Lesson - 10

Agents of Erosion

Indogenetic and exogenetic forces form different landforms on the earth surface. The exogenetic forces (weathering, erosion and mass translocation) tranforms the outer layers of the rocks. The structure of landforms constantly undergoes changes due to these exogenetic forces and new landforms are also formed.

Erosion is a static process. The forces which contribute in erosion like rivers ,sea waves, winds ,glaciers and underground water are called the agents of erosion. It is not always necessary that these agents of erosion work in the same way and at the same speed, the other factors like climate and composition of rocks and their structure also affects erosion.

The factors which play an important role in the erosional and depositional work of different landforms, on the earth's surface are as follows:-

1. River - Fluvial topographies
2. Sea Waves - Coastal topographies
3. Wind - Arid Topographies
4. Glacier -Glaciated tomographies
5. Underground water - Karst topographies

River -Fluvial topographies

The flowing water in the valley, erodes the valley bottom and its sides and carries the eroded material along with it and deposit it at some other places. This process of erosion and deposition gives birth to many landforms.

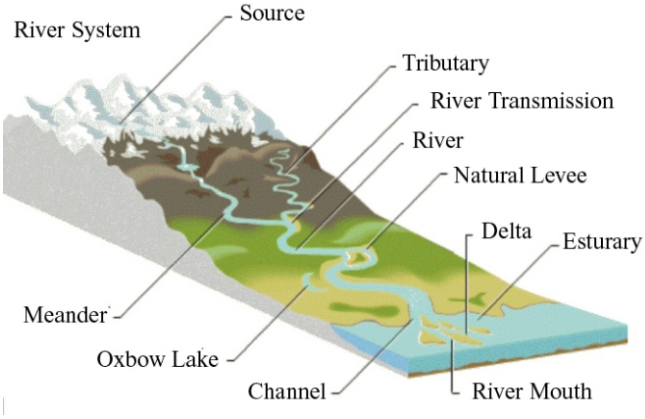

Fig 10.1 : Fluvial Topographies

A) Erosional topographies

1. **Gorge -** It is a narrow deep valley with almost vertical sides.
2. **Canyon-** These are comparatively more narrower and more deeper valleys than Gorges.
3. **Waterfalls -** When the river water plunges almost vertically from a higher level to lower level it forms water fall. (Fig 10.2)
4. **Rapids -** The river appears to be jumping over the hard rocks which leads to the formation of rapids. (Fig 10.3)
5. **Pot Holes -** The holes created in the bottom of the valleys as the result of the drilling action of water are called pot holes.
6. **Structural benches-** When the hard and the soft rocks are arranged horizontally in the course of the river differential erosion results in the formation of structural benches.

