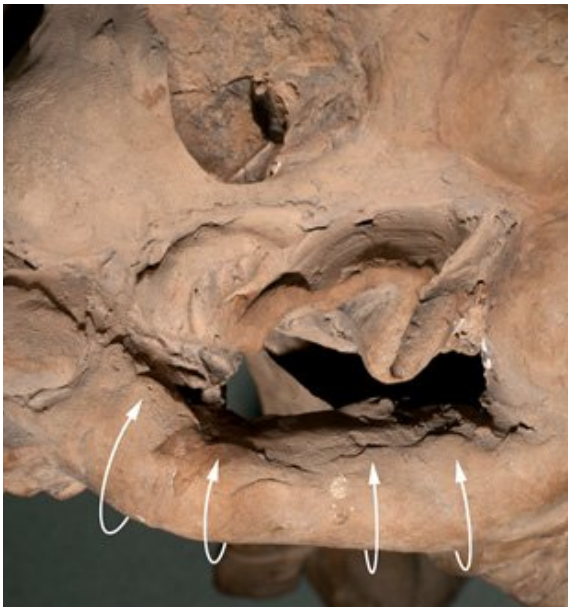


Figure 5. Bernini's habit of pushing clay around limbs can be seen on the arms of an Angel with the Superscription *(ca. 1670). The State Hermitage Museum, Saint Petersburg. Photograph by Anthony Sigel, © 2012 President and Fellows of Harvard College.*

valued his models as art objects. He is known to have given drawings as gifts but not terracottas, and when he wanted to bequeath something to Cardinal Giacomo Rospiglioso but no longer had any marble sculptures in his possession, he left a painting instead. Nonetheless, Bernini did go to the trouble of providing some longevity by firing his terracottas, which are lively in spite of resultant firing cracks (Figure 2), not to mention missing limbs and heads. Bernini's heirs treated his terracottas as without value and after his death put them in storage, where nearly all were broken. At first, there seems to have been relatively little interest on the part of contemporary collectors towards Bernini's terracottas as art objects, attributed at least in part to lack of finish compared to models by the likes of Alessandro Algardi and the supremacy of painting during the seventeenth century. Toward the end of Bernini's long career, however, a cult developed around the sculptor, which not surprisingly coincides with the dates of most of his surviving *bozzetti*. By 1666, Cardinal Flavio Chigi owned terracottas likely by Bernini, which eventually found their way into Vatican collections. And by 1729, when the French philosopher Montesquieu recorded a conversation in his diary with a young French sculptor, his interlocutor clearly respected Bernini's models as artworks. Finally, none other than Bartolomeo Cavaceppi, the eighteenth-century sculptor and restorer of Antique statues, may have been the owner of 27 terracottas purchased by Harvard University's Fogg Museum in 1937. Among them are 15 autograph works by Bernini, which the museum loaned for the first time to this exhibition.

For conservators, the highlight of the catalog will surely be Sigel's 22-page "Visual Glossary." It demonstrates the value of close observation and provides an excellent roadmap as to how to approach a similar project. Topics include assembly of the terracottas, especially Bernini's habit of columnar formation evident on the underside of

