

Using the scientific equipment at the Smithsonian National Postal Museum



Scott 233a

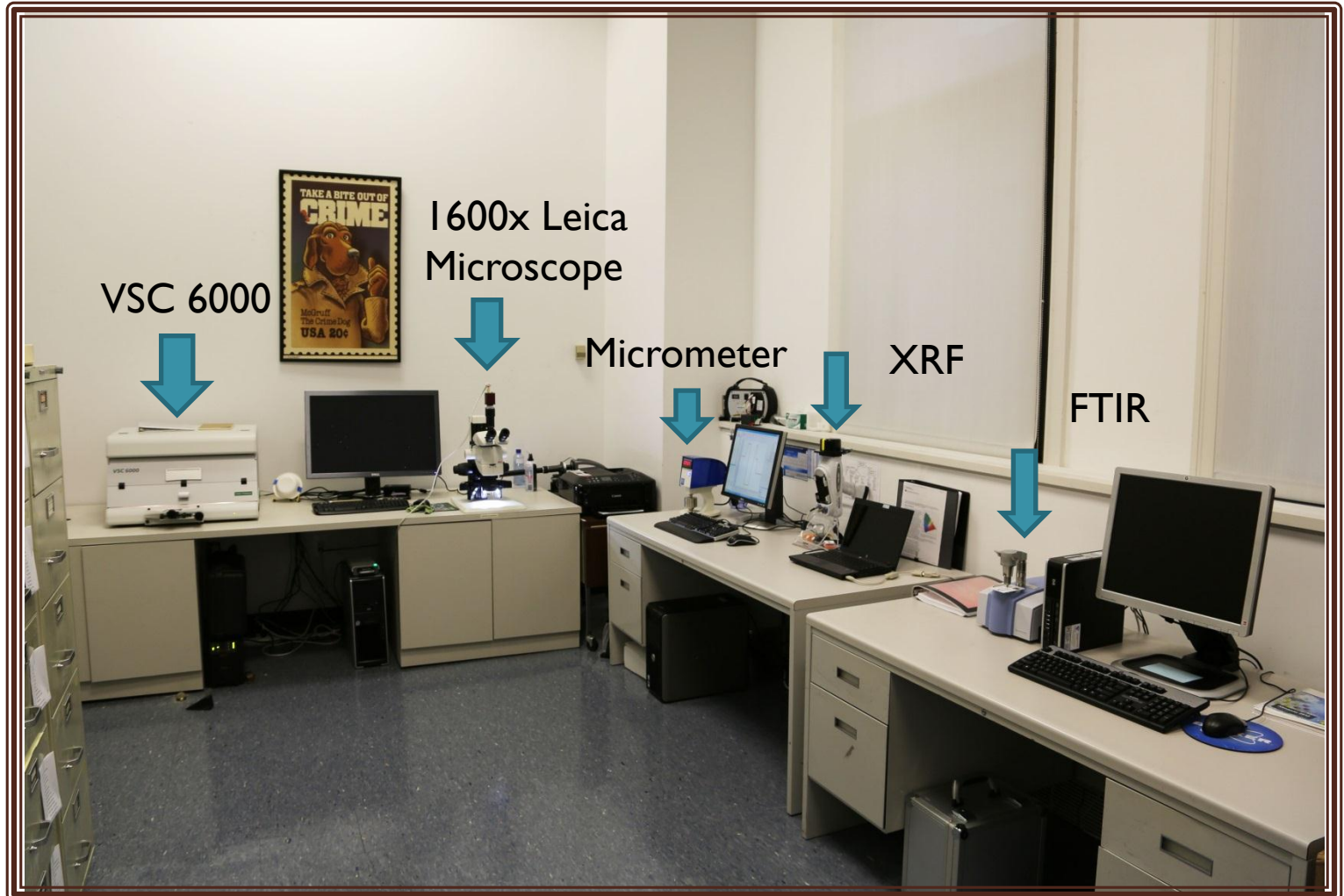
Stampshow, Hartford Connecticut
August 22, 2014

Thomas Lera, research chair

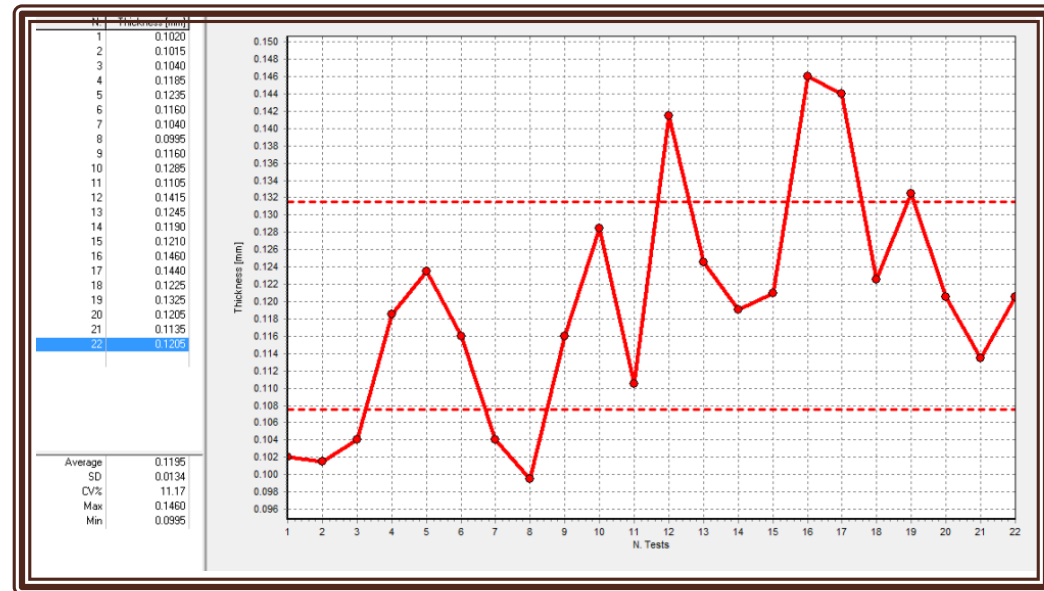


Smithsonian
National Postal Museum

NPM Scientific Laboratory



Micrometer



Measuring range is 0.000-1.250 mm with a resolution of 0.1 micron.

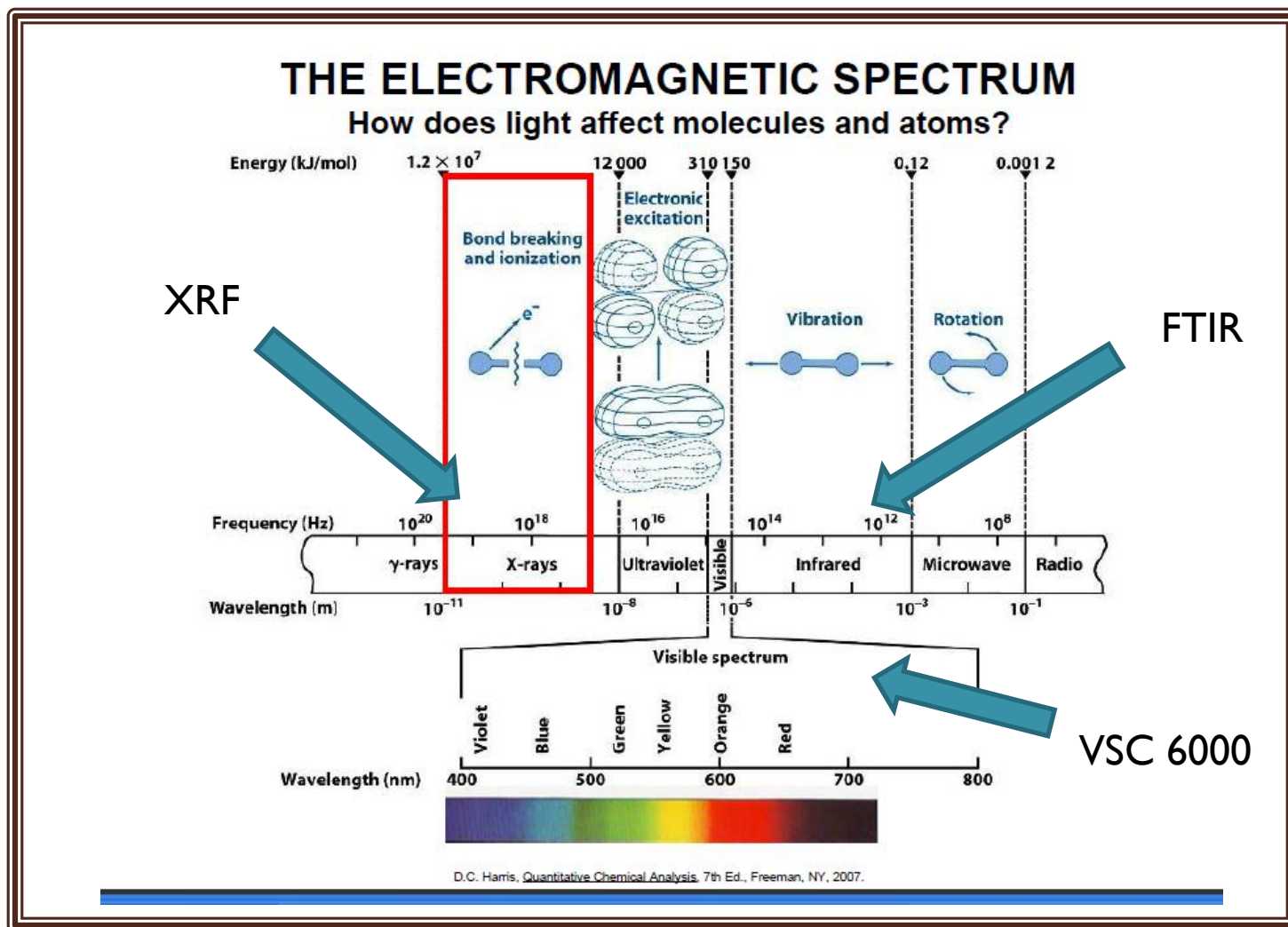
Anvil diameter is 0.630 inch with a contact pressure of 7.3 PSI.

Conforms to TAPPI T-411 standards

Data can be exported to an Excel spreadsheet

Stamp	Thickness (mm)	Standard Deviation (mm)
Chile 1 (Red)	0.1161	0.0028
Chile 8 (Red)	0.1227	0.0034
Chile 2 (Blue)	0.1116	0.0085
Chile 11 (Yellow)	0.1411	0.0022
Chile 12 (Blue)	0.1349	0.0069
Chile 13 (Green)	0.1098	0.0026

Electromagnetic Spectrum

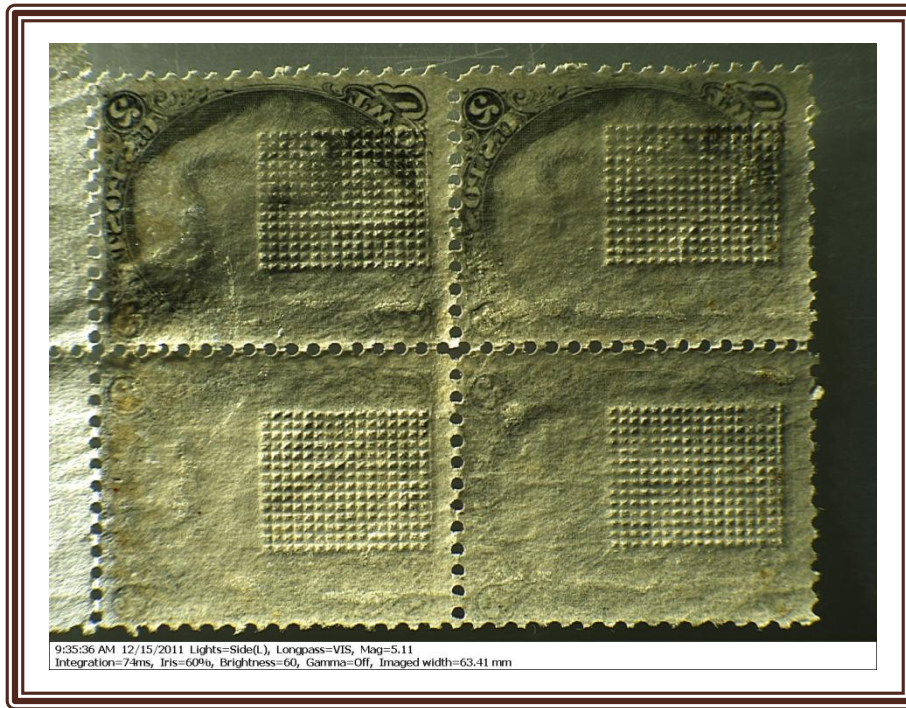


Video Spectral Comparator–VSC 6000

- Compare and analyze what is visually observable
- Magnification 0-135x, digital to 1080x, with external Leica Microscope 1600x
- Different light sources from Ultraviolet (254nm) to low Infrared (1000nm)
- Spectral analysis color differentiation 400-1000nm



