# Workplace Environmental Management

## WEEK 4 – Environmental of Earth - 2

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# Objectives

At the end of this topic students will be able to:

- Understand the Lithosphere and its components
- Understand the Biosphere and its components
- Relate the elements of Earth Environment

# 4.0 Recap

- The Earth and its environment may be divided into several dominant regions ending in sphere. They include atmosphere (air), hydrosphere (water), lithosphere (rocks), biosphere (living things), and the magnetosphere (magnetic fields).

- Four fundamental components or elements of earth's environment include, atmosphere, hydrosphere, lithosphere and biosphere, corresponding to air, water, rock or land and life (biological component of environment) respectively.

- The abiotic factors including air, water, soil, climate etc. make physical components broadly classified into 3 groups: Atmosphere, Hydrosphere and Lithosphere. Then scientists use the term "biosphere" to describe the zone of l ife (other worldwide sum of ecosystems).

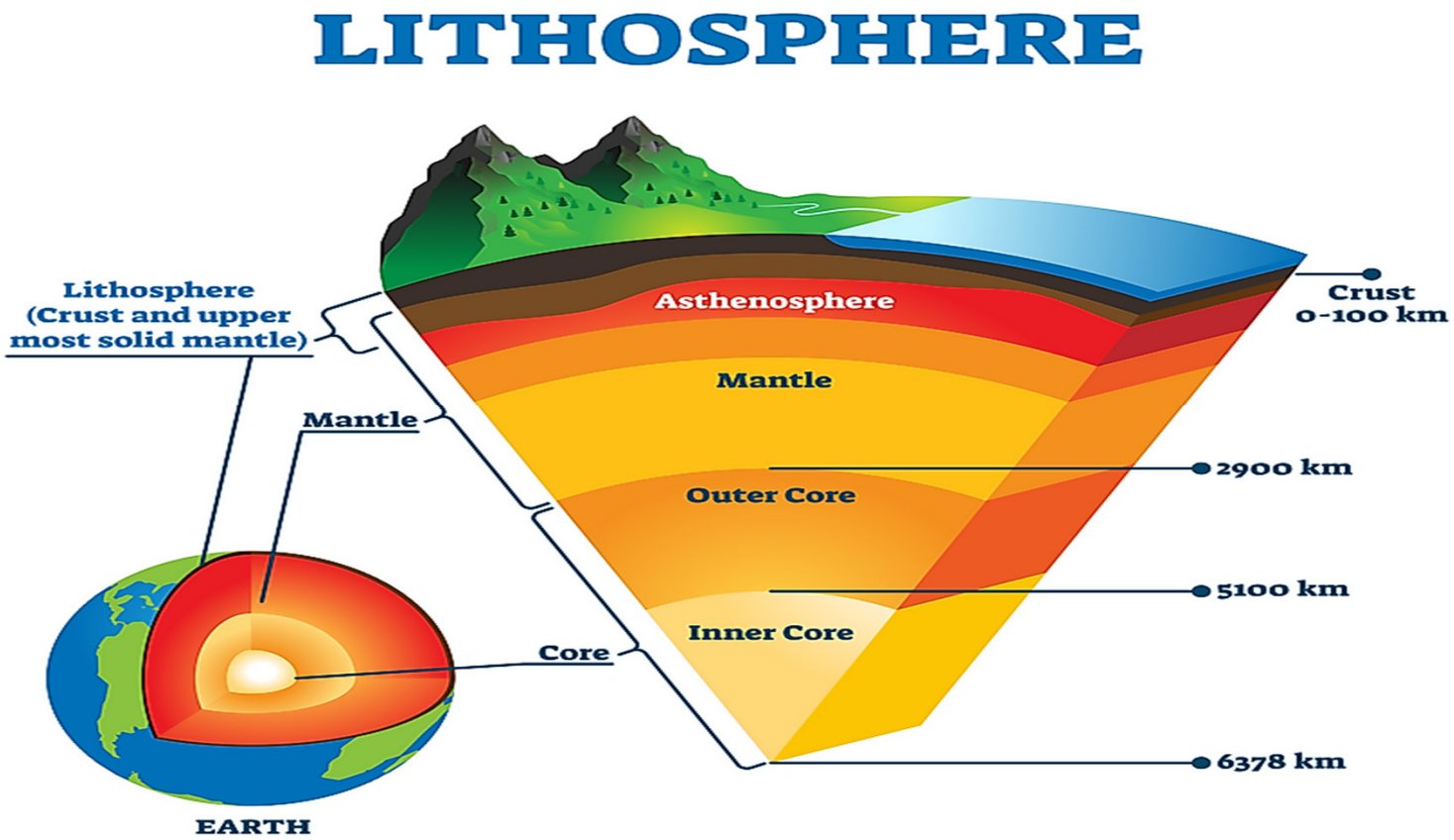
# 4.1 Lithosphere

- Lithosphere is the outermost layer of earth called crust also called outer boundary layer of solid earth which is made of different minerals. Depth up to 100 Km.
- It is found on both land (terrestrial crust) and oceans (oceanic crust); the main component of lithosphere is earth's tectonic plates. (https://www.studyiq.com/articles/components-of-environment/#:~:text=The%20four%20fundamental%20elements%20of,of%20the%20environment%2C%20or%20biosphere).
- Basically, Lithosphere is a crustal system composed of various layers: Core, Mantle and outer Crust.

