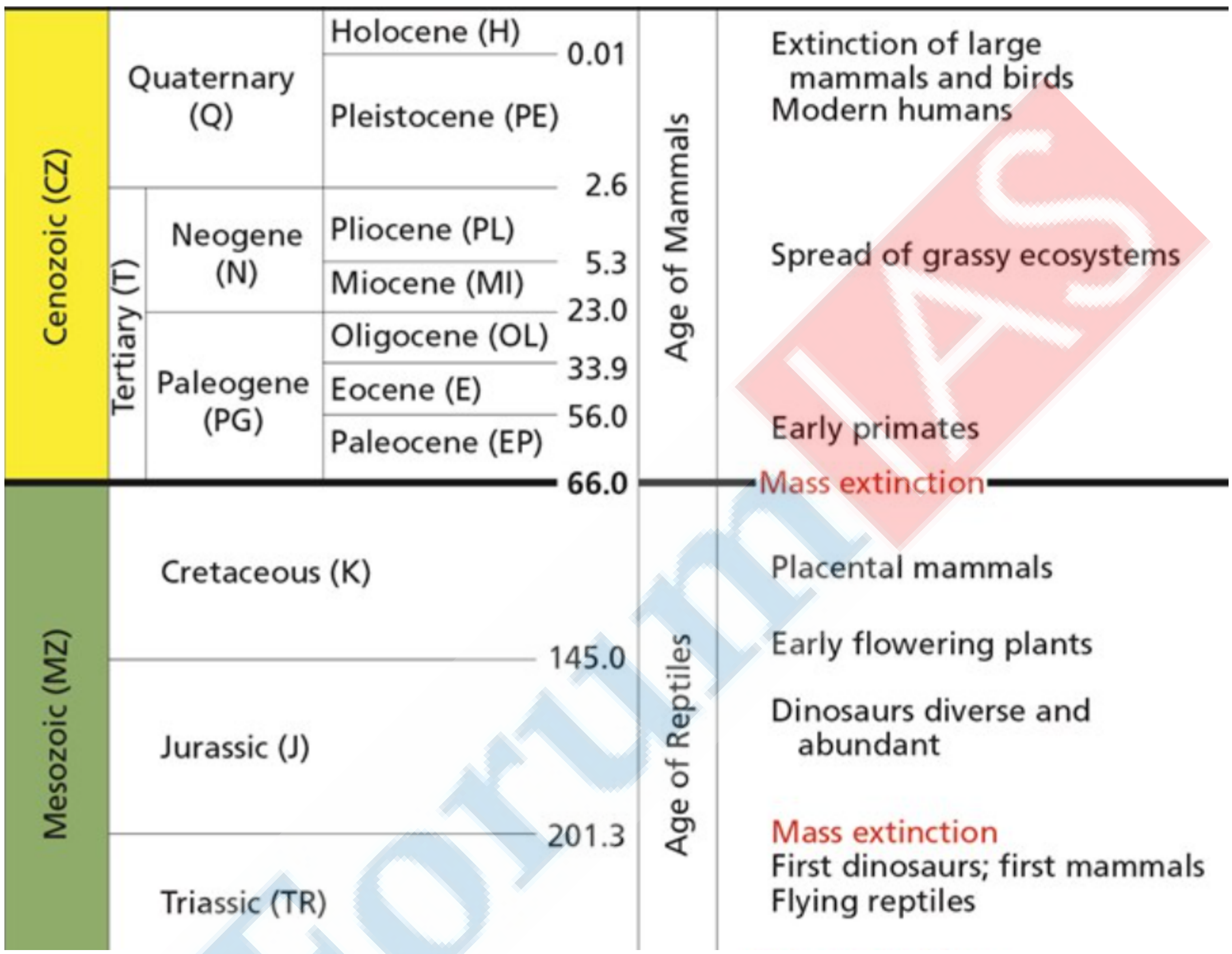
PRRC 2023

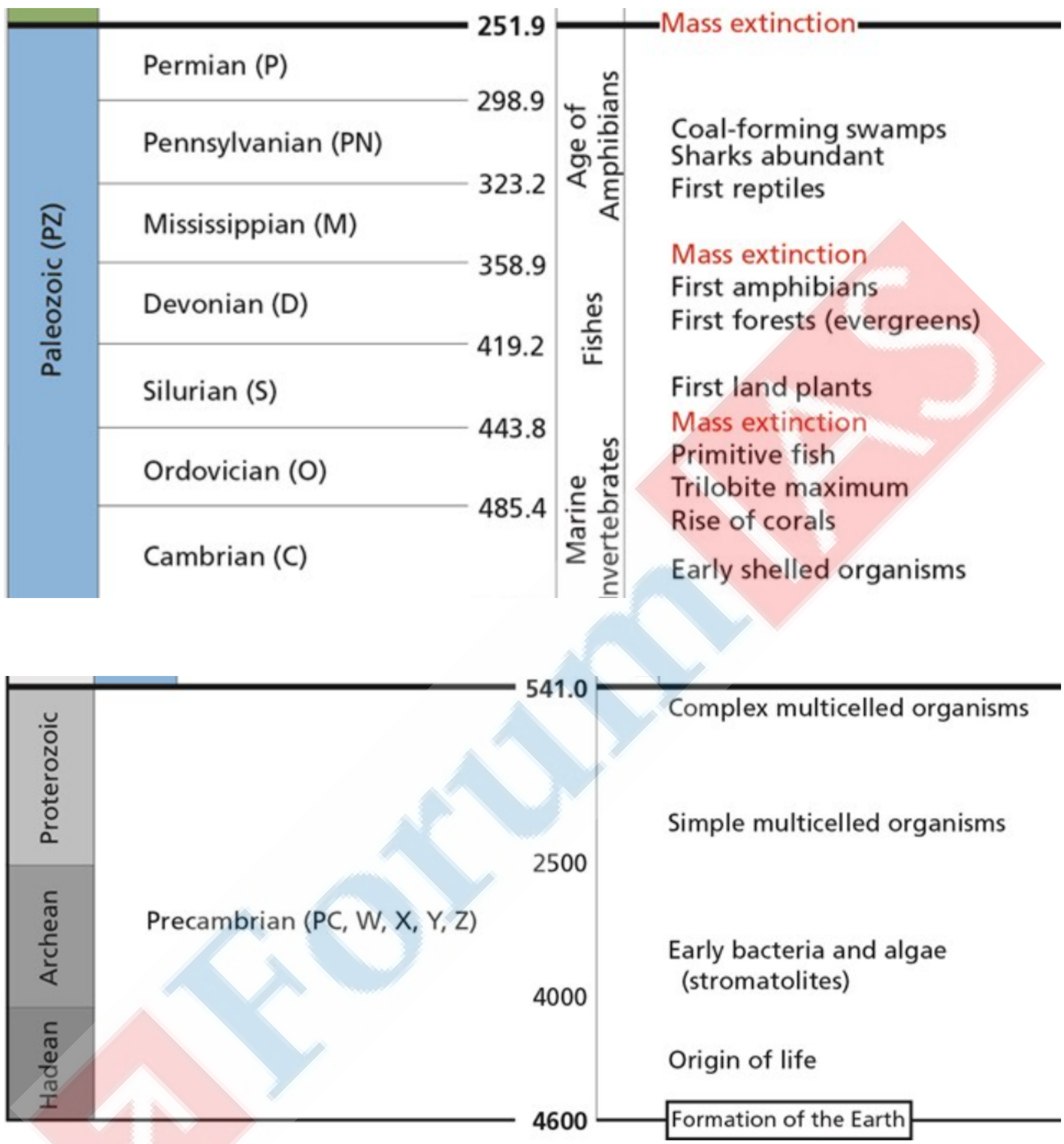
Geography
(Class Handouts)

ForumIAS

Geography Prelims special

Geological History of Earth





Precambrian -

- **Origin of life in Water**
- Rivers and seas formation
- Formation of Crust
- Oldest fold mountains - Aravallies

Palaeozoic

1. Cambrian - no life on continents

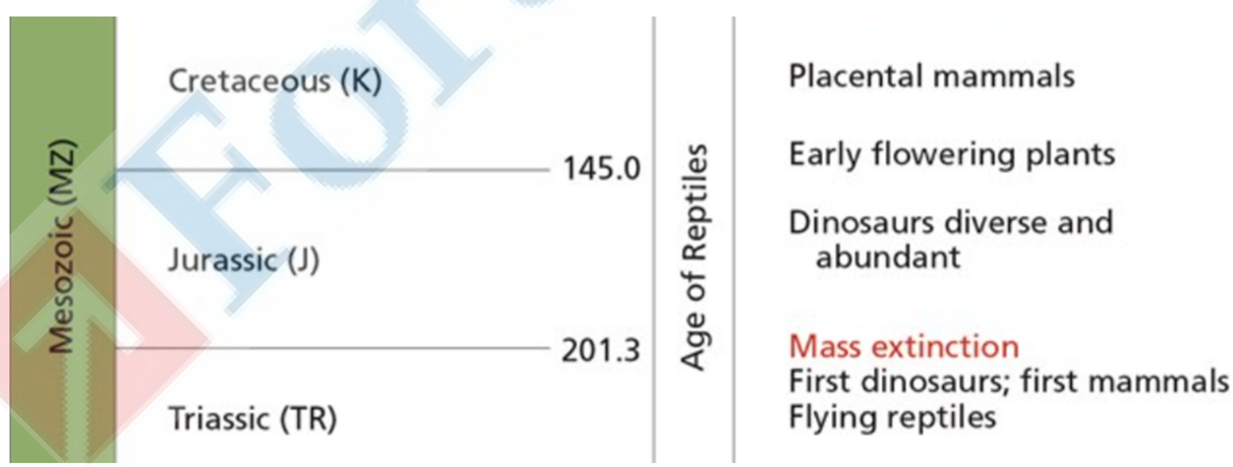
- Era of marine Invertebrates
- Sea grasses
- No Land animals

2. Ordovician
    a. vegetation and Animals - Water
3. Silurian
    a. **Leafless plants** on Land
4. Devonian
    a. Age of fishes
    b. Amphibians - later phase
5. **Carboniferous**
    a. Coal formation
    b. Small and shallow seas
    c. Most parts of Europe and Russia - under water

    Note : Indian Coal - Gondwana

6. Permian
    a. Deciduous trees evolved

Mesozoic



Cretaceous -

- Extinction of Dinosaurs
- Volcanic Activities -
    - formation of Lava plateaus

- deccan , Colombia snake plt. Etc
- Mountain building started

Cenozoic Era

1. Quaternary - modern man
2. Tertiary - fold mountains

Cenozoic (CZ)	Quaternary (Q)		Holocene (H)	0.01	Age of Mammals	Extinction of large mammals and birds Modern humans
			Pleistocene (PE)	2.6		
	Tertiary (T)	Neogene (N)	Pliocene (PL)	5.3		Spread of grassy ecosystems
			Miocene (MI)	23.0		
		Paleogene (PG)	Oligocene (OL)	33.9		
			Eocene (E)	56.0		
			Paleocene (EP)			Early primates

Continental Drift theory - Alfred Wegenar - 1912

- Displacement Hypothesis
- Explaining major Climate variations in Past

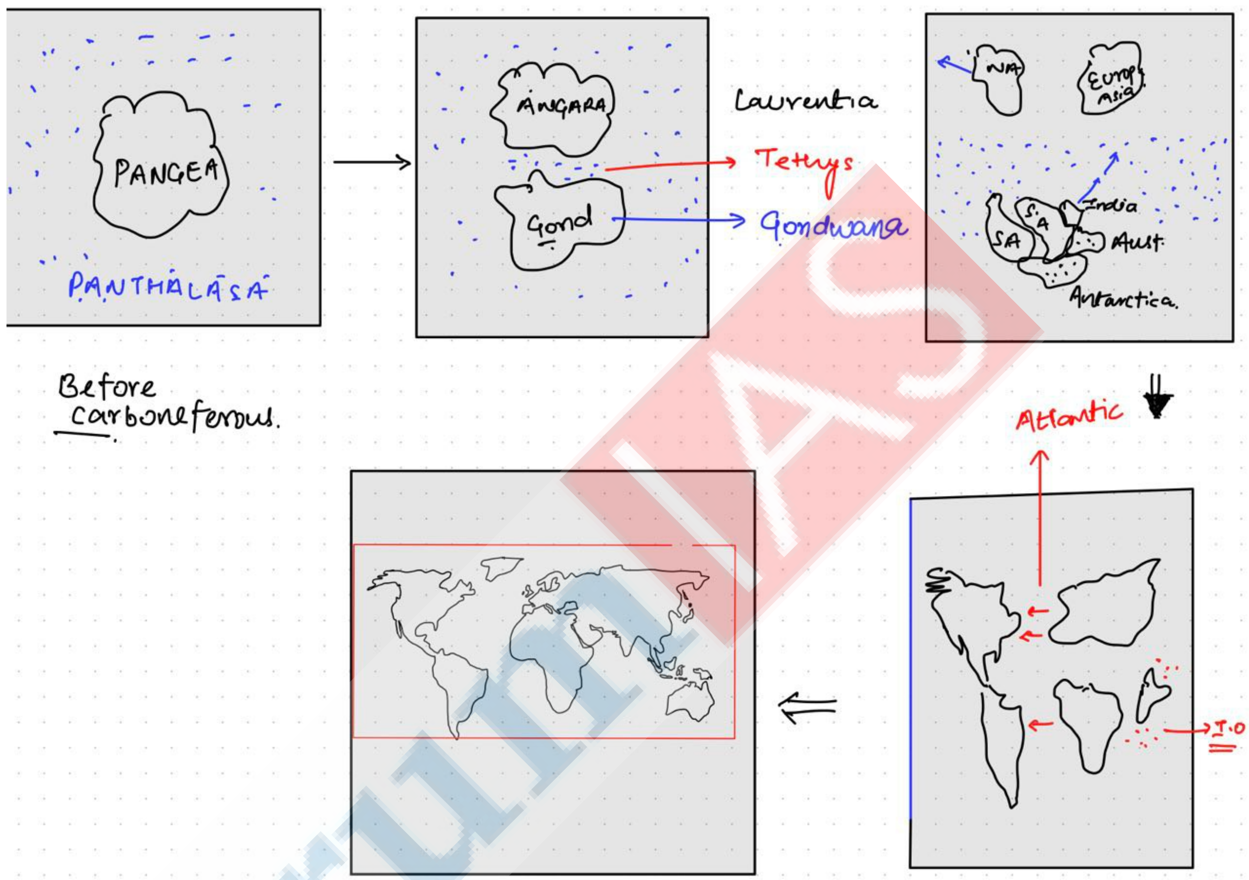
Assumptions

1. SIAL floating over SIMA
2. Forces -
   - Tidal pull of Sun and Moon
   - Force of Buoyancy
   - Gravitational force

Theory -

Before carboniferous -
Pangea intact landmass

Panthalassa - SuperOcean



1. North and South America - North and westward movement - Opening of Atlantic
2. Africa and India Moved North - opening of Indian ocean
3. Arc and festoons - left over parts of Continents
4. Original Panthalassa - Pacific sea
5. Mountains - At continental margins - As plates were moving with friction and hence, sediments were uplifted. Eg - Rockies

Evidences -

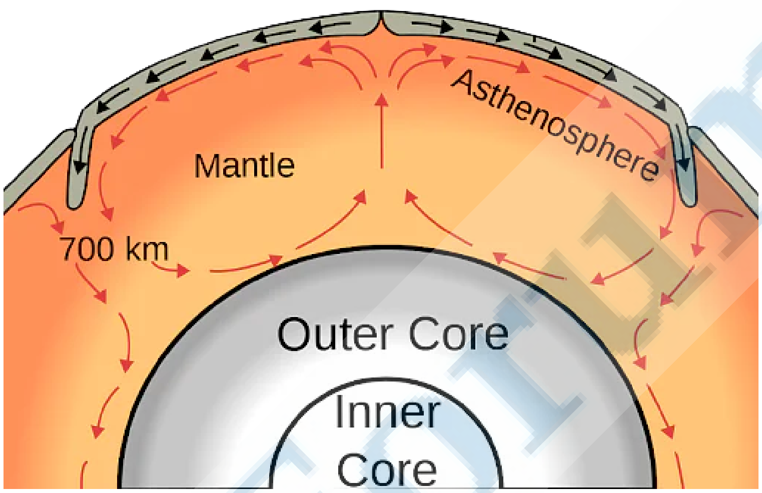
1. Jigsaw fit continents
2. Age and formation of ages of Rocks across Atlantic Ocean - Applacians, Ireland and Scandinavia
3. Gold deposits of Ghana
4. Behavior of animals - lemmings of Scandinavia
5. Fossils of Glossopteris flora
6. Glacial evidences

Criticisms -

1. Forces - Unscientific
2. Why drifting started in Carboniferous ?
3. Errors in theory - formation of mountains and Islands

Convectional current theory - Arthur Holms 1930s

- Solved the question - why plates move
- Convection - convection current - molten material and high temperature



Interior of earth

1. Older view - SIAL over SIMA
2. Recent View

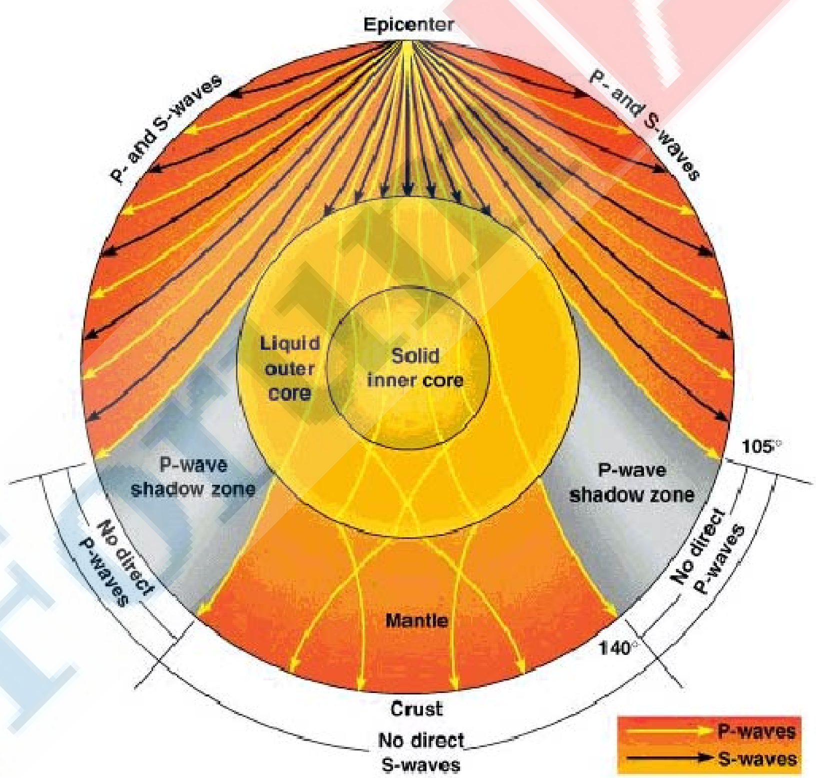
Sources -

1. **Direct**
   a. MINING
   b. Study of Magma
2. **Indirect**
   a. Meteors
   b. Study of temperature and Pressure
   c. Gravity

d. Magnetic Survey
e. Seismology
f. Density
g. Pressure

Seismic waves

1. **Body waves** (inside body)
    a. Primary
    b. Secondary
2. **Surface Waves/ long period waves**
    a. L waves (die out at smaller depth)



P waves

- Primary , fastest and First to occur
- Analogous to sound waves
- Compression and refraction or **<u>To and fro motio</u>**n
- Can pass - through Solids and liquids

S- waves

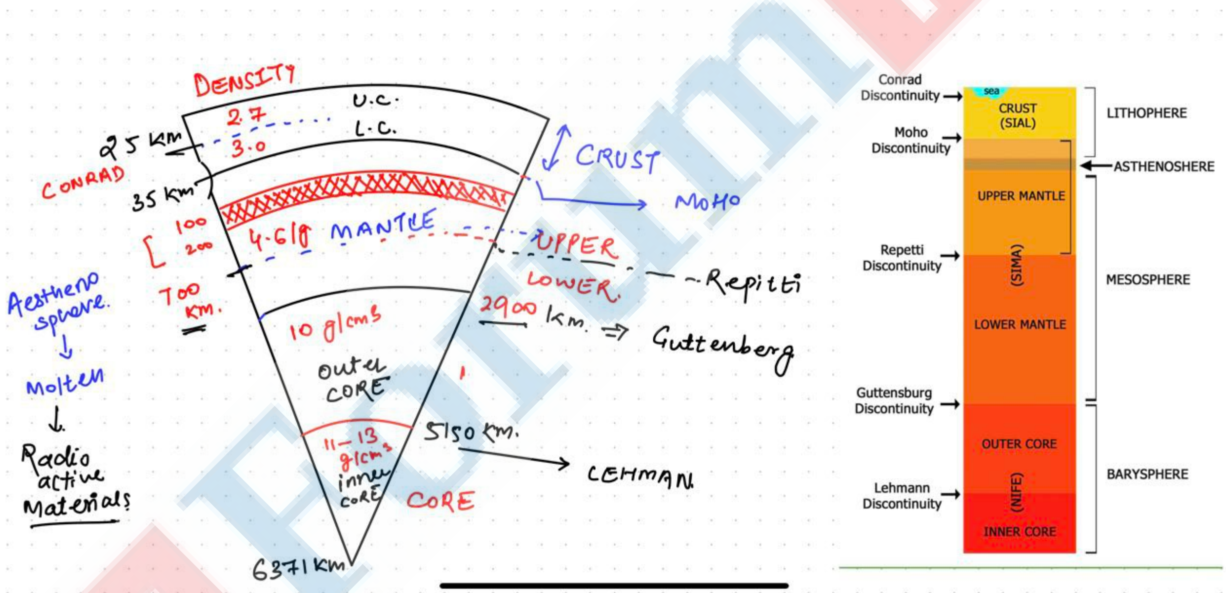
- Half speed of P waves
- Movement - transverse or distortional (perpendicular to wave propagation)
- **<u>Pass through Solids only</u>**
- **<u>Light wave or water ripple</u>**

<u>Surface wave</u>

- Covers longest distance
- Most violent and destructive one

Wave propagates-

- Curves - density of medium varies
- Change in direction - medium changes
- Sudden bends - discontinuity



Crust -

- Uppermost
- Continents - SIAL - Granitic and lighter , Avg thickness - 35KM
- Oceanic - thinner, dense and Basaltic rocks, SIMA , 5 Km

Mantle -

- Crust + Upper mantle = Lithosphere
- Asthenosphere = 100 - 200KM

Lower mantle - Dense and solid

Mantle Plume -

- Hot nucleated rock at mantle Core boundary and Driven Upwards by Convection currents
- When reaches to shallow depth at Crust - Melts
- Sources **of Volcanic activities**
- **Theory first proposed by - Wilson in 1663**
- **Developed by J. Morgan 1971**

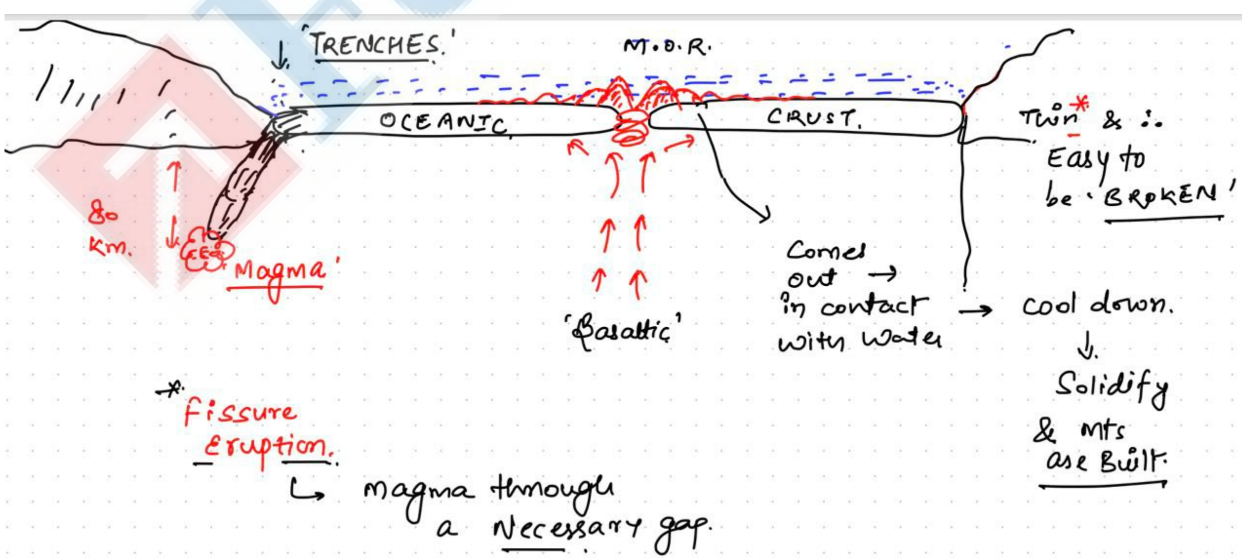
Core

Denser NIFE layer

Volume and mass - 16 and 32%

1. **Outer Core -**
    a. liquid (temp >> pressure)
    b. Charge particles - Rotation → magnetic properties
2. **Inner Core**
    a. Solid
    b. Densest (dominated by Iron)
    c. Speed

Sea floor Spread - Harry Hess



Evidences -

1. PAcific reduction and MORs
2. Iceland - Volcanic origin
3. Age of oceanic crust - 100 to 150 mya
4. Equidistant rocks of same age

Plate tectonic Theory -

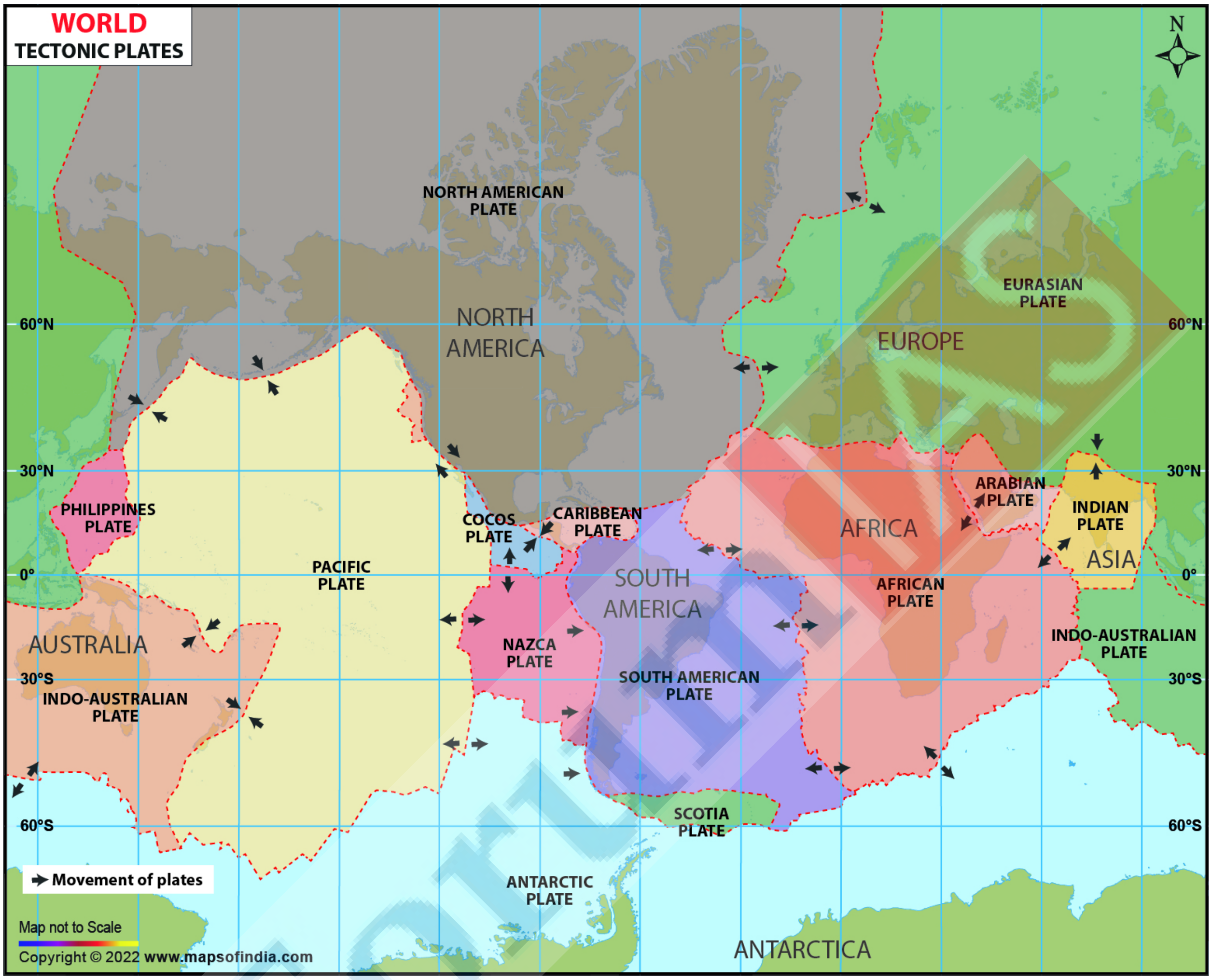
Based on -

- CDT and Sea floor Spreading

Plate Movement, effects and Outcome - **Plate Tectonic**

Term plate - by J Wilson -1965
Mckenzie and Parker - Mechanism of Plate Motion
Morgan - 1968 - Elaborated plate tectonics

Plates



Major plates

1. North American
2. S. American
3. Pacific - largest and Oceanic
4. African
5. Eurasian
6. Indo- australian

Minor -

- Nasca
- Juan-De-Fuca
- Cocos

- Arabian
- Philippines
- Burmese plate

Plate Margins -

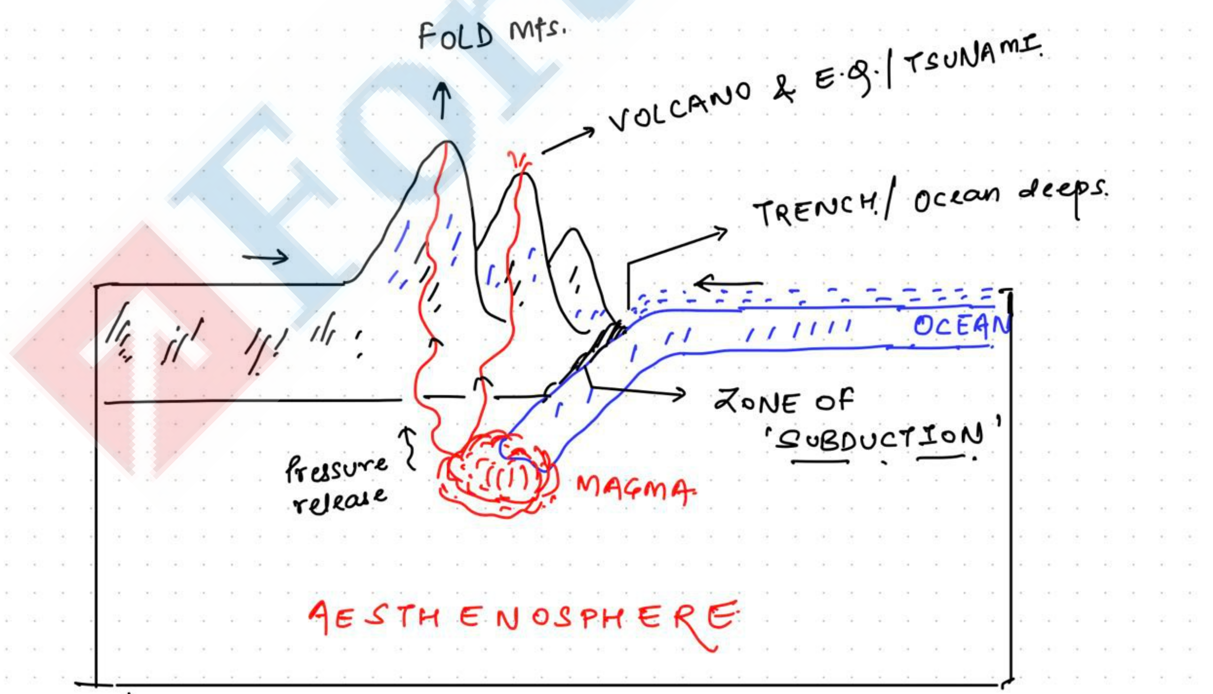
1. **Convergent / destructive**
- O-C
- C-C
- O-O
2. **Divergent** / Constructive
3. **Transform /** Conservative

Convergence -

A. Oceanic - Continental

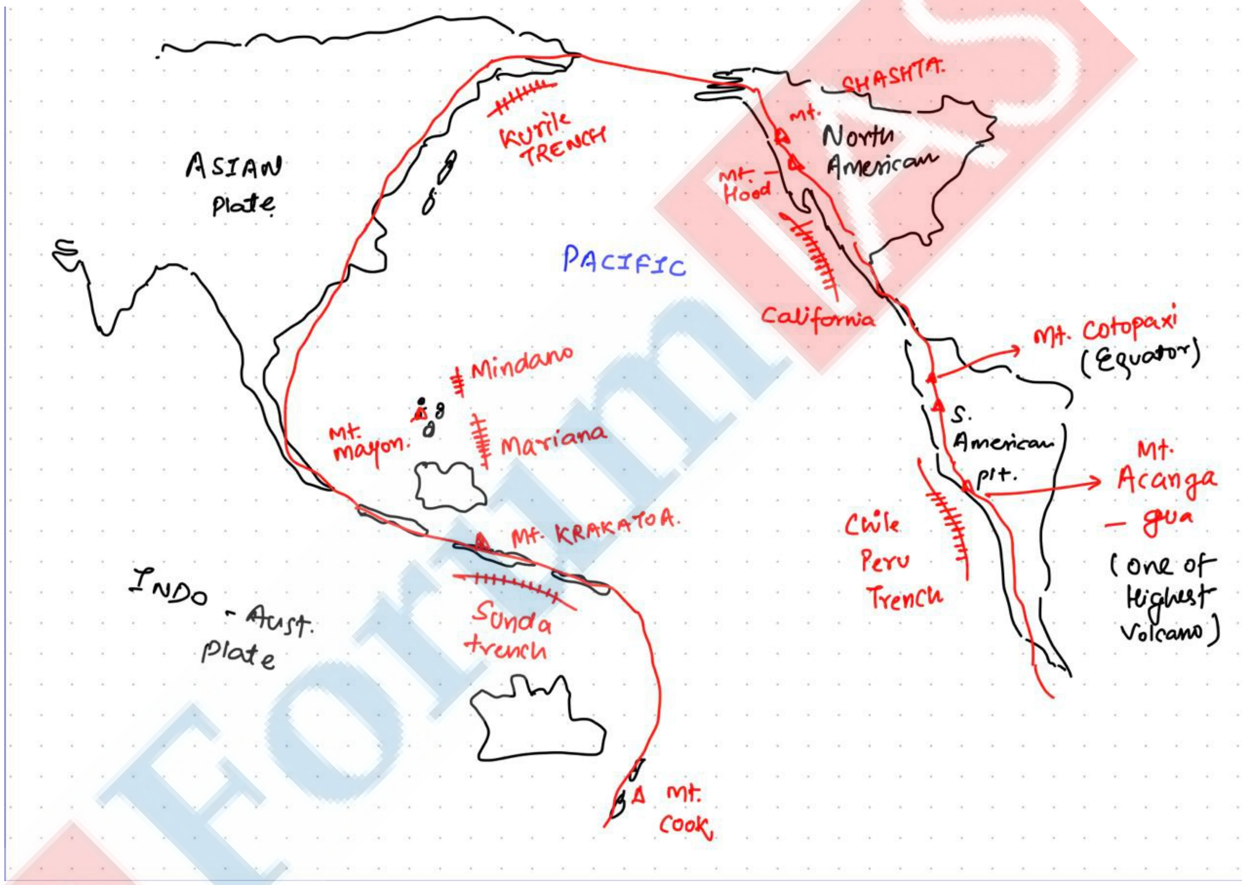
a. Most common

b. Fold mts., EQs, Volcanoes & Trenches



Eg -

1. Rockies - Juan + Pacific || N. american
2. Andese - Nasca || S. American
3. Alps - Asian and African
4. Circum Pacific Ring of Fire



5. Mid continental belt - Alps formation

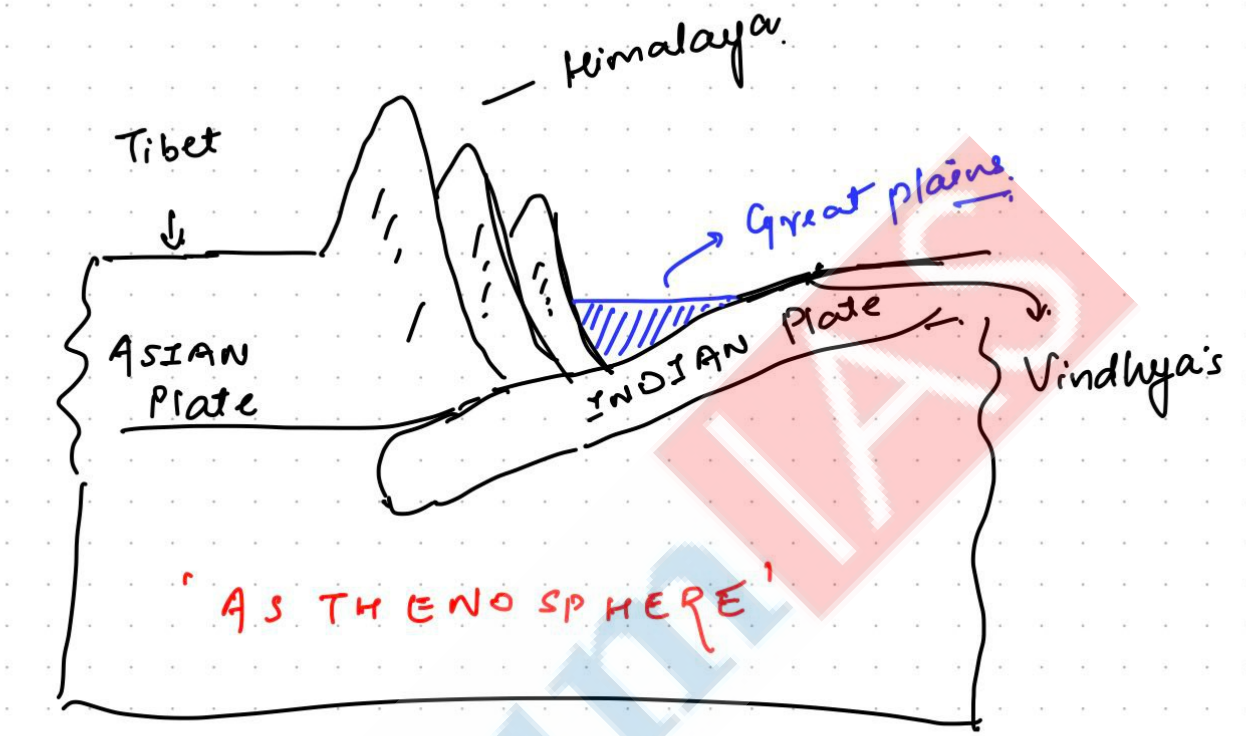
B. **Continents -Continent (C-C)**

Eg - Himalayas formation

Indian plate is slightly denser

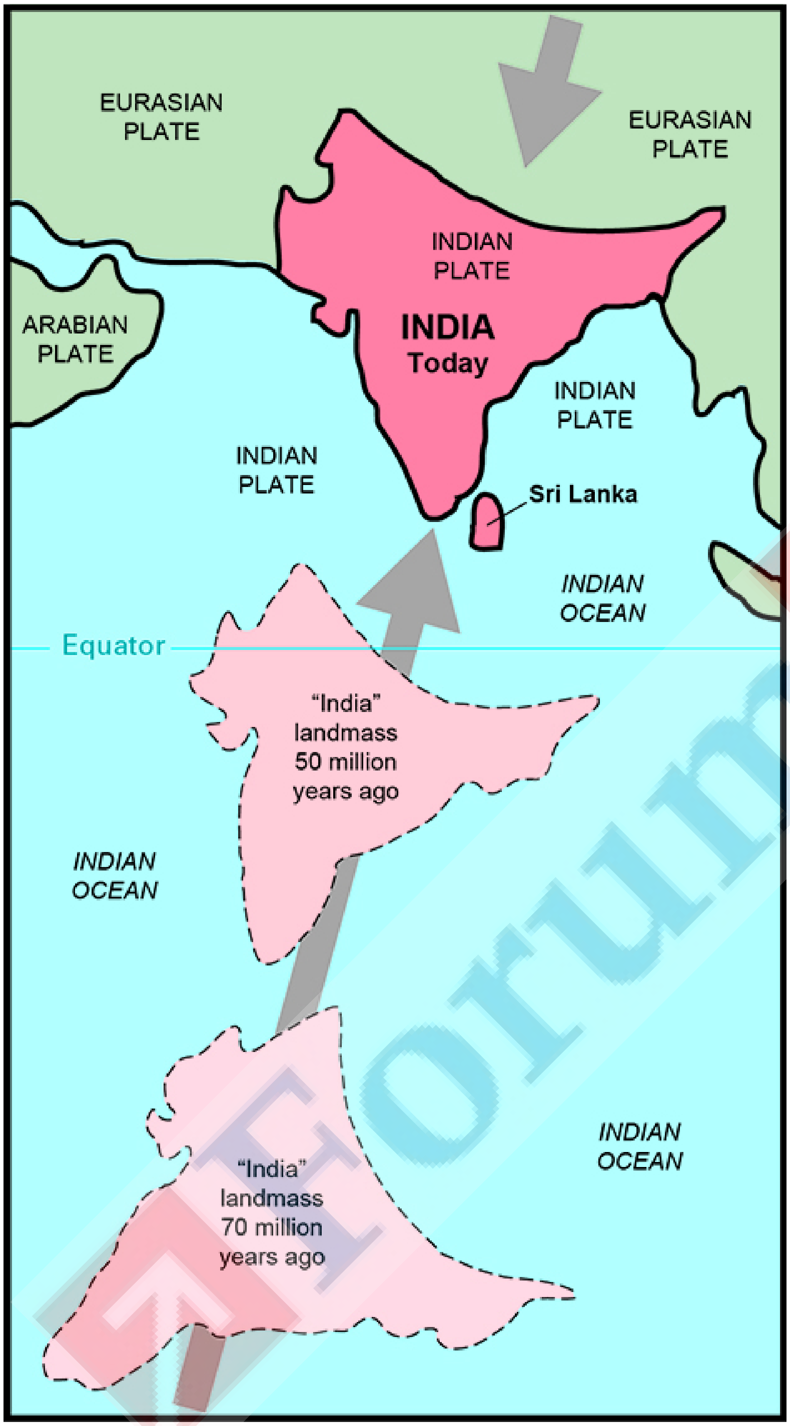
- Moving faster and has oceanic Component

- Doubling of Crust



Features -
- Earthquakes
- High Mountains
- Volcanoes X

Himalayas Formation



Features -

- Syntaxial bends - 2 pushes
- Steeper southern side
- Arc shape

- Marine Fossils

Question -

Arrange oldest to Youngest

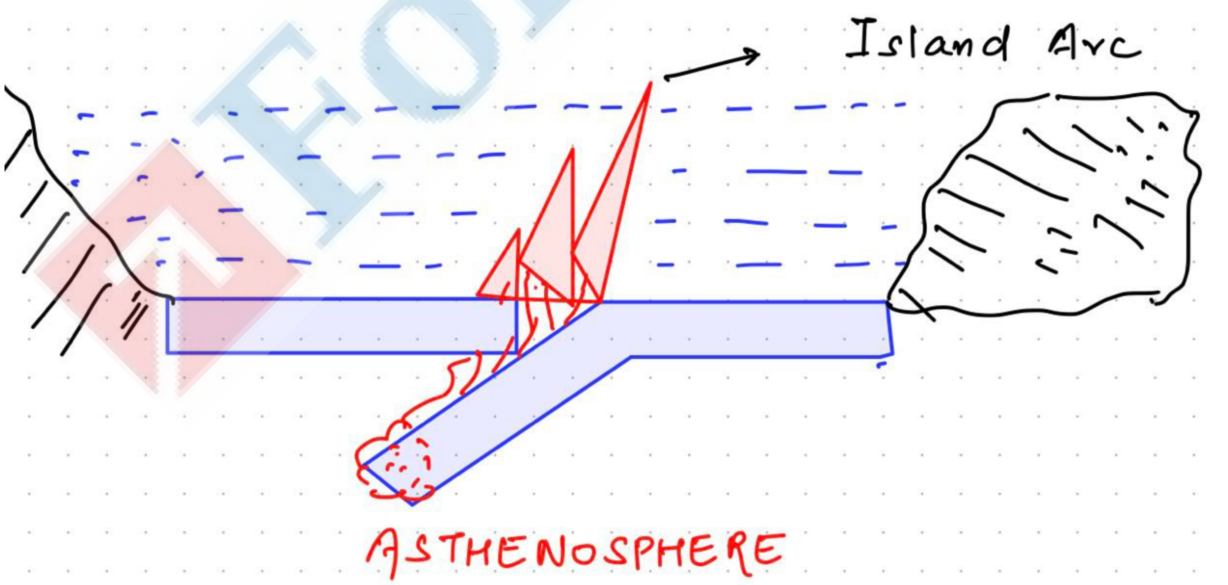
- Aravallies
- Deccan plateau
- Trans- himalayas
- Himalayas
- Plains

Evidences -

- Himalayas still rising
- Marine sediments and Fossils
    - Sea buckthorn
- Petroleum reserves
- Saline lakes at tibet plt.

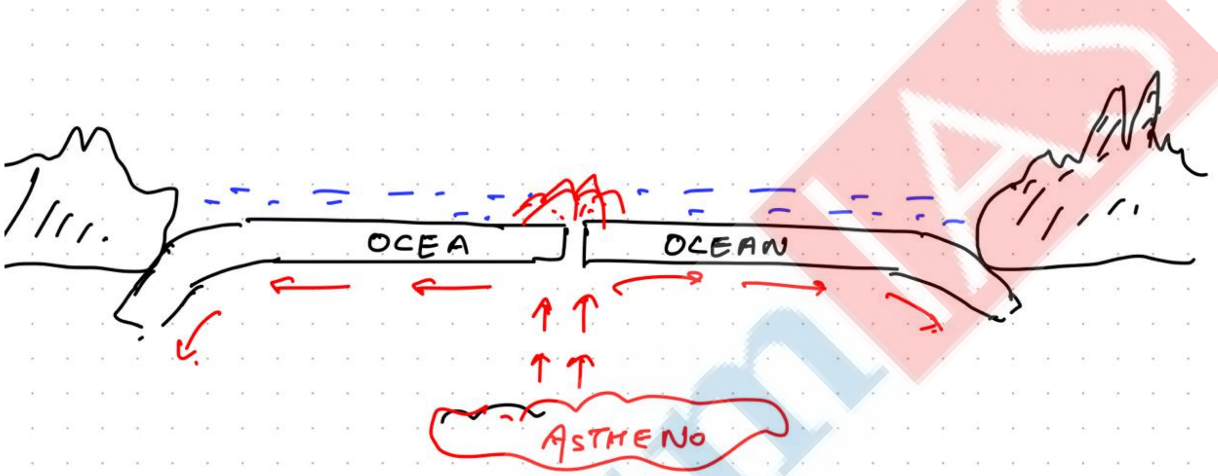
C. Ocean -Ocean Convergence -

Formation of islands and festoons



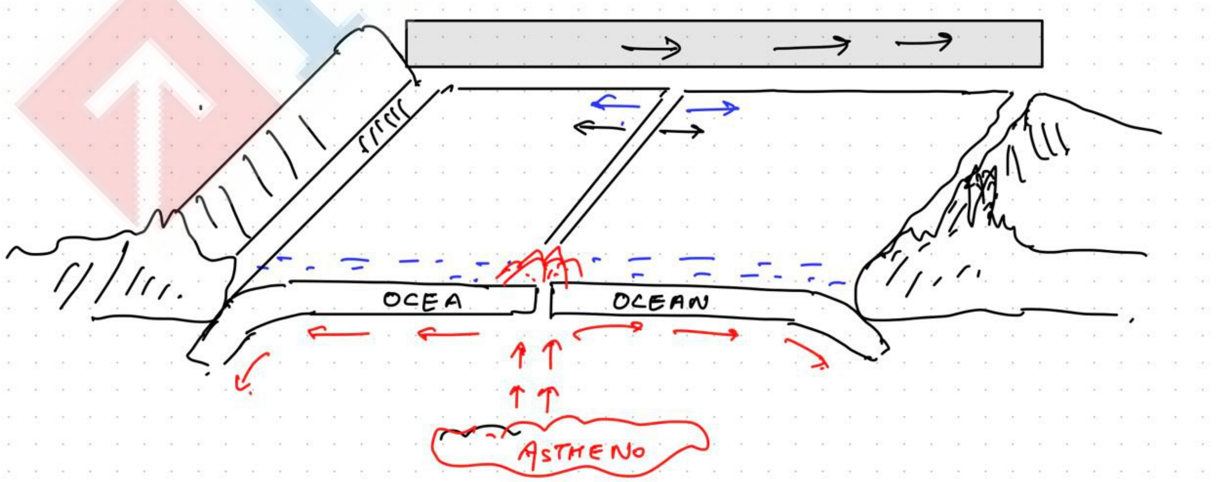
Eg.
Caribbean islands - n.america and caribbean plate
Japan islands - Asian+ Philippine || pacific

2. Divergent boundary



Features -
- MORs
- Fissures earthquakes
- Rift valleys etc

3. Transform/ conservative /Shear plate margin



Features -

- Powerful EQs
- Faults and Rift Valleys -

Eg San andreas Fault

Volcano and Volcanism

Volcano - vent
Volcanism - Process

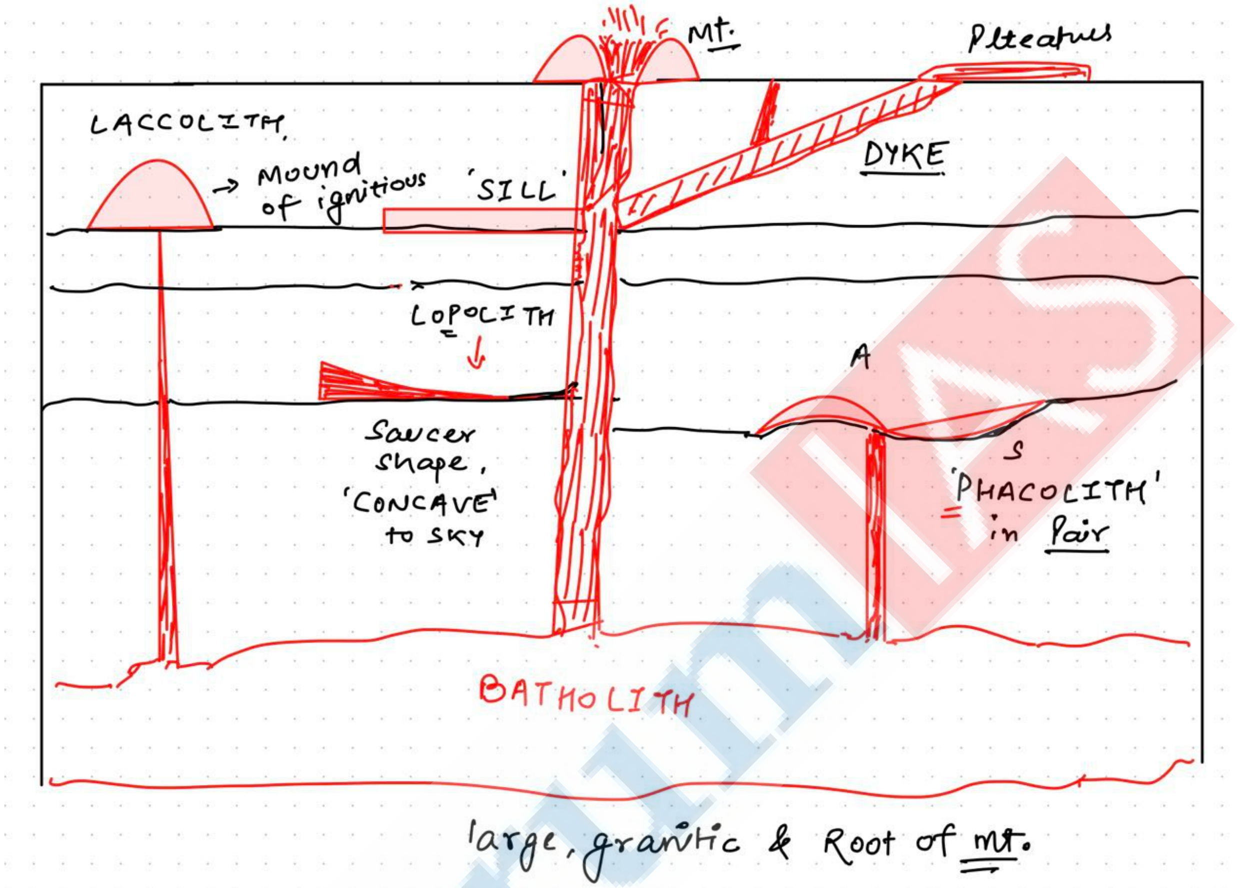
Volcano - magma + gasses and Water Vapor + Pyroclastic materials

Magma -

1. **Acidic**
    a. High Si and less Iron
    b. Viscous
    c. Violent eruptions - mts formation
       Granitic and lighter
2. **Basic**

Volcanic landforms

1. **Intrusive**



2. **Extrusive -**
   a. Cones
   b. Craters
   c. Volcanic plt. And plains
   d. Hot Springs and Geysers

Cones

1. Cinder cones
2. Composite or Strato - highest
   a. Eg - Shasta, Rainier, Mt hood, Aconcagua and Cotopaxi
3. Parasitic Cones
4. Shield Cones - Basic lava

Craters -
Vent or opening
Caldera - big Opening

Volcanic plt. -
- Basaltic
- Deccan plt

Hot springs and Geysers

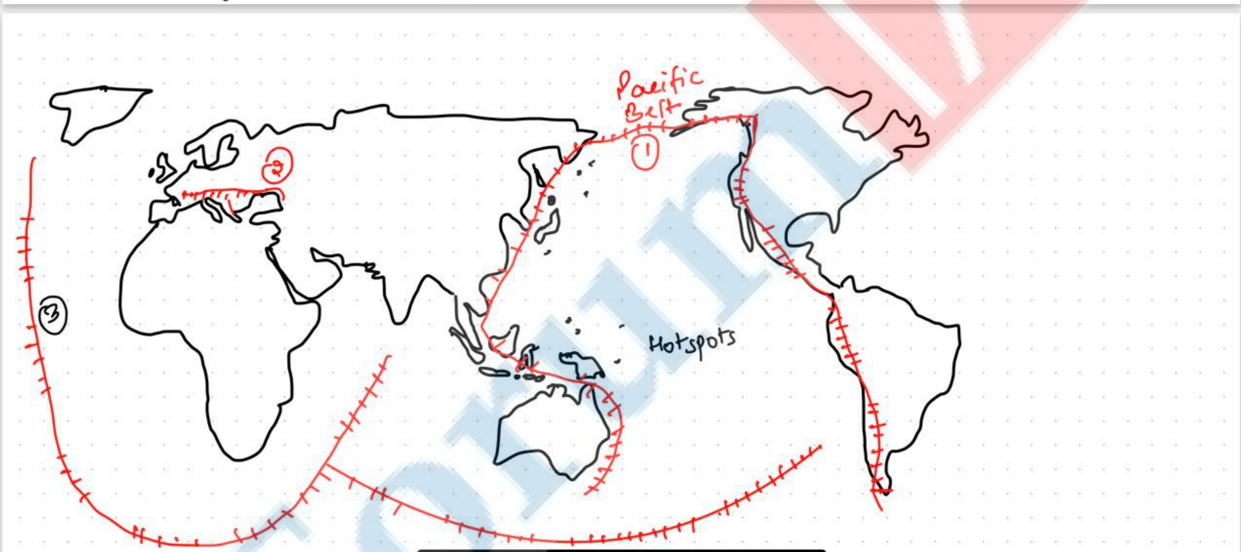
Hot Springs - water coming out

Geysers - forceful than Hot springs
Eg - old faithful geyser

Fumaroles - Superheated Steam coming out

World distribution of Volcanoes

1. Pacific Ring
   - 60% of Volcanoes
   - "CONVERGENCE"
2. Mid continent Belt.
   - 20%
   - CONVERGENCE
   - Except – Himalaya
3. M.O.R.
   - 15%
   - Divergent, fissure type
4. Hotspots
   - Volcanoes → deep inside the plate
   - 5% of world's volcanoes
   - Regions of
     - Thin crust
     - High tempr of magma
   - Hawain
   - Reunion etc.



