CHAPTER 2: WEARING DOWN LANDFORMS: RIVERS & ICE

Pgs. 22 - 38

INTRODUCTION

Denudation:

- the laying bare (wearing down) of rocks by weathering and erosion.

Weathering:

- the **BREAKING** down of rock by physical and chemical forces.

Erosion:

- the breaking down and **REMOVAL** of rock from one location to another.

Deposition:

- the **DROPPING** and settling of material on the Earth's surface.

PHYSICAL VS. CHEMICAL WEATHERING (1.2.1, 1.2.2, 1.2.3 & 1.2.4)

1. PHYSICAL WEATHERING:

- The disintegration or splitting up of rock without chemical change.

4 TYPES OR PROCESSES

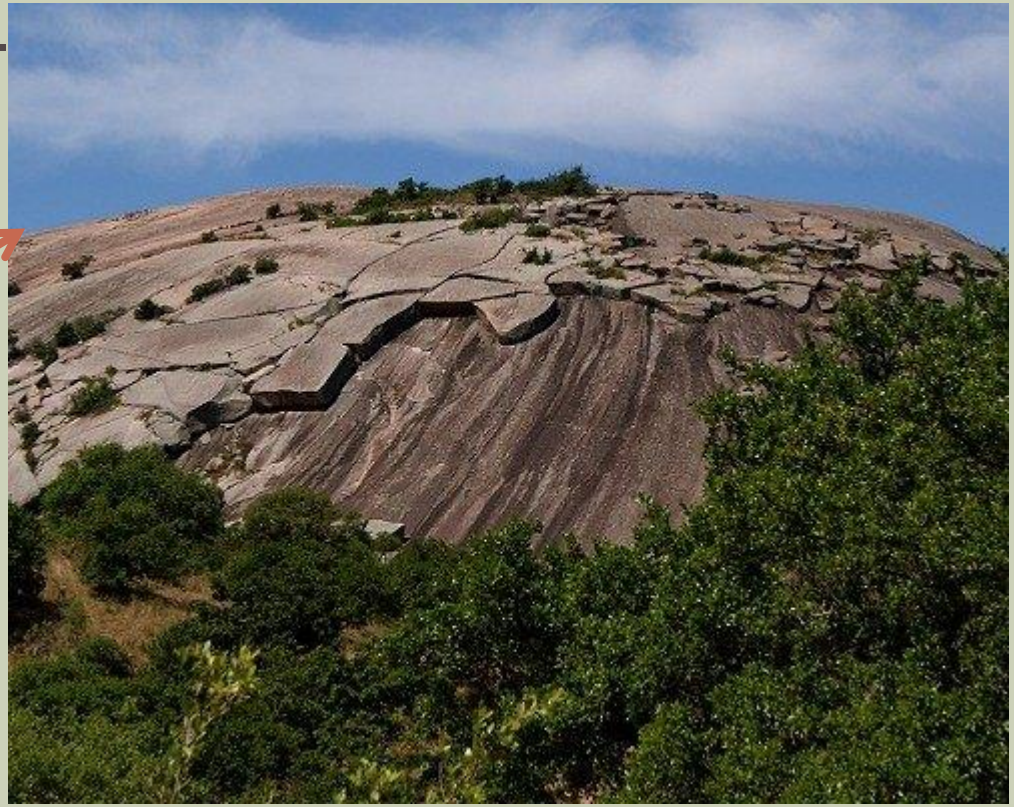
A. FROST FRACTURE:

- Water catches in rocks, freezes, expands, breaks rocks.

B. EXFOLIATION:

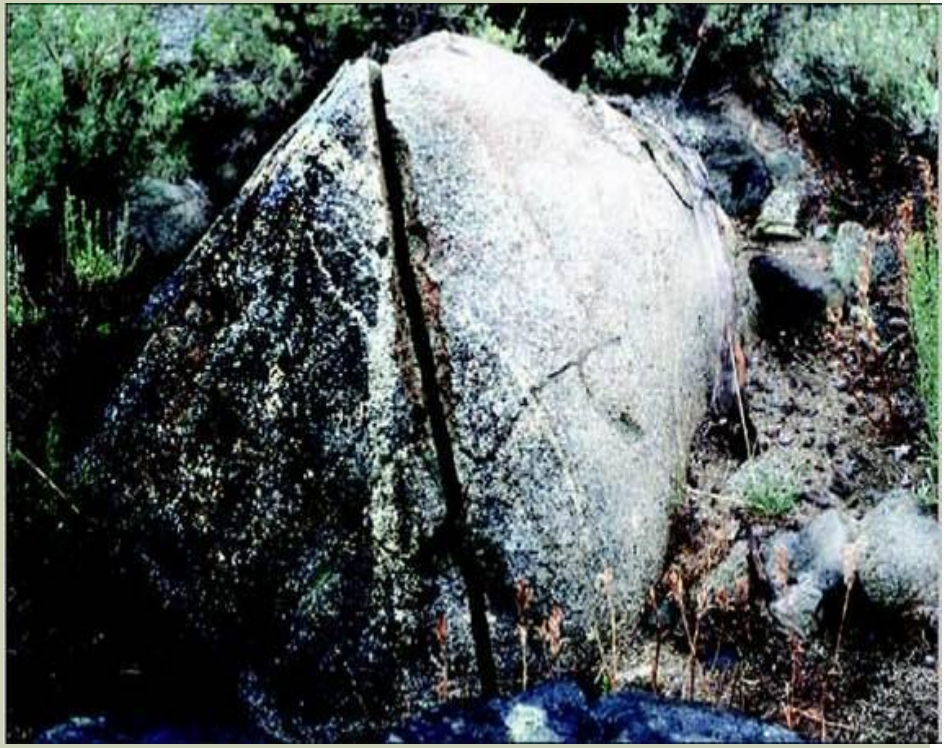
- Internal pressure in rock causes rock to break apart in rounded sheets (**LAYERS**).

NOT



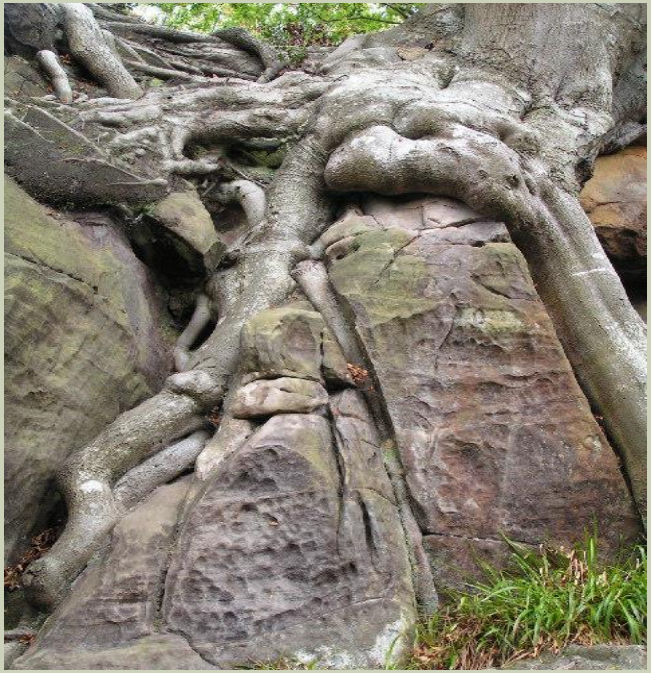
C. EXTREME TEMPERATURE CHANGE:

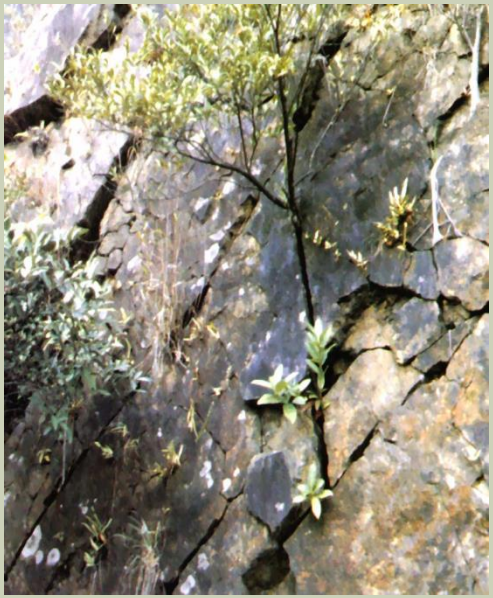
- Rocks expand (heat), and the contract and break.(cold)



D. PLANT GROWTH:

- Roots of trees and plants crack the rock.





E. BURROWING ANIMALS:

- Burrow or tunnel into ground and rock breaking the rock.

2. CHEMICAL WEATHERING:

- The breakdown of rocks that causes chemical change.

3 TYPES OR PROCESSES

A. SOLUTION:

- A fluid dissolves rock minerals (water/carbonic acid)

B. HYDROLYSIS:

- Rainwater reacts with silicate compounds.

C: OXIDATION:

- The oxygen in water reacts with metallic minerals in rocks.

BILL NYE – EROSION VIDEO

RIVER EROSION AND DEPOSITIONAL FEATURES:

LIFE CYCLE OF A RIVER (1.3.1)

- There are **4** stages:

1. YOUTHFUL:

- Relatively straight.
- V-shaped and steep sides.
- Fast moving.
- Not a lot of water.
- Found in highland regions.
- Only stage that has **rapids**

- **Diagram A on page 28**

2. EARLY MATURE:

- Well developed **TRIBUTARIES**.
- Broad, flat river valley with floodplain.
- Broad river channel; as it erodes and loses its shape.
- Begins to **MEANDER**.

- **Diagram B on page 28**

3. LATE MATURE:

- More pronounced meanders.
- Much more lateral erosion has taken place.

- **Diagram C on page 28**

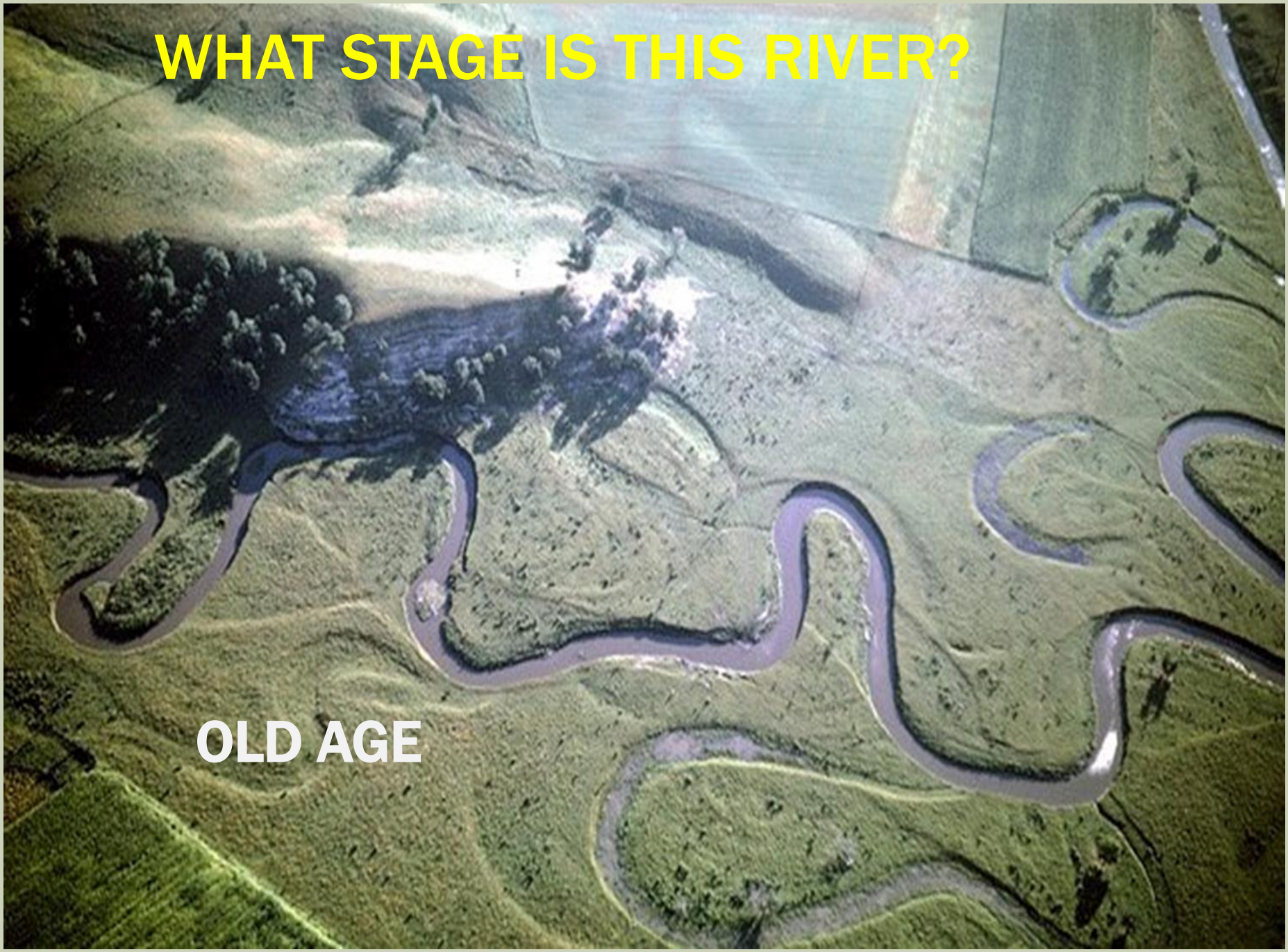
4. OLD AGE:

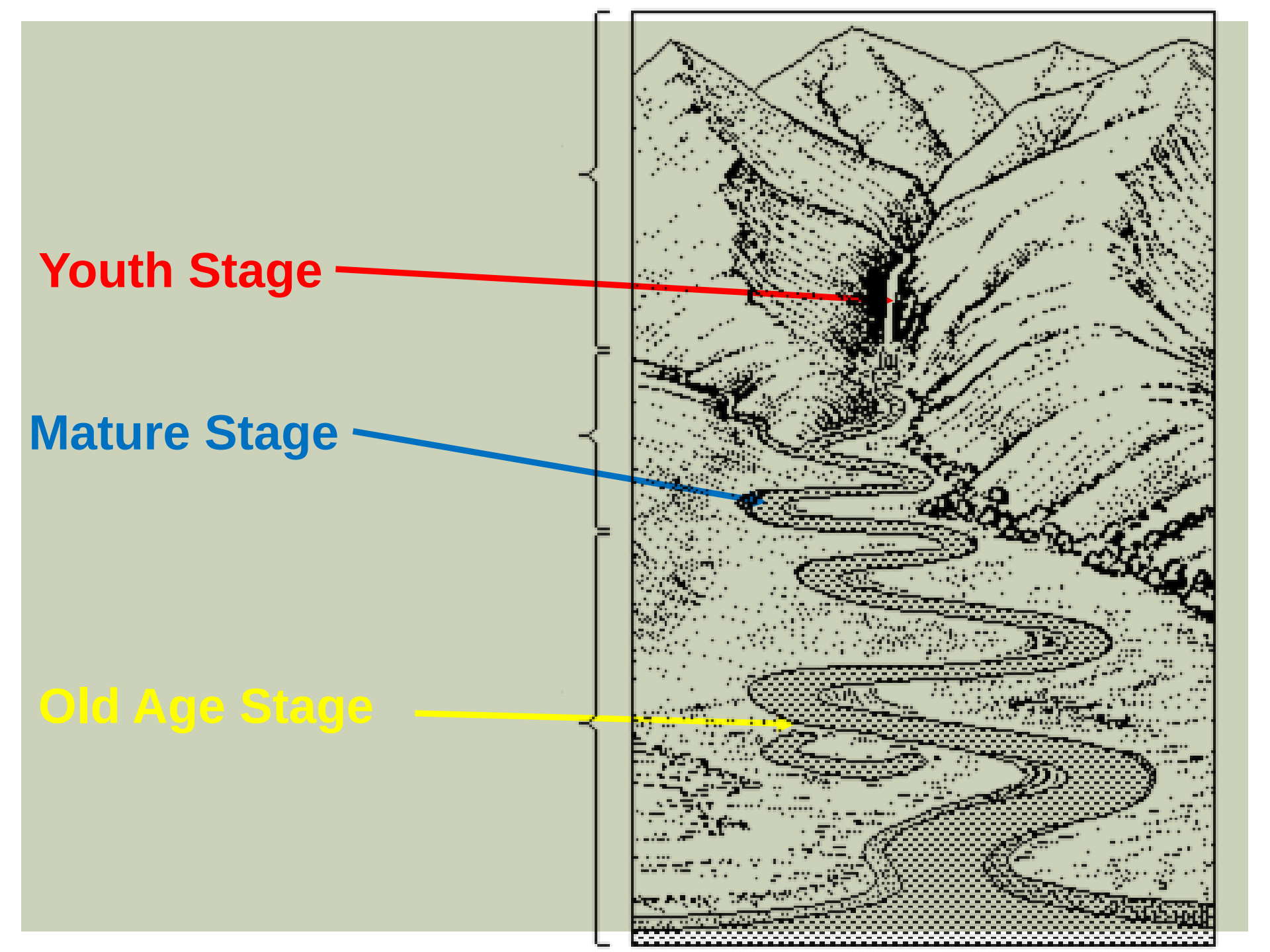
- Pronounced meanders.
- Large flood plain (extremely flat).
- Very muddy.
- Slow moving.
- Only stage that has **OXBOW LAKES**.
- Mostly associated with **FLOODING**.

- **Diagram D on page 28**

JOSEPH HOLMES :: NATURAL LIGHT

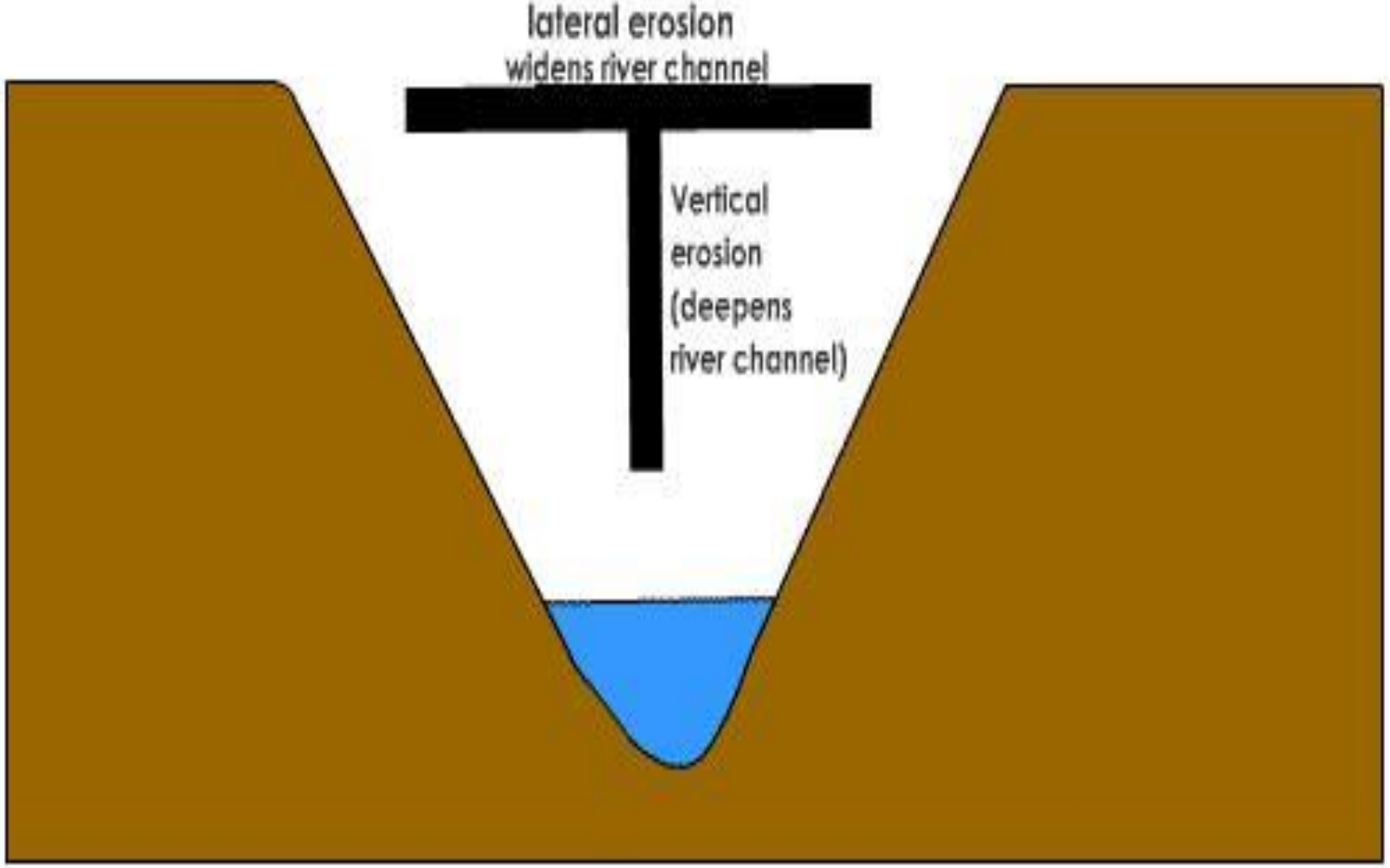

Google


WHAT STAGE IS THIS RIVER?
OLD AGE


Youth Stage
Mature Stage
Old Age Stage

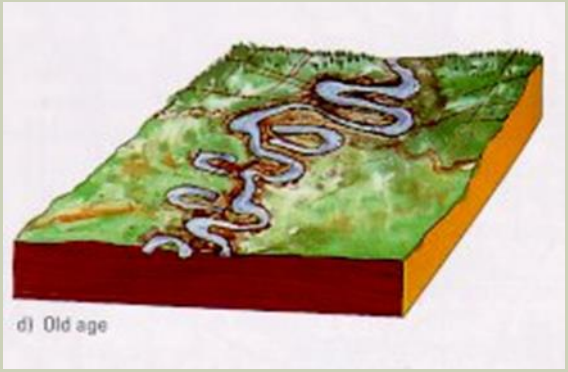
RIVER EROSION (1.3.2)

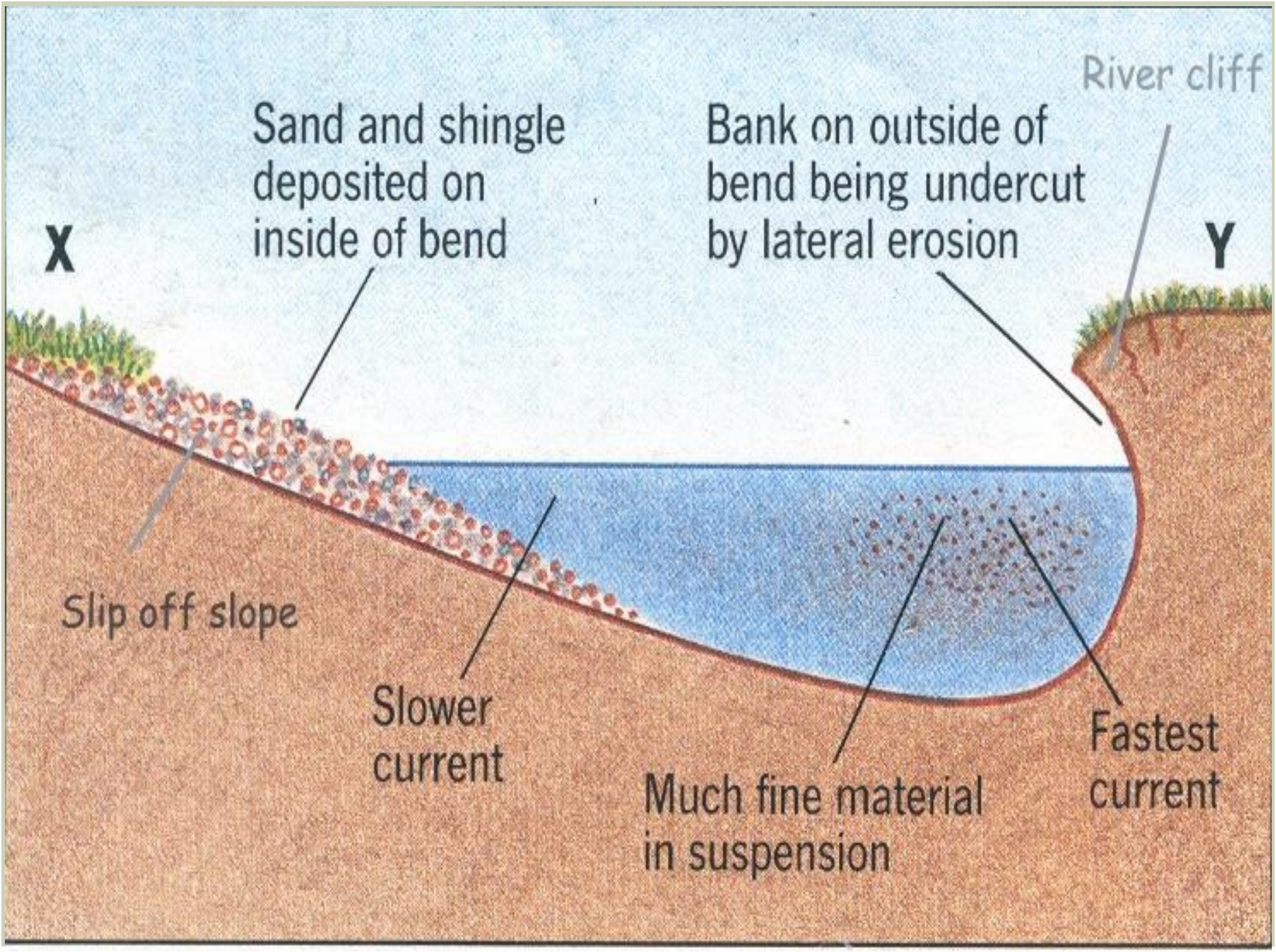
- Two ways:

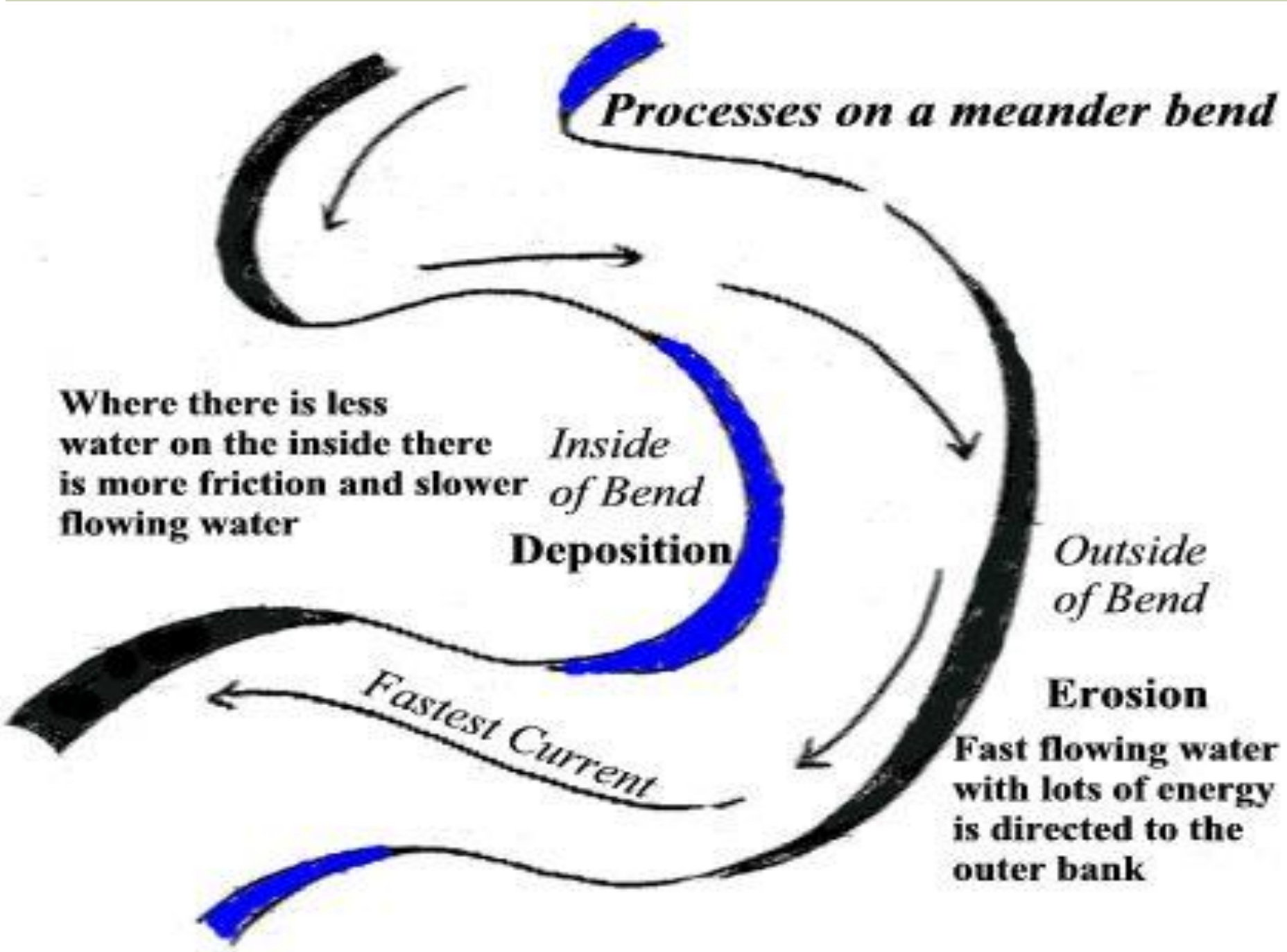

lateral erosion
widens river channel
Vertical
erosion
(deepens
river channel)

1. LATERAL EROSION:

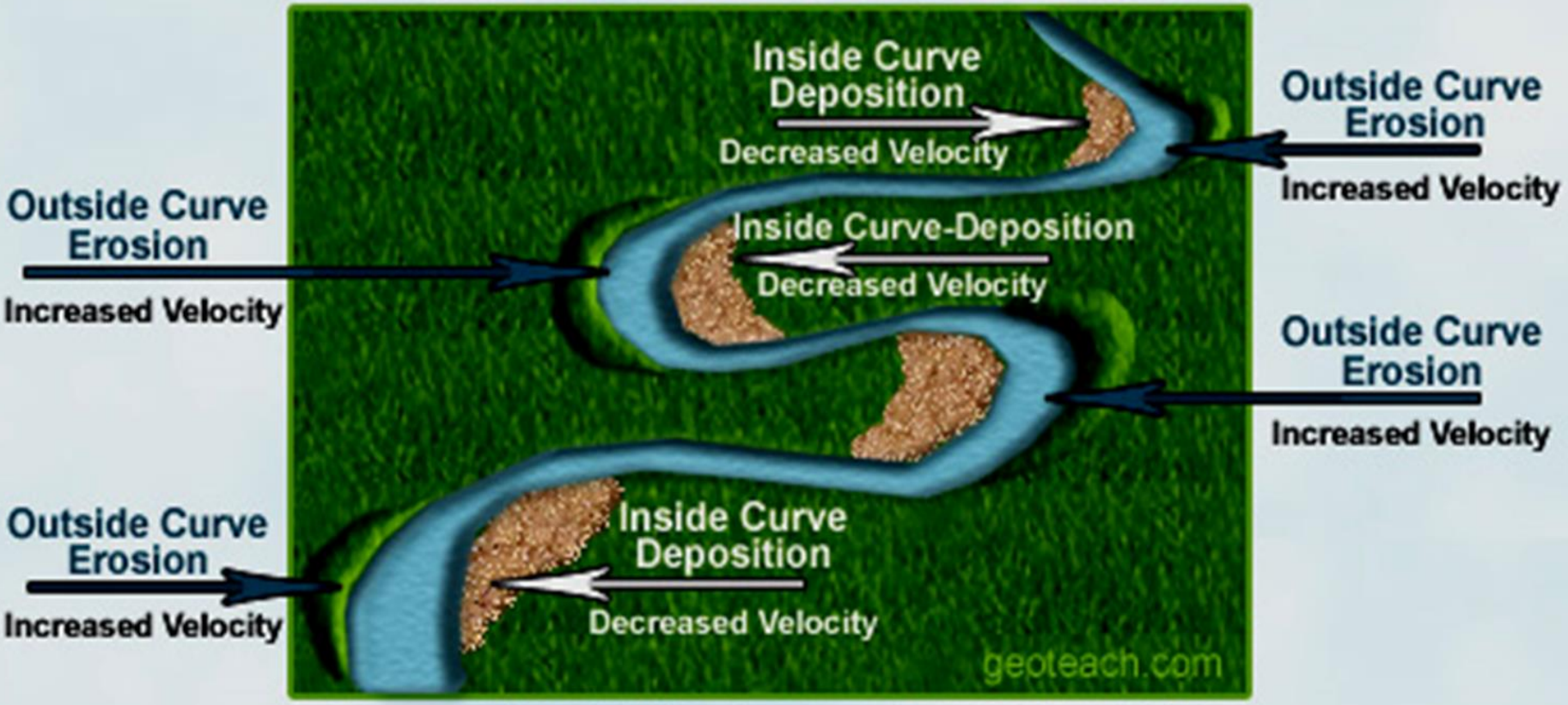
- River erodes **BANKS** or sides. (WIDER)
- Occurs at lower elevations.
- No steep slopes.
- Gives rivers meandering shape.




River cliff
Sand and shingle deposited on inside of bend
Bank on outside of bend being undercut by lateral erosion
X
Y
Slip off slope
Slower current
Much fine material in suspension
Fastest current


Processes on a meander bend
Where there is less water on the inside there is more friction and slower flowing water
Inside of Bend
Deposition
Outside of Bend
Erosion
Fast flowing water with lots of energy is directed to the outer bank
Fastest Current

Erosional and Depositional Patterns in a River Meander



Erosion occurs on outside meander curves due to an increase in river velocity.

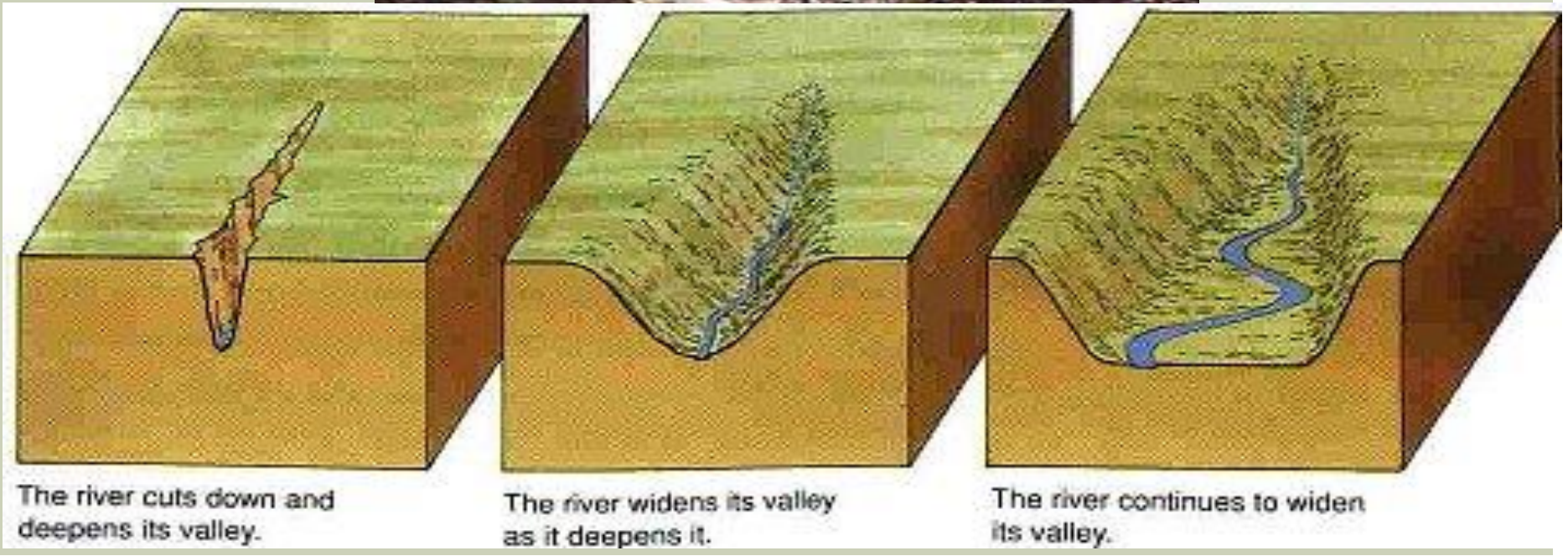
Deposition of Sediments occurs on outside meander curves due to a decrease in river velocity.

VIDEO TIME:

- Meander Formation animation

2. VERTICAL EROSION:

- River erodes the bottom. (DEEPER)
- Occurs when rivers are **youthful** and at high elevations.


The river cuts down and deepens its valley.
The river widens its valley as it deepens it.
The river continues to widen its valley.

1.3.3: DETERMINE THE LIFE CYCLE STAGE OF A RIVER

- **Evidence to look for:**

1. Slope of the river
2. Relief of the banks
3. Width of the valley
4. Meandering
5. Size of flood plain
6. Rapids or water falls

RIVER DELTAS (1.3.4 & 1.3.5)

How they form?

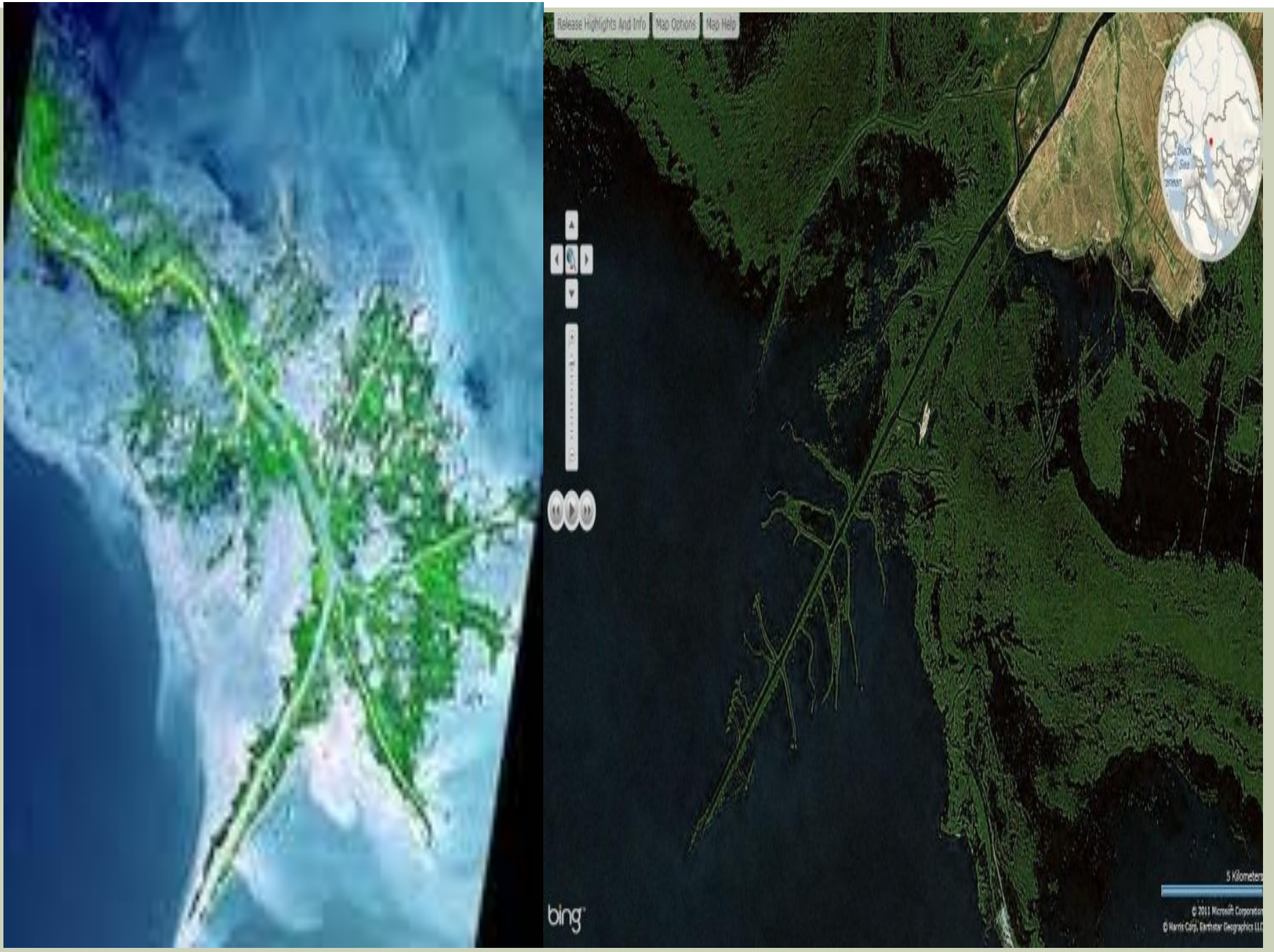
- A low-lying area found at the mouth of a river and formed of deposits such as silt, laid down by rivers.
- Deposit of sand, silt, and clay where a river flows into a body of standing water.

