

# **Wood Anatomy & Identification Slideshow**

Developed by:

Lee Stover

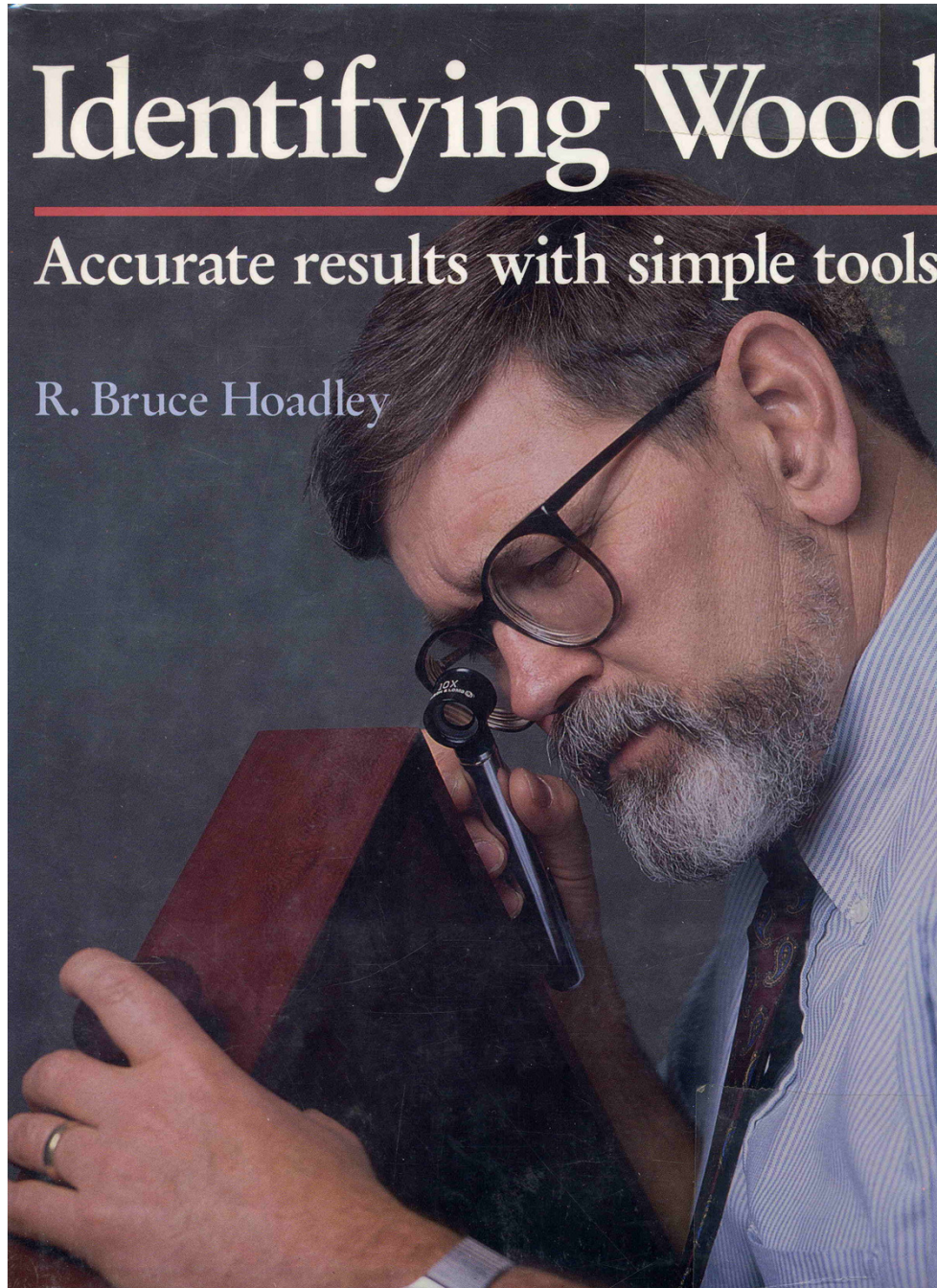
Photos from: *Identifying Wood* (R. B. Hoadley)

# Identifying Wood

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Accurate results with simple tools

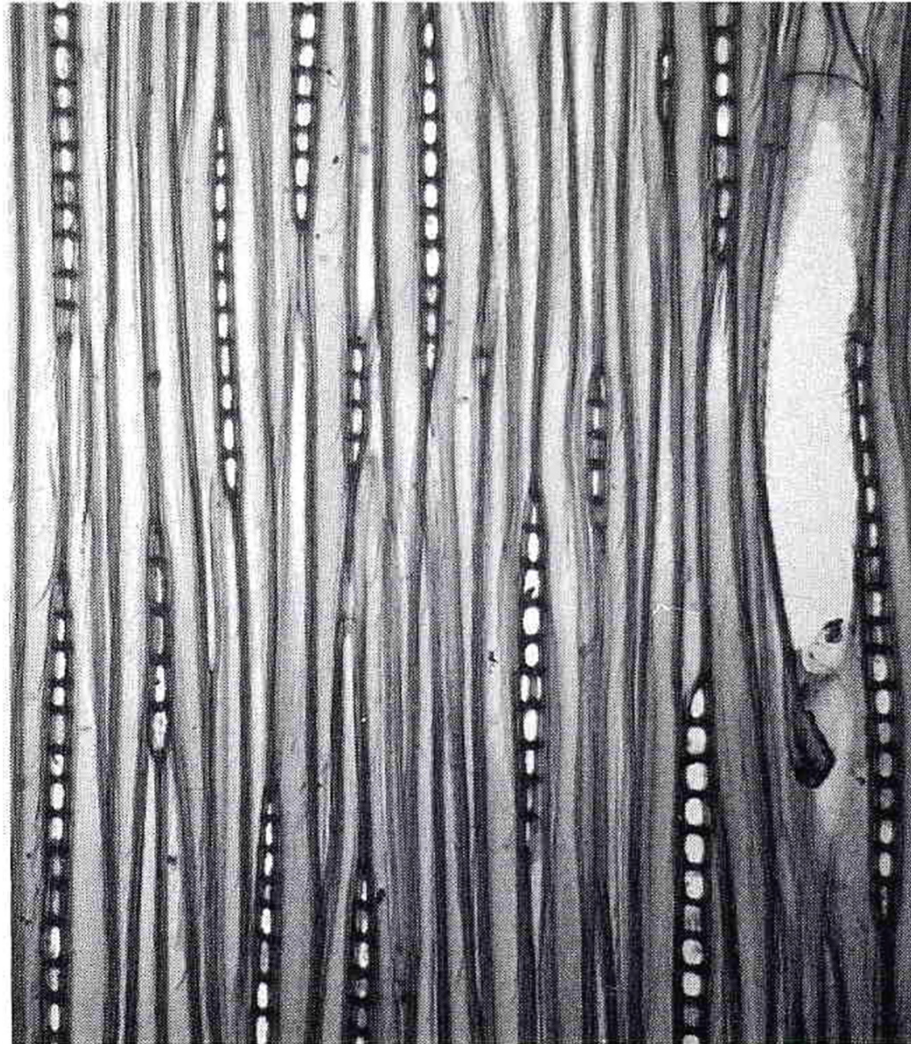
R. Bruce Hoadley



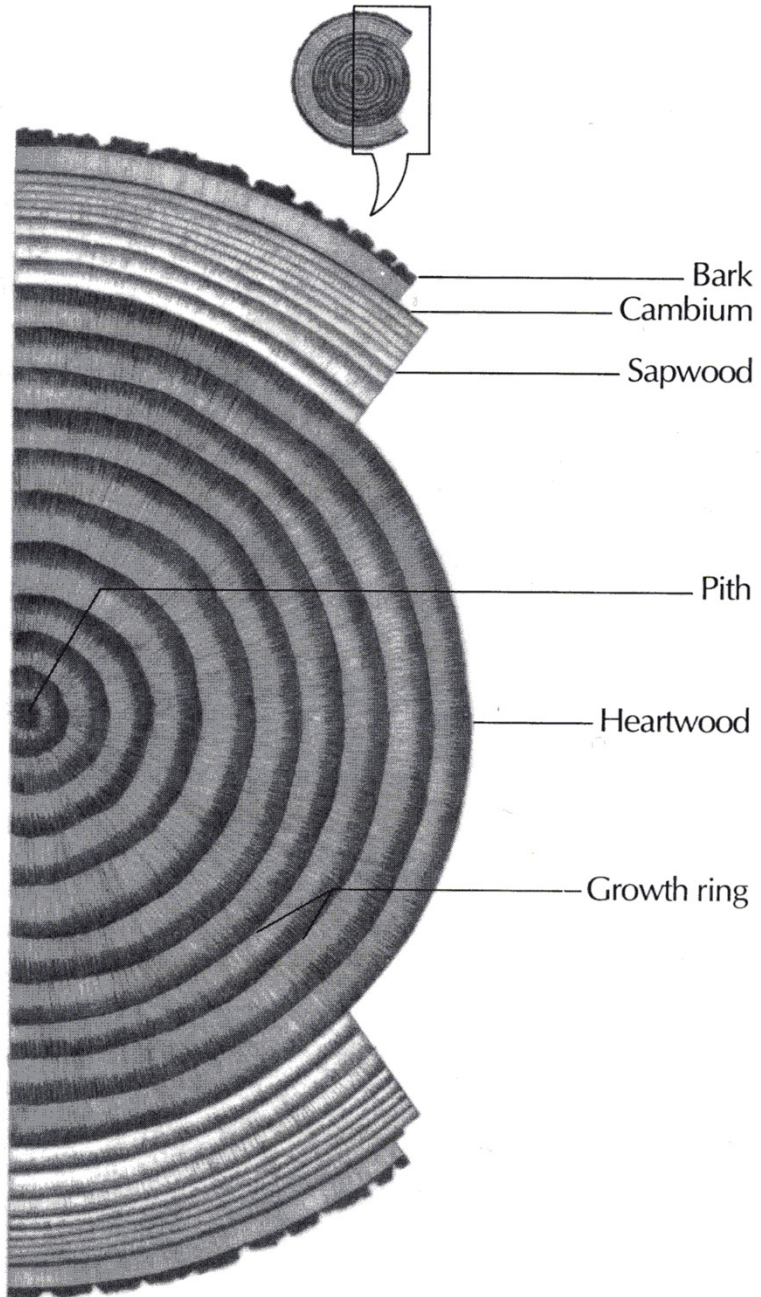


## UNISERIATE RAYS IN CHESTNUT

Rays in chestnut are uniseriate, or occasionally partially biseriata. (100x)



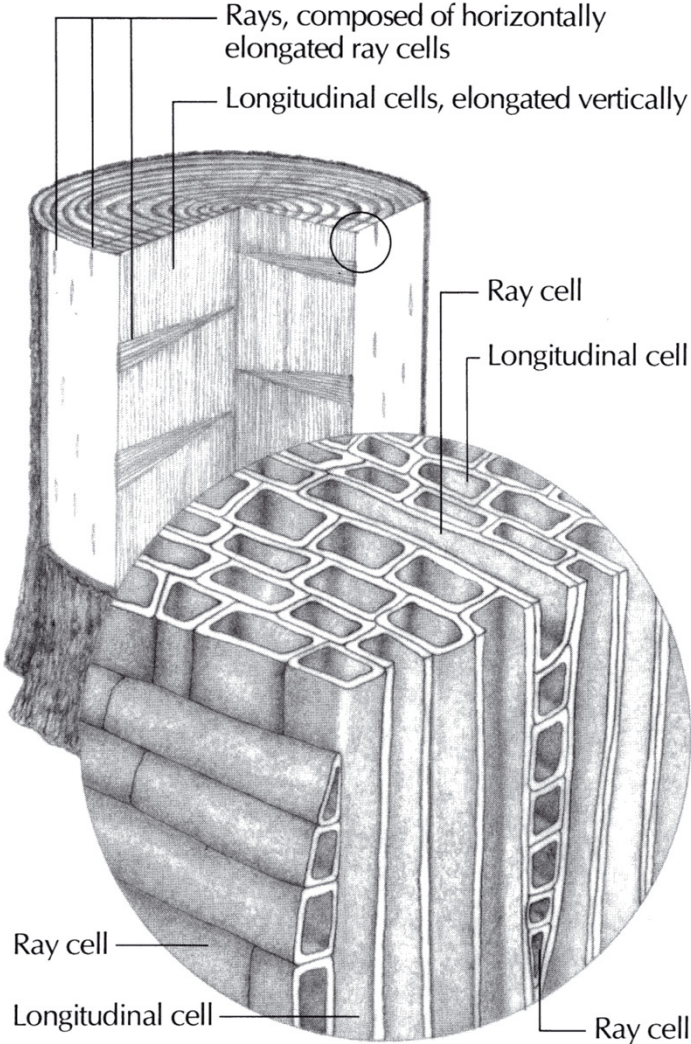
# PRINCIPAL FEATURES OF A TREE STEM





# LONGITUDINAL AND HORIZONTAL WOOD TISSUE

Wood consists mostly of longitudinal cells, which are elongated vertically along the stem and thereby determine the grain direction of the wood. The ray cells are elongated horizontally in the radial direction and form the rays.





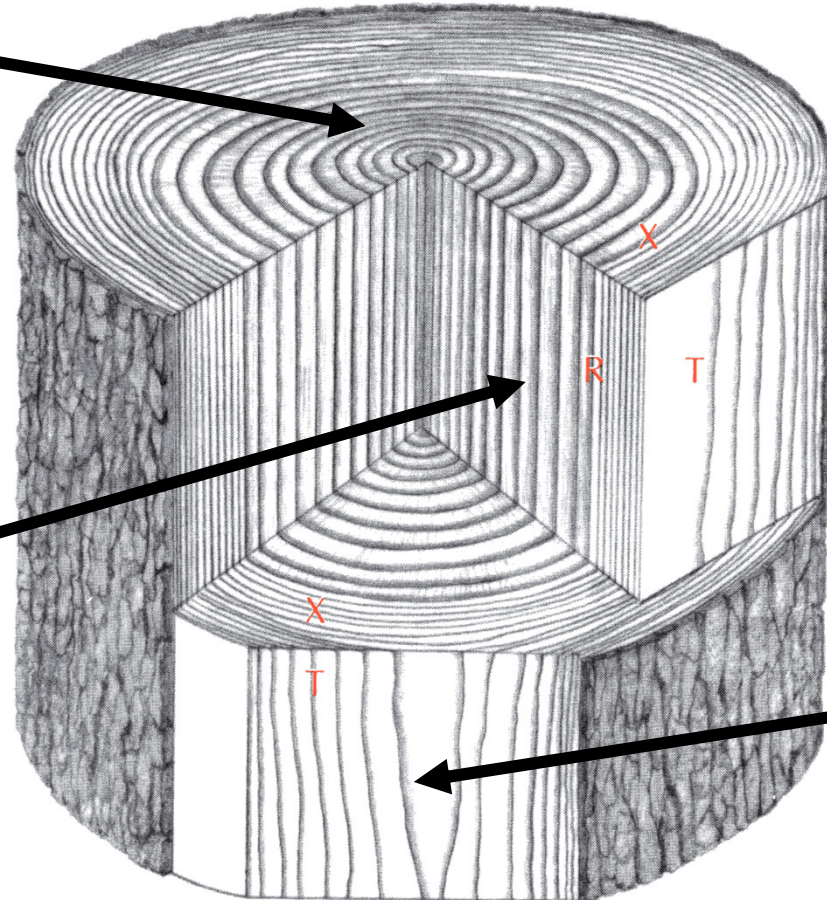
## PRINCIPAL STRUCTURAL PLANES IN A STEM: X, R, T

The cross-sectional or transverse plane (X) is perpendicular to the stem axis. The radial plane (R) passes through the pith. The tangential plane (T) forms a tangent to the cylindrical plane of the growth rings; it is therefore a 'compromise', being most truly tangential where the plane forms a right angle with the rays.

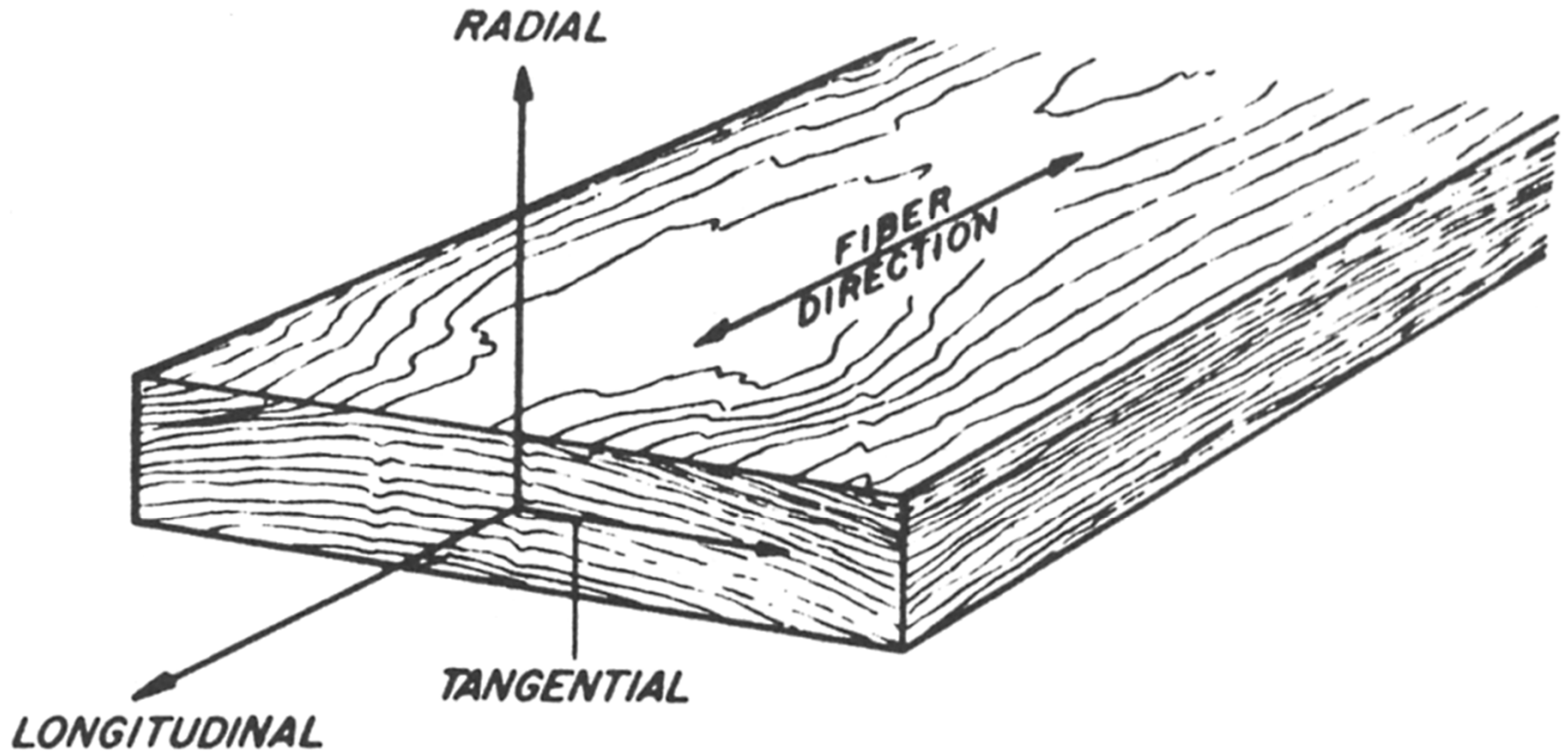
**Cross Section**

**Radial Section**

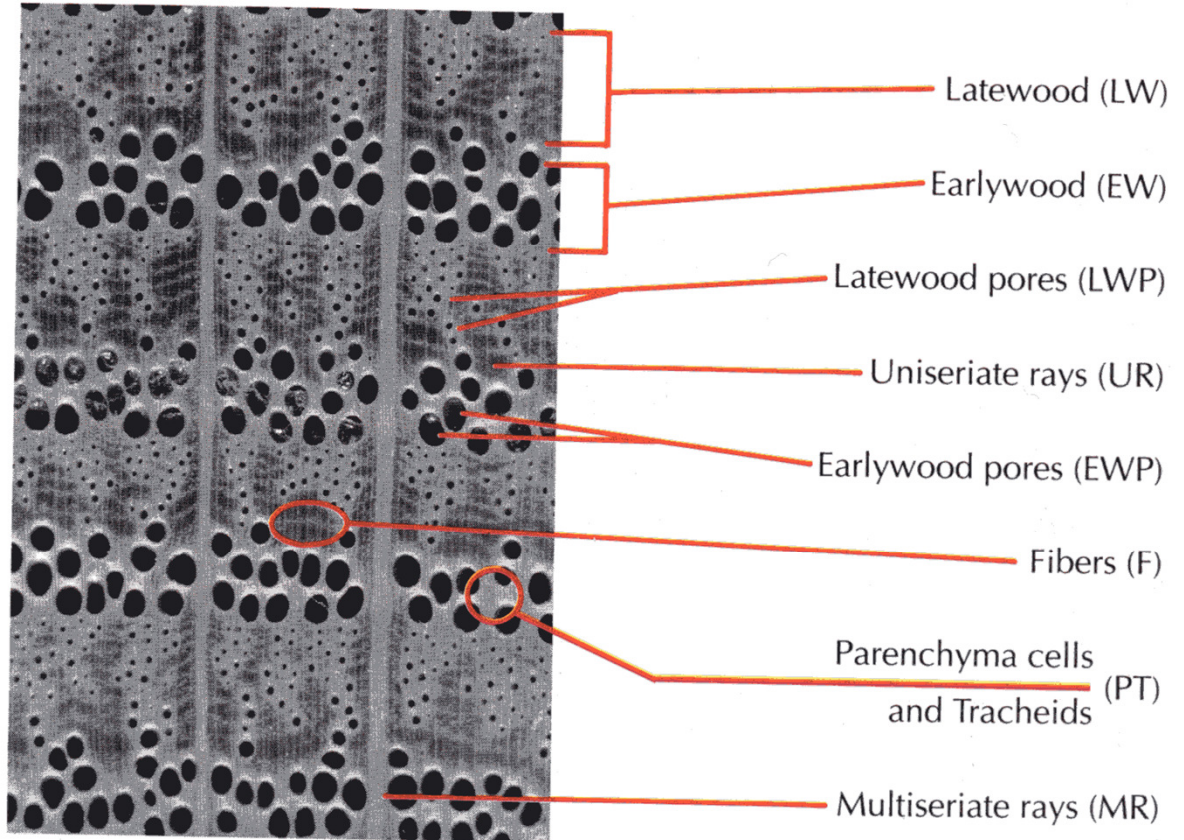
**Tangential Section**



### 3 Principle planes used for wood identification:



**INTRODUCTORY VIEW OF  
HARDWOOD ANATOMY: RED OAK**  
 This is a cross-sectional surface of northern red oak as seen with a hand lens. Within each growth ring, the first-formed earlywood is clearly defined by a zone of large pores, followed by latewood with its smaller pores. Other visible features include large multiseriate rays, narrow uniseriate rays, lighter-colored masses of mixed parenchyma cells and tracheids and darker masses of fibers.

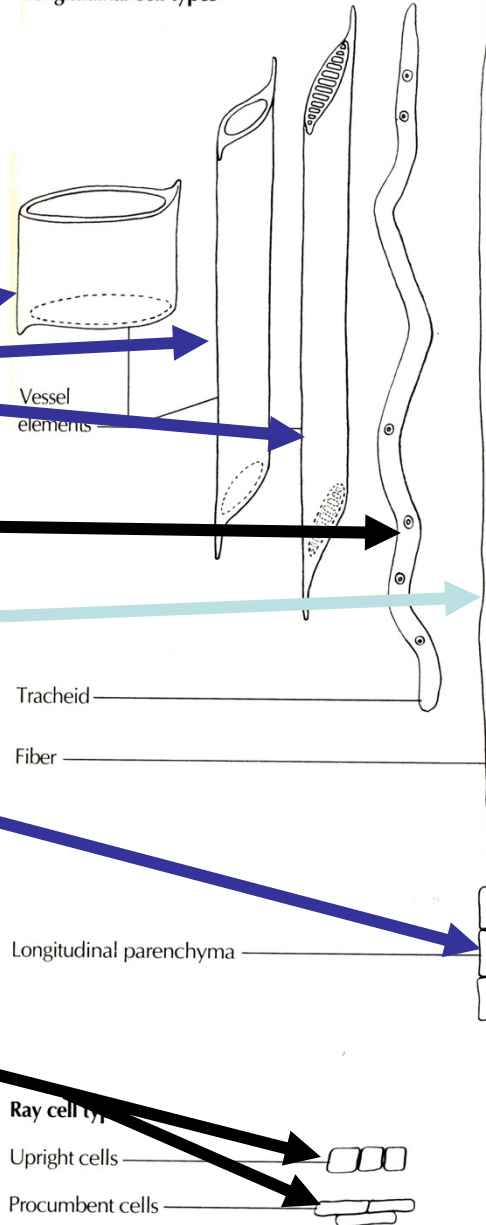




## HARDWOOD CELL TYPES

This diagram shows the relative sizes and shapes of typical cell types found among hardwoods.

