

UNIT – V

GEOMORPHIC PROCESSES: GLACIER

- Glaciers are a mass of ice moving under its own weight. They are commonly found in the snow-fields.
- We know that the landmass on the earth is not entirely the same as we see around. Some areas are covered by thick green forests, some with dry hot deserts, some with permanent ice covers etc. Among these varied landmasses, the permanently ice-covered regions on the earth surface are called as snow-fields. The lowest limit of permanent snow or snow-field is called as the snowline.
- A Glacier forms in areas where the accumulation of snow exceeds its ablation (melting and sublimation) over many years, often centuries.
- They form features like crevasses, seracs etc. A crevasse is a deep crack, or fracture, found in an ice sheet or glacier, as opposed to a crevice that forms in rock. A serac is a block or column of glacial ice, often formed by intersecting crevasses on a glacier.
- Ogives are alternating wave crests and valleys (troughs) that appear as dark and light bands of ice on glacier surfaces. They are linked to seasonal motion of glaciers; the width of one dark and one light band generally equals the annual movement of the glacier.
- Glaciers cover about 10 percent of Earth's land surface and they are the largest freshwater reservoirs on earth.

On the basis of the location of the glacier, they can be classified as:

1. **Continental Glacier/Piedmont Glacier:** they move outward in all directions
2. **Valley/Mountain Glaciers:** Move from higher elevation to lower

Erosional landforms due to Glaciers

1. Cirque or Corris

- They are deep, long and wide troughs or basins with very steep concave to vertically dropping high walls at its head as well as sides.
- They are simply a bowl-shaped depression formed due to the erosional activity of glaciers.
- When these depressions are filled with water, they are called as Cirque lake or Corrie Lake or Tarn Lakes.



2. Hanging Valleys or U-shaped Valleys, Fjords/fjords

- The Glacier doesn't create a new valley like a river does but deepens and widens a pre-existing valley by smoothing away the irregularities.
- These valleys, which are formed by the glacial erosions assume the shape of letter 'U' and hence are called as U-shaped Valleys or Hanging Valleys.
- A fjord is a very deep glacial trough filled with sea water and making up shorelines.
- A fjord is formed when a glacier cuts a U-shaped valley by ice segregation and abrasion of the surrounding bedrock and this valley gradually gets filled with the seawater (formed in mountains nearby sea).



3. Horns and Aretes

- Horns are sharp pointed and steep-sided peaks.
- They are formed by headward erosion of cirque wall.
- When the divide between two cirque walls gets narrow because of progressive erosions, it results in the formation of a saw-toothed ridge called Arete.



Depositional Landforms due to Glaciers

Glacial deposits are of two types:

- (i) Glacial Till – unassorted coarse and fine debris;
- (ii) Outwash – assorted roughly stratified deposits.

1. Moraines

- Moraines are long ridges of deposits of glacial till.
- When these deposits are at the end of a glacier, they are called as Terminal moraines and when they are deposited on both sides, they are called as Lateral moraines.
- When lateral moraines of two glaciers join together, they form Medial moraines.
- When the lateral moraines of both sides of a glacier join together, it forms a horse-shoe shape.
- Ground moraines are deposits left behind in areas once covered by glaciers.



2. Eskers

- When glaciers melt in summer, the water which formed as a result of melting accumulates beneath the glacier and flows like streams in channels beneath that ice.
- Very coarse material like boulders, blocks and some minor fractions of rock debris are carried away by these streams.
- They later get deposited in the valleys itself and once the ice melts completely, they are visible to the surface as sinuous ridges.
- These ridges are called as Eskers.



3. Drumlins

- They are smooth oval-shaped ridge-like structures composed mainly of glacial till.
- It shapes like an inverted spoon with the highest part is called as Stoss End and the lowest narrow part is called as Tail End.
- They are formed as a result of glacial movement over some minor obstruction like small surface rocks.
- The glacial till gets deposited in those obstructions and the movement of glacier shapes these deposits like an inverted spoon.

