

# 6

## THE WORK OF MOVING ICE, WIND AND SEA WAVES

You have learnt in the previous lesson about the gradational role of running water and underground water. In addition to these two agents, moving ice, wind and sea-waves too are powerful agents of gradation. These three agents too perform the threefold function of erosion, transportation and deposition. In other words, they are removing the weathered material, transporting it from the elevated ground and are depositing the same into low lying areas. This process also tends to 'grade' or 'level off' all irregularities on the surface of the earth in the areas of their operation. We will learn during the course of this lesson how each of these three agents of gradation functions as well as note the details of topographical features formed by each of them.



### OBJECTIVES

After studying this lesson, you will be able to :

- define glacier, snow-line, snowfield, continental and valley glaciers;
- explain with the help of diagrams the formation of main erosional and depositional features produced by glaciers;
- differentiate among the various types of moraines;
- explain the features formed by the wind with the help of diagrams;
- explain with the help of diagrams the various relief features formed by sea-waves;
- give examples of features formed by these three agents of gradation preferably from India.

### 6.1 SNOW - FIELDS

In regions where the temperature always remains below freezing point, precipita-



tion occurs in the form of snowfall. Wherever the rate of snow melting or its evaporation is lower than the rate of snowfall in a year, snow accumulates into great mass of ice. Permanently snow covered regions of this type are called snow - fields. Snow - fields occur in polar regions and on high mountainous areas. Snowfields are always found above the snow line. Snow line is an imaginary line above which there is permanent snow. The height of the snow - line is not uniform and is affected by latitude, amount of snowfall, direction of winds and slope.

- Region permanently covered by snow and ice is called snow- field.
- Snowline is the lowest limit of permanent snow. Factors affecting snowline are-latitude, amount of snowfall, direction of winds and slope of the land.

**6.2 GLACIER**

In region experiencing snowfall, the snow keeps on accumulating in layers one above the other. Its overlying pressure is applied to the underlying snow. It is so great that snow in lower layers becomes granular, hard and compact. The pressure also quickens the melting of some of the snow, which on refreezing starts turning into a granular ice. Again it is the pressure of the overlying layers which makes this solid mass of ice mobile. This great mass of ice moving more under its own weight is called a glacier. Its velocity is very low and it moves from a few centimetres to a few metres in a day.

**Types of Glaciers**

On the basis of their location or area of origin, glaciers are divided into two types:

(i) continental glaciers and (ii) valley glaciers.

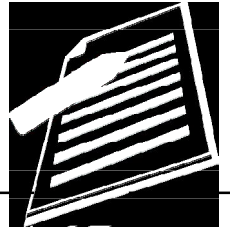
**(i) Continental Glaciers**

A thick ice sheet covering vast area of land is called a continental glacier. The thickness of ice in such regions goes upto thousands of metres. Glaciers of this type build up at the centre and move outward in all directions. Continental glaciers of today are found mainly in Antarctica and Greenland. The precipitation in these regions occurs in the form of snow. It gets accumulated year by year because of relatively slower rate of its melting.

**(ii) Valley Glaciers**

When a mass of ice from the high mountainous regions starts moving down into the pre-existing valleys, it is called a valley glacier or a mountain glacier. The shape of the valley glaciers depends on the valley it occupies. Where the valley is broad, the glacier spreads outwards and where the valley is narrow, the glacier contracts.

The longest glacier in India is the Siachen Glacier in Karakoram range which is 72 kilometres long. Gangotri Glacier in Uttarakhand is 25.5 kilometres long. There are many smaller glaciers in other parts of the Himalaya. Their length varies from 5



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to 10 kilometres. The two important rivers of India, the Ganga and Yamuna, originate from Gangotri and Yamunotri glaciers respectively.

- A moving mass of ice and snow is called a glacier. Glaciers are of two types-continental glaciers and valley glaciers.



**INTEXT QUESTIONS 6.1**

Answer the following questions briefly:

1. What is the name given to a moving mass of ice and snow?  
\_\_\_\_\_.
2. What is the name given to the areas lying above the snow-line?  
\_\_\_\_\_.
3. What is the name given to the lowest limit of snow - fields?  
\_\_\_\_\_.
4. Name two types of glaciers.  
(a) \_\_\_\_\_  
(b) \_\_\_\_\_

**6.3 LANDFORMS PRODUCED BY GLACIER**

Like running water and underground water, glacier also does the work of erosion, transportation and deposition. Although the zone of action of glaciers is rather limited, topographical features made by them are frequently found spread over even in areas once affected by glacial action.

**(A) Erosional work of glacier**

As a glacier moves over the land, it drags rock fragments, gravel and sand along with it. These rock fragments become efficient erosive tools. With their help glacier scrapes and scours the surface rocks with which it comes in contact. This action of glacier leaves behind scratches and grooves on rocks.

