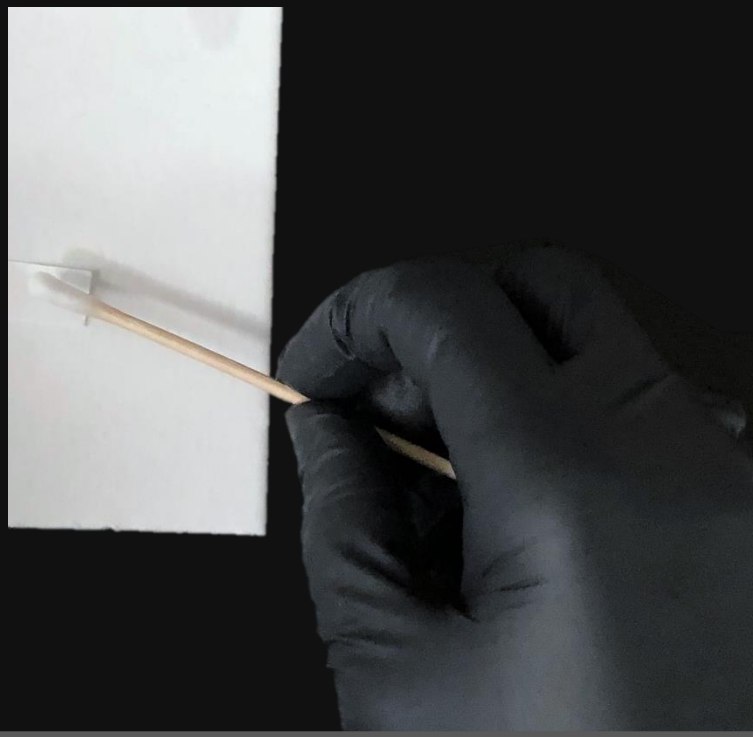
ACCELERATED AGING STUDY OF PAPERS TREATED WITH CITRATE SOLUTIONS



Madison Brockman[1] and Laura Maccarelli[2]

[1] Winterthur/ University of Delaware Program in Art Conservation [2] Los Angeles County Museum of Art

