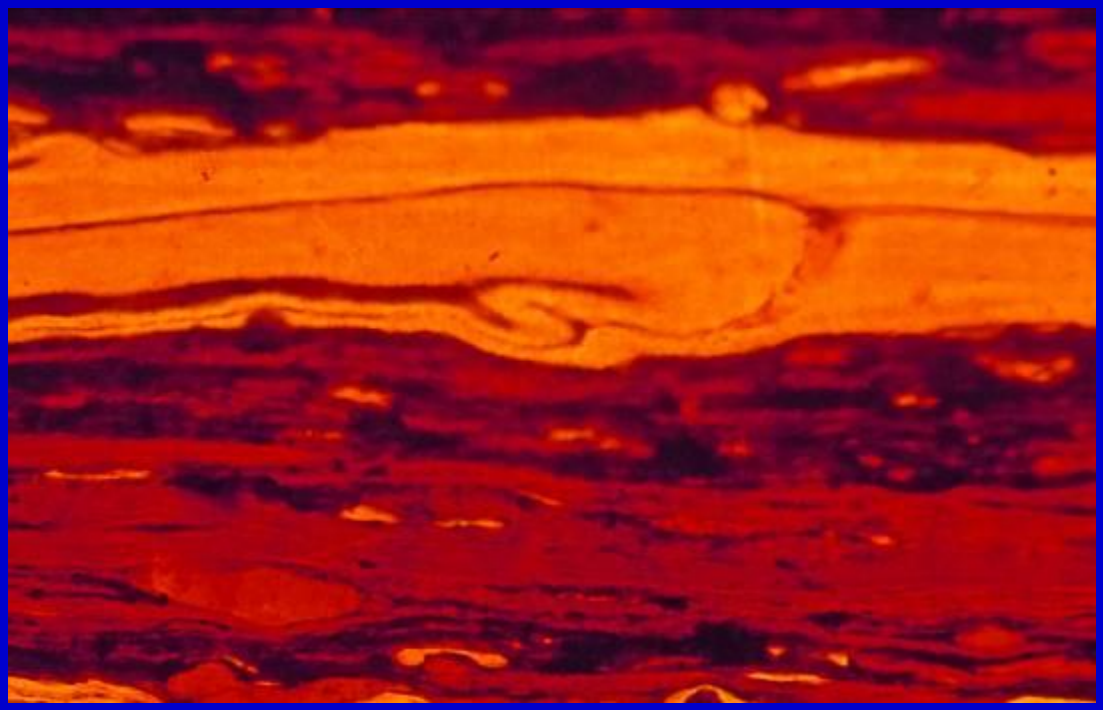
Late Pennsylvanian & Lowest Permian Coal Forming Plants from Eastern Pennsylvania and Western West Virginia, Joggins, N.S.



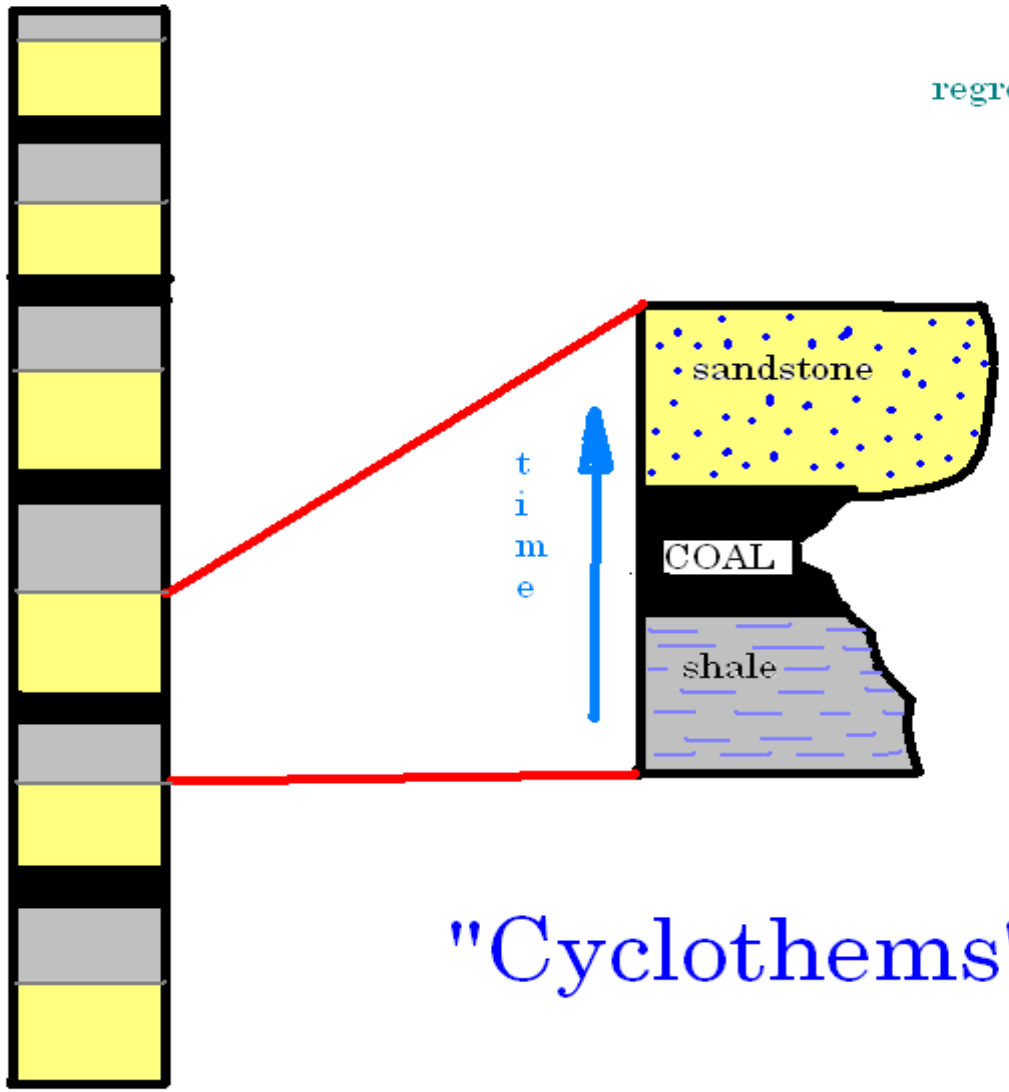
Squashed megaspore in Dunkard Gp lP to P BITUMINOUS Coal, WVa

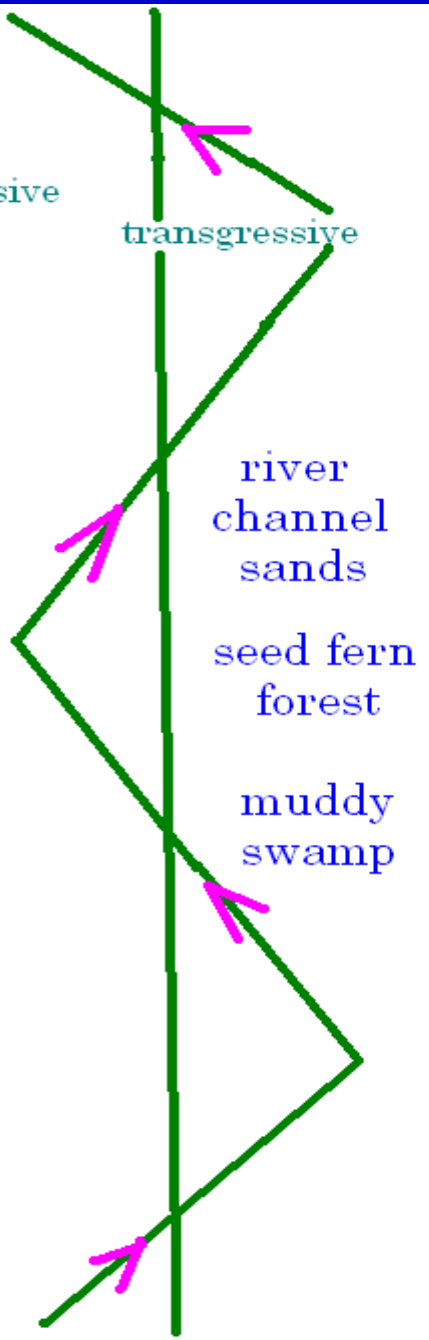
Llewellyn Fm. fossil plant site, St. Clair, Pennsylvania

Surface mine for *Anthracite Coal* (metamorphosed coal) in Folded Appalachians of eastern Pa.: note luster

‘Soft’ coal of western Pa and WVa: BITUMINOUS COAL, High Sulfur, more ash

Coal deposited in ‘cyclothems’ (100’s) due to transgressive/regressive fluctuations of sea level burying coastal swamps in turn due to southern hemisphere continental glaciation while Pangaea is forming.


sandstone
COAL
shale
t
i
m
e


regressive
transgressive
river
channel
sands
seed fern
forest
muddy
swamp

"Cyclothems"

