

Printing Defects on Three-Ring Notebook Paper

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This paper addresses the significance of printing defects in the margin lines and horizontal lines of typical notebook paper. A brief overview of notebook paper printing and assembly is provided. Two cases involving defects on sheets of notebook paper are discussed.

The opinions and assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Virginia state laboratory system.

Introduction

One of the most frequent examinations performed by a Forensic Document Examiner is a handwriting comparison. If a suspect has been identified and appropriate known writing is submitted, there is a good chance for authorship identification or elimination if there is sufficient individuality in the writing. Sometimes the questioned entries or known writing is inadequate, and only a qualified opinion of authorship can be rendered. And sometimes no opinion of authorship can be rendered at all, such as when a suspect has not yet been located or no known writing is available for comparison. In these cases, additional information obtained by a careful examination of the document becomes much more important.

If the document medium is a typical sheet of notebook paper, such as from a three-ring binder, notepad or spiral notebook, then several examinations immediately come to mind.

The recovery of indented writing or invisible images may lead an investigator directly to a suspect. Providing a submitter with some individual letterforms or writing habits to "screen" a population may also help locate a suspect. And the fact a writer appears to be left-handed may allow a victim to suggest co-workers, neighbors or ex-friends as suspects. The results of other document examinations tell

a submitter **what** they are looking for rather than **who** they are looking for. This information might include the type of notebook, its size, shape, color, printed lines or presence of a watermark; the type of writing instrument, its color, gooping habits or striation patterns; and the type of equipment used, such as a computer, photocopier or inkjet printer.

An important piece of information that could be overlooked is the presence of printing defects on notebook paper. Recently this author was involved in two cases where printing defects played a significant role in identifying the authors of questioned documents. In both cases, the paper was typical three-ring notebook paper.

Background

Notebook paper comes in many different shapes and sizes. A typical sheet is white, with three or more holes along the left-hand side, one or more red margin lines printed vertically along the left-hand side, and a series of blue horizontal lines from top to bottom. Typical sizes include 8" x 10.5" and 8.5" x 11."

The red margin lines, and blue horizontal lines or "faint lines" as they are known in the industry, are printed by a flexographic printing process (a soft rubber-type mat with a raised printing surface). Paper from a large roll continuously passes multiple cylinders, positioned on both sides, that print the margin lines and faint lines.

The margin lines are mounted on rings that can be slid on and off a cylinder. If the sheets

are being printed three-wide, then three rings are appropriately spaced on the cylinders to make three continuous red lines parallel to the direction that the paper roll is moving. The industry term for three-wide printing is "three-up," and three-up is an industry standard (with some exceptions including five-up and nine-up). The rings are used for multiple runs until they break or become so flawed that their defects are noticed by inspectors.

Since red margin lines are continuous, the circumference of a cylinder is irrelevant. They can be small to fit a particular machine's space requirement, or large to save on wear and tear of the printing surface and machine components. In fact, most cylinders have a circumference larger than a sheet of finished paper. At American Pad & Paper Co. (AMPAD), one of the country's largest manufacturers of notebook paper, the circumference most commonly used is about 15." In any case, printing defects in a margin line will not occur at the same place on recurring sheets of paper within a package or notebook unless the circumference of the drum is in exact proportion to the height of a sheet of paper (almost never). Add to this the fact that the cylinder is usually three sheets wide and it becomes easy to see that a highly individual printing defect may be a significant piece of circumstantial evidence.

The faint lines are made by wider flexographic mats, rather than rings. If the paper is being printed three-up, the mat will consist of horizontal lines the width of at least three sheets. The circumference of the flexographic mats on the cylinders matches the height of a sheet of paper to ensure the faint lines are in registration with subsequent sheets in the same stack of paper. Further, the back faint line cylinder is in (near) exact registration with the front.

Theoretically the circumference of the cylinder could be in multiples of the sheet height, however the industry standard is to match one sheet. At AMPAD, the size matches the exact height of one sheet of paper. Faint line printing defects should appear on every sheet in a package, and should always be in exact horizontal and vertical registration. Once again, a highly individual printing defect may be a significant piece of circumstantial evidence.

Once the printing is completed the notebook paper passes by "splitter blades" and is cut at the correct width; and then is cut horizontally at the correct height. The sheets are then

dropped into stacks and wrapped for shipping as each stack reaches a required number, such as 500 sheets. There is no mixing of sheets from adjacent lanes, and there is no orderly or systematic way to package the individually wrapped stacks for shipment. Wrapped stacks are merely placed in storage until ready for a shipment. The holes along the left edge are made either by drilling or punching depending on whether the end-product is a bound or spiral notebook, or individual sheets.