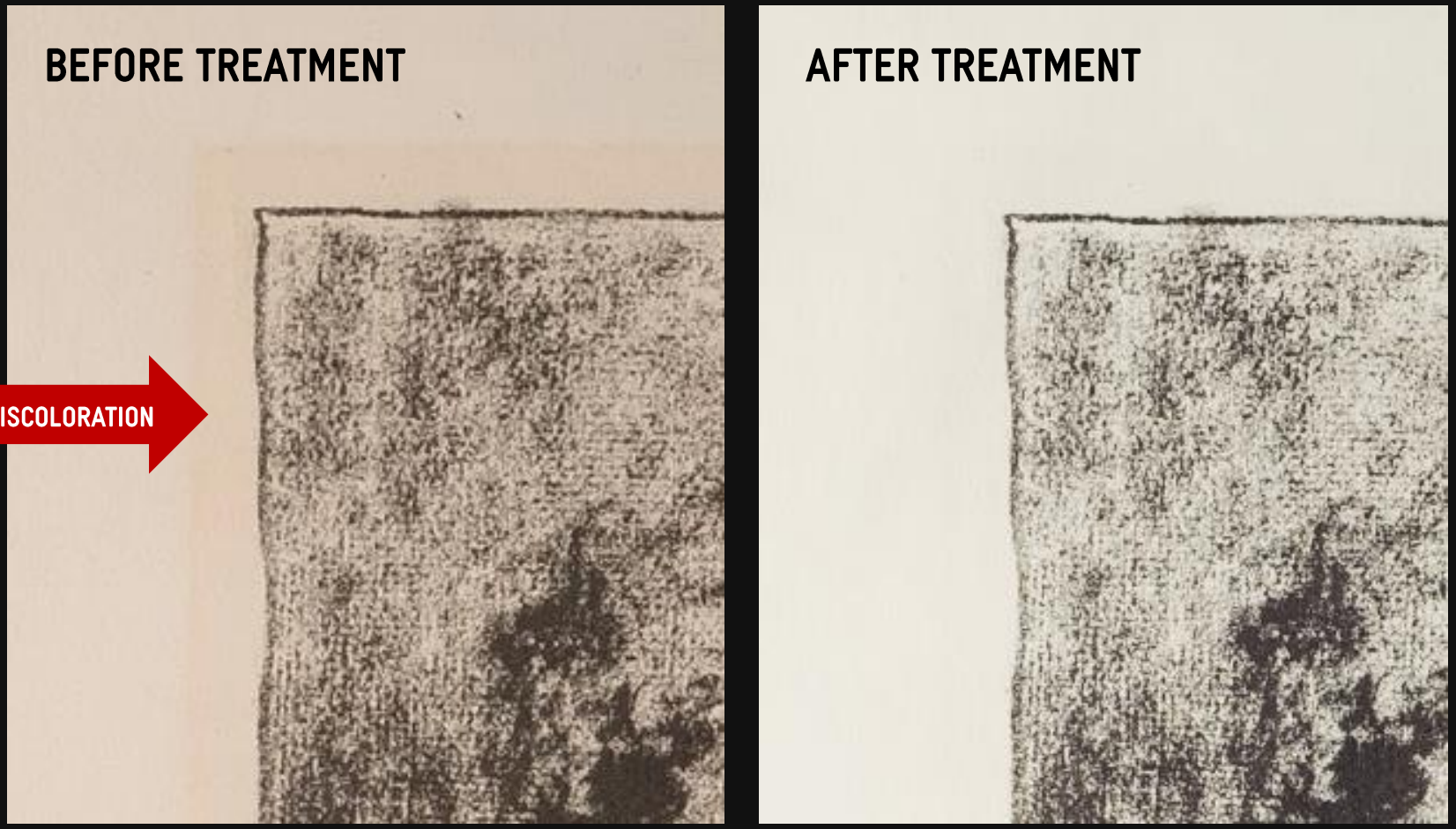
Lightning Round Session

2019 Association of North American Programs in Art Conservation Conference

Los Angeles, CA | April 12, 2019

BACKGROUND

A SAMPLE AQUEOUS TREATMENT WITH 1% SODIUM CITRATE

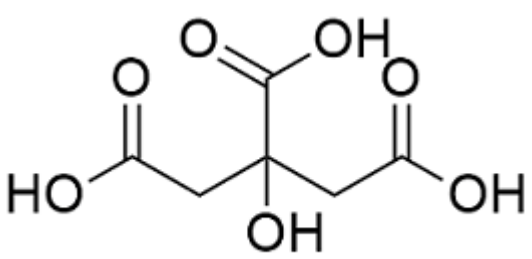


BACKGROUND

CITRATES IN PAPER CONSERVATION:

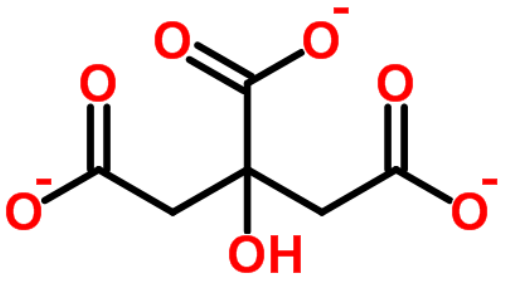
- CITRIC ACID
- AMMONIUM CITRATE (DIBASIC, TRIBASIC)
- SODIUM CITRATE (TRIBASIC DIHYDRATE)

CITRIC ACID



IONIZATION

CITRATE ANION



HTTP://WWW.SOFTSCHOOLS.COM/FORMULAS/CHEMISTRY/CITRIC_ACID_FORMULA/480/

KIDNEYSTONES.UCHICAGO.EDU

EXPERIMENTAL DESIGN

TWO PAPER SAMPLES:

1. WHATMAN FILTER NO. 1 (W)
2. ANTIQUE RAG (A)

1% W/V SODIUM CITRATE,

ADJUSTED TO PH 7 WITH CITRIC ACID

EXPERIMENTAL DESIGN

TWO PAPER SAMPLES:

1. WHATMAN FILTER NO. 1 (W)
2. ANTIQUE RAG (A)

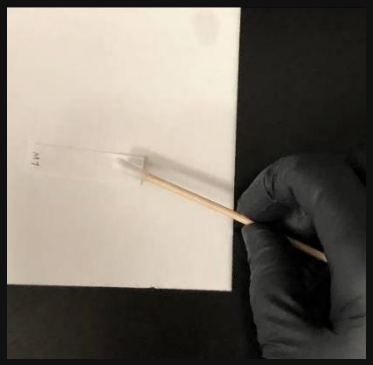
FOUR COUPONS PER PAPER:

1. CONTROL (C)
2. OVERALL BATHING, NO RINSING (O)
3. OVERALL BATHING AND RINSING (R)
4. LOCAL SWAB WITH SWAB RINSING (L)

OVERALL

RINSING

LOCAL APPLICATION WITH RINSING



EXPERIMENTAL DESIGN

TWO PAPER SAMPLES:

1. WHATMAN FILTER NO. 1 (W)
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FOUR COUPONS PER PAPER:

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3. OVERALL BATHING AND RINSING (R)
4. LOCAL SWAB WITH SWAB RINSING (L)

LIGHT EXPOSURE:

1. COVERED (CV)
2. EXPOSED (EX)

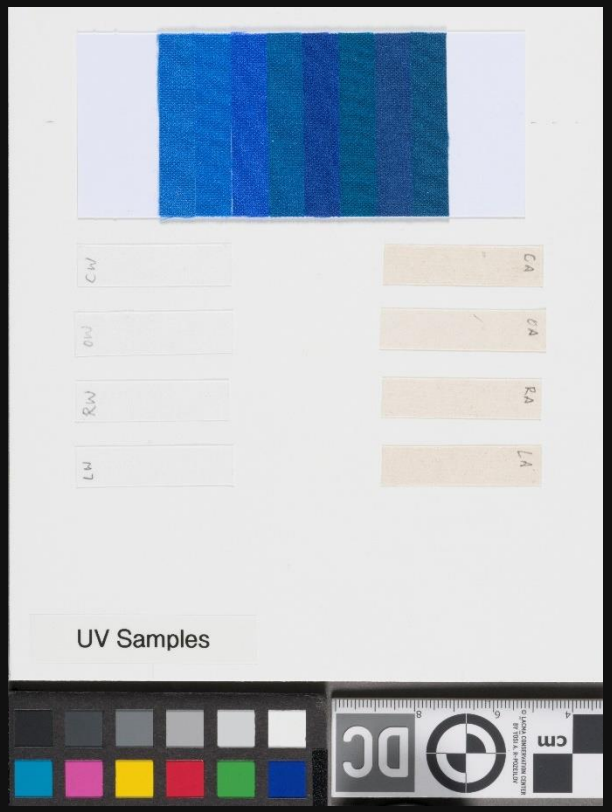
PAPER TYPE AND TREATMENT — BLUE WOOL (BW)

COVERED	EXPOSED
BW1CV	BW1EX
BW2CV	BW2EX
BW3CV	BW3EX
BW4CV	BW4EX
CWCV	CWEX
CACV	CAEX
OWCV	OWEX
OACV	OAEX
RWCV	RWEX
RACV	RAEX
LWCV	LWEX
LACV	LAEX

