

## Geological Time Scale/Era's:

- Earth is about 4.5 billion years old
- The Strata (or rock layers in the earth) represent a slice of time
- Superposition: Any given Stratum is older than those above it and younger than those below
- Cenozoic Era: most recent/65.5 million years ago to present
- Paleozoic Era: oldest/225 to 570 million years ago
- Anthropocene: geological epoch dating from the commencement of significant human impact on Earth's geology and ecosystems, including anthropogenic climate change.

## Layers of the Earth:

- Exosphere: the outermost region of a planet's atmosphere.
- Thermosphere: the layer in the Earth's atmosphere directly above the mesosphere and below the exosphere. Within this layer of the atmosphere, ultraviolet radiation causes photoionization/photodissociation of molecules, creating ions in the ionosphere.
- Mesosphere: the third layer of the atmosphere, directly above the stratosphere and directly below the thermosphere. In the mesosphere, temperature decreases as altitude increases.
- Stratosphere: The stratosphere is the second major layer of Earth's atmosphere, just above the troposphere, and below the mesosphere. Where the Ozone Layer is found.
- Troposphere: the lowest layer of Earth's atmosphere, and is also where nearly all weather conditions take place. It contains 75% of the atmosphere's mass and 99% of the total mass of water vapour and aerosols. Usually the height at which planes travel.
- Lithosphere (crust/mantel): the rigid, outermost shell of a terrestrial-type planet, or natural satellite. It is composed of the crust and the portion of the upper mantle that behaves elastically on time scales of thousands of years or greater. Where life lives!
- Asthenosphere: is the highly viscous, mechanically weak and ductile region of the upper mantle of the Earth. It lies below the lithosphere, at depths between approximately 80 and 200 km below the surface.
- Outer Core: a fluid layer about 2,400 km thick and composed of mostly iron and nickel that lies above Earth's solid inner core and below its mantle. Its outer boundary lies 2,890 km beneath Earth's surface.
- Inner Core: the innermost geologic layer of the Earth. It is primarily a solid ball with a radius of about 1,220 kilometres, which is about 20% of the Earth's radius or 70% of the Moon's radius.

### Continental Drift Theory:

- All present day continents derived from one large land mass, Pangea.
  - Pangea began to break away 200 million years ago
  - Evidence: Fossilized tropical plants found beneath ice caps, glaciated landscapes found in Africa & South America, continents fit together like pieces in a puzzle, & similarities in rocks from Americas and Africa/Europe.

### Seafloor Spreading Theory:

- Occurs at mid-ocean ridges where new oceanic crust is formed through volcanic activity and then gradually moves away from the ridge
- Youngest rock occurs at ridge and gets progressively older as it moves away

### Subduction Convergent Plate Boundaries:

- Two plates slide toward each other forming either a subduction zone - if one plate moves underneath the other - or an orogenic belt - if the two plates collide and compress
- When a denser oceanic plate moves underneath a less dense continental plate, an oceanic trench is produced on the ocean side and a mountain range forms on the continental side
  - (i.e. Cascade Mountains)

### Divergent Plate Boundaries:

- Two plates slide apart from each other - most occur at bottom of oceans
- Deep sea vents are common. When mid-oceanic ridge is above sea level, volcanic islands form
  - (i.e. Iceland)

### Transform Plate Boundaries:

- Two plates slide past each other, causing earthquakes - (i.e. San Andreas Fault)
- No volcanic activity

### Earthquakes:

- Result from a sudden release of energy in the Earth's crust - create seismic waves
- Can be caused by rupture of geological faults, volcanic activity, landslides, and major human activity (i.e. mine blasts, nuclear)
- Result: landslides, avalanches, fires, tsunamis, infrastructure damage, loss of life
- Focus: an earthquake's point of initial rupture
- Epicenter: the point on the surface directly above the focus

### P-Waves:

- Shake the ground the same direction and the opposite direction as the direction of the wave
- Have the highest velocity - first to be recorded on a seismogram
- Earthquake advance warning is possibly detection of non-destructive P-waves - travel more quickly through the Earth's crust (i.e. similar to hearing thunder before lightning strikes)
- Travels through solids and liquids

### S-Waves:

- Move through the body of an object
- Up and down motion is perpendicular to the direction of wave propagation
- Arrive after P-waves because S-waves travel more slowly in rock
- Do not travel through liquids

### Tsunamis:

- Series of waves created when a body of water is rapidly displaced, usually by an earthquake
- Generated when plate boundaries abruptly move and vertically displace the overlying water
- Formed usually through subduction zone related earthquakes and in Pacific/Indian Oceans

### Volcanoes:

- A volcano is an opening or rupture in the crust that allows hot, molten rock, ash, and gases to escape from below the surface
- Generally found where tectonic plates are pulled apart or come together
  - i.e. Mid-Atlantic Ridge has volcanoes caused by divergent (pulling apart) tectonic plates; Pacific Ring of Fire has volcanoes caused by convergent (coming together) tectonic plates
- Volcanoes can also form where there is thinning and stretching of the Earth's crust (i.e. African Rift Valley)

### Igneous Rock:

- Formed either underground or above ground
- Underground formation: when magma, deep within the Earth becomes trapped in small pockets. The pockets of magma cool slowly underground, magma becomes igneous rock
- Above: when volcanoes erupt, causing the magma to rise above the Earth's surface
  - This is called lava. Igneous rock is formed as the lava cools above ground

### Metamorphic Rock:

- Formed deep beneath the Earth's surface, high temperatures and large amounts of pressure
- Can be formed by tectonic processes, such as continental collisions, which cause horizontal pressure, friction, and distortion
- Also formed when rock is heated up by the intrusion of hot molten rock called magma from the Earth's interior

### Sedimentary Rock:

- Formed as particles of sediment buildup. Pressure squeezes the sediment into layered solids in a process known as lithification
- Laid down in layers called beds or strata
- Contain fossils, the preserved remains of ancient plants and animals
- Differences between successive layers indicate changes to the environment that have occurred over time