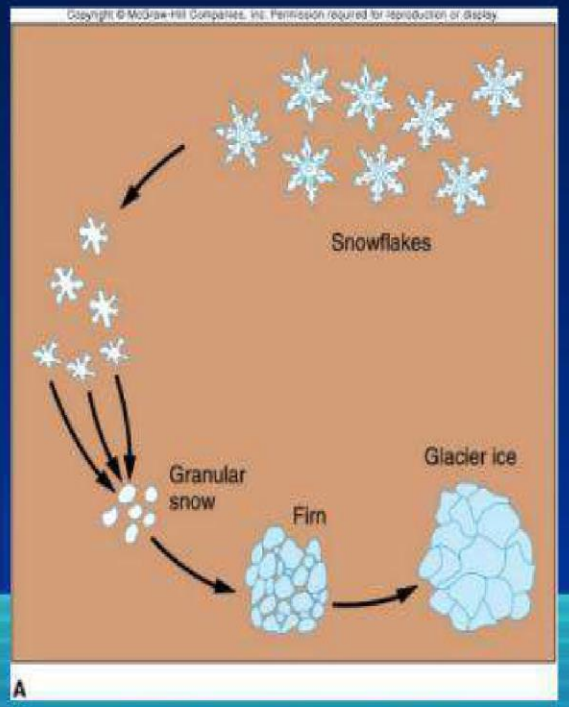
GLACIAL LANDFORMS

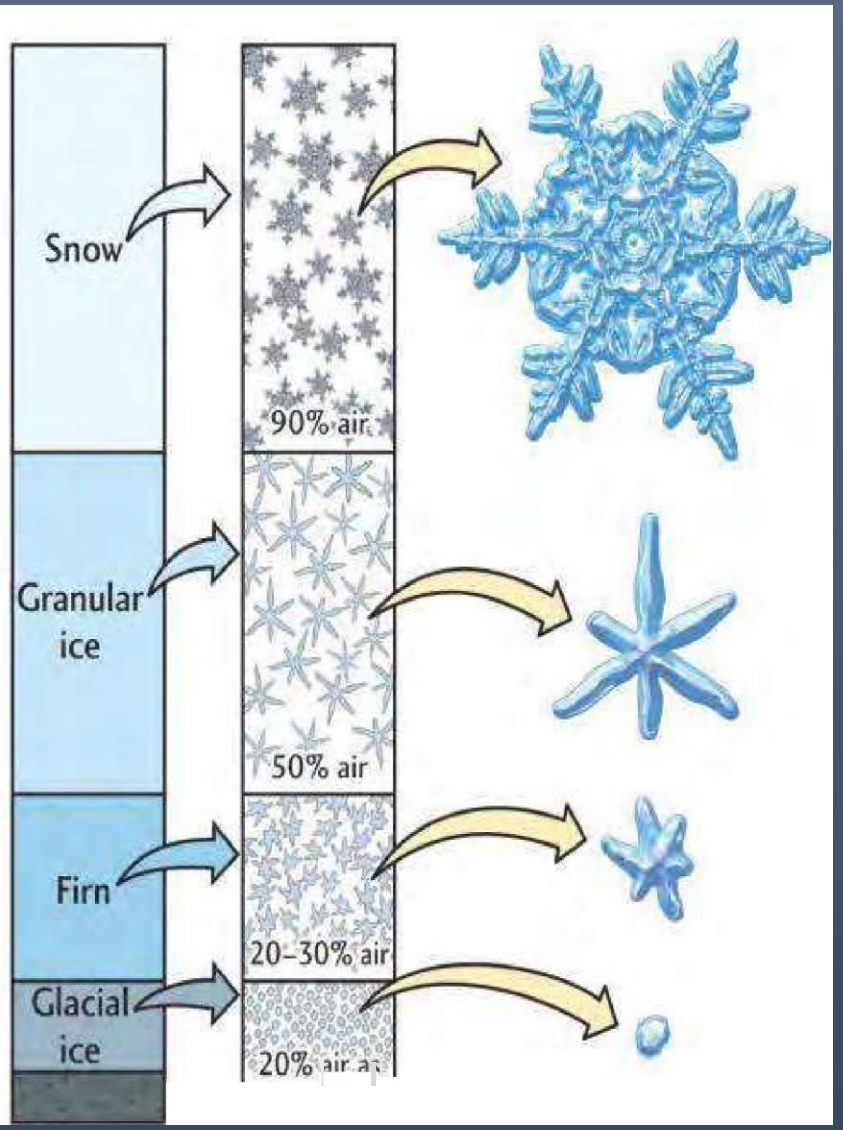
Dr.J.Killivalavan
Guest Faculty
Department of Geography
Bharathidasan University

Formation of Glacier



Snowflake ---> Granular snow ---> Firn ---> Glacial ice

Changes are due to increased pressure because of accumulation of overlying snow.



