10

WEATHERING, GRADATION AND FORMATION OF SOILS.

10.1 INTRODUCTION

The land features seldom retain any fixed form - their shape is constantly changing. One group of exogenetic forces includes those which weaken and disintegrate the rocks at their original location. The second group consists of forces which remove the disintegrated rocks from high lands and deposit them in low lands. Thus the forces of the first type prepare the stage on which the forces of the second type, running water, winds, waves, glaciers and underground water, play a major role in modifying the land features of the earth.

Each of the above groups of forces leads to a different process involving disintegration or decay of the rocks or the physical movement of rock fragments to new positions. The first type leads to weathering, involving no transportation of rocks from their original position. The second type leads to gradation, involving physical movements of rocks to new positions, lower in altitude, usually under the influence of mobile agents.

These twin processes have been responsible for disintegrating rocks and shaping new landforms. They are also partly responsible for the formation of soil, which is very important for us. We know that human population is mostly concentrated in those region of the world where rich fertile soils have helped man to grow different crops and domesticate animals.

In this lesson you will be learning about weathering and its types, the process of gradation and the significance and formation of soils.

10.2 OBJECTIVES

After studying this lesson you will be able to :

- explain the term weathering with suitable examples;

- describe the three types of weathering with sub-types and suitable examples;
- explain the various gradational processes changing the face of the land;
- differentiate between degradation and aggradation;
- explain the significance of soil for human beings;
- relate weathering with soil formation and
- explain the various factors contributing to soil formation;

10.3 WHAT IS WEATHERING ?

The disintegration of surface rocks is a result of primarily the influence of the atmosphere through the elements of weather. Among these elements temperature, rainfall, frost, fog and ice are the important ones. Weathering begins as soon as rocks come in contact with one or more than one elements of weather on the surface of the earth. As a localised process, it involves disintegration and decomposition of rocks at a particular site. In disintegration, rocks physically or mechanically break up under the influence of temperature changes or frost action. In the case of decomposition, chemical changes take place within the body of the rock. Minerals in the rocks lose their coherence (i.e. sticking together) through a process of dissolution. In nature, generally both the disintegration and decomposition act together at the sametime and assist each other. To some extent plants through their root growth and animals particularly through their furrowing act help in the process of weathering. We must remember that the weathered material (i.e. disintegrated and decomposed) lie in situ (i.e. at its original position). In this process no transportation or movement of material is involved other than its falling down under the force of gravity.

* Weathering is the process by which exposed rocks are disintegrated and decomposed in situ (i.e their original position).

INTEXT QUESTIONS 10.1

1. Name the two processes involved in weathering?

   (a) _____ (b)_____

2. When are rocks subjected to weathering?

   _____

3. Why do fragmented rocks slide downslope?

   _____

4. What kind of change occurs in rocks through decomposition?

   _____

10.4 TYPES OF WEATHERING

As we have already studied in the earlier section, the elements of weather at first weaken the rocks by widening the cracks or joints and then break them into fragments. Simultaneously, they may also alter the chemical composition of the rock. Due to first type of action, rocks are broken into progressively smaller fragments. But due to second type of action, rocks get decomposed and crumble down. Animals and plants also contribute to this disintegration and decay, in their own way. Thus weathering can be divided into three types.

1. Mechanical weathering.
2. Chemical weathering.
3. Biotic weathering.

10.5 MECHANICAL WEATHERING

When the rocks are broken up into smaller fragments without any chemical change in their composition, it is called mechanical weathering or sometimes physical weathering. This type of weathering is maximum in areas of dry and cold climates.

Mechanical weathering takes place in different ways in different types of areas. They have been explained here with examples.

(a) Block disintegration

We all know that the successive heating and cooling causes expansion and contraction of the rocks. In hot desert regions, day temperature are very high while nights are very cold. This high diurnal range of temperature causes successive expansion and contraction of the rocks which tend to enlarge the joints. Finally the rocks disintegrate into smaller blocks. This process is known as block disintegration.

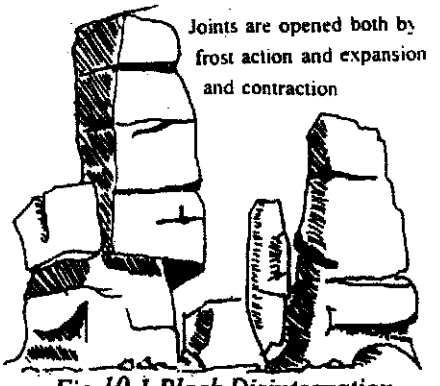

Fig 10.1 Block Disintegration

(b) Exfoliation

Rocks are generally poor conductors of heat. As a result of intense heating the outer layers of the rock expand rapidly while the inner layers remain almost unaffected by heat. Due to successive expansion and contraction, the outer layer of the rock subsequently peels off from the main mass of the rock in the form of concentric shells. The peeling of rocks in layers by this process is very similar to

the peeling of successive layers of an onion. The process is called exfoliation. Almost all rounded forms of dolerite blocks of rocks in Singhbhum district of Bihar are due to this process. Granite domes of Mahabalipuram, particularly '*Krishna Ka Laddu*' and those near Jabalpur on Madan Mahal Hill are good examples of exfoliation.

