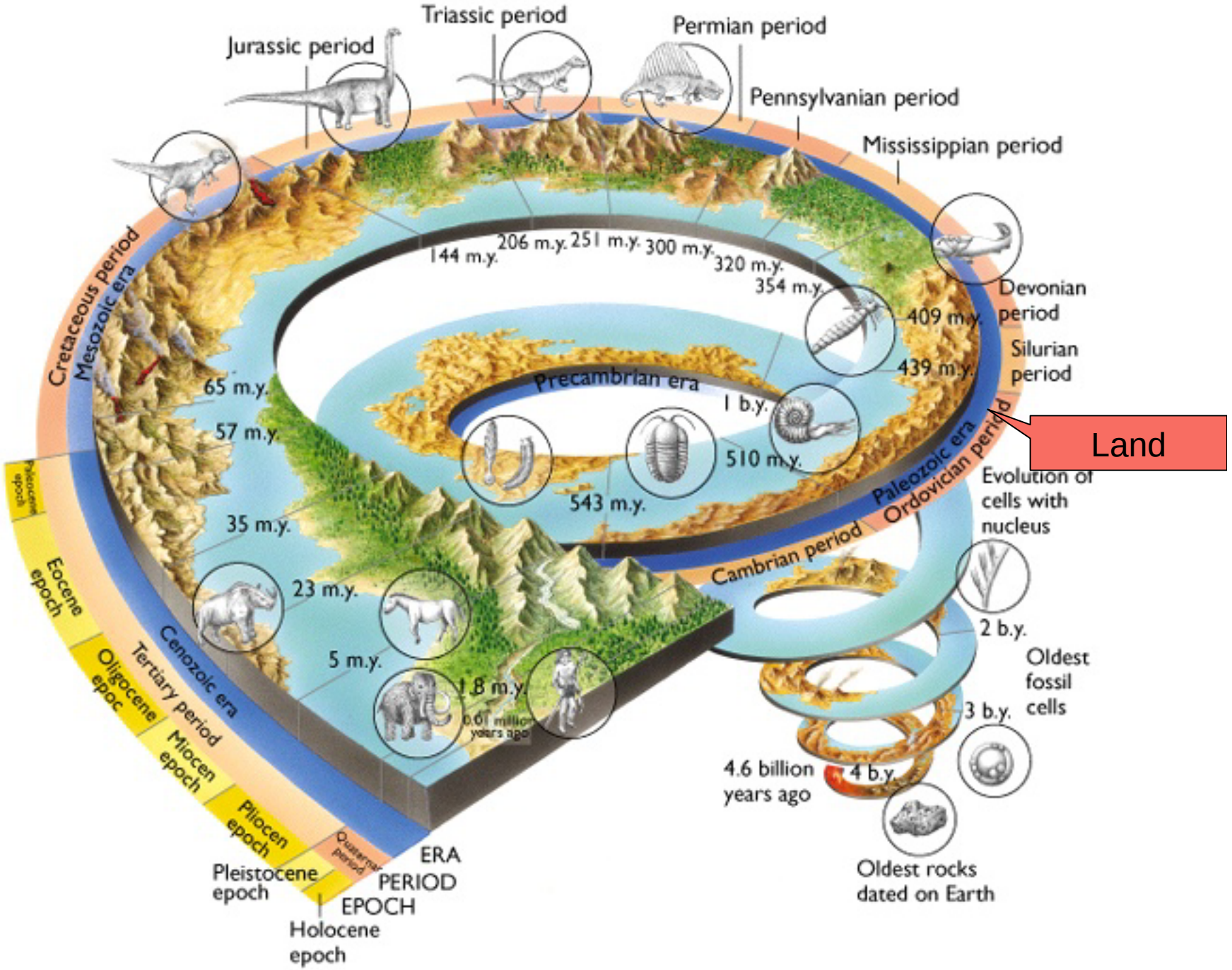

NEW YORK
Lake Erie
Erie
Susquehanna
Delaware
Titusville
Scranton
Williamsport
Wilkes-Barre
Allegheny
POCONO MTS.
Hazleton
New Castle
PENNSYLVANIA
State College
Bethlehem
Altoona
Allentown
Ohio
Pittsburgh
Lebanon
Reading
Johnstown
HARRISBURG
Norristown
Lancaster
APPALACHIAN MTS.
Philadelphia
Gettysburg
York
Monongahela
Chester
NEW JERSEY
WEST VIRGINIA
MARYLAND
DELAWARE


Jurassic period
Triassic period
Permian period
Pennsylvanian period
Mississippian period
Devonian period
Silurian period
Ordovician period
Cambrian period
Precambrian era
Paleozoic era
Mesozoic era
Cretaceous period
Cenozoic era
Tertiary period
Eocene epoch
Oligocene epoch
Miocen epoch
Pliocen epoch
Pleistocene epoch
Holocene epoch
Quaternar period
ERA
PERIOD
EPOCH
144 m.y.
206 m.y.
251 m.y.
300 m.y.
320 m.y.
354 m.y.
409 m.y.
439 m.y.
1 b.y.
510 m.y.
543 m.y.
65 m.y.
57 m.y.
35 m.y.
23 m.y.
5 m.y.
1.8 m.y.
0.01 million years ago
Land
Evolution of cells with nucleus
2 b.y.
Oldest fossil cells
3 b.y.
4 b.y.
4.6 billion years ago
Oldest rocks dated on Earth

Leafy and Thalloid Liverworts


David Webb

Pellia endiviifolia (Dicks.) Dum. (a liverwort)

