Geological Time Scale

UG Hons.1st Year)

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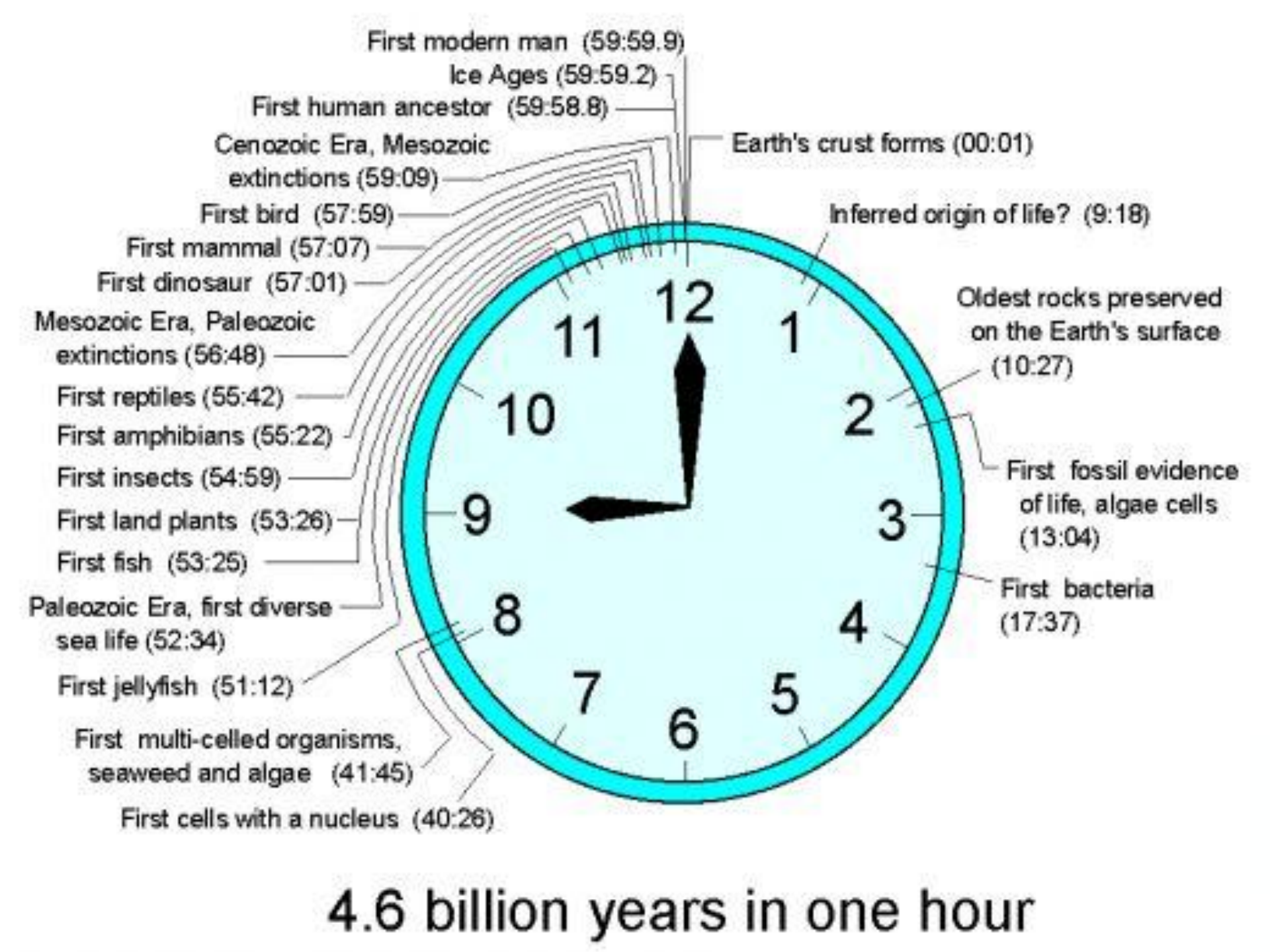
Imagine putting everything that has happened on Earth into a one hour time frame!



4.6 billion years in one hour

Geologic Time in 24 Hours

- 12:00am – Earth forms
- 7:00am - Earliest one-celled organisms appear.
- 7:00am-9:00 pm- Simple, soft-bodied organisms like worms
- Little past 9:00pm - Complex organisms evolve in oceans
- Little past 10:00pm - Reptiles and insects first appear
- Just before 11:00pm - Dinosaurs arrive
- 11:30pm - Dinosaurs go extinct
- 11:59:59 - Humans appear one second before midnight