3 TYPES OF DELTAS

1. DIGITATE DELTA

- Finger-like shaped.
- Asymmetrical and in the shape of a bird's foot.
- **Diagram B on pg. 32**

Mississippi River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Map Help
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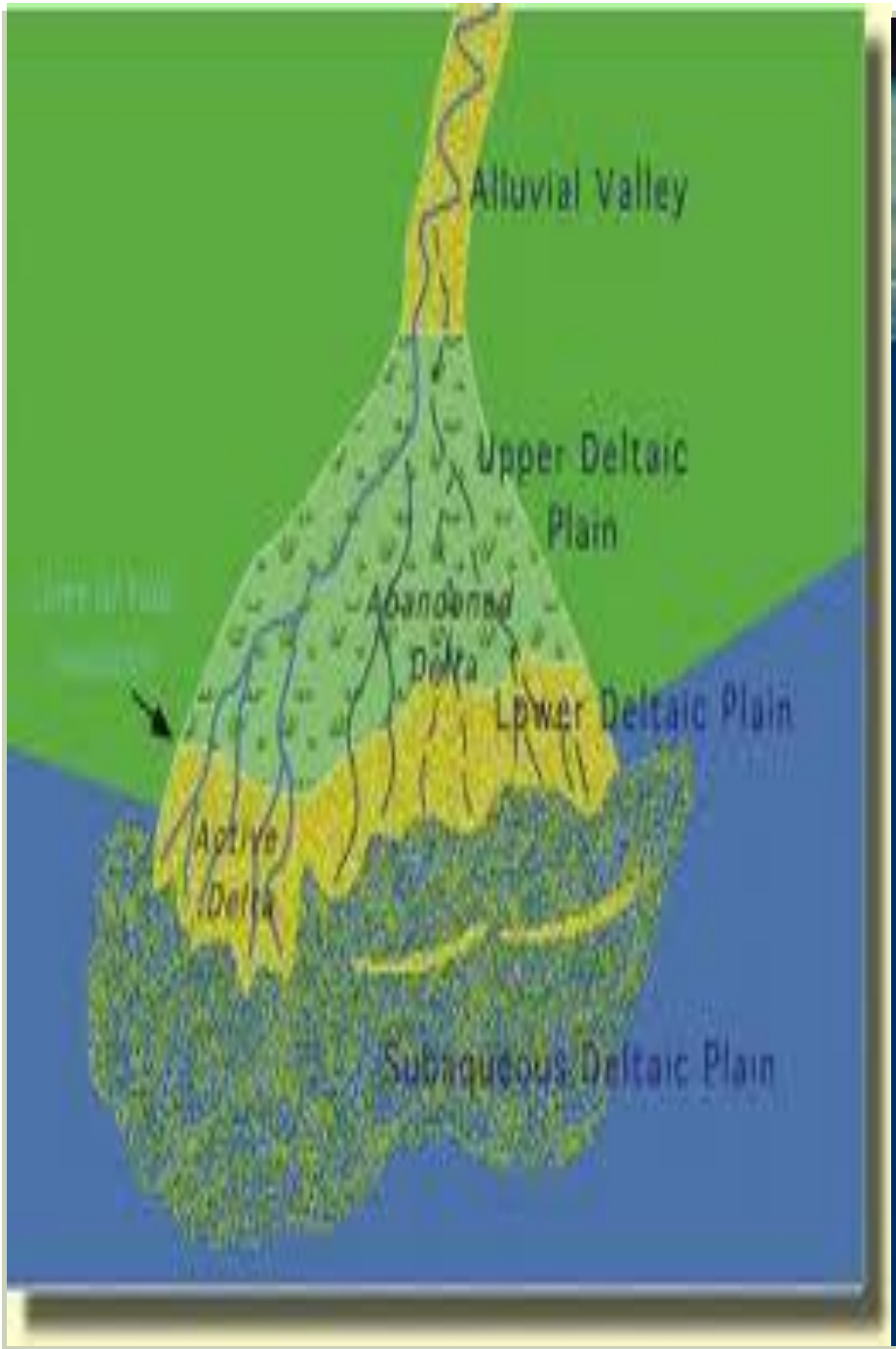
2. ARCUTE DELTA

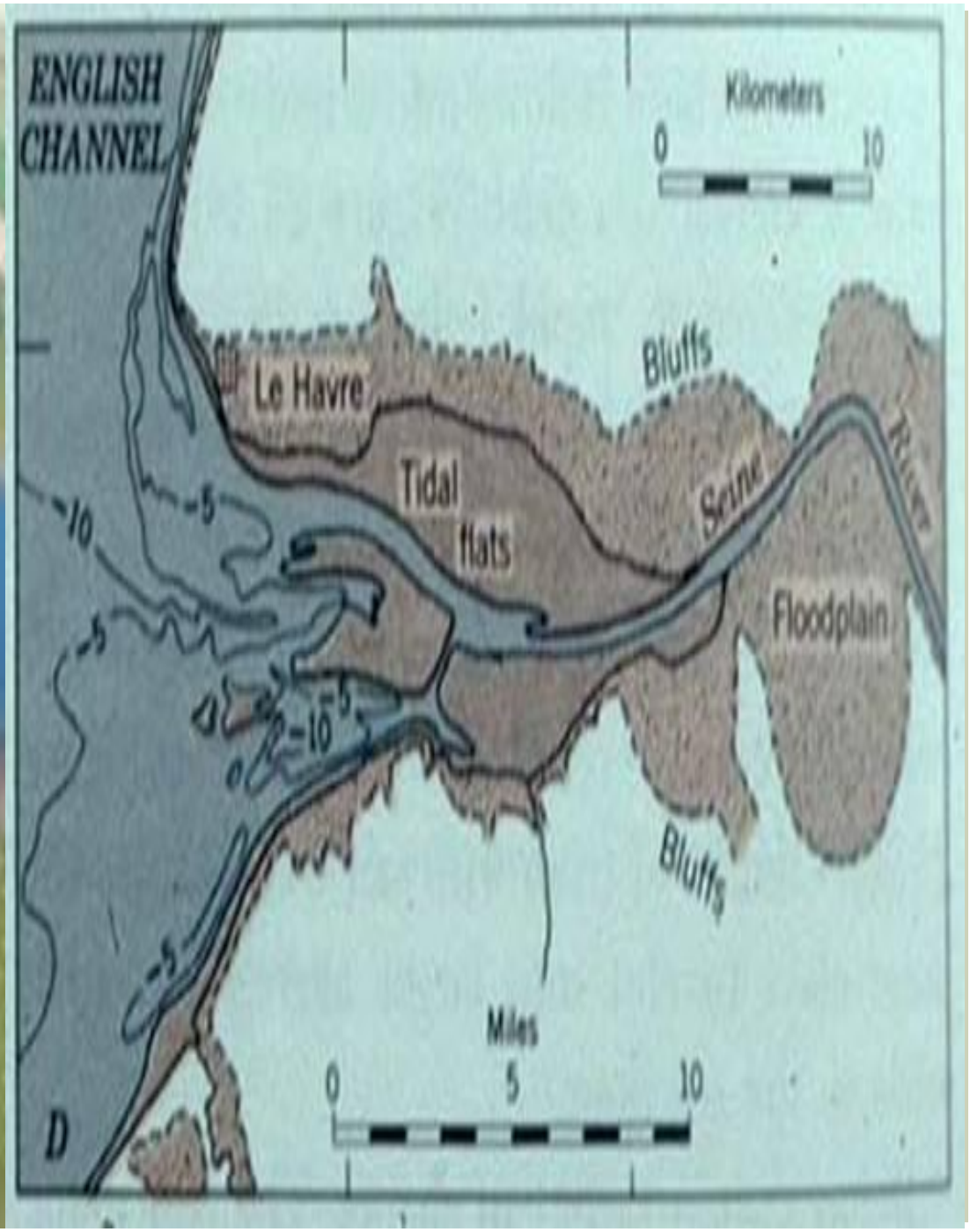
- Curved in the shape of a bow.
- Symmetrical and triangular in shape.
- **Diagram A on pg. 32**

Nile River


Alluvial Valley
Upper Deltaic Plain
Abandoned Delta
Lower Deltaic Plain
Active Delta
Subaqueous Deltaic Plain

3.ESTUARINE DELTA

- Formed in an area of a river mouth which is affected by sea tides.
- Seen in the form of **TIDAL MUD FLATS**.
- **Diagram C on pg. 32**


ENGLISH CHANNEL
Kilometers
0
10
Le Havre
Bluffs
Tidal flats
Seine
River
Floodplain
-10
-5
-5
-10
-5
-5
Bluffs
Miles
0
5
10
D

WHAT ARE THEY?

DELTA SIMILARITIES & DIFFERENCES

Similarities

- Arcuate & digitate both flow into open ocean
- All three allow river water to flow out
- All have channels or distributaries cut into them by the river

Differences

- Estuarine empties into a bay whereas other 2 empty into open water
- Three different shapes

GLACIAL EROSION AND DEPOSITIONAL FEATURES:

- **TWO** types of Glaciers:

1. Continental
2. Alpine

ALPINE GLACIATION AND CONTINENTAL GLACIATION:

Similarities

Both:

- move and cause erosion.
- change the landscape.
- develop in constantly cold < 0^0C.

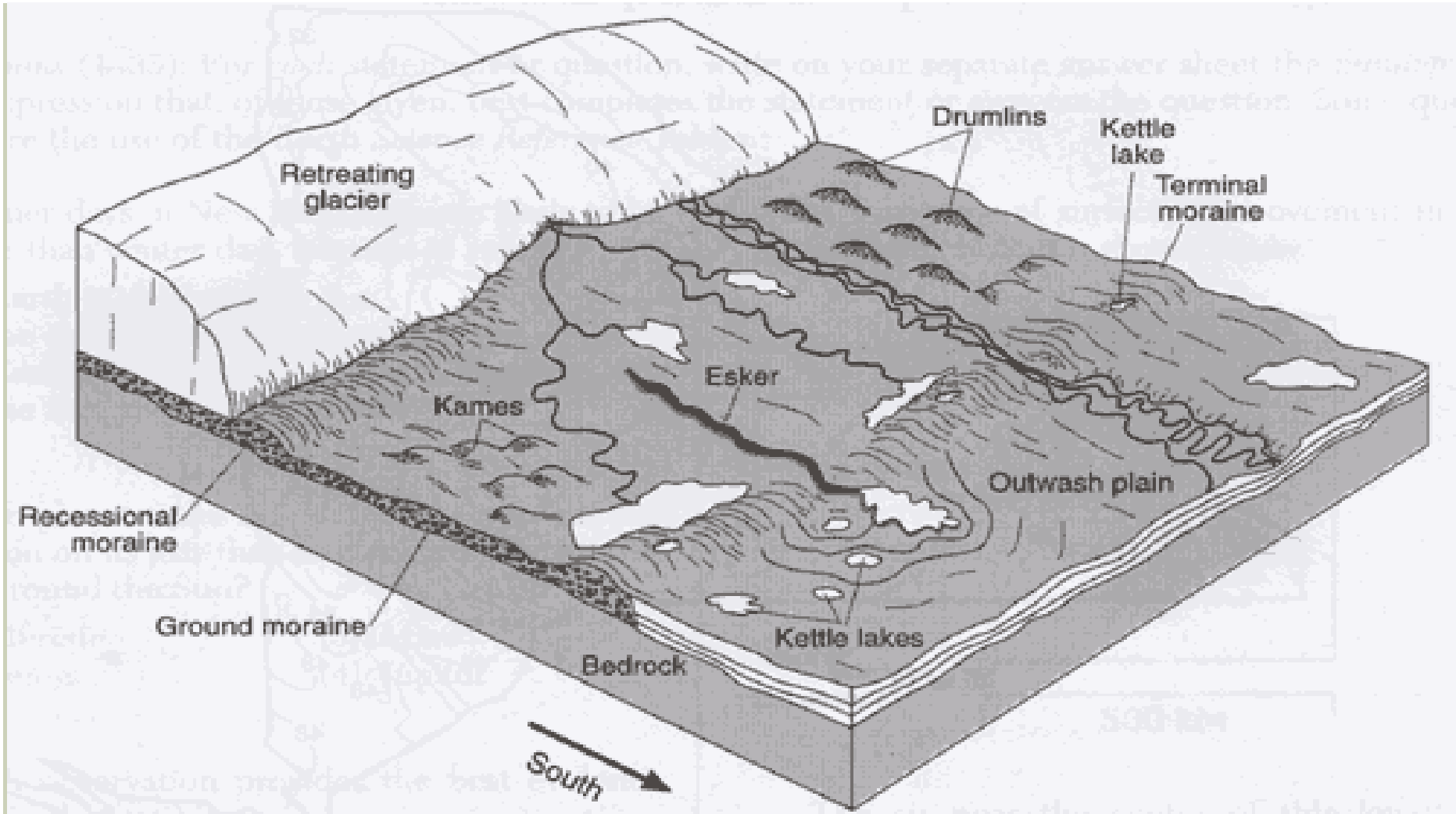
Differences

- **Location**
  - Alpine = mountain
  - Continental = earth poles
- **Size**
  - Alpine > smaller
  - Continental > larger

1. CONTINENTAL GLACIATION (1.4.1)

- Large ice sheets covering major portions of entire continental areas.

