HSIN-CHEN TSAI

Investigating Crayon Removal from Paper Based Japanese Prints

ABSTRACT

This paper investigates solvents and techniques that could be applied towards removing crayon graffiti from a group of Munakata Shiko's prints in the collection of the Museum of Fine Arts, Boston. The twelve prints to be treated were printed with black *sumi* ink[1] on Japanese paper in the 1960's. After the images were printed, they were mounted as a pair of folding screens, each with six prints with additional papers for the surround and backing. At some point, these works were defaced with graffiti. This graffiti was applied with crayon and it appears on one of the prints and three of the backing papers.

Before treatment could proceed, a number of tests using mockups were conducted to determine the best course of action. Different brands of crayons were tested. After using mechanical techniques to remove most of the crayon, four solvents: petroleum ether, toluene, mineral spirits and xylenes, which are located at the non-polar, wax area on the Teas-chart, were chosen for removing the graffiti. Test results show that toluene and xylenes have better solubility to crayon than other solvents; the use of mineral spirits resulted stains on the paper. These mockups were also examined using ultraviolet light, and in some cases fluorescent tide-lines were observed. Tide-line formation seems to depend upon how much crayon remained after mechanical cleaning and how the solvents evaporated. Taking into consideration the properties of Japanese paper, crayon and solvents, this paper also proposes three different techniques for solvent application that will avoid tide-line formation.

INTRODUCTION

In 2001, twelve woodblock prints by Munakata Shikô (1903–1975), were acquired by Museum of Fine Arts, Boston. These woodblock prints were mounted as a pair of six-panel folding screens. The images are printed with black *sumi* ink onto thin to medium weight Japanese paper. One of prints and several backing papers had been defaced by crayon (figs. 1–2).

This study presents tests for removing crayon on mockups using three different combinations of mechanical, solvent and wet treatment techniques. After these treatments, mockups

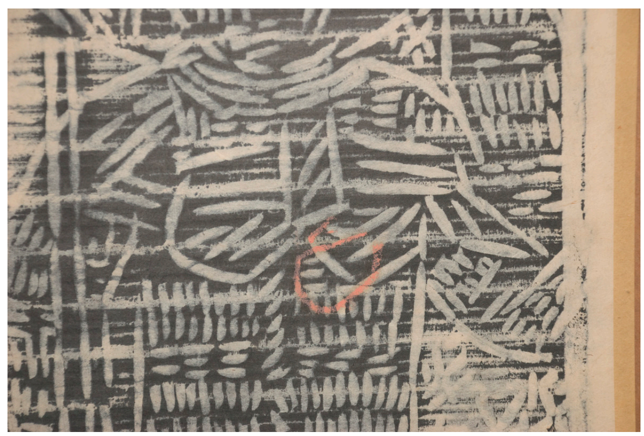


Fig. 1. Flesh crayon is located at the print on the left 6 panel

Fig. 2. Green crayon is located at the backing paper on the right 4 panel

Presented at the Book and Paper Group Session, AIC's 39th Annual Meeting, May 31–June 3, 2011, Philadelphia, Pennsylvania.

were observed under normal and ultraviolet light in order to see if they caused tide-lines to form.

TYPES OF GRAFFITI

When viewed under the microscope the various strokes of crayon-like graffiti on the print and backing papers appear different. After spot tests using water, it was determined that some of graffiti was actually made by a water soluble marker-like material. Table 1 lists the types of graffiti on the screens.

When examined under the microscope, two different materials appear to have been used. They appeared similar to crayon and marker. Therefore, mockups using crayon and water soluble marker were prepared for comparison with the graffiti found on the screens. The yellow graffiti appears to be absorbed into the paper similarly to the marker mockup (figs. 3–4). The flesh, blue and green graffiti appear thick and chunky and it covers the printing and the paper in a manner similar to the crayon mockup (figs. 5–6). These images illustrate the similar appearance between the mockups and graffiti.

		Graffiti	Spot test(water)	Appearance under microscope
Print	R1	Yellow	○	Thin strokes absorbed into the paper.
	R3	Yellow	○	Thin strokes absorbed into the paper.
	R4	Yellow	○	Thin strokes absorbed into the paper.
	R5	Yellow	○	Thin strokes absorbed into the paper.
	R6	Yellow	○	Thin strokes absorbed into the paper.
	L1	Orange	○	Thin strokes absorbed into the paper.
	L6	Flesh	×	Thick strokes cover the paper.
Backing paper	R2	Yellow	○	Thin strokes absorbed into the paper.
	R4	Green	×	Thick strokes cover the paper.
	R5	Yellow	○	Thin strokes absorbed into the paper.
	L5	Flesh	×	Thick strokes cover the paper.