***Concretions* in shales below coal**

Ogg,2006

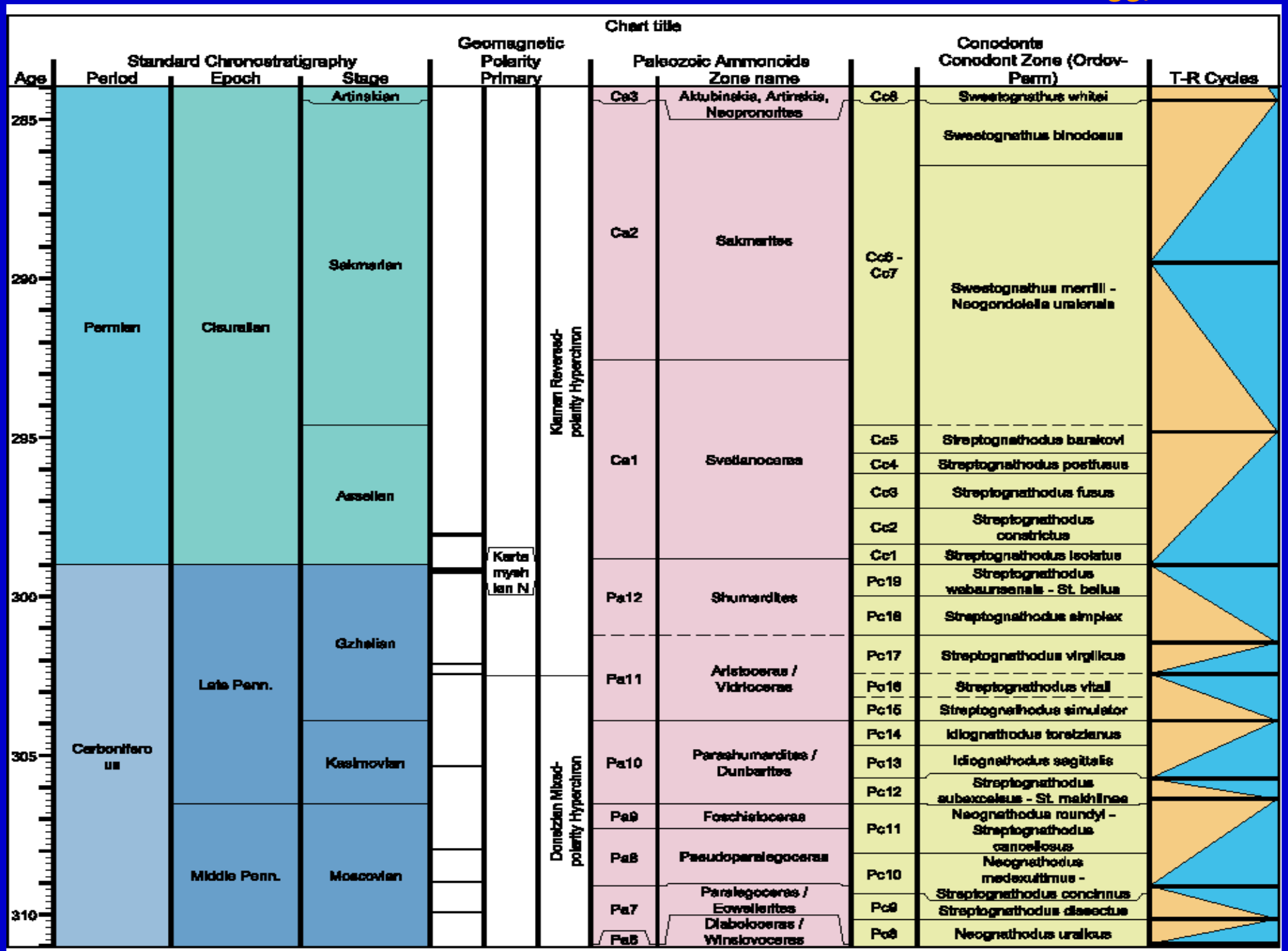
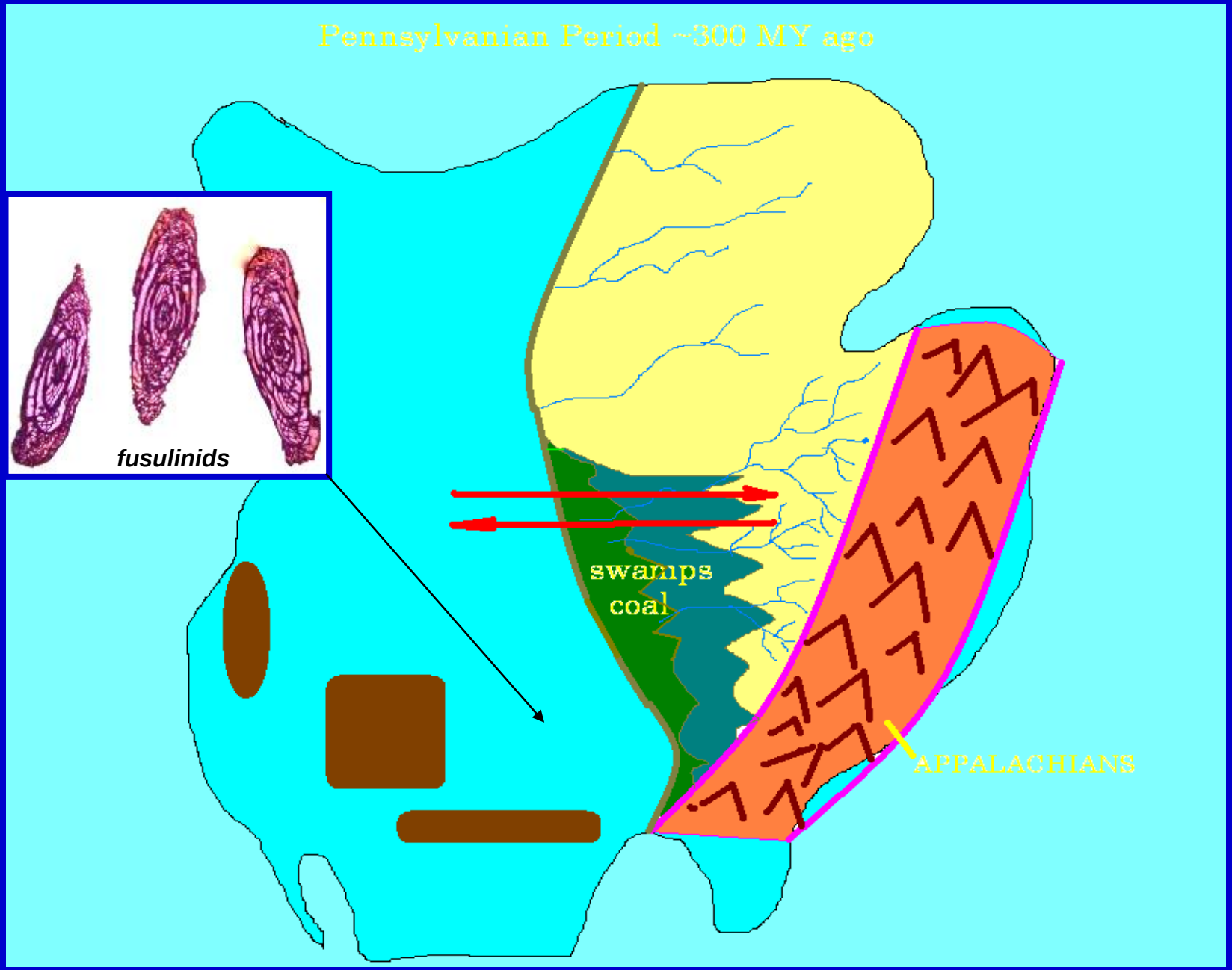
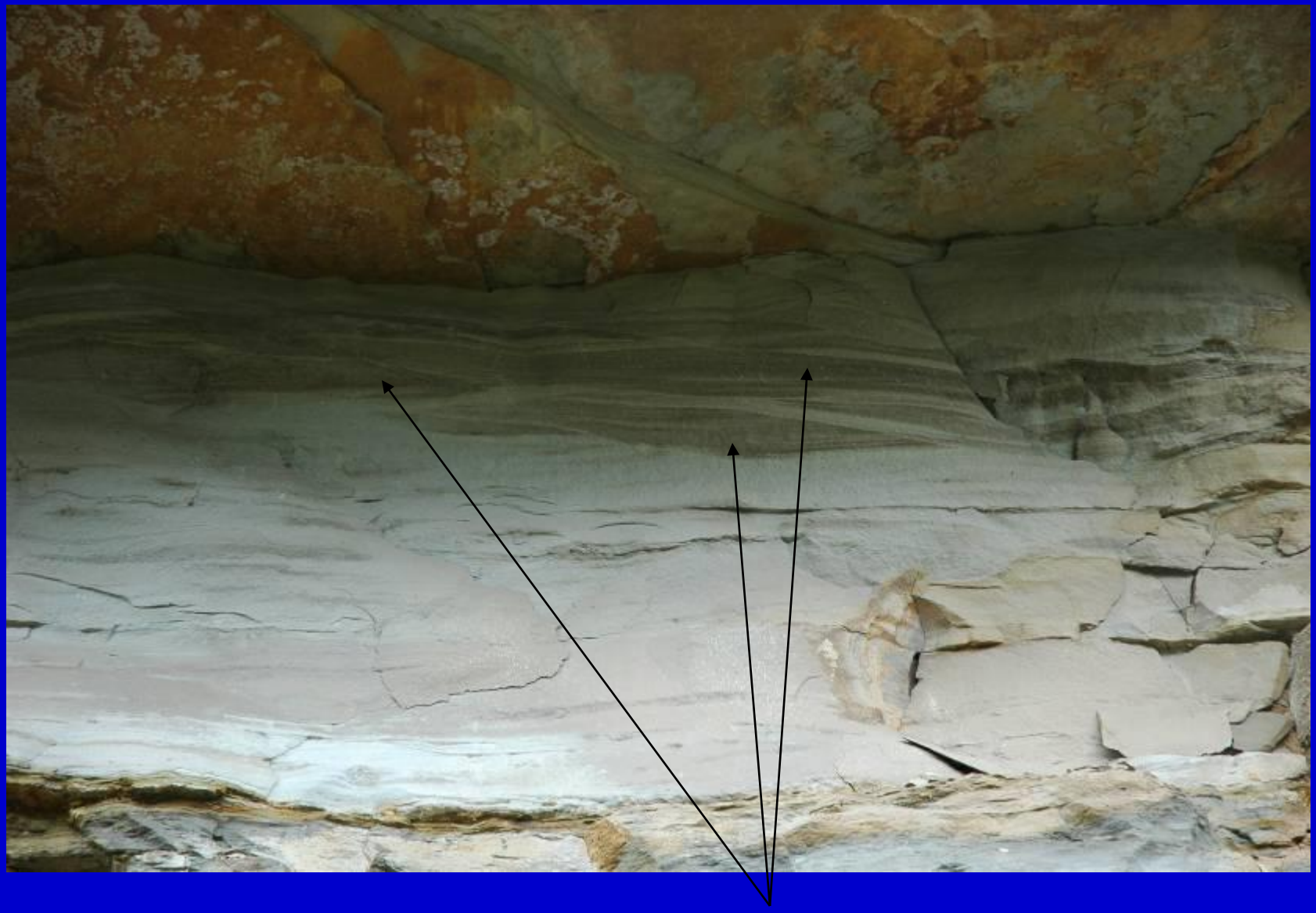


