Biyani's Think Tank

Concept based notes

Physical Geography

B.A. SEM I

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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 endeavor 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

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Unit- I

Definition, Scope And Development Of Physical Geography, Origin Of The Earth- The Big-Bang Hypothesis, The Interstellar Dust Hypothesis, Geological history of the Earth,. Origin of the Continents and Oceans: Continental Drift Theory and Plate Tectonic Theory

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Unit- III

Mountain Building Theories: Kober & Holmes, Rocks- Classification & characteristics. Denudation- Erosion & Weathering: Cycle Of Erosion: Views of W.M. Davis And W. Penk, Drainage system and Pattern.

Unit- IV

Erosional And Depositional Topographies of River, Underground Water, Glacier, Wind And Oceanic Waves.

Physical Geography

Q.1 What do you understand by physical geography? Write its scope and development?

Ans: Geography is an independent subject it equips us to Study of space and place their effects on varity of topics such as Economics, Social, Health, Climate, Plants and Animals, etc. Hence it is highly a inter disciplinary subject. Thus, it is called "The Mother of all sciences" The term geography is derived from two Greek words "geo" and "graphs" which means earth and its description. Several geographers have defined geography, some important definitions are according to vidal - de- la -balche - "geography is a science of places." Alexander- von-humbolt- "geography as the description of the earth which deals with inter relationship of phenomena that exist together in area." thus it means that geography is "a bridge between the human and phsycal science". It studies variety of physical features like (land, vegetation, mountains, deserts, ocean, rivers, etc,) cultural features or man made features like races of mankind, population, economcs, social, cultural etc.) biotic features like flora and fauna (plants and animals.) these features are not unifom on the surface of the earth they differ from one place to another.

In this segment, we are concerned with the study of Natural Elements, which is already exist on the earth surface. Like Rocks, Mountains, Water, Soil vegetation, land forms etc. Hence the study of these elements of physical environment is known as physical geography.

According to Arthur Holmes – "The study of physical environment by itself is physical geography which includes consideration of surface relief of the globe (Geomorphology) of the seas and the oceans (oceanography) and of the air (Meteorology) and (Climatology).

OXFORD DICTIONARY "The scientific study of the natural features on the earth's surface" eg. Mountain and Rivers. All these above definitions, it may be pointed out that presently physical geography is not only the agglomeration and unification of earth sciences, but it also studies the patterns of interactions between human activities and physical environment. The field of physical geography is very vast and has several branches.

The 4 main factors responsible to influence, determine, distribution, condition and all activities of man on earth are studied are under the following groups

Lithosphere Hydrosphere Atmosphere Biosphere All living organisms, animals, plants or man, found in different parts of the world or on earth, vary from one place to another in different ways according to the different environmental conditions. Physical geography has its own individual scope and it is vast. This individuality does not obstruct the flow of information. The study of physical geography deals with phenomena of nature ranging from local variation to worldwide patterns. Physical geography follows its own methodology to study; this makes it distinct from others. It emerges as a discipline of evaluating and ranging natural resources. To understand the intricate relationship between man and environment. It is essential to know the physical environment, which provides resources to man, and man utilizes these resources and ensure there, economy and social developments with the help of modern technology and advance skills.

Thus, physical geography is a systematic study of man and physical environment, therefore there would not be geography if there was no man and physical features on earth surfaces. The nature of physical geography is a integrated study of physical features on the within the earths surfaces. The study of physical geography and human are both not static but highly complex and dynamic. They change from place to place and from time to time. It is a process between ever changing earth and untiring and ever active man.

Example: Physical features of India have, a lot of changes from North to South and East to West, As according to the Physical features life and activities of man changes.

Recent developments in geography: 4 major component of earth.

(a) Lithosphere: (Land forms, drainage, reliefs and physiography) It is the solid outer layer of the earth, surface area of the earth is 510 million sq. km, about 361 million sq. km or ¾ is covered with water bodies that is 71%, remaining 149 million sq. km or 1/3 island surface that is 29 percent.

(b) Hydrosphere: (Oceans, seas, lakes, and associated features with water) About 71 percent of the earth's surface is covered by water mass or ¾ known as hydrosphere. It consists of oceans seas, lakes, rivers, ponds, gulfs bays etc.,

(c) Biosphere: (Life forms, including main and macro organism, food chain, ecological parameters, and ecological balances). It is a zone on earth which consists of various organisms it occupy the lower part of atmosphere, upper

parts of lithosphere and lower parts of hydrosphere.

(D) Atmosphere: The atmosphere is the gaseous shell that surrounds Earth. This sphere is composed of many critical components essential to life, such as oxygen, carbon, water, and nitrogen that flow around Earth.

Importance of geography:

The study of physical geography is emerging as a discipline of evaluating and managing natural resources, it has evolved a great successive stages of development in terms of methodology, approaches, etc., since the birth of philosophical ideas, reports, thinkers, philosophers, historians, of the ancient time to the present status has attained a dynamic changes, where different components are added from time to time. Ex: Previously physical geography has only 4 components. Lithosphere, hydrosphere, Biosphere and atmospheres gradually or later biosphere, and the distinct branches like geomorphology, Oceanography, climatology and biography is discussed and separately dealt with.

Q.2 What is the Big bang hypothesis, and how does it explain the origin of the universe? Elaborate it.

Ans: The Big Bang Theory: The Big Bang Theory is an astrophysical model of the universe that can be observed by human senses. The theory gives details about the origins of the universe from its early formations to its modern-day evolutions.

The Big Bang Theory explains how the universe expanded from an initial state of extremely high density and high temperature by offering a detailed explanation of observed phenomena, radiation, an abundance of light elements, and large-scale structures.

This idea of the creation and expansion of the universe and its scientific explanation had started to be examined in the early years of the 1940s. It initially appeared in the scientific form in 1931 in a paper by Georges Lemaitre. He is a Belgium cosmologist and in the meantime was a catholic priest. This theory has been approved by almost all astronomers presently. It was a radical shift of the earlier scientific orthodoxical ideas about the origin of the universe in the 1930s. At that time many astronomers were hesitating to accept the idea of an expanding universe. They saw this theory as

preposterous.

In 1927, Lemaître published a virtually unnoticed paper that provided a solution to the equation of general relativity for the case of an expanding universe. This idea has already been developed in 1922 by Russian mathematician Alexander Friedman. Friedman was interested in the mathematics of a range of idealised solutions which includes both expanding and contracting universes but failed to provide a definite explanation of whether this universe was expanding or contracting. This was solved by Lemaitre who approached the problem of cosmology from a physical point of view and observed that his theory has evaluated and predicted that this universe is expanding.

