

Biyani's Think Tank

Concept based notes

Physical Bases of Geography

M.A./M.Sc.(Prev. Geography)

Kalpana Depan

Deptt. of Arts

Biyani Girls College, Jaipur



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Ph : 0141-2338371, 2338591-95 • Fax : 0141-2338007

E-mail : acad@biyanicolleges.org

Website : www.gurukpo.com; www.biyanicolleges.org

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the “Teach Yourself” style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director (Acad.)* Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this endeavour. They played an active role in coordinating the various stages of this endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

Syllabus

Section-'A'

Introduction to physical Geography, Definition, Recent Trends in Physical Geography, Models and systems in Physical Geography.

Geomorphology: Zonning of the earth's interior, Thermal state of the interior, Endogenetic forces, Mountain Building Theories, (Kober, Jeffreys, Joly, Holms, Wegener and plate tectonics), Volcanic activity and Earth quakes, Isostasy, Denudation types or weathering: Physical and chemical weathering; factors affecting weathering processes. Rivers and Drainage Basins: Work of Rivers, classification of Valleys, Drainage pattern, Drainage basin and morphometry, baseline changes, Glacial and peri-glacial landforms. Desert and tropical landforms, process of desertification. Coastal features, Factors affecting coast and shoreline processes. Cliffs and platforms, coastal classification. Karst and limestone topography. Landscape development, reconstruction of landscape, cyclic (Davis, Penck, King) and non-cyclic (Hacks) development of Landscape.

Section-'B'

Climatology: The structure of Atmosphere, Atmospheric energy air temperature, heat balance, Layered structure of atmosphere and characteristics of each layer. Moisture in the Atmosphere, humidity and its expression, Evaporation and condensation, adiabatic non-adiabatic processes, stability and instability, precipitation, Thunderstorms, World precipitation pattern, Air Motion, Pressure variations, Pressure belts, forces governing air movement, upper air motion. General circulation, the planetary wind system, the mechanism of the circulation surface features and circulation. Fronts, airmasses and Types, Depression, cyclones (Tropical and extra tropical) and anticyclones. Climatic types: Koppen's, Thorthwait's schemes of climatic classification.

Section-'C'

Soil and Vegetation: Soil genesis, classification and distribution: biotic succession and major biotic regions of the world with special reference to ecological aspects of savannah and monsoon biomes.

Oceanography: Oceanic water circulation, Ocean bottom relief, horizontal and vertical distribution of temperature, ocean deposits, origin and impact of ocean currents, Tides and tidal theories of coral reef formation, atolls and coral islands, marine resources- biotic, mineral and energy resources and their utilization.

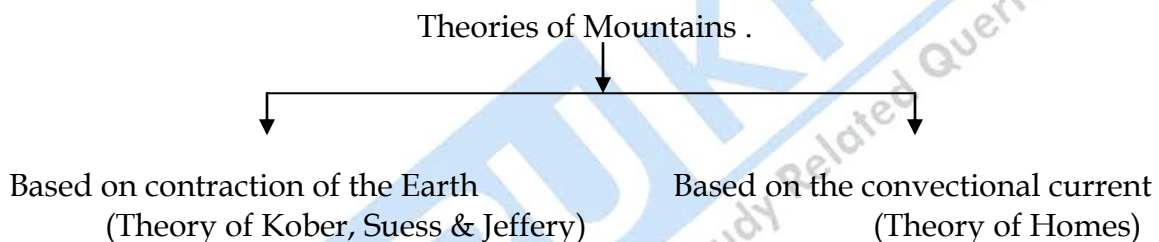
Lithosphere

Q Define different theories of origin of Mountain Building?

Ans : Mountain is the significant relief feature of 2nd order on the Earth Surface. It covers the whole part of 1/3 or 27% of the Earth Surface in its length, height & weight & new folded mountains are suited are one of these.

According to **Salisbury**,

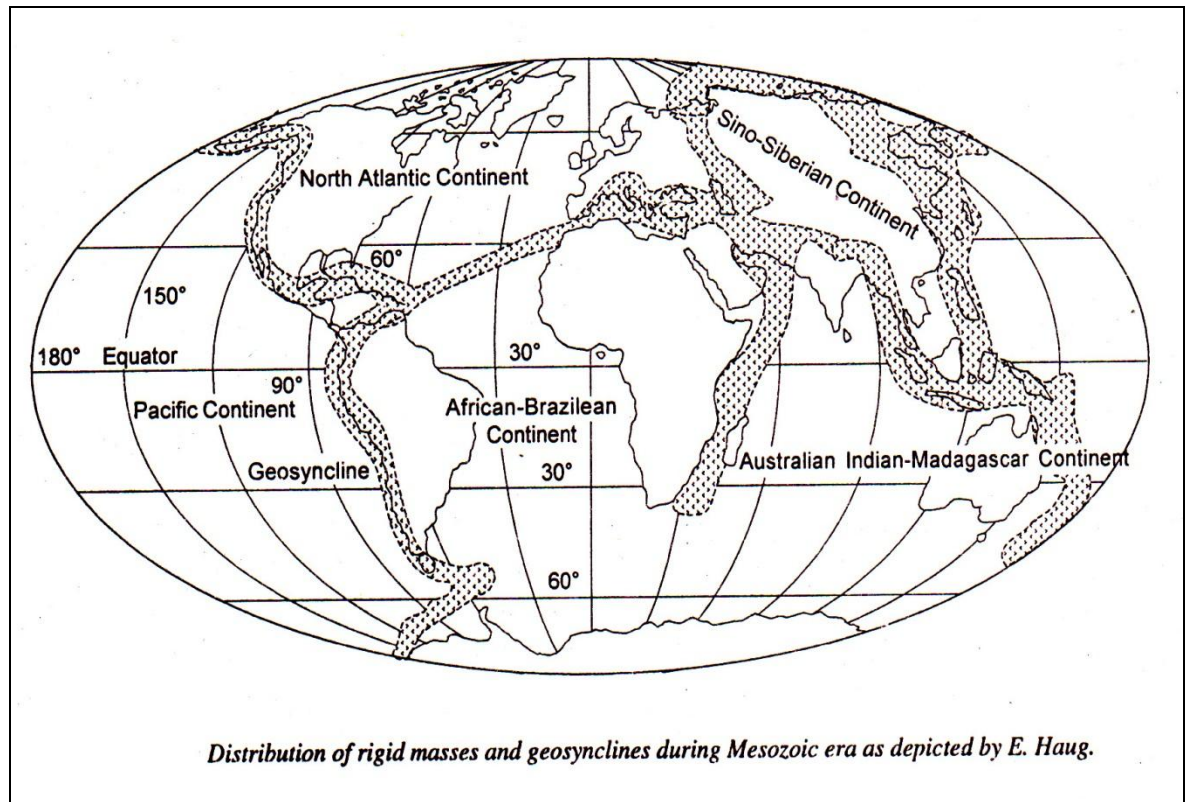
"Mountains are consequently high land which has narrow but slight arrow summit areas. Mountains building processes was a problem to explain this phenomena may views & theories were presented. These theories may be divided into 2 ways-



I. Geosynclines Orogen theory of Kober

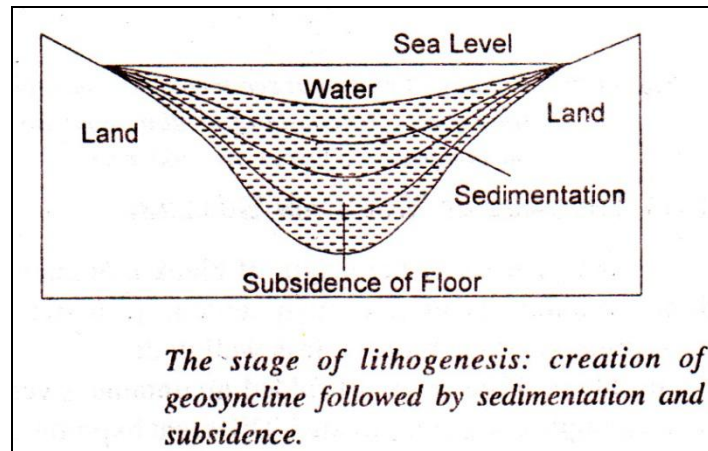
Importance & objective of the Theory:

Kober was a German geologist & he presented a varied & systematic description of Earth features in his famous book '**Der Bender Erode**'. The main objective behind presenting this theory is that is that he wanted to establish a relationship between geosynclines (long, narrow, shallow water area) which he called '**Orogen**' & rigid masses which he called '**kratogen**'. Such kratogen includes the Canadian Shield, the Baltic shield, the Siberian shield, Peninsular Indic, Chinese massif & the Brazilian & the African Shield.



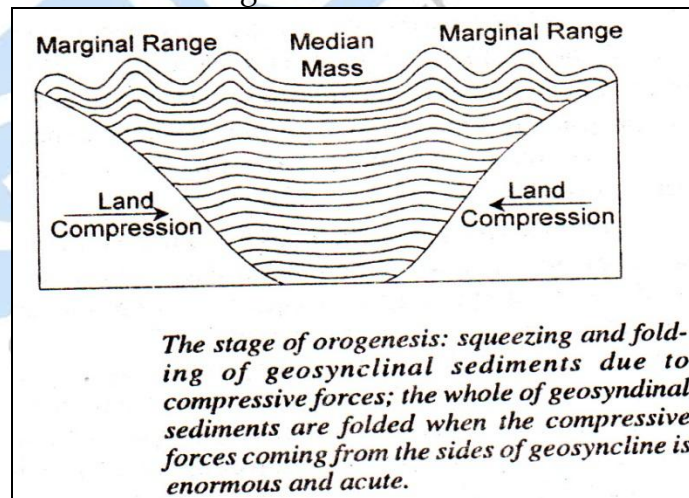
Kober opined that the whole process of mountain building passes through 3 stages.

1. **Lithogenesis-** This is the stage of creation of geosynclines, sedimentation and subsidence. That is formed due to contraction caused by cooling of earth. The geosynclines are narrow & wide mobile zone of water which is bordered by rigid cases the kober named as forelands or kratogen.



The forelands or kratogens which border geosynclinals succumbed to the forces of denudation.

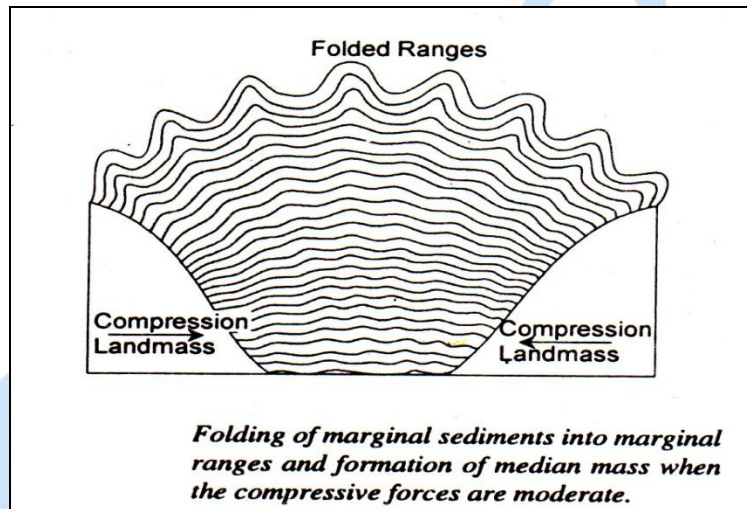
2. **Orogenesis-** In this stage the geosynclinal sediments are squeezed & folded into mountain ranges.



Both the forelands start to move forwards each other because of horizontal movements caused by force of contraction. The parallel ranges formed on either side of the geosynclines have been termed by Suess as *randketten*.

Example. Alps- proper, Carpathians, Balkan mountain & Caucasus Mountain were formed due to northward movement of African foreland.

3. **Gliptogenesis-** This phase of mountain building is characterized by a gradual ascent of mountain ranges and the ongoing denudation processes by natural agents.



Criticism-

1. The force of contraction produced by the cooling of the earth is not adequate for the formation of massive mountain like Himalayas, Alps.
2. Suess argued that the only one side of geosynclinals moves while the other side remains static. Suess termed the moving side as 'backland' & the stable side as 'foreland'. He opined that the Himalayas were formed by the southward movement of Angara land & Gondwanaland did not move.
3. Geosynclines are found along the continental margins'.
4. Geosynclines may exist in front of river mouth.

II Thermal Convection Current Theory

Arthur Holmes postulated his thermal convection current theory in 1928-29 to origin of major relief features of earth's surface.

Orogenetic Force:

The driving force of Mountain building in by Arthur Holmes is thermal convection current originating deep within the earth. The main source of the origin of convective currents is excessive heat in the substratum where in disintegration of radioactive elements generates heat regularly.

Base of the theory: Holmes on the bases of interval structure of earth into 2 bases.

1. Crust (2) Substratum

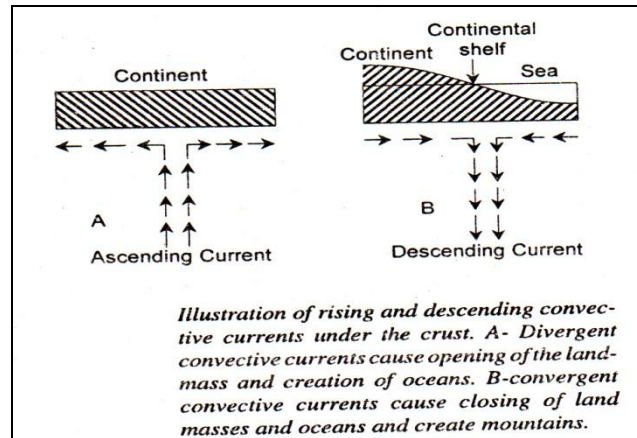
The origin of convective currents within the earth depends on the presence of radioactive elements in the rocks. According to him, these are maximum Concentration of radioactive elements in the crust but temperature is not so high because there is gradual loss of heat through conduction & radiation. On the other hand, through there is very low concentration of radioactive elements in the substratum but the gradual accumulation of heat produced by radioactive elements causes convective current.

Mechanism of the Theory:

It may be pointed out that the currents originate under the equatorial crust moves towards. There are two situations

- i) The crustal mass, where 2 rising convective current diverge in opposite direction is stretched & thinned due to the tensional forces & ultimately the crust broken into 2 blocks. This divergent convective currents cause continental drift.
- ii) Where 2 lateral convective currents originating under the continental & Oceanic Crusts converge compressive force is generated which causes subsidence giving birth to geosynclinals & closing the sea. Those convective currents move the crustal rocks away in opposite

directions & thus create seas & Ocean while convergent convective currents bring crustal blocks together & thus Form Mountain.



Homes define 3 stages for Mountain building formation.

1. Stage-I

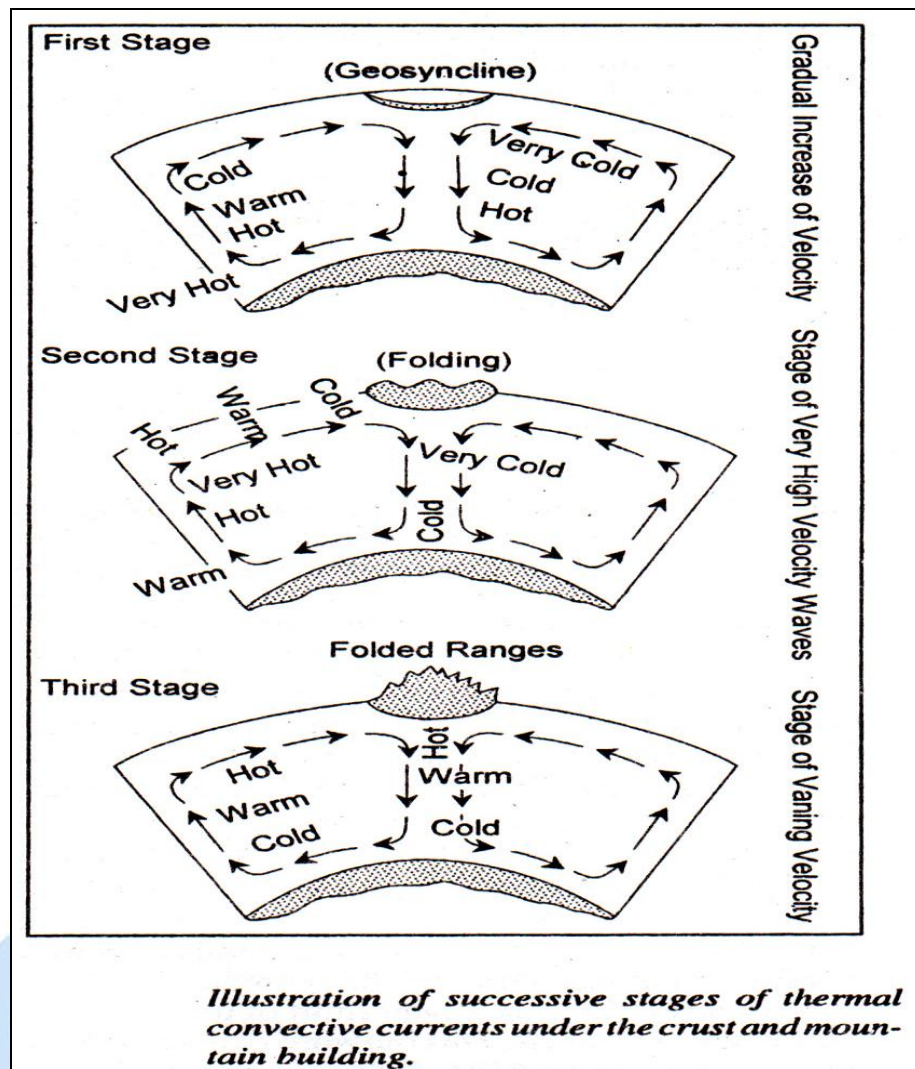
In it the convergent current are originated in substratum & thus geosynclines forms and that geosynclines are subjected to continuous sedimentation & subsidence.

2. Stage-II

That increase in the velocity of convective currents. The main cause increase in the velocity of convective currents is the downward movement of cold materials in the falling column & upward movement (rise) of hot materials in the rise of column of convective currents. This buckles geosynclinals sediments & thus initiates process of mountain building.

3. Stage-III

This stage is known as stage of Gliptogenesis. In it the velocity is become low & gradually, the rising column becomes a cold column & convective current is become end.



Criticism:-

1. Rising & falling column are doubtful phenomenon.
2. The whole mechanism of convective currents depends on the heat generated by radioactive elements in the substratum but doubt about the availability of required amount of heat generated by radioactive elements.
3. The horizontal flow of thermal convective currents under the continental & Oceanic Crusts is also a doubtful phenomenon because of lack of required amount of heat to drive these currents.

III. Radioactivity Theory of Joly

Objectives:

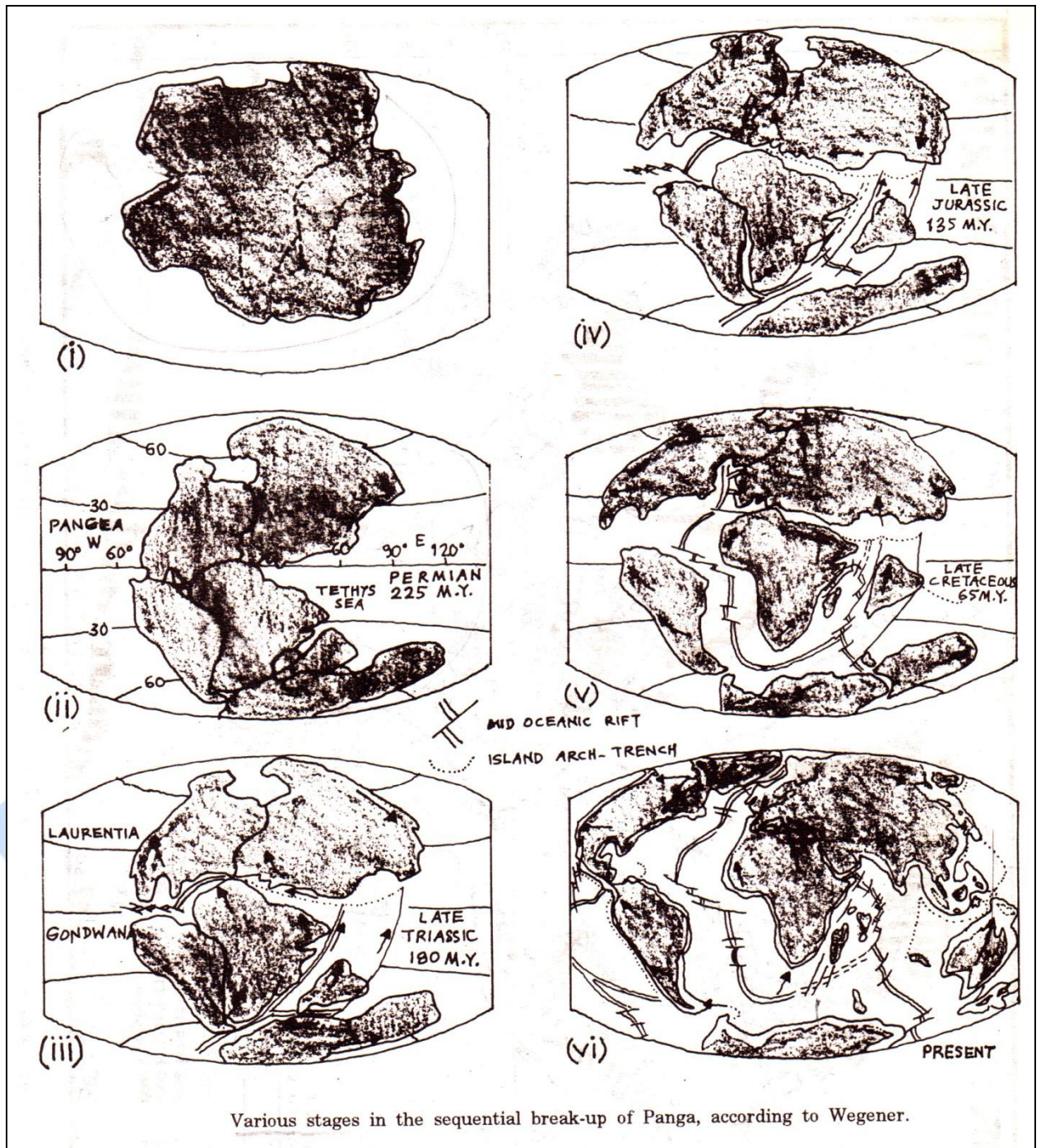
Joly postulated his theory based on radioactivity in 1925. The driving force of mountain building by Joly is provided by expansion & contraction of the substratum of the earth resulting into transgression & regression phases of the sea. Joly describe firstly the interior structure of earth. Continents are made of lighter silica materials the density of which is 2.62 while the Oceanic beds are formed of heavier material of sima having average density of 3.0. Thus the crust has been assumed to have been composed of sial & substratum of basalt (sima), sial is not found in Oceanic beds.

According to him, the rocks of the earth contain radioactive elements but their distribution is not uniform in all zones of earth. Radioactive elements are found maximum in abundance in continental rock whereas they are less in Oceanic Crust. Due to continuous breakdown of those elements generates heat.

Q. Explain the Continental Drift theory in detail?

Ans Alfred Wegener (1922) was a climatologist and wanted, to investigate the relative distribution of land & sea & the climatic aberrations of the past. He postulated that originally in the carboniferous prescribed there was a one big land masses called pangea which was covered by one big ocean called panthalassa. A sea called Tethys divided Pangaea into 2 huge land masses Laurentia to the north & Gondwanaland to the south of Tethys. The land masses consisted of sial (lighter) crust while the ocean had a simatic (heavier) case.

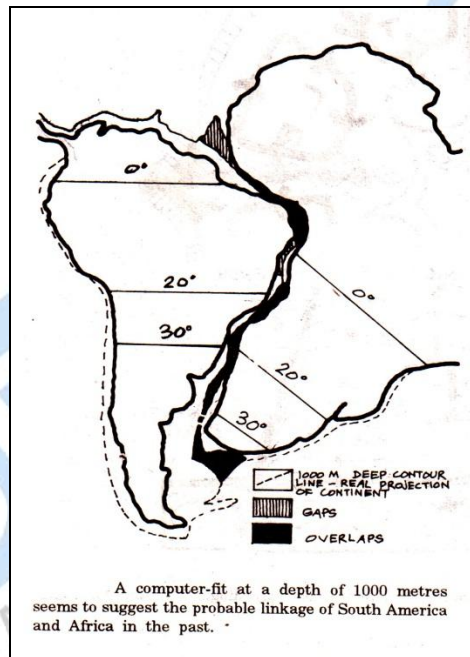
According to Wegener, the drift started around 200 million years ago (Mesozoic era) & the continent base is began to break up and drift away from one another.



The drift was in two directions- equator wards due to the interaction of forces of gravity & westward due to tide currents according to him the drift is still continued.

Critical analysis of evidence for continental Drift-

1. **Apparent Affinity of Physical features-** South America and Africa seem to fit in with each other especially the bulge of Brazil fits into the Gulf of Guinea (Jig 800 fit.).



Greenland seems to fit in well with Elsmere and Baffin islands.

2. **Causes of drift-** Gravity of the earth buoyancy of the seas & the tidal currents were giving as the main factors causing the drift.
3. **Interplay of sima & sial-** The lighter sial was carried by heavier sima, thus creating cordillera formations on western edges of North America. These formations are folded & warped.

4. **Botanical evidence**- Presence of glossopteris vegetation in India, Australia, South Africa, Antarctica etc. proves that these parts were linked in the past.
Criticism- Such vegetation is also formed in the North parts of Afghanistan, Iran & Siberia.
5. **Palaeomagnetism**- The magnetic field of the earth has magnetized many iron-based rocks in the past.

Criticism- The evidence in this regard is not conclusive & is being further explored. Such magnetic conditions may be due to local factor.

Main drawback of Wegener model-

Wegener ignored the time factor & took a two dimensional view of the subject, trying to solve the mystery like a jigsaw puzzle. He fails to explain why this drift began only in the Mesozoic era & not in the period prior to it.

Q. Explain the Plate Tectonics theory with diagrams ?

Ans: The rigid lithosphere slabs & solid crustal layers are technically called '**plates**'. The whole mechanism of the evolution, nature & motion of plates & resultant reactions is called 'plate tectonics.' The moot of these plates causes the formation of various lands. Forms & is the principal cause of all earth movements H. Hess presented this concept in 1960.

Crustal Plates-

There are 6 major plates & 20 minor plates & 14 minor plates.

1. Eurasian, Indian, African, American, Pacific & Antarctica.

This theory is based on major scientific evidence.

- i. Evidences of Palaeomagnetism
- ii. Evidences of sea-floor spreading

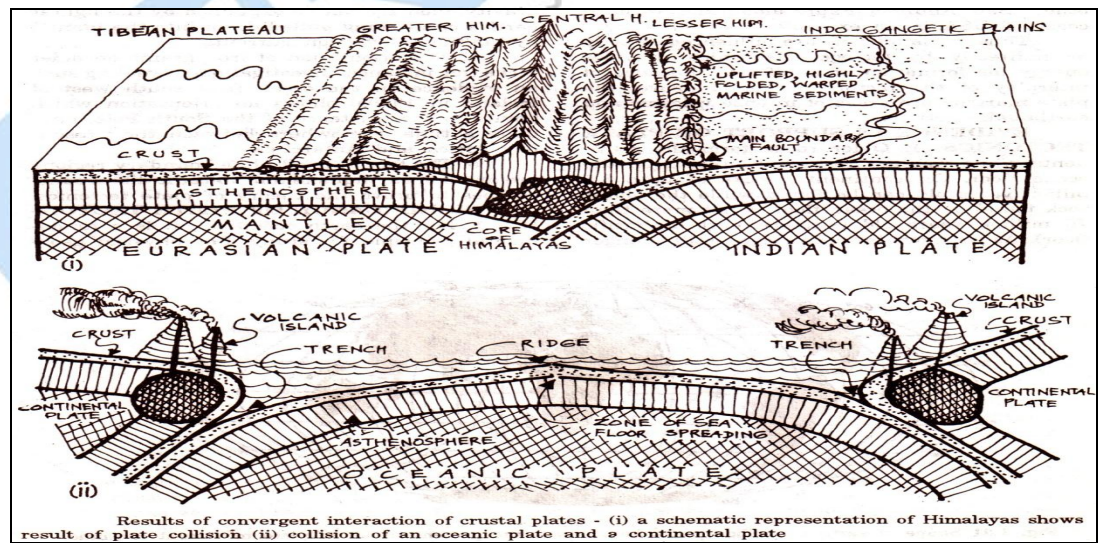
Plate margins are generally- into 3 groups.

1. **Constructive Margins or divergent Plate boundary-**

In it there is continuous upwelling of molten material (lava) & thus new Oceanic Crust is continuously formed. Infact, Oceanic plates spit apart along the mid Oceanic ridges & move in opposite direction.

2. **Destructive Plate or convergent edge-** is formed when 2 plates meet head on. The zone of collision may undergo crumpling & folding & folded mountains may emerge. Himalayan boundary fault is one such example.

3. **Conservative Plate-** Here two plates' moves past each other without directly interacting with each other & thus crust is neither created nor destroyed.



Sea floor spreading-

This concept was first given by Harry Hess in 1960. According to this theory, like intense heat generated by radioactive substance in the mantle seeks a path to escape & gives rise to the formation of convection currents in the mantle. Where ever rising limbs of these currents meet, oceanic ridges are formed on the sea floor & where ever the falling limbs meet, trenches are formed.

At the ridges the eruption results in upwelling of the magnetic material. This causes movement of the crust. After upwelling the hot magma cool down solidifies and moves apart to make way for the material of successive eruptions. This results in effective sea floor spreading. The rate of movement Perhaps 2.5 cm per year but it is measurable.

Q. Define Weathering and also define its different forms ?

Ans The process of disintegration and decomposition of rocks in situ is generally called **weathering**.

It means weathering is a static process.

Factors controlling of weathering-

1. **Composition & structure of Rocks-** The joints in rocks permit water to enter the rock and achieve chemical and physical weathering.
2. **Nature of Ground Slope-** It controls mechanical disintegration of rocks and mass movement of weathered products down the slope.
3. **Climatic Variations-** Climates determines whether physical or chemical weathering will predominate and the speed with which these processes will operate.
4. **Floral Effects-** It also determined by the presence or absence of vegetation in a particular region.
5. **Topography-** It directly affects weathering by exposing rocks and in directly through the coconut precipitation, temperature & vegetation.

Types of weathering

There are 2 main types of weathering.

1. Physical or Mechanical weathering.
2. Chemical weathering.
3. Biological or Organic weathering
1. **Physical or Mechanical weathering**- The physical or mechanical weathering leads to fragmentation & breakdown of rock masses into big blocks and boulders, cobbles & pebbles, sand. This may be caused by 6 agencies, which are as follows-
 - i. **Frost action**- Water expands when being transformed into the solid state, called frost or ice. This expansion exerts enormous pressure so that when water freezes within the cracks of the rock, great strains are caused & fragments may be broken off, or the rocks are shattered to a considerable depth. Shattered rocks are frequently met with in the higher elevations of the Himalayas.
 - ii. **Daily temperature changes**- Weathering due to diurnal temperature changes are essentially a consequence of direct heating of rocks.
 - iii. **Exfoliation**- The breaking or peeling off of concentric plates from bare rock surfaces is called '**exfoliation**'. Plutonic rocks like granites normally get exfoliated. The result is peeling off of scales from their surface & appearing as exfoliation domes as in the Khasi hills, Jyellang, Meghalaya.
 - iv. **Relative hardness of rocks**- Some rocks like sand stone are hard, & some like shale's are soft. Weathering of soft rocks under a capping of hard rock's give rise to 'pedestal rocks'. Such land feature found in Satpura Hills, Himachal Pradesh.
 - v. **Action of Plants & animals**- The roots of trees on the hill sides penetrate into cracks of rocks & widen them. This facilitates the percolation of water & air the total effect of which is the breakdown of rocks.

- vi. **Gravity-** It is an indirect cause of mechanical weathering. We see huge boulders standing in the edge of a cliff about to fall down & when they actually tumble down the slope, they may break off portions of hill slopes.
2. **Chemical weathering-** Decomposition and disintegration of rocks due to chemical reaction is called Chemical Weathering results in:-
- An increase in volume which produces stresses within the rocks.
 - Lower density materials
 - Particles of smaller size which produce a larger surface for chemical interactions.
3. **Biological or Organic weathering-** Plants assist in surface weathering by both chemical & mechanical means. Algae, mosses, lichens & other vegetation retain water on the surface of the rock & various organic acids help to decay the rock beneath so that a tuft of moss may lie in a small & growing hollow in the rock. The mechanical disintegration effect of vegetation is mainly due to the penetrating & expanding power of roots which exert considerable force as they grow & help to wide cracks & crevices this allowing water & air to enter.

Que What is Erosion? Explain its different forms?

Ans Erosion is the earth sculpting processes by which the rock debris produced by weathering is transported. Agents that move rock fragments include gravity, running water, moving ice, wind waves, tides & currents.

1. **Corrosion-** The wearing a way of rock or soil by chemical & solvent action, i.e.-by carbonation, Hydration, Hydrolysis, Oxidation & solution. This is mostly occurring by the water.
2. **Abrasion-** The process of wearing down of a land surface by money weathering rock debris or by the river flow.
3. **Attrition-** This is also done by River, glacier, wind & sea waves. When the large boulders or rock erode the river floor or the sand particles present in winds erode this process is called attrition.
4. **Plucking-** One of the main erosion processes carried out by a glacier, effecting the removal of rocks from its valley floor water enters cracks

in the rocks of the floor freezes & detaches rock fragments, which becomes frozen to & carried away by the under surface of the glacier as it moves along.

5. **Deflation-** The removal of fine rock debris by wind, especially likely to occur in Arid or semi arid.
6. **Hydraulic Action-** The processes in which minerals combine with water & Expend there by exerting pressure within the rock pores (exfoliation). They like affected in chemical weathering.

Q. What are the Differences between Weathering & Erosion

Ans In **weathering** there is only the disintegration or decomposition of rock through different factors but in it transport is not involved whereas in **erosion** this transportation work is included. Means the processes of wearing a way of land surface by natural agents (water, ice, waves, and winds) & the transport of rock debris that results in called erosion.

Q. Define the process of Mass Wasting ?

Ans: The movement of weathered material under the influence of gravity & with or without the influence of rain water is called mass movement. They may be take place in a variety of ways.

1. **Talus cones-** Rock particles created by processes of mechanical weathering move down high mountains slopes & steep rock walls of gorges. These particles tend to get deposited in distinctive landforms the talus coves. A talus slope or scree slope has a constant slopes angle of 34° or 35°.
2. **Earth flow-** In humid regions where these are steep slopes, the masses of soil saturated with water overburden or weak bedrock may slide down slopes during a period of a few hours in the form of earth flow.
3. **Land Slide-** This is rapid sliding along hill slopes of rock mass. Two basic forms of landslide are-
 - i) Rock slide in which the bedrock mass slip on relatively flat include rock plain such as fault.

- ii) Slump in which there is a backward rotation on a curved on concave slip plane.
- 4. **Soil Creep-** This is the extreme by slow down Slope Mountain of soil & over burden on almost all moderately steep, soil-covered slopes.

Q. Explain the concept of Cycle of Erosion by W.M.Davis?

Ans The hypothetical sequence of changes or stages through which an uplifted land surface would pass in its reduction to base level by the action of natural agencies in the processes of Erosion this cyclic processes is called **cycle of Erosion**.

W.M. Davis- William Morris Davis, American geomorphologies, was first present a general theory of land for development. In 1899 he presented his theory. Davis assumed that any land part or structure cannot developed suddenly whereas its development is a long process which passes through from several stages in a form of cycle & at last this converted into a plain.

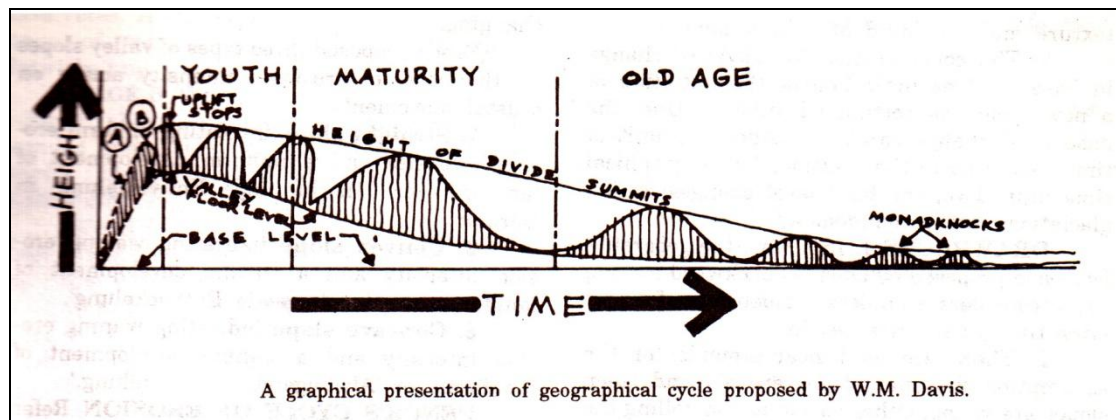
According to Davis 3 factor play important role in the origin & development of land forms of a particular place. These 3 factors are called '**Trio of Davis**'. & his concept is expressed as follow- "landscape is a function of structure, process & time."

1. **Structure-** means lithological (rock types) & structural characteristics (folding, faulting, joints etc.) of rocks.
2. **Process-** means the agents of denudating including both weathering & Erosion.
3. **Time-** In it different stages (Youth, Mature & Old stage) are included.

The whole cycle passes from 3 stages-

1. **Youthful Stage-** Erosion starts after the completion of the upliftment of the landmass. (The top surface is not affected by Erosion because the rivers are small & widely spaced.) This stage is characterized by rapid rate of vertical erosion & valley deepening & in absolute height remains constants.

2. **Mature Stage-** In it the vertical erosion or valley deepening is remarkably reduced, there marked lowering of absolute relief. Thus absolute relief & relative relief both decreases.
3. **Old Stage-** In it almost total absence of valley incision but lateral erosion & valley widening is still active process. The valleys become almost flat with concave valley side slopes & convert into monad hocks & at end the complete landforms converted into penne plane valley.



Positive Aspect of Davis Model:

1. This model was highly simple & applicable.
2. This model explains the whole processes form the formation of land form in a simple way. This is mode to known blow any land form is made.
3. Davis based his model on detailed & careful filed observations.
4. The change is base land is thoughtful & it show the correct form of erosion.

Criticism: -

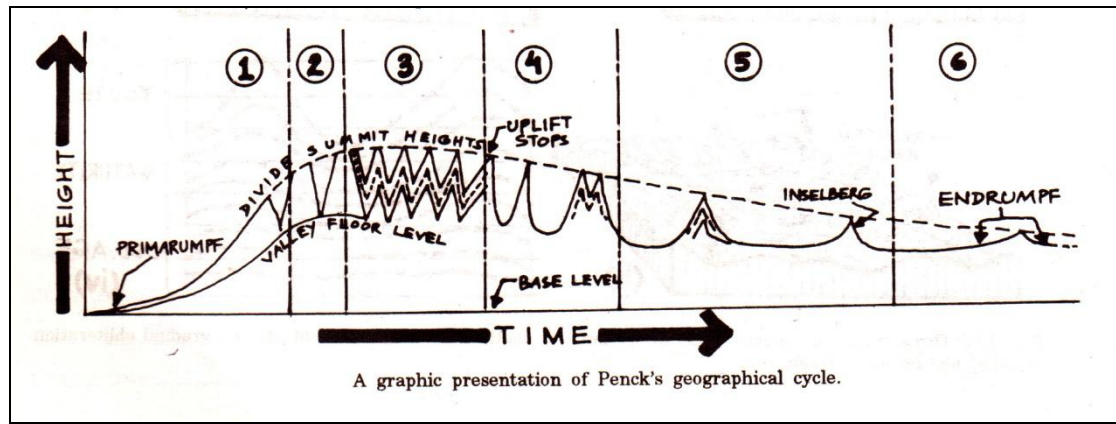
1. His concept of upliftment is not acceptable. He has described rapid rate of upliftment of short duration but as evidenced by plate tectonics upliftment is long continued process.
2. Davis concept of relationship between upliftment & Erosion is erroneous.

3. An ideal Davison cycle would take millions of years of complete. What about the earth movements during the cycle?
4. It is unlikely that a cycle can be complete because interferences such as climate changes or other elements bound to upset the orderly progress of cycle.

Q. Define the Penck model of cycle of erosion?

Ans German Scientist Walther Penck presented his model based on Davison model. According to Penck land for development should be interpreted by means of ratios between the rate of uplift & rate of vertical erosion & their interaction between the 2 factors, uplift & degradation is continuous. The whole cycle passes through 3 stages.

1. **Aufsteigende Entwicklung** - means the phase of accelerating means the rate of landform development. Initially the land surface rises slowly but after some time the rate of upliftment is accelerated. The rate of valley widening. This results the formation of U-shaped valley).
2. **Gleichformige Entwicklung**- means uniform development of land forms. This phase is subdivided into 3 sub phases.
 - a) **Phase (a)** - is characterized by still accelerated rate of uplift. Absolute height still increases because the rate of erosion is still less than the rate of upliftment.
 - b) **Phase (b)** - Attitude neither increase nor decrease.
 - c) **Phase (c)** - Upliftment of the land stops completely attitudes of summit divides start decreasing because of absence of upliftment.
3. **Absteigende Entwicklung**- means the waning development & landscape (during & consequent valley widening & valley deepening through vertical down cutting). Absolute relief decreases because of total absence of upliftment but continued down wasting of divide summits. Relative relief also decreases & lowered in height while down cutting of valley floor decreases.



Criticism-

1. Penck gave too much importance to the rate of endogenetic forces.
2. German language is too different to understand.
3. The orderliness in land form changes, as assumed by Penck, may be difficult to achieve.

Q. Describe the land forms associate with Karst topography?

Ans. Karst is special region of well jointed carboniferous limestone in which carbonation is the dominant weathering process. In this region the underground water will aquifers or seepage maximum amount due to this they abrade the found & make new forms of structure or features. These are mainly found in Yugoslavia

Necessary conditions for the development of karst topography.

1. Karst topography generally develops in those areas where thick beds of massive limestone's lie just below the layer of surficial material.
2. They also develops en collimate, times tunes & chalk.
3. Limestone should be massive, thickly, bedded, hard, well jointed & should not be porous & not by the mass of rocks.
4. There should be enough rainfall so that required coconut of water is available to dissolute carbonate rocks.
5. The limestone should be highly folded or fractured or faulted.

There are 2 types of force work here.

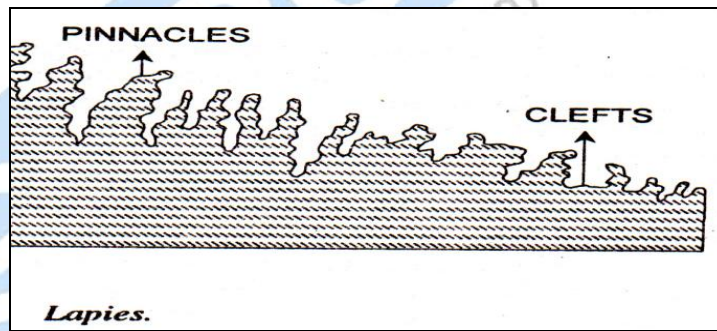
1. Erosional landforms
2. Depositional landforms

1. Erosional landforms-

Erosion land forms developed because of solution & Carbonation.

