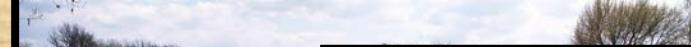


# DRVO

## ANATOMIJA, IDENTIFIKACIJA I PRIMJENA U ARHEOBOTANIČKI

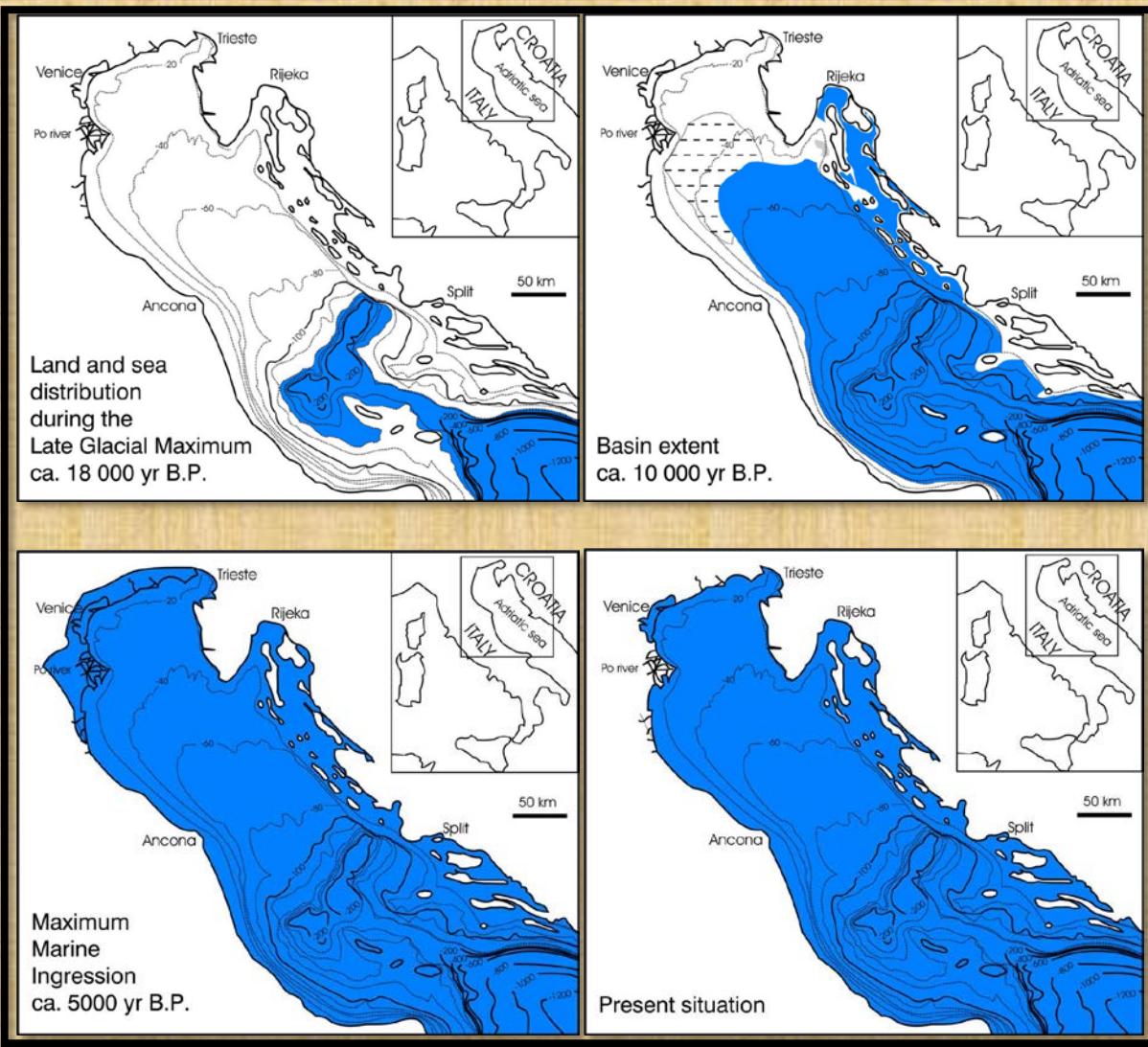


# Uloga i važnost drva kroz ljudsku povijest



## Zašto je drvo važno u arheobotanici?





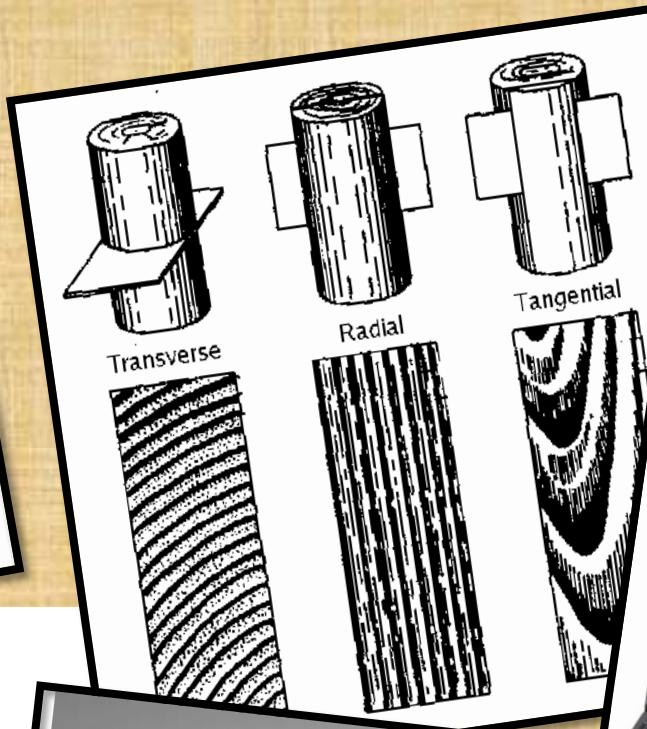
Promjena razine Jadranskog mora u zadnjih 18 000 godina  
(preuzeto iz: CORREGGIARI et al., 1996).

## Vrste nalaza tj. stanje drvnih ostataka:

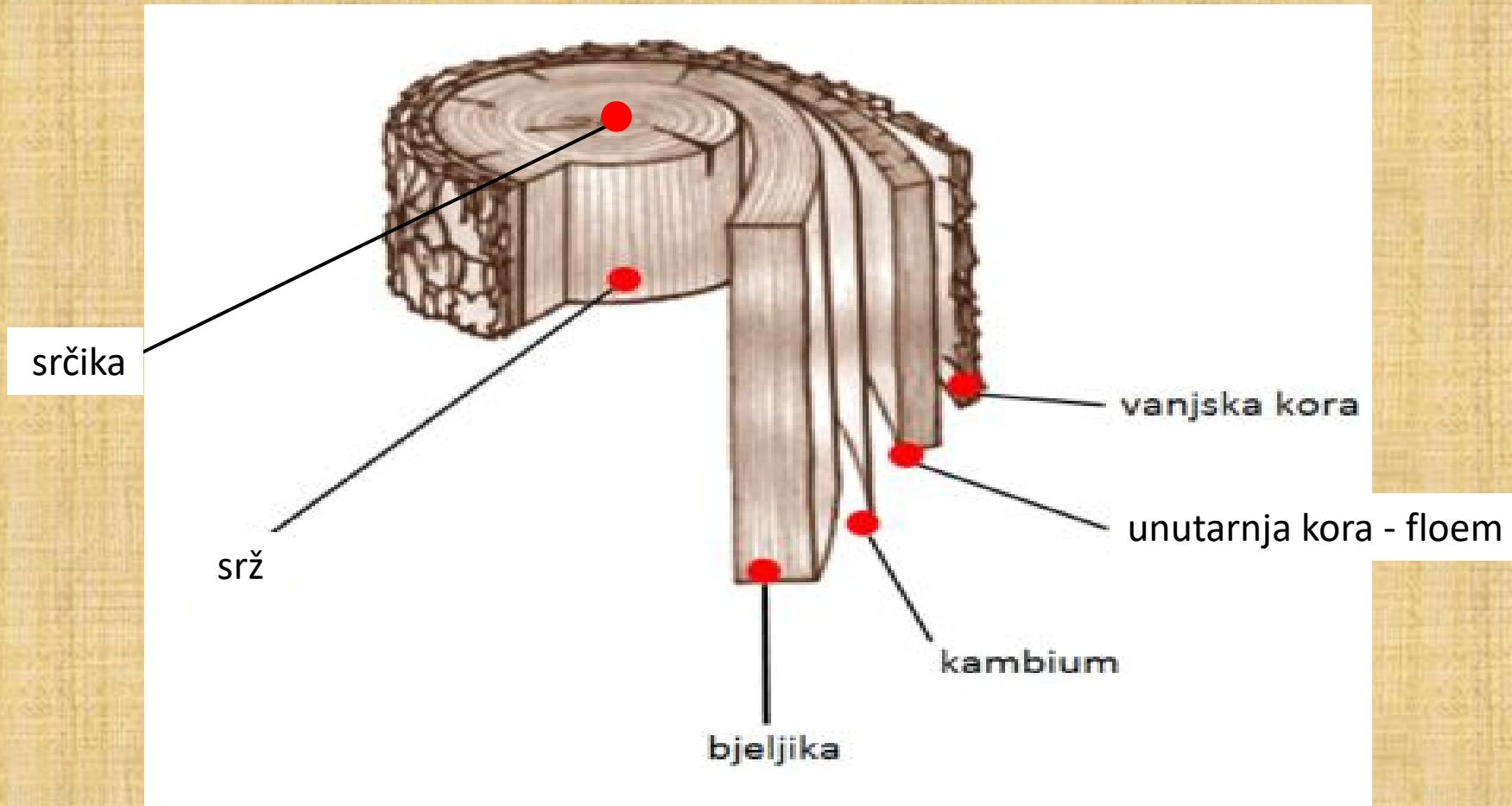
- 1) Karbonizirano drvo
- 2) Drvo kontinuirano izloženo vodenom mediju
- 3) Drvo sasušeno u aridnim klimama



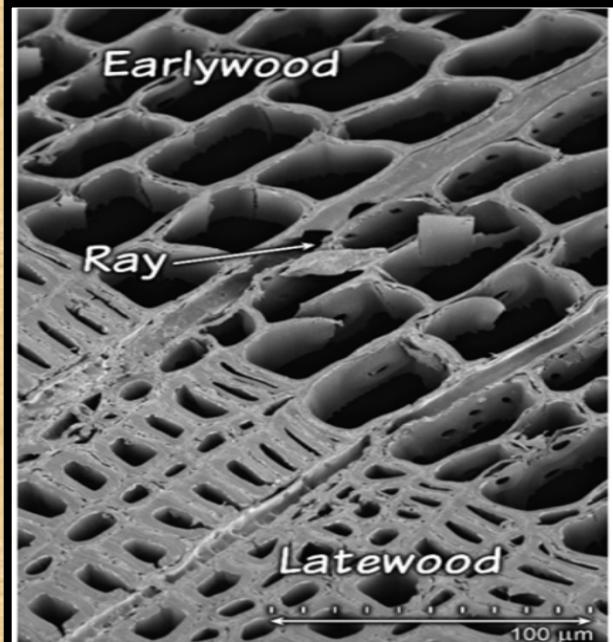
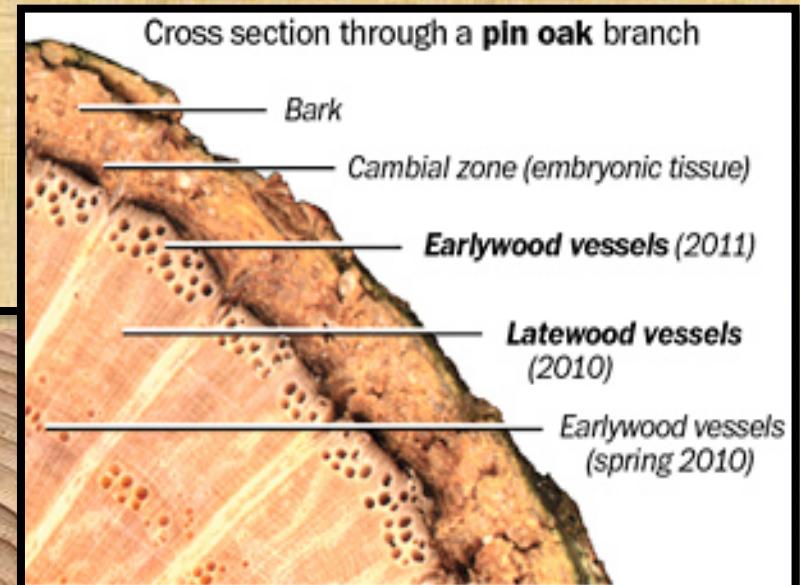
## Kako identificirati pronađenu vrstu drveta?

