

## Botany 422 – Biogeography

### Short review of paleo-botanical, paleo-geographic, and paleo-geological events

#### Paleozoic [*Campbells Ordinary Soups Develop Carbohydrates Permanently*]

- **Cambrian** (ends ~ 500Mya): no evidence of land life, chordates, fungi, marine algae diversifying
- **Ordovician** (460Mya): first evidence of land life, spores of liverworts; glomalean fungi indicating mycorrhizal symbiosis with land plants
- **Silurian** (ends ~ 410Mya): non-vascular *Cooksonia* in tropical Euramerica and Australia; first vascular lycopod in late Silurian; first microphyll (primitive leaf); carnivorous arachnids; land communities forming
- **Devonian** (ends ~ 360Mya): “greening of the earth” – evolution of most critical features for land plant life; vascular *Rhynia*; first lichen; progymnosperm *Archaeopteris* tree; first megaphyll (complex leaf); first true ferns; first forests and fires; first seeds in “seed ferns”; arthropods diversify and amphibians seen; world-wide warm and wet climate and no floristic provincialism
- **Carboniferous** (ends ~ 290Mya): polar ice caps and provincialism; extensive forests and highest O<sub>2</sub> levels worldwide; equatorial “coal swamps” of lycopods (*Lepidodendron*) and horsetails (*Calamites*); “seed ferns” diversity and first insect pollination; reptiles diversify
- **Permian** (ends ~ 250Mya): lycopods and horsetails still dominate; true ferns, “seed ferns”, and early gymnosperms begin to replace them; Pangaea begins to coalesce, Tethys Sea in Austral-Asia region; 3 provincial floras – 1. tropical Cathaysia of lycopods, horsetails, “seed ferns”, 2. northern Angarar of gymnosperms, 3. southern Gondwanan glossopterids; ends with greatest extinction event ever

#### Mesozoic [*Three Juicy Creatures*]

- **Triassic** (ends ~ 200Mya): Age of Cycads; *Dicroidium* seed ferns replace glossopterids; conifers and ginkgoes diversify; Araucariaceae and Podocarpaceae big trees; modern fern families seen; dinosaurs evolve

- **Jurassic** (ends ~145Mya): Age of Dinosaurs; break up of Pangaea and very warm and high sea levels world-wide; cosmopolitan flora; *Dicrodium* seed ferns diversify; genera *Gingko* and *Equisetum* seen; extinct Cycadeoids (angiosperm ancestors?)
- **Cretaceous** (ends ~65Mya); Age of Angiosperms; continued break up of Pangaea and very warm and high sea levels world-wide; Epicontinental Seas; *Archaeofructus* first flowering plant at 127Mya; most families of angiosperms evolve; ends with 2<sup>nd</sup> greatest extinction event

### **Cenozoic / Tertiary + Quaternary** [*Please, Easy On My Pliable Quads*]

- **Tertiary** – 1st half (Paleocene, Eocene – ends ~ 40Mya): W North America – E Asia flora, E North America – W Europe flora; very warm times especially towards poles; Araucariaceae/Podocarpaceae extinct in North America; redwoods and dawn redwoods dominate in N. Hemisphere; grasses diversify; Arcto-Tertiary forest flora dominate in N. Hemisphere; Epicontinental Seas retreat; mountain building initiates in W North America; interior North America dries out; Euramerica separates
- **Tertiary** – 2nd half (Oligocene, Miocene, Pliocene – ends ~ 2Mya): significant cooling worldwide – opening of Drake and Tasman Passages, closure of Isthmus of Panama; fragmentation of Arcto-Tertiary flora; final uplift of Rockies, Sierra Nevada, Cascades in that order; Great Plains form
- **Quaternary – Pleistocene** (ends ~ 10,000ya); glacial cycles ending with Wisconsin; height of Wisconsin glacial at 18,000ya; retreat of ice at 14,000ya
- **Quaternary – Holocene** (Recent); interglacial; warming to 8,000ya at Hypsithermal; cooling (oscillations) since; assembly of Great Lakes' vegetation and flora