Rocks. — Aggregation of minerals.

Igneous (Primary)

Solidification & cooling of magma

- 'Hypa Basal' (Fast cooling) — Eg. gabbro
- 'Plutonic' (slow) — Eg - Granite

Acidic → 'Si' content ↑

Basic → Mafic - Gabbro
'Si' ↓

Igneous –
No fossil
Hardy rocks.

Sedimentary

S → C → C

'Lithification'

↓ Based on origin.

- **Mechanical** — Eg. Sand, Clay, SHALE, Loess
- **Chemical** — ↓ NaCl
- **Organic** — ↓ coal & Petrol
  - Limestone

Sedimentary Rocks

- Layered
- fossils, food production
- Permeable → ground water.

Metamorphic

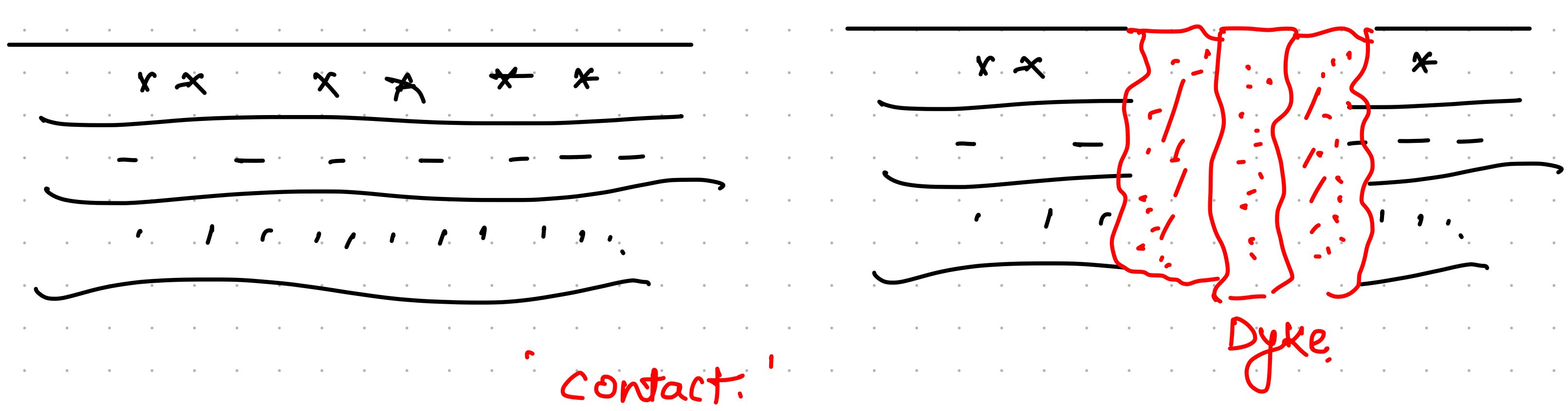
change in form without disintegration.

Metamorphic Rocks. → Change in form or composition w/o disintegration.

Eg - Dharwar rocks.

- **Agents**
  - Temp.
  - Pressure / Dynamic
  - Hydro
  - Hydro / thermal
- **Area**
  - ✓ Contact (Local)
  - ✓ Regional (Wide ↑)
- **Composite**
  - Contact - Thermal
  - Regional - Dynamic

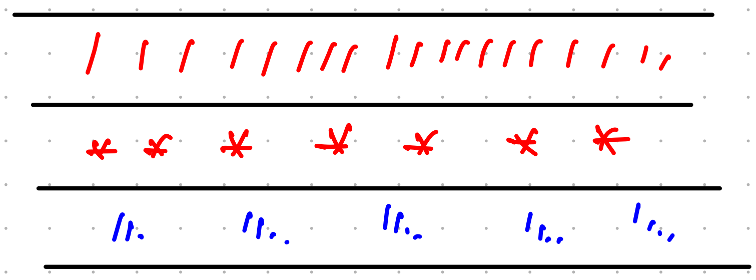
(1)

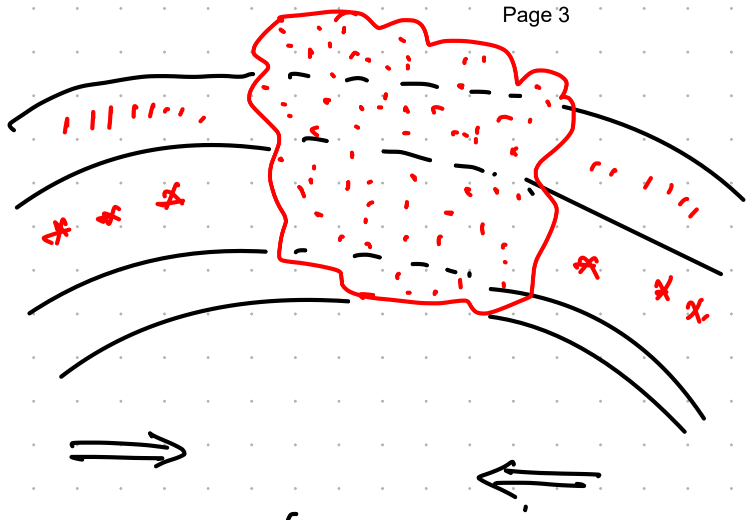


'Contact'

Limestone → Marble

(2)

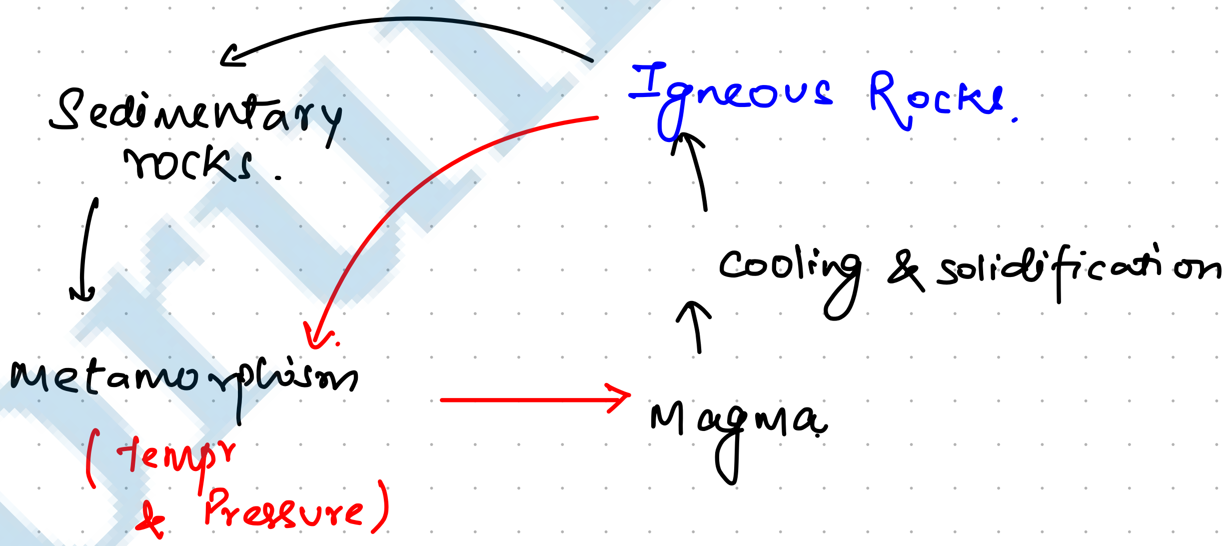




Eg.

SHALE →	Schiest.
Limestone →	Marble
Coal →	diamond
Granite →	Gneiss
Sandstone →	Slate

Rock cycle



Earth Movement

↓

ENDOGENETIC (CONSTRUCTIVE)

- DIASTROPHIC (Slow)
  - EPIROGENETIC (continent Building)
    - EMERGENCE (E. coast) & Submergence (W. coast)
  - OROGENETIC (Mt. Building)
    - Folding (Highest) Mts. & Faulting
- CATASTROPHIC (sudden)
  - E.g & Volcanoes

EXOGENIC (DESTRUCTIVE)

(Forces of 'DENUDATION')

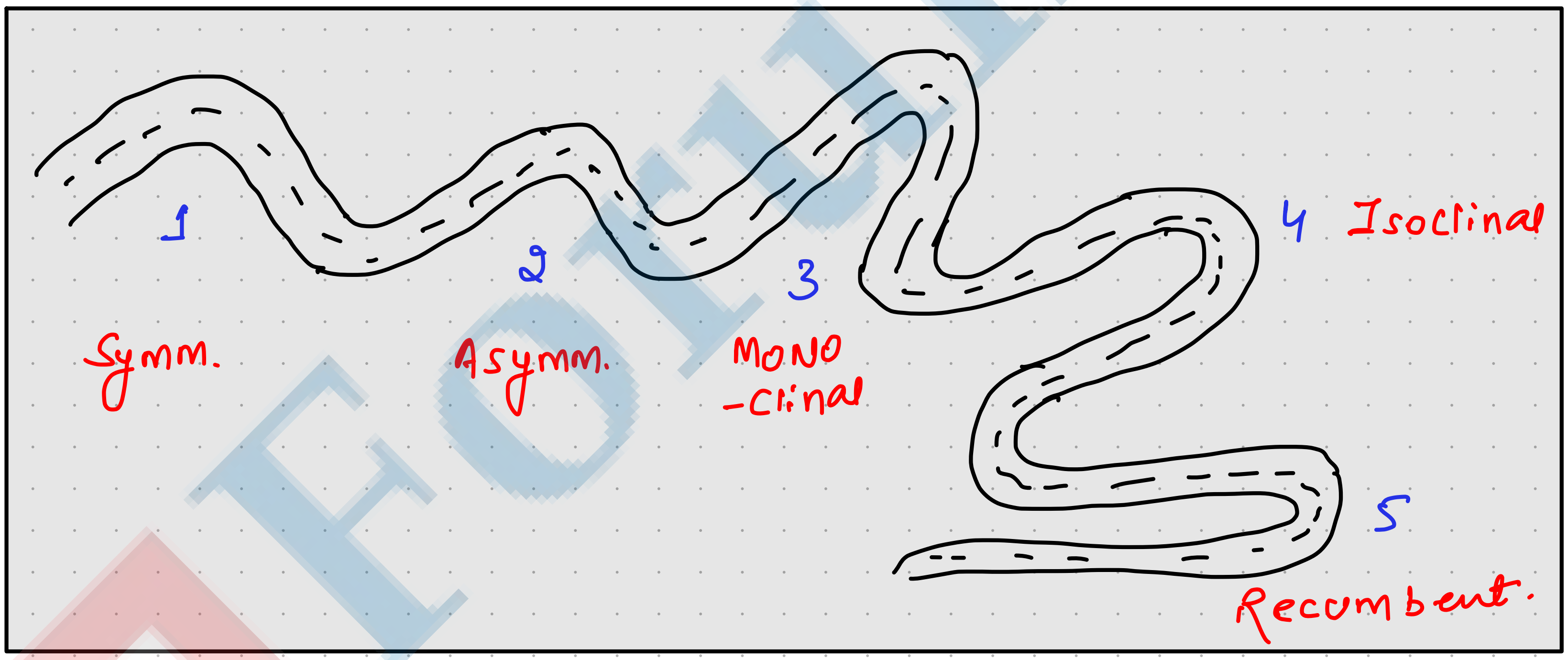
↓

Weathering (in- situ) & Erosion. (Ex-situ)

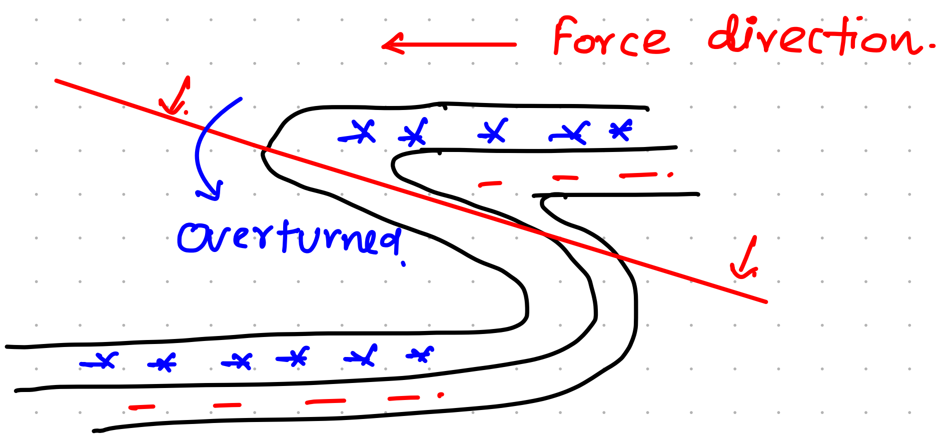
↓

Transport By
- Rivers
- winds
- & Glaciers

Orogenic forces. → Folding.



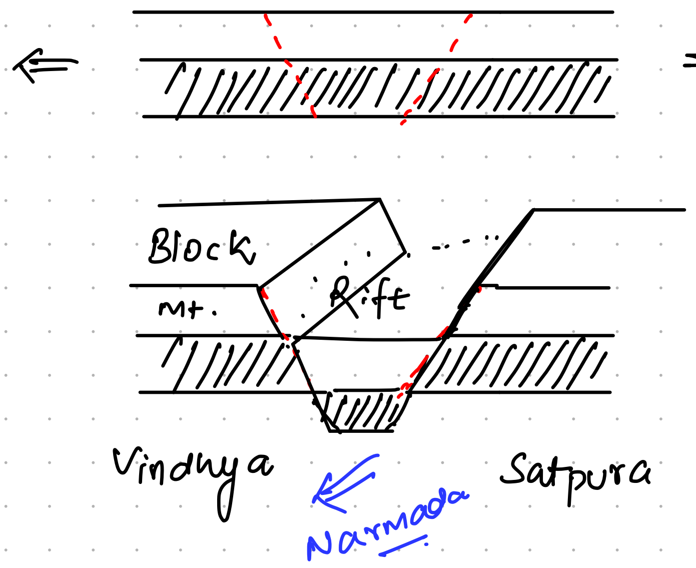
5. Overturned Fault.



'Nappe' (if separated part.)

⇒ Faulting / Fracture → Cracks along 'joints'
'tensional' force

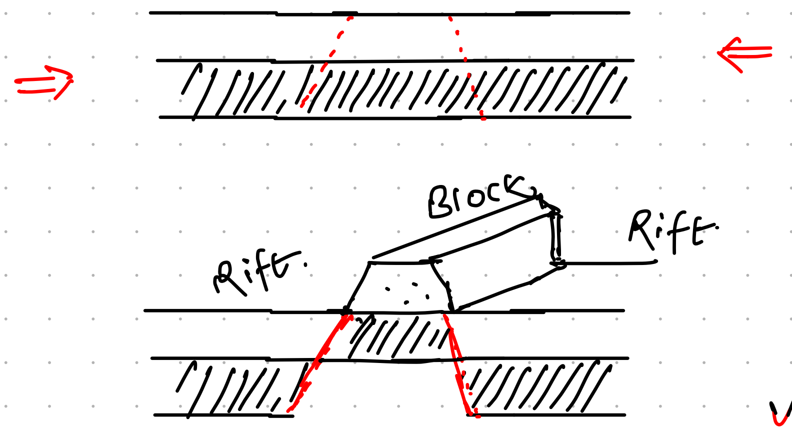
① Normal fault:



Block Mt. – Flat / Table Top Mountain.

Normal fault ⇒ Tensional force
⇓
Elongation of Earth's crust.

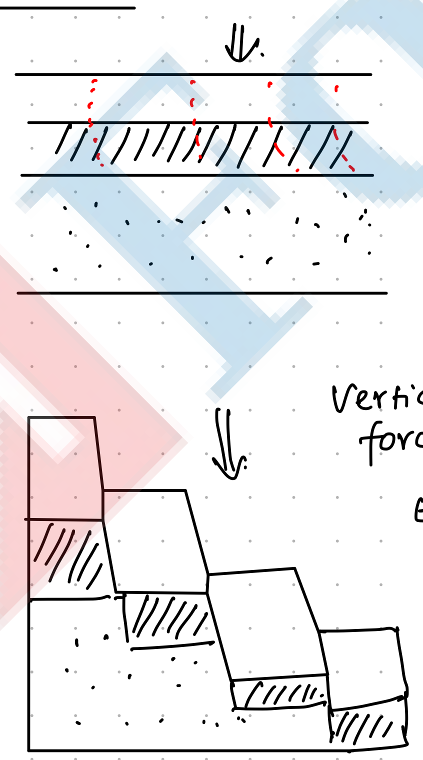
② Reverse Fault ⇒
Thrust / Compressional



Force of 'compression'
⇓
shortening of Earth's crust.

Vertical stress is minimum & Horizontal stress is max.

③ Step Faults ⇒



Vertical forces

Eg – Deccan traps.

Rift valley →
Rhine rift valley
Vordon river valley
Death valley, California

'Denudation' →

Lowering of relief.
'Erosion & Weathering'
(Exogenic forces)

'Weathering'
↓
- Static
- in-situ.

'Erosion'
- Dynamic
- Transport of material.

Depends –
Composition & structure
Climate
Slope
Biotic factors.

Weathering.

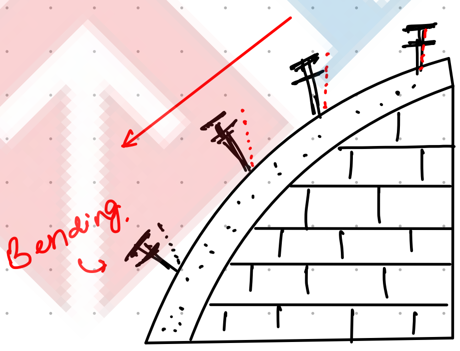
Physical
- Block disintegration.
- Granular "
- Exfoliation
- Expansion & unloading.
- Shattering.

Chemical
- Solution
- Carbonation
- Hydration
- Oxidation

Biological

Mass Movement →

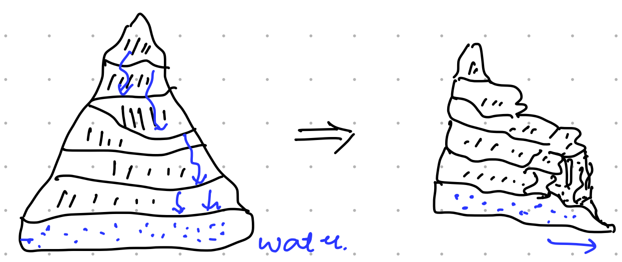
'Soil creep.'



'Flow'
(Solifluction)
↳ water saturated.

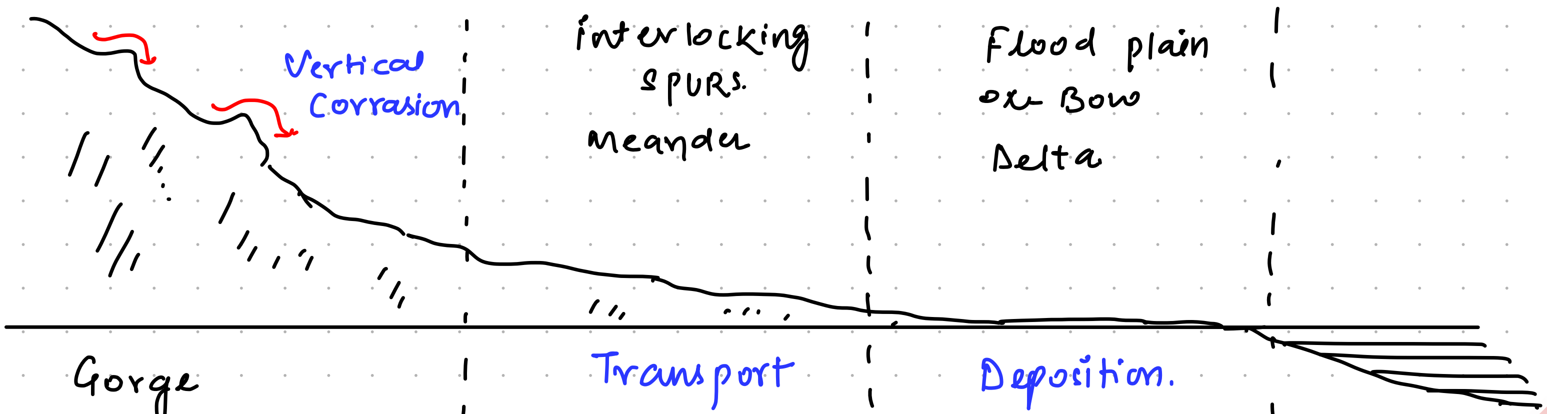
'Fall / Slide.'

water lubricating Agent.

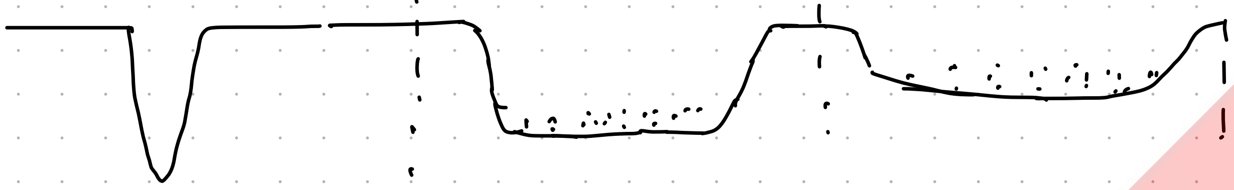


River & related landform & features ⇒

Youth	Mature	Old.
	Interlocking spurs.	Flood plain
	Meander	ox Bow
		Delta

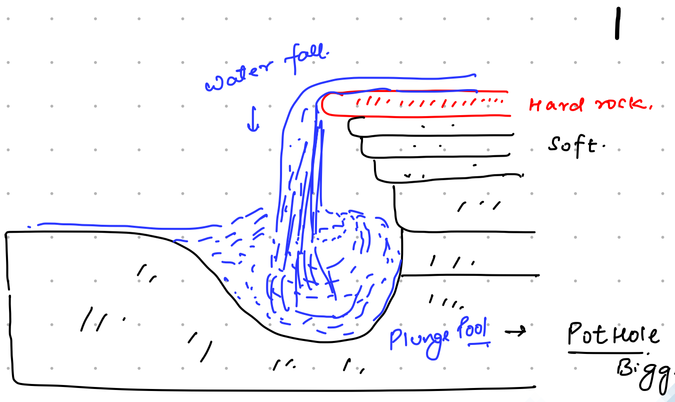


	Transport	Deposition.
Gorge		
Rapids & waterfall		
River capture etc		

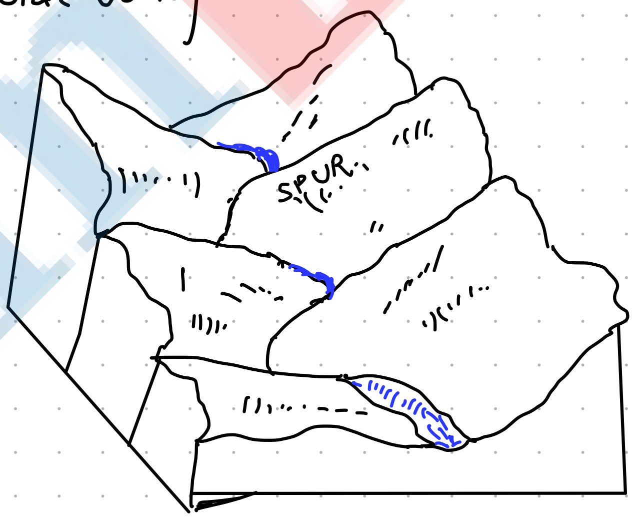


Vertical ↓	← valley → widening + Some Alluvium deposition	Deposition of Alluviam
		Gentle slope wide valley

valley → Gorge.
↓
'canyon.'

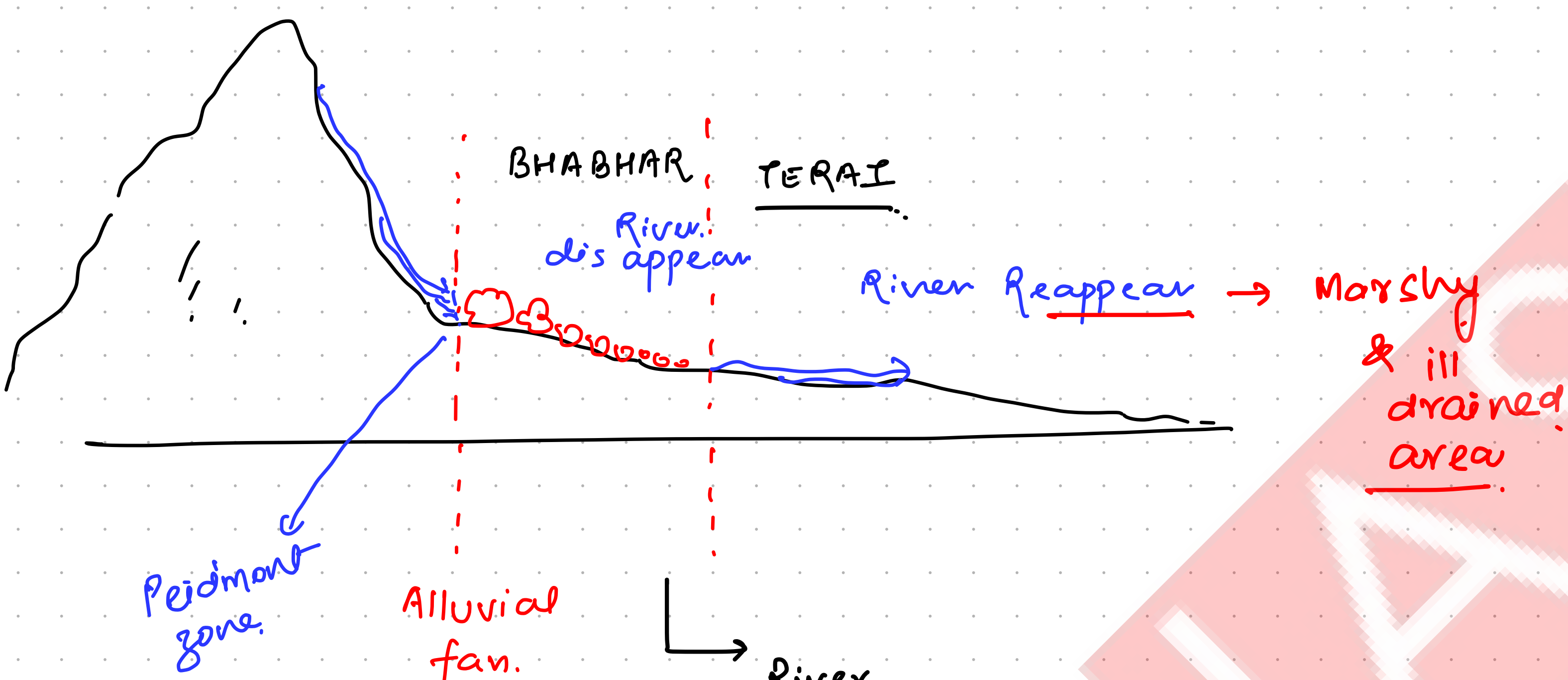


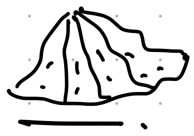
→ Pot Hole of Bigger size



MATURE Stage of River. →

- Speed ↓
- carrying capacity ↓
- Vertical Erosion ↓ (Now lateral Erosion)
- Deposition started
- Shallow 'U' shape valleys.





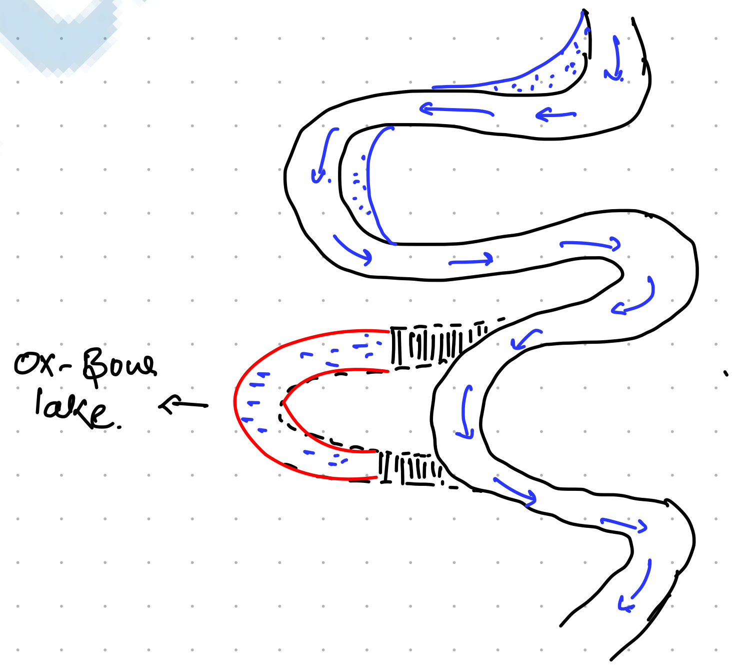
River disappear here.

Old stage ⇒

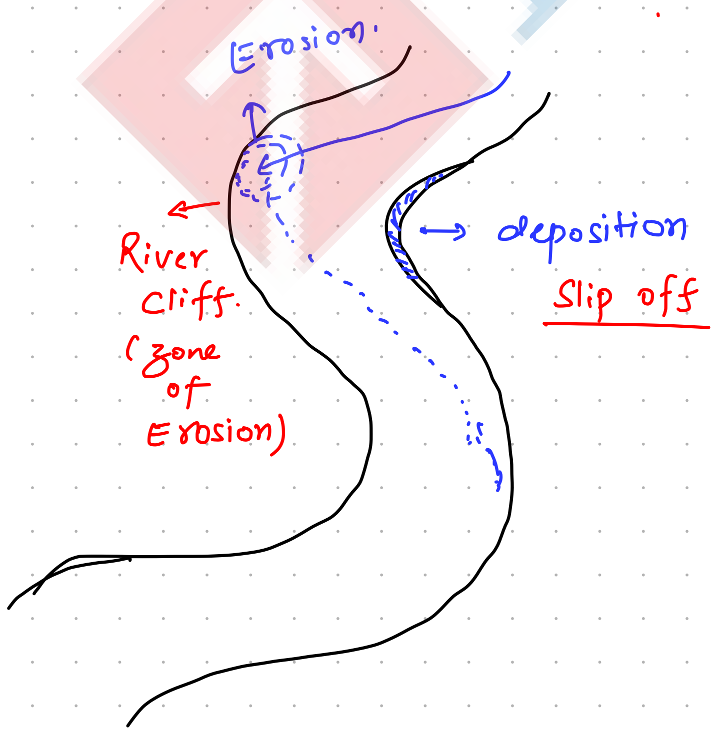
① 'Ox-Bow lake' / Mort lake

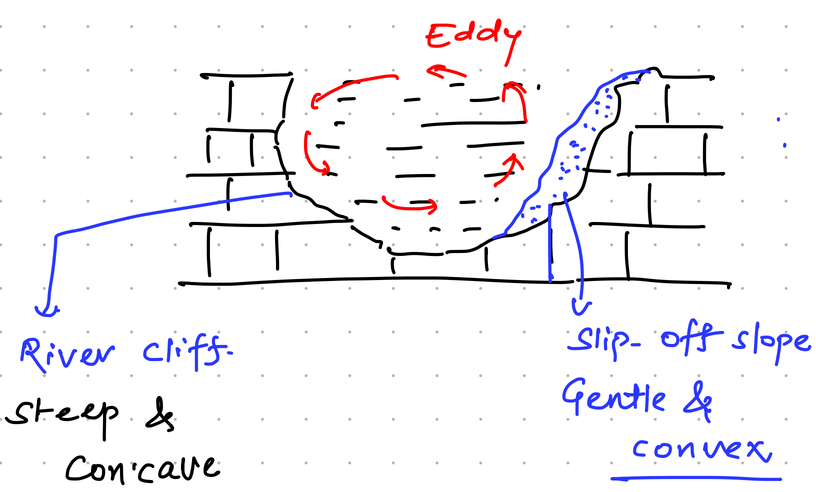
'Meandering'

↳ Sinosuous bends in longitudenal profile of river.

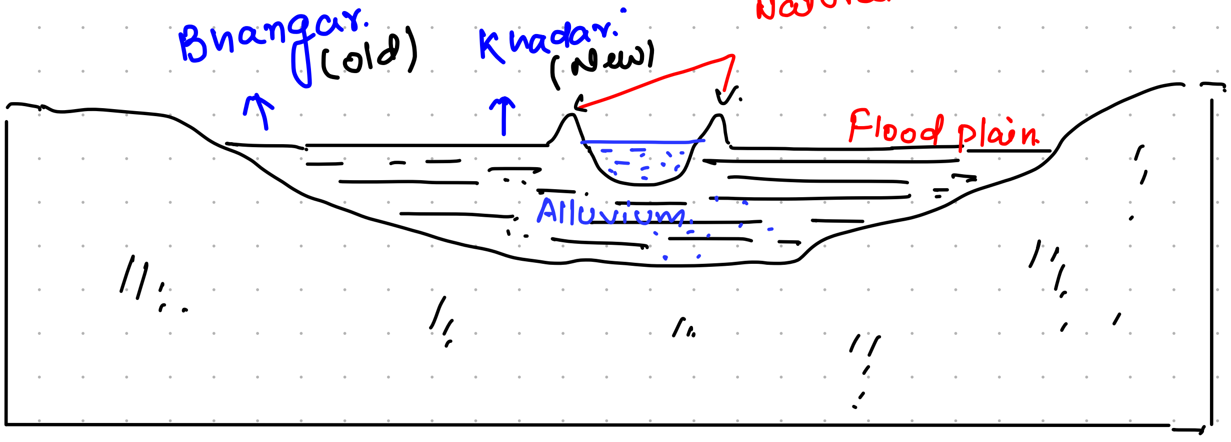


Eg- Kanwar lake
Dul & Wular lake





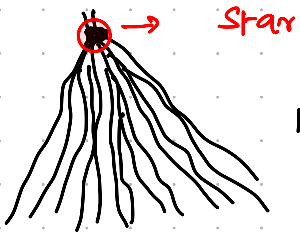
② Flood plains.



③ Deltas

(A) FAN SHAPED

Due to sediments ↑↑

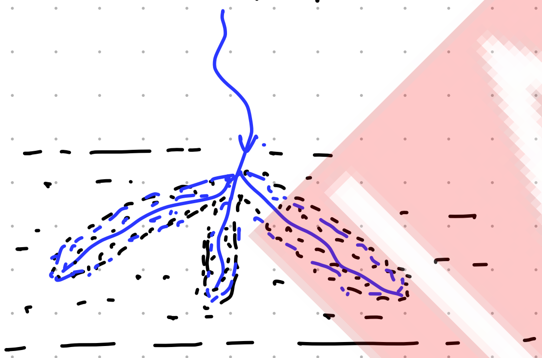


Start Breaking from Here.

FAN SHAPED / ARCUATE DELTA

(Arc like feature)

(B.) Bird foot



(C) Estuarine delta / Truncated Δ

Long & Narrow

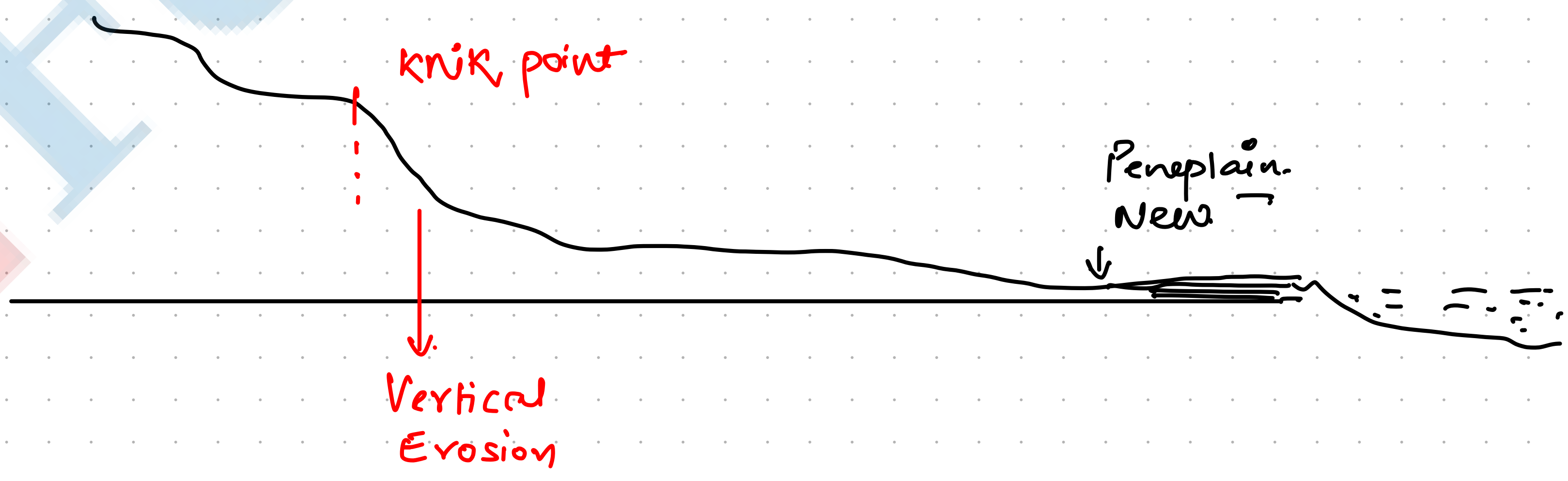
Eg - Narmada & Tapi

Conditions for formation of delta

1. Long rivers (sediments ↑)
2. Shallow sea & lake shores.
3. Calm sea at the mouth of river
4. Stable Sea coast

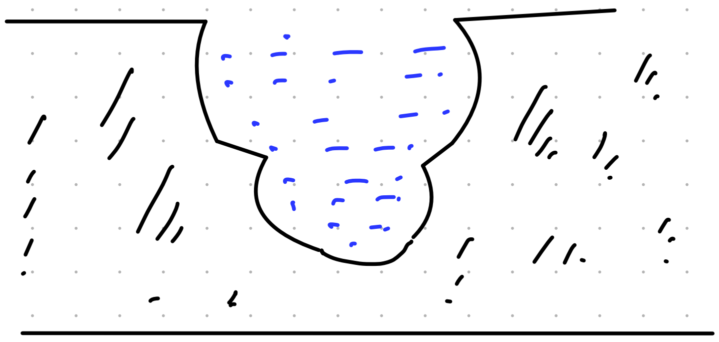
* River Rejuvenation

Acceleration in Erosional Power.

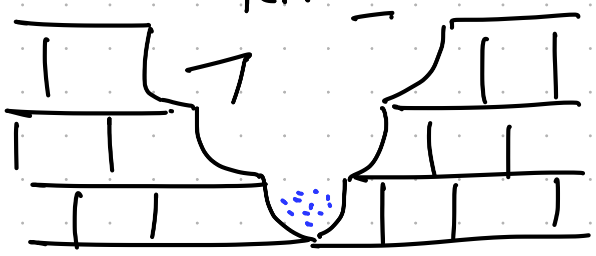


Reasons →
- Dynamic - land upliftment
- Eustatic - Sea level
- Static - River load ↓ Volume of water ↑.

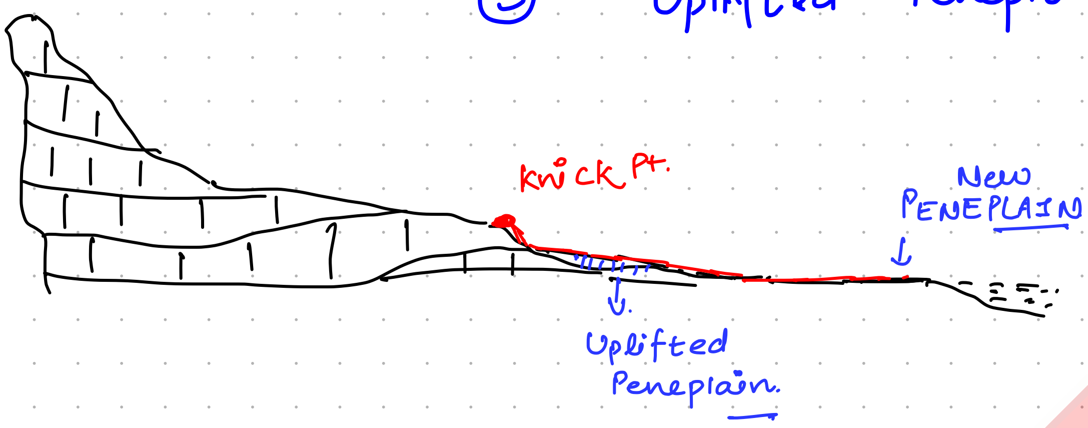
① incised meanders



② Terraces

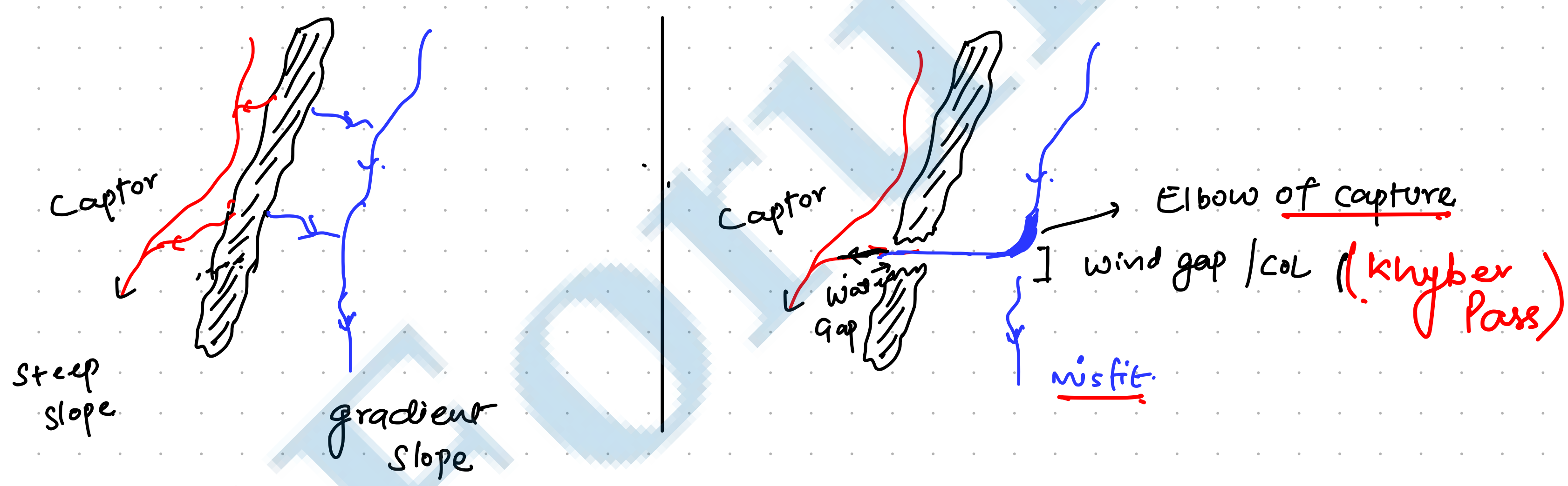


③ Uplifted Peneplains.



Ranchi & Hazari bag plt.

*. River capture :→



Primarily because of →

① Headward Erosion.

② Lateral Erosion.

③ Intersection of MEANDERS

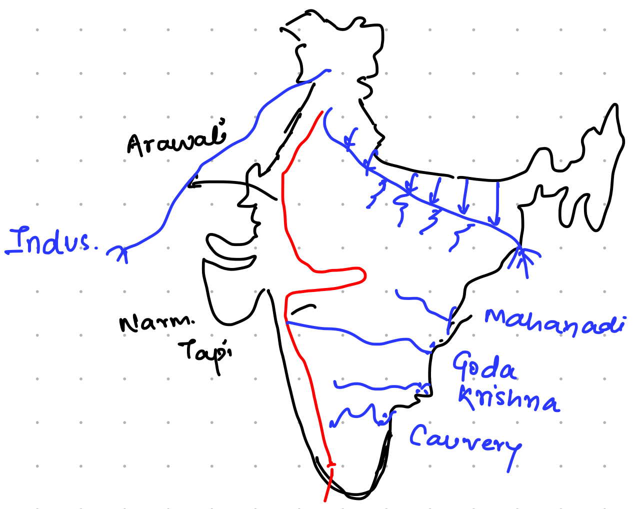
River capture forms "Barbed drainage pattern."

Drainage System & 'Pattern'

- Drainage System → Origin, development & intensity
- 'Pattern' → Spatial arrangement, Shape & geometrical pattern.

Drainage System.

- Himalayan
- Peninsular.



Water divide → 2 sides river

Drainage system. →

- SEQUENT (follow Slope)
  - Consequent
    - follow slope.
    - Ganga.
  - Sub-sequent.
    - first gen. tributaries
    - SONG
    - ASAN
  - Obsequent.
    - ↓ Opposite direction to Main river.
    - Shyok river.
  - Resequent.
    - ↓ trib. of recent origin.
    - Chambal.
- 'Insequent.'
  - Antecedent
  - Superimposed

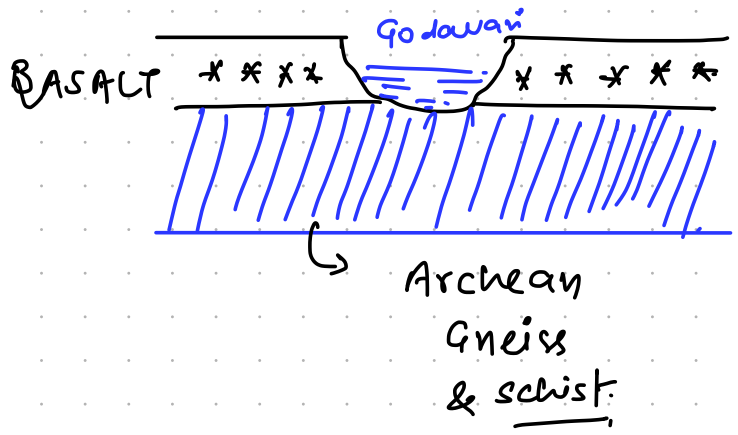
2. Insequent →

① Antecedent.

↳ Existed prior to the upliftment of land & cut across this raised land.

Eg - Indus
Ganga,
Gandak,
Brahma
Satluz.

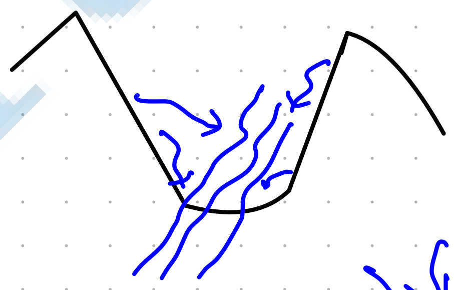
② Superimposed ⇒ Not adjusted to geological structure.

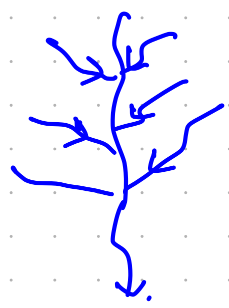


Drainage Patterns →

① Trellised

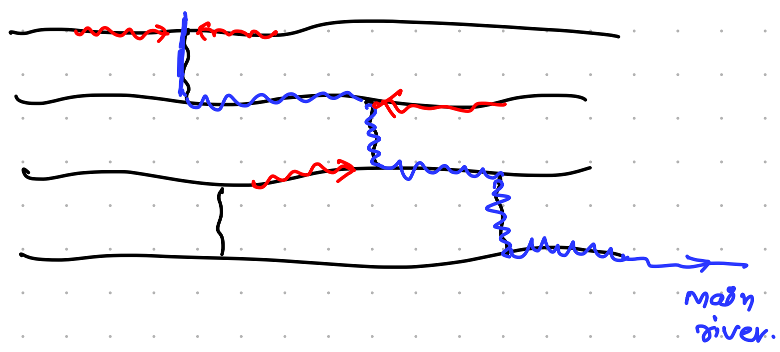
Folds
Dip & strike areas.
Tributaries - 'closely Spaced'





② Rectangular.

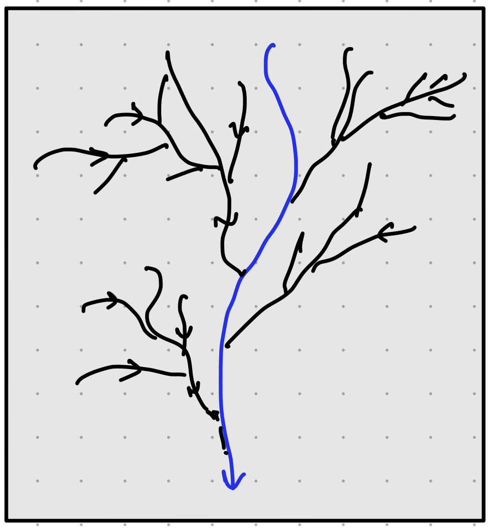
Trib. — At right angle.
- Widely Spaced.
- guided by fractures & cracks.



③ Dendritic

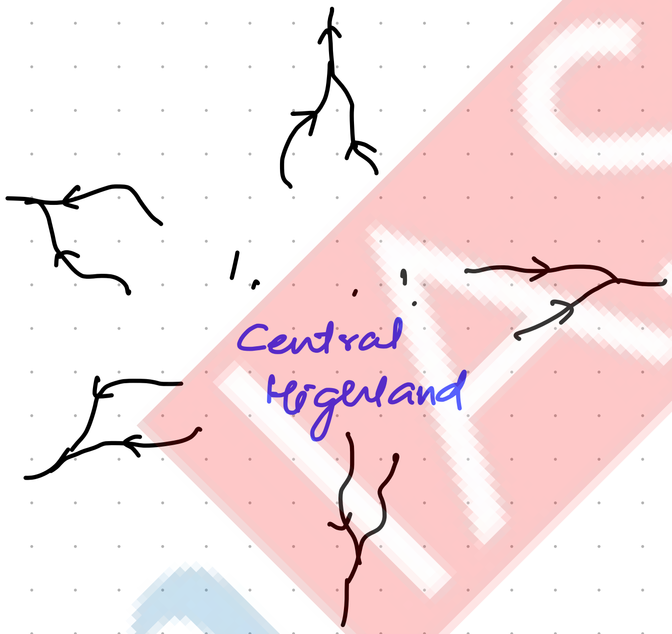
Most common.