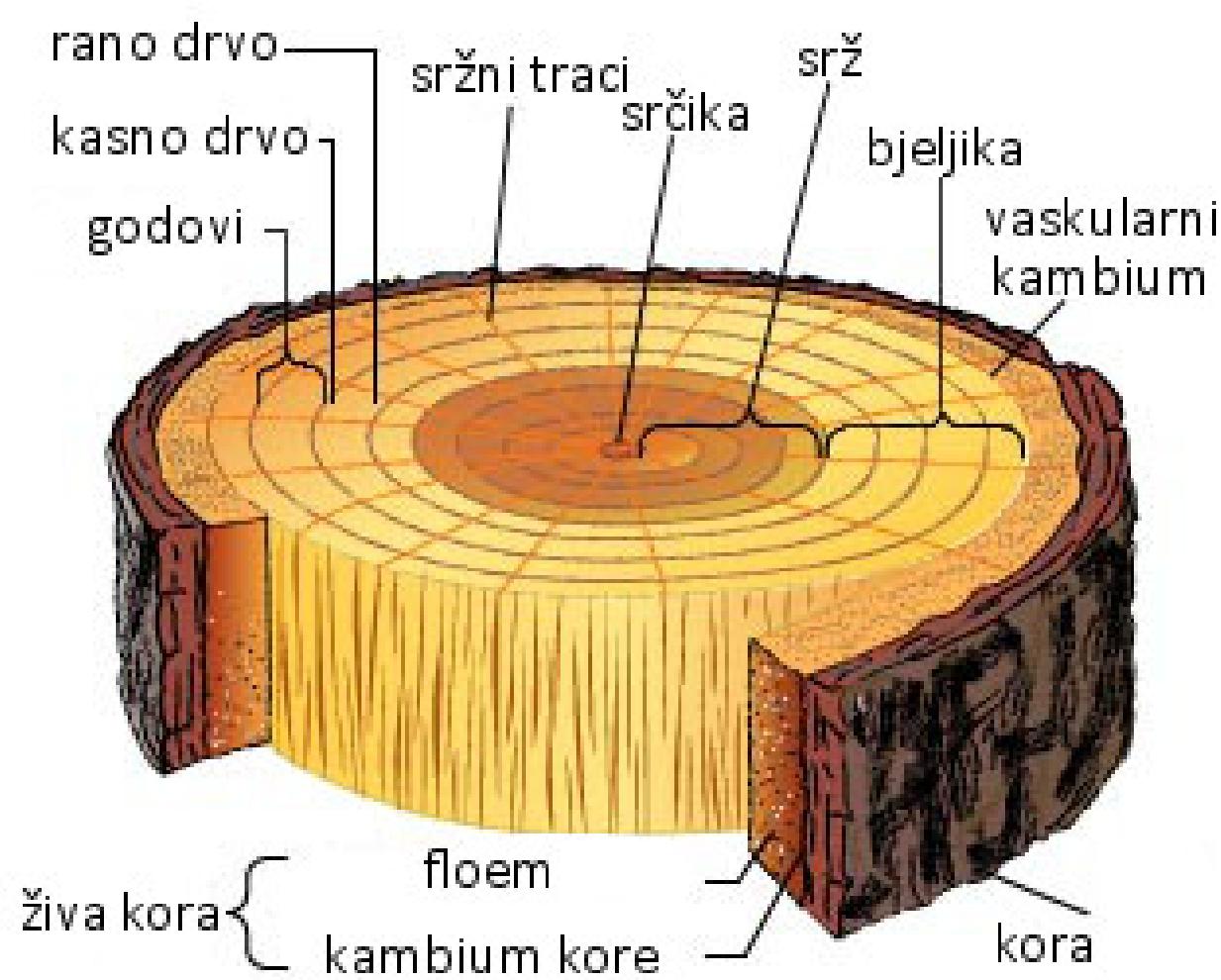


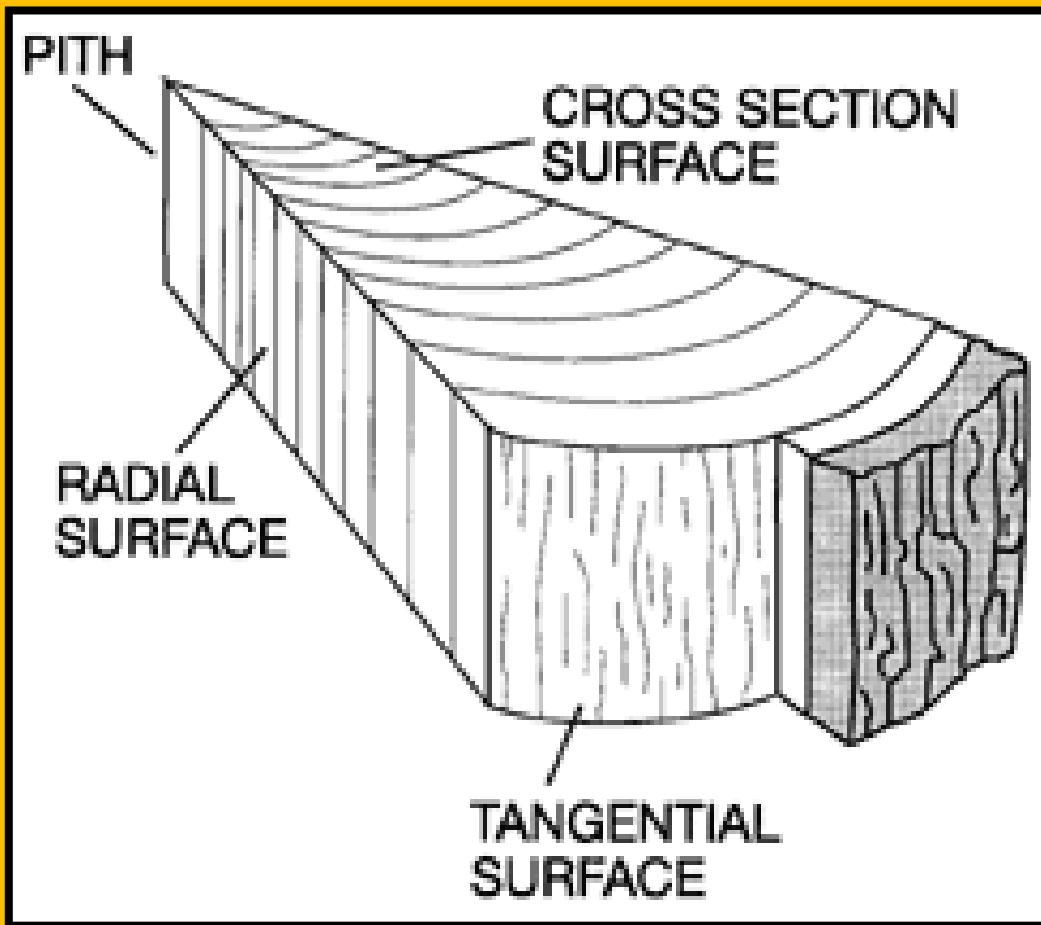
# ANATOMIJA DRVA



## Godovi - plašt prirasta u jednoj vegetacijskoj sezoni



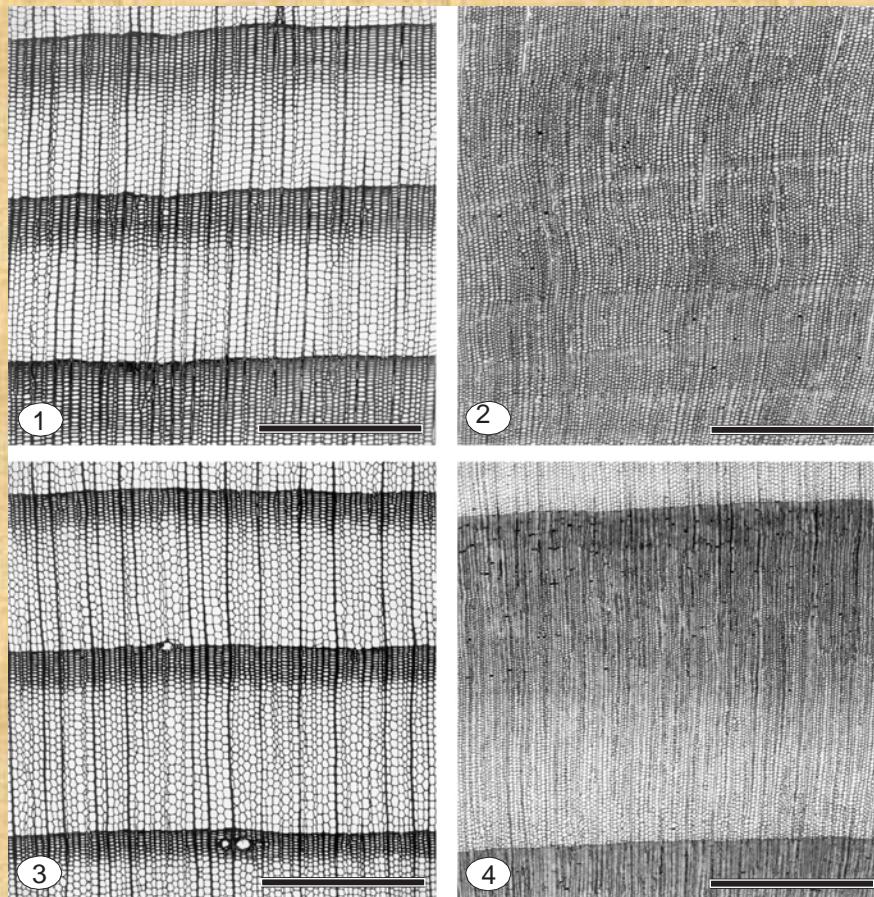




# ANATOMIJA DRVA ČETINJАČА

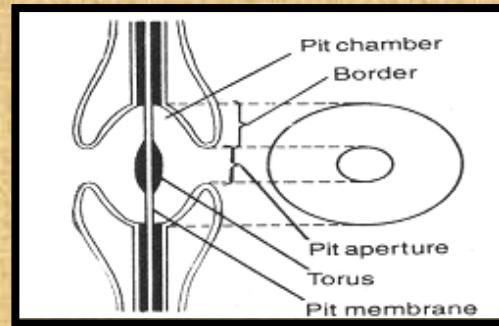
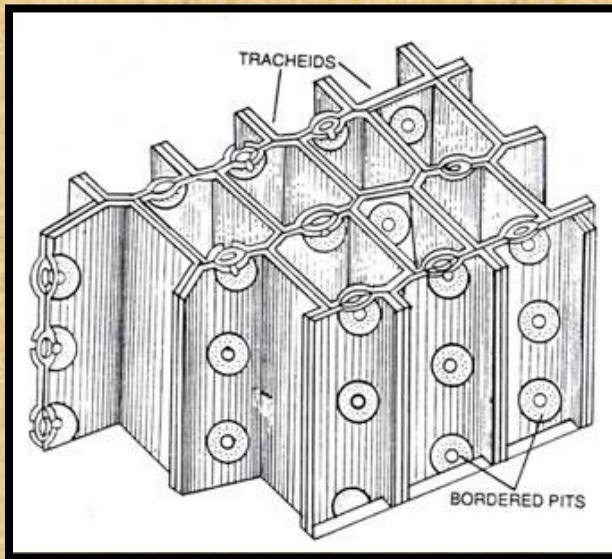
I) **Traheide** su izdužene stanice, čija je funkcija provođenje vode s mineralnim tvarima iz korijena prema krošnji te mehanička potpora biljke.

## Granica goda



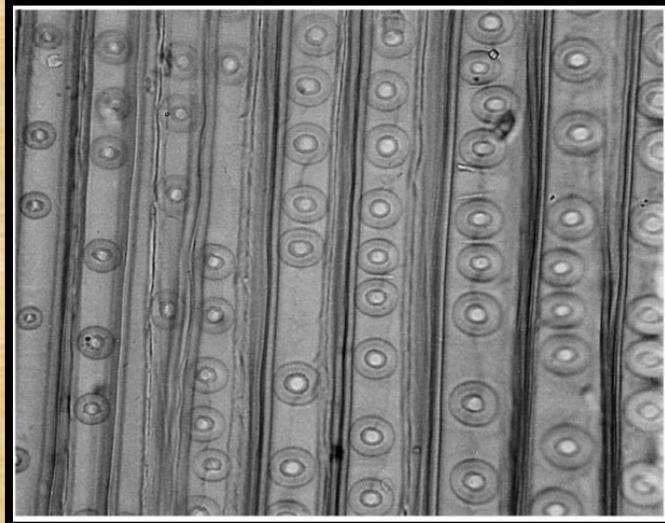
- 1 - linija granice goda **jasno vidljiva** (*Abies alba*)
- 2 – granica goda **nepostojeca** ili vrlo teško uočljiva (*Austro-taxus spicata*)
- 1 i 3 - **nagli prijelaz** iz ranog drva u kasno drvo (*Larix decidua*).
- 4 - **postepeni prijelaz** iz ranog drva u kasno drvo (*Cryptomeria japonica*)

# Jažice

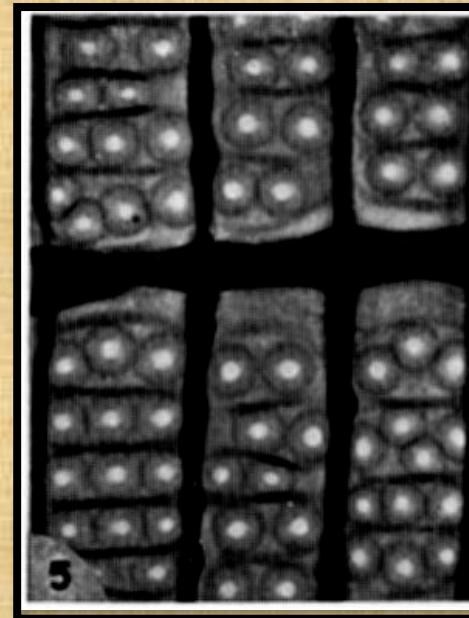


Jednostavna jažica

Ograđena jažica

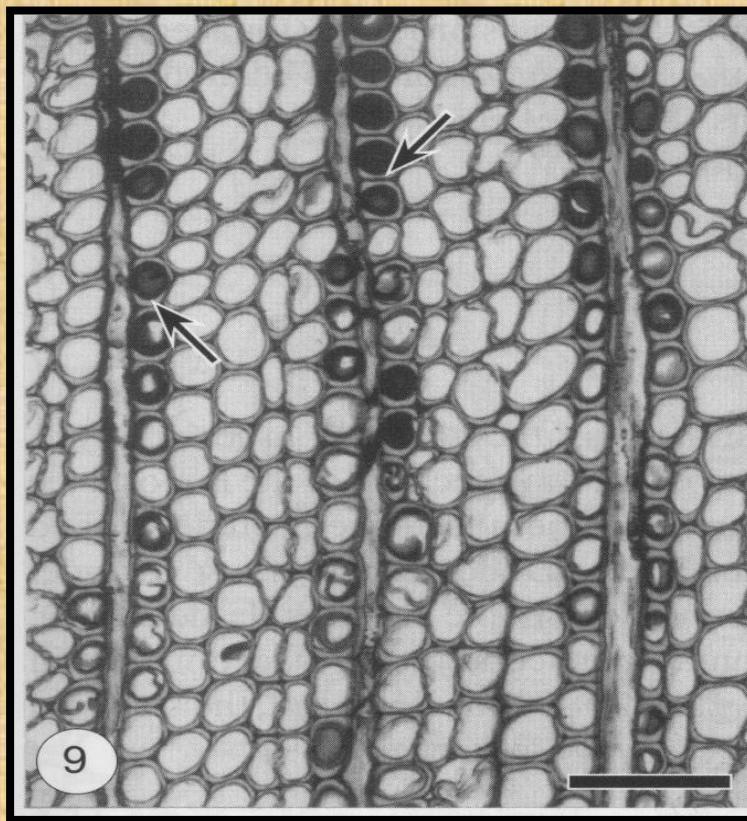


Radijalni  
presjek drva  
bora s  
prikazom  
jažica u  
jednom redu



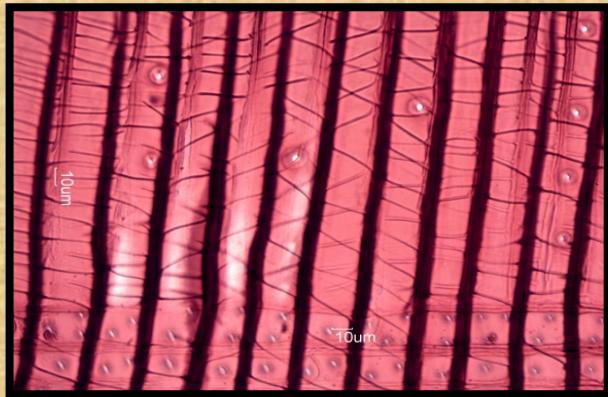
Radijalni  
presjek drva  
taksodija s  
prikazom  
jažica u  
**2-3 redu**

