GEOGRAPHY NOTES FORM 2

Specific Objectives

By the end of the topic, the learner should be able to:

a. define earth movements

b. explain the causes of horizontal and vertical earth movements

c. explain the theories of Continental Drift and Plate Tectonics

d. define folding, faulting, vulcanicity and earthquakes

e. explain the processes of folding, faulting and vulcanicity

f. describe types of folds, faults and forms of vulcanicity

g. explain the resultant features due to folding, faulting and vulcanicity

h. explain the causes of earthquakes

i. describe how earthquakes are measured

j. account for the or distribution of earthquake zones, fold mountain systems and features due to faulting and vulcanicity

k. explain the significance of the resultant features of folding, faulting, vulcanicity and the effects of earthquakes.

INTERNAL LAND FORMING/ENDOGENETIC PROCESSES

Processes operating in the interior of the earth resulting in the formation of natural physical features or land-forms.

They are caused by earth movements.

Examples of these processes are folding, faulting and Vulcanicity.

Formation of land forms by internal land forming processes is determined by:

- Nature and age of earth materials
- Type of movement involved
- Intensity and scale of movement involved

Crustal Earth Movements

Displacement of the earth's crustal rocks.

They are brought about by tectonic forces which originate and operate in the interior of the earth e.g. tensional forces (which operate along horizontal plane moving away from each other), compressional forces (which operate along horizontal plane moving towards each other), shear forces (which move past each other with unequal strength) and gravitational forces (which attracts things to the earths centre).

Earth movements are of 2 types:

1. Horizontal/lateral/orogenic movements
2. Vertical/epeirogenic movements

Horizontal Earth Movements

Movements which act along a horizontal plane within crustal rocks.

They are caused by tensional and compressional and shear forces.

Learner's Short Notes

Effects

They cause:

⇒ Strain and stretching of crustal rocks due to stretching caused by tensional forces which cause formation of cracks or faults.

⇒ Squeezing and shortening of crustal by compressional forces rocks which cause them which also cause formation of faults.

⇒ Crustal rocks to shear by slipping past each other or by dividing into layers which is caused by shear forces.

Results of Horizontal Earth Movements

Results in the formation of the following features:

1. Faults
2. Rift valleys
3. fold mountains
4. Escarpments
5. Basins
6. Tilt blocks
7. Block mountains

Vertical Earth Movements

Movements which occur along the earth's radius or towards the earth's surface or towards its centre.

Effects

Causes:

i) Subsiding/sinking/downwarping or pulling of crustal rocks downwards.
ii) Uplifting/upwarping or pushing of crustal rocks upwards
iii) Tilting of crustal rocks or shearing in vertical direction due to grater uplift on one side.

Learner's Short Notes

Results of Vertical Earth Movements

1. Raised cliffs
2. Tilt blocks
3. Rift valleys
4. Fault scarps/escarpments
5. Plateaus
6. basins

Causes of Earth Movements

(a) Magma movement within the earths crust.
(b) Gravitational force
(c) Convectional currents in the mantle
(d) Isostatic adjustment

(a) Magma Movement within the Earths Crust

- When magma moves with force pushing crustal rocks horizontally or vertically.
- When magma moves from reservoir and leaves empty spaces onto which crustal rocks are pulled inwards.

(b) Gravitational Force

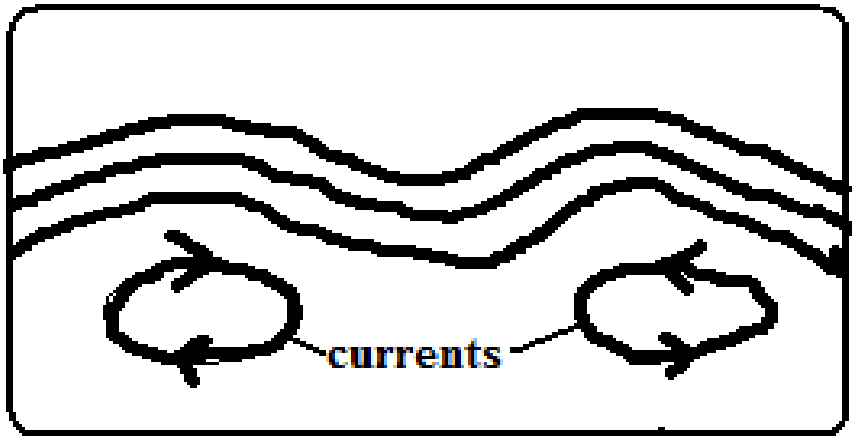
When the attractive force of the earth pulls crustal rocks into empty spaces left after magma escaping from the reservoir.

(c) Convectional Currents within Mantle

When convectional currents in magma in mantle drug crustal rocks by friction.

Horizontal movement of currents cause horizontal movements while vertical cause vertical movements.

Learner's Short Notes



Isostatic Adjustment

Rising of continental masses to restore the upset state of balance between sial and sima layers.

Isostacy is the state of balance between sial and sima layers.

It can be disturbed by erosion on continents and melting of continental ice sheets.

The reduced weight causes continental masses to rise.

Theories Explaining the Earths Movements

A theory is reasoned ideas intended to explain facts or ideas.

There are 2 theories which explain the earth's movements namely the Continental Drift Theory and the Plate tectonics theory.

Learner's Short Notes

i) Theory of Continental Drift

Its proponent was A. Wegener.

It explains the origin of 6 continents.

It states:

- The earth was a single sialic land mass called **Pangaea** surrounded by a huge ocean called **Panthalasa** whose floor was a mass of sima.
- Pangaea broke into two parts called **Laurasia** (N. Hemisphere) which lay around equator and **Gondwanaland** (S. Hemisphere) which lay around south pole which were separated by a narrow ocean called **Tethys** (the present Mediterranean Sea).
- Laurasia broke into Laurentian Shield and Fennoscandia (Europe, Asia and N. America) and moved northwards to their present positions.
- Gondwanaland broke into Africa, Australia, S. America and Antarctica and India subcontinent.

Evidences Supporting the Theory

1. Fitting of western coast of Africa and S. America into a jigsaw.
2. Discovery of coal 40◦N and 55◦N which was formed by burying of tropical vegetation.
3. Considerable displacement of rocks along some faults e.g. along the Great Glen Fault of Scotland.
4. Cape and Buenos Aires folds resemble one another by having east west trend.
5. Red sea shores show evidence of having undergone lateral displacement an indication that it was formed by movement of the earth's crust.
6. Evidence of ancient Glaciation to the south of equator in Africa in Madagascar and India where there is presence of ancient glacial deposits suggesting these areas were once around south pole.

Learner's Short Notes

ii) **Plate Tectonics Theory**

It states that:

The earths crust is made of blocks called plates.

7 Large Ones

1. Eurasian plate
2. Australian plate
3. Africa plate
4. Antarctic plate
5. N. American plate
6. S. American plate
7. Pacific plate

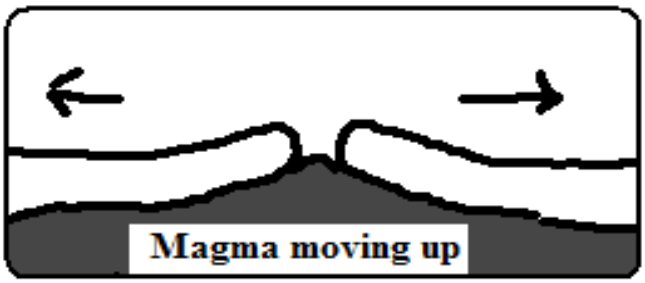
Smaller Ones

1. Indian
2. Arabian
3. Caribbean
4. Cocos
5. Somali plates
6. Juan de Fuca
7. Nazca
8. Philippine
9. Scotia

These plates are two types : tectonic plates:

1. Oceanic plates which form major areas of the ocean floor including coastal lowland.
2. Continental plates which form the bulk of the continental land mass.

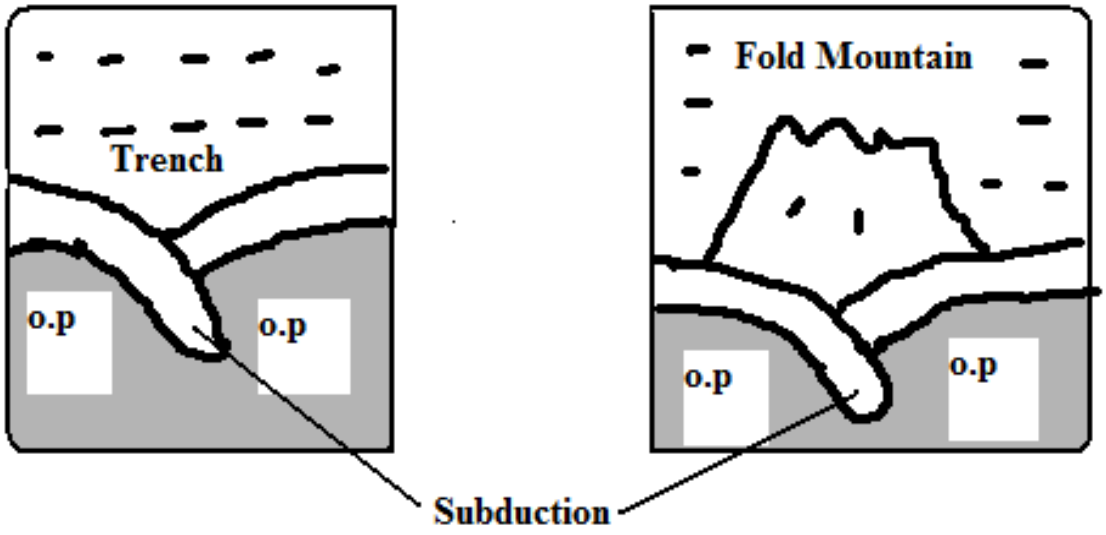
- The plates float on molten mantle layer called **Asthenosphere.**
- The plates move relative to each other due to convectional currents in the mantle.
- They move away from each other forming **extension** or **constructive boundary** called so because magma fills the space between.



- They move towards each other forming **compressional** or **destructive boundary** called so because materials between are crushed. The movements of those two types of plates have the following effects:

Learner's Short Notes

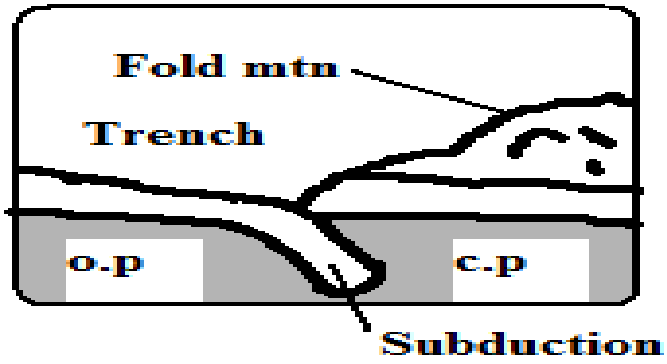
1. **When two oceanic plates meet**



- There is subduction and the ocean floor is pulled inwards forming a trench e.g. Java Trench .**Subduction** is the passing of edge of one plate beneath the edge of another.
- Sediments on the sea floor in the region of subduction are compressed to form Fold Mountains.

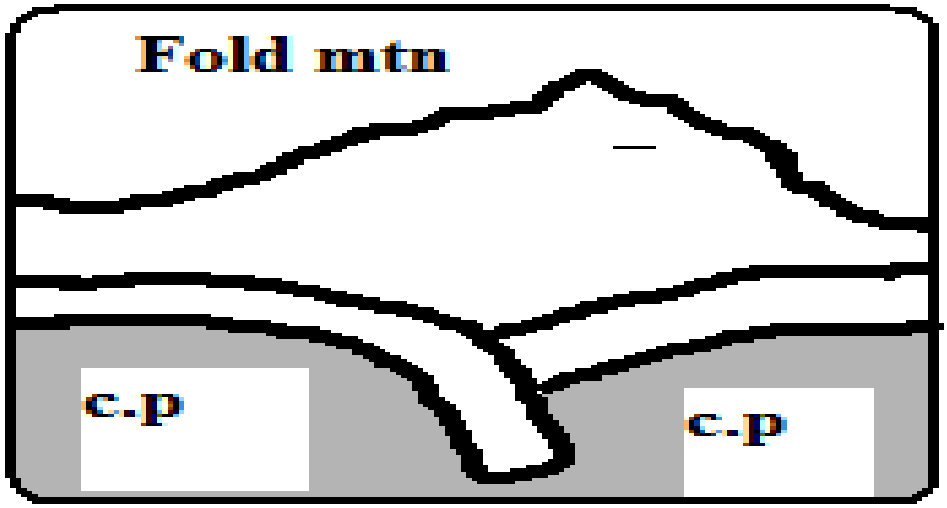
i) **When an oceanic plate meets a continental plate** the edge of the oceanic plate slides beneath the continental plate in a movement called subduction.

- Sediments on the sea floor in the region of subduction are compressed to form Fold Mountains.
- Fold Mountains are also formed at the edge of the continent when the sial layer is compressed.
- The edge of the oceanic plate bends into the mantle forming a trench.

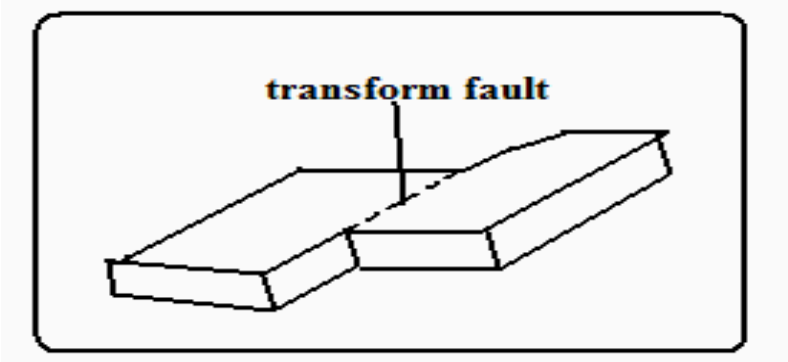


Learner's Short Notes

ii) **When two continental plates collide** the sial layer is folded into mountains



They move past each other forming **transform** or **conservative boundary** called so because there is neither construction nor destruction which occurs where the plates are separated by a major fault.



Significance of Plate Movements

1. Are sources of earthquakes and Vulcanicity.
2. Causes formation of land forms such as Fold Mountains and ocean trenches.
3. Spectacular landscapes formed are a tourist attraction.
4. Eruption of magma can result in formation of valuable minerals.

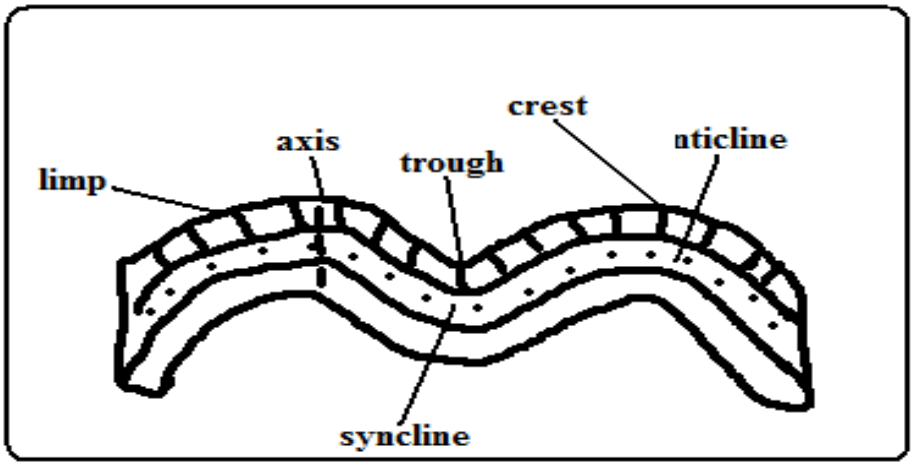
Learner's Short Notes

FOLDING

Process in which crustal rocks are distorted by compressional forces by being caused to bend upwards and downwards.

It occurs on fairly young sedimentary rocks.