# 4.1 Lithosphere cont'd

- The land makes the Lithosphere an important part of the earth's four spheres as it assists human life by providing forests, grasslands, minerals, natural resources, among others.
- Within the Lithosphere, we experience the movement of tectonic plates, volcanos, earthquakes, etc. (https://collegedunia.com/exams/lithosphere-types-composition-importance-science-articleid-1506)
- Tectonic activity, such as earthquakes and tsunamis are the main activities found within Lithosphere.

# 4.1 Lithosphere cont'd




(https://www.worldatlas.com/geography/the-four-spheres-of-the-earth.html)

# 4.1.1 Composition of Lithosphere

- Earth’s lithosphere composition varies depending on whether it lies under oceans or on land.
- The earth’s crust is made up of several layers of rocks and hence is not a homogeneous substance.
- Sedimentary rocks are on the top
- Metamorphic rocks are in the middle, and at the bottom
- Basaltic rocks are at the bottom constituting the earth’s crust.
- The Earth's crust also consists of various large dynamic tectonic plates which keep moving slowly but continuously at an average rate of around 10 cm.

# 4.1.2 Rock Cycle

- The rock cycle is made of Volcanoes which send melted rock or magma to the earth's surface and become igneous rock after melting.

- The climate changes, natural events and rivers break it into small pieces of sediment and after many years, sediment builds up and become hard to make up sediment rock.

- Sediment rock gets covered slowly with other rocks and ends up deep inside the earth's crust, when pressure and heat become high enough, that will metamorphose into a metamorphic rock starts over again forming different rocks.

