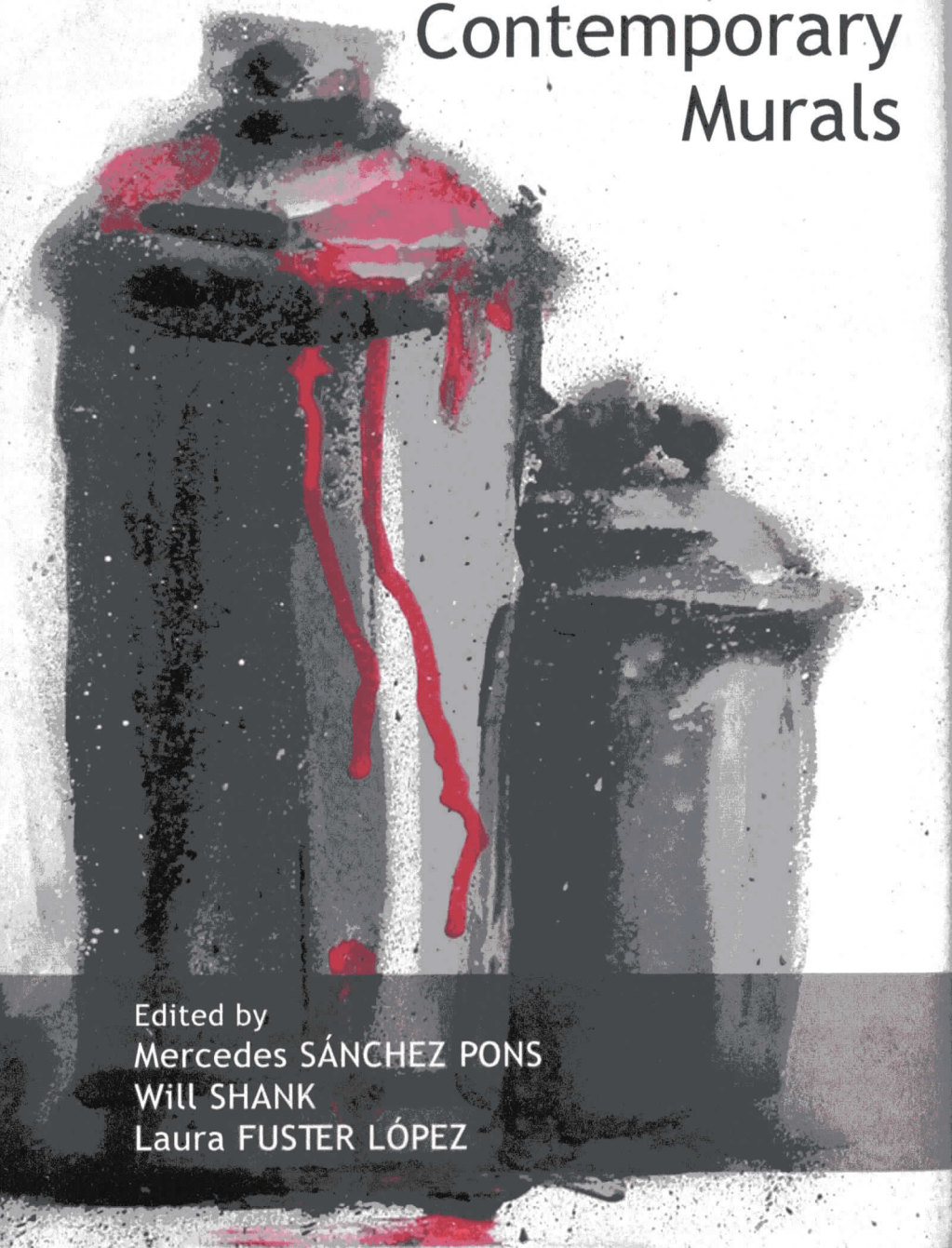
Conservation Issues in Modern and Contemporary Murals



Edited by
Mercedes SÁNCHEZ PONS
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This volume represents a forum for conservators, conservation scientists, artists and heritage managers. It includes the voices of many of the different partners involved in the complex task of preserving artworks:

- The vital experience of artists who create murals and are sometimes asked to treat their creations;
- Theoretical reflections on how to deal methodologically with conservation;
- Scientific studies on the identification of constituent materials and/or on the development of procedures for their preservation;
- The opinion of cultural managers;
- The specific experiences of conservators.

All of the above must have a voice in the difficult task of preserving such a challenging and changing heritage.

Este volumen se plantea como un foro de encuentro entre conservadores restauradores, científicos, artistas y gestores del patrimonio. En él se incluye el trabajo de los diferentes interlocutores que participan en la compleja tarea de conservar una obra de arte:

- La experiencia vital del artista creador de murales, que a veces es llamado para restaurar lo que ya hizo;
- Las reflexiones teóricas sobre el modo de enfrentarnos metodológicamente a su conservación y restauración;
- Los estudios científicos destinados a la identificación de materiales constitutivos o la puesta a punto de procedimientos para su conservación;
- La opinión de quienes se encargan de su gestión;
- Las experiencias concretas de conservadores restauradores.

