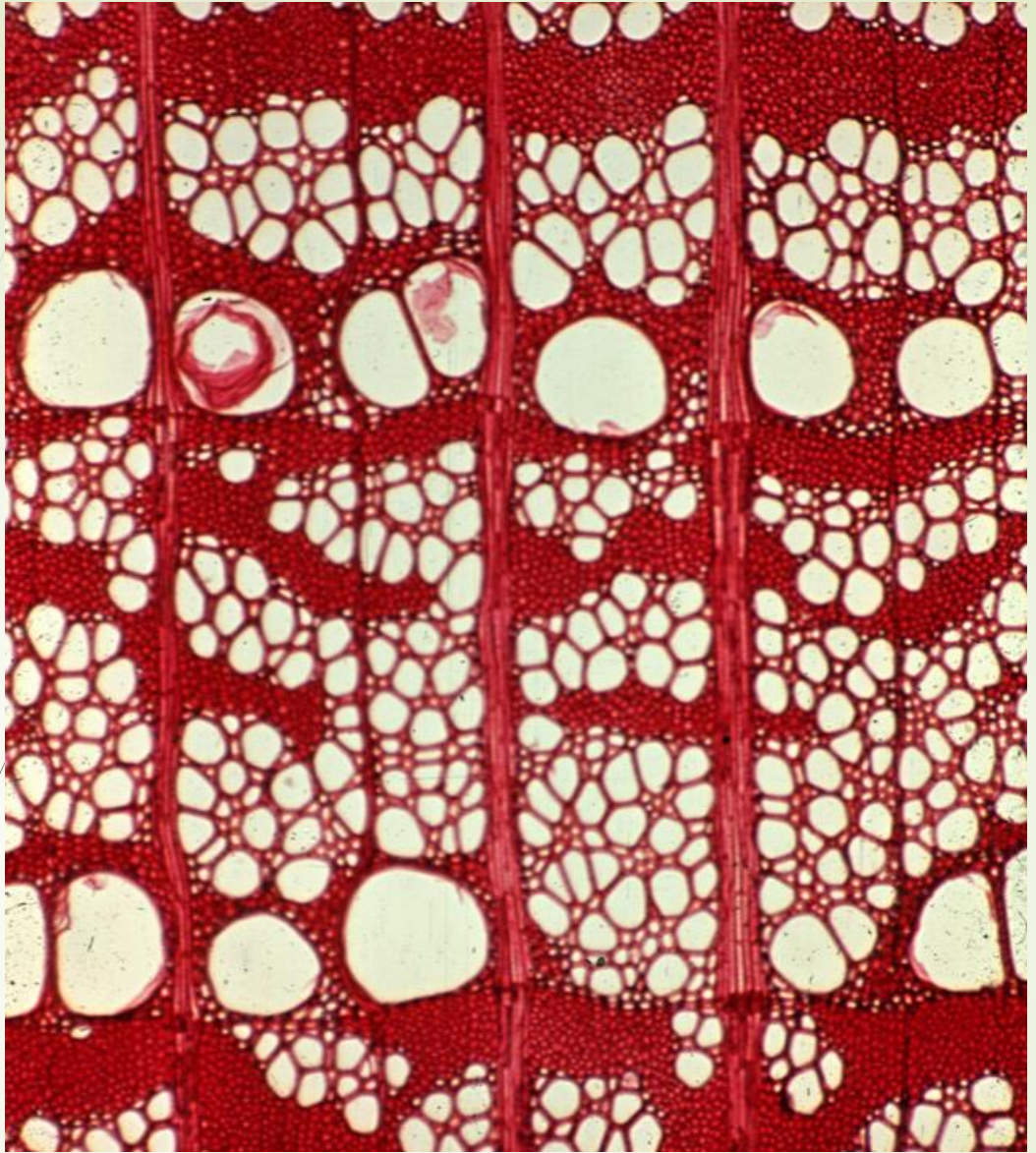


Curtis, Lersten, and Nowak, 2002 rev. 2015 : *Ulmus* (elm) wood cross section



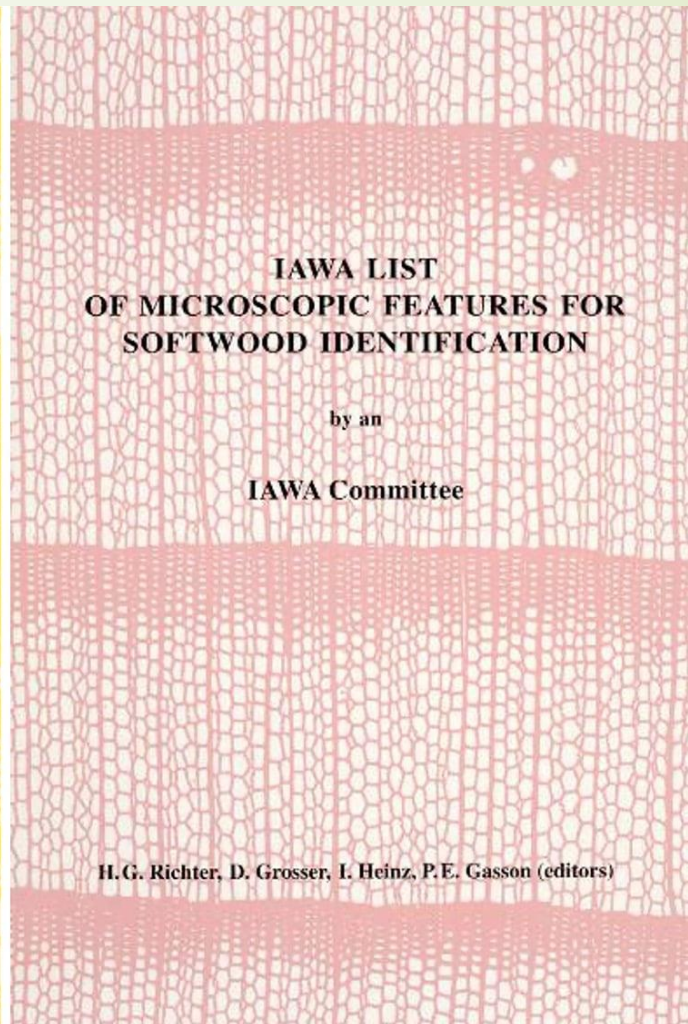
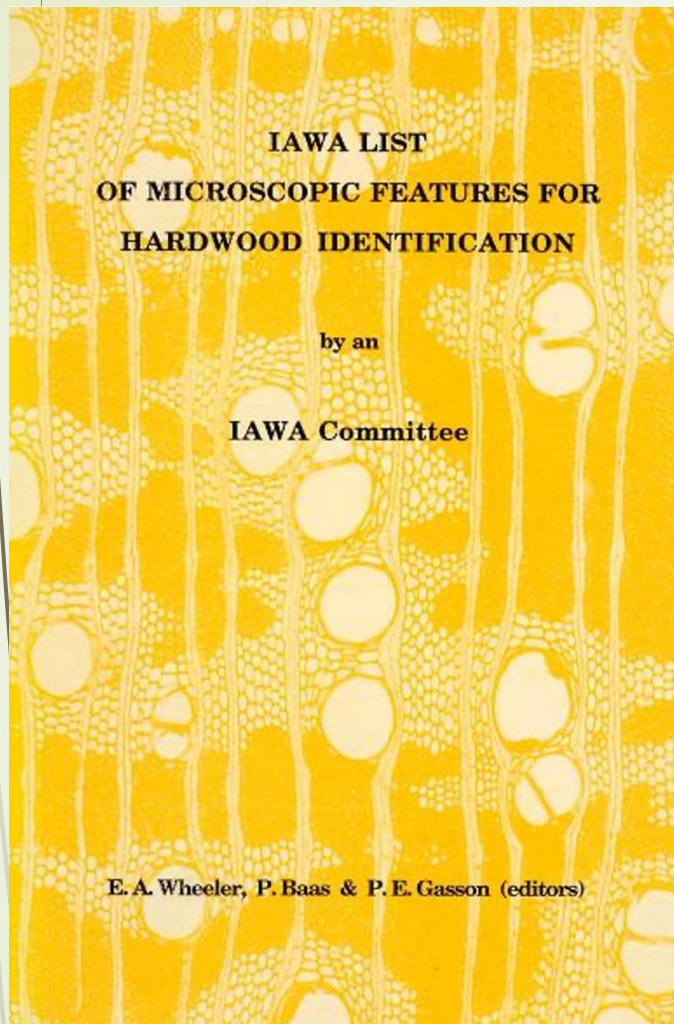
## Some interesting Wood Anatomical Features for Species Identification

Samuel Bouchut



## IAWA & InsideWood

The reference for wood anatomical descriptions  
& species identifications !



Along with the Inside Wood database website :

**INSIDE WOOD**

[Search](#) [Welcome](#) [About](#) [Contact / Contribute](#) [Citing Us](#) [IAWA](#) [Links](#)

**Welcome**

The InsideWood project integrates wood anatomical information from the literature and original observations into an internet-accessible database useful for research and teaching. The InsideWood database contains brief descriptions of fossil and modern woody dicots (hardwoods) and modern softwoods. It is worldwide in coverage. The database is searchable by an interactive, multiple-entry key. This wood anatomy web site has over 50,000 images showing anatomical details, primarily photomicrographs.

The descriptions use features from the International Association of Wood Anatomists (IAWA) **List of Features for Hardwood Identification** (IAWA Committee 1989) and **List of Features for Softwood Identification** (IAWA Committee 2004). We highly recommend that database users ([DOWNLOAD](#)) these publications and refer to them when choosing features to use in an identification search.

Articles about wood identification and InsideWood

Wheeler, E.A. & P. Baas. 1998. Wood Identification – A Review. *IAWA Journal* 19 (3): 241-264. [PDF](#)

Wheeler, E.A., P. Baas, & S. Rodgers. 2007. Variations in dicot wood anatomy: A global analysis based on the InsideWood database. *IAWA Journal* 28 (3): 229-258. [PDF](#)

Wheeler, E.A. 2011. InsideWood – A Web Resource For Hardwood Identification. *IAWA Journal* 32(2): 199-211. [PDF](#)

Wheeler, E.A., P.E. Gasson, & P. Baas. 2020. Using The InsideWood Web Site: Potentials And Pitfalls. *IAWA Journal* 41 (4): 412-462. [PDF](#)

