

Pleistocene - the Ice Ages



Sleeping Bear Dunes National Lakeshore

Pleistocene - the Ice Ages

| CONIFERA | PERIOD | EPOCH | MYA | | |
|----------------|-------------|---------------|-----------|--|------------------------|
| PHANEROZOIC | QUATERNARY | RECENT | 0.01 | ICE AGE ENDS | |
| | | PLEISTOCENE | 2.6 | ICE AGE BEGINS EARLIEST HUMANS | |
| | TERTIARY | PALEOGENE | PLIOCENE | 5.3 | |
| | | | MIOCENE | 23.7 | |
| | | | EOCENE | 36.6 | FORMATION OF HIMALAYAS |
| | MESOZOIC | CRETACEOUS | PALEOCENE | 57.8 | |
| | | | 66 | DINOSAUR EXTINCTION ROCKY MTS. FORMED | |
| | | | 144 | | |
| | | JURASSIC | 208 | FIRST MAMMALS PANGAEA BREAK UP FIRST DINOSAURS | |
| | | TRIASSIC | 245 | | |
| PALEOZOIC | | PERMIAN | 286 | | |
| | | PENNSYLVANIAN | 320 | FIRST REPTILES FIRST AMPHIBIANS | |
| | | MISSISSIPPIAN | 360 | | |
| | | DEVONIAN | 408 | | |
| | | SILURIAN | 438 | FIRST LAND PLANTS FIRST FISH | |
| | ORDOVICIAN | 505 | | | |
| | CAMBRIAN | 570 | | | |
| PROTEOZOIC EON | | | 2500 | EARLIEST SHELLED ANIMALS | |
| | ARCHEAN EON | | 3800 | EARLIEST FOSSIL RECORDED OF LIFE | |
| | | | 4600 | | |

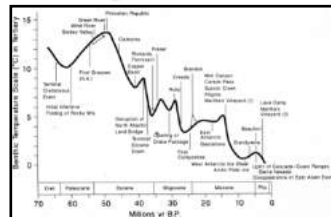
- Stage is now set to understand the nature of flora and vegetation of North America and Great Lakes
- Pliocene (end of Tertiary) - most genera had already originated (in palynofloras)
- Flora was in place
- Vegetation units (biomes) already derived

Pleistocene - the Ice Ages



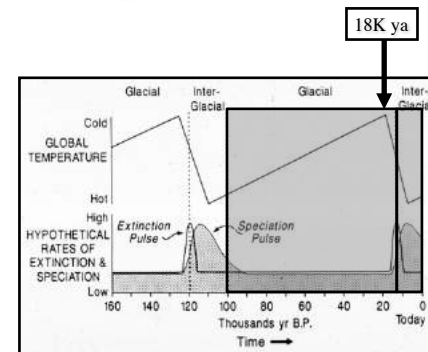
Maximum extent of glaciation in the most recent or Wisconsin stage (Pleistocene epoch).

- In the Pleistocene, earth experienced intensification towards climatic cooling
- Culminated with a series of glacial-interglacial cycles
- North American flora and vegetation profoundly influenced by these "ice-age" events



Pleistocene - the Ice Ages

What happened in the Pleistocene?

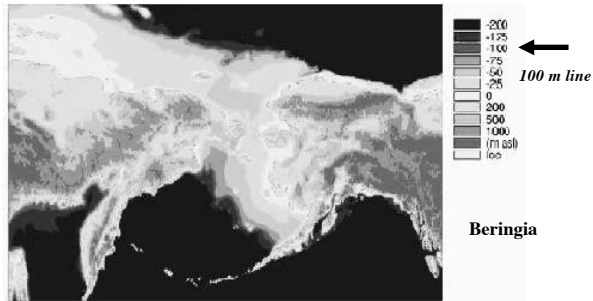


- Holocene (Recent) - the present interglacial started ~10,000 ya
- Wisconsin - the last glacial (Würm in Europe) occurred between 115,000 ya - 10,000 ya
- Height of Wisconsin glacial activity (most intense) was 18,000 ya - most intense towards the end of the glacial period

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What happened in the Pleistocene?

- up to 100 meter drop in sea level worldwide
- coastal plains become extensive
- continental islands disappeared and land bridges exposed

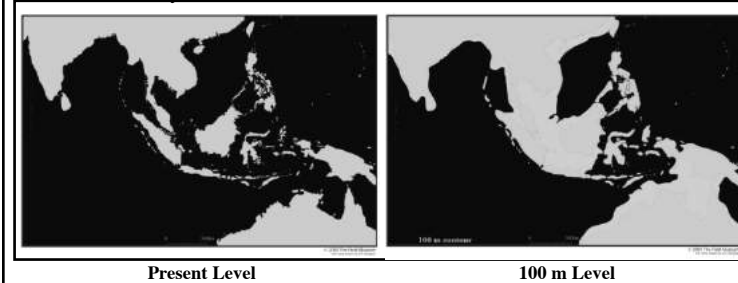


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What happened in the Pleistocene?

