



# Lecture 5



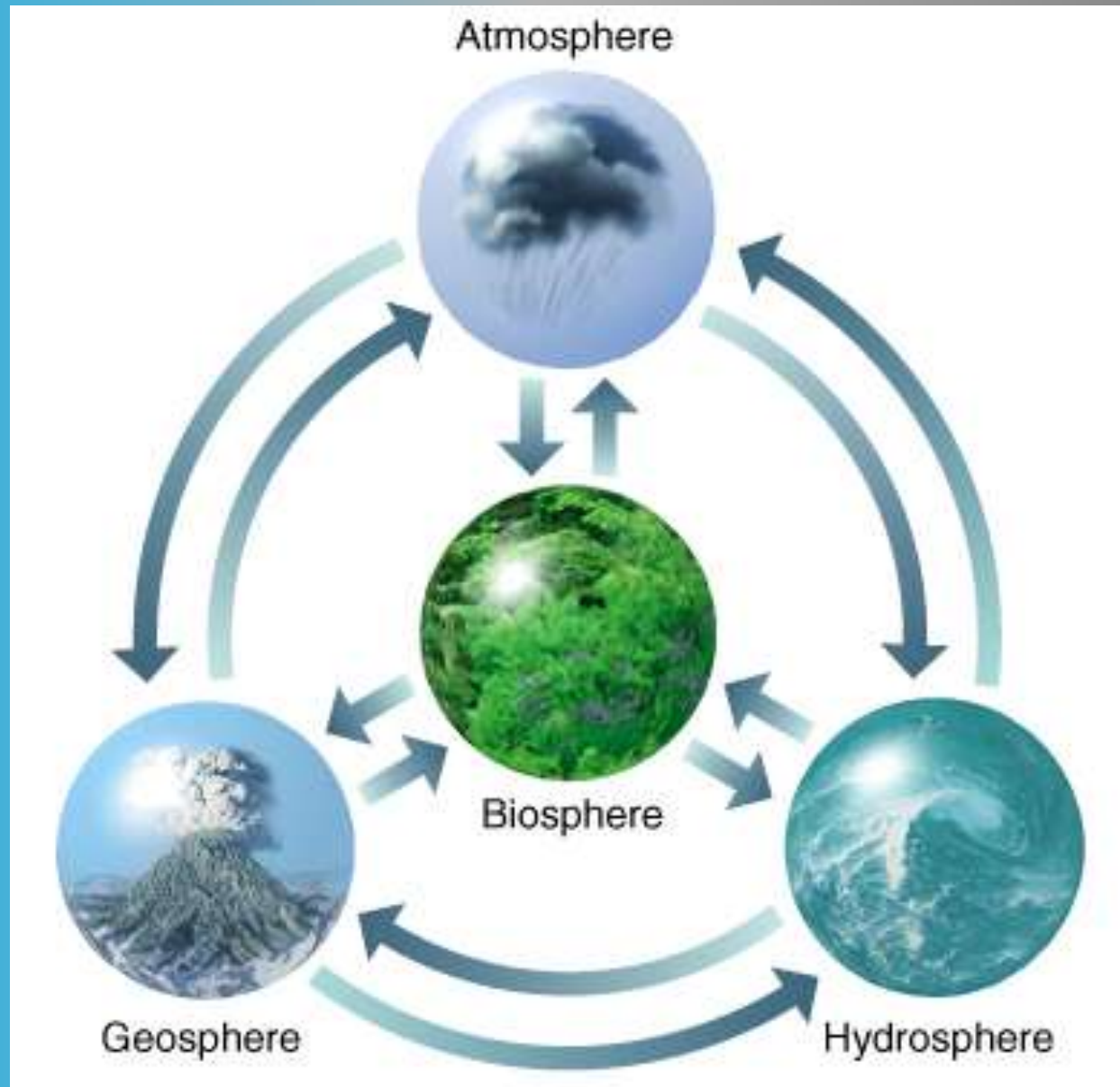
# The Earth

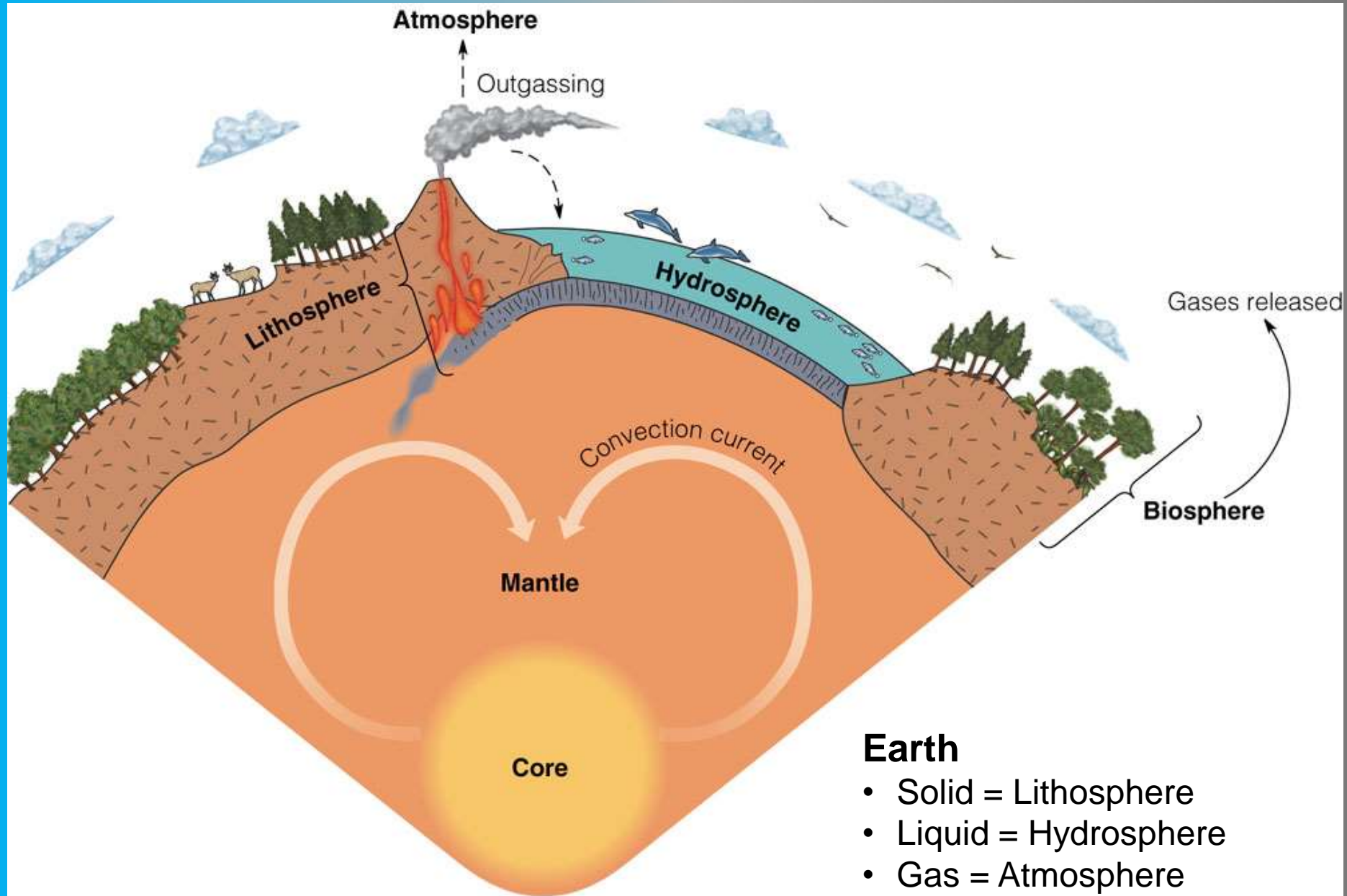


- About 4.5 billion years old
- Third planet orbiting around the sun
- Only planet in our solar system to have surface liquid water
- Home to the only known life in the universe
- Very dynamic, both internally and externally



# Earth's Four Spheres





Earth has 3 major connected systems of **Biosphere** are:

a. **Hydrosphere**- all of Earth's water, ice, water vapor

b. **Atmosphere**- the air blanketing Earth's solid and liquid surface

c. **Lithosphere**- features of Earth's surface (continents, rocks, sea floor, and everything below Earth's surface)

# What Is the Biosphere?

The biosphere is the global sum of all ecosystems; integrating all living beings and their relationships, including their interactions with the elements of the lithosphere, hydrosphere, and atmosphere.



