

## CASE REPORT

Nicholas Petraco,<sup>1</sup> M.S.

### Trace Evidence—The Invisible Witness

---

**REFERENCE:** Petraco, N., "Trace Evidence—The Invisible Witness," *Journal of Forensic Sciences*, JFSCA, Vol. 31, No. 1, Jan. 1986, pp. 321–328.

**ABSTRACT:** This paper reviews the use of microscopic trace evidence in actual casework. Three cases are discussed in which the microscopic analysis of trace evidence was used to: associate the people, places, and things involved in the incident; reconstruct the event; and describe the occupation(s) of the participants. Each case is discussed in detail from the initial stages of the investigation through the use of the trace evidence during the investigation and at the trial.

**KEYWORDS:** criminalistics, trace evidence, microscopy

The use of the microscope and microscopic methodology for the examination of trace evidence in criminal cases has a long-standing history of success. Despite the many notable cases cited in the literature [1–5], in times past, the microscope has met with declining influence in the crime laboratory for the study of trace evidence. An article written several years ago discusses, in detail, the reasons for the microscope's loss of prestige in the past four decades [6]. This same article goes on to point out that, currently, there is a "resurgence of interest" in the use of the microscope as an analytical tool in the crime laboratory. In support of this resurgence, this author believes (even in this day of highly advanced laboratory instrumentation) that the microscope, especially the polarized light microscope, is the most important and versatile instrument available to the criminalist for the study of trace evidential materials. To substantiate this belief, and more importantly, to encourage further the use of microscopy in the crime laboratory, three criminal cases will be cited in which the microscope and trace evidence played a vital role in solving the cases.

#### Case 1

On a cold winter's day in February 1978, a female was found in the alleyway of an east Harlem tenement. In close proximity to the body was a California florist flower box and a plastic liner. The decedent was identified as a member of a well-known church. She was known to have been selling church literature in the buildings that surround the alley in which the body was discovered. The detectives investigating the case forwarded the flower box, plastic liner, and the decedent's clothing to the forensic science laboratory. On the box and liner were found tan wool fibers, red acrylic fibers, and navy blue wool fibers (all identified by polarized light microscopy). The three types of questioned fibers were compared microscopically with the

Received for publication 19 Feb. 1985; accepted for publication 3 June 1985.

<sup>1</sup>Detective, New York City Police Department, New York, NY.

decedent's clothing. All three were found to be consistent in all respects to the textile fibers composing the decedent's clothing (tan wool overcoat, navy blue wool/polyester blend slacks, and red acrylic sweater), thereby associating the woman with the flower box and liner. In addition, light blue nylon rug fibers and several brown-colored rabbit hairs were found on the box and liner. Similar light blue nylon rug fibers and rabbit hairs, as well as red colored nylon rug fibers, were found on the decedent's tan wool overcoat. Neither the rabbit hairs, nor the nylon rug fibers, could be associated with the victim's environment (her clothing or residence).

All this information was conveyed to the field investigators. Upon further inquiry in the neighborhood, the investigating officers learned the identification of a man who had, the day after the body was discovered, sold a full length, brown-colored, rabbit hair coat to a local man. The investigators obtained the rabbit hair coat from the purchaser. The hair composing the coat was compared microscopically to the questioned rabbit hairs found on the victim's wool coat, and the flower box liner. The specimens of questioned rabbit hair were found to be consistent in all physical and microscopic characteristics to the rabbit hair composing the suspect's coat (see Fig. 1). Armed with this information, the police now had probable cause to obtain a search warrant for the suspect's apartment.

In the suspect's apartment two rugs were found. One was colored light blue and the other was red in color; both rugs were composed of nylon fibers. Samples of each rug were collected by the crime scene unit and forwarded to the forensic science laboratory for comparison with the questioned rug fibers found on the victim's clothing, the flower box, and plastic liner. Both the questioned and known rug fibers were found to be consistent in all respects. The presence of light blue nylon rug fibers, red nylon rug fibers, and brown-colored rabbit hairs on the flower box, plastic liner, and woman's clothing enabled the author to make associations between the woman, flower box, and liner found in the alleyway with the suspect and his apartment. The various associations made possible by the trace evidence are shown in Table 1.

