09/06/12 Geography-I V.P.GAUTHAM (1)
Geomorphology - Climatology (Partly)

ORIGIN OF EARTH

→ Earth was initially a nebula (semi-solid form).
→ The entire earth was made of lava.
→ Lava mainly consists of CO_2 & H_2O (vapour)
→ These gases were expelled through continuous volcanic eruptions.
→ The atmosphere now contains a lot of CO_2, which is a greenhouse gas and hence it absorbs a lot of heat. Thus, earth's temp. increases to thousands of degrees.
→ The escaped water vapour goes to high altitudes.
→ The water vapour molecules combined to form clouds.
→ These clouds, at great heights, undergo condensation to form rain.
→ The thrown out lava contains a lot of basalt which got deposited in the earth.
→ The rain, on trying to enter the earth system, got evaporated (due to high temp.) before reaching earth surface.
→ The rain tried to break through this temp. barrier for hundreds of years.
→ Finally, it broke the barrier and water reached the earth surface. There was continuous rain for several years.

→ The basalt on earth's surface didn't allow water to percolate inside.

→ The water washed away all the basalt to troughs and settled there as ocean. So, all the basalt got deposited under oceans.

→ This washing of basalt exposed the rocks underneath, called GRANITE. So, most of the land is made of granitic rocks.

⇒ The clouds, containing water vapour, on collision created thunderstorms, which created life made of nitrogen. Till now, Nitrogen is the basic component of life (as DNA & RNA).

→ In the lava, the most abundant gas was CO_2 next it was nitrogen.

→ The early life form was absorbed a lot of CO_2. This decreased the CO_2 % & nitrogen remained constant. Now, nitrogen is the most abundant gas.

→ The later living organisms absorbed O_2 & gave out CO_2. This was an agreed pact by nature to keep the gaseous equilibrium.

→ But, this equilibrium has been disturbed by humans, resulting in global warming.

Nebula → Nova → Supernova → Red Giant

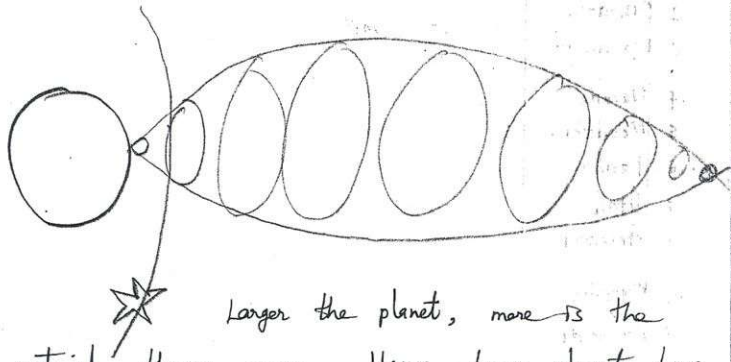
↓

White dwarf Black Hole. (High density)

Chandrasekar limit ⇒ 1.44 (Mass of the sun.)

→ Expanding universe concept:

The space between planets keeps on increasing continuously.



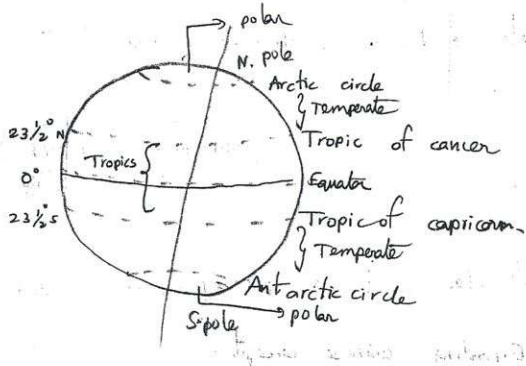
Larger the planet, more is the material thrown away. Hence, larger planets have many moons, whereas mercury has no moon.

→ But, Uranus & Venus rotate in the opposite direction to all other planets.

→ Big Bang theory.

⇒ Large haldron collider → CERN, switzerland...

→ A brief history of time → Stephen Hawking.



United States of America [50 states]

1. California
2. Oregaon
3. Washington
⇒ western coast

4. Nevada
5. Mountana
6. Idaho
7. Utah
8. Arizona
⇒ Arid lands

9. Wyoming
10. Colorado
11. New Mexico
12. Texas
13. Oklahoma
14. Kansas
15. Nebraska
16. South Dakota
17. North Dakota
18. Minissetta
19. Ohio
20. Illinc
21. Indic
22. Iowc
23. Kentu
24. Tenn
25. Arka
26. Miss
27. Mis
28. Alabc
29. Geor
30. Flori
31. Soutl
32. North
33. Mary
34. Penr
35. Virg
36. New
37. Conr
38. Ma
39. Wis
40. Mic

19. Ohio
20. Illinois
21. Indiana
22. Iowa
23. Kentucky
24. Tennessee → first multipurpose river project in the world.
25. Arkansas
26. Missourie
27. Mississippi ⇒ Has the largest river of U.S.
28. Alabama
29. Georgia
30. Florida
31. South Carolina
32. North Carolina
33. Maryland
34. Pennyslvania
35. Virginia
36. New Jersey
37. Connecticut
38. Massachussetts
39. Wisconsin
40. Michigan

→ MAINS

GS II ⇒ 75% to 80% → newspaper.

Essay → read editorials; take a neutral stand.

Interview → the summary sheet is very important.

History → conc. 95% on Modern History.

CSAT ~~ARC~~ → Arihant

History → Spectrum.

Do not go for multiple books for a specific subject.

→ Always write your best question first.

SPORTS NEWS ⇒ imp

→ keep track of all sportspersons winning Intl. games. (Asian, olympic, S.Asian, etc.).

Paper-II ⇒ statistics → full scoring.

thava1862@gmail.com

Environment → basics (ICSE 9th or 10th) Newspaper.

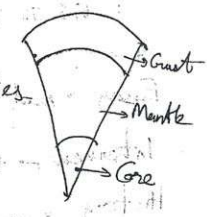
Geography ⇒ Draw diagrams for almost all questions. (maps)

→ Maps ⇒ mainly India maps (90%).

• keep track of imp. places in India, which figure in news.

16/07/12

EARTH'S INTERIOR



- The 3 layers of earth have been identified by studying its seismic activities.

- SEISMIC WAVES
  1) Primary (P)
  2) Secondary waves (S)
  3) Low(or) Surface waves (L).

Focus :- pt. where earthquake originates.
Epicentre :- pt. where the earthquake is first received

- The seismic waves originate (focus) in the crust. From there, it starts radiating in all directions & attacks the earth's crust.

P-waves

- Travels through solid & liquid.
- Similar to sound waves ⇒ TRANSVERSE
- Shadow zone ⇒ 103° - 143°

S-waves

- Pass only through the solid.
- Longitudinal → similar to water ripples.
- Shadow zone ⇒ > 103°.

L-waves (surface waves)

- Travels only along the circumference of earth.
- Longest waves, since they travel the entire surface of the earth.
  - No shadow zone;
  - Cause maximum damage.

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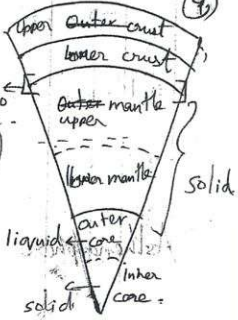
Asthenosphere → a semi-solid layer in the upper mantle.

↓

Between crust & mantle.



→ As we go interior into the earth, temperature increases.

→ But, why is only the outer core a liquid?

• Though both the outer & inner core is made of the same material, the melting point of inner core is increased due to the increased pressure. So, the inner core is in solid state.

M·P· ∝ Pressure.

→ Why asthenosphere is semi-solid?

Rotating magma (during earth's formation) rich in uranium and radioactive materials get deposited under the crust. These radioactive materials, on disintegrating gave out energy. This energy makes this layer in a semi-solid state.

↓

heavy metal. But these got trapped beneath the crust, due to the rotating movement of the earth (centripetal force). ⇒ due to magnetic convection.

→ This is why Uranium is available in the surface in Canada, Australia.

Asthenosphere → also contains basalt, & other igneous rocks.

→ Crust → SiAL → Silicon, Aluminium.

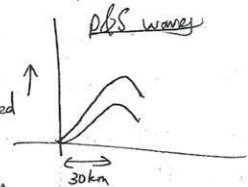
→ Mantle → SiMa → Silicon, Magnesium.

→ Core → NiFe → Nickel, Iron.

Asthenosphere → 30 km depth.

When we pass P & S waves [into the earth's crust, their speed drops at a depth of 30 km

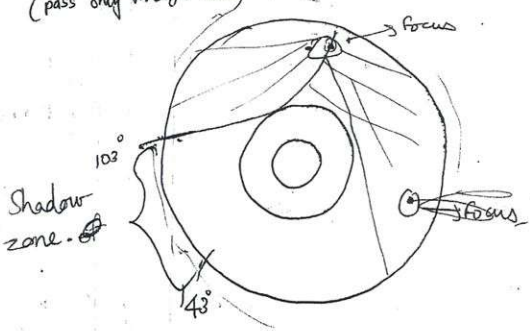
If asthenosphere was completely liquid, speed would have dropped to zero, but it got reduced because of a change in state (solid to semi-solid)



Density changes, speed decreases

SHADOW ZONE

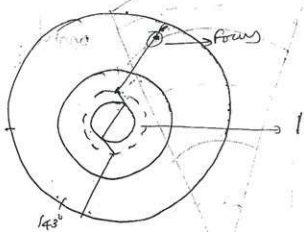
⇒ S-waves (pass only through liquid) do not pass through places in between 103° & 143°.



- S- waves don't pass through liquid layer.
- This means S-waves can't reach $103° < \theta < 143°$ because of a presence of a liquid layer underneath.

• Using these angles, the depth of outer core (liquid) is calculated.

→ P-waves can't pass through 103° to 143°.



P waves → can travel through both solid & liquid.

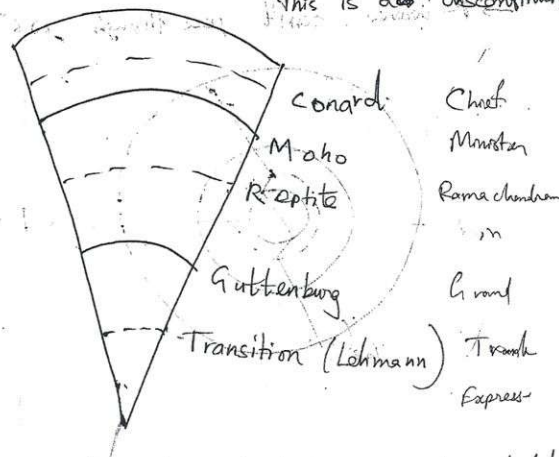
Due to repeated refractions (as the wave travels from heavy to light medium (mantle to outer core), light to heavy (outer to core inner heavy) & so forth), the P-waves will never be able to surface at an angle b $103° < \theta < 143°$.

→ The angle 'θ' is measured with respect to the focus of the earthquake.

→ Since neither P nor S waves can reach places in the region $103° < \theta < 143°$ with respect to focus, it is called shadow region. Only 'L' waves will appear at shadow zone.

→ The shadow zone proves the presence of a liquid outer core.

→ At every layer junction (upper crust – lower crust, lower crust to upper mantle, so ...), there is a sudden change in the velocity of P and S waves. This is a discontinuity



→ But, Asthenospheric junctions are not included in these discontinuities.

VOLCANO

→ Source of volcano → Asthenosphere

→ If magmatic ~~lava~~ comes out from outer core, earth would have shrunk & its speed of rotation increased.

1. Discus critic
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3. Critica
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6. Elucio Geom
7. Commen
8. Brief
9. Descri
10. Justi Subst
11. Differe
12. Compa
13. Evalua

Question

1. Discuss, critically analize, → straight → our views & opinions, positives & negatives, & give conclusions. positive → 50%; negative → 50%.

2. Explain, describe → straight → normal elaborate notes.

3. Critically analize (examine)

4. Criticize

5. Enlist (enumerate) → throw up facts

6. Elucidate (Explain) → Explain with relevant examples.

7. Comment → take a stand [on any one of the choices] but, give 10% at the unopted stand.

8. Brief note on → touch all the major points of the supposedly vast topic & compress as a brief note.

9. Describe

10. Justify → Substantiate → Give facts & reasons supporting the statement given.

11. Differentiate → Say only the differences, not similarities.

12. Comparative analysis → Give both the similarities and difference.

13. Evaluate

Questions:
- Open-ended (The question doesn't give the stand to be taken).
- Directed (The question itself gives the stand to be taken).

~~Critically analize Tendulkar as a batsman.~~

PART A

①

②

③

④

PART-B

①

②

③

④

~~Discuss Tendulkar~~

Upto 2008 ⇒ no split-ups usually 80 m questions

Paper I

① World Map
② Geomorphology
③ Climatology
⑤ Short notes
⑧ Models & theories.

Paper II

① India - Map
② India - physical setting
③ Agriculture
⑧ Contemporary issues

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15 m ⇒

Diag
DIAGRAM

After 2008

30m - 30m split up.

→ The two split-ups will be from different chapters.

→ General questions, rather than technical (since only 30 marks).

→ Map in paper I, not sure. May come. May not come.

→ Write the exam based on examiner's psychology, not on your psychology.

→ Write your 'BEST QUESTION FIRST'.

→ Write the exam for a layman, not for a researcher. (even a person who has not come across that topic must understand the entire answer).

→ No word limit, but keep a time limit to yourself.

Time Allocation

1 → 40 mins
2 → 40 mins
3 → 35
4 → 35
5 → 30

For each 30 m question, allocate 15 minutes.

Diagrams

15 m ⇒ 2 to 4 ; 30m ⇒ 3 to 6 ; 60m ⇒ 6 to 8.

Diagrams absolutely necessary in Geography.

DIAGRAMS → Piechart, graph, flowchart, picture, map

⇒ You can write either in paragraphs (or) points.

1 paragraph → not more than 6 lines.

Use short & complete sentences.

⇒ Diagram should be complete in establishing facts.

→ Place the diagrams in the right portions of text.

→ Even if we take a negative stand against something, do it in a diplomatic way (not in harsh words) (both in mains & interview).

Prelims : (Assertion reason type)

(1) A ⇒ Area between 103° & 143° is called shadow zone.

R ⇒ No waves is detected between 103° & 143°.

i.e. S waves do not pass through liquid. P waves are refracted.

(C) ⇒ A (✓) R (✗)

Surface wave is detected.

(2) A → Area between - 103° & 143° is called shadow zone.

R ⇒ No waves is detected after 103° ~~after~~ except L waves.

(C) ⇒ ~~Do~~ (R) is wrong :

~~after 103°~~,

after 103°, till 143°.

③ A.

I

R ⇒

But

Mc

1) How understo

2) Ea

3) Seism

4) Seis understo

Tomo

→

next

Sat → P

Sun → E

c) points.
lines.
facts.
rtions
against
in harsh words
shadow zone.
3°.
s are refracted.
led shadow zone.
° ~~after~~
108°, till 143°.

③ A → 'L' waves travel entire circumference of the earth.

R → It is the longest wave among the 3 waves.

ⓑ ⇒ both A & R are right.

But A is the reason for R.

Mains

1) How far seismic waves are helpful in understanding earth's ~~atmosphere~~ interior? (30 m).

2) Earth's interior (15 m).

3) Seismic waves (15 m).

4) Seismic wave is the only authentic source to understand the earth's interior. Discuss. (30 m).

write ans. for this.

SCHEDULE

Tomorrow's topic

→ Isostacy & earth movement.

next
Sat → Plate tectonics → continent & ocean ba
Sun → Earthquake & volcanicity.

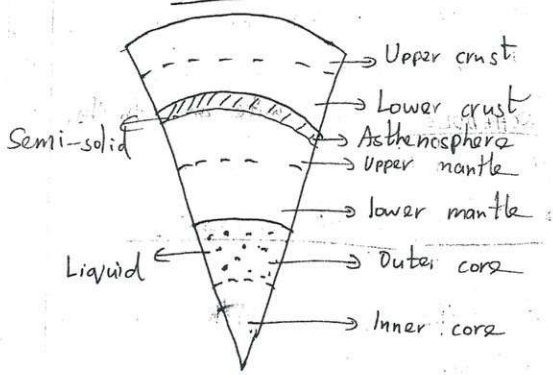
→ How far seismic waves are helpful in studying interior of the earth?

Earth's interior

The earth is essentially made up of 3 layers → 1) Crust 2) Mantle and 3) Core. Further classification brings into light

Upper crust
Lower crust
Asthenosphere
Upper mantle
Lower mantle
Outer core
Inner core

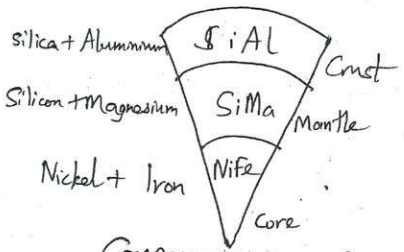
Layers of earth



Of these layers, the asthenosphere is semi-solid.

The outer core is liquid (molten state).

All other layers are in solid state.



COMPOSITION OF EARTH

→ Define

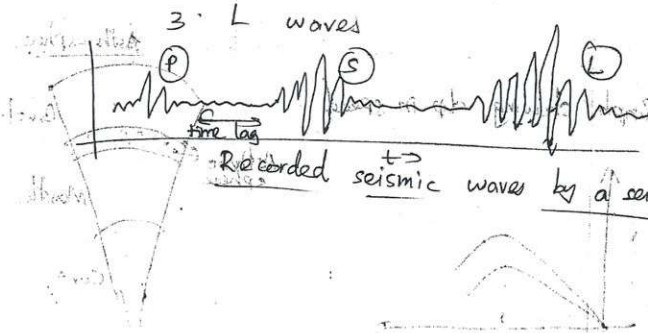
SEISMIC WAVES — AN INTRODUCTION

The study of the interior of the earth has been greatly facilitated by the seismic waves, whose simulation & study has provided scientists with a lot of substantiating facts.

The seismic waves originate at the focus (in the crust), and reach the surface at the epicentre (on the earth's surface).

Types of seismic waves.

1. P waves
2. S waves
3. L waves



Recorded seismic waves by a seismograph.

P waves

- P waves can travel through both solid & liquid states.
- Their properties are similar to those of sound waves.

S-waves

- S-waves can travel only through solid.

L waves

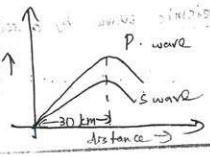
- These are surface waves.
- They are the longest waves since they travel along the entire circumference of earth.

~~SHADOW ZONE~~

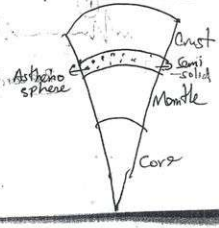
Discovery of asthenosphere

When the seismic waves were passed through the earth, they experienced a sudden dip in speed at a depth of 30 km. This indicated a change in density, hence a change in medium after 30 km, which led to the discovery of asthenosphere.

Graph showing dip in speed

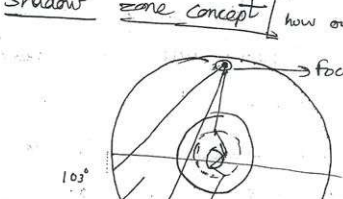


Asthenosphere



If asthenosphere was liquid, then S waves would have been stopped. But, the penetration of S-waves proved the semi-solid nature.

Shadow zone concept [how outer core is liquid?]



refraction of P-waves.

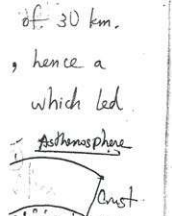
→ S waves - originating at a focus cannot reach the earth's surface beyond 103° of the focus point. ($\theta > 103°$ S-shadow region)

→ This proved the presence of a liquid layer.

→ By calculating angles, it was proven that outer core was in liquid state.

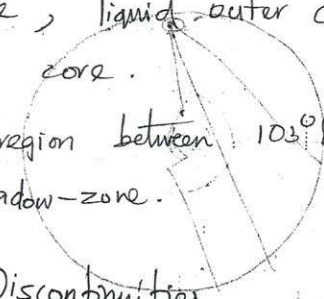
Refraction of P-waves

→ P waves, originating at a focus could not reach the earth's surface between 103° & 143°. ($103° < \theta < 143°$ ⇒ P shadow region).



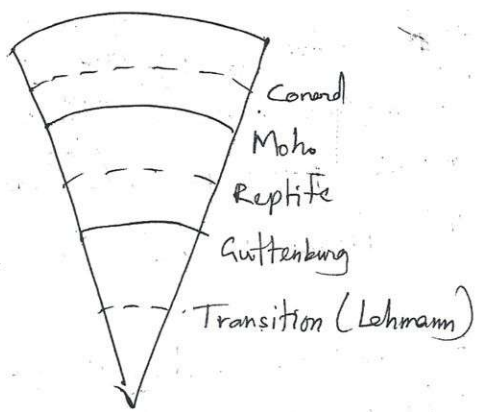
→ This was due to ~~continuous~~ repeated (double refraction ⇒ mantle to inner outer core ; outer core to inner core) refraction, as it progressed from solid to liquid to solid layers.

→ This proves the presence of a solid mantle, liquid outer core, ~~liquid~~ solid inner core.



The region between 103° & 143° is called shadow-zone.

Discontinuities



Further, the P waves showed a change in speed at 5 different points, and these were called discontinuities.