EROSIONAL & DEPOSITIONAL FEATURES:



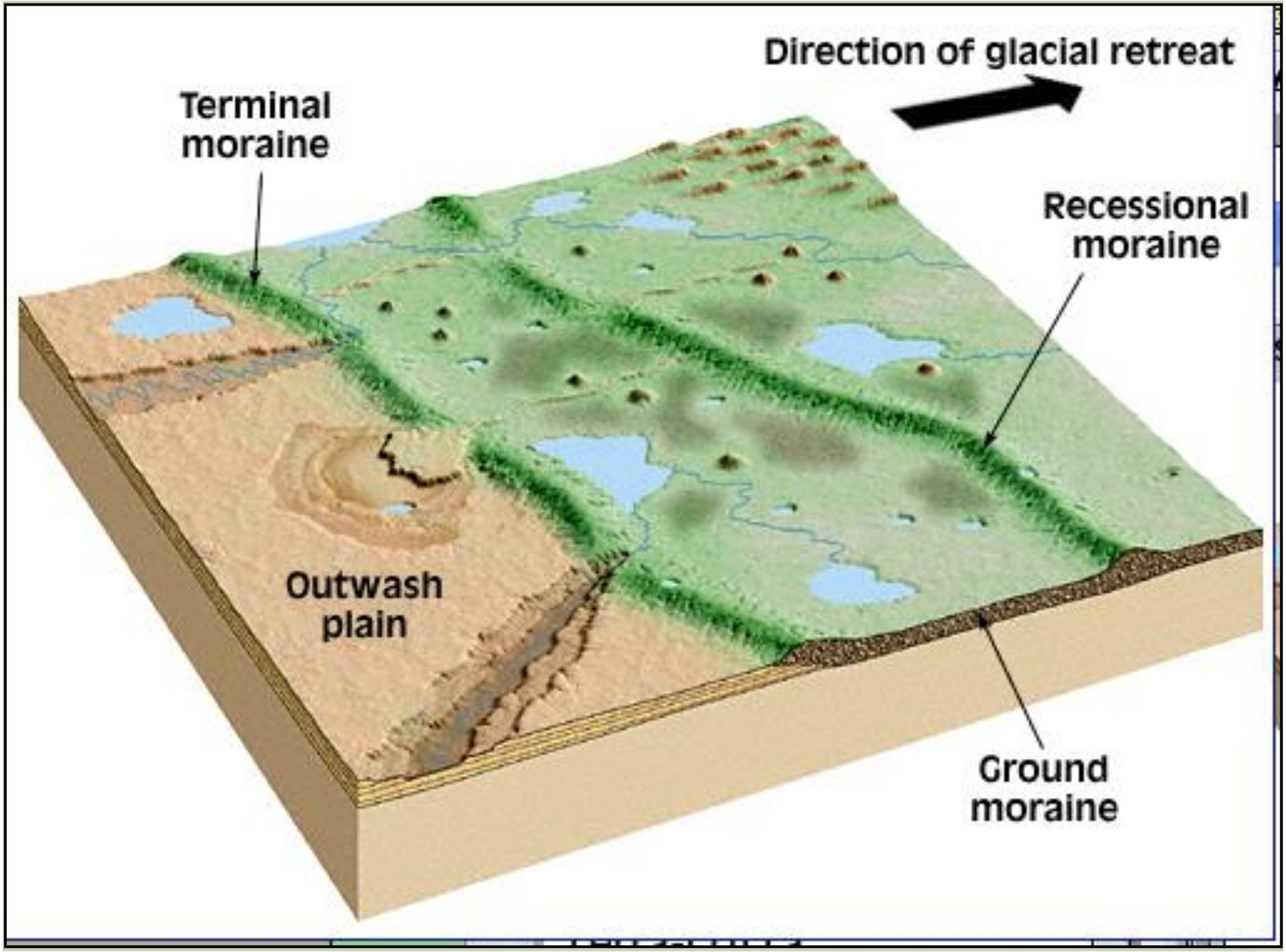
A. OUTWASH PLAIN:

- Plain formed by glacial melt water.
- Huge amount of sand and gravel washed out of glacier and deposited in flat outwash plain. (like a river delta)
- Material is sorted into layers with sand and soil left on top.


A. Werner

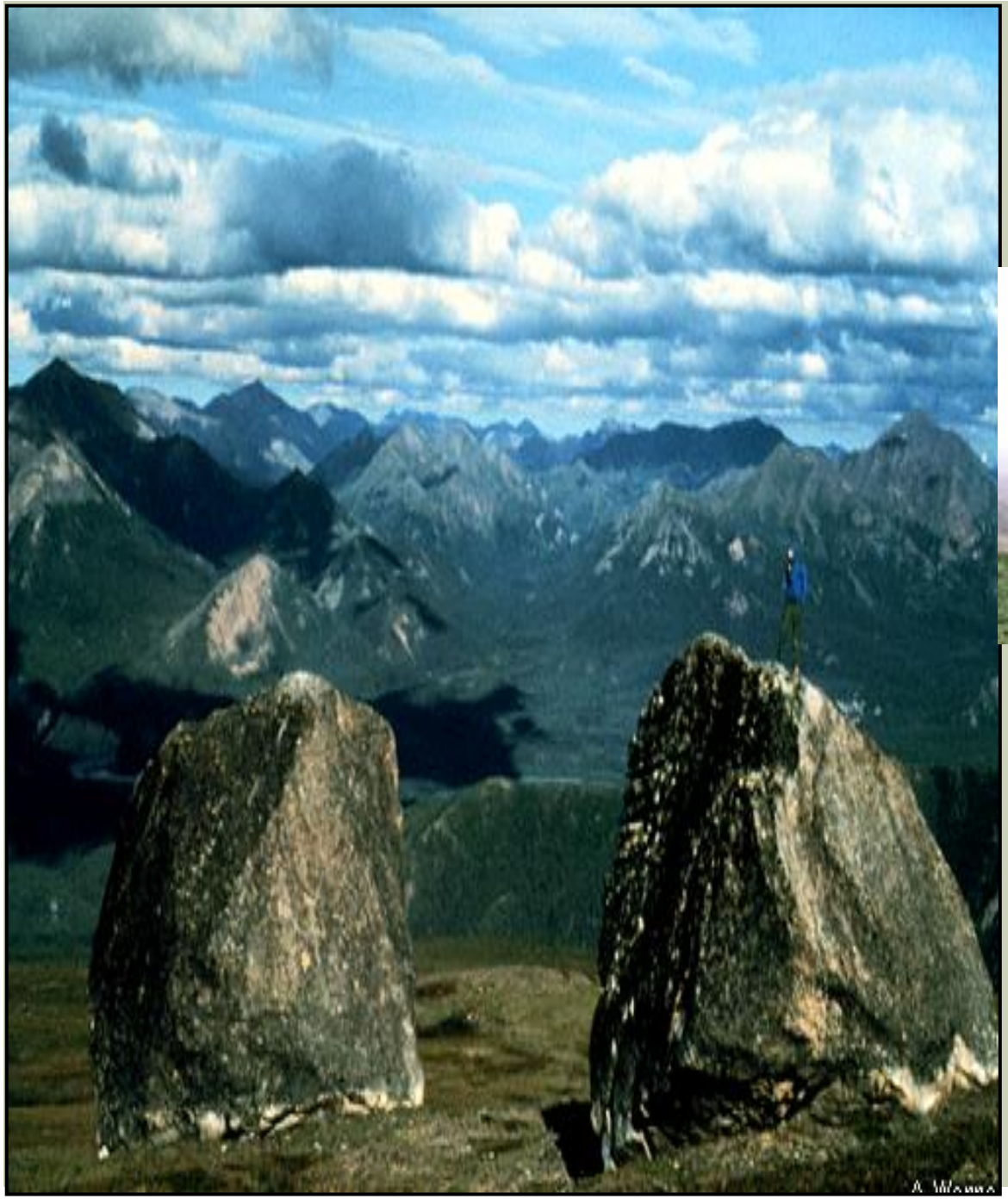
B. TERMINAL MORAINE:

- A heap or ridge of unsorted debris found at the melting **END** of the glacier.
- As a glacier retreats it deposits debris/gravel.
- Think of a bull dozer!!!


Direction of glacial retreat
Terminal moraine
Recessional moraine
Outwash plain
Ground moraine

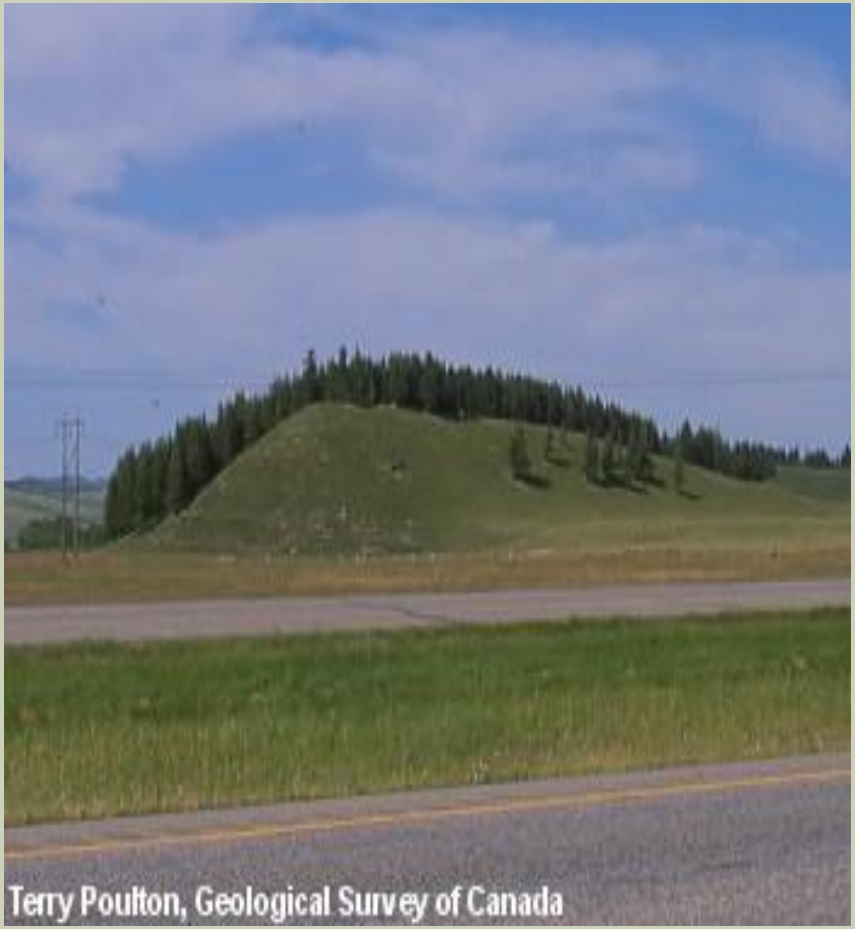
C. ERRATIC:

- A “big – ass” boulder.
- Rocks found out of place, transported by a glacier.
- Now sit in a region and look very much out-of-place.



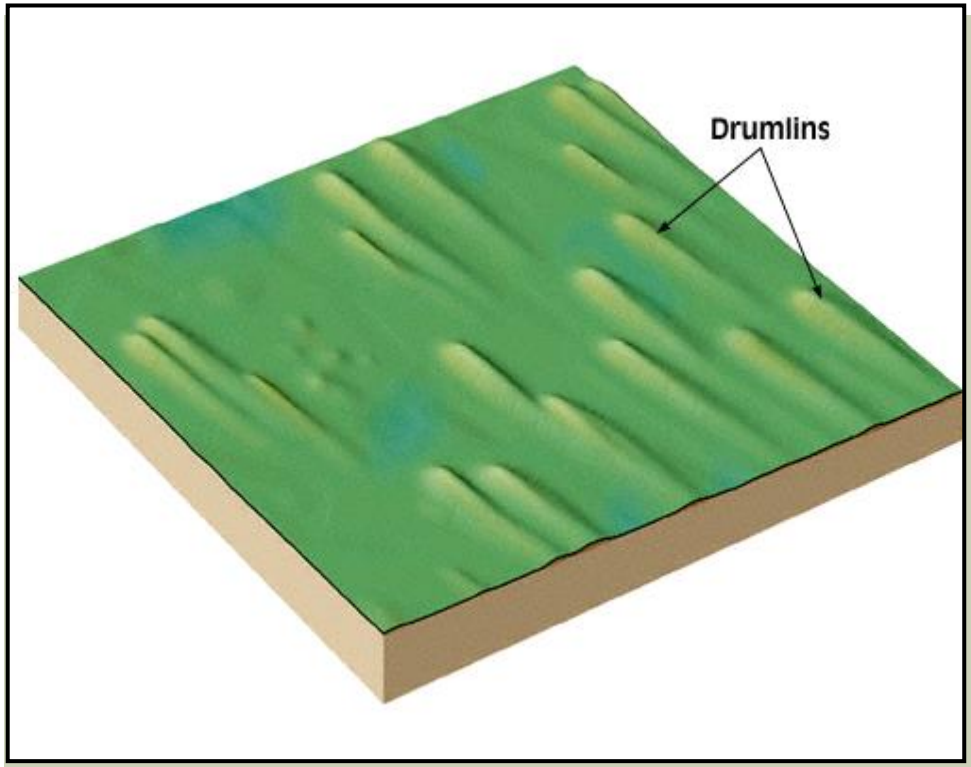
D. DRUMLIN:

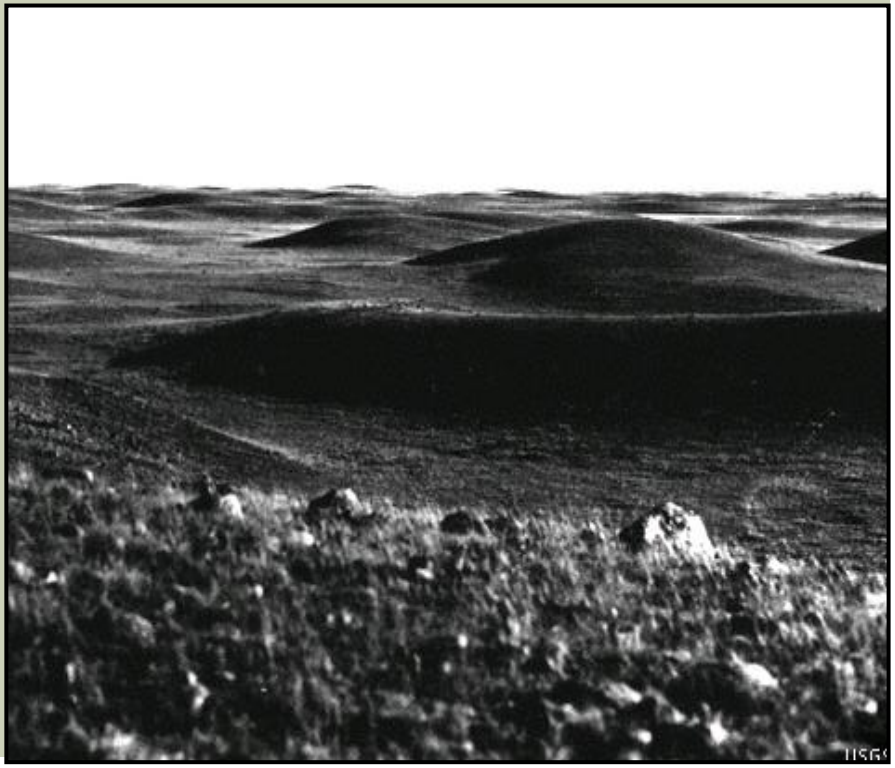
- An egg shaped (oval) or tear drop hill.
- Formed under glaciers.
- The end facing the ice is blunt, while the other end is shallow.
- Sloped or Pointy end points in direction of ice flow



FORMATION OF DRUMLINS:

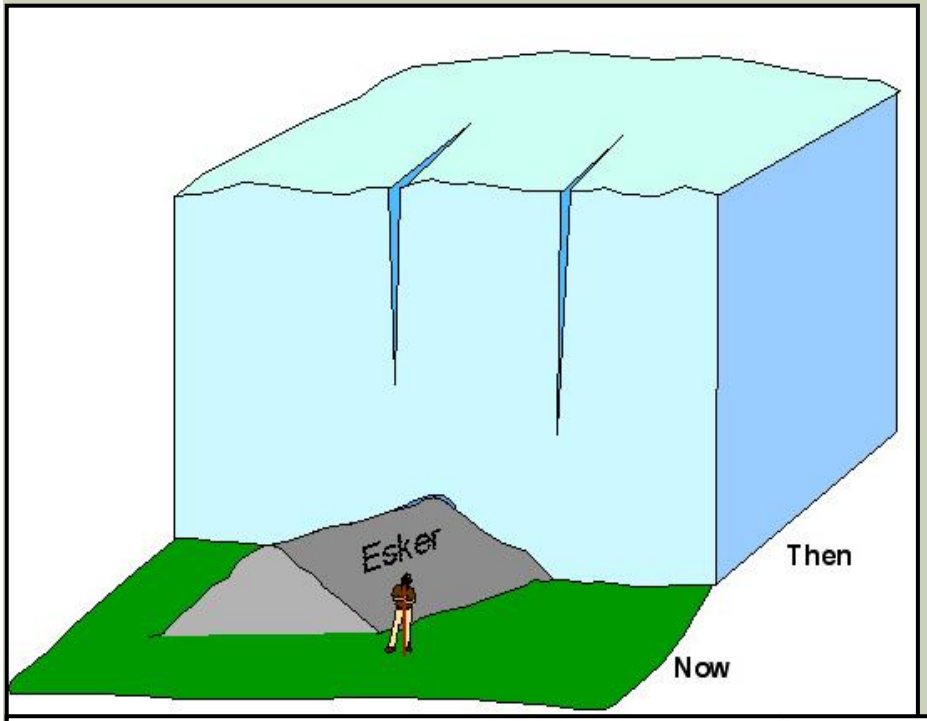
- Ice melts under glacier.
- Deposits of gravel made.
- Glacier moves forward.
- Deposits are bull-dozed along and catches up in rough areas forming piles or drumlins.

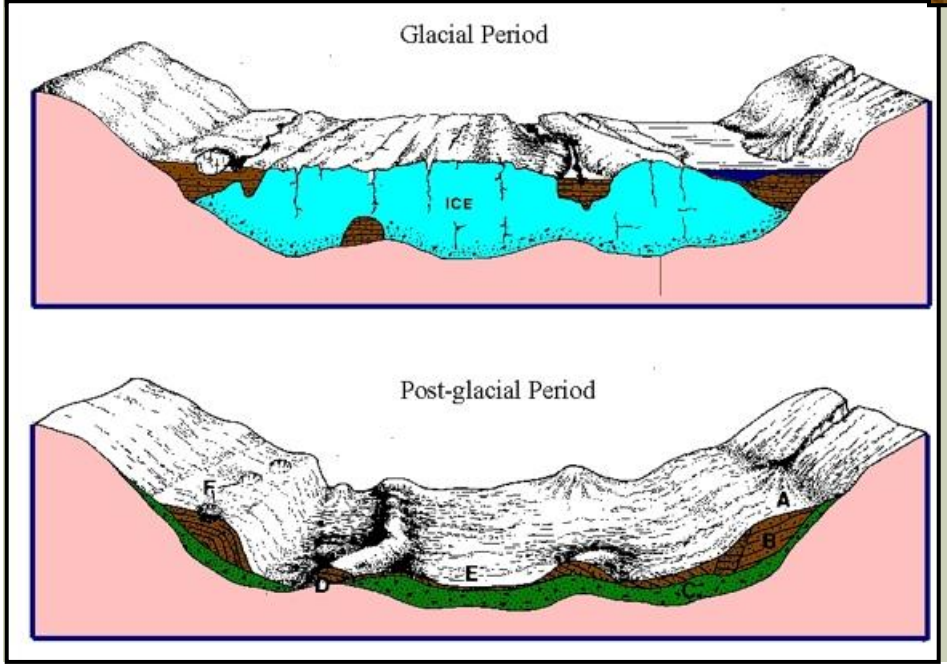

Drumlins

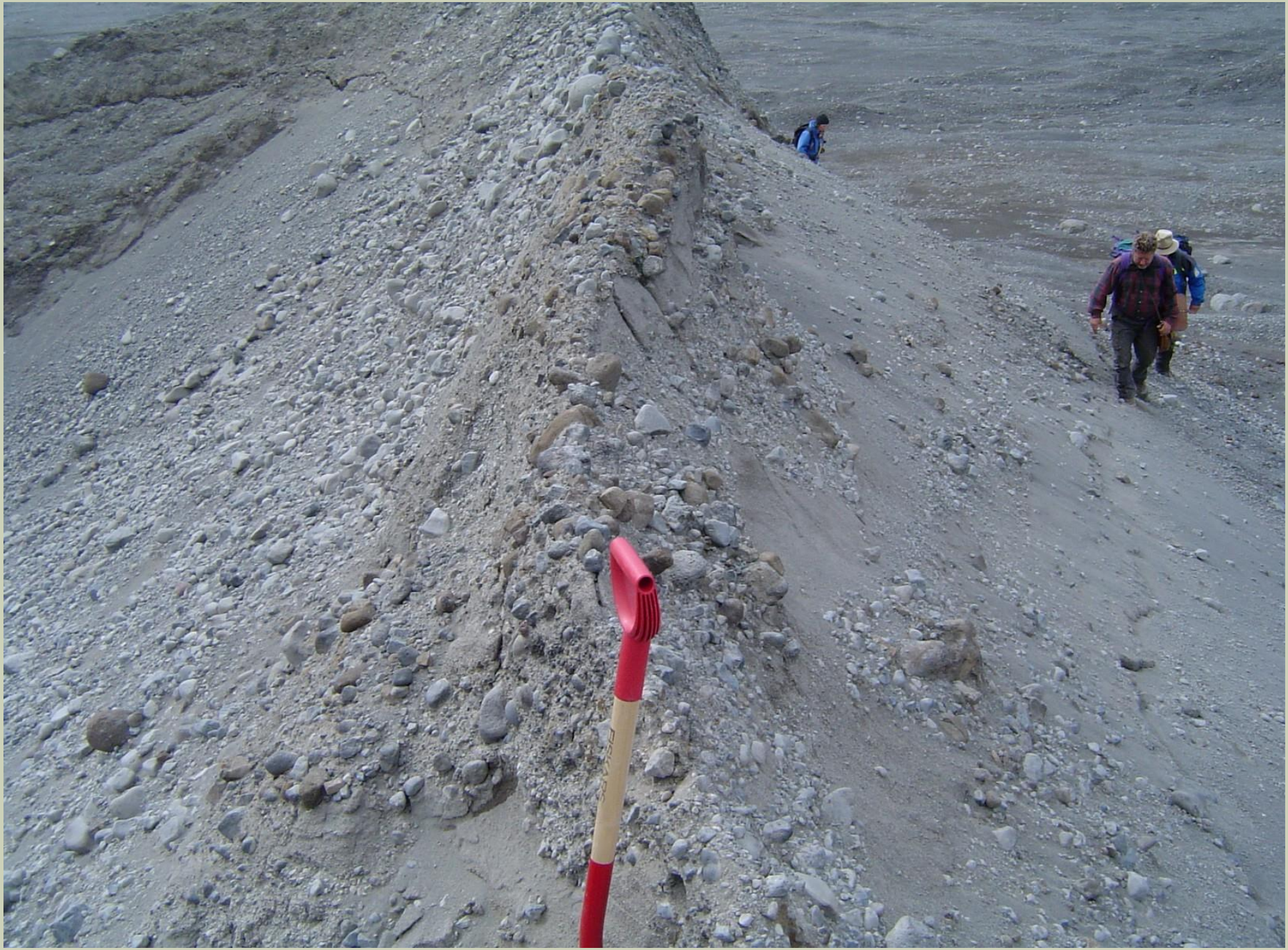


E. ESKER:

- Debris deposited by a sub-glacial stream like all rivers.
- Produces long, narrow, winding ridges of sand and gravel. (snake-like)


Esker
Then
Now


Glacial Period
ICE
Post-glacial Period
A
B
C
D
E
F

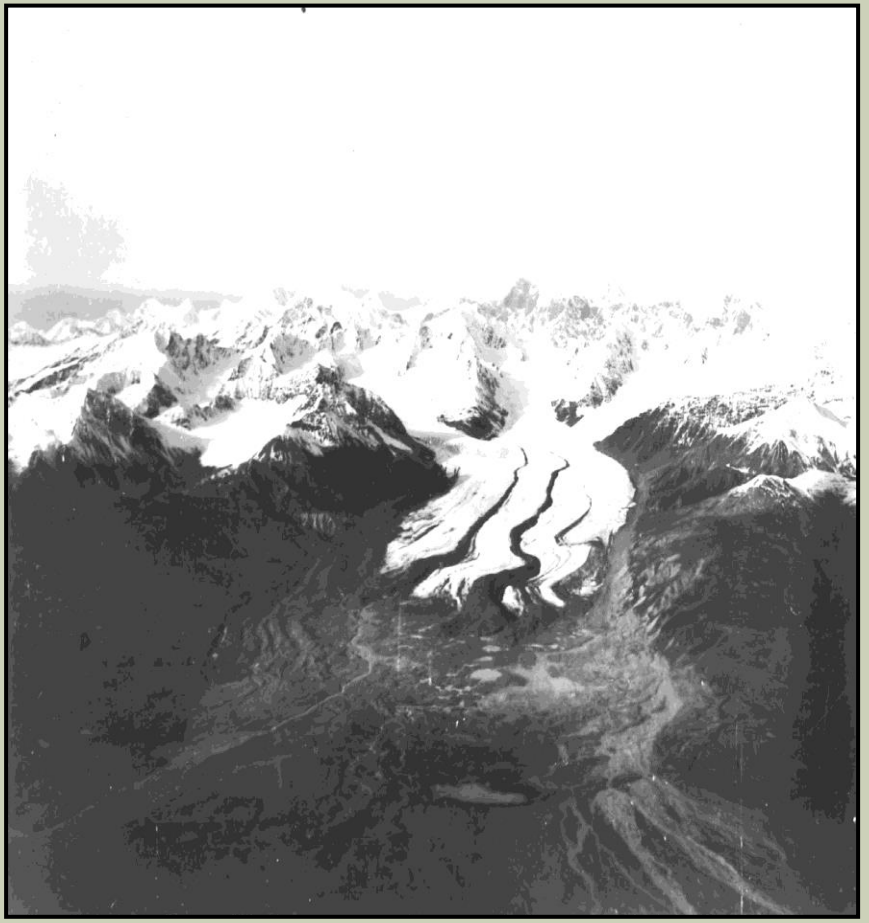


HOW TO TELL THE DIRECTION OF MOVEMENT OF A CONTINENTAL GLACIER? (1.4.2) – ALWAYS ON PUBLIC!!!!!