Table 1. Graffiti are found on the screens

Comparison between the mockups and the graffiti found on prints R1, R3, R4, R5, R6, L1 and backing paper R2, R5 shows that it might be made from yellow makers; graffiti found on print L6 and backing papers R4, L5 might be flesh and green colored crayons.

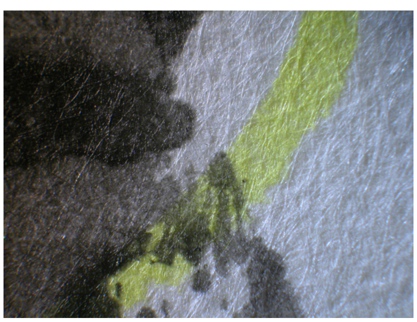
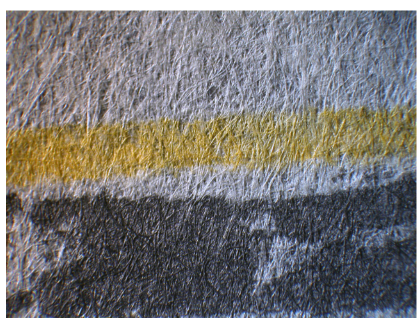
Analysis of the graffiti found on L6 and backing paper R4, L5 using transmitted light infrared micro spectroscopy indicates that they contain a hydro carbon wax similar to paraffin as a binder, titanium dioxide or kaolin clay as a filler, and colorants.

SOLVENT SELECTION

Since analysis showed the crayon graffiti to contain paraffin as a binder, non-polar solvents were considered appropriate for removing it from the paper support. According to the Teas-chart, the area for wax (non-polar materials) is located at the lower right corner (fig. 7). Petroleum ether (fig. 8 number 6), toluene (fig. 8 number 7) and xylenes (fig. 8 number 8) were chosen as appropriate solvents for removing crayon. Due to the toxicity of toluene and xylenes, mineral spirits (fig. 8 number 4) were also selected because it is located at the extreme non-polar corner. Mineral spirits could be mixed with another, less toxic solvent to approximate the solvency characteristics of xylenes and toluene.

CRAYON REMOVAL TESTS

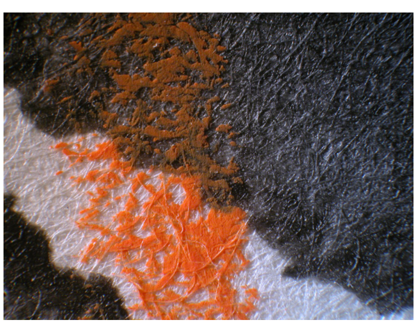
Mockups emulating the conditions found on the works of art to be treated were prepared by woodblock printing black sumi ink on a similar paper and lining these with

LEFT TO RIGHT

Fig. 3. Mockup of marker under microscope

Fig. 4. Graffiti on the panel L1 under microscope




LEFT TO RIGHT

Fig. 5. Mockup of crayon under microscope

Fig. 6. Graffiti on the panel L6 under microscope

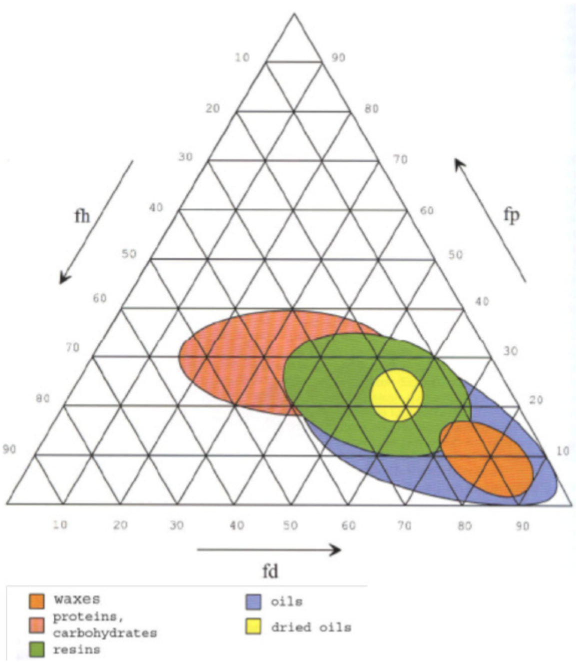


Fig. 7. Teas-chart; solubility-areas of common binding media[2]