Hence, 6 layers were established.

Method of approach

Try to go with the question flow?

How are seismic waves helpful in understanding earth's interior?

→ Why to study earth's interior?

Since, geographical changes on earth's surface are deeply related with the interior.

→ Define seismic waves?

A form of energy waves transmitted to surface of the earth in a widening circle, from an originating focal pt.

→ Properties of P, S, L waves.

→ How earth is not homogeneous?

Since seismic waves don't travel in straight line.

→ Why 3 layers?

Both P & S have 3 rays with diff. velocities. (P_g-S_g, P^*-S^*, P-S)

→ Asthenosphere?

Both P & S pass, with change in velocity.

→ How outer core (2900 km) is liquid?

Shadow zone concept.

→ How discontinuities?

Velocity change at 5 pts.

- Read less, think more.

⇒ Seismic waves are the only authentic means to study earth's interior. Discuss.

There are various means to study earth's interior

Direct sources	Indirect sources
1) Drilling	1) Temp, pressure, density
2) Mines	2) Gravitational force.
3) Volcanic material	3) Meteors
	4) Seismic waves

1) Drilling
2) Satellite images.
3) Rocks
4) Natural
5) Artificial
6) Seismic waves.

Temperature, pressure.., drilling, volcanic material. Most authentic.

Though all these provide a slight knowledge abt earth's interior, the seismic waves are the best means to give a clear & indepth understanding of the earth's interior.

⇒ Non-conventional energy is the future of the nation. Discuss.

We should also mention the disadv. of conventional energy

→ Earth's interior. Discuss. (15 m)
→ open ended.

The entire chapter. Condense into 2 pages. (structure. Its study. (seismic waves & artificial sources))

→ Seismic waves. Discuss (15 m).

- Definition.
- Types.
- Properties of each type.
- Uses of ~~Uses of~~ Behaviour in the interior of earth.
- Uses of seismic waves.

See NCERT for more diagrams & clear explanation on this topic.

NCERT
→ Good diag. for P & S shadow zone.
→ Direct & indirect sources.

Sawindra
→ Interior of the earth → structure.

17/06/12

ISOSTACY
(mechanical stability)

Gravitational equilibrium that exists between upstanding block & low-lying area [equilibrium b/w degradation & upgradation], on a rotating earth.

Airy → First to propose Isostatic theory.

Iceberg floatation principle

Any floating body should have at least $9/10^{th}$ of it under water.

Airy adopted the floatation principle

AIRY

Any body on the earth's crust has $9/10^{th}$ of it submerged. ~~in the asthenosphere~~ (below the crustal surface)

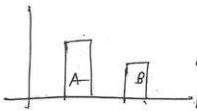
→ The entire crust has uniform density, but varying thickness [thickness as measured from asthenosphere]. Uniform density, varying depth.

* Airy's theory → Sawindra Singh
* A. Pratt's theory → Sawindra

Bigger the column, lesser the density. Lesser the column, bigger the density.

Uniform depth, varying Density.

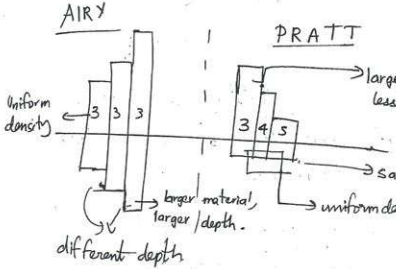
(~~below~~ here



A & B have varying density, but same depth.

Pratt's concept ⇒ derived from 'Law of Compensation'; (below the level of compensation, density is uniform)

Airy's concept ⇒ derived from 'Law of flotation'.



By Pratt's theory, the density of compensates for the size, so they submerge to the same extent.

↓

('This again alludes to flotation principle.' (root formation)).

Hayford & Bowie :-

→ Extension of Pratt's theory.

Pratt ⇒ Line of compensation.

H & B → Plane of compensation (at a depth of 100 km)

H & B just ~~removes~~ divides from the 'root formation' of Pratt.

JOLY

A & B

plane of compensation ⇒ zone of compensation

(16 km thickness).

Joly says, "Uniform density above zone of compensation, but varying density below zone of compn".

Holmes:

→ Accepts Airy's floatation theory to a certain extent, that the columns submerge but not in 1:9 ratio.

→ Larger columns submerge to a greater extent, because lighter material is available under larger column to a greater depth.

→ Smaller columns have lighter material below them upto a lesser depth, so they are submerged less.

ISOSTACY

• Suppose a mountain (Himalayas) is denuded. The eroded material is deposited in the ocean floor. The ocean flow, now having become heavier, presses

Questions

→ Make a comparative analysis of theory of Airy & Pratt's. (30 m)

→ Bring out the different views on isostacy (30m).

→ Isostacy [15 m]. → open ended.

Intro

CONTINENT & OCEAN BASINS

→ Since earth is a sphere, on drilling a hole, we'll emerge diagonally in the opposite side.

→ If we ~~open~~ drill a hole at all places on continental crust, we always open up into oceans, except at only 2 places.

On cutting into New Zealand, we emerge at Spain. On cutting into South China, we emerge in the Patagonian desert.

→ ~~All~~ Most of the continents (Americas, India) & most oceans are in triangular shape.

→ N. pole is surrounded by ocean, while S. pole is surrounded by land mass.

→ Most of the land mass is concentrated in N. hemisphere, while most of the ocean basin is in S. hemisphere.

→ Ocean crust (basalt) is heavier (higher density than continental crust (granite). So, ocean bed is always lower than the land mass.

Continental Drift Theory

Taylor & Wegner ⇒ Primary Aim:- To account for climatic change.

Age of Earth ⟶ (4·6 billion years ago)
Universe [13·6 billion yrs ago]

Historical evidence dt. back to 700 million yrs ago. [before ⇒ nebula form]

Primary period
- C ⇒ Cambrian period ⇒ first land mass
- O ⇒ Ordovician ⇒ huge volcanic activities
- S ⇒ Silurian ⇒ rainfall in earth
- D ⇒ Devonian ⇒ Age of fish; End of Devonian: full forest cover.
- C ⇒ Carboniferous ⇒ Age of coal. All forest cover was buried. Coal);
- P ⇒ Permian.
  - ↳ Age of Oil (oozes from buried animals led to formation of Petroleum & Oil.).

Secondary period (Age of dinosaurs & flowering plants)
- Triassic
- Jurassic
- Cretaceous.

Tertiary period
- Paleocene
- Eocene
- Oligocene
- Miocene
- Pliestocene

Quarternary period ⇒ Holocene (1'm years ago) ⟶ Age of Humans.

→ Taylor proposed the continental drift theory

→ Wegener made significant contributions to this theory. He wanted to explain the climatic changes of earth.

Hypothesis 1.

Continent may be stationary → climate must have changed.

Hypothesis 2.

Climate has been stationary, continents may be changing!

Europe & Applachan mts. have large deposits of coal.

Coal formation must be due to huge forest cover buried in the earth.

But, Europe doesn't have a climate suitable for thick forest cover (high temp. & heavy rainfall). So, he proposed the two hypothesis.

But, he rejected hypothesis 1, since if the climate drifted → then all places south of Europe's coal deposits should have some coal, since India's deccan trap has coal.

Assumption 1

During carboniferous period,
PANGEAE ⇒ A single continent
PANTHALAS ⇒ A single ocean

Assumption 2

SiAl is freely floating on SiMa.

Keeping these assumptions in mind, he started collecting evidences.

Evidences

1- Jigsaw fitting of continents.

2. Mountains on the either Coasts of Atlantic ocean of these fitting continents had same structure, age, material.

3. Fossil evidence - Similar fossils found in the same latitude of several continents. (Mesosaurus - Cynognathus)
placer deposits → Brazil, Africa (east of Ghana)

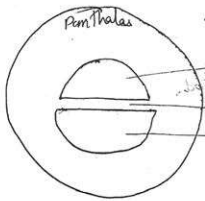
4. Lemings → these animals don't know swimming. And on population increase, they migrate towards WEST.
Condwana glaciation
Lemings' fossils are found in N. America & Europe.

5. Polar wandering...

How the continents split?

EARTH'S MOVEMENTS

- Equatorial
  - force of Buoyancy
  - Differential gravity force
- Westward
  - Tidal force of sun
  - Tidal force of moon.



- Centre of gravity of the earth lies in the centre of earth.

- After the split of the ~~pantha~~ pangea, the centre of gravity pulled the northern & southern land masses towards equator. These land masses collided ~~near equa~~ to form ~~fold~~ mountains [~~ex~~ Alps, Iranian mts, Himalayas] Since it is a north-south collision, these mts. are in the east-west direction.

- Earth rotates from west to east. So the sun & moon move from east to west. The tidal forces of sun & moon drifted the landmasses from ~~west to~~ east to west.

- SiAl movement on SiMa was restrained during movement from east to west. This caused the fringes in western part of North & South America [Rocky (in N. America) & Andes (S. America)]

Death valley ⇒ highest daily range of temp. (Hot in day; very cold in night)

Copper deposits in Pittsburg.

Texas → Largest cotton textile producing country.

Houston: refineries

Dallas: cotton.

Columbia plateau → } volcanic plateaus (similar to Deccan trap)
Colorado plateau → }

PRAIRIES → temperate grasslands (wheat production)

Wheat baskets of the world.

Longitude of Kansas, Nebraska, S & N Dakota, Saskatchewan. ⇒ (Fully mechanised cultivation).

Thousands of acres of grassland.

All over the world, wherever there is a temperate grassland, there is wheat cultivation. Wherever there is wheat cultivation, there is maize cultivation nearby.

⇓

The maize, after collecting corn is fed as fodder to cattle. ⇒ CATTLE INDUSTRY

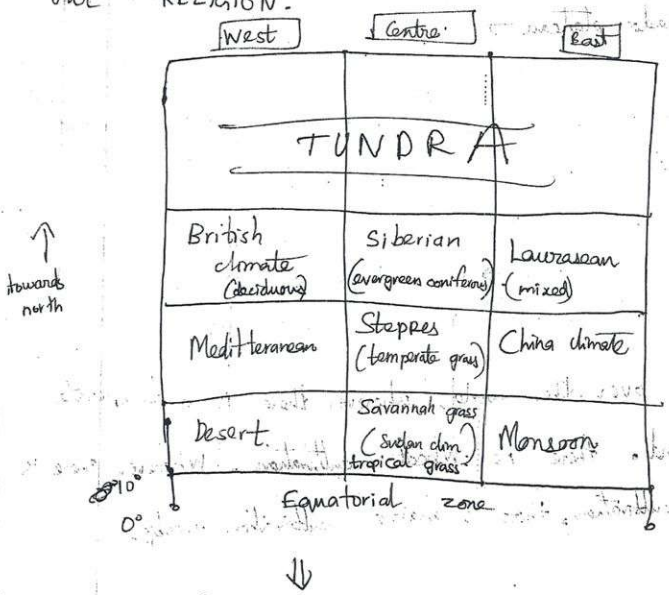
Meat → Meat-packing (Chicago)

Dairy (waste byproduct: hay powder (protein) → (body building) → Fed to pigs → PIG INDUSTRY.

→ Even in N. India (Punjab & Haryana) temperate grasslands are there.

Punjab – known for wheat cultivation.
Maize is also cultivated extensively.

So, DAIRY INDUSTRY is developed
But, meat industry is not developed due to our RELIGION.



Th

→ Bring out the different views on Isostacy.

Isostacy:

Isostacy is the mechanical stability (Gravitational equilibrium) between the upstanding areas and the lowlying basins on a rotating earth.

There have been various views on isostacy,

Airy's concept

→ Sial (crust of lighter material) is floating on Sima (substratum of denser material).

→ He adopted the 'Law of Flotation', that the ratio of freeboard to draught is 1:9.

→ He said all columns on earth (plains, plateaux, mountains) had the same density, irrespective of their thickness (height).

Illustration

Criticism:

→ We know, from experimental findings that, the density of earth's crust is not uniform everywhere

→ The flotation theory, if applied to Himalayas, demands a root of 70 km, under surface which would melt the Himalayas (since temp. is too high at that depth)

Pratt's concept

→ Pratt adopted the Law of Compensation.

→ Greater the height of the column, lesser is its density.

→ He expressed that all columns have UNIFORM DEPTH, BUT VARYING DENSITY.

→ There is a LINE OF COMPENSATION, ~~below~~ on which the mass of all columns is same.

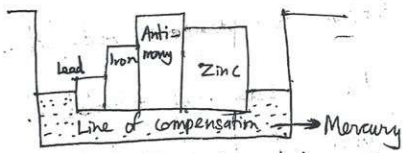


Illustration of Pratt's isostacy

CRITICISM.

→ Though Pratt doesn't believe in law of floatation, it indicates root formation indirectly.

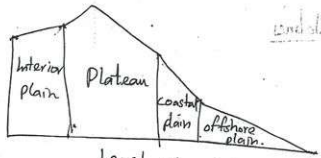
Concept of Hayford & Bowie

→ This concept is similar to the Pratt's concept.

→ There is a plane of compensation, rather than a line of compensation.

→ The zone below this plane has uniform density in the lateral direction.

→ Plane of compensation is located at a depth of 100 km.



Hayford & Bowie's concept

Criticism

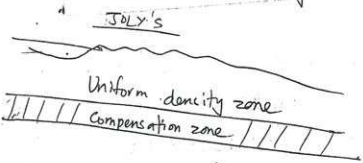
→ That the crustal parts are in vertical columns is not tenable, because crustal features are found as horizontal layers

→ Plane of compensation, if at 100 km depth, would be liquefied.

CONCEPT OF JOLY

→ Joly believed in a ZONE OF COMPENSATION of 16 km thickness.

→ His concept is closer to Airy's.



HEISKENEN CONCEPT

→ He Combined the views of Airy & Pratt.

→ He said density of different columns were different, and density of a same column increased with depth. (downwards)

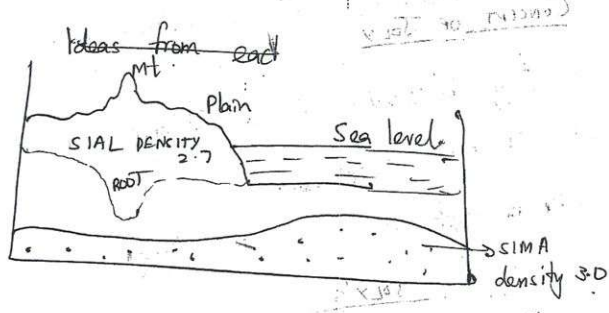
→ Density of rocks vary both horizontally & vertically.

Concept of Holmes

→ He said "Higher columns are submerged to a greater depth than lower columns' but not in the ratio of 1:9.

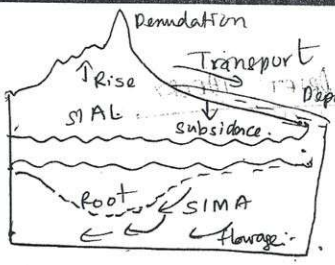
→ Higher columns are submerged greatly, because there is lighter material below them for greater depth.

→ Smaller columns have lighter material below them only upto a lesser depth.

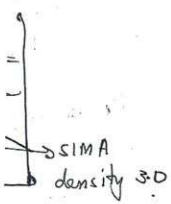


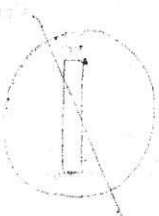
~~Isostatic~~ Nature always tends towards isostatic adjustment.

For eg:- a mt. is denuded. This causes lowering of mt. The denuded materials are deposited at the sea-bed. This makes the ocean bed heavier & mt. lighter. This causes a rise in the mt. & subsidence of sea floor. To maintain isostatic balance, SIMA must flow from ocean bed to mt. under the level of compensation.



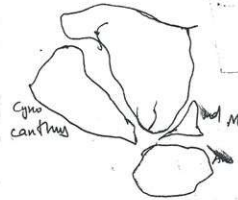
The various views on isostacy have led to a greater understanding of the earth's equilibrium. Though the various endogenetic forces & tectonic events cause disturbance to isostacy, nature always tends to isostatic adjustment.





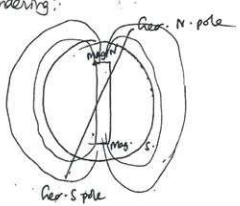
23/06/12

CONTINENTAL DRIFT THEORY



Criticism:-

1) The aim of Wegner is itself unstable.
2) Fitting:- Erosion might have shaped the continents.
3) Fossil:- Simultaneous evolution in the species in all the continents
4) Polar wandering:-



→ The core (Iron-Nickel) acts as a magnet. Since the core is stationary but crust is rotating, due to change in magnetic flux $d\phi/dt$, it produces a magnetic

field. The core (since it's a liquid) is constant but the crust is moving due to continental drift. So, the position of magnetic poles on earth's crust wanders. magnetic N pole ∋ Canada (Ellesmere island), magnetic S pole ⇒ south of New Zealand in Antarctica.

Even though core is constant, ~~the~~ and its magnetic north & south pole are ~~not~~ constant, the crustal surface over the magnetic N. & S. is continuously drifting. ~~Through~~ This is the apparent movement of magnetic pole. This is called polar wandering.

Magnetic poles, now in Canada & Antarctica may change its position after thousands of years due to ~~Real~~ continental drift.

Criticism:

5) Does the moon & sun have such an enormous gravity to drag the land masses? If it was so, then the gravitational force might have absorbed the entire earth itself?

6) If Equatorial movement pulls all land mass towards equator, then the equatorial region will bulge and at one point stop the rotation of earth.

2½ 7) The formation of fringes (Rocky & Andes) was due to the SiMa resistance to westward movement of SiAl. ~~Why did~~ It is contrary to assumption ②. self-made contrary statement.

e) If there was a united land mass in carbaniferous period why was it united only till carbaniferous period?

a) How did the split occur?

PLATE TECTONICS THEORY:

Aim:- To explain all geological activities — mountain building, earth quake, volcano, etc.

Mid Altantic ocean ridges ⇒ north-eastern direction.

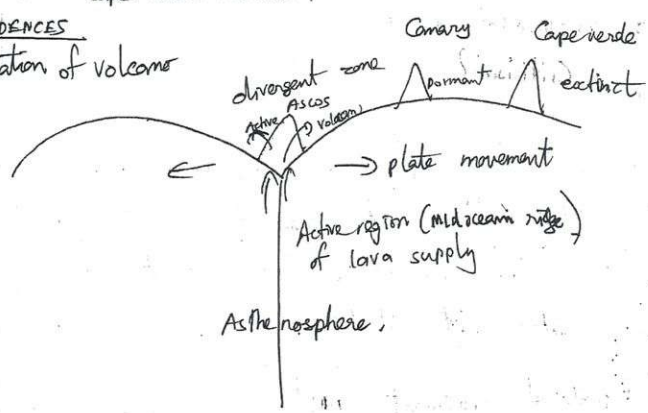
Ascos ⇒ Active

Canary → dormant

Cape Verde → extinct

4 EVIDENCES

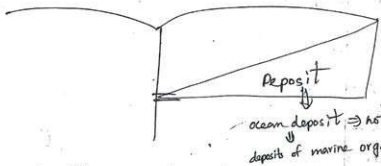
① Location of volcano



② Sea floor Spreading :-

As the magma comes out, it forms new floor, resulting in spreading of sea.

③ Thickness of ocean deposit.



- Ocean deposit increases as we move away from the mid-atlantic ridge.
- Deposit ∝ Time
- Older the plate, more is the exposure and more is the deposit. Hence, the thickness of ocean deposit increases as we move from mid-atlantic ridge towards the continent.

Ocean floor is thin & conti is thick. ~~Ocean floor is young & co~~

④ Age of ocean floor :-

Study of rocks shows that the age at the mid-atlantic ridge is 3 million yrs old and continental crust is 300 m yrs old. This shows ocean floor is young & continent is old.

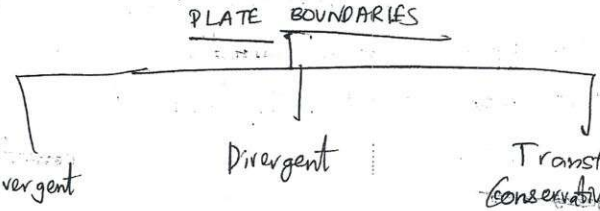
(5) ~~Polar~~ Polar Wandering

(6) Paleo magnetism : ⇒ The alignment of magnetic susceptive materials in the rocks, with respect to the horizontal during their formation.

PLATES

- 7 major plates
- 22 minor plates.