Parts of a Fold

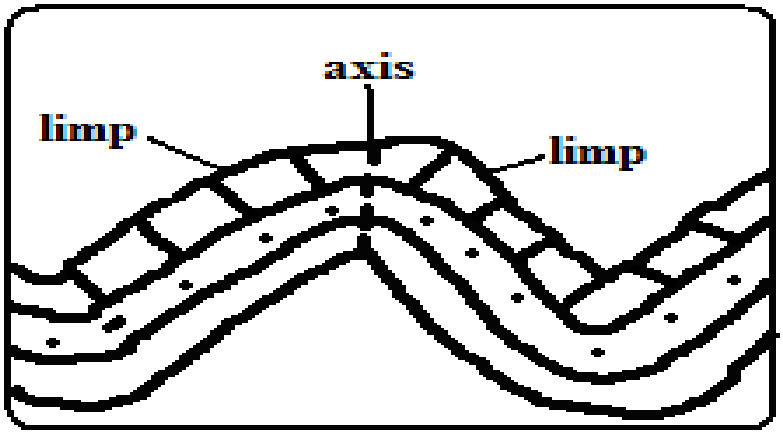


(a) Anticlines (upfolds)-parts of the earths surface which bend upwards when folding occurs.
(b) Synclines (down folds)-Parts of the earths surface which bend downwards when folding occurs.
(c) Crest-upper most part of Anticline.
(d) Trough-lowest part of a syncline
(e) Limp-rock layers sloping on both sides of a fold
(f) Axis-imaginary line drawn vertically through the centre of the anticline.

Learner's Short Notes

Types of Folds

1. **Simple Symmetrical Folds**



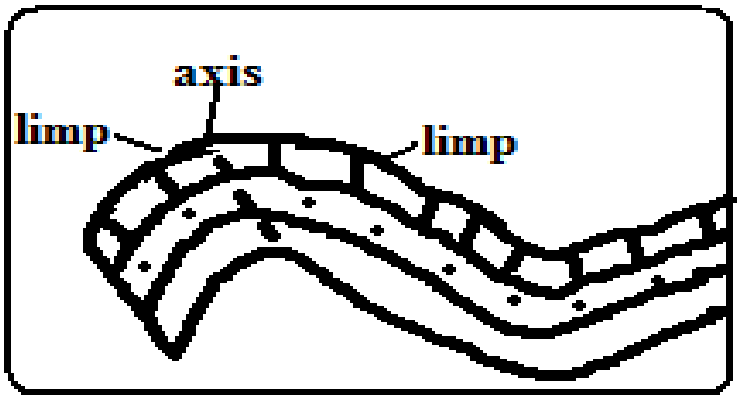
Which are symmetrical about the anticline.

Formed by 2 compressional forces of equal magnitude.

2. **Asymmetrical Folds**

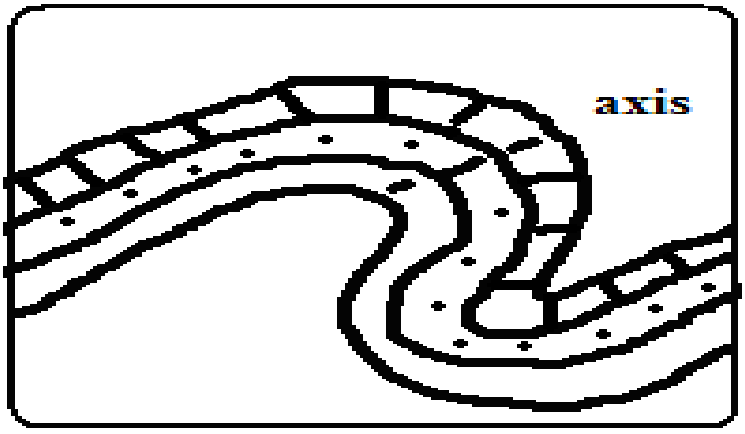
Which are asymmetrical about the anticlines axis or in which one limp is steeper than the other.

Formed by two compressional forces of unequal magnitude in which one is stronger than the other.



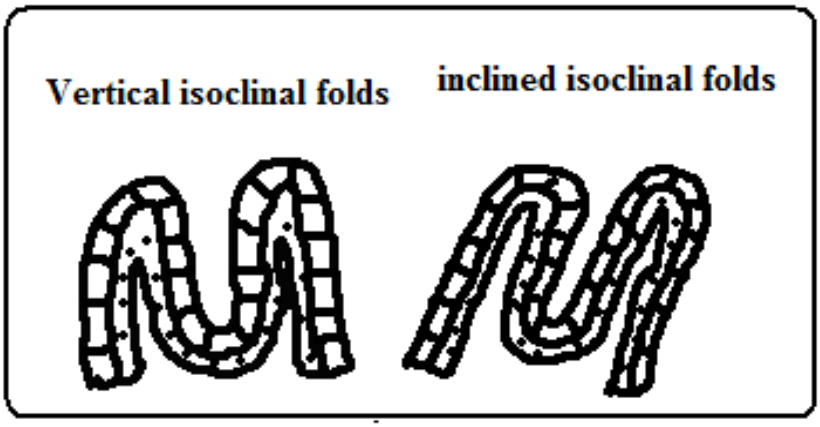
Learner's Short Notes

3. **Over Folds**



In which anticline of one fold is pushed over the limp of the other.

4. **Isoclinal Folds**

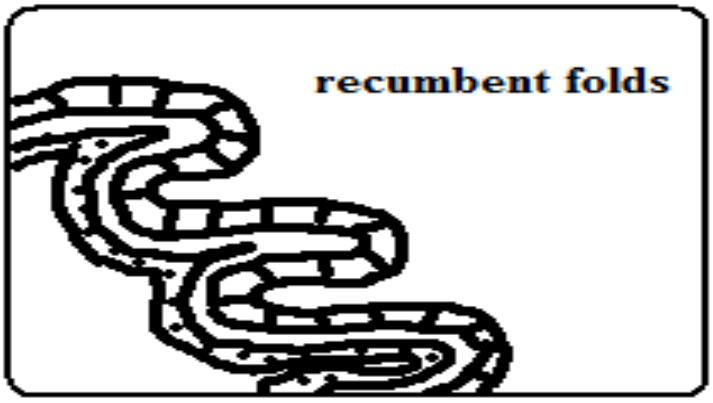


Which are packed closely together and with limps almost parallel to each other.

Vertical Isoclinal folds are formed by compressional forces of equal magnitude while inclined Isoclinal folds are formed by forces of unequal magnitude.

Learner's Short Notes

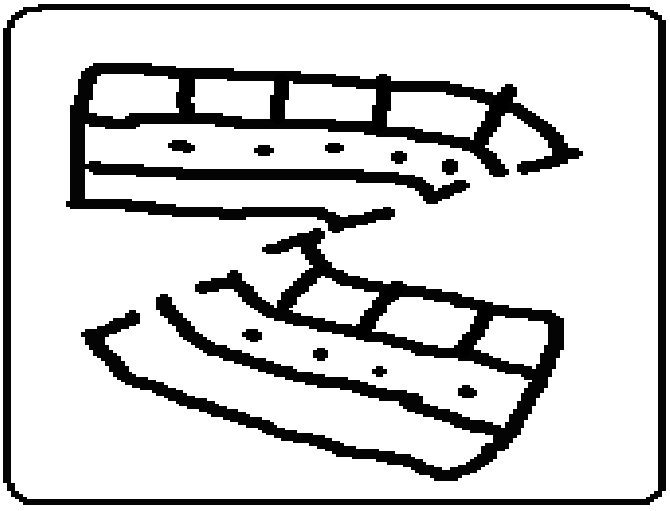
5. **Recumbent Folds**



Which lie in a horizontal manner.

Formed by two compressional forces one of which is very strong.

6. **Nappe/Overthrust Fold**

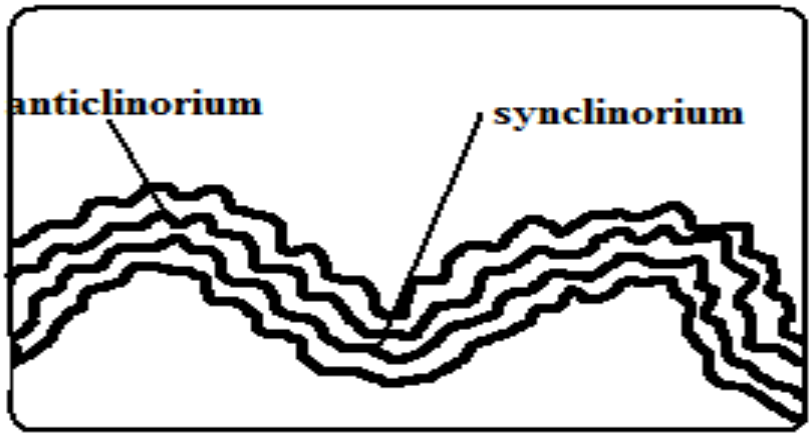


In which one limp is pushed over the other limp.

The forces are very strong and they cause a fracture/fault to develop.

Learner's Short Notes

7. **Anticlinorium and Synclinorium Complex**



Folds characterized by minor upfolds and minor downfolds.

- Land is first subjected to weak compressional forces resulting into minor folds.
- Later the land is subjected to much greater compressional forces resulting into new upfolds with minor folds (Anticlinorium) and new down folds with minor folds (Synclinorium).

Resultant Features Due To Folding

1. Fold Mountains and Their Distribution

Worlds highest and most impressive mountains and the most conspicuous feature of folding.

1. Himalayas-Asia
2. Everest-Nepal-Tibet border-highest point.
3. Andes-Peru in S. America
4. Alps-South Central Europe
5. Rockies-W.N. America
6. Atlas-N.W. Africa.
7. Appalachian-E.N. America

Learner's Short Notes

Theories of Origin of Fold Mountains

a) **Contraction Theory**

During the earth's formation surface rocks cooled faster and wrinkled to form Fold Mountains.

b) **Convectional Currents Theory**

Horizontal convectional currents in the mantle exerted frictional pull on crustal rocks.
Continental crusts were pulled towards each other.
Sediments between them were squeezed into folds.

c) **Continental Drift Theory**

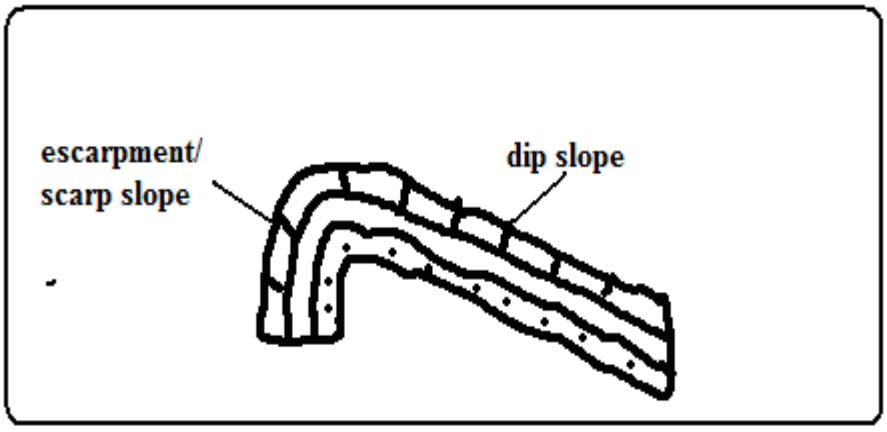
- During break of Gondwanaland India drifted northwards and collided with Eurasia.
- Sediments between were squeezed to form fold mountains e.g. Himalayas and Everest.

d) **Plate Tectonics Theory**

When an oceanic plate meets another or it meets a continental plate the sediments under the sea are compressed to form Fold Mountains.
When two continental plates meet the sial layer is compressed to form fold mountains

E.g. Alps was formed when Africa plate pushed against the rigid European plate.

2. **Escarpments**

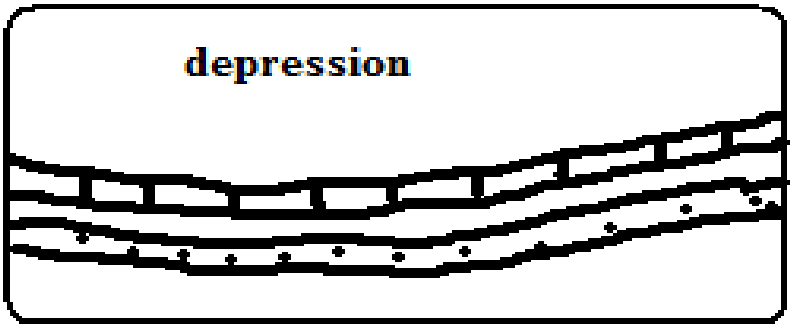


Learner's Short Notes

A relatively continuous line of steep slopes facing the same direction.

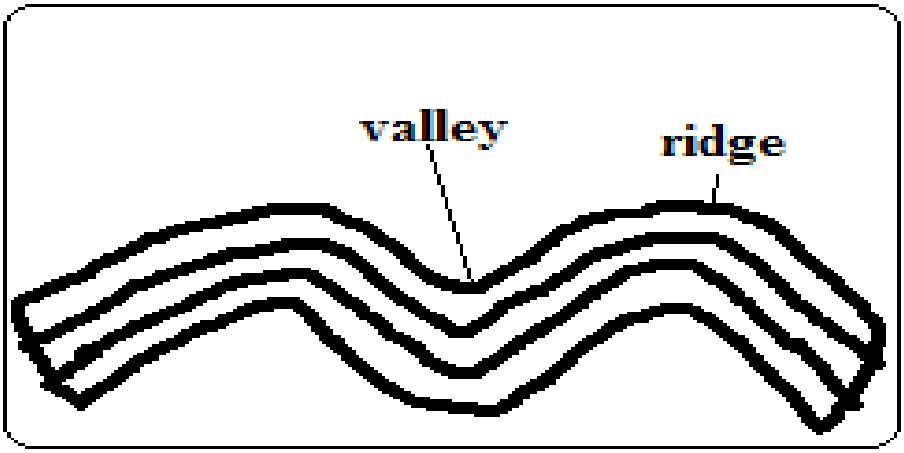
Formed one compressional force causes folding resulting in one steep limp of the anticline which forms the escarpment.

3. **Depressions**



Formed when not very strong forces cause folding causing some parts of the earths surface to form syn-clines forming basins.

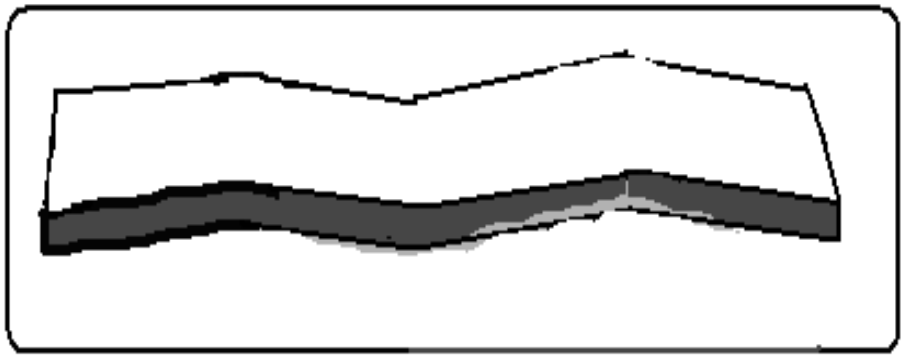
4. **Ridges and Valleys**



Learner's Short Notes

When folding occurs anticlines form uplands/ridges/hills while synclines form valleys.

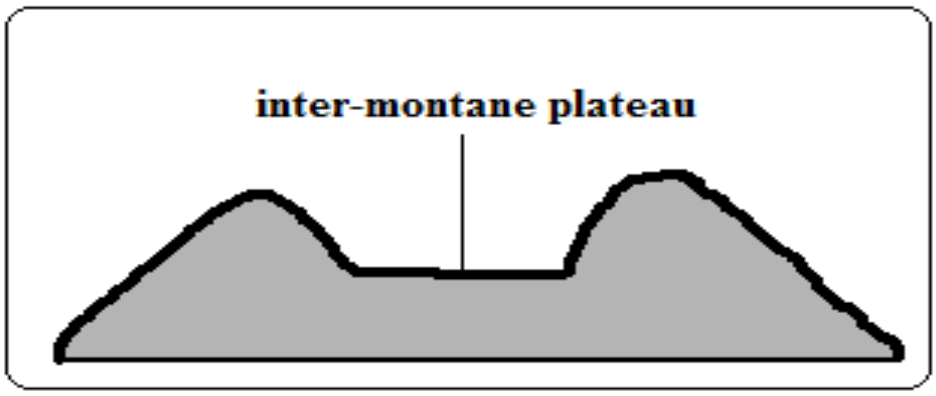
5. **Rolling Plains**



Plains which appear to rise and roll.