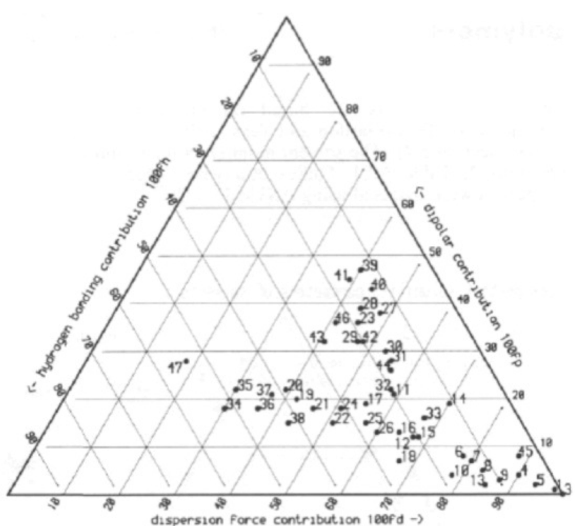


Fig. 8. Location of solvents in the Teas-chart[3]

two layers of Japanese paper to create a total thickness is 0.22mm. Once created, four varieties of wax-based crayon[4] were applied in stokes onto them in a manner similar to that found on the works needing treatment. Additionally, two water soluble crayons[5] were applied to mockups as described for the wax-based crayons. Comparison between the two allowed for observation of the effects of solvents on them. Solubility tests were undertaken using the following steps: application with a cotton swab, air drying, checking front and back. Table 2 shows the results for the tests conducted on these six types of crayon.

	Product/brand name	Water	Petroleum ether	Toluene	Mineral Spirit	Xylene
1	NeoART-WS	◎	Δ	○	Δ	○
2	Neocolor-WS	◎	Δ	○	Δ	○
3	Sennelier	×	×	Δ	○	○
4	Sakura	×	×	○	○	○
5	Crayola	×	×	○	○	○
6	Crayons	×	×	○	○	○

Table 2. Solubility test results (×=insoluble, Δ=slightly soluble, ○=soluble, ◎= very soluble.)

Solubility tests show wax-based crayon is soluble to slightly soluble in xylenes, toluene and mineral spirits. However, they are not as soluble as water is to the water soluble crayon. Solvents located at the wax area on the Teas-chart were not able to dissolve large amounts of crayon. Therefore, most of the crayon had to be removed using mechanical cleaning methods before using solvent cleaning. Therefore a treatment using mechanical and solvent techniques was explored.

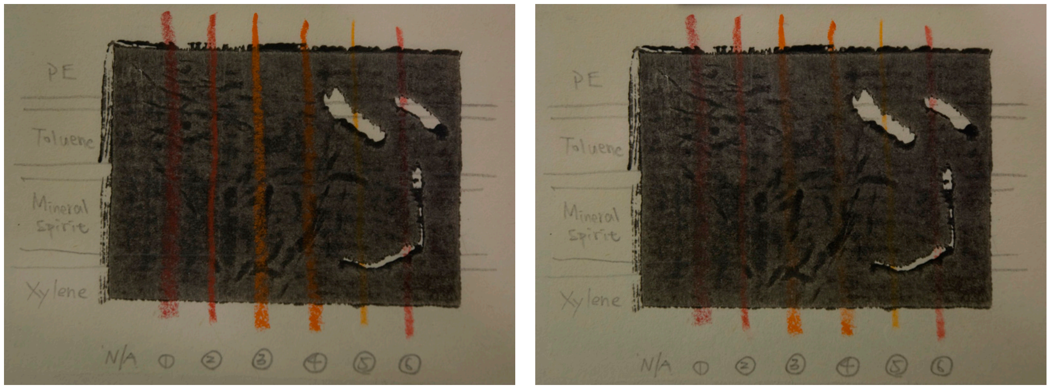
Fig. 9. Before mechanical cleaning

Since the crayon was thickly applied on top of the paper fibers, gentle pouncing with a kneaded eraser was able to remove most of it from the surface. A scalpel was also used to release additional crayon as required. After mechanical cleaning, most of the loose crayon was removed as seen in figures 9–10; but some crayon was still left and needed further treatment.