Case #1

A submission was received from a small town in western Virginia that involved three threatening letters to a female high school student. The letters were received over the span of several months and no strong suspect had been developed. Each letter was several sentences of intentionally distorted handwriting or hand printing totaling about a half-page or more, and there was evidence of common authorship among all three letters. The letters were written on two different types of three-ring notebook paper, with either ballpoint ink (two letters) or pencil (one letter). One of the letters was signed with two initials, and the victim suspected a schoolmate whose name matched them. The letters had been left either in the victim's locker or on her desk.

The investigator contacted the laboratory to discuss the case prior to its submission. Several suspects had been developed, but due to the circumstances and age of the students it was hoped the investigation could remain covert. As such, the investigator was advised to collect several school assignments from the victim and each suspect, and to submit them with the threatening letters for comparison.

Upon receipt of the submission, handwriting examinations were conducted. None of the suspects were identified as the writer of any of the letters however a qualified opinion of authorship was rendered for the victim for one letter. The letters were examined for indented writing, however none was found.

A comparison of the paper used to write the threatening letters to the submitted known writing of each person revealed that one type of questioned notebook paper matched some of the sheets collected from the victim. Specifically, two of the questioned letters matched two (of six) of the sheets collected from the victim.

The paper was about 7.5" x 10.5" in size, with one wide red margin line along the left side and 27 horizontal lines (in the same registration). The left edges had an apparent laser perforation, and appeared to have been torn from a bound or spiral notebook. More importantly, within the margin line of the threatening letters was what appeared to be a highly individual

printing defect consisting of an irregularly shaped non-printed area or "void" within the line. As would be expected, the defect was not in registration for both pages. None of the other suspects' collected papers matched this type of notebook paper. An overview of a questioned letter and close-ups of the defect are shown in Figures 1A-C.