### Longitudinal cell types



## Hardwood cell types:

Vessel elements

Tracheids

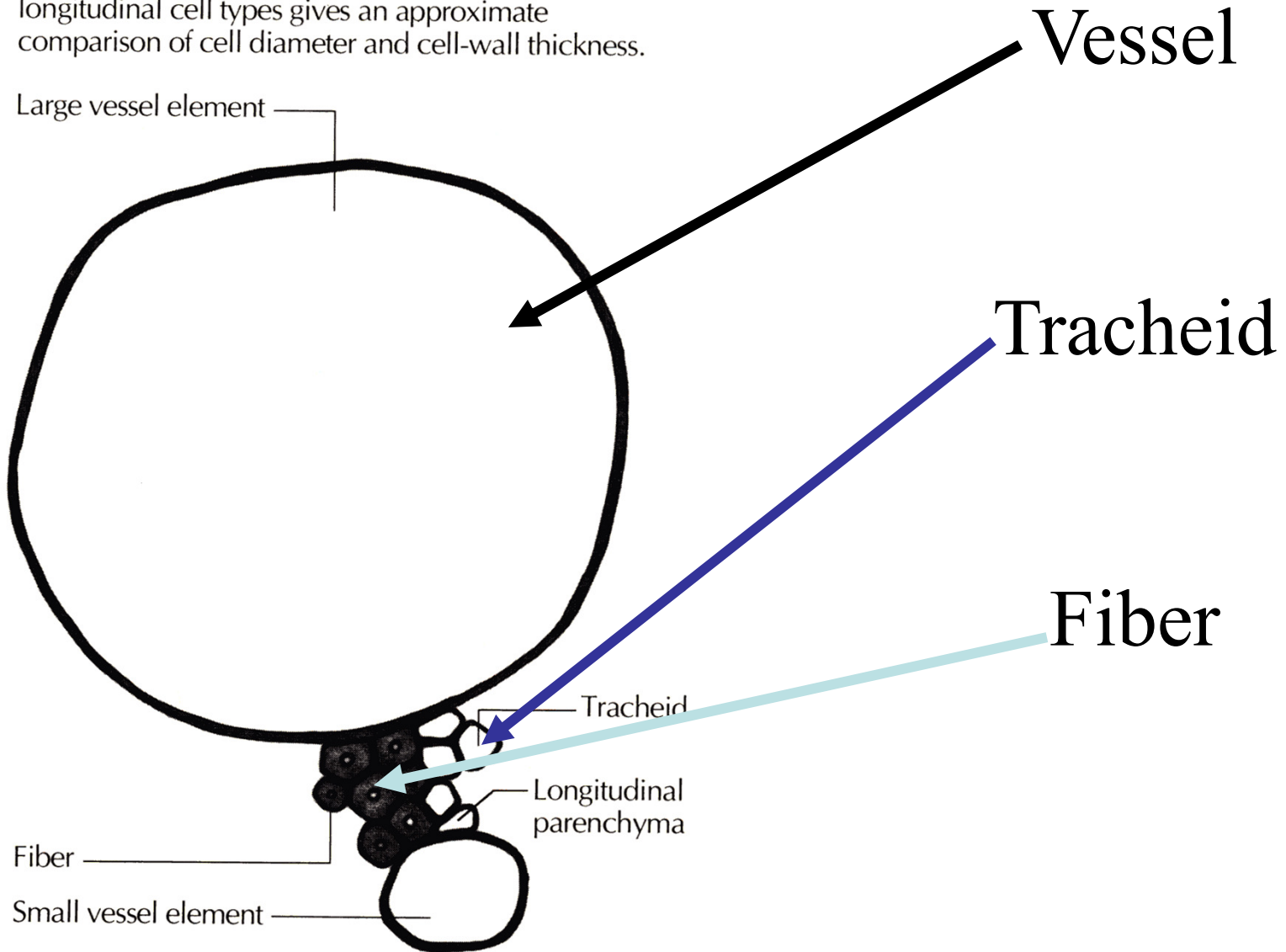
Fibers

Longitudinal parenchyma

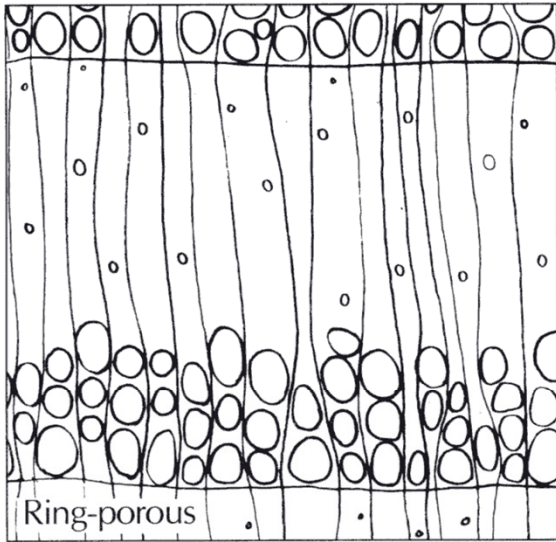
Ray cells

# RELATIVE HARDWOOD CELL DIAMETER AND WALL THICKNESS

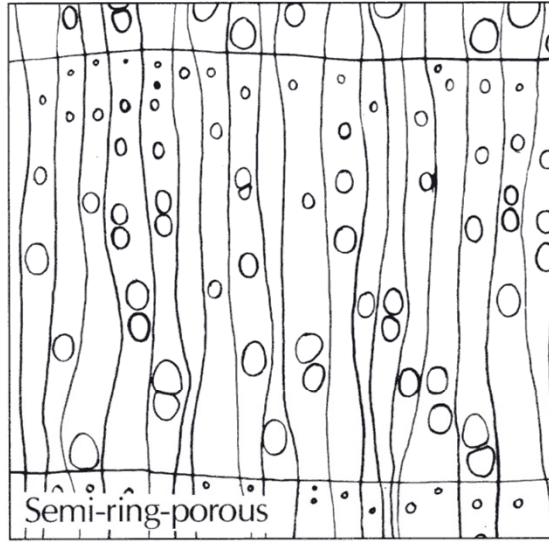
This diagrammatic transverse view of hardwood longitudinal cell types gives an approximate comparison of cell diameter and cell-wall thickness.



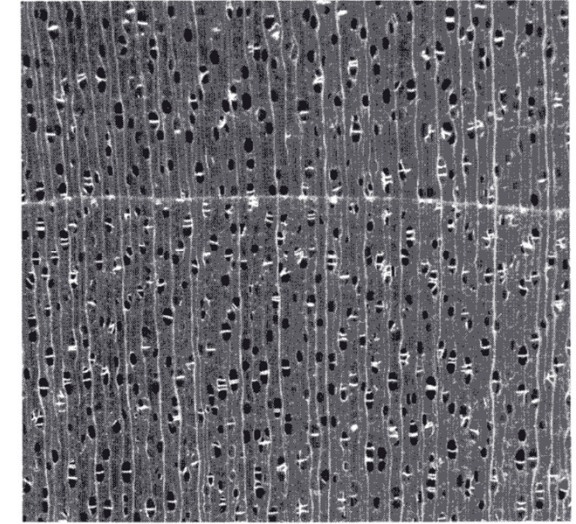
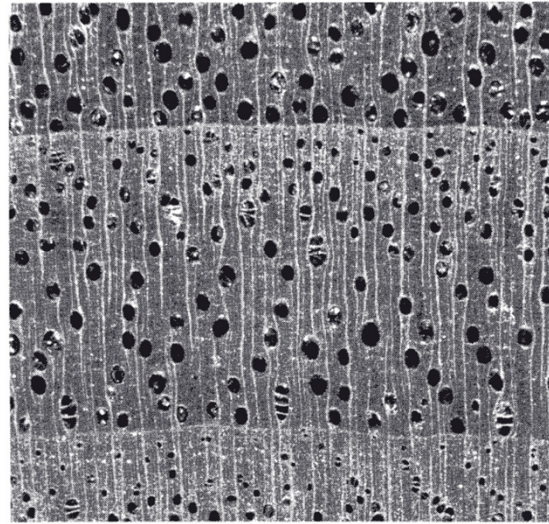
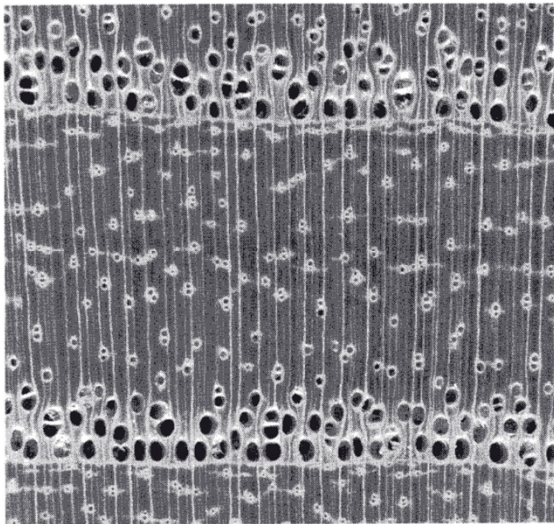
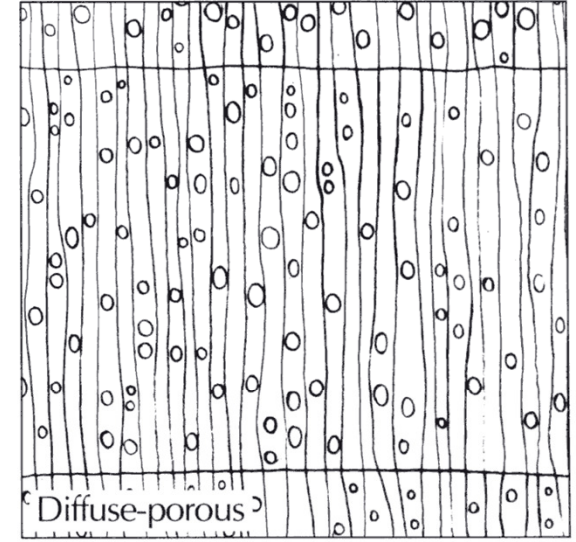
## Ring Porous



## Semi-Ring Porous



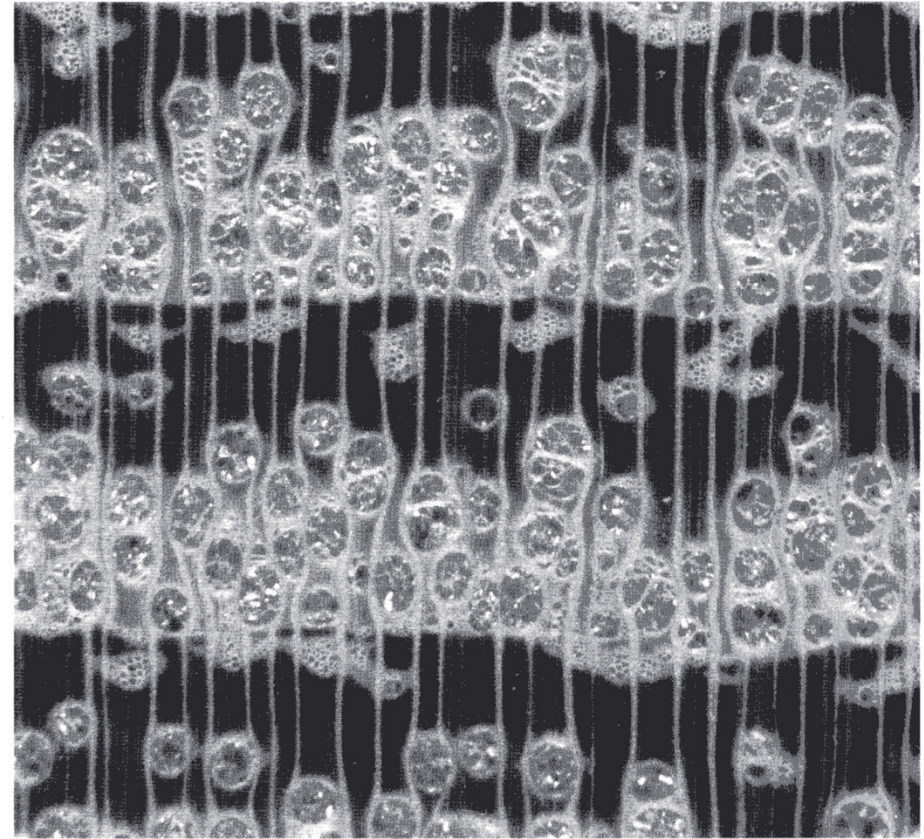
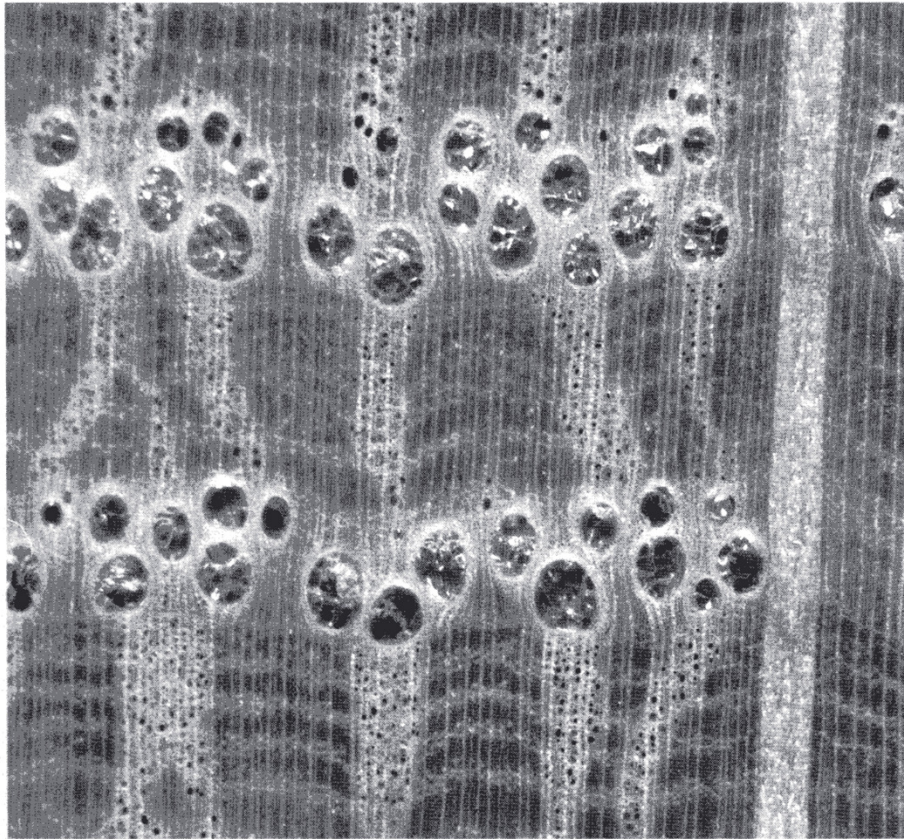
## Diffuse Porous



### CLASSIFICATION OF RING POROSITY

Hardwoods are classified as ring-porous, semi-ring-porous (or semi-diffuse-porous) or diffuse-porous, based on pore size and distribution within a growth ring as viewed with a hand lens in cross section.



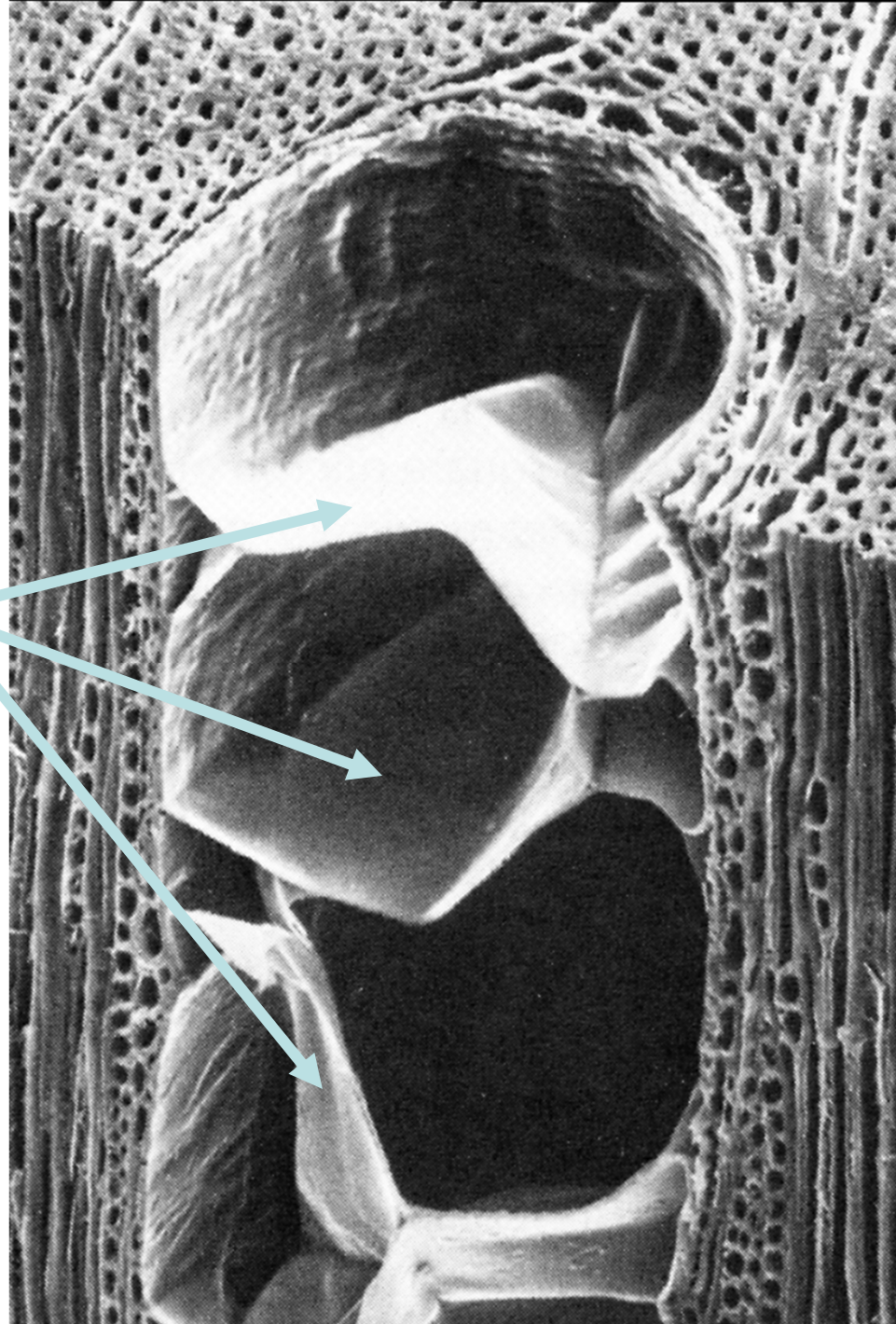


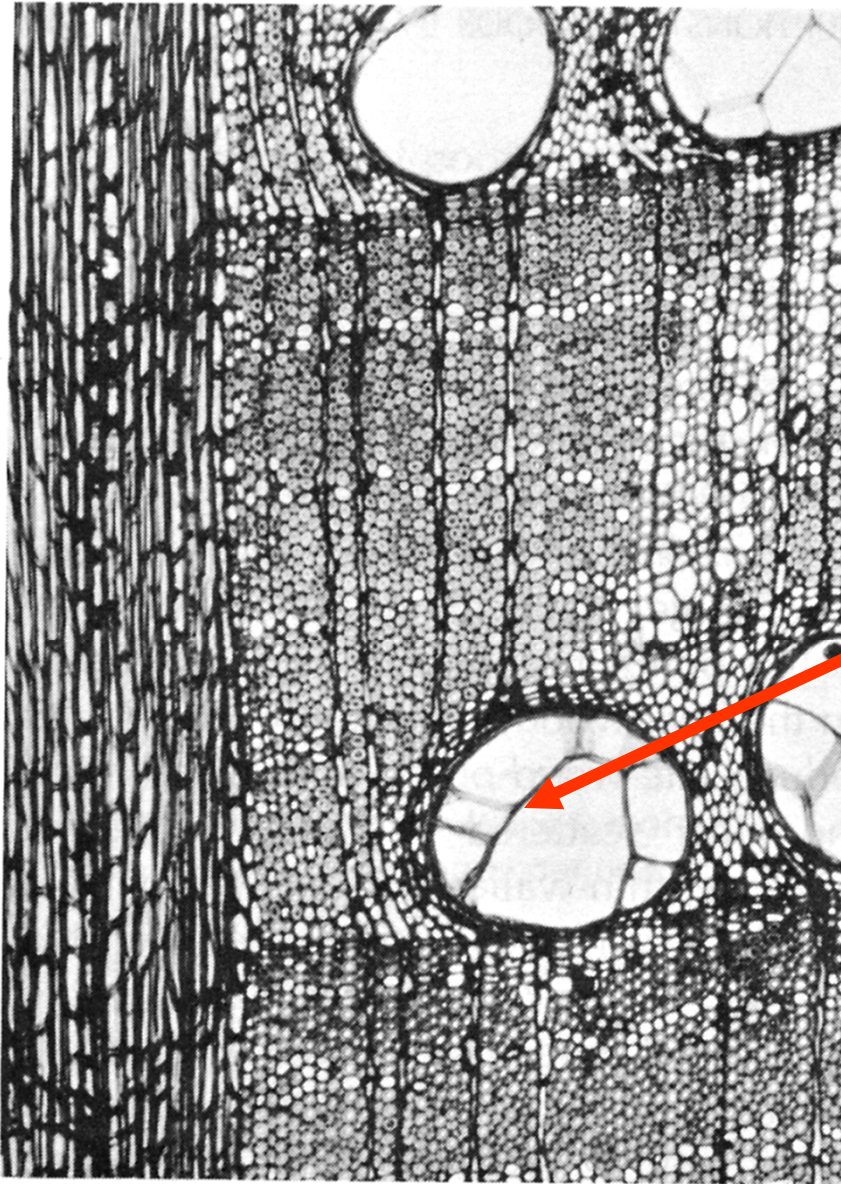
### TYLOSES IN VESSEL ELEMENTS

Abundant tyloses can be seen in the vessel elements in these cross-sectional views of white oak (left) and black locust (right). (20x)



