CHAPTER-1
Physical Geography

1.01 : Geomorphic Process :

The surface of the earth is not plain. As there are hills and mountains, plateaus, river valleys etc. on the continents, there are also some submerged highlands and lowlands of various shapes and sizes on the ocean bottom. In this way the surface of the earth is being characterised by varied types of features. These features present over the earth's surface are called landforms. A particular branch of geography studies about the origin, evolution, morphology and distribution of the landforms. This branch is known as geomorphology.

The origin of landforms on the earth's surface depends on various processes. Some of these are exogenic and some others are endogenic. Among the exogenic processes or factors the principal ones are wind, rainfall, rivers, glaciers, ocean waves and currents. On the other hand, the endogenic processes or factors mainly include the earthquakes and volcanoes. The landforms develop on the surface of the earth as a result of interaction of these two types of processes. These processes invloved in the creation of landforms are collectively called geomorphic processes. Winds and glaciers are the two most important geomorphic processes which are continuously causing changes in certain areas on the earth's surface.

1.02 Works of wind :

Winds have their varying effects in all places of the world. The actions of winds are experienced more or less in all parts of the continents and oceans. However, the role of winds in the creation and modification of landforms is very extensive in certain regions of the world. Generally the actions of wind as

an agent of landform modification are more active in the deserts, where vegetative cover is very thin and the surface is sandy. As rainfall is vary less in desert, actions of running water and rivers are very limited. Wind plays the major role in creating and changing the geomorphic features in the desert areas.

Wind performs three activities in desert-erosion, transportation and deposition. The sand and small rock particles are easily carried away by wind in desert due to thin vegetative cover and sandy surface. In this way, some areas of the desert are relatively lowered by wind actions, and this process is called deflation. As a result of transportation of materials to other parts, some areas may be lowered down almost to the level of underground water giving rise to some depressions, which are then termed as oasis. Some vegetations grow in oasis and little amount of agriculture is also done here.

On the other hand, the wind blown sands get deposited and some areas are thus aggraded. The deposits of sand may take the form of hills in due course of time. Such hill-like sand deposits are known as sand dunes. The shape and size of the sand dunes vary in time and over space. Some sand dunes are formed longitudinally along the direction of wind. These are called longitudinal sand dunes (Fig. 1.01). Again some others are formed being transverse to the wind direction. Such sand dunes are called transverse sand dunes. In certain areas of

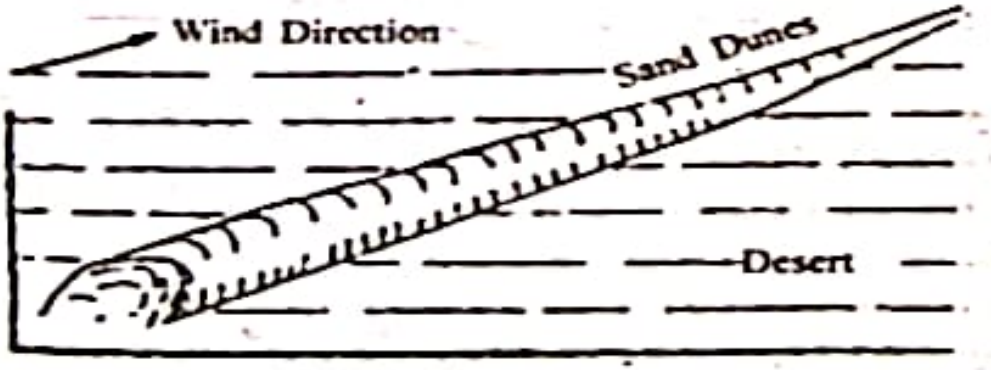

Figure-1.01 : Longitudinal Sand dune

desert, some sand dunes become cresent-shaped. These are called barkhans (Fig. 1.02). In fact, the shape and size of sand dunes depend on different factors like properties of wind, wind direction and energy, vegetative cover, surface structure etc. Sand dunes are the characteristic feature of desert landscape.

