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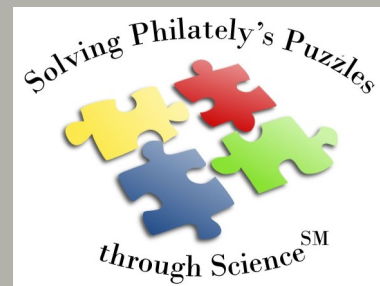
Institute for Analytical Philately, Inc.

**Host:**

Thomas Lera

Winton M. Blount Chair of Research

Smithsonian National Postal Museum



**FIRST INTERNATIONAL SYMPOSIUM  
ON  
ANALYTICAL METHODS IN PHILATELY**

**ABSTRACTS  
OF  
PAPERS AND PRESENTATIONS**

12-14 November 2012

Smithsonian National Postal Museum

Washington, DC

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## INTRODUCTION

The purpose of this document is to provide an overview of the papers presented at the *First International Symposium on Analytical Methods in Philately* by presenting their Abstracts. This will allow attendees, and others, to have some idea of what each paper will discuss. For those interested, good summaries of the technologies used may be found online using Wikipedia. Suggested search topics include:

X-Ray Fluorescence Spectroscopy

Raman Spectroscopy

PIXE Spectroscopy

One can also go directly to the manufacturers web sites:

For the VSC 6000: [www.fosterfreeman.com/index.php?option=com\\_content&view=article&id=9:vsc6000&catid=1:examination-of-questioned-documents&Itemid=28](http://www.fosterfreeman.com/index.php?option=com_content&view=article&id=9:vsc6000&catid=1:examination-of-questioned-documents&Itemid=28)

For Bruker XRF: [www.bruker-axs.com/handheldx-rayspectrometry.html](http://www.bruker-axs.com/handheldx-rayspectrometry.html)

For Bruker FTIR: [www.brukeroptics.com/ftir.html](http://www.brukeroptics.com/ftir.html)

For Panel discussions and concluding remarks, it is hoped that a transcribed audio recording will be available.

## PAPER 1

### KEYNOTE ADDRESS

#### **The Place of Analytical Methods in Philately**

David Beech (British Library, London, UK)

**ABSTRACT.** This talk has two principal themes. The first theme relates to my realization that certain philatelic problems were potentially able to be solved or better understood by science than the *ad hoc* methods used in many previous eras. This was reinforced by my access to the developments at the British Library in terms of conservation and preservation of rare documents. In 2001 the opportunity to work with University College London on a project to use spectrographic analysis to study the very rare (and valuable) 'Post Office' Mauritius stamps of 1847 arose. This work resulted in definitive information about the inks used and established a baseline against which others could judge. Further it showed the great potential that analytical philately had. This led to a similar study in 2002 when an evaluation of the 1851-52 so-called Grinnell missionary stamps of Hawaii took place.

The second theme is that of expertization. It is not the purview of IAP, NPM or BL to perform specific expertization. Rather, as the theme of this Symposium indicates, their goal is the development of advanced methods (some of which will be discussed in detail in the papers presented) for performing various analyses on stamps and other postal matter. Nonetheless, one of the most important applications of such methods will be expertization. I have pondered the problems inherent in expertizing for many years and will present my views and observations on this critical endeavor largely based on supporting the Expert Committee of The Royal Philatelic Society London.

## PAPER 2

### SPECIAL GUEST LECTURE

#### **Using XRF for Philatelic Analysis**

Dr. Bruce Kaiser (Chief Scientist, Bruker Elemental, USA)

**Presentation Only**

## PAPER 3

### WORKSHOP INSTRUCTIONS

#### **The Group Brainstorming Exercise**

Dr. John Barwis (IAP)

**Presentation Only**

## **PAPER 4**

### **Measuring Paper Characteristics of the U.S. Three-Cent Bank Note Co. Issues**

Dr. John Barwis (IAP)

**ABSTRACT.** This paper describes laboratory research conducted on the United States three-cent postage stamp issues of 1870, 1873, 1879 and 1881 (Scott Numbers 147, 158, 184, 207) (Scott, 2012) to characterize the types of paper used by the three private printing companies who produced these stamps. The goal of this work was to use quantitative methods to address a long-standing philatelic controversy about how many papers each company used, and whether a given paper was used by more than one company. Analyses included measurement of paper thickness, fiber length, fiber deformation, bending resistance, permeability, and sizing chemistry. It is demonstrated that combinations of these variables discriminate between the multiple paper types used by each company.