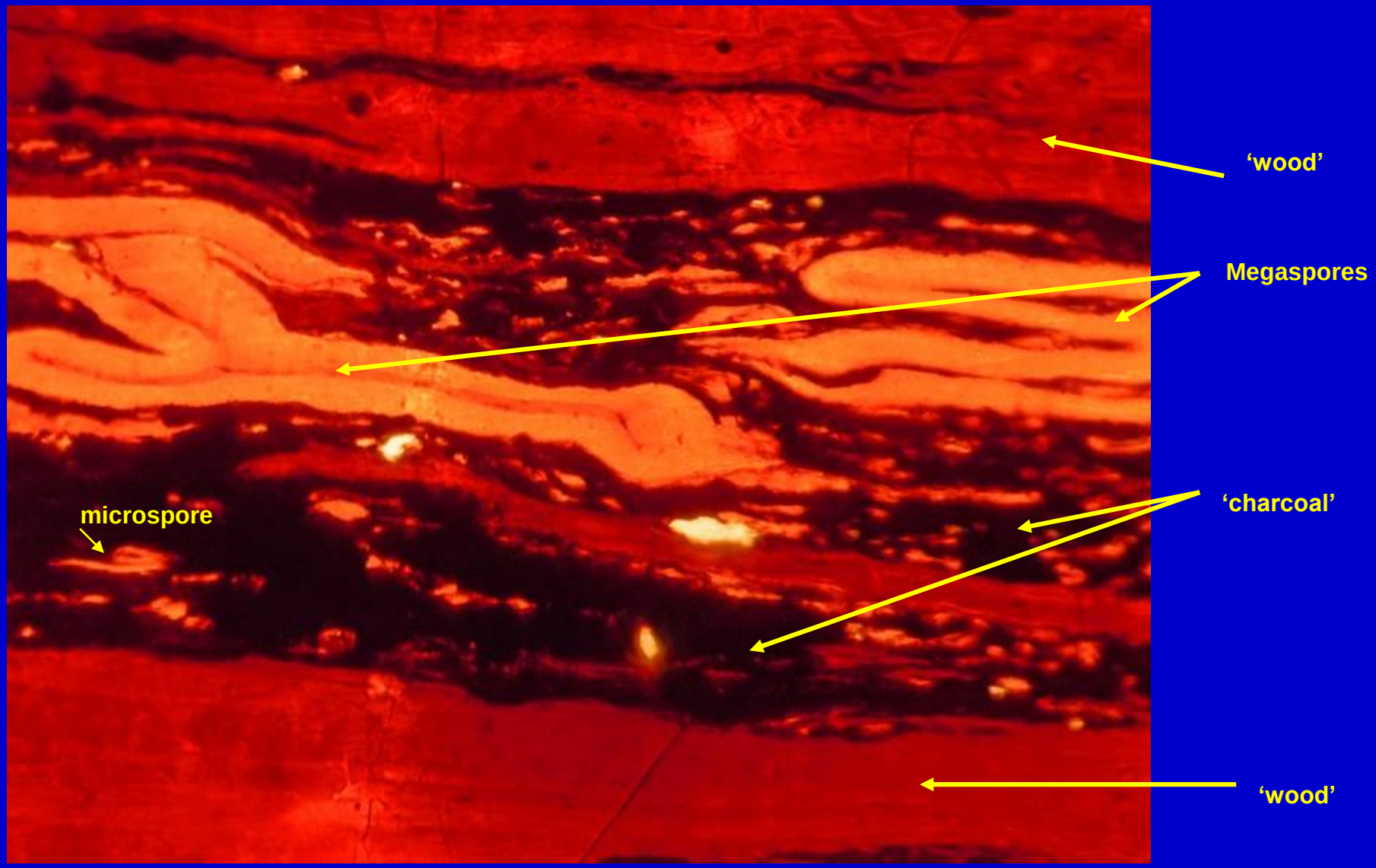
Chart title
Age
Standard Chronostratigraphy
Period
Epoch
Stage
Geomagnetic Polarity
Primary
Paleozoic Ammonoid Zone name
Conodonts
Conodont Zone (Ordov-Perm)
T-R Cycles
285
290
295
300
305
310
Permian
Cisuralian
Artinskian
Sakmarian
Asselian
Carboniferous
Late Penn.
Gzhelian
Kasimovian
Middle Penn.
Moscovian
Kiaman Reversed-polarity Hyperchron
Kartamyshlan N
Donetzian Mixed-polarity Hyperchron
Ca3
Aktubinskia, Artinskia, Neopronorites
Ca2
Sakmarites
Ca1
Svetlanoceras
Pa12
Shumardites
Pa11
Aristoceras / Vidrioceras
Pa10
Parashumardites / Dunbarites
Pa9
Foschisioceras
Pa8
Pseudoparalegoceras
Pa7
Paralegoceras / Eowellerites
Pa6
Diabolaceras / Winslovoceras
Cc8
Sweetognathus whitei
Sweetognathus binodosus
Cc6 - Cc7
Sweetognathus merrilli - Neogondolella uralensis
Cc5
Streptognathodus barskovi
Cc4
Streptognathodus postfusus
Cc3
Streptognathodus fusus
Cc2
Streptognathodus constrictus
Cc1
Streptognathodus isolatus
Pc19
Streptognathodus wabaunsensis - St. bellus
Pc18
Streptognathodus simplex
Pc17
Streptognathodus virgilicus
Pc16
Streptognathodus vitali
Pc15
Streptognathodus simulator
Pc14
Idiognathodus toretzianus
Pc13
Idiognathodus sagittalis
Pc12
Streptognathodus subexcelsus - St. makhlinae
Pc11
Neognathodus roundyi - Streptognathodus cancellosus
Pc10
Neognathodus medexultimus - Streptognathodus concinnus
Pc9
Streptognathodus dissectus
Pc8
Neognathodus uralicus

