

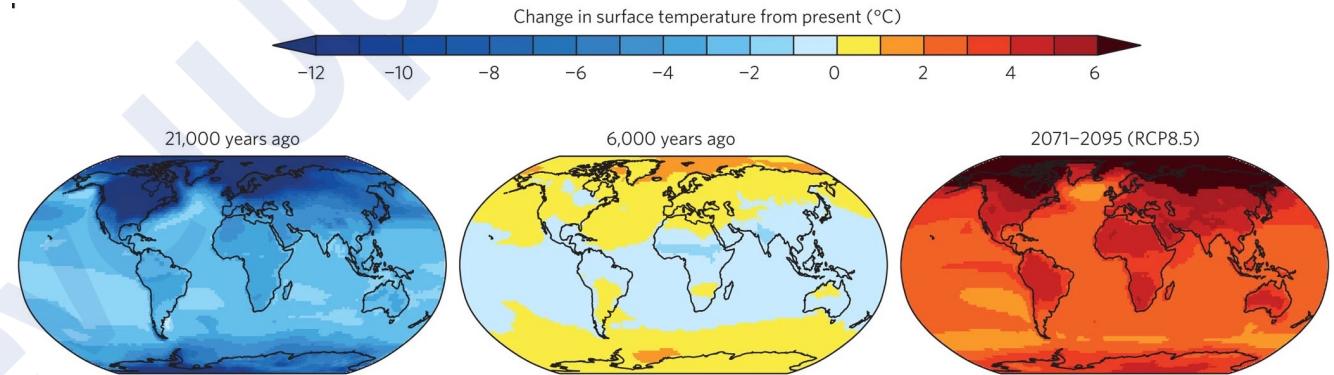
# Continental Drift Theory: Background

## Debate: Major Variation in Earth's Climate

- The continental drift theory was proposed by Wegener to explain major variations in the earth's climate.

The cause for such variations can be-

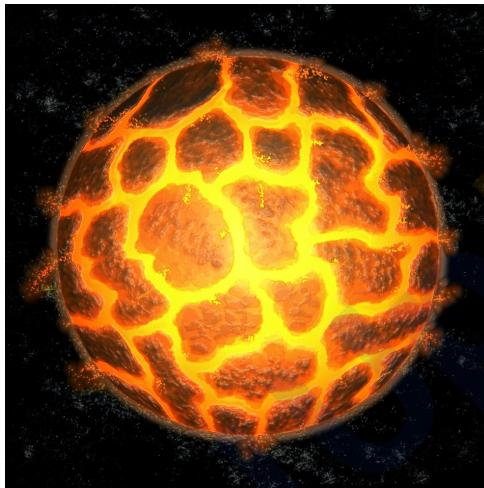
- The continents remained stationary, while the climatic zones changed.
- The climatic zones remained stationary and the continental land might have displaced.
- As Wegner did not find any evidence of changes in climatic zones, he proposed continental drift as the reason.



# Continental Drift Theory: Background

## Debate: Academic Debate

- Debate about the permanency of Earth's Crust
- How did the crust form?
- How did the ocean and continent differentiate?
- How did ocean and continents change in time and why?
- What was the nature of the first crust and the first ocean and the continent?
- How did the landforms in ocean and continents differ?



# Continental Drift Theory: Background

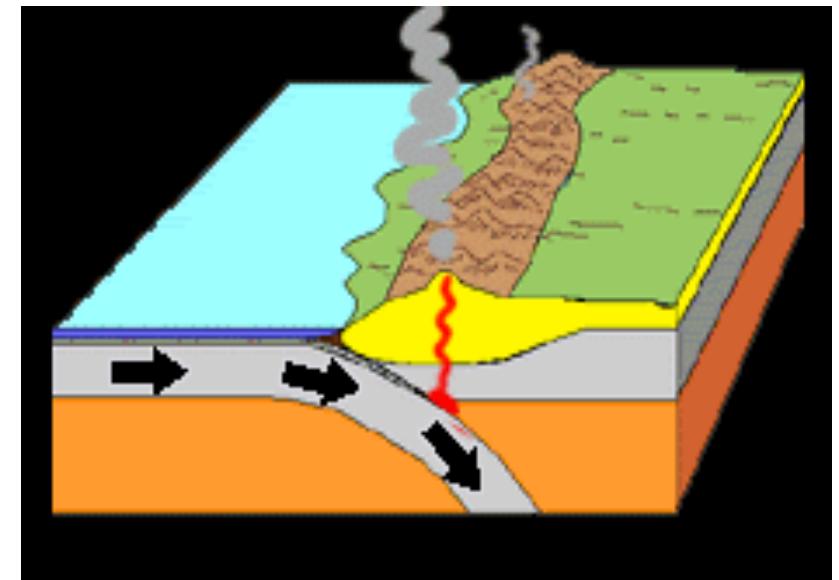
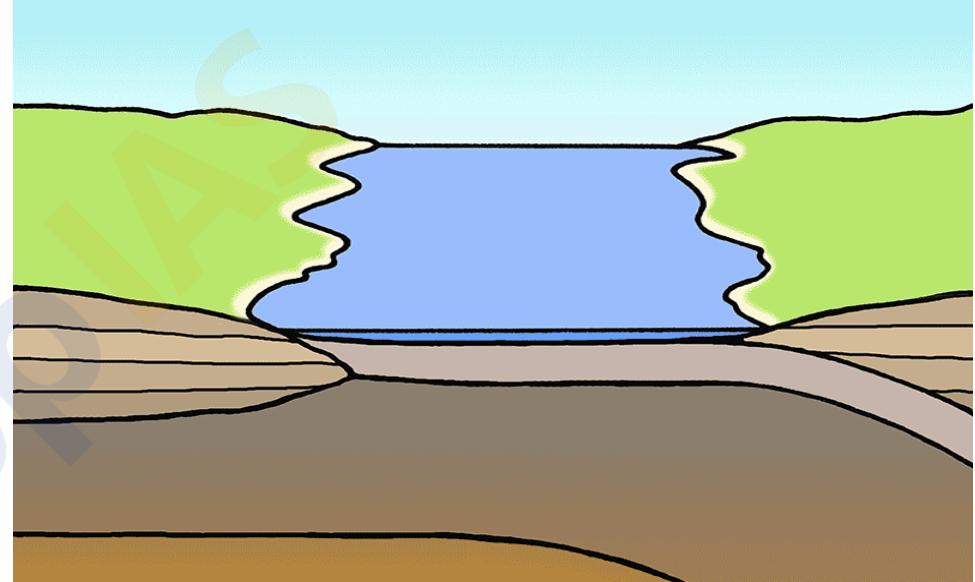
## Debate: Academic Debate

- What is the mystery of the fold mountains?

**Fold mountains:** Composed of marine sediments and have long linear chain of mountain. Fold Mountains are unique to the earth and understanding fold mountain is like understanding the evolution of the crust.

Earlier Interpretation:

Mountains are the wrinkles on the earth's surface associated with the cooling.



# Ideas prevalent at that time

## Older Idea:

- Ocean and continents were like what they are today and oceans do not move and change. This is called as the permanency of the ocean and the continents.

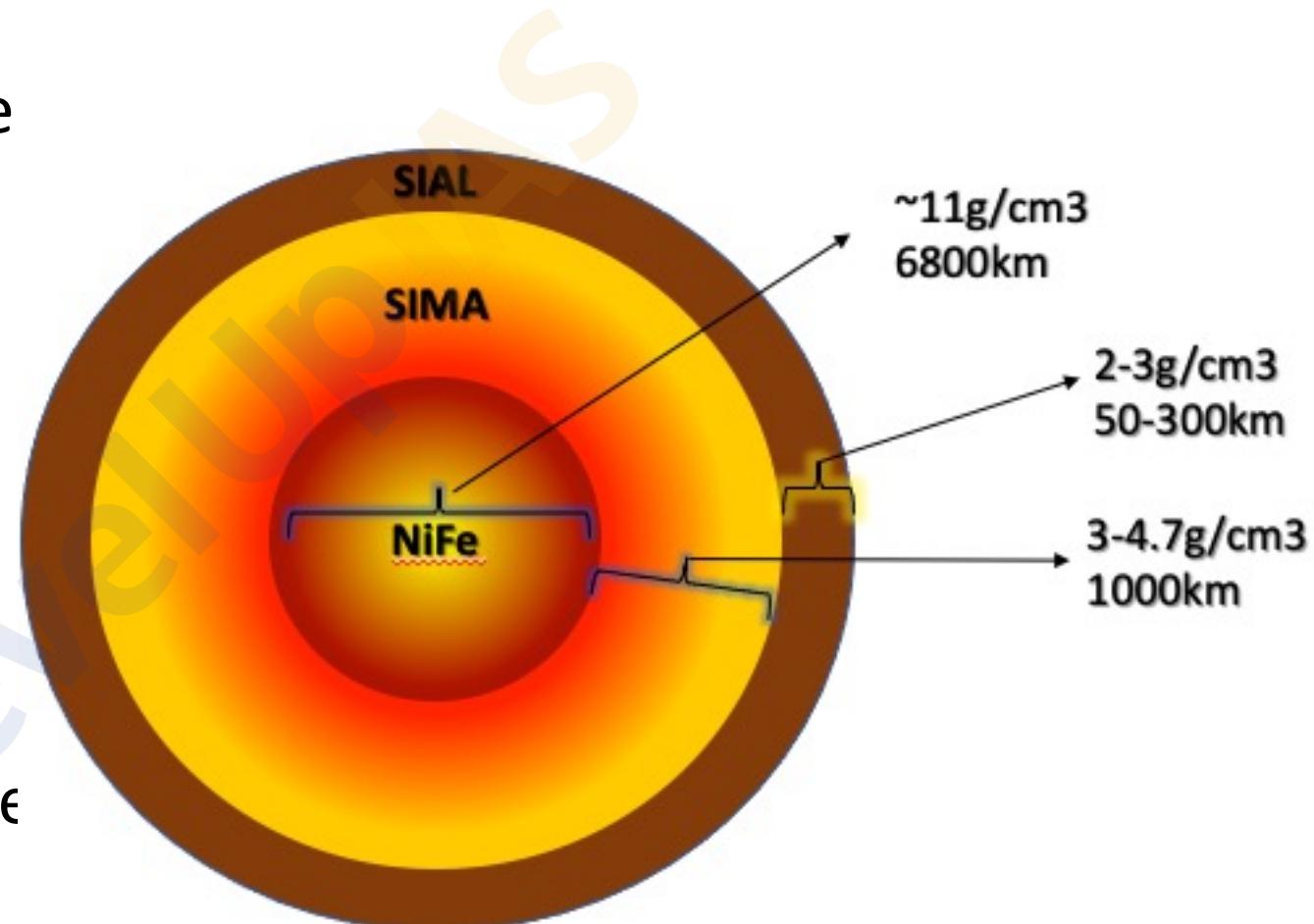
**Newer Idea:** Some of the observation from the voyages of 14th and 15th century mentioned that continents and oceans could have been broken and moved.

1. Matching coastline of South Atlantic
2. Eastern coastline of South America seems to be matching with the western coast of Africa
3. Coal fields of USA in Appalachian in East match with the coal fields of Western Europe (Pennines)



# Assumptions:

- He proposed three layers of the earth with
  - Outer SiAl,
  - Intermediate SiMa,
  - Inner NiFe.
- SiAl was the continental mass whereas Oceanic crust was SiMa.
- SiAl masses were assumed to be floating on SiMa without any resistance.



# The postulates

Super continent– Pangea,  
Super ocean – Panthalassa

Fold mountains, islands  
volcanos and earthquakes are  
result of SIAL floating over SIMA

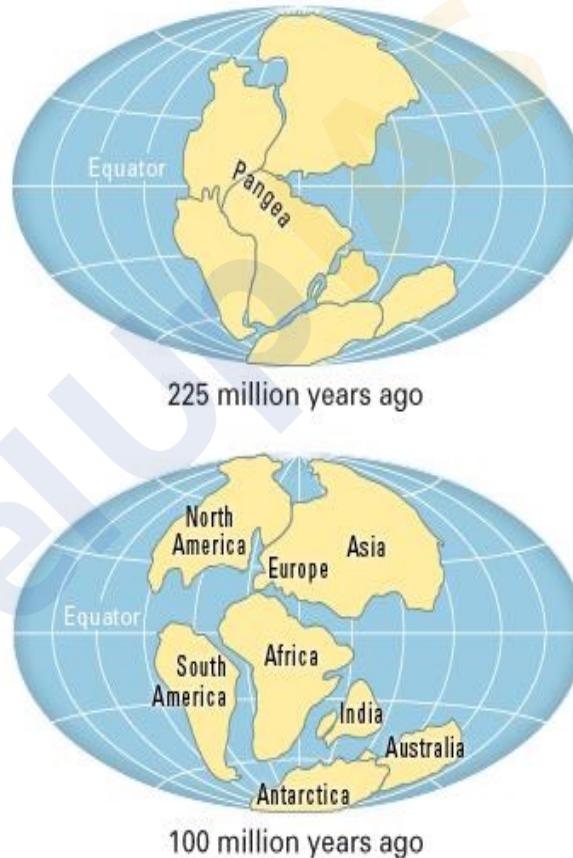
Pangea was mostly in southern  
hemisphere

mid Mesozoic era → it broke and  
drifted apart.

- Northern part- Angaraland/ Lauresia
- Southern part- Gondwanaland.
- In between lies – Tethys sea

# Theory:

- Proposed by **Alfred Wegner** in 1912
- During the Carboniferous period (250 million years ago), there was only one supercontinent (Pangea) and a single ocean (Panthalassa)
- Pangaea consisted of all the present continents merged together.
- This Supercontinent started to split during the Mid Mesozoic period (230-180 million years ago) into Angaraland /Laurasia (North ) and Gondwanaland (South). The water body separating the two was Tethys sea.
- The northern portion i.e. Angaraland consisted of North America, Greenland, and Eurasia without India and Arabia.



225 million years ago



150 million years ago



100 million years ago

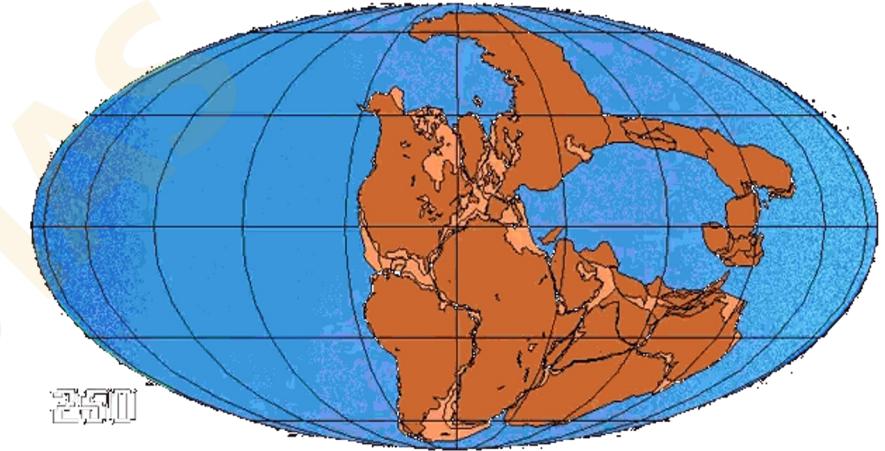


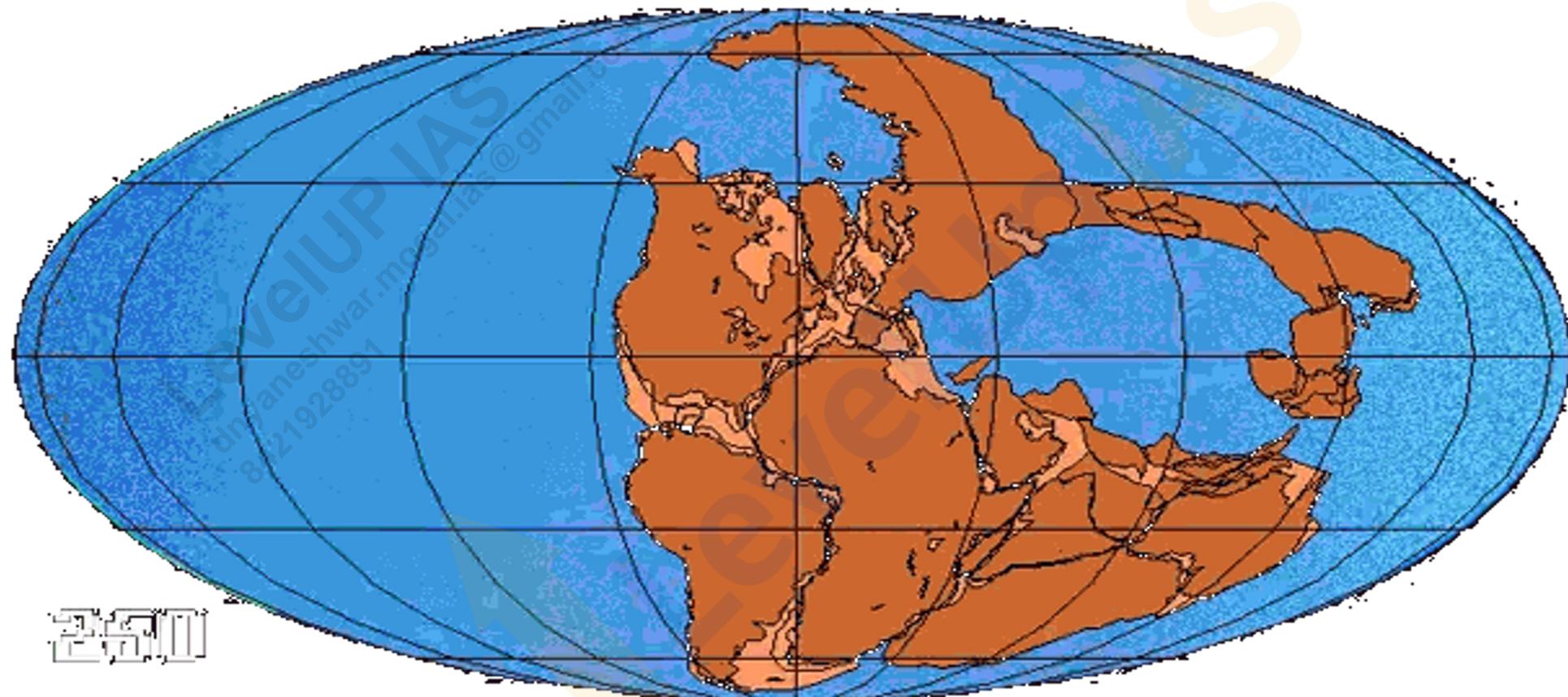
Earth today

© 2007 EB Inc.

# Theory:

- The Gondwanaland consisted of Africa with Arabia, South America, India, Australia, and Antarctica.
- Gradually, there was a separation in North America from Eurasia and South America from Africa as Laurasia started to move towards the West.
- India started moving towards the North, Australia got separated from Antarctica and moved towards North
- Around 20 MYA, Arabia got separated from Africa and merged into Asia
- As continent moved and scrapped the ocean floor, the ocean floor got broken and deformed. This lead to Earthquake, Volcano, Mountain Building.



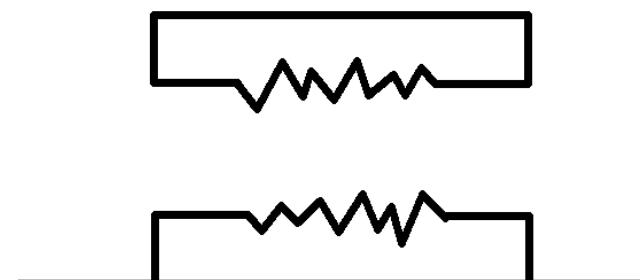
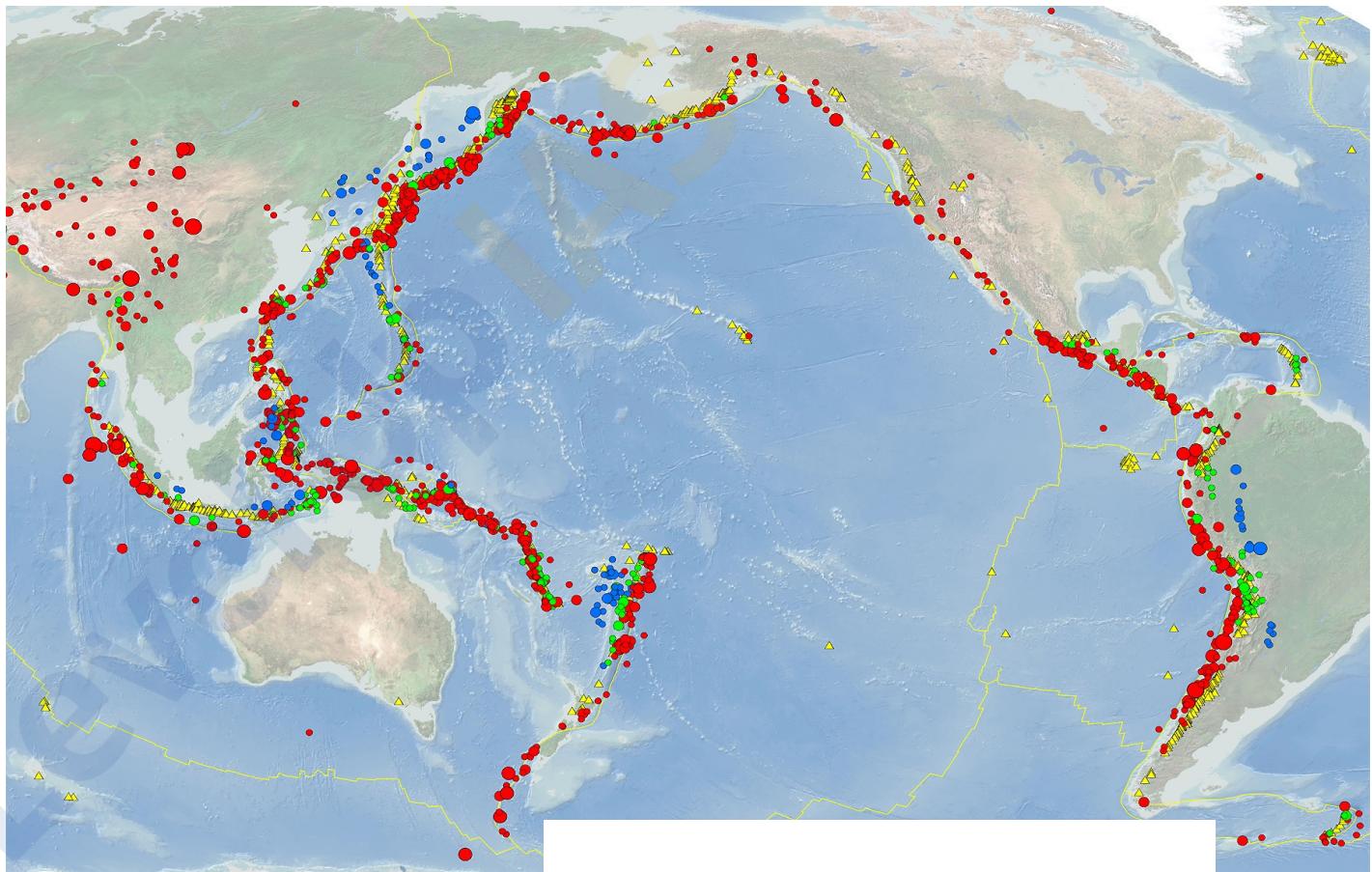


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# Wegener's explanation of Volcanism and Earthquake

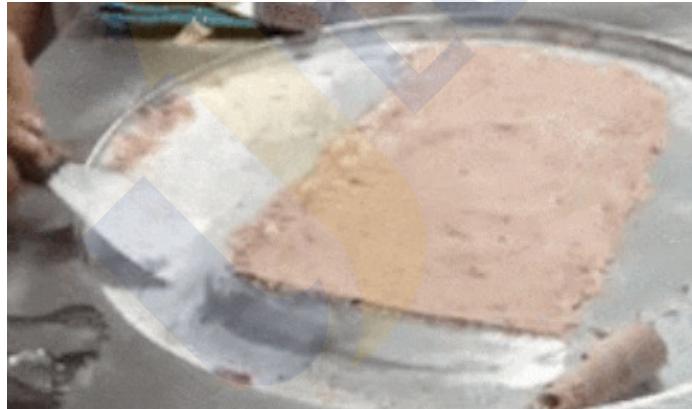
1. As Sial is hard, brittle and light. It floats over SiMa and can get deformed, split and can cut the ocean floor. The rupture on the ocean floor results in volcanism on the ocean floor

2. While scrapping Sial over Sima, there are disturbance leading to Earthquake



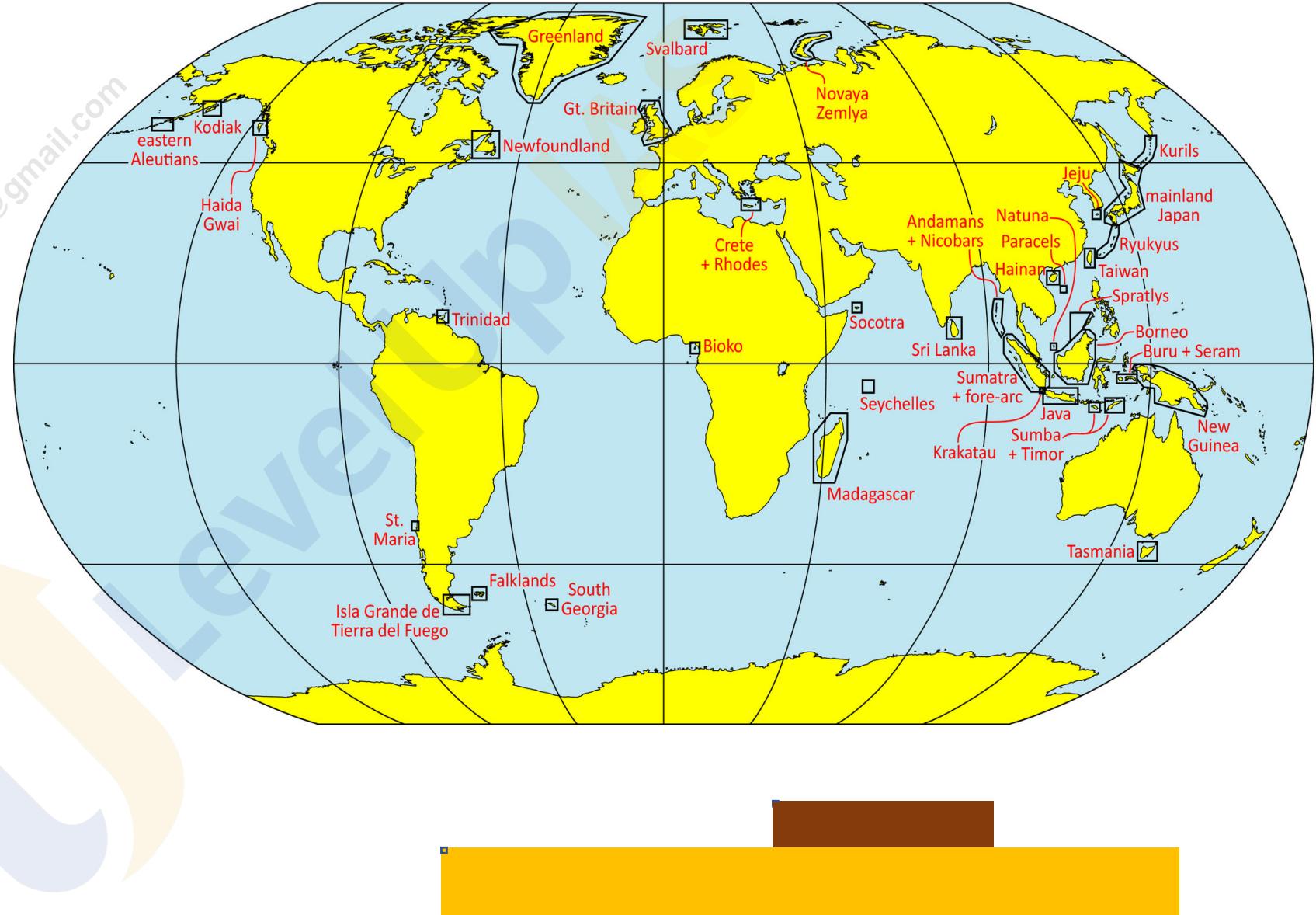
# Wegener's explanation of Fold Mountains

SiAL scraps the ocean floor and accumulates the sediments on the leading edge. The sediments are marine sediments at the pile up and form the fold mountains on the edge of the continents.



# Wegener's explanation of Islands

- As SiAL floats over the SiMA.
- SiAL are subjected to tremendous drag and friction the trailing edge break off to form the islands.
- Trailing Edge is unable to keep pace with the leading edge and hence breaks off.
- Wegner used this to justify the continents moving north and westward with an evidence at all the major continents having islands are at the South East corner.



## Evidences

Jigsaw fit

Structural fit/rock similarity

Fossil evidence

Paleo climatic evidence.

# Evidence:

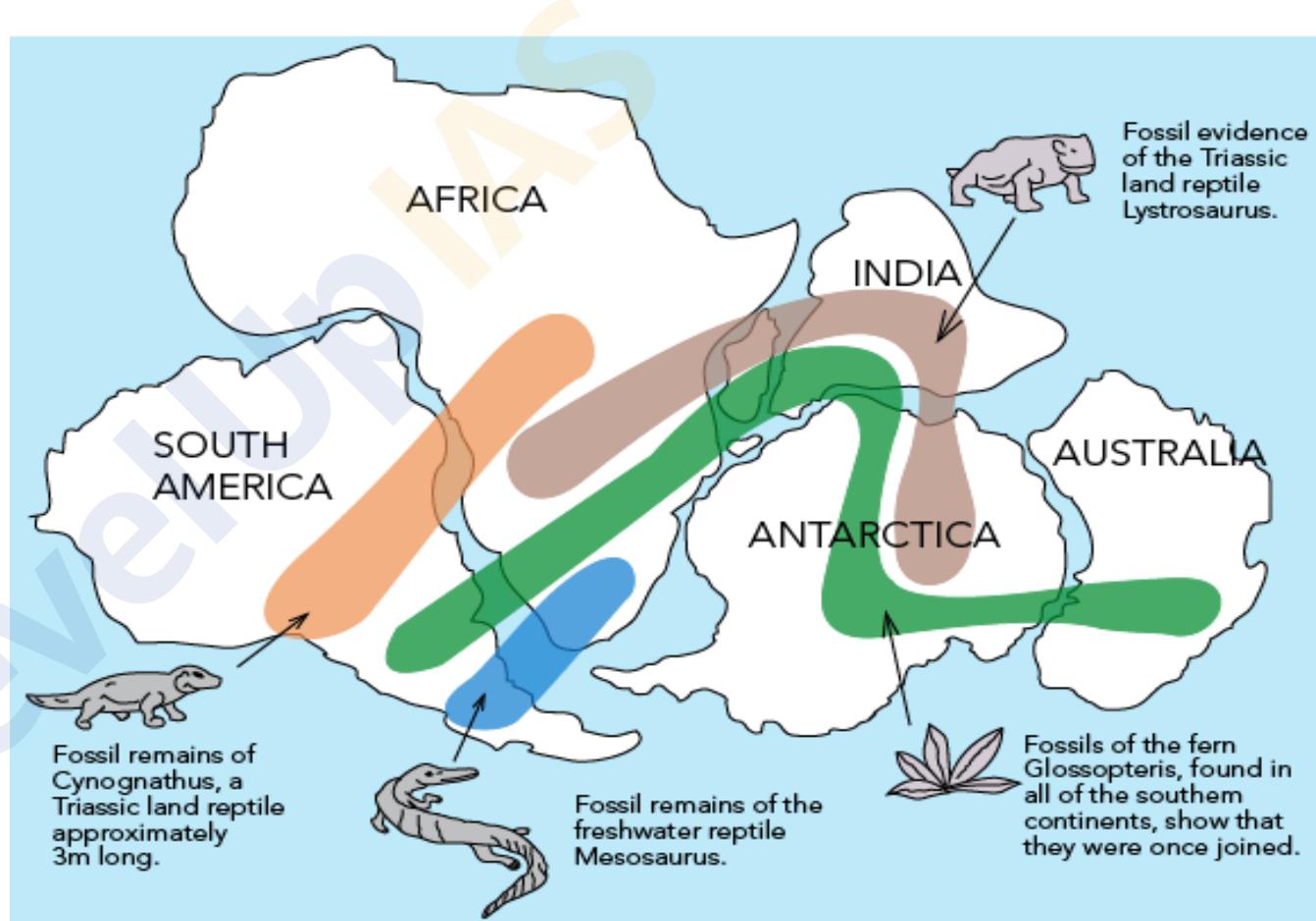
- 1. Jig Saw Fit:** Fitting shape of the coastline of the continents like the eastern side of the South America coast fits into the western Africa
- 2. Stratigraphic Evidence:** not only the shape match the rock type and the rock age also matches on the either side of the Atlantic Ocean
- 3. Structural Evidence:** Eastern Brazilian Highlands and the Borborema plateau seems to extend into the gulf of Guinea and the Loma mountains. Gold seams of Ghana has a match with those of the Brazil. Patagonian plateau has a structural similarities with Angola highland. Guyana highland seems to fit into Fouta Djallon and Loma mountains.



# Evidence:

## 4. Fossil Evidence:

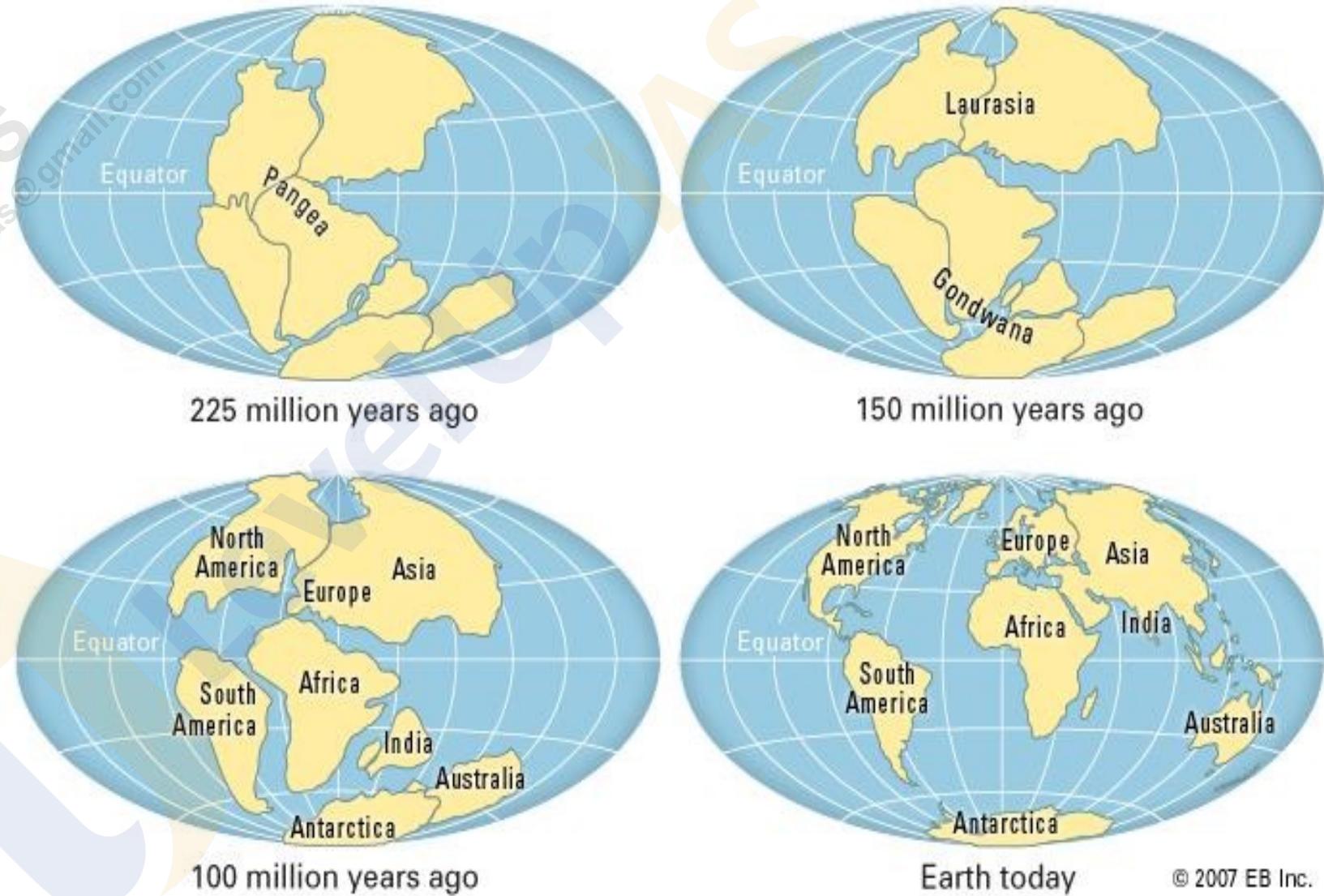
- **Mesasaurus**, an aquatic reptile whose fossil remains are found only in eastern South America and South Africa. Had it been able to swim across the vast Ocean, it should have been widely distributed.
- **The fossils of Glossopteris**, a fern grown only in supolar climate are now found in warm climatic regions separated by wide Oceans.
- **Fossil of Lystrosaurus**
- **Fossil of Cynognathus**



# Evidence:

- Fossil Evidence:  
Wegner's Explanation:

Wegener concluded that the continents must have been together and lifeform must have evolved at some location with continental breaking and the continental drift. Lifeform and their fossil remains must have got distributed in the typical distribution.



# Evidence: Paleo Climatic Evidence

## Distribution of Coal:

Richest coalfield of the world: Appalachian, Newfoundland, Pennines. The northern cool dry climate and not the dense forest of today have richest coal fields.

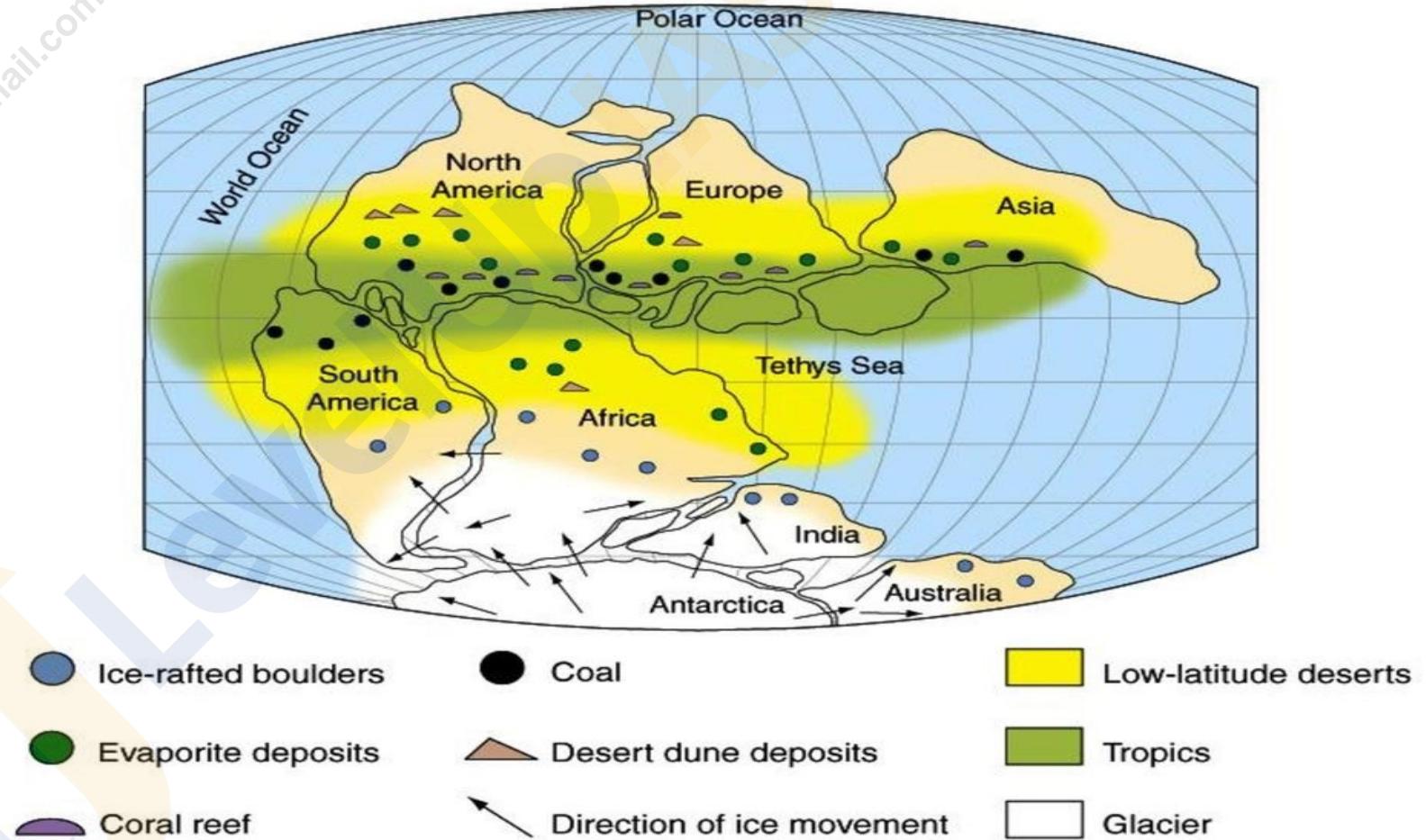
While African and South America almost no coal fields despite dense Equatorial forest there is no coal, India's coal is also of poor quality.



# Evidence: Paleoclimatic Evidence

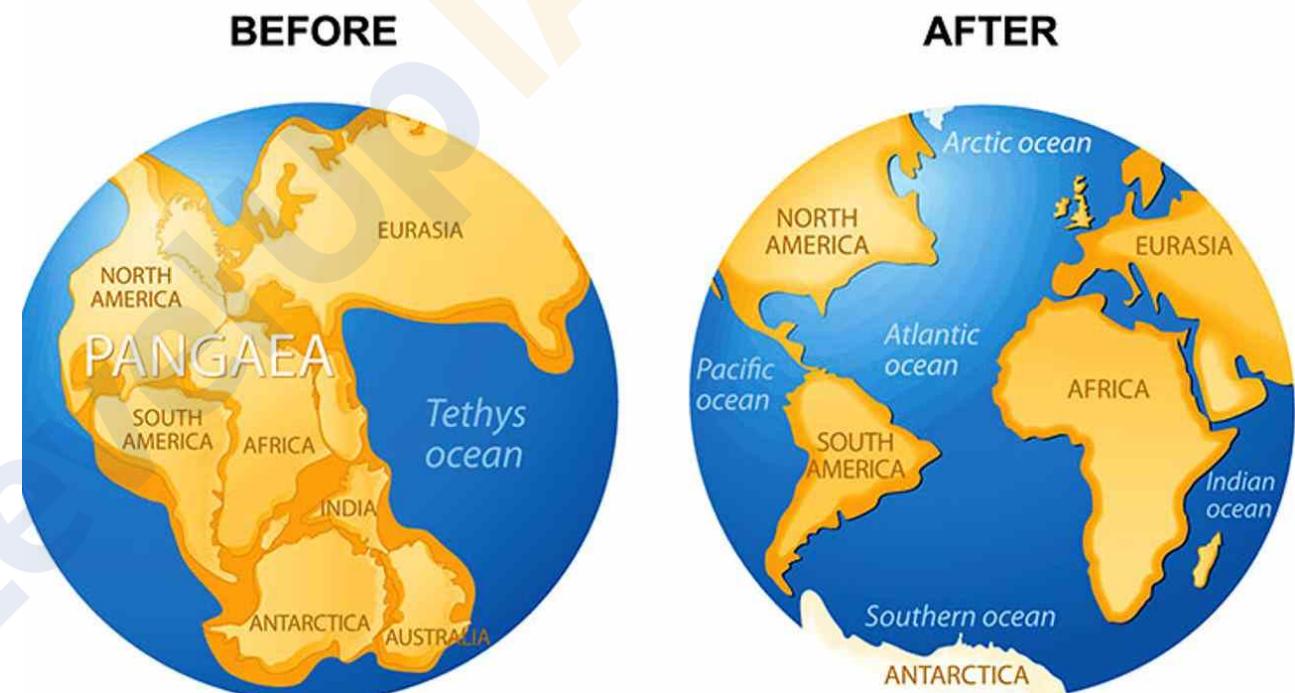
## Glacial Till:

The similarity in the glacier and the Permafrost evidence of the glacial till and the Moraines of South America Africa and Antarctica. Parts of southern and the central India also have glacial erosion evidences and are of same age deposits of the South America and Durban. This seems to be climatic anomaly as India is in the tropical latitude.



# Paleo Evidence are climatic Anomaly

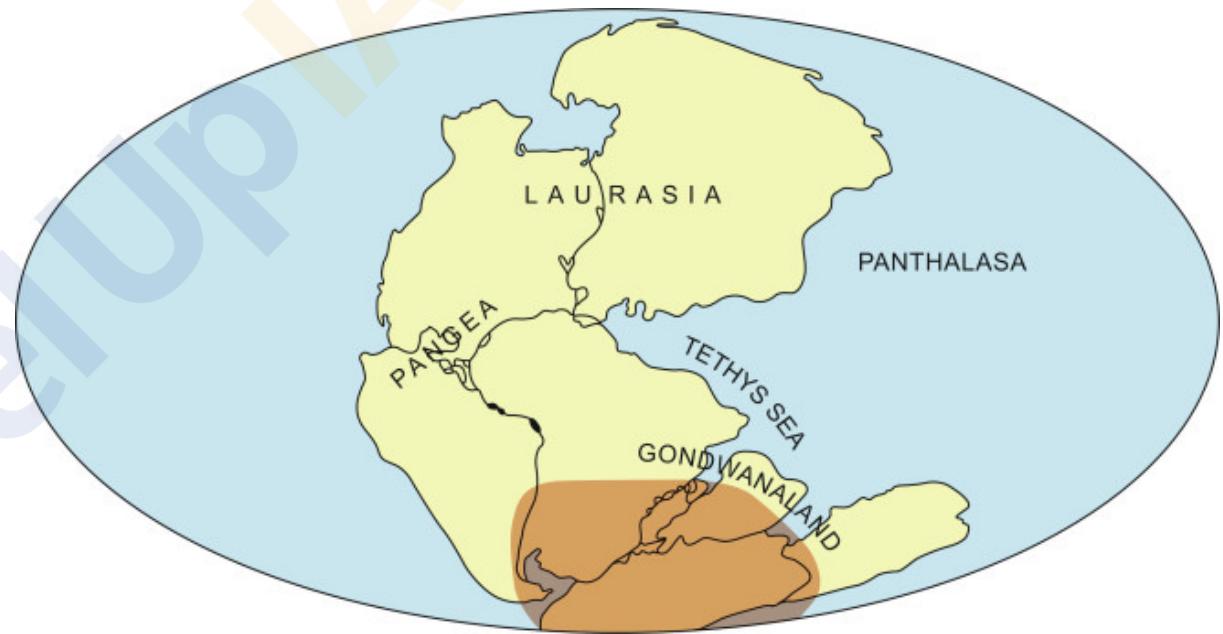
1. The northern temperate latitudes have coalfields indicating warm conditions unlike what they have today
2. The southern tropical latitudes have evidence of glaciations in Patagonia Durban and India. This is another climatic anomaly.



# Evidence:

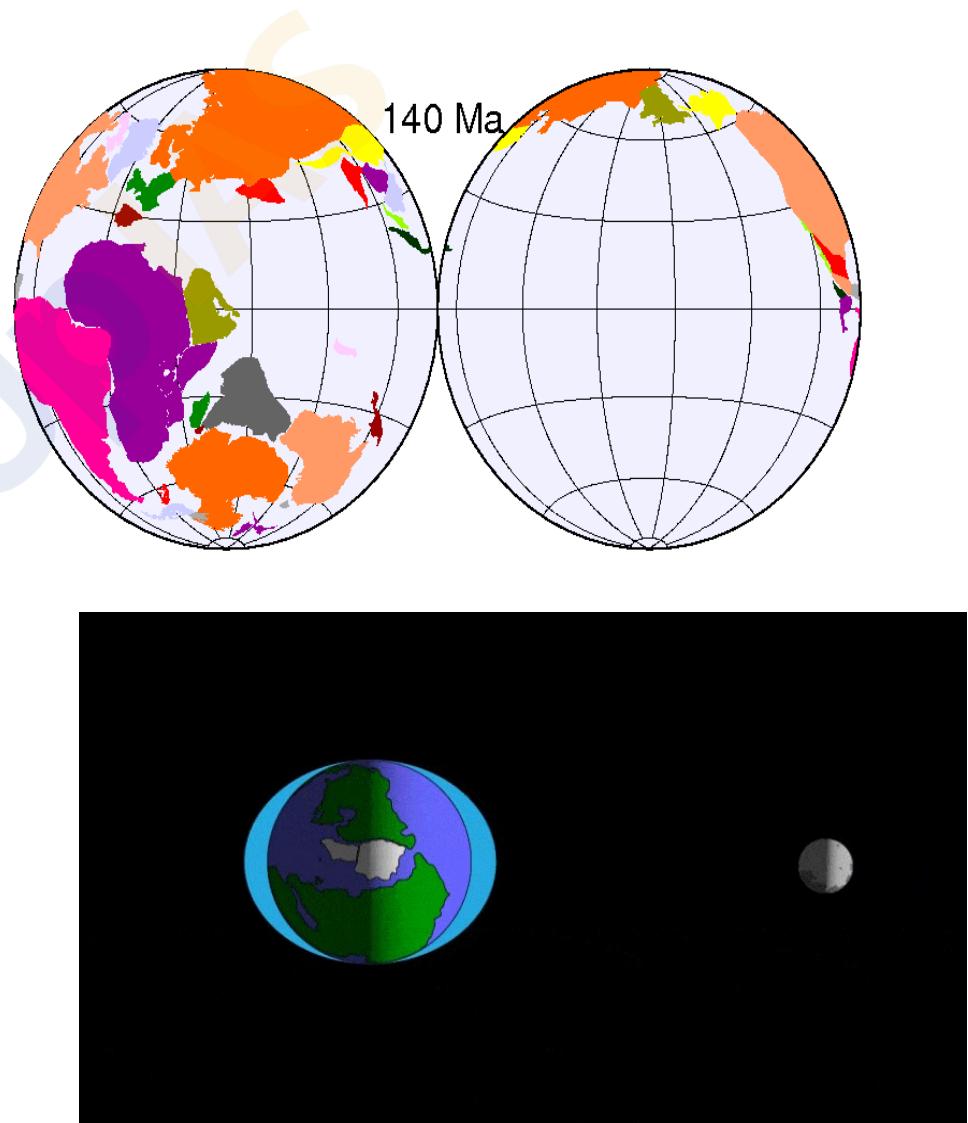
## Paleo Climatic Evidence: Wegner's Explanation:

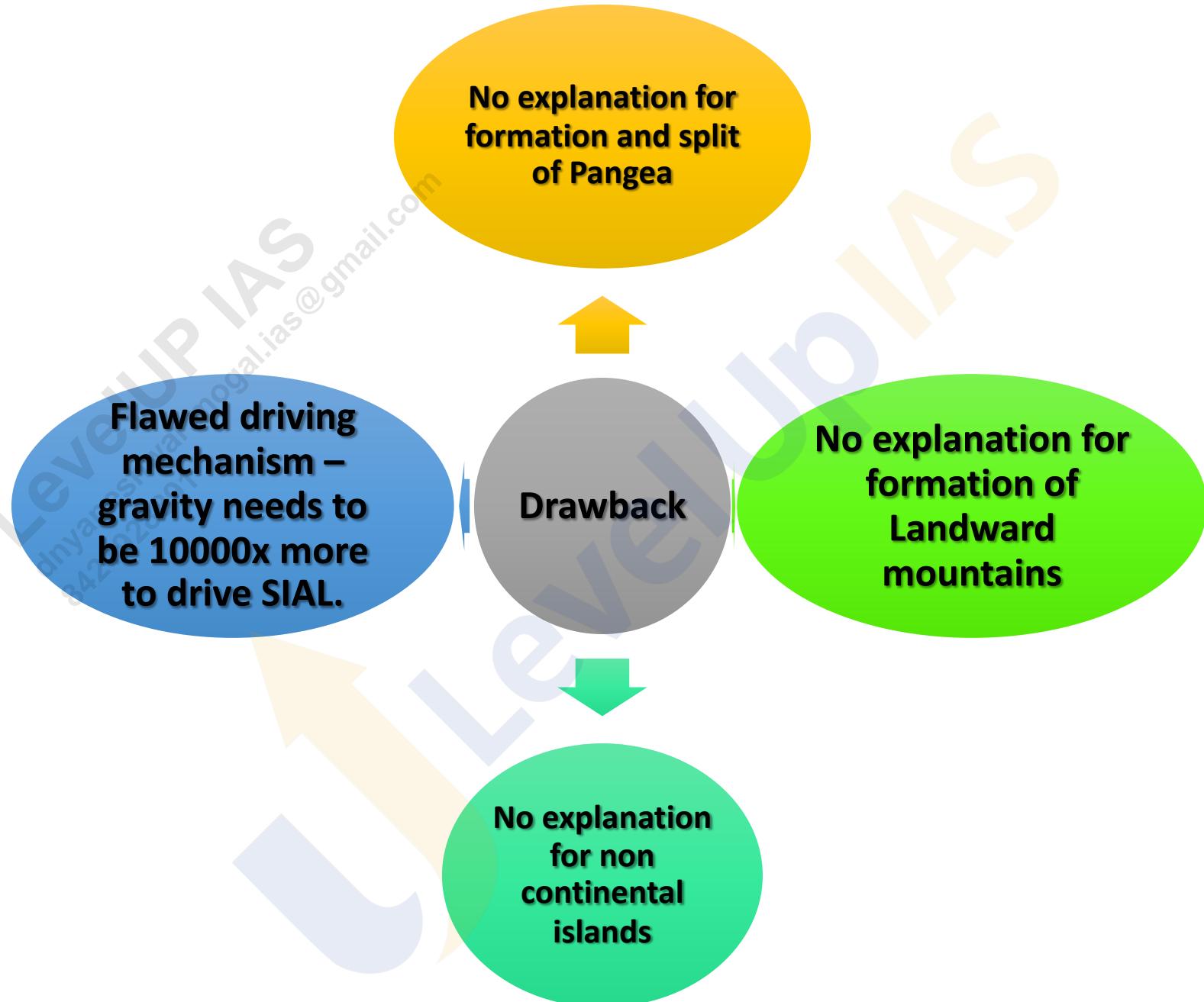
- Wegner explained that the continent is a part of Pangea was once together and located in the southern hemisphere.
- So the northern temperate locations were once in the southern latitude with warm wet conditions that forms the coal fields and
- The tropical locations of today were more close to the South poles and therefore have glacial evidences.
- Paleo-Climatic evidence are one of the most convincing evidence for the continents to have drifted



# Forces:

- The forces suggested by Alfred Wegner as the cause of continental motion-
- Equatorward or North-South movement caused by the Pole-fleeing force due to Gravitational differential force and the force of Buoyancy to adjust the center of gravity and the center of Buoyancy.
- The westward movement caused by the tidal forces of the Sun and Moon.





# Criticisms:

- Has used incorrect conceptualisation of Earth's Interior. Continents do not float over Ocean. Reality is Lithospheric plates float over asthenosphere
- No explanation on what created Pangaea. The theory did not describe the situations of pre-carboniferous times.
- No explanation why panagaea broke.
- Forces suggested are inadequate.
- In reality, island are not found in South East Section alone. All the island are not continental island.
- No explanation for landward mountains



# Contribution

1. Logically deduced theory
2. Bold departures from the then existing idea that the continents and the oceans are permanent and static
3. Bold alternative to how fold mountains are formed that are uplifted marine sediments.
4. One of the pioneer to challenge permanency of the Continents and Oceans
5. Idea was correct even though the evidence and driving mechanism was incorrect. Idea was revived by Plate Tectonic Theory

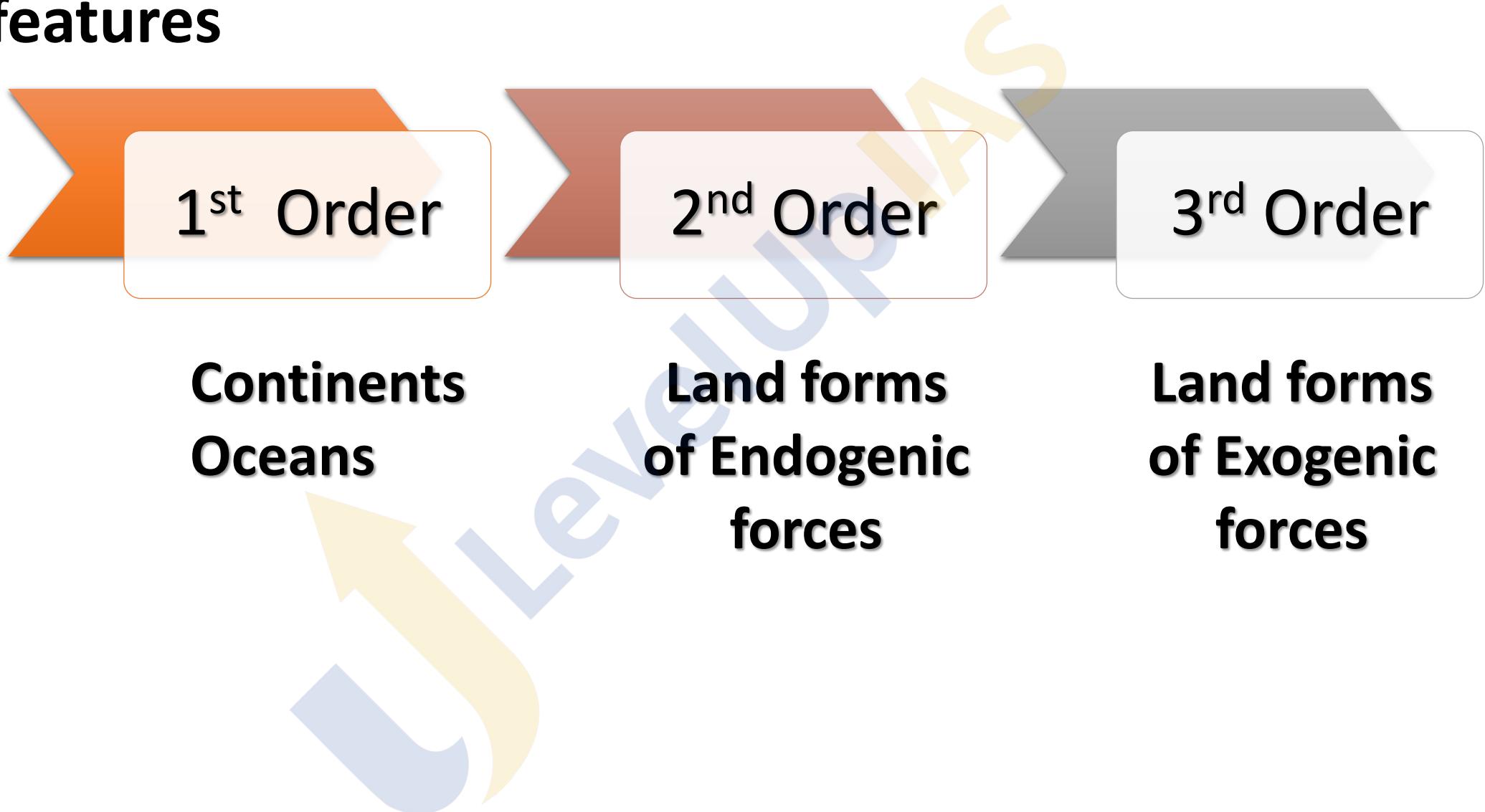




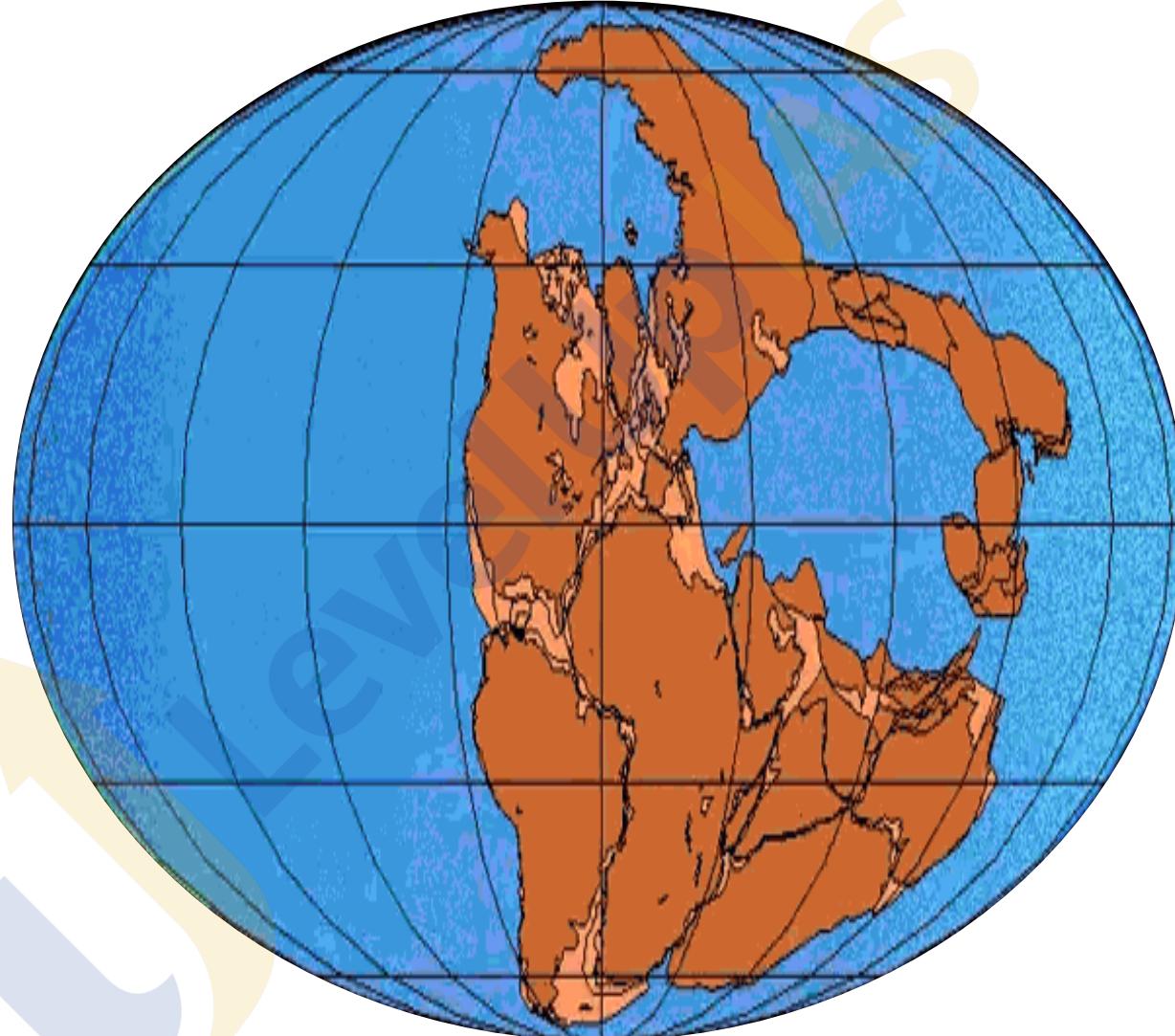
# Landforms

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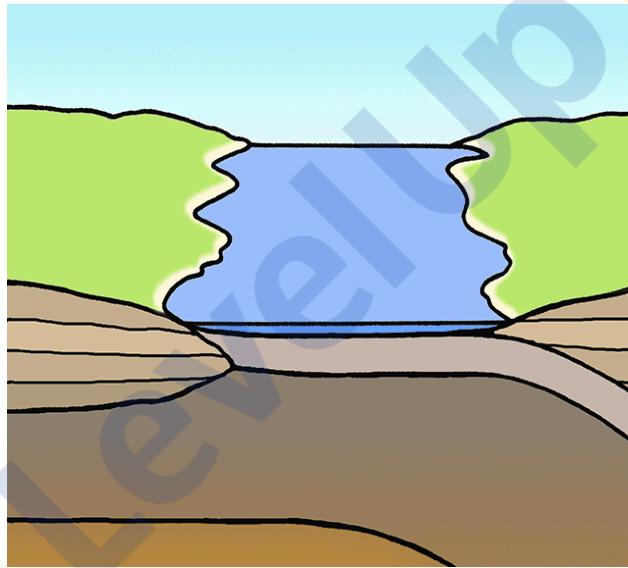
# Landforms on the basis of relief features



1<sup>st</sup> Order



## 2<sup>nd</sup> Order



## 3<sup>rd</sup> Order



# Geomorphic Process

- 

**Geomorphic process**

**Endogenic**

**Exogenic**

Diastrophic

Volcanism

Weathering

Mass  
movement

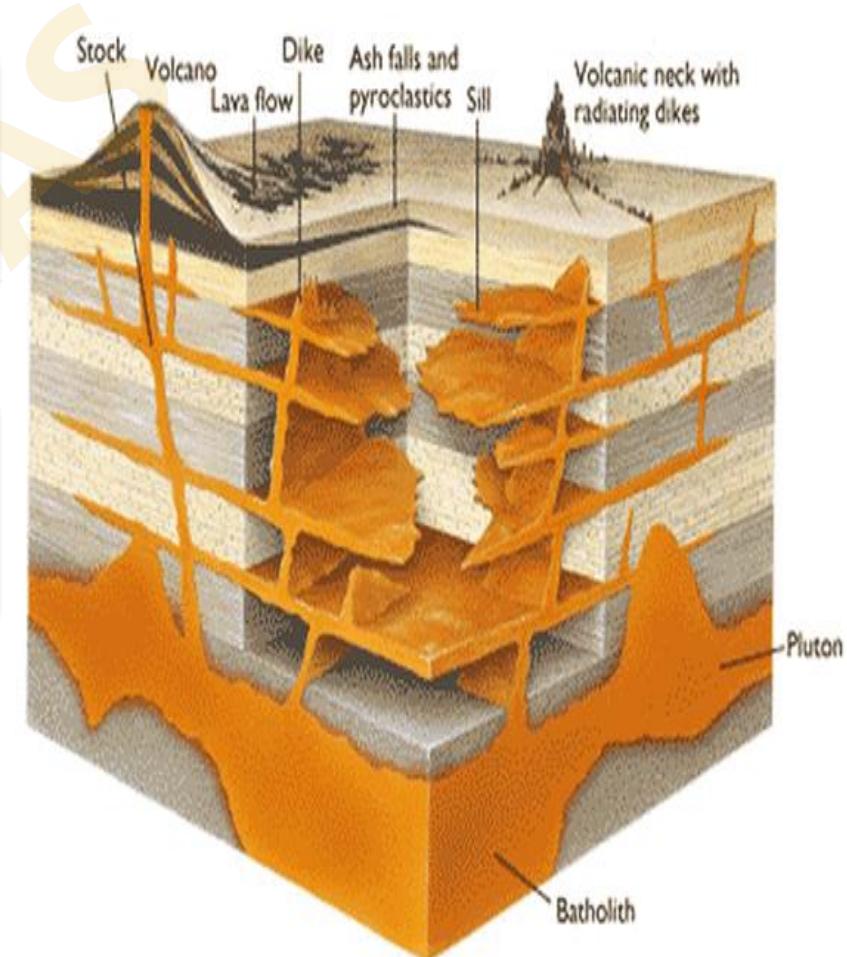
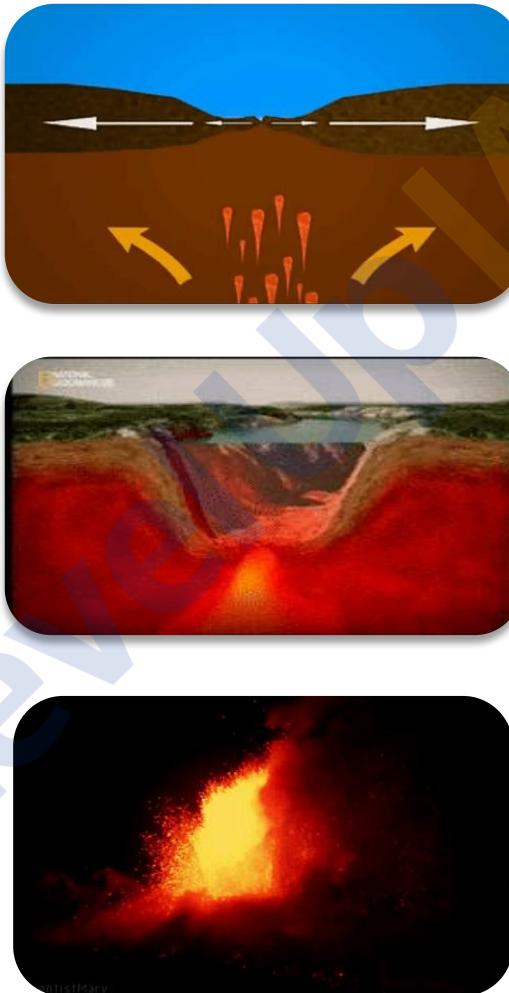
Erosion  
/deposition

# Endogenic

## Diastrophic processes

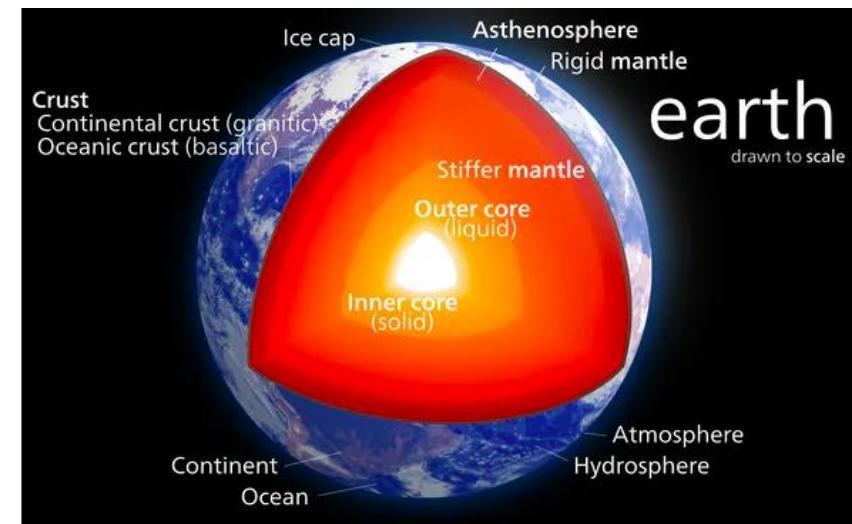
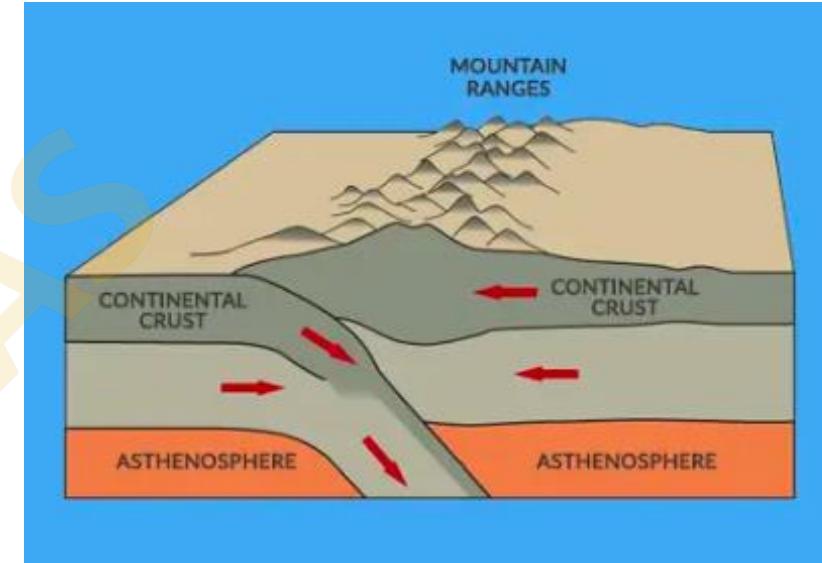


## Volcanic processes



# Endogenic Forces

- Earth's crust is dynamic and is influenced by Internal forces and External Forces.
- Internal forces that build up the crust are also known as Endogenic forces.
- Endogenic forces continuously elevate or build up parts of the earth surfaces.
- Endogenic forces are called as land building forces.
- For endogenic processes, energy emanates from within the Earth's Interior.
- Energy is mostly generated by radioactivity, primordial heat from the origin of the earth.
- Diastrophism processes elevate or build up the portion of earth crust.
- Diastrophism process include **orogenic forces (mountain building)** and **epeirogenic forces (upliftment of the large portion of earth's crust)**, **Earthquake**, **Plate Tectonics** involving horizontal movement of plates



# Exogenic Forces

- External forces induced by sunlight are also known as Exogenic Forces.
- Exogenic forces even out the relief variation on the surface of earth.
- Exogenic forces are called land wearing forces
- Any exogenic element of nature like water, ice, wind, capable of acquiring and transporting of earth material is called geomorphic agent. Elements of nature become active due to gradient, they remove the material from slope and transport them over slope and deposit them at lower level.
- They derive their energy from sun and gradient
- All the exogenic geomorphic process is covered under general term: Denudation. (Denude means to uncover)



# Denudation Processes

**Weathering:** Very Little or no motion of material takes place in weathering. It is an *in situ*/ on site process

**Mass movement**

**Erosion/  
deposition**

**Gravitation**

**Molecular  
stress**

**Chemical  
Alteration**

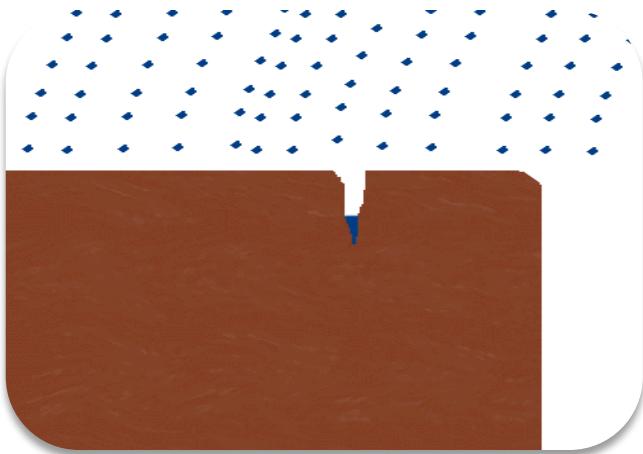
**Gravitational  
Force**

**Kinetic  
energy**

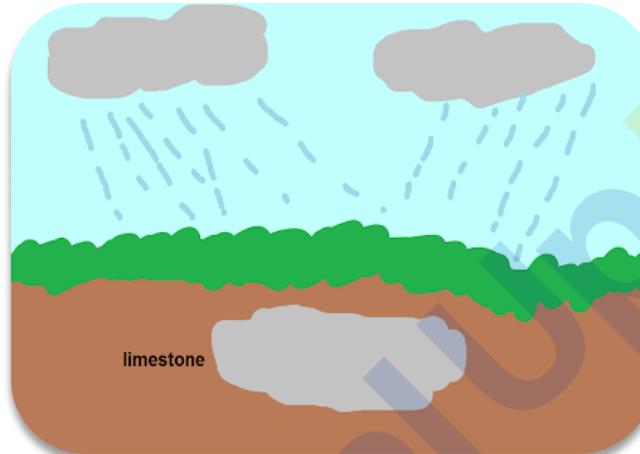
Gravitation force acting on slope pushes the material downslope

# Weathering

Weathering is mechanical disintegration and chemical decomposition of rocks due to varied action of weather and climate over earth material



**Physical**



**Chemical**

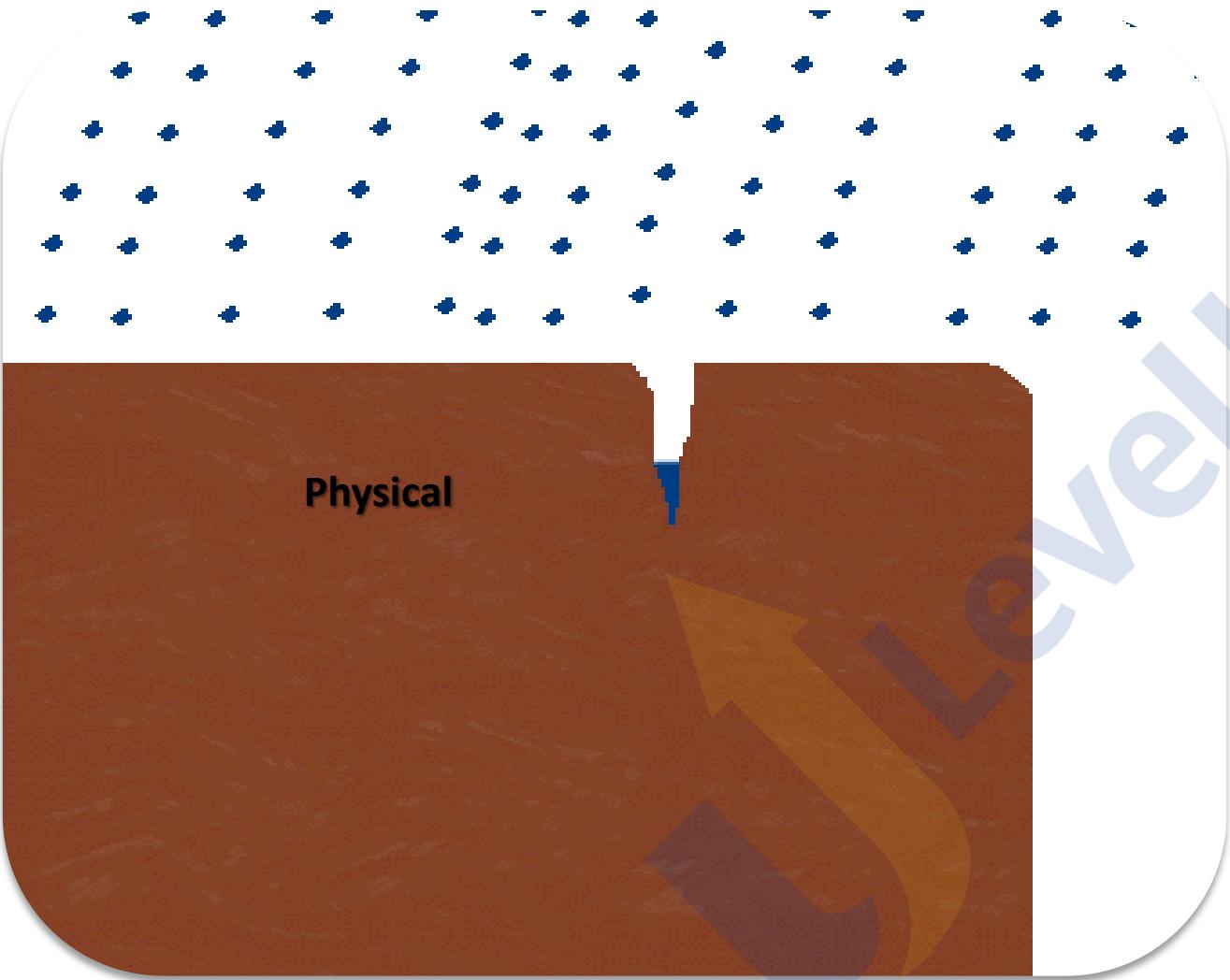


**Biological**



**Onion peeling/ Exfoliation**

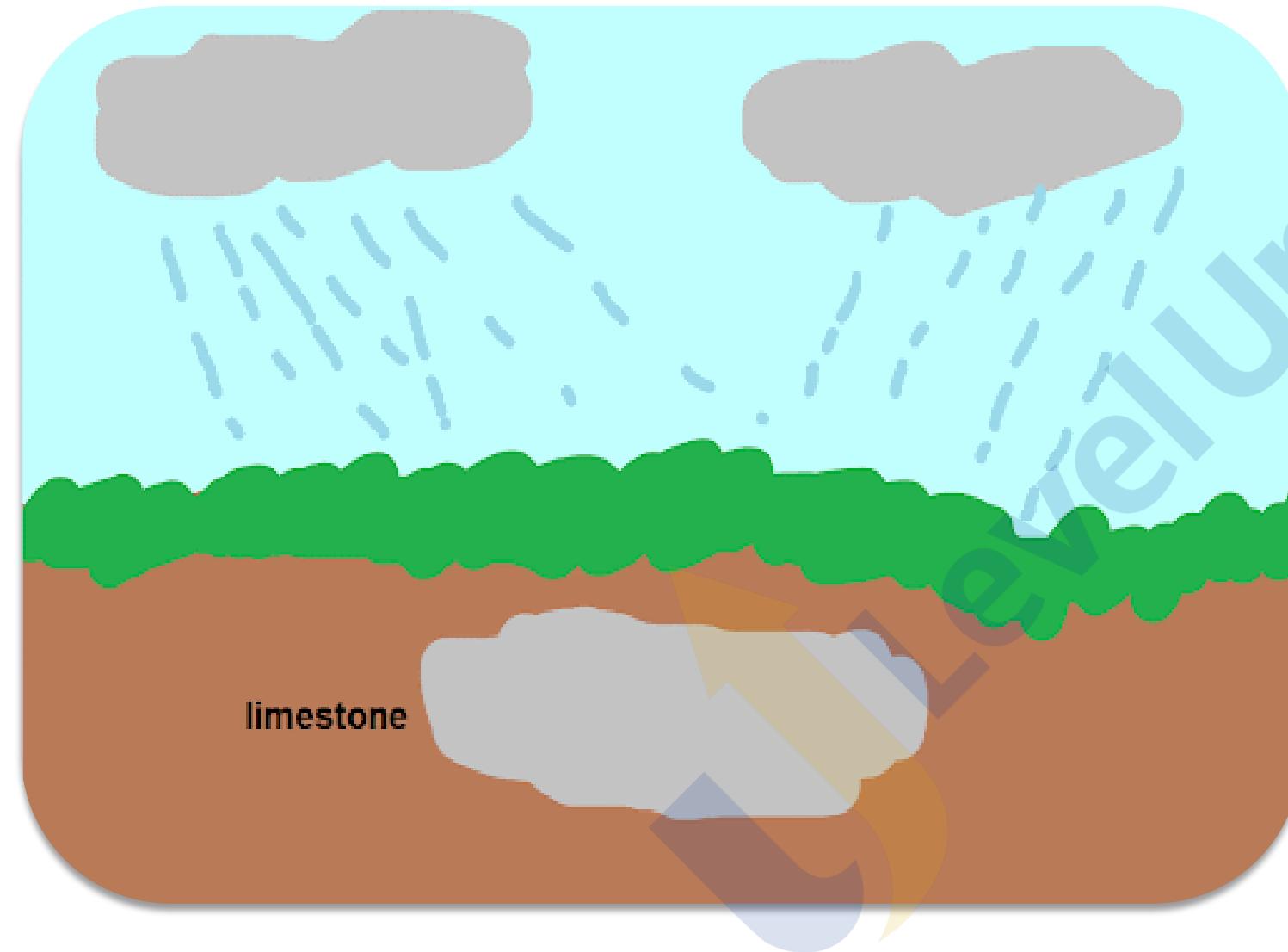
# Physical Weathering



Physical weathering process involves

1. Expansion forces due to temperature change
2. Water pressure controlled by alternative wetting and drying cycles
3. Overburden pressure or load