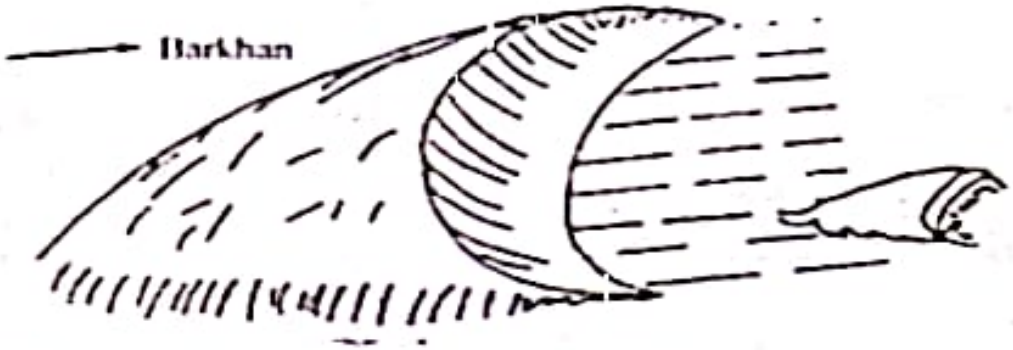

Figure-1.02 : Barkhan

Some erosional features are also found in deserts. The wind blown sands at high velocity hit the elevated lands on their

Figure-1.03 : Inselberg

way and thereby erode them. Such erosion caused as a result of friction is called abrasion. Abrasion process is responsible for creation of inselberg, yardang and other kinds of erosional features. The inselberg is an isolated low hillock (Fig. 1.03). The upper part of inselberg is steep due to high intensity of wind action in this part than on its lower part. On the other hand, yardang is an another feature in the desert which is usually

patterned by elongated ridges and shallow grooves (Fig. 1.04). The relatively soft rocks between hard rocks of two sides are easily eroded by wind and as a result a high rugged surface is formed.

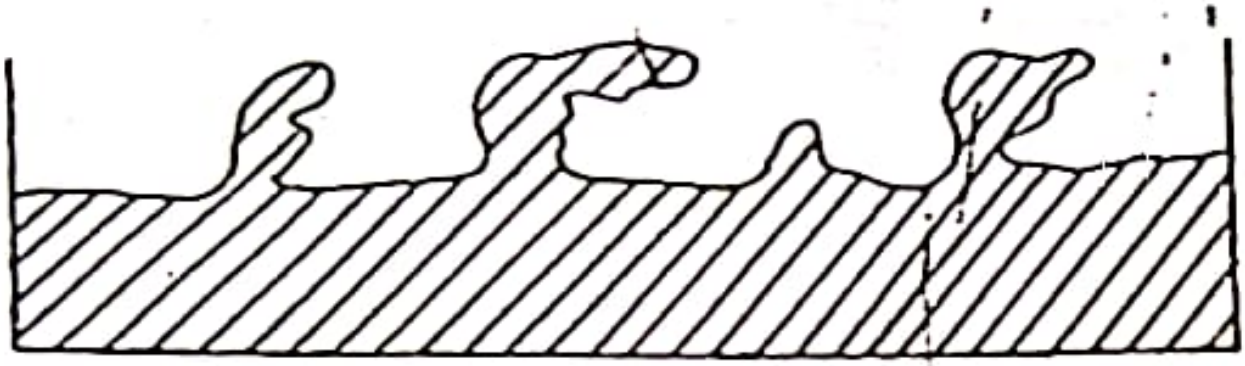

Figure-1.04 : Yardang

Attrition is an another process of wind erosion in desert. The wind-blown sand materials collide each other while in transit and thus the particles themselves get broken gradually into smaller pieces. This process by which the sand and rock particles are broken into smaller pieces through their mutual collision is known as attrition.

Generally, little amount of rainfall occurs in the desert. In most of the areas, average annual rainfall is less than 20 cm. There may not be any rainfall in some years. But, sometimes heavy rainfall takes place in the desert within a very short period of time. Such rainfall suddenly creates floods in the desert leading to modification of desert landforms. The flood that occurs covering large areas of desert is known as sheet flood. Such sheet floods transport the clay, sand and other materials of the desert from one place to another and bring about drastic changes in desert topography.

The aeolian processes mentioned above create various kinds of features or landforms in the peculiar environment of the desert. These landforms have their peculiar geomorphic characteristics which are different from that of the fluvial or glacial landforms.