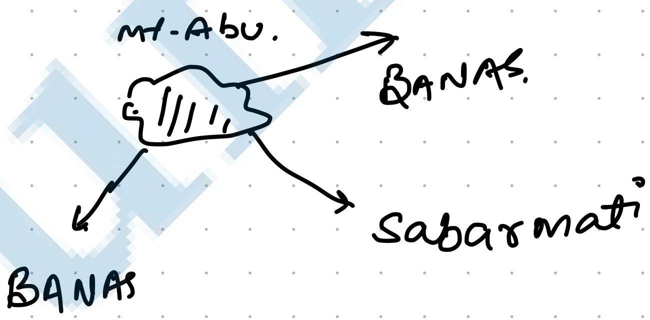
@ Gentle slope & flat relief.



④ Radial Drainage

Eg. - Amarkantak Plt.





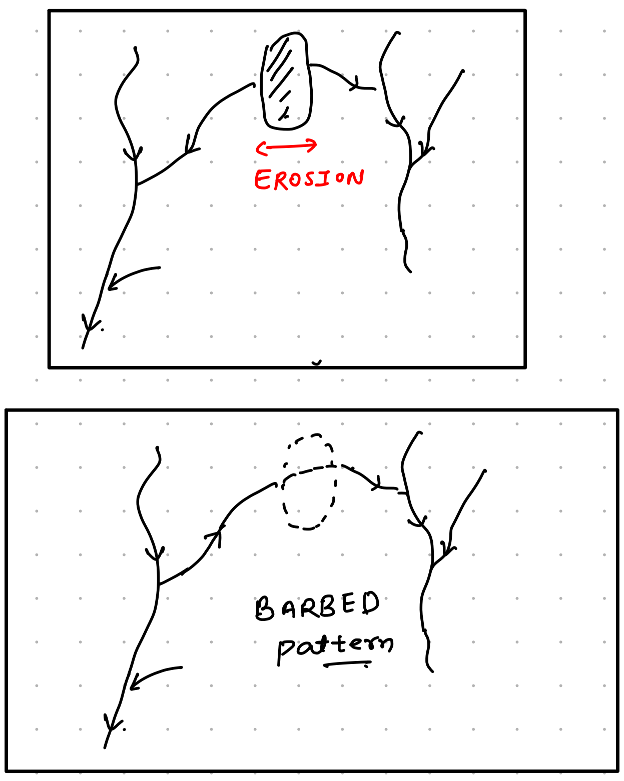
5. Centripetal

Eg. - Ladakh. Raj.

6. Parallel - W. ghats.

7. Barbed Pattern.

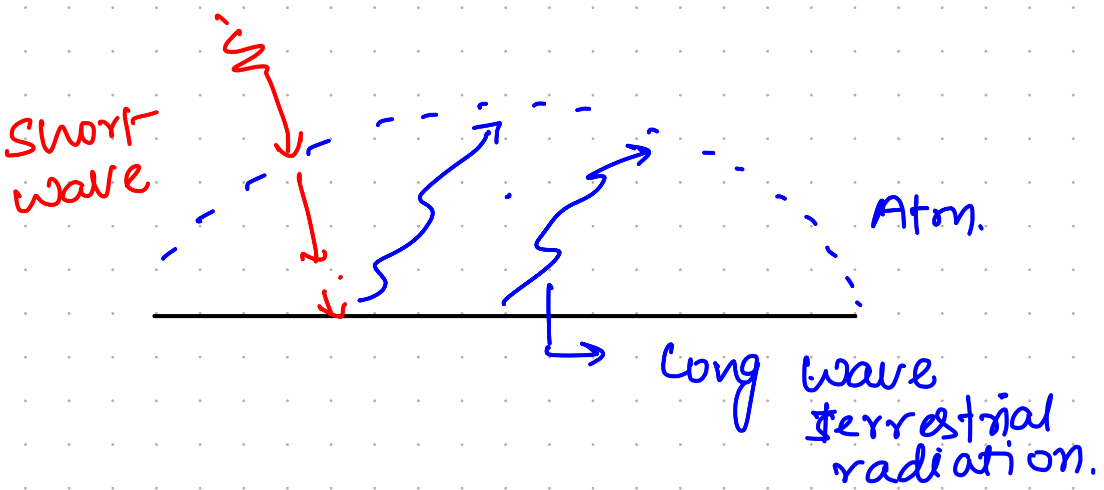
'Due to river capture'



Atmosphere composition & structure

Atmosphere –
↳ Gaseous envelop surrounding Earth. (Gravity)

Composition –
- Gases
- water vapour
- Aerosols / Dust particles.



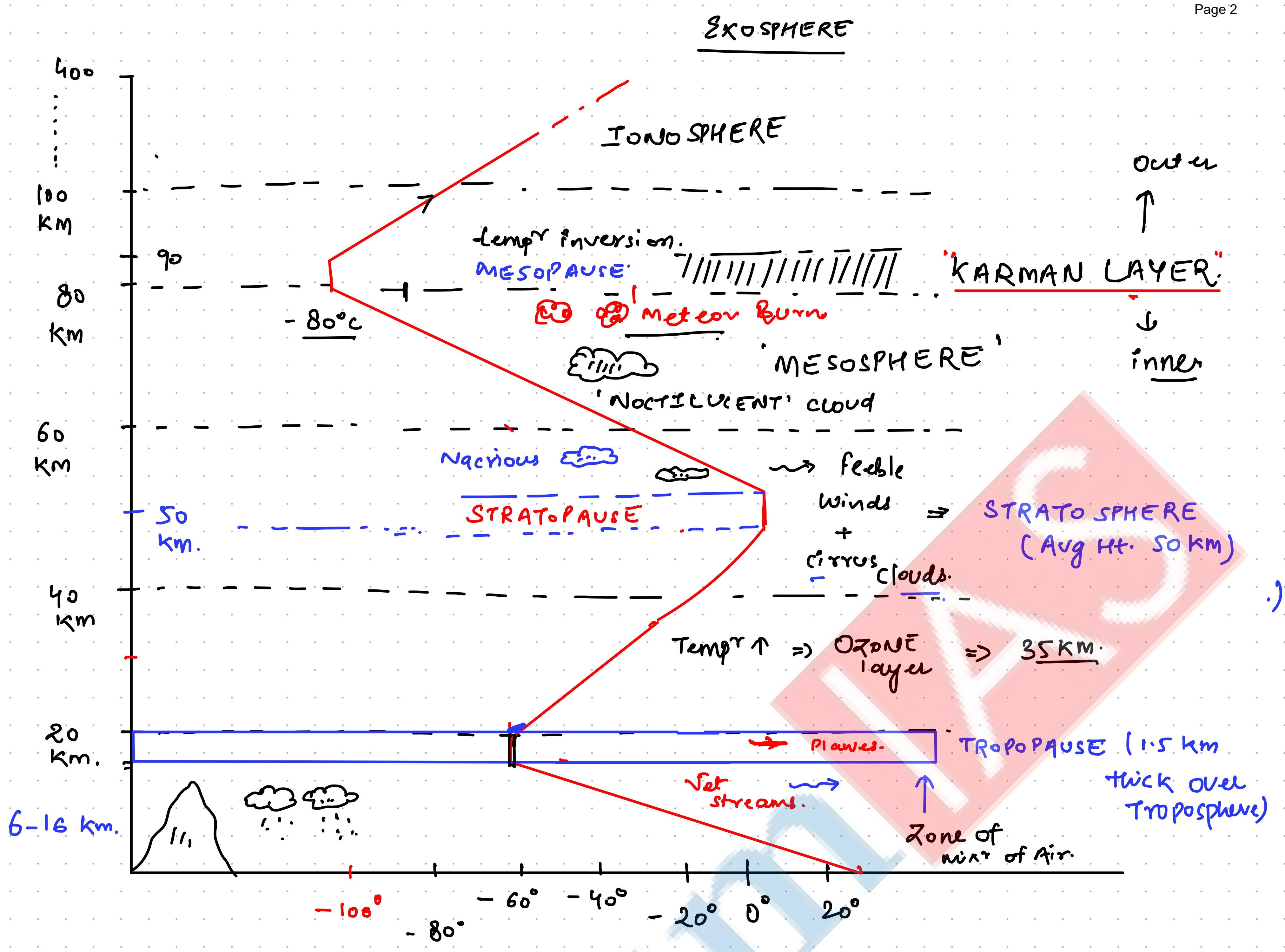
Structure of Atmosphere ⇒

Based on tempr. & Pressure & CHEMICAL Composition.

① **TROPOSPHERE** ⇒ 6– 16 km.
- All weather phenomenons.
- Tempr. decreases with Altitude
  6·5°C / km (NLR)
  – 70°c @ Equator. (over)

Mixing of air (upto tropopause)

② **Stratosphere** –
Avg ~ 50 kms.
✓ Feeble winds & cirrus clouds.
✓ Lower part ⇒ 15–35 km Ozone.' ⇒ tempr ↑ with Altitude
Cirrus → Nacreous Cloud → Mother of Pearls'



(3) MESOSPHERE →

50 - 80 km

tempr. → -80°c At Mesopause → After again increases after MESOPAUSE

↑ Outer

Karman layer. - - - - - - - - - -

↓ inner dense Atmosphere

- Meteorites burn* in Mesosphere.
- Noctilucent cloud → Because of meteoritic dust.

(4) THERMOSPHERE →

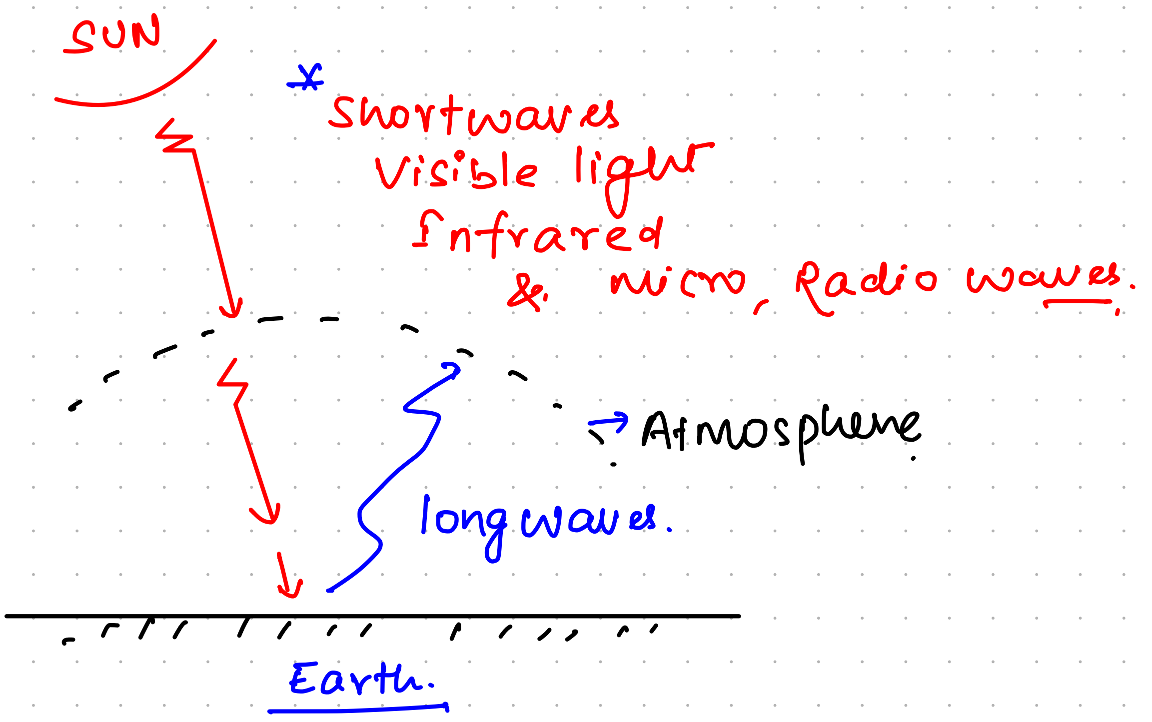
Beyond 80 kms.

Temperature Measurement - difficult. (Rare Atmosphere)

Divided into
- IONO (80 - 640 km)
- EXO (640 km Beyond)

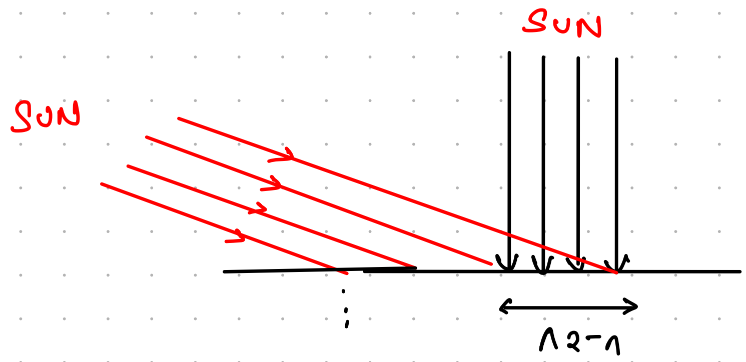
Insolation →

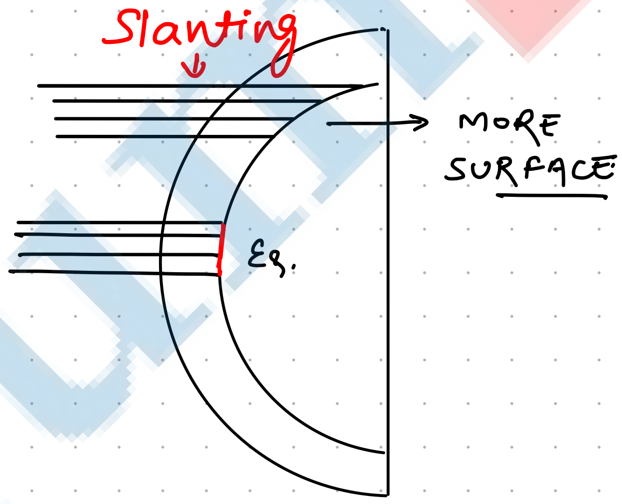
Incoming solar Radiation
'Shortwaves' *



Factors Affecting Insolation.

① Angle of Sun Rays.





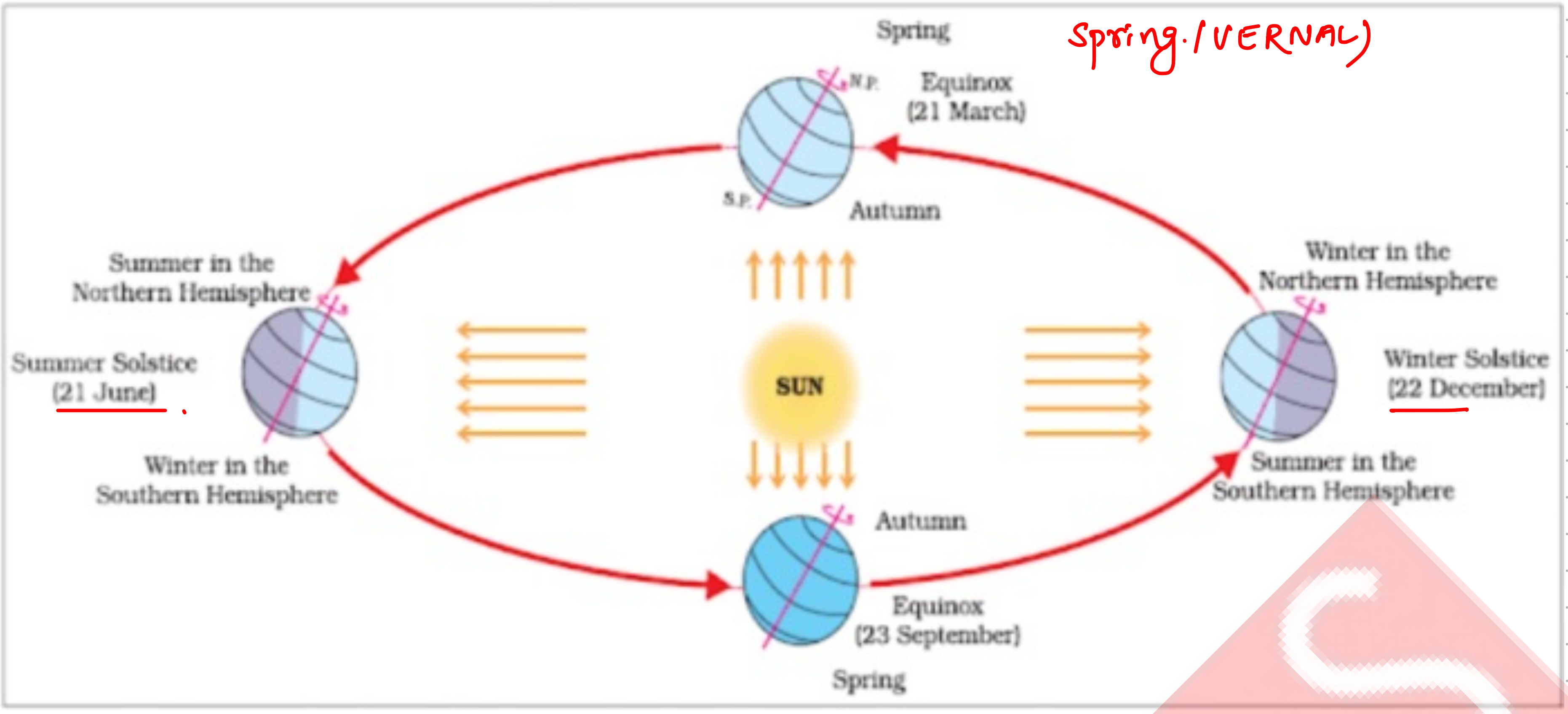
② Rotation of Earth.
(change in length of day & Night.)

Length of day = Alway Equal at Equator.
↓
Rotation
Inclination
Revolution.

→ length of day ↑es
Equator to Pole

↑ (SUN (Northward)

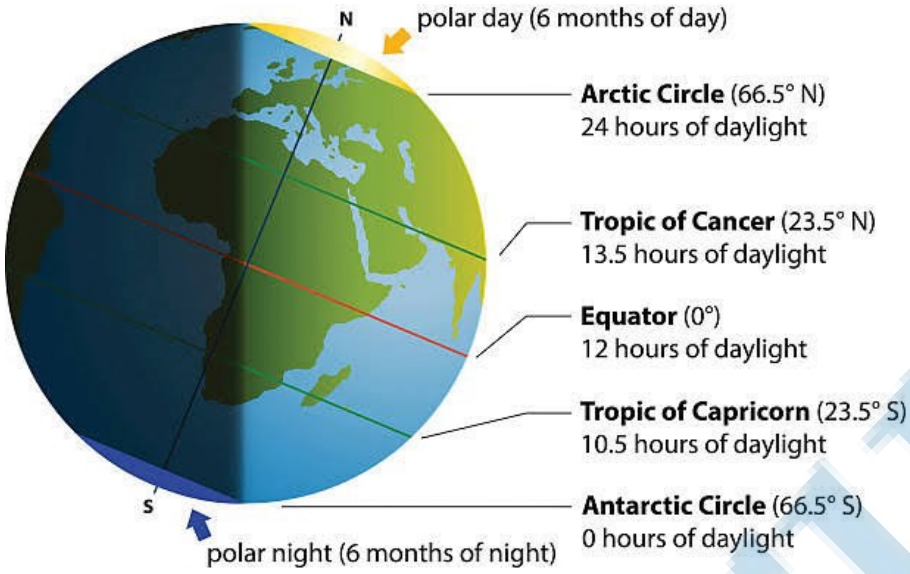
Day length – North Pole
= 21st March to 23rd Sept.
6 months. (During Northward movement of SUN)



Spring (VERNAL)

Autoumnal equinox.

summer solstice (June 21)

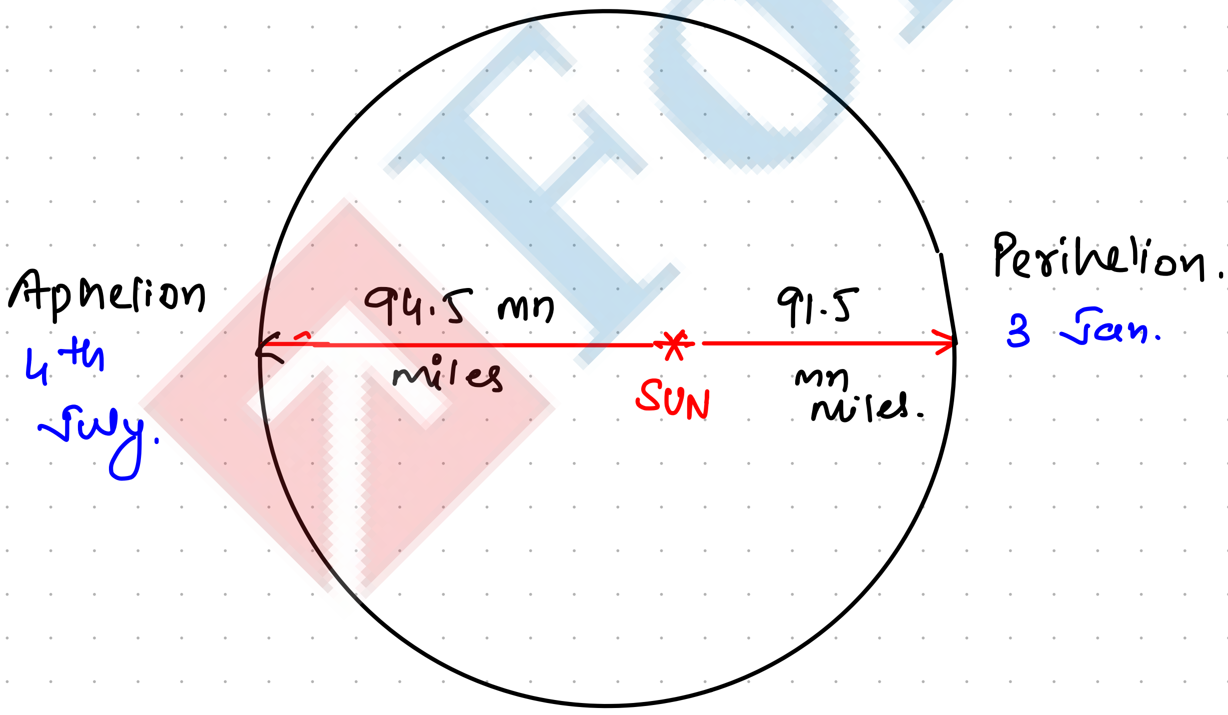


NOTE :→

During summer solstice length of day from Equator to North Pole* = increases.

(Reverse in winter solstice)

③ Distance from Sun. –



④ Number of sunspots.

Darker area
↳ comparatively cooler.

11 year cycle.

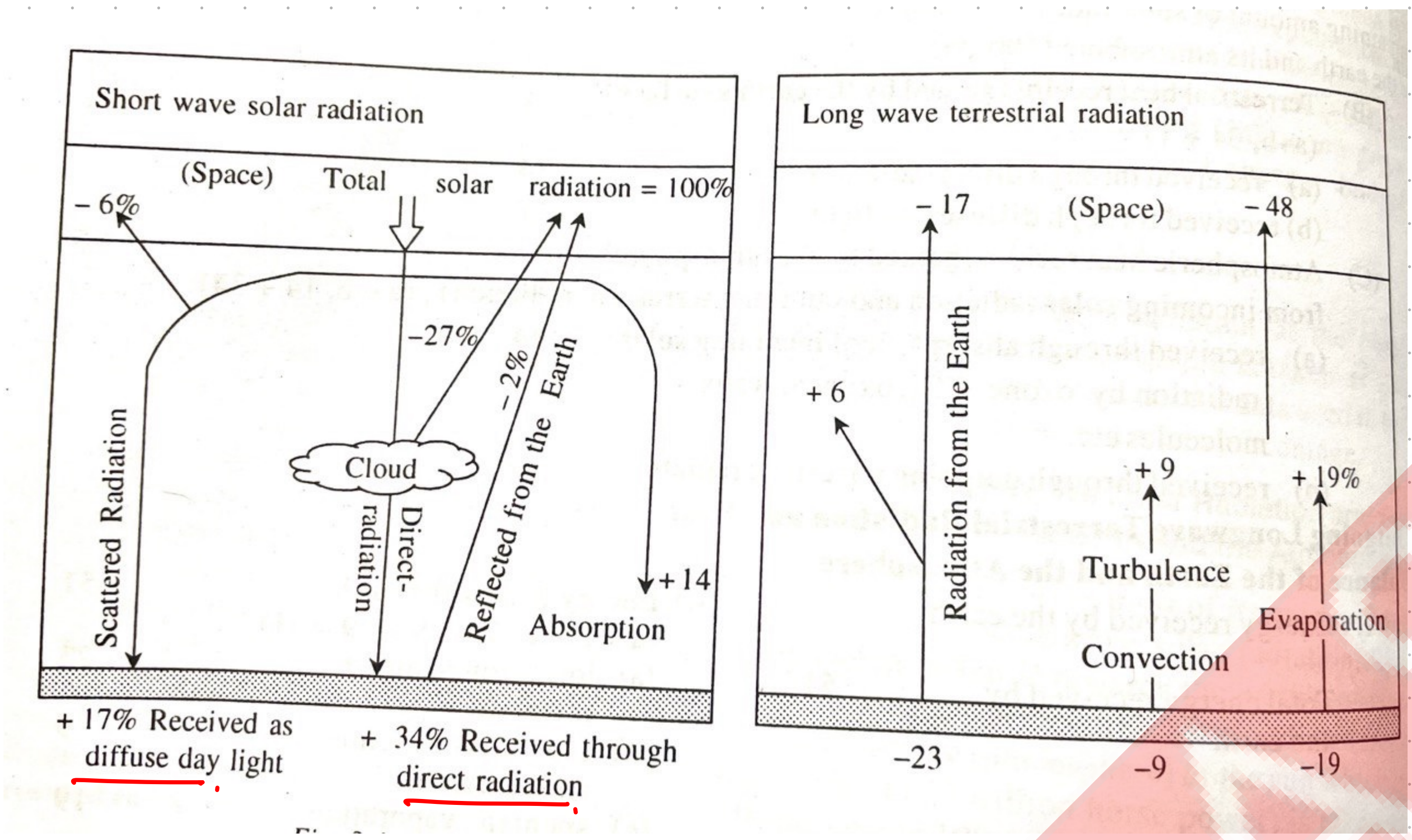
Dark – umbra
lighter – Penumbra

⑤ 'Atmosphere' →

Reflection
diffusion
& scattering etc.

NOTE → Sun is never overhead beyond tropics.

Heat Budget & Albedo →



Albedo →

Rate of Reflection in %

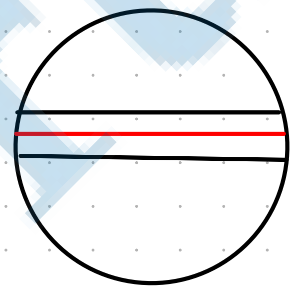
Cirrus cloud > Fresh snow > old snow > Desert > Grasses > coniferous > Tropical forests.

LONGITUDES & LATTITUDES.

'LONGITUDES'

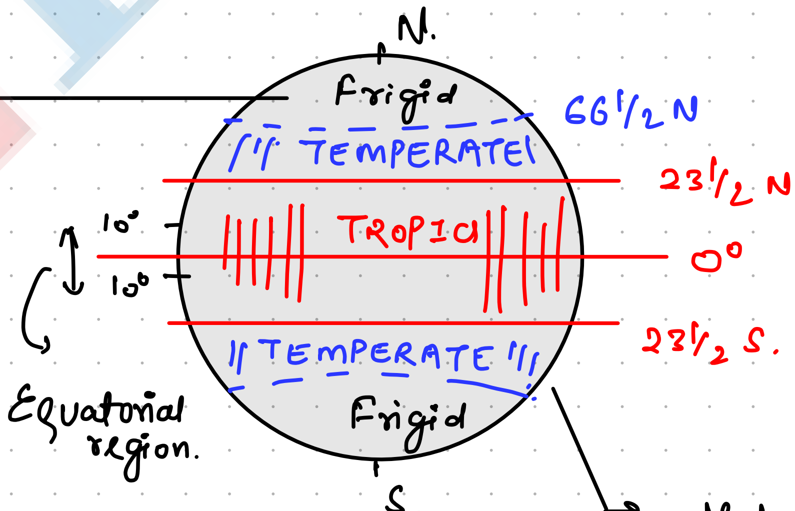
'Parallel Equidistant.'

1° latt. = 111 km.



Eq. (imag.)

used in –
Distance
& Climatic zones.



Sun rays always slanting
+
Highest albedo of ice cover

Vertical Sun Rays = TROPICS

max. march of Sun

Hot summers (sun comes over 23 1/2 N)
&
Mild winters

2. LONGITUDES →

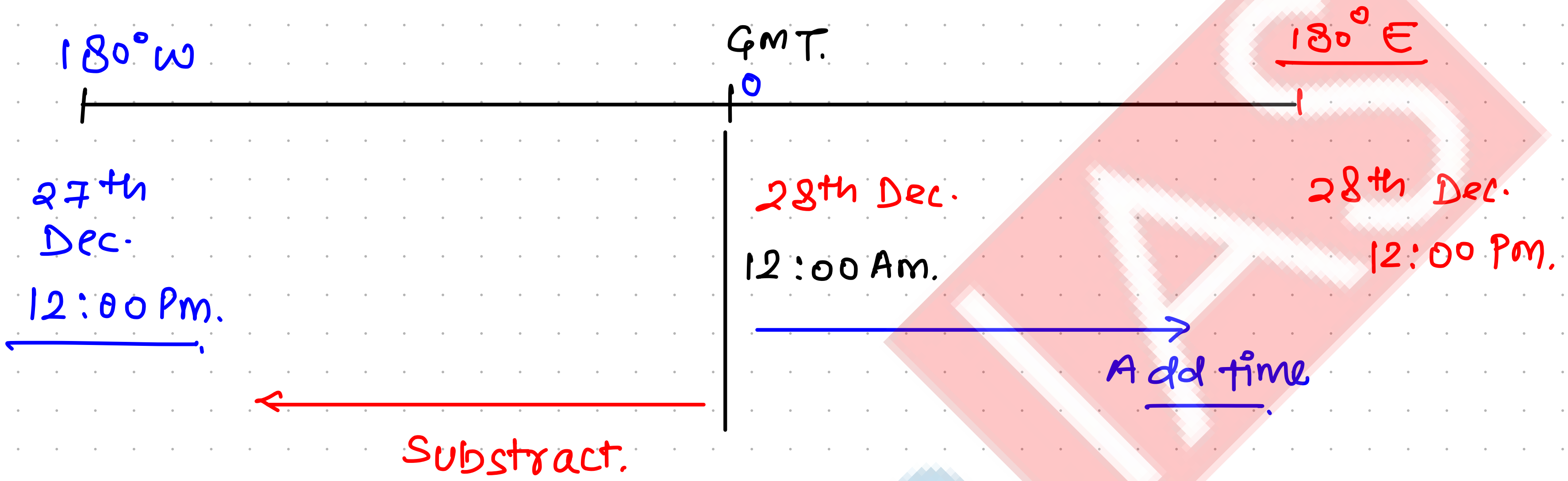
imaginary lines → Pole to Pole

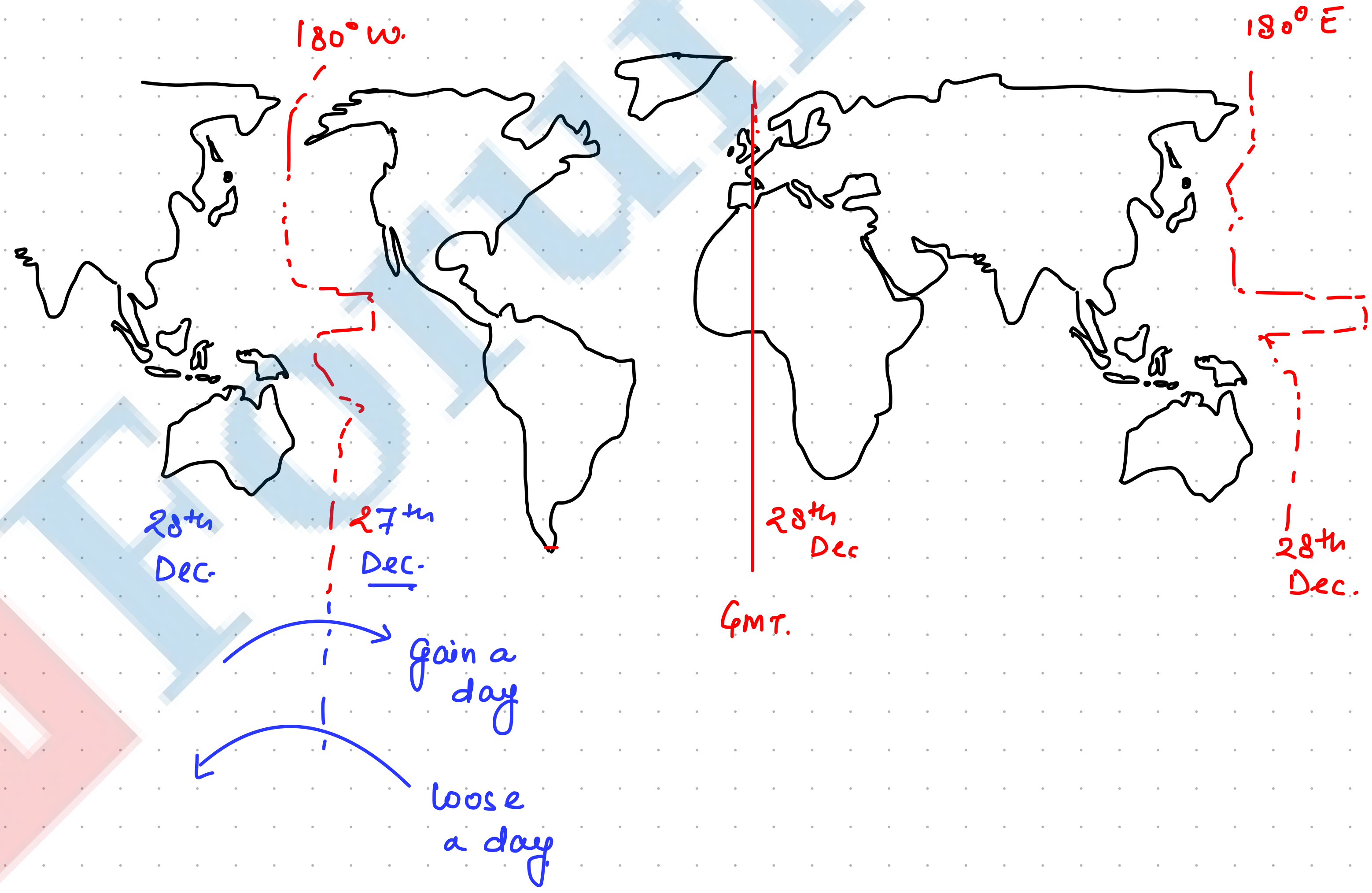
Not equidistant. → At Pole = Zero

At Eq. = Max. distance

1° = 4 min
15° = 60 min / 1 Hr.

* For calculation of time.





International date line. = zig-zag.

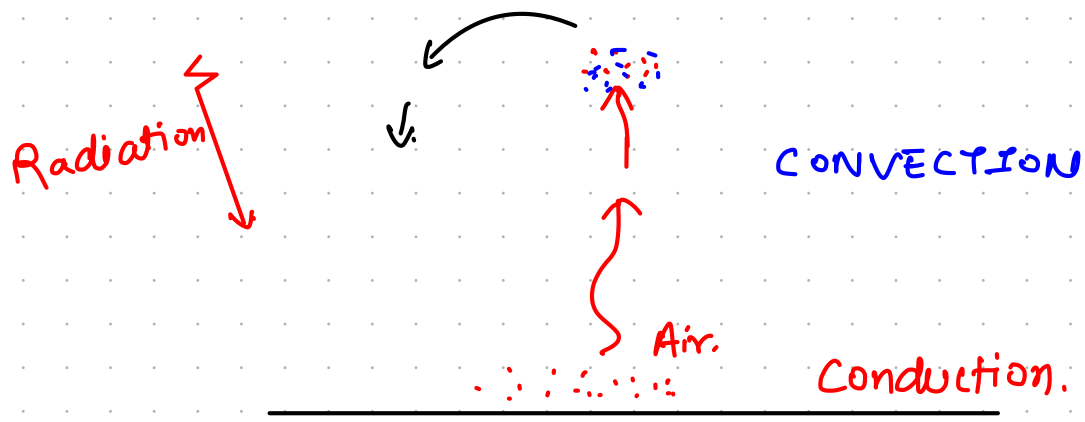
TEMPERATURE

HEAT – ENERGY

TEMPERATURE – Degree of Hotness & coldness.

TRANSFER of Heat.

1. Radiation. – w/o medium.
2. Conduction – Direct contact.
3. CONVECTION – Through movement of Mass.

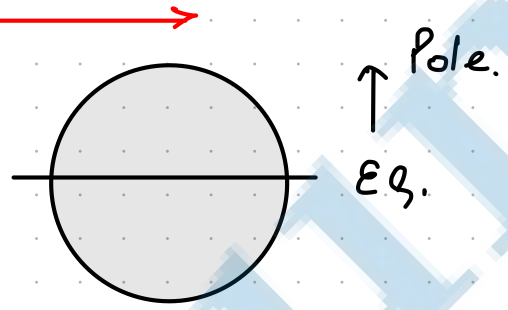


Distribution of temperature. ⇒

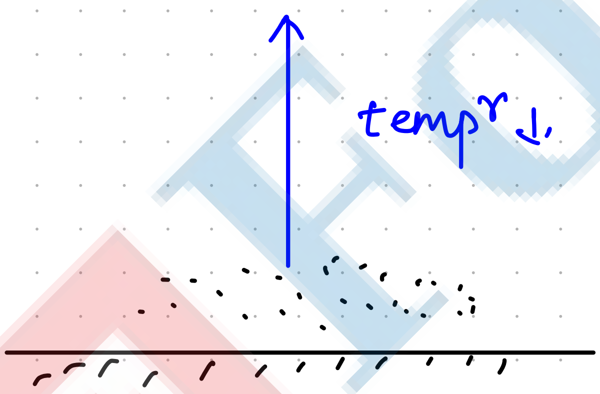
Factors affecting –

① Lattitude

max. tempr.
20°N, July.



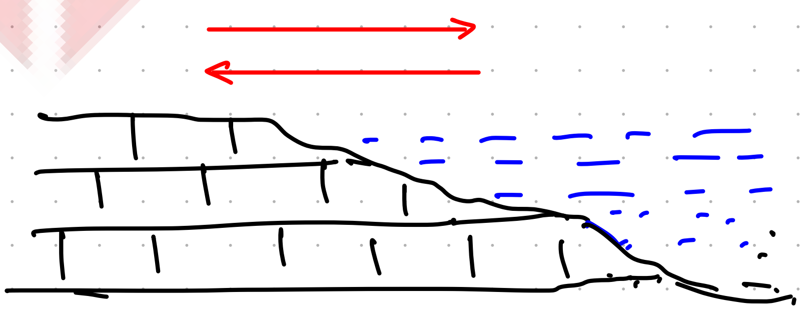
② Altitude.



Atmosphere = less denser. At. Height.

less water vapour at. Height.

③ Distance from Sea. →



'Land & Sea Breeze.'

Mixing of winds.

④ Nature of land & water.

Land – Heats up faster.

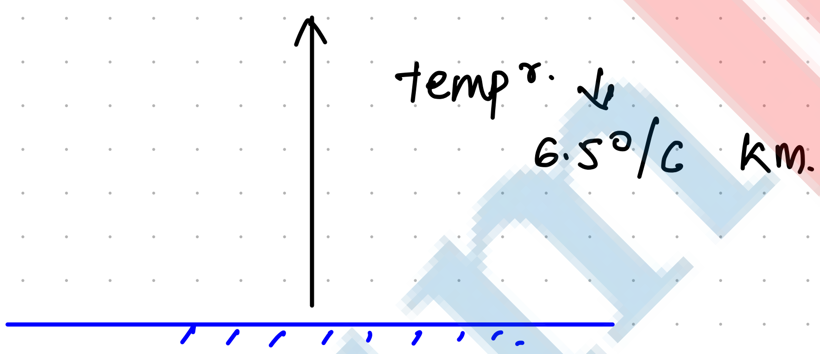
– Sun light penetration limited.

- Convection & movement → Not possible
- less Evaporation
  Heat loss.
- Albedo of land ↑
- Clouds presence.

(5) PREVAILING winds.-

Ocean to lands
Poles to Equator. (or reverse)
Ocean currents. - Eg. North Atlantic drift.

VERTICAL Distribution. →



Temperature inversion. →

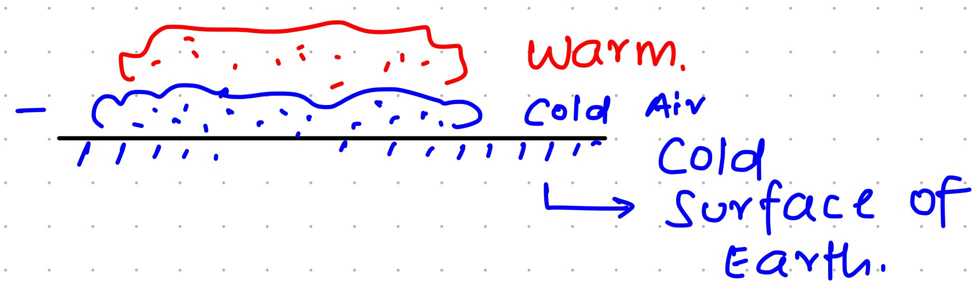
/ or Negative lapse rate.

Non- Advectional
- Ground / Surface
- Upper Air.

Advectional
Frontal
Valley
Surface

Mechanical.
Subsidence
(Common in Mid lat.)

(1) Ground / Surface.

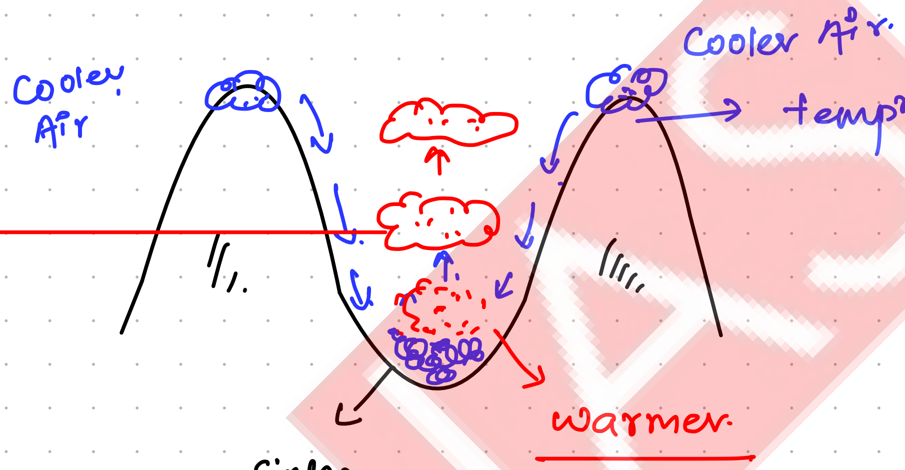


Long Nights
Dry air Near ground
Slow / No movement of air.

② Advectional → Dynamic → Because of Movement of air.

Conditions. –
- strong winds.
- Unstable Atm.

(A.) Valley Inversion. →

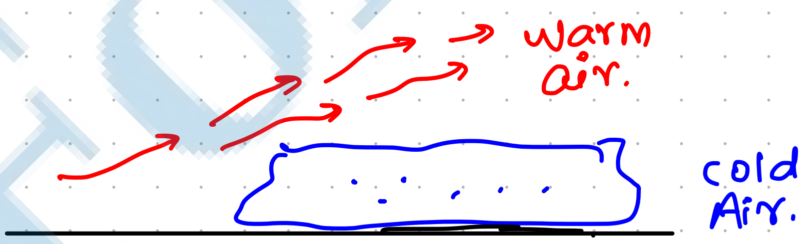


Upper parts of valley = warmer & frost Free

In winter nights. due to radiation

Sinks & pusheshh warmer air above → Creates frost in valley Bottom.
- ↓ Human Settlement ×
- ↓ Agr. damages.

(B.) FRONTOL ⇒



in Mid lat.

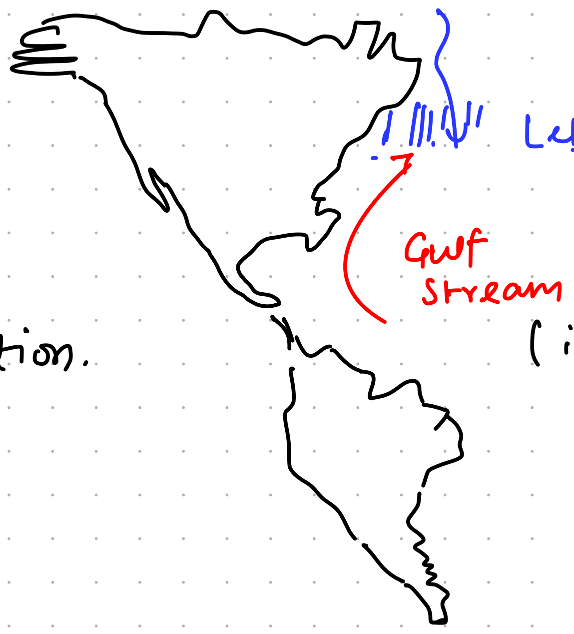
Westerly warm ⇅ Cold Polar winds.

(C) SURFACE inversion. →

Horizontal Movement of air.

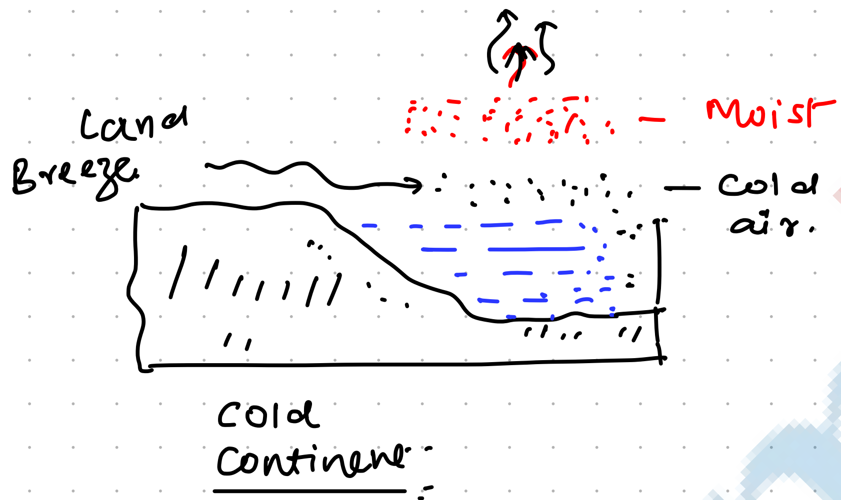
(A) OCEANIC Currents

=> Dense fog formation.

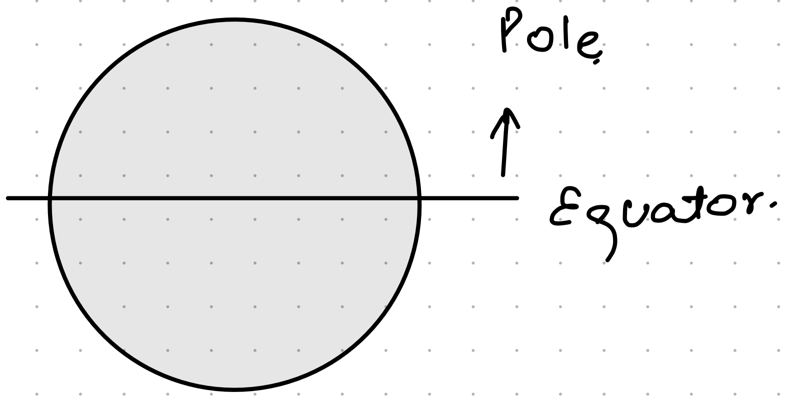


=> Grand Banks
New Foundland

(B) SEA SMOG



Horizontal distribution of temperature ⇒



"temperature changes"

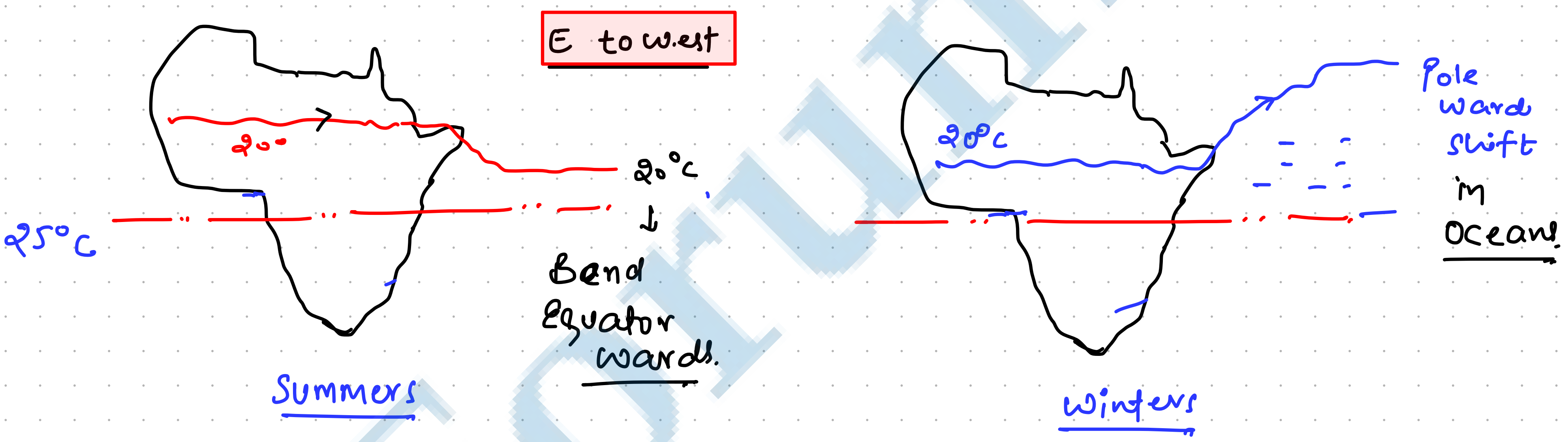
ISOTHERMS. →

Imaginary lines of equal temperature.
(Reduced to sea level)
↓
∴ do not depict real temperature

Normally -

Run East - West.
Parallel to lattitudes.

- Closely spaced in N. Hemisphere



"PRESSURE & Winds"

- Pressure Belts.
- Winds
  - Permanent
    - Trade
    - West.
    - Polar Easterly.
  - Regional → Monsoon, La-Nina, El-Nino
  - Local.
- Jet streams.

Temperature & Pressure => $T \propto 1/P$

Pressure is controlled by →
- Tempr.
- Earth's rotation
- Air circulation
- Water vapour etc.

Horizontal distribution of Pressure →

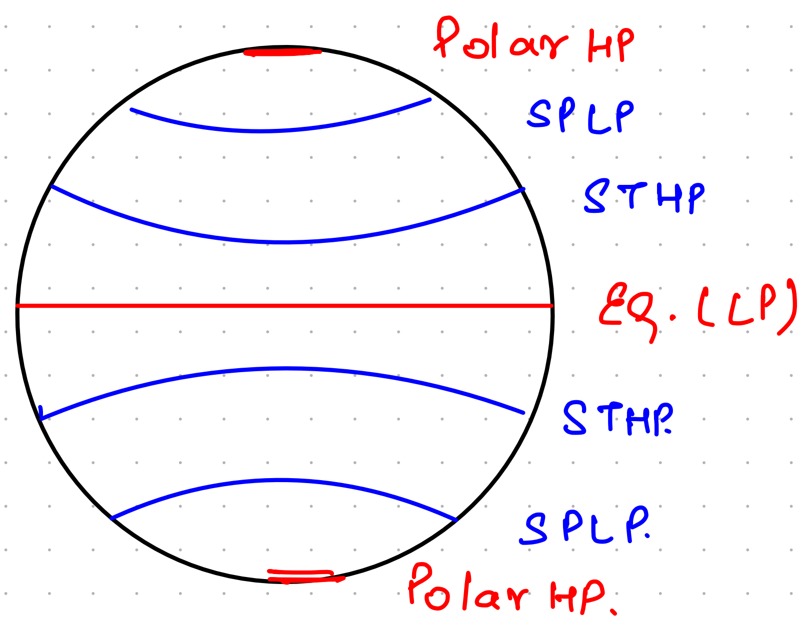
ISOBARS – imag. pressure lines.

Pressure Belts. –
- Broken – N. Hemi
- Continuous – S. Hemi

7 Pressure Belts

THERMAL
- Equator L.P.
- Polar HP – North
- Polar H.P. – South.

DYNAMIC
- Sub-Tropical HP. – $23\frac{1}{2}$ N & S.
- Sub-Polar LP. – $66\frac{1}{2}$ N & S.



① Equatorial L.P.

5° N & S.
Seasonal shifting with Sun
ZONE of 'CONVERGENCE'
'Doldrum'

② STHP.

Origin – Dynamic
Anti-cyclonic
Hot deserts
'HORSE Latt.'