**Featured Wood**

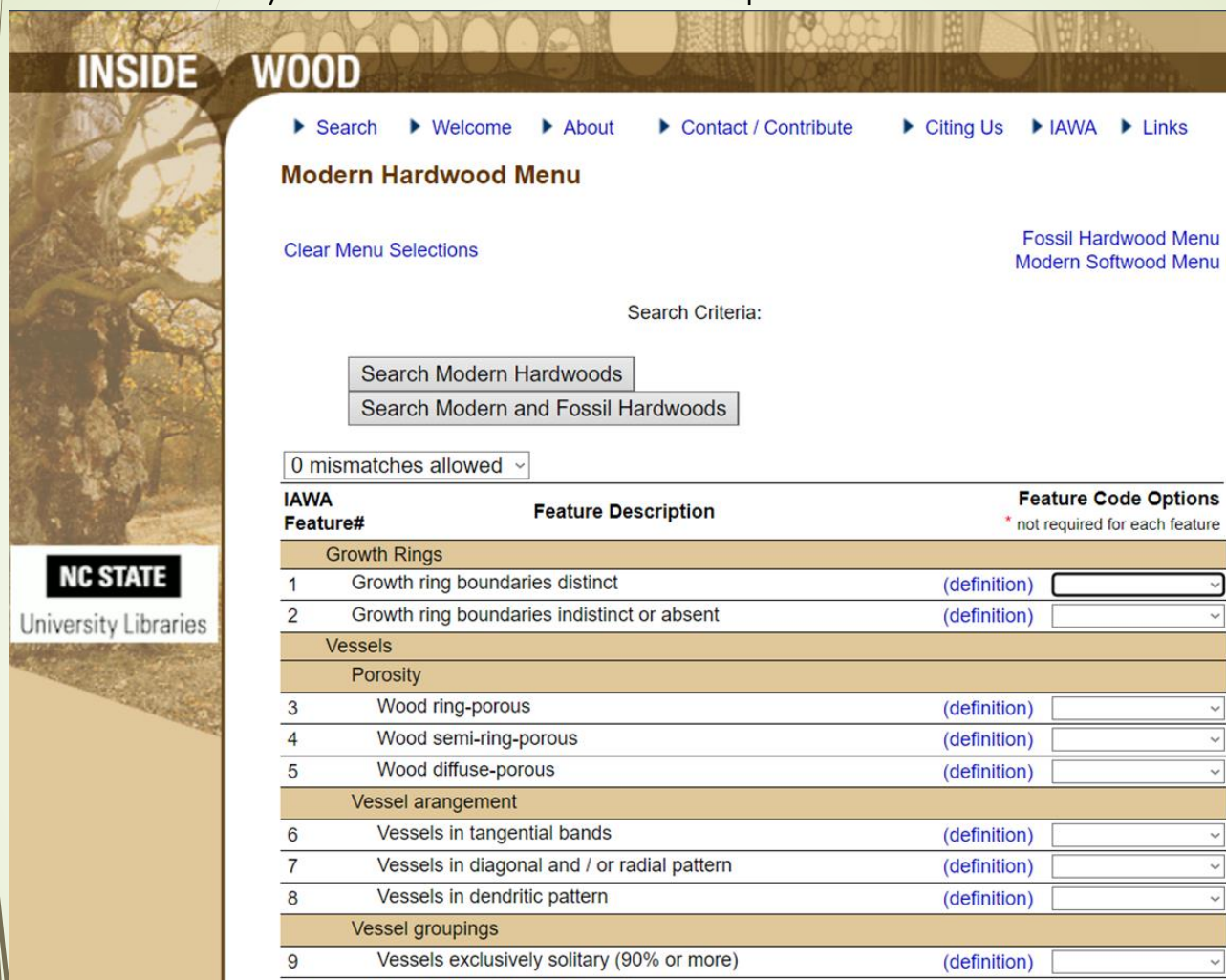
**NC STATE**  
University Libraries



## IAWA & InsideWood

The reference for wood anatomical descriptions  
& species identifications !

Interactive keys and Feature codes to help in identifications :



The screenshot shows the InsideWood website interface. On the left is a vertical banner with a tree image and the text "NC STATE University Libraries". The main content area has a header "INSIDE WOOD" and a navigation menu with links: Search, Welcome, About, Contact / Contribute, Citing Us, IAWA, and Links. Below the menu is the "Modern Hardwood Menu" section, which includes links for "Clear Menu Selections", "Fossil Hardwood Menu", and "Modern Softwood Menu". A "Search Criteria:" section contains two buttons: "Search Modern Hardwoods" and "Search Modern and Fossil Hardwoods". Below these is a dropdown menu set to "0 mismatches allowed". The main part of the interface is a table with three columns: "IAWA Feature#", "Feature Description", and "Feature Code Options". The table lists various wood features like Growth Rings, Vessels, and Vessel groupings, each with a corresponding feature number and a dropdown menu for feature code options. A note at the bottom of the table states "\* not required for each feature".

IAWA Feature#	Feature Description	Feature Code Options
Growth Rings		
1	Growth ring boundaries distinct	(definition) <input type="text"/>
2	Growth ring boundaries indistinct or absent	(definition) <input type="text"/>
Vessels		
Porosity		
3	Wood ring-porous	(definition) <input type="text"/>
4	Wood semi-ring-porous	(definition) <input type="text"/>
5	Wood diffuse-porous	(definition) <input type="text"/>
Vessel arrangement		
6	Vessels in tangential bands	(definition) <input type="text"/>
7	Vessels in diagonal and / or radial pattern	(definition) <input type="text"/>
8	Vessels in dendritic pattern	(definition) <input type="text"/>
Vessel groupings		
9	Vessels exclusively solitary (90% or more)	(definition) <input type="text"/>

All images come from the InsideWood database :

InsideWood. 2004-onwards. Published on the Internet.  
<http://insidewood.lib.ncsu.edu/search>

Wheeler, E.A. 2011. InsideWood – A Web Resource For Hardwood Identification. IAWA Journal 32(2): 199-211.

Wheeler, E.A., P.E. Gasson, & P. Baas. 2020. Using The InsideWood Web Site: Potentials And Pitfalls. IAWA Journal 41 (4): 412-462.



Transverse section →

**Specimen** BWCw 8544

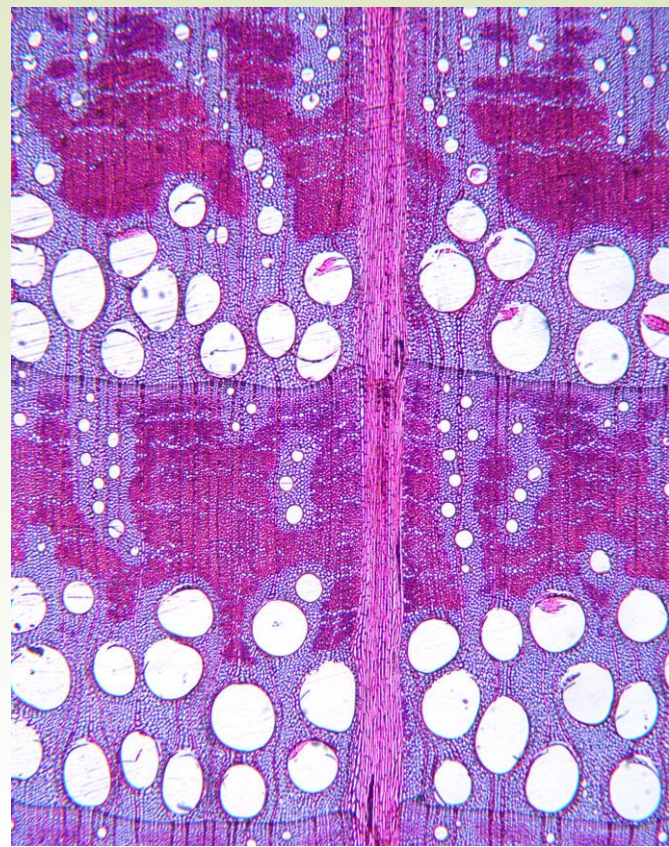
**Name** FAGACEAE *Quercus*  
*coccinea*

