15. Change Management in Materials Conservation

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Within Australia there are more than 250 practicing conservators who are members of our professional society, the Australian Institute for the Conservation of Cultural Materials (AICCM). Conservators are employed by state and commonwealth archives, art galleries and museums, and 20 per cent of the members of the institute are engaged in private practice (AICCM 2013). For every type of material there is a specialist conservator who knows how to stabilise and preserve elements of our material culture that range from ephemeral art works to plastic furniture and toys to digital media. The world of the conservator is secured by a bastion of rules and regulations that were established in the last 100 years. This chapter draws on my experience during a 35-year museum career, especially in strengthening mutual understanding between practitioners in materials conservation and their senior managers and in meeting modern-day requirements of increased efficiency and public engagement.

Having served eight years as a practising bench conservator and research chemist, I became head of the conservation team at the Western Australian Museum 27 years ago and was able to begin the process of introducing change. The time had come to change perceptions of senior management regarding conservators and their roles in the museum. Initially my role was almost like that of a peacemaker who would share information between conservator and management camps so that trust began to be re-established. Tensions began to dissolve and operational trust came to fruition. In particular, management gave greater credence to reports made by conservators and acted on them. Having demonstrated a commitment to change management, it was perhaps not surprising that a restructure of the museum saw additional management roles added to my responsibilities. This led me to gain a wider view of the operations of the museum.

The year 1993 saw the largest change in the 120-year history of the museum. The Minister for Culture and the Arts made the decision to close the main museum building in Perth and bought a 3.5-hectare site 9 km from the city centre with an existing 9,000-square-metre tilt-slab building on it. There was also a 3,500-square-metre adjoining steel bonded warehouse and a two-storey, 1,200-square-metre administration complex. The greatest change in my working life occurred when I was appointed project manager for the relocation of 3.5 million objects and 60 staff. My task was also to convert the empty warehouse into a state-of-the-art collections research and storage facility and to achieve it in 18 months on an $11 million budget. The process completed my metamorphosis from a research officer studying corrosion of copper on shipwrecks to a museum director. Despite the increased administrative load, my job requires me to continue to conduct research into better conservation and preservation methods for museum collections. The outputs of this work are new and cost-effective methods of stabilising collections which have placed the museum at the front of collections management practice. It is on this basis that my reflections on change management in materials conservation are presented.

Changes in operating environments

The first program for conservators began at the University of Canberra in 1980. Before the introduction of the inaugural program run by Professor Colin Pearson, most conservators in Australian cultural institutions had been European-trained technicians in paintings and objects conservation. Much fine work was done by highly skilled tradespeople who were well versed in working with a wide variety of material types. In the nineteenth century most of the present role of conservators was done by preparators of natural science specimens or by willing bands of seamstresses who worked on textiles. Faithful sacristans have worked in churches for hundreds of years conserving the textiles that form the basis of ecclesiastical garment collections. They used traditional methods of stitching down degraded fibres of sacred and preciously embroidered fabrics onto sympathetic new support structures. From the time of the classic painters in the Renaissance, the restoration of images on canvas was done by assistants in the schools of Rembrandt and other renowned portrait artists.

Interventive conservation went out of fashion, replaced by rigid obedience to traditional 'recipes' found in major works and in the early publications of the International Council of Museums Committee for Conservation. Understanding of the causes of decay that were written up by Plenderleith and Werner in the 1960s and subsequently (Plenderleith and Werner 1971) languished. As a consequence, conservators were periodically confronted with unexpected secondary complications of the treatments. I give the following examples of such interactions to help elucidate the complexities of the operating environment for objects in museum collections, which have particular storage requirements.

Months or years after an apparently successful intervention, the surface of ceramics can become covered with white efflorescences of hydrated calcium acetates as the low-fired earthenware corrodes in an atmosphere containing acetic acid, coming from the decay of old wooden showcases. These storage cabinets were often made of oak, which is one of the worst timbers to use, but it is one that had been traditionally used in institutions in Europe. There are, however, timbers that age to give a neutral pH, such as Queensland hoop pine, and this is now the preferred wood for construction of showcases and pallets in storage areas.

A similar problem occurs in showcases made of particle board used for storing lead and its alloys, for these objects can grow white whiskers of lead acetate and lead formate as the objects corrode in a microenvironment of acetic acid and formic acid fumes. Such reactions can take place in a matter of a few months after installation. They reveal that suppliers have not kept to the design specifications of the museum and have used formaldehyde in the manufacture of the medium-density particle board. The formic acid which leads to the problem comes from the oxidation of that formaldehyde.