Tyloses in  
vessel element



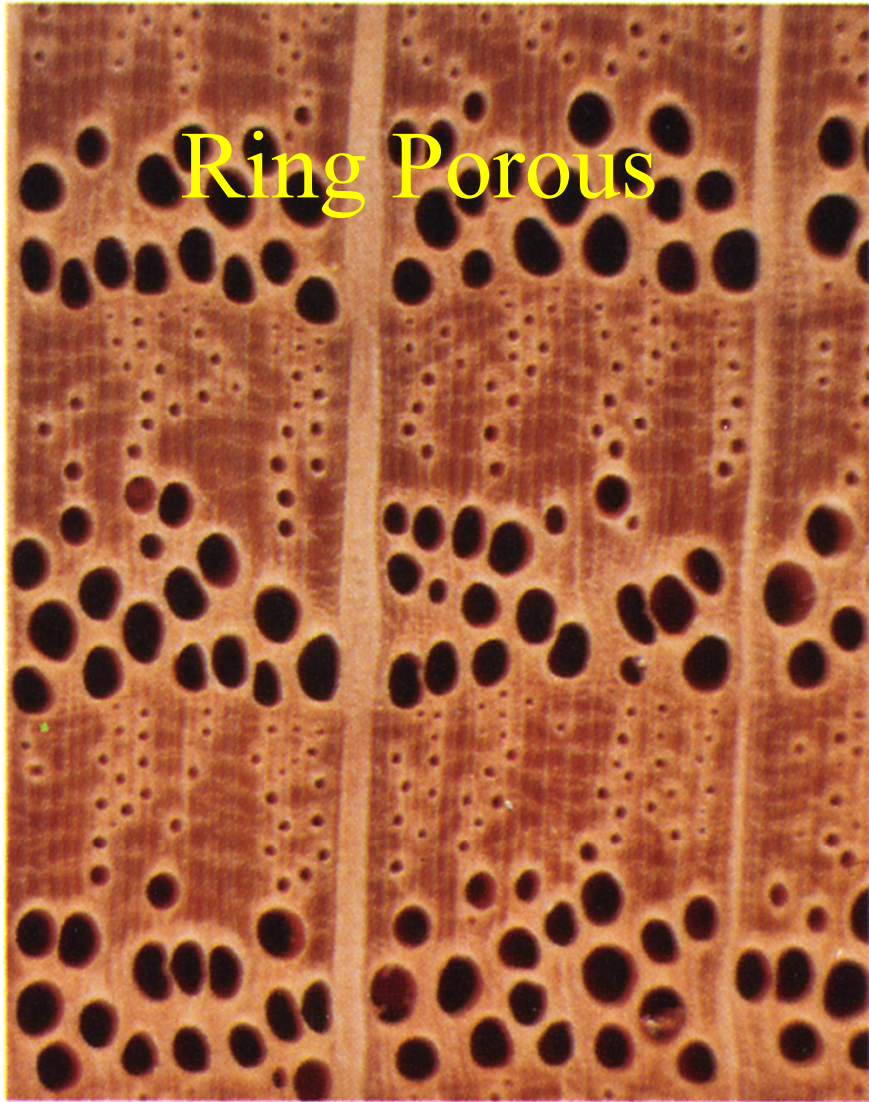


Tyloses shown in  
the cross section  
of white oak

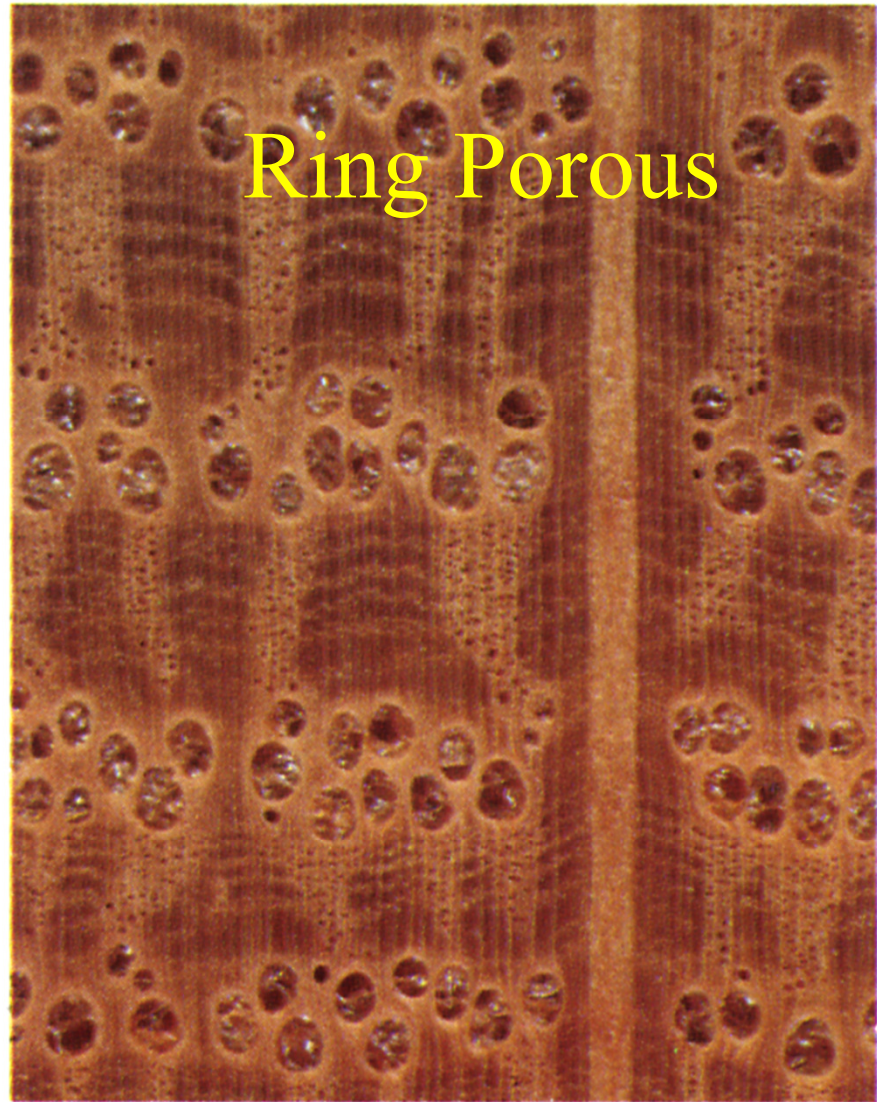
x—75×

White oak, *Quercus alba* L.





