label: "63"

title: Stabilization Processing of Canvas Paintings Damaged by Tsunami

subtitle: Blotter Washing in the Conservation of Acrylic Paintings on Cotton Canvas

contributor:

* first\_name: Yuko

last\_name: Tsuchiya

title: Painting Conservator

affiliation: Tokyo University of the Arts

* first\_name: Eriko

last\_name: Hoshi

title: Conservation Scientist

affiliation: Joshibi University of Art and Design

* first\_name: Hiroshi

last\_name: Haze

title: Painting Conservator

affiliation:Haze Painting Studio

* first\_name: Marie

last\_name: Moto

title: Paper Conservator

affiliation: Japan Conservation Project

* first\_name: Nobuyuki

last\_name: Kamba

title: Conservation Scientist

affiliation: Tokyo National Museum

keywords:

abstract: A large number of cultural properties were damaged in the March 2011 tsunami that devastated Japan’s Tohoku region. A problem arises when we are faced with removing salt matter from paintings: salts absorb moisture from the atmosphere, and that moisture can promote deformation of the support. The Tokyo National Museum began in 2011 to research methods for removal of salt matter from paintings on canvas. Through a number of experiments, methods of desalination were developed for acrylic paintings on cotton canvas. In one method, the canvas was temporarily removed from its original wooden frame, edge-lined with polyester cloth, and then stretched on a temporary frame. Water was sprayed on the reverse and moisture absorbed with blotting paper. Experiments that followed confirmed that the amount of moisture and the period of immersion influenced the removal of remaining salts. Using techniques from paper conservation, moistened blotting paper was used as compress, and water containing dissolved salts was removed as quickly as possible using polymer sheet. This process was repeated several times for desalination. As a result, it was possible to control the contraction of the canvas to about 0.3%, and the chloride concentration was reduced to about what is contained in tap water in Tokyo.

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# <A-head> Background

A large number of cultural properties were damaged in the March 2011 tsunami, an unprecedented natural disaster that devastated Japan’s Tohoku region ([**fig. 63.1**](fig-63-1)). The process of conserving these properties has lasted nine years and remains ongoing to this day. At that time, I was working at the Conservation and Preservation Department of Tokyo National Museum, and I was put in charge of research looking into how to desalinate canvas paintings as part of the second stage of the rescue process. Specifically, I was entrusted with the task of restoring fifty-three canvas paintings from Rikuzentakata City Museum. These paintings were wrapped in plastic coverings at the time of the disaster ([**fig. 63.2**](fig-63-2)). After the tsunami, they absorbed large volumes of grime and moisture and were kept in this moist state. As a result, mold grew across the surfaces, and there was a considerable amount of paint flaking.

As a first step in the rescue process, remedial treatment was undertaken to remove the surface grime and mold and to fumigate the paintings ({{Ito 2014}}). However, it was impossible to remove the embedded grime and salt without using water, so those were left untreated during this stage. Chloride compounds left on the canvasses after the tsunami ionized, and a certain amount of moisture was needed to remove them. Given the assumption that canvas shrinkage is a major factor impacting the status of the paints, the question arose as to how much shrinkage was tolerable. Based on research already carried out overseas, the shrinkage rate was set at within 0.5% ({{Mecklenburg 2007a}}; {{Mecklenburg 2007b}}), and we set a goal of minimizing the damage to the paint layer by minimizing the shrinkage as much as possible.

After carrying out several experiments, our research focused on acrylic paintings painted on cotton canvasses. We made several attempts to clean these paintings using water. In the end, myself and the rest of the research group decided to adopt a desalination method that used the blotting technique when removing salt from the acrylic paintings ({{Tsuchiya et al. 2017}}). We essentially achieved our target with regard to the amount of chlorine remaining after treatment ({{Tsuchiya 2018}}).

# <A-head> Desalination Process

The desalination work to remove the embedded grime and salt from the canvasses could not be undertaken with any solvent besides water. However, there was a danger water might cause the canvas to shrink or the surface paints to peel off. We focused on the conservation state of fifteen large acrylic paintings among those canvas paintings damaged by the tsunami.

Hardly any of the wooden frames were warped, even with the larger paintings, while the canvasses had only minimal shrinkage and there was no paint flaking. As a result, it was adjudged that shrinkage could probably be kept to a minimum even if water was applied to these canvasses. We prepared a life-size mock-up of a large acrylic painting, stretched it over an actual stretcher, and applied water ([**fig. 63.3**](fig-63-3)). Hardly any shrinkage was observed ({{Tsuchiya et al. 2014}}).