# Biosphere

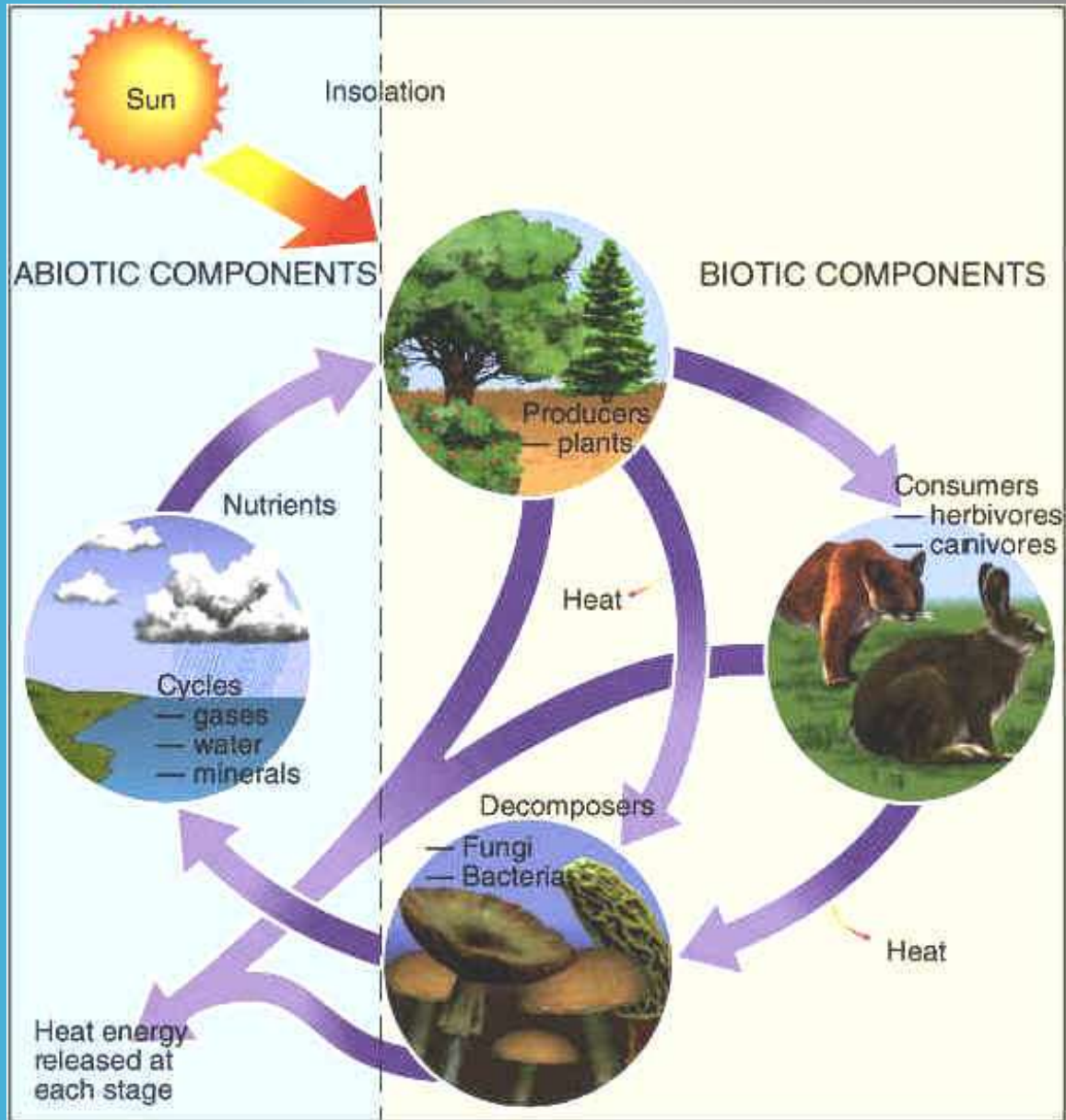
- The sphere that includes all living organisms. Plants, animals, and microbes are all part of the biosphere. It also includes organic matter not yet decomposed.



- Most of Earth's life is found from about 3 metres below the ground to 30 meters above it and in the top 200 metres of the oceans and seas.
- But...life can thrive in the most unlikely places, from hot springs to ice caps.