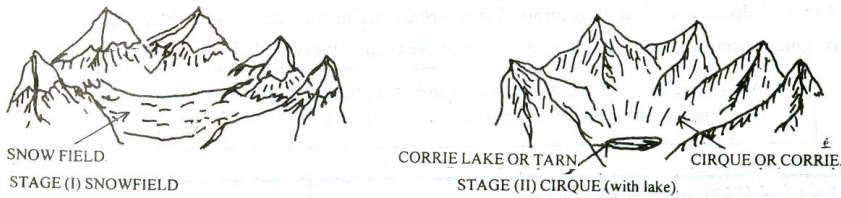
The landforms created by glacial erosion are:

**(i) Cirque (or Corrie)**

Snow collects at the upper end in a bowl shaped depression, is called cirque. Layers of snow in the process of compaction and recrystallization are called firn. Sometimes the deepest parts of these hollows are occupied by accumulated-water, to form Corrie Lake (or Tarn).



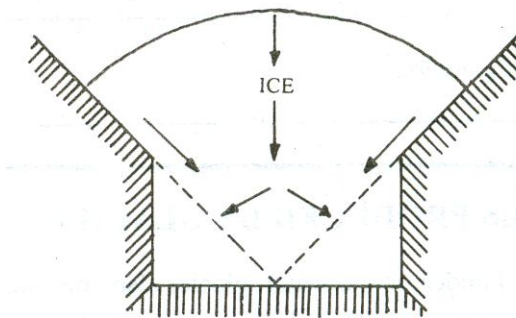
**Notes**



*Fig. 6.1 Formation of Cirque*

**(ii) ‘U’ - shaped Valley**

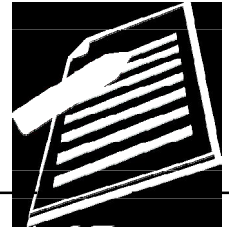
The glacier does not carve a new valley like a river but deepens and widens a preexisting valley by smoothening away the irregularities. In this process the glacier broadens the sides of the valley. The shape of the valley formed in this manner resembles the letter ‘U’. It is therefore called a ‘U’ - shaped valley. (See Fig. 6.2). Such a valley is relatively straight, has a flat floor and nearly vertical sides.



*Fig. 6.2 U-shaped Valley*

**(iii) Hanging Valley**

Just like tributary streams of river, there are tributary glaciers also which join the main glacier after moving over their mountainous path. These tributary glaciers like the main glaciers carve U - shaped valleys. However, they have less volume of ice than the main glaciers and thus their rate of erosion is less rapid. As a result their valleys are smaller and not as deep as that of the main glacier. Due to this difference in deepening; the valley of the tributary glacier is left at a higher level than that of the main glacier. The valley of the tributary glacier just looks like hanging downwards at the point of its confluence with the main valley. This type of a topographical feature is called a hanging valley. This feature is visible when ice has melted in both the valleys. (See Fig.6.3 and 6.4). When the ice in the hanging valley melts, a waterfall is formed at the point of confluence of this stream with the main river.



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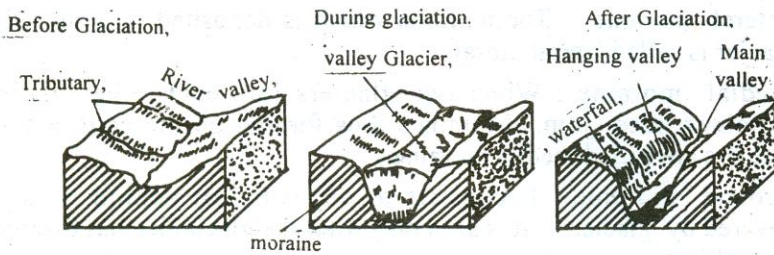


Fig. 6.3 Stages in the development of a glaciated valley

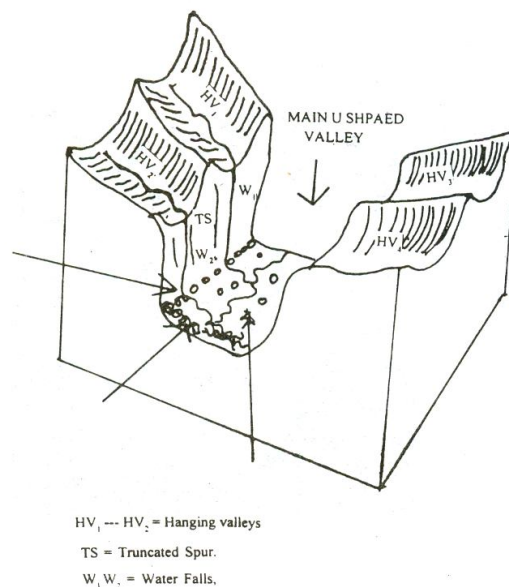


Fig. 6.4 Main Features of a Glaciated Valley

- The main erosional features formed by a valley glacier are (i) Cirque(or Corrie), (ii) U-shaped valley and (iii) hanging valley.

### (B) Transportational work of Glacier

Although the glacier moves very slowly, it drags with it large boulders and rock fragments. Glacier gets this material from the mountain slopes, valley sides, valley bottom and from air. This material is called the load of glacier.