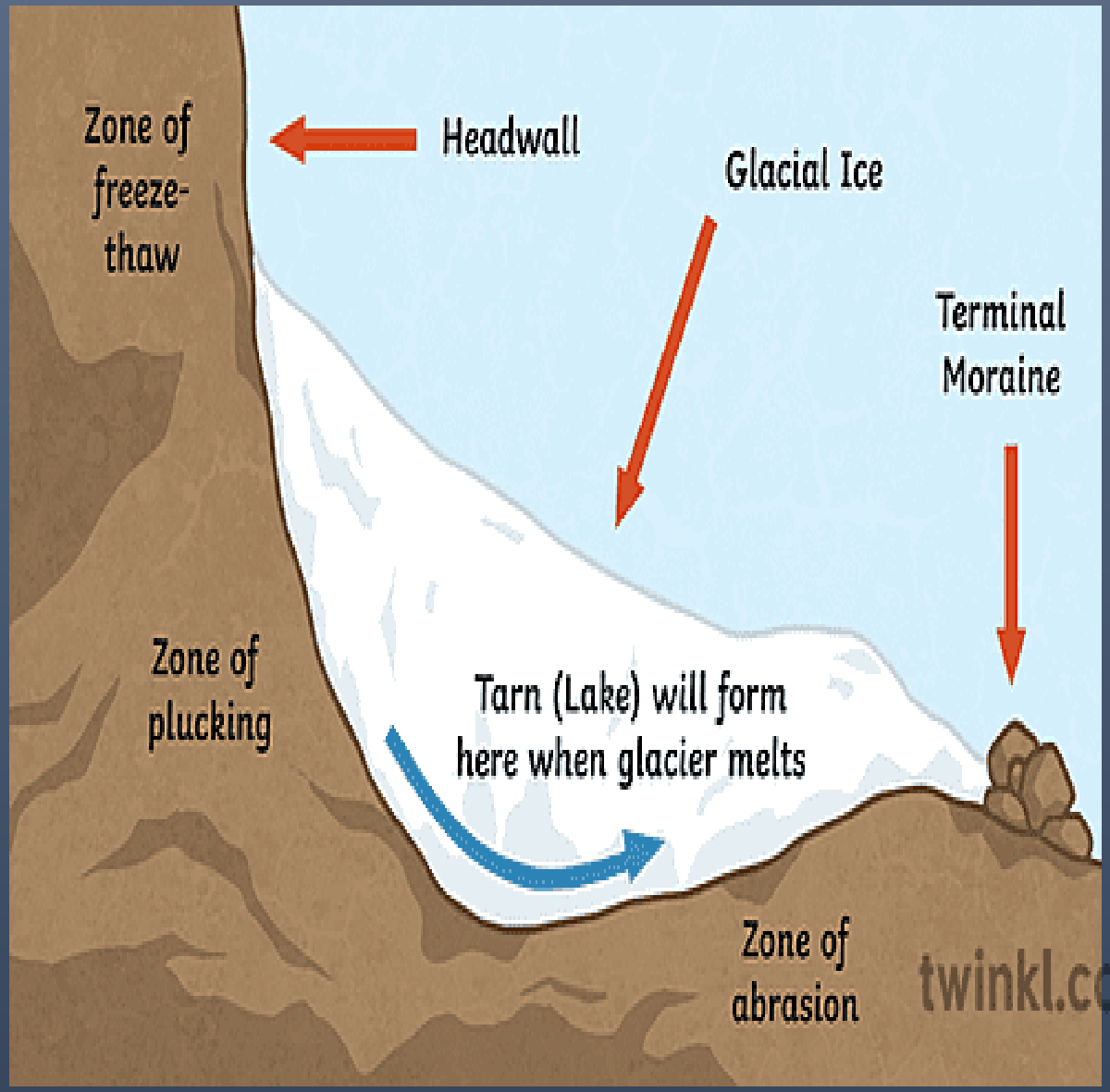
INTRODUCTION

Glaciers are powerful agents of erosion, transportation, and deposition.

Erosion

Glaciers erode the landscape through several processes, including plucking, abrasion, and freeze-thaw.

- **Plucking** occurs when the glacier freezes onto a rock and then pulls it away as it moves.
- **Abrasion** happens when the glacier's movement causes rock fragments to grind against the bedrock, wearing it down.
- **Freeze-thaw** happens when water enters cracks in the rock and freezes, expanding and causing the rock to break apart.