By 1930, many cosmologists such as Einstein, Sitter and Eddington had already started concluding that the static model of the universe was inaccurate to explain the universe. After that, Edwin Hubble using the largest space telescope had shown that the distant cosmic entities such as galaxies appear to be distancing each other or receding from us at speeds proportional to their distances. At this point, Lemaitre drew Eddington's focus on the earlier works of Lemaitre, where the explanation of the relation between distance and recession velocity of the galaxies has been provided. This paper, along with Hubble's observation, convinced the majority of the astronomers that this universe is indeed expanding and not static. After the further evaluation of the expansion of the universe, it was conceded too that expansion must be followed by a starting point and the idea of the big bang came into existence.

The birth of the universe

It is humanly not possible to see every instance that happened after the big bang. Therefore, scientists simulated nearly 4,000 versions of the current universe using a massive supercomputer. It is much like guessing a baby photo by observing the current picture of the person. Traditional Big Bang theory says that this universe has come into existence with a singularity; a point of intense heat, density and gravity. It is difficult to grapes by the human mind. This idea may not accurately reflect reality. Many researchers say due to the assumption of singularity coined by Einstein's general relativity theory, the whole theory of the Big Bang is based. This theory does not take the quantum mechanics of matters into its account.

Scientists say that they have confirmed that the universe has gone through a sudden disrupting inflation, which has happened at a speed more than the speed of light. Therefore, whatever is assumed for the origin of the universe, it must be doubled in size which might be 100 times more all within a fraction of

a second if the explanation of quantum physics is applied.

Conclusion

In conclusion, it can be said that the theory of the Big Bang has its historical stake in the development, but has drawbacks in the present explanation of the origin of the universe. The applications of quantum physics have compelled scientists to rethink the explanation of this theory. Apart from that, this theory is unable to explain the limit of expansion of the universe. This has been done by some recent scientists, they say the expansion of the universe will lead to contraction of the same after a certain limit. Just like if one throws a ball upward, it will come to the earth after the ball reaches a certain limit. Therefore, the theory of Big Crunch came into existence.

Q.3 : Explain the Interior structure of the earth surface ?

Ans: The **internal structure of Earth** is the layers of the Earth, excluding its atmosphere and hydrosphere. The structure consists of an outer silicate solid crust, a highly viscous asthenosphere and solid mantle, a liquid outer core whose flow generates the Earth's magnetic field, and a solid inner core.

Scientific understanding of the internal structure of Earth is based on observations of topography and bathymetry, observations of rock in outcrop, samples brought to the surface from greater depths by volcanoes or volcanic activity, analysis of the seismic waves that pass through Earth, measurements of the gravitational and magnetic fields of Earth, and experiments with crystalline solids at pressures and temperatures characteristic of Earth's deep interior.

Sources of Information about the interior of the earth:-

1. Artificial Sources
2. Natural Sources

1. Artificial Sources

A. Temperature

These evidence along with molten lava erupted from the earth's interior supports that the temperature increases towards the Centre of the earth.

The different observations show that the rate of increase of temperature is not uniform from the surface towards the earth's center. It is faster at some places

and slower at other places.
In the beginning, this rate of increase of temperature is at an average rate of 1^0C for every 32m increase in depth.
While in the upper 100kms, the increase in temperature is at the rate of 12^0C per km and in the next 300kms, it is 20^0C per km. But going further deep, this rate reduces to mere 10^0C per km.
The temperature at the centre is estimated to lie somewhere between 3000^0C and 5000^0C, may be that much higher due to the chemical reactions under high-pressure conditions.

B. Pressure

Just like the temperature, the **pressure is also increasing from the surface towards the centre** of the earth.
It is due to the huge weight of the overlying materials like rocks.
It is estimated that in the deeper portions, the pressure is tremendously high which will be nearly 3 to 4 million times more than the pressure of the atmosphere at sea level.
At high temperature, the materials beneath will melt towards the centre part of the earth but due to heavy pressure, these molten materials acquire the properties of a solid and are probably in a plastic state.

C. Density

Due to increase in pressure and presence of heavier materials like Nickel and Iron towards the centre, the **density of earth's layers also gets on increasing towards the centre**.
The average density of the layers gets on increasing from crust to core and it is nearly 14.5g/cm3 at the very centre.

2. Natural Sources

Earthquake

An earthquake is the sudden shaking of the earth's surface. Earthquakes occur due to the release of energy which generates seismic waves that travel in all directions. The study of seismic waves provides information about the interior of the earth.
Focus is the point where the energy is released during an earthquake, also called **hypocentre**. The seismic waves travel in all directions and reach the surface. **Epicentre** is the point on the surface nearest to the focus. It is directly above the focus.
All natural earthquakes occur in the lithosphere. It extends up to the depth of

200 km from the surface of the earth.
An instrument called a "seismograph" records the waves reaching the earth's surface. The earthquake waves/seismic waves are broadly of two types – body waves and surface waves.
Body waves – Body waves are generated due to release of energy at the focus and these waves travel in all directions through the interior of the earth. There are two types of body waves:
P-waves or Primary waves or Compressional waves – P-waves travel faster, about 6 km per sec in the upper crust and are first to arrive at the surface. These waves are similar to sound waves as they travel through gas, liquid as well as solid materials. P-waves vibrate parallel to the direction of the wave.
S-waves or Secondary waves or Shear waves – S-waves arrive at the surface with some time lag, and are slower (about 3.5 km per sec in the upper crust). S-waves only travel through solid materials. This characteristic feature of S-waves helps in understanding the structure of the interior of the earth.
Surface waves – The body waves interact with the surface rocks and generate new sets of waves called surface waves. These waves move along the surface. These waves are more destructive, causing the displacement of rocks thereby collapsing the structure.

Volcano

A volcano is an opening in the earth's crust through which gases, ashes and molten rock material are released to the earth's surface.
The upper position of the mantle of the earth is called the asthenosphere which is a weaker zone. It is from this weaker zone the molten rock materials find their way to the surface.
The molten rock material found in the interior of the earth is called **magma**. Once the magma reaches the earth's surface it is called **lava**.
The materials that reach the earth's surface include lava flows, pyroclastic debris, volcanic bombs, ash, dust and gases such as sulphur compounds, nitrogen compounds and some amounts of chlorine, hydrogen and argon.