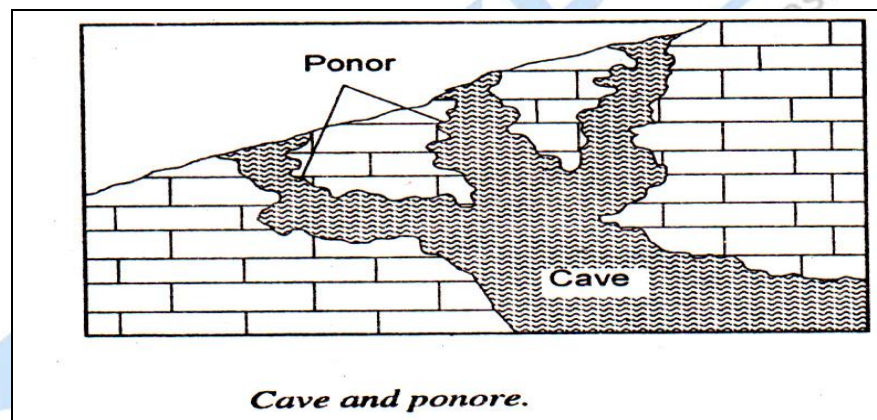
Karst land forms develop best under certain favorable circumstances – Presence of soluble bedded & jointed rocks like limestone & moderate rainfall.

1. **Lapies-** The highly corrugated & rough surface of limestone, characteristics by low ridges & pinnacles & narrow clefs & numerous solution holes are called Lapies. In different place it is known as clints or graykes in N. England, Karren in Germany, bogaz in Yugoslavia & Siberia. Chemically active rain water dissolves limestone & other Carbonate rocks along their joints & numerous types of solution holes are developed. They are small in size & wide are called sink holes.

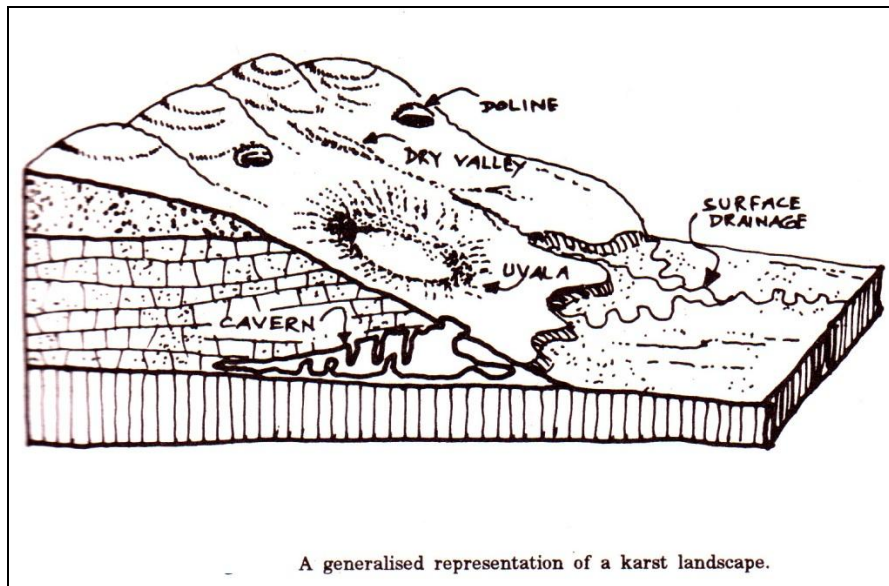


2. **Solution Holes & associated features-** Due to continuous dissolution of limestone's results in the closely spaced sink hole into one large hole which is called "Swallow hole".
3. **Doline-** Some sink holes are further enlarged due to continuous solution into larger depressions which are called dolines.

4. **Uvalas-** A number of adjoining dolines may come together to form a large depression called uvalas. They are also called the compound sink holes.
5. **Polje-** When many uvalas combined or most extensive, larger than dolines depressions are called 'poljes'. They are vertical side walls, flat alluvial floors, irregular borders & central lake.
6. **Karst window-** is formed due to collapse of upper surface of sink holes or dolines. These windows enable the investigators to observe sub surface drainage & other features formed below the ground surface.
7. **Ponors-** The vertical pipe like passages that connect the comets & the Swallow holes are called 'ponores'.



8. **Caverns-** These are underground comes formed by water action by various method in limestone area. For example found in India near Dehradun and S. Bihar.
9. **Blind valley-** In the limestone region when the surface streams which flow out from the hole over the surface than that valley disappear. That valley is called Blind valley.
10. **Natural Bridge-** Due to Collapse of the roof of cause than they make the form of natural Bridge.
11. **Karst Valley-** During rainy season small surface streams formed this U-shaped valleys developed on lime stones are called Karst valley or solution valley.



Depositional land forms-

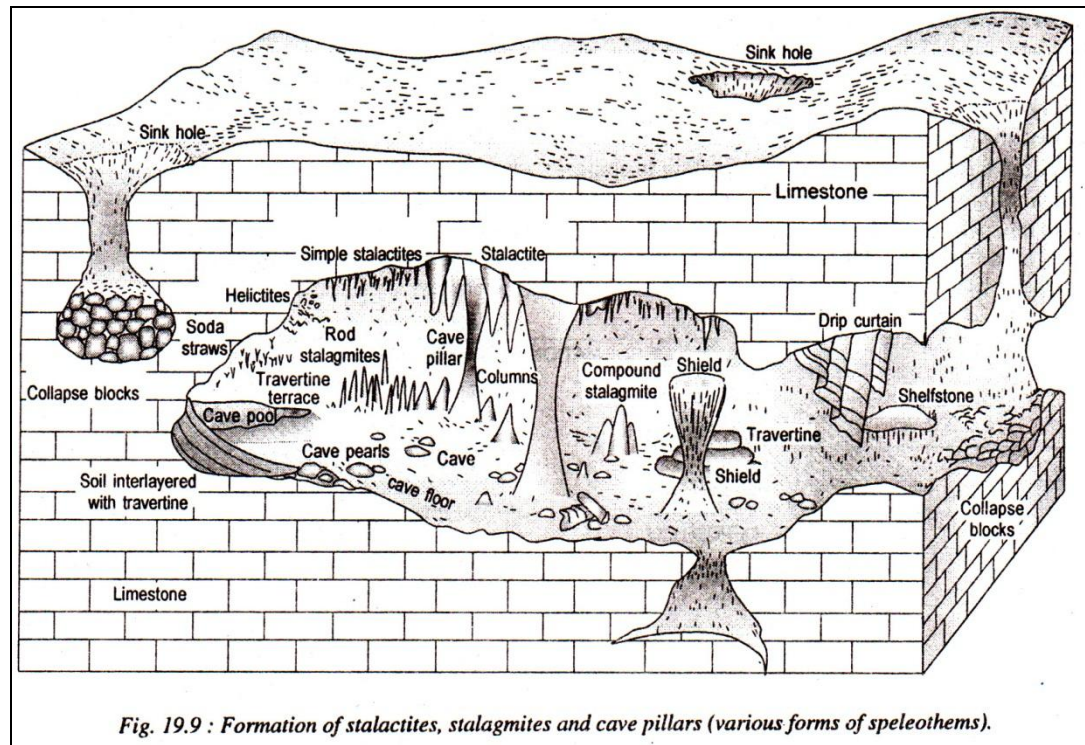
Depositional landforms take place aided by chemical reaction, temperature, and pressure, loss of because and evaporation of water.

Causes of deposition:

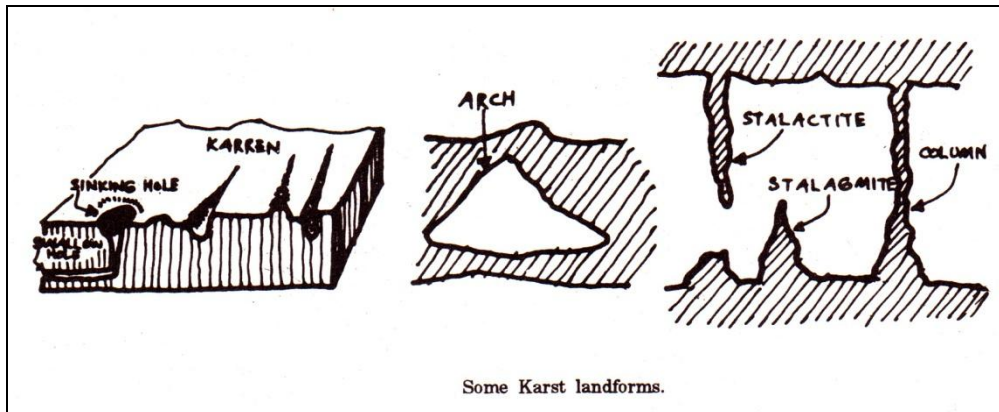
1. Chemical reactions
2. Loss of carbon di oxide
3. Change in temperature and pressure
4. Evaporation

Depositional landforms

1. **Speleothems:** deposits in the caves are collectively, called "Speleothems:" calcite is the common constituent.



2. **Drip stones:** calcareous deposits formed by dripping of water in dry caves.
3. **Stalagmites:** A column of calcium carbonate which grows upwards from the floors of a cave.
4. **Stalactite:** formed due to deposits of calcium carbonates from ceiling.
5. **Cave pillars:** are formed when stalagmite and stalactites meet together.



Q. Define the landforms formed by Marine or Coastal?

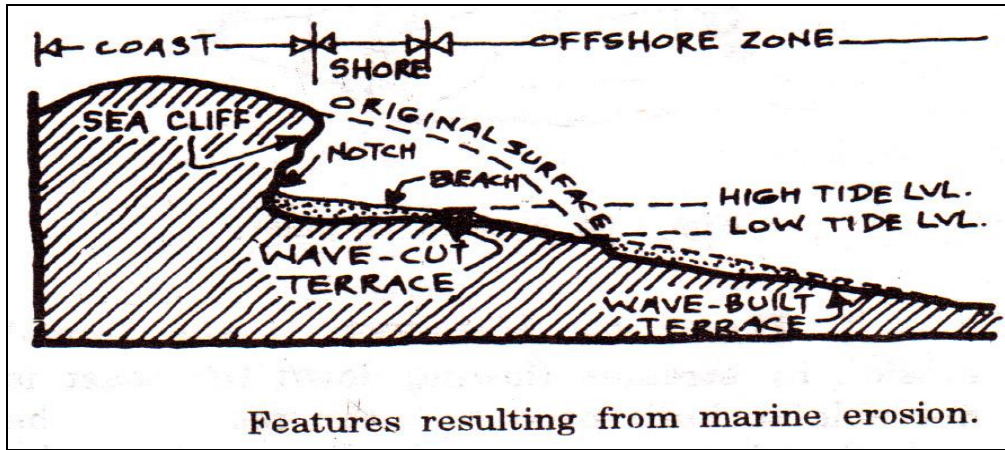
Ans Marine land form are produced by the joint action of oceanic waves, currents & tides on the coastline of all these factors, waves are the most important of all in carving our landforms.

Mechanism

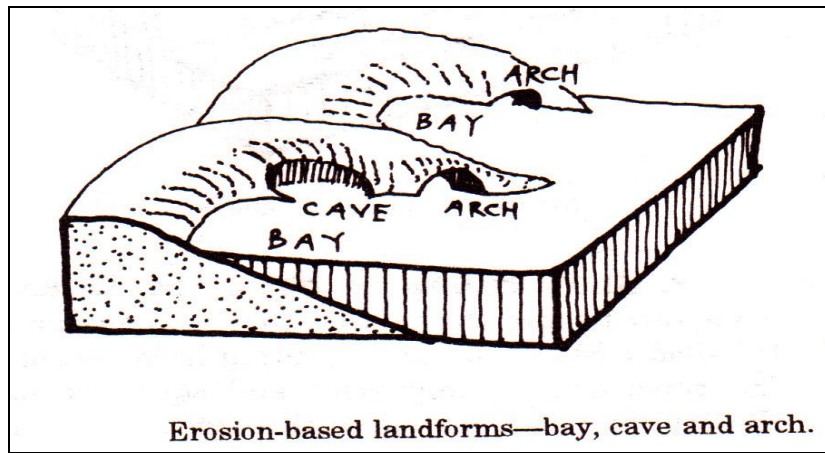
1. **Corrosive action**- Boulders, pebbles & sands are hurled against the coast by breaking waves & this causes under cutting & rock break up.
2. **Hydraulic action**- When water is thrown against the shore, by braking waves, the air expands suddenly often explosively. This causes rocks to shatter & crake become enlarged & extended.
3. **Attrition action**- The particles are themselves worm down by friction and impact, and become finer and finer.
4. **Corrosion & solution**- is simply a solvent action.

Erosional landforms:-

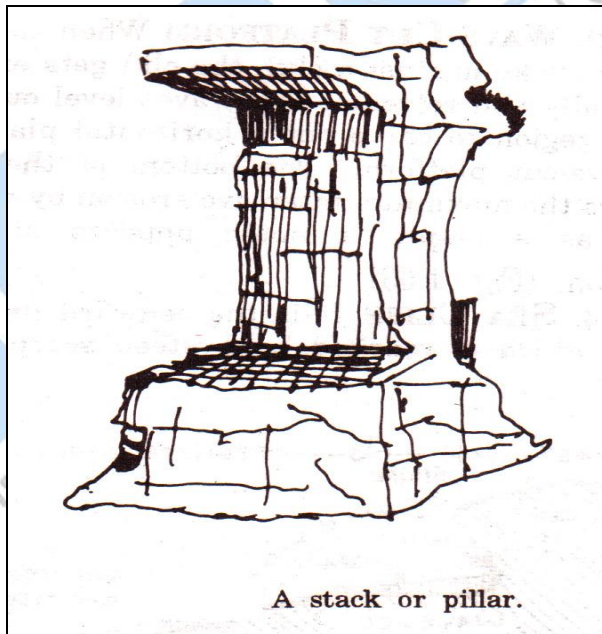
1. **Cliff**- Steep rocky coast rising almost vertically above sea water is called sea cliff.



2. **Notch**- The point of wave attack at the base of cliff is sometimes preserved in resistant strata as a wave-cut notch.
3. **Wave-cut Platform**- is formed due to cliff recession. A wave cut platform is produced at its base.
4. **Sea caves**- Where hard & soft rocks lie alternately softer rocks are worn back into inlets coves or bays & harder one persists are headlands.
5. **Sea Arch**- (The headland is subjected to erosion from 2 sides. Thus, cause is excavated in both the sides of the headland) or When two caves developing on either sides of headland join to gather, they give rise to natural arch or sea arch.



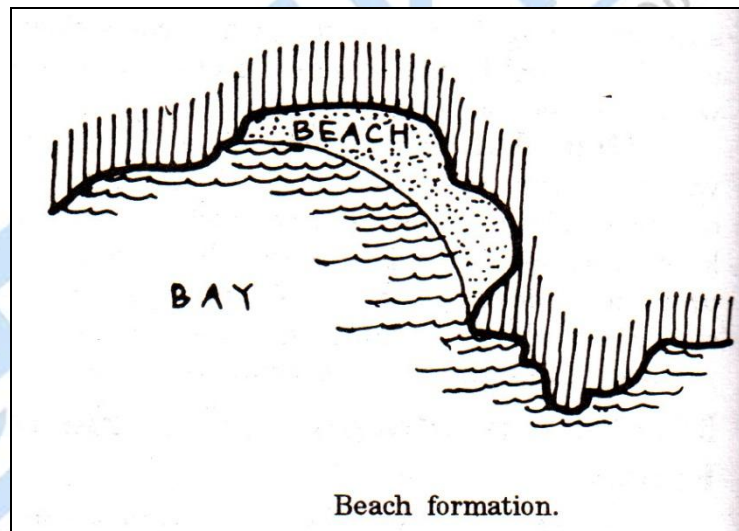
6. **Stack**- The arch collapses & an isolated pinnacle, called stack, is left in front of the cliff.



7. **Stump**- These rock pinnacles crumble & collapse & end up as were stumps slightly above sea level.
8. **Blow Hide**- Sometimes, the air in the cave is compressed by up rushing powerful storm waves & finding no other route to escape it breaks open the roof of the cave & appears with great force making unique whistling such holes are called 'natural chimneys' or 'blow holes'.

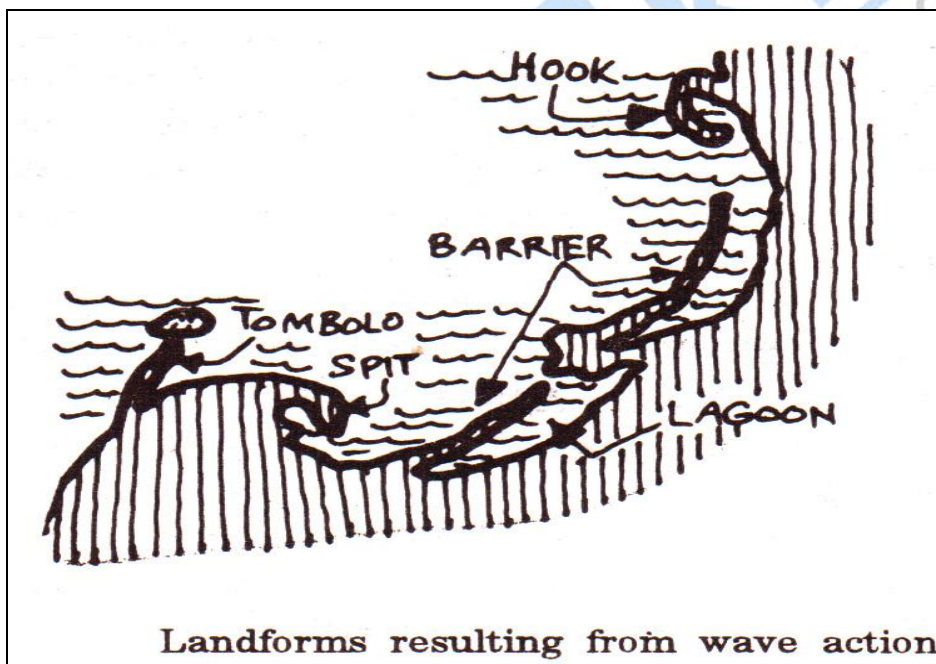
Depositional Landforms -

1. **Beaches**- A beach is a land on shore between the high water mark and low water mark. It is built of unconsolidated sediment like cobbles, boulders, fine silt & clay.



2. **Carp Beach**- is small regular embayment and a series of headlands composed of shingles.
3. **Spits**- If the sand bars are formed in such a way that there one end is attached to the land while the other end projects or opens out towards the sea, they are called spits.
4. **Bars**- The ridges, embankments or mounds of sands formed by sedimentation through sea waves parallel to the shorelines are called bars.

5. **Off-Shores bars**- If the bars are formed in such a way that they are parallel to the coast but are not attached to the land they are called off-shores bars.
6. **Compound hook**- It is a curved spit. The hook once formed is modified by many cross currents & the spits go lengthening by successive additions, as compound hook.
7. **Loop**-The spits are bent to such an extent that they are attached to the mainland (coast) & thus form complete loop, which enclose sea water in the form of lagoon. Such forms of a spit is called **loop**.
8. **Tombola**- A bar connecting mainland with an island or connecting a headland with the island called tombola.



Q. Define the Glacier topography?

Ans The moving ice mass down slope under the impact of gravity is called glacier. About 10% of the earth's surface is now covered by glaciers.

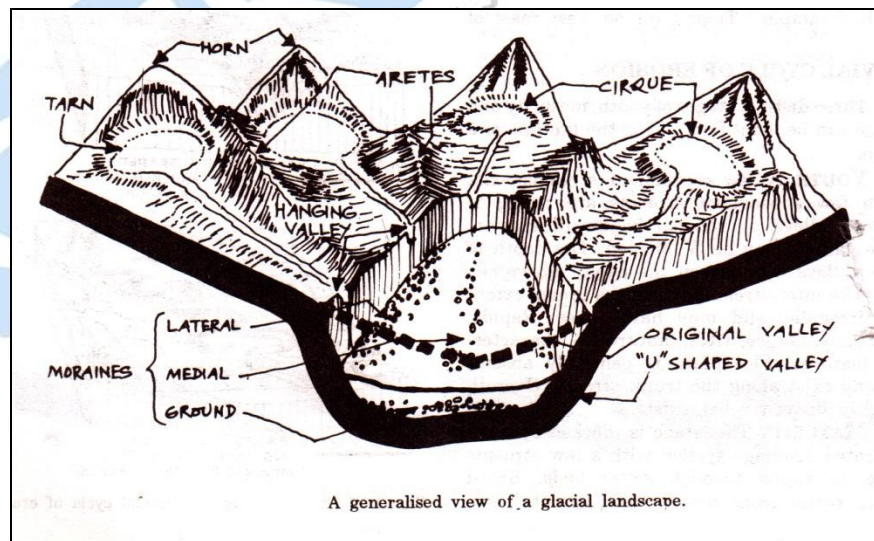
Glaciers are formed due to accumulation of ice above snow-line, under extreme cold climate

A glacier during its life time creates various land forms which may be classified into erosional & depositional land forms.

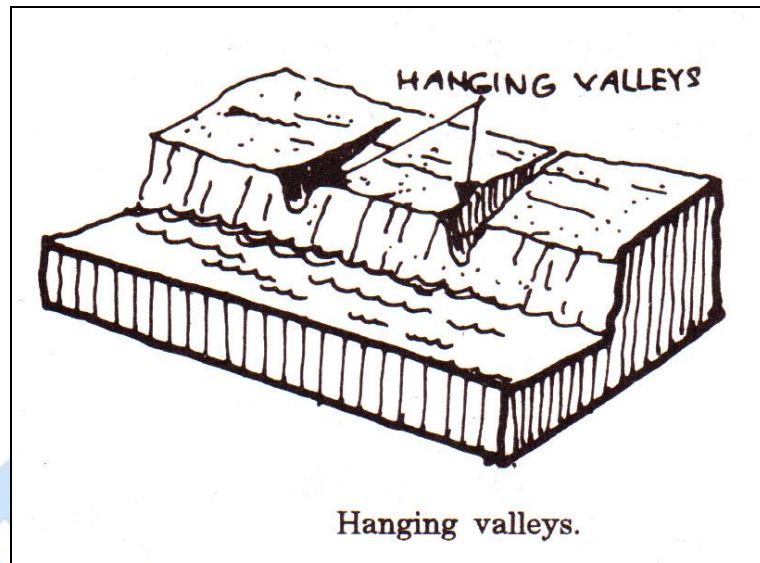
I. Erosional Landforms-

A glacier is supposed to erode the rocks, transport the eroded materials & deposit the eroded materials at suitable places like other agents of erosion & depositions.

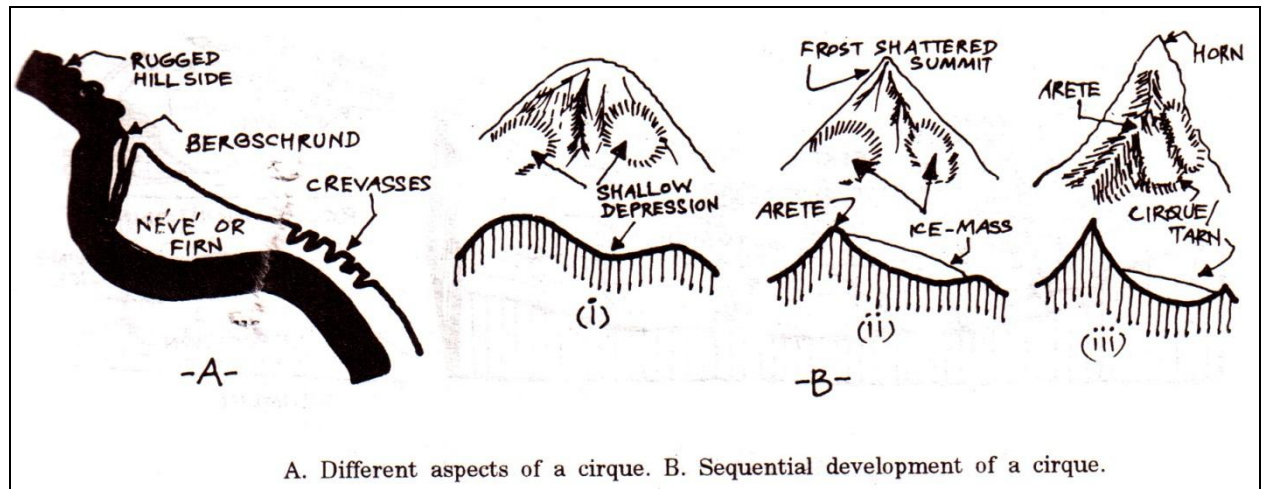
1. **Cirque**- The armchair-shaped or horse shoe-shaped, step, walled depression represents a glaciated valley head.



2. **U-shaped valley**- is another typically glacial feature. Since glacial mass is heavy & show moving erosional activity is uniform horizontal as well as vertical. Steep sides & flat bottomed valley of 'U' shaped.
3. **Hanging Valley**- valleys of tributary glaciers which join the main glacial valleys of much greater depth are called hanging valleys.



4. **Horn**- A pyramidal or triangular faceted peak formed due to recession & intersection of three or more cirques is called horn.
5. **Tarn**- A rock basin is formed as a cirque basin due erosion consequent upon greater thickness of ice mass & its enormous pressure. After that it filled with water and make a small lake is called Tarn Lake.
6. **Arêtes**- is a steep sided, sharp-tipped summit with the glacial activity Arête cutting into it from two sides.

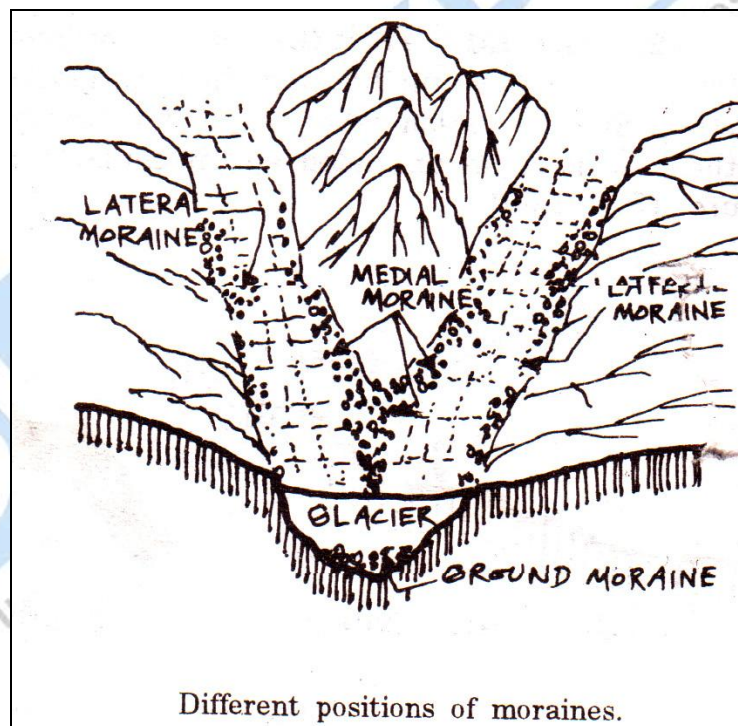


7. **Col**- The crest line of arêtes & pyramidal places is called 'Col & Peak' topography. Example Mount Kailash in Tibet.
8. **Nunatak**- The higher peak & mounds surrounded by ice from all sides are called nunataks. They look like scattered small islands amid extensive ice masses.
9. **Crag & Tails**- A peculiar land forms having vertical eroded steep side up glacial side & tail like structure with lower weight called crag or tail.
10. **Sheep rocks or Roches Moutonees**- are a streamlined asymmetrical hillocks or hills having one side smoothly mounded with gentle slope & steeped & craggy lee side.
11. **Glacial Stairways**: - are very picturesque glaciated landforms. The length of each stair ranges from few meters to several kilometers. The advancing ice of fanciers covers out giant stairway through the process of abrasion & plucking in form of stairs.
12. **Fiords**- are formed as a steep sided narrow entrance like feature at the coast where the stream meets the coast.

II Depositional land forms-

They are formed due to setting down of glacial drift.

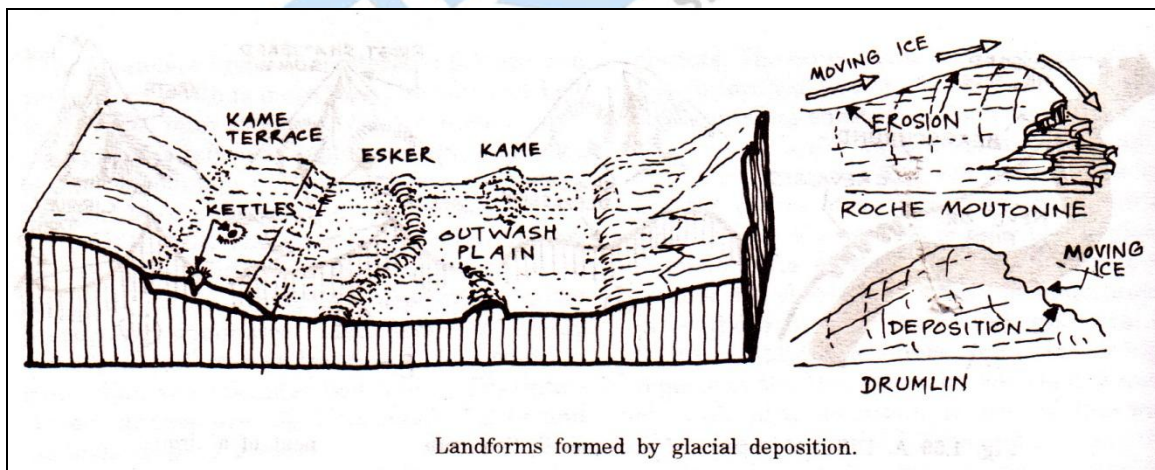
1. **Moraines:** - Moraines are ridge like depositional features of glacial tills. It may be in association with active ice or deposited by former & ice sheets.
It may be transported on the surface of the ice, within the ice or beneath the ice are in 4 categories:
a) Terminal, b) Lateral moraines, c) Medial moraines, d) Ground moraine



2. **Drumlin-** The swarms of rounded hummocks resulting from the deposition of glacial till are called drum lines. They look like an inverted boat or spoon.

II. Glacio- Fluvial Deposits & land forms:

1. **Eskers**- are long, narrow & sinuous ridges of regular & are situated in the middle of ground moraines. The sides of eskers are very steep. Sometimes, a series of swellings are strung along the eskers at regular intervals. Each esker is called beaded eskers.
2. **Kames**- are small hills bedded sands & gravels which are deposited by melt water near or at the edge of set reacting ice sheets.
3. **Kettles & Hummock**- are depressions in the out wash plains kettles are formed due to melting of ice.
4. **Out Wash**- When the glacier reaches its lowest point & melts, it leaves behind a stratified deposition material consisting.



Q. Define the Arid Topography

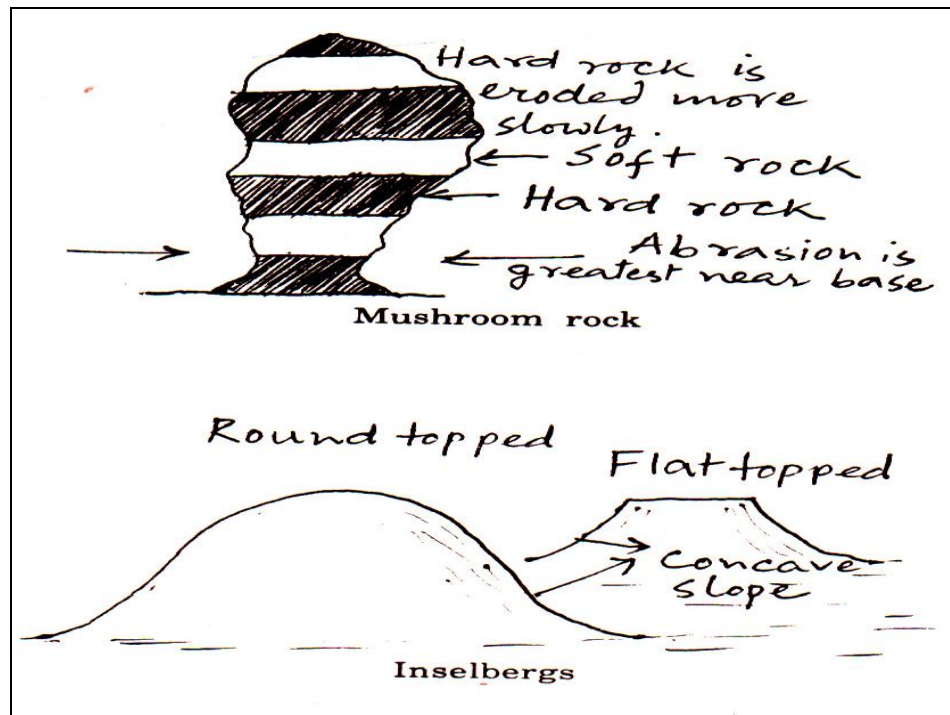
Ans In the desert region, the wind is active in those areas & with the help of erosional & depositional work of sand, gabbles, dust, pebbles etc. various types of features are formed called arid topography.

Wind Erosion takes in 3 ways

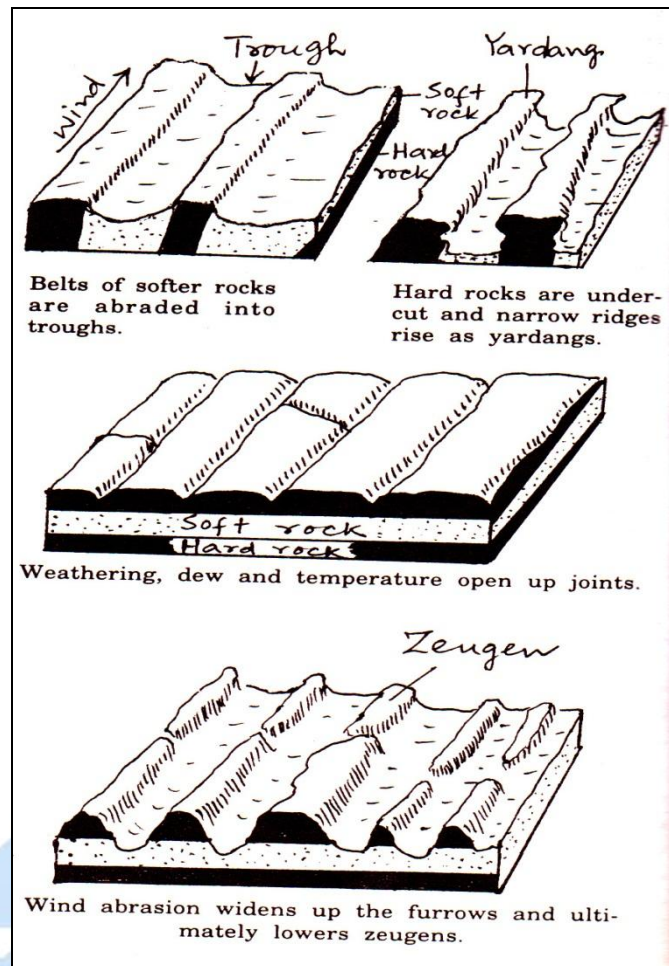
1. **Deflation**- Deflation is the lifting & rolling of loose particles of rock such as dust grains of sand & pebbles in the air.
2. **Abrasion**- Sand blast action using the entrained sand grains as tools against rock surfaces or either grains acting in a way similar to that of the artificial sand blast used in etching glass.
3. **Attrition**- The processes by which borne particle collide with one another & are reduced into millet seed sand.

I. Erosional land forms: -

1. **Deflation Basins**- Depression formed in the deserts due to removal of sands through the process of deflection are called deflation basis.
2. **InSelbergs**- Depression formed in the deserts due to removal of sends through the process of deflection are called deflation basis.
3. **Mushroom Rock**- The rocks having broad upper part & narrow base resembling an umbrella or mushroom are called mushroom rocks.



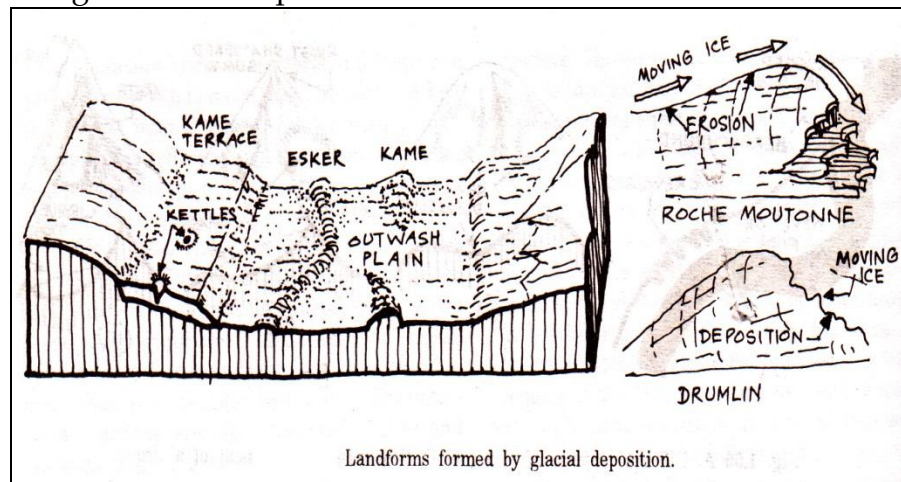
4. **Demoiselles**- These are rock pillars which stand as resistant rocks as a result of differential erosion of hard & soft rocks.
5. **Zeugen**- Rock masses of tabular form resembling a capped inkpot standing on softer rock pedestal of shale, mudstone etc. is called zeugen.



6. **Yardanges**- are steep sided deeply undercut over hanging rock ridges separated from one another by long grooms or relatively softer rocks.
7. **Dreikanter**- Faceted rock boulders, cobbles & pebbles abraded by long periods of wind erosion called ventifacts.

Dreikanter are formed when a ventifact is abraded on as many as three sides

8. **Stone Lattice**- In deserts rocks made of varying compositions & existence are converted into pitted & fluted surfaces as powerful winds charged with rock particles remove weaker sections of rocks.

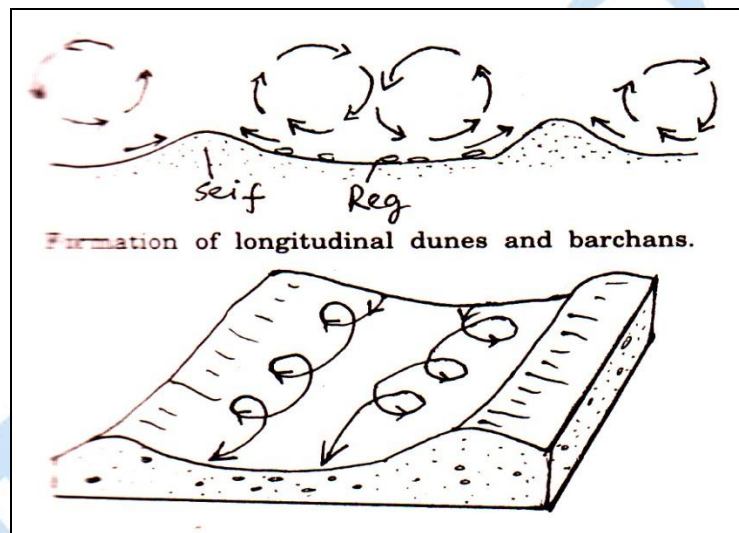


II. **Depositional landforms:**

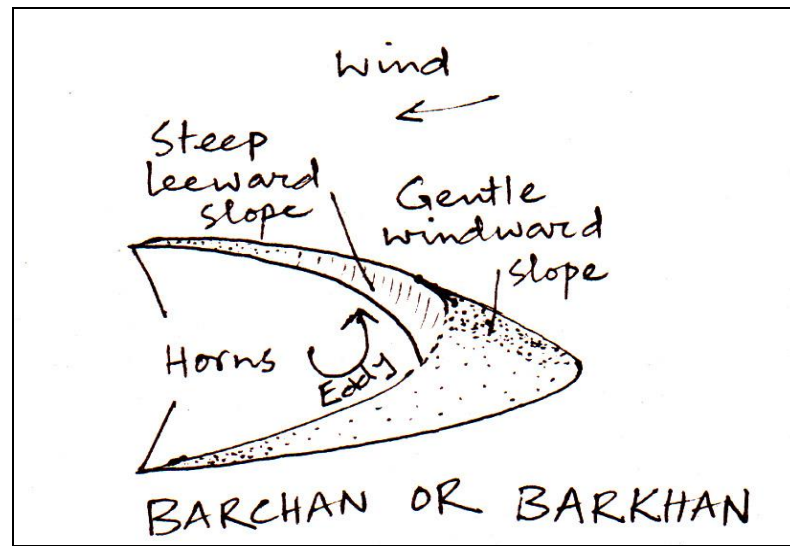
1. **Ripple Marks**- These are depositional features on a small scale formed by saltation.
2. **Sand Dunes**- Heaps or mounds of sands are generally called sand dunes. They are significant depositional feature of desert & also formed in all those areas where sand is available.

(Formation of sand dunes begins with the accumulation of sands in form of sand mounds due to obstructions (e.g. trees, bushes, grasses, rocks, hill etc.)

- i) **Longitudinal dunes**- Sand dunes formed parallel to the wind direction are called longitudinal dunes. Windward slope is gradual & slope is steep.
- ii) **Parabolic dunes**- are generally developed in partially stable sandy deserts. They are U-shaped.
- iii) **Transverse dunes**- Formed due to transverse to the direction of prevailing winds are called transverse dunes. Phase is formed by in effective wind along the coast & margins of deserts.



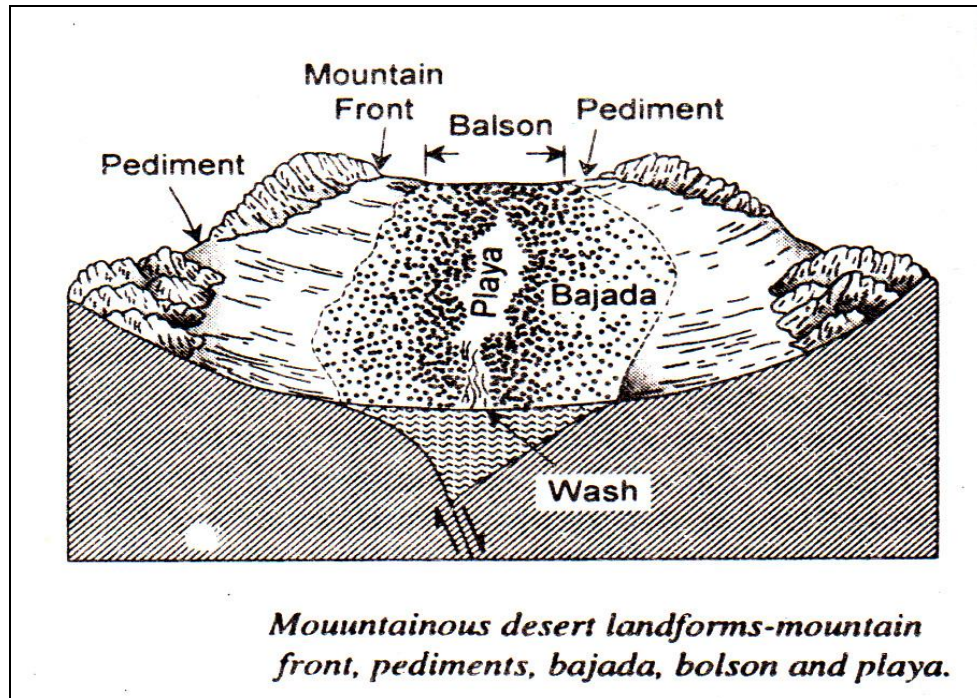
- 3. **Barkhans**- Have a crescent slope with 2 horns. The windward side is convex whereas the leeward side is concave & steep.