**Family** FAGACEAE

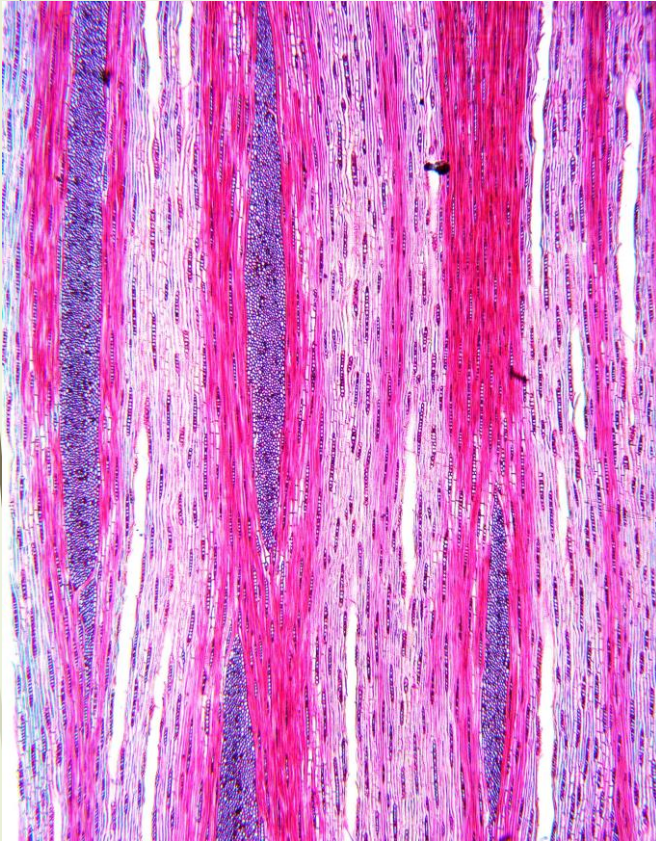
**Species** *Quercus coccinea*

**Type of Wood** Modern  
Hardwood

© Elizabeth Wheeler



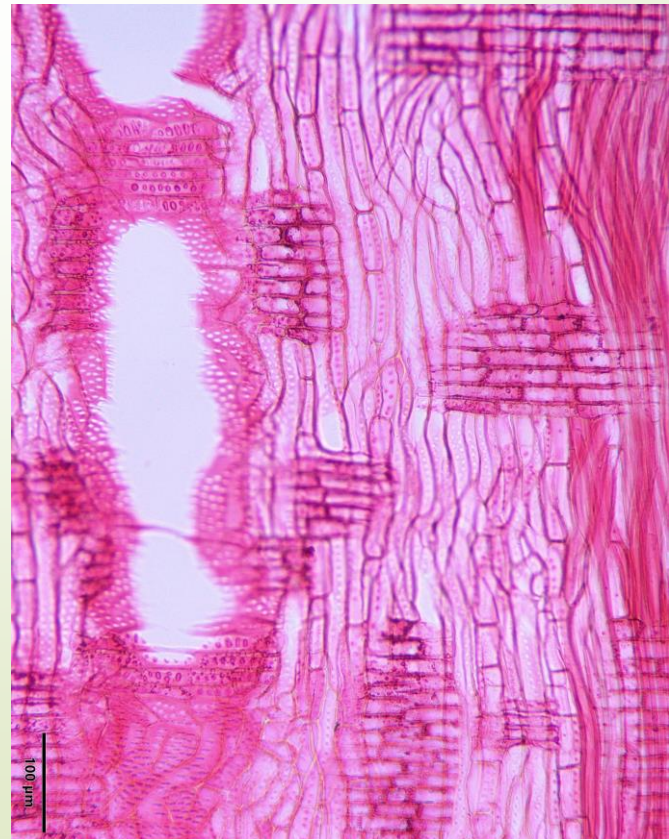
← Tangential section



**Angiosperms**

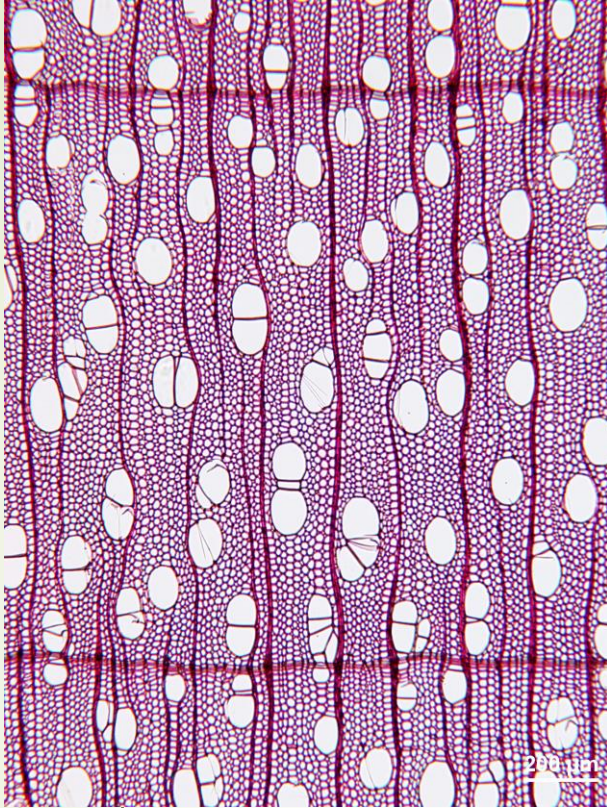
Heteroxylous wood

Radial section →





# Wood diffuse-porous



**Image ID** 48681

**Specimen** BWCw 8126

**Name** BETULACEAE *Betula papyrifera*

**Family** BETULACEAE

**Species** *Betula papyrifera*

**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 004

**Contributor** Elisabeth  
Wheeler

**Image ID** 660

**Specimen** BWCw  
s.n.A.sacch

**Name** SAPINDACEAE *Acer saccharinum*

**Family** SAPINDACEAE

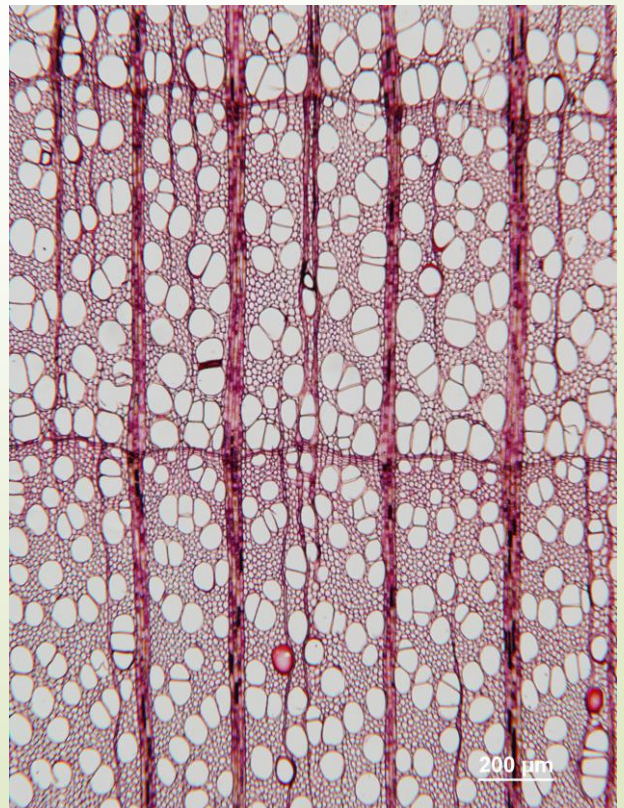
**Species** *Acer saccharinum*

**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 004

**Contributor** Elisabeth  
Wheeler



See also : Gums and deposits in vessels



# Wood ring-porous



**Image ID** 66990

**Specimen** BWCw 8071

**Name** FAGACEAE Quercus  
alba