Tide-lines were observed around the tested areas after using solvents indicating that some materials must have been dissolved from the crayon after testing. In addition, colorants were seen on the back of the paper, especially in areas free of printing. Therefore, obtaining acceptable cleaning results without causing tide-lines and dissolving colorants to the back of the paper would be desirable. Three techniques were carried out: 1. Small amounts of solvents were applied to the crayon from the front using cotton swabs. 2. The mockups were bathed in water followed by brush applied solvent to the front and picking up the crayon with blotting paper squares; 3. Moistened the mockup with water and placed it face up onto the damp blotting paper, brush applied solvent to the front and picking up the crayon with blotting paper squares (fig. 11).

RESULT AND DISCUSSION

The cleaning results are seen in figures 13, 15, and 17. In technique 1, treatment could be controlled by using a tiny swab with small amounts of solvent and changing the cotton frequently and there is no colorant or stain seen at the back after treatment. Basically swabs with solvents dissolved crayon and lifted it away at the same time preventing colorants from penetrating the paper. Technique 1 appears to have a fair cleaning result. Toluene or xylenes were more successful at removing crayon than petroleum ether or mineral spirits; use of mineral spirits resulted in the formation of haloes.



Figs. 9–10. Before (left) and after (right) mechanical cleaning

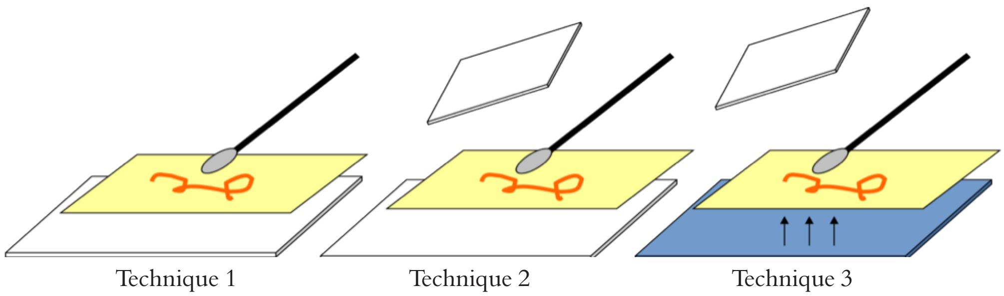
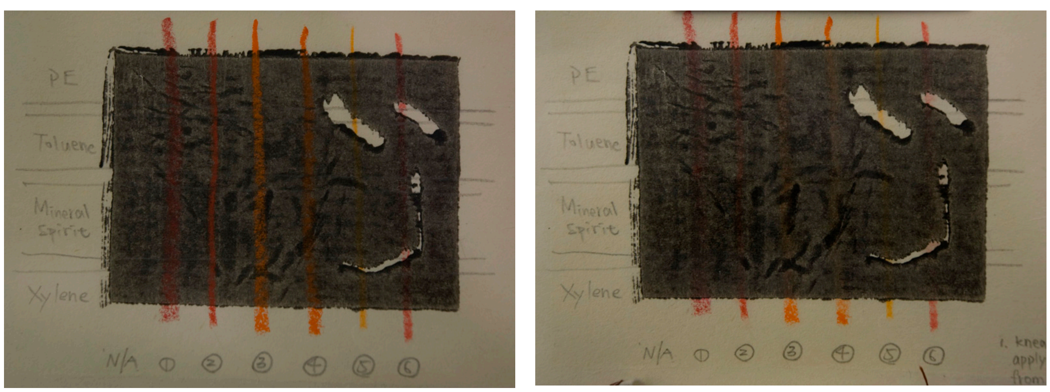
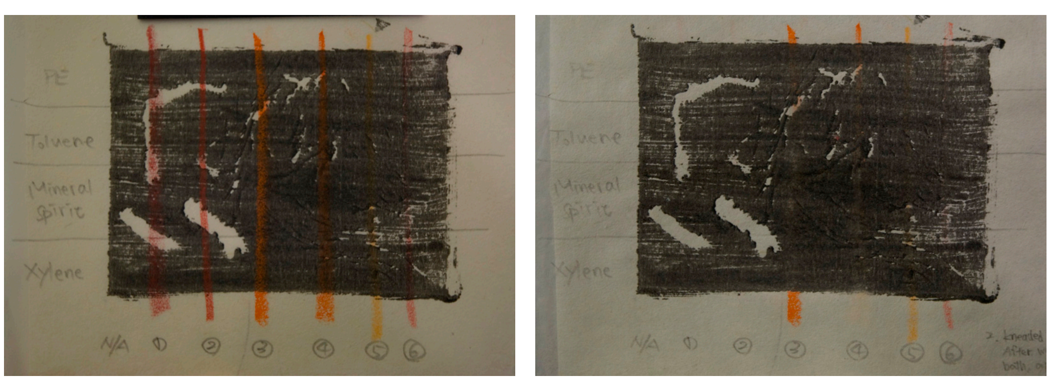