# 4.1.3 Types of Lithosphere

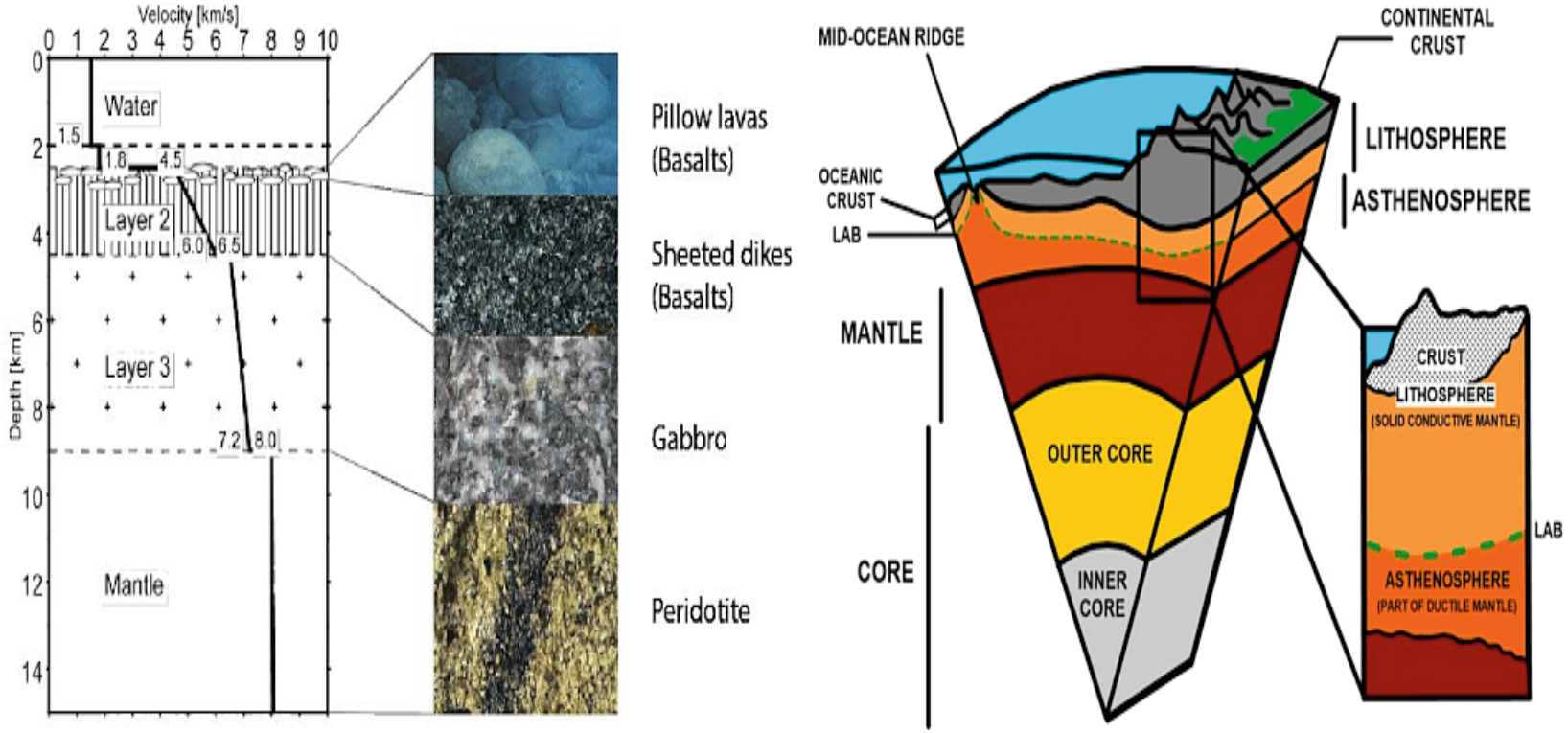
## Oceanic Lithosphere

- It is for oceanic crust and exists in the ocean basins and also called the oceanic lithosphere.
- It has high density because it lies in the upper mantle and crust of oceans and seas.

## Continental or Terrestrial Lithosphere

- It is for continental crust with thickness ranging from about 35 to 45 km.
- It comes into direct contact with the atmosphere containing igneous and sedimentary rock that forms the continents and hold about 40% of the Earth's surface and about 70% of the volume of Earth's crust.

# 4.1.3 Types of Lithosphere cont'd




(https://collegedunia.com/exams/lithosphere-types-composition-importance-science-articleid-1506)

# 4.1.4 Importance of Lithosphere

- It is integral part of the earth’s four spheres helping life to expand on earth.
- It provides forests, grasslands, taking the responsibility for agriculture, human settlements and provision of minerals like iron, aluminium, copper, magnesium, and many more.
- Without tectonic plates' movement, no mountain ranges, volcanoes and continents would have been formed on earth.
- Volcanoes and earthquakes help in the growth of new vegetation and life as they give rise to fertile soil and lands. It is the source of all types of rocks.
- Organic compounds such as coal, natural gas, oil, etc are biotic remains buried in the lithosphere for millions of years controlling energy needs and producing power.

# 4.1.5 Interesting Facts about Lithosphere

- While the oceanic lithosphere is almost 170 million years old, certain parts of the continental lithosphere are about a billion years old.
- The lithosphere is about 100 km thick. However, its thickness depends on its age, i.e., the older the lithosphere, the thicker it tends to be.
- There is another name for the lithosphere; it is also known as the geosphere at times as it refers to all the rocks of the Earth.
- The mafic crust along with the ultramafic mantle comprises the totality of the oceanic lithosphere.
- Most abundantly found elements in the lithosphere include oxygen, iron, silicon, and calcium. (https://www.vedantu.com/physics/lithosphere)

# 4.2 Biosphere

- It refers to all the regions on Earth where life exists. The ecosystems that support life could be in soil, air, water or land. Biosphere refers to the total sum of all living matter; the biomass or biota.
- It extends from the polar ice caps to the equator, with each region holding some form of life suitable to the conditions there.
- In this sphere we find all biological elements of the earth also called Ecosphere.
- Biodiversity is defined under biosphere to mean the existence of the diverse number of species of plants and animals in the environment.
- It is estimated several species above 30 millions.

# 4.2 Biosphere cont'd

- The biosphere is a narrow zone on the surface of the earth where soil, water and air combine to sustain life. Life can only occur in this zone. From fungi and bacteria to large animals, there are several different types of life.
- The biosphere is characterized as an area that contains all living organisms and the products of their activities.
- As a result, it plays a critical role in the maintenance of ecosystems for the existence of species and their reciprocal interactions.
- It is also critical for climate regulation. (https://byjus.com/chemistry/what-is-biosphere/)