### (C) Depositional work of Glacier

When the glacier melts or retreats, it deposits its load in different parts. The debris thus deposited are called moraines. Depending upon their location in the valley. moraines are of four types:- (i) terminal moraine, (ii) lateral moraine, (iii) medial moraine and (iv) ground moraine. (See fig. 6.5)



- (i) **Terminal Moraine :** When the glacier melts, the debris are deposited at the end of the valley glacier in the form of a ridge. It is called terminal moraine. Morainic material ranges from fine clay to large angular boulders.
- (ii) **Lateral moraine:** The moraine which is deposited on either side of a glacier is called lateral moraine.
- (iii) **Medial moraine:** When two glaciers join each other their lateral moraines also join. Moraines thus formed on the confluence of two glaciers are called medial moraines.
- (iv) **Ground moraine:** It consists of deposits left behind in areas once covered by glaciers. It is seen only after the glacial ice has disappeared by melting.



*Fig. 6.5 A Glacier with Small Tributaries (showing moraines)*

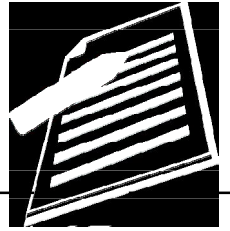
- Moraines are accumulation of angular blocks of rocks, boulders, pebbles and clay that has been deposited by melting glacier or ice-sheet at the edges.
- The moraines deposited at the end of the valley glacier is called terminal moraine.
- Moraine deposited on the sides of the glacier is called the lateral moraine.
- Moraine deposited at the confluence of two glaciers is called the medial moraine.
- Moraine deposited at the bottom of the glacier is called ground moraine.



**INTEXT QUESTION 6.2**

1. Name three topographical features made by glacial erosion.  
 (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_





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2. Name one topographical feature made by glacial deposition.

\_\_\_\_\_

3. Name three functions of glacier.

(a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_

### 6.4 LANDFORMS PRODUCED BY THE WIND

Wind action moves mineral particles when they are in a dry state and unprotected by a vegetation cover. These conditions are found in deserts and semiarid regions of the world, as well as on sandy shorelines.

#### (A) EROSION BY WIND

Wind performs three kinds of erosional work abrasion, attrition and deflation. Loose particles laying on ground surface may be lifted into the air or rolled along the ground by wind action. In the process of wind abrasion, wind drives sand and dust particles against an exposed rock or soil surface. When the wind borne material strike against each other, they are reduced in smaller particles. This process is known as attrition. The removal of loose particles from the ground is termed “deflation”.

#### Landforms Produced by Wind Erosion

Some of the topographical features made by wind erosion are as follows: (i) **Mushroom Rocks ( Or Rock Pedestals)**

When rocks, consisting of alternate hard and soft layers are subjected to wind abrasion, differential erosion results. The soft layers are easily eroded but the hard layer’s resist erosion. As a result of undercutting near the base (due to greater amount of sand and rock particles being transported close to the ground), the resulting feature resembles a rock pillar shaped like a mushroom, It is aptly called rock pedestal or mushroom rock, Such formations are common in the Sahara Desert, and are also seen near Jodhpur. (See fig. 6.6)

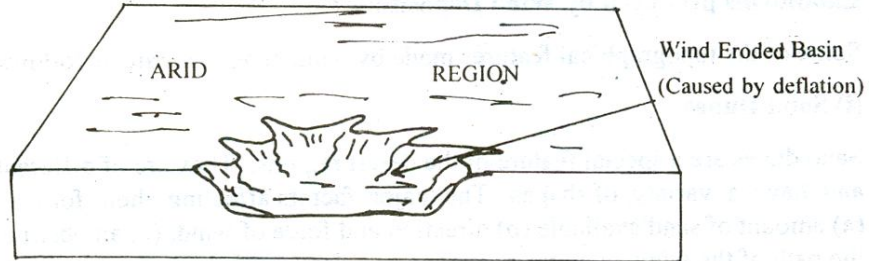


Fig. 6.6 Mushroom Rock



**(ii) Wind Eroded Basins**

A land form produced by deflation is a shallow depression called a “blowout”. The Quattara depression in Egypt is perhaps the finest example of such a hollow.



*Fig. 6.7 Wind Eroded Basin*

- Mushroom rocks are formed in the desert regions by means of wind erosion.
- Wind-eroded basins are formed by wind deflation.

**(B) TRANSPORTATION BY WIND**

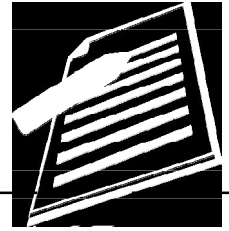
Wind is an important agent of transportation in the arid region. The transported material is sometimes deposited in areas very far away from the place from where the dust particles have been picked. Winds blowing from Gobi Desert carry dust to the northern parts of China. In our country also winds blowing from Thar Desert bring dust particles to western Uttar Pradesh and the adjoining parts of Haryana & Punjab. This transported material is deposited in the fertile plains of Uttar Pradesh.

