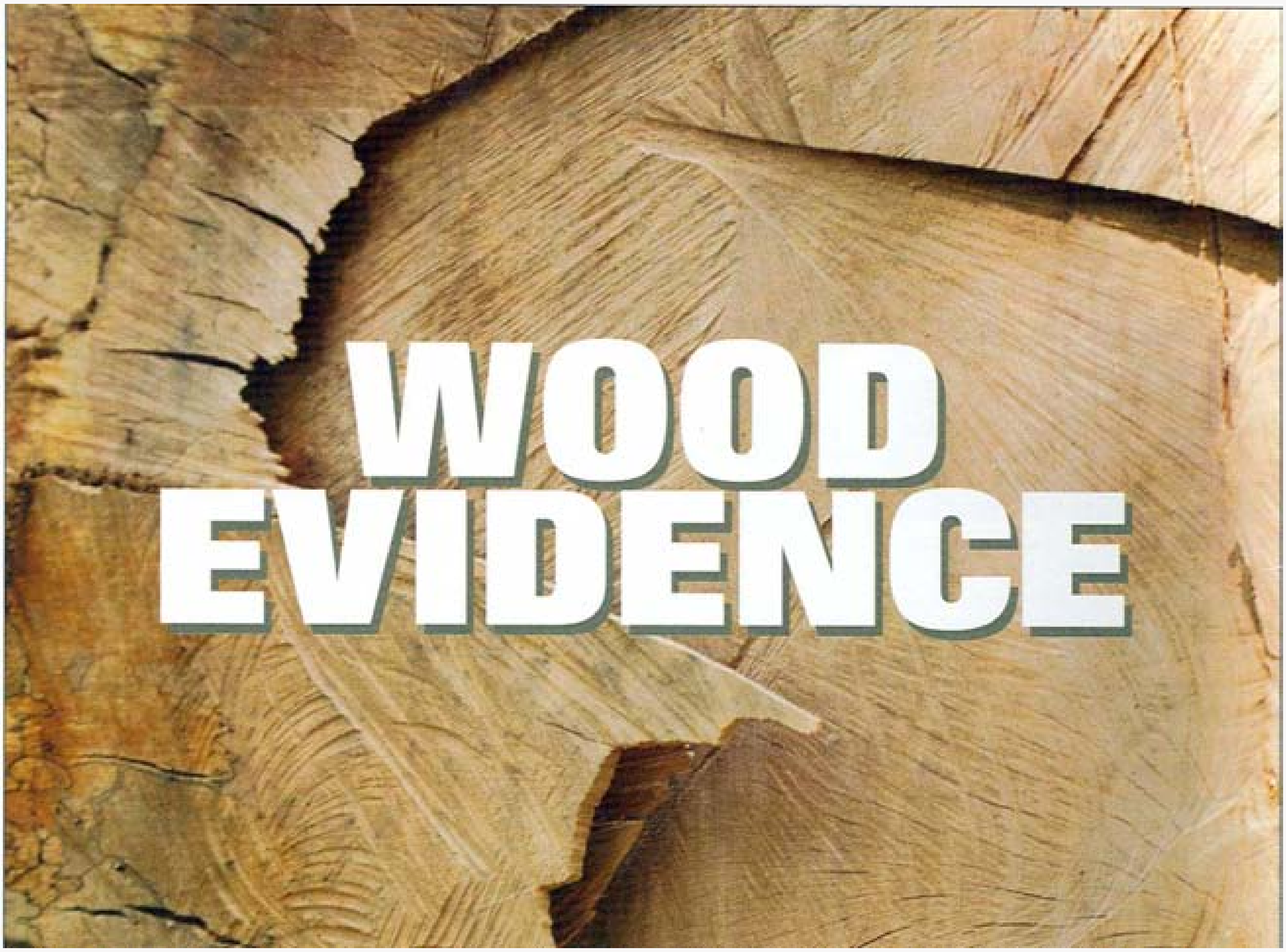

Proper collection, documentation, and storage of wood evidence from a crime scene

Written by Alex C. Wiedenhoeft, Botanist

WOOD CAN BE FOUND at crime scenes in many forms: as a murder weapon, as material used to hide a body, or as trace evidence from forced entry or vandalism. In the course of my work at the Forest Products Laboratory, Center for Wood Anatomy Research, I have been part of several forensic investigations that were adversely affected by inappropriate procedures used to collect, document, and store wood evidence. This did not result from carelessness on the part of crime-scene personnel, but rather from a general ignorance of what can, cannot, should, and should not be done with wood evidence. This article offers suggestions for maximizing the scientific and evidentiary potential of wood found at crime scenes.