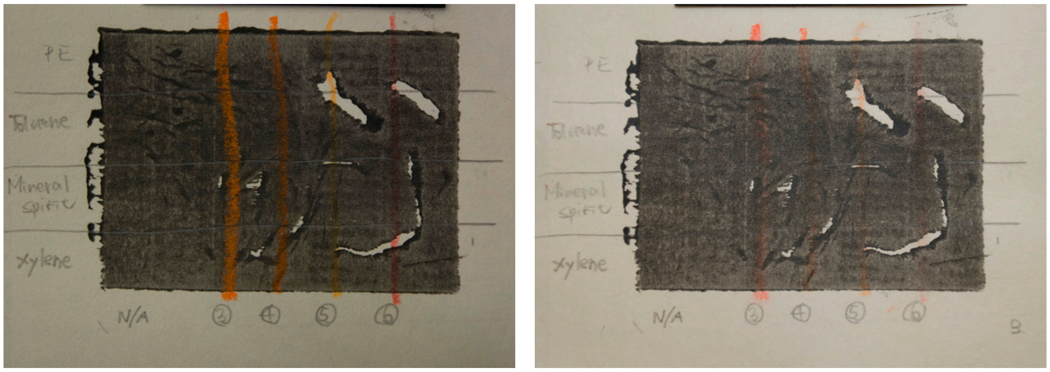
Fig. 11. Three techniques of crayon removal



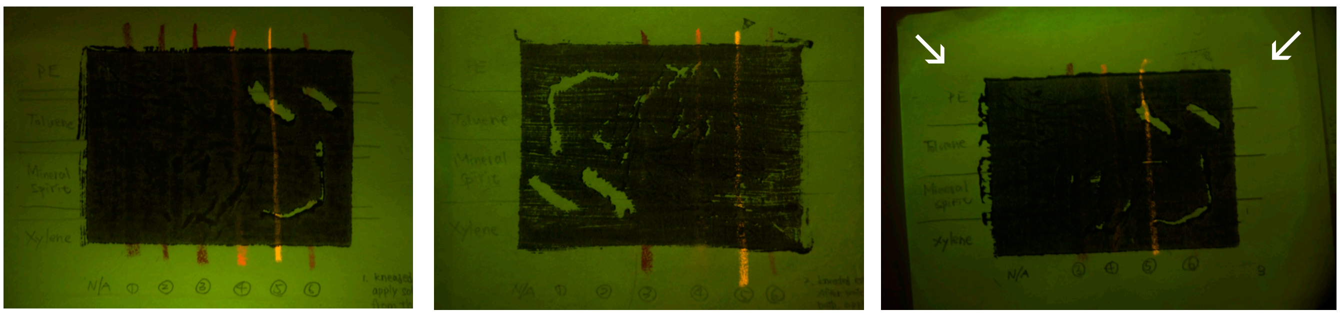
Figs. 12–13. Before (left) and after (right) treatment of technique 1



Figs. 14–15. Before (left) and after (right) treatment of technique 2



Figs. 16–17. Before (left) and after (right) treatment of technique 3



Figs. 18–20. Under ultraviolet light after treatment of technique 1 (left), technique 2 (middle), technique 3 (right)

It is likely that the use of *sumi* containing an animal glue binder for printing in addition to the cross-linking between paper and this binder over time decreased its solubility to water which allowed for wet treatment to be considered as part of the treatment to remove the crayon. Techniques 2 and 3 employed treatment with water.