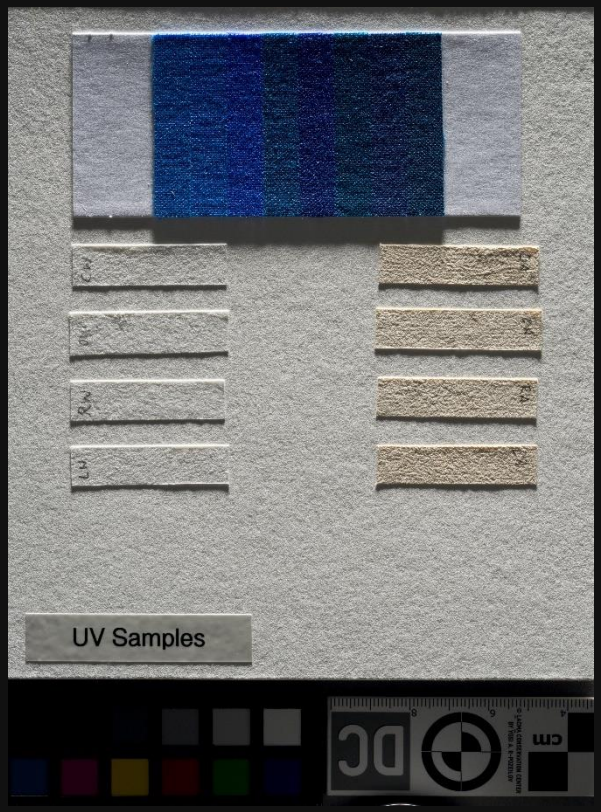
EXPERIMENTAL DESIGN

BEFORE TESTING

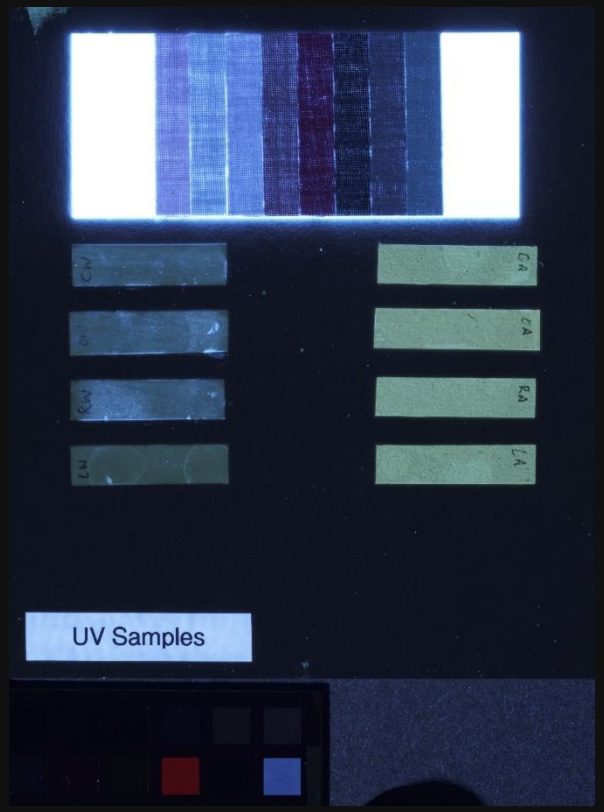
NORMAL LIGHT



RAKING LIGHT



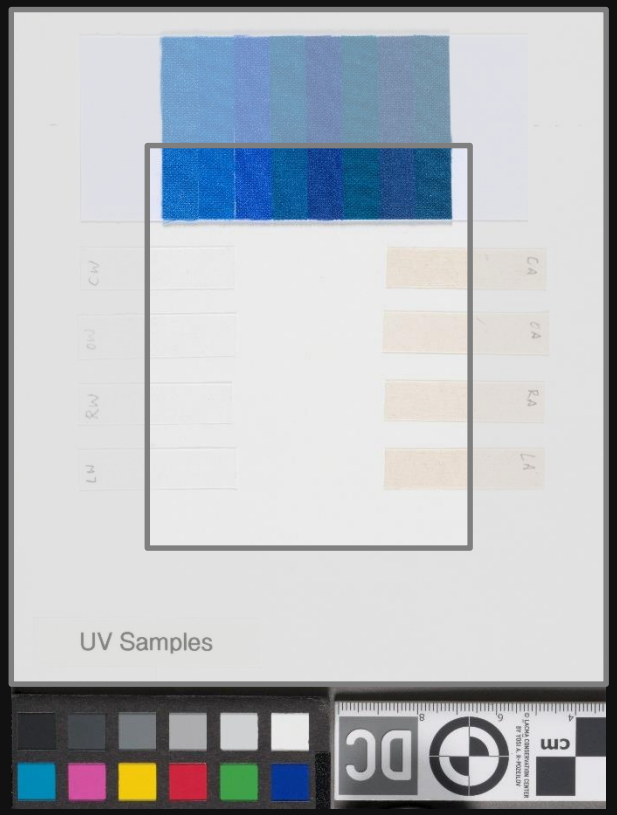
UV LIGHT



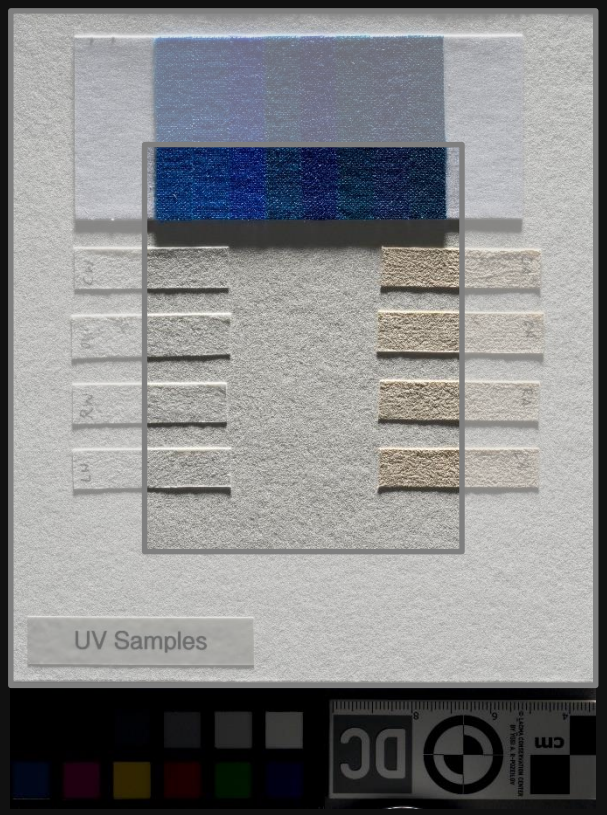
EXPERIMENTAL DESIGN

COVERED AREAS