Understanding how to collect, process, and store wood evidence requires some basic knowledge about wood, trees, and how wood evidence can be ruined.

First, of roughly 18,000 different woody species in the world, only a few hundred are commonly used commercially in wood products, and even fewer grow in any particular area. Under ideal circumstances, the botanical limits of wood identification hover between the species level and the genus level; you won't find a respectable wood anatomist confirming an exact relationship between two specimens on the basis of microscopic wood structure alone. "This chip undoubtedly came from that tree" won't be heard in a courtroom without other significant observations contributing to the inference. For evidence from a crime scene, which is often far from ideal, the botanical limits of wood identification may be even less specific. The botanical identity of a piece of wood, however, is not the only information that wood evidence may have to offer.

The physical condition of the wood may be critical: Is it a small, machine-cut piece of wood or a ragged splinter broken from a larger piece? Does it show saw-tooth marks on the cut ends or other telltale marks of human processing? Such details were important in analyzing wood evidence at the site of the Lindbergh kidnapping in the 1930s.

In addition to physical characteristics, the biological condition of the specimen can be important: Does the wood show clear signs of decay, or is it sound? Are insect holes present in the specimen? Is it from the center of a tree or from near the bark? Is it a branch, stem, or root? Does the specimen show heartwood, sapwood, or both? Is reaction wood present? Can anything be done with tree-ring matching?

Crime-scene personnel cannot be expected to have the expertise to answer all these and other possible questions. Such work is best reserved for a wood expert. But your wood expert's ability to make these determinations in the laboratory will depend in large part on details attended to in the field–quality of the sample collected, accuracy of notes and photographs made at the time of collection, and proper storage and maintenance of the specimen so it arrives at the lab in the most representative condition possible.

In an ideal world, your wood expert would assess the evidence at the crime scene, but that is rarely an option. Preserving the specimen in place–without removing it from its immediate context–is desirable but also not often possible. (The wood evidence shown in *Figure 1* represents an exception. In this case, being able to leave the specimen in place was beneficial to the investigation.)

The next best thing to leaving a specimen in place for examination is to record as much information as possible about each piece of evidence. In the case of wood, much of the story is immutable in the specimen, provided that it is stored correctly. However, a few properties–most notably odor and color–will change with time in storage or because of exposure to the elements. The odor of a freshly cut or recently broken sample of wood can be quite pungent compared with the same sample after a few hours of exposure; crime-scene personnel should carefully document their observations if the odor is particularly notable. Color can change, particularly if the wood becomes significantly wetter or drier or if it is exposed to the sun; color should be recorded photographically at the crime scene. Prior exposure to the elements is most easily estimated by crime-scene personnel–field notes on parameters including temperature, recent rainfall, and overall exposure of the site can save