# Organski depoziti u traheidama

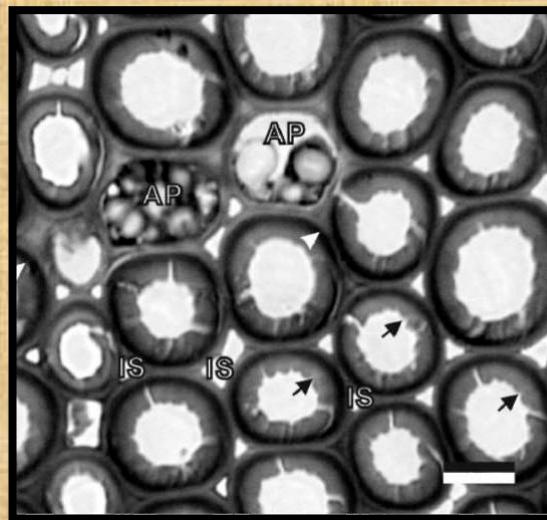


Strelice označavaju traheide zapunjene organskom zapunom  
(*Agathis labillardieri*)

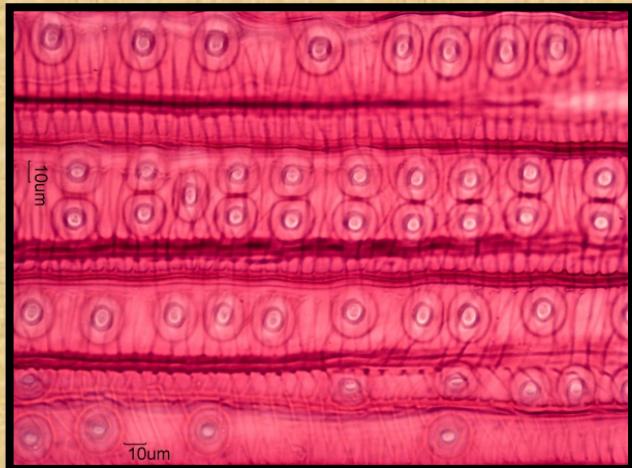
# Spiralno zadebljanje stijenke



Spiralna zadebljanja na radijalnom presjeku roda *Taxus*



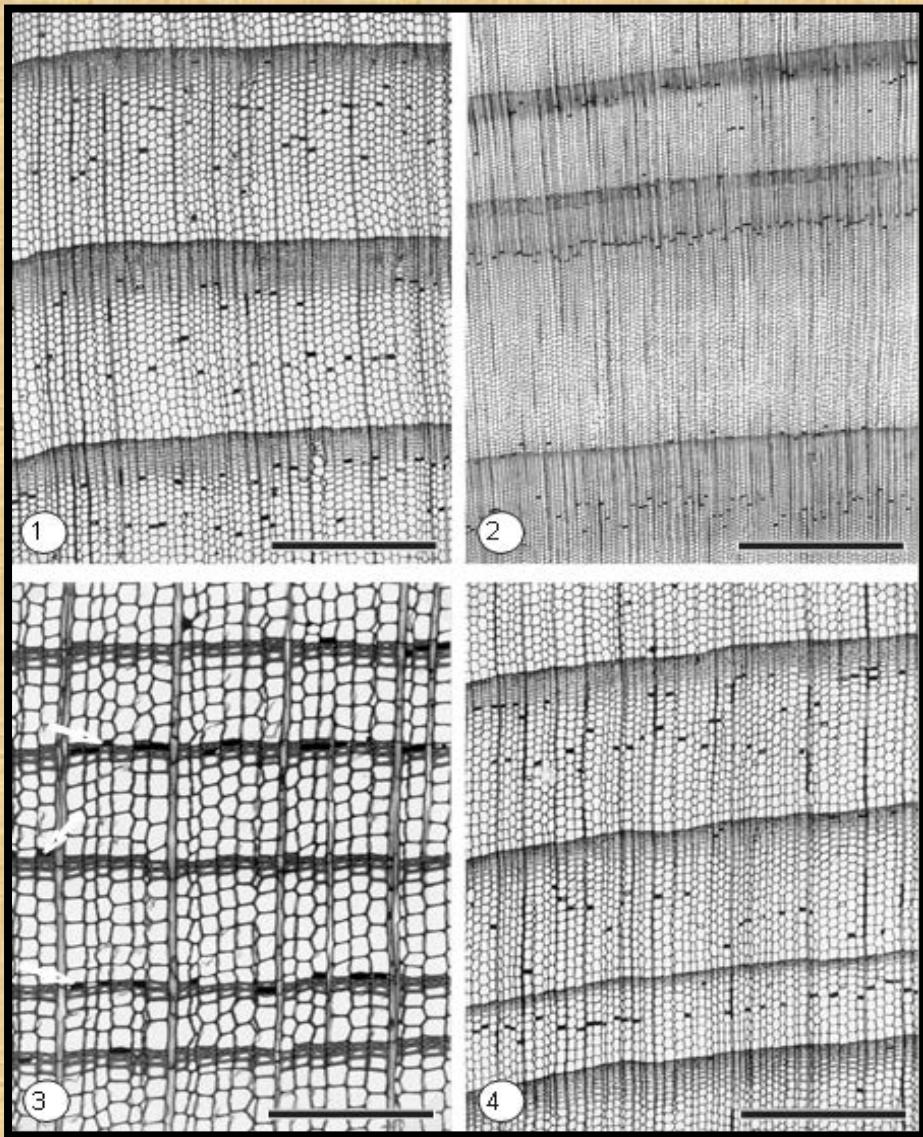
Reakcijsko drvo



Spiralna zadebljanja na radijalnom presjeku roda *Pseudotszuga*



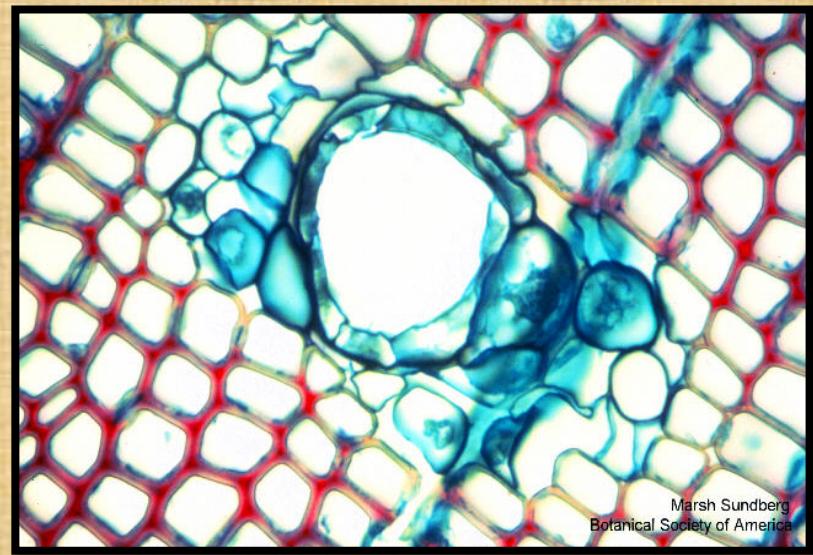
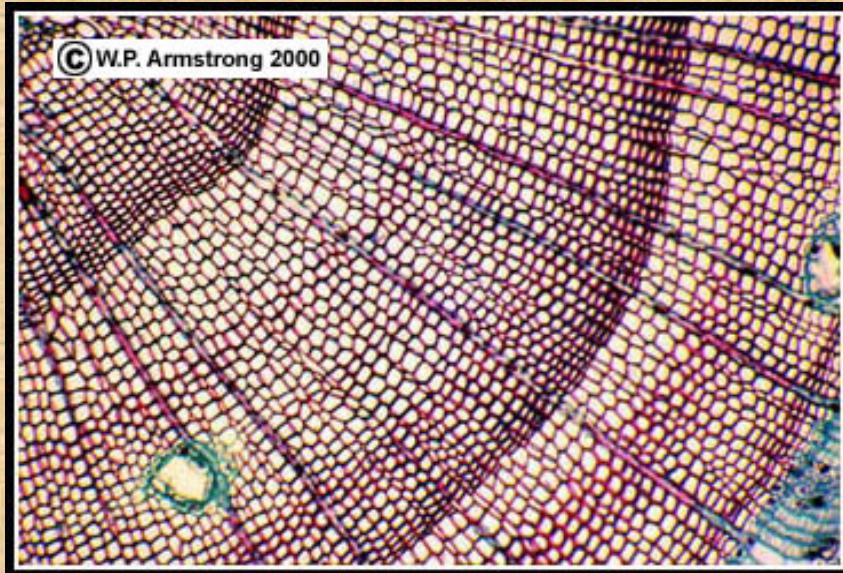
**Aksijalni parenhim** je kod golosjemenjača rijedak i ako postoji, zauzima manje od 6 %. Njegova je funkcija je prije svega skladištenje hrane (i transport).



### Zonacija aksijalnog parenhima

- 1 – difuzna/rastresita (*Taxodium distichum*),
- 2 – tangencijalna (*Cryptomeria japonica*),
- 3 – tangencijalna u kasnom drvu na granici goda (*Sequoia sempervirens*),
- 4 – difuzna/rastresita i tangencijalna (*Taxodium distichum*)

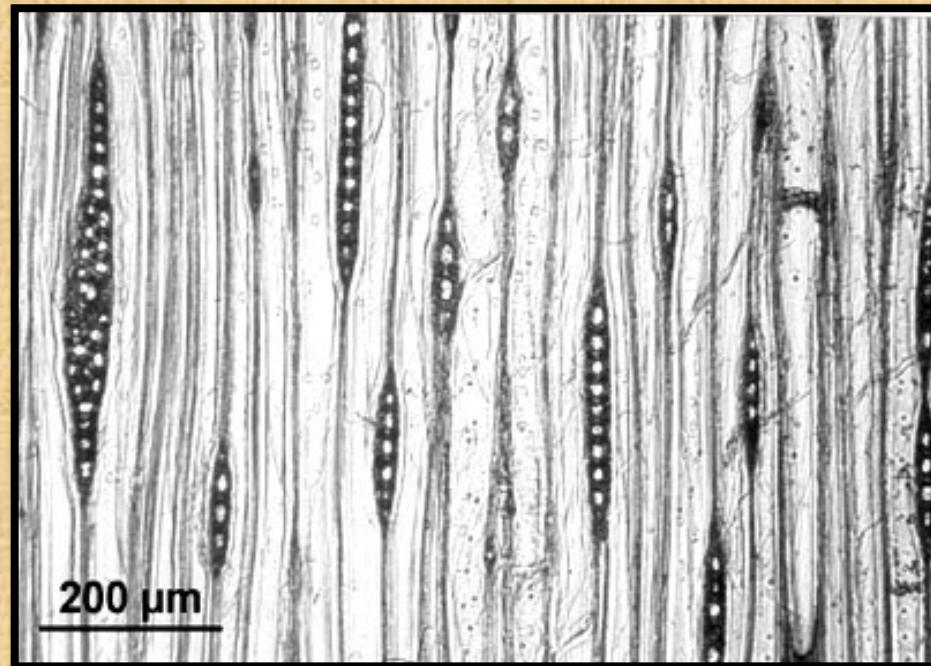
**Smolenice ili smolni kanali** su međustanični prostori omeđeni epitelnim (parenihimskim) stanicama, koje proizvode smolu.



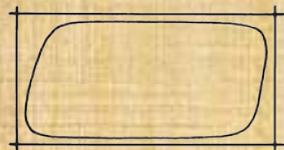
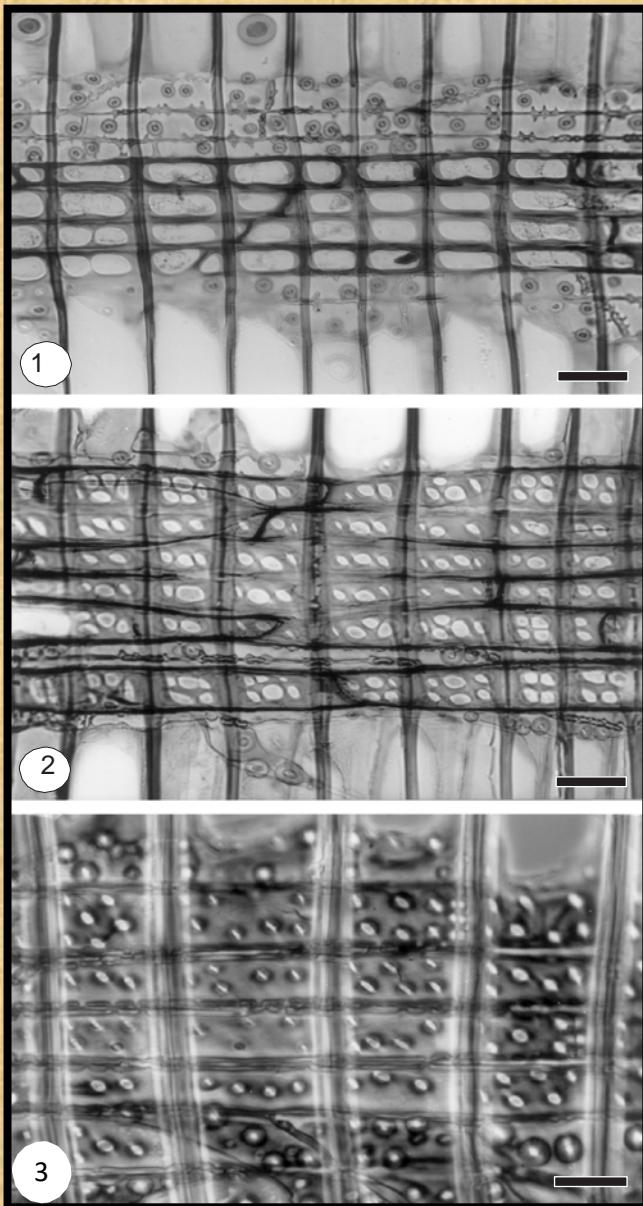
**II) Drvni traci** kod četinjača čine do 10 % drva. Traci su radijalno usmjereni od srčike prema kori.

Traci mogu biti građeni samo od parenhimskih stanica i tad ih zovemo **homocelularni** trakovi (npr. jela) ili su pak građeni i od horizontalno položenih traheida pa ih nazivamo **heterocelularni** trakovi.

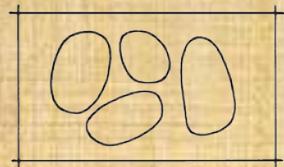
Njihova glavna uloga je skladištenje, sinteza i lateralni transport biokemisjkih tvari (i u puno manjoj mjeri vode).