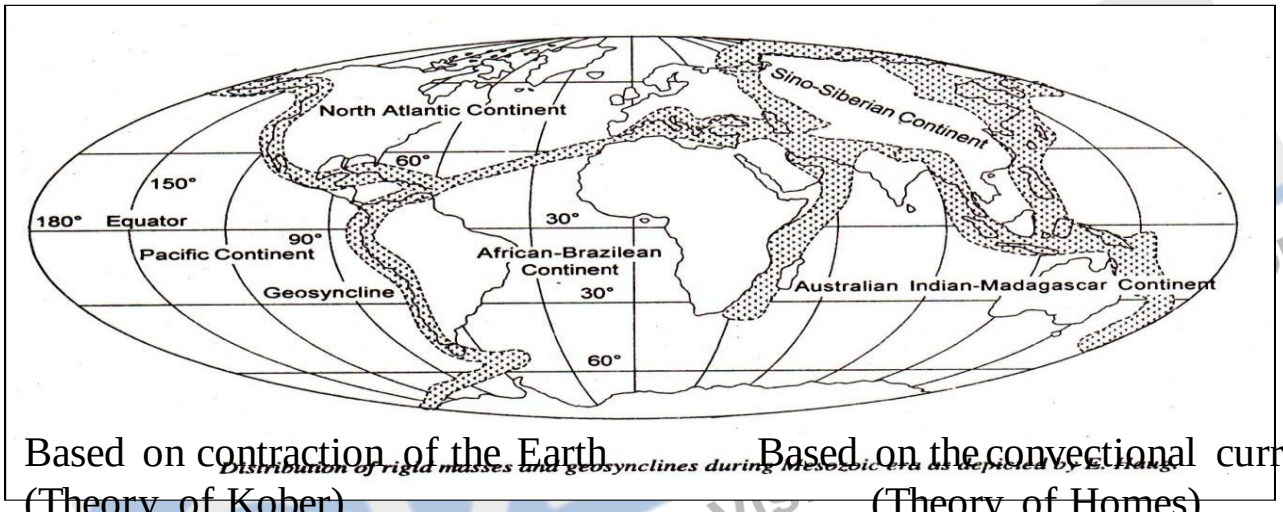
Q 4: Define the mountain building process. Explain the Geosynclines theory of mountain building in detail?

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



Distribution of rigid masses and geosynclines during Mesozoic era as depicted by L. Hug.

Based on contraction of the Earth (Theory of Kober)

Based on the convectional current (Theory of Homes)

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 thistheory 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.

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.

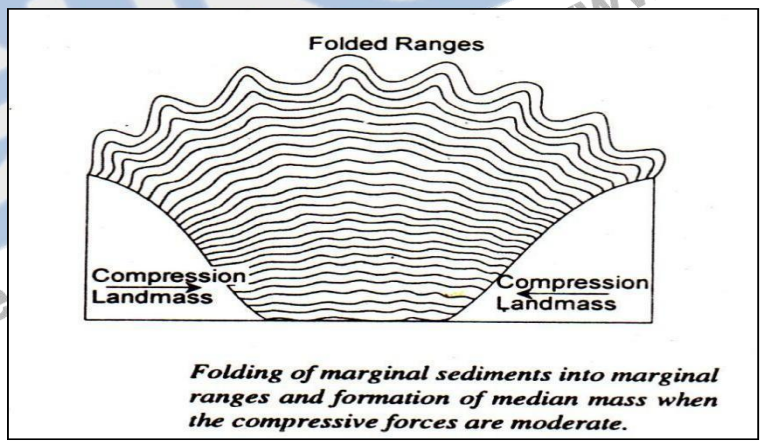
The forelands or kratogens which border geosynclinals succumbed to the forces of denudation.

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

Both the forelands start to none 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 kober as randketten.

Example Alps- proper, Carpathians, Balkan mountain & Caucasus Mountain were formed due to northward mountains 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.



Folding of marginal sediments into marginal ranges and formation of median mass when the compressive forces are moderate.

Criticism-

The force of contraction produced by the cooling of the earth is not adequate for the formation of massive mountain like Himalayas, Alps.

Seuss argued that the only one side of geosynclinals moves while the other side remains static. Seuss 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.
Geosynclines are found along the continental margins".
Geosynclines may exist in front of river mouth.

Q5: Explain the Thermal Convection Current Theory of Mountain building in detail?

Ans: 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 curst but temperature is not so high because there is gradual loss of heat through conduction & radiation. On the other land, through there is very low concentration of radioactive elements in the substratum but the gradual accumulation of heat produced by radioactive elements causes connective current.

Mechanism of the Theory:

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

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 connective currents cause continental drift.

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.

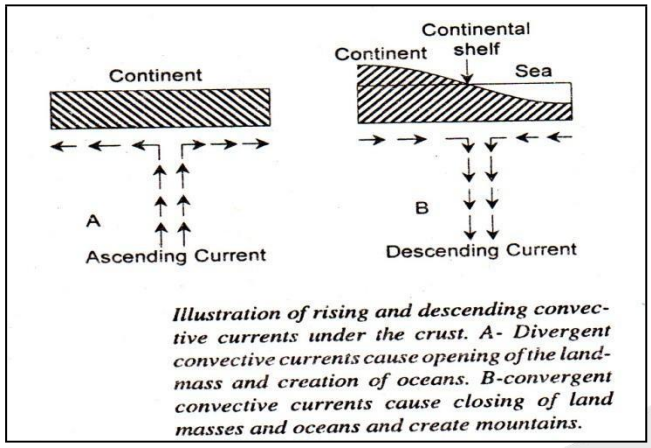


Illustration of rising and descending convective currents under the crust. A- Divergent convective currents cause opening of the landmass and creation of oceans. B-convergent convective currents cause closing of land masses and oceans and create mountains.

Homes define 3 stages for Mountain building formation.

Stage-I

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

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.

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.