(1) N. Amer
(2) S. American
(3) Eurasia
(4) Africa
(5) Indo-Aus
(6) Antarctic
(7) Pacific.



t of magnetic
to the horizontal
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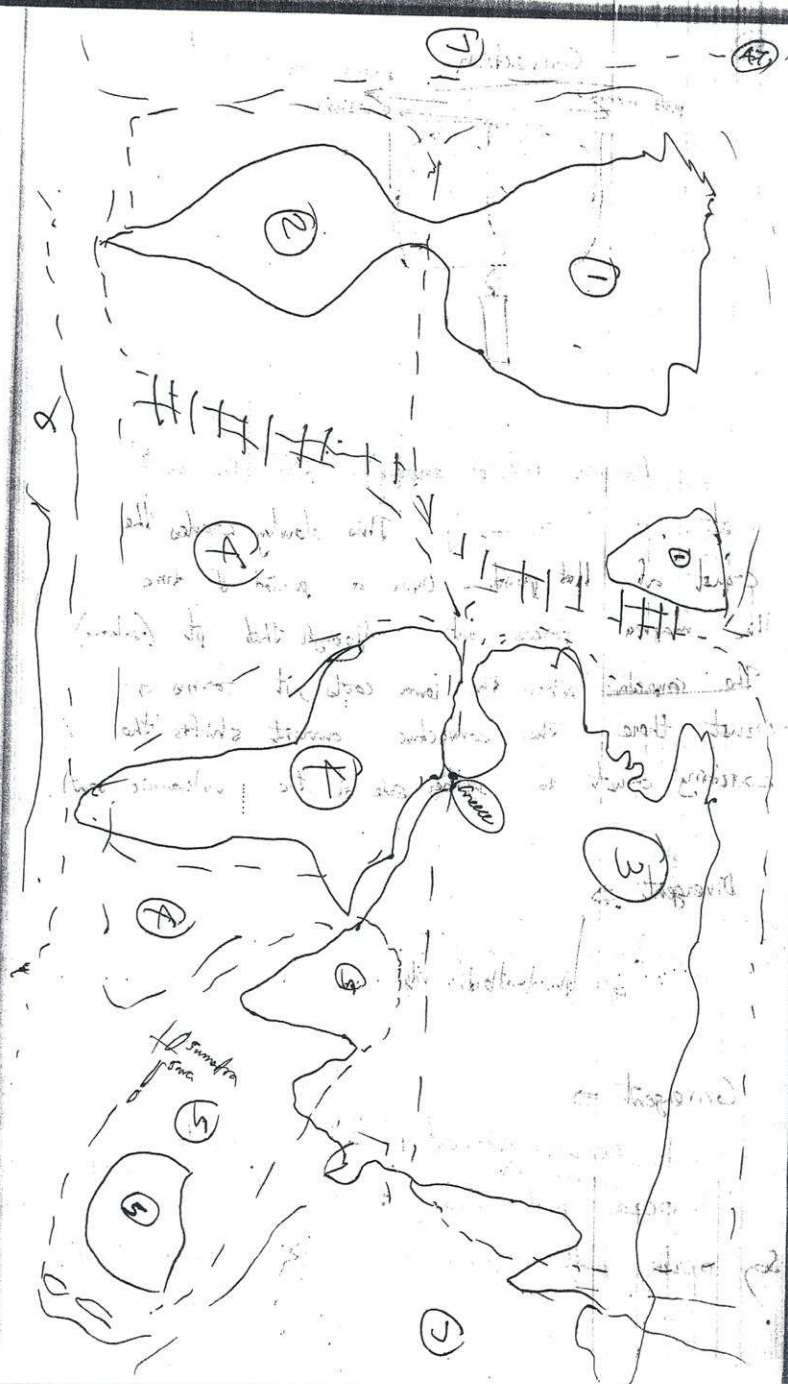
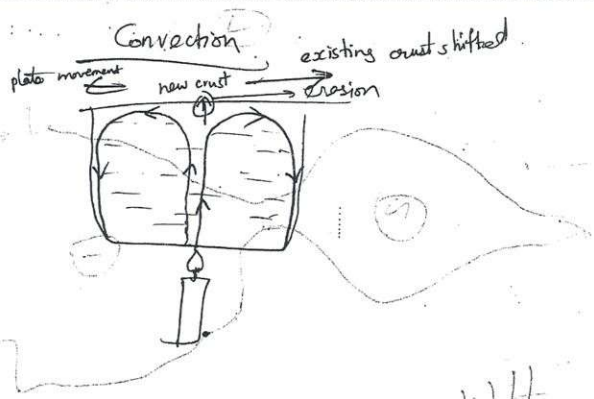




Magma (full of energy) hits the earth's crust at ① constantly. This slowly erodes the crust at that point. Over a period of time this magma forces out through that pt (volcano) ~~The convection~~ When the lava cools, it forms a crust there. The convective current shifts the existing crust to either side of the volcanic vent.

Divergent ⇒

Ocean – ocean plate.
eg:- Mid-atlantic ridge

Convergent ⇒

ocean – continent plate
(basalt) (granite)
ocean plate: heavy ; continent plate light.
So, ocean plate subducts under continental plate

The
plate
over
Thi
plate
excess
out.
fractu

break
result

oceani
mounta

Ear

moon
earth's
the ea

The ocean plate freely moves under continental plate. Continental plate can't freely move over the ocean plate due to its obstruction. This results in fractures. The subducting ocean plate melts in the asthenosphere and this excessive magma searches for some space to move out. This magma comes out through the fractures in continental crust ⇒ volcano.

The subducted ocean ~~plate~~ plate first breaks and then melts. When it breaks, it ~~results~~ releases energy. ⇒ Earthquake.

The continental crust on colliding with oceanic crust bends and forms fold mountains. ⇒ fold mountains (Rockies, Andes)

Mt. Logan, Whitney, Mt. Aconcagua

volcanic peaks

Earthquakes → mostly from 1 am to 9 am ⇒ moon's direct rays.

Dec-Jan ; April-May

Apogee : Perigee : ⇒ near

Is far

During these months & time earth is very close to moon. The moon's tidal force (and attraction of earth's crust) will allow free movement of the earth's crust.

↓ convergent volcanoes :-

The most explosive. Since the magma comes out through a small vent, the energy is very high ⇒ explosive.

Divergent volcanoes :-

Not explosive. Since it has a large vent (the entire mid-atlantic ridge). ~~It has~~ Less energy density (Iceland ⇒ Eyjafjallajökull).

Ocean-continent convergence

North American — Pacific

west ward

ocean plate subducts.

Continent-continent convergence

Indo Australian — Eurasian

northward (northeastly) southward

↓ This subducts

Indo-Aus plate will subduct under Eurasian plate, since Indo-Aus plate has a lot of ocean floor & hence it's heavier.

Ocean-ocean convergence

Japan (minor ocean plate) — Pacific

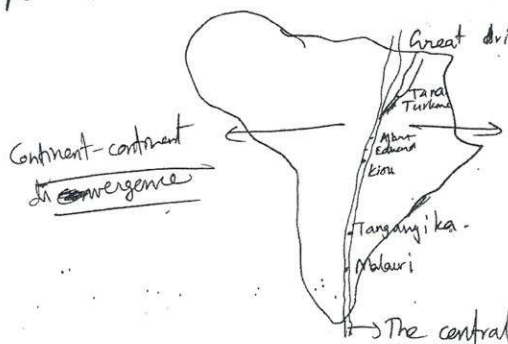
east ward

↓ heavier

This subducts

Great ~~A~~rift valley

~~Africa~~ due to fracture in the mid African plate.



→ The central plate has went down (into asthenosphere)

Future

Atlantic ocean will expand (due to sea-floor spreading at mid Atlantic ridge)

Pacific ocean will shrink.

N. America close to India. (shrinking of Pacific)

Delhi under Himalayas (Indo-Aus - Eurasian plate convergence)

Africa → East Africa
AFRICAN SEA (due to the Great African rift)
→ West Africa

Divergence ⇒ only in ~~Atlantic~~ ocean

~~minor divergence in~~

CONSERVATIVE: neither convergence nor divergence (plates slide past each other) eg: San Andreas fault (California)

Balancing mechanism:

reprocessing of magma & crust.

crust to magma ⇓ convergence

magma to crust ⇓ divergence

Convergence & divergence balances the size of the earth.

Yellowstone national park (S. Dakota, Wyoming)

→ Hot geyser. ⇒ ~~California Oregon~~ ~~Mt. Whitney~~

⇓

every 18 seconds, hot water comes ~~out~~

Lava

⇓

When magma comes out through a volcano.

Magma

⇓

in asthenosphere

Greece ⇒ Africa – Eurasia plate

⇓

has faced a lot of earthquakes, volcanoes, tsunamis.

eg:- Pompeii earthquake

So, They have undergone a lot of evolutionary thinking.

Greeks have several gods ⇒ fire, water, land due to their fear for these.

Ocean – ocean convergence ⇒ one which has lesser ~~land~~ continental crust will subduct.

equator → less gravity ; pole → more gravitational force.

Questions

→ Difference b/w Davis & Penk theory

→ Isostacy.

→ Plate tectonics on earthquake, volcano, mountain building

North America

Columbia plateau, Colorado plateau ⇒ Inter mountainic plateau

↓

volcanic (also Deccan trap in India)

↓

between Rocky & Coastal Range.

Ozark plateau ⇒ between Mississippi – Missouri plain

↳ Oklahoma

↓

dome shaped plateaus.

Appalachan → one of the oldest mt. mountains → formed during convergence of Pangaea 1 & Pangaea 2.

Chesapeake bay → near Washington D.C.

Tuticorin

Ise bay

→ Artificial pearl cultivation.

- Philadelphia, New York — East coast ⇒ Cod fish

↓

Cod liver oil → vitamin A.

New foundland

- Anapolis ⇒ American Apple.
  - Has the longest drizzling throughout the year.

→ Warm current & cold currents meet. So, fishes thrive. Fishing port.

→ Titanic sank

Kodiak island ⇒ Alaska
↳ rich in oil resources:-

West coast

↳ Solomon fish ⇒ anadromous fish

↓ lives in sea water & lays eggs in river water.

One of the costliest fishes.

↓

Construction of dam affects fishes

Laurentian plateau

↳ N. E. U.S.A

↳ one of the undeformed lands of original Pangaea.

Hot, Wet equatorial climate

→ 10° N to 10° S.

→ High temp. due to direct sun rays.

→ High temp. causes air mass to move up. This results in formation of clouds. This causes heavy rainfall. (convectional rainfall) ⇒ (3 pm to 6 pm)
↓
air mass has risen.

→ Temp. high throughout the year ⇒ So, rainfall is heavy throughout the year. So, high humidity.

→ No seasons.

→ Equator passes through Africa (Congo forests), S. America (Amazon forests), Indonesia.

→ 12 hrs day ; 12 hrs night,

→ Equinox (2 times in equator) ; Summer solstice ; Winter solstice.
↓ (→ sun crosses equator twice.)
At April & October
↓ sun directly above equator.
Double rainfall peaks.

Summer solstice → Least rainfall in equator.
Winter solstice → Least rainfall in equator.

→ Very heavy sweating (due to high humidity), So, they do not wear much clothes.

→ After 3 pm, due to heavy air mass, there is dense cloud formation. This obstructs sunrays. It is dim after 3 pm. The collision of clouds causes thunderstorm & lightning.

⇒ Heavy rain & high temp. makes trees to grow well. The trees grow very high to reach the sunlight. Since all the light is absorbed by the trees, grass doesn't grow.

⇒ The tribal ppl (Negroes) have big eyes (to see in the dark canopy), tall structure (to pluck fruits from tall trees), dark skin (high exposure to sunlight).

→ Earth's crust composition (Si > Al > Fe).
The heavy rain washes away all the silica. So, a large amount of aluminium (bauxite) & iron.

Bauxite ore → Suriname.

Iron is very much in the soil. This makes the soil reddish ⇒ Laterite soil.

Eg:- kerala (kozhikode)

Not fertile enough. supports Cashew.

Burning this soil makes it strong → used to make tiles (ओढ़ी) ⇒ Kerala tiles → red colour

→ Occupation :- No agriculture possible (due to lateritic soil)
Hunting, Gathering, fishing

→ Spicy food ⇒ to preserve the food - decaying from the hot & humid climate.

→ Evergreen forests.

- Leaves are broad (more water, more transpiration).
- Mixed species. Each species shed leaves during different seasons. So, overall the forest looks evergreen.
- Hard wood trees

Mahogny, Ebony, Green hagg, Red → chinona. (Carminre drug) ↓ anti-malaria

→ Competition among species is very high

⇓

Survival of fittest → That's why Darwin did his research in Galapogas. (Ecuador) in equatorial region.

→ High temp., heavy rainfall ⇒ large no. of mosquitoes

⇓

Malaria.

(Nigeria) ⇓ causative (mosquito) & cure (chincona) in same place.

Development

→ When trees are cut down to lay roads all the grass seeds get sunlight to grow and grow rapidly thus covering the roads choking development.

→ British colonisation cut down the trees & planted cocoa, rubber & used imported slaves to work in these plantations.

next class: Earth's rotation; plate tectonics ⇒ mains form.

24/06/12

Continental drift	Plate tectonics
Aim:- To study climatic changes.	To study major geological activities.
Period:- Carboniferous	Pre-cambrian period
Evidences:-	
- Fitting of continents	- Location of volcanoes
-	-
-	-
-	-
→ only continents moves	→ both ocean & continents moving
Forces - Exogenetic	Endogenetic.
→ Tidal force	→ Convectional current
Movement	
→ equatorial & westward.	→ multi-direction.
1 cycle → 1 Pangaea	multi-cycle → Pangaea 1, Pangaea 2

Comparative analysis

Intro

1 major similarity & 1 major difference.

→ A single line intro of Continental drift & Plate tectonics.

→ The aim.

→ Period :-

→ Assumption :- note it → similarity.

→ Evidences

↳ Just list down the evidences (don't elaborate unless the question is directly on evidences).

Take 1 evidence of Wegner & prove that the evidences are logically concluded rather than scientifically proved.

tectonics:-

major
activities

brian period

of volcanoes

continent moving/-
ic.
tional current

1-direction.
) Pangaea 1, Pangaea 2

ference.

Plate tectonics.

(don't elaborate evidences).
ot the evidence
ntifically proved.

Plate tectonics evidences are authentically scientifically proved. (59)

→ Wagner ⇒ talks only about continent, leaves ocean unexplained.
Tectonics deals with ocean & continental plates:

FORCES:-

→ • Tidal forces & criticism. Equatorward & criticism. Si Ma's friction in westward → self-contradiction.

• Convective current → scientific:-

Cycles:-

• No explanation of pre-carboniferous. How pangea at that time?

• Explains about Pangea 1 & Pangea 2.

Eastern Ghats → during Pangeae 1
Western Ghats ⇒ Escarpment,

⇓

The deccan plate is tilted towards the south (in Chennai). The raised side of the deccan plate broke & fell into the ocean. This is why one side of W.Ghats is steep (scarp) while other is gentle. (slope)

During Pangaea I closing ⇒ Appalachian, Ural, Aravali;

Due to exogenetic force → Grand Canyon, Arizona

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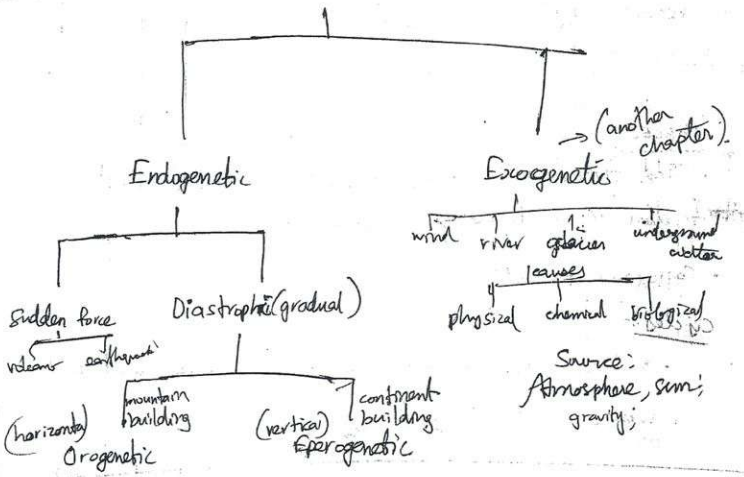
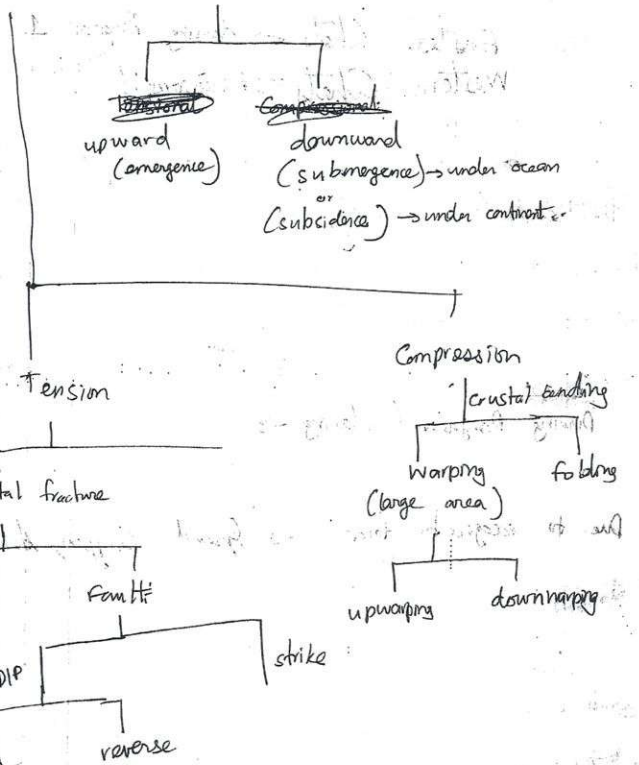
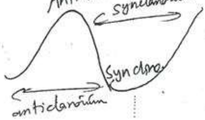
Earth's movements

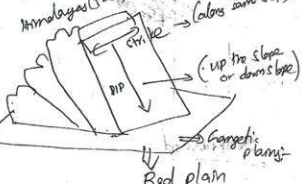


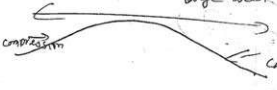


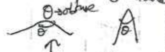
(61)

Folding ⇒ compression in small area :-







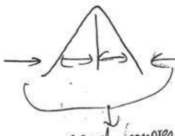


SAMIRO FOC

(Symmetric, Asymm, Monocline, Isocline, Recumbent, Overturn, Fanfold, Open, Closed

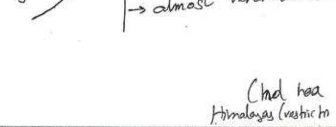
Symmetrical

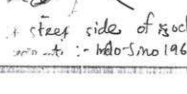
Asymmetrical



Monoclinal : more force ⇒ steep
less force ⇒ gentle slope

Isocline
(eg:- Himalayas)
(very huge compression
limbs parallel; vertical to plane of bending





India : steep side of isocline
Himalayas (restriction ... :- Indo-Sino 1962.

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Recumbent

intense compression:- Siwaliks

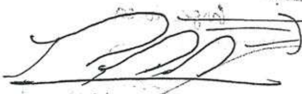
Rec

— plane of bending (plain bed)

Both limbs of fold parallel; The limbs are horizontal to bed plain (plane of bending)

Overturned

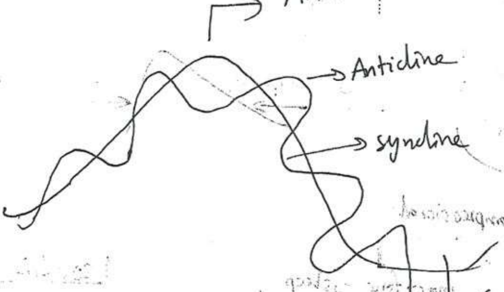
eg: Uttarakhand.



overthrust folds

• One limb of a fold over the limb of another fold.

Fan fold



An anticline & syncline has several anticlines & synclines within.

Sudden force

volcano

(horizontal)

Orog

Crust

Crack

DI

Normal

Napp

In

unbearab

fold m

upward

compre

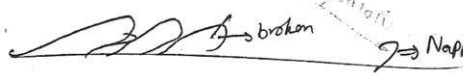
compr

up

Nappes ⇒ autochthonous ⇒ thrown over the next fold
→ exotic → thrown far away

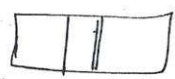
(63)

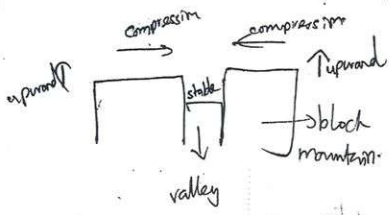
In case of overthrust folds due to unbearable compressive forces, one limb of a fold may be cut off & thrown off. This is called Nappe.



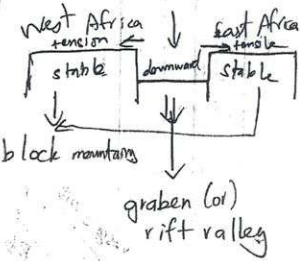
TENSIONAL ROCK — fault / fracture

~~Fracture~~ ~~fault~~ fault



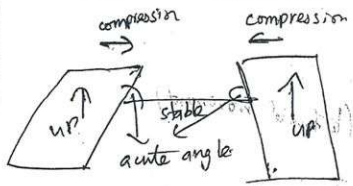


Great rift valley

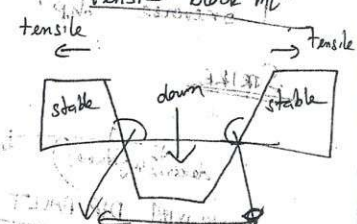


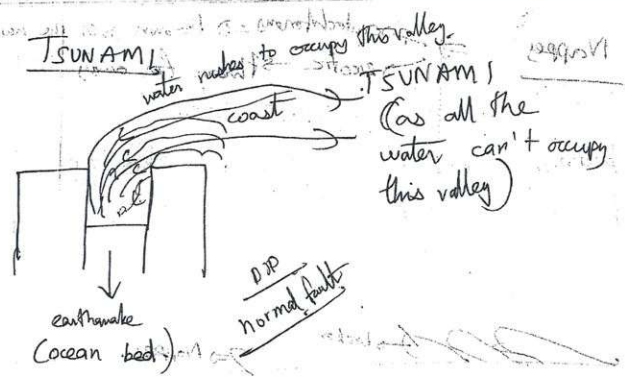
structure

compressional block mt.



tensile block mt.