Formed when plains are acted upon by weak compressional forces resulting into gently sloping anticlines and very wide synclines.

6. **Inter-montane Plateaus**



A high fairly level land between mountains.

Formed when rocks at the edges of a region become intensely folded and the middle parts resist folding resulting into mountains which enclose a high fairly level land.

7. **Inter-montane basins**

Formed when some parts of inter-montane plateau sink more to form basins.

Learner's Short Notes

Significance of Folding

To Human Activities/Economic significance

Positive/advantages

1. Fold Mountains are a tourist attraction which brings foreign exchange.
2. Fold Mountains are water catchment areas and sources of rivers.
3. Some fold mountains have valuable mineral deposits such as coal and petroleum.
4. Fold Mountains act as protective barriers during war.
5. Some fold mountains on the path of rain bearing rainfall influence rainfall causing the windward slopes to receive heavier rainfall.
6. Folding can lead to formation of valuable minerals due to metamorphism.
7. Folding brings valuable minerals to the surface making them easily available.

Negative/disadvantages

8. Fold Mountains on the path of rain winds cause the leeward slopes to receive less rainfall.
9. Fold Mountains discourage settlement due to cold temperatures and rugged terrain
10. Folding can lead to burying of minerals.
11. Fold Mountains are a barrier to road and railway where there are no passes and where there are passes they may be covered by snow. Orographic fog hinders pilot's visibility.

To Physical Environment

1. Folding can result in submerged coastal zones which are used as harbours.
2. Can lead to metamorphism of rocks changing their original state and making them more resistant to erosion.
3. Depressions formed by folding turn into wet land important for water purification.
4. Folding leads to faulting and magma may escape through faults leading to Vulcanicity and earth quakes.

Learner's Short Notes

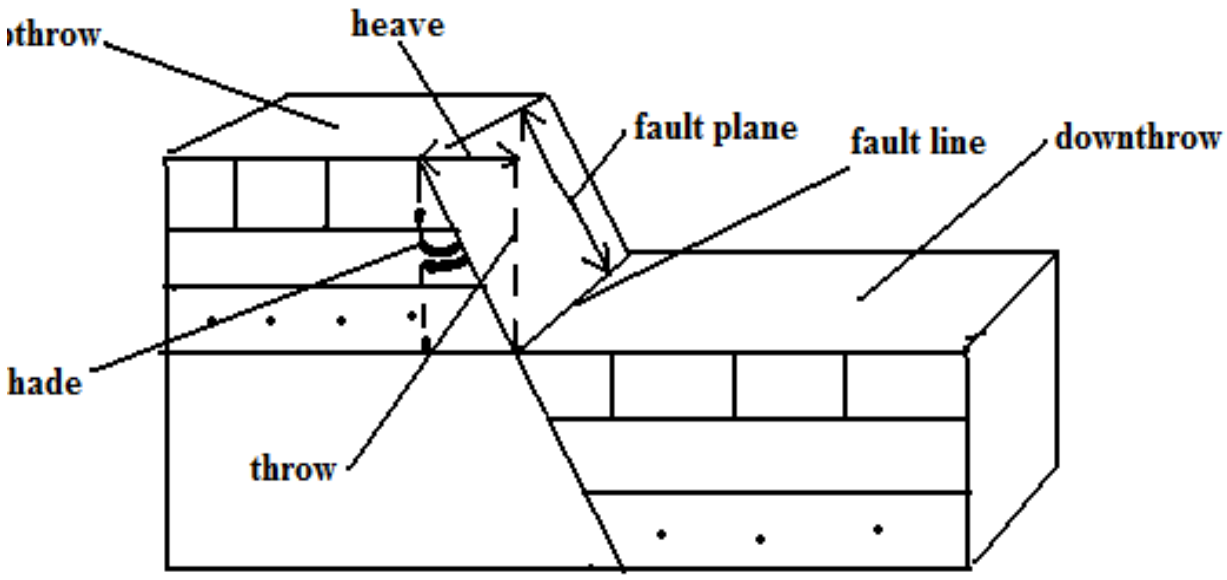
FAULTING

Faulting is the cracking/fracturing of the brittle crustal rocks due to tectonic forces.

Faults are fractures or cracks that develop in the crust.

- When tensional forces cause crustal rocks to stretch and fracture at the region of maximum tension.
- When compressional causes squeezing of crustal rocks to fracture at the areas where they are intensely squeezed.
- When vertical movements exert pressure on rocks leading to fracturing.
- When shear forces cause crustal rocks to tear.

Parts of a Fault



Learner's Short Notes

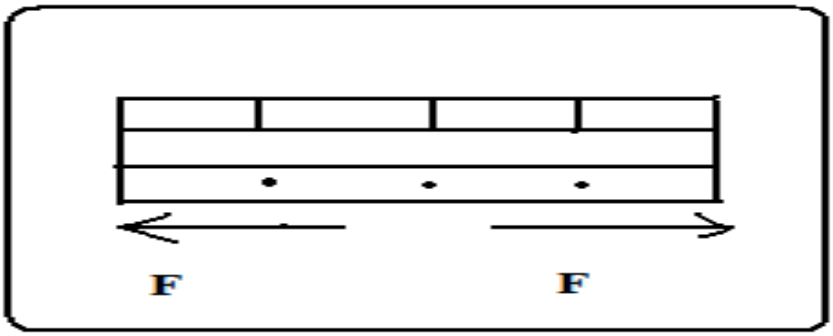
1. Upthrow-part of the land displaced upwards.
2. Down-throw-part of the land displaced downwards.
3. Throw-vertical displacement.
4. Heave-horizontal displacement
5. Hade-inclination of fault to vertical plane
6. Fault line-fault path
7. Fault plane-separation of land created by the fault

Types of Faults

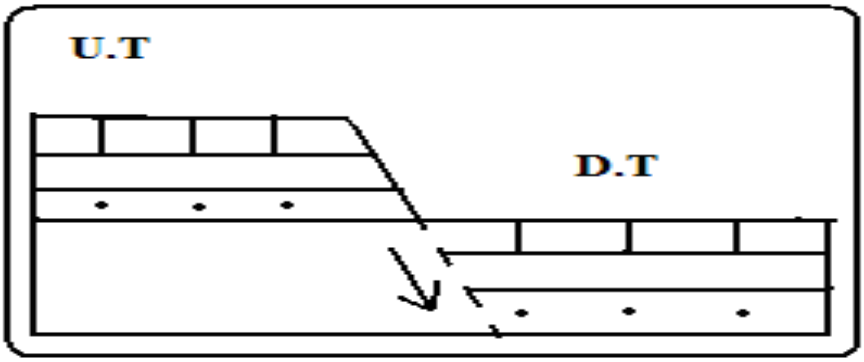
Normal Faults

Type formed by tensional forces in which one block slides downwards in relation to the other.

- Rocks are subjected to tensional forces

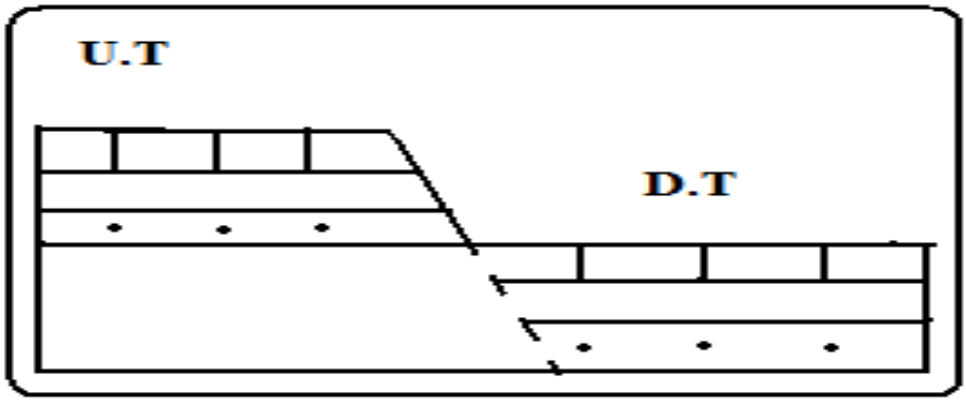


- A normal fault develops



Learner's Short Notes

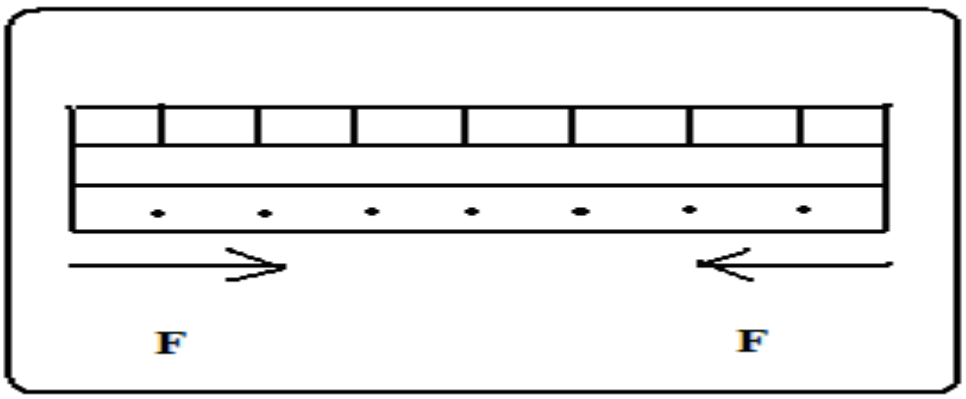
- One block slides downwards.



Reverse Fault

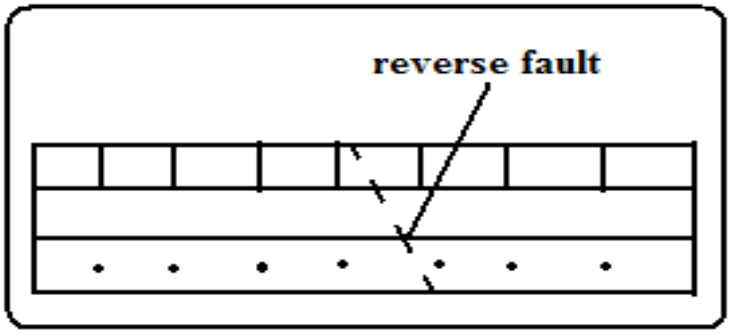
Type formed by compressional forces in which one block of land is pushed upwards in relation to the other.

- Rocks are subjected to compressional forces.

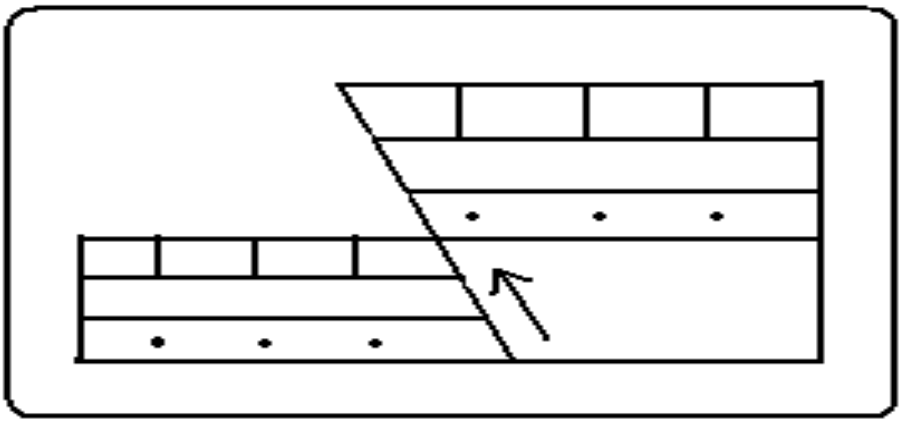


Learner's Short Notes

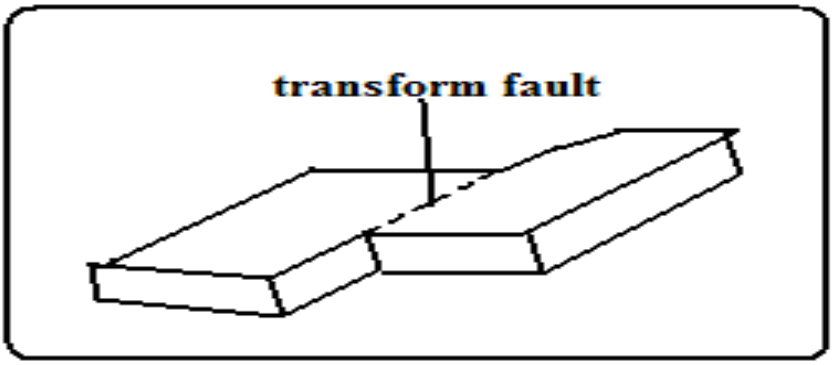
- A reverse fault develops.



- One block is pushed over the other.



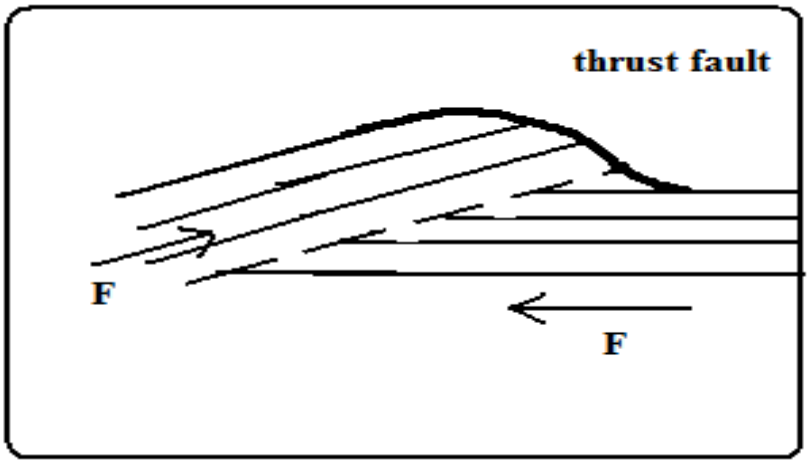
Shear/Tear Fault



Learner's Short Notes

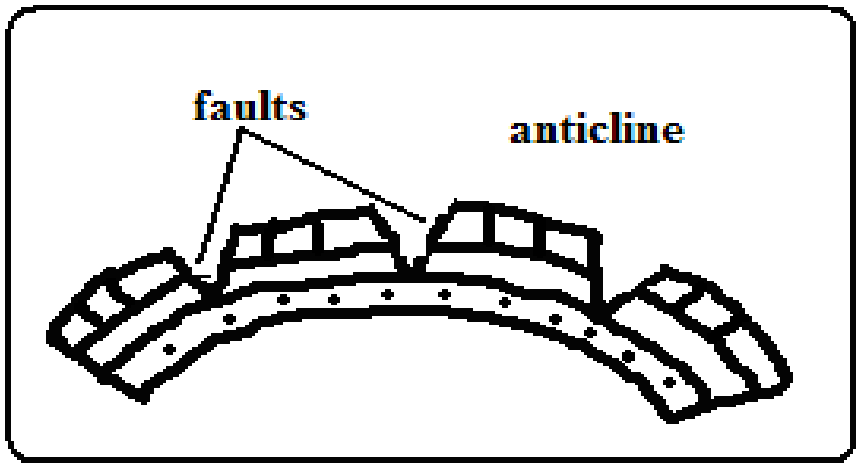
Type formed by shear forces in which adjacent blocks of land slide past one another. If a shear fault occurs between continents it's called a **Transform fault** e.g. San Andrean fault of California and great glen fault of Scotland.

Thrust Faults



Type formed when very strong compressional forces cause almost horizontal faults to develop and one block of land is pushed over the other.