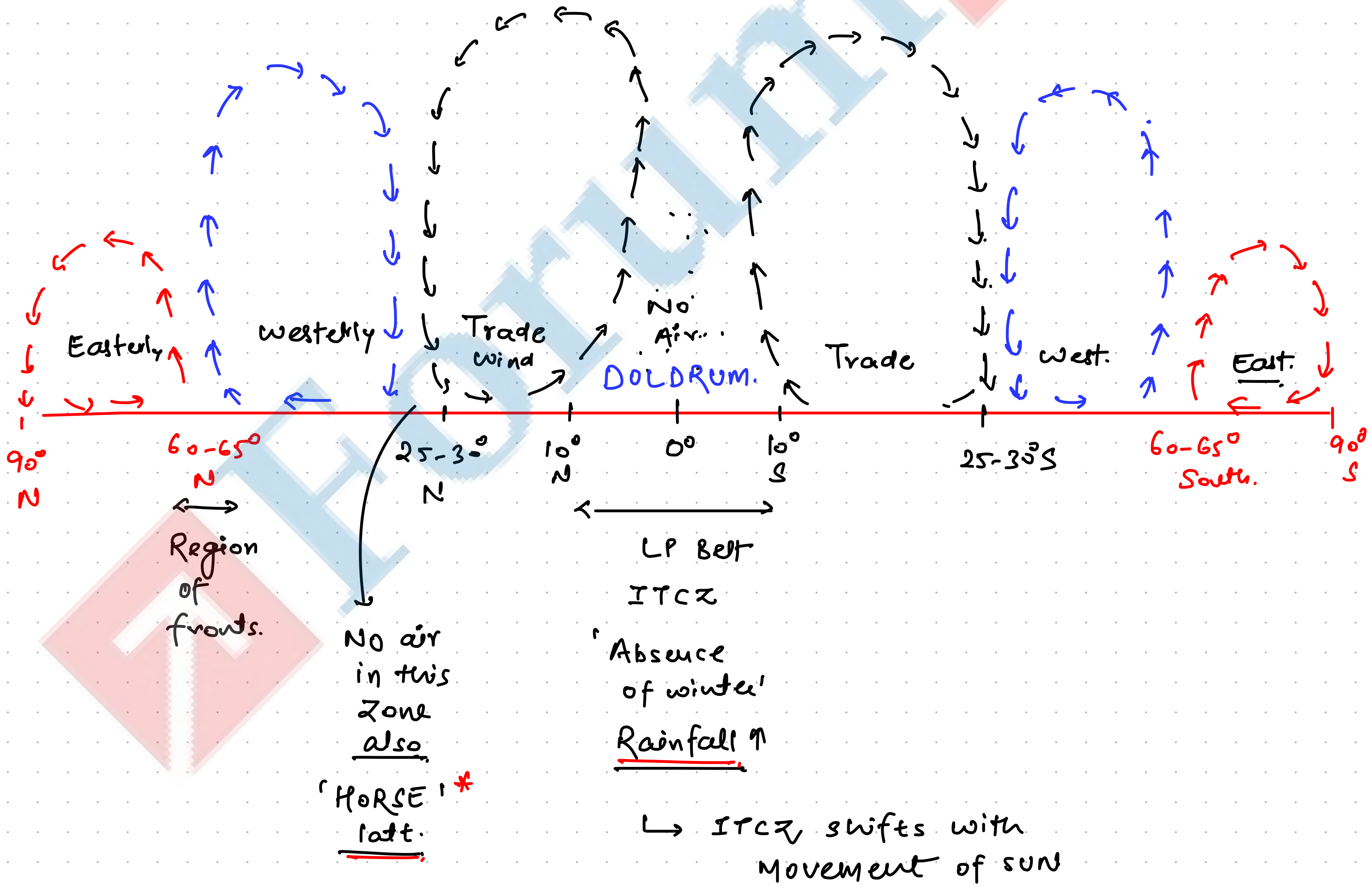
③ SPLP

60–65° N & S.
Origin → Dynamic
- Rotation of Earth.
- sinking of winds.

*. Regular in S. Hemisphere & Broken in Northern Hemi.

④ Polar HP.

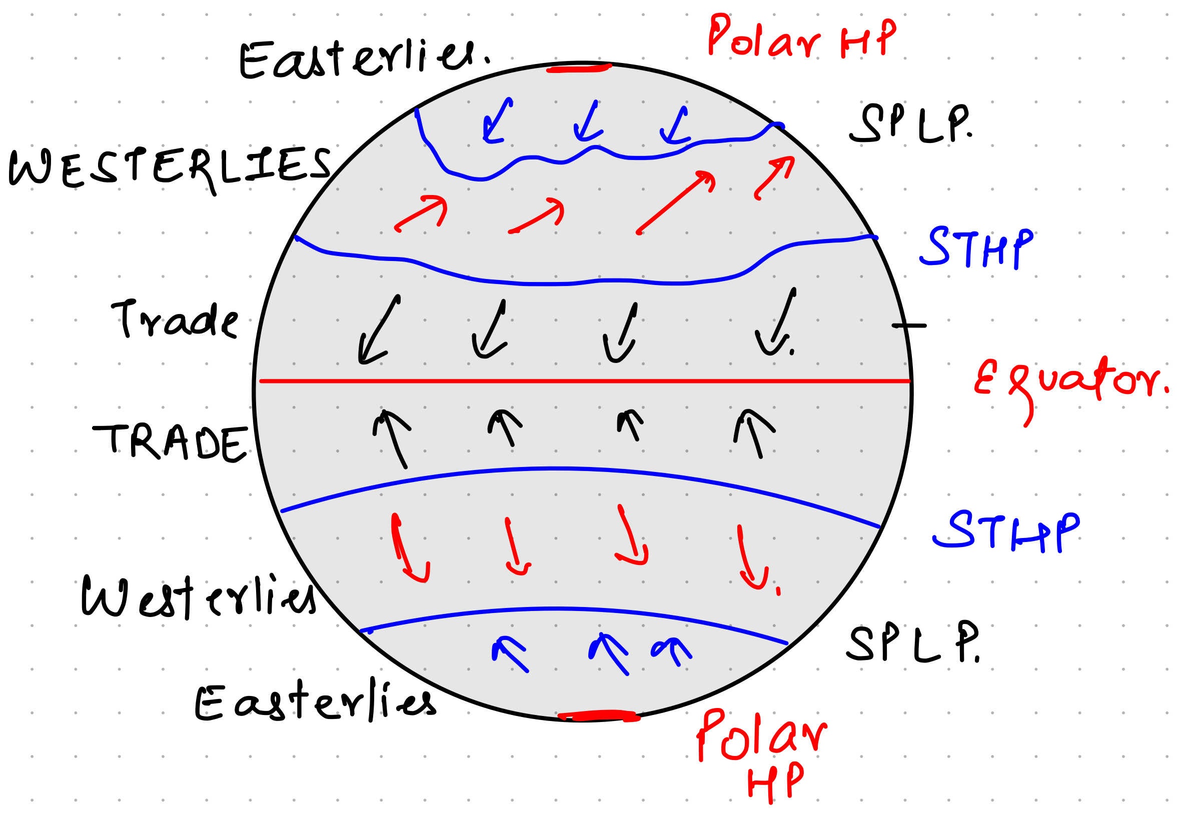
Low tempr. all the year.



↳ ITCZ shifts with Movement of sun

↳ During Monsoon
- over great plains.

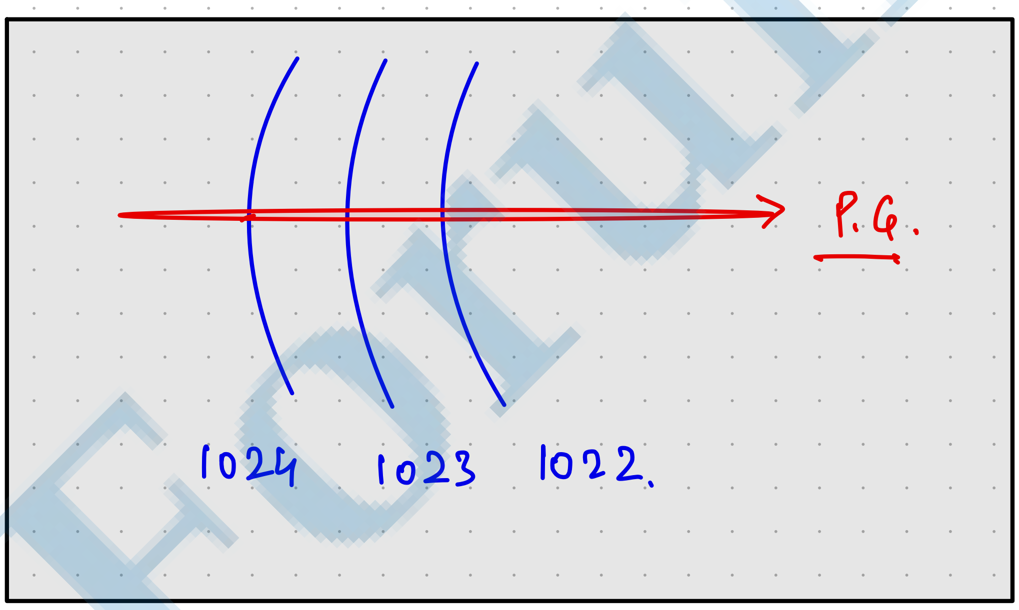
Also known as 'MONSOON TROUGH'



PRESSURE Gradient / Barometric slope

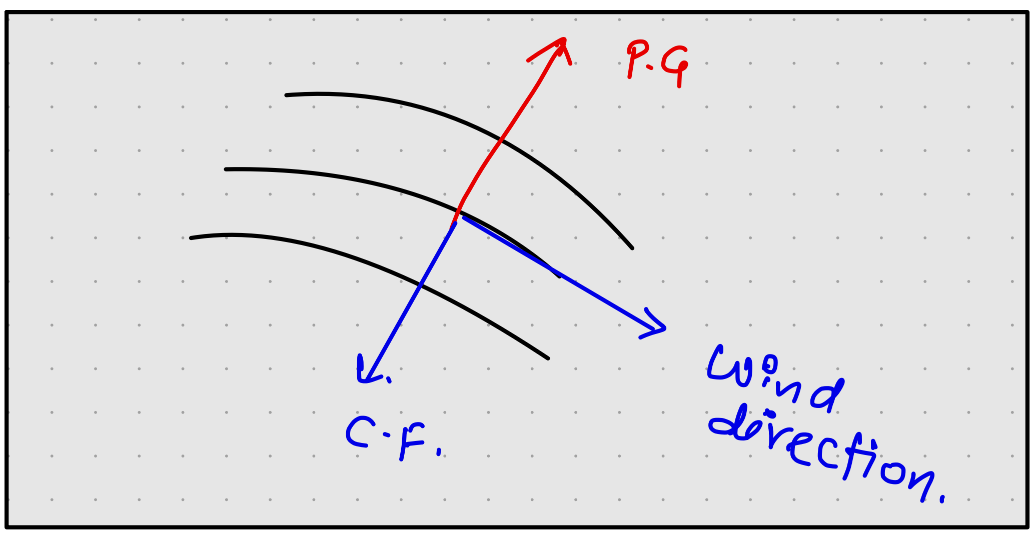
difference of pressure b/w two places.

- closely spaced isobars — steep gradient.
- widely spaced " — low P.G.



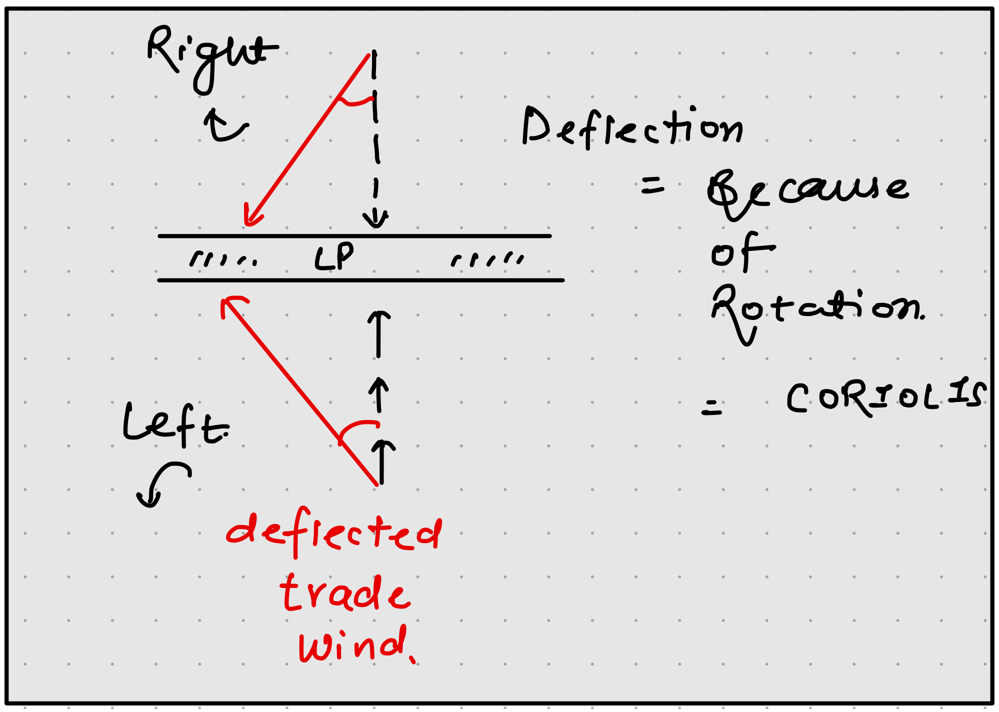
But due to coriolis force there is some deflection.

GEOSTROPHIC Wind ⇒



At Heights. →
Pressure gradient force is balanced by Coriolis force & wind blows exactly parallel to isobars.
= GEOSTROPHIC winds.

CORIOLIS FORCE ⇒



Not a force in real but an effect of rotation of Earth.

- Affects direction & Not speed.

- CF ∝ 1 / Rotational speed of earth

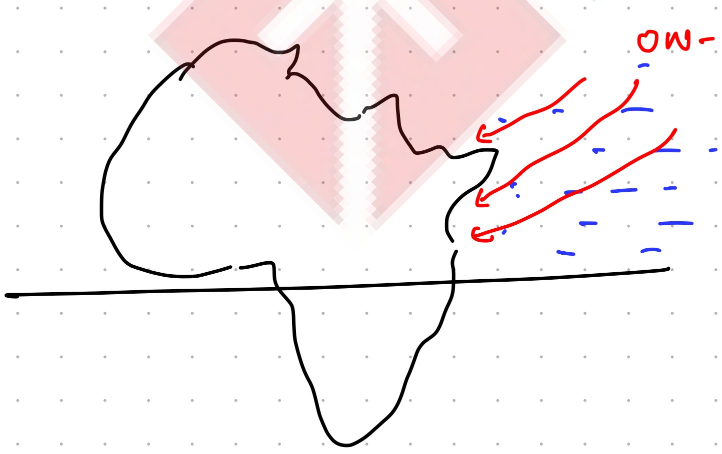
CF = Zero at Equator.* As rotational speed or sine function of latitude

Factors affecting winds →

1. Pressure gradient.
2. Coriolis force (only direction)
3. Frictional force (speed + direction)
4. Gravitational or centripetal forces.

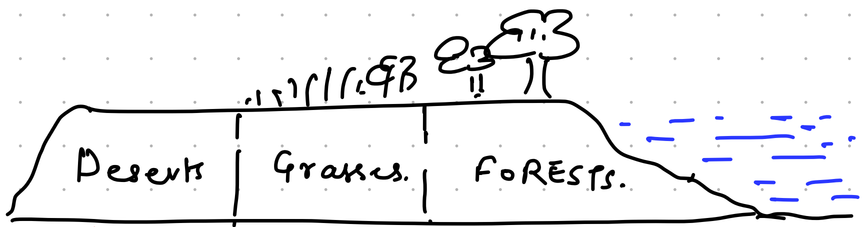
PRIMARY circulation / Global winds.

1. TRADE winds →



ON-SHORE Trade winds.

→ East coast of continent.

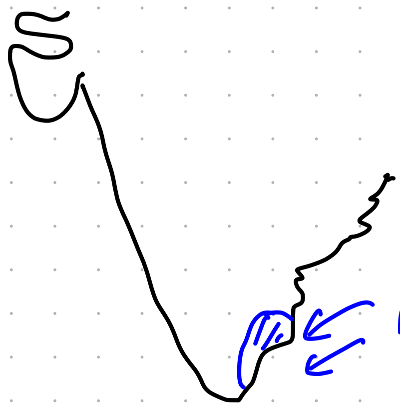


Deserts ↓ Hot deserts.

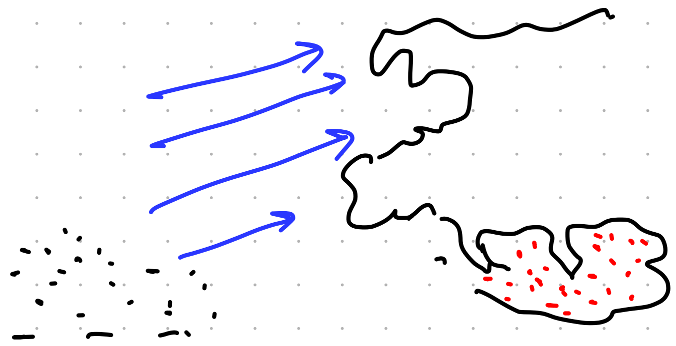
SAVANA Tall grasses ↓ Elephant. Tropical grassland.

MONSOON / Desciduous

Indian Monsoon* – Trade winds of Southern Hemi. (Modified)



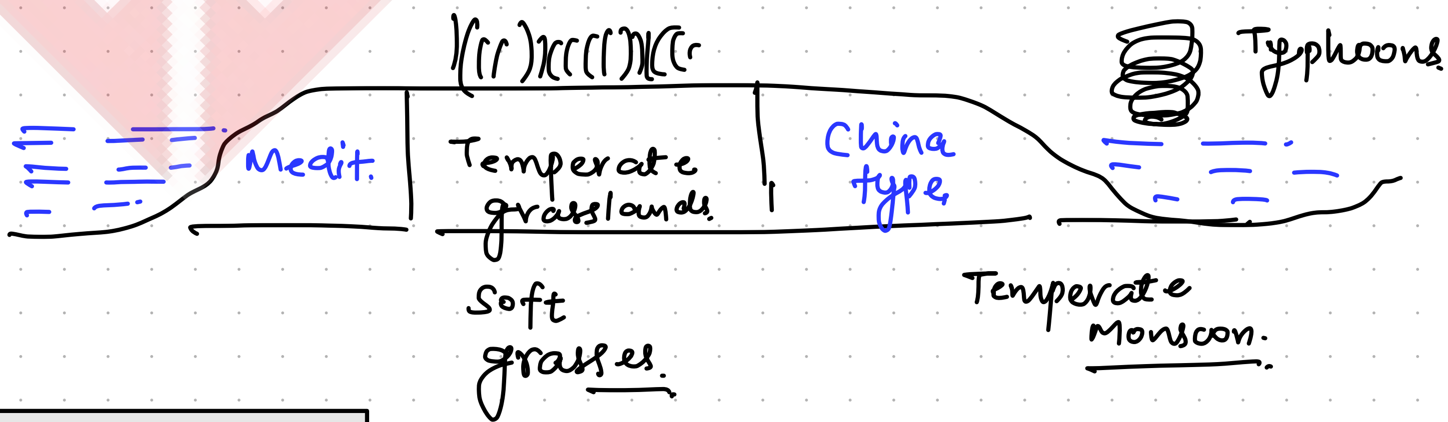
(9) **WESTERLIES** →



Moisture from oceans
↓
Rainfall over western part of Europe.

*British type of climate
(or) Western part Europe
Summer – 21°C
winter – 4°C.

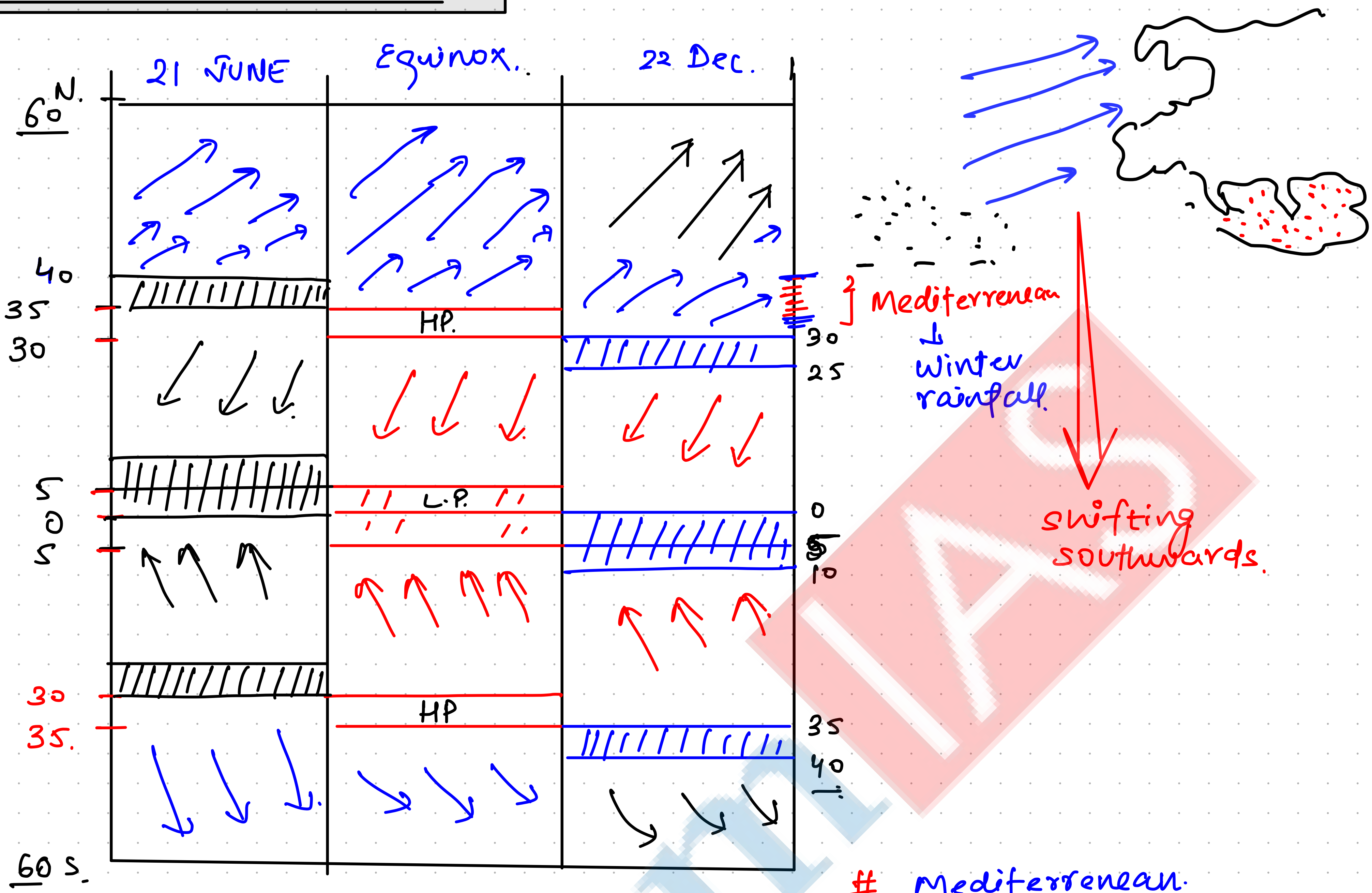
→ in Southern Hemisphere
land is less
∴ less obstruction.
Speed of westerlies ↑↑.
Roaring 40
Furious 50
Shrieking 60s.



Grasslands

- Prairies – USA
- Pampas – S. America
- Steppes – Russia
- Downs – Aust.
- Cantebury – NZ.
- Manchuria – China.

SHIFTING of Pressure Belts. ⇒

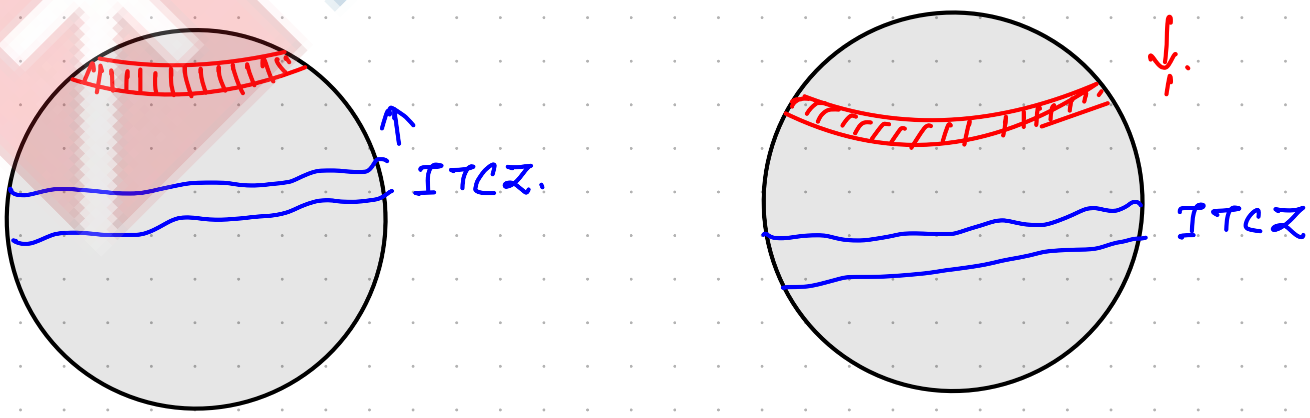


Mediterrenean Climate

- Dry summers (Trade) offshore
- wet winters. (westerlies)

⇒ Abundant sunshine through out the year.

③ POLAR EASTERLY. →



SUMMERS.

Westerlies invade the area of Polar Easterly.

Winters.

Polar Easterly Extends. & become strong.

Regional Winds.

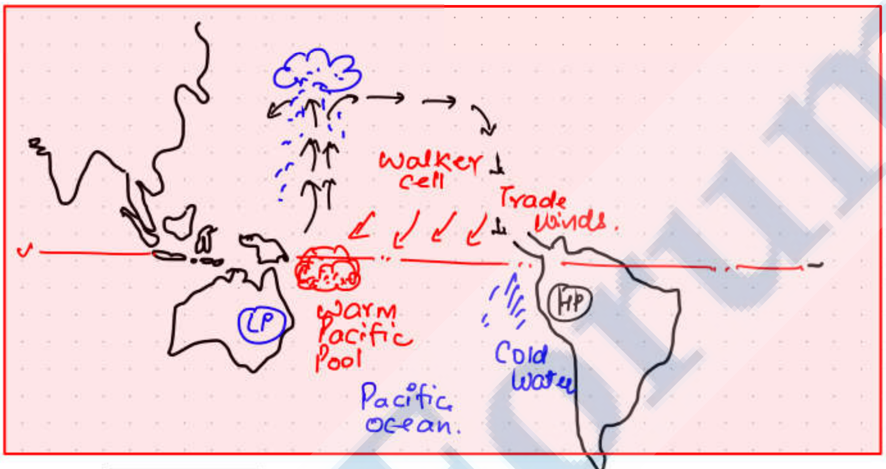
① Monsoon.

Factors → ① STJS (Subtropical Jet stream)
② Tropical Easterly Jet.
③ ITCZ.
④ SOMALI Jet.

Impact of.
- Indian ocean dipole
- La-Nina
- El-Nino

① Southern Oscillations. →

Normal conditions



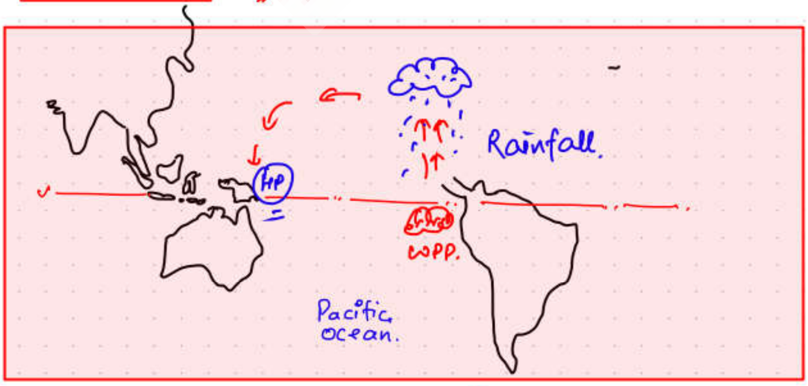
Normal

Rainfall over Australia.

After 2-3 Years.

S.O. ⇒ Oscillations in Pressure gradient & walker circulation

El-Nino



During El-Nino ⇒

- Low Pressure over PERU → Rainfall
- Australia → H.P. → dry.
- Trade winds = weak
  - ↳ impacts E's rotational speed. & day length.
- Walker cell → weakens.

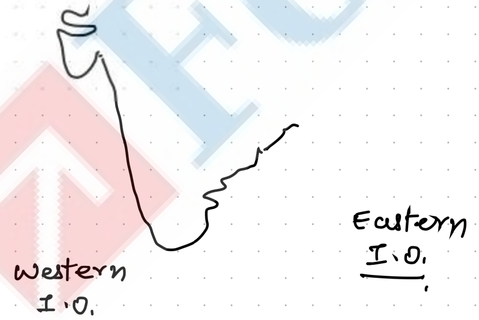
Southern Oscillation Index. ⇒

Darwin (Aust.) ———— Tahiti (French Polynesia)

Tahiti – Darwin ⇒
+ve = good for India
–ve = Not good.

ENSO →
Southern Oscillations associated with El-Nino.

Indian Ocean dipole →

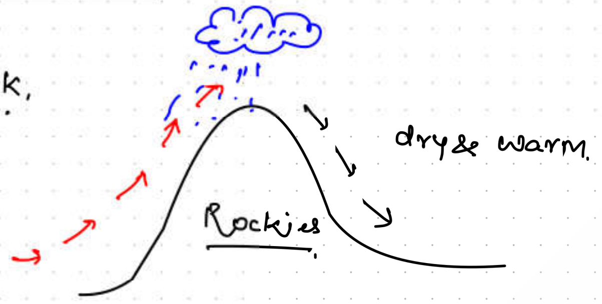


LOCAL Winds

- Topographic
  - Land & Sea Breeze
  - Mt. & Valley Breeze
- Geographic
  - Warm
  - Cold

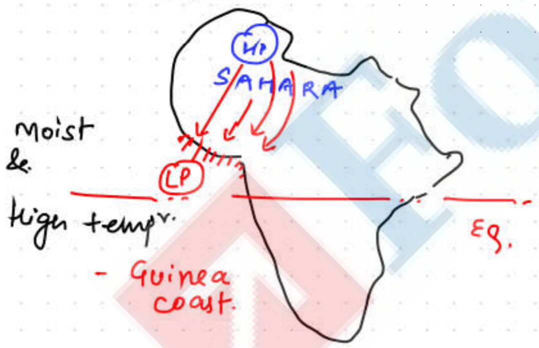
"Important LOCAL Winds" →

① CHINOOK.



Foehn – Alps
Santa Ana – USA.

② Harmattan. →



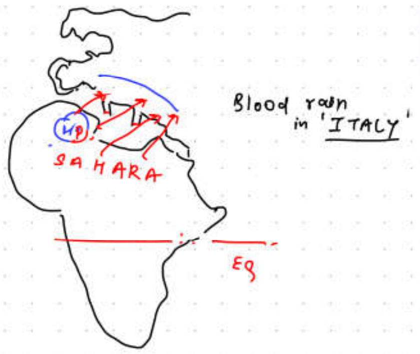
Similar winds.

Brickfielder – Victoria (Aust.)
Blackroller – USA plains
SHAMAL – Persian gulf.
NORWESTERS – N.Z.

③ SIROCCO

Dry & Dusty

Sand content (Red)
+
Moisture from Medit.



KHAMSIN	–	Egypt
Gibli	–	Lybia
Chilli	–	TUNISIA
Simoom.	–	Arab desert.

other WARM →

YAMO – Japan
ZONDA – Argentina
TRAMONTANE – central Europe

COLD LOCAL Winds. →

① MISTRAL ⇒

Extremely Cold
- in winters
(HP over Europe
LP over Medit.)

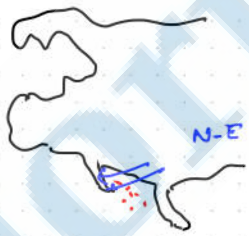
Through 'Rhone valley' → Violent cold winds
S. France
- Injurious to flights.

BISE – Extremely cold
= France

② BORA.

Extremely Cold

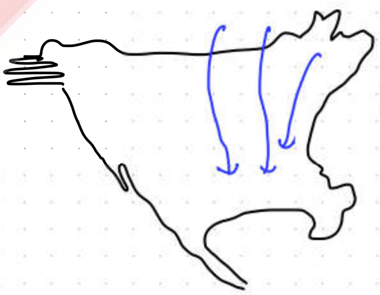
Italy ← Adriatic Sea



Levanter – strong Easterly
S. Spain

③ Blizzard

Extremely cold & Powdery



in Siberia
– BURRAN

No East-west Mt Barrier in USA.
So enters deep
Called 'Norther.'

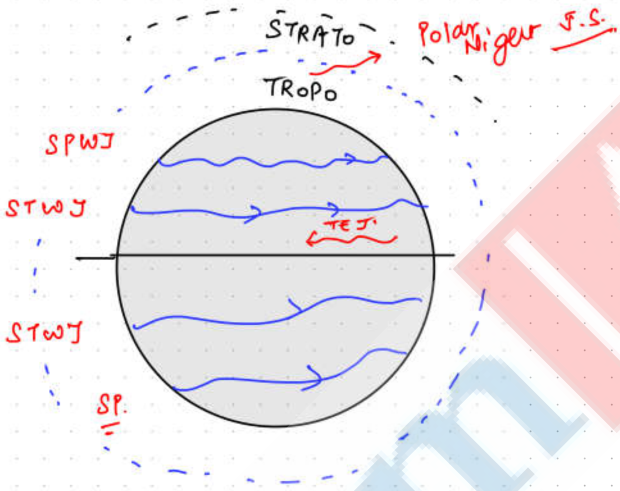
Other:

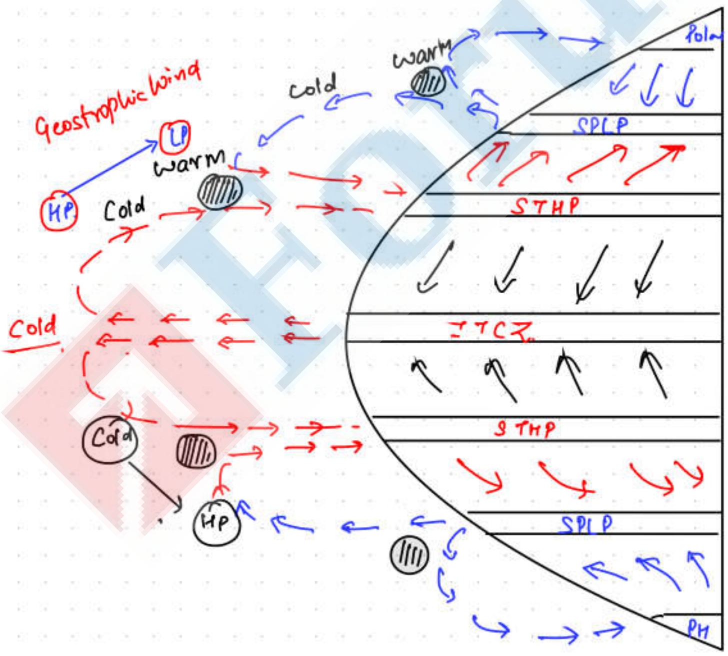
- PURGA — Snow laden → Russian Tundra
- PAMPERO — Pampas of S. America, Extremely cold

JET streams ⇒

- ✓ circumpolar.
- ✓ W to E
- origin – due to difference in tempr.
- 7.5 to 14 kms.
- ✓ wavy & MEANDERING.

(Rossby waves)





No Jet over Equator
↓
in upper air
No tempr. difference.

Absence of contrasting air masses

"Humidity & Rainfall"

Humidity – Amount of moisture actually present

Humidity capacity – moisture holding capacity

H.C. $\propto$ tempr.

* **Relative Humidity** →

$$\frac{\text{Absolute Humidity}}{\text{H.C.}} \times 100$$

$$R.H \propto \frac{1}{\text{tempr.}}$$

R.H = 100% = Saturated air.

(Dew point = tempr where saturation occurs)

R.H → determines instability & stability conditions

[80% to 20%]

Latent Heat of Vapourization

water ⟶ Vapour. ⟶ water

latent Heat of Condensation.

Cloud formation →

↳ coalscense & coalition process.

condensation

Evaporation

CLOUDS

Height

Cirrus. – High (8 – 20 km)
(icy, transparent)

Alto. – Mid (2.5 to 6 km)

Stratus – Lower (2.5 km)

SHAPE

Stratus = thin & sheet like

Cumulo ⇒  cummulative

if Rainfall ⇒ Nimbus*.

Cirrus Clouds. (Albedo ↑ ↑)

fibrous appearance.

MARES Tale

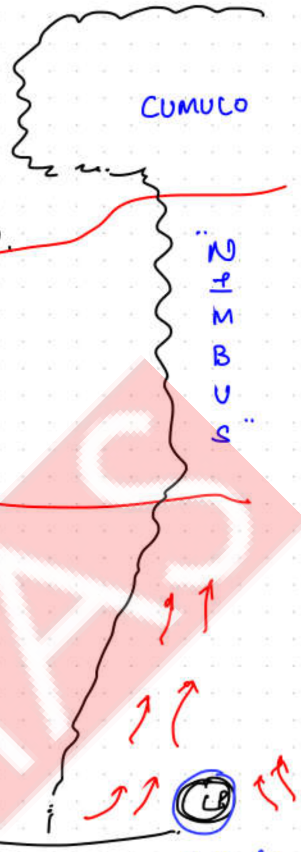
MACKEREL SKY

Patches of round clouds (Dotted sky)

HALO

Sheet, thin & layered white

Brilliant Halo of sun & moon.



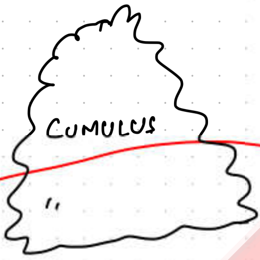
ALTO

Alto-Stratus

watery look.

CUMULUS

wool pack cloud

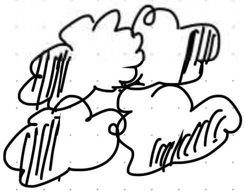


with No definite Height

Base – Near ground

STRATUS.

Dark.



Close to ground

if rainfall.

= Nimbo-stratus.

Light, Moderate & Heavy rainfall

No lightening & Thunder

Rough rounded

- contrast b/w. dark & white sides

Fair weather

A large single cloud.

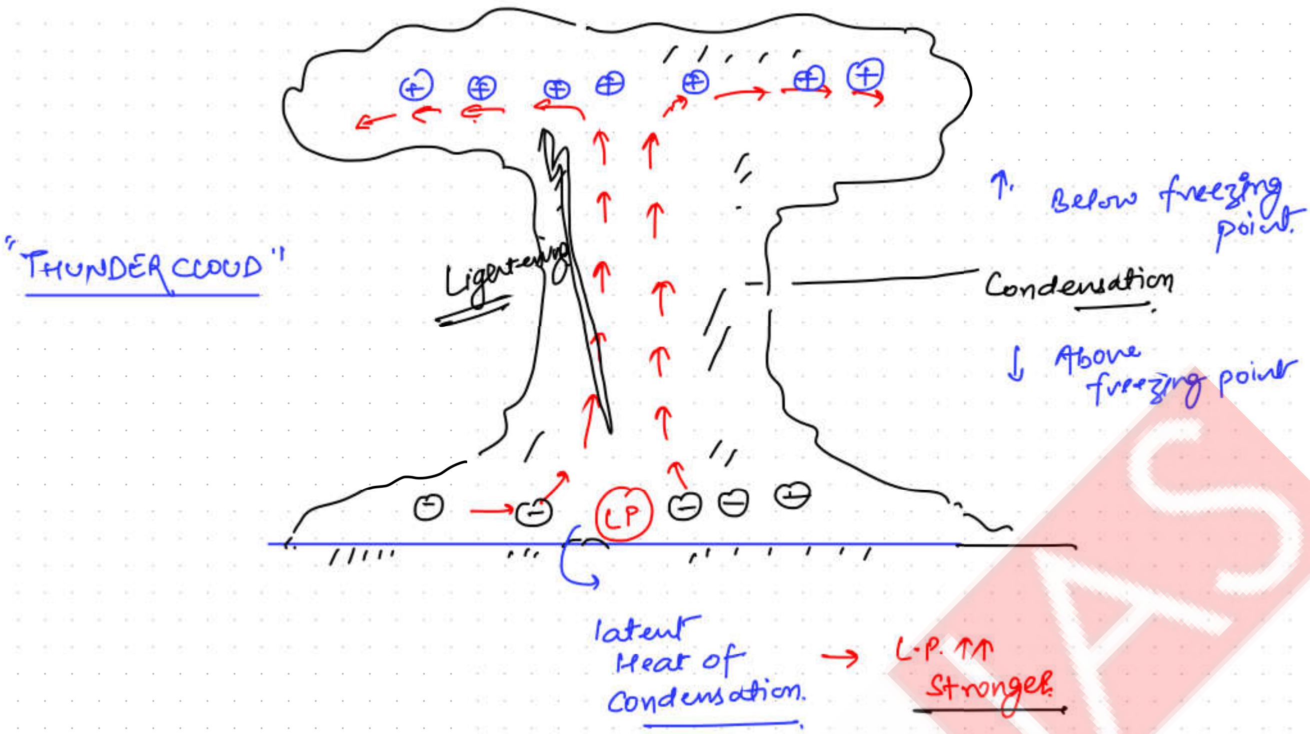
- generally white in color.

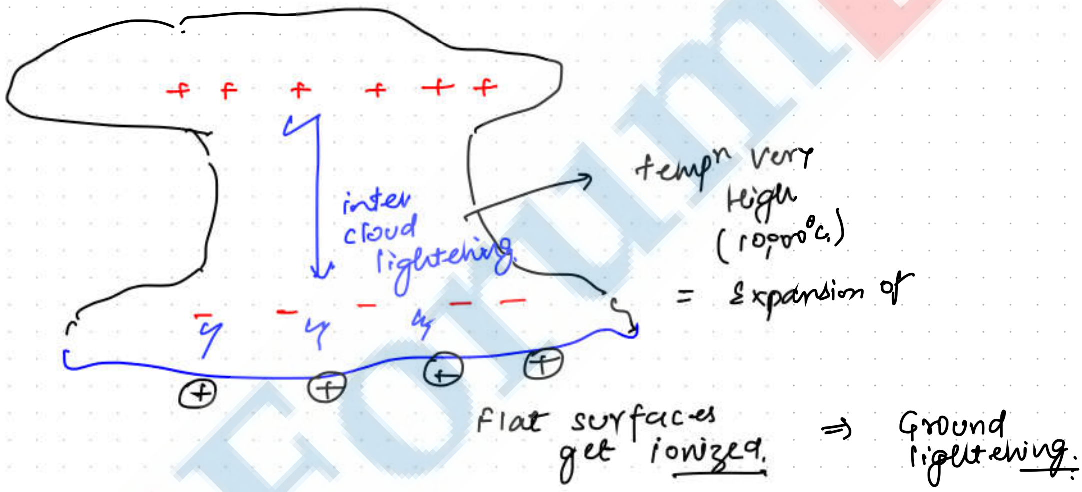
Rounded top & flat Bottom

→ warm weather conditions

- Tropics & sub-tropics

- Fair weather & No rainfall

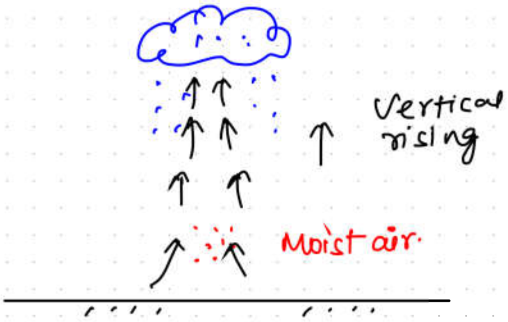

"THUNDER CLOUD"
Ligertening
LP
↑ Below freezing point.
Condensation
↓ Above freezing point
latent Heat of Condensation. → L.P. ↑↑ Stronger.


inter cloud lightening
tempn very High (10,000°C)
= Expansion of
flat surfaces get ionized. ⇒ Ground lightening.

Rainfall

- Convectional
- Orographic
- Cyclonic rainfall

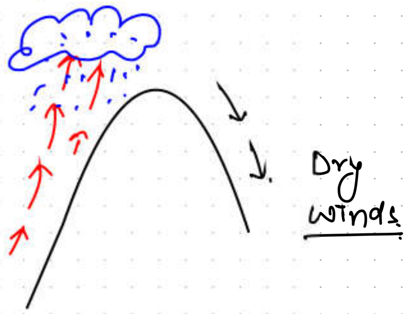
Convectional



Eg. Equatorial rainfall

↳ 4'o clock rain.

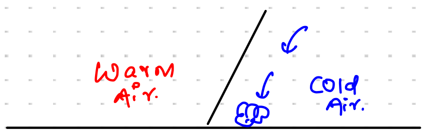
Orographic



Airmasses, Fronts & cyclones.

"Airmass" – Large body of air with uniform temp., moisture & lapse rate.

Fronts. →



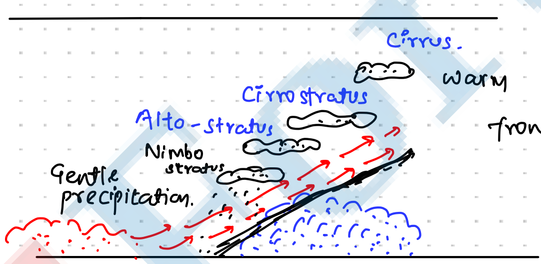
1. Contrast airmass
2. CONVERGENCE

FRONTS. ⇒

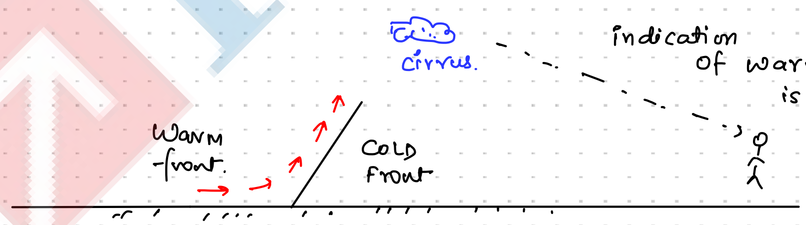
- Warm
- Cold
- Stationary
- occluded

① WARM →

warm air gently rises & ∴ sheet like cooling

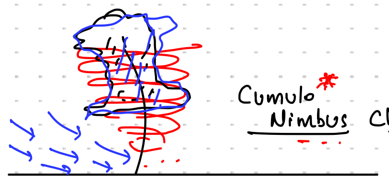


moving through West



Cooling in sheet like manner = stratus clouds

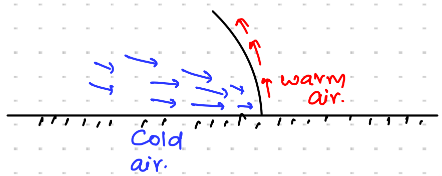
③ Cold front ⇒



Cumulo* Nimbus Cloud

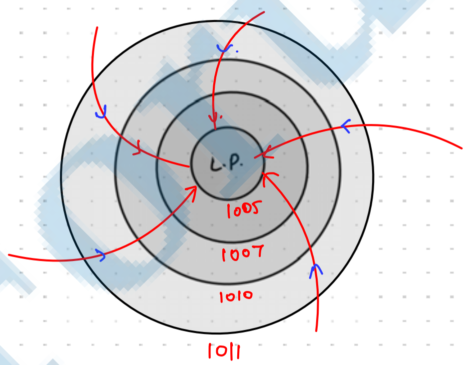
Steep Slope → Fast rise = Rainfall ↑↑

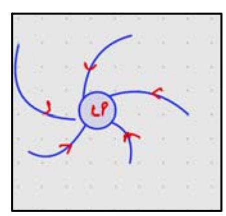
with
- Thick clouds
- Heavy rainfall
- Thunderstorm
- Snowfall & Hailstorm.



CYCLONES. ⇒

Closed isobars & Pressure increasing outwards.





Northern Hemisphere

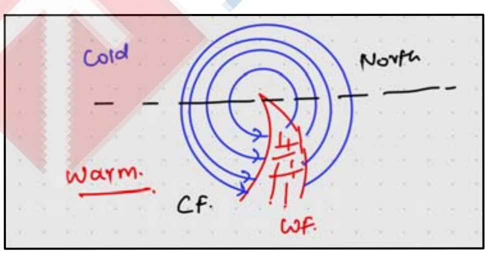
CYCLONES.

- **Tropical**
  - 10-30°N & 10-30°S
  - Trade wind belt (W ← E)
- **Extra-Tropical** or Temperate cyclone
  - 35-65°N & 35-65°S.
  - (westerly W → E)

Extratropical cyclone ⟹

wave cyclone / extra / Temperate

- contrasting air masses. (fronts)
- Origin – Both land & sea 35-65° N&S.
- No closed isobars
- W → E
- Have different tempr. in different parts.
- Pressure gradient is not strong. ∴ wind speed = 35-40 kmph



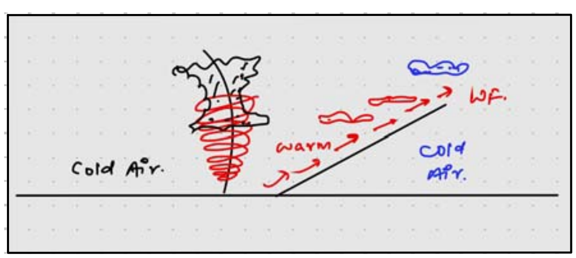
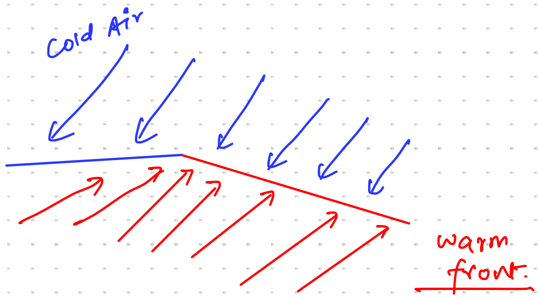
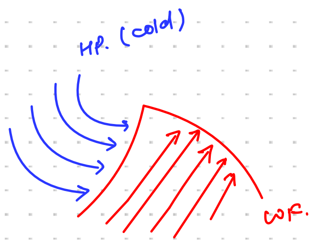


Fig. temperate cyclone

CYCLONE formation *



①

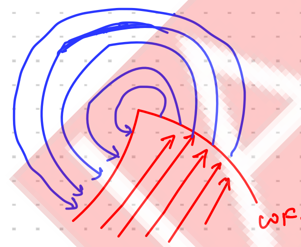


Pressure gradient

HP → LP
cold warm.

deflected due to CORIOLIS force

②



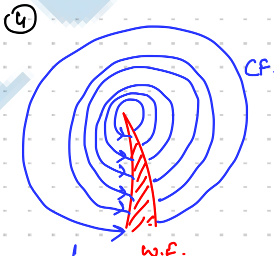
Cold air vertically uplifting warm air.

warm air rising over cold air.

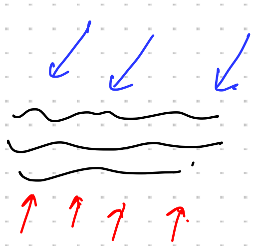
(Area of warm front ↓)

③

④



↓ Cold front completely takes the warm front = Occluded front



Cold air on the ground (warm air) ✗

Northern Hemisphere.

TROPICAL CYCLONES →

Depression	< 68 KMPH
Cyclonic storm	68 – 120 KMPH
Cyclone	> 120 KMPH

Conditions →

1. Warm sea surface > 27°C
2. Coriolis force (Absent in 5°N & 5°S)
3. ITCZ.
4. Latent Heat of condensation.
5. H.P in Upper Atmosphere (Anticyclonic)

Different Names ⇒

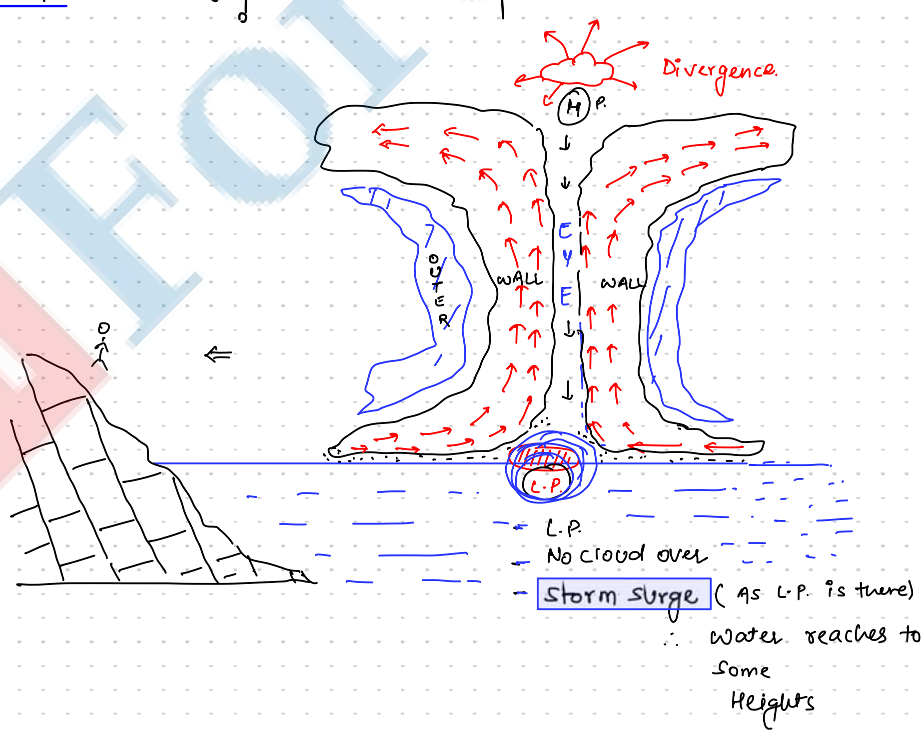
Hurricane – gulf of florida & mexico

Typhoon – S. China Sea

Taifu – Japan

Willy-willy – Australia.