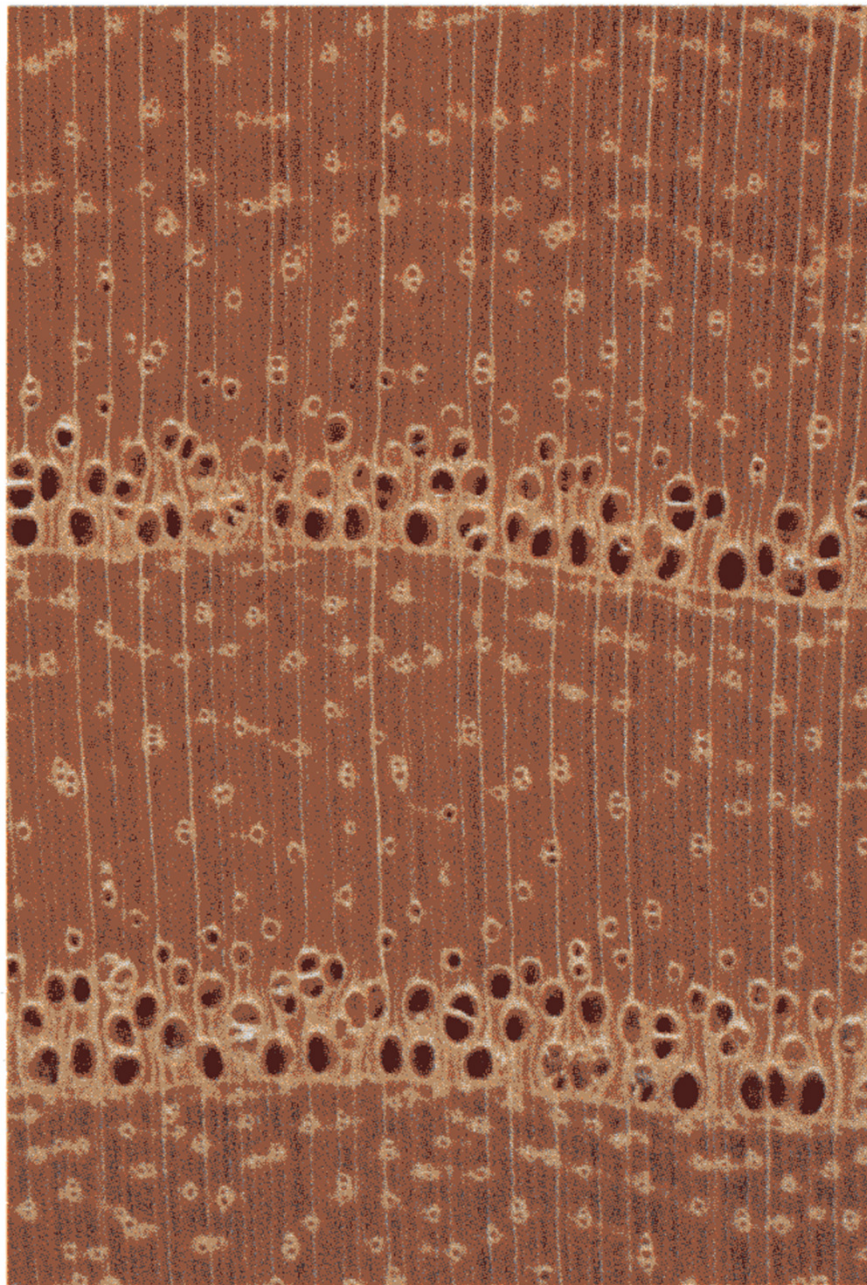
NORTHERN RED OAK  
*Quercus rubra*



WHITE OAK  
*Quercus alba*

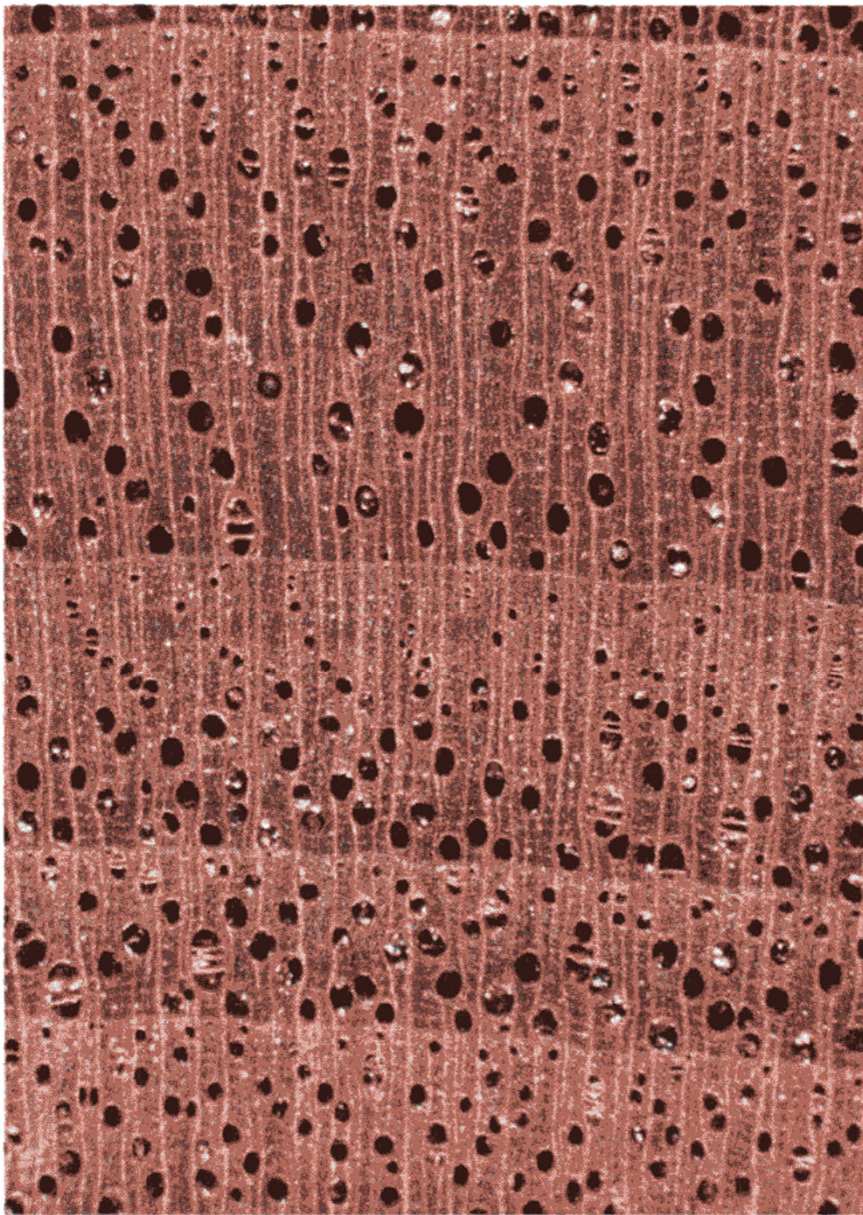


# Ring Porous



WHITE ASH  
*Fraxinus americana*





Semi-Ring Porous

BLACK WALNUT  
*Juglans nigra*



Diffuse Porous  
“Hard” maple



SUGAR MAPLE  
*Acer saccharum*

Diffuse Porous  
“Soft” maple



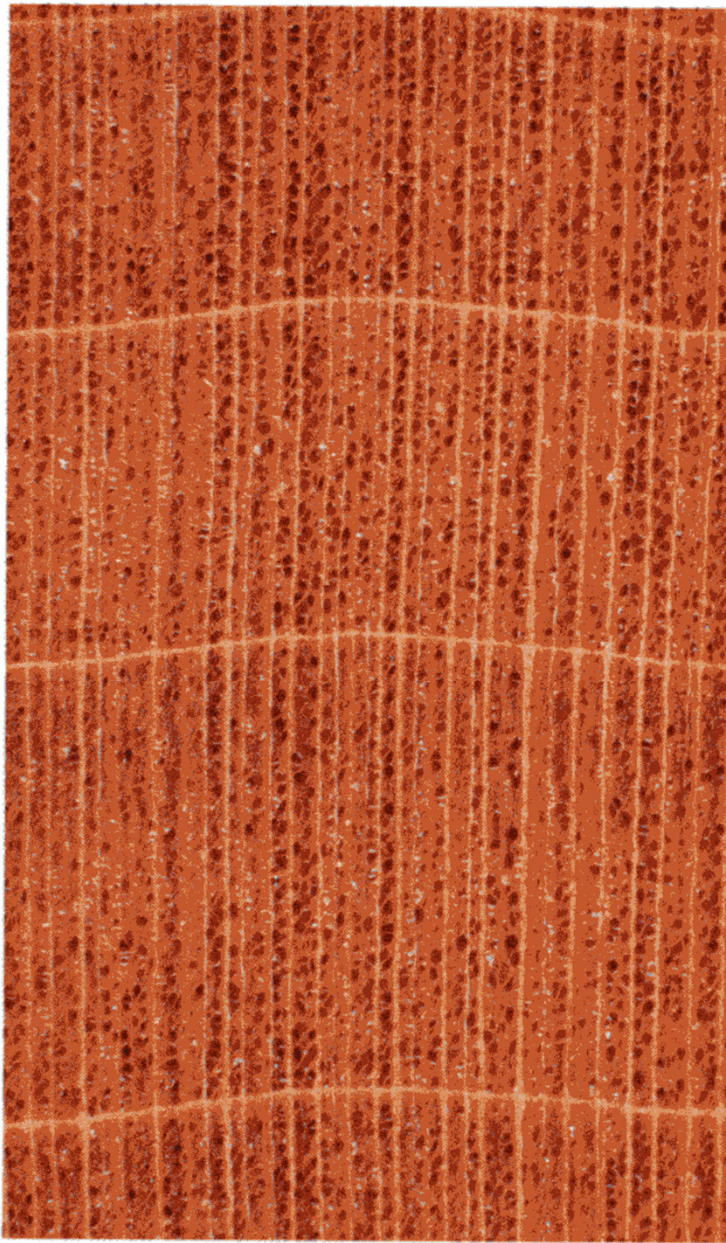
RED MAPLE  
*Acer rubrum*



# Diffuse Porous



**BLACK CHERRY**  
*Prunus serotina*

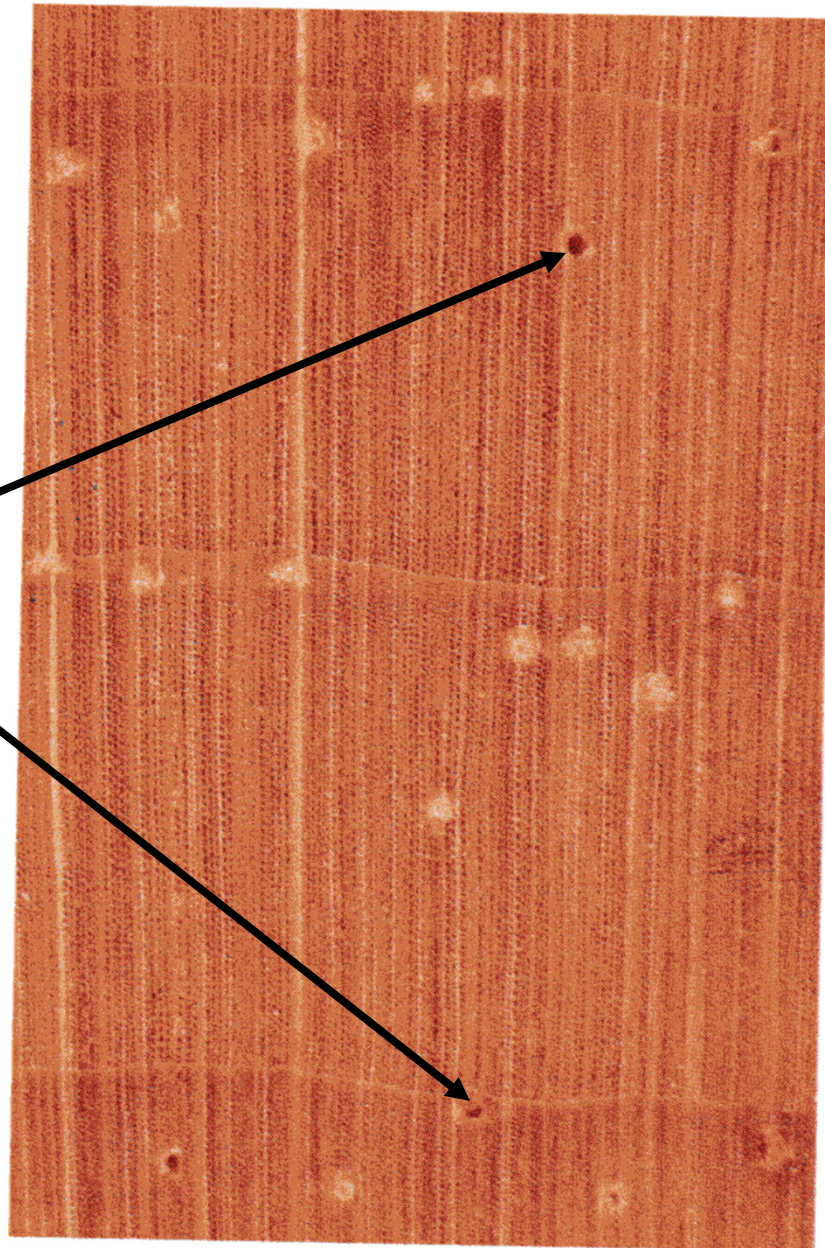


## Diffuse Porous

**YELLOW-POPLAR**  
*Liriodendron tulipifera*

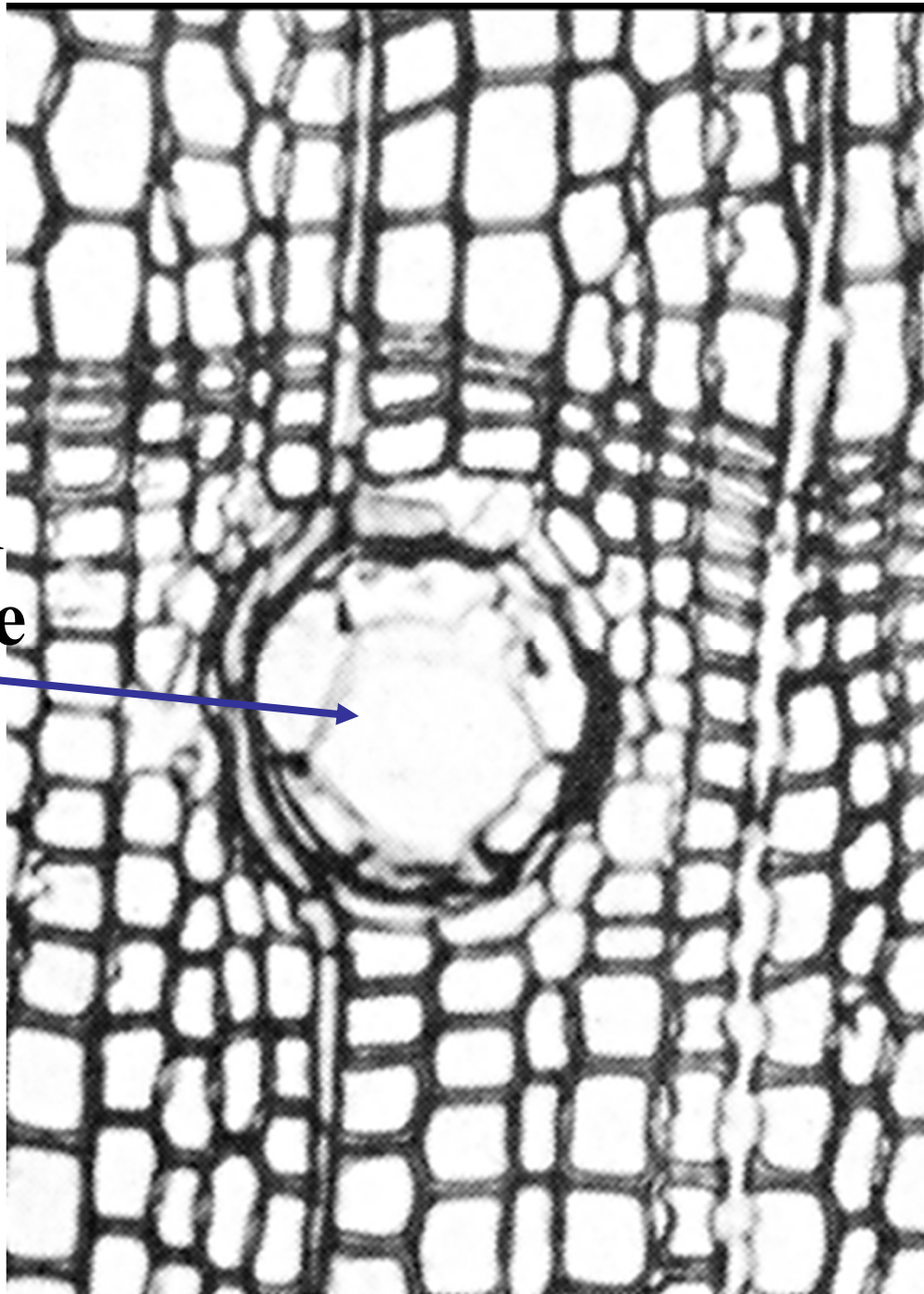


**Resin canals  
in white pine**

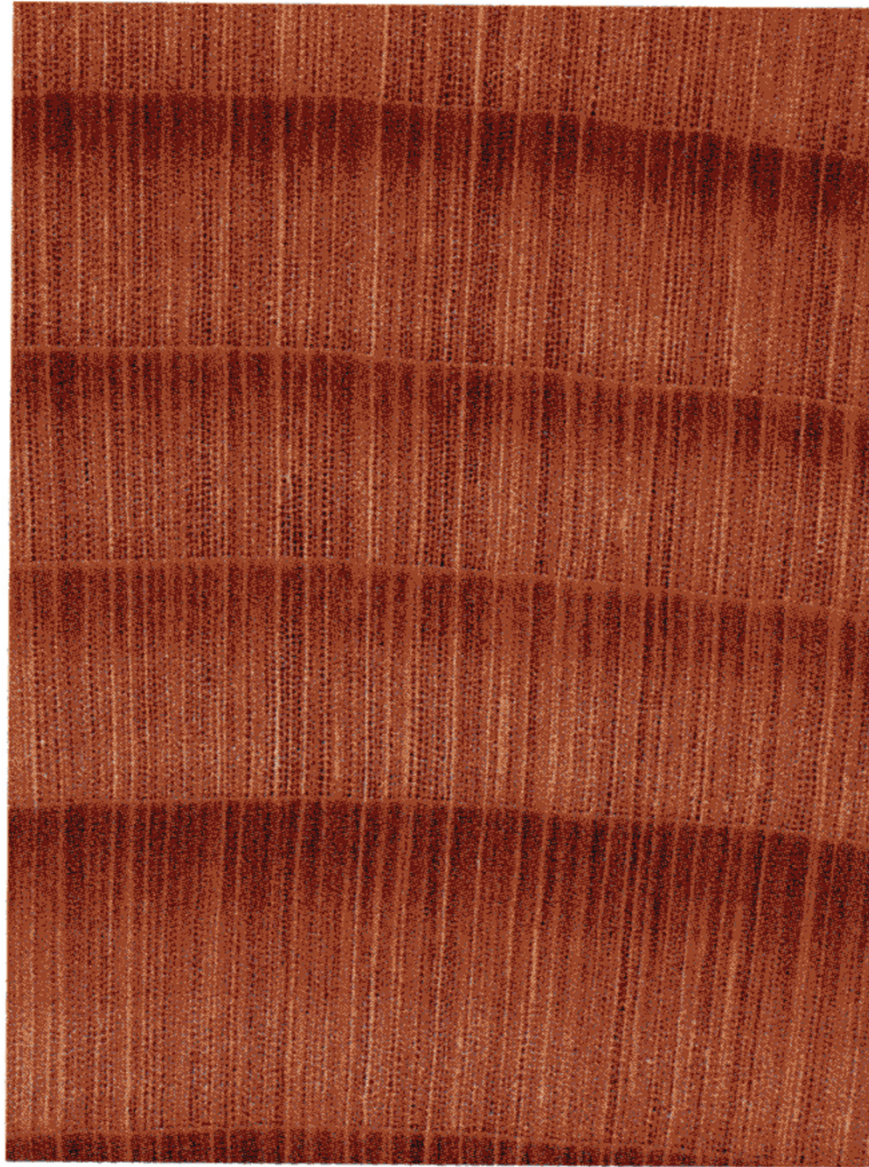


**EASTERN WHITE PINE**  
*P. strobus*

**Resin canal  
in white pine**

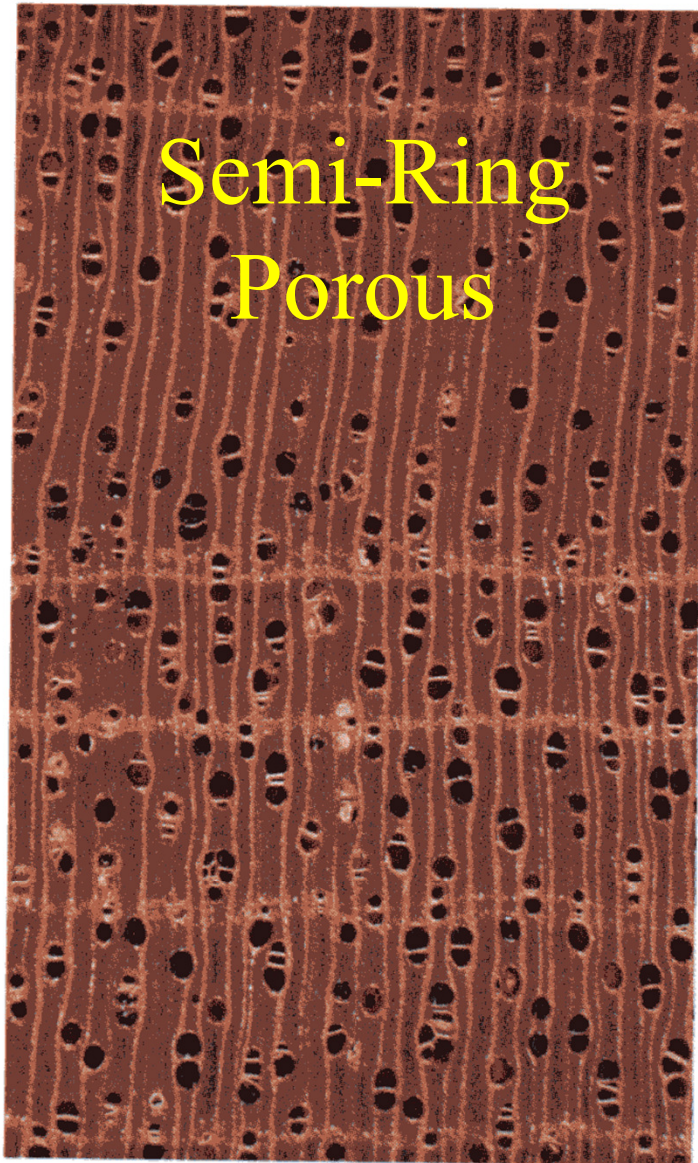






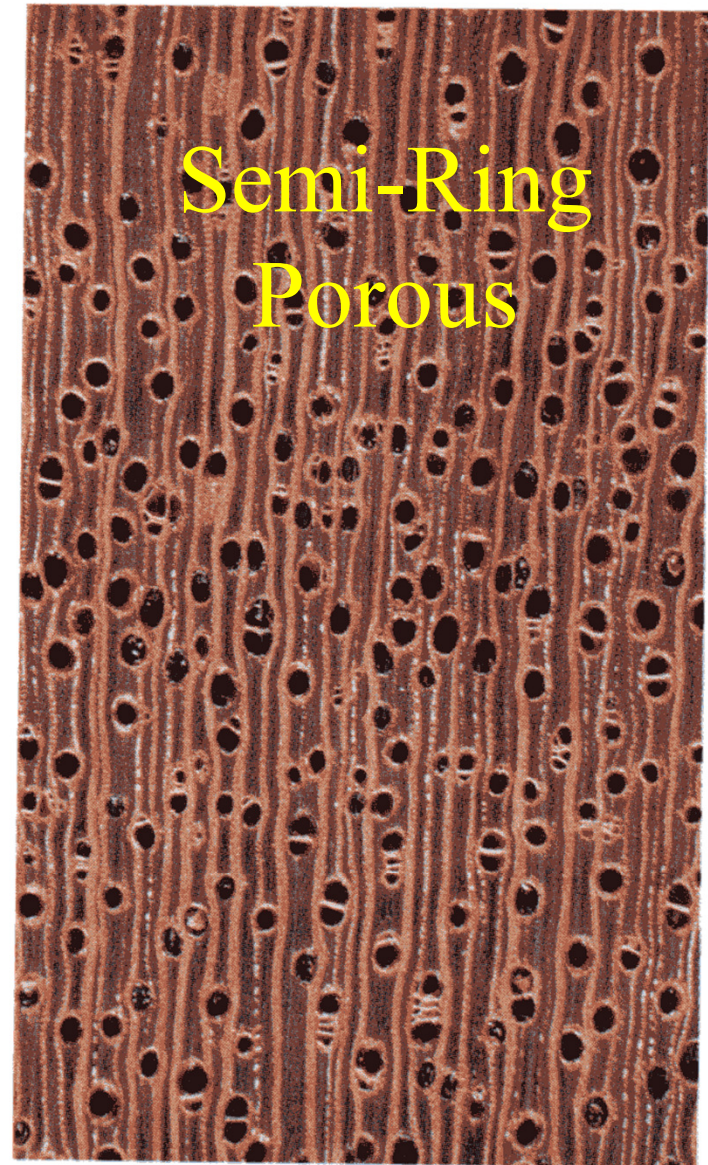
EASTERN HEMLOCK  
*Tsuga canadensis*





Semi-Ring  
Porous

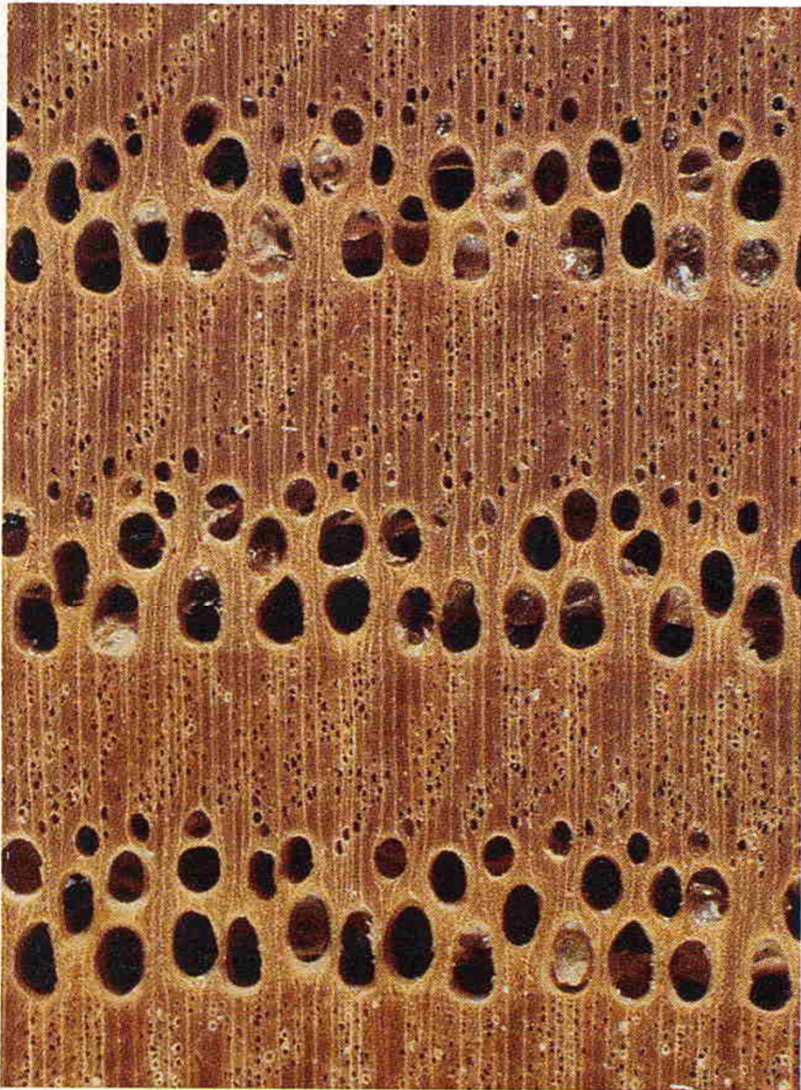
CENTRAL AMERICAN  
MAHOGANY  
(*Swietenia* spp.)



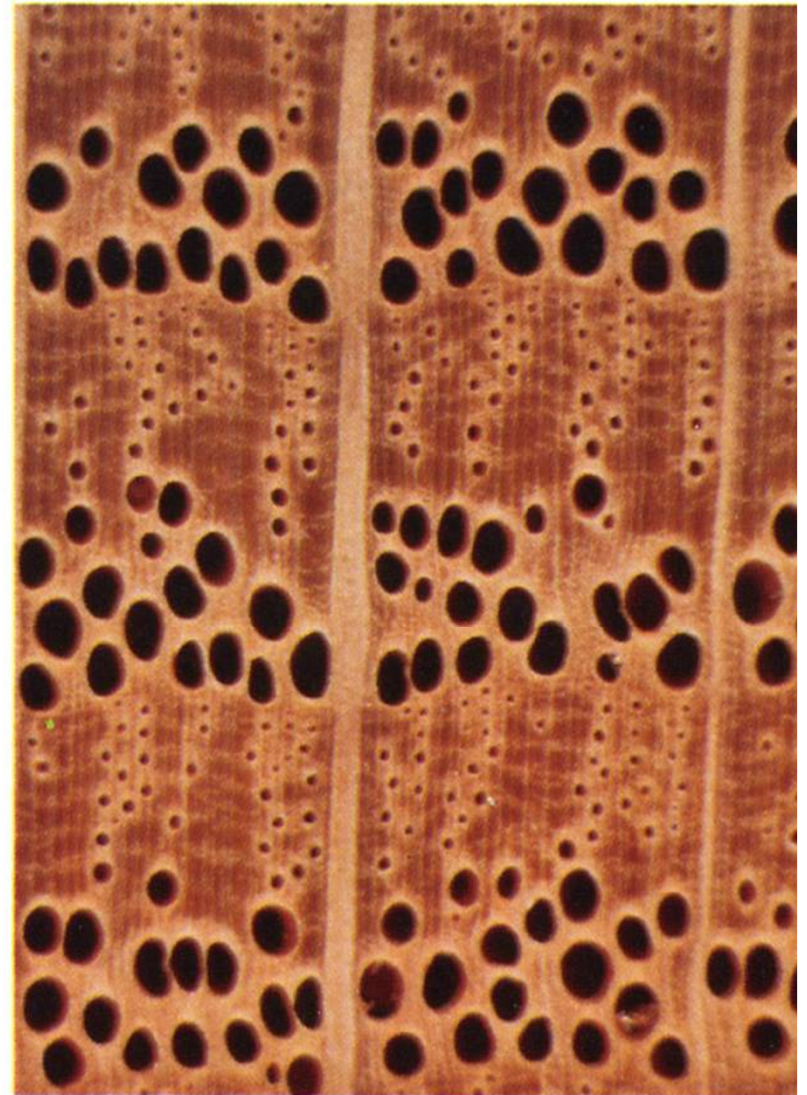
Semi-Ring  
Porous

AFRICAN MAHOGANY  
(*Khaya* spp.)