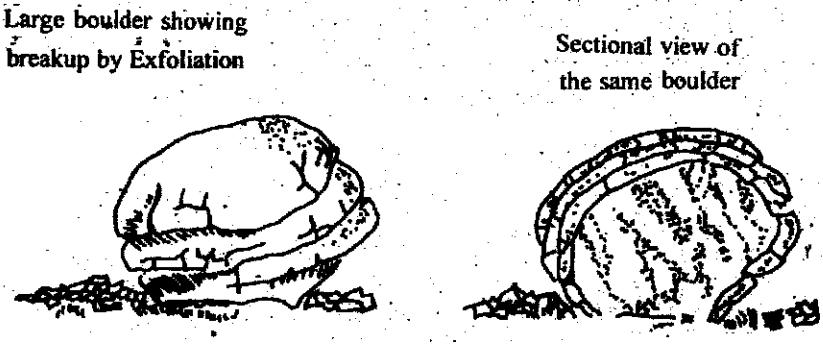

Fig 10.2 Peeling of Layer of the Rock

(c) Frost Action

In the cold mountainous regions, the alternate freezing and melting of water inside the joints of the rocks, splits them into fragments. This is because conversion of water into ice increases the volume of water by 10 percent. In cold regions rocks are disintegrated into small particles through this process. It is called frost action.

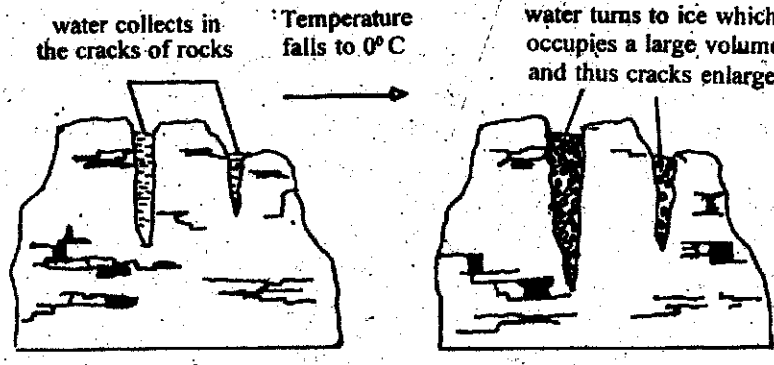

Fig 10.3 Frost Action

* disintegrated of rocks into smaller fragments without any change in their chemical composition is called mechanical weathering.
* The rapid heating and cooling of the rocks create a series of joints and cracks which leads to breaking up into smaller blocks. This process is known as block disintegration.
* A weathering process by which the outer layers of the rock peel out in concentric cells due to difference of temperature in the outer layers is called exfoliation.
* Breaking up of rocks due to freezing of water in the rock joints and cracks, in very cold regions, is called frost action.

INTEXT QUESTIONS 10.2

1. Name three types of weathering.

   (a) _____ (b) _____ (c) _____

2. In which areas is mechanical weathering more pronounced?

   _____

3. Give appropriate technical terms for each of the following statements:

   (a) Peeling of successive layers of rocks like the layers of an onion

   _____

   (b) Widening of joints and cracks due to alternative freezing and melting of water in them

   _____

   (c) Disintegration of rocks without any change in their chemical composition

   _____

10.6 CHEMICAL WEATHERING

Chemical changes in the rocks through formation of new compounds or formation of new substances is called chemical weathering. Water, oxygen and carbon dioxide are the main agents of chemical weathering. The rate and intensity of chemical weathering is rapid in areas of high temperature and humidity.

> * Decomposition of rocks by chemical processes with the help of water and atmospheric gases is called chemical weathering.

Chemical weathering involves four major processes :

(a) Oxidation

This is the process in which atmospheric oxygen reacts with the rock to produce oxides is called oxidation. Greatest impact of this process is observed on ferrous minerals. Oxygen present in humid air reacts with iron grains in the rocks to form a yellow or red oxide of iron. This is called rusting of the iron. Rust decomposes rocks completely with passage of time.