Todos ellos deben tener voz en la difícil tarea de conservar un patrimonio complejo y cambiante.

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RESEARCH INTO ANTI-GRAFFITI COATINGS FOR ACRYLIC MURALS: PRELIMINARY TESTING AND EVALUATION

E. MACDONALD-KORTH, L. RAINER AND T. LEARNER

Introduction

In the past forty years, outdoor murals have become a familiar feature in many cities in America and around the world. Murals are painted by a range of people, from community groups to professional artists. Murals have gained attention as important historic landmarks and as influential and often beautiful works of art. As cities struggle to save these significant artworks, serious preservation issues have begun to reveal themselves. Deterioration of outdoor murals is commonly caused by: exposure to weathering, pollution, and biological effects; detrimental interactions between building materials and art materials; failure within and between preparatory layers, paint layers, and coatings; and human interaction, such as flawed restoration, overpainting, and vandalism, particularly graffiti.

Graffiti has existed since ancient times with examples dating back to ancient Greece and Rome, and today graffiti is a recognized and often appreciated artistic style. Unfortunately outdoor public murals have become targets for graffiti in recent years, and anti-graffiti coatings have been developed to protect murals from this type of vandalism. An anti-graffiti coating is a clear coating applied over a mural, which creates a barrier between the mural paint and graffiti medium, and is specifically designed to guard murals from the harms of vandalism. Anti-graffiti coatings differ from varnishes because they have specific properties that facilitate removal of graffiti from their surface without disturbing the original paint layers beneath.

Rapid removal, aided by anti-graffiti coatings, is one common method of mitigating graffiti. It is widely believed that graffitists move on from places where their work is not allowed to stay on view, and rapid or immediate removal of graffiti is sometimes the standard in mural preservation plans. Murals are a valuable expression of modern society and should be preserved for future generations to benefit from their cultural import.

Getty Conservation Institute Anti-graffiti Coatings Project

Objectives

Fig. 1. Test mural design.

The Getty Conservation Institute has undertaken research into anti-graffiti coatings, focusing initially on those that are currently on the market and used by artists, conservators, and city arts programs. After a literature review on these products, eleven anti-graffiti coatings designed for exterior surfaces, comprising six permanent coatings and five sacrificial coatings, were selected for testing on two test murals. The

project was designed to simulate a conservation treatment in the field, and in doing so, collect realistic, practical results and useful observations regarding the performance of the anti-graffiti coatings employed in the study (Fig.1).

Test mural design

Conservators and scientists from the Getty Conservation Institute (GCI) created three sets of two test murals (six murals total). Each mural measures approximately 2.5 x 3.5 meters. The murals were painted on exterior walls out of public view at the Getty Center, home to the GCI, in Los Angeles (see Figure 1). Each mural was painted using acrylic paints and covered with a clear acrylic varnish. A selection of eleven anti-graffiti coatings was applied to one set of two murals. To assess the performance and effectiveness of the anti-graffiti coatings, a selection of common graffiti materials was applied over the anti-graffiti coatings, and then the graffiti was subsequently removed using methods recommended by the coating manufacturers. The major forms of documentation for the application and removal testing phase included photography, video, and written observations entered on standardized forms designed for the project.

Paints

The test murals were painted using two brands of acrylic paint commonly used to paint outdoor murals, Nova Color Artists' Acrylic Paint and Golden Artist Colors. The palette for each mural consisted of ten colours: two reds, two blues, two yellows, white, and tints of three colours (see Materials section for a complete list of paints). The ten paint colours were applied in vertical columns of equal width, with one additional stripe of exposed primer. The eleven columns make one mural of the six total murals. A proprietary primer and a varnish, recommended by each manufacturer, were also used as part of the painting system (see Materials section) to replicate a typical paint system used by artists to paint outdoor murals.

Anti-graffiti coatings

Based on a review of the literature and anecdotal information, eleven coatings were selected for application to the set of two test murals (see Figure 2 and Materials section). Other important considerations when

selecting the coatings were health and safety, and environmental impact. Volatile organic compounds, or VOCs, can be dangerous to human health and cause harm to the environment; and a source of man-made VOCs are solvents in paints and protective coatings. Environmental awareness and regulations have increased in recent years, and paint and coating industries have increasingly shifted toward aqueous paint and coating systems. To be consistent with safe and sustainable standards, low or no VOC coatings were preferred; of the eleven coatings included in the experiment, ten were in aqueous solutions.