Further inquiry about the suspect was made in the neighborhood by the investigating officers. A witness was located who stated he saw the suspect carrying a large California flower box a day or two before the body was discovered.

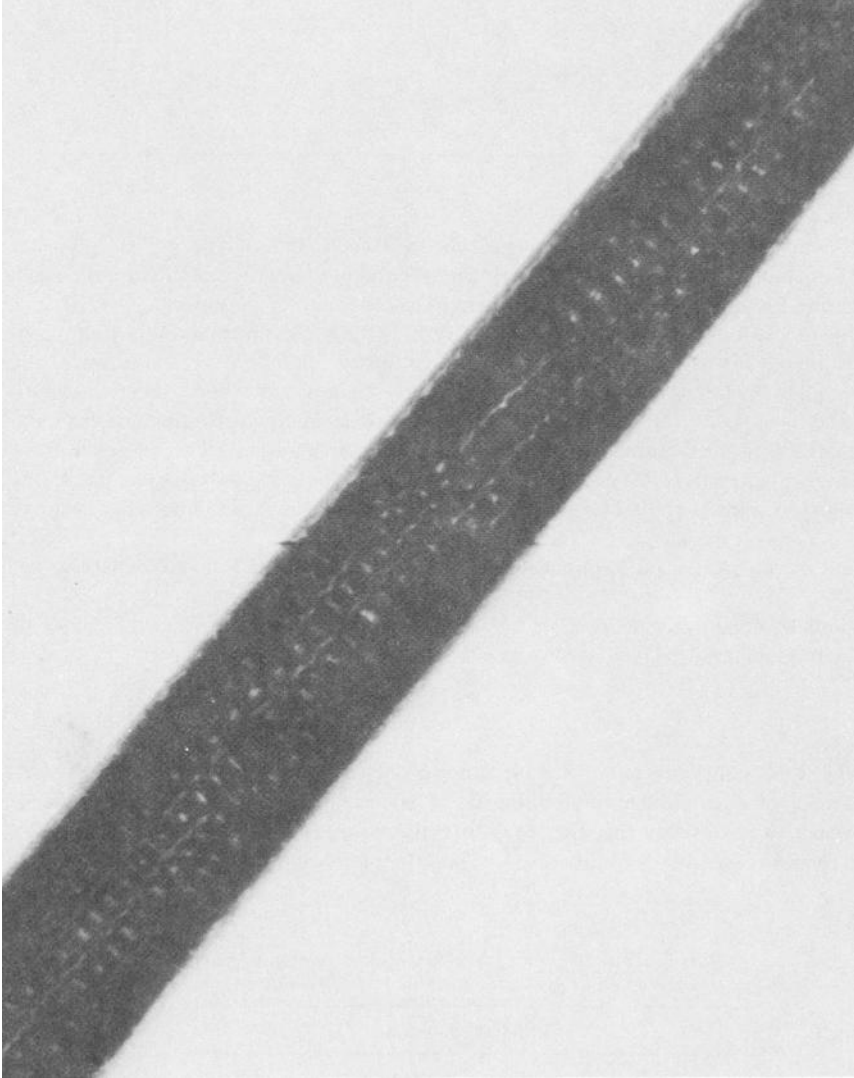
From the evidence it was theorized that the woman was killed in the suspect's apartment, placed in the flower box, brought up to the roof of the building in which the defendant resided, and thrown off the building into the alley below. On the basis of all of this evidence, the suspect was arrested, indicted, and tried for murder in the second degree. After two trials, at which extensive testimony (three days) about the trace evidence was given by the author, the defendant was found guilty of murder in the second degree, and subsequently sentenced to life imprisonment.

This case demonstrates the kinds of associations that can be made by trace evidence between people, places, and things. Another form of information which can often be obtained from trace evidence is describing the occupation or environment of the principals in a case. The next case is a good example of how this information can be useful in a real-life situation.