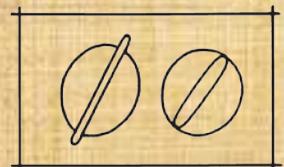
## Vrste jažica u polju ukrštavanja



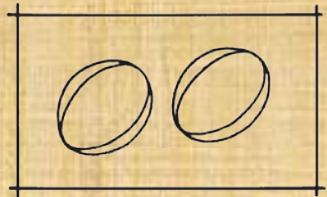
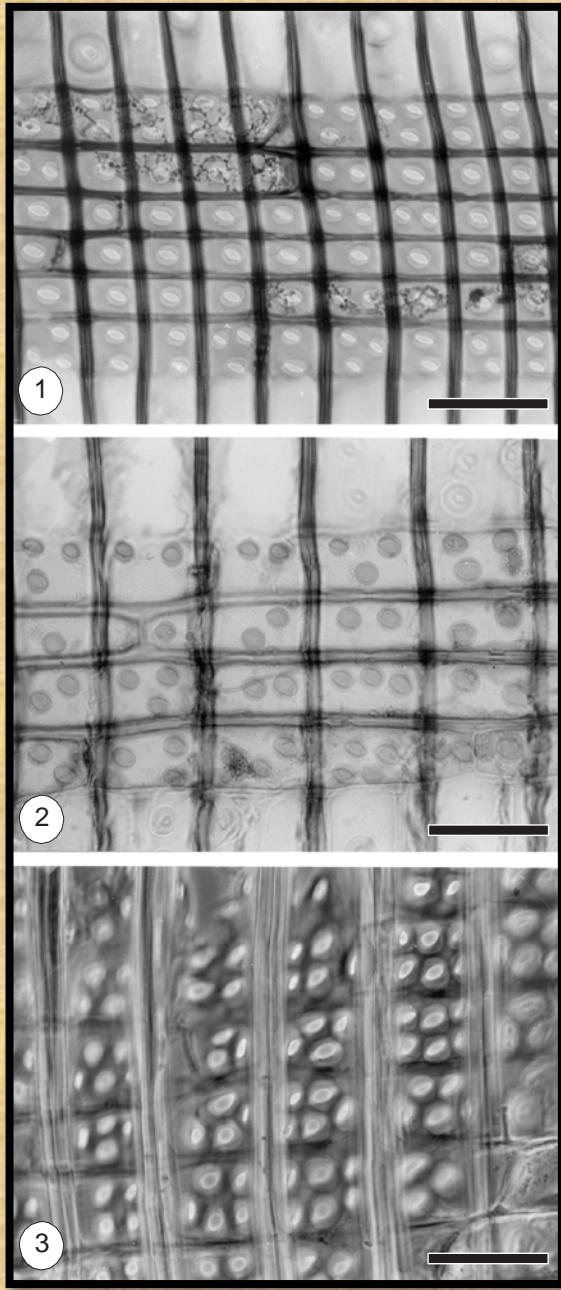
fenestriformne



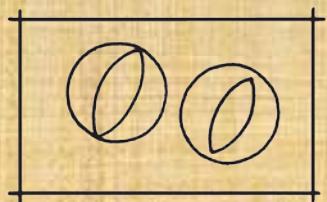
pinoidne



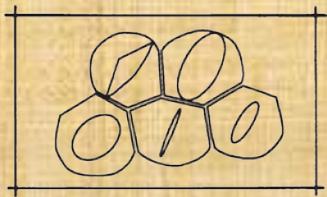
piceoidne



kupresoidne



taksodioidne



araukoidne



fenestriformne

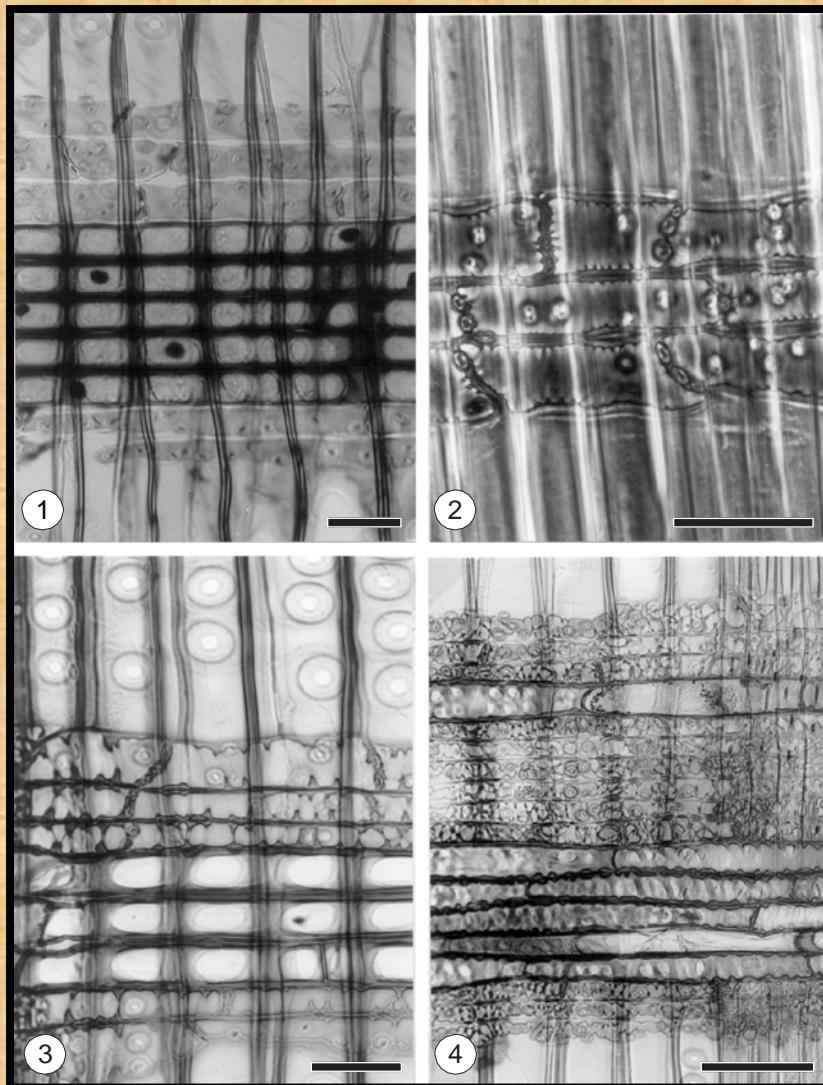
pinoidne

piceoidne

taksodioide

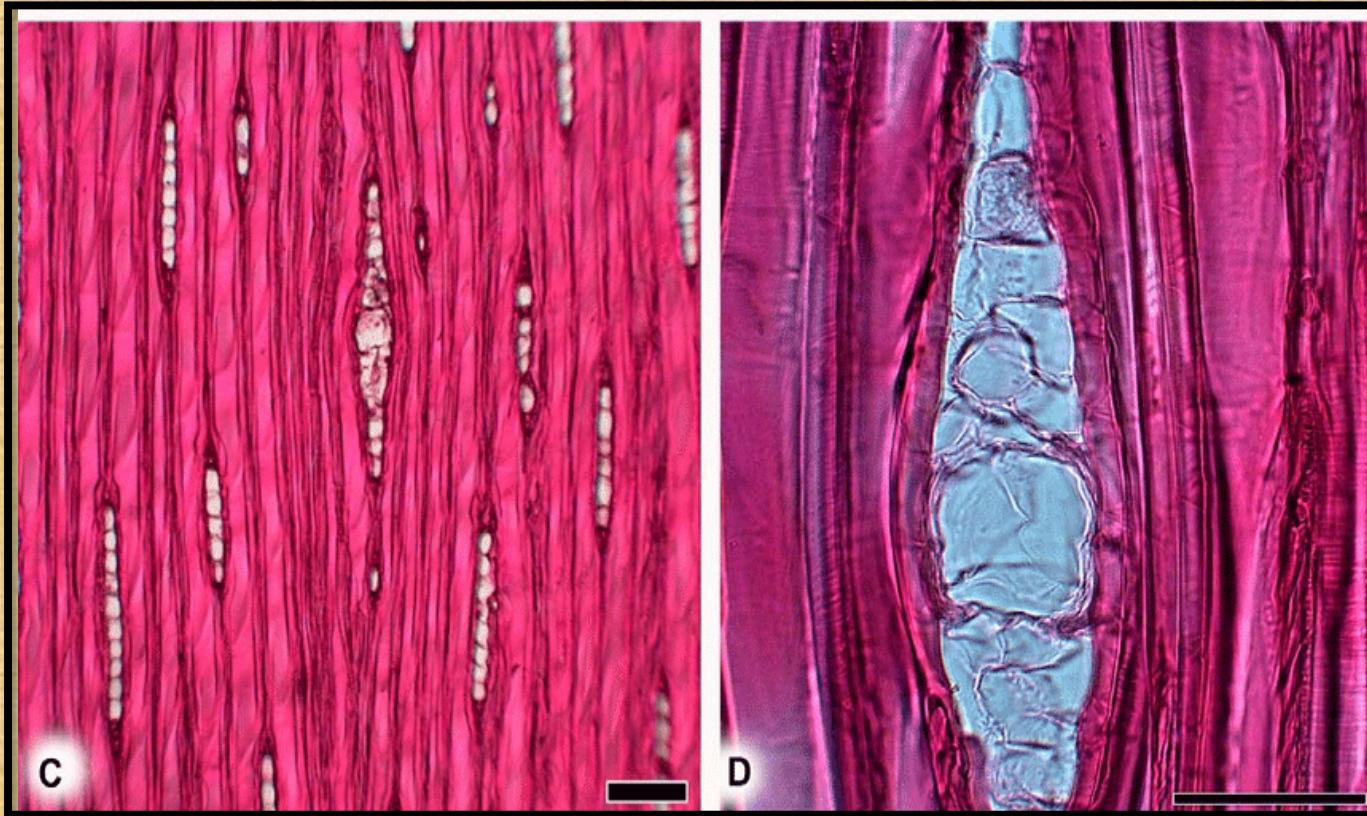
kupresoidne

**Horizontalne traheide mogu imati nazubljene (dentatne), mrežaste ili glatke stijenke.**

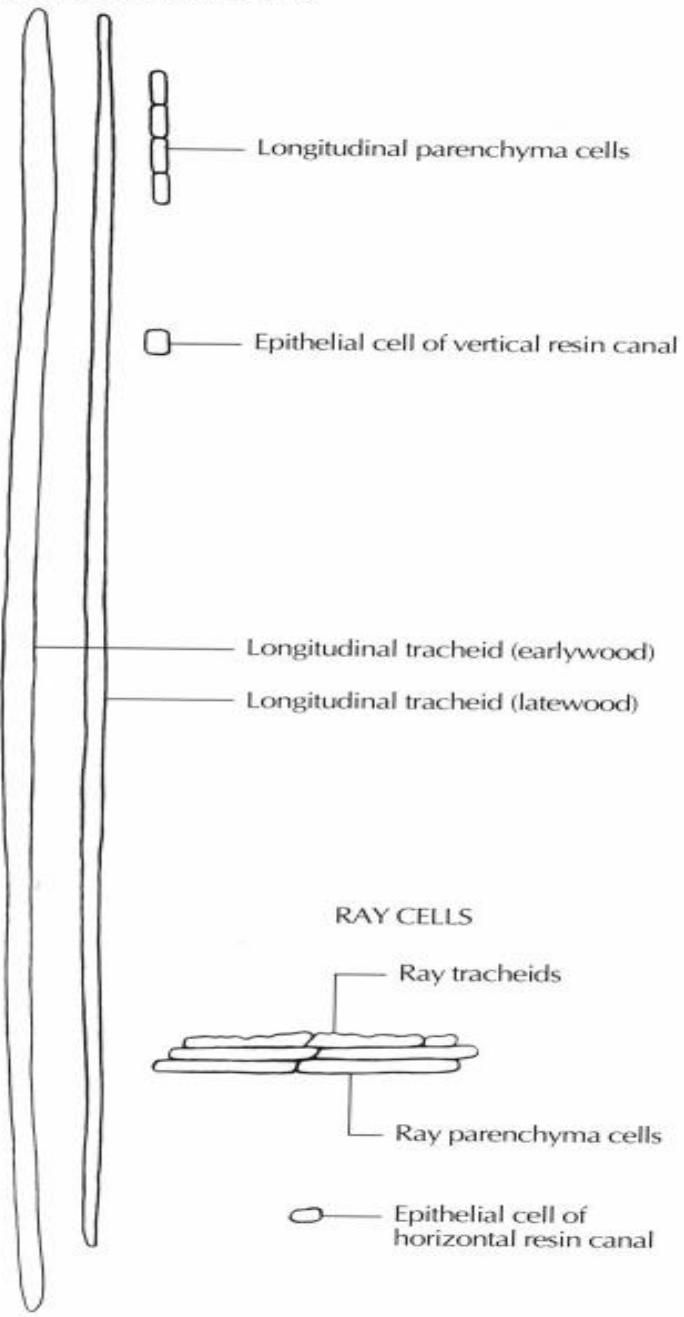


- 1 – glatka stijenka (*Pinus strobus*)
- 2 – stijenka s helikalnim zadebljanjima i finom nazubljeničću (*Picea abies*)
- 3 – izraženo nazubljena stijenka (*Pinus sylvestris*)
- 4 – mrežasta stijenka (*Pinus ponderosa*)

