

PHYSICAL GEOGRAPHY P250/1

The topics covered in this paper include:

- Introduction to physical Geography
- Structure of the earth
- Origin of continents and ocean basins
- Map work
- Photograph interpretation
- Rocks
- Weathering and slope development
- Mass wasting
- Tectonism
- Glaciation
- Lakes
- Vegetation
- Climatology and meteorology
- River systems and resultant landforms
- Soils
- Coastal geomorphology

1. INTRODUCTION TO PHYSICAL GEOGRAPHY AT ADVANCED LEVEL

Physical Geography is one of the several branches of geography that specifically focuses on the study and understanding of the natural phenomena on and within the earth.

Physical Geography involves:

- ❖ Studying the Geomorphic processes that shape the Earth's landscape
- ❖ Studies about water bodies such as Oceans, lakes and rivers
- ❖ Studies about soils, plants and animals (biogeography)
- ❖ Studies about the atmospheric phenomena of weather and climate

Geomorphology, a component of physical geography, is the scientific study of the Earth's landforms.

Landforms are the result of Geomorphic processes shaping the rocks of the earth. It is descriptive as well as explanatory.

It seeks to account for the origin and development of landforms.

The processes that shape the landforms are known as **Geomorphic processes**

Geomorphic processes fall into two main groups, namely;

- a. Internal or endogenetic processes and,
- b. External or exogenetic processes

Internal or endogenetic processes are initiated (originate) from the Earth's interior. They are brought about by geochemical reactions associated with radioactivity. These processes are vulcanicity, faulting, warping and folding.

External or exogenetic processes are activities which occur or operate on the surface of the earth. The fundamental cause of operation of exogenetic processes is potential energy arising from the height of material above sea level, solar energy coupled with gravity effect. The major exogenetic processes are weathering, mass wasting, erosion and deposition.

Exogenetic processes lead to **Denudation or degradation** and **Deposition or aggradation**

Denudation is the destruction of the landscape by the work of weathering, mass wasting and erosion.

Erosion is the wearing away of the land by the natural agents of Rivers, waves, tidal currents, glaciers, ice sheets and wind.

- The same agents act as a means of transport for the removal of the eroded materials.

Denudation therefore causes gradual wearing down of the earth's crust which ultimately lowers the surface resulting into formation of a range of landforms.

Deposition or aggradation is the laying down of transported materials by rivers, waves, tidal currents, glaciers, ice sheets and wind.

It leads to evolution of a whole range of depositional landforms.

N.B. While weathering, mass wasting and erosion are destructive, deposition is constructive

2. THE STRUCTURE OF THE EARTH

The Earth

The earth is the third planet from the sun, and the only astronomical object to support life. It's wrapped in an envelope of air called the atmosphere. It spins around as it travels through space.

The earth and the heavenly bodies make the universe, the home of man.

The shape of the earth

The shape of the earth is called oblate spheroid/ovoid/geoid due to being an imperfect sphere by being wide at the equator and flat at the poles.

The earth is flattened at the north pole and the south. It is enlarged at the position of the equator and becomes smaller as one moves towards the poles. The earth is not perfectly round/spherical. Therefore, the true shape of the earth is an **oblate**

spheroid or a geoid.

The enlargement/bulging of the earth at the equator is caused by its rotation.

Proofs/evidences that the earth  is spherical

- a. All the planets are spherical so the earth being one of them is also spherical
- b. Aerial Photographs, photographs taken by satellites at great distances from the earth all show that the Earth's surface is curved.
- c. The moon's eclipse, when there is an eclipse of the moon the shadow of the earth cast on the moon is always round.
- d. Circumnavigation of the earth, if one moves towards the east by land, sea or air in a straight line he will end up where he started.
- e. Sunrise and sunset, places in the east see the sun before (earlier than) places in the west because the earth rotates from west to east. If the earth were flat, all places would see the sun at the same time. I.e all places would have sunrise at the same time, and all would sunset at the same time.
- f. The Earth's curved horizon, the Earth's horizon appears curved when observed from a tower, ship, plane or high cliff. The curved horizon widens as the observer's altitude increases until it becomes circular.
- g. A ship's visibility, when a ship is approaching the smoke is seen first, then the mast and finally the whole ship.
- h. Surveying with poles on level ground, poles of equal length when driven into level land, at equal intervals, don't give a perfect level. The center pole usually projects above the level of the poles at either end. This is caused by the curvature of the earth. If the earth were flat, the tops of all the poles would lie at the same line of sight.

The Origin of the earth 

According to the latest scientific evidence, the age of the universe is put at 15 billion years. The origin of the earth can be explained basing on two major groups of theories. It is suggested that the earth and the universe came into existence as a result of sudden and catastrophic events as well as gradual

events

Under the gradual theories we have:

i) Thales theory

ii) Emmanuel Kant's theory

The theories under the sudden and catastrophic events include:

i) Big bang theory

ii) Biblical theory

EMMANUEL KANT'S THEORY

He came out with the theory in 155BC and this theory is based on scientific research. According to the theory it is suggested that the earth was formed from the ring of hot gases that detached themselves from a mass of gas (sun). According to Kant each of the rings of hot gases moved away from the sources and gradually condensed to form the planet earth at the center.