Date: 2 October 1997, VC: Berks, UK

Thallus

Mosses

Figure 16-1
Biology of Plants, Seventh Edition

Figure 16-30a
Biology of Plants, Seventh Edition

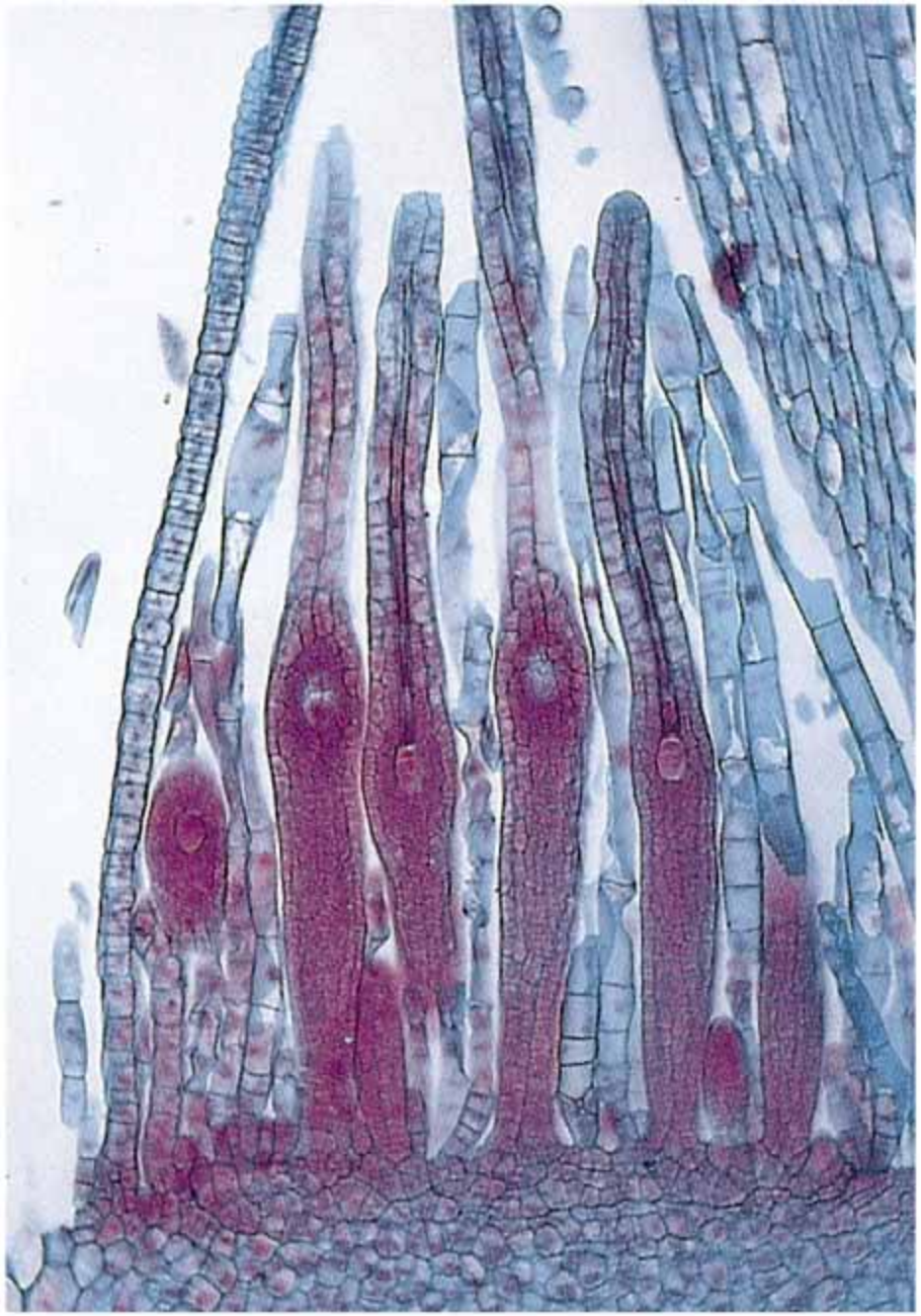


Figure 16-26a
Biology of Plants, Seventh Edition

Figure 16-26b
Biology of Plants, Seventh Edition

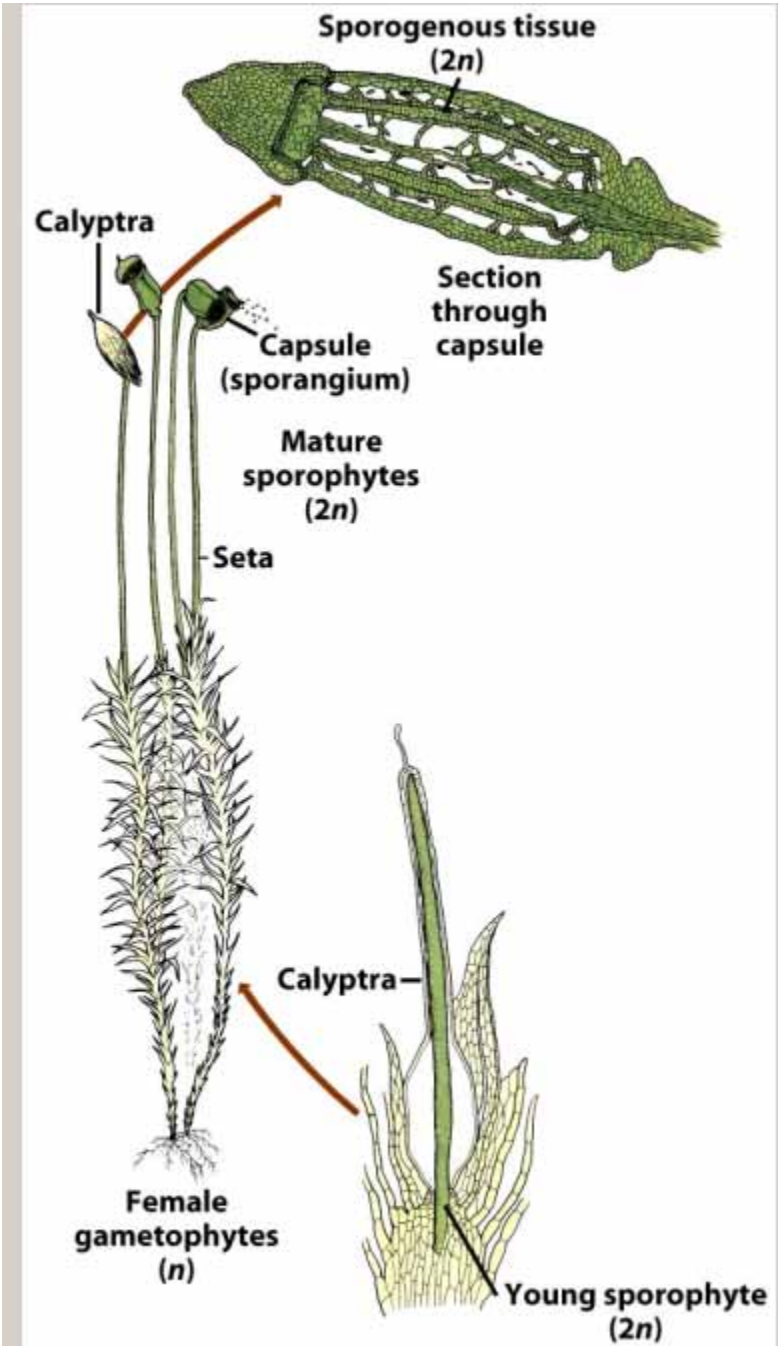


Figure 16-25 part 5
Biology of Plants, Seventh Edition

Rhyniophytes and Psilotophytes (e.g., Rhynia and Psilotum)

Seedless Vascular Plants (freesporing)

- xylem (phloem) - fossil record good b/c of lignin
- Sporophyte dominant (gametophyte progressively reduced)
- Spores as dispersal unit
- exosporic gametophyte development
- H_2O needed for fertilization
  - ↳ Plesiomorphic (shared w/ bryophytes)

- cuticle well developed
- stomata in all.

