# The Identification of Timber

Timber has a variety of form which enables it to serve a variety of uses and contributes to its pleasing aesthetic appearance. However, the variability also means that there is lack of uniformity, which is a disadvantage when the timber is used for engineering applications and also means that a particular timber which is good for one purpose may not be as useful for a different one. Thus it is essential to know the species of the timber on hand in order to be sure that it is appropriate for its intended job.

Timber identification aims at naming the species of tree from which the unknown sample has been cut, thus providing a means of assessing much useful information about the timber which would otherwise be unavailable.

There are two basic types of wood:
1) Softwoods: are from trees of Sub-phylum Gymnospermae – Order Coniferales - the conifers. The trees do not have true flowers, seeds are naked (not enclosed in any way) and borne on a scale of a cone. Leaves are usually needle-like and evergreen.
2) Hardwoods: are from trees of Sub-phylum Angiospermae – Class Dicotyledae - the flowering trees – seeds are produced inside an ovary or fruit. Leaves are typically broad and flat.

The terminology; softwood/hardwood is somewhat misleading because some hardwoods have wood that is much softer than some softwoods and visa versa. For example, the wood of *Callitris* (cypress pine), which is technically a softwood, is quite hard whereas the wood of *Ochroma lagopus* (Balsa) which is technically a hardwood, is very soft.

**Softwoods** (produced by conifer trees) use tracheids to carry water up the tree and also to support the canopy. A tracheid is a hollow tube, sealed at the ends, and 10-30 µm wide (one quarter diameter of human hair) and 3-7 mm long. Tracheids are aligned axially in the tree and are interconnected to one another by bordered pits, which are apertures with a membrane, situated in the side walls of tracheid. Tracheids make up about 93% of the total volume of the wood. Rays are tissue aligned radially in the trunk. They provide radial conduction and storage of foodstuffs. Rays account for about 7% of the total volume of a softwood. See Figures 1 & 2.

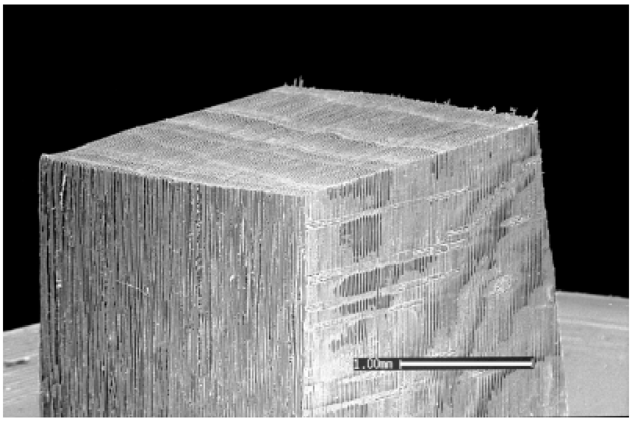



*Fig. 1. A small block of a softwood*
*The scale bar indicates 1mm*

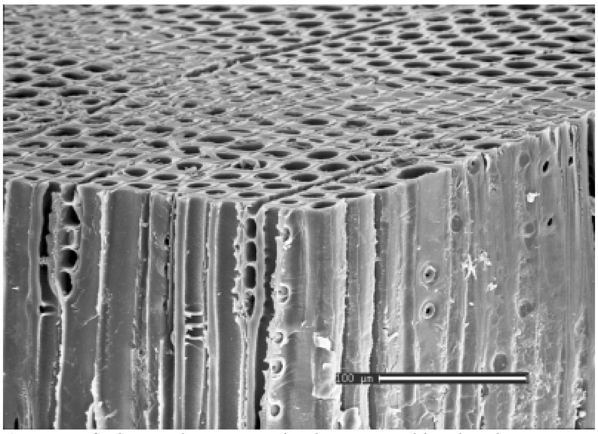



*Fig. 2. Magnified view showing tracheids, rays, and bordered pits*
*The scale bar indicates 0.1mm*

**Hardwoods** (produced by flowering trees) use vessels to carry water up the tree. Vessels are much wider than tracheids and the vessel elements are connected end to end to form a wide, hollow tube which can extend for several metres. Unlike the tracheids of softwood, they do not provide support for the tree canopy. Instead, canopy support is provided by fibres which are elongated, thick-walled cells used to give strength to the tissue in which they occur. Parenchyma cells are thin-walled cells which look soft against the main mass of fibrous tissue. Rays (radially-oriented tissue) provide radial conduction and storage.