Geologic Time Scale

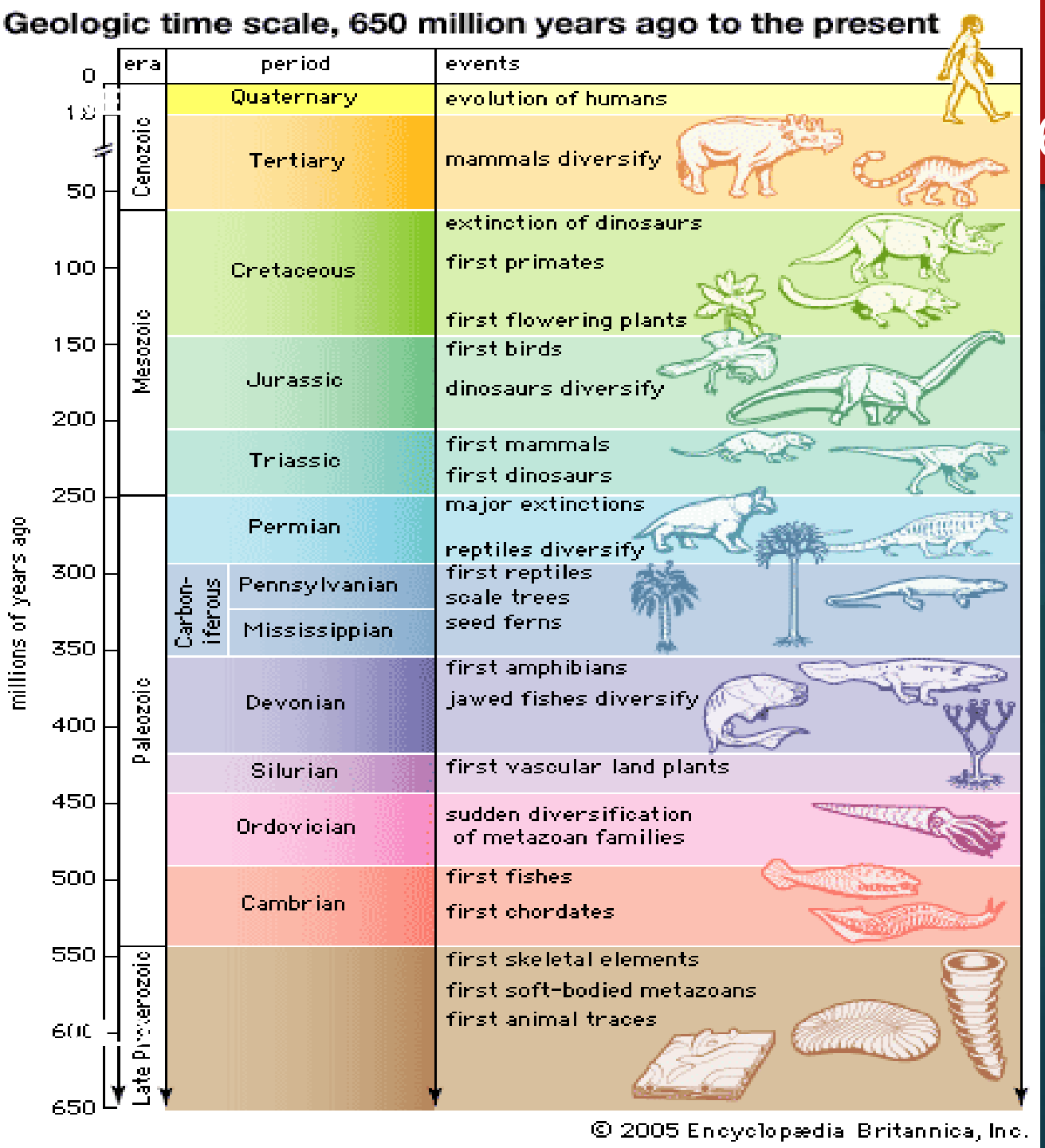
A record of the life forms and geologic events in Earth's history.

Scientists placed Earth's rocks in order by relative age to create the geologic column.

We developed the scale by studying these rock layers
and index fossils.

Radioactive dating helped us determine the absolute date of the divisions in the scale.