1.03 Works of Glaciers :

Some regions on the earth's surface still remain covered with snows. The polar regions and the high altitude regions of the mountains like the Himalayas and the Alps have extensive deposits of ice and snow. These vast deposits of ice and snow over the earth's surface contain a total of about 29 million cubic km. of water.

The snow blocks usually move downward following the slope of the surface. Their downward movement is however very slow. These move only for a distance of few millimeters to few meters in a day. The slow moving snow and ice blocks when come down the slope are called glacier. The glaciers flow down due to downward pressure of the snow deposits of the upslope zone on the one hand, and the force of gravity on the other hand. Presently about 1 percent of the earth's land area is under the impact of glacial actions.

Like rivers, glaciers also create different types of features and modify the earth's surface through the processes of erosion, transportation and deposition. As a result, the regions under glacial action have their peculiar characteristics. It is important to note that the glaciers can be divided mainly into three types based on the situation and environment of the snow-covered regions. These are –

a. Continental glacier
b. Mountain or Alpine or Valley glacier and
c. Piedmont glacier.

These glaciers have differences in terms of their location, velocity and actions. They create different types of glacial landforms based on their varying actions of the geomorphic processes.

a. Continental glaciers : These glaciers cover extensive areas of the polar regions. Northern Canada, Greenland, Scandinavia, Antarctic etc. are extensively covered by the

continental glaciers. These glaciers move downslope very slowly according to the surface gradient.

b. Mountain glaciers : These glaciers originate in the high altitude regions of the mountains. They are found mostly in the Alps of Europe, the Rockies of North America and the Himalayas of Asia. Generally they flow through the valleys confined between two mountain ranges. They are comparatively little faster than the continental glaciers.

c. Piedmont glaciers : Sometiems a number of mountain or valley glaciers move downward and meet at the foot of the mountains. Thereafter they flow further down and cover extensive areas of the nearby plains. As these glaciers originate in the piedmont zone of the mountains, they are called piedmont glaciers. Such piedmont glaciers are common in Alaska of North America.

Erosional features created by glaciers :

The glaciers carry some rock blocks, stones and sand alongwith the snow blocks. All these materials cause erosion along their courses and a U-like valley is formed. The materials carried by glaciers create deep and steep-sided course with their strong friction. There forms a horn-like feature on the topmost parts of the mountains when the mountain sides are actively eroded by a number of glaciers (Fig. 1.05). The

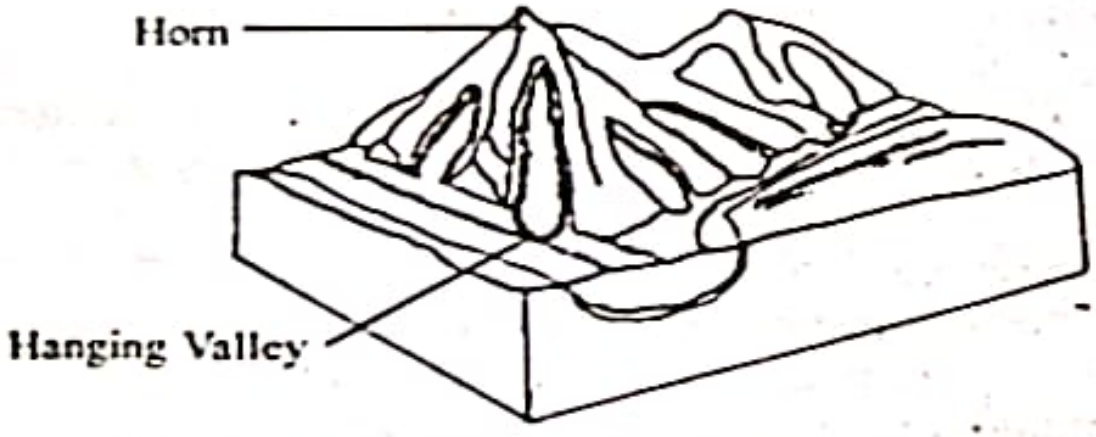

Figure-1.05 : Horn and Hanging Valley

mountains like the Alps and the Himalayas have such horn-like pointed peaks. Metahorn is a good example of such horn in the Swiss Alps.

