6 Rocks, Minerals and Soil

There are vast layers of solid and liquid matter on the Earths surface. The outer layer known as crust is made of solid matter. This layer of solid matter is known as the Lithosphere. It is made up of solid matter known as rock. Hence this outer crust is known as the Lithosphere or Rocksphere. Rocks are made of combination of different matter. Thus, rock is a combination of one or more minerals.

There are three basic types of rocks based on the process of formation :

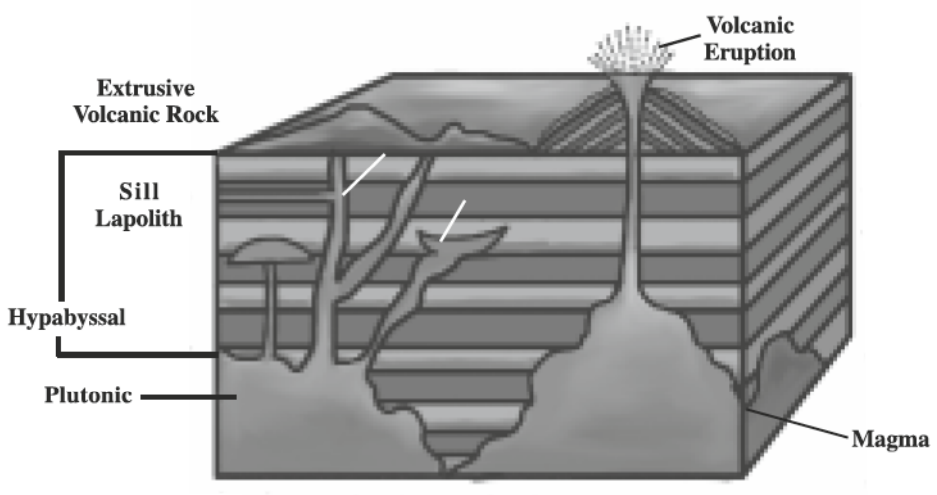
Rock Types

- Igneous Rocks
- Sedimentary Rocks
- Metamorphic Rocks)

(1) Igneous rocks : Meaning of igneous is 'made of fire'. As the Earths interior is hot its red hot material-magma gets cooled into various forms. Rocks formed in this way are known as igneous rocks. As these rocks were formed first, they are also known as **primary rocks**. There are two main types of igneous rocks : (1) Intrusive igneous rocks (2) Extrusive igneous rocks.

Igneous Rocks

- Intrusive
  - Plutonic
  - Hypabyssal
- Extrusive
  - Volcanic



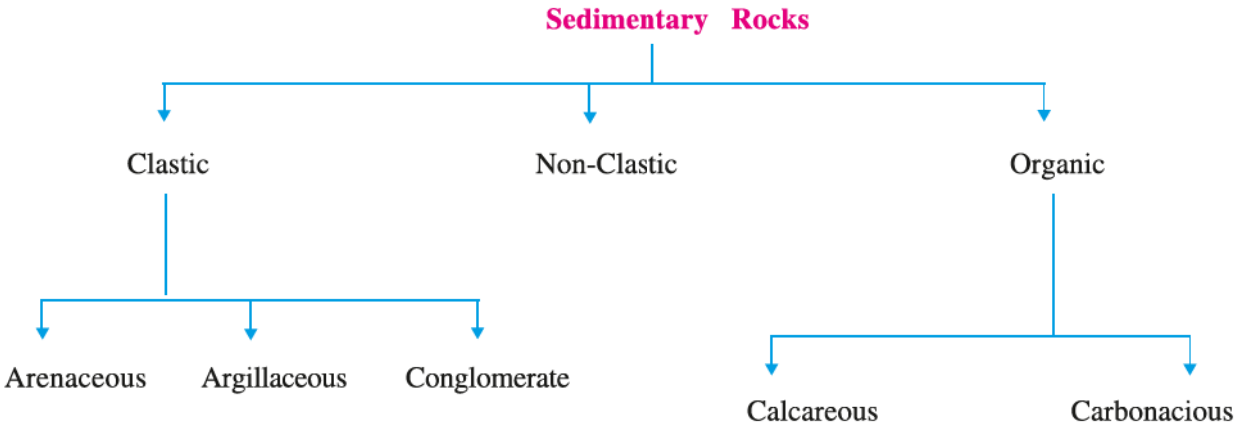
6.1 Forms of Igneous Rocks

(1) Plutonic igneous rocks : These type of igneous rocks are formed by the cooling of magma. If this magma cools and solidifies deep in the interior, such rocks are formed. As there is more heat at greater depth, magma cools and solidifies slowly. Rocks formed in this way have big sized crystals. **Granite** is the best example of plutonic igneous rock. Such rocks are found in plateau of south India, Rajasthan and Madhya Pradesh.

Hypabyssal igneous rocks : During volcanic eruption, magma tries to reach the Earths surface. But gets solidified somewhere between plutonic rocks and extrusive rocks. It takes various forms known as sill, dyke, lopolith and laccolith. These rocks are known as hypabyssal igneous rocks.