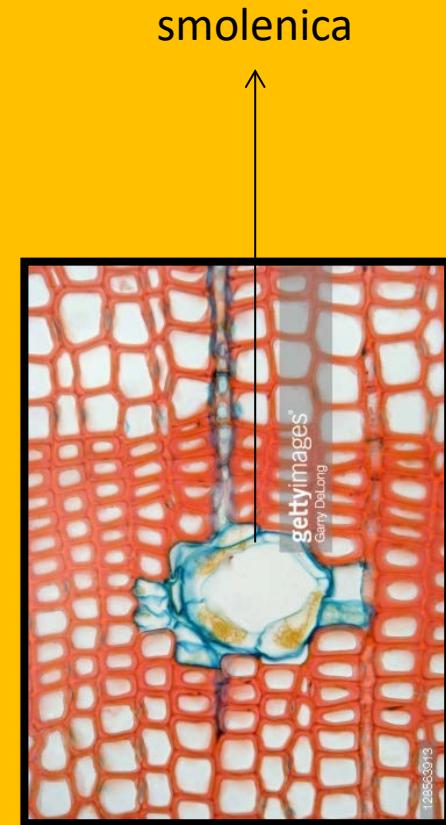
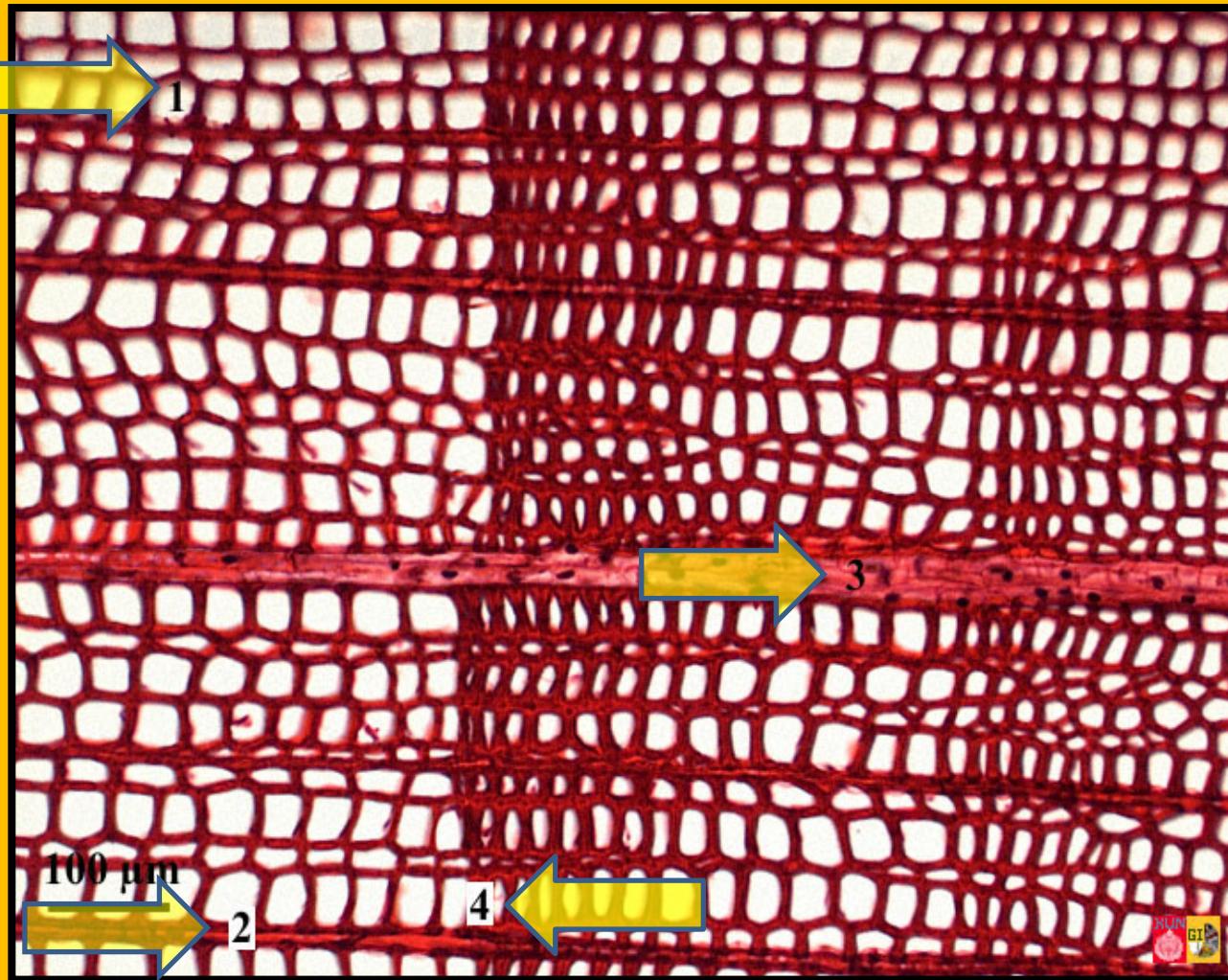
## **Radijalni smolni kanali**



### LONGITUDINAL CELLS

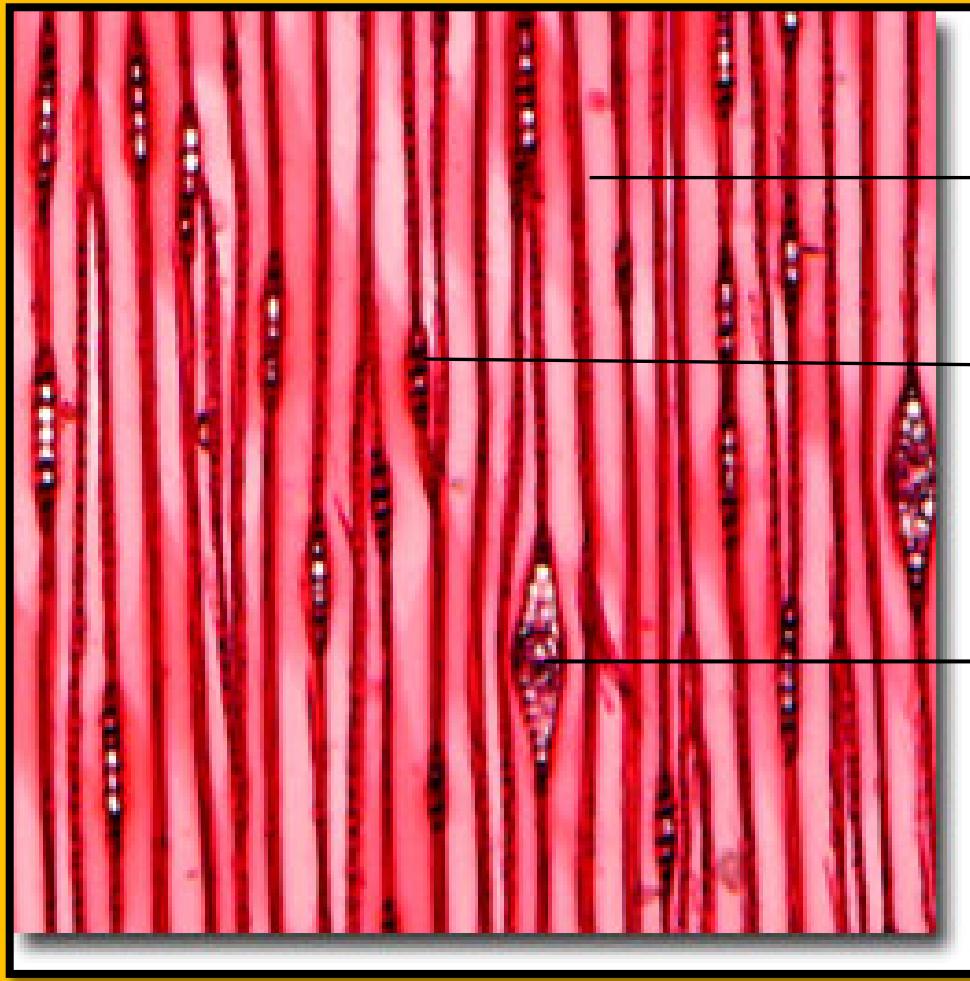


## Poprečni presjek



- 1 - traheida
- 2 – drvi trak
- 3 – drvni trak sa smolenicom
- 4 - granica goda

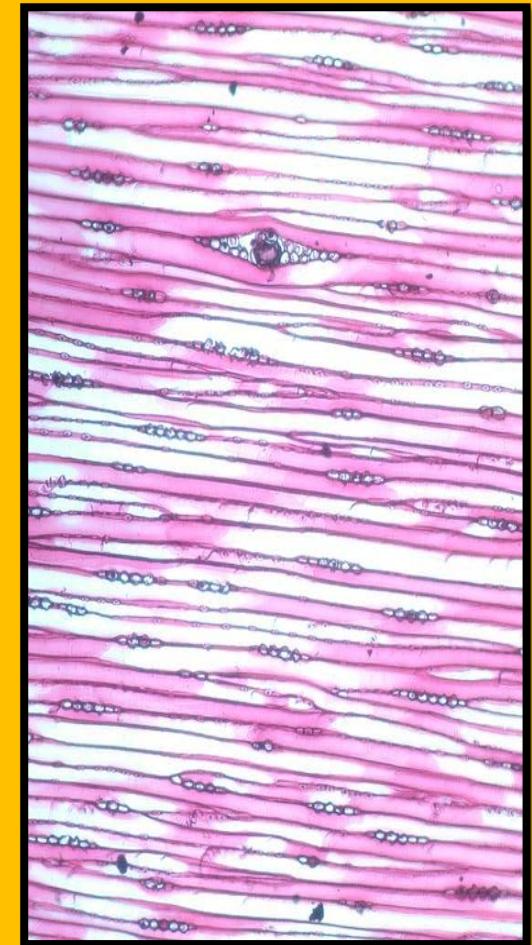
## Tangencijalni presjek



1 – traheide

2 –drvni trak

3 – smolenica unutra drvnog traka

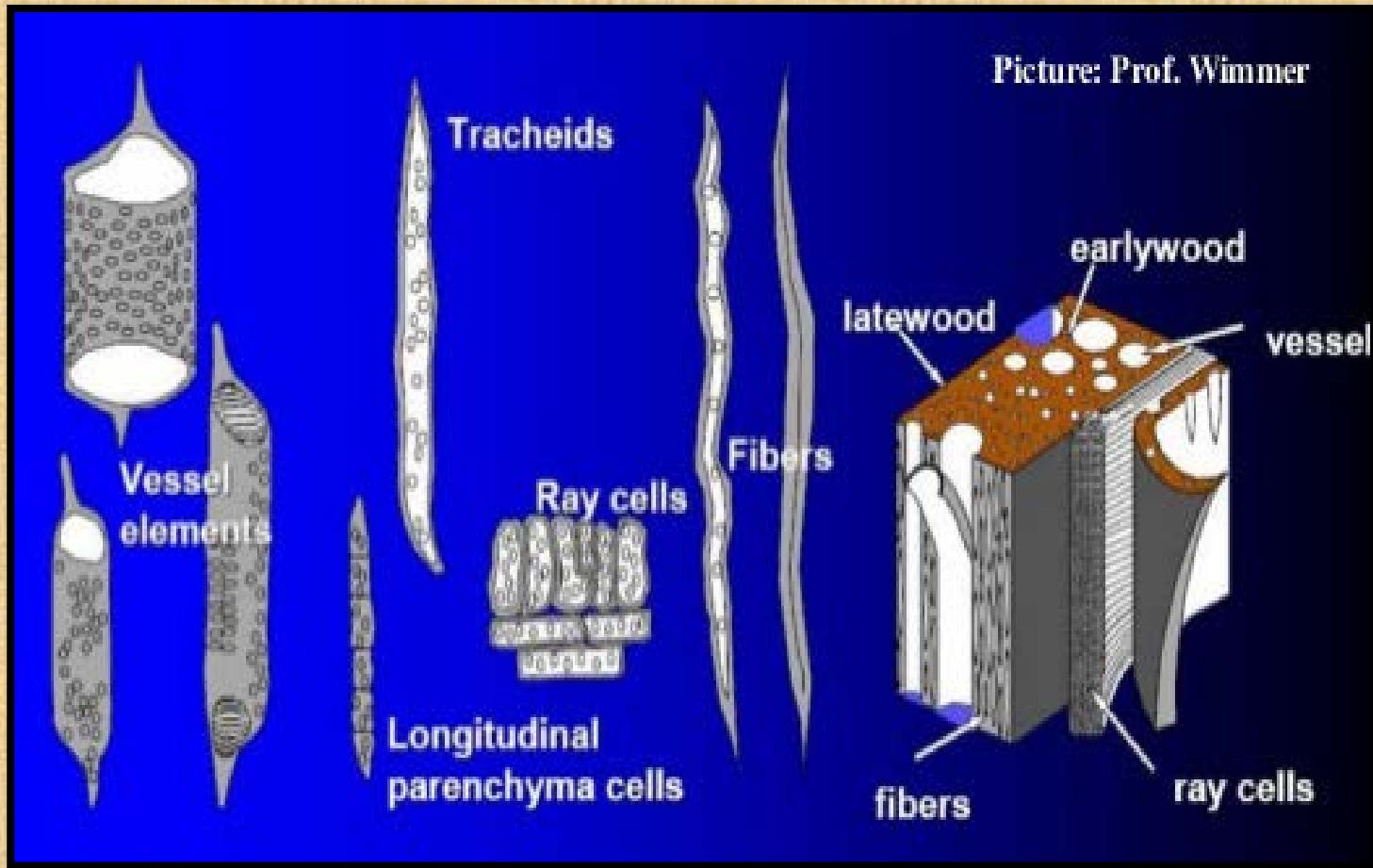


## Radijalni presjek



- 1 - drvni trak
- 2 - traheide u drvnom traku
- 3 - parenhim u drvnom traku
- 4 - traheida
- 5 - ograđene jažice
- 6 - jažice drvnog traka
- 7 - male jažice

# ANATOMIJA DRVA LISTAČA



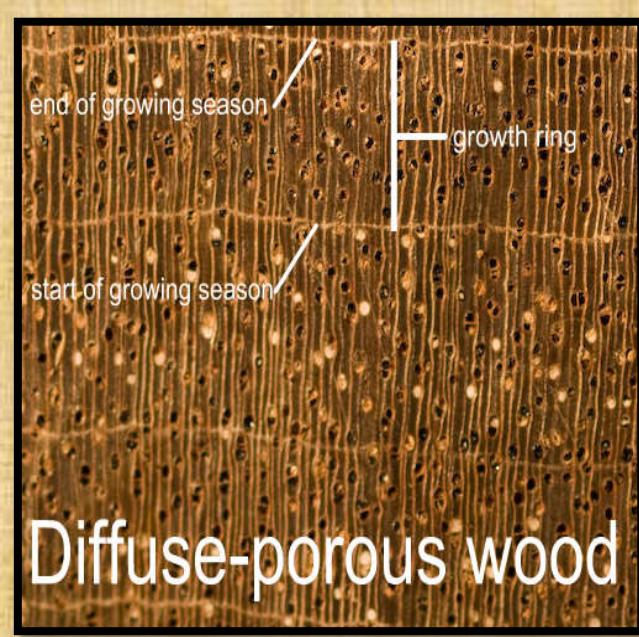
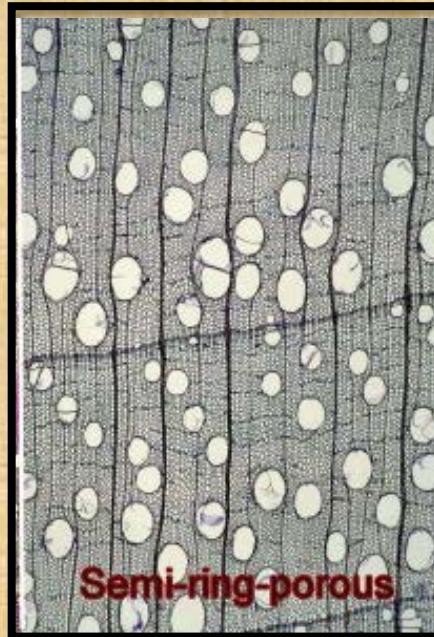
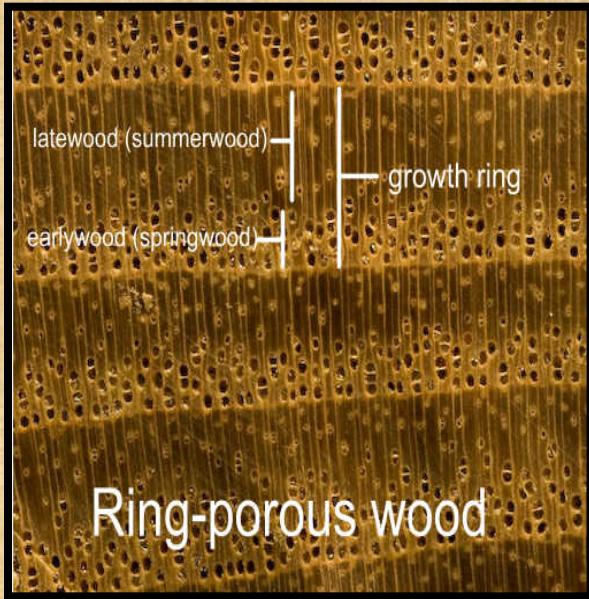
**I) Traheje** su velike provodne stanice koje se nastavljaju jedna na drugu u uzdužnom smjeru i čine provodne sudove, koji su u stanju provesti veliku količinu vode od korijena prema krošnji.

