GEOLOGICAL TIME SCALE

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What is Geological Time Scale ?

- The Geological time scale is a record of the life forms and geological events in Earth's history.
- It provides a chronological framework for understanding the history of our planet and the evolution of life on Earth.
- Scientists developed the time scale by studying rock layers and fossils world wide.
- Radioactive dating helped determine the absolute divisions in the time scale.

- **The Principle of Horizontality**

  All rock layers were originally deposited horizontally.

- **The Principle of Superposition**

  The layer on the bottom was deposited first & that is oldest.

Different Methods For Determining Geological Time Scale :

- Salinity Method
- Sedimentation Method
  - $$\text{Age of the Earth} = \frac{\text{The thickness of the sediment}}{\text{The rate of deposition of the sediment}}$$
- Tidal Method

The Geologic Time Scale is divided by the following divisions

- ***EONS:*** Longest subdivision; based on the abundance of certain fossils.
- ***ERAS:*** Next to longest subdivision; marked by major changes in the fossil record.
- ***PERIODS:*** Based on types of life existing at the time.
- ***EPOCHS:*** Shortest subdivision; marked by differences in life forms and can vary from continent to continent.

Term Occurs from

Quaternary	Latin, “fourth”	1822
Tertiary	Latin, “third”	1760
Cretaceous	Latin creta, “chalk”	1822
Jurassic	Jura Mountains, Switzerland	1795
Triassic	Latin, “three-fold”	1834
Permian	Perm, Russia	1841
Carboniferous	Rich Deposits of Coal	1822
Devonian	Devonshire, England	1840
Silurian	Silures, a pre-Roman tribe	1835
Ordovician	Ordovices, a pre-Roman tribe	1879
Cambrian	Medieval Latin name: Cambria, “Wales”	1835

EONS:

CRYPTOZOIC : Earliest span of time

PHANEROZOIC: Everything since

ERAS:

Paleozoic

Mesozoic

Cenozoic

PERIODS:

Paleozoic
"Age of Invertebrates"

Cambrian
Ordovician
Silurian
Devonian
Carboniferous
(Missippi & Pennsylvanian)
Permian

Mesozoic
"Age of Reptiles"

Triassic
Jurassic
Cretaceous

Cenozoic
"Age of Mammals"

Paleogene
Neogene
Quaternary

EPOCHS:

Paleocene
Eocene
Oligocene

Miocene
Pliocene

Pleistocene
Holocene

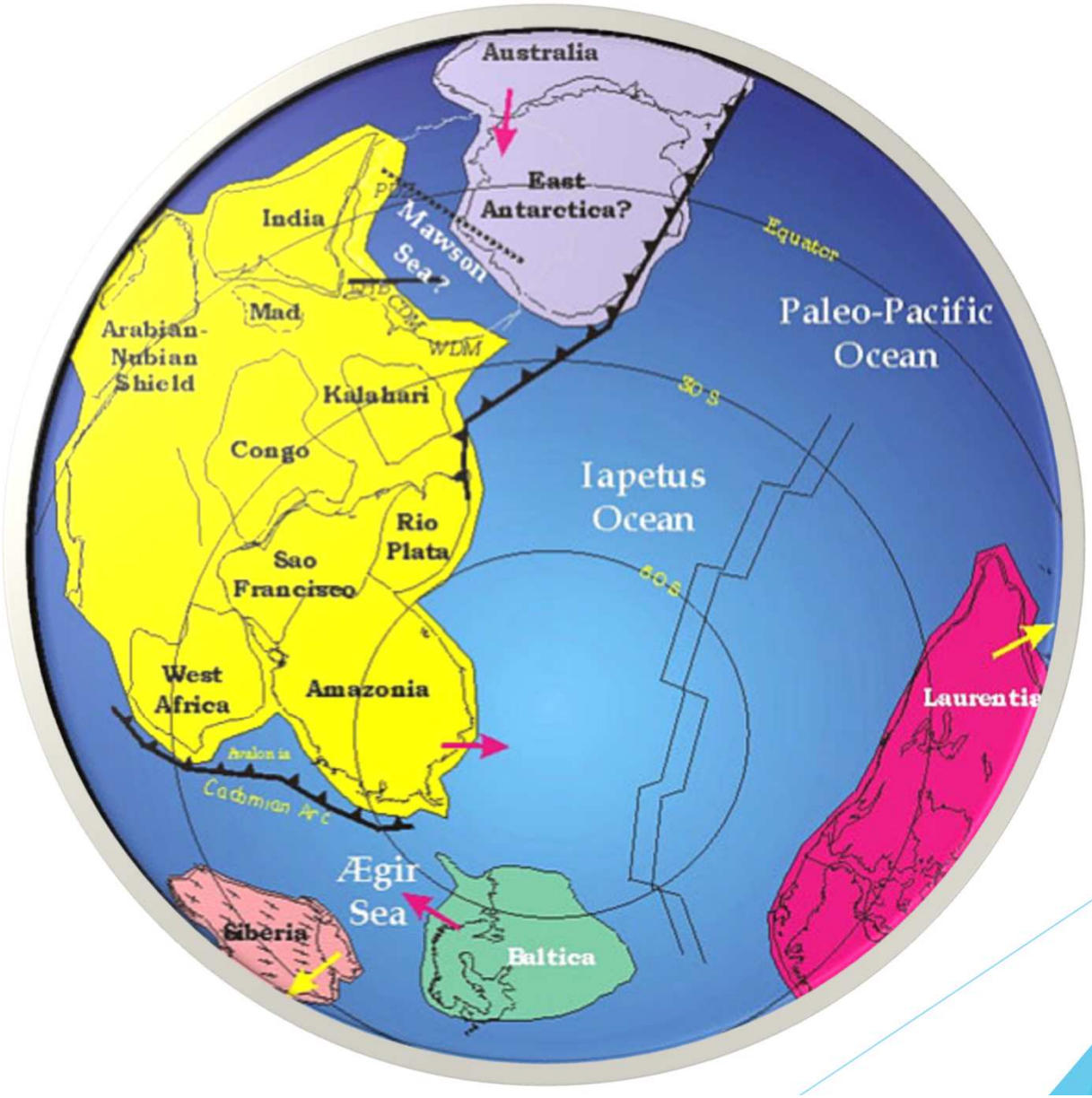
PALEOZOIC

CAMBRIAN

- Increase the rate of Continental Movement.
- Most of the Land was submerged into the Sea.
- Supercontinent Gondwana forms near the South Pole (Position of present-day Florida).
- Life forms in warm seas as oxygen levels rise enough to support life.
- All existing phyla come into being at this time.
- Dominant animals: Marine invertebrates (Trilobites and Brachiopods).

ORDOVICIAN

- FOUR MAIN CONTINENTS: Laurentia (Now North America), Gondwana, Siberia and Baltica (Now northern Europe) were still independent continents.
- Gondwana drifted toward the South Pole from Equator.
- Sea levels were high.
- The beginning of the construction of South Carolina.
- Constant Changes of land and Sea boundaries.
- The 1st animals with bones appear, though dominant animals are still trilobites, brachiopods and corals.


Australia
East Antarctica?
India
Pinjarra
Mawson Sea?
Equator
Paleo-Pacific Ocean
Mad
Arabian-Nubian Shield
WLM
Kalahari
30 S
Congo
Iapetus Ocean
Rio Plata
Sao Francisco
60 S
West Africa
Amazonia
Laurentia
Arabonia
Cadomian Arc
Ægir Sea
Siberia
Baltica

SILURIAN

- The vast ocean of Panthalassa covered most of the northern hemisphere.
- Laurentia collides with Baltica and closes Iapetus Sea.
- Sea levels dropped again.
- Formation of Mountain structure in European Part.
- First land plants appear and land animals follow.
- Coral reefs expand and land plants begin to colonize barren land.
- First millipede fossils and sea scorpions (Euryptides) found in this period.

DEVONIAN (Age of the Fish)

- Pre-Pangea forms ; Near the equator, the plate of Euramerica and Gondwana were starting to meet.
- Sea levels were high worldwide, and much of the land lay under shallow seas.
- Oceans still freshwater and fish migrate from southern hemisphere to North America.
- Present-day Arctic Canada was at the equator.
- Appalachian Mountains began to Emerged.
- Dominant animal: fish.
- Amphibians, evergreens and ferns appear & Hardwoods began to grow.