The results of this research contradict generally held assumptions about paper types, which were based largely on non-quantitative assessments of paper thickness and stiffness. Thickness-frequency distribution data are shown to provide important clues about whether thickness variations are due to lax manufacturing controls, versus the existence of multiple paper types with different mean thicknesses. Results also provide insight to papermaking standards of the 1870s and '80s, with particular regard to composition, quality control of thickness, and the use of sizing.

## **PAPER 5**

### **A Comparative Study of Security Measures Used by Stamp Printers**

Garfield Portch and Charles J. G. Verge (VGGF, Canada)

**ABSTRACT.** The purpose of this paper is to document the learning of the features of the Foster + Freeman Visual Spectral Comparator model 6000 (VSC 6000) for use in expertizing at the Vincent Graves Greene Philatelic Research Foundation (Greene Foundation). As a project, the authors undertook to look for, discover, identify and compare the individual and common security features used by Royal Mail in the United Kingdom and by the Canada Post Corporation in Canada during the production of their high value definitives in the 1980s, 1990s and 2000s. The project was undertaken as a training exercise by the authors using already published material available from each of the postal entities. After familiarizing themselves with some of the VSC 6000's many features the authors applied their new found skills to a new tobacco revenue recently introduced in Canada before using material sent in by customers to the Greene Foundation's Expert Committee. Each of the steps of the project is detailed in this paper.

## **PAPER 6**

### **Comprehensive Forensic Investigation of three Great Britain 1858-79 1d Plate 77 stamps on Cover**

Abed H. Najjar (London, UK)

**ABSTRACT.** In 2003, the author obtained an 1865 cover franked with three Great Britain 1858-1879 1d Plate 77 stamps (SG 43) (Gibbons, 2010). If genuine, this is a very valuable and historically significant philatelic item. Discoveries of Plate 77 stamps are always met with suspicion because they are so rare and have often been the subject of attempted fakery.

This paper presents a detailed scientific study of this cover and stamps. It begins by presenting a compilation of possible methods that might be used for faking the Plate 77 stamps. It then develops an analysis plan that carefully examines each possibility. Appropriate analytical equipment is identified for each step in the process. Finally, the stamps in question were subjected to rigorous testing. The majority of the testing was performed by state-of-the-art, independent laboratories in the UK.

Many different analyses were employed. These included: optical and scanning electron microscopy; x-ray fluorescence spectroscopy; Raman spectroscopy, and more. The paper then presents the results of these analyses and the conclusions drawn from them. All of these data were reviewed by outside forensic experts in order to validate the scientific procedures.

Two anomalies that arose during testing are discussed and hypotheses posed to account for them.

**PAPER 7**  
**WORK IN PROGRESS —1**

**Reflectance Spectroscopy of Colored Overprints**  
Dr. Lyman Caswell (IAP)

**ABSTRACT.** This paper develops a new methodology for analyzing overprinted stamps. This methodology is based on two procedures. The first performs precise measurements of the dimensions of overprints and a statistical analysis of the minor variations present among them. The second performs a colorimetric analysis of the ink used for printing the overprints. The goal is to determine if these methods can differentiate between overprints made by different printers, and can allow rapid identification of counterfeit overprints.

A set of overprinted stamps from part of post-World War I Hungary were selected for testing samples. These stamps had many varieties, were produced by two different print shops and were often counterfeited. After describing the different scientific testing performed, the paper outlines general procedures that may be used by other researchers.