(b) Carbonation

This is the process by which various types of carbonates are formed. Some of these carbonates are soluble in water. For example, when rain water containing carbon dioxide passes through pervious limestone rocks, the rock joints enlarge due to the action of carbonic acid. The joints enlarge in size and lime is removed in solution. This type of breakdown of rocks is called carbonation.

(c) Hydration

This is the process by which water is absorbed by the minerals of the rock. Due to the absorption of water by the rock its volume increases and the grains lose their

shape. Feldspar, for example, is changed into kaolin through hydration. Kaolin on Vindhyan Hills near Jabalpur has been formed in this manner.

(d) Solution

This is the process in which some of the minerals get dissolved in water. They are therefore removed in solution. Rock salt and gypsum are removed by this process.

* Chemical weathering involves the process of oxidation, carbonation, hydration and solution.

INTEXT QUESTION 10.3

1. In which region is chemical weathering more effective?

   _____.

2. Which process is involved when gypsum gets dissolved in water?

   _____.

3. Which process of chemical weathering causes rusting of iron?

   _____.

4. Which chemical action is predominant in limestone regions?

   _____.

10.7 BIOTIC WEATHERING

Biotic weathering is carried out by plants, animals and man.

(a) Plants

Plants contribute to both mechanical and chemical weathering. The roots of the plants penetrate into the joints of the rocks. They grow longer and thicker. In this manner they exert pressure on the rocks and the rock joints are thereby enlarged and break into smaller fragments.

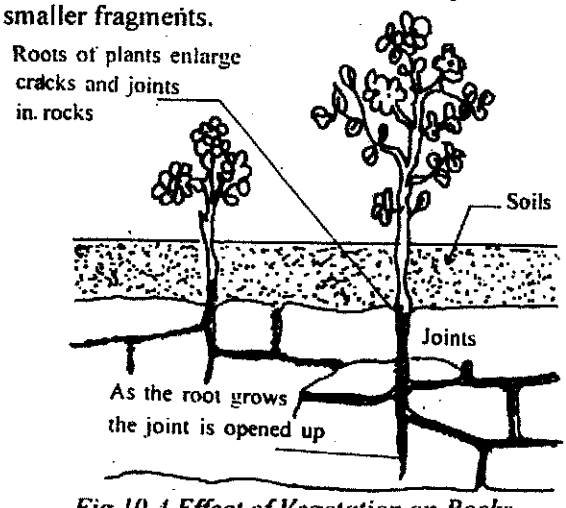

Fig 10.4 Effect of Vegetation on Rocks

(b) Animals

Burrowing animals like earthworms, rats, rabbits, termites and ants break-down the rocks. These disintegrated rocks can easily be eroded or removed by wind etc. Hooves of animals break the soil and thus assist soil erosion. The role of earthworms and termites is of special significance. According to scientists, there is a possibility of occurrence of about 1,50,000 earthworms in an acre and they can convert 10 to 15 tonnes of rock mass into good soil and bring it to the surface.

(c) Man

Human beings play a very important role in weathering of various rocks. Man breaks a large amount of rocks in the course of his activities, like agriculture, construction of houses, roads etc. He quarries for mining minerals, Thus helps in weathering by breaking, weakening and loosening the rocks.

* Biotic agents like plants, animals and man also contribute to physical and chemical weathering.

INTEXT QUESTIONS 10.4

1. Name the three agents of biotic weathering.

   (a) _____ (b) _____ (c) _____ .

2. What is the effect of the growth of plants roots on rocks?

   _____ .

3. Give examples of two activities of man helping in weathering.

   (a) _____ (b) _____ .

10.8 WEATHERING AND SOIL

We have studied the processes of weathering and have learnt how different types of land features are produced in areas of different types of climate through this process. Weathering also plays an important role in formation of soil which provides a basis for agriculture and world's food supply.

Mechanical weathering of the surface rocks disintegrates the rock and converts it into a fine powder. These small particles are deposited in layers with the help of water. Biotic weathering produces humus. This organic matter is formed through the action of plants and animals which helps in the formation of soil. Various processes of weathering help in giving different colours and properties of soil.

* The process of weathering contributes significantly to soil formation besides disintegrated of rocks.

INTEXT QUESTIONS 10.5

1. Which important matter is formed by weathering?

2. Where does humus in soils come from?

10.9 GRADATION

Exogenetic forces are constantly working to bring about levelling or the gradation of land. They attempt to achieve a condition of balance between erosion and deposition which mean a graded position. The above forces operate through the process called the process of gradation. Agents of gradation like rivers, glaciers winds, sea, waves and underground water perform their task with the help of the triple action of weathering, erosion and deposition. The levelling down of elevated portions of the earth's surfaces is done by erosion. The filling up of depressions is done by deposition of the eroded material transported by the external agents of gradation as spoken earlier.

