Rocks & Soils

ROCKS

- Lithosphere is the upper most and significant Layer of the earth.
- It is composed of solid Rocks and unconsolidated materials.
- The Literal meaning of lithosphere is "The sphere of rock".
- The rocks are the solid mineral materials forming a part of the surface of the earth and other similar planets.
- The earth's crust (Lithosphere) is Composed of rocks.
- A rock is an aggregate of one or more minerals.
- Rock is an important natural Resource and is found in solid state.
- It may be Hard or soft in nature.
- An estimation reveals that there are 2,000 different types of minerals found on the earth surface out of which only 8 basic Minerals commonly found all over the earth.
- Minerals are chemical substances which exist in nature.
- They may occur either in the form of Elements or compounds.

Classification of Rocks:

- According to the mode of formation the Rocks are classified into three types as follows.
    - Igneous Rocks
    - Sedimentary Rocks and
    - Metamorphic Rock

Igneous Rocks:

- The igneous rocks are formed by the Solidification of molten Magma.
- These rocks are also called as the 'Primary Rocks' or 'Parent Rocks' as all other rocks are formed from these rocks.

Characteristics of Igneous Rocks:

- These rocks are hard in nature
- These are impermeable
- They do not contain fossils
- They are associated with the volcanic Activities

- These rocks are useful for construction Works

Types of Igneous Rocks Igneous Rocks are of two types. They are:

- Extrusive Igneous Rocks
- Intrusive Igneous Rocks

Extrusive Igneous Rocks:

- The lava comes out from a volcano.
- Lava is actually a fiery red molten Magma comes out from the interior of the earth on its surface.
- After reaching the earth Surface the molten materials get solidified and form rocks.
- Rocks formed in such a way on the crust are called Extrusive igneous Rocks.
- These rocks are fine grained and glassy in nature due to rapid solidification.
- Basalt Found in the north western part of peninsular India is the example for this type of rock.

Intrusive Igneous Rocks:

- The molten magma sometimes cools down Deep inside the earth's crust and becomes solid.
- The rock formed this way is called 'Intrusive Igneous Rocks'.
- Since the cool down slowly and Form crystals.
- Hence they are called 'crystalline Rocks'.
- Intrusive Igneous rocks are two types. They are,
    - Plutonic rocks
    - Hypabysal rocks.
- The deep seated rocks are called 'Plutonic rocks' and the ones formed at shallow depths are called 'Hypabysal rocks'.
- Granite, Diorite and Gabbro Are the example of plutonic rocks and dolerite is an example of hypabysal rocks.
- **Some major Active Volcanoes:** Mount Vesuvius, Mt. Stromboli and Mt. Etna in Italy and Mauna Loa and Mauna Kea in Hawaii Islands.

Sedimentary Rocks:

- The word 'Sedimentary' has been derived from Latin word 'Sedimentum' Means settling Down.
- The Sedimentary Rocks are formed by the sediments derived and deposited by various agents.
- Due to high Temperature and pressure, the undisturbed Sediments of long period cemented to form Sedimentary rocks.
- Sedimentary rocks Consist of many layers which were formed by the sediments deposited at different periods.
- As it consists of many strata, it is also known as 'Stratified rocks.
- Sedimentary rocks are the important source of Natural resources like coal, oil and natural gas.

Characteristics of Sedimentary Rocks:

- They have many layers.
- They are non-crystalline rocks.
- They contain fossils.
- They are soft and get eroded easily

Types of Sedimentary Rocks

1. **Organic Sedimentary Rocks**
    - These rocks are formed as a result of the Decomposition of dead plants and animals.
    - It Contains fossils.
    - Chalk, Talc, Dolomite and Limestone rocks are of this category.
2. **Mechanical Sedimentary Rocks**
    - These rocks are formed due to the Disintegration of igneous and metamorphic Rocks.
    - The natural agents erode and transport these rocks and deposit them at some places.
    - After a long period of time, they cemented to Form rocks.
    - Sandstone, Shale and Clay are the Examples of rocks of this type.