Anti-graffiti coatings can be categorized into two general types, permanent and sacrificial. Permanent anti-graffiti coatings remain on the mural after the graffiti is removed; sacrificial anti-graffiti coatings are removed from the mural along with the graffiti and require reapplication after each graffiti removal. The anti-graffiti coatings in this experiment consisted of six permanent and five sacrificial coatings. Anti-graffiti coatings have many different formulations. The following classes of coatings were included in this study: fluorinated acrylic, polyurethane, acrylate, siloxane, silicone polyester, polysaccharide, and wax. The coatings were applied in horizontal rows over the two test murals. Permanent coatings were applied on the upper section of the mural, and sacrificial coatings were applied on the lower section. (Figs. 2 and 3).

Figs. 2 and 3. Application of the different graffiti materials.

Graffiti materials

Graffiti materials were selected based on popularity, availability, and low price. Art supply stores, Internet searches, and research into graffitist's work aided in the selection of five representative graffiti materials for the experiment. Each of the five graffiti materials had a distinct colour that contrasted with the test mural paint colour beneath for

optimal visibility. The graffiti materials included: purple and metallic gold spray paint; black permanent marker, white oil-based paint marker; and green latex house paint (see Materials section).

Anti-graffiti coating test design

Each test mural is composed of eleven columns and sixteen rows (see Figure 4). Columns were painted in colour stripes as described above, and one distinct anti-graffiti coating was applied to each row[1]. A clear varnish was applied over each mural, with one unvarnished row of painted columns at the bottom of each mural. The anti-graffiti coatings were applied horizontally across the mural so that each anti-graffiti coating covered a section of every painted and varnished column. Each graffiti material was applied vertically, on four of eleven columns, over the anti-graffiti coatings (Fig. 3). The four graffiti columns represented temporal differences. To evaluate potential changes in performance over time, the graffiti was left on the surface for four different time periods prior to graffiti removal. The four time periods for graffiti removal were: one day after application, for 10 successive rounds; one month after application; six months after application; and one year after application. (Fig. 4).

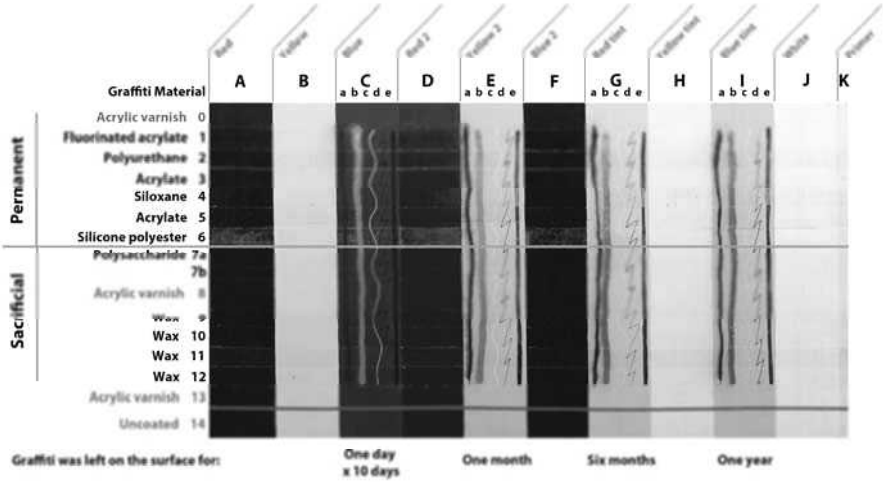

Fig.4. Schedule of the four time periods.

Graffiti Removal

Graffiti was removed at different times over a period of one year as described above. In the case of removal after one day for 10 successive rounds, graffiti was applied, removed and reapplied within one day, and repeated over a period of 10 days. Sacrificial coatings were reapplied locally following each removal.

The project tested anti-graffiti coating systems designed by coating manufacturers and specific recommendations for graffiti removals were used during the experiment whenever possible. In an effort to be consistent with the low or no VOC standard of the project, the most environmentally friendly methods of graffiti removal were used. According to the manufacturers of the coatings that were tested, high-pressure hot water spray could be used to safely remove graffiti from the permanent coatings, and to remove the sacrificial coatings along with the graffiti. Many of the coating systems that were tested included proprietary graffiti removers in the form of solvent-based liquids and gels. The removal process started with high- pressure hot water, sprayed from a commercial sprayer[2], followed by solvent-based removers on remaining graffiti (Fig. 5). The results using high-pressure hot water were not consistent for all coatings.

Fig. 5. During the removal process.

Consequently, the use of high-pressure hot water as a first step in all cases was discontinued. Instead, solvent graffiti removers were used for some of the coatings without the high-pressure hot water spray. Using a combination of high-pressure hot water spray, proprietary solvent-based graffiti removers, and various mechanical techniques an effective removal method was developed for each coating (Fig. 5).