# Chemical Weathering



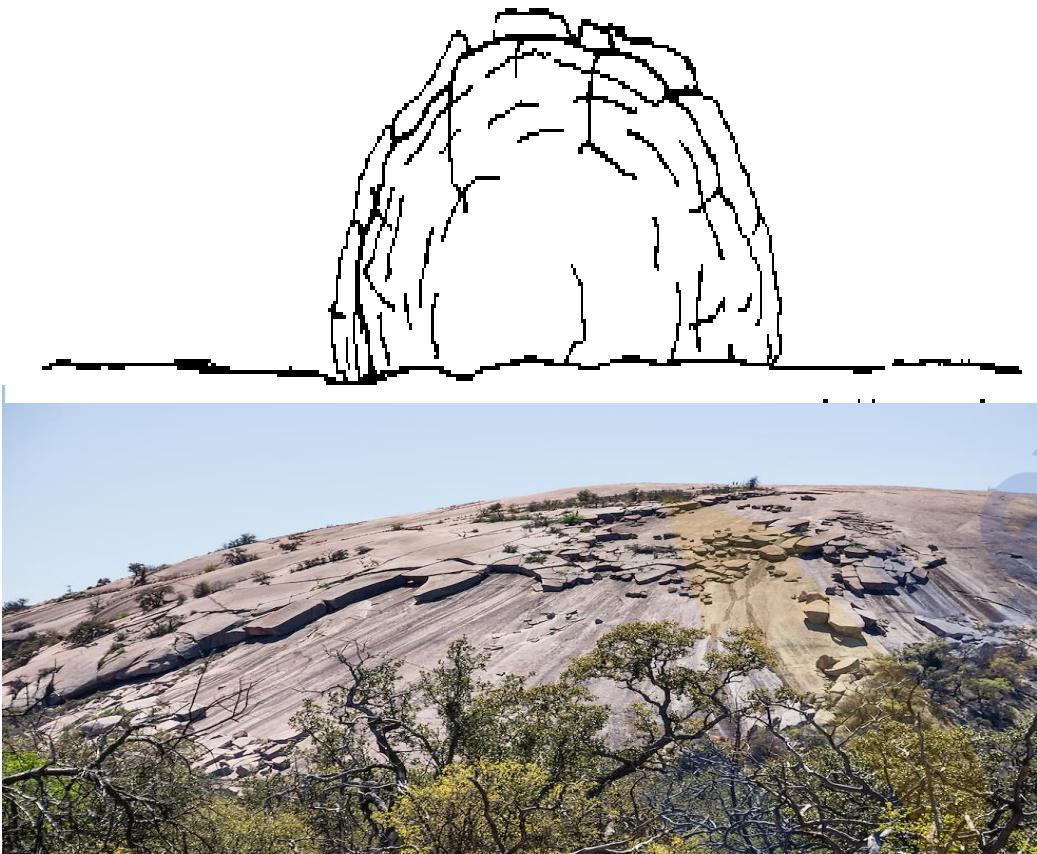
Chemical weathering processes include solution, carbonation, hydration and oxidation and reduction act on rock to decompose the rock

# Biological Weathering



1. Removal of material due to growth of organisms
2. Burrowing of material by earthworm, termites, rodents
3. Plants roots break the earth mechanically

# Special Landform: Exfoliation and Onion Peeling

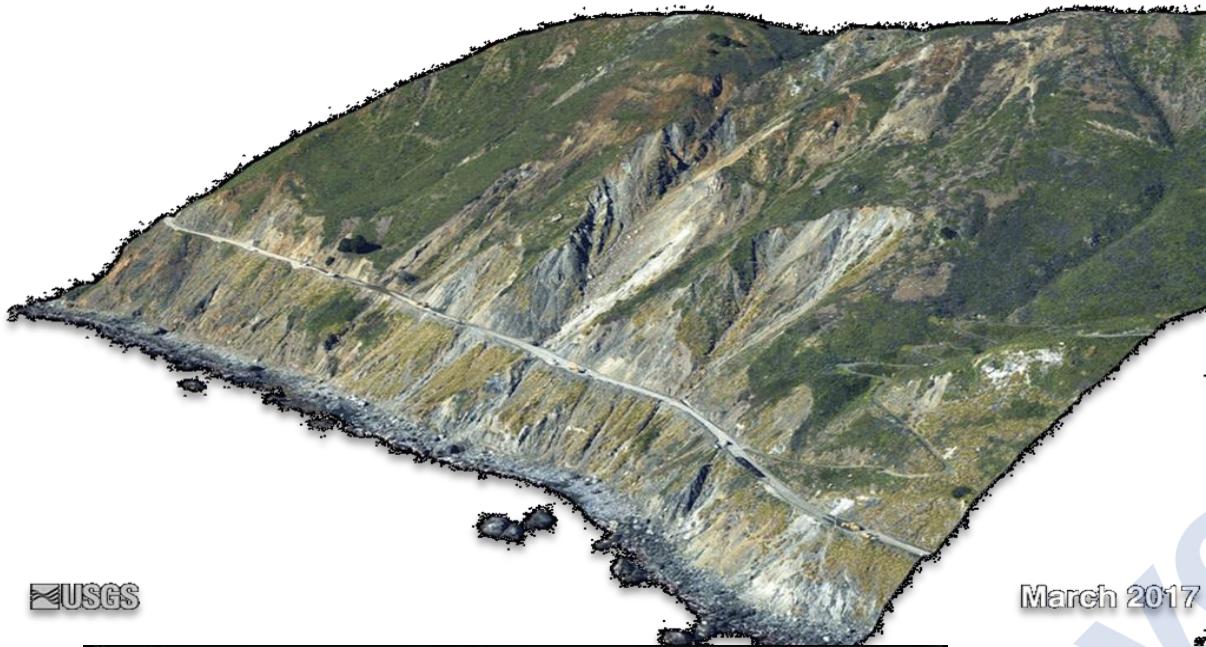


# Mass Movement

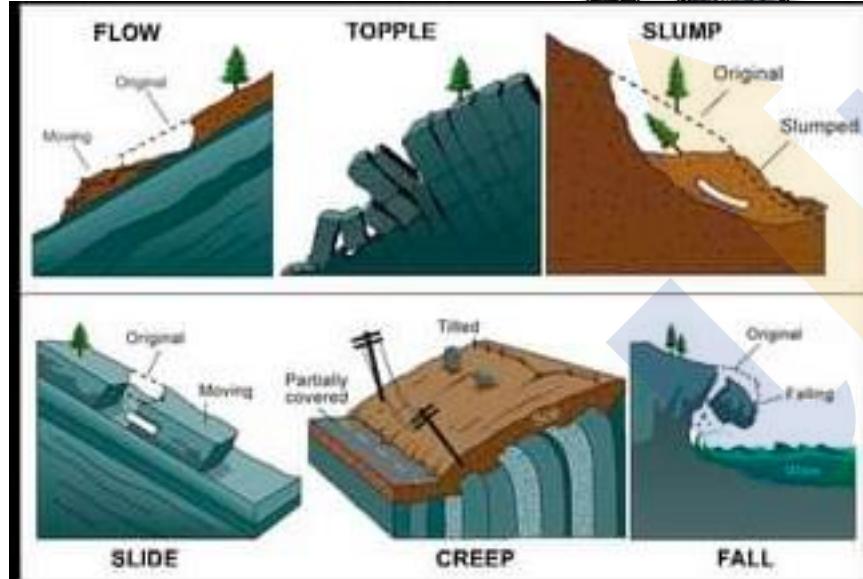


- Mass movement transfers the mass of rock debris down the slope under the direct influence of gravity.
- It ranges from slow to rapid movement affecting shallow to deep columns
- It includes creep, flow, slide.
- Weathering is not a prerequisite for mass movement.
- No geomorphic agent like running water, glaciers, wind, waves participate in the process of mass movement
- Mass movement do not come under erosion

# Mass Movement



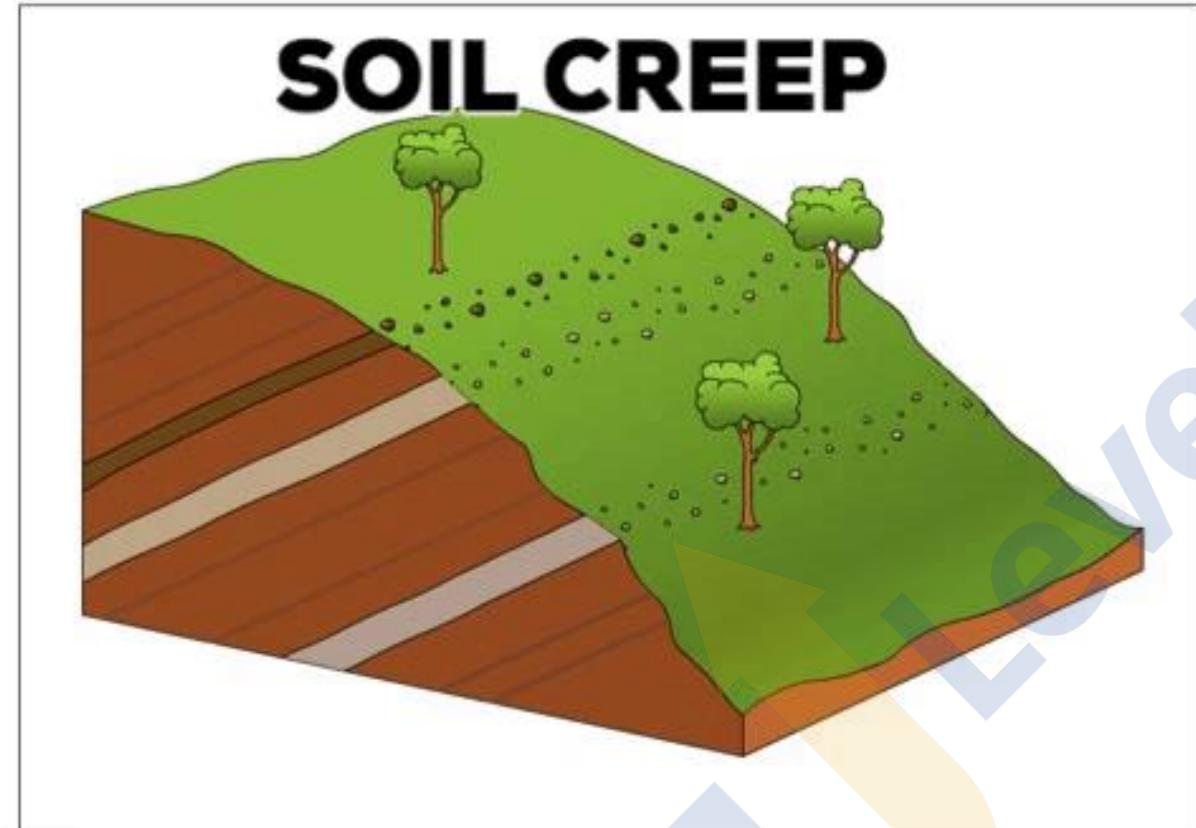
March 2017



- Landslide is relatively rapid and perceptible movement
- Slumping is slipping of one of the several units of rock debris with a backward rotation motion with respect to slope



# SOIL CREEP



- It occurs on moderately steep, soil-covered slopes (and does not require water lubrication unlike solifluction).
- Except by prolonged observation, the movement is exceedingly slow and unnoticeable.
- Eg: Electric posts in sloppy regions have drifted from their horizontal linearity. This is called a **creep effect**.

# Rapid Movements

- **Earthflow:** Earthflow refers to the movement of water-saturated clayey or silty earth elements down low-angle terraces or hillsides.
- **Mudflow:** A mudflow occurs when thick layers of weathered materials become saturated with water and flow down along definite pathways in the absence of vegetation and cover, and when significant rainfall occurs.
- **Debris avalanche:** It occurs more frequently in humid areas with or without vegetation. It is similar to a snow avalanche and happens in narrow pathways on steep mountains.



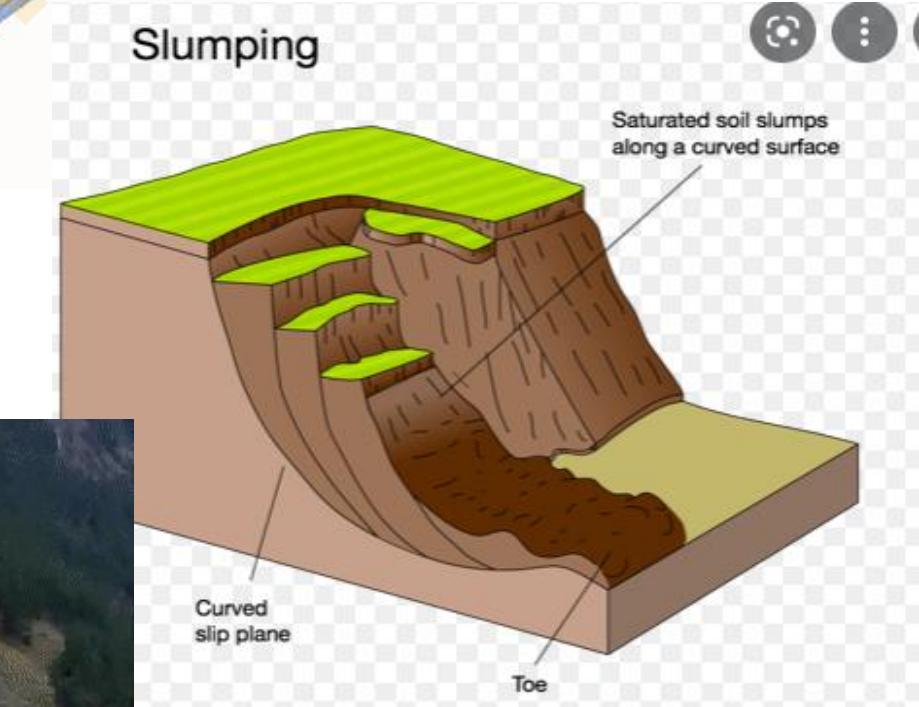
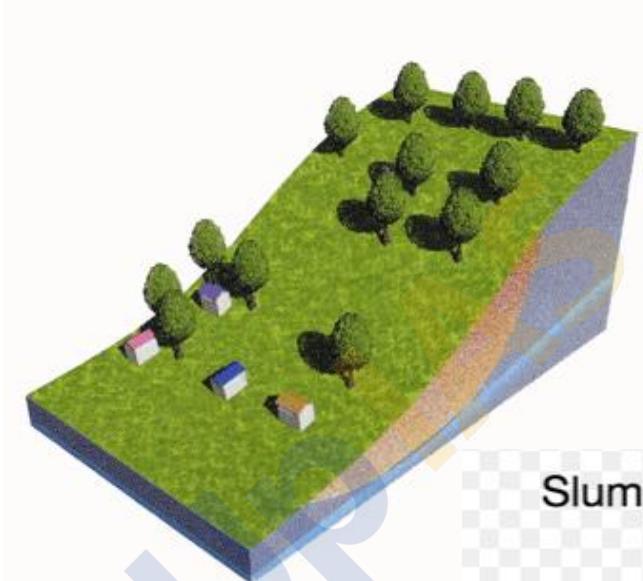
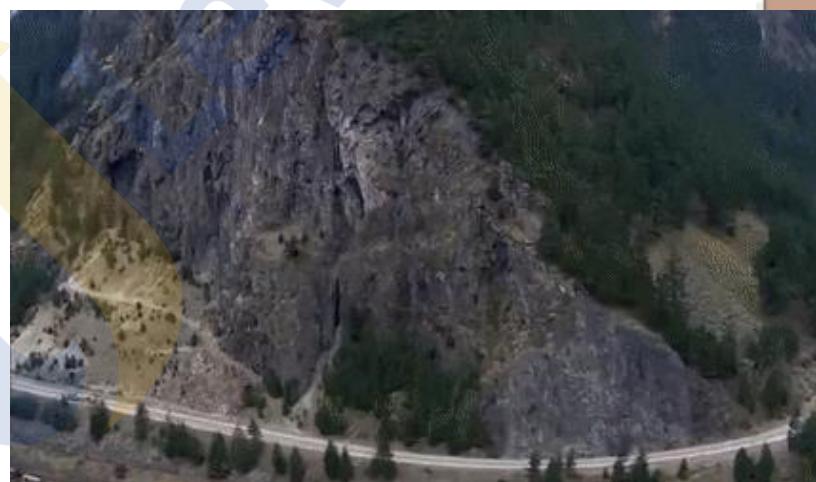
# Solifluction

- It's the gradual downslope movement of water-saturated or lubricated soil mass or fine-grained rock debris.
- It's a kind of creep in which the movement is influenced by lubricated water.
- Because groundwater strata are occupied in between permanently frozen soil and rocks in permafrost zones, it primarily occurs there.

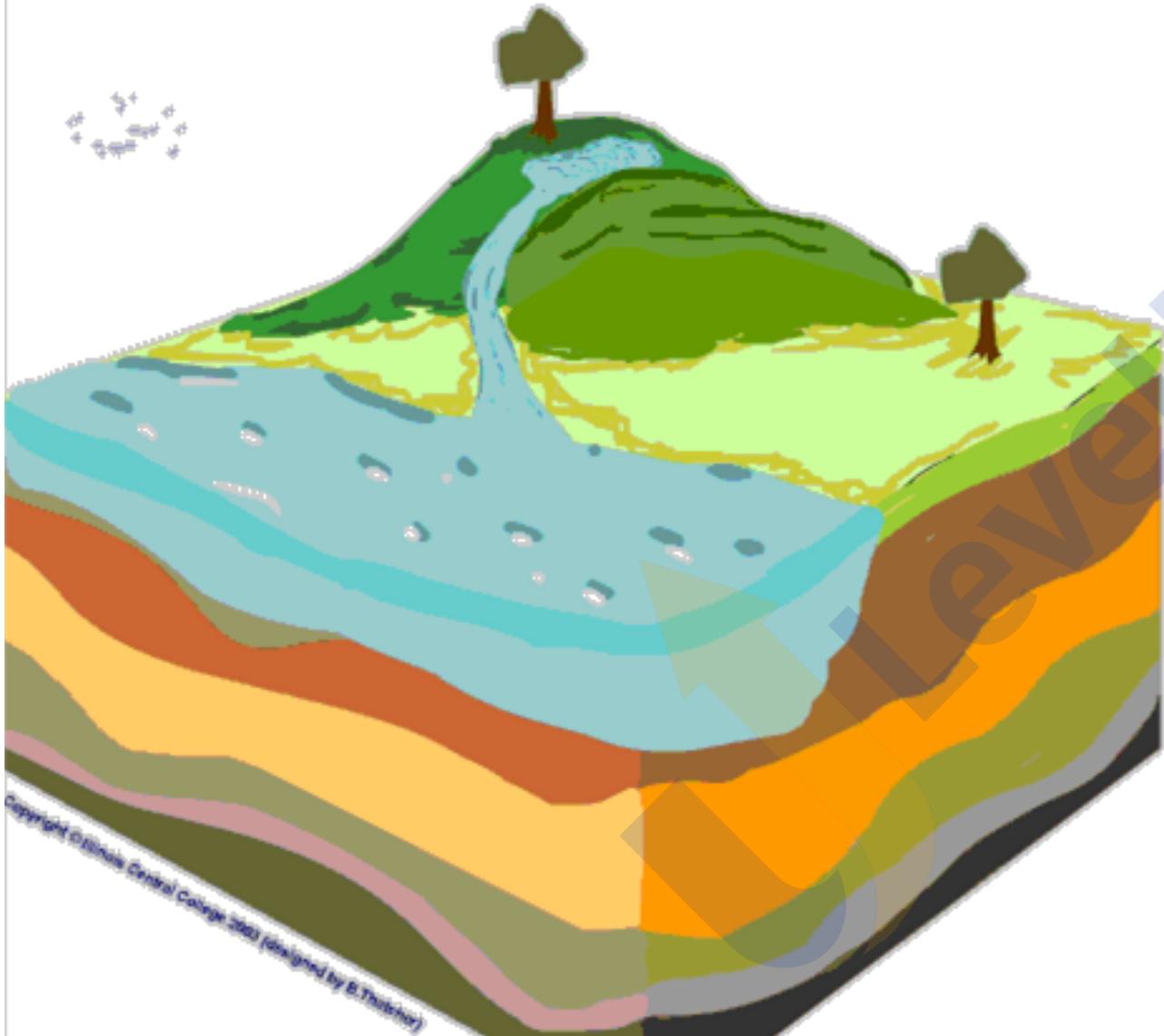


# Landslide

- Landslide is relatively rapid and perceptible movement
- In landslide, the materials involved in landslides are rather dry.
- **Slumps, debris slides, rockslides** are the forms of landslides
- **Slump:** A form of landslide in which many units of rock debris slide backward in relation to the slope over which the movement occurs.
- **Debris slide:** There is no backward rotation in this sort of landslide. The drop is nearly vertical.
- **Rockslide:** refers to the movement of individual rock masses.

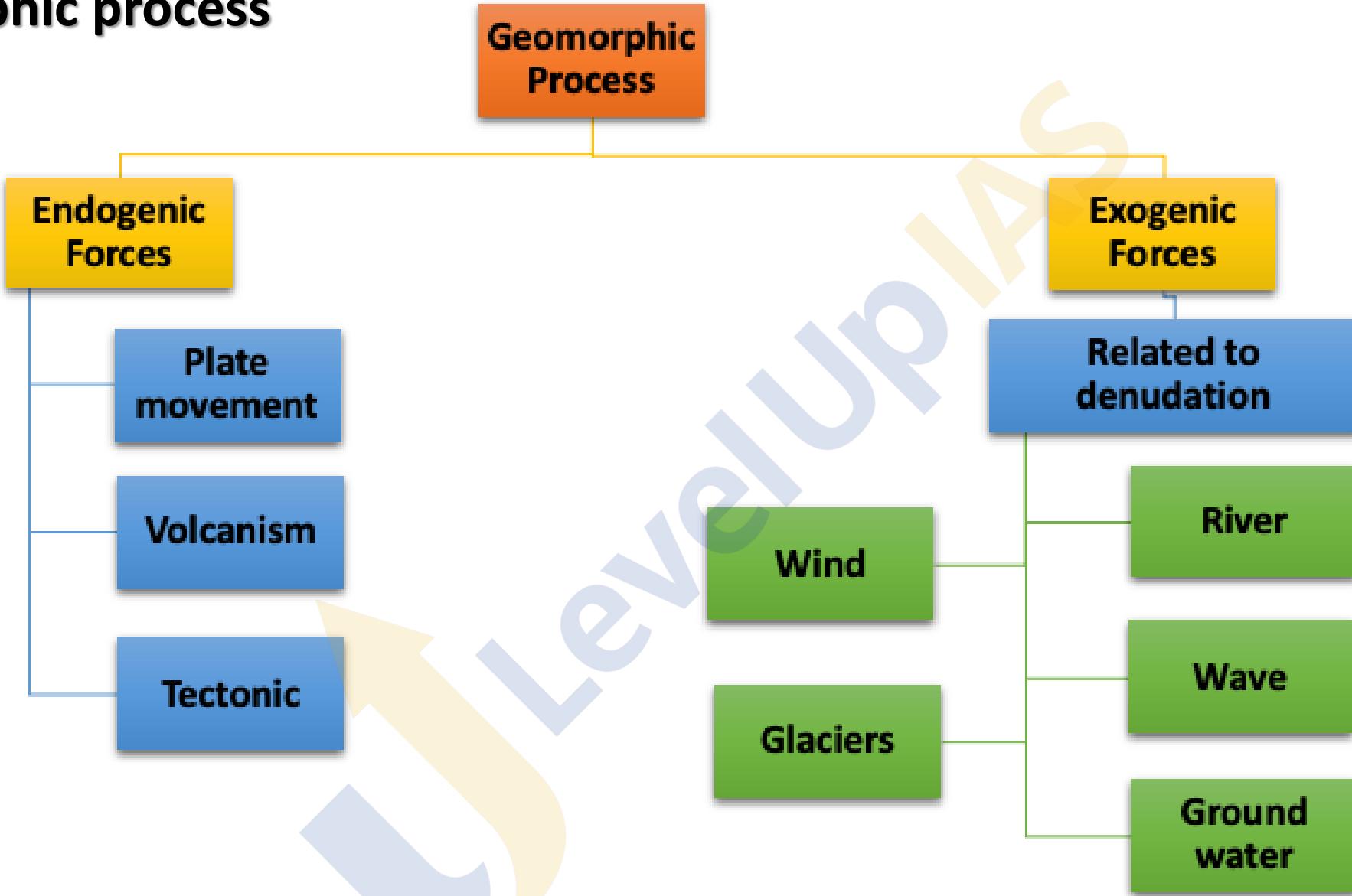


# Erosion/ deposition



- Erosion is the process of rock debris being collected and transported by geomorphic processes such as running water, wind, and waves.
- Weathering enhances erosion, although it is not a requirement for erosion to occur. (i.e erosion can occur in both weathered and unweathered environments).
- Deposition occurs as a result of erosion.
- On moderate slopes, erosional agents lose their velocity and energy, and the materials they carry begin to settle.
- No agents are involved in the deposition process. It's simply the effect of erosion.

# Geomorphic process



2013

Consider the following:

1. Electromagnetic radiation
2. Geothermal energy
3. Gravitational force
4. Plate movements
5. Rotation of the earth
6. Revolution of the earth

Which of the above are responsible for bringing dynamic changes on the surface of the earth?

- (a) 1, 2, 3 and 4 only
- (b) 1, 3, 5 and 6 only
- (c) 2, 4, 5 and 6 only
- (d) 1, 2, 3, 4, 5 and 6

# Factors responsible for dynamicity

1. Electromagnetic radiation
2. Geothermal energy
3. Gravitational force
4. Plate movements
5. Rotation of the earth
6. Revolution of the earth

# Landform by the rivers



Erosional Landforms

Depositional  
landforms

Special features

Course flow

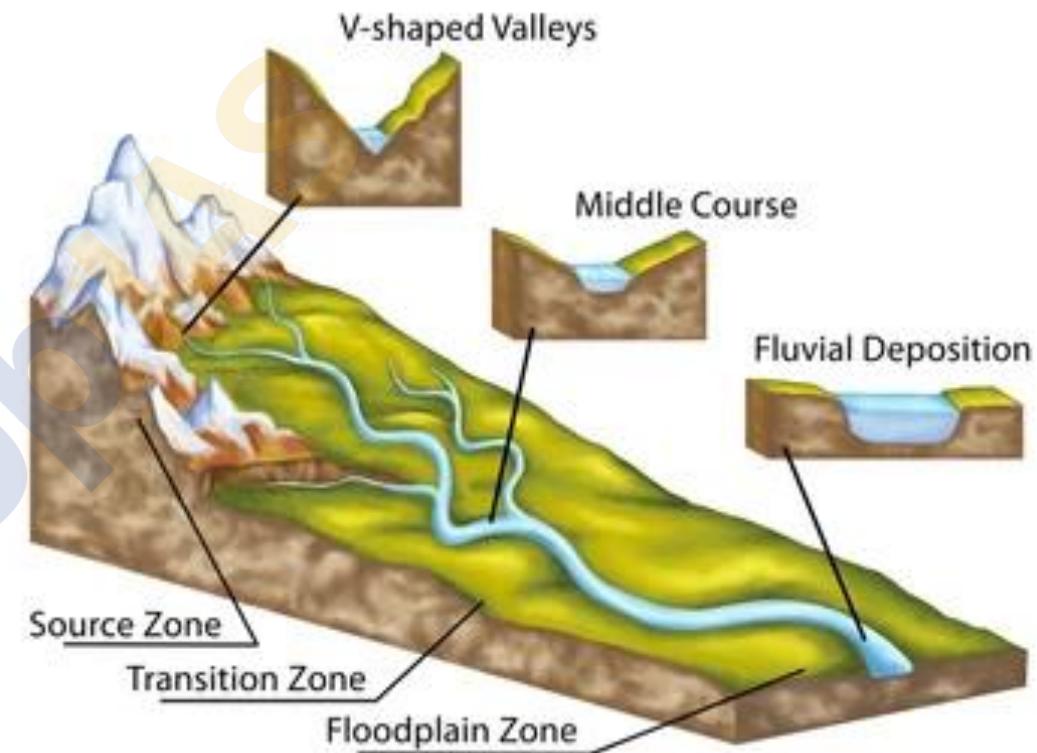
1. Most of the erosional landforms by river are associated with rivers flowing over steep gradient. (Steep Slope: More erosion and less deposition) (Erosion: Vertical Erosion is more than Lateral Erosion)

2. With time, stream channels over steep gradients turn gentler due to continued erosion, vertical erosion becomes less dominant and lateral erosion of banks increases. (Middle Course)

3. With continued erosion, slope turns gentle and as a result rivers lose their velocity and facilitate active deposition. (Gentle Slope: More deposition and less erosion)

4. Gentler the river channels in gradient or slope, the greater is the deposition and as a consequence the hills and valleys are reduced to plains (Peneplain)

## River: Process and landform



# River: Process and landform

## Youth

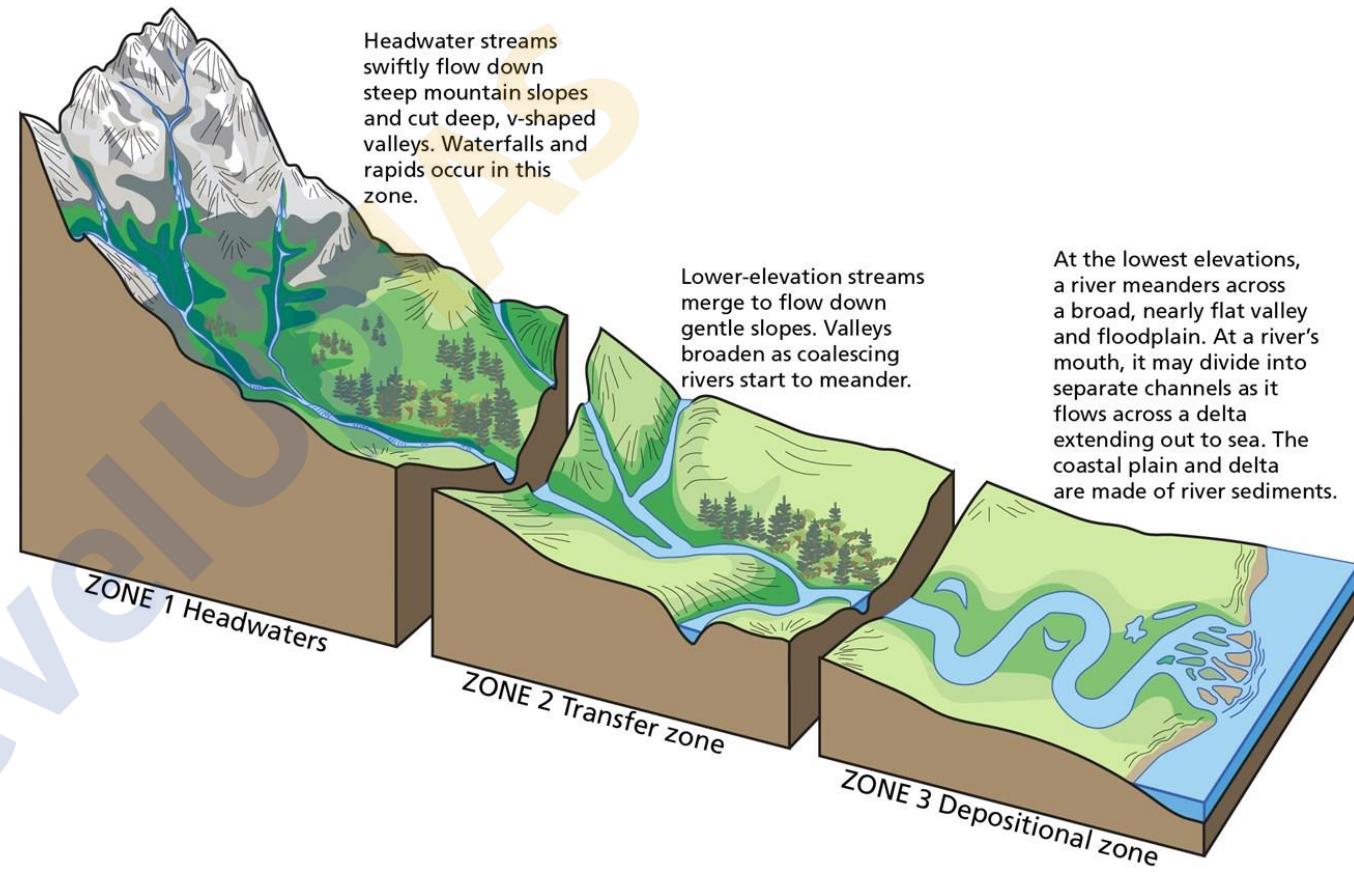
1. Streams are few
2. Shallow V shaped valleys
3. Very narrow floodplain
4. Meanders if present develop over these broad upland surfaces.
5. Waterfalls and rapids may exist .

## Mature

1. Streams are plenty
2. The valleys are still V shaped but deep;
3. Wider floodplains so streams flow in meanders
4. Waterfalls and rapids disappear.

## Old

1. Gentle gradients.
2. Streams meander freely over vast floodplains showing natural levees, oxbow lakes, etc.
3. Most of the landscape is at or slightly above sea level.



# Erosion by the river



# Landforms by erosion



**Janub Al-batina George,  
Oman**

## Canyon

V shaped valley  
Steep step like Slope  
Wider at top than at bottom

## George

Deep Valley with very steep to straight side  
Almost vertical wall and almost equal in width at top as well as at bottom



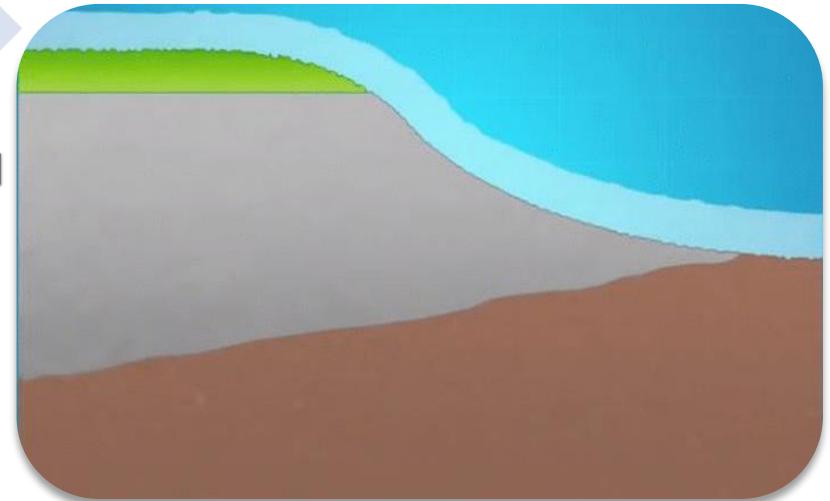
**Grand Canyon, USA**

# Landforms of erosion

1. Over the rocky beds of hill stream circular depressions are formed called potholes
2. Formed because of abrasion of bedrock by rock fragments.
3. Once a small and shallow depression forms, pebbles and boulders get collected in those depressions and get rotated by flowing water and consequently the depressions grow in dimensions.
4. At the foot of waterfalls also, large potholes, quite deep and wide, form because of the sheer impact of water and rotation of boulders. Such large and deep holes at the base of waterfalls are called plunge pools



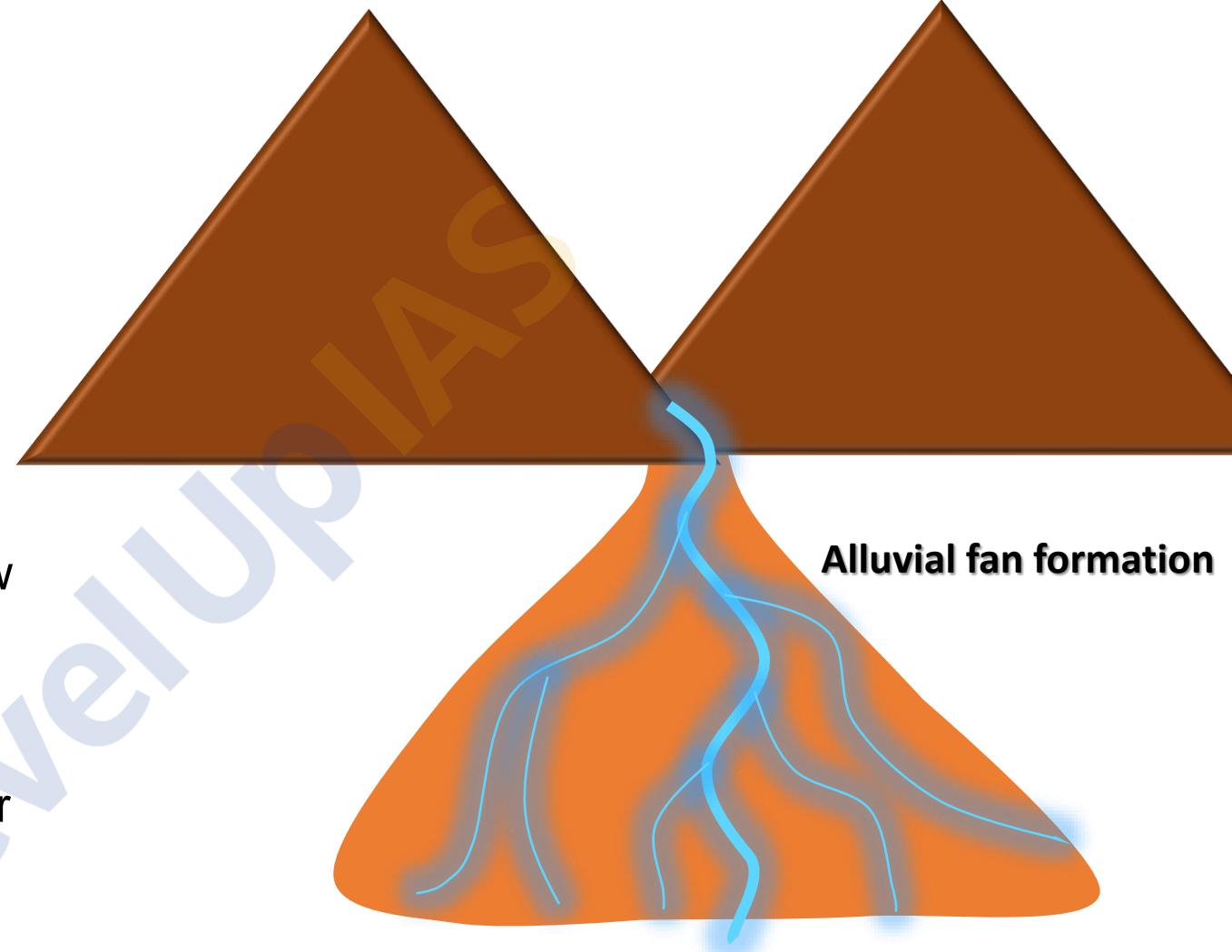
Pot holing



Plunge pool formation

## Landforms of deposition: Alluvial Plain

1. Alluvial fans are formed when streams flowing from higher levels break into foot slope plains of low gradient.
2. Normally very coarse load is carried by streams flowing over mountain slopes.
3. This load becomes too heavy for the streams to be carried over gentler gradients and gets dumped and spread as a broad low to high cone shaped deposit called alluvial fan
4. Usually, the streams which flow over fans are not confined to their original channels for long and shift their position across the fan forming many channels called distributaries.
5. Alluvial fans in humid areas show normally low cones with gentle slope from head to toe and they appear as high cones with steep slope in arid and semi-arid climates.



## Landforms of deposition: Natural Levee



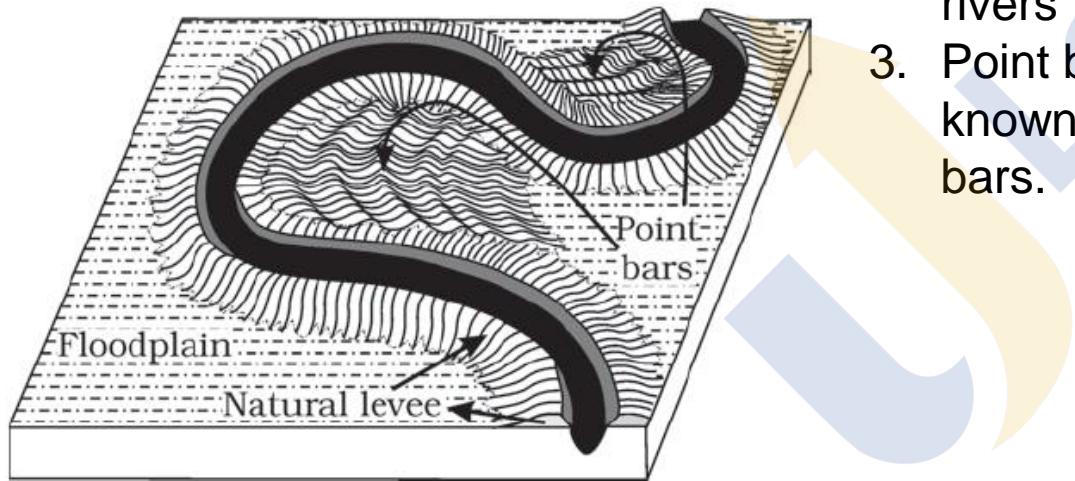
### Formation of river terraces

1. **River terraces** are surfaces marking old valley floor or floodplain levels.
2. River terraces are basically **products of erosion** as they result due to vertical erosion by the **stream into its own depositional floodplain**.
3. There can be a **number of such terraces at different heights** indicating former river bed levels.
4. The river terraces may occur at the same elevation on either side of the rivers in which case they are called **paired terraces**.

## Landforms of depositions:

### Flood Plain

1. Floodplain is a major landform of river deposition.
2. Fine sized materials like sand, silt and clay are carried by relatively slow moving waters in gentler channels and are found in the plains
3. In plains, channels shift laterally and change their courses occasionally



### FLOOD PLAIN

#### Natural levees

1. They are found along the banks of large rivers.
2. They are low, linear and parallel ridges of coarse deposits along the banks of rivers
3. Point bars are also known as meander bars.

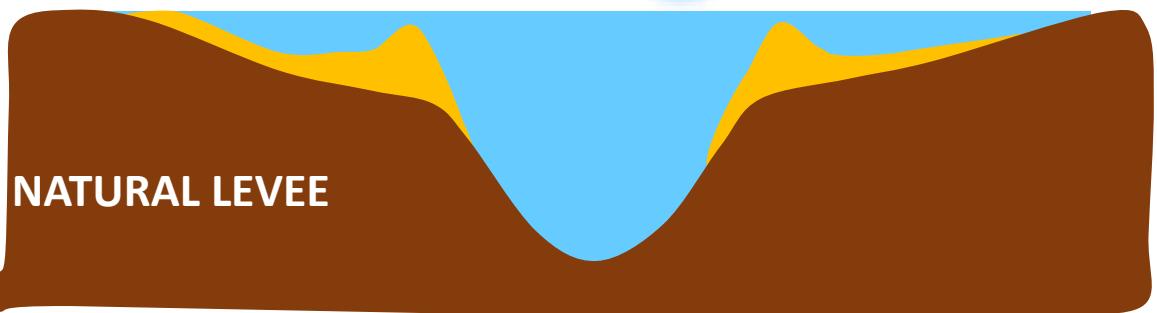
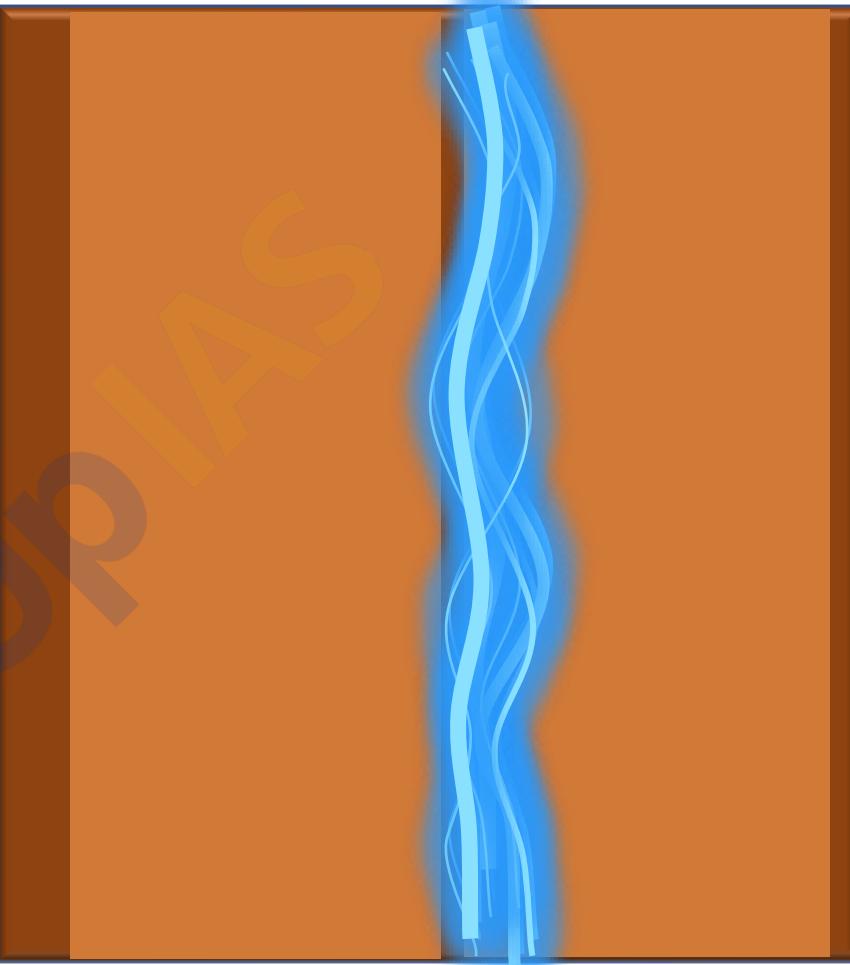


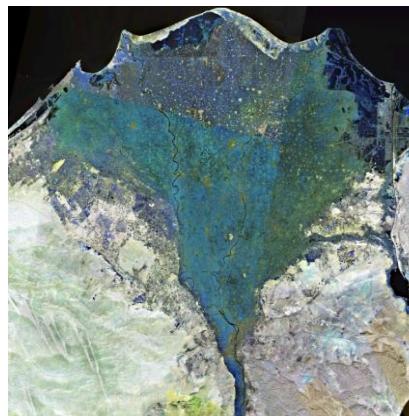
Figure 7.5 : Natural levee and point bars

## Landforms of depositions:

### Deltas

1. Deltas are like alluvial fans but develop at a different location.
2. The load carried by the rivers is dumped and spread into the sea.
3. If this load is not carried away far into the sea or distributed along the coast, it spreads and accumulates as a low cone.
4. Unlike in alluvial fans, the deposits making up deltas are very well sorted with clear stratification.
5. The coarsest materials settle out first and the finer fractions like silts and clays are carried out into the sea. As the delta grows, the river distributaries continue to increase in length and delta continues to build up into the sea.

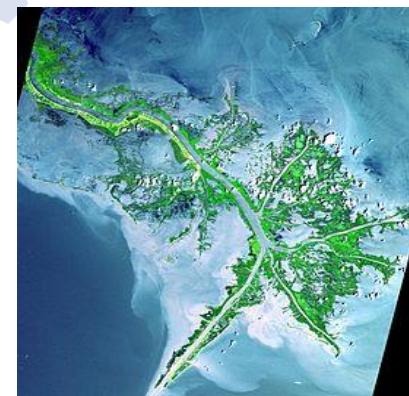
**Types of Delta:** Arcuate Delta, Cuspate Delta, Bird-foot Delta.



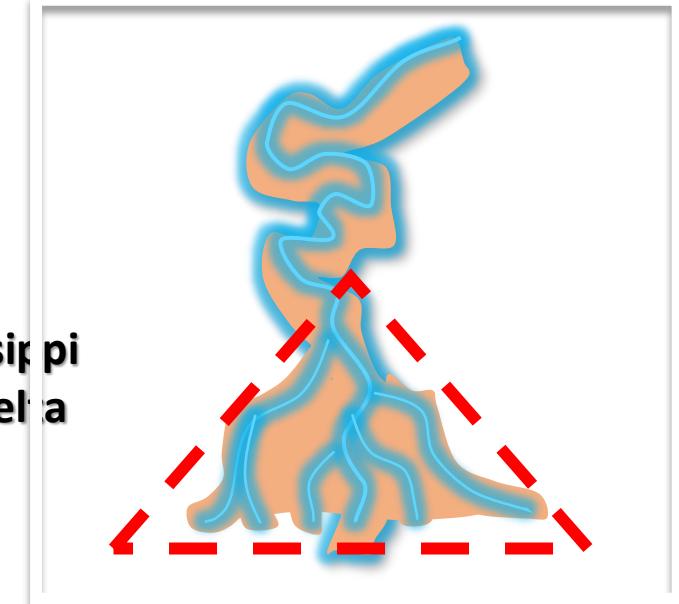
**Nile river delta**



**Ebro river delta**



**Mississippi river delta**

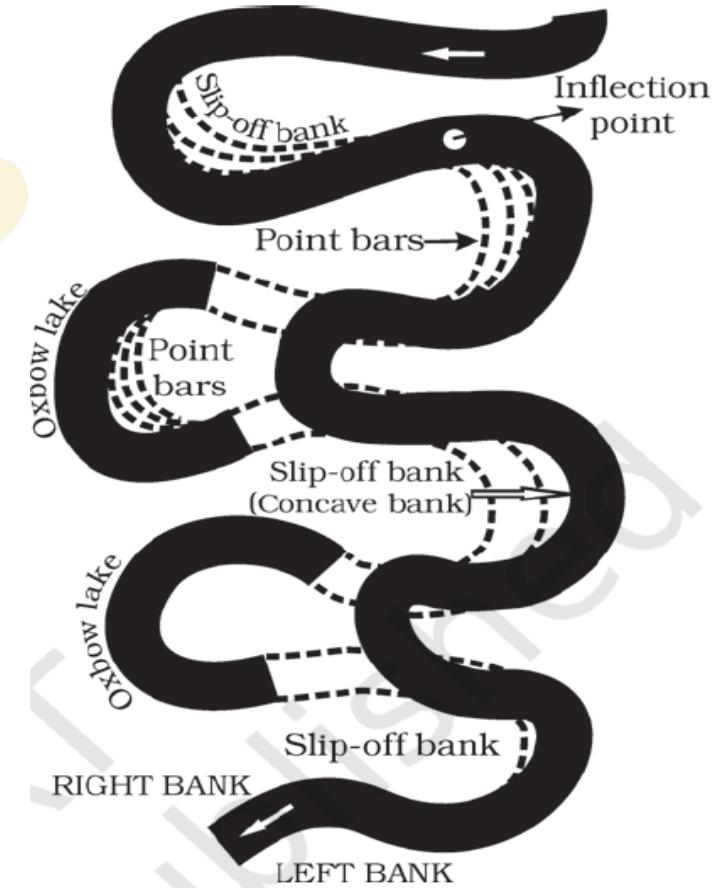




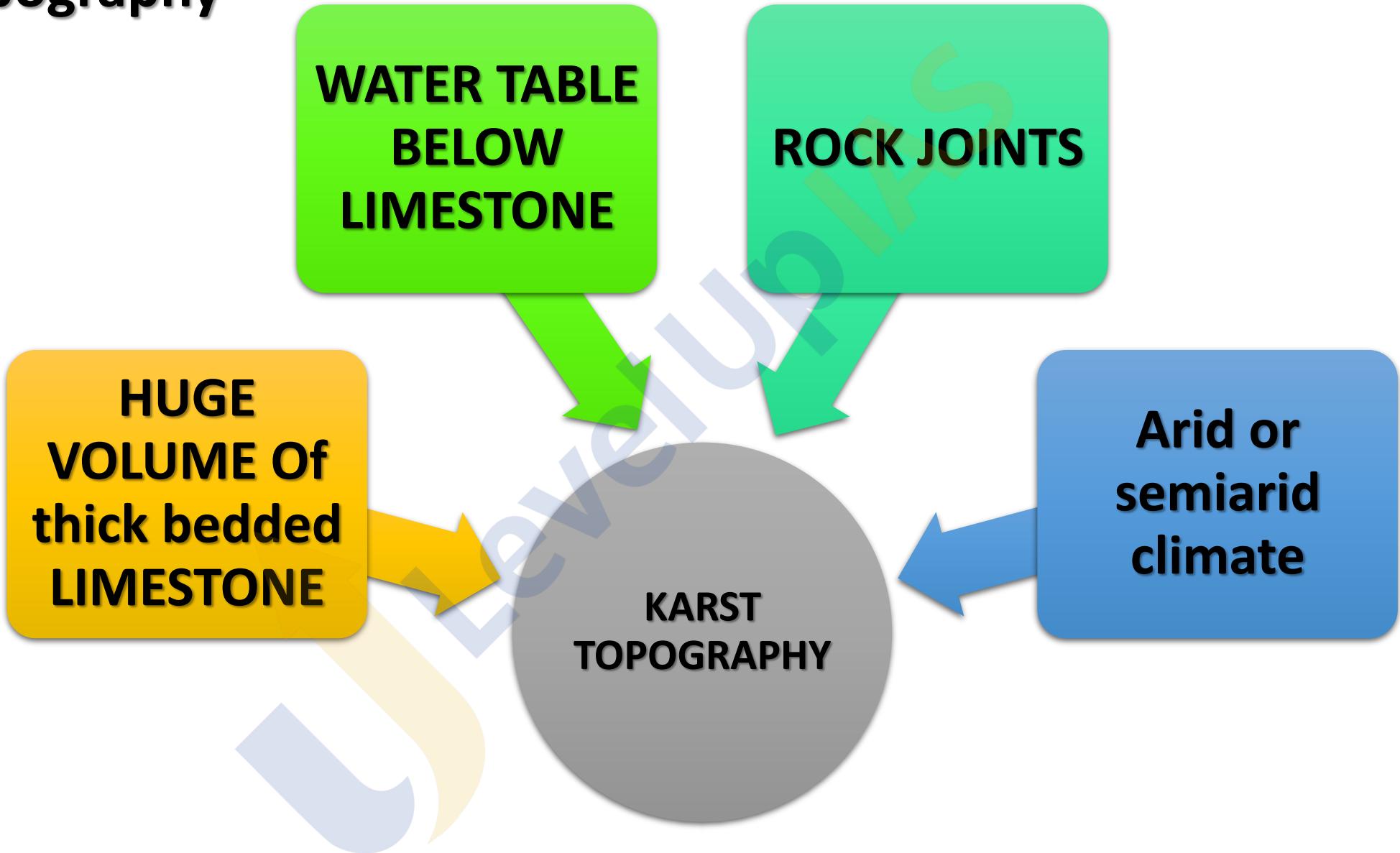
Minute  
Earth

# Meander

1. In large flood plains, rivers rarely flow in straight courses and tend to meanders
2. **Reasons:** (i) Water work laterally on gentle gradient bank (ii) Soft unconsolidated alluvial deposits along the bank (iii) Coriolis force acting on the fluid water
3. Due to meander, slight irregularities widen into a **curvature**.
4. Curvature deepens due to deposition on the inside of the curve and erosion along the bank on the outside. If there is no deposition and no erosion, the river will not change its course.
5. There is active deposition along concave bank (**Cut off bank**) and undercutting along convex bank. The concave bank is known as **slip off bank**.
6. As meanders grow into deep loops, loops cut off at the inflection points and are left as ox-bow lakes.



# Karst Topography

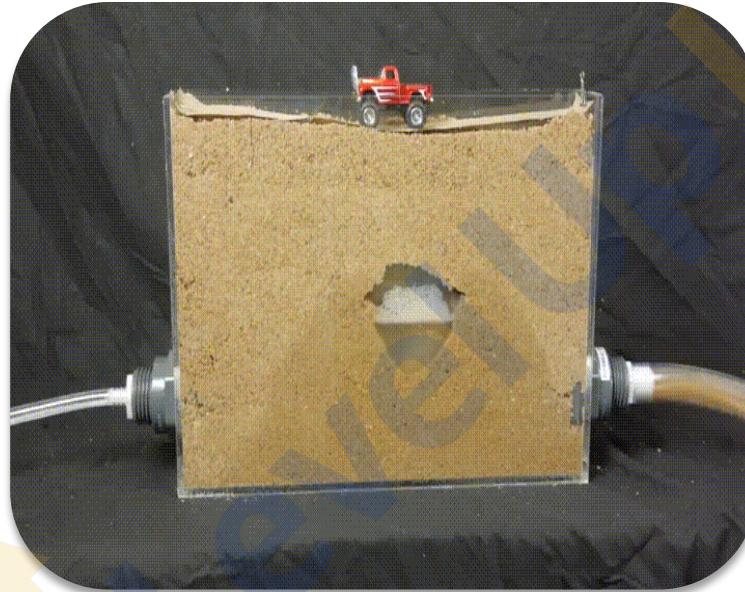
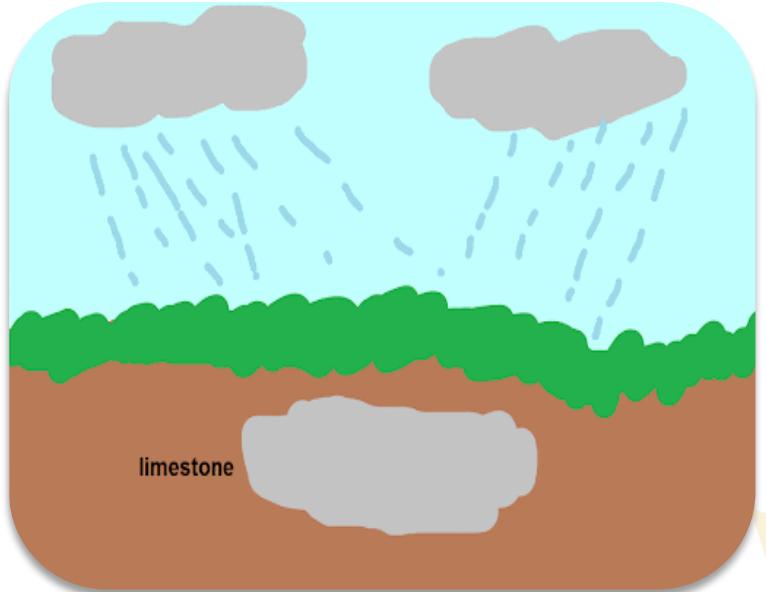


# Ground Water

1. Surface water percolates well when the rocks are permeable, thinly bedded and highly jointed and cracked.
2. After vertically going down to some depth, the water under the ground flows horizontally through the bedding planes, joints
3. It is this downward and horizontal movement of water which causes the rocks to erode.
4. Physical or mechanical removal of materials by moving groundwater is insignificant in developing landforms. That is why, the results of the work of groundwater cannot be seen in all types of rocks.
5. But in rocks like limestones or dolomites rich in calcium carbonate, the surface water as well as groundwater through the chemical process of solution and precipitation deposition develop varieties of landforms.
6. These two processes of solution and precipitation are active in limestones or dolomites creating Karst Topography



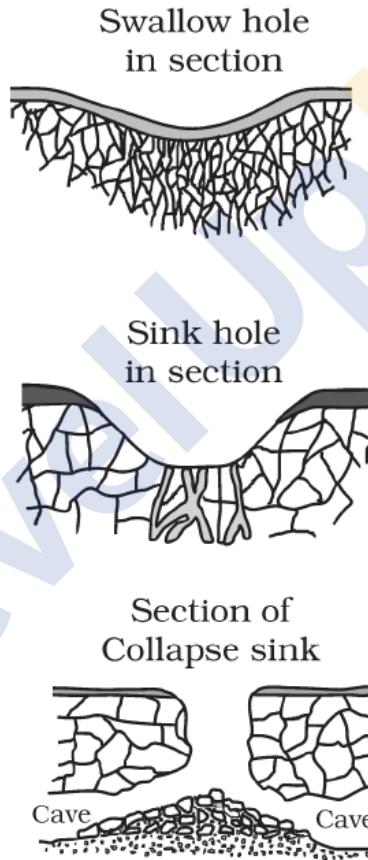
# SOLUTION:



# Erosional Landform

1. Small to medium sized rounded shallow depressions called swallow holes
2. A sinkhole is an opening more or less circular at the top and funnel-shaped towards the bottom with sizes varying in area
3. Sinkhole forms as solution forms first and if the bottom of a sinkhole forms the roof of a void or cave underground, it might collapse leaving large cave or a void below called as collapse sinks/ Doline
4. When sink holes and dolines join together because of slumping of materials along their margins or due to roof collapse of caves, long, narrow to wide trenches called valley sinks or Uvalas form.
5. Gradually, most of the surface of the limestone is eaten away by these pits and trenches, leaving it extremely irregular surface called as limestone pavements.

60



FUNDAMENTALS OF PHYSICAL GEOGRAPHY

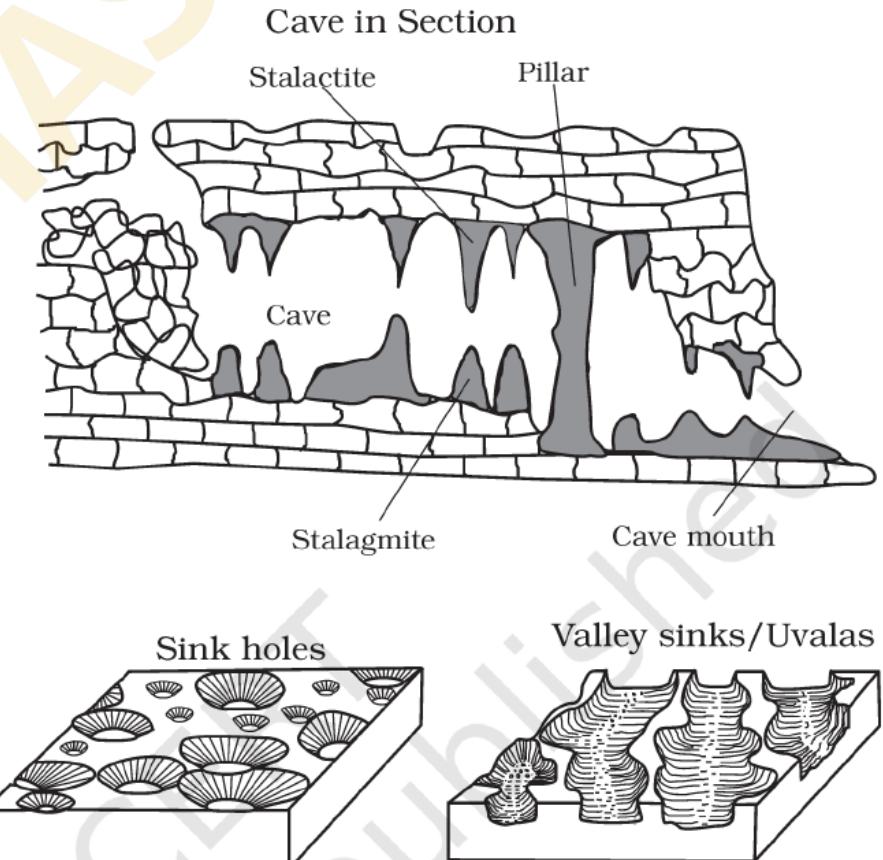
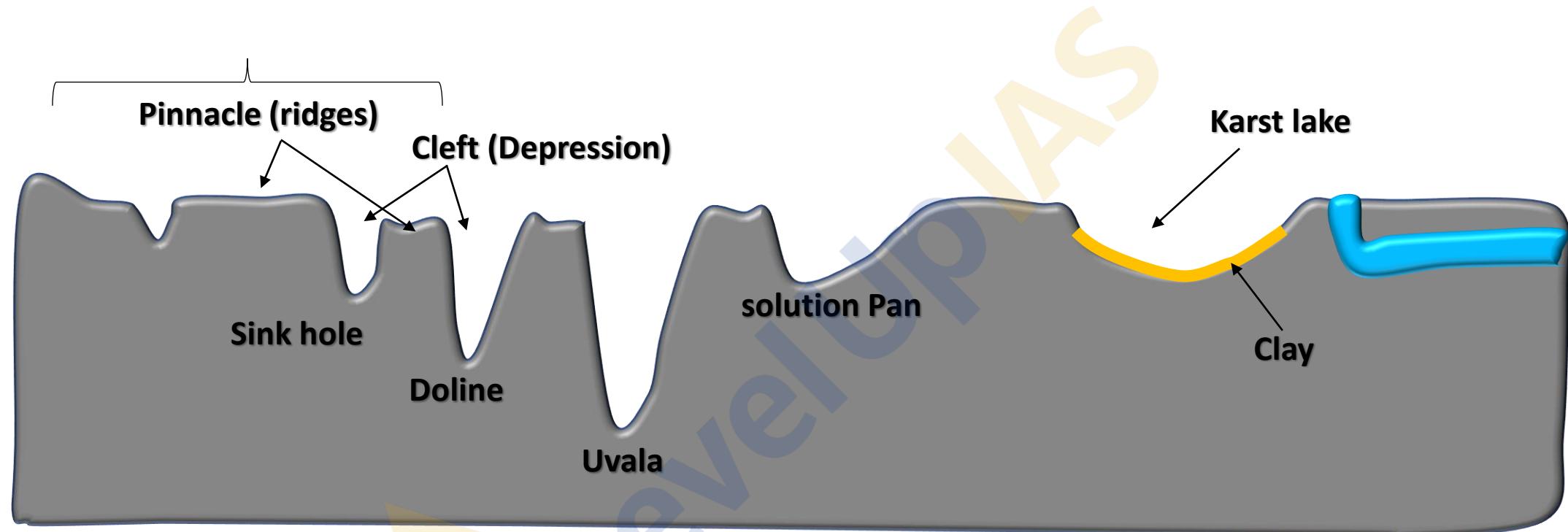


Figure 7.8 : Various karst features



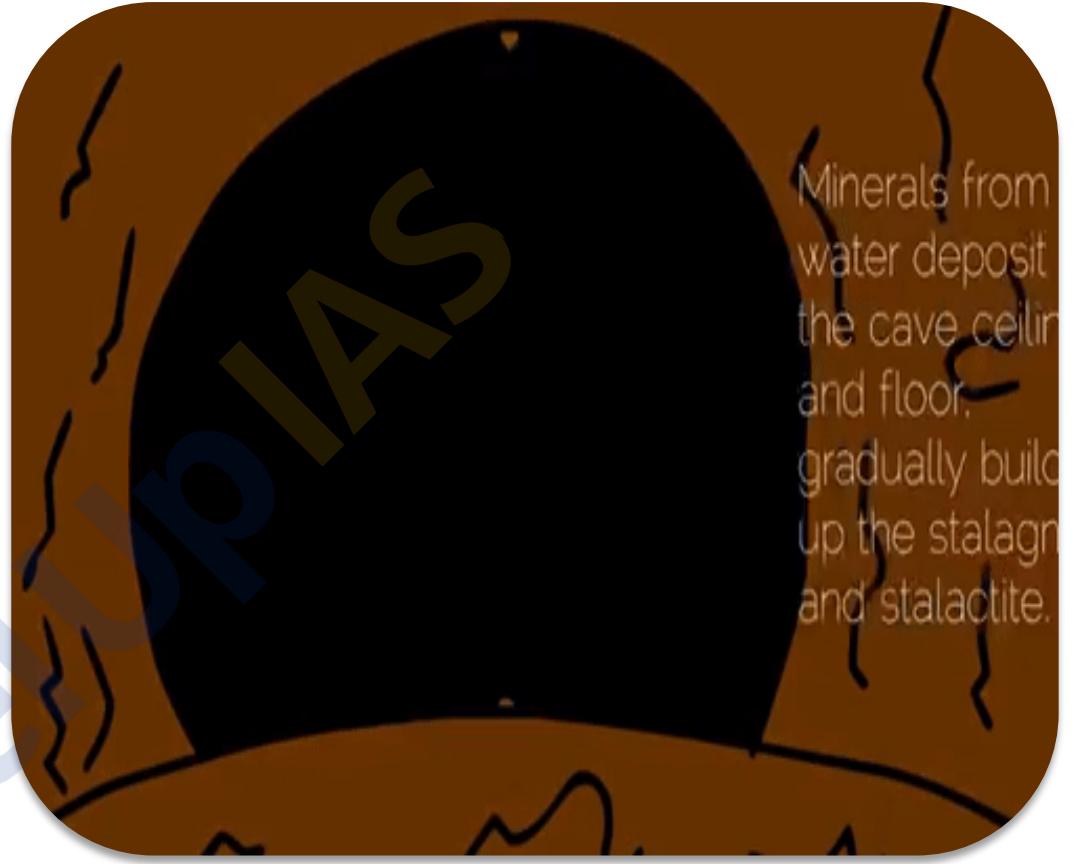
## Limestone Pavement



## Different Types of Karst Landforms

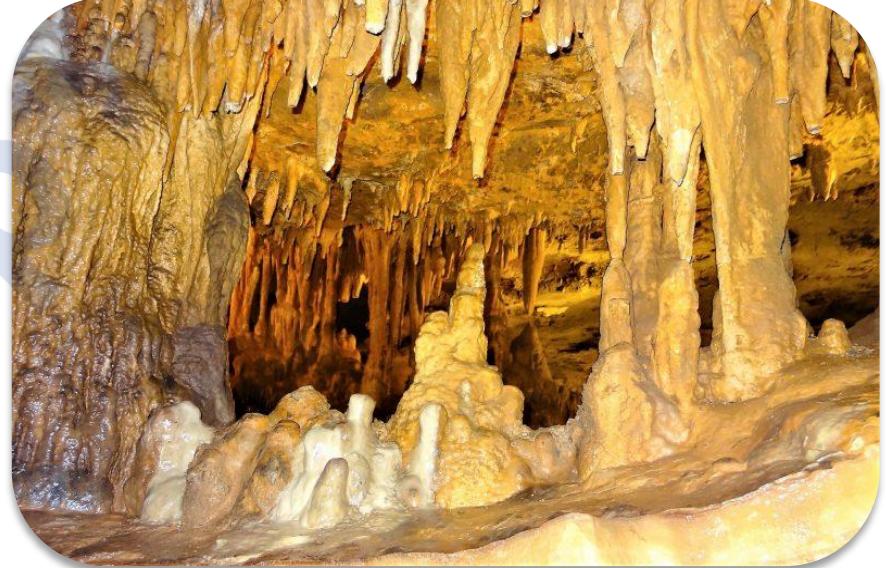
# Depositional Landform

1. Stalactites hang as icicles of different diameters. Normally they are broad at their bases and taper towards the free ends showing up in a variety of forms.
2. Stalagmites rise up from the floor of the caves. In fact, stalagmites form due to dripping water from the surface or through the thin pipe, of the stalactite, immediately below it
3. Stalagmites may take the shape of a column, a disc, with either a smooth, rounded bulging end or a miniature crater like depression.
4. The stalagmite and stalactites eventually fuse to give rise to columns and pillars of different diameters.



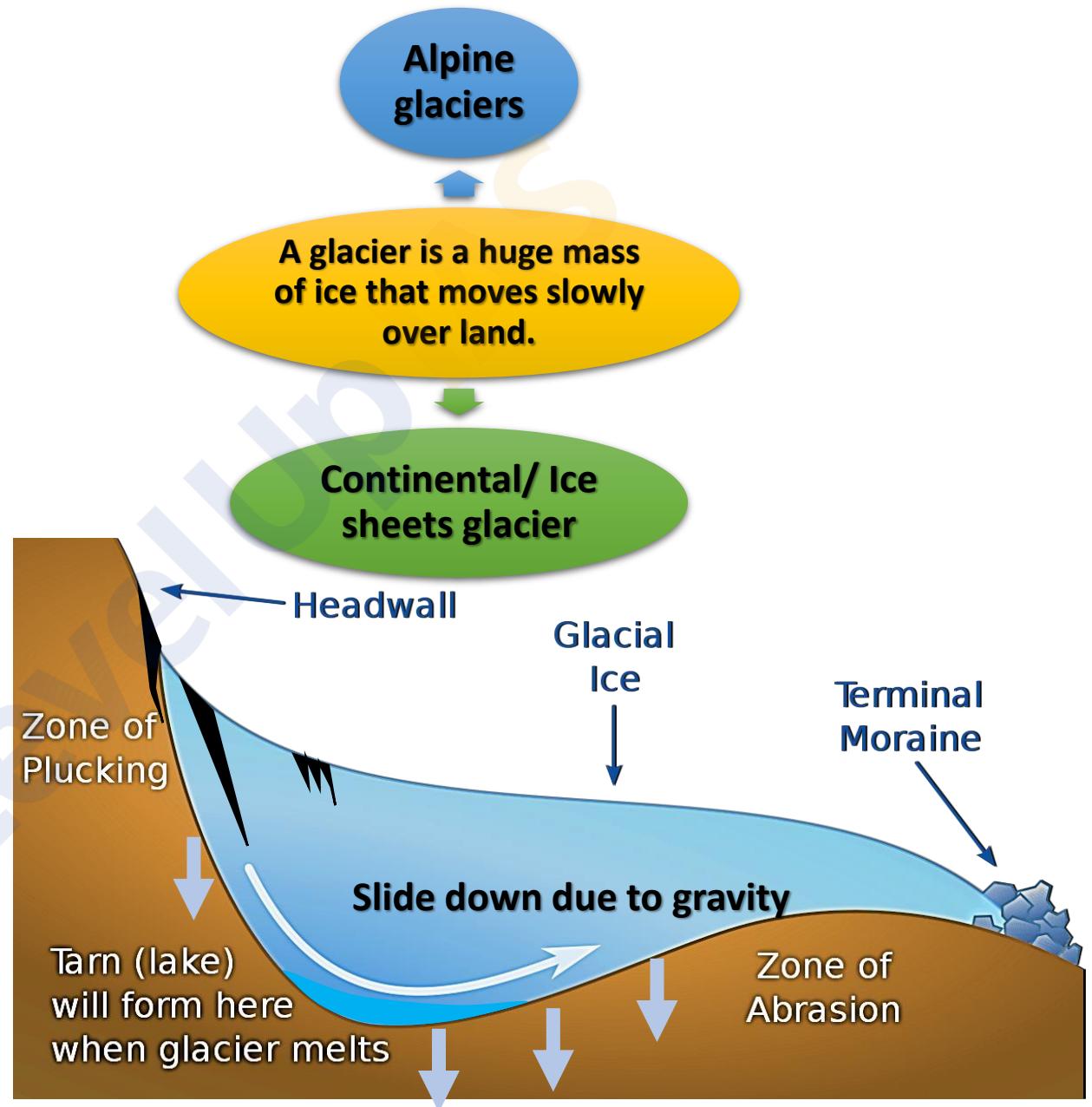


**Cave Curtains**



**Karst cave**

1. Masses of ice moving as sheets over the land (continental glacier or piedmont glacier if a vast sheet of ice is spread over the plains at the foot of mountains) or as linear flows down the slopes of mountains in broad trough-like valleys (mountain and valley glaciers) are called glaciers
2. The movement of glaciers is slow unlike water flow.
3. The movement could be a few centimetres to a few metres a day or even less or more.
4. Glaciers move basically because of the force of gravity.
5. Erosion by glaciers is tremendous because of friction caused by sheer weight of the ice.





1. The material plucked from the land by glaciers (usually large-sized angular blocks and fragments) get dragged along the floors or sides of the valleys and cause great damage through abrasion and plucking.
2. Glaciers can cause significant damage to even unweathered rocks and can reduce high mountains into low hills and plains.
3. As glaciers continue to move, debris gets removed, divides get lowered and eventually the slope is reduced to such an extent that glaciers will stop moving leaving only a mass of low hills and vast outwash plains along with other depositional features.