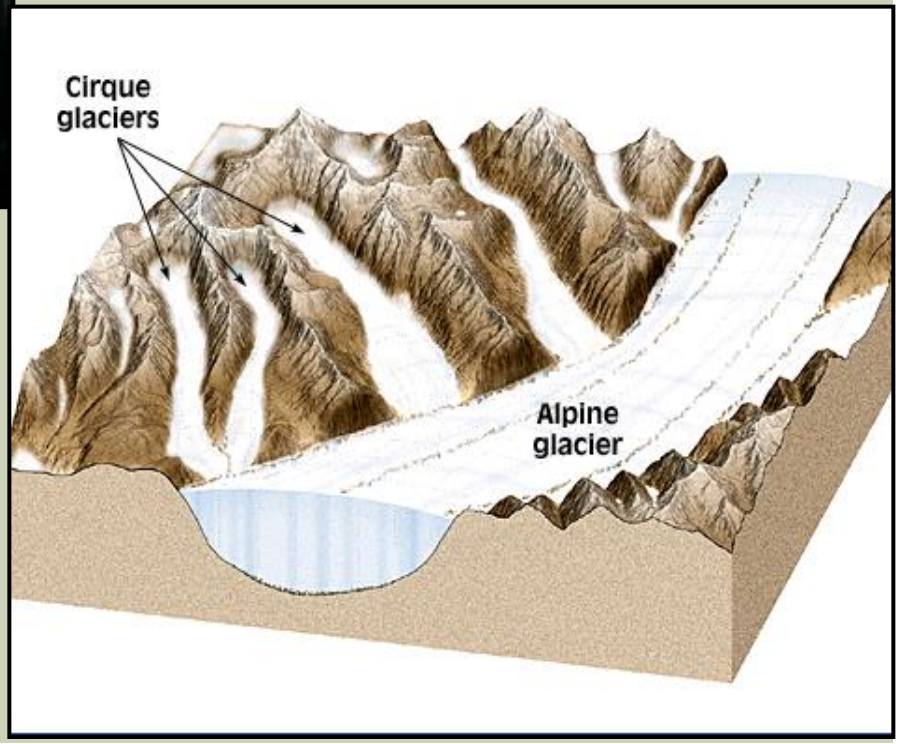
- You use Drumlins.
- The tail end points in the direction glacier moved.

2. ALPINE GLACIATION (1.4.3)

- Large ice sheets covering high mountain valleys above the snow line so the snow never melts.
- Alpine glaciers are like very slow moving rivers of ice flowing down high mountain valleys.




USGS


Cirque
glaciers
Alpine
glacier

EROSIONAL & DEPOSITIONAL FEATURES

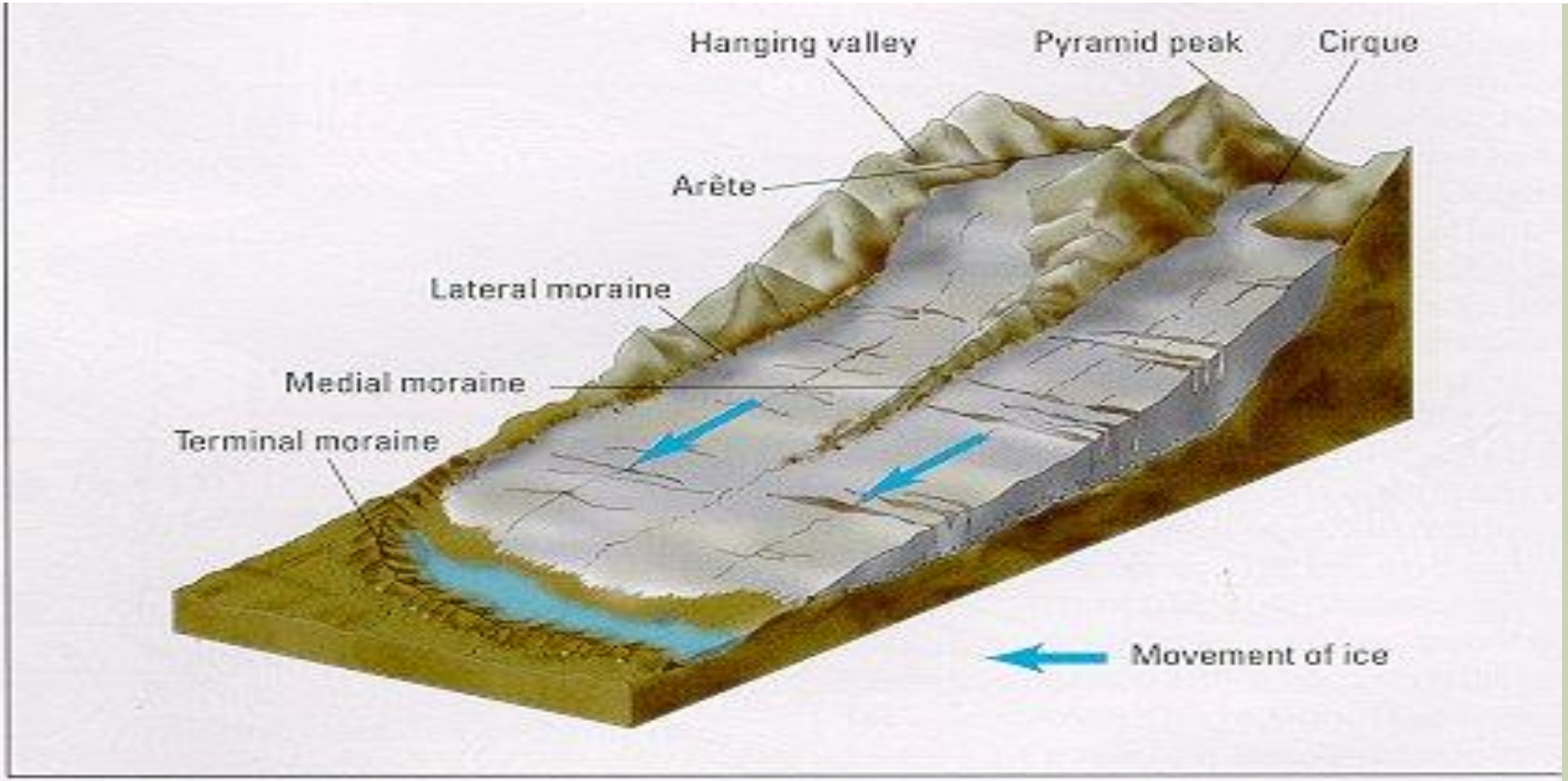


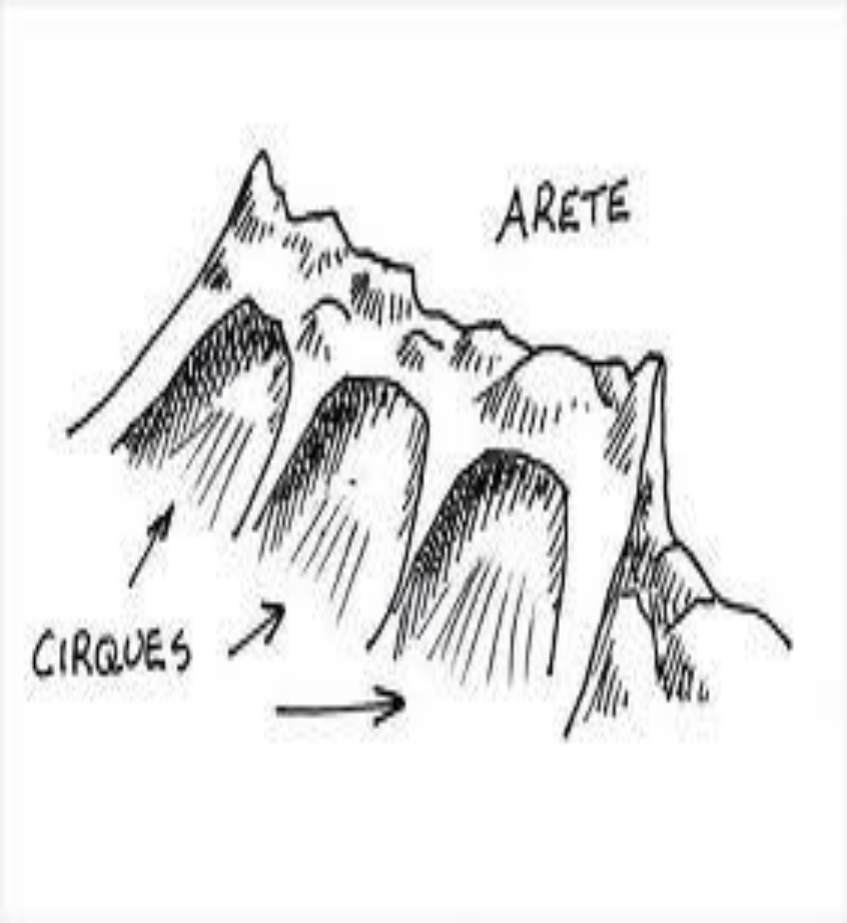
Figure 2.15
Features of an Alpine Glacier

A. CIRQUE:

- A circular hollow cut into the side of a mountain (horseshoe shaped).
- Side and back walls are steep but front wall opens downward

B. ARÊTE:

- A steep knife-edged ridge between several cirques in a mountainous region.




Stefano Anghileri

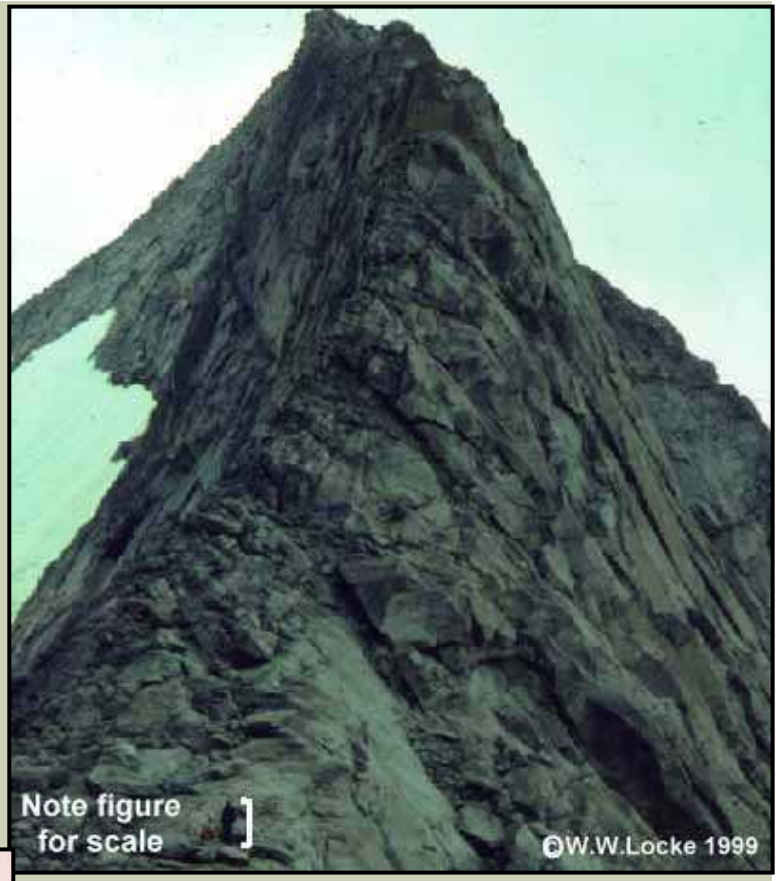
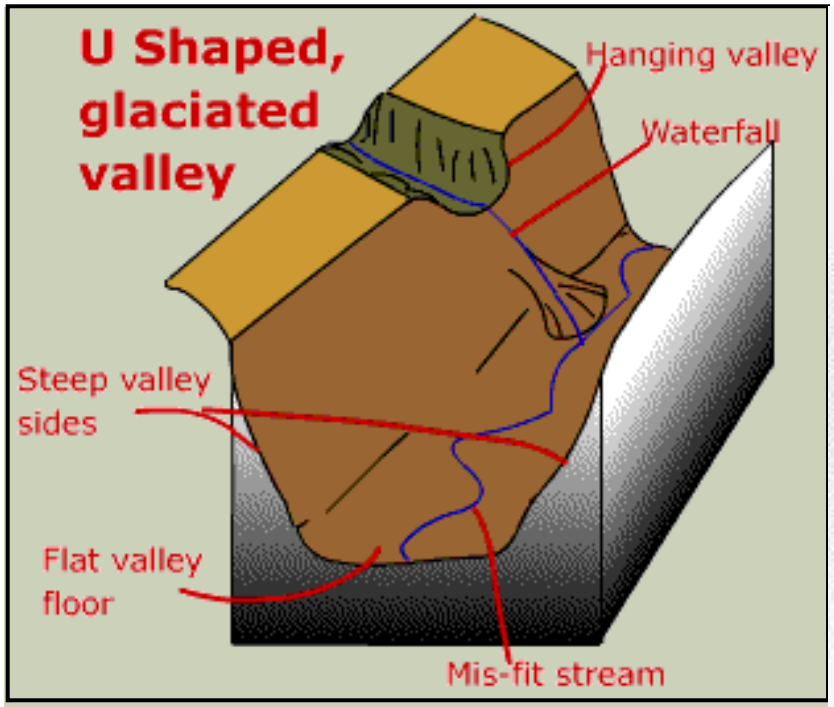
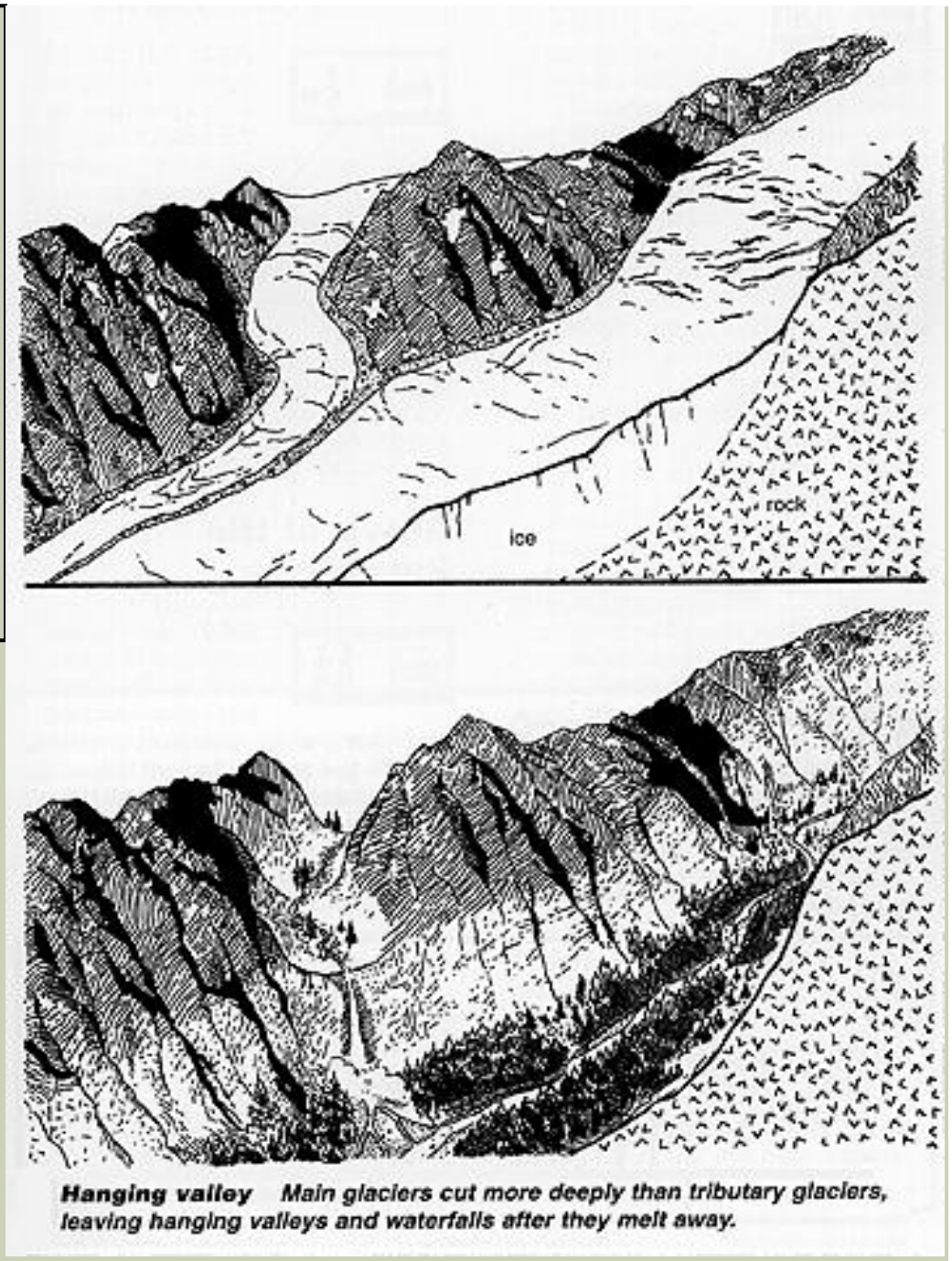