# Biosphere





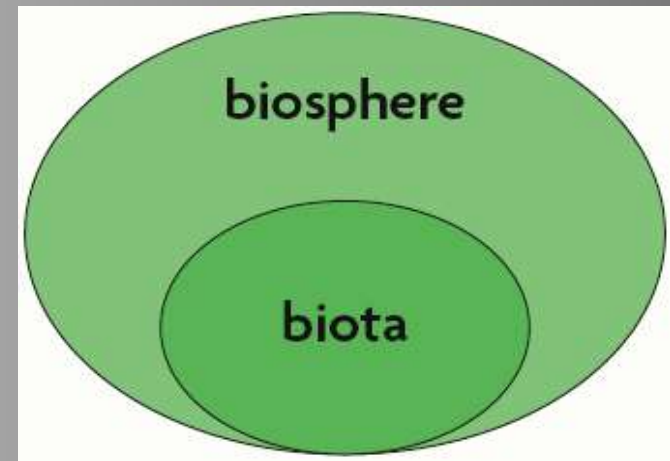
# The Biosphere

The biosphere is the portion of the Earth that is inhabited by life

**Biosphere**- part of Earth where life exists

a. Includes all living and non-living parts

b. **Biota**- collection of just living things in biosphere



# Characteristics of the Biosphere

- Ecology is the study of organisms and their interactions with the environment. (eco-home)
- The biosphere is the life-supporting region of the earth. It includes all the land, air and water in which organisms live.



Some important roles of the biosphere:

1. Aids in weathering (e.g. formation of acids in soil).
2. An important sink for certain elements (especially carbon).
3. Mediates the formation of some minerals.
4. Photosynthesis maintains the oxygen content of the atmosphere.

# Lithosphere

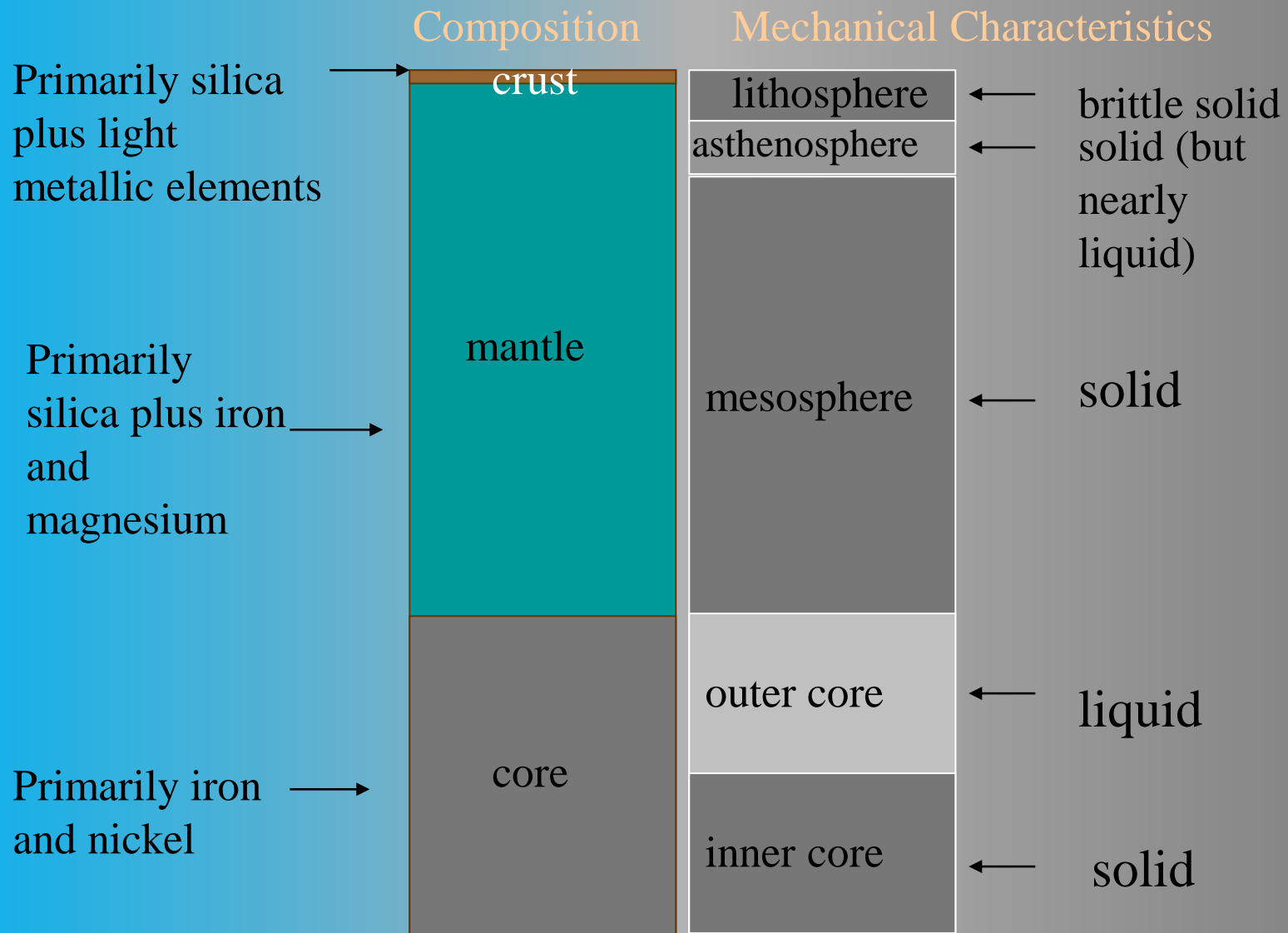
Lithosphere: The solid, inorganic Earth, including Earth's surface and layers of its interior.