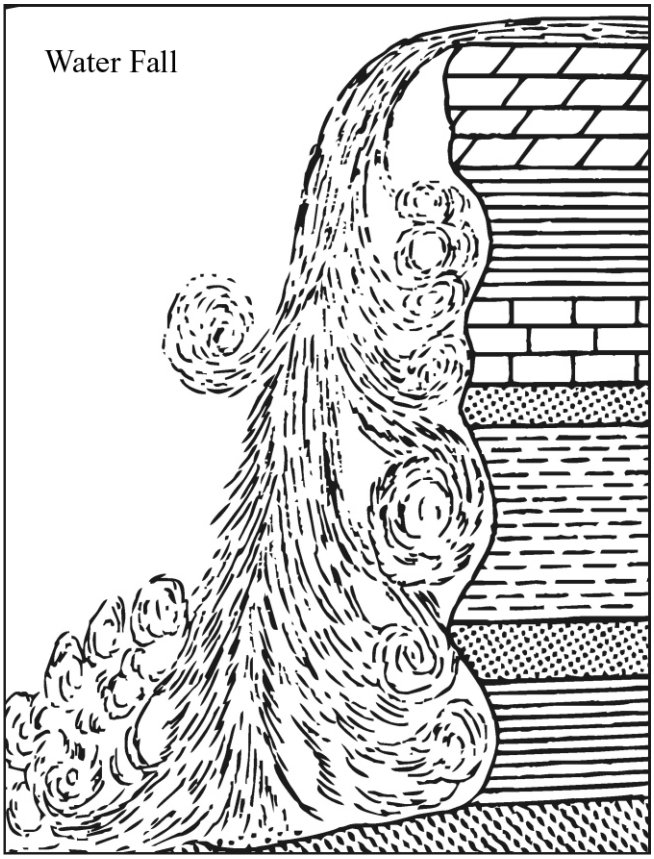

Fig 10.2 : Waterfall

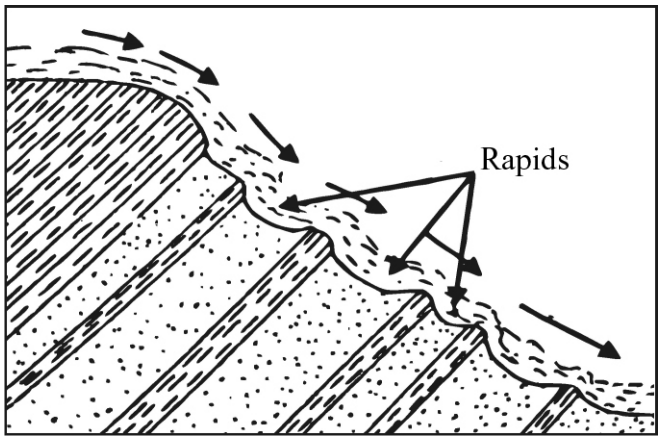

Fig 10.3 : Rapids

7. **River meanders -** The river bends in the latter stages of fluvial erosion in a serpentine manner, which are called meanders.
8. **Peneplain -** This is a featurless plain formed by the river with a very gentle slope.

B) Depositional topographies

1. **Alluvial cone -** When the rivers progresses from the mountain slopes towards the valley floors, the deposition of eroded material in form of cone is called Alluvial cone. (Fig 10.4)
2. **Alluvial fan -** The deposition of sediments brought by the river on the foothills of the mountains in the form of fans, are called Alluvial fans. (Fig 10.4)
3. **Delta -** The triangular shape deposition of sediments at the mouth of the river is called delta. (Fig 10.1)
4. **Natural Levees-** The sand materials deposited at the banks of the river on both of its sides are called natural levees.
5. **Flood plain-** The part of the river where it deposits all the sediments during the floods leads to the formation of floodplain.
6. **Oxbow lake-** When the rivers follow a straight course leaving behind its meanders, these meanders are filled with water, these are called oxbow lakes. (Fig 10.1)

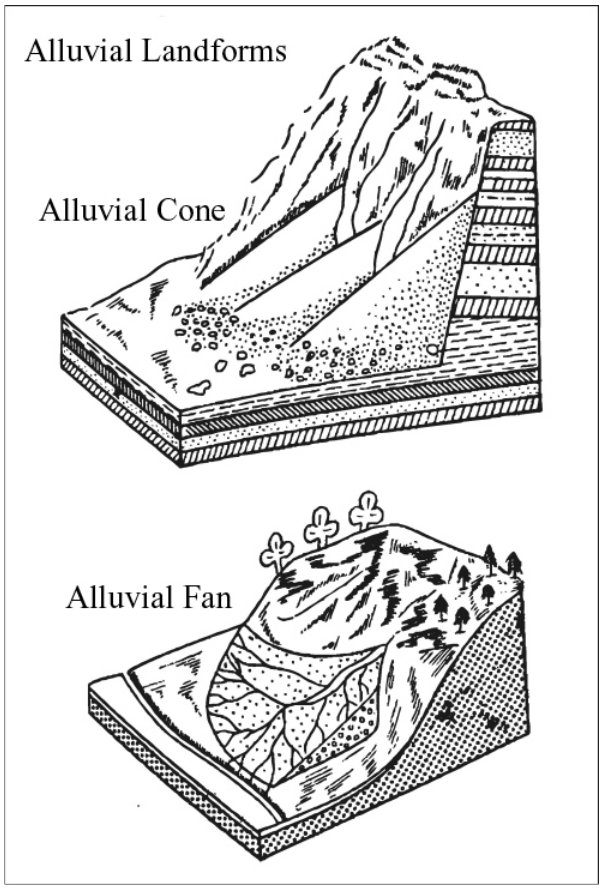

Fig 10.4 : Alluvial Cone and Fans

Sea waves- Coastal topographies

The movement of the water under the impact of the wind is termed as a wave. The sea waves forms many erosional and depositional landforms in the coastal regions through the erosion and deposition of sediments, resulting from the processes of abrasion, attrition and hydraulic action.