VSC 6000 Capabilities



Grill from the Miller Collection



Surcharge uncovered

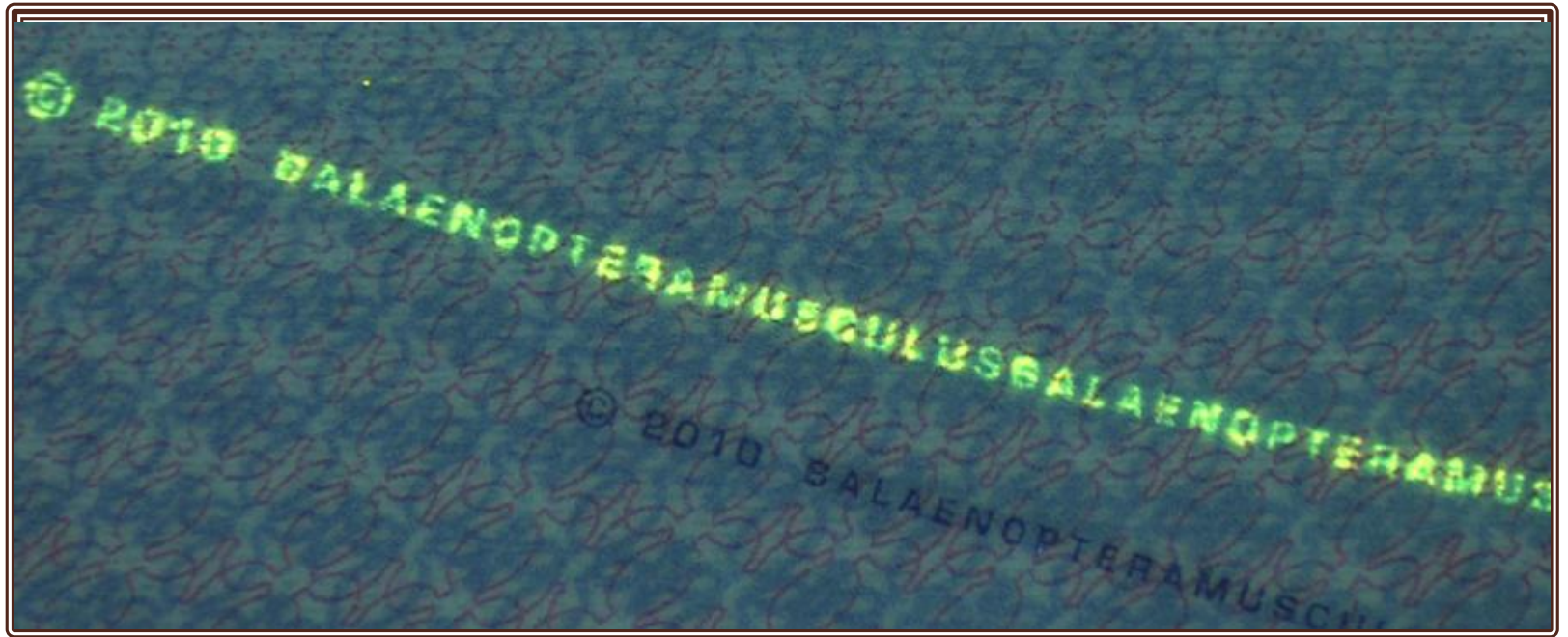
VSC 6000 Capabilities

Canada \$10 Blue Whale – Security Features



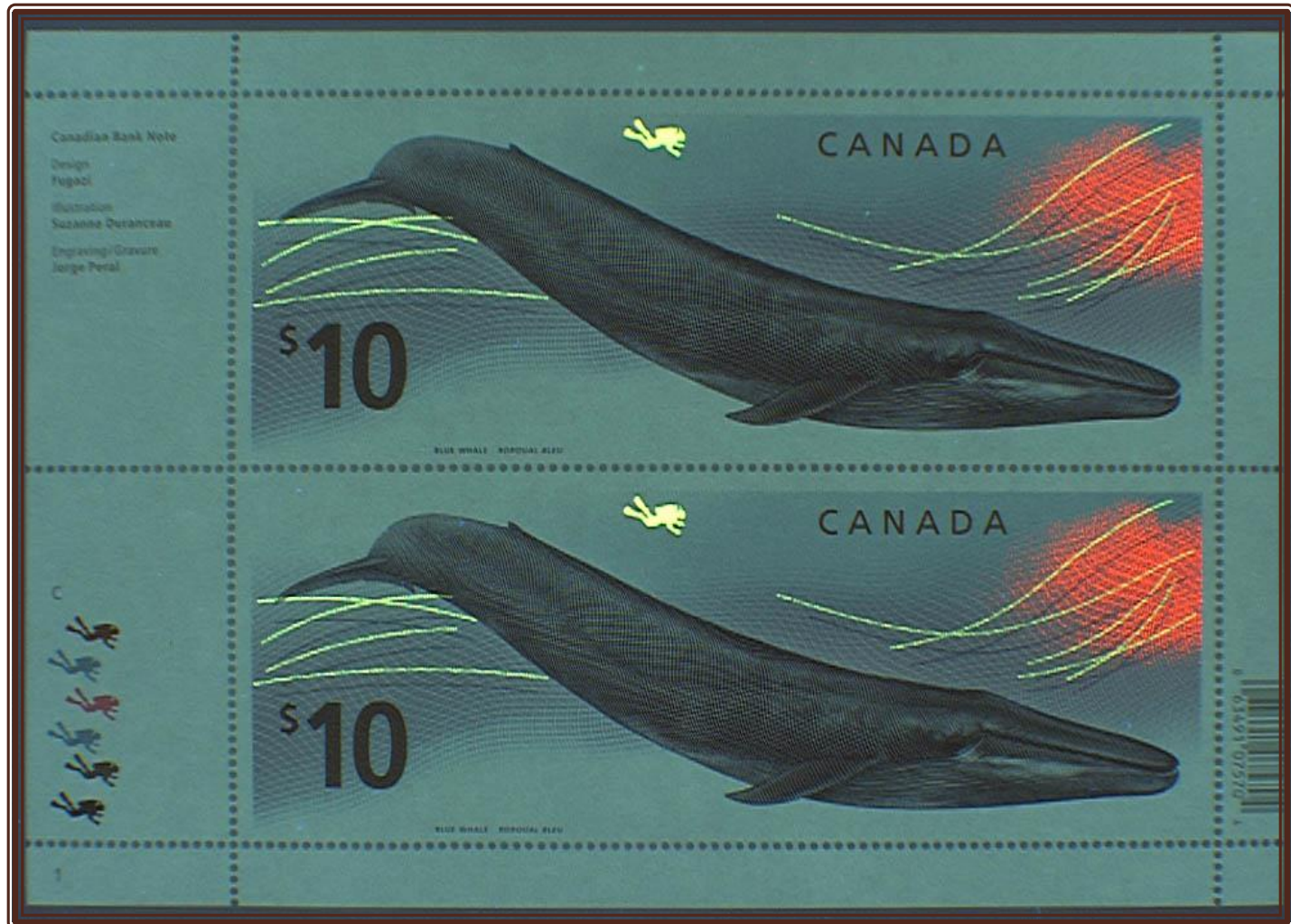
- Thick security paper measures .047” compared to usual .036” used on other high value wildlife stamps.
- Multiple printing processes include lithography, intaglio and silk screen.
- Optically variable and fluorescent inks.
- Extensive use of micro-printing.

Printing Methods



Composite Lithography and Intaglio

Seen under 365 nm Ultra Violet



“Secret” Whitening Process

revealed by spot fluorescence



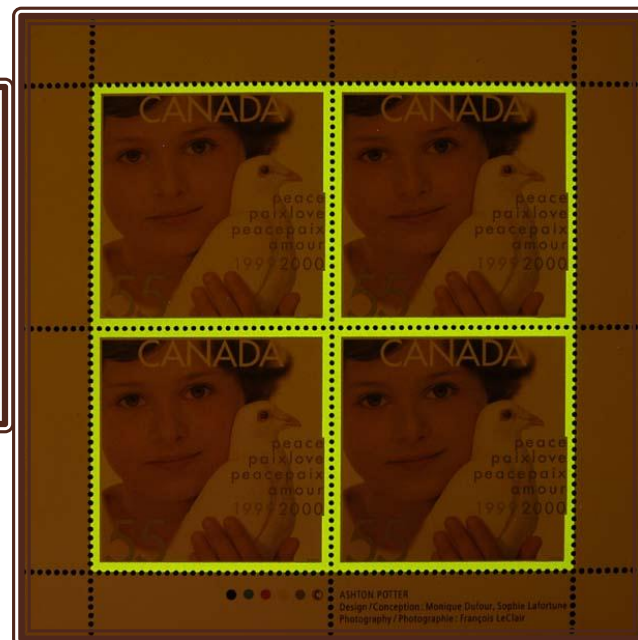
VSC 6000 Capabilities



“Scrambled Indicia”