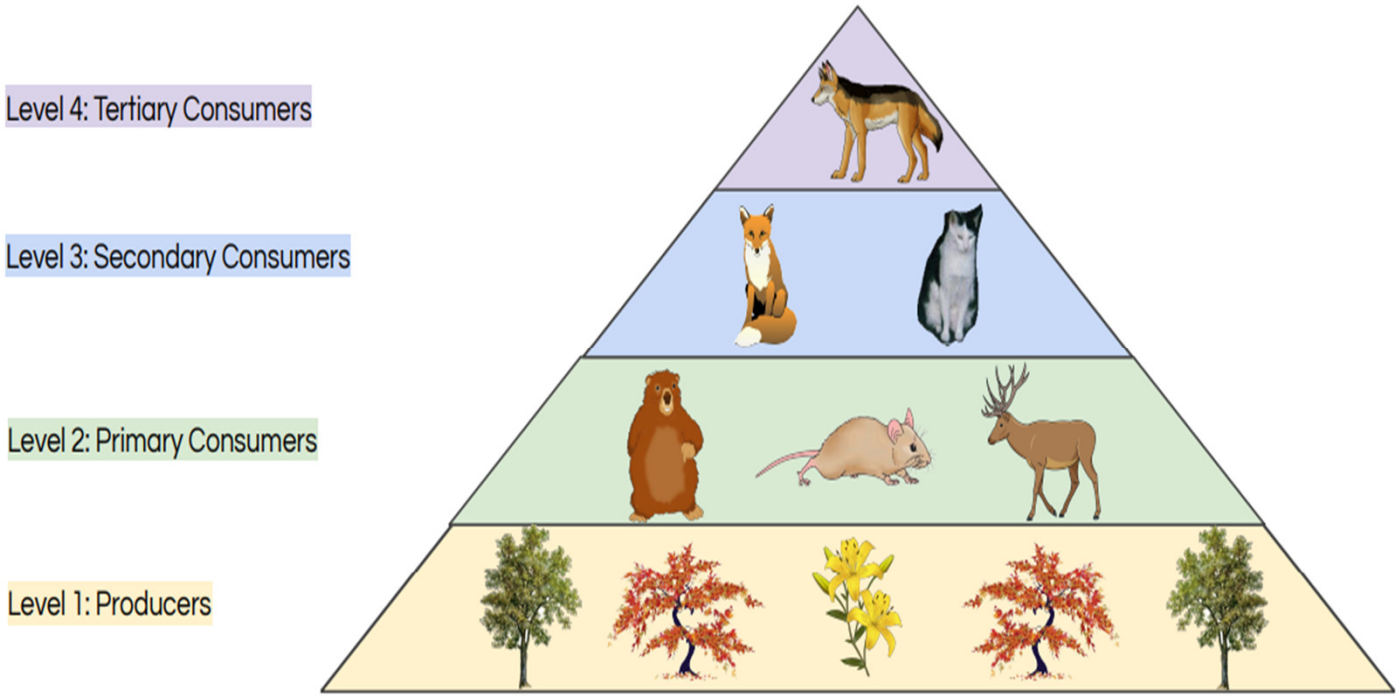
# 4.2.1 Locating the Biosphere

- It is all about life in all region of earth Including the outer region of the earth (the lithosphere) and the lower region of the atmosphere (the troposphere).
- It also includes the hydrosphere; the region of lakes, oceans, streams, ice and clouds comprising the earth's water resources.
- It is considered to extend from the bottom of the oceans to the highest mountain tops, a layer with an average thickness of about 20 kilometres.
- Scientists now know that some forms of microbes live at great depths, sometimes several thousand meters into the earth's crust.

# 4.2.2 Importance of Biosphere

- It makes our planet to be the only planet with life, thus making it so special.
- It provides the balance and interconnectivity of the planet (the environment of Earth).
- It is divided into biomes with distinct climates, soil, vegetation and wildlife.
- The species are from individual, population, community, ecosystem, biome to Biosphere, this including humans and all organic matter that has not yet decomposed making all living things important and useful to each other.
- It facilitates a study of the interaction between living things ( which can or can not be seen by human eye) in their environment in terms of producers, consumers, decomposers.

# 4.2.2 Importance of Biosphere cont'd




(https://www.cmu.edu/gelfand/gelfand-outreach/go-documents/updated-biospheres-handouts-with-answer-sheets.pdf)

# 4.2.3 The Earth System interacts with the Biosphere

- Dynamic interactions occur between the biotic region (biosphere) and the abiotic regions (atmosphere, lithosphere and hydrosphere) of the earth.
- Energy, water, gases and nutrients are exchanged between the regions on various spatial and time scales depend upon and altered by, the environments of the regions.
- Chemical processes of early life on earth (photosynthesis, respiration, carbonate formation) transformed the reducing ancient atmosphere into the oxidizing (free oxygen) environment of today.
- All those kind of interactions are to maintain the planet equilibrium for better environmental management and sustainable development. (https://eartheclipse.com/science/geography/4-different-spheres-of-earth.html)

# 4.2.3 The Earth System interacts with the Biosphere cont'd

**Atmosphere:** The temperature of the Atmosphere close to the surface and precipitation determine the areas that different species contained within the Biosphere can survive and successfully thrive.