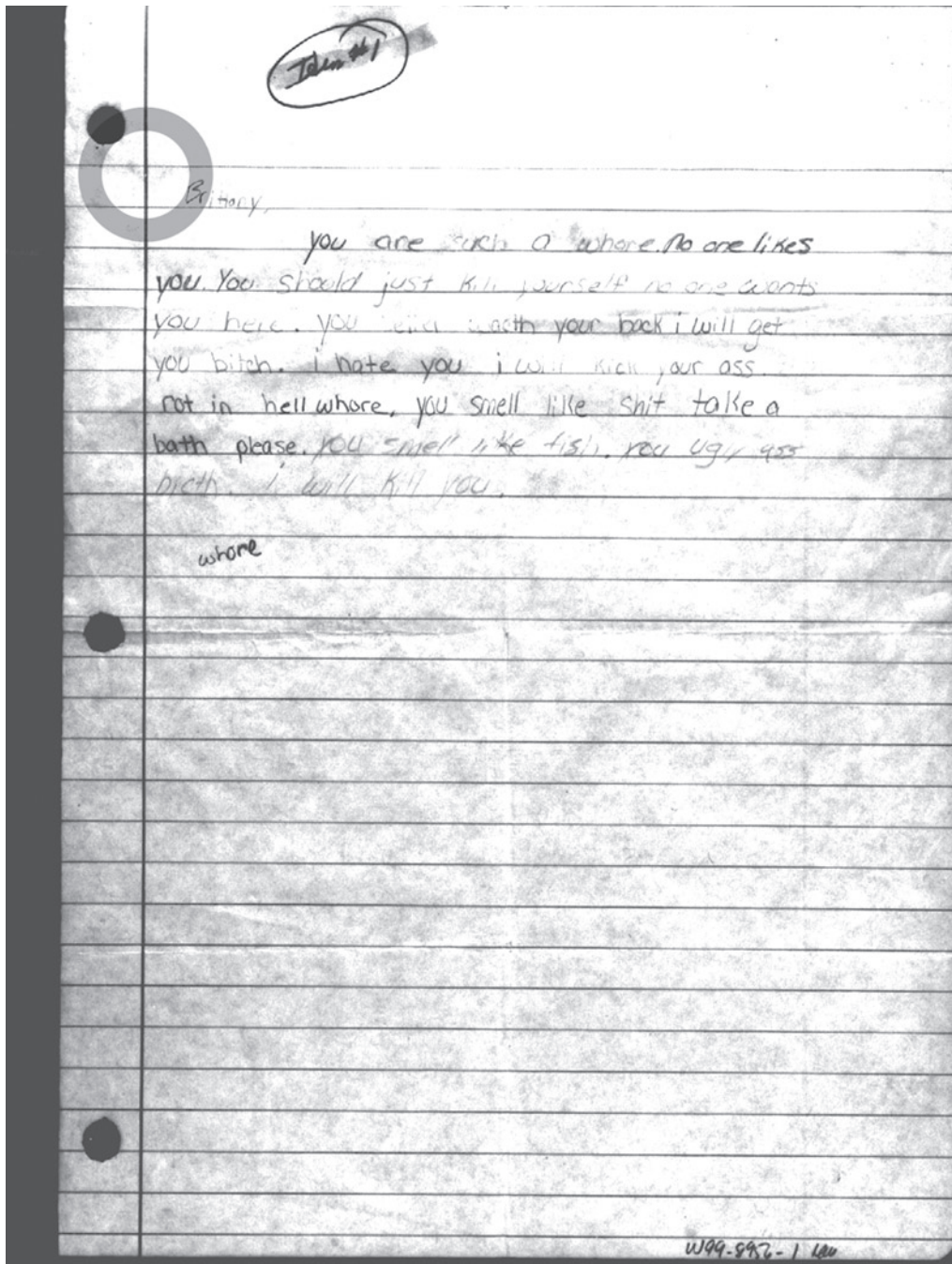


Figure 1A. Overview of entire questioned letter (see circled area).