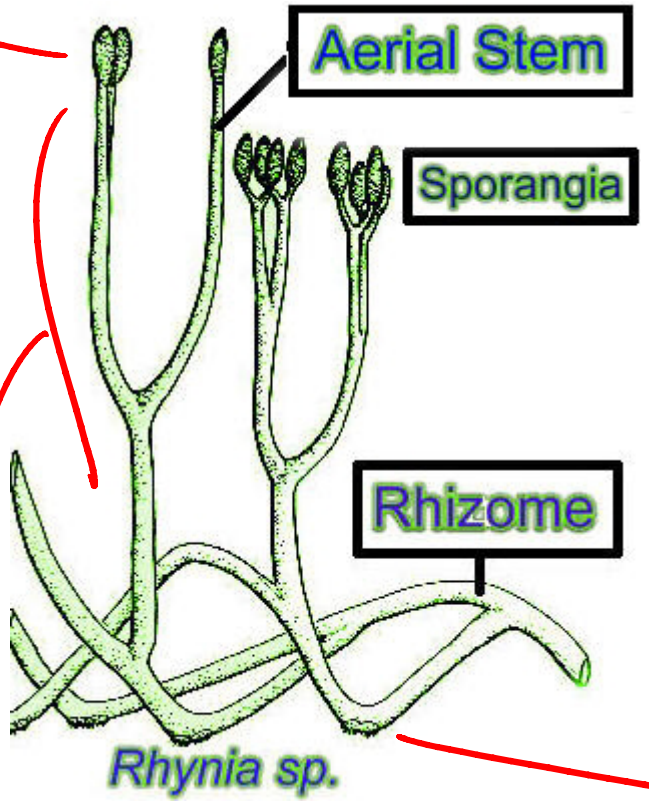
Trends to watch:

- No leaves → leaves (microphylls & megaphylls)
- No roots → roots
- Gametophyte reduction
- Homospory → Heterospory
- Branching dichotomous → axillary
- structural adaptations to land

Ⓐ Rhyniophytes (e.g. Rhynia)

Silurian Period (> 410 mya)

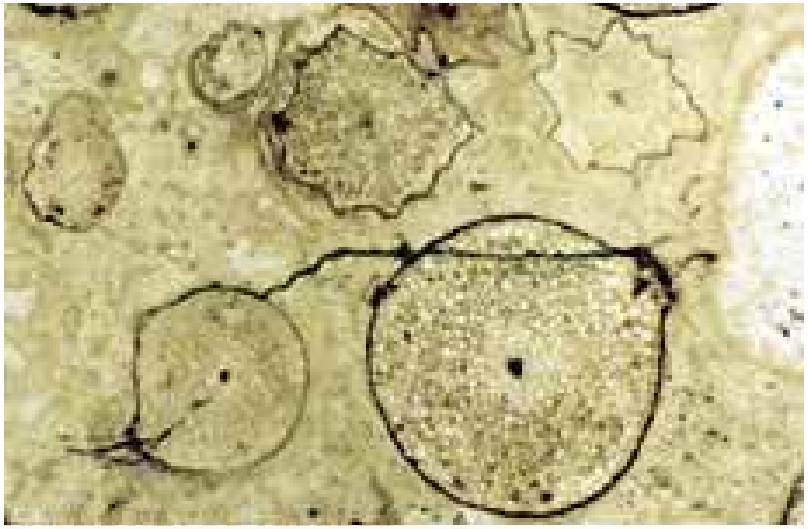
shoot terminated by single sporangium.

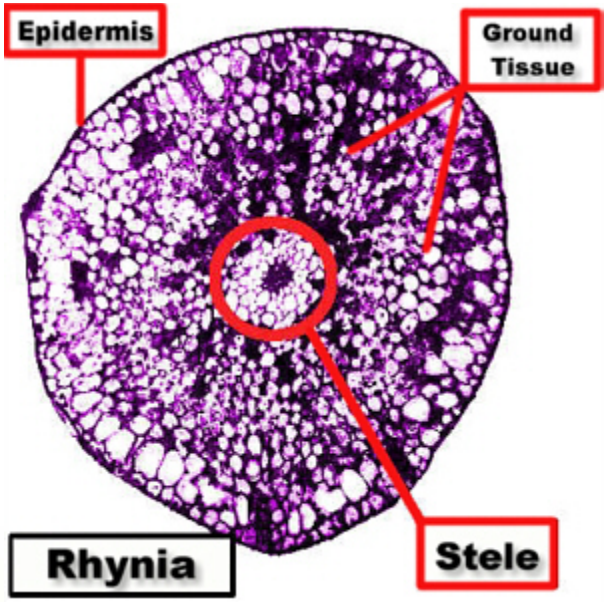


Rhynie chert, Scotland.

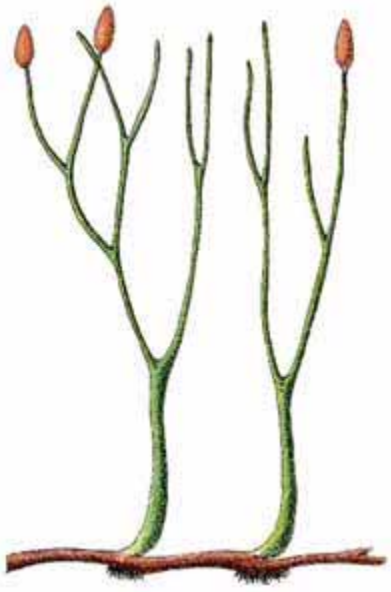
No Roots (only rhizoids)