A) Erosional topographies

1. **Cliff-** The formation of vertical coast due to the hydraulic action of the sea waves are called Cliffs.
2. **Caves-** The formation of oval shaped cavities parallel to the coast due to the erosion of hard and soft rocks are termed as Caves.
3. **Sea Caves-** In the coastal areas when the grooves are constantly eroded by the sea waves, it results into formation of sea caves.
4. **Blowout-** When the sea waves forms a hole on the roof of the sea caves, it is called as blowout.(Fig.10.5)
5. **Arches -** In the coastal regions, when the two caves are formed adjacent to each other, arches are formed.(Fig. 10.5)
6. **Stack-** Due to the collapse of arches stacks are formed. (Fig. 10.5)
7. **Wave cut platform -** These platforms are formed as the Cliffs and they constantly recedes backward from the coast.

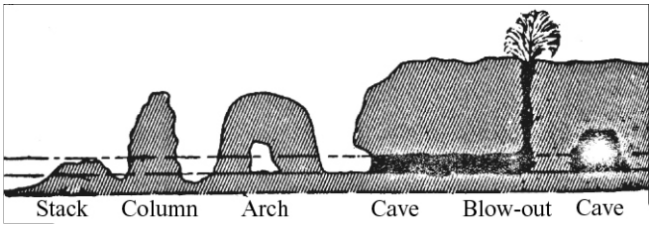

Fig. 10.5 : Coastal Topography

B) Depositional topographies

1. **Beach -** The deposition of the marine sediments on the sea coast forms the sea coast.
2. **Cusp beach-** A triangular beach which is formed of cobbels, boulders and sand and that extends seaward is called cusp beach.
3. **Spit-** The formation of an embankment due to deposition along the coast line towards the sea is called spit.
4. **Bars-** The elongated depositions of shingles much parallel to the coastline are called bars.
5. **Offshore bars-** When the bars are formed away from the coastline but parallel to it, its called Offshore bars.
6. **Hook -** The semi circular depositional spits are called hooks.
7. **Loop-** The land along the growth of the hook are called loop.
8. **Connecting bars-** When the spits joins or connects two headlands or islands it is termed as connecting bars.
9. **Lagoon and Bay Bars-** When the two edges of a bay are connected by a wall or a barrier formed of deposits , it is called Bay bars and the closed bay is called Lagoon.
10. **Tombolo-** The bar that connects the islands with the mainland is called Tombolo.

Wind - Arid Topographies

The erosional and depositional work of the wind forms many landforms in the desert regions. Wind through the process of attrition, ablation and abrasion erodes the rocks and then transport the eroded material extensively in the desert region this results in formation of many erosional and depositional landforms.

A) Erosional Topographies

1. **Blow out -** The troughs or trenches which are formed due to the ablation of the wind are called blowout.
2. **Inselbergs -** These are steep sided hills of hard Rocks rising from a plain region in the vast deserts. They often resemble like an island or a mountain.(Fig. 10.6)
3. **Mushroom rock -** These are actually residual of the hard rocks which takes the shape of a mushroom. (Fig. 10.6)
4. **Demoisells-** These are earth pillars which are protected by hard rocks as a outer cover. (Fig. 10.6).
5. **Dreikanter-** A rock piece which is braided and polished by wind blown sands in the deserts is called Dreikanter.
6. **Stone lattice-** The pitted and fluted rock

surfaces which contains lots of holes formed by the powerful winds in the deserts are called stone lattice.

7. **Zeugen -** They are in form to deep cuts in the layers of the rocks of varying hardness due to the erosional work of winds. (Fig. 10.6)
8. **Yardang-** These are the steep sided over hanging ridges parallel to the direction of the winds in the deserts. (Fig 10.6)