Baguio – Phillipines.

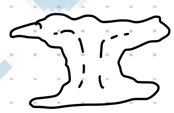
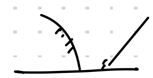


TROPICAL CYCLONE →

Diameter → 80 – 300 km
Speed

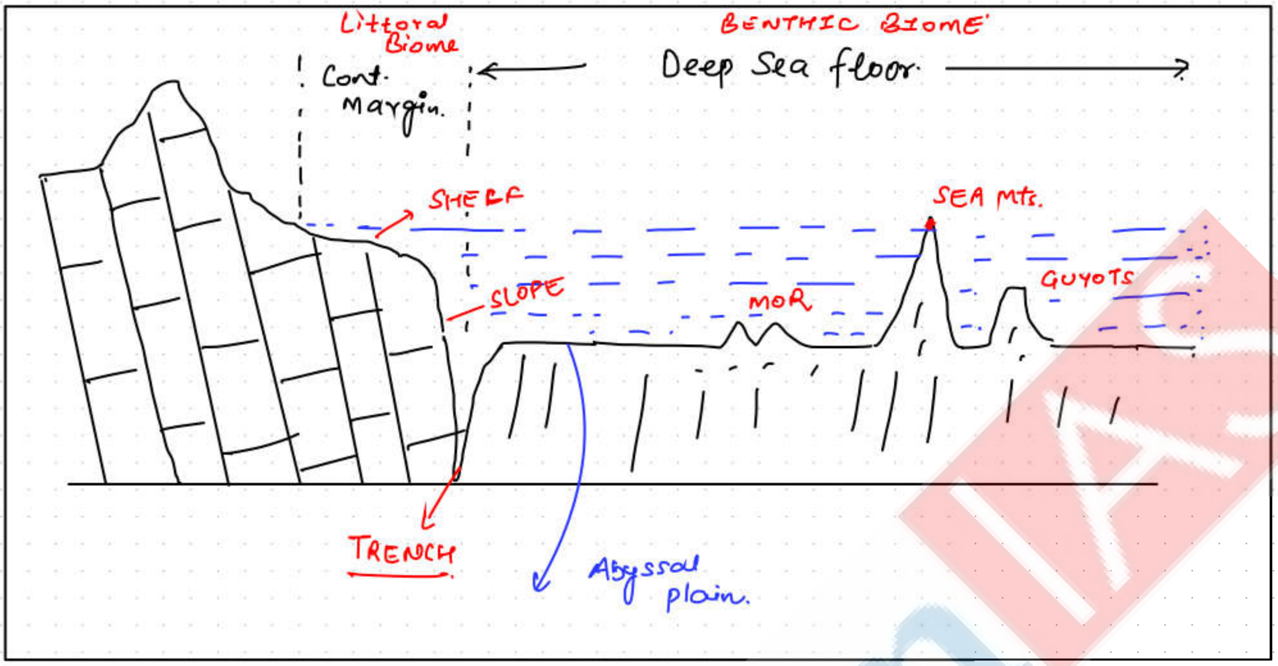
Extent – ITCZ
Extremely low pressure & closed isobars.

TROPICAL CYCLONE	TEMPERATE CY.
Tempr. variations ✗	✓
Rainfall everywhere	only in fronts.
W ← E	W → E
Affected area ↓	↑↑
in summers & over oceans.	Any time over land & sea

	Tropical	Temperate
Origin location	10 – 25° N & S.	30 – 65° N & S
Mechanism origin	Extreme Heating (Thermal)	Fronts (Dynamic)
Source of Energy	Latent Heat of condensation	Difference of tempr. Cold & Warm
Pressure	Closed isobar PG ++ Speed greater	Not closed PG less speed ↓
Tempr	Uniform warm	different temperature
Precipitation	Heavy rainfall CumuloNimbus 	Across fronts Cold – Heavy warm – light 
Impact	Natural disaster	much Needed rainfall in India

OCEANOGRAPHY

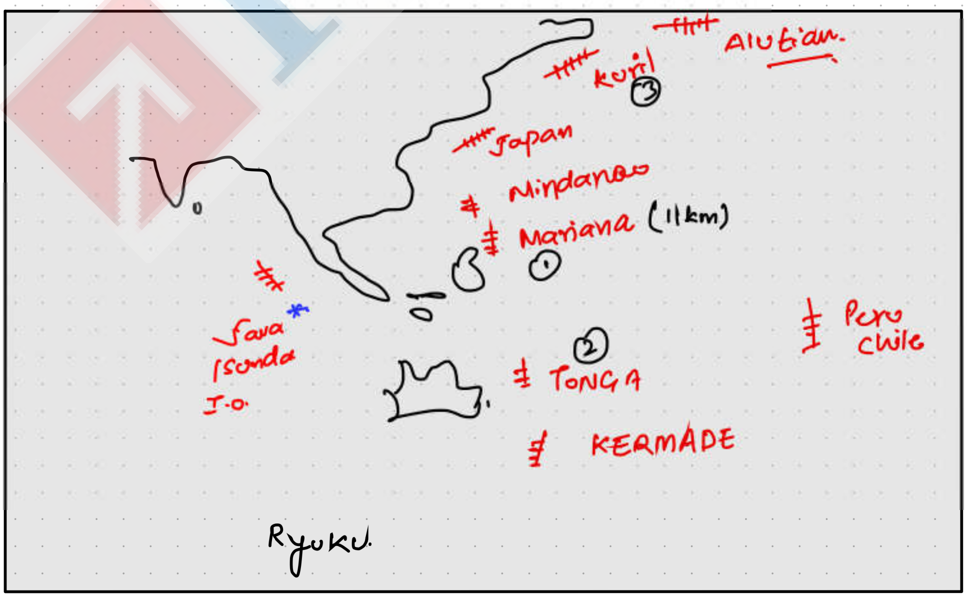
OCEAN BOTTOM TOPOGRAPHY / Hypsographic curve / BATHYMETRIC CURVE



CONTINENTAL Margin.
- Slope – 2-5°
- SHELF → Slope 1-3°, 600 Feet.
- Rise

Deposition (E. Coast) & W. coast (Wide)

Abyssal plain –
- Trenches
- MORs
- SEA mound
- GUYOTS.



Atlantic OCEAN –

Puerto rico
Romanche / Tizard deep.

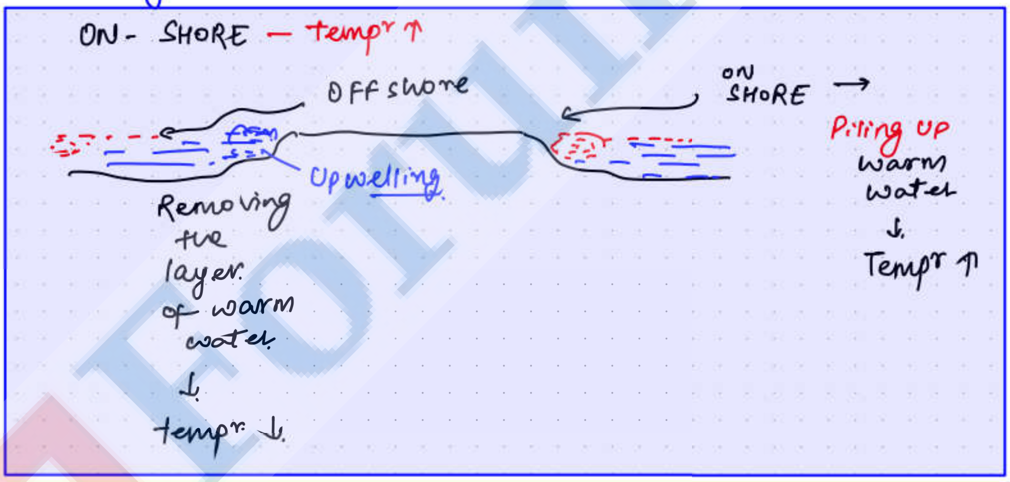
TEMPERATURE

Factors
Horizontal dist^n
Vertical dist^n.

- Avg. tempr of Northern Hemi. ocean's = greater
(land ++)

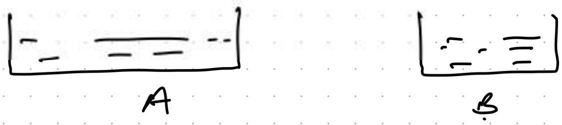
FACTORS. →

1. Latitude – insolation
20°N.
2. Ocean currents
3. Prevailing winds



- ONSHORE – High tempr.
lower latt. Eastern coast.
Higher latt. – W. coast.

4. Weather conditions
5. Enclosed sea.



Lower latt. B > A

Higher latt. A > B , B cools faster

small & marginal seas at low latt. — High temp^n

Eg. Red sea > Meditt. Sea.

High latt. →

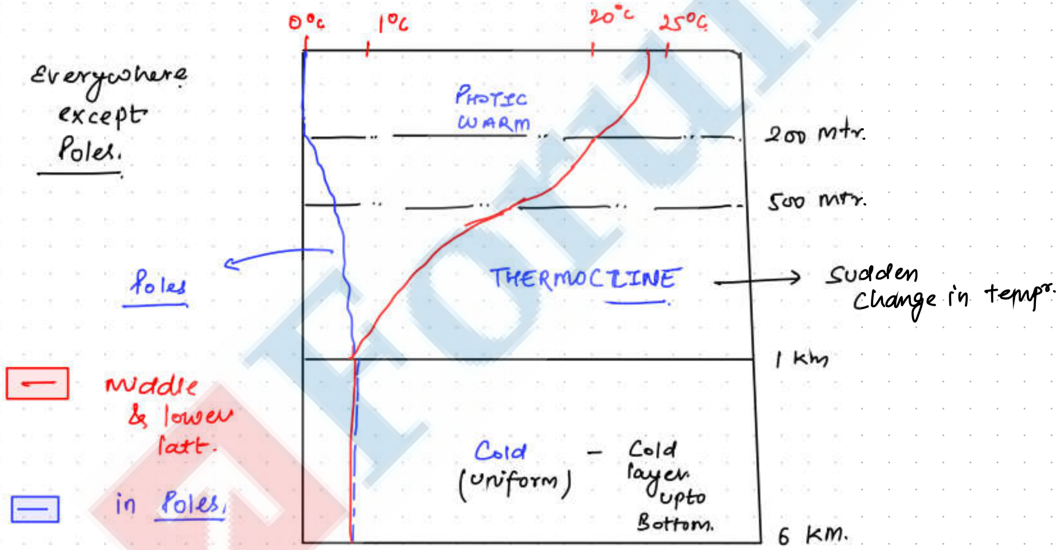
Enclosed Sea = low tempr.

Eg. – North sea (open) > Baltic

Horizontal distribution. →

(1) equator to pole → tempr. ↓
Except (25-30° latt.)

(2) vertical distribution. ⇒



SALINITY

FRESH WATER
(0-5‰)

- LOTIC – MOVING Rivers
- LENTIC – Stagnant - LAKES
  - WULAR (OXBOW)
  - DAL
  - KOLLERU (K-G)
  - LOKTAK (MANI)

BRAKISH
5-35‰

- CHILKA
- PULICAT (AP & TN)
- VEMBANAD
- ASTHAMUDI.

SALINE
35-50‰

'OCEANS'

BRINE
> 50‰

- SAMBHAR
- Dead SEA (Is-Jord)
- GREAT SALT LAKE (UTAH)
- VAN-GOLU (TURKEY)

Factors Affecting →

① Fresh water -
River water reduces salinity
- B.O.B < Arabian Sea
- Persian gulf < Red sea
  - ↳ Euphrates & Tigris.

② Rainfall - Equatorial region less salinity
- A&N < B.O.B.

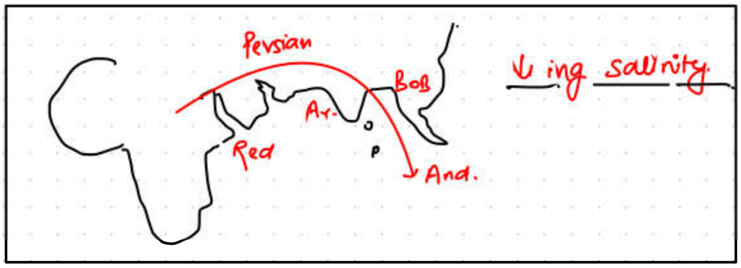
③ Melting of ice caps & glacier.
Eg - Baltic sea
- Gulf of Bothnia.

Factors increasing salinity

① Evaporation.*
② Temperature* ↑
  └ warm currents. (ON-shore)
③ Mixing of water.*

Red Sea > PERSIAN Gulf > Arabian > B.O.B. > Andman

(small & evaporation is faster)



Mediterrenean Sea > Black Sea > Caspian Sea.

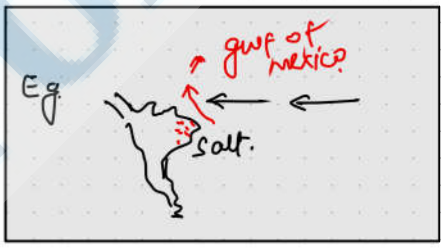
(Evaporation ↑↑) (Rivers) (Volga)

③ Atmospheric pressure & winds –

Stable air (HP.) & High tempr. = ↑ salinity = STHP

Gulf of Mexico > Gulf of California.

④ Circulation of oceanic water →



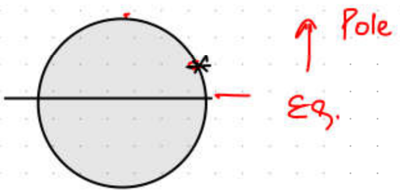
Horizontal salinity distribution →

Avg. = 35 ppt

Southern Hemi > Northern Hemi

less on Equator – Rainfall

least on Poles – ice caps



⇒ decreases Except STHP Belt (20–40°N) Highest.

Vertical Salinity →

500 mtr. — 1000 mtr. = Sudden change
- Halocline

'No definite trend'

MOVEMENT of Water

MOVEMENT OF OCEAN WATER.

WAVE

Rise & fall due to frictional force of winds

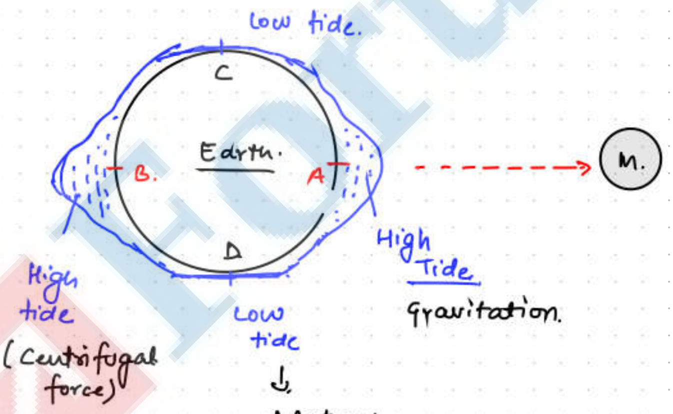
TIDES.

Rise & fall.

Gravitational force of sun & moon.*

(Movement towards coast. — High tide

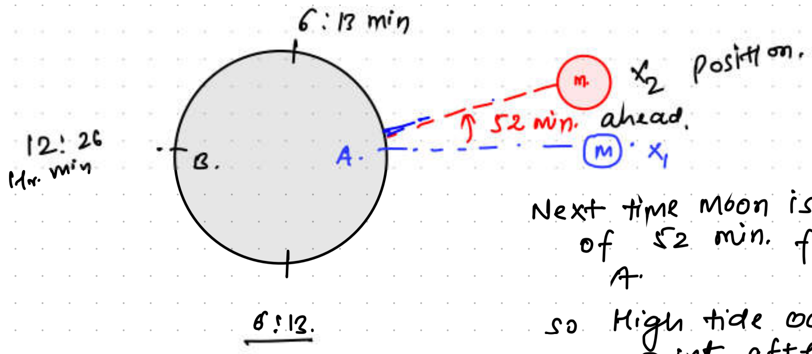
towards sea — low tide Ebb.



↓

Water is Pulled away towards High tides.

*. Next day delay of 52 min.



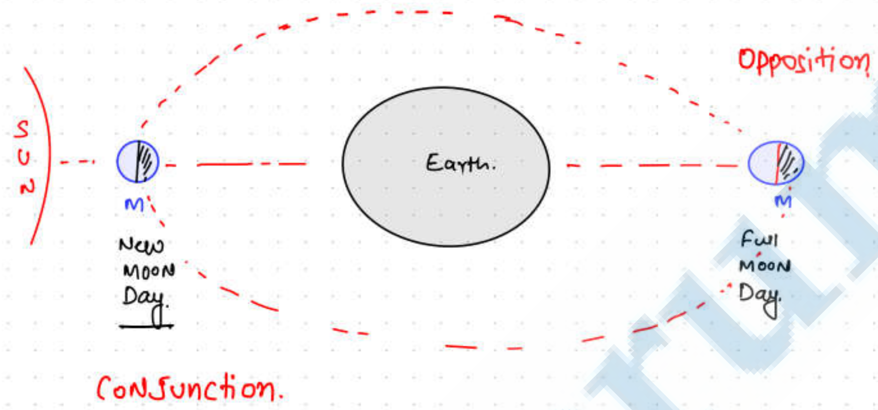
Next time Moon is ahead of 52 min. from place A.

so High tide occur at this point after 52 min.

other High tide = 52/2 = 26 min delayed

Type of Tides ⇒

SPRING TIDE

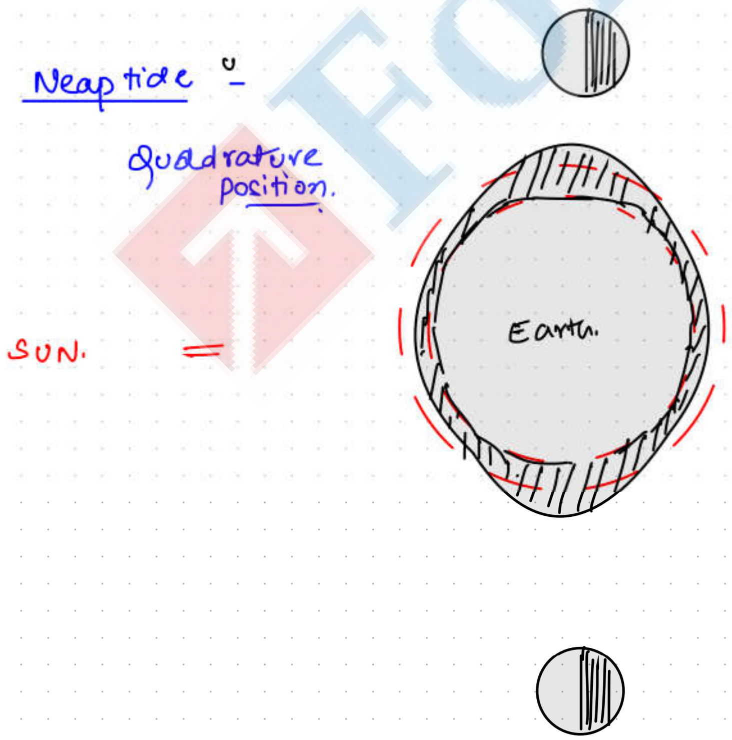


SYZYGY *

Spring tides (High tide) 25% greater than Normal.

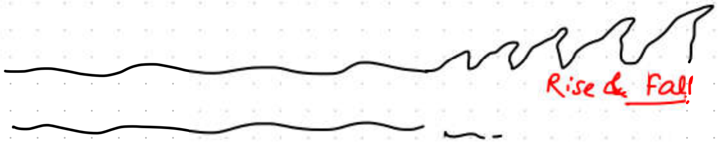
② Neap tide :-

Quadrature position.



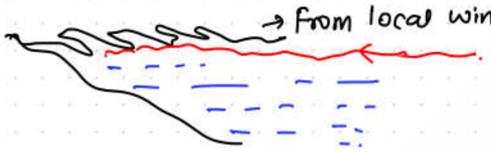
WAVES ⇒

- Rise & fall of oceanic water due to frictional force of wind



- ✓ Energy & not the water which moves.
- ✓ Small circles → due to gravity & friction.
- ✓ Surface water phenomenon.

WAVE approaching coast → slow & breaks.



Steady with slow speed caused by Permanent winds. & may have originated in other Hemisphere

Steep → By LOCAL winds.

wave – imp. form of Energy

wave + Tidal Energy potential ≃ 53 GW

OCEANIC currents →

General Movement of mass water in definite direction.

- Cold currents.
- warm currents.

Drifts – Speed ↓

Currents → Speed ↑

Streams. → Speed & Volumes ↑

Origin:

① Rotation of Earth.

- coriolis force

- equatorial currents.

② Oceanic factors.

temp^r.
salinity & Density

Surface – less density
depth – High densi
movement.

Atlantic Ocean ⇄ Meditr. sea (High salinity)

→ Lower density to High density

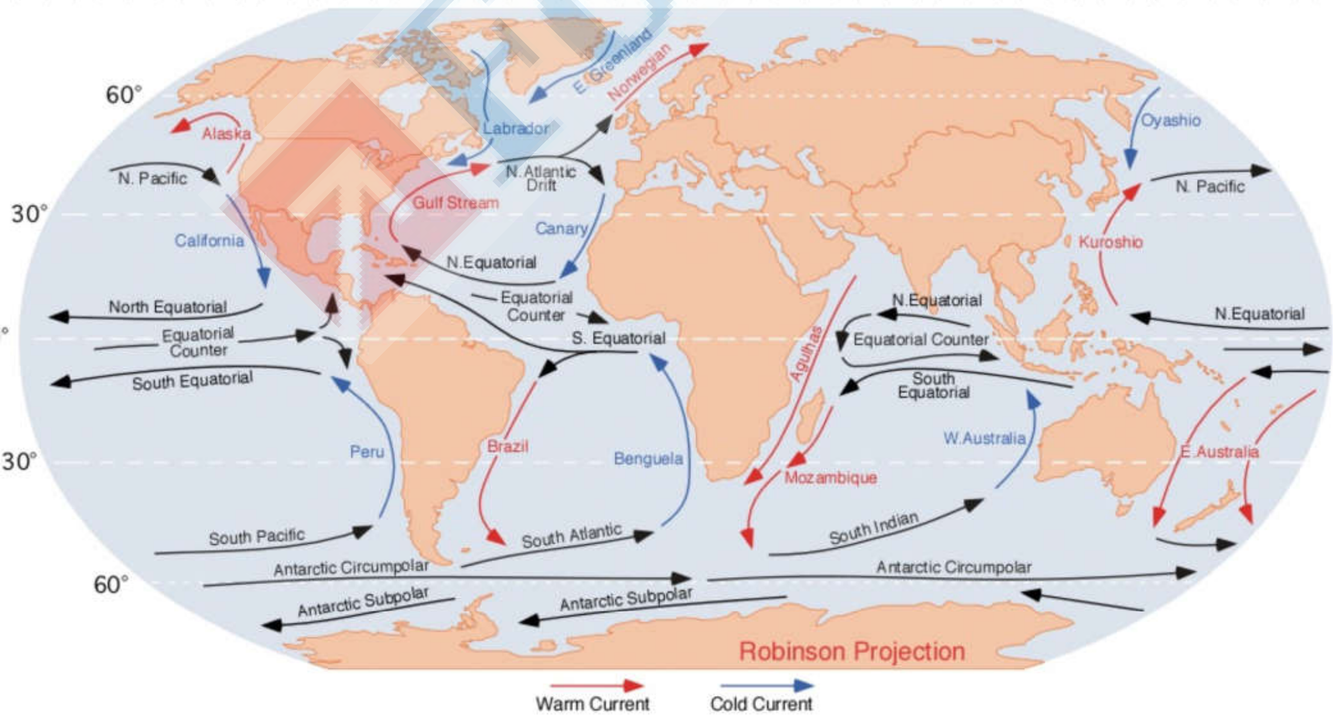
③ Atmospheric factors.

Air. pressure & winds

④ Rainfall & Evaporation. → Rainfall ↑ → water level ↑
↳ water moves in low water areas.

Modifying factors –

- configuration of coasts.
- Bottom relief.
- Seasonal variation (I.O. – monsoon)



Drainage System and Patterns

INDIA

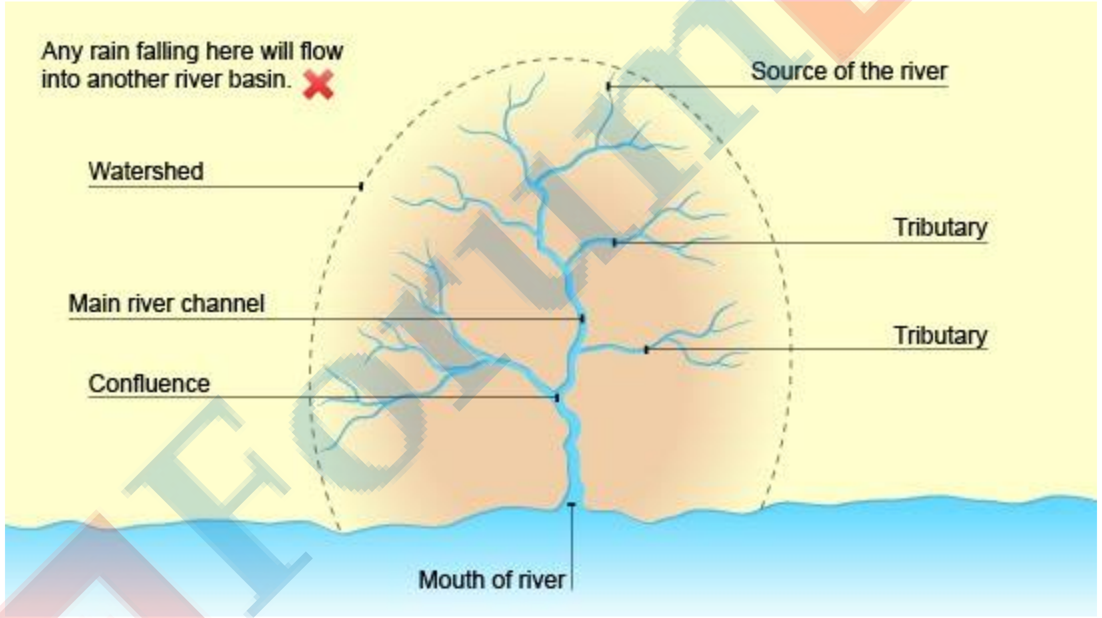
What is Drainage?

- The **flow of water through well-defined channels** is known as Drainage.
- Natural or artificial removal of surface water and sub-surface water from an area with excess of water.
- ‘Drainage’ is a term that defines an area’s river system.

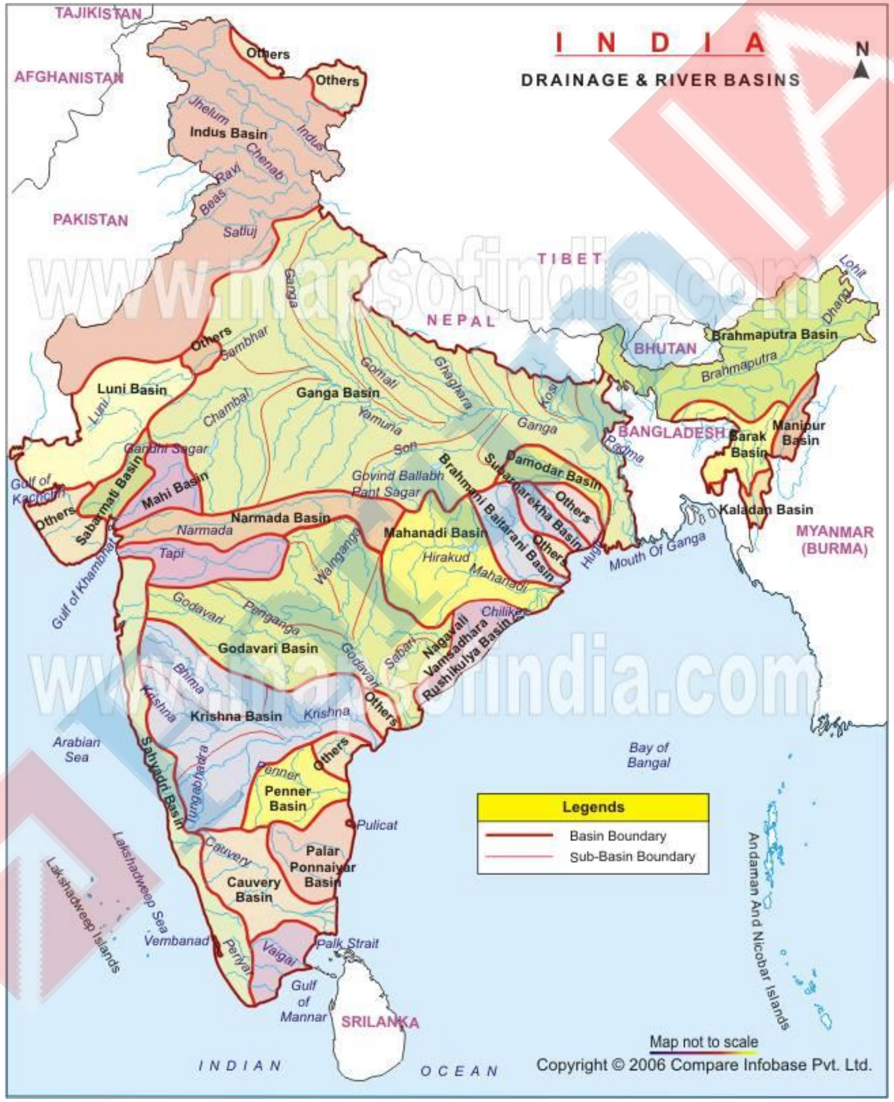
What is Drainage Basin?

- A drainage basin is any area of land where **precipitation collects and drains off into a common outlet**, such as into a river, bay, or other body of water.
- The drainage basin includes **all the surface water** from rain runoff, snowmelt, hail, sleet and nearby streams that run downslope towards the shared outlet, **as well as the groundwater underneath** the earth's surface.
- The drainage basin **acts as a funnel by collecting all the water within the area** covered by the basin and channeling it to a single point.
- Other terms for drainage basin are catchment area, catchment basin, drainage area, river basin, water basin, and impluvium. In North America, the term **watershed** is commonly used to mean a drainage basin

Diagrammatic Representation

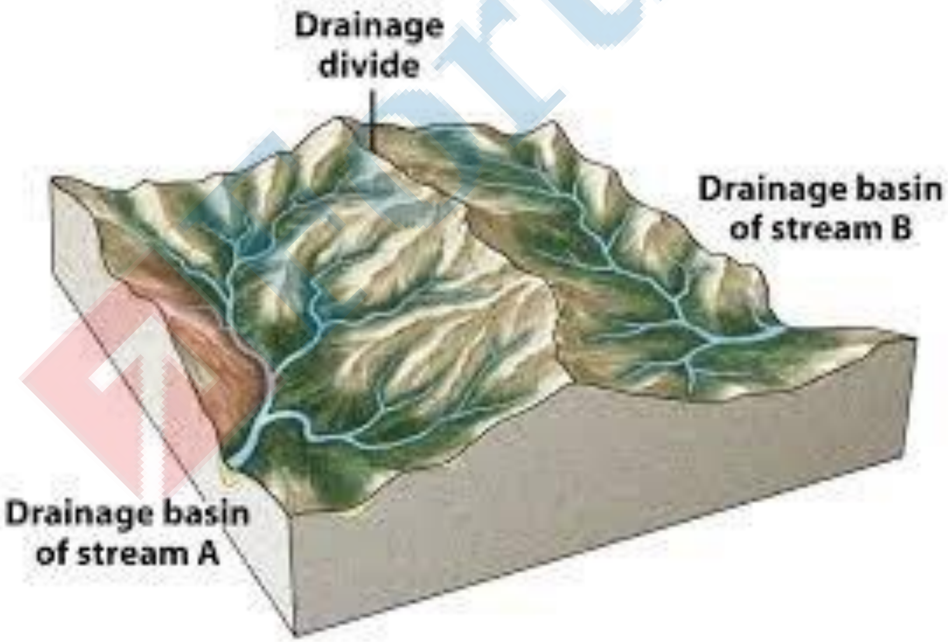


Drainage Basins of India



What is Drainage Divide?

- Each drainage basin is **separated topographically from adjacent basins by a perimeter**, the drainage divide, making up a succession of higher geographical features (such as a ridge, hill or mountains) forming a barrier.



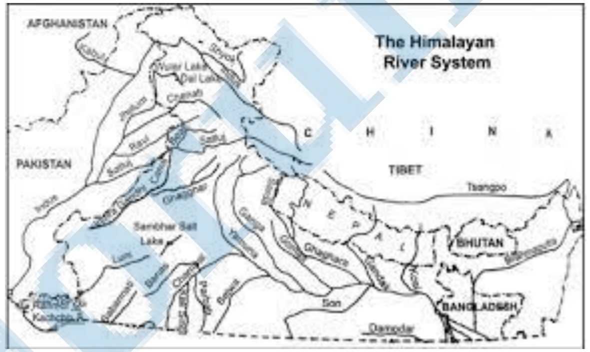
What is Drainage System?

- Drainage systems, also known as river systems, are the **patterns formed by the streams, rivers, and lakes in a particular drainage basin.**
- They are **governed by the topography of land**, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.
- The number, size, and shape of the drainage basins varies and the larger and more detailed the topographic map, the more information is available.

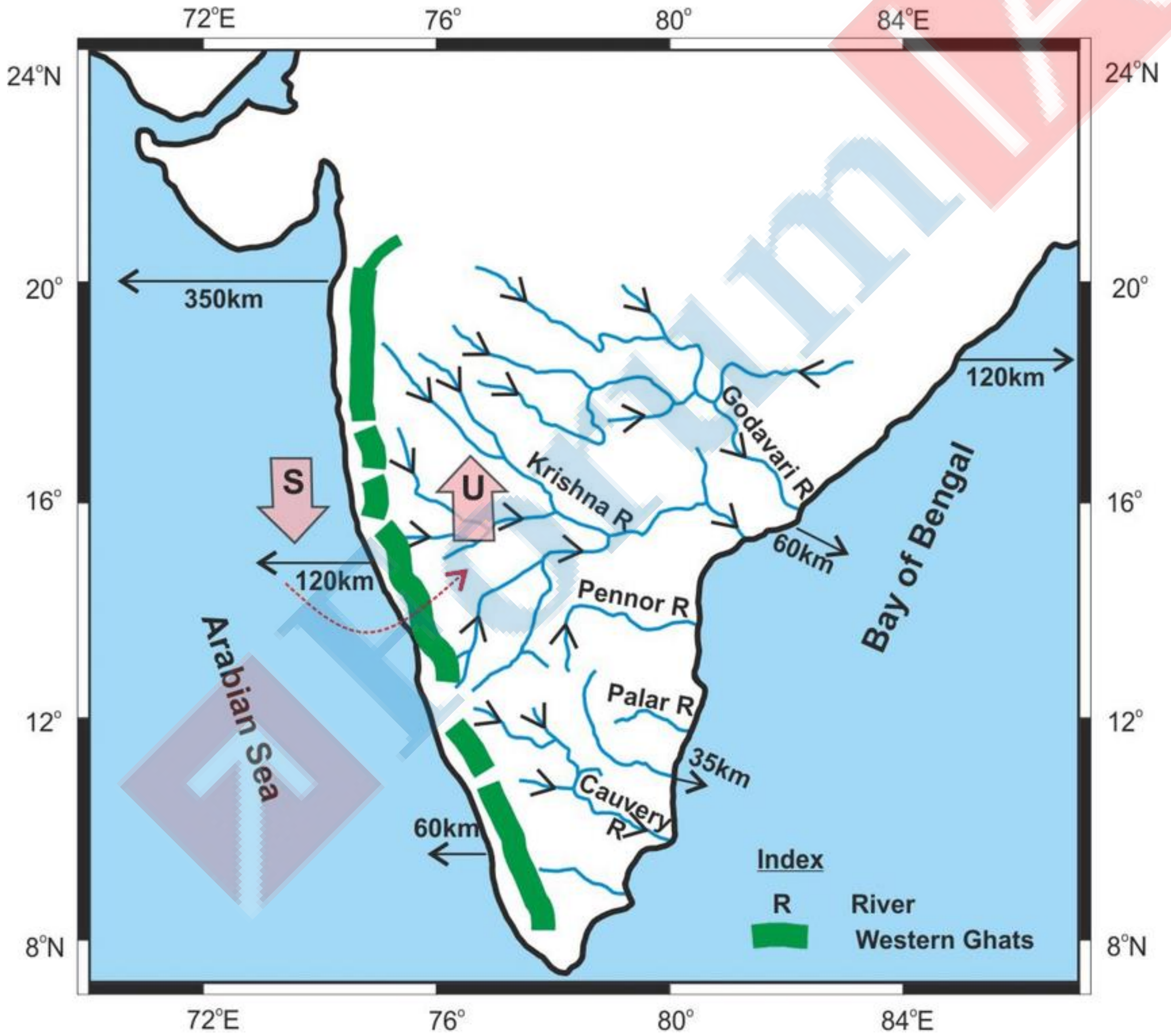
What is Drainage Pattern?

- Drainage pattern refers to the **geometrical patterns in terms of geometrical shapes** that rivers and streams develop in a particular drainage basin.
- **Factors** governing drainage Pattern:
  - Topography of Land
  - Gradient of Land
  - Climatic Condition
  - Rock types
  - Geological structure

Drainage Pattern – Himalayan Rivers



Drainage Pattern – Peninsular India



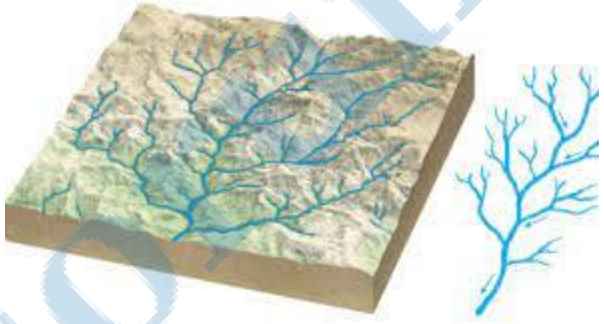
Broader types of Drainage Pattern

- **Concordant**
  - Consequent
  - Subsequent
  - Obsequent
  - Resequent
- **Discordant**
  - Antecedent
  - Superimposed

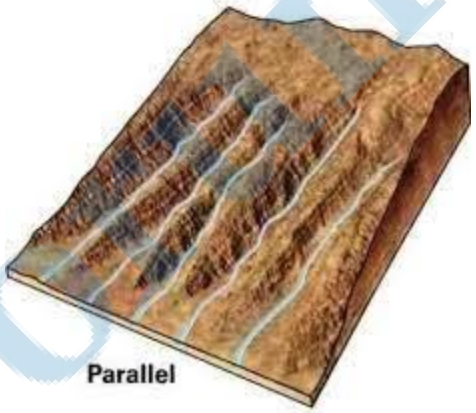
Specific Types of Drainage Pattern

- Dendritic drainage pattern
- Parallel drainage pattern
- Trellis drainage pattern
- Rectangular drainage pattern
- Herringbone drainage pattern
- Annular drainage pattern
- Radial drainage pattern
- Centripetal drainage pattern
- Inland drainage pattern.

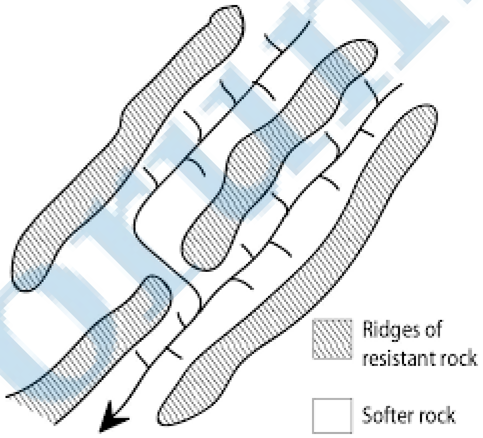
Dendritic Drainage Pattern



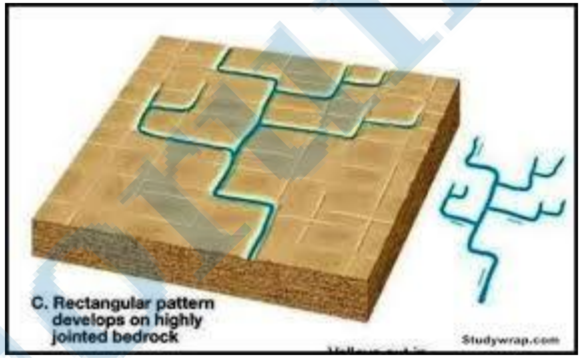
Parallel Drainage Pattern



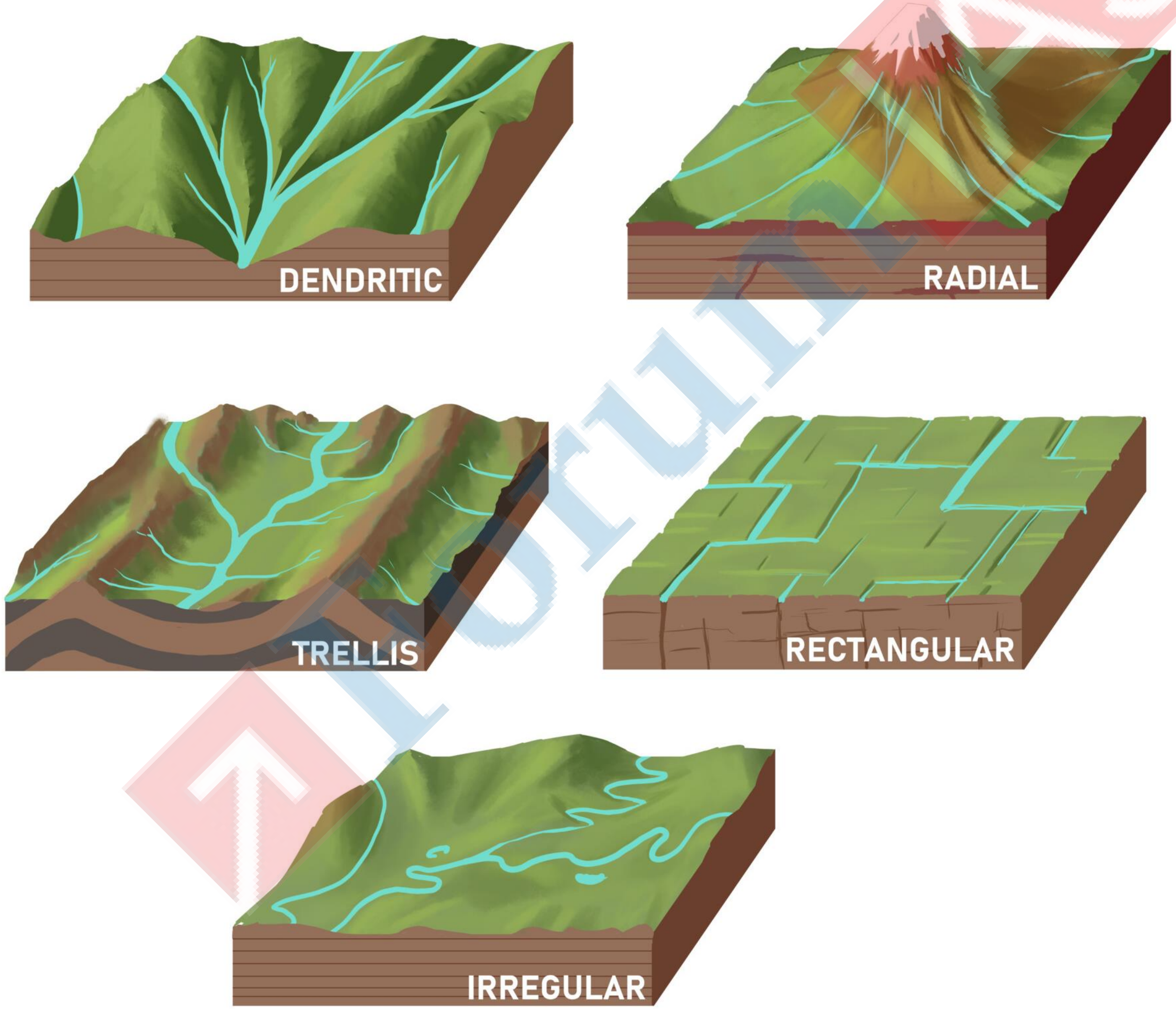
Trellis Drainage pattern



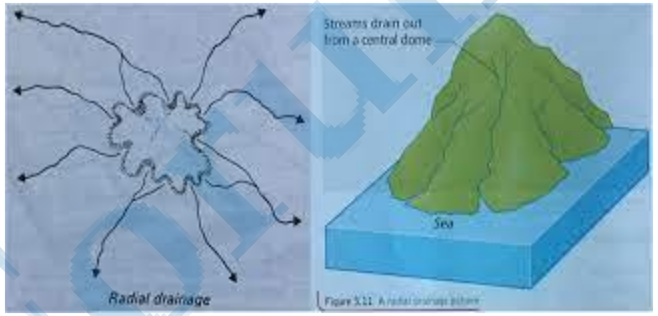
Rectangular Drainage Pattern



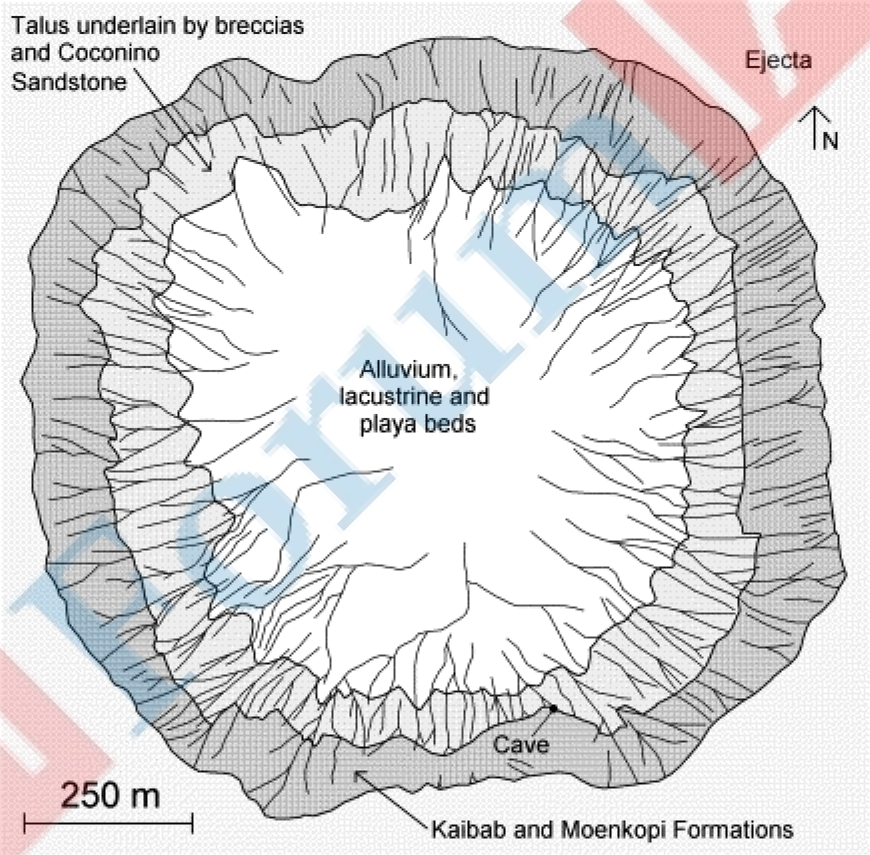
Drainage Patterns



Radial Drainage Pattern



Centripetal drainage pattern



Inland Drainage Pattern

Geological structure

- It includes arrangement and deposition of rocks in the Earth's crust.

Significance

a) Helps in understanding of the relief of land and nature of soils

b) It plays a vital role in agricultural and industrial growth and in the economic prosperity of our country

eg Black soil of Deccan Trap is good for cotton cultivation

eg Chottanagpur Plateau → rich in minerals.

c) Helps in land use planning, development of transport and communication.

d) Increasing potential for irrigation

e) Determining the quality and quantity of groundwater resources.

f) Understanding disasters like EQ's, landslides, floods etc.

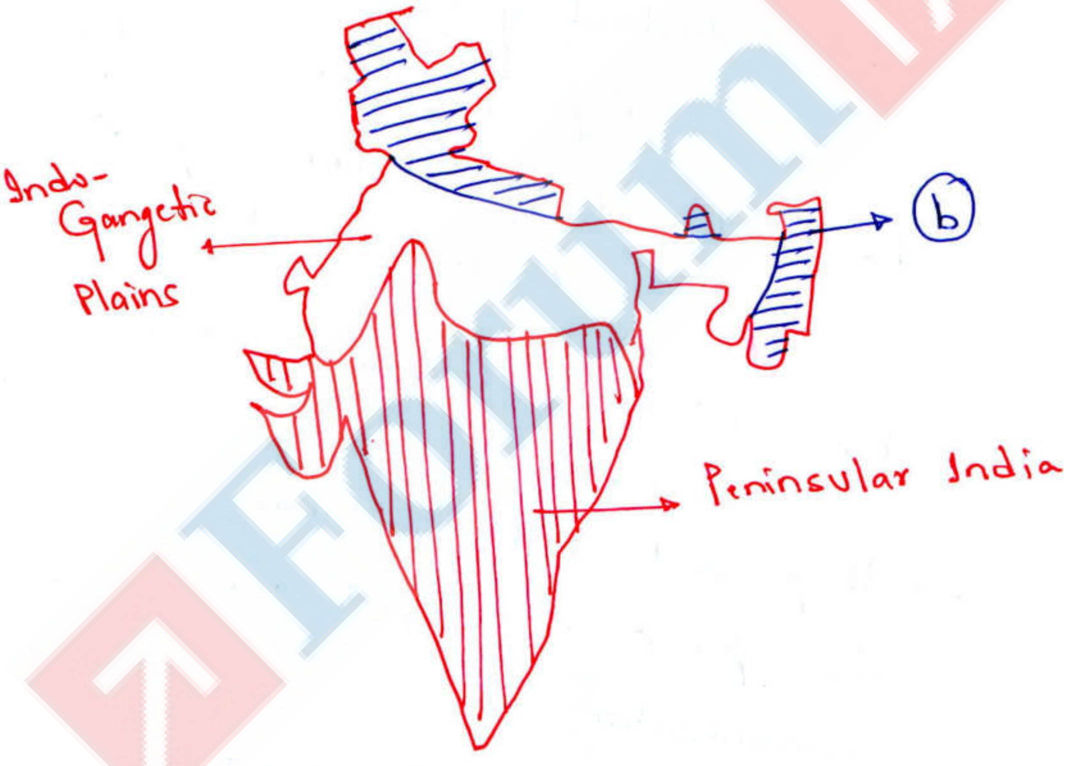
Geological Division of India

Geologically, India is divided into 3 regions:-

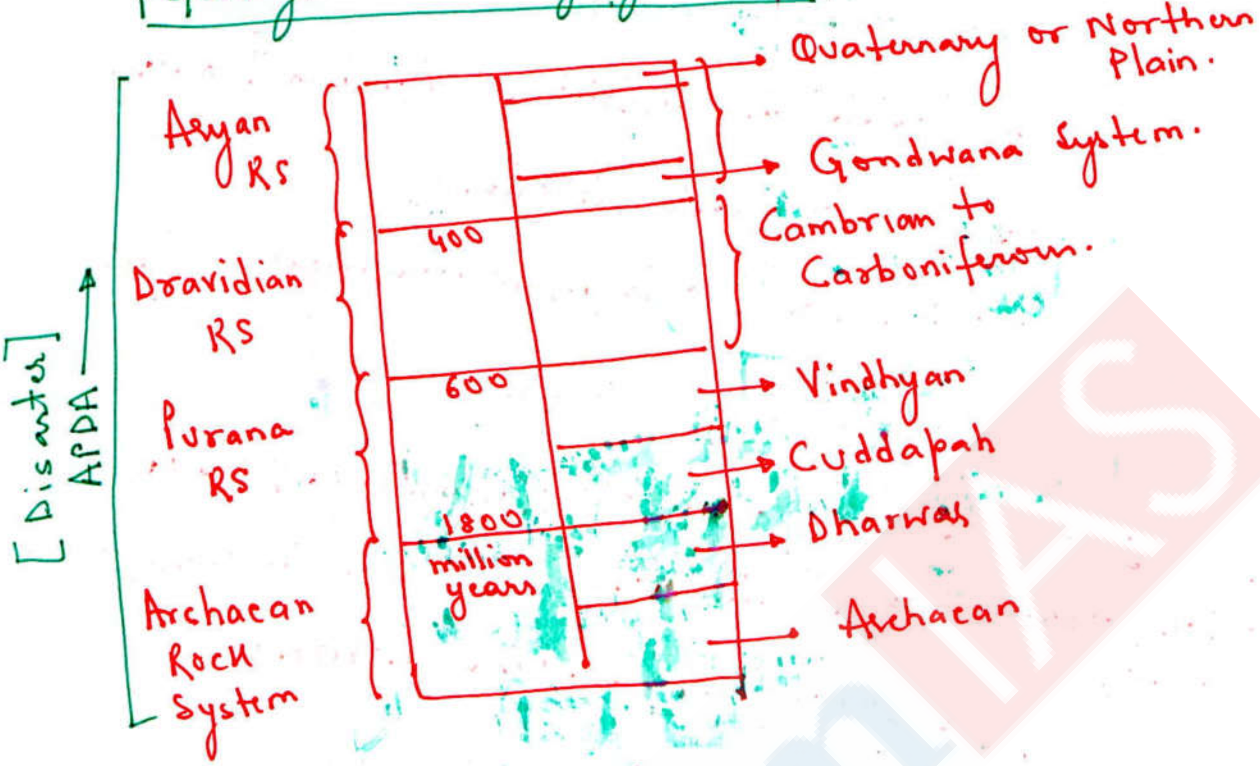
a) Peninsular Region [Meghalaya + Kutch + Kathiawar]

b) Himalayan and their eastern extension including Andaman and Nicobar Islands.

c) Indo-Gangetic Plains.