4. **Loess**- Loess is loose, stratified, non-indurate, buff-colored fine sediments which are deposited at places far from their source of origin.

III Fluvial Desert land forms-

1. **Bad Land Topography**- The ground surface becomes so uneven & corrugated due numerous gullies & ravines. Such types of landscape are called bad land topography.
2. **Pediments**- Situated between Mts. Front & bajada in intermountain basin are broad, extensive & gentle slope.
3. **Bajada**- Gentle sloping depositional plain between pediments & playa is called bajada.
4. **Playas**- The intermountain basins in arid or semi-arid areas are called playas.



Que : Explain the landforms formed by Fluvial ?

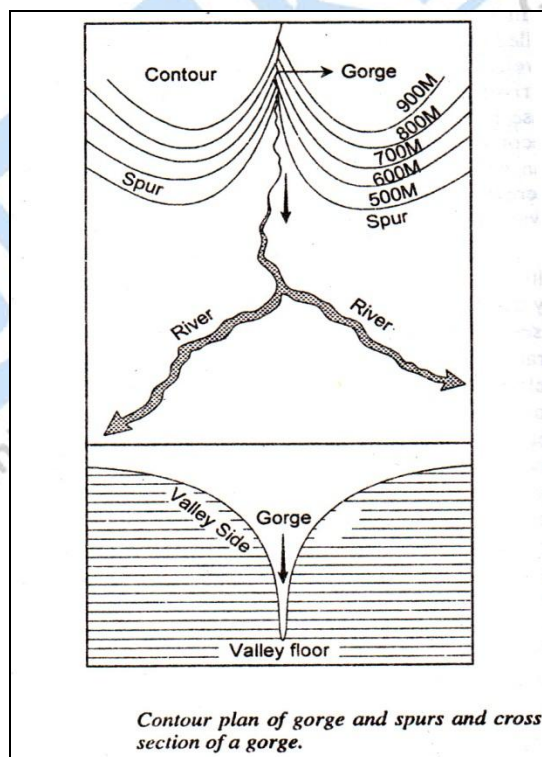
Ans: The land forms created as a result of degradation action (erosion) or depositions of running water are called fluvial land forms.

I. **Erosional land forms-**

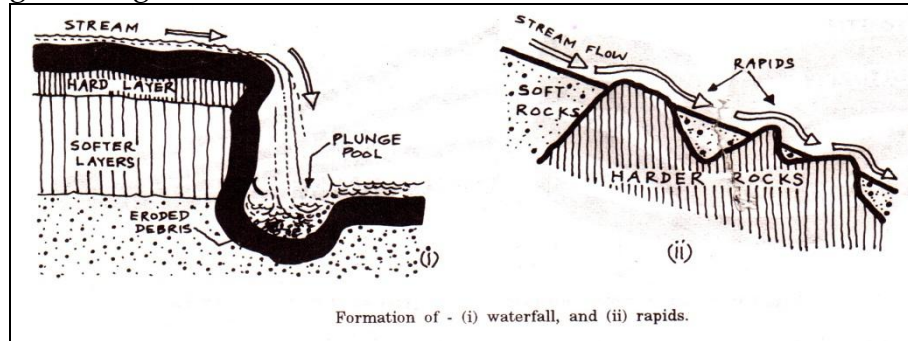
1. **River Valley-** The extended depression on ground through which a stream flows throughout its course is called river valley. At different stages of the erosional cycle the valley acquires different profiles. Resemblance to English letter V.

2. They are further transformed into very broad & shallow valley having concave side slope of very gentle are called 'V' shaped valley.

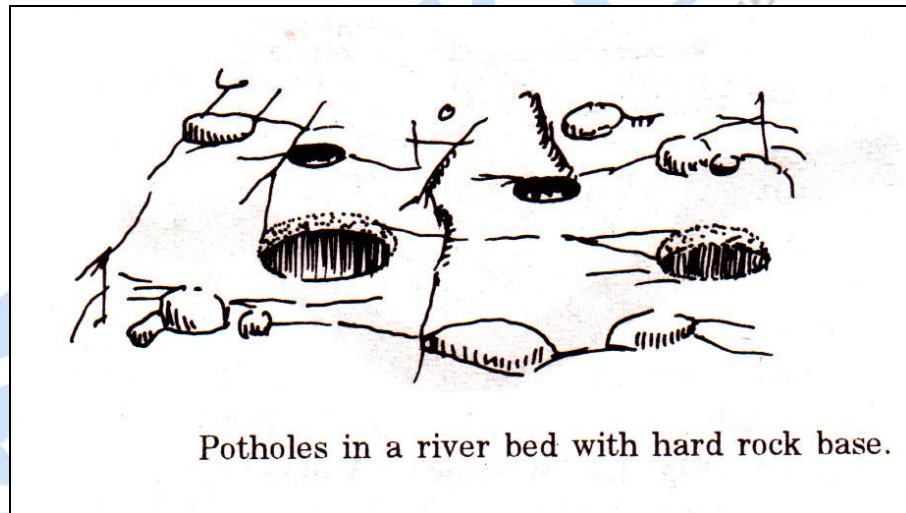
- (i) **Gorges**- Represent very deep & narrow valley having very steep valley side slopes say well like steep valley sides.
- (ii) **Canyons**- are extended form of gorges. It represent very deep, narrow but long valley.



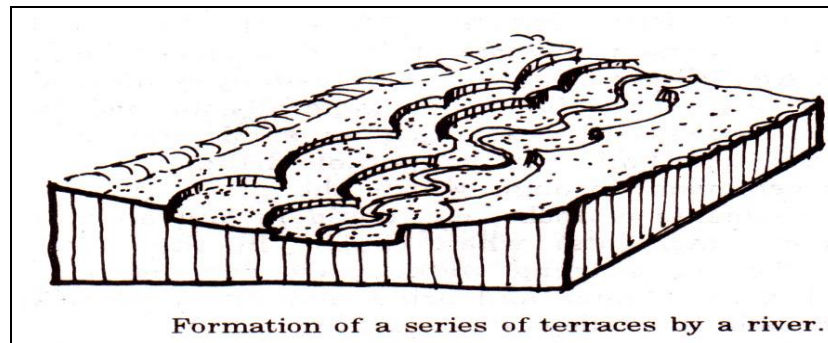
3. **Waterfalls**- Simply the fall of enormous volume of water from a great height.



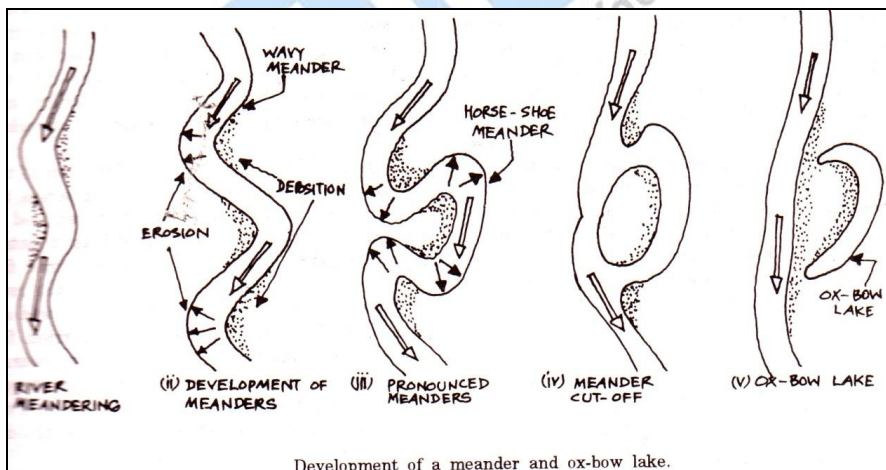
4. **Pot holes**- The kettle like small depressions in the rocky beds of the river valley are called pot holes are in a cylindrical shape.



5. **Terraces**- Stepped benches along the river course in a flood plain are called terraces.



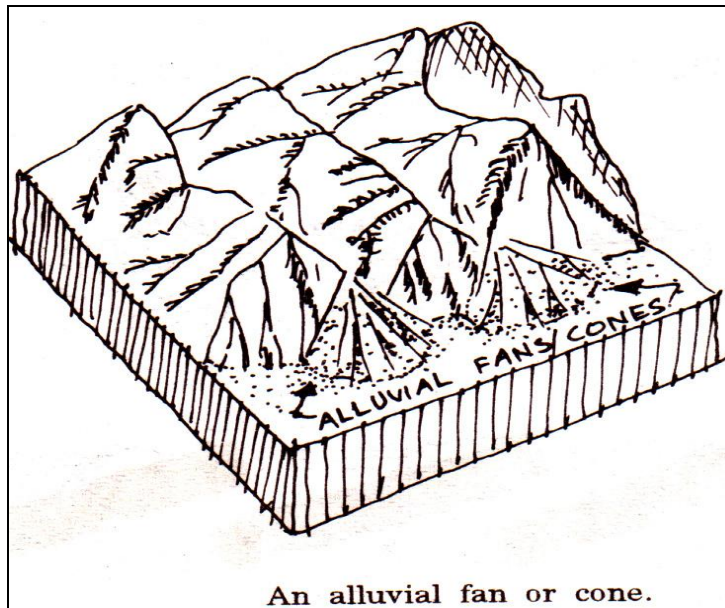
6. **Gullies**- It is formed when water from over land flows down a slope especially following heavy rainfall.
7. **Meanders**- are defined as pronounced curve or loop in the course of a river channel. The outer bend of loop is intensive erosion and vertical cliff heaving on cause slope.
8. **Ox-Bow lake**- The lakes formed due to impounding of water in the abandoned meander loops due to erosion are called ox-bow Lake.



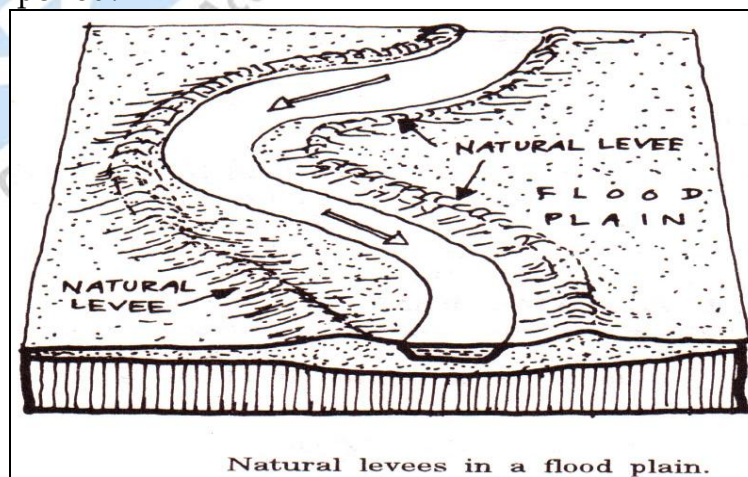
9. **Peni-plane**-Represents low featureless plain having undulating surface.

II. Depositional landforms-

1. Alluvial forms & Cones- When the heavily laden stream reaches the plain its velocity is checked, it widens & much of its load is deposited. That deposited sediments spread out forming alluvial form.



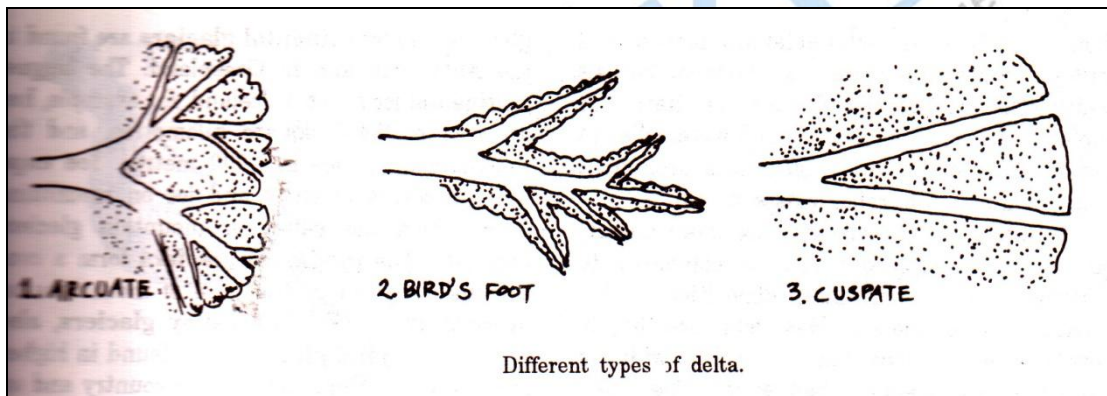
2. Natural Levees- These are narrow ridges of low heights on both sides of river built by deposition of sediments during flood period.



3. **Delta-** is a tract of alluvium usually fan shaped, at the mouth of a river where it deposit more material then can be carried away. So the river cans 2 or more channels.

Types of delta-

- a) **Fan shaped-** This type of delta results when light depositions give rise to shallow, shifting distributaries & a general fan shaped profile e.g. Nile.
- b) **Birds Foot delta-**
This type of delta emerges when the lines tones sediment deposits do not allow downward seepage of water resembling the shape of foot of a bird. Examples Mississippi delta.



- c) **Estuaries-** The deltas formed due to falling of estuaries of rivers called estuaries deltas. These are sub merged under marine water & sea waves remove the sediments brought by rivers.
- d) **Cuspate-** This is a pointed delta formed generally along straight coasts & is subjected to strong wave action. Example Tiber River of western Coast of Italy.

Climatology

Q1 Define the structure of Atmosphere with diagram?

Ans. STRUCTURE OF ATMOSPHERE

The atmosphere is a significant component of the biosphere eco-system because the life on the earth's surface is for this atmosphere otherwise the earth would have become barren like moon. The height of the atmosphere upto 800Km is most important. The atmosphere consists of several zones and layers. They are as follows:

1. Troposphere:

The lower most layer of the atmosphere is known as the troposphere and is the most important layer because almost all of the weather phenomena (fog, dew, cloud, frost, rainfall, lightning etc) occur in this layer. Temperature decreases with increasing height at the rate of 6.5°C per 1Km/1000 m. This rate of decrease of temperature is called normal lapse rate. There is seasonal variation in the height of troposphere; its height decreases during winter from equator toward the poles and it becomes increased during summer. The average height of troposphere is about 16 Km. over the equator and 6 Km over the poles. The upper limit of troposphere is called tropopause which is about 1.5 Km. thick and height is 18Km over the equator and 9 to 10 Km over the poles. There is also a seasonal variation in its height. The word troposphere means 'zone or region of mixing' whereas the word tropopause means 'where the mixing stops'.

2. Stratosphere:

The layer just above the troposphere is called stratosphere. The height of this zone is up to tropopause to about 50Km. Here no change in temperature. The upper limit of the stratosphere which is known as

stratosphere, so here major weather phenomena like winds, cirrus cloud etc.

3. Ozonosphere:

It is extended between the 30⁰ to 60⁰ Km. suited between the middle of Stratosphere & Mesosphere. This layer contains most of atmospheric ozone. Atmosphere it absorbs almost of the ultra violet rays of solar radiation & thus protects the Earth surface from becoming too hot. In this layer temperature increase at the rate of 5°C for 1 Km.

4. Mesosphere:

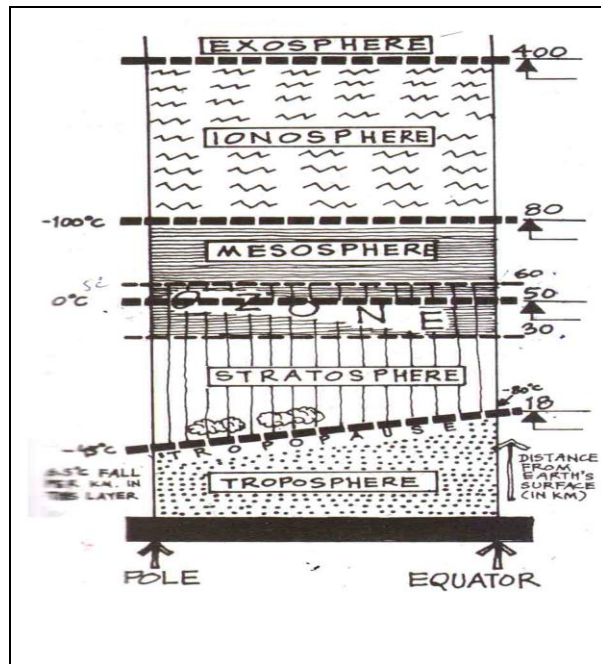
It extended between 50 to 80 Km. Temperature again decrease with increase in height. Pressure is very low in this layer.

5. Thermosphere :

It is suited on the mid of 80 to 400 Km. is an electrically conducting layer from which radio signals can be reflected. Temperature rise with height, owing to the absorption of ultraviolet radiation by atomic oxygen.

6. Exosphere & Magnetosphere:

This is the upper most layer of Atmosphere extended between 400-800 Km. The densities become extremely low and temperature increases.



Q2: Define Air Pressure and explain the air pressure belts ?

Ans: Air pressure is the weight of column of air at any given place & time (1sq inch, 1sq foot, 1sq cm, 1sq m etc). The atmospheric pressure is maximum at sea-level. The atmospheric pressure is maximum at sea level. It exerts the weight of 14.7 pounds on the area of 1 sq inch at sea level. The distribution of atmospheric pressure is shown on a map by isobars.

Horizontal distribution of Air pressure & Pressure Belt:

The distribution of atmospheric pressure across the latitude is termed as global Horizontal distribution of air pressure on the globe is studied by isobars lines. On our earth there are 7 main pressure belts as follows:

1. Equatorial low pressure belt doldrums:-

It is extended between the either sides of equator in zones of 10° S to 10°N latitudes but this zone is not stationary because there is seasonal shift of this belt with the north ward & southward its width 5°N 5°S to 20°N 20°S. Thus warmed air expands, becomes light, can sequentially rises upward causing low pressure. The equator low pressure belt represents the zone of convergence of North and South trade winds. Because of frequent calm conditions this belt is called 'belt of calm' or 'doldrum'.

2. Sub-tropical high pressure belt or Horse latitudes:-

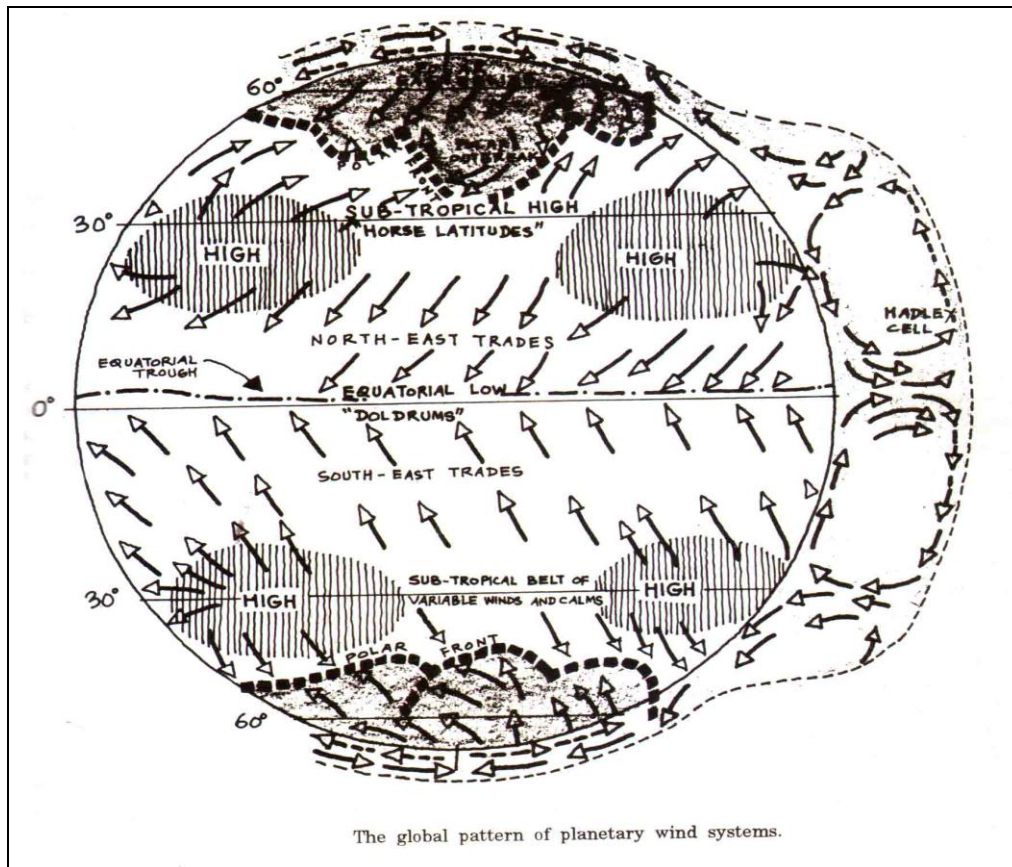
Sub-tropical high pressure belt extends between the latitude of 25° - 35° in both the hemispheres. This is why this zone is characterized by anticyclonic conditions which cause atmospheric stability and aridity. This is one of the reasons for presence of hot desert of world in the western parts of continents.

3. Sub-Polar low pressure Belt:-

This is located between 40° to 65° latitude mid of Antarctica & Arctic circles. The surface air spreads outward from this zone due to rotation of the earth & low pressure is caused. This factor should be more effective at the poles but the effect of the rotation is regrettably & prevailing low temperature through out the year at the poles. The sub polar low pressure more developed & regular in the S-hemisphere while it is broken in the N-hemisphere because of over dominance of water in the former. Example one center Aleutian island in the Pacific Ocean & the other center between Greenland & Iceland in the Atlantic Ocean.

4. Polar high pressure belt:-

High pressure persists at the poles throughout the year because of prevalence of very low temperature (below freezing point) all the year round. Infact both the factors, thermal and dynamic operate at the poles. Polar High pressure Belt are small in area & spread outwards from the poles.



Q3: Give the detailed classification of Wind?

Ans: Wind is the horizontal movement of air, from one place to the other or one latitude to the other and are parallel to the earth surface is called winds.

Classification of winds:

1. Primary and Planetary winds:

Those are the planetary winds which blow extensively over continents & oceans from high pressure to low pressure areas in the same direction throughout the year.

(i) Trade winds or Easterlies:

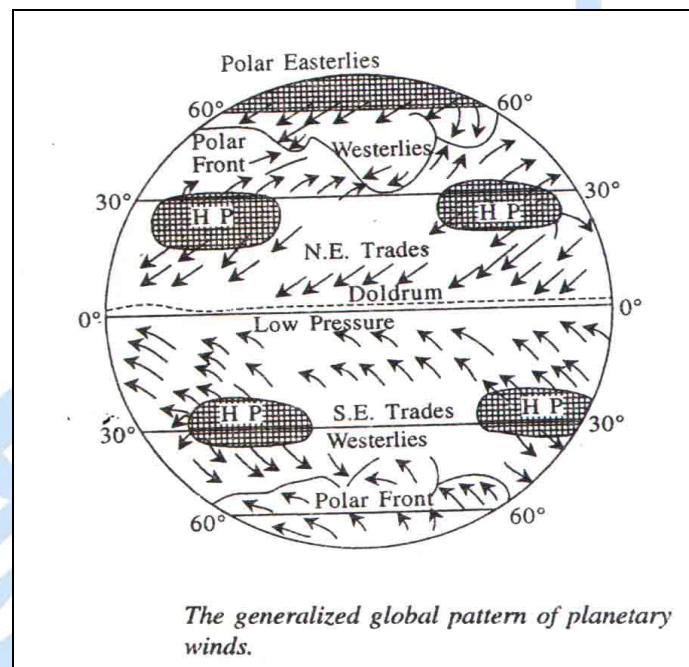
They blow from subtropical high pressure areas towards equatorial low pressure areas between 30°N to 30°S over the globe.

(ii) Westerlies:

Winds blowing from the horse latitude Sub-tropical high pressure belt to temperate low pressures. They blow from S-W to N-E in the southern hemisphere. They are best developed in 40°S to 65°S latitude. Due to tremendous speed in S-hemisphere they are known roaring forties, furious fifties & shrieking sixties –dreaded terms for sailors.

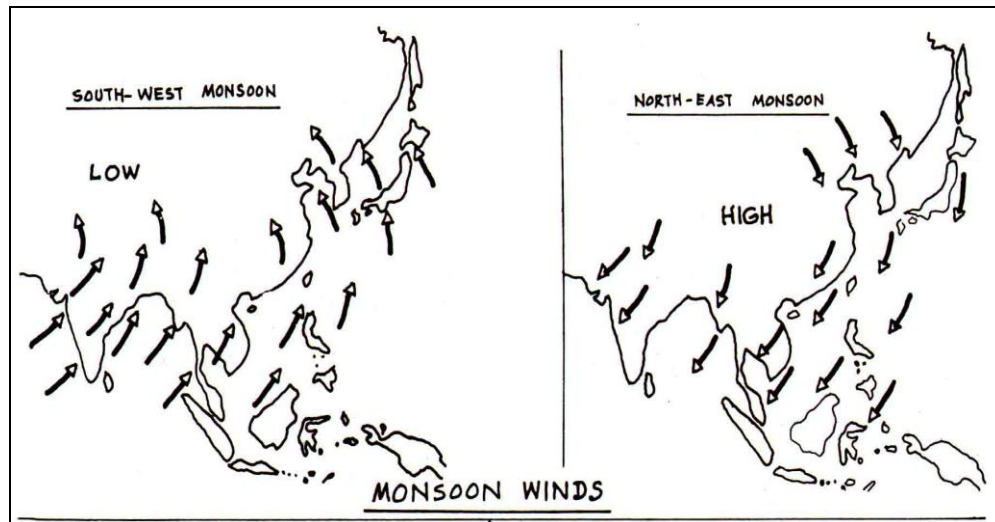
(iii) Polar Easterlies:

They blow from polar high pressure regions to the sub polar low pressure regions. Their direction in N-hemisphere is from N-E to S-W from S-W to N-E in S-hemisphere.

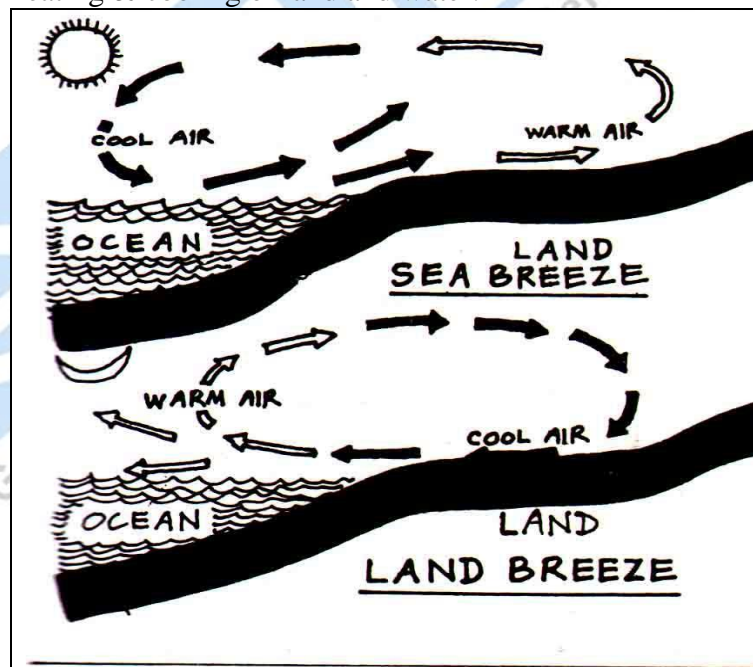


II. Secondary or Periodic winds: - These winds change their direction with change in season.

1. Monsoons winds: The word 'Monsoon' indicates the winds in the areas where they change their direction twice every year. It refers to such an atmospheric circulation which reverses its direction every 6 months.

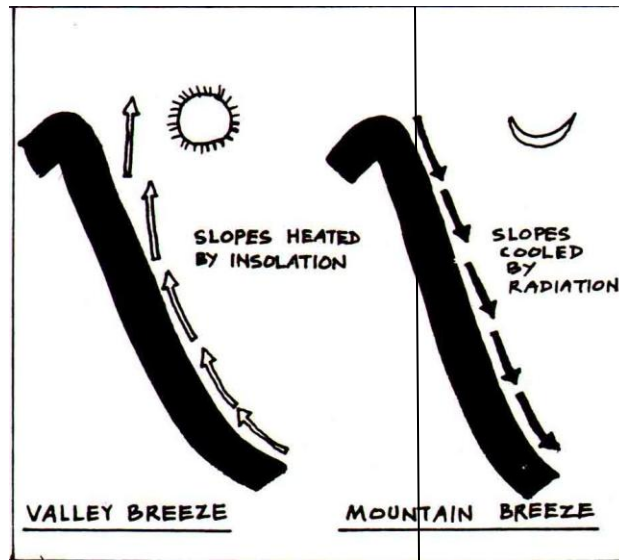


2. Land & sea breezes: Representing a complete cycle of diurnal winds, they change their direction twice in every 24 hours. Seabreeze blows from sea to land during day time & land breeze moves from land to sea during night due to differential heating & cooling of land and water.



3. Valley breeze & Mountain breeze: During day time the slope of mountain is heated more than the valley floors. As such air from the valley flows up the slope

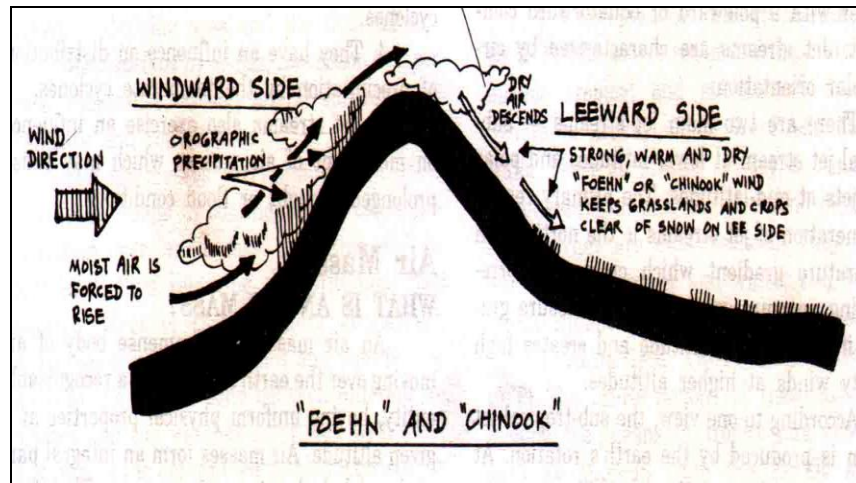
is called valley breeze. After sunset, the pattern is reversed. Rapid loss of heat along mountain slopes resulting in sliding cold dense air from higher elevation to valleys. This is called mountain breeze.



III. Local winds: local differences in temperature and pressure produce local winds. Such winds are local in extent and are confined to the lowest levels of the troposphere.

1. Foehn: is a hot wind of local importance in the Alps. It is a strong, dry & warm wind which develops on the leeward sides of the mountains.

2. Chinooks: winds in U.S.A. & Canada move down the west slopes of Rockies, become warm & dry and are called chinooks.



3. Harmattan: The warm & dry winds blowing from N-E to E-W in the eastern parts of Sahara desert are called Harmattan. These winds become extremely dry.

4. Siracco: is a warm, dry & dusty local wind blowing in northerly direction from Sahara desert. After crossing over Mediterranean sea reaches Italy, Spain etc. This wind is the major agent of cyclonic storm in Mediterranean Sea.

5. Loo: It is a hot and dry wind of N-India and Pakistan blowing from west in the months of May to June.

6. Mistral: It is a cold local wind which blows in Spain & France from N-W to S-E directly. It is channelled through the Rhine valley.

7. Bora: is an extremely cold and dry wind blowing along the shore of Adriatic Sea. Bora becomes more effective in north Italy where it descends through the southern slopes of the Alps.

8. Blizzard: is a violent stormy cold and powdery polar wind blowing in N and S Polar Regions, Siberia, Canada & U.S.A.

Q.4 Explain Front? And also explain its types.

Ans: A front is a narrow zone of convergence where 2 different types of air masses i.e. cold & dry and the warm and moist air converge.

Here the change from one type of air mass to another is sufficient to be represented conveniently by a line in a weather map.

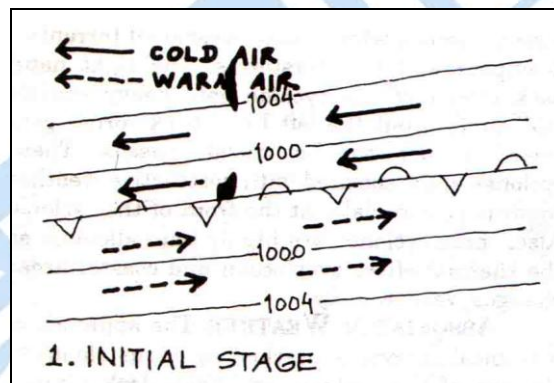
Frontogenesis: The process associated with the creation of new fronts or the regeneration of decaying fronts already in existence is called frontogenesis. The region having convergence of contrasting air masses is called the region of frontogenesis.

Frontolysis: The process of destruction or dying of fronts is called frontolysis.

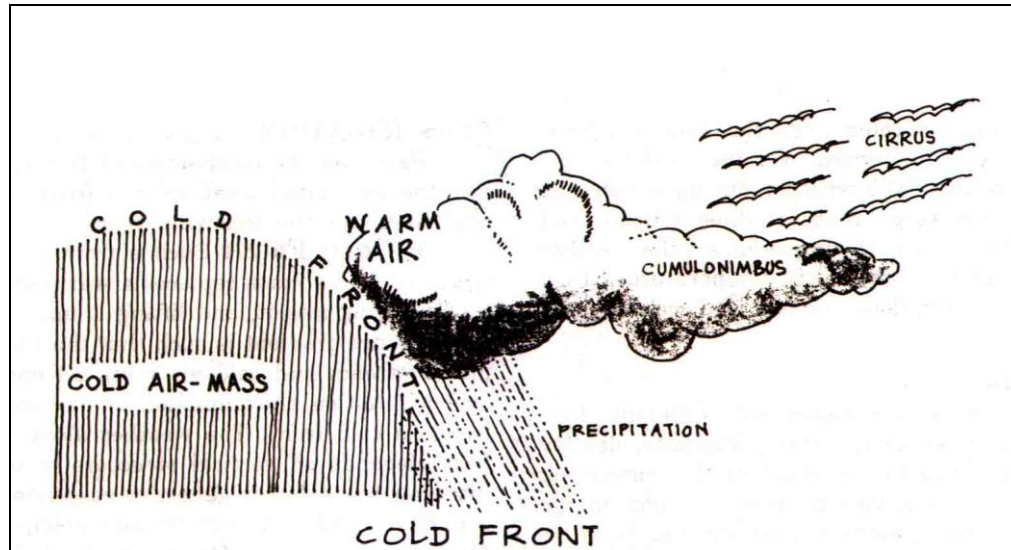
Classification of Fronts

Based in the Mechanism of frontogenesis & the associated weather, the fronts can be studied under the following types:

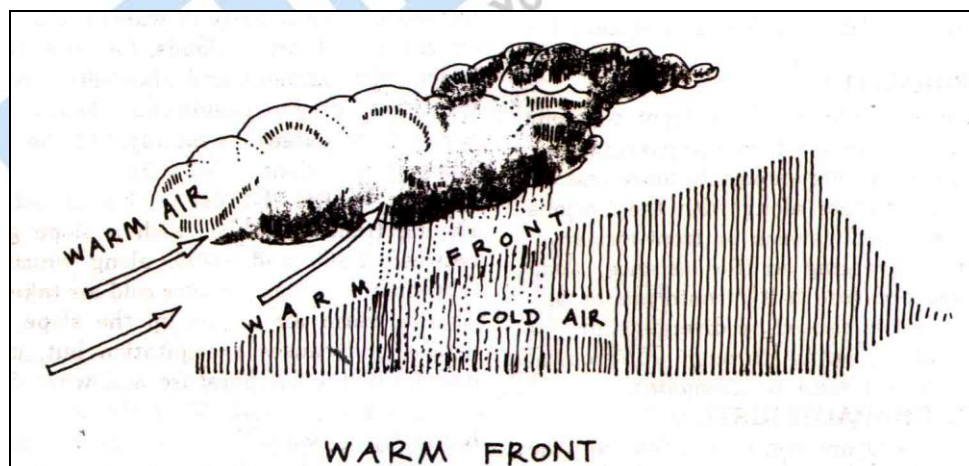
1. Stationary Front: is formed when two contrasting airmasses converge in such a way that they become parallel to each other & there is no ascent of air. The surface position of stationary front does not move either forward or backward.



2. Cold Front: Such a front is formed when cold air masses replace a warm air mass by advancing into it, and lifting it up or when the pressure gradient is such that the warm air mass retreats & cold air advances. In such a situation, the transition zone between the two is a cold front.

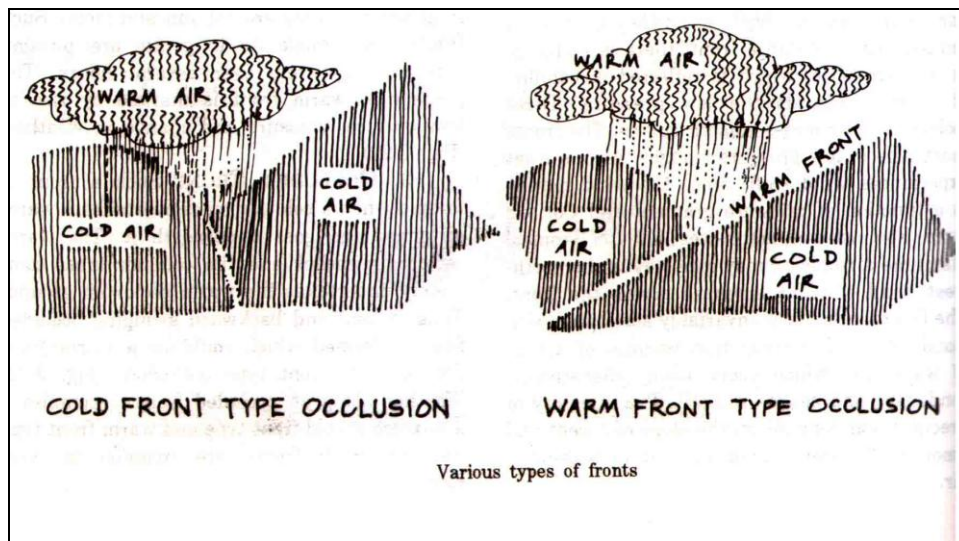


3. Warm Front: It is actually a sloping frontal surface with a slope gradient between 1:100 & 1:200 along which active movement of warm air over cold air takes place. As the warm air moves up the slope, it condenses & causes precipitation.



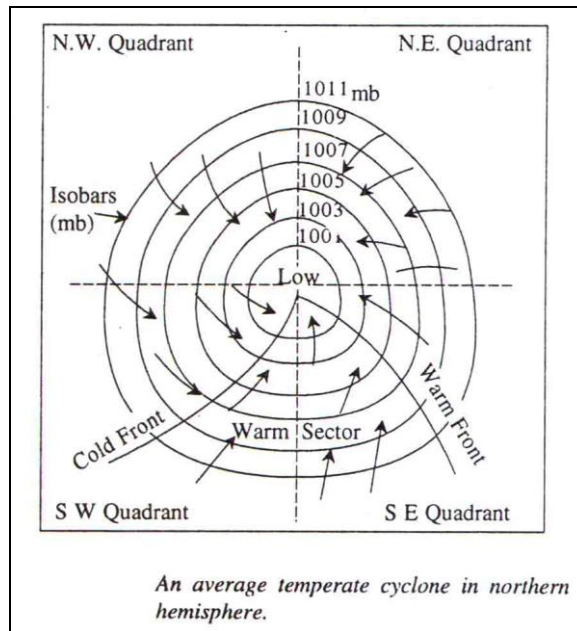
4. Occluded Front: is formed when cold front overtakes warm front & warm air is completely displaced from the ground surface.

- a) **Cold Front Occlusion:** When the cold air behind the cold front, is colder than that of the cold air advance of the warm front.
- b) **Warm Front Occlusion:**
When the cold air behind the cold front, is warmer, than that of the cold air in advance of the warm front.



Q.5 Describe the weather conditions associated temperate cyclone.

Ans The cyclones are irregular wind movements involving closed air circulation around a low pressure center. The air blows inward in anticlockwise in the N-hemisphere and clockwise in the S-hemisphere.



TEMPERATE CYCLONE:

Temperate cyclones are active over mid latitudinal region between 35° latitude & 65° latitude in both hemispheres are also called extra tropical cyclone, frontal depression & wave cyclones.

Characteristics

1. They are having low pressure at the center & increasing pressure outward.
2. They are of varying shapes such as near circular, elliptical or wedge.
3. They are formed in the regions between 35° N and S latitude.
4. It has a zone of conflicts between two air masses of different nature i.e. cold & dry Polar air and warm & moist tropical air masses.

There are some other Characteristics:

Size & shape: They are asymmetrical & shaped like an inverted 'V'. They stretch from 500Km & 600Km. They may go up to 2500 Km over N.America. They have the height of 8 to 11 Km.

Wind velocity & strength: These aspects of a temperate cyclone vary with season, location & from cyclone to cyclone there is low pressure in the center &

air pressure is created outward & hence winds flow from the periphery towards the centre but these winds do not reach the centre straight rather they cut the isobars at the angle of 20° to 40° due to Coriolis force and thus wind direction becomes anticlockwise in N.hemisphere & clockwise in the S.hemisphere.

Orientation & Movement: General movement is west to east (N.E.) because of:

- a) Westerlies have a westerly component.
- b) According to wave theory –movement in such ways that warmer air remains at the right hand & colder air remains at the left hand.

Speed: 30Kms/hr in summer and 50Km/hr in winter.

Weather conditions Associated with Temperate cyclone:

1. Arrival of cyclone:

When the cyclone coming from the western direction draws nearer to the observation point, wind velocity slows down, air pressure decreases and sun & moon are encircled by halo. So their veils of cirrus and cirrostratus clouds in west. Temperature of cyclone is suddenly increased, wind direction changes from easterly to S-Easterly, sky becomes overcast with dark and low clouds.

2. Weather associated with Cold front:

Cold and dense air becomes active and cold air invades warm air region and pushes it upward while the being denser settles downward. If the front becomes stationary, the sky becomes overcast with cumulonimbus clouds which yield heavy showers, with cloud thunder & lightning but precipitation of short duration because of cold sector is very close.

3. Cold Sector: Weather again changes remarkably with the passage of cold front & arrival of cold sector. sky becomes cloudy & hence clears. There is a sharp fall in temperature & air pressure is in rise but decreases are specific humidity. After the occlusion cyclone the weather conditions of pre cyclone period again set in.

4. Weather associated with warm front: Warm air becomes active & aggressive along warm front as it invades cold air zone & thus it being lighter, rises over cold air. Cooling of warm air causes condensation & cloud formation by precipitation. If

aggressive warm air is stable less humid. Condensation occurs at great height & hence much lifting of air is required. On the other hand if the warm and moist air is unstable causes condensation & precipitation. The warm front precipitation is of long duration. When warm front advances forward, the warm sector comes over the observation with arrival of warm sector example sudden increase in temperature and specific humidity, decrease in air pressure, disappearance of clouds, clear sky.

Origin of Temperate Cyclone:

Polar Front theory (also called frontal theory Wave theory / Bergen theory.