**(C) DEPOSITION BY WIND**

Under certain conditions, the material transported by wind starts getting deposited at a particular site along its running track. The conditions favouring it are:

- (i) When the amount of dust particles present in the air exceed its carrying capacity, a part of the material being transported is deposited. This is the material which is in excess of the transportation capacity of the wind.
- (ii) When the speed of the wind is reduced, its carrying capacity is also reduced. The material in suspension is thus deposited.
- (iii) When an obstruction comes in the path of the wind, air has to rise above this obstruction. When it rises, the velocity of the wind is reduced and it starts dropping its load. This material is deposited in the form of a mound at the foot of the obstruction.





### Landforms produced by Wind Deposition

Some of the topographical features made by wind deposition are as follows:

#### (i) Sand Dunes

Sand dunes are a special feature of the desert regions. They are of different types and have a variety of shapes. The major factors affecting their formation are (a) amount of sand available (b) direction and force of wind, (c) an obstruction in the path of the wind e.g. a bush, a stone or a dead animal. As long as the wind is strong enough to carry the sand, the sand dunes are mobile and they keep on shifting from one place to another. If vegetation or a line of trees starts growing on the dunes they become fixed. They also become stationary when they are blocked by a hillock. In case there is no such obstruction, sand dunes may bury agricultural land, plains and settlements.

There are two main types of sand dunes:

#### (a) Barchan

One common type of sand dune is an isolated heap of free sand called a barchan, or crescentic dune. This type of dune has the outline of a crescent, and the points of the crescent are directed downwind. On the upwind side of the crest, the sand slope is gentle and smoothly rounded. They are found in large numbers in the Sahara Desert.

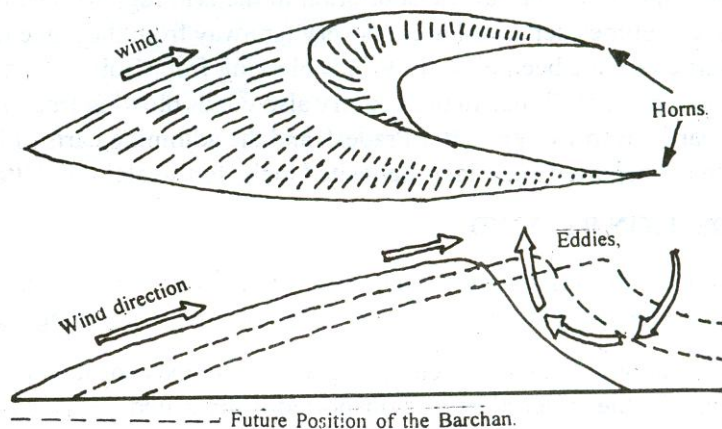


Fig. 6.8 Barchan and its Migration

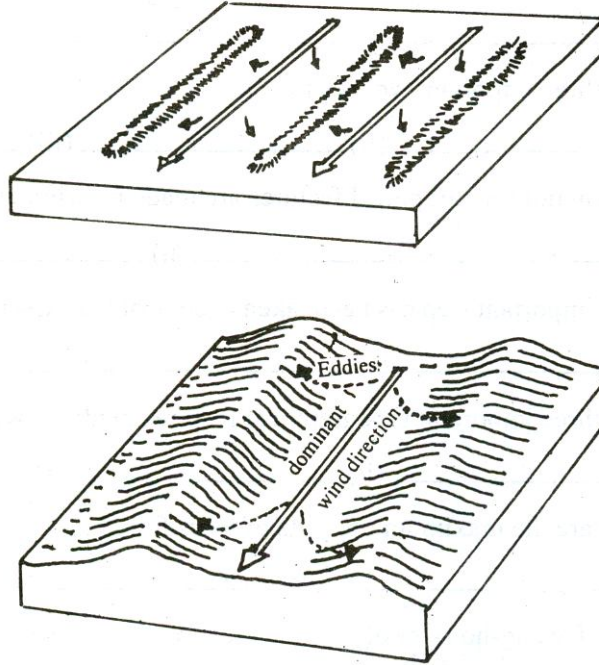
#### (b) Seif Dunes

These are long, narrow ridges of sand that lie parallel to the direction of the prevailing winds. The winds blow straight along the corridors between the lines of dunes, sweeping the corridors clear of the sand. However, eddies set up in the winds blow towards the sides of the corridors, depositing sand there to form these nar-



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row elongated dunes. Seif dunes are common in the western part of the Thar Desert of India.



*Fig. 6.9 Seif Dunes*

**(c) Loess**

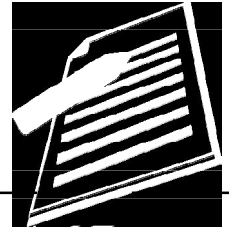
In several large areas of the world, the surface is covered by deposits of wind-transported silt that has settled out from dust storms over many thousands of years. This material is known as loess.

Loess tends to break away along vertical cliffs whenever it is exposed by the cutting of a stream or grading of a roadway. It is also very easily eroded by running water and is subject to rapid gullying when the vegetation cover that protects it is broken. The thickest deposits of loess are in northeast china, where a layer over 30m deep is common and a maximum thickness of 100m has been measured. Besides China, deposits of loess occur in Mississippi Valley of North America and north of Central European Upland in Germany, Belgium and France. Loess deposits are found in Australia also.