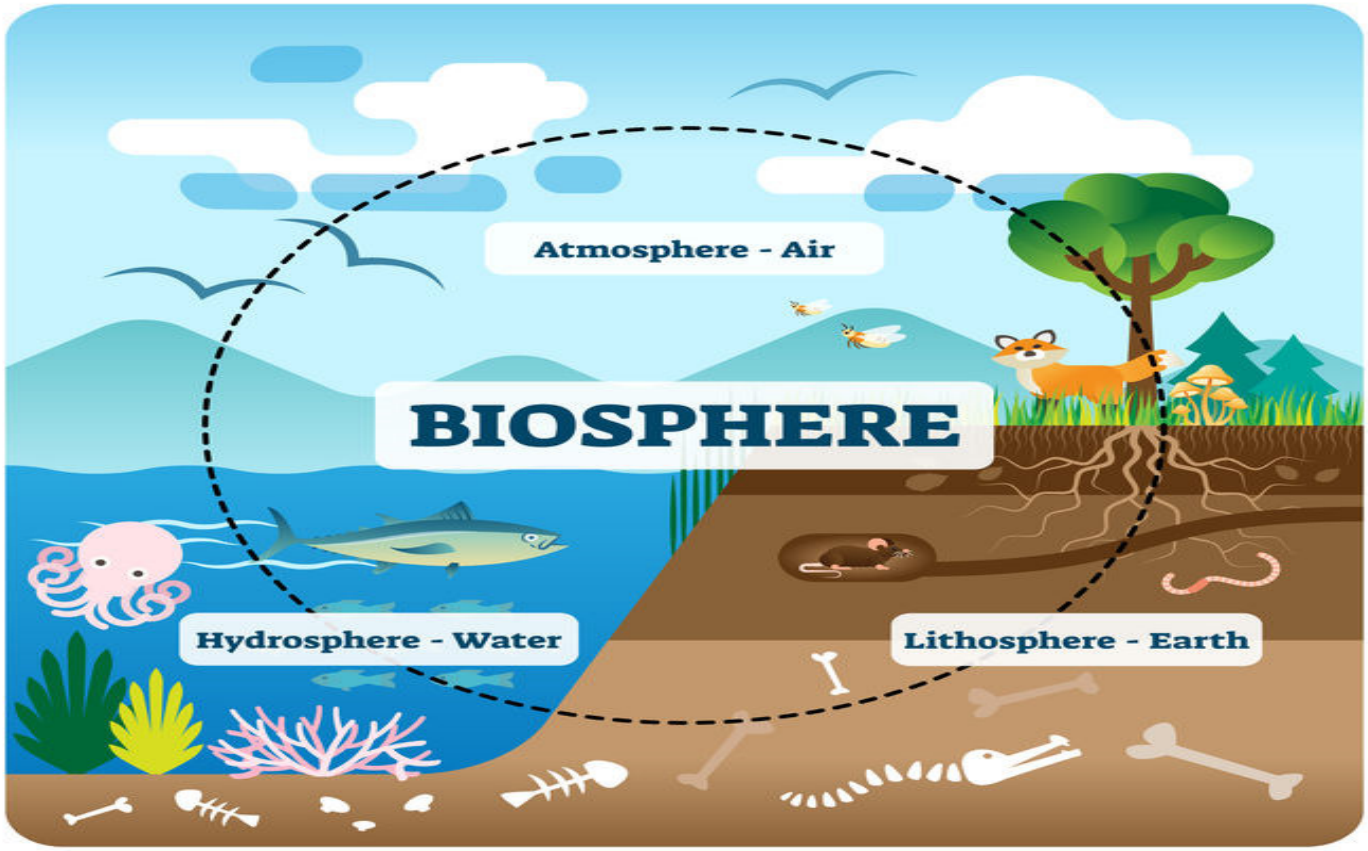
**Hydrosphere:** The Hydrosphere is an important medium for life, and a habitat for many species within the Biosphere. Dissolved nutrients and oxygen in the hydrosphere support the well-being of species within the Biosphere.

**Geosphere:** Plate tectonics continually change the global distribution of habitats for life in the Biosphere on long time scales. Volcanic islands and seamounts provide important habitats for coral and sea birds.

**Cryosphere:** The Cryosphere provides a habitat for many different living organisms. Also, many plants and animals depend upon the melting snow and ice during the spring and summer months for fresh water.