THALES THEORY

This was the first person to put the theory about the origin of the earth based on observation and traditional beliefs. He lived at the delta between 624 – 565 BC.

According to him, water was the source of the earth. While in the Nile delta he observed that deposition of silt from the Nile led to the outward development of the delta and this drove him to such a conclusion. However, Thales never explained the sources of the silt that led to delta development.

BIG BANG THEORY

This was advanced by Lemaitre in 1927. According to the theory there was nothing and out of nothingness a big bang explosion occurred i.e. the big bang matter came into existence and the matter began expanding to form the earth. However, the doubtful fact about the theory is how nothing can explode to form the universe.

BIBLICAL THEORY

This is based on the book of Genesis and it suggests that the earth was created

by God who created it out of nothing but a mere command “let there be and it was.” However scientists disagree with the theory and they base their argument on rock dating. Basing on rock dating the earth is estimated to be at least 12 billion years old.

Qn. Explain the origin of the earth or Account for the formation of the earth.

Approach: Define the earth,

Explain the origins while giving the theories.

THE STRUCTURE OF THE EARTH

The earth is composed of three major parts i.e.

- i) The crust
- ii) Mantle
- iii) Core

CRUST

This is the outer shell of the earth consisting of three main elements distinguished by their being in three different physical States.

The **atmosphere** or gaseous portion consists of a mixture of various types of gases of which the dominant ones are nitrogen and oxygen.

The **hydrosphere** or liquid part is dominated by the ocean water although a small portion is on land in form of lakes and rivers.

The **lithosphere** or solid part consists of rocks that make up the continents and bed of oceans.

N.B the lithosphere consists of Earth's crust and upper mantle

Crust varies in thickness. The two types of crust are continental crust and Oceanic crust.

Continental crust is made up of mainly granitic rocks with a relatively low density containing a large proportion of Silica (Si) and aluminum (Al). They are therefore known by a group name of **Sial**. This layer Sial varies in thickness. On continents the layer can be extremely thick but over ocean floors especially the Pacific the layer can be thin or even wholly absent in some sections.

Beneath the sial, lies **Oceanic crust**, a layer of denser rocks consisting mainly of silica (Si) and magnesium (Mg) and are therefore collectively known by the group name of **Sima**. These mainly form ocean floors.

Sial and Sima collectively form the earth's crust.

MANTLE

This is a region of heavy rocks that are rich in silicates i.e. Ferromagnesian – silicate minerals. The region is very hot with temperatures reaching 5000 °C and this has made the mantle to be in a semi liquid form (molten form). The molten rocks generate convective currents which result into crustal disturbances such as earth quakes. The mantle has a depth of about 2900 km.

There is a discontinuity between the rocks of the mantle and those of the crust. The boundary surface where there is a change in physical properties of rocks is known as **Mohorovicic (Moho) discontinuity**.

The mantle is divided into two parts (i.e. the upper and lower mantle) by a layer of less rigid and more plastic rocks which are hot, weak and almost molten known as **asthenosphere**.

Lithosphere is broadly used to refer to the crust (sial and sima) and upper mantle.