Zone of freeze-thaw
Headwall
Glacial Ice
Terminal Moraine
Zone of plucking
Tarn (Lake) will form here when glacier melts
Zone of abrasion
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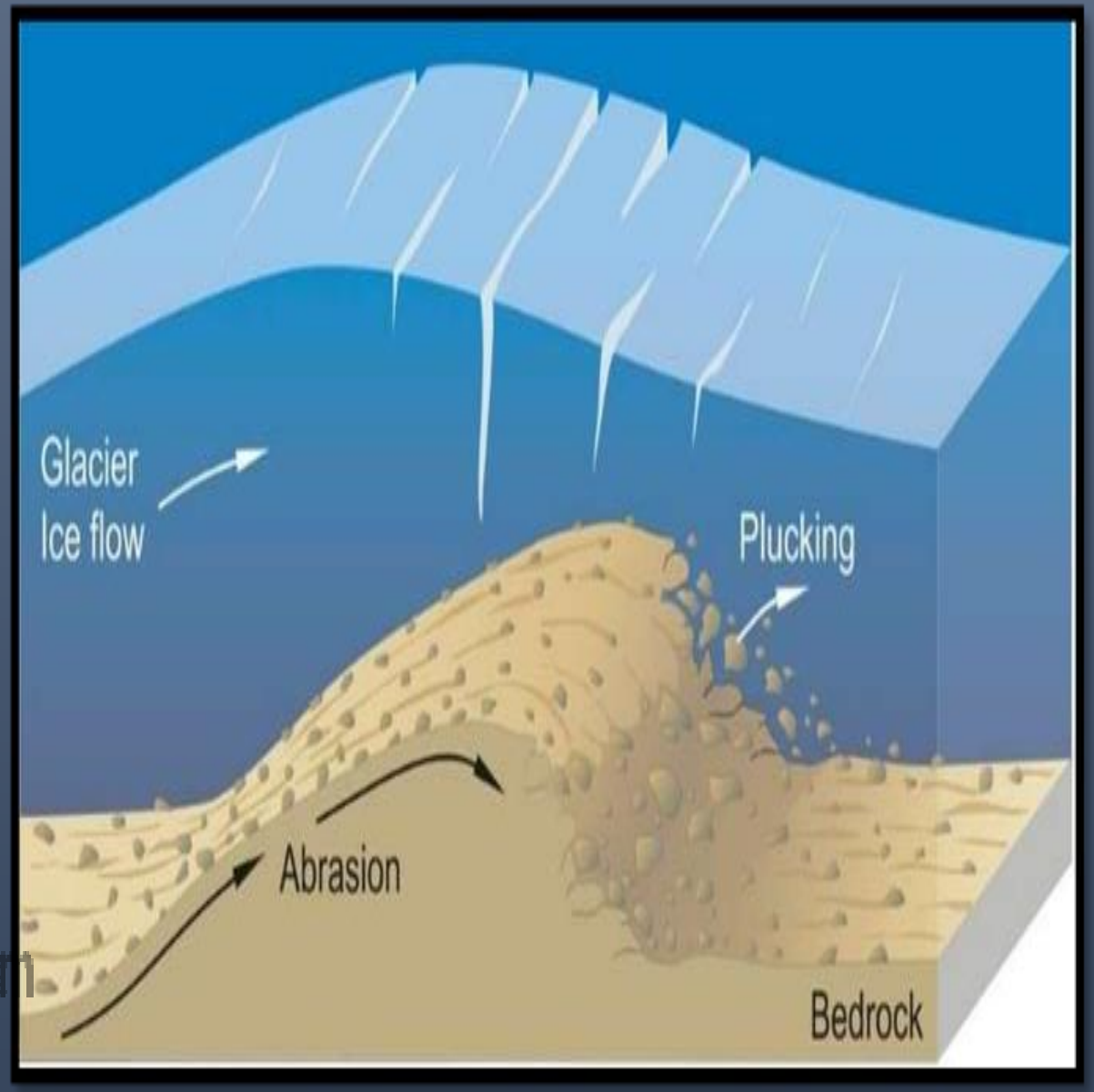
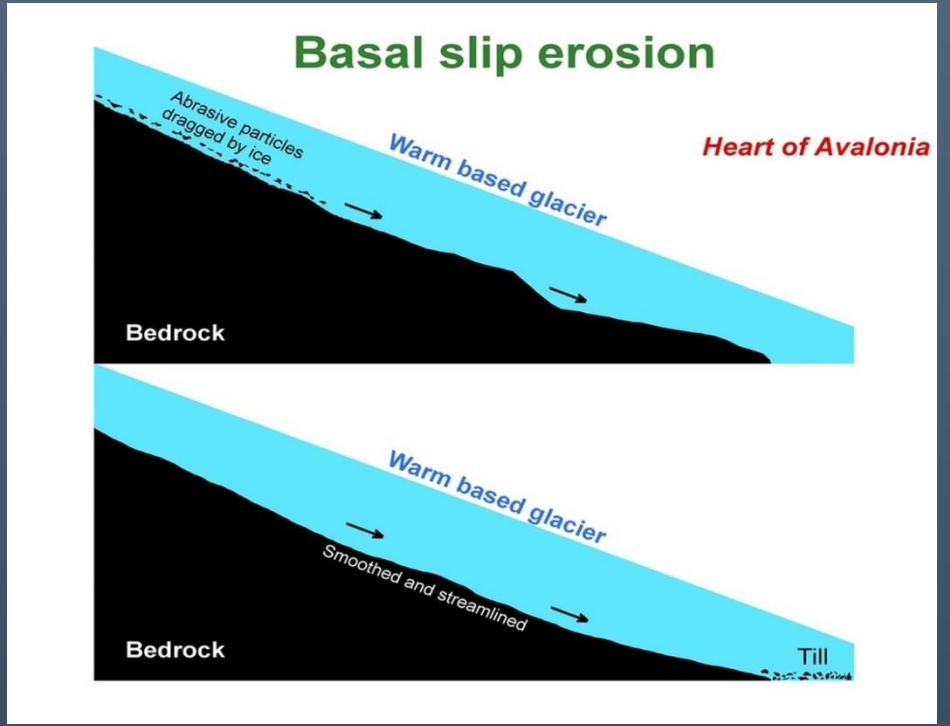

Glacier Ice flow
Plucking
Abrasion
Bedrock

Transportation

- Glaciers transport large amounts of rock and sediment as they move.
- The size and amount of material that is transported depend on the glacier's size, speed, and slope.
- Glaciers can carry rocks of all sizes, from fine sand to large boulders.
- Glaciers transport material by entrainment, which is when rock and sediment are picked up by the glacier's movement, and basal sliding, which is when the glacier's weight causes it to slide along its bed.



Deposition

- Glaciers deposit sediment and rock in a variety of ways.
- Moraines, which are ridges of sediment left behind by a glacier, can be deposited along the glacier's sides, at its end, or in the middle.
- Glaciers can also deposit sediment in lakes, oceans, and river valleys. When a glacier melts, it can leave behind landforms such as drumlins, eskers, and kames.
- These landforms are formed from sediment that was transported by the glacier and deposited in unique patterns.

TYPES OF GLACIERS

CONTINENTAL GLACIERS

- Continental glaciers cover vast areas of land. Today, continental glaciers are only present in extreme polar regions: Antarctica and Greenland.
- Continent glaciers can form and grow when climate conditions in a region cool over extended periods of time. Snow can build up over time in regions that do not warm up seasonally, and if the snow accumulates in vast amounts, it can compact under its own weight and form ice.
- The Antarctic Ice Sheet is vastly larger than the Greenland Ice Sheet.

ALPINE GLACIERS

- Alpine glaciers (also called valley glaciers) originate high up in the mountains, mostly in temperate and polar regions but also in tropical regions in high mountains.
- The flow of alpine glaciers is driven by gravity, and primarily controlled by the slope of the ice surface.
- Alpine glaciers grow due to accumulation of snow over time. In the zone of accumulation, the rate of snowfall is greater than the rate of melting.

PIEDMONT GLACIERS

- The glaciers formed due to coalescene of several mountain or valley glaciers at the foothill zone are called piedmont glaciers.
- Such glaciers are found only In colder areas and not in the tropical or temperate regions because they melt when they reach the foothill zone. Ex: Melaspina glacier of Alaska

CIRQUE GLACIER

- The ice occupying an arm chair shaped cirque in the mountain is called cirque glacier.