The Earth is composed of nested shells that are classified according to their chemical and mechanical characteristics.

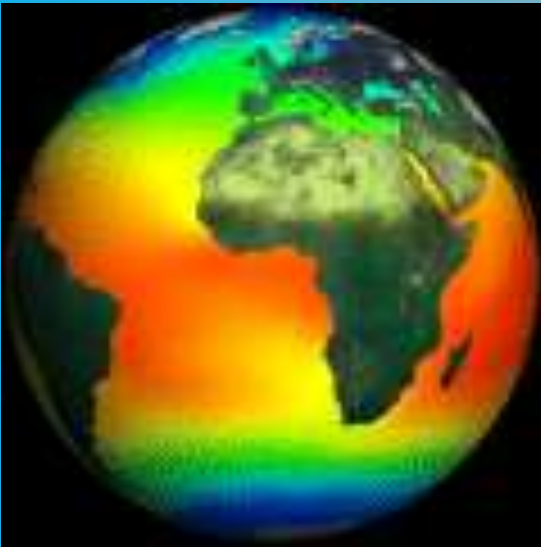


# Earth's Layers: Composition and Mechanical Characteristics



# Hydrosphere

The hydrosphere is composed of all of the water in the Earth system, including water in the oceans, rivers, lakes, air, and below Earth's surface.



Surface temperatures of oceans  
(blue= coldest red= warmest)

- 97 percent of the earth's water is in the oceans.
- The remaining 3 percent is fresh water (mostly in ice sheets, but also in the air as vapour, and below Earth's surface as groundwater).
- The presence of liquid surface water makes our planet unique.