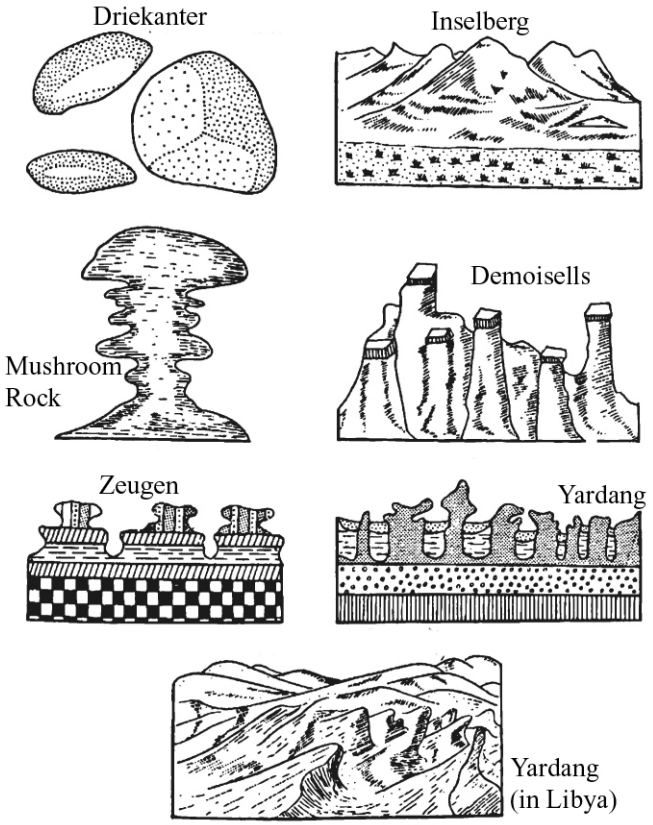

Fig. 10.6 : Arid Topography

B) Depositional topographies

1. **Sand dunes-** These are heaps or mounds of sands that move continuously along with the wind in the deserts.
2. **Ripples-** These are marks produced on the sand dunes perpendicular to the wind direction.
3. **Sand drift-** These are longitudinal accumulation of sands around the obstacles and moves along with the wind in the deserts.
4. **Sand Levees-** These are sand ridges having a broad and longitudinal peak.
5. **Loess -** The deposition of the fine sand particles by the deflation process of the winds is called Loess.

Glaciers- Glaciated Topographies

Glaciers are the mass of ice that drift slowly on the earth's surface, from the place of their accumulation. The glaciers in the higher latitudes erodes the rocks in through the process of plucking and abrasion, the eroded material is then deposited in form of moraines. This erosional and depositional work of the glaciers forms many different landforms.

A) Erosional topographies

1. **"U" shaped Valley -** Glaciers transforms the pre existing river valleys into 'U' shape valleys. These valleys have steep slopes , broad and flat valley floor. (Fig. 10.7)
2. **Hanging valley -** These valleys are formed by the tributary Glacier which joins the main glacier valley and appears to be hanging in the main glacier valley. (Fig. 10.7)

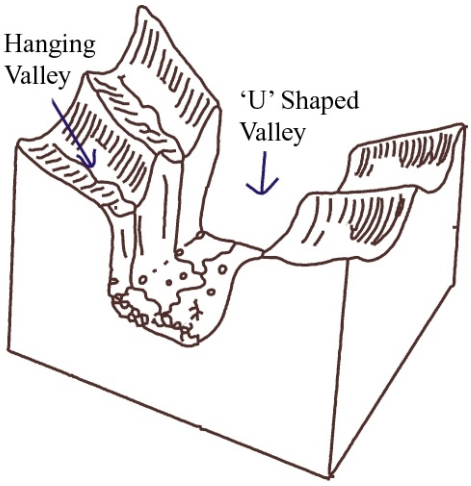

Fig. 10.7 : "U" shaped and Hanging Valley

3. **Cirque-** The armchair shaped depression formed in a glacial valley is called cirque. (Fig. 10.8)
4. **Tarn -** A basin formed at the floor of the cirque due to the glacial erosion is called tarn.
5. **Nunatak -** The higher peaks of the ridges that

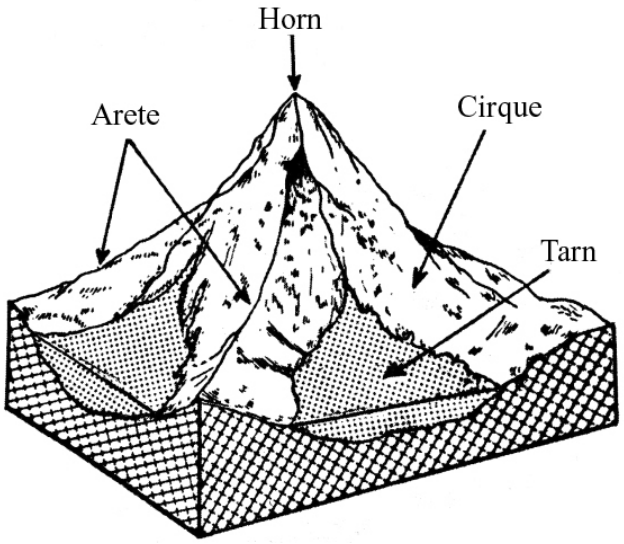

Fig. 10.8 : Glaciated Topography

projects from the ice sheets are called Nunatak.

