B.Sc. Part I Paper II A

Concept of Biosphere (Lithosphere, Hydrosphere and Atmosphere) (Part-I)

Biosphere is the life supporting environment of Earth - Each and Every living organism has its specific surrounding, medium / environment to which it continuously interacts and remains fully adapted. The biosphere is composed of following three chief media - air, water and soil, which are the components of three major sub-divisions of the biosphere - atmosphere, hydrosphere and Lithosphere. These medias are not completely isolated from each other, however, some of the atmospheric gases are dissolved in all natural water and some moisture is present almost everywhere in the atmosphere.

A Lithosphere - The solid Component of Earth is called Lithosphere. The Lithosphere is multilayered and is divided into three sub-layers - Crust, Mantle & Core. The Core is the central fluid or vaporised sphere having diameter of about 2500 Kms.

from the Centre and is probably composed of Nickel-Iron. The mantle extends about 2900 kms above the core. This is in molten state. The outermost solid zone of the earth is called crust which is about 8 to 40 kms above the mantle. The Crust is very complex and its surface is covered with soil supporting rich and varied biological Communities for living organisms. As the soil, the upper layer of Lithosphere, only supports life, so, we mainly study soil and its formation. The soil is the loose, friable, unconsolidated top layer of earth crust which is the site of decomposition of organic matter and mineral materials and is the crossroad of terrestrial communities. It provides mechanical anchorage to plant, besides serving as a reservoir of food materials and water. It is the site where nutrients elements are brought into biological circulation by mineral weathering. The soil harbours the bacteria which incorporate atmospheric nitrogen into the soil.

<u>Soil formation</u> or <u>Pedogenesis</u> involves mixing inorganic and organic materials in stratified quantity, both of which are decomposition products. The mineral

constituent of soil are derived from some parent rock by fragmentation or weathering, while, organic component of soil are formed either by decomposition of dead remains of plants or animals or through metabolic activities of living organisms present in the soil. Basically, there are three kinds of soil forming rocks - Igneous rocks, sedimentary rocks and metamorphic rocks.

I Igneous rocks are formed by cooling of molten magma. There are again of three types - Granite, Diorite and Basalt.

1. Granite - is usually light in colour, coarse to medium grain. The principle minerals of soil-forming rocks are - Quartz, Feldspar, mica, amphibole, Iron oxides.
2. Diorite - Gray to dark in colour, coarse to medium grain, mainly contains Feldspar, amphibole, Iron oxide, biotite.
3. Basalt - dark to black in colour, dense to fine grain. contains Feldspar, Pyroxene, Iron Oxide, biotite..

II Sedimentary rocks - are formed by decomposition of weathered minerals which derived from igneous rocks. It is again of three types - a. Shales - Light to dark in colour, thinly laminated. e.g It contains clay, mineral, quartz.

b. Sandstone - Light to red in colour, granular

and porous. Principle minerals forming Sandstone are Quartz, clay, minerals, iron oxides, Calcium Carbonates.

c. Limestone — These are light, grey, red, brown or black in colour, fine grained and compact. The principle minerals forming these are calcite, dolomite, iron oxides, clay, minerals etc.

III. Metamorphic Rocks — This is formed by change in Pre-existing rock e.g. igneous or sedimentary rock through heat and pressure. There are again of three types — a. Gneiss - formed from rocks with light and dark bands. Principle minerals are Quartz, Felspar, mica, Iron oxides.

b. Schist - formed from rocks with foliated structure. Principle minerals of soil forming rocks are — clay, — Felspar, Iron oxide, biotite, quartz.

c. Slate - These are grey to black in colour, compact and uniform texture. It has similar composition as it is formed from shale.

d. Quartzite — These are light to brown in colour, compact and uniform texture. It has similar composition to sandstone from which it is formed.

e. Marble — This is light, red, green or black in colours, compact, fine to coarse texture. Formed from calcite, dolomite as in limestone.

Soil Profile - It is the term used for the vertical section of earth crust generally upto the depth of 6ft or upto the parent material to show different layers or horizons of soil for the study of soil in it undisturbed state. It is made up of a succession of horizontal layers called Horizons, which has different thickness, colour, texture, structure, cracking, porosity, acidity and composition.

In general, soils have four Horizons - Organic or O Horizon and three mineral (A, B, C) horizons. R horizon is the consolidated bed rock or which a soil profile rests. A and B horizon forms the true soil or solum.

(i) O-horizon - The O-horizon, once designated as L.F.H. or is the surface layer forming above the mineral layers and composed of fresh or partially decomposed organic material as found in temperate forest soils. It is usually absent in cultivated soil, O-horizon contains both kinds of humus and is subjected to the greatest changes in soil temperature and moisture condition. It contains most organic carbon. [illegible] and upper part of A-horizon

is the region where life is most abundant.

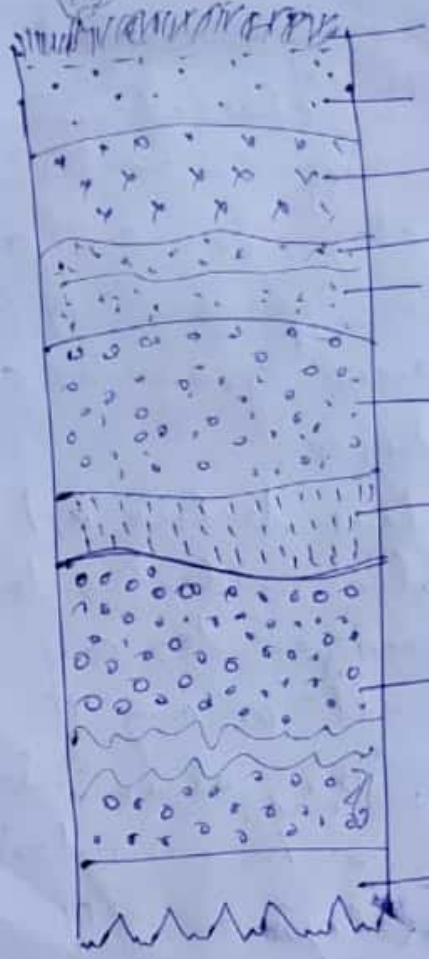
(ii) A-horizon - It is characterised by major organic matter accumulation by the loss of clay, iron and aluminium and by the development of organo-mineral complexes, granular crumbs or platy structures.

(iii) B-horizon - It lies below a A horizon and also called sub-soil. It is characterized by an illuvial concentration of all or any of the silicates, clay, iron, aluminium and humus, alone or in combination and by the development of blocky, prismatic or columnar structure.

(iv) C-horizon - Below B-horizon and above the surface of weathered parent rock, is the zone of regolith or C-horizon. It is a light coloured horizon containing weathered parent material.

(v) R-horizon - Below all three horizons may lie the R-horizon, which is the region of consolidated rock.

Soil formation is started by disintegration or weathering of parent rocks by some physical, chemical and biological agents because of which



A generalized profile of soil

The soil forming rocks are broken down in small particles called regoliths. Regoliths are basic material which under the influence of various other pedogenic process finally develop into mature soil. The process of weathering may be physical, chemical or biological. The physical weathering agent are climatic in character, while chemical weathering includes chemical decomposition or chemical transformation. Activities of a no. of organisms like bacteria, fungi, worms etc transform regoliths into soil.

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