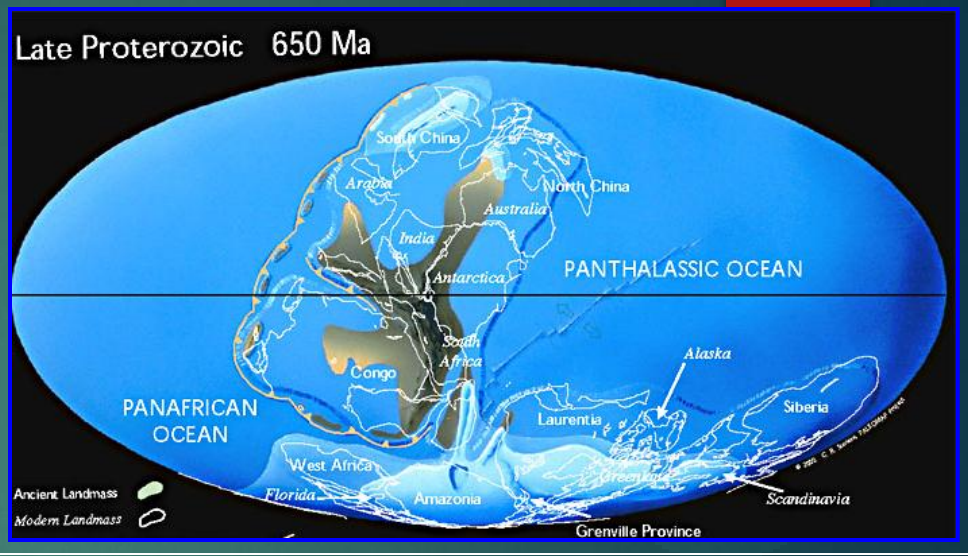
Geologic Time Scale



The Earth Through Time

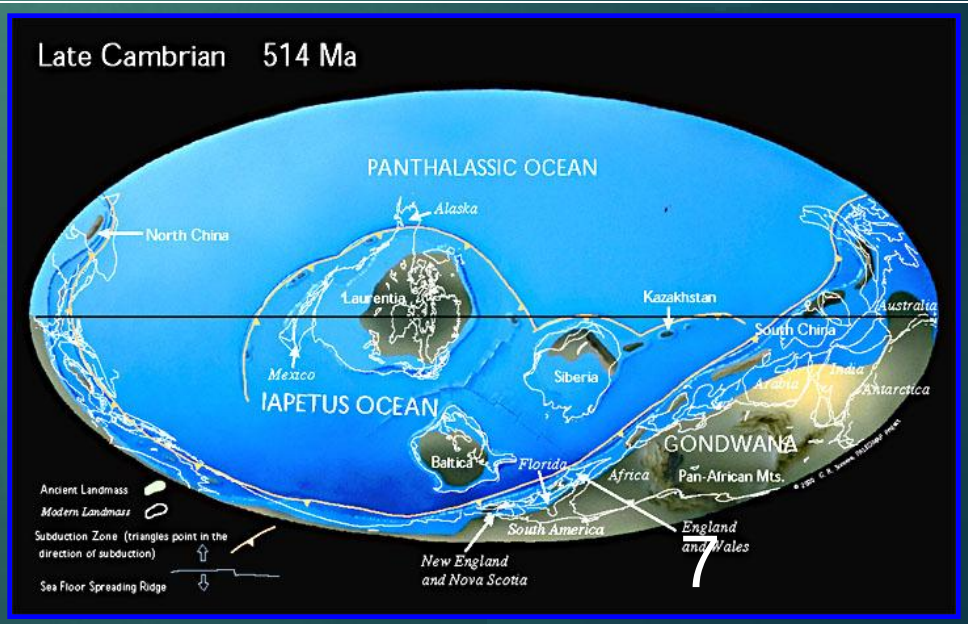
The Proterozoic:

- **No life possible as the Earth initially forms 4.6 billion years ago.**
- **Simple, single-celled forms of life appear 3.8 billion years ago, Land masses gather to make up a continent called "Rodinia"**



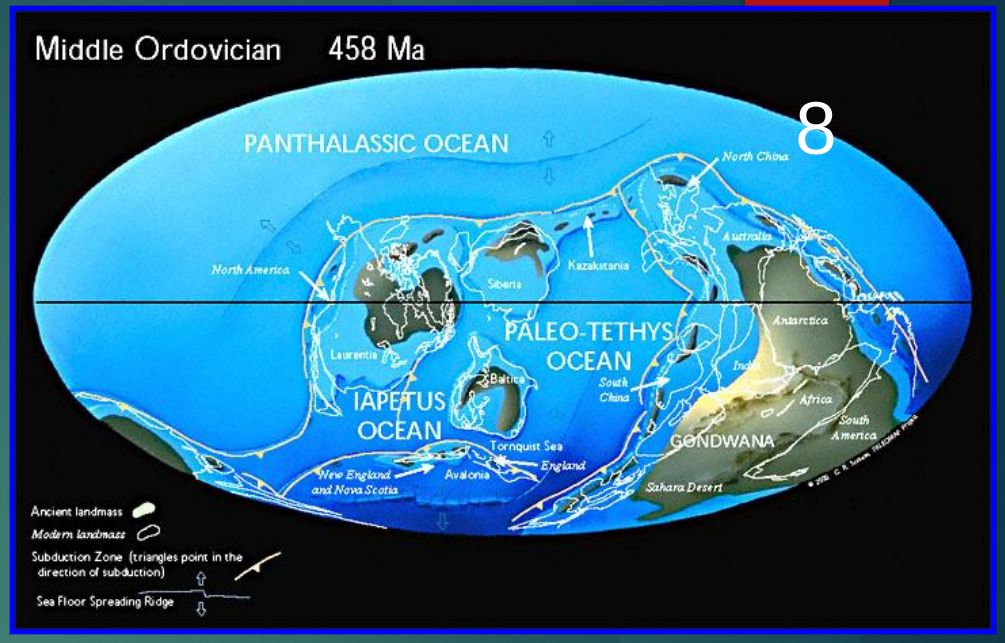
Cambrian:

- Explosion of life
- All existing phyla come into being at this time
- Life forms in warm seas as oxygen levels rise enough to support life
- Dominant animals: Marine invertebrates
- Supercontinent Gondwana forms near the South Pole (note position of present-day Florida)



Ordovician:

- The 1st animals with bones appear, though dominant animals are still trilobites, brachiopods and corals
- Four main continents: Gondwana, Baltica, Siberia and Laurentia



Silurian:

- First land plants appear and land animals follow
- Laurentia collides with Baltica and closes Iapetus Sea.
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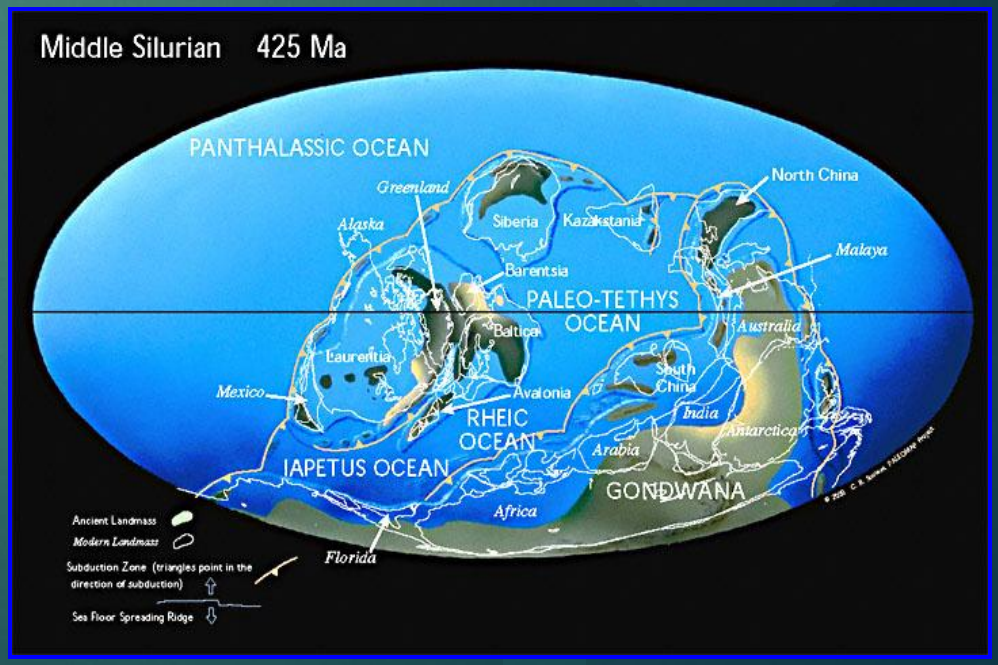

Devonian (Age of the Fish)

- Pre-Pangea forms. Dominant animal: fish
- Present-day Arctic Canada was at the equator and hardwoods began to grow.
- Amphibians, evergreens and ferns appear
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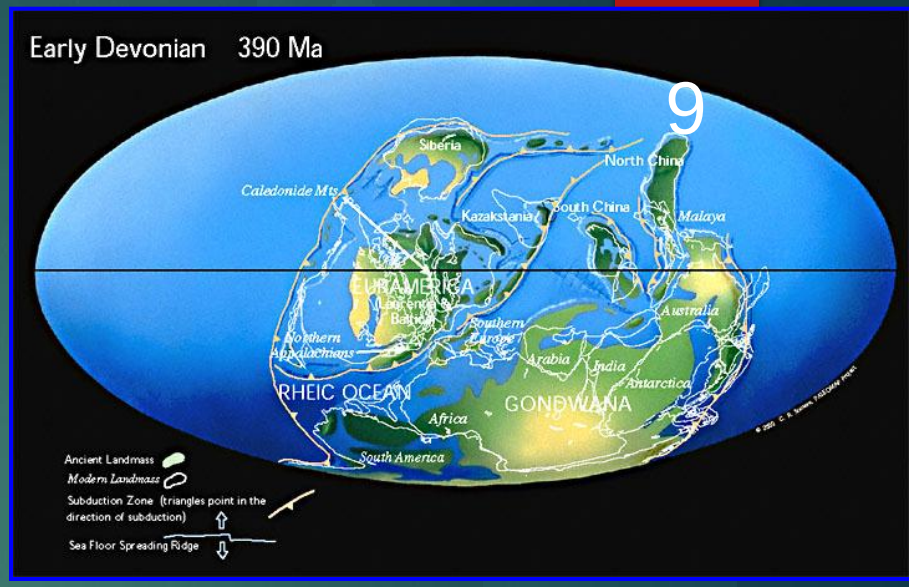