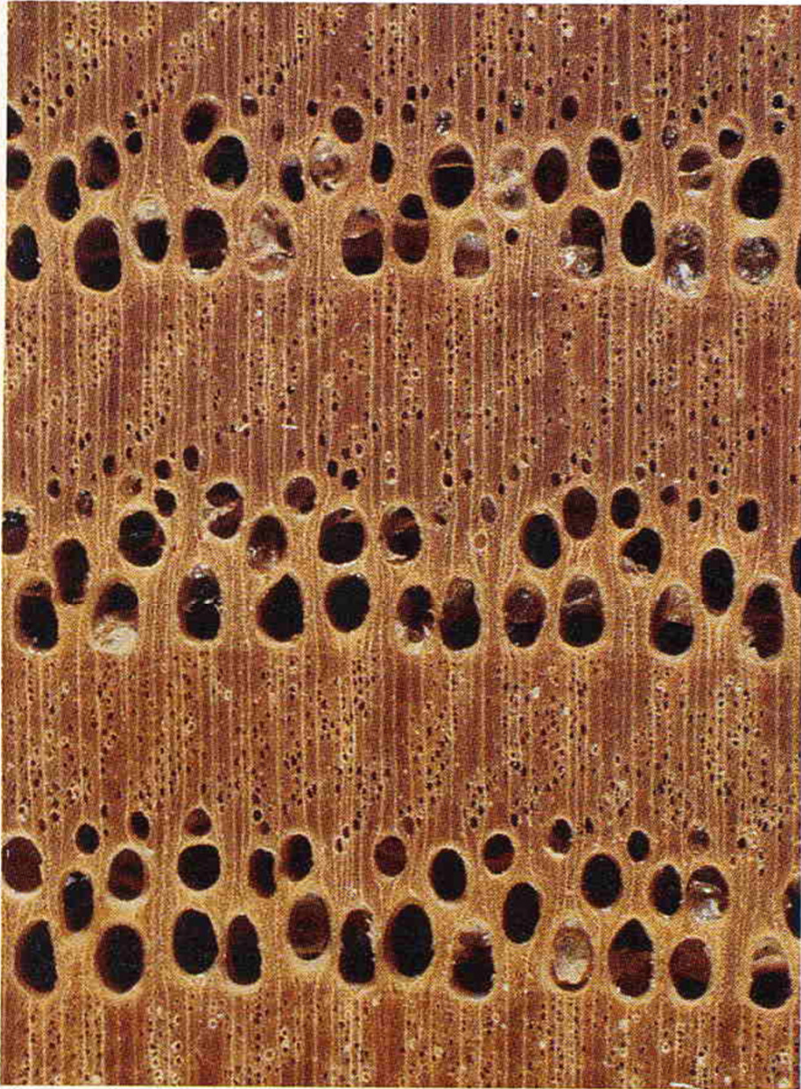


AMERICAN CHESTNUT  
*Castanea dentata*

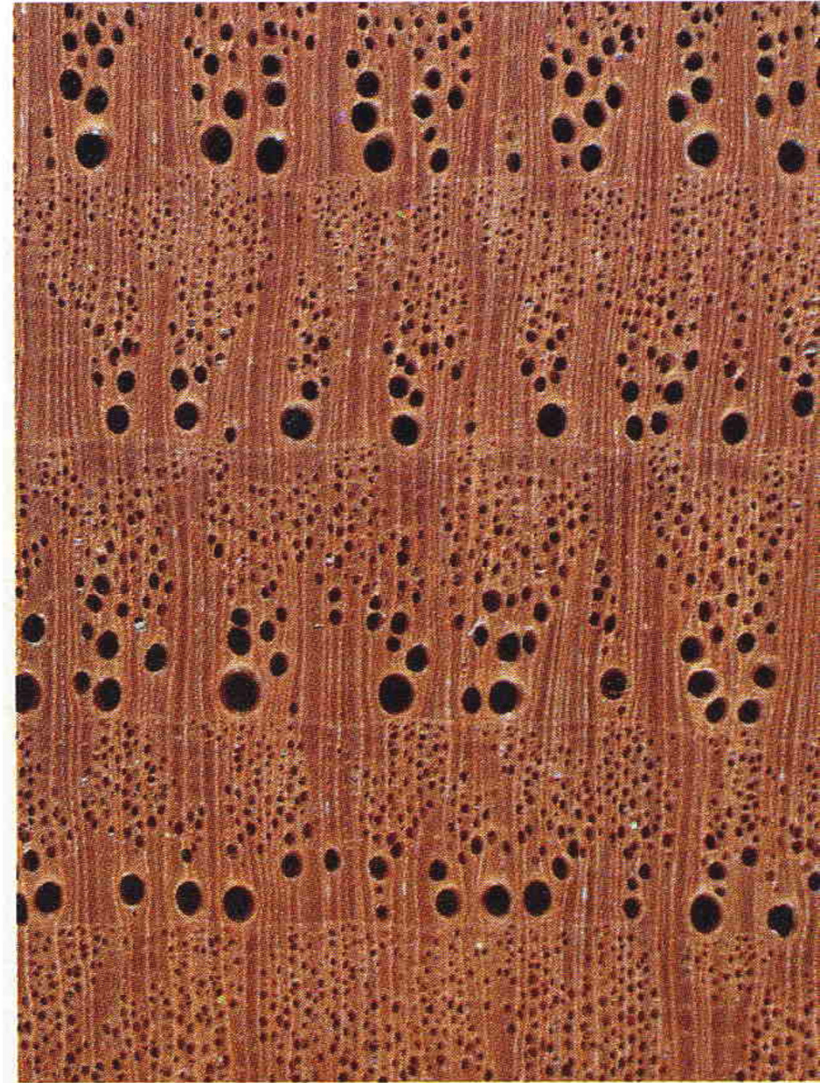


NORTHERN RED OAK  
*Quercus rubra*



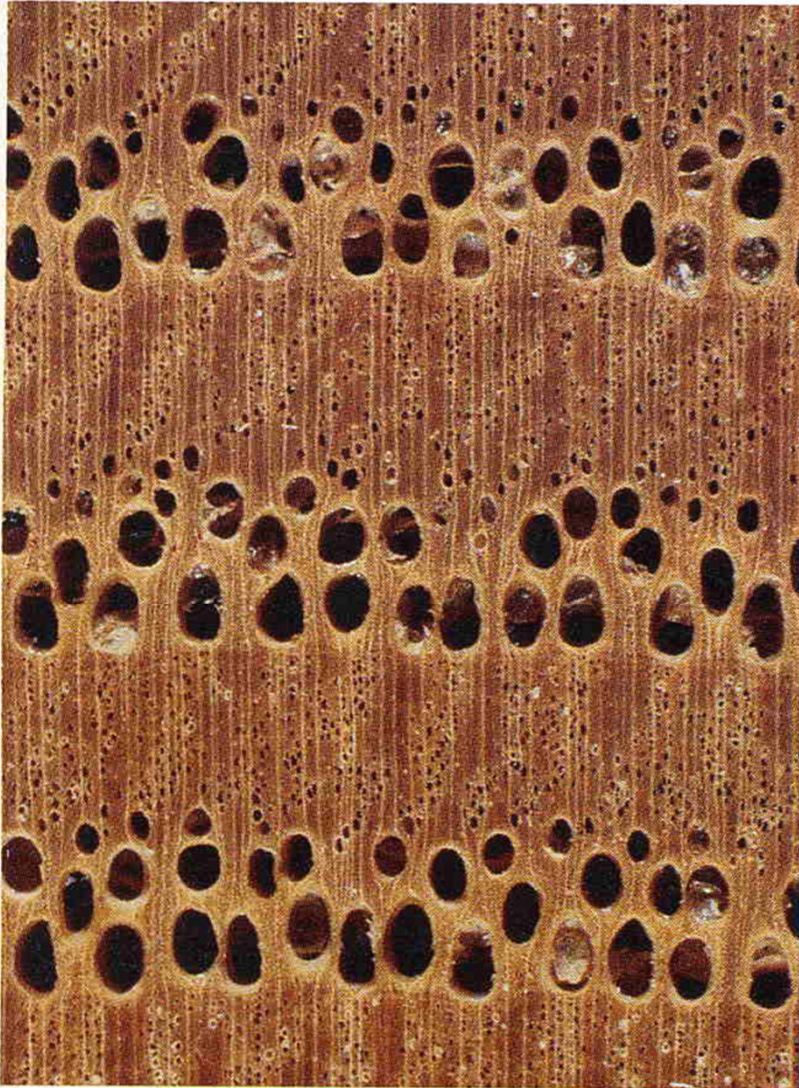


AMERICAN CHESTNUT  
*Castanea dentata*



GIANT CHINKAPIN  
*Castanopsis chrysobrylla*



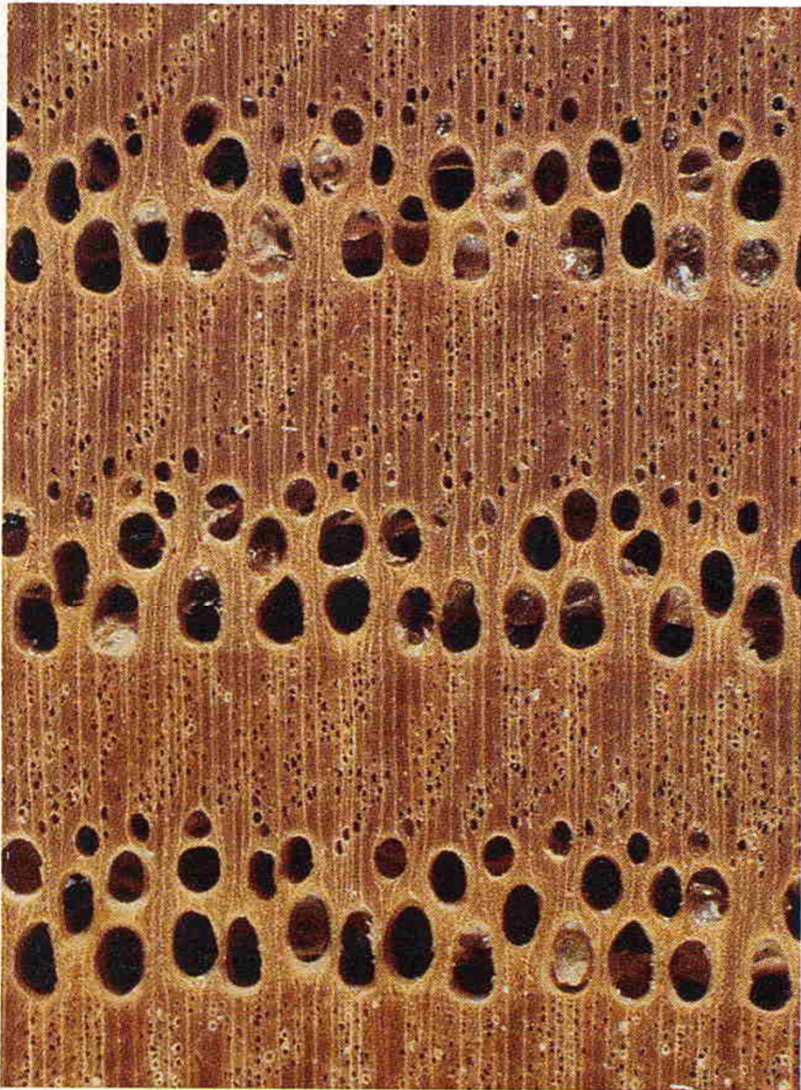


AMERICAN CHESTNUT  
*Castanea dentata*

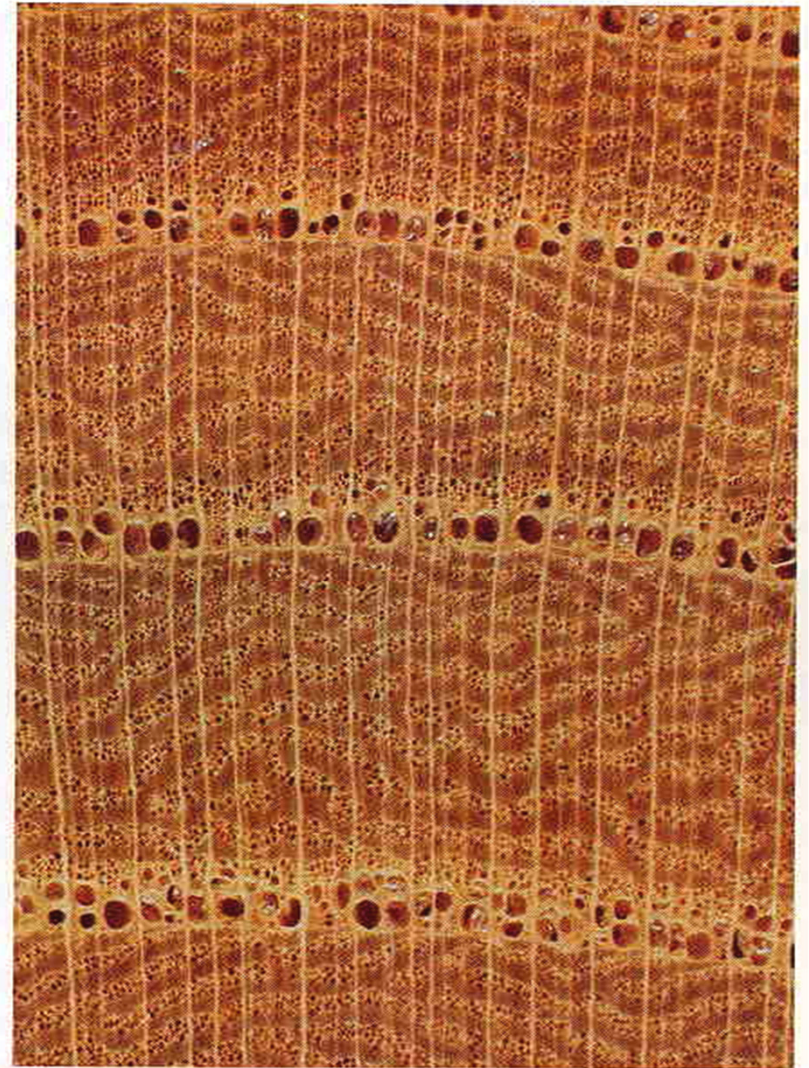


WHITE OAK  
*Quercus alba*



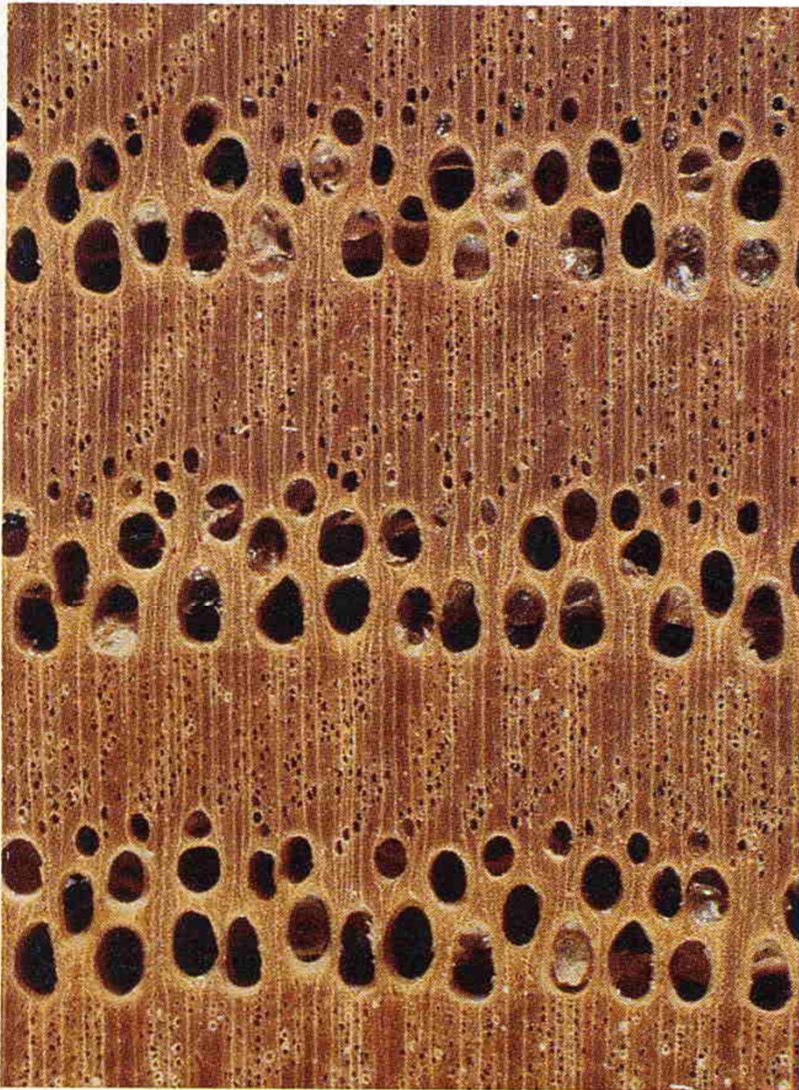


AMERICAN CHESTNUT  
*Castanea dentata*

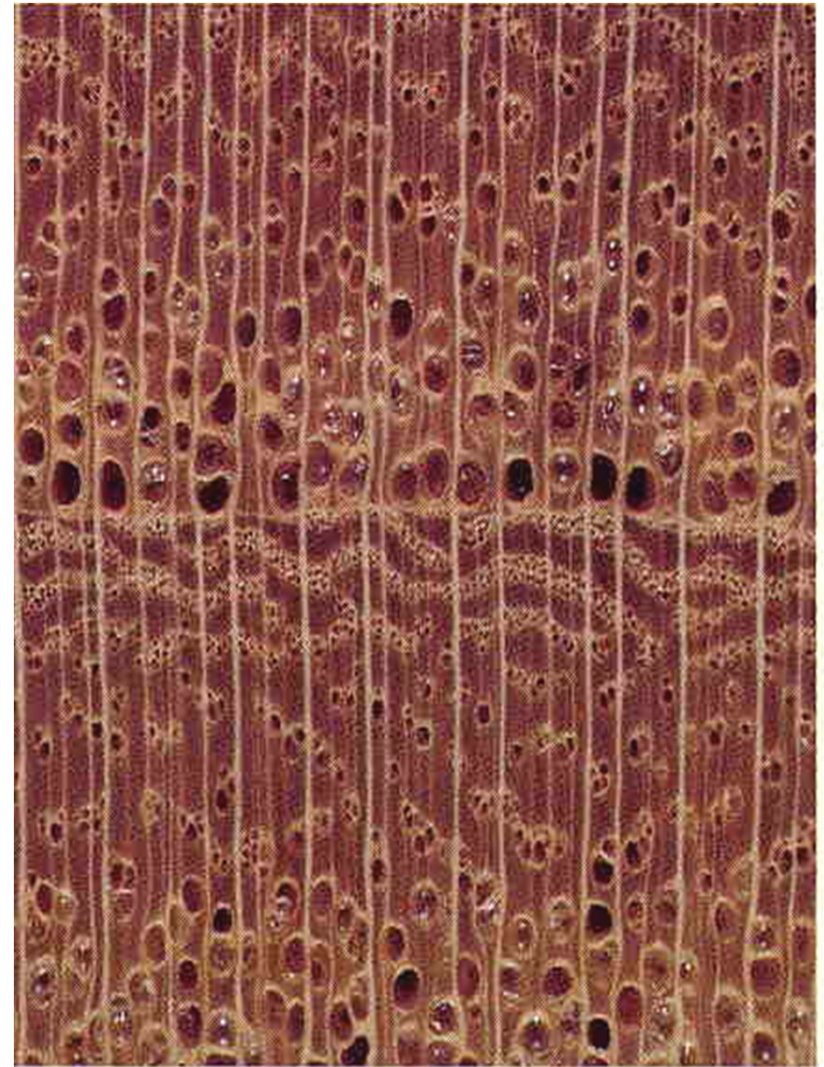


AMERICAN ELM  
*Ulmus americana*



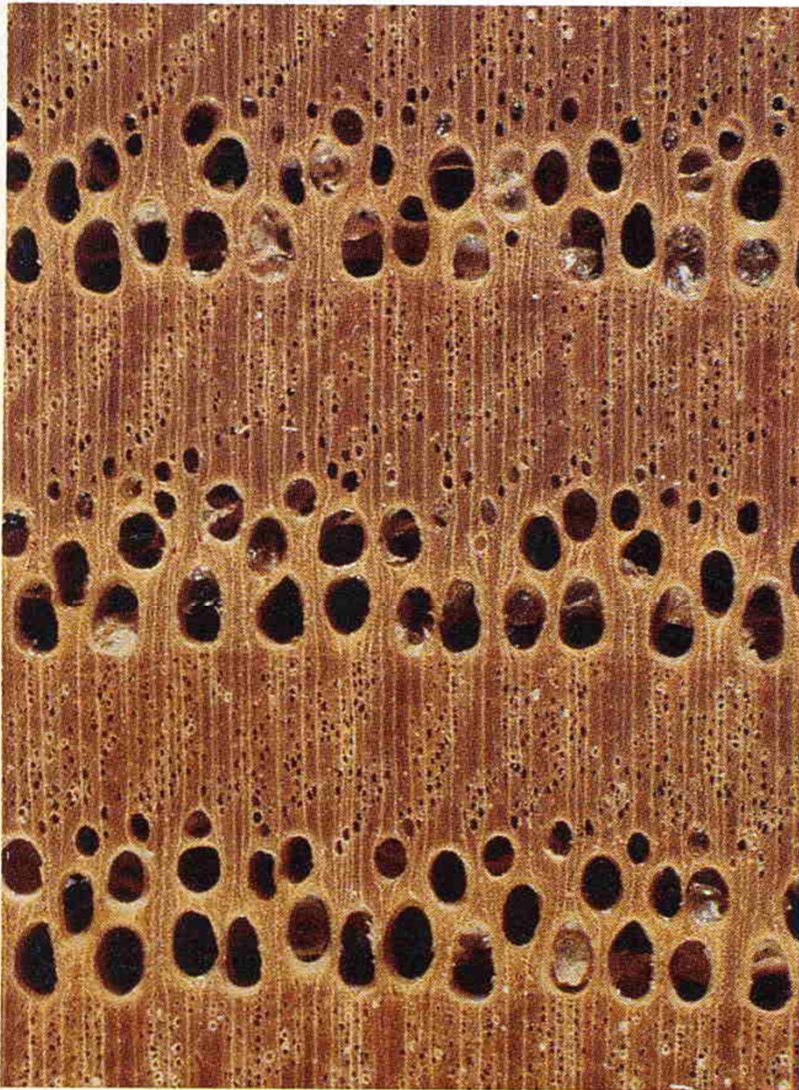


AMERICAN CHESTNUT  
*Castanea dentata*

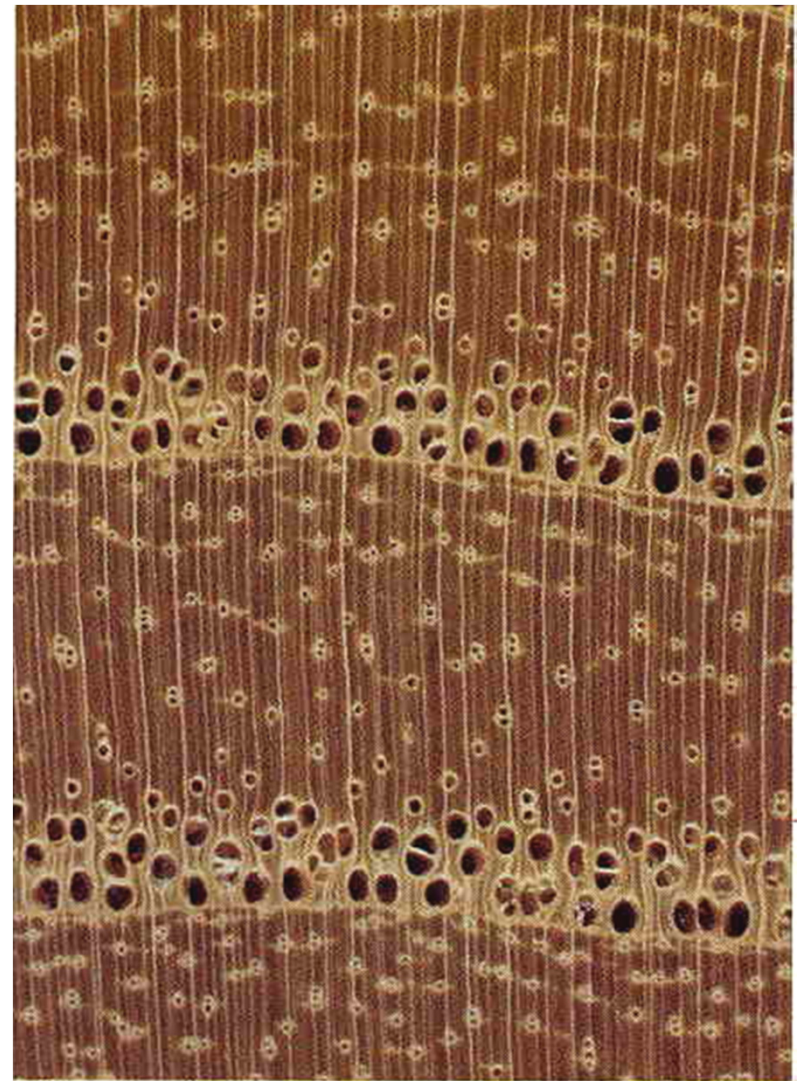


COMMON HACKBERRY  
*Celtis occidentalis*



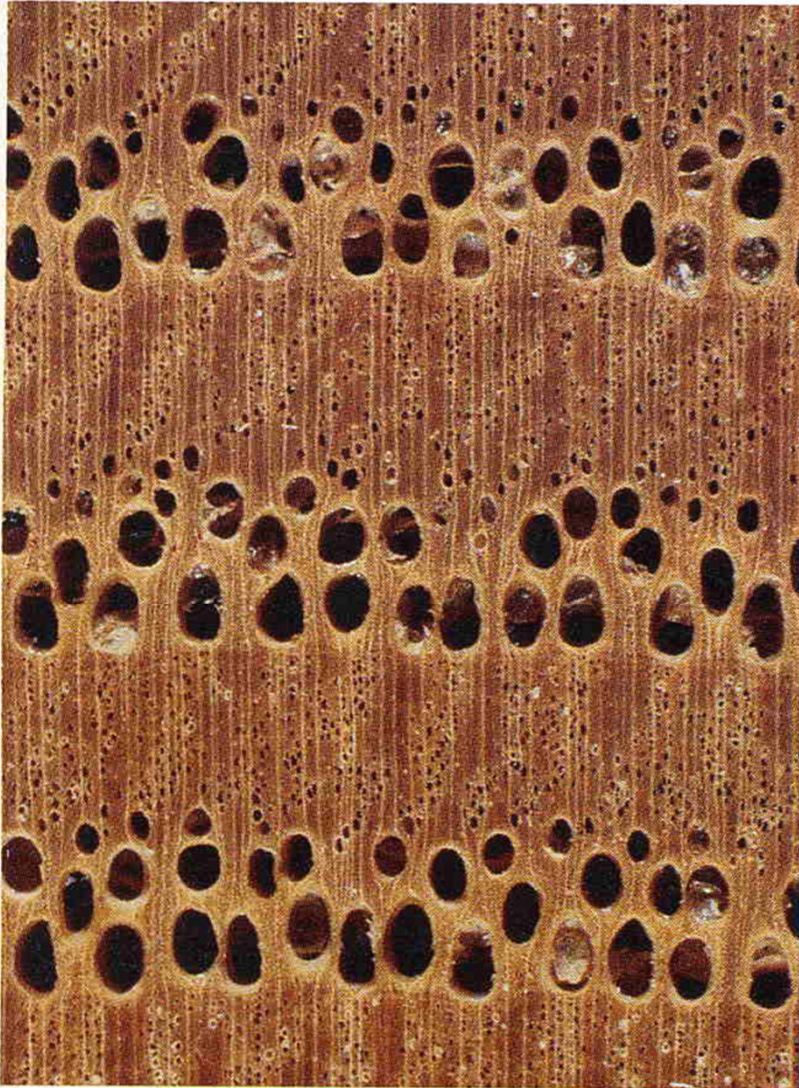


AMERICAN CHESTNUT  
*Castanea dentata*

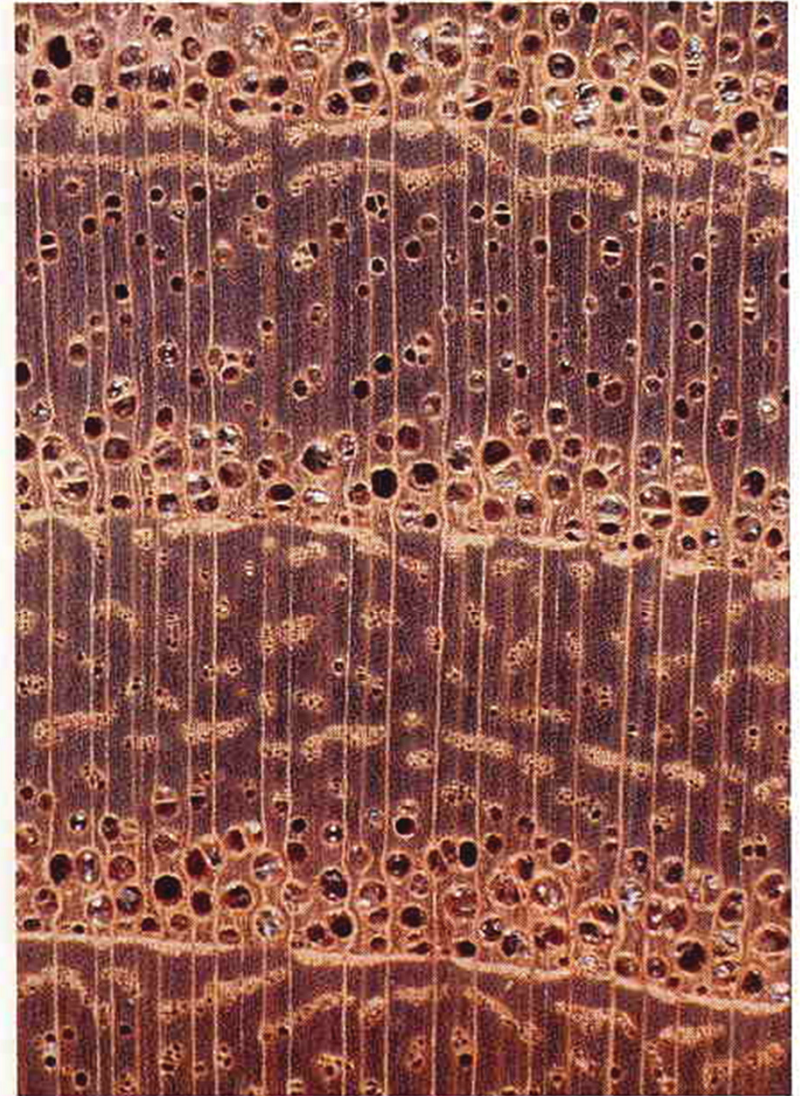


WHITE ASH  
*Fraxinus americana*



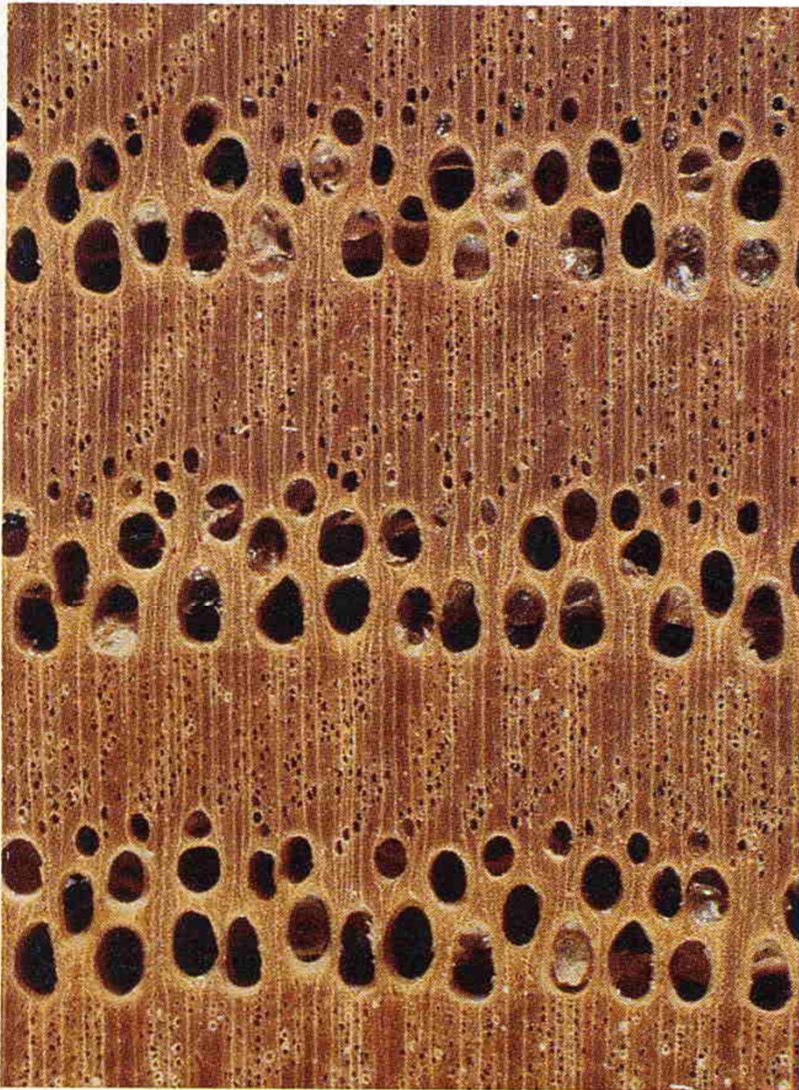