A surface can be said to be a featureless plain if it is neither being filled nor levelled by exogenetic forces. However such areas are never permanent as both endogenetic and exogenetic forces continue undoing the work of each other.

We have studied that the endogenetic forces of the earth give rise to major landforms on the earth surface and the exogenetic forces level them down.

The work of gradation has two components (a) degradation and (b) aggradation.

(a) Degradation :

When rocks are removed by scraping, scratching and cutting as a result of the process of erosion, thereby lowering the elevation of the land, it is called degradation. Degradation, first of all includes the work of weathering that is the movement of scarped and scratched material aided by the great force of gravity. It also include the work of erosion implying the transportation of the rock material by an agent of gradation. The increase in the movement of rock debris increases both its erosional and transportational capacities.

(b) Aggradation

Filling up of low-lying areas of depression by eroded material is called deposition. Deposition starts when the agents of gradation lose their force or have obstruction in their way. As a result eroded material is deposited in depressions which not only creates new landforms but also modifies the existing ones.

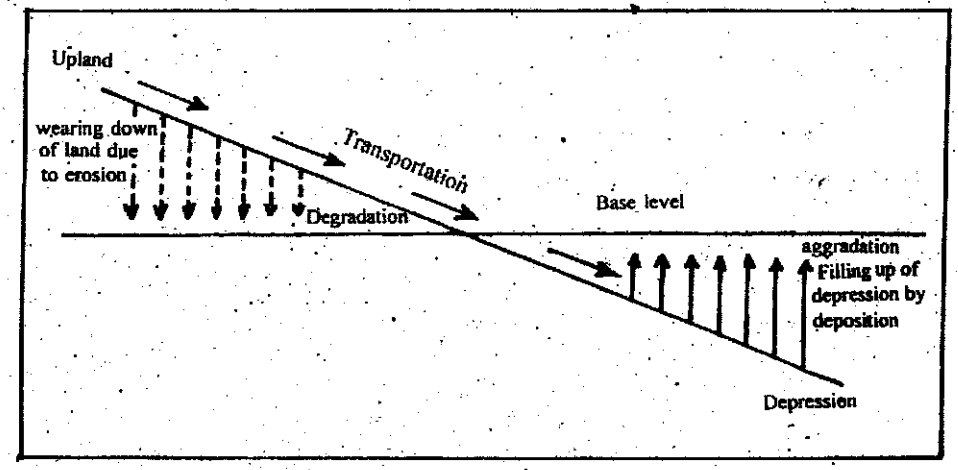

Fig 10.5 Process of Gradation

Let us now look at the figure. It explains the total process of gradation and its two components-degradation and aggradation. It shows the elevated portions continuously being lowered by weathering and erosion. The debris consisting of the eroded material is transported and deposited in the low lying areas. The surface of the lower areas on the other hand is raised through deposition of this debis. Finally, the position of a uniform or near uniform level is achieved. The process of gradation is not performed by a single agent. It is rather a result of the work of all agents of gradation acting simultaneously. It is however possible for a single agent of gradation to be more active in particular area or at a particular time.

* Levelling and smoothening of land surface is called gradation includes both degradation and aggradation.
* The wearing of the land surface by erosion is called degradation and raising or filling up of depressions by deposition is called aggradation.

In the sections which follows you will study in detail about the action of various agents of gradation and the topography formed by them.

INTEXT QUESTIONS 10.6

1. Which process is involved in the the levelling of the earth's surface?

   _____.

2. Which two processes constitute gradation?

   (a)_____(b)_____.

3. Which term is used for raising or filling up of depressions by deposition?

_____.

4. What is degradation?

_____.

10.10 SOIL AND ITS FORMATION

Soil is a dynamic thin top layer of the earth's surface comprising of minerals particles, decayed organic material, living organism, water and air .

(A) FACTORS OF SOIL FORMATION

The five factors, which control the formation of soil are parent rock, relief, time, climate and plant and animal organisms. The former three are called the passive factors while the later two are the active factors. The parent material and climate are the most important because these two affect the other factors.

(a) Parent rock

A soil is derived from the underlying rock or the parent rock material containing different minerals. The parent rock gets broken into tiny pieces and is decomposed slowly by mechanical, chemical and biological weathering. It furnishes inorganic mineral particles of the soil. The parent rock also influences the rate of soil formation, the chemical composition, colour, texture, structure, mineral content and fertility.

(b) Relief

Topography of an area affects the degree of erosion of the parent rock material and the rate of surface run off of water. Thus, the relief affects directly and indirectly the processes involved in soil formation. Steep slopes are subjected to more rapid run off of surface water than the gentle slopes. Therefore there is less infiltration of water on steeper slopes which retards soil forming processes. In addition rapid run off on steep slopes often erodes their surface faster than soil can develop. It is because of this that the mountainous topography develops coarse, thin and infertile soil and the plain areas have rich well developed fertile soils.