No leaves



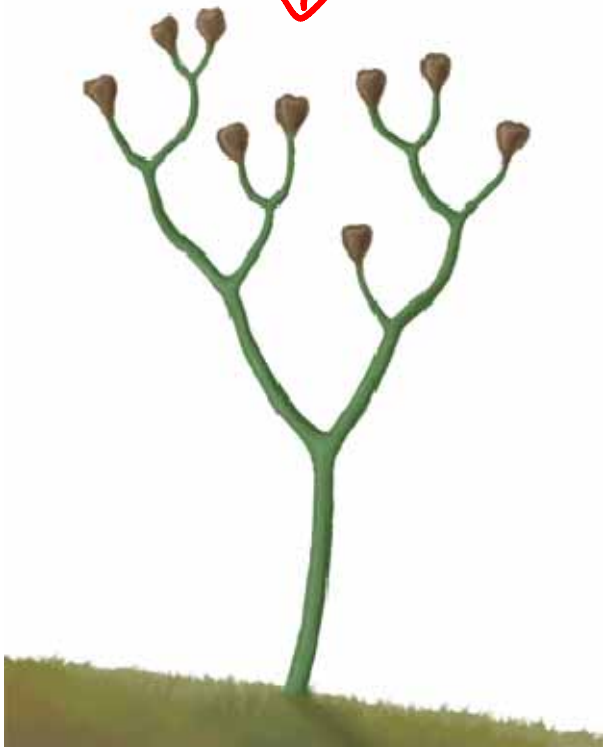

Epidermis
Ground Tissue
Rhynia
Stele


5cm



Rhynia

Cooksonia




Cooksonia (late Silurian)
"First plants"
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Lycopods (e.g., club-mosses)

Figure 17-16b
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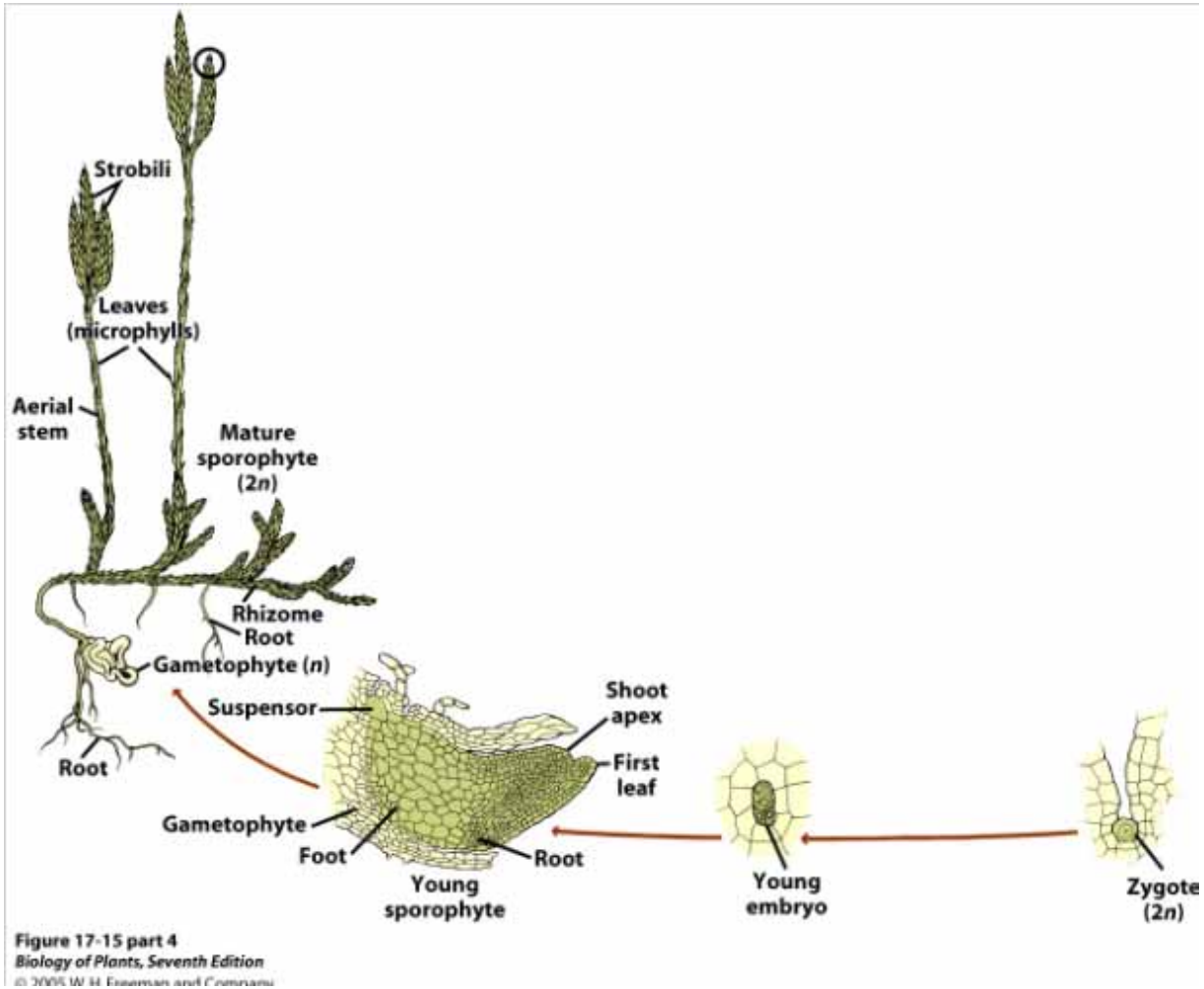