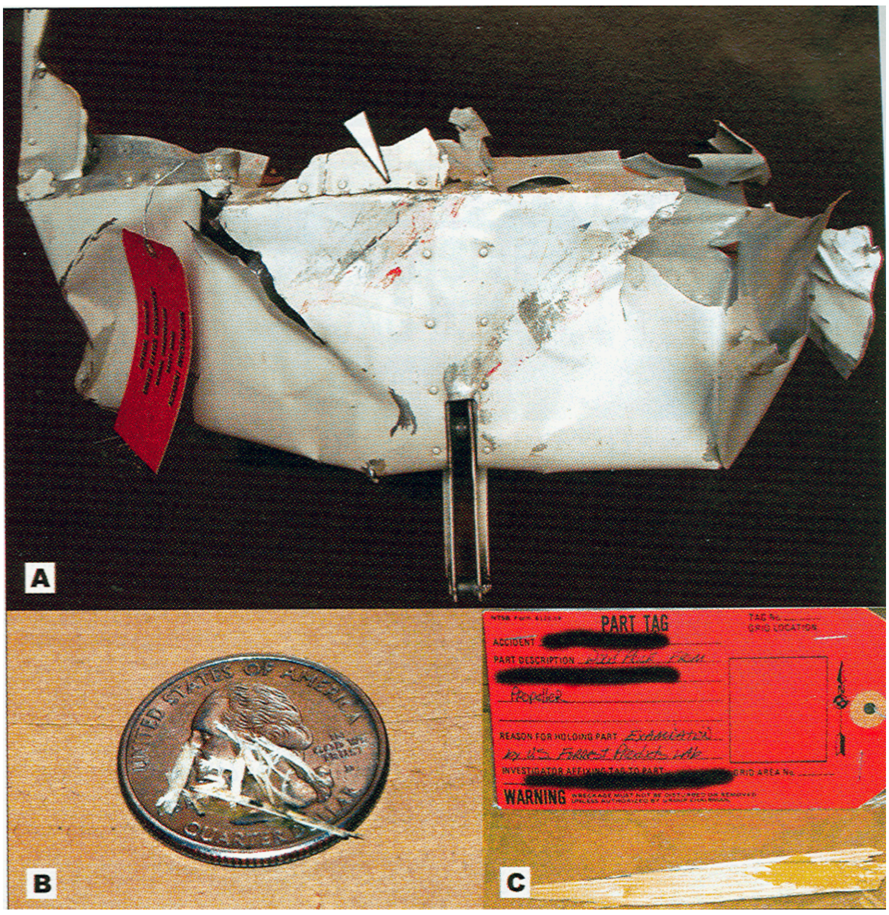

Figure 1–*Wood evidence from a mid-air collision between two airplanes. The portion of the plane submitted (A) held small pieces of wood evidence (B) under a metal flap(arrowhead in A). A piece of the wooden propeller of another plane (C) provided a reference sample.*

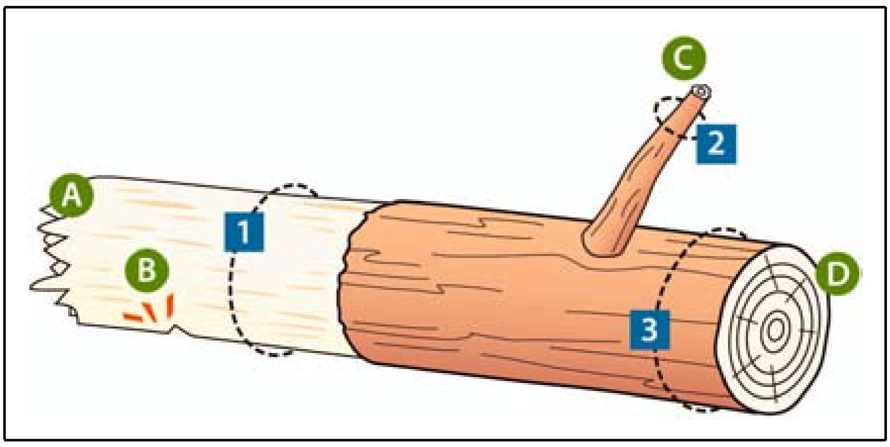

Figure 2–*Sketch of a log used to cover the body of a stabbing victim at the scene of the stabbing. The broken end of the log (A) was bare of bark and showed fresh mechanical injuries (B). The broken end of a branch (C) and the saw-cut end of the log (D) had both bare wood and bark; the cut surface (D) retained marks from the saw used to make the cut. Numbers indicate planes of cut suitable for producing samples containing all four principal features: Cut 1 will provide Features A and B as a single sample and also a record of the full cross-sectional dimensions of the log at this end. Cut 2 will provide Feature C and will include both wood and bark samples. Cut 3 will provide Feature D, a record of the cross-sectional dimensions of log at this end, and both wood and bark samples.*

a great deal of research time when the evidence is processed in the laboratory.

How wood evidence is sampled by crime-scene personnel should be governed by the type of evidence found. Photographs and notes are critical in tracking individual samples of evidence. When possible, keep the entire specimen. When this is not possible, crime-scene personnel should take one or more samples of the specimen, based on the condition and type of wood. When samples are taken, photographs (before and after) and/or sketches are critical to documenting sample locations.

Crime-scene personnel must sample appropriately, according to the type of wood evidence on hand:

- ❑ **Large piece of solid wood, lumber, branch, root, or trunk–**Take a “cookie” (i.e., a disk cut across the entire piece that will represent the full cross-sectional dimensions of the member); keep broken or saw-cut ends and, if present, samples of bark (*Figure 2*). With large specimens, crime-scene personnel must carefully observe the entire specimen prior to taking samples, lest a critical portion of the specimen–such as feature B in *Figure 2*–be left at the scene.
- ❑ **Multiple small pieces–**Collect and track each specimen separately. Do not mix many separate pieces together in the same container, which could confuse the analysis. For example, if multiple types of wood are present, any useful information that might come from correlating type and position would be lost by storing the pieces in the same container.
- ❑ **Sawdust or shavings that are finely or widely dispersed–**Gather them together and store them in a single container. When it is impossible to reasonably track separate small specimens, or it is obvious that all the specimens were dispersed at the same time or in the same action, compiling them into a composite specimen is appropriate.