**Family** FAGACEAE

**Species** Quercus alba

**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 002

**Contributor** Elisabeth  
Wheeler

See also : Tyloses in vessels,  
Vessels in diagonal, dendritic and / or  
radial pattern  
Axial parenchyma in narrow bands or  
lines

**Image ID** 57674

**Specimen** Hw s.n.Frax.am

**Name** OLEACEAE Fraxinus  
americana

**Family** OLEACEAE

**Species** Fraxinus americana

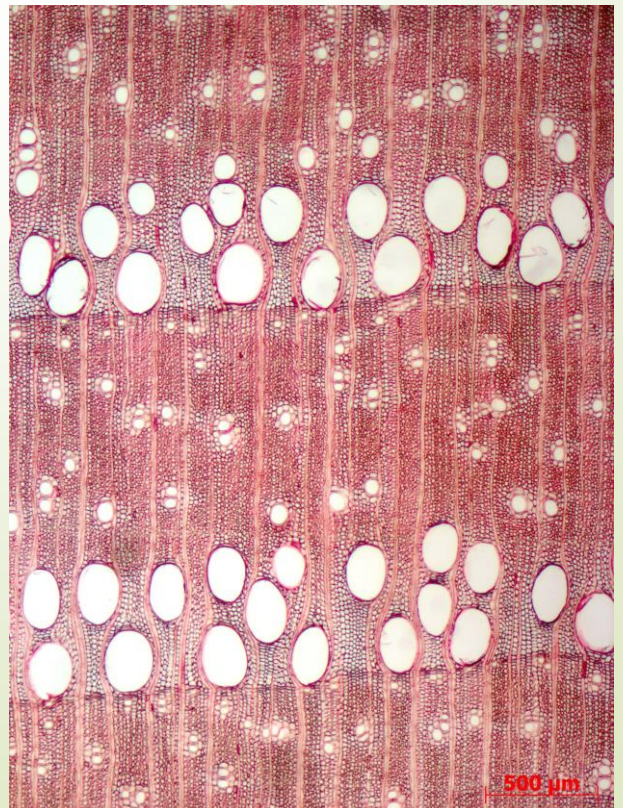
**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 002.5

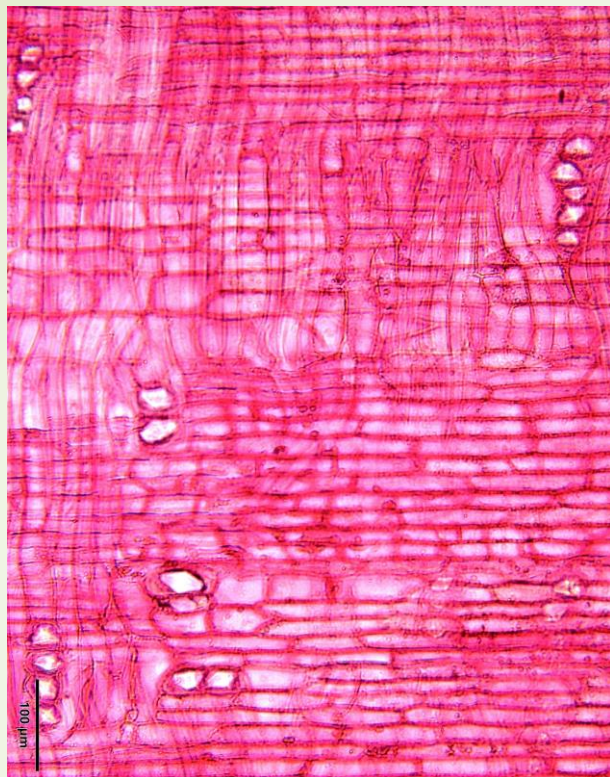
**Contributor** Peter Gasson

See also : Vascular / vasicentric  
tracheids





# Prismatic crystals



**Image ID** 66986

**Specimen** BWCw 8071

**Name** FAGACEAE Quercus  
alba

**Family** FAGACEAE

**Species** Quercus alba

**Type of Wood** Modern  
Hardwood

**View** radial section

**Magnification** 010

**Contributor** Elisabeth  
Wheeler

See also : Prismatic crystals in  
procumbent ray cells/in chambered  
axial parenchyma cells