Prema **poroznosti** drvo dijelimo na:

1) prstenasto porozno

2) semiprstenasto porozno

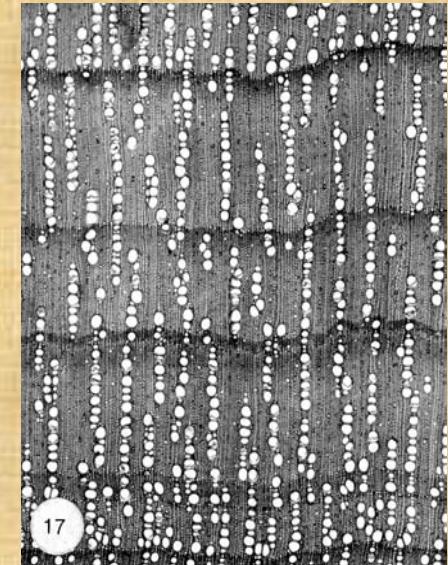
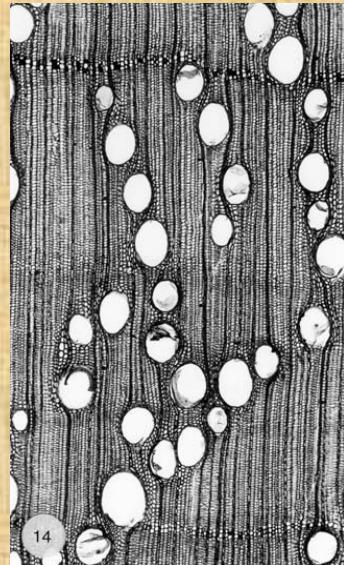
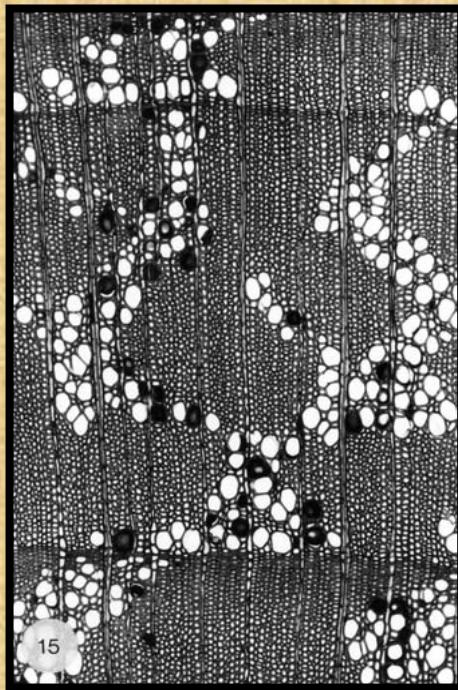
3) difuzno/rastresito porozno



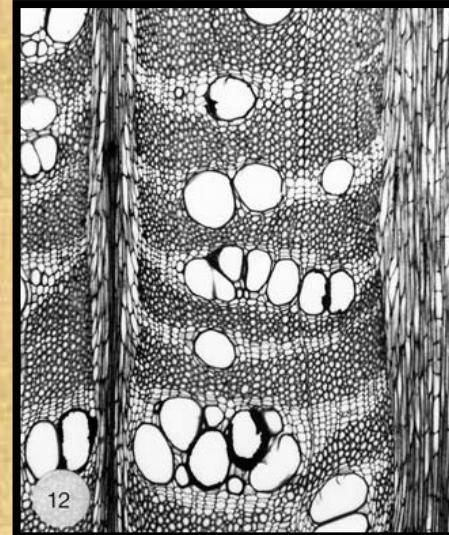
Traheje mogu u drvu biti razmještene u:

2) dijagonalnom i/ili radijanom uzorku

1) razgranatom (dendritic) uzorku

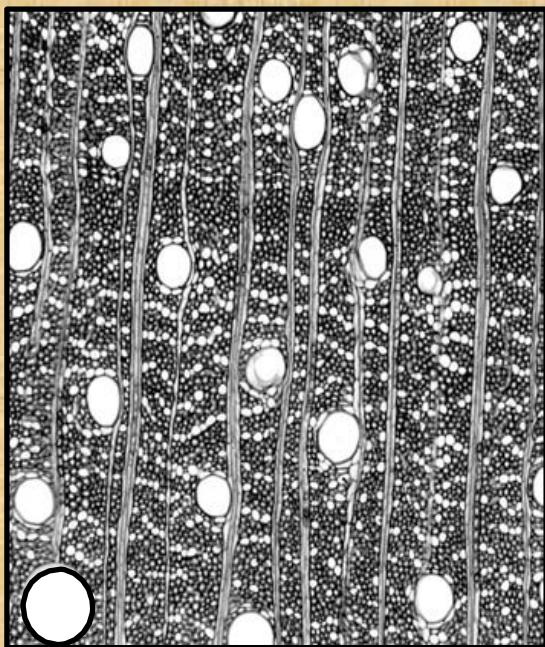


3) tangencijalnim vrpcama

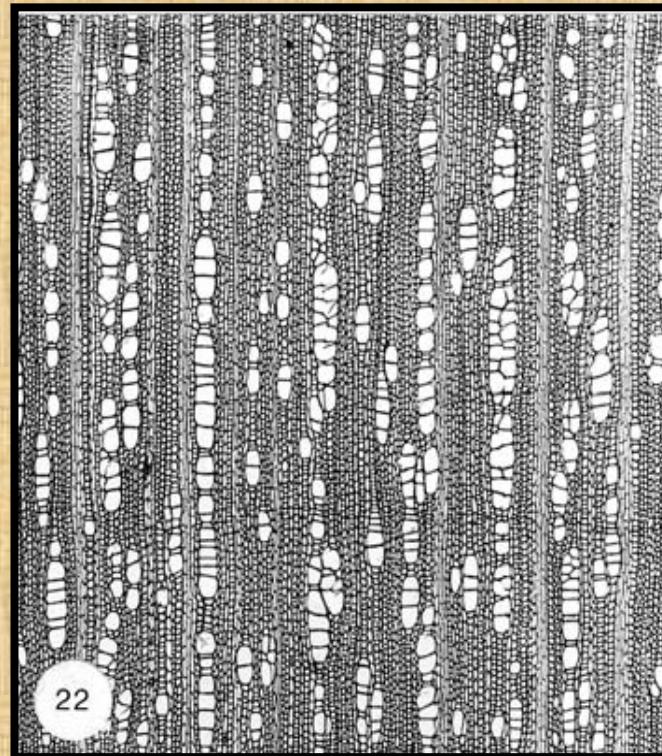


## Prema grupiranju traheje mogu biti:

1) samostalne

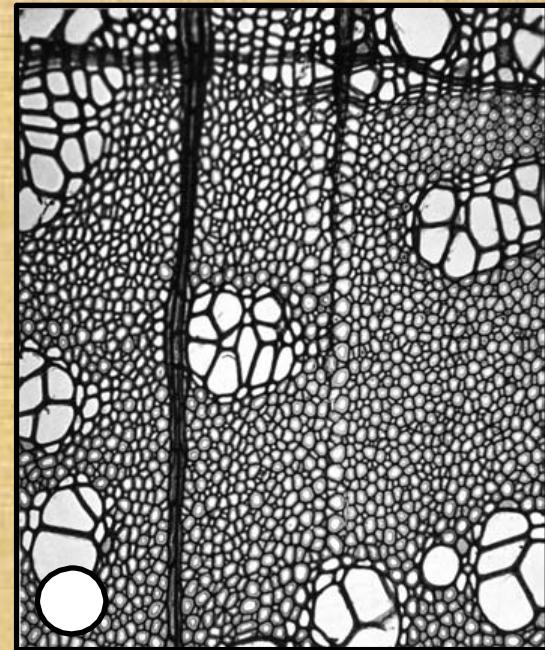


2) u radijalno postavljenim skupinama od 4 ili više traheje



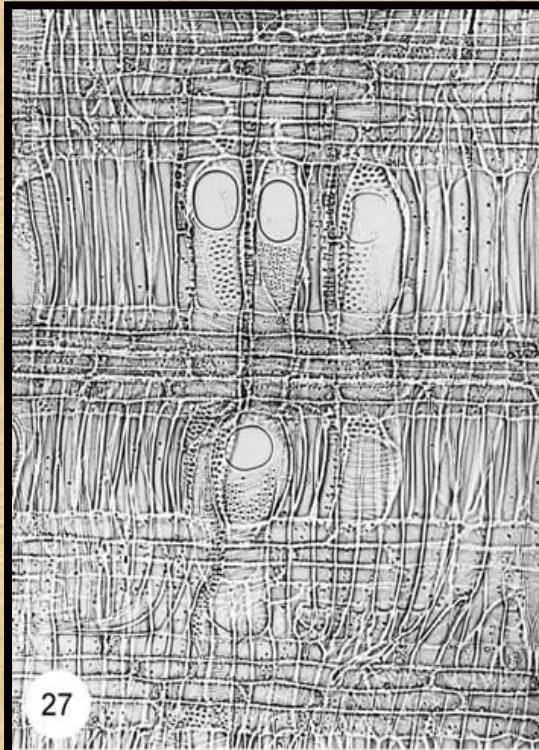
22

3) u skupini nepravilnog izgleda (cluster)

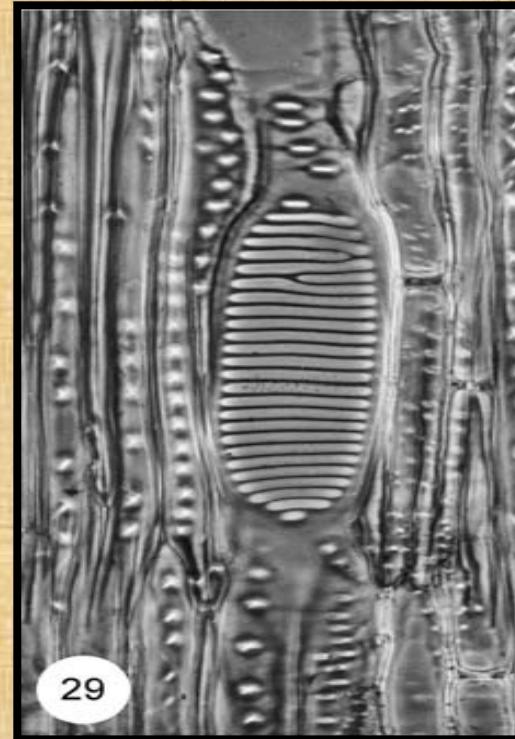


**Perforacijska ploča** je dio membrane stanice, kojom su spojeni susjedni članci traheja istog niza.

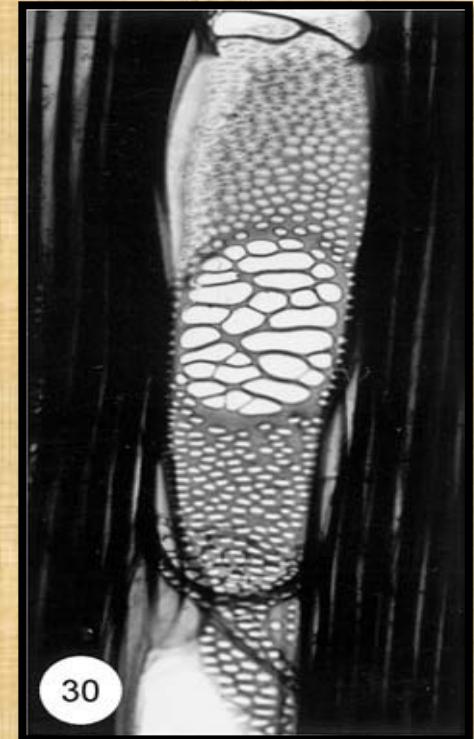
Jednostavna



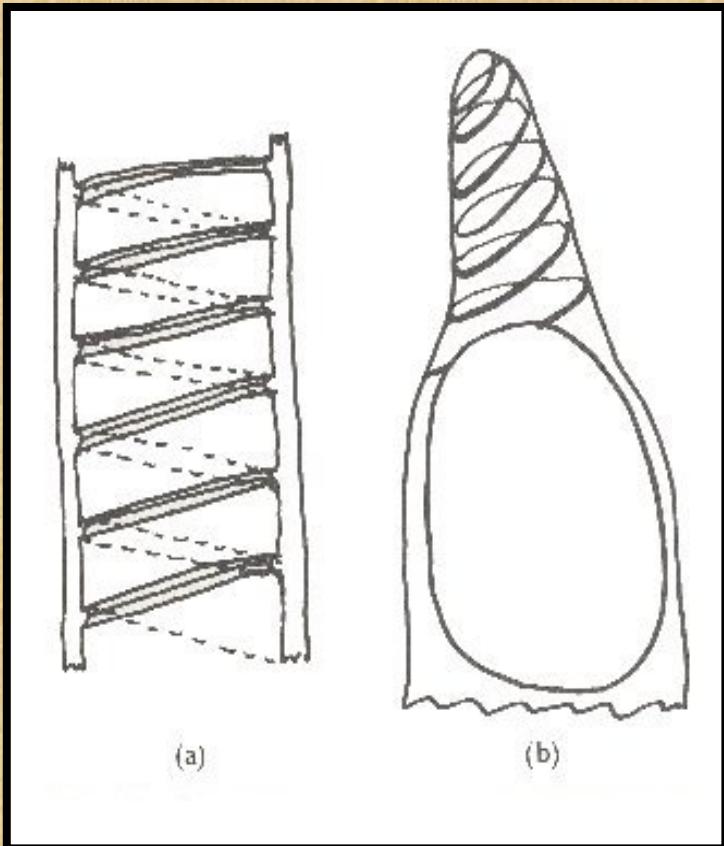
Ljestvičasta (skalariformna)



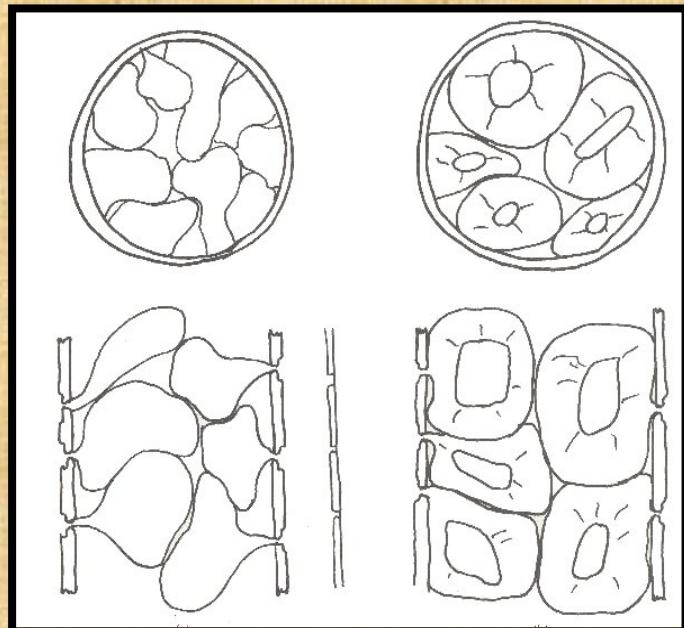
Mrežasta (retikularna)



Neke traheje imaju **spiralna zadebljanja stijenke**



Ponekad su traheje zapunjene **tilom**. Tila je izraslina stanice parenhima traka ili aksijalnog parenhima kroz šupljinu jažice u susjednu traheju.