# **Landforms of erosion**

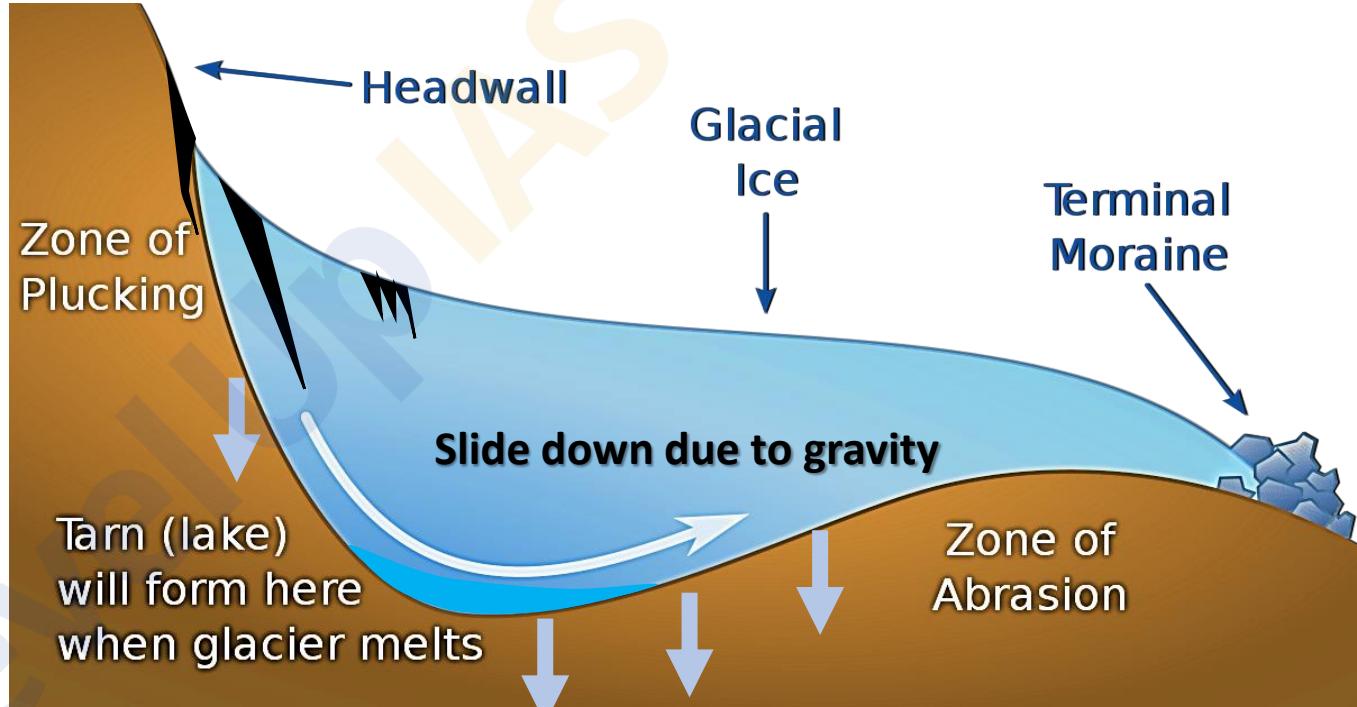
**Cirque/ Cwm/  
Corrie**

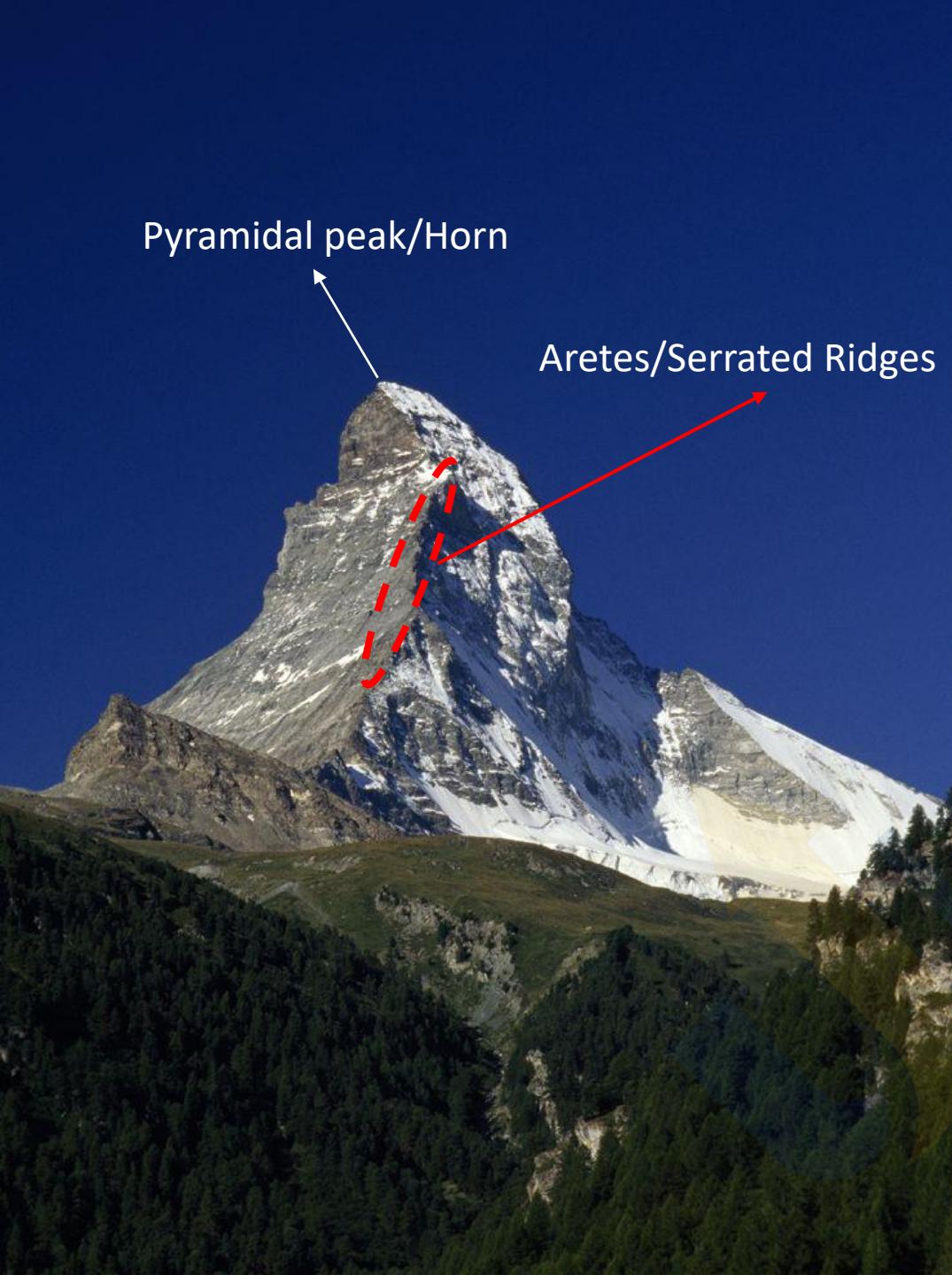
**Horns (Pyramidal  
Peak) and Serrated  
Ridges (Arete)**

**Glacial  
Valleys/Troughs:  
Hanging Valley and  
U Shaped Valley**

# Cirque/ Cwm

1. Most common landform in the glaciated mountains
2. Found at the head of the glacial valleys
3. Downward movement of the glaciers leads to intense shattering of the upland slope producing a depression
4. Plucking operates on the back wall while movement of ice abrades the floor creating a depression called as Corrie/ Cirque/ Cwm
5. When the ice eventually melts water is collected in the depression called as Corrie Lake or Tarn

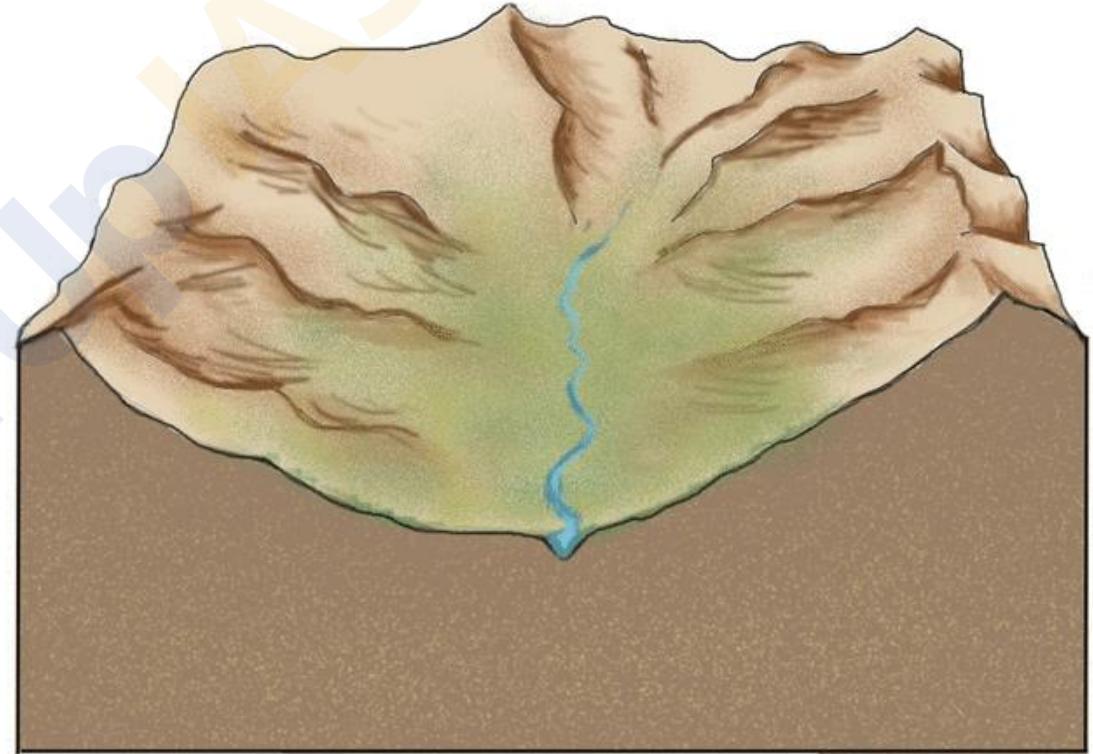
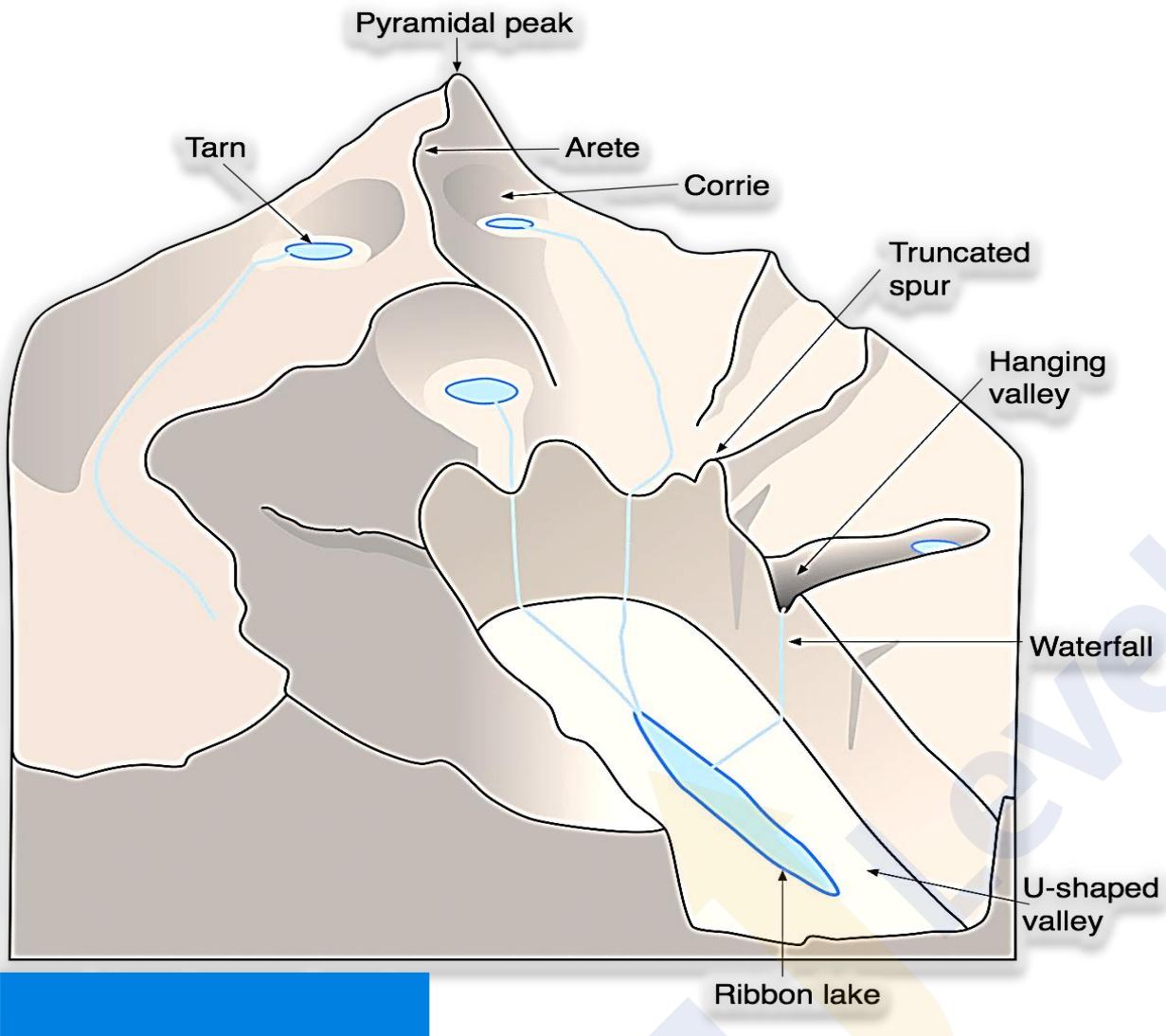




## **Pyramidal peak/Horn, Arete / Serrated Ridge**

- 1. Arete:** When two Corries cut back on the opposite side of the mountain a Knife-edged ridge/ Zigzag Ridge are formed called Arete or Serrated Ridge
- 2. Horn:** When 3/more cirques cut back together they form angular horn or pyramidal peak.

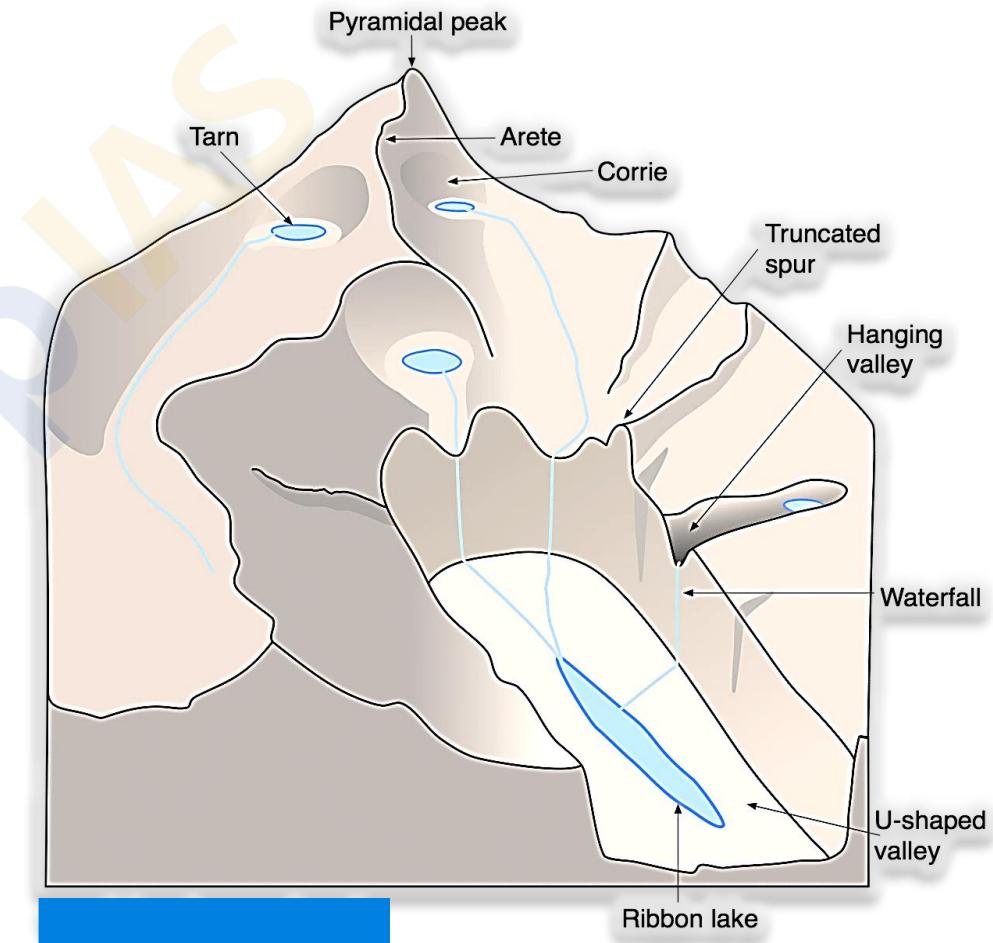
**The Matterhorn, part of the Alps in Switzerland, is a glacial horn.**



## Glacial Valleys/Troughs

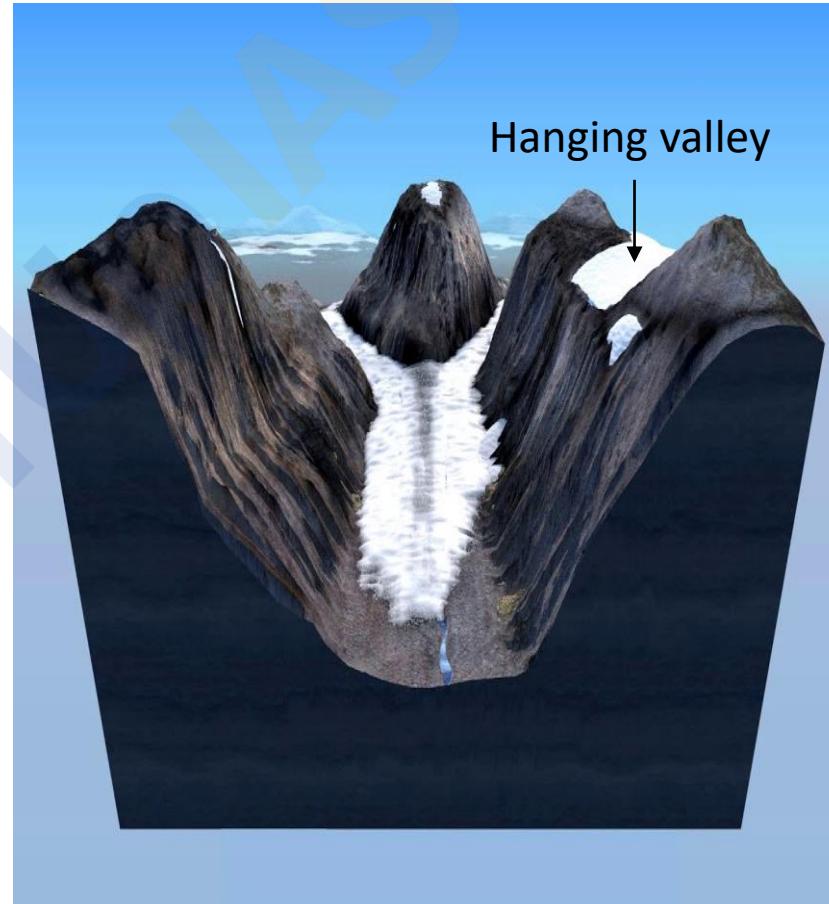
# U shaped Valley

- Glacier on the downward journey fed by ice from several Corries like tributaries that join a river begins to wear away the sides and the floor of valley down
- It straightens any protruding spur on its course and the interlock spurs are blunted to form truncated spurs
- A U shaped valley is formed because of this process.
- After the disappearance of the ice, glacial valley may be filled with water forming Ribbon Lake

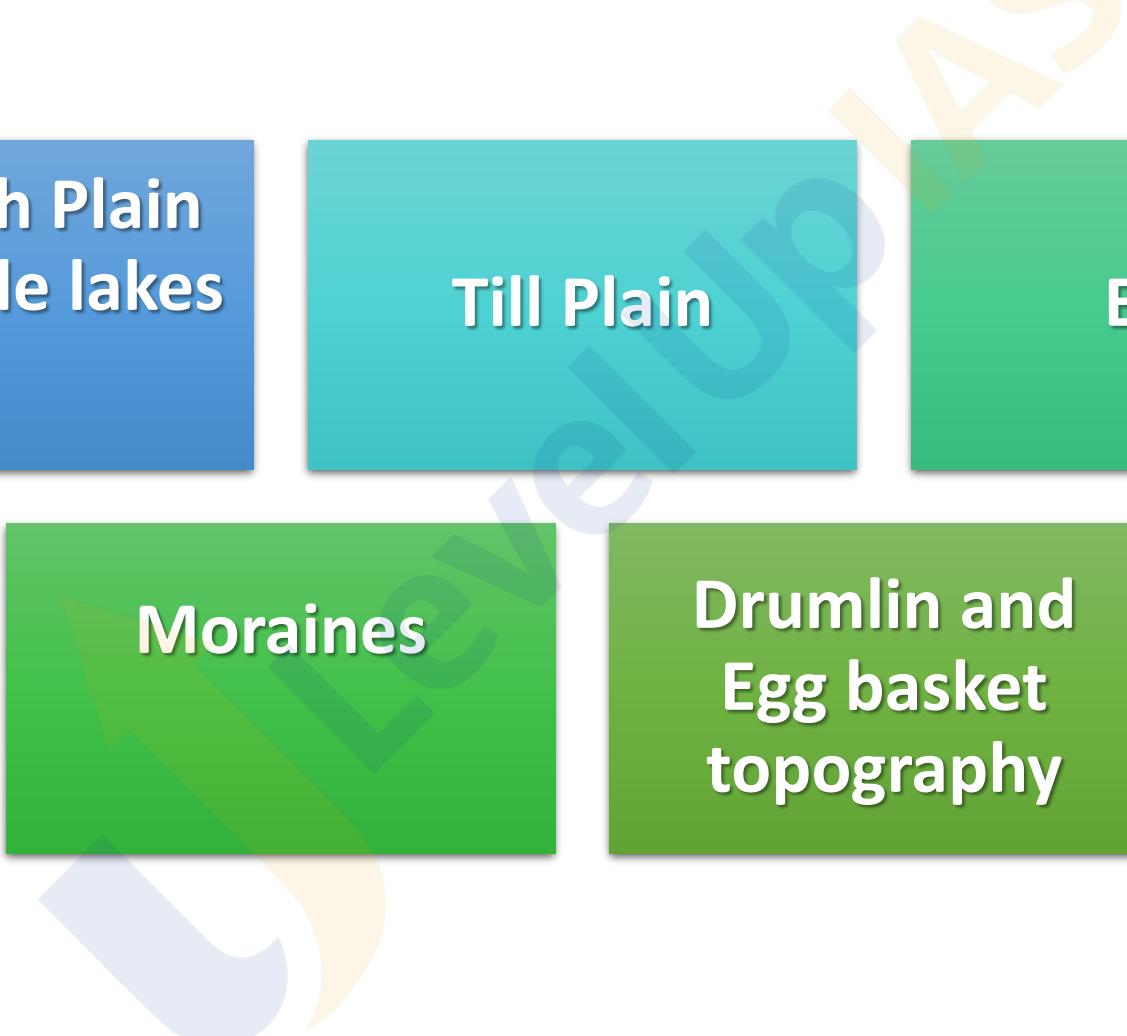


# Hanging Valley

- The main valley is eroded much rapidly than the tributary valleys
- After the ice has melted, a tributary valley therefore hangs above the main valley.
- Search tributary valleys are termed as hanging valley



# **Landforms of Deposition**



**Outwash Plain  
and Kettle lakes**

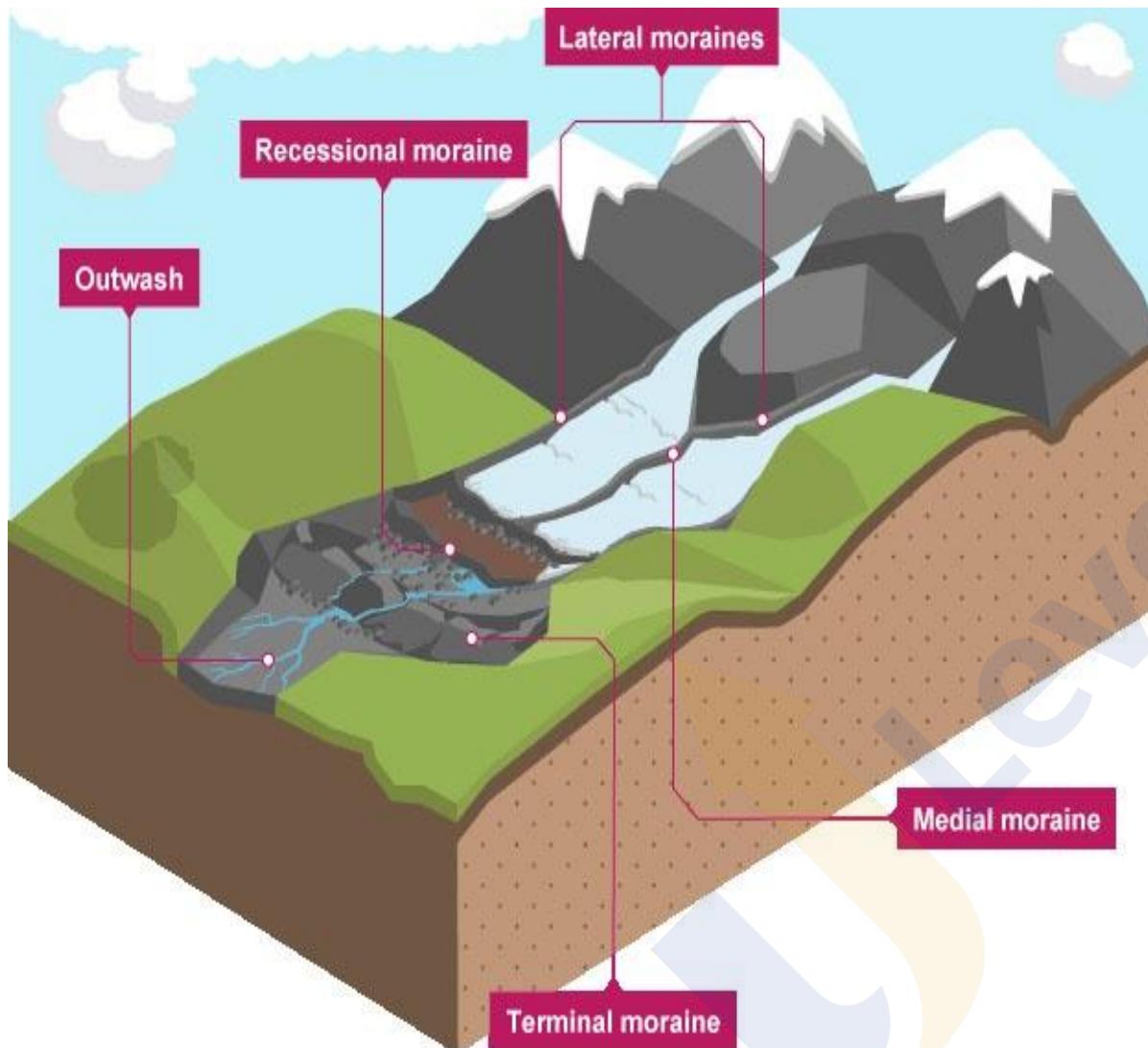
**Till Plain**

**Esker**

**Moraines**

**Drumlin and  
Egg basket  
topography**

# Moraine



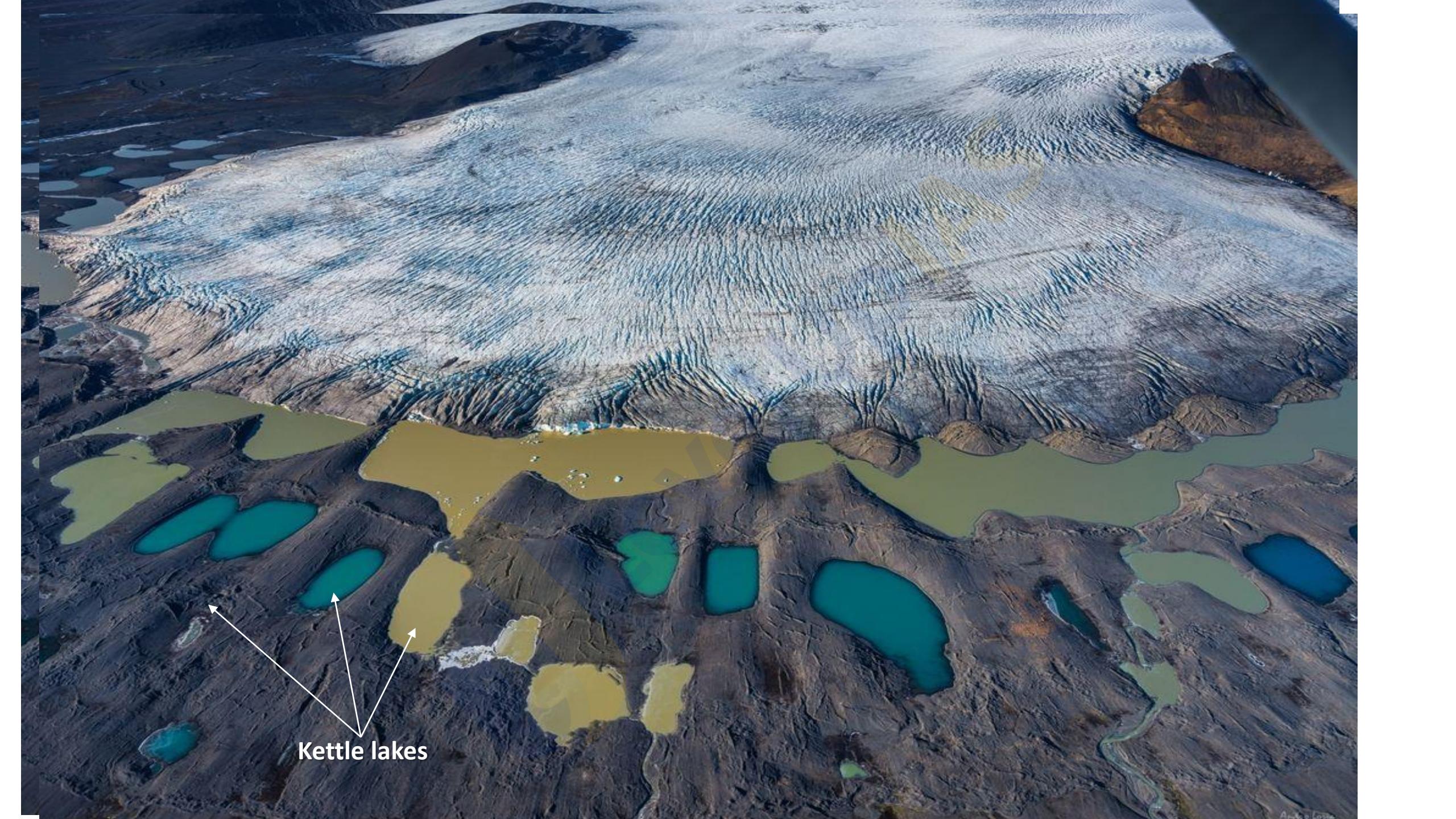
Moraine: Long ridges of deposit of glacier till.

- **Terminal moraines**: Long ridges of debris deposited at the end (toe) of the glaciers.
- **Lateral moraines**: Formed along the sides parallel to the glacial valleys. The lateral moraines may join a terminal moraine forming a horse-shoe shaped ridge
- **Medial Moraine**: The moraine in the centre of the glacial valley flanked by lateral moraines
- **Recessional Moraine**: Deposition of end moraine may be in several succeeding waves, as the ice may melt back by stages forming a series of moraine

# Outwash Plain

- Small amount of rock debris are small enough to be carried by the streams formed by the melting glaciers are called as glaciofluvial deposits
- Such glaciofluvial deposits are called outwash deposits
- Unlike till deposits, the outwash deposits are roughly stratified and assorted
- Melt water sort and re-deposits the material in variety of form
- When the deposition takes the form of alternating ridges and depressions the later may contain kettle lakes and give rise to knob and kettle topography



This aerial photograph captures a vast, light blue-grey glacier in the upper half of the frame, characterized by its distinct surface textures and crevasses. Below the glacier, a large, irregularly shaped body of water is visible, showing a gradient from dark brown to bright turquoise. Numerous small, scattered lakes of varying sizes are nestled in the dark, rocky terrain at the base of the glacier. In the bottom left corner, three white arrows point upwards towards a cluster of these smaller lakes, which are labeled "Kettle lakes".

**Kettle lakes**

# Till Plain



- The **unsorted** coarse and fine debris dropped by melting glacier is called as glacial till
- Most of the rock fragments in the angular to sub angular
- It is spread in sheets and not mounds
- Form Till Plain
- Landform is monotonous and featureless



# Esker



They are long narrow sinuous ridges composed of sand and gravel



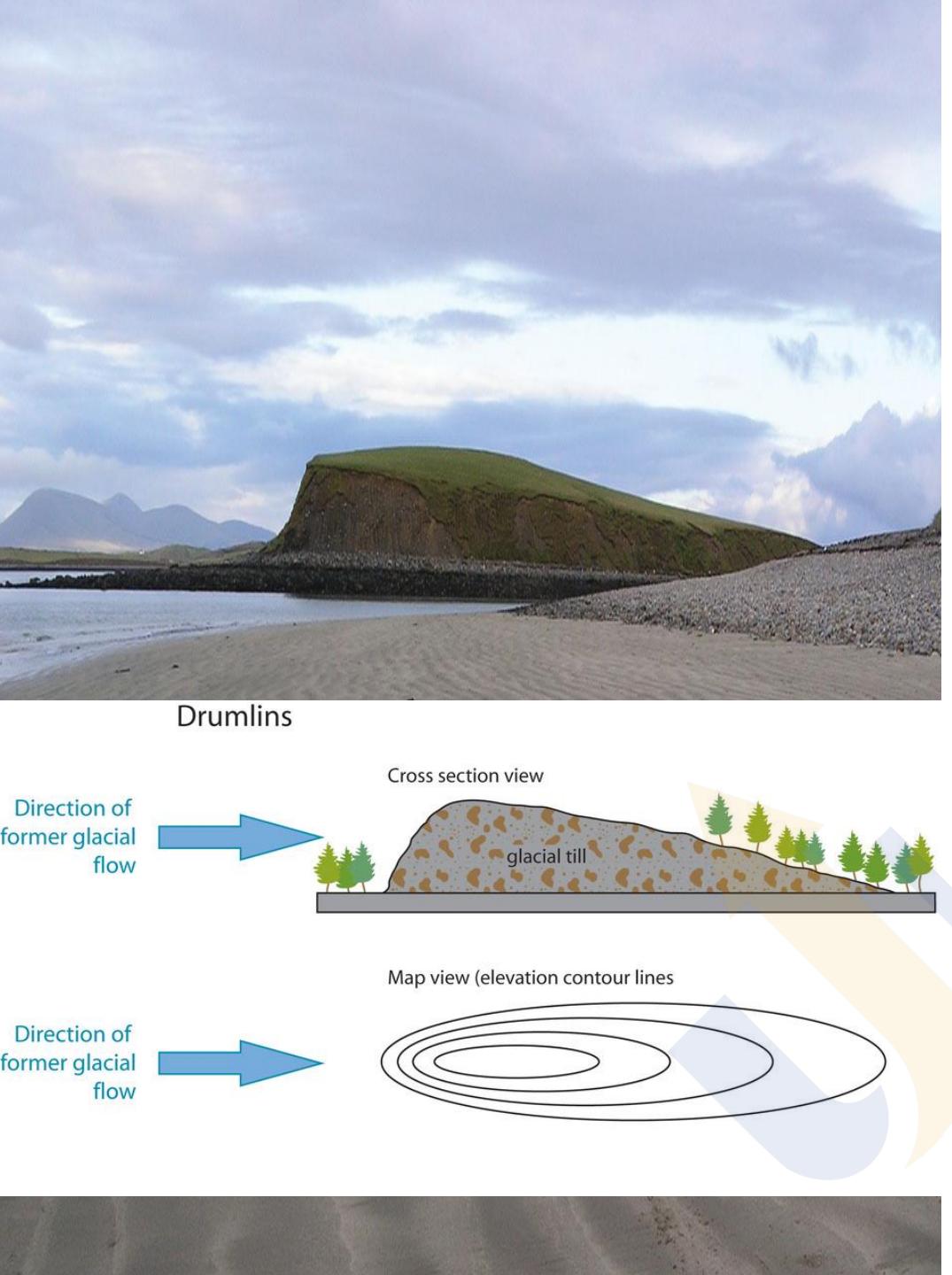
They mark the former site of subglacial meltwater streams



They may be few feet in height but are several miles long



they are made up of highly porous sand and gravel so water is rapidly drained off from their crest



# Drumlin



They are smooth Oval shaped features composed of glacial till along with gravel and sand



The long axis of drumlin are parallel to the direction of the ice movement so drumlin indicate the direction of glacier movement



One end of the drumlin facing the glacier are called stoss end which is a blunter and steeper than the other end



The stoss end gets blunter due to pushing by the moving ice

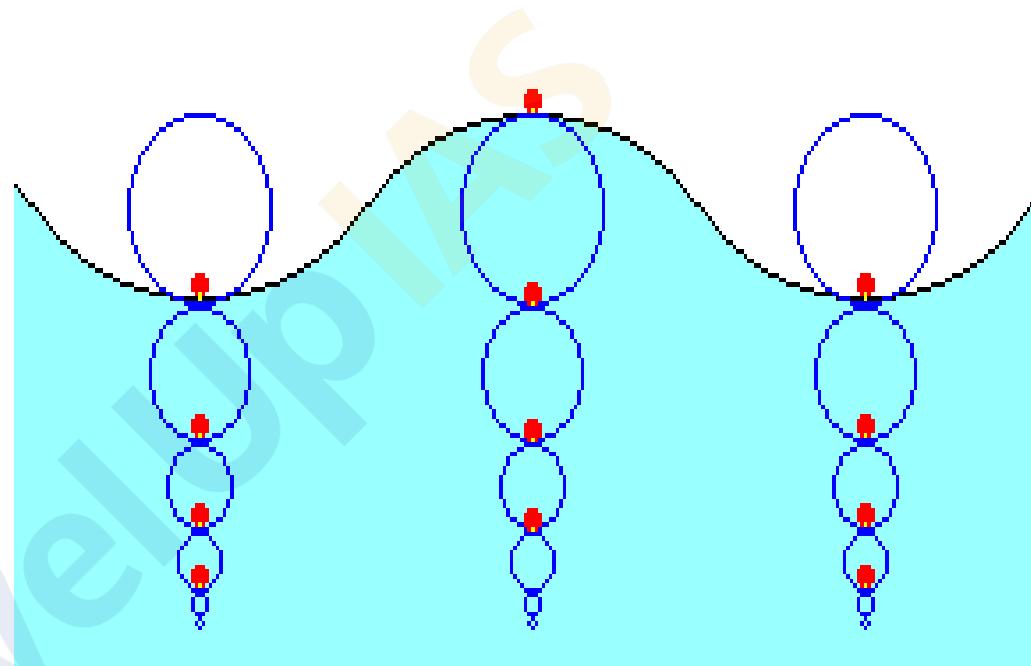
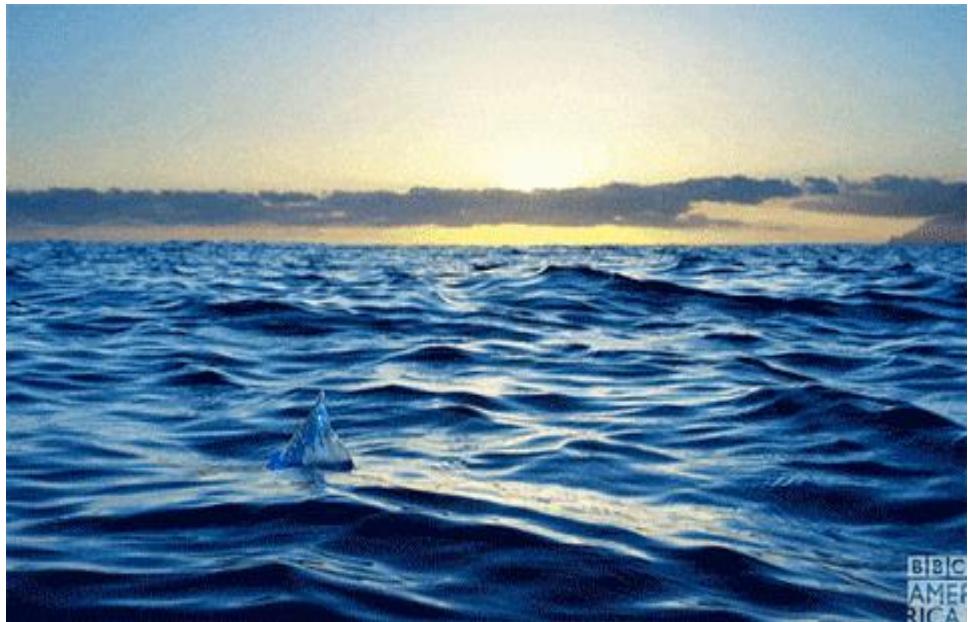


The other end is called as tail



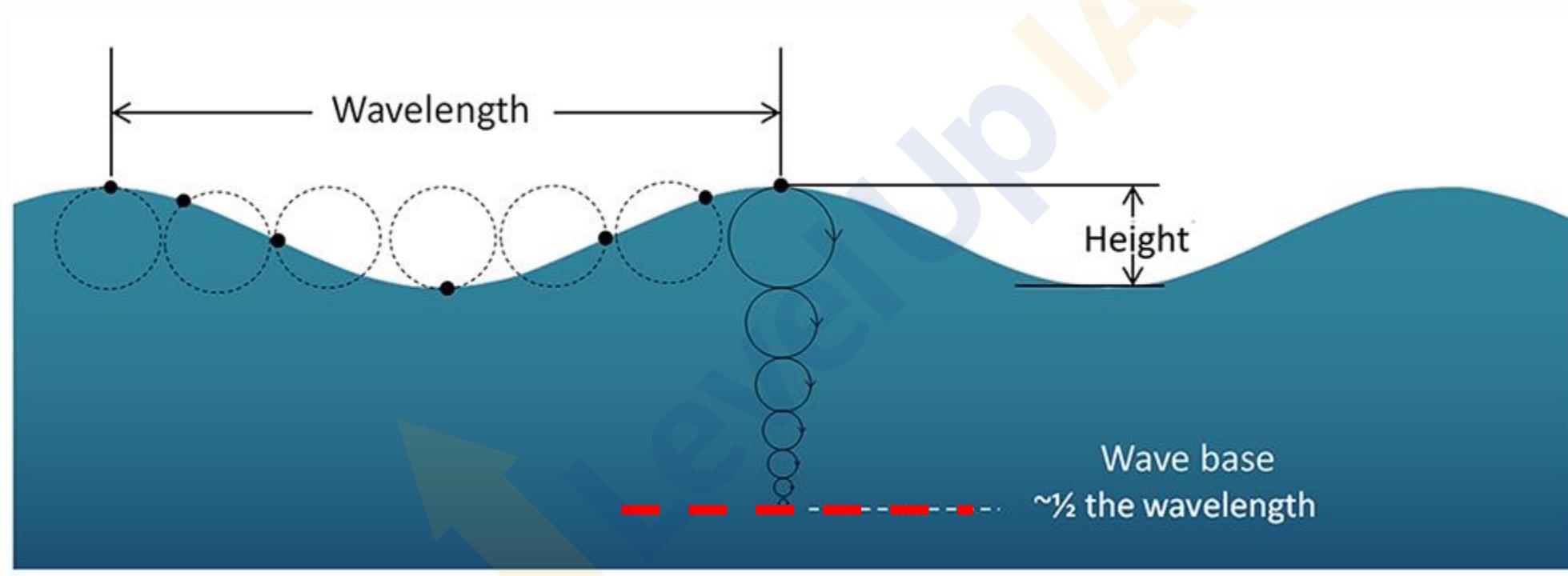
**Egg basket topography**

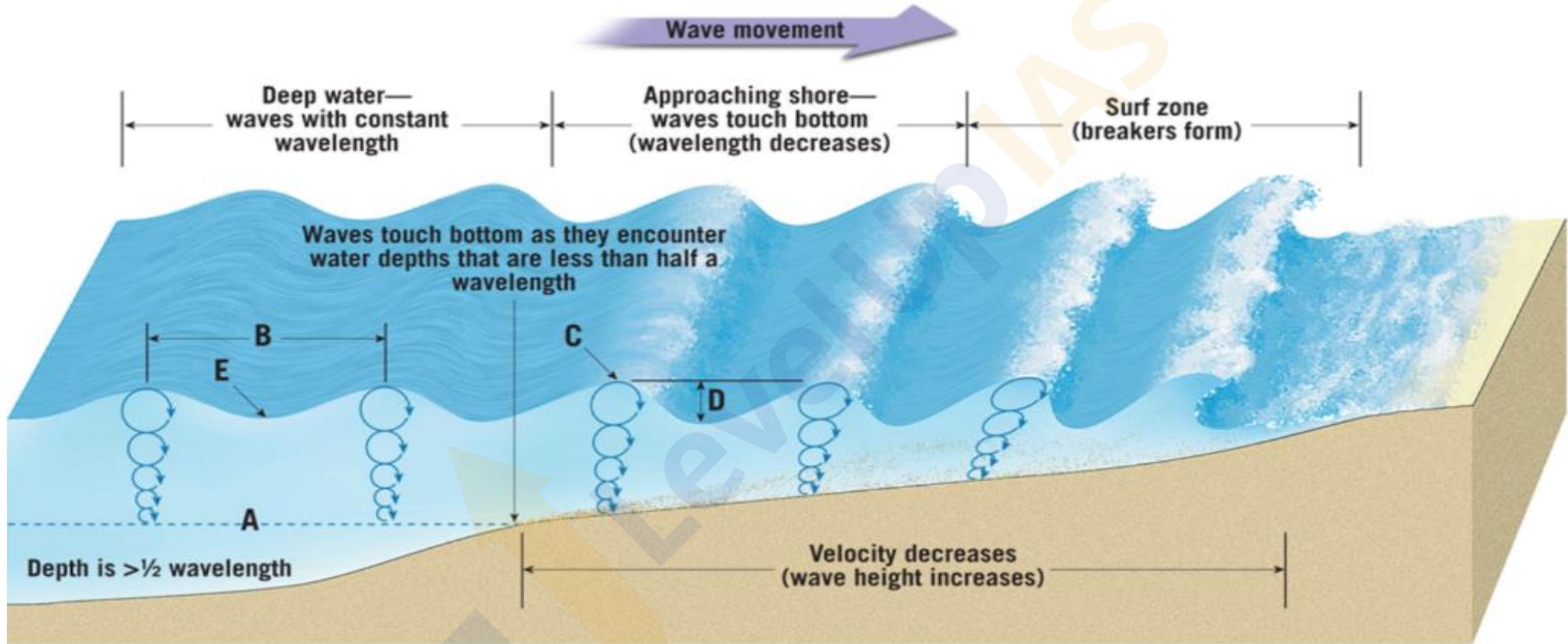
# Waves



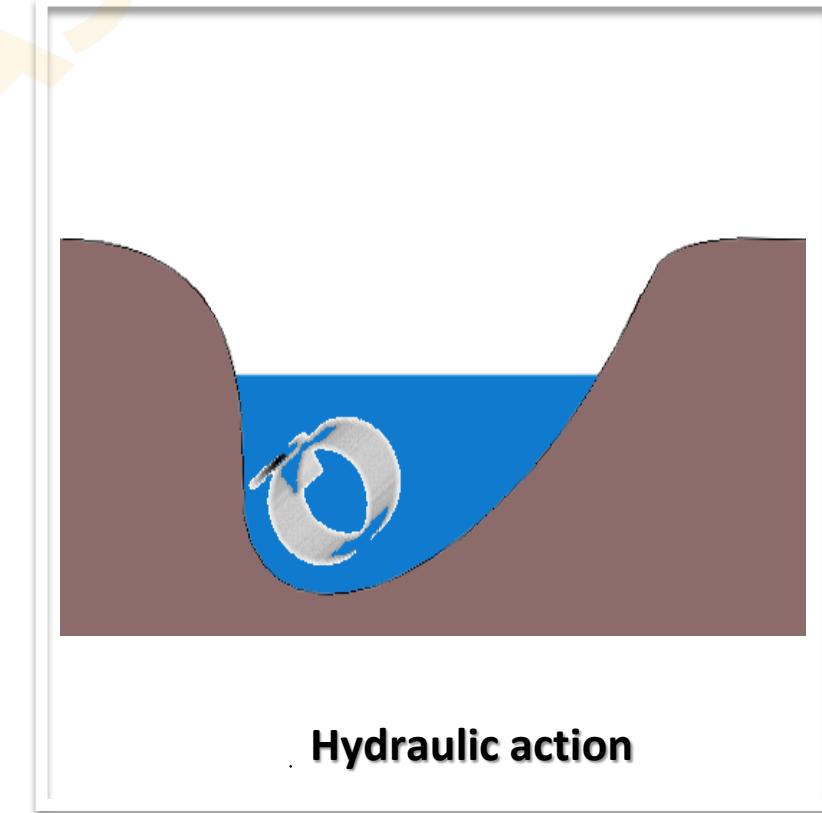
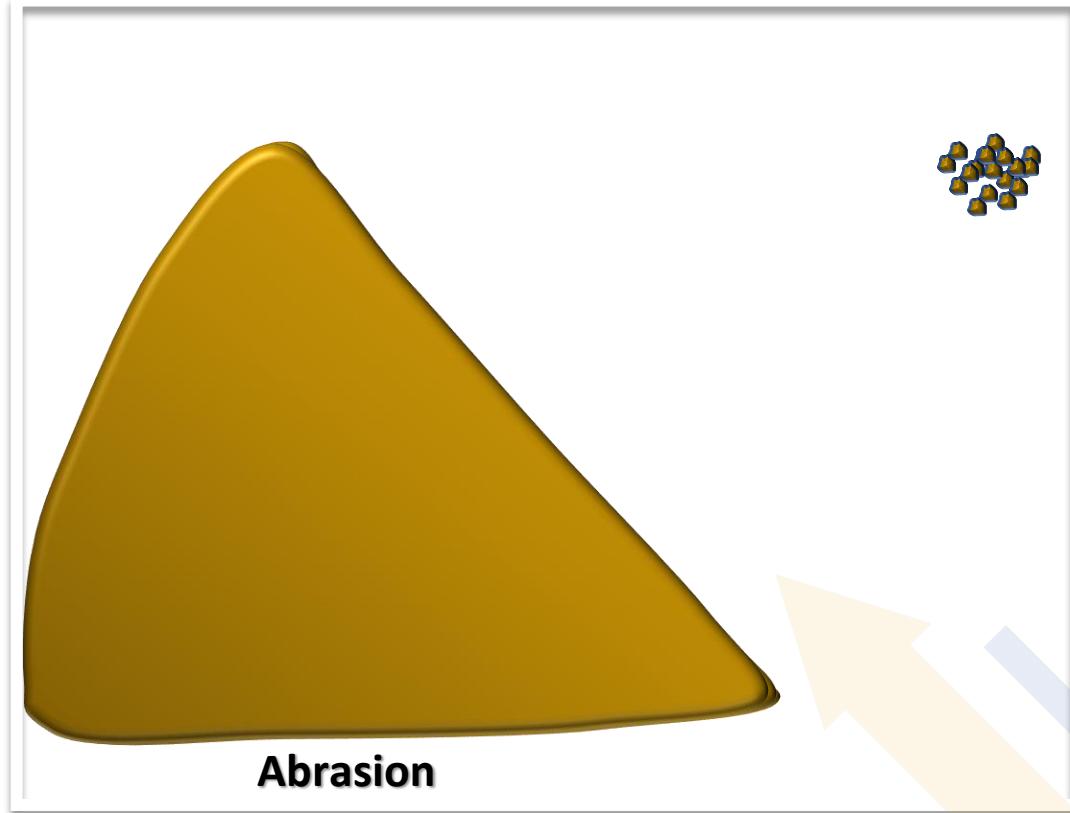
## Waves:

1. Waves are disturbances or ripples formed over sea surface as energy moves from one place to another.
2. Do not involve movement of water particles it is the only the energy which moves.
3. Formed when producing force remains smaller than the resisting force due to which the energy is unable to carry the water particle and is only successful in creating disturbances





# Erosion by the water



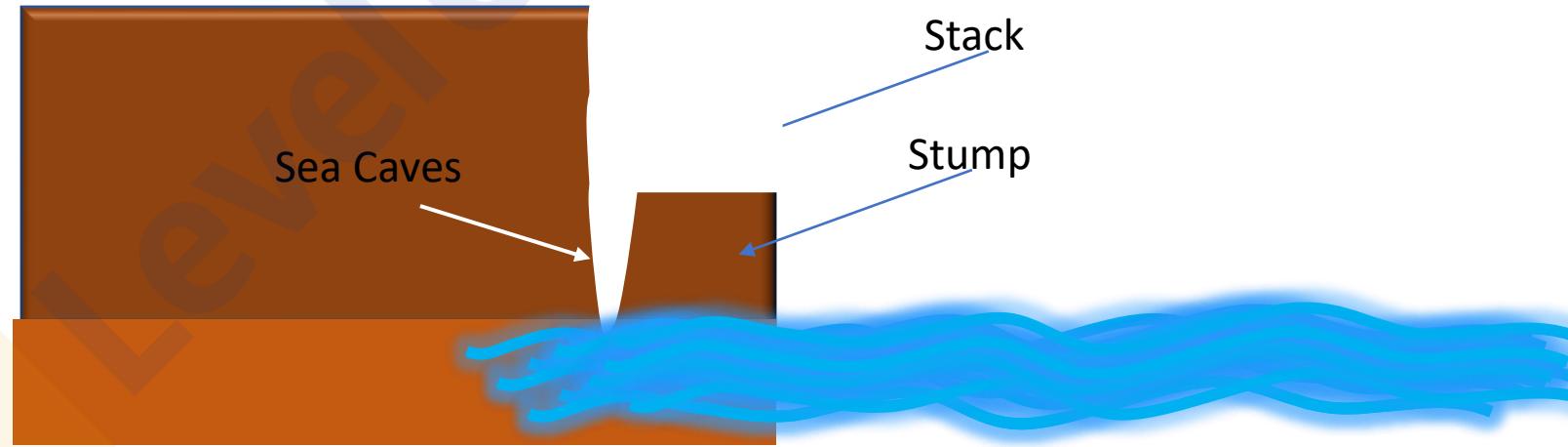
# Erosional Landforms

1. **Wave-cut cliffs** is one of the most dominant erosional landform
2. Almost all sea cliffs are steep
3. At the foot of such cliffs there may be a flat or gently sloping platform covered by rock debris derived from the sea cliff behind. Such platforms occurring at elevations above the average height of waves is called a wavecut terrace.

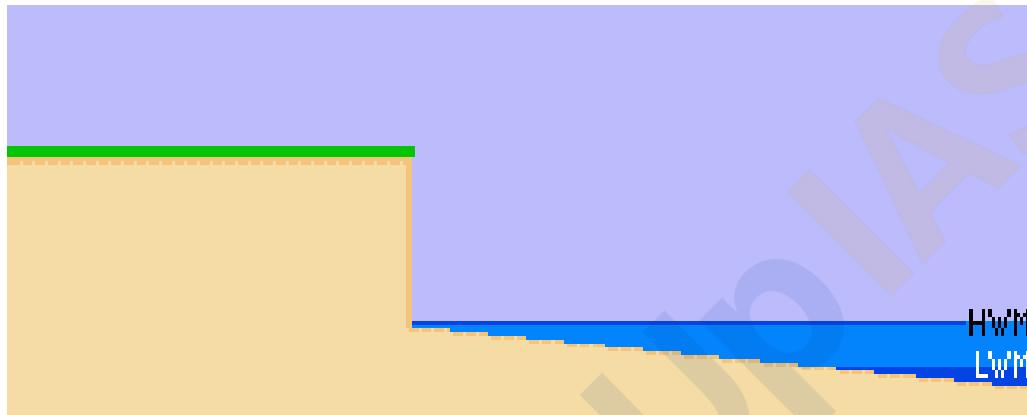


## Cave

1. The lashing of waves against the base of the cliff and smashing of rock against the cliff create hollows and these hollows get widened and deepened to form sea caves.
2. The roofs of caves collapse and the sea cliffs recede further inland.
3. Retreat of the cliff may leave

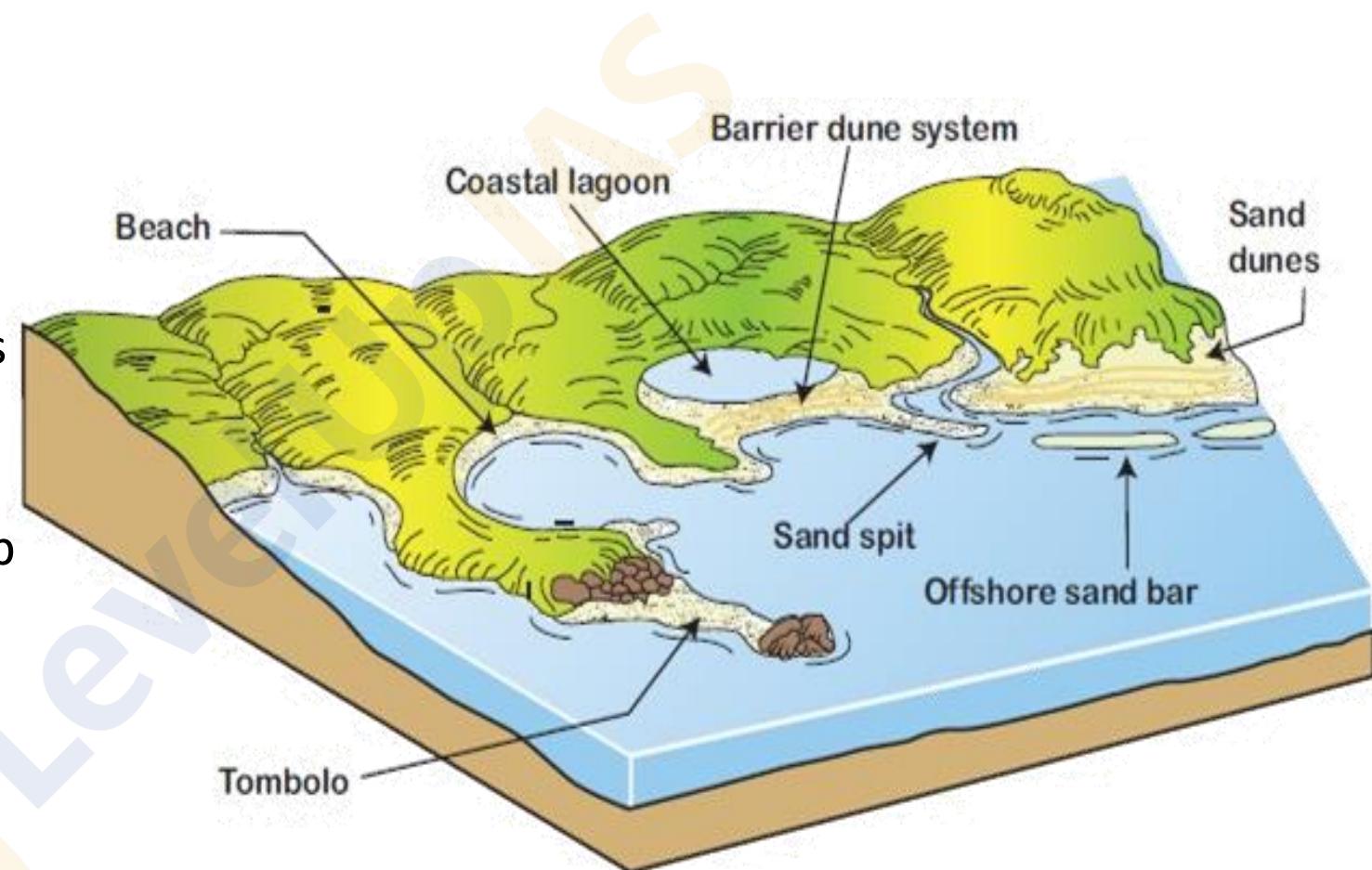


# Coastal Landform of erosion

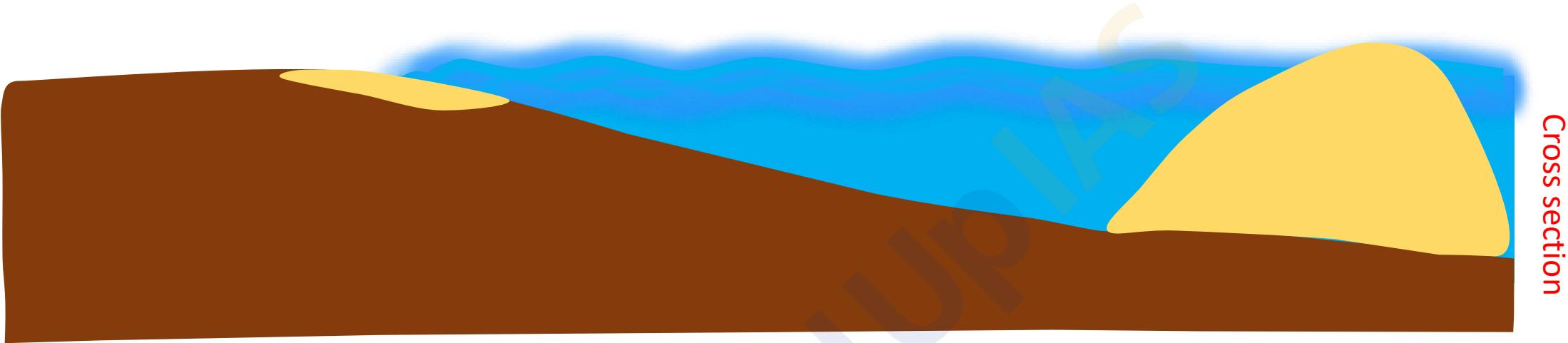


# Formation of offshore Bars/ spits/ Tombola

1. **Offshore Bar:** A ridge of sand and shingle formed in the sea in the off-shore zone lying approximately parallel to the coast is called an off-shore bar.
2. **Barrier Bar:** An off-shore bar which is exposed due to further addition of sand is termed a barrier bar.
3. **Spits:** When barrier bars get keyed up to one end of the bay when they are called spits
4. Barriers, bars and spits developed along a bay can gradually extend leaving only a small opening of the bay **into the sea forming a lagoon.** The lagoons get filled up gradually by sediment



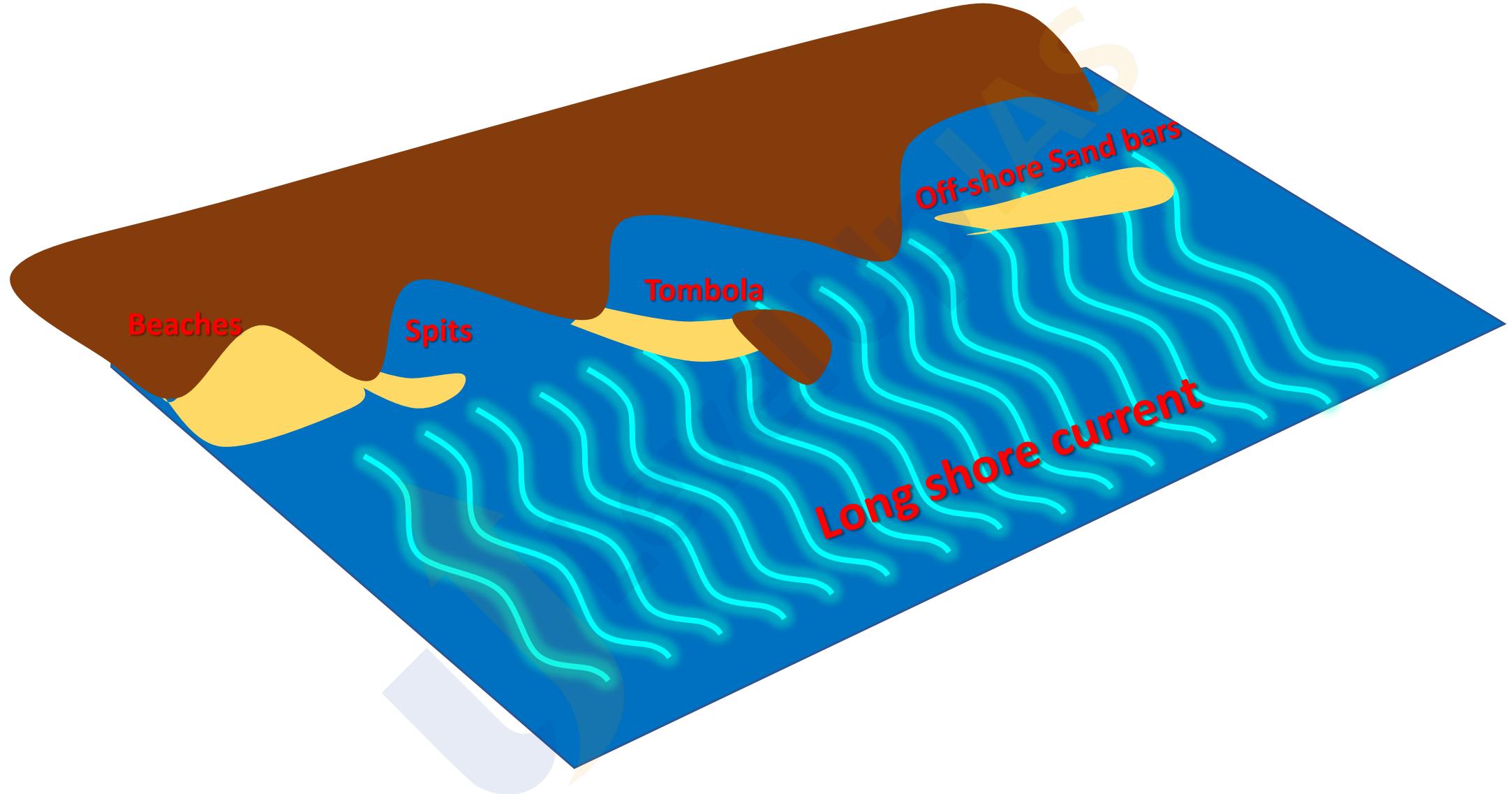
## Formation of offshore Bars/ spits/ Tombola



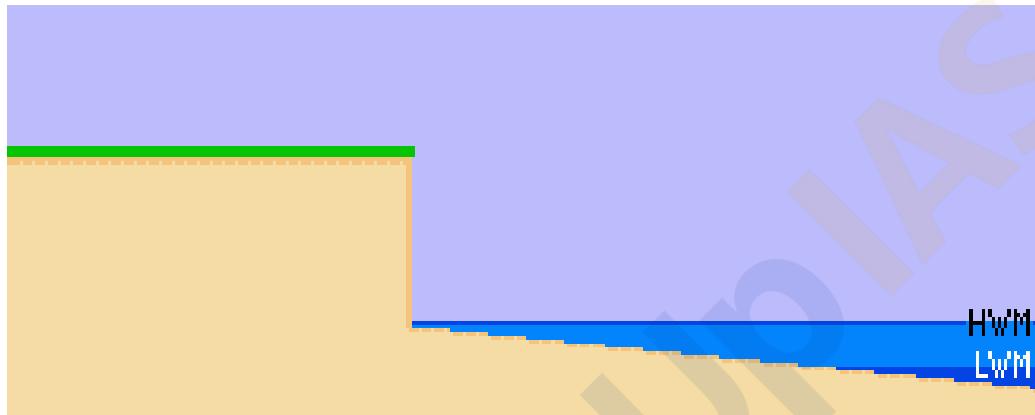
Cross section



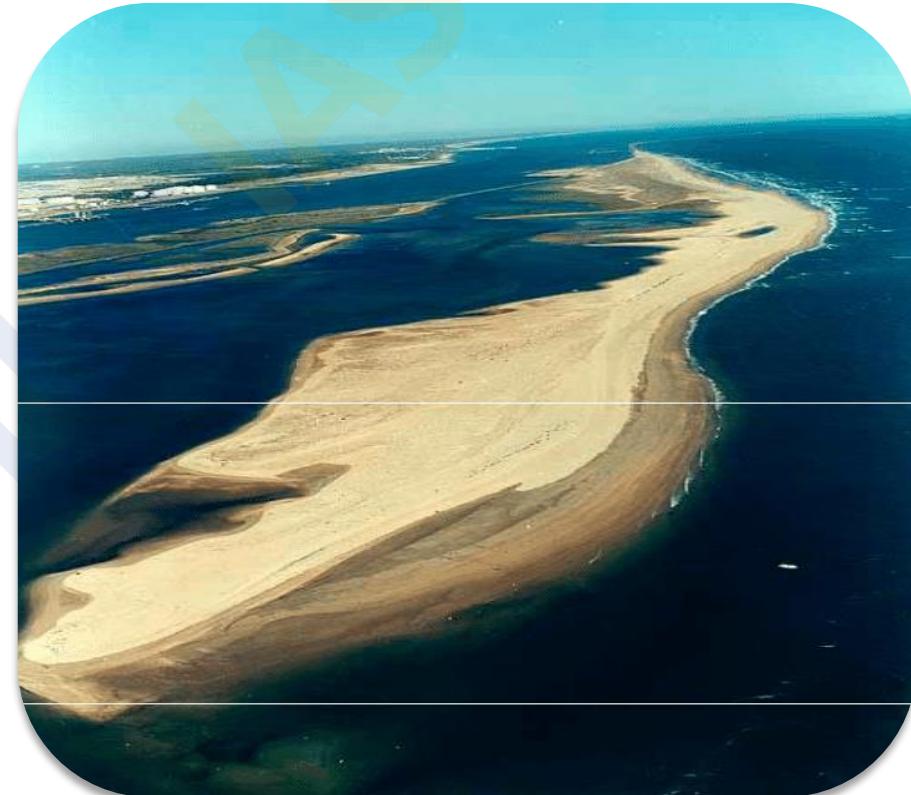
Top view



# Coastal Landform of erosion



# Identify



# Desert

- Nearly 20% of world land's is made up of deserts.
- Characteristics of deserts:
  - Low mean annual rainfall (less than 250 mm)
  - Practical absence of vegetation
  - Very high daily and annual ranges o f temperature,
  - Dust storms, high velocity winds
  - Dominance of sands
  - Occasional torrential rainfall
- Some deserts are rocky, others stony and rest sandy.



**Hamada**

**Hamada el Haroma in Sahara desert, Libya,**



**Reg**

**Serir in Sahara desert, Libya,**

## **Five types of deserts**



**Mountain desert**

**Ahaggar mountains in Sahara desert,  
Algerian**



**Badland**

**Painted desert of Arizona  
USA**



**Erg**

**Calansico in Sahara desert, Libya,**

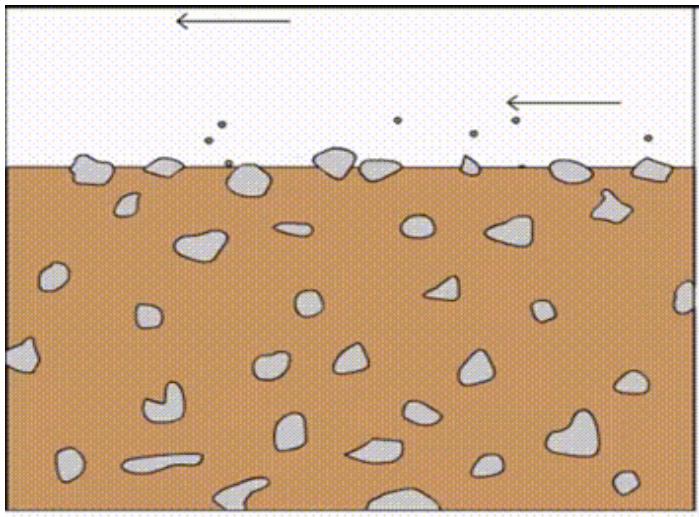
# Weathering of rock



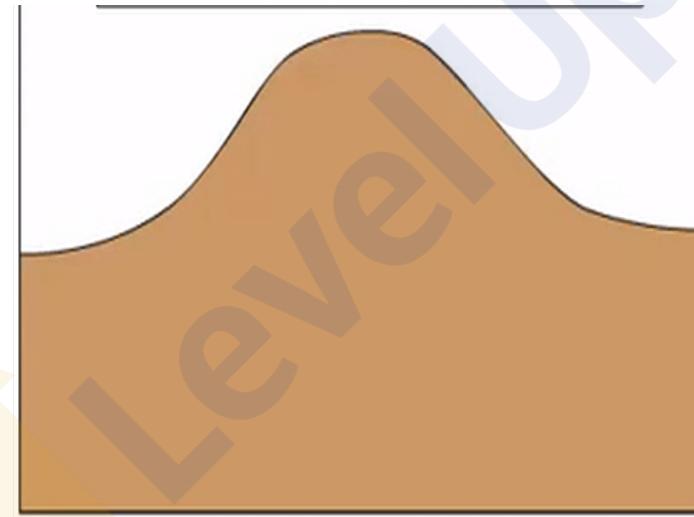
**Onion peeling/ Exfoliation**

- Most potent factor in reducing rocks to sands in the arid region
- Intense heating during day and rapid cooling at night by radiation setup stresses in the rock which eventually crack
- Outer surface of rock is rapidly heated by hot sun while inner rocks remain quite cool
- Heating causes the outer surface to expand and prise itself off from the interior rock in successive layers called as Onion Peeling or exfoliation
- When water gets into crack of rocks the temperature at night suddenly drops and water freezes and therefore expands causing prising of the outer layers

# Wind Erosion: Three ways



**Deflation**



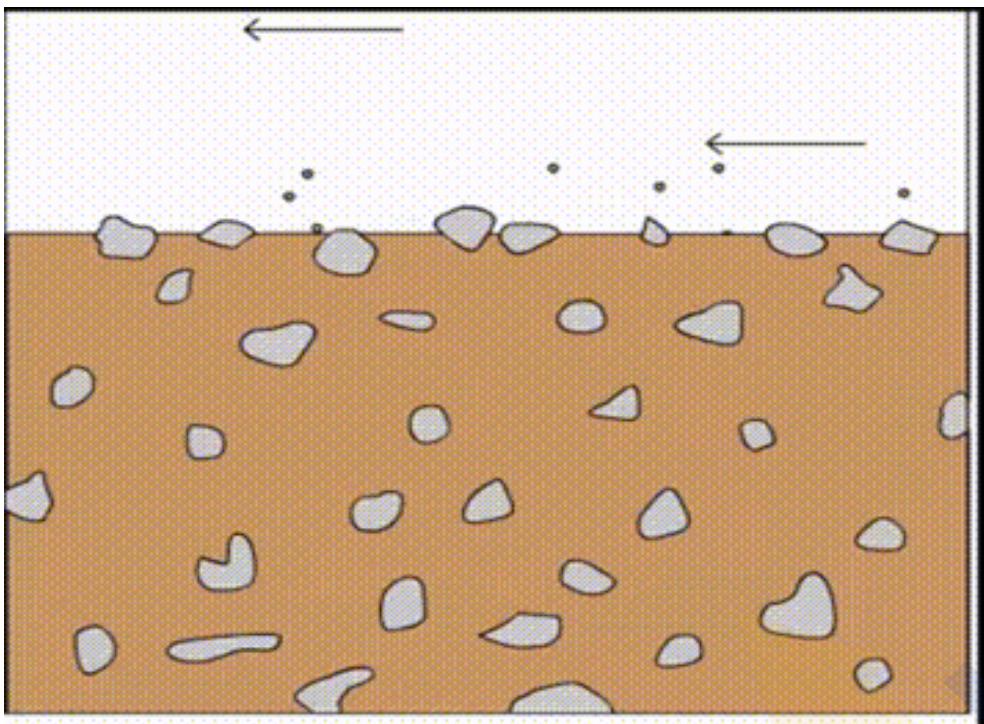
**Abrasion**



**Attrition**

# Deflation

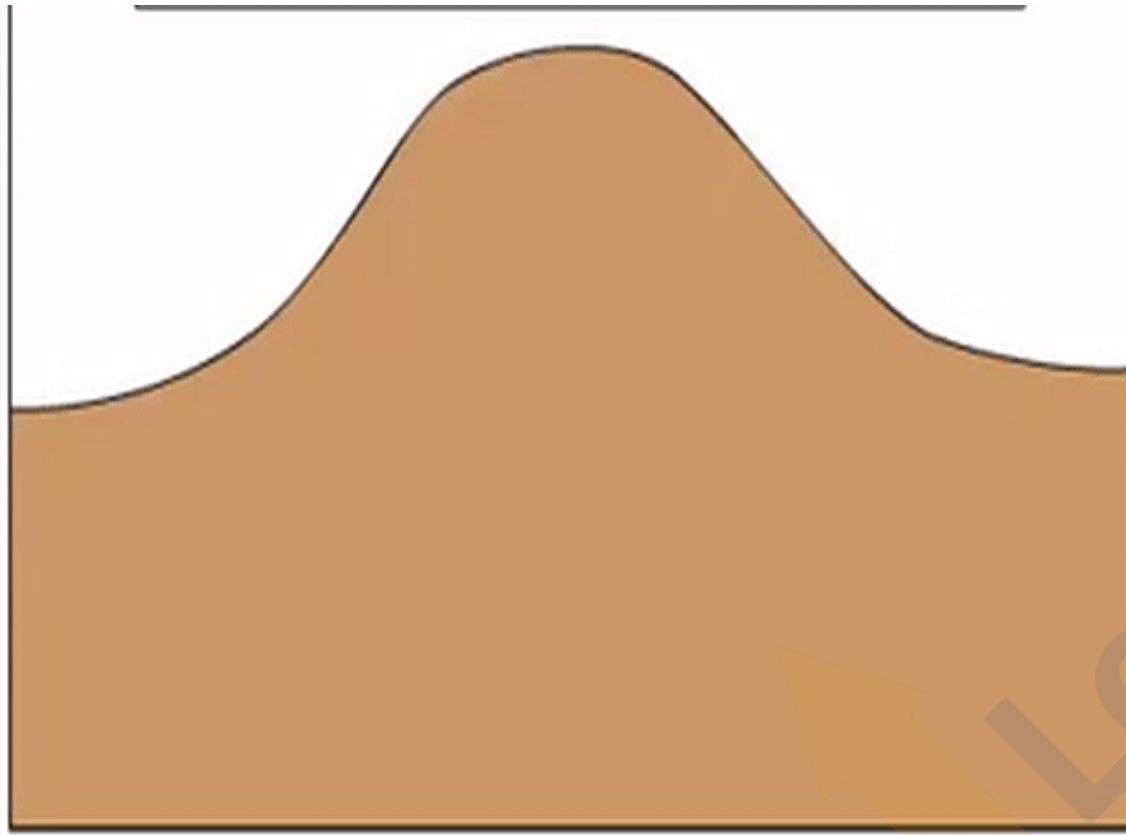
DEFILATION



- Latin word deflatus, which means blowing away
- Process of removing, lifting and blowing away dry and loose particles of sands and dusts by winds
- Long continued deflation removes loose materials forming depressions/ hollows also known as blow outs
- Bedrocks are then exposed to wind abrasion (corrision).

# Abrasion

WINDS



- Wind armed with sand grains acts as tools of erosion attacks the rocks and erodes them
- Also known as sand blasting
- Wind abrasion is minimum at ground level because wind velocity is retarded by friction.
- Beyond the height of 182 cm from the ground level because normal wind cannot lift
- Maximum abrasion occurs at the height between 20-25 cm from the ground surface.
- Abrasion undercuts the upstanding objects from all sides because wind very often changes its direction.
- This explains why Telegraph poles in desert are protected by a covering of metal by a foot above the ground

# Attrition

Attrition



- Mechanical tear and wear of the particles suffered by themselves while they are being transported by wind
- When the particles are moving, they collide against each other and are reduced to finer particles

# Erosional Landforms

Mushroom  
Rocks

Deflation  
Hollows

Ventifacts and  
Dreikanters

Inselberg

Messa..  
Butte..  
Pinnacle



# The Mushroom Rock

THE WHITE DESERT EGYPT

- Rocks having broad upper part and narrow base resembling an umbrella or mushroom
- These mushroom - shaped rocks are formed due to ABRASION
- Base of rock block is abraded vigorously from all sides because of variable directions of wind
- Active abrasion limited to 6 feet height from the ground while the upper part is least affected by abrasion.