**PAPER 8**  
**WORK IN PROGRESS —2**

**New Ways of Looking at Pre-Philatelic Inks**  
Dr. Dieter Bortfeldt (Colombia)

**ABSTRACT.** This paper describes investigations carried on over the last two years that study the authenticity of inks used for postal markings on colonial and pre-stamp letters. Examples used are postal history items from Colombia and Peru. After exploring various possibilities, a new spectrophotometric method, called **CONTRA TEST**, has been developed. The paper presents the details of this method and shows that it is a viable way to expertize such pre-stamp items.

**PAPER 9**

**Application of PIXE Analysis to Philately**  
Prof. Thomas E. Gill (University of Texas at El Paso)

**ABSTRACT.** Subtle variations in ink color and paper of postage stamps can affect their value and desirability to collectors and investors. Proton-Induced X-Ray Emission Spectrometry, or PIXE, is a generally nondestructive forensic analysis tool that reveals the concentrations of chemical elements in a sample. PIXE and related methods have been used for more than thirty years to differentiate philatelic printing techniques, quantify differences between different shades, varieties and reprints of stamps, and to separate genuine stamps from forgeries. This presentation reviews the history of philatelic paper and ink analysis by PIXE, through a focus on case studies from the 1980s to the present.

For example, PIXE has been used to show distinct chemical signatures between genuine stamps from China, Czechoslovakia, Eastern Silesia, South Africa, South West Africa, and Taiwan, and forgeries thereof. PIXE analysis showed how variations in ink chemistry control color shades of stamps from Mexico and reveal the origin (country of printing) of Iranian stamps, suggesting early (pre-20<sup>th</sup> century) utilization of organic inks on European-printed stamps from both nations. The technique was utilized to determine variations in paper types on stamps from China and Taiwan, and how original People's Republic of China stamps from the early 1950s can be separated from modern reprints. The paper concludes with a PIXE investigation of Mexico's 1895- 1898 *Mulitas* stamps. The analysis reveals that unlike previous Mexican issues, the *Mulitas* were printed with organic-based inks on largely clay-free papers. Differing amounts and/or formulations of metal (zinc, lead, and titanium) oxide whiteners apparently controlled the present-day color shade of the stamps, either directly or indirectly, with bluish inks having relatively more zinc and lead, and greenish inks having relatively more titanium.

**PAPER 10**

**Statistical Estimates of Rare Stamp Populations**  
Dave Herendeen (IAP) and Prof. Gary C. White (Colorado State University)

**ABSTRACT.** This paper describes a statistical method for estimating the population of rare stamps from auction catalogs, price lists, expert certificates and other generally available records. The method presented was developed by biologists to estimate animal populations. Such estimates are done by first capturing, marking and releasing specimens, and then recapturing them. From these data, statistics may be developed that can be used to estimate the total population. The latest generation computer software used for such analyses, called MARK, has been developed by White and others at Colorado State University (White, 2006). This paper explains how MARK may be used by the everyday philatelist interested in estimating the number of rare or very scarce stamps or covers in their collecting area. Methods are described so that it is not necessary to be a mathematician to use them successfully. The methodology is then applied to four test cases in order to illustrate the efficacy of the approach.

## **PAPER 11**

### **A Layman's Forensic Adventure**

Roland H. Cipolla II

**ABSTRACT.** This paper describes how current developments in analytical philately were used by a layman, i.e. someone without formal scientific training, to determine that an exciting, newly discovered US postal history item was not a fake. Access to the equipment used was provided by the Smithsonian National Postal Museum. It included the Foster + Freeman Video Spectral Comparator 6000, the Brucker Tracer III – SD X-ray Florescence Analyzer and the Bruker Alpha FT-IR.

The analytical tools were used to determine if there were any anomalies along the cut sides of a bisected stamp, the application of the cancellation, or the chemistry of the sheet to which the stamp was applied.