Note figure
for scale
©W.W.Locke 1999


Photo by K. A. Lemke.

C. HANGING VALLEY:

- Tributary valley occurring above the level of a valley.
- U-shaped valleys on the side of mountains that join the main valley.





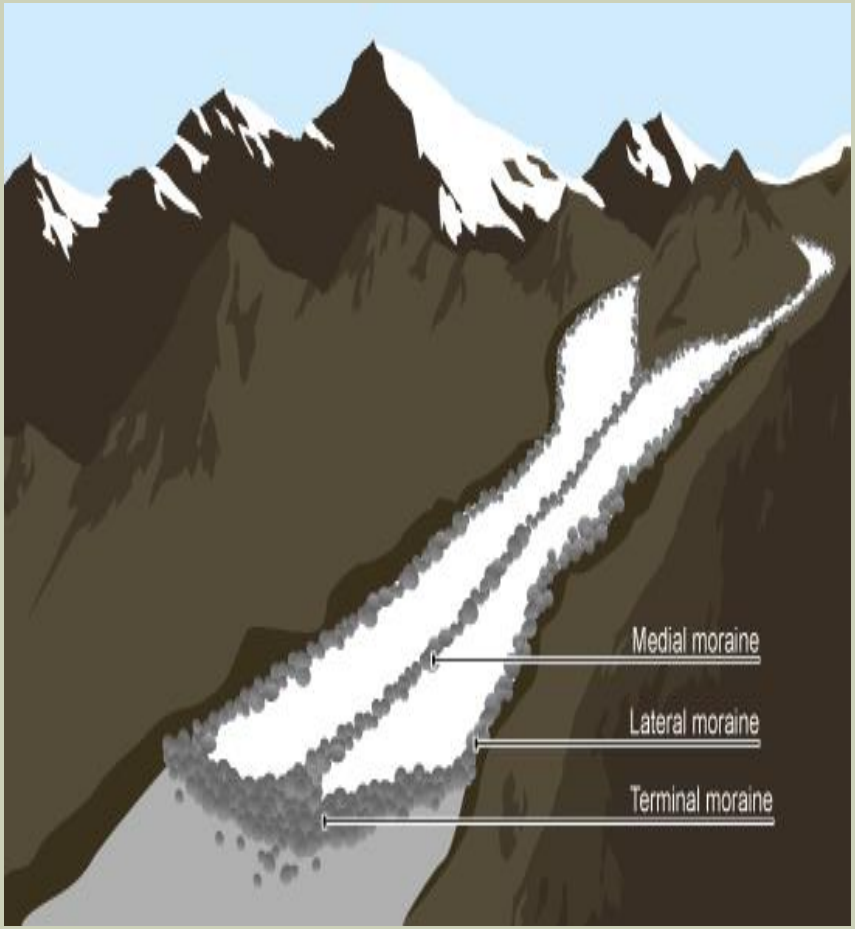
Hanging valley *Main glaciers cut more deeply than tributary glaciers, leaving hanging valleys and waterfalls after they melt away.*

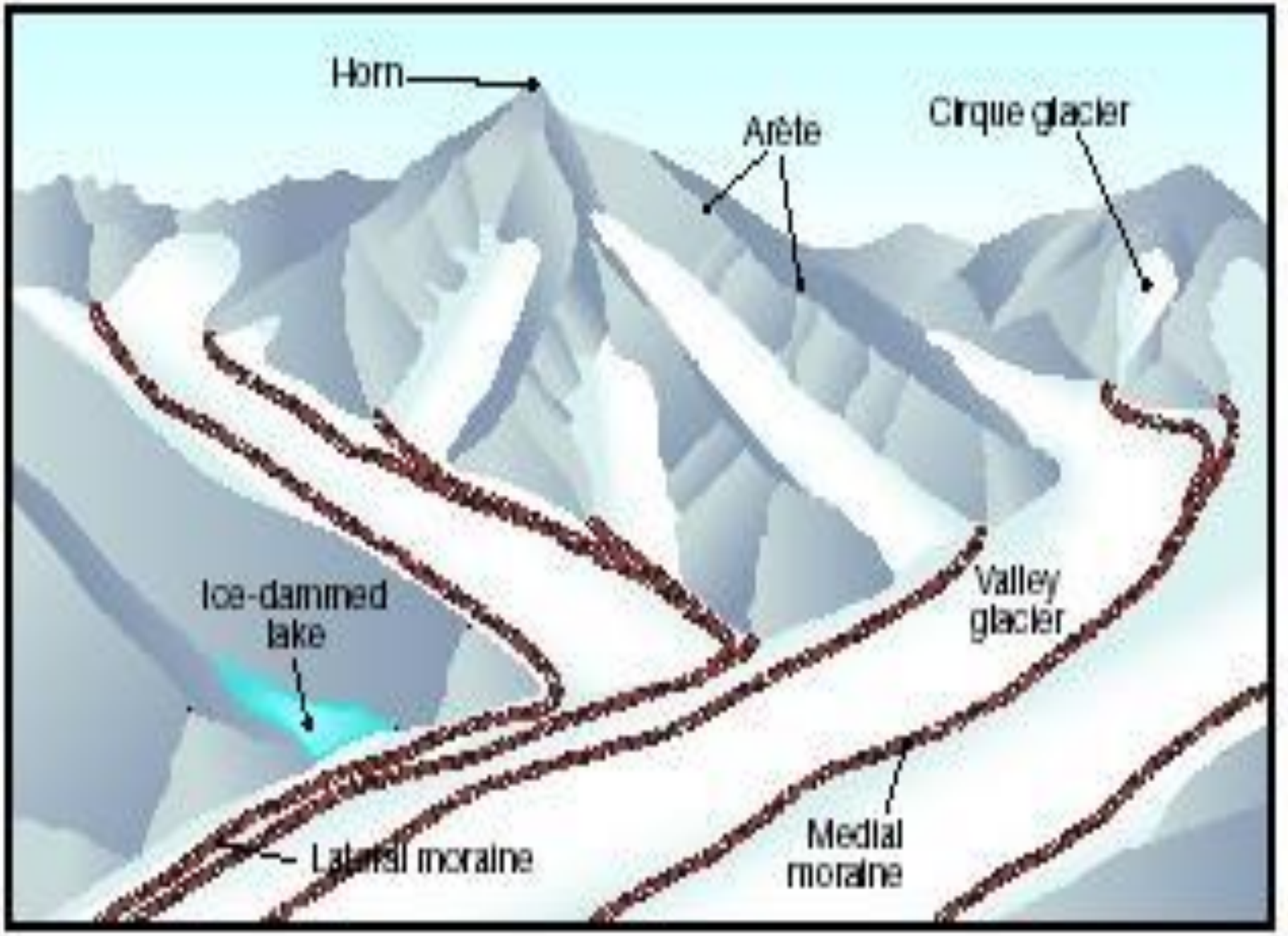
HANGING VALLEY IN NEWFOUNDLAND

- Hanging Valley in Gros Morne National park .
- Trout river pond

D. LATERAL MORAINE:

- Debris (rock, gravel, soil) found on the **SIDES** of an alpine glacier.




Horn
Arête
Cirque glacier
Ice-dammed lake
Valley glacier
Lateral moraine
Medial moraine

E. TERMINAL MORAINE:

- deposits that mark the farthest extent of the glacier.

REVIEW:

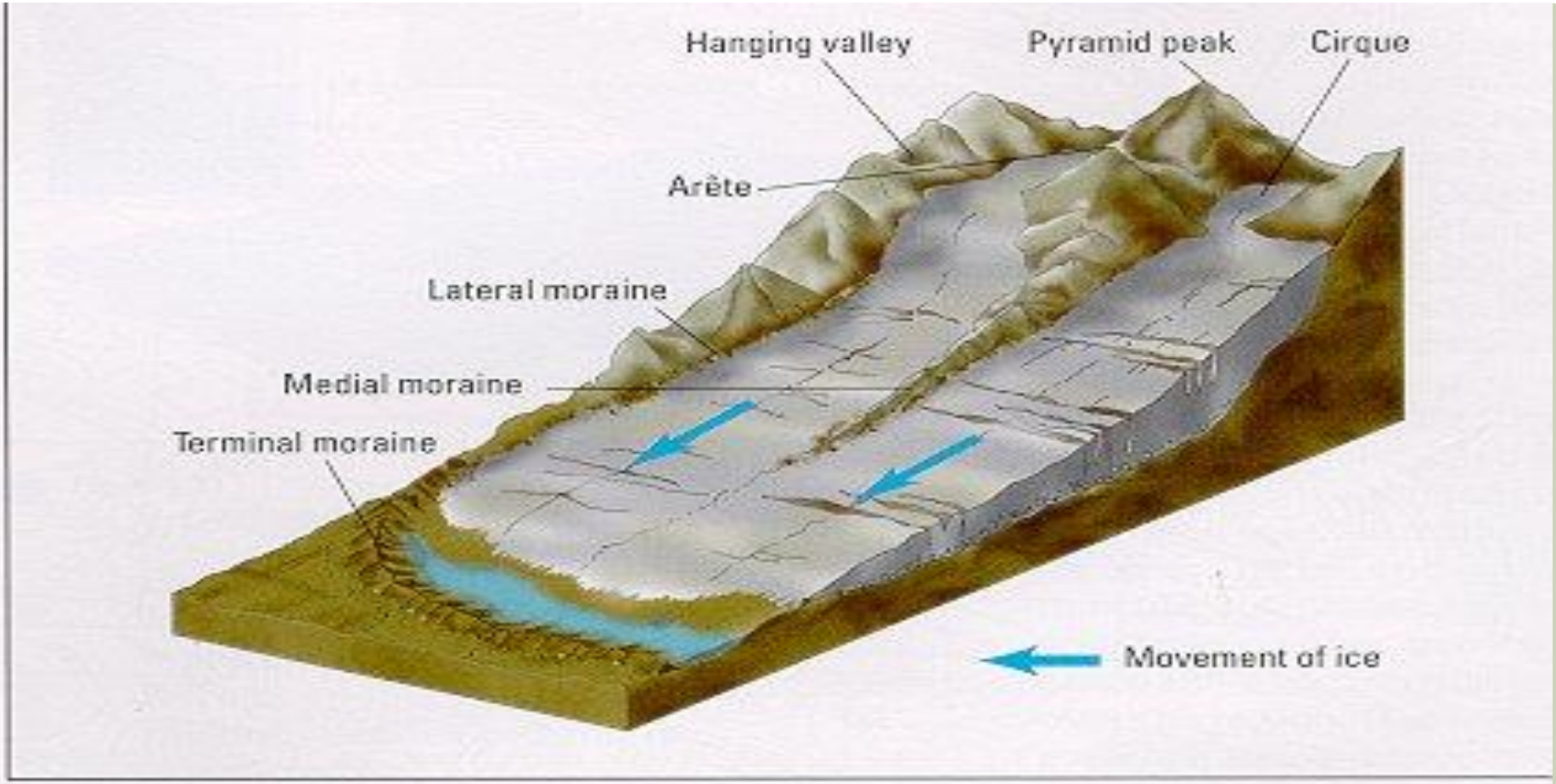


Figure 2.15
Features of an Alpine Glacier

FIORDS (1.4.4)

- A long, narrow arm of the sea which is the result of the “drowning” of a glaciated valley.
- Have steep sides.
- Often very deep.

HOW DID THEY FORM?

- Glacial ice formed these valleys.
- Many years ago, when the ice melted, the level of the sea rose and the water filled the valleys.