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Mississippian:

- First seed plants appear
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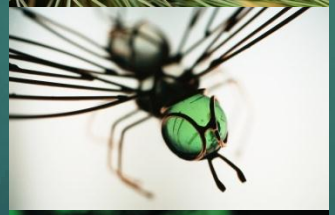
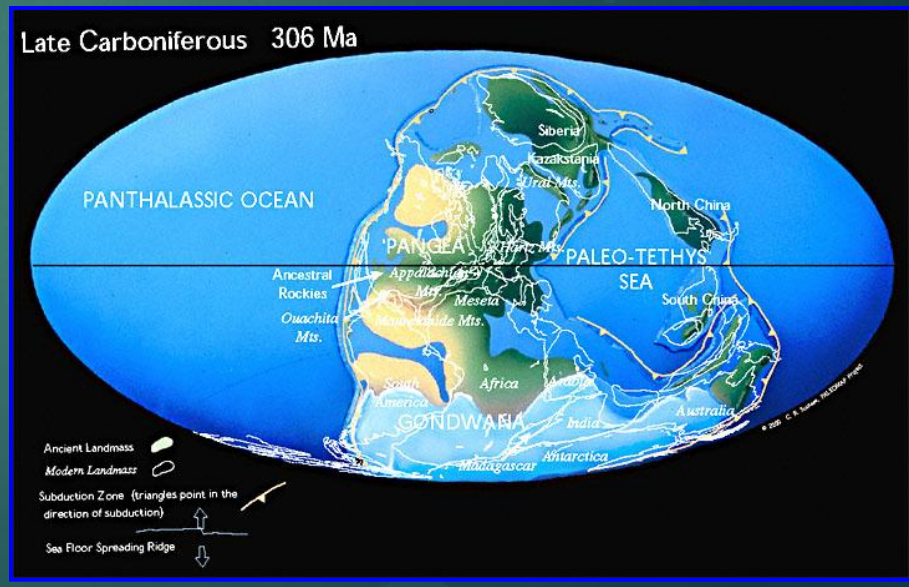


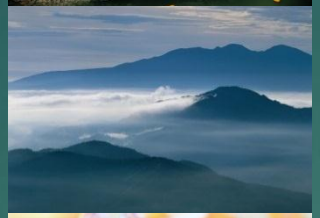
Pennsylvanian:

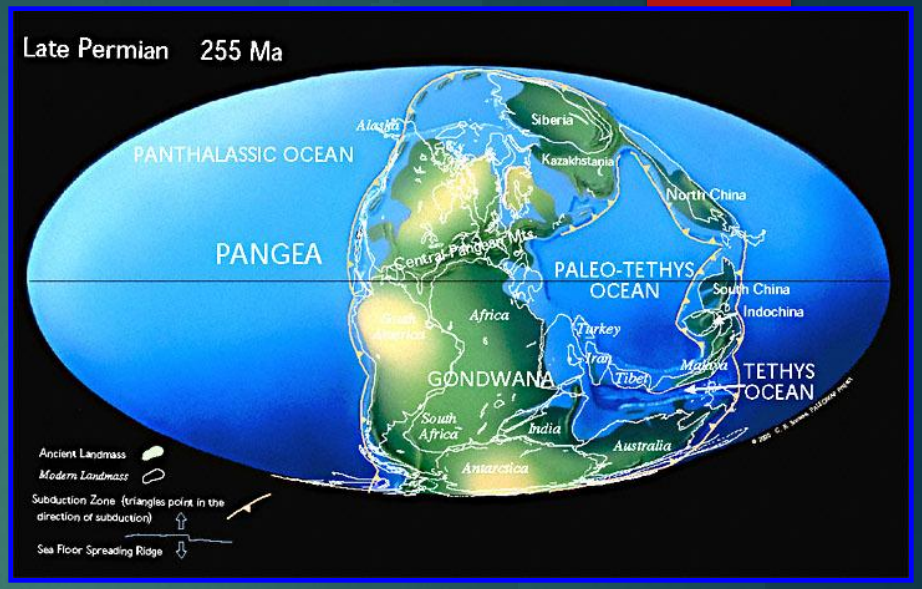
- Modern North America begins to form
- Lizards and winged insects first appear.