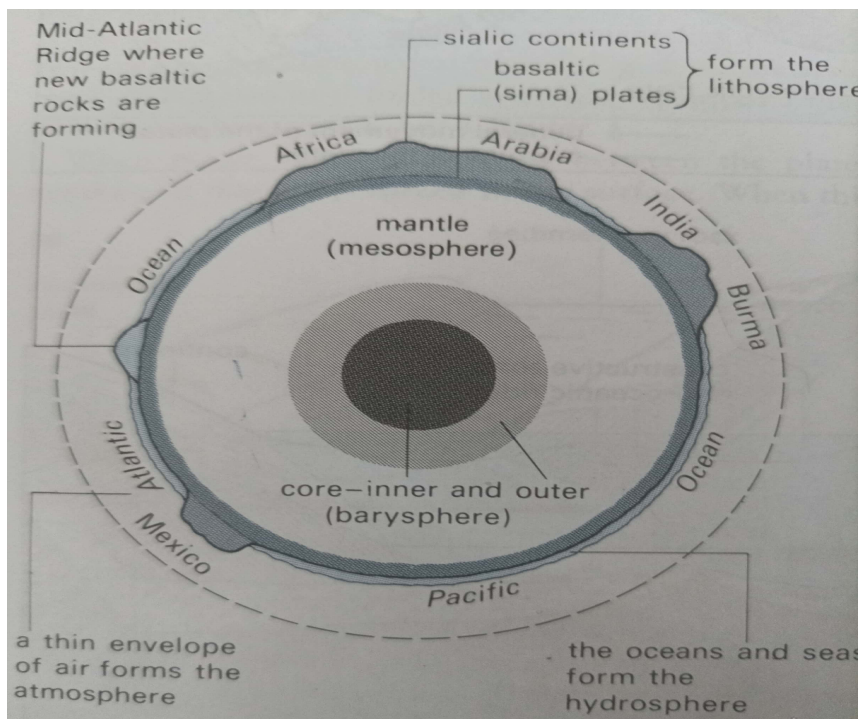
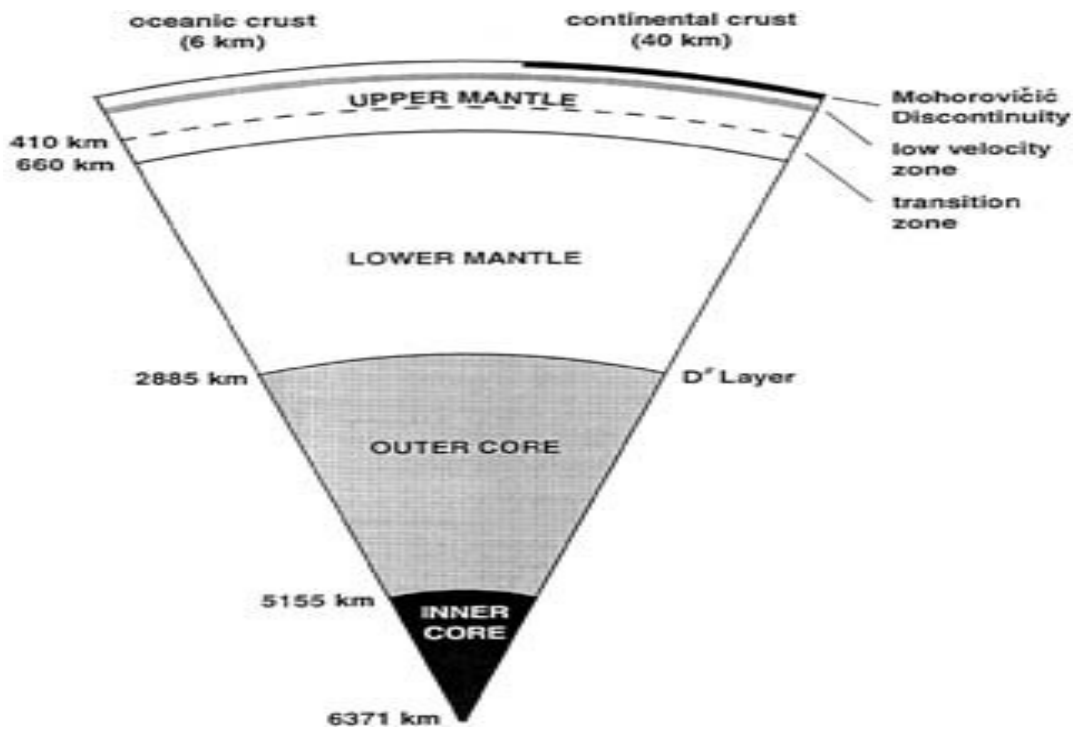
THE CORE

Beneath the mantle lies the core which is subdivided into two layers, the **outer core** and the **inner core**. The outer core is believed to be liquid while the inner core is said to be totally solid.

In general, the core is a region of extremely high temperatures. The dominant rocks comprise Nickel and Iron (NiFe). The depth from surface of the earth to the inner core is estimated to be about 6370 km.

The core is separated from the mantle by a boundary surface known as the **Gutenberg discontinuity**.

ILLUSTRATION OF THE STRUCTURE OF THE EARTH



3. ORIGIN OF CONTINENTS AND OCEAN BASINS

Before the 19th people believed that continents and ocean basins always remained fixed in the positions they occupy i.e. suggesting that no movements have taken place.

However, people like Francis Bacon in 1620 and Antonio Snider in 1858 had already started arguments about the possibility of continents having changed positions.

Bacon was impressed by the parallelism of the coast of Africa and South America and suggested that they may have been joined together.

Antonio showed on maps how Africa and South America might once have been joined together but then split and moved away from each other to form the Atlantic ocean.

The concept of Continental Drift

Continental Drift is the movement of the Earth's continents relative to each other. (i.e towards each other, away from each other or alongside each other)

The Earth's surface is made up of Continents and Ocean basins. The continents are Asia, Africa, Europe, Americas, Australia, Antarctica while the major Oceans are Pacific, Atlantic, Indian and the seas include Mediterranean, Red, North sea, Norwegian, Tasman, South China sea.

Several theories have been advanced to explain the origins of these continents and Ocean basins. These collectively fall under continental drift. They include

1. Expanding earth theory
2. Taylor's theory of continental drifting
3. Wegner's theory of continental drift
4. The sea floor spreading theory
5. The plate tectonic theory.