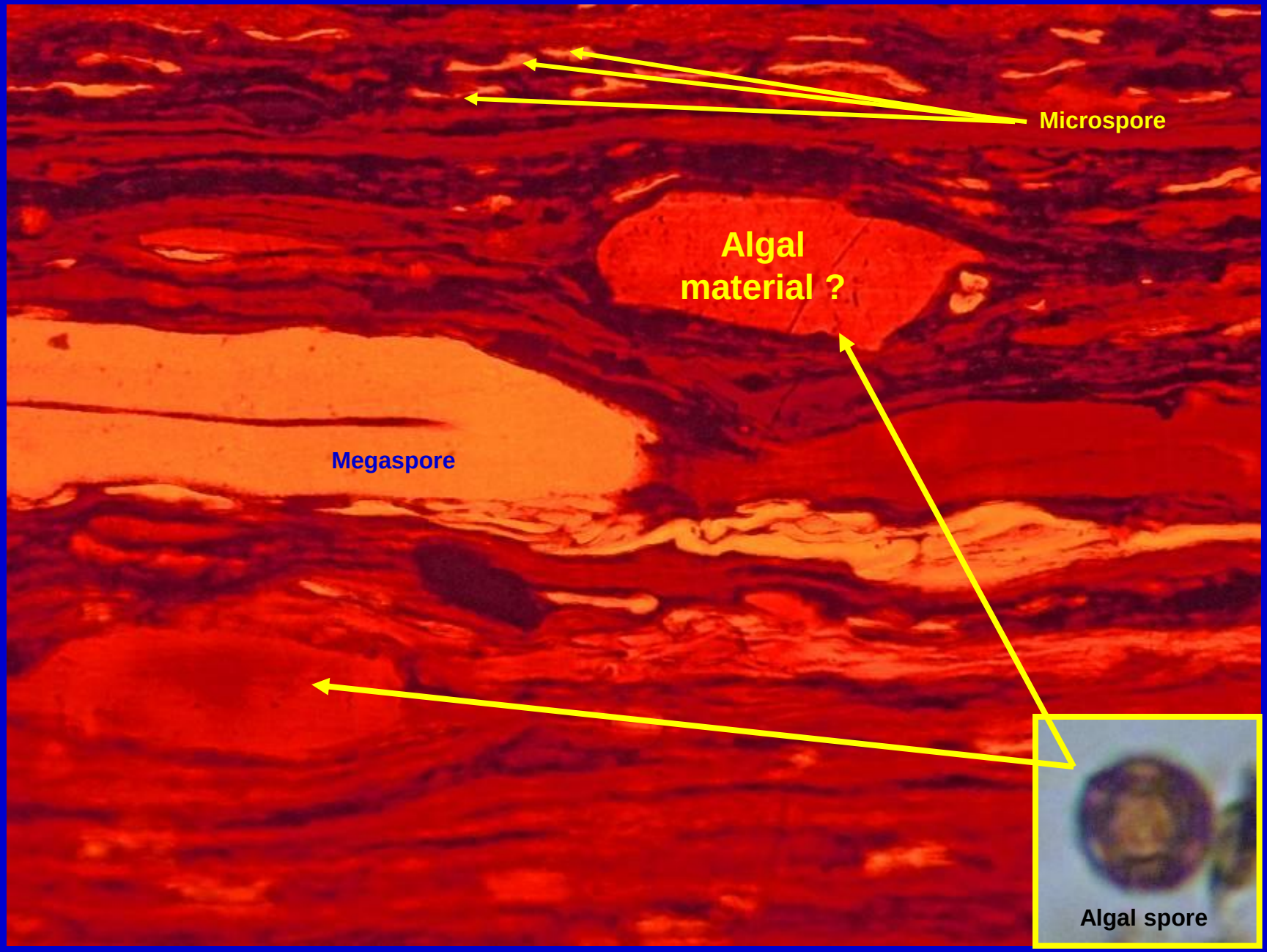

Pennsylvanian Period ~300 MY ago
fusulinids
swamps
coal
APPALACHIANS

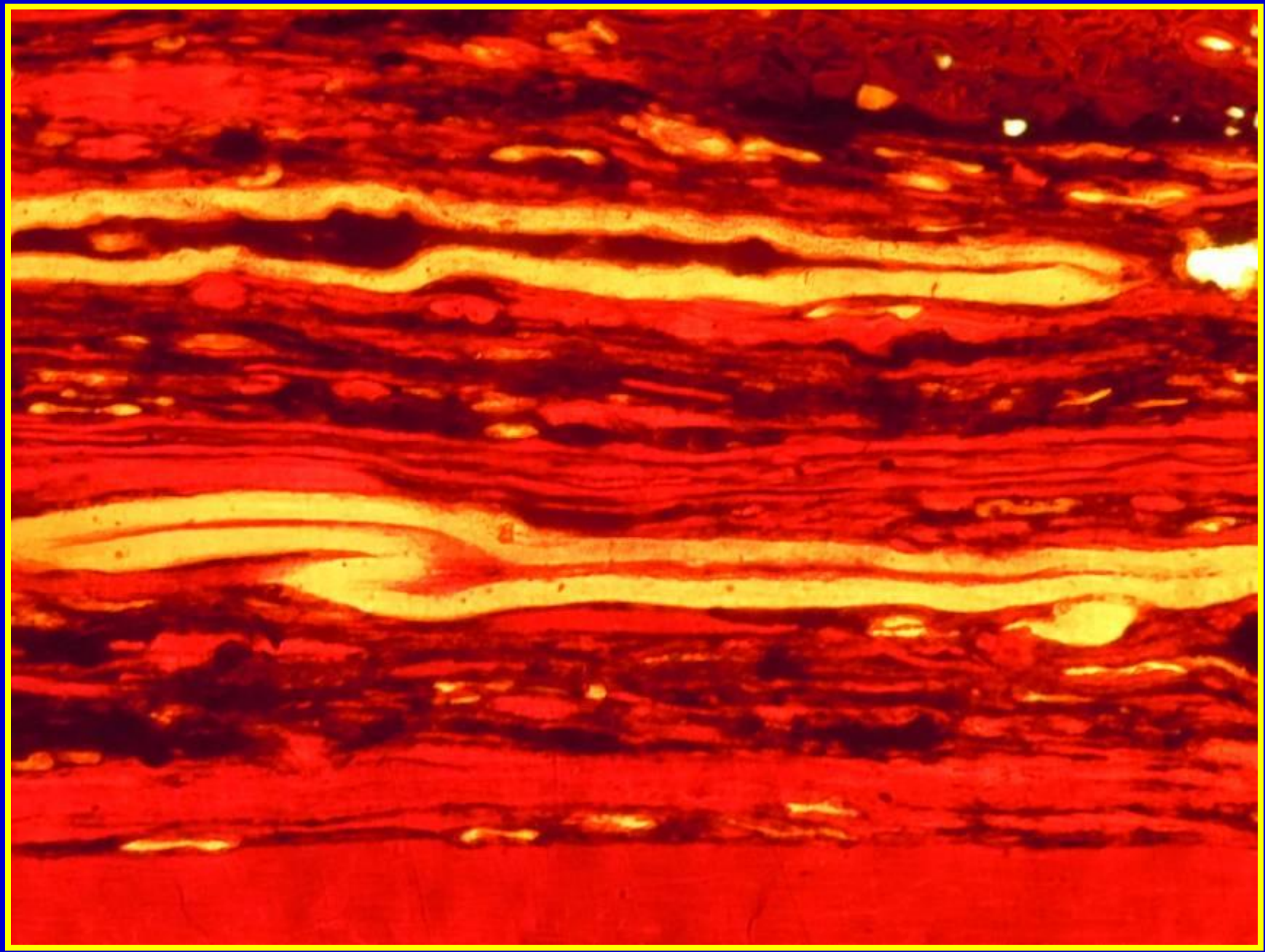


Lenticular cross beds of stream channels (sandstones) above coal

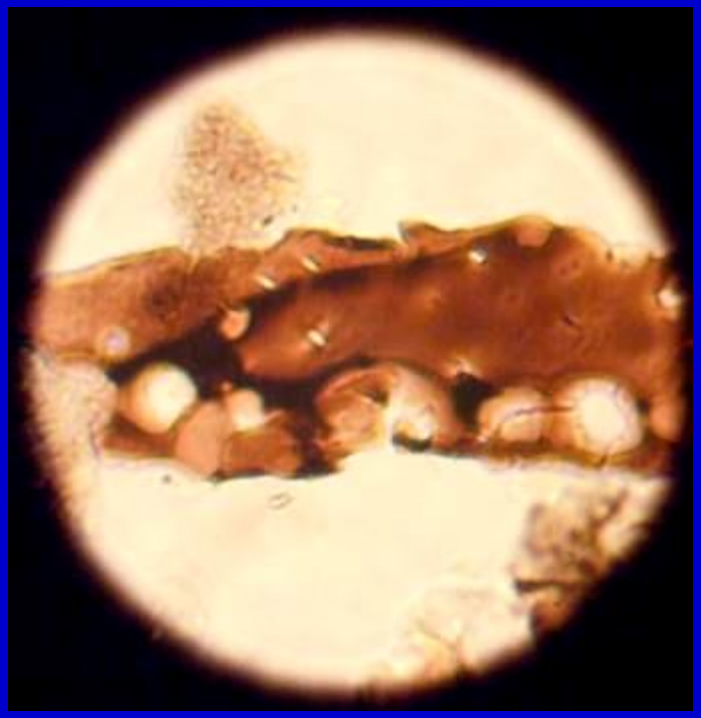
Mid Pennsylvanian to Early Permian (Dunkard?) Bituminous coal thin sections