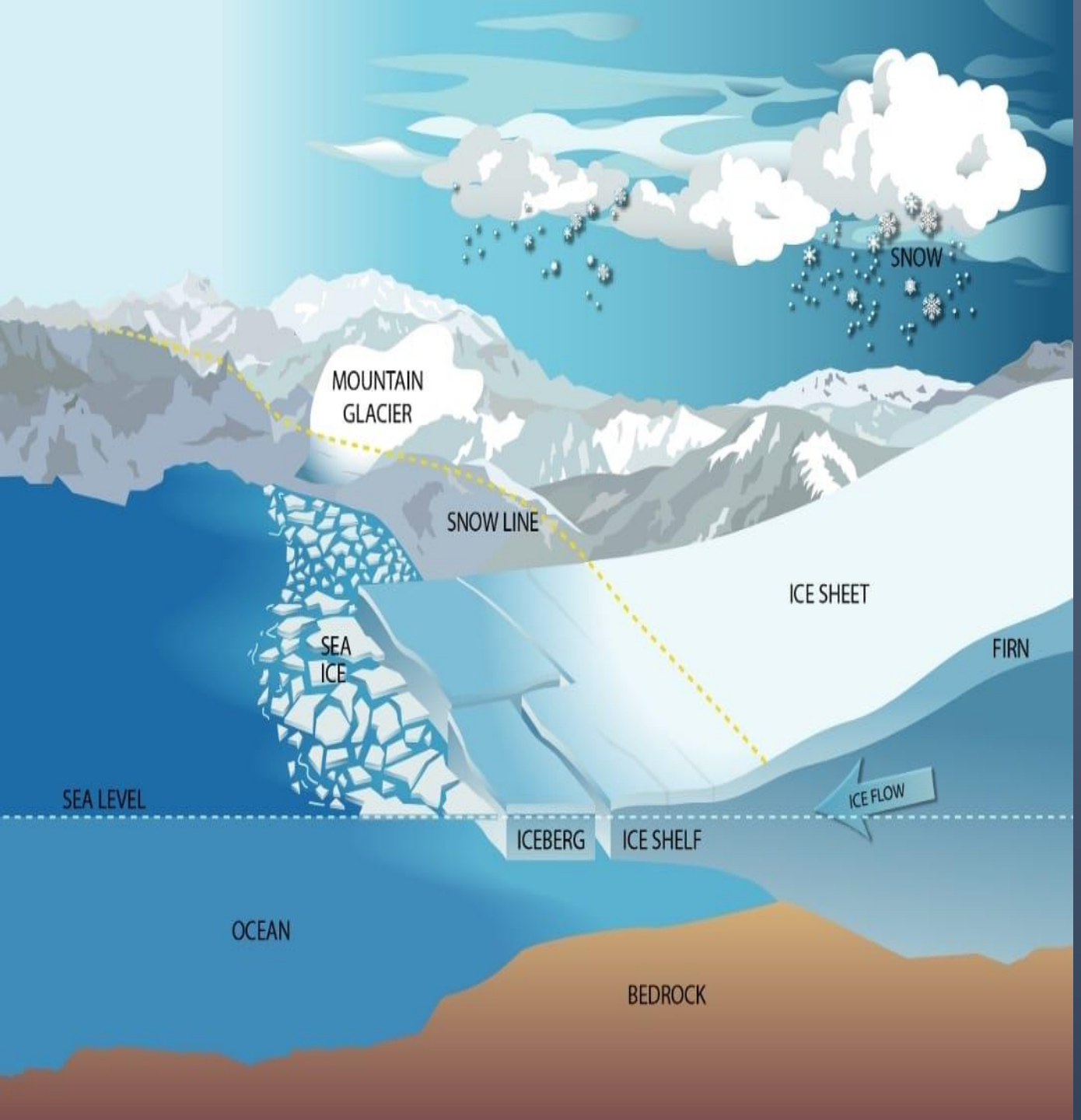
ICE SHEETS

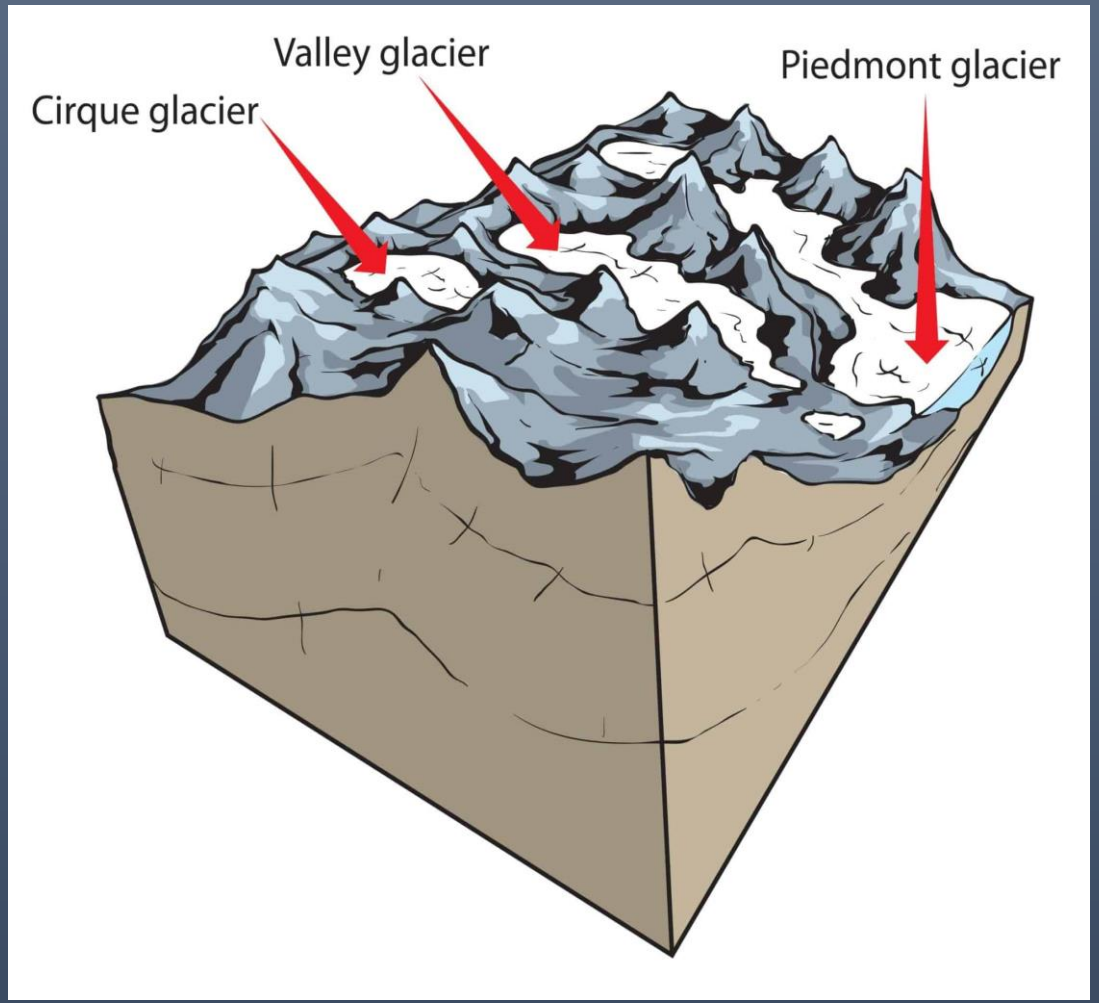
- The biggest glaciers on the earth's land surface are called Ice sheets which are broad domes with flattened cross-section covering thousands of square kilometers.