Extrusive igneous rock : During a volcanic process, magma comes out rupturing the rock layers. On coming in contact with open air, the lava cools rapidly. Microscopic crystals are formed in it. **Basalt** rock is its example, which is found in south and western Gujarat.

(2) Sedimentary Rocks : Forces of weathering and erosion result in the breaking of igneous rocks. The fragmented rock material continues to be deposited in water and layers are formed. Thus layers develop one above another. After some time, stratified rocks are formed from them. Therefore, sometimes these rocks are also known as depositional rocks. Some chemical and organic matter is found in sedimentary rocks. On the basis of this matter, these are classified into following sub-types :



Clastic sedimentary rocks : Process of weathering disintegrates rocks. Mobile forces like river, glacier and wind transport sediments elsewhere. With decline in speed of these forces, the transported sediments get deposited in different places. Layers of rock matter are formed with the passage of time. Such rocks are known as clastic rocks. Sandstone, shale and conglomerate are examples.

Non-Clastic sedimentary rocks : Certain chemicals present in rocks become dissolved as solution in running water. With decline in speed of water, rocks formed by the deposition of chemical matter dissolved as solution are known as non-clastic rocks. Gypsum and rock-salt are examples.

Organic sedimentary rocks : Animal and plant remains get deposited over a period of time to form rocks. Depending on the amount of lime and carbon they are of two sub-types. When rocks with lime are broken and carried away by rivers and deposited into sea, they are eaten up by coral forming organisms. Remnants of such marine organisms get deposited to form rock layers, known as limestone.

Remains of vegetation get buried and under the impact of pressure and internal heat get transformed into rocks. They are known as carbonaceous rocks. Mineral coal is its best example.

Metamorphic rocks : When there is a change in basic composition and form of igneous and sedimentary rocks, they get transformed into new type of rocks known as metamorphic rocks.

Rocks get transformed in two ways : Physical metamorphism and chemical metamorphism. Thus, shape and form of mineral matter of original rocks get transformed into rocks with new crystals.

When local rocks come in contact with hot liquid magma, they get transformed. This is known as contact metamorphism.

Rocks over wide areas undergo change in their composition and form, because of temperature and pressure. This is known as regional metamorphism. Marble and quartzite are examples.

Minerals

Organic and inorganic matter under the impact of heat and pressure, get transformed with specific chemical composition, known as a **mineral**.

Crystalline composition, density, hardness, colour, lustre etc. are primary characteristics of a mineral. Every mineral has a certain density. Density is a minerals heaviness.

When a scratch is made on a mineral, the resistance offered by it determines its hardness. Hardness of a mineral is given on a scale of 1 to 10. For example, hardness of talc is 1 and that of diamond is 10.

Every mineral surface reflects sunlight. This determines a minerals lustre. Different minerals and metals have different lustre.

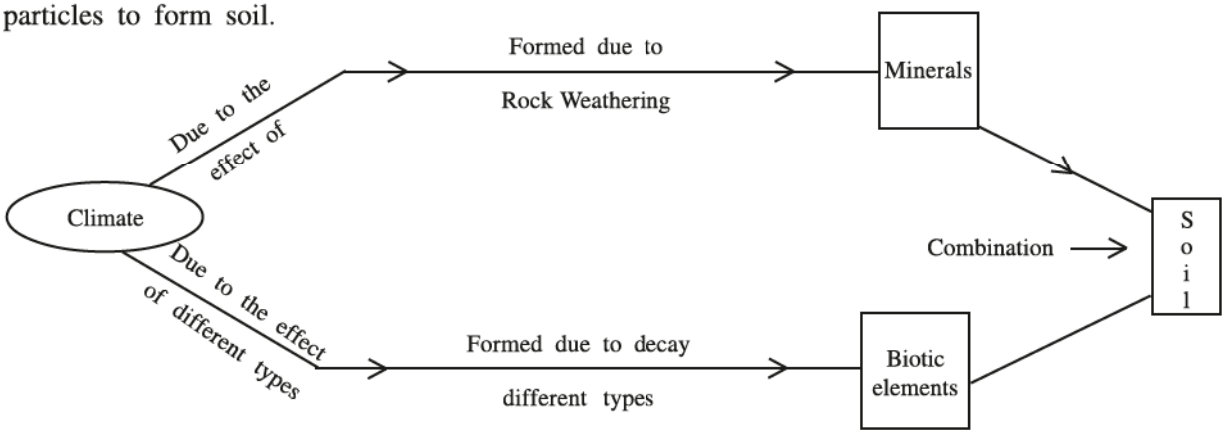
Minerals exhibit different colours as well. Depending on the impurities present, minerals may be dark or light in colour.

Thus, based on primary characteristics, minerals may be categorized as metallic and non-metallic. Iron, copper, gold, etc. are metallic minerals, while potash, sulphur, nitrate and fluorspar are non-metallic minerals.

Coal and mineral oil are used as fuel. Hence they are placed under a special category of power minerals.

Soil

Impact of sunshine, temperature, snow, rain and other forces on the open surface of rocks causes weathering, leading to formation of regolith. Organic matter, air and water get mixed with these rock particles to form soil.