Results

Evaluation of removal techniques

According to the coating manufacturers, hot water sprayed at high pressure was a safe removal method for all coatings, and the use of water was favourable over solvents. However, in this testing, high-pressure hot water did not work well on many of the coatings. In some cases the permanent coatings came off under the high heat and pressure, leaving the mural uncoated after the treatment. In other cases though, particularly on the siloxane coating and the sacrificial coatings, the high-pressure hot water was effective.

The high-pressure hot water spraying unit that was used had complications, namely the temperature and pressure of the equipment were not easily regulated and inconsistent. Generally, under high-pressure water spray, the permanent coatings performed better, and sacrificial coatings each performed in a different way (some required very high temperature and low pressure while others required high pressure at any temperature). As a result, when the sprayer did not reach high temperatures or pressures on a certain day, the coatings that require such factors did not perform at their best. Some conclusions can be made about the high-pressure hot water treatment: both the anti-graffiti coatings and the sprayer performed better on warm days, and the second of the two murals to undergo the removal process on any given test day received higher temperature water because the water became hotter during use.

It should also be noted that high heat is inherently unsafe for acrylic murals because it softens the paint, making it more vulnerable to damage. With the addition of high pressure, the situation can become dangerous for the paint. For instance, several of the mural test sections were damaged by the high-pressure hot water treatment: areas of paint were sprayed off the mural creating losses, and some theoretically permanent coatings were inadvertently removed in the same way (Fig. 6). From this testing, it was found that high-pressure hot water was not a good option to safely clean

acrylic murals. However, if the high-pressure hot water spraying unit had fully controllable temperature and pressure settings, then it is possible that a safe setting could be found for each coating (Fig. 6).

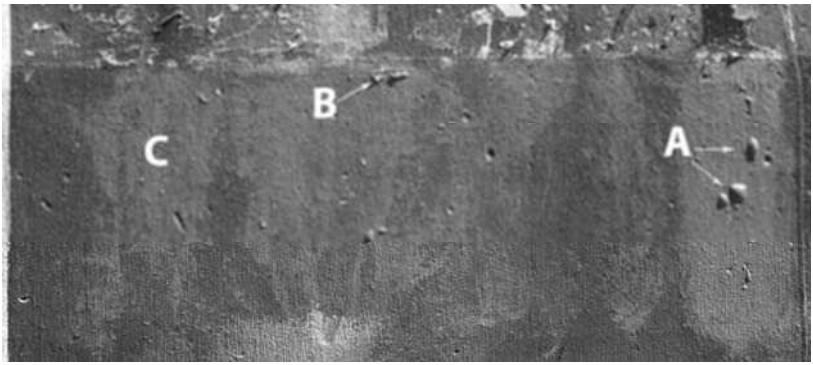

Fig. 6. Damaged found after high-pressure hot water treatment.

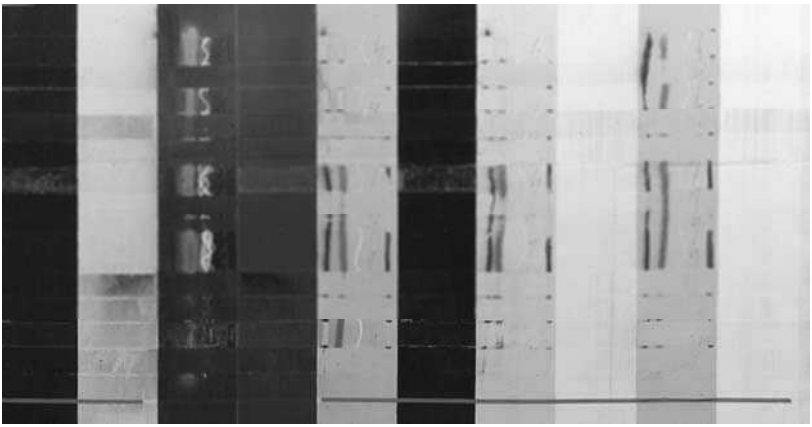

Fig. 7. Solvent-based removal testing.

High-pressure hot water was followed with or preceded by solvent removal, using proprietary removal products made by the coating manufacturers as part of their anti-graffiti coating system. Overall the solvents worked, however it was not possible to acquire some removers because of VOC laws, discontinuation of materials, and limitations on quantity. Although the removal products that were acquired worked well to dissolve the graffiti, in some instances they were also capable of solubilizing the anti-graffiti coating, and swelling or dissolving the mural

paint below. During the removal process, when the surface began to show damage such as deformation, abrasion, or mural paint transferred to the cleaning tool, the removal was halted and the solvent was cleared from the surface. In some cases more graffiti could have been removed, however the solvent-based removal products were difficult to control safely (Fig. 7).

Appearance

The anti-graffiti coatings were evaluated according to several criteria including: appearance, performance, and stability. The appearance category included the colour, clarity, and sheen of each coating. Visual evaluation and colourimetry were used to compare the change in colour between coated and uncoated mural sections (Fig.7).