Anticlinal fault

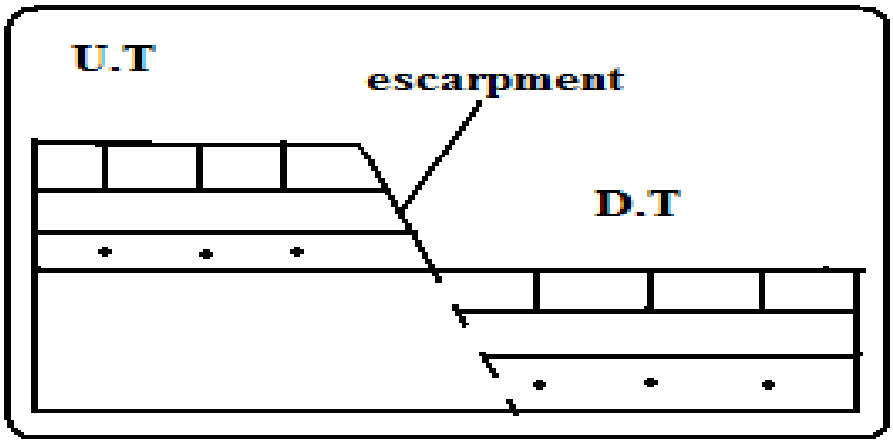


Type formed when anticlines are compressed further and cracks form on the crest.

Learner's Short Notes

Features Resulting From Faulting

i) **Fault Scarp/Escarpment**



Steep line of slopes formed by vertical movement of earth along a fault e.g. Mau, Nguruman, Nyandarua and Nandi.

-Are exposed parts of a fault plane.

It may be formed due to normal faulting or reverse faulting when overhanging blocks are eroded.

ii)**Fault Steps**

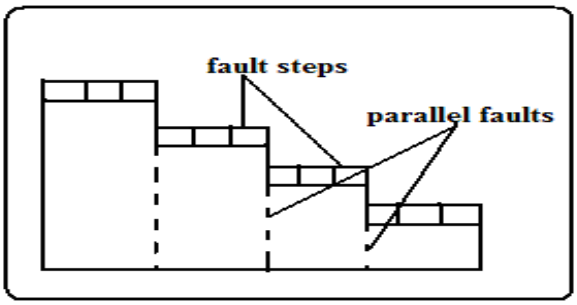
Land resembling the staircase or steps of a house with a series of fault scarps at different levels.

•Parallel vertical faults develop.

• Land between the faults is unequally displaced downwards.

• A series of fault scarps at different levels is formed.

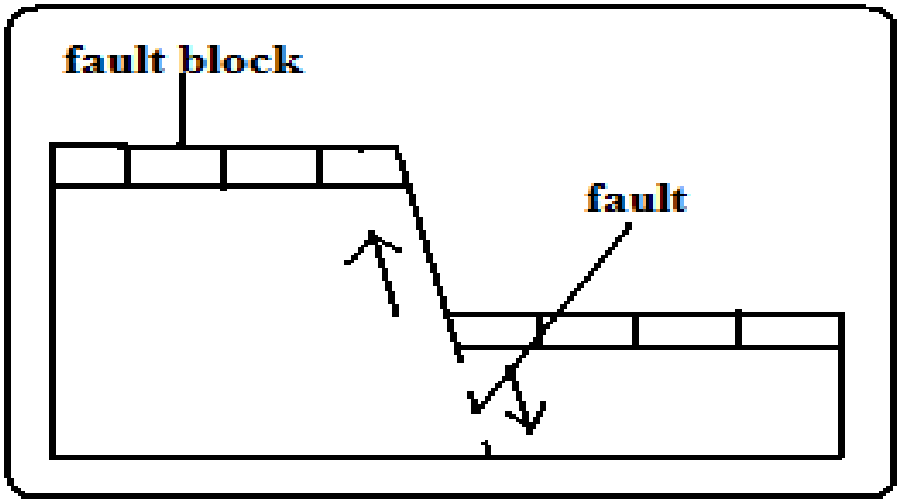
E.g. Keiyo escarpment and at Kijabe.



Learner's Short Notes

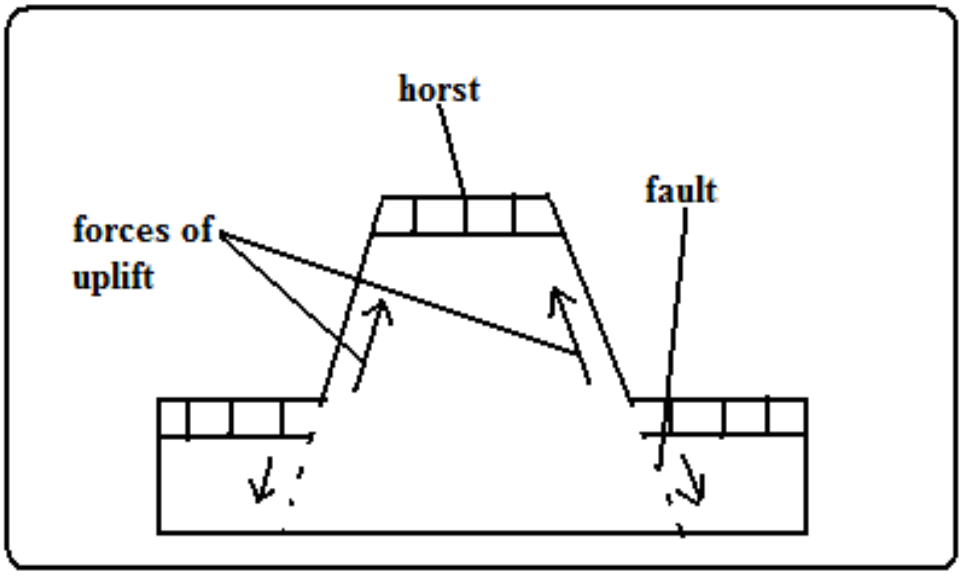
iii)**Fault Blocks/Block/Horst Mountains**

Blocks of land raised above the surrounding land.



Where tectonic forces cause faulting and land on one side of the fault get raised or sink along the fault planes.

Examples of fault blocks are Aberdare/Nyandarua ranges, Mau escarpment and Nandi Hills.



Learner's Short Notes

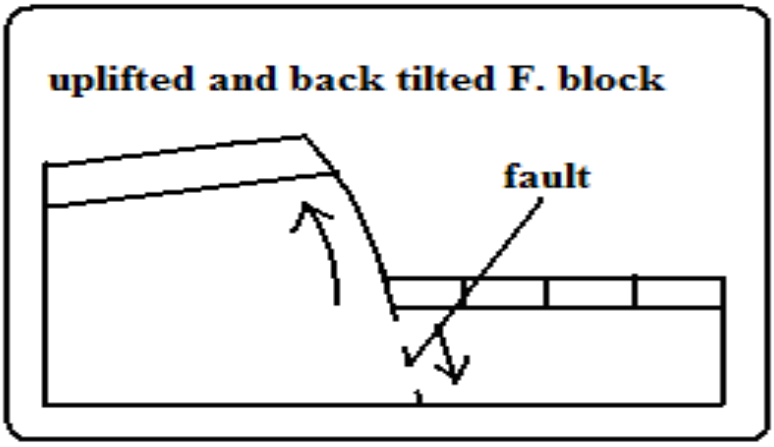
Where Blocks of land bordered by normal faults which are almost parallel to each other sink leaving the middle block standing.

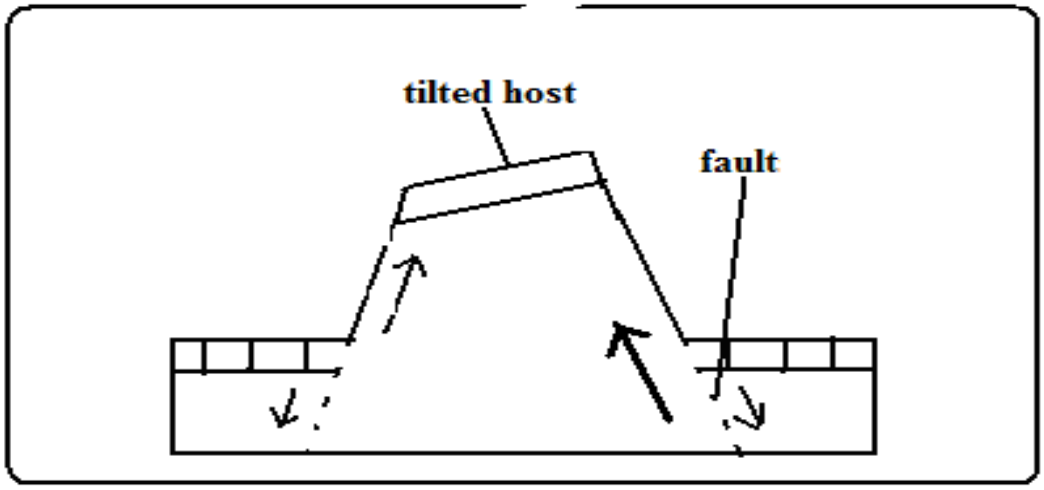
Examples of horsts are Ruwenzori of W. Uganda and Usambara and Pare mountains of Tanzania.

iv)**Tilt Blocks**

Fault blocks which are inclined on one side.

Occurs when the fault block, horst or fault steps have greater uplift on one side and as a result they are not flat at the top but tilted. The resultant features are tilted fault blocks, tilted horst and tilt fault steps which form ridges and fault guided valleys.





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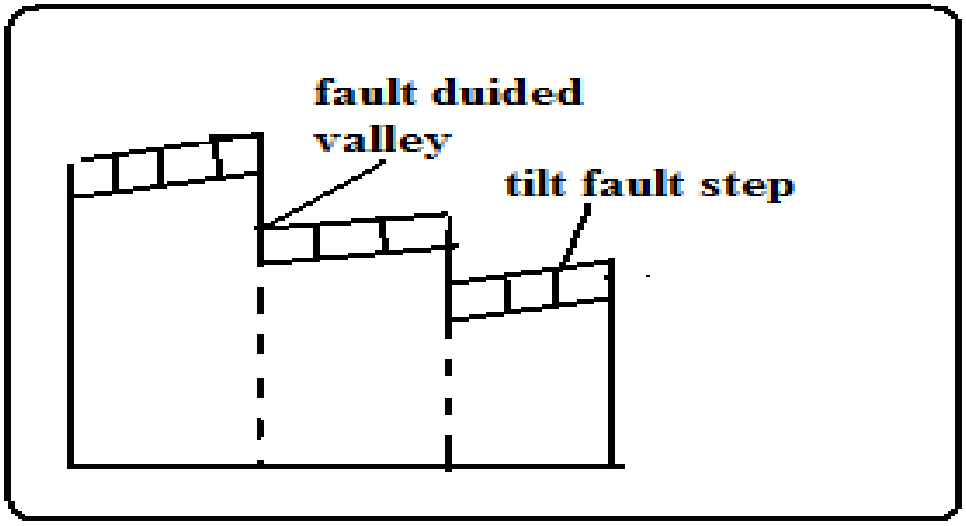


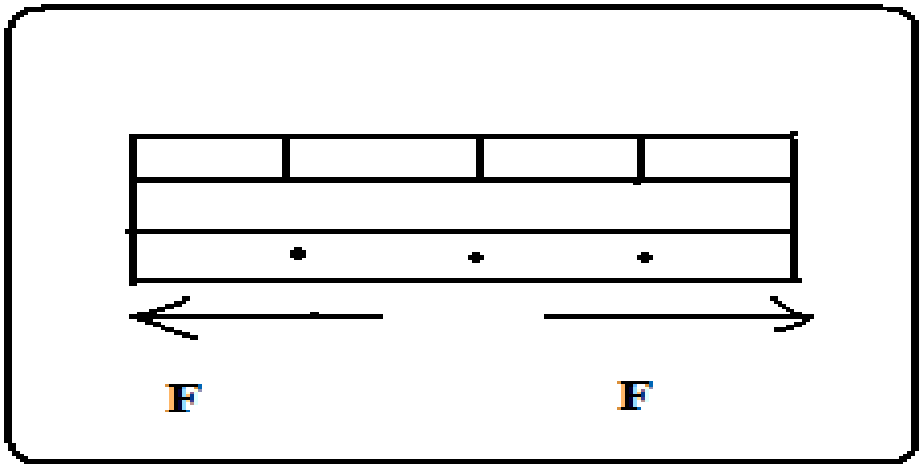
v) **Rift Valley**

Along narrow trough with steep escarpments on both sides.

Theories of Formation

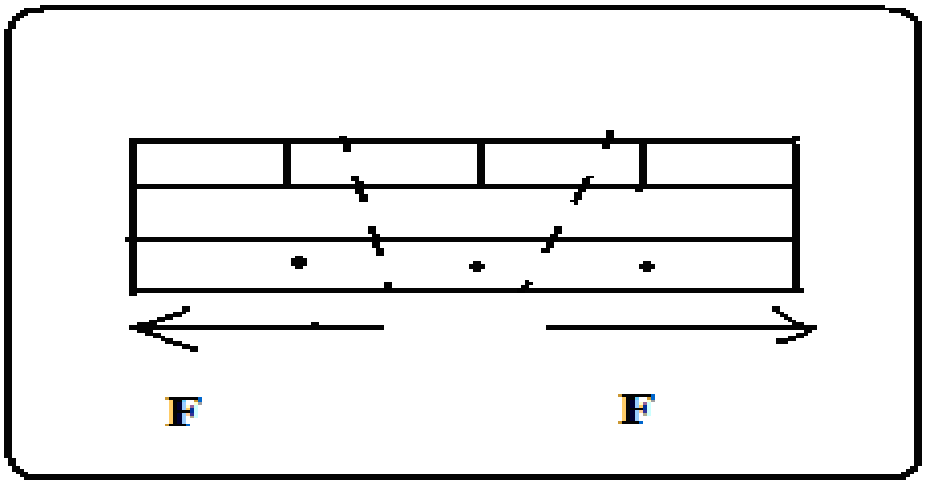
a) **Tensional Theory**

- Rocks are subjected to tensional forces.

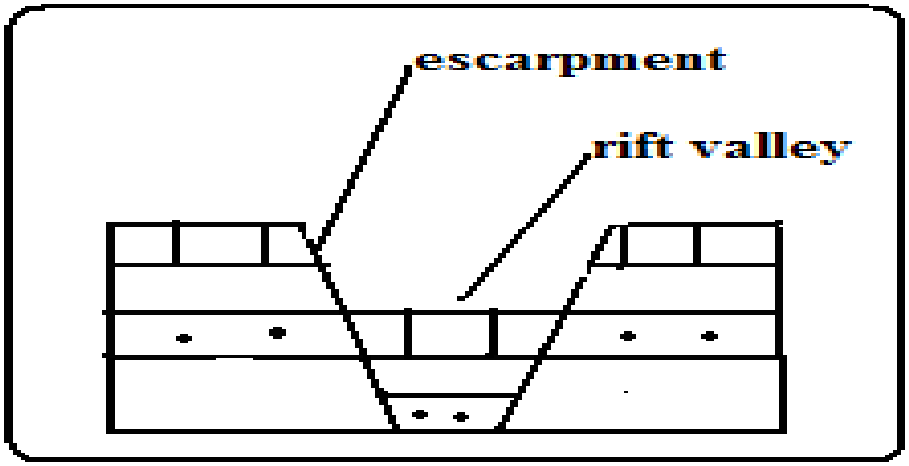


Learner's Short Notes

- Normal faults which are almost parallel develop.



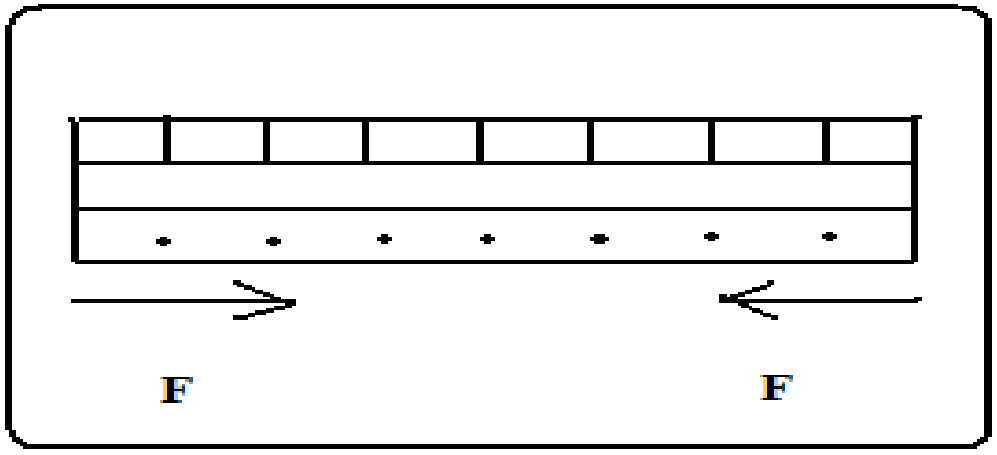
- One block slides downwards forming the rift valley.