These problems are exacerbated as an unexpected consequence of solving another problem. In efforts to minimise exchange of gases from an external uncontrolled environment with delicate objects inside the showcases, high quality seals can have the desired effects of minimising stresses in objects caused by rapid changes in relative humidity. But the adverse consequence stemming from high quality seals is to exacerbate the degradation issues associated with the off-gassing of volatile organic compounds, as described above. Exclusion of these corrosion issues from off-gassing is part of the due diligence which has to be exercised when objects are on loan from another institution, since such uncontrolled events can lead to great tensions between the borrowing and the lending museums and galleries.

Thus one change in the operating environment has been to reintroduce and build on understanding about decay and active intervention. Another has been in workflow and prioritising the order in which objects are treated. In the first decade of its operations the Western Australian Museum conservation laboratories saw a large volume of shipwreck material appearing, as a result of major underwater archaeological excavation. Previous management directions allowed the conservators to pick and choose what objects they wished to treat, using the rationale that ultimately all of the collection had to be treated, so it did not matter which ones were done first. Forty years on, the museum is still treating objects that were raised in the 1970s excavation programs on the wrecks of the Vereenigde Oostindische Compagnie (Dutch East India Company) vessels *Batavia* (1629) and the *Vergulde Draeck* (1656). Staff much prefer to treat more glamorous objects such as pulley blocks and wooden food bowls rather than less than desirable objects, like ordinary pieces of timber that came from the hull planking. One of the changes I introduced was to prioritise by importance rather than glamour.

An ageing workforce and unusual demographics

A long-term challenge is the structure of the workforce, epitomised by a colleague working in archaeological conservation of Egyptian sites, who wrote to me saying:

> I think a lot about the change that should be happening in this field. We need to be part of that change. In my opinion, what needs to change is engaging in more collaboration between the conservation field and allied fields and moving out of the straight jacket that we seem to have put ourselves into. [There needs to be] an end to the oodles of graduates that think single-focus object conservation is what they are going to do for the rest of their lives and that this is real conservation. How to justify what we do in the wider community in better ways is vital and we need a focus on encouraging more diversity in our field. Our field is full of old white ladies, that's right! There are not enough men and not enough non-white people in our field and the lack of diversity is going to be an issue in the future as the population changes.

Conservators in Australia are also strongly represented by women, but there is a more even gender distribution in conservation scientists and in senior management of conservation departments. Nevertheless there were only three Indigenous conservators working in Australia in 2013.

We also need changes in training and engagement. Another colleague wrote:

> Conservation training programs need to be integrated into existing departments within Universities, so that cross-training is ensured. … i.e. archaeological conservators train in archaeology, and archaeologists in conservation. One way is to embed the training programs in already-established departments as some programs are already doing.[1]

When museums and galleries around Australia support flexible training programs that facilitate the training and employment of Indigenous people in the conservation of Aboriginal collections, a new and exciting era will have arrived. We need to develop new training opportunities in-country in order to capitalise on the power of connection of the people with the artefacts, since this will result in an increased capacity to tell of the non-tangible cultural heritage values embodied in the collections.

1 C Chemello, senior conservator, Kelsey Museum of Archaeology, University of Michigan, pers comm 12 January 2013.

Tradition, training and tales

Conservators need to have fine motor coordination skills, and keen eyes for detail and the discernment of patterns. Although my experience in museum practice has come through on-the-job training as a conservator, I have the necessary basic skills for the work through training as an experimental scientist. What was an unfamiliar experience to me was finding a team that seemed to be split down the middle into those who had received on-the-job training and those who came from a physical sciences background. Those who had learned their craft of being a conservator through an apprenticeship of working alongside practitioners had not been trained to write up detailed comments about the treatment. Yet from my perspective as a manager detailed analyses of data obtained from a variety of assessments and reporting the conservation outcomes form an essential step in improving outcomes for the organisation. Recourse to an array of comparative analyses is essential for the task of continuous improvement. We shifted the culture by starting a series of internal presentations through which the conservation team gradually built up the courage to share their treatment methods. Gradually treatment reports became more detailed and a sense of pride was engendered when the conservators were able to demonstrate that they knew more than the maritime archaeologists about the objects.

Upon enquiry as to why nobody collected corrosion products from degraded silver coins, the answer 'We have not done that before' was thought to be a sufficient reason why nothing should change. The underlying response appeared to be based on a combination of fear of new processes and puzzlement that there was a new approach to degradation. When it was explained that there were great opportunities to recover important archaeological information and technical data on the manufacture of the coins and of their site history that would show conservators in good light, the outright suspicion diminished. Bringing in new experts to undertake this work made the addition of this new process feasible.