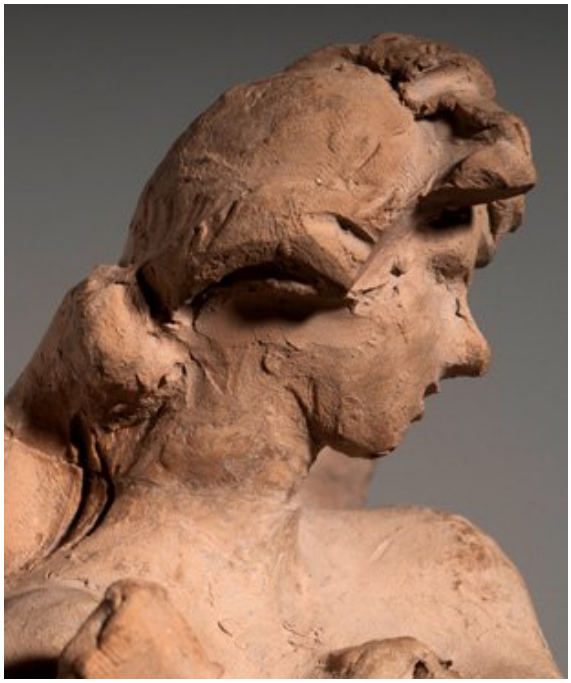


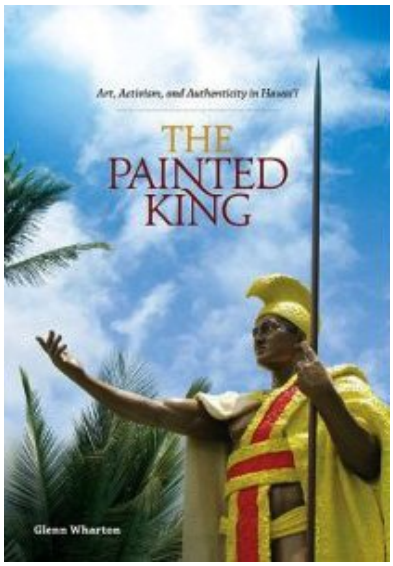
Figure 6. Bernini's fingernail impressions can be seen at the nape of the angel's neck on the Angel with the Superscription *(ca. 1667-68). Harvard Art Museums/Fogg Museum, Cambridge, Massachusetts. Photograph by Anthony Sigel, © 2012 President and Fellows of Harvard College.*

bases (Figure 3) and use of clay buttresses for stability in lieu of iron armatures (Figure 2); clay; damage and restoration; examination techniques; analysis of fingerprints found on the *bozzetti* (Figure 4), which has produced several notable matches confirmed by experts; hollowing; measuring, pointing, and layout marks; signature modeling techniques, such as pushing clay around limbs (Figure 5) and delineating forms with his fingernails, notably hair (Figure 6); stages of work; surface decoration; surface textures; tools and toolmarks (Figure 2); and X-radiographic evidence. A triumph from this conservator's point of view is that results of Sigel's technical study regarding Bernini's hand seem to have been largely accepted by art historians. The chapter is his most comprehensive work on Bernini, but some material will be familiar from essays by Sigel and other staff of the Harvard's Strauss Center for Conservation and Technical Studies in *Sketches*, volume 6 of the Harvard University Art Museums Bulletin published in 1999 and edited by Ivan Gaskell and Henry Lie. That publication focused on the best of the terracottas purchased by the Fogg Museum in 1937, and its studies no doubt served as the basis for Sigel's knowledge of Bernini's terracottas, but he has expanded his expertise with detailed examination of other possible Bernini *bozzetti* and *modelli*. Other publications include an essay on the modello seen here in Figure 1, published in *Bernini: The Modello for the Fountain of the Moor* (2002).

The Fogg's terracottas in themselves have many interesting connections to the history of conservation, especially in the United States. Not only is there the tantalizing connection of ownership by the eighteenth-century restorer Cavaceppi, but there is the fact that the terracottas were purchased for the Fogg under the aegis of Edward Waldo Forbes, the museum's director from 1909 to 1944. Forbes was a seminal figure for American conservation, as described in Francesca Bewer's excellent 2010 history, *A Laboratory for the Arts: Harvard's Fogg Museum and the Emergence of Conservation in America, 1900-1950*. He was instrumental in creating the first scientific conservation laboratory in the United States at the Fogg, and he especially promoted the technical study of artworks. But I have digressed with my paean to Forbes. The Bernini catalog is wonderful: get it.

Carol Grissom is Senior Objects Conservator at the Smithsonian's Museum Conservation Institute.

THE PAINTED KING: ART, ACTIVISM, AND AUTHENTICITY IN HAWAI'I



Review by Daniel Cull

Author: Glenn Wharton
Publisher: University of Hawai'i Press, Honolulu
Publication Year: 2012
Pages: 216
ISBN: 978-0-8248-3495-1 (Cloth)
978-0-8248-3612-2 (Paperback)
Language: English

"let me tell you the story of the King's new clothes"
extract from "Ke Ki'i Nui 'O Kohala" (p. 161)