- Depositional work of wind results in formation of topographical features like sand dunes, Barchan, seif dunes and loess.



**INTEXT QUESTIONS 6.3**



Notes

- (a) In which region is the work of wind more effective?  
\_\_\_\_\_
- (b) Name three important works of wind.  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_ (iii) \_\_\_\_\_
- (c) Which major topographical features are made by wind erosion?  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_
- (d) Name three important topographical features made by wind deposition.  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_ (iii) \_\_\_\_\_
- (e) Where are the maximum deposits of loess found?  
\_\_\_\_\_

**6.5 LANDFORMS PRODUCED BY SEA WAVES**

We are aware of the fact that the water in the oceans is never at rest. The tides, waves and ocean currents contribute to the restlessness of ocean. Their continuous effect on coast creates a number of relief features. The work of sea waves as an agent of gradation includes erosion, transportation and deposition. A number of topographical features are made through these actions of waves. Such features are found in the coastal regions. Let us study the work of sea waves in some more details.

**(A) EROSION BY SEA WAVES**

Sea waves have a great erosive force. In their role of an erosional agent they perform four functions. When the sea water loaded with rock fragments and sand attack the coastal rocks it is called *abrasion*. The rock particles present in the water hit against each other and break into progressively smaller particles. This process is called *attrition*. Thirdly the broadening of cracks and crevices in the cliffs along the coast due to the attack of the sea waves is called the *hydraulic action*. The rocks made up of limestone are subjected to *solution action* by the sea waves. All these processes help in formation of new features on the coastal margins.

- The three major works of sea waves are erosion, transportation and deposition.
- Abrasion, attrition, solution and hydraulic action are the processes which help in erosion by the sea waves.

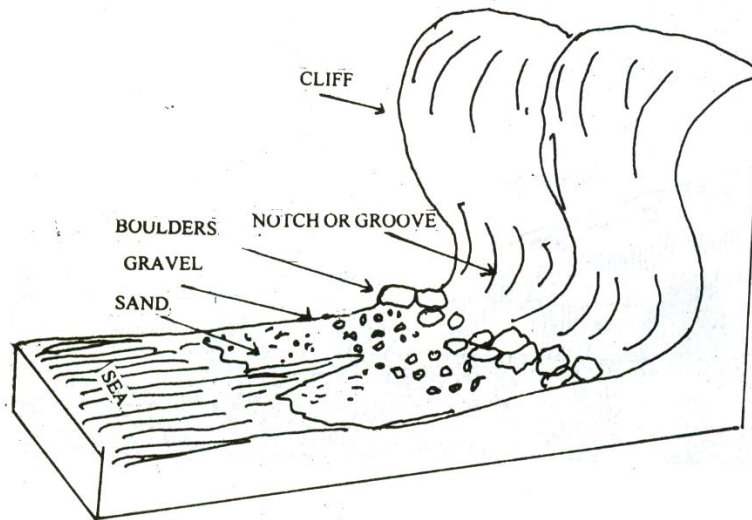


**Landforms Produced by sea Wave Erosion**

Waves, like streams erode the coastal rocks with the help of rock fragments present in the water. Due to the continued erosion by waves, the coastline keeps retreating and a number of topographical features are formed in the process. Some of the important features made through sea wave erosion are mentioned here:

**(i) Sea Cliff**

The maximum impact of the sea waves is observed on the lower part of the coastal rocks and consequently the lower part of the rocks is eroded more rapidly than the upper part. This results in the formation of a hollow under the rock and with the passage of time this excavation in the lower part of the rock keeps on becoming larger.

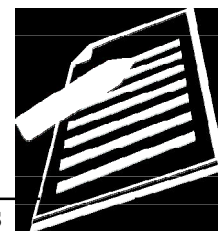


*Fig. 6.10 A Sea Cliff*

The upper part of the rock is thus left projecting out towards the sea. After some-time, this projecting part fall into the sea under its own weight. As a result a vertical wall is left. This vertical wall is called a cliff. In India a number of sea cliffs are found along the Konkan Coast of India.

**(ii) Sea Caves**

When the upper part of the coastal rock is hard and the lower part is soft, the erosion is not uniform. The lower part of the rock in such circumstances is eroded much faster than the upper part. Due to differential erosion a hollow is created in the lower part of the rock. When the waves pound against this hollow, air present in the hollow gets compressed. When the wave comes out of the hollow, the pressure on air is also released and it expands. Due to continuous compression of the air in the hollow, the rocks are subjected to a great pressure and they break. in this process, the hollows in the lower part of the rock keep on enlarging. With



passage of time they attain the form of caves and are known as sea caves. Formation of caves depends upon the nature of the coastline and the force of the waves.

### (iii) Sea Arches

When a part of coast extends to some distance into the sea, sea waves working from opposite directions cut a passage through the soft rocks. In the initial stages, this passage is a narrow hole but it enlarges into a broad arch. These broad door-like features are called sea arches or natural bridges.