Based on these methods of visual evaluation, this study found the majority of permanent anti-graffiti coatings made the mural appear slightly darker and more saturated than the uncoated colors. Some coatings in this study attracted dirt and grime, particularly the wax and silicone coatings, making the mural colours appear slightly grey. One wax-based coating appeared to be yellow and slightly opaque[3]; if applied to a mural, this coating could potentially misrepresent the appearance of original mural colours. Sheen varied between coatings but, overall, the permanent coatings were generally glossier than the sacrificial coatings.

Performance

There are a number of factors to consider when evaluating the performance of anti-graffiti coatings. In this study, the term performance refers to: ease of application, ease of graffiti removal, efficiency of graffiti removal, and durability of the coatings during the removal process. According to these criteria, the sacrificial coatings outperformed the permanent coatings. Most sacrificial coatings were easy to apply and graffiti removal was straightforward using proper methods. Because sacrificial coatings are removed along with graffiti; graffiti removal and durability of those coatings during removal were not distinguishing factors.

Permanent coatings in this study did not perform as well as sacrificial coatings. Application of the permanent coatings was uncomplicated; however the removal was problematic. Ease of graffiti removal and efficiency of graffiti removal were a challenge to assess because many

factors contributed to ambiguity in the evaluation. For example, some coatings are not specifically formulated for painted surfaces, and a few proprietary removal products for specific systems could not be acquired. As a result those coatings were not tested using exact manufacturer's recommendations. One coating failed prior to graffiti removal testing and was excluded from further study[4].

In some cases permanent coatings were partially removed during high-pressure hot water spraying or use of solvent-based graffiti removers; the anti-graffiti coating was gone in some areas, yet, graffiti was reapplied and the performance testing continued. In these cases, after subsequent graffiti applications, graffiti materials often preferentially adhered to areas that had lost their coating and this created a challenge in estimating the amount of graffiti left behind after each round of removal. Another issue that primarily affected the permanent coatings (and complicated the removal efficiency evaluation) was: select graffiti materials (namely the purple spray paint, and the black permanent marker) penetrated some permanent anti-graffiti coatings, mural varnish, and mural paint as well, therefore graffiti could not be safely removed from the anti-graffiti coating without also picking up the mural paint. When this occurred, the removal treatment was halted before all graffiti was removed. Though the graffiti could not be completely removed from the anti-graffiti coatings, another layer of graffiti was applied for further testing and earlier graffiti underlayers remained visible under each successive round.

Durability

In the durability evaluation, permanent coatings did not perform as well as expected. The permanent coatings in this test were affected by one or more of the following issues: adhesion failure under high-pressure hot water; deformation, delamination, and/or dissolution when using the designated solvent-based graffiti remover; surface damage due to the amount of mechanical action required to remove graffiti materials completely.

Stability

During the one-year testing period, all coatings, except one that failed almost immediately, appeared to be stable. Atmospheric dirt deposition and water drips created a grime layer over the anti-graffiti coatings, but the coatings did not exhibit any noticeable deterioration. Stability of the anti-

graffiti coatings used in this study will be assessed over time, on the murals, with continued evaluation of ageing and colour change.

Time-testing

The results of the four time-based removals (once a day for ten days, removal after one month, six months, and twelve months) showed that as the materials aged over longer time periods, particularly the twelve-month test, both the sacrificial coatings and the graffiti materials became more tenacious, probably due to increased drying time and resultant hardening. To dissolve and remove the coatings and graffiti after ageing, solvent-based cleaning systems required more time on the surface, and water spray required increased temperature and pressure. In a real-world situation this means rapid removal of graffiti from a mural with anti-graffiti coating is easier and more likely to provide satisfactory results than graffiti that is left for longer periods.

Discussion

In this test, anti-graffiti coatings were tested over a varnished mural. The paint manufacturers included in this study suggested the use of a protective varnish over murals produced with their paints. To recreate a realistic mural preservation situation, the varnishes were applied to the test murals. The varnishes complicated the interpretation of graffiti removal results because during high-pressure hot water spraying and solvent-based graffiti removal steps, it was not always possible to estimate which layer, varnish or anti-graffiti coating, allowed for the removal of graffiti because both layers were colourless, transparent, and vulnerable to high heat and pressure, and solvent solubilisation. Based on anti-graffiti coating trials carried out in this study, a desirable anti-graffiti coating should: be easy to apply, aesthetically pleasing, and should not misrepresent mural colors or sheen; allow for easy graffiti removal; be stable; contain low or no volatile organic compounds; be easy to maintain; durable; and inexpensive. None of the anti-graffiti coatings that were tested have all these characteristics. Despite this, some useful conclusions were made (see Fig. 8): sacrificial coatings performed better than permanent coatings, but were less aesthetically pleasing and required more maintenance; the wax-based coatings used in this study attracted dirt and required more frequent cleaning than coatings with less tacky surfaces. Though sacrificial coatings performed better than permanent coatings, and are also desirable because they can be reversed (unlike permanent coatings), sacrificial coatings are more

Table 1. Information table showing some characteristics of anti-graffiti coatings involved in this study.