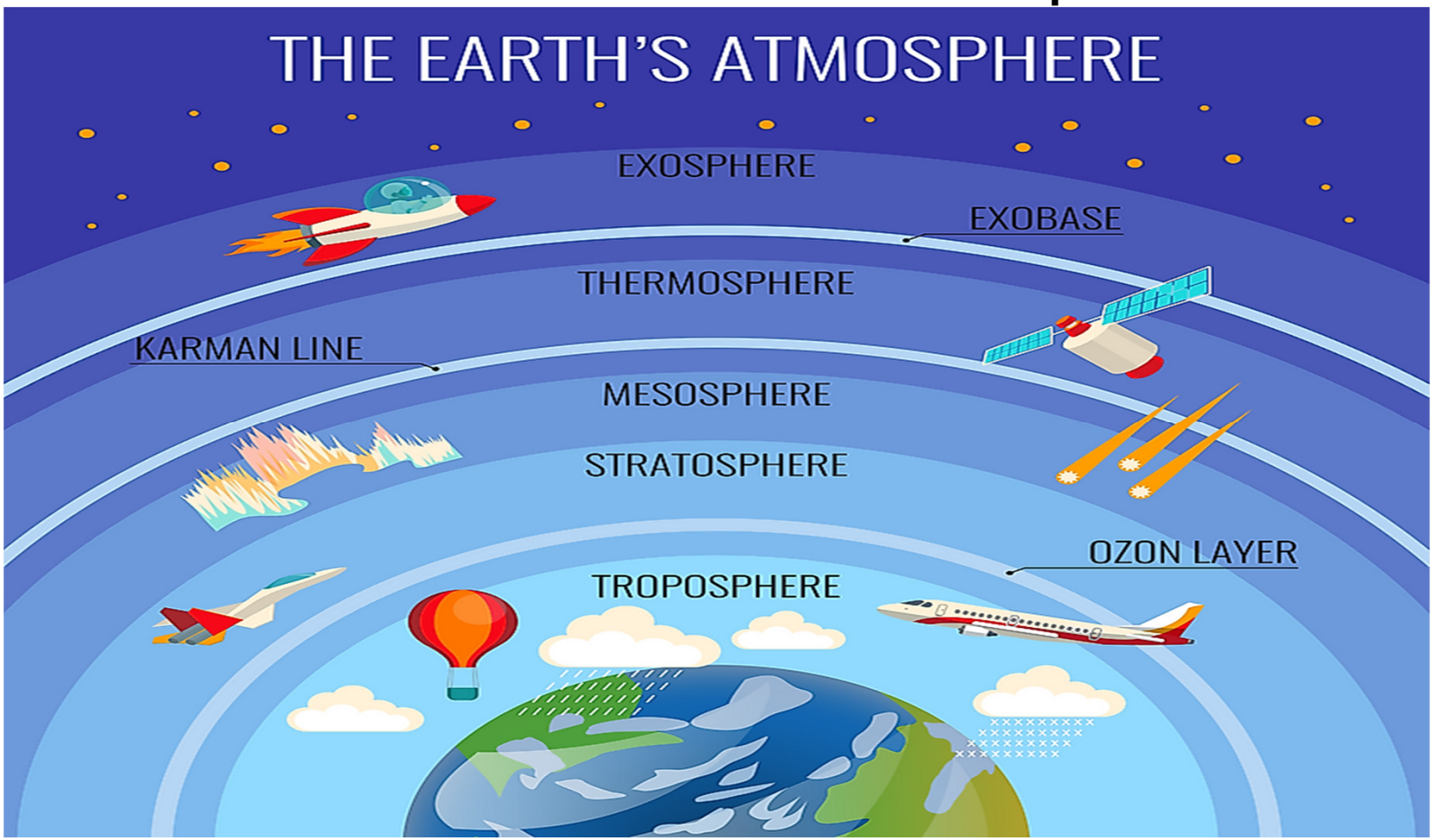
(https://mynasadata.larc.nasa.gov/basic-page/about-biosphere)