CARBONIFEROUS

1. **MISSISSIPPIAN** *(Early Carboniferous)* :

- Much of North America is covered by shallow seas.
- Sea life flourishes (bryoza, brachipods, blastoids).
- First seed plants appear.

2. **PENNSYLVANIAN** *(Late Carboniferous):*

- Modern North America begins to form.
- Ice covers the southern hemisphere and coal swamps formed along equator.
- Pangea Looked like English alphabet "O"
- Lizards and winged insects first appear.

PERMIAN

- Last period of the Paleozoic.
- A large ocean that existed between Asia and Gondwana : Paleo-Tethys Ocean.
- The Appalachians rise continue.
- Pangaea forms complete.
- Reptiles spread across continents.
- 90% of Earth's species become extinct due to volcanism in Siberia. (Enough Carbon-dioxide from the eruptions to raise world temperatures five degrees Celsius)

MESOZOIC

TRIASSIC

- Pangea breaks apart, initial break-up of Pangaea, which separated New Jersey from Morocco.
- Rocky Mountains form.
- Africa was connected to Pangea.
- First dinosaurs appear.
- First mammals- small rodents appear.
- First turtle fossil from this period.

JURASSIC

- The Supercontinent Pangaea broke up into the northern supercontinent Laurasia and the southern supercontinent Gondwana.
- North America continues to rotate away from Africa (Jig-Saw-Fit).
- Several massive batholiths were emplaced in the northern American cordillera.
- Formation of Gulf of Mexico.
- First birds appear.
- Dinosaurs flourish "Golden age of dinosaurs"

CRETACEOUS

- Massive lava beds called the *Deccan Traps* were erupted in the very late Cretaceous and early Paleocene.
- The Tethys Sea continued to narrow.
- One third of the continental margin submerged into the sea.
- Rocky, Andes, Alps Mountains accelerated the structure.
- Mass extinction marks the end of the Mesozoic Era, with the demise of dinosaurs and 25% of all marine life.
- First snakes and primates appear.
- Deciduous trees and grasses found, First flowering plants.

CENOZOIC

TERTIARY

1. PALEOCENE :

- Greenland and North America were beginning to separate.
- Continued to uplift the Rocky Mountains.
- Indian and Eurasian plate Collided.
- Warm seas circulated throughout the World including the poles.
- The end of the Epoch was marked by the Paleocene-Eocene Thermal Maximum (PETM).
- First horses appear and tropical plants dominate.

2. EOCENE :

- Laurasia began to fragment, as Europe, Greenland and North America drifted apart.
- Tethys Sea finally disappeared, initiate formation of the Himalayas.
- Grasses spread and whales, rhinos, elephants and other large mammals develop. Sea level rises.

3. OLIGOCENE:

- Antarctica became more isolated and finally developed an ice cap.
- Continued to uplift Alps in Europe.
- South America was finally detached from Antarctica.
- Limestone and lignite coal layer found.
- Dogs, cats, and apes appear.

4. MIOCENE:

- South America was approaching the western subduction zone in the Pacific Ocean : rise of the Andes.
- Formation of Shivalik mountain.
- Australia got drier as it entered a zone of low rainfall in the Late Miocene
- Horses, camels, and tigers appears.

5. PLIOCENE:

- South America became linked to North America through the Strait of Panama.
- Africa's collision with Europe formed the Mediterranean Sea.
- Grand Canyon forms.
- Formation of Black sea, Caspian Sea and Aral Sea .
- Oceans continued to be relatively warm.

QUATERNARY

1. PLEISTOCENE :

- The modern Continents were essentially at their present positions.
- The Andes were covered in the south by the Patagonian ice cap during the Pliocene.
- Most of the Northern Hemisphere covered with Snow.
- Modern humans develop.

2. HOLOCENE :

- Global Climate continue to warm.
- The sea level rise and temporary land depression.
- Holocene Humans flourish.

END