Types	Coating	Class	Application	Appearance	Performance
Permanent	1	Fluorinated acrylate	Coating was easy to control and apply evenly. Coating was in an aqueous solution.	Coating was clear and moderately glossy. Coating did not appear to impart a color, though color measurement confirmed slight darkening.	Coating did not perform well; graffiti was partially removed; some graffiti materials penetrated the coating; the recommended remover could not be acquired because of VOC and quantity restrictions; the coating was partially removed under high-pressure hot water. According to the manufacturer, the coating is not designed for painted surfaces.
	2	Polyurethane	Coating was easy to control and apply evenly. Coating was in an aqueous solution.	Coating was very glossy and appeared to darken, yellow, and create a slight haze on some colors. Coating attracted dirt.	Coating performed acceptably using the recommended solvent-based graffiti removers and mechanical action; most graffiti was removed; some graffiti materials may have penetrated the coating; the coating was partially removed under high-pressure hot water.

3	Acrylate	Coating was difficult to control because of very low viscosity. Coating was in an aqueous solution.	Coating was slightly hazy and low gloss. Coating attracted some dirt.	Coating did not perform well; graffiti was partially removed; some graffiti materials may have penetrated the coating; the coating was partially removed under high-pressure hot water.
4	Siloxane	Coating was hard to apply evenly because of the aerosol delivery system. Coating was in a solvent-based solution.	Coating was very glossy and uneven in sheen. Coating was clear but appeared to darken, yellow, and saturate the paint colors. Coating attracted dirt.	Coating did not perform well; graffiti was largely removed; some graffiti materials penetrated the coating; graffiti removal required mechanical action that damaged the coating; high-pressure hot water may have also damaged the coating.
5	Acrylate	Coating was easy to control and apply evenly. Coating was in an aqueous solution.	Coating was clear, low gloss, and appeared to darken the paint colors. Coating attracted dirt.	Coating performed acceptably using the recommended solvent-based graffiti removers and great care because the removers were also capable of solubilizing the coating and the mural paint; most graffiti was removed; the coating was partially removed under high-pressure hot water.

	6	Silicone polyester	Coating required multiple materials and steps and was difficult to control. Coating was in an aqueous solution.	Coating was very glossy and uneven in sheen, appeared to darken, yellow, and create an opaque white haze on some colors.	Coating largely delaminated from the mural prior to graffiti removal testing and for this reason was not included in the graffiti removal trials.
Sacrificial	7	Polysaccharide	Coating was hard to control and apply evenly because of high viscosity. Two application methods were tested, airless sprayer and brush; airless sprayer did not function well. Coating was in an aqueous solution.	Coating was clear, low gloss, and created a slight darkening on some colors. Uneven application resulted in brush and drip marks. Rapid drying of the coating in direct sun caused bubbles to become trapped in the coating creating opaque regions.	Coating performed well; most graffiti was removed; high-temperature low-pressure water worked well; no solvent-removers were recommended; coating requires reapplication after each graffiti removal. The high temperatures needed to dissolve the coating are also capable of softening acrylic mural paint and are not safe to use in combination with high pressure water spray.

9	Wax	Coating was moderately easy to control and apply evenly. Coating was in an aqueous solution.	Coating was slightly hazy on dark colors, gray on light colors, imparted an overall darkening, and low gloss. Coating attracted some dirt.	Coating performed acceptably using high-pressure hot water followed by recommended solvent-based graffiti removers and great care because the removers were also capable of solubilizing the coating and the mural paint; most graffiti was removed; coating requires reapplication after each graffiti removal. The coating attracted dirt, appears gray over time, and requires periodic removal and reapplication.
10	Wax	Coating was moderately difficult to control because of very low viscosity. Coating was in an aqueous solution.	Coating was clear, imparted an overall darkening, and low gloss. Coating attracted some dirt.	Coating did not perform well using high-pressure hot water; graffiti was partially removed; recommended remover could not be acquired because of VOC laws; coating requires reapplication after each graffiti removal. After repeated removal and reapplication the remaining coating created a disfiguring build-up of material. The coating attracted dirt and requires periodic removal and reapplication.