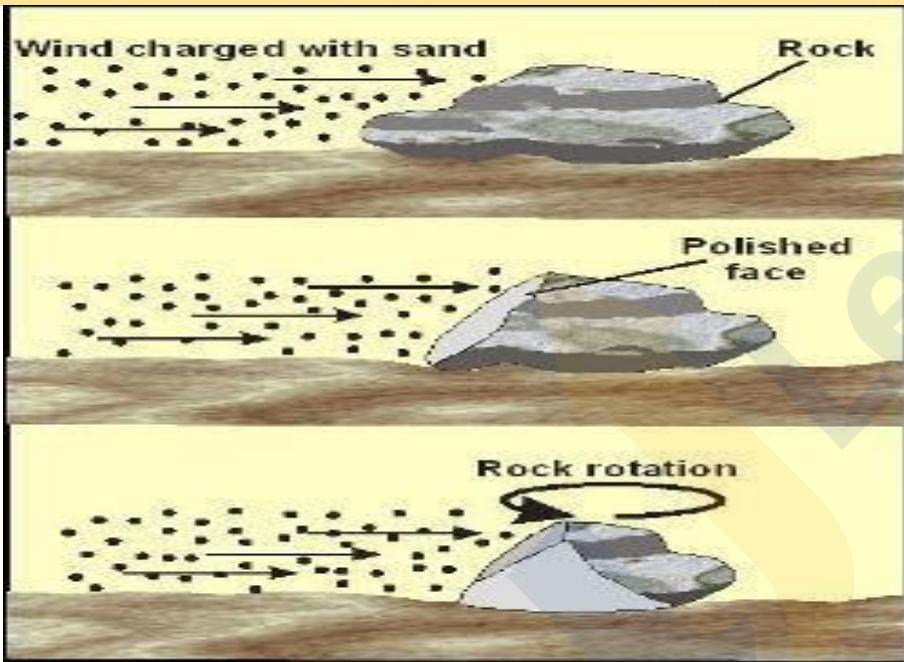


## **Deflation hollows or Deflation Basin or Blow outs or desert Hollows**

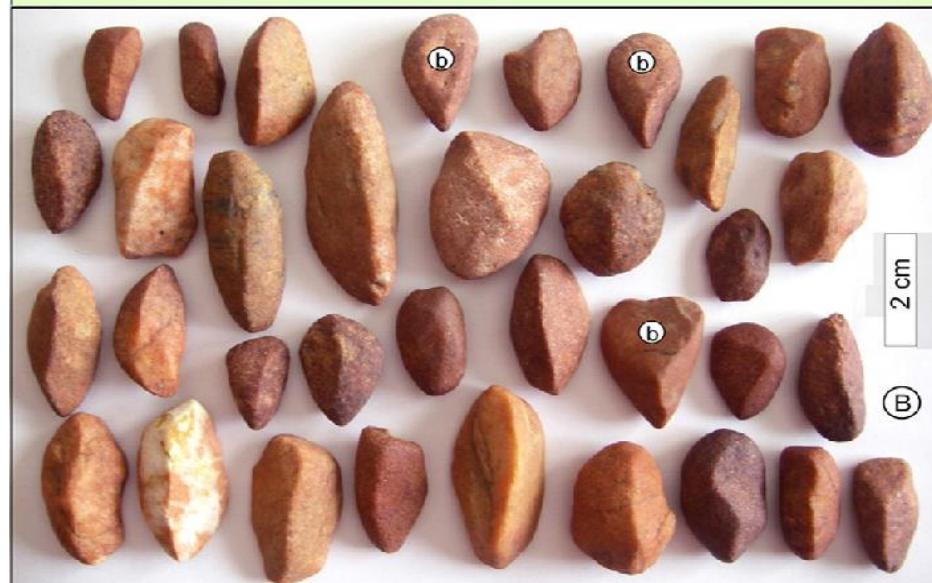
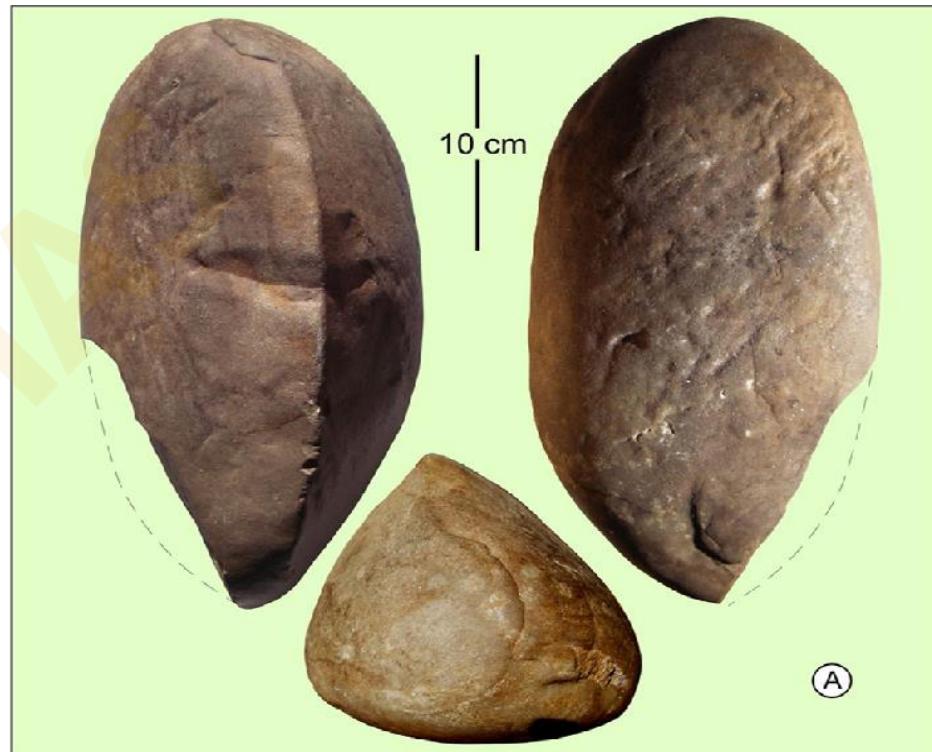
- Depressions in deserts formed due to removal of sands through the process of deflation
- The size of these enclosed depressions varies from smaller ones like 'buffalo wallows' of the American Great Plains to very large depressions such as great
- Qattara depression of Egypt

## ABRASION

# Formation of Ventifact/ Dreikanter



- Faceted rock boulders or pebbles abraded by long periods of wind erosion
- Ventifact or faceted can have as many as eight abraded facets.
- Rock pieces having three abraded facets are called dreikanter
- Boulders with two abraded facets are called Zweikanter.





# Inselberg

Quite controversial landforms.

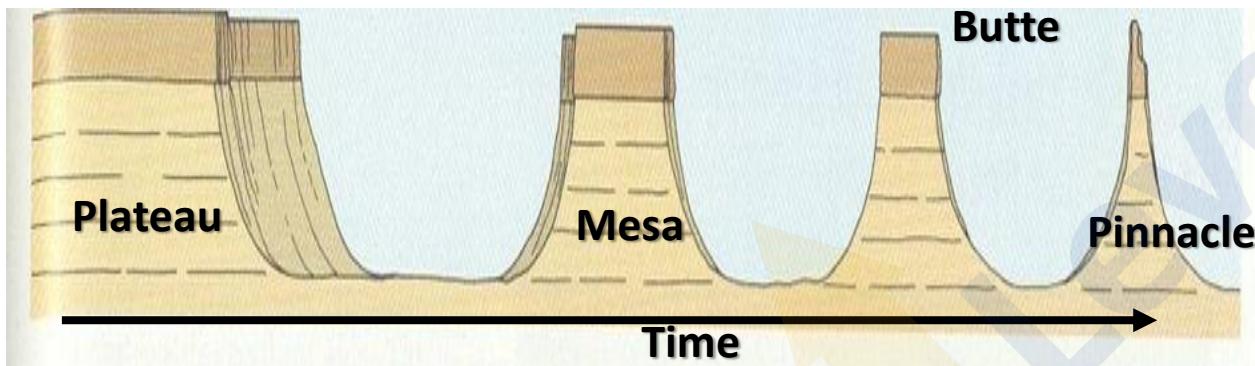
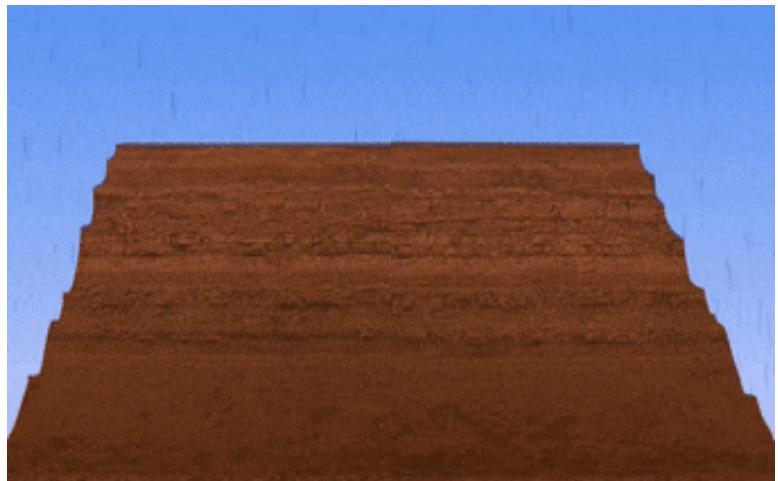
Also known as Bornhardts

Refers to sharply rising residual hill above the flat surfaces

Have steep slope and rounded tops

Are residual hills (remnants of an original plateau) and mounds of relatively resistant rocks (Granitic or Gneissic) in the arid regions

## Formation sequence of Mesa → Butte → Pinnacle



**Monument Valley canyons in Arizona**

Mesa means table

It is a flat table like landmass with very resistant horizontal top layer and very steep sides

Hard stratum on the surface resist denudation and protects the underlying layer of rocks from being eroded away

Continuous denudation through ages may reduce mesa to isolated flat topped hills called buttes

# Deposition and Landforms formed





## **Obstacles at the base of sand dunes**

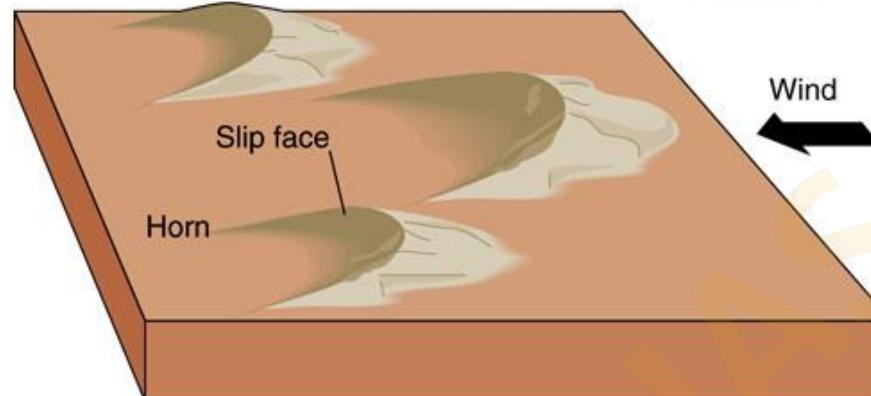
Most of sand dunes are mobile landforms as they generally move forward.

### **Formation of dunes:**

- Begins with the accumulation of sands in form of low sand mounds due to obstruction in the wind speed.
- The mounds then become obstacles in themselves and leads to gradual accumulation of sands
- **Condition for formation:**
  - Abundance of sands
  - High velocity wind to transport huge quantity of sands
  - Obstacles of trees, bushes, forests to trap the sands
  - Suitable places for the accumulation of sands

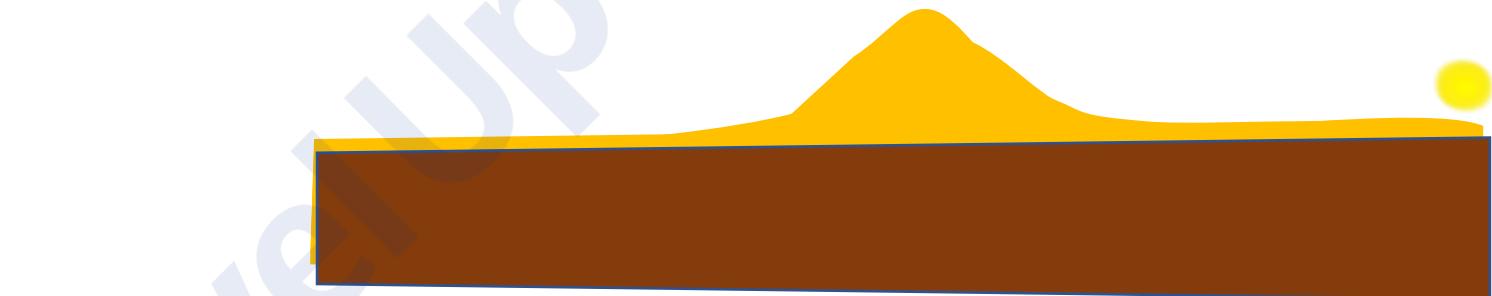
# SAND DUNES

1. Crescent shaped dunes called barchans with the points or wings directed away from wind direction i.e., downwind, form where the wind direction is constant and moderate and where the original surface over which sand is moving is almost uniform.

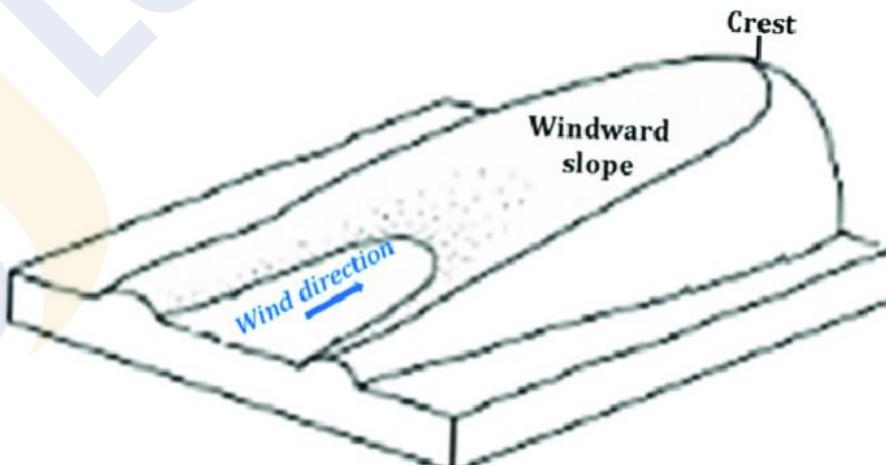


A Barchans

2. Parabolic dunes form when sandy surfaces are partially covered with vegetation. That means parabolic dunes are reversed barchans with wind direction being the same.

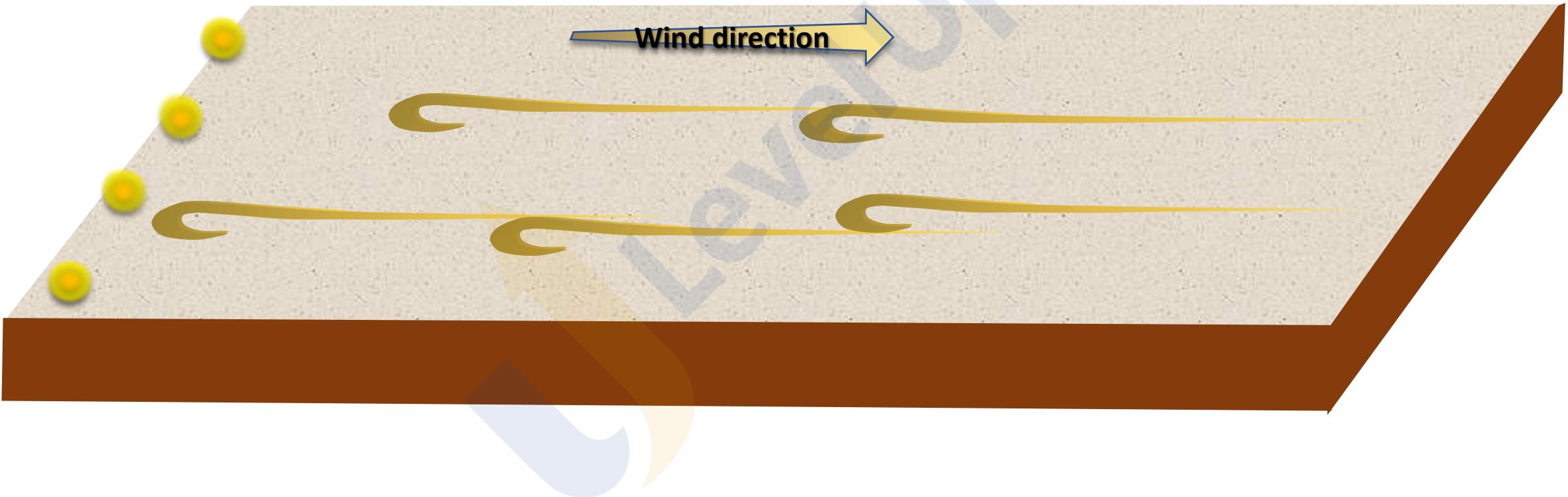


Eddies



# SAND DUNES

**Seif is similar to barchan with a small difference.** Seif has only one wing or point. This happens when there is shift in wind conditions. The lone wings of seifs can grow very long and high. Longitudinal dunes form when supply of sand is poor and wind direction is constant. They appear as long ridges of considerable length but low in height.





# LOESS

Refers to fine loam and thick deposits of fine grained sediments found beyond the desert

Are found at very distant places from the source areas of sediment

It is yellow friable material usually very fertile

It is very coherent and extremely porous

Initial reliefs are eliminated due to deposition of loess and the depositional surface becomes featureless.

The loess terrain can develop huge ravines and gullies leading to formation of badland topography.

Most extensive loess deposit is found in Hwang Ho Basin.

Chinese loess is yellow in colour, very soft and impermeable.



LevelUp IAS

# Sociology

Foundation Batch 2.0

CSE 2024

by **NISHAT SINGH**



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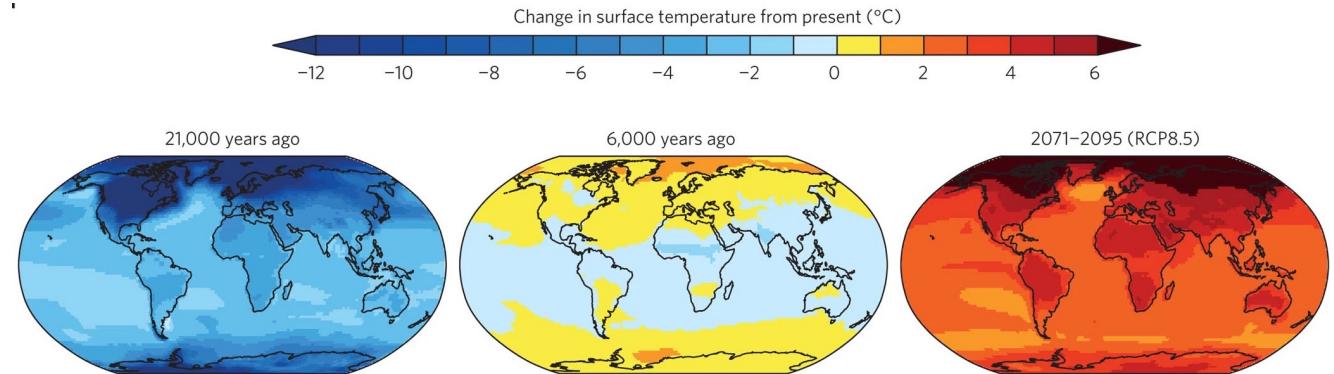
# Continental Drift Theory: Background

## Debate: Major Variation in Earth's Climate

- The continental drift theory was proposed by Wegener to explain major variations in the earth's climate.

The cause for such variations can be-

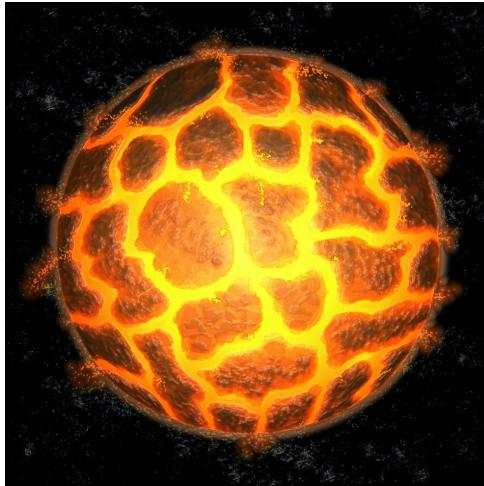
- The continents remained stationary, while the climatic zones changed.
- The climatic zones remained stationary and the continental land might have displaced.
- As Wegner did not find any evidence of changes in climatic zones, he proposed continental drift as the reason.



# Continental Drift Theory: Background

## Debate: Academic Debate

- Debate about the permanency of Earth's Crust
- How did the crust form?
- How did the ocean and continent differentiate?
- How did ocean and continents change in time and why?
- What was the nature of the first crust and the first ocean and the continent?
- How did the landforms in ocean and continents differ?



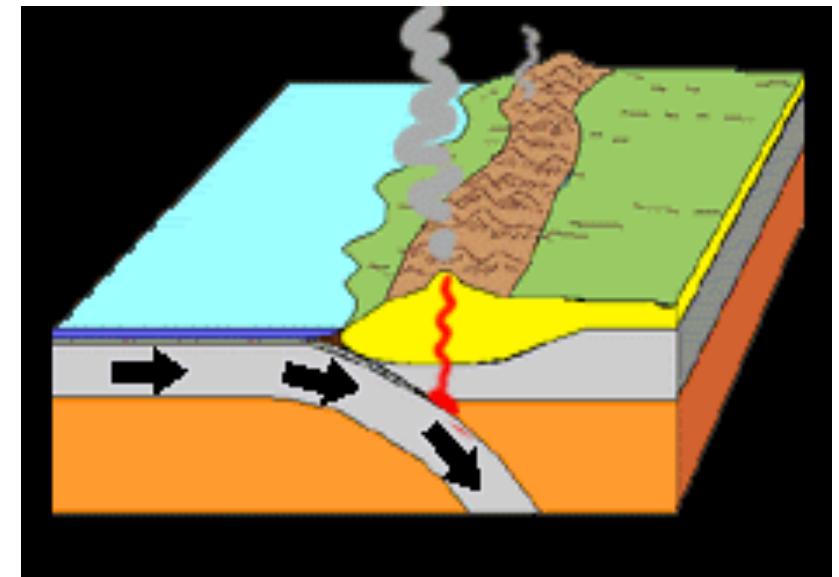
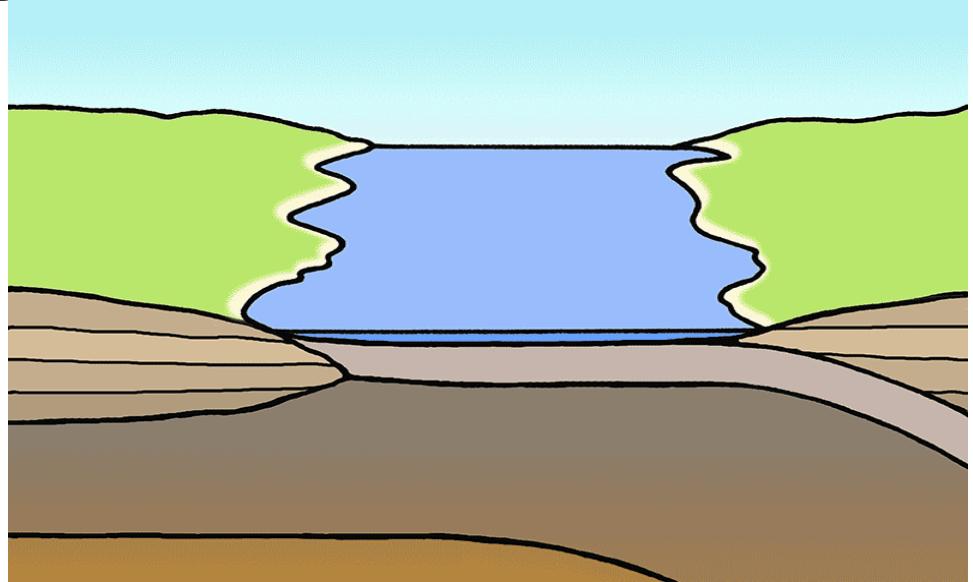
# Continental Drift Theory: Background

## Debate: Academic Debate

- What is the mystery of the fold mountains?

**Fold mountains:** Composed of marine sediments and have long linear chain of mountain. Fold Mountains are unique to the earth and understanding fold mountain is like understanding the evolution of the crust.

Earlier Interpretation:  
Mountains are the wrinkles on the earth's surface associated with the cooling.



# Ideas prevalent at that time

## Older Idea:

- Ocean and continents were like what they are today and oceans do not move and change. This is called as the permanency of the ocean and the continents.

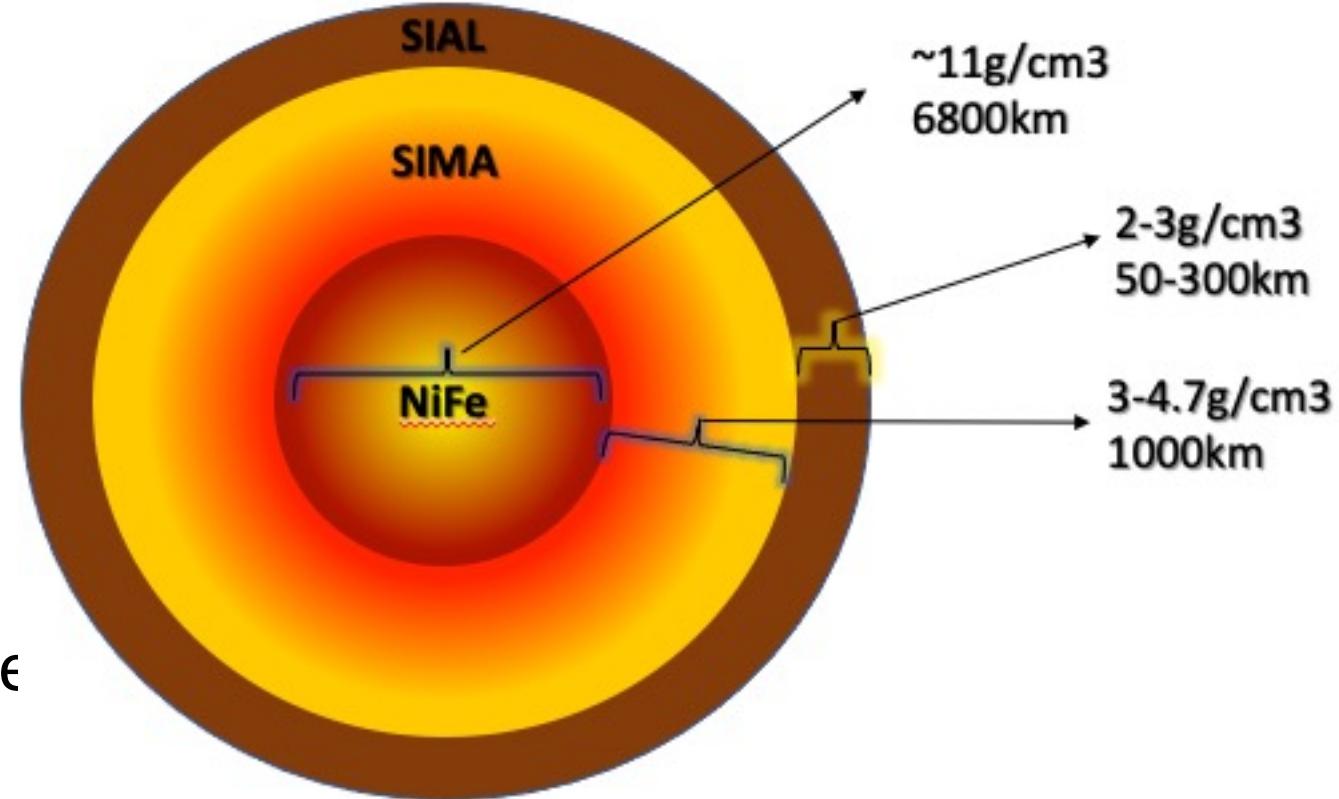
**Newer Idea:** Some of the observation from the voyages of 14th and 15th century mentioned that continents and oceans could have been broken and moved.

1. Matching coastline of South Atlantic
2. Eastern coastline of South America seems to be matching with the western coast of Africa
3. Coal fields of USA in Appalachian in East match with the coal fields of Western Europe (Pennines)



# Assumptions:

- He proposed three layers of the earth with
  - Outer SiAl,
  - Intermediate SiMa,
  - Inner NiFe.
- SiAl was the continental mass whereas Oceanic crust was SiMa.
- SiAl masses were assumed to be floating on SiMa without any resistance.



# The postulates

Super continent– Pangea,  
Super ocean – Panthalassa

Fold mountains, islands  
volcanos and earthquakes are  
result of SIAL floating over SIMA

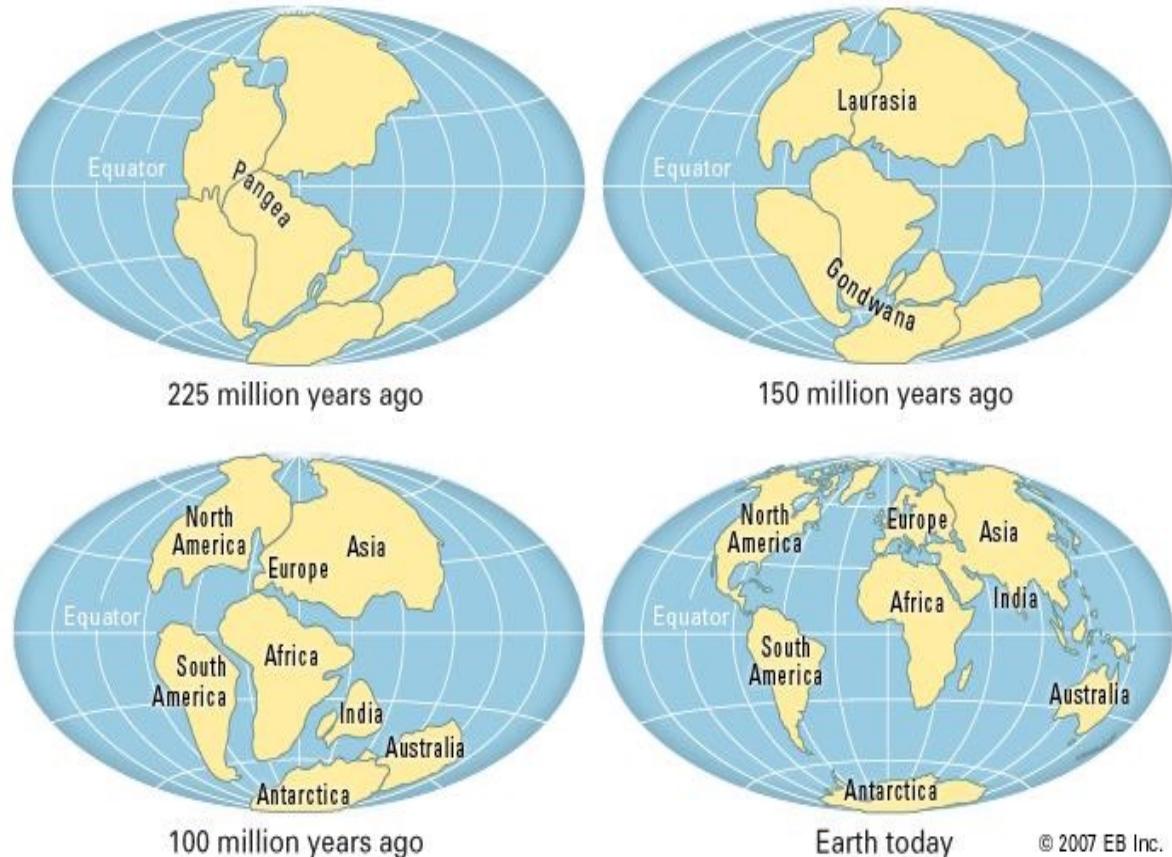
Pangea was mostly in southern  
hemisphere

mid Mesozoic era → it broke and  
drifted apart.

- Northern part- Angaraland/ Lauresia
- Southern part- Gondwanaland.
- In between lies – Tethys sea

# Theory:

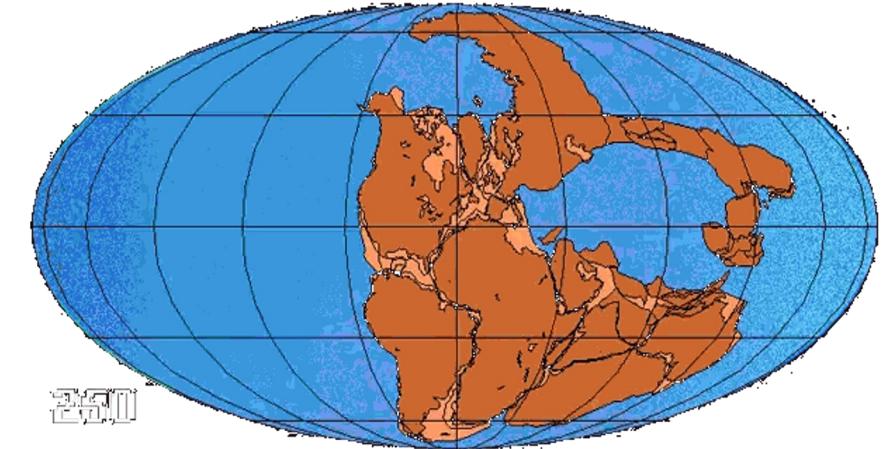
- Proposed by **Alfred Wegner** in 1912
- During the Carboniferous period (250 million years ago), there was only one supercontinent (Pangea) and a single ocean (Panthalassa)
- Pangaea consisted of all the present continents merged together.
- This Supercontinent started to split during the Mid Mesozoic period (230-180 million years ago) into Angaraland /Laurasia (North ) and Gondwanaland (South). The water body separating the two was Tethys sea.
- The northern portion i.e. Angaraland consisted of North America, Greenland, and Eurasia without India and Arabia.

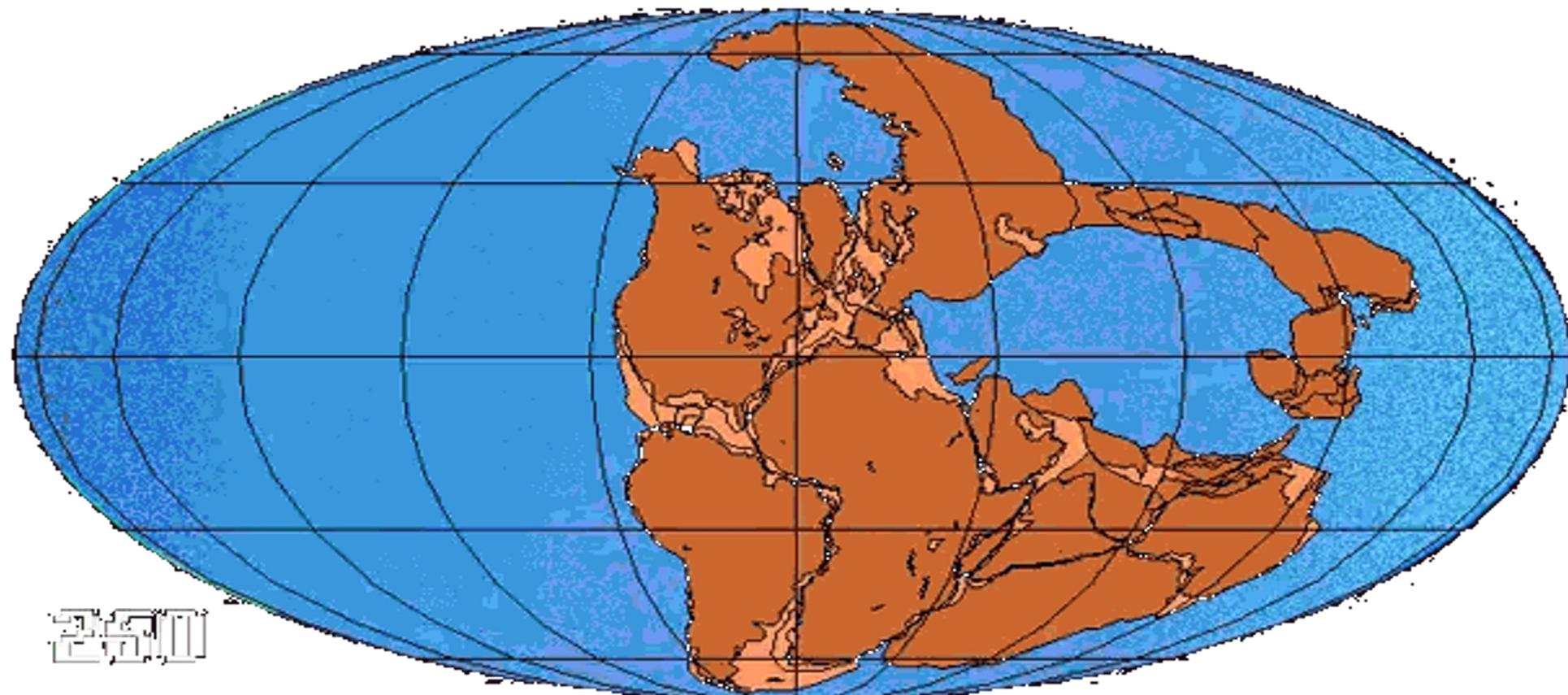


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# Theory:

- The Gondwanaland consisted of Africa with Arabia, South America, India, Australia, and Antarctica.
- Gradually, there was a separation in North America from Eurasia and South America from Africa as Laurasia started to move towards the West.
- India started moving towards the North, Australia got separated from Antarctica and moved towards North
- Around 20 MYA, Arabia got separated from Africa and merged into Asia
- As continent moved and scrapped the ocean floor, the ocean floor got broken and deformed. This lead to Earthquake, Volcano, Mountain Building.

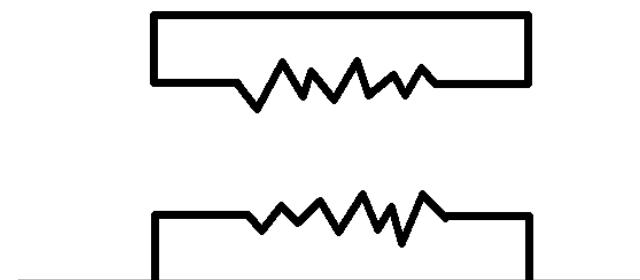
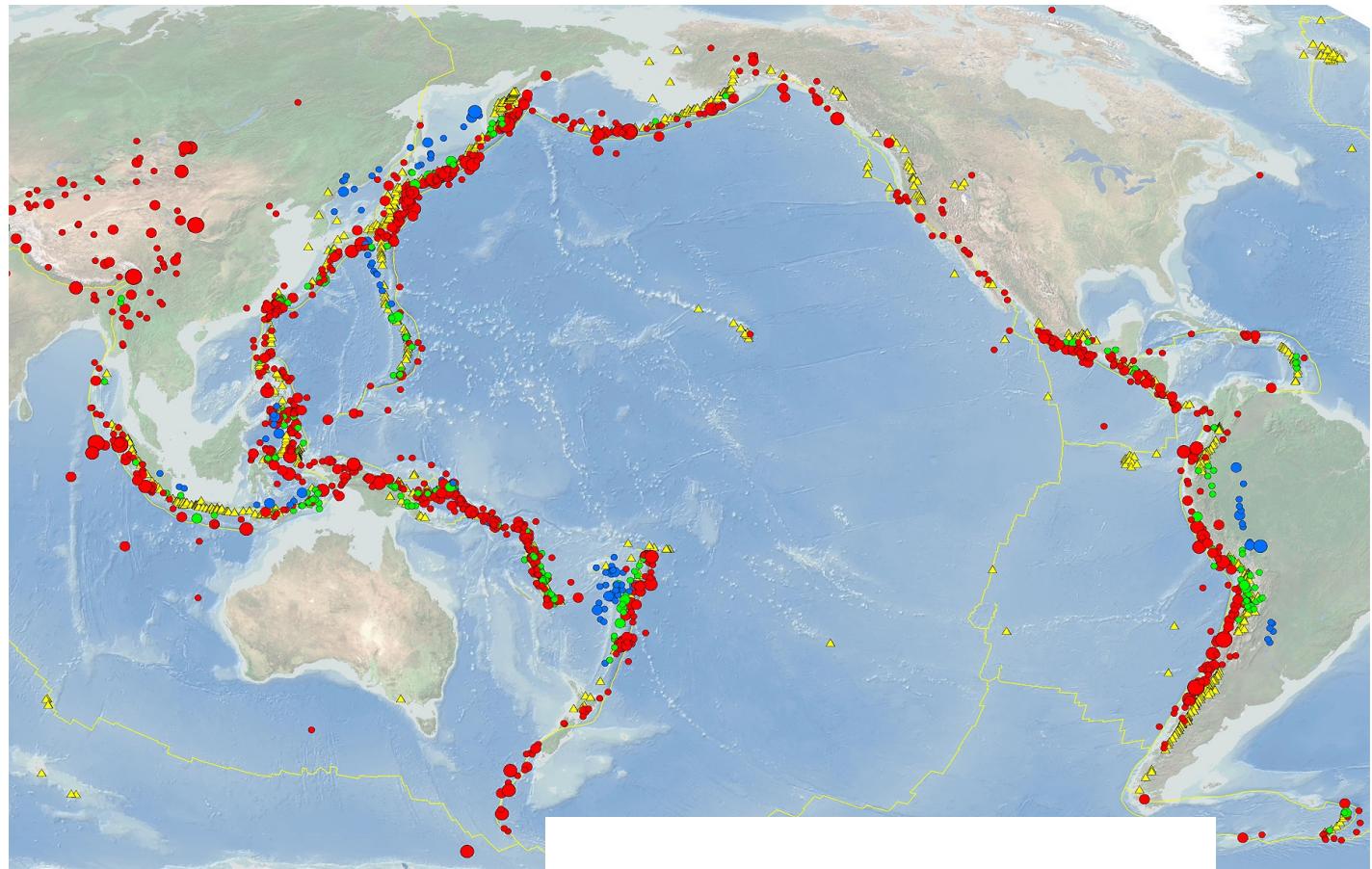




# Wegener's explanation of Volcanism and Earthquake

1. As Sial is hard, brittle and light. It floats over SiMa and can get deformed, split and can cut the ocean floor. The rupture on the ocean floor results in volcanism on the ocean floor

2. While scrapping Sial over Sima, there are disturbance leading to Earthquake



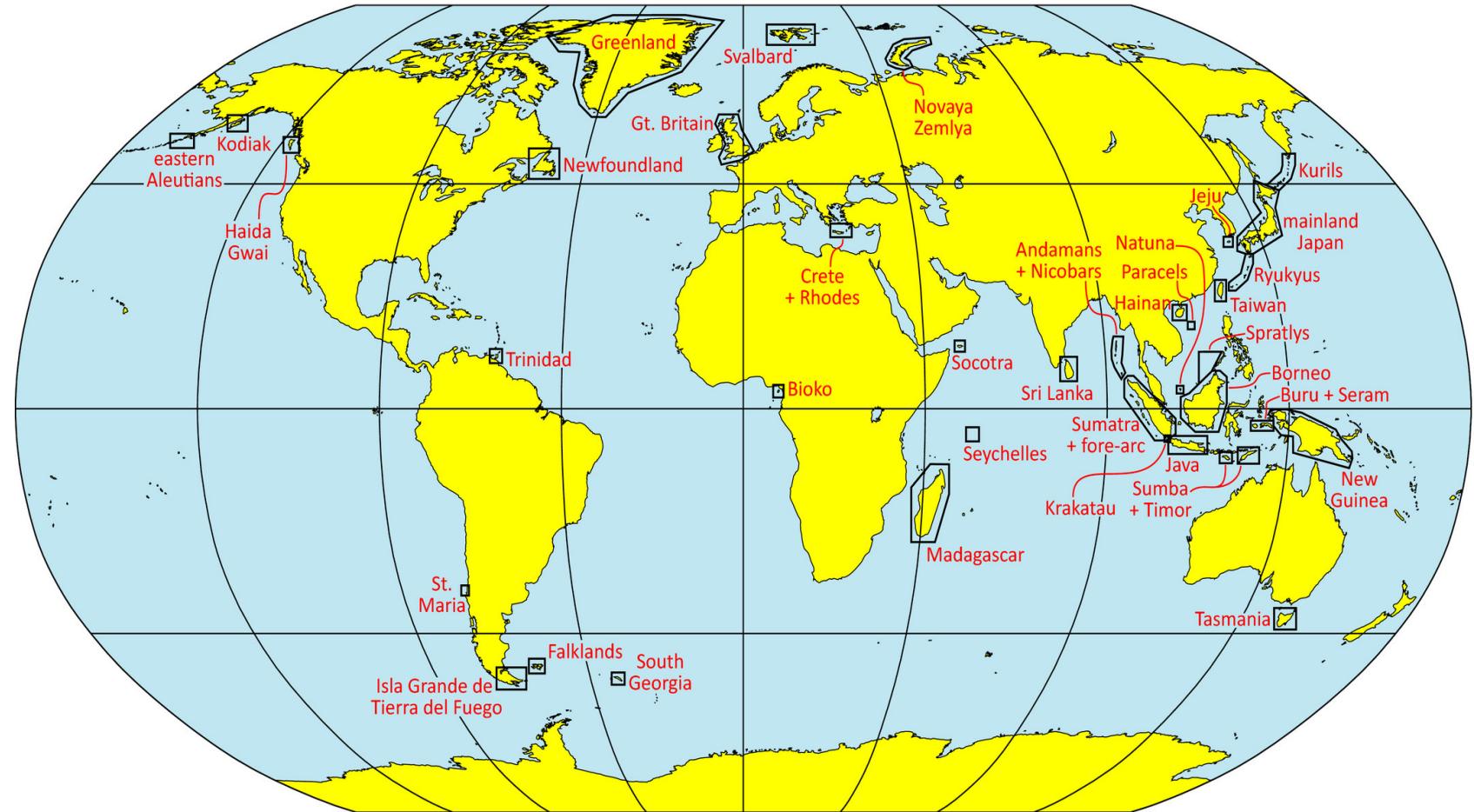
# Wegener's explanation of Fold Mountains

SiAL scraps the ocean floor and accumulates the sediments on the leading edge. The sediments are marine sediments at the pile up and form the fold mountains on the edge of the continents.



# Wegener's explanation of Islands

- As SiAL floats over the SiMA.
- SiAL are subjected to tremendous drag and friction the trailing edge break off to form the islands.
- Trailing Edge is unable to keep pace with the leading edge and hence breaks off.
- Wegner used this to justify the continents moving north and westward with an evidence at all the major continents having islands are at the South East corner.



## Evidences

Jigsaw fit

Structural fit/rock  
similarity

Fossil evidence

Paleo climatic  
evidence.

# Evidence:

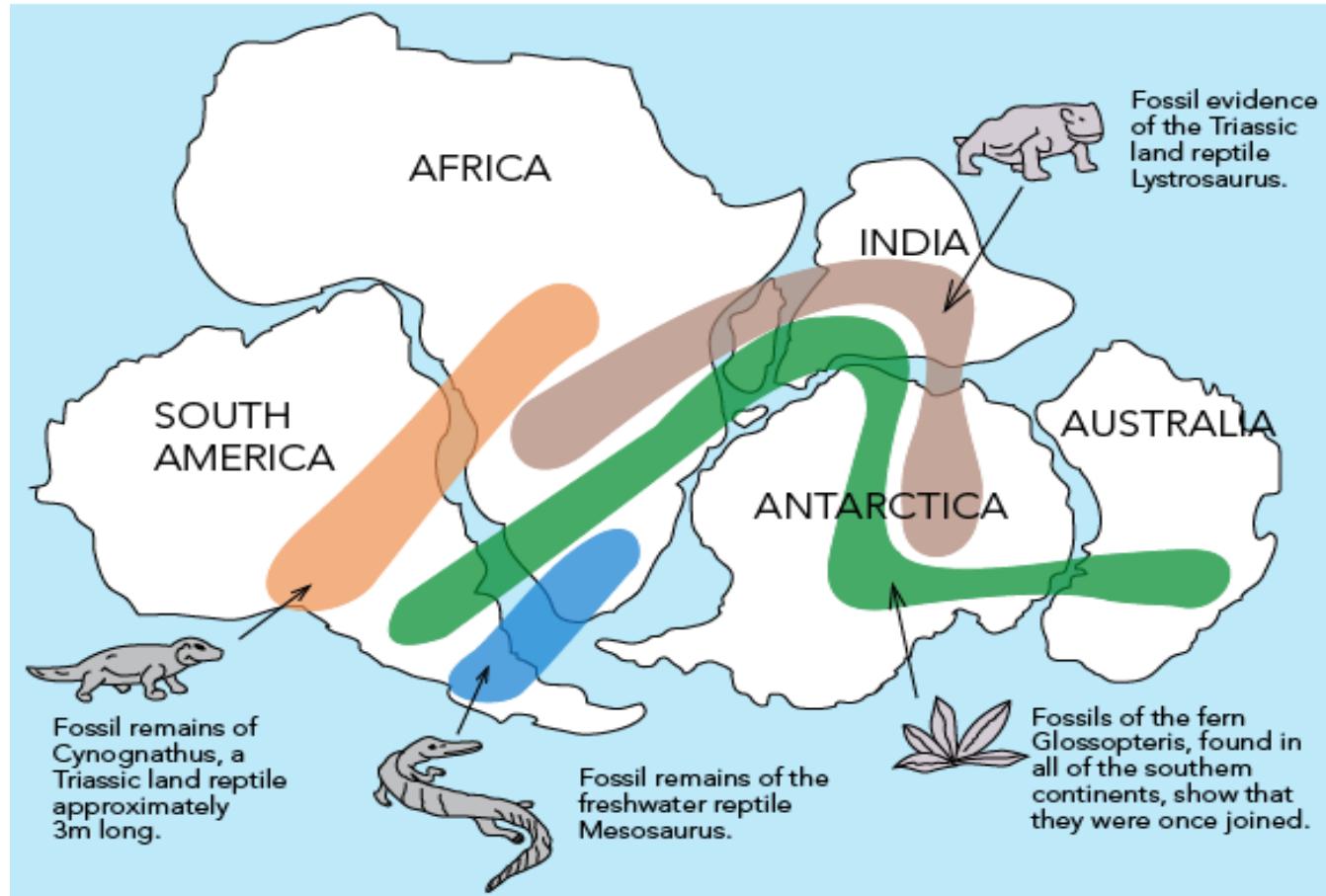
- 1. Jig Saw Fit:** Fitting shape of the coastline of the continents like the eastern side of the South America coast fits into the western Africa
- 2. Stratigraphic Evidence:** not only the shape match the rock type and the rock age also matches on the either side of the Atlantic Ocean
- 3. Structural Evidence:** Eastern Brazilian Highlands and the Borborema plateau seems to extend into the gulf of Guinea and the Loma mountains. Gold seams of Ghana has a match with those of the Brazil. Patagonian plateau has a structural similarities with Angola highland. Guyana highland seems to fit into Fouta Djallon and Loma mountains.



# Evidence:

## 4. Fossil Evidence:

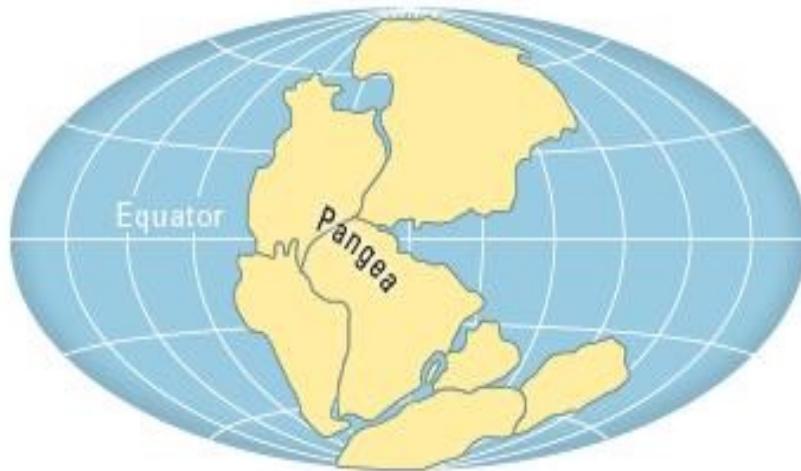
- **Mesasaurus**, an aquatic reptile whose fossil remains are found only in eastern South America and South Africa. Had it been able to swim across the vast Ocean, it should have been widely distributed.
- The fossils of **Glossopteris**, a fern grown only in supolar climate are now found in warm climatic regions separated by wide Oceans.
- **Fossil of Lystrosaurus**
- **Fossil of Cynognathus**



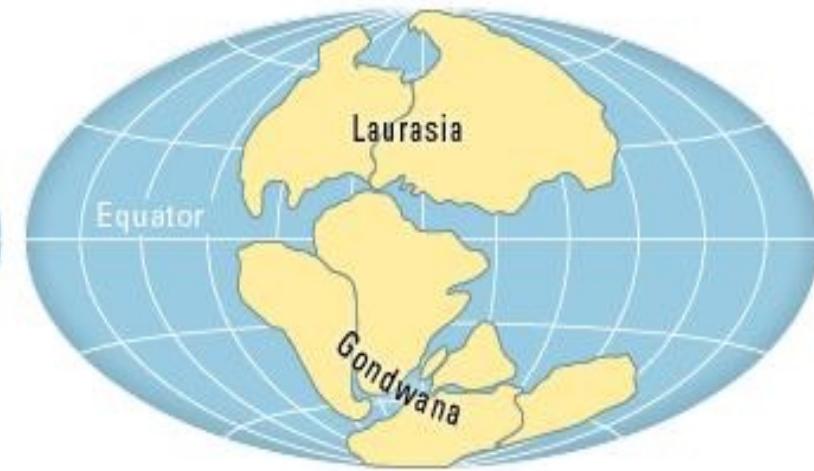
# Evidence:

- Fossil Evidence:  
Wegner's Explanation:

Wegener concluded that the continents must have been together and lifeform must have evolved at some location with continental breaking and the continental drift. Lifeform and their fossil remains must have got distributed in the typical distribution.



225 million years ago



150 million years ago



100 million years ago



Earth today

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# Evidence: Paleo Climatic Evidence

## Distribution of Coal:

Richest coalfield of the world: Appalachian, Newfoundland, Pennines. The northern cool dry climate and not the dense forest of today have richest coal fields.

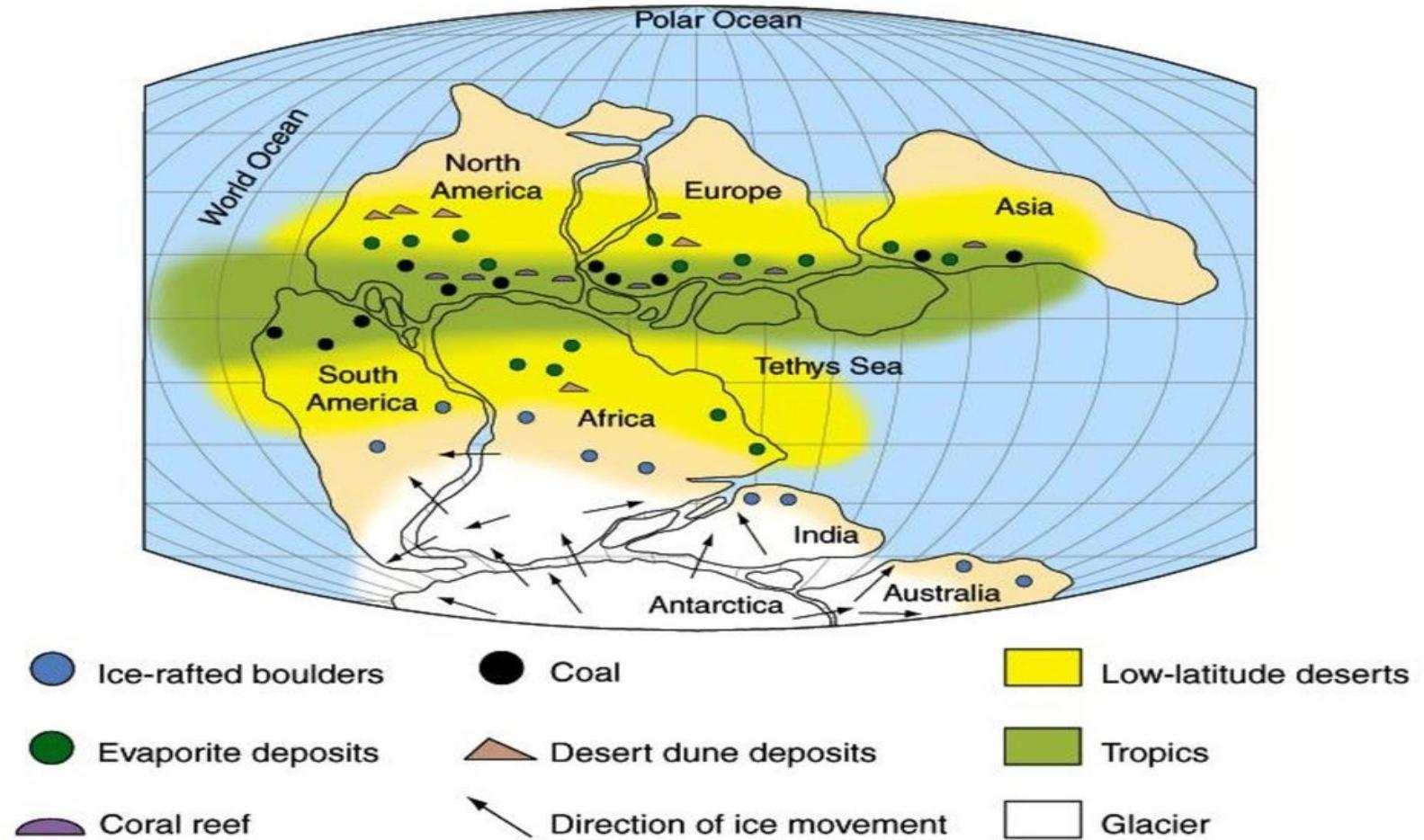
While African and South America almost no coal fields despite dense Equatorial forest there is no coal, India's coal is also of poor quality.



# Evidence: Paleoclimatic Evidence

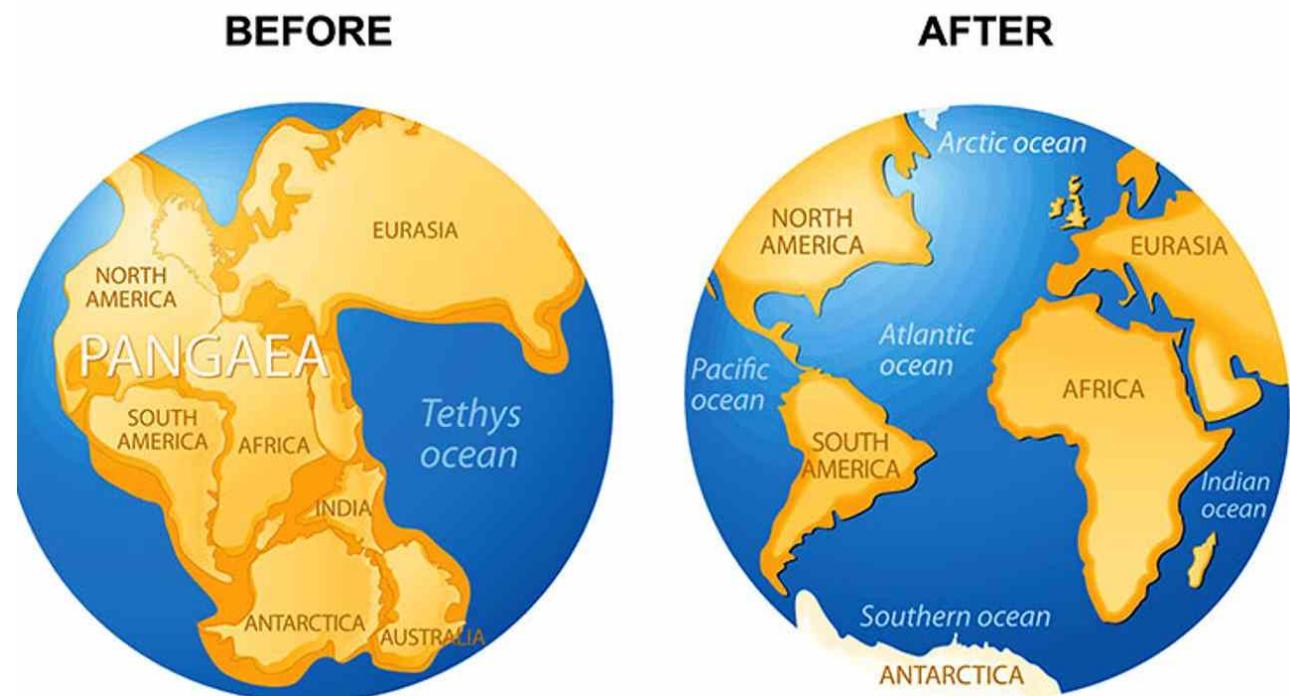
## Glacial Till:

The similarity in the glacier and the Permafrost evidence of the glacial till and the Moraines of South America Africa and Antarctica. Parts of southern and the central India also have glacial erosion evidences and are of same age deposits of the South America and Durban. This seems to be climatic anomaly as India is in the tropical latitude.



# Paleo Evidence are climatic Anomaly

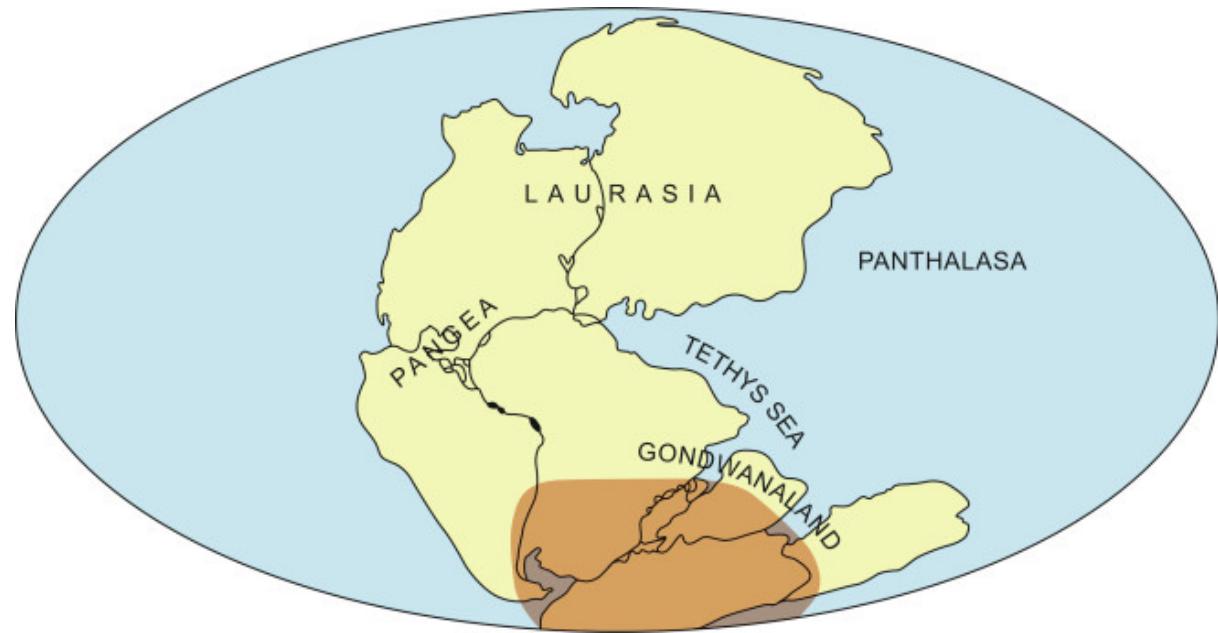
1. The northern temperate latitudes have coalfields indicating warm conditions unlike what they have today
2. The southern tropical latitudes have evidence of glaciations in Patagonia Durban and India. This is another climatic anomaly.



# Evidence:

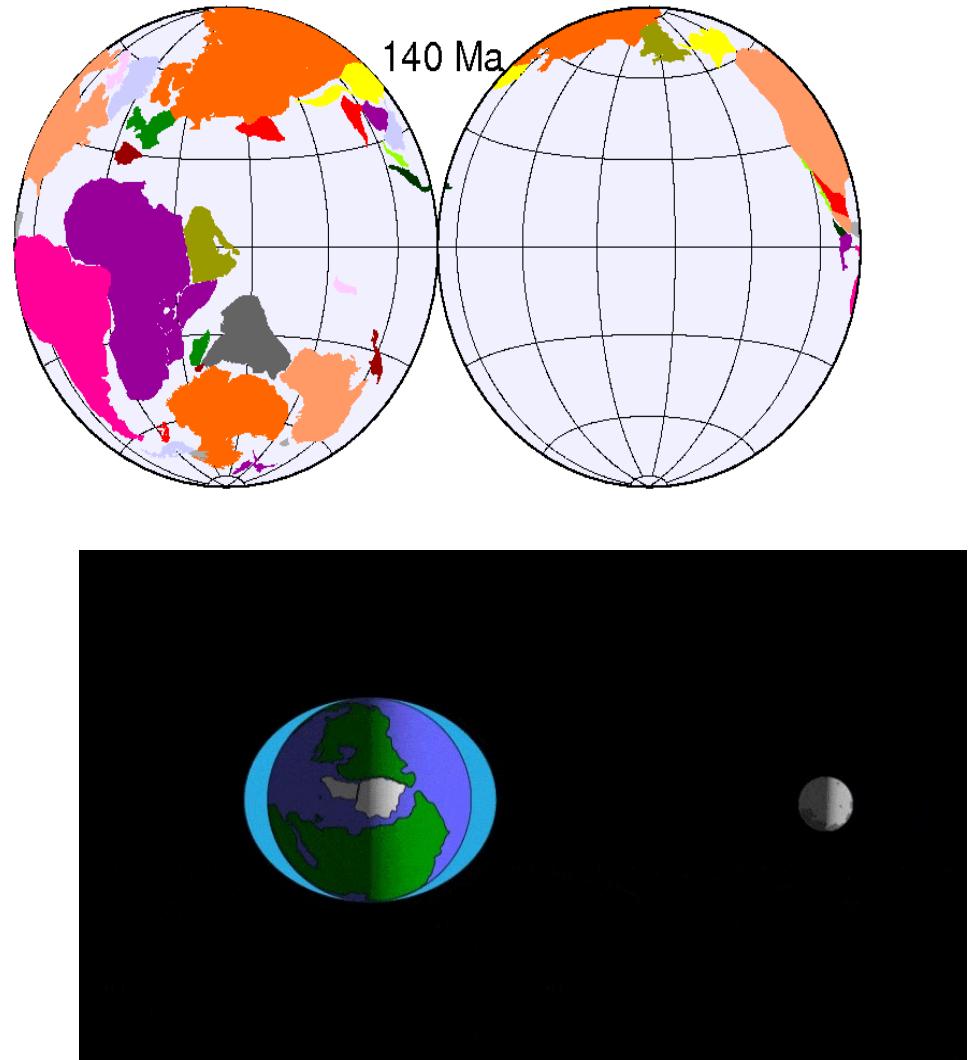
## Paleo Climatic Evidence: Wegner's Explanation:

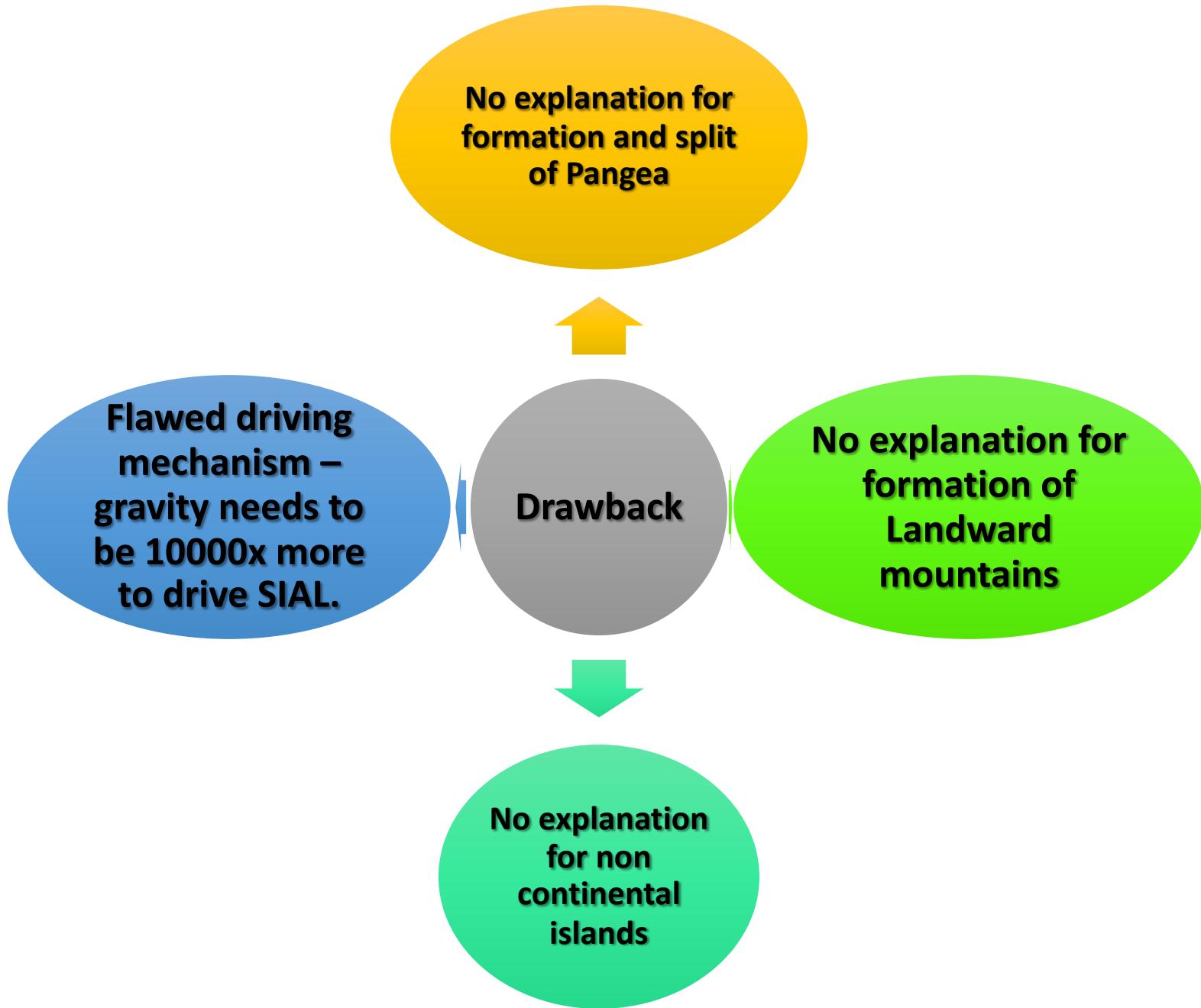
- Wegner explained that the continent is a part of Pangea was once together and located in the southern hemisphere.
- So the northern temperate locations were once in the southern latitude with warm wet conditions that forms the coal fields and
- The tropical locations of today were more close to the South poles and therefore have glacial evidences.
- Paleo-Climatic evidence are one of the most convincing evidence for the continents to have drifted



# Forces:

- The forces suggested by Alfred Wegner as the cause of continental motion-
- Equatorward or North-South movement caused by the Pole-fleeing force due to Gravitational differential force and the force of Buoyancy to adjust the center of gravity and the center of Buoyancy.
- The westward movement caused by the tidal forces of the Sun and Moon.





# Criticisms:

- Has used incorrect conceptualisation of Earth's Interior. Continents do not float over Ocean. Reality is Lithospheric plates float over asthenosphere
- No explanation on what created Pangaea. The theory did not describe the situations of pre-carboniferous times.
- No explanation why panagaea broke.
- Forces suggested are inadequate.
- In reality, island are not found in South East Section alone. All the island are not continental island.
- No explanation for landward mountains



# Contribution

1. Logically deduced theory
2. Bold departures from the then existing idea that the continents and the oceans are permanent and static
3. Bold alternative to how fold mountains are formed that are uplifted marine sediments.
4. One of the pioneer to challenge permanency of the Continents and Oceans
5. Idea was correct even though the evidence and driving mechanism was incorrect. Idea was revived by Plate Tectonic Theory

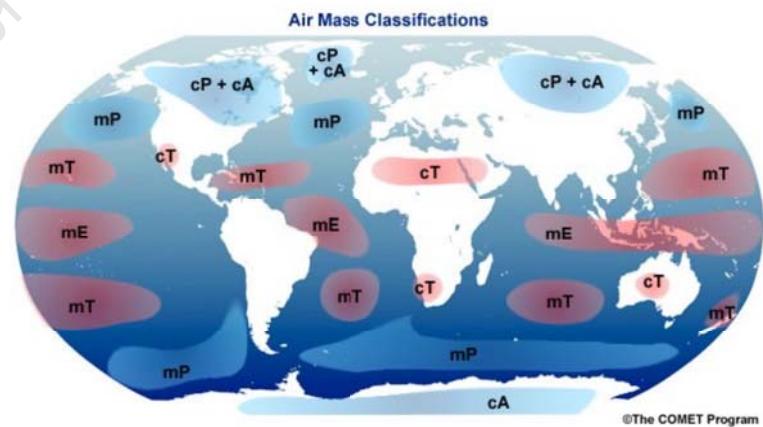


# Air Mass, Cyclone

- Dimple Nankani

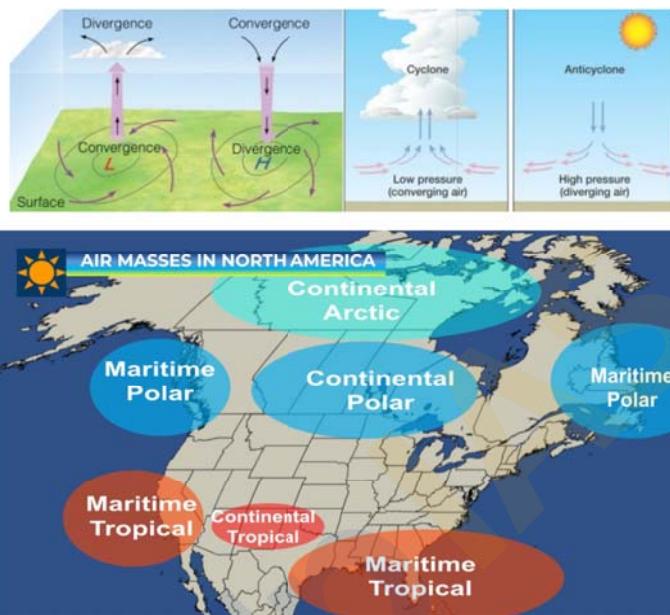
## Air Mass

- These are massive bodies of air covering thousands of sq km (horizontally across the Earth's surface) and for entire height of troposphere.
- Airmass have nearly same temperature and moisture levels horizontally.
- Nature and properties of airmasses are acquired from the surface over which airmass develops.



## Air Mass Formation: Properties of Source Regions

- Air masses form over source regions that give them their uniform temperature and humidity. **They form on relatively flat surface and extensive surface**
- Airmass develop in region of **High Pressure Conditions and atmospheric stability**. These condition prevent these large volumes from moving. So, while they stay stationary over a region, they acquire the conditions of that region, either temperature or humidity: **Siberian High Pressure condition in winters, Canadian High Pressure Conditions in Winters.**



## Types of Air Masses

**Based on places of the formation:** There can be 4 types of air masses:

- **Antarctica:** These air masses form in the Antarctica region and are very cold.
- **Arctic:** These air masses form in the Arctic region and are very cold.
- **Tropical:** These air masses form in low lying latitudes and are warm up to a moderate level.
- **Polar:** These air masses form in the high-latitude region and are cold.

**Based on nature of surface:** There can be 2 types of air masses:

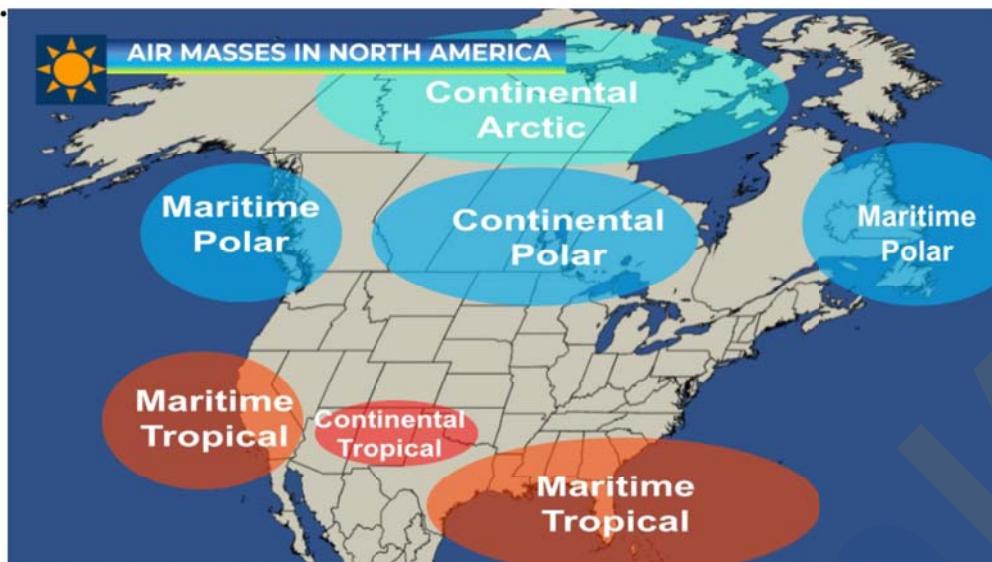
- **Maritime:** Maritime ones form over the water bodies and are filled with moisture.
- **Continental:** Whereas, the Continental ones form over the land and are arid.
- **Eg:** An air mass formed over Siberia is a continental polar air mass that is cold and dry. However, one that is formed over the Indian Ocean is a tropical air mass that is humid and warm.

Accordingly, following types of airmasses are recognised:

1. Maritime tropical (mT);
2. Continental tropical (cT);
3. Maritime polar (mP);
4. Continental polar (cP);
5. Continental arctic (cA).
6. Continental Antarctica (CAA)

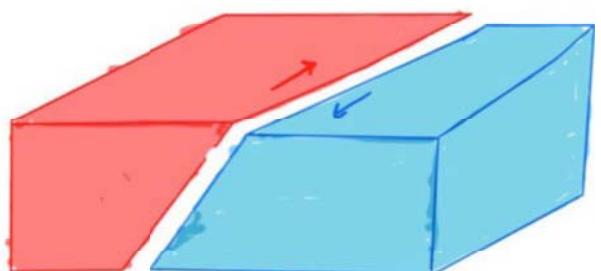
Tropical air masses are warm  
polar air masses are cold.