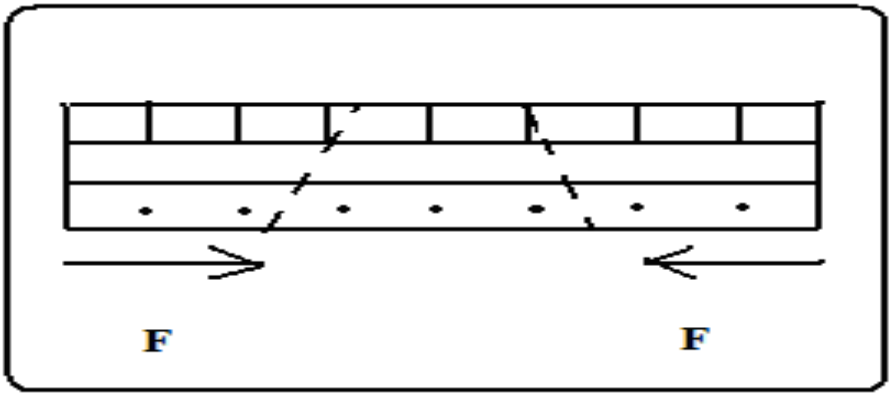
Learner's Short Notes

b) **Compressional Theory**

- Rocks are subjected to compressional forces.

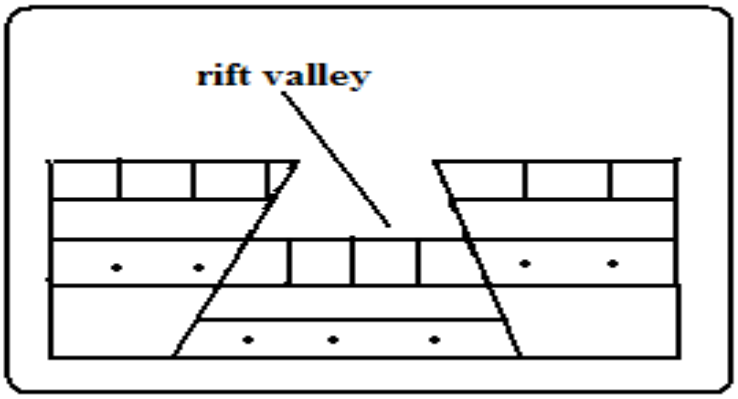


- Reverse fault which are almost parallel develop.

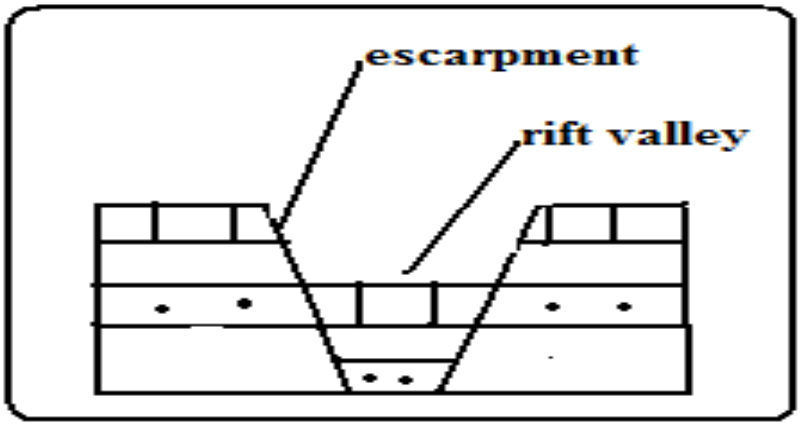


- The side blocks are pushed over the middle block.

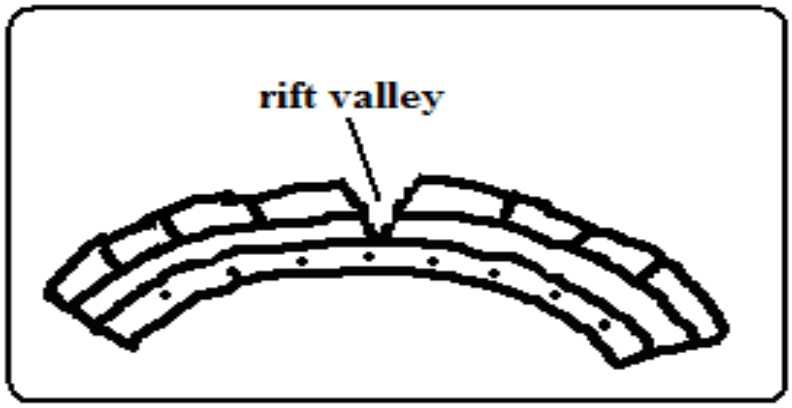
Learner's Short Notes



- Overhanging blocks are worn out by denudation to form escarpments



c) **Anticlinal Theory**



Learner's Short Notes

Suggests the rift valley was formed by Anticlinal arching.

- Upward forces pushed sedimentary rock strata upwards.
- The rock layers bent into a big arch.

- A gaping/huge crack developed at the crest of the arch due to tension forming the rift valley.

The Great Rift Valley/The Great E.A Rift Valley

The world's biggest rift valley.

It starts in Syria and ends in Mozambique.

It's divided into 4 parts.

1. Ethiopian Rift system-starts from Afar in Ethiopia to the Kenyan border around L. Stephanie.
2. Gregory Rift system-Starts from the northern border of Kenya with Ethiopia to Tanzania. It has a small N.E -S.W branches:

- Kano Rift valley in Kenya
- L. Eyasi Rift Valley in Tanzania

3. Western Rift valley-Starts at Sudan border to south of L. Rukwa. Features which are here are Ruwenzori Mountain and Lakes Albert, Edward, Kivu, Tanganyika and Rukwa.
4. Malawi Rift valley-a continuation of Gregory Rift system to Zambezi River in Mozambique. It has a small N.E-S.W branch called Luangwa valley.

Learner's Short Notes

The Gregory Rift Valley

-Named after a geologist called Gregory J.W who carried out extensive studies in this area.

It's where the Rift Valley features are more pronounced.

Features associated with it

i) Fault blocks-Aberdare range, Mau, Nandi and Cherangani hills.
ii) Step faults-Kijabe and Tambach
iii) Tilt blocks-Aberdare range uplifted and tilted eastwards and Mau escarpment uplifted and tilted westwards.
iv) Lava flows and volcanic cones e.g. Menengai and Ngorongoro crater.
v) Rift Valley lakes formed when unequal sinking created faults which were later filled with water. The lakes are deep and elongated. Examples are Lakes Naivasha, Nakuru, Elementaita, Baringo, Bogoria, Ol Bolossat and Turkana. Most of the lakes are salty with exception of L. Naivasha which has fresh water.

Why Most Rift Valley Lakes Are Salty

(a) Lack of outlets to drain away salts contained in them.
(b) Lack of enough water to dilute salinity due to little rainfall and lack of rivers flowing in them.
(c) High rates of evaporation causing increased accumulation of salts.
(d) Lake's water being in contact with rocks with mineral salts which it directly dissolves.
(e) Washing into the lake of mineral rich soils by surface runoff.

Why L. Naivasha Has Fresh Water

(a) It has underground drainage to the Indian Ocean.
(b) There is inflow of fresh water from rivers and rain.
(c) The latest volcanic eruption covered the bed rock with lava.

Major Faulted Areas of the World

(a) The Great Rift Valley from Syria to Mozambique.
(b) Northern England and the Great Glen Fault of Scotland.
(c) The Central Massif of Europe.
(d) The middle Rhine Rift Valley region.

Learner's Short Notes

Significance of Faulting

To Human Activities

1. Rift valley lakes are important for fishing, irrigation and domestic use.
2. The Rift Valley and associated features are a tourist attraction which earns foreign exchange.
3. Hot springs and geysers formed during faulting can be harnessed for geothermal power.
4. Block Mountains are water catchment areas and sources of rivers due to the heavy rainfall they receive on the windward side.
5. Faulting results in the exposure of minerals such as diatomite in Gilgil and Fluorspar in Kerio Valley.
6. Fault scarps may expose underground water resulting in the formation of scarp springs.
7. Unequal subsidence caused by faulting may cause formation of depressions which may form lakes which useful for fishing, transport and mining e.g. L. Naivasha.

Negative

1. Faulting disrupts transport and communication by disjointing land.
2. Faulting may lead to loss of life and property by causing land to sink.
3. Faulting may cause a river to disappear or change its course and flow along the fault line.
4. Steep scarp slopes formed by faulting are prone to soil erosion.
5. Faulting has given rise to semi-desert conditions in some areas when Block Mountains on the path of rain winds cause leeward sides to receive little rainfall.

Learner's Short Notes

VULCANICITY

Process in which solid, liquid or gaseous materials are forced out of the interior of the earth into the earth's crust or onto the earth's surface.

These materials are magma, lava, gases, dust, ash and cinder.

Causes of Vulcanicity

- Magma under high temperature and pressure moving through lines of weakness or faults.
- When tectonic plates move away from each other and boundaries give way to magma.
- Underground water coming into contact with hot materials hence changing into gaseous form.

There are 2 types of Vulcanicity:

Extrusive Vulcanicity (volcanic): in which materials intrude crustal rocks and don't reach the earth's surface. **Magma** is the molten material while it's underground.

Intrusive Vulcanicity (plutonic): in which materials reach the earth's surface. **Lava** is the molten material after it reaches the surface.

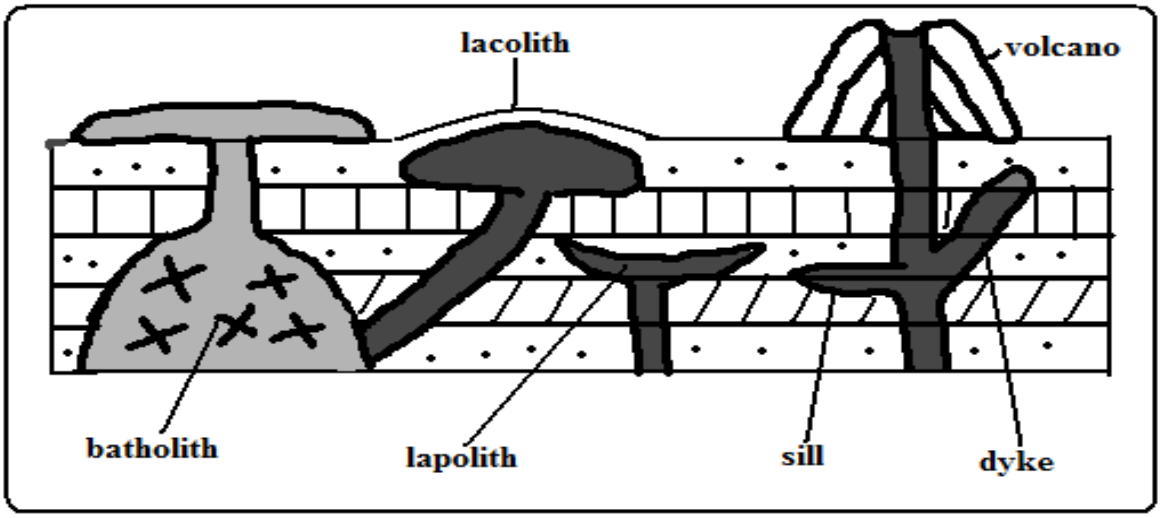
There are two types of lava and magma, acidic and basic. Acidic lava is viscous and solidifies quickly and doesn't spread far but accumulates around the vent. Basic lava is more fluid or less viscous and takes longer before cooling and spreads for great distances before doing so. Other materials emitted are **gases**, **ashes, dust and cinder.** The solid materials are called **pyroclasts**. Materials come out through a **hole/vent (vent eruption)** or **crack/fissure (fissure eruption)**.

Learner's Short Notes

Features Resulting From Vulcanicity

Divided into intrusive and extrusive features or landforms.

1. Intrusive/Plutonic Features



Features formed by intrusive Vulcanicity when materials intrude the earth's crust.

Sill

An igneous intrusion which lies along a bending plane of rock strata.

Formed when magma forces its way between rock layers then cools and solidifies.

It forms ridge like escarpments when exposed by erosion e.g. Fouta Djalon highland of Guinea and 3 sisters of S. Africa.

Dyke

Wall-like igneous intrusion which lies across the bedding plane of rock strata.
Formed when magma intrudes cracks or faults cutting across bedding planes of rocks then cools and solidifies.
Can be vertical or inclined.
When exposed it forms ridges e.g. Kaap Valley in Transvaal S. Africa and Jos Plateau in Nigeria.

Learner's Short Notes

Laccolith

A mushroom-shaped igneous intrusion lying between bending planes of a country rock.

Formed when viscous magma pushes its way through a vent and accumulates around the vent before reaching the earth's surface pushing the overlying rock into a dome shape.

Its so high that land is turned into mountains e.g. El Koub Hill in Algeria, Henry Mountains in Utah U.S.A and Fonjay Massif in Madagascar.

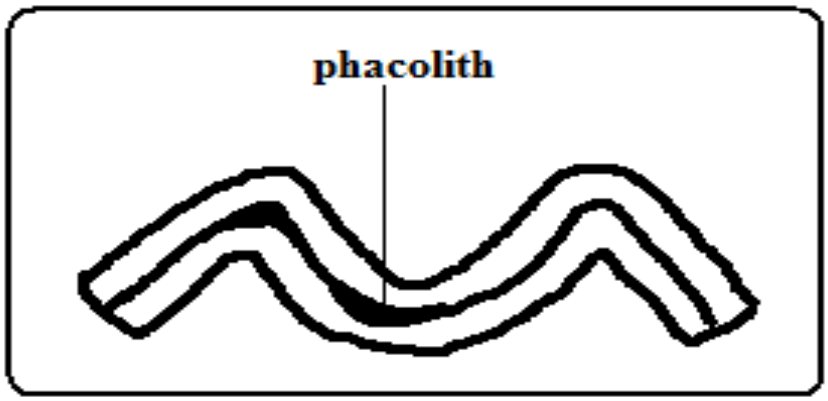
Batholiths

Largest igneous intrusion formed underground formed when very hot magma intrudes bedding planes of rocks and replaces or metamorphoses it e.g. Chaila Massif in Gabon, Ikhonga-Murwe in Kakamega and the largest is in British Columbia.

Lopolith

A large saucer shaped igneous intrusion formed when viscous magma intrudes into bedding planes of a country rock. They form shallow depressions on the earths surface of the earth e.g. Bushveld complex in S. Africa and Duluth Gabbro mass in U.S.A.

Phacolith



Lens shaped igneous intrusion which forms in the crest or trough of an anticline e.g. Corndon Hill in England.

Learner's Short Notes

2. Extrusive/Volcanic Features

Formed when magma reaches the earth's surface through vents or fissures.

Volcanoes

A volcano is a cone shaped hill formed when volcanic materials flow out and accumulate around a vent. Volcanoes are classified into three groups:

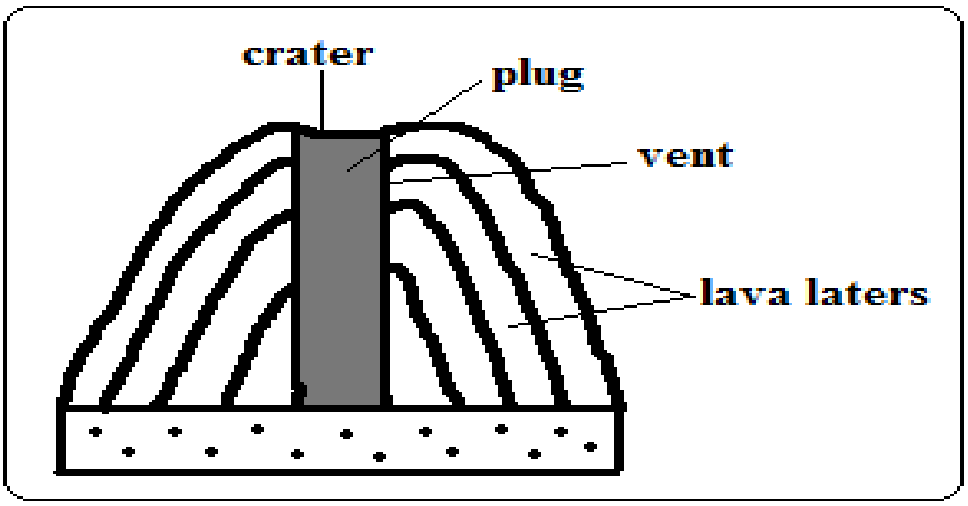
i) Active volcano- which is known to have erupted in recent times e.g. OL donyo Lengai in Tanzania and Mt. Cameroon, and Mauna Loa in Hawaii.

ii) .Dormant volcano-not known to have erupted in the recent past but show signs of volcanic activity such as presence of hot springs, geysers and fumaroles e.g. Mt. Kilimanjaro, Longonot and Menengai.

iii) Extinct volcano-which has not shown signs of possible future eruptions e.g. Mountains Kenya and Elgon.

