

Wood Identification

Reading endgrain with a hand lens

by Jon Arno

Wood identification is becoming increasingly difficult in today's complex and global lumber trade. Foreign species are especially troublesome, but with the popularity of terms such as "white woods," "spruce-pine-fir (S-P-F)" and "mixed hardwoods," the identity of even common domestic species is easily lost between stump and lumberyard.

Most woodworkers can identify a variety of woods by eye or by a combination of features, such as density, color, figure and even smell. But mistakes are inevitable, because almost every wood has a look-alike. However, the woodworker who really wants to identify domestic and exotic cabinetwoods can do so most of the time. For less than \$100, you can purchase the needed reference books (see references, p. 79). The only other requirements are a \$10 hand lens and a well-honed pocketknife. Although many woods are deceptively similar in outward appearance, under magnification, each species' anatomical structure, especially on the endgrain, will reveal the wood's unique signature or "fingerprint."

This system is not foolproof: Sometimes microscopic examination of individual cells, chemical analysis, ultraviolet tests and years of training are needed to identify a species. In some cases, not even the most advanced technology can prevail. For example, several species are sold as "white oak," and science, as of yet, has no foolproof way of distinguishing these by examining the wood alone. Nonetheless, it's surprising how far a woodworker

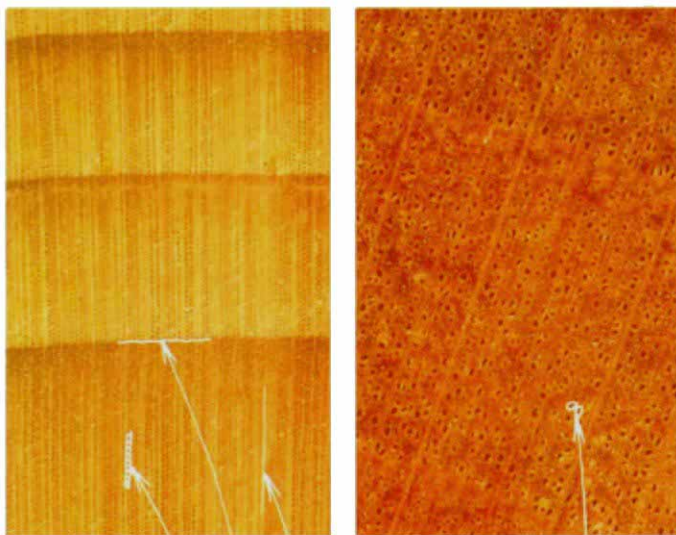
can get with just a hand lens and some reference material.

Any lens with a reasonably broad field of view and at least 10x power will do. I prefer a jeweler's loupe with a wide-angle 10x lens at one end and a higher-power 15x lens at the other. The 10x lens will bring into focus the full width of at least one annual growth increment (the wood between two annual rings), which allows for a quick appraisal of the pore patterns. The 15x lens can then be used to study finer details.

It's necessary to have an absolutely smooth-cut surface on the endgrain of the sample or the features will be blurred. The cut should span at least one annual growth increment. For cutting, some specialists rely on disposable blades, such as scalpels or heavy-duty razor blades, but a well-honed pocketknife will suffice.

The following tips will help: Once the surface is cut, touch it to your tongue or otherwise dampen it. This brings up the contrast and makes details easier to spot. Next, position the sample so it receives maximum light. Now, bring the hand lens up as close to the eye as possible so the field of view will be as wide as the lens can provide. Finally, move either the sample or your head until the scene is brought into focus.

You will see the wood's cellular structure in about the same way it appears in the photographs here. Let's start by distinguishing between softwoods and hardwoods, then we'll examine some of the more important cabinetwoods. Here are things to look for:



Balsam fir

A B C

Basswood

D

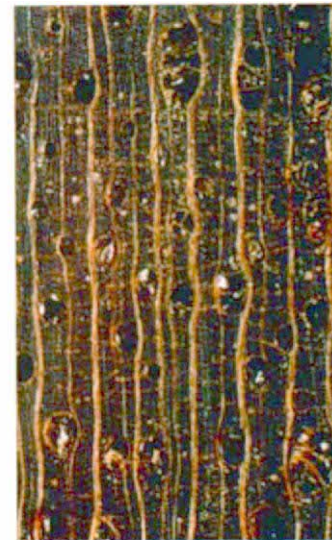
Softwoods and hardwoods are normally easy to separate. While some hardwoods are softer and lighter than most softwoods, their anatomical structure is quite different. The endgrain of a typical softwood, such as balsam fir (*Abies balsamea*), reveals a simple structure made up of very small fluid-conducting cells called tracheids (A), annual rings (B) and cells that grow horizontally out from the center of the tree, which form the rays (C). Basswood (*Tilia americana*) is actually lighter in weight than balsam fir. However, being a hardwood, its endgrain reveals a more complex structure including pores (D), which are the cross sections of specialized fluid-conducting structures called vessels.

Some softwoods, such as pine (*Pinus strobus*), have resin canals (A), which under low magnification look much like the pores in hardwoods. But pores in hardwoods are many times more plentiful than are the resin canals in even the most resinous softwoods. Compare pine to walnut (*Juglans nigra*): The greater anatomical complexity of a hardwood is readily apparent.



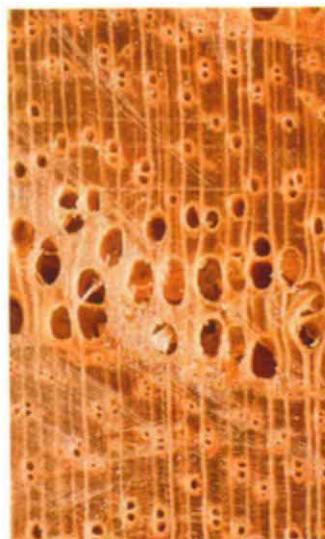
Pine

A



Black walnut

Hardwoods may be generally divided into ring-porous species, such as ash (*Fraxinus americana*), and diffuse-porous species, such as yellow poplar (*Liriodendron tulipifera*). However, many species are neither truly ring-porous nor diffuse-porous. To varying degrees, in most woods the pores are spread throughout the annual growth increment but tend to become smaller in the latewood, which is growth produced toward the end of the season. Moreover, in tropical regions, where growth occurs all year long, large and small pores may be spread throughout the wood in almost every pattern imaginable.



Ash



Yellow poplar

In most cases, an accurate identification is based on correctly appraising a combination of features. You must learn to read the entire signature. Take for instance elm (*Ulmus americana*) and hickory (*Carya ovata*): Both are more or less ring-porous (A), and both have light-color wavy bands in the latewood (B). Hickory is about half again as dense and heavy as elm, but a sample of hickory sapwood compared to elm heartwood could lead to confusion. Upon close examination, however, you can see that the light, wavy bands in hickory are formed by faint concentric rings of specialized storage cells called parenchyma, which are not associated with the latewood pores. In elm, these bands contain the latewood pores, making them bold enough to be easily seen with the naked eye. This feature, in combination with the fact that elm normally forms a single row of large, earlywood pores, helps to confirm the diagnosis. Furthermore, if the samples are fresh, elm will have a distinct, unpleasant odor, doubtless the genesis of the term "piss elm."

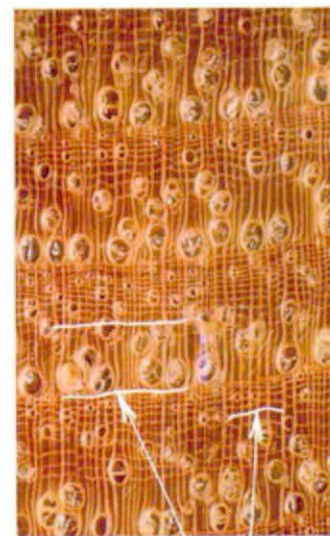
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Elm

A

B



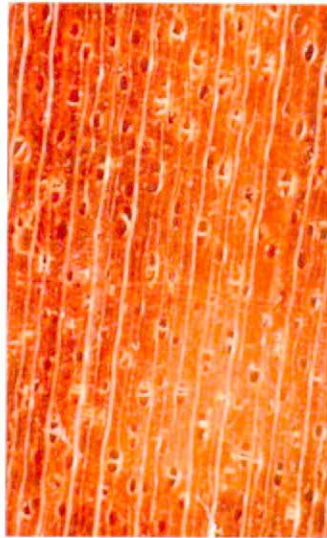
Hickory

A

B



Sugar maple



Black birch

Sugar maple (*Acer saccharum*) and black birch (*Betula nigra*) are two diffuse-porous, fine-textured woods with comparable color and density. Under hand-lens magnification, however, the rays on the endgrain of birch are narrower than the diameter of the largest pores; in maple, there are two sizes of rays and the wider ones are as wide as or wider than the largest pores. With a hand lens, separating birch from maple is easy, but distinguishing between the many species within a genus can be tricky, especially among the maples (*Acer*) and the birch (*Betula*).