DIP ⇒ vertical movement of plate

normal fault → downward ↓ movement of fault

reverse fault → upward ↑

These DIPs in oceans will cause TSUNAMI.

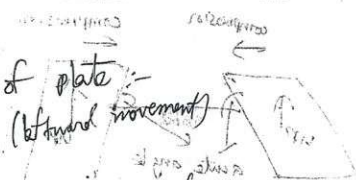
Rhine ⇒ rift valley. due to compressional force.

↳ reverse dip :-

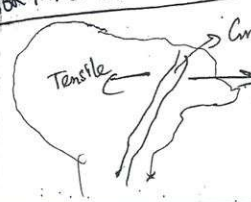
STRIKE

Horizontal movement of plate :-

dextral (rightward) ⇒ sinistral (leftward movement)



NORMAL DIP FAULT



Fault ⇒ A fracture in the crustal plate

Reverse fault

Rhine valley → Black Forest } Block mt.
Rift valley → Vosages }

⇒ Vindhya, Satpura ⇒ Block mountains (due to compression)

rift valley :- Narmada & Tapti :-

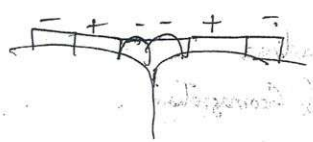
⇒ Damodar valley is a rift valley.

} but not perfect examples

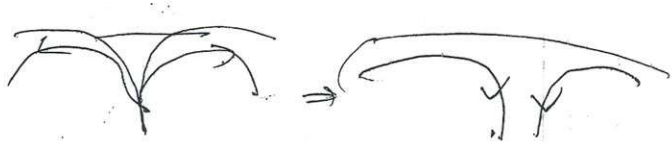
from Plate tectonics theory

Palaeomagnetism
↓ ↓
old magnetic property.

Parallelism in magnetic property of similar aged rocks and the reversal of magnetic field of different aged rocks. (magnetic reversal between successive magma coming out).



Magmatic reversal



Flow of magma

Savanna

Toda tribes in Ooty → pastrolism
↳ polyandry

Pastrolism → constant house; but wander for cattle grazing.

nomadism → wandering house & cattle.

squirrel → short term memory loss.

N. eastern states → dog as meat.

30m

→ Comparative analysis of the theories

→ Compare the evidences & forces of the theories.

→ How is plate tectonics improved over continental drift theory?

15m

→ Sea-floor spreading.

→ Paleomagnetism & Geomagnetism.

→ plates.

MAINS QUESTION

→ Bring out a comparative analysis of Wegner's continental drift theory and plate tectonics theory.

The proposition of both the continental drift theory and plate tectonics theory put an end to the dogma that earth's crust was a stable entity, thus opening up a wide range of possibilities to account for the continuous changes on the earth's surface and its relief. Though, it is quite evident that these theories had a lot of differences and contradictions starting from the very objective, they converged in their conclusion making a point that earth's crust is a dynamic entity.

Wegner's continental drift theory, states that the earth's continental land mass which was a single entity till carboniferous has split and moved apart under the effect of equatorial and tidal forces. On the other hand, plate tectonics provides scientific & geographical evidences right from the pre-cambrian period to prove the random motion of earth's crustal plates due to the convective current cycle of magma.

Aim of the theories.

Wegner started his research to account for the climate change in the earth's continents and ended up in the continental drift theory to substantiate this climate change. Thus his objective was unstable and wavering. Plate tectonics theory, initiated to account for all geological changes on the earth (volcano, earthquake, mountain building) was very stable right from its objective to conclusion.

Pangaea :.

Wegner says that there was only one land mass called Pangaea till the carboniferous period. He doesn't account why Pangaea was united till then and split after. Plate tectonics theory says Pangaea in the carboniferous period was pangaea 2 and that its various plates had been moving even before the carboniferous period. Thus, plate tectonics gives a proper multi-cycle theory for Pangaea, while Wegner's is blunt.

Evidences :.

The evidence of similar fossil records in different continents may be due to the simultaneous evolution of species across the world (just as the

case of Homo sapiens). Other evidences of continental drift theory

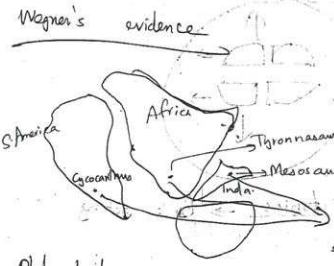
1) Jig-saw fitting of continents
2) Lemings remains on different continents
3) Similar rocks on either side of ocean.

These were empirical & logical evidences.

Plate tectonics provided more scientific evidences. Sea floor spreading is explained by the position of active, dormant and extinct volcanoes in the mid-atlantic ridge.

Other evidences

1) Age of ocean floor
2) Thickness of ocean deposit
3) Paleo magnetism

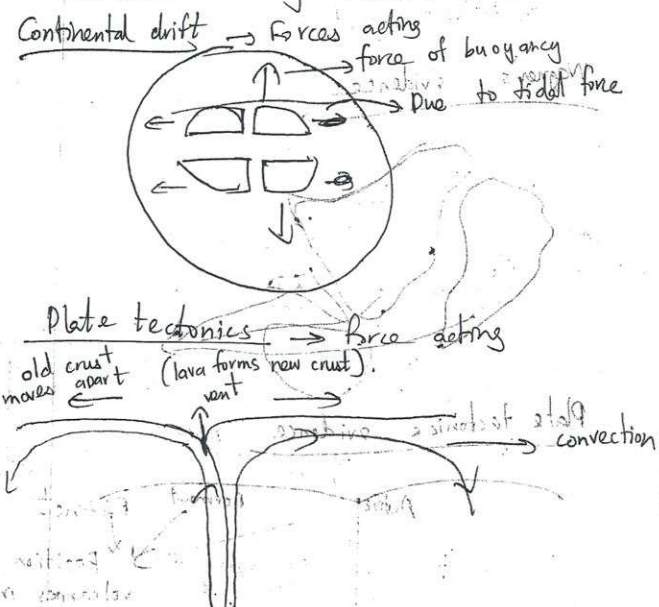


Explanation to mount building
Wegner ⇒ friction of SIAL on SIMA
Drift ⇒ folding, compression

Causative forces

Wegner said the continents moved only westward or equatorward and he quoted the buoyant force, equatorial force and tidal force of sun and moon responsible for these movements. If the sun and moon were powerful enough to move the continents, then they would have easily attracted earth's crust into their gravity.

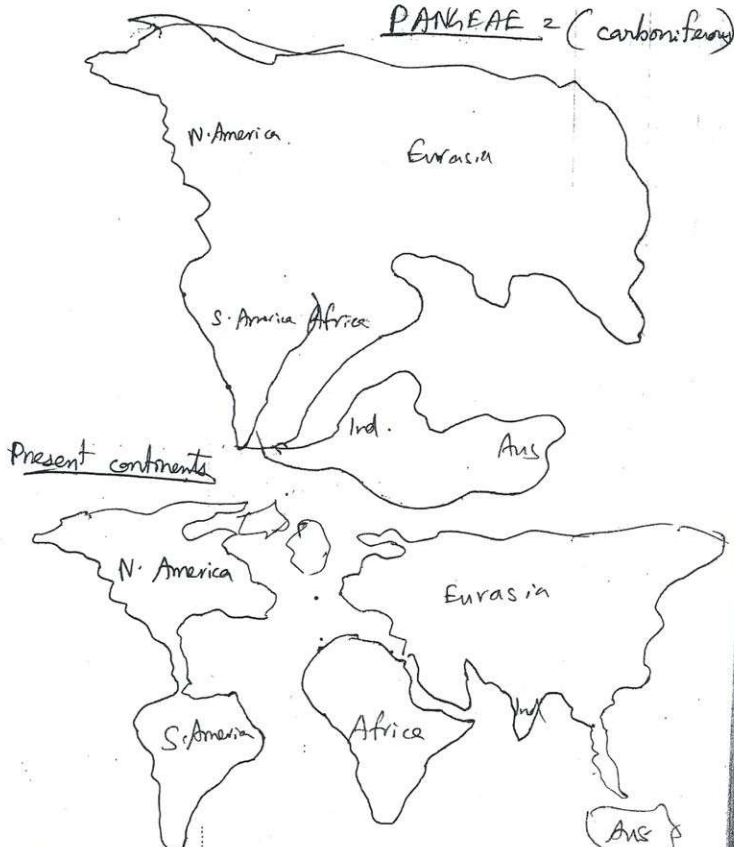
But, plate tectonics says that the convective cycle under the earth's crust is responsible for the movement and that the plates can move in any random direction.



Movement
Wegner → only continents move
Drift → both oceanic cont. plates move.

Similarities

The assumptions of a single land mass (Pangaea) ~~was~~ by Wegner was also adopted by Plate tectonics. This gave a very strong foundation to the tectonics theory. And, Wegner's hypothesis of continental movement was the driving force for many scientists to find out the actual reason behind it, which were promptly brought about by Plate tectonics.



These theories have opened a new era of crustal dynamics and substantiated 'EVERYTHING BUT CHANGE CHANGES'. This will help in finding the volcano and quake prone zones and assist those areas with the help of technology. It will also be used to predict the climate changes and relief changes in the future and help us develop adaptations to these changing scenario.

8 m:-

→ Plates.

The rigid lithospheric slabs or rigid and solid crustal layers are called plates. The introduction of the phenomenon of plates in the PLATE TECTONICS THEORY led to the clear understanding of the movement of the earth's crust, thus leading to the comprehensive understanding of various geological phenomena (like earthquakes, volcanoes).

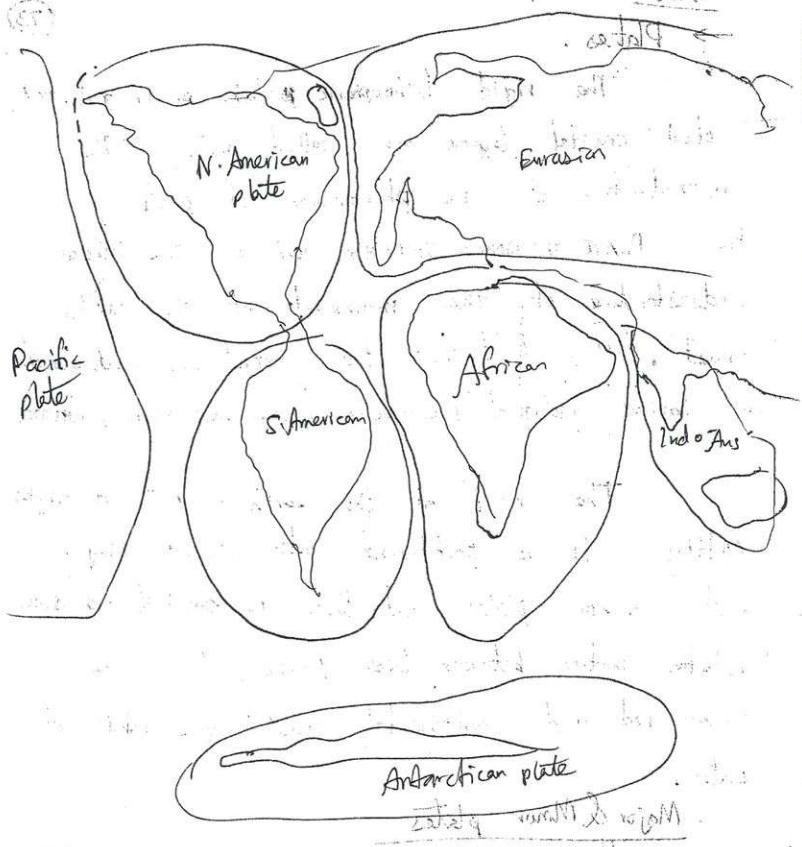
The crust of the earth is not a single entity. It is partitioned into several major and minor plates and there is constant and slow relative motion between these planes. Both the ocean bed and continental crust are made of plates.

Major & Minor plates

There are 7 major and 22 minor plates. Generally, the ocean plates are heavier than the continental plates.

Major plates

1) N. America
2- S. America
3. Africa
4 - Indo-Aust
5. Eurasia
6. Pacific
7. Antarctic



Types of plate boundaries:

Convergent:

When two plates are moving towards one another, it is a convergent boundary. The heavier plate subducts under the lighter plate (continental). The fracture of the subducted plate produces seismic waves → earthquake. The subducted plate melts in the asthenosphere and the excessive magma tries to come out

through a weak crustal portion ⇒ volcano.

The lighter plate, unable to slide freely over the subducted one, bends and results in a fold → mountain building.

eg:- Indo-Aus & Eurasia

Divergent

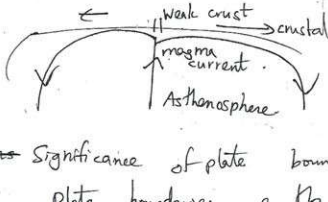
When two plates move away from each other.
eg:- Mid-atlantic ridge, great rift valley of S.Africa.
It results in less explosive volcanoes or forms lakes.

Transform

When two plates slide across each other.
eg:- San Andreas fault.

Forces responsible for plate movement

The convective current of magma in asthenosphere is responsible for plate movement.



~~Cons~~ Significance of plate boundaries

Plate boundaries are the region where most dramatic geological changes take place.
eg:- earthquake, volcano, etc.

→ conclusion :-

The ; identification of the plates and their boundaries and the movement helps us to ;identify areas which may be affected by the earthquakes and by installing adequate response forces in those areas.

Properties

- Plates may be continental or oceanic.
- Oceanic (basalt) plates are heavier than the continental (granitic) plates
- Most of the plates are ~~ocean~~ continental plates.
- Oceanic plates are made of basalt, whereas continental are granitic.

Earth's movements

→ Discuss (30m) the landforms created by endogenetic forces.

→ Nappes (15m)

→ Fold (15 m)

→ Fault (15 m)

Don't classify the forces. first, write the landforms created (fold mountains, block mt, rift valley, plateau, volcanize (landform) [extrusive, intrusive.

→ Give examples for each.

→ For fold, just mention the SAMMIROFOC mone diagram.

→ Map of the world (showing landforms)

→

→ Significance :-

Nappes

→ D

→ th

→ sig

30/06/12

A

which

volc

c

silica

Si

This occ

forces the

Nappes → autochthonous
→ exotic

→ Defn.
→ types
→ places where nappes are found: (draw a map).
→ significance:- to understand compressive forces, rock age & structure, possibility of drilling.

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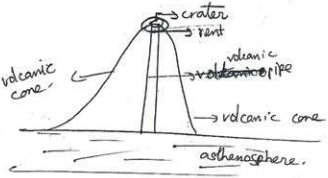
VOLCANOES

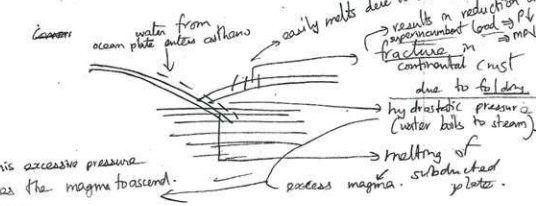
Lava = Magma − (CO_2, H_2O gases)
(crust, mantle)

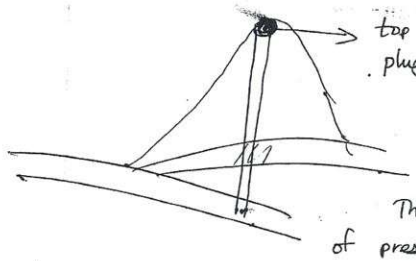
A small opening in the earth's crust through which magmatic material forcibly erupts out as lava



Flow of lava depends on the amount of silica in the magma.

Silica content ↑ ⇒ viscosity ↑ (sticky ↑) ⇒ fluidity ↓ (does not spread easily)





top of the cone has been plugged (due to solidified lava)

This results in accumulation of pressure, over a period of time, since lava can't easily flow out due to solidified upper cone. The pressure accumulates and finally the magma comes out violently throwing the entire cone top out, forming a crater.

Viscosity ↑ ⇒ eruption ↑

→ All volcanoes in convergent boundaries are explosive. eg:- Logan, Whitney (Rockies), Acancagua (Andes) since, the magma has to come out through a small fracture

→ Volcanoes in divergent boundaries are quiet. eg:- Mid-atlantic ridge. since, lava has the long fracture to come out, it's not eruptive.

- Divergent volcanoes don't form sharp cones, because the silica content is low and lava is less sticky and it flows throughout the entire area, so it is rather flat.

Exception:- Eg jafkajokull volcano in Iceland.

Himalayas → fold mt → but not volcanic. why? (79)

- No ocean crust, for water's hydrostatic pressure.
- A lot of nappes are there. Due to intense pressure, there are a lot of layers of mt. The magma finds it difficult to pierce through these thick layers. Intense folding & the thick crust in Himalayas prevent magma from coming out.

Types of volcanoes (based on eruption).

1) Central eruption (or) explosive.

a) Hawaiian

- Mauna Loa, Mouna kea (in Hawaii)
  → Hawaiian god of fear
- Pele's hair ⇒ molten lava solidifies in threads (like hair).

b) Strombolian

- continuous & rhythmic eruption
- Lighthouse of the Mediterranean.
  Mt. Etna

c) Vulcanian → cauliflower shape cloud.

d) Peleean → flows along the floor, can't go high into the air due to high magma viscosity (thicken wt.).

e) Vesuvius :- magma thrown 1000s of m into the sky. Then the ashes & dust form a cauliflower-shaped cloud. (due to high accumulated pressure) ⇒

Pyroclastic material → fragmented volcanic material

Pyro → fire; clastic → mechanical.

- Volcanic material eruption ⇒ Basaltic - rich in nutrients: good for agriculture. High CO_2. High water vapour content ($H_2O > CO_2$)

Terms used for volcanic material

- Big volcanic material → volcanic bomb.
- small volcanic material → lapilli
  → volcanic ash
  → dust

→ 80% of volcanoes in the world are explosive, since most of the volcanoes are located in ocean-continent convergence.

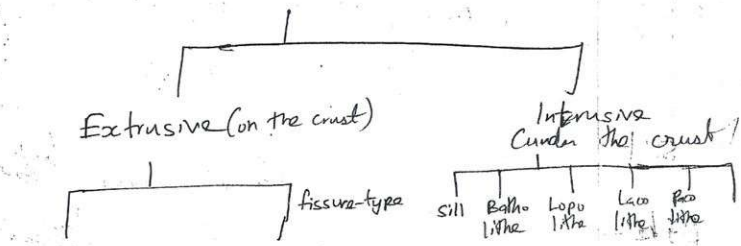
Divergent (or) ariet type

1. Divergent fracture : rupture
2. Horizontal ~~movement~~ displacement.

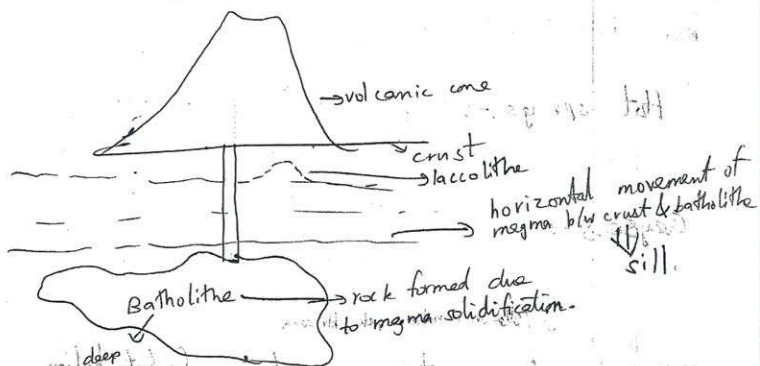
~~Rodact~~
~~Fissure~~

Reduction in supercumbant load.
Reduction in pressure. ⇒
Lava fissures out.
Spreads very ~~wi~~ widely.
Formed a long chain of mountains (mid-ocanic ridge).

Landforms created by volcanic activity



Intrusive igneous bodies



lithe ⇒ rocks.

Lopolithe → sill that gets deposited in the lower bends of (positions in) earth's crust. (Looks in syncline).

Phacolithe → Packed alternatively in anticlinal syncline.

Laccolithe → The sill ascends slightly to try to open out of crust, but due to lack of pressure, it continues to follow the original path.

→ Laccolithe may sometimes erode the crust and protrude out as rock structure
⇓
Dindigul rock fort

Sill → movement of magma along the layers (rock strata) (horizontal movement)

Dike → movement of magma across layers (rock strata) (vertical movement)

→ When magma solidifies under the crust, it becomes GRANITIC -

→ If magma solidifies outside the crust, it becomes BASALTIC -

Hot springs → Magma flow may increase the temperature of water table (aquifers)

Geysers → hot water vapour sprouting out in areas of volcanic activity, at regular intervals
↓ minor form of volcanic activity
↳ eg:- Australia. → All GEYSERS are hot springs
eg:- Yellowstone national park, Arizona

only question on volcanoes:
⇒ Explain the nature, mechanism & distribution of volcanoes with the help of plate tectonics.