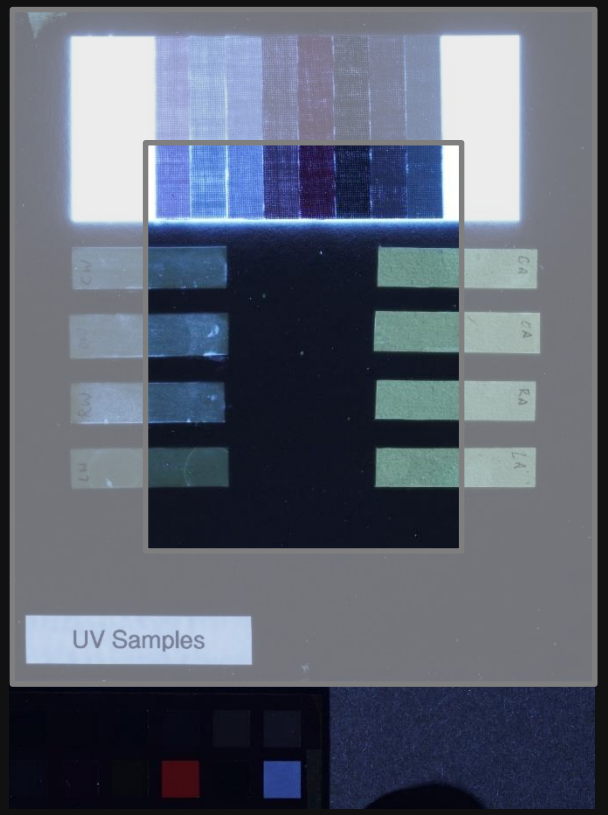
NORMAL LIGHT



RAKING LIGHT



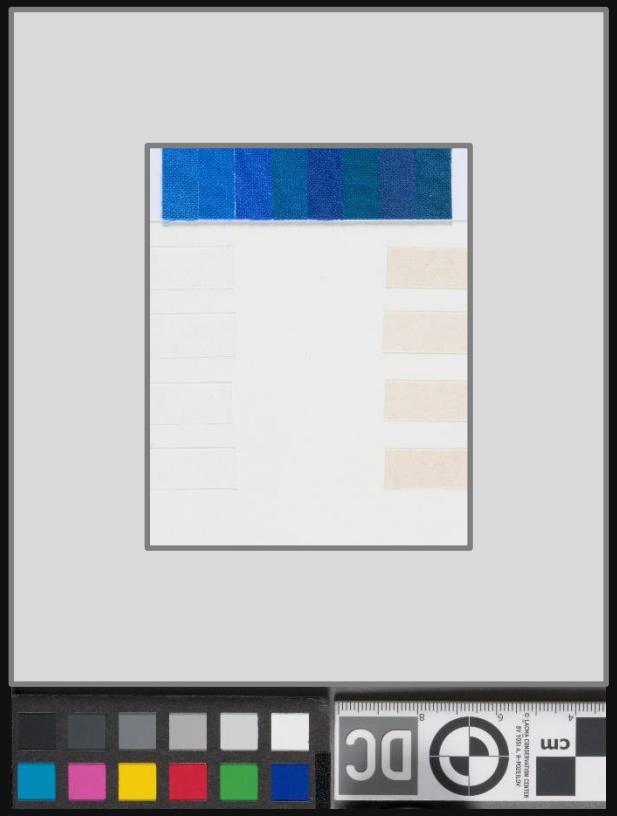
UV LIGHT



EXPERIMENTAL DESIGN

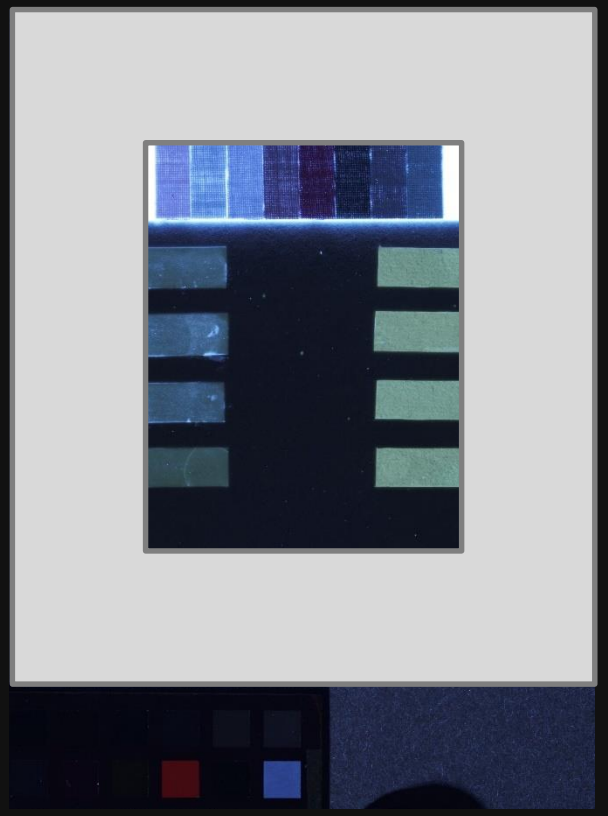
EXPOSED AREAS

NORMAL LIGHT



RAKING LIGHT

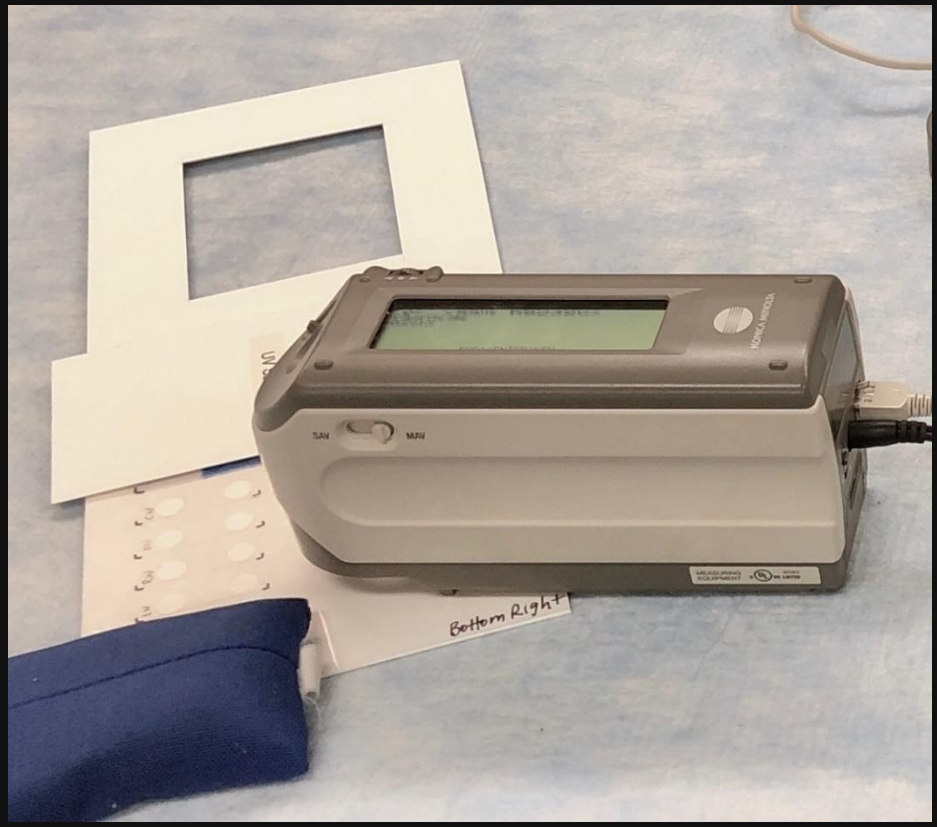
UV LIGHT



PRELIMINARY ANALYSIS

MICROFADE TESTING

SPECTROPHOTOMETRY



UV AGING

UV FLUORESCENCE ANALYSIS CABINET

UVA/B range, 400-280 **nm**
“Spectroline” Model CL-150, Spectronics Corp.

SPECTROPHOTOMETER & SOFTWARE

Konica Minolta 2600D
OnColor Software, v.5.5.5.3 QC
Color Sensor Version: 1.0 Demo, CyberChrome, Inc.