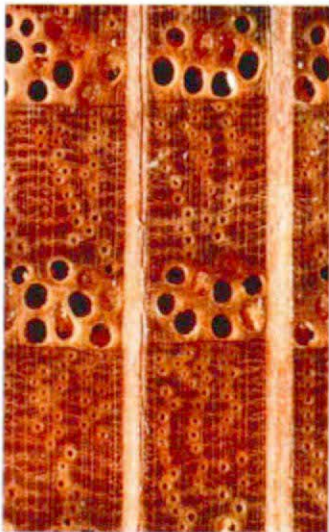
Honduras mahogany

A



Lauan

Because of the sheer number of species involved and the often confusing trade names being employed today, identifying imported woods is a special challenge. Perhaps the area of greatest confusion lies with the many woods that are marketed as "mahogany." The true mahoganies come from the genus *Swietenia*, of which Honduras mahogany (*S. macrophylla*) is the most common. Lauan (*Shorea spp.*), however, is often marketed as mahogany. These lauans are extremely variable in color and density, and there are some 70 species in the *Shorea*, *Parashorea* and *Pentacme* genera whose woods are intermingled in the lumber trade. Note that under the lens, the growth rings in true mahogany are highlighted by a thin band of light-color cells (A). This is usually visible on the tangential surface of the board as well, without magnification.



Red oak



White oak

Both red oak (*Quercus rubra*) and white oak (*Quercus alba*) are ring-porous woods with prominent rays. White oak, however, normally has lighter-color rays, and the latewood is denser, with many small pores. Red oak has fewer, but larger pores in the latewood. The pores of white oak are clogged with a foam-like substance called tyloses (A), while those of red oak are normally open. White oak can therefore be used to make watertight barrels, whereas red oak cannot.

Summing up—At first, resorting to a hand lens and studying reference books may seem complicated and downright academic, but it isn't that difficult. In much the same way that old-time woodworkers memorized the general characteristics of the woods they used, the hand-lens user begins to memorize the end-grain signatures of the more popular cabinetwoods. You'll find the whole process is actually fun. And, it's always pleasant to avoid the problems of mistaken identity that haunt all aspects of woodworking. For example, to edge-glue ash and elm together is one of the best ways to invite a warped tabletop or panel. Also, mixing spruce and pine can be a finisher's nightmare. These two soft, creamy white woods look very much alike in the raw state, but they don't stain the same.

As you develop your hand-lens skills, it's a good idea to develop your senses as well. Each time I work with an unfamiliar species, I study it thoroughly. I visually examine its color, texture and figure. I heft it and jam my fingernail into it to get a sense of its density. I even smell the fresh-cut sawdust to become familiar with its scent, which is often an important key to identification. Walnut, sassafras, catalpa, elm, cedar and many others have distinct odors that are hard to mistake. These odors are the product of complex and subtly unique volatile substances, which can be identified more exactly through chemical analysis, but your nose is often the only equipment you need.

I've had some old guys tell me that almost all woods have a scent, even those that we normally think of as being odorless. When the wood is moist or freshly cut, they can separate maple from birch or basswood and pine from spruce or fir on the basis of scent alone. Personally, my nose isn't that good, and while I do not challenge their honesty (they can in fact correctly separate samples of these species), I suspect their great skill is the product of other senses working in tandem. Through their eyes and hands, they are picking up other attributes, such as color, density, figure and texture, then instantaneously processing this input through a brain-based experience/memory program that would put a computer mainframe to shame.