But, the landforms by volcanoes can be explained in landforms due to endogenetic forms.

→ Explain the nature, mechanism & distribution of volcanoes with the help of plate tectonics.

Volcano → dependent
↓
main theme

Plate tectonics → independent
↓
supporting theme

- Define volcano. ⇒ volcano diagram
- Define plate & plate tectonics → mechanism of evolution and nature & motion of plates and resultant reactions
- Connection b/w volcano & plate tectonics
  Location of volcanoes on the plate margins.

- Plates
  - Geometric
    - 7 major
    - 22 minor
  - kinematic
    - convergence
    - divergence
    - conservative.

Mechanism
- Convergent volcanoes ⇒ mechanism & diagram.
  ↓ EXPLOSIVE

Distribution
Ocean – continent
- America-Pacific (write about Rockes, Andes, Logan, Rotomaxy, Whitney, Acaneagua).

Map

Ocean-ocean
Japan – pacific.

Continent-continent

Africa-Eurasia ⇒ eg:- Strombolion, ~~Pacific~~ pompei, vesuvius

Divergence → mechanism

ocean-ocean

Distribution

eg:- Mid-atlantic ridge.

OCEAN-OCEAN

volcanic islands → stitelens Cape Verde Ascas. (mid-atlantic ridge)

→ QUIET VOLCANOES

continent-continent divergence

African rift valley.

few volcanic activities ⇒ Mt. Kilimanjaro.

quiet

Intra-plate volcanoes

→ not in the plate margin

eg:- Mouna kea, Mouna Loa (Hawaii)

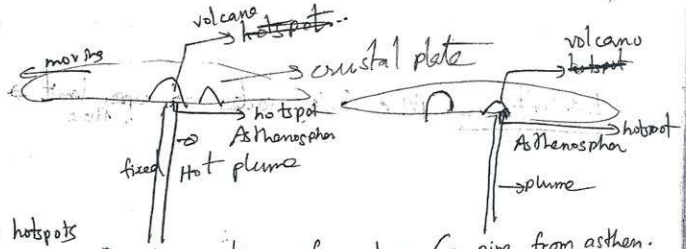
→ called 'HOTSPOTS'.

Hotspots

A hot plume is fixed under the crust in certain isolated portions of the earth.

But, the plates over the hot plume is moving. So, all the places over the plume will become a volcano.

eg:- Hawaiian islands [Mouna Loa, Mouna Kea].



2 theories for hotspots

Hotspots → due to existence of a plume (a pipe from asthen. to crust),

→ due to excessive temp. in tat post of asthen.

Significance:-

→ disaster

→ some adv :- fertile soil, islands.

→ consequence of eruption :- global warming, (due to high CO_2 contents)
volcanic winter, ash cloud ⇒ affects air traffic
(eg:- Icelandic volcano)

→ Mechanism & distribution of earthquake using plate tectonics

→ nature, mechanism & distribution of mountains using plate tectonics

Replace volcano with 'earthquake' or 'mountain'

Convergent ⇒ high magnitude earthquake; Divergent → mild earthquake

Convergent → fold mountains; Divergent → block mountains & rift valleys

Earthquake :-

Violent shaking of the earth's surface due to the energy waves originating from a point of origin (focus) and reaching the crust (at the ~~hypo~~epicentre) in widening circles.

tremor → mild earthquake ;

Magnitude ⇒ Richter scale ⇒ Logarithmic scale

~~To~~ ⇒ A measurable quantity (Lower limit : 1, Upper limit : no)

Measures the energy of the seismic waves

Intensity ⇒ M.o Caulay scale → upper limit is there ⇒ 12.

→ Measures the amount of damage and destruction caused by the earthquake.

Richter scale

→ logarithmic scale of vibration

⇒ Mag. 2 is 10 times frequency higher than mag. 1

but 32.5 times higher energy than 1.

Increase of '1' in Richter scale

⇓

10 times increase in frequency of vibration

⇓

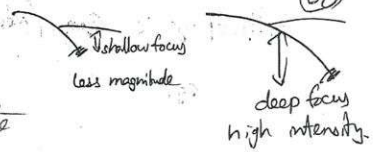
32. times increase in energy of waves.

Causes of earthquake

1) Plate movement 2) Volcano

3) Elastic rebound factors. 4) Anthropogenic (human) activities

Convergence → mechanism



- convergence of plate
- subduction of ocean plate
- ~~break~~ stress on continental plate → compression → folding.
- fracture of continental plate → epicentre.
- break of (by melting) ocean plate releases energy ⇒ seismic waves.
- Focus - Epicentre.

↓

depth of focus ↑ ⇒ stress built up ⇒ energy ⇒ magnitude of eaq. ↑

- Even for shallow focus earthquakes, magnitude may be high, if angle of subduction is steep. eg:- Philippines earthquake 2012

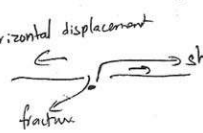
- Shallow earthquakes are less intense. (focus at a depth < 40 km)
- deep earthquakes (depth of focus > 70 km)

Convergent → high magnitude earthquake.

- Since the subducted plate may melt & break at greater depths, the focus may be deep → intense.

DIVERGENT

- rupture
- fracture
- horizontal displacement
- Release of energy
- Only shallow focus. (fracture near the surface)
- Focus ~~deep~~ shallow ⇒ so, low magnitude eaq.



less intense.

Conservative ⇒ eg:- San Andreas fault - (California).

- Highest magnitude earthquake.
- No focus & epicentre mech
- Plates slide across ⇒ lateral stress ⇒ both focus & epicentre on surface

↓

shearing;

Anthropogenic (intra-plate) ← dam, urbanization, nuke explosion, drilling

withdrawal of underground water

eg:- Chennai ⇒ disturbs isostatic equilibrium.

Human activities → deep drillings, high underwater withdrawal

- High superincumbent load → buildings.
- Nuclear explosion
- Reservoirs (RIS) → Koyna-Warna (Maharashtra), Hoover dam, Colorado

induced seismicity

Elastic rebound

The elasticity of the rocks in the earth's crust is high. When a stress is applied on the rocks, they try to immediately come back to their original position. This elastic rebound causes vibrations and earthquakes.

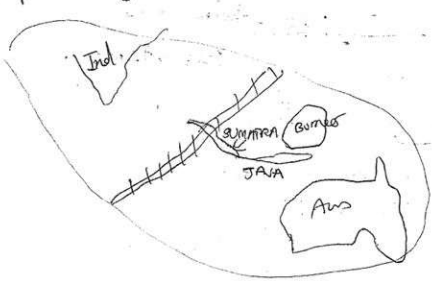
In reservoirs, the water percolates through the rocks & cause the rocks to rebound.

R.I.S (reservoir induced seismicity)

~~INTRA-PLATE EARTH~~

Breaking of major plates

Earthquake in sumatra (tremors felt in Chennai) on Apr 11, 2012 was the highest magnitude (8.2 richter) intra-plate earthquake. A study reveals that it is due to the breaking (a very gradual process) of Indo-Aus plate along the Sumatra coast.



• Hot desert & Mid latitude deserts

Distribution

U.S — Sonoran, Mojave

South America — Patagonian (due to leeward), Atacama

Africa — Sahara, Kalahari, Namib

Arabian, Turk (Afghan), Thar, Gobi (↑ China), Australian.

- All deserts are in the Western part of the continents.
- All deserts have cold currents flowing along their coasts.
- Largest desert → Antarctica.
  Largest hot desert → Sahara.

Climate:

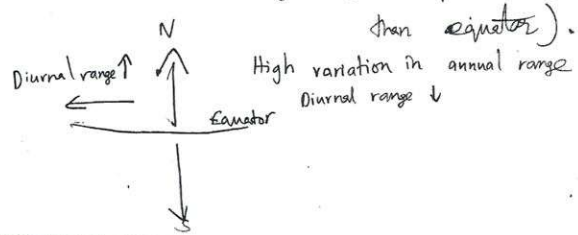
→ No cloud.

→ Sun's rays enter directly in the day (hot). They are re-radiated easily in the evening (cold).

→ Highest diurnal range of temperature ⇒ (highest in the world) (Death Valley) near Mojave desert.

→ No or less rainfall.

→ Small annual range of temperature (but higher than equator).



Vegetation

→ no rainfall ; no vegetation.

→ People → highly nomadic.

→ xerophytic adaptation → cactus, opuntia.

→ ANIMALS ⇒ Aestivation
↓
summer sleep

→ In Oases region → date palms and settlements

People — Tribes

→ Kalahari → Bushmen

→ Australia → Aborigines (or) Bindibu

→ Arabia → Bedoines
↓↓
(They treat guests superbly till the 3rd day. Then they ask the guest when they'll leave.

Aborigines

- They discovered Boomerangs → to kill animals
- Have dogs called DINGO.

Oil boom

→ In Arabia, oil booms resulted in a lot of artificial settlements..

→ Arabs are good horsemen. By hearsay they heard about India's rich resources. Forced migration caused Arabs to go out of their natural habitat and invade several countries like Afghan, India. They were pretty good at travelling on land.

01/07/12

→ Discuss the mechanism, types and distribution of earthquakes with plate tectonics.

→ Introduction → defn., why to study

→ Define plate tectonics.

→ Magnitude & depth of focus

Mechanism

Convergence

Convergence
subduction
stress accumulation
fracture
less superincum load → less pressure
less M.P.
~~stens~~ magnitude & depth of focus :-
no. of eqv ⇒ less
ocean-continent — Peru earthquake ... Map
ocean-ocean — Fukushima (2011) ... Map
2 nuclear earthquake
continent-continent — Bhuj (Ind.), Muzaffarabad (Pak) :- Map

Divergence

rupture, fracture
Horizontal displacement
Release of energy
shallow focus
low magnitude
no. of earthquakes ⇒ more.

Conservative

- shear stress — 2 way plate move
- Highest magnitude.

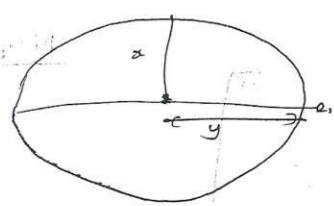
map :- eg:- San Andreas fault.

~~Anthrop~~ Intra-plate e.q.

- due to man-made (anthropogenic)
- Explain Reservoir Induced Seismicity → infiltration of water into rocks accelerate elastic rebound.
- other → deep drilling, nuclear explosion, rapid urbanization
  - ↓ vibrations on earth's surface may induce e.q.
  - ↓ disturb isostatic equilibrium (unbalanced superincumbent load)

Significance

- Though it is not possible to prevent earthquakes altogether, by effective use of technology, disaster management and rapid response forces can be



$y > x$

→ effective gravity less on the equator.

→ effective gravity is highest in the poles.

→ Since escape gravity is less in the equator, most satellite launch pads are along the equator (or near) (French Guyana, Sri Hanikota, since the effective ESCAPE VELOCITY is lesser

→ all domestic flights move in troposphere.

→ all intl. flights move in the stratosphere,

→ The
the ea

⇒ L
distance
the equ
why fl

That
is gre
range

→ The atmosphere (all the layers) rotate along with the earth (due to earth's gravity).

⇒ Longitudes converge at the poles. So, the distance between two longitudes is the maximum at the equator and the least at the poles. That's why flights always do not prefer to go along the equator.

That is why, though India's north-south distance is greater than east-west distance, the latitudinal range is almost equal to the longitudinal range.

01/07/12

MOUNTAINS

Mountains > 900m ;
Hill < 900 m ;

1) Fold mountain
2) Block mountain
3) Volcanic mountains (mountains of accumulation)
4) Residual mountains [left-over]

Fold mt.

All fold mountains of the world are narrow in width, by have great length. Why?

→ Presence of marine deposits on high mountains.

Geosyncline →

A long, narrow, shallow water body characterised by continuous sedimentation and consequent subsidence is called GEOSYNCLINE.

Mountain ~~building~~

(Saurabh Singh)

Don't read everything. (no need all the theories)
Just read classification.

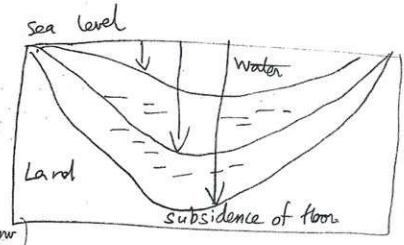
Volcanoes :-

→ Just read mechanism, distribution.

No need volcanic materials, ~~types~~ of volcanoes → just enough to know.

Geosynclines concept

Hall & Dana concept



(long, narrow, shallow)

The shallow subsided floor containing lighter particles (due to river sedimentation) cannot subside beyond a certain extent due to presence of heavier particles on the two sides of the subsided floor.

So, the heavy particles on either side due to supernumbent load make the shallow subsided floor come up, resulting in ~~fold~~ the mountains.
So, this marine deposit in subsided floor, during upfolding, went to high alt.

But, how can a shallow subsided floor on inversion resulting in HIGH mountains?

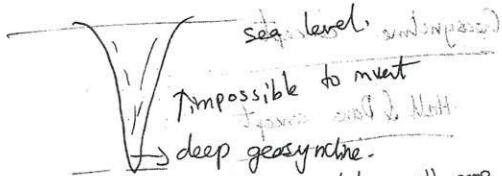
Haug concept

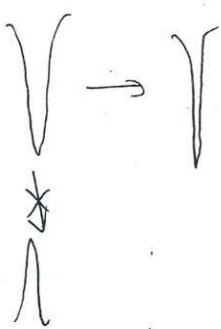
The answer was given by HAUG.

Geosyncline is not a shallow body, but a deep subsided floor. This only on inversion can create high mountains.

CRITICISM

But, such deeply subsided floor – it is impossible to upturn





So, this was rejected. Hall & Dunna theory was accepted.

with evolution of Plate tectonics, Hall & Dunia's theory was rejected.

Plate tectonics

Convergence of plates and the resulting compressive force results in fold mountains. In ocean – continent convergence, when ocean plate subsides, the marine deposits are left back on the continental crust thus the MARINE ORGANISM DEPOSIT are found at high mountains?

Stages of Geosynclines (Hall & Dana)

i) lithogenesis → creation of geosyncline, sedimentation & subsidence bed

ii) orogenesis → squeezing & folding of geosyncline into mountains.

iii) gliptogenesis → gradual rise of mt., denudation & consequent lowering of heights.

→ Introduction → Defn. of mountains & importance.

→ Plate tectonics → defn. ⇒ geometrics, kinema

→ Fold mountains ⇒ on convergent zones

→ Block mountains ⇒ divergent zones.

→ Mechanism

convergence, ocean plate subsidence accumulation of stress on conti plate, buckle, fold, squeeze and thrust the land to uplift ξ

OCEAN → CONTINENT CONTINENT – CONT

Continent – continent

Himalayas Map

Ocean – Ocean

Japanese mountains. Map :-

Block mountains → Divergent zones

continent – continent divergence

Dip → Dip movement → Normal

→ African rift valley ⇒ African mountains :-

→ Rhine valley ⇒ Vosges ⇒ reverse fault
Black forest

→ Volcanic mt :-

→ ocean-ocean divergent

Cape Verde, Canary.

Intra-plate

Aravali, Appalachan, Ural.

→ These are not in the plate margins.

→ These were originated during Pangaea I cycle. No active mt. building now, since they are not in convergent zone. Only erosion (denudation) is dominating. So, they became RESIDUAL MOUNTAINS.

Conclusion

significance & contemp issue

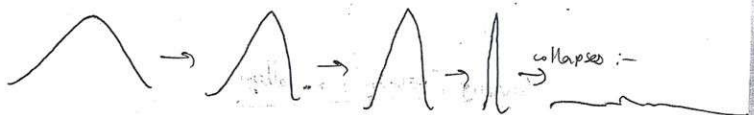
Geomorphic Cycles

1) Davis 2) Penck.

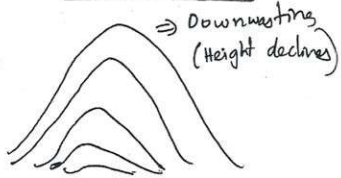
→ Any mountain may be reduced to plain, as the land undergoes degradation, over a period of time.

Davis (downwast)

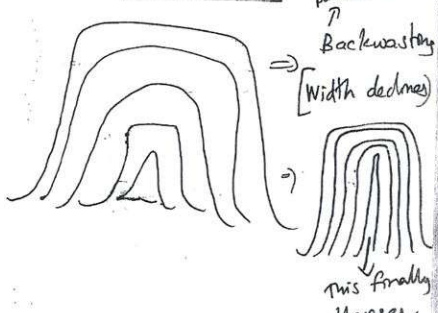
Penck (backwast)



Davis theory



Penck theory



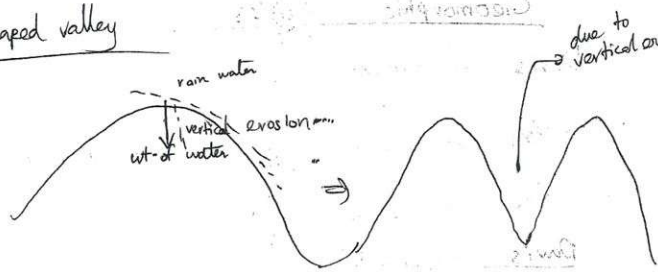
Absolute height

Ref. → mean sea level.

Relative ht.

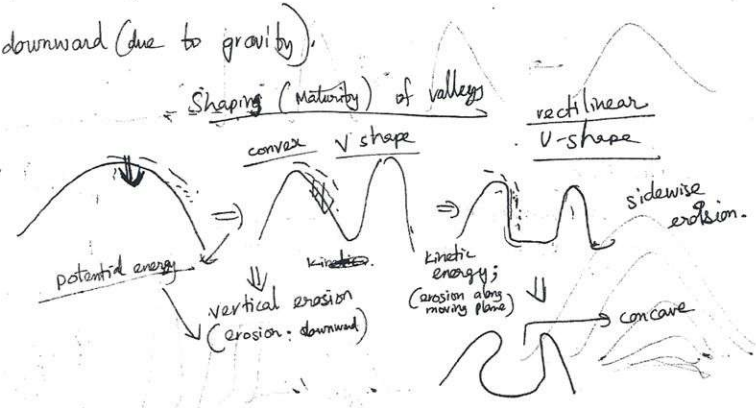
Ref. → some other reference nearby (usually bedding plane) :-
(or the valley depth)

V-shaped valley



→ Water always tries to erode vertically (kinetic energy) since it reaches the bedding plane or mean sea level. The wt. of water acts vertically downward (due to gravity).

Shaping (maturity) of valleys



The eroded material is carried away by the river water and heavy materials is deposited in the plains and finer particles are carried as silt to the DELTA.

Reliefs found in mountains:

1) Peaks 2) Valleys 3) Gorges → steep valleys 4) Canyons → wide, deep, steep, high valleys

5) Potholes
↓
(holes created when waterfall falls)

James Hutton → coined
→ cyclic nature of earth history
→ no vestige of a beginning
→ no prospect of an end
→ present is key to the past

Uniformitarianism

The same physical process & laws, which operate today, operated throughout the geologic time, although not necessarily with the same intensity as now.

eg:- wind erosion which is predominant in Rajasthan now was very weak in the past (Harappan civilization). Water erosion (dominant in the past → Harappan) is now minor.

DAVIS THEORY

Davis ⇒ Geographical cycle

Any uplifted landmass undergoes transformation through land sculpting process and ends in featureless plain called Peneplain.

Aim

To provide a general theory for systematic description & genetic classification of landmass.
(how it originated? a denudation chronology)

Assumption

Landforms are function of structure, process and time.

Trios of Davis → Structure, process & time.

2) Sudden & rapid upliftment of landmass.

3) Erosion starts only after the completion of upliftment.

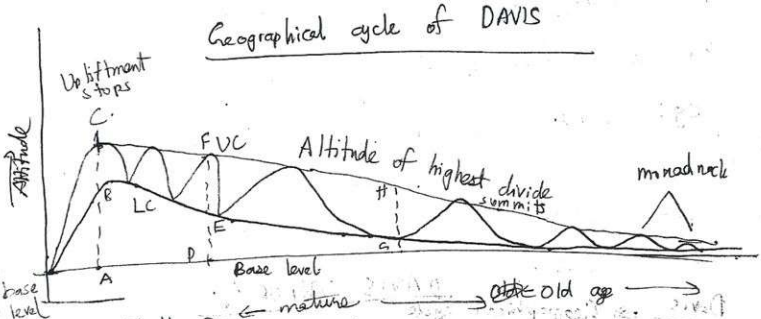
4) All erosions take place in tectonically stable landmass.

5) Landforms undergo sequential development.

6) Each stage has its own distinct landmass.

7) Finally it ends in a low featureless peneplain.

Geographical cycle of DAVIS



VC → upper curve ⇒ hill tops or crests of ranges [absolute relief]

LC → lower curve ⇒ valley floors ⇒ Lowest relief from sea level.

AC → initial absolute relief

BC → initial average relief (relative relief).

EF →

DF →

Stages of geographical cycle of Davis

1) Preparatory stage
2) Youth stage
3) Mature stage
4) Old stage

reliefs found in plain

meandering → oscillation of river water

leeves →

river bank

delta → silt deposited at the plain, near the mouth

Preparatory stage

→ rapid upliftment

→ only upliftment, so both absolute & relative relief increases.