Figure 17-15 part 4
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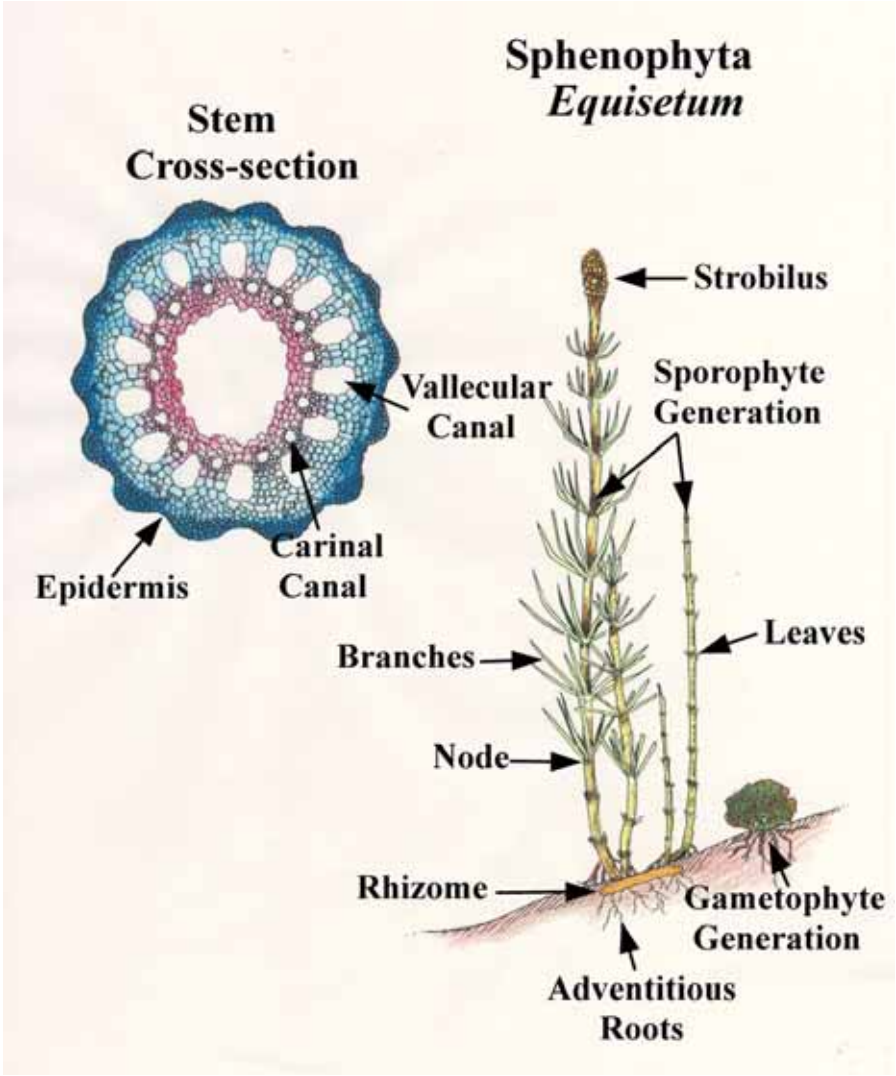
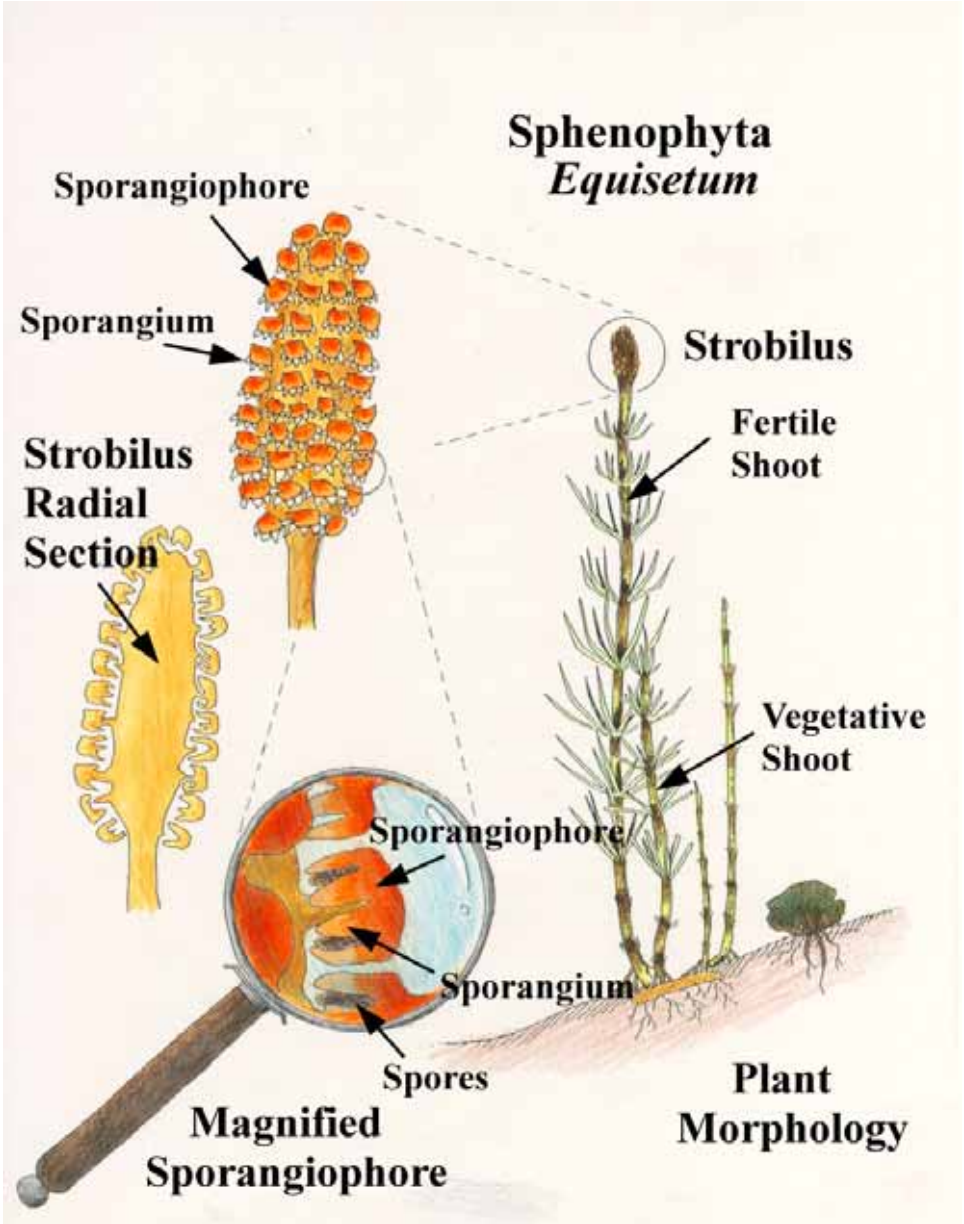
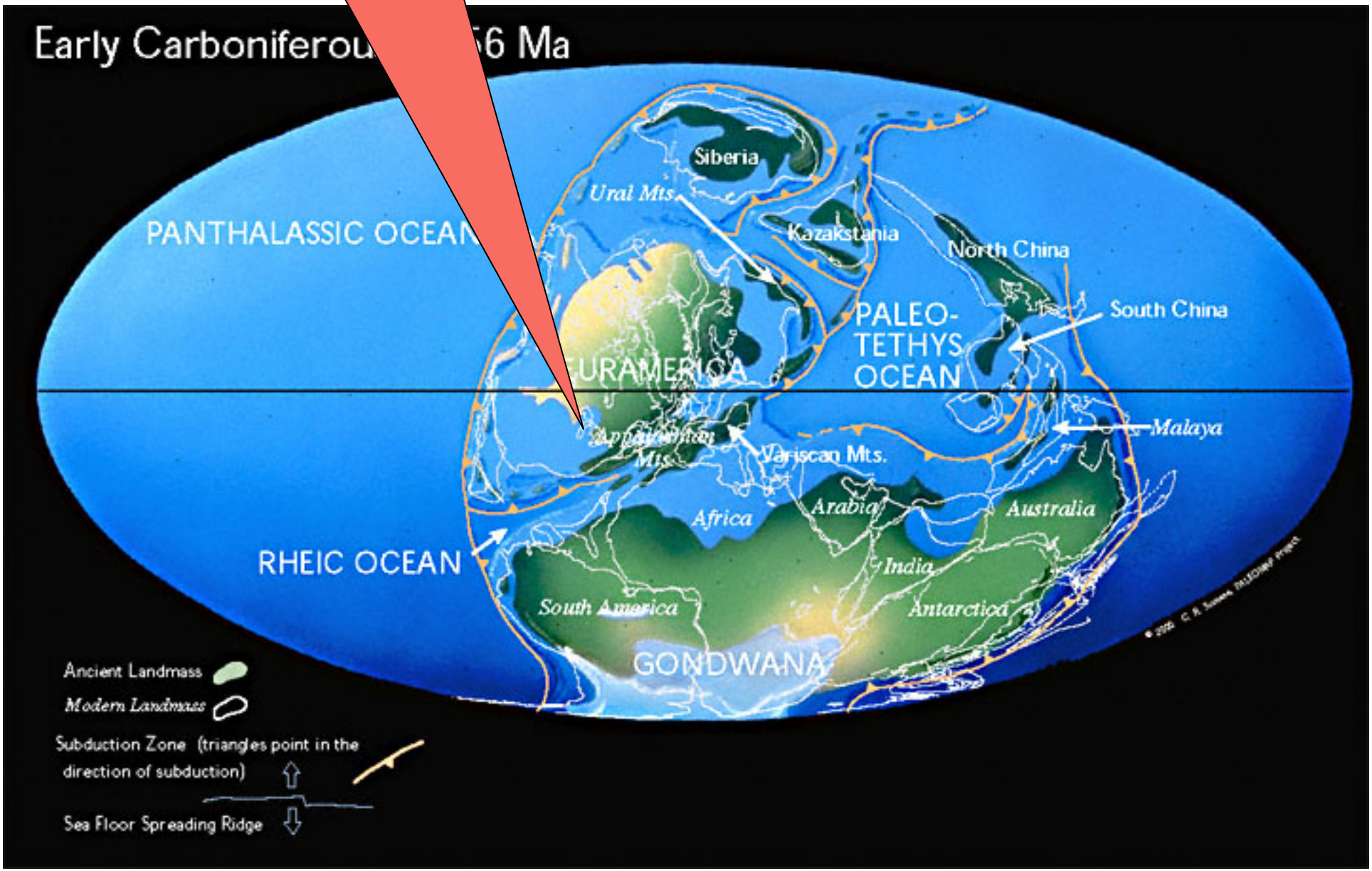
Horsetails & Scouring-Rushes