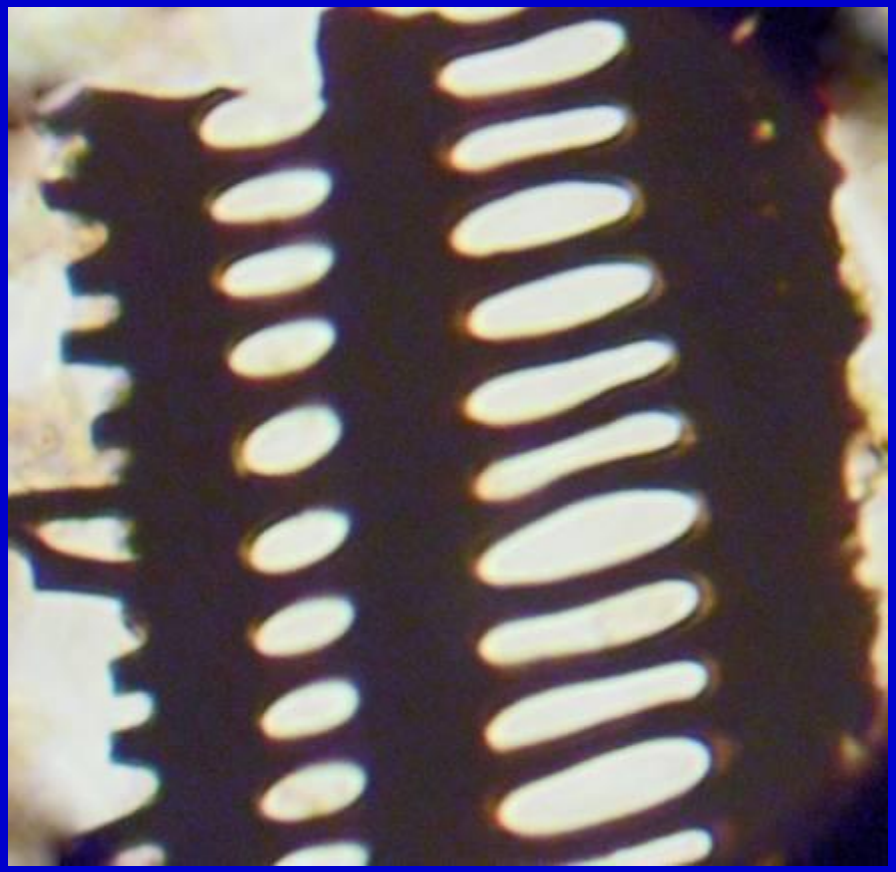


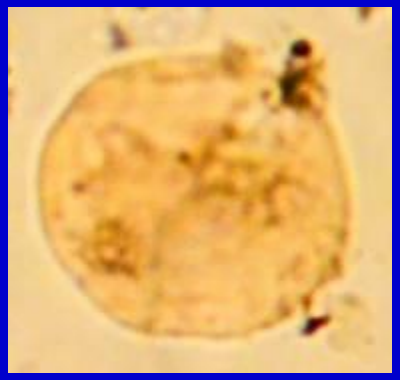

Microspore
Algal material ?
Megaspore
Algal spore

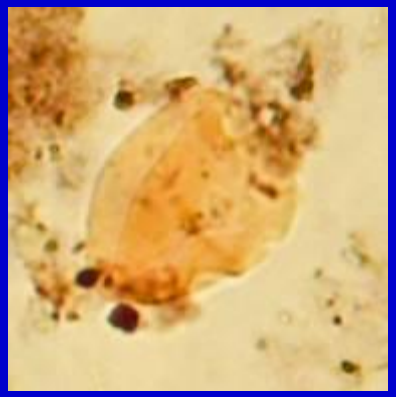


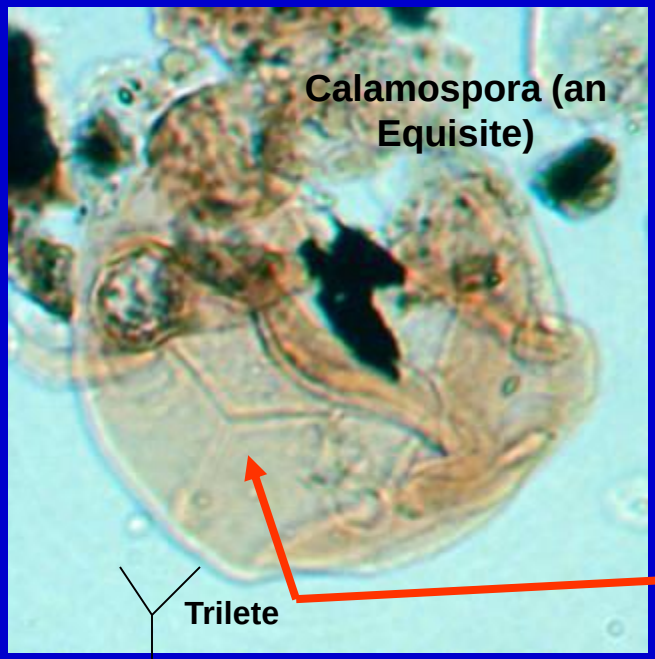
Microscopic plant fragments in coal macerations (ground bituminous coal subjected to corrosive baths and centifuged) mostly Xylem, in vascular bundles. see PALYNOMORPHS (spores) in next slide

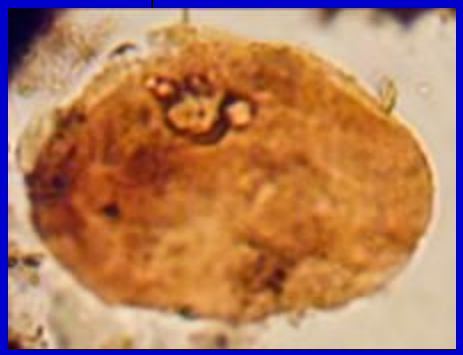


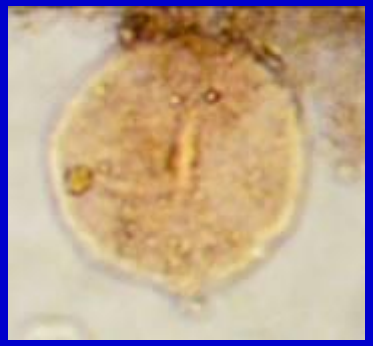


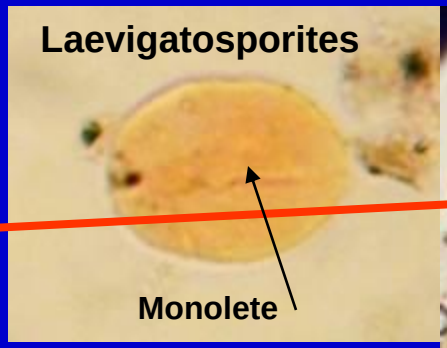


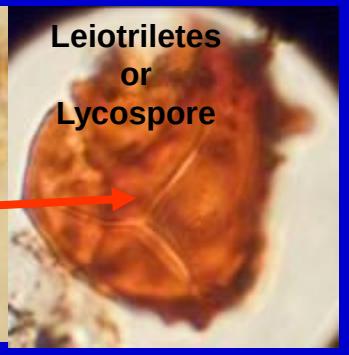


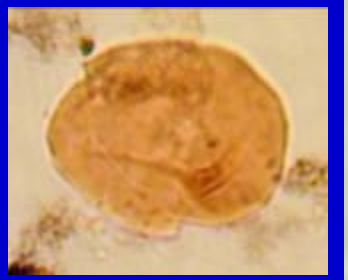




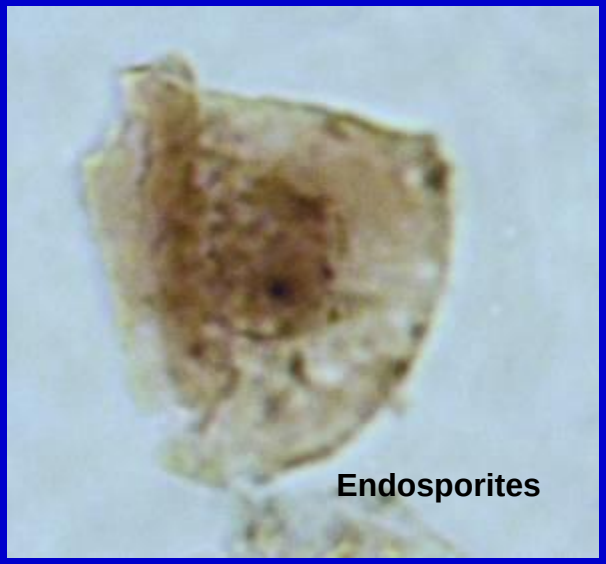








Palynomorphs
Dunkard Gp.