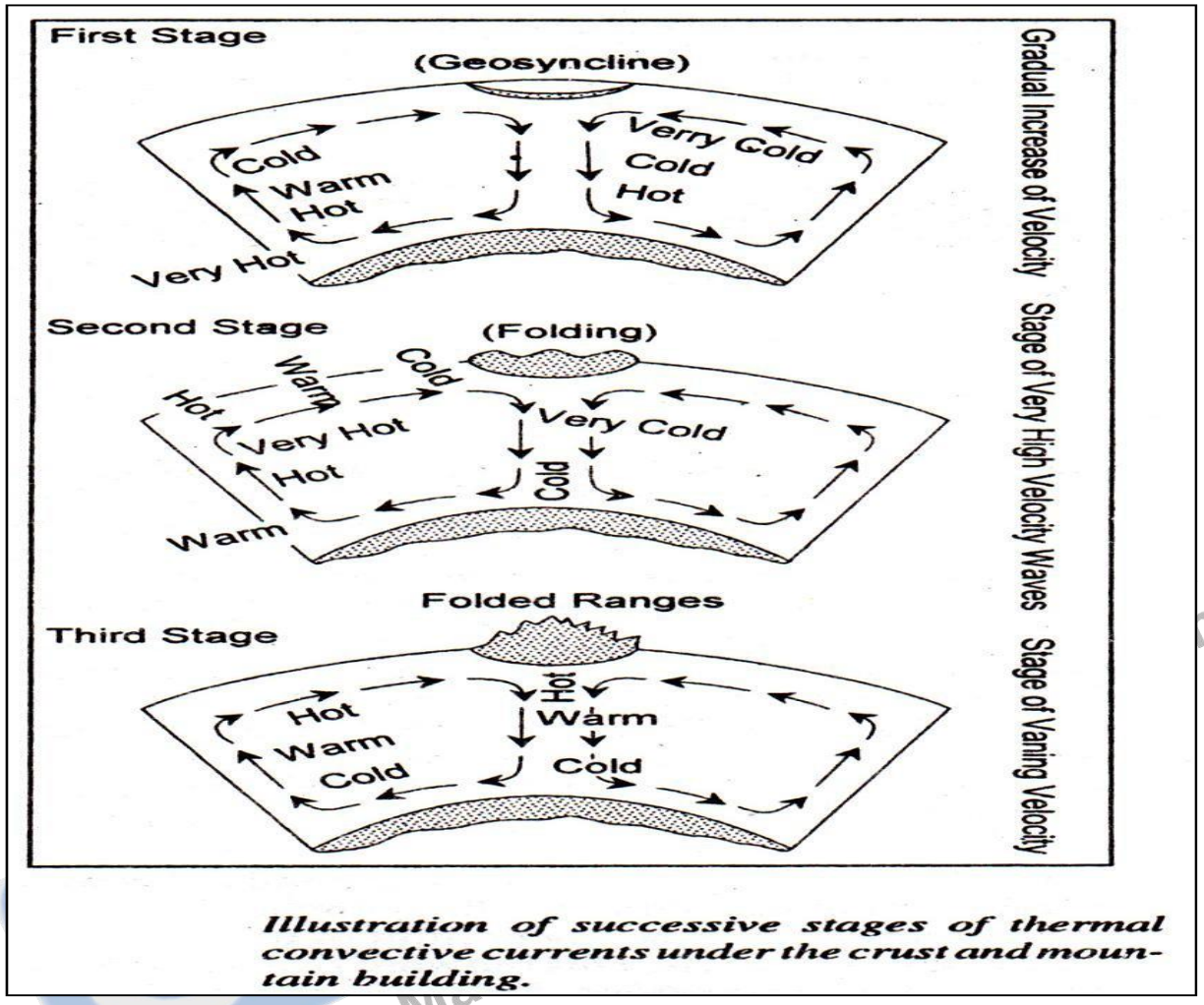


Illustration of successive stages of thermal convective currents under the crust and mountain building.

Criticism:-

Rising & falling column are doubtful phenomenon.

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.

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.

Q6. What do we understand by continental Drift theory? Critically explain Wegner's continental Drift theory

Ans: The continental drift hypothesis (introduced by Alfred Wegener in 1912) states that at one point in time, all of the continents were joined together as one large mass of land, then the land spread apart and drifted into their current positions.

- Continental drift theory was proposed by Alfred Wegener in 1912.
- It was first put forward by Abraham Ortelius in 1596 before fully being developed by Alfred Wegener.
- The theory deals with the distribution of the oceans and the continents.
- According to Wegener's Continental Drift theory, all the continents were one single continental mass (called a Super Continent) – Pangaea and a Mega Ocean surrounded this supercontinent. The mega ocean is known by the name Panthalassa.
- Although Wegener's initial theory did not cover mantle convection until Arthur Holmes later proposed the theory.
- The supercontinent was named Pangaea (Pangea) and the Mega-ocean was called Panthalassa.
- According to this theory, the supercontinent, Pangaea, began to split some two hundred million years back.
- Pangaea first split into 2 big continental masses known as Gondwanaland and Laurasia forming the southern and northern modules respectively.
- Later, Gondwanaland and Laurasia continued to break into several smaller continents that exist today.

Evidence supporting the Continental Drift Theory

1. **The Matching of Continents (Jig-Saw-Fit)**

- The coastlines of South America and Africa fronting each other have a remarkable and unique match.
- In 1964, Bullard created a map using a computer program to find the right fit of the Atlantic margin and it proved to be quiet.

2. **Rocks of the Same Age across the Oceans**

- The radiometric dating methods have helped in correlating the formation of rocks present in different continents across the ocean.
- The ancient rocks belts on the coast of Brazil match with those found in Western Africa.
- The old marine deposits found in the coasts of South America and Africa belong to the Jurassic Age. This implies that the ocean never existed before that time.

3. **Tillite**

- It is the sedimentary rock made from glacier deposits.
- The Gondwana system of sediments from India is recognized as having its counterparts in 6 different landmasses in the Southern Hemisphere.
- Counterparts of this series are found in Madagascar, Africa, Antarctica, Falkland Island, and Australia not to mention India.
- At the base, the system has thick tillite signifying widespread and sustained glaciation.
- Generally, the similarity of the Gondwana type sediments shows that these landmasses had exceptionally similar origins.
- The glacial tillite gives clear evidence for palaeoclimates and the drifting of continents.

4. **Placer Deposits**

- The presence of abundant placer deposits of gold along the Ghana coast and the complete lack of its source rocks in the area is a phenomenal fact.
- The gold-bearing veins are present in Brazil and it is evident that the gold deposits of Ghana in Africa are obtained from the Brazil plateau from the time when the two continents were beside each other.
- The widespread distribution of Permo-Carboniferous glacial sediments in South America, Africa, Madagascar, Arabia, India,

Antarctica, and Australia was one of the major pieces of evidence for the theory of continental drift.

- The continuity of glaciers, inferred from oriented glacial striations and deposits called tillites, suggested the existence of the supercontinent of Gondwana, which became a central element of the concept of continental drift.

5. **Distribution of Fossils**

- The interpretations that Lemurs occur in India, Africa, and Madagascar led to the theory of a landmass named "Lemuria" connecting these 3 landmasses.
- Mesosaurus was a tiny reptile adapted to shallow brackish water.
- The skeletons of these creatures are found in the Traver formations of Brazil and Southern Cape Province of South Africa.

Force for Drifting

- Wegener proposed that the movement accountable for the drifting of the continents was instigated by tidal force and pole-fleeing force.
- The polar-fleeing force relates to the rotation of the earth.
- The shape of the earth
- The second force that was proposed by Wegener, the tidal force.
- Though, most of the scholars considered these forces to be insufficient.

Drawbacks of the Theory

- Wegener did not explain why the drift started only in the Mesozoic era and not earlier.
- Oceans are not taken into account in the hypothesis.
- Proofs rely significantly on generalizable assumptions.
- Buoyancy, tidal currents, and gravity forces are insufficient to move continents.
- Modern theories (Plate Tectonics) acknowledge the existence of Pangaea and comparable land masses but explain the reasons for drift in a fundamentally different way.

Despite being factually incorrect on several counts, Wegener's hypothesis represents a key milestone in the study of tectonics, laying a solid framework for future hypotheses such as seafloor spreading and plate tectonics.

Q 7: 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-

Composition & structure of Rocks- The joints in rocks permit water to enter the rock and achieve chemical and physical weathering.

Nature of Ground Slope- It controls mechanical disintegration of rocks and mass movement of weathered products down the slope.

Climatic Variations- Climates determines whether policy or chemical weathering will predominate and the speed with which these processes will operate.

Floral Effects- It also determined by the presence or absence of vegetation in a particular region.

Topography- It directly affects weathering by exposing rocks and in directly through the coconut precipitation, temperature & vegetation.

Types of weathering

There are 3 main types of weathering.