Two most imp airmasses are: cP, mT



## Fronts

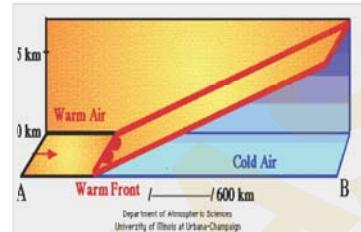
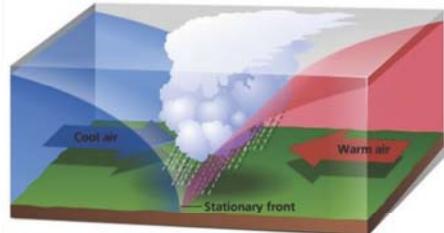
- It is an inclined zone along which two opposing air masses (having contrasting characteristics in terms of air temperature, humidity, density) converge together.
- The frontal zone is inclined at a low angle to the Earth's surface.
- Along a front, one airmass will be relatively warmer than the other airmass. Warmer Airmass will try to rise along the front and cooler airmass will drag beneath



## Types of Fronts

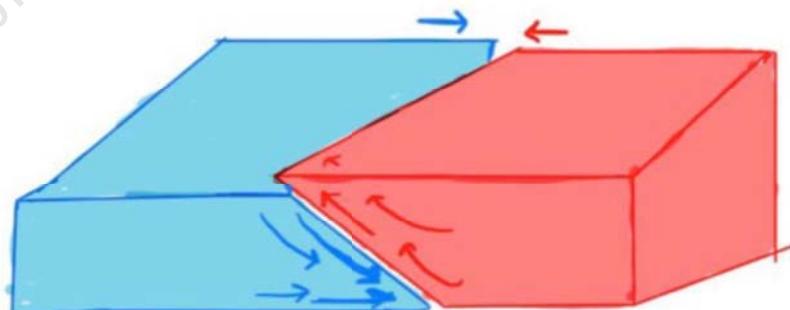
Based on the nature of convergence, relative acceleration of air masses, and stages of front formation, four types are identified:

1. **Stationary Front:** 2 airmass standing in front of Each Other
2. **Warm Front:** Warm airmass is active and moves into region of cold airmass
3. **Cold Front:** Cold airmass is active and moves into region of warm airmass
4. **Occluded Front:** Warm airmass is completely tossed above cold airmass



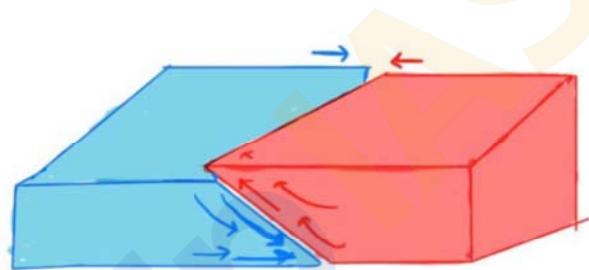
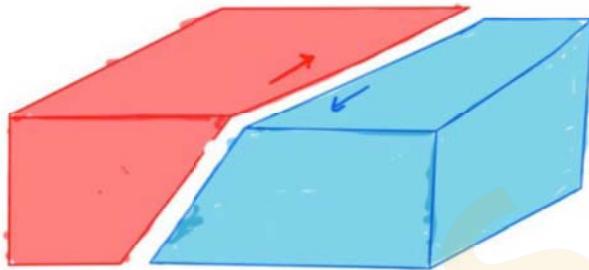
## Some Important Points

- Warm airmass rises above and cold airmass is pushing from below always whether in warm or cold front
- Cold Front is relatively more steep and warm front is relatively more gentle
- Cold Airmass moves fast as compared to warm Airmass



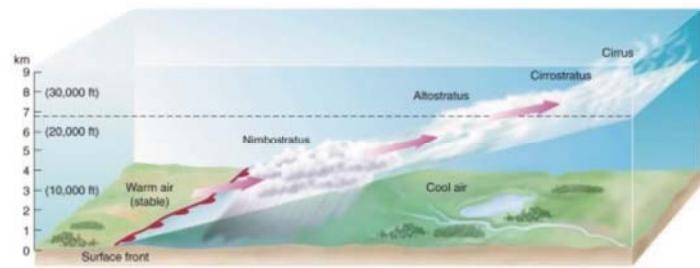
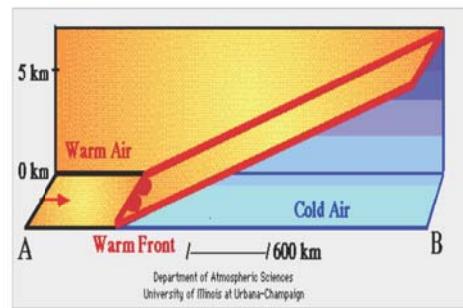
## Stationary Front

- In this type two air masses having contrasting physical properties rest against each other without showing any major movement.
- Weather generally remains stable but sometimes it might rain.



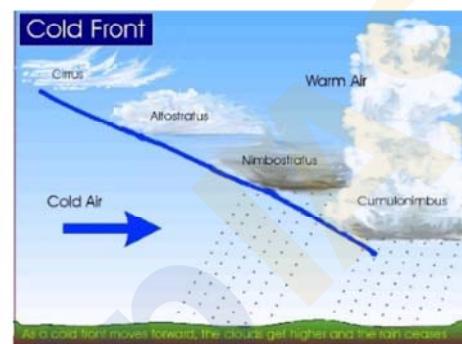
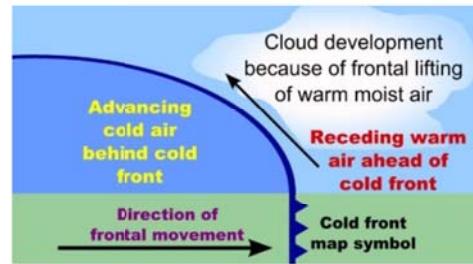
## Warm Front

- When a warm air mass collides against the cold air mass, it rises above the cold air mass (cold air mass is relatively heavier and denser)
- The warm front is a gently sloping frontal surface along which warm and light air becomes active and aggressive and rises slowly over cold and dense air. Due to this condensation takes place gradually.
- It leads to nimbostratus, altostratus and cirrostratus cloud formation. These clouds produce moderate to gentle precipitation over a relatively large area for several hours



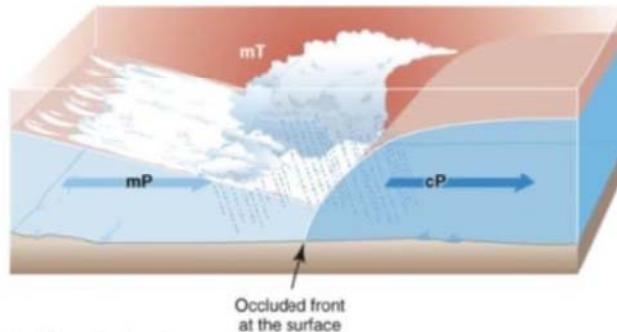
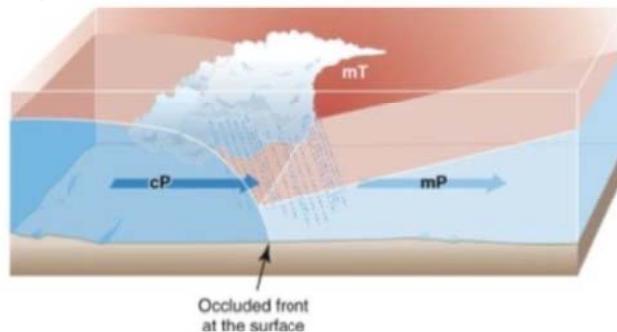
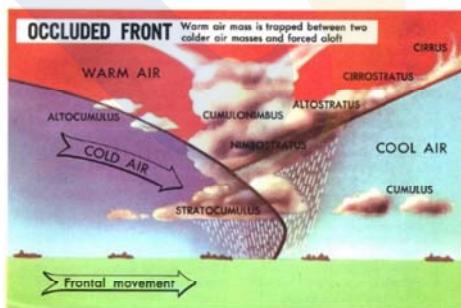
## Cold Front

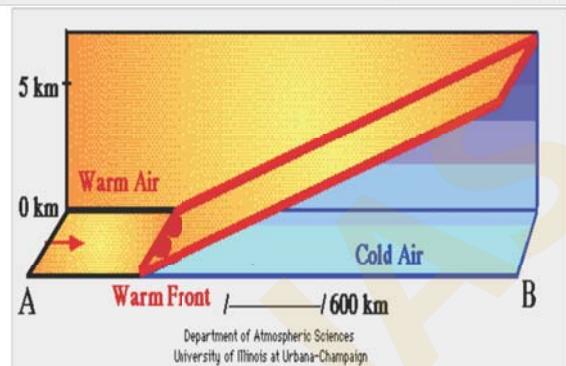
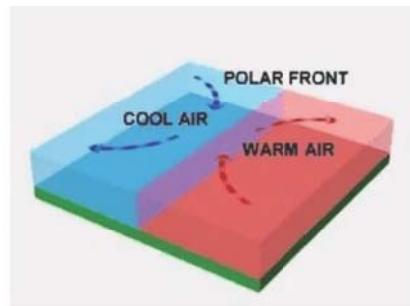
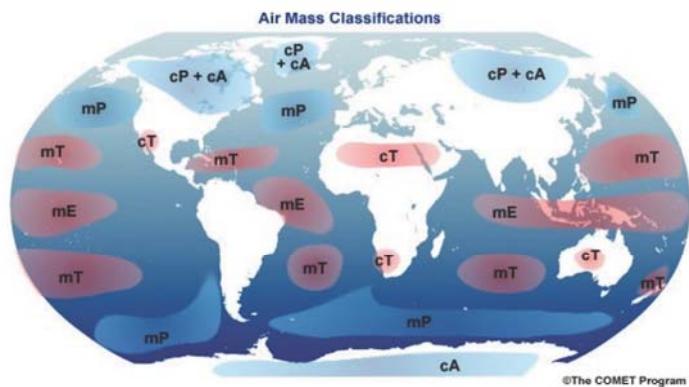
- This is formed when cold air mass initiates the movement and hits the warm air mass and makes it rise.
- It is a steep frontal surface and so condensation takes place rapidly.
- Cirrus, Alto stratus, Nimbostratus and Cumulonimbus clouds are formed and heavy rainfall with lightning and thundering takes place.



## Occluded Front

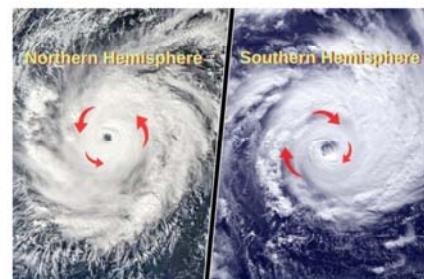
- When warm air mass is completely raised over the cold air mass it is called an occluded front.
- Weather along this sector is complex—a mixture of cold front type and warm front type weather. These are common in western Europe.





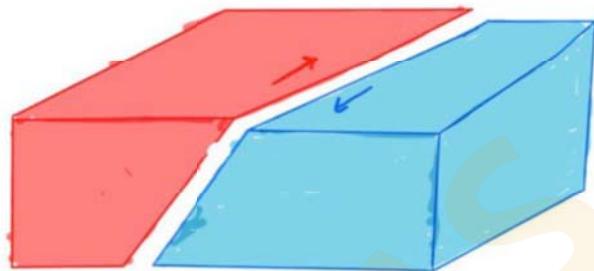
## Cyclone

- Are Low pressure System
- Are Rotating System
- Localised low pressure centre with winds converging from all sides.
- Moves Anticlockwise in NH and Clockwise in SH
- At the equator, the Coriolis force is zero so low pressure gets filled instead of getting intensified. That is the reason why tropical cyclones are not formed near the equator.
- Genesis of Low Pressure can be
  - Thermal Origin: Heating and Rising Air. This is seen in tropical latitude: TROPICAL CYCLONE
  - Dynamic Origin: Related to Upper Tropospheric Conditions (Rossby Wave) or due to movement of air mass: TEMPERATE CYCLONE



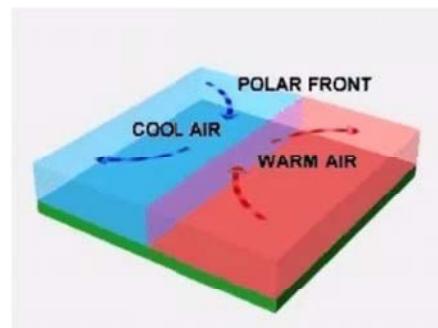
## Temperate Cyclone (Extra-Tropical Cyclones)

- Extra-Tropical Cyclones are storm systems emerging in the mid and high latitudes (60 degree – 65 degree), away from the tropics.
- Very extensive ~500km.
- Generates around the dynamically induced low pressure i.e due to the movement of the Upper Tropospheric Wind and movement of front.
- In the beginning, the front is stationary.



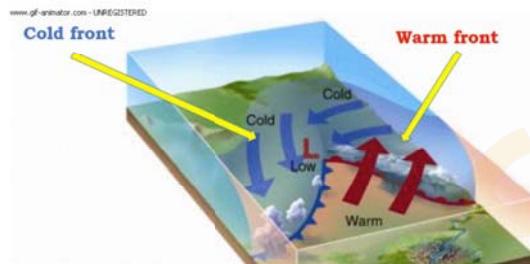
## Formation of Temperate Cyclone (Extra-Tropical Cyclones)

- Then a low pressure develops
- In the Northern hemisphere, cold air blows from the north of the front and warm air blows from the south.
- When the pressure falls along the front, the cold air move towards the south, and the warm air moves northwards setting in motion an anticlockwise cyclonic circulation.
- The cyclonic circulation results in a well-built extratropical cyclone, with a cold front and a warm front.

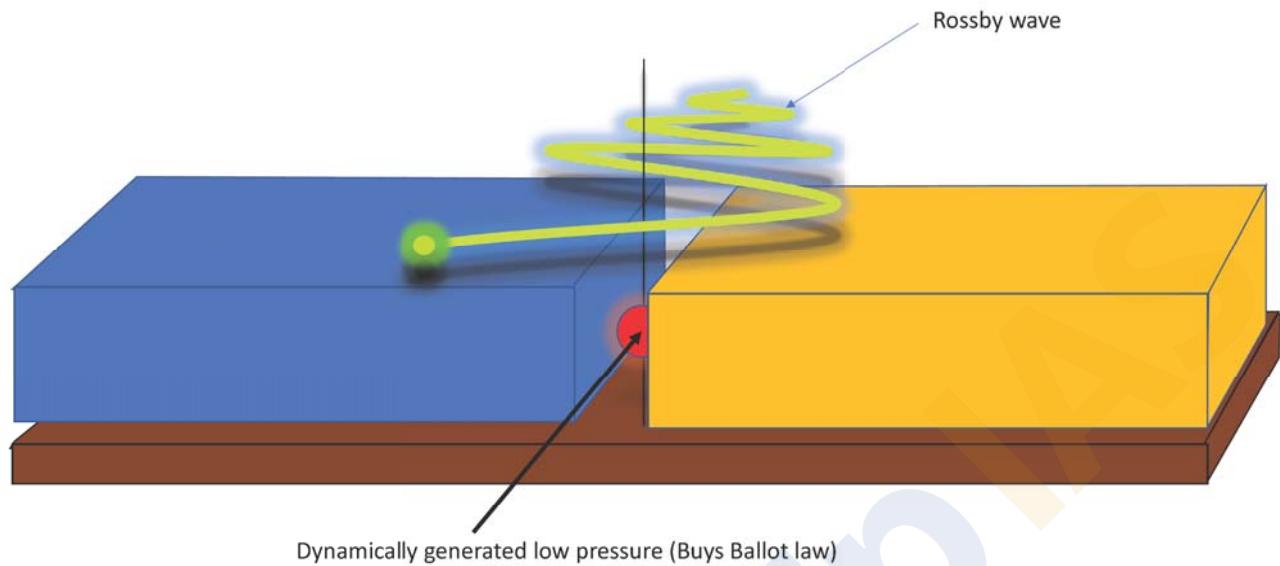


## Formation of Temperate Cyclone (Extra-Tropical Cyclones)

- There are pockets of warm air compressed between the forward and the rear cold air.
- The cold front moves faster than the warm front eventually surpassing the warm front.
- The warm air is entirely lifted and the front is occluded and the cyclone dissipates.

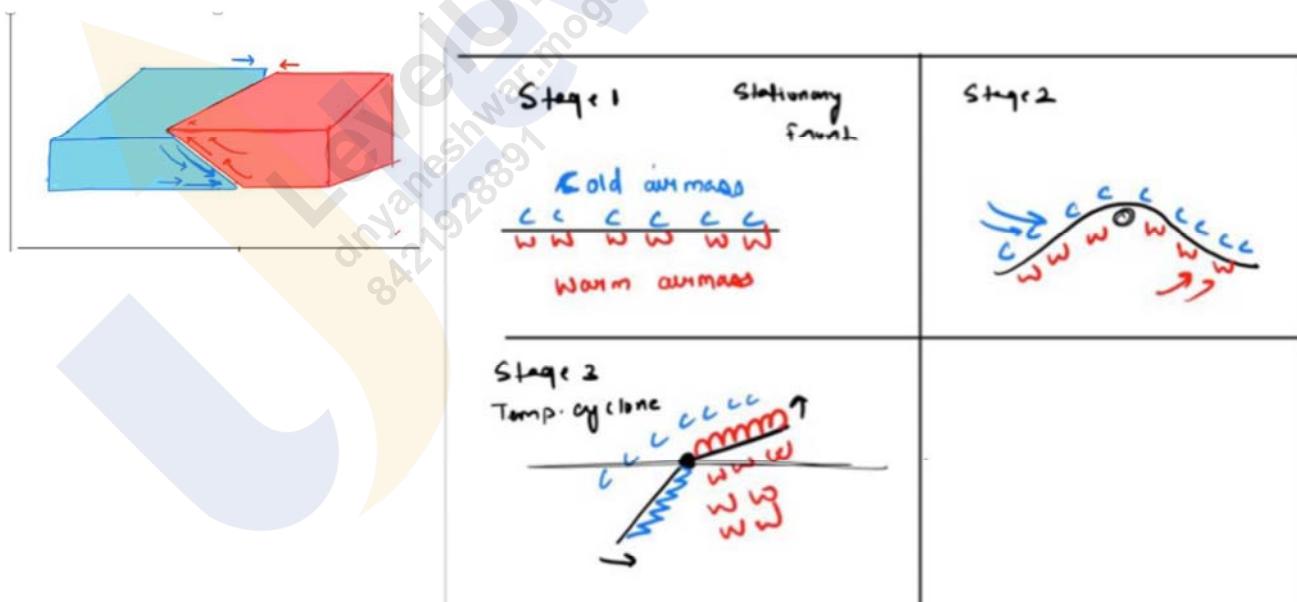
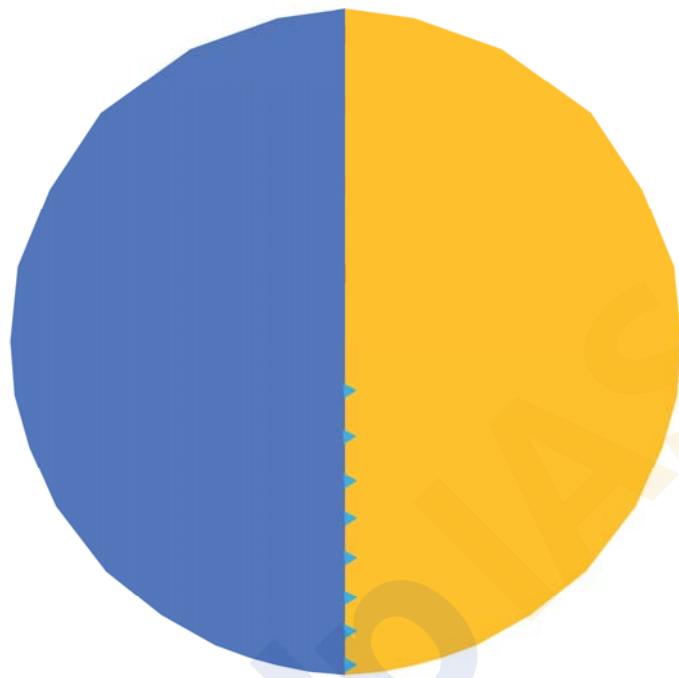


### Frontogenesis and creation of Low pressure



### Front starts to move



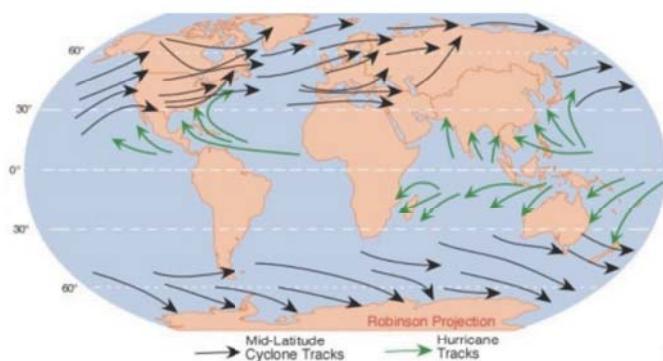
Cold front catching up warm front

## Characteristics of temperate cyclone

1. Temperate cyclone are massive system over thousands of square kilometre with their radius exceeding 200 to 300 km
2. They are more intense in the winters because of the stronger air mass contrast
3. Compared to tropical cyclone which are much smaller and stronger system, temperate cyclone are not as violent.
4. Wind velocity is within 50 km/hour and sometime above 80 km/hour

## Characteristics of temperate cyclone

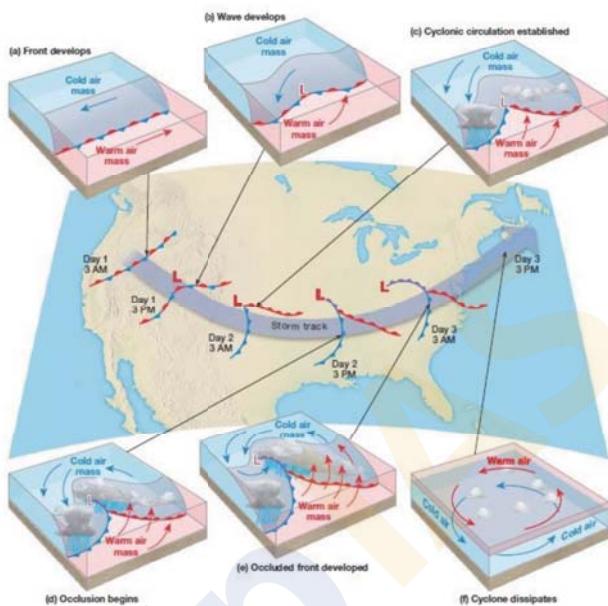
5. Temperate cyclone move from West to east due to the influence of the westerlies
6. Temperate cyclone can form on land and also on waters but they are relatively more developed on the land unlike tropical cyclone that always form on the warm waters and never on land
7. In high mid latitudes following are the preferred location for low pressure development like Aleutian low pressure region, Icelandic low pressure region, Mediterranean Sea low pressure system.



## REVISION

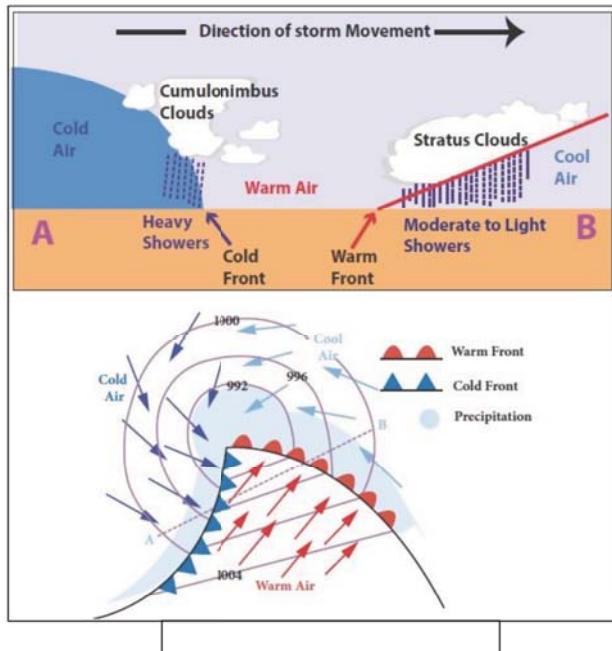
### Life cycle of temperate cyclone

- Stage 1 – low pressure develops between the two fronts
- Stage 2 – low pressure intensifies, the fronts starts rotating
- Stage 3 – As the cold air mass is denser it keep tossing the warm air up as the cold front advances.
- Stage 4 – now cold front catches the warm front and completely occludes it above the ground
- Stage 5 – the low pressure dissipates gradually.



### Structure of temperate cyclone

These cyclones are nothing but a rotating cold and warm fronts around a dynamically induced low pressure. All the weather phenomena are those which are associated with the cold and warm fronts.

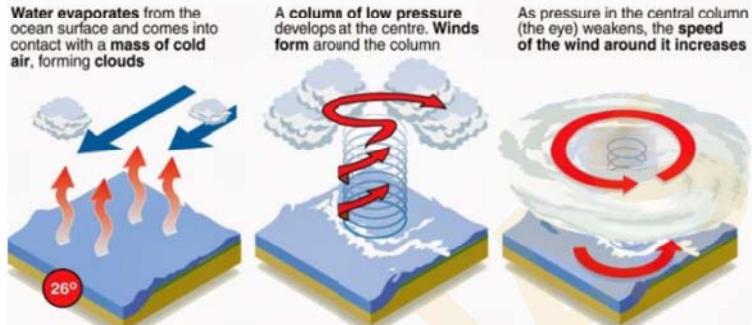


## Tropical Cyclone

- Tropical cyclones are violent low pressure system that originate over oceans in tropical areas and move over to the coastal areas bringing about large scale destruction caused by violent winds, very heavy rainfall
- Move Anticlockwise in NH
- Move Clockwise in SH

### How tropical storms are formed

High humidity and ocean temperatures of over 26°C are major contributing factors

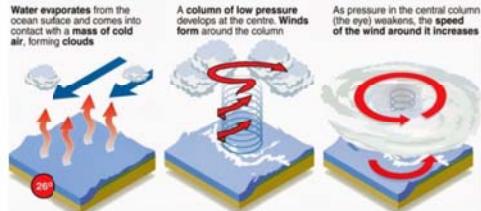


## Favourable Conditions for the Formation of Tropical Cyclone

- A large area of water surface with a temperature above 27° C.
- The Coriolis force is strong enough to form a cyclonic vortex.
- A weak low-pressure area or low-level cyclonic circulation already exists on ocean surface
- There should be a divergence around 9 km to 15 km which sucks the air from ocean surface above and thus the upward movement of air is accelerated and low pressure centre at the surface is further intensified.
- Variations in the vertical wind speed are minor. This is referred to condition of **Low Wind Sheer**
- Tropical cyclones develop around inter-tropical convergence zone

### How tropical storms are formed

High humidity and ocean temperatures of over 26°C are major contributing factors





Annual movement of the intertropical convergence zone (ITCZ). Source:

## Inter tropical convergence zone

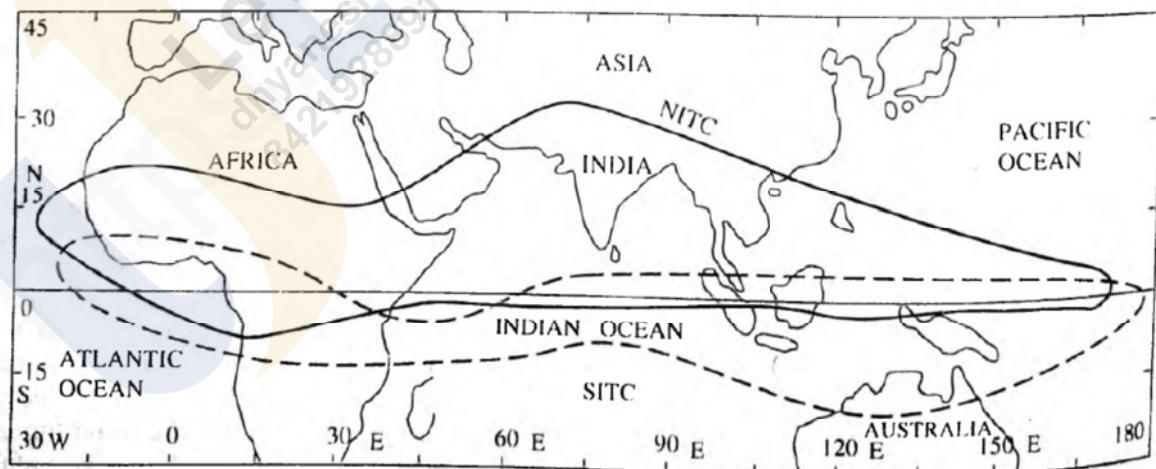


Fig. 6.5 : Intertropical convergence (NITC and SITC).

## Origin of Tropical Cyclone

- Tropical cyclones arise over tropical oceans in late summers and have a thermal origin (August to mid-November).
- Because of the Coriolis effect, the powerful local convectional currents take on a whirling motion at these regions.
- These cyclones form and move under the influence of trade wind towards the land

### How tropical storms are formed

High humidity and ocean temperatures of over 26°C are major contributing factors

Water evaporates from the ocean surface and comes into contact with a mass of cold air, forming clouds

A column of low pressure develops at the centre. Winds form around the column

As pressure in the central column (the eye) weakens, the speed of the wind around it increases

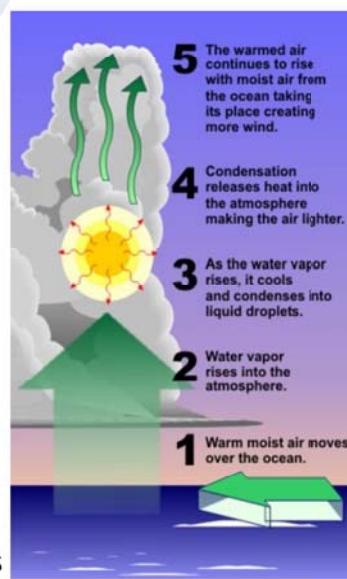


## Developmental Stages of Tropical Cyclone

Tropical cyclone development can be classified into 3 stages

### 1. Formation and Initial Development Stage

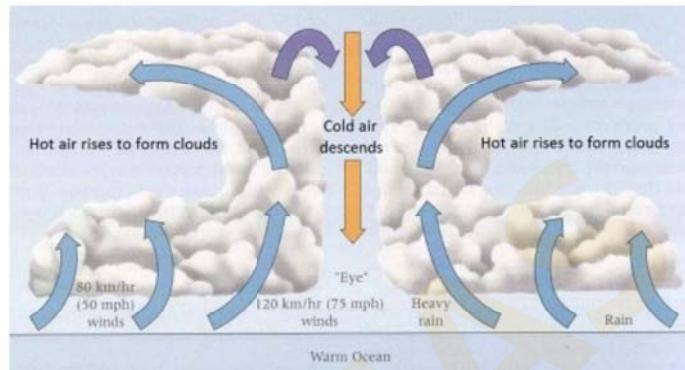
- Transport of water vapor and heat from the warm ocean to overlying air, largely through evaporation from the sea surface, leads to the creation of a cyclonic storm.
- Condensation of rising air above the ocean surface stimulates the creation of huge vertical cumulus clouds.
- Condensation releases heat and keeps entire air column warm



## Developmental Stages of Tropical Cyclone

### 2. Mature Stage

- Rising air intensify as a tropical storm and spread horizontally at tropopause level.
- When air spreads out, some portion of air migrates downward and subsides in eye.
- When subsidence is induced, the air warms up due to compression, resulting in a warm 'Eye' (low-pressure center). Sinking in the eye does not reach the ocean surface, but only reaches a depth of 1-3 kilometer.



## Developmental Stages of Tropical Cyclone

### 3. End of cyclone

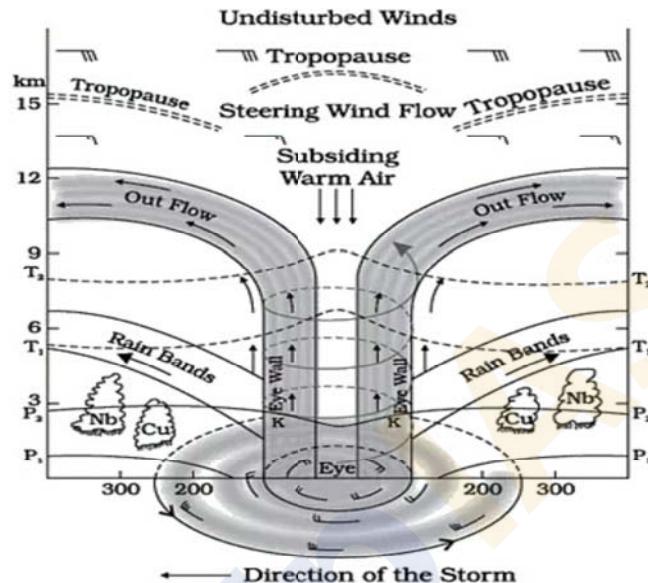
- As soon as the source of warm moist air is abruptly cut off, a tropical cyclone begins to weaken.
- On reaching the land the moisture supply is cut off and the storm dissipates.
- The place where a tropical cyclone crosses the coast is called the landfall of the cyclone.



## Structure of Tropical Cyclone: Eye, Eye Wall, Spiral Bands

### 1.Eye:

- The "eye" is a roughly circular area at the center of a severe tropical cyclone with comparatively mild winds.
- There is little to no precipitation in the eye.
- The eye is the area with the lowest surface pressure and the warmest temperatures.

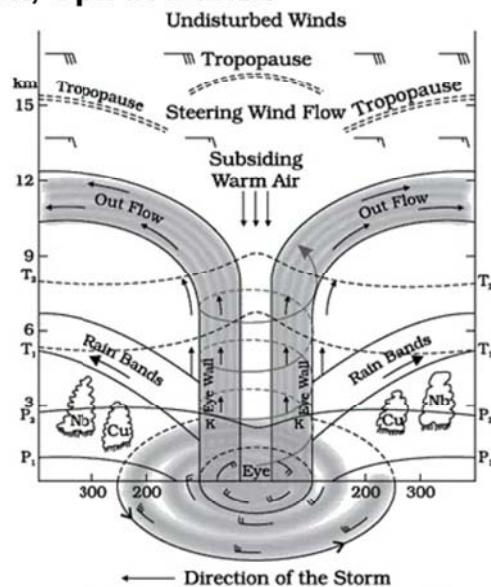


*Fig: Vertical section of the tropical cyclone*

## Structure of Tropical Cyclone: Eye, Eye Wall, Spiral Bands

### 2.Eyewall:

- The "eyewall" a roughly circular ring that surrounds the eye with strong spiralling ascent of air
- It is the area of the tropical cyclone with the strongest surface winds.
- The wind reaches maximum velocity in this region, reaching as high as 250 km per hour.
- Torrential rain occurs here.

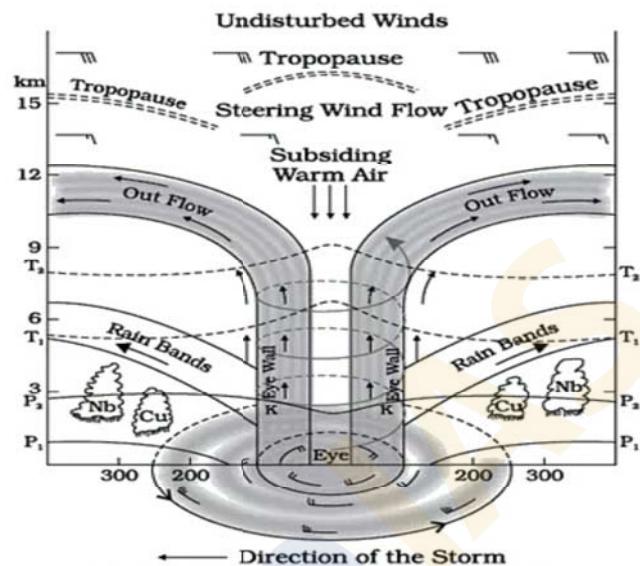


*Fig: Vertical section of the tropical cyclone*

## Structure of Tropical Cyclone: Eye, Eye Wall and

### 3. Spiral Bands:

- From the eye wall rain bands may radiate and trains of cumulus and cumulonimbus clouds may drift into the outer region.
- Spiral bands are so named because they appear to spiral along the cyclone

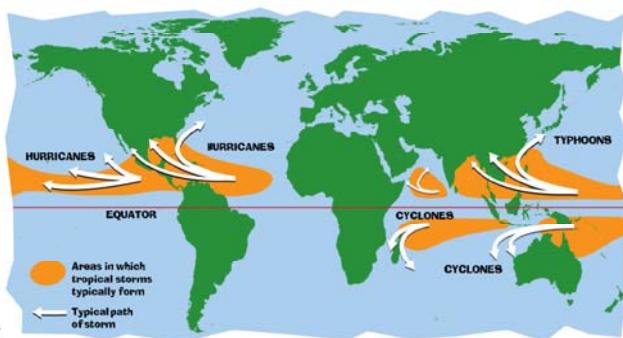


*Fig: Vertical section of the tropical cyclone*

## Favourite Breeding Grounds and Local Name

### Favourite Breeding Ground:

- South-east Caribbean region (called **hurricanes**).
- Philippines islands, eastern China (called **typhoons**).
- Bay of Bengal and Arabian Sea (called **cyclones**).
- Around the south-east African coast and Madagascar-Mauritius islands.
- North-west Australia.



**Local Names of Tropical Cyclone:** In different areas, cyclones are referred to by different names.

1. **Hurricanes** – In the Atlantic and Eastern Pacific.
2. **Typhoons** – In Southeast Asia
3. **Cyclone** – In the Indian Ocean and Western Pacific around Australia

2020

**Consider the following statements:**

1. Jet streams occur in the Northern Hemisphere **only**.
2. Only some cyclones develop an eye.
3. The temperature inside the eye of a cyclone is nearly 10 C lesser than that of the surroundings.

**Which of the statements given above is/are correct:**

(a) 1 only (b) 2 and 3 only

(c) 2 only (d) 1 and 3 only

TROPICAL CYCLONE	TEMPERATE CYCLONE
Tropical cyclones, move from east to west.	These cyclones move from west to east
A tropical cyclone has an effect on a comparatively smaller area than a Temperate cyclone.	Temperate cyclone affect a much larger area
The velocity of wind in a tropical cyclone is much higher and it is more damaging.	The velocity of air is comparatively lower
Tropical Cyclone forms only on seas with temperature more than 26-27degree C and dissipate on reaching the land.	Temperate cyclones can be formed on both land and sea
A tropical cyclone doesn't last for more than 7 days	Temperate cyclone can last for a duration of 15 to 20 days

2015

In the South Atlantic and South-Eastern Pacific regions in tropical latitudes, cyclone does not originate. What is the reason?

- (a) Sea surface temperatures are low
- (b) Inter-Tropical Convergence Zone seldom occurs
- (c) Coriolis force is too weak
- (d) Absence of land in those regions

2020

Consider the following statements:

1. Jet streams occur in the Northern Hemisphere only.
2. Only some cyclones develop an eye.
3. The temperature inside the eye of a cyclone is nearly 10 C lesser than that of the surroundings.

Which of the statements given above is/are correct:

- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1 and 3 only

2013

On the planet earth, most of the freshwater exists as ice caps and glaciers. Out of the remaining freshwater, the largest proportion

- (a) is found in atmosphere as moisture and clouds
- (b) is found in freshwater lakes and rivers
- (c) exists as groundwater
- (d) exists as soil moisture

2021

With reference to the water on the planet Earth, consider the following statements:

1. The amount of water in the rivers and lakes is more than the amount of groundwater.
2. The amount of water in polar ice caps and glaciers is more than the amount of groundwater.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

## Mains Questions

Q) Briefly mention the alignment of major mountain ranges of the world and explain their impact on local weather conditions, with examples. 2021

Q) How do the melting of the Arctic ice and glaciers of the Antarctic differently affect the weather patterns and human activities on the Earth? Explain. 2021

Q) How does the cryosphere affect global climate? 2017

Q) Discuss the concept of air mass and explain its role in macro-climatic changes. 2016

Q) Tropical cyclones are largely confined to the South China Sea, Bay of Bengal, and the Gulf of Mexico. Why? 2014



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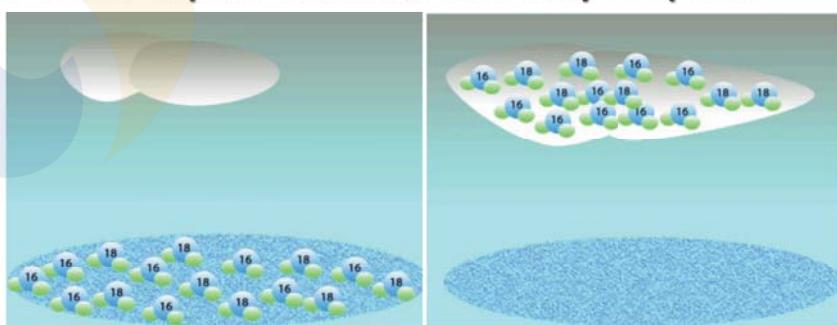
# Condensation, Precipitation

- DIMPLE NANKANI

## Forms and types of condensation

**Cooling → Saturation of air → Leads to condensation and precipitation**

**Condensation=water vapour converts into tiny droplets**



## Forms of Condensation

- Condensation at/very near to ground surface = Dew, Frost, Fog, Mist
- Condensation at higher height = Cloud

### DEW

- It refers to direct deposition of water vapour in form of water droplets on surface like grass, plants and soil
- 
- Conditions= Air above the ground in winters becomes very cold and is not able to hold water vapour and deposits the water vapour on objects
  - In Dew, Condensation occurs above the freezing point
  - The ideal conditions for its formation are clear sky, calm air, high relative humidity, and cold and long nights.



## FROST

- Transformation of water vapour directly into solid form at ground surface
- The ideal conditions for the formation of white frost are the same as those for the formation of dew, except that the air temperature must be at or below the freezing point.



## FOG AND MIST

- Condensation of water vapor into water droplet on condensation nuclei like dust particles, smoke etc suspended in air. (Air has dust particles, smoke, soot and these acts as condensation nuclei and hygroscopic nuclei (attracts water). These suspended water droplets forms fog/mist.
- Fog and Mist are suspended water droplets in the air and so reduces visibility
- Difference between fog and mist is wrt size of water droplets. In mist water droplets are microscopic (v.v. small) as compared to fog. Mist has more moisture as compared to fog

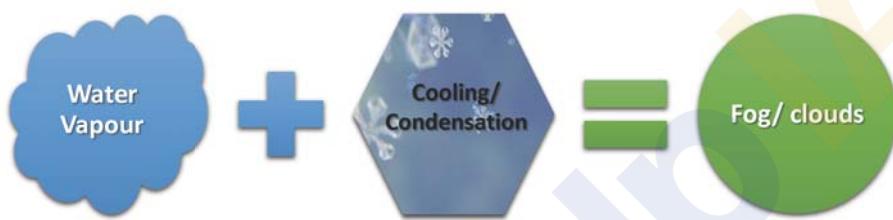
FOG



MIST

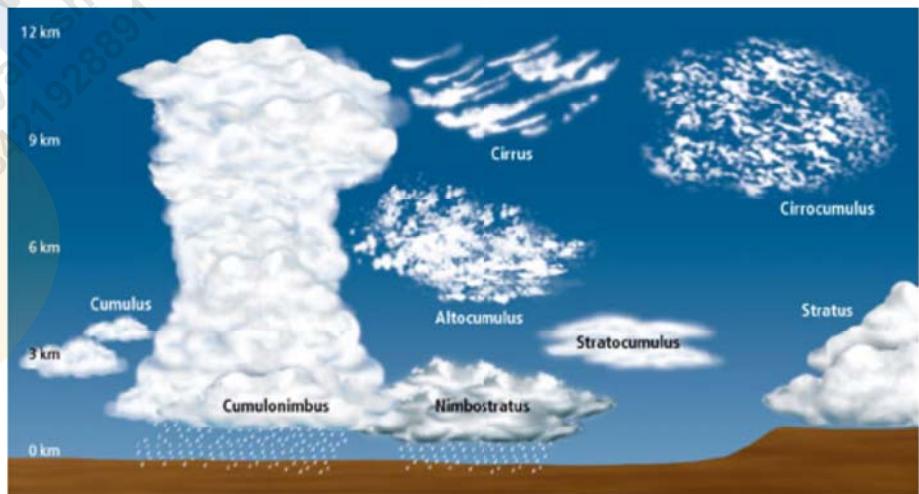


## Formation of fog



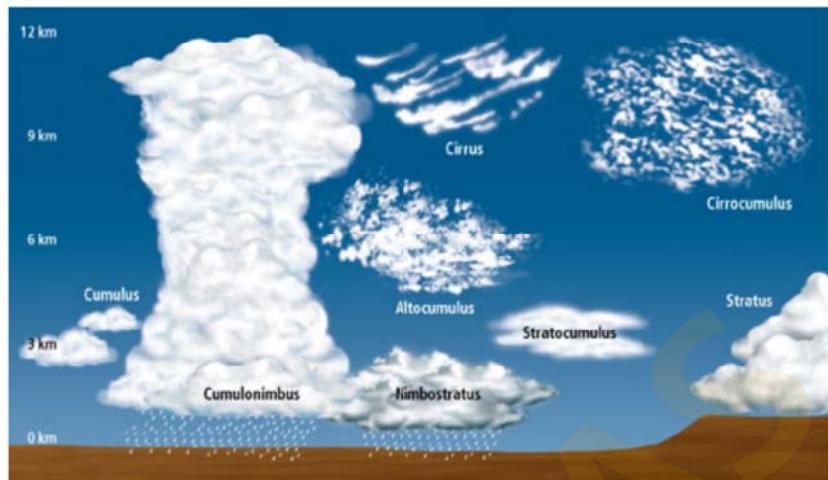
**CLOUDS** = Aggregate mixture of minute water droplet, ice particle or both in air at considerable elevations

- Condensation refers to conversion of water vapour to water droplet
- Precipitation= Falling down to water droplets/ ice when the air is unable to hold them



## Types of Clouds

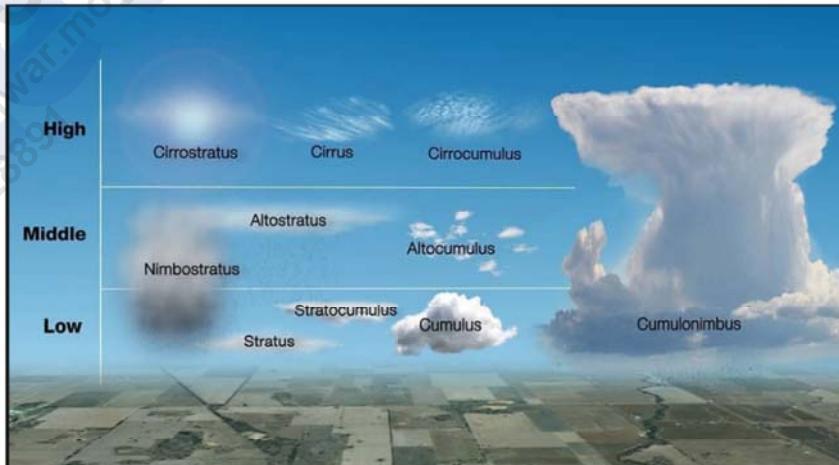
- **Cirrus** = High Altitude cloud around 6 - 10 km. Thin cloud. White Colored
- **Alto** = Medium Level Cloud. It is around 5 km
- **Cumulus** = Wooly/ Bumpy
- **Stratus**= Thin sheet
- **Nimbus** = Rain bearing



- Low clouds are mainly stratus/ Sheet clouds.
- **Cloud with great vertical Extent=** Cumulonimbus, Cumulus.

## Types of clouds

- **High Clouds:** Cirrus, Cirrostratus, Cirrocumulus
- **Middle clouds:** Altostratus and Altocumulus
- **Low clouds:** Stratocumulus and Nimbostratus and
- **Clouds with extensive vertical development –** Cumulus and Cumulonimbus.



## High Clouds: Cirrus, Cirrostratus, Cirrocumulus

- **Cirrus:** White Coloured and indicate fair weather
- **Cirrocumulus:** White, woolly cloud
- **Cirrostratus:** Resembles thin white sheet in the sky. Sun and moon shines with a halo



## Medium Clouds: Altostratus and Altocumulus

- **Altostratus:** Medium cloud. They are dense clouds
- **Altocumulus:** White, woolly and bumpy cloud



## Low Clouds: Stratus, StratoCumulus, Nimbostratus

- **Stratus:** Very Low cloud. It brings drizzle, Grey Coloured
- **Stratocumulus:** Low level Bumpy cloud.
- **Nimbo Stratus:** Dark Cloud. It is also known as Rain Cloud. Brings continuous Rain

STRATUS



STRATOCUMULUS



NIMBOSTRATUS



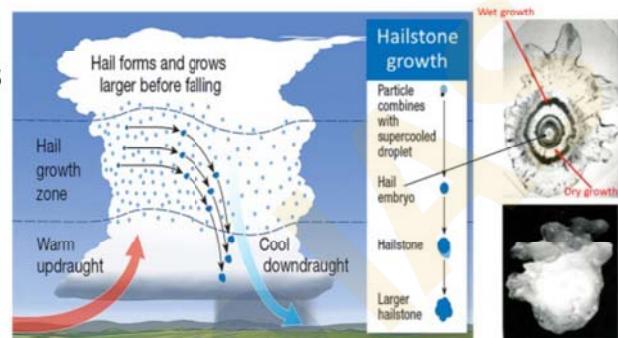
## Clouds with great vertical extent: Cumulus, Cumulonimbus

- **Cumulus** = Vertical cloud, Rounded Top and Horizontal Base. Fair Weather Cloud. It is associated with rising convection current.
- **Cumulonimbus Cloud** = Overgrown cumulus cloud, Looks like an anvil. Brings Convectional Rain accompanied by lightning and thunder



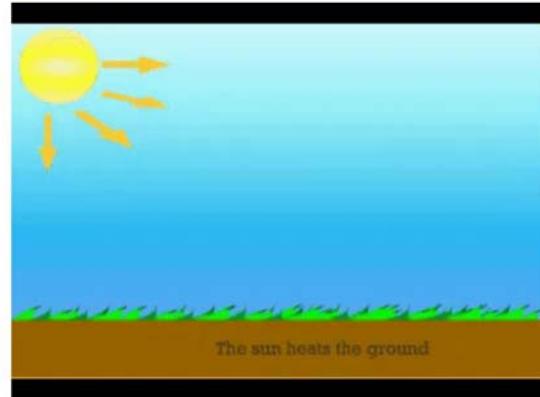
## Types of Precipitation

- Condensed particles to grow in size and fall on Earth as precipitation. This may take place in liquid or solid form.
- Precipitation in the form of water is called **rainfall**
- Snowfall:** When the temperature is lower than zero degree Celsius, precipitation takes place in the form of fine flakes of snow.
- Sleet** is frozen raindrops and refrozen melted snow-water.
- Hailstone** = Hailstones have several concentric layers of ice one over the other. These are formed by the rainwater passing through the colder layers.



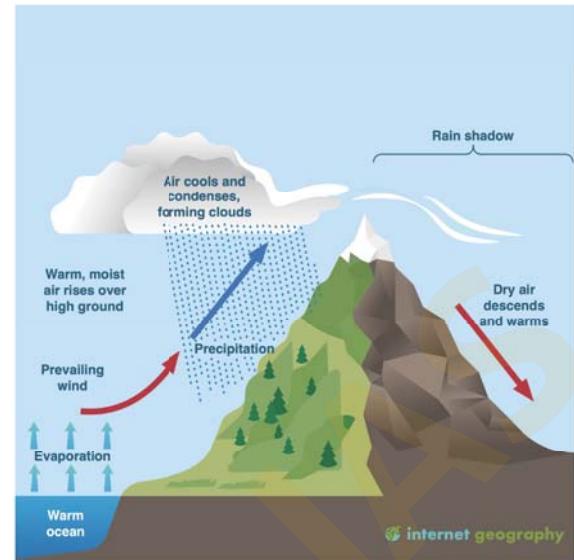
## Types of rainfall

- Convectional Rain:** The air on being heated, becomes light and rises up in convection currents. As it rises, it expands and loses heat and consequently, condensation takes place and cumulous clouds are formed. With thunder and lightning, heavy rainfall takes place but this does not last long. Such rain is common in the summer or in the hotter part of the day. It is very common in the equatorial regions.



## Types of rainfall

- **Orographic Rain/ Relief Rain:** Air comes across a mountain, is forced to ascend and as it rises, it expands; the temperature falls, and the moisture is condensed. Windward slopes receive greater rainfall. After giving rain on the windward side, winds on the leeward slope descend, their temperature rises and its capacity to take in moisture increases and hence, these leeward slopes remain rainless and dry. The area situated on the leeward side, which gets less rainfall is known as the rain-shadow area.
- **Cyclonic Rain:** Tropical Cyclone and Temperate Cyclone



## World Distribution of Rainfall

- In general, as we proceed from the equator towards the poles, rainfall goes on decreasing steadily.
- In general, the coastal areas of the world receive greater amounts of rainfall than the interior of the continents.
- The rainfall is more over the oceans than on the landmasses of the world because of being great sources of water.
- Between the latitudes 25 degree and 35 degree N and S of the equator, the rain is heavier on the eastern coasts and goes on decreasing towards the west.
- Between 45 degree and 65 degree N and S of equator, due to the westerlies, the rainfall is first received on the western margins of the continents and it goes on decreasing towards the east. Wherever mountains run parallel to the coast, the rain is greater on windward side and it decreases towards the leeward side.

## World Distribution of Rainfall

- **Equatorial Belt:** Convective Rainfall, Very Heavy Rainfall. Average rainfall of 300 cm/year.
- **Tropical Monsoon:** 75-225 cm rainfall, Not a dry climate, Rainfall in monsoon month.
- **Tropical Grassland:** Summer rainfall, less than 75 cm, Savannah region
- **Desert:** Offshore trade winds, Rainfall less than 25 cm
- **(Warm Temperate) Mediterranean Climate:** Winter rainfall, <75 cm rainfall, semi arid region
- **Mid Latitude Desert:** dry condition and rainfall < 25 cm
- **Temperate Grassland:** Less than 50 cm/ year.
- **Cool Temperate:** Rainfall around 90 cm
- **Taiga Belt:** Rainfall throughout year, Rainfall well distributed. Coniferous forest. 70 cm
- **Tundra Belt:** Rainfall less than 20 cm.

2013

"Climate is extreme, rainfall is scanty and the people used to be nomadic herders." The above statement best describes which of the following regions?

- (a) African Savannah
- (b) Central Asian Steppe
- (c) North American Prairie
- (d) Siberian Tundra

2015

"Each day is more or less the same, the morning is clear and bright with a sea breeze; as the Sun climbs high in the sky, heat mounts up, dark clouds form, then rain comes with thunder and lightning. But rain is soon over.

"Which of the following regions is described in the above passage?

- (a) Savannah
- (b) Equatorial
- (c) Monsoon
- (d) Mediterraneana

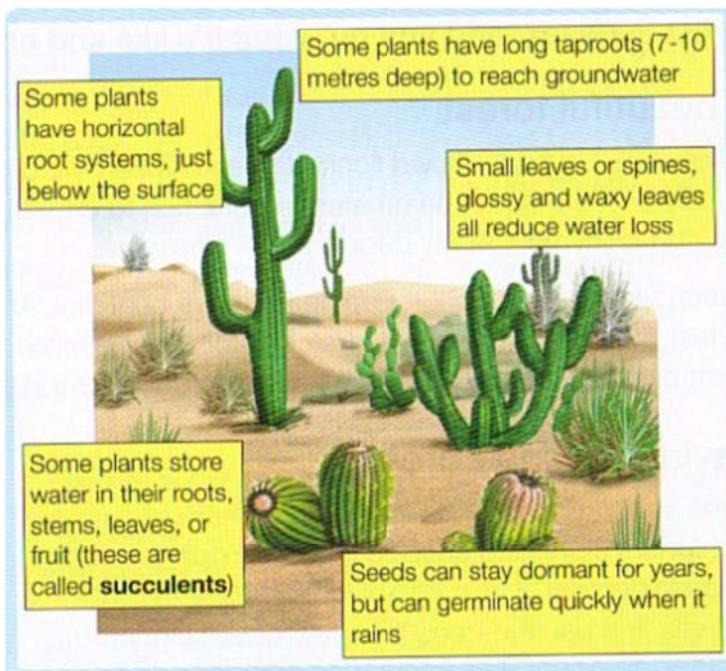
2018

**Which of the following leaf modifications occur (s) in the desert areas to inhibit water loss?**

- 1. Hard and waxy leaves
- 2. Tiny leaves
- 3. Thorns instead of leaves

Select the correct answer using the code given below:

- (a) 2 and 3 only
- (b) 2 only
- (c) 3 only
- (d) 1, 2 and 3



2013

**Which of the following is/are unique characteristic/characteristics of equatorial forests?**

1. Presence of tall, closely set trees with crowns forming a continuous canopy
2. Coexistence of a large number of species
3. Presence of numerous varieties of epiphytes

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2021

Leaf litter decomposes faster than in any other biome and as a result, the soil surface is often almost bare. Apart from trees, the vegetation is largely composed of plant forms that reach up into the canopy vicariously, by climbing the trees or growing as epiphytes, rooted on the upper branches of trees." This is the most likely description of

- (a) Coniferous forest
- (b) Dry deciduous forest
- (c) Mangrove forest
- (d) Tropical rain forest



# Mapping India

DIMPLE NANKANI

## Important Lines

- Tropic of cancer passes through which states?
- IST passes through which states?
- North, South, West, East point of India

2015

Which one of the following pairs of States of India indicates the easternmost and westernmost State?

- (a) Assam and Rajasthan
- (b) Arunachal Pradesh and Rajasthan
- (c) Assam and Gujarat
- (d) Arunachal Pradesh and Gujarat

NDA 2021 Exam: Part 2

**74. The Tropic of Cancer does *not* pass through which one of the following States ?**

- (a) Manipur
- (b) West Bengal
- (c) Gujarat
- (d) Jharkhand

## NDA 2021 Exam: Part 2

77. Which one of the following is the longest parallel of latitude?

- (a) Tropic of Cancer
- (b) Tropic of Capricorn
- (c) Arctic Circle
- (d) Equator

## NDA 2021 Exam: Part 2

- ARU
- NA
- MA
- MI

37. Identify the State on the basis of the following characteristics :

1. Tropic of Cancer passes through the State.
2. The State has more north-south extension.
3. The State has international border with Bangladesh and Myanmar.

Select the correct answer using the code given below :

- (a) Tripura
- (b) Mizoram
- (c) Nagaland
- (d) Manipur

## NDA 2021 Exam: Part 2

63. Which of the following statements is/are correct with respect to Time Zone in India ?
1. There is one standard time for the whole country.
  2. Andaman and Nicobar Islands and Lakshadweep Islands have different Time Zones.
  3. Indian Standard Time (IST) is five and half hours behind GMT.

Select the correct answer using the code given below :

- (a) 1 only
- (b) 2 only
- (c) 1 and 2 only
- (d) 1 and 3 only

## NDA 2021 Exam: Part 2

M wants to visit a place in a Union Territory, which is located at  $34^{\circ}$  N and  $77^{\circ}$  E. Which one of the following Union Territories must he have planned to visit ?

- (a) Andaman and Nicobar Islands
- (b) Lakshadweep
- (c) Puducherry
- (d) Ladakh

2014

Which one of the following pairs of islands is separated from each other by the "Ten Degree Channel"?

- (a) Andaman and Nicobar
- (b) Nicobar and Sumatra
- (c) Maldives and Lakshadweep
- (d) Sumatra and Java

Important Channels:

6 degree: Great Nicobar and Sumatra

8 degree: Minicoy and Maldives

9: Minicoy and Lakshadweep

10: Andaman and Nicobar

11 degree: Aminidivi and Cannanore

Latitude: Important Lines: 2018

**Among the following cities, which one lies on a longitude closest to that of Delhi?**

1. Bengaluru
2. Hyderabad
3. Nagpur
4. Pune

2017

Which of the following is geographically closest to Great Nicobar?

- (a) Sumatra
- (b) Borneo
- (c) Java
- (d) Sri Lanka

2017

If you travel by road from Kohima to Kottayam, what is the minimum number of States within India through which you can travel, including the origin and the destination?

- (a) 6
- (b) 7
- (c) 8
- (d) 9

2017

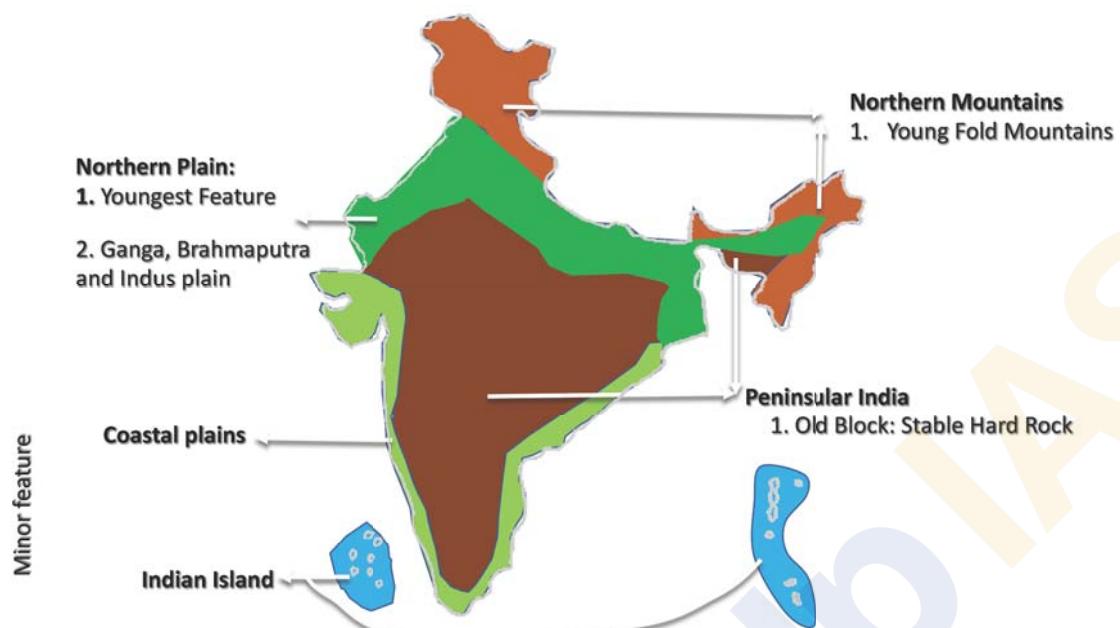
If you travel by road from Kohima to Kottayam, what is the minimum number of States within India through which you can travel, including the origin and the destination?

- (a) 6
- (b) 7
- (c) 8
- (d) 9

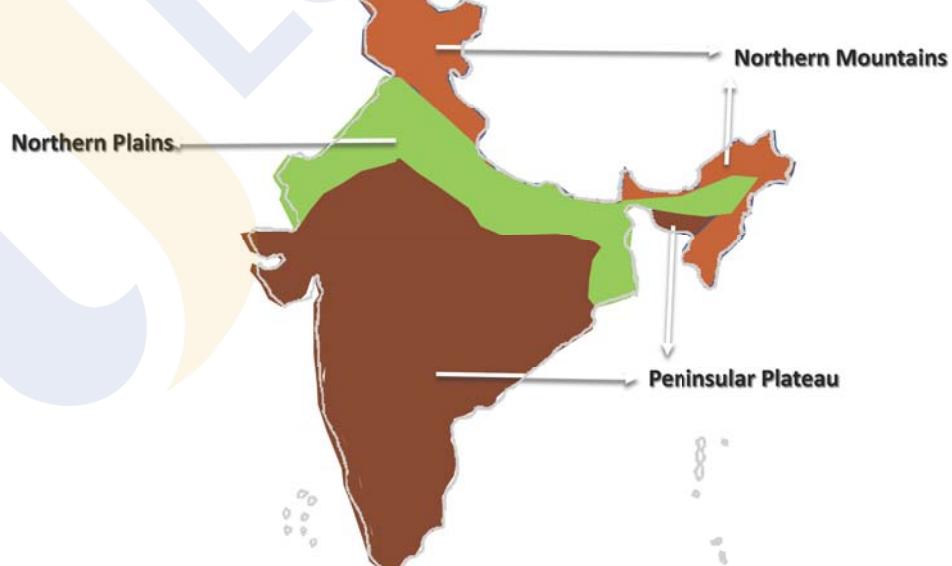
Answer: B

Kerala, Tamil Nadu, Andhra, Odisha, West Bengal, Assam , Nagaland (Then Andhra was combined)  
(Need an understanding of Borders of State)

### Physiographic division of India

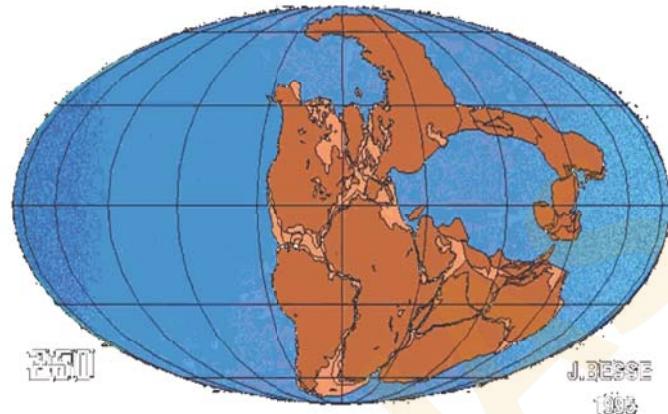


### Triple tectonic division of India



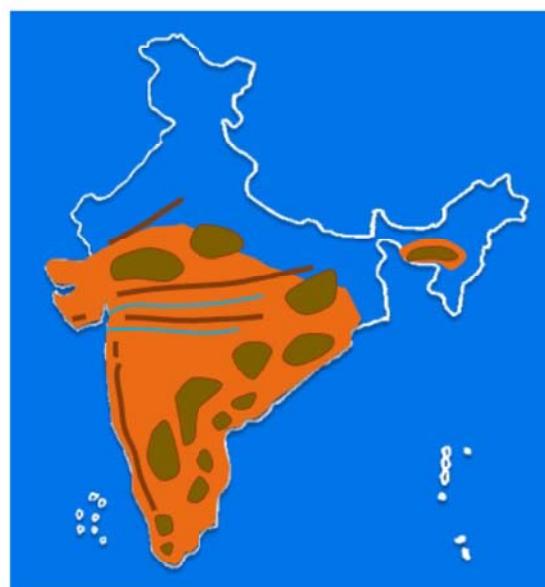
## History of India:

1. Indian plate was to the south of the equator millions of years ago
2. It was much larger in size and the Australian plate was a part of it.
3. Over millions of years, this plate broke into many parts and the Australian plate moved towards the south-eastern direction and the Indian plate to the north.
4. Northward movement of the Indian plate is still continuing



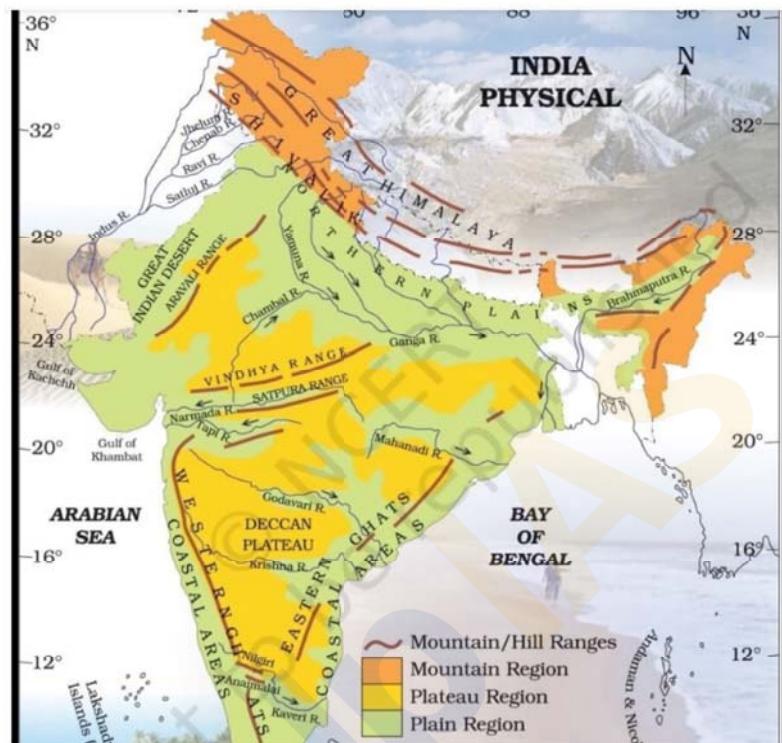
## About the Peninsular Block: Shape and Extent

1. **Shape:** Northern boundary is an irregular line running from Kachchh following the Aravali Range then roughly parallel to the Yamuna- Ganga as far as the Rajmahal Hills and the Ganga delta. Southern: irregular triangle
2. **Karbi Anglong and Meghalaya Plateau** in the NE is part of Plateau. NE parts are separated by the Malda fault in West Bengal from the Chotanagpur plateau
3. **Rajasthan** also has extensions of block. In Rajasthan, desert overlay this block.



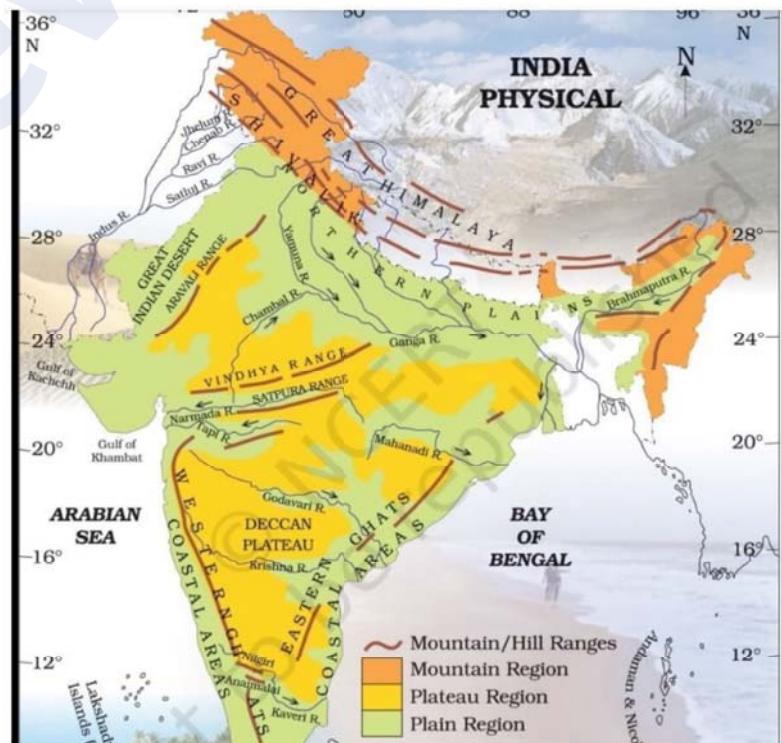
## Peninsular block

1. Height: 150 m-900 m
2. Mountains on outer extension: Delhi ridge in the northwest (extension of Aravalis), Rajmahal hills in the east, Gir range in the west and the Cardamom hills in south
3. Series of plateaus such as the **Hazaribagh plateau, Palamu plateau, Ranchi plateau, Malwa plateau, Coimbatore plateau and Karnataka plateau.**



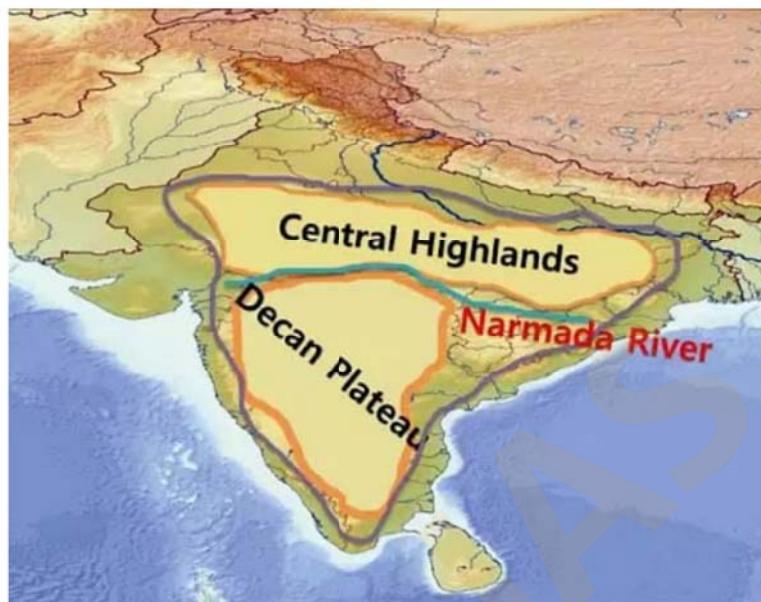
## Peninsular block

1. General elevation of plateau: West to East, proved by the pattern of the flow of rivers
2. Western and North-western part of Plateau has **black soil**.
3. Peninsular plateau has undergone through **phases of upliftment and submergence**



## Central Highland

1. Bounded to west by Aravali range.
2. **Satpura range** forms the southernmost part of Central Highlands. These are **relict mountains** which are highly denuded and form discontinuous ranges.
3. **Slope of Central Highlands**: From south-western to north-eastern directions .
4. **Origin of rivers**: Most of tributaries of Yamuna have their origin in the Vindhyan and Kaimur ranges.  
(Exception: Banas, tributary of Chambal originates from Aravalli)
5. **Eastern extension of Central Highland** is **Rajmahal hills**.
6. South-Eastern side: **Chotanagpur Plateau**



## Deccan Plateau

- **Bordered by the**
  - Western Ghats in the west,
  - Eastern Ghats in the east
  - Satpura range in the north.
- Western Ghats are **locally** known as such as
  - **Sahyadri** in Maharashtra
  - **Nilgiri hills** in Karnataka -Tamil Nadu
  - **Anaimalai hills** and **Cardamom hills** in Kerala.



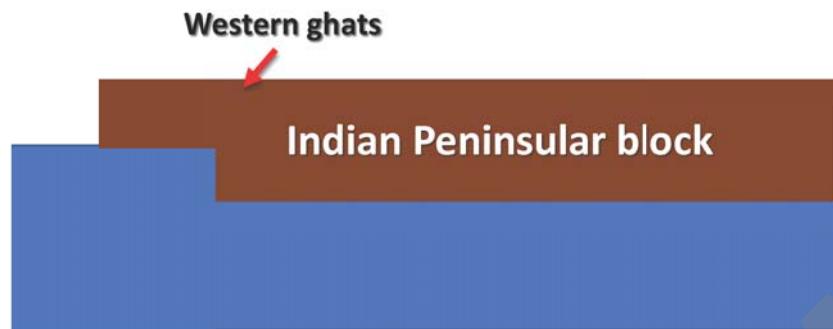
## Peninsular Block: Movements Experienced

1. **Composed:** Ancient gneisses and granites. Hard Rocks and so stable
2. One of the **oldest and the most stable landmass** of India Since the **Cambrian period**, the Peninsula has been standing like a rigid block in stable condition.
3. Peninsula has relict-residual mountains like **Aravali, Nallamala, Javadi, Veliconda, Palikonda, Mahendragiri hills**
1. But it has gone tectonic movements like:
  1. Formation of Western Ghat
  2. Rifting
  3. Formation of Deccan Lava Plateau
  4. Formation of Rajmahal Garo Gap
  5. Marine Transgression



## Formation of Western Ghat

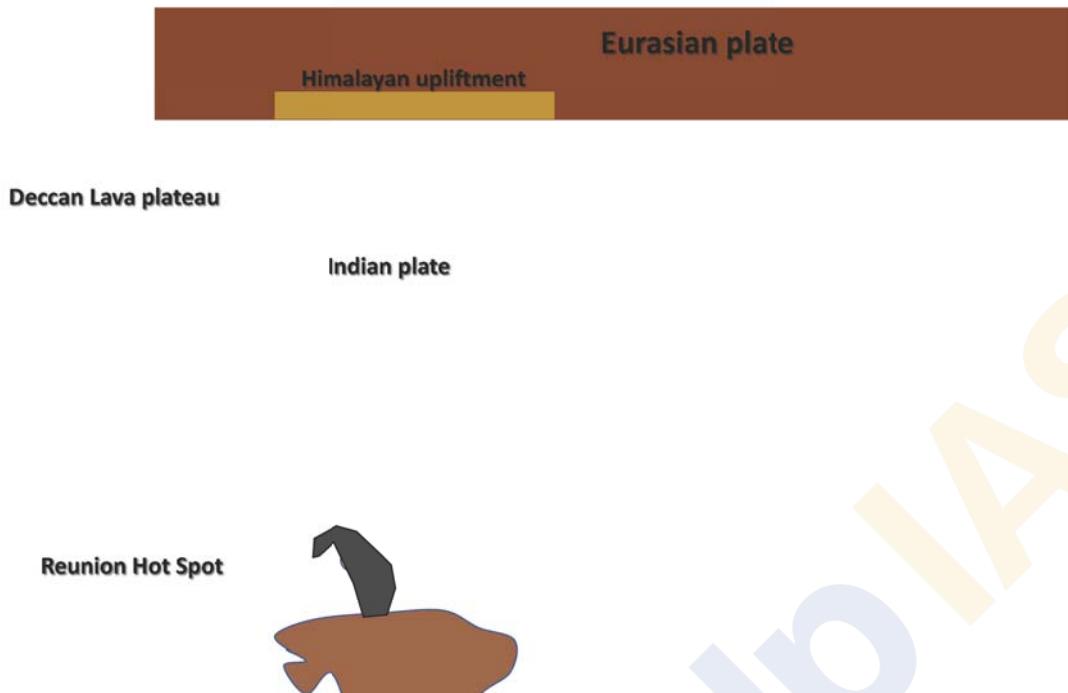
1. Peninsular Plateau was bigger in size than present day size
2. Peninsular Plateau developed cracks and the western side of peninsular plateau submerged under water
3. Remaining portion of peninsular plateau rotated eastward and western edge of peninsular plateau formed Western Ghat
4. Western Ghats are block Mountains



## Rifting

1. Due to Plate movement, PP has undergone **vertical movements** like **faulting, rifting**.
2. Eg: Rift valleys of Narmada, **Tapi**, **Mahanadi**, **Son**, **Damodar**, **Subarnarekha**. Rivers flow via these rift valleys and these are associated with the **coal fields**.
3. River valleys in peninsular India are shallow with low gradients.





### Formation of Deccan lava Plateau

Indian Plate was passing over Reunion Hot Spot

Western Part experienced lava flow over it

It formed deccan lava Plateau

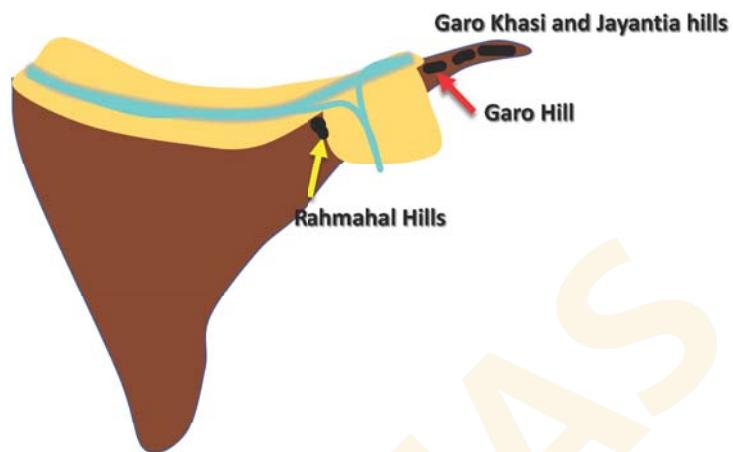
Location: Maharashtra, Gujarat, Some part of M.P, Malwa.

Region has Basalt rocks and forms the regur soil of India



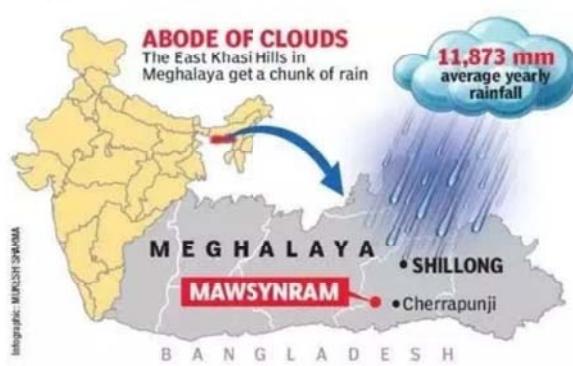
## North Eastern Plateau

- Extension of Peninsular plateau.
- Force exerted by the northeastward movement of the Indian plate at the time of the Himalayan origin, a huge depression was created between the Rajmahal hills and the Meghalaya plateau.
- Depression created is called as Rajmahal Garo Gap
- Later, this depression got filled up by the deposition activity of the numerous rivers.
- Today, the Meghalaya and Karbi Anglong plateau stand detached from the main Peninsular Block.