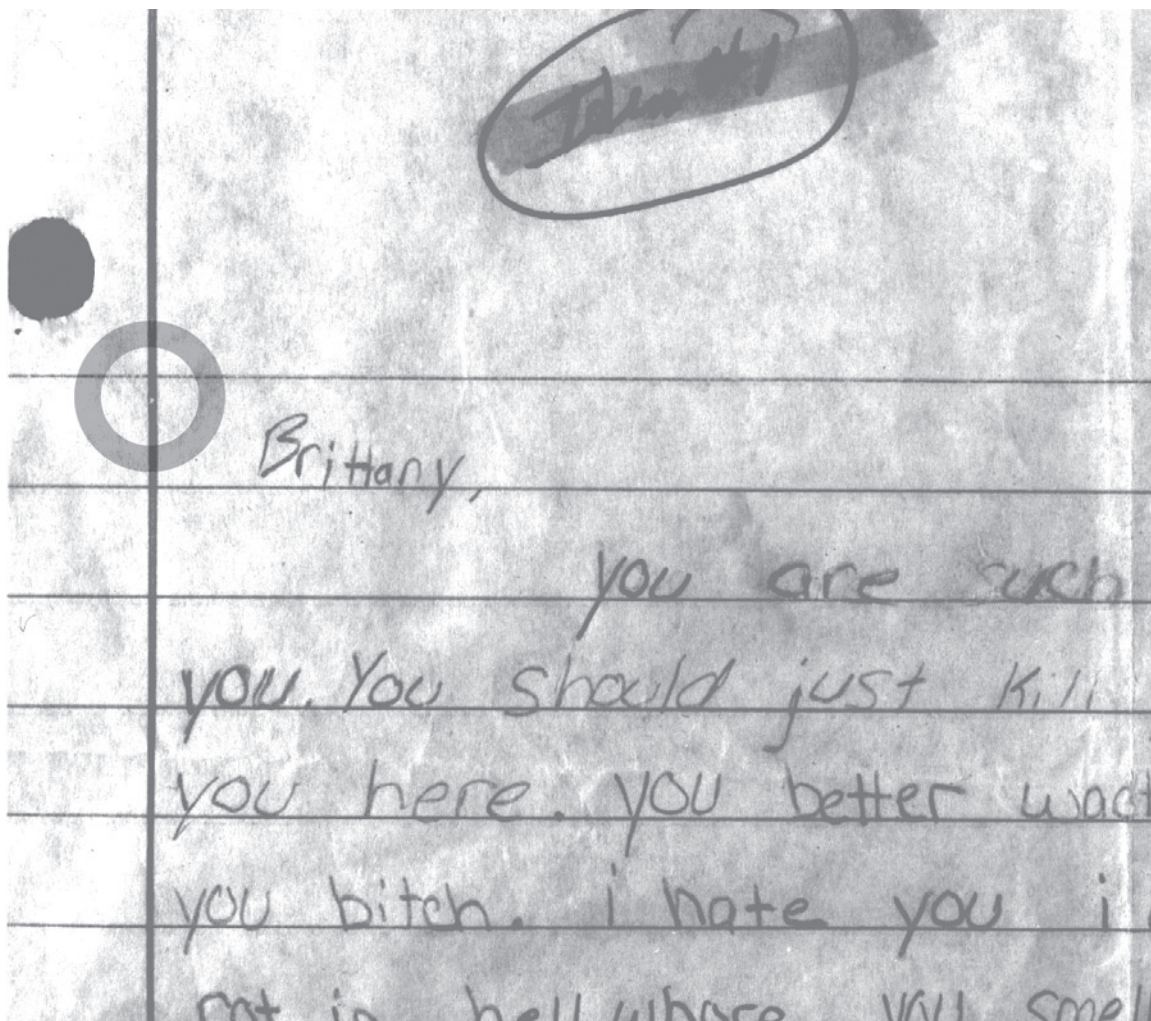


Figure 1B. Close up of printing defect on questioned letter (see circled area).



Figure 1C. Extreme close-up of printing defect on questioned letter.

When the victim's similar notebook paper was more closely examined the same defect was observed in some of the margin lines. The defect also was not in registration for these sheets. An overview of a sheet of collected paper and close-up of the defect are shown in Fig. 2A-B. The investigator was contacted and briefed regard-

ing the likelihood that the victim had written the threatening letters, and the fact that she was the only person who had used similar notebook paper. The defect, and its significance, was also discussed. Subsequently, the victim was re-interviewed and admitted writing the letters to herself.