1) Physical or Mechanical weathering
2) Chemical weathering
3) Biological weathering

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-

Frost action- Water expends 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 ofdirect heating of rocks.

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 dames as in the Khasi hills, kyllang, Meghalaya.

Relative hardness of rocks- Some rocks like sand stone are hard, & some like shale"s are soft. Weathering of soft rocks under a copping of hard rocks gene rise to pedestal rocks". Such land feature found in Satpura Hills, Himachal Pradesh.

Action of Plants & animals- The roots of trees on the hill ides penetrate into cracks of rocks & widen then. This facilitates the percolation of water & air the total effect ofwhich is the breakdown of rocks.

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.

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

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.

Q8: 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.

a) **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.
b) **Abrasion**- The process of wearing down of a land surface by money weathering rock debris or by the river flow.
c) **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.
d) **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.
e) **Deflation**- The removal of five rock debris by wind, especially likely to occur in Arid or semi-arid.
f) **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 9: 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 10: 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."

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

The whole cycle passes from 3 stages-

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.

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.

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:

This model was highly simple & applicable.
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.
Davis based his model on detailed & careful filed observations.
The change is base land is thoughtful & it show the correct form of erosion.

Criticism: -

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.
Davis concept of relationship between upliftment & Erosion is erroneous.
An ideal Davision cycle would take millions of years of complete.
What about the earth movements during the cycle?
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 11. 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:-
Karst topography generally develops in those areas where thick beds of massive limestone‟s lie just below the layer of surficial material. They also develops en collimate, times tunes & chalk.
Limestone should be massive, thickly, bedded, hard, well jointed & should not be porous & not by the mass of rocks.

There should be enough rainfall so that required coconut ofwater is available to dissolute carbonate rocks.
The limestone should be highly folded or fractured or faulted.
There are 2 types of force work here.

1. Erosion landforms 2. Depositional landforms

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.

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 hides.

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".

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

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

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

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.

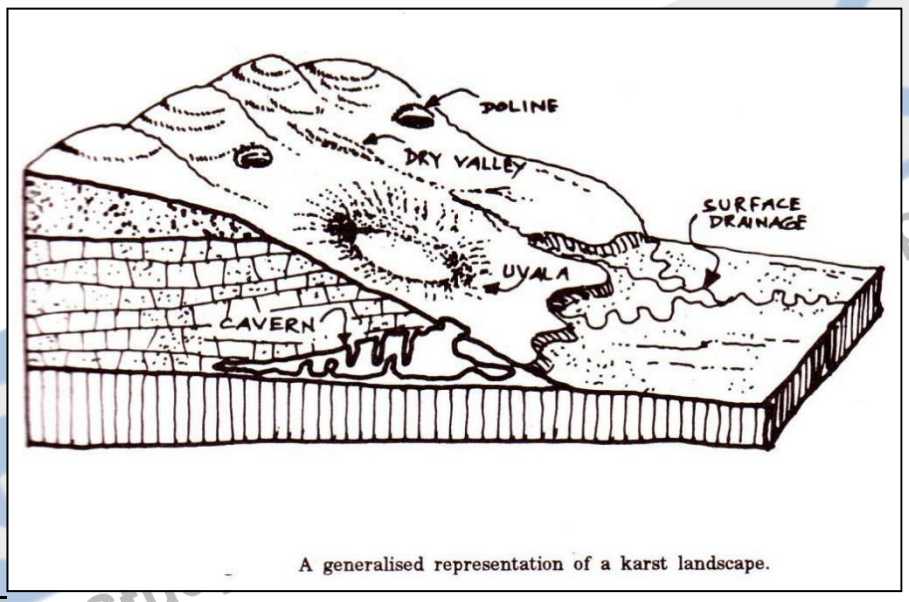
Ponors- The vertical pipe like passages that connect the comets & the Swallow holes are called „ponores".

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.

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.

Natural Bridge- Due to Collapse of the roof of cause than they make the form of natural Bridge.

Karst Valley- During rainy season small surface streams formed this U-shaped valleys developed on lime stones are called Karst valley or solution valley.



A generalised representation of a karst landscape.

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.

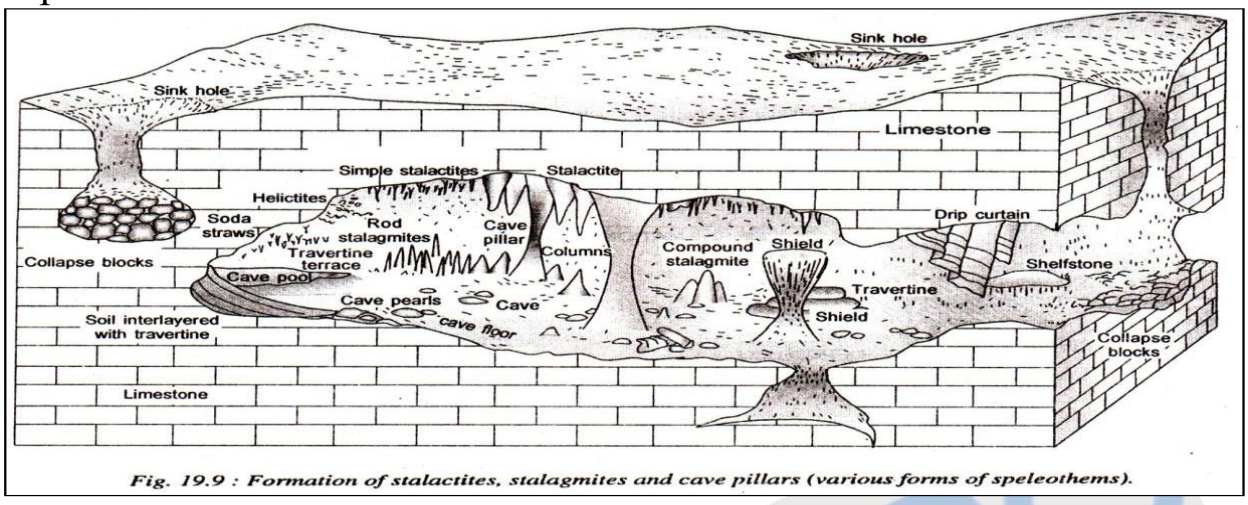


Fig. 19.9 : Formation of stalactites, stalagmites and cave pillars (various forms of speleothems).

Drip stones: calcareous deposits formed by dripping ofwater in dry caves.

Stalagmites: A column of calcium carbonate which grows upwards from the floors of a cave.

Stalactite: formed due to deposits of calcium carbonates from ceiling.

Cave pillars: are formed when stalagmite and stalactites meet together.

Que12: 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:

Corrosive action- Boulders, pebbles & sands are hurled against the coast by breaking waves & this causes under cutting & rock break up.