ICE SHELF

- Ice shelf is a floating thick Ice sheet or Ice cap attached to the coast. Since there is no friction of ice with the bed and hence Ice can spread freely.
- Such glaciers are abundantly found along the Antarctic coasts. Ex: Ross Ice Shelf.

ICE FIELD is comparatively flat and extensive mass of Ice sheets.


SNOW
MOUNTAIN GLACIER
SNOW LINE
ICE SHEET
SEA ICE
FIRN
SEA LEVEL
ICE FLOW
ICEBERG
ICE SHELF
OCEAN
BEDROCK


Valley glacier
Piedmont glacier
Cirque glacier

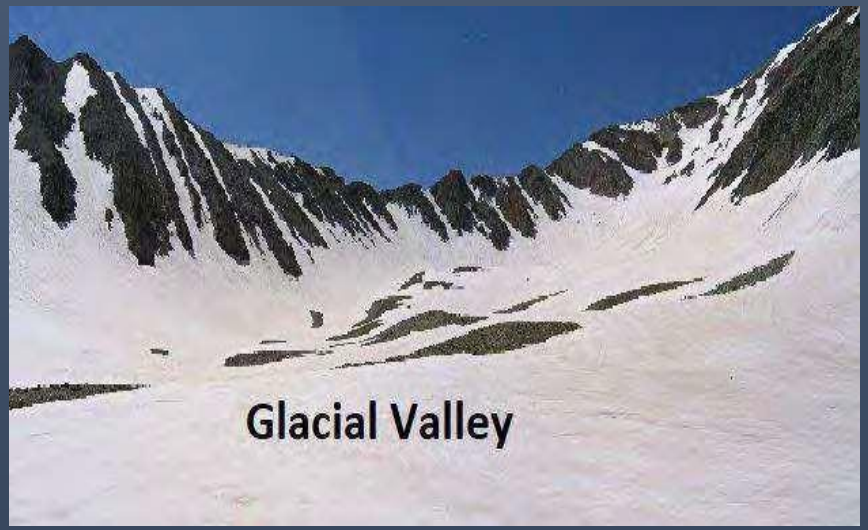
Glacial Erosional Landforms

Cirque/Corrie

- Hollow basin cut into a mountain ridge.
- It has steep sided slope on three sides, an open end on one side and a flat bottom.
- When the ice melts, the cirque may develop into a tarn lake.

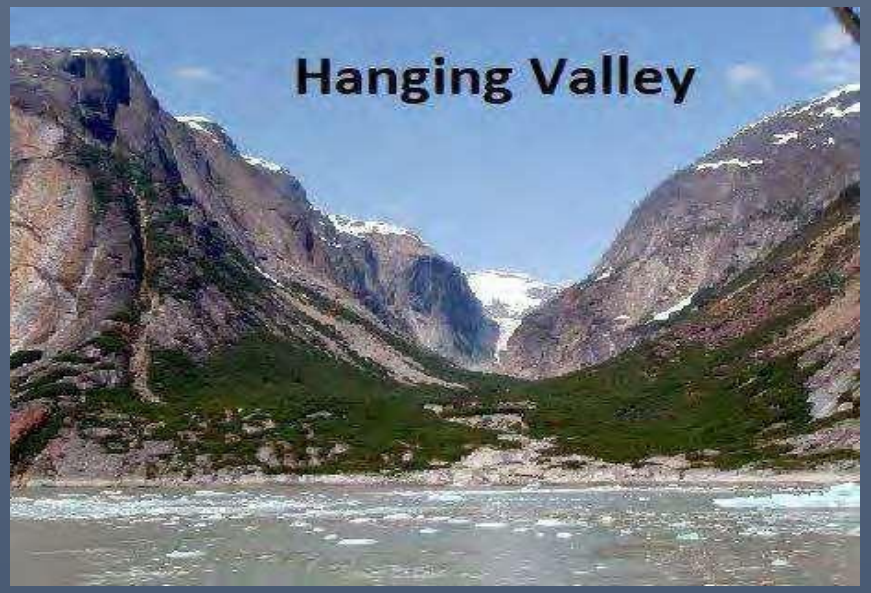
Glacial Trough

- Original stream-cut valley, further modified by glacial action.
- It is a ‘U’ Shaped Valley. It at mature stage of valley formation.
- Since glacial mass is heavy and slow moving, erosional activity is uniform – horizontally as well as vertically.
- A steep sided and flat bottomed valley results, which has a ‘U’ shaped profile.