→ No erosion

Youth stage :-

→ Vertical erosion only.

→ top of the mt. not affected ⇒ abs. relief constant

→ only the bottom of valley eroded, its depth increase ↓ relative relief increase

→ absolute relief same.

→ relative relief increases.

Mature stage :-

→ Vertical erosion very less;

→ Horizontal erosion is prominent.

→ top of the mt. is also eroded.

→ so, both absolute & relative relief decreases

Old stage :-

→ only horizontal erosion.

→ rapid erosion

→ abs. & relative relief decrease rapidly.

→ leaves few isolated hills here and there ⇒ MONADNOCKS eg:- Palani hills, Dindigul dist.

Warm Temperate Western margin.

(MEDITERRANEAN) → (30° - 45°).

Distribution:-

→ Western coast of continent.

→ California, Santiago (Chile), Cape town (South Africa), (Morocco, Tunisia, Spain, Italy, France, Portugal, Greece.) ⇒ around Mediterranean sea. Victoria, Adelaide, Perth (Aus.).

Unique feature → Mediterranean countries receive rainfall only during WINTER. (Chennai also has this feature

→ All Mediterranean regions are backed by mountains (Rockies, Andes, Alps, Pyrenees, Pennines)

→ Due to these mountains, the winds move from high altitude to low altitude. So, all these regions have a lot of local WINDS.

⇒ Dry summer
Rainy winter

The people take their cattle to the mountainous pastures, but live in the plains. ⇒ TRANHUMANCE
↓
vertical movement of

NOMADISM
↓
horizontal movement of people.

Vegetation →
→ OLIVE tree.
→ CORK tree.
⇒ Cedar, Cypress.
→ Scented trees ⇒ Loreal,

Wine:-
→ Grapes ⇒ vineyards → VITICULTURE;

→ No cattle farming; only sheep,
↓ ↳ wool production
no dairy.
Because, the cattle can't withstand the dry summers!

→ Eucalyptus tree ⇒ biological drainage.
→ drains underground water.
→ doesn't allow any plant or tree to grow near it (allelopathic)

Mediterranean climate → mild & pleasant climate.
→ sunny, dry, warm summers (not too hot)
→ pleasant, mild rainy winter.
→ people are very fair.

Criticism of Davis theory

1) Sudden upliftment of land mass?
2) Erosion absent during upliftment?
3) Injustice to structure & process... only true-dependent.
4) No account of vegetation in erosion.
5) Only in crustally stable areas?
6) Deposition process left out.
7) Sequential development? (cycle?) ⇒ not always true (polycyclic or rejuvenated landforms)
8) Peneplain? ⇒ (only in tectonically stable areas)
9) Deductive approach (very general & overall view)
10) Does not account for all climatic regions.

PENCK THEORY

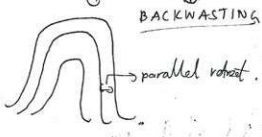
→ Landforms are evolved as a function of rate & phase of upliftment and rate & phase of degradation.

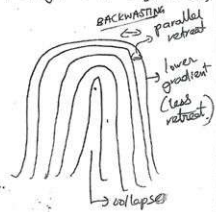
⇒ i.e. interaction of endogenetic & exogenetic forces.

AIM:
Morphological analysis of landforms

Assumptions:-

- Any slope (even curved) is made up of straight slope segments.
- All slopes undergo parallel retreat.





- Slope retreatment is a fn. of gradient.

Retreat $\propto$ Gradient

(As the slope undergoes parallel retreat, its gradient increases & hence retreatment is faster and finally it results in collapse),

- Shape of slope $\Rightarrow$ fn (endogenetic, exogenetic forces)
- Erosion & upliftment simultaneous.
- Upliftment is ~~gradual~~ of varying rate. ~~of upliftment~~.
- Both the erosion & upliftment, in tectonically unstable areas

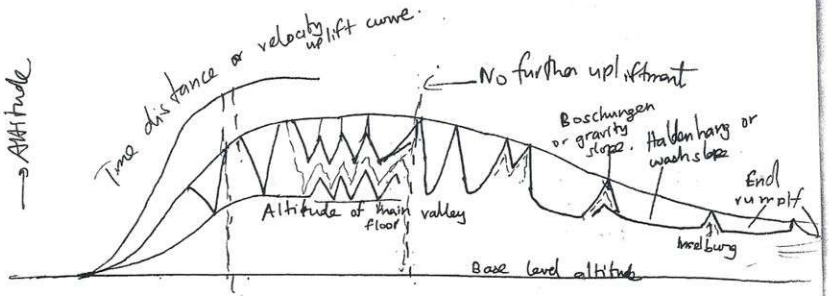
$\Rightarrow$ slope

Convex
Straight valley
Concave

} similar to DAVIS -

$\Rightarrow$ LANDFORM $\rightarrow$ fn (structure, process, STAGES)

Penck's model of Landform Development

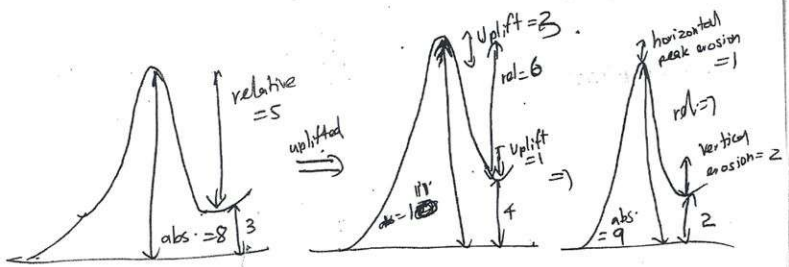


Uplift stage
↓
Combines Preparatory & Youth stage of Davis

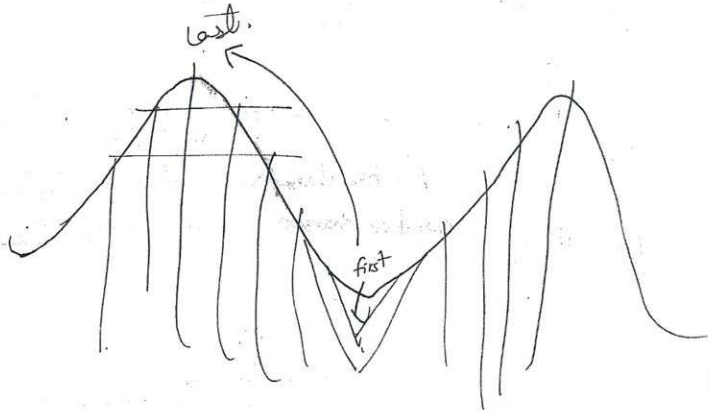
→ Absolute relief increases (due to uplift)

→ Vertical erosion is fast ⇒ Relative relief also increases

Mature stage



General erosion



Nature

	Youth	1	2	3	Old stage :-
~~Eo~~ Abs	↑	↑	c	↓	↓
Relative	↑	c	c	c	↓

⇒ Land ends in INSELBERG.

↓

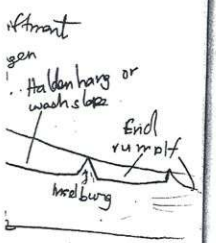
Largest single inselberg (monolithic) ⇒ Area rock (in Australia) (Uluru rock).

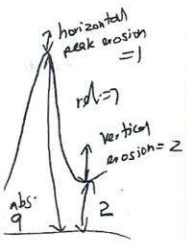
↓

changes colour from day to night

Map → north America ⇒ 30 marks

All theories upto Davis





14/07/12

Glaciation

→ Decrease in sea level.

→ Delta moves down into the erosible ocean.

→ The youth stage moves further down. (mature stage replaced by youth stage.)

Positive change → sea level rises. (no new landforms. only transition.)

Deglaciation

Negative change → sea level decreases [many new landforms]

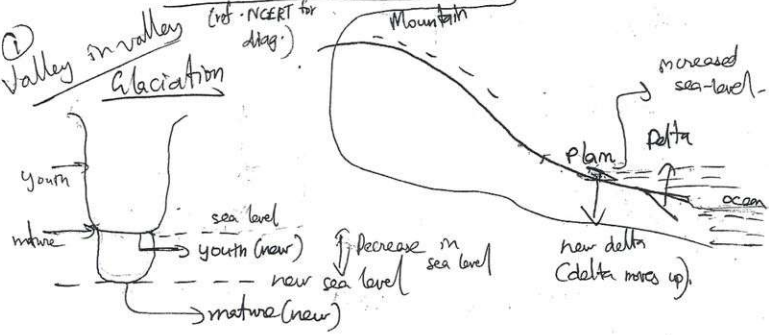
- increase in sea level.

- Delta moves further up in the plains.
- Youth stage goes up. (youth stage replaced by mature stage)
- The existing delta submerges.

REJUVENATED or POLYCYCLIC LANDFORMS | Deglaciation

(ref. NCERT for diag.)

① Valley in valley Glaciation



These new landforms formed are called

② Uplifted peneplain → Isostasy
→ tectonic uplift (Ranchi plateau)

- Deglaciation → sea level goes down.
- So, a new peneplain is formed in the ocean bed
- So, the existing peneplains seems UPLIFTED, compared to the newly formed peneplain. This is UPLIFTED peneplain.

③ Incised

→ Deg

→ The

at sea

mature

vertical

though w

due to

④ Paired

→ T

→ forme

⑤ K

longitu

results

waterfalls

-

② Incised Meanders :- ⇒ Meanders inscribed on rocks :- (III)

→ Deglaciation → sea level goes down.

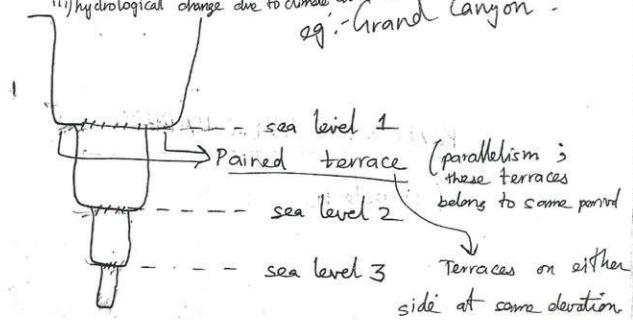
→ The meanders in the plain ~~chan~~ are now not at sea level (uplifted peneplain). So, this changes from mature ~~chang~~ stage to youth stage. So, there is vertical erosion (incised meanders). The plain (river bed) though wide, the river is concentrated in the centre due to the incised meanders.

④ Paired terrace ⇒ old marks of old flood plain levels or valley floors

→ Type of Valley in Valley

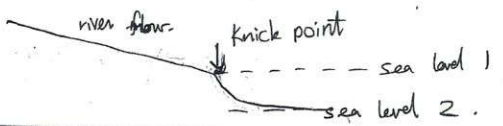
→ formed due to i) sea level variation ii) tectonic upliftment iii) hydrological change due to climate change

eg.- Grand Canyon.

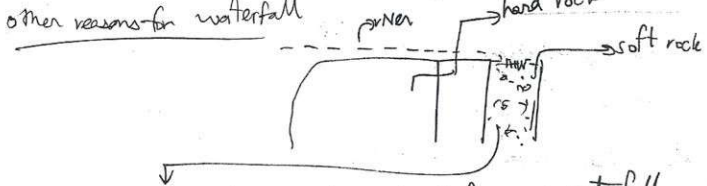


⑤ Knick Points

Decrease in sea level breaks the smooth longitudinal profile of a river bed ~~meander~~ and results in a knick point. At these knick points, waterfalls form. eg:- Hogenakkal.



other reasons for waterfall



river erodes this soft rock & forms a waterfall.

→ Great lakes (US) & BSA Rain Winnipeg (Canada) :- ⇒ formed due to deglaciation.

SHORT NOTES

* Polycyclic (or) Rejuvenated landforms

① SEA LEVEL VARIATION ② TECTONIC UPLIFT ③ CLIMATIC CHANGES.

* Polycyclic landforms are due to GLACIATION & Deglaciation, earthquakes and Volcanoes.

KARST TOPOGRAPHY (refer NCERT Physical Geo. for diag. & explanation; certificate for significance; Savindra for sequenced landforms)

(Limestone or DOLOMITE topography)

↳ CARBONATE ($CaCO_3$).

eg:- Former Yugoslavia, Virginia, Lukmer plains (Ans → south of Great Victoria deserts), cave entry in Vaishnodevi temple (J&K)

→ solution is the predominant process.

→ It absorbs water & releases heat (exothermic)

Agents → Ground water and surface water.

Actions → Solution and Precipitation deposition.

Conditions for Karst topo dvpt:-

1) The limestone must be MASSIVE, THICKLY BEDDED, HARD, TENACIOUS, WELL CEMENTED & WELL JOINTED.
(or else limestone will be dissolved).

2) Limestone should NOT be POROUS, but permeability is controlled by JOINTS.

(If the water enters limestone everywhere (in POROUS), it will create a sieve and collapse.):.

3) Limestone should be ABOVE GROUNDWATER TABLE.

4) Widely distributed ⇒ both in area & depth.

5) Limestone should BE CLOSE TO THE SURFACE.

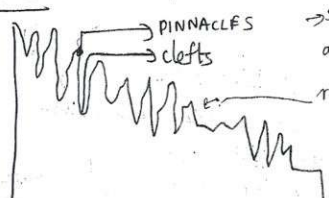
6) Limestone should be FOLDED, FRACTURED or FAULTED
(If it is plain, the water will run away fast — no effect on limestone).

7) There should be ENOUGH RAINFALL.

Karst Topography ~~should~~ can create:
1) Erosional landforms 2) Depositional landforms

Erosional landforms

Lapies



→ surface of limestone is eaten away irregularly, resulting in

Other erosional landforms

sink hole → circular, funnel shaped on the surface.

swallow hole

doline → collapse

uvala → doline & sink hole

polije → several uvalas.

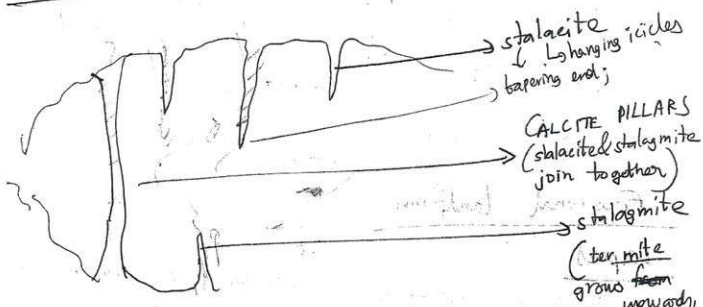
sink valley

sink → increasing area of depressions.

The accumulated water inside the limestone shelf creates a CAVE (a very large one at that! may even house a city). TUNNEL - Cave, open @ both ends.

* Cultivation possible (due to deposition of soil over limestone over a period of time). Only grass.
* But, construction of building in such Areas requires CAREFUL EXAMINATION or the building may collapse. * Cement → $CaCO_3$ * LEAD

DEPOSITIONAL LAND FEATURES



CAVE

→ alternating layer of rocks & limestone.
→ Water percolates horizontally through limestone bed & dissolves it, but beds of hard rock on either side remain.
→ This results in wide gaps ⇒ caves. Cave with opening at both ends → tunnel.

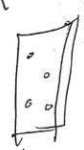
Questions

Discuss the
→ Essential conditions for Karst topo.
→ Karst landforms.
→ Sequential development of Karst landforms.
→ Typical features in a region of limestone rocks
↳ various landforms.

Sequential dvpt. of Karst landforms

→ Geomorphic cycle → doh.

→ Youth

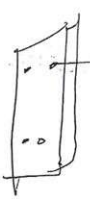


→ rainwater circulates in top; funnel like → in bottom
→ sink hole, swallow hole.
→ ends in doline. → caves are formed.
→ appear as shallow lakes.
May collapse (like quicksand in desert)
↳ ⇒ DOLINE or collapse sink

→ Mature

→ due to lateral erosion & absorption, dolines widen.
(or) valley sink
UVALA & POLJE & LAPIES are formed)
↳ → dry waterless on the surface.
sink holes & dolines join

→ Old



extensive deposition ⇒ all landforms collapse.
→ hums (monadnocks or inselbergs)
→ results in peneplain-like structure.

Significance

from certificate Physical geo.

- cement
- road construction, tunnels, dams
- aquifers
- minerals (read, zn).

→ Discuss the essential conditions for Karst. (short notes)

Karst → introduction

Essential conditions

⇒ Don't write more facts.

⇒ Discuss each/every condition, analyse the conditions.

Significance

→ Karst topography (open ended)
(write all topics (without elaborating) except the CYCLES)

→ What is Karst?

→ Distribution. ⇒ (Yugoslavia, Virginia).

→ Essential conditions (compress into one paragraph)

→ Landforms → Erosional (1 para) (1 diagram)
→ Depositional (1 para) (1 diagram)

→ Significance.

⇒ Discuss the significance of limestone topo.

→ What is limestone topo (Karst), distribution & conditions?
↳ 1 para.

→ Landforms ⇒ both landforms together 1 para.

→ SIGNIFICANCE ⇒ ~~2 to~~ 3 paragraphs.

① No vegetation. Only grass, Sheep rearing.
due to surface drainage ↳ So population ... sparse.

② LEAD occurs in veins of limestone

③ Construction of buildings in the region not possible.

④ CEMENT INDUSTRY develops. Limestone is used as BUILDING MATERIAL.

→ Comparative Analysis of Davis & Penck.

→ Geomorphic cycle → defn :- DAVIS

→ AIM :- genetic classification of landforms; (PENCK: Morphological system)

→ Assumption :- 1) uplift ment ⇒ sudden — waxing, uniform, waning.

2) erosion & uplift ment ⇒ both separate — simultaneous.

3) tectonically stable — even in unstable area

4)

→ ~~BASIS~~ FACTORS :- Structure, process, time ⇓ — land → rate & phase of ~~erosion~~ Endogenetic forces

too much stress on time

→ SLOPE DVPT :- ~~BASIC~~, ⇒ down wasting (decrease in gradient) — diag: backwasting (parallel retreat) increase in gradient.

→ STAGE (time) — LANDFORM DEVLPMT (structure).

→ names of landforms : monadnock, peneplain (diag) inselberg, endrumpf.

→ ONE-CYCLE — . Polycyclic (accounted for rejuved landforms).

→ Prep. stage ⇒ exist — NO.

Youth, Mature, Old } · Abs., rel. relief — Abs., rel. relief...

→ SIGNIFICANCE :- applicable, simple — not applied nowadays.

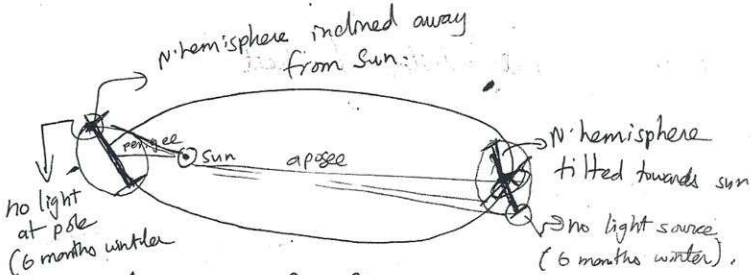
lucid, easy language. — German : incomplete ; difficult terminology.

→ CLIMATE :- ~~Mediterranean~~ humid temperate areas — Arid & dry areas

→ Youth Stage :- V-shaped valleys, gorges, canyons, thin streams, narrow floodplains, marshes & swamps
steep gradient → vertical erosion waterfall rapid EROSION

Mature stage :- river bed, plains, meanders, integrated stream, wide floodplain, no marsh
gentle gradient → lateral erosion EROSION & DEPOSITION

Old stage :- Delta ; oxbow lakes, natural leeves.
DEPOSITION



Apogee ⇒ far from the sun.

N. hemisphere ⇒ summer (tilted towards sun)

S. hemisphere ⇒ winter.

Perigee ⇒ near to the sun.

N. hemisphere ⇒ (tilted away from sun) ⇒ WINTER.

S. hemisphere ⇒ (tilted towards sun) ⇒ SUMMER.

↓

S. hemisphere has a severe summer (bcoz, it it tilted towards sun & also in perigee (close to sun)).

But, the huge ocean mass in S. hemisphere compared to land, compensates for this severe summer.

* Revolution of earth and the accompanying relative change in inclination of the earth w.r.to sun is responsible for seasonal changes

* Nowhere in the world, cyclone attacks in the WEST COAST.

CYCLONE attacks only EAST COAST (TN, Andhra);

Cyclones → in the sea ; Tornado → in the land.

→ Earth is a bad-conductor of heat.

Thumb rule

- When air mass rises, it gives rainfall.
- When air mass subsides, it does NOT give rainfall.

Evaporation

↓

Endothermic reaction. (as it takes away heat for evaporation, resulting in COOLING)

Latent Heat :-

Energy can neither be created nor destroyed.

After heating water beyond 100°C, it evaporates. The excess heat supplied after this is stored (hidden) by WATER VAPOUR MOLECULES. This is called LATENT heat. Due to this increase in latent heat, the temp. does not increase beyond 100°C, during boiling.

→ Methane ⇒ ~~just~~ released in moist conditions.

↓

when it comes into contact with the atmosphere, it burns.