Endosporites

To see reproductive methodology of primitive GYMNOSPERMS (like cordaites and seed ferns) see presentation on *Cycads* on this web site

Plant Group	relative import in Pennsylvanian Lower	Mid	Upper	Palynomorph Genera
Lycopods	x	x		*Endosporites, Crassispora and Lycospora*
Seed Ferns tree-like *Psaronius*			x	*Laevigatoporites(small) and Thymospora*
& Medullosans:Pteridosperms		x	x	monoletes
Sphenopsids:		x	x	*Laevigatoporites(large) and Calamospora*
Cordaites		x		*Florinites*

PTERIDOSPERMS

St. Clair fossils are found in shales below anthracite coal. Through reduction and oxidation organic remains have been replaced with ***pyrite*** then ***pyrophyllite*** (silvery to yellow)

SEED FERNS or PTERIDOSPERMS

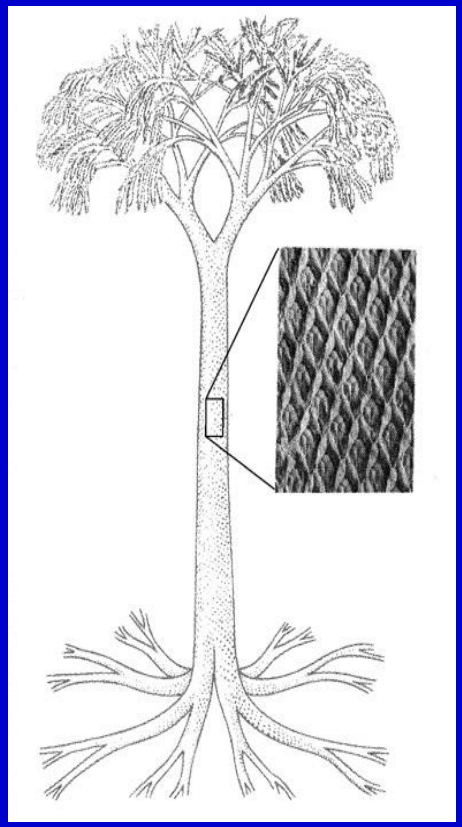

Alethopteris


Lygenopteris
Neuropteris
ONE CENT
UNITED STATES OF AMERICA

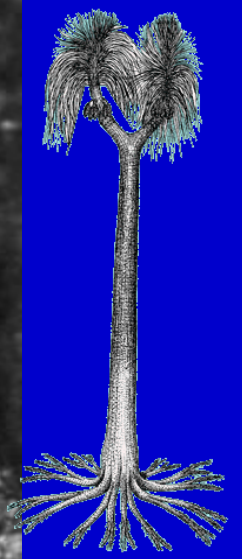
Lygenopteris

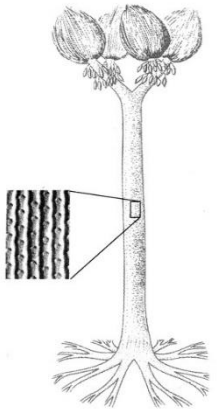
LYCOPODS

Lepidophylloides on twig of *Lepidodendron*



LYCOPODS:

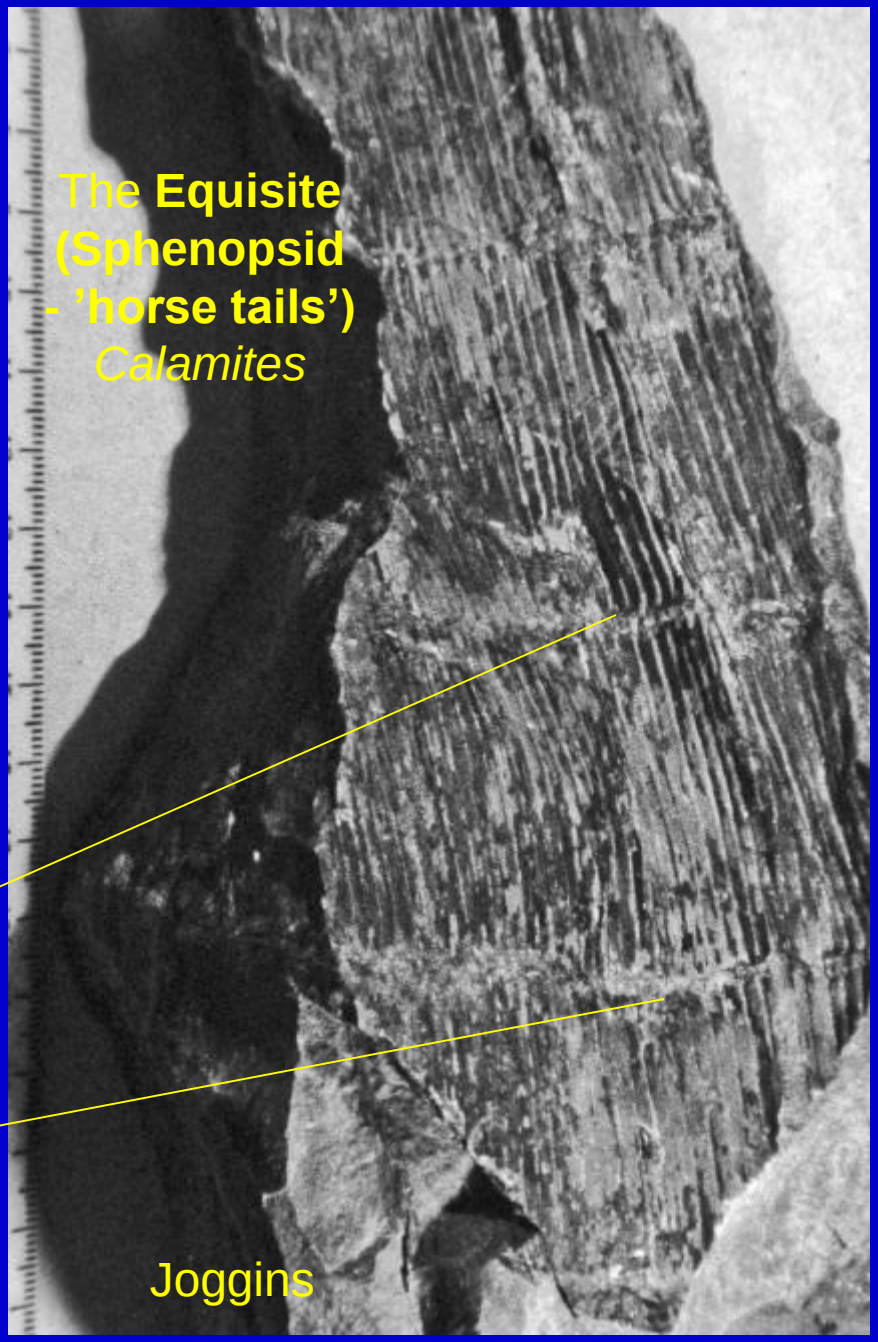




Stigmaria (‘root’ of ***Lepidodendron***)