Permian:

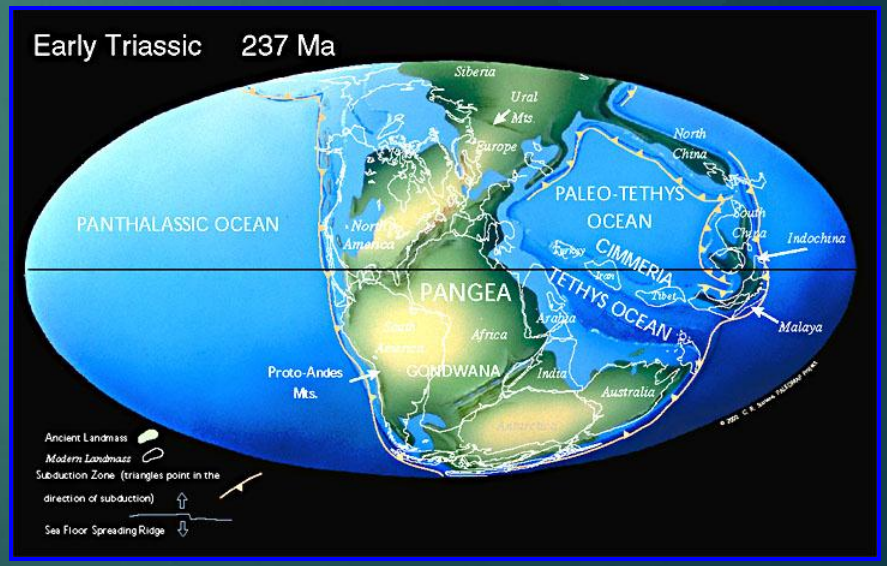
- Pangea forms. Reptiles spread across continents.
- The Appalachians rise
- 90% of Earth's species become extinct due to volcanism in Siberia.





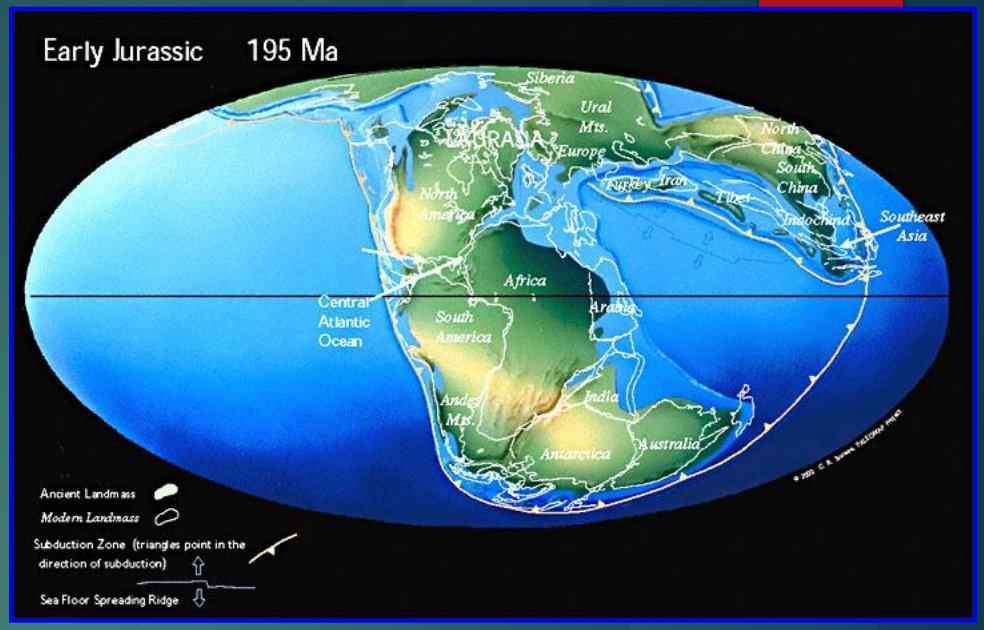
Triassic:

- First dinosaurs appear
- First mammals- small rodent appear
- Rocky Mountains form.
- First turtle fossil from th period
- Pangea breaks apart



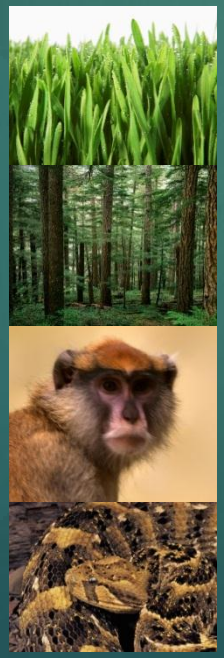
Jurassic:

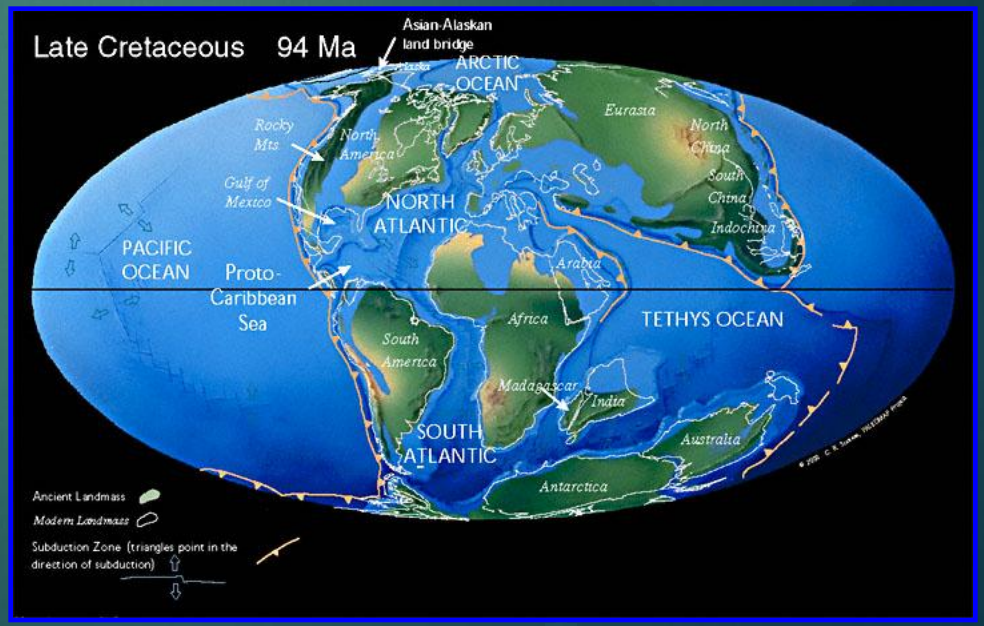
- Pangea still breaking apart
- Dinosaurs flourish "Golde of dinosaurs"
- First birds appear
- North America continues to rotate away from Africa



Cretaceous:

- First snakes and primates appear
- Deciduous trees and grasses common
- First flowering plants
- Mass extinction





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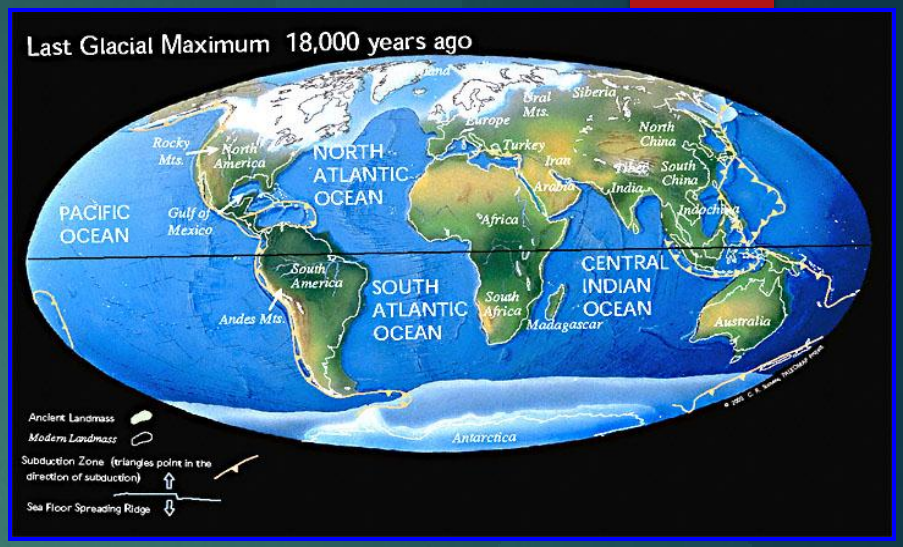
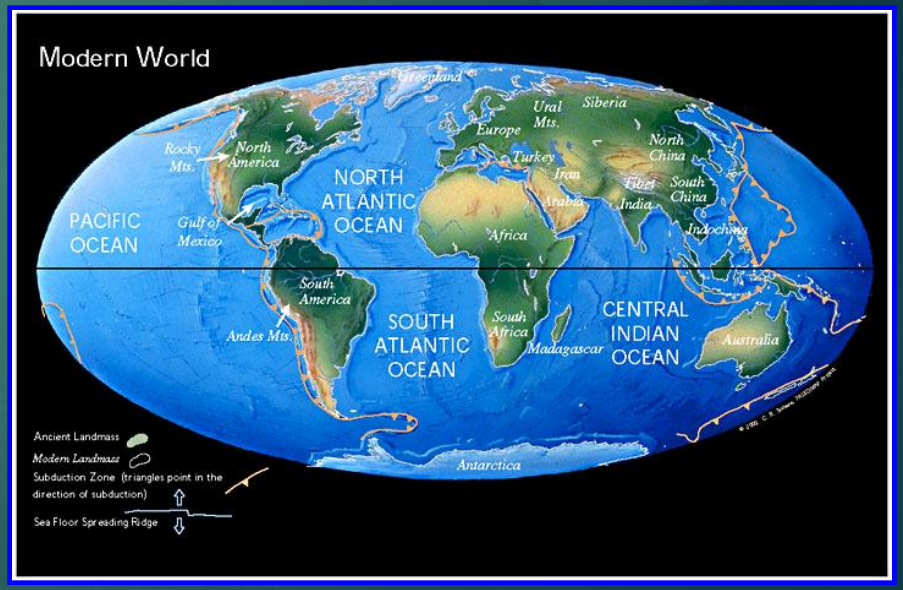
Tertiary:

- First horses appear and tropical plants dominate (Paleocene)
- Grasses spread and whales, rhinos, elephants and other large mammals develop
- Dogs, cats, and apes appear (Oligocene)

Quaternary:

- Modern humans develop and ice sheets are predominant- Ice age (Pleistocene)
- Holocene Humans flourish (Holocene)





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Divisions of Geologic Time

As they studied the fossil record, they found major changes in life forms at certain times.

They used these changes to mark where one unit of geologic time ends and the next begins.

Divisions of the geologic time scale depend on events in the history of life on Earth.

Divisions of Time

- **EON** – largest division of geologic time
- **ERA** – 2nd largest, includes two or more periods
- **PERIOD** – 3rd largest, unit into which eras are divided
- **EPOCH** – 4th largest, the subdivision of a period

EON > ERA > PERIOD > EPOCH

EONS

- **Hadean** – rocks from meteorites and moon
- **Archean** – earliest rocks on earth form
- **Proterozoic** – organisms with well developed cells
- **Phanerozoic** – means "visible life" well represented in the fossil record

Eons:
Precambrian: Earliest span of time
Phanerozoic: Everything since

Eras:
Paleozoic
Mesozoic
Cenozoic

Periods:

Paleozoic "Age of Invertebrates"
- Cambrian
- Ordovician
- Silurian
- Devonian
- Carboniferous *(Missipp. & Pennsylvanian)*
- Permian

Mesozoic "Age of Reptiles"
- Triassic
- Jurassic
- Cretaceous

Cenozoic "Age of Mammals"
- Paleogene
- Neogene
- Quaternary

Epochs:
- Paleocene
- Eocene
- Oligocene
- Miocene
- Pliocene
- Pleistocene
- Holocene

We are living in the Phanerozoic Eon, Cenozoic Era, Quaternary Period, Holocene Epoch…….BUT

ERAS

- **Paleozoic** – "early life" 544 → 244 mya
- **Mesozoic** – "middle life" 245 → 66 mya
- **Cenozoic** – "recent life" 66mya → present

Which one do you live in today?

PERIODS

PAST

PRESENT

Cambrian – Explosion of life

Ordovician – 1st Vertebrates

Silurian – 1st Land Plants

Devonian – Age of Fish

Mississippian – Winged insects

Pennsylvanian – First reptiles

Permian – Age of Amphibians

Triassic – First Dinosaurs/Small mammals

Jurassic – First Birds/Flowering Plants

Cretaceous – Heyday of Dinosaurs

Tertiary – Mammals Thrive

Quaternary – Age of Man/Technology

Remember…Early Earth

- Earth formed 4.6 billion years ago.
- Scientists think that Earth began as a ball of dust, rock and ice.
- Gravity pulled this mass together.
- As Earth grew larger, gravity increased. Pulled in nearby dust, ice and rock.
- As objects hit Earth at high speeds, their energy changed into thermal energy.
- Energy from collisions caused Earth's temp to rise until planet was very hot.
- Scientist believe Earth may have become so hot it melted.
- Denser materials sank toward the center—formed Earth's dense iron core.
- At same time, Earth continuously lost heat to cold of space.
- Less dense molten material hardened to form Earth's outer layers. Oceans form.

Mass Extinction

Occurs when many living things go extinct at the same time (Impacts plants and animals on land and in sea)

- Only happened twice in Earth's history.

- **1st: Between Paleozoic and Mesozoic Eras**
  - Trilobites suddenly went extinct. Think climate change from continental drift may have caused extinction. Formation of Pangaea caused deserts to expand in tropics. Sheets of ice covered land closer to South Pole. Organisms could not survive.

- **2nd: Between Mesozoic and Cenozoic Eras**
  - **Wiped out over half of all plant and animal groups on Earth. No dinosaurs survived**

Two Theories

Asteroid hit earth. Impact threw huge amounts of dust and water into atmosphere blocking sunlight. No sun = plants died and plant eating animals starved. Clouds also caused temperatures to drop.

Climate changes were caused by increased volcanic activity. Volcanic output would block sun as well and same process would follow.

References

- A Text Book Of Geology by P.C. Rao & D.B. Rao
- A Textbook of Geology: Historical geology by S R Saxsena (Springer)
- Textbook of Geology by G B Mahapatra