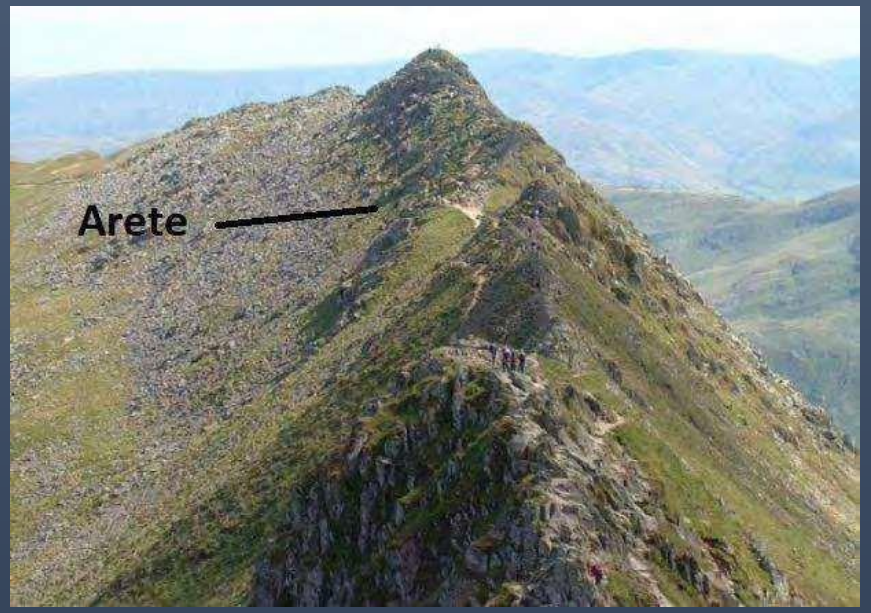
Hanging Valley

- A hanging valley is a tributary valley that is higher than the main valley. Hanging valleys are common along glaciated fjords and U shaped valleys.
- The main valley is eroded much more rapidly than the tributary valleys as it contains a much.



Arete

- Arete is a narrow ridge of rock which separates two valleys.
- The divides between Cirque side walls or head walls get narrow because of progressive erosion and turn into serrated or saw toothed ridges referred to as aretes with very sharp crest and a zig-zag outline.

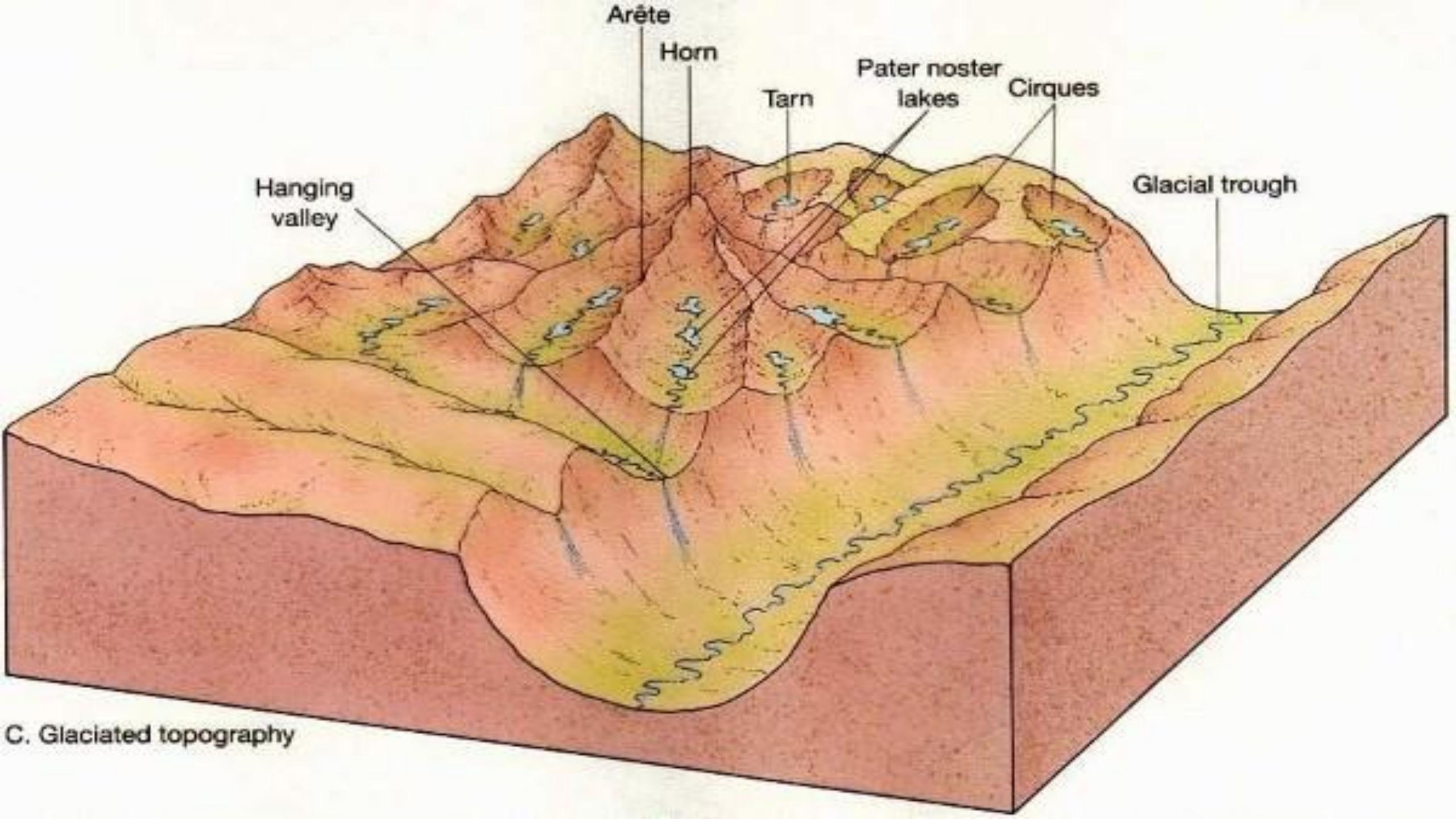


Horn

- Horns form through head ward erosion of the cirque walls.
- If three or more radiating glaciers cut headward until their cirques meet, high, sharp pointed and steep-sided peaks called horns form.