## **PAPER 12**

### **US 1851 3c – Color, Chemistry, and Changes**

Jim Allen (IAP)

**ABSTRACT.** This paper describes research performed on the United States 3c 1851 stamp (Scott Numbers 11 and 11A) (Scott, 2012) to determine analytically both the elemental composition of their printing inks and quantitative measures of their color. The principal analytical tools for performing these analyses were X-Ray Fluorescence Spectroscopy (XRF) and optical spectroscopy. A relatively simple technique for determining significant elements in the ink pigment is presented. The resulting elemental data is then correlated with documented chemical formulae and visual properties of pigments and inks of the period. This correlation allowed the likely and predominant pigments used in the manufacture of the inks used to produce the stamps to be surmised. From this, a general methodology for the evaluation of ink colors in terms of likely pigments was formulated.

The use of rigorous scientific analyses led to results which challenge long-held historical beliefs about particular inks used for these stamps. The older hypotheses, while posited using a technical approach, did not access the types of analytical tools available today.

## **PAPER 13**

### **Documenting Science in the Philatelic Literature**

Dave Herendeen (IAP)

**ABSTRACT.** This paper addresses how scientists in the philatelic community may best document highly technical work in a manner that is interesting and readable for laypersons — stamp collectors. After describing the different scientific aptitudes of philatelists, the paper suggests guidelines that scientists might use to reduce complicated concepts to their essence. This is crucial if there is to be an efficient technology transfer of science into the mainstream hobby. Methods posed include a moderation in technical complexity and an increased use of visualization tools including photos, charts, drawings, graphs and more. The paper concludes with a discussion of publishing venues for scientific articles so that the most appropriate audience may be reached.

## PAPER 14

### A Scientific Analysis of the First Issues of Chile 1853-1862, London Printing

Tom Lera (NPM) and Jennifer Giaccai (MCI)



**ABSTRACT.** The London printings of the Chilean postage stamps between 1853 and 1862 were analyzed using various analytical instruments available at the Smithsonian Institution. There are four broad major technical areas important to philatelic research: color science (colorimetry and luminescence), paper chemistry (composition, thickness, and roughness), ink chemistry (pigment and binder composition), and printing methods (engraved and lithography). The analyses performed in this study address the four broad major technical areas discussed above while providing an understanding of the characteristics of these stamps, showing the utility and capability of forensic and scientific equipment available to philatelic researchers, and offering an effective, rapid, and nondestructive way of identifying the pigments and dyes in the inks and papers used.

X-ray fluorescence (XRF), Fourier transform infrared spectroscopy (FT-IR), colorimetry, and X-ray diffraction (XRD) were all used on the stamps without removing samples. In some cases (XRF, FT-IR) multiple instruments using the same analytical technique at the Smithsonian were used to further explore the capabilities of different instruments in analytical philately. Because of the significant sensitivity differences of the equipment, the results are often complementary. Only by combining the results from several pieces of equipment was it possible to gather enough information to fully differentiate between the stamps and to obtain the complete characterization for each ink, pigment and paper. This paper gives guidance as to which scientific instruments and methods are most useful when examining different characteristics of stamps.

The results show the stamp inks vary considerably between different printings. In the various red inks used by Perkins, Bacon and Co. the variation in the amounts of iron, calcium and potassium used in the stamps examined show regular experimentation in the exact recipe used to make the ink. However, comparison between two blue inks from 1853 and 1862 show little variation in the components used in the ink. This suggests that much of variation in the red ink recipe is due to Perkins, Bacon and Co. trying to solve the bluing problem present in many of their stamps from this time period.

## PAPER 15

### Complimentary Micro Raman and Micro Energy Dispersive X-Ray Fluorescence Analysis for Applications in Philately

Prof. Gene Hall (Rutgers, State University of New Jersey)

**ABSTRACT.** Our laboratory uses micro energy dispersive X-ray fluorescence ( $\mu$ -EDXRF) to characterize different features in philatelic material. Our  $\mu$ -EDXRF spectrometer has a beam spot size of 50-microns so that we can analyze separately features that include paper, printing ink, and cancellation ink in the samples. In addition, elemental maps are produced of these features that allow more detailed information on the chemistry of the materials used in the features. Because  $\mu$ -EDXRF gives elemental (Na-U) composition, there is a need to associate these elements with specific chemical compounds so that additional information on the philatelic material such as dating, forgery, and methods of production can be realized.