Concept c

→ Why

→ Why hill

→ Why rose

→ Hot ~~ter~~ why d

→ If there MIST

→ Why

→ green h

→ Why equa

→ How

→ Why top of

→ Wh

→ Wh

→ Why

→ Why

→ Wha

→

Concept clarity questions

→ Why mt. (near to sun) is cooler rather than latter?

→ Why hill stations in mid-mt rather than peak?

→ Why rose cheeks (blood vessel) in mt.?

→ Hot ~~temp~~ rises airmass, forms clouds & gives rain. Then, why do deserts ~~not~~ get rain (like equator)?

→ If there is no water vapour in desert, how does MIST form heavily?

→ Why do we not ~~try~~ to reduce H_2O (water vapour) greenhouse gas in the atmosphere (like CO_2 emission reduction)?

→ Why is ozone hole in poles greater than in equator?

→ How do poles & equator rotate with the same speed?

→ Why is in mid mt. there is heavy vegetation, while top of the mt. has only grass?

→ [illegible] Himalayas. How?

→ Why blood pressure varies with altitude?

→ Why cyclones (all over the world) attack only EAST COAST?

→ Why sea breeze comes only in the evening?

→ What is the physical state of a cloud (solid, liq or gas)?

→

15/01/12

Desertic Landforms or Arid landforms

→ Types of desert landforms

1) Hamada or Rocky → Sahara

2) Erg or sandy. → ~~Stuart Stony~~ Iguidi, Ogadan.

3) Reg or stony. (or serir) → Stuart stony

Wind

- Wind is a relatively weak Geomorphic agents.
- Wind cannot erode the [redacted] attached to the ground (due to friction).
- Wind cannot erode objects greather than 1m from the ground.
- Wind erodes best at an ~~distant~~ elevation of 1m from (3feet) the ground.

~~Mechanisms of Arid erosion~~

Types of wind action in desert

1) Deflation → lowering of land surface to form depression. Sand is lifted & blown away.
When this depression reaches water table → OASIS.
Qarattara depression → lowest pt. in Africa.

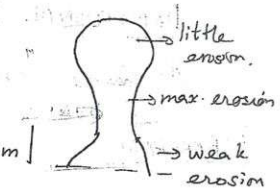
2) Abrasion → sand-blast → particles carried by ~~the~~ wind hit the rocks and break them.

3) Attrition.
↳ particles carried by wind collide with one another & break into small fragments

Landforms of wind erosion in deserts

i) Mushroom rock or Rock Pedestals:-

eg:- Sphinx



ii) Hollows & caves (due to abrasion of rocks ; first form blow-offs. They develop into rocks) :-

ii) Zeugen

→ horizontal

Hard & soft rocks arranged ~~horizontally~~ as horizontal strata. Alternate hard & soft one above other.

iii) Yardangs:-

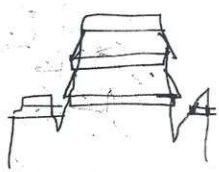
Hard & soft roks are arranged as vertical strata, adjacent to each other.

iv) MESA & BUTTES:-

Table like area → ~~small~~ large → mesa

↓ with lava at the top.

↳ ~~large~~ small → Buttes.



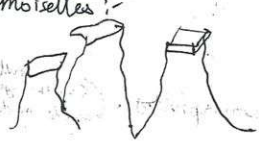
steep slope ; horizontal top layer.

v) Inselbergs:-

Inselberg has steep ~~sides~~ slopes on both sides.

eg:- Ayers rock in Australia.

vi) Demoiselles:-



vii) Stone lattices

cave, tunnels

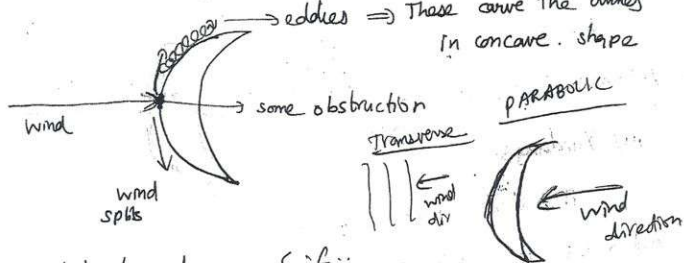
DEPOSITIONAL LANDFORMS

All ~~do~~ are sand depositions → sand-dunes:-

① DUNES

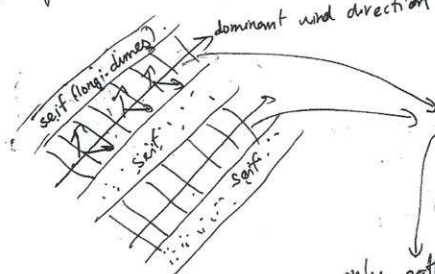
(i) BARCHAN

Crescent shaped sand dunes.



⇒ These carve the dunes in concave shape

(ii) Longitudinal dunes → Seifs:



② LOESS

Deposits of fine quality sand, that is carried over by wind to large distances.

eg:- SHANXI, SHAANXI provinces of China.

DESERT → Old (senile) stage of Geomorphology. (so, no full geomorphic cycle in desert).

↓ isolated inselberg :- huge plains..

→ Landforms created by exogenetic forces;-

i) Desert → wind
ii) Coastal →
iii) Karst → surface & underground water
iv) Waterfalls (GLACIAL) → running water.

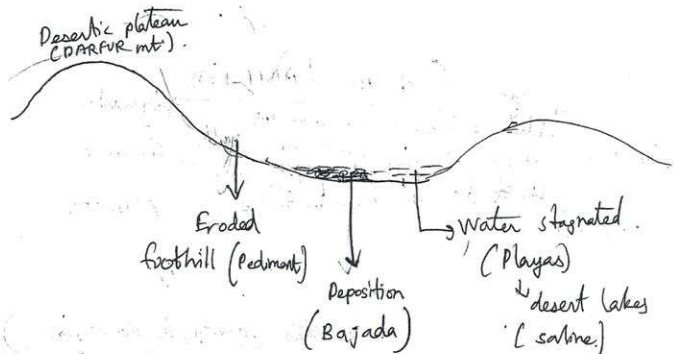
Fluvial desert landforms:- (due to fluid action).

i) Playa (Bolsons) → ~~eroded foothill~~ → stagnated water in inter-mt. depression

ii) Bajada → deposition from foothill; depositional plain.

iii) Pedimental → eroded foothill; erosional plain

iv)



Geomorphic cycles → Arid erosion

Youth

Interm. region basins (playas), bajadas & pediments formed.

Mature

Summit of mt. reduced. Playas (interm. basin) reduced (since deposition dominates, playa is filled up by sand);-

Old

Pedeplains. Inselberg. Playas disappear.

HINTS

Define geomorphic cycle.

Wind → Deflation → mainly deflation effect in deserts.
Wind → Abrasion (sand-blast)
Wind → Attrition (breaking of bigger sand into fine sand).

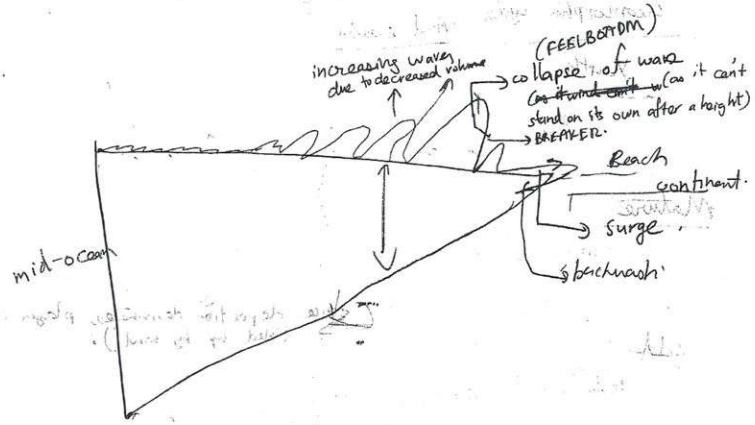
Landforms → Erosional → i) Inselberg ii) Pemosella iii) Mesas & Buttes iv) Mushroom v) Zeugen vi) Yardang
Landforms → Depositional → Dunes → parabolic, Barchan, Self, transverse
Depositional → Loess (fine sand)

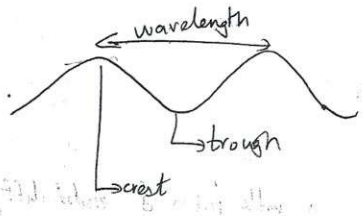
Arid cycle of erosion → Youth → fluvial (due to fluvial action) ⇒ Bajada, Pediment, Playas
Arid cycle of erosion → Mature ⇒ summit erosion
Arid cycle of erosion → Old → inselberg, demoiselle.

COASTAL LANDFORMS

COAST — Advancing (emerging) → low sedimentary
COAST — Retreating (submerging) → stand rocky
(deposition)
(erosion)
Marine agents actions — Hydraulic, Corrasion, Attrition.

Marine agents → Waves (friction b/w wind & surface water.)
Marine agents → ~~Tides~~ (gravity of moon & sun)

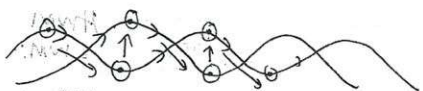




Feel bottom → wave collapses

Depth $\leq \frac{1}{2} \times$ Wavelength.

↳ results in breakers



CENTRE OF OCEAN

The water does not make translation. It just ascillates. The alternating crest & trough makes any body floating on the ocean ~~and~~ moves towards coast.

NEAR COAST

Water makes translation.

BREAKERS (at Feel bottom)

i) Spilling → waves spills (foaming coast). ⇒ India east coast
in front of other waves

ii) Surging → surge towards the coast. ⇒ Manitoba, Canada (blue colour beach)

iii) Plunging → waves fall vertically ⇒ West coast India.
(esp. in submergity coast)

Action of waves
- Corrasion
- Attrition
- Hydraulic action
- ~~Solution~~ solvent action

Land forms

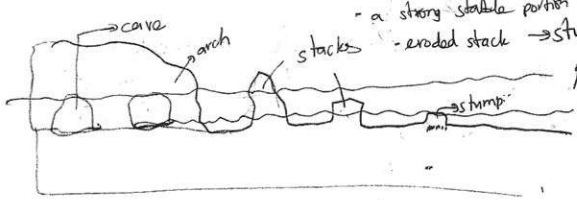
Erosional landforms

i) Cliff:- Steep slopes almost vertically above sea level.

wave-cut terraces - a gentle portion of eroded cliff inclined towards sea → wave-cut platform

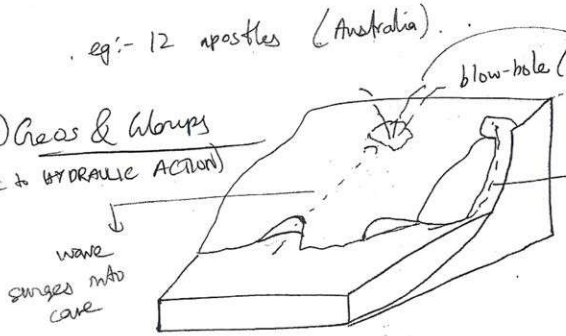
ii) Cave, arch, stack & stump:-

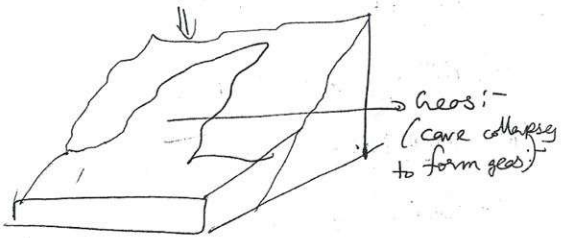
- Two caves combine to form arch.
- a strong stable portion of eroded cliff → stack
- eroded stack → stump.



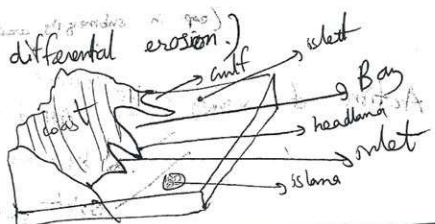
eg:- 12 apostles (Australia).

iii) Geos & Gloups (due to HYDRAULIC ACTION)





iv) Bays (due to differential erosion.)



~~Coastal fea~~

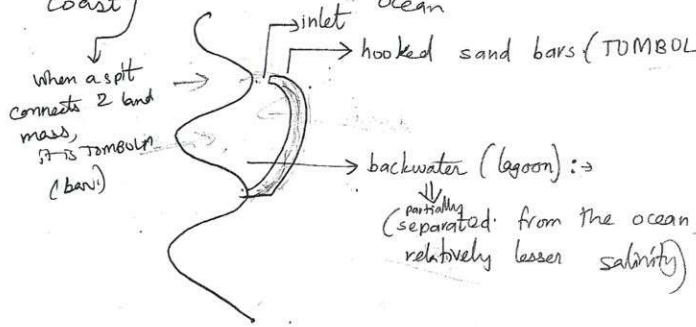
DEPOSITION

hook shaped sand bar

① Tombolo, spit, bar, barrier

When a bar rises & visible above sea level, it is barrier

⇒ (due to Chumming of breakers)



eg:- Vembanad lagoon, Pulicat lake.

If TOMBOLO closes the inlet, then it forms a lake → KOLLERU LAKE.

② Beach (attrition) :⇒ ③ Marine dunes

Geomorphic cycle of COASTAL LANDFORMS

~~Initial stage~~ ⇒

Youth stage ⇒ sea cliff, ~~arches~~

caves, arch, stacks, stumps, LAGOONS ⇓ TOMBOLA :-

Mature stage ⇒ Height of cliff reduces.

stumps, tombolai Deposition features (sand bars) are destroyed. Lagoons opened.

Old stage ⇒ All adjoining areas are brought down to sea level by EROSION.

beach, sand dunes.

Mains

⇒ Landscape development / Denudation chronology } ⇒ Youth, Mature, old stage.

→ Erosional landforms ⇒ only the erosional landforms of ARID, COASTAL, KARST, GLACIAL.

→ All landforms due to exo & endogenetic ⇒ endogenetic: Mountains (fold, block, ~~arches~~, rift valley); Volcanic land (cone, caldera, vent, ~~vate~~ dome)

exogenetic: Karst, Arid, Coast, Glacial.

India's research stations in poles

1) Arctic → Himadri
2) Antarctica → Dakshin Gangotri, Mytreyi, Bharti.

ATMOSPHERE

Nitrogen → 78%.

Oxygen → 21%.

Carbon dioxide → 0·03%.

~~Atomic~~ weights

Nitrogen can't exist in elementary form ← N_2 → $2 \times 14 = 28$

CO_2 → $12 + 2 \times 16 = 44$

Oxygen can exist as nascent (elementary) ← O → $1 \times 16 = 16$

↓ Decreasing wt. Decreasing gravity (hold);

So, initially, CO_2 was the most predominant gas. But, due to absorption of CO_2 by all plants, the CO_2 reduced drastically in proportion. Nitrogen became the most abundant gas.

Why we feel cooler when we move to a higher altitude (closer to sun!?)?

Earth is not heated by direct solar radiation. Heating of earth is due to

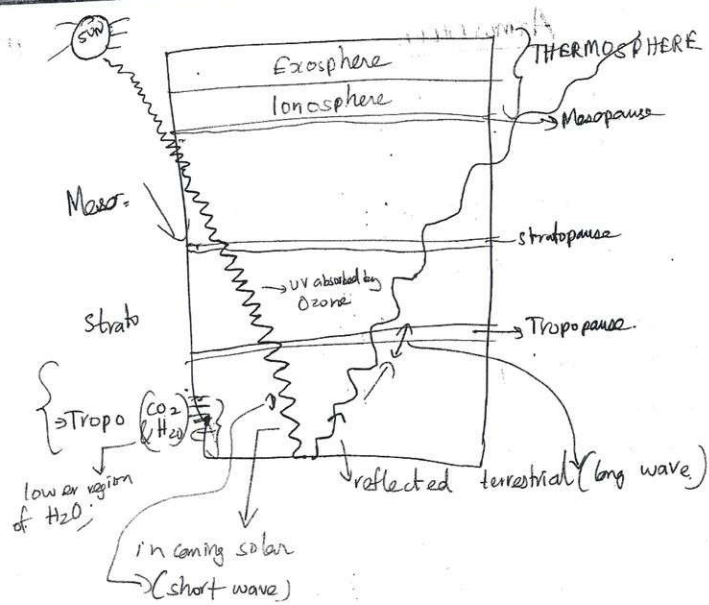
CO_2 & H_2O in the atmosphere.

⇓

(more dominant in lower region of troposphere).

CO_2 & H_2O allow solar radiation ~~in the~~ to enter the earth (short wave; high energy) but trap the reflected ~~Solar~~ terrestrial radiation (long wave; less energy) from the ground.

CO_2 & H_2O (being heavy) are abundant in the lower region of troposphere.



→ When we go to higher attitudes, the air mass becomes lighter (due to the reduction in percentage of CO_2 & H_2O in higher troposphere) and not much terrestrial radiations are trapped (due to less CO_2 & H_2O). So, temperature of atmosphere reduces as we go to higher altitudes.

Equator → rainfall occurs after 3 PM

Noon → max. incoming solar radiation.

But, for this max. radiation is terrestrially reflected and absorbed by CO_2 & H_2O. for this, a time period of 2 to 3 hrs. That is why

→ As we move to a higher altitude than the troposphere, into the ~~topos~~ stratosphere, temp. increases. ? Why?

Presence of Ozone in stratosphere

$$Ozone \Rightarrow O_2 + [O] \Rightarrow O_3$$

ENDOTHERMIC REACTION.

energy (UV from incoming solar).

Formation of Ozone requires energy. This energy is absorbed from UV rays of incoming solar radiation. This absorbed energy is stored as latent heat by O_3, thus increasing temperature.

→ Ozone (even with higher wt.) cannot enter into troposphere, though it has higher wt.? Why?

Due to the presence of a tropopause (which is a separating layer).

→ Though tropopause is present, CFCs released from earth (troposphere) reaches stratosphere, to destroy ozone layer ? - How?

By the process of very slow diffusion.

→ Ozone is relatively thin at the poles & also during night. Why?

Ozone (O_3) formation requires UV rays from incoming solar radiation. Due to absence of sunlight for long periods in poles, no ozone formation takes place. So, O_3 is thinner at poles.

→ How ozone depletion takes place?

CFCs (Chloro Flouro Carbons) diffuse to the stratosphere slowly. Chlorine in CFC undergoes rapid reactions with nascent oxygen.

$$Cl + [O] \rightarrow Cl.O$$

This depletion of nascent oxygen by Cl results in absence of [O] to form Ozone. So, not much ozone is formed.

→ Why ozone in the stratosphere not uniform throughout the earth (by distribution from thin to thick areas)?

Stratosphere → static atmosphere.
No circulation of air (like in troposphere).
This is why aeroplanes travel through stratosphere, since no turbulent winds is present.

→ Why is ozone so important to earth?

Since ozone absorbs UV rays (from incoming SOLAR rays) during its formation, UV rays do not enter the earth. These UV rays are carcinogenic.

→ Why Cl combines with oxygen in the stratosphere, not troposphere?

Chlorine combines only with NASCENT OXYGEN. But nascent oxygen is present in abundance in STRATOSPHERE, not in troposphere.

→ Mesosphere is the coolest layer. Why?

As we go higher, temp. decreases (due to decrease in CO_2 & H_2O). So, as we move to higher regions of troposphere, temp. decreases. But, as we move higher into stratosphere, temp. increases (due to OZONE). As we cross the strato into MESO, temp. decreases (no OZONE; no CO_2 & H_2O) ⇒ so COOLEST.

→ CO_2 & H_2O are greenhouse gases. Why?

CO_2 & H_2O absorb the long-wave terrestrial radiations and traps the heat. This increases the temperature of earth, producing a greenhouse effect.

→ ~~After~~ As we move higher than mesosphere, temp. increases. Why?

Mesosphere is the coolest layer of atmosphere. It cannot absorb terrestrial long wave radiation (due to absence of CO_2, H_2O or ozone). But, after mesosphere, from thermosphere ~~and in exosphere~~, temp. starts increasing with ~~higher~~ increasing height due to absorption of INCOMING SOLAR (short wave) RADIATION by Helium and Hydrogen.

→ Only THERMOSPHERE absorbs DIRECT INCOMING SOLAR WAVE RADIATION, due to presence of Helium & Hydrogen. No other lower layers can absorb incoming solar radiation.

NLR → Normal Lapse ray

→ In troposphere, as altitude increases, temp. decreases. (in the rate of $-6.5\,^{\circ}C/km$).

→ In stratosphere, as altitude increases, temp increases ($1\,^{\circ}C/km$)

→ Beyond thermosphere, temp. increases with increase in height.

→ How do the satellites (at 1000s of km beyond thermosphere) NOT burn?

Heat is not sensible due to rarified air particles. No ATMOSPHERE to absorb the heat. (no collision of air particles → no transfer of heat →).

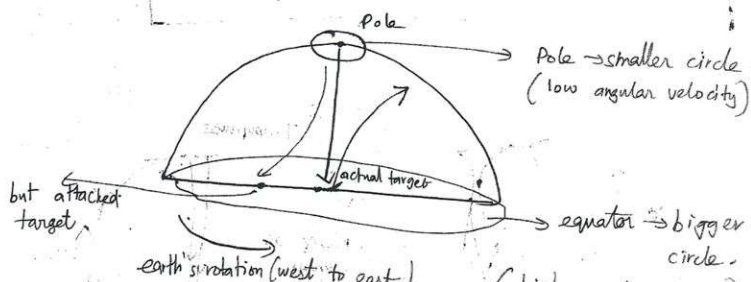
Air is rarified, because of very low pressure. (Height ↑ ⇒ Pressure ↓).