3. Chemical Sedimentary rocks

- These are formed by precipitating of Minerals from water.
- It is formed usually through evaporation of chemical rich solutions.
- These rocks are also called as evaporates.
- Gypsum is an example of this kind.

Metamorphic Rocks:

- The word Metamorphic is derived from two Greek words "Meta" and "Morpha", Meta Means change and Morpha means shape.
- When Igneous and sedimentary rocks subject to high temperature and pressure, the original Rocks get altered to form a new kind of rock Called metamorphic rocks.
- Metamorphism is of two types. They are
    1. **Thermal Metamorphism**
    2. **Dynamic Metamorphism**
- If the change in the rocks is mainly caused by high temperature, the process is called as 'Thermal Metamorphism'.
- If the change in the rock is mainly caused by high pressure, the process is called as 'Dynamic Metamorphism'.

Formation of Metamorphic Rocks from Igneous rocks:

- Granite into gneiss caused by dynamic Metamorphism.
- Basalt into slate caused by thermal Metamorphism.

Formation of Metamorphic Rocks from Sedimentary rocks:

- Sandstone into quartz caused by thermal Metamorphism.
- Shale into slate caused by thermal Metamorphism.

Characteristics of Metamorphic Rocks:

- Metamorphic rocks are mostly crystalline in nature.
- They consist of alternate bands of light and dark minerals.

Rock cycle:

- Igneous rocks are the primary rocks Formed first on the earth.
- These rocks are weathered, eroded, transported and deposited at some places to form sedimentary rocks.

- The Igneous and Sedimentary rocks are changed into metamorphic rocks under the influence of temperature and pressure.
- The Metamorphic rocks are also get disintegrated And deposited to form sedimentary rocks.
- Formation of igneous rocks takes place when there is an outflow of molten materials.
- Like this, the rocks of the earth crust keeps on Changing from one form to another form under various natural forces and agents.
- The Endless process is referred as Rock Cycle.

Uses of rocks:

- Rocks have been used by mankind throughout the history.
- Rocks are highly Valuable and important to almost all aspects of our economy.
- The minerals and metals in Rocks have been found essential to human Civilization.
- Rocks are used for many purposes in our life and some of them are given below Rocks are useful for making
    - Cement
    - Writing chalk
    - Fire
    - Building materials
    - Bath scrub
    - Kerb stone
    - Ornament
    - Roofing materials
    - Decorative materials
    - These are valuable source of minerals Such as gold, diamond, sapphire etc.

SOIL

- Soil is a mixture of organic matter, minerals, Gases, liquids and organisms that together Support life.
- Soil minerals form the basis of soil.
- It forms on the surface of the earth.
- It is known as the 'skin of the earth'.
- Soils are formed from rocks (parent material) through the processes of weathering and natural erosion.
- Water, wind, temperature change, gravity, chemical interaction, living organisms and pressure differences all help break down parent material.
- It leads to the formation of loose material.
- In course of time, they further break down into fine Particles.
- This process releases the minerals locked in the rock fragments.
- Later on, the vegetative cover which develops in that region forms humus content in the soil.
- This way the soil gets matured gradually.

Soil Composition:

- The basic components of soil are mineral, organic matter, water and air.
- It consists of about 45% mineral, 5% organic matter, 25% of water and 25% air.
- It is only a generalized Fact.
- The composition of soil varies from Place to place and time to time.

Soil profile:

- The soil profile is defined as the vertical Section of the soil from the ground surface and extends downwards.

Layers of Soil:

- **O-Horizon** or Humus this layer is dominated by organic material (leaves, needles, twigs, Moss and lichens).
- **A-Horizon** or Top Soil It is a part of top soil, composed of organic matter mixed with Mineral matter.