**Image ID** 62259

**Specimen** BWCw 8034

**Name** FAGACEAE Quercus  
alba

**Family** FAGACEAE

**Species** Quercus alba

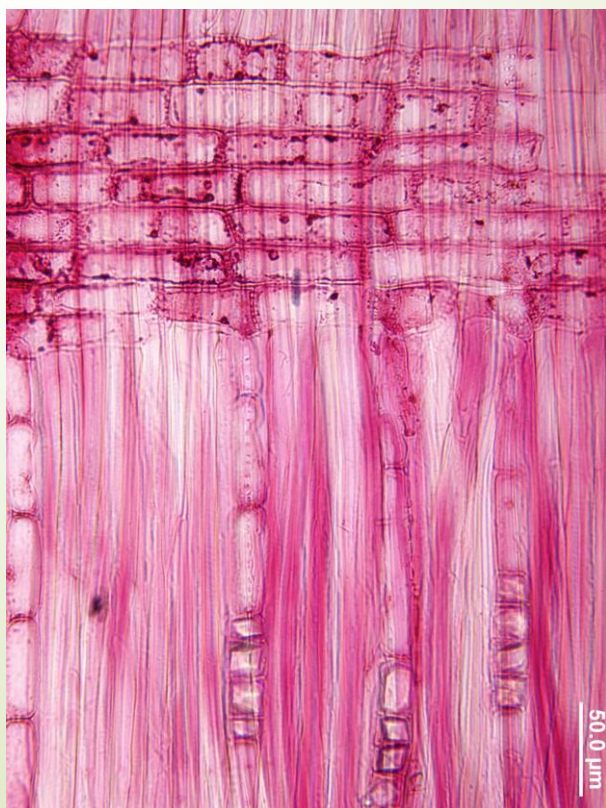
**Type of Wood** Modern  
Hardwood

**View** radial section

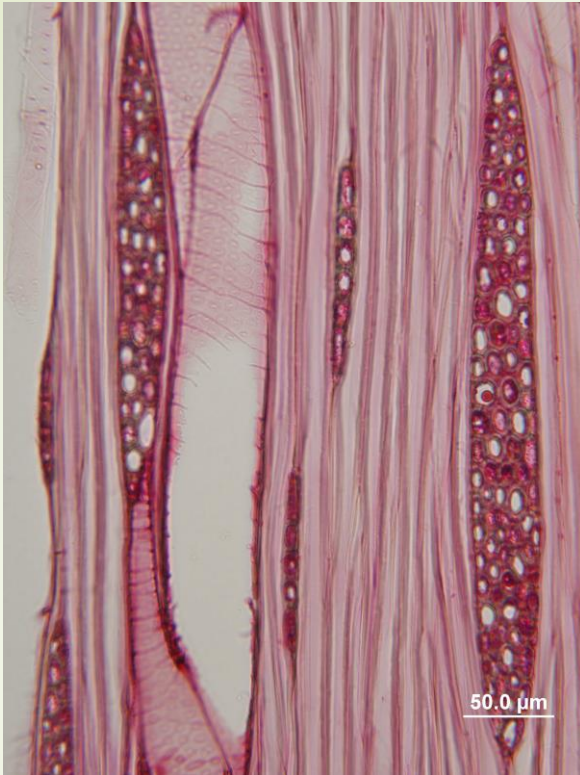
**Magnification** 020

**Contributor** Elisabeth  
Wheeler

See also : Prismatic crystals in  
chambered axial parenchyma  
cells



# Helical thickenings in vessel elements



**Image ID** 667

**Specimen** BWCw  
s.n.A.sacch

**Name** SAPINDACEAE Acer  
saccharinum

**Family** SAPINDACEAE

**Species** Acer saccharinum

**Type of Wood** Modern  
Hardwood

**View** tangential section

**Magnification** 020

**Contributor** Elisabeth  
Wheeler

See also : Rays of two distinct sizes  
(uni- + multi-seriate),  
Intervessel pits alternate

**Image ID** 271

**Specimen** BWCw 8420

**Name** SAPINDACEAE Acer  
saccharum

**Family** SAPINDACEAE

**Species** Acer saccharum

**Type of Wood** Modern  
Hardwood

**View** intervessel pitting

**Magnification** 040

**Contributor** Elisabeth  
Wheeler

See also : Simple perforation  
plates





# Scalariform perforation plates



**Image ID** 48679

**Specimen** BWCw 8126

**Name** BETULACEAE Betula  
papyrifera

**Family** BETULACEAE

**Species** Betula papyrifera

**Type of Wood** Modern  
Hardwood

**View** radial section

**Magnification** 020

**Contributor** Elisabeth  
Wheeler

See also : Intervessel pits alternate,  
Shape of alternate pits polygonal

**Image ID** 74720

**Specimen** BWCw 8000

**Name** BETULACEAE Betula  
papyrifera

**Family** BETULACEAE

**Species** Betula papyrifera

**Type of Wood** Modern  
Hardwood

**View** radial section

**Magnification** 020

**Contributor** Elisabeth  
Wheeler



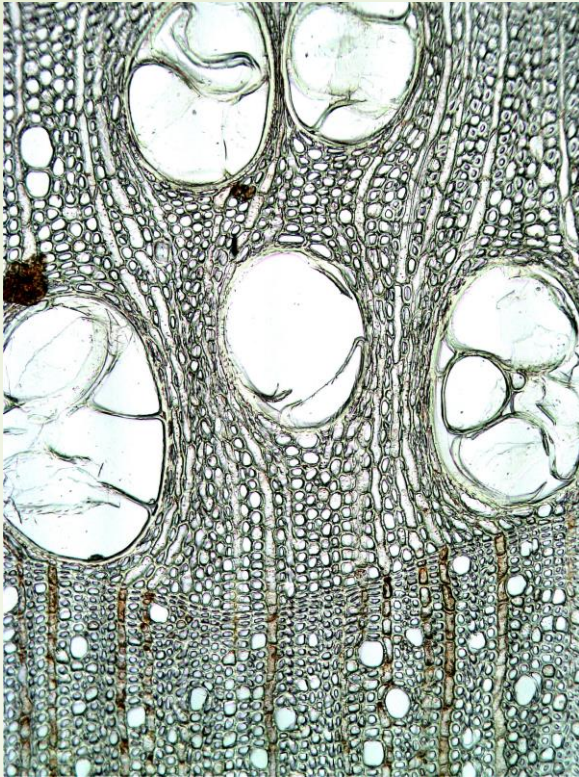
See also :



## Transverse section

# Tyloses

Protrusions emanating from axial paratracheal parenchyma cells into xylem vessels through pits linking the two. When the plant is stressed by drought or infection, tyloses will fall from the sides of the cells and "dam" up the vascular tissue to prevent further damage to the plant (i.e. embolism or pathogens propagation).