AMERICAN CHESTNUT  
*Castanea dentata*

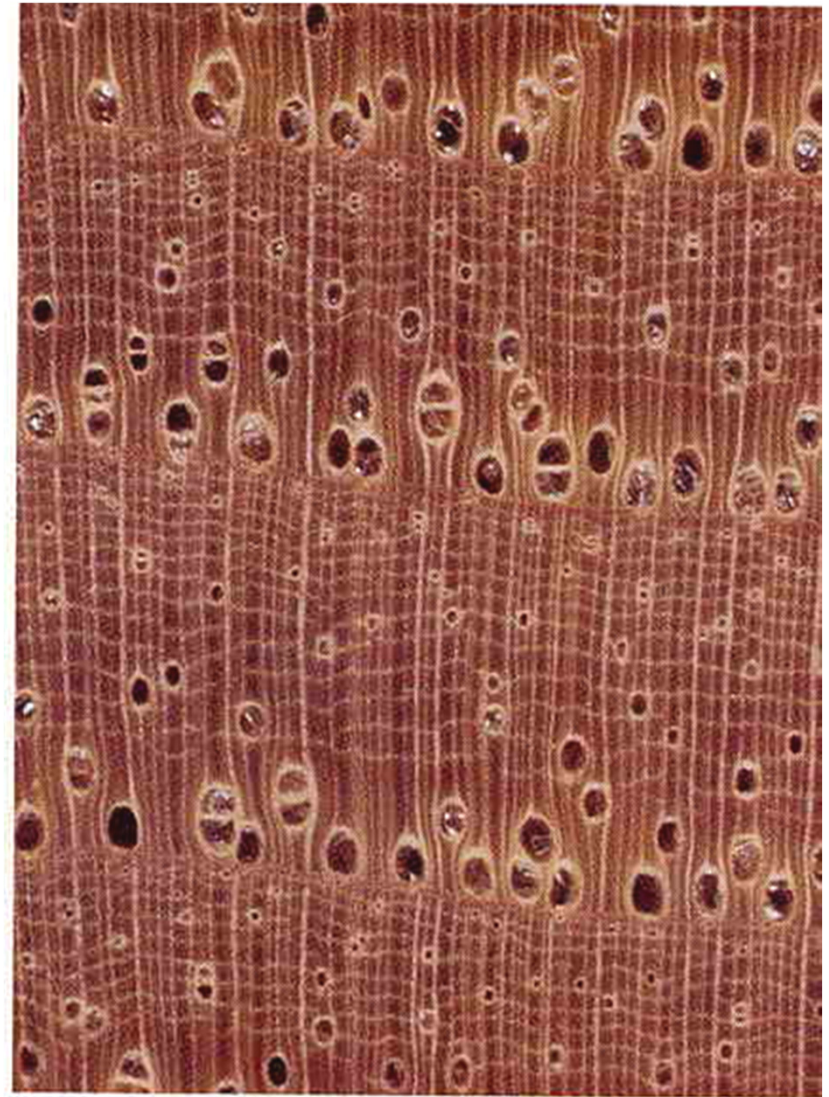


NORTHERN CATALPA  
*Catalpa speciosa*



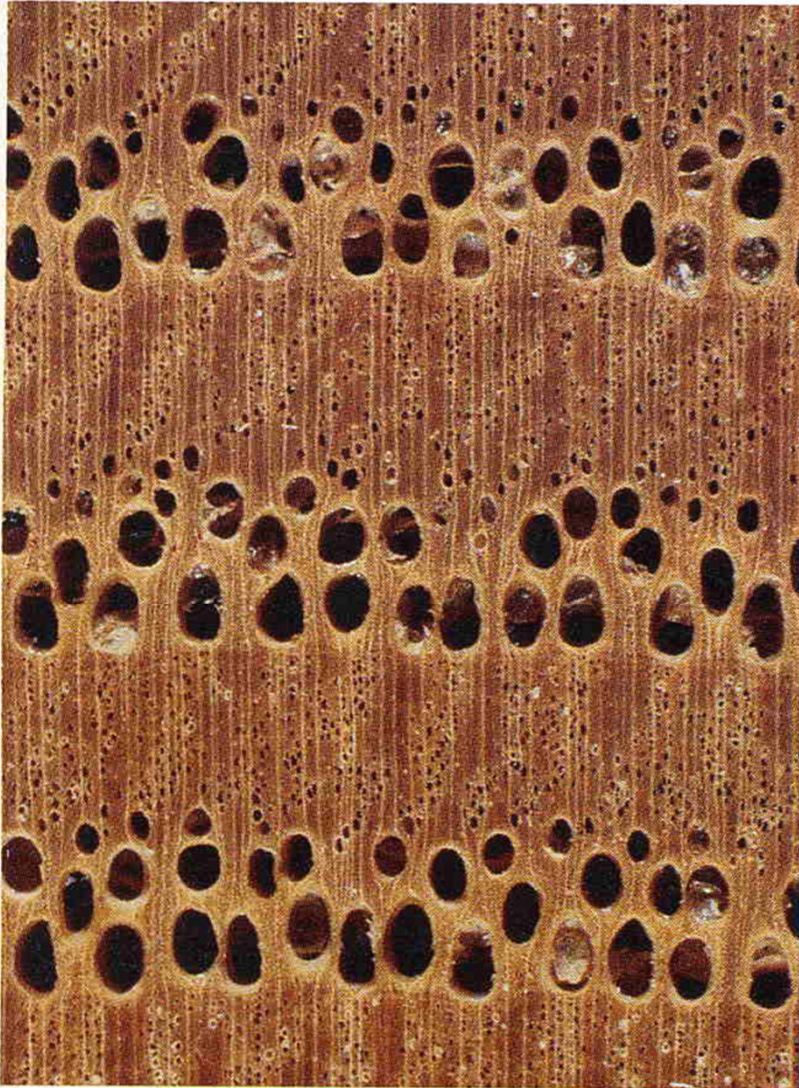


AMERICAN CHESTNUT  
*Castanea dentata*

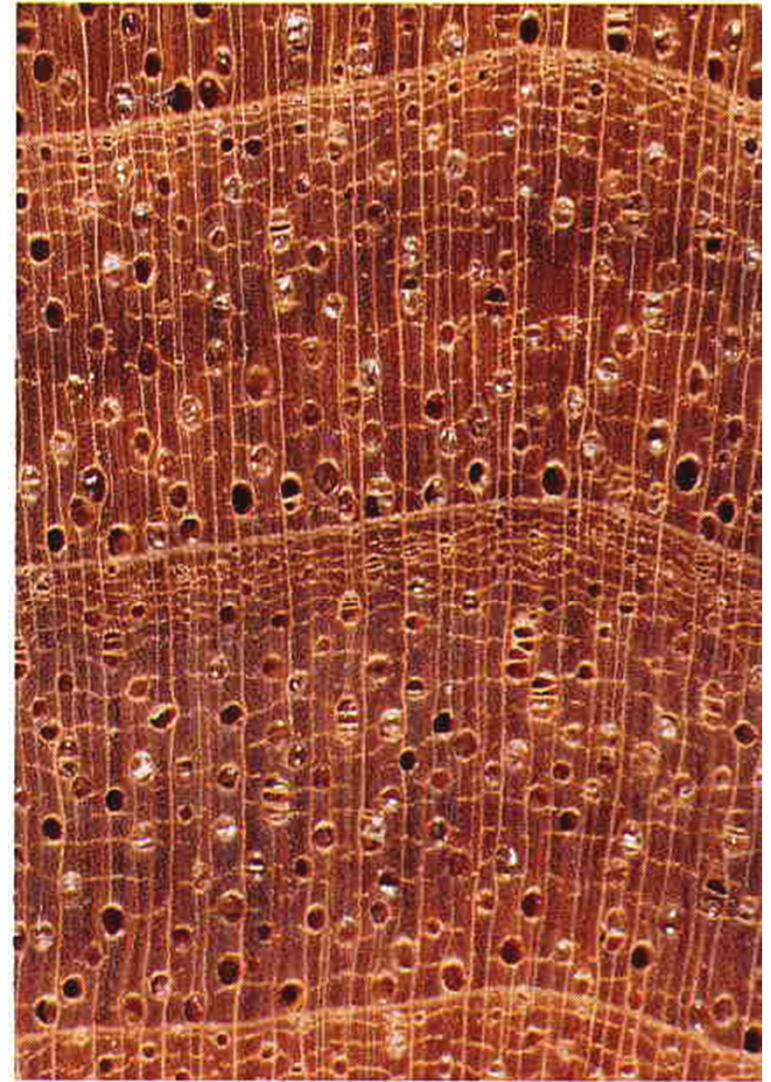


SHAGBARK HICKORY  
*Carya ovata*



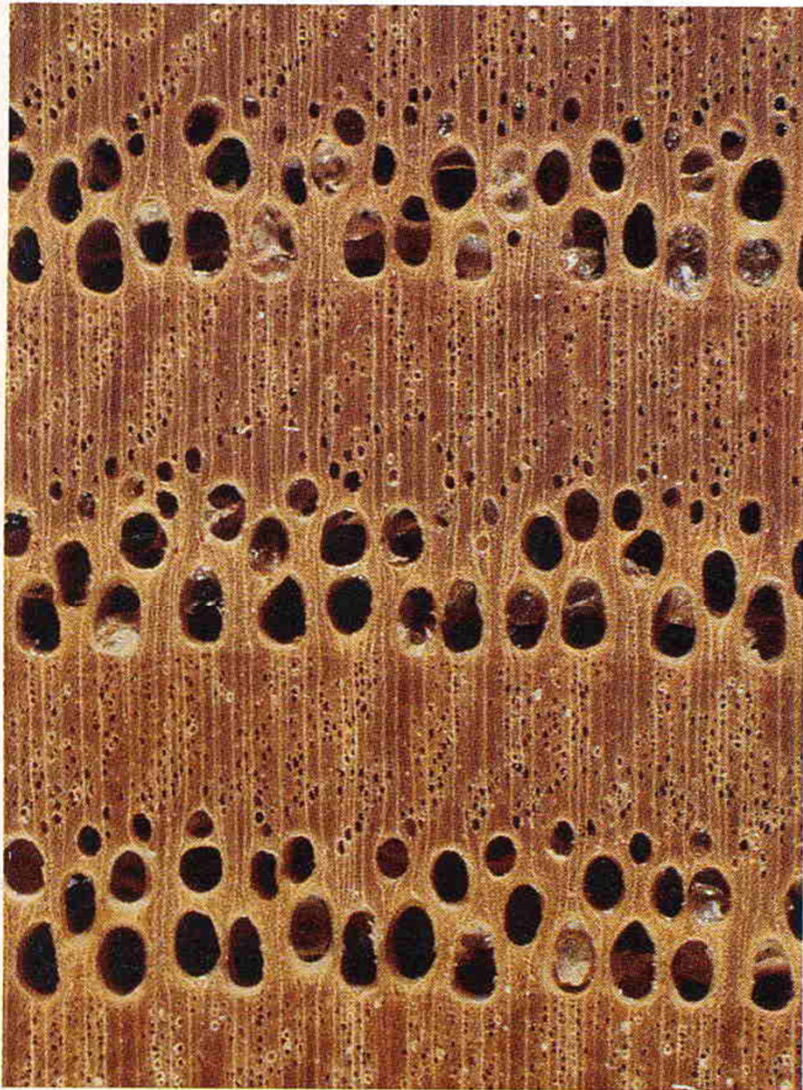


AMERICAN CHESTNUT  
*Castanea dentata*

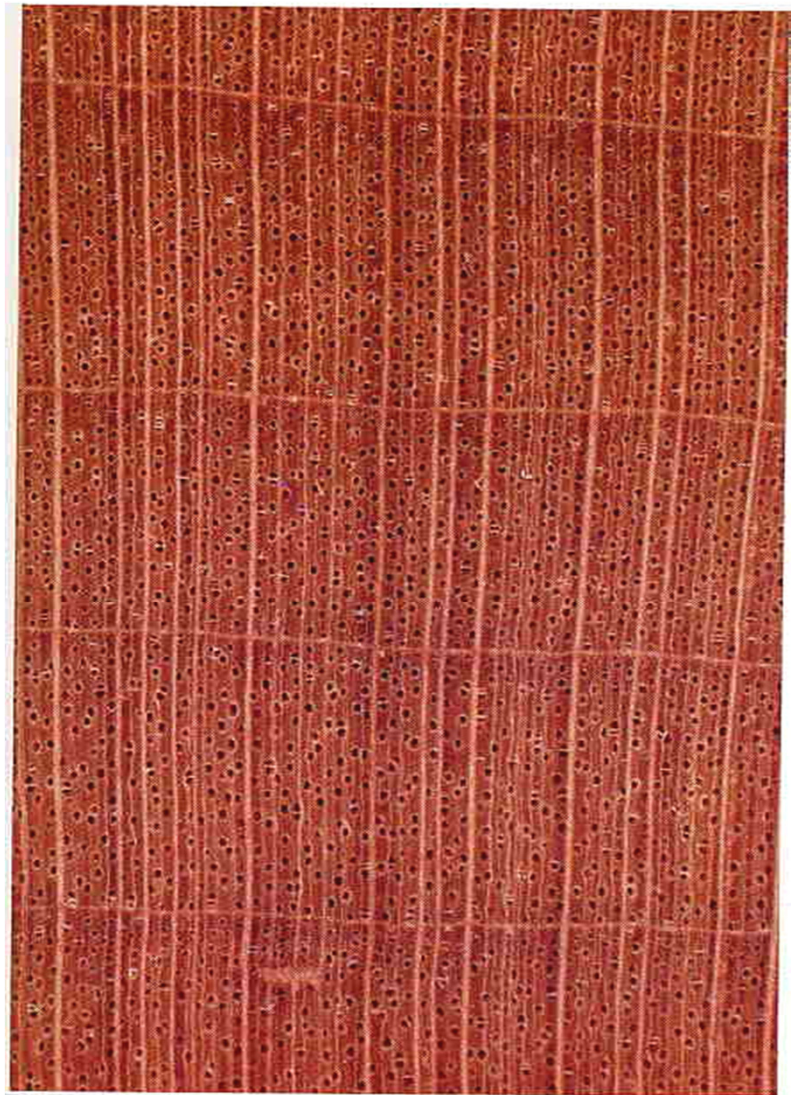


BUTTERNUT  
*Juglans cinerea*



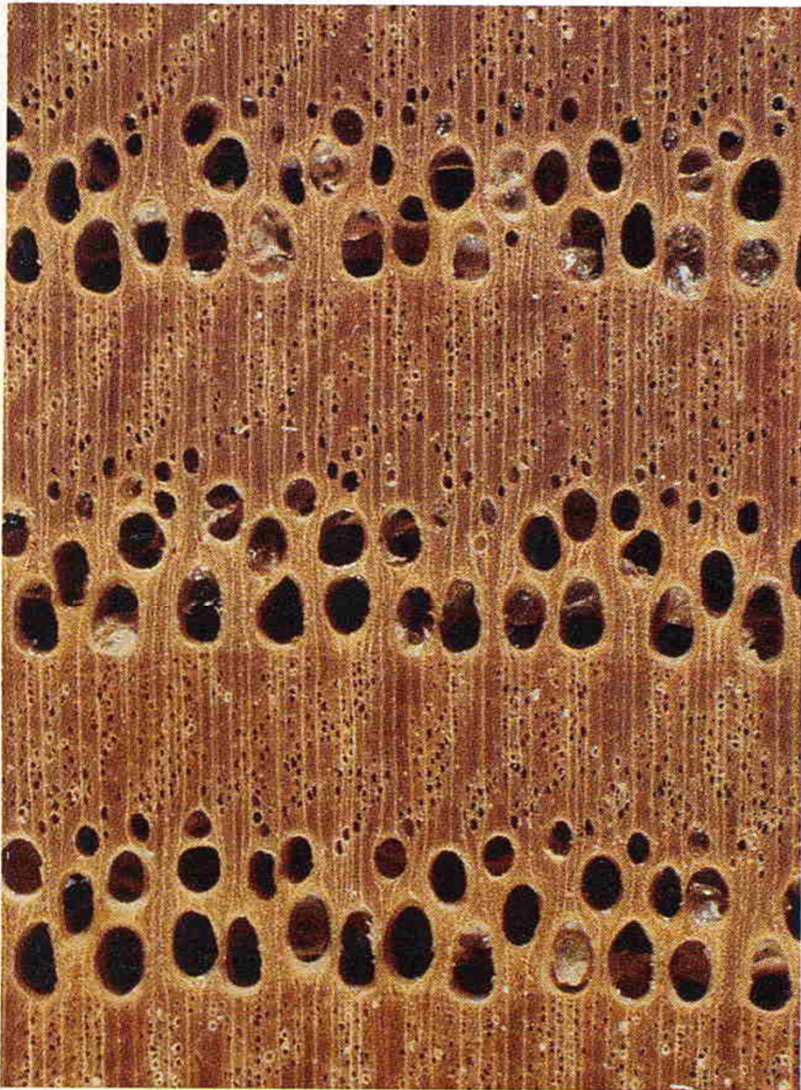


AMERICAN CHESTNUT  
*Castanea dentata*



SUGAR MAPLE  
*Acer saccharum*



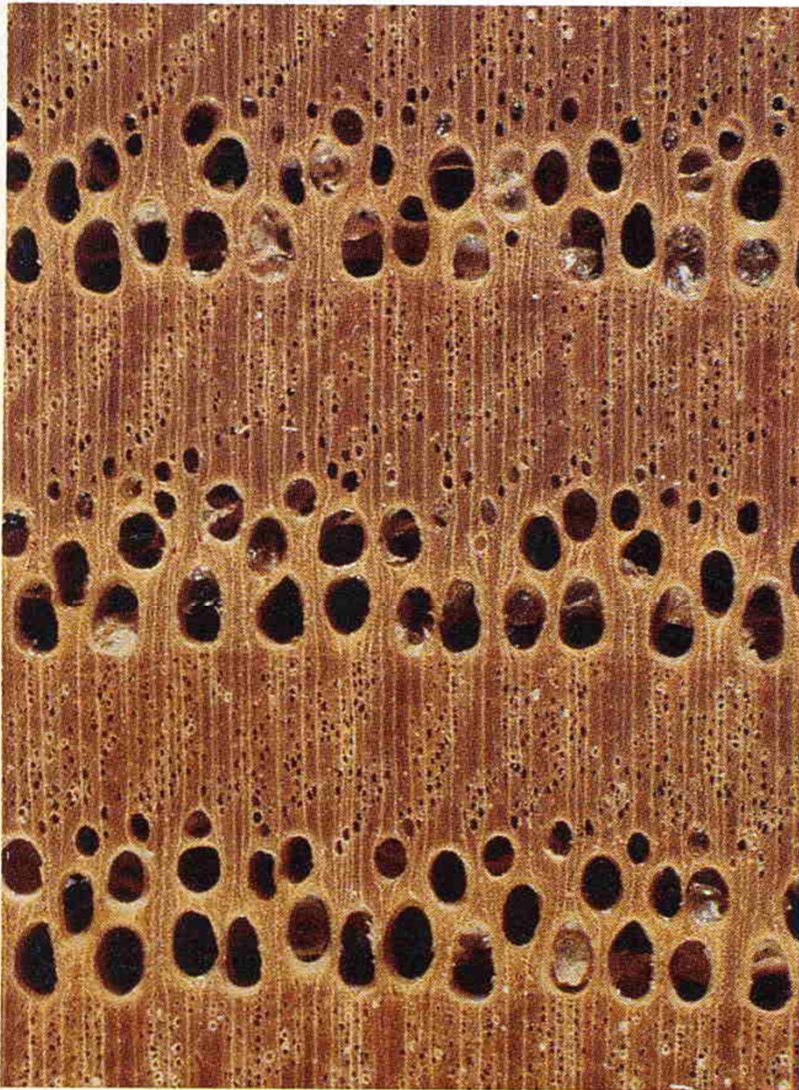


AMERICAN CHESTNUT  
*Castanea dentata*

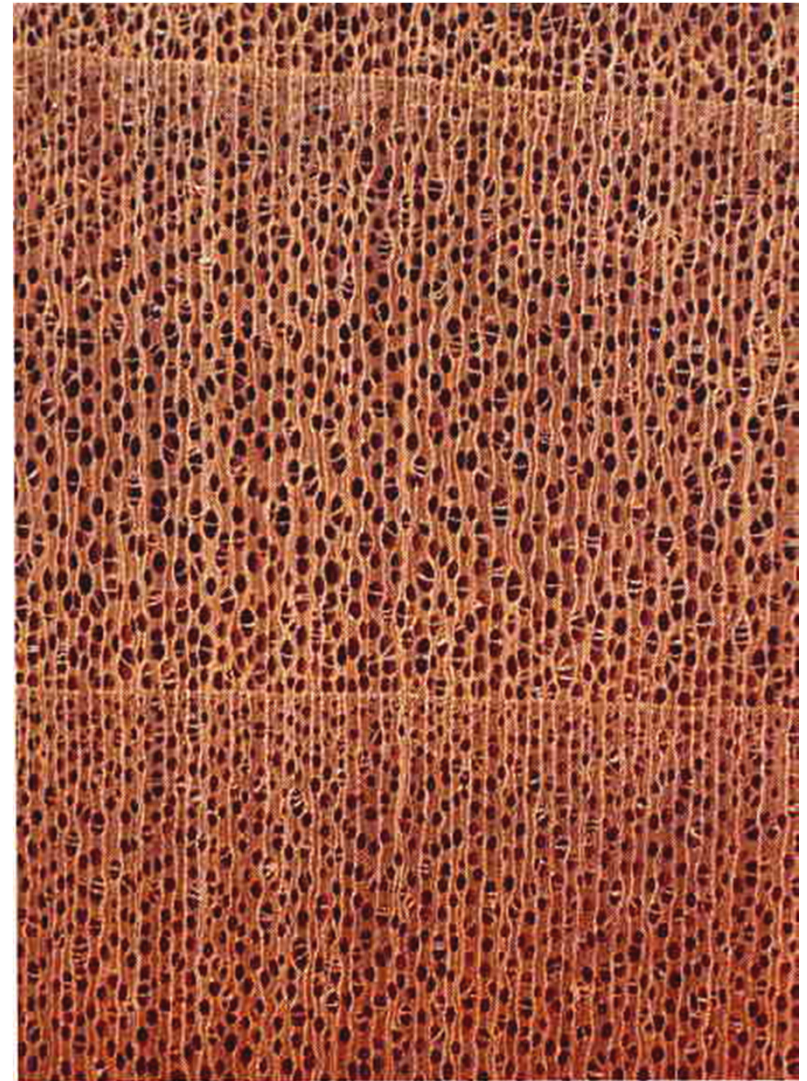


YELLOW-POPLAR  
*Liriodendron tulipifera*



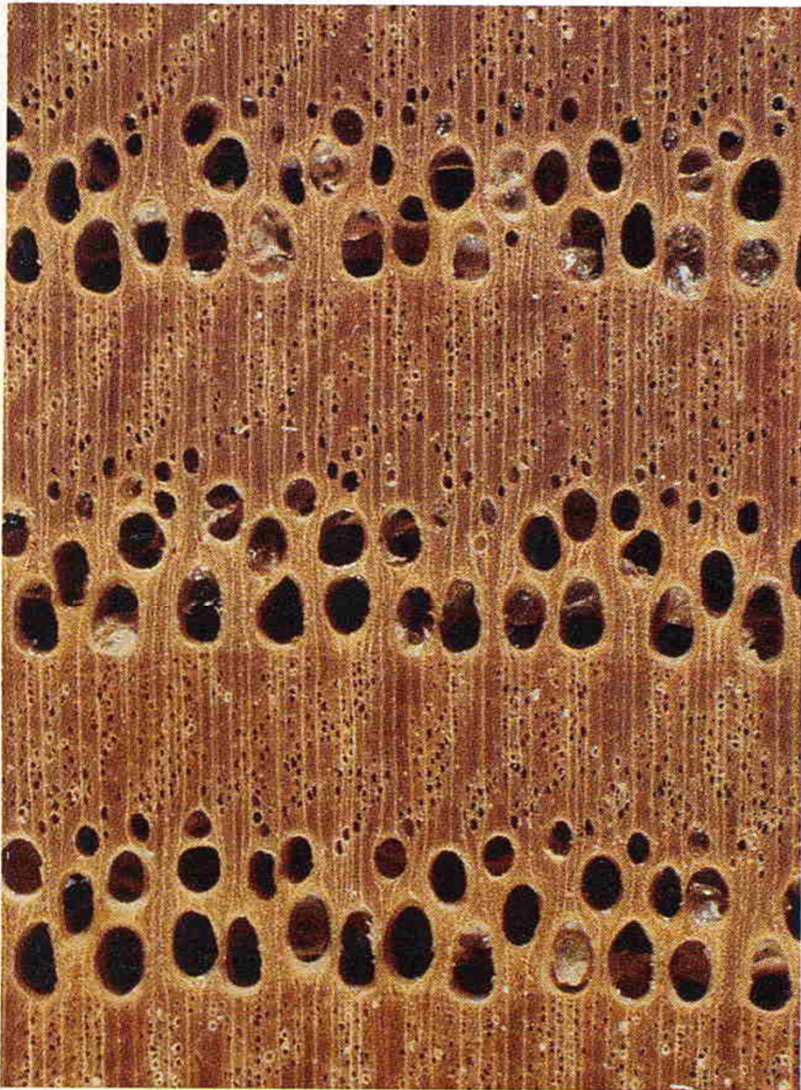


AMERICAN CHESTNUT  
*Castanea dentata*

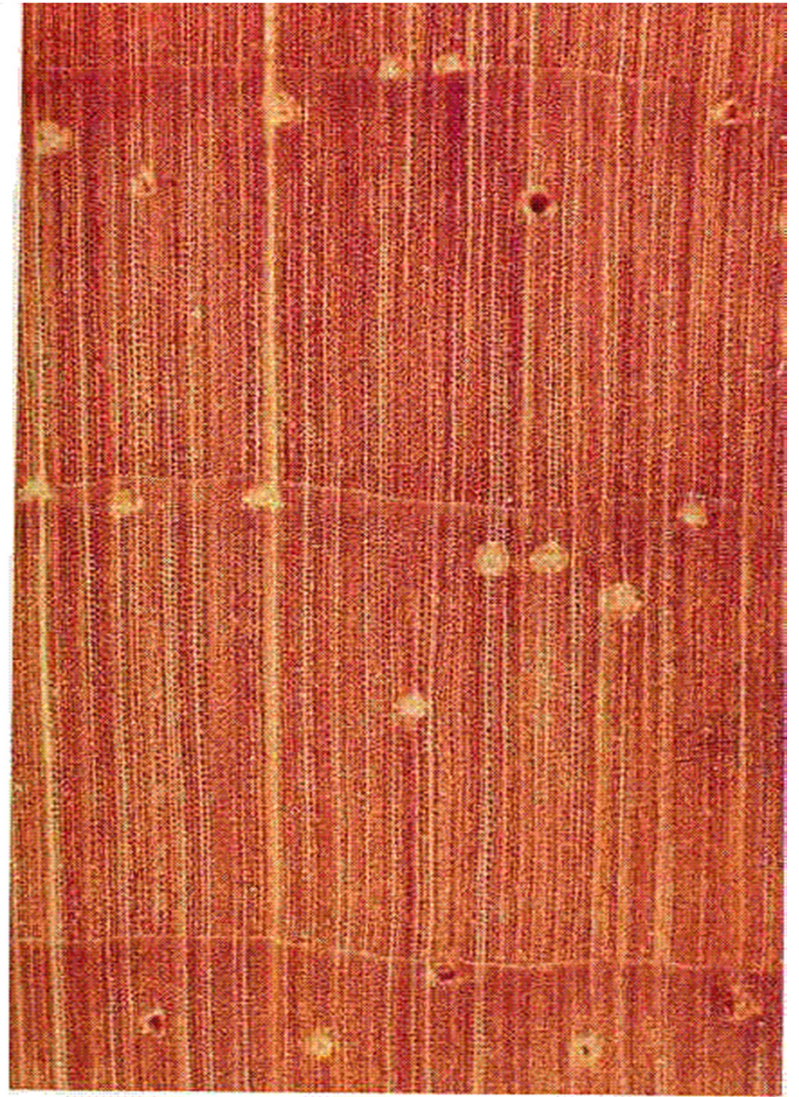


BLACK WILLOW  
*Salix nigra*



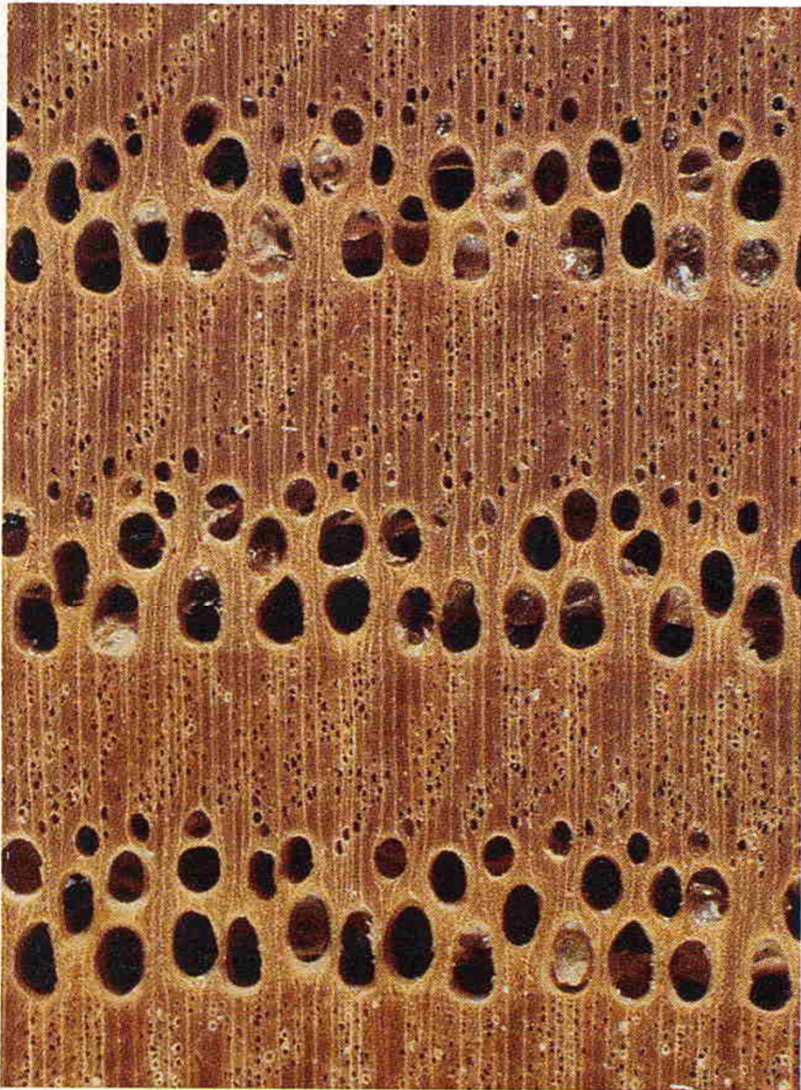


AMERICAN CHESTNUT  
*Castanea dentata*