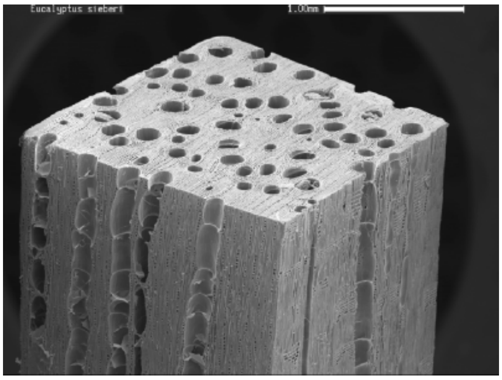



*Fig. 3. A small block of a hardwood*
*The scale bar indicates 1mm*

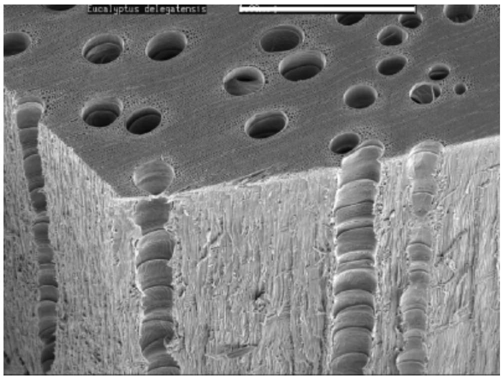



*Fig.4. Magnified view showing vessels and fibres.*
*The scale bar indicates 0.1mm*

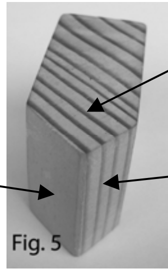
**Identifying timber** People who use timber continually, carpenters, builders, cabinet-makers become familiar with the timbers they use by observation of physical properties such as colour, odour, texture, figure, and density, and can often immediately identify the various types that they use. But these properties can be quite variable so are not reliable, and describing these features to others is mainly a personal matter since they can't be quantified.

Reliable identification of wood can be carried out by examination of its microscopic structural features and comparing the presence/absence, size, shape distribution and frequency of the various features with those of a known standard.

Viewing the microscopic characters of the wood can be carried out using the following tools:

- A magnifying glass which will give 4 to 20 times magnification - usually sufficient for hardwoods but not for softwoods
- A light microscope gives 5 to 400 times magnification and is the prime tool for wood identification
- Scanning electron microscopy (SEM) gives up to 100,000 times magnification, 3D views, no colour. But is expensive.

There are three basic planes to wood (Fig. 5):
The Transverse plane (TS) – the horizontal plane in the trunk
Radial longitudinal (RLS) – one passing through a radius of the trunk
Tangential longitudinal (TLS) – one at a tangent to the trunk




For best visibility of features present in the wood, sections for viewing should be cut in each of these three planes.

**Viewing the wood specimens**
Firstly, it is essential to note whether the timber is softwood (conifer) or hardwood (angiosperm) since hardwoods and softwoods have entirely different distinguishing features.

Important identifying features for softwoods:
* In woods from regions with strong seasonal differences, there are noticeable seasonal changes between the  tracheids that form the latewood and the earlywood whereas in woods tropical regions, tracheid size is basically the same throughout the growth ring.
* Presence of resin canals - present in *Pinus*, *Larix* (larch); *Picea* (spruce) and *Pseudotsuga* (douglas fir)
* Bordered pit arrangement (uniseriate is common; multiseriate staggered in Araucariaceae; multiseriate opposite in Sequoia)

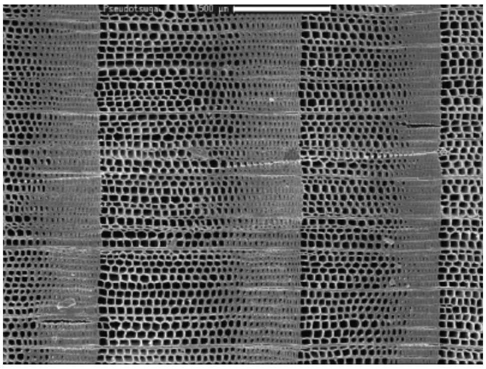


*Fig. 6. Transverse section of a softwood (Douglas fir) showing two complete growth rings. The scale bar indicates 0.5 mm*

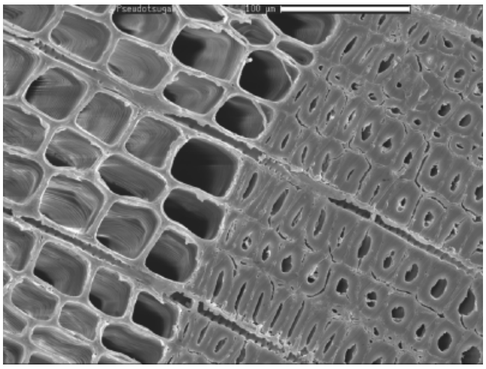


*Fig. 7. Magnified view showing earlywood (at left) and latewood on the right. The scale bar indicates 0.1 mm*