I recently spent a week in Palm Springs at the Western Association for Art Conservation annual meeting [1] and I returned with a copy of Glenn Wharton's book The Painted King which I was particularly pleased to have won in the annual silent auction. I had previously read a little about the project in a paper Wharton published in the *Journal of the American Institute for Conservation* [2] so I was looking forward to a book length exploration of the topic. On the surface the project appears laughably simplistic, boiling down to a choice between painting or regilding a sculpture. The devil, as always, is in the detail. In the book Wharton guides us through the project as he experienced it, taking a few detours to explain the fascinating history of the sculpture, and to analyze his experiences in the context of conservation theory and practice. This narrative approach works well. Wharton tells the story of his initial encounter with the sculpture and more significantly the chance conversation with a local person about the conservation project, it is this chance conversation that sets the project in a new direction, as the question shifted away from a simple 'how should it be refinished?' to a more complex 'why is it important, and, what is important about it?'. I was interested to read that Wharton received some criticism for his community based approach, I suspect all of us who have worked with source communities have received similar criticism for our decision to make conservation an inclusive practice, and I think this book is a fabulous response to the critics.

The sculpture that this book is concerned with is the first in a series of monuments to King Kamehameha, a celebrated figure for uniting the Hawaiian archipelago in the late eighteenth

century, he later became Hawai'i's first King. The sculpture is situated in front of the courthouse in the small town of Kapa'au, in the North Kohala district of Hawai'i. The history of the sculpture is tied up with the history of the islands, Wharton does an excellent job of guiding the reader through this history and the complex community relationships that are found today as a result of settler colonialism, the plantation period, immigration, foreign commercialization, and tourism. Wharton is careful to give voice to both indigenous, immigrant, and *haole* (foreign, caucasian) opinions.

The sculpture was commissioned in 1878, and installed five years later on May 8, 1883, the prime mover behind the commission was Hawaiin legislature Walter Murray Gibson, who worked with the Boston artist Thomas Rodgeway Gould to design the sculpture which was made at the Barbedienne foundry in Paris. On August 21 1880 the sculpture left Bremen, Germany, en route to Honolulu, but the ship sunk in a storm off the coast of Argentina. Fortunately the sculpture was insured so a second cast, this one with an additional decorated base, was made. But before it could arrive the original sculpture appeared on March 27, 1882, having apparently been dragged from the sea by fishermen, before being bought by a British captain who recognized the sculpture and an opportunity to make some money selling it to Hawai'i. The sculpture was broken and so replacement parts were designed and arrived with the second sculpture in January 1883. The monument committee decided the second cast was in better condition and should be installed in Honolulu where it remains today, while the original after some negotiation ended up in Kohala, near Kamehameha's birthplace. Today the sculpture in Kohala has become a central part of Kamehameha Day, a major cultural event for the town. During the celebrations on this day the sculpture is draped in lei offerings and looks quite amazing. While the second sculpture has been regularly regilded the first has been painted, and the investigation of this difference is where this fascinating story begins.

The heart of the book is concerned with the decision making process that took place to consider painting versus re-gilding. The key to the project was to develop ways of investigating the idea of significance, not as an ephemeral or intangible idea but as a concrete reality lived by everyone in the community. One of the ideas Wharton raised in discussing significance that I really liked was the idea that "perhaps we should think of an artwork as also having inherent vice in a cultural sense. Over time, its meaning may no longer be tolerable to new generations that surround it" (p. 121). Wharton lays out the various different groups of people that might have an opinion, and the limiting factors to how to find out their opinion. The resulting decision making process would be hard to categorize, it involved using a wide array of processes so that people would be able to utilize the one they're most comfortable with. The important aspect was that everyone should be involved, and that the process should be one of ongoing dialogue. The book also discussed the ways in which the project became, and similar projects could become, models for less 'soft' decisions within the community, such as land rights, water rights, and similarly complex political questions. The decision making described is a great example of the idea of conservation as 'process' that I believe is the essential factor of the emergent contemporary conservation praxis. One of the most emotive aspects of such projects is that they often end with some form of ceremony. To take part in such ceremonies leaves a real feeling of value in the project for all involved. Wharton does a great job of describing the ceremonies

that surrounded this project, and for anyone who's ever experienced this process of conservation and the emotional result of such work you will really feel the words on the page. I should mention that the book is wonderfully illustrated throughout, I only wish the book included a photograph of the "Mr. Wharton" puppet!