Geological History of India



Archaean Rock System

a) Archaean
- Oldest Rock
- Thoroughly Crystalline
- Also called 'Fundamental Complex' or 'Basement Complex'

b) Dharwar System
- studied in Dharwar district of Karnataka
- Economically important
  - High grade iron ore [Hematite]
  - Manganese
  - Copper

Purana Rock System

a) The Cuddapah System
- Cuddapah district of Andhra Pradesh
- **Cement grade limestone**
- Minerals → iron, manganese, copper.

b) The Vindhyan System
- Formation of sandstones, shales and limestones
  - Unfossiliferous
  - Devoid of metalliferous minerals
- **Diamond** bearing horizons

The Dravidian Rock System

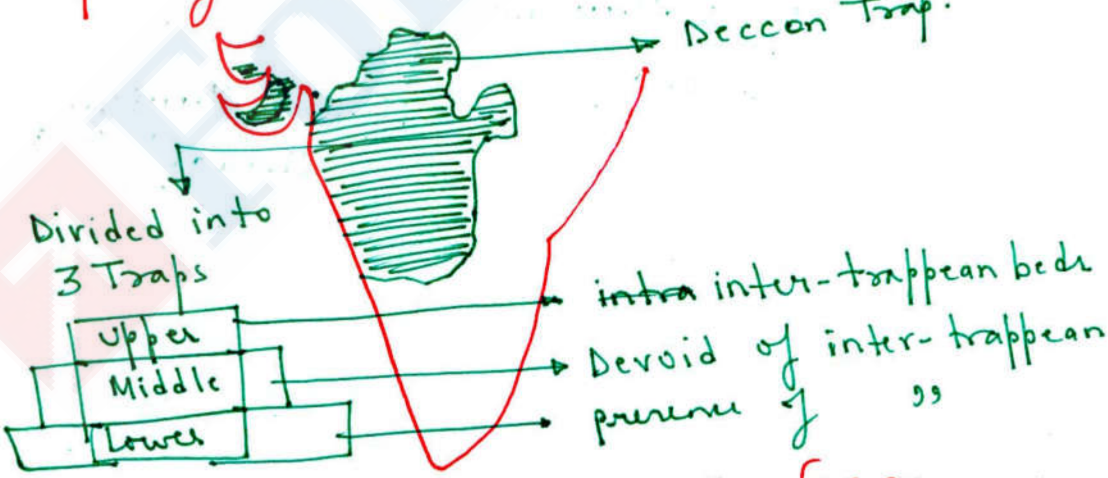
- Conspicuously absent in Peninsular India except for Umaria
- **Haimanta system** [Extensive fauna - Spiti Valley - HP]
-

The Aryan Rock System

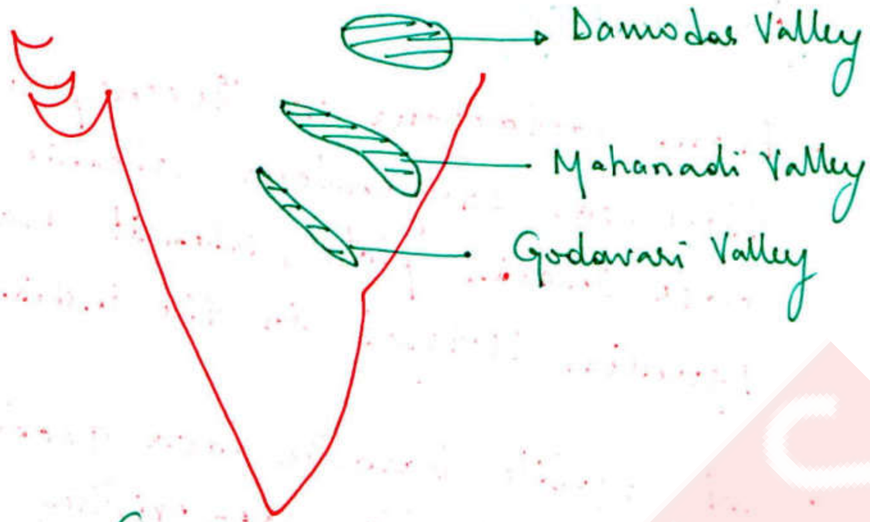
- Main areas = Gondwana Rock.
  - Damodar Valley
  - Mahanadi River Valley
  - Godavari Valley
- 98% of the **coal** reserves are found in Gondwana Rocks.

Decan Trap

- From Cretaceous to Eocene period, there was stupendous volcanic outburst over Indian plate, when it was over Reunion Hotspot in the Indian Ocean.
- The mobile basaltic lava gradually spread over the pre-existing topography.
- The volcanic deposits have flat top and steep sides → so, they appear as gigantic steps from a distance and therefore called '**trap**'. [Swedish meaning → step].



The weathering of these rocks for a long time has given birth to black cotton soil known as '**Regur**'.

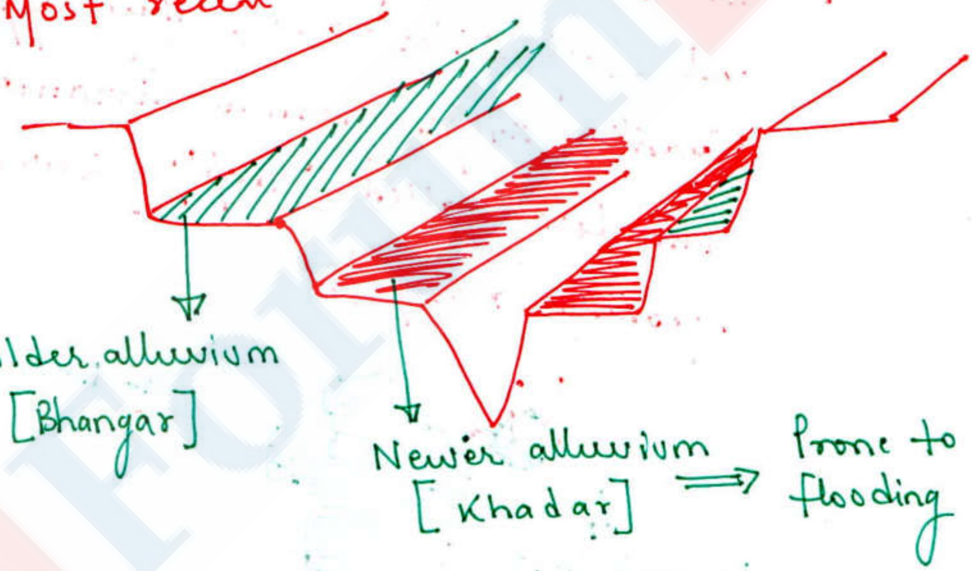


Gondwana Rocks

Quaternary — Indo Gangetic Plains

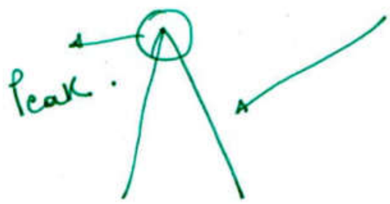
↳ Most Recent

↳

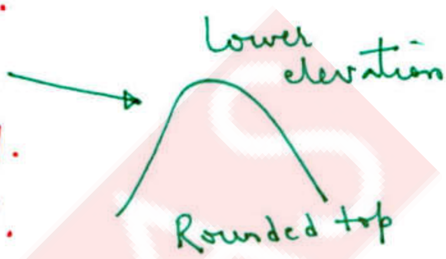


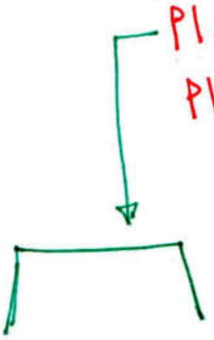
Physiography

It studies the present relief features of the Earth's surface or of natural features.



Mountain → 10.7%.
Hilly → 18.6%.
Plateau → 27.7%.
Plains → 43%.





Broadly, India is divided into 5 physiographic division :-

a) The Himalayan Mountains
b) The Great Plain of North India
c) The Peninsular plateau
d) The Coastal Plain
e) The Islands.

The Peninsular Block

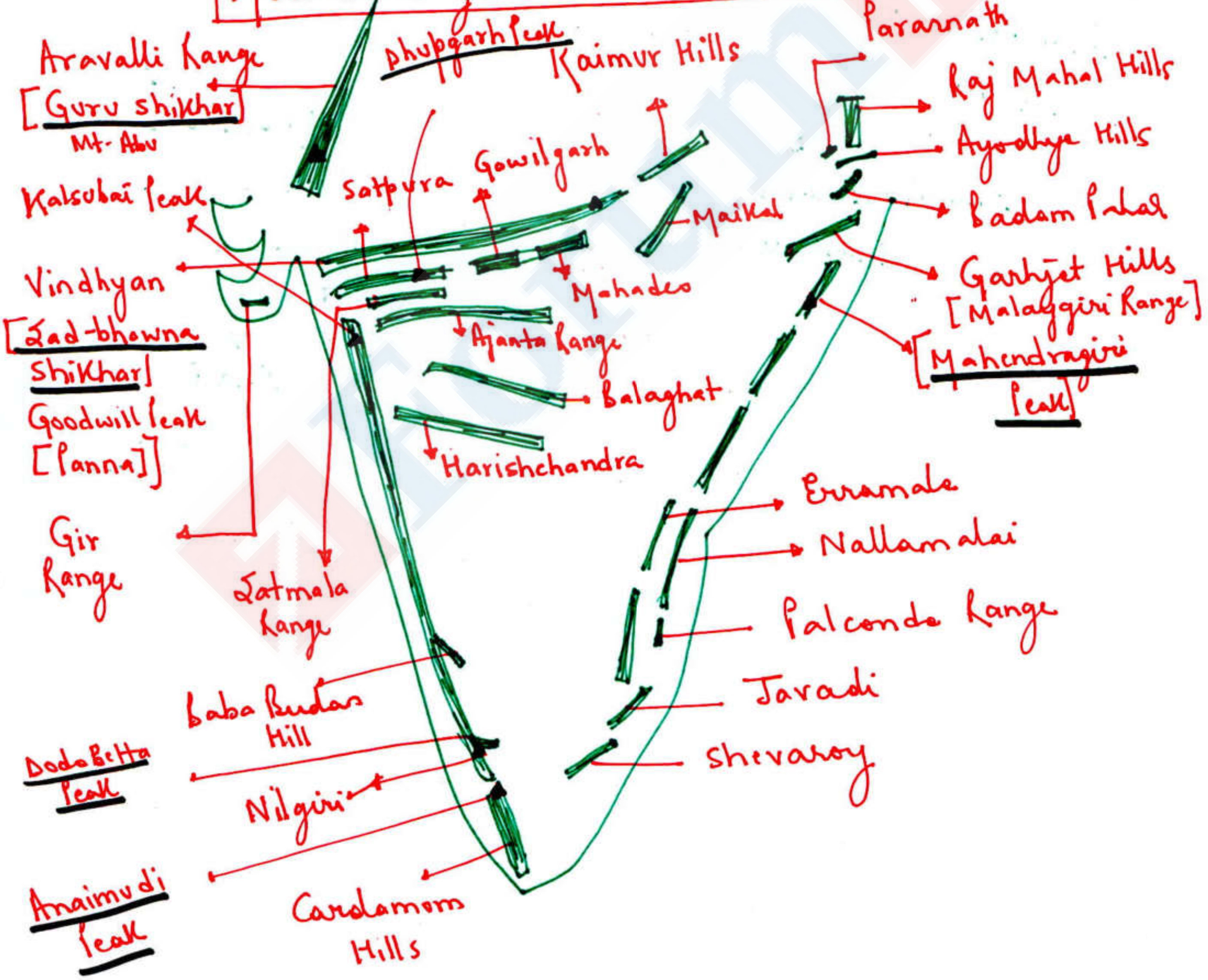
↳ Essentially formed of gneisses and granites.

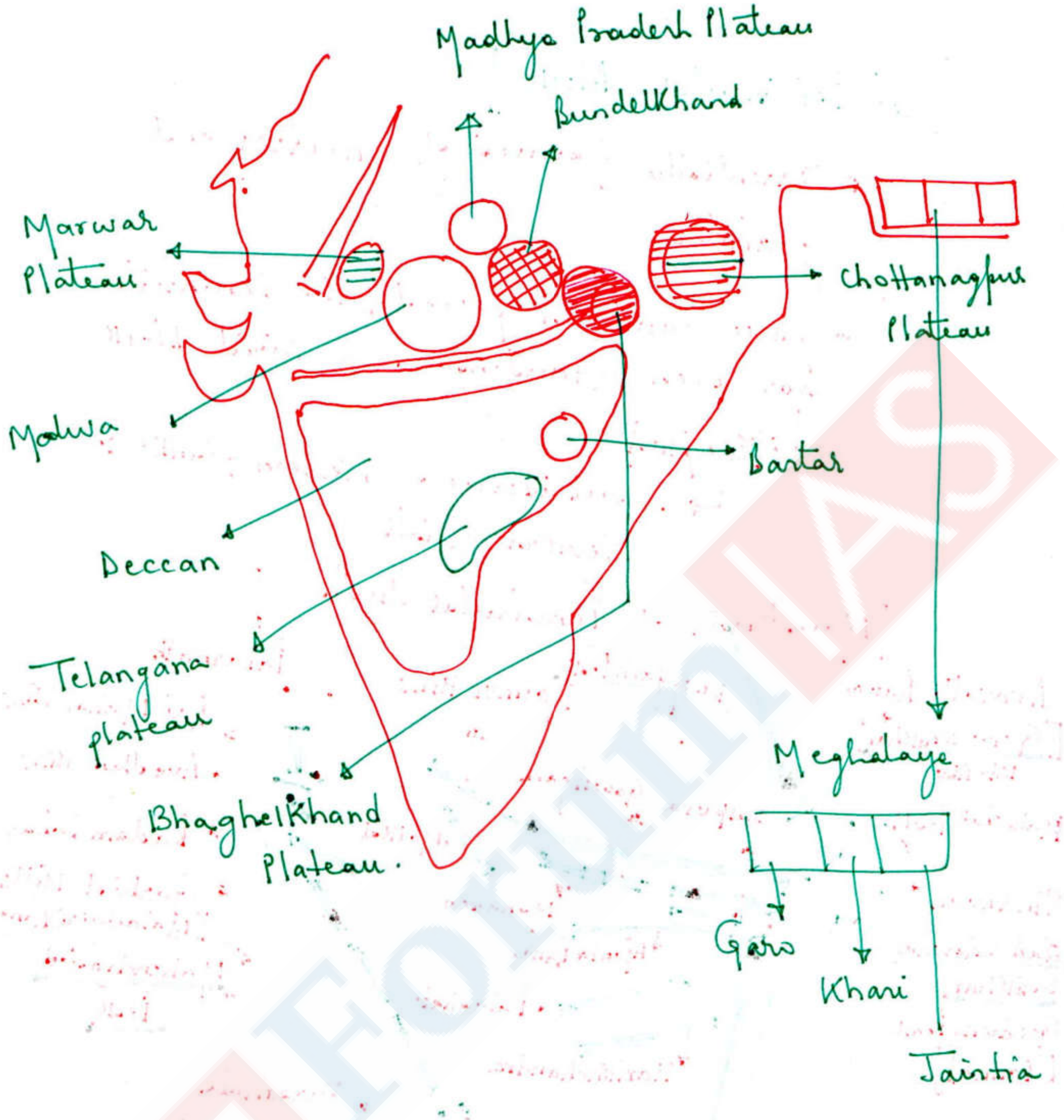
↳ Since Cambrian period, the Peninsula has been standing as a rigid block

↳ Exception

↳ ① Subsidence of Western flank → Western Ghats

Mountains of Peninsular India



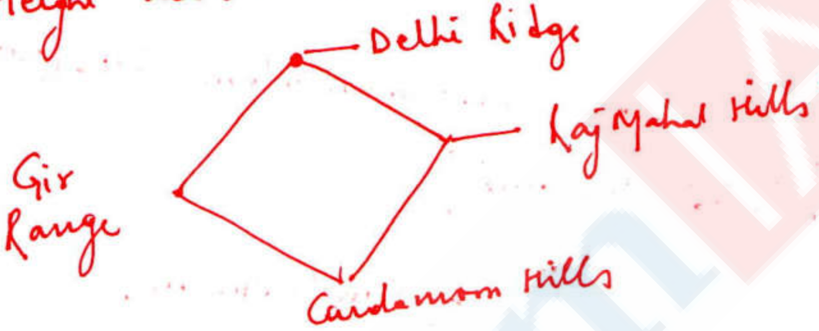

Madhya Pradesh Plateau
Bundelkhand
Marwar Plateau
Chottanagpur Plateau
Malwa
Bastar
Deccan
Telangana plateau
Bhaghelkhand Plateau
Meghalaya
Garo
Khasi
Jaintia

Q→ Discuss the characteristics of Chottanagpur plateau and its significance !

Q→ ——— " ——— of Deccan ~~Trap~~ Plateau and its significance !

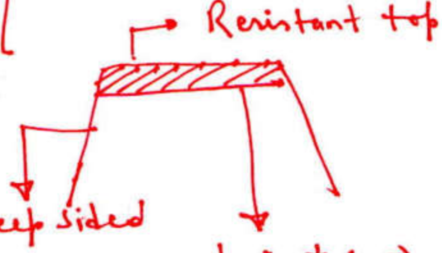
The Peninsular Plateau

↳ Height above sea level = 150 m.



↳ Extension ⇒ Shillong and Karbi-Anglong Plateau

↳ Made up of patlands [



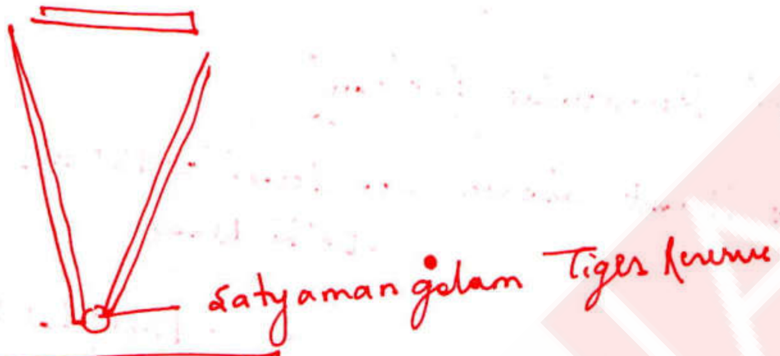
Ex = Hazaribagh Plateau
→ Palamu
→ Ranchi
→ Malwa
→ Coimbatore

↳ oldest & most stable land mass.

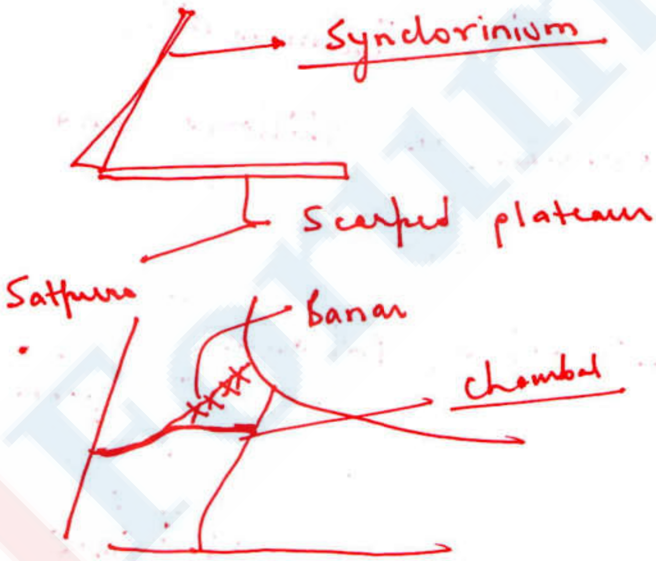
↳ General elevation is from West to East

↳ Recurrent phases of upliftment and submergence accompanied by crustal faulting and fractures.

Deccan Plateau



Central Highlands



The North Eastern Plateau

↳ Extension of main Peninsular plateau

↳ A huge fault was created b/w Rajmahal Hills and Meghalayan plateau

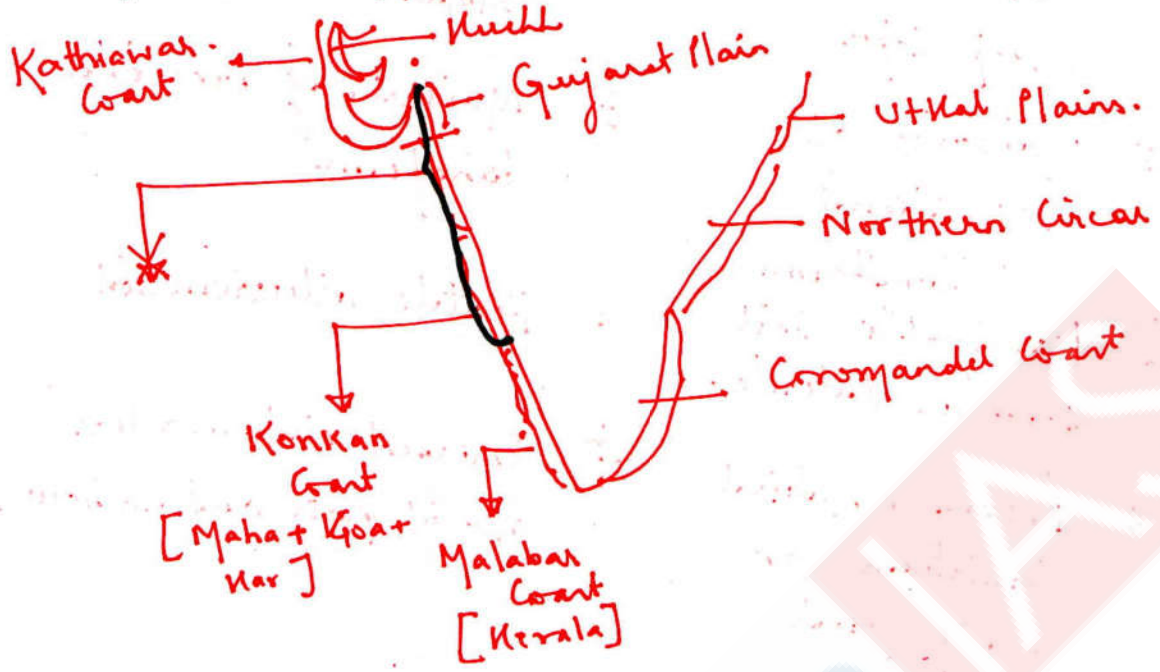
↓

Depression got filled with deposition brought by numerous rivers.

Malda Gap

↳ Meghalaya plateau → Rich in Mineral Resources

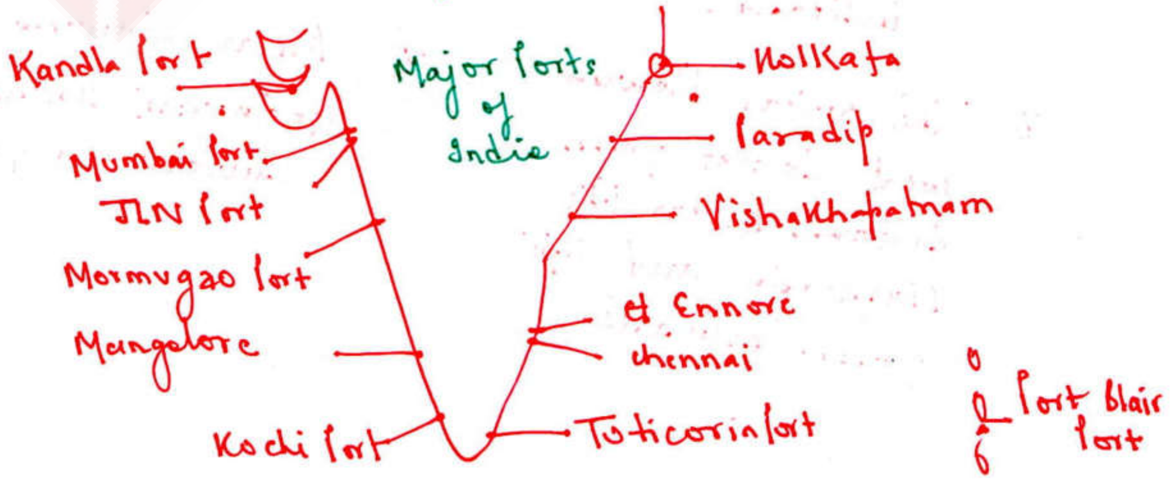
The Coastal Plains →



Differences

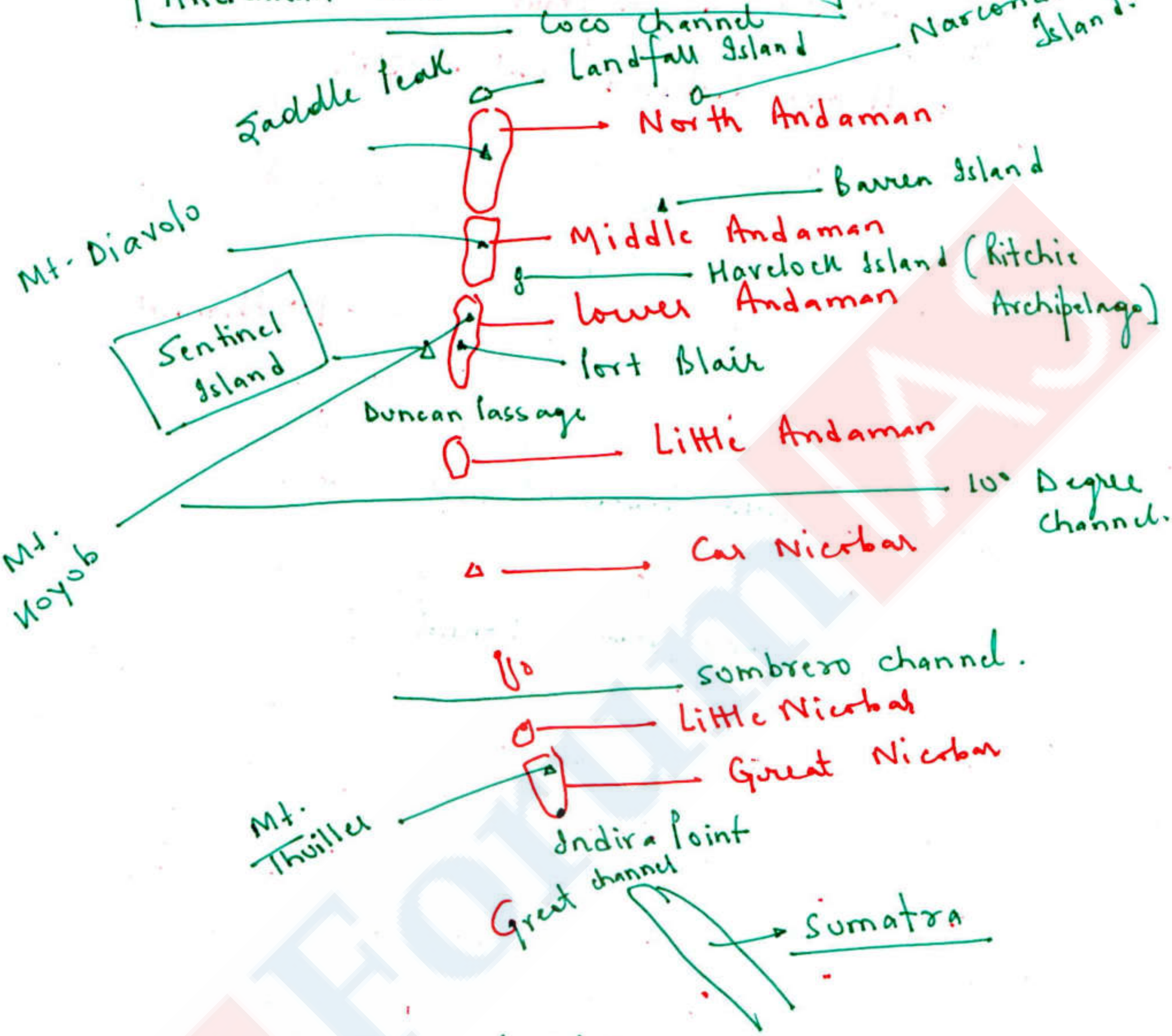
Western Coast	Eastern Coast
① ~~Emergent~~ Submergent Coastline ↳ ~~Wide belt~~ Narrow strip of Coastal land.	① Emergent Coastline ↳ ~~Narrow strip~~ Wide belt of Coastal land
② Continental shelf is narrower → as short as 60km off Quilon in Kerala.	② Continental shelf extends upto 500km from the Sea.
③ The rivers flowing west do not form deltas. Rivers like Narmada and Tapi form estuaries.	③ Rivers flowing such as Godavari, Krishna, Cauvery → form deltas

4) Indented coastline with steep slopes	4) Smooth coastline with low slopes.
5) Majority of depositional landform	5) Majority of erosional landform
6) Less fertile soil such as laterite.	6) Fertile alluvium soil
7) Provides natural condition for ports and harbours.	7) Emergent nature → less no. of ports and harbours
8) Presence of 'Kayals' backwaters	8) There is absence of 'Kayals'
9) Less amount of mangroves.	9) Lagoon and Mangroves Ex ⇒ Chilika Lake, Sunderban
10) Less affected by cyclones.	10) Severely affected by cyclones.



The Islands

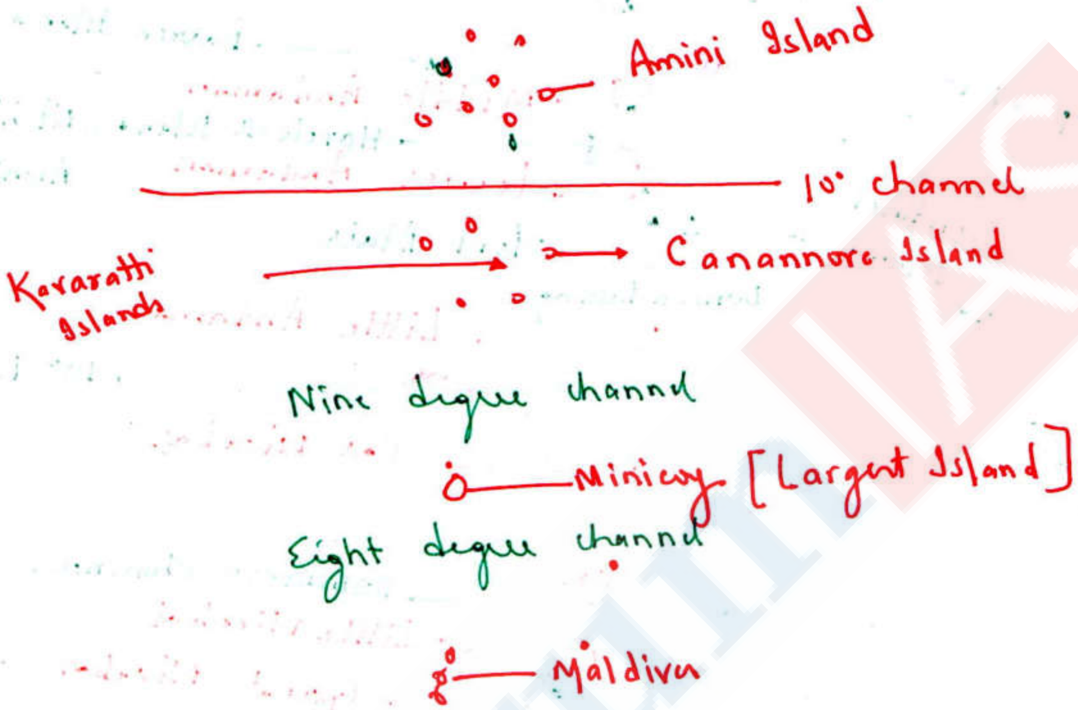
Andaman and Nicobar Islands

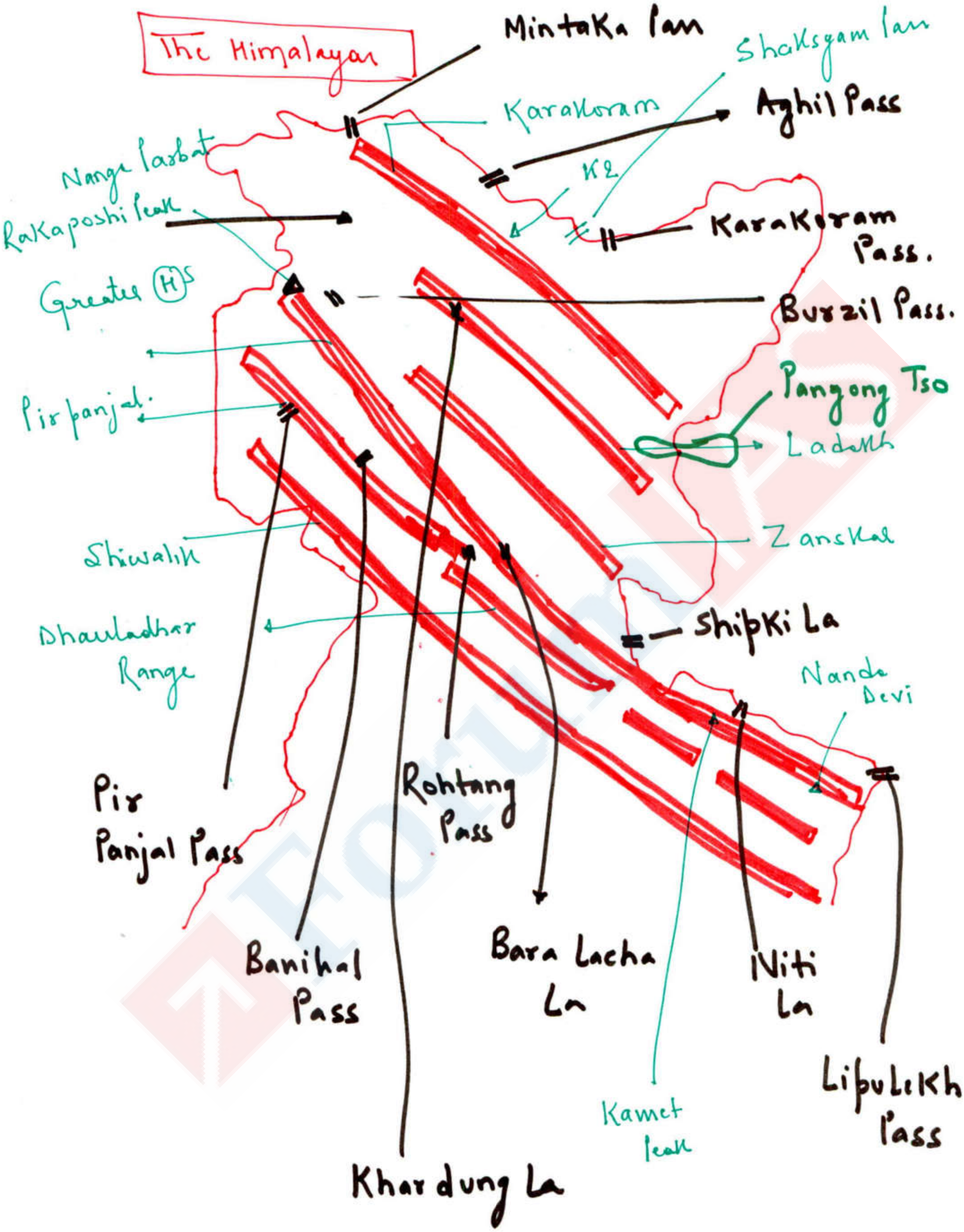


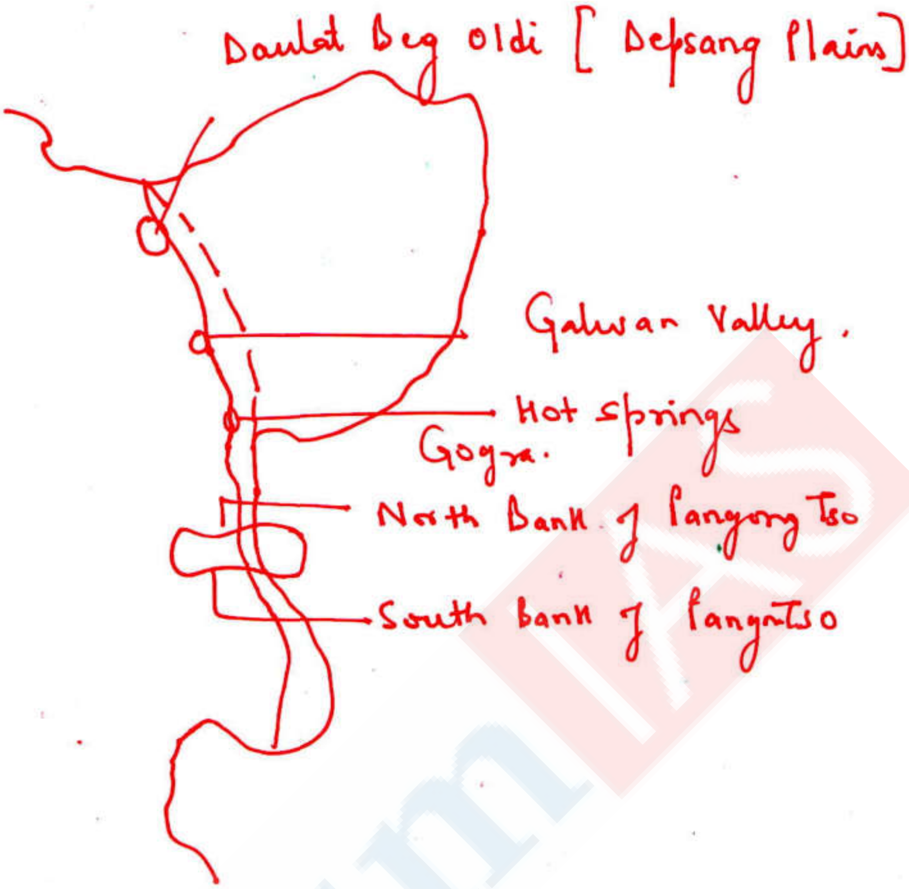
- Convectional Rainfall
- Baratang Mangroves
- Coral beaches.
- Equatorial type of Vegetation

Lakshadweep and Minicoy

- full of coral deposits
- 11 are habited out of 36.




The Himalayas
Mintaka Pass
Shaksgam Pass
Karakoram
Aghil Pass
Nanga Parbat
K2
Rakaposhi Peak
Karakoram Pass.
Greater Hs
Burzil Pass.
Pangong Tso
Pir Panjal.
Ladakh
Shiwalik
Zanskar
Dhauladhar Range
Shipki La
Nanda Devi
Pir Panjal Pass
Rohtang Pass
Banihal Pass
Bara Lacha La
Niti La
Lipulekh Pass
Kamet Peak
Khardung La


Daulat Beg Oldi [Depsang Plains]
Galwan Valley.
Hot springs
Gogra.
North Bank of Pangong Tso
South bank of Pangatso

G.C LEONG → CHAPTER-2 → The Earth's Crust

How earth was formed → evidence - Volcanic eruptions, EQ's waves, deep mine operations, crustal boring.

- Continent → upper part → Granitic

Igneous rocks → **Granite** - acid igneous rock, less dense, lighter in colour

Plutonic rocks → cooled & solidified slowly - Granite, diorite & Gabbro

Volcanic rocks → solidified rapidly - fine crystals - on earth's surface.

Basalt - Lava plateau → Antrim in N. Ireland

Basalt Solidifies → polygonal Columns - columnar basalt of the Giant's causeway in Antrim

Sedimentary rocks → sediments accumulated for long periods, usually under water classified according to age, origin & composition:-

∴ Mechanically formed Sedimentary rocks - accumulations - materials - cemented sandstone, coarse sandstone → grit

∴ Organically formed SR:- formed due to remains of living organism → corals, shellfish - Calcareous - limestone, chalk

Carbonaceous → vegetative matter - swamps & forest - peat, lignite, coal

∴ Chemically formed SR → precipitated chemically - Rock salts [derived from strata which once formed the beds of seas, lakes] gypsum or Calcium sulphate - evaporation of salt lakes like Dead Sea.

Metamorphic rocks →

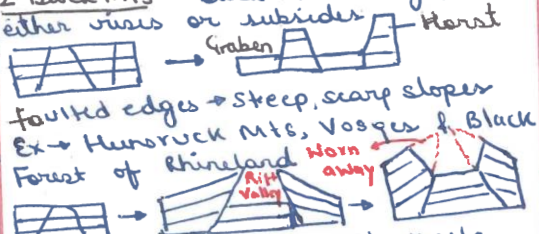
Highest peak - West - Malaysia - Gunong Tahan - quartzite

Limestones - resistant bcoz of their permeability - prominent steep sided hills - near Span & Perlis.

- Hercynian Mts → Welsh highlands in Britain, Harz mts in Germany, plateau of Siberia & China.

Types of Mts:-

1. **Fold Mts** → Mt. of elevations
2. **Block Mts** → Block enclosed by faults - either rises or subsides

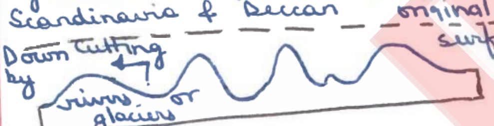


faulted edges → steep, scarp slopes

Ex → Hunsruck Mts, Vosges & Black Forest of Rhineland

- Rift Valleys → Tension - Block Mts.

3. Volcanic Mts → Mt of Accumulation
Ex → Mt. Mayon (Philippines), Mt. Merapi (Sumatra), Mt. Agung (Bali)
4. **Residual Mts** → Mts. evolved by denudation Ex → Mt. Manodnock (USA)
- Also evolve from dissected plateaus by rivers → Highlands of Scotland, Scandinavia & Deccan



Types of plateau

- Tablelands

① **Tectonic plateau** → earth movements, causes upliftment - They include Continental blocks -

- Meseta of Central Iberia (Tilted),
- Harz of Germany (faulted)

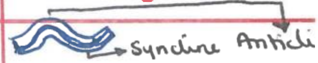
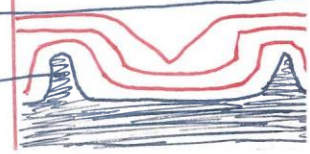
2. **Volcanic plateau** → Antrim plateau of N. Ireland, N-W part of Deccan plateau
3. **Dissected plateau** → due to erosion - stream action, glaciation, cut deep narrow valleys
Ex → Mesas, buttes

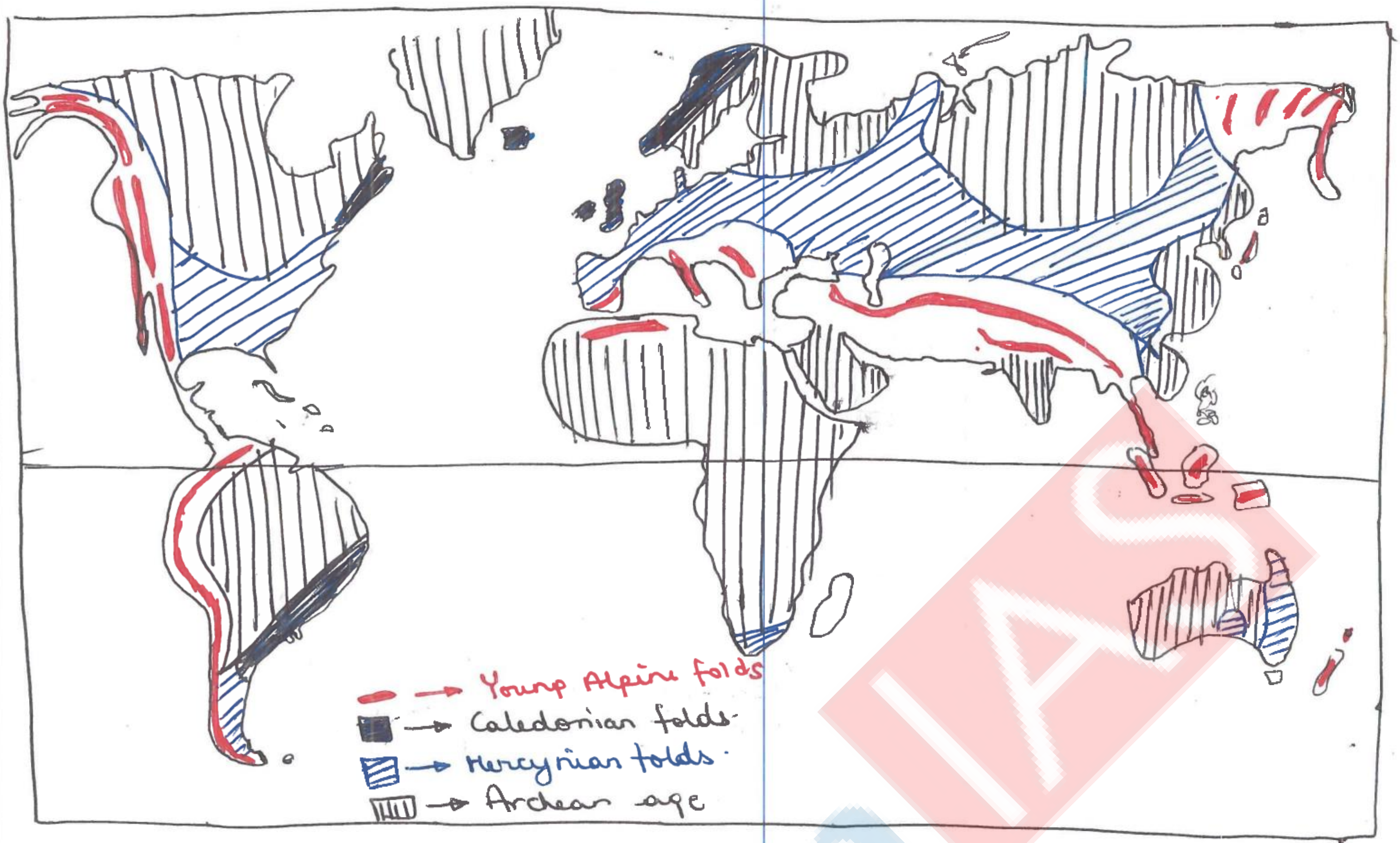
Types of plains →

① **Structural plain** → formed by horizontally embedded rocks, undisturbed by crustal movement of earth. Ex → Russian platform, Great plains of USA, central lowland of Australia.

② **Depositional plains** → formed by deposition of sediments - most productive agricultural plains
Alluvial plains, Flood plains & Deltaic plains - Nile delta [rice & cotton]
Ganges Δ [rice & jute]

③ **Erosional plains** → plains carved due to agents of erosion - Rain, river, ice & wind

No	Names	Erosional / Depositional	Description	Example	Diagram
1.	Anticline		upfolded waves due to compression		 Syncline Anticline
2.	Syncline		Downfolded waves due to compression		
3.	Intermontane plateau		plateaus enclosed by fold mts	• Tibetan plateau [Himalayas & Kunlun] • Bolivia plateau - b/w [Ranges of Andes]	
4.	Outwash plain	Depositional Plains	Glaciers & ice sheets may deposit a widespread mantle of unsorted fluvio-glacial sands and gravels in the outwash plain or may drop a boulder clay	• Parts of Holland, & N. Germany.	Usually barren lands
5.	Till plain or Drift -"-	-"- Plains	A mixture of various sizes of boulders & clay to form till plain.	Mid West of USA, East Anglia in England	Valuable farming land
6.	Coastal plain	-"-	winds often drive materials mud, sand, & deposit them on coastal plains to form swamps, mud-flats, tidal & estuarine lowland	coastal lowland of Belgium, Netherland Gulf Coast of USA	
7.	Emergent Coastal plain	-"-	Uplift may raise the coastal lowlands slightly	Coastal margins from Florida to Texas	level an undulating land  Very fine Sediment
8.	Loess	Aeolian deposit	Very fine particles from interior deserts or barren surfaces - deposit on hills, Valleys, plains — Loess plateau	N-W china (Loess plain), Pampas of Argentina	* fertile agricultural region
9	Peneplains	Erosional plain	Meaning - 'almost plain', plains of denudation		
10	Ice-scoured plains	-"-	In glaciated regions, glaciers & ice sheets scoured & levelled the land forming these plains → filled by lakes	Northern Europe & N. Canada. Finland → 35,000 lakes.	
11	Reg	-"-	Arid & Semi-arid regions, wind deflation, sweeps - eroded desert materials, lowering the level of land - forming extensive plains	stony desert plain	It is called Reg in Africa.
12.	Pediments or Pediplains	-"-	Mechanical weathering in arid & semi-arid regions - wears back mt. slopes to leave a gently sloping called pediplain	Steep-hill remains Inselberg	



Rocks differ in texture, colours, shape, permeability, mode of occurrence and degree of resistance to denudation

Landforms of Igneous Intrusions :-

Sill → Hypabasal intrusive landform - accumulation of molten magma or solid horizontally along the bedding planes of sedimentary rocks.
Denudation of sedimentary rocks - expose the intrusion - bold escarpment like Great whin Sill of N.E England
Dykes → Similar intrusions in vertical shape. Ex → Cleveland dyke of Yorkshire (England), Isles of Mull & Arran (Scotland), resistant dyke of quartzite forms a long ridge - North of Kuala Lumpur.

The origin of Volcanoes

Gases with magma → CO_2, Sulphurated hydrogen, (nitrogen, chlorine) → In small quantity.
Gases & vapour increase the mobility & explosiveness of the lavas.
1) Basic lavas → 1000°c, hottest lava, highly fluid, dark coloured, rich in Fe & Mg, poor in Silica, flow quietly

Extensive lava sheet
Wide diameter & forms a flattened shield or dome.
2) Acid lavas → highly Viscous, high MP
% of Si, light Coloured, low density,
resultant Cone - steep sided → rapid
congealing of lava - obstructs the flow -
resulting in loud explosions - throwing
volcanic bombs or pyroclasts

Types of Volcanoes

1. Active → when they frequently erupt
2. Dormant → Known to erupt & signs of possible eruption in future
3. Extinct → That have not erupted in historic times but retain features of volcanoes

Extrusive Landforms

1. Lava plains 2. Lava domes or shield
Volcanoes - Mauna Loa & Kilauea
Kilauea → steep walled caldera, active vent pours fed hot lava forming lava pit of Halemaumau
3. Ash & Cinder Cones → small volcanoes, occurring in groups.
- The Volcanic dust or ash falls as black snow.
4. Composite Cones / strato Volcano → Highest & most common volcanoes - built by several eruptions of lava, ashes, each new eruption add a new layer of ashes or lava. Ex → Etna, Stromboli, Vesuvius, Fuji, Chimborazo & Popacatapetl

Some Volcanic Eruptions

Mt. Vesuvius → Naples, - AD-79 → white hot lava from parasitic cones - gigantic luminous clouds in cauliflower form - followed by torrential downpour of heavy rain - destroyed Pompeii - Herculaneum → mudflow of ashes & cinders
Mt. Krakatau → 2/3rd of island Collapsed, huge submarine caldera was formed
Mt. Pelee → West Indies, St. Pierre (Capital of Martinique destroyed).

Pacific Ring of Fire

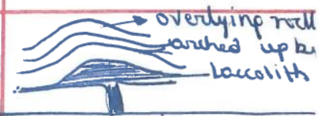
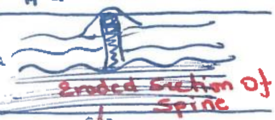
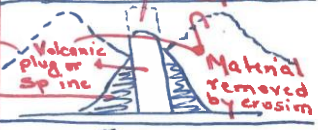
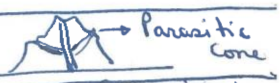
Atlantic Coast → few active Volcanoes
dormant or extinct → Madeira, Ascension, St. Helena, Cape Verde Islands, Canary Island → active → Iceland & Azores
Mediterranean (Vulcano) - Asia Minor
Mt. Ararat, Mt. Elbruz.
- Active Volcano of west Africa - Mt. Cameroon.