- **E-Horizon** or Elevated layer E-Stands for elevated layer. This layer is significantly leached of clay, Iron, and aluminum oxides, which leaves a concentration of ore
- **B-Horizon** or Sub-soil this layer reflects the chemical or physical alteration of parent Material. Thus iron, clay, aluminum and organic compounds are Found accumulated in this horizon.
- **C-Horizon** or Parent Rock Partially weathered parent material accumulates in this layer.
- **R- Horizon** Parent Rock this layer consists of unweathered part of bed rock.

Types of Soils:

- The Indian Council of Agriculture Research (ICAR) set up in 1953 divides the Soils of India into the following eight major Groups. They are
  - Alluvial soil
  - Black soils
  - Red soils
  - Laterite soils
  - Forest and mountain soils
  - Arid and desert soils
  - Saline and alkaline soils
  - Peaty and marshy soils

Alluvial Soil:

- **Khadar** – light coloured, more siliceous.
- **Bhangar** – the older alluvium composed of lime Nodules and has clayey composition. It is dark in colour.
- **Formation** – sediments deposited by streams and rivers when they slowly loose
- **Chemical properties** – rich in potash, Phosphoric acid, lime and carbon compounds but poor in nitrogen
- **Nature** –Sandy-loam-silt-clay Profile shows no marked differentiation

- **Distribution** - Ganga and Brahmaputra River valleys; Plains of Uttar Pradesh, Uttaranchal, Punjab, Haryana, West Bengal and Bihar and river Mouth of east Coast.
- **Crops growing** - Rice, Wheat, Sugarcane and Oilseeds

Black soils:

- **Formation** – Derived from basalts of Deccan Trap.
- **Colour** – black colour, due to presence of Titanium, iron.
- **Chemical properties** – Consist of calcium and Magnesium carbonates, high quantities of iron, Aluminium, lime and magnesia. Rich in potash lime, Aluminium calcium and Magnesium poor in Nitrogen Phosphoric acid and humus.
- **Nature** – Sticky when wet High degree of moisture retentivity
- **Distribution** - Maharashtra and Malwa plateaus, Kathiawar Peninsula, Telangana and Rayalaseema Region of Andhra Pradesh and Northern part of Karnataka.
- **Crops growing** - Cotton, Millets, Tobacco and Sugarcane

Red soils:

- **Formation** – decomposition of ancient Crystalline rocks like granites and gneisses and from rock type
- **Chemical properties** – rich in minerals such as Iron and magnesium. Deficient in nitrogen, humus, phosphoric acid and lime.
- **Nature** – Light texture, porous friable presence of limited soluble salts Clay fraction of the red Soils generally consists of Kaolinitic minerals.
- **Distribution** - Eastern parts of Deccan plateau, Southern states Of Kerala, Tamil Nadu, Karnataka and Chota Nagpur plateau (Jharkhand)
- **Crops growing** - Wheat, Rice, cotton, Sugarcane and Pulses

Laterite Soils:

- **Formation** – formed in the regions where alternate wet and hot dry conditions prevail. It Is formed by the process of leaching
- **Chemical properties** – Composed mainly of Hydrated oxides of iron and aluminium,

- **Nature** – More acidic on higher areas poor in High level, cannot retain moisture while plains they consist of heavy loam and clay and easily Retain moisture
- **Distribution** - Assam hills, Hill summits of Kerala and Karnataka and Eastern Ghats and region of Odisha
- **Crops growing** - Coffee, Rubber, Cashewnut and Tapioca
- **Formation** – due to mechanical weathering Caused by snow, rain, temperature variation
- **Chemical properties** – are deficient in potash, Phosphorus and lime.
- **Nature** – light, sandy, thin and found with the Pieces of rock. Their character changes with the parent rocks. Very rich in humus. Slow Decomposition makes it acidic.
- **Distribution**- Coniferous Forest Belts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim. Eastern and Western Ghats.
- **Crops growing** - Coffee, tea, rice, Maize, potato, Barley, tropical Fruits and various Types of spices.