	11	Wax	Coating was easy to control and apply evenly. Coating was in an aqueous solution.	Coating was low gloss, thick, hazy, and appeared to darken and yellow the paint colors. Brush strokes were visible. Coating attracted some dirt.	Coating did not always perform well using high-pressure hot water; no solvent-removers were recommended; graffiti was partially removed; coating requires reapplication after each graffiti removal. After repeated removal and reapplication the remaining coating created a disfiguring build-up of material. The coating attracted dirt and requires periodic removal and reapplication.
	12	Wax	Coating was fairly difficult to control because of very low viscosity. Coating was in an aqueous solution.	Coating was clear, low gloss and slightly uneven in sheen, and imparted a slight darkening to the paint colors. Coating attracted some dirt.	Coating performed unsatisfactorily using high-pressure hot water followed by recommended solvent-based graffiti removers; results were inconsistent and graffiti removal was incomplete; coating requires reapplication after each graffiti removal. The removal process was often halted prior to complete graffiti removal because the solvent-based graffiti remover began to dissolve the mural paint. The coating attracted dirt and requires periodic removal and reapplication.

involved to use; the coating is removed along with the graffiti and requires reapplication, thus higher maintenance. Even with no graffiti removal, manufacturers recommend periodic removal and reapplication of the wax coating

By looking at the preliminary results of this study, the coatings with acceptable results include:

- Polyurethane, coating #2: a permanent coating; high-pressure hot water should not be used on this coating and graffiti removal should be carried out with the recommended solvent removers only.

- Acrylate, coating #5: a permanent coating; high pressure hot water should not be used on this coating and graffiti removal should be carried out with the recommended solvent removers and with great care because the removers can also dissolve acrylic paint.

- Polysaccharide, coating #7: a sacrificial coating; high temperature water is the only method of effective coating removal (the coating requires temperatures that are not safe for acrylic murals when combined with high-pressure water spray).

- Wax, coating #9: a sacrificial coating; graffiti removal should be carried out with the recommended solvent removers; the surface attracts dirt, consequently appearing gray over time, and requires periodic removal and reapplication.

Chemicals and compounds in graffiti materials can react with anti-graffiti coatings, mural varnish, and mural paints in unpredictable ways. Graffiti material formulations vary widely, and one coating cannot protect a mural from all types of graffiti attack. In this area, the sacrificial coatings in this study performed more effectively than the permanent coatings; graffiti material did not penetrate any sacrificial coating test area, and when the coating worked, all the graffiti came off with the coating. Based on the results of this limited test, the most promising coating in this experimental set was coating #9, a wax-based sacrificial coating. Coating #9 performs well; it can be easily removed with solvents if necessary, and allows for relatively easy graffiti removal. However, coating #9 grays over time because it is semi-soft and dirt becomes embedded; it therefore requires removal and reapplication to maintain a suitable appearance.

Conclusions

The anti-graffiti coatings in this study were evaluated according to several criteria: appearance (colour, clarity, sheen), performance (ease of application, ease and efficiency of graffiti removal, durability of the coatings), and stability (colour change and ageing). Preliminary results show that sacrificial coatings performed fairly well and, in general: they are easy to apply, sufficiently durable, allow for easy and efficient graffiti removal, and are more resistant than permanent coatings to common graffiti materials. Some sacrificial coatings also had the following drawbacks: they tend to be less aesthetically pleasing than permanent coatings, the coatings must be reapplied after every graffiti removal, and maintenance is an issue for some, which discolour and attract dirt, requiring removal and reapplication. Advantages of permanent coatings were, in general: ease of application, an aesthetically pleasing appearance, low maintenance, and the fact that reapplication of the coating after graffiti removal is not necessary. Some permanent coatings had the following drawbacks: adhesion failure with high-pressure hot water spray, deformation and dissolution when using solvent-based graffiti removers, surface damage due to the mechanical action required to remove graffiti, and the irreversibility of the coatings.

In this study, the specific characteristics and behaviour of a variety of anti-graffiti coatings that are currently on the market and used by artists, conservators, and municipalities have been investigated. The many factors involved in anti-graffiti coating evaluations have been narrowed down, some preliminary conclusions have been made, and the characteristics of an ideal anti-graffiti coating have been identified. None of the coatings that were tested in this study exhibited all the desirable characteristics; however, further investigation into other anti-graffiti products could be valuable. Currently, no single coating meets all necessary requirements. Instead, a combination of coatings may be more effective. A layered coating system, or a new product developed from materials currently on the market may also be a viable solution.

Materials

Golden Heavy Body Acrylic Colors			
Column	**Color and Pigmentation**	**Light-fastness**	**Product and Batch Identification**
A	Pyrrol Red	I	GOLDEN #1277-7, Series 8
B	Yellow Ochre	I	GOLDEN #1407-7, Series 1
C	Phthalo Blue (Green Shade)	I	GOLDEN #1255-7, Series 4
D	Naphthol Red Light	II	GOLDEN #1210-7, Series 5
E	C.P. Cadmium Yellow Light	I	GOLDEN # 1120-7, Series 7
F	Ultramarine Blue	I	GOLDEN #1400-7, Series 2
G	Titanium White /Naphthol Red Light, (9:1, v:v)	see D and J	
H	Titanium White /C.P. Cadmium Yellow Light, (9:1, v:v)	see E and J	
I	Titanium White /Ultramarine Blue, (9:1, v:v)	see F and J	
K	Titanium White	I	GOLDEN #1380-8, Series 1
J	Sherwin Williams Exterior Acrylic Primer (Masonry Coatings Systems: Loxon High Performance), White	N/A	A24 W 300, 101-7268, Batch WE1578B 00813 CJK VJR
A-K	Golden MSA (Mineral Spirit Acrylic) Varnish with UVLS, Gloss	N/A	GOLDEN #7730-7, Batch 344104

