FORENSIC EXAMINATION OF INK AND PAPER

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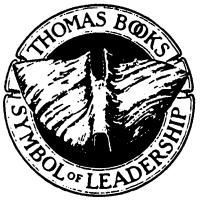

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To the ink and paper industry
whose help
has contributed significantly
to the forensic application
of ink and paper analyses and,
consequently,
the administration of justice.

PREFACE

PROBABLY no other field of forensic science has had more of an impact on the detection of white collar crimes or has stirred as much interest as the forensic examination of ink and paper. Over the past fourteen years, law enforcement agencies, nationwide and at all levels of government, have turned to the forensic examination of ink and/or paper for assistance in determining the authentic or fraudulent nature of questioned documents. The investigation of Spiro Agnew, Watergate, the Howard Hughes (Mormon) Will, and Juan Corona are just a few headline cases that relied heavily on the forensic examination of ink and paper.

Forensic science is rapidly becoming a field of many specialties. Rapidly developing technology and the application of this technology to the examination of many types of physical evidence makes it very difficult for anyone to keep current and be truly an expert in all areas of forensic examination. Forensic ink and paper examination is such a specialty.

Advancements in the ability to distinguish, identify, and date questioned documents through ink and paper examination over the last fourteen years have paved the way for a completely new approach to the examination of questioned documents. Document examiners have extended the scope of their traditional examinations to include the comparison and dating of inks and papers; or, in some laboratories, document examiners work closely with forensic chemists to perform these examinations. Barriers preventing minimal damage to documents have been broken and the laboratory procedures used are now routinely admissible as evidence in federal and local courts of law.

This book was prompted by the need to convey the many advancements that have occurred in the field of forensic examination to the forensic science community and to provide a suitable text for courses in the forensic examination of ink and paper at universities with graduate or undergraduate degree programs in forensic science. Apart from the value this book will have to the forensic and academic communities, we feel that prosecuting and defense lawyers, investigators, and anyone associated with the criminal justice system will also benefit. The laboratory methodology will be of interest to the ink and

paper industries as well.

The Forensic Examination of Ink and Paper is complete in itself. That is, in addition to a complete discussion of laboratory procedures and forensic applications for the examination of ink and paper, the history of the development of ink and paper, their chemical and physical properties, and court admissibility of the techniques used are also addressed. Several forensic cases are included in the text to help explain how the procedures described can be applied to real-life criminal and civil investigations. Every attempt was made to write this text in a style that can be understood by forensic chemists, document examiners, lawyers, judges, investigators, industrial scientists, students, or anyone with an interest in the subject matter.

The authors are indebted to many people for their generous assistance and advice so essential to the successful completion of this book. In the field of questioned document examination we would like to express our gratitude to the large number of examiners who provided excellent feedback regarding our paper analysis and watermarks sections. To the ink industry, we would like to thank those companies who allowed and encouraged our interest in the production of writing and printing inks. We are grateful for the generous assistance of the research and library staff at the Institute of Paper Chemistry for providing invaluable materials and information regarding the production of paper, paperboard, and watermarks. Our thanks too to a number of individuals from varying disciplines incorporated within the framework of forensic science for their critiques on the forensic sections in this textbook. The Writing Instruments Manufacturers Association, Inc., contributed materials on the nomenclature of writing instruments which are considered "state of the art" for that industry. The authors are indebted to the hundreds of individuals whose kindness and patience encouraged the completion of this work.

Particular thanks are given to Doctor Antonio A. Cantu, former ATF ink specialist, for his valuable input to this text. The authors also acknowledge the help of Larry F. Stewart and Albert Lyter, III, former employees of the ATF Forensic Science Branch. Special thanks are also given to Roland Wilder and Tony Wadsworth, photographers employed by the Forensic Science Branch of the Bureau of Alcohol, Tobacco and Firearms, for their assistance in the preparation of photographs for the text.

The authors are indebted to the Bureau of Alcohol, Tobacco and Firearms for giving permission to publish this book and for contributing photographs and illustrations.

We also want to express our sincere appreciation to our families, Dawn, Desiree, Holly, Heidi, and Barbara; Wayne and Eileen for inspiring the writing of this book and for tolerating moods—sometime good, but often frustrating—during the preparation of the manuscript.

The views and opinions expressed in this book are those of the authors and do not necessarily reflect those of the Bureau of Alcohol, Tobacco and Firearms.

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CHAPTER 1

INTRODUCTION

UNDERSTANDING and application of the material in this text requires a brief explanation of the overall approach to the forensic examination of ink and paper and a brief comparison of modern approaches with procedures followed in the past.