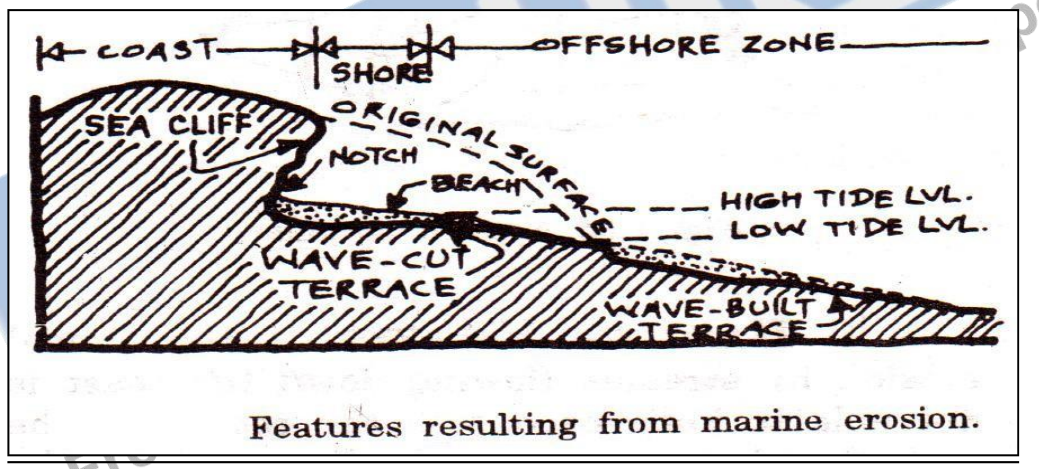
Hydraulic action- When water is thrown against the shore, by braking waves, the air expends suddenly often explosively. This causes rocks to shatter & crake become enlarged & extended.

Attrition action- The particles are themselves worm down by friction and impact, and become finer and finer.

Corrosion & solution- is simply a solvent action.

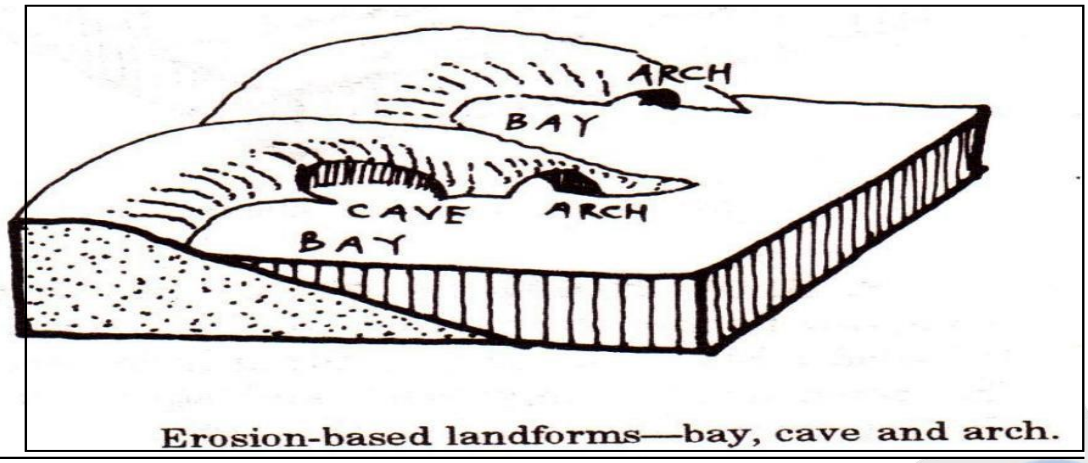
Erosional landforms:-

Cliff- Steep rocky coast rising almost vertically above sea water is called sea cliff.
Notch- The point of wave attack at the base of cliff is sometimes preserved in resistant strata as a wave-cut notch.
Wave-cut Platform- is formed due to cliff recession. A wave cut platform is produced at its base.
Sea caves- Where hard & soft rocks lie alternately softer rocks are worm back into inlets coves or bays & harder one persists are head.
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.

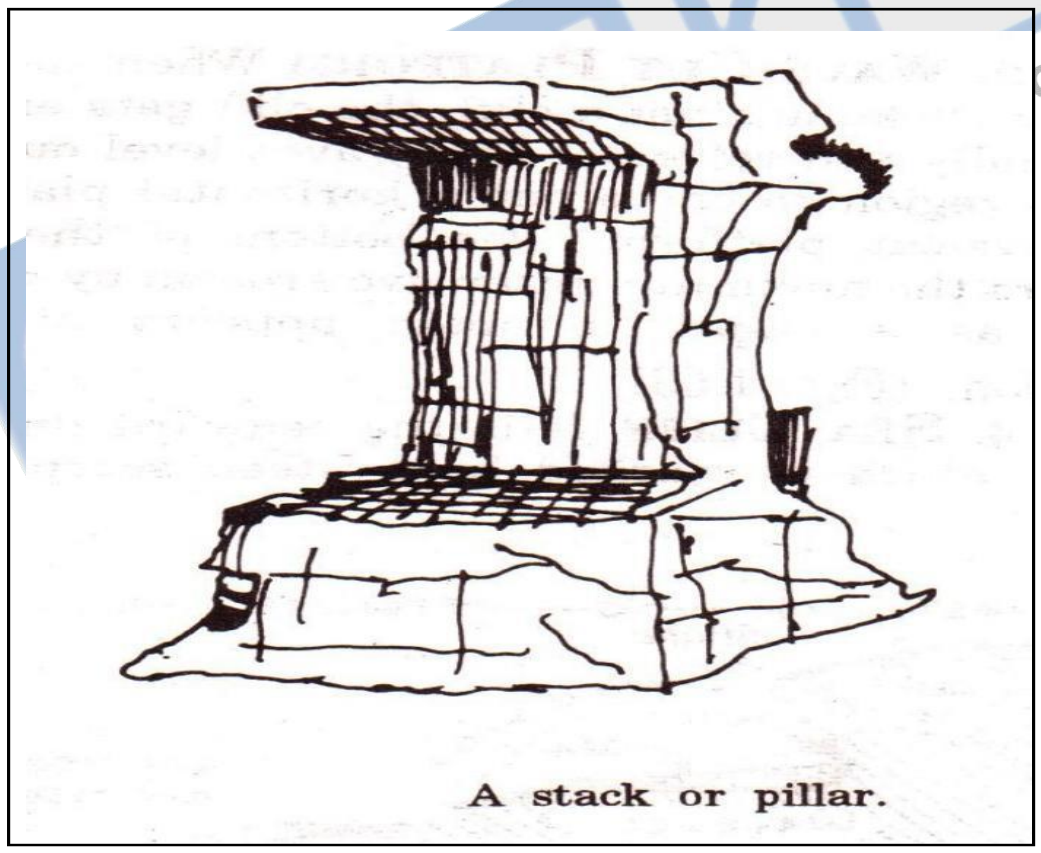


Features resulting from marine erosion.

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



Erosion-based landforms—bay, cave and arch.



