IN-BRIEF
IPTES 2018 Workshop: Forensic Wood Identification

"Wood examination is one of the ever-shrinking specialty areas of trace evidence, and training in such areas is often difficult for individual laboratories to provide."

—Larry Peterson
Trace Evidence Examiner, Retired

Introduction

The Forensic Technology Center of Excellence (FTCoE), led by RTI International, is supported by a cooperative agreement with the National Institute of Justice (NIJ), award 2016-MU-BX-K110. The FTCoE supports the implementation of new forensic technology and best practices by end users, bridging the gap between the scientific and justice communities. One way the FTCoE accomplishes its mission is through hosting national meetings that bring together professionals spanning several areas of expertise.

The FTCoE hosted the Impression, Pattern and Trace Evidence Symposium (IPTES) on January 22–25, 2018 in Arlington, Virginia. This symposium brought together more than 600 practitioners and researchers to enhance information-sharing and promote collaboration among the law enforcement, legal, and impression, pattern, and trace evidence communities. Participants were able to engage in a variety of content, including keynote addresses, panel discussions, and poster and scientific sessions.

Prior to these general plenary sessions, the FTCoE hosted 13 interactive workshops spanning several topics, including firearm and tool mark examinations, probabilities and likelihood ratios in pattern evidence, and applied polarized light microscopy. This in-brief report highlights the Forensic Wood Identification workshop, which provided an overview of the topic and guided participants through hands-on exercises.

Objectives

- Provide an overview of wood identification, including commercial aspects, nomenclature, and forensic applications.
- Educate forensic scientists on the macroscopic and microscopic features of wood that are useful for identification.
- Guide participants through the sample preparation techniques necessary for successful wood characterization.
- Practice illustrated concepts on known and unknown wood samples.
- Discuss case examples and considerations for courtroom testimony.

Overview

Purpose

Trace evidence represents any small-scale material that could be changed or transferred from a person, object, or environment during the commission of a crime; wood examination is one specialty area of this forensic discipline. The purpose of this workshop was to provide scientists with little or no experience in forensic wood identification an overview of the topic. This workshop included lectures on the macroscopic and microscopic features that are useful for discrimination/classification, sample preparation techniques, and hands-on exercises. This hands-on approach was critical to ensuring that the participants learned both the sample preparation techniques and morphological characteristics needed for successful wood characterization.

About the Instructor

Larry Peterson retired from the Georgia Bureau of Investigation (GBI) with 30 years of experience in trace evidence examinations. After retiring from GBI, Mr. Peterson served more than 8 years with the Defense Forensic Science Center/U.S. Army Criminal Investigation Laboratory Trace Evidence Branch. His areas of expertise include hair, textiles, tape, glass, and wood examinations.

Summary of Workshop Material

Wood Structure

The term 'wood' refers to the cellular structure inside the bark and cambium layers of tree trunks. Wood is comprised of several types of tubular units, or cells, that are bound together. Two major divisions of wood exist: softwood and hardwood. These terms refer only to the density of trees and serve to classify their reproductive system. Although all trees reproduce by seed production, the seed structure varies between softwoods and hardwoods.

Softwoods, or gymnosperms, have needle-like leaves and produce seeds in cones. Hardwoods, or dicotyledon angiosperms, have broad leaves and produce seeds in fruits. The cell structure of softwoods consists primarily of long conductive cells called tracheids. Some softwoods have occasional resin canal pores. Hardwoods have numerous pores called vessels which act as conductive cells and fibers that provide support (**Figure 1**).

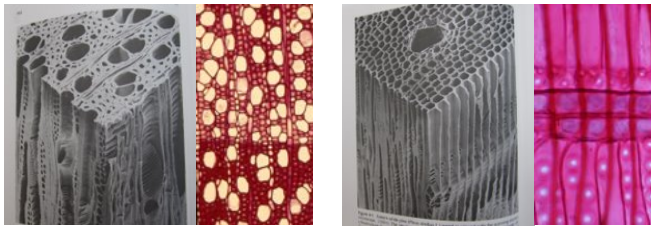

Figure 1. The cellular structures of hardwood (*left*) and softwood (*right*). B&W images produced by a scanning electron microscope. Colored images shot using reference slides. Images taken from the workshop presentation.

Identifying Known and Unknown Samples

The identification of an unknown wood fragment can be accomplished in two ways: 1) through a physical match with a known sample or 2) through an examination of its macroscopic and microscopic features. These wood fragment examinations can help to determine if the unknown fragment originated from the same type of wood as the known sample.

Workshop participants examining wood fragments.

Macroscopic features include color, grain, and growth ring structure. Microscopical examinations allow for the separation of even small fragments of wood through the observation of cell substructure. The variation of morphological features within both hardwood and softwoods allows for genus and sometimes species identification depending on sample size and condition. A microscopical examination begins by preparing small cross, radial, and tangential sections of a larger piece. Samples are then placed on glass slides and covered in a 1:1 mixture of glycerin and water (or ethanol). The slides are then placed on a heat block and allowed to boil. As the water boils off, the glycerin replaces the air in the cells allowing for observation of cell structure. The sample can be pre-stained with safranin or methylene blue to aid in the visualization of microscopic features. The observed features can be compared to reference slides, and/or a classification key may be used to identify the wood type.

Forensic Significance

As with other types of trace evidence, wood fragments can help reconstruct the events surrounding a criminal investigation. Through a comprehensive examination, an analyst can determine if an unknown fragment originated from the same type of wood as a known sample and possibly connect the two pieces via a physical match. This workshop provided participants with a foundation in forensic wood identification and illustrated how this type of evidence can be useful in casework.

Reference slides can aid in the microscopic characterization of an unknown fragment.

Further Reading and More Information

Mr. Peterson suggests the following resources on wood identification:

[1] Panshin, A. J., & de Zeeuw, C. (1980). *Textbook of wood technology* (4th ed.). New York City, NY: McGraw-Hill.

[2] Hoadley, R. B. (1990). *Identifying wood*. Newtown, CT: The Taunton Press.

[3] Esau, K. (1960). *Anatomy of seed plants*. Hoboken, NJ: John Wiley & Sons.

[4] Gibbs, N. (2012). *The real wood bible*. Richmond Hill, ON: Firefly Books.

[5] Jane, F. W. (1970). *The structure of wood* (2nd ed.). London, UK: A & C Black Publishers Ltd.

[6] Core, H. A. (1979). *Wood structure and identification* (2nd ed.). Syracuse, NY: Syracuse University Press.

[7] Parham, R. A. (1982). The *practical identification of wood pulp fibers*. Peachtree Corners, GA: TAPPI Press.

[8] Edlin, H. L. (1969). *What wood is that?.* New York City, NY: Viking Press.

[9] White, L. & Gasson, P. (2000). *Mahogany*. Richmond, UK: Kew Publishing.

[10] Forest Products Laboratory. (1999). *Wood handbook – Wood as an engineering material* (FLP-GTR-113). Madison, WI: U.S. Department of Agriculture, Forest Service.

[11] Wheeler, E., Bass, P., & Gasson, P. (1989). IAWA list of microscopic features for hardwood identification. *IAWA Journal*, *10*(3), 219–332.

For more information about the 2018 Impression, Pattern, and Trace Evidence Symposium (IPTES), visit https://forensiccoe.org/workshop/18-iptes/.

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