1. Propounded by V. Bjerknes & J. Bjerknes in 1915.
2. Based primarily in processes of the formation of fronts (convergence of airmasses of contrasting character).
3. In the beginning the (i.e. Polar & tropical) surface separating two opposing air masses (i.e. surface of discontinuity) is almost straight but it becomes unstable & wave like when the warm & cold masses attempt to penetrate in the region of one another. Such unstable wavy front is called Polar fronts.
4. When south westerly warm and moist air mass the territory of cold polar air mass along the polar front, it being lighter rises up where with the result a centre of pressure is formed.
5. Winds from all directions rush up towards this centre of low pressure & thus a cyclone is formed.
6. Two parts of cyclone:
 - (a) Eastern part: Where eastward advancing warm tropical or subtropical air masses ascend over a wedge of cold air mass is called warm front.
 - (b) Western part: Where cold polar air mass pushes warm air mass upward forcibly is called cold front.
7. Warm air mass is aggressive along the warm front; cold air mass is aggressive along the cold front because it replaces warm air by pushing it upward.
8. South- Eastern – Warm sector
North–Western - Cold sectors

9. Due to low pressure in the centre, it draws winds from near areas, resulting cold front advances more rapidly.

10. Consequently cold & warm fronts come close to each other resulting in to destruction of warm front.

11. The cyclone dies due to disappearance of warm front known as occlusion.

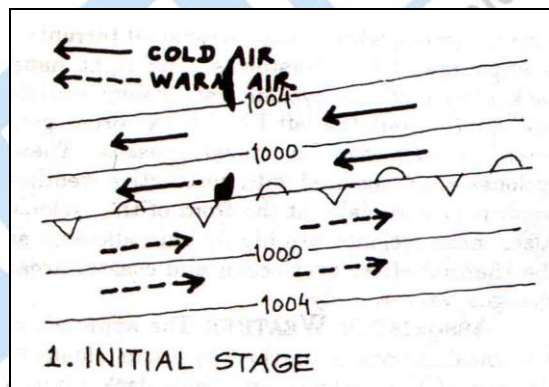
Period of Inception known as **Cyclongensis**

Period of Termination known as **Frontolysis/occlusion**

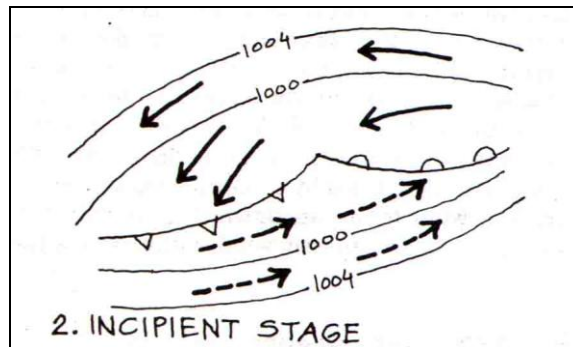
Life cycle of Cyclone

1. The first stage / Initial stage:

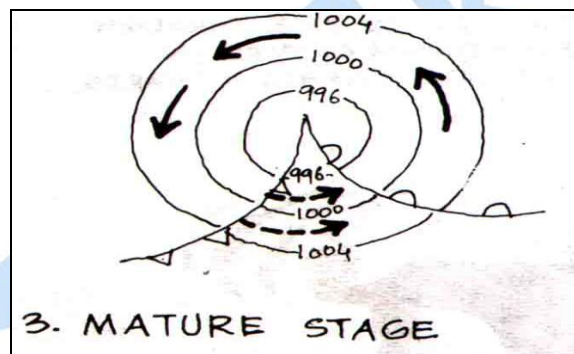
Convergence of two air masses of contrasty physical properties & direction. Initially the air masses more paralled to each other & a stationary front is formed.



3. **Incipint stage:** during which the warm & cold air masses penetrate in to the territories of each other & thus a name like front is formed.



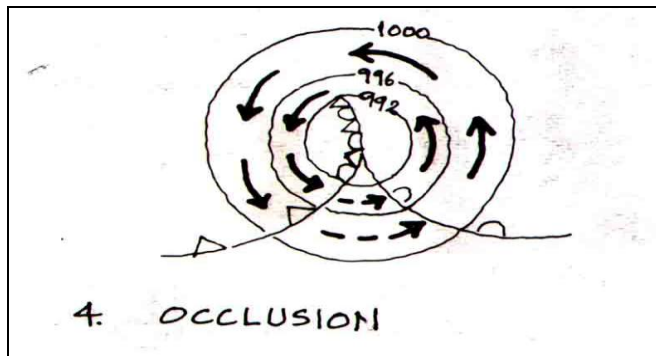
- 4. Mature stage:** When the cyclone is fully developed & isobars become almost circular. Nimbostratus, stratus, cirrostratus & high anticyclones are formed at the warm front complete cyclonic circulation is established.



- 4. Full Maturity:** warm sector is narrowed in extent due to the advancement of cold front come nearer to warm front.

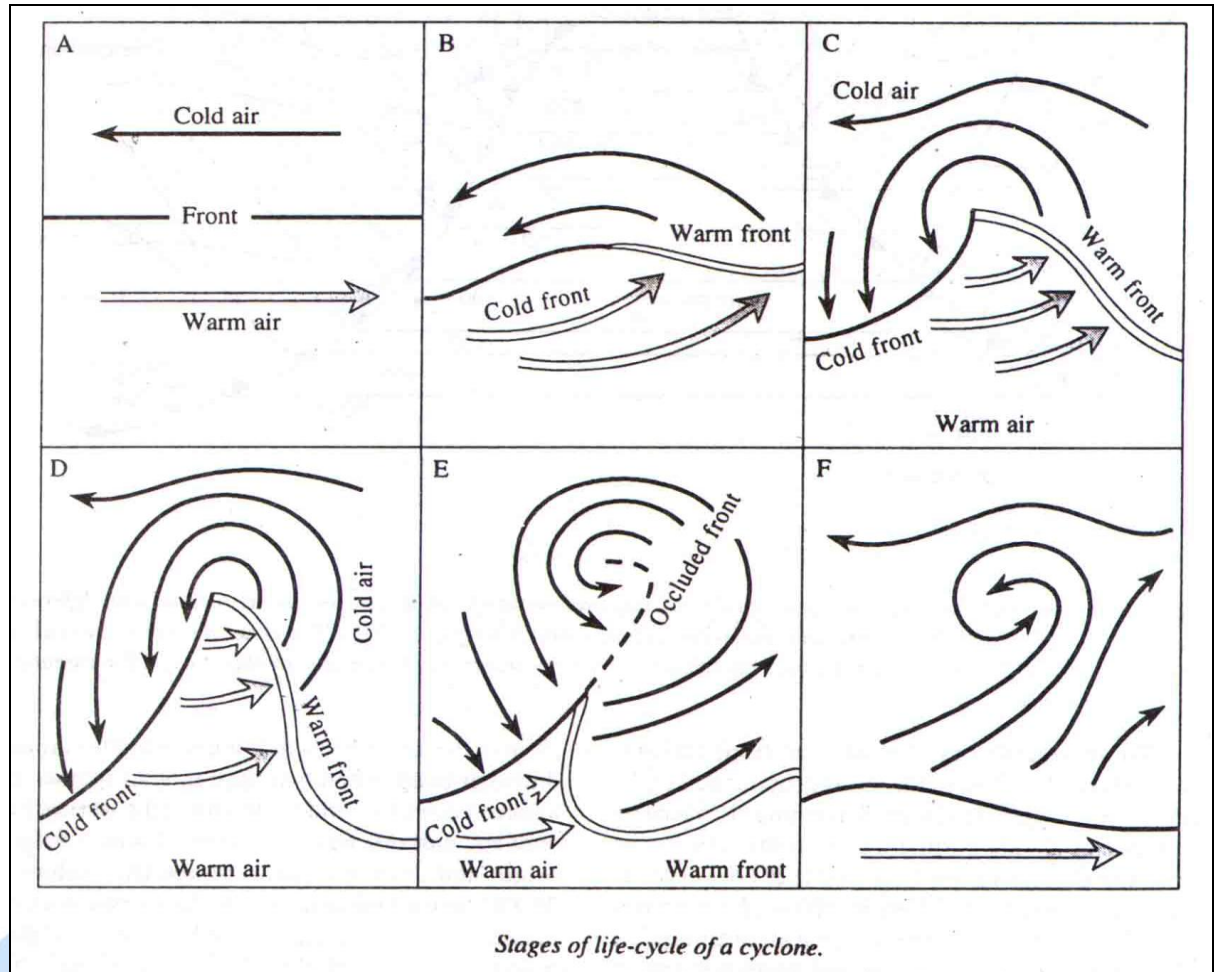
5. Old stage / occluded stage:

Starts with the occlusion of cyclone when the advancing cold front finally overtakes the warm front & an occluded front is formed cold occluded front – if air coming from.



6. End stage: Warm sector completely disappears, occluded front is eliminated & ultimately cyclone dies out & a new stationary front is formed.

SS



Q.5 Describe the weather conditions associated with a Tropical cyclone?

Ans

TROPICAL CYCLONE

Cyclone developed in the regions lying between the tropics of cancer & Capricorn are called tropical cyclones, which are not regular& inform like extra tropical or temperate cyclone

The ideal conditions for the development of tropical cyclone are:

- Quite air
- High temperature
- Highly saturated atmospheric conditions

Characteristics:

1. Size & shape: Tropical cyclone has symmetrical elliptical & circular shape with steep pressure gradient. They have a compact size – 80 Km. near centre which may develop upto 300 Km. to 1500 Km.

2. Wind velocity & strength:

Wind velocity, in a tropical cyclone, is more in pole ward margins than at centre & is more over oceans than over the land masses which are scattered with physical barriers. Weak example known at speed of 32Km./hour while hurricanes move 120Km/h.

4. Area Affected: 8° to 30° latitude in both the hemisphere.

5. Movement: The center of cyclone is characterized by extremely low pressures. Isobars are more or less circular but are fewer in number. This is why winds hurriedly rush up toward the center & attain gale velocity.

6. Time of occurrence:

N.Hemisphere – May to November.

Greatest frequency in September & October & less in June- November.

S.Hemisphere : Jan. to March (both inclusive)

7. Latent heat: is the source of origin.

8. Development: only over the oceans due to –

I. Proximity of sun

II. More amount of insolation.

III. Higher evaporation from the oceans

IV. Liberation of latent heat of condensation

V. Latent heat increases the temperature causes the air to rise (formation of cumulo-nimbus clouds).

9. Path of the winds: 8° to 15° westward & N.W. Ward

15° to 20° - North ward (N.Hemisphere)

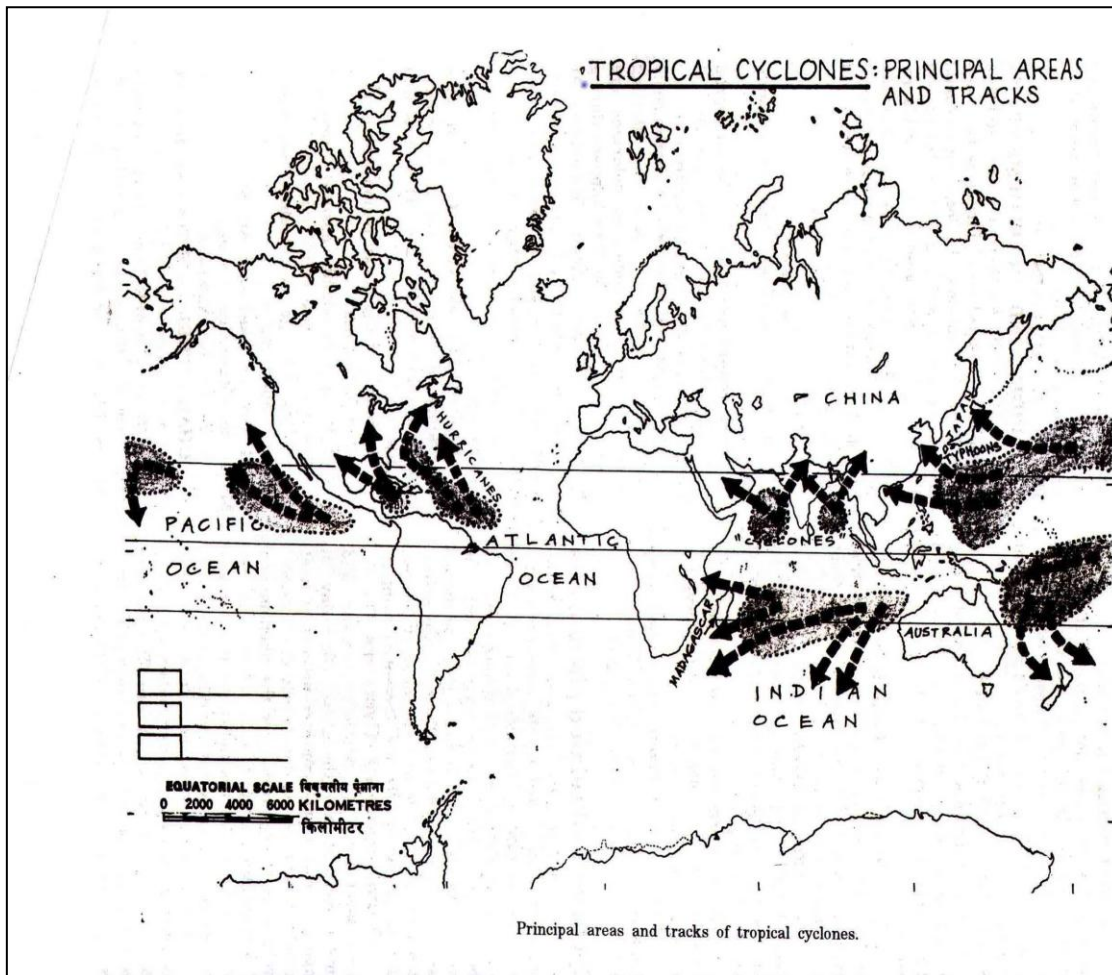
South wards (S.Hemisphere)

20° to 30° – North East ward (Decay in sub tropical are)
(Enter the zone of westerlies)

10. Weather:

1. (i) During the day preceding the storm the air is generally calm.

- (ii) Pressure some what above normal
 - (iii) Cirrus clouds originates from the horizon which makes halo to the sun & moon.
 - (iv) Red sunset
- 2. Long so well over the oceans (Develop of very high waves)
- 3. on approach of storm
 - (i) Severe fall in barometer (increase in temperature)
 - (ii) Wind velocity increases from a gentle breeze to hurricane (force 120 Km /h.)
 - (iii) Dark wall of cirrus, cirrostratus & cumulonimbus clouds approaches.
- 4. Sky is darkly overcast.
- 5. Torrential rains with thundering & lighting
- 6. Winds of terrific speed continuous
- 7. Visibility is sometimes reduced to (O'zero)
- 8. Terrible storm continuous for hours
- 9. Approach of the 'eye' of the storm.
 - (a) Wind ceases
 - (b) Rainfall stops
 - (c) Sky is cleared
 - (d) No fall in pressure
 - (e) This condition prevails for about 30min. but seas are mountainous
- 10. Then again the storm with all its severity begins but
 - (i) Winds blow from opposite direction
 - (ii) Pressure rise torrential rains, over cast sky.
 - (iii) Violent winds cease and visibility zero, violent waves
 - (iv) This storm prevails for 12 -24 hours more destructive than the frontal part.



Q.6 Write a short note on Anti Cyclones:-

Ans . Nature & Location:-

- Areas of relatively high pressure (highest pressure recorded 1070) surrounded by closed isobars.

Characteristics:-

- Termed as 'High' or 'wedge'
- A mass of relatively dense air.

Location:-

- 35°-65° Latitude

Direction:- - Movement from west to east (because of westerlies winds) warmer air in the right & cold air in the left.

Pressure:- - High Pressure at the center

Low Pressure at the Margins.

Winds:- - Winds blow out from the centre
 - Clockwise circulation in N.Hemisphere
 - Anticlockwise circulation in S. Hemisphere
 - Composed of subsiding of air or vertical setting of air or subsidence.
 - No fronts like that in a cyclone (as divergence present wind temperature uniform)

Rain:- - Develop in stable condition hence no cloudiness lack of precipitation, dry & fair weather.

Size:- - Larger than cyclones. It's Diameter 20% larger than that of cyclones.

- Stretch may reach 2000 miles.

Speed:- - Speed less barometric gradient less speed than that of a cyclone.

Types:- - (i) Rapidly moving cold anticyclone composed of air originating in higher latitudes & located in the near of middle latitude cyclones (Siberia & Canada) height 2Kms.(Rapid radiation in winter)

(ii) Warm anticyclones: - Composed of air originating in subtropical latitudes.

Associated with high pressure cells of subtropics, less pressure gradient.

- How movement – stagnancy for days front.

Westerly, Rear- Easterly.

- Low wind velocity – Owing to lesser gradient centre remains calm, Strong wind on margins.

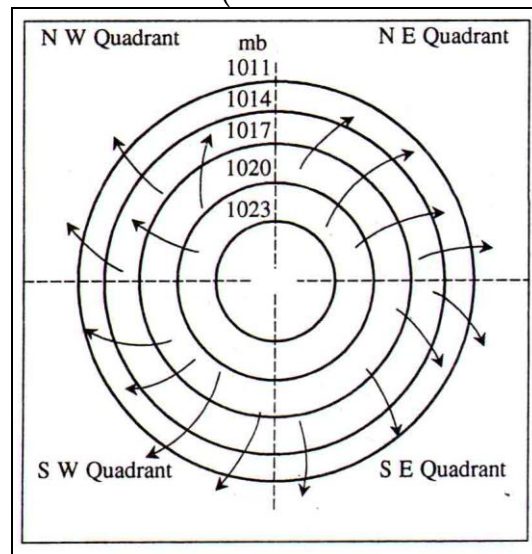
Weather: Because of divergence, fair weather, very little cloudiness, meagre rainfall while passing over the warm ocean surface. They absorb moisture leading to considerable rainfall.

Temperature:- Depends on 3 factors:

1. The nature of air mass.
2. Season of the year

3. Amount of humidity & cloudiness.

Anticyclones of North Canada, Central Eastern USA mass of cold & dry polar air, leading to cold wave & frost. Sub tropical anticyclones over continents Heat waves (more in solution & less radiation from the earth).



ANTICYCLONE

Que. Give the climate classification of Koeppen's?

Ans. Koeppen's classification:

Koeppen's scheme of climate classification of the world is empirical & based on numerical values. Thus is a quantitative scheme. His climate divisions generally coincide with vegetational divisions.

A. Humid Tropical: Winterless climate, warm throughout all month's temperature above 18°C .

Af: Tropical Rain forest or Equatorial climate: This type of climate is experienced over equatorial region. Mean annual temperature exceeds 27°C . It means warm throughout the year rainfall is abundant 250cm. These factors support luxuriant vegetation

Aw : Tropical Savanna : Mean annual temperature is 23°C example rainfall is 160 cm. wet summers (due to convectional rainfall) alternate with dry winters (due to influence of trade winds). Floods & droughts are common.

Am: Monsoon type: Hot seasonally heavy /excessive rainfall (summers). Found over Pacific coast of Colombia, Guinea coast of w.Africa, S.E.Africa, S.E. Asia.

As : Dry Summer: This is a rare climate type. Central areas of eastern coast of S.India dry during summer monsoon because they lie in rain shadow areas & receive winter rainfall from retreating monsoon.

B: Dry Climate: Potential evaporation exceeds precipitation & constant water deficiency is experience.

Bwh : Tropical hot Desert : Mean average temperature is 38°C . & rainfall scanty .These regions are dry because of sub tropical high pressure conditions. Vegetation varies with the soil type and marked stability of sub tropical anticyclones.

Bwk : Mid- latitude Desert : Cool & cold desert. This is prevailing over TaklaMakan (china) & Gobbi (Mangolia).

Bsh & Bsk: Samiarid & steppe: These climatic conditions are experienced in the deep interiors of landmasses such as Eurasia & N.America. Mean are temperature is 21°C & rainfall merge 30 cm.

C: Humid mesothermal / warm temperate Rainy: Mild winters, warm temperature of coldest month is below 18°C but above -3°C both summer & winter are found.

Cfa : Humid sub tropical or china type climate : Average annual temperature is 20° & rain fall 100cm, which is well distributed . Summers are hot & humid & winters are mild.

Cfb : Marine West Europe climate : W. European type mild winter , moist all seasons , warm summers.

Cs : Mediterranean climate : Mean temperature during summers is 20°C - 27°C , Summer are warm & dry due to subtropical high pressure conditions. During winters the temperature is 4° to 10°C are mild & rainfall 40-60 cm.

D: Humid micro thermal or cold forest climates: Severe winters mean temperature of coldest month is below -3°C & the warmest month is 10°C .

Df: Cool East Coast climate: Summers are hot & humidity under the influence of tropical maritime air mass with a mean temperature of 25°C , winters are cold with mean temperature between -4°C & 0°C . Snow fall is experienced in winters.

Ds: Taiga Climate: 'Taiga' actually refers to the soft wood coniferous forest cover. The climate of this region is influenced by continental polar air mass. Summers are short mean temp is 10°C - 15°C & winters are cold and long.

E: Polar Climate: Temperature of warmest month is below 10°C . There is no warm season.

ET: Tundra Climate: spread over Arctic Ocean short, cool summers occur with long, cold winter's precipitation is meager.

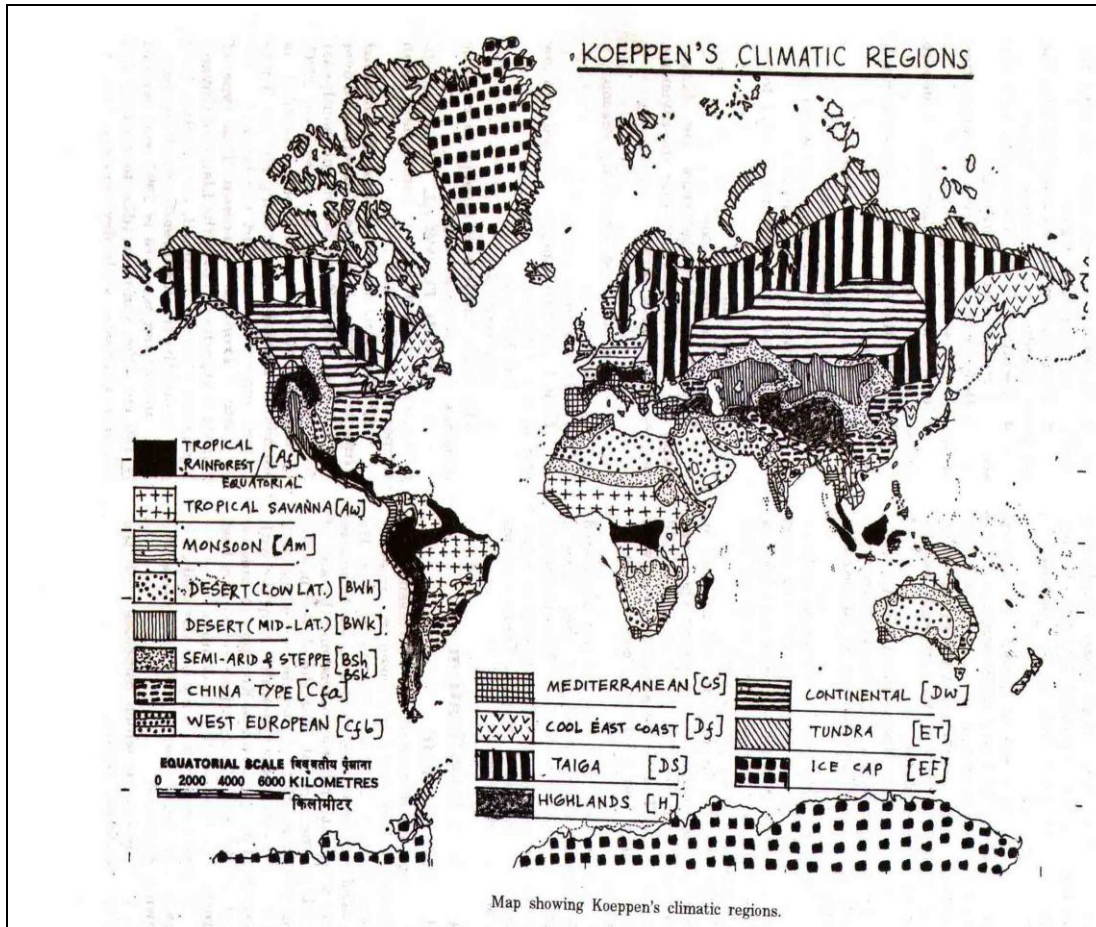
Ef: Ice cap: There is a areas permanently covered with snow. Average temperature of warmest month is below 0°C . These conditions occur over the poles & the interiors of Greenland.

Advantages:

1. The basis on which the scheme is designated i.e. temperature & precipitation is simple to measure.
2. It is based on statistical parameter each region is precisely defined.
3. New classes of climate can be easily added.
4. The schemes use only three alphabets to represent climatic type. It does not use long and complex sentences.

Dis advantages:

1. The scheme ignores the causative factors of climate.
2. Mean monthly values of temperature & precipitation can only be estimated rather than measured effectively.
3. There is no complete agreement between the distribution of natural vegetation & climate. This is to be expected since factors, other than average climate conditions (e.g. soils), affect the distribution of vegetation.



Que: What do you mean by the inversion of temperature? How is it caused?

Ans: Temperature decreases with increasing altitude in the troposphere at an average rate of $6.5^{\circ}\text{C}/100\text{m}$ or $1^{\circ}\text{C}/165\text{m}$. But sometimes this normal trend of decrease of temperature with increasing i.e. temperature increase upward up to a few Kms from the Earth's surface. This is called **negative lapse rate**. Thus warm air layer lies over cold air layer. This phenomenon meteorologically is called **inversion of temperature**.

Types of Temperature inversion:

1. Non –Advectional Inversion:

(i) Ground or surface inversion

- (ii) Upper air inversion

2. Advectional Inversion:

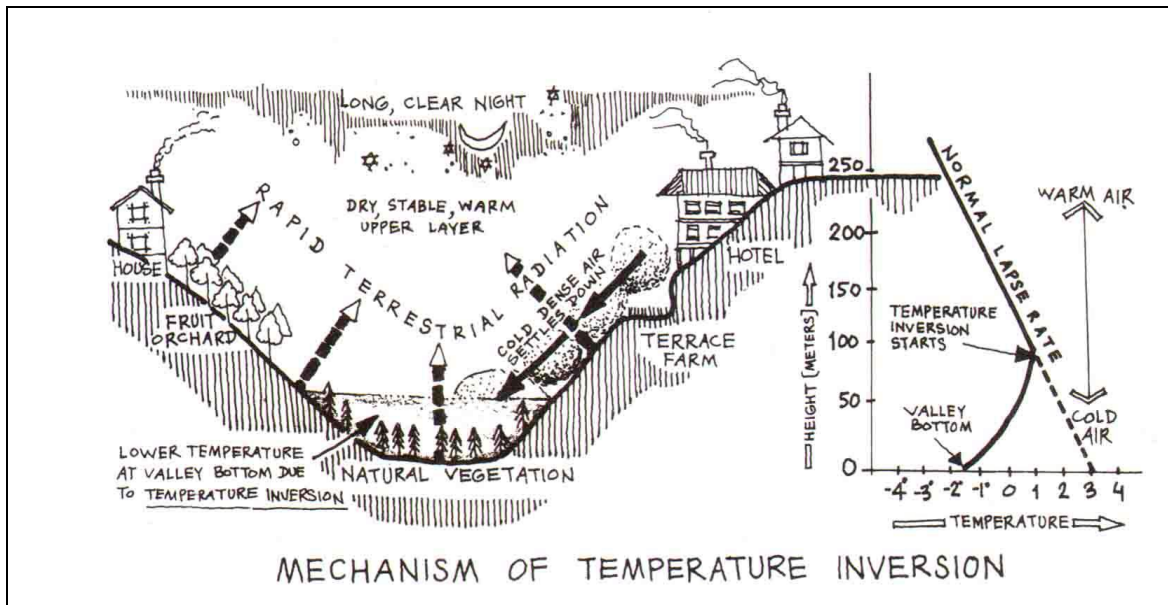
- (i) Frontal Inversion or cyclonic Inversion
- (ii) Valley Inversion due to vertical movement.
- (iii) Surface inversion due to horizontal air movement

3. Mechanical Inversion:

- (i) Subsidence Inversion
 - (ii) Turbulence & convective inversion.
- Significance of Inversion of Temperature:

Significance of Inversion of Temperature:

- (i) Fog is formed, urban smog; reduce visibility wires with atmosphere, pollutants. O_2 and becomes poisonous, sometimes favourable for some crops such as coffee plants in vemen hills of Arabic where fog protects coffee plants from direct strong sun's rays.
- (ii) Inversion of temprature causes frost, when the condensation of warm air due to its cooling by cold air, below freezing point. Destructs orchards of fruits & vegetables in California coffee is planted in upper slopes of hills in Brazil.
- (iii) Inversion causes stability, which stop ascent & descent of air. So discourages rainfall and faveours dry conditions. The inversion of temperature caused by the subsidence of air resulting in to anti cyclonic condition increase aridity. This is why the western parts of continents situated between 20^0 - 30^0 latitudes & characteristis by anti cyclonic conditions represent most widespread tropical deserts of the world.



Oceanography

Q-1 What are coral reefs? How are they formed?

Ans. Coral reefs and atolls are significant sub-marine features. These are formed due to accumulation & compaction of skeletons of lime secreting organism's known as coral polyps. Coral reefs are formed due to formation of one shell upon another shell along submarine platforms at suitable depth.

Conditions for the Growth of Coral Polyps:-

- a. Corals require high mean annual temp ranging bet 68° F and 70° F (20°C to 21°C) So they mainly found in the tropical oceans & seas. They cannot survive in the waters having either very low temperature or very high temperature.
- b. Corals require not more than 200-250 feet (60-77m) depth of water, because they die in much deeper water due to lack of sufficient amount of sun light & O₂, Which are very essential for the growth of coral polyps.
- c. They required sediment free fresh water because muddy water clogs the mouths of coral polyps.
- d. Complete fresh water is also injurious for their growth. This is why corals avoid coastal lands & live away from the areas of river mouths.
- e. Complete saline water is injurious for their growth, because such water contain little amount of calcium carbonates whereas lime is important food of coral. The oceanic salinity bet 27 ‰ to 30 ‰ is most ideal for their growth
- f. Oceans currents & waves are favourable for corals because they bring through transportation food supply for the polyps. Current & waves also determine the shape of corals.

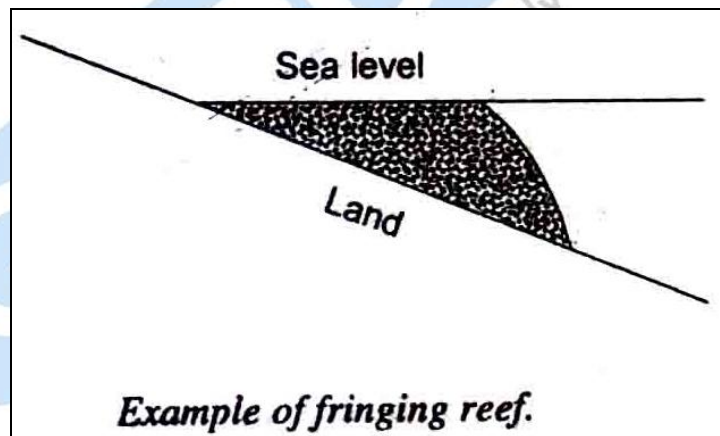
Type of Coral Reef

On the bases of nature, shape & mode of occurrence (Fringing reef, barrier coral reef, & Atoll)

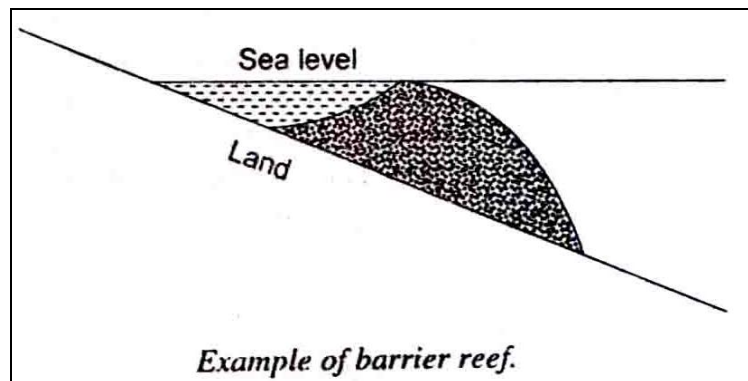
On the bases of location
(a) (Marginal belt reefs)
(b) (Tropical C.R.)

- 1- **Fringing reef** - Coral reefs developed along the continental margins or along the islands are called Fringing reef. The seaward slope is steep & vertical while the land ward slope is gentle. The upper surface is uneven.

For example: - Sakan island, South Florida, Mehetia island.

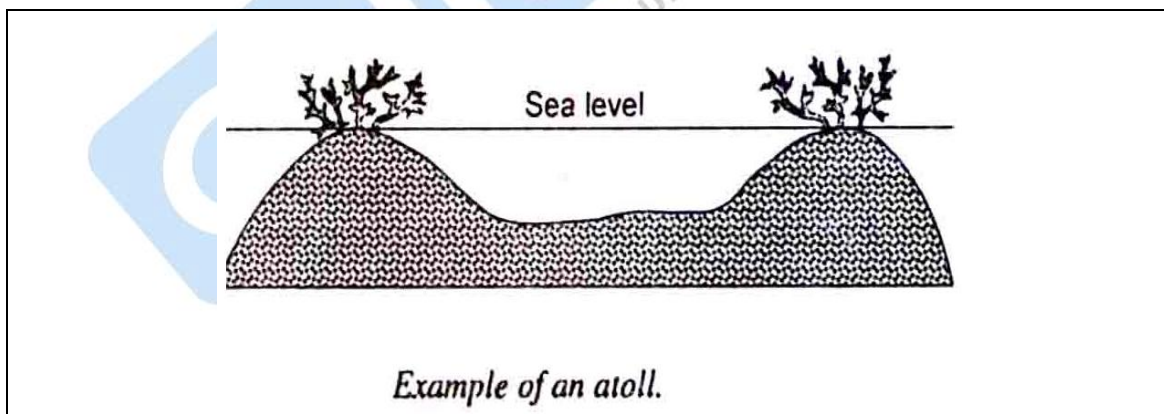


2-**Barrier Reef**:- The largest coral reefs off the coastal platforms but parallel to them are called Barrier Reef. The average slope is about 45. e.g. Great Barrier reef, located parallel to the east west of Australia is world highest Reef (1200 miles)



3-Atoll -: A ring of narrow growing corals of horse- shoe shape & crowned with palm trees is called atoll .It is generally a found around an island or in elliptical form on a submarine platform. There is a lagoon in the middle of coral ring .They are found in Real sea, China Sea, Antilles sea, Indonesian sea.

Example: - Shallow lagoon reefs are minor reef in world located in South China Sea.



Atolls - This is mainly divided into 3 types.

- (i) True Atoll - Characterized by circular reef enclosing a shallow lagoon but without island.

- (ii) Island Atoll - Having an island in the central part of lagoon enclosed by circular reef.
- (ii) Coral island or Atoll island - Does not have island in the beginning but later on island is formed due to erosion & deposition by marine waves.

On the base of location:-

- (i) **Tropical Coral Reef:-** They are mainly found in tropical zone formed in Atlantic Ocean, Indian Ocean, Pacific Ocean. Due to warm air flows in the eastern part of N. America, S.America, Australia they are formed.
- (ii) **Marginal belt Coral Reef:** - They are founded in 25° N-30° to 32 S. Exampel are Barmuda, Bahamas, & Hawai Island.

Que: Explain the diferent Theories for the origin of Coral Reefs.

Ans **Stand Still Theory Of Murray:** - Theories based on the concept of Non - subsidence or stand still situation of land fall in 2 categories.

- (i) First group: - Corals grow upon suitable stable submarine platforms with unchanging sea level.
- (ii) Second group :- Necessary suitable submarine platform become available due to lowering of sea level & consequent erosion of land by sea waves but land always remain stable.

The theory of Murray belongs to the first group:-

Murray propounded his theory of formation of coral reefs in the year 1880 .on the basis of the information received during challenger expedition.

According to him:

- 1-Coral polyps can live upto a depth of 30 fathom.
- 2-Sea level & submarine platforms are stable.
- 3-Several submarine plat, volcanic peaks, islands are present below sea level.

- (I) If the submarine land platforms are above the permissible depth for the survival of coral polyps they are subjected to wave erosion & solution, so that their heights are lowered down.
 - (II) If the submarine platforms are below the required depth of sea of 30 fathoms, their height is increased due to deposition of marine sediments.
4. After getting suitable foundation at required depths of 30 fathom. Coral polyps began to grow upward along the coast & fringing reef is formed.
 5. Outward growth results in growth of barrier reef in due course of time.
 6. Atolls are formed due to outward growth of corals in all directions at the top of submarine platforms. Thus a ring is formed around a solution lagoon.
 7. Lagoon wards coral -dead seaward -growing /living.

EVALUTION OF THEORY:

- 1- Requires numerous suitable sub marine platforms at a depth of 30 fathom, but this is not possible.
- 2- Two contradictory possibilities not possible i.e, deposition & erosion on submarine platforms.
- 3- A limit of 30 fathom for deposition & erosion cannot be accepted.
- 4- Lagoon formed due to solution of coral (dead) not acceptable because the pelagic deposited down on the submarine platforms or peaks would also be dissolved.
- 5- If the submarine platforms are stable then the lagoons would be completely filled up with the marine sediments & disappear.
- 6- According to Murray coral reefs cannot be found beyond a depth of 30 fathom, but contradiction is found.

Subsidence Theory of Darwin - Charles Darwin postulated his subsidence theory first in 1837, modified in the 1842, during his voyage on the 'Beagle'.

Observation & Conclusion -

1. Darwin was convinced that coral polyps could grow only in shallow oceanic waters, though coral reefs were found at greater depths where coral polyps could not survive at any cost.
2. Darwin postulated his theory in order to solve the riddle of the contradiction.

According to him:

The land or island involved in the origin & growth of coral reefs is seldom stationary rather it under goes gradual subsidence.

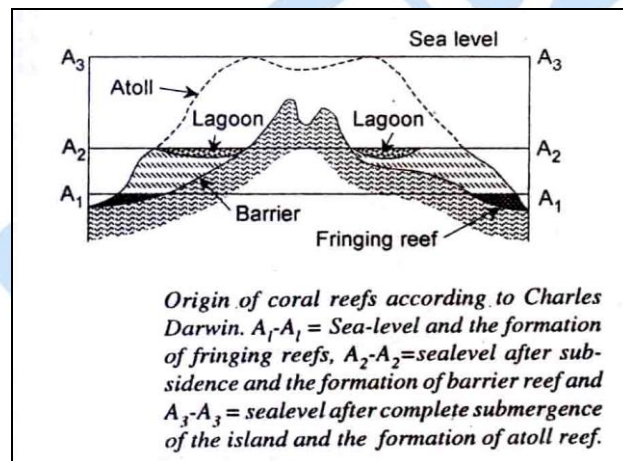
Fringing reefs, barrier reefs & atolls are successive stages of the development of coral reefs.

Origin of Coral reef according to Charles Darwin

A₁-A₁- Sea level, fringing reef

A₂-A₂- Sea level after subsidence barrier reef

A₃-A₃- Sea level after complete submergence & Atoll.

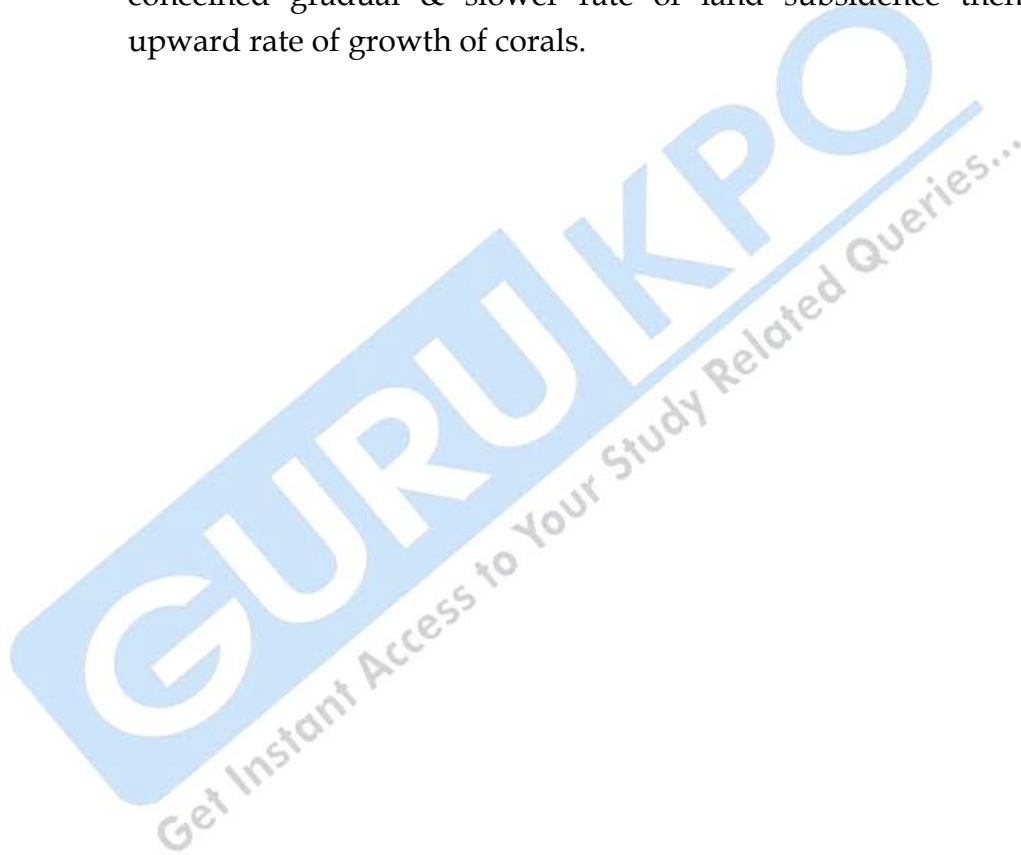


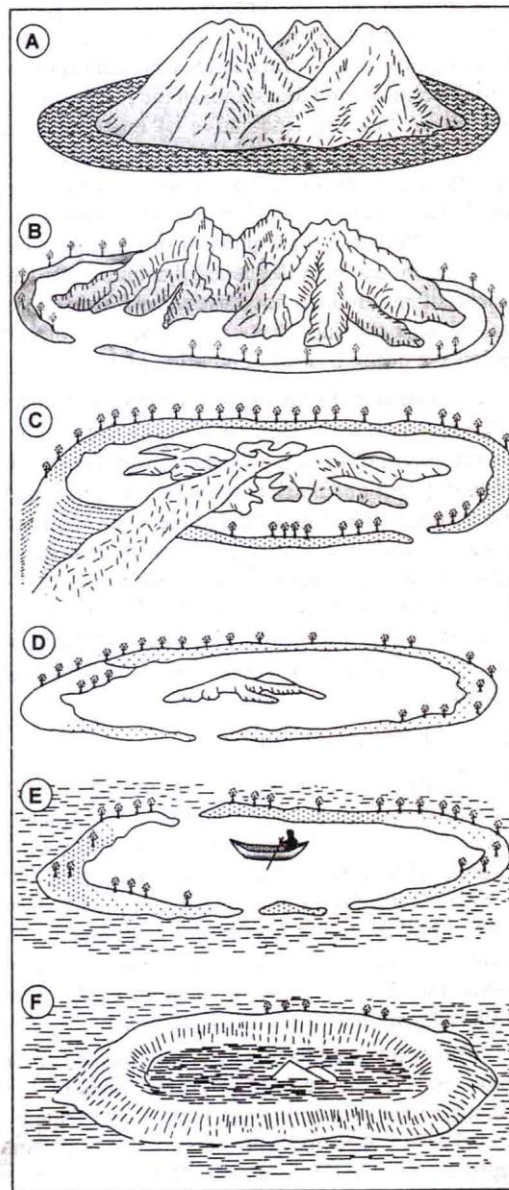
Stages of theory:

1. Coral polyps clog around/along a suitable submarine platform, grow upward, fringing reef formation (stable condition of land)
2. Land is subjected to subsidence because of tectonic forces, coral polyps also reach greater depth (where they may not survive.)