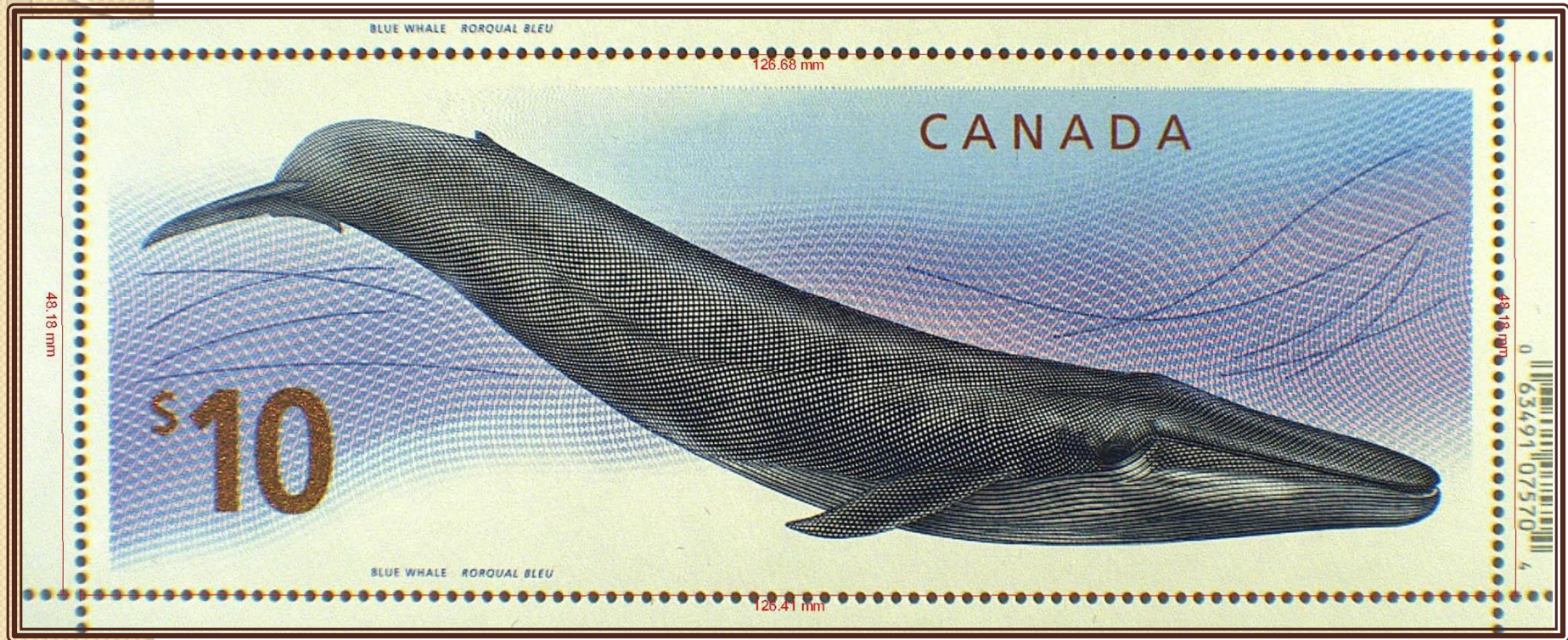
Using UV for tagging



Italian Stamp showing UV florescence suggesting madder lake was used

Useful Measurements

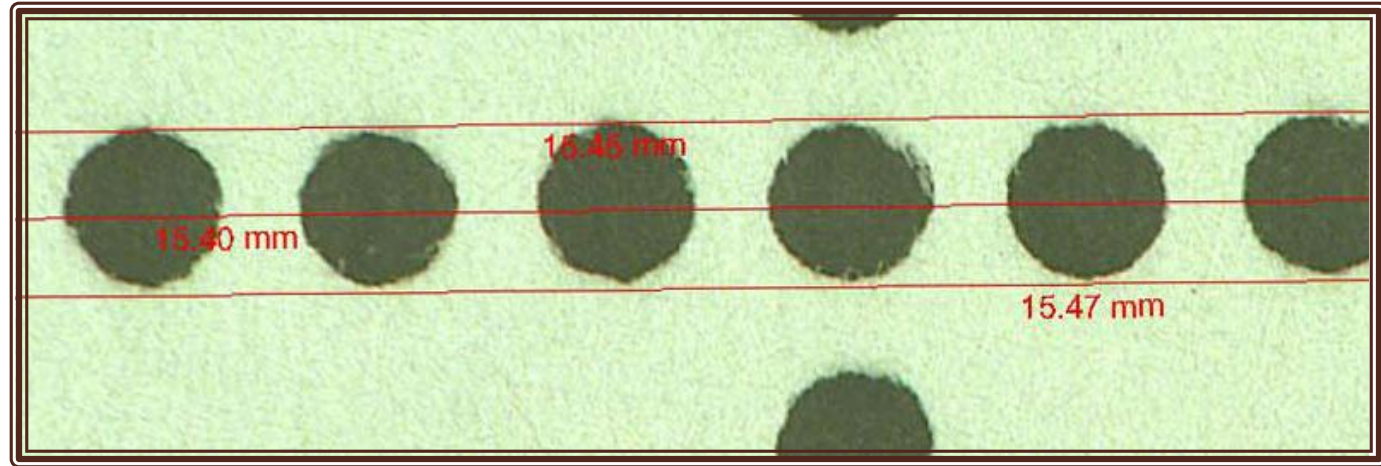
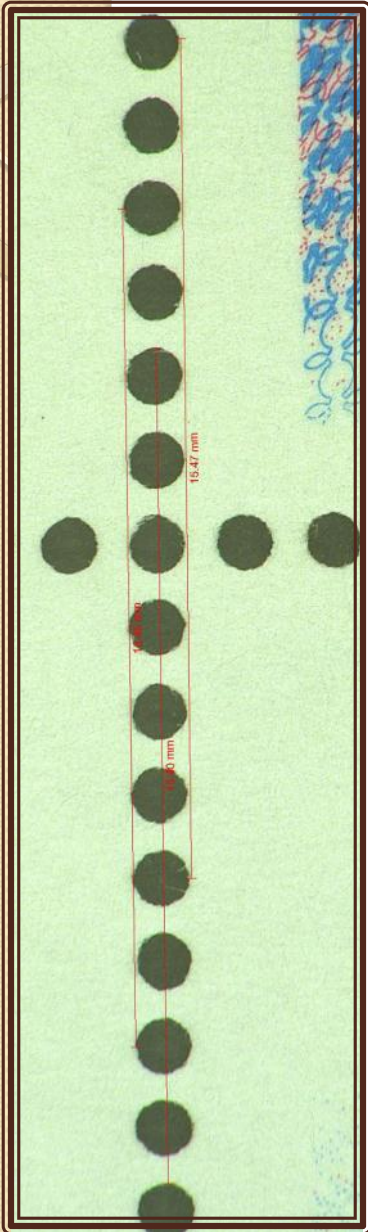
using VSC6000 toolbox



Measurements in millimeters

Perforation Measurements

using VSC6000 toolbox



Scales variable – inches, millimeters, microns, pixels

1856 British Guiana 1c magenta

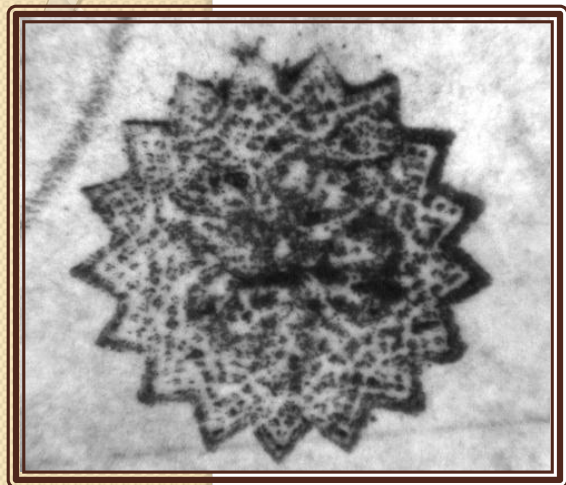
VSC 6000 analysis



Front of Stamp - Circle Date Stamp measured at 25mm
Inverse of the front at 830nm (infrared) clearly showing the date

1856 British Guiana 1c magenta

VSC 6000 analysis

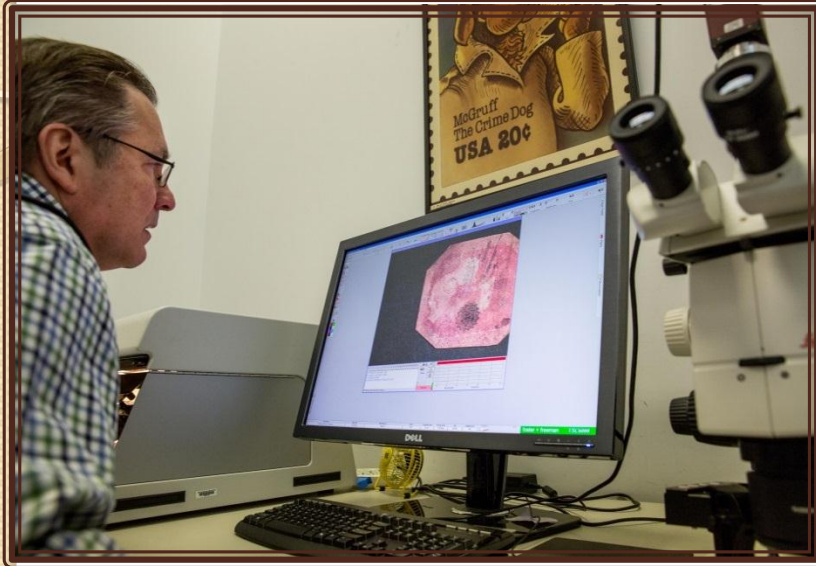


Back of stamp showing markings:

- two stamps of Ferrari's trefoil mark
- a large faint "H" of Arthur Hind
- a small "FK" of Finnbar Kenny, the stamp manager at Macy's who brokered its sale by Hind's widow
- a small shooting star added by Frederic Small who owned it from 1940 to 1970;
- a penciled "IW" by Irwin Weinberg
- a large penciled "J E d P", initials of DuPont.

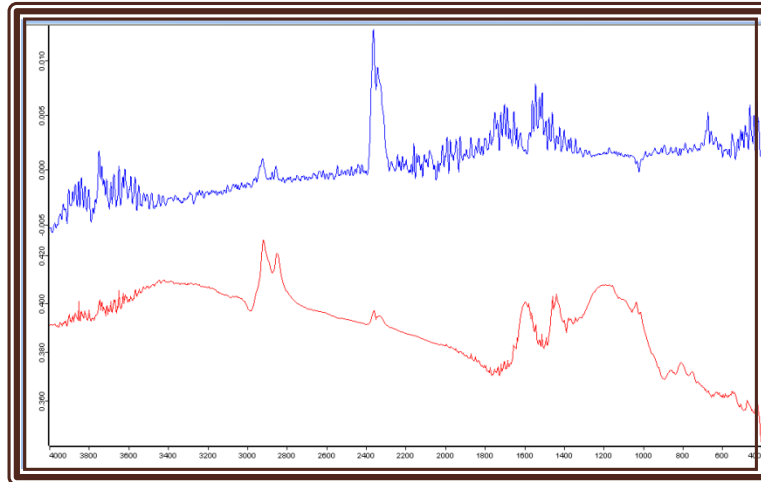
1856 British Guiana 1c Magenta

VSC 6000 and FTIR analysis



Spectrographic analysis
of the back of the stamp.

David Redden from Sotheby's
positioning the stamp for
FTIR analysis.

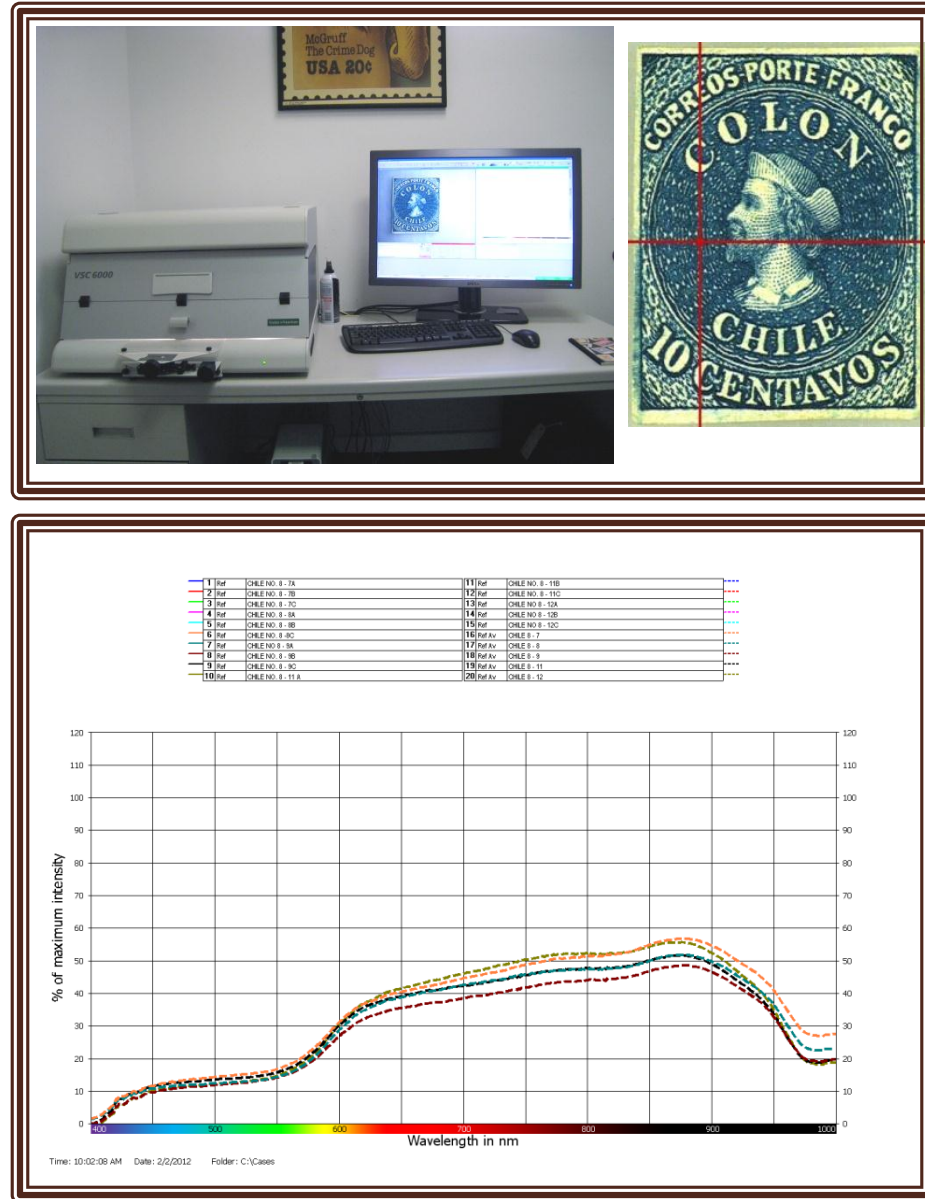


FTIR of Front (Blue), Hydrocarbon (red)

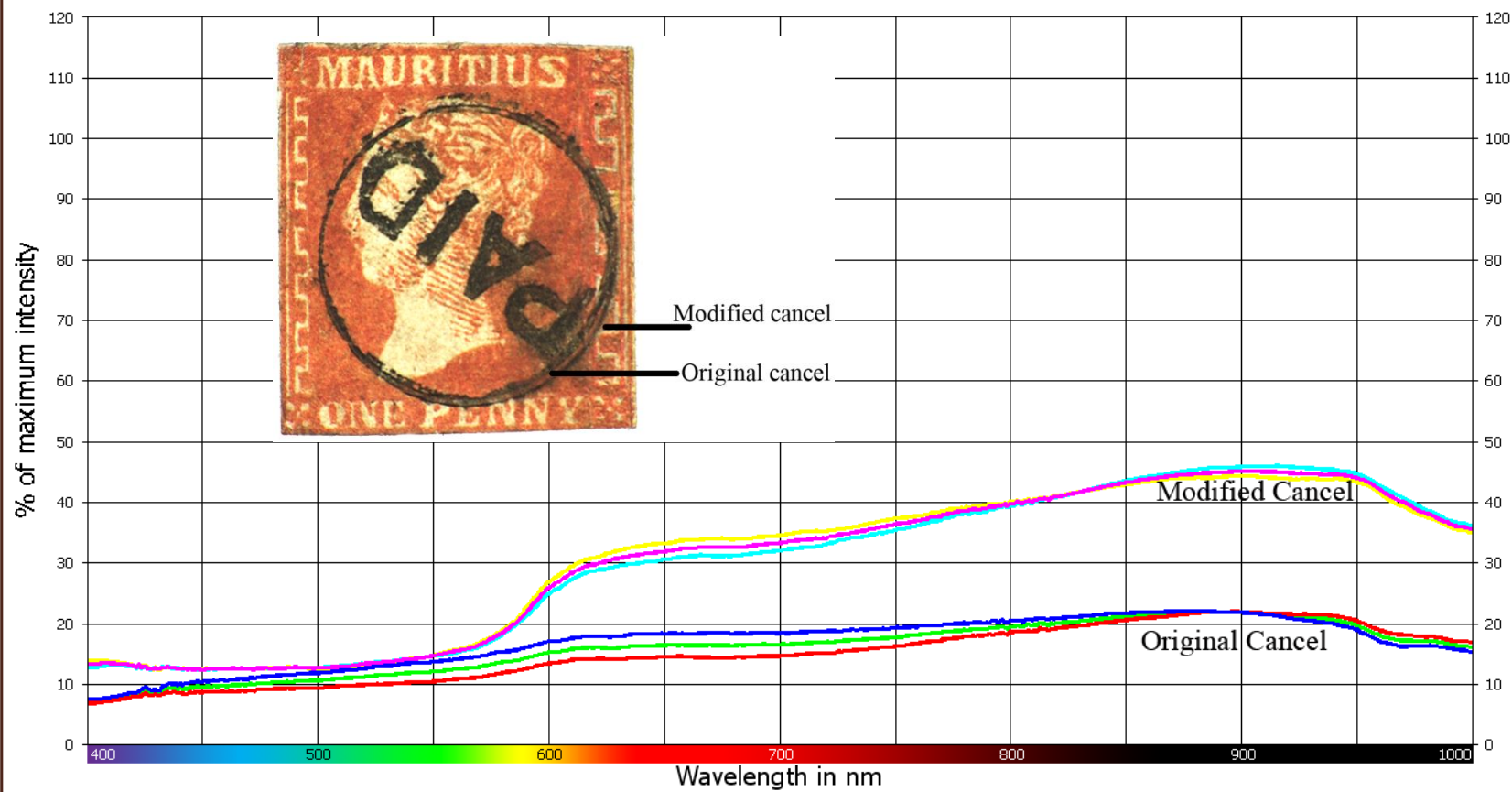


Colorimetry

- Twenty Chile stamps of each issue were tested.
- Three sample points per stamp and then averaged.
- Each stamp was placed in the VSC6000 and enlarged using a magnification factor of 8.
- The sensor area (represented by crosshairs) was able to analyze the color over a small, 0.2 mm² area