# 4.3 Earth elements' relationship



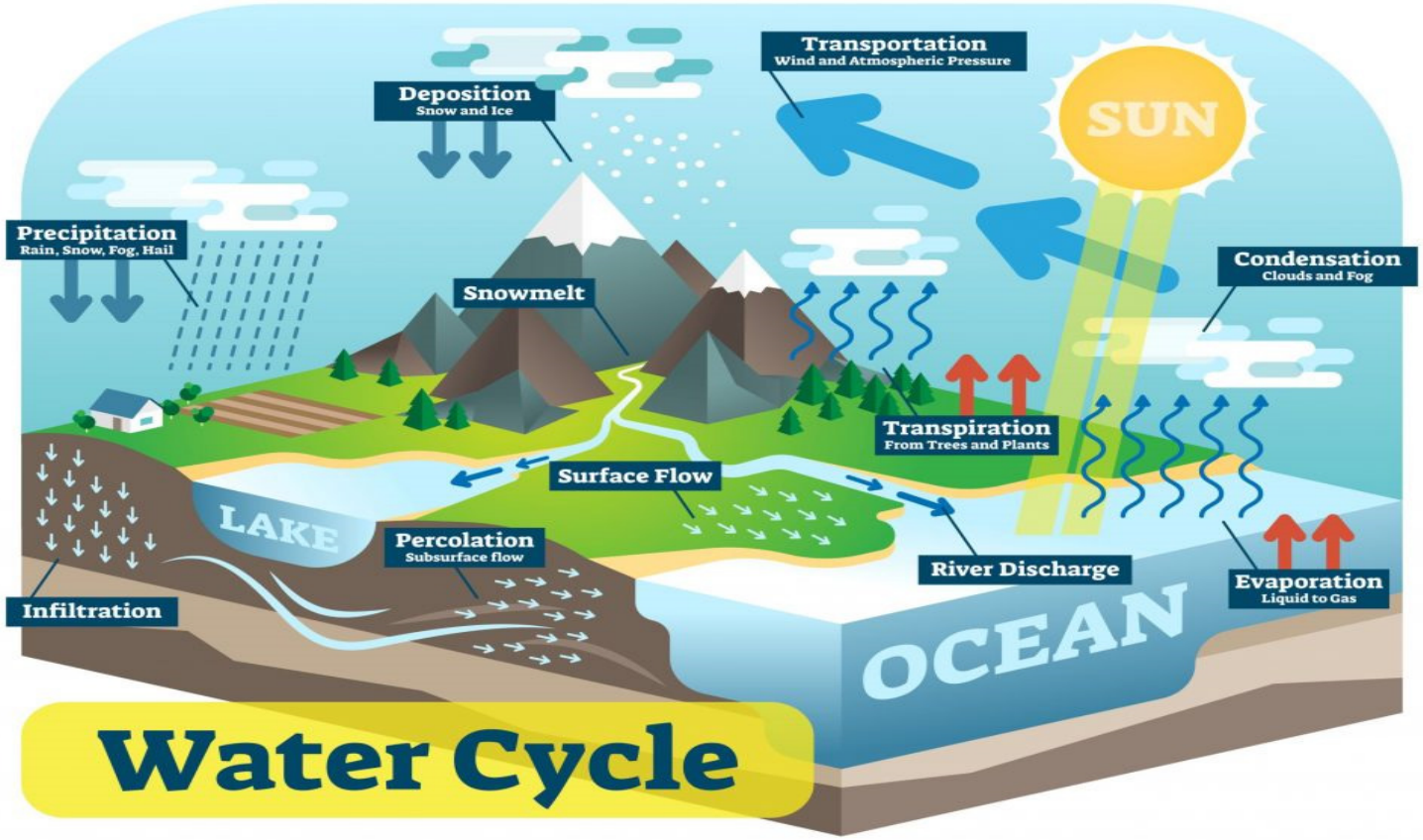

(https://www.australianenvironmentaleducation.com.au/education-resources/what-is-the-biosphere/)

# 4.3 Earth elements' relationship cont'd




(https://www.worldatlas.com/geography/the-four-spheres-of-the-earth.html)

# 4.3 Earth elements' relationship cont'd

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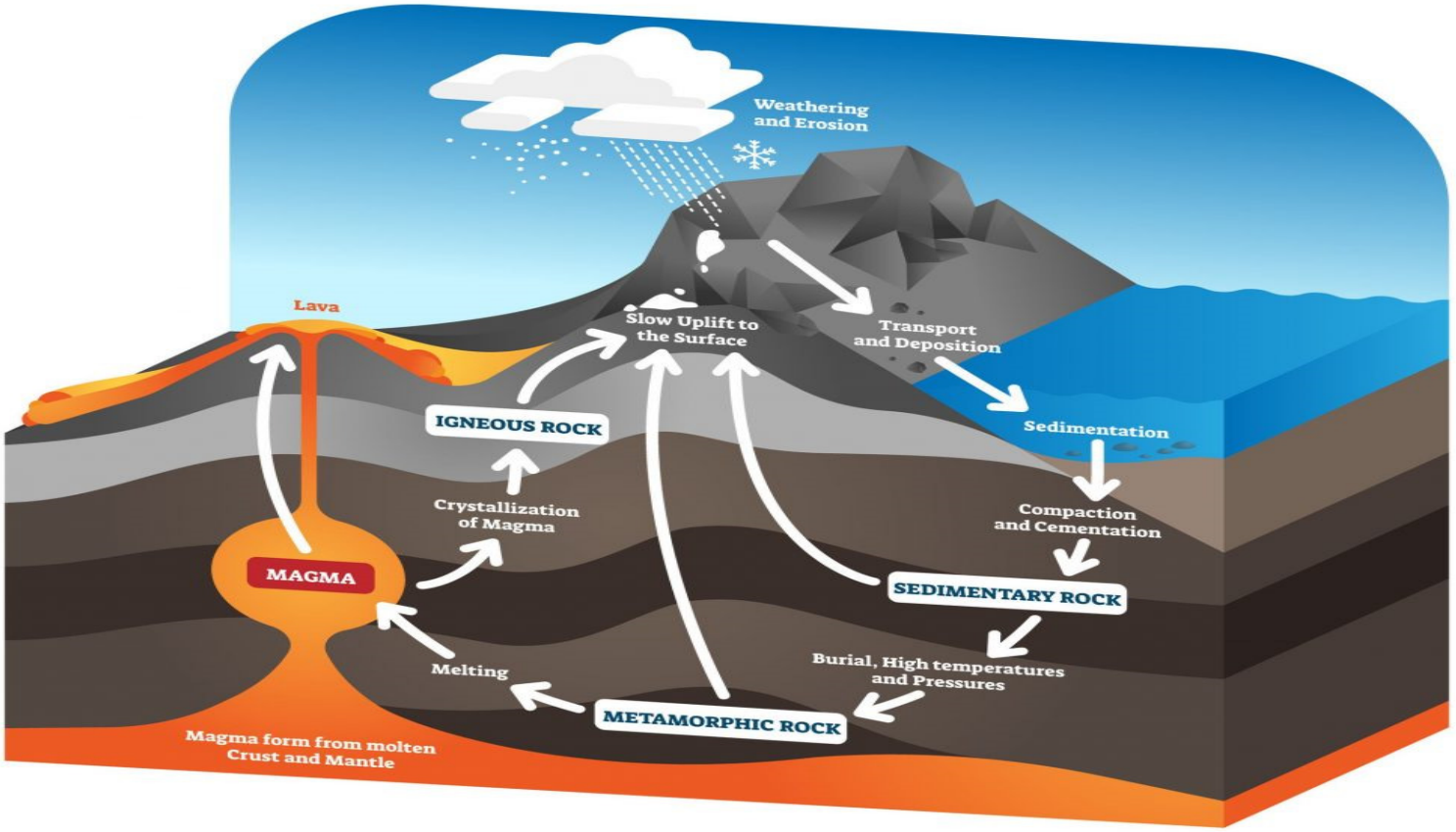
# 4.3 Earth elements' relationship cont'd