Sphenophyta
Equisetum
Stem
Cross-section
Vallecular
Canal
Carinal
Canal
Epidermis
Strobilus
Sporophyte
Generation
Leaves
Branches
Node
Rhizome
Gametophyte
Generation
Adventitious
Roots

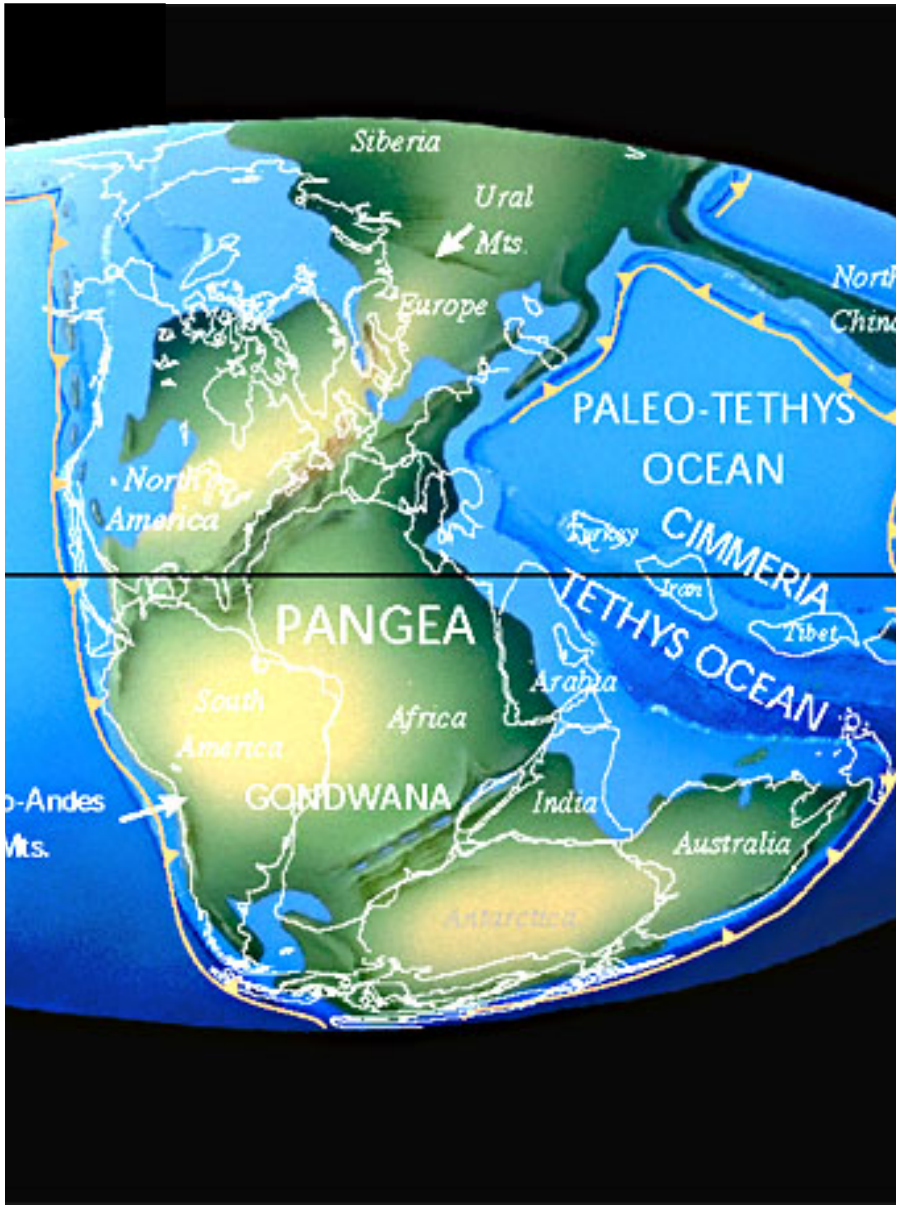

Sphenophyta
Equisetum
Sporangiophore
Sporangium
Strobilus
Fertile
Shoot
Strobilus
Radial
Section
Vegetative
Shoot
Sporangiophore
Sporangium
Spores
Magnified
Sporangiophore
Plant
Morphology

Ancient Coal Swamps

Lycopod & Horsetail Swamps.
What good were these?