Pennsylvanian Coal-forming forests and swamps of the ~300 M. Y. ago

The **Equisite (Sphenopsid - 'horse tails')**
Calamites

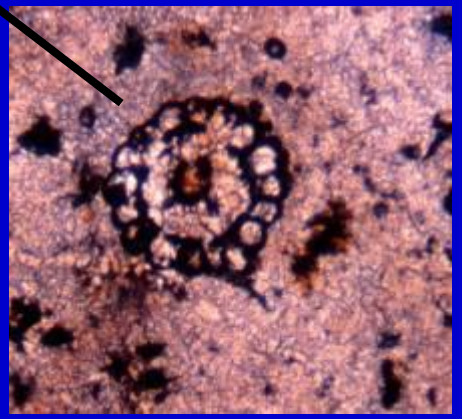


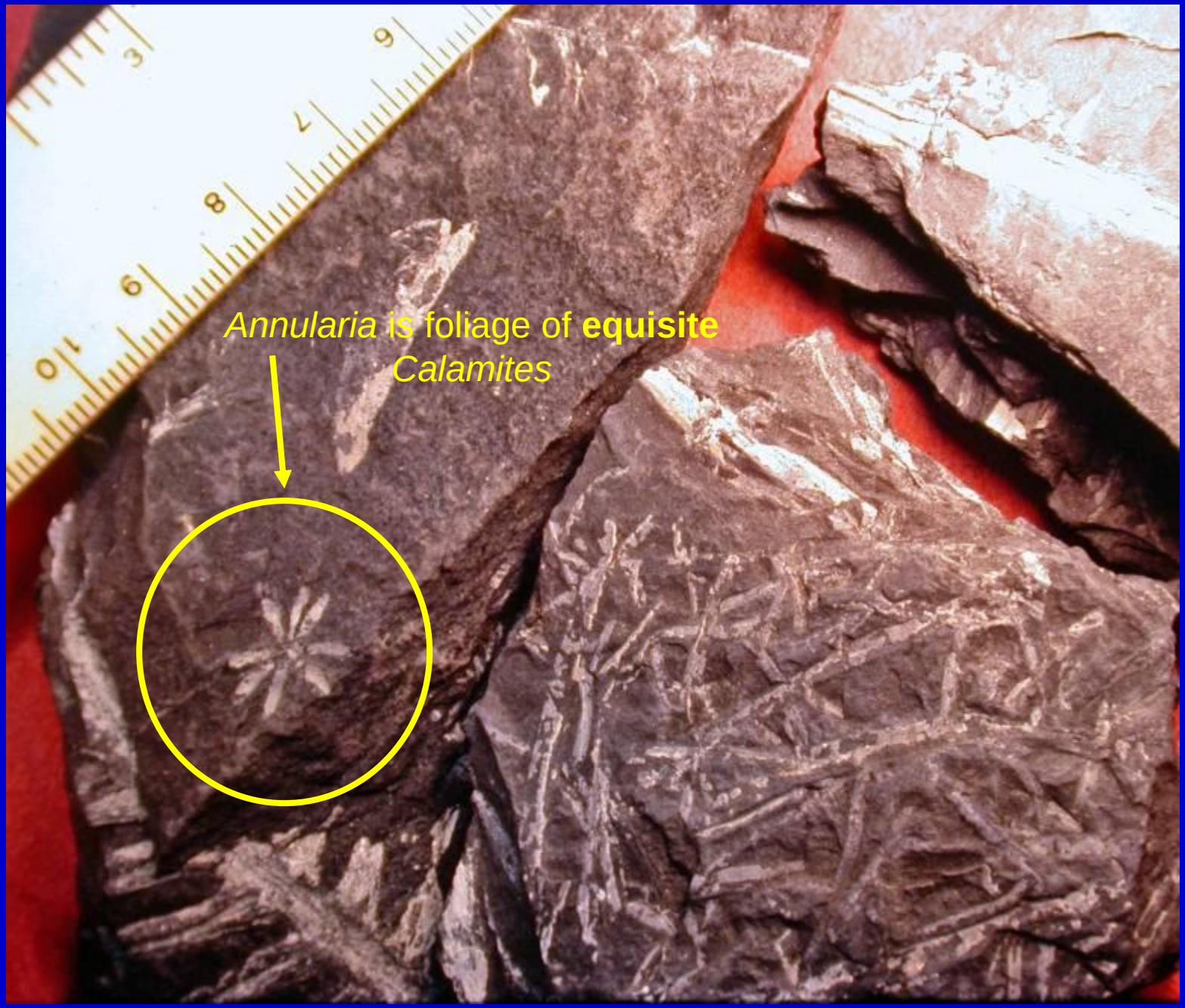
Joggins

Equisite or Sphenopsid

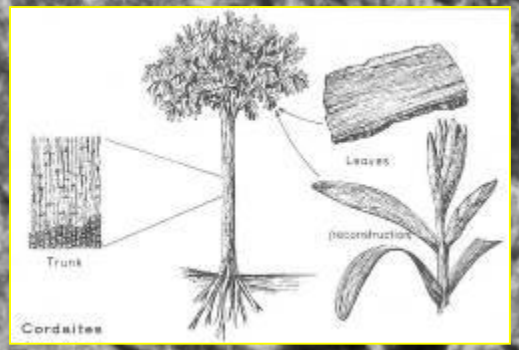
Small stem note annulations

Acetate peel of coal ball from Illinois: cross section of **equisite** like *Calamites*

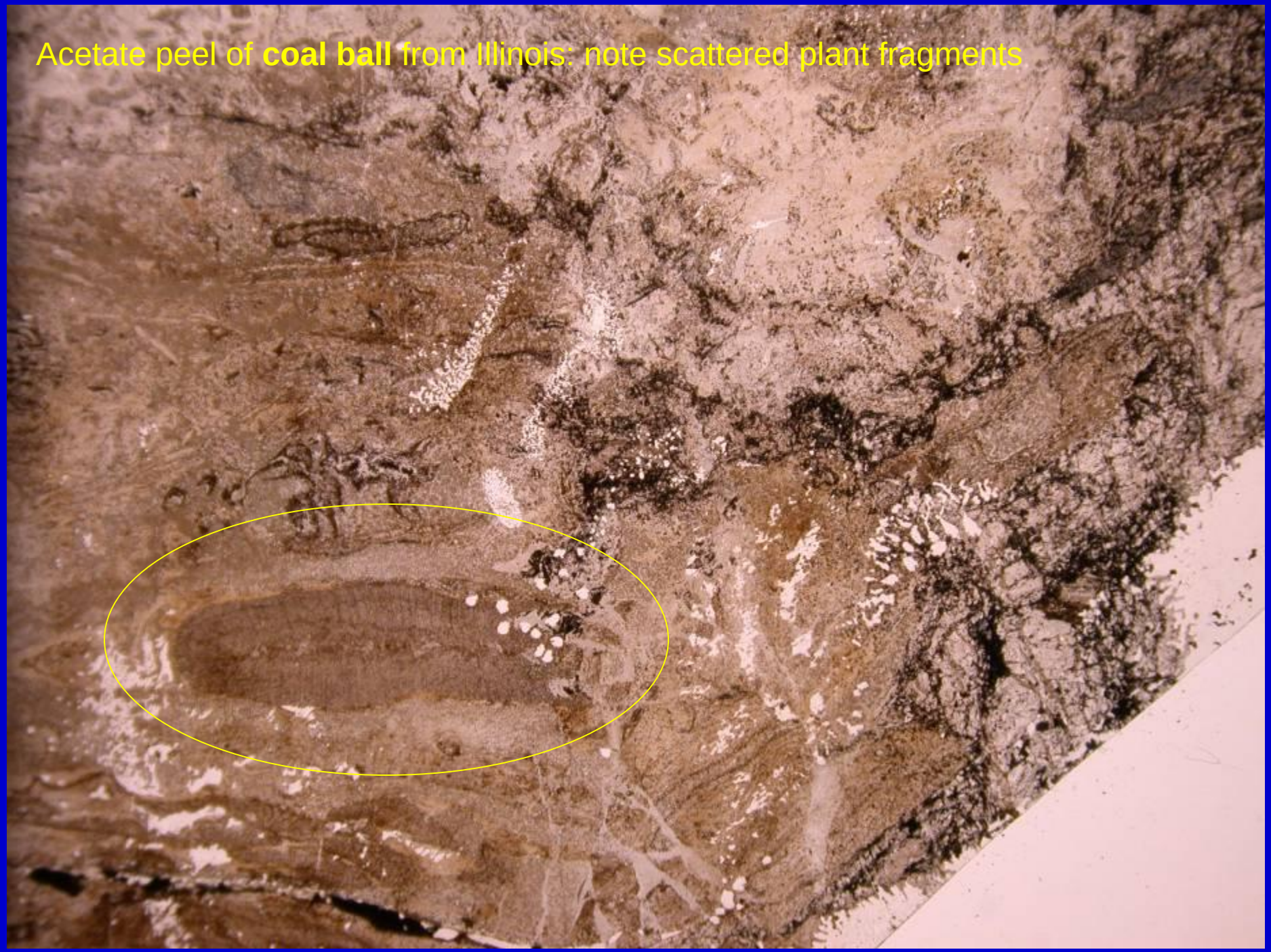


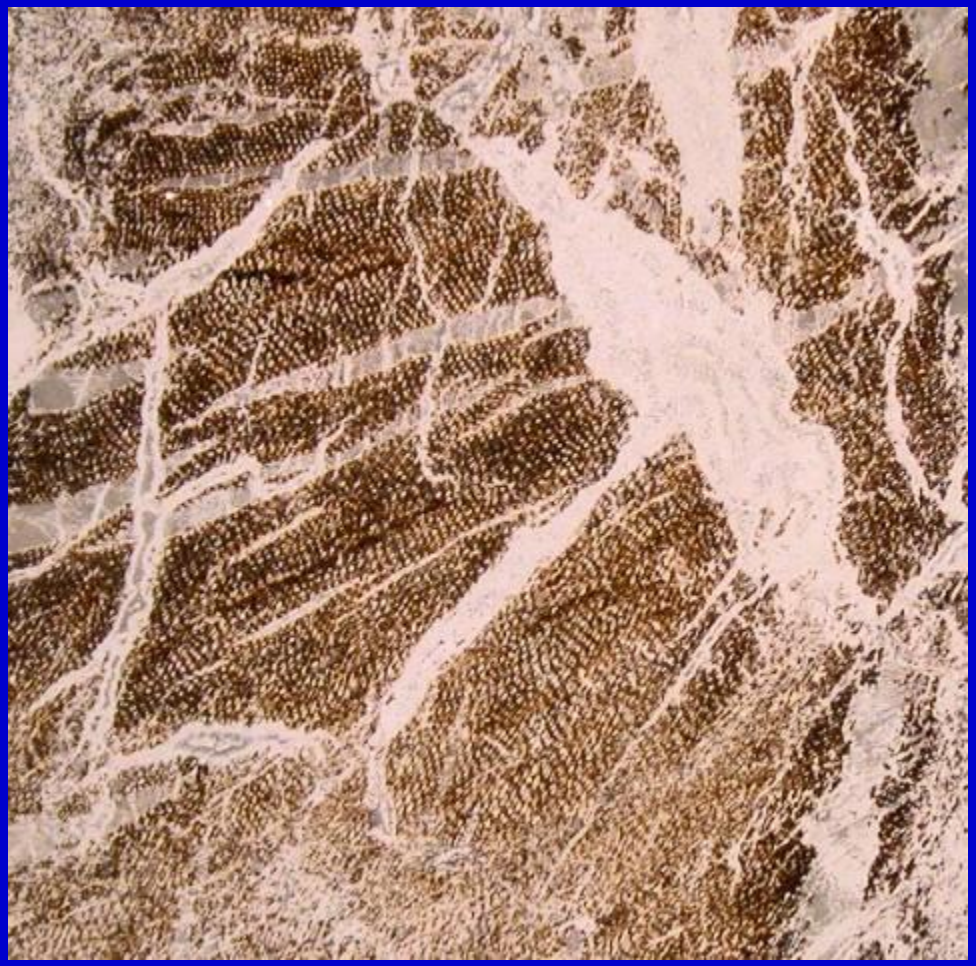

Annularia is foliage of **equisite**
Calamites

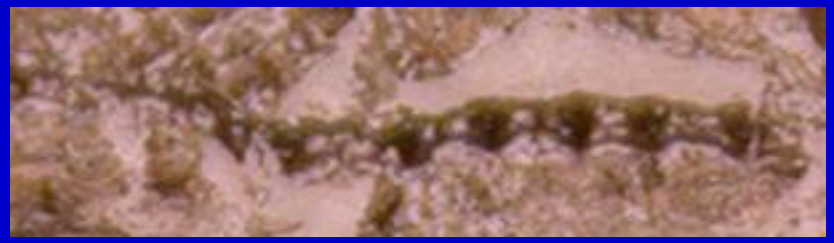
Blade-like foliage of *Cordaites* a **gymnosperm** of the late Paleozoic