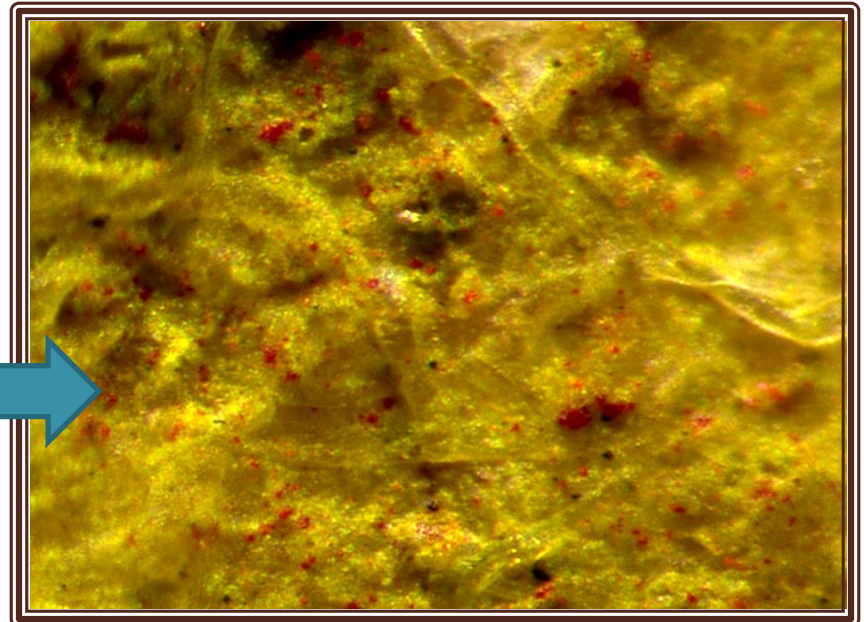
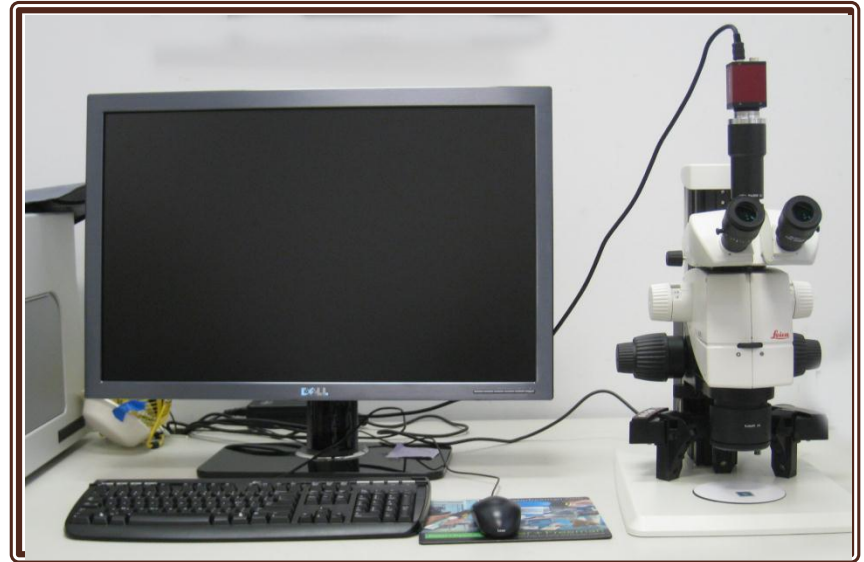


Colorimetry



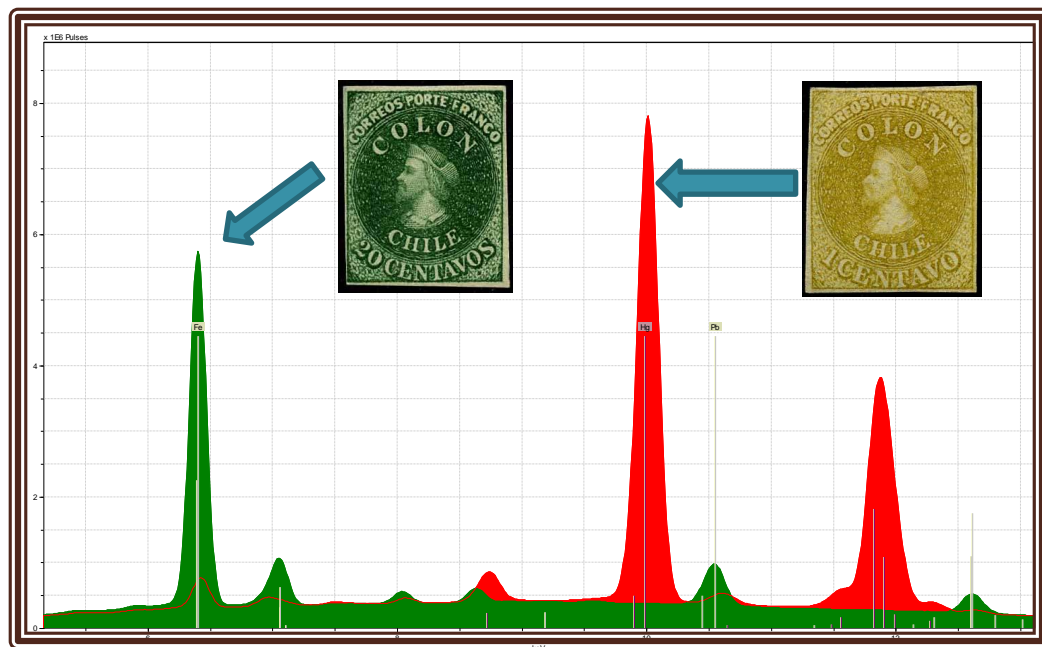
Microscopy

- Leica microscope
- Magnification range 78 to 1600x
- Can be used to record close examination details
- Image at right contains small bright red pigment particles in overall yellow-green ink.
- These particles are vermilion pigments (600x).

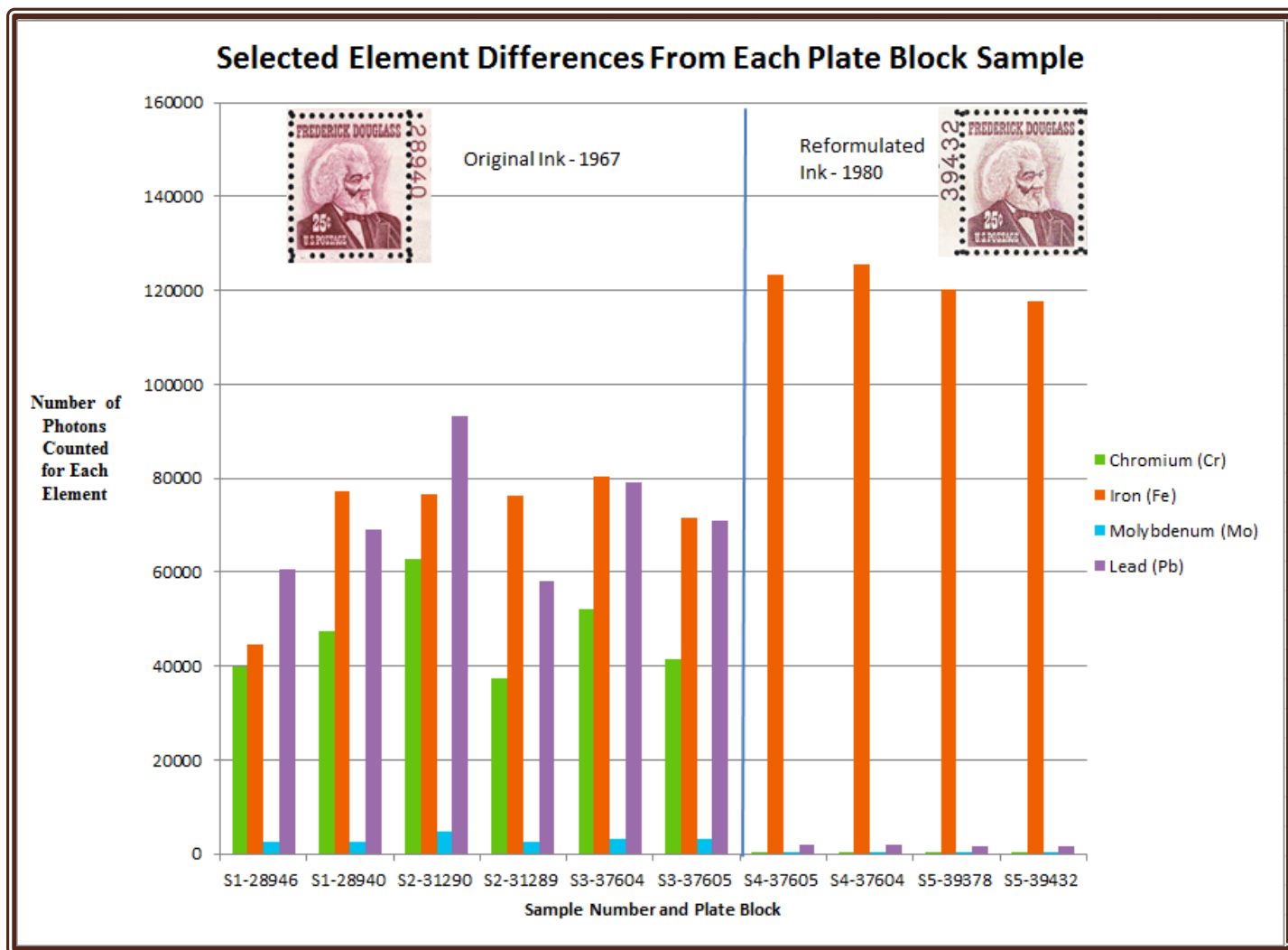


X-Ray Fluorescence (XRF) Tracer

- Spot size is ~3 mm x 4 mm
- Vacuum available to identify lighter elements
- Identifies chemical elements not molecules
- Penetrates all layers of stamp
 - Affected by albums, envelopes, hinge residue etc.