WIND AND WAVES:

In the previous articles, we have been discussing various exogenic geomorphic agents like water (running water and groundwater) and glaciers. We have seen the evolution of landforms due to these agents. In this post, we discuss in detail how the wind and the waves cause the evolution of various landforms on the earth surface.

Action of Winds:

- The wind is the main geomorphic agent in the hot deserts.
- Winds in hot deserts have greater speed which causes erosional and depositional activities in the desert.

- The landforms which are created by erosional and depositional activities of wind are called as Aeolian Landforms.
- This process is not unique to the Earth, and it has been observed and studied on other planets, including Mars.
- An erg (also known as sand sea / dune sea / sand sheet if it lacks dunes) is a broad, flat area of desert covered with wind-swept sand with little or no vegetative cover. It is defined as a desert area that contains more than 125 square kilometres of aeolian or wind-blown sand and where sand covers more than 20% of the surface. Smaller areas are known as “dune fields”. The largest hot desert in the world, the Sahara, contains several ergs.

Erosional Landforms due to Wind

1. Pediplains

- When the high relief structures in deserts are reduced to low featureless plains by the activities of wind, they are called as Pediplains.

2. Deflation Hollows

- Deflation is the removal of loose particles from the ground by the action of wind.
- When deflation causes a shallow depression by persistent movements of wind, they are called as deflation hollows.

3. Mushroom Tables

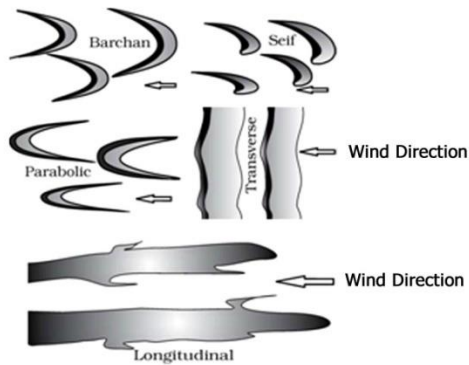
- Ventifacts are rocks that have been abraded, pitted, etched, grooved, or polished by wind-driven sand or ice crystals.
- These geomorphic features are most typically found in arid environments where there is little vegetation to interfere with aeolian particle transport, where there are frequently strong winds, and where there is a steady but not overwhelming supply of sand.
- Mushroom Tables / Mushroom rocks are Ventifacts in the shape of a mushroom.
- In deserts, a greater amount of sand and rock particles are transported close to the ground by the winds which cause more bottom erosion in overlying rocks than the top.
- This result in the formation of rock pillars shaped like a mushroom with narrow pillars with broad top surfaces.



Mushroom rocks

Depositional Landforms of Wind

1. Sand dunes



- Dry hot deserts are good places for sand dune formation.
- According to the shape of a sand dune, there are varieties of sand dune forms like Barchans, Seifs etc.
- The crescent-shaped dunes are called as Barchans and they are the most common one.
- Seif is similar to Barchans but has only one wing or point.

2. 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. These depositions are called as Loess.

Action of Waves:

- Coastal processes are the most dynamic and hence most destructive.
- Some of the changes along the coast take place very fast. Storm waves and tsunami waves can cause far-reaching changes in short period of time than normal breaking waves.
- The coastal landforms in the world can be classified into two categories:

1. High Rocky Coast/ Submerged Coast/ Retreating Coast



- In these type of coasts, the sea will be very close to the land without any coast or sometimes a narrow coast.
- The shores of these high rocky coasts do not show any depositional landforms.
- Erosional feature dominates here.
- Wave-cut platforms, cliffs, sea caves etc are common here.
- Most of the west coasts of the Indian Peninsula belong to this category.