Types of Volcanoes

a) **Acidic Lava Domes**



Learner's Short Notes

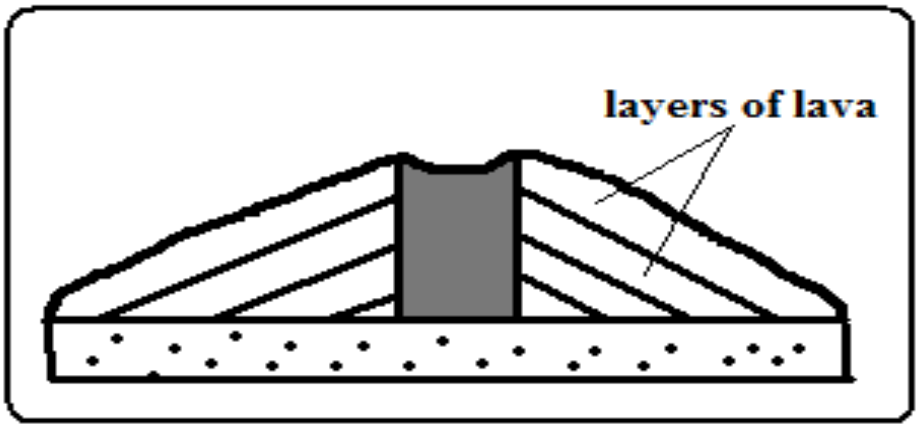
A steep dome shaped volcanic hill made of acidic lava.

⇒ Viscous lava flows out through a vent.
⇒ It accumulates around the vent because it's viscous.
⇒ Eruptions occur later and lava flows out covering the layers below.
⇒ A steep sided dome shaped mound of volcano is formed e.g. Itasy Massif of Madagascar, Mt. Kenya and Kilimanjaro.

Characteristics

(a) Its dome-shaped
(b) Has steep slopes
(c) Made of acidic lava
(d) Has lava layers
(e) Has steep slopes
(f) Has a narrow base

b) Basic Lava Domes/Shield Volcanoes



A low lying volcanic hill made of basic lava.

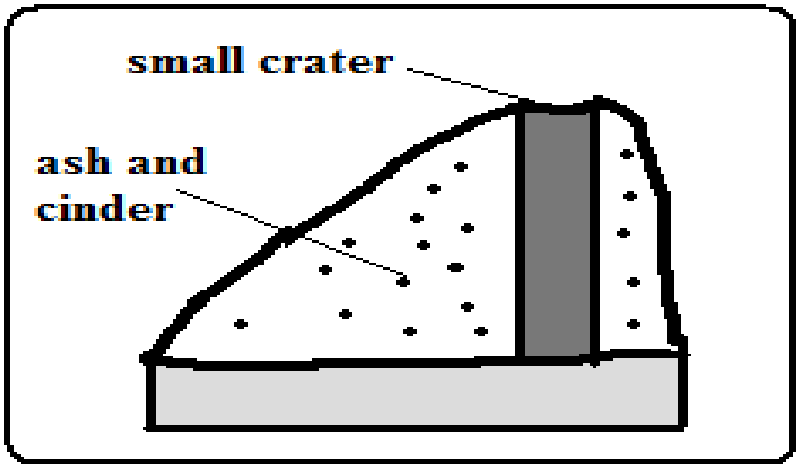
- Basic magma flows out to the surface through a vent.
- The lava flows far before solidifying because its fluid.
- Eruptions occur later and lava spreads over the old lava.
- A shield shaped mound of volcano is formed e.g. Canary Islands, Cape Verde and Sao Tome which are volcanic Islands in the Indian Ocean.

Learner's Short Notes

Characteristics

(a) Dome/shield shaped
(b) Has gentle slopes
(c) Made of basic lava
(d) Has lava layers
(e) Has a broad base

c) Ash and Cinder Cones



A volcano built from ash and cinder or small fragments of lava.

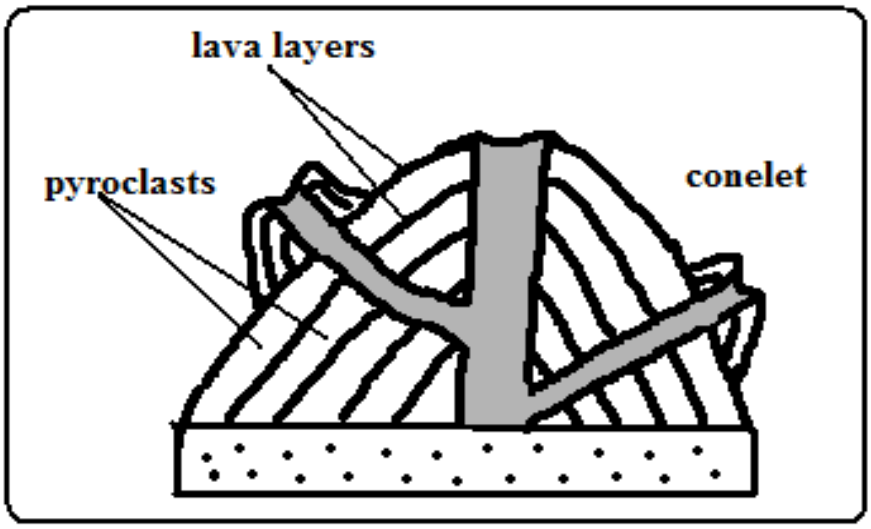
- Violent vent eruption occurs.
- Ash and pyroclasts are emitted and thrown high.
- Some materials fall and settle around the vent forming a hill.
- Light materials are blown by wind to the leeward side e.g. Chyulu Hills, Teleki and Likaiyu near L. Turkana.

Characteristics

(a) Made of pyroclasts
(b) Asymmetrical about the axis
(c) Cone shaped
(d) Has smooth slopes
(e) Has steep windward slope and gentle leeward slope

Learner's Short Notes

d) **Composite /Complex/Stratified Volcanoes**



A volcano made of alternating layers of lava and pyroclasts and conelets.

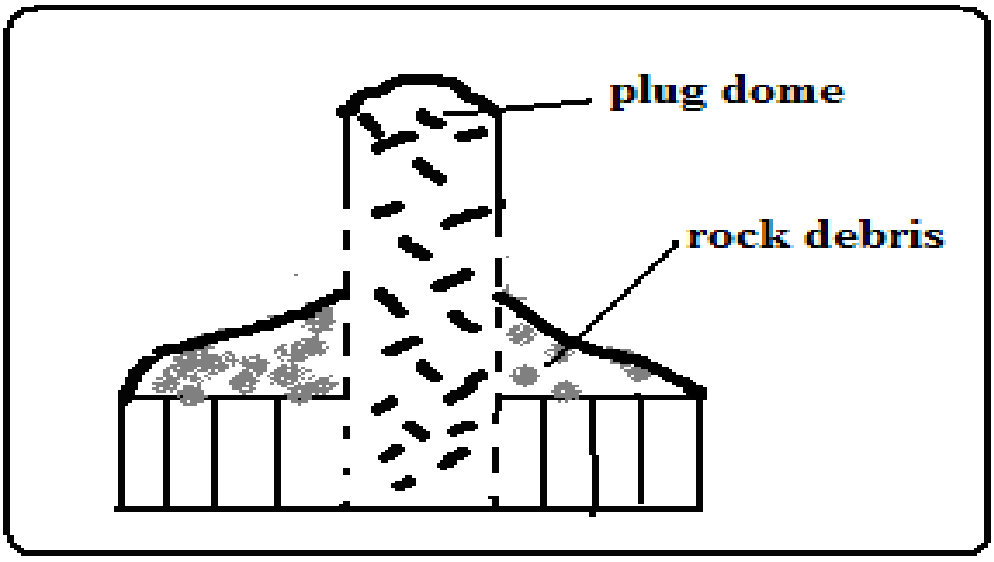
- The first eruption throws out pyroclasts.
- Then viscous lava flows out and solidifies on them.
- Eruption occurs later blowing the rocks sealing the vent.
- The pieces of rock settle on earlier solidified lava.
- Another mass of lava flows out and spreads over pyroclasts and solidifies.
- The process is repeated causing the volcano to build upwards
- The conelets are formed when magma is unable to overcome the plug and finds its way through weak lines at the sides and then pyroclasts and lava accumulate around the side vent e.g. Mountains Kenya, Longonot, Elgon and Kilimanjaro.

Characteristics

(a) Cone shaped
(b) Stratified (made of alternating layers of lava and pyroclasts.
(c) It has conelets (parasitic cones).
(d) It has steep slopes.
(e) Made of acidic lava

Learner's Short Notes

e) **Plug Dome/volcano/Spine**



A column of very viscous lava which sticks above the ground.

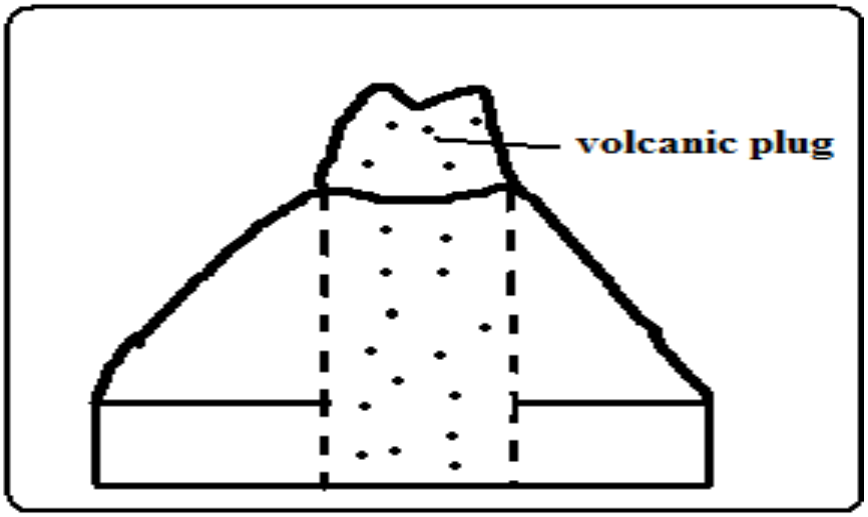
- A column of very viscous magma flows out of the ground.
- It cools and hardens rapidly as it rises vertically.
- Pieces of rock break from the plug and accumulate on the sides e.g. Mont Pelee in West Indies, Hyrax and Fischer's Tower at Hells gate in Naivasha and Devils Tower in U.S.A.

Characteristics

i) Made of very viscous lava.
ii) It is dome shaped like a mushroom germinating out of the ground.
iii) Has debris on its sides.
iv) Has very steep sides
v) Cylindrical in shape
vi) Disintegrates fast due to rocks undergoing rapid cooling

Learner's Short Notes

f) **Volcanic Plug**



Stump of rock formed when magma which solidified inside a vent (plug) is exposed by denudation.

⇒ A volcano is first formed.

⇒ Lava on the sides of the volcano is eroded fast due to cooling fast.

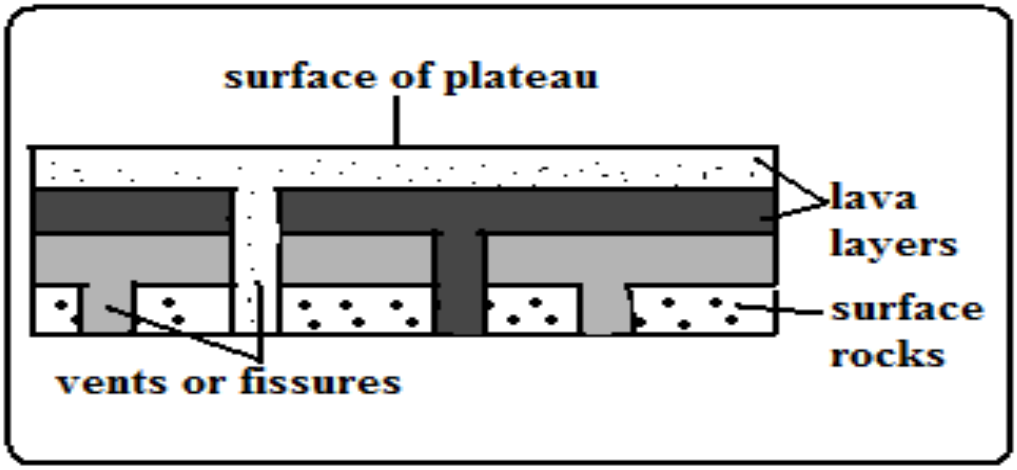
⇒ The lava in the vent which is hard due to slow cooling is exposed forming a stump of rock e.g. Peaks of Mt. Kenya, Rangwa Hill and Tororo Rock.

Characteristics

(a) It resembles a stump of a tree.
(b) Its dome shaped.
(c) Very steep at the top and less steep at the bottom
(d) Made of hard/resistant rock

Learner's Short Notes

g) **Lava Plains and Plateaus**



Lava plain: fairly level lowland below 500m above sea level covered by thin lava layers.

Lava plateau: fairly level highland/upland above 500m above sea level covered by thick layers.

Formed by fissure eruption.

- Magma of low viscosity comes out of the ground through a fissure.
- It flows for a long distance before cooling and solidifying filling depressions and valleys forming a plain.
- Eruption occurs later and lava flows out through lines of weakness on crustal rock and solidified lava.
- The new lava spreads on top of the old lava forming a new layer.
- The process is repeated and a plateau is formed e.g. Mwea, Nandi and Laikipia Plains and Yatta and Uasin Gishu Plateaus.

Learner's Short Notes

h) **Craters**

A funnel shaped depression found on top of a volcano.

Modes of Formation

(i)**Cooling and Contraction of Magma**

- Eruption occurs and a volcano is formed.
- Magma in the vent cools and contracts.
- It withdraws into the vent leaving a depression at the vents mouth e.g. Ngorongoro and Menengai craters.
- Rain water or water from melting snow may collect into craters to form crater lakes e.g. L. Paradise on Mt. Marsabit, L. Magadi on Ngorongoro Crater and L. Chala on Kenyan Tanzanian border.

(ii)**Explosion**

- Gases underground expand due to heat from magma.
- They force their way out through a weak line in the crustal rocks.
- An explosion occurs leaving a hole in the ground called a **ring crater** e.g. Ghama and Dobot craters in Tanzania and Hora craters in Ethiopia.
- Water from underground or rivers may accumulate into ring craters to form lakes called **maars** e.g. Lakes Katwe and Nyungu in Uganda.

(iii)**Falling of a Meteorite**

- A meteorite falls on the earth's surface.
- It sinks into the rocks leaving a depression.
- Water may collect into the depression forming a lake e.g. L. Bosumtwi in Ghana.

(iv)**Calderas/Basal Wreck**

A very large basin-shaped depression on the summit of a volcano.