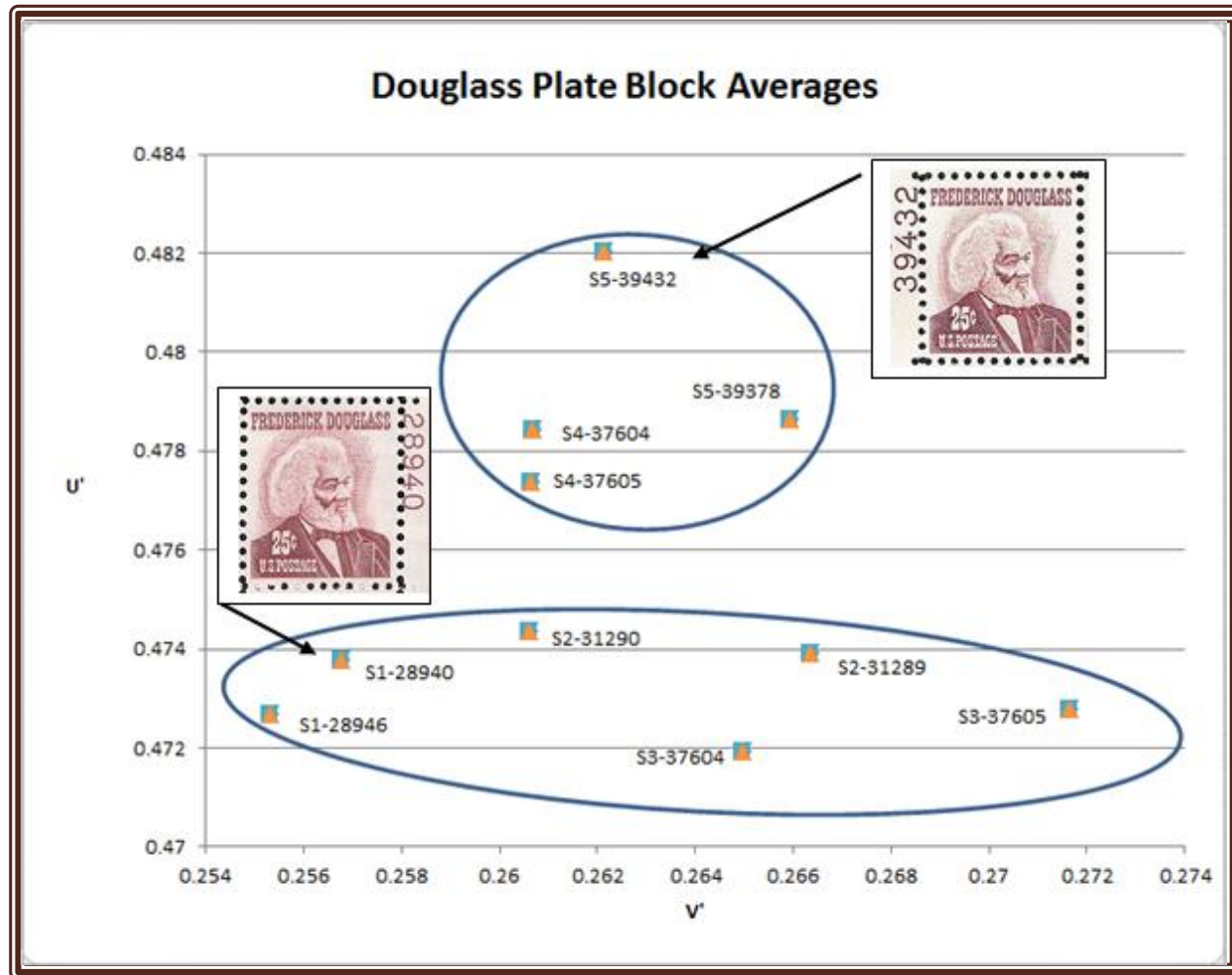


X-Ray Fluorescence (XRF) Analysis

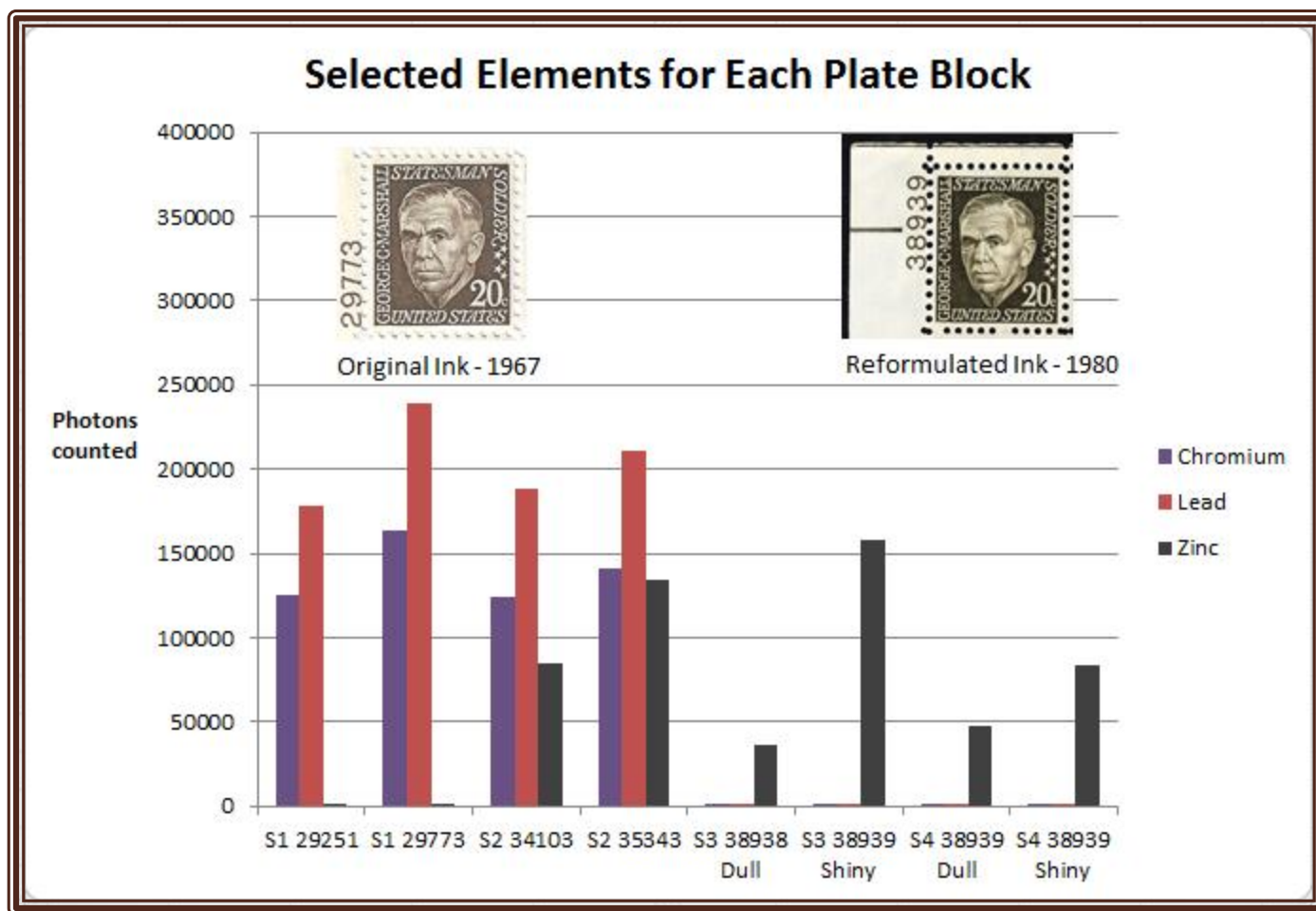


Lead Molybdate Chrome Orange ($\text{Pb}(\text{CrMoS})\text{O}_4$) pigment eliminated

VSC Colorimetry Analysis



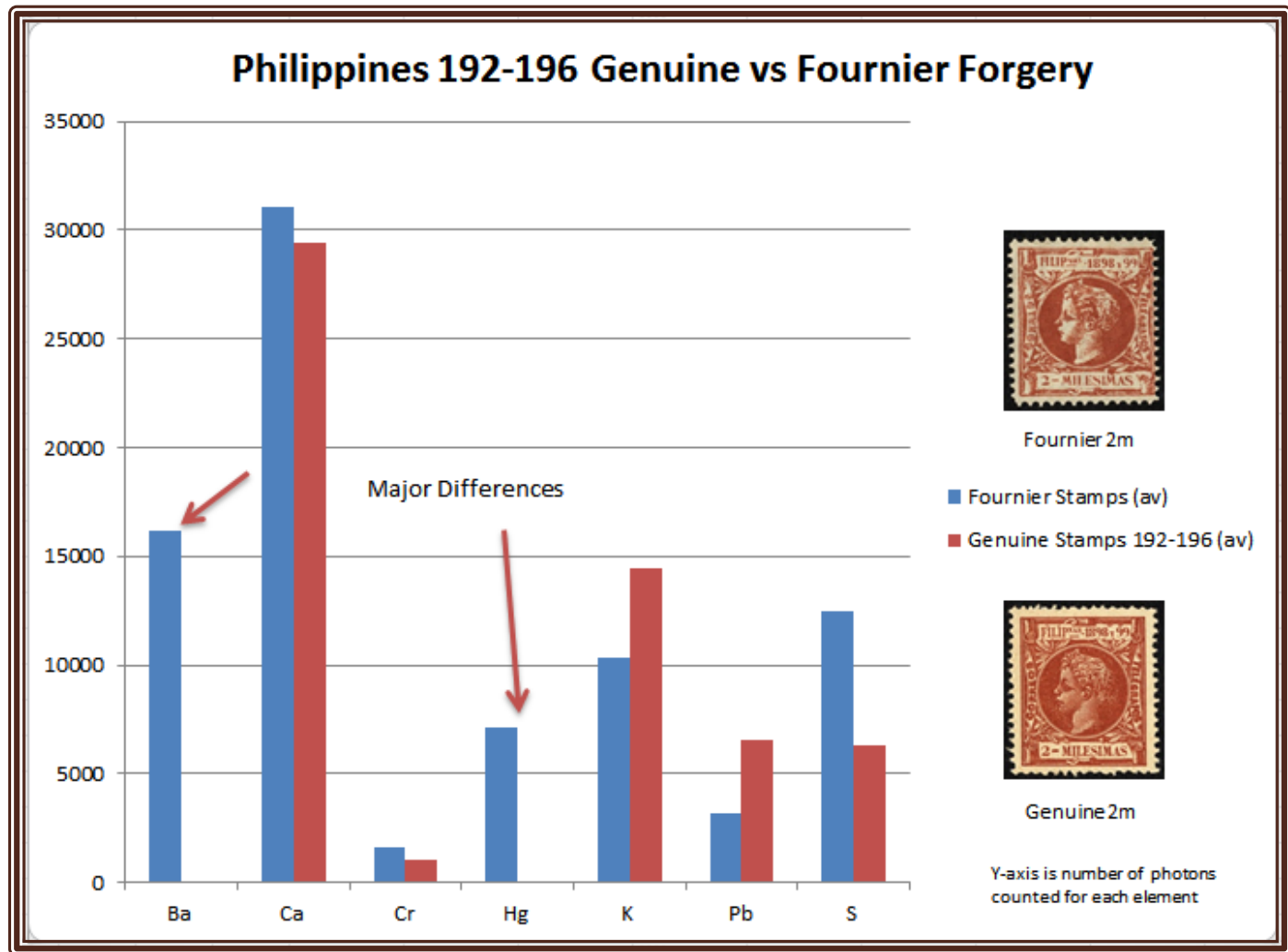
X-Ray Fluorescence (XRF) Analysis



The principal tagging agent was a pigment using zinc silicate activated with small amounts of copper ($\text{Zn}_2\text{SiO}_4[\text{Cu}]$) developed by Sylvania Electric Products Company

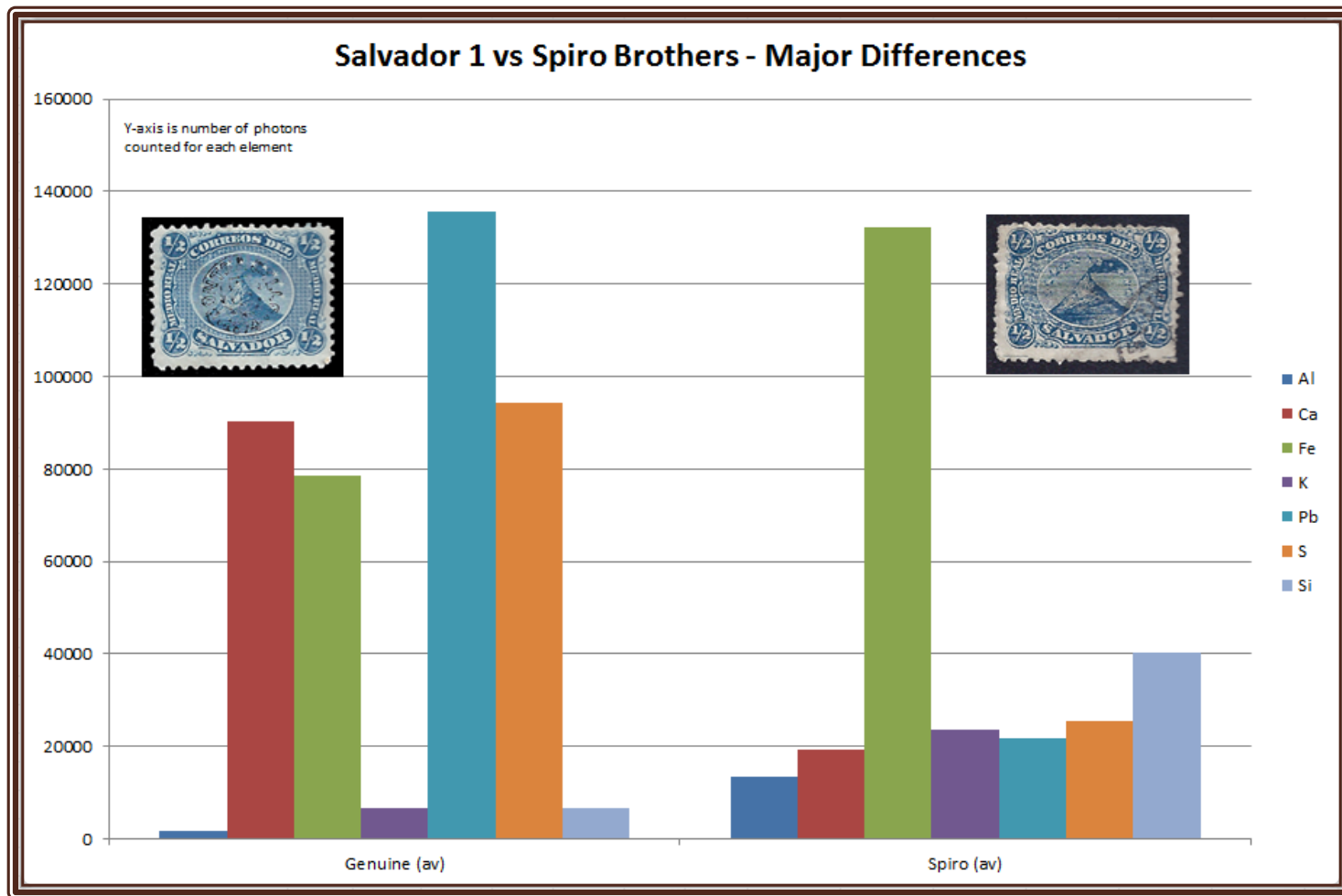
X-Ray Fluorescence (XRF) Analysis

Original ink (1898) versus Fournier Forgery Ink (1900s)