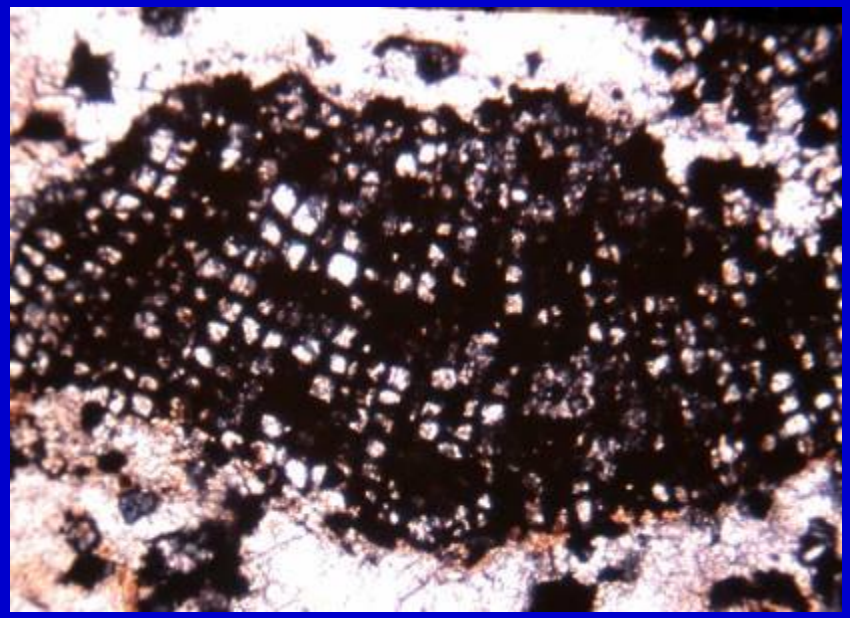



Acetate peel of **coal ball** from Illinois: note scattered plant fragments

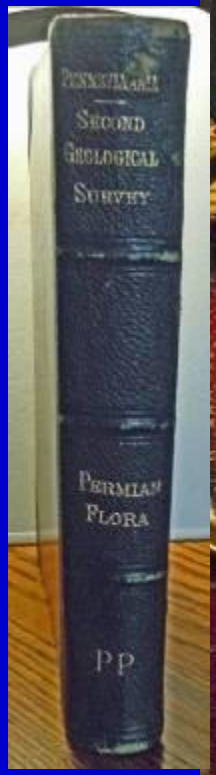

Acetate peel of **coal ball** from Illinois: note scattered plant fragments







Acetate peel of **coal ball** from Illinois: note scattered plant fragments



SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA:
REPORT OF PROGRESS
PP.

THE PERMIAN OR

UPPER CARBONIFEROUS FLORA

OF

WEST VIRGINIA

AND

S. W. PENNSYLVANIA.

BY

WM. M. FONTAINE, M. A.,
Late Professor of Chemistry and Physics in the University of West Virginia.
Now Corcoran Professor of Geology in the University of Virginia.

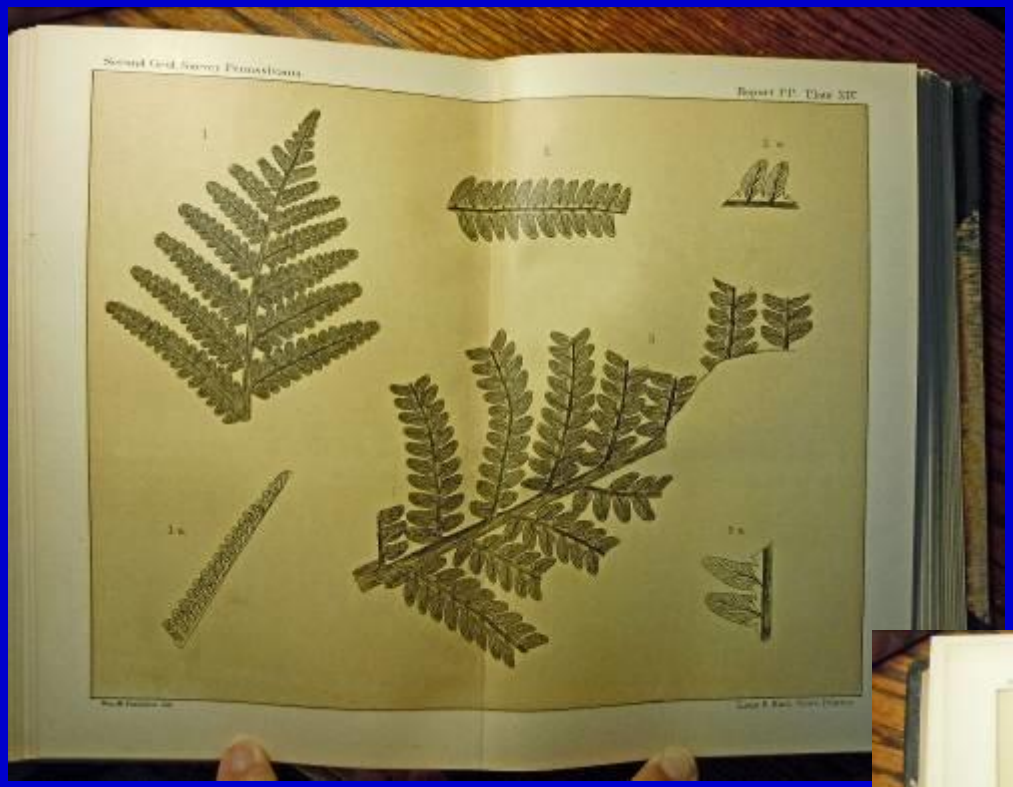
AND

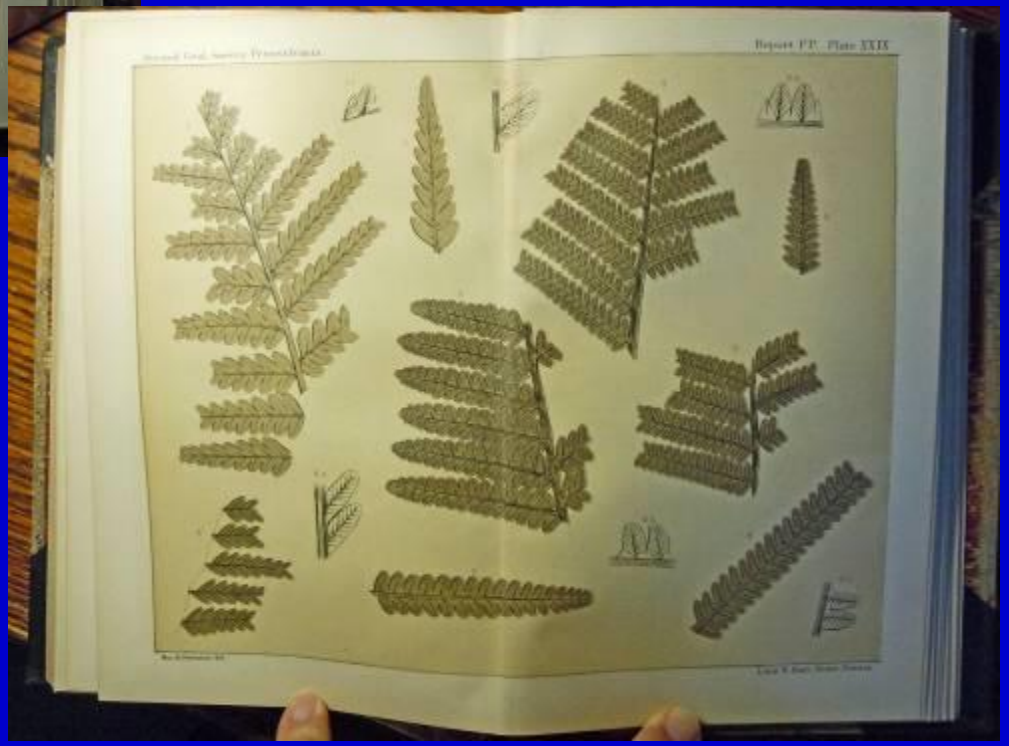
I. C. WHITE, A. M.,
Professor of Natural History in the University of West Virginia, and Assistant Geologist on the Geological Survey of Pennsylvania.

WITH THIRTY-EIGHT PLATES.

HARRISBURG:
PUBLISHED BY THE BOARD OF COMMISSIONERS
FOR THE SECOND GEOLOGICAL SURVEY.
1880.

1880


Second Geol. Survey Pennsylvania
Report PP. Plate XIC


Second Geol. Survey Pennsylvania
Report PP. Plate XXIX

Burning bituminous coal in Electric plants produces CO, CO_2, SO_2, H_2SO_4 and produces carbon fragments that are inhaled: not a condemnation but a reminder of a better way to go in the future

Cooling tower collapsed killing over 100 men