(https://www.australianenvironmentaleducation.com.au/education-resources/what-is-the-biosphere/)

# Summary

- Biosphere provides the ecosystem that is needed for survival. Adaptation to the biosphere's climate is expected for living organisms. Biodiversity thrives within ecosystems, and the biosphere is a reliable source of food on Earth. Biodiversity is just what it sounds like biological variety.

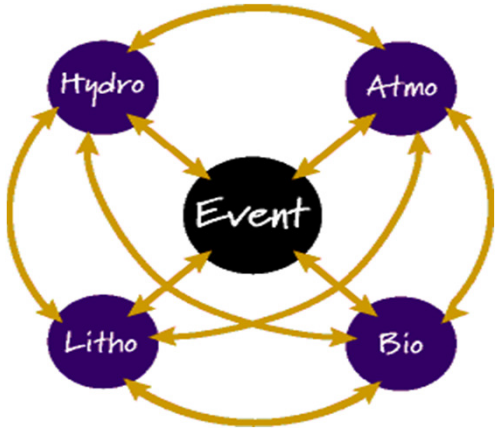
- Safe areas for the protection of plants and animals are known as biosphere reserves.  It functions as the planet's life support system, assisting in the control of atmospheric composition, soil health, and the hydrological (water) cycle. (https://byjus.com/chemistry/what-is-biosphere/)

- Environmental science studies the interactions between the physical, chemical, and biological components of the environment, including their effects on all types of organisms

# Summary cont'd

- Earth science (also known as geoscience), is an inclusive term for all sciences related to Earth (geology, meteorology, oceanography, etc). Although environmental and earth science cover essentially the same material, environmental science places greater emphasis on the biological realm, while earth science places greater emphasis on the physical realm.

- Environmental and earth science study the interactions of four major systems or "spheres"




(http://www.csun.edu/science/books/sourcebook/chapters/8-organizing/files/earth-systems-interactions.html)

# Summary cont'd

- Volcanoes (an event in the geosphere) release a large amount of particulate matter into the atmosphere.
- These particles serve as nuclei forming water droplets (hydrosphere).
- Rainfall (hydrosphere) often increases following an eruption, stimulating plant growth (biosphere).
- Particulate matter in the air (atmosphere) falls out, initially smothering plants (biosphere), but ultimately enriching the soil (geosphere) and thereby stimulating plant growth (biosphere).

# Summary cont'd

- Interactions Between Spheres: The interoperability of Earth's spheres is a remarkable dance of interconnected processes.
- The lithosphere; solid ground beneath our feet, interacting with the hydrosphere; the vast expanse of water covering our planet. Rivers carve through mountains, shaping valleys and canyons. Sediments from eroded rocks find their way into oceans, where they influence  marine ecosystems.
- The atmosphere; balance of gases, plays a crucial role in the interplay. Winds carry moisture from oceans to land, creating weather patterns that impact both the lithosphere and the biosphere. Volcanic eruptions release gases into the atmosphere, affecting climate and life. These interactions are not isolated; they weave together, shaping Earth's dynamic processes.

# Summary cont'd

- Life's influence on Earth's Spheres: The biosphere, teeming with life, profoundly influences other spheres. Plants, through photosynthesis, absorb carbon dioxide from the atmosphere, releasing oxygen. Forests stabilize soil, preventing erosion. Animals migrate across continents, connecting ecosystems. Microorganisms break down organic matter, enriching soil. The lithosphere provides habitats for diverse organisms. Mountain's harbours unique flora and fauna, while fertile plains sustain agriculture.
- The hydrosphere supports aquatic life in all forms. All these interactions create a delicate balance. Understanding this interoperability is essential for environmental stewardship and ensuring a harmonious coexistence between Earth's spheres.

Thank you for your good attention

Q&A

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