Based on this, we undertook a desalination trial using the absolute minimum amount of moisture. We first tried a treatment method using gel sheets. Gel sheets with a 1.5% concentration and a 7:2:1 ratio of carrageenan (a seaweed-based emulsifying agent), xanthan gum, and locust bean gum were chosen for their ease of use and suitability for the syneresis process. A 16 x 11 x 2 cm sheet was pressed against the rear side of the canvas and left for about thirty minutes before being replaced with a new sheet. This process was carried out twice. However, the chlorine (CI) values of the canvas (rear side) remained at between 50%–80% of the initial values ({{Tsuchiya et al. 2015}}). This was because the gel sheets alone did not have sufficient moisture to remove the salt and other material that had seeped into the canvas fiber.

We next examined the blotter-washing technique used in paper conservation. After several experiments, we reached the conclusion that this method could be used to desalinate the acrylic paintings among the canvas paintings in Rikuzentakata City Museum’s collection, so we carried out conservation work accordingly.

# <A-head> Preparing a Calibration Curve for the Cotton Cloth Used for the Canvas

The residual chlorine CI values were measured using X-ray fluorescence spectroscopy (XFR). The obtained values were in centipoise (cP), so a calibration curve was prepared to convert these into parts-per-million (ppm) values. As the affected acrylic painting canvas was on cotton, we prepared a cotton cloth for our trials. We also prepared CI water solutions of 1, 10, 50, 100, 200, 300, 500, 700, 1000, 10,000, 35,000, and 100,000 ppm ([**fig. 63.4**](fig-63-4)). These were applied to pieces of the cotton cloth and then dried. These were set as reference standards and measured using XRF. We targeted a figure of 33 ppm (the CI value of drinking water in Tokyo) for the residual CI density on the post-treatment canvas ([**fig. 63.5**](fig-63-5)).

# <A-head> The Desalination Work

The target work was an acrylic painting by Masayoshi Nameki (**figs.** [**63.6**](fig-63-6)**,** [**63.7**](fig-63-7)). The canvas had already been removed from the original stretcher. Polyester strips were attached to the edges of the canvas (strip-lining) and it was remounted on a larger stretcher. The size of the canvas was recorded before applying water, and then the desalination process was carried out.

1. Water mixed with ethyl alcohol was sprayed onto the back of the canvas to apply moisture to the entire surface ([**fig. 63.8**](fig-63-8)).
2. The entire surface was covered with dampened blotting paper and left for eight minutes ([**fig. 63.9**](fig-63-9)).
3. A highly absorbent resin sheet was placed over the blotting paper for two minutes to soak up the grime and salt absorbed by the blotting paper ([**fig. 63.10**](fig-63-10)).
4. The blotting paper and resin sheet were removed and steps 1–3 were repeated five or six times. After the first application, the water that was sprayed on did not contain alcohol.
5. A thin paper sheet was placed against the surface and sprayed with water. This process was carried out twice to remove the absorbed grime and salt.
6. The salinity concentration levels of the chloride test paper were measured each time ([**fig. 63.11**](fig-63-11), [**fig. 63.12**](fig-63-12), [**table 63.1**](table-63-1)).
7. Canvas shrinkage was recorded directly after each application of water, after the desalination process was totally finished, and the following day, when the canvas had dried ([**fig. 63.13**](fig-63-13)).

# <A-head> Conclusion and Future Issues

The blotting method can be used to remove residual salt from acrylic paintings painted thinly on cotton-fiber canvases. The shrinkage rate of the canvas can by kept to within 0.5% of the total surface by maintaining the painting under tension during the treatment ([**table 63.2**](table-63-2), [**table 63.3**](table-63-3)).

Researchers outside of Japan have been aware of the dangers of using excess moisture when cleaning paintings since the 1980s. In particular, there has been considerable debate about problems involving acrylic paints (a relatively new painting material), such as the swelling of resins due to the impact of various additives ({{Jablonski et al. 2003}}; {{Tumosa and Mecklenburg 2004}}; {{Ormsby and Learner 2009}}; {{Doménech-Carbó et al. 2013}}; {{Toriumi 2018}}; {{Hackney, Stephen. 2020}}). Additive agents in acrylic paints tend to rise to the surface of paints, so these paintings probably lost these additives as a result of the tsunami. Furthermore, a water-based treatment was also used during the desalination process. In light of these factors, from here on we will need to ascertain the damage to the paints by carrying out experiments while preparing specimens.

Acrylic paints are a new painting material, so we still have a lot to learn with regard to the deterioration process. While searching for a way to remove grime without damaging the paint layer, we need to constantly carry out post-treatment observations and the like to check for any problems with the method we adopted.

Further research will be needed to determine the extent to which this method can be applied to oil paintings on linen canvases.

# <A-head> Acknowledgments

This research was carried out with support from the National Task Force for the Japanese Cultural Heritage Disaster Risk Mitigation Network’s Cutting Edge Scientific Research into Disaster Risk Mitigation, a subsidy provided by the Agency for Cultural Affairs. Technological advice regarding the blotting process was provided by Norie Nishihara and Otoyo Yonekura. We would also like to thank the Smithsonian Institution’s Dr. Marion Mecklenberg for providing invaluable advice about canvas shrinkage.