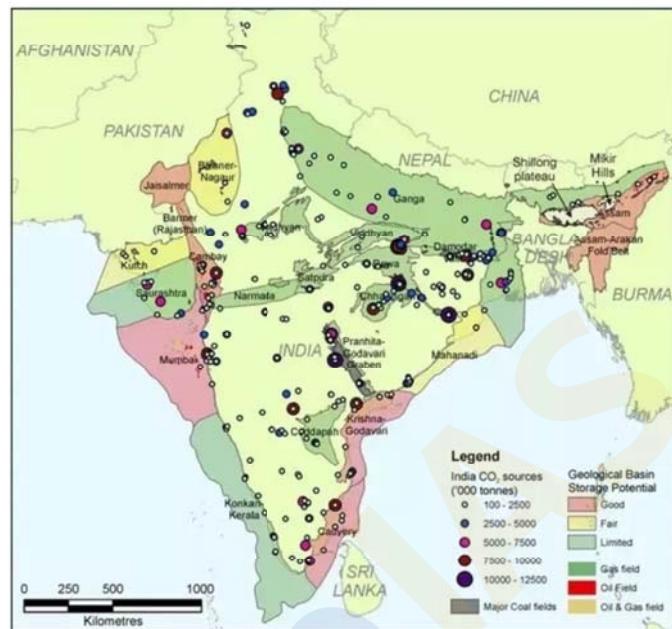
## North Eastern Plateau: Meghalayan Plateau

- Meghalaya plateau is further sub-divided into three:
  - (i) The Garo Hills;
  - (ii) The Khasi Hills;
  - (iii) The Jaintia Hills
- Extension of this is also seen in Karbi Anglong hills of Assam.
- Similar to the Chotanagpur plateau, the Meghalaya plateau is also rich in mineral resources like coal, iron ore, sillimanite, limestone and uranium.
- This area receives maximum rainfall from the south west monsoon. As a result, the Meghalaya plateau has a highly eroded surface. Cherrapunji displays a bare rocky surface devoid of any permanent vegetation cover.



## Marine Transgression

- As India Plate moved northward, there are 4 events of marine transgression (sea water entering into Peninsular Plateau)
- These areas form the major oil and gas resources
  - Kutch Saurashtra Shelf: South Bassein, Bombay High
  - K G Basin: Rawa Oil Fields
  - Assam Region: Naharkatiya, Sibsagar, Moran Hugrijan.



## Deccan Plateau: Western Ghats

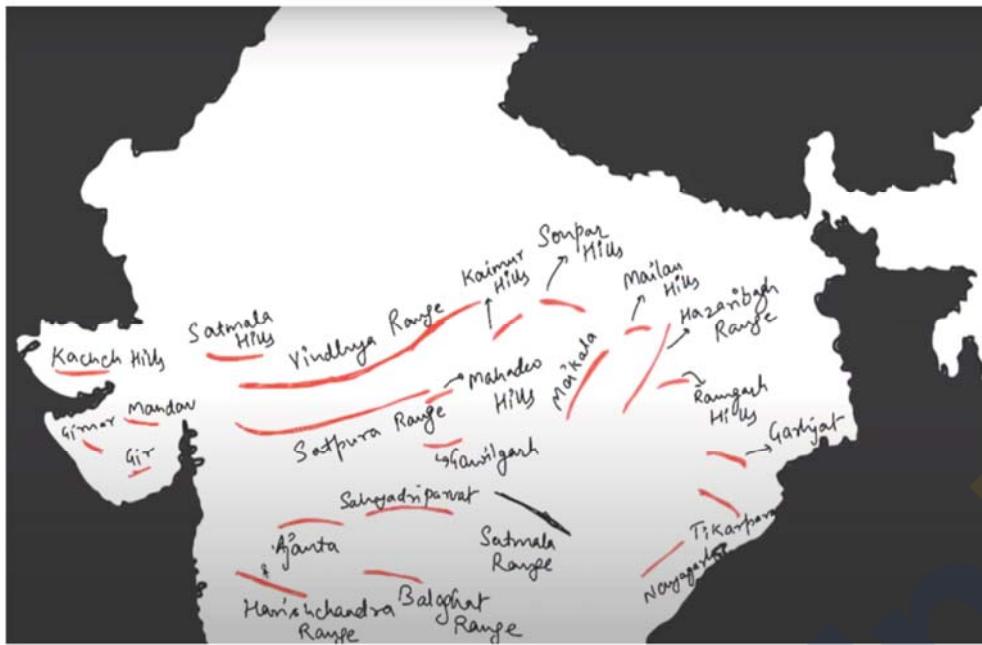
- W. Ghats has higher elevation and are more continuous than E. Ghats.
- Western Ghats: Elevation is 1,500 m with the height increasing from north to south.
- Anaimudi= Highest peak of Peninsular plateau on Anaimalai hills
- Dodabetta is highest peak of Nilgiri hills.
- Peninsular rivers have their origin in Western Ghats.



## Deccan Plateau: E Ghat

- Eastern Ghats are **discontinuous and low hills** are highly eroded by rivers of Mahanadi, Godavari, Krishna, Kaveri
- Some of the hills are Javadi hills, Palconda range, Nallamala hills, Mahendragiri hills, etc.
- Eastern and Western Ghats** meet each other at the Nilgiri hills.





- RGMAM: Satpura
- Goodwill peak is highest peak of Vindhayas: Sadbhavana Peak
- Dhoopgarh Peak is on Mahadeo Hills
- Chikaldhara Hillstation on satpura
- Amarkantak: Son, narmada, Johilla
- Maikal Range: Kanha National Park
- Gawilgarh: Melghat Tiger Reserve

## Plateau System



## 2023

Consider the following statements:

1. Amarkantak Hills are at the confluence of Vindhya and Sahyadri Ranges.
2. Biligirirangan Hills constitute the easternmost part of Satpura Range.
3. Seshachalam Hills constitute the southernmost part of Western Ghats

How many of the statements given above are correct?

- a) Only one
- b) Only two
- c) All three
- d) None

## 2023

- **Statement 1 is incorrect:** Amarkantak is a pilgrim town in Anantpur, Madhya Pradesh, India. The Amarkantak region is a unique natural heritage area and is the meeting point of the Vindhya and the Satpura Ranges, with the Maikal Hills being the fulcrum.
- **Statement 2 is incorrect:** The Billigirirangan hills are not a part of the Satpura range. The Biligirirangan Hills is a hill range situated in south-western Karnataka, at its border with Tamil Nadu (Erode District) in South India. The area is called Biligiri Ranganatha Swamy Temple Wildlife Sanctuary. It is part of Eastern Ghat.
- **Statement 3 is incorrect:** The Sesachalam hills, also known as Tirumala hills, are not a part of the Western Ghats. Seshachalam Hills are hilly ranges part of the Eastern Ghats in southern Andhra Pradesh state, in southeastern India. The Seshachalam hill ranges are predominantly present in Tirupati district of the Rayalaseema region in Andhra Pradesh, India.

2016

Consider the following pairs:

Place of Pilgrimage	Location
1. <u>Srisailam</u>	<u>Nallamala Hills</u>
2. <u>Omkareshwar</u>	<u>Satmala Hills</u>
3. Pushkar	Mahadeo Hills

Which of the above pairs is/are correctly matched ?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2013

In which of the following States is lion-tailed macaque found in its natural habitat?

- 1. Tamil Nadu
- 2. Kerala
- 3. Karnataka
- 4. Andhra Pradesh

Select the correct answer using the codes given below.

- (a) 1, 2 and 3 only
- (b) 2 only
- (c) 1, 3 and 4 only
- (d) 1, 2, 3 and 4

2014

Consider the following pairs:

Hills and Region

1. Cardamom Hills: Coromandel Coast
2. Kaimur Hills: Kokan India
3. Mahadeo Hills: Central India
4. Mikir Hills: North East India

Which of the pairs are correctly matched?

- (a) 1 and 2 only (b) 2 and 3 only  
(c) 3 and 4 only (d) 2 and 4 only



2016

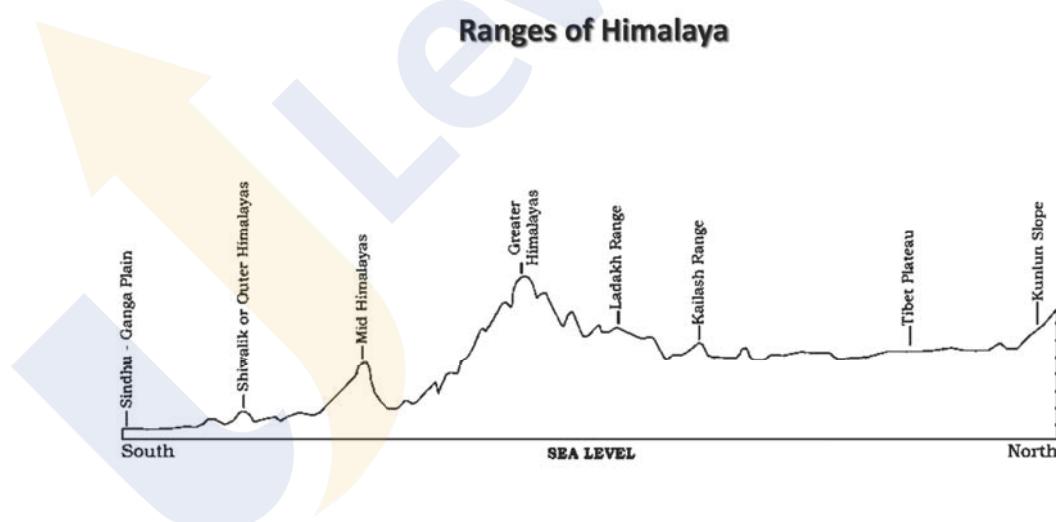
Consider the following pairs:

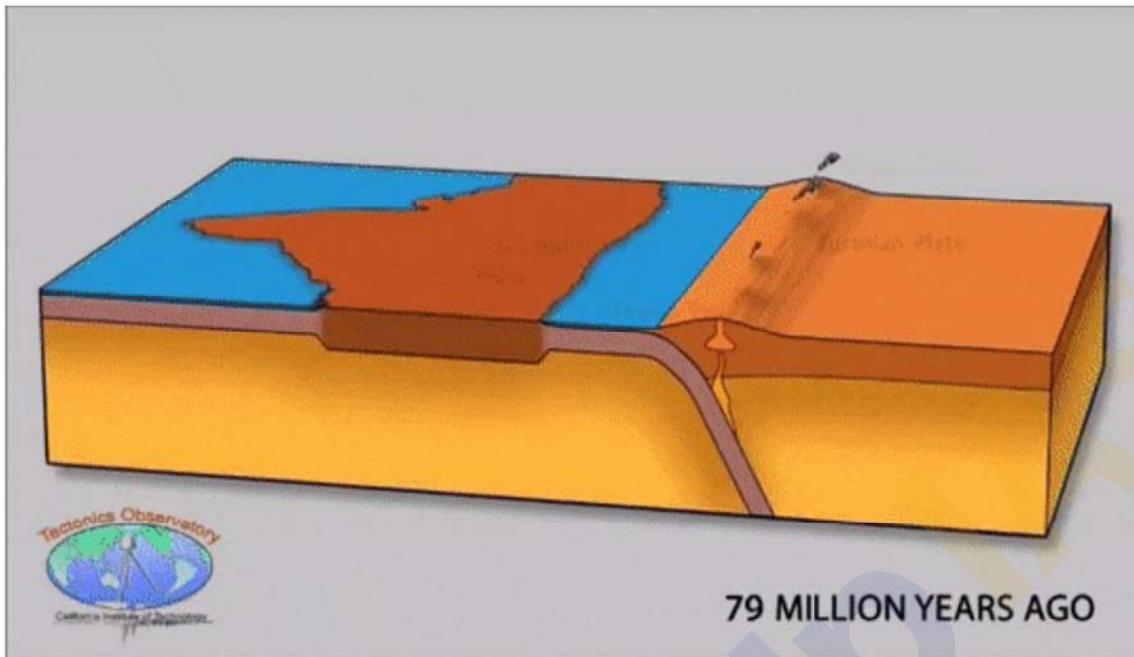
Famous Place: Region

1. Bodhgaya: Baghelkhand
2. Khajuraho: Bundelkhand
3. Shirdi: Vidarbha
4. Nasik (Nashik): Malwa
5. Tirupati: Rayalaseema

Which of the pairs given above are correctly matched?

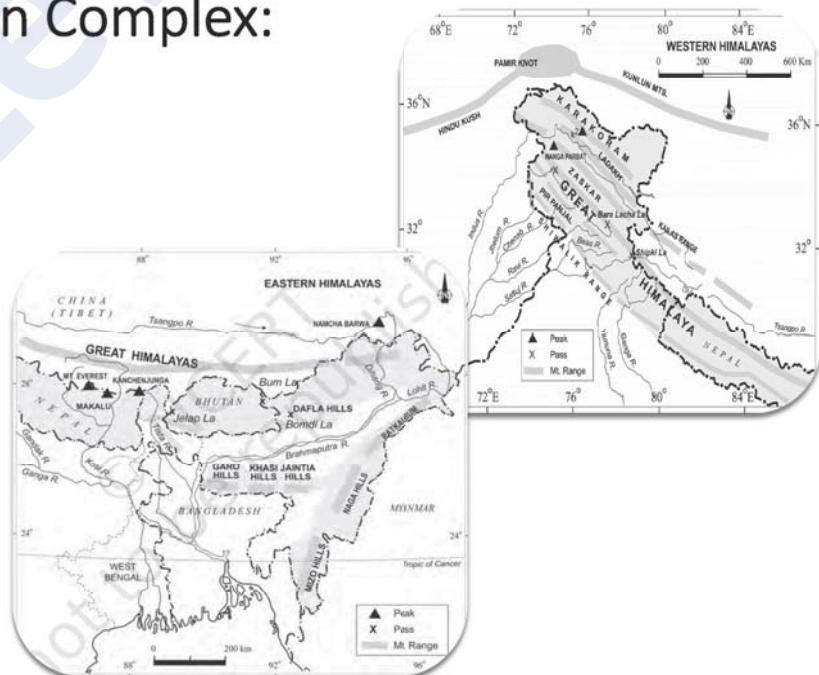
- (a) 1, 2 and 4 (b) 2, 3, 4 and 5  
(c) 2 and 5 only (d) 1, 3, 4 and 5





## Northern Mountain Complex:

- Are series of parallel mountain range
- Are young, weak and flexible unlike rigid & stable Peninsular Block.
- Are tectonic in origin (formed due to collision of Indian Plate with Eurasian Plate)
- Length: 2,500 km from east to west
- Width: 160-400 km from north to south



## Details of Northern Mountain Complex

- Series of ranges:
- **Trans Him:** Karakorum, Ladakh, Zaskar: Formed by Upliftment of Tethys Sea Sediments: O-C Collision
- **Great Him:** Continuous Range: C-C Collision: Formed by Upliftment of marine sediments: sedimentary and metamorphic
- **Middle Himalayas:** C-C Collision: Formed by Upliftment of marine sediments: sedimentary and metamorphic
  - Broken Ranges and are locally known by different names like:
    - Pir Panjal in Jnk and H.P
    - Dhauladhar in H.P
    - Mussorie, Nagtibba, Garhwal in UTK
- **Shivalik:** C-C Collision: Formed by upliftment of fluvial deposits
- **Purvanchal Range:** CC Collision: Marine Sediments.

## Details of Northern Mountain Complex

- Upliftment still continues and Indian Plate is moving at speed of 5-10 cm/year making the northern portion tectonically unstable
- Himalayas **are tallest mountain range** because:
  - Young (Not eroded much)
  - Upliftment still continues
  - Doubling of crust
  - Enormous sediment between Eurasian Plate and Indian Plate
- Himalayan Range extend from Namcha Barwa (Above Aru Prad) and Nanga Parbat (JnK)



## Door Slam Shut

Sequence of collision of Peninsular Plateau

- Collision first happened on Western Side
- Plateau then rotated in anti clockwise manner and got hinged on the NE side and western side got opened.
- Opening of Western Edge led to slumping of sediments on W. Him whereas Eastern Him continues to be squashed.
- This explains why Western Himalayas are broader while the Eastern Himalayas do not have distinct range.

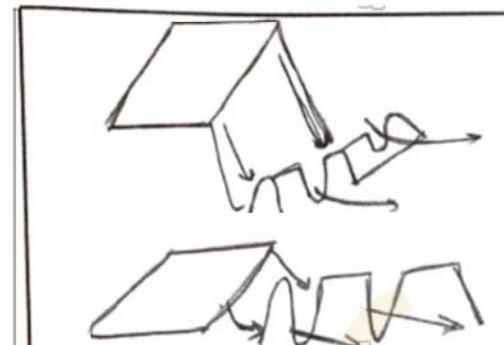


## Eastern Himalayas V/s Western Himalayas

Eastern Himalayas	Western Himalayas
Broader: 400 km: N-S	Narrower: 250 km: N-S
Ranges are more distinct: TH, GH, MH, Shivalik.	Ranges are not distinct: TH, GH, MH, Shivalik cannot be distinguished.
They are not as steep. They rise up as a series of steps	Very Steep. Rise abruptly from foothills
They have more Hill stations and Glaciers	They have less Hill stations and Glaciers
More Drier	More Wetter, Moist
Coniferous, Deciduous forest	Evergreen Forest

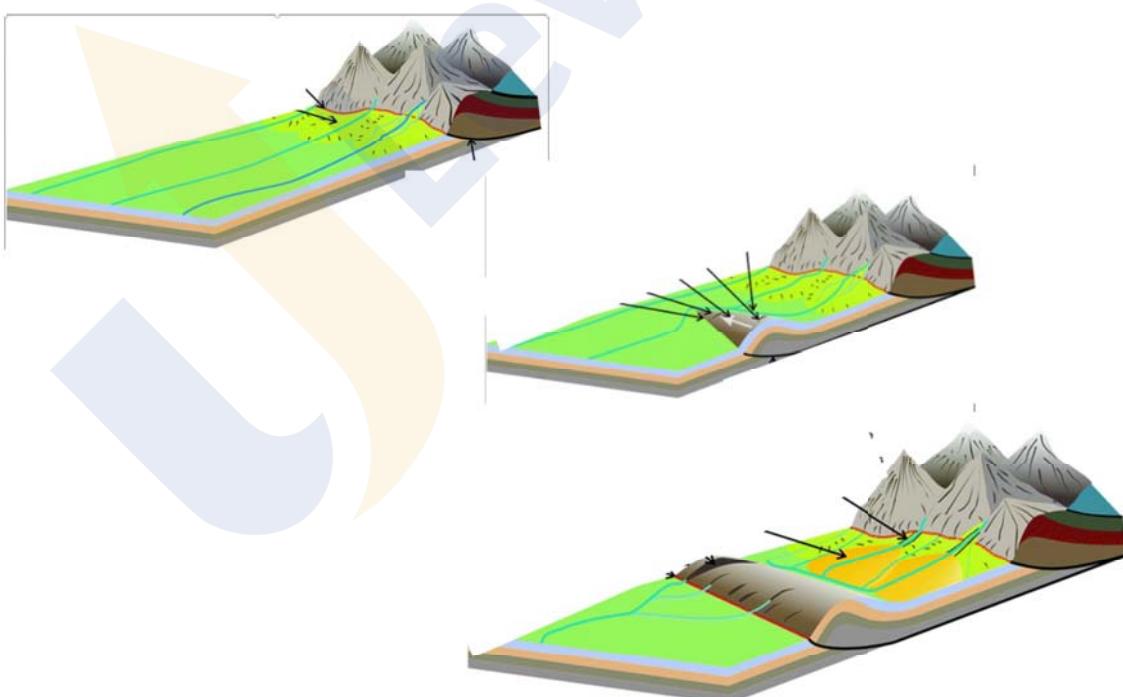
## Himalayas are not water divide

1. Almost all the Himalayan rivers cut across mountains and drain into N. Plain
2. Such Rivers are called as **Antecedent Rivers**. Rivers are older than Himalayas as Himalayas uplifted the rivers could cut across the Himalayas.
3. This happened as rivers were large enough and Himalayas were rising at the rate, where the rivers could keep pace and erode
4. When **Mountains were being uplifted**, the rivers form Tibetan highlands were blocked and formed longitudinal lakes between the ranges.
5. Eventually as the rivers cut across the lakes were drained leaving behind the dry lake beds called as **DUN/WADI between Him Ranges**
6. These are location for **agriculture and Horticulture** because of fertile lacustrine Deposits

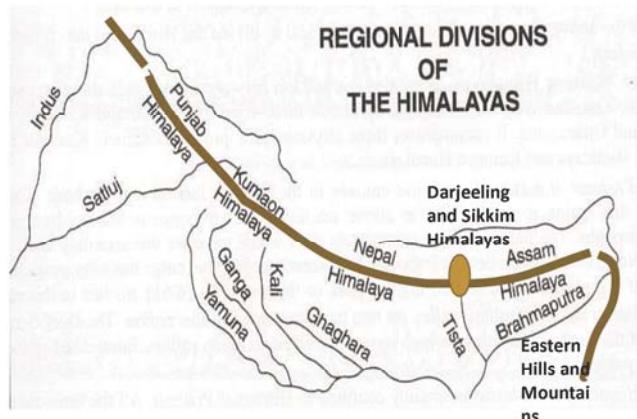


Longitudinal valley is an elongated valley found between two almost-parallel mountain chains in geologically young fold mountains

**Lacustrine Means  
Derived from Lake**



## Division of Northern mountains



### Punjab Himalayas:

- This part lies between the Indus and Sutlej. From west to east, this is also known as Kashmir Himalaya and Himachal Himalaya; respectively.

### Kumaon Himalayas:

- This part lies between Sutlej and Kali rivers.

### Nepal Himalayas:

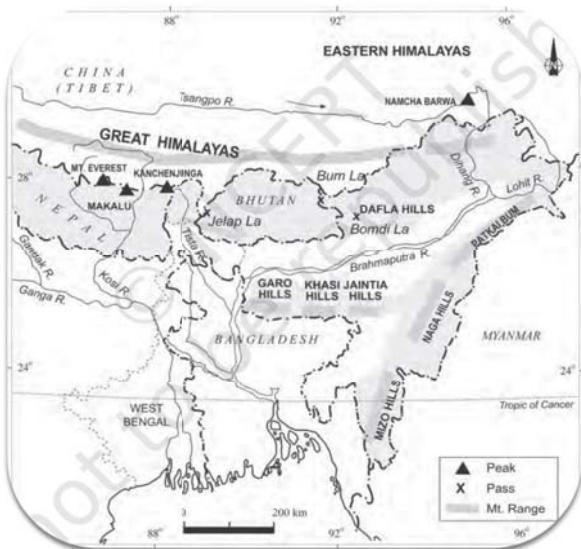
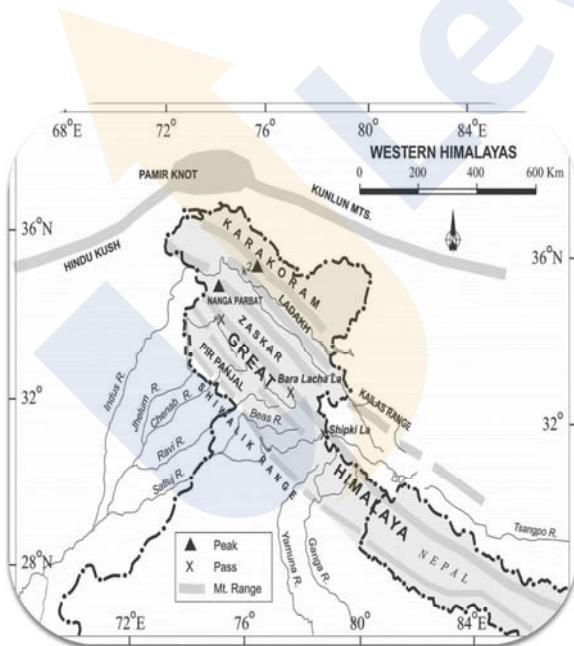
- This part lies between the Kali and Tista rivers.

### Assam Himalayas:

- This part lies between the Tista and Dihang

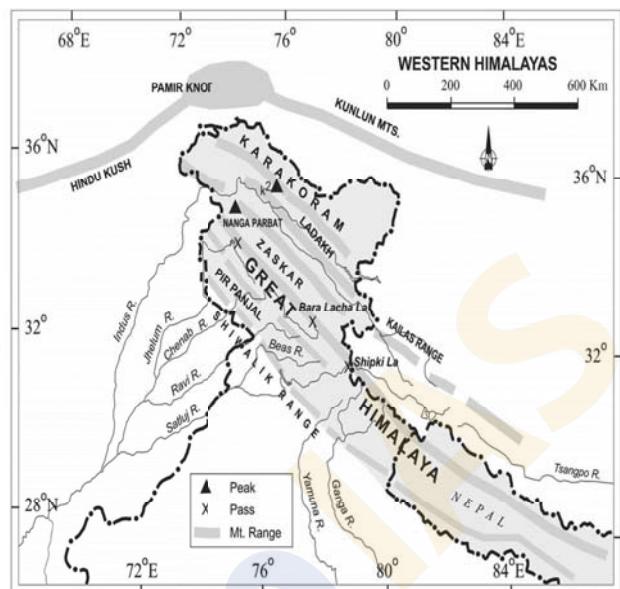
### Eastern hills

- Patkai Hills, Naga Hills, Manipuri Hills and Mizo Hills.



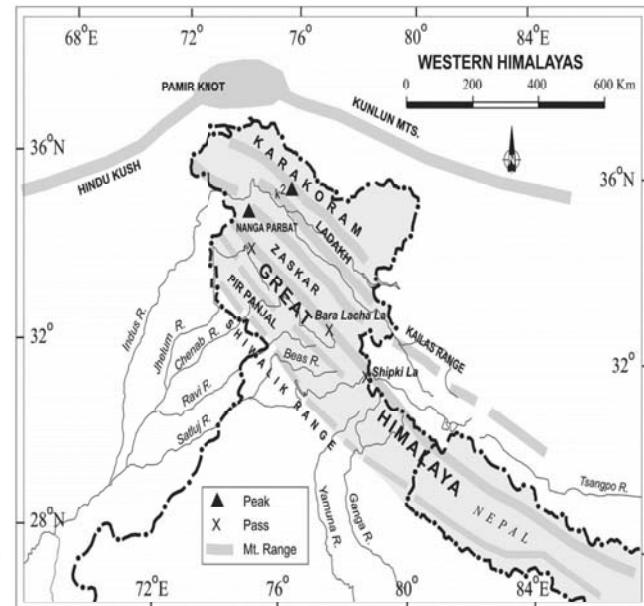
## Kashmir Himalayas

- Series of Range: Karakoram, Ladakh, Zaskar, Great Himalayas, Pir Panjal, Shivalik
- Valley of Kashmir and Dal Lake is in between Great Himalayas and Pir Panjal.
- Glacier: Baltoro and Siachen.
- Famous: Karewa formations for cultivation of Zafran, local variety of saffron.
- Imp passes of the region are
  - Zoji La on Great Himalayas,
  - Banihal on Pir Panjal,
  - Photu La on Zaskar
  - Khardung La on Ladakh range.



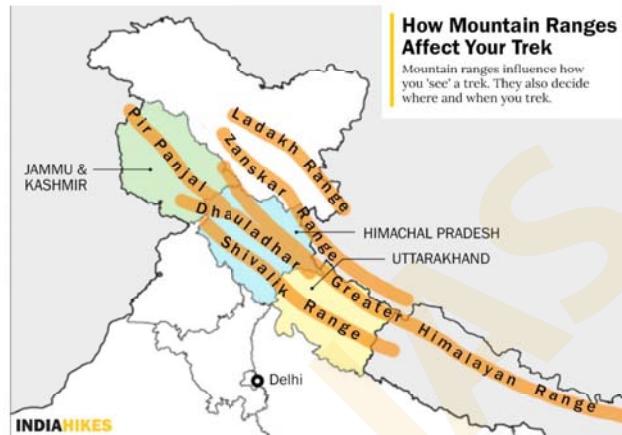
## Kashmir Himalayas

- Imp Fresh Water lakes: Dal (has Srinagar City) and Wular
- Salt water lakes: Pangong Tso and Tso Moriri
- River in regions: Indus, Jhelum (has Srinagar City), Chenab.
- Famous pilgrimage centre: Vaishno Devi, Amarnath Cave, Charar -e-Sharif,
- Has longitudinal valleys known as 'duns'. eg: Jammu dun, Pathankot dun
- Jhelum river meanders because of local base level provided by Dal Lake



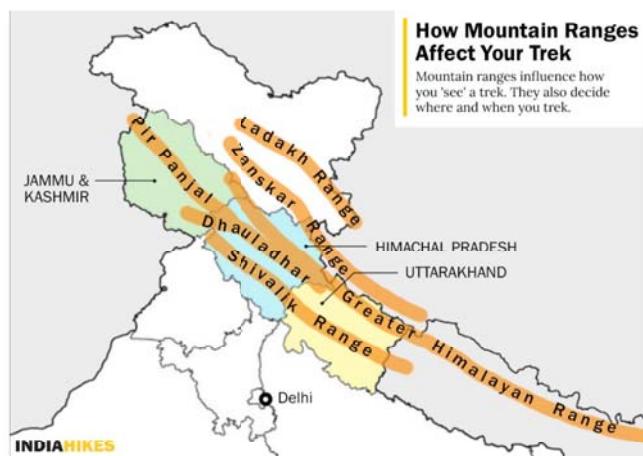
## Himachal and Uttarakhand Himalayas

- Between Ravi River (West) and Kali on East (tributary of Ghaghara)
- Drained by 2 major river systems: Indus & Ganga.
- Tributaries of Indus: Ravi, Beas and Satluj.
- Tributaries of Ganga: Yamuna and the Ghaghara.
- All 3 ranges of Himalayas are visible: Great Him, Middle Him (Known as Dhaoladhar in HP & Nagtibha in UTK) and Shiwalik Range.



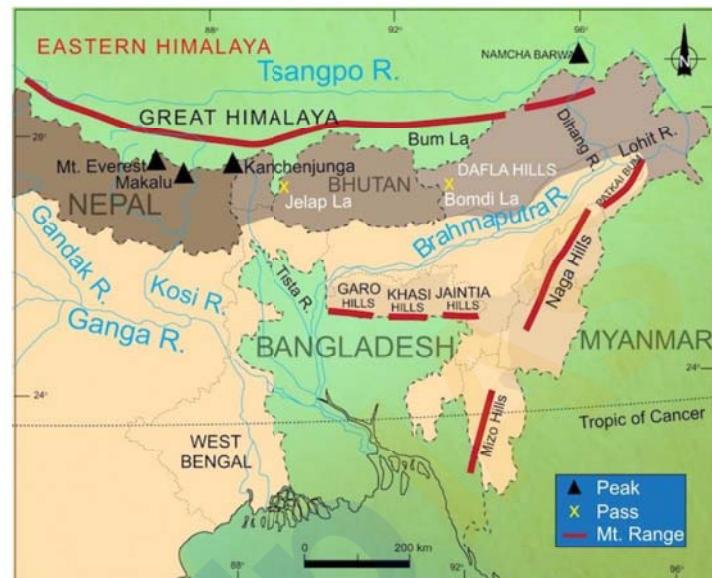
## Himachal and Uttarakhand Himalayas

- Imp hill stations: Dharamshala, Mussoorie, Shimla, Kaosani, Kasauli, Almora, Lansdowne and Ranikhet,
- Imp dun: Chandigarh-Kalka dun, Nalagarh dun, Dehra Dun, Harike dun, Kota dun, etc.
- Tribes: Inhabited by nomadic Bhotia tribe who migrate to 'Bugyals' (the summer glasslands in higher reaches) during summer months and return to the valleys during winters.
- Imp tourist location: 'Valley of flowers', Gangotri, Yamunotri, Kedarnath, Badrinath, Hemkund Sahib



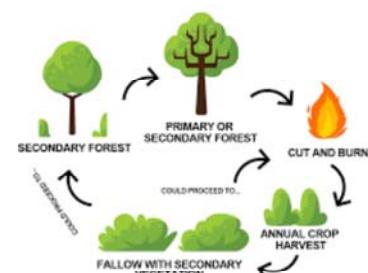
## Darjiling and Sikkim Himalayas

- Flanked by Nepal Himalayas (West) & Bhutan Himalayas (East).
- Rivers such as Tista
- Peaks: Kanchenjunga
- Tribe: Lepcha tribes
- Tea Gardens: Moderate slope, thick soil cover with high organic content, well distributed rainfall throughout the year and mild winters (Duar formations)



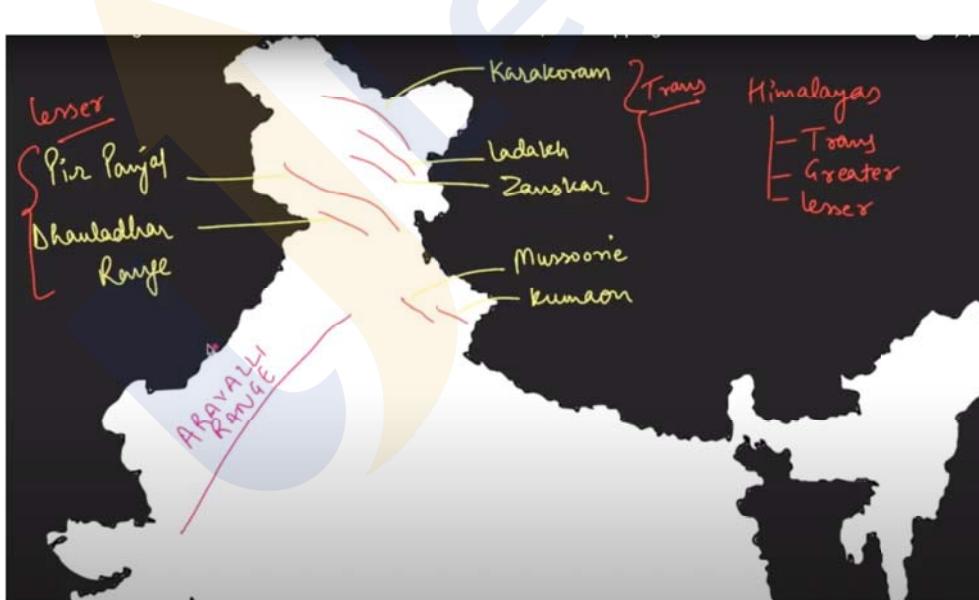
## Arunachal Himalayas

- East of Bhutan Him upto Diphu pass (in East)
- Imp Mtn Peak: Namcha Barwa.
- Imp Rivers: Bhramaputra, Kameng, Subansiri, Dihang, Dibang, Lohit.
- Imp Tribe: Monpa, Abor, Mishmi, Nyishi and Nagas.
- Tribes practise Jhumming (Shifting or slash and burn cultivation).



## Eastern Hills and Mountains

- General alignment: North to South direction.
- Local Names: Patkai Bum, Naga hills, Manipur hills, Mizo or Lushai hills.
- Imp River: Barak River
- Manipur has famous lake (Loktak lake)
- Mizoram has 'Molassis basin': soft unconsolidated deposits.



### Important Passes:

- Sasser La: Karakoram
- Khardung La: Ladakh
- Photu La: Zaskar
- Zozila: Great Himalayas
- Rohtang Pass: Pir Panjal
- Banihal Pas: Pir Panjal
- Shipki La: Dhauladar
- Wular Lake & Dal Lake: Between Great Himalayas & Pir Panjal



- Passes:
  - Sikkim: Jelep La, Nathu La:
  - Tse La: Dafla

## 2022: Location

Consider the following pairs:

### Peak

1. Namcha Barwa
2. Nanda Devi
3. Nokrek

### Mountains

- Garhwal Himalaya  
Kumaon Himalaya  
Sikkim Himalaya

Which of the pairs given above is/are correctly matched?

- (a) 1 and 2
- (b) 2 only
- (c) 1 and 3
- (d) 3 only

## 2017: Location

**Consider the following statements:**

1. In India, the Himalayas are spread over five States only
2. Western Ghats are spread over five States only.
3. Pulicat Lake is spread over two States only.

Which of the statements given above is/are correct?

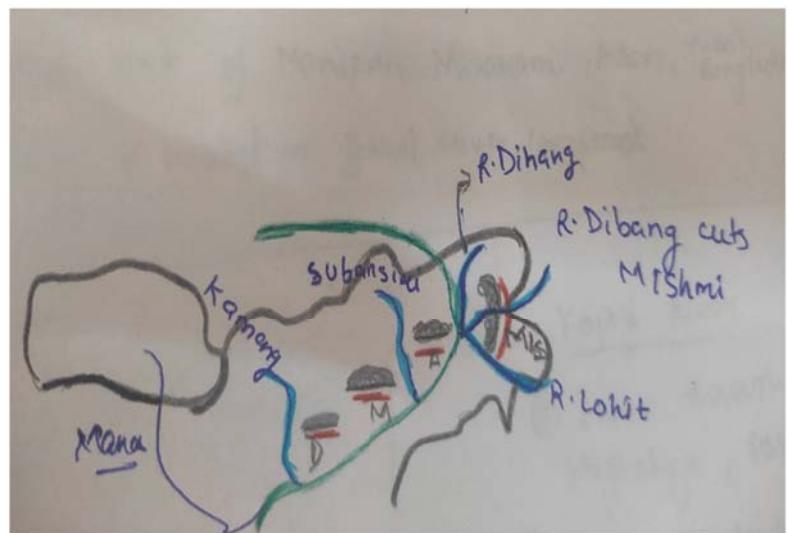
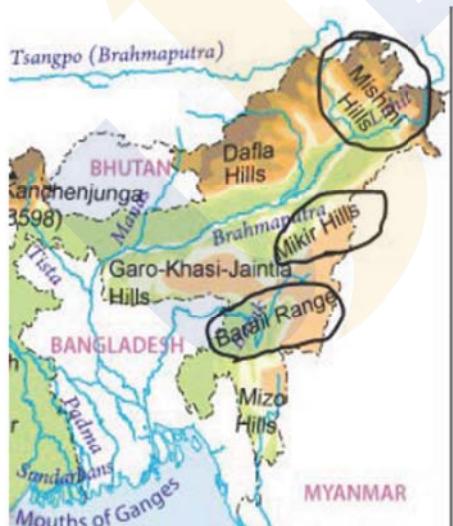
- (a) 1 and 2 only
- (b) 3 only
- (c) 2 and 3 only
- (d) 1 and 3 only

### Himalayas Spread

1. JNK, HP, UTK, SIKKIM, West Bengal, Arunachal Pradesh and West Bengal
2. Western Ghat: Guj, Mah, Goa, Karnataka, Kerala, Tamil Nadu
3. Pulicat: Andra and T. N



D, M, A, M



## North East

- Patkai: Arunachal: Diphu pass, Monpa Tribe
- Naga Hills: Nagaland: Saramati Peak, Mollen Nation Park
- Manipur: Loktak Lake, Metei tribe, Lalmatol Range
- Barail Range: Assam, Naga, Manipur, Source of Barak River, Watershed between Brahma and Barak River
- Mizo Hill: Blue Mountain, Molassis Basin, Lushai Hills
- Meghalaya: Nokrek peak is on???? Khasi which is capital of Shillong is on? Bamboo Drip???
- Sikkim: Kunchenjugna Peak, Lepcha Tribe, Khecopalri Lake, Zemu Glacier, Rumtek Monastery, Teesta river
- Tripura: Kamlasagar Lake, Rudrasagar Lake

## India Map Location

**2013:**

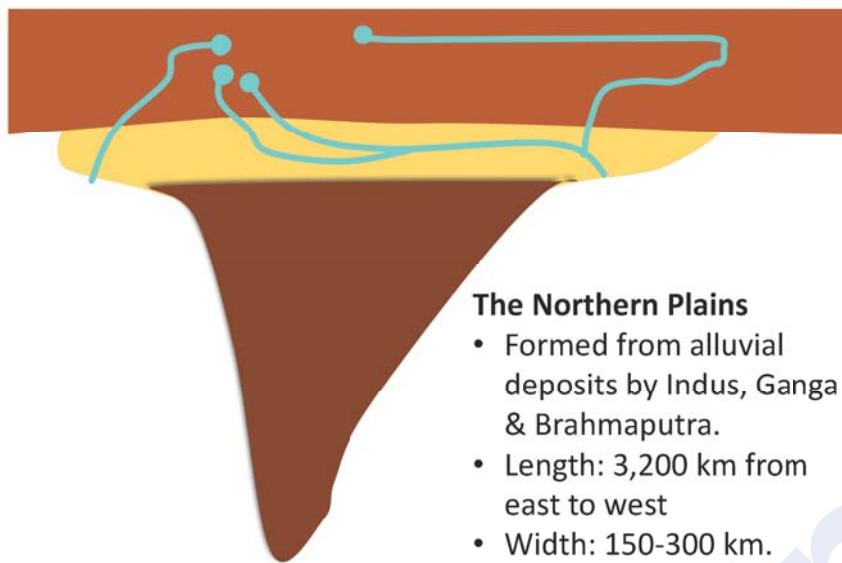
Consider the following pairs:

1. Nokrek Biosphere Reserve : Garo Hills
2. Loktak Lake : Barail Range
3. Namdapha National Park : Dafla Hills

Which of the above pairs is/are correctly matched?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1, 2 and 3
- (d) None

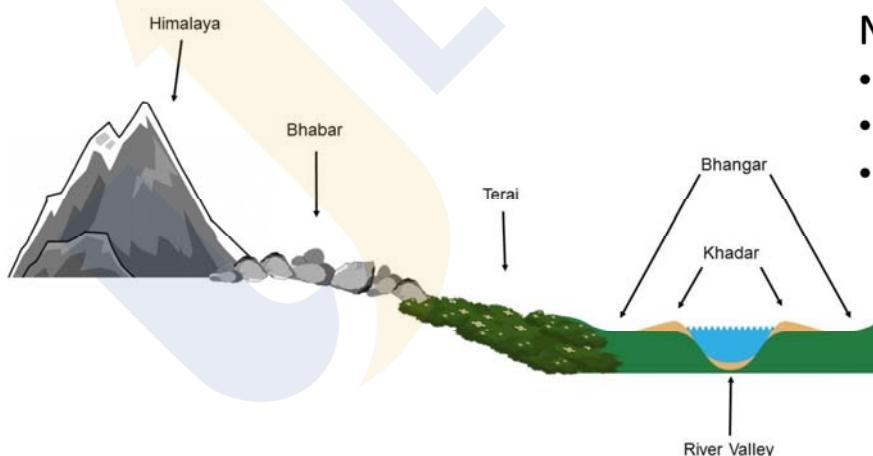
## Formation of northern plains



### The Northern Plains

- Formed from alluvial deposits by Indus, Ganga & Brahmaputra.
- Length: 3,200 km from east to west
- Width: 150-300 km.
- Depth: 1,000-2,000 m.

## THE NORTHERN PLAINS



### North to south Division:

- Bhabar
- Tarai
- Alluvial plains: Khadar and Bhangar.

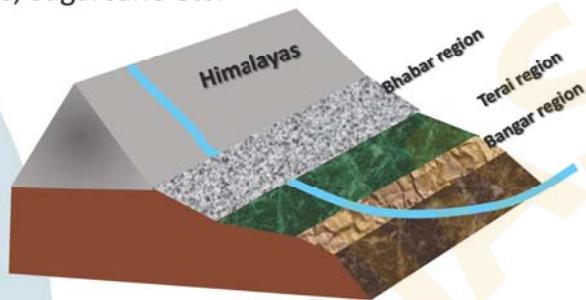
## PLAINS OF THE NORTHERN INDIA

### THE BHABAR PLAINS

- Narrow belt: 8-10 km parallel to Shiwalik
- Lie to the south of Shiwalik
- Jammu to Assam.
- Rivers coming from mountains deposit bigger rocks, boulders
- River disappear in this zone
- Not suitable for cultivation: Forested Areas and Big trees

### THE TARAI PLAIN

- South of the Bhabar tract
- Width: 10-20 km
- Rivers re-emerge here creating marshy-swampy conditions
- Good for the cultivation of Wheat, rice, maize, sugarcane etc.



### Alluvial Plain: Bhangar and Khadar

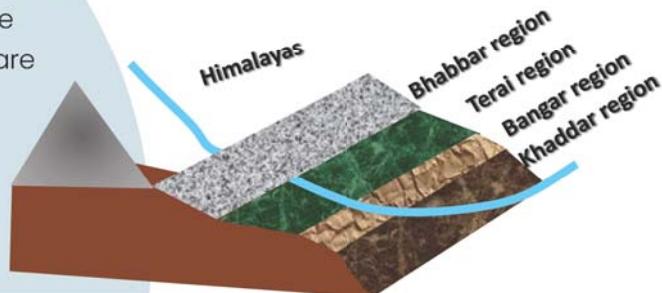
- Features: Sand bars, meanders, oxbow lakes and braided channels.
- Have periodic floods and shifting river courses
- Mouths of rivers has largest deltas of the world. For eg: Sunderbans delta

### THE BHANGAR PLAINS

- Older alluvial plains.
- Contains the calcium carbonate nodules called 'Kankars' which are impure in nature.

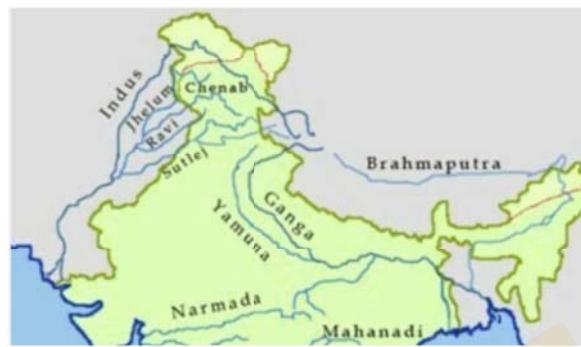
### THE KHADAR PLAINS

- Newer Alluvial Plain
- Enriched by fresh deposits of silt every year.
- Consists of silt, mud, clay, and sand.
- Cultivation of sugarcane, rice, wheat, maize and oilseeds.



## Features of North Plain

1. Form some of the largest deltas of the world like Sunderbans delta.
2. Generally featureless plain with an elevation of 50-150 m
3. Haryana and Delhi form a water divide between the Indus and the Ganga river systems.
4. Brahmaputra river flows from the northeast to the southwest direction before it takes an almost 90° southward turn at Dhubri before it enters into Bangladesh.
5. River valley plains have a fertile alluvial soil cover which supports a variety of crops like wheat, rice, sugarcane and jute, and hence, supports a large population.



## Islands: 2 Major Group

- Andaman and Nicobar:
  - 572 islands/islets.
  - Between 6°N-14°N and 92°E -94°E.
  - The two principal groups of islets include the Ritchie's archipelago and the Labrynth island.
  - Two broad Category: Andaman in the north and the Nicobar in the south separated by a waterbody which is called the Ten degree channel.
  - Some believe it is an elevated portion of submarine mountains.
  - However, some smaller islands are volcanic in origin.
  - Barren island, the only active volcano in India is also situated in the Nicobar islands
  - Has corals and has equatorial vegetation

## Islands: 2 Major Group

- Lakshadweep:
  - 8°N-12°N and 71°E -74°E longitude.
  - Entire island is coral deposits.
  - 36 islands of which 11 are inhabited.
  - Minicoy is the largest island
  - Islands are divided by the Ten degree channel, north of which is the Amini Island and to the south of the Canannore Island..

2021

With references to India, Didwana, Kuchaman, Sargol and khatu are the names of

- (a) Glaciers
- (b) Mangrove areas
- (c) Ramsar sites
- (d) Saline lakes

2018

Consider the following statements:

1. The Barren Island volcano is an active volcano located in the Indian territory.
2. Barren Island lies about 140 km east of Great Nicobar.
3. The last time the Barren Island volcano erupted was in 1991 and it has remained inactive since then.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3
- (c) 3 only
- (d) 1 and 3



### Indus:

- Origin: Bokarchu Glacier (West of Mansarovar)
- Has Blind Indus Dolphin
- Aka Singhikhambab
- Lake: Satpara Lake
- Hemis High Altitude National: Largest and Highest NP, Snow Leopard
- Imp left Bank Tributary: Suru, Zaskar River
- River Shyok, Gilgit( Tributary:Hunza) are right bank tributary.
- River Shyok has origin in Siachen



## INDUS RIVER

### LEFT TRIB.

Jhelum  
Chenab  
Ravi, Beas  
Satluj  
Zanskar, Panjnad

### RIGHT TRIB.

Shyok  
Hunza, Gilgit  
Swat  
Kunar, Kabul  
Kurram

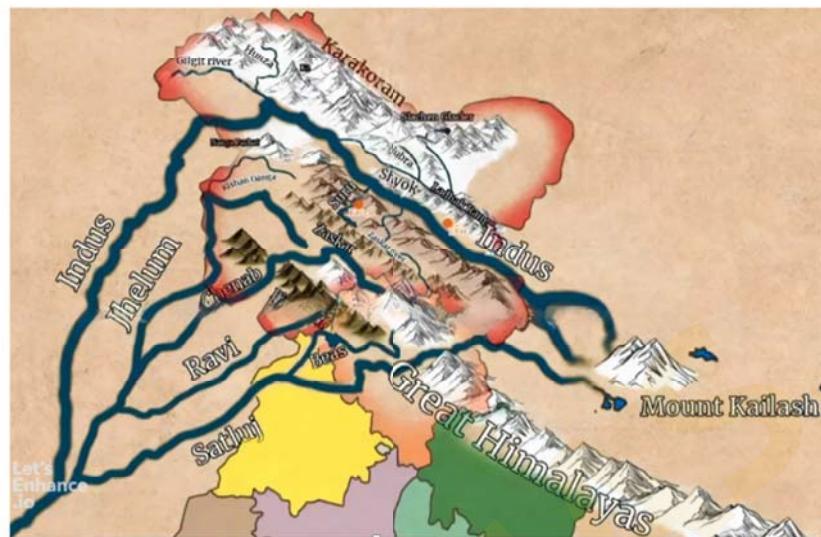
### Jhelum:

- Origin: Verinag Spring at foot of PirPanjal
- Tributary: Neelam, Kishenganga
- Has wular lake, Dal Lake, Srinagar
- Forms border between India and Pakistan
- Meets Chenab in Pakistan



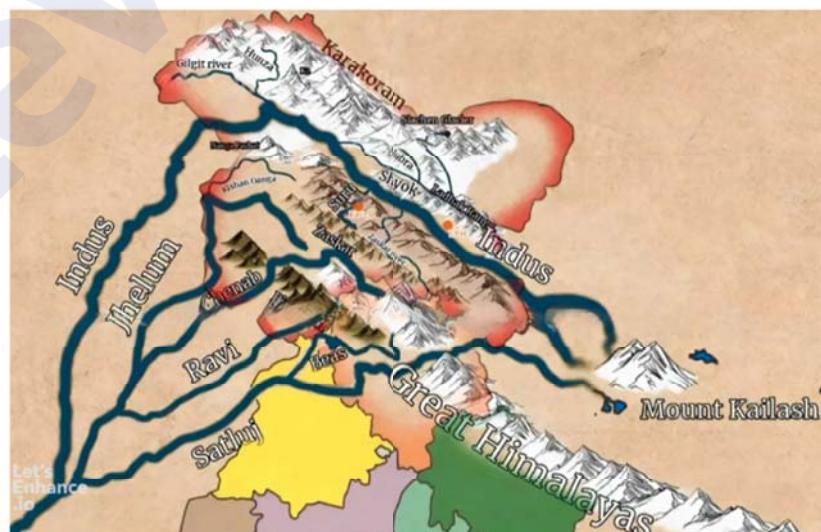
### Chenab:

- Made of Chandra and Bhaga: Both meets at Keylong: Hence called as Lady of Keylong
- Origin: Baralacha La Pass
- Largest Tributary of Indus
- Meets Indus River



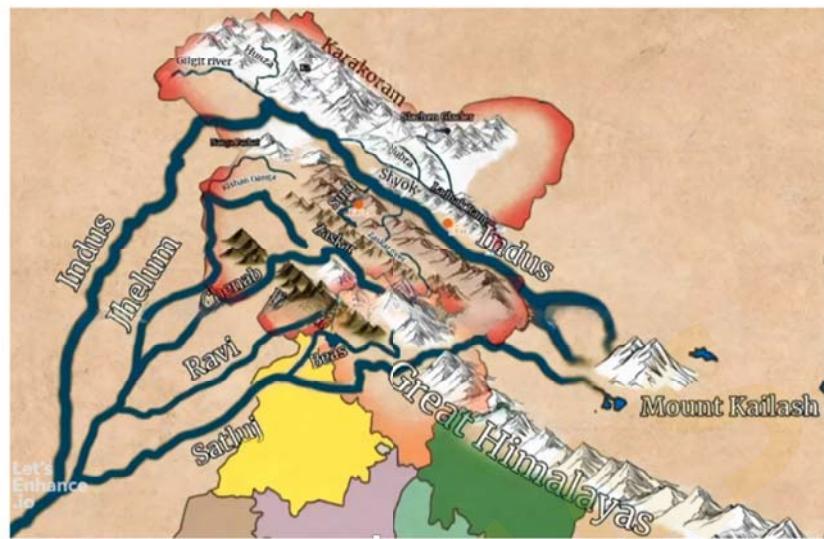
### Ravi

- Origin: Rohtang Pass (HP) in Kullu
- Between Pir Panjal and Dhauladhar
- Cuts Dhauladhar
- Dalhousie is on Ravi
- Meets Chenab River in Pakistan



### Beas:

- Origin: Beas Kund (HP) near Rohtang Pass
- Dam: Pong Dam aka Maharana Pratap Sagar Dam
- Has Pong Wetland, Harike Wetland
- Flows entirely in India
- Beas and Sutlej meet at Harike to form Harike wetland



### Sutlej:

- Origin Rakas Lake near Mansarovar
- Aka Langchen Khambab in Tibet
- Passes through Shipki La Pass in Dhauladhar Range
- Dam: Bhakra Nangal Dam aka Govind Sagar Dam (HP);
- Has Harike Wetland
- Meets River Chenab in Pakistan



2021: UPSC

With reference to the Indus River system, of the following four rivers, three of them pour into one of the which joins the Indus direct. Among the following, which one is such river that joins the Indus direct?

- (a) Chenab
- (b) Jhelum
- (c) Ravi
- (d) Sutlej

2020: UPSC

Siachen Glacier is situated to the

- (a) East of Aksai Chin
- (b) East of Leh
- (c) North of Gilgit
- (d) North of Nubra Valley

Practise Question:

Q) This Flows entirely in India. This River meets Sutlej meet at Harike to form Harike wetland?

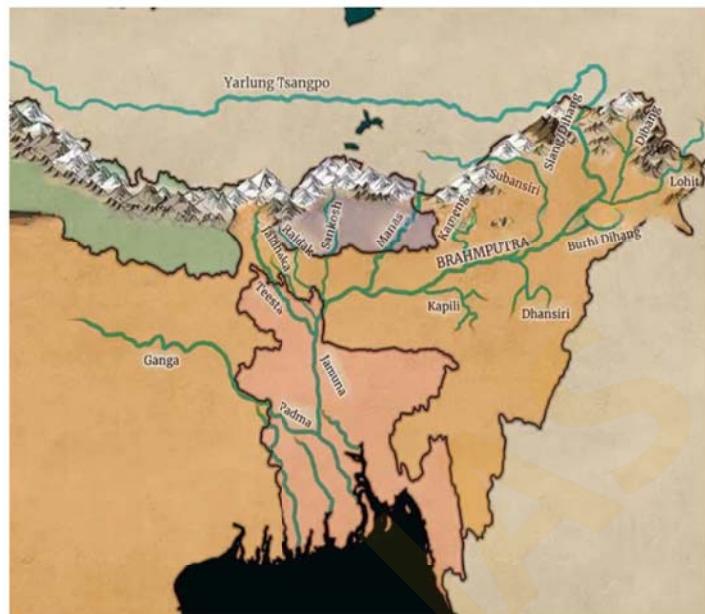
Q) This river has origin in Rakas Lake in Tibet and passes through Shipki la

Q) This river has Dal Lake on it and it forms border between India and Pakistan



## BRAHMAPUTRA

- Origin: Chemayungdung glacier of Kailash range near Mansarovar lake.
- It travels eastward in Tibet (Known as Tsangpo)
- Enters India near Namcha Barwa
- The river is named of Siang or Dihang
- After meeting left bank tributaries of Dibang/Sikang and Lohit it is known as Brahmaputra.
- Major left bank tributaries: Burhi Dihing, Dhansari (South)
- Right bank: Subansiri, Kameng, Manas and Sankosh.
- In Bangladesh, the Tista joins it on its right bank then it is known as Jamuna.



## 2016: Brahmaputra River

**Which of the following is/are tributary tributaries of Brahmaputra?**

1. Dibang
2. Kameng
3. Lohit

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

## 2014: Brahmaputra River

Consider the following rivers:

1. Barak
2. Lohit
3. Subansiri

Which of the above flows / flow through Arunachal Pradesh?

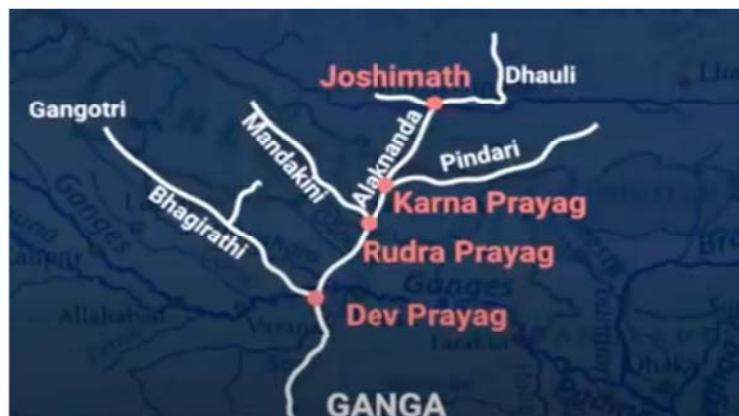
- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

### Sources of Ganga:

- Bhagirathi Origin: Gangotri Glacier
- Alaknanda Origin: Saptapanth Glacier. It passes via Valley of Flowers
- **Left Bank Tributaries are:** Ramganga (origin: India), Gomti (origin: India), Ghagra (origin: Nepal), Gandhak (origin: Nepal), Kosi (origin: Nepal), Mahananda (origin: India)
- **Right Bank Tributaries:** Yamuna, Son

### Ganga river:

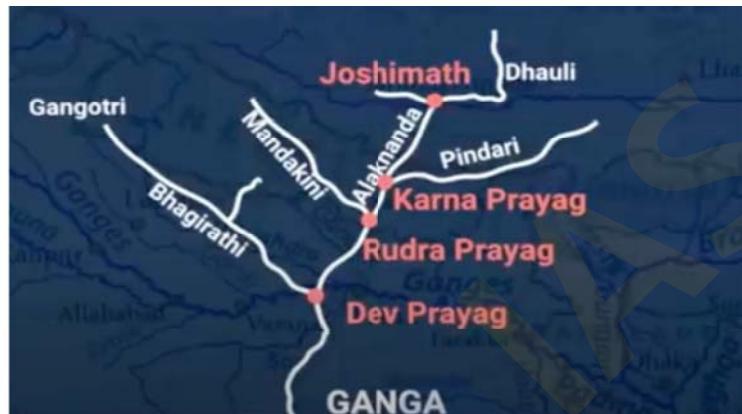
- Origin: Gangotri Glacier near Gomukh in Uttarakhand where river Alaknanda meets Bhagirathi at Devprayag to form Ganga



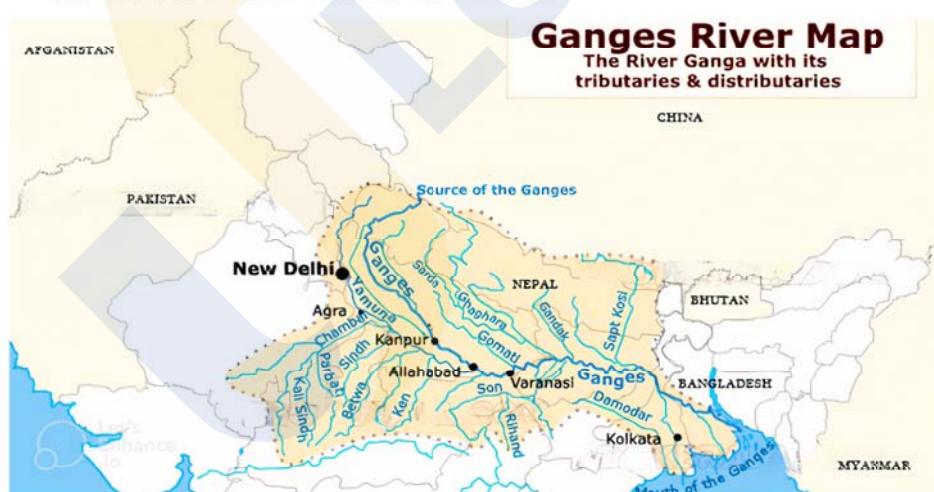
- **Important Lake:**  
Kanwar Lake. Asia's largest freshwater Oxbow Lake in India. Made by Gandhak River
- **Ganga Passes via Rajaji National Park**
- **Ganga** breaks at Malda Gap into River Hooghly and River Padma
- **Sagar Island** is in Bay of Bengal near Ganga's Mouth

**Ganga river:**

- Origin: Gangotri Glacier near Gomukh in Uttarakhand where river Alaknanda meets Bhagirathi at Devprayag to form Ganga



## GANGA RIVER SYSTEM



- Barila wetland is at confluence of Ganga, Punpun and Gandhak in River;
- Uduwa Wetland which is the only bird sanctuary in Jharkhand

- **Important Dam:**  
Tehri on River Bhagirathi (Highest Dam in India),
- Narora Dam on Ganga in U.P.  
Narora is also Nuclear Power Plant



### Ramganga River:

- Origin: Namik Glacier near Garhwal Hills
- It passes via Corbet National Park

### Gomti:

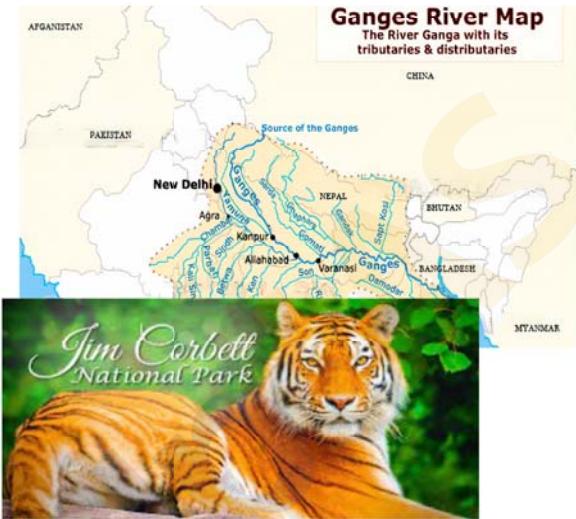
- Origin: Gomat Tal (U.P)

### Ghagra:

- **Origin:** Mapchachungo Glacier near Mansarovar in Tibet
- **By Volume,** ghagra is largest tributary of Ganga

### Ganga river:

- Origin: Gangotri Glacier near Gomukh in Uttarakhand where river Alaknanda meets Bhagirathi at Devprayag to form Ganga



### Ramganga River:

- Origin: Namik Glacier near Garhwal Hills
- It passes via Corbet National Park

### Gomti:

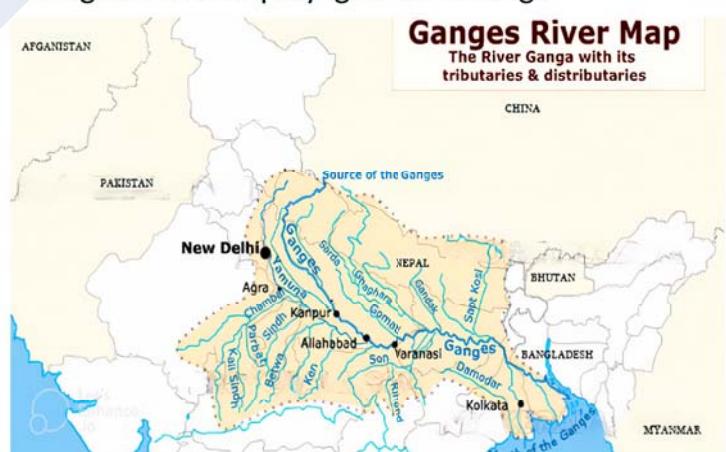
- Origin: Gomat Tal (U.P)

### Ghagra:

- **Origin:** Mapchachungo Glacier near Mansarovar in Tibet
- **By Volume,** ghagra is largest tributary of Ganga

### Ganga river:

- Origin: Gangotri Glacier near Gomukh in Uttarakhand where river Alaknanda meets Bhagirathi at Devprayag to form Ganga



2013

Consider the following pairs

National Park	Rivers flowing through the Park
1. Corbett National Park	Ganga
2. Kaziranga National Park	Manas
3. Silent Valley National Park	Kaveri

Which of the above pair is/are correctly matched?

- a) 1 and 2
- b) 3 only
- c) 1 and 3
- d) None of the above



#### Gandak:

- Origin: Nepal
- It meets Ganga at Patna
- It has Valmiki Nagar National Park/Tiger Reserve
- Lies between Dhaulagiri Peak and Mount Everest
- It divides Nepal into Half

#### #5) Kosi:

- Origin: Tibet
- Aka Sorrow of Bihar

#### #6) Mahananda:

- Origin: Darjeeling Hills

### Important Right Bank Tributary:

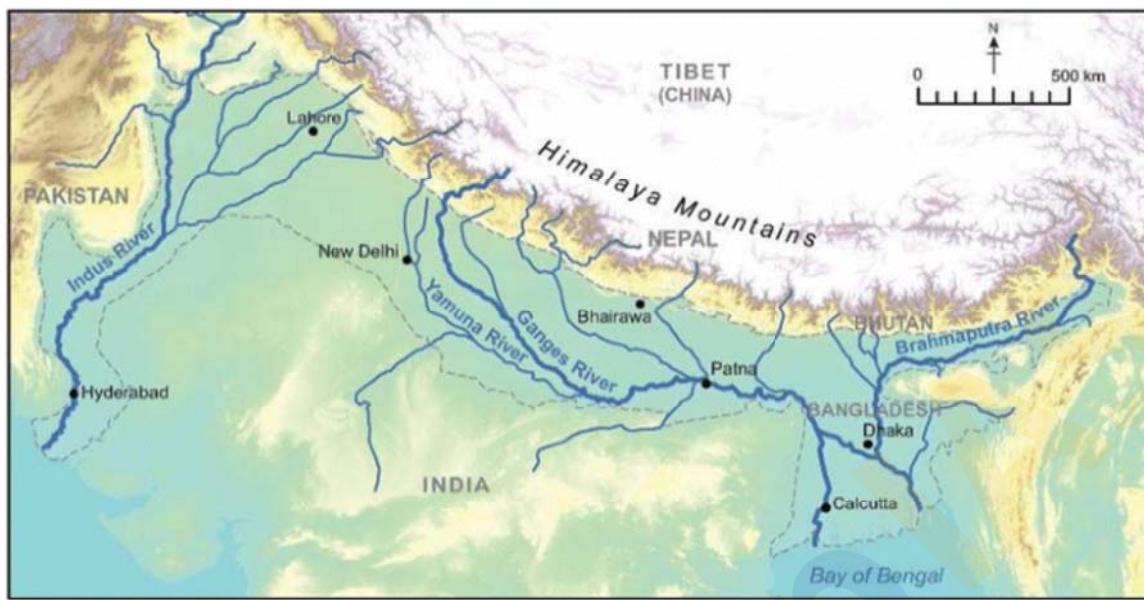
#### #1) Yamuna:

- Origin: Yamunotri Glacier from Banderpunch Peak in Uttarakhand
- Joins Ganga at Prayag (Allahabad) in U.P
- Longest Tributary of Ganga
- Forms a border between UP and Haryana
- Passes via 4 states and 1 UT: Uttarakhand, Himachal Pradesh, Haryana, UP and Delhi
- Tributaries: **Left:** Chambal, Sindh, Betwa, Ken



### Evolution of Himalayan Drainage:

- Mighty River Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and Sindh, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period (5-24 million years ago)
- Continuity of Shiwalik and its lacustrine origin and alluvial deposits support this viewpoint.
- In time Indo-Brahma river was dismembered into three main drainage systems:
  - (i) The Indus and its five tributaries in the western part;
  - (ii) The Ganga and its Himalayan tributaries in the central part; and
  - (iii) Brahmaputra in Assam and its tributaries in the eastern part.
- The dismemberment was due to the Pleistocene upheaval of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus.
- Downthrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal

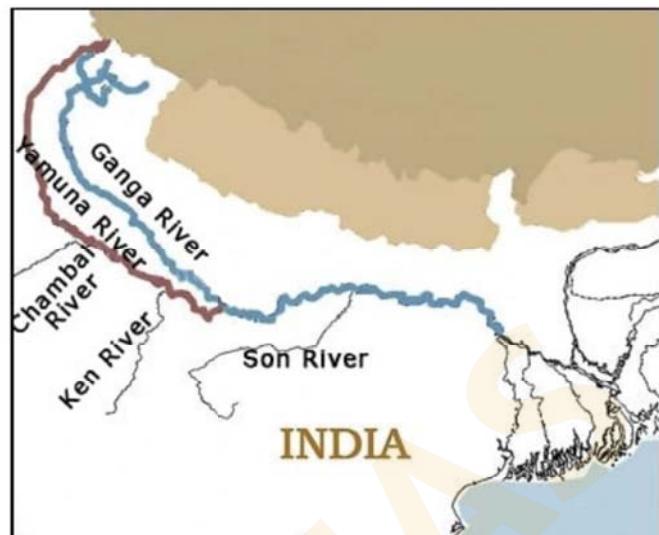


## Evolution of Peninsular Drainage:

- Three major geological events in the distant past have shaped the present drainage systems of Peninsular India:
- (i) Subsidence of the western flank of the Peninsula leading to its submergence below the sea during the early tertiary period. Generally, it has disturbed the symmetrical plan of the river on either side of the original watershed.
- (ii) Upheaval of the Himalayas when the northern flank of the Peninsular block was subjected to subsidence and the consequent trough faulting. The Narmada and The Tapi flow in trough faults and fill the original cracks with their detritus materials. Hence, there is a lack of alluvial and deltaic deposits in these rivers.
- (iii) Slight tilting of the Peninsular block from northwest to the southeastern direction gave orientation to the entire drainage system towards the Bay of Bengal during the same period.

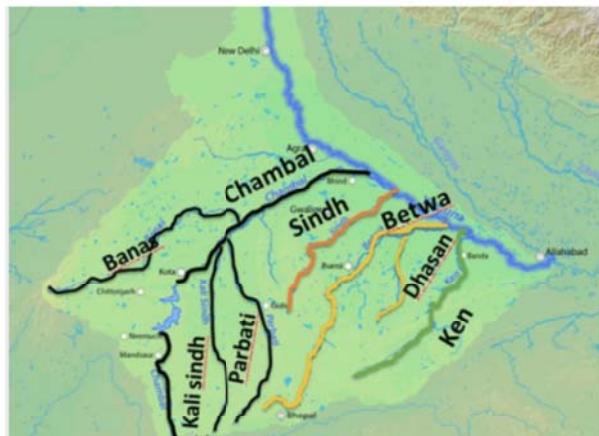
## #2) River Son

- Origin: Amarkanthak Plateau
- Tributary: Rihand and North Koel
- Dam: Rihand Dam (aka Ballabh Pant Sagar Dam) on Rihand River in UP;
- Bansagar Dam on River Son in U.P



## Chambal River

- Vindhyan Range
- National Chambal Sanctuary is at confluence of Chambal and Yamuna.
- It is famous for Gharial, Red Crowned Turtle
- Chambal forms the boundary between Rajasthan & M.P ; and also between M.P & U.P.
- Kota is on Chambal River



### Gharial:

**Does not attack humans**

Feed on corpses

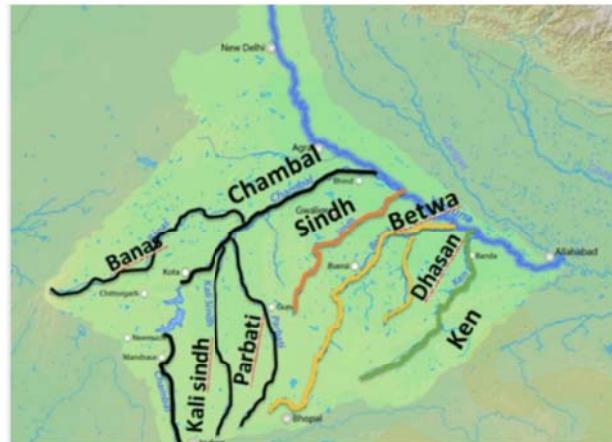
Gavial or fish-eating crocodile





### Chambal River

- Tributaries:
  - Left: Banas (Origin: Aravalli Range)
  - Right: Kalisindh (Origin: Vindhyan Range), Parbati (Origin: Vindhyan Range), Kshipra (Origin: Vindhyan Range near Ujjain, joins Chambal at M.P Raj Border, Famous for Kumbh)
- Chambal & Banas meets at Ranthambore National Park in Rajasthan
- Gandhi Sagar Dam is on Chambal River (MP)



### Betwa:

- Origin: Vindhyan Range
- Dam: Parichha
- Tributary: Dhasan River rises from Vindhyas in M.P

### Ken

- Origin: Vindhya Range near Banher Range
- Falls: Raneh Falls
- It has Ken Gharial Sanctuary and Panna National Park
- **Ken Betwa Link:** Dhaudhan Dam: River from Ken to Betwa



## Practise Question:

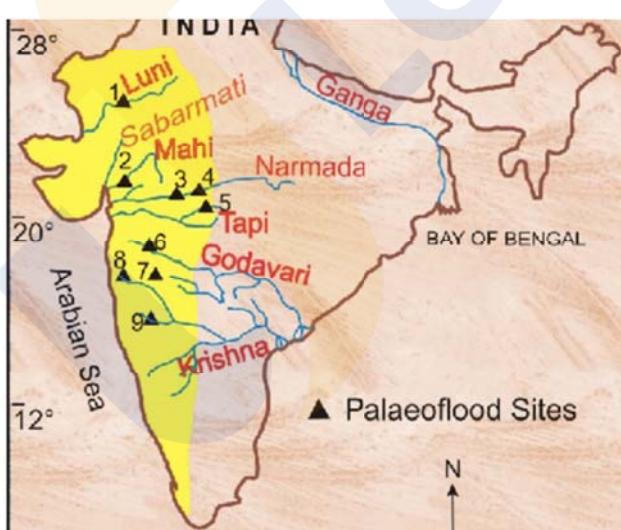
- Q) Dhauli meets alknanda at?
- Q) Mandakini meets at?
- Q) Tehri Dam is on?
- Q) Rajaji NP is on?
- Q) Origin of Ghagra?
- Q) Origin of Son?
- Q) Chambal & Banas meets at Ranthambore National Park in Rajasthan
- Q) Ken Betwa Link. Which Dam

## The superlative

Let's practise!

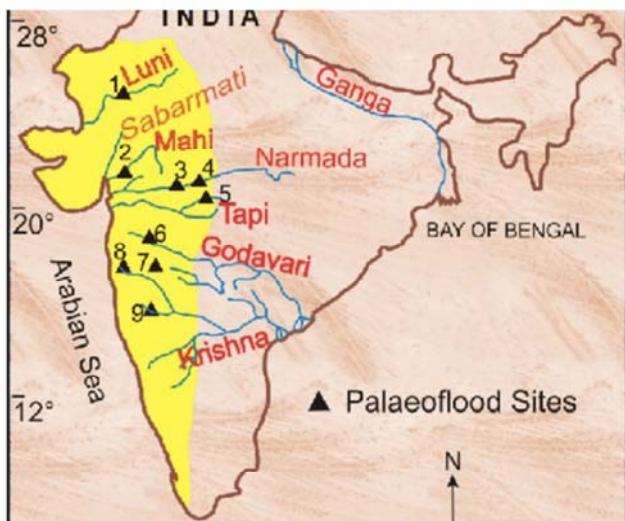


Some Small Rivers



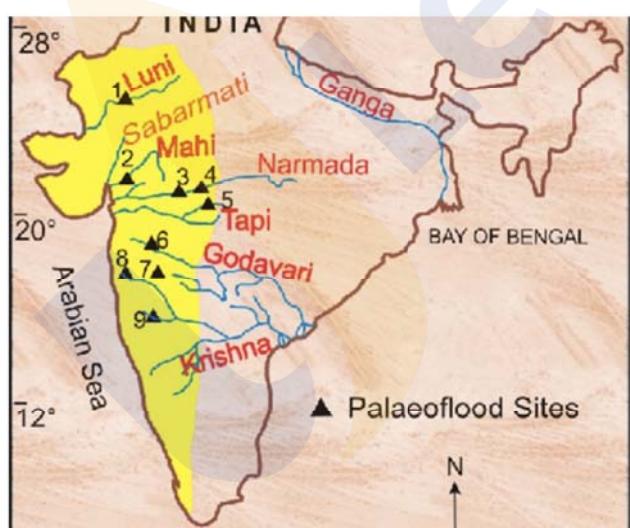
### 1) Luni River

- **Origin:** Aravalli Range near Pushkar Lake in Ajmer Rajasthan
- Originate in 2 branches: Saraswati & Sabarmati which join at Govingarh
- Lakes: Sambhar Lake, Pushkar Lake and Pachpadra Lake
- Passes via Thar Desert and end in Rann of Kutch
- It is the largest river system of Rajasthan



### #2) Sabarmati River

- Origin: Debbar Lake in Aravali Range in Rajasthan in Udaipur
- Dam: Dharoi Reservoir
- Lake: Vastrapur Lake and Kankaria Lake
- Drain: Gulf of Khambat
- Ahmedabad City is on Sabarmati River

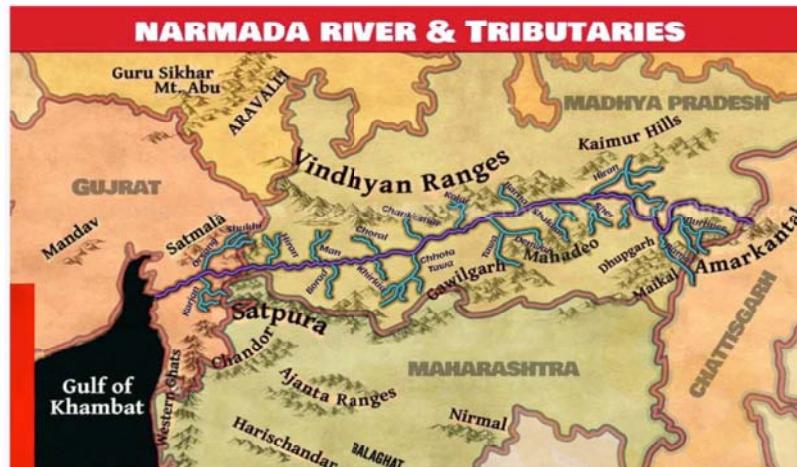


### #3) Mahi River

- Origin: Bagh Hills in MP
- Dam: Mahisagar Dam in Rajasthan
- Mahi encircles Ratan Mahal Wildlife Sanctuary in Gujarat. It is a sloth bear sanctuary
- It cuts tropic of cancer twice
- Drains in Gulf of Khambat

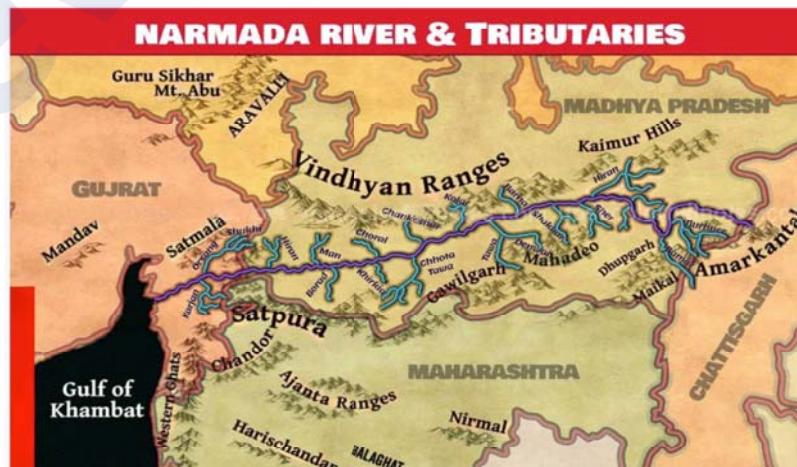
### Narmada:

- Origin: Amarkanthak Plateau
- Passes via M.P, Mah & Gujarat
- Flows via Rift Valley
- Between Satpura and Vindhya Ranges and drains in Gulf of Khambat
- Tributaries: Tawa (Rises from Betul)
- Waterfall: Dhuandhar Waterfall; Marble Rock



### Narmada:

- Longest West Flowing River
- Aliabet is estuary of Narmada formed at the mouth of River
- Dam:
  - Sardar Sarovar Dam in Gujarat
  - Indira Sagar Dam in MP
  - Gandhi Sagar Dam in MP
  - Omkareshwar Dam in M.P
  - Tawa Reservoir in MP
- Narmada passes via Mandla Fossil National Park in M.P



2013

The Narmada river flows to the west, while most other large peninsular rivers flow to the east. Why?