The idea was to make use of the antipathy between polar/water and non-polar/crayon and non-polar solvents to prevent migration of the crayon into the paper. Technique 3 introduced additional water by placing the mockup face-up on damp blotting paper to keep it moist. The results show that techniques 2 and 3 have a better cleaning effect than technique 1, especially technique 3 because the damp blotting paper kept the back of the mockups moist during treatment. This helped keep the solvent on the surface longer which aided in dissolving the crayon more efficiently. However, because the mockups were wet, it became difficult to control the amount of solvent used and the areas being treated.

Observation under ultraviolet light reviews the amounts of crayons on the surface, Technique 1's mockup showed more crayon remaining than the other mockups; technique 2 and technique 3 have better results. However, a fluorescent tide-line was visible at the edge of techniques 3's mockup where the damp blotting paper was. The additional moisture must have pushed the solvents along with the crayon causing a tide-line to form as the mockup dried.

CONCLUSION

Through tests of crayon removal on the mockups, investigating conclusion is as following:

1. No solvent works perfectly. Although toluene and xylenes do dissolve crayon well, use of solvent needs to be combine with either mechanical or wet treatment to achieve desirable results.
2. Mineral spirits causes paper to stain and become transparent in the treated area. This result was seen when it was mixed with other solvents as a substitute for toluene and xylenes.
3. Technique 1 allowed the most control during treatment. A combination of the wet treatment as techniques 2 and 3 did achieved better cleaning results. However, avoiding the formation of tide-lines is an important consideration if the technique 3 is to be used.
4. Crayon removal treatments using solvents shows a better cleaning result in areas of printing, because the printing acts as a barrier to solvents and dissolved colorants. In areas free of printing, cleaning is difficult and not as effective.

ACKNOWLEDGEMENTS

The author would like to thank the following MFA colleagues: Jacki Elgar, Head of Asian Conservation Studio, Joan Wright, Bettina Burr Asian Conservator, Jing Gao, Cornelius Van der Starr Conservator of Chinese Painting, Michele Derrick, Schorr Family Associate Research Scientist.

MATERIALS

Caran d'Ache® NEOART Water-soluble wax pastel 7300
No.070***
CARAN D'ACHE SA
Chemin du Foron 19
PO Box 332
CH-1226 Thônex, Genève
Suisse
www.carandache.ch

Caran d'Ache® NEOCOLOR II Water-soluble wax pastel
Light Cadmium Red (Hue) 7500 No.560
CARAN D'ACHE SA
Chemin du Foron 19
PO Box 332
CH-1226 Thônex - Genève
Suisse
www.carandache.ch

Sennelier Artist' oil pastel No. 132501.200 Pigment: PO73
PW6
Z.I. 2, rue Lamarck, BP 204
22 002 St-Brieuc Cedex
France
Tel. +33(0)2 96 68 20 00
www.sennelier.fr

Sakura Cray-Pas® Expressionist® XLP#006
30780 San Clemente Street
Hayward, CA 94544
www.sakuraofamerica.com

Crayola® Orange
1100 Church Lane
Easton, PA 18044-0431
Tel. +1(0)610 253 6272
www.crayola.com

Crayons Red
Beantown Marketing & Promotions Add Specialties, Inc.
PO Box 26
Middleton, MA 01949-0026
Tel. +1(0) 978 777 4422
www.kidsspecialtiesco.com

Sanford® Design® kneaded rubber erasers
www.sanfordcorp.com

REFERENCES

Horie C.V., *Materials for Conservation*, Butterworth-Heinemann, 1987.

Smith, M. Jones, N.M.M., Page, S.L., Dirda, M.L. 'Pressure Sensitive Tape and Techniques for
Its Removal from Paper' *Journal of the AIC* Vol.23, No.2, 1984. p.101–113.

Pietsch, Annik, *Lösemittel*, Theiss, 2001.

NOTES

1. A black ink composed of soot and animal glue.
2. Pietsch, Annik, *Lösemittel*, P172.
3. Horie C.V., *Materials for Conservation*, p194
4. The crayon's brands are Sennelier, Sakura, Crayola and Crayons.
5. The crayon's brands are Caran D'Ache NeoART and Caran D'Ache NeocolorII.

HSIN-CHEN TSAI
Andrew W. Conservation Fellow
Asian Conservation studio
Museum of Fine Arts
Boston, Massachusetts
Htsai@mfa.org