(c) Time

The soil forming process is very slow. A well developed soil result's as an end product of physical, chemical and biological processes operating collectively for a very long period of time.

(d) Climate

It is by far the most important factor in the sense that over a long period of time it not only tends to reduce the difference caused by the parent material but also influences biological activities within the soil. Due to this factor two different parent materials may develop the same type of soil in one type of climatic region. For example, granite and sandstone have developed into sandy soil in dry Rajasthan

desert. On the other hand, two different types of soils may develop from the same parent material in two climatic regions. For example, the crystalline granites have developed laterite soils in monsoon regions and non laterite soils in sub humid regions.

The process of weathering, its effectiveness and the type of plant and animal organisms in a region are directly linked with the seasonal change of temperature and distribution and nature of precipitation. Hence, climate plays an important role in soil forming processes.

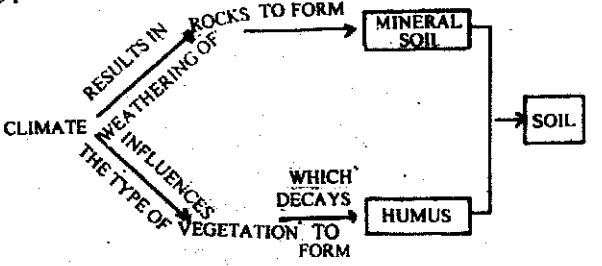

Fig. 10.6 Factors of Soil Formation

(e) Plant and Animal Organisms

Plants and animals play an active role in transforming parent material into a mature soil. Dead plants and animals contribute to the organic content of the soil. The process of decay, added by bacterial action, transforms organic matter into humus. Humus is responsible for the fertility of the soil. It also enhance water retention capacity of the soil. This organic material helps the soil to support plant life. The plant cover in turn protects rich upper layer of the soil from erosion by increasing the proportion of rainfall entering into the soil rather than running off the surface. It also prevents greater evaporation of soil moisture by its thick canopy. Thus allowing soil to mature and become fertile.

* The climate and plant and animal organisms are the active factors of soil formation.
* The parent material, relief and time are the passive factors of soil formation.

INTEXT QUESTIONS 10.7

1. Name two active factors of soil formation.

   (a) _____ (b) _____.

2. Name the three passive factors of soil formation.

   (a)_____ (b)_____ (c)_____.

3. Fill in the blanks with appropriate word given in the blanks below :

   (organic material, inorganic mineral particles, biological activities).

   (a) The parent material provides _____ within the soil.

(b) The climate of a region influence _____ within the soil.

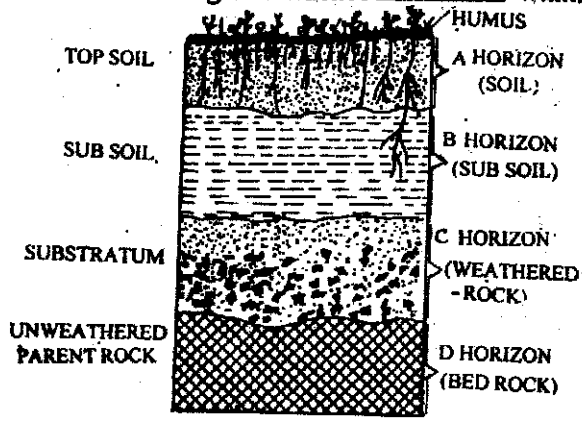

Fig. 10.7 Soil Horizons and Bedrock

(B) SOIL PROFILE

A vertical section of a fully developed soils is arranged in layers of horizons of differing texture, colour and consistency overlapping each other. Such an arrangement of layer is known as soil profile. Generally there are four parts of the soil profile. Horizon 'A' is the upper most layer of the soil which is known as top-soil. It is rich in humus. That is why it is dark in colour. Horizon 'B' lies below the top soil and it is known as sub soil. It is a sort of leaching zone. These two horizons constitute the main part of the soil. Horizon 'C' is actually a part of weathered parent rock. It is darker than the sub soil due to accumulation of soil colloids. Soil colloids are extremely fine particles of humus or mineral. Horizon 'D' is the zone of unweathered parent rock and it is the deepest horizon of soil profile. Each of these horizons is distinct from one another in their physical and chemical composition and organic contents. Such a soil profile develops only where the weathered material keeps lying at the same place for quite sometime. Such soils are called residual soils. They are best seen in the hills. A soil profile of this type is not found in regions where soil have been developed on transported materials brought and deposited by agents of gradation. Alluvial soils are examples of such transported soils.