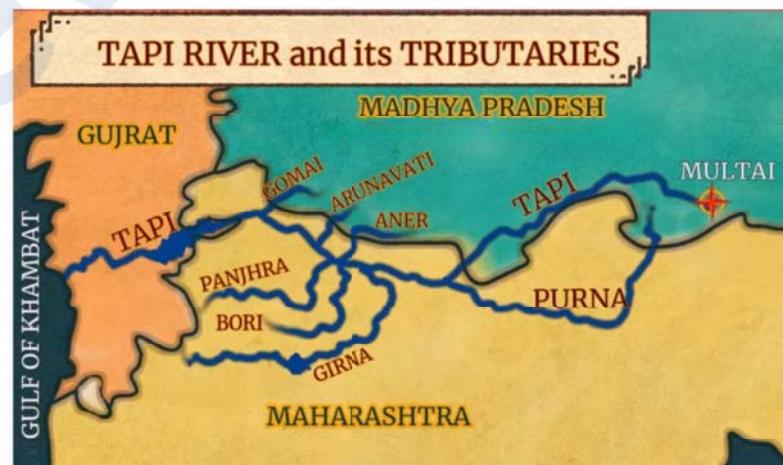
1. It occupies a linear rift valley.
2. It flows between the Vindhya and the Satpuras.
3. The land slopes to the west from Central India.

Select the correct answer using the codes given below.

- (a) 1 only
- (b) 2 and 3
- (c) 1 and 3
- (d) None

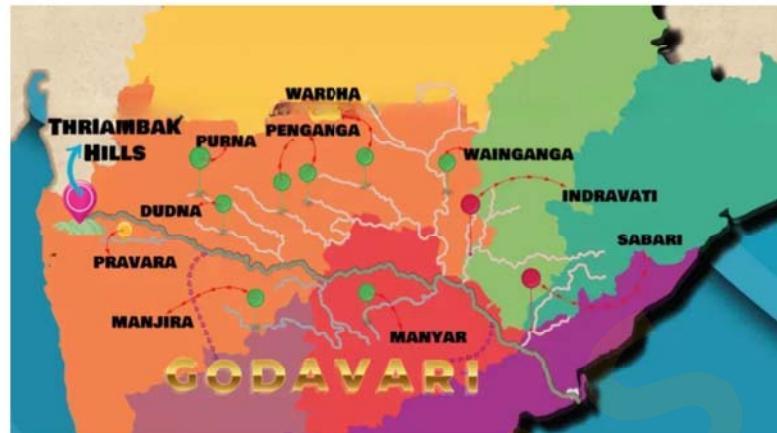
#### Tapi

- Origin: Betul district in MP
- Passes via MP, Mah and Gujarat
- Tributaries: Purna, Girna
- Dam: Ukai Dam
- WLS: Yawal WLS(Mah),
- Melghat Tiger Reserve (MP-MAH border)



## Godavari

- Origin: Trimbakeshwar in Nashik district in Maharashtra
- Main River and Tributaries flows through Maharashtra, Telangana, Andhra, Chattisgarh, Odisha
- Largest Peninsular River: aka Dakshin Ganga



## Godavari

- Left bank tributaries:
  - Left: Dudhna, Purna, Peinganaga Weinganga, Indravati (Indravati NP), Sabari, Silleru, Pranhita (Kaleshwaram lift irrigation system)
- Right bank tributaries: Manjhra, Pravara



**Pranhita River** is the largest tributary of Godavari River covering about 34% of its drainage basin conveying the combined waters of the Penganga River, the Wardha River, and the Wainganga River

## 2015: UPSC

Consider the following rivers :

1. Vamsadhara
2. Indravati
3. Pranahita
4. Pennar

Which of the above are tributaries of Godavari ?

- (a) 1, 2 and 3
- (b) 2, 3 and 4
- (c) 1, 2 and 4
- (d) 2 and 3 only

## 2015

Consider the following rivers :

1. Vamsadhara
2. Indravati
3. Pranahita
4. Pennar

Which of the above are tributaries of Godavari ?

Answer: 2 and 3

- Vamsadhara: River Vamsadhara is an important east flowing river between Rushikulya and Godavari, in Odisha and Andhra Pradesh states in India.
- Pennar: Pennar rises in the Nandi Hills in Karnataka and runs north and east through the states of Karnataka and Andhra Pradesh to empty into bay of Bengal in Andhra Pradesh.

## Krishna River

- Origin: Mahabaleshwar in Maharashtra
- Right bank: Ghat-prabha, Tungabhadra, Mallaprabha.
- Left: Bhima, Musi
- River Koyna rises in Mahabaleshwar and Joins Krishna
- Bhima river is also known as **ChandraBhaga** river.
- Bhima is the **longest** (largest is tungabhadra) tributary of the river Krishna.



## #7) Krishna River

- Krishna has: Almati dam, Srisalam dam, Nagarjuna sagar dam are on Krishna River
- It has Nagarjuna Srisagar Tiger Reserve and Srisalem Tiger Reserve
- Musi river has Hyderabad city
- Vijaywada is on Krishna river



Places: 2019  
Famous place: River

1. Pandharpur : Chandrabhaga
2. Tiruchirapalli : Cauvery
3. Hampi : Malaprabha

Which of the pair given above are correctly matched

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

## Answer: a

The Chandrabhaga (Bhima is also known as Chandrabhaga) river flows through the Pandharpur. So #1 is right.

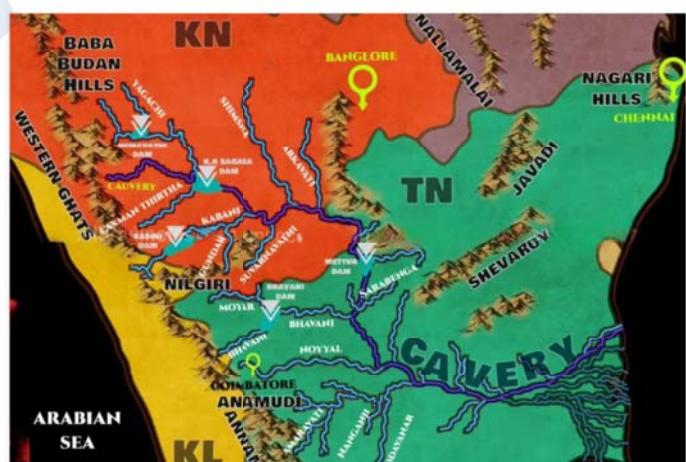
Tiruchirappalli, situated on the banks of the river Cauvery is the fourth largest city in Tamil Nadu. So #2 is right.

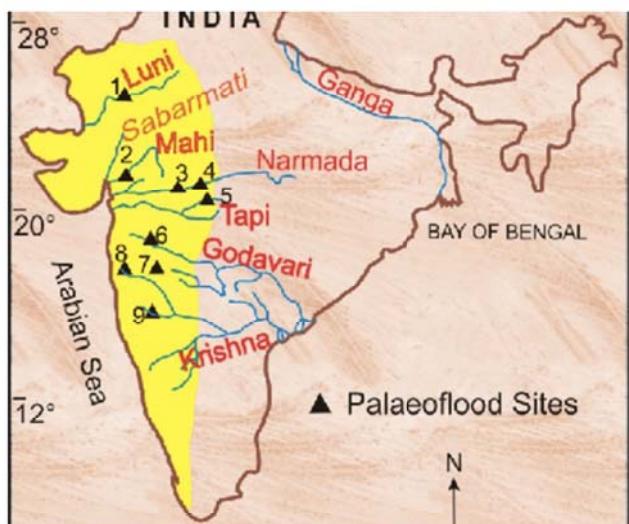
Hampi, the 14th century capital of one of the greatest empires of medieval India called the Vijayanagar Empire, lies in the state of Karnataka protected by the tempestuous river Tungabhadra. So #3 is wrong



### Kaveri River

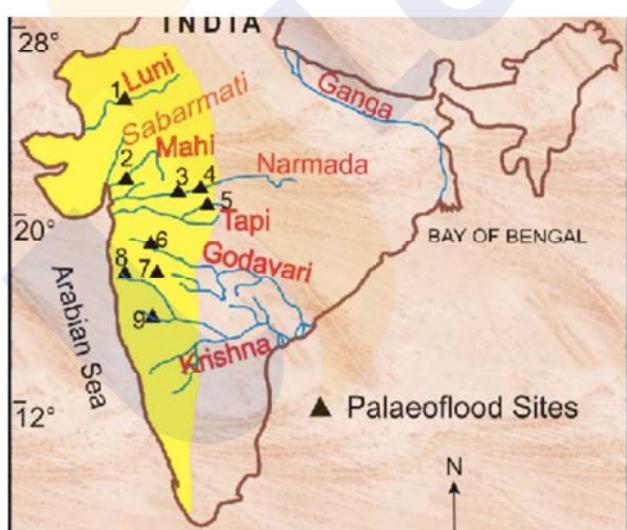
- Origin: Tala Kaveri in Brahmagiri Hills
- Tributary: Amravati, Hemavati, Kabini, Shimsha, Bhavani, Noyil
- Dam: Krishnaraj sagar dam, Mettur dam, bhavanisagr dam on bhavani river
- Falls: Shivasamudram falls
- Hongenekkal Falls
- Srirangam Island and Shivasamudram island





### # ) Vagai

- Origin: Varusunadu hills
- Dam: Vaigai Dam
- Empties into Palk Strait

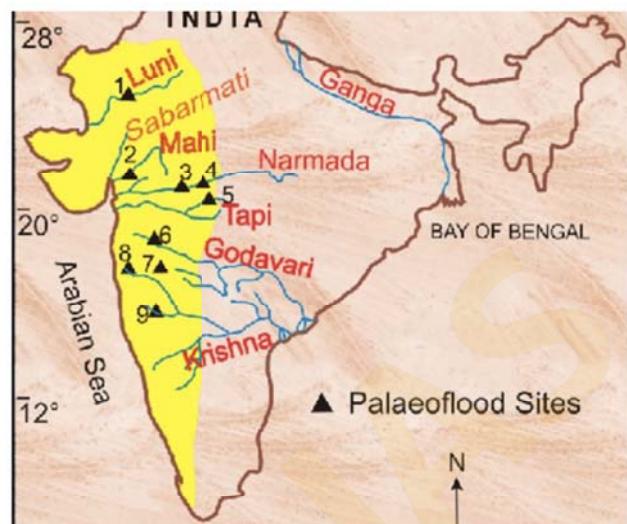


### #) Periyar Reserve

- Longest river of Kerala (ORIGIN: Kerala and flows through Kerala only)
- It is between Palani Hills and Cardamom Hills
- Dam: Idukki Dam, Mullaperiyar dam
- Lake: Vembanad Lake, Vembanad wetland
- Sabarimala temple is in Periyar Tiger Reserve

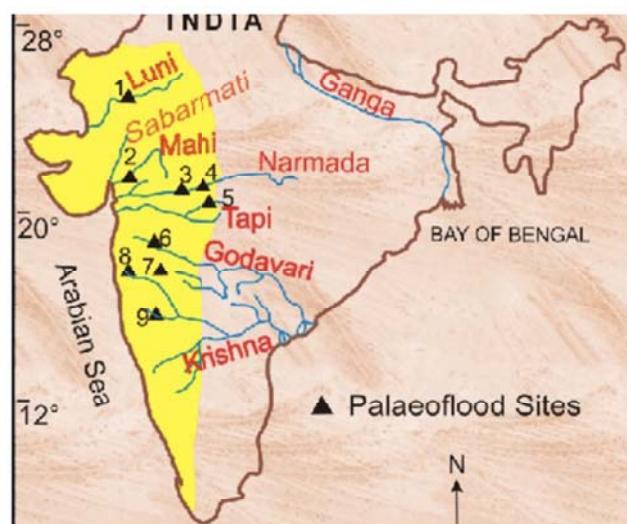
## Luni River

- **Origin:** Aravalli Range near Pushkar Lake in Ajmer Rajasthan
- Originate in 2 branches: Saraswati & Sabarmati which join at Govingarh
- Lake: Sambhar Lake, Pushkar Lake and Pachpadra Lake
- Passes via Thar Desert and end in Rann of Kutch
- It is the largest river system of Rajasthan



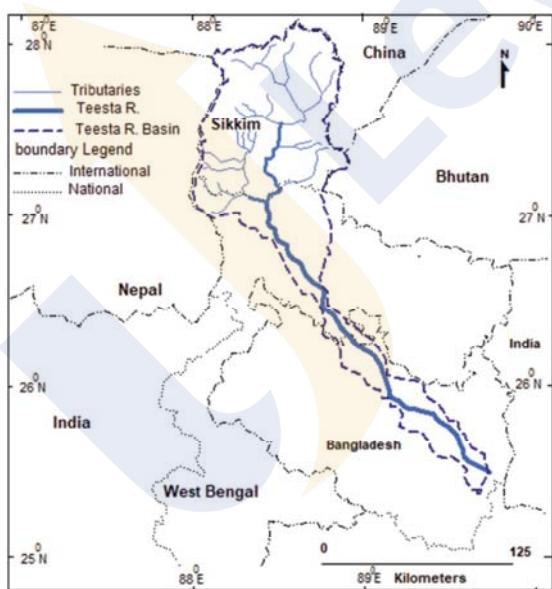
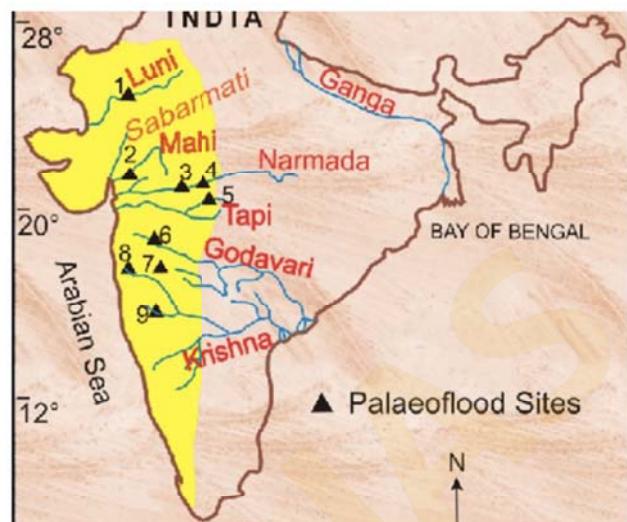
## Sabarmati River

- Origin: Debbar Lake in Aravali Range in Rajasthan in Udaipur
- Dam: Dharoi Reservoir
- Lake: Vastrapur Lake and Kankaria Lake
- Drain: Gulf of Khambat
- Ahmedabad City is on Sabarmati River



## Mahi River

- Origin: Bagh Hills in MP
- Dam: Mahisagar Dam in Rajasthan
- Mahi encircles Ratan Mahal Wildlife Sanctuary in Gujarat. It is a sloth bear sanctuary
- It cuts tropic of cancer twice
- Drains in Gulf of Khambat



### #) Teesta

- Origin: Tso-lhamo lake, cholamu lake, Zemu Glacier
- Tributary of Brahmaputra
- Rangit river is tributary of Teesta
- Dam: Teesta Barrage
- BR: Kunchenjunga BR
- Flows through Sikkim and West Bengal only and meets Brahmaputra in Bangladesh

2017: River Teesta

**With reference to river Teesta, consider the following statements**

1. The source of river Teesta is the same as that of Brahmaputra but it flows through Sikkim
2. River Rangeet originates in Sikkim and it is a tributary of river Teesta.
3. River Teesta flows into Bay of Bengal on the border of India and Bangladesh.

Which of the statements given above is/are correct?

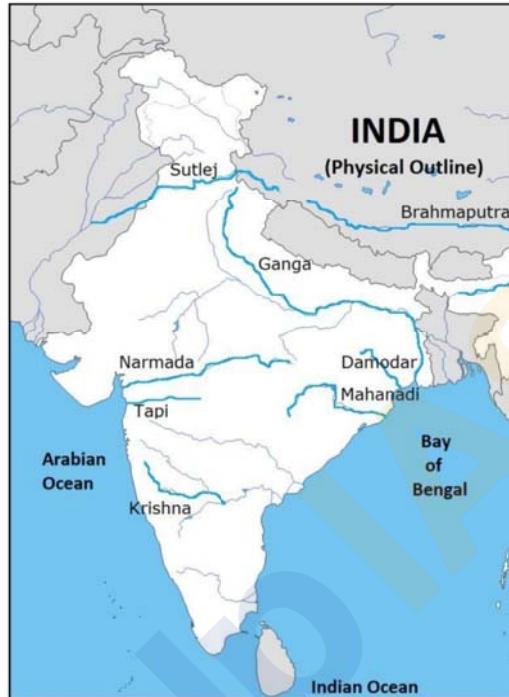
- (a) 1 and 3 only
- (b) 2 only**
- (c) 1 and 3 only
- (d) 1, 2 and 3

#### Teesta River

- **Teesta River** rises in the eastern Himalayas,
- flows through the Indian states of Sikkim and West Bengal
- Enters Bangladesh: Meets brahmaputra river
- Origin:: Tso Lamo Lake/ Zemu Glacier

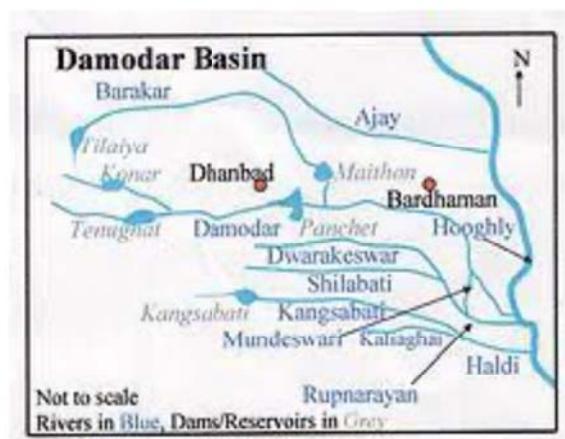
## Rivers of Peninsular Plateau and above Eastern Ghat

- #) Damodar
- #) Subarnarekha
- #) Baitarni
- #) BRAHMANI
- #) Mahanadi



### #) Damodar

- Origin: CNP
- Divide CNP in two parts: Hazaribagh and Ranchi
- Tributaries: Barakar, konar
- Dam: **Tillaya** and **Maithon**: Barakar, Panchet: Damodar, Konar: Konar River
- DVC

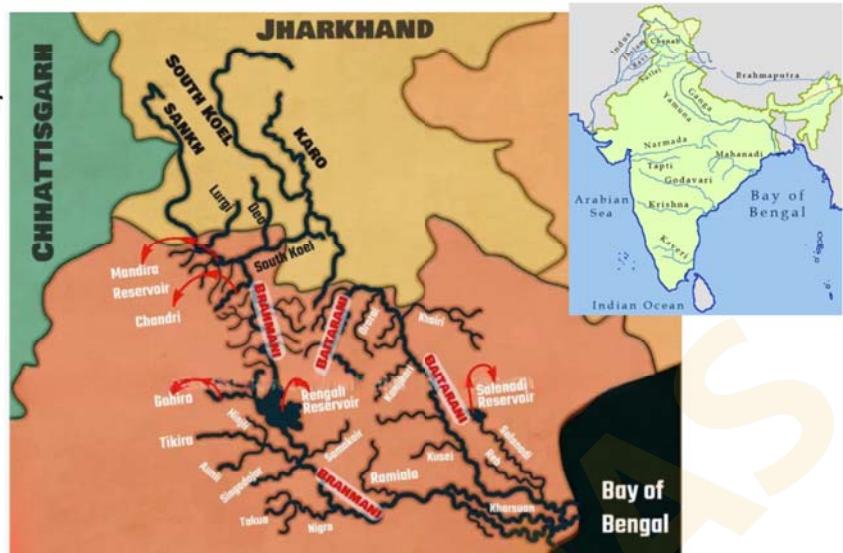


### #) Subarnarekha

- Origin: Ranchi along CNP
- Falls: Hundru Falls

### #) Baitarni

- Gonasika hills of Keonjhar district
- Origin: Garjhat Hills
- Passes through Bhitarkanika



### #) Mahanadi

- Origin: Dandakanya plateau
- Tributaries: Hasdeo, Seonath, Mand, Ib, Tel
- Flows via Satkosia Tiger Reserve in Odisha
- Flows via chhattisgarh and Odisha
- Hirakud Reservoir



### MAHANADI RIVER MAP



2021

Consider the following Rivers:

1. Brahmani
2. Nagavali
3. Subarnarekha
4. Vamsadhara

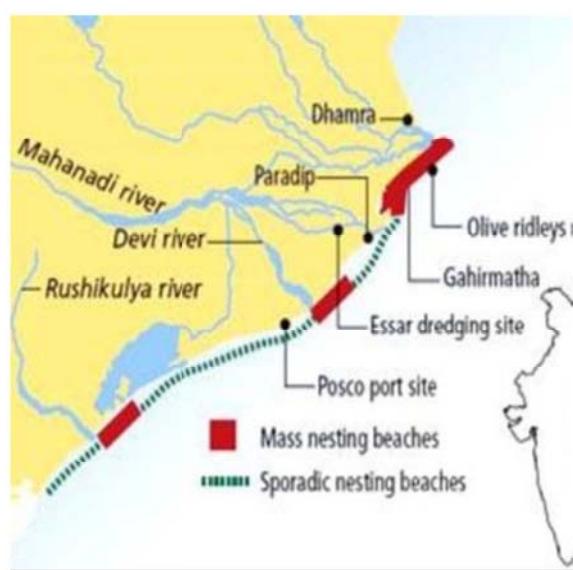
Which of the above rise from the Eastern Ghats?

- (a) 1 and 2
- (b) 2 and 4
- (c) 3 and 4
- (d) 1 and 3

2021

1. Nagavali: The River Nagavali also known as Langulya is one of the main rivers of Southern Odisha and North Andhra States in India, between Rushikulya and Godavari basins

2. Vamsadhara: River Vamsadhara is an important east flowing river between Rushikulya and Godavari, in Odisha and Andhra Pradesh states in India.



## Quick Revision

-----: Hemis High Altitude National

-----: Has wular lake, Dal Lake, Srinagar

-----: Made of Chandra and Bhaga: Both meets at Keylong: Hence called as Lady of Keylong

**Beas and Sutlej meet at ----- wetland**

----- **Origin:** It passes via Valley of Flowers

**Ganga Passes via ----- National Park**

----- : It passes via Corbet National Park

**National Chambal Sanctuary** is at confluence of ----- and -----

**Chambal & Banas** meets at ----- National Park in Rajasthan

## 2019: Rivers

**Consider the following Pairs :**

Glacier: River

1. Bandarpunch : Yamuna

2. Bara Shigri : Chenab

3. Milam : Mandakini

4. Siachen : Nubra

5. Zemu : Manas

Which of the following pairs given above are correctly matched?

(a) 1,2 and 4

(b) 1,3 and 4

(c) 2 and 5

(d) 3 and 5

## 2019: Rivers

1. Siachen Glacier, one of the world's longest mountain glaciers, lying in the Karakoram Range system of Kashmir. It is the source for Nubra River
2. Bandarpunch: Yamuna as correct.
3. River Mandakini actually originates from the springs fed by melting snow of Chorabari glacier about one km above Kedarnath temple.
4. Ncert: Sarda or Saryu river rises in the Milam glacier in the Nepal Himalayas
5. Bara Shigri is the largest glacier located in Lahaul Spiti region in Chandra Valley, Himachal Pradesh. It is a 30-km long glacier, the second longest glacier in the Himalayas after Gangotri. It flows northwards and feeds the Chenab river.

2022

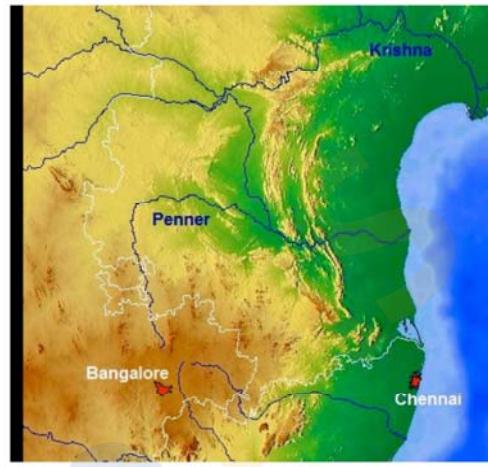
Gandikota canyon of South India was created by which one of the following rivers ?

- (a) Cauvery
- (b) Manjira
- (c) Pennar
- (d) Tungabhadra

**CASE STUDY**


**Figure 4.10** The Canyon of Gandikota, the Pennar River in Andhra Pradesh

Gandikota, Kadapa district of Andhra Pradesh is known for its spectacular gorge formed by river Pennar that cuts through the Erramala hills. This handsome piece of Nature's architecture is known as the **Hidden Grand Canyon of India**. Magnificent Gandikota fort is located majestically on top of this gorge. Belum Cave found here is the second largest cave system in India. In fact, geologists have also found **surplus deposits of Quartz** in the stalactite and stalagmite formations of the cave. Adjacent to Gandikota fort, lies a magnificent lake that is believed to have been established by emperor Sri Krishnadevaraya using water from the Pennar river.



2022

Consider the following pairs:

Reservoirs : States

1. Ghataprabha : Telangana
2. Gandhi Sagar : Madhya Pradesh
3. Indira Sagar : Andhra Pradesh
4. Maithon : Chhattisgarh

How many pairs given above are not correctly matched?

- (a) Only one pair
- (b) Only two pairs
- (c) Only three pairs
- (d) All four pairs

2022

Consider the following pairs:

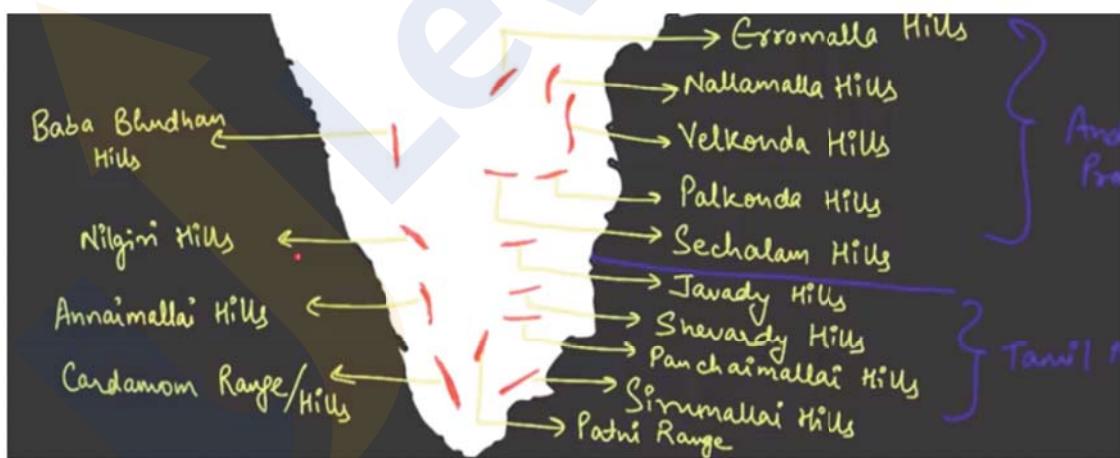
Reservoirs : States

1. Ghataprabha : Telangana
2. Gandhi Sagar : Madhya Pradesh
3. Indira Sagar : Andhra Pradesh
4. Maithon : Chhattisgarh

1. Ghataprabha : Karnataka
2. Gandhi Sagar : M.P.
3. Indira Sagar : M.P.
4. Maithon : Jharkhand

How many pairs given above are **not** correctly matched?

- (a) Only one pair
- (b) Only two pairs PAY
- (c) Only three pairs
- (d) All four pairs



**Focus:**

- Nilgiri Biosphere Reserve,
- Agasthamalai Biosphere Reserve

- Palghat Pass: Anamalai Hills
- Bhaoghat: Mumbai-Pune
- Thalghat: Mumbai-Nasik
- Mekrai: Cardamom Hills

## 2023 Rivers

Consider the following statements:

1. Jhelum River passes through Wular lake.
2. Krishna River directly feeds Kolleru Lake.
3. Meandering of Gandak River formed Kanwar Lake.

How many of the Statements given above are correct?

- a) Only one
- b) Only two
- c) All three
- d) None

## Mains Questions: 2013-2022

**2013:** There is no formation of deltas by rivers of the Western Ghats. Why?

**2013:** Bring out the causes for the more frequent occurrence of landslides in the Himalayas than in the Western Ghats

**2014:** Bring out the relationship between the **shrinking Himalayan glaciers and the symptoms of climate change** in the Indian sub-continent.

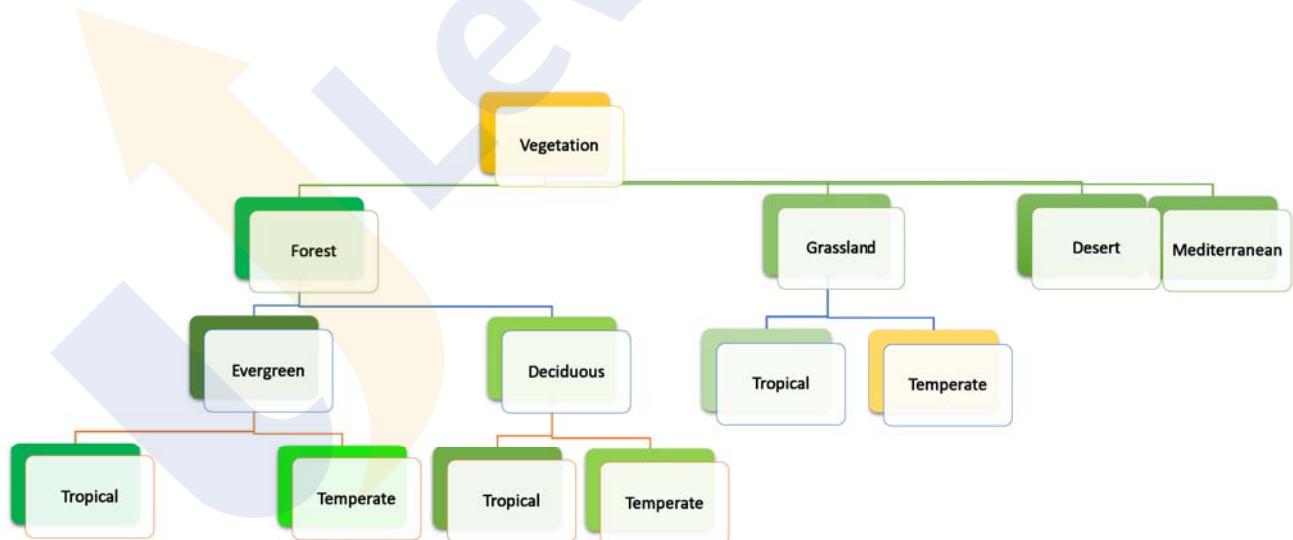
**2016:** “**The Himalayas are highly prone to landslides.**” Discuss the causes and suggest suitable measures of mitigation.

**2021:** Why is India considered as a sub-continent? Elaborate your answer. (Answer in 150 words) 10

**2022:** Discuss the natural resource potentials of ‘Deccan trap’. (Answer in 150 words) 10

# Topic – Vegetation of India and Soil of India

Dimple Nankani



## Types of Vegetations



Tropical evergreen forest



Temperate evergreen forest



Tropical deciduous forest



Temperate deciduous forest



Temperate grassland



Tropical grassland



Mediterranean vegetation



Desert vegetation



Conifer forest

### Tropical evergreen forest

It occurs in the regions near the equator

Climate is hot and receive heavy rainfall throughout the year but maximum rainfall around the Equinox. Average maximum temperature is around 30 degree Celsius and 20 degree

Because of absence of dry season trees do not shed their leaves at the same time.



## Tropical evergreen forest

Because of absence of dry season trees do not shed their leaves at the same time.

Each day is more or less the same, the morning is clear and bright with a sea breeze; as the Sun climbs high in the sky, heat mounts up, dark clouds form, then rain comes with thunder and lightning. But rain is soon over

e.g. - Rosewood, Ebony, Mahogany

In India it is seen in AnN, Lak, Western side of Western Ghat



## Temperate evergreen forest

It is located in the mid-latitudinal coastal region.

They are commonly found along the eastern margin of the continents.

Common in - south east USA, South China and in South East Brazil

Comprise both hard and soft wood trees

e.g. - oak, pine, eucalyptus. In India it is found in Himalayas



### Tropical deciduous forest

Are the monsoon forests

It is found in the large part of India, northern Australia and in central America

Trees shed their leaves in the dry season to conserve water

The hardwood trees found in these forests

These are useful for making furniture. Seen across the India



### Temperate deciduous forest

Found in higher latitudes.

Shed their leaves in dry season

North eastern part of USA, China, New Zealand, Chile and Western Europe.

Trees - oak, ash, beech. In India it is found in Himalayas



## Temperate Grassland

These are found in the mid-latitudinal zones and in the interior part of the continents.

Usually, grass here is short and nutritious.

In steppe, Climate is extreme, rainfall is scanty and the people used to be nomadic herders

In India it is seen in Himalayas



## Tropical grassland



Found on the either side of the equator and extend till the tropics

Grasses here are very tall, about 3 to 4 metres in height

Savannah grasslands of Africa are of this type. In India is it seen in Peninsular Plateau

## Tropical grassland

Low latitude

Grasses are not nutritious.

Trees are present

Savana, Llanos, Campos.

## Temperate grassland

Mid-latitude

Grasses are nutritious

Pure grassland (no trees)

Prairies, Pampas, Pustaz, Veldts, Steppes, Downs

## Mediterranean vegetation



Found in west and south west margins of the continents

Areas around the Mediterranean, California in the USA, south west Africa, south western, South America and South west Australia.

It has warm and dry climate, mild and wet winter

Citrus fruits such as oranges, figs, olives and grapes are commonly cultivated. Evergreen oak trees are also present. It is not seen in India

## Desert vegetation

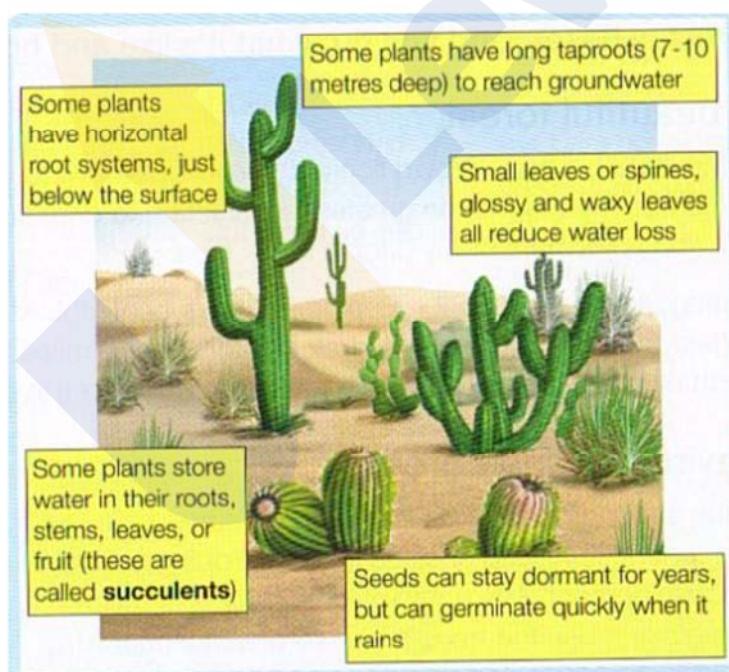


It found in the desert

Vegetation is adapted to scanty rain and scorching heat

The vegetation cover is scarce

In India it is seen in Ladakh, Rajasthan, Gujarat



## Conifer forest



In the higher latitudes ( $50^{\circ} - 70^{\circ}$ ) on upper altitude.

It has tall, softwood evergreen trees.

Woods of these trees are very useful for making pulp, paper newsprint, and match boxes.

e.g. - Chir, pine, cedar. In India it is seen along Himalayas

## Tundra Vegetation



Coldest biome and very fragile biome on Earth

Temperature is below freezing for most of the year. Its frozen layer of ground is called permafrost.

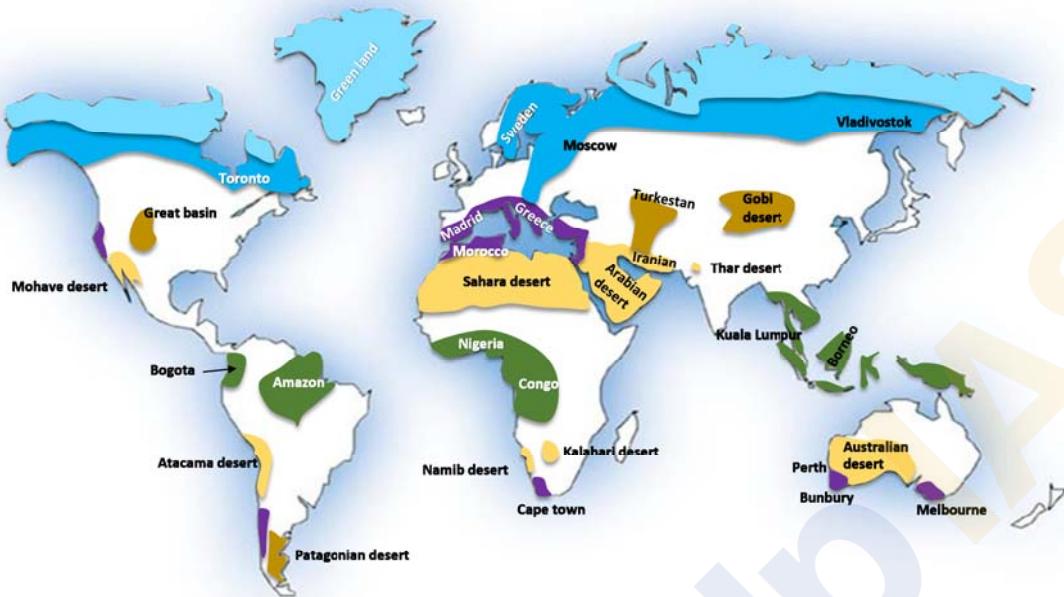
Unique due to its harsh climate and limited vegetation and animal life.

Plants which grow in the tundra include grasses, shrubs, herbs, and lichens

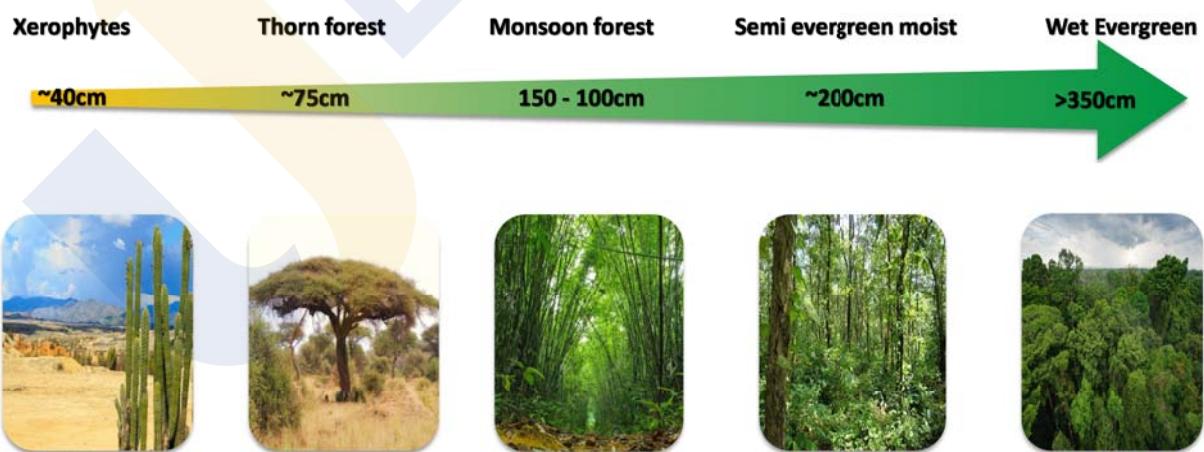
Animals in the tundra have small tails as well as ears.

Areas: South of Arctic Region: Canada and Siberia. In India it is seen along Himalayas

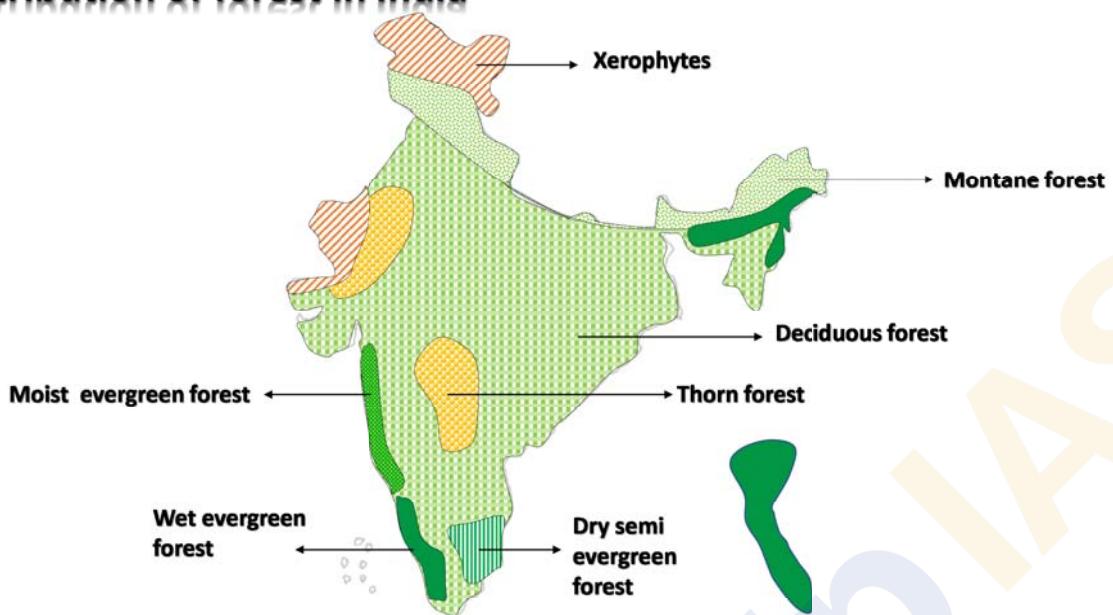




## Types of forest based on rainfall

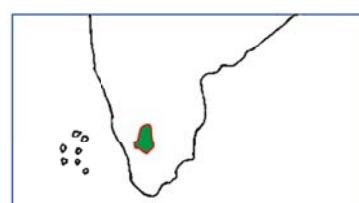


## Distribution of forest in India



### Southern Mountain Forest

1. Southern mountain forests include the forests found in three distinct areas of Peninsular India viz; the Western Ghats, the Vindhyas and the Nilgiris.
2. As they are closer to the tropics, and only 1,500 m above the sea level, vegetation is temperate in the higher regions, and subtropical on the lower regions of the Western Ghats, especially in Kerala, Tamil Nadu and Karnataka.
3. The temperate forests are called Sholas in the Nilgiris, Anaimalai and Palani hills.
4. Some of the other trees of this forest of economic significance include, magnolia, laurel, cinchona and wattle.
5. Such forests are also found in the Satpura and the Maikal ranges



## Littoral and Swamp forest

### 1. Wetland habitats in India:

- About 70 per cent is under paddy cultivation.
- Total area of wetland is 4 million ha.
- Two sites: Chilika Lake (Odisha) and Keoladeo National Park (Bharatpur) are protected as water-fowl habitats under the Convention of Wetlands of International Importance (Ramsar Convention)

### 2. Mangroves:

- Mangroves grow along coasts in the salt marshes, tidal creeks, mud flats and estuaries.
- They have number of salt-tolerant species of plants.
- These forests give shelter to a wide variety of birds.
- Mangroves are found along entire coast with vase stretches along Andaman and Nicobar Islands, Sunderbans of West Bengal, Mahanadi, the Godavari and the Krishna deltas.



**THE MANGROVE ECOSYSTEM**  
Extreme Conditions and Extremely High Biodiversity

Mangrove forests are found on coastlines in tropical and subtropical areas. The mangrove tree looks a bit strange because its roots are partially above water, making the tree look like it's standing on many gnarly stilts. The roots are exposed to help the tree take in oxygen in a waterlogged environment. Fish, shrimp, crabs, and mollusks are among the organisms that take shelter within mangrove roots. This ecosystem is home to considerable biodiversity, but is unfortunately threatened by shrimp farming and rising sea levels. In some countries, shrimp farming clears large sections of mangroves to build holding tanks and processing facilities. The maps below show the changes to the mangrove ecosystem in Honduras from 1987 to 1999, where much of it has been removed to store shrimp brought in from the Gulf of Fonseca.

**Coastal Protection**  
Mangrove forests are able to bear the brunt of storms that hit the coast. They reduce the impact of strong waves on anything that lives further inland, including humans. Mangrove trees also protect the coast from erosion by collecting sediments from rivers and ocean tides around their roots. These sediments build up and strengthen the shoreline.

**The Ocean's Nursery**  
Mangrove ecosystems host a lot of biodiversity, in part due to the mangrove tree's strange root system. The roots serve as a nursery for the larvae of many fish species, such as barracuda, tarpon, and snook. This is where fish can develop into adults before moving out to the big, unforgiving ocean. In fact, around one-third of all marine fish species are sheltered from predators in mangrove forests as juveniles.

**Detritus**  
Leaves and branches that have fallen into the water are called detritus, and are broken down by bacteria to return nutrients to the water.

**1987**

**1999**

**American Crocodile**  
*Crocodylus acutus*

**Pink Shrimp**  
*Farfantepeanauta duorarum*

**Bocourt Swimming Crab**  
*Callinectes bocourtii*

**Gray snapper**  
*Lutjanus griseus*

**Hardclam**  
*Meretrix mercenaria*

**Great Blue Heron**  
*Ardea herodias*

**Little Red Bat**  
*Lasiurus minus*

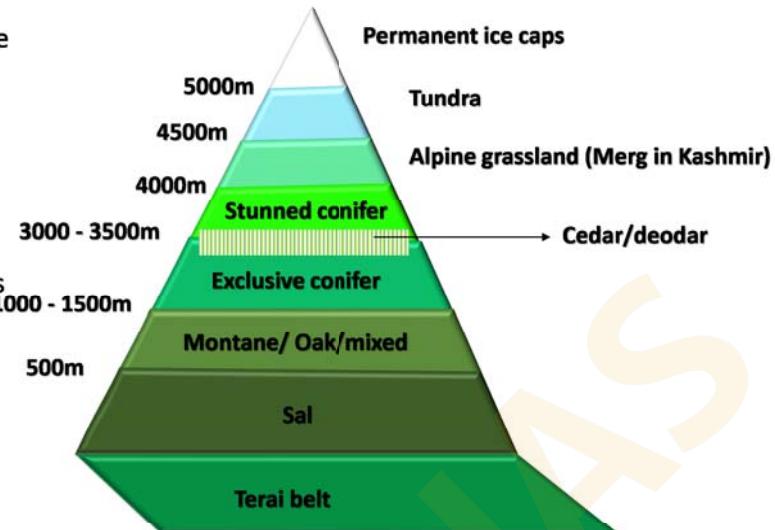
**Great Egret**  
*Ardea alba*

**Brown Pelican**  
*Pelecanus occidentalis*

**NATIONAL GEOGRAPHIC**

## Montane forest

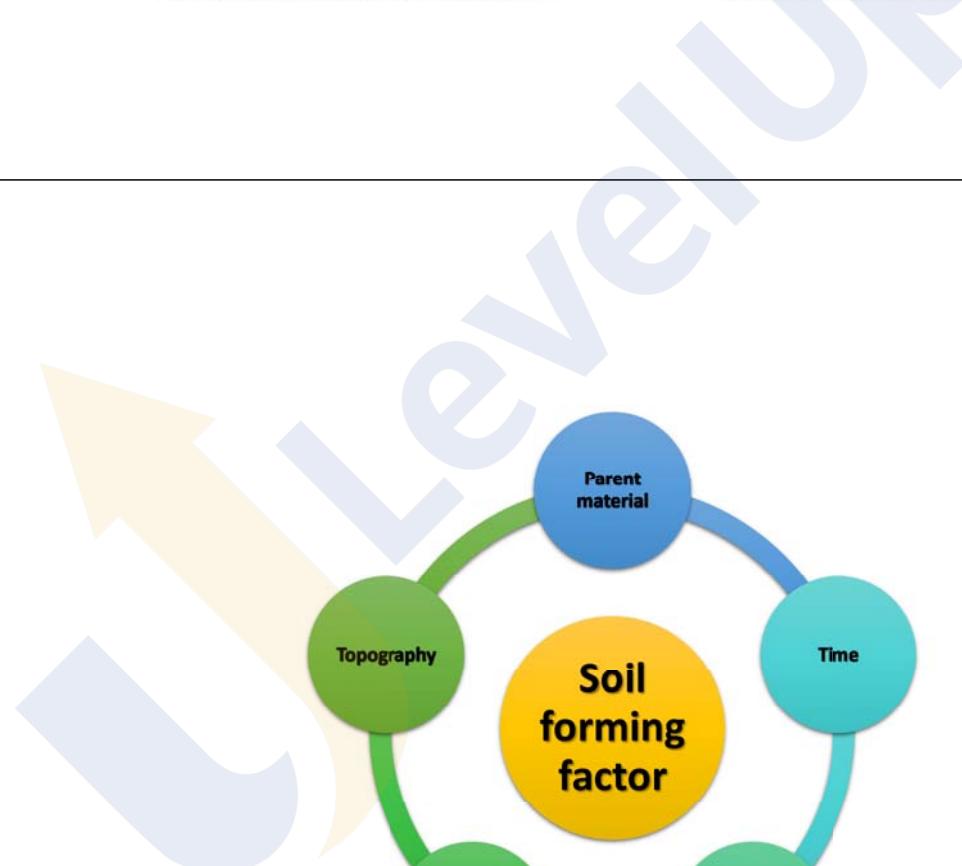
1. Decrease in temp with increasing altitude leads to change in natural vegetation from tropical to the tundra
2. Some name of species that can be memorised: oak, chestnut, pine forests such as Chir Pine, Deodar, Chinar , Walnut, Blue pine , Spruce, Silver firs, junipers, pines, birch and rhododendrons
3. Pastures are used extensively for transhumance by tribes like the Gujjars, the Bakarwals, the Bhotiyas and the Gaddis.
4. Southern slopes of the Himalayas carry a thicker vegetation cover because of relatively higher precipitation than the drier north-facing slopes
5. At higher altitudes, mosses and lichens form part of the tundra vegetation.



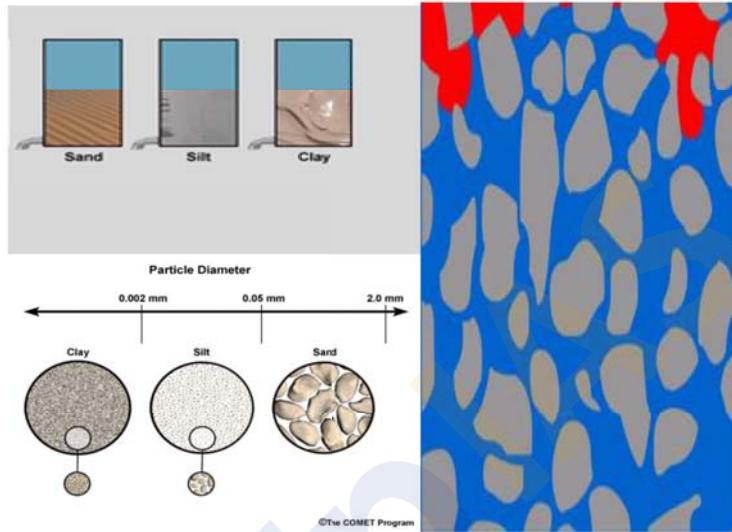
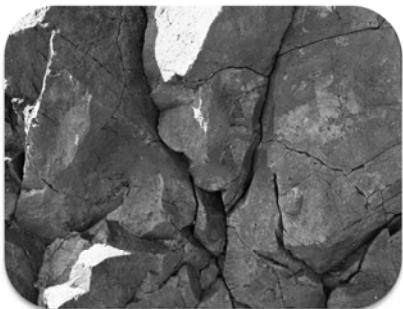
## Soil

- **Weathered Parent Rock:** Weathering
- **Factors:** 5 major factors
- **Process:** Weathering, Leaching, Capillary Action.

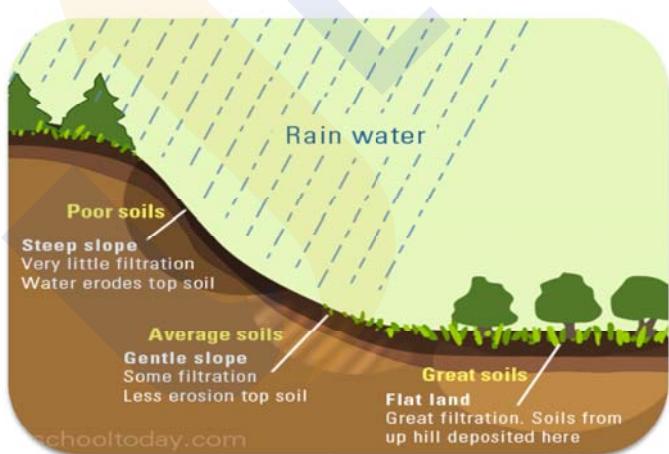
### Soil as a Ecosystem

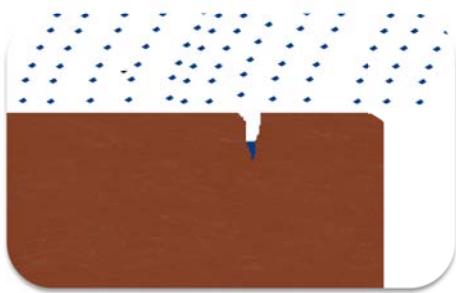


## Parent material

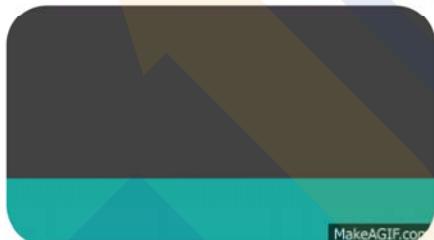


## Topography



**Climate**

Freeze Thaw action

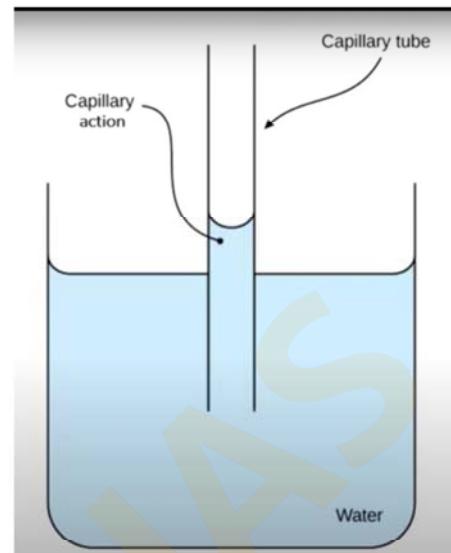
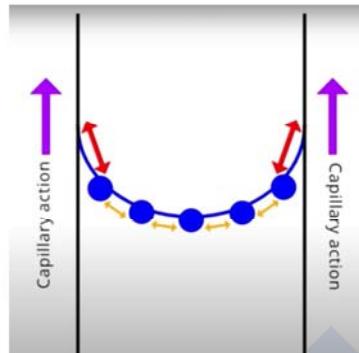
**Climate**<https://youtube.com/shorts/e9axSq3xzNw?feature=share><https://www.youtube.com/watch?v=b-9H1GWR4Qo>

Capillary action

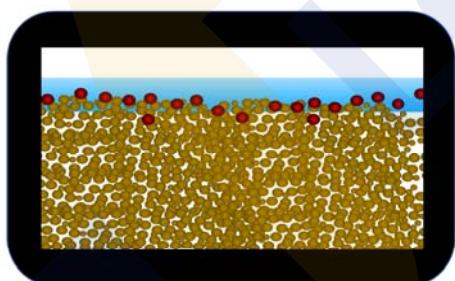
**DESERT SOIL**

# Capillary Action

- It is the ability of a liquid to flow through narrow spaces of a solid material without the help of external force. The flow can be against the gravity to a certain extent
- Drawing up of liquid occurs a result of intermolecular attraction between the liquid and surrounding solid surface



## Climate



Leaching

## Laterite Leaching





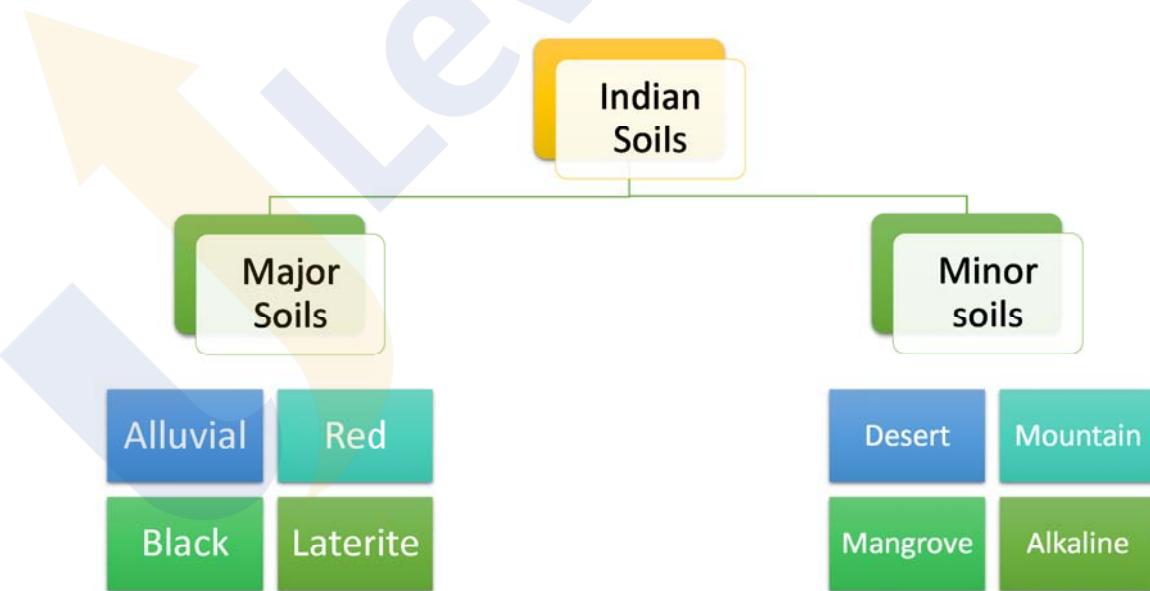
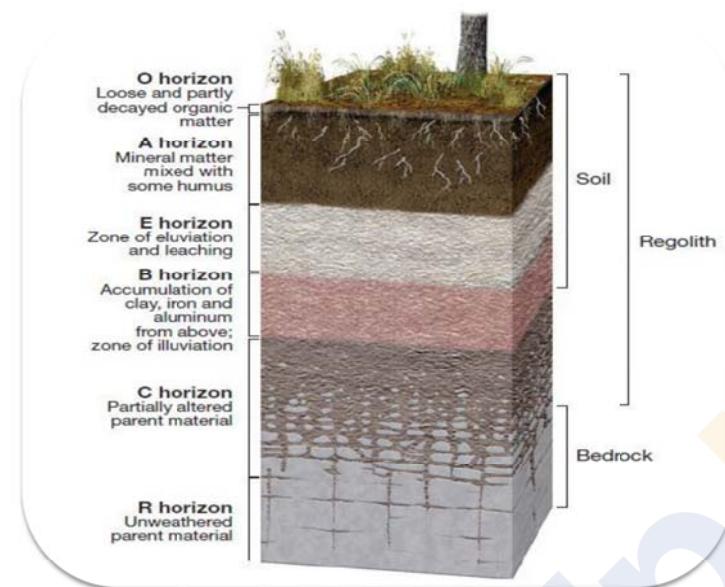
**Biota**

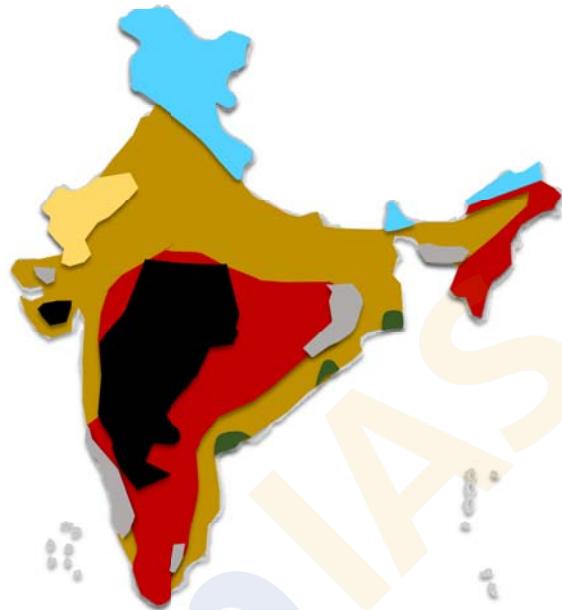
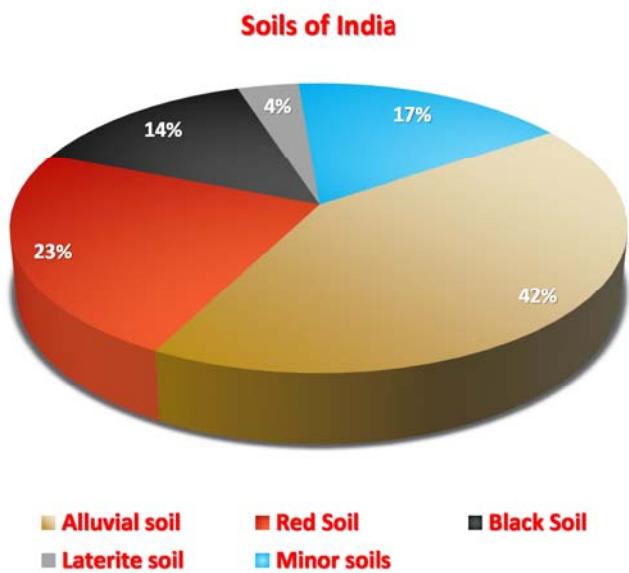


**Time**



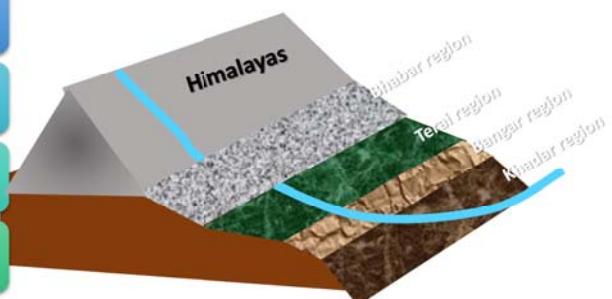
## Soil Profile





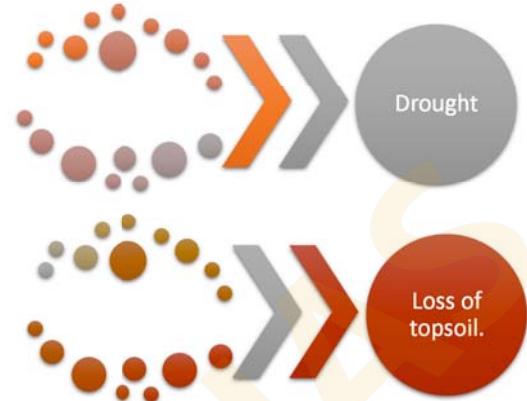
### Alluvial Soil

- Transported soil
- Deposited by the river
- Rich in Potash
- Poor in Phosphorus
- Found in River basin, Valleys and deltas
- Supports all types of crops.
- Over cultivation, sand mining



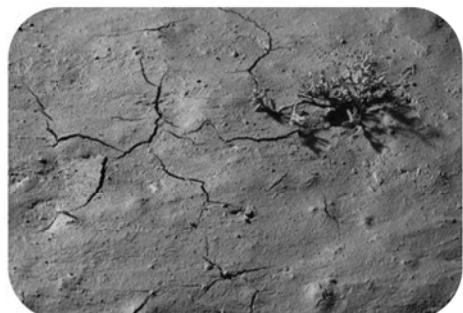
### Red Soil

- Most common in Peninsular region
- From weathering of Gneissic rock
- Poor in nitrogen, phosphorus and humus
- Dry soil with coarse texture (Fit for agriculture with fertilizers)
- Supports dry crops – Oilseeds, Pulses Millets, Tobacco, etc.
- Found in Telangana, Karnataka, Bundelkhand, T.N Plain/Plateau



### Black Soil

- Soil of Deccan region
- From weathering of basalt rock
- Found in Maharashtra, Kathiawar, South MP, Telangana, Karnataka pt.
- Rich in Lime, Iron, Magnesia, Alumina



## Laterite Soil

In Highland with Hot and humid climate

Through the process of laterization → leaching

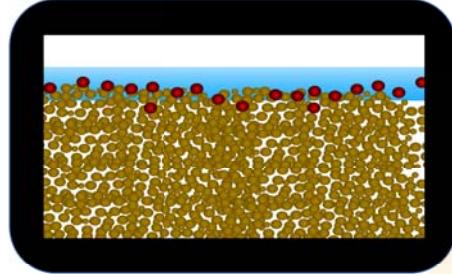
Red in colour

Fit for forestry and plantation crops.

Poor soil for agriculture.

Used mostly for brick making, Aluminum industries

Formation of IRON PAN



## Minor Soil

### Forest soil

Mountain Region

Parts of the Podsol

Best for forestry

### Arid Soil

Rajasthan

Poor in humus

Kankar Formation: Problem

With irrigation these are fit for the agriculture

### Peaty soil

Along the coast

Black and sticky

Water logged

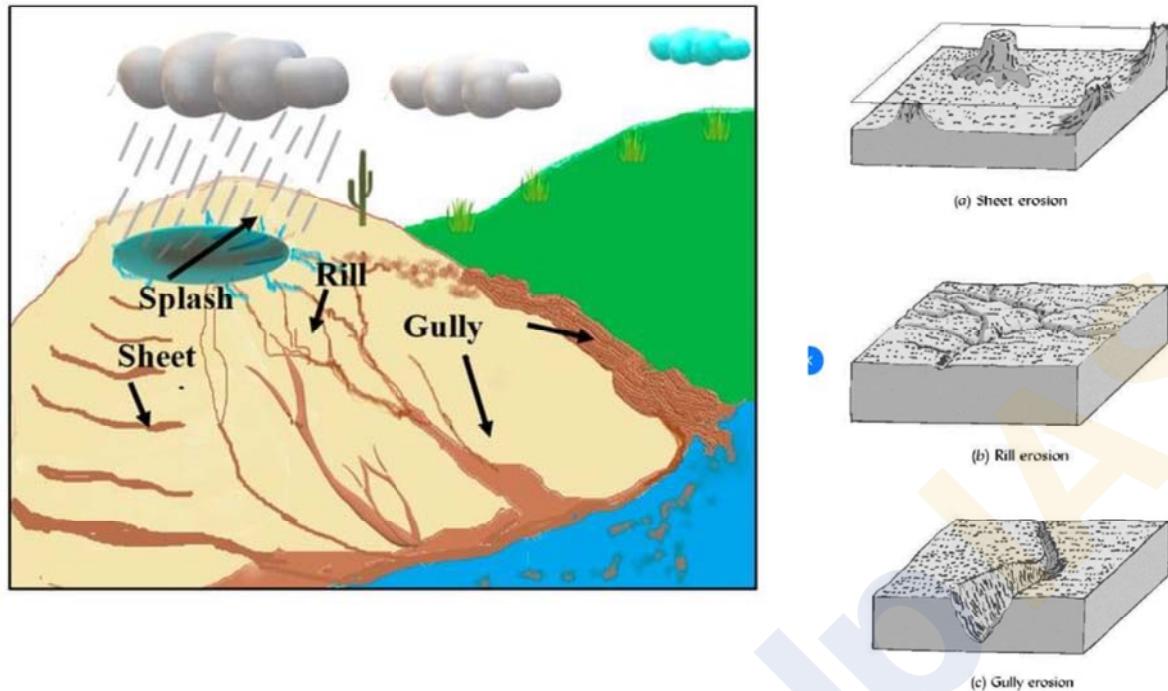
High peat content. Not for cultivation

### Saline soil

Degraded soils (Over irrigation)

Found in poor drained and Dry region, also in water logged regions

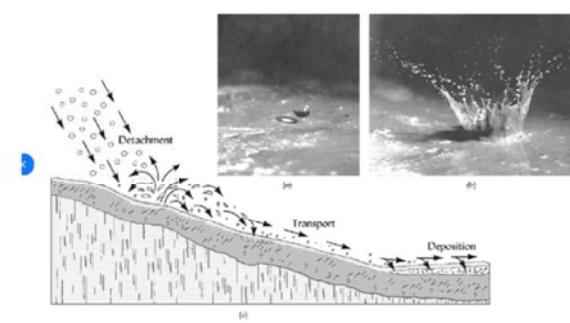
Sundarban, Gujarat



## SOIL PROBLEMS

### 1. Soil Erosion:

- Removal of fertile top layer. It is associated with mining, wrong agricultural practices like fallow land (bare land without any crop cover), deforestation, over grazing.
- Fallowing of land exposes soil to hitting of raindrop leading to splash erosion. Continuous erosion by raindrop leads to erosion of entire surface in form of sheet known as sheet erosion.
- Surface water flows that cause sheet erosion rarely travel more than a few metres before turning into rills and causing Rill Erosion
- Rill eventually widen to become gully erosion



1 (a) Raindrop falling on the surface (b) Splash impact of raindrop (c) Process of water erosion (modified from Stittcher 2010) 12.2.1.3. Rill erosion (channel erosion)

## SOIL PROBLEMS

**2. Soil Degradation:** It refers to decline in productivity and quality of soil. It can be due to:

- **Soil Pollution:** Excessive use of chemical fertilizers, pesticides etc  
Waste Dumping, Mining, Disposal of industrial effluents
- **Wrong Agricultural Practices** like monoculture, unscientific rotation of crops, salinisation due to cultivation of water intensive crops in dry regions, Shifting Cultivation.
- Capillary action leads to accumulation of calcium carbonate beneath (kankar), the soil will act as impermeable to water and water gets logged as happened in Indira Gandhi canal regions of Rajasthan.

## SOIL PROBLEMS

**3. Soil Desertification:** Extreme form of soil degradation where soil is no longer fit for cultivation

• **Reasons:**

- Spread of desert like conditions along the productive soil.
- Extreme form of Land degradation: Same points as degradation but with more intensity

## Solutions

- **Soil organic matter** should be maintained as it provides fertility, better water retention and holds the soil together
- **Plant trees, shrubs** to provide wind protection and also binds soil to roots.
- **Mulching:** Covering on ground of hay, straw and crops residue which prevents soil from erosion and preserves moisture in soil. It also prevents growth of weeds
- **No-Till/Minimum Tillage Methods** to conserve the soil of moisture, reduce erosion and does not disturb the soil
- **Erosion-reducing grazing practises:** Rotational grazing is a method of moving livestock from one pasture paddock to the next. Each paddock is given a rest period and is allowed to regrow naturally, reducing soil compaction and erosion.
- **Terracing esp in hilly areas** to prevent ploughing against the slope.
- **Windbreaks (also known as shelterbelts)** are rows of trees and shrubs planted along the edges of agricultural fields to provide wind protection
- **Organic farming, Precision farming** to reduce the excessive use of fertilizers, pesticide
- **Growing climate suitable crops** to prevent soil degradation

2011

23. If a tropical rain forest is removed, it does not regenerate quickly as compared to a tropical deciduous forest. This is because
- (a) the soil of rain forest is deficient in nutrients
  - (b) propagules of the trees in a rain forest have poor viability
  - (c) the rain forest species are slow-growing
  - (d) exotic species invade the fertile soil of rain forest

2012

**Which one of the following is the characteristic climate of the Tropical Savannah Region?**

- (a) Rainfall throughout the year
- (b) Rainfall in winter only
- (c) An extremely short dry season
- (d) A definite dry and wet season

2012

**Consider the following statements : If there were no phenomenon of capillarity**

- 1. It would be difficult to use a kerosene lamp
- 2. One would not be able to use a straw to consume a soft drink
- 3. The blotting paper would fail to function
- 4. The big trees that we see around would not have grown on the Earth

**Which of the statements given above are correct?**

- (a) 1, 2 and 3 only
- (b) 1, 3 and 4 only
- (c) 2 and 4 only
- (d) 1, 2, 3 and 4

## 2012

**Consider the following agricultural practices :**

1. Contour bunding
2. Relay cropping
3. Zero tillage

**In the context of global climate change, which of the above helps/help in carbon sequestration/storage in the soil?**

- (a) 1 and 2 only
- (b) 3 only
- (c) 1, 2 and 3
- (d) None of them

## 2013

**Which of the following is/are unique characteristic/characteristics of equatorial forests?**

1. Presence of tall, closely set trees with crowns forming a continuous canopy
2. Coexistence of a large number of species
3. Presence of numerous varieties of epiphytes

**Select the correct answer using the code given below:**

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2013

"Climate is extreme, rainfall is scanty and the people used to be nomadic herders." The above statement best describes which of the following regions?

- (a) African Savannah
- (b) Central Asian Steppe
- (c) North American Prairie
- (d) Siberian Tundra

2013

Which of the following statements regarding laterite soils of India are correct?

- 1. They are generally red in colour.
- 2. They are rich in nitrogen and potash.
- 3. They are well-developed in Rajasthan and UP.
- 4. Tapioca and cashew nuts grow well on these soils.

Select the correct answer using the codes given below.

- (a) 1, 2 and 3
- (b) 2, 3 and 4
- (c) 1 and 4
- (d) 2 and 3 only

2014

If you travel through the Himalayas, you are likely to see which of the following plants naturally grow there?

1. Oak
2. Rhododendron
3. Sandalwood

Select the correct answer using the code given below

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2015

"Each day is more or less the same, the morning is clear and bright with a sea breeze; as the Sun climbs high in the sky, heat mounts up, dark clouds form, then rain comes with thunder and lightning. But rain is soon over.

"Which of the following regions is described in the above passage?

- (a) Savannah
- (b) Equatorial
- (c) Monsoon
- (d) Mediterraneana

2015

In a particular region in India, the local people train the roots of living trees into robust bridges across the streams. As the time passes, these bridges become stronger. These unique 'living root bridges' are found in

- (a) Meghalaya
- (b) Himachal Pradesh
- (c) Jharkhand
- (d) Tamil



2015

Consider the following States:

1. Arunachal Pradesh
2. Himachal Pradesh
3. Mizoram

In which of the above States do 'Tropical Wet Evergreen Forests' occur?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2015

In India, in which one of the following types of forests is teak a dominant tree species?

- (a) Tropical moist deciduous forest
- (b) Tropical rainforest
- (c) Tropical thorn scrub forest
- (d) Temperate forest with grasslands

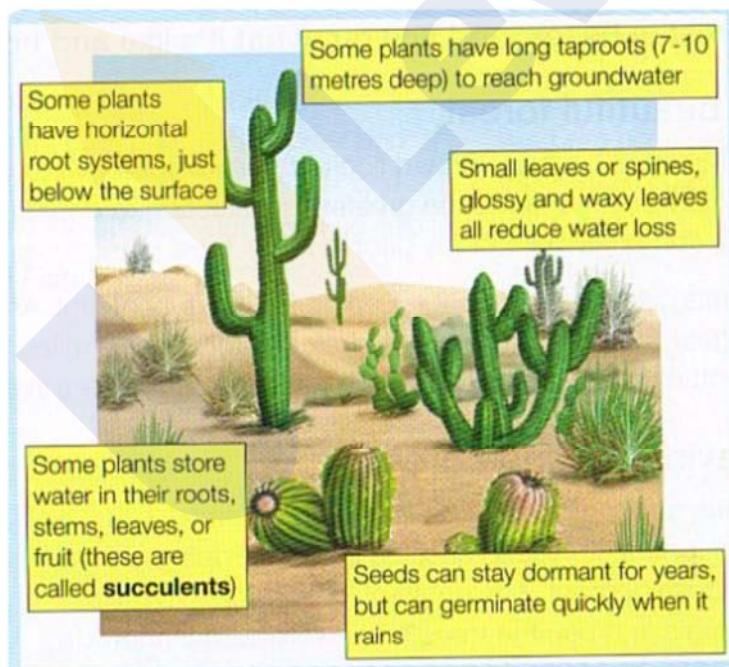
2018

**Which of the following leaf modifications occur (s) in the desert areas to inhibit water loss?**

1. Hard and waxy leaves
2. Tiny leaves
3. Thorns instead of leaves

Select the correct answer using the code given below:

- (a) 2 and 3 only  
(b) 2 only  
(c) 3 only  
(d) 1, 2 and 3



## 2018

With reference to agricultural soils, consider the following statements :

1. High content of organic matter in soil drastically reduces its water holding capacity.
2. Soil does not play any role in the sulphur cycle.
3. Irrigation over a period of time can contribute to the salinization of some agricultural lands.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

## 2021

The vegetation of savannah consists of grassland with scattered small trees. The forest development in such areas is generally kept in check by one or more or a combination of some conditions. Which of the following are such conditions?

1. Burrowing animals and termites.
2. Fire
3. Grazing herbivores
4. Seasonal rainfall
5. Soil properties

Select the correct answer using the code given below.

- (a) 1 and 2
- (b) 4 and 5
- (c) 2, 3 and 4
- (d) 1, 3 and 5

2021

The black cotton soil of India has been formed due to the weathering of

- (a) Brown forest soil
- (b) Fissure volcanic rock
- (c) Granite and schist
- (d) Shale and limestone

2021

Leaf litter decomposes faster than in any other biome and as a result, the soil surface is often almost bare. Apart from trees, the vegetation is largely composed of plant forms that reach up into the canopy vicariously, by climbing the trees or growing as epiphytes, rooted on the upper branches of trees." This is the most likely description of

- (a) Coniferous forest
- (b) Dry deciduous forest
- (c) Mangrove forest
- (d) Tropical rain forest

2023

Consider the following statements:

**Statement-I:** The soil in tropical rain forests is rich in nutrients.

**Statement-II:** The high temperature and moisture of tropical rainforests cause dead organic matter in the soil to decompose quickly.