6. **Col-** It is a pass or a gap formed when two adjacent cirques combine.
7. **Craig and tail-** This landform is characterized by vertical eroded steep sides and a tail like appearance on its other side which is lower.
8. **Sheep rock-** These are hillocks eroded by

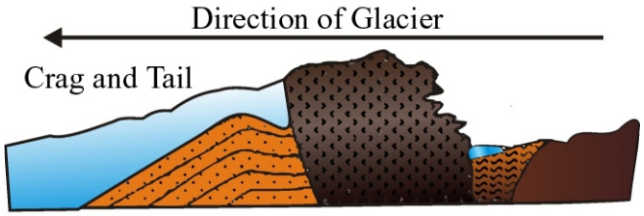

Fig. 10.9 : Craig and Tail

glacier and resembles a sheep's back.

9. **Fiords-** These are highly distorted coasts of the submerged glaciated valleys.

B) Depositional topographies.

1. **Moraines-** These are formed by the deposition of glacier debris which includes pebbles, boulders and cobbles. Moraines are deposited at sides of the glaciers, and its floor or at the end of the glaciers.
2. **Esker -** These are long, narrow and wavy low ridges formed by the deposition of glacial debris.
3. **Kame -** It is a steep sided ridge or a conical hill formed by glacial moraines.
4. **Kettle-** These are depressions formed due to the melting of glacial blocks.
5. **Drumlin-** These landforms are formed of boulder clay and often resemble a basket of eggs.
6. **Outwash Plain-** The fan shaped extensive deposition of glacial debris in larger region by glacial meltwater is called Outwash plain.

Ground water - Karst topographies

The water present in holes and cracks beneath the earth surface is termed as groundwater. Many different landforms are formed by the ground water through the process of solution in the regions of Limestone rocks .The region of limestone rocks are called Karst region. The origin of the word 'Karst' is from 'Krass' word meaning 'region of limestone' in Yugoslav language. The word Karst region has been taken from Karst region of Yugoslavia. The limestone topography in the entire world having the similar characteristic of Karst region of Yugoslavia is called Karst topography, where many erosinal and depositional landforms are formed.

A) Erosional topographies.

1. **Tera- Rossa -** Red and brown soils is formed due to solution are called Terra- Rosa.
2. **Lapies-** It is highly rugged and rough surface of limestone region with pinnacles. (Fig. 10.10)

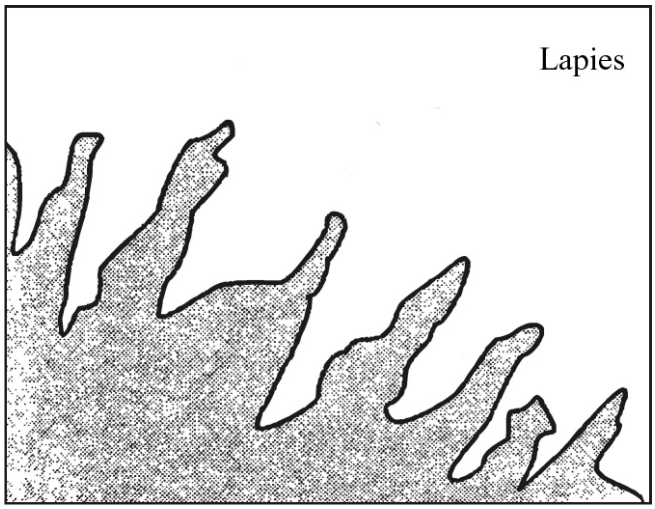

Fig. 10.10 : Lapies

3. **Sink Hole -** These are sinkholes formed due to solution process of carbonated water. Swallow hole and Doline are sinkholes of same kind which are larger in size respectively. (Fig. 10.11)

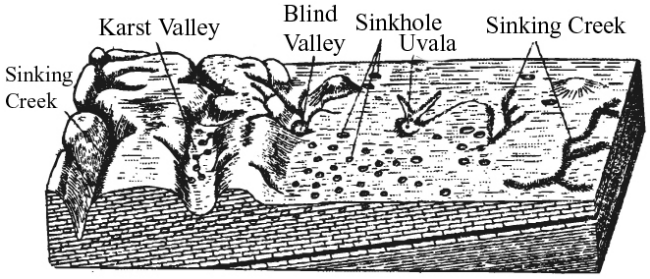

Fig. 10.11 : Karst Erosional Topography

4. **Swallow Hole -** These are larger depressions than the sinkholes.
5. **Doline -** These are larger size of swallow holes.
6. **Uvala-** When many dolines merge together, it leads to the formation of Uvala.
7. **Polije-** These are formed when many Uvalas merge together.
8. **Sinking Creek-** Due to the presence of many sink holes on the surface of limestone, water disappears through them and the topography resembles 'a sieve', this type of landform is called Sinking Creek.
9. **Blind valley-** The river goes underground through sinkholes or dolines in limestone topography, the valley seems to be dry, this type of valley is called Blind Valley.