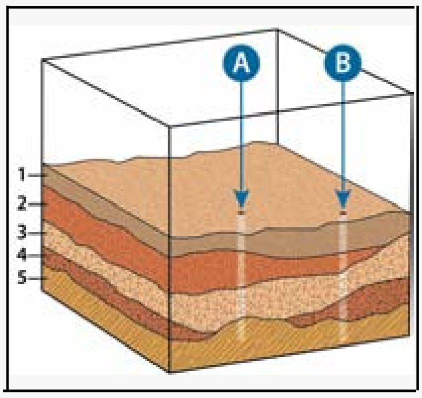

***Figure 3–**Illustration of several uneven layers or horizons of sawdust or shavings in a container. If crime-scene personnel sample vertically through the full depth at A, the sample will contain four horizons (1, 2, 3, and 5). If they do so at B, it will contain five horizons (1 to 5). Local depletions of material in a container may occur due to its use in another application (such as an incendiary device) by the suspect, and thus taking a sample in the same place the suspect removed material could lead to a failed match. Collection of multiple samples, if not the entire container or its contents, could prevent this.*

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- **Sawdust or shavings** in a container should be sampled at different depths and in different locations in the container. A storage container may contain spatial variability corresponding to the addition of different materials at different times, and these materials may not be uniformly distributed throughout the container. *Figure 3* shows an instance where non-uniform contents could influence the results of a laboratory analysis.

- **Decayed and sound wood** should be collected from the same piece, if relevant. Decayed wood is more difficult to identify because of erosion by fungi of some of the cellular features used in identification. The presence of certain types or patterns of fungal decay, however, can be useful in matching specimens. Thus, the best policy is to collect both sound and decayed wood, each into separate containers, and then record appropriate notes, photographs, and drawings to indicate the origin of the specimens.

Once samples or entire specimens have been taken from the scene and packaged, they must be handled and stored appropriately. For example, storing small, fragile specimens in a hard-bodied container will prevent them from being crushed, and they must be packed inside the container in such a way that they do not rattle themselves apart during transport.

Perhaps the most important part of wood specimen storage, however, is the control of moisture. As a biological material, wood can be adversely affected by other living organisms, specifically decay fungi, mold, and insects. In most cases, none of these organisms will grow, feed, or develop if the wood is kept dry. When wood evidence collected at a crime scene is wet, there are two options for storage: freezing the evidence or drying it.

- Samples that will be stored wet must be wrapped tightly in plastic wrap, sealed in airtight containers, and placed in a freezer. This treatment will keep the moisture in the sample and prevent biological degradation.

- Samples to be dried can either be exposed to open air in a normal laboratory or office setting and allowed to dry somewhat slowly or be placed in controlled conditions to determine the rate of drying. Samples should not be dried in an oven, because rapid drying will generally introduce cracks in the wood that may reduce its value as evidence. If a sample is to be dried, its weight should be recorded immediately after collection at the crime scene, after it has dried, and then again when it is removed from storage. Storage temperature and relative humidity should also be recorded with other information about the sample. These data could prove critical to a wood expert if an estimation of initial moisture content of the wood should be important.

For example, Feature B in *Figure 2* shows fresh mechanical injuries to the log inflicted by a sharp instrument. Given that the crime involved a stabbing, the knife used in the stabbing may also have made these marks in the log. Linking a particular knife to the marks in the log could play a significant role in the case, but correct analysis of the size and shape of the cuts and stabs in the log would depend on properly determining the moisture content of the log at the time of injury. Because wood shrinks or swells as it loses or gains moisture, a sample that dries during storage will be smaller than it was at the time of the crime, whereas the size of the knife blade would not change appreciably. Comparing the sizes of the knife blade and the marks in the log after storage could lead to the proper inferences only by using the careful notes recorded by crime-scene personnel.

Summary

Regardless of the crime committed or the form of the wood evidence, you can ensure that wood evidence is of high quality for your scientific experts if the proper procedures are used for collection, documentaton, and storage. The evidence can then be available to make the best possible contribution to solving the case.

In summary, wood evidence can take several forms, each of which requires special handling to maximize the potential contribution to the case. In most cases, wood can be stored dry or kept frozen when it is wet, with little degradation of its value as evidence.

This article has focused on the evidentiary potential of wood by means of physical and microscopic analysis. DNA identification of wood evidence is a developing field of science. Progress has been made in specific cases where the considerable costs–in terms of time and materials–have been justified, but DNA identification of wood evidence is not yet a well-developed or commonly used technique.

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About the Author:

Alex C. Wiedenhoeft is a botanist with the Center for Wood Anatomy Research at the United States Department of Agriculture Forest Service's Forest Products Laboratory in Madison, Wisconsin. Wiedenhoeft can be contacted by e-mail at:

acwieden@wisc.edu

For information on the Center for Wood Anatomy Research, go to:

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