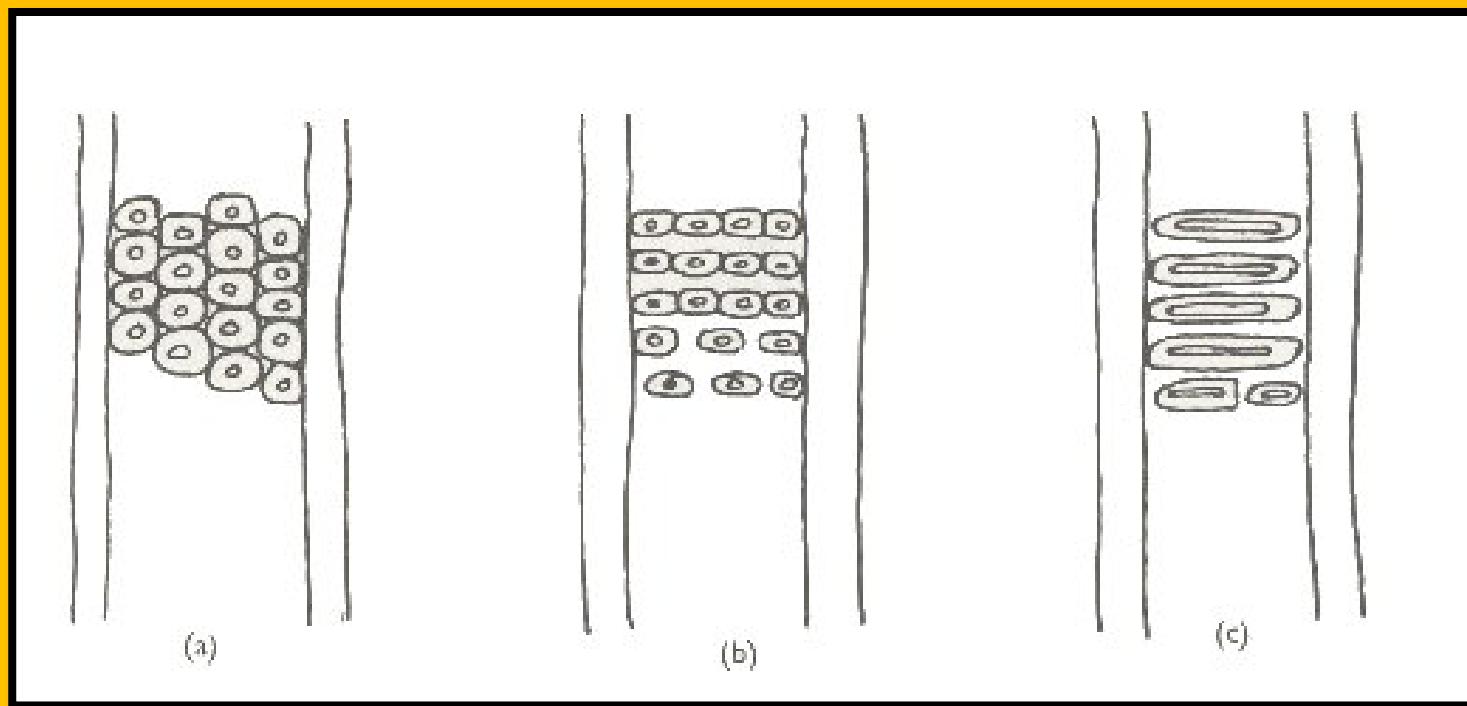
Spiralno zadebljanje;

- a -kroz cijelu traheju (*Tilia* sp.),
- b - samo u završetku traheje (*Liquidambar styraciflua*)

Tile s vrlo debelom, lameliranom i lignificiranim membranom i jažicama ramiformnog tipa naziva se sklerotična tila.

Jažičenje među trahejama može biti ljestvičasto (skalariformno), nasuprotno i naizmjenično.

4

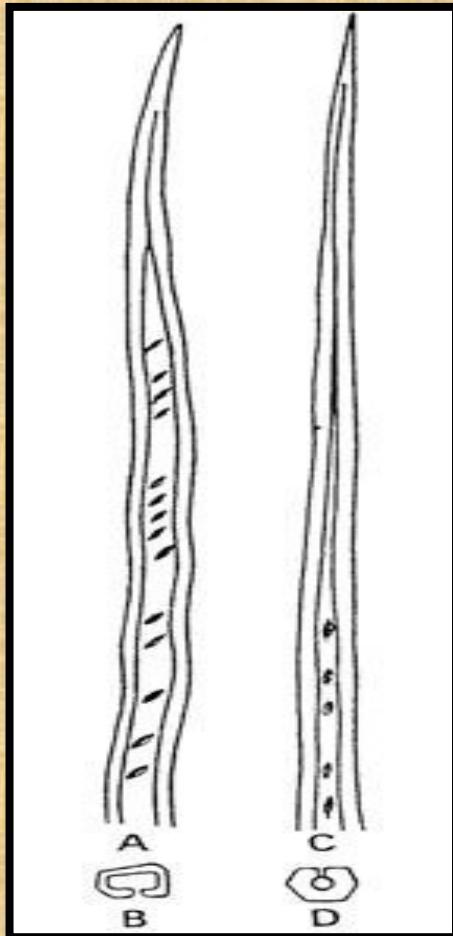


naizmjenično

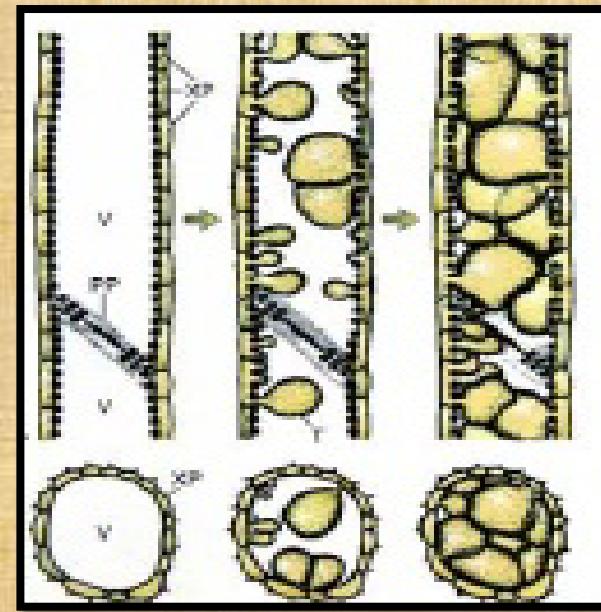
nasuprotno

ljestvičasto

**II) Drvna vlakna** su izdužene stanice s relativno debelom staničnom stijenkom i uskim lumenom. Njihova glavna uloga je mehanička potpora, a o debljini stijenke ovise gustoća i čvrstoća svake pojedine vrste.

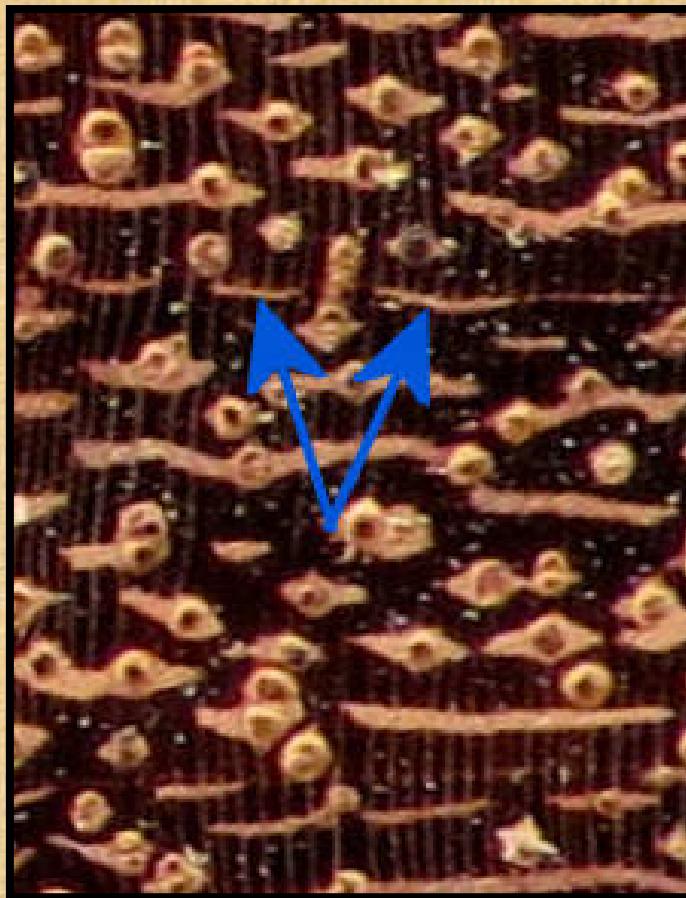


**III) Aksijalne parenhimske stanice** imaju tanku stijenku i veliki lumen. Glavna funkcija parenhima je akumulacija i distribucija hranjivih tvari.



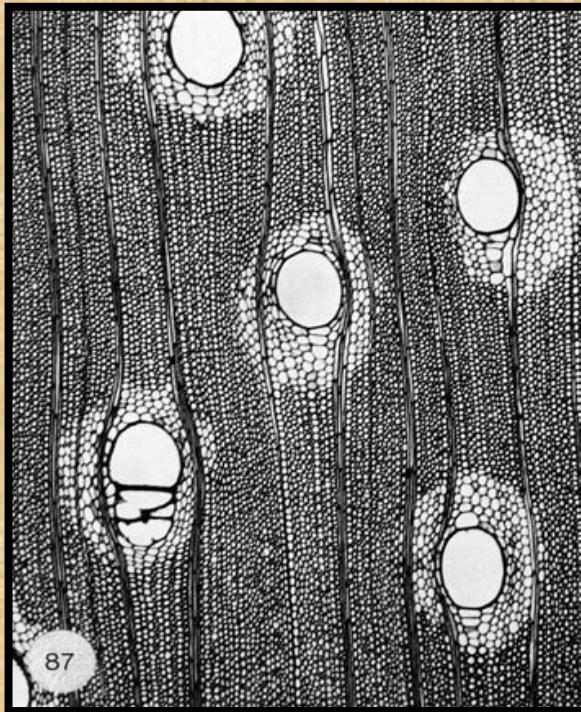
## **Apotrahealni parenhim – nije u kontaktu je s trahejama**