Nova Color Artists' Acrylic Paint			
Column	**Color and Pigmentation**	**Light-fastness**	**Product and Batch Identification**
A	Quinacridone Magenta (Transparent)	I	No. 147, Batch 1179
B	Bismuth Yellow (Translucent)	I	No. 133, Batch 1029
C	Cobalt blue (Opaque)	I	No. 105, Batch 1129
D	Naphthol Crimson (Translucent)	II	No.171, Batch 1189
E	Azo Yellow (Transparent)	I	No.144, Batch 1518

F	Ultramarine Blue (Translucent)	I	No.122, Batch 1219
G	Titanium White /Naphthol Crimson, (9:1, v:v)	see D and J	
H	Titanium White /Azo Yellow, (9:1, v:v)	see E and J	
I	Titanium White /Ultramarine Blue, (9:1, v:v)	see F and J	
J	Titanium White (Opaque)	I	No. 118, Batch 1229
K	Gesso (White, Non-Yellowing Acrylic Priming Ground)	N/A	No. 200, Batch 1209
A-K	Nova Color Exterior Varnish #216	N/A	No. 216, Batch 11010

Anti-graffiti coatings and recommended graffiti removers

Row	Type	Class	Manu-facturer	Product name	Material (according to the manufacturer)	Recommend-ed remover
1	Perm-anent	Fluorinated acrylate	PSS	Faceal Oleo HD	Fluorinated acrylic copolymer in an aqueous phase	PSS AR 900 PSS AR 628 High-pressure hot water
2	Perm-anent	Polyurethane	Genesis Coatings	GCP 1000	Water-based aliphatic polyurethane	Genesis Graffiti Gold Genesis Graffiti Terminator High-pressure hot water
3	Perm-anent	Acrylate	Pelicoat	Pro Stone	Aqueous phase acrylic copolymer	High-pressure hot water
4	Perm-anent	Siloxane	SEI	Graffiti Proofer GPA-300	Dihydro poly-dimethyl siloxane	High-pressure hot water
5	Perm-anent	Acrylate	TSW	TSW4 Gloss Acryli-Master	Water-based, cross-linked acrylic copolymer	TSW2 Multi-Master High-pressure hot water
6	Perm-anent	Silicone polyester	US Coatings Solutions	Primer: AGS 1 Topcoat: AGS 2A, AGS 2B	Water-based silicone polyester	AGS Graffiti Kleen High-pressure hot water
7	Sacrif-icial	Poly-saccharide	PSS	PSS 20	Vegetable polysaccharid es and water	High-pressure hot water

9	Sacrif-icial	Wax	Genesis Coatings	Graffiti Melt	Water, and food grade paraffin wax	Genesis Graffiti Ease-Away Genesis Graffiti Terminator High-pressure hot water
10	Sacrif-icial	Wax	Mapei	Wall Gard Graffiti Barrier	Water emulsion of polymer waxes	WallGard Graffiti Remover Gel High-pressure hot water
11	Sacrif-icial	Wax	Pelicoat	Vegetal Wax Protect-ion 67	Biodegradable vegetable wax	High-pressure hot water
12	Sacrif-icial	Wax	PROSOCO	Defacer Eraser Sacrif-icial Coating SC-1	Water-based paraffin coating	PROSOCO Defacer Eraser PROSOCO Sure Klean High-pressure hot water

Graffiti materials		
Column	**Material**	**Maufacturer**
a	Spray paint, purple	Krylon
b	Spray paint, metallic gold	Krylon
c	Oil-based paint marker, white	Sharpie
d	Permanent marker, black	Sharpie
e	Latex paint, green	Rust-Oleum

Notes

1. PSS 20 was applied in two rows, one row was applied by spraying (7a), and the other row was applied by brush (7b). The coating manufacturer recommended the Ryobi speed sprayer, model SSP050 to apply the coating; this model sprayer was used to apply row 7a.
2. 2 sprayers were used: Mi-T-M HSP-3003-3MGR 3500 psi Hot-Pressure Washer for 10-day and one-month trials; Shark SGP-403573E 3500psi Hot Water Commercial Series Pressure Washer (with adjustable thermostat) for 6-month and 12-month trials.
3. Row 11, Pelicoat Vegetal Wax Protection 67.

4. Row 6, US Coatings AGS 1 (primer), AGS 2A and 2B (topcoat); the coating largely delaminated from the mural prior to graffiti removal testing and for this reason was not included in the graffiti removal trials; coating application may have contributed to the adhesion failure.

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