WWW.SENSING.KONICAMINOLTA.US

CYBERCHROME
Color Control Software for Industry

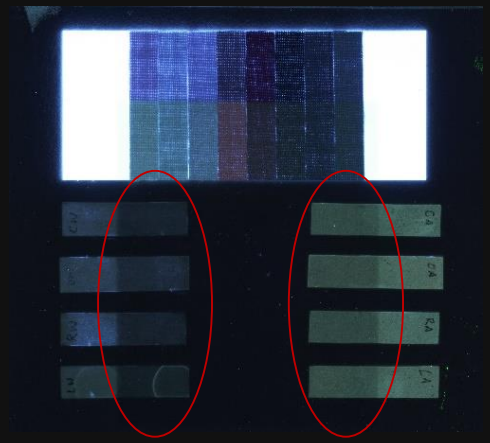
WWW.CYBERCHROMEUSA.COM

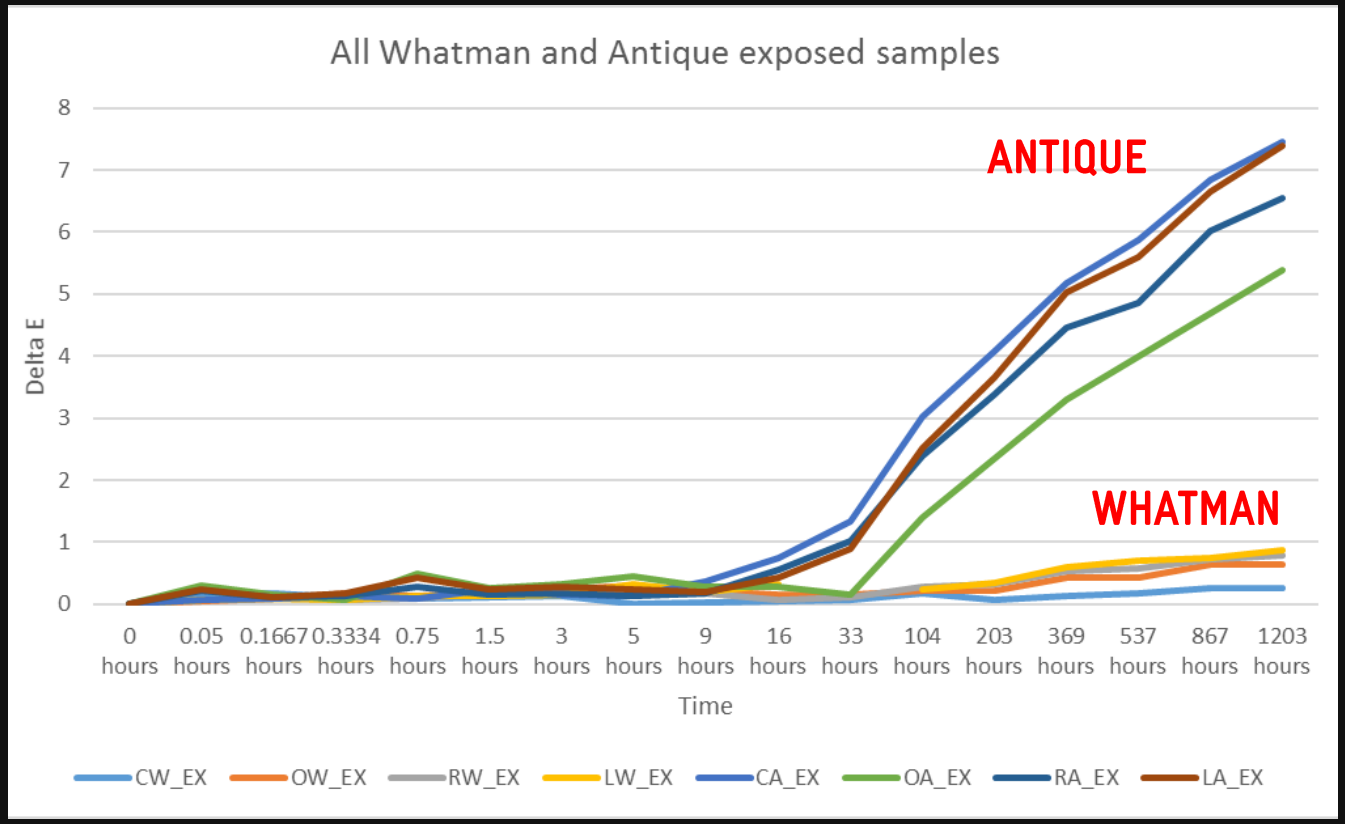
TRIAL 1	3 MIN
TRIAL 2	10 MIN
TRIAL 3	20 MIN
TRIAL 4	45 MIN
TRIAL 5	1.5 HRS
TRIAL 6	3 HRS
TRIAL 7	5 HRS
TRIAL 8	9 HRS
TRIAL 9	16 HRS
TRIAL 10	33 HRS
TRIAL 11	104 HRS
TRIAL 12	203 HRS
TRIAL 13	369 HRS
TRIAL 14	537 HRS
TRIAL 15	867 HRS
TRIAL 16	1203 HRS

RESULTS

AT, NORMAL

AT, UV





COLOR CHANGE HAPPENS, BUT AT A SIMILAR RATE TO THE CONTROL SAMPLES.