**Which one of the following is correct in respect of the above statements?**

- a) Both Statement-I and Statement-II are correct and Statement-II is Correct the explanation for Statement-I
- b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I
- c) Statement-I is correct but Statement-II is incorrect
- d) Statement-I is incorrect, Statement-II is correct

## Questions

**2020:** The process of desertification does not have climatic boundaries. Justify with examples.

**2020:** Examine the status of forest resources of India and its resultant impact on climate change.

**2019:** Discuss the causes of the depletion of mangroves and explain their importance in maintaining coastal ecology.



**Countries: Size Wise:  
Continents: Size Wise**



## Oceans: Size Wise:



## Important Latitude and Longitude



## Asia: Division

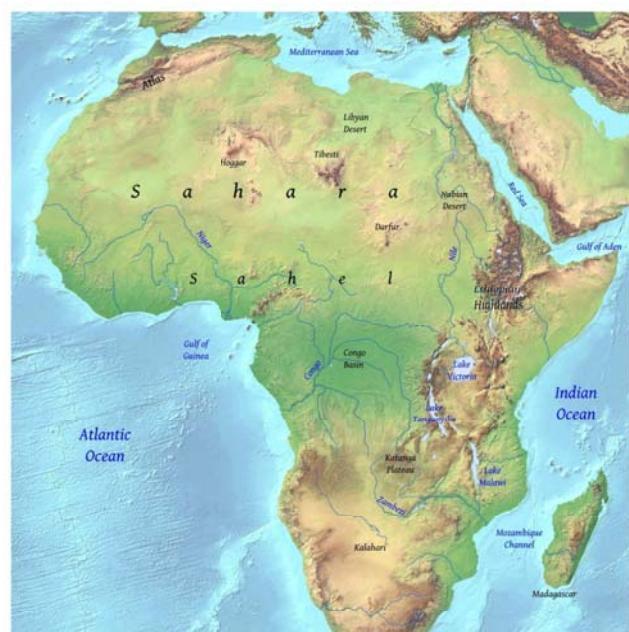
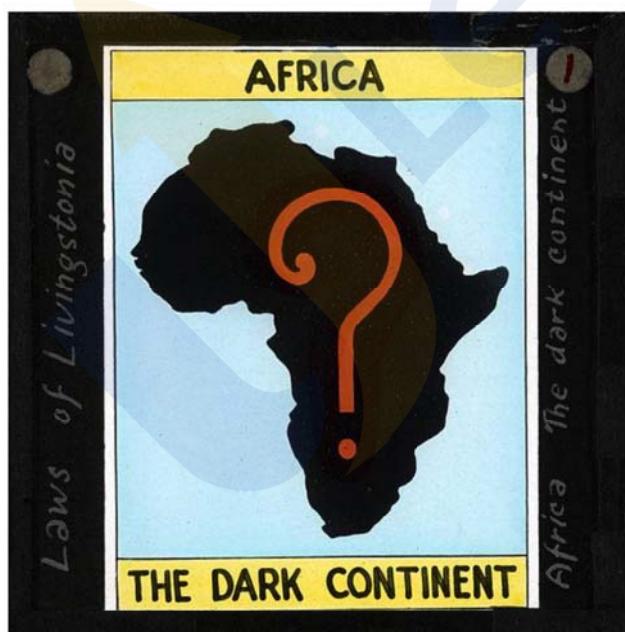
**Birth of  
Human Race  
and home to  
some of the  
oldest  
civilization**

**Look at the Physiography**



## Out of Africa

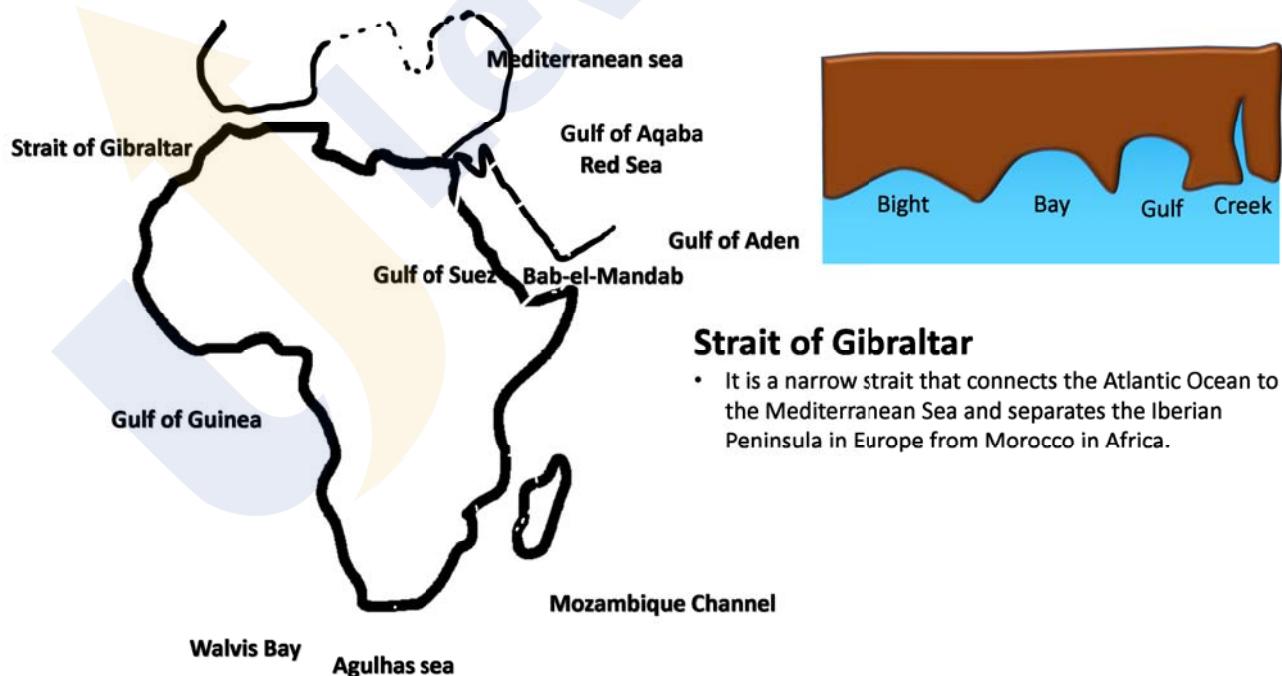
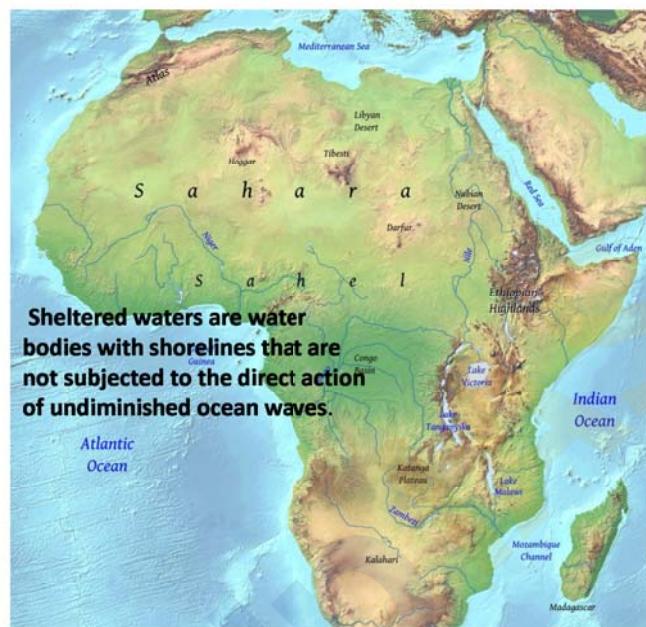
Bindibu: Aus  
Jarawa: AnN

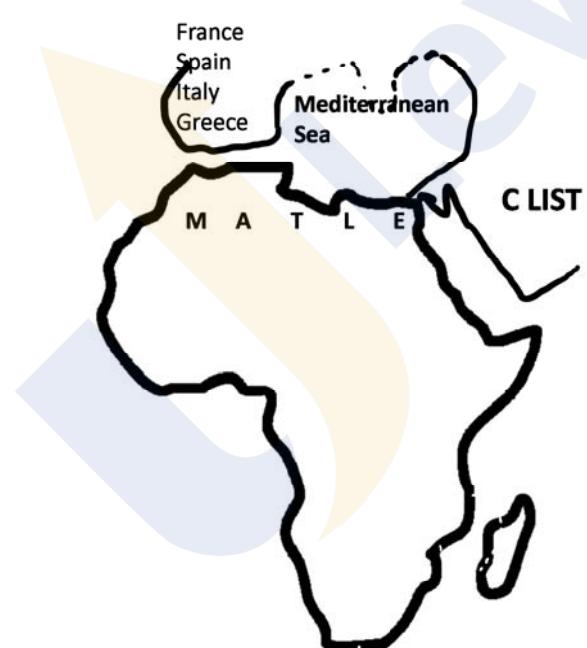
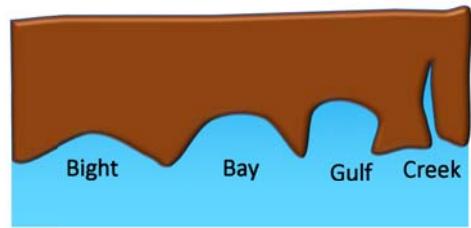
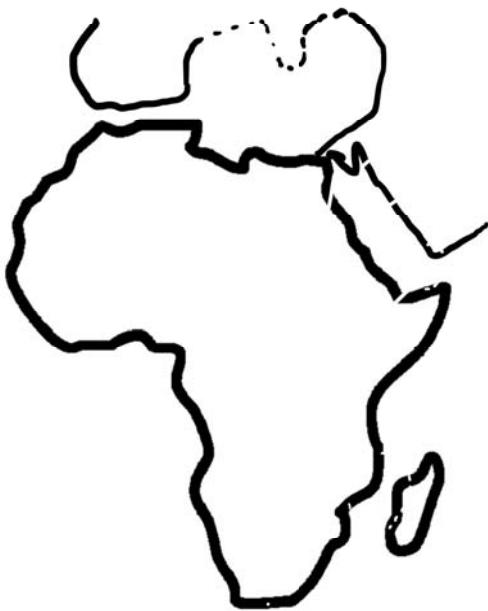


## Dark Continent: Difficult Physiography and difficult to access

### Physiography:

- African continent is a **plateau and table land**
- No Good ports (**Good port development needs: Deep waters, good connectivity with hinterland, Tides**)
- Long coastline but it is not **favourable for the location of ports**
- Desert in North: Sahara
- Mountains and Waterfalls along the East coast
- Only one common way to enter was Sinai Peninsula





C → Cyprus  
L → Lebanon  
I → Israel  
S → Syria  
T → Turkey

2015: Question

Which one of the following countries of South-West Asia does not open out to the Mediterranean Sea?

- (a) Syria
- (b) Jordan
- (c) Lebanon
- (d) Israel

Mediterranean Sea: UPSC Question 2017

Mediterranean Sea is a border of which of the following countries?

1. Jordan
2. Iraq
3. Lebanon
4. Syria

Select the correct answer using the code given below:

- (a) 1, 2 and 3
- (b) 2 and 3 only
- (c) 3 and 4 only
- (d) 1, 3 and 4 only

## REMEMBER COUNTRIES SURROUNDING RED SEA

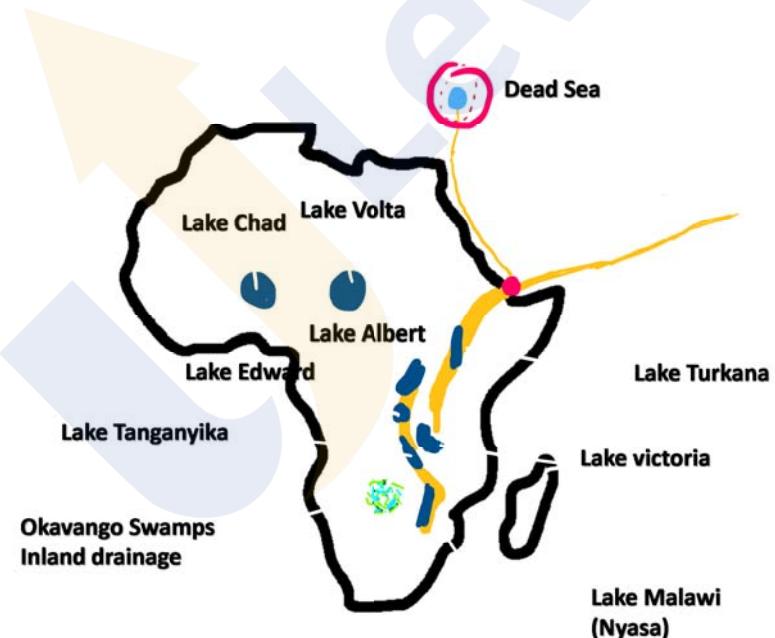
- D → Djibouti
- E → Eritrea
- S → Sudan
- S → Saudi Arabia
- E → Egypt
- Y → Yemen

NOT SOMALIA





Both are  
Mt. desert



### Rift Valley

Extends along the Red Sea, Gulf of Aqaba, Along with river Jordan till Dead sea.

It is the most extensive valley system on land

AETM

### DIVERGENT boundary



Victoria fall, Zimbabwe  
Part of great African Rift valley system



Present

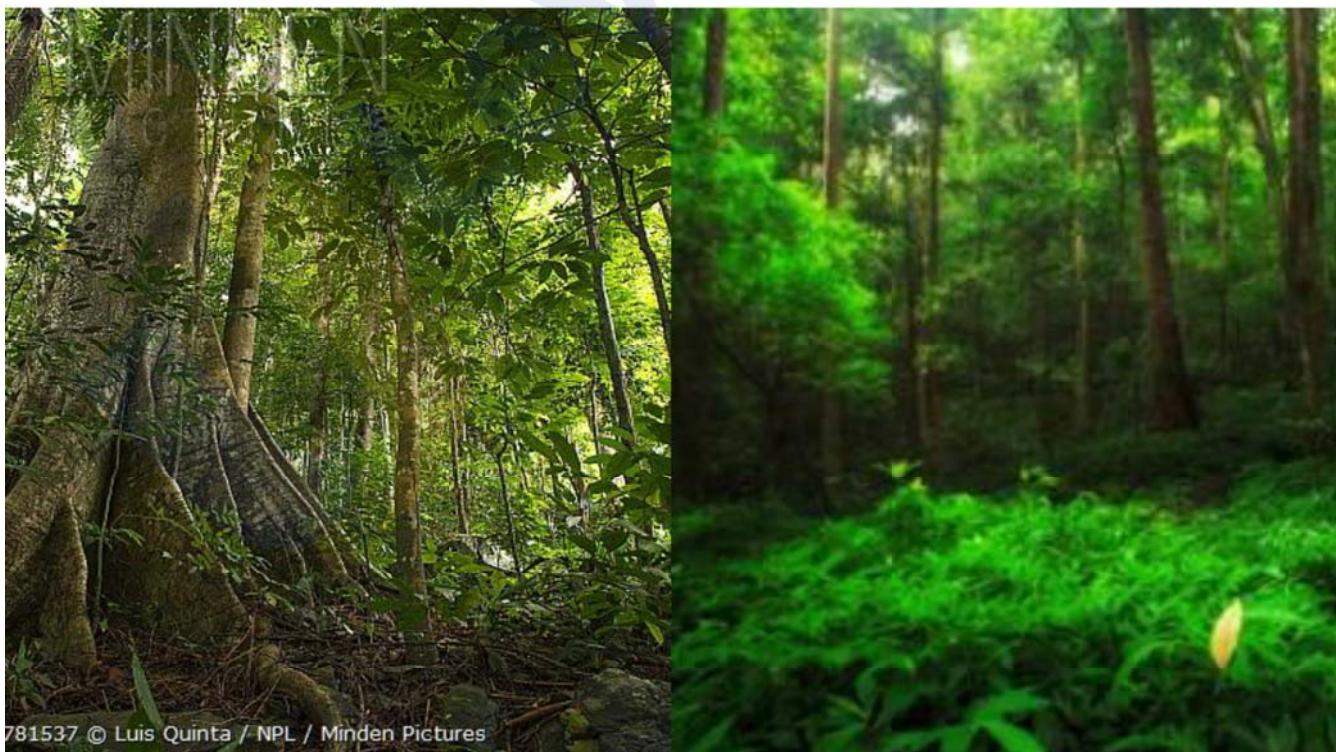
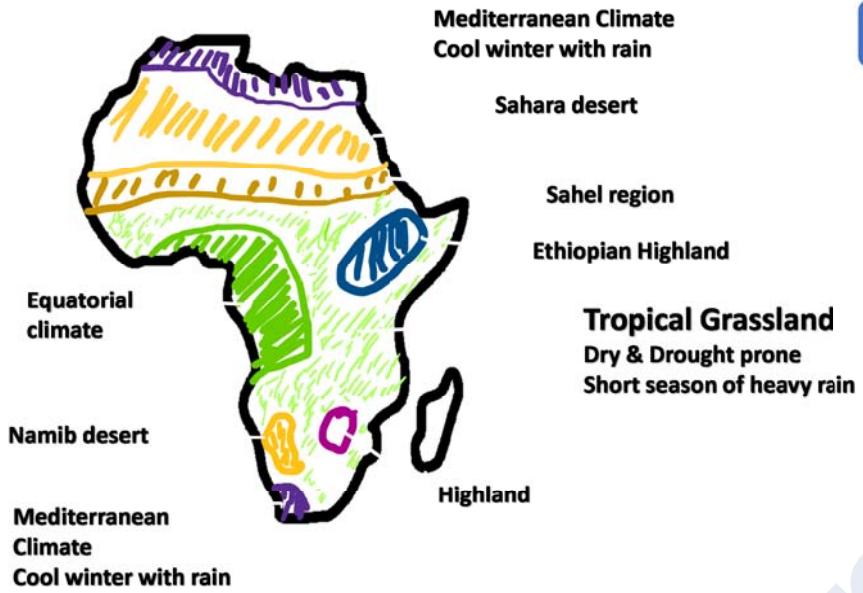


Future



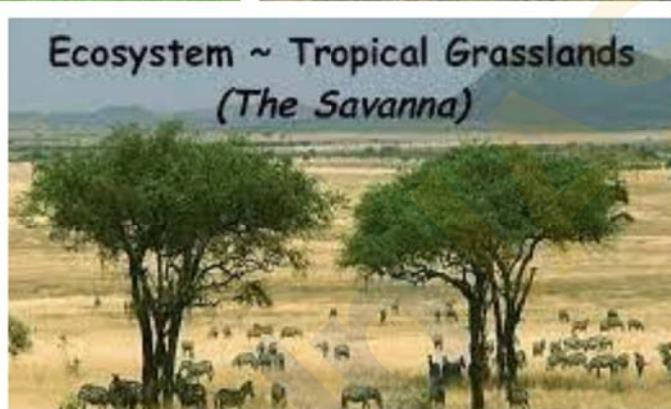
#### Rift Valley

Extends along the Red Sea, Gulf of Aqaba, Along with river Jordan till Dead sea.  
It is the most extensive valley system on land





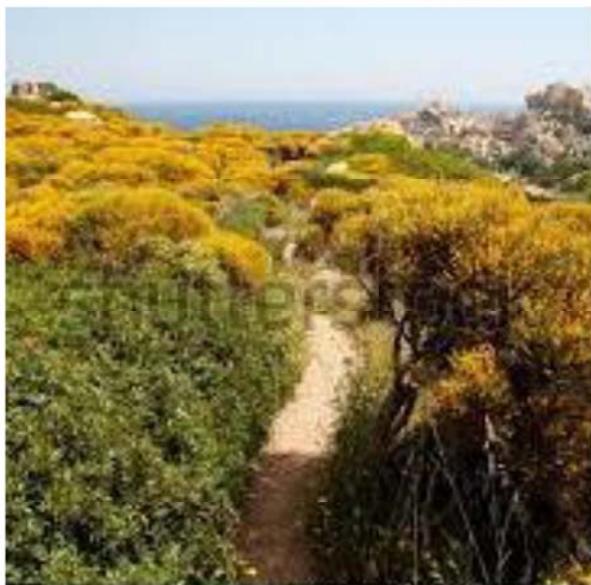
**Ecosystem ~ Tropical Grasslands  
(The Savanna)**



## Types of desert based on the Causal factors

Tropical desert	Mid-latitude continental desert	Cold desert	Rain shadow desert
<ul style="list-style-type: none"> <li>Under influence of off-shore trade wind.</li> <li>At western margin</li> <li>Always hot.</li> <li>e.g. - Thar, Sahara, Australian, Namib deserts</li> </ul>	<ul style="list-style-type: none"> <li>Due distance from the water bodies</li> <li>In temperate region</li> <li>e.g. – Taklamakan, Gobi desert</li> </ul>	<ul style="list-style-type: none"> <li>Found in polar/high altitude region.</li> <li>e.g. – Antarctica, Ladakh</li> </ul>	<ul style="list-style-type: none"> <li>Lee ward side of the mountain.</li> <li>e.g. – Patagonia desert</li> </ul>





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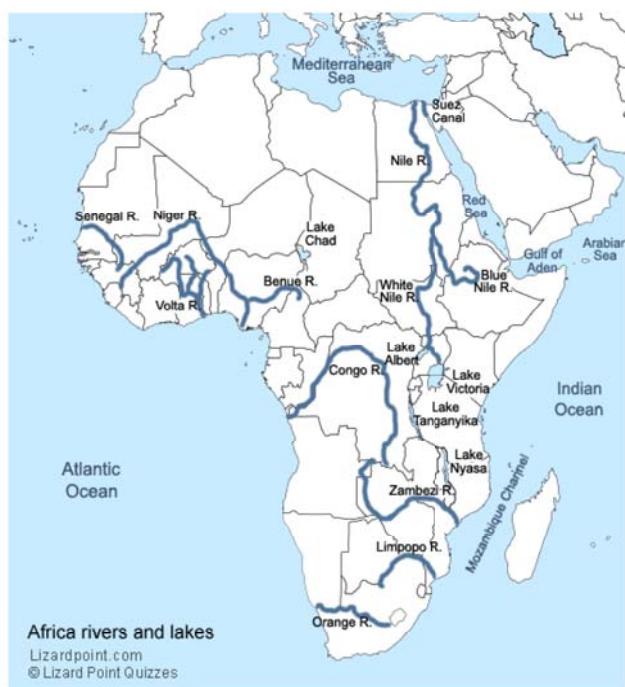
Africa rivers and lakes  
Lizardpoint.com  
© Lizard Point Quizzes

### Rivers which drain in Atlantic Ocean: VCN, SON

1. Senegal
2. Volta
3. Niger
4. Congo
5. Orange
6. Nile

### Rivers which drain in Indian Ocean

1. Zambezi
2. Limpopo



## Nile River

1. World's Longest River
2. Has Aswan Dam, Lake Naser
3. Port Alexandria and Port Said
4. Tributaries:
  1. White Nile from Victoria
  2. Blue Nile ???Highland
  3. Black Nile (Atbara): Ethiopian Highland near Tana

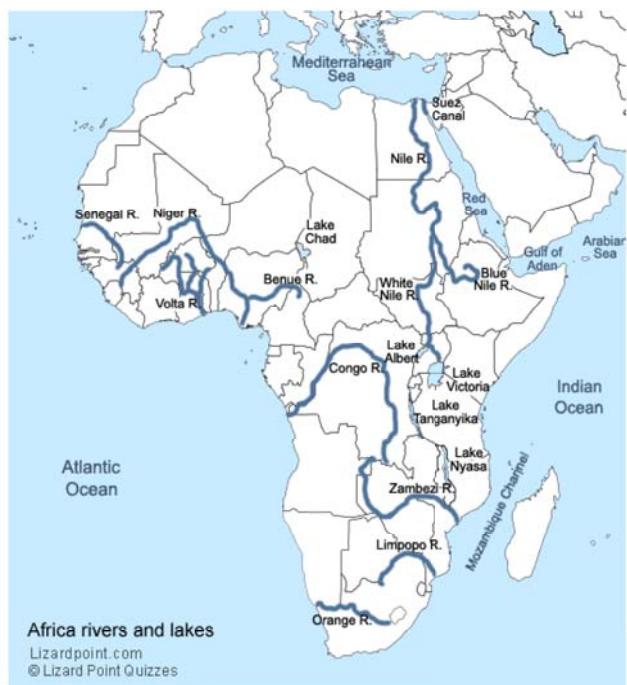
## Congo River (Zaire River):

1. Origin: ..... Plateau
2. Cuts EQ twice
3. Huge Volume of Water.. Largest River of Africa
4. Boyoma Waterfalls (Stanley Falls)



## Zambezi River:

1. Origin: ..... Plateau
2. Zambezi river has Victoria Waterfall



**Niger River:**  
Origin: .... Mountain

**Orange River**  
1. Origin: ..... Range  
2. Famous for Gold Deposit

**Limpopo River:**  
1. Cuts Tropic of Capricorn twice

**Chari River:**  
1. Lake Chad is on it

## Mapping Rivers: 2020 UPSC

### River – Flows into

1. Mekong — Andaman Sea
2. Thames — Irish Sea
3. Volga — Caspian Sea
4. Zambezi — Indian Ocean

**Which of the pairs given above is/are correctly matched?**

- (a) 1 and 2 only
- (b) 3 only
- (c) 3 and 4 only
- (d) 1, 2 and 4 only

## Geography Prelims Question: 2022 Question

Consider the following pairs:

Region often mentioned in the news: Country

- |                 |          |
|-----------------|----------|
| 1. Anatolia     | Turkey   |
| 2. Amhara       | Ethiopia |
| 3. Cabo Delgado | Spain    |
| 4. Catalonia    | Italy    |

How many pairs given above are correctly matched?

- (a) Only one pair
- (b) Only two pairs
- (c) Only three pairs
- (d) All four pairs

## Geography Prelims Question: 2022 Question

Which one of the lakes of West Africa has become dry and turned into a desert?

- Lake Victoria
- Lake Faguibine
- Lake Oguta
- Lake Volta

## Geography Prelims Question: 2022 Question

The term "Levant" often heard in the news roughly corresponds to which of the following regions?

- (a) Region along the eastern Mediterranean shores
- (b) Region along North African shores stretching from Egypt to Morocco
- (c) Region along Persian Gulf and Horn of Africa
- (d) The entire coastal Mediterranean Sea of areas

## World Geography

**2014: UPSC CSE**

**Turkey is located between**

- A. Black Sea and Caspian Sea
- B. Black Sea and Mediterranean Sea
- C. Gulf of Suez and Mediterranean Sea
- D. Gulf of Aqaba and Dead Sea

## 2014: WHY?

Consider the following pairs:

<b>Region often in news</b>	:	<b>Country</b>
1. Chechnya	:	Russian Federation
2. Darfur	:	Mali
3. Swat Valley	:	Iraq

Which of the above pairs is/are correctly matched?

- (a) 1 only      (b) 2 and 3 only  
(c) 1 and 3 only    (d) 1, 2 and 3

## 2014: Question: South East Asia

What is the correct sequence of occurrence of the following cities in South-East Asia as one proceeds from **south to north**?

1. Bangkok
2. Hanoi
3. Jakarta
4. Singapore

Select the correct answer using the code given below.

- (a) 4-2-1-3 (b) 3-2-4-1  
(c) 3-4-1-2 (d) 4-3-2-1

2015: Question

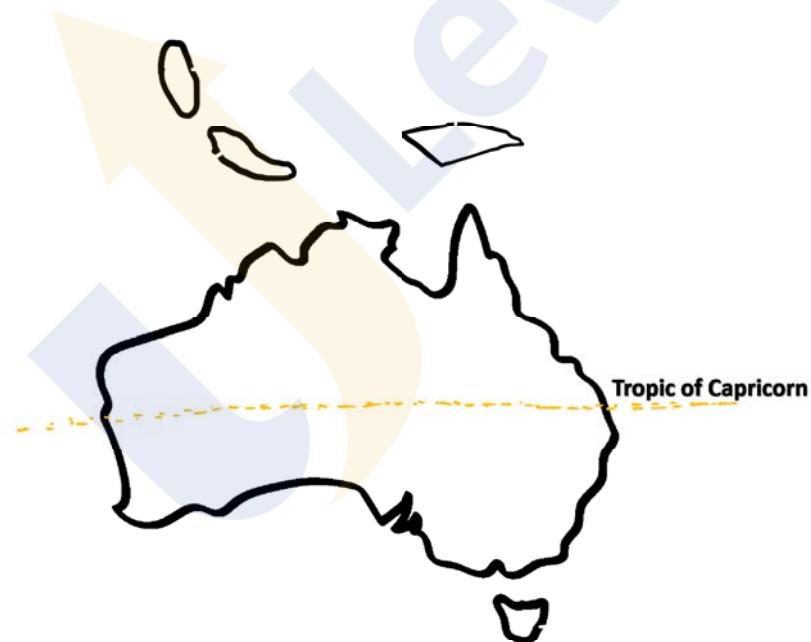
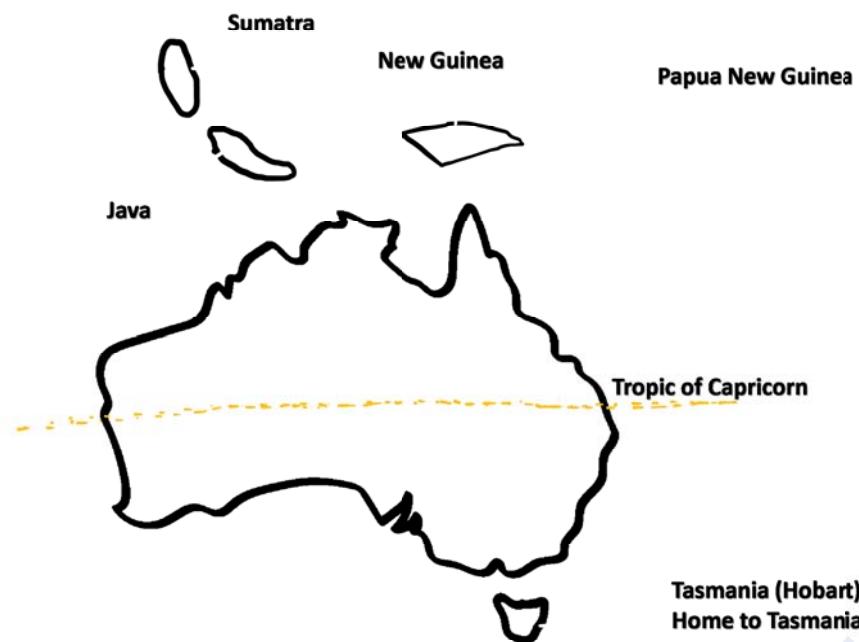
Which one of the following countries of South-West Asia does not open out to the Mediterranean Sea?

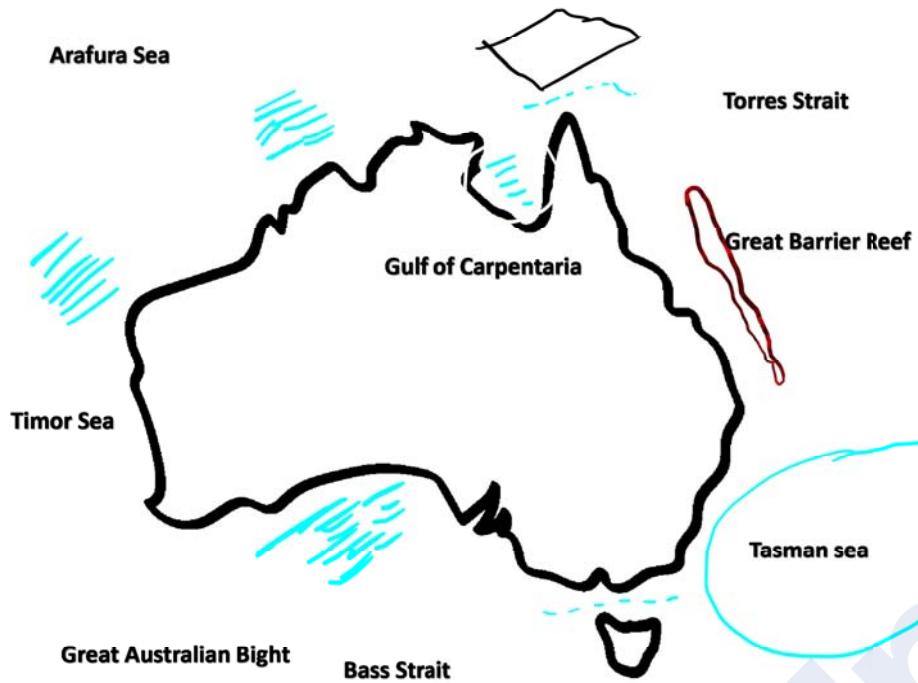
- (a) Syria
- (b) Jordan
- (c) Lebanon
- (d) Israel



### Australia:

1. It is a continent but it is referred to as Continent Country
2. 6<sup>th</sup> largest country area wise
3. Entirely south of Equator and tropic of Capricorn bisects it
4. New settlements
5. Largest Island

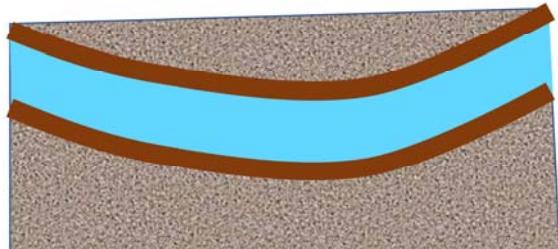
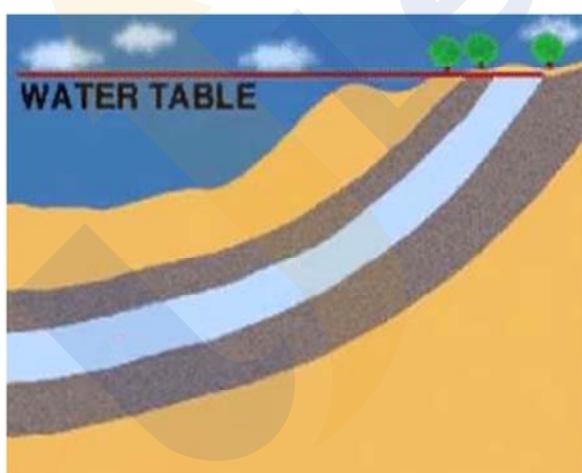


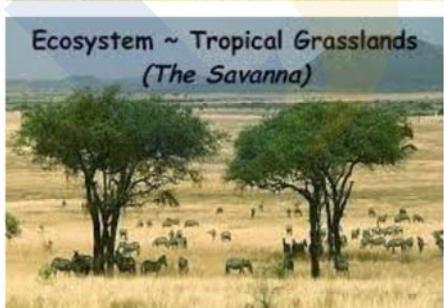






1. Western Highland	Plateau region
2. Low lying plain	It is a desert area (Nullarbor Desert)
3. Dry basin	Lake Eyre Basin (Part of the desert)
4. Eastern central Australia	Low land Known for Artesian wells
5. Mountains and highland	Great dividing range





### Vegetation –



Gibson Desert

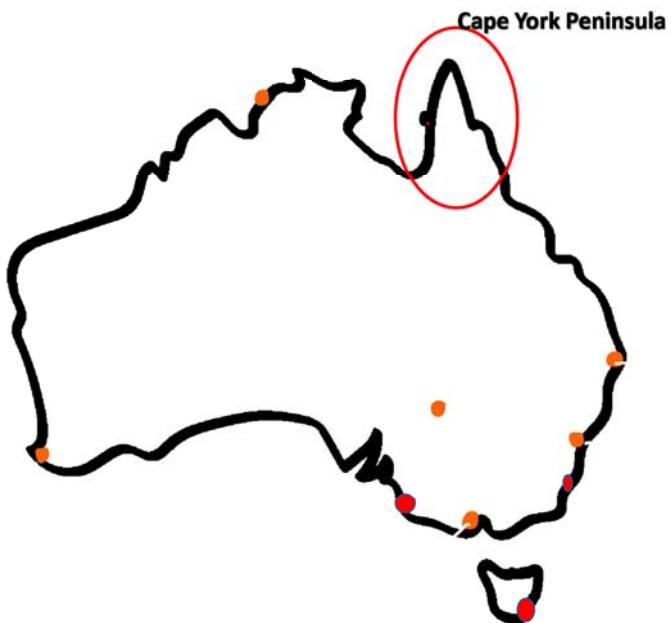
Stony Stuart Desert

Great Victorian  
Desert

Nullarbor Desert

Lake Eyre Basin

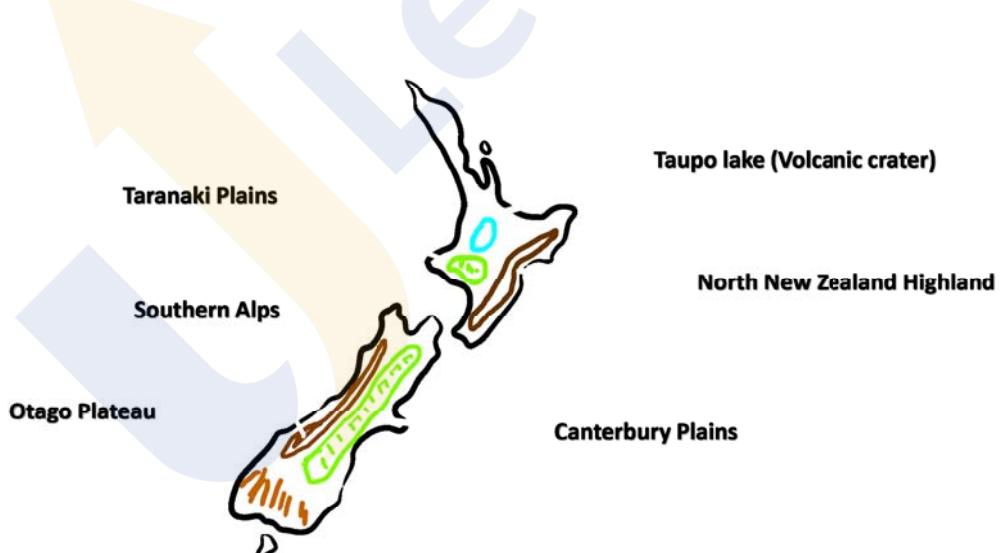




Most of the New Zealand is of Volcanic Origin and has Young fold mt.



Most of the New Zealand is of Volcanic Origin and has Young fold mt.



**New World (NW)**

- North America
- South America
- Europe
- Australia

**Old World (OW)**

- Asia (older civilisation)

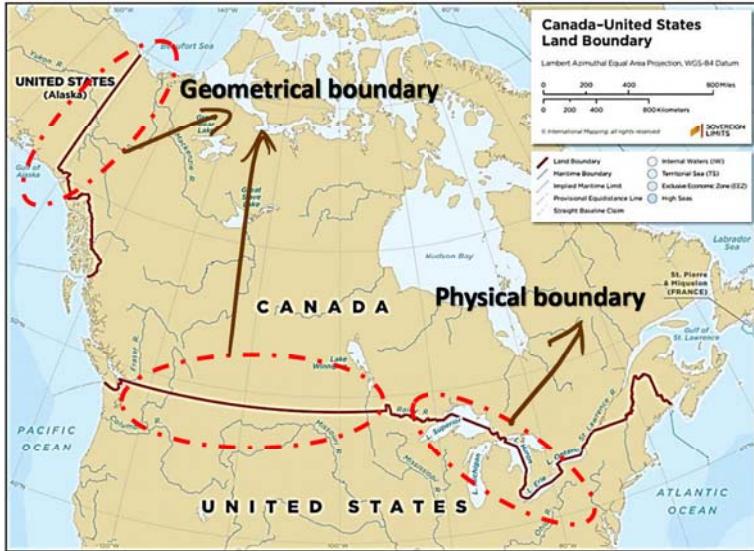


**Central America**  
Belize, Guatemala, El  
Salvador, Honduras,  
Nicaragua, Costa Rica,  
Panama

**Northern America**  
USA + Canada + Mexico

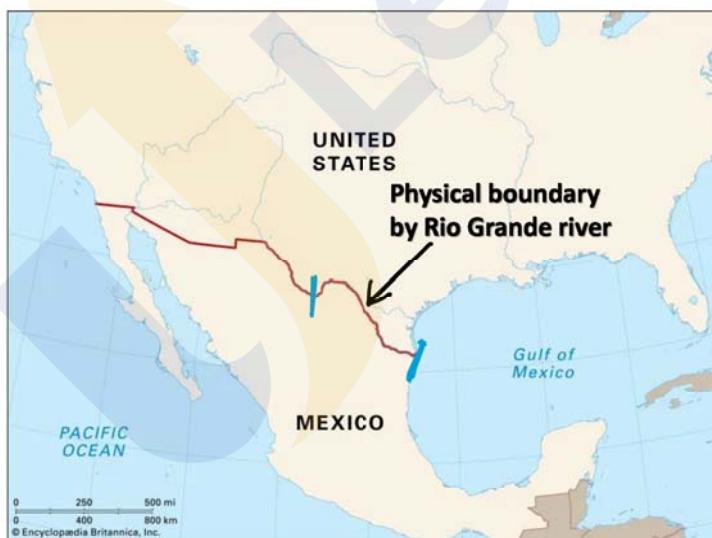
**Caribbean Nations**  
Cuba, Dominica,  
Dominican Republic,  
Puerto Rico





### Types of Political boundaries

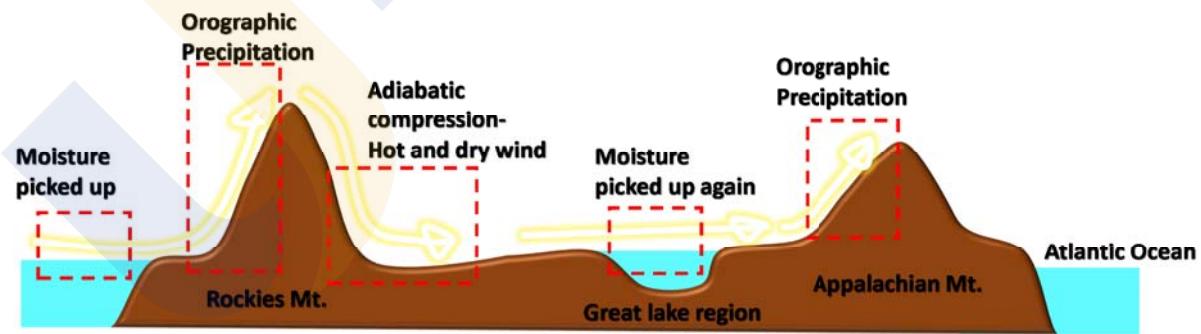
- **Physical** – Demarcated using physical features
- **Geometrical** – demarcated based on Longitude and latitude.







### Impact of the Great lake region





### BoWash Conurbation

Highest population area.

First settlement of British

- Boston,
- New York
- Philadelphia DC
- Baltimore
- Philadelphia



### Great Plains

Prairies region

Temperate grassland

Extremely Flat topography

Wheat basket.

#### Tropical grassland

Low latitude,

Grasses are not nutritious.

Trees are present

Savana, Llanos, Campos.

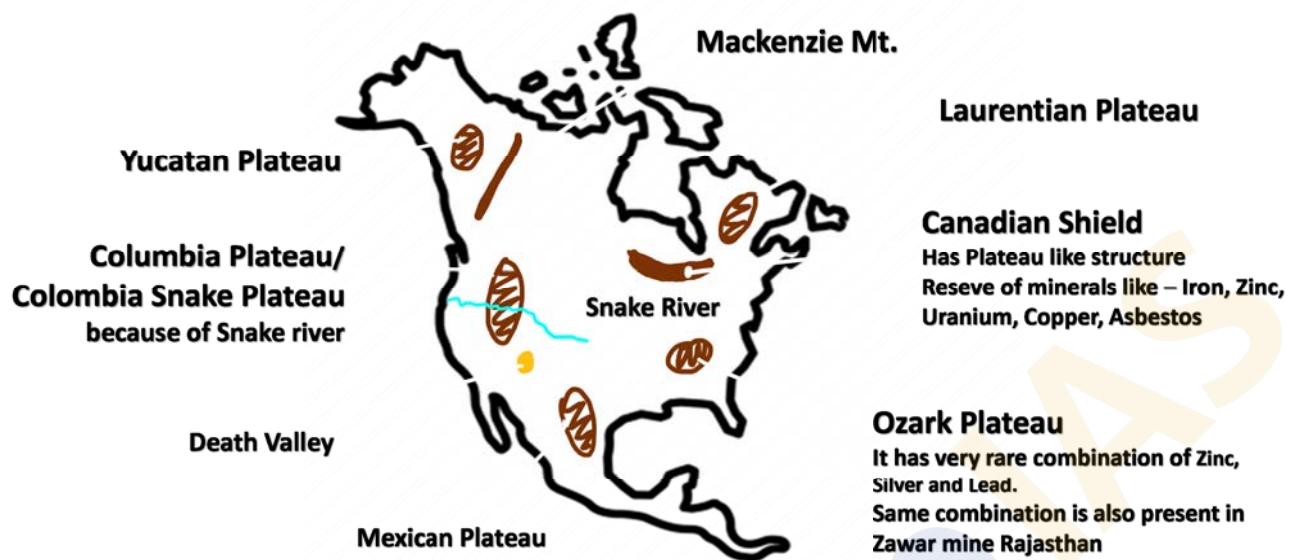
#### Temperate grassland

Mid-latitude

Pure grassland (no trees)

Grasses are nutritious

Soil has good humus





### Hot Spring

No sudden eruption

Mineral-rich water

E.g. Hot spring of Rajgir, Bihar

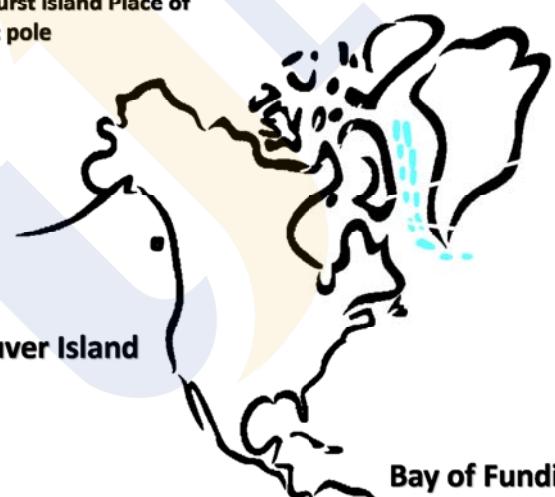
### Geyser

Sudden eruption (like a fountain)

E.g. Old Fountain geyser, Yellow stone park

Queens Elizabeth Island  
Has Bathurst island Place of  
Magnetic pole

Vancouver Island



Baffin Island

Davis Strait

Newfound land island  
Has fog (Danger for navigation)  
Confluence of cold (Labrador current)  
and warm current (Gulf Stream)

Bay of Fundi

**Isthmus of Panama**  
Formed in last 2 – 3 million years



South America and North America have very different kinds of life forms.

Only after formation of Isthmus of Panama they started migrating.

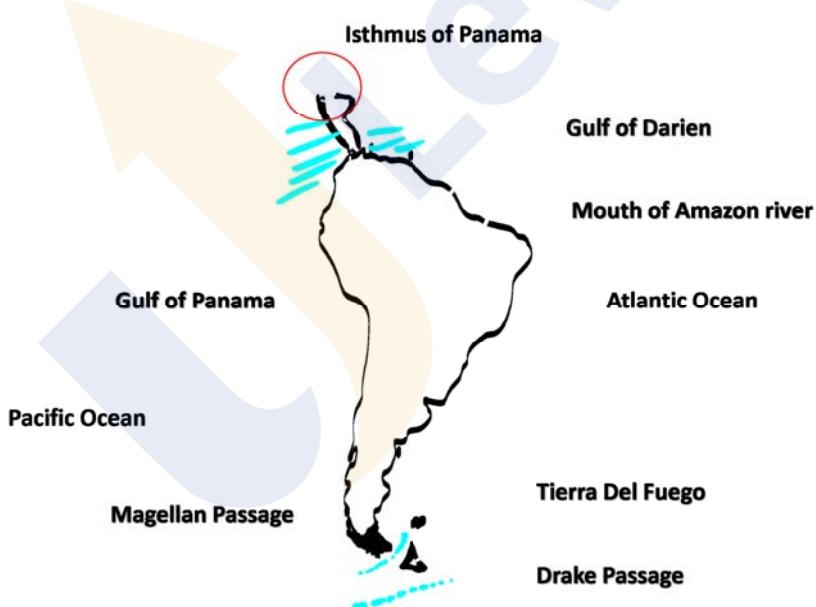
Eg –

- Armadillo
- Ant eater



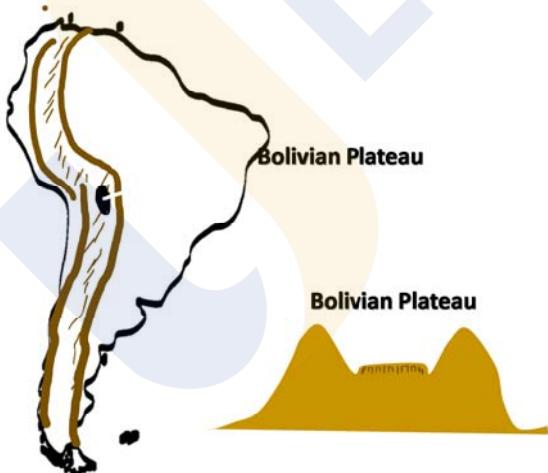


1. Equator passes through?
- Answer: ECB
2. Tropic of Capricorn passes through?
- Answer: CAP-B
3. Only 2 Landlocked country:
- Answer.





## ANDES MOUNTAIN RANGE



One of the largest mountain range

Has active volcanos

- Chimborazo
- Cotopaxi
- Ojas Del Salados (Highest volcano of the world)

Aconcagua Mt.

- Highest peak in the Andes

Bolivian Plateau

- Intermontane Plateau between Andes ranges

It has two navigable lakes –

- Lake Titicaca, Lake Poppo

**Countries included**

- Venezuela
- Surinam
- Guyana
- French Guyana

It is Important for Bauxite mining

It is part of Gondwana land



The southern part of  
the plateau is Mato  
Grasso

There is rock similarity  
between Brazil  
highland and Loma Mt  
of Africa

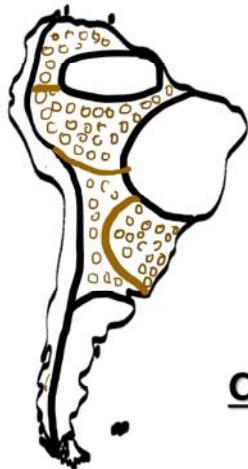


It is partly Volcanic in origin

Rain Shadow desert plateau

**IDENTIFY THE FEATURES?**





**Central Lowlands**



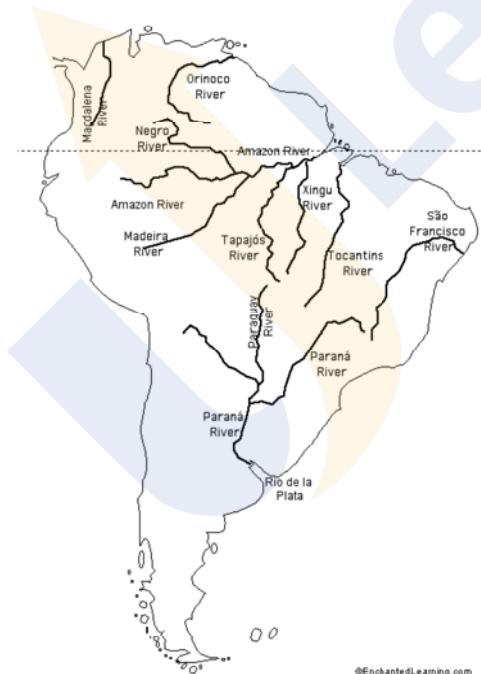
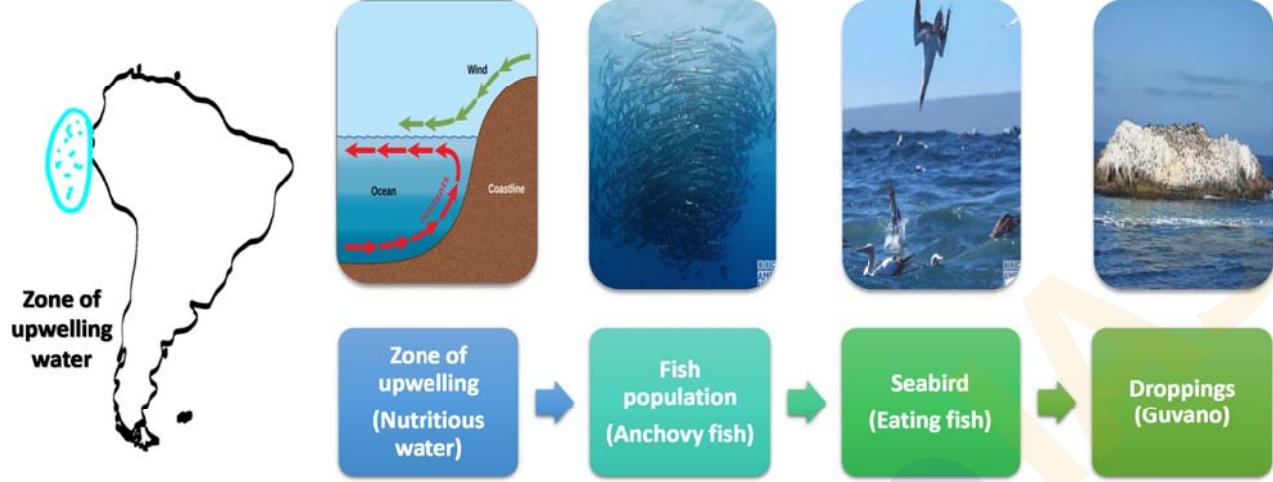
## Vegetation

1. **Selvas:** Dense Equatorial Forest
2. **Campos and Llanos:** Tropical Grasslands
3. **Sertao and Catinga:** Dry Scrubland
4. **Pampas:** Temperate Grassland
5. **Extreme desert:** Chile Desert
6. **Semi Arid:** Patagonia Desert

## Types of desert based on the Causal factors

Tropical desert	Mid-latitude continental desert	Cold desert	Rain shadow desert
<ul style="list-style-type: none"> <li>Under influence of off-shore trade wind.</li> <li>At western margin</li> <li>Always hot.</li> <li>e.g. - Thar, Sahara, Australian, Namib deserts</li> </ul>	<ul style="list-style-type: none"> <li>Due distance from the water bodies</li> <li>In temperate region</li> <li>e.g. – Taklamakan, Gobi desert</li> </ul>	<ul style="list-style-type: none"> <li>Found in polar/high altitude region.</li> <li>e.g. – Antarctica, Ladakh</li> </ul>	<ul style="list-style-type: none"> <li>Lee ward side of the mountain.</li> <li>e.g. – Patagonia desert</li> </ul>





### **Amazon River System:**

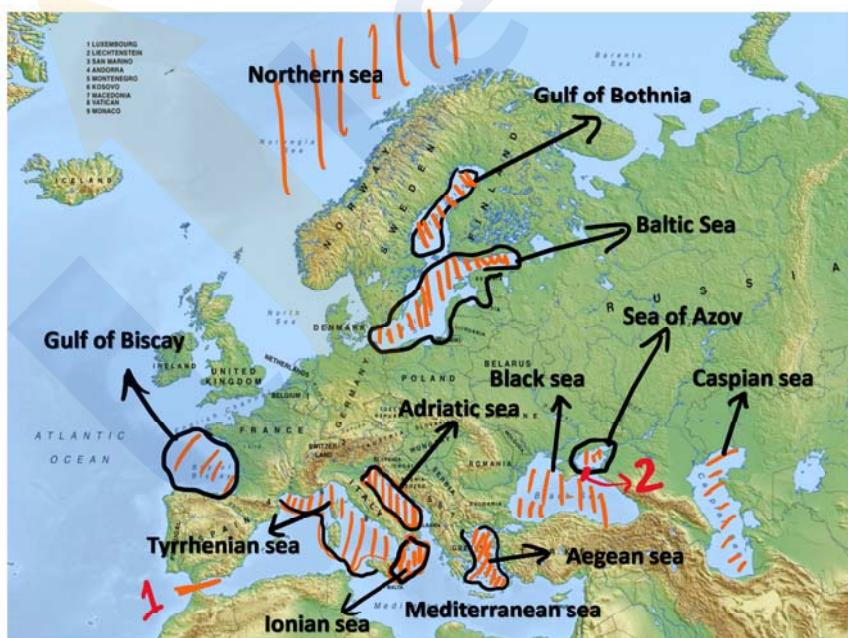
1. World's largest river
2. Origin: Andes
3. Has equatorial forest : Amazon of forest (Lungs of the Forest)
4. Petroleum is at mouth
5. Forest Fire and Deforestation

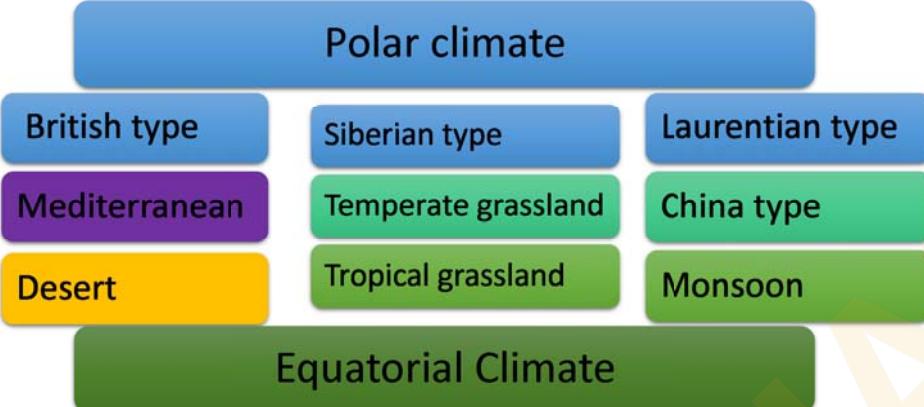
### **Parana and Paraguay River System:**

1. Paraguay and Parana River: Rises in Brazilian Highland
2. Parana Paraguay river meets Uruguay River
3. Important for Hydroelectricity
4. Both drain at Rio de La plata region

### **Uruguay River**

1. Source: Brazilian Highland
2. Drains in Rio de La plata region





### Countries of Scandinavian Peninsula –

- Norway
- Sweden
- Finland
- Denmark
- Iceland

#### Very High In HDI ranking

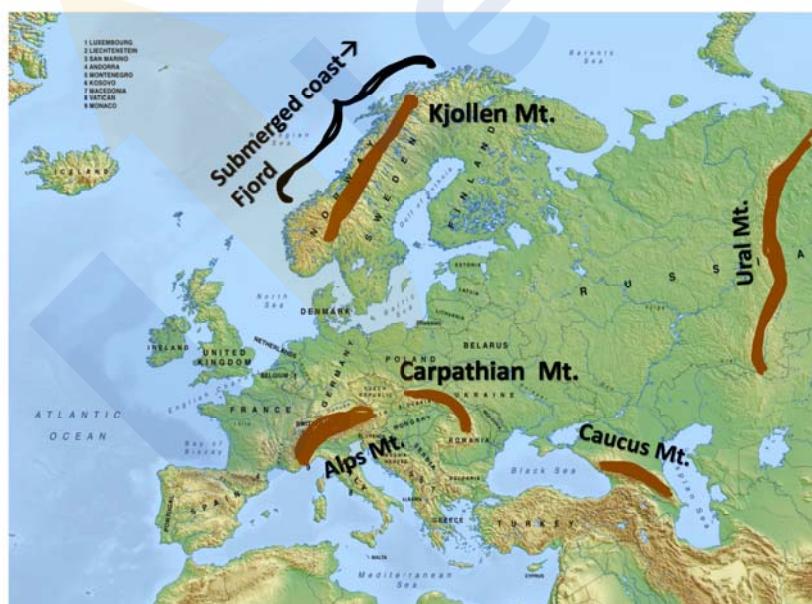
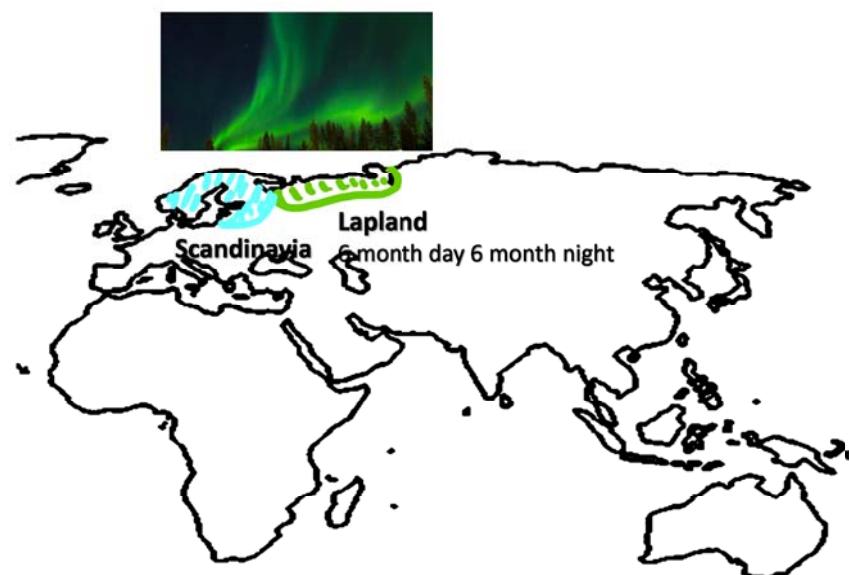
- Literacy
- Life expectancy
- Per capita



Lapps tribe

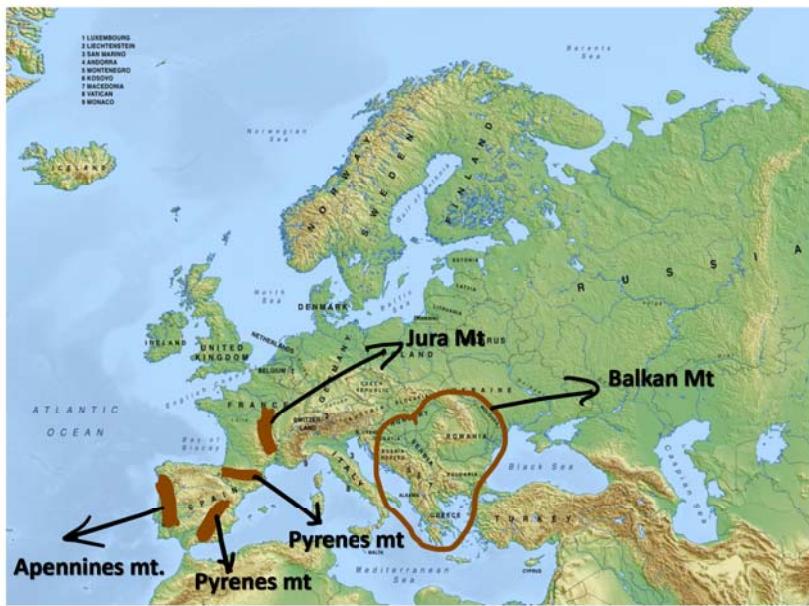


Samoyeds tribe



**Kjollen Mt.**  
Sandwiched between  
Norway and Sweden

**Carpathian Mt.**  
3rd largest mt in Europe  
after Ural and  
Scandinavian mt.



**Jura Mt**  
**Black forest**  
**Block mountains**  
**Rhine Valley**

## Important Rivers



## World Geography

**2014: UPSC CSE**

**Turkey is located between**

- A. Black Sea and Caspian Sea
- B. Black Sea and Mediterranean Sea
- C. Gulf of Suez and Mediterranean Sea
- D. Gulf of Aqaba and Dead Sea

**2014: WHY?**

Consider the following pairs:

<b>Region often in news</b>	<b>Country</b>
-----------------------------	----------------

- |                |   |                    |
|----------------|---|--------------------|
| 1. Chechnya    | : | Russian Federation |
| 2. Darfur      | : | Mali               |
| 3. Swat Valley | : | Iraq               |

Which of the above pairs is/are correctly matched?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

## 2014: Question: South East Asia

What is the correct sequence of occurrence of the following cities in South-East Asia as one proceeds from **south to north**?

1. Bangkok
2. Hanoi
3. Jakarta
4. Singapore

Select the correct answer using the code given below.

- (a) 4-2-1-3 (b) 3-2-4-1  
(c) 3-4-1-2 (d) 4-3-2-1

## 2015: Question

Which one of the following countries of South-West Asia does not open out to the Mediterranean Sea?

- (a) Syria  
(b) Jordan  
(c) Lebanon  
(d) Israel

**2013**

Consider the following pairs

Geographical Feature	Region
(a) Abyssinian Plateau	Arabia
(b) Atlas Mountains	North-Western Africa
(c) Guiana Highlands	South-Western Africa
(d) Okavango Basin	Patagonia

Which of the pairs given above is/are correctly matched?

**2014: UPSC CSE**

**Turkey is located between**

- A. Black Sea and Caspian Sea
- B. Black Sea and Mediterranean Sea
- C. Gulf of Suez and Mediterranean Sea
- D. Gulf of Aqaba and Dead Sea



Answer



2014: OTHER UPSC EXAM PAPER

Between Black Sea and Mediterranean Sea which is the country Located..

You know the answer

What is the lesson??

2014: WHY?

Consider the following pairs:

<b>Region often in news</b>	<b>Country</b>
1. Chechnya	: Russian Federation
2. Darfur	: Mali
3. Swat Valley	: Iraq

Which of the above pairs is/are correctly matched?

- (a) 1 only              (b) 2 and 3 only
- (c) 1 and 3 only    (d) 1, 2 and 3

## Elimination Technique

On 9 October 2012, while on a bus in the Swat District, after taking an exam, Yousafzai and two other girls were shot by a Tehrik-i Taliban Pakistan gunman in an assassination attempt in retaliation for her activism; the gunman fled the scene.

2014: Question: South East Asia

What is the correct sequence of occurrence of the following cities in South-East Asia as one proceeds from **south to north**?

1. Bangkok
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4. Singapore

Select the correct answer using the code given below.

- (a) 4-2-1-3 (b) 3-2-4-1  
(c) 3-4-1-2 (d) 4-3-2-1

Answer: C

Other things to ponder?

Which of them is Landlocked?

L: Laos: Landlocked

Name countries

Mekong River

Mekong Ganga Co-operation



2015: Question

Which one of the following countries of South-West Asia does not open out to the Mediterranean Sea?

- (a) Syria
- (b) Jordan
- (c) Lebanon
- (d) Israel

## Landlocked countries in West Asia



Dead Sea?  
Gulf of Aqaba



### Gulf of Aqaba: JESI

**The Gulf of Aqaba or Gulf of Eilat**

Gulf at the northern tip of the Red Sea,

east of the Sinai Peninsula

west of the Arabian Peninsula.

Its coastline: Egypt, Israel, Jordan, Saudi Arabia.



## 2015: GOLAN HEIGHTS

The area known as "Golan Heights" sometimes appears in the news in the context of the events related to

- (a) Central Asia
- (b) Middle East
- (c) South-East Asia
- (d) Central Africa

Answer: B



2016

Community sometimes in the affairs of mentioned in the news

1. Kurd : Bangladesh
2. Madhesi : Nepal
3. Rohingya : Myanmar

Which of the pairs given above is/are correctly matched?

- (a) 1 and 2
- (b) 2 only
- (c) 2 and 3
- (d) 3 only

2016

Answer: c

Khurd: SITI. Northern Kurdistan (Turkey); Southern Kurdistan (Iraq); Eastern Kurdistan (Iran); Western Kurdistan (Syria)



2017: Again Med Sea

Mediterranean Sea is a border of which of the following countries?

1. Jordan
2. Iraq
3. Lebanon
4. Syria

Select the correct answer using the code given below:

- (a) 1, 2 and 3
- (b) 2 and 3 only
- (c) 3 and 4 only
- (d) 1, 3 and 4 only

Ans: C



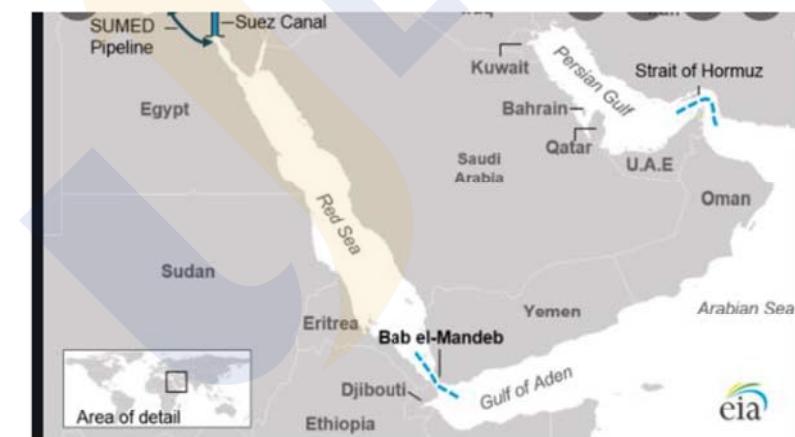
Know More:



## Know More



## Revise With me



Home Work:

**Capitals of West Asia**

**Capitals of Central Asia**

**North to South Location**

2017: Closest to Nicobar

**Which of the following is geographically closest to Great Nicobar ?**

- (a) Sumatra
- (b) Borneo
- (c) Java
- (d) Sri Lanka

What is the question asking: West to east Islands of



So ja Bali Lombadi Aane Wali Hai

2018: Question

Which of the following has/have shrunk immensely/dried up the recent past due to human activities?

1. Aral Sea
2. Black Sea
3. Lake Baikal

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 and 3
- (c) 2 only
- (d) 1 and 3

Answer: A

- Aral Sea used to be the fourth largest lake in the world, after the Caspian Sea, and Lakes Superior and Victoria. Now barely 10% of it is left. BBC-2014. This eliminates B and C, because they don't contain #1.
- So, it all boils down to whether Lake Baikal has shrunk immensely or not?
- Baikal **might** share the destiny of the Aral Sea in future. 'Construction of three hydro power stations on the Selenga River and its tributaries **can cause** the unique lake to dry out.'
- Lake Baikal's had issues like disappearance of the omul fish, rapid growth of putrid algae and the death of endemic species of sponges but there is no mention of immensely drying up.

## 2018: Countries and Places

Consider the following pairs:

Towns in news	Country
1. Aleppo	Syria
2. Kirkuk	Yemen
3. Mosul	Palestine
4. Mazar-i-sharif	Afghanistan

Which of the following pairs given above are correctly matched?

1 and 2 only

**1 and 4 only**

2 and 3 only

3 and 4 only

Ans: B





## 2018: Map

Consider the following pairs:

Regions in news - Country

1. Catalonia - Spain
2. Crimea- Hungary
3. Mindanao- Philippines
4. Oromia- Nigeria

Which of the pair given above are correctly matched?

- (a) 1, 2 and 3
- (b) 3 and 4 only
- (c) 1 and 3 only
- (d) 2 and 4 only

Answer: c

Catalonia Issue:

The 2017–2018 Spanish constitutional crisis, also known as the Catalan crisis, was a political conflict between the Government of Spain and the government of the autonomous community of Catalonia until 28 October 2017—over the issue of Catalan independence

## Crimea



## Oromia: Ethiopia



2019

Consider the following pairs: Sea Bordering country

1. Adriatic Sea : Albania
  2. Black Sea : Croatia
  3. Caspian Sea : Kazakhstan
  4. Mediterranean Sea : Morocco
  5. Red Sea : Syria
- Which of the pairs given above are correctly matched?
- (a) 1, 2 and 4 only  
(b) 1, 3 and 4 only  
(c) 2 and 5 only  
(d) 1, 2, 3, 4 and 5

## Mnemonics

REMEMBER COUNTRIES SURROUNDING BLACK SEA

BURGR-T



**B → BULGARIA**

**U → UKRAINE**

**R → RUSSIA**

**G → GEORGIA**

**R → ROMANIA**

**T → TURKEY**

Not Tajik..

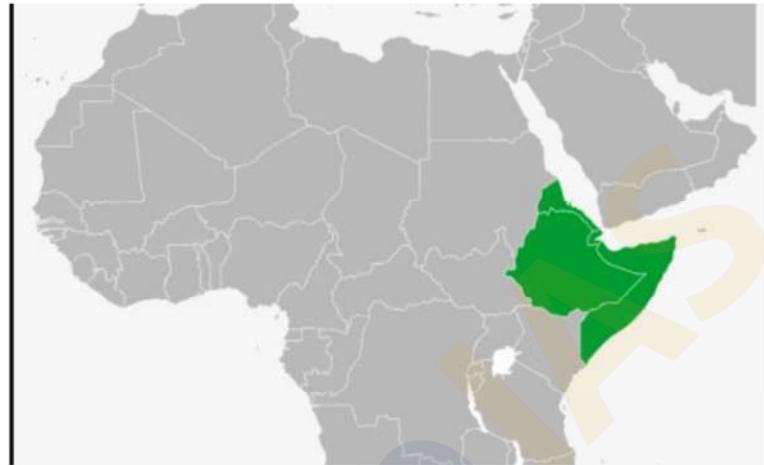


REMEMBER COUNTRIES AROUND CASPIAN SEA

- T —> Turkmenistan
- A —> Azerbaijan
- R —> Russia
- I —> Iran
- K —> Kazakhstan

## REMEMBER HORN OF AFRICA COUNTRIES

- S → Somalia
- E → Ethiopia
- E → Eritrea
- D → Djibouti



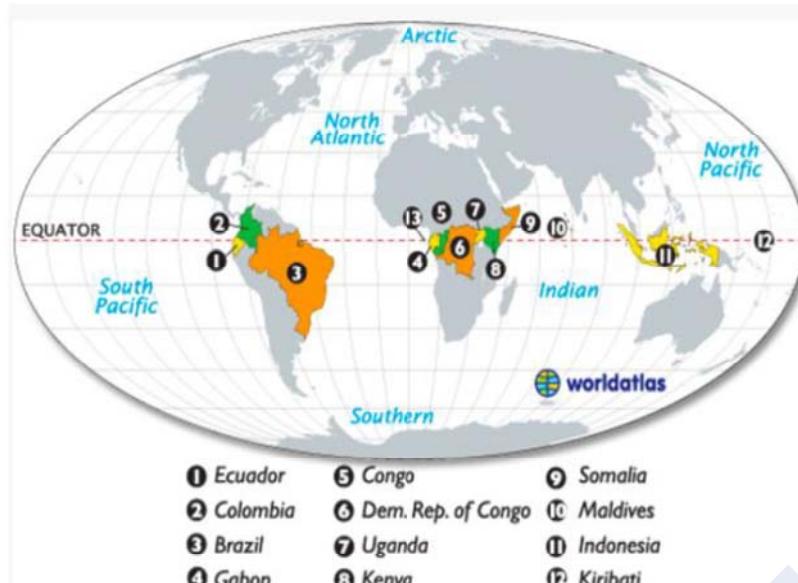
## REMEMBER COUNTRIES SURROUNDING RED SEA

- D → Djibouti
- E → Eritrea
- S → Sudan
- S → Saudi Arabia
- E → Egypt
- Y → Yemen

NOT SOMALIA



## Equator Passes through which countries



1. South America: ECB
2. Africa-Near: GS-DUCKS
3. South East Asia- Near: KIM

REMEMBER COUNTRIES SURROUNDING SOUTH CHINA SEA

### VIMPS-BCT

- V → Vietnam
- I → Indonesia
- M → Malasia
- P → Phillipines
- S → Singapore
- B → Brunei
- C → China
- T → Taiwan

China, Republic of China (Taiwan), the Philippines, Malaysia, Brunei, Indonesia, Singapore, and Vietnam.



S → SINGAPORE  
V → VIETNAM  
I → INDONESIA  
M → MALASIA  
P → PHILIPPINES  
B → BRUNEI  
C → CHINA  
T → TAIWAN

REMEMBER AFRICAN COUNTRIES SURROUNDING MEDITERRANEAN SEA

- M → Morocco
- E → Egypt
- T → Tunisia
- A → Algeria
- L → Libya

## REMEMBER ASIAN COUNTRIES SURROUNDING MEDITERRANEAN SEA

- C → Cyprus
- L → Lebanon
- I → Israel
- S → Syria
- T → Turkey

2020

. Consider the following pairs:

Rivers	Flows into
1. Mekong	Andaman Sea
2. Thames	Irish Sea
3. Volga	Caspian Sea
4. Zambezi	Indian Ocean

Which of the pairs given above is/are correctly matched?

- (a) 1 and 2 only
- (b) 3 only
- (c) 3 and 4 only
- (d) 1, 2 and 4 only

## Important Information

Answer: C

- Thames: North Sea
- Mekong Drain in South China Sea
- The Irrawaddy River and its tributaries flow into the Andaman Sea through the Irrawaddy Delta.
- Indian Ocean: Limpopo, Zambezi
- Volga rises in the Valdai Hills northwest of Moscow, the Volga discharges into **the Caspian Sea**
- Zambezi River: The Zambezi River is the fourth-longest river in Africa, the longest east-flowing river in Africa and the largest flowing into the Indian Ocean from Africa. Its drainage basin covers 1,390,000 square kilometres, slightly less than half of the Nile's

2022

Consider the following pairs:

Region often mentioned in the news: Country

- |                 |          |
|-----------------|----------|
| 1. Anatolia     | Turkey   |
| 2. Amhara       | Ethiopia |
| 3. Cabo Delgado | Spain    |
| 4. Catalonia    | Italy    |

How many pairs given above are correctly matched?

- a) Only one pair
- (b) Only two pairs
- (c) Only three pairs
- (d) All four pairs

Africa: 4-5 regions in News

- Okovango
- Lake Chad
- Darfur: Sudan
- Oromia: Ethiopia: Tigrae Population
- Europe: Bavaria Region
- Saxon: Germany, Poland
- Gallic Region: Scotland
- Chechenya: Russia
- Transvalania: Romania
- Taiwan: Fukien Taiwanese are ethnic Group
- Estonia, Latvia, Lithuania: Countries around Baltic Sea

- Anatolia: Turkey
- Catalonia is Spain.
- Amhara: Ethnic groups in Ethiopia
- Cabo Delgado: Mozambique, Cabo is Portuguese word and it means Cape.
- Cabo da Rama in Goa: Cape of Rama,

Know other region:

- Canada: Nunavut: Arctic melting
- Cao Roque: Droughts Delta: Extreme poverty
- Amazonia:
- Iraq: Khurd
- Armenia: Naxcivan: Azerbaijan ka autonomous region

2022

Which one of the lakes of West Africa has become dry and turned into a desert?

1. Lake Victoria
2. Lake Faguibine
3. Lake Oguta
4. Lake Volta

Answer: Lake Faguibine

- Lake Victoria is in news
- Lake Volta. Akosombo Dam – also known as the Volta Dam – is on the Volta River in south east Ghana. Lake volta is artificial Lake
- Lake Kainji: Dam on River Niger, 4 major dam: Jubba, Shiroro, Kandadji
- Lake on Congo: Stanley Falls, Congo, former name for the Boyoma Falls
- Lake on Zambezi: Stanley
- Lake Nasser: Egypt and Also Aswan dam
- Vaal River, northern tributary of the Orange River, South Africa

Lake around Desert:

- Great Bear, Great Slave, Athabasca: Canada
- Salt Lake: USA
- Poppo, Titicaca: South America
- Panatal: Largest Wetland
- Nyasa, Tanganyiga, Turkana (Rudolf), Lake Asal(Djibouti),
- Lake Van: Turkey
- Lake Urumia: Iran
- Dead Sea: Jordan, Israel
- Lake Chad:
- Lake Baikal:
- Lake Ton Le sab: Cambodia
- Lake Ladoga is a freshwater lake located in the Republic of Karelia and Leningrad Oblast in northwestern Russia, in the vicinity of Saint Petersburg. It is the largest lake located entirely in Europe, the second largest lake after Baikal in Russia
- Lake Taupo: Crater Lake

2022

The term "Levant" often heard in the news roughly corresponds to which of the following regions?

- (a) Region along the eastern Mediterranean shores
- (b) Region along North African shores stretching from Egypt to Morocco
- (c) Region along Persian Gulf and Horn of Africa
- (d) The entire coastal Mediterranean Sea of areas

Answer: East Mediterranean

It is borrowed from the French levant 'rising', referring to the rising of the sun in the east or the point where the sun rises. Beirut is part of East. It is part of green Crescent. Levant includes

Know about:

1. Scandinavia
2. Balkan
3. Caucasus

Answer: Elimination of option 1.

- Know the border along Ukraine and Black Sea, Israel, North Korea and
- The **Syngman Rhee Line** (was a marine boundary line established by South Korean President Syngman Rhee in his "**Peace Line**" declaration of January 18, 1952, establishing a wide area of maritime sovereignty, beyond internationally accepted territorial waters, around the entire Korean Peninsula)