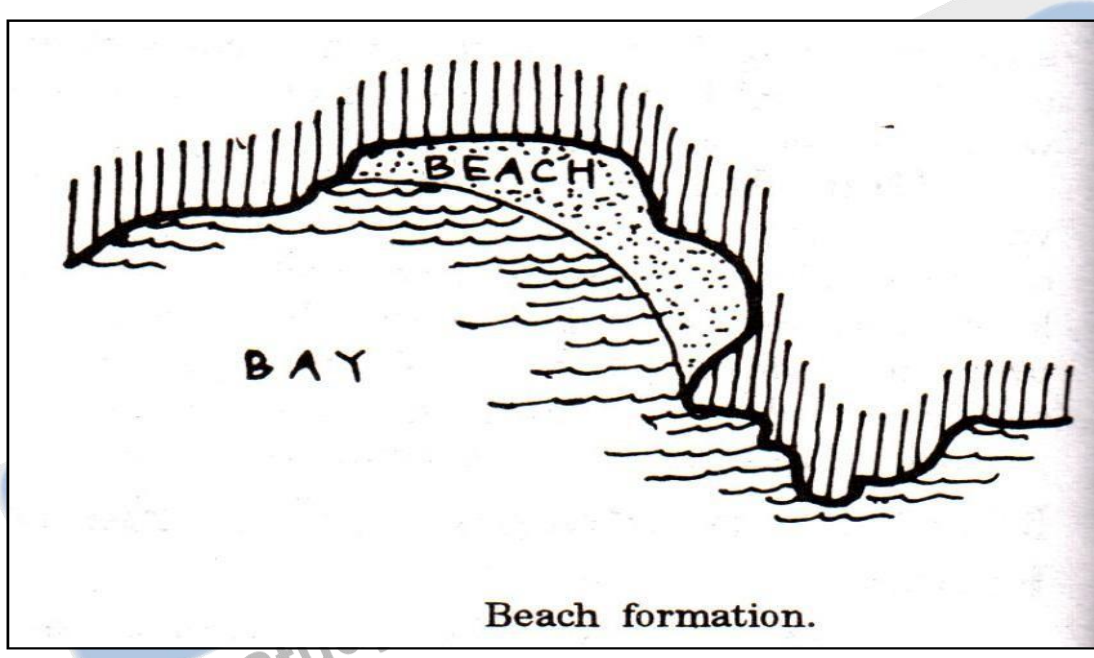
A stack or pillar.

Stump- These rock pinnacles crumble & collapse & end up as were stumps slightly above sea level.

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 -

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, five silt & clay.



Beach formation.

Carp Beach- is small regular embayment and a series of headlands composed of shingles.

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.

Bars- The ridges, embankments or mounds of sands formed by sedimentation through sea waves parallel to the shorelines are called bars.

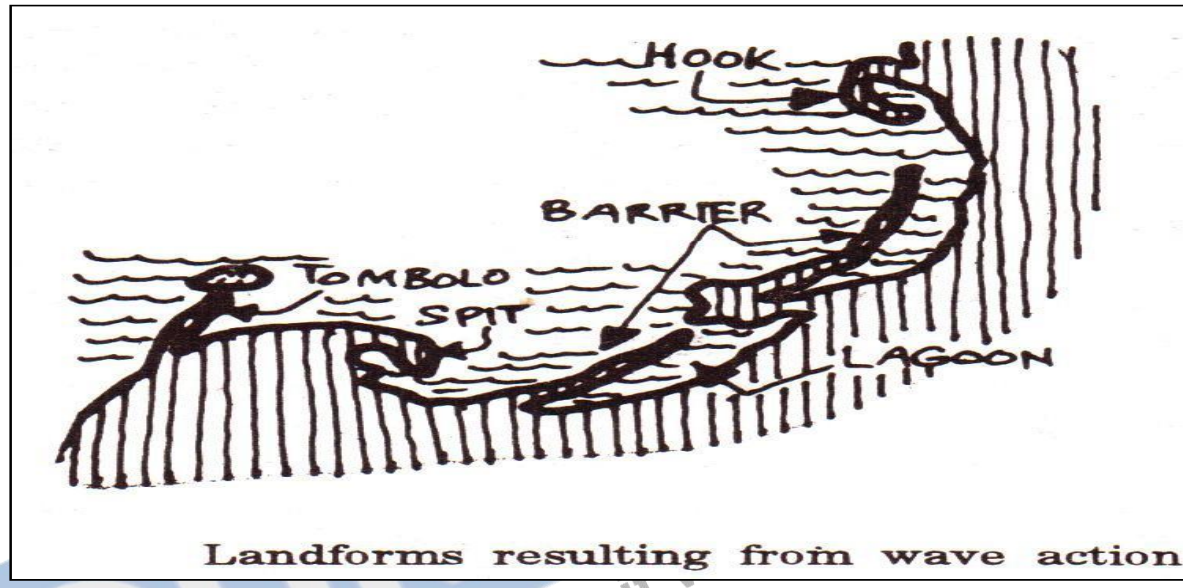
Off-Shores bars- If the bars are formed in such a way that they are parallel to the coast but are not attached to the land they are called off-shores bars.

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.

Loop-The spits are bent to sauce 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**.

Tombola- A bar connecting mainland with an island or connecting a headland with the island called tombola.



Landforms resulting from wave action

Que13: 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.

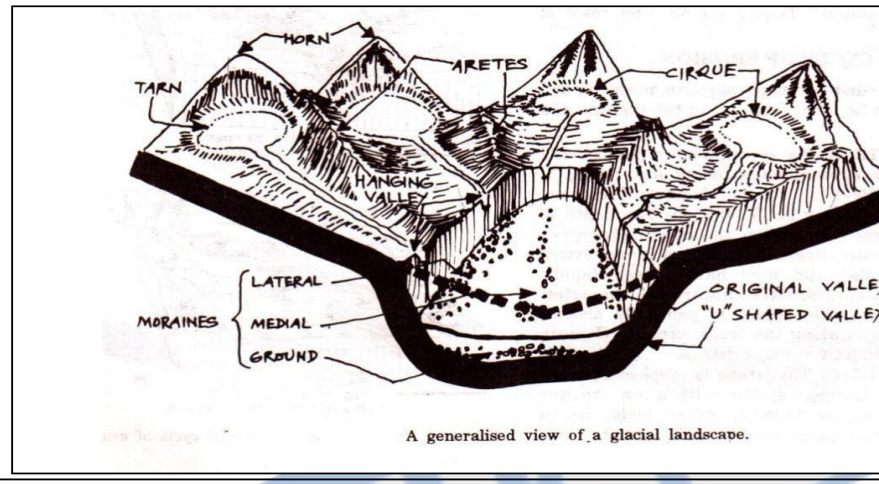
Glaciers are formal due to accumulation of ice above snow-line, under extreme cold climate