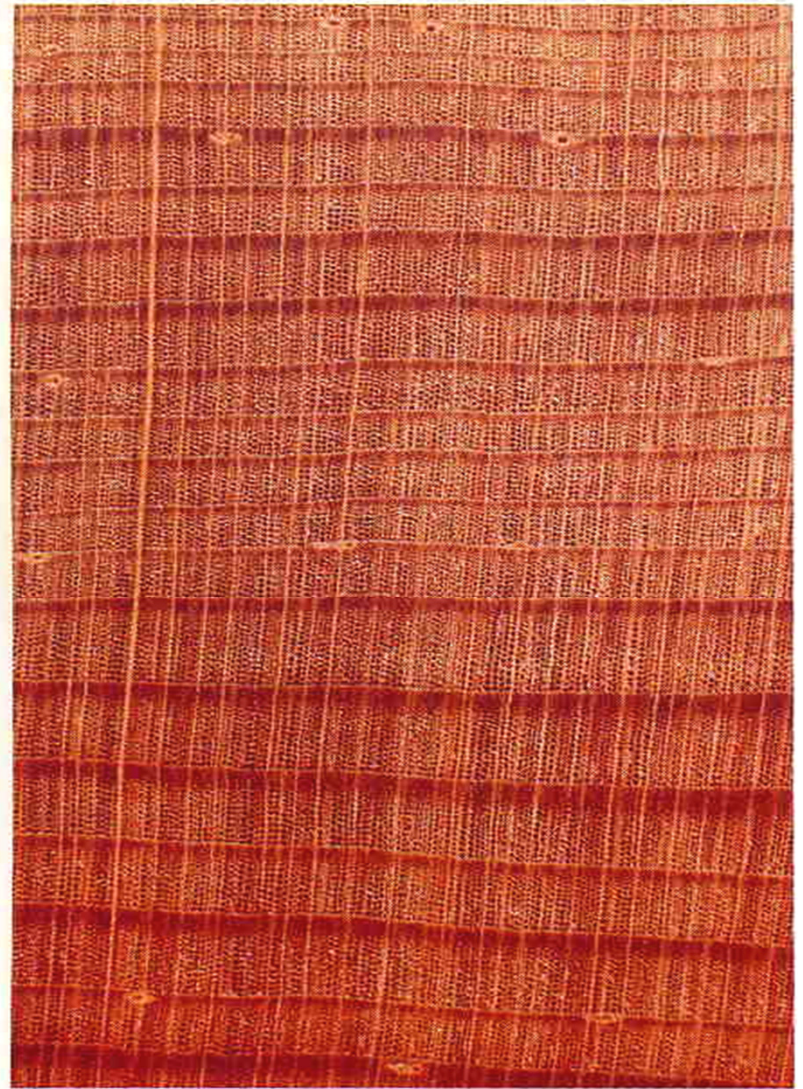


EASTERN WHITE PINE  
*P. strobus*



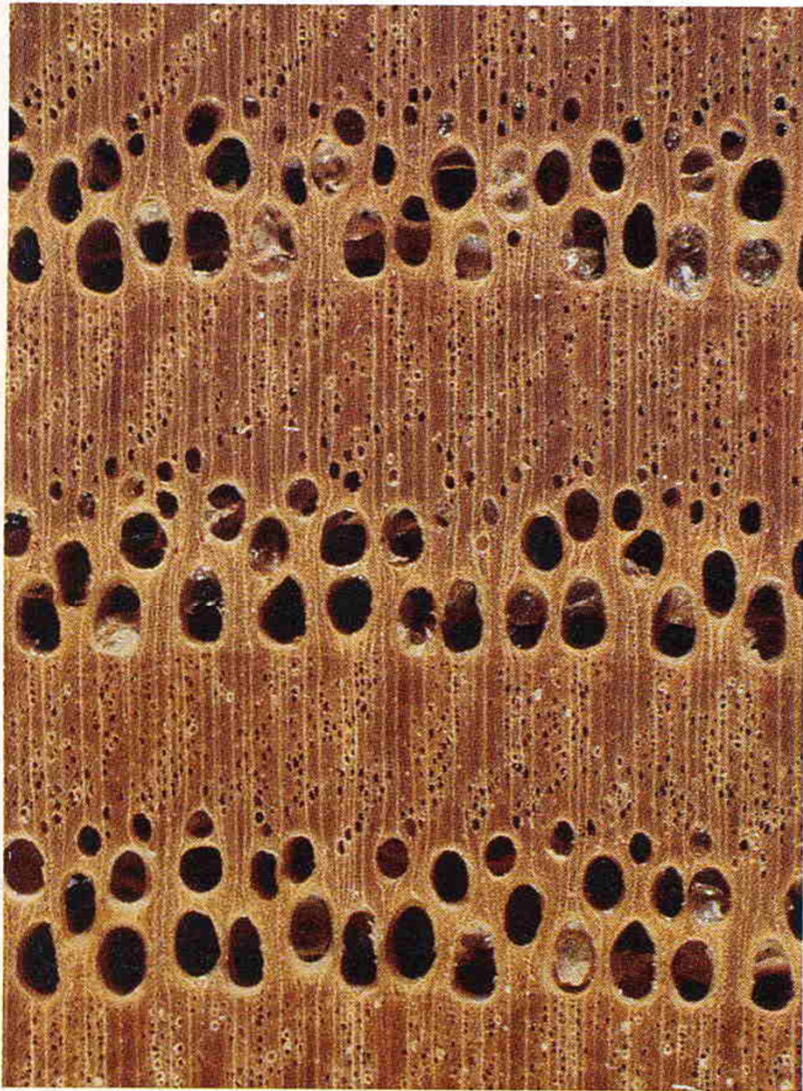


AMERICAN CHESTNUT  
*Castanea dentata*



DOUGLAS-FIR  
*Pseudotsuga menziesii*





AMERICAN CHESTNUT  
*Castanea dentata*

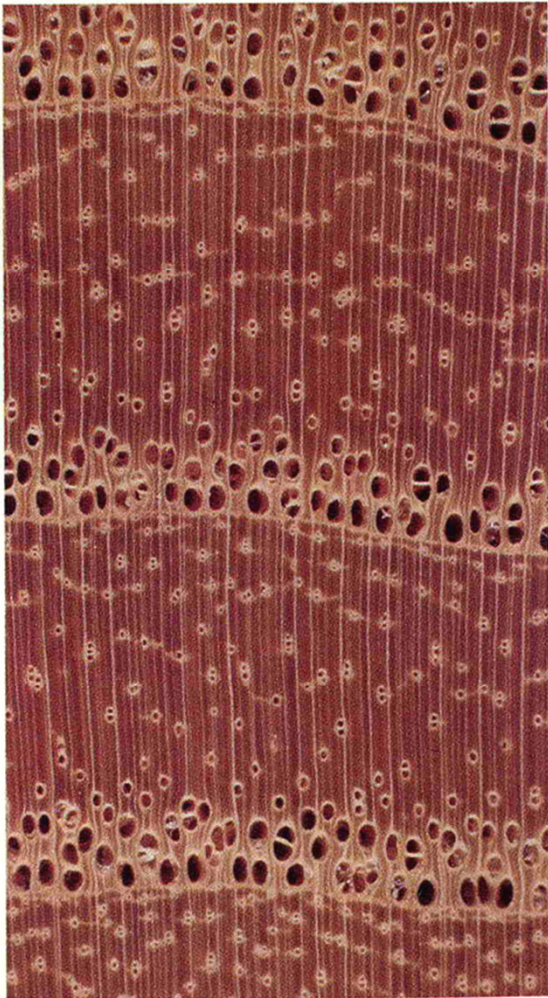


EASTERN HEMLOCK  
*Tsuga canadensis*

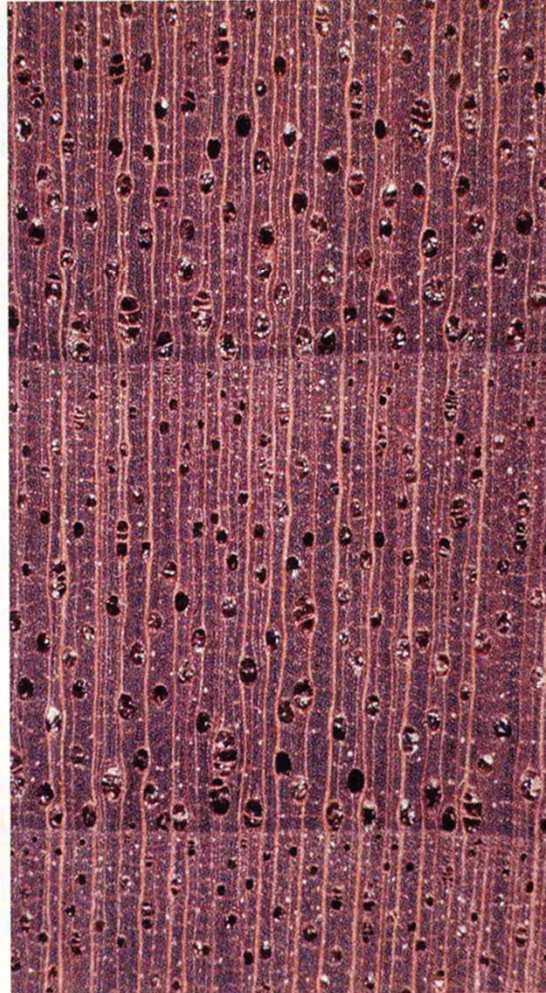


## HARDWOOD CLASSIFICATION

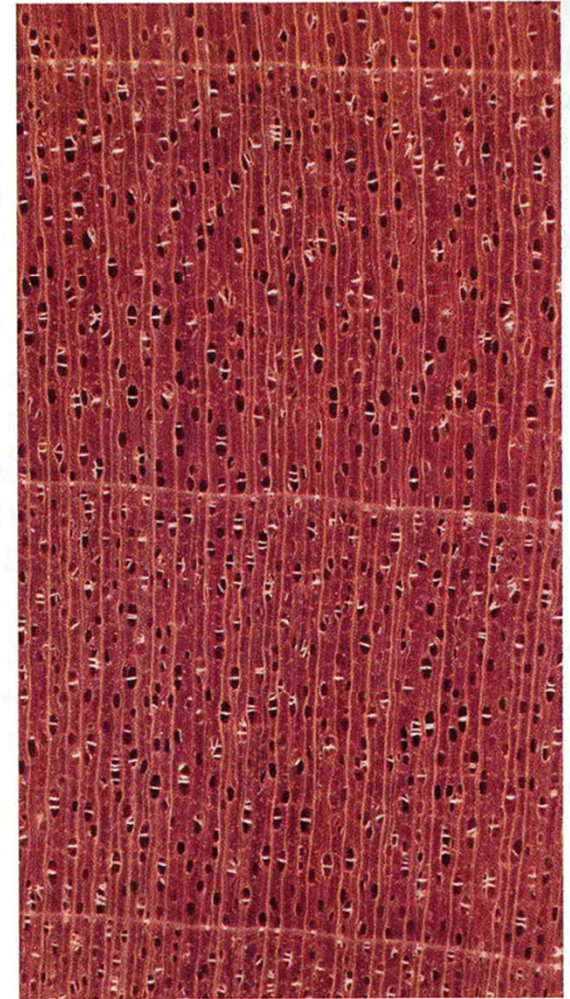
Hardwoods are classified as ring-porous, as seen in white ash (left), semi-ring-porous, as seen in black walnut (center), or diffuse-porous, as seen in yellow birch (right).



See Group I: ring-porous hardwoods above.



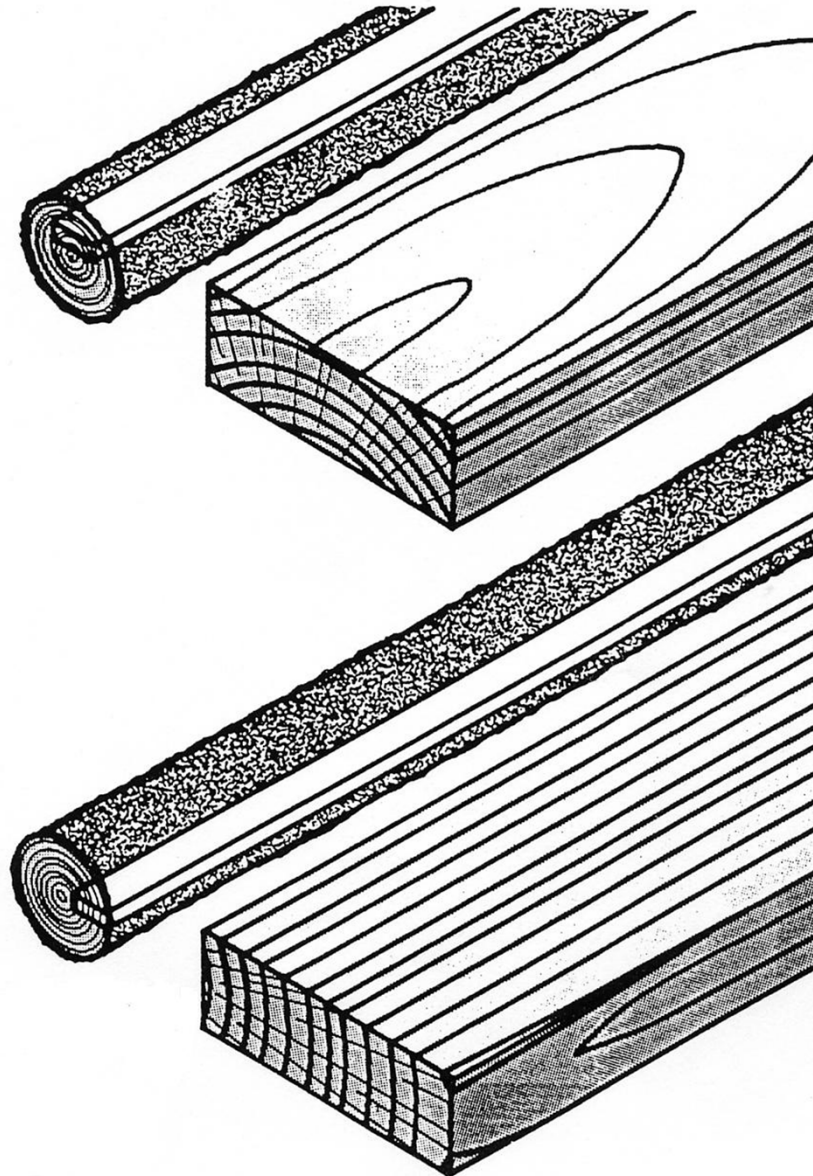
See Group II: semi-ring-porous or semi-diffuse-porous hardwoods, p. 114.



See Group III: diffuse-porous hardwoods, p. 117.



## Classification of lumber by the manner of cutting





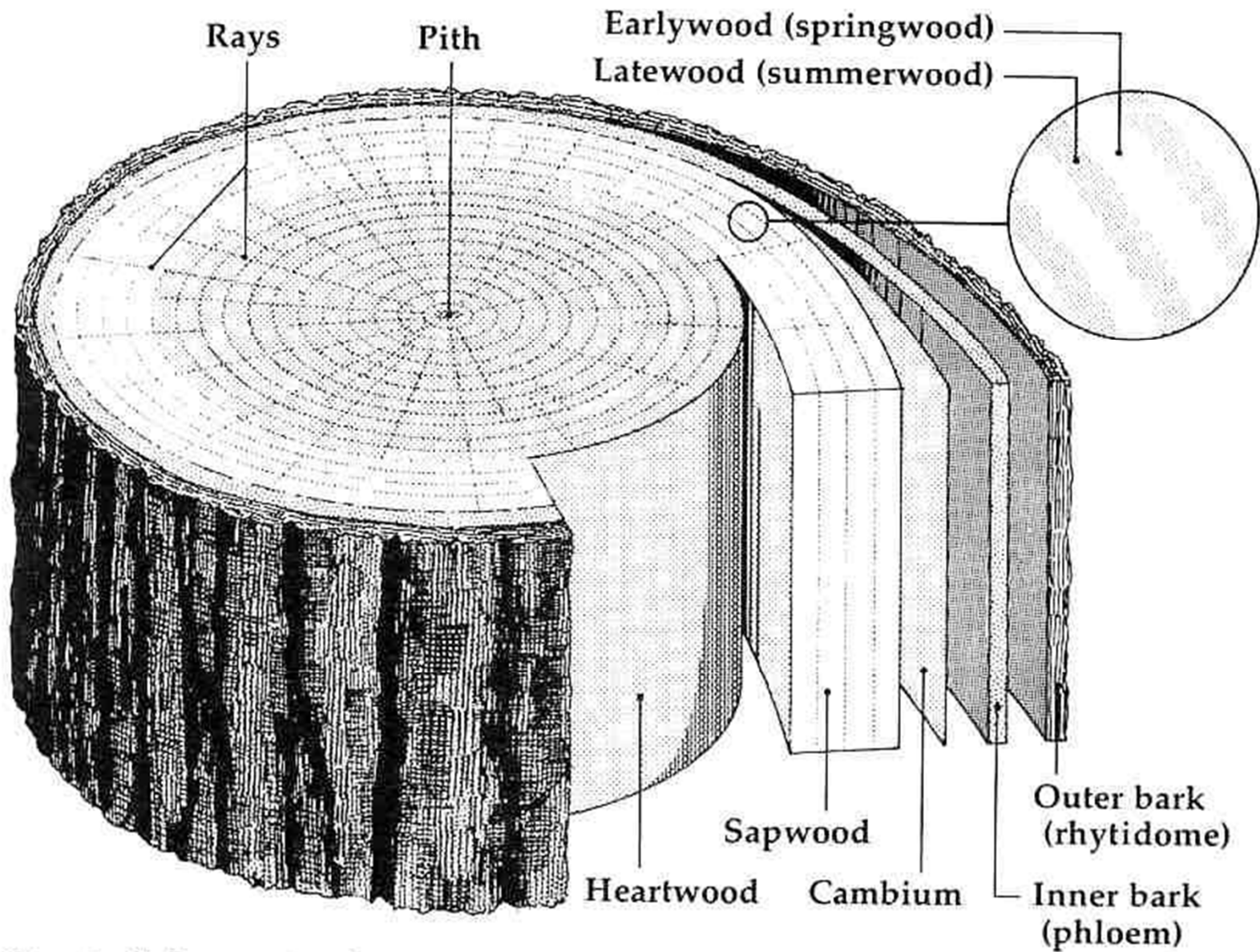
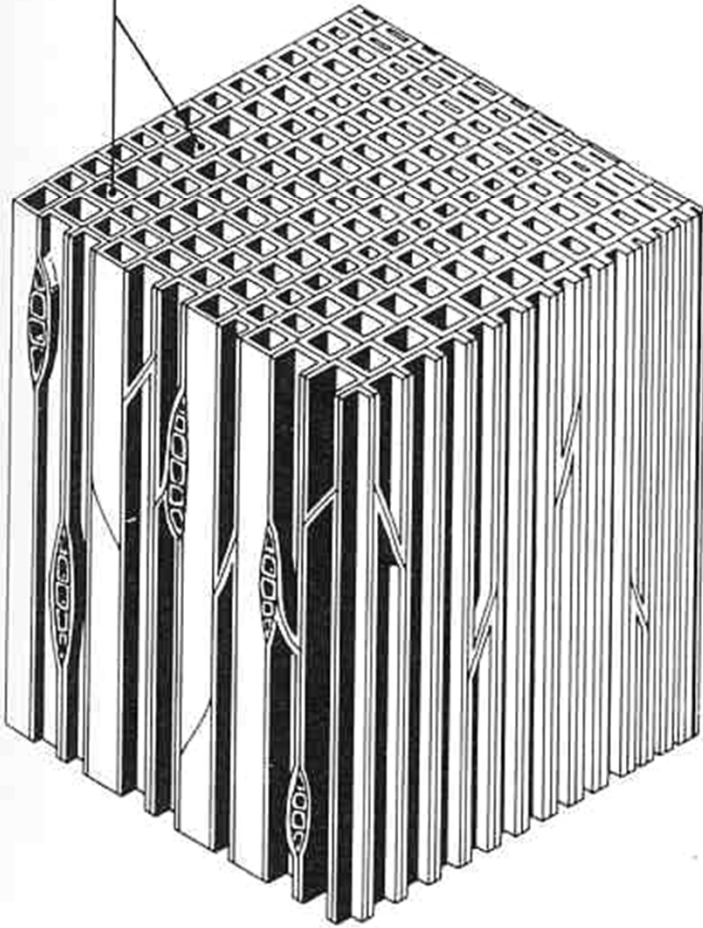