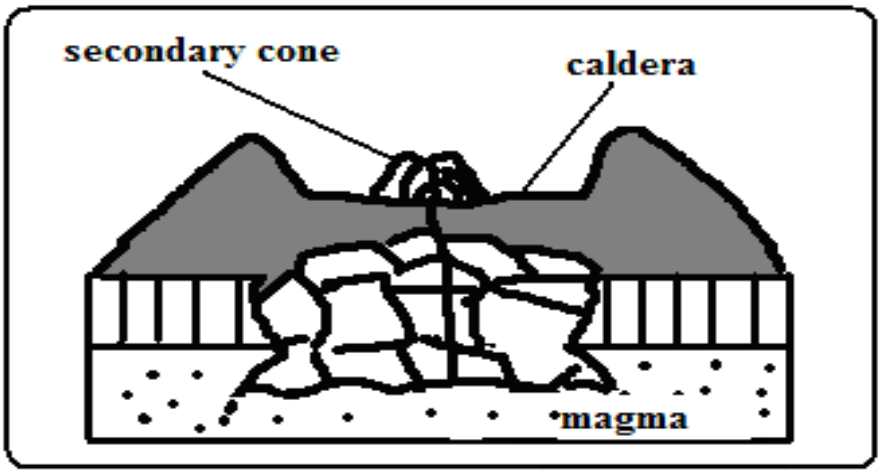
Learner's Short Notes

Modes of Formation

a) **Violent Explosion**

- Gases and water heated by magma expand.
- They force their way through a vent.
- The rocks at the top of the volcano are blown off forming a large depression e.g. Nyirarongo Caldera in DRC and Sabiro Caldera in Uganda.

b) **Block Subsidence/Cauldron**



- Eruption occurs to form a volcano.
- An empty space (cauldron) is left in the magma reservoir in the mantle.
- The rocks forming the middle of volcano are pulled inwards by gravity.
- The middle of the volcano collapses forming a large depression at the top e.g. Menengai Caldera near Nakuru and Ngorongoro caldera which is the largest in E. Africa and 6th largest in the world.
- Water from rain or underground may fill calderas to form lakes e.g. L. Magadi in the Ngorongoro caldera and L. Ngozi in Tanzania.

c) **Outward Collapsing**

- Ash and pyroclasts volcano grows high.
- Materials on top exert pressure on those below.
- Materials at the base begin to spread outwards.
- The top of volcano collapses inwards forming a collapse caldera e.g. Napak Caldera in Uganda.

Learner's Short Notes

A vent in a volcano which emits gases.

d) Fumaroles

The gases come from chemical reactions in crustal rocks when heated by magma or when minerals in rocks come into contact with hot air and steam underground.

They are of two types:

Mofette: fumarole which emits carbon dioxide.

Solfatara: fumarole which emits gases with sulphurous compounds.

e) Hot Springs and Geysers

Hot spring is a place where hot water is emitted from the ground quietly e.g. at the shores of Lakes Magadi and Bogoria.

A geyser is a jet of water and steam which are violently ejected from the ground e.g. at Olkaria and western shores of L. Bogoria.

How They Are Formed

Percolating water is heated by hot rocks or magma.

- Some collect into chambers called sumps where it develops pressure causing it to be superheated super heated.
- The pressure forces the steam outwards towards the earths surface through holes and cracks in rocks.
- The steam comes out of the ground which reduces pressure in sumps causing the water to expand/boil and come to the surface.
- The steam comes out with a whistling sound accompanied by water forming a geyser.
- The escaping steam heats ground water in surrounding rock.
- The heated water may find its way to the surface where it quietly comes out of the ground forming a hot spring.

Learner's Short Notes

Differences

Hot spring	Geyser
-Water comes out quietly. -only water comes out. -water may just be warm.	-Water and steam come out violently. -water is accompanied by steam. -water is very hot.

Pools of Boiling Water

Small area of still water which appears to be boiling.

- Actual heating of pool water by gases and steam causing the water to boil.
- Gases and steam coming out below the pool of water causing the pool to bubble and appear as if it's boiling.

World Distribution of Volcanoes

(a) Regions of faulting e.g. the Great Rift Valley of E. Africa.
(b) Mid-Atlantic ocean ridge.
(c) The western coast of America.
(d) Zones of recent mountain building e.g. fold mountains of S.E Asia.

Learner's Short Notes

Significance of Volcanicity

Positive

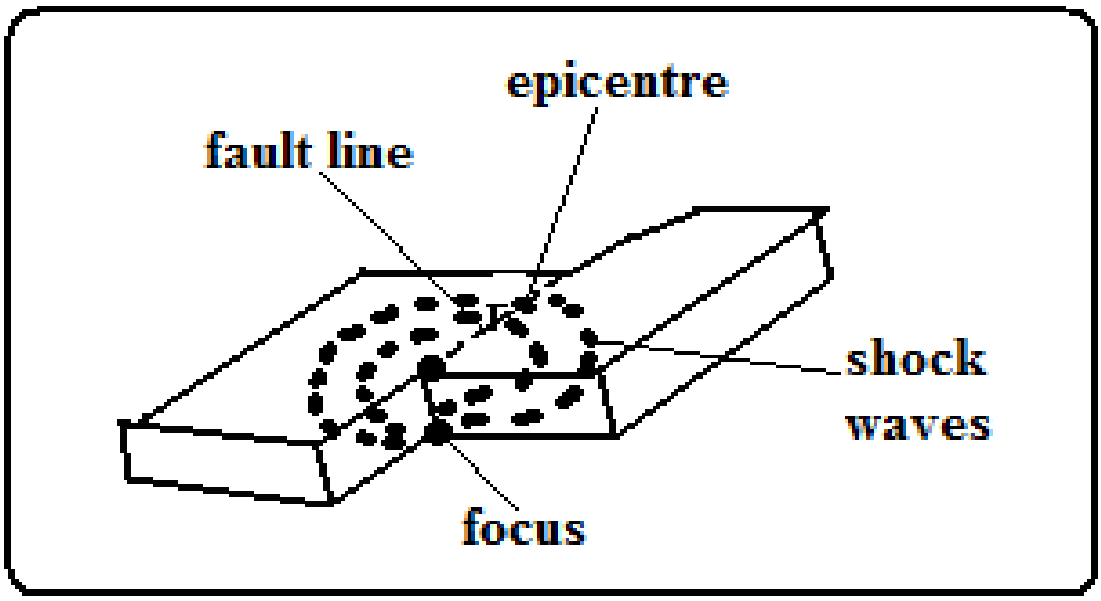
1. Volcanic rocks weather to form fertile agriculturally productive soils e.g. basalt.
2. Geysers are sources of geothermal electricity e.g. at Olkaria.
3. Hot springs water is pumped into houses for heating during winter e.g. Iceland.
4. Volcanic features are a tourist attraction e.g. hot springs, geysers and snow capped Mt. Kenya.
5. Igneous rocks e.g. phonolites are crushed to make ballast for building roads, bridges, etc.
6. Crater lakes are a source of fish e.g. L. Katwe in Uganda, sources of minerals e.g. L. Magadi and sources of water for domestic use.
7. Volcanic mountains are catchment areas, sources of rivers and habitats for wildlife.
8. Pumice a volcanic rock is used as a scrubbing stone.
9. Vulcanicity is useful for production of gases e.g. carbon dioxide used in soft drinks manufacture.

Negative

1. Volcanic eruptions cause of life and destruction of property e.g. sulphur dioxide, ash, cinder and lava may bury houses and farm land.
2. Volcanic mountains are barrier to transport and communication.
3. Volcanic mountains on the path of rain winds cause leeward slopes to receive little rainfall by preventing rain bearing winds from reaching there.
4. Volcanic eruptions cause environmental pollution from dust, ash and sulphur dioxide.

Learner's Short Notes

EARTH QUAKES



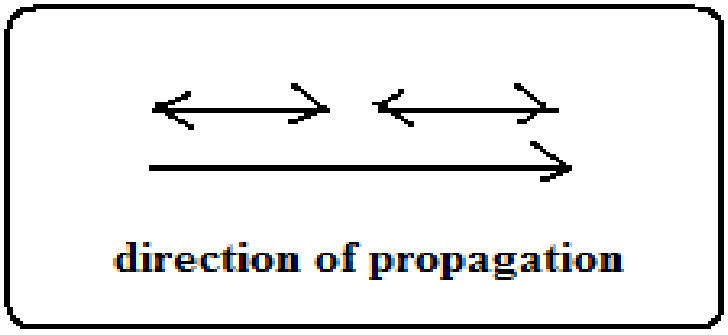
Sudden and rapid movement of the earths crust.

Areas prone to them are called **seismic zones** and those not prone are called **aseismic zones**.

It's caused by shock waves.

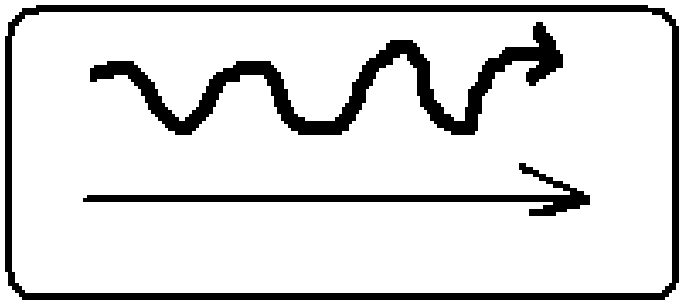
There are 3 types of earthquake waves namely:

1. Primary waves-which travel fastest and cause the rock particles to vibrate in a push and pull manner and can pass through gases, liquids and solids.



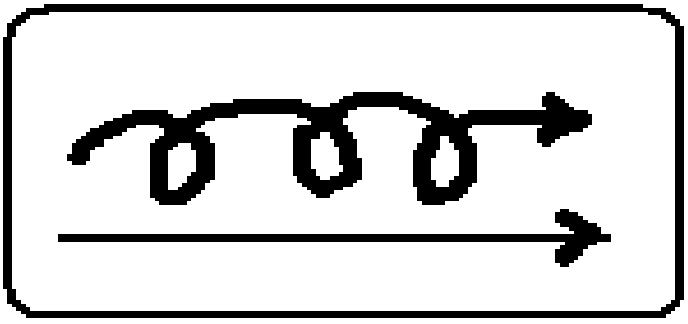
Learner's Short Notes

2. Secondary waves-which cause rock particles to vibrate at right angles to the direction of wave movement.

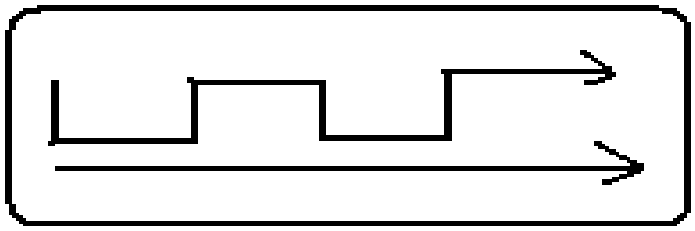


3. Surface longitudinal waves-which cause surface rocks to shake sometimes causing buildings to collapse.

i. Rayleigh waves-Which cause surface rocks to move in elliptical orbits.



ii. Love waves-which cause rock particles to move in a horizontal manner at right angle to the direction of wave.



Learner's Short Notes

Earth quake originates from a point known as **seismic focus/origin**.

The part of the earth vertically above the seismic focus and where the shock waves are first experienced is called **epicentre**.

Causes of Earthquakes

Natural Causes

(i) Tectonic movements e.g. movement of tectonic plates. They cause tectonic earthquakes.
(ii) Vulcanicity when magma movement displaces rocks suddenly shaking and shuttering them.
(iii) Gravitative force when crustal rocks collapse into cauldron due to gravity.
(iv) Energy release in the mantle when radioactivity takes place in mantle releasing explosive energy which sends shock waves outwards.
(v) Isostatic adjustment when the continental masses rise to restore the upset state of balance between sial and sima layers.

Human Causes

(i) Exploding nuclear bombs underground which causes shock waves which spread outwards and are felt in the neighborhood.
(ii) When a train rolls on its rails causing the ground to vibrate.
(iii) Explosion of explosives used in mining and quarrying which cause vibrations to be felt in the neighborhood.
(iv) When large reservoirs are constructed and the heavy weight of water reactivate dormant faults causing tremors.

Measurement of Earthquakes

Seismograph is a pendulum based instrument used to measure earthquakes.

It records seismic impulses on a graph-like record called seismogram mounted on it.

Earthquakes are measured by their intensity and magnitude.

Learner's Short Notes

Intensity

-Measure of how strong/hard the quake shakes the ground.

It's seen from the effects the earthquake has on people, buildings and other structures.

It's measured on the **Mercalli Scale** which uses a scale running from Roman i-xiii e.g.

i) I- description -imperceptible
ii) V-rather strong-sleepers are awakened and there is swinging of objects.
iii) VIII-destructive-gaping cracks in walls some brought down.
iv) XII- major catastrophe-every building destroyed.

Magnitude

Measure of amount of energy given off by an earthquake.

It's measured on Richter Scale which ranges from 0-8.9.

Intensity values depend on how far a place is from epicenter.

The higher the scale the more severe the earthquake is.

i) Intensity I-magnitude 2
ii) Intensity VIII-magnitude 6
iii) Intensity XII-magnitude 8.5.

Learner's Short Notes

World Distribution of Earthquakes

- Within the zones of major faulting e.g. Rift Valley.
- In areas of Vulcanicity e.g. Oldonyo Lengai in Tanzania.
- Along boundaries of tectonic plates e.g. Japan, Philippines, East Indies and west coast of north and South America.

Effects of Earthquakes

a. Can cause loss of life and property when buildings collapse burying people.
b. Disrupt transport and communication by vertically and laterally displacing land which disconnects pipelines, electricity lines, roads and railways.
c. Causes landslides which also cause loss of life and property and disrupts communication.
d. Causes raising and lowering of the sea floor and the coastal regions.
e. Cause huge sea waves called Tsunami which may flood the neighbouring coastal areas.
f. Trigger folding, Vulcanicity and fires.
g. Give off a lot of explosive energy more than an atomic bomb.
h. Cause fear and panic.
i. Hinder settlement as it is restricted to aseismic areas.
j. Cause violent motions of the earth's surface.

Learner's Short Notes

PAST KCSE REVISION QUESTIONS

INTERNAL LAND FORMING PROCESSES – EARTH MOVEMENTS.

1. (a) Name the two types of earth movements that occur within the earth's crust (2mks)

(b) Describe the origin of the continents according to the Theory of continental Drift (3mks)

2. Explain what you understand by each of the following:

(i) Earth movements.

(ii) Internal land forming processes.

(iii) External land forming processes. (6mks)

3. Explain four evidences put forward to proof continental drift theory. (8mks)

INTERNAL LAND FORMING PROCESS – FOLDING

1. (a) In your answer booklet, draw a diagram to show a simple fold and on it mark and name,

(i) An anticline. 1 mrk

(ii) A limb. 1 mrk

(iii) A syncline 1 mrk

(b) Name two fold mountains in Africa. 2 mrks

2. (a) Name one fold mountain in;

(i) Asia

(ii) North America

(iii) South America

(b) (i) Apart from Fold Mountains, name three other features resulting

from folding.

(ii) With the aid of a labelled diagram, describe the formation of an overthrust fold.

(c) Explain four effects of Fold Mountains on human activities.

(d) (i) How would students in your school prepare themselves for study of landforms in your district,

(ii) State two advantages of studying landforms through field work.

3. Define orogenesis. 2 mks

4. What is folding? 2 mks

6. Differentiate between limb and axis in relation to folding. 4 mks

7. Differentiate between foreland and back land. 4 mks

8. Fill in the table provided details on age, period and features formed in each named orogenies. (6MRKS)

Orogeny	Years (age)	Period	Mountains/features built
Charnian	1	Pre-cambrian period	2
Caledonian	Old 440 million years ago		Akwapim Hills of Ghana - Scottish highlands
Hercynian	3	Upper Carbon ferrous period	- Cape ranges -Appalachian mountains - Ural mountains
Alpine	Youngest 70 million years ago		4

9. Explain formation of Fold Mountains by contraction theory.

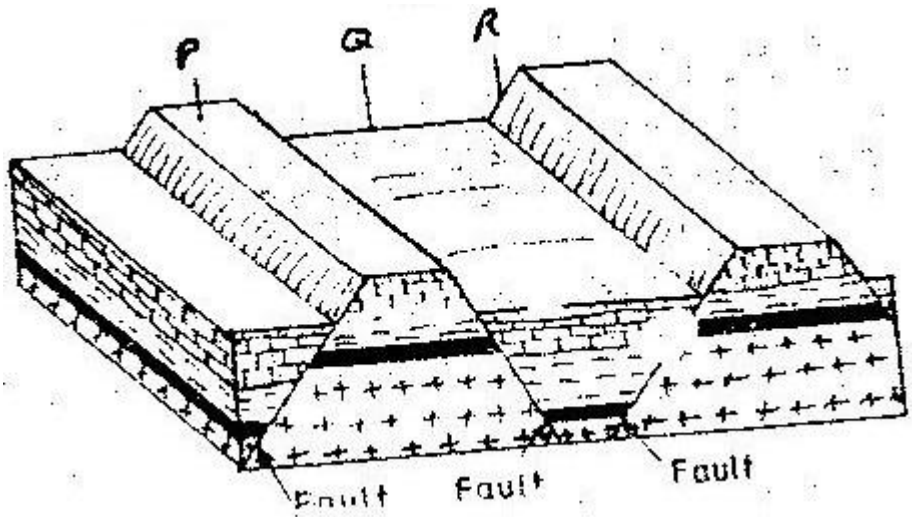
INTERNAL LAND FORMING PROCESSES – FAULTING

1. a) A part from the Rift Valley name two other relief features that were formed as result of faulting. (2mks)

b) With the aid of a well labeled diagram, describe how a Rift Valley is formed by tensional forces. (8mks)

2. The diagram below represents features produced by faulting.

Use it to answer questions that follow.



a) Name the features marked P, Q, and R

b) Differentiate between a normal faulty and a reverse fault.