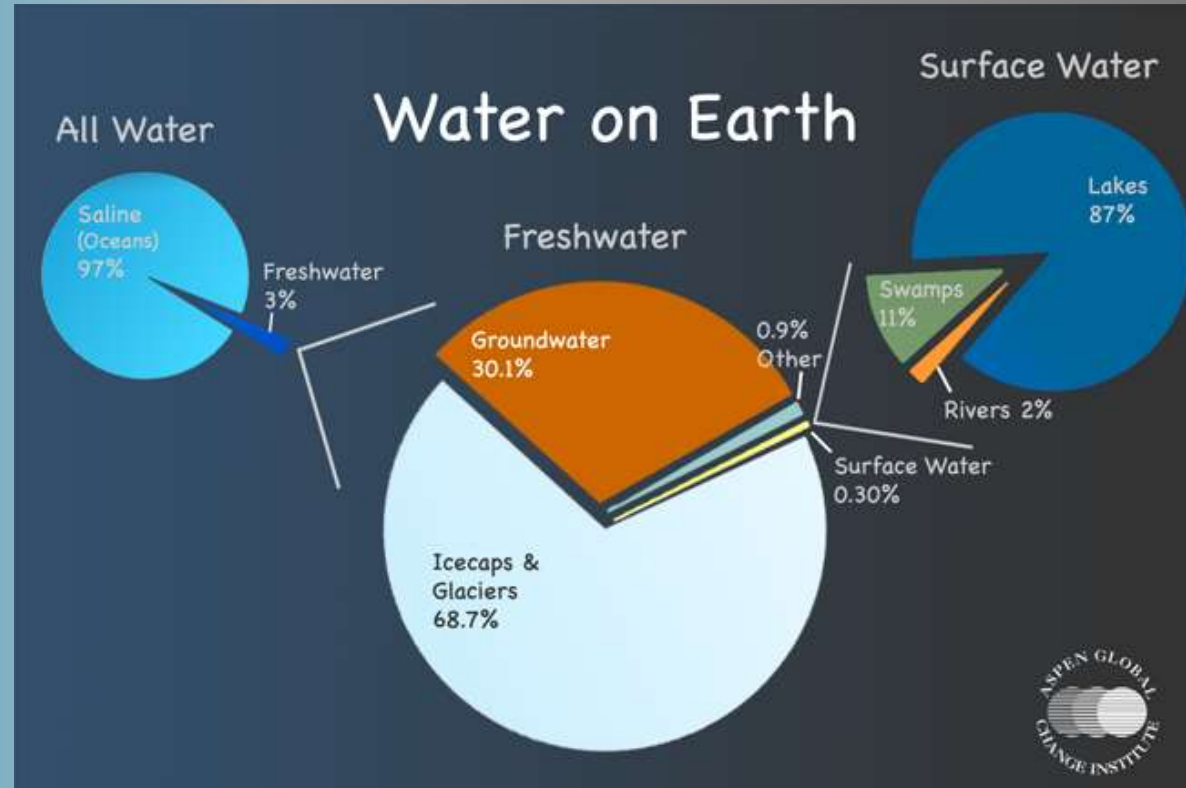
# Hydrosphere

Some important roles of the hydrosphere:

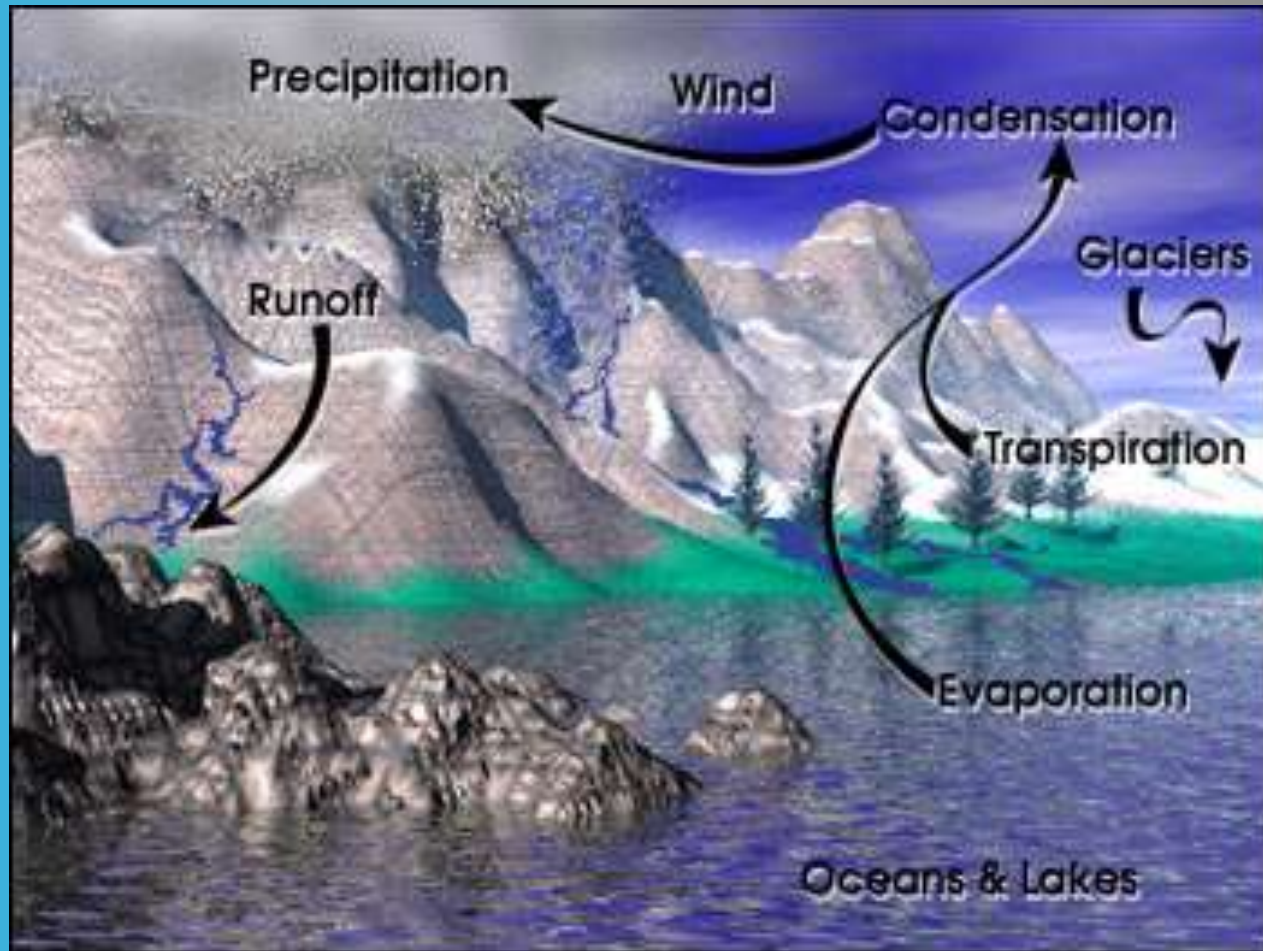
1. Moderates climate
2. Transfers heat
3. Organisms need water to transport nutrients and waste
4. Water is essential in many of Earth's processes, from mineral formation to the weathering and erosion of rock.