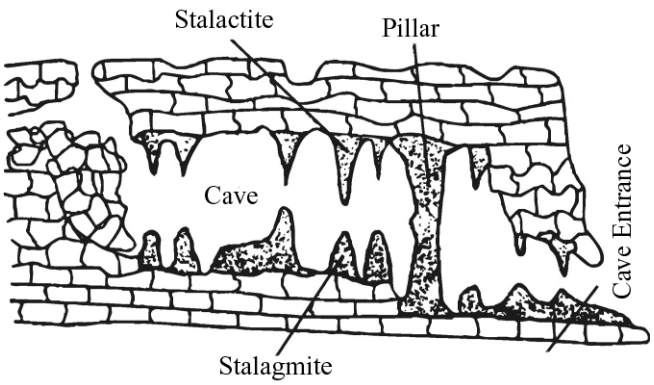

Fig. 10.12 : Karst Depositional Topography

B) Depositional topographies

1) **Stalactite-** The hard, solid and sharp depositional features hanging downwards from the ceiling of caves, formed due to the evaporation of carbonated water are called stalactite.
2) **Stalagmite-** The pillar shaped depositional features that are formed due to dripping of carbonated water on the cave floors are called stalagmite.
3) **Cave Pillar -** When stalagmite and stalactite merge together cave pillars are formed.
4) **Drip Stone -** Smaller pillars on the floor of the caves that resembles a curtain is called drip stones.
5) **Nodules -** The deposition of a type of a mineral solution in the holes of the rocks are called Nodules.

Important Points

1. Rivers, Sea waves, Winds, Glaciers and Underground water are major agents of Erosion.
2. When rivers follows a straight course instead of meandering, the left off curved portion filled with water is called Oxbow Lake.
3. Gorges, Waterfalls, Rapids, Alluvial cones, Natural leeves and Deltas are some of the major landforms formed by the rivers.
4. Cliff, Caves, Beach, Cusp beach, Spit, Bars Lagoon, Bay bars etc are major landforms formed by of sea waves.
5. Blow out, Inselberg, Mushroom rock, Driekanter, Zuegens, Yardang, Loess etc. are major features formed by the work of winds.
6. Tarn, Hanging valley, Nunatak, Craig and Tail, Kame etc are major landforms formed by the work of glaciers.
7. Terra Rosa, Lapies, Sink holes, Dolines, Stalactites, Stalagmites etc are landforms formed by the work of underground water.

Exercise
Multiple choice questions

1. The landscape formed by the deposition of river is-
   A) Gorge
   B) Alluvial Fan
   C) Pot Holes
   D) Waterfall

2. Landscape which is formed by waves is-
   A) Cliff
   B) Delta
   C) Mushroom rock
   D) Doline

3. Which of the following landforms is not formed by erosional work of the wind-
   A) Sandune
   B) Mushroom rock
   C) Inselberg
   D) Zuegen

4. Which landform of the following is not formed by the work of Glacier-
   A) Fiords
   B) Glacial Stairways
   C) Craig and tail
   D) Esker

5. The wavy formations in the deserts perpendicular to wind direction are called-
   A) Sand Levees
   B) Ripples
   C) Barchans
   D) Loess

Very short type questions-

6. What are Alluvial fans?
7. What are gorges?
8. What do we call the basins of cirques when filled with water?
9. Name the landform which is also called "the basket of eggs topography" .
10. What are Yardangs?

Short type

11. How are oxbow lakes formed?
12. How are lagoons formed?
13. How are mushroom rocks formed?
14. What is Blind Valley?
15. What are Cirques?

Essay type

16. Describe the landforms formed by the river.
17. Describe the landforms formed by the Glacier.
18. Explain erosion and describe the different landforms formed by its agents.

Answer key

1. B. 2. A. 3. A. 4. D. 5. B