* Soil profile is the arrangement of the soil into layer like horizons which are physically, chemically and biologically different from each other.

INTEXT QUESTIONS 10.8

1. Give the Geographical term for each of the following:

   (a) The dynamic upper layer of earth's crust composed of solid liquid and gaseous substances.

   (b) A vertical arrangement of different layers of soils.

   (c) The horizon of soil rich in humus.

   (d) The horizon of soil that accumulates soil colloids.

10.11 SOIL EROSION

The top soil horizon which is the most important and valuable resource for man is under continuous strain of natural forces such as temperature, rainfall, frost, drainage and winds etc. Man and animals have also added to their efforts. Due to these forces, destruction and removal of soil is seen at many sites. This process of an excessive destruction and removal of soil material is called soil erosion.

(A) Type of Soil Erosion

Soil erosion is of three main types: wind erosion, sheet erosion and gully erosion.

(i) Wind Erosion

Winds carry away vast quantity of fine soil particles and sand from deserts and spread it over adjoining cultivated land and thus destroy their fertility. This type of erosion is known as wind erosion. It takes place in and around all desert regions of the world. In India, over one lakh kilometres of land is under Thar Desert, spread over parts of Gujarat, Haryana, Punjab and Rajasthan states. These areas are subject to intense wind erosion.

(ii) Sheet Erosion

Water when moves as a sheet takes away thin layers of soil. This type of erosion is called sheet erosion. Such type of erosion is most common along the river beds and areas affected by floods. In the long run, the soil is completely exhausted due to removal of top soil and becomes infertile.

(iii) Gully Erosion

When water moves as a channel down the slope, it scoops out the soil and forms gullies which gradually multiply and in the long run spread over a wide area. This type of erosion is called gully erosion. The land thus dissected is called bad lands or ravines. In our country, the two rivers Chambal and Yamuna are famous for their ravines in U.P and M.P states.

The controlling factors in the last two types of erosion are the velocity and amount of surface run off, the erodability of the soil, nature of slope, the texture and structure of the soil, nature of precipitation and vegetation cover. The speed and frequency of winds or dust storms and vegetation cover are the controlling factors in wind erosion. Seawaves are responsible for eroding soils along the coasts formed by weak rocks such as limestone etc. This type of erosion is wide spread along Kerala coasts. Substantial soil erosion is also caused by changing river channels and snowfall specially in river basins and hilly regions.

Alongwith these forces of nature which disturb the equilibrium between soil forming processes and denudation, man also helps in soil erosion through destruction of forests, over grazing by cattle on hilly slopes, wrong farming practice, unplanned mining and finally by misuses of soils for purposes such as making houses, bricks, roads and railways, etc. This way man accelerates the process of soil erosion to such an extent that the soil cover which might have taken thousands of years to be removed may completely be eroded within a few years.

* The removal of soil material naturally or by human action is called soil erosion.
* Soil erosion is of three types wind erosion, sheet erosion, gully erosion.
* Factors influencing soil erosion are velocity and amount of surface run off, nature of slope, texture and structure of soils and frequency and speed of winds.

10.12 SOIL CONSERVATION

Soil is one of the most important natural resources which sustains different types of lives directly or indirectly. Moreover, soil forming is a slow natural process. The process of soil erosion not only destroys this wonderful gift of nature in a shorter span of time. It creates new problems like floods, damage to roads and rail bridges, hydro electric projects, water supply and pumping stations.

The material carried by rivers clogs their flow and reduces their capacity of draining out the water. The silting of river beds is the obvious cause of flood which cause serious damage to standing crops in agricultural lands. For example, the bed of the river Kaveri in Thanjavur and Tiruchirapalli districts of Tamil Nadu has gradually risen. This has resulted in blocking drainage inlets and irrigation canals. Soil erosion has also caused silting of irrigation tanks, navigation channels and artificial lakes of multipurpose projects. Soil erosion also carries away valuable plant food in solution. Thus soil erosion not only takes away the valuable soil cover but also creates many other problems to man and hence there is an urgent need to conserve soil.

Soil conservation constitutes those methods which prevent soil from being removed. The methods to control soil erosion of different type in different parts of the world are as under :

(a) Protection of forest : Indiscriminate felling of trees in the forest has been one of the major causes of soil erosion. Since roots of the trees hold the soil material together, it is desirable to protect these tree from such felling. This has led governments to declare forests as reserved in which felling of trees has been banned. This method of soil conservation is most suited to all types of landscapes. Forests are also harbinger of rain which increases the process of soil formation.