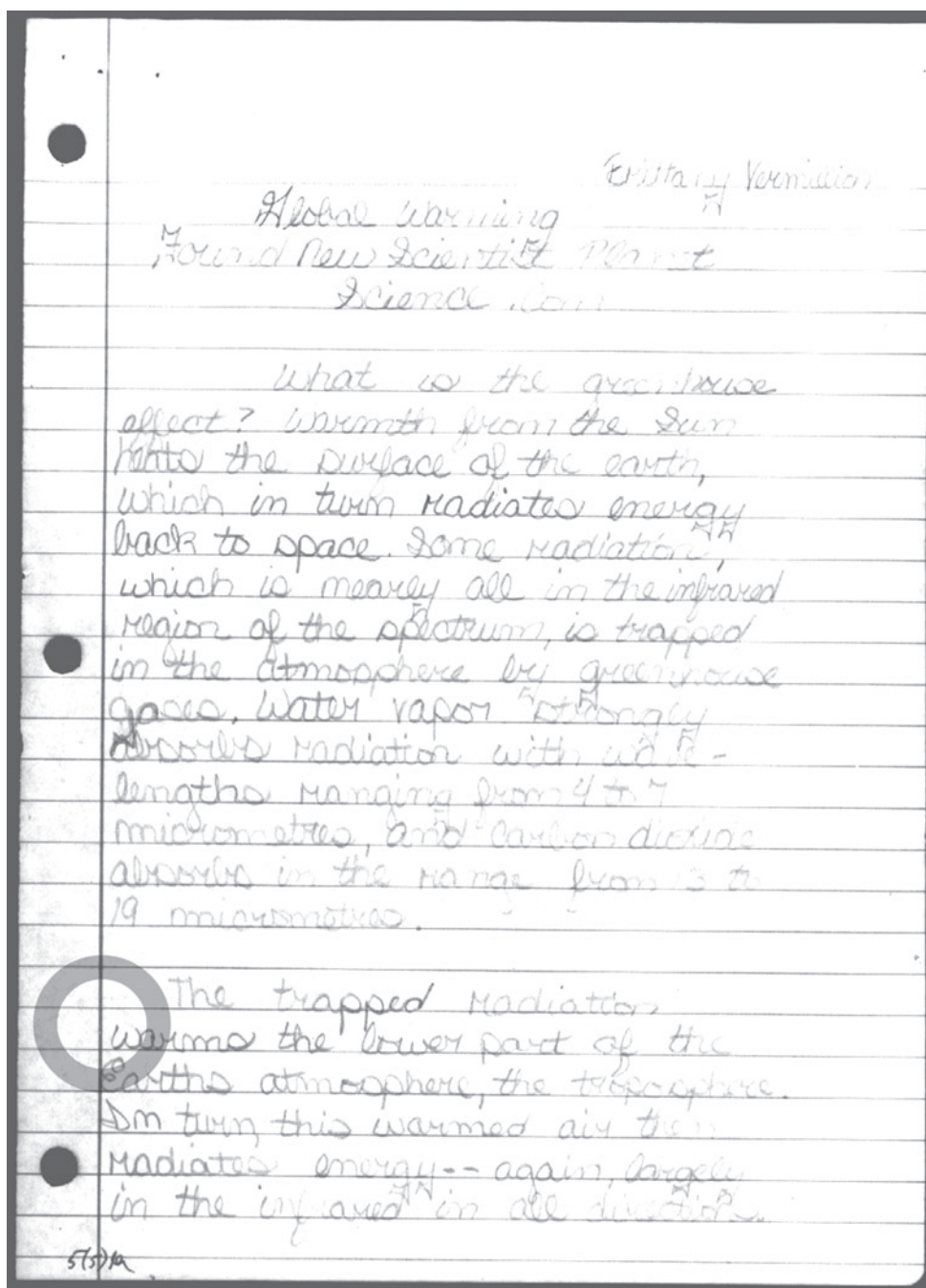
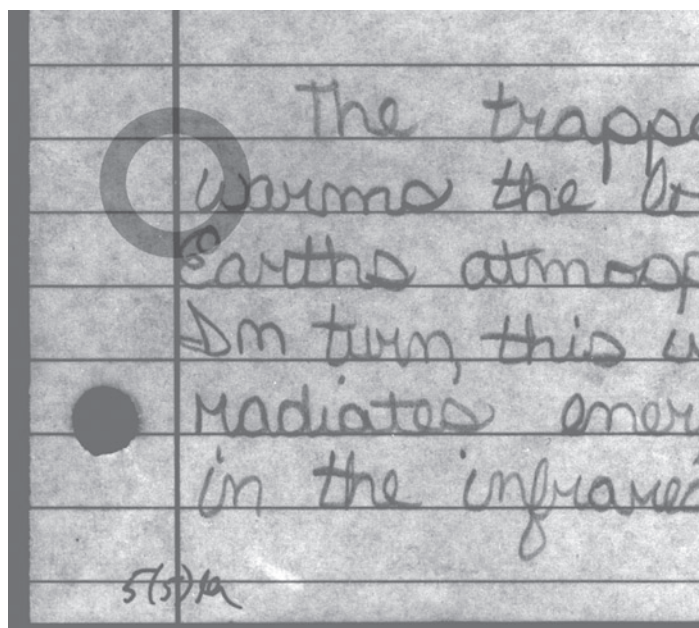
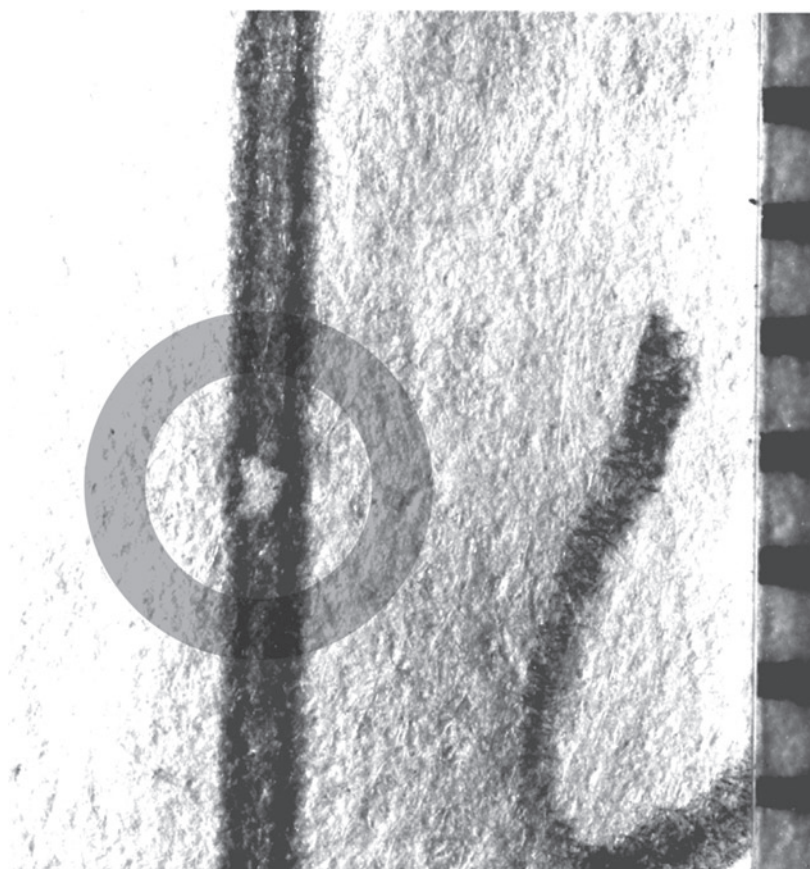


Figure 2A. Overview of entire paper from suspect's notebook.