6.2 Process of Soil Formation

When under the influence of climate, mineral matter is formed from weathered rocks and organic matter from decomposition of vegetation and plant remains gets mixed with it, a thin layer of loose material is formed known as soil. Soils have four main physical characteristics :

(1) Colour (2) Structure of particles (3) Arrangement of soil particles (4) Soil structure

Colour is an important characteristic of soil. Colour changes with mineral elements and according to the process of origin. Soils with dark colour have more organic matter. Red, yellow or almond coloured soils have more iron content.

Sand and clay content varies in soils with different composition. Size of sand particles are bigger while that of clay particles are smaller. Hence in clay soils, there is more moisture retaining capacity as well as fertility.

Various soil particles are arranged differently. Thus is formed arrangement of soil particles. This arrangement determines soil porosity. Thus, because of typical soil arrangement or structure, air, water and plant roots penetrate into soil.

If a vertical cut is made on soil layers, distinct layers or Horizons of soil can be seen very easily from top to bottom. It is known as Soil-profile.

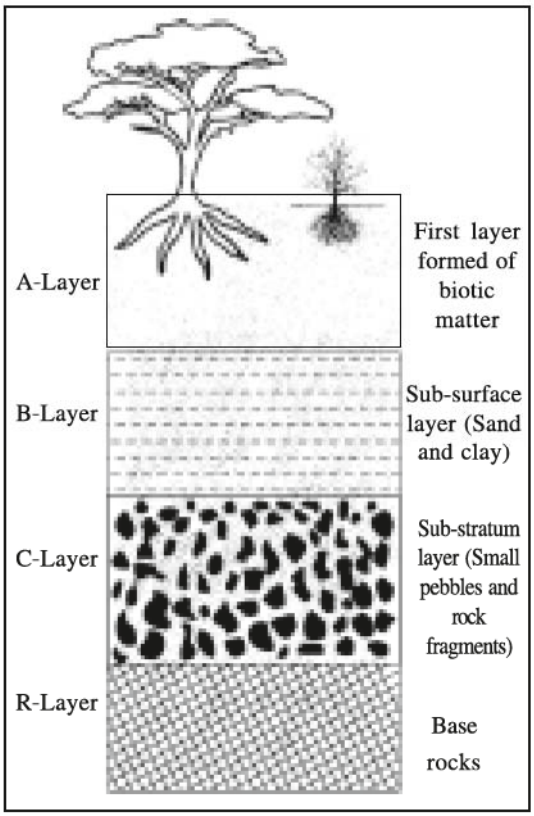
In different layers of soil profile, differences can be noticed in its structure of particles, arrangement of soil particles, colour, etc. These soil layers are known as A-horizon, B-horizon, C-horizon and R-horizon. (Fig. 6.3)

The topmost soil particles of A-horizon are minute. In this layer, animal life is the most active. The layer is more fertile because of more of organic matter.

In B-horizon, there are more sand and clay particles. It has less organic matter and is also known as the sub-soil.

C-horizon is made of pebbles, small rock fragments and big soil particles. Generally, it is less fertile.

R-horizon is at the lowest. It is made of bed rock. Its rock particles are attached to each other.



6.3 Soil Profile

Types of Soil

Depending on the soil formation process, soil can be divided into two main sub-types :

(1) Residual soils (2) Transported soils

After being formed from weathering of parent rocks, soils that continue to overlie them are known as residual soils. Such soils are found in the forest regions.

When under the influence of mobile forces like river, glacier, wind, silt and load is transported from their source and gets deposited elsewhere to form soils, such soils are known as transported soils. Such soils are fertile. There is more amount of minute clay particles of organic and mineral matter in it. Ganga river plain is of this type.

EXERCISE

1. Answer the following questions in detail :

(1) What is a rock ? Explain its major types.

(2) Define mineral and discuss its characteristics.

(3) Explain the process of soil formation and write in detail about its main characteristics.

2. Answer the following questions in brief :

(1) How many types of rocks are there ? Which are they ?

(2) Mention the sub-types of igneous rocks.

(3) What is an organic rock ?

(4) What are the divisions of soil structure ?

(5) Mention the major soil types.

3. Answer the following questions in one-two sentences :

(1) What is magma ?

(2) Give an example of Hybayssal igneous rock.

(3) Which organisms form calcareous sedimentary rocks ?

(4) State the main types of minerals.

(5) What is residual soil ?

4. Select the correct option from the options given and answer the question :

(1) Granite is an example of which kind of rock ?

(a) Sedimentary (b) Igneous (c) Metamorphic (d) None of them

(2) Marble is an example of which kind of rock ?

(a) Igneous (b) Sedimentary (c) Metamorphic (d) Volcanic

(3) Which is the most soft mineral ?

(a) Gold (b) Aluminium (c) Copper (d) Talc

(4) There is similarity between which type of soil and composition of parent rock ?

(a) Transported (b) Residual (c) Both A and B (d) None of them

Activity

- Make a collection of rock and soil specimens around you and display them in your classroom.