## Case 2

In June 1978, the body of a young woman, in her twenties, was found in a parking lot in midtown Manhattan. Black fibrous material was found in the victim's hands by the medical examiner. Microscopic examination of the black fibers revealed a blend of synthetic fibers which consisted of 80% modacrylic fibers, 15% acrylic fibers, and 5% polyester fibers. A search of the victim's husband's van, which was found in New Jersey, produced similar looking tufts of black fibrous material. Although the van's interior had been recently cleaned and stripped of its carpeting, black fibers were found on a wooden plantholder, which the husband used in his floral business, and in the samples of vacuum sweepings, which were collected from the rear of the van.

Polarized light microscopic analysis of the black fibers found in the van revealed the pres-



*FIG. 1—A photomicrograph of the similar rabbit hair from the suspect's known rabbit hair coat (top left) and the questioned rabbit hair found on the victim's coat (bottom right).*

TABLE 1—*A list of the various associations made between the people, places, and things involved in the case.*

Association Made From	People		Places		Things	
	Victim	Suspect	Alley	Apartment	Liner	Box
Textile fibers from victim's clothes	...	...	...	...	X	X
Trace fibers from victim's clothes	...	X	...	X	...	...
Suspect's coat (rabbit hair)	X	...	X	...	X	...
Suspect's apt. (nylon rugs)	X	...	X	...	X	X

ence of a blend of synthetic fibers consisting of 80% modacrylic, 15% acrylic, and 5% polyester fibers. The comparison of the black synthetic fibers found in the victim's hands and the black synthetic fibers found in the van disclosed them to be consistent in all respects.

During the investigation, a question arose concerning the victim's husband's previous occupation. Although he was now employed in the florist industry, it was believed that he was at one time involved in the building industry, as a contractor. The investigator also wanted to know if the van had been used to transport building materials. Polarized light microscopic examination and analysis of the vacuum sweepings removed from the van disclosed the presence of the following trace materials which could be associated with the building industry (see Table 2).

Although the items in Table 2 do not conclusively prove the occupation of the van's owner or user, they do at the very least provide a strong indication. At the trial, both the black fibers and particulate matter were used to implicate the woman's husband and his accomplice in her death.

Occasionally, unequivocal association between people, places, and things can be made by trace evidential materials. The following case is an example of such an occasion.

### Case 3

In the early morning hours of 12 April 1982, atop a lonely roof garage on the westside of Manhattan, three men were found murdered. Each man had been shot once in the back of the head. A light-colored van was seen speeding away from the scene. Hours later, in a secluded alley street on the lower eastside of Manhattan, the body of a fully clothed woman was found lying

TABLE 2—*Trace materials found in the van's vacuum sweeping which could be associated with the building industry.*

Building Materials
Aluminum—brass chips
Dried adhesive compound
Fiberglass insulation and resin
Gypsum fragments (plaster)
Iron shavings and filings
Mica chips
Plate glass fragments
Red brick fragments
Wood chips and shavings (sawdust)

face down by two dog walkers. The woman had been killed in the same manner as the men on the roof garage.

The condition of the woman's body, and other evidence, made it apparent that she had been shot at the garage, and then transported to the alley.

An eyewitness to the incident stated that he saw a man shoot a woman and place her in a light-colored van. The gunman then chased down the three men who were coming to the woman's aid, and shot each one of them. Days later, the prime suspect to the killings was arrested in Kentucky, in a black-colored van.

Numerous items of evidence (over 100) were collected from the van, and forwarded to the New York City police laboratory for examination. Among the items of evidence forwarded were three sets of vacuum sweepings from the van's interior.

An autopsy of the woman produced several items of trace evidence that were removed from the victim and forwarded to the author for microscopic examination. The woman's clothing was also received by the author for trace analysis.