Arid and Desert soils:

- **Formation** – Due to prevalence of the dry Climate, high temperature and accelerated Evaporation, the soil is dry, it also lacks humus Content due to the absence of vegetative cover
- **Chemical properties** – Contain high Percentages of soluble salts, alkaline with varying degree of calcium carbonate and are poor in organic matter; rich enough in Phosphate though poor in nitrogen
- **Nature** – light in colour, low humus, friable Structure, low in moisture.
- **Distribution** - Rajasthan, Northern Gujarat and southern Punjab.
- **Crops growing** - Millets, Barley, cotton, Maize and pulses (with irrigation)

Saline and Alkaline Soils:

- **Formation** – formed due to ill drainage which Causes water logging, injurious salts are transferred from subsurface to the top soil by the capillary action; it causes the salinisation of Soils.

- **Chemical properties** – liberate sodium, Magnesium and calcium salts and sulphurous Acid.
- **Nature** – Consists of an excess of sodium salts and mineral fragments which are weathering.
- **Distribution** - Andhra Pradesh and Karnataka. In the drier Parts of Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan and Maharashtra.
- **Crops growing** - Crops do not grow because Of excess Salinisation of Soils

Peaty and Marshy Soils:

- **Formation** – formed in humid regions from the
- **Organic matter** - It is found in the areas of heavy Rainfall and high humidity Peaty soils are black, Heavy and highly acidic.
- **Chemical properties** – deficient in potash and Phosphate.
- **Nature** – Contain considerable amount of Soluble salts and 10-40 per cent of organic Matter; and high proportion of vegetable matter.
- **Distribution** - Kottayam and Alappuzha Districts of Kerala; and Coastal areas of Odisha and Tamil Nadu, Sundarbans of West Bengal, In Bihar and Almora district of Uttarakhand
- **Crops growing** - Paddy, jute

Soil Erosion:

- Soil erosion is the removal or destruction of the top layer of soil by natural forces and Human activities.
- Soil erosion reduces the Fertility of soil which in turn reduces the Agricultural productivity.
- Running water and Wind are the major agents of soil erosion.
- Sheet erosion, Rill erosion and Gully erosion Are the major types of soil erosion.

Soil degradation:

- Soil degradation is an acute problem in India.
- According to a 2015 report of the Indian institute of remote sensing (IIRS).
- The estimated the amount of soil.
- erosion that occurred In India was 147 million hectares.

- The main problems of the Indian soils are
  - Soil erosion (sheet erosion, Rill erosion, Gully erosion, Ravine and Bad land)
  - Degradation of Soil,
  - Water-logging,
  - Saline and Alkaline, and
  - Salt Flats, types of soils are different erosion.

Methods of Conservation and Management of Soil:

- Afforestation
- Constructing Dams and Barrages
- Prevention of Overgrazing
- Improved methods of Agricultural practices
- Contour method, Rotation of crops, Contour bunding, Strip cropping, Planting of shelter belts, adopting the techniques of sustainable agriculture are different conservation methods for better Soil management.

Uses of soils:

- Soil is one of the important natural Resource. It is a basic requirement for plant Growth and supports various life forms on the Earth.
  - The minerals present in the soil enhance and nourishes the crops and plants.
  - It is used in making of ceramics or pottery.
  - It is a source of material for construction and handicraft works.
  - It acts as natural filter of water and purifies it.
  - Soil supports ecosystem and play an important role in land management.
- Rocks and soils are the important renewable Natural resources.
- Both of them play an important role in everyday life of human beings as well as economic development.
- Nowadays Rock-based companies are in increase which Provide employment to a sizeable population.
- Soils attract human settlement and other Economic activities.

- As India is an agricultural Country, the proper management of soil resource will lead to sustainable food production besides its use for various other purposes. So, the soil Resources must be conserved.