When I joined the museum conservation team it had been in operation for a decade in cramped and poor conditions in a former American World War II laundry at the rear of the Fremantle Arts Centre. My arrival was met with a mixture of curiosity and suspicion. Who the heck was this chemist who had come to join the team as a research officer? After a few months one of the staff said 'Just wait until you have been here for a year or two and you will also lose your enthusiasm'. The reason this did not occur lies perhaps in the nature of the individual parties concerned and the nature of the training received. For team members who had been 'apprenticed', there was greater cynicism, while for those from a more academic background, the opportunities for creating a profile were apparently boundless. Joining the museum at a time when there was public adulation of the work of the shipwreck excavators and conservators was enjoyable, for it seemed that all we touched turned to gold. New challenges of formerly untreatable objects were presented and solutions to complex problems of decay were found—the treated artefacts are still stable more than 30 years later. There was an openness of shared experiences of roughing it on field work in the remote parts of Western Australia and of rapidly finding new solutions to complex stabilisation problems thousands of kilometres from the laboratory in Fremantle. The challenge was to enthuse wider museum staff with the same energy and creativity.

Fortunately for the museum, the laboratory was led by a physical chemist who pioneered new treatment methods for the most problematic of all objects, viz., cast-iron cannonballs. Being spherical in nature they have a high surface area to volume ratio, and are very responsive to changes in their microenvironment when they move out of the sea and into the dry air of the excavation field station. Conservators were happy to embrace the need for the most expeditious movement of the cannonballs from their acidic and chloride-rich solution under the protective marine concretions into caustic solutions, which inhibit corrosion, and begin the conservation of the objects. They knew that this worked since previous experience without recourse to this treatment had caused cannonballs to fall apart in a matter of hours after documentation had taken place. This willingness to accept changed procedures was in part due to changes in practice in the Netherlands on their wooden shipwrecks from the polders, and in Sweden with the work of the *Vasa* (1628) shipwreck in Stockholm (De Jong 1975, Håfors 2010). If a process was discovered, developed and tested overseas then it 'must be OK'.

Preventive conservation rises from the wreckage of intervention challenges

The fashion in materials conservation has changed from intervention to prevention since there were often unwanted secondary effects on objects following treatments by traditional methods. An example of these types of processes is found in the desalination of copper alloy objects in solutions of sodium sesquicarbonate, after initial citric acid stripping. Following many months of soaking, an unattractive blue–green patina would often cover the surface. This artificial patina was remarkably uniform and made the objects look artificially aged or somehow contrived. In some cases the objects were speckled with bright blue crystals of chalconatronite, first seen on Egyptian bronzes recovered from tombs along the Nile. The reaction to such problems was to store the untreated objects in sealed bags containing oxygen scavengers and vapour phase corrosion inhibitors to stop the chloride-induced decay process.

Rather than deal with the underlying cause, this storage approach simply puts off intervention for years and leaves it in the hands of a future generation of conservators.

Analysis of the solution liquids which were free of such problems and those with the undesired patina showed that the build-up of soluble copper ions in the wash solution was the critical issue. There was nothing inherently wrong with the treatment, so long as the solutions were not allowed to turn a deep blue of the copper (II) carbonate complex. Regular changes of the washing solutions would prevent this but the drawback was the time and the chemical costs associated with this approach. An alternative was to use the reactivity of copper ions and aluminium metal to remove copper in solution. Placing crumpled soft-drink cans or aluminium cooking foil in the wash solution removed copper and so prevented the unwanted patina forming on the desalinating objects. There was also new monitoring equipment to check on the progress of the treatment to replace prolonged washing.

Resistance to adopting the new approach was overcome by having a contract conservator do the experiment. Because this new method removed the problem, staff have now accepted the change since it was wrought by an independent overseas colleague and not something introduced by management. This was the catalyst to bring about the change in perception amongst the tenured staff.

Introduction and use of key performance indicators

An underlying belief that it was possible to quantify the work that conservators were doing led to the development of a way of measuring the output of the laboratory. In terms of budget management and demonstration of effectiveness, it was important to find some yardstick to confirm the reasons why the laboratory had to be supported. There was a real need to convert the intangible elements of conservation into some numerical system or deal with the consequences of an externally imposed set of values. The risk with the latter process is that there would be no control over the input parameters. During discussions with many conservators at national council meetings of the Australian Institute for the Conservation of Cultural Materials in Canberra, I discovered that no other institution had developed suitable indicators. My colleagues encouraged me to have a go and wished me luck.