Consequently they grow upward & outward at much faster rate so that they can get food for survival growth is related toward the land. A lagoon is formed between them. Fringing reef is formed between them. Fringing reef is formed.

3. There is further subsidence of land and the island is completely submerged on a ring in coral reef in the form of atoll is formed. Darwin did not invoke sudden and rapid subsidence of land, his conceived gradual & slower rate of land subsidence then the upward rate of growth of corals.





Stages of the development of coral reefs and atolls on the basis of subsidence theory.

Criticism of the theory

1. If barrier reef, fringing reef and atoll reefs maintained by Darwin are only 3 stages of the evolutionary growth of a reef, then fringing reef of barren should not be found on either side of the same island at the same level.
2. If subsidence theory is accepted then most of the islands of the Pacific Ocean would be submerged.
3. There are also some evidences of the existence of coral reefs associated with the emerging islands.

Glacial Control theory of Daly

Daly propounded his theory of coral formation in the year 1915 after he was convinced that coral reefs were formed after Pleistocene Ice Age.

According to him:

1. Sea level fell by 33 to 35 fathoms due to glaciations (Confinement of sea water in the form of ice on the continents).
2. The existing corals died due to lowering of temperature of marine water.
3. Wave cut platforms were formed along continental coasts and islands due to abrasions by sea waves.
4. After end of ice age sea level again rose by 33 to 35 fathoms due to return of sea water (by melting of ice on the continents).
5. Thus the wave cut platforms were submerged upto the depth of 33 to 38 fathoms.
6. The corals which were able to survive during ice-age, began to grow outward and upward and seaward edges of submarine platform.
7. Fringing reef was formed on broad wave eroded platforms, while barrier reefs were formed on broad wave cut platforms.
8. Lagoons of uniform depth were formed between the reefs and the land because of uniform lowering of sea level due to glaciations during Pleistocene Ice age.

Evaluation of the theory-

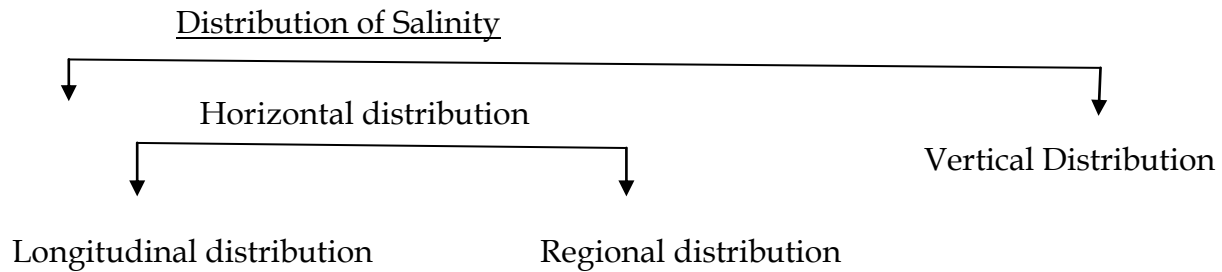
1. All the lagoons of atolls & barrier reef should be uniform but actual observation do not validate this concept.
2. The cliffs formed during glacial period should also be present but they are seldom found.
3. If all the marine islands, were eroded upto 33 to 38 fathoms then there should not be islands between the coasts & coral reefs but numerous such islands are formed.

Que: What are the causes of salinity in the ocean and give an account of its amount in open closed & practically closed seas.

Ans: The presence of salt in the Oceanic water is called 'salinity'. Generally salinity is defined as the total amount of solid material in grams contained in 1kg. Of sea water (means 30 Gms of salt in 1000gms of sea water). The oceanic salinity not only affects the marine organisms and plant community but it also affects the physical properties of oceans such as temperature, density, pressure, waves & currents etc,. The freezing point of ocean also depend on it eg. More saline water freezes slowly in comparison to less saline & the boiling point of saline water is higher than the fresh water. Salinity also increases the density of sea water. Evaporation is also controlled by salinity as it is lower over more saline water than over less saline water.

Sources of Oceanic Salinity:

- 1 Basically the source of Oceanic salinity is Land.
- 2 River brings salts in solution form from the Continental areas.
- 3 Volcanic ashes also provide some salt to the Oceans.



1) **Horizontal distribution:** In this, the pattern of latitudes & regional distribution & also the distribution of salinity in enclosed, practically enclosed & open seas is also considered.

1. Latitudinal Distribution: - On an average salinity decreases from equator to -words the poles. High salinity is recorded near eg. Because this zone records high temp & exploration but high rainfall reduces the salt. These eg.accounts only 35‰ salinity .The highest salinity is observed between 20⁰-40⁰N (36⁰) because this zone have high temp high evaporation but significantly low rainfall. Salinity further decreases in the polar zones because of melt water.

2. Regional distribution: On the basis it is divided in to three

1. Seas having salinity above normal:- (i) Red Sea (34-41‰)
(ii) Persian Gulf (37-38‰)
(iii) Mediterranean Sea (37-39‰)
2. Seas having normal salinity: -(i) Caribbean Sea & Gulf of Mexico (935-36‰)
(ii) Bass strait (35.5‰),
(iii) Gulf of California (35-35.5 ‰)
(ii) N-Australian Sea (33-34 ‰)
(iii) China Sea (25-35 ‰)
(iv) Japan Sea (30-34‰) etc.
2. Much below: (i) Baltic Sea (3-15‰)

(ii) Hudson bay (3-15‰)

Distribution of Salinity in Pacific -Ocean

There is a wide range of salinity differences in the Pacific Ocean because of its shape & larger areal extent. It has the maximum Salinity of 35 per thousand occurs bet 15° & 30° latitude north & South of the equator .In the higher latitude in the western & north ward part of Pacific ocean it becomes 31‰ in Okhotsk sea & 34‰ near Manchuria because of influx of melt water brought by the oyshio current coving from bring sea & due to weakening of Kuroshio warm current.

Salinity also decreases along the Californian, Middle American & Peruvian coast due to transfer of water & upwelling of cold water .Low water salinity is noted in front of river.

Months (yellow river=30‰ & YangtzeKiang=33‰)

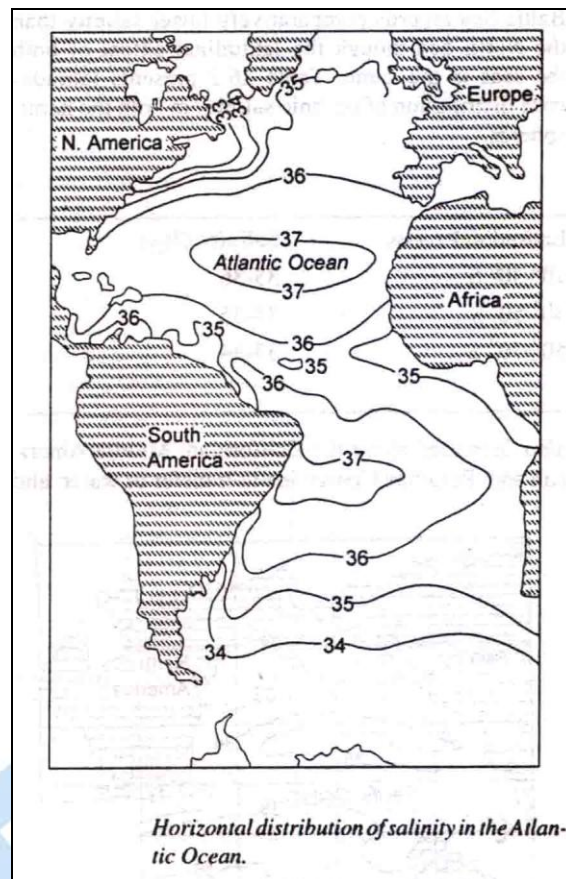
Distribution of Salinity inAtlantic Ocean

The average salinity of Atlantic ocean is 35.67‰ .It is recorded between 5°N, 15°N & 15°S as 34.98‰, 36‰ & 37.77‰ respectively indicates increasing trend of salinity from equator towards the tropics of cancer & capricorn.The central zone of the North Atlantic Ocean located between 20°N & 30°N & 20°W -60°W records maximum. Salinity (37‰) & it decreases towards north -ward but varying trends. The eastern margin areas of N-Atlantic beyond 40 latitude record higher salinity in compare them the western margin because the Gulf Stream carries saline water from the American coast to the north -western European coast. Salinity is higher along the western margin than the eastern margin between 10°-30° in the south Atlantic because of upwelling of water along the African coast. Low salinity is found in front of River mounts.

(St. Lawrence=31‰ Amazon 15‰, Congo=34‰, Niger=20‰, Rhine 32‰ etc)

The pattern of spatial distribution of salinity is quite different in the partially enclosed seas of Atlantic Ocean. The North Sea in spite of its location in higher latitude records 34‰ salinity due to more saline water brought by the N- Atlantic Drift. On the other hand Baltic Sea records low salinity due to supply of river water. Further northward salinity continues decreases as it becomes 7 to 8‰ around Rugen Island. It becomes as low as 2‰ in the Gulf of Bothnia due to influx of fresh water. The Mediterranean sea it records high salinity due to evaporation & little mixture of Atlantic water. In its western part of this sea salinity increases 36.5‰ to the eastern part (39‰) but it is remarkably recorded to 17-18‰ in black sea due to fresh water brought by Dnieper, the Danube etc.

There is high salinity in Gulf of Mexico (36 ‰) & the Caribbean Sea due to more saline water brought by the north equatorial current.

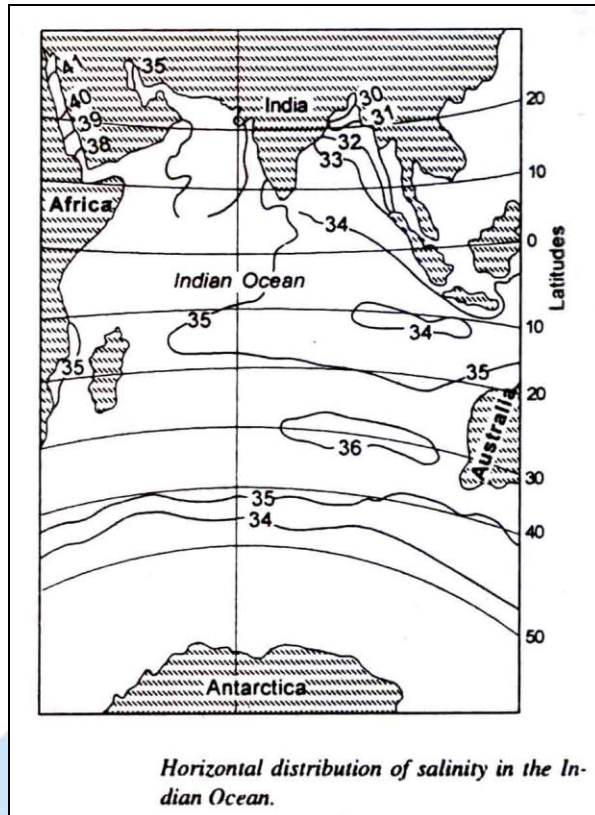


Distribution of Salinity in Indian Ocean

An average salinity 35 ‰ is found between 0°-10° N and it decrease north ward in the Bay of Bengal (33.5‰ at 10° N latitude to 30 ‰ at the mouth of the Ganga.) because of fresh water brought by Ganga River. On the other level the Arabian Sea records higher salinity (36‰) then Bay of Bengal because there is higher rate of evaporation, low humid condition and low fresh water supply .The western coast of Australia records higher salinity due to dry weather .The partially enclosed seas has higher salinity eg. It is 37‰ at the head & 40‰ in the interior of Persian Gulf.

The red sea records the highest salinity because of low precipitation & very high evaporation.

Salinity is devoted in Oceans & seas is represented by isohalines. Which are the lines that join the places of equal salinity at the sea surfaces.



Que. Give a brief account on the Reliefs of Ocean Basin.

Ans Total area of globe = 50.99 crore square km or 509,950, 000 km²

Area covered Lithosphere = 361,060,000 km²

Area covered Hydrosphere = 148, 890, 000 km²

Water resources = 70.8 % and Land = 29.2%

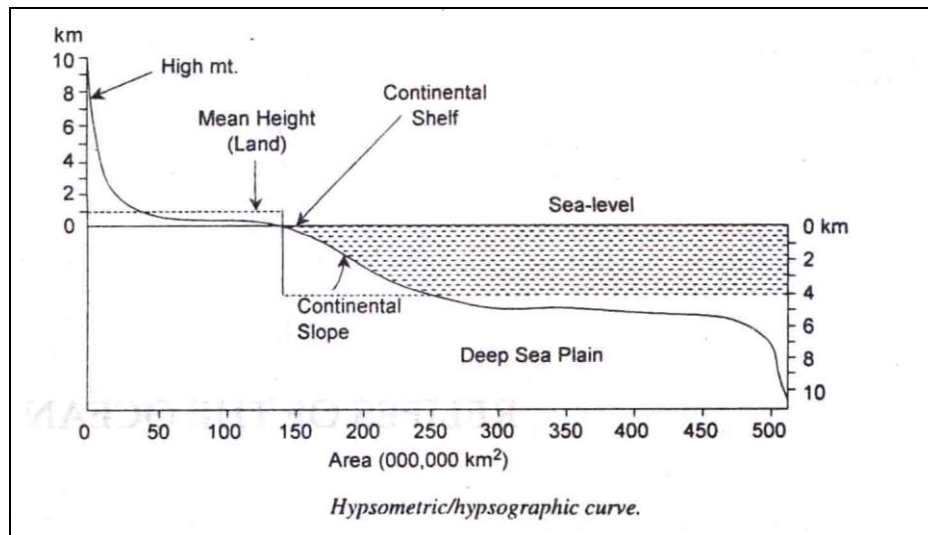
Pacific Ocean = 165, 000, 000 km²

Atlantic Ocean=82,000,000km²

Indian Ocean = 73,000,000

Average Depth of Ocean =3,800m

The different height & depth zones of the lithosphere & hydrosphere are represented by Hypsographic or Hypsometric curve.



There are four relief zones in ocean basic:-

- 1- Continental shelves
- 3- Deep sea plains

- 2-Continental slopes
- 4-Oceanic trenches

- I. **Continental shelves** :- The continental marginal areas submerged under oceanic water with average water depth of 100 Fathoms & gently sloping 1°-3° towards the sea or oceans are called continental shelves cover 8.6% of total ocean basin. The North Sea & Baltic Sea are examples of seas that lie in continental shelf

Origin of Continental Shelves:-

1. They are basically extended form of continental platforms. Marine waves and currents erode the continental margins & thus form extensive plat forms which receive deposits of sediments brought down by the rivers & sea waves. Thus this is the result of marine erosion & fluvial deposits.
2. They are formed through sediments deposited by rivers. Such type of continental shelves is formed only in these areas where sea conditions are calm.
3. Rising thermal connective currents form beneath the continents .The resultant compressive force causes subsidence of the continental margins & thus continental shelves are formed.
4. Parallel faults created in the continental margins. This event causes subsidence of the marginal land areas & consequent submargine under sea
- 5 Continental shelves are formed through marine erosion of the continental margins where there is a negetive change in sea level due to subsidence of oceanic floor.
- 6 The submerged of continental margins due to tilting of land towards the sea results into the formation of continental shelves.

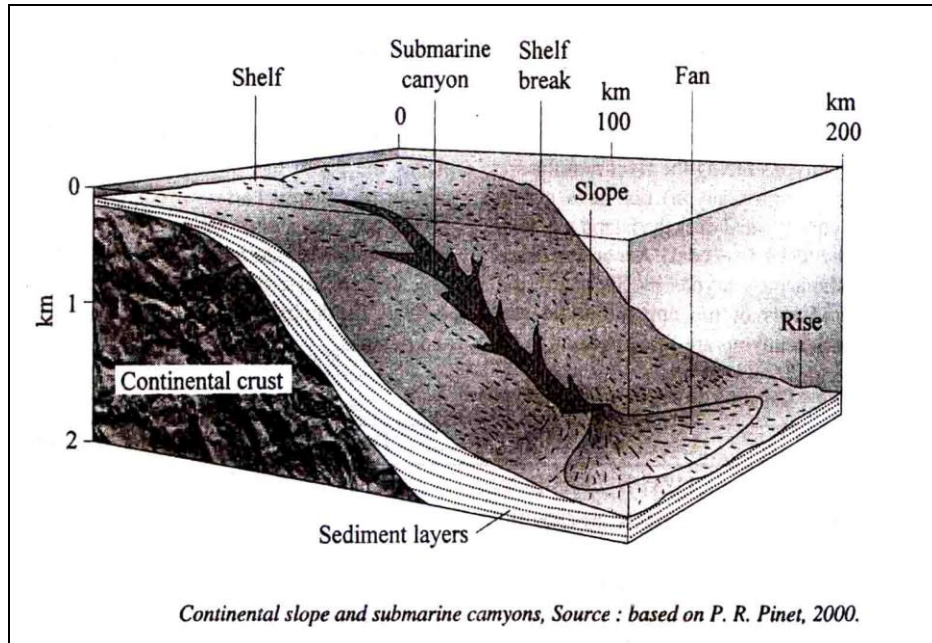
II Continental Slope: -

The zone of steep slope extending from the continental shelf to the deep sea plains is called continental slope. It Occupy only 8.5% of the total area of ocean basing but it varies from one ocean to other eg,- Atlantic Ocean 12.4%, Pacific Ocean=7% & Indian Ocean=6.5%

Origin of continental slope

- 1- Slopes are formed due to erosion by marine processes mainly sea waves.
- 2- According to tectonic theory faulting is hold responsible for the origin of continental slope.
- 3- Some exponents belive that the continental slopes are formed due to bending & warping of continental shelves followed by sedimentation.

- 4- The most extensive continental slopes are formed bet 20°N & 50°N latitude and 80°N & 70°S latitude.



III Deep Sea Plains: -

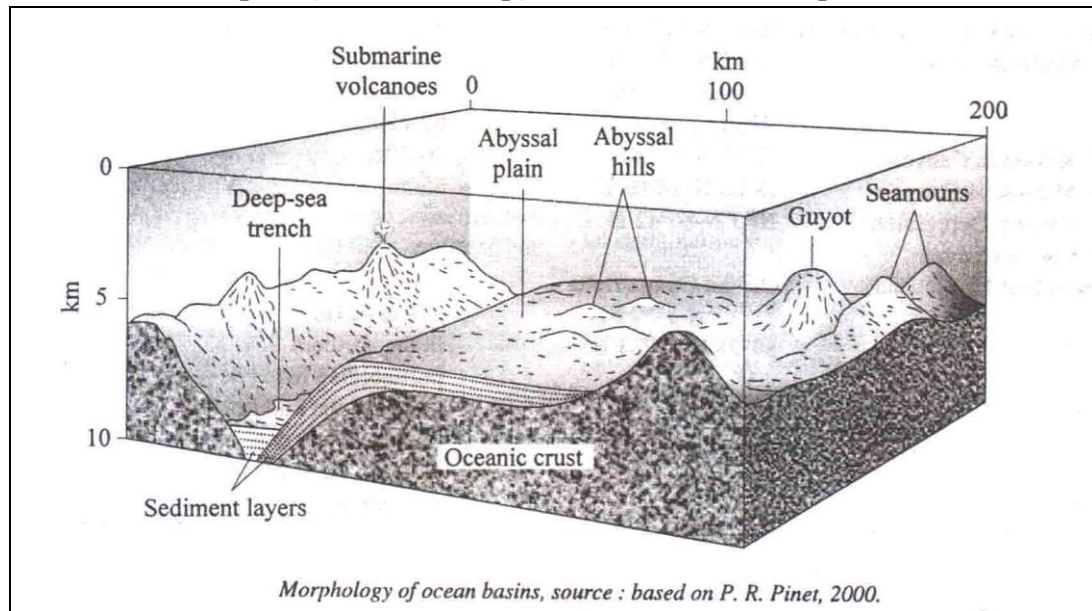
Deep sea plain characterized by flat & rolling submarine plain is the most extensive relief zone of the ocean basins. The depths of these plains 3000m to 6000m cover 75.9% of the total area of ocean basins.

Mid-Atlantic ridge, east pacific rise, & mid Indian Ocean ridge are typical examples.

- IV **Ocean Deeps:** - Ocean Deeps representing depressions & trenches on the Ocean floors are the deepest zones of the ocean Basins. Phase are generally located parallel to the coasts facing mountains & along the islands. They are of 2 types.

1. Very deep but less extensive depressions are called deeps.
2. Long & narrow linear depressions are called trenches.

Mariana trench located to the west of Philippines in the North Pacific Ocean is the deepest (11.02 km deep) of all the Ocean deeps.



Q. What are Ocean deposits & give its proper classification & world distribution?

Ans. The Unconsolidated sediments, derived from various sources, deposited at the sea floors are included in Ocean deposits.

According to Murrey & Ronald the main source of this deposition are of 4 types.

- 1- **Terrigenous materials:** - On the earth surface due weathering the rocks are decomposed & weathering the rocks are decomposed & thus fine material are transported by the river to the oceans & seas. This material is called terrigenous material. some 15,000 million to 20,000 million tonnes per year of solid material are discharged through the rivers to the oceans.

In this material there is various in the size & shape .It are divided into subparts:-

(i)-Gravels: - The diameter of gravels ranges 2 to 256mm. It is sub-divided on bases of diameter (boulders=256mm, cabbles=64mm, pebbles=4mm granules=2mm)

Deposited near the cost on the continental shelves.

(ii)-Sands: - The sediments varying in diameter from 1mm to 1/10mm are termed sand. It is classified into 5 types on the bases of grains are (i) very coarse sand =1mm, (ii) coarse sand=0.5mm (iii) medium sand=0.25mm (iv) fine sand (0.125) (v) very fine sand =0.0625mm deposited away from the coast & coarser sand are deposits in oceans.

(iii)-Silt, clay & mud :- Silt have 1/32mm to 1/256mm diameter clay have 1/512mm to 1/8192mm clay is significant connecting elements. Clay & mud deposited in calm sea water at the depth of 100 to 1000f (600 to 600 feet). Murray divided mud in 3 types:-

- (a) **Blue mud** - material rich in iron sulphide & organic elements. Generally found it depth of continental shelves. It contain 35% of calcium carbonate (Mediterranean sea, Arctic sea)
- (b) **Red mud**- rocks rich in iron oxide .The reddish color due to dominance of iron content 32% of calcium carbonate. (yellow sea, Brazilian cost & floors of Atlantic ocean)
- (c) **Green mud** : formed due to chemical weathering the color of blue mud is changed to green mud due to reaction of sea water .It contains green silicate of potassium & glauconite (form of iron) 7-8% of total mineral composition & 56% of calcium carbonate. (Atlantic & Pacific ocean).

II Volcanic Materials: It is of 2 types.

- (i) **Volcanic eruption on the land:** Those volcanic material after eruption are collected Nearer to the coastal lands are blown by wind or by rives & carried to the Oceans & Deposited over here.

- (ii) **Volcanic eruption in the Oceans & the seas:** in such cases volcanic materials are deposited directly. It contains Blue mud & is grey to black in colour.

III Organic Material: The source of organic material is sea itself. They include skeletons of marine organisms & plant remains. They are of 2 categories:

1. Neretic Matter
2. Pelagic matter

1. **Neretic Matter:** They include Skeltons of marine organism & plants. They deposited mostly on the continental shelves & are generally covered by terrigenons materials.
2. **Pelagic Matter:** Contains of different types of algae & mostly in form of liquid mud, generally known as Ooze. It is further devided into two:

- a) **Calcareons Ooze:** Contain lime contents are abundance & found in greater depth because of high degree of solubility. They are found in sea floor at the deptgh of 1000 Fathoms to 2000 Fathom.(6000 TO 72000 Feet)

It is further subdivided

- a. Pteroped Ooze
- b. Globigerina Ooze

- b) **Siliceons Ooze:** It content Silica, this Ooze does not dissolve because of less calcium carbonate & dominance of Silica. Thus they are found in both warm & cold water at greater depths.This further devided in to two sub parts:

- a. **Radiolarian Ooze**
- b. **Diatom Ooze**

- IV. InOrganic Materials:** Varions inorganic matter is dolomite, amorphous silica, iron, manganese oxide, phosphate.

Red clay is also an organic matter. It covers the largest area of deep sea deposits.Silicates of alumina 85.35% & oxide of iron are chief consist in red clay.

Que. Give a brief account of the major Ocean Current of the Oceans.

Ans. The general movement of a mass of Oceanic water in a definite direction is called Ocean current.

Ocean currents are divided on the basis of temperature are:

- (i) Warm currents
- (ii) Cold currents

They are also devided on the basis of velocity, dimension & direction are:

- (i) Drifts
- (ii) Currents
- (iii) Streams

(i) **Drift:** The forward movement of surface water of the oceans under the influence of Prevailing winds are called drift. Example, West wind drift

(ii) **Ocean current:** They involve the movement of oceanic water in a definite direction with greater velocity.

(iii) **Streams:** Involves movement of larger mass of ocean water like big rivers of the Continent in a definite direction with greater velocity than the drifts & currents e. Gulf Stream.

Origin of currents

1. **Factors Related to the Rotation of the earth:** The rotation of the earth on its axis from west to east results in Coriolis force which deflects the general direction of Ocean currents. For example the currents flowing from equator towards the North Pole are deflected to their right.

2. **Factors related to the oceans :**

(a). **Temperature difference:** unequal heating of the sea by the sun is major cause of the Oceans circulation, particularly in the deep layers. In Polar Regions especially during winters, extremely cold, salty & dense water sinks far below the surface & moves toward the equator in very slowly moving layer. At the same time, warm & less dense tropical water in the ocean's upper layer moves towards the poles. Example the Gulf Stream & Kuroshio warm currents moving from equator towards north.

(b) **Salinity difference:** Oceanic salinity affects the density of ocean water & density variation causes ocean currents. Salinity increases the density of Ocean water.

Currents of Indian Ocean

The current system of the Indian Ocean are largely controlled & modified by land masses & monsoon winds. The current in the North Indian Ocean changes their flow direction twice a year due to north-east & south west monsoon winds.

1. N.E. Monsoon Current (warm):

These blow from land to the ocean during winter season in the Northern hemisphere & thus westward blowing north East monsoon currents are produced between Andaman & Somali. This Current flows to the south of 5° North latitude.

2. Indian Counter Current (warm):

It originates during winter season (N-Hemisphere), flow in easterly direction between 2°-8°S latitude from Zanzibar to Sumatra.

3. S.W. Monsoon Current (warm):

There is complete reversal in the direction of monsoon winds during summer season. It means N-E Monsoon winds of winter become S-W during summer in the N-hemisphere. This reversal of direction of monsoon winds also reverses the direction of ocean currents of Indian Ocean during summer season. The general direction of monsoon current is from South West to North-East & move in Bay of Bengal & Arabian Sea. This current originates Eddy in Arabian Sea & Bay of Bengal. The Indian counter current disappears due to this current.

4. Indian Equatorial Current (warm):

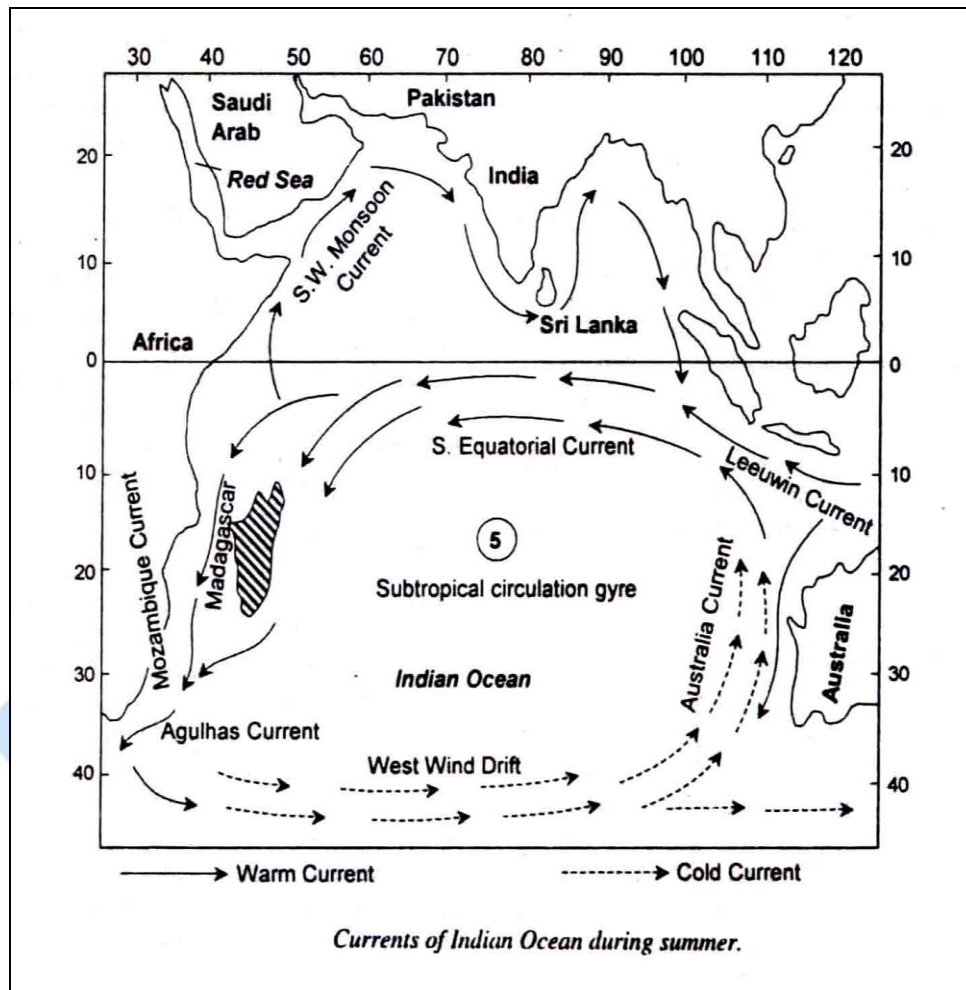
This current flows from east to west between 10°S & 15°S latitudes from Australian coast to African coast. After being obstructed by Madagascar this current is divided into many branches. One major current (warm) flows southward in the name of Agulhas current while the other branch is directed towards the North.

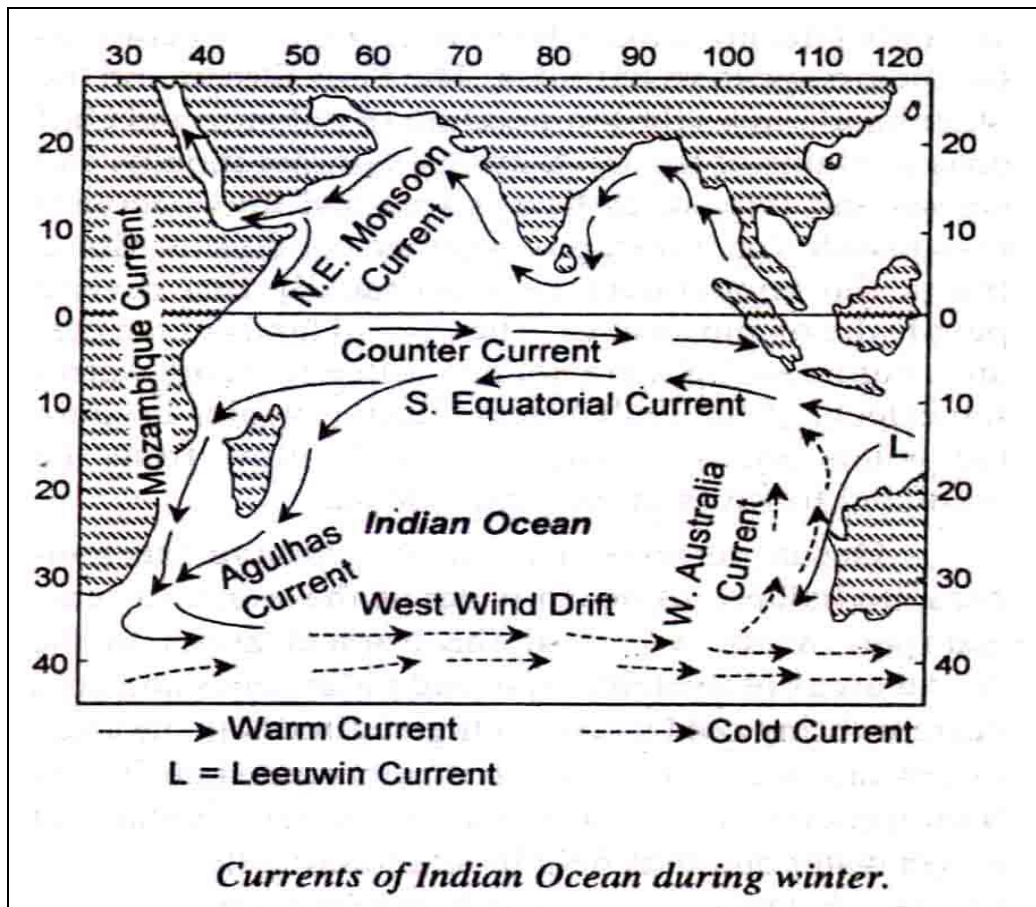
5. Mozambique current (warm):

One branch of the southern Indian equatorial current moves southward through Mozambique channel known as Mozambique current. This current joins the Agulhas current near 30°S latitude & moves up to the southern tip of Africa & is ultimately diverted eastward.

6. West wind drift (cold):

This is produced due to eastward blowing westerlies along 40°N latitude known as 'roaring forties'. This current divided near 110°E longitude. One branch turns North - West & flows as west Australia cold current along the western coast of Australia and near the tropic of Capricorn turns towards west and north and ultimately merges with the south-equatorial current near 100°E longitude. The second branch of the west-wind drift turns southward.





CURRENTS OF THE PACIFIC OCEAN

Pacific Ocean is more extensive than Atlantic Ocean. It is less steep from north & wider in south. The general pattern of circulation of currents is similar to that of Atlantic Ocean but Sargasso type sea condition does not form.

1. NORTH EQUATORIAL CURRENT (WARM) :

The North equatorial current originates off the Western Coast of Mexico and flows in westerly direction and reaches the Philippines coast. This is

originated because of California current & north-east monsoon. A few branches also came out of the main current and turn towards north and south. One branch emerges from North equatorial current and flows northward to join 'Kuroshio Current' while the Southern branches turn eastward to form **counter equatorial current**. With the northward to southward migration of such this current flows northward and southward but it always remains to the north of equatorial.

2. SOUTH EQUATORIAL CURRENT (WARM)

It is originated due to the influence of South-East trade winds and flows from East to West. This current is stronger than the North Equatorial current. The velocity of current ranges between 12 and 18 miles / day. With the Northward and Southward to migration of sun this current moves northward and southward but it always remains to the north of Equator.

3. COUNTER EQUATORIAL CURRENT (WARM)

It flows west to East between Norths to South equatorial currents. This extended up to the Panama Bay. The current transport Oceanic Water at the rate of 25 million m³ per sec.

4. KUROSHIO SYSTEM (WARM)

This comprised of several current and drifts is similar to the Gulf Stream system of Atlantic Ocean. This system runs from Taiwan to the Bering Strait.

KUROSHIO CURRENT : -

The North-Equatorial current turns Northward due to the obstruction of Philippines and thus gives birth to the Kuroshio Current. This is similar to the Florida current of North-Atlantic Ocean.

a. KUROSHIO EXTENSION

It leaves Japanese coast and turn eastward near 35°North latitude. Under the influence of westerlies.

b. NORTH PACIFIC DRIFT

It extended further eastward under the influence of westerlies and reach the western coast of N-America. It bifurcated into 2 branches. The Northern

branch becomes Aleutian current while the Southern branch gives birth to the Californian cold current.

c. TSUSHIMA CURRENT

Near 30° North latitude. One branch separated from the Kuroshio Current and enters the Japan Sea and flows along the Western Coast of Japan in the name of Tsushima current. This is a warm current.

d. COUNTER KUROSHIO CURRENT

The current form a Gyral System between Hawaiian Island and American coast and this ocean water moves in Westerly direction is name counter Kuroshio Current.

5. OYASHIO CURRENT (COLD)

Also known as Kurile cold current, it flows across the coast of Kamchatka Peninsula to merge with the warmer waters of Kuroshio.

6. CALIFORNIA CURRENT (COLD)

The other branch of the North Pacific current moves south ward along the coast of California as the cold California current. It joins the North Equatorial current to complete the cycle.

7. PERU CURRENT (COLD)

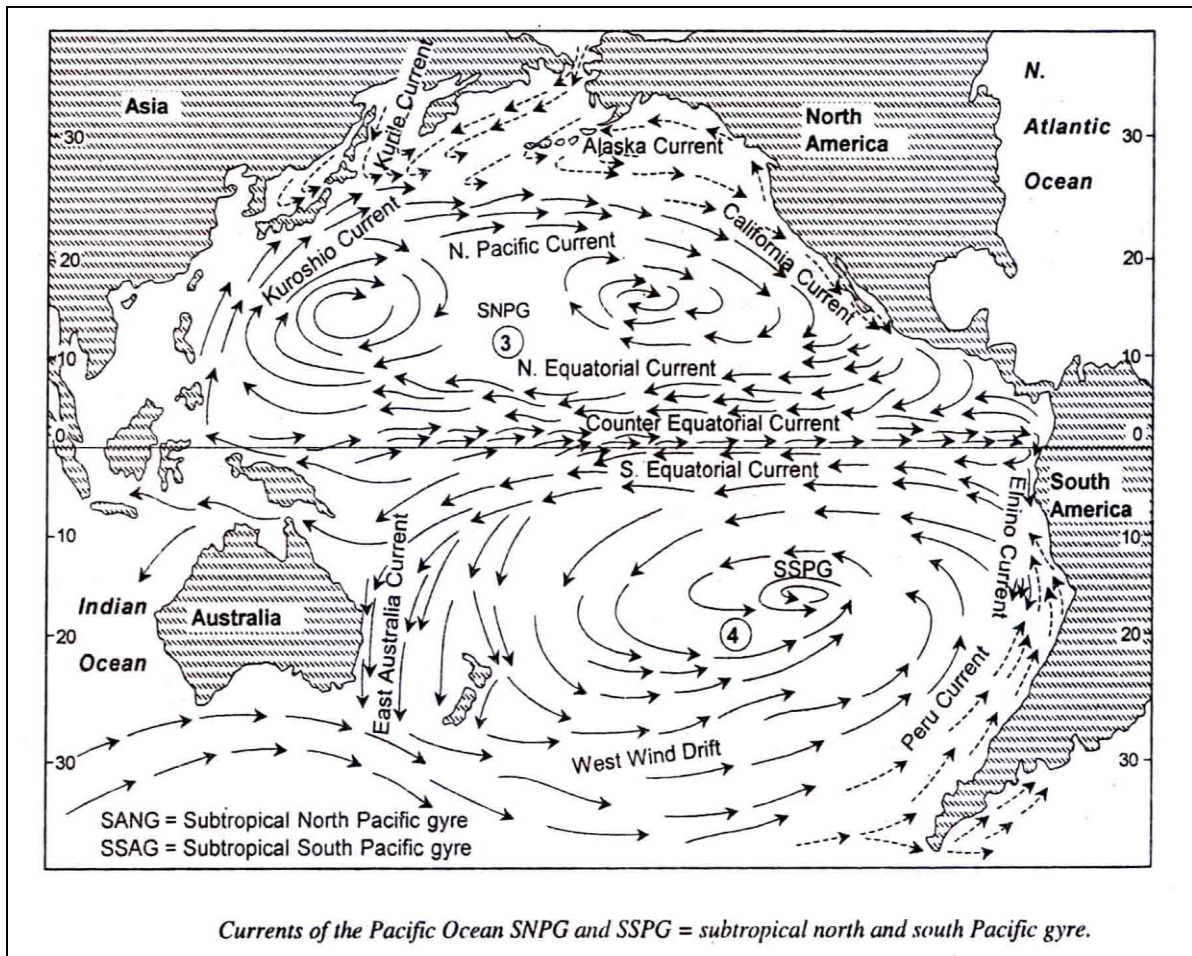
The cold current flowing along the Western coast of South America from South to North is called Peru Current or Humboldt Current.

8. EAST AUSTRALIA CURRENT (WARM)

South equatorial current flows in the anticlockwise direction and turns southwards as the east Australian current.

9. WEST WIND DRIFTS

A strong ocean current flows from west to east under the influence of Westerlies between Tasmania and S. American coast in zone of 40° – 50° S latitude. This current is strong because of immense volume of water mass and high velocity winds called 'roaring forties'.



Que. Discuss briefly the phenomena of Tides.

Ans. The rise and fall of sea water due to gravitational forces of the sun and the moon are called tides.

Nature and Factors affection of Tides.

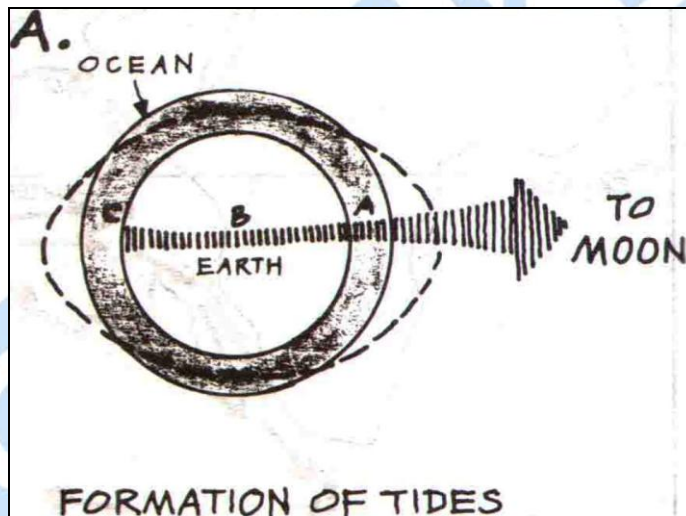
1. Movement of Moon in reference of Earth.
2. Changes of position in Moon and Sun in relation of Earth.
3. Mose distribution of water of Earth.
4. Non similarity between the sizes of oceans.

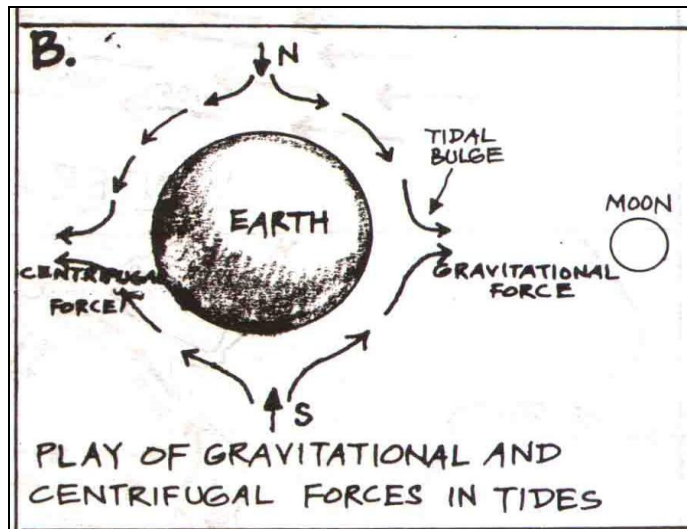
There is also narrations in the high of tides for of this is Aukha (Gujrat) here the height of tide is 2.5 m and Bay of Fundy (U.S.A.) here height of tide is 15 to 18 m.