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

Erosional Landforms-

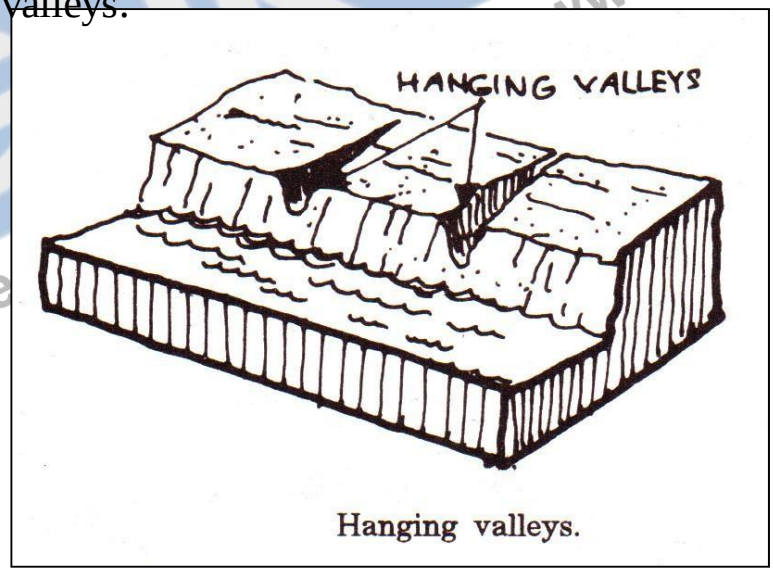
A glacier is supposed to erode the rocks, transport the eroded materials & deposit the eroded materials at suitable places like other agents of erosion & depositions.

Cirque- The armchair-shaped or horse shoe-shaped, step, walled depressing represents a glaciated valley head.
U-shaped valley- is another typically glacial feature. Since glacial mass is heavy & show moving erosional activity is uniform horizontal as wee as vertical. Steep sides & flat bottomed valley of „U" shaped.



A generalised view of a glacial landscape.

Hanging Valley- valleys of tributary glaciers which join the main glacial valleys of much greater depth are called hanging valleys.



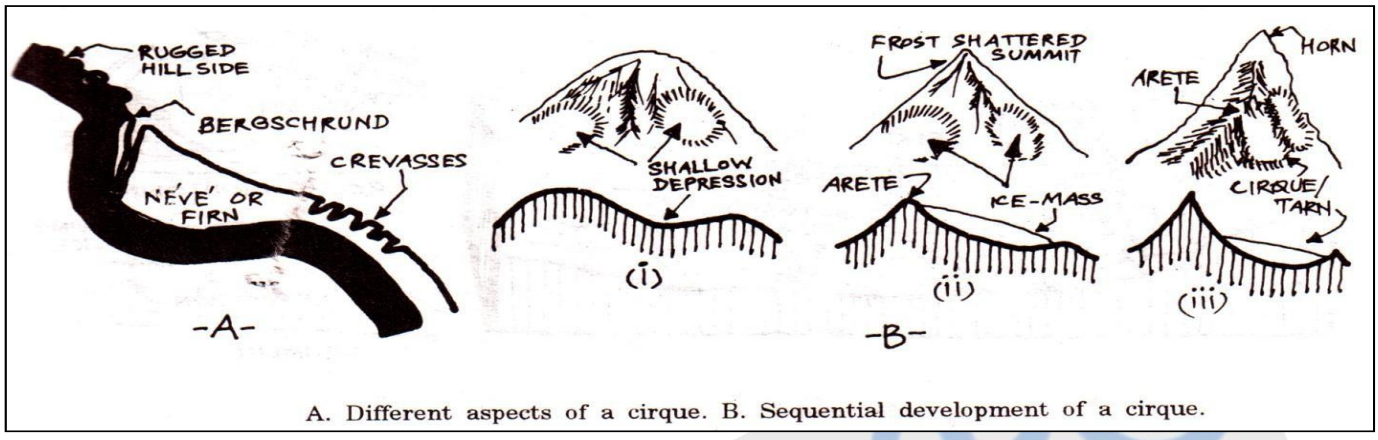
Hanging valleys.

Horn- A pyramidal or triangular faceted peak formed due to recession & intersection of three or more cirques is called horn.

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.

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.

Col- The crest line of arêtes & pyramidal places is called „Col & Peak" topography .Example Mount Kailash in Tibet.
Nunatak- The higher peak & mounds surrounded by ice from all sides are called nunataks. They look like scattered small islands amid extensive ice masses.
Crag & Tails- A peculiar land forms having vertical eroded steep side up glacial side & tail like stricture with lower weight called crag or tail.
Sheep rocks or Roches Moutonees- are a streamlined asymmetrical hillocks or hills having one side smoothly mounded with gentle slope & steeped & craggy lee side.
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.
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.

Key Words of Physical Geography

Geomorphology

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

Satellite- A natural or artificial celestial body constrained by Gravitation and moving in Orbit around another more massive heavenly body.

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.

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.

Meteoric dust- The dust in the atmosphere derived from disintegrating meteors and trapped in the Earth's gravitational field.

Meridian- Terrestrial, one of the lines of longitude which link the North Pole to the South Pole and cut the equator at right angle.

Latitude- The angular distance of any point on the Earth's surface worth or South of the Equator, as measured from the Centre of the Earth, in degrees, minutes and seconds.

Lauragia- The northern part of the great Precambrian land masses, Pangaea.

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 lend in the south being separated by a west ocean.

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.

International date line- An imaginary line agreed internationally which flows 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.

Corrosion- The wearing a way of rocks by chemical action. This covers a wide variety of processes, including solution, hydration and oxidation.

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.

Epeirogenesis- Pertaining to the formation of continents, applied to the type of mass earth movements which result in charges of level over large areas.

Orogenesis- Tectonic activity and mountain building.

Orbit- The closed course of a heavenly body, especially the closed path of a planet around the sun.

Eclipse- The passage of all or part of a celestial body into the shadow of another.

Solar ellipse- Occurs when the new moon passes exactly between the sun and the earth, casting a shadow on the earth.

Lunar eclipse- Occurs when the earth passes exactly between the sun and the full moon.

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.

Gutenberg Discontinuity- The discontinui9ty occurring between the lower surface area of the Mantle and the core of the earth.

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.

Glacier- Originally a river of ice moving down a valley.

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.

Epicentre- The point on the Earth's surface immediately above the seismic focus or origin of an earthquake.
Fluvial- Relating to a river the term fluvial is usually applied to aspects of stream flow and corrosion by the stream.
Barchans- A crescent shaped sand dune, the leeward slope is relatively steep and windward slope gentle.
Aphelion- that point farthest from the sun in the orbit of a planet. The earth arrives at aphelion on 4 July, when it is same 152 km distant from the sun.
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.
Perigee – The point in the orbit of any of the earth's planets or satellites when it is nearest to the earth.
Paternoster lakes – lakes in a glaciated valley caused by the damming action of moronic ridges.
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.
Volcano- A right or vent in the earth's crust through which molten material is erupted and solidifies on the surface as lava.