# Hydrosphere

- all water at or near the earth's surface
- found as water vapor, liquid water, ice and frozen in permafrost
- 97% of the earth's water is found in the ocean (cover 71% of earth's surface)







Water moves - within between rocks, air, oceans, ice, life  
(hydrologic cycle)

# Fresh Water

- Lakes, ponds, rivers, and streams are freshwater habitats. So too are swamps, bogs, and marshes.
- It amounts to precious little water, less than half a percent of the world's water supply.
- Yet it is essential to a wide variety of life on earth.
- The distribution of fresh water is uneven globally. Four countries hold nearly 50% of all the fresh water on Earth.

# Salt water



- The water of the seas and oceans is salty because of the vast quantity of mineral salts dissolved in it.

# Atmosphere

- The atmosphere is the body of gases that surrounds our planet.



- Most of our atmosphere is located close to the earth's surface where it is most dense.
- The air of our planet is 79% nitrogen and just under 21% oxygen; the small amount remaining is composed of carbon dioxide and other gases.



# Atmosphere

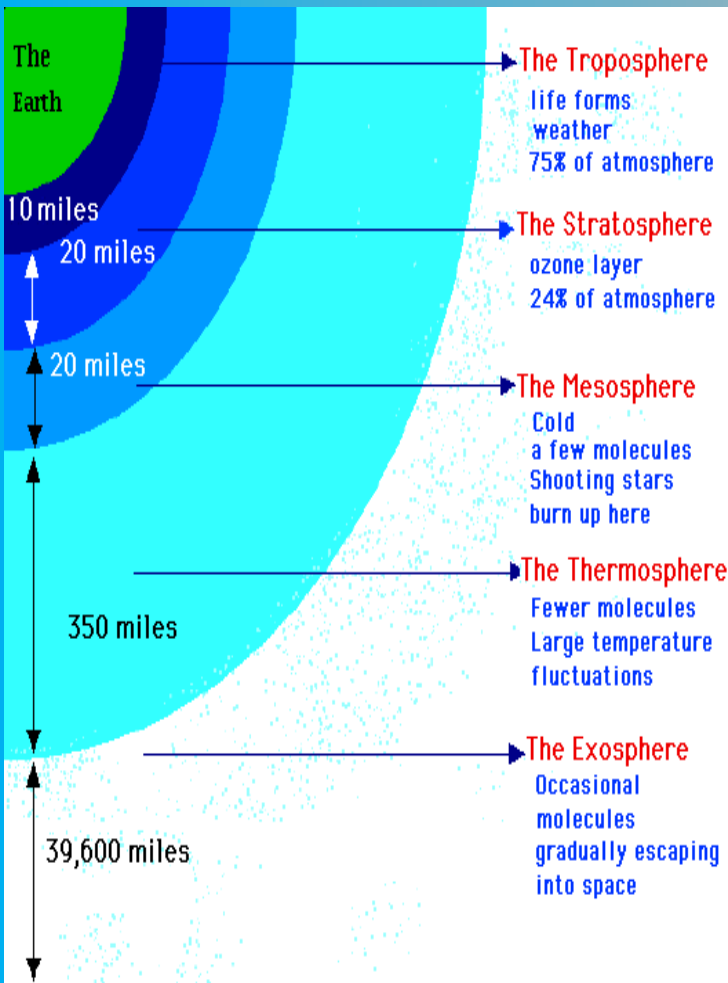
- Thin layer of gases surrounding earth's surface.
- Layers of the atmosphere include:

## Troposphere

- Altitude:** 0 to about 8-15 km (5-9 miles) above sea level.
- Key Features:** This is where we live, and it contains most of the atmosphere's mass, including water vapor. It's where weather events occur (clouds, storms, rain, etc.), and the temperature decreases with altitude.
- Temperature:** It generally decreases with height (about 6.5°C per kilometer).
- Boundary:** The boundary at the top of the troposphere is called the **tropopause**.

## Stratosphere

- Altitude:** 15 to about 50 km (9 to 31 miles) above sea level.
- Key Features:** This layer contains the **ozone layer**, which absorbs and scatters ultraviolet solar radiation. The stratosphere is generally calm and stable.
- Temperature:** In contrast to the troposphere, the temperature increases with altitude in the stratosphere due to the absorption of UV radiation by the ozone layer.
- Boundary:** The boundary between the stratosphere and the troposphere is the **tropopause**, while the boundary between the stratosphere and the next layer is the **stratopause**.



## Mesosphere

- **Altitude:** 50 to about 85 km (31 to 53 miles) above sea level.
- **Key Features:** This is where most meteors burn up upon entering the atmosphere. It is characterized by decreasing temperatures with altitude.
- **Temperature:** The temperature decreases with height, and this layer has the coldest temperatures in the atmosphere.
- **Boundary:** The upper boundary, where the mesosphere transitions to the thermosphere, is called the **mesopause**.

## Thermosphere

- **Altitude:** 85 to about 600 km (53 to 373 miles) above sea level.
- **Key Features:** The thermosphere contains a small proportion of the atmosphere's overall mass. Solar radiation causes ionization of gases, which is why this layer is so hot. It's where the auroras (northern and southern lights) occur.
- **Temperature:** The temperature increases dramatically with altitude, reaching up to 2,500°C (4,500°F) or more. However, it would feel cold to a human because the air density is so low.
- **Boundary:** The boundary between the thermosphere and the exosphere is known as the **thermopause**.

## Exosphere

- **Altitude:** 600 km to about 10,000 km (373 to 6,200 miles) above sea level.
- **Key Features:** This is the outermost layer, where atmospheric particles are so far apart that they can travel hundreds of kilometers without colliding. This layer is considered the transitional zone between Earth's atmosphere and space.
- **Temperature:** The temperature is extremely high in this layer, but the low density of particles means heat is not transferred effectively.

Some important roles of the atmosphere:

1. Contains the gases that living things need for survival (e.g., carbon dioxide for photosynthesis, and oxygen for aerobic respiration).
2. Transfers heat.
3. Ozone in stratosphere protects living things from excess ultraviolet radiation.
4. Plays a part in weathering and erosion.

## Relevance to Lithosphere

1. Heat from the fire causes rocks to crack (therefore enhancing weathering).
2. Soil erosion is also enhanced by the removal of vegetation.



3. Ash particles from the fire alter the chemistry of the soil.



## Relevance to Atmosphere

1. Smoke and ash particles are carried by wind to other areas.



2. Increased precipitation elsewhere is enhanced due to the ash particles acting as nucleation centres for water droplets.
3. Gaseous pollutants such as carbon dioxide ( $\text{CO}_2$ ) are produced during the burning of the vegetation and carried into the air by the wind.

## Relevance to Hydrosphere

- Heat from the fire further removes moisture from the air, soil, and vegetation through the process of evaporation.
- Increased siltation of streams due to enhanced erosion (particles are then deposited as sediment).



## Relevance to Biosphere

1. Immediate destruction of habitat in burn area.



2. Smoke in the air may coat the lungs of animals, including people, and affects their ability to breathe.
3. Ash particles in water clog the gills of fish and other aquatic organisms.

## Relevance to Biosphere

4. On the positive side, nutrients released from ash from the fire can, on the long term, benefit future plant communities.



5. Also, seeds of some plants may require that their outer shells be burned before they can germinate (so the forest fire benefits these plants).

*END*