Important identifying features for hardwoods:
# In woods from regions with strong seasonal differences, there are obvious seasonal changes in vessel (pore) size e.g.*Ulmus* (elm)
# In woods from tropical regions, vessel (pore) size is often the same throughout the growth ring
# Vessels (pores) can be solitary or can be clustered into "radial multiples" (usually 2 – 4 together)
# Pore groups can be distributed evenly or arranged in radial, diagonal lines, or tangential lines.
# Parenchyma cells (soft tissue) – There are many patterns formed by soft tissue which are useful for identification

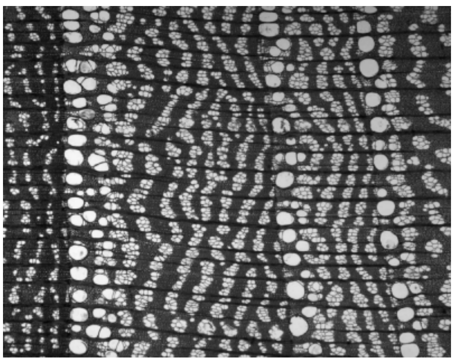


*Fig. 8. A TS section of Ulmus (elm) wood showing definite seasonal change in vessel size in the two complete growth rings*

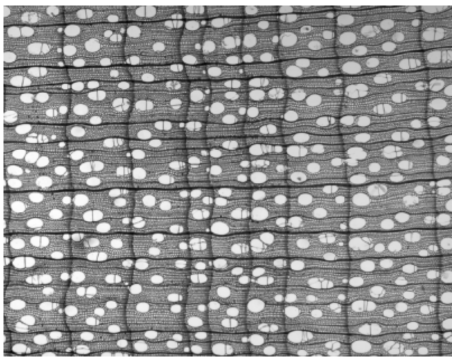


*Fig. 9. A TS section of Betula (birch) wood showing no seasonal changes in vessel size in the eight complete growth rings*

**Making use of the data**
With the physical, and visual information of the wood features on hand, two main procedures are used to identify a timber:

1) Compare the salient features of the sample with published drawings, photographs, or textual descriptions
   CSIRO Atlas for hardwoods has photos of 1800 species, (4 photos of each species) However, it takes a long time to look through a book with species arranged in alphabetical order looking for a particular set of features.

2) Use a card index system.
   In 1933 Clarke produced a card for each species of timber and put all the features of that species on the card. All possible features ware represented by a hole, and the hole was notched if the feature was present in that particular species. The features could be sorted by using a thin steel rod. The use of these cards proved very useful in New Guinea during World War 2.The number of features used in card keys was limited by the number of holes that could be fitted around the perimeter of the cards.

The modern equivalent of the punched card sorting system is a computer program which can sort through the equivalent of thousands of cards in milliseconds. The system can be made available on a PC or accessed via the internet. There is no limit to the number of features that can be represented. An example is the internet-based "IAWA list of features for hardwood identification" which is a wood identification key that can also illustrate features, pertinent literature references as well as identify species. Address for the key is:

http://insidewood.lib.ncsu.edu/search.0;jsessionid=94e7430435d6b0ee8107293221b8

A total of 5,590 hardwood species are listed in this key.
The key comes complete with images of features present in individual species.

Computerised keys have undoubtedly made the identification of both common and uncommon timbers easier. With modern computing methods and by combining systematic examination of a timber's structural, physical and chemical properties it may be thought that it will one day be possible to identify any timber specimen that comes to hand. However, in spite of all the advances in microscope technology, as more and more data on the various features of different timbers becomes available, and as it becomes easier to process these large amounts of data, it becomes clear that this is a false hope, and we will never be able to differentiate between some timbers of closely-related species because they are not different enough to make them individually distinct. Even today, most Eucalypt species can often only be identified to group, e.g. gum, ash, bloodwood etc. There is also within-tree and between-tree variation, differences between trees grown within and outside of their native conditions, and human error in identifying timber features to contend with. In general, timber identification is not an exact science, there is always variation.

One day it may be possible to use DNA technology to identify timber. It isn't practical yet because extracting DNA from wood cells is very difficult (wood is made up mostly of empty dead cells) and it was once thought to be impossible. However, according to several internet sites, it is now feasible but still being actively researched.