**Image ID** 65441

**Specimen** WUR 14 162

**Name** FAGACEAE Quercus  
alba

**Family** FAGACEAE

**Species** Quercus alba

**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 010

**Contributor** Raimund  
Aichbauer

See also :

**Image ID** 66991

**Specimen** BWCw 8071

**Name** FAGACEAE Quercus  
alba

**Family** FAGACEAE

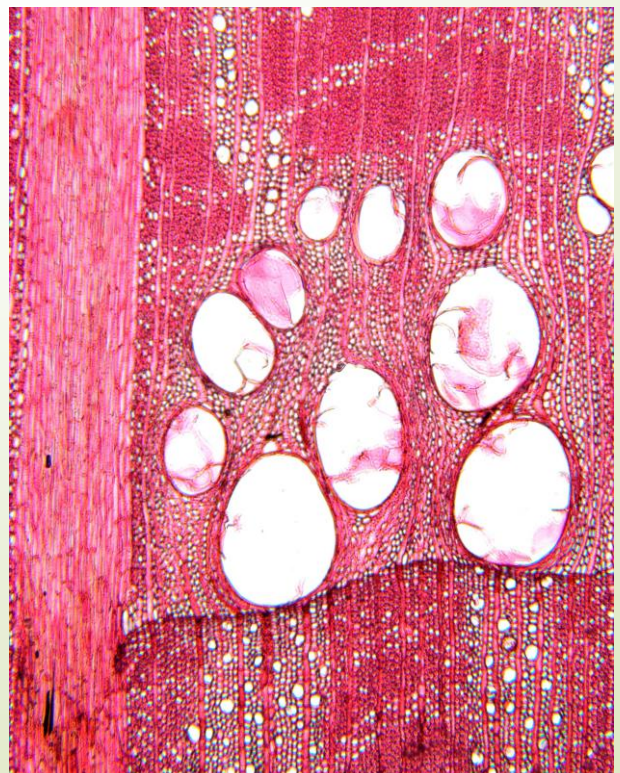
**Species** Quercus alba

**Type of Wood** Modern  
Hardwood

**View** cross section

**Magnification** 004

**Contributor** Elisabeth  
Wheeler



See also :



Transverse section →

**Specimen** BWCw 8010

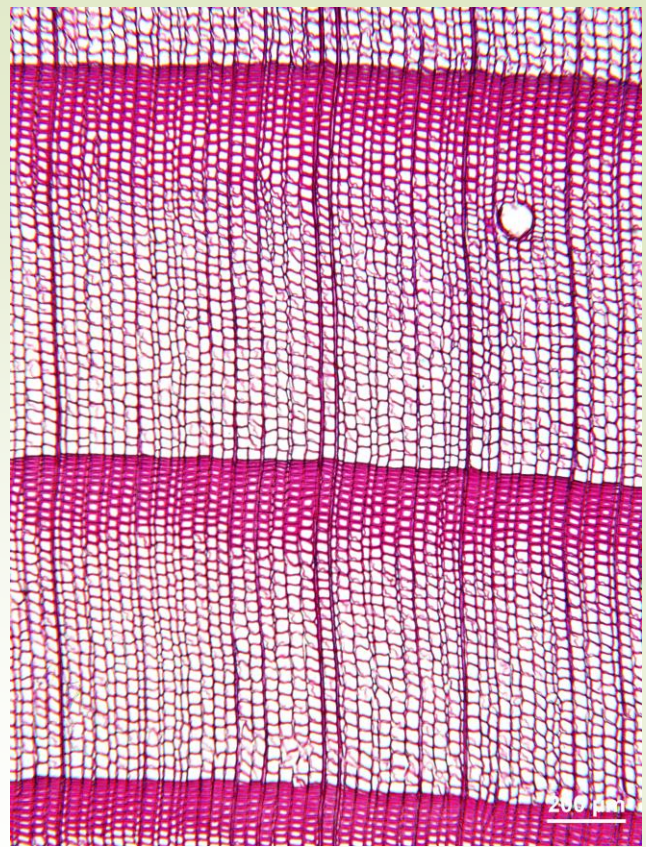
**Name** PINACEAE *Picea*  
*mariana*

**Family** PINACEAE

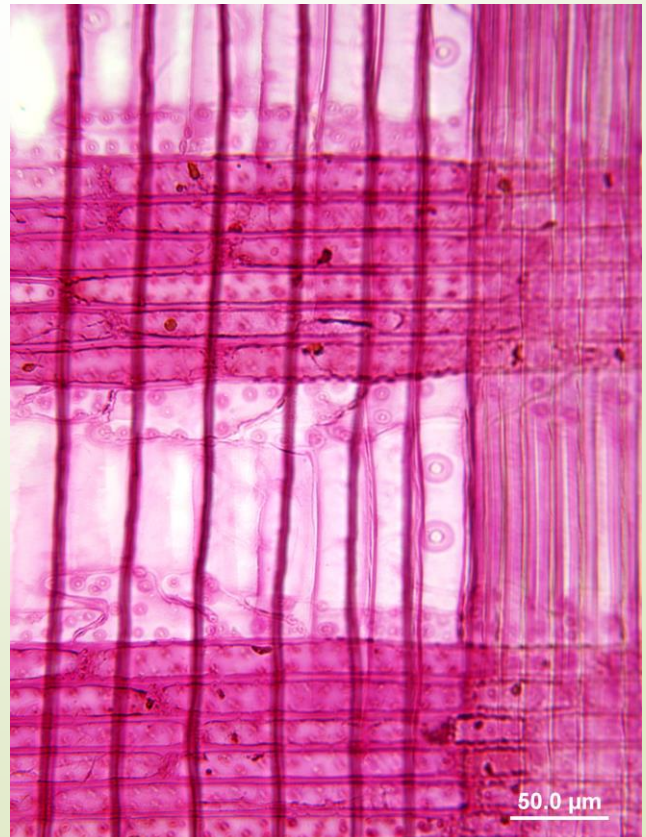
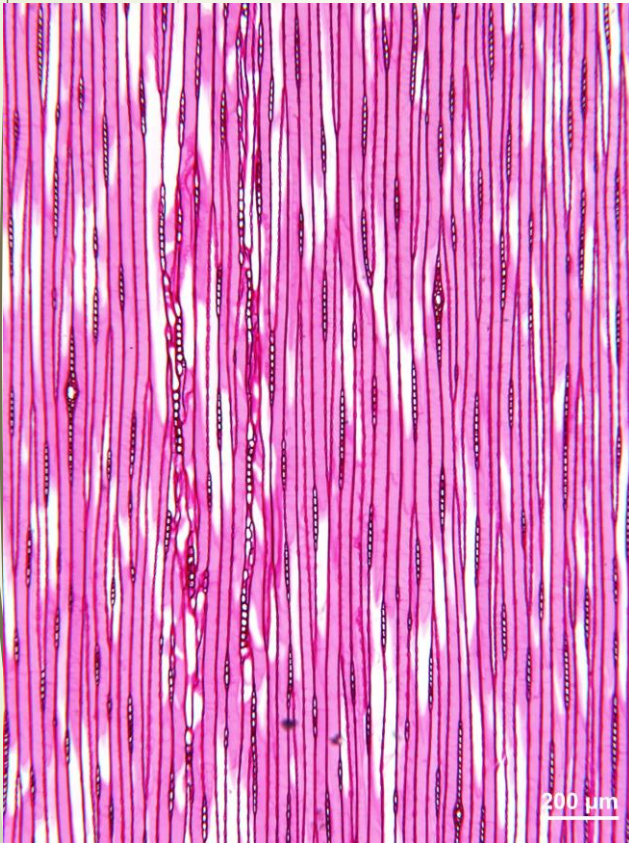
**Species** *Picea mariana*