Close-up of printing defect.



Extreme close-up of printing defect.

Figure 2B. Close-ups of printing defect on paper from suspect's notebook.

Case #2

A submission was received from central Virginia involving a bomb threat at a local high school. The threat was written with a wide-tip yellow marker on three-ring notebook paper. A student had found the threat in a school telephone booth and brought it to the attention of school officials. The student had previously exhibited behavioral problems and was considered a suspect when he turned in the note. School officials had seized the student's notebook and a yellow marker in his possession at that time.

Dictated hand printing from two suspects was submitted for comparison to the note. There were indications one of the suspects did not write it; but the other (the student who found the note) could neither be identified nor elimi-

nated as the writer. The note was examined for indented writing, however nothing was located.

Four sheets of blank notebook paper were removed from the suspect's notebook and submitted for comparison to the questioned note. Not surprisingly, they were similar. Specifically, they were all about 8" x 10.5", with one red margin line along the left side and 33 blue horizontal lines. Each sheet was loose, and had not been part of a spiral or bound notebook. There was a printing defect consisting of a "break" in line 24 of the questioned threat about 1/2" from the right edge. This defect appeared on two of the collected sheets in the same exact registration. An overview and close-up of the defect as depicted on the questioned threat and on a sheet of collected notebook paper is shown in Figure 3A-C.

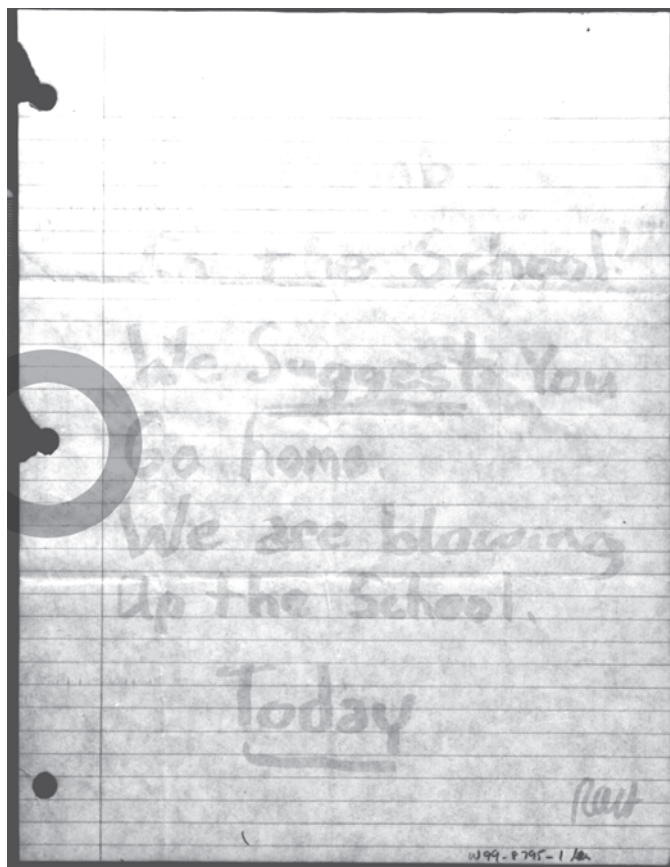
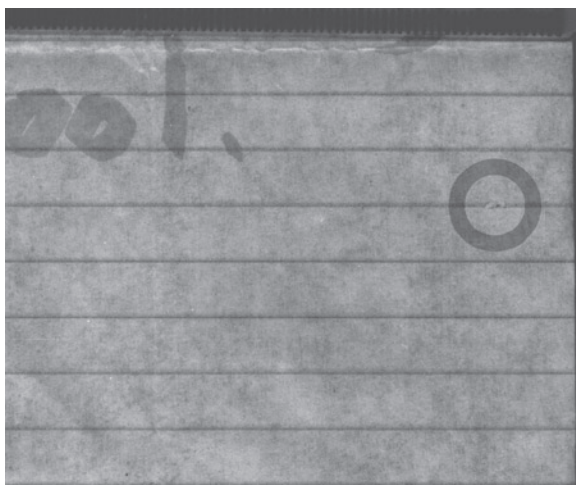
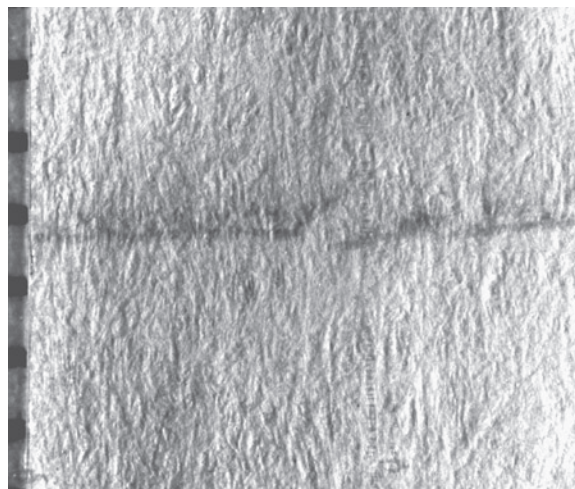