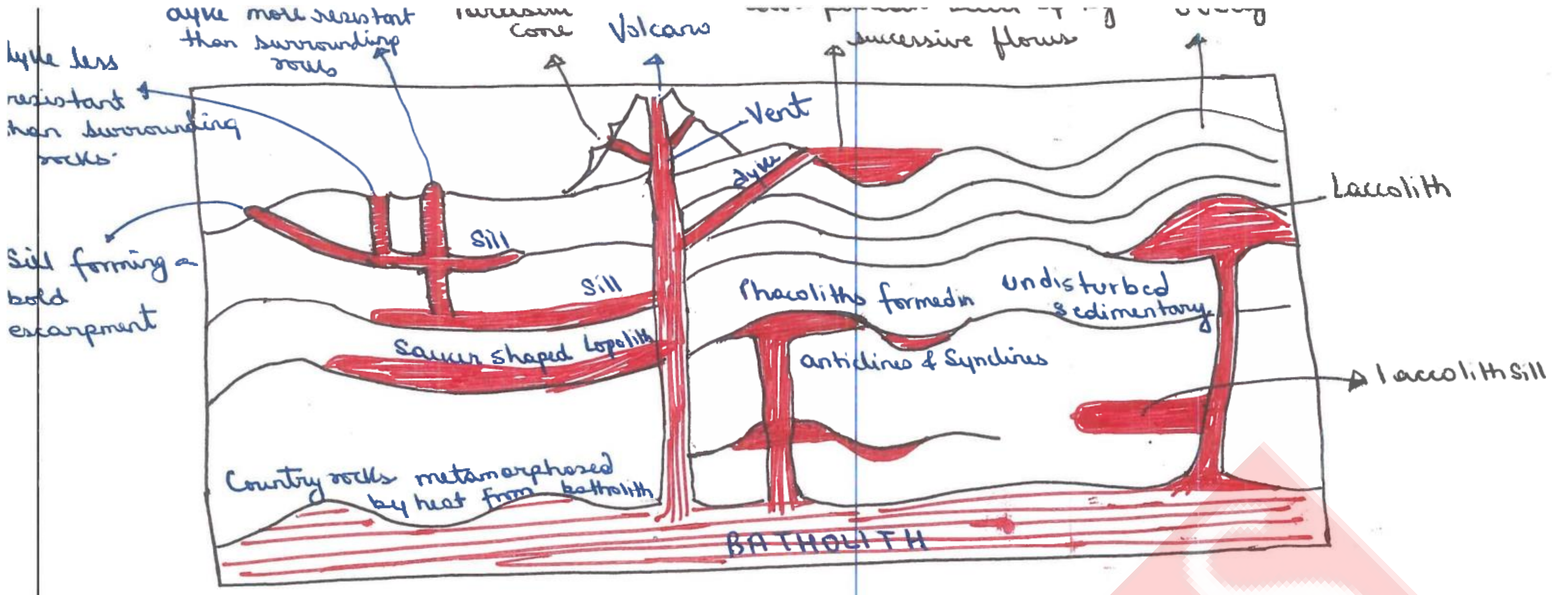
Geysers & Hot Springs

Ft. of hot water & superheated steam
Ex - Iceland, Rotorua district of North Island, New Zealand, Yellowstone NP 'Old Faithful' Wyoming
Hot springs → water rises without any explosion, Water sinks deep beneath - heated by interior forces. dissolved minerals - medicinal Value.

Earthquakes

distribution of EQ - coincides with that of Volcanoes.
Regions of greatest seismicity → Circum pacific areas, 70% of EQ's → Circum-pacific belt

No	Names	Erosional/ Depositional	Explanation	Examples	Diagram
1.	Laccolith		Dome-shaped upper surface - level base fed by a pipe like Conduit from below. It arches the overlying strata of sedimentary rocks	Henry Mts in Utah USA	
2.	Lopolith		Igneous intrusion with a saucer shape - a shallow basin is formed - in the midst of Country rocks.	Bushveld Lopoliths of Transvaal, S-Africa	
	Phacolith		lens shaped mass - crest of an anticline or bottom a syncline - fed by conduit from beneath	Cordon Hill Shropshire, England	
4.	Batholith		huge mass of igneous rocks - usually granite - removal of overlying rocks - forms massive and resistant upland. origin - Controversial	Wicklow Mts of Ireland uplands of Brittany, France Main Range of West Malaysia	
	Spine or plug		lava so viscous - they form a spine or plug at the crater → The spine is resistant & may remain → Ex → Puy de Dome, France	Mt. Pelee in Martinique	
	Ash & Cinder cone		less fluid lava - explode more violently - large central craters, steep slopes - Lava solidify after a short distance	Mt. Nuovo (Naples) Mt. Paricutin (Mexico)	
	Lava Tongue	obstruction	lava flows viscous - consolidify quickly - confined in Valleys	other features associated with lava obstruction → Lava bridge, tunnels.	
	Lava Damned Lakes	obstruction	When the highly viscous lava after solidifying dams a river valley		
	Parasitic Cones		From the main Conduit, subsidiary dykes or pipes may reach the surface as feeders	Mt. Etna in Sicily 100 parasitic Cones	
	Crater		During eruption - top cone is blown off or collapses into the vent widening the orifice	outline of former Volcano	
	Caldera		Greatly enlarged depressions - several miles across - Water may collect - caldera lakes	Lake Toba in Sumatra	



dyke more resistant than surrounding rocks
Cone
Volcano
successive flows
dyke less resistant than surrounding rocks.
Vent
dyke
Laccolith
Sill forming a bold escarpment
Sill
Sill
Phacoliths formed in anticlines & Synclines
Undisturbed sedimentary
Saucer shaped Lopolith
Laccolith sill
Country rocks metamorphosed by heat from batholith
BATHOLITH

Denudation → process - wearing away of the earth causes a general lowering and levelling out of the surface.

4 Phases:-

1) weathering ② Erosion
3) Transportation ④ Deposition

It depends on:-

1) Nature of relief ② structure of rocks ③ local climate
4) Interference by man.

Weathering

1) CHEMICAL WEATHERING

extremely slow & gradual, decomposition of rocks due to exposure to air & water

Air & Water - chemical elements - sufficient to set up chemical rxn's in surface layers - exposed rocks

Rxn's. weaken or entirely dissolve certain constituents of the rock - loosening the other crystals & weakening the whole surface

Ex → Granite [quartz + feldspar + mica], feldspar - quickly weathers away.

Rock - weathered material - loosened particles removed by erosive agents but much of the weathered material or regolith may stay in position forming the basis of soil.

Rain water absorbed by soil - stronger weathering agent than pure rain water acting on bare rock

major chemical weathering process:-

a) Solution

Minerals dissolved by water

Rain water - enough CO_2 - weak acid

Rate of solution depends upon:-

i) Mineral Composition → Limestone - rainwater dissolves $CaCO_3$

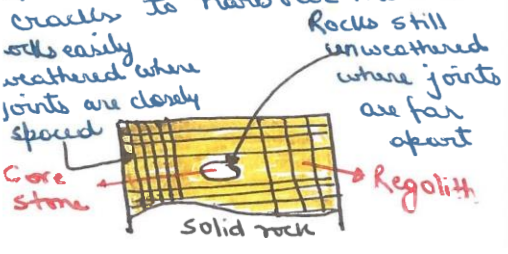
ii) structure of rocks → sedimentary rocks - pore spaces b/w the grains - water enters & attacks the rock

iii) Density of joints or cracks in the rock

iv) climate → warm wet climate (Tropical) → rapid chemical weathering

Dry climates - inhibits chemical weathering, promotes physical or mechanical weathering

Core stones → pieces of solid rock - resisted weathering - all surrounding rock - weathered. More resistant - fewer joints or cracks to harbour moisture



(b) Oxidation

→ rxn of Oxygen in air or water with minerals in rock. Ex → rock (iron) → iron oxide - brownish crust or rust, crumbles easily

(c) Decomposition by organic acids

- Within soils rocks are covered by bacteria - thrive on decaying plant or animal, produces acids gets dissolved in water - speed up weathering of underlying rocks
- Mosses & Lichens → absorb chemical elements from rocks & produces organic acids - agent of both chemical & mechanical weathering

② PHYSICAL OR MECHANICAL Weathering

- physical disintegration of rock
- They work more easily when rocks - weakened by chemical weathering

ⓐ Repeated Temperature changes

- Deserts → rocks - exposed - blazing sun - outer layers expand - during day
- Night - temp ↓ - outer layer contract - setting up internal stresses
- For years - causes rock to crack & split.
- Surface layers of rounded boulders gradually split off - onion peeling - technical term - exfoliation

ⓑ Repeated wetting & drying

- Especially in tropical regions or nearby coasts
- Rocks - absorb moisture & expand - when dry - moisture evaporates - quickly shrink - repeatedly - outer layers split off

ⓒ Frost Action

- Temperate latitudes
- Rocks contain cracks - shower water or snow collects in these places - at night temp ↓ - water freezes - expands by 1/10 of volume
- On mt peaks - process creates sharp pinnacles & angular outlines - such peaks described as frost - shattered peaks.
- Angular fragments of rocks are prised from mt sides or cliff faces & fall to the foot of the slope where they accumulate to form screes.

ⓓ Biotic factors

- Plants grow in the cracks & crevices due to chemical & mechanical weathering.

✱ Man interference → Mining, road construction, farming

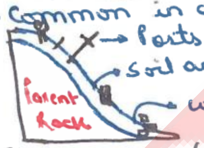
Mass Movement

- Movement of weathered materials down a slope due to gravitational forces.
- Factors:-

ⓐ Gradient of slope ⓑ weight of the weathered debris ⓒ Availability of lubricating moisture supplied by rain - water.

① Soil Creep

- Slow, gradual, continuous movement
- Common in damp soil



② Soil flow (solifuction)

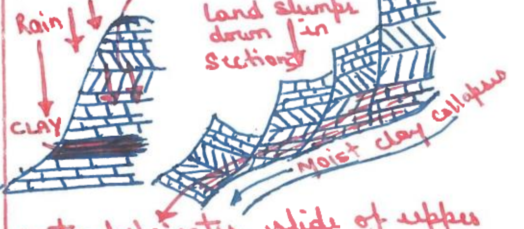
- Soil completely saturated with water - individual particles are almost suspended in water - move easily over one another over the underlying rock.
- Soil acts like liquid - soil flow or mud flow occurs.
- Areas of peat soils - absorbs moisture - saturation point reached - peaty soil flow downslope. In Ireland - such flows - 'bog bursts'

③ Landslides (slumping or sliding)

- Rapid kind of movement and occurs when a large mass of soil or rock falls suddenly.
- occur on steep slopes.
- Landslides are caused due to:-

ⓐ Steep slope undercut by a river or a sea
ⓑ EQ's or Volcanic disturbances
ⓒ Man-made steepening - undercut the rocks & set up vibrations - loosen rocks or soil.
ⓓ lubricating action of rain water

- Slumping → common where permeable debris or rock layers overlie impermeable strata such as clay.
- water sinks - halted by impermeable strata - damp clay or regolith provides smooth slippery surface on which upper layers easily slide.



- Man often enhances the possibility of landslide:-

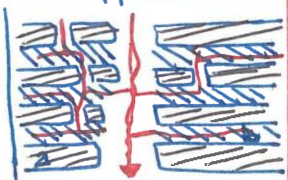
① clearing natural vegetation for agriculture or housing
② over grazing

CHAPTER-5 → Landforms Made by Running Water

Consequent stream → Initial stream that exists as a consequence of the slope.
Tributaries join either obliquely or at right angle depending on :-
1) Allingment of rocks
2) Degree of resistance of rocks

Dendritic Drainage
Rocks composed of homogeneous beds, uniform resistance to erosion, tributaries join main stream obliquely as insequent stream, tree like appearance

a-Insequent
b-Consequent



a → hard rock
b – soft rock.

Trellised Drainage
Rocks composed of alternate layers of hard & soft rocks, tributaries join at right angles. rectangular in shape.

The Mechanism of Humid Erosion
1 soil creep → slow movement of soil down a hill slope.

The process of River Action
3 types of rivers load
1) Materials in solution → dissolved minerals
2) Materials in suspension → sand, silt & mud
3) The traction load → pebbles, stones, rocks & boulders.

1) Upper Course → Gorge, rapids & waterfalls, River capture, predominantly erosion
2) Middle Course → Interlocking spurs, meanders, river cliffs, mainly transportation
3) Lower Course → Flood plains, ox-bow lakes, deltas, mainly deposition

Processes which go on simultaneously

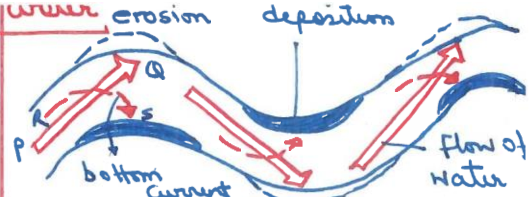
1) Corrasion or abrasion → mechanical grinding – traction load against banks & bed of the river
2) Corrosion or solution → rocks getting dissolved in water – Ex → limestone
3) Hydraulic Action → Mechanical loosening & sweeping away of materials by the river water

4) Attrition → wear & tear of transported materials – roll & collide into one another

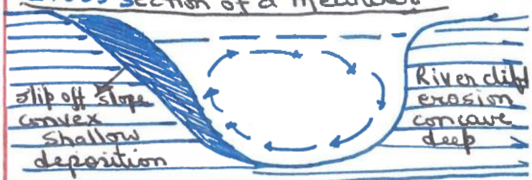
The Course of a River
1) The upper or Mountain Course
2) River capture
· beheaded stream is called misfit.
· Reason for headward erosion → either one side of the divide is of greater gradient or receives more precipitation
6) Rapids, cataracts & Waterfalls

· Similar falls of greater dimension → cataracts.
· Hindrance in smooth Navigation
· Waterfalls are formed in several ways
1) Bar of resistant rock lies transversely across a river Valley
Niagara Fall
2) Fault line scarp caused by faulting lies across a river →
Victoria Fall on river Zambezi
3) Water plunges down the edge of a plateau – Livingstone fall on river Congo
4) Glaciation produces hanging valleys where tributary streams reach the main U-shaped valley below as waterfalls → Yosemite fall California.

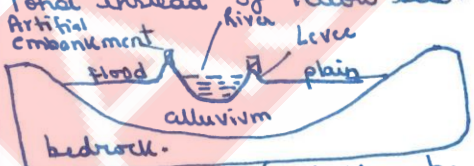
2) The Middle or Valley Course
a) Meanders → The irregularities of the ground force the river to swing in loops forming meanders
b) River cliffs and slip off slopes
· When flow of water PQ enters the bend of the river, it dashes straight into Q, eroding the outer bank into a steep river cliff at Q. The water piles up on the outside of the bend becoz of centrifugal force. A bottom current RS is set up in a cork screw motion & is hurled back into mid stream & the inner bank. Shingle is thus deposited here at S. where the slip-off slope is very gentle. The outer bank is therefore the bank of continuous erosion & the inner bank is the bank of continued deposition



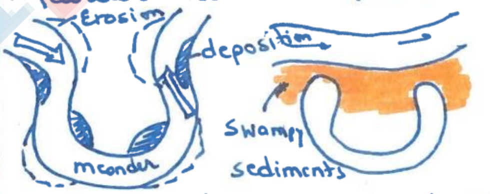
Cross section of a meander



3) The lower or plain Course
· Large sheets of materials are deposited on the level plain & may split the river into several complicated channels – Braided stream.
· Hwang Ho drains into Gulf of Pohai instead of Yellow sea.



· Ox-bow lake → Cutt offs or bayous in Mississippi basin. also called mort lake (dead lake)
· Meanders become much pronounce



· Delta → fine materials deposite at mouth, forming a fan shaped alluvial area called delta
Factors influencing Δ :-
Rate of sedimentation, depth of the river & sea-bed, character of the tides, currents & waves
· Mississippi → bird's foot Δ
· Nile, Ganga & Mekong → Arcuate Δ (fan shape)
· Amazon, Ob & Vistula → Δ partly submerged → estuarine Δ
· Ebro of spain – tooth like projections at their mouth – cuspate Δ
Conditions favourable for formation of Δ
1) Active vertical & lateral erosion – upper course of river – provide extensive sediments
2) coast should be sheltered preferably tideless
3) sea adjoining the Δ should be shallow or else the load will disappear in the deep waters
4) No large lakes in the river course to 'filter off' the sediments
5) No strong current running at right angles to the river mouth, washing away the sediments

~~River Rejuvenation~~

Rapids & waterfalls interrupt the navigability of a river

- Deltas are less satisfactory sites than estuaries for the siting of large ports

Advantages of river

1. Upper Course → hydroelectric power – metallurgical industries, engineering & aluminium smelting – cheap abundant power
2. Dams constructed across rivers feed water to irrigation canals
3. The upper stream – river capture – wind gap – construction of upland roads & railways.
4. River valleys – convenient mode of land communication
5. Richest agricultural areas – flood plain (Ganges Δ → whole of jute) → Δ – equally fertile (Nile Δ – cotton)
6. Fresh water fishing.
7. Waters for domestic consumption
8. Political boundaries b/w countries
   Mekong (Thailand & Laos)
   Yalu (North Korea & eastern USSR)

Groundwater

Intensity of groundwater depends on:-

a) climate :-
- Deserts → mostly evaporate
- humid conditions → relatively more water percolates as ground is wet - run off also occurs.

b) Season of the year
- In rainy - more water percolates

c) Nature of rocks :- rocks differ in porosity & permeability
- porous → sandstone
- porous rocks are also impermeable
- some porous rocks - impermeable like clay
- granite → non-porous but pervious

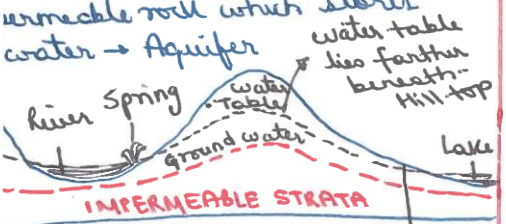
The Water Table

Water seeps in - moves downward under the force of gravity until it reaches impermeable layer of rock through which it cannot pass. Water accumulates saturates the rocks.

The surface of the saturated area is called the water table

Depth of water table depends on:-
a) Relief b) Type of rocks.
c) Seasons

Permeable rock which stores water → Aquifer



Zone of saturation (Permeable Rocks)

Valley & hill-slope → water table is closer to surface.

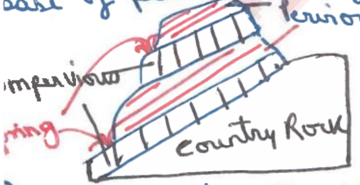
Spring & Wells

1) Spring

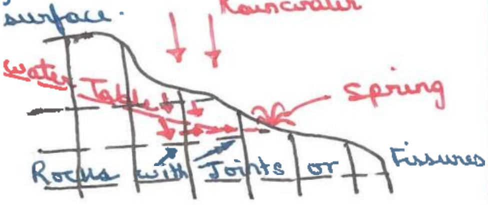
Ground water stored in the rock released onto the surface where the water table reaches the surface

Types of springs

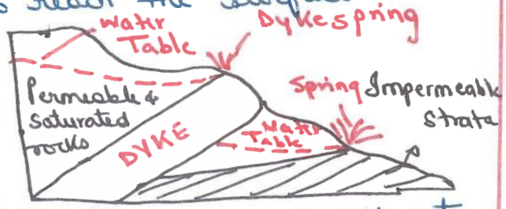
a) Areas of tilted strata → permeable & impermeable rocks alternate - water emerges at the base of permeable layers



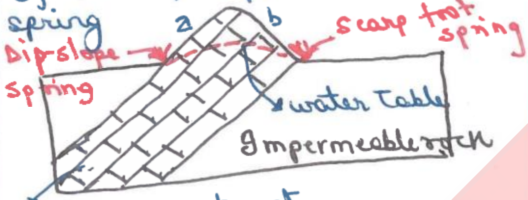
b) Well-jointed rocks - water percolates until it reaches a joint which emerges at the surface.



c) Dyke or sill of impermeable rock intruded through permeable rocks - causes water table to reach the surface

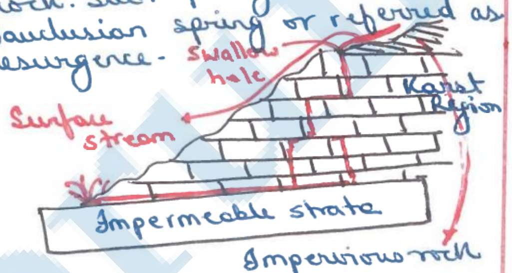


d) Limestone or chalk escarpments - permeable rocks lies b/w impermeable strata. water issues at the foot of the scarp → scarp-foot spring or near the foot of the dip slope → Dip slope spring

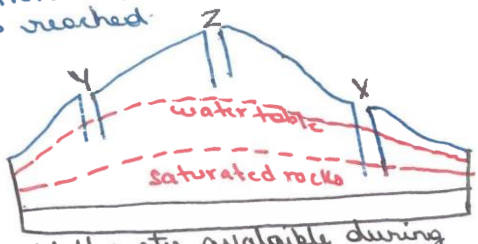


Limestone escarpment
a → Dip slope b → scarp foot

e) Karst regions - rivers often disappears underground. They then flow through passages worn in the rock by solution, & may re-emerge when limestone gives place to some impermeable rock. Such spring is called vauclusian spring or referred as resurgence.



2) Wells
- Springs → natural emergence
- Man make use of stored water through sinking wells
- Wells - impⁿ in arid regions
- Hole is bored - until water table is reached



Y → Well water available during wet season

Z → Dry Hole

X → Well water available all the time

Artesian Basin

water trapped - aquifer under great pressure - well bored - water gushes onto the surface like a fountain due to pressure.

Ex → Great plains of USA, Artesian basin of Australia

CHAPTER-6 → Landforms of Glaciation

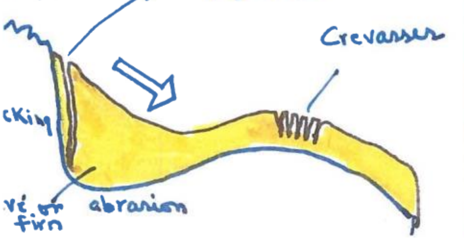
snataks → peaks of loftier
ts projecting above the surface
lacier — river of ice;
ongue shaped, broadest at
the source, becomes narrower
downhill.
rate of movement - greatest
middle - no friction
glacier moves faster at the
entre than the sides
ongest glacier of Europe →
Aletsch Glacier in the Bernese
berland of Switzerland
iedmont glacier → At foot of
t ranges, several glaciers
ay converge to form an
xtensive ice mass.
→ Malaspina Glacier (Alaska)

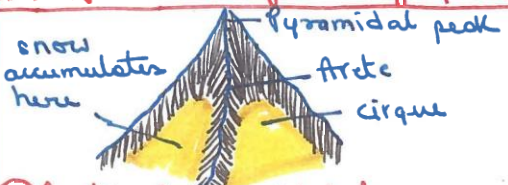
andforms of Highland laciation

lacier erodes its valleys
y plucking & abrasion.
ucking → freezes the beds &
nderlying rocks, tears out
ndividual blocks & drags
em away.
brasion → glacier scratches,
crapes, polishes & scours the
alley floor
ate of erosion determined
y several factors
locity of flow, gradient of
e slope, weight of the glacier,
mp° of ice, geological
tructure of valley.

Corrie, cirque or cwm

Downslope movement of
lacier - intensive shattering of
pland slopes - produce a
epression - firn/névé accumulates
rocess of plucking operates
n the back wall, steepening
. & the movement of the ice
erodes the floor, deepening
he depression into a step
re shoe shaped basin called
irque (French), corrie (Scotland)
wm (Wales).
Rocky ridge at the exit of
orrie - ice melts & collects
hind this barrier - corrie lake
- tarn → Bergschrund





② Aretes & Pyramidal Peaks

· Two corries cut back on opposite sides of a mt, knife edge ridges are formed called aretes.
· 3-4 cirques cut together, their ultimate recession will form an angular horn or pyramidal peak
Ex → Matterhorn (Switzerland)

③ Bergschrund

· At the head of the glacier, where it begins to leave the snowfield of a corrie, a deep vertical crack opens up - Bergschrund (Germany) rimaye (French).
· Happens in summer - ice melts & move out of corrie - no new snow to replace it.
- Major obstacle to climbers
· Further down when the glacier negotiates a bend or a precipitous slope - more crevasses or crack are formed.

④ U-shaped glacial trough

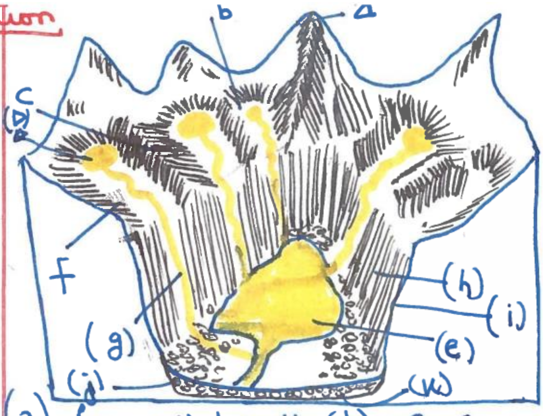
Glacier downward journey - ice fed by several corries like tributaries - wear away sides & floor of valley - U shape - wide, flat floor & steep sides.
· Interlocking spurs blunted to form truncated spurs.
· After ice disappears - deep sections of long narrow glacial troughs filled with water - Ribbon lakes / trough lakes / finger lakes
Ex → Loch Ness & Lake Ullswater

⑤ Hanging Valley

Tributary valley hanging perpendicularly above the main valley - stream plunges down as waterfall - generating hydro-electricity power.

⑥ Rock basins & Rock steps

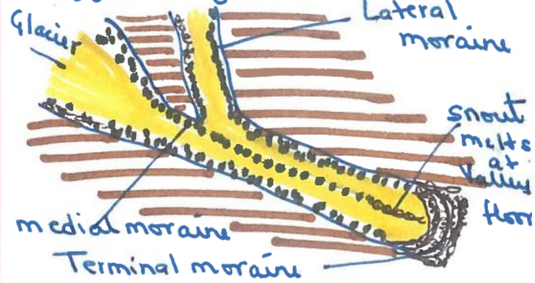
· Glacier erodes & excavates the bed rock in an irregular manner - unequal excavations give rise to rock basins - later filled by lakes in the valley trough.
· Tributary valley joins main valley additional weight of ice - main valley cuts deeper into the valley floor - point of convergence forming a rock step



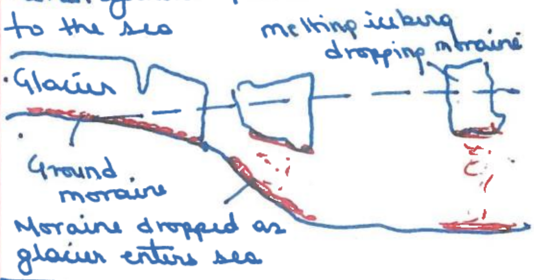
(a) - Pyramidal peak, (b) - Corrie (c) - arete, (d) - tarn, (e) - Ribbon lake, (f) - hanging valley, (g) - waterfall, (h) - truncated spur (i) - steepened U shaped valley (j) - Lateral moraine (k) → Ground moraine.

⑦ Moraines

· Made up of pieces of rocks that are shattered by frost action, imbedded in the glaciers & brought down the valley
· rocks that fall on the sides of the glacier, mainly screes - lateral moraine
· 2 glaciers converge - inside lateral moraine unites to form medial moraine
· Glacier melts - at the foot of the valley - pile of transported materials left behind at the snout is the terminal moraine or end moraine
· deposition of end moraines may be in several succeeding waves - recessional moraines
· Ground moraine → rock fragments dragged along beneath the frozen ice



· when glacier flows right down to the sea



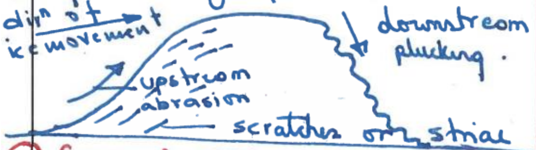
where the lower end of the trough is drowned by the sea it forms a deep, steep sided inlet - Fjord - Norwegian Coast

Landforms of glacial lowlands

· Mainly depositional in nature

① Roche Moutonnee →

resistant residual rock hummock, erosional feature, upstream side striated by ice & smoothed by abrasion, downstream side roughened by plucking.



② Crag & Tail →

erosional feature, crag is a mass of hard rock with a precipitous slope on the upstream side - protects the softer leeward slope from being completely worn out by the on-coming ice.

Ex→ Castle rock of Edinburgh, Scotland

③ Boulder clay or glacial till

· Unsorted glacial deposit - boulders angular stones, sticky clay, spread out in sheets, not mounds & forms gently undulating till or driftplains

· Monotonous or featureless

· Unstratified glacial drift

Ex→ Boulder clay plains of East Anglia & Northern Mid West USA

④ Erratics

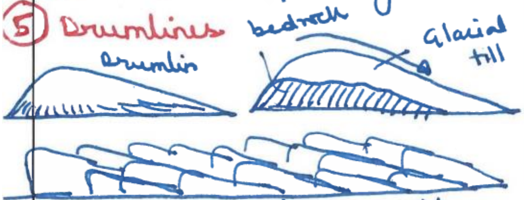
Boulders of varying sizes transported by ice - left stranded in the regions of deposition - composed of materials entirely different from the region

· Useful in tracing the dirn of ice movement

· Some erratics may be found perched in precarious position

Ex→ Silurian grits are found perched on the carboniferous limestone of the Pennines → hindrance to farming.

⑤ Drumlins



Basket of eggs topography.

· swarms of oval, elongated whale back hummocks composed wholly of boulder clay

· downstream side → elongated

· steeper - onset side, taper off leeward end

Ex→ plains [illegible] Lakes (USA), County Down in Northern Ireland.

⑥ Eskers —

Long narrow sinuous ridges composed of sand & gravel which mark the former sites of sub glacial melt-water streams.

Ex→ Punkaharju Esker of Finland

· Does not support many trees.

⑦ Terminal Moraines

Coarse debris deposited at the edge of the ice sheet to form hummocky & hilly Country

Ex→ Baltic heights of Northern European plains

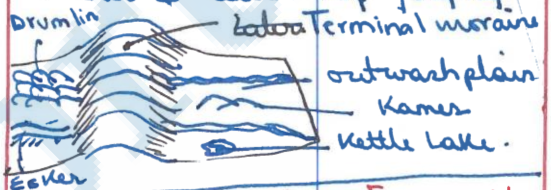
⑧ Outwash plains

Made up of fluvio-glacial deposits washed out from the terminal moraines by the streams & channels of the stagnant ice mass

It consists of

① Kames → small rounded hillocks of sand & gravel

② Kettle lakes → when deposition takes the form of alternating ridges & mts - the latter may contain Kettle lakes → give rise to 'Knob & Kettle' topography.



Economic activities favourable due to glaciated landforms

① Hanging valley - hydro electricity

② Great lakes - Navigation

③ Magnificent Scenery - Tourism

④ when glaciated lakes eliminated - beds with fresh alluvium support heavy cropping

⑤ Eskers & Kames - excavated to provide sands & gravels for highway & building Construction.

Transhumance → Animal-migration type of farming

CHAPTER-4 → Arid or Desert Landforms

1/5th of world land - deserts
Mostly confined within 15-30°
N & S, lie in trade wind belt,
western part of continent where
trade winds are offshore,
bathed by cold currents -
desiccating effect → Tropical
hot deserts.

Gobi & Turkestan desert →
continental interiors → extremes
of tempr

1) Hamada or rocky desert
Large stretches of bare rocks,
swept clear of sand & dust
by the wind - rocks - thoroughly
smoothed & polished (Hamada el Homra)
Ex → Sahara Desert (Libya)

2) Reg or Stony desert
Extensive sheets of angular
pebbles & gravels - winds are
not able to blow off.
More accessible than sandy
desert, camels are kept here
Ex → Serir (Libya & Egypt) &
rest of Africa (reg).

3) Erg or Sandy desert →
sea of sand. Vast stretches
of undulating sand dunes
Ex → Calansc̈io Sand Sea (Libya)
Turkestan sandy desert (Kaum)

4) Badlands → An arid
area in S. Dakota (USA) - hills
badly eroded by occasional
rainstorms into gullies & ravines
extent of water action on
hill slopes & rock surface was
so great that region was
abandoned by inhabitants.
Ex → Painted desert of Arizona

5) Mountain desert →
deserts found on highlands
(Mts & plateaus) - steep slopes
are cut by wadis (steep sided
dry valleys) & the action of
frost has carved out
irregular edges.
Ex → Ahaggar & Tibesti Mts
(Sahara desert)

The Mechanism of Arid Erosion
Arid landforms : factors -
- Insufficient rainfall (<5 inches)
at irregular periods
- Coupled with high tempr
- Rapid rate of evaporation

Ex → Atacama desert — Trough

Ways of Wind erosion

① Deflation → lifting & blowing
away of loose materials from the
ground - results in lowering of
land surface. → called
deflation hollows Ex - Qattara
Depression (Sahara)

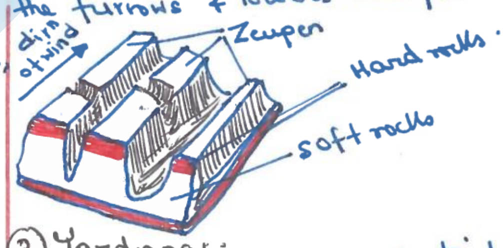
② Abrasion → sand blasting of
rock surfaces by winds when
they hurl sand particles against
them. Abrasion is most effective
at or near the base of rocks,
where the amt of material the
wind is able to carry is greatest.
Explains → telegraph poles in desert
are covered by metal for a foot
or two above the ground.

③ Attrition → Collision b/w
wind-borne particles - wear
out each other & their sizes are
reduced - attrition.

Landforms of Wind Erosion in deserts

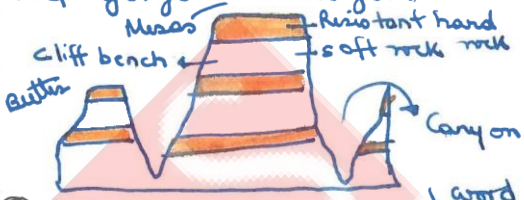
① Rock Pedestals or Mushroom Rocks
- Sand blasting effect of winds -
wears away the softer layers -
irregular shape is formed -
Rock Pedestals.
- Rock Pillars further eroded
near the bases - friction greatest
- Mushroom shape - Mushroom
rocks or gour in Sahara.

② Zeugen → tabular masses,
soft rocks lying beneath hard
rocks → due to wind abrasion -
it becomes 'ridge & furrow'
landscape. Hard rocks stand
above the furrows as ridges
or zeugen.
- Continuous abrasion widens
the furrows & lowers zeugen.



③ Yardangs.
Hard & soft rocks are vertical
bands allinged in the direction of
prevailing winds. Wind abrasion
excavates the bands of softer rocks
into long narrow corridors
separating steep sided over hanging
ridges of hard rocks - Yardangs

(4) Mesas & Buttes
- Table like land mass, very
resistant horizontal top layer
& steep sides - protect underlying
rocks from getting eroded.
Ex → Arizona. Table Mt of Cape
Town (South Africa).
- Continued denudation - Mesas
reduces into - isolated flat-
topped hills - Buttes
- Buttes & Mesas separated by
deep gorges or canyons.



⑤ Inselberg → German word
'Island mt', rounded tops, steep
slopes, composed of granite or
gneiss, isolated residual hills
rising abruptly from the
level ground → Ex - Kalahari
desert, Western Australia, Ayer

⑥ Ventifacts or Dreikanter
Pebbles faceted by sand
blasting - with the change in
dirn of wind different facets
are developed, Flat faces, sharp edges
- Ventifacts with three wind-faceted
surface - Dreikanter
- Form desert pavement - smooth
mosaic like region

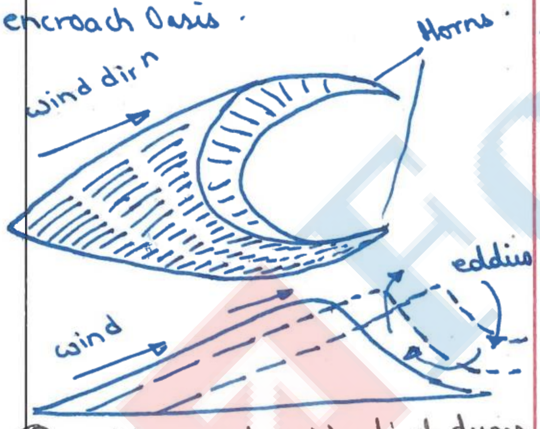
⑦ Deflation hollows →
Lowering of grounds due to wind
blowing away unconsolidated
materials forming depressions
- Minor faulting also creates
depressions.
- Oases or swamps are formed
in deflation hollows.
Ex → Faiyum depression (Egypt)
Great Dust Bowl (USA)

Landforms of Wind Deposition in deserts

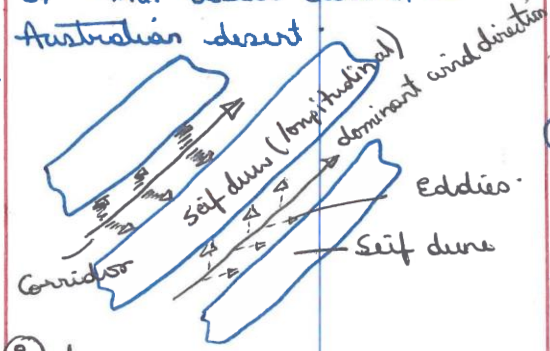
Blood Rains → Dust from Sahara
desert blown across the
Mediterranean in Italy or glaciers
of Switzerland.
- Migration pattern of Sand
dunes depends upon :-
ⓐ Size of particles
ⓑ Velocity of winds
ⓒ Location & nature of surface
ⓓ Absence or presence of water
& natural vegetation.

4) Dunes → Hills of sand formed by accumulation of sands & shaped by movement of winds, mostly found in erg type of desert
· Live dunes - constantly move
· Fixed dunes - rooted with vegetation

(a) Barchan → crescentic or moon shaped dunes, live dunes, mostly in Turkistan & Sahara
· Barchans are initiated at an obstacle such as patch of grass or heap of rocks
· Occurs transversely to wind, horns thin out & become lower in direction of wind due to reduced frictional retardation of the winds around the edges
· windward side is convex & gently sloping while the leeward side being sheltered is concave & steep.
· The crest moves forward
· sand driven up the windward side & on reaching the crest slips down the leeward side so that the dune advances.
· Migration of barchans may be a threat to desert life, it can encroach Oasis.



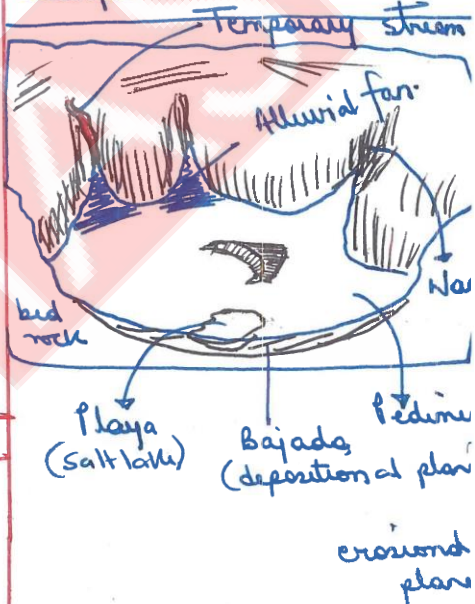
(b) Seifs or longitudinal dunes
· seif- Arabic word- sword
· long narrow ridges of sand, over hundred miles long lying parallel to the dirn of prevailing winds
· Dominant wind blows straight along the corridor
· Eddies that are set up blow towards side of corridors, having less power, drop the sand to form dunes.
· Prevailing winds increase the length of the dunes into tapering linear ridges while occasional cross winds tend to increase their height & width
Ex → Thar desert, Sahara, West Australian desert



(2) Loess →
· Fine dust blown beyond the desert limits is deposited on neighbouring lands - loess
· Yellow, very fertile, fine loam, rich in lime, extremely porous
· badland topography may develop.
Ex → N-W China (loess plateau - Hwang Ho basin)
· Called Limon (Germany, France & Belgium)

Landforms due to water Action in deserts

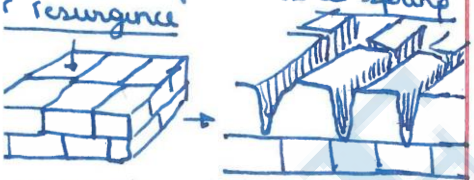
· Alluvial Cone or fan → Masses of debris deposited at the foot of hill or mouth of the valley
· Gullies & Ravines → eroding the land due to movement of loose gravel + sand + fine dust + water along the hill.
· Wadis → Large dry channels or valleys that are deepened by vertical corrasion by raging torrents during the occasional cloudbursts.
· Desert streams fed by melting snow of a distant mt → exotic streams - carves out steep walls - which rises abruptly from the stream bed -
In Algeria such gorges are called Chebka
· water collected in a depression or a desert basin due to outflowing streams from upland region results in temporary lakes.
· Contains high % of salts due to evaporation - The lakes & alluvial plains formed by them are called - playas, salinas or salars in US & Mexico and shotts in Northern Africa.
· Floor of the depression is made up of 2 features
(a) Bajada → Depositional feature made up of alluvium material laid down by the intermittent streams
(b) Pediment → An erosional plain formed at the base of the surrounding mt scarps.



imestone & chalk – Sedimentary rocks of organic origin from the accumulation of corals & shells in the sea.
Limestone pure state → calcite or calcium Carbonate
Pure state + Magnesium → dolomite
Limestone + rain water → weak acid.
Karst Topography → A very distinct type of topography developed ~~due to~~ in the region with a large stretch of limestone. Name developed from Karst district of Yugoslavia.

Characteristic Feature of a Karst Region

bleak landscape (exposed & barren and often windswept) occasionally broken by precipitous slopes.
Absence of surface drainage – most surface water has gone underground.
Surface Valleys are dry
water penetrates to the base of the limestone & meets non-porous rocks it re-emerges to the surface as a spring or resurgence



Progressive widening by solution enlarges these cracks into trenches & most intriguing feature called limestone pavement is developed.
Enlarged joints – Grikes
Isolated, rectangular blocks – Clints
Swallow holes / Sinkholes → small depression carved out by solution where rain water sinks into the limestone at a point of weakness.
Limestone Gorge → Due to etching of caverns & passages along joints or bedding planes by the action of water onto limestone, roof of an underground tunnel collapses forming a precipitous limestone gorge such as Cheddar gorge.

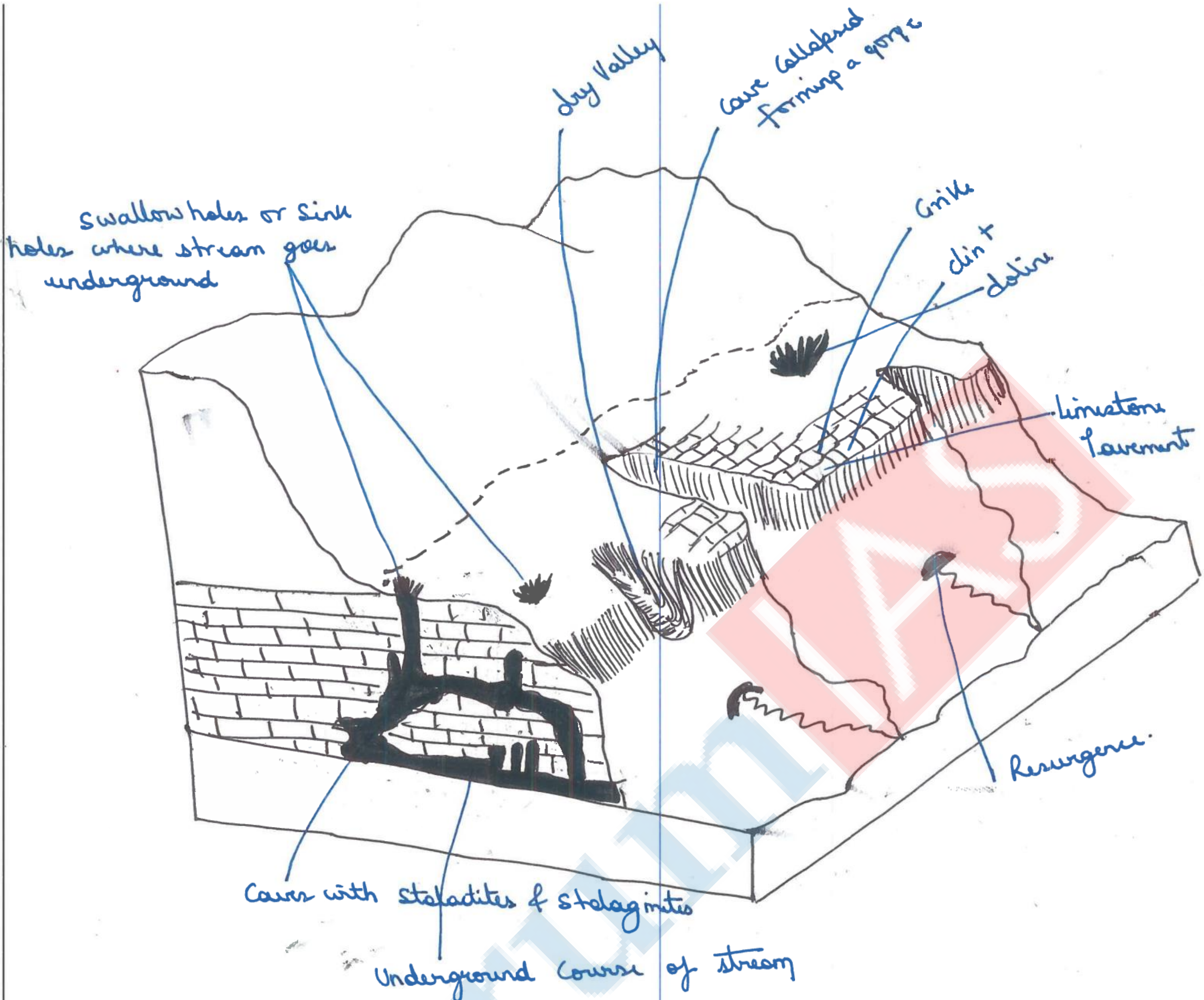
- Doline → Number of swallow holes coalesces to form a larger hollow.
- Uvala → Several doline may merge as a result of subsidence to form a larger depression.
- In Yugoslavia – large depressions are called Polje but these are partly due to faulting.
- Stalactites → sharp, slender, downward growing pinnacles that hang from the cave roofs.
- Water carries calcium in solution – lime charged water evaporates leaves behind solidified crystalline calcium carbonate.
- Stalagmites → As moisture drips from the roof it trickles down the stalactites and drops to the floor where calcium is deposited to form stalagmites.
- Pillar → Over a long period, the stalactite hanging from the roof is eventually joined to the stalagmite growing from the floor to form a pillar.
Ex → Kuala Lumpur (Batu Caves)
Postojna Caves (Yugoslavia).
- Stalagmites are shorter, fatter & more rounded.

Human activities of Karst Region
- often barren
- Vegetative growth difficult →
(a) porosity of rocks
(b) Absence of surface drainage
(c) Very thin layer of soil.

Limestone Vegetation in tropical areas – luxuriant because of heavy rainfall all year around.

① Settlements are scarce, scattered, population sparse
② Mineral of importance – lead
③ Good quality limestone → used for building materials or quarried for the cement industry

Chalk
- No surface drainage & valleys which contained rivers are now dry called Coombes
- It forms low rounded hills in Southern & S-E England called downs.
- Used for arable & pasture farming



Dry Valley
Cave Collapsed forming a gorge
Swallow holes or Sink holes where stream goes underground
Grike
clint
doline
Limestone Pavement
Resurgence.
Caves with stalactites & stalagmites
Underground course of stream

akes → Hollow land where water accumulates.
Temporary feature of arth's crust

ormation & Origin of Lakes

) Lakes formed by Earth Movement

) Tectonic Lakes

ue to warping, sagging, ending & fracturing of the arth's crust, tectonic depressions occur.
→ Titicaca, Caspian Sea

) Rift Valley Lakes

ue to faulting, a rift Valley formed by the sinking of and b/w two parallel faults deep, narrow & elongated n character.
x – Lake Tanganyika, Malawi udolf, Edward, Albert, Dead ea

) Lakes formed by Glaciation

) Cirque lakes or tarns →

lacier on its way down the alley leaves behind circular ollows in the heads of the alleys up in the mts.
x – Blea Water in Westmorland England).
Water occupying long & deep lacial troughs – Ribbon lakes
x – Lake Ullswater

) Kettle Lakes → Depressions the outwash plain left by e melting of masses of stagnant ice.
lever of any great size
→ Kettle lake of Orkney in Scotland

) Rock Hollow Lakes

ormed by ice-scouring when valley glaciers or ice heets scoop out hollows on the surface.
Ex → (Suomi - the land of akes) → Finland, 35,000 glacial lakes.

) Lakes due to morainic damming of Valleys :- →

Water accumulation behind the barrier formed due to deposition of morainic debris across a valley by Valley glaciers.
· Lake Windermere of Lake District, England.

(e) Lakes due to the deposition of glacial drifts

· Glaciated lowlands with predominant drumlin landscape - drainage poor - intervening depressions forming lakes
Ex → County Down in Northern Ireland.

(3) Lakes formed by Volcanic activity

(a) Crater or caldera lakes

Volcanic explosion – top of cone blown off – leaving behind a natural hollow called a crater – enlarged by subsidence into a caldera
· Normally dry. steep cliffs & roughly circular in shape.
Ex → Crater Lake in Oregon, Lake Toba in Northern Sumatra & Lake Avernus near Naples.

(b) Lava-blocked Lakes →

Stream of lava flowing across a valley, solidifying and damming the river forming a lake.
Ex → Sea of Galilee (blocking of Jordan Valley)

(c) Lakes due to subsidence of a Volcanic land surface

· crust of a hollow lava flow way collapse – subsidence leaves behind a wide & shallow depression
Ex – Myvatn of Iceland.

(4) Lakes formed by erosion

(a) Karst Lakes →

Solvent action of rain water on limestone carves out solution hollows – when these become clogged with debris, lakes are formed.
· Collapse of limestone roofs of underground caverns may result in the exposure of long narrow lakes Ex → Lac de Chaillexon in Jura mts.
· Large depressions called Poljes which naturally do not have surface outlets, may contain lakes.
Ex → Lake Scutari in Yugoslavia

(b) Wind deflated lakes

· Deflating action of winds in deserts creates hollows – slowly ground water seeps out. Excessive evaporation causes them to become salt lakes and playas.
Ex → Qattarah depression in Egypt
Great Basin of Utah, USA

(5) Lakes formed by deposition

(a) Lakes due to river deposits

· A river may shorten its course during a flood by cutting across its meandering loops, leaving behind a horse-shoe shaped channel – ox-bow lake
Ex → Flood plains of lower Mississippi (USA)

(b) Lakes due to Marine deposits

action of winds & waves may isolate lagoons along coasts
Ex → found along deltas of Nile & Ganga (Lagoons are)
· Called haffs in East Germany & Poland

(c) Lakes due to landslides screes & avalanches

· Lakes formed by these processes are called barrier lakes
· Short lived lakes
Ex – Lake Gormire (Yorkshire)

(6) Lakes formed by Human & biological activities

(a) Man-Made Lakes :- →

· By erecting a concrete dam across rivers – reservoirs are formed

(b) Lakes made by animals →

Animals like beavers live in communities & construct dams across rivers with timber.
· They are quite permanent (Beaver dam)
Ex → Beaver Lake in Yellowstone National Park (USA)

C) Ornamental lakes →
man-made lakes to attract tourists.
Ex → Lake Gardens, Kuala Lumpur

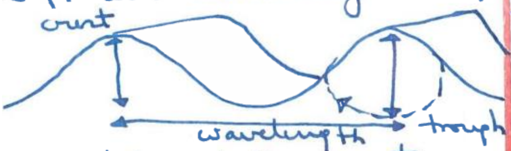
Lakes & Man

1. Means of Communication
2. Economic & industrial development
3. Water storage
4. Hydro-electric power generation
5. Regulating river flows (Absorbs excess water during heavy floods)
6. Agricultural purposes.
7. Moderation of climate
8. Source of Food (Sturgeon fish → Caspian Sea)
9. Source of Minerals
Salts, Borax (salt lakes of Mojave desert), Gypsum, potash
10. Tourist attraction & health resorts.

It is in storms that
the ravages of the waves
reach their greatest magnitude.
Tides affect marine erosion
mainly by extending a line of
erosion into a zone of
erosion. [HT & LT]
Currents help to move eroded
debris and deposit it as
silt, sand and gravel along
the coasts.

The Mechanism of Marine Erosion
Most powerful agent – waves.
Origin → sweeping of winds
over the water surface
creating a series of undulating
swells surging forward.

In normal wave → vertical
height b/w crest & trough =
10 ft and wavelength = 400 ft



Approaching shallow water –
speed is reduced and waves
are curved or refracted.
In shallow water, less than the
height of the waves checks the
forward movement and break
onto the shores in a mass of
foam as breakers.

Water rushes up the beach &
hurls rock debris against the
land – swash
Water is sucked backed &
retreats as backwash
Undertow → An element of
offshore drift, flows near the
bottom away from the shore,
current exerts a pulling effect
which can be dangerous to
sea-bathers.

Marine agents of Erosion
operate in the following ways:-
1) Corrasion → waves armed
with rock debris, charge
against the base of the cliff
and wear them back by
corrasion
2) Attrition → waves hurl
these fragments such as boulders,
pebbles, shingle & fine sand
against one another and are
broken down by attrition into
very small pieces.
Grinding & polishing of
fragmented materials against cliff
faces & against each other –
responsible for fine sand.