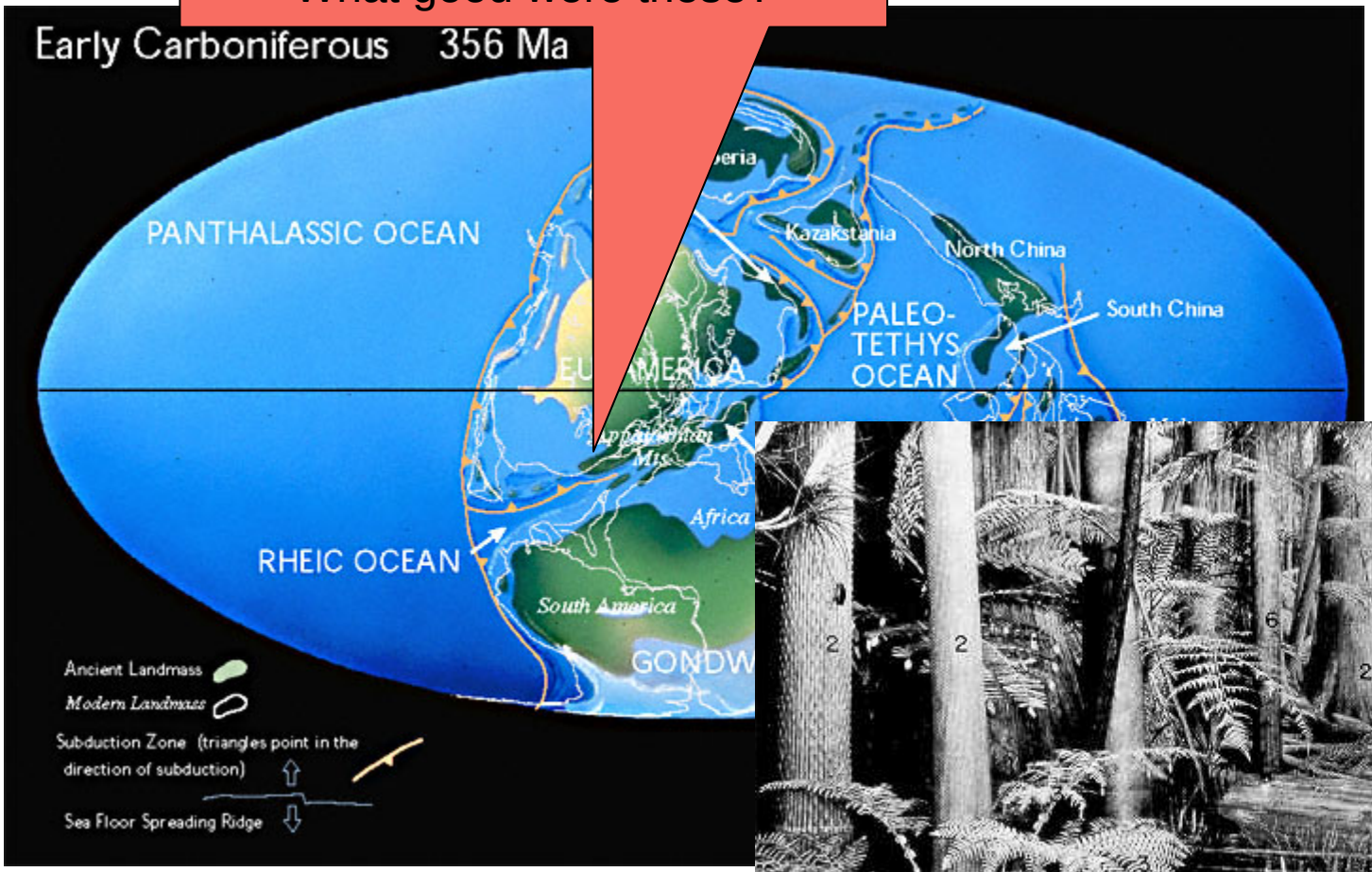


Early Triassic (237 Ma)



Late Jurassic (152 Ma)

Lycopod & Horsetail Swamps.
What good were these?




"Calamites & Drepanophycus"
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Ferns