Figure 3A. Overview of entire questioned bomb threat paper.

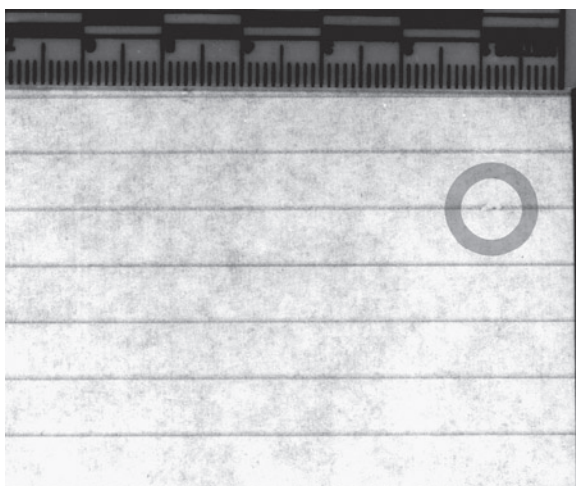


Close-up of printing defect on questioned note.

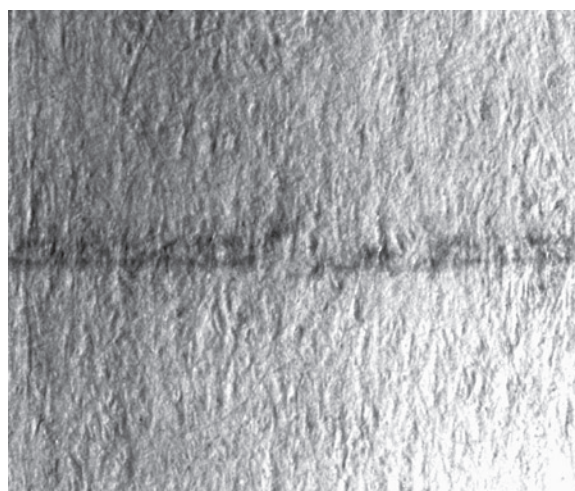


Extreme close-up of printing defect on questioned note.

Figure 3B.



Close-up of printing defect from suspect's notebook paper.



Extreme close-up of printing defect from suspect's notebook paper.

Figure 3C.

In addition was the fact that the questioned note had been torn from the notebook and two cone-shaped bits of paper were missing from the top two punch holes. Subsequently, several bits of paper found inside the suspect's notebook were examined and one of them was matched to the center punch hole of the note (Figure 4).

The investigator was contacted and briefed regarding the significant findings. The printing defect, and its significance, was also discussed. The suspect was re-interviewed and admitted writing the bomb threat.