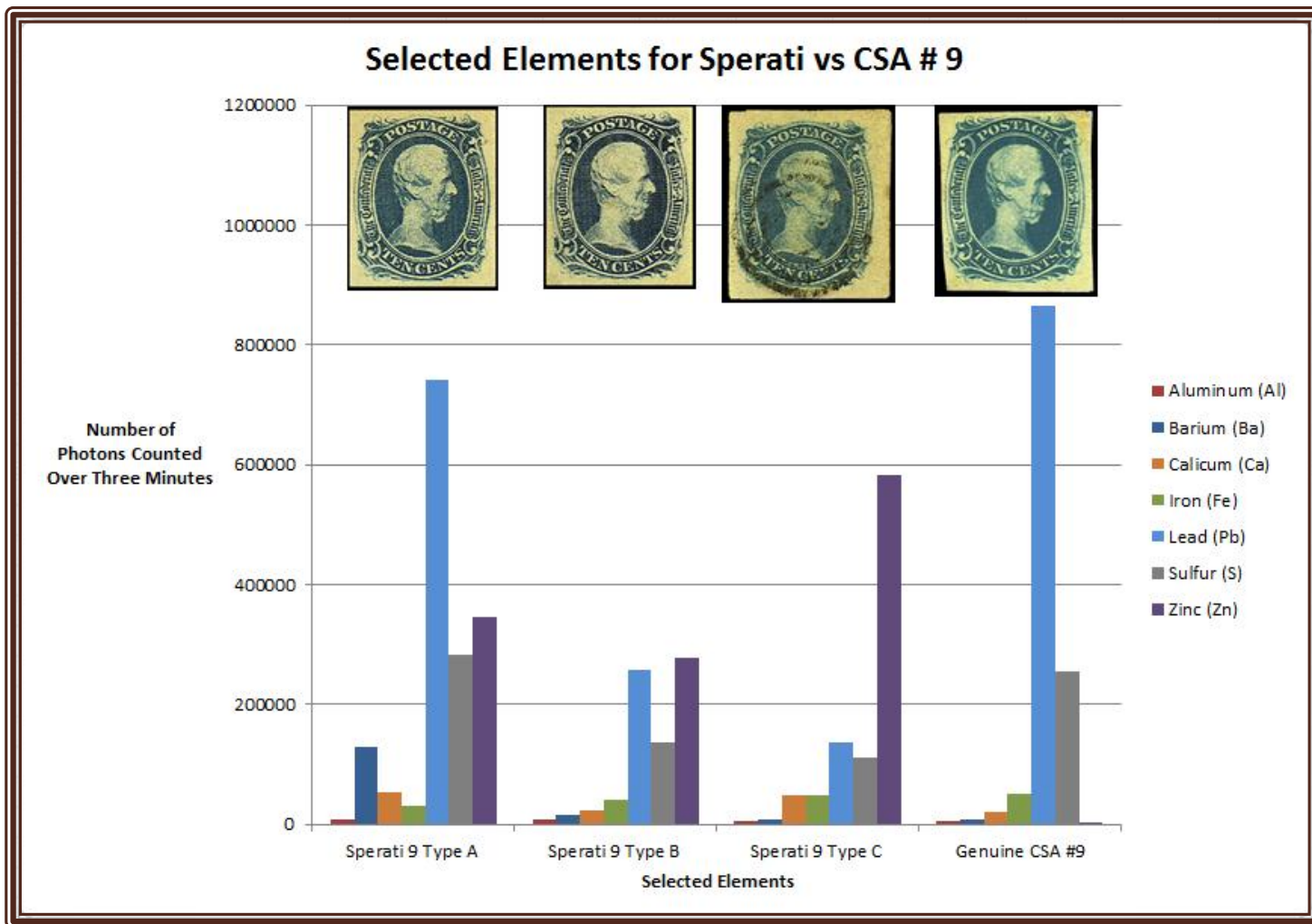
X-Ray Fluorescence (XRF) Analysis

Original ink (1867) versus Spiro Brothers Forgery Ink (1870s)



X-Ray Fluorescence (XRF) Analysis

Original ink (1867) versus Sperati Forgery Ink (1860s)

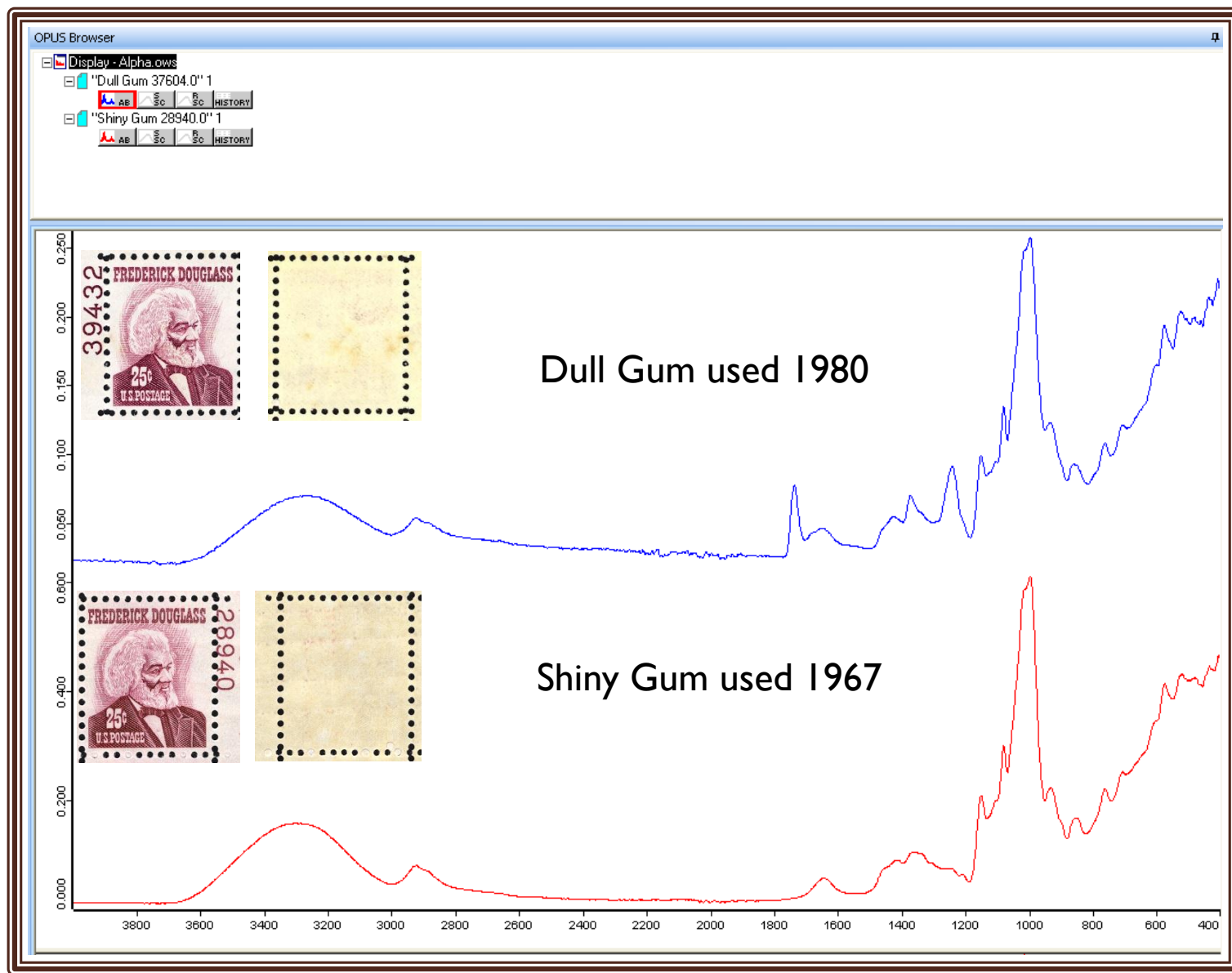


Fourier Transform InfraRed Spectroscopy (FTIR)

- Fingerprints gum, organic dyes, pigments, and more
- Results compared to existing libraries developed by other museums and laboratories
- Spot size is ~ 1 mm