Fig. 2 Schematic diagram of a tree cross-section



## Softwood

Tracheids

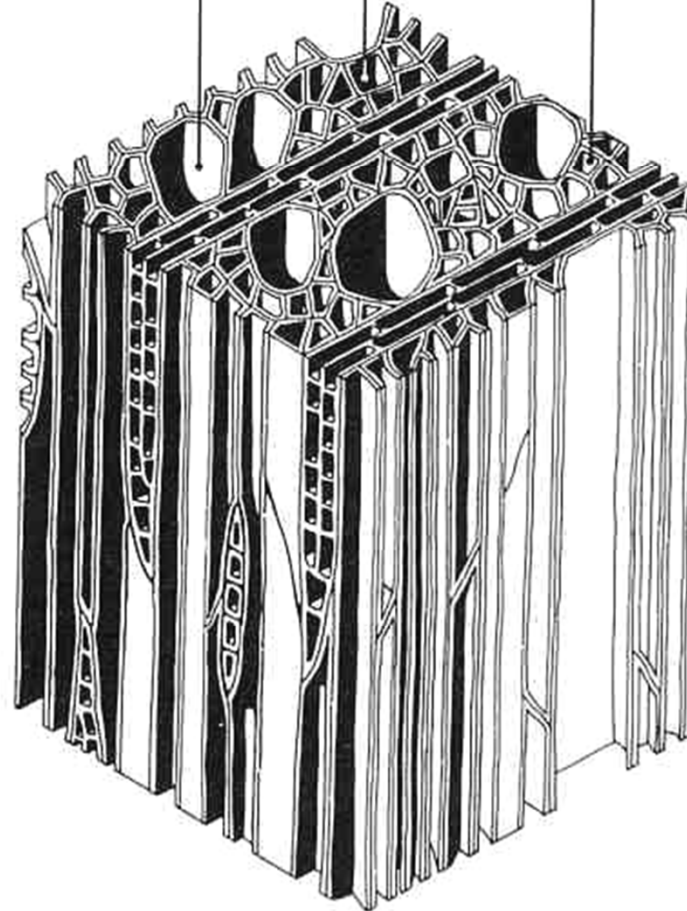


## Hardwood

Vessel (pore)

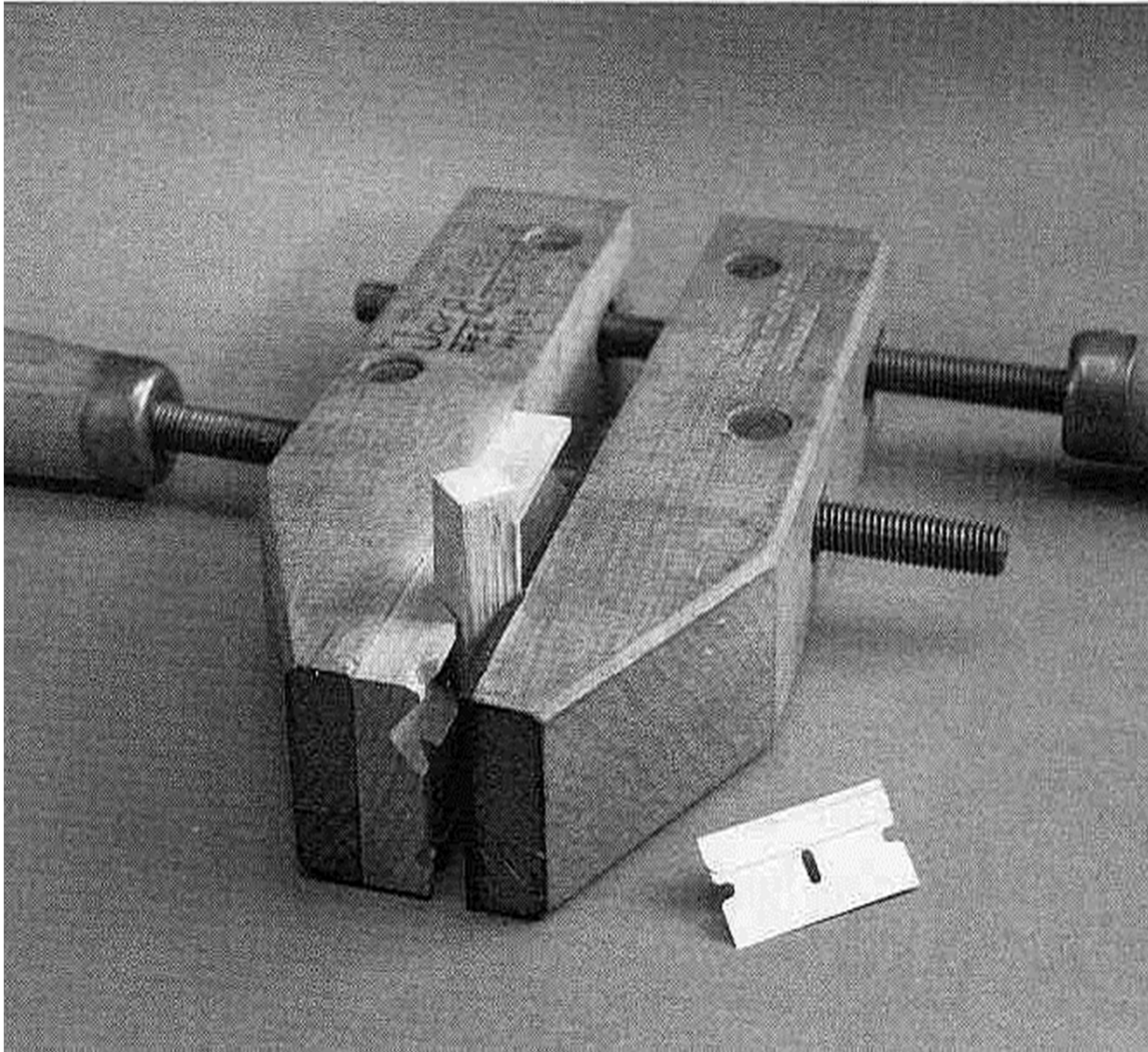
Tracheid

Fiber

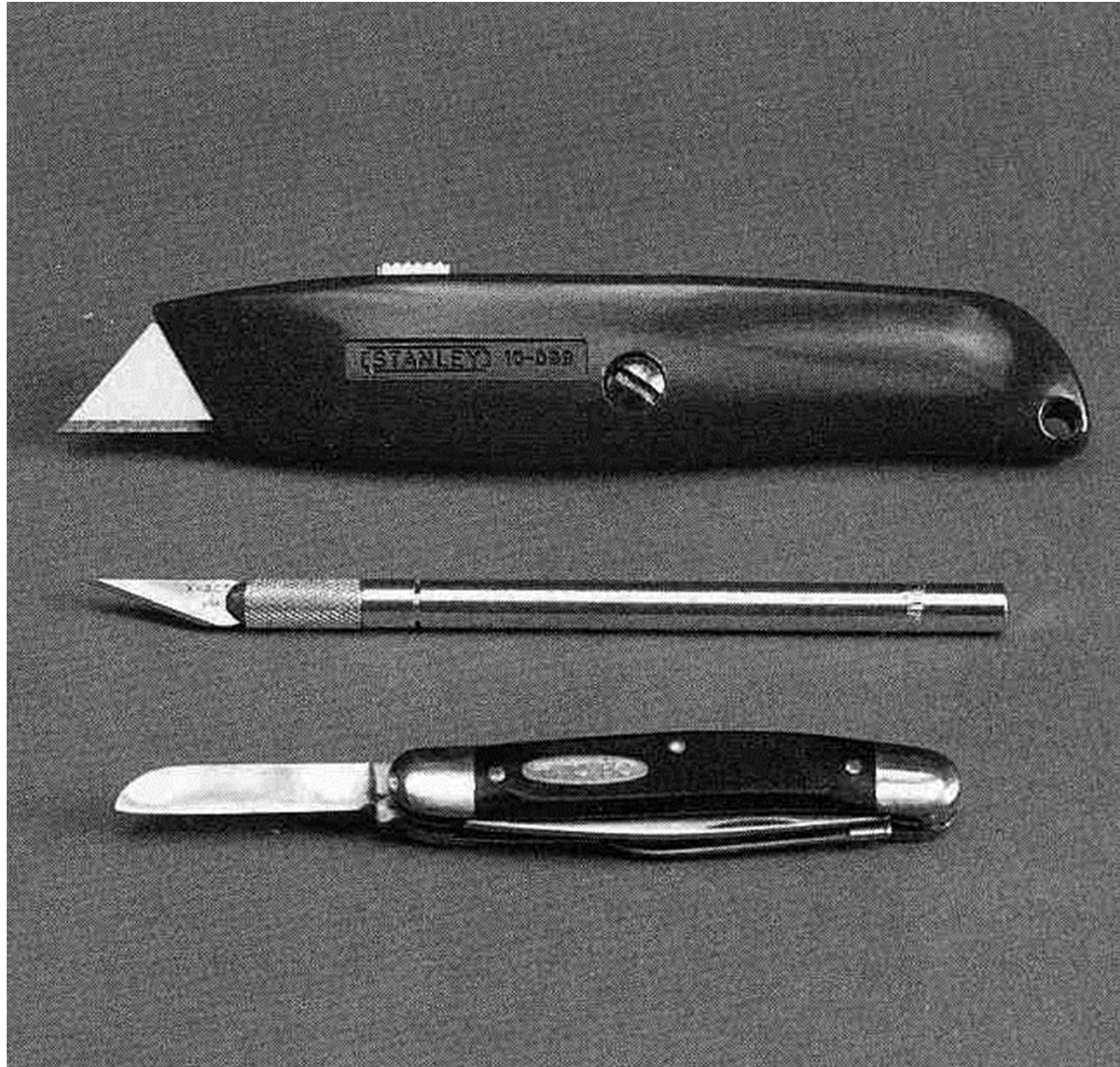


**Fig. 6** Schematic diagram of softwood and hardwood illustrating the relative appearance of vessels and tracheids









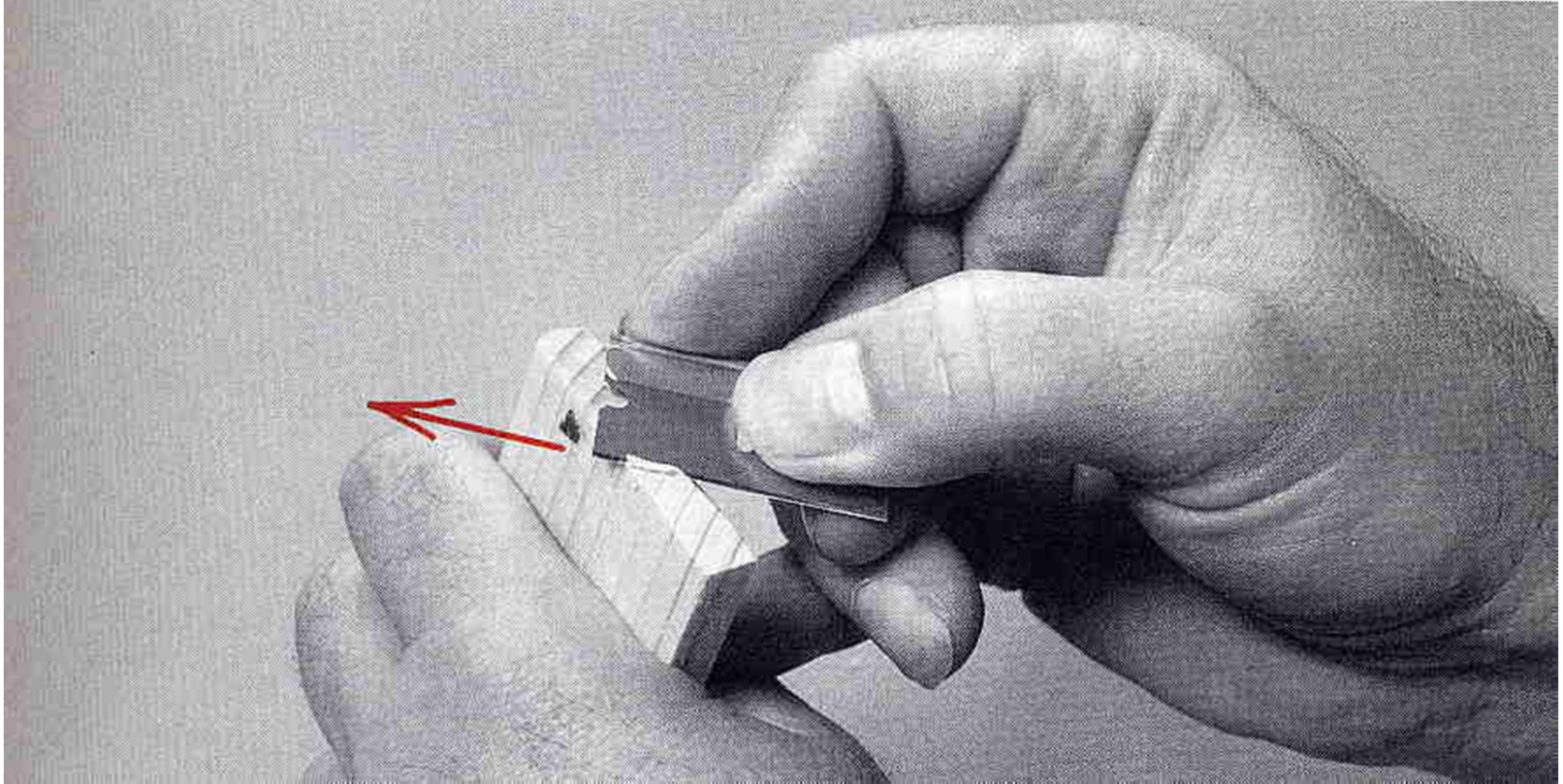




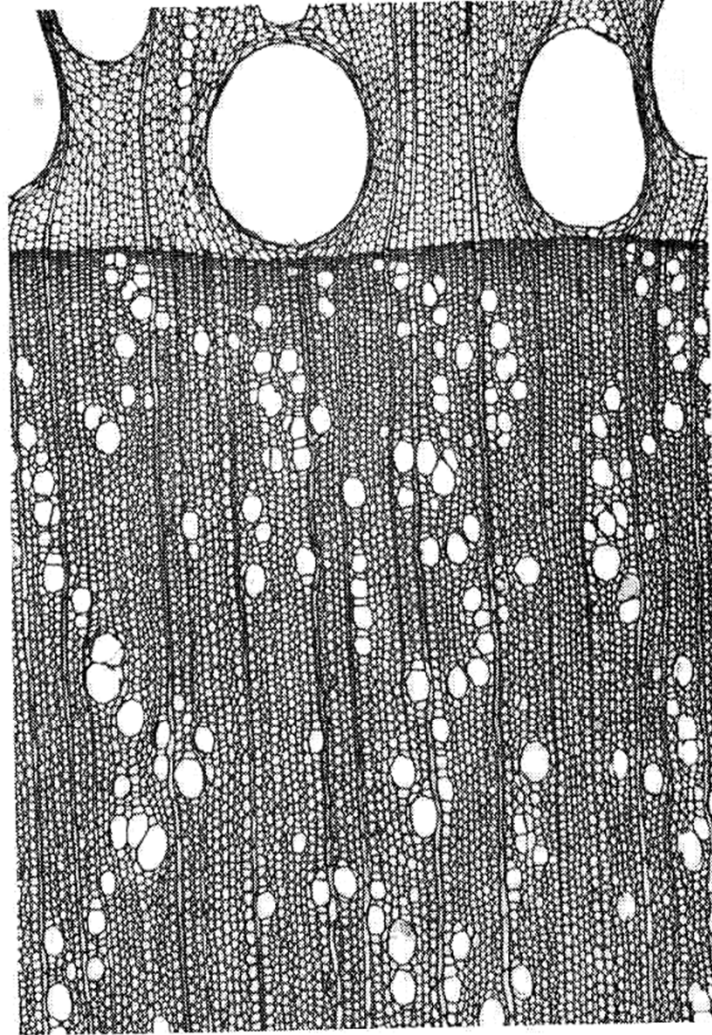












b. Dendritic

*Castanea dentata*, 30X

Chestnut

Other examples:

*Ostrya* spp.

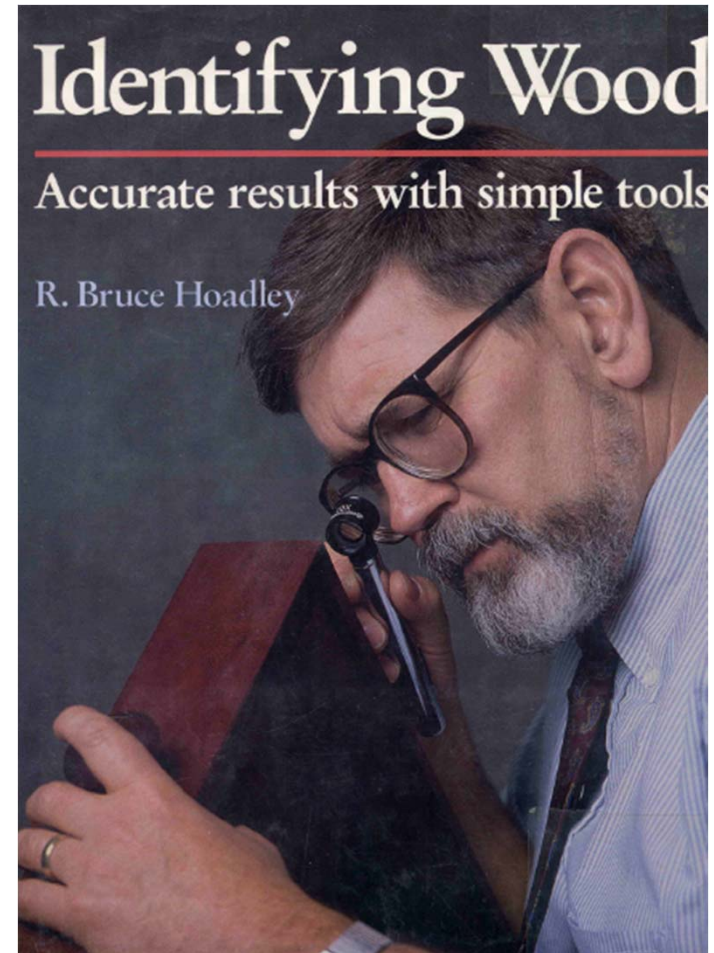
*Carpinus* spp.



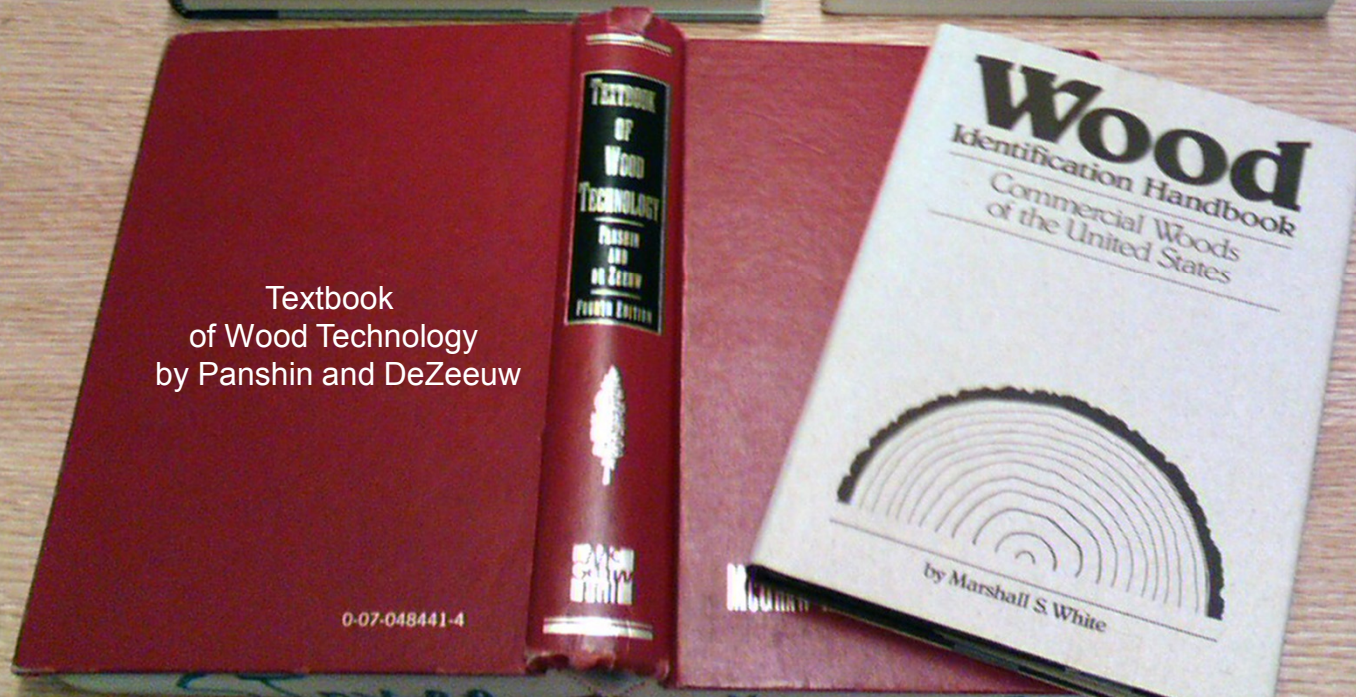
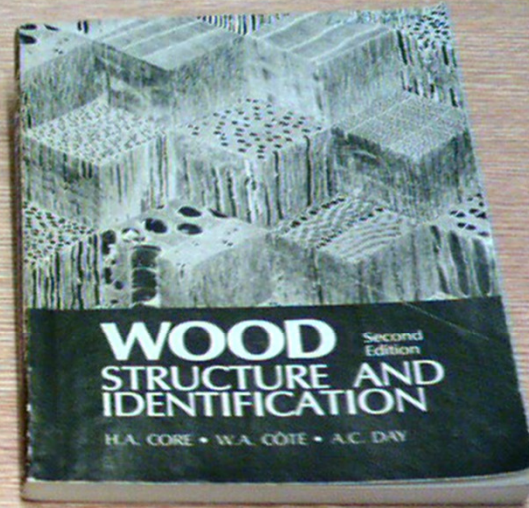
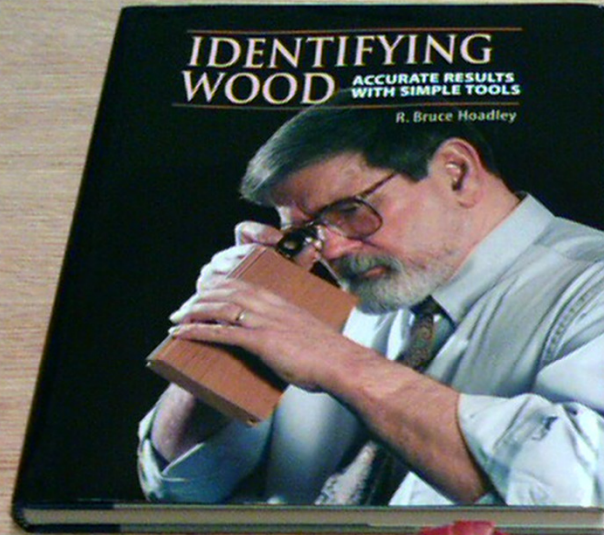
# Wood ID References



- [http://www.fpl.fs.fed.us/research/centers/woodanatomy/wood\\_idfactsheet.php](http://www.fpl.fs.fed.us/research/centers/woodanatomy/wood_idfactsheet.php)
  - Send in samples for ID by USFS professionals
- <http://www.utextension.utk.edu/publications/pbfiles/PB1692.pdf>
  - Extension bulletin with description of common woods.
- <http://www.cefts.org/Wood-ID.htm>
  - Presentation with many great photos of commonly seen woods
- Hoadley's - Identifying Wood







Textbook  
of Wood Technology  
by Panshin and DeZeeuw

0-07-048441-4

TEXTBOOK  
OF  
WOOD  
TECHNOLOGY  
PANSHIN  
AND  
DE ZEEUW  
FOURTH EDITION

McGraw-Hill