2. Low Sedimentary Coast/ Emerging Coast/ Advancing Coast

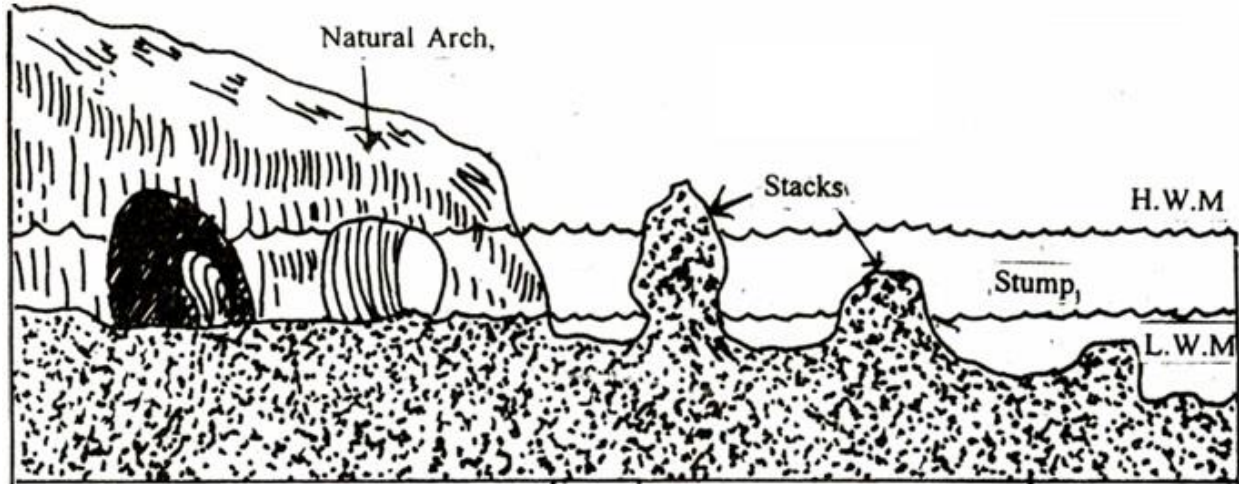


- The rivers in these coasts extend the length of the coast by building coastal plains and deltas.
- Thus, depositional features are dominant here.
- Bars, Barriers, spits, lagoons etc are common on these coasts.
- Most of the east coasts of the India Peninsula are of this category.

Erosional Landforms due to Waves

Cliffs, Terraces, Caves, Stacks and Stumps

- Cliffs are common on the high rocky coasts.
- At the foot of such cliffs, there may be flat or gently sloping platform covered by rock debris derived from the sea cliff behind.
- Such platforms occurring at an elevation above the average height of waves is called as a wave-cut terrace.
- When the upper part of a coastal rock is hard and the lower part is soft, the erosion will not be uniform. The lower part erodes easily which results in the formation of a hollow part.
- This hollow part, by frequent wave action, gradually develops into a **sea-cave**.
- Sea arches are also formed in the same manner.
- **Sea stacks** are nothing but the isolated standing rocks in the sea which were once a part of the cliff.
- These stacks look will like small islands in the sea.
- Small underwater stacks are known as stumps.



Depositional Landforms due to Waves

1. Beaches and dunes

- Beaches are characteristics of shorelines that are dominated by deposition.
- Beaches are temporary features which are made up of sand-sized materials.
- Beaches which contain excessively small pebbles and even cobbles are called as Shingle Beaches.
- Sand dunes are formed just behind the beaches as long ridges parallel to the coastline.

2. Bars, spits, and Lagoons

- Bars are deposits of sand and gravel laid down by waves and currents which separate the shoreline from the sea.
- They act as a barrier between the mainland and the sea.
- When one end of such bar is attached to the coast and other extends into the sea, it is called as a spit.
- Tombolo is a deposition landform in which an island is attached to the mainland by a narrow piece of land such as a spit or bar.
- Sometimes due to deposition of waves and currents, both ends of the bar join to enclose a part of sea water between the coast and the bar. This enclosed part of the sea forms a lake of saline water called as Lagoon.
- A lagoon is generally connected with the sea through a narrow passage.
- Chilika and Pulicat lakes are examples of Lagoon Lake.