Hanging valley is an another erosional feature created by glaciers. Like the tributaries which flow to the main river, the tributary glaciers also flow and meet the main glaciers. The main glaciers have their relatively wide and deep valleys, whereas the tributary glaciers have narrow and less deep valleys. The tributary glaciers while meeting the main glaciers appear to be hanging over the main glaciers. So the valley of the tributary glacier is called hanging valley (Fig. 1.05). Later on waterfalls are formed when water from the hanging valley drops vertically into the main glacier.

Depositional features created by glaciers :

Glaciers also perform deposition activities like rivers. Glaciers carry different types of materials in addition to ice blocks while flowing through their valleys. All such materials or sediments are collectively known as moraines. Generally the moraines are carried down through the steep-sided valleys. The moraines flowing along the side of the valley are called lateral moraines. Lateral moraines are deposited on the two sides of the glacier valley. On the other hand, some other moraines move along the bottom bed of the glacier valley

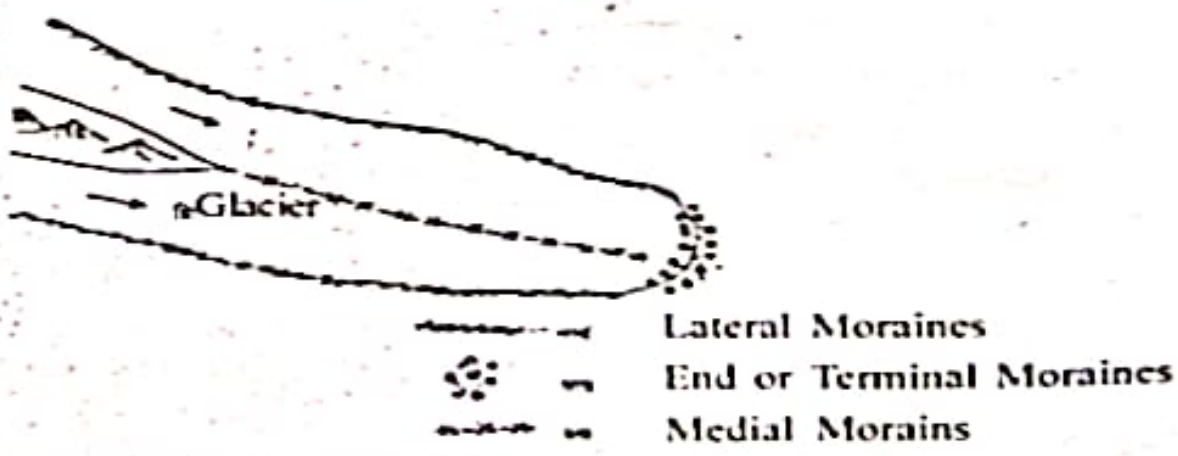

Figure-1.06 : Different types of moraines

and these are then known as ground moraines. When glaciers meet together, their lateral moraines unite and move along the middle course of the big glacier. The moraines that move along the middle course of the glacier are known as medial moraines. The point where the glaciers coming from the high mountaneous zone start melting, the coarse and heavy sediments (moraines) get deposited. Thus the moraines deposited at the terminal limit of the glacier are termed as terminal or end moraines (Fig. 1.06). The moraines so deposited on the bed of the glaciers bring about significant changes of the morphology of the glacier valley. Moreover, some depositional features are also found to develop in the terminal areas of glaciers. Among these the esker, drumlin and kame are important. However, the scientists are of the opinion that the existence, location and processes of the glaciers will be greatly affected by global warming taking place in recent years.

Questions

1. What is landform?
2. Define geomorphology.
3. Write down the meaning of the geomorphic processes.
4. Mention the exogenic processes or factors.
5. What do you mean by the term 'deflation'?
6. What is inselberg? Explain with diagram.
7. What is oasis? What is its significance?
8. What are sand dunes? How are they formed?
9. What is abrasion? What are the features formed due to abrasion?
10. Define attrition.
11. What are glaciers? What is the reason for their slow movement?
12. What are the different types of glaciers? Write briefly about each of them.

13. Draw a figure to show the shape of a glacier valley.
14. What is a hanging valley ?
15. What are moraines? What are their different types? Show the location of different moraines with the help of a figure.
16. Based on your general knowledge, state how global warming may have its various effects on glaciers.

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