(b) Afforestation : Planting of trees along river courses, waste lands and mountainous slopes is another method of soil conservation. It reduces excessive erosion taking place in these regions. Afforestation is also effective in controlling wind erosion along the desert regions. Tree plantation along desert boundary stops swallowing of agricultural land by desert sands. In our country large scale planting of trees is being carried out in Rajasthan, Haryana, Gujrat and Punjab to control the extension of Thar Desert.

(c) Flood Control : During rainy season, the amount of water in rivers, increases exceedingly which in turn increases soil erosion. Dams are being constructed to control floods and consequently the soil erosion. This can also be done by divert-

ing river water to dry regions through canals and by other well planned methods of water conservation.

(d) Planned Grazing : Over grazing on hill slopes has helped loosening and washing away of soils in these areas. If grazing is carried out in a planned way it will reduce soil erosion by protecting vegetation cover in these areas which are comparatively more prone to soil erosion.

(e) Bunding : Construction of bunds or obstruction is applied in lands affected by gully erosion. This method is not only helpful in controlling soil erosion but maintaining soil fertility, conserving water resources and levelling of sloping lands.

(f) Terracing : To conserve poorly developed thin soils on mountain slopes, terracing is another method. Terracing refers to the construction of terraces across the slope in a mountainous region. This helps in controlling soil erosion and using water resources of these areas economically and effectively for growing different crops on these terraces.

(g) Contour Ploughing : This method of soil conservation is most suited to areas having rolling landscape. Ploughing and tilling of land along the contour levels in order to cause furrows to run across the landslope reduces the rate of soil erosion. This method is also applied to maintain the fertility and soil moisture.

(h) Adoption of Strip Farming : This method is most suited in rolling plains and regions situated in arid and semiarid regions. Fields are divided into strips and the farming in one year is done on one strip while the other strip is left uncultivated. The grassy vegetation cover of the left strip controls soil erosion and maintains fertility of soils. Next year, the process is reversed.

(i) Crop Rotation : Crop rotation refers to a systematic succession of different crops cultivated in a given piece of land in order to avoid exhaustion of the soil. Thus, rotation of crops is applied to conserve the fertility of soil from over cultivation of growing continuous crops from where population pressure is more on limited agricultural lands. This methods is applied in most of the countries of the world.

(j) Reclamation of Lands : Soil erosion is also being controlled by levelling lands gullied down by water channels and converted them to waste lands or ravines. This methods of soil conservation is most suited in river basins and hilly terrains. Vast areas have been levelled in Chambal and Yamuna ravines, in our country.

* Soil conservation methods include protection of forest, afforestation, bunding, reclamation of lands, controlling floods, over grazing, terracing, strip farming, contour ploughing and crop rotation.

INTEXT QUESTIONS 10.9

1. Fill in the blanks with the appropriate words given in the brackets :

   (a) The complete removal of soil cover is known as _____ (Gullying, wind, sheet erosion)

(b) _____ is the best suited method of soil conservation in desert outskirts, (strip farming, afforestation, bunding)

(c) Sheet erosion is mostly caused by_____(floods, rains, deforestation).

2. Give the geographical term for each of the following :

(a) Removal of soil material naturally or by man's action.

(b) Removal of soil by water channel.

(c) Planting of trees in deforested lands.

(d) Removal of soil by dust storms.

(e) Tilling of land along the contour levels.

WHAT YOU HAVE LEARNT

Landforms undergo a constant change. The exogenetic forces act upon them to make the surface level.

The rocks undergo various types of change in their own location under the process of weathering. The rocks become weak due to the impact of the weather elements - temperature, moisture, frost etc. They develop cracks and disintegrate into small boulders, pebbles or fine fragments. This is called mechanical weathering. This type of weathering is more pronounced in areas of hot and dry or very cold climates. Rock minerals undergo chemical changes due to the effect of water and gases as a result of oxidation, carbonation, hydration and solution. This is called chemical weathering. This type of weathering is more important in areas of warm and humid climates. Plants, animals, insects and men are the agents of biotic weathering and they contribute to both mechanical and chemical weathering.

Soil is a natural resource of unestimated value to man as he gets his food, clothing and other things directly or indirectly from it. Soil is a thin layer of loose inorganic and decayed organic matter covering the earth's surface. Different factors such as parent materials, climate, plants and animal organism, water and time along with processes such as mechanical, chemical and biological are responsible in making this valuable resource. Mature soils develop a profile which constitutes four horizon, each having different characteristics.

Soil erosion is a natural process of destruction and removal of soil material from its place. Running water, winds, sea waves and glaciers are the most active agents of erosion. Erosion of soils takes place in three ways wind erosion, sheet erosion and gully erosion. Removal of soil cover depends on velocity and speed of water, nature of slope, texture and structure of soils, frequency of dust storms and nature of precipitation. Man through his misdeeds, has also helped natural forces in increasing the problem of soil erosion. Methods to prevent soils from being eroded constitute soil conservation. These methods are protection of forests, afforestation, contour ploughing, terrace and strip farming, bunding, flood control, etc.