Fjords/Fiords

- Steep-sided narrow entrance-like feature at the coast where the stream meets the coast.
- A fjord or fiord is a long, narrow and steep-sided inlet created by a glacier.
- Fjords are common in Norway, Chile, and New Zealand etc.



C. Glaciated topography

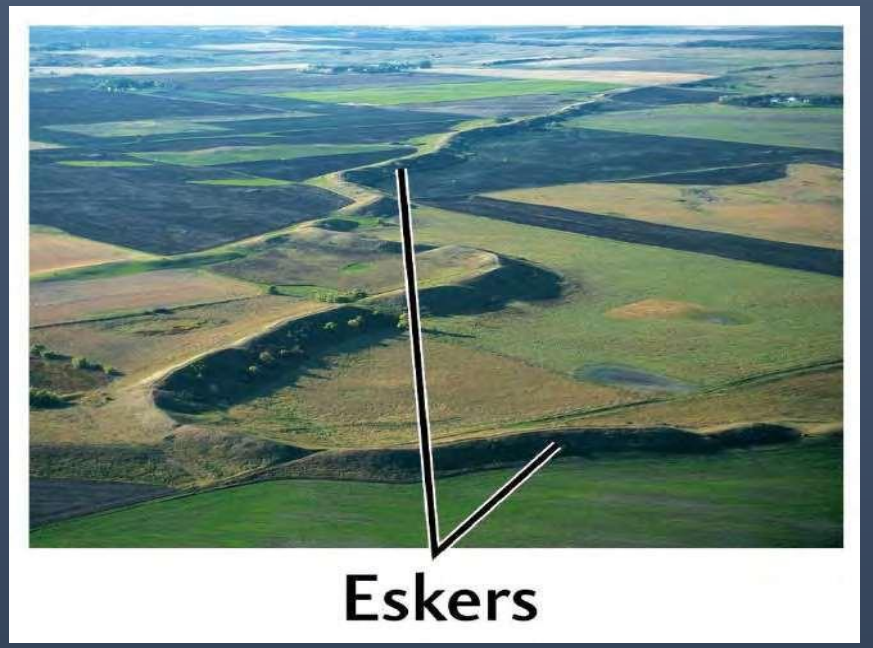
Glacial Depositional Landform

Outwash Plain

- When the glacier reaches its lowest point and melts, it leaves behind a stratified deposition material, consisting of rock debris, clay, sand, gravel etc.
- This layered surface is called till plain or an outwash plain.

Esker

- Winding ridge of un-assorted depositions of rock, gravel, clay etc. running along a glacier in a till plain.
- The eskers resemble the features of an embankment and are often used for making roads.



Drumlin

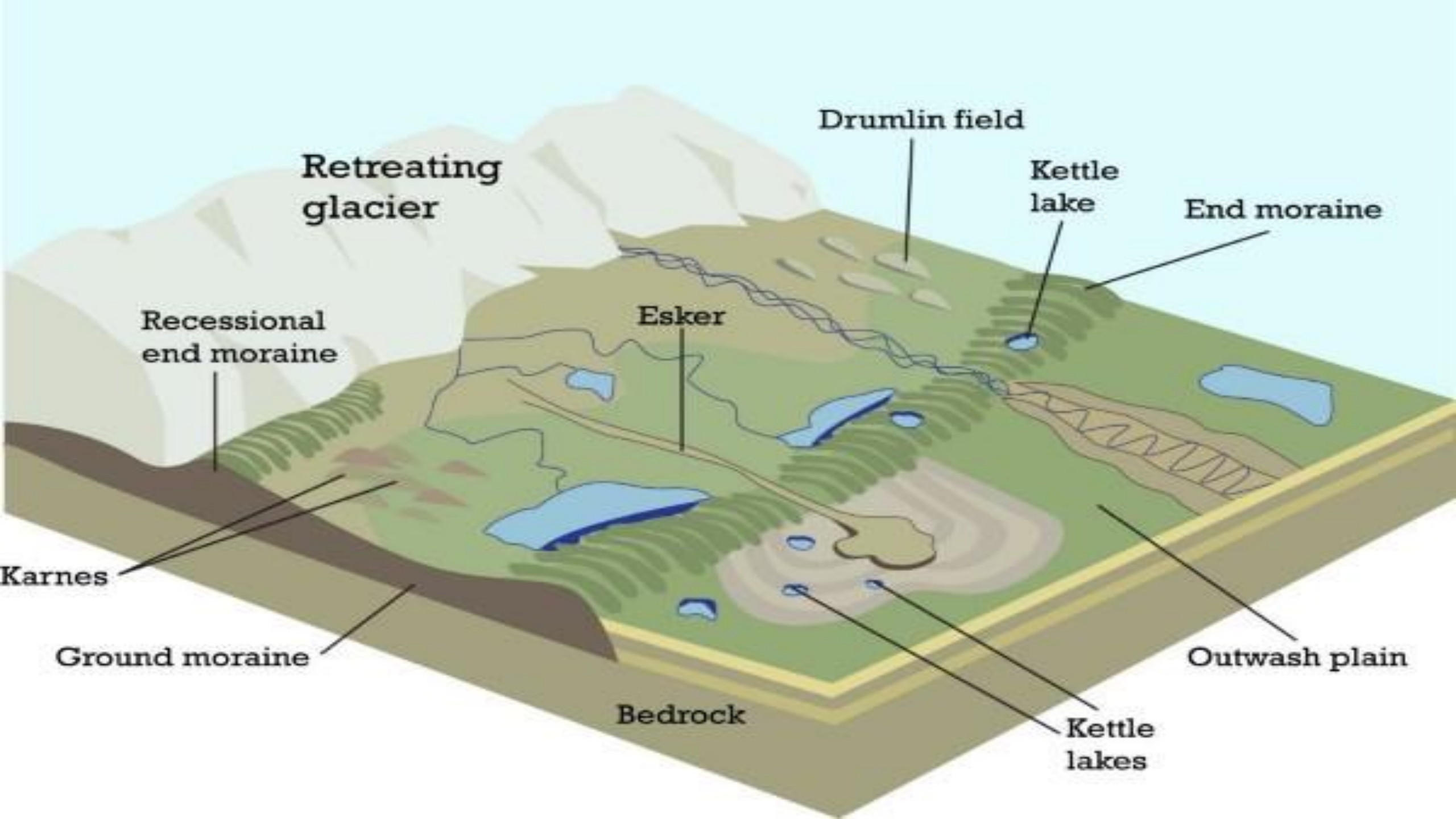
- The drumlins form due to the dumping of rock debris beneath heavily loaded ice through fissures in the glacier.
- The long axes of drumlins are parallel to the direction of ice movement.
- They may measure up to 1000m in length and 30-35 m or so in height.