### (iv) Sea Stacks

When the roof of an arch is broken by erosion or under its own weight or due to any other reason a part of the original rock remains standing as a solitary mass. It may be the rock forming the side of the arch. This type of a feature is called a sea stack. Stacks are of a number of types depending upon their shape and the nature of the rocks. Sometimes they take the shape of islands but such islands are not permanent. Small underwater stacks are known as stumps.

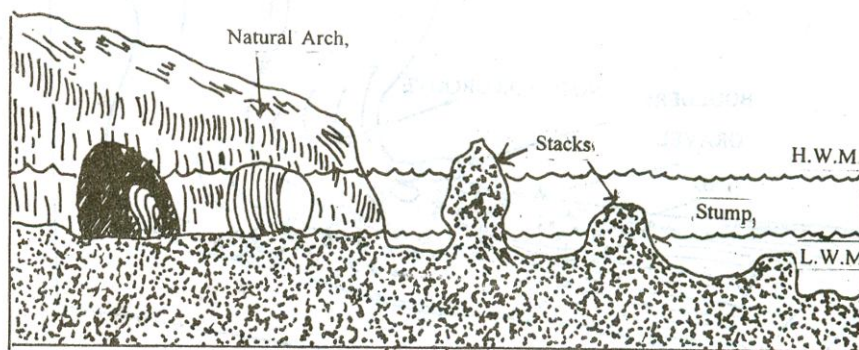


Fig. 6.11 Topographical features made through wave erosion

- Wave erosion is responsible for the formation of sea cliffs, sea caves, sea arches and sea stacks.

### (B) Transportation by Sea Waves

Sea waves, currents and tides are the main agents of transportation of eroded material in the coastal regions. However, the role of waves is more important in connection with the formation of coastal relief features. The material deposited on the coasts by the rivers and glaciers etc. is removed and transported by the waves. Transportation by sea waves is carried out in two ways:

- Removal and transportation, towards the sea, of the material deposited by river etc. on the coast.
- Carrying of material found in the sea to the coastal areas. During this process, the oceanic materials like pearls, conches and other shells are brought to the coast.





**Notes**

- Transportation by sea waves is responsible for ocean ward transportation of the material deposited on the coast and coastward transportation of the material found in the sea.

**(C) Deposition by Sea Waves**

Sea waves are helpful in the deposition of the material eroded from the coastal areas. Oceanic current are also helpful in deposition of the transported material. Deposition of the material along the coast is selective. The larger particles are deposited first therefore they are found near the coast. On the other hand, the finest particles are deposited last and they are deposited generally away from the coast. This selective deposition is sometimes altered or affected by a change in the intensity or force of the waves. Thus it is sometimes possible to find very fine particles deposited near the coast where generally larger particles are deposited.

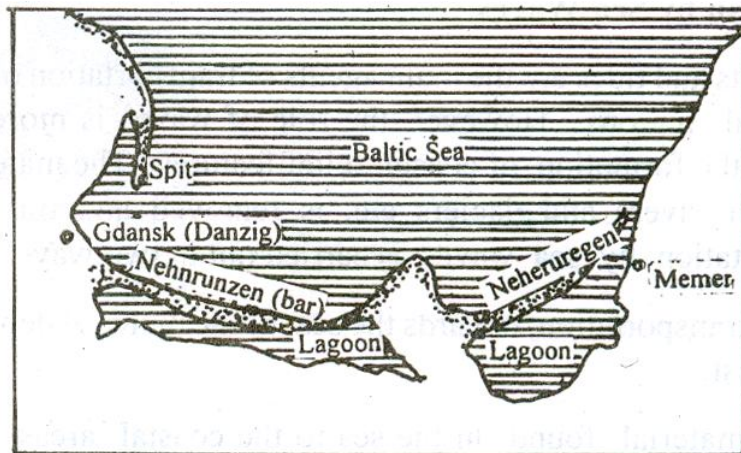
A number of topographical features are formed due to deposition by waves and currents. Some of these topographical features are discussed here:

**(i) Beach**

Most of the material eroded and picked up by the waves is deposited near the coast. Due to this deposition, the sea becomes shallow and a part of the coastal area is raised above the water level. This raised portion is almost like a flat plain of a platform formed of gravel and sand. This type of depositional features along the coast is called a beach. Beaches are centres of tourist attraction. Marina Beach of Chennai and Kovalam Beach of Thiruvananthapuram are the famous beaches of India.

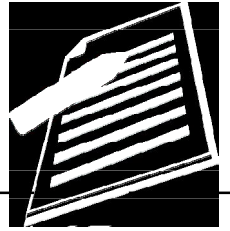
**(ii) Sand Bar**

Sometimes the deposits of sand and gravel laid down by waves and currents form embankment, separating shoreline from the sea. They thus form barriers between the sea and the mainland. Such deposits are called sand bars. They sometime pose difficulties in navigating.



*Fig 6.12 Sand Bar and Spit*





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**(iii) Spit**

When one end of a bar is attached to the coast and other extends into the sea, it is called a spit. These spits are formed by the accumulation of materials brought by waves like sand and gravel.