There are a variety of interesting arguments that the book brings together in the conclusion, I'd like to mention just a couple of them. Probably the most interesting for the conservation field is that Wharton comes to the conclusion that "there are clear reasons to conserve objects from the past, but they are not necessarily those typically provided by conservators and other professionals within the heritage industry" (p. 174). This is a pretty important realization and it lies at the heart of the project, the book, and contemporary conservation. In terms of the choice made as to the final look of the sculpture it was interesting to discover that Wharton found that "contrary to my prior assumptions about what I would find in North Kohala, no clear patterns emerged between treatment preferences and peoples' ethnicity, age, religion, or length of time in the community" (p. 168). This serves to underline the idea of cultural hybridity that the book discusses. What particularly interests me is that this multi-cultural-hybridity is the reality many of us live with, and most of the conservation theory has thus far been built upon dualities that for the most part don't really exist. There is certainly potential for rethinking conservation praxis through this lens.

However, the book did leave me with a troubling question, one that I've been struggling with for several years now. Wharton describes how "the project had a stamp of authority that was beyond the state government's opposition" (p. 165) due to the national funding from the Getty Trust, the Smithsonian Institution, the Ford Foundation, the National Park Service, Heritage Preservation, and the National Endowment for the Arts. The question that troubled me is how can we (as conservators) run projects like this without the backing of major institutions and funding bodies? For it seems to me that if culturally based conservation is to have long-term positive effects it cannot be through one-off projects, but it must become widely practiced. I wonder if the model of conservation as it exists now is in this case fit-for-purpose?

To conclude I should return to the auction and let you know that the money raised, approximately US$700, was donated to an arts program at the disability charity Desert Arc. Oh, and I guess you're interested to find out if the community chose to paint or regild the sculpture, well you should probably read the book!

Notes

1. Rose Cull, "Conference Review: Western Association for Art Conservation", *e-conservation magazine* 25, 2012, pp. 20-22 [URL]

2. Glenn Wharton, "Dynamics of Participatory Conservation: The Kamehameha Sculpture Project", *Journal of the American Institute for Conservation* 47, 2008, pp. 159-173

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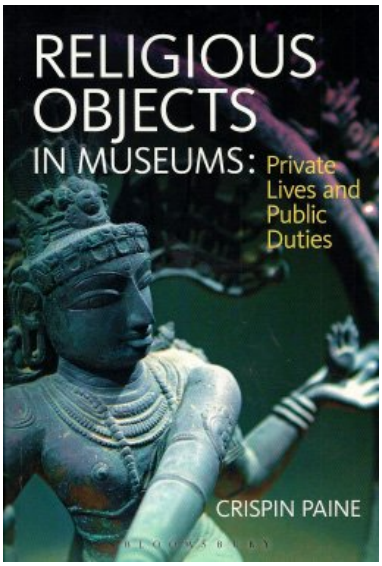
RELIGIOUS OBJECTS IN MUSEUMS: PRIVATE LIVES AND PUBLIC DUTIES



Review by Daniel Cull

Author: Crispin Paine
Publisher: Bloomsbury Publishing
Publication Year: 2013
Pages: 192
ISBN: 978-1-8478-8774-0 (Hardback)
978-1-8478-8773-3 (Paperback)
Language: English

"We need much more information on how people respond to religious objects in museums - how they regard them and how they respond to them."
(Paine, pp. 116)

Crispin Paine previously edited a collection of essays entitled Godly Things [1]. This new book, now a solo effort, is in some ways an update on the topic, and in other ways an exploration of new terrain, for in the 12 years since the first book was published Paine quite rightly contends that there has been a growth in the ways in which objects of religious significance have found a role and sense of place within museums. Paine states that "The first aim of this book is [...] to review the way museums now handle religion. As we shall see, there is now much more going on" (p. xiii). Although this book is primarily written for a more curatorial audience, it is nonetheless relevant to conservators and does reference aspects of conservation practice numerous times. It is also worth remembering when reading the book that the author specifically states that within the book he has "used the term 'curator' to include everyone involved" (p. 12). Moreover as conservators are interested in the use of objects within museums, it is worth noting that Paine continues to say that his specific interest for the book is to consider the role of objects, and justifies this position with one of the best defences of the use of objects within museums that I have seen: "The unique role of museums is to use objects to tell stories, to raise spirits and to advance arguments, and though museums have many other agendas and use many other techniques, it is their collection and deployment of objects that is their special genius" (p. xiv).