FORMATION OF TIDES :

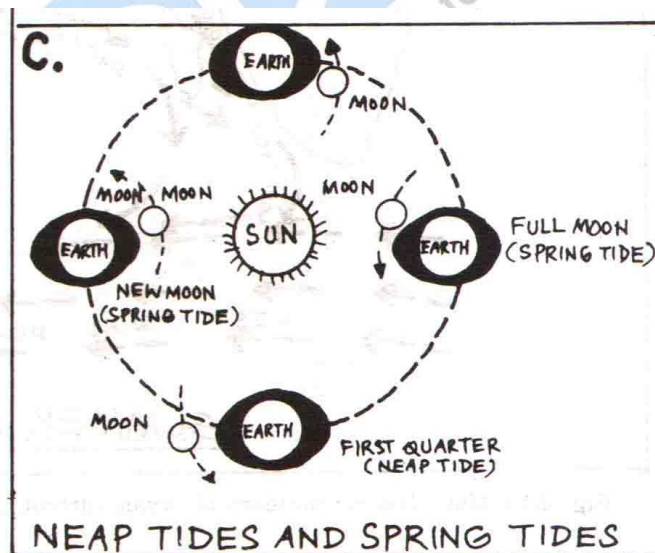
The gravitational forces of Sun and the Moon are responsible for the original tides. Sun due to its large size more attract but due to maximum distance from Earth; its effect is not maximum. On the other hand moon is much nearer to the Earth it attracted the Earth water more in compair to Sun. So that way, moon get more affect the tides. The tides origin power of Moon is just double to the sun.

According to figure.





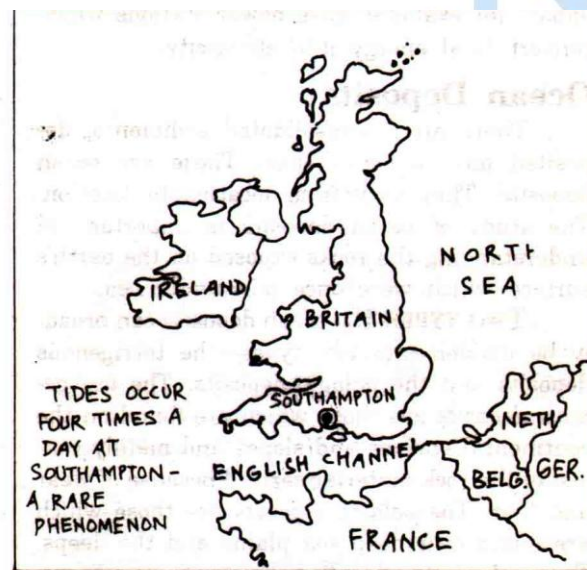
The gravitation effect on 'A' is highest 'B' is low & 'C' is lowest over the earth surface. Whereas 'C' is also affecting for this tidal force, so that way 'C' is major affected by the centrifugal force. On the reference of earth the position of Moon affected the result & formation of tides. When the sun, Moon & Earth come in the almost same line (Syzygy) during the Full moon, so the gravitational forces of Sun & Moon works together with combined force & thus High tide or spring tide is caused. Such tides occur twice every month (during full moon New Moon).



Whereas when the Sun, the Earth & Moon comes in Right angle on 7th & 8th day of every fortnight of a month & thus the tide producing forces of Sun & the Moon work in opposite direction, with the result low tide is caused or called Neap tide.

On an average every place experiences tides twice a day. Every tide occur after 12 hours but it delay occur over 12 hours 26 minutes due to the region of moon rotates on its axis west to east while revolving around the earth. Since the earth rotates west to east hence the tide centre shifts westward. So due to this the time difference between the 2 tides are 24 hours 52 mint.

In England over Southempton here tides occur 4 times in a day. This region is near to the North Sea & English Channel.



Que. Explain the different theories of the origion of Tides?

Ans. Equilibrium Theory of I. Newton – In the year 1682 A.D. Sir Issac Newton explained the tide producing forces of the Sun & Moon. It stated – “Two bodies attact each other with a force directly proportional to their masses but inversely proportional to the square of distance between them.

Tide Producing Force-

1. Moon & over earth revolves round a common centre of gravity i.e. Barysphere, which lies about 1000 miles within the earth on a line joining the centre of the earth & the moon.
2. Two forces are acting on the earth as a whole-
 - Gravitational pull of the moon & the sun.
 - Centrifugal force of the earth

Both the forces are equal at the Barycentre.

3. To explain the phenomena of tides

m – Mass of the moon

d – Distance between the centre of the earth & the moon

r – Radius of the earth

Accordingly at the centre of the earth both the gravitational force of the moon & sun centrifugal force of the earth is equal & hence the tide producing force is zero.

But at the point of the earth which is nearest to the moon the gravitational force is more than the Centrifugal force, because of its nearness and the point of the earth which is farthest from the moon the centrifugal force is greater than that of the Gravitational pull because of the farness.

This difference between the Centrifugal force & the gravitational force is the tide producing force.

On account of which the water being liquid begins to pile up just below the moon & in its opposite direction which causes tides.

At the Centre of the earth

Centrifugal force is m/d^2

Gravitational force is m/d^2

❖ Tide producing force at the center of earth is zero

❖ Tide producing force at 'X' (nearest to the moon)

At x – Gravitational force is $m/(d-r)^2$

Centrifugal force is m/d^2

Tide producing force is

$$m/(d-r)^2 - m/d^2$$

(Direct High Tide at 'x')

Tide producing force at 'y' farthest from the moon

At y - Gravitation force is, $m/(d+r)^2$

Centrifugal force is m/d^2

Tide producing force at 'y' is

$$m/d^2 - m/(d+r)^2$$

At 'Y' indirect high tide is produced.

The Sun is a huge heavenly body, but its tide producing force is less than of the moon.

Though the mass of the Sun is 255 lakh times more than that of the moon but the distance of the Sun from the earth is 387 times more than that of the distance of moon.

Hence when the tide producing force of the Sun is $3/200$, tide producing force of moon is $1/30$, the ratio being = $3/200 : 1/30$ or $9/20$ or $5/77$

Distance of the moon - 2, 40,000 miles

Distance of the sun - 9, 30,000 miles

Stationary Wave Theory

1. R.A. Harris propounded this theory.
2. Oscillation in the Ocean water because of gravitational of moon
3. Oscillation causes Stationary wave & stationary waves creates tide
4. Experiment
5. Oscillation causes bimodal lines which depend on the relief of the Oceans, depth & rotation.
6. Higher Oscillation higher Stationary waves. In the Bays of lesser depth - lesser high waves
7. Islands, continents etc.
Create obstruction in Oscillation & creates Amphidanic points where the water remains calm.

8. Oscillation around amphidormic points & stationary waves began to travel causing tides.
9. North & South stationary waves oscillation determine tide of the Atlantic Ocean.

Progressive wave theory:

1. William whewell-1833, G.B.Airy 1842
2. Presumption- Gravitation force of the moon causes a tidal wave in the open oceans.
3. This tidal wave creates tides.
4. If whole of the world had been covered by water, the tides would have occurred in the form of a wave, crest would have become flood & trough the -ebb (speed depends on the depth)
5. Movement of this wave from East to West
6. Extension of continents -North to South
7. No occurrence of this wave in every ocean but only in the southern (Antarctic) ocean from continental interruption.
8. Origin of an independent progressive wave which moves from East to West independently. It is known as Primary wave.
9. When it passes through Pacific, Indian & Atlantic Ocean secondary waves develop moving northwards in this ocean. Now begins to move south to North.
10. The speed of secondary waves is the highest in the center of oceans (depth) & low speed near the continents.
11. These secondary waves i.e. the crest causes flood & trough causes ebb

Que Explain the Bottom relief of Indian Ocean.

Ans Introduction

The Indian Ocean is smaller, less deep than the Pacific and Atlantic Ocean. Since it is completely blocked in the north by the Asian landmass, it can be considered only half an ocean.

1. Size & shape - Triangular in shape
Area- 73,000,000 km²
Width - 9000 kms (between S. Africa & New Zealand)

Average depth - 4000 mts.

Enclosed by – Asia in North & East

Africa in West

Australia in S. East

Austractica in South

- Apex towards North, Base towards South
- Marginal Seas - less in Number than Pacific & Atlantic
- Mozambique channel
- Red sea
- Persian Gulf
- Andeman Sea
- Arabian Sea
- Bay of Bengal
- Malagasy & Srilanka (Big)
- Socotra, Zanzibar (Small)

Hypographic curve

1. **Continental Shelf** - Extensive along – Arabian Sea (Mouth of Gangas), Bay of Bengal, Eastern Coast of Africa & Madagasker narrow- Jana & Sumatra Austrelian coast.

Area- 4.2%

Average width - 640 km.

- (iii) **Continental Ridges** – Extension from India to Antarctica divides ocean into Eastern & W. Trough.

It is known by different names in different parts.

- a) **Laccadine Chagos Ridge** – The main central ridge starts from the Continental shelf of Southern tip of Indian peninsula.

Width- 200 km.

Depth- 6000'

Undulating creast bearing many small islands .

- b) **Chagos St. Paul Ridge** - extension between 0° & 30° S at 50° S it extends towards South East average depth = 8000, width and 200 km
- c) **Austerdam St. Paul Plateau:**
Extension ____ 30° S & 50° S
Width ____ 1600 km/ 1000 miles
Depth of water ____ 12000 ft.

c) **Austerdam St. Paul Plateau:**

Extension 30° S & 50° S

Width _____ 1600 km/ 1000 miles

Depth of water ____ 12000 ft.

The Central Ridge bifurcates to South of 50° S latitude.

Branches of the Central Ridge

1. **Socotra chagos Ridge** - near 50°S latitude N.W. direction (carlsberg Ridge)
2. **SeyChelles** - Mauritius Ridge- bifurcates from the main ridge around 18° South latitude near Mauritius island, North West direction
3. **MadagasKar Ridge** - extends from south tip of madagaskar to 40° S latitude (Wedas)
4. **Edward Grozet Ridge** - bet 40°& 50°S / 45° -55°E
5. **S.W. Indian Ridge** - S.W. branch near 23° S

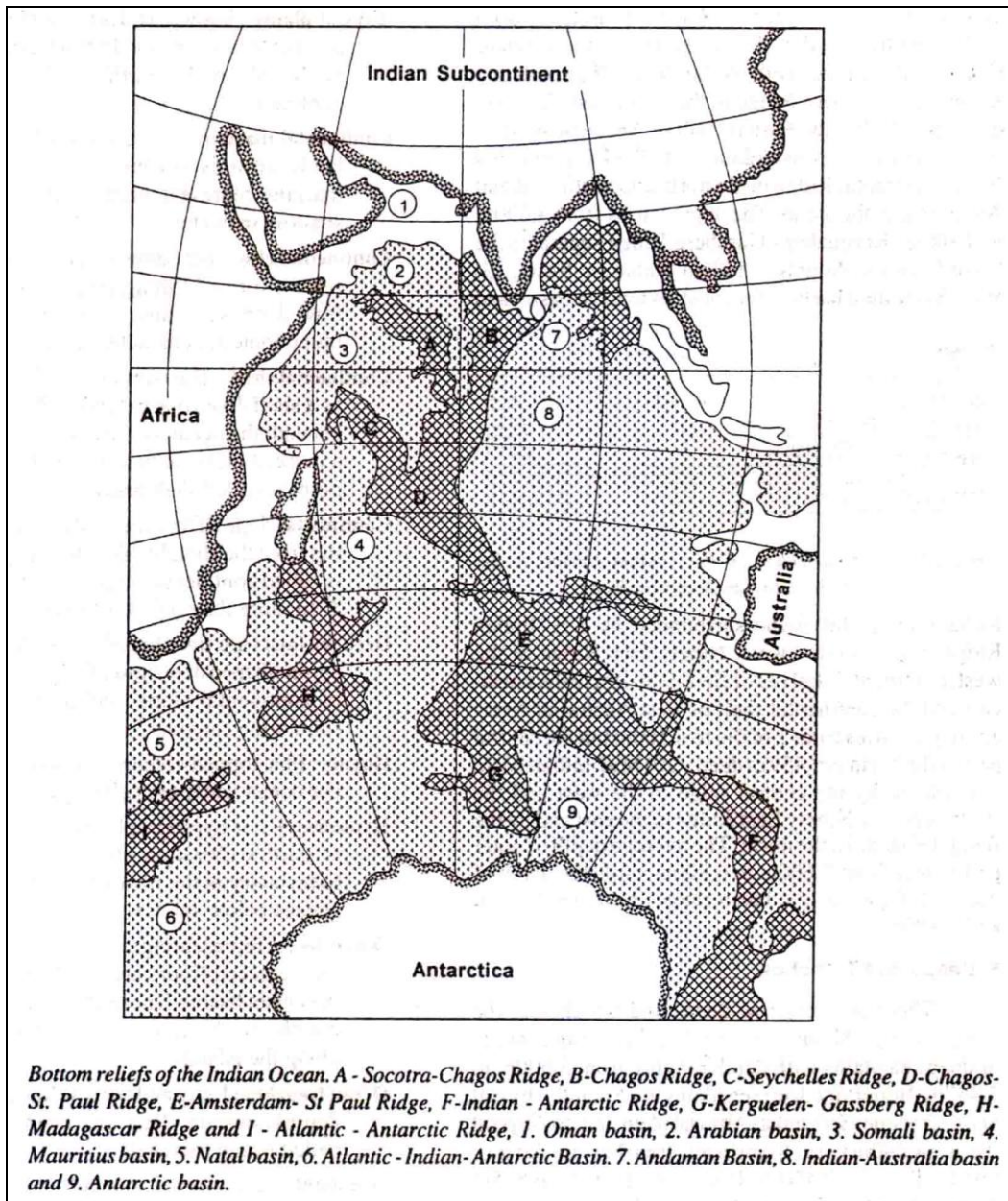
3. **Somali Basin**- Surrounded by Scotia chaques & St. Paul & Seychelles in the east of Somalia (more than 12,000')
4. **Mauritices Basin**- Broad basin between Madagascar & St. Paul Ridge – 18,000'
5. **Natal Basin**- S.W. of Madagascar & South of Africa about 12,000.
6. **Agalhas Basin**- South of Africa in the west of Crozet Ridge.
7. **Atlantic Indian Antarctic Basin**- Between Antarctica & Africa above 15,000 (south of Prince Edward Crozet Ridge).
8. **Andaman Basin** – Shallow basin of 6000' depth in east of Andaman Rise in Bay of Bengal.
9. **Cocos Keeling Basin** – Most extensive basin in the east of Central Ridge, South of Java & west and north west Australia
10. **Eastern Indian Antarctic Basin**- South of 50°S east of Kerguelen Ridge.

Area – deep sea plains out of the total (abyssal) (58% deep sea plains)

Depth – 12000-18000 Somali, Ceylon, Indian Plains (4380 km)

Deeps – The deeps are almost absent deepest part lies in a furrow known as Sunda trench.

This trench lies parallel to & south of Sunda Islands. The greatest depth is 4080 fathoms. Wharton deep is located in the eastern Indian Trough at 19°S & 100°E



Que Explain the bottom relief of Bottom Relief of Pacific Ocean

Ans The Pacific Ocean, the largest ocean of the world having 1/3 area of globe has a triangular shape

Average Depth = 4572 m.

Total area = 16.5 crore Km.

Extends = from east to west=16,000 Km. from East coast of Asia to Australia.

= from North to south=14,880 Km. between Bering strait in the North to Cape Adre in south. It has the largest number of islands (more than 2000 grouped in 3 categories).

1. **Continental Islands** - Aleutian island, Chilean islands, British Columbia (island of Columbia)
2. **Island Arcs & festoons:** Kurile Islands, Japanese Archipelago (group of Islands), Philippines islands, Indonesian island.
3. **Scattered & smaller islands:** Hawaiian Islands, Fiji islands, Micronesian islands, Faunafuti Island, Melanesia islands, Caroline Islands Gilbert Island, Ellice Island, Polynesia islands.

Important seas - Bearing sea, Okhotsk Sea, Japan Sea, Coral sea, yellow sea, Java sea, China sea, Tasman Sea, Arafura sea.

East Pacific rise- The east pacific rise is a ridge known as 'Albatross plateau' is 16 Km wide & extends from New Zealand to the California coast.

Minor Ridges:

- (i) **Galapagos Ridge** - Eastern island Galapagos islands has 2 branches, Carnegie ridge & Cocos ridge.
- (ii) **Nazca ridge** = Peru coast.
- (iii) **Norfolk Island ridge** = Between New Caledonia & New Zealand
- (iv) **Eauripik-** North of New Guinea
- (v) **Caroline ridge** - North of Solomon Island.

Continental shelf in Pacific Ocean-

These shelves are quite broad & extensive along the eastern coast of Australia & Asia

Depth between =1000-2000 m

Average Width is 80 Km.

=several islands are seated on these broad continental shelves

=These continental shelves also carry numerous marginal seas.

= The continental shelves are less extensive along the western coasts of America because of nearness of cordilleran chains of folded mountains to the coastal lands.

Ocean deeps: several trenches & deeps in the Pacific Ocean trenches are found mainly in the western Pacific Ocean important trenches are

(i) Mariana - depth = 11,022

(ii) Tango - depth =10,882

(iii) kurile- depth = 10,498

(iv) Phillippine

(v) Japan

(vi) Karmadec

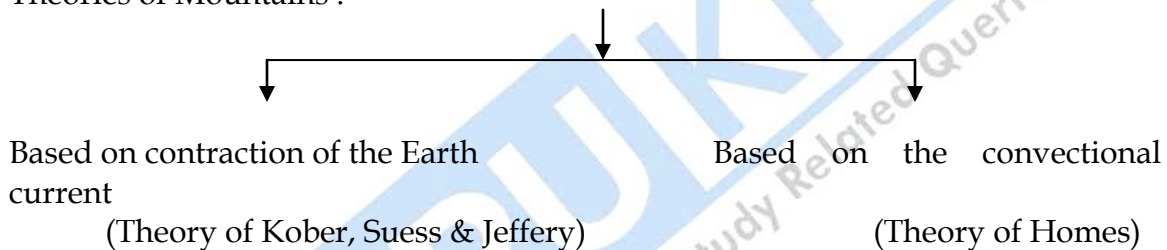
Q.1 Define different theories of origin of Mountain Building?

Ans : Mountain is the significant relief feature of 2nd order on the Earth Surface. It covers the whole part of 1/3 or 27% of the Earth Surface in its length, height & weight & new folded mountains are suited are one of these.

According to **Salisbury**,

“Mountains are consequently high land which has narrow but slight arrow summit areas. Mountains building processes was a problem to explain this phenomena may views & theories were presented. These theories may be divided into 2 ways-

Theories of Mountains .

**II. Geosynclines Orogen theory of Kober****Importance & objective of the Theory:**

Kober was a German geologist & he presented a varied & systematic description of Earth features in his famous book '**Der Bender Erode**'. The main objective behind presenting this theory is that is that he wanted to establish a relationship between geosynclines (long, narrow, shallow water area) which he called '**Orogen**' & rigid masses which he called '**kratogen**'. Such kratogen includes the Canadian Shield, the Baltic shield, the Siberian shield, Peninsular Indic, Chinese massif & the Brazilian & the African Shield.

Kober opined that the whole process of mountain building passes through 3 stages.

4. **Lithogenesis-** This is the stage of creation of geosynclines, sedimentation and subsidence. That is formed due to contraction caused by cooling of earth. The geosynclines are narrow & wide mobile zone of water which is bordered by rigid cases the kober named as forelands or kratogen.

The forelands or kratogens which border geosynclinals succumbed to the forces of denudation.

5. **Orogenesis-** In this stage the geosynclinals sediments are squeezed & folded into mountain ranges.

Both the forelands start to move towards each other because of horizontal movements caused by force of contraction. The parallel ranges formed on either side of the geosynclines have been termed by kober as randketten.

Example. Alps- proper, Carpathians, Balkan mountain & Caucasus Mountain were formed due to northward movement of African foreland.

6. **Gliptogenesis-** This phase of mountain building is characterized by a gradual ascent of mountain ranges and the ongoing denudation processes by natural agents.

Criticism-

5. The force of contraction produced by the cooling of the earth is not adequate for the formation of massive mountain like Himalayas, Alps.
6. Suess argued that the only one side of geosynclinals moves while the other side remains static. Suess termed the moving side as 'backland' & the stable side as 'foreland'. He opined that the Himalayas were formed by the southward movement of Angara land & Gondwanaland did not move.
7. Geosynclines are found along the continental margins'.
8. Geosynclines may exist in front of river mouth.

II Thermal Convection Current Theory

Arthur Holmes postulated his thermal convection current theory in 1928-29 to origin of major relief features of earth's surface.

Orogenetic Force:

The driving force of Mountain building in by Arthur Holmes is thermal convection current originating deep within the earth. The main source of the origin of convective currents is excessive heat in the substratum where in disintegration of radioactive elements generates heat regularly.

Base of the theory: Holmes on the bases of interval structure of earth into 2 bases.

2. Crust (2) Substratum

The origin of convective currents within the earth depends on the presence of radioactive elements in the rocks. According to him, these are maximum Concentration of radioactive elements in the crust but temperature is not so high because there is gradual loss of heat through conduction & radiation. On the other hand, through there is very low concentration of radioactive elements in the substratum but the gradual accumulation of heat produced by radioactive elements causes convective current.

Mechanism of the Theory:

It may be pointed out that the currents originate under the equatorial crust moves towards. There are two situations

- iii) The crustal mass, where 2 rising convective current diverge in opposite direction is stretched & thinned due to the tensional forces & ultimately the crust broken into 2 blocks. This divergent convective currents cause continental drift.
- iv) Where 2 lateral convective currents originating under the continental & Oceanic Crusts converge compressive force is generated which causes subsidence giving birth to geosynclinals & closing the sea. Those convective currents move the crustal rocks away in opposite directions & thus create seas & Ocean while

convergent convective currents bring crustal blocks together & thus Form Mountain.

dia

Homes define 3 stages for Mountain building formation.

4. Stage-I

In it the convergent current are originated in substratum & thus geosynclines forms and that geosynclines are subjected to continuous sedimentation & subsidence.

5. Stage-II

That increase in the velocity of convective currents. The main cause increase in the velocity of convective currents is the downward movement of cold materials in the falling column & upward movement (rise) of hot materials in the rise of column of convective currents. This buckles geosynclinals sediments & thus initiates process of mountain building.

6. Stage-III

This stage is known as stage of Gliptogenesis. In it the velocity is become low & gradually, the rising column becomes a cold column & convective current is become end.

Drawings-

Criticism:-

4. Rising & falling column are doubtful phenomenon.
5. The whole mechanism of convective currents depends on the heat generated by radioactive elements in the substratum but doubt about the availability of required amount of heat generated by radioactive elements.
6. The horizontal flow of thermal convective currents under the continental & Oceanic Crusts is also a doubtful phenomenon because of lack of required amount of heat to drive these currents.

III. Radioactivity Theory of Joly**Objectives:**

Joly postulated his theory based on radioactivity in 1925. The driving force of mountain building by Joly is provided by expansion & contraction of the substratum of the earth resulting into transgression & regression phases of the sea. Joly describe firstly the interior structure of earth. Continents are made of lighter silica materials the density of which is 2.62 while the Oceanic beds are formed of heavier material of sima having average density of 3.0. Thus the crust has been assumed to have been composed of sial & substratum of basalt (sima), sial is not found in Oceanic beds.

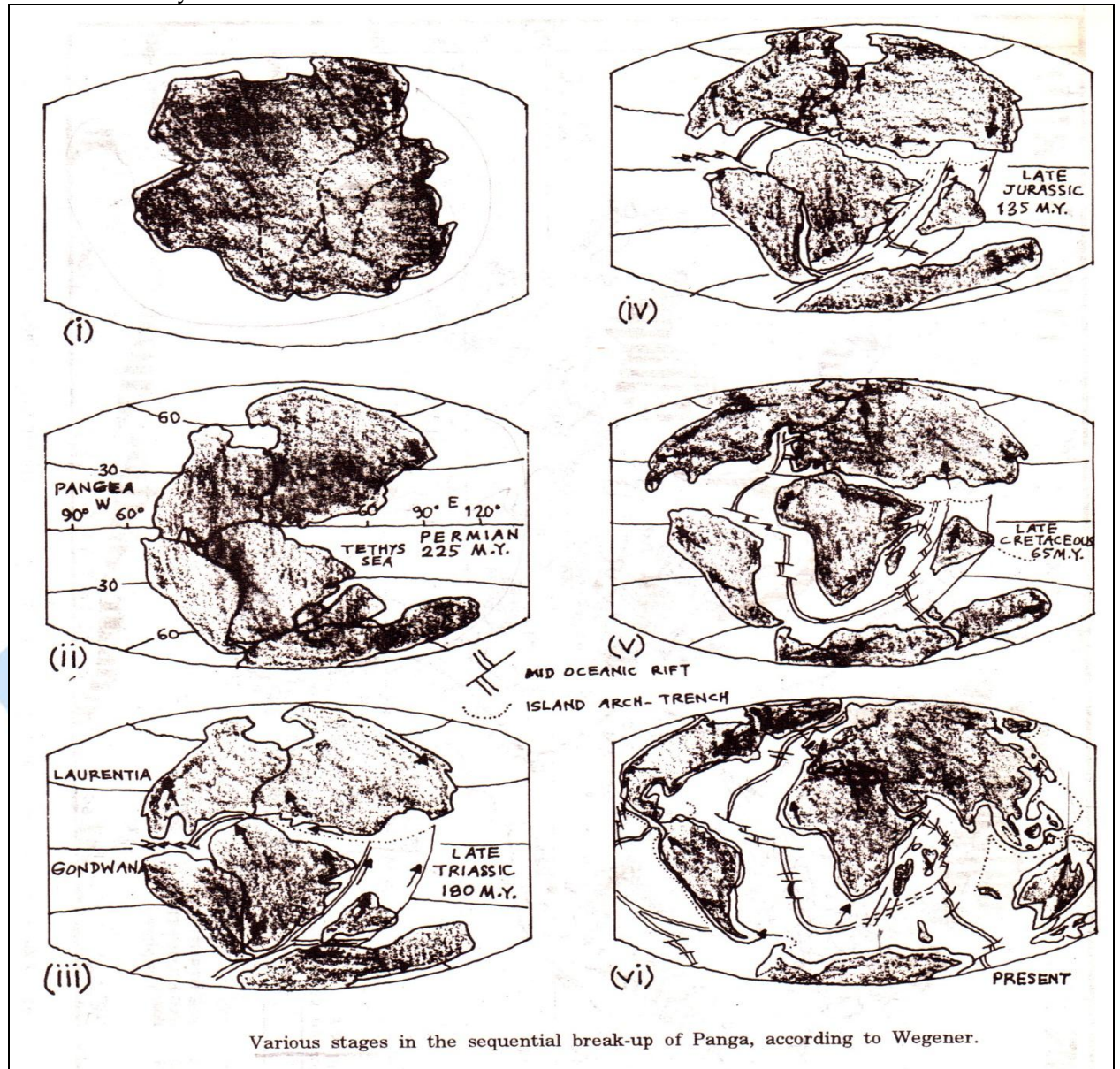
According to him, the rocks of the earth contain radioactive elements but their distribution is not uniform in all zones of earth. Radioactive elements are found maximum in abundance in continental rock whereas they are less in Oceanic Crust. Due to continuous breakdown of those elements generates heat.

Que: Explain the Continental Drift theory in detail?

Ans: Alfred Wegener (1922) was a climatologist and wanted, to investigate the relative distribution of land & sea & the climatic aberrations of the past. He postulated that originally in the carboniferous prescribed there was a one big land masses called pangea which was covered by one big ocean called panthalassa. A sea called Tethys divided Pangaea into 2 huge land

masses Laurentia to the north & Gondwanaland to the south of Tethys. The land masses consisted of sial (lighter) crust while the ocean had a simatic (heavier) case.

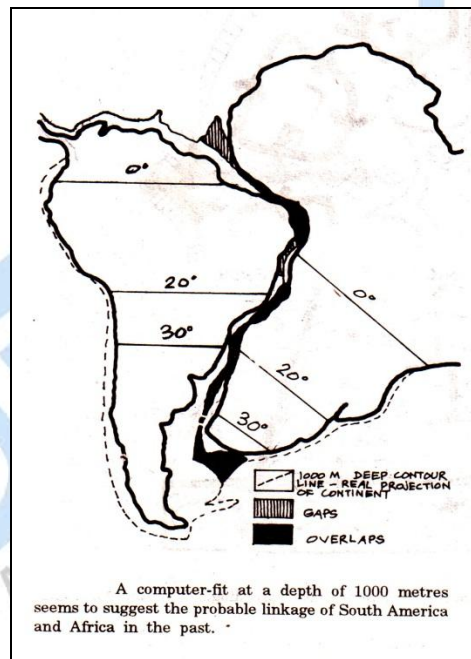
According to Wegener, the drift started around 200 million years ago (Mesozoic era) & the continent base is began to break up and drift away from one another.



The drift was in two directions- equator wards due to the interaction of forces of gravity & westward due to tide currents according to him the drift is still continued.

Critical analysis of evidence for continental Drift-

6. **Apparent Affinity of Physical features-** South America and Africa seem to fit in with each other especially the bulge of Brazil fits into the Gulf of Guinea (Fig 800 fit.).



Greenland seems to fit in well with Elsmere and Baffin islands.

7. **Causes of drift-** Gravity of the earth buoyancy of the seas & the tidal currents were giving as the main factors causing the drift.
8. **Interplay of sima & sial-** The lighter sial was carried by heavier sima, thus creating cordillera formations on western edges of North America. These formations are folded & warped.

9. **Botanical evidence**- Presence of glossopteris vegetation in India, Australia, South Africa, Antarctica etc. proves that these parts were linked in the past.

Criticism- Such vegetation is also formed in the North parts of Afghanistan, Iran & Siberia.

10. **Palaeomagnetism**- The magnetic field of the earth has magnetized many iron-based rocks in the past.

Criticism- The evidence in this regard is not conclusive & is being further explored. Such magnetic conditions may be due to local factor.

Main drawback of Wegener model-

Wegener ignored the time factor & took a two dimensional view of the subject, trying to solve the mystery like a jigsaw puzzle. He fails to explain why this drift began only in the Mesozoic era & not in the period prior to it.

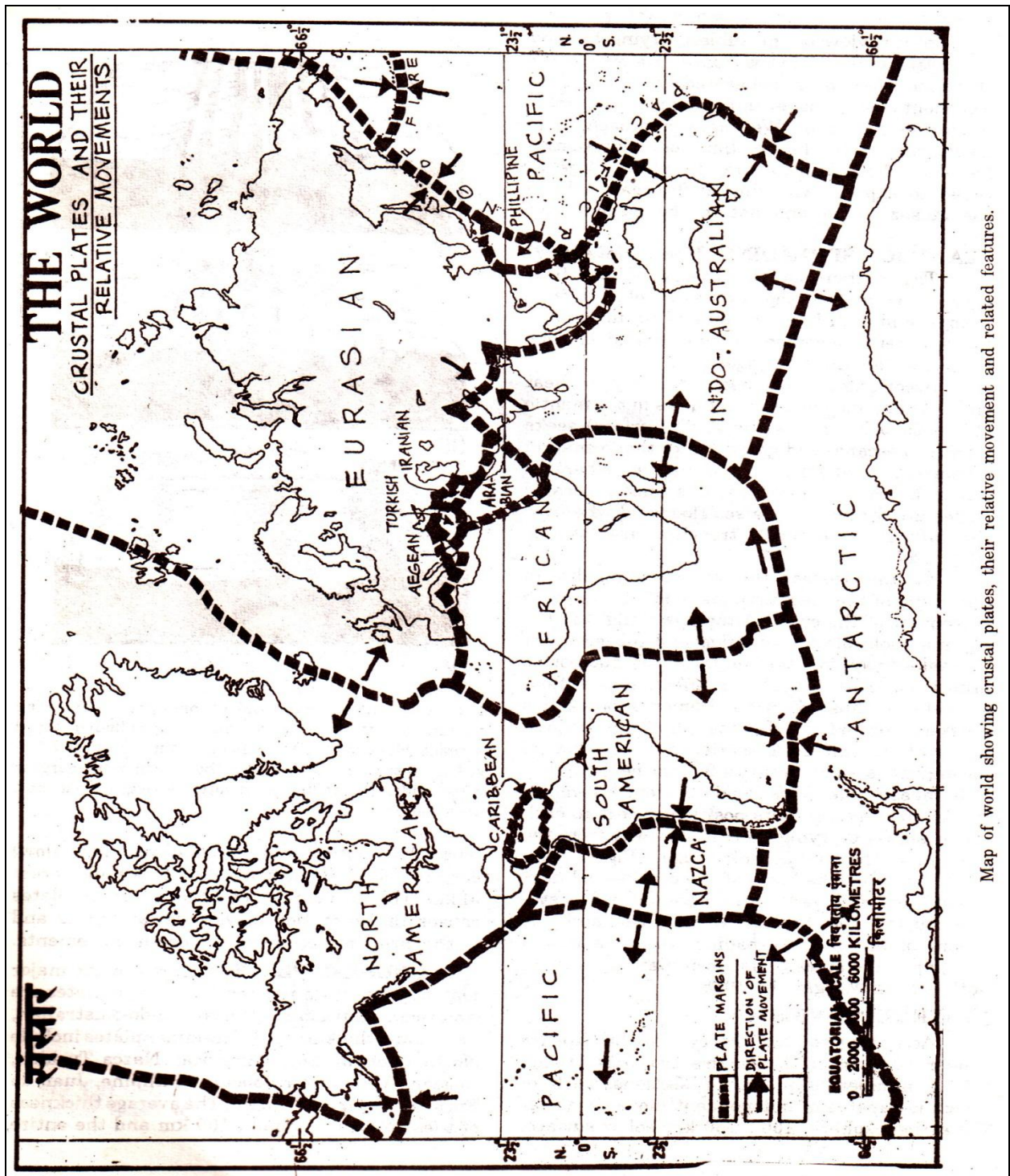
Que : Explain the Plate Tectonics theory with diagrams ?

Ans: The rigid lithosphere slabs & solid crustal layers are technically called 'plates'. The whole mechanism of the evolution, nature & motion of plates & resultant reactions is called 'plate tectonics.' The moot of these plates causes the formation of various lands. Forms & is the principal cause of all earth movements H. Hess presented this concept in 1960.

Crustal Plates-

There are 6 major plates & 20 minor plates & 14 minor plates.

2. Eurasian, Indian, African, American, Pacific & Antarctica.



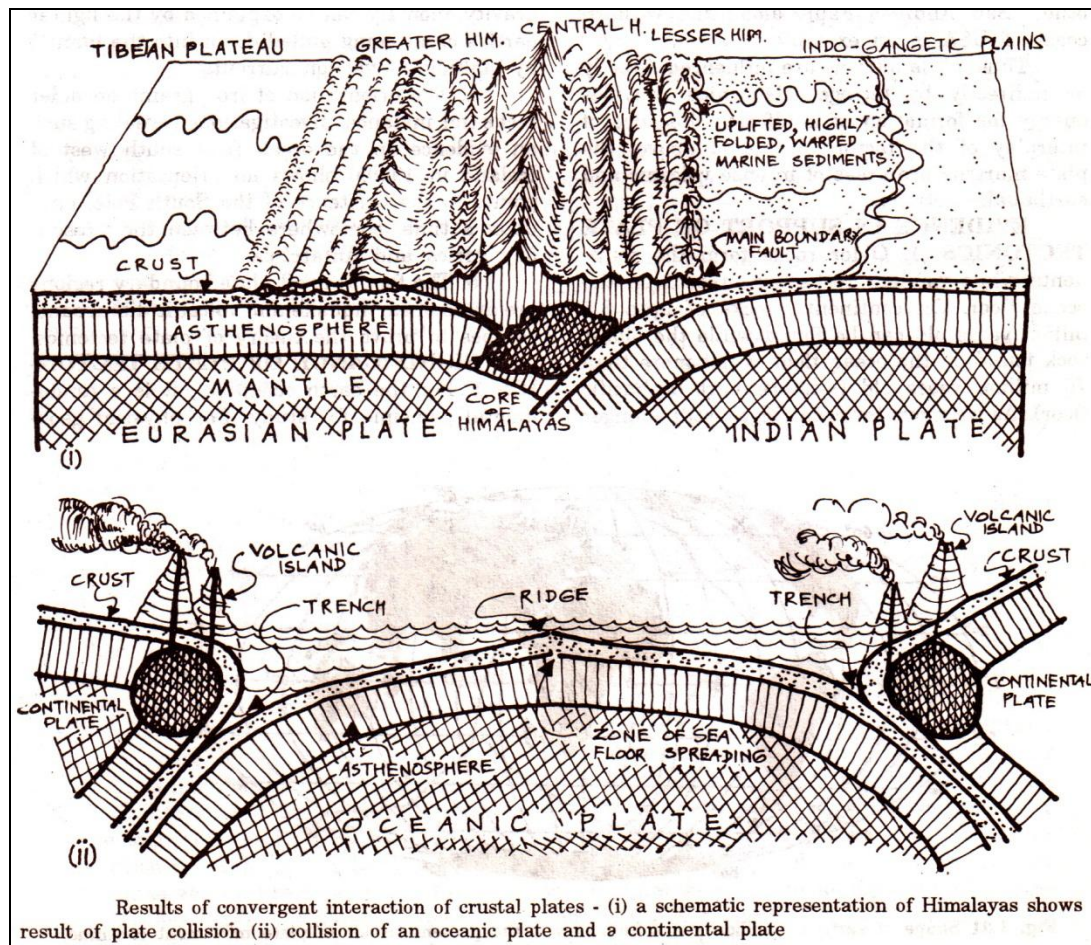
Map of world showing crustal plates, their relative movement and related features.

This theory is based on major scientific evidence.

- iii. Evidence of Palaeomagnetism
- iv. Evidence of sea-floor spreading

Plate margins are generally - into 3 groups.

4. **Constructive Margins or divergent Plate boundary-**
In it there is continuous upwelling of molten material (lava) & thus new Oceanic Crust is continuously formed. Infact, Oceanic plates split apart along the mid Oceanic ridges & move in opposite direction.
5. **Destructive Plate or convergent edge-** is formed when 2 plates meet head on. The zone of collision may undergo crumpling & folding & folded mountains may emerge. Himalayan boundary fault is one such example.
6. **Conservative Plate-** Here two plates' move past each other without directly interacting with each other & thus crust is neither created nor destroyed.



Sea floor spreading-

This concept was first given by Harry Hess in 1960. According to this theory, like intense heat generated by radioactive substance in the mantle seeks a path to escape & gives rise to the formation of convection currents in the mantle. Where ever rising limbs of these currents meet, oceanic ridges are formed on the sea floor & where ever the falling limbs meet, trenches are formed.

At the ridges the eruption results in upwelling of the magnetic material. This causes movement of the crust. After upwelling the hot magma cool down solidifies and moves apart to make way for the

material of successive eruptions. This results in effective sea floor spreading. The rate of movement Perhaps 2.5 cm per year but it is measurable.

Que : Define Weathering and also define its different forms ?

Ans : The process of disintegration and decomposition of rocks in situ is generally called **weathering**.

It means weathering is a static process.

Factors controlling of weathering-

6. **Composition & structure of Rocks-** The joints in rocks permit water to enter the rock and achieve chemical and physical weathering.
7. **Nature of Ground Slope-** It controls mechanical disintegration of rocks and mass movement of weathered products down the slope.
8. **Climatic Variations-** Climates determines whether physical or chemical weathering will predominate and the speed with which these processes will operate.
9. **Floral Effects-** It also determined by the presence or absence of vegetation in a particular region.
10. **Topography-** It directly affects weathering by exposing rocks and in directly through the coconut precipitation, temperature & vegetation.

Types of weathering

There are 2 main types of weathering.

4. Physical or Mechanical weathering.
5. Chemical weathering.
6. Biological or Organic weathering
4. **Physical or Mechanical weathering-** The physical or mechanical weathering leads to fragmentation & breakdown of rock masses into big blocks and boulders, cobbles & pebbles, sand. This may be caused by 6 agencies, which are as follows-
 - vii. **Frost action-** Water expands when being transformed into the solid state, called frost or ice. This expansion exerts enormous pressure so that when water freezes within the cracks of the rock, great strains are caused & fragments may be broken off, or the rocks are

shattered to a considerable depth. Shattered rocks are frequently met with in the higher elevations of the Himalayas.

Daily temperature changes- Weathering due to diurnal temperature changes are essentially a consequence of direct heating of rocks.

viii. **Exfoliation-** The breaking or peeling off of concentric plates from bare rock surfaces is called '**exfoliation**'. Plutonic rocks like granites normally get exfoliated. The result is peeling off of scales from their surface & appearing as exfoliation domes as in the Khasi hills, Jyellang, Meghalaya.

ix. **Relative hardness of rocks-** Some rocks like sand stone are hard, & some like shale's are soft. Weathering of soft rocks under a capping of hard rock's give rise to 'pedestal rocks'. Such land feature found in Satpura Hills, Himachal Pradesh.

x. **Action of Plants & animals-** The roots of trees on the hill sides penetrate into cracks of rocks & widen them. This facilitates the percolation of water & air the total effect of which is the breakdown of rocks.

xi. **Gravity-** It is an indirect cause of mechanical weathering. We see huge boulders standing in the edge of a cliff about to fall down & when they actually tumble down the slope, they may break off portions of hill slopes.

5. **Chemical weathering-** Decomposition and disintegration of rocks due to chemical reaction is called Chemical Weathering results in:-

iv. An increase in volume which produces stresses within the rocks.

v. Lower density materials

vi. Particles of smaller size which produce a larger surface for chemical interactions.

6. **Biological or Organic weathering-** Plants assist in surface weathering by both chemical & mechanical means. Algae, mosses, lichens & other

vegetation retain water on the surface of the rock & various organic acids help to decay the rock beneath so that a tuft of moss may lie in a small & growing hollow in the rock. The mechanical disintegration effect of vegetation is mainly due to the penetrating & expanding power of roots which exert considerable force as they grow & help to wide cracks & crevices this allowing water & air to enter.

Que : What is Erosion? Explain its different forms?

Ans: Erosion is the earth sculpting processes by which the rock debris produced by weathering is transported. Agents that move rock fragments include gravity, running water, moving ice, wind waves, tides & currents.

7. **Corrosion**- The wearing a way of rock or soil by chemical & solvent action, i.e.-by carbonation, Hydration, Hydrolysis, Oxidation & solution. This is mostly occurring by the water.
8. **Abrasion**- The process of wearing down of a land surface by money weathering rock debris or by the river flow.
9. **Attrition**- This is also done by River, glacier, wind & sea waves. When the large boulders or rock erode the river floor or the sand particles present in winds erode this process is called attrition.
10. **Plucking**- One of the main erosion processes carried out by a glacier, effecting the removal of rocks from its valley floor water enters cracks in the rocks of the floor freezes & detaches rock fragments, which becomes frozen to & carried away by the under surface of the glacier as it moves along.
11. **Deflation**- The removal of five rock debris by wind, especially likely to occur in Arid or semi arid.
12. **Hydraulic Action**- The processes in which minerals combine with water & Expend there by exerting pressure within the rock pores (exfoliation). They like affected in chemical weathering.

Que: What are the Differences between Weathering & Erosion

Ans: In **weathering** there is only the disintegration or decomposition of rock through different factors but in it transport is not involved whereas in **erosion** this transportation work is included. Means the processes of

wearing a way of land surface by natural agents (water, ice, waves, and winds) & the transport of rock debris that results in called erosion.

Que : Define the process of Mass Wasting ?