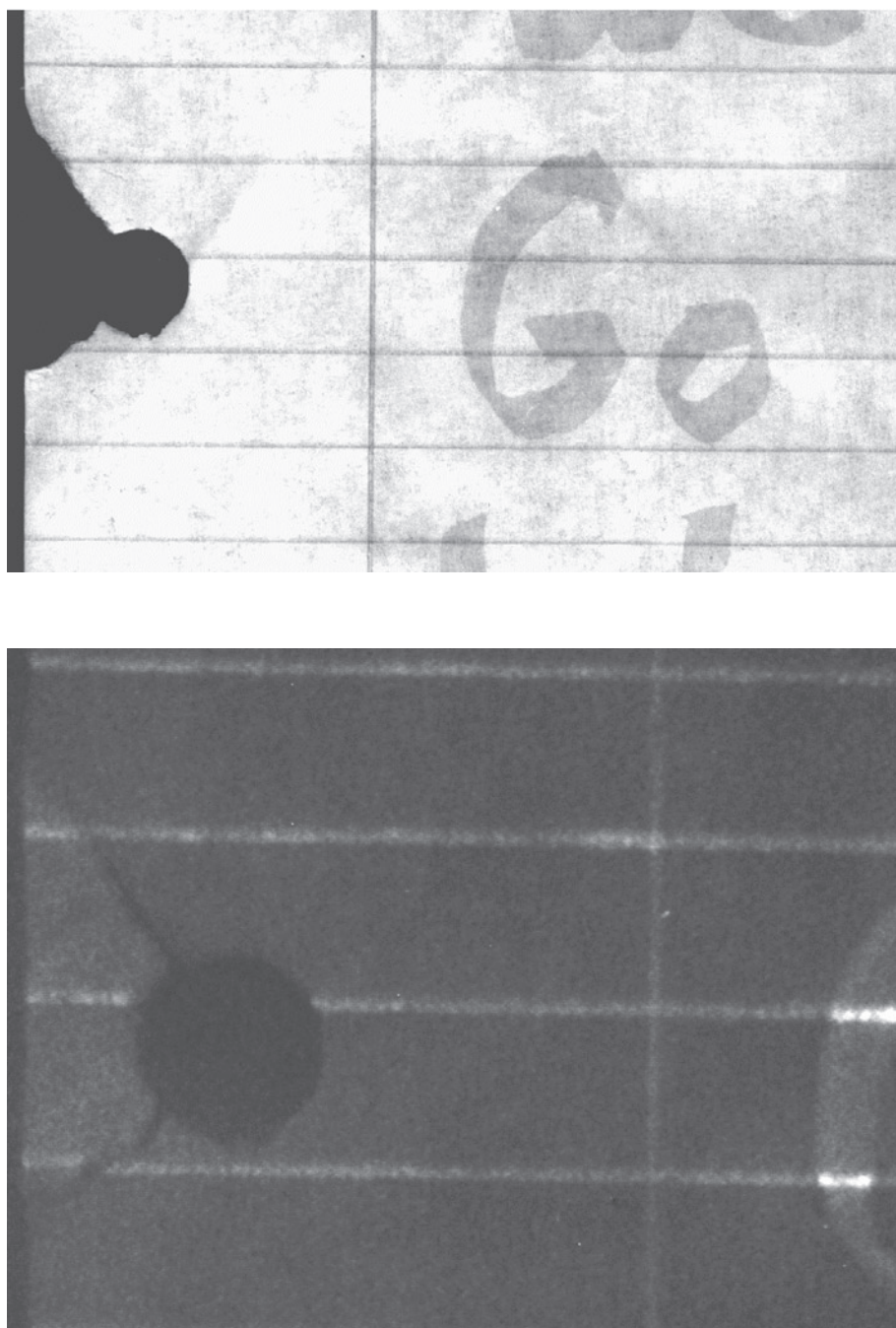


Fig. 4. Close-up of edge match from questioned note (top) to a piece retrieved from suspect's notebook (bottom).

Summary

There are dozens, maybe hundreds, of different types and sizes of notebook paper in today's market. The fact that a suspect uses the same brand and type of paper that was used as a medium for a questioned document is significant. If both papers have the same printing defect in the margin line or faint line it is that much more significant.

A margin line cylinder with a 15" circumference will place a defect on about three of every five sheets within a particular row of continuously printed paper, since the length of five sheets on a continuous run is about 55" (five sheets times 11") and the defect will be printed every 15." Given a three-up run, the 10 sheets in the other two rows will not have any defects. Thus, defects would appear on about three of every 15 sheets (about 20%). A five-up run would be about three of 25 sheets (about 12%). A nine-up run would be about three of every 45 sheets (about 7%).

A faint line defect should appear on every successive sheet in a run. Given a three-up run, the two sheets in the other two rows will not have any defects. Thus, defects would appear on one of every three sheets (about 33%). A five-up run would be one in five (20%); a nine-up run would be one in nine (about 11%).

In the two cited cases, printing defects were significant evidence that helped solve the case. Hopefully this paper has shed a little bit of light on how and where the defects will occur, as well as to how significant they could be.

Acknowledgments

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