The book seeks to explore how this special genius plays out in relation to religious objects. The author utilizes a wide definition of religious objects in order to allow objects that have any connection to religion to be included. Considering the breadth of the topic the book is surprisingly short, but it packs a punch above its weight, covering a wide range of topics including; ascribing religious significance to objects, how museum objects become museum objects, how religious objects relate to visitors, politics and repatriation, the concept of respect as it related to museum objects, how secular objects have spirituality, how objects are given to museums to render them harmless to their former owners, how religious objects can be made to fight for new masters be they religious or atheist, how objects can promote the faith of their masters, how objects can be used to explain the faith of their source of origin, and how objects can be used to fulfil the public duties of museums. The author has a fabulous writing style and the way sections segue from one to another is a joy to behold, for example the segue from museums of atheism, through missionary museums, to creationist museums is just wonderful.

One of the weaknesses of the book is in part attributable to its brevity, but also perhaps an unfamiliarity with practice-based rather than academic sources of information. For example, when discussing comparisons between conservation approaches to Native American and African objects the author relies heavily on the views of the Smithsonian's National Museum of African Art (NMAA) conservator Stephen Mellor [2], who holds (or held?) the position that it is not necessary to treat African objects out of their original context with the same strict behaviours that would apply within their context. Whilst this does explain the difference in approaches between different museums (namely the National Museum of the American Indian and the NMAA) it is far from the uncontested approach that is presented as and references to contemporary African, and African Diaspora, conservators would give a more nuanced understanding, for example the paper by Novellette-Aldoni Stewart [3] which questions and analyses many of these ideas. The reader is left to wonder if Mellor speaks more for the orthodoxy of the Smithsonian than for the community for whom the objects hold signifi- cance. Furthermore, it is unclear whether Mellor's views published in 1992 are the same today, after all the conservation field has developed dramatically in the last 20 years. It does speak of a necessity for critical voices in our field to be more widely encouraged so that those beyond our own field are more aware of their existence.

Although the book is relatively short it is jam packed with well illustrated and carefully considered case studies. I particularly found it useful that Paine chose to use cases from all across the Globe; both in/famous and unknown. The case studies selected vary widely from Soviet era museums of atheism run by the somewhat hilariously titled League of the Militant Godless, through the production of Tibetan mandalas in gallery spaces, to the highly enjoyable stories about the origins of legends surrounding haunted objects, to contemporary museums of creationism in the UK and USA run by evangelical Christians. It was great to learn about so many case studies of religious objects in museums that were new to me. The book is in many ways a primer for the study of religious objects in museums, not only does it give a good grounding in theoretical understanding of the variety of ways in which religious objects have come to be used in museums, but it also gives sound case studies to illustrate them. These coupled with the excellent bibliography give the reader a myriad of potential

points of departure for further reading and research. The author should be congratulated for distilling such a vast body of work into an easily digestible format, and if for no other reason this makes the book incredibly valuable and a 'must have' for museum professionals.

Of the many ideas the book developed I particularly found the discussion of syncretism to be useful. Paine argues that: "There has probably always been a distinction between the religion of ordinary people and the religion of the churches. Ordinary people have (always?) taken what they found useful from 'official' religion, and used it for their own purposes, resisting the efforts of the clergy to force them into an approved pattern of practice and belief" (p. 21). It is noted that museums have relied upon official religious figures to assist them in their efforts to understand religion and religious objects, as such the views that museums present are inherently orthodox, and in many ways miss out on the possibilities of heretical and alternative visions of religion and religious objects that have inspired ordinary people (including many artists) in the past, and continue to inspire people today; myself included.

For Paine, "one of the odder consequences of our post-modern, multi-faith world is that we feel we need to respect not just other people's beliefs, but also the symbols of the beliefs" (p. 56), which I found an interesting statement, as it was precisely this idea of respect that drew me to reading this book, and to want to know more about how objects of a variety of faith traditions are being treated and used within the museum environment. As an ethnographic conservator I am accustomed to considering indigenous religious or sacred objects in a particular manner, it has long been my contention that this method of treating objects is not only the most appropriate for indigenous peoples but also for all peoples. For it is my belief that mutual respect lies at the heart of creating a better profession and indeed a better world.

Notes

1. C. Paine (ed), *Godly Things: Museums, Objects and Religion*, Frances Pinter Publishers, 1999

2. S. P. Mellor, "The Exhibition and Conservation of African Objects: Considering the Non-tangible", *Journal of the American Institute for Conservation* 31(1), 1992, pp. 3-16

3. N.-A. Stewart, "Conserving the Sacred", *ICON News* 8, pp. 30-31. 2007

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