Many conservators seemed to prefer curators to hand them the objects with little or no engagement about the expected outcomes. The next contact would take place months or years later, on return of the artefacts once they had been stabilised and documented. This approach supported the thesis that conservation was part of a mystery of controlled chemical magic that had been wrought upon the objects. However, such approaches were likely to be misinterpreted by senior budget managers within the museum hierarchy.

The solution to the problem of monitoring the output was to establish the degree of complexity of the conservation process and the procedures that were involved in the treatment program, and to use this as one factor in an output matrix. Simple level one tasks would involve photographic documentation and preparation of custom supports and general cleaning. As the scope of the works increased, the level increased up to a maximum of 10, which involved extensive analysis of the object, a series of physical and chemical assessments of the materials before and after treatment, and writing up the observations and conclusions into a publishable paper and presenting them at a conference.

By using this degree of difficulty coefficient, the output of the conservators dealing with complex objects and very intricate procedures with detailed analytical work could be 'weighted' so that one object could gain an output or activity score of 10. In the same vein hundreds of simple objects were ranked as level one tasks, as they were jobs of low complexity. Using such a system showed that the quarterly output of the laboratory was relatively steady when the number of objects completed was corrected by the degree of difficulty. Having been able to demonstrate that the output of the laboratory could be readily quantified, the museum management team relaxed and accepted the simpler output of jobs completed per month as an indicator of productivity. The massive variations in the number of completed works was understood as being a reflection of the varying degrees of complexity of jobs, and was not seen as a slur on the productivity of particular staff.

Change management and tenured staffing

Given the low numbers of trained conservators, there is value in aligning personality with task complexity, as part of good career path management. A metals conservator decided that they wanted a change from the relatively messy work of treating corroded coins in formic acid solutions. One of the reasons was that the outcomes of the treatments were somewhat problematic, especially if there was no residual solid metal in the core of the coins. This lack of control was distressing to the member of staff concerned, who liked positive outcomes. A move into the more managed world of textiles conservation took place and over the years the conservator became quite accomplished at this area of work. The change worked for a decade but tensions within the textile team plus a desire to create a personal niche were the drivers for the next change. Following a staff development opportunity of being trained in paper conservation techniques, the third and final transition was effected. Paper conservation is regarded as having the most controlled set of outcomes when standard methods are applied. The person is now fully content and is very productive.

When I transitioned into management I had to take over a program for the treatment of the *Batavia* and *Vergulde Draeck* timbers mentioned above. This allowed me to develop an applied research program which has resulted in better outcomes for the treated objects and better managed shipwrecks. Having established in situ corrosion measurements on metals on shipwrecks, it seemed logical to apply similar methods for waterlogged wood. Whilst cleaning a 3000 litre tub of iron-stained waterlogged wood from the *Vergulde Draeck* wreck, I assessed the pH and the voltage of the corrosion products. The most surprising result was that, despite having been excavated for more than 30 years, the timber underneath the layer of rust was still in a fresh anaerobic microenvironment, as pristine as the day it was taken from the ocean floor after immersion for more than 300 years. This meant that the massive amounts of iron corrosion products, from cannon and fastenings, would still be able to be extracted in the wet state without damaging the delicate degraded structure of the waterlogged wood. Results from a new research officer had shown that reactive timbers should not be held in tap water but in a weak solution of polyethylene glycol. This approach simultaneously began the extraction of soluble iron (II) corrosion products from the timber and stabilisation of the waterlogged structure. This resulted in objects becoming available for examination by the archaeologists six to eight years ahead of schedule.

Working as a team of an organic chemist research officer and the curator of conservation led to a new approach of quantifying the burial and storage microenvironment. The previously viewed poor cousin of materials began to take its correct place on the treatment stage. Data on the pH and the reduction potential or voltage due to soluble electrochemically active components proved to be an indispensable tool. The method was extended to the in situ assessments of wooden wrecks in a post-excavation microenvironment: this approach has become international best practice. The Western Australian Museum conservation team is now acknowledged as a world leader in this area, with key workers receiving invitations to give plenary lectures at international symposiums. How was this change wrought? It was done through the art of subtle suggestion that if the research officer wanted to try this approach, then they would be able to achieve success and establish a new line of work. As head of the department, I was in a position to determine allocation of budgets and treatment priorities, so the path was made easier and the staff involved ran with it. The change was fundamentally good for the collections.