Kame Terraces

- Broken ridges or un-assorted depositions looking like hump in a till plain.

Kettle Lakes or Holes

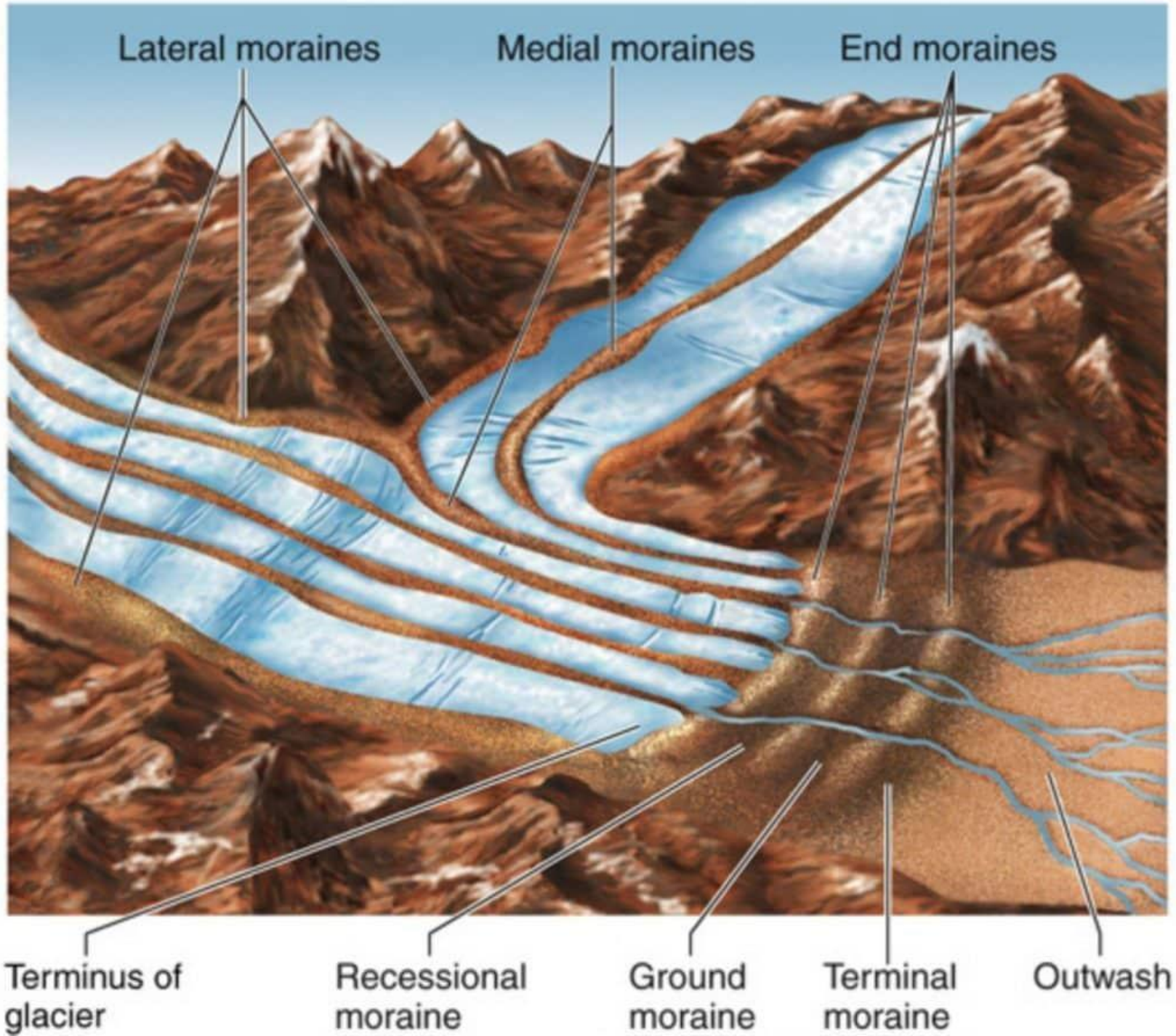
- Formed when the deposited material in a till plain gets depressed locally and forms a basin.


Retreating glacier
Drumlin field
Kettle lake
End moraine
Recessional end moraine
Esker
Karnes
Ground moraine
Bedrock
Kettle lakes
Outwash plain

Moraines

Moraines are accumulations of rock debris (till) deposited by glaciers, forming distinct landforms. They can be categorized into several types:

1. Terminal Moraines: Long ridges of debris deposited at the end (toe) of the glaciers.
2. Lateral Moraines: Form along the sides parallel to the glacial valleys.
3. Medial Moraines: Formed where two glaciers converge, creating a ridge between them.
4. Ground Moraines: Irregular blankets of till deposited beneath glaciers.
5. Recessional Moraines: Secondary ridges formed during pauses in glacier retreat.


Lateral moraines
Medial moraines
End moraines
Terminus of glacier
Recessional moraine
Ground moraine
Terminal moraine
Outwash

THANK YOU