PHILOSOPHY BEHIND FORENSIC EXAMINATION OF PAPER AND INK

The approach to conducting a forensic examination of ink and paper differs in several respects from the traditional analysis of these products by ink or paper chemists. Traditionally, these materials are examined primarily for reasons of quality control to insure inks or papers are being made according to a prescribed formulation or to evaluate the various physical properties such as drying properties of inks or the strength or whiteness of paper. When these examinations are conducted by manufacturers, the precise formulas of the products are known and quantity of material for analysis is abundant.

Forensic examination of ink and paper are normally performed for three reasons:

- Comparison of two or more samples to determine whether they are the same or different. This would be done for example to determine whether a particular ink entry on a check or ledger had been altered.
- Determination of whether two or more similar samples have a "common" origin. As for inks, the "commonness" or "rarity" of their formula defines the degree of their "common" origin. In paper, once the manufacturer can be identified, as through a watermark, one can make statements on the degree of their "common" origin.

- Determination of the date a document was executed. While the absolute dating of ink, in general, is not yet possible with any reliable accuracy, it is possible to (a) determine the earliest a particular ink formulation could have been used for writing purposes, (b) in some instances, estimate the length of time an ink has been written on a document, and (c) in some situations, determine that an entry was written subsequent to other entries on a page. Similarly, paper can be dated by the identification of a watermark or formula changes prior to which these specific changes did not exist. More on this will be explained later.

Major differences involved with the forensic approach to the examination of ink and paper rather than the traditional approach include the following:

- Only limited sample of ink and paper is available for analysis lest the document be destroyed. Therefore, methods of analysis used must of necessity be changed to accommodate this fact.
- The precise formula of the ink and paper is seldom known to the forensic examiner. From this, it is obvious that the support of the ink and paper industry is required in many instances where it is necessary to obtain information pertaining to formula changes in their products. Such is often the case when the situation requires the dating of ink or paper.
- The results of the examinations require that the examiner interpret the evidentiary value of the results rather than an evaluation of the quality of the product or to determine whether the prescribed ingredients have been added according to a specified formula.
- In the absence of some unique ingredient or combination of ingredients in the products, such as a tag in an ink or the use of new synthesized or natural dye, positive identifications are seldom possible. Such is the situation with most types of trace evidence such as paint, soil, glass, metal, etc. Positive determinations as to origin are not always possible with this type of evidence either.

From the above discussion it can be seen that the forensic approach to the analysis of ink and paper is considerably different from the traditional analysis of these products. The forensic scientist interprets the results of the examination relying on experience and knowledge of the material being analyzed, and the conclusion rendered is an opinion, not fact. Nevertheless, the criminal justice system is relying more and more on the forensic scientist to arrive at the truth in cases adjudicated in or out of court. A forensic expert's testimony has been generally proven to be more reliable than that of an eye-witness. The well-trained, experienced, and ethical forensic scientists will objectively limit the extent of their conclusion to be consistent with the facts available from the similarly ethical ink and paper manufacturers with which we, in the forensic community, have dealt.

COMPARISON OF MODERN APPROACHES TO PAPER AND INK EXAMINATION WITH TRADITIONAL METHODOLOGY

The establishment of the Standard Ink Library at the Bureau of Alcohol, Tobacco and Firearms and its use for the matching and dating of writing inks in 1968 is generally accepted by forensic scientists as the beginning of the modern approach to ink examination. Therefore, pre-1968 methodology will be arbitrarily referred to as traditional methods, recognizing that many pioneering efforts during the early 1960s made possible what are referred to in this text as the modern methods for the analysis of ink and paper.

Prior to 1968, due to the basic structure of most crime laboratories, analysis of ink and paper fell under the purview of the examiner of questioned documents. Any problem concerned with a questioned document, be it handwriting, typewriting, alterations to ink, paper, etc., was given to the examiner of questioned documents for examination. Forensic chemists were more concerned with analysis of trace evidence such as drugs, soil, paint, glass, blood, and other types of evidence that clearly required chemical analysis. Examiners of questioned documents were therefore responsible, for the most part, for the little forensic ink and paper examination that was conducted by traditional methods.

Little research and development of methodology for ink and paper analysis was accomplished prior to 1968 because—

- Examiners of questioned documents had, with few exceptions, nontechnical backgrounds, which understandably inhibited their research in these areas.
- Traditionally, no damage to a questioned document, no matter how little, was permitted. This philosophy prevailed throughout the profession of questioned document examination and obviously prevented any significant research on chemical methods of analysis of ink and paper that does require some, although very minimal damage to the document.
- Forensic chemists traditionally left matters dealing with documents to the examiner of questioned documents, and there was very little interaction between the forensic chemist and the examiner of questioned documents. This reality served as a barrier to progress to the application of chemical and physical methods for the forensic examination of paper and ink.

TRADITIONAL METHODS FOR THE FORENSIC EXAMINATION OF PAPER AND INK

To examine inks, examiners of questioned documents relied almost totally on nondestructive methods for comparison. Examinations primarily used var-