Figure 17-26
Biology of Plants, Seventh Edition

Figure 17-27a
Biology of Plants, Seventh Edition

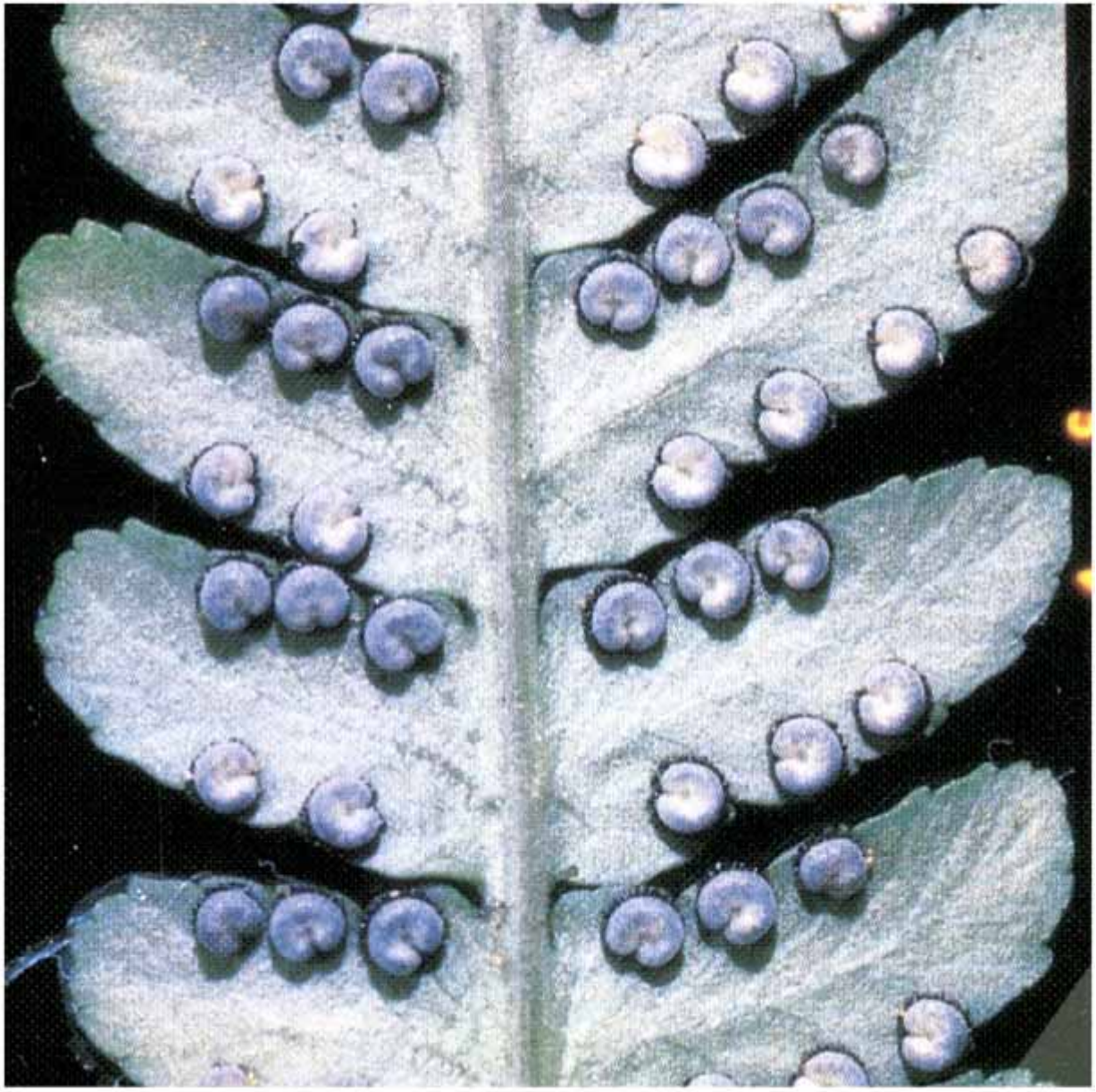

Figure 17-27c
Biology of Plants, Seventh Edition

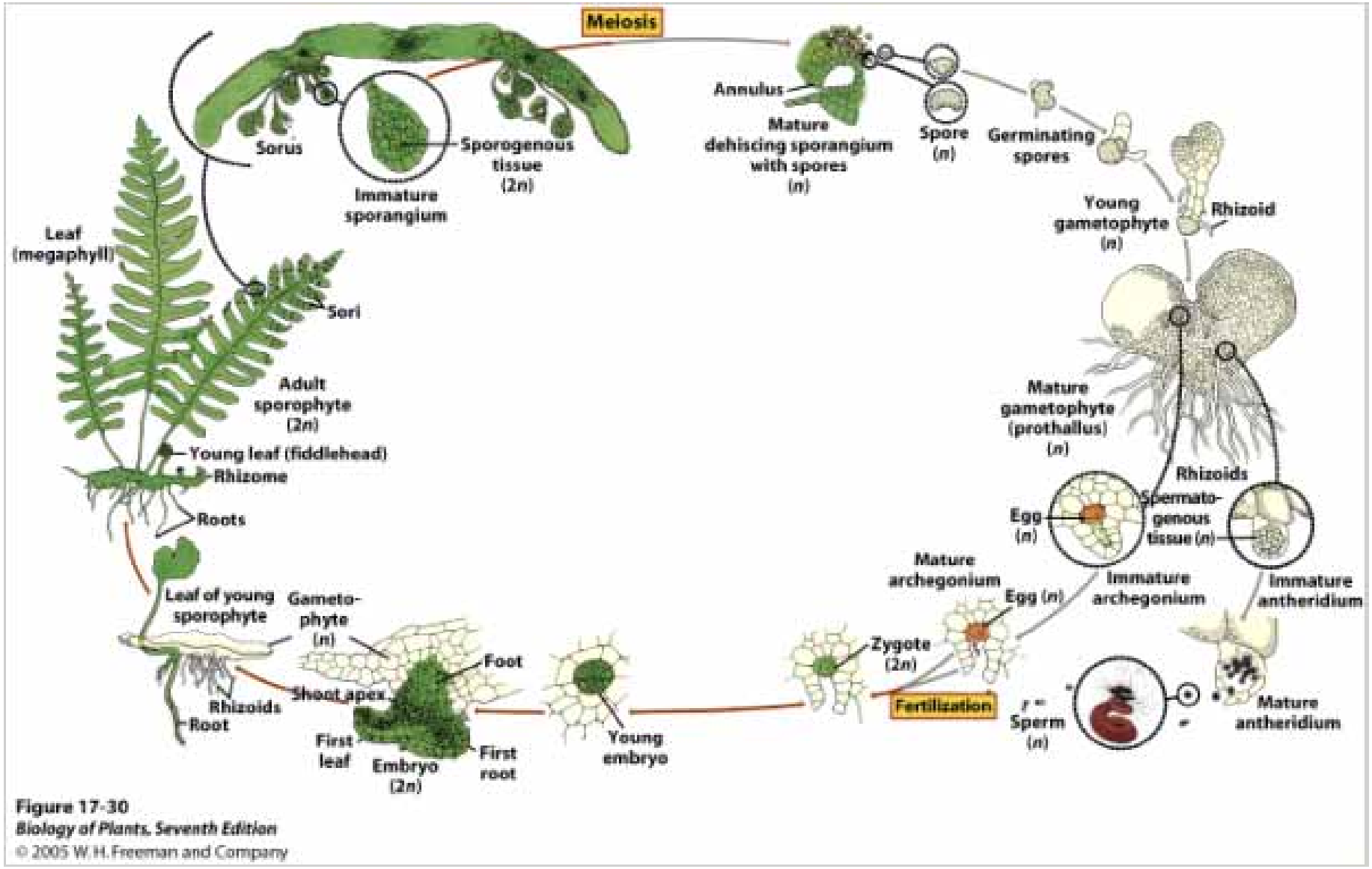

Figure 17-30
Biology of Plants, Seventh Edition