③ Hydraulic action → waves
splashing against the rock,
enter joints & crevices in the
rocks – air imprisoned inside
is immediately compressed –
waves retreat – compressed
air expands with explosive
violence – action repeated again
& again – enlarges the cracks.

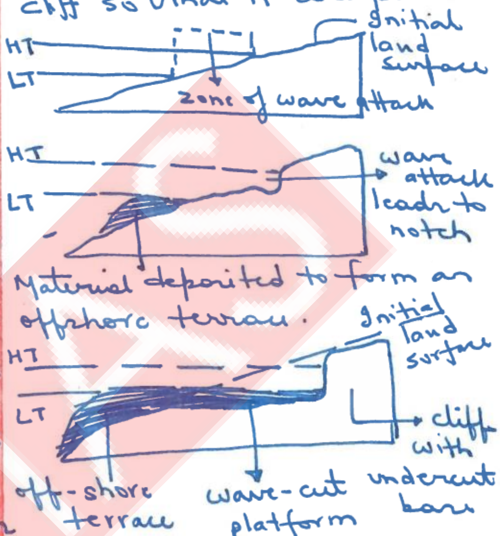
④ Solvent action → limited to
limestone coast, solvent action
of sea water on $CaCO_3$ sets up
chemical changes in the rocks &
disintegrates.

* Rate of marine erosion depends
on a) Nature of rocks. b) Amount
of rock exposed c) Effects of
tides & currents d) Human
interference in coastal protection.
e) Volcanicity, glaciation, earth
movement & organic
accumulations

Coastal features of Erosion
① Capes & bays → continual
action of waves on rocks of
varying resistance causes the
coastline to be eroded
irregularly. Ex – particularly
pronounced when granite and
limestone – occur in alternate
bands with – sand & clay.
⊙ Softer rocks are worn back
into inlets, coves or bays
⊙ Harder ones persist as
headlands, promontories or capes
Ex – Dorset coast of Sⁿ England.

② Cliffs & wave-cut platforms
Very steep rock face adjoining
the coast forms a cliff.
Rate of recession – depends on its
geological structure – stratification
jointing of rocks & their
resistance to wave attack.
a)

⊙ If the beds dip seawards,
large blocks of rocks – dislodged
& fall into the sea.
⊙ beds dip landwards – more
resistant to wave erosion
Ex – chalk cliff (English Channel)
⊙ At the base of the cliffs, the
sea cuts a notch – which
gradually undermines the
cliff so that it collapses.



The development of shore profile
cliff recedes landwards under
the pounding of waves, an
eroded base is left behind
called a wave cut platform
⊙ Eroded particles are swept
away in the sea and are
deposited on the offshore
terrace.

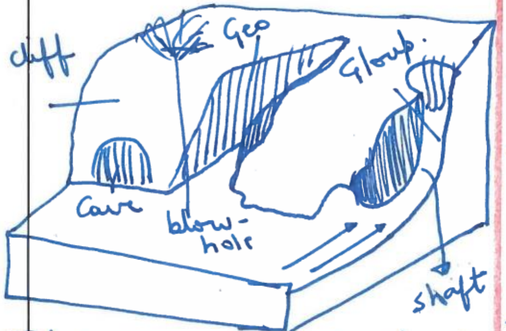
③ Cave, arch, stack & stump

This surface needs to be sloping
⊙ Prolonged wave attack – on
the base of a cliff excavates
holes in regions of local
weaknesses called caves.
Ex – Flamborough head, England
⊙ when two caves approach one
another from either side of
a headland & unite – they form
an arch
Ex – Neddie Eye near Scotland
⊙ Further erosion – lead to
collapse of arch – seaward
portion of the headland
will remain as pillar of
rock called stack.
Ex – Old Man of Hoy (Orkneys)
⊙ Vertical rock pillars are
further eroded, leaving behind
only the stump – which are
only just visible above the
sea level
Ex – St. Kilda Group.

(4) Geos & gloups

The occasional splashing of waves against the roof of a cave may enlarge the joints when compressed air is trapped inside. — Natural shaft is formed. Waves breaking into the cave may force water or spray or just air out of this hole. Such shaft is called gloup or blow-hole

Ex – Holborn head in Scotland

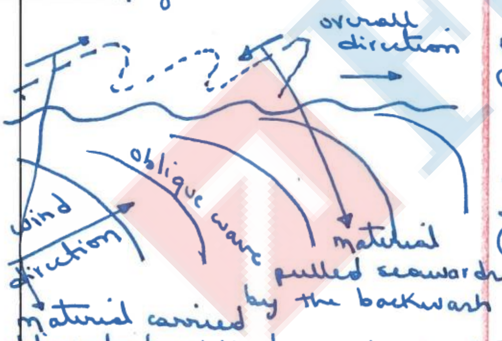


Enlargement of blow-hole & continued action of waves – weakens the cave roof. When roof collapses, a long narrow inlet or creek develops. These are called geos.

Ex – the Wife Geo, Scotland.

Coastal features of Deposition

(1) Beaches → Sands and gravels loosened from the land are moved by waves to be deposited along the shore as beaches. The longshore drift which comes obliquely to the coast carries the material along the shore in the direction of the dominant wind.



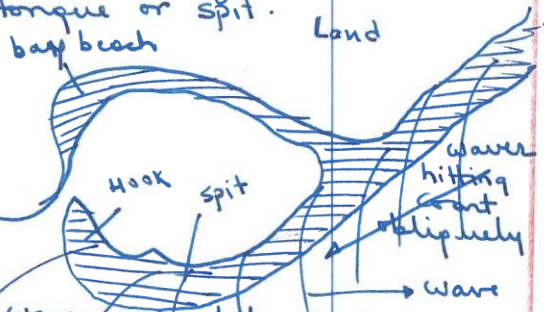
⊙ Backwash deposits eroded materials on the off-shore terrace.

⊙ The coarser materials (cobbles & boulders) – dropped at the top of beach

⊙ Fine materials (pebbles & sand grains) – carried by the backwash are dropped closer to the sea.

Ex – Chilean Coast – long beaches are absent.

(2) Spits & bars → debris eroded by waves, moved by longshore drift – indentation in the coast like mouth of a river, or a bay – material gets deposited across the inlet. As more materials are added – pile up into a ridge or embankment of shingle forming a tongue or spit.



waves refracted so that spit is recurved.

Ex – Calshot spit, Southampton

⊙ When the ridge of shingle is formed across the mouth of a river or the entrance to the bay, it is called a bar.

Ex – Chesil Beach in Dorset (England)

⊙ Such a Connecting bar that joins two land masses is better known as tombolo.

⊙ Baltic Coast – Poland & Germany large bodies of water completely enclosed by long bars – locally termed nehrungs.

(3) Marine dunes & dune belts

With the force of on-shore winds, a large amount of coastal sand is driven landwards forming extensive marine dunes that stretch into dune belts.

Common in Belgium, Denmark & Netherland

⊙ To arrest the migration of sands – marram grass & pines are planted.

Types of Coasts

(1) Coastlines of Submergence – Due to sinking of land or the rise of the sea.

a) Ria Coast →

Ice age – great deal of water was locked up in ice – warmer climate followed – sea level rose.

⊙ Upland coastal regions – mts run at right angles to the sea that is transverse or discordant – a rise in sea level submerges or drowns the lower part of valleys to form long narrow branching inlets separated by narrow headlands.

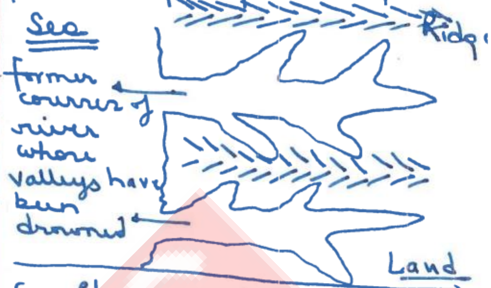
⊙ Difference b/w fjords & rias

(1) They are not glaciated

(2) Depth increases seawards

Ex – Atlantic coast – France, Sp

⊙ Rias are backed by highlands – support few large commercial ports though they have deep water



Ex – Plymouth (England)
Brest (France)

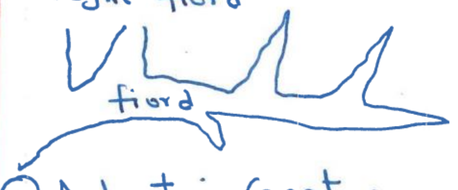
b) Fiord Coast → submerged U-shaped glacial troughs – have steep walls often rising straight from the sea, with tributary branches joining the main inlet at right angles. They mark the path of glaciers that plunged down from the highlands.

⊙ It complicates coastal navigat[ion] because – due to greater intensity of ice erosion fiords are dee[p] for great distances inland but there is a shallow section at the seaward end formed by ridge of rock called threshol[d]

⊙ Confined to the higher latitudes of the temperate regions.

Ex – Norway, Canada, Alaska

Sogne fiord



(3) Dalmatian Coast → longitudinal Coast where mts run parallel or concordant to the coast. It produces with long, narrow inlets which a chain of islands parallel to the coast. Typical to pacific coa[st]

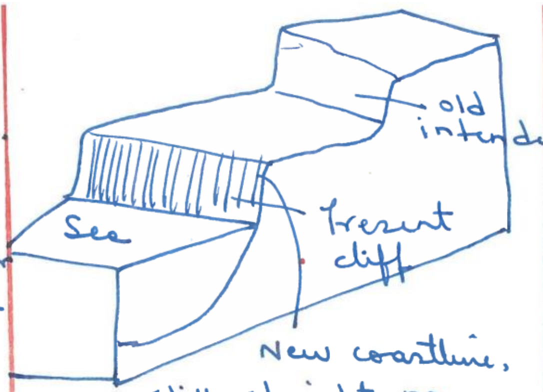
⊙ It hinders communication inland – has no distinguished ports – Exception – San Francisco

⊙ Ex – western coast of N. America & S. America.

(4) Estuarine Coast →

In submerged lowlands, the mouths of rivers are drowned so that funnel-shaped estuaries are formed. If their entrances are not silted by moving sand banks, they make excellent sites for ports. Ex - Thames, Elbe, Plate River

London | Germany (Hamburg) | Buenos Aires



) Coastlines of Emergence

~~Uplifted~~ Due to uplift of the land or a fall in sea level.

) Uplifted lowland Coast →

The uplift of part of the continental shelf produces a smooth, gently sloping coastal lowland. The offshore waters are shallow with lagoons, salt-marshes & mud-flats.

Ports that were once located on the former coast becomes inland towns.

Ex - Rio de La plata (Argentina) western finland.

) Emergent upland Coast →

Faulting & earth movement may thrust up coastal plateau so that the whole region is raised, with consequent emergent features. A raised beach is the most prominent.

Ex - western coast of Deccan. India, Scotland.

) Continental Islands CHAPTER-11 → Islands & Coral Reefs

art of the mainland & are
ow detached from the Continent,
eperated by a shallow lagoon
 a deep channel.
Their seperation could be
ue to subsidence or rise in
sea level
Their former connection
with the mainland can be
traced from the similar
hysical structure, flora & fauna
that exist on channel.
) Individual Islands →
ery much associated with
e characteristic features
 the mainland.
Ex- Madagascar, Sri Lanka
) Archipelagos → comprise
roups of islands of varying
hapes & sizes.
x- British Isles, philippines
 Festoons or Island arcs →
rchipelago in the shape of a
oop around the edge or the
ainland, marking the
ontinuation of mt ranges
which can be traced on the
ontinent.
x - Aleutian, Kurils, RyuKyu.
) Oceanic Islands
mall & located in the
midst of oceans., no connection
with mainland
x- Galapagos Is.
ery sparsely populated
stops for aeroplanes & ships
or refuelling.
) Volcanic Islands →
rise from the ocean bed,
slands are the topmost parts of
he cones of volcanoes.
x - Mauna Loa in Hawaii
Mauritius, Reunion Is).
) Coral Islands → Unlike
olcanic Is, the coral Is. are
very much lower & emerge
ust above the water surface.
x- Marshall Is, Bermuda Is.
accadive & Maldives.

Read chapter -12 from book

rometer, Aneroid barometer, altimeter, barogram → instruments measure pressure
To obtain Fahrenheit → (1·8×°c) + 32°F
To obtain centigrade → (°F − 32) ÷ 1·8
To measure humidity - hygrometer
Speed of wind - Anemometer
To measure sunshine - Sun dial
Places with equal sunshine duration → isohels
Amount of cloud cover in the sky is expressed in eighths or oktas.
Places with an equal degree of cloudiness - isonephs

Classification of clouds

(a) High clouds → Mainly Cirrus - feathery, > 6000 m.
i) Cirrus (Ci) → looks fibrous and appears like wisps in the blue sky, often called 'mares tails', indicates fair weather and often gives a brilliant sunset
ii) Cirrocumulus (Cc) → appears as white globular masses, forming ripples in a 'mackerel sky'
iii) Cirrostratus (Cs) → resembles a thin white sheet or veil. sky looks milky & the sun or moon shines through it with a characteristic 'halo'.

(b) Medium clouds → Mainly stratus or sheet clouds, 2000 < cloud base < 6000
~~iv) Stratocumulus (St-Cu) → rough, bumpy cloud~~
Mainly Alto clouds, 2000 m < cloud base < 6000 m
iv) Altocumulus (Alt-Cu) → woolly, bumpy clouds arranged in layers and appearing like waves in blue sky. normally indicate fine weather.
v) Altostratus (Alt-St) → denser, greyish clouds with watery look. fibrous or striated structure through which sun's rays shines faintly.

(c) Low clouds → mainly stratus, cloud base < 2000 m
vi) Stratocumulus (St-Cu) → rough, bumpy cloud, waves more pronounced than altocumulus, great contrast b/w bright & shaded parts
vii) Stratus (St) → very low cloud, uniformly grey & thick, appears like a low ceiling or highland fog. brings dull weather with light drizzle, reduces visibility of aircraft & is thus a danger
viii) Nimbostratus (Ni-St) → dark, dull cloud, clearly layered, known as rain cloud, brings continuous rain, snow or sleet.

(d) clouds with great Vertical extent
mainly cumulus or heap clouds with no definite height
ix) Cumulus (Cu) → Vertical cloud, rounded top. horizontal base. typical of humid tropical regions, associated with up-rising convectional currents, great white globular masses, look grey against the sun but it is a 'fair-weather cloud'
x) Cumulonimbus (Cu-Ni) → tremendous vertical height. 2000 feet to 30,000 feet, cauliflower top with anvil shape, seen in tropical afternoon, also called 'thunder cloud', black & white globular masses

(a) Haze → caused by smoke & dust particles or due to unequal refraction of light in air due to unequal densities in the lower atmosphere, humidity < 75%.

(b) Mist → condensation of water vapour in air causes small droplets of water to float forming clouds at ground level called mist.
· Occurs in wet air unlike Haze humidity > 75%.

(c) Fog → water condensing on other particles like smoke from houses & factories.
· Dense fogs are more likely to occur in the high & middle latitudes rather than the tropics.

Radiation from sun consists of three parts — Visible, Ultra-violet & Infra red.

Only that part of the sun's radiation which reaches the earth is called insolation

Temperature

Importance

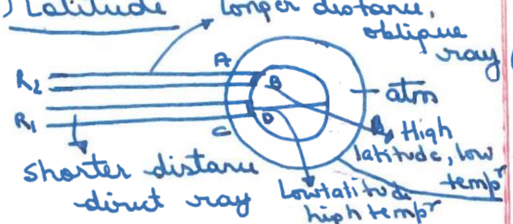
1) Influences actual amt of water vapour

2) Evaporation & condensation — governs degree of stability of atm.

3) Relative humidity - cloud formation & precipitation

Factors influencing temperature

1) Latitude



AB > CD ⇒ heat is much more absorbed by clouds, water vapour & dust particles

R1 → heat up smaller area

R2 — heat up larger area (tempr low)

2) Altitude → Normal lapse rate

3) Continentality → land-water differential

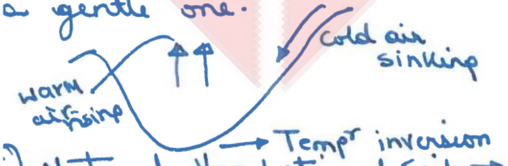
4) Ocean currents & winds →

Fohn, chinook, Sirocco, Mistral

Westerlies → Britain & Norway → cool winds in summer & warm winds in winter

5) Slope, shelter & aspect →

steep slope experiences more rapid change in tempr than a gentle one.



6) Natural Vegetation & Soil →

Dense forest → less sunlight reaches ground → cool & shady

Light soil reflects more heat than darker soils

Day time - trees looses water by evapotranspiration — RH increases - mist & fog may form.

CHAPTER-14 → CLIMATE

Precipitation

(1) Convection rainfall →

→ day, tropics, summers in temperate

- earth's surface heated by conduction, air rises in a convection current - cumulonimbus clouds — torrential downpour

(2) Orographic or relief rainfall →

→ Moist air forced to ascend mt. barrier - best developed when moisture laden winds comes from sea, cools by expansion

· There is evaporation and little or no precipitation

(3) Cyclonic or frontal rainfall →

- Convergence of two different air masses with diffn tempr & physical properties

· In ascent, pressure decreases, the air expands & cools. condensation — frontal rain

Pressure & Planetary Winds

· 30°N & S → STHPB — air dry, region of descending air currents, — wind divergence & cyclones — Horse latitudes

· Sub-polar low pressure areas are best developed over oceans.

· Ferrel's law of deflection → deflection in direction of winds

Westerlies → More variable, play a valuable role in carrying warm equatorial waters and winds to western coasts of temperate lands.

· This warming effect & other local pressure differences have resulted in a very variable climate in the temperate zones, dominated by the movements of cyclones & anticyclones.

NOTE → Not all the western coasts of the temperate zone receive westerlies throughout the year.

Ex — California, Iberia, central Chile, Southern Africa & South-West Australia receive westerlies only in winter — caused due to 'shifting of wind belts' for regions which lie approximately between the latitudes 30° & 40° N and S.

· June — sun overhead - Tropic of cancer - belts moves 5-10° North of their average position → Mediterranean parts of Southern continents - come under influence of westerlies receive rain in June (Winter in Southern hemisphere)

· Dec - Sun overhead - Tropic of capricorn - 5-10° South - Mediterranean parts of Europe & California - come under influence of westerlies receive rain in Dec (Winter in Northern hemisphere)

Cyclonic activity

· Tropical cyclones, typhoons, hurricanes, tornadoes

· Well developed low pressure systems into which violent winds blow.

· Tornadoes → Guinea lands of West Africa & the Southern USA

Typhoons also occurs in Japan (Mainly)

· between 6° & 20° N & S

· frequent from July to October

· smaller than temperate cyclones

· Much steeper pressure gradient

Tornadoes →

· Most frequent in spring

· Small but very violent tropical & sub-tropical cyclones.

· Appears as a dark funnel cloud

· Mostly in Mississippi basin

Cyclones

· Temperate cyclones also known as depressions

· Rotates anticlockwise in N.H & clockwise in S.H

Anticyclones →

· opposite of cyclones

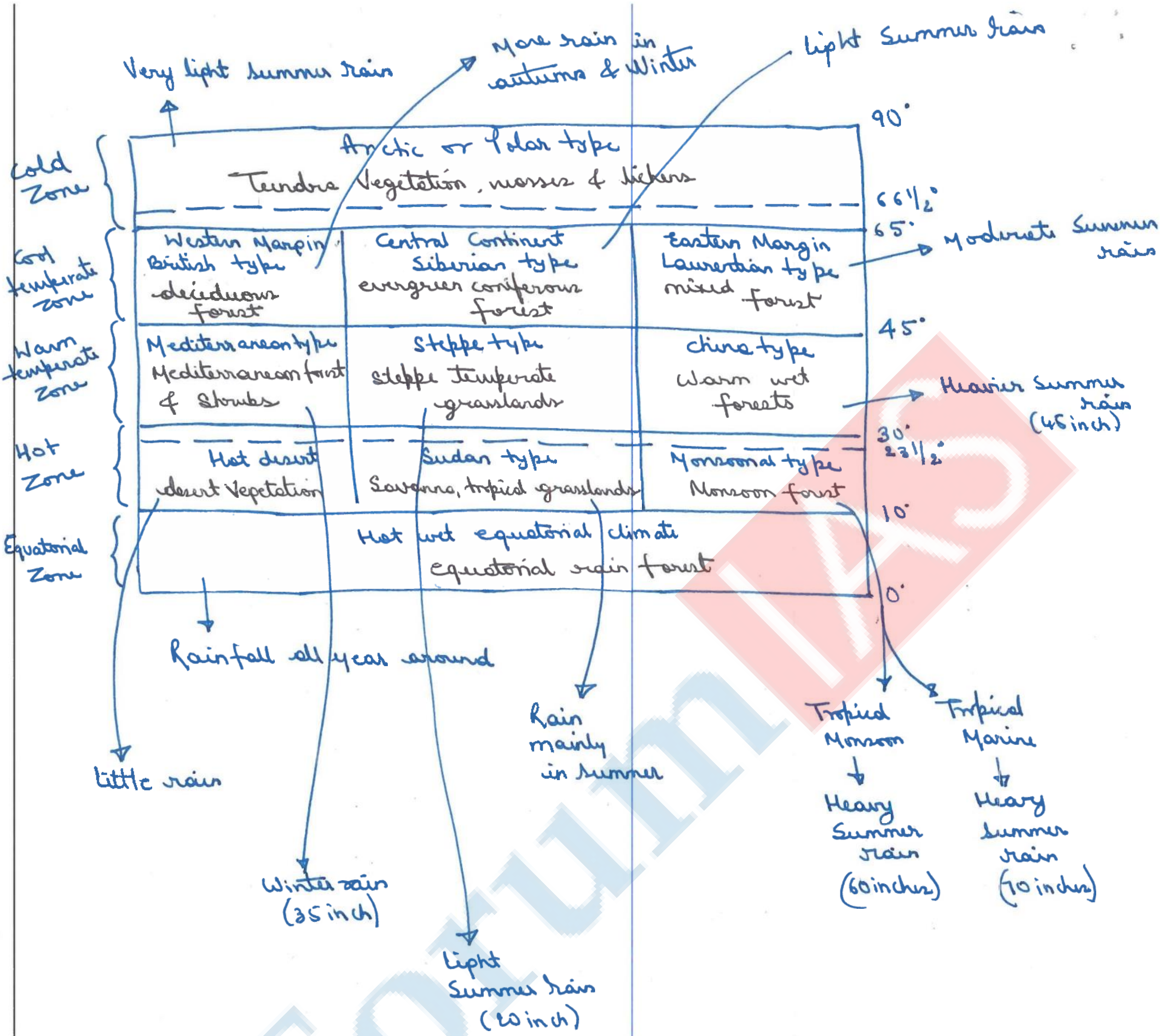
· High pressure in the centre

· Normally herald fine weather

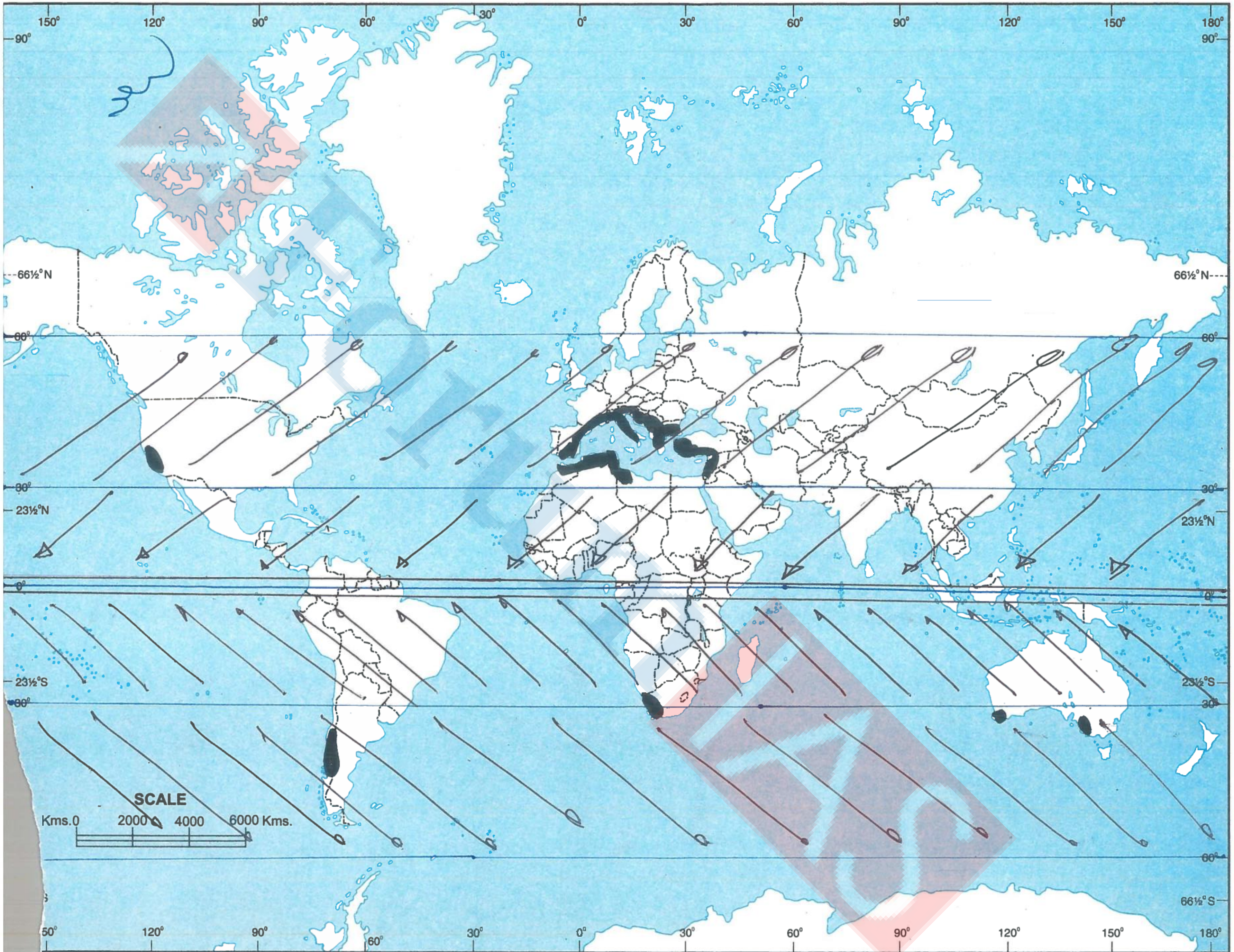
· skies are clear, air is calm

· Wind blow outwards

· clockwise in N.H & anti-clockwise in S.H


Very light summer rain
More rain in autumn & winter
Light summer rain
90°
Cold Zone
Arctic or Polar type
Tundra Vegetation, mosses & lichens
66½°
65°
Cool temperate zone
Western Margin British type
deciduous forest
Central Continent Siberian type
evergreen coniferous forest
Eastern Margin Laurentian type
mixed forest
Moderate Summer rain
45°
Warm temperate zone
Mediterranean type
Mediterranean forest & shrubs
Steppe type
steppe temperate grasslands
China type
Warm wet forests
Heavier summer rain (45 inch)
30°
23½°
Hot Zone
Hot desert
desert vegetation
Sudan type
Savanna, tropical grasslands
Monsoonal type
Monsoon forest
10°
Equatorial Zone
Hot wet equatorial climate
equatorial rain forest
0°
Rainfall all year around
Rain mainly in summer
Tropical Monsoon
Heavy Summer rain (60 inches)
Tropical Marine
Heavy summer rain (70 inches)
Little rain
Winter rain (35 inch)
Light Summer rain (20 inch)

THE WORLD - POLITICAL



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CHAPTER-15 → The Hot, Wet Equatorial climate

5°–10°) N & S of equator
owlands of Amazon, Congo,
alaysia & the East Indies

Equatorial highlands →
istinctively cooler climate,
odified by altitude,
ameron highlands in Malaysia,
orthern Andes, Kenyan
ighlands in east Africa

CLIMATE

Temp^r →
great uniformity of temp^r
No winter
cloudiness & heavy precipitation
→ moderate the daily temp^r

recipitation →
ery heavy & well distributed
roughout the year
Max^m rainfall in April &
ctober → shortly after equinoxes
Least rainfall → June &
ecember solstice
Double rainfall peaks coinciding
ith the equinoxes are a
haracteristic feature of
quatorial climates
② Due to great heat in
equatorial belt, mornings are
right & sunny.
Convectional rain in afternoon
rom towering cumulonimbus
clouds
) Mountainous regions
experience orographic rainfall
) Intermittent showers from
yclonic atmospheric disturbances
aused by the convergence of
air currents in the doldrums
RH Very high → feel sticky &
ncomfortable
Monotonous climate, oppressive
. enervating, taxes one's mental
alertness and physical
apability, though along the
oasts refreshing sea breeze
to bring some relief.

Equatorial Vegetation

High temp^r & abundant
rainfall → supports tropical
rain forest

· Amazon lowland forest →
Selvas
· Growing season here is all
year around for plants

① A great variety of vegetation

· Multitude of evergreen
forests
· Tropical hardwood → Mahogany,
ebony, greenheart, cabinet woods,
& dyewoods.
· smaller palm trees
· climbing plants like lianas
or rattan – hundred feets long
· Epiphytic & parasitic plants
that live on other plants

② A distinct layer arrangement

· plants struggle upwards for
sunlight. ~~and appears to~~
· From air forest appears like
a thick canopy of foliage
· Undergrowth is not dense

③ Multiple species

· Many tropical countries are net
timber importers – why?
① As many as 200 species of
trees found in an area of forest –
made commercial exploitation of
~~timber~~ tropical timber difficult
② Many tropical hardwoods
do not float readily on water
& this makes haulage an
expensive matter

④ Forest clearings

· Forest cleared either for
lumbering or shifting cultivation
· After clearing less luxuriant
secondary forest called
belukar in Malaysia spring up
· coastal areas & brackish
swamps, mangrove forests thrive

Life & development in the equatorial region

· sparsely populated
· Practices shifting cultivation
· Abundance of food → fruits,
fishes, animals, vegetables.
· Amazon basin (Indian tribes)
collect wild rubber
· Congo basin (Pygmies) gather
nuts
· Malaysia (Orang Asli) make all
sorts of cane products and
sell them to people in villages
& towns.
· Crops like manioc (tapioca),
yam, maize, bananas &
groundnuts are grown
· Plantations of natural
rubber. (first discovered in
its wild state as hare
rubber in Amazon basin)
· Malaysia & Indonesia →
leading producers –
accountable for more than a
third of the world production
· Cocoa → extensively
cultivated in West Africa,
Gulf of Guinea
· 2 most imp^r producers →
Ghana & Nigeria
· Oil palm has also done
equally well

Factors affecting the development of equatorial regions

① Equatorial climate & health
· excessive heat & high
humidity reduces the capacity
for active work & resistance
to diseases.
· Exposure to diseases such as
malaria, yellow-fever
② Prevalence of bacteria &
insect pests
· hot wet climate encourages
the spread of insects & pests
· Insects & pests not only
spread diseases but are
injurious to crops.
③ Jungle hinders development
& maintenance
· Lalang (tall grass) & thick
undergrowth spring up as
soon as the shade trees
are cut
④ · Rivers form the only
natural highways.
④ Rapid deterioration of
tropical soil
· Misconception → tropical soils
are rich.
· Virgin state of soil – heavy
leaf fall – decomposition by
bacteria – thick mantle of
humus.
· Torrential downpours
washes out nutrients –
soil deteriorates rapidly.

Problems in lumbering :-

1) Trees do not occur in homogeneous stand
2) No frozen surface to facilitate logging
3) Tropical hardwoods are sometimes too heavy to float in the rivers.

Problems in livestock farming

1) Absence of meadow grass
2) Grass is so tall & coarse that it is not nutritious
3) In Africa, domesticated animals are attacked by tsetse flies that cause ngana, a deadly disease

- Farmers clears new land for cultivation called ladangs by felling or burning trees.

est developed in Indian sub-Continent → Burma, Thailand, aos, Cambodia, parts of Vietnam, outh china & Northern Australia

Tropical Marine climate → climate modified due to onshore trade winds all year round, evenly distributed rainfall

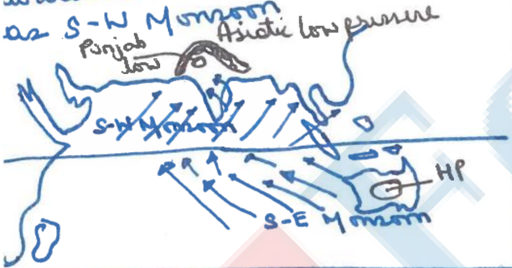
• Central America, West Indies, N-E Australia, Philippines, parts of East Africa, Madagascar, Guinea coast & eastern Brazil

Climatic conditions in Tropical Monsoon Lands

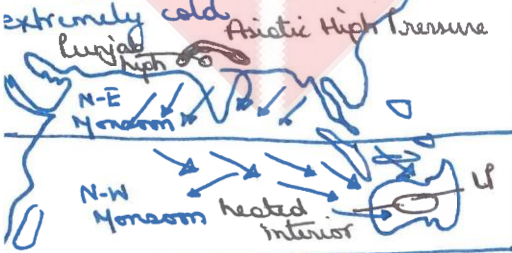
Basic cause of monsoon climate → difference in the rate of heating & cooling of land & sea.

Summer → sun overhead at tropic of cancer - lofty Himalayan & Tibetan plateau heated up - region of intense low pressure

Same time winter in S.H → high pressure develops in the continental interior of Australia. Wind blows outwards as S-E Monsoon to Java and after crossing equator are drawn towards continental low pressure as S-W Monsoon



Winter → Conditions are reversed (Tropic of Capricorn - sun overhead) - Asia interiors extremely cold.



The Seasons of tropical Monsoon climate

1) The Cool dry Season (Oct to Feb) small amt of rainfall in Northern India — Western disturbance

• N-E Monsoon - acquires moisture from Bay of Bengal - brings rain to south-eastern tip.

2) The hot dry Season (March to mid-June).

• Practically no rain anywhere

3) The rainy season (mid-June to September)

• This pattern of concentrated heavy rainfall in summer is a characteristic feature of Tropical Monsoon climate.

The tropical Marine climate

• Experienced along eastern coast of tropical lands.
• receive steady rainfall - trade winds
• Tendency towards maximum summer as in monsoon but without any distinct dry period.
• 70% rainfall concentrated b/w Jan to Apr
• No month without any rainfall
• Prone to severe tropical cyclones, hurricanes or typhoons.

Tropical Monsoon Forest

• depends on amt of summer rainfall.
• Normally deciduous → shed their leaves in dry period - to withstand the drought.
• Forests - more open & less luxuriant than the equatorial jungle
• Durable hardwoods → Timber, teak
• Burma - 75% of world's production of ~~teak timber~~ teak — used for ship building, furniture, construction purposes.
• Timber includes → Sal, acacia, Eucalyptus
• Bamboo thickets also grow
• Monsoonal Vegetation is thus most varied, ranging from forests to thickets, and from Savanna to Scrubland

Agricultural Development in the Monsoonal Lands

1) Wet padi Cultivation →

• impn staple Crop.
• grown in lands where rain (>70 inches).
• 2 types — Wet padi & dry Padi

2) Lowland cash Crops

• Most impn - Sugarcane → 2/3rd of world's sugar production comes from tropical countries
• Jute → Ganga-Brahmaputra Δ
• Manila hemp → Philippines - for high quality rope
• Indigo (India & Java), Cotton

3) Highland Plantation Crop

• Origin goes to Colonization.

Coffee → origin (Ethiopia & Arabia) — Brazil (1/2 the world's production) - cultivated on eastern slope of Brazilian plateau

Tea → (origin - china)

• moderate tempr (60°F), heavy rainfall (60 inches), well drained highland slope.

4) Lumbering →

Burma → Main money earner commodities → Rice & then teak.

• 150 yrs for a teak tree to mature into commercial timber
• Green teak logs - heavy - so poison the trees several years before actual felling
• Then it become dry & light enough to be floated down the Chindwin & Irrawaddy to reach saw mills at Rangoon.

5) Shifting Cultivation →

• Most primitive form of farming
• Farming mostly for subsistence
• Tropical Soils → Latosolic (rapidly leached & easily exhausted) → first crop may be bountiful but the productivity from next crops deteriorates

• Local names

Ladang - Malaysia
taungya - Burma
Tamrai - Thailand
Caingin - Philippines
Humah - Java
chena - Sri Lanka
Milpa - Africa & Central America

CHAPTER-17 → The Savanna or Sudan climate

Transitional type of climate b/w equatorial forest & trade wind hot deserts

Best developed in Sudan where the dry & wet seasons are most distinct

Africa, → S. America (Llanos of Orinoco basin & Campos of Brazilian highlands)

Australian Savanna → located south of monsoon strip

Climate of the Sudan Type

Rainfall → Alternate hot, rainy season and cool, dry season

N. Hemisphere → hot rainy season begins in May till Sept as in Kano, Nigeria → Rest of the year – Cool & dry

Annual precipitation less than tropical Monsoon climate

S. Hemisphere → Rainy season Oct - March) as in Salisbury Rhodesia)

Temperature →

Highest temp^r do not coincide with the period of the highest sun (June in N.H) but occur just before the onset of the rainy season. i.e April in Kano, October in Salisbury

Extreme diurnal range of temp^r another characteristic feature of the Sudan type of climate

Wind →

Harmattan flows

Trade winds are offshore – very less moisture

Harmattan (dry, dust-laden wind) provides relief from damp air of the Guinea lands.

It ruins crops & stirs up a thick dusty haze & impedes inland river navigation.

Natural Vegetation →

Savanna landscape → tall grass & short trees.

Misleading to call Savanna 'tropical grassland' bcoz trees are always present with luxuriant tall grass.

Terms 'parkland' or 'bush-veld' describes the landscape better.

Trees →

Grow best towards equatorial humid latitudes or along river banks & but decrease in height & density away from equator

- deciduous & scattered individuals
- shed leaves in cool dry season to avoid excessive loss of water through transpiration Ex – acacia.
- Baobab & bottle trees → broad trunks with water storing devices
- Trees are mostly hard, gnarled & thorny and may exude gum like gum-arabic.
- Umbrella shaped, exposing only a narrow edge to strong winds.

Grasses → tall & Coarse (6-12 feet)

- Elephant grass (even 15 feet)
- Grows in compact tufts & has long roots
- In between the tall grasses are scattered short trees & low bushes
- Towards desert savanna merges into thorny scrub.

Animal life of the Savanna

- Known as 'big game Country'

Human Life in the Savanna

① The Masai. cattle pastoralists

- Nomadic tribe who once wandered in Kenya, Tanzania & Uganda
- At present mainly confined to Kenya & Tanzania (15,000 miles²)
- They occupy less favoured areas on the lower slopes of east African plateau → droughts are frequent & prolong, grasses are not nutritious.
- In drought – Masai move upwards to the higher & cooler plateau
- Cattle kept by Masai – Zebu cattle with humps & long thorns.
- They are never used as draught animals and are kept entirely for the supply of milk & blood.
- The Masai never slaughter cattle animals (bulls & Cow) for food.
- Another tribe in Kenya – Kikuyu They depend on agriculture.
- Masai obtain agricultural goods from Kikuyu.

② The Hausa, settled Cultivators

- Inhabit Savanna lands of the Bauchi plateau of northern Nigeria.
- Lives in towns & Villages – in (Kano)
- Do not practice shifting cultivation
- Uses crop rotation technique
- Cultivated lands are left fallow to regain fertility by natural forces.
- Maize, Millet, Groundnut, Banana, cotton, tobacco, etc.
- They also domesticate animals for both milk & meat

Problems, Prospects & development of Savanna

- Central Africa, northern Australia & eastern Brazil → immense potential for plantation agriculture like cotton, sugarcane, coffee, oil palm, even tropical fruits
- Uganda, Kenya, Tanzania & Malawi → have taken large scale production of cotton & sisal hemp.
- New drought resistant Varieties have to be introduced
- Adequate provision for irrigation, improved crop varieties, scientific farming techniques.
- Sudan climate – distinct Wet & dry period – responsible for rapid deterioration of soil.
- Rainy season – torrential downpour – leaching – nitrates, phosphates & potash are dissolved & washed away
- Summer – intense heating & evaporation dry up the soil
- Savanna – natural cattle country – but they often fall victim to tropical diseases – ngana or sleeping sickness carried by tsetse fly.
- Necessary to introduce temperate cattle – English Short-horn, Friesian or Guernsey to cross with tropical Zebu
- An attempt has been made in Queensland – has become Australia's largest cattle producing state

CHAPTER-18 → The Hot Desert & Mid-latitude Desert Climates

Aridity of hot deserts - mainly due to the effects of off-shore trade winds - hence also called Trade wind Deserts

Temperate deserts - rainless due to interior locations - away from rain bearing winds.

Major hot deserts - western coast - between latitudes 15° & 30° N & S.

Mid-latitude desert → Gobi, Turkestan & Patagonia (more due to its rain shadow position on the leeward side of Andes than to Continentality)

Climate →

Annual precipitation (<10 inches)

Driest desert → Atacama

Reasons for aridity

1) Most hot deserts lie astride horse latitudes or STHPB - descending air - no precipitation

2) Trade winds blow off shore

3) Westerlies that are on shore blow outside the desert limits

4) Presence of cold currents on western coast - dessicating effect

Temperature →

Reason for high tempʳ → clear, cloudless sky - intense insolation & rapid rate of evaporation

Diurnal range of tempʳ in the deserts is very great.

Frost may occur at night in winter.

Climatic Conditions in the Mid-latitude deserts

Summers are very hot & winters are very cold. Continentality accounts for these extremes

Desert Vegetation

Predominant vegetation of both hot & mid-latitude desert is xerophytic or drought resistant

Includes - bulbous cacti, long rooted thorny bushes, long wiry grasses & scattered dwarf acacia.

Oasis - trees & date palms

Cold currents results in mists & fog & nourish a thin cover of vegetation

- Soil → Intense evaporation increases the salinity & absence of moisture retards the rate of decomposition & desert soils are very deficient in humus.
- Plants have to survive for both water & soil.
- No leaves and the foliage is either waxy, leathery, hairy or needle shaped to reduce water loss through transpiration
- Cacti have thick succulent stems to store up water for long droughts

Life in the deserts

① The primitive hunters & Collectors

- Bushmen (Kalahari) & Bindibu (Australia) - primitive tribes
- Dew is gathered from leaves
- Nomadic hunters & food gatherers, growing no crops & domesticating no animals
- Wear loin cloth or go virtually naked.
- Bindibus or Aborigines (Australia) - Same as bushmen.
- Skilled trackers, domesticate a dog (dingo)
- One distinct difference → Bindibu always stay close to water supply as they have still not devised a means of tapping & storing water

② The nomadic herdsmen

- Pursue a livestock economy
- Ride on horses & live in tents → Bedouin of Arabia, Tuaregs of Sahara, Gobi Mongols
- Engaged in trade with the caravan merchants & oases people
- Animal provides everything → meat (occasionally), milk, cheese, hides (Water bags, clothing, etc)

③ The Caravan traders

- Travelling merchants of the deserts
- They use Camel to transport goods
- Camel provides milk & hair
- Between the interior oases & scattered out-posts beyond the reach of roads, the caravan routes remain the only form of available transport.

④ The Settled Cultivators

- Irrigation obtained through oases, rivers or dams
- Basin irrigation → Nile flooded during summer, overflowed water caught in basins with raised banks & led into the fields to irrigate the crops - widely practiced
- ~~Aswan~~ Aswan & Sennar dam on River Nile - extensive irrigation works.
- Some famous & big Oasis Tafilalet Oases in Morocco, Ghadames Oasis in Libya
- A wall is usually constructed around the Oasis to keep out the violent dust storms called simooms.
- Heart of settlement is dominated by suq (central market place).
- Most impⁿ tree - date palm

⑤ The Mining Settlers →

- Lure of mineral wealth has attracted many immigrants
- Some impⁿ mines of Australian desert → Kalgoorlie & Coolgardie - Gold
- Kalahari desert - 'thirstland' (Diamond & Copper)
- Atacama → Mining of Caliche (cemented gravels) from which sodium nitrate - a fertiliser is extracted & exported
- World's largest Copper town - Chuquicamata (Chile)
- In N. America → uranium (Utah), Copper (Nevada) & Silver (Mexico)
- In recent years, discovery of oil in Saharan & Arabian desert - has transformed the globe.
- 'Liquid Gold'
- pipelines over 1000 miles long have been laid to bring oil from the shores of the Persian Gulf across Saudi Arabia to Saida (Lebanon) & Banias (Syria) on the Mediterranean coast.

CHAPTER-19 → The Warm temperate Western Margin (Mediterranean) climate

Entirely confined to western portion of continental masses b/w 30° & 45° N & S of equator.
Basic cause → shifting of wind belts
· Winter rain climate
Mediterranean regions → California (around San Francisco), South-Western tip of Africa (around Cape Town), Southern Australia (in southern Victoria and around Adelaide bordering the St. Vincent & Spencer Gulf) and S-W Australia (Swanland). Central Chile.

Climate

1) A dry, warm summer with off-shore trades
Sun overhead Tropic of cancer belt of influence of Westerlies is shifted a little polewards.
· Rain bearing winds are therefore not likely to reach the Mediterranean lands
Trade winds are off-shore - practically no rain.
Days are excessively warm

2) A concentration of rainfall in winter with on-shore Westerlies
Rain in winter - westerlies shift equator wards
Rain comes in heavy showers and only on a few days with bright sunny periods b/w them.
Mediterranean regions are often ~~marked~~ backed by mts.
Rain begins in Sept & reach its peak in Oct.

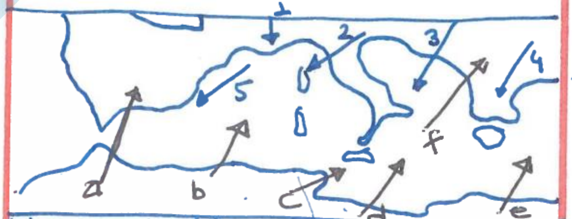
3) Bright, sunny weather with hot dry ~~cool~~ summers & wet, mild winters.
Summers → Warm & bright
Winters → Mild & Cool.
Sky almost cloudless - Sunshine is always abundant
The climate is mild → on shore winds & maritime breezes keep the tempr down

4) The prominence of local winds around the Mediterranean Sea.

· Cyclones from Atlantic, anti-cyclones from north, cold air masses from continental interiors — result in birth of local winds.

(a) Sirocco
· hot, dry & dusty wind
· Originates in Sahara
· More frequent in spring
· Damage is particularly serious - during the times when vines & olives are in blossom.
· Local names → Chili (Tunisia), Ghibli (Libya), Khamsin (Egypt & Malta). Leveche in (Spain). Gharbi (Adriatic & Aegean Sea)
· Also called 'blood rain' - wind carrying red dust of Sahara desert.

(b) Mistral
· Cold wind from North rushing down the Rhone Valley.
· Velocity intensified - funnelling effect in the Valley between Alps & Central Massif.
· More frequent in winter
· ~~It~~ Similar cold N-easterly wind experienced along Adriatic Sea — Bora [H.P over Continents & L.P over Mediterranean during winter] - It is more violent than mistral
· Other Cold winds → Tramontana & Gregale.



(a) → Leveche (b) - Sirocco (c) - Chili
(d) - Ghibli (e) - Khamsin (f) - ~~Gharbi~~ ~~Ghabi~~ Gharbi
(1) - Mistral, (2) - Tramontana, (3) - Bora, (4) - Gregale (5) - Levante

Natural Vegetation

· Half year is dry - one cannot expect the natural vegetation to be luxuriant
· Absence of shade
· Trees - small broad leaves, never very tall

(1) Mediterranean Evergreen forest
- open woodlands with evergreen oaks
· Cork-oaks of Spain & Portugal best known.
· Trees are normally low, even stunted, with massive trunks, deeply fissured barks, small leathery leaves, wide spreading root system in search of water
· Red wood - California
· Jarrah & Karri — commercially important
· In Australia eucalyptus replaces evergreen oak.

(2) Evergreen Coniferous forest
· Pines, firs, Cedars & Cypresses - needle shaped leaves & tall straight trunks

(3) Mediterranean bushes & shrubs
· Predominant Vegetation
· Common species - Rosemary, lavender, myrtle
Local names of Scrub Vegetation
· Maquis → Southern France
· Macchia - Italy
· chaparral - California
· Mallee Scrub - Australia
- Garrigue → In limestone uplands where the soil is extremely thin & the scrub deteriorates into highly Xerophytic ground creepers.

(4) Grass →
· Conditions do not suit grass as most rains come in winter, when growth is slow
· Not suitable for animal farming coz grasses become wiry & bunchy
· Cooking oil obtained from olives.

Economic Development of the Mediterranean Regions

· Mediterranean shore lands were once called cradle of world civilization.

(1) Orchard farming
· Mediterranean lands also known as orchard lands
· Citrus fruits such as oranges, lemons, limes, citrons & grapefruit

· Meyer Desert - Israel
Best Orange - Sunkist (California)
· Seville - oranges of spain
· Jaffa orange - Israel
Tangiers → Tangerine orange
· China & Japan → Mandarin Orange
· Mediterranean lands accounts for 70% of the world's export of citrus fruits.
· Olive Oil → Soap, Margarine, cooking
chestnut, walnut, hazlenut & almond are also grown

2) Crop Cultivation →

· Cereals are impⁿ
· wheat leading food crop.
· Barley next popular crop.
· Summer crops are raised only where irrigation is possible.
· Ebro basin in spain, Po Valley in Italy & in California → rice successfully cultivated
· Transhumance is widely practised

3) Wine Production →

· 85% produced grapes go to wine.
· Viticulture - Tradition
Accounts for 75% of world's production of wine.
· quality of fermented grape juice is divided by :-
a) Types of vines grown
b) Quality of the soil
c) climate of the region
d) Method & extent of fermentation
Wine from southern spain → sherry
Portugal - Port wine
Italy - chianti, asti & marsala
France → champagne in Paris basin, Bordeaux in Garonne basin & Burgundy in Rhone-Saone Valley
Dried grapes → currants from Levantine grapes, raisins from California & Sultanas from Asia Minor

CHAPTER-20 → The Temperate Continental (Steppe) Climate

Bordering the deserts, away from the mediterranean regions & in the interiors of continents are the temperate grasslands.

Lie in Westerly Wind belt

Treeless

Eurasia - Steppes → Eastward from the shore of the black sea across the great Russian plane to the foothills of the Altai mts.

Pustaz of Hungary & in the plains of Manchuria (China)

N. America - Prairies → foothills of rockies & in the Great Plains of USA - both in Canada & USA

In S. Hemisphere → grasslands are less continental & are rather restricted

Pampas → Argentina & Uruguay

South Africa → sandwiched b/w Drakensburg & Kalahari desert. → More tropical Bush Veld in the north & more temperate High Veld in South.

Australia → Downs - Darling - Murray Basin.

CLIMATE →

Little maritime influence

Climate thus continental with extremes of tempr

Winters are very cold - Continentality

In S.H → winters are mild - moderating effect of ocean.

Annual range of tempr is great - due to continentality.

Winters are so cold - parts of Eurasian steppe - snow covered

Tremendous difference between annual tempr range - North & south hemisphere - Continentality.

Precipitation →

Annual precipitation - light

Heaviest rains - June & July - continental interiors are intensely heated.

Most of the rains - Summer

S.H → steppe → more rainfall due to warm ocean currents → (Nov - Feb)

Natural Vegetation

Steppe vegetation geographically refers to scanty vegetation of the sub-arid lands of continental Eurasia.

· Professor Sir Dudley stamp extended the term to include the temperate grassland all over the world.

· Practically treeless & grasses are much shorter → difference from Savanna.

· Rainfall more → long prairie grass

· —"— less → short steppe grass

· Areas less suitable for arable farming and are used for ranching as in High Plains of USA.

· Trees are less because of scanty rainfall, long droughts & severe winters.

· Polewards towards transition zone → conifers & towards equator → thorny scrub.

Economic Development →

· The grasslands have been ploughed up for extensive, mechanised wheat cultivation & are now the 'granaries of the world'.

· Tuffed grasses have been replaced by more nutritious lucerne or alfalfa grass for cattle & sheep rearing.

· leading ranching regions of the globe

① Nomadic Herding →

This type of migratory animal grazing has almost disappeared from the major grasslands.

· The herders were wandering tribes Eg - Kirghiz, Kazakhs & Kalmuk, they domesticate animals too

② Extensive Mechanised wheat cultivation

· ideal for extensive wheat cultivation

· The cool moist spring stimulates early growth & light showers in the ripening period help to swell the grains to ensure a good yield.

· The levelness of the steppes & other temperate grasslands all over the world makes ploughing & harvesting a comparatively easy job.

· One distinct drawback → extensive mechanised farming results in low yield

whereas wheat yield in countries that practice intensive farming are much higher - attributed to greater attention given to smaller piece of land.

· Winter Wheat → 75% of world's wheat, sown in winter or late autumn, hard wheat, low moisture content being ripened in hot, sunny, continental summer, best for bread making.

Spring Wheat → Polewards where winter tempr's are too cold for the wheat seedlings to survive, spring wheat is grown.

· Soft wheat, suitable for cake, biscuits

③ Pastoral Farming →

· With development of refrigerated ships - temperate grasslands became major pastoral regions.

· Development was particularly spectacular in S. Hemisphere → winters are milder & rainfall is more evenly distributed

· leader in world's export of beef.

· The growth was rapid & towns like Buenos Aires, Bahia Blanca, Fray Bentos & Montevideo became known throughout the world

· Beef is also produced in Great plains of USA & Australia became the world's leading wool exporter.