Ans: The movement of weathered material under the influence of gravity & with or without the influence of rain water is called mass movement. They may be take place in a variety of ways.

5. **Talus cones-** Rock particles created by processes of mechanical weathering move down high mountains slopes & steep rock walls of gorges. These particles tend to get deposited in distinctive landforms the talus coves. A talus slope or scree slope has a constant slopes angle of 34° or 35° .
6. **Earth flow-** In humid regions where these are steep slopes, the masses of soil saturated with water overburden or weak bedrock may slide down slopes during a period of a few hours in the form of earth flow.
7. **Land Slide-** This is rapid sliding along hill slopes of rock mass. Two basic forms of landslide are-
 - iii) Rock slide in which the bedrock mass slip on relatively flat include rock plain such as fault.
 - iv) Slump in which there is a backward rotation on a curved on concave slip plane.
8. **Soil Creep-** This is the extreme by slow down Slope Mountain of soil & over burden on almost all moderately steep, soil-covered slopes.

Que : Explain the concept of Cycle of Erosion by W.M.Davis?

Ans The hypothetical sequence of changes or stages through which an uplifted land surface would pass in its reduction to base level by the action of natural agencies in the processes of Erosion this cyclic processes is called **cycle of Erosion**.

W.M. Davis- William Morris Davis, American geomorphologies, was first present a general theory of land for development. In 1899 he presented his theory. Davis assumed that any land part or structure cannot developed

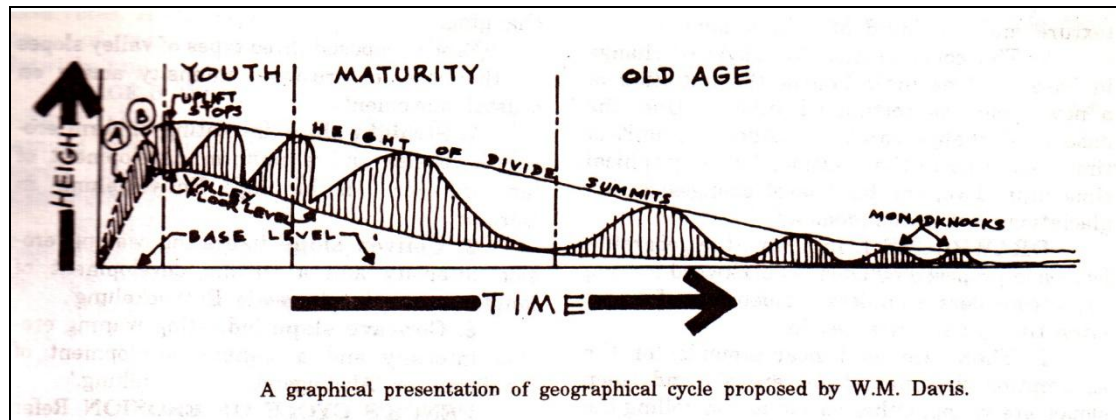
suddenly whereas its development is a long process which passes through from several stages in a form of cycle & at last this converted into a plain.

According to Davis 3 factor play important role in the origin & development of land forms of a particular place. These 3 factors are called '**Trio of Davis**'. & his concept is expressed as follow- "landscape is a function of structure, process & time."

4. **Structure-** means lithological (rock types) & structural characteristics (folding, faulting, joints etc.) of rocks.
5. **Process-** means the agents of denudating including both weathering & Erosion.
6. **Time-** In it different stages (Youth, Mature & Old stage) are included.

The whole cycle passes from 3 stages-

4. **Youthful Stage-** Erosion starts after the completion of the upliftment of the landmass. (The top surface is not affected by Erosion because the rivers are small & widely spaced.) This stage is characterized by rapid rate of vertical erosion & valley deepening & in absolute height remains constants.
5. **Mature Stage-** In it the vertical erosion or valley deepening is remarkably reduced, there marked lowering of absolute relief. Thus absolute relief & relative relief both decreases.
6. **Old Stage-** In it almost total absence of valley incision but lateral erosion & valley widening is still active process. The valleys become almost flat with concave valley side slopes & convert into monad hocks & at end the complete landforms converted into penne plane valley.



Positive Aspect of Davis Model:

5. This model was highly simple & applicable.
6. This model explains the whole processes from the formation of land form in a simple way. This is mode to know how any land form is made.
7. Davis based his model on detailed & careful field observations.
8. The change in base land is thoughtful & it shows the correct form of erosion.

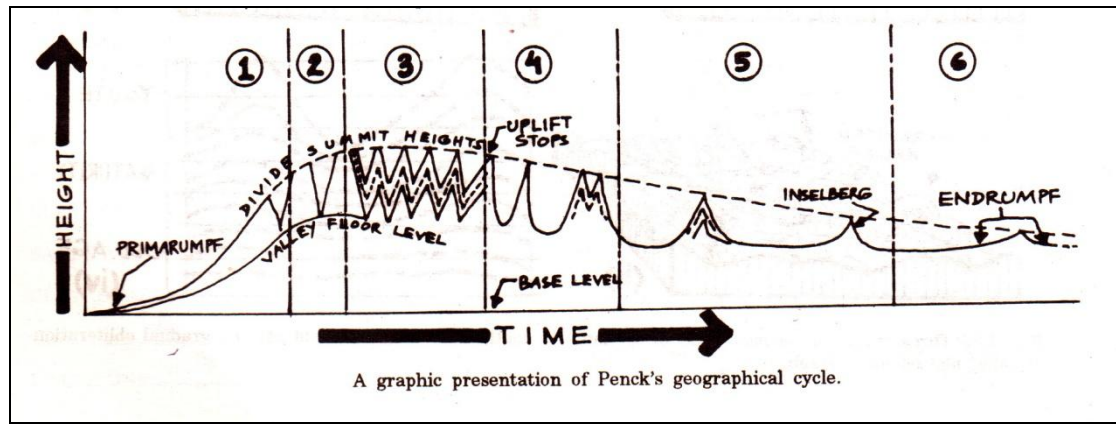
Criticism: -

5. His concept of upliftment is not acceptable. He has described rapid rate of upliftment of short duration but as evidenced by plate tectonics upliftment is a long continued process.
6. Davis' concept of relationship between upliftment & Erosion is erroneous.
7. An ideal Davisian cycle would take millions of years to complete. What about the earth movements during the cycle?
8. It is unlikely that a cycle can be complete because interferences such as climate changes or other elements bound to upset the orderly progress of cycle.

Que : Define the Penck model of cycle of erosion?

Ans: German Scientist Walther Penck presented his model based on Davison model. According to Penck land for development should be interpreted by means of ratios between the rate of uplift & rate of vertical erosion & their interaction between the 2 factors, uplift & degradation is continuous. The whole cycle passes through 3 stages.

4. **Aufsteigende Entwicklung** - means the phase of accelerating means the rate of landform development. Initially the land surface rises slowly but after some time the rate of upliftment is accelerated. The rate of valley widening. This results the formation of U-shaped valley).
5. **Gleichformige Entwicklung**- means uniform development of land forms. This phase is subdivided into 3 sub phases.
 - d) **Phase (a)** - is characterized by still accelerated rate of uplift. Absolute height still increases because the rate of erosion is still less than the rate of upliftment.
 - e) **Phase (b)** - Attitude neither increase nor decrease.
 - f) **Phase (c)** - Upliftment of the land stops completely attitudes of summit divides start decreasing because of absence of upliftment.
6. **Absteigende Entwicklung**- means the waning development & landscape (during & consequent valley widening & valley deepening through vertical down cutting). Absolute relief decreases because of total absence of upliftment but continued down wasting of divide summits. Relative relief also decreases & lowered in height while down cutting of valley floor decreases.



Criticism-

4. Penck gave too much importance to the rate of endogenetic forces.
5. German language is too different to understand.
6. The orderliness in land form changes, as assumed by Penck, may be difficult to achieve.

Q. Describe the land forms associate with Karst topography?

Ans. Karst is special region of well jointed carboniferous limestone in which carbonation is the dominant weathering process. In this region the underground water will aquifers or seepage maximum amount due to this they abrade the found & make new forms of structure or features. These are mainly found in Yugoslavia

Necessary conditions for the development of karst topography.

6. Karst topography generally develops in those areas where thick beds of massive limestone's lie just below the layer of surficial material.
7. They also develops en collimate, times tunes & chalk.
8. Limestone should be massive, thickly, bedded, hard, well jointed & should not be porous & not by the mass of rocks.
9. There should be enough rainfall so that required coconut of water is available to dissolute carbonate rocks.

10. The limestone should be highly folded or fractured or faulted.

There are 2 types of force work here.

2. Erosional landforms 2. Depositional landforms

2. Erosional landforms-

Erosion land forms developed because of solution & Carbonation.

Karst land forms develop best under certain favorable circumstances – Presence of soluble bedded & jointed rocks like limestone & moderate rainfall.

12. Lapies- The highly corrugated & rough surface of limestone, characteristics by low ridges & pinnacles & narrow clefs & numerous solution holes are called Lapies. In different place it is known as clints or graykes in N. England, Karren in Germany, bogaz in Yugoslavia & Siberia. Chemically active rain water dissolves limestone & other Carbonate rocks along their joints & numerous types of solution holes are developed. They are small in size & wide are called sink holes.

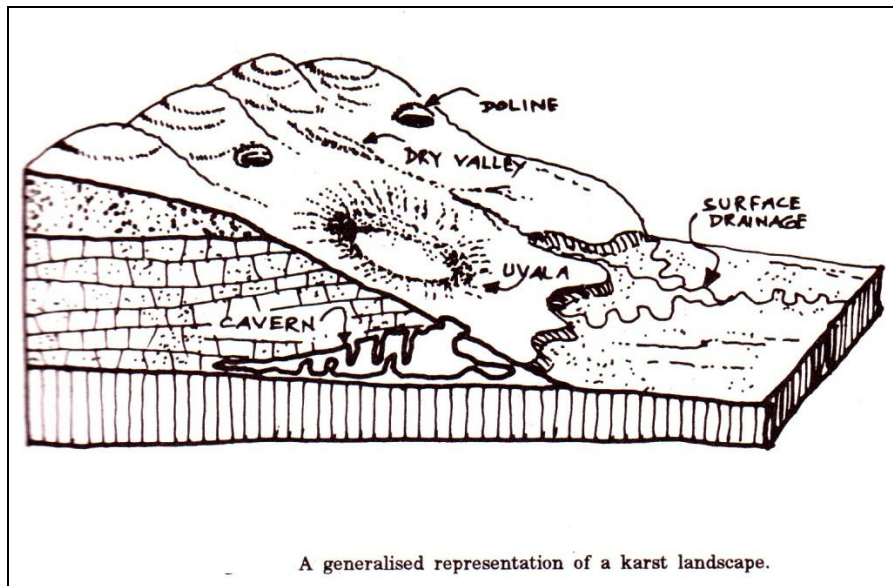
13. Solution Holes & associated features- Due to continuous dissolution of limestone's results in the closely spaced sink hole into one large hole which is called "Swallow hole".

14. Doline- Some sink holes are further enlarged due to continuous solution into larger depressions which are called dolines.

15. Uvalas- A number of adjoining dolines may come together to form a large depression called uvalas. They are also called the compound sink holes.

16. Polje- When many uvalas combined or most extensive, larger than dolines depressions are called 'poljes'. They are vertical side walls, flat alluvial floors, irregular borders & central lake.

17. **Karst window-** is formed due to collapse of upper surface of sink holes or dolines. These windows enable the investigators to observe sub surface drainage & other features formed below the ground surface.
18. **Ponors-** The vertical pipe like passages that connect the comets & the Swallow holes are called 'ponores'.
19. **Caverns-** These are underground comes formed by water action by various method in limestone area. For example found in India near Dehradun and S. Bihar.
20. **Blind valley-** In the limestone region when the surface streams which flow out from the hole over the surface than that valley disappear. That valley is called Blind valley.
21. **Natural Bridge-** Due to Collapse of the roof of cause than they make the form of natural Bridge.
22. **Karst Valley-** During rainy season small surface streams formed this U-shaped valleys developed on lime stones are called Karst valley or solution valley.



Depositional land forms-

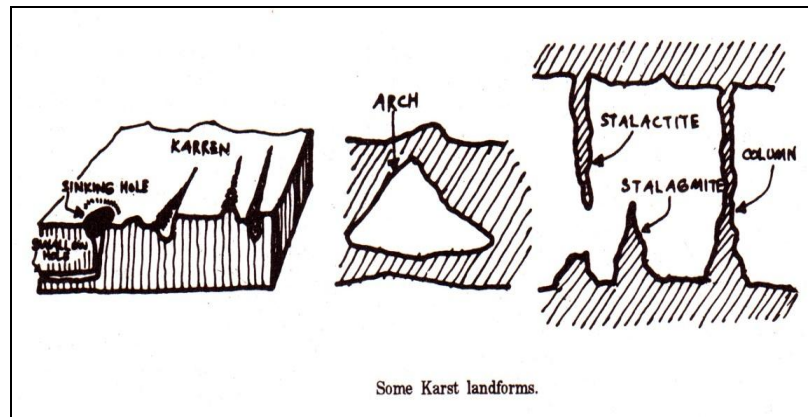
Depositional landforms take place aided by chemical reaction, temperature, and pressure, loss of because and evaporation of water.

Causes of deposition:

5. Chemical reactions
6. Loss of carbon di oxide
7. Change in temperature and pressure
8. Evaporation

Depositional landforms

6. **Speleothems:** deposits in the caves are collectively, called "Speleothems:" calcite is the common constituent.
7. **Drip stones:** calcareous deposits formed by dripping of water in dry caves.
8. **Stalagmites:** A column of calcium carbonate which grows upwards from the floors of a cave.
9. **Stalactite:** formed due to deposits of calcium carbonates from ceiling.
10. **Cave pillars:** are formed when stalagmite and stalactites meet together.



Que: Define the landforms formed by Marine or Coastal?

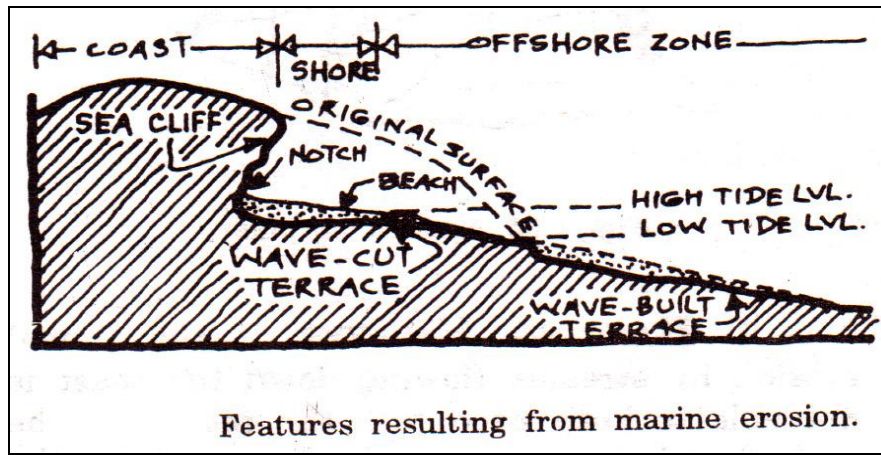
Ans: Marine land form are produced by the joint action of oceanic waves, currents & tides on the coastline of all these factors, waves are the most important of all in carving our landforms.

Mechanism

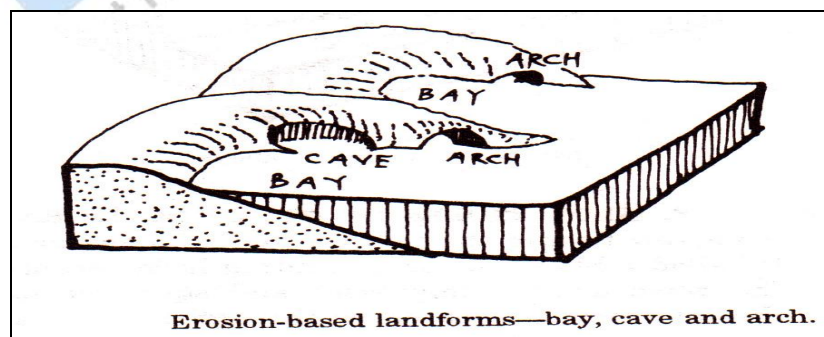
5. **Corrosive action**- Boulders, pebbles & sands are hurled against the coast by breaking waves & this causes under cutting & rock break up.
6. **Hydraulic action**- When water is thrown against the shore, by breaking waves, the air expands suddenly often explosively. This causes rocks to shatter & cracks become enlarged & extended.
7. **Attrition action**- The particles are themselves worn down by friction and impact, and become finer and finer.
8. **Corrosion & solution**- is simply a solvent action.

Erosional landforms:-

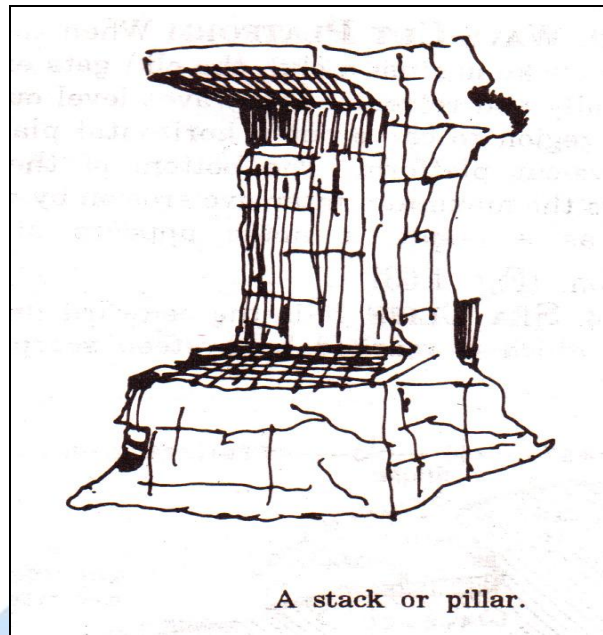
9. **Cliff**- Steep rocky coast rising almost vertically above sea water is called sea cliff.



10. **Notch**- The point of wave attack at the base of cliff is sometimes preserved in resistant strata as a wave-cut notch.
11. **Wave-cut Platform**- is formed due to cliff recession. A wave cut platform is produced at its base.
12. **Sea caves**- Where hard & soft rocks lie alternately softer rocks are worn back into inlets coves or bays & harder one persists are headlands.
13. **Sea Arch**- (The headland is subjected to erosion from 2 sides. Thus, cause is excavated in both the sides of the headland) or When two caves developing on either sides of headland join to gather, they give rise to natural arch or sea arch.



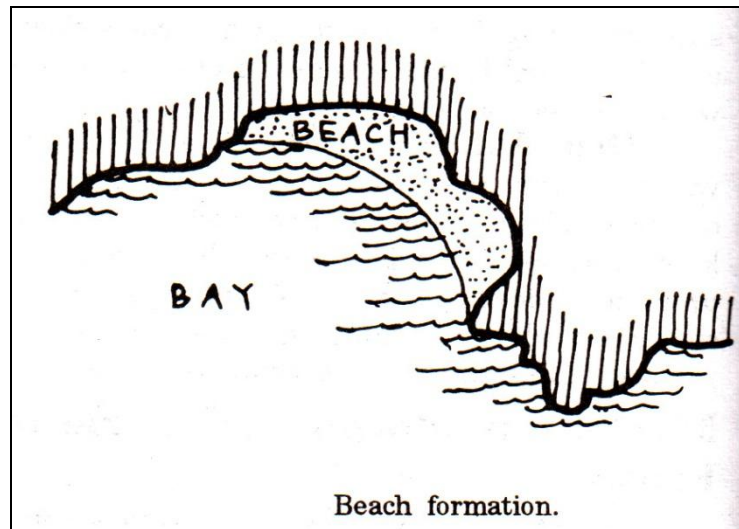
14. **Stack**- The arch collapses & an isolated pinnacle, called stack, is left in front of the cliff.



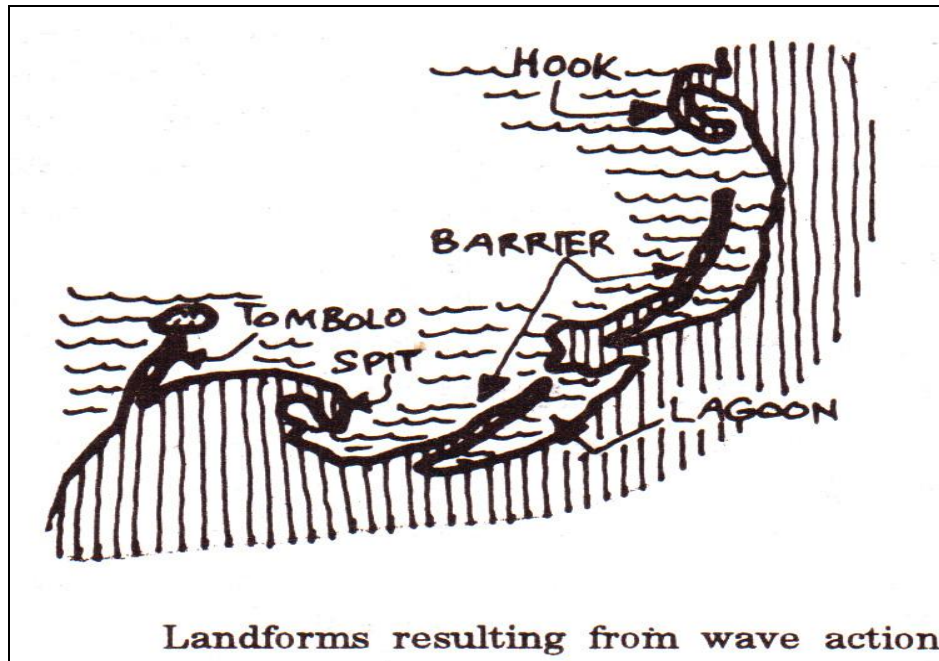
15. **Stump**- These rock pinnacles crumble & collapse & end up as were stumps slightly above sea level.
16. **Blow Hole**- Sometimes, the air in the cave is compressed by up rushing powerful storm waves & finding no other route to escape it breaks open the roof of the cave & appears with great force making unique whistling such holes are called 'natural chimneys' or 'blow holes'.

Depositional Landforms -

9. **Beaches**- A beach is a land on shore between the high water mark and low water mark. It is built of unconsolidated sediment like cobbles, boulders, fine silt & clay.



10. **Carp Beach**- is small regular embayment and a series of headlands composed of shingles.
11. **Spits**- If the sand bars are formed in such a way that there one end is attached to the land while the other end projects or opens out towards the sea, they are called spits.
12. **Bars**- The ridges, embankments or mounds of sands formed by sedimentation through sea waves parallel to the shorelines are called bars.
13. **Off-Shores bars**- If the bars are formed in such a way that they are parallel to the coast but are not attached to the land they are called off-shores bars.
14. **Compound hook**- It is a curved spit. The hook once formed is modified by many cross currents & the spits go lengthening by successive additions, as compound hook.
15. **Loop**-The spits are bent to saucer on extent that they are attached to the mainland (coast) & thus form complete loop, which enclose sea water in the form of lagoon. Such forms of a spilt is called **loop**.
16. **Tombola**- A bar connecting mainland with an island or connecting a headland with the island called tombola.



Que: Define the Glacier topography?

Ans: The moving ice mass down slope under the impact of gravity is called glacier. About 10% of the earth's surface is move covered by glaciers.

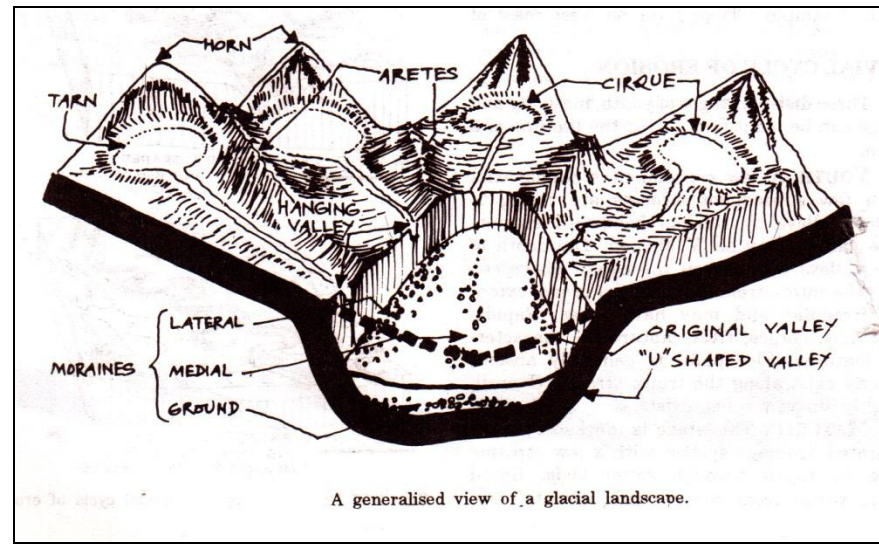
Glaciers are formal due to accumulation of ice above snow-line, under extreme cold climate

A glacier during its life time creates various land forms which may be classified into erosional & depositional land forms.

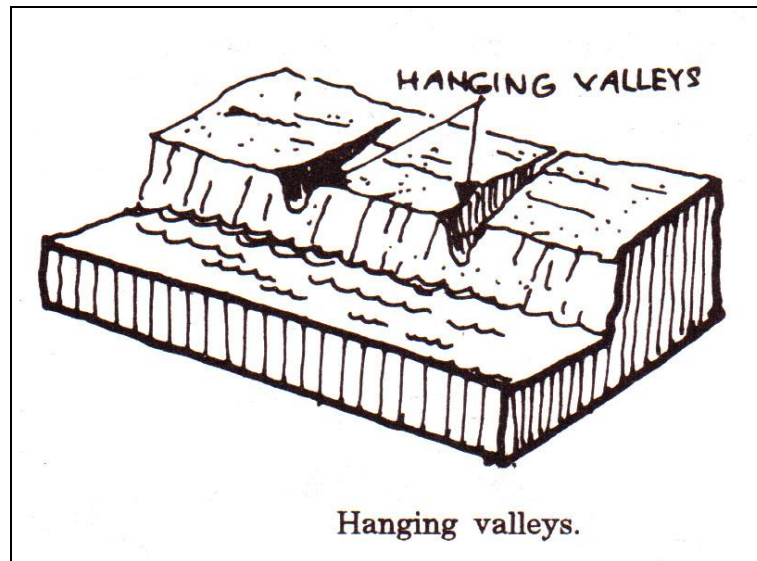
III. Erosional Landforms-

A glacier is supposed to erode the rocks, transport the eroded materials & deposit the eroded materials at suitable places like other agents of erosion & depositions.

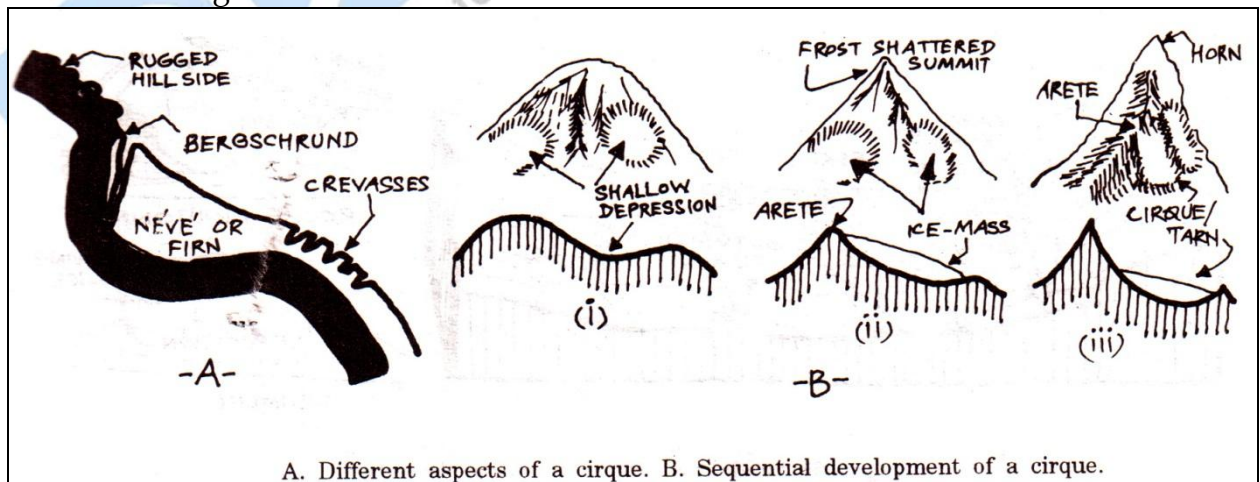
13. Cirque- The armchair-shaped or horse shoe-shaped, step, walled depressing represents a glaciated valley head.



14. **U-shaped valley**- is another typically glacial feature. Since glacial mass is heavy & show moving erosional activity is uniform horizontal as well as vertical. Steep sides & flat bottomed valley of 'U' shaped.
15. **Hanging Valley**- valleys of tributary glaciers which join the main glacial valleys of much greater depth are called hanging valleys.



16. **Horn**- A pyramidal or triangular faceted peak formed due to recession & intersection of three or more cirques is called horn.
17. **Tarn**- A rock basin is formed as a cirques basin due erosion consequent upon greater thickness of ice mass & its enormous pressure. After that it filled with water and make a small lake is called Tarn Lake.
18. **Arêtes**- is a steep sided, sharp-tipped summit with the glacial activity Arête cutting into it from two sides.



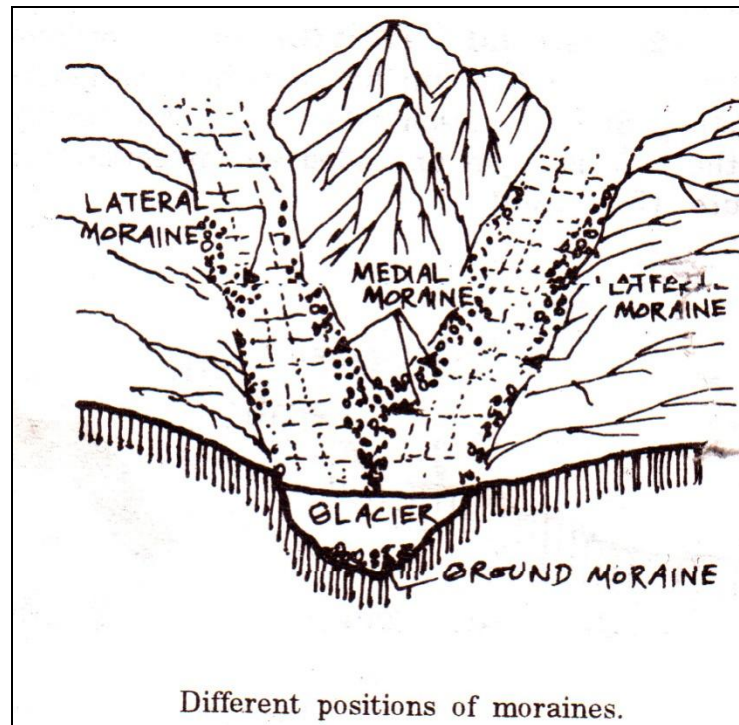
A. Different aspects of a cirque. B. Sequential development of a cirque.

19. **Col**- The crest line of arêtes & pyramidal places is called 'Col & Peak' topography. Example Mount Kailash in Tibet.
20. **Nunatak**- The higher peak & mounds surrounded by ice from all sides are called nunataks. They look like scattered small islands amid extensive ice masses.
21. **Crag & Tails**- A peculiar land forms having vertical eroded steep side up glacial side & tail like structure with lower weight called crag or tail.
22. **Sheep rocks or Roches Moutonees**- are a streamlined asymmetrical hillocks or hills having one side smoothly mounded with gentle slope & steeped & craggy lee side.
23. **Glacial Stairways**: - are very picturesque glaciated landforms. The length of each stair ranges from few meters to several kilometers. The advancing ice of fanciers covers out giant stairway through the process of abrasion & plucking in form of stairs.
24. **Fiords**- are formed as a steep sided narrow entrance like feature at the coast where the stream meets the coast.

II Depositional land forms-

They are formed due to setting down of glacial drift.

3. **Moraines**: - Moraines are ridge like depositional features of glacial tills. It may be in association with active ice or deposited by former & ice sheets.
It may be transported on the surface of the ice, within the ice or beneath the ice are in 4 categories:
 - b) Terminal,
 - b) Lateral moraines,
 - c) Medial moraines,
 - d) Ground moraine

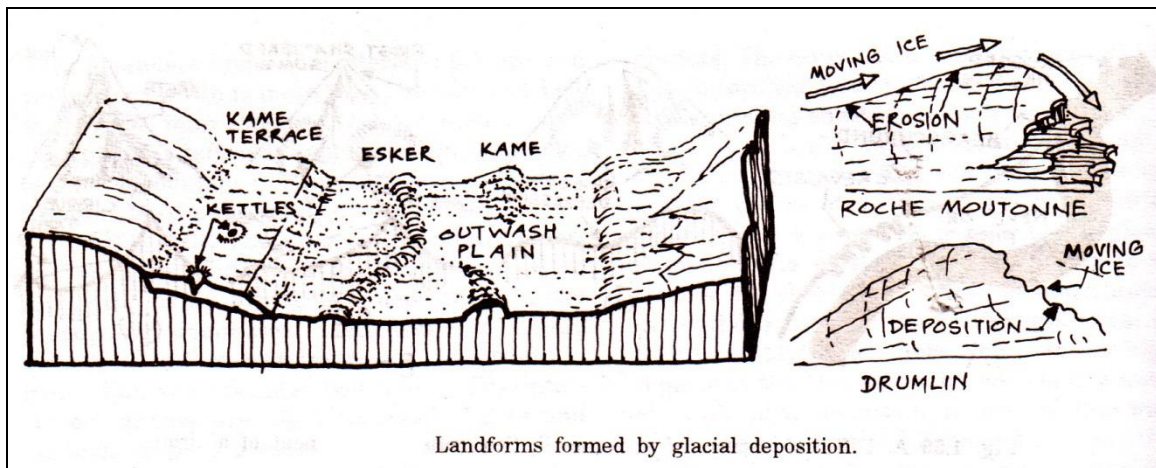


4. **Drumlin**- The swarms of rounded hummocks resulting from the deposition of glacial till are called draw lines. They look like an inverted boat or spoon.

IV. Glacio- Fluvial Deposits & land forms:

5. **Eskers**- are long, narrow & sinuous ridges of regular & are situated in the middle of ground moraines. The sides of eskers are very steep. Sometimes, a series of swellings are strung along the eskers at regular intervals. Each esker is called beaded eskers.
6. **Kames**- are small hills bedded sands & gravels which are deposited by melt water near or at the edge of set reacting ice sheets.
7. **Kettles & Hummock**- are depressions in the out wash plains kettles are formed due to melting of ice.

8. **Out Wash-** When the glacier reaches its lowest point & melts, it leaves behind a stratified deposition material consisting.



Que: Define the Arid Topography

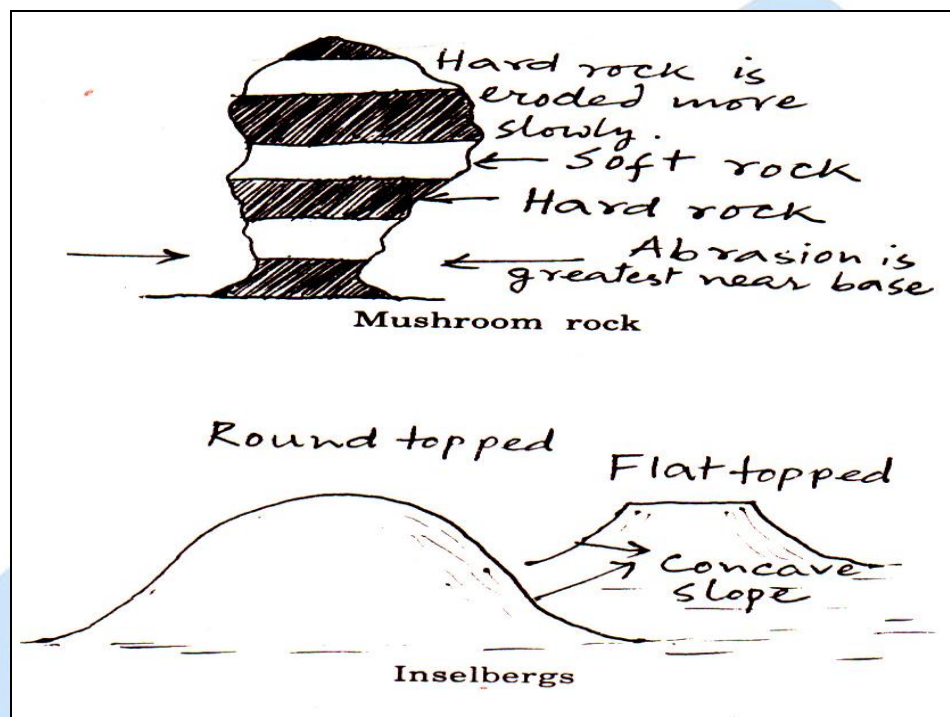
Ans: In the desert region, the wind is active in those areas & with the help of erosional & depositional work of sand, gabbles, dust, pebbles etc. various types of features are formed called arid topography.

Wind Erosion takes in 3 ways

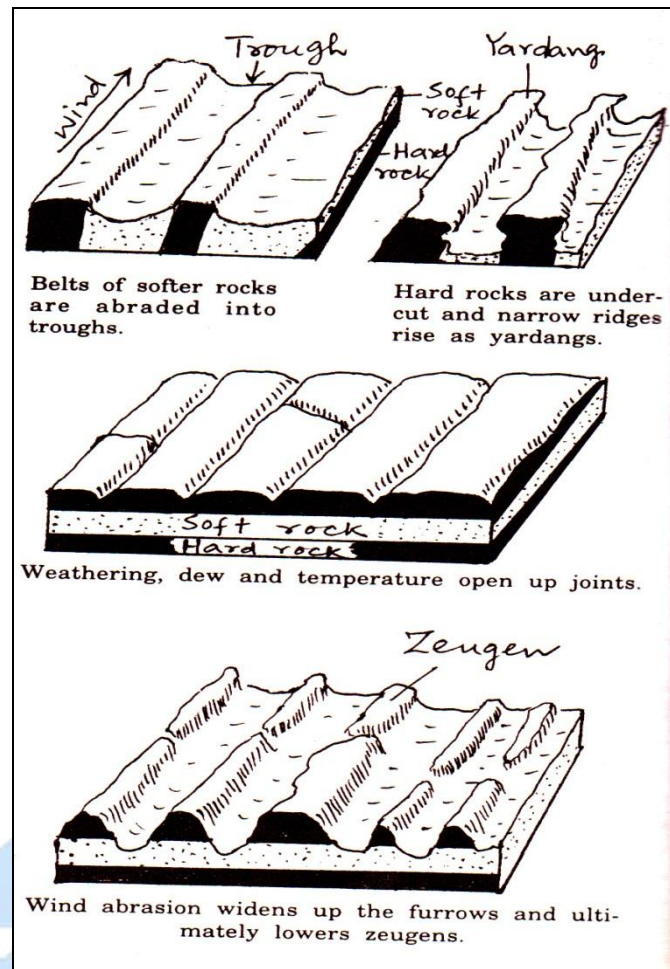
4. **Deflation**-Deflation is the lifting & rolling of loose particles of rock such as dust grains of sand & pebbles in the air.
5. **Abrasion**- Sand blast action using the entrained sand grains as tools against rock surfaces or either grains acting in a way similar to that of the artificial sand blast used in etching glass.
6. **Attrition**- The processes by which borne particle collide with one another & are reduced into millet seed sand.

III. **Erosional land forms:** -

9. **Deflation Basins**- Depression formed in the deserts due to removal of sands through the process of deflection are called deflation basis.
10. **InSelbergs**- Depression formed in the deserts due to removal of sends through the process of deflection are called deflation basis.
11. **Mushroom Rock**- The rocks having broad upper part & narrow base resembling an umbrella or mushroom are called mushroom rocks.



12. **Demoiselles**- These are rock pillars which stand as resistant rocks as a result of differential erosion of hard & soft rocks.
13. **Zeugen**- Rock masses of tabular form resembling a capped inkpot standing on softer rock pedestal of shale, mudstone etc. is called zeugen.



14. **Yardanges**- are steep sided deeply undercut over hanging rock ridges separated from one another by long grooms or relatively softer rocks.

15. **Dreikanter**- Faceted rock boulders, cobbles & pebbles abraded by long periods of wind erosion called ventifacts.

Dreikanter are formed when a ventifact is abraded on as many as three sides

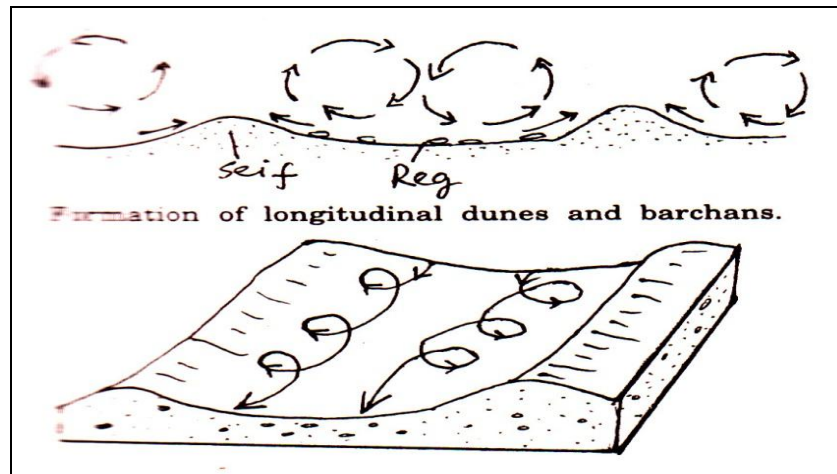
16. **Stone Lattice**- In deserts rocks made of varying compositions & existence are converted into pitted & fluted surfaces as powerful winds charged with rock particles remove weaker sections of rocks.

IV. **Depositional landforms:**

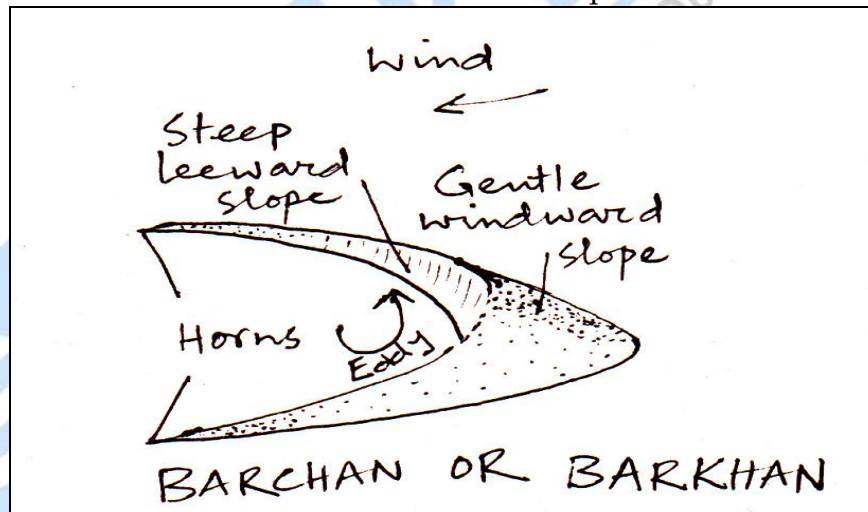
5. **Ripple Marks**- These are depositional features on a small scale formed by saltation.
6. **Sand Dunes**- Heaps or mounds of sands are generally called sand dunes. They are significant depositional feature of desert & also formed in all those areas where sand is available.