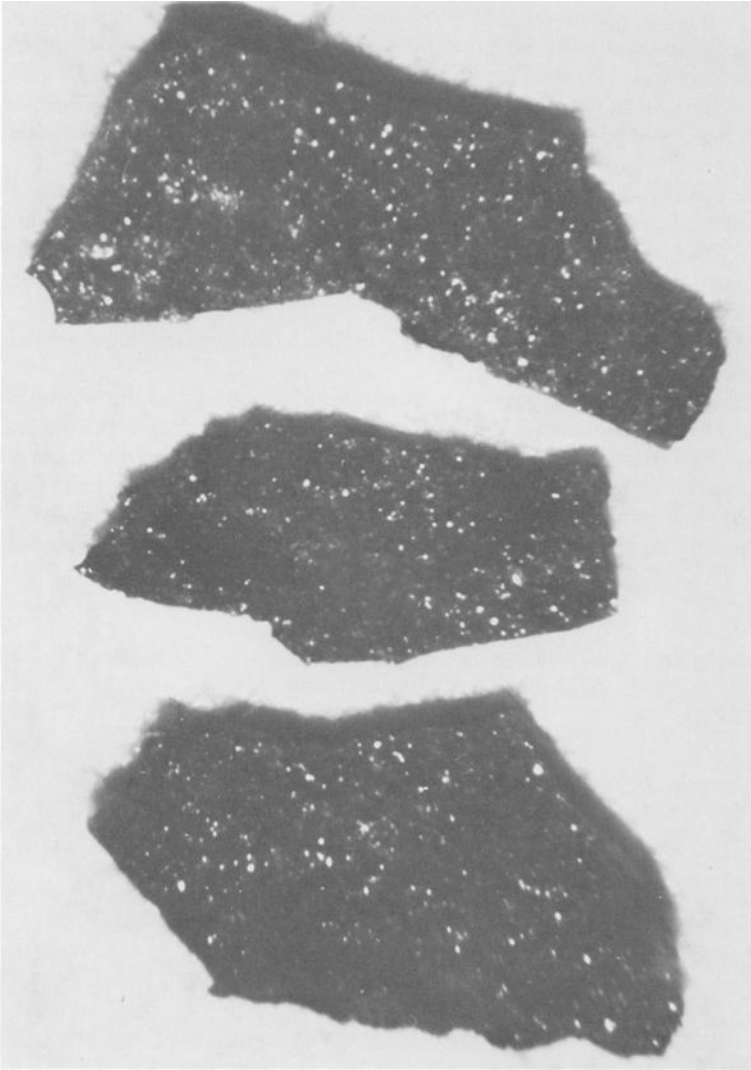
A prime question that arose during the investigation was: could the woman's body, which had been placed in a light-colored van at the garage, and later left in an alley on the lower east-side, be associated with the black van recovered over 1000 km (600 miles) away from the scene? Microscopic analysis and comparison of the trace evidential materials found on the victim and inside the van made this association possible.

Listed in Table 3 are all the items of similar trace materials that both the victim and the van had in common.

Microscopic comparisons of the questioned human head hair present on the victim's clothing were made with known samples. Ten of the brown-colored and gray-colored caucasian head hairs from the victim's blazer were consistent in microscopic characteristics to the defendant's known head hair sample. One chemically treated head hair found on the victim was consistent in microscopic characteristics to the known head hair sample obtained from the defendant's wife. One forcibly removed, brown-colored, caucasian head hair that was found on the

TABLE 3—*Items of similar trace evidence that were recovered from both the victim and the van's interior.*

Trace Evidence	Source	
	Victim	Van
White seed	mouth	sweepings
Paint chips gray metallic/black	hair and wool blazer	sweepings and floor
Sawdust	hair, blazer, and sheet	sweepings and misc. items
Glass fragments clear amber green	wool blazer and sheet	sweepings and misc. items
Cellophane	wool blazer	floor
Urethane foam	wool blazer	sweepings, misc. items and foam mattress
Blue olefin plastic	skirt	floor
Dog hair brown/white white	wool blazer	sweeping and misc. items
Human hair brown gray	wool blazer	hair brush, sweepings, and misc. items



*FIG. 2—A photomicrograph of the matching paint chips from the victim (center) and the suspect's van: (left) a standard from the van's floor and (right) a sample from the vacuum sweepings.*

rear door of the van's interior by the Kentucky state police was found to be consistent in all characteristics with the decedent's known head hair sample.