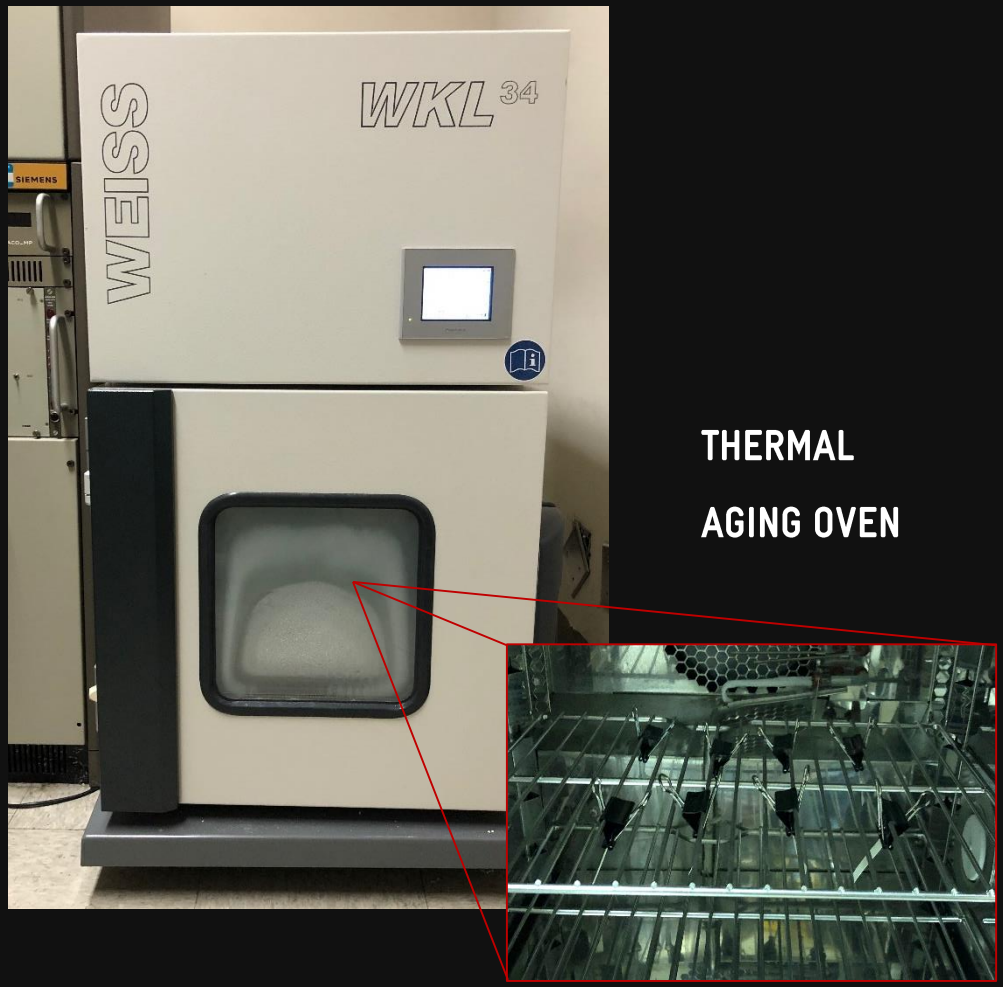
ALL SAMPLES ARE LESS UV LIGHT SENSITIVE THAN BLUE WOOL 4 (ΔE 18.65).

FURTHER RESEARCH

TWO MORE TYPES OF AGING:

1. GALLERY LIGHTING
2. THERMAL AGING OVEN

GALLERY LIGHT SAMPLES



THERMAL

AGING OVEN

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UNIVERSITY OF DELAWARE
PROGRAM IN ART CONSERVATION

ANAGPIC 2019
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IN CONSERVATION OF
ARCHAEOLOGICAL AND
ETHNOGRAPHIC MATERIALS

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