(Formation of sand dunes begins with the accumulation of sands in form of sand mounds due to obstructions (e.g. trees, bushes, grasses, rocks, hill etc.)

- iv) **Longitudinal dunes**- Sand dunes formed parallel to the wind direction are called longitudinal dunes. Windward slope is general & slope is steep.
- v) **Parabolic dunes**- are generally developed in partially stable sandy deserts. They are U-shaped.
- vi) **Transverse dunes**- Formed due to transverse to the direction of prevailing winds are called transverse winds. Phase is formed by in affective wind along the coast & margins of deserts.



7. **Barkhans-** Have a crescent slope with 2 horns. The windward side is convex whereas the leeward side is concave & steep.

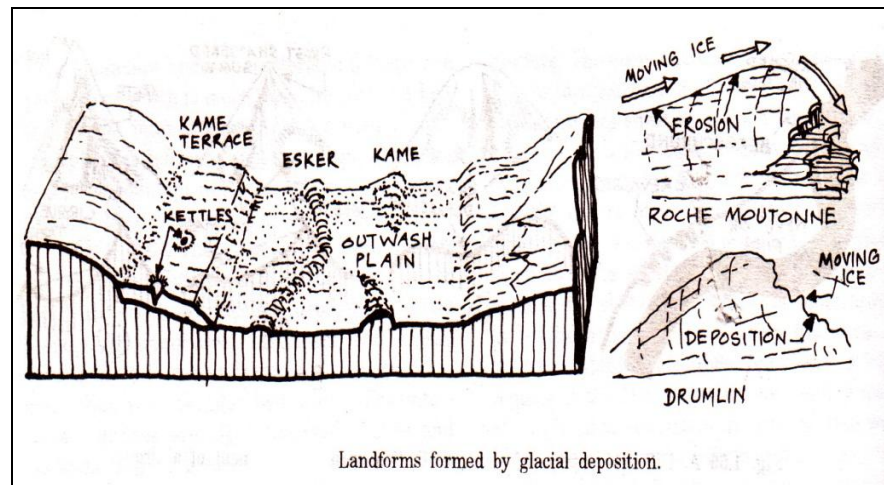


8. **Loess-** Loess is loose, stratified, non-indurate, buff-colored fine sediments which are deposited at places far from their source of origin.

III Fluvial Desert land forms-

5. **Bad Land Topography-** The ground surface becomes so uneven & corrugated due numerous gullies & ravines. Such types of landscape are called bad land topography.
6. **Pediments-** Suited between Mts. Front & bajada in intermountain basin are broad, extensive & gentle slope.

7. **Bajada**- Gentle sloping depositional plain between pediments & playa is called bajada.
8. **Playas**- The intermountain basins in arid or semi-arid areas are called playas.



Que : Explain the landforms formed by Fluvial ?

Ans: The land forms created as a result of degradation action (erosion) or depositions of running water are called fluvial land forms.

III. Erosional land forms-

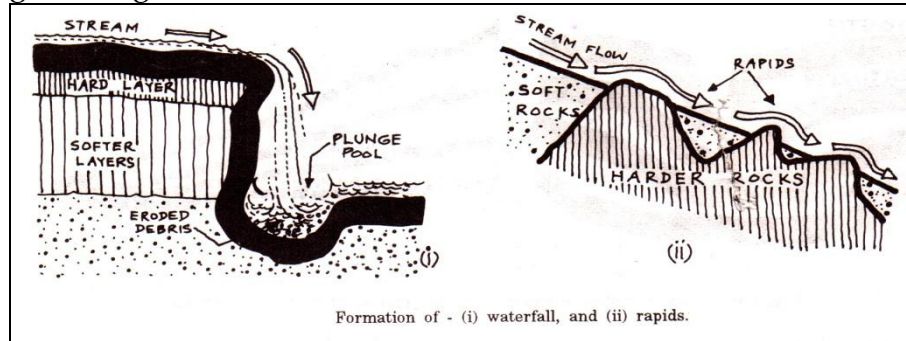
10. River Valley- The extended depression on ground through which a stream flows throughout its course is called river valley. At different stages of the erosional cycle the valley acquires different profiles. Resemblance to English letter V.

11. They are further transformed into very broad & shallow valley having concave side slope of very gentle are called 'V' shaped valley.

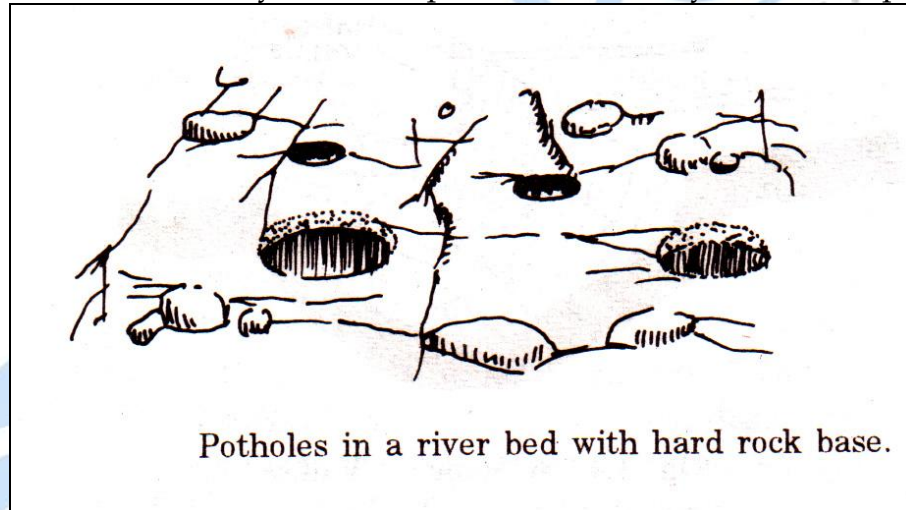
(iii) **Gorges-** Represent very deep & narrow valley having very steep valley side slopes say well like steep valley sides.

(ii) **Canyons-** are extended form of gorges. It represent very deep, narrow but long valley.

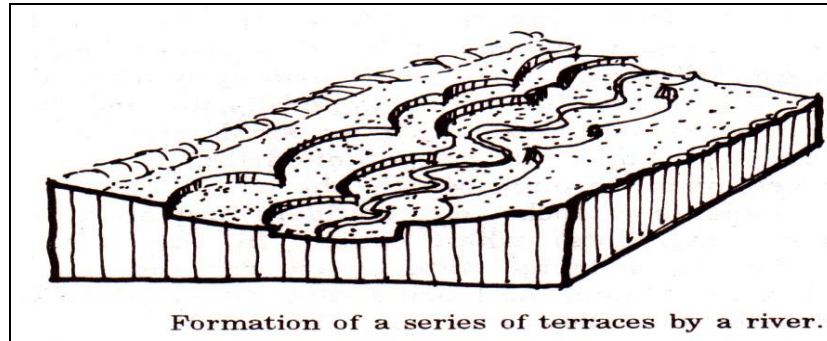
12. **Waterfalls**- Simply the fall of enormous volume of water from a great height.



13. **Pot holes**- The kettle like small depressions in the rocky beds of the river valley are called pot holes are in a cylindrical shape.



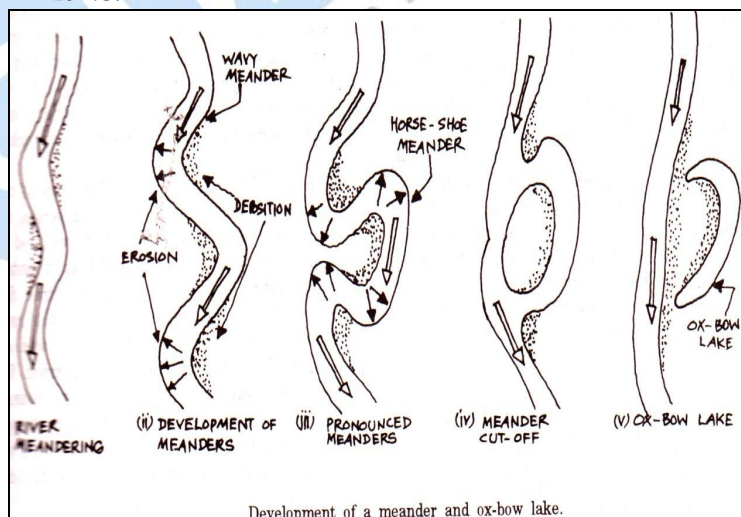
14. **Terraces**- Stepped benches along the river course in a flood plain are called terraces.



15. **Gullies**- It is formed when water from over land flows down a slope especially following heavy rainfall.

16. **Meanders**- are defined as pronounced curve or loop in the course of a river channel. The outer bend of loop is intensive erosion and vertical cliff heaving on cause slope.

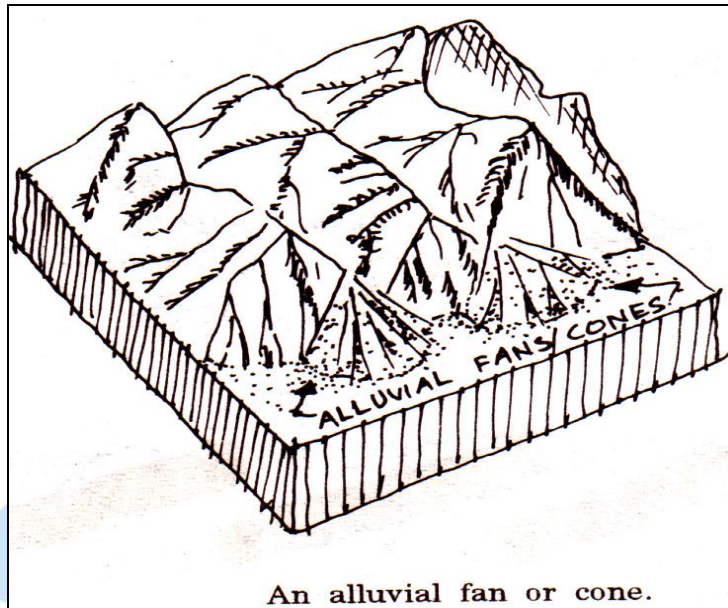
17. **Ox-Bow lake**- The lakes formed due to impounding of water in the abandoned meander loops due to erosion are called ox-bow Lake.



18. **Peni-plane**-Represents low featureless plain having undulating surface.

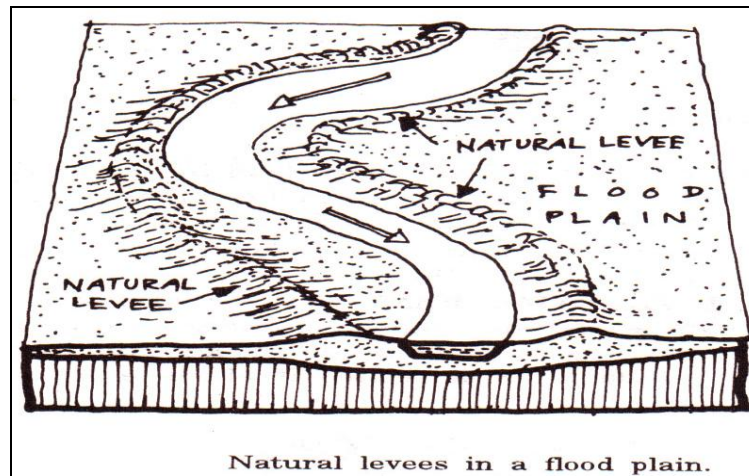
IV. **Depositional landforms-**

4. **Alluvial forms & Cones**- When the heavily laden stream reaches the plain its velocity is checked, it widens & much of its load is deposited. That deposited sediments spread out forming alluvial form.



An alluvial fan or cone.

5. **Natural Levees**- These are narrow ridges of low heights on both sides of river built by deposition of sediments during flood period.



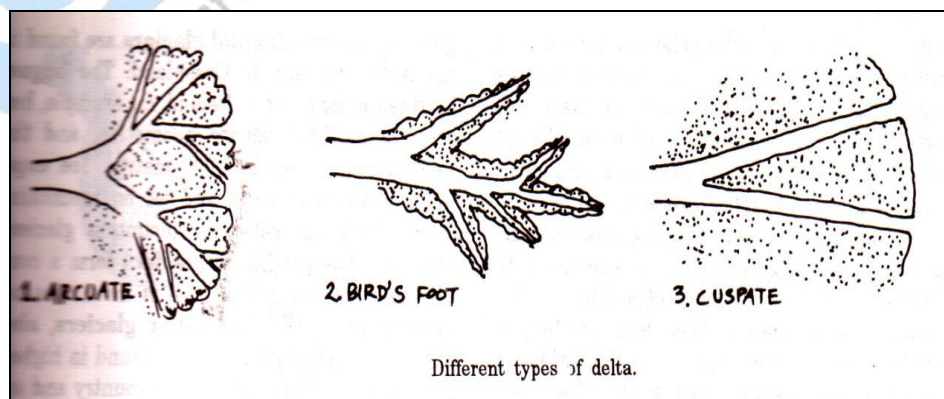
6. **Delta**- is a tract of alluvium usually fan shaped, at the mouth of a river where it deposit more material then can be carried away. So the river cans 2 or more channels.

Types of delta-

- e) **Fan shaped**- This type of delta results when light depositions give rise to shallow, shifting distributaries & a general fan shaped profile e.g. Nile.

- f) **Birds Foot delta**-

This type of delta emerges when the lines tones sediment deposits do not allow downward seepage of water resembling the shape of foot of a bird. Examples Mississippi delta.



- g) **Estuaries**- The deltas formed due to falling of estuaries of rivers called estuaries deltas. These are sub merged under marine water & sea waves remove the sediments brought by rivers.
- h) **Cuspate**- This is a pointed delta formed generally along straight coasts & is subjected to strong wave action. Example Tiber River of western Coast of Italy.



Multiple Choice Questions

Set 1

1. The study of Universe on grand scale is called _____
 - a. **Universe**
 - b. Earth
 - c. Galaxy
 - d. Milky Way
2. What form does the Milky Way Galaxy has
 - a. **Spiral**
 - b. Ellipitical
 - c. Irregular
 - d. Barbed
3. If Sun dies it will be transfromed into a _____
 - a. White dwarf
 - b. **Black dwarf**
 - c. Quasar
 - d. All of the above
4. The most important constituent of the Sun's mass is ____
 - a. Hydrogen
 - b. Helium
 - c. Silicon
 - d. Iron
 - i) **1 and 2**
 - ii) 2 and 3
 - iii) 3 and 4
 - iv) 1,2 and 3
5. Which of the following not a plant of a Sun
 - a. Murcury
 - b. Mars
 - c. **Sirius**
 - d. Earth
6. Name the biggest Planet of the Sun

- a. Earth
 - b. Saturn
 - c. Jupiter**
 - d. Mars
7. Which planet is approximately thirty times farther from the Sun than Earth is?
- a. Saturn
 - b. Uranus
 - c. Neptune**
 - d. Jupiter
8. Which planet takes more time to complete one rotation on its axis than to complete one revolution around the Sun?
- a. Mercury
 - b. Venus**
 - c. Mars
 - d. Jupiter
9. Energy is transferred from the Sun to Earth mainly by
- a. molecular collisions
 - b. density currents
 - c. electromagnetic waves**
 - d. red shifts
10. Which planet has an orbit with an eccentricity most similar to the eccentricity of the Moon's orbit around Earth?
- a. Earth
 - b. Jupiter
 - c. Pluto
 - d. Saturn**

Set 2

1. When the Earth is at its maximum distance from the Sun it is called
- a. Aphelion
 - b. Perihelion**
 - c. Equinox
 - d. Sidereal
2. The direction of the rotation of the Earth on its axis is
- a. North to South

- b. West to East**
 - c. South to North
 - d. East to West
- 3. Earth can be best describe as a
 - a. Geoid**
 - b. Circle
 - c. Sphere
 - d. Oblate sphere
- 4. What is the total number of degrees that the earth rotates on its axis during a 12 hrs period?
 - a. 360°
 - b. 90°
 - c. 180°**
 - d. 15°
- 5. Seasonal changes on the Earth 's surface are caused by
 - a. Earth's rotation
 - b. Earth's revolution**
 - c. Earth's rotation and inclination of its axis.
 - d. Earth's revolution and inclination of its axis.
- 6. If the earth's axis had no inclination there would have been the absence of:
 - a. High tides
 - b. Neap tides
 - c. Deflection of wind direction
 - d. Changes in the duration of day and night.**
- 7. Which planet has the largest number of satellites?
 - a. Jupiter
 - b. Uranus
 - c. Neptune
 - d. Saturn**
- 8. The age of the Earth is about:
 - a. 1.8 billion years
 - b. 2250 million years
 - c. 4.5 billion years**
 - d. 1950 million years
- 9. All the planets revolve around the Sun in an elliptical orbit in the _____ direction.
 - a. Clockwise**

- b. Anticlockwise
 - c. Same
 - d. Variable
10. Beyond ____ the sun is never overhead at any time of the year.
- a. 40° N and S
 - b. $23\frac{1}{2}^{\circ}$ N and S**
 - c. $66\frac{1}{2}^{\circ}$ N and S
 - d. 25° N and S

Set 3

1. The first person to say that the earth is a Sphere was
 - a. Galilio
 - b. Archimedes
 - c. Eratosthenese
 - d. Copernicus**
 2. The Asteroidal belt lies between
 - a. Jupiter and Mars**
 - b. Earth and Mars
 - c. Uranus and Neptune
 - d. Mercury and Venus
 3. Match the following theories of the origin of the Earth and their proponents.

1. Nebular Hypotheses	A. Kant
2. Protoplanet	B. Von Wilsacker
3. Planetesimal theory	C. Chamberlin
4. Binary Star theory	D. Russell and Littleton.
- 1) 1A,2B,3C,4D**
2) 1C,2D,3A,4D
3) 1D,2C,3B,4D
4) 1D,2A,3B,4C
5. The name of the layer of the Earth that separates the crust from the core is the ____?
- a) Magma

- b) Lithosphere
- c) Asthenosphere

d) Mantle

6. What powers the Earth's internal heat engine?

- a. Radioactivity**
- b. solar energy
- c. volcanoes
- d. ocean tides

7. The crust of the Earth is static and stable.

- a. True
- b. False**

8. The terms **crust** and **lithosphere** are synonymous

- a. True
- b. False**

9. The lithosphere is approximately _____ kilometers thick.

- a. 50-100**
- b. 1-5
- c. 20-40
- d. 10-25

10. Continental Drift Theory was given by

- a. Wegner**
- b. Holmes
- c. Daley
- d. Davis

Set 4

1) Granite is a-

- (a) Igneous Rock**
- (b) Sedimentary Rock
- (c) Metamorphic Rock
- (d) Glacial Rock.

2) Convection Current theory of mountain building was given by-

- a) Hall
- b) Haug
- c) Holmes**

- d) Kober
- 3) The density of the earth as a whole is
 - a) **Granitic Rock**
 - b) Sedimentary Rock
 - c) Metamorphic Rock
 - d) Basaltic Rock.
- 4) The basic difference between oceanic and continental crust is in its
 - a) Asthenosphere
 - b) Hydrosphere
 - c) Oceanic block
 - d) **Lithosphere**
- 5) The main cause of faulting is___
 - a) **Tension**
 - b) Wind
 - c) Tidal activity
 - d) Glacial Rock.
- 6) Epeirogenic movement gives rise to
 - a) Folded mountains
 - b) **shields**
 - c) plains
 - d) none of these
- 7) Richter's scale is used for measuring the
 - a) Relative humidity of the atmosphere
 - b) Electric conductivity of water
 - c) **Magnitude of the earthquake**
 - d) Speed of winds
- 8) Surface waves in an earthquake are:
 - a) S- waves
 - b) **L-waves**
 - c) P-waves
 - d) P & S waves

9) The lake formed by volcanicity is called:-

- a) **Caldera**
- b) Meander
- c) Lagoon
- d) Tarn

10) Bay's Ballot's law is related to

- a) **Air Pressure**
- b) Speed of Air
- c) Direction of Air
- d) Temperature Air.

Set 5

1. The term 'Isostasy' was coined by:

- a) George Airy
- b) **C.E. Dutton**
- c) J.H. Pratt
- d) A.Holms

2. Median deep is associated with

- a) **Kober**
- b) C.E. Dutton
- c) Pratt
- d) A.Holms

3. Palaeomagnetic evidences best support

- a. Isostasy
- b. **Continental drift**
- c. Kober's Theory
- d. Holms theory

4. The main cause of Tsunami is

- a. Volcanoes
- b. Cyclone
- c. **Earthquake on sea floors**

5. Fujiyama Volcano is-
- d. Moon's attraction
 - a. Dormant Volcano
 - b. Active Volcano**
 - c. Extinct Volcano
 - d. None of these
6. Coronosphere is related to:
- a. Jupiter
 - b. Venus
 - c. Sun**
 - d. Moon
7. A 'rift valley' is formed by:
- a. Faulting activity**
 - b. Folding activity
 - c. Wind erosion
 - d. Water erosion
8. Thermal Contraction Theory of Jeffrey explains
- (a) About the mountain building**
 - (b) Ocean currents
 - (c) Desert landscape
 - (d) Formation of clouds
9. A geyser can be called
- a. A faulting spring
 - b. An artesian well
 - c. A hot water spring**
 - d. A mineral spring
10. Magma is
- a. Liquid form
 - b. Gas form
 - c. Solid form
 - d. A combination of liquid , solid, gas**

Set 6

1. Which of the following is NOT an aspect of volcanicity?
 - a. Geyser
 - b. Batholith
 - c. Dyke
 - d. **Fold**

2. Batholith is:
 - a. **an intrusive volcanic feature**
 - b. an extensive volcanic feature
 - c. a volcanic plug
 - d. a caldera

3. Physical weathering takes place in region with
 - a. Dry climate
 - b. Wet climate
 - c. **Diurnal temperature changes of greater range.**
 - d. Annual temperature fluctuation.

4. Which of the following do NOT belong to mechanical weathering
 - a. Burrowing animals
 - b. Ice wedging
 - c. **Sheeting**
 - d. Salt accumulation into cracks by sea water

5. Chemical weathering is more effective than mechanical weathering in
 - a. Semi arid region
 - b. Arid region
 - c. Coastal region
 - d. **Cool temperature**

6. Which of the following is a concordant feature
 - a. Laccolith
 - b. Phacolith
 - c. Bismuth

d. Batholith

7. The convection current in the earth are generated in

- a. The mantle
- b. Asthenosphere
- c. Mantle plume

d. All of the above

8. Who propounded the 'Normal cycle of erosion '.

a. W. M. Davis

- b. Penk
- c. Holmes
- d. Daley

9. Penck's name for the cycle product is

- a. Primarumpf
- b. Endrumpf**
- c. Haldenhang
- d. Endslope

10. The speed of a river decreases when it enters

- b. A lake
- c. A sea
- d. A flat or gently sloping plane
- e. All of the above**

Set 7

1. Formation of an Oxbow lake is related to:-
 - a) Corals
 - b) Glaciers
 - c) Wind
 - d) Water.**
2. The feature not related to winds is:-
 - a) Inselberg
 - b) Mushroom rock
 - c) Lapies**
 - d) Zeugen
3. "George" topography is related with
 - (a) Glacier
 - (b) Underground water
 - (c) Wind
 - (d) Running water.**
4. Maximum velocity of the occurs at
 - a. Upper part of the river**
 - b. Middel part of the river
 - c. Lower part of the river
 - d. It is difficult to say
5. A waterfall provides an ideal site for
 - a) Plunge pool
 - b) Artificial lakes
 - c) Producing hydroelectricity**
 - d) Tourism
6. The landforms which are different from the others with the mode of origin are:
 - a) Alluvial Fan
 - b) Delta
 - c) Natural Levees
 - d) Water fall**
7. The feature related to glacier is:
 - (a) Yardangs
 - (b) Cirque**
 - (c) Lapies

- (d) Gorge
8. 'Pot holes' are formed by:-
- (a) Wind
 - (b) Glacier
 - (c) **Rivers**
 - (d) Waves
9. Ox-Bow lake is the result of:
- (a) Glacial erosion
 - (b) River erosion
 - (c) Wind erosion
 - (d) Coastal erosion
10. Alluvial fans are formed
- a. Along the shore
 - b. **In the foothill region**
 - c. Of silt accumulation
 - d. At meanders intersection

Set 8

1. Brahmaputra river is an example of ____ river
- a) Subsequent
 - b) Obsequent
 - c) **Antecedent**
 - d) Superimposed
2. "Landscape is a function of structure, process and stage"
- This statement is given by
- a. J. Hutten
 - b. Penk
 - c. **Davis**
 - d. Playfair
2. Moraine are the feature related with
- a. River

- b. Wind
 - c. Waves
 - d. Glaciers**
3. U- Shaped valley is related with ____
- a. River
 - b. Wind
 - c. Underground water
 - d. Glaciers**
4. Dreikanter is a topography related to ____
- a. Wind**
 - b. River
 - c. Water
 - d. Waves
5. Cliff is the landforms associated with
- a. Waves**
 - b. Running water
 - c. Water
 - d. Underground water
6. Blind valley is the example of ____
- a. Wind
 - b. Karst**
 - c. Running water
 - d. Waves
7. Ganga river delta is a example of
- a. Arcuate delta**
 - b. Bird foot delta
 - c. Estuarine delta
 - d. Misfit delta
8. Water percolation from a fracture in the roof may form a thin , vertical sheet of rock called a ____
- a. Stalacite
 - b. Stalagmite
 - c. Dripstone
 - d. Drip curtain**
9. Two or more dolines join up to give a large opening is known as
- a. Polje

- b. **Uvala**
 - c. Grikes
 - d. Swallow holes
10. The crescent shaped dune is also called
- a. Transverse dune
 - b. **Barchan**
 - c. Longitudinal dune
 - d. Oblique dune



Key Words

Planet – A heavenly body that is not a meteor, comet or artificial satellite, which revolves around a star or sun.

1. **Satellite**- A natural or artificial celestial body constrained by Gravitation and moving in Orbit around another more massive heavenly body.
2. **Comet**- A celestial body consisting of a gaseous cloud enveloping a bright nucleus, moving around the sun in an elliptical orbit. When it comes nearer to the sun, the pressure of the sun's Radiation forces the gas of a comet into a tail, pointing away from the sun.
3. **Meteorite**- A solid extra terrestrial body which reaches the earth's surface typically formed of Metals (iron-nickel) or silicates or a combination of both described as stony iron or iron according to composition.
4. **Meteoric dust**- The dust in the atmosphere derived from disintegrating meteors and trapped in the Earth's gravitational field.
5. **Meridian**- Terrestrial, one of the lines of longitude which link the North Pole to the South Pole and cut the equator at right angle.
6. **Latitude**- The angular distance of any point on the Earth's surface north or South of the Equator, as measured from the Centre of the Earth, in degrees, minutes and seconds.
7. **Laurasia**- The northern part of the great Precambrian land masses, Pangaea.
8. **Pangaea**- The name given by A- Wegener in his theory of continental Drift to a great land mass, the supercontinent of Precambrian times, probably split in two parts, Gondwana land in the south being separated by a vast ocean.
9. **Longitude**- The angular distance between the Meridian passing through a given point and the prime, standard, initial and Zero meridian. This angular distance, i.e. longitude is measured in degrees, minutes and seconds east or west of the Greenwich meridian (0°) to 180°, east and west.
10. **International date line**- An imaginary line agreed internationally which follows the meridian of 180°, with some deviations to accommodate certain land areas. In crossing the line from West to East a whole day is lost.

11. **Galaxy**- One of the great number of systems in the Universe, consisting of stars, nebular and interstellar particles etc. and classified by shape (ellipsoidal, elliptical, spheroid, spherical, spiral). The earth lies in a spiral galaxy, the Milky Way.
12. **Geography**- The study the deals with the material and human phenomena in the space accessible to human beings and their instruments, especially the pattern of, and variation in their distribution in that space, on all scales, in the past or present.
13. **Corrosion**- The wearing a way of rocks by chemical action. This covers a wide variety of processes, including solution, hydration and oxidation.
14. **Coriolis force**- The effect of the force produced by the earth's rotation on a body moving on its surface. The body is deflected to the right of the path of movement in the northern hemisphere, to the left in the southern.
15. **Epeirogenesis**- Pertaining to the formation of continents, applied to the type of mass earth movements which result in changes of level over large areas.
16. **Or genesis**- Tectonic activity and mountain building.
17. **Orbit**- The closed course of a heavenly body, especially the closed path of a planet around the sun.
18. **Eclipse**- The passage of all or part of a celestial body into the shadow of another.
19. **Solar ellipse**- Occurs when the new moon passes exactly between the sun and the earth, casting a shadow on the earth.
20. **Lunar eclipse**- Occurs when the earth passes exactly between the sun and the full moon.
21. **Buy's Ballot's law**- A law postulated by the Dutch metrologies Christophe Buys Ballot in 1857, which states that if an observer in the N-hemisphere stands
22. **Gutenberg Discontinuity**- The discontinuity occurring between the lower surface area of the Mantle and the core of the earth.

23. **Geosynclines**- a very large linear depression or syncline or down warping of the Earth's crust, filled with a deep layer of sediments derived from the land masses on each side and deposited on the floor.
24. **Glacier**- Originally a river of ice moving down a valley.
25. **Geostrophic wind**- The concept of a wind blowing parallel to the isobars as a result of the force exerted by the horizontal atmospheric pressure gradient in one direction a balanced by the deflection of the coriolis force in the opposite direction.
26. **Epicentre**- The point on the Earth's surface immediately above the seismic focus or origin of an earthquake.
27. **Fluvial**- Relating to a river the term fluvial is usually applied to aspects of stream flow and corrosion by the stream.
28. **Barchans**- A crescent shaped sand dune, the leeward slope is relatively steep and windward slope gentle.
29. **Aphelion**- that point farthest from the sun in the orbit of a planet. The earth arrives at aphelion on 4 July, when it is some 152 km distant from the sun.
30. **Perihelion**- the point nearest to the sun in the orbit of comet or planet around it. The earth arrives at its perihelion about 3 January, when it is some 147.3 km from the sun.
31. **Perigee** - The point in the orbit of any of the earth's planets or satellites when it is nearest to the earth.
32. **Paternoster lakes** - lakes in a glaciated valley caused by the damming action of moronic ridges.
33. **Weathering**- In geology the mechanical or physical, chemical and biological processes by which rocks are decomposed or disintegrated by exposure at or near the earth's surface.
34. **Volcano**- A right or vent in the earth's crust through which molten material is erupted and solidifies on the surface as lava.

Climatology

1. **Air mass**- One of the large bodies of air that moves around the world.
2. **Climatologist**- A Scientist who studies climates and how they change over a long time.
3. **Weather**- A general term for the conditions prevailing in the atmosphere, especially in the layer near the ground over a short period of time, at any one place and as affecting human beings.
4. **Climate**- The average weather conditions and variations in these conditions in both space and time over a large area. Weather conditions over a specific length of time, usually a period of at least 30 years are taken into consideration.
5. **Condensation**- When a gas or vapor is changed into a liquid by cooling.
6. **Isobars**- These are lines which are drawn on weather maps. They link together points on the maps which have the same air pressure.
7. **Cyclone**- An area of low air pressure winds spiral in towards its centre.
8. **Barameter**- An instrument used to measure air pressure.
9. **Air Pressure**- The pressure caused by the weight of air above the earth pushing down on its surface. Air pressure is measured in bars or in millibars (1 bar = 1000 millibars)
10. **Anticyclone**- An area of high air pressure. Light winds spiral outwards from its centre.
11. **Chloro fluoro (CFCs)**- Gases used by people in things such as spray cans and refrigerators. They damage the ozone layer.
12. **Evaporation**- What happens when a liquid, such as water, is changed into a gas, by heat.
13. **Natural Gas**- A gas found naturally near underground oil. It is used as a fuel. When natural gas burns it gives out carbon dioxide.
14. **Occluded front**- An occluded front forms when a warm air mass is caught between two cooler air masses and pushed above them.

15. **Ozone**- A pale blue gas with a sharp smell. It is found naturally in the Earth's upper atmosphere. Ozone filters out dangerous ultra violet rays sent out by the sun.
16. **Poles**- The two points (north and south) which mark the end of the line around which the Earth turns.
17. **Sun spot**- A dark patch seen on the surface of the sun. Sunspots last only a few weeks or months, and tend to appear in bursts of activity every eleven years.
18. **Temperature**- The amount of hotness or coldness of something. Temperature is usually measured in degrees Celsius with a thermometer.
19. **Ultraviolet rays**- Invisible rays which occur in sunlight. Ultraviolet rays can cause sunburn in lot clear weather.
20. **Front**- The boundary on the ground between two air masses of different temperatures. Rain and clouds often gather along a front.
21. **Wind**- air in motion usually restricted to natural horizontal movement, varying in strength from light to hurricane.
22. **Westerlies**- Winds which blow frequently from the subtropical high pressure area to the temperate low pressure area, between 35°N and 65°S & 65°S.
23. **Typhoon**- A violent tropical Revolving storm in the China Sea and adjacent regions, commonly occurring in the period from July to October.
24. **Tropopause**- A zone of the atmosphere consisting of several, over lapping levels, separating the Troposphere from the stratosphere.
25. **Thermometer**- An instrument used to measured temperature on any temperature scale.

Oceanography

1. **Ocean**- The body of salt water which covers 70.78% of the Earth's surface.
2. **Ocean Crust**- That part of the crust of the earth which lies under the floor of the Ocean Basins.
3. **Monsoon**- A large scale seasonal reversal of winds pressure and rainfall in the tropics.
4. **Wave**- in a body of water, particularly in the Ocean, the rise and fall in the forward movement in the surface area of the water, due to the oscillation of water particles.
5. **Current**- The permanent of seasonal flow of water in a defined direction in the surface water of an Ocean, e.g. the North Atlantic Drift, Labrador Current.
6. **Continental Shelf**- the gently sloping part of a continent that lies submerged below the sea.
7. **Continental Slope**- The marked slope, commonly with an angle between 2° & 5° , lying between the edge of the continental shelf and the deep Ocean floor.
8. **Cliff**- A very steep or vertical rock face.
9. **Base level**- The lowest level to which a running stream can erode its bed under stable conditions of the earth's crust.
10. **Atoll**- A circular or horse shoe shaped coral reef, the crust lying at a low height above sea level.
11. **Abyssal Zone**- The deepest regions of the Ocean, depth not precisely defined.
12. **Geyser**- A periodic jet of hot water and steam that is ejected under pressure from a vent in the earth's crust.
13. **Tombolo**- A bar connecting two head lands and islands is called tombolo, which acts as a bridge between the coast and an island.
14. **Hooks**- The spits when bent by powerful sea waves, assume the shape of a hook.

15. **Beaches**- Temporary or short lived deposits of marine sediments consisting of sands, shingles, cobbles, pebbles etc. on the sea shores are called beaches.
16. **Streams**- Ocean streams involve moments of enormous volume of Ocean water like big rivers of the continents in a definite direction with greater velocity.
17. **Corals**- The living organisms of the category of marine animals and related to jelly fish, which are responsible for building coral reefs, are called corals.
18. **Faros**- Faros are chains of small atolls having shallow small lagoons.
19. **Boat Channel**- The lagoon formed between the fringing reef and the lagoon is called boat channel which is long but narrow in width.
20. **Mari culture**- Mari culture, also known as marine farming or marine culture.
21. **Centrifugal force**- Is the force that works outward on a body rotating about an axis.
22. **Tides**- The rise and fall of sea level caused by the gravitational attractions of the moon and the sun are called tides.
23. **Ebb**- The fall of sea water and its movement away from the coast, i.e. toward the sea, is called ebb.
24. **Neap tide**- the tide which has lower tidal range than the normal tidal range is called neap tide.
25. **Quadrature**- The position of the sun, the earth and the moon in right angle is called quadrature.

M.A./M.Sc. (PREVIOUS) EXAMINATION, 2011

GEOGRAPHY

Second Paper

(Physical Basis of Geography)

(भूगोल का भौतिक आधार)

Time allowed: Three hours

Maximum

Marks: 100

किसी भी परीक्षार्थी को पूरक उत्तरपुस्तिका नहीं दी जावेगी। अतः परीक्षार्थियों को चाहिये कि वे मुख्य उत्तर पुस्तिका में ही समस्त प्रश्नों के उत्तर लिखें।

किसी भी एक प्रश्न के अन्तर्गत पूछे गए विभिन्न प्रश्नों के उत्तर उत्तर-पुस्तिका में अलग-अलग स्थानों पर हल करने के बजाय एक ही स्थान पर हल करें।

प्रत्येक खण्ड से कम से कम एक प्रश्न का चयन करते हुये, कुल पाँच प्रश्नों के उत्तर दीजिये। सभी प्रश्नों के अंक समान हैं।

Section-A (खण्ड-अ)

1. Critically analyse either the Continental Drift Theory of Wegener or Convectional Current Theory of Arthur Holms on the origin of folded mountains. 20

वलित पर्वतों की उत्पत्ति के संबंध में वैगनर के महाद्वीपीय विस्थापन सिद्धान्त अथवा आर्थर होम्स के सवहन तरंग सिद्धान्त की आलोचनात्मक समीक्षा कीजिए।

2. Discuss the mechanism of geomorphic processes either of arid or glacial regions and describe the resultant landforms.

10+10

शुष्क अथवा हिमानी प्रदेशों में क्रियाशील भ्वाकृतिक प्रक्रमों की क्रियाविधि की विवेचना कीजिए तथा उनमें उत्पन्न स्थलरूपों का वर्णन कीजिए।

3. Explain any two of the following-

10+10

- (i) Thermal state of earth interior
- (ii) Davis and Penck's view on the cycle of erosion
- (iii) Physical weathering.

निम्न में से किन्हीं दो को समझाइये-

- (i) पृथ्वी की अन्तःतापीय अवस्था
- (ii) अपरदन चक्र पर डेविस तथा पैक के विचार
- (iii) भौतिक अपक्षय

Section-B (खण्ड-ब)

4. Divide earth's atmosphere into different layers and discuss in detail the characteristics of each layer.

10+10

पृथ्वी के वायुमण्डल को विभिन्न परतों में विभाजित कीजिए तथा प्रत्येक परत की प्रमुख विशेषताओं की विस्तृत विवेचना कीजिए

5. Discuss the Thornthwaite's system of Climatic Classification of the world and evaluate its merits and demerits.

15+5

विश्व जलवायु वर्गीकरण संबंधी थॉर्नथ्वेट प्रणाली की विवेचना कीजिए तथा उसके गुण व दोषों का मूल्यांकन कीजिए।

6. Write short notes on any two of the following-

10+10

- (a) Thunderstorm
- (b) Tropical cyclone
- (c) Isolation.

निम्न में से किन्हीं दो पर संक्षिप्त टिप्पणियाँ लिखिये—

- (i) झंझावात
- (ii) डण्णकटिबन्धीय चक्रवात
- (iii) सूर्यताप

Section-C (खण्ड-स)

7. Describe the bottom relief of Atlantic Ocean.

20

अन्य महासागर के तलीय उच्चावचों का वर्णन कीजिए।

8. What are ocean deposits? Classify ocean deposits and provide a brief account of the ocean deposits of Indian Ocean.

5+5+10

महासागरीय निक्षेप क्या है? महासागरीय निक्षेपों का वर्गीकरण कीजिए तथा हिन्द महासागर के सागरीय निक्षेपों का संक्षिप्त विवरण प्रस्तुत कीजिए।

9. Explain the following-

10+10=20

- (i) Marine biotic resource
- (ii) Oceanic water circulation

निम्न को समझाइये—

- (i) महासागरीय जैविक संसाधन

(ii) महासागरीय जल का परिसंचरण



M.A./M.Sc. (PREVIOUS) EXAMINATION, 2012
GEOGRAPHY
Second Paper
(Physical Basis of Geography)

Time allowed: Three hours

Maximum

Marks: 100

किसी भी परीक्षार्थी को पूरक उत्तर पुस्तिका नहीं दी जावेगी। अतः परीक्षार्थियों को चाहिये कि वे मुख्य उत्तर पुस्तिका में ही समस्त प्रश्नों के उत्तर लिखें। किसी भी एक प्रश्न के अन्तर्गत पूछे गए विभिन्न प्रश्नों के उत्तर उत्तर-पुस्तिका में अलग-अलग स्थानों पर हल करने के बजाय एक ही स्थान पर हल करें। प्रत्येक खण्ड में कम से कम एक प्रश्न का चयन करते हुए, कुल पाँच प्रश्नों के उत्तर दीजिये। सभी प्रश्न प्रश्नों के अंक समान हैं।

Section-A (खण्ड-अ)

1. Define Isostasy. Discuss the views of Airy and Pratt on Isostasy.
संतुलन को परिभाषित कीजिये। संतुलन के सिद्धान्त से संबंधित एयरी तथा प्राट के विचारों का विवेचन कीजिये।
2. Discuss the thermal state of the earth's interior and its zoning.
पृथ्वी के आंतरिक भाग की तापीय स्थिति एवं उसके मण्डलन (zoning) की व्याख्या कीजिये।
3. Critically examine the views of Arthur Holmes and Wegener on the origin of folded mountains.
वलित पर्वतों की उत्पत्ति के संबंधी में आर्थर होम्स एवं वेगनर के विचारों का आलोचनात्मक परीक्षण कीजिये।

Section-B (खण्ड-ब)

4. Discuss the 'Polar Front Theory' of the origin of Temperate Cyclones and describe their main characteristic.
शीतोष्ण, कटिबन्धीय चक्रवातों की उत्पत्ति संबंध 'ध्रुवीय वाताग्र सिद्धान्त' की विवेचना कीजिये तथा शीतोष्ण कटिबन्धीय चक्रवातों की प्रमुख विशेषताओं का वर्णन कीजिये।
5. Provide a detailed account of the planetary wind system.
सनातनी पवन प्रणाली का विस्तृत विवरण प्रस्तुत कीजिये।
6. Discuss in detail Koppen's system of world climatic classification.
कोपन द्वारा प्रदत्त विश्व के जलवायु वर्गीकरण प्रणाली की विस्तृत विवेचना कीजिये।

Section-C (खण्ड-स)

7. Explain oceanic water circulation system. Provide a detailed account of the currents of Atlantic Ocean.
महासागरीय जल परिसंचरण तंत्र को समझाइये। अन्ध महासागर की धाराओं का विस्तृत विवरण प्रस्तुत कीजिये।
8. Discuss the various theories of the formation of coral reefs.
प्रवाल भित्तियों की उत्पत्ति से संबंधित विभिन्न सिद्धान्तों की विवेचना कीजिये।
9. Explain the factors which control the distribution of horizontal and vertical distribution of temperature in the Indian Ocean.
हिन्द महासागर के क्षैतिज एवं लम्बवत तापक्रम के वितरण को नियंत्रित करने वाले कारकों की व्याख्या कीजिये।

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Bibliography

1. Strahler, A.M. : Modern Physical Geography. John Wiley and Sons. 1983.
2. Bury, G.S. : The Face of the Earth, Penguins. 1980 Edition.
3. Small, R J : The Study of Land forms, Cambridge University Press, Cambridge (Latest Edition)
4. Bartholomew, R.B. : Earth Science, Health & Co. Toronto, 1984.
5. Wooldridge, S.W. : The Geographer as Scientist, Thomas Nelson and Sons. Ltd, London, 1956.
6. Trewartha, G.T. and Ikrata: Introduction to Climate, International Studies.
7. Critchfield, H.-General Climatology, Prentice Hall, New York (Latest Edition).
8. Banerji, R C. and Upadhyaya, D.S. : Mausam Vigyan, Rajasthan Hindi Granth Academy, Jaipur, 1978.
9. Lyolph, Paul, E : The Climate of The Earth, Rowmen and Allanheld, Totowa H.J. 1985.