- 1) difuzan/rastresit
- 2) difuzan/rastresit (vrpčast) u agregatima

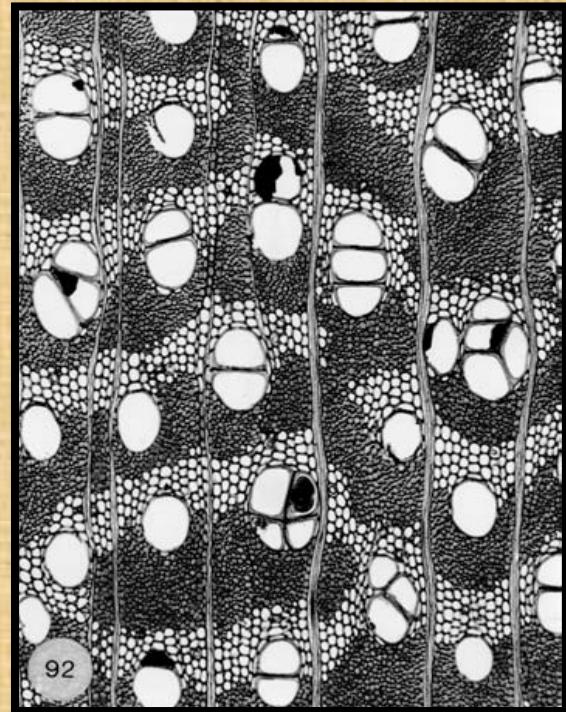


## **Paratrahealni parenhim – u kontaktu je s trahejama**

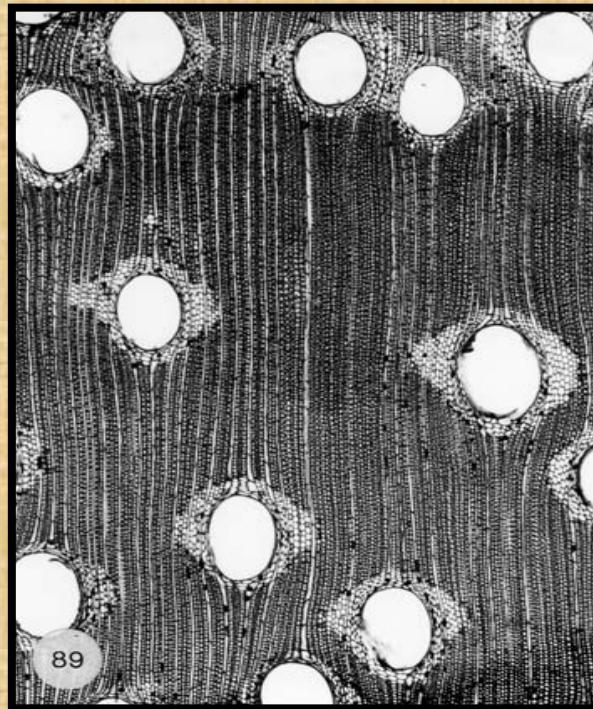
1) vazicentričan



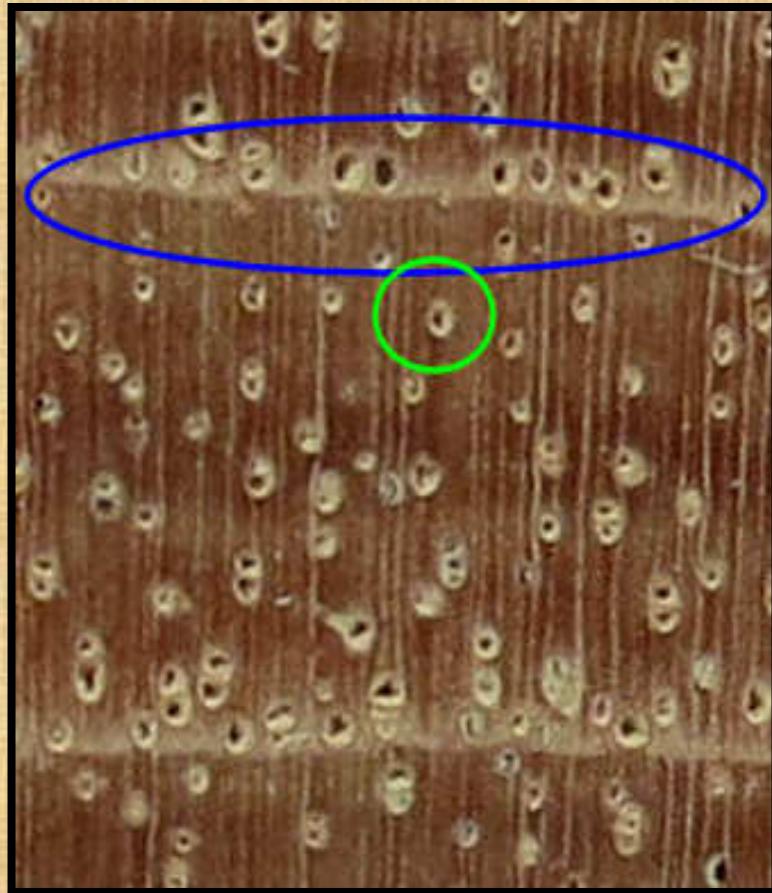
3) konfluentan



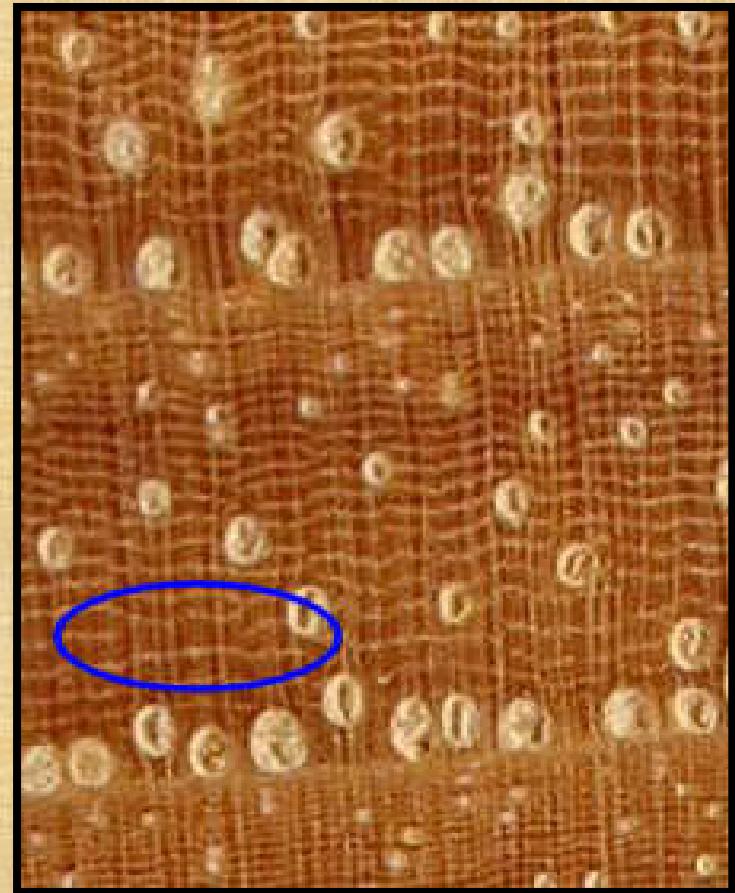
2) u obliku krila (aliforman)



4) rubni (marginalni)

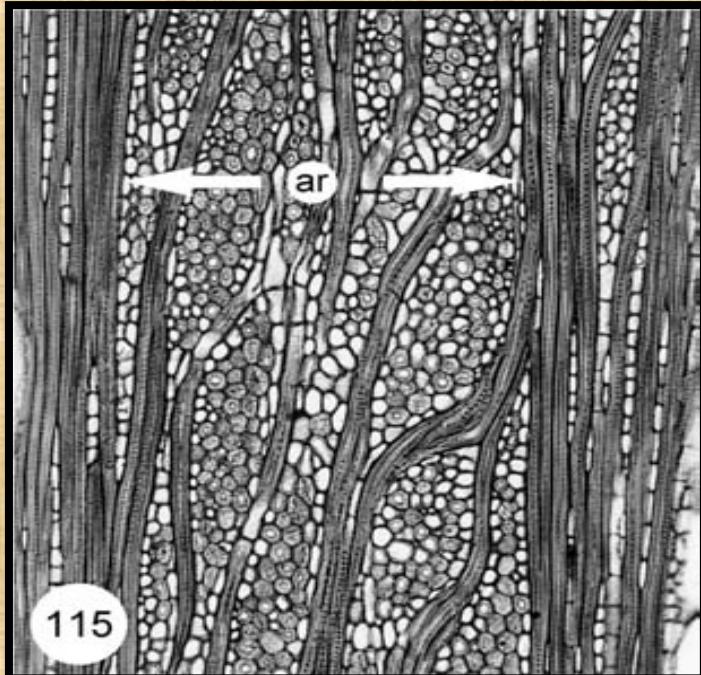
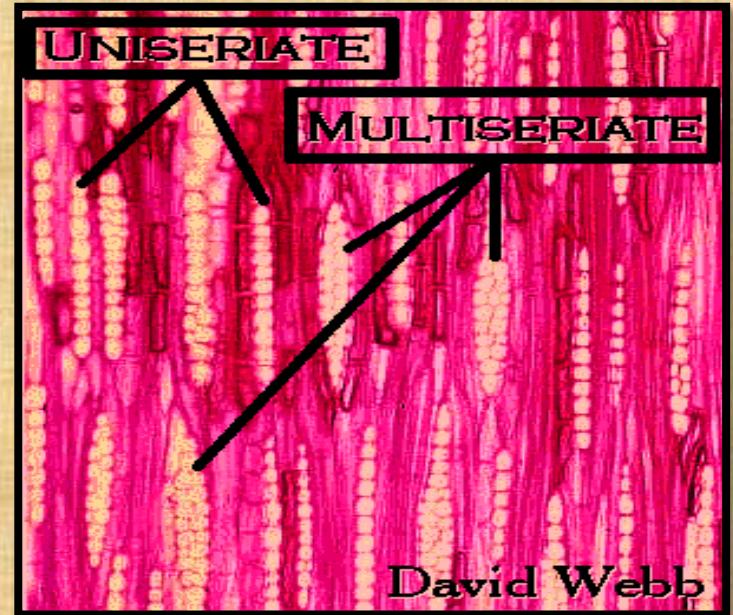


5) vrpčasti



#### IV Drvni traci

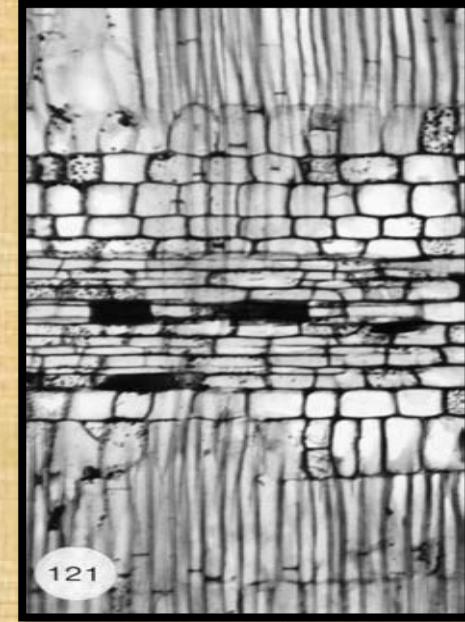
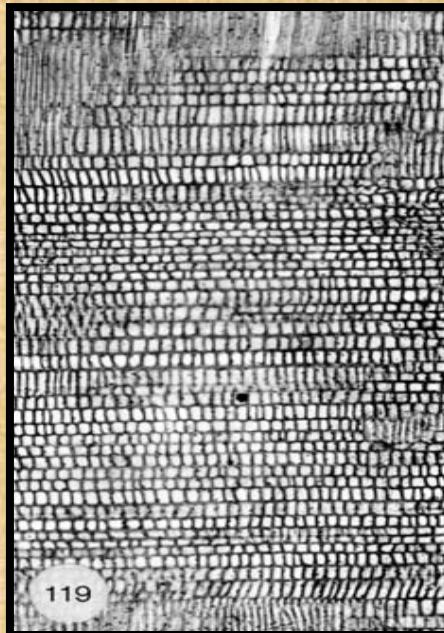
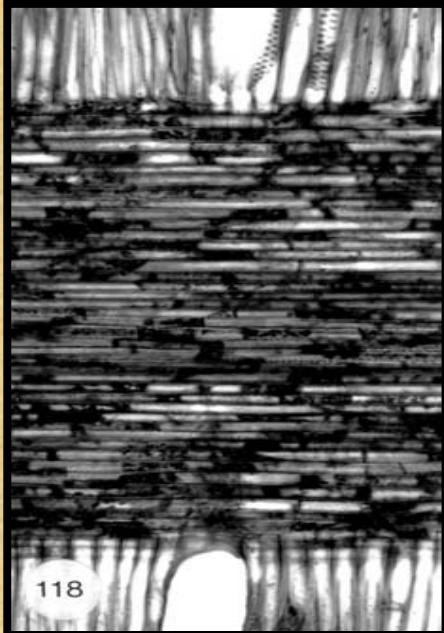
Najčešće su građeni od 2-4 reda stanica, a mogu biti građeni i od samo jednog reda ili pak više od više od njih 10.



Trakovi su ponekad međusobno združeni u aggregate.

Trakovi su kod listača građeni isključivo od parenhimskih stanica.

Da je tkivo traka **homogeno** kažemo ako su sve stanice u traku polegnute (tj. najduljom stanicom su orientirane u radijalnom smjeru) ili su pak sve uspravno položene ili imaju oblik kvadrata. Ukoliko su pak neke stanice uspravne, a neke položene, tad govorimo o **heterogenom** tkivu.

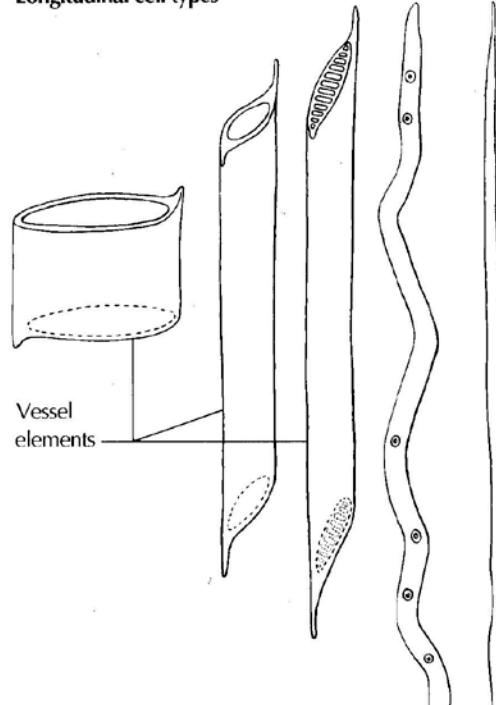


Drvni trak s homogenim tkivom;

- 118 – stanice položene vodoravno,
- 119 – stanice imaju oblik kvadrata

Drvni trak s heterogenim tkivom  
– trak s položenim parenhimskim  
stanicama i s 2-4 reda  
uspravnih/kvadratnih stanica

### Longitudinal cell types

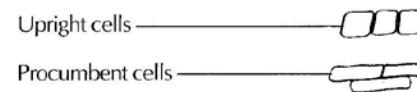


Tracheid

Fiber

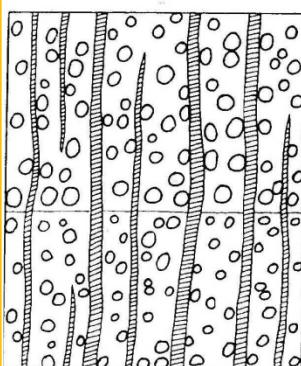
Longitudinal parenchyma

### Ray cell types

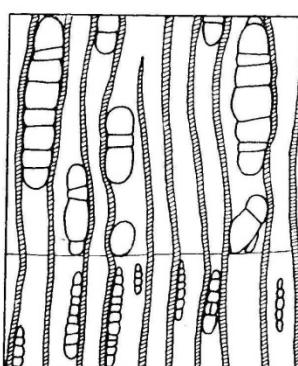


Upright cells

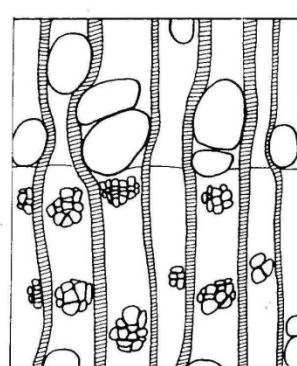
Procumbent cells



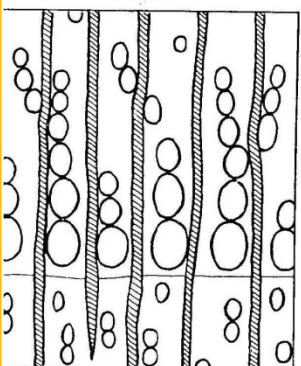
79



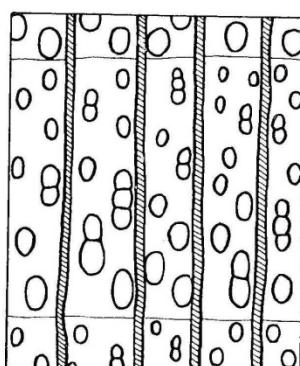
80



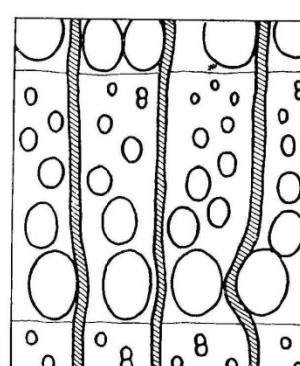
81



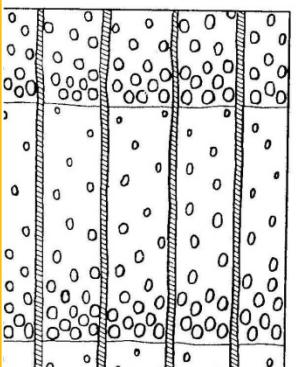
82



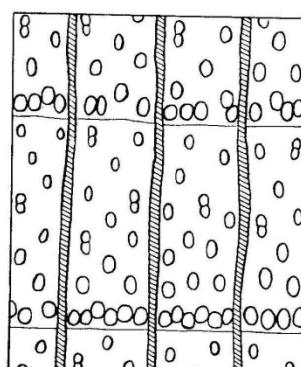
83



84



85



86

Semiprstenasto drvo: 85, 86

Pore u radijanom nizu: 80, (79)

Difuzno porozno drvo: 79, 83

Prstenasto porozno drvo: 84

Pore u nepravilno raspoređenim skupinama (cluster): 81

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