TERMINAL QUESTIONS

Answer the following questions with suitable examples :

1. Why does the surface of the earth not remain static?
2. What is weathering ?. Name the different types of weathering.
3. How does frost disintegrate rocks?
4. How does chemical weathering take place?
5. Differentiate between

   (a) disintegration and Decomposition

   (b) Degradation and Aggradation.

   (c) Oxidation and Solution.
6. Explain the process of gradation.
7. How does physical weathering differ from chemical weathering? Name four processes involved in chemical weathering.
8. How does man become an important agent of weathering?
9. Explain the following processes of weathering by drawing simple diagrams :

   (a) Block disintegration.

   (b) Frost action.

   (c) By plant action
10. Give a brief account of soil profile. Illustrate your answers with a diagram.
11. Discuss various factors responsible for soil formation.
12. What is humus? How is it formed? What is its significance?
13. What is soil erosion? Explain the different ways in which soil is eroded. Discuss the various methods being used to conserve soil.

CHECK YOUR ANSWERS

INTEXT QUESTIONS

10.1

1. (a) Disintegration (b) decomposition
2. When they are exposed to elements of weather.
3. Due to force of gravity
4. Chemical changes in rocks.

10.2

1. (a) Mechanical weathering (b) Chemicals weathering
   (c) Biotic weathering.
2. In dry and very cold regions.
3. (a) Exfoliation (b) Frost action (c) Mechanical weathering.

10.3

1. In warm and humid regions.
2. Solution
3. Oxidation
4. Carbonation

10.4

1. (a) Plants (b) Animals (c) Man.
2. The cracks in rocks are widened and the rocks are broken.
3. (a) Agriculture (b) Mining

10.5

1. Soil
2. Through bacterial activity on organic matter.

10.6

1. Gradation
2. (a) Degradation or lowering down of raised surfaces.
   (b) Aggradation or raising up of low lying areas.
3. Aggradation.
4. Lowering down of raised portions through erosion of material.

10.7

1. (a) Climate (b) Plant and animal organisms
2. (a) Parent rock (b) relief or topography (c) Time
3. (a) Inorganic mineral particles (b) Biological activities

10.8

1. (a) Soil (b) Soil profile
   (c) Top soil (d) zone of weathered parent rock

10.9

1. (a) Sheet erosion (b) Afforestation (c) Floods
2. (a) Soil erosion (b) Gully erosion
   (c) Afforestation (d) Wind erosion
   (e) Contour ploughing.

TERMINAL QUESTIONS

1. The surface of the earth never remains the same because of the continuous struggle between internal and external forces of the earth. Internal forces create new landforms on the earth surface while on the other hand external forces try to level down the irregularities produced by internal force.
2. Weathering is a process by which rocks are disintegrated and decomposed in situ. See para 10.3.

   Types of weathering-Mechanical, Chemical and Biotic weathering. Define each type and give examples also.
3. See para 10.5 (c) under "Frost action".
4. See para 10.6 under "Chemical weathering".
5. (a) disintegrateion of rock is physical breaking up or shattering of rock under the influence of temperature or frost action. Decomposition is due to chemical change. by which rock minerals break up or get dissolved. Give examples of each type.

   (b) See para 10.9 (a) and (b)

   (c) See para 10.6 (a) and (d)
6. See para 10.9 (a) and (b) and Fig 10.5
7. See para 10.5 "Mechanical weathering" and para 10.6 "chemical weathering".
8. See para 10.7 (c) biotic weathering.
9. See Fig. 10.1, 10.3 and 10.4.

10. Points to be discussed in detail include :

    Meaning of soil profile-..fer to 10.10 Section B. Answer is to be ulustrated with the help of Fig. 10.7.

11. Points to be eleborated - parent rock, relief, time, climate and plant and animal organism (Active and non-active factors) Importance of each of these points should be highlighted (Refer 10.10 Section A).

12. The decayed or decomposed organic matter of soil is called humus. The quantity of humus in a soil determines its fertility. Formation of humus due to chemical and biological processes, decaying and decomposition of plant and animal organism. Significance : Increases in quantity of humus increases the fertility of soil. Reflects on the characteristic of the soil.

13. Soil erosion refer 10.11 Section

    Types of soil erosion - wind erosion, sheet erosion, gully erosion (Refer 10.11 Section)

    Methods to conserve soils - Protection of forests, afforestation, flood control, planned grazing, reclamation of lands, bunding, terracing, contour ploughing, strip farming, crop rotation (Refer to 10.12 Section).