Air is a poor conductor of heat. It transfers heat only when two particles are very close to each other.

⇒ Though heavy veg. is present in mountains, why doesn't CO_2 content increase?

The CO_2 & H_2O released by ~~transp~~ respiration and transpiration goes down to the valleys, due to gravity & higher wt.

Coriallis force

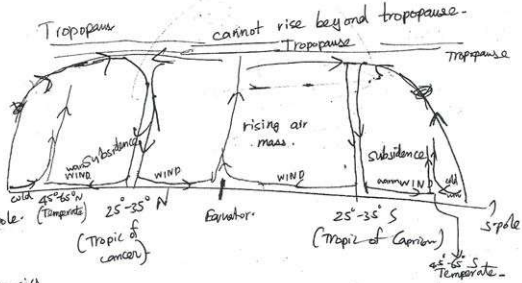


Pole is a smaller circle but equator is a bigger circle. But, both have to ~~move~~ cover the same angular distance in the same time, (360° in 24 hrs). So, equator (larger circle) moves with a higher velocity than the poles. So, any object travelling in the NORTHERN HEMISPHERE is deflected to the RIGHT of the source-to-target path. This DEFLECTION (due to the varying ~~angular~~ velocity of ROTATION) is called CORIALLES FORCE.

Thumb rules

- Air travelling in N. hemisphere is deflected to the right of its direction of propagation (clockwise deflection), whereas in S. hemisphere airmass is deflected to the Left (anti-clockwise direction).

- Rising airmass → increases rainfall → reduces temperature.
  → increases humidity
  Subsiding airmass → increases temperatures ⇒ & decreases HUMIDITY.
  (Long rain)



Tropics So, in the tropics, despite the high temperatures, air mass cannot rise due to subsidence of airmass (from equator & poles).

Temperate The subsided airmass in the tropics branch towards the poles & equator. This warm wind from the tropics collides with the cold wind from the poles. The warm & cold airmass

do not mix and the warm airmass pushed up. Warm airmass rises, in spite of the less temperature in the 45°-65° latitudes (TEMPERATE), and hence these regions get ample rainfall. The coldwind is also gradually heated up & ~~the~~ rises up.

<u>Poles</u>

→ Subsidence of airmass.

→ increases temp (from -50°C in atmo. to -10°C in ground) (decreases humidity).

→ Air mass absorbs all the moisture from vegetation (tries to decrease humidity). ⇒ <u>DRY COLD</u>.

→ To escape from this loss of moisture, vegetation tries to ~~ma~~ close its leaves [PINE LEAVES] and also → a waxy coat (to prevent transpiration). Despite this, the moisture is aborbed. So, the height of vegetation decreases in these regions. ⇒ COLD DESERT.

Humidity & temperature → independent phenomena.

Equator ⇒ high temp; high humidity ⇒ rising air mass.

Tropics ⇒ high temp; low humid ⇒ subsidence

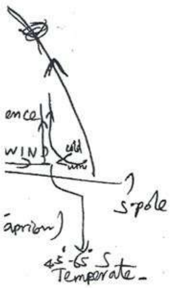
Temp ⇒ medium temp; high humid. ⇒ rising

Pole ⇒ low temp; low humid ⇒ subsidence

flected to
(clockwise
irmass is
direction).

decreases
HUMIDITY.

popause.



e high
due to
& poles).
tropics
This warm
the cold
& cold air mass

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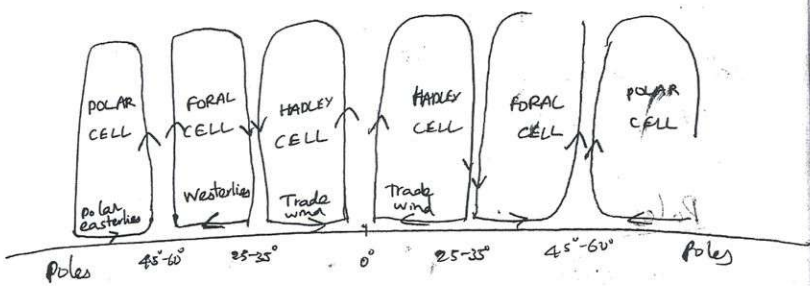
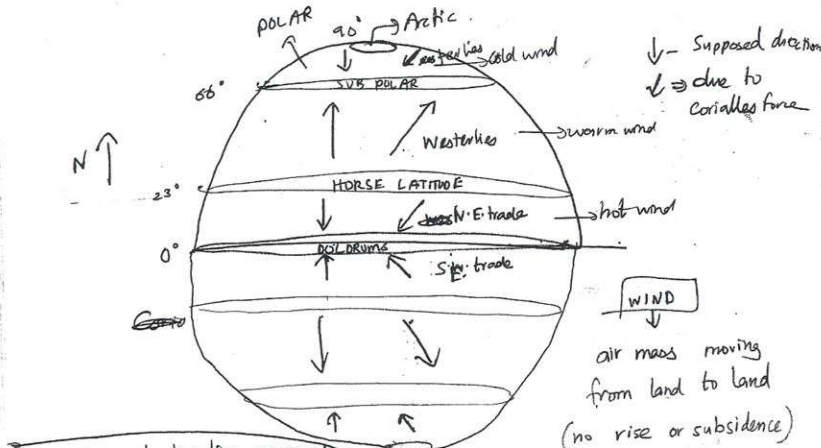
CLIMATOLOGY





↓ – Supposed direction

↙ ⇒ due to Coriolis force

* All wind directions represent their POINT OF ORIGIN.

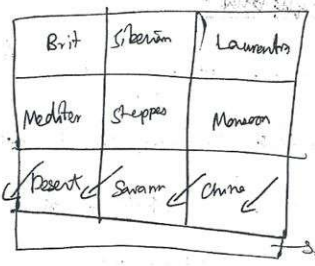
→ Coriolis force deflects wind to its right in N. hemisphere.

→ Coriolis force " " to its LEFT in S. hemisphere

Easterlies → originate in EAST

Westerlies → originates in WEST

N.E. trade → originates in N. East



↙ ⇒ N.E. trade → hot winds

- Carries moisture from East coast.
- ⇒ So, rainfall decreases from East to West.
- Western coast has the minimum rainfall in the 25°-35° (tropical) region. So, deserts are formed in the West Coast of a Continent.

eg:- Arizona (Sonoran, Mojave) Atacama Sahara, Thar, Gobi.

0° → Mid-latitud equator ⇒ Doldrums

23½° → Tropic ⇒ Horse Latitude

66½° → Sub-polar ⇒

90° → Polar

25°-35° ⇒ Tropics → Horse latitude.

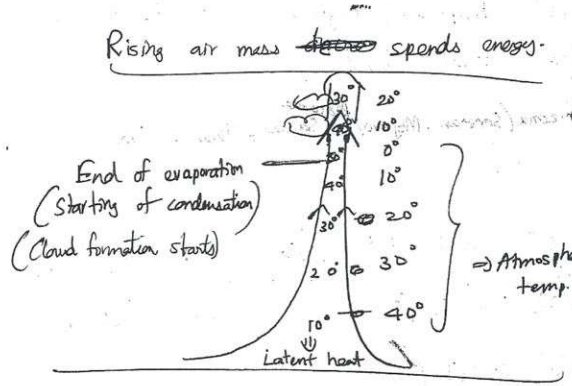
- Subsidence of air mass increases the air pressure.
- This will sink a ship. So, ships carrying horses (for horse trade) were forced to throw the horses into the sea.
- Since it obstructed horse trade, TROPIC is called HORSE LATITUDE.

Doldrums (Equatorial)

- The entire air mass rises from here
- All the subsided air mass reaches as trade winds
- There is collision & turbulence of winds
- So, turbulence ⇒ DOLDRUMS

Latent heat

Heat hidden & stored by air particles.
It is not sensible (can NOT be detected by thermometer).



Evaporation ⇒ Absorption of heat (energy) → ENDOTHERMIC.

Condensation ⇒ releases energy ⇒ EXOTHERMIC.

As air mass rises, the temp. ~~of it~~ decreases (due to increase in altitude). This causes the air mass to CONTRACT. As it contracts, the relative moisture content in the air mass increases.

→ As it goes to a very high altitude, the contraction is so high that the relative moisture is 100%. ⇒ SATURATION POINT ⇒ CLOUD FORMATION.
(it cannot absorb more moisture.)

→ After SATURATION, condensation starts. As a part of the CONDENSATION releases energy (increases temp.) and produces rainfall. Now, the cloud moves slightly up. Here, again, another part of cloud CONDENSES. Finally, all the cloud CONDENSES & only the dry air mass moves towards other latitudes. So, subsiding airmass does not bring rain.

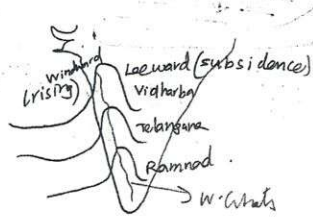
→ Subsiding airmass contains very little moisture. As it subsides, it expands due to increase in temp. (with decrease in altitude). As it expands, it tries to absorb the moisture from surroundings. So, it INCREASES HUMIDITY. (tries to suck in the water vapour).

HUMIDITY → Moisture content in airmass.

EQUATOR → more Clouds.

~~TROPICS~~ (Desert) ⇒ NO CLOUD

Sub-polar ⇒



* Air is different ; Air particle is different

As altitude increases, air mass expands but

AIR PARTICLES CONTRACT.

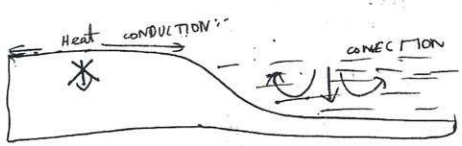
Altitude ↑ ⇒ Pressure ↓ ⇒ air mass expands
Space b/w air particles decreases

Altitude ↓ ⇒ Temperature ↓ ⇒ air particles contract.

After cloud formation, due to wind turbulence the contracted air particles (at a great distance) collide to form a cloud. Cloud formation is also due to change dupt.

- Air mass is a bad conductor of electricity.

Air mass does not mix its heat with the surroundings. It loses this heat (energy) only on its own work (by rising).



CONDUCTION ⇒ transfer of heat from one particle to another due to CONTACT.

~~Heat~~ by conduction
- Land → is heated fast & loses heat fast (Doesn't allow heat to pass through the surface - Only the upper superficial is heated.
- Sea → heated by convection:⇒ sea is heated slowly & cools slowly.

Sea breeze: (Day time):

- At noon, land heats faster than sea. So, land is at a higher temp. than sea.

Temp of land > Temp of sea ⇒ Pres of land < Pres of sea

↓

Air mass rises faster :- empty space is created. This empty space is filled by air mass from sea.

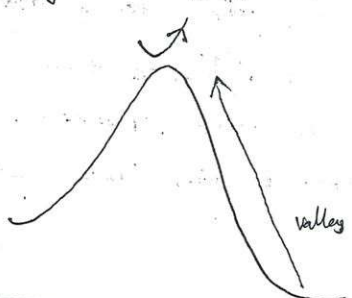
SEA BREEZE. ⇒ (day time)

Land breeze (during night)

- Land cools faster than sea.
- Temp of land < Temp of sea:
- Air mass subsides more at land
- This air mass moves towards sea → land breeze

Mountains

Valley breeze (Day time)



~~Day time ⇒ Mountain~~

Mountain is heated faster than plain & cools faster than plains (bcoz of less CO_2 & H_2O ⇒ which is responsible for ~~cbo~~ retaining heat).

Valley breeze (warm)

Day ⇒ Mountain heated ~~faster~~ faster than ~~the~~ valley.

Temp. of mt. > Temp. of valley.

• ~~Warm~~ air mass in mt. rises fast. This emptiness is filled by wind from valley. (warm wind)

(since from lower altitude)

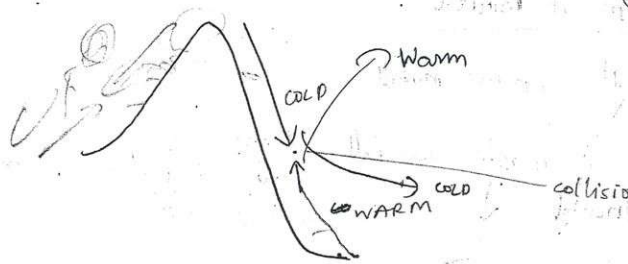
· Mountain breeze

NIGHT ⇒ Mountain cools faster than valley.

Temp. of mt. < Temp. of valley.

• Air mass subsides more in mt. This subsided air mass moves towards valley ⇒ COLD MOUNTAIN BREEZE

This is why houses in ~~mountain~~ are built with windows & door facing down ~~SLOPE~~ valley. This is to receive warm ~~VALLEY~~ breeze during days. If they have windows facing upwards, then the COLD MT. BREEZE will hassle them.



Due to collisim of warm & cold winds, The heavier cold air mass settles at a LOWER LEVEL & warm air mass settles at a higher level. Fog in mountains

This cold air mass at lower mountainous areas (valleys) produce FOG (MIST) ⇒ due to condensation of cold air mass.

FOG (MIST) → cloud at ground level.

Temperature inversion

The settling of cold airmass at lower altitude and warm airmass at high altitude [contrary to the increasing temp. with increasing altitude] is called temp. inversion.

Fog in landlocked areas.

DAY ⇒ convective current
- Warm air mass goes up.
- Cold air mass comes down.

NIGHT
- Cold air mass that came down during day settles DOWN.

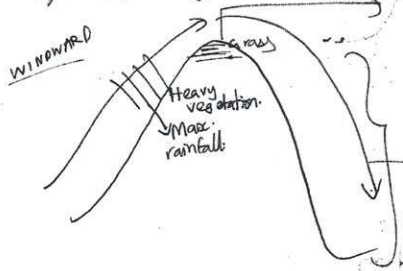
⇓
FOG.

Types of rainfall

1) Convective rainfall — equator → heat rises the air mass

2) Orographic rainfall — Kerala → mountain

3) frontal — Britain → cold wind pushes warm airmass up → little rainfall.



As the rising air mass condenses as it goes up (after a specific altitude), the rainfall will be relative less at the PEAK. In the windward slope, the airmass has no moisture and hence no rainfall.

- If there was no Coriolis force,
  1) rainfall would've decreased uniformly from equator to pole.
  2) snowfall would've decreased uniformly from pole to equator

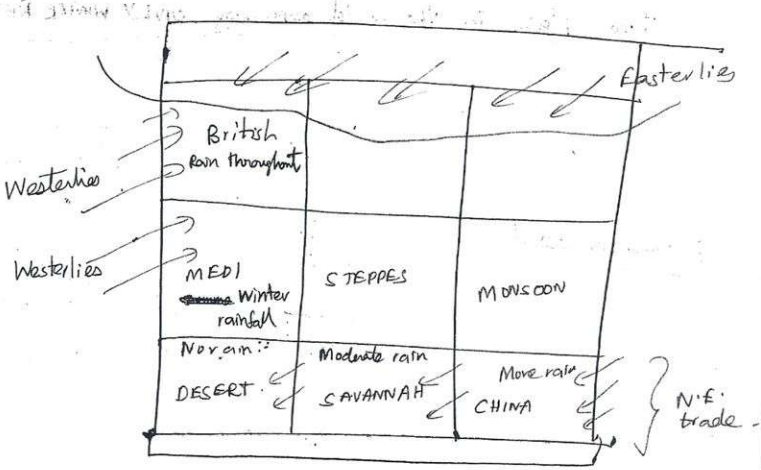
India

S.W. Monsoon → local modification
↳ S.W. trade → (local modifications);-

N.E. monsoon → N.E. trade [NORMAL pattern].

→ Though equator receives direct solar rays, it records lower temperature than deserts (middle latitudes).

- Due to thick cloud cover. → reflects solar rays
- Due to heavy rainfall, → cools down
- Due to heavy vegetation → prevents direct rays; absorbs solar energy.



→ In summer, more airmass rises. So, the winds ~~belt~~ is shifted a little northwards.

→ Mediterranean ⇒ under the influence of Westerlies in Winter. During summer, the westerlies shift northward (towards British). The trade winds shift north (towards medi). So, in summer, medi. is under the influence of trade winds. Since it is on the WEST coast, it gets NO rainfall due to Trade winds.

Mediterranean ⇒ ~~cor~~ rainfall during winter (↑ WESTERLIES)
NO rain in summer.
↳ N.E. Trade

British climate → under the influence of westerlies both in winter & summer. So, rainfall during entire year.

Two places in the world experiencing ONLY WINTER Rainfall

- Mediterranean climate
- Chanai coast (N.E. trade) → but it does not exist during SUMMER.

Patagonian desert
↓
under the influence of Westerlies. But, NO RAIN because of subsidence of airmass due to ANDES MOUNTAIN.

Foga × (leeward slopes) CONDITION → favours grape cultivation
↓
~~Dhanbad~~, Dindigul, Theni, Pune.

Mumbai → windward ; Pune → leeward.

Savannah	Steppes (Prairies, Pampas)
• N.E. trade	Westerlies
• Moderate moisture ⇒ moderate rain	Moderate moisture ⇒ moderate rain
• Warm temp.	Cool temp.
• More (relatively) air mass rises. ↳ relatively more ppt.	Relatively less air mass rises ↳ relatively less ppt.
• Grass; some trees	Only grass.

Onshore winds → from SEA to LAND ⇒ sea breeze

Offshore winds → from LAND to SEA ⇒ Land breeze.

Mediterranean climate

- Westerlies.
- But ran ~~over~~ relatively less. [because of mountains → Rockies, Andes, Alps
  ↓ California, ↓ Santiago, ↓ France, Germany]

Steppes

N. America → Prairies; S. America → Pampas; Europe: Steppes

→ Grasslands
→ Wheat & maize ⇒ ranching ⇒ cattle & sheep rearing

⇓ extensive cultivation
⇓ mechanised farming
(Prairies) ⇒ combine harvesters;

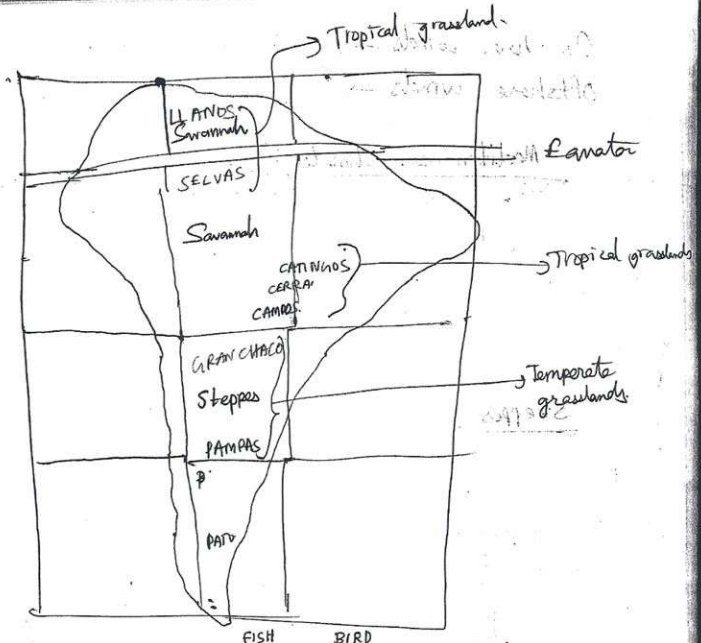
Milk, butter, meat
↓ meat-packing
(Chicago, Buenos Aires)

wool → Australia

ASIAN STEPPES → drought during summer; Nomadic herders;
↓ Kazhak, Kirghiz & Kalmuk

Prairies → Bread Basket of the world
↳ wheat & corn
↓ If U.S. faces drought, the wheat & corn prices of the world will increase.

⇒ Banana, Rubber, Coffee, Sugar ⇒ require high temperature & high rainfall. (0-15° Latitude;
⇓
These plantations are found in Cuba, Brazil, S. India, Central American countries.
↓ Banana republic



WEST COAST ⇒ Anchowish → Guano → Guano fertilizer.
(COLD CURRENT) → El nino → Anchowish dies → Guano dies.
(warm current)

Amazon

Tributaries ⇒ Madeira, Jura, Purus, Xingu, Negro.
(largest tributary)

- A lot of ~~tributaries~~ tribes.
- Mouth of Amazon ⇒ Marajo island ⇒ Brazil
  largest riverine is.

~~Cape~~
- Magdaleena river ⇒ ~~Venezuela~~ COLUMBIA. ⇒ Coffee belt.
  World's tastiest coffee.

- L. Maracaibo ⇒ Venezuela ⇒ oil
  Gulf of Guayaquil → Ecuador → oil

Punta Arenas (Chile)
↓
Southern most inhabited city.

- BRAZILIAN HIGHLANDS
  High rainfall; high temp.

Sao Paulo ⇒ world's largest coffee growing city ⇒ 40% of Brazil's GDP.
↳ largest city in s hemisphere.
↳ Santos ⇒ Coffee port of the world.

- ...raria, Paraguay, Amazon form ESTUARIES, not DELTAS.

Meat triangle → Rosaria, ARGENTINA Buenos Aires, Bahia Blanca ⇒ Cowboy stories.