Microscopic comparisons of the white- and brown/white-colored dog hair from the victim's clothing, and the van's interior, were made with known samples of dog hair obtained from a dog owned by the defendant's nephew, the van's previous owner. The questioned dog hairs were found to be consistent with the hair from the nephew's dog.

The white seed that was recovered from the victim's mouth by the medical examiner, and the white seed that was found in the van's sweepings by the author, were forwarded to an internationally known botanist for identification and comparison. During the trial, the botanist testified that the two seeds were identical in all respects, and that although he could not identify the seed, both were either from the same species of plant, *if not the same plant*, probably a rare wild flower.

Sixteen gray metallic/black-colored paint chips from the victim and her clothing were compared to the gray metallic/black-colored paint removed from the van. Samples from the questioned and known sources were examined and compared by microscopic, chemical, and instrumental means. All of the paint specimens from the van and from the victim were found to be similar in all respects (see Fig. 2).

The remaining items of trace evidence from the victim and the van were examined and compared microscopically, and where necessary, by chemical and instrumental methods. Each of the remaining types of trace evidence from the victim was found to be similar to its counterpart from the van.

Blue- and black-colored flakes of acrylic paint were found in the van's sweepings, and on the suspect's sneakers. No blue- or black-colored paint flakes were found on the victim or her clothing. During a crime scene search of the defendant's residence in New Jersey, a large quantity of blue- and black-colored acrylic paint was found in the garage. It was apparent from the evidence present in the defendant's garage that a large rectangular shaped object had recently been painted with blue- and black-colored paint. The blue and black paint flakes from all the sources and the known blue (undercoat) and black (topcoat) paint from the van were compared by microscopic, chemical, and instrumental means. All the samples of paint were found to be consistent in every respect.

At the trial, extensive testimony concerning the collection, examination, identification, and comparison of the trace evidence from the victim and the van was given by the author, over a two-day period. When questioned about the source of the trace evidence found on the victim and her clothing, the author stated unequivocally that the trace evidence on the victim was from the defendant's van. On the basis of this evidence and other circumstantial evidence, the defendant was found guilty of all charges and sentenced to 100 years in prison.

## Conclusion

The importance of the microscopic analysis of trace evidence in criminal cases cannot be overemphasized. As shown by the cases offered here, the information obtained can be used to help reconstruct the incident; describe the occupation(s) of the principals in the case; and describe the scene(s) or location(s) as well as associate the people, places, and things involved in the event. A powerful witness indeed, and one which is barely used by our criminal justice system. It is the author's sincere hope that this paper, by showing the practical use of the microscopic analysis of trace evidence in casework, will encourage further the current resurgence of interest in the use of microscopy for the study of trace evidence in the crime laboratory.

## References

- [1] Locard, E., "The Analysis of Dust Traces. Part III," *American Journal of Police Science*, Vol. 1, 1930, pp. 496-514.

- [2] Palenik, S., "Microscopic Trace Evidence—The Overlooked Clue, Part I. Albert Schneider Looks at Some String," *The Microscope*, Vol. 30, 2nd Quarter, 1982, pp. 93-100.
- [3] Palenik, S., "Microscopic Trace Evidence—The Overlooked Clue, Part II. Max Frei—Sherlock Holmes with a Microscope," *The Microscope*, Vol. 30, 3rd Quarter, 1982, pp. 163-169.
- [4] Palenik, S., "Microscopical Trace Evidence—The Overlooked Clue, Part III. E. O. Heinrich—The 'Wizard of Berkeley' Traps a Left-Handed Lumberjack," *The Microscope*, Vol. 30, 4th Quarter, 1982, pp. 281-290.
- [5] Deadman, H. A., "Fiber Evidence and the Wayne Williams Trial (Part I)," *FBI Law Enforcement Bulletin*, Vol. 53, No. 3, March 1984, pp. 12-20.
- [6] Palenik, S., "Microscopy and the Law," *Industrial Research/Development*, March 1979, pp. 85-88.

Address requests for reprints or additional information to  
Nicholas Petraco  
New York Police Department  
235 E. 20th St.  
New York, NY 10003