We use Raman spectroscopy to compliment our elemental data of the philatelic material to determine the specific chemical compounds associated with the elements determined by  $\mu$ -EDXRF. For example, Ti is an element commonly found in philatelic material both in the inks and paper. However,  $\mu$ -EDXRF does not provide the chemical compound. Using Raman to analyze the same identical spot (2 microns), Ti is associated with the chemical compound  $\text{TiO}_2$ . Furthermore, Raman can identify the specific crystal structure, rutile or anatase that can be used to date the material.  $\mu$ -EDXRF cannot determine C content of black ink that is commonly used in the printing and cancellation inks on philatelic material. However, we use Raman to determine C content and its type (soot) in the material and it is the only analytical method that can perform this analysis.

This presentation will focus on specific applications of  $\mu$ -EDXRF and Raman to assist in understanding the chemical and elemental composition of philatelic material. Specific examples pertaining to the Hawaiian Missionary stamps from the NPM and from two collectors will be presented. Other examples of the complementary nature of the two techniques applied to philatelic covers will also be presented as well as the chemical composition of inks used on philatelic materials.

This presentation is dedicated to Wilson Hulme II and Vince Arrigo who have passed on. They have trusted me with the non-destructive analysis of Hawaiian Missionary stamps that was very exciting.

## **PAPER 16**

### **A Forensic Study of the Ink and Paper of the Typographed 1862 5c Blue CSA Stamps**

Dr. Harry G. Brittain (Center for Pharmaceutical Physics)

**ABSTRACT.** It has been determined that X-ray diffraction (XRD) is a highly useful analytical tool for study of the paper used in the printing of postage stamps of the Confederate States of America. Through use of the technique, one may differentiate among different types of paper that were used in the printings, primarily through a characterization of the inorganic salts that were used as sizing and filling agents. When combined with attenuated total reflectance (ATR) sampling, Fourier-transform infrared (FTIR) spectroscopy can be used to study the pigments used in the printing inks, and with comparison with suitable reference standards, FTIR-ATR spectra can be used to identify the pigments used in these inks.

The utility of XRD and FTIR-ATR will be illustrated using the 5-cent blue, typographed postage stamps featuring the portrait of Jefferson Davis that were issued by the Confederacy during 1862-1863 (Scott CSA-6 and CSA-7). Through study of appropriate examples, it has been found that FTIR-ATR spectroscopy can be used to distinguish between the printing ink used by the De La Rue Company (London, England) and by the Archer & Daly Company (Richmond, Virginia). It has also been found that XRD can distinguish between paper supplied by De La Rue and paper obtained locally by the Archer & Daly. The protocol that has been developed is to first use FTIR-ATR to determine whether a given stamp should be classified as being either CSA-6 or CSA-7. Subsequently, XRD is used to confirm that a CSA-6 stamp is printed on London-sourced paper, or whether a CSA-7 stamp is printed on London-sourced or Richmond-sourced paper.

## **PAPER 17**

### **PANEL DISCUSSION TRANSCRIPTION**

#### **PLANNING A RESEARCH PROJECT**

Jennifer Giaccai (Smithsonian MCI), Moderator Dr. Harry G. Brittain (CPP), Dave Herendeen (IAP)

## **PAPER 18**

### **Multispectral Imaging**

Dr. William Christens-Barry (Equipoise Imaging, LLC)

**Withdrawn**

## **PAPER 19**

### **TRANSCRIPTION**

#### **Where Do We Go from Here? Summary of Group Brainstorming Exercise**

Dr. John Barwis (IAP)

## **PAPER 20**

### **PANEL DISCUSSION TRANSCRIPTION**

#### **FORUM ON NPM FORENSIC EQUIPMENT**

Tom Lera (NPM), Moderator Dr. Bruce Kaiser (Bruker Elemental) Jennifer Giaccai (Smithsonian MCI)

## **PAPER 21**

### **TRANSCRIPTION**

#### **Closing Comments and Attendee Feedback**

Dave Herendeen (IAP)