**(iv) Lagoon**

Sometimes due to deposition of waves and currents both the ends of the bar join to enclose a part of the sea water between the coast and the bar. This enclosed part of the sea forms a lake of saline water. This saline water lake is called a lagoon.

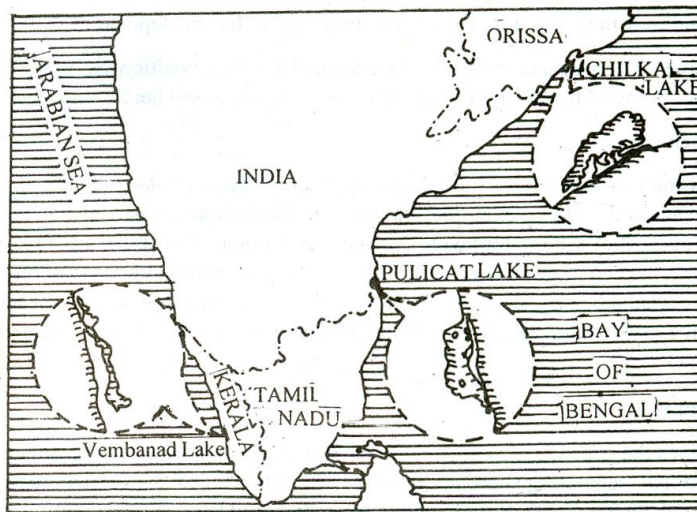


Fig. 6.13 Map showing Famous Lagoons of India

Sometimes the lagoons are formed due to wave erosion also. A lagoon is generally connected with the sea through a narrow passage. The Chilka and Pulicate lakes on the north-eastern coast and lake Vembanad on Kerala coast are examples of lagoon lakes in India.

- Topographical features like beaches, bars, spits and lagoons are formed by the action of waves.



**INTEXT QUESTIONS 6.4**

1. Fill in the blanks

- (a) Cutting of coastal rocks by sea waves is known as their \_\_\_\_\_ work.
- (b) The four processes contributing to erosional action of sea waves are:
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_
  - (iii) \_\_\_\_\_
  - (iv) \_\_\_\_\_

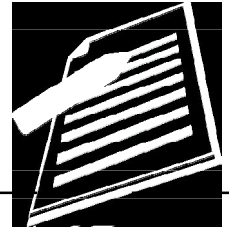
**Notes**

- (c) Sea cliff is a result of \_\_\_\_\_ action of sea waves.
2. Name any three relief features made through erosional action of sea waves.  
 (i) \_\_\_\_\_ (ii) \_\_\_\_\_ (iii) \_\_\_\_\_
3. Name two important factors on which the formation of the sea caves depends.  
 (i) \_\_\_\_\_ (ii) \_\_\_\_\_
4. Which action of waves is responsible for the formation of spit  
 \_\_\_\_\_.
5. Classify following relief features made by erosional and depositional action of waves:  
 Sea stack, Bars, Sea caves, Sea cliffs, Beaches and Arches.
- Categories:
- (i) Made through erosion (1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_
- (ii) Made through deposition (1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_

**WHAT YOU HAVE LEARNT**

In areas where the temperature always remains below freezing point, precipitation occurs in the form of snow. Therefore, these areas are covered with snow. Such regions are called snow-fields. Snow-fields are found always above the snowline. Snowline is that line above which the snow never melts completely. Moving ice is called a glacier. They are of two types- continental glaciers and valley glaciers. Glaciers do the work of erosion, transportation and deposition through which a number of topographical features are formed. The major topographical features of glacial erosion are the 'U' -shaped valleys and hanging valleys. The major depositional features of glacial action are the moraines. There are three types of moraines-terminal moraine, lateral moraine and medial moraine. Topographical features made by glaciers are found in areas of high altitude and high latitude.

Wind like running water, moving ice and underground water, is an important agent of gradation. Action of wind is more effective in arid and semi-arid regions. Wind erodes the rocks, transports the broken material and deposits it in different areas. These three actions of wind are known as erosion, transportation and deposition. Erosional work of wind include abrasion, attrition and deflation. One of the major topographical features made by wind erosion is mushroom rock which resembles an umbrella in shape. The transportation work of wind is also extensive, the broken particles of rocks are transported to thousands of kilometres. Deposition of the transported material results in formation of a number of topographical features. The important ones among these are the sandunes and loess.



The most important agent shaping coastal landform is wave action. The important works of waves are the breaking up of the rocks, removal of broken material and laying down of this material in different parts of the coastal areas. These three actions of waves are called erosion, transportation and deposition. Erosion by waves is achieved through the processes of abrasion, attrition, hydraulic action and solution. Erosion by sea waves results in formation of topographical features like sea cliff, sea caves, arches and stacks. Transportation work of waves makes possible seaward movements of the material accumulated on the coast and coastward movement of the material found in the sea. Depositional work of sea waves is responsible for formation of topographical features like bars, spit, beaches and lagoons.