Conservation and sustainability of large collections

The collections of the Western Australian Museum cover the full spectrum of earth and planetary sciences, terrestrial and aquatic zoology, anthropology, social and maritime history and maritime archaeology. The bulk of the output from the conservation laboratory has been focused on the materials needs of the objects most at risk, and these consist of maritime archaeological materials. This determined the juxtaposition of the museum laboratories with the offices and storage areas of the department of Maritime Archaeology in Fremantle. While the number of shipwreck objects represents only 4.2 per cent of the entire collection, they consume 60 per cent of the conservation time in hands-on treatment and in the areas of research and development.

For all organisations operating in the cultural sector, almost all of the budget is fixed on salaries and utility costs. Fixed costs consume 91.3 per cent of available funds, leaving $92,000 a year for conservation consumables and external services. The fixed costs of gas and electricity to run the central collections and research centre are approximately $1.2 million. This high cost is relatively small on a per artefact basis, since 94.4 per cent of the 4.6 million objects are housed on this site and the cost of services can be seen as a measure of the organisational contribution to preventive conservation through provision of storage in optimal conditions. The combined preventive and interventive conservation costs amount to close to $2 million or roughly 44 cents per object per year. This is in many ways a very small per item cost for preservation of the collection of the people of Western Australia. But high costs and sustainability are an Australia-wide issue, with the Western Australian Museum amongst the worst funded cultural institutions in Australasia. Sustainability of collections is a major topic of conversations amongst museum directors.

Recent escalations in the cost of gas and electricity amounted to more than $200,000 a year, which brought close attention to the continuing cost of storing the objects in standard conditions of 22±0.5°C and 50±5 per cent relative humidity. By manually resetting the building management system to 23°C in the summer and 21°C in the winter and keeping the relative humidity at the same level, about $85,000 was saved in the first year. The reason why only two adjustments were made is that Perth typically has a hot dry summer and a cool wet winter. In other climates it is advisable to change the temperature set points at the spring and autumn equinox and at the summer and winter solstice. Apart from the benefit of saving the cost of one conservator's salary, there were no consequences of the small changes.

No one noticed the changes until they were documented in a management report. A debate then arose between the importance of rigid adherence to the international standard and a more realistic and pragmatic approach. The basis of the latter was that most collection stores fail to achieve the rigorous standards, which are mere guidelines. The principal issue is that one should avoid rapid swings in temperature and relative humidity as these can cause significant stress to paintings, to some organic specimens and to some fine furniture as well as to Indigenous cultural materials. Owing to the thermal mass of the 9,000-square-metre building and the volume occupied by the millions of items, resetting of the temperature takes 24 hours to be effected throughout the complex and such changes have a negligible impact on collections.

It is not logical to assume that maintenance of environmental conditions is of such great significance that variations cannot be allowed. Recent research by the Canadian Conservation Institute in Ottawa has shown that collections can in fact take a much larger range of temperatures and relative humidity without any significant damage. Typically the relative humidity is allowed to gradually vary by ± 10 per cent and the temperature by ± 2.5°C, and this relaxation can provide significant savings on the running cost of a collection store and laboratories (O'Connell 1996).

In Europe and in the United Kingdom whole museums are now being closed because governments cannot afford to run them and to keep caring for the collections. In such situations the curators and conservators all lose their jobs, so a demand for 'ideal conditions' can result in a pyrrhic victory. Four years ago a collections management working party of the Australian Institute for the Conservation of Cultural Materials began to collect data on storage conditions and the need to find a new set of guidelines (Bickersteth 2011). Once such recommendations have been endorsed on a museum by museum basis, the Council of Australian Museum Directors would be in a position to adopt the Australian standard museum conditions and apply them to specifications for loans within Australia. Currently very large sums of money are spent in trying to attain the European (International) exhibition conditions. When visiting conservators and curators come to check on our conditions at the time of mounting a travelling exhibition, they acknowledge that their museums in the UK do not keep the conditions that they are specifying for their loans.

Conservators by the very nature of their training become experts at noticing fine detail and changes in the conditions of objects under their care. One of their greatest challenges in ensuring continuing relevance of their arguments for specific storage and exhibition conditions is their capacity to think holistically about the organisation that employs them. It is unrealistic to ask for more funds from the government to improve wages, conditions, the storage of collections and proper access to professional development. All organisations have finite budgets, so that managing change and bringing about improved conditions is best done through self-examination. Team leaders need to be champions of change and to have a commitment to bring about the necessary shifts in attitudes. When a dispassionate analysis of the current operating museum environmental conditions is conducted, the black and white rules can be seen to change their hue and become more of a grey colour. Change management is best effected through internal discovery to find the courage needed to take collections and their management into a more sustainable future. Without that leap of faith the chance of the objects speaking to generations of museum visitors as yet unborn is very limited.

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