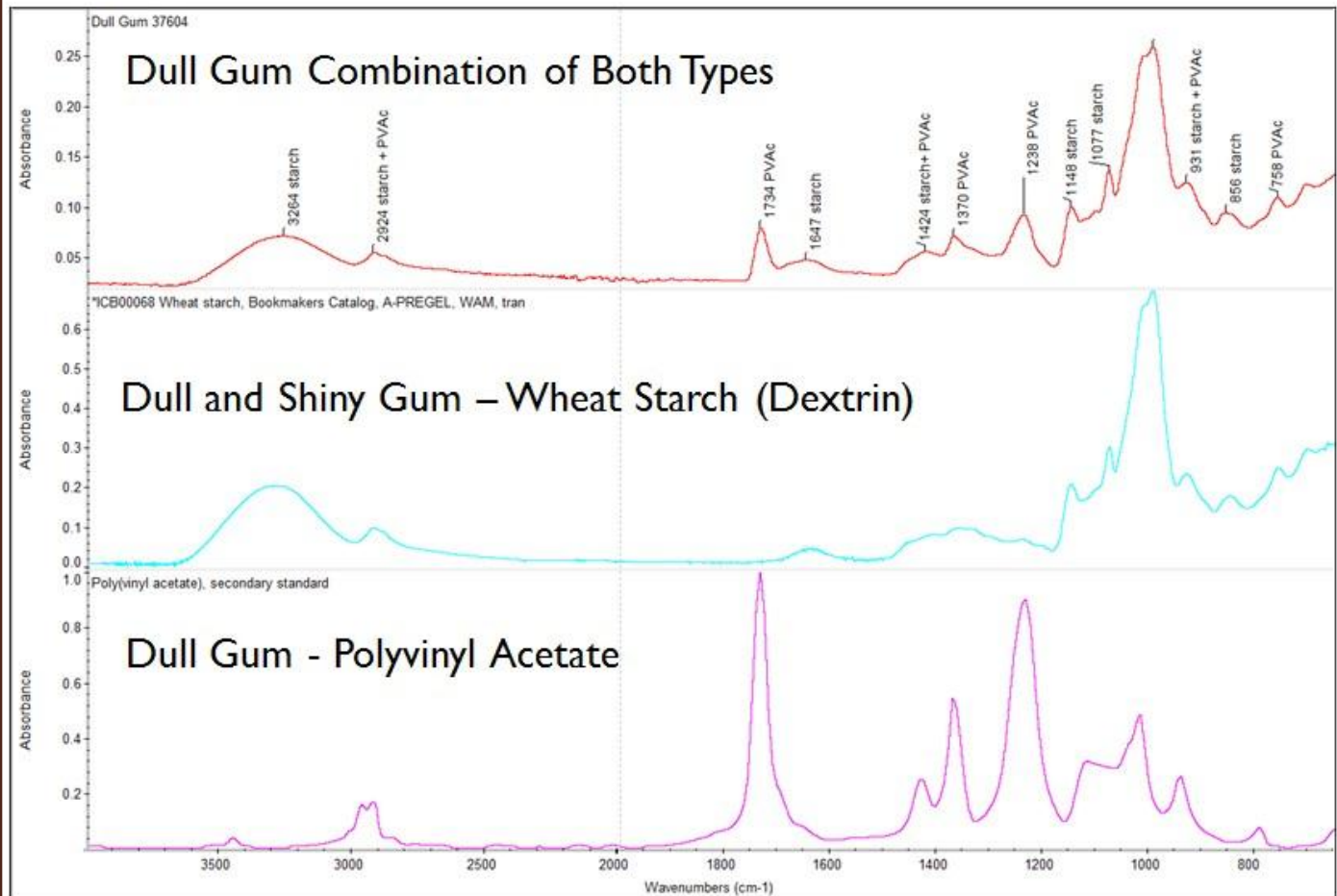
FTIR Spectroscopy Used for Gum Analysis



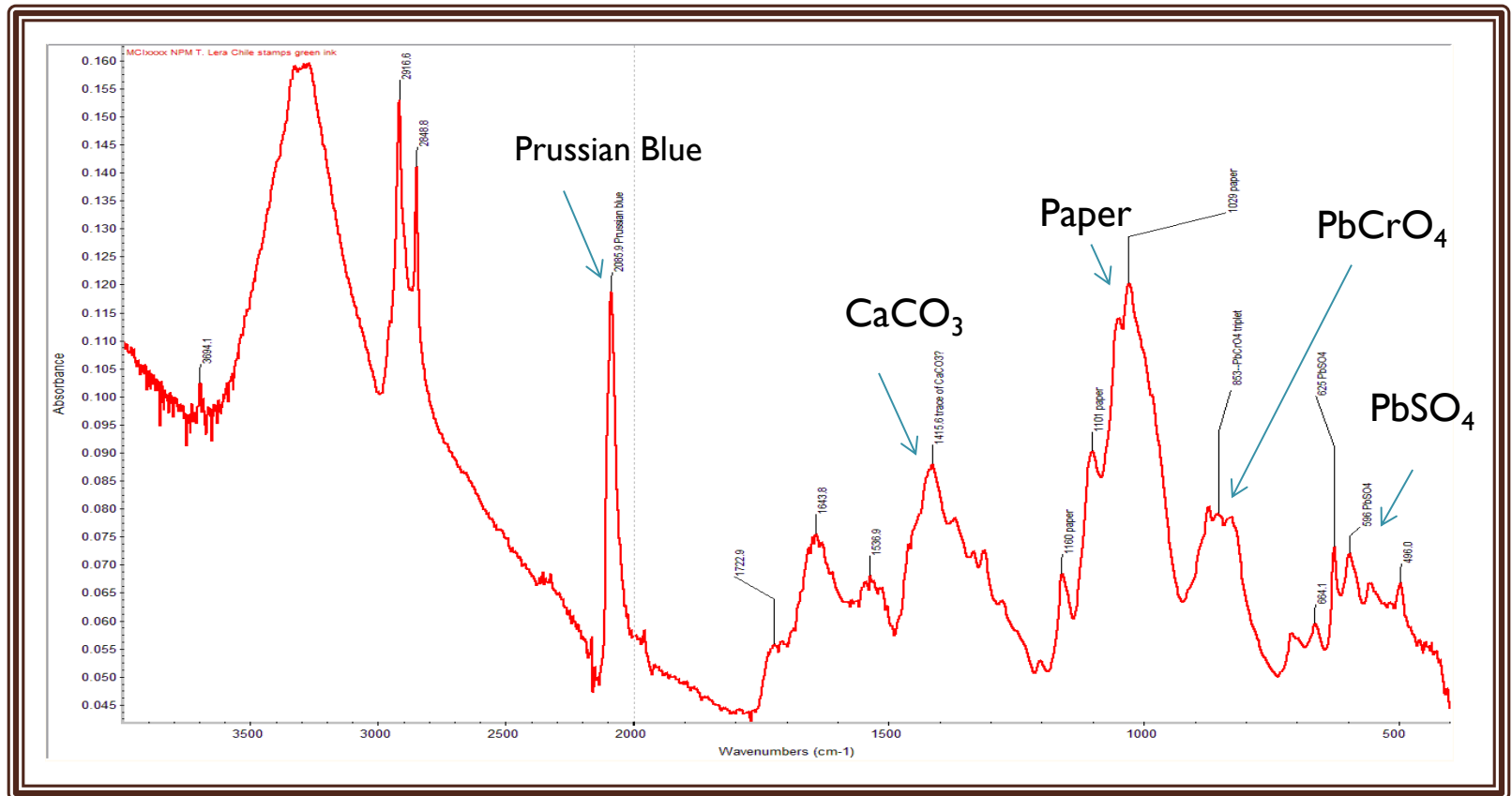
FTIR Spectroscopy Used for Gum Analysis

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Analysis of FTIR Results for Dull and Shiny Gums



FTIR Ink Results Chile #13



- PbSO₄ and PbCrO₄ from chrome yellow
- Trace limestone or chalk (CaCO₃) filler
- CN peak from Prussian blue



1893 1-cent, 4-cent and the 4-cent Colombian error



Scott 230



233a Bright Blue



Scott 233

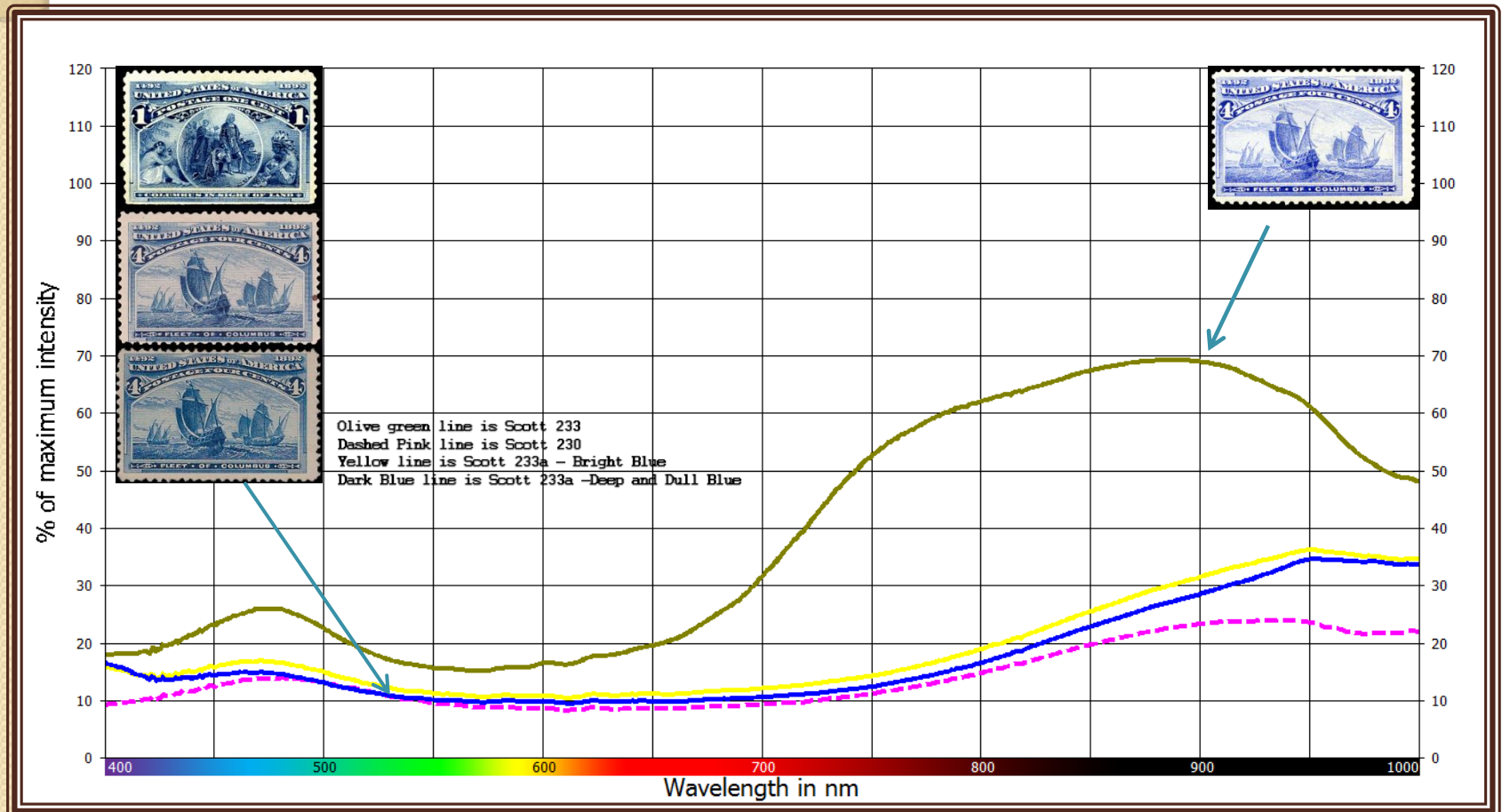


233a Deep and Dull Blue

1893 1-cent, 4-cent and the 4-cent Colombian error

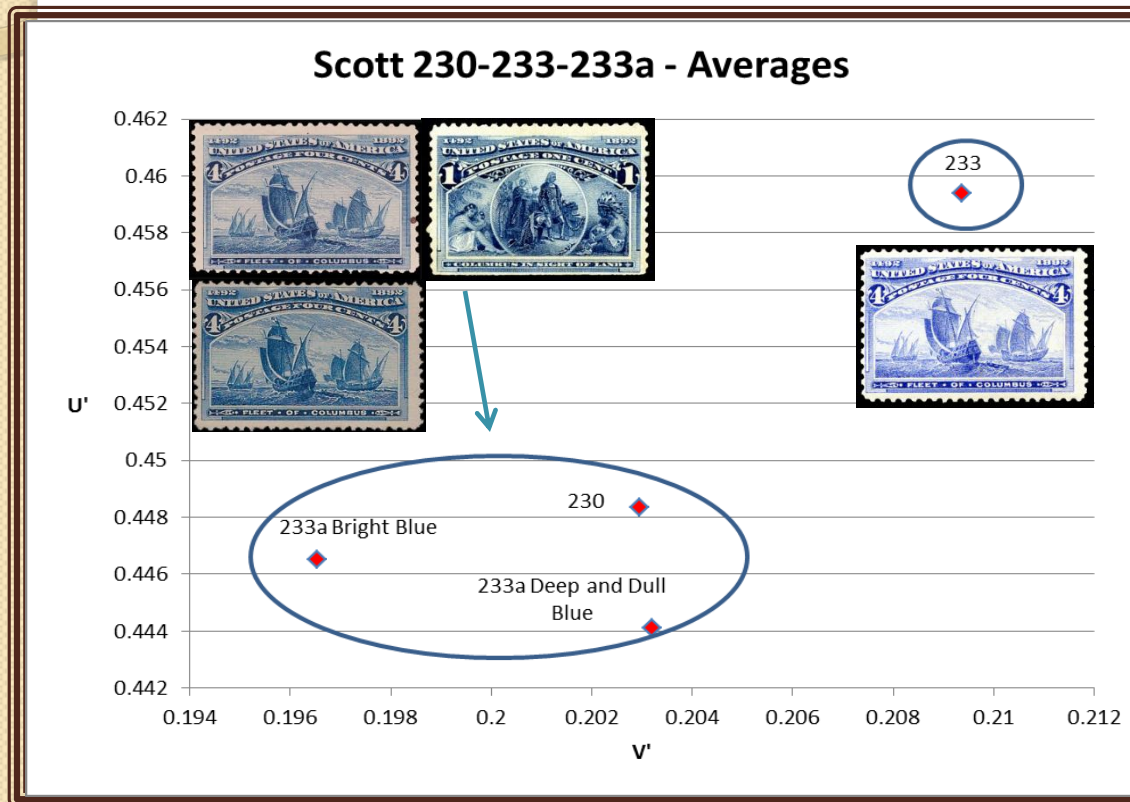
VSC 6000 Results

Spectrographic Analysis



1893 1-cent, 4-cent and the 4-cent Colombian error

VSC 6000 Results

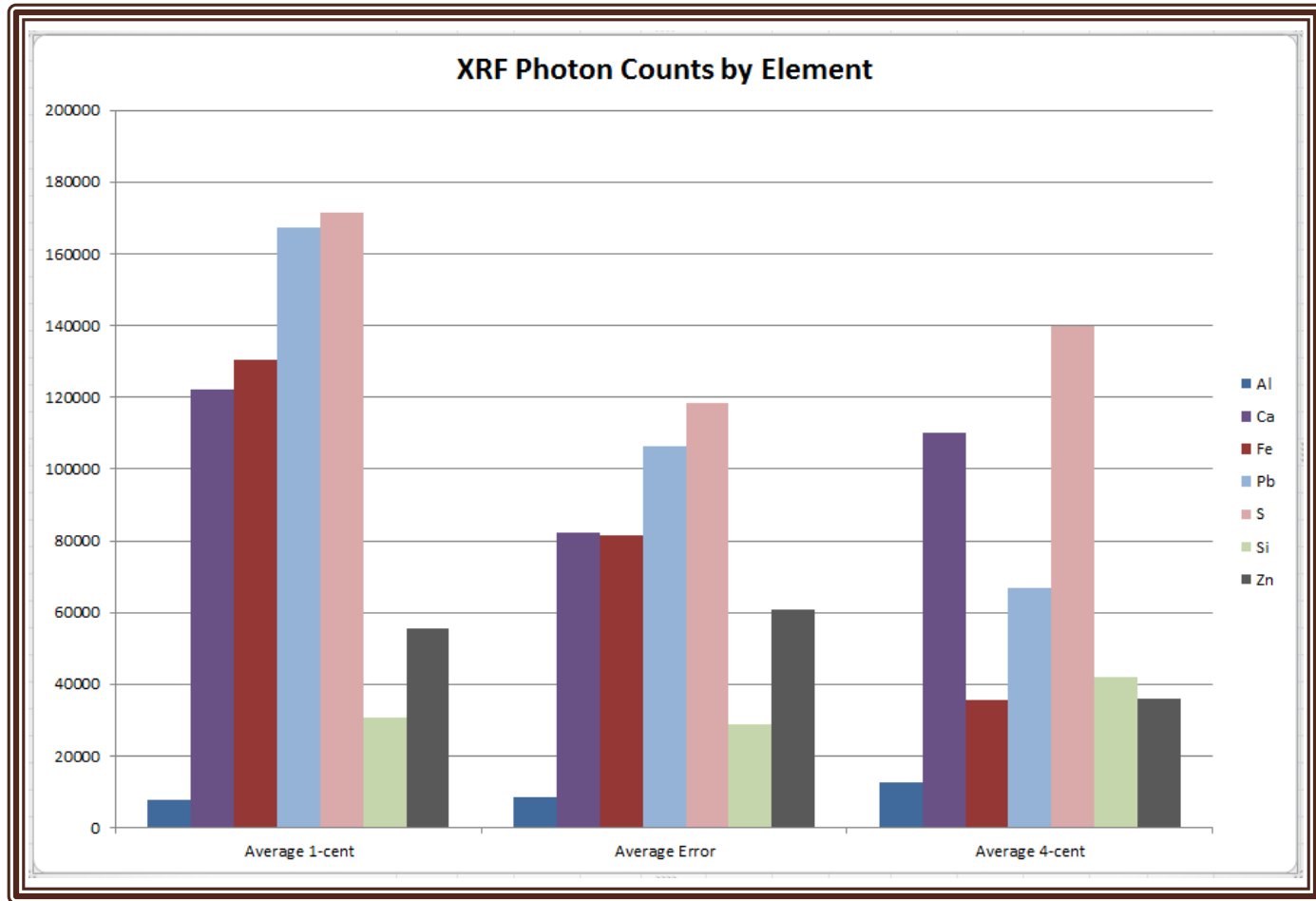


Very strong correlation between the ink used in the 1893 4-cent Scott 233a color error and the 1893 1-cent Scott 230.