The scientific community doesn't scoff at these skills; they are real and documentable. But this undisciplined approach has its limitations. Perhaps the most significant limitation is that you can never identify a wood you haven't studied or worked with before. While it might once have been possible for a woodworker to amass enough experience to recognize any wood he might encounter, there are so many species available in today's world market that learning them all would be virtually impossible.

As you gain more experience with wood identification, you'll find that the need to consult reference books and guides becomes less frequent and often is used only to make a final, confirming choice between two or three possible species. These "close calls" usually require an accurate and balanced appraisal of several features, including those not easily described in a book, such as color and odor. Because of this, I think it's essential to develop a collection of known wood samples. This starts by simply saving samples of each new wood you use, but it inevitably graduates to foraging through scrap piles at the local lumberyard and ultimately to joining organizations such as the International Wood Collectors Society (see references at right). The membership of the IWCS is worldwide, and the exchanging of wood samples is one of its founding purposes.

If the wood samples still can't help you decide the wood's identify, you can take the material to a wood technologist for microscopic examination. Most species can be identified by minute differences in the tissue, such as the surface texture of the cells or the way the cells connect to one another through valve-like

structures called pits. This method's degree of certainty begins to approach what you would call "beyond a reasonable doubt."

As you pursue the more technical methods of wood identification, the process begins to circle back on itself. By exploring wood's anatomical structure, you'll develop a far greater understanding of how the cellular arrangement affects the general appearance—texture and figure—of a species. This allows you to become conscious of which features are distinctive and which irrelevant. In like respect, a little book learning on organic chemistry strengthens the awareness of why woods have unique color and odor.

It would be irrational to suggest it is time for the typical woodworker to clear off a place on the workbench for beakers, vials, Bunsen burners and a microscope. After all, your basic senses can still get the job done with reasonable certainty. It's just that nowadays, in the species-glutted lumber trade, it takes a few reference books, a drawer or two of samples and a hand lens to give yourself a fighting chance. □

Jon Arno is an amateur woodworker and wood technologist in Schaumburg, Ill.

References

The books I use most often are:

Understanding Wood by R. Bruce Hoadley. The Taunton Press, Box 355, Newtown, CT 06470; 1980. Hoadley's book is an excellent place to start, presenting the basics of wood anatomy in an easily understood fashion. Fifty-four macrophotographs for major domestic species and a few imports are accompanied by clear, descriptive copy.

Wood Identification Handbook by Marshall S. White. Charles Scribner's Sons, 115 Fifth Ave., New York, NY 10003; 1982. This manual outlines the terminology of wood anatomy. It provides a fairly effective system for categorizing structural patterns and recognizing key details. The woods covered are limited to commercial woods of the eastern United States.

The Wood Handbook for Craftsmen by David Johnston. Prentice Hall Press, 200 Old Tappan Road, Old Tappan, NJ 07675; 1983. This book is currently out of print, but it may be available from libraries and used-book dealers. More international in scope, the book provides macrophotographs of approximately 100 species, including most major cabinetwoods imported into Europe and North America.

Textbook of Wood Technology by A.J. Panshin & Carl de Zeeuw. McGraw-Hill Book Co., 1221 Ave. of the Americas, New York, NY 10020; 1980. This text deals strictly with domestic species but covers the subject in complete detail. Macrophotographs are provided for virtually all native woods. This is one of the best references on the subject, but it is also very technical.

International Wood Collectors Society (IWCS), c/o Robert M. Bartlett, secretary/treasurer, 2913 3rd St., Trenton, Mich. 48183. The membership of IWCS is worldwide, and the exchanging of samples is one of its founding purposes.

A word about keys—Some reference books offer keys to guide the user through a series of "yes/no" choices until an identification is made. The keys create a trail configured something like a branching tree. You start at the bottom of the trunk, then when the tree first branches, you determine which branch to take by answering a relatively simple question, such as whether the sample is a hardwood or a softwood. From there you proceed to the next branching and the next question. The process eventually takes you to the tip of a twig and, hopefully, to the sample's identity.

In theory, this is fine, but judgement and experience are needed to answer many of the key questions. Just one wrong choice, especially early on, and you can find yourself trying to decide whether your sample is a date palm or a bullrush, when plainly it's neither.

Keys can be helpful if used with caution, but for my money, a hand lens is more accurate and easier. For positive results, either method should be confirmed by comparing the wood to a known sample. —J.A.