### TERMINAL QUESTIONS

1. Answer the following questions in brief:
  - (i) What is snowline?
  - (iii) What is a hanging valley? How is it formed?
2. Distinguish between the following:
  - (a) Continental glacier and valley glacier. (b) V-shaped valley and U-shaped valley.
3. Name the major relief features formed by glacial erosion and deposition and explain the process of formation of each with the help of diagrams.
4. In which region is the work of wind more effective? Why is it so?
5. Explain the three processes which help in the wind erosion.
6. How is a mushroom rock formed? Explain with the help of a diagram.
7. Where is the greatest deposits of loess found?
8. Which topographical features are formed through erosional action of sea waves? Explain the mode of formation of each.
10. How is a beach formed? Name two important beaches of India.
11. Differentiate between:
  - (i) Erosional and depositional work of wind.
  - (ii) Solution action and hydraulic action of sea-waves.
  - (iii) Lagoon and beach.



Notes



**ANSWERS TO INTEXT QUESTIONS**

**6.1**

1. Glacier. 2. Snowfield. 3. Snow-line 4. (a) Continental glaciers, (b) Valley glaciers.

**6.2**

1. (a) U-shaped valley (b) Hanging valley (c) Cirque
2. Moraine
3. (a) Erosion, (b) Transportation, (c) Deposition

**6.3**

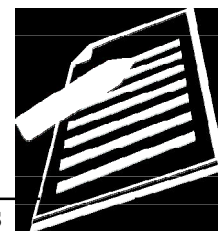
- (a) Desert and semi-desert regions.
- (b) (i) Erosion (ii) Transportation (iii) Deposition
- (c) (i) Mushroom rock, (ii) Wind eroded basin
- (d) (i) Sand dunes (ii) Barchans or Seifdunes, (iii) Loess
- (e) In North China

**6.4**

1. (a) Erosional (b) (i) Abrasion, (ii) Attrition, (iii) Hydraulic action; (iv) Solution. (c) Erosional
2. (i) Sea cliffs (ii) Sea caves (iii) Sea arches (iv) Sea stack (any three)
3. (i) Nature of the coastline (ii) Force of waves
4. Depositional work.
5. (i) Made through erosion: Sea stacks, cliffs, caves, arches.  
(ii) Made through deposition: Bars, beaches.

**HINTS TO TERMINAL QUESTIONS**

1. (i) Snowline is an imaginary line above which there is Permanent snow.  
(ii) Refer to section 6.3 (a) (iii) for answer draw the diagram (Fig. 6.4) given on that page.
2. (a) (i) Continental glacier: A large area covered with ice and snow.  
(ii) Valley glacier: is formed when ice and snow start moving from high mountains into some pre-existing valleys. This moving mass of ice and snow is called a valley glacier.



- (b) U-shaped Valley: Due to a steep slope in the higher mountainous regions, the flow of the rivers is very rapid. They erode the bottom of their valleys at a higher rate and this results in the formation of a V-shaped valley. (See figure in the foregoing lesson).

U-shaped valley: Glaciers do not form their valley as the river does. They flow through some old valleys. Such narrow valleys are broadened and deepened by the glaciers to form U-shaped valleys. U-shaped valleys are deep and steep-sided and they are formed through erosion on the valley floor and the valley sides. (See Fig. 6.2).

3. Major relief features formed by glacial erosion are (i) U-shaped valley, (ii) Hanging valley. Major relief features formed by glacial deposition are: (i) Lateral moraines, (ii) Terminal moraines, (iii) Ground moraines, (iv) Medial moraines.
4. In arid or desert regions  
Due to partial or total absence of vegetation cover, the wind finds the conditions ideal for blowing over vast areas uninterrupted. Besides mechanical weathering breaks the rocks into small particles which are easily blown away.
5. The three processes are abrasion, attrition and deflation. (For details Refer to Section 6.4 (A)).
6. Mushroom rock is formed by wind erosion. (For details and see Section 12.6 (i)).
7. Greatest expanse of loess deposits is found in North China. Where a layer over 30M is common and a maximum thickness of 1000M has been measured.
8. The major topographical features made through wave erosion are sea cliffs, sea caves, sea arches and sea stacks. (For details of their mode of formation refer to section 6.5 (A)).
9. Beaches are formed through depositional work of : Sea waves. Two famous beaches of India are Marina Beach of Chennai and Kovalam Beach of Thiruvananthapuram. (For details of mode of formation see Section 6.5 (C) (i)).
10. (i) Breaking lip and frictional reduction of rocks by wind is called erosion and the process of laying down of wind-borne material is called deposition. (For details refer to section 6.4 (A) and (C)).

## MODULE - 2

*Changing face of the Earth*



**Notes**

### The Work of Moving Ice, Wind and Sea Waves

- (ii) The term hydraulic action refers to the process of broadening of the rock joints and cracks by the pressure exerted by air entrapped in the coastal ‘rocks. The term solution refers to the action of water on the soluble rocks like limestone. Such rocks are dissolved by water and thus eroded. (For detail refer to Section 6.5).
- (iii) Lagoon and beach are both formed through depositional action of waves. A beach is a raised portion on the sea coast made through deposition of sand and gravel. A lagoon is the enclosed part of the sea separated from the open sea by an enlarged bar. (For details refer to 6.5 (C) (i) and (iv).