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Malaysia to Asia & New Guinea and New Caledonia to Australia

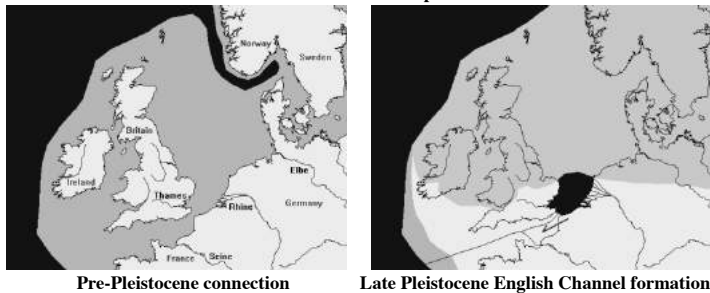


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What happened in the Pleistocene?

- up to 100 meter drop in sea level worldwide
- coastal plains become extensive
- continental islands disappeared and land bridges exposed

Great Britain to Europe



Pleistocene - the Ice Ages

What happened in the Pleistocene?

Ice-free Areas in North America

- North America south of glaciers
- Beringia, much of Alaska, Siberia
- Coastal plains, steep coastlines of Pacific northwest
- Wisconsin Driftless Area - never completely surrounded by ice



What was happening south of the glacial maxima?

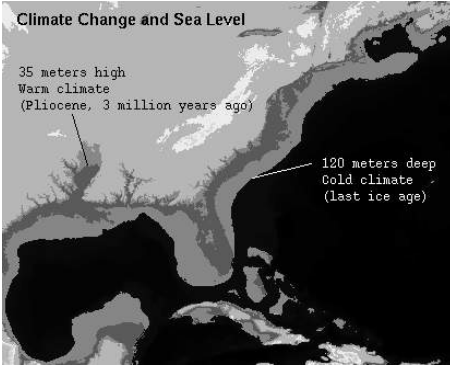
Historical composite of all glacial advances in the Pleistocene epoch. The Driftless Area was never completely surrounded by ice at any one time.

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Climate Change and Sea Level

35 meters high
Warm climate
(Pliocene, 3 million years ago)

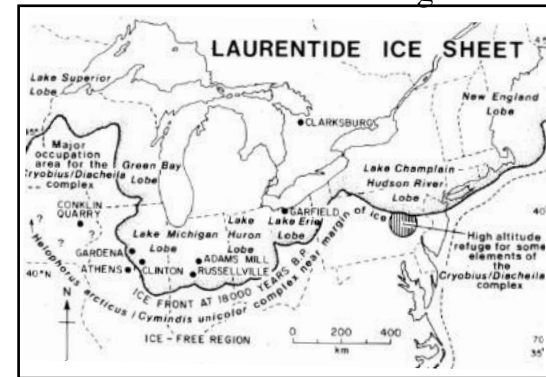
120 meters deep
Cold climate
(last ice age)



What was happening south of the glacial maxima?

- Coastal plain (extensive) emerges on continental shelf with sea water drop

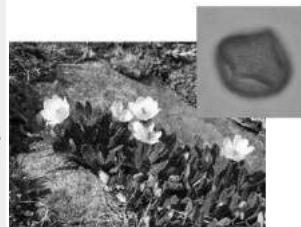
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Wisconsin glaciation reached a climax at 18,000 years ago

Tundra conditions existed at the margins of ice lobes. *Dryas* (Rosaceae), *Helophorus arcticus* (water scavenger beetle), *Cymindis unicolor* (alpine ground beetle)

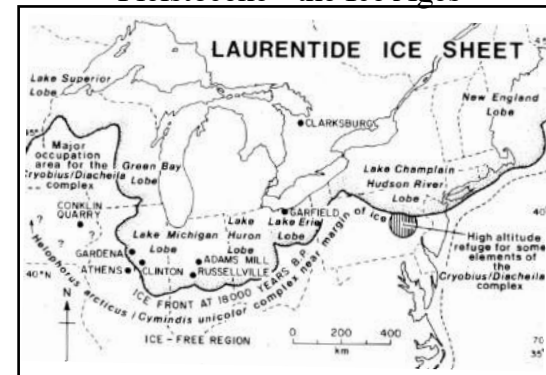
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Dryas

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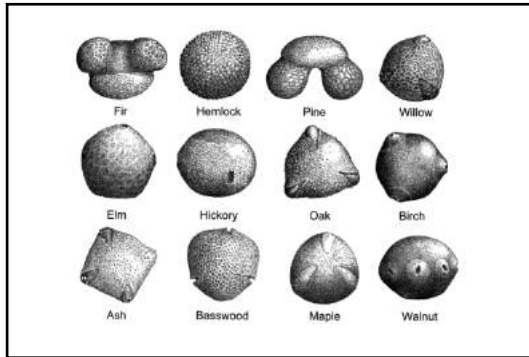
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Wisconsin glaciation reached a climax at 18,000 years ago

Tundra conditions existed at the margins of ice lobes. How do we know what vegetation/flora existed south of the glacial maxima?