**Type of Wood** Modern  
Softwood

© Elizabeth Wheeler



← Tangential section



**Conifers**

Homoxylous wood

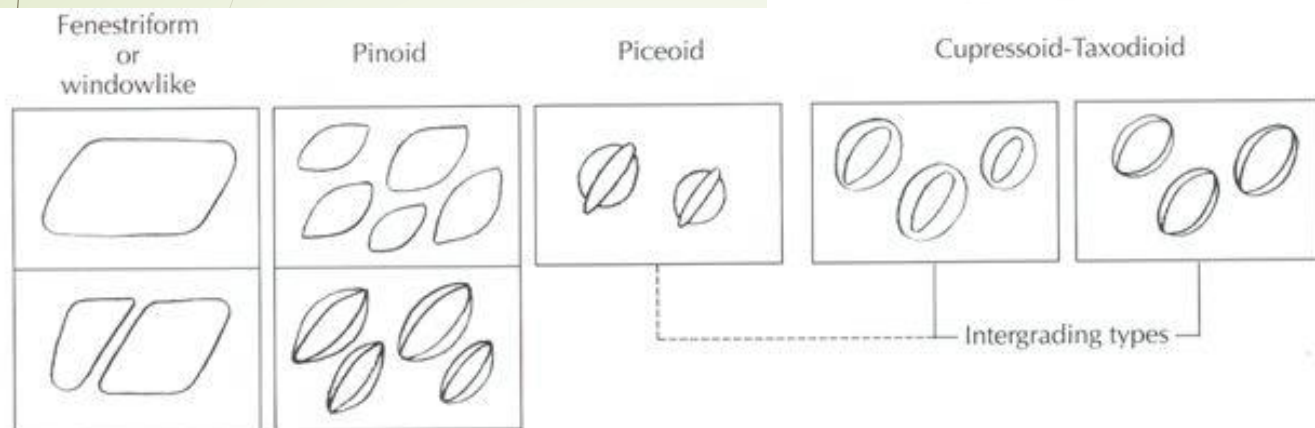
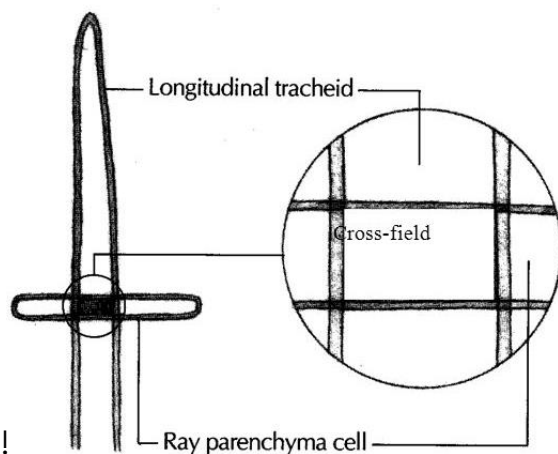
Radial section →



# Radial section

## Cross-field pitting

A very important feature for conifer identification !



### SPECIES WITH RESIN CANALS

### SPECIES LACKING RESIN CANALS

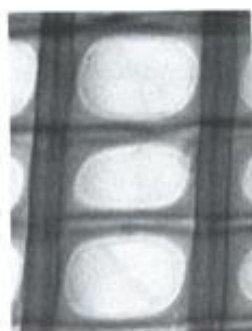
Soft pines  
Red pine  
Scots pine  
Windowlike

Hard pines (other than red pine and scots pine)  
Pinoid

Spruce  
Larch  
Douglas-fir  
Piceoid

Cupressoid

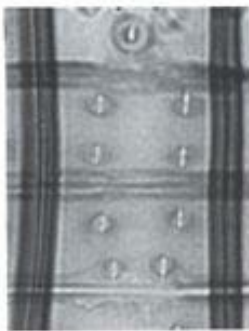
Taxodioid



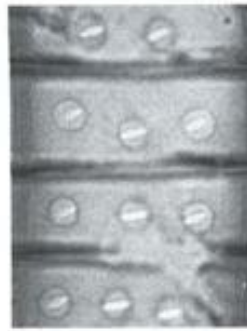
EASTERN WHITE PINE (750x)



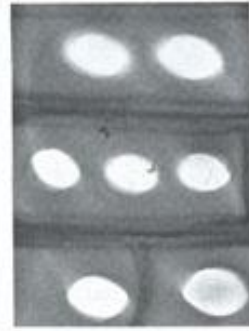
SOUTHERN YELLOW PINE (750x)



EASTERN SPRUCE (750x)



INCENSE-CEDAR (750x)



REDWOOD (750x)



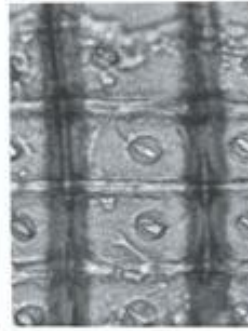
RED PINE (750x)



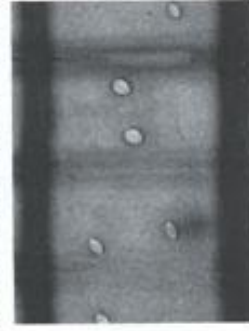
SHORTLEAF PINE (750x)



RED SPRUCE (750x)



EASTERN REDCEDAR (750x)



WHITE FIR (750x)