Scott 233 is a different ink

1893 1-cent, 4-cent and the 4-cent Colombian error

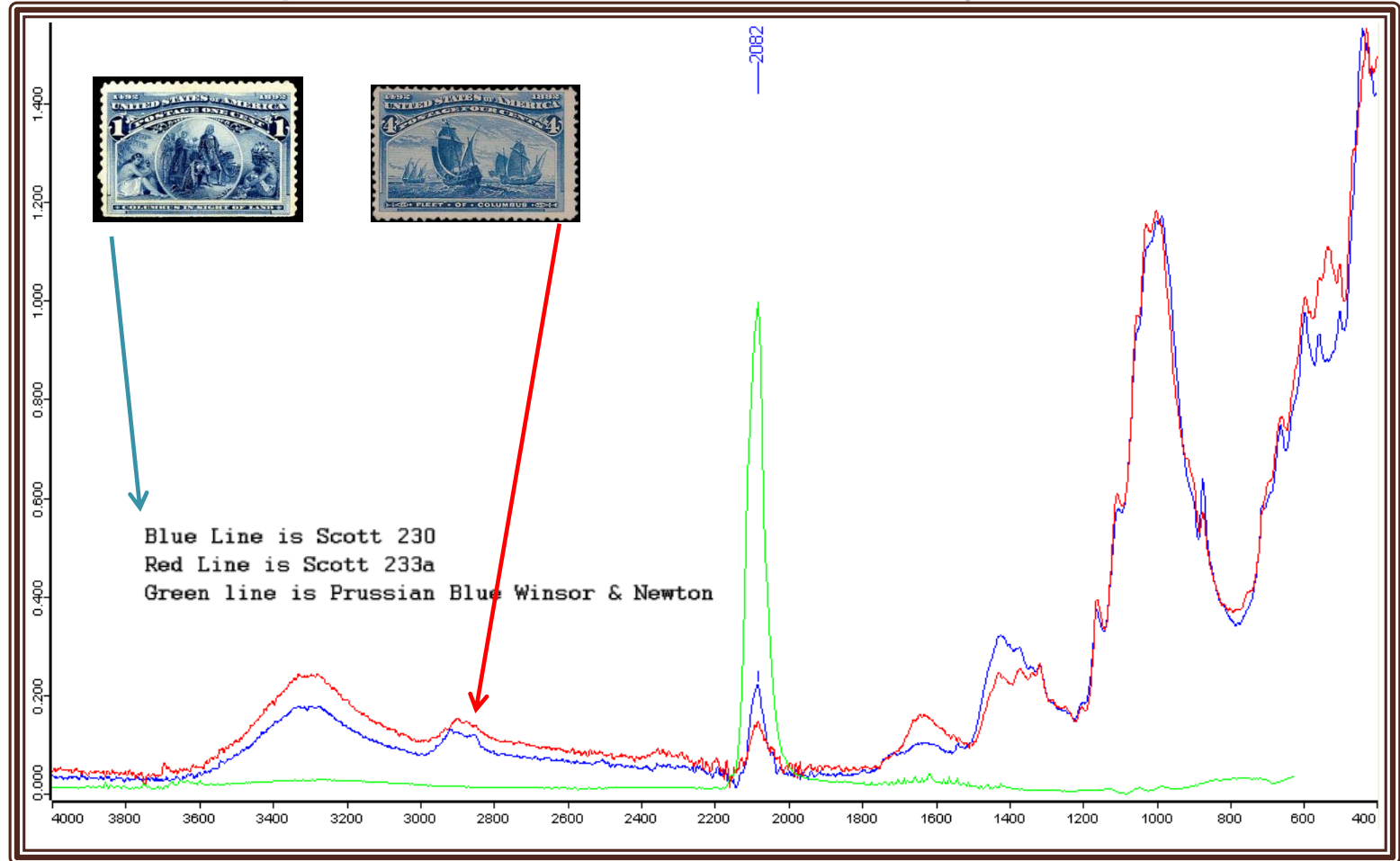
XRF Results



The 1-cent and 4-cent color error stamps have similar characteristics while the regular 4-cent stamp Scott 233 is different indicating two major pigments were used.

1893 1-cent, 4-cent and the 4-cent Colombian error

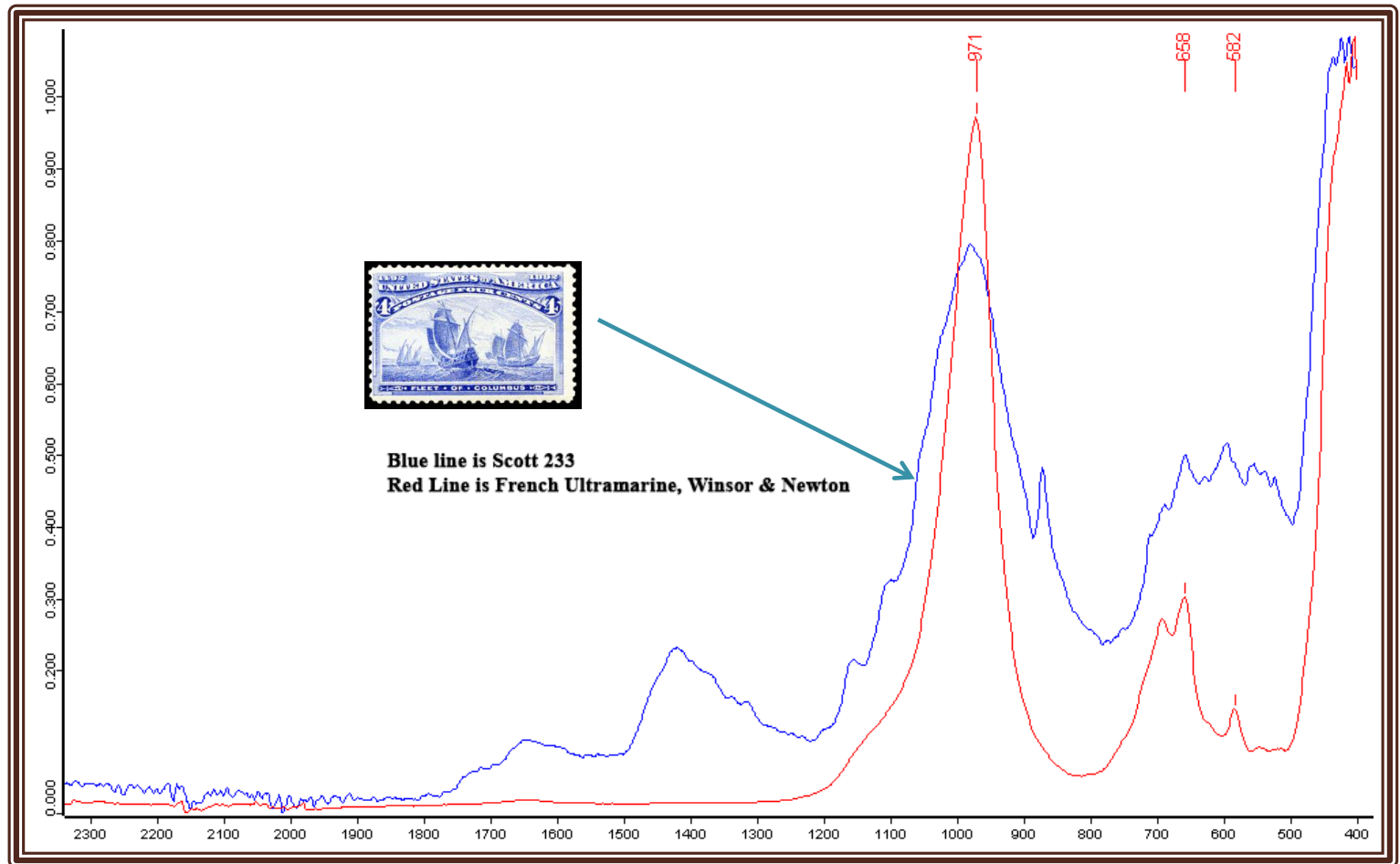
FTIR Results for the 1-cent and 4-cent error (Scott 230 and 233a)



Scott 230 (1-cent) and 233a(4-cent) used as Prussian blue as the major pigment, indicated by the very strong peak at 2081 cm^{-1} .

1893 1-cent, 4-cent and the 4-cent Colombian error

FTIR Results for the 4-cent (Scott 233)



Scott 233 (4-cent) used ultramarine the major pigment, indicated by a very strong peak at 971 cm^{-1} . There is no Prussian blue at 2081 cm^{-1} in this stamp.

Instrument Review

- Good visual inspection required.
- UV/VIS spectroscopy can be useful for the identification of both inorganic and organic colorants but not for binding media.
- Micrometer measurements may be greatly affected by previous treatments.
- X-ray techniques penetrate all the way through the stamp.
- XRF identifies many elements but can't identify molecular composition - generally not useful for binding media.
- FTIR spectroscopy offers the possibility to identify pigments and binders.

Analytical / Scientific Philately

Why is this important?

- To establish analytical methods to validate the authenticity of stamps or covers (genuine or counterfeit)
- To share our knowledge by teaching other philatelists and organizations how to use the appropriate equipment and interpret the results
- To better understand our collections

Scholarships and Research Grants

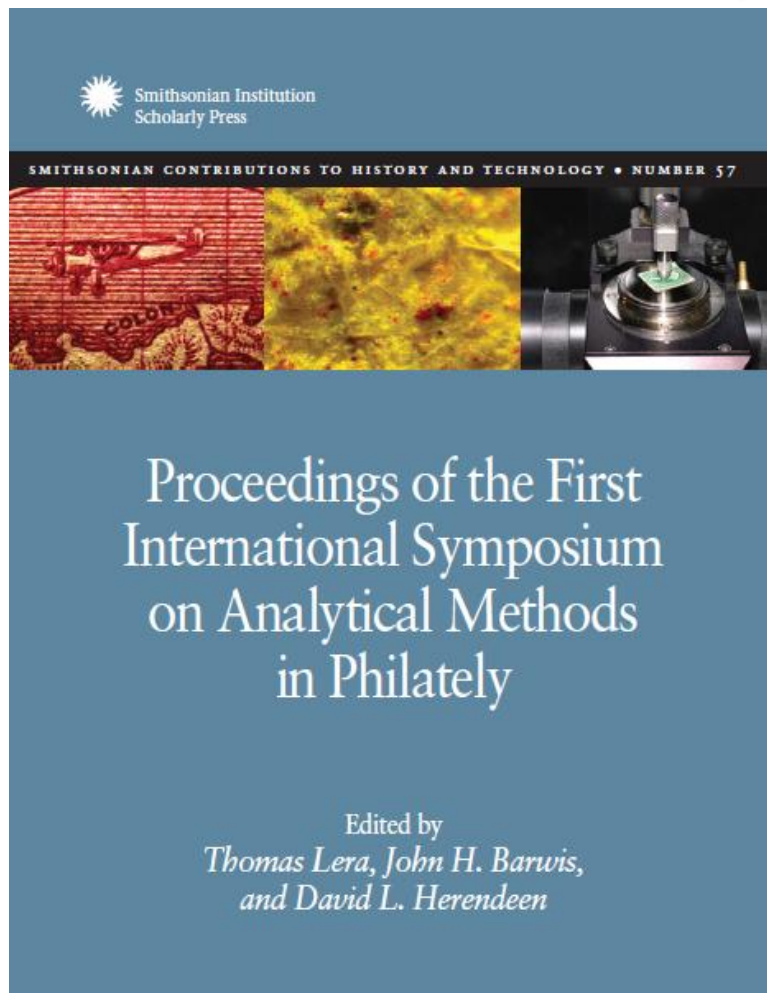
The Smithsonian National Postal Museum has
scholarships available:

<http://www.postalmuseum.si.edu/Scholarships> or
email Thomas Lera lerat@si.edu

The Institute for Analytical Philately can provide
research grants

<http://www.analyticalphilately.org/applyingforagrant.html>
or email John Barwis jbarwis@charter.net

Next International Symposium November 20-21, 2015



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