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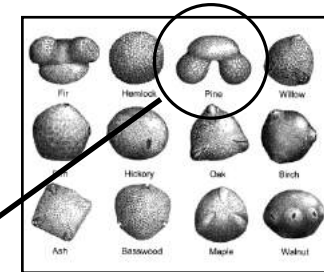


Paleobotanists have been aided by the record of plant remains in lakes and bogs. Pollen (especially from trees) is the single most important record that has been used to identify vegetation/flora at a site and track vegetation changes following ice retreat.

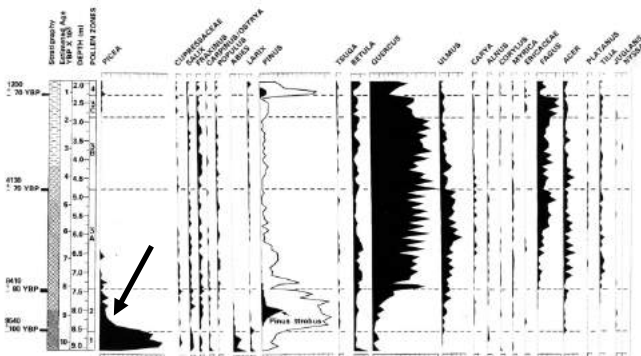
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Yearly deposits accumulate in lake bottoms to be covered by silt in layers, or in bog peat strata



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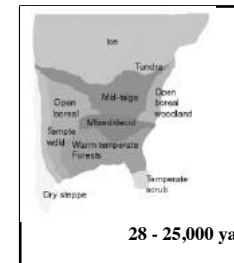


- Pollen record of White Pond, South Carolina
- Note boreal elements (spruce) early in the record

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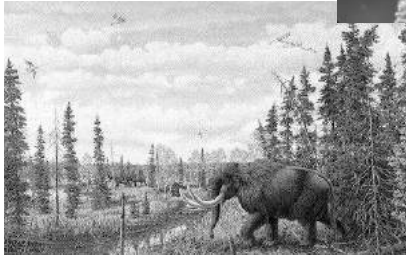


- Extensive boreal forest zone S to 33° N
- Mixed deciduous forest zone near Gulf
- 18,000 ya harshest conditions; zones were further north earlier



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- Much of eastern North America would have looked like this boreal scene



White spruce - *Picea glauca*

Most widespread tree in North America

Illinois 16K

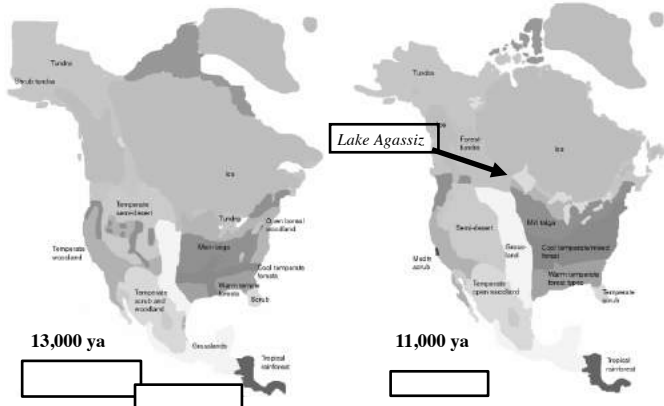
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- 14,000 ya ice begins retreat
- Vegetation units move north



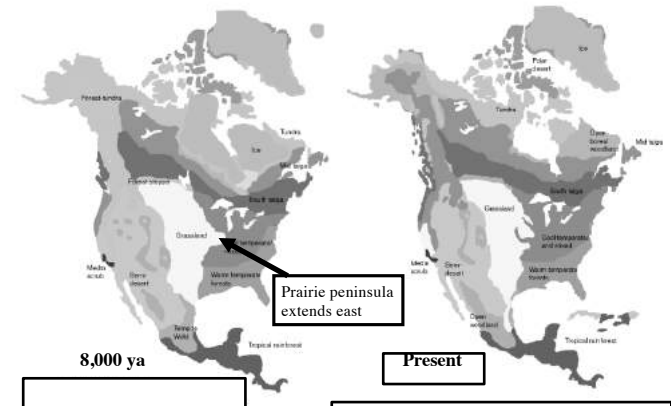
Pleistocene - the Ice Ages

- 14,000 ya ice begins retreat
- Vegetation units move north
- Proglacial lakes form
- St. Lawrence Seaway exposed



Holocene - the Recent Times

- Ice retreats continues into Holocene (10,000 ya)
- Warmest time of Holocene is Hypsithermal - 8,500 to 6,000 ya



Holocene - the Recent Times

- With 2/3 of this interglacial completed, earth should be cooling
- Last 100 years the average earth temperature is rising dramatically