3. State ways in which faulting influences drainage. (3mks)

4. Name two examples of Horst Mountains in East Africa. (2mks)

5. Explain two ways in which features resulting from faulting are of economic importance (4mks)

6. (a)

(i) With aid of diagrams outline formation of rift valley by tension theory. (5mks)

(b) Students are planning to carry out field study of an area affected by faulting.

(i) State four importance of having a pre-visit of the area.

(ii) Give three disadvantages of using observation to study such an area.

7. Name three types of fault. (3mks)

8. Explain how compressional forces lead to formation of rift valley. (5mks)

9. Give two of escarpments in East Africa. (2mks)

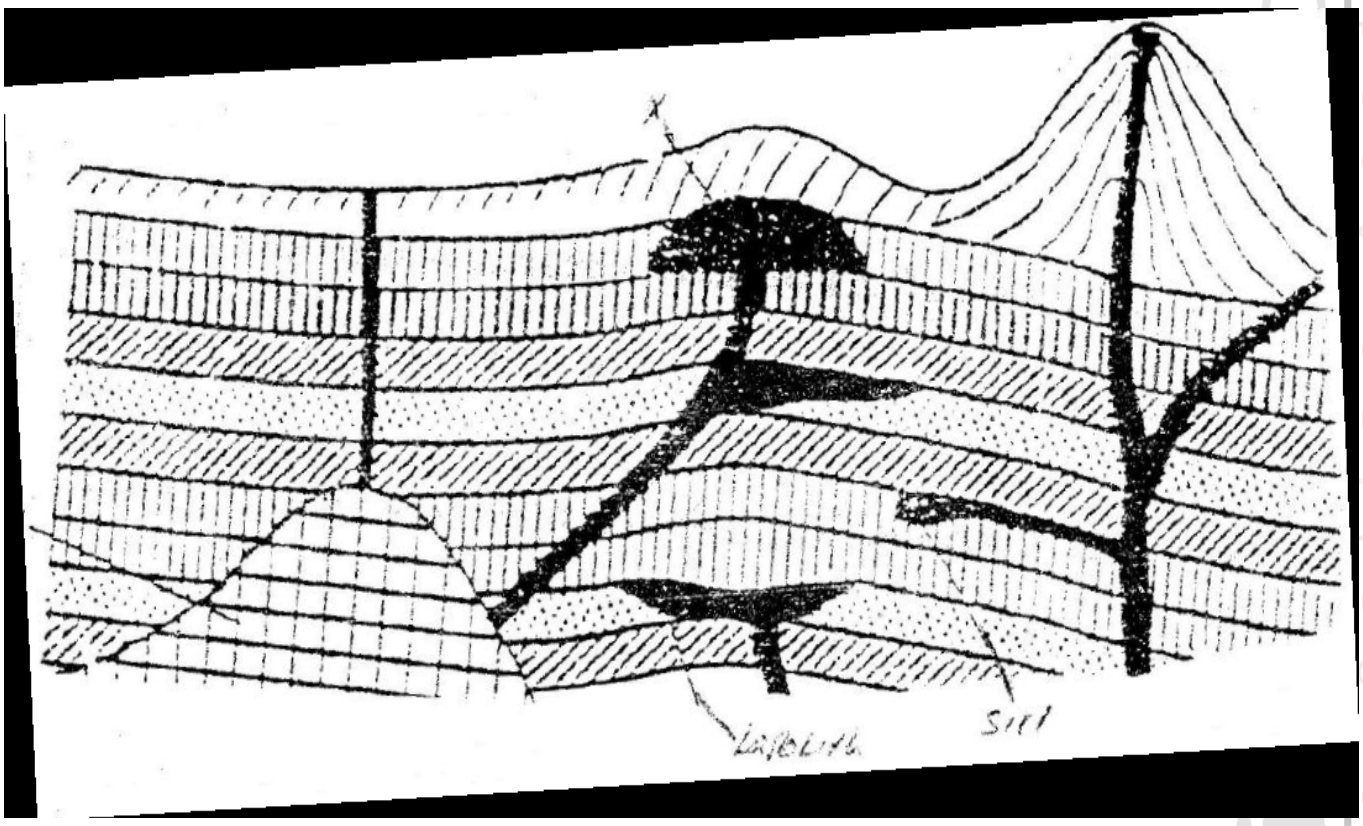
10. Explain ways in which features resulting from faulting are of importance. (8mks)

11. Describe formation of fault steps with aid of diagrams. (6mks)

INTERNAL LAND FORMING PROCESSES – VULCANICITY

1. The diagram below shows some intrusive features formed by vulcanicity.

Use it to answer question (a)



a)

i) Name features marked X,Y, and Z (3mks)

ii) Explain how a sill is formed (4mks)

b) Describe the characteristics of a composite volcano (4mks)

c) Explain **four** ways in which volcanic mountains positively influence human activities. (8mks)

d) Students carried a field study on volcanic rocks

i) Give **four** reasons why it is necessary to collect rock samples during such a field study. (4mks)

ii) State **two** problems they are likely to have experienced during the field study (4mks)

2.

(a) Differentiate between plutonic rocks and volcanic rocks

(b) Describe how lava plateau is formed

(c) (i) Name three volcanic features found in the rift valley of Kenya

(ii) Explain four negative effects of vulcanicity in Kenya

(d) You intend to carry out a field study of a volcanic landscape

(i) State four reasons why it is necessary to conduct a reconnaissance of the area of study.

(ii) During your field work, you intend to study volcanic rocks, state why you would need the following items

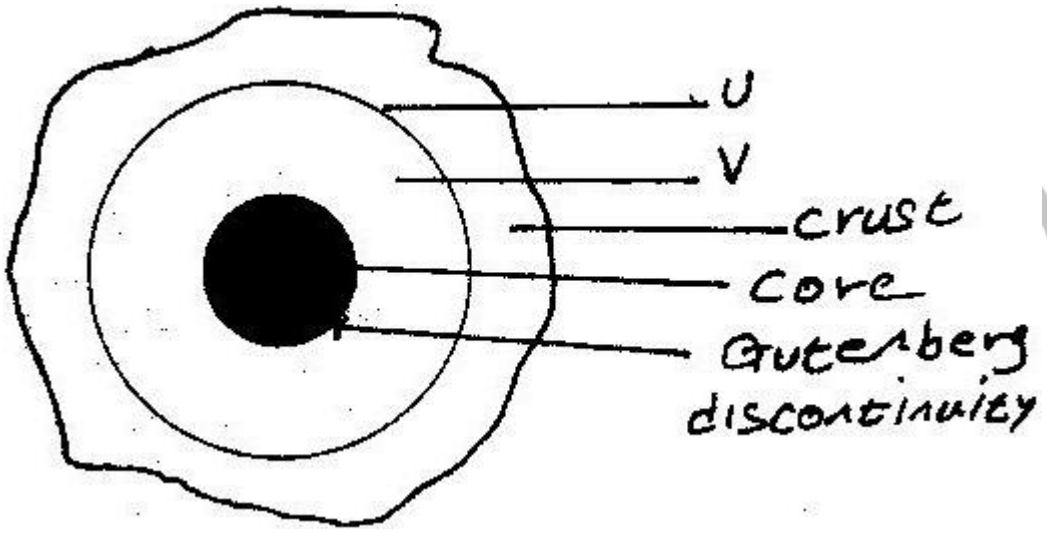
3. Name three volcanic features found in the Rift Valley of Kenya. (3mks)
4. Explain four negative effects of vulcanicity in Kenya. (8mks)
5. Describe how lava plateau is formed. (5mks)
6. Differentiate between sill and dyke. (4mks)
7. What is vulcanicity. (2mks)
8. Describe how Crater Lake is formed. (5mks)
9. Describe how Mt. Kenya was formed.

INTERNAL LAND FORMING PROCESSES – EARTHQUAKES

1. (a) Name two scales used to measure the intensity of an earthquake (2mks)

(b) Give three causes of earthquakes (3mks)

2. The diagram below represents the internal structure of the earth. Use it to answer question(a)



(a) Name the part marked U and V.

(b) Describe the deposition of:

i. The crust

ii. The core

c) (i) What are earthquakes

(ii) Name two types of earthquakes.

(iii) State the five ways in which the earths' crust is affected by earthquakes.

(d) You intend to carry out a field study of an area recently affected by intense earthquake.

i. Give two sources of information that you would use in preparation for the study.

ii. Explain two factors that would make it difficult for you to collect accurate data during the field study.

3. (a) State three causes of earthquakes

(b) Give two effects of earthquakes in built up areas

4. State the major causes of earthquakes (2mks)

5. Explain how intensity of earthquake is measured. (2mks)

6. List major effects of earthquakes where they occur. (4mks)

7. Distinguish between seismograph and seismogram (4mks)

8. Differentiate between intensity and magnitude of earthquake (4mks)

9. Students from your school intend to carry out a field study of an area recently affected by intense earthquake.

(i) Give two sources of information that you would use in preparation for the study.

(ii) Explain two factors that would make it difficult for you to collect accurate data during the field study.

MARKING SCHEME

EARTHS MOVEMENT

1. (a)
   i) Vertical movement/ epierogenic
   ii) Horizontal movement/ lateral/orogenic

(b) Describe the origin of continents according to the theory of continental drift.

- Theory first explained by F.B Tylor (91908), J.B Backer (1911) and adopted by German meteorologist Alfred Wegner in 1912.
- Says the present distribution of continents was due to disruption of super continent known as Pangea. Pangea was surrounded by a large super water body - Panthalasa.
- Pangea broke first into two continents i.e. Godwanaland and Laurasia.
- The two continents were separated by a long narrow ocean known as Tythys.
- Godwanaland broke further and drifted into southern contents of present Africa, South America e.t.c. while Laurasia drifted to present Eurasia, North America e.t.c.

2.

- Earth movement are movements which occur within the crustal rocks due to tectonic-forces.
- Internal land forming processed are those processes operating inside the earth. They are also known as endogenetic.
- External land forming processes operates on the surfaces of the earth. Also known as exogenetic.

3. Evidences of continental drift

(i) Geometrical fitting of Western coastline of Africa and Eastern Coastline of America.

(ii) Similar plant and animal remains in different continents.

(iii) Similarities in rock structures along coast of West Africa and Eastern South America.

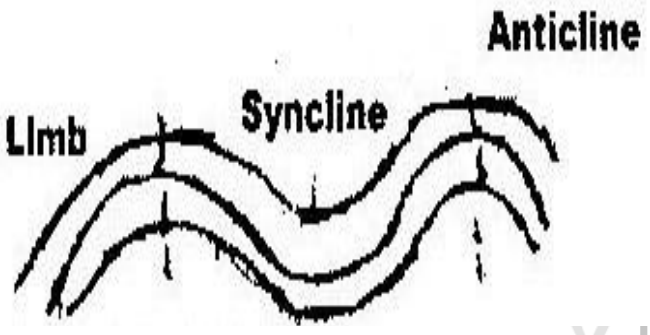
(iv) Evidence of glaciation in Southern continents which are formed from glaciated regions.

(v) Presence of coal in mild and high latitude regions coal is usually formed in tropical areas with dense vegetation.

(vi) Similarities of fold mountains found in S. Africa and Argentina. Both in age and East -West trend.

4.

- Plate tectonic theory suggests the earth is made of rigid blocks (plates) floating of molten material.
- The plates are mobile.
- They move towards each other away from each other or parallel past each other.



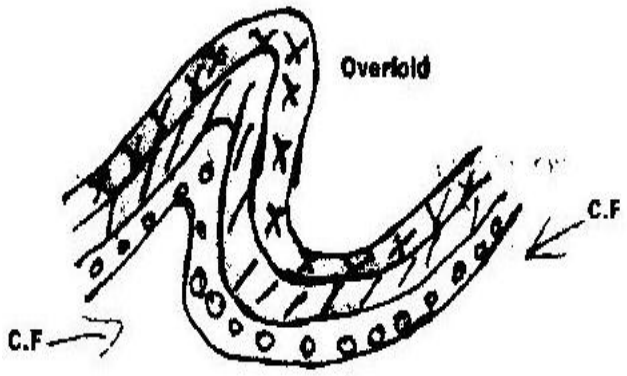
INTERNAL LAND FORMING PROCESSES - FOLDING

b) Atlas, Dakenberg

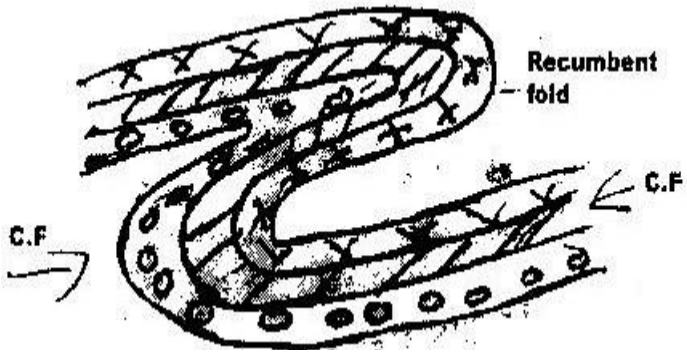
2. a) Fold mountains in
   - Asia – the Himalayas
   - North America – Rocky Mountains and the Appalachians
   - South America – The Andes Mountains

b)
i) Rolling plains, ridge and valley landscape, inter-mountain plateau,
inter-mountain basic, escarpments.
ii) Formation of over thrust fold.

- Layers of rock of the earth's crust are subjected to compression forces.
- Intense compression results in formation of over-fold

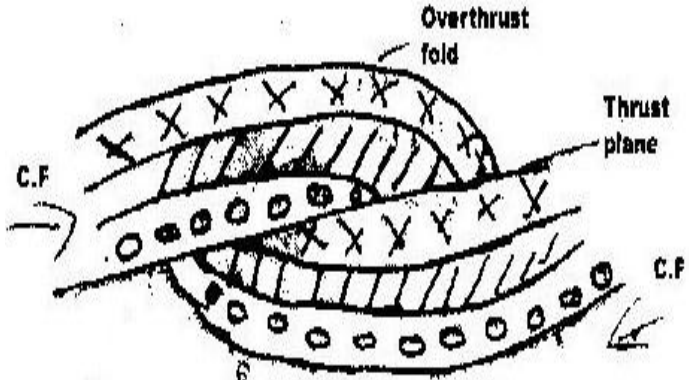


- With increased pressure the overfold results in the for-



mation of recumbent fold

- When pressure is very great a fracture occurs along the axis in the recumbent fold producing thrust plane.
- The upper part of recumbent fold slides forward over the lower part along the plane resulting to the formation of an over thrust fold.



c) Effects of fold mountains to human activities.

a.windward side of fold mountains receive heavy precipitation which

b.Enhance agricultural activities / forestry.

c.Rivers which originate from fold mountains provide water which is used

d.For generation of HEP/irrigation/domestic and industrial purposes.

d.Some fold mountains have exposed minerals deposits which are exploited.

e.Fold mountains are important tourist attractions/snow capped mountains encourage sporting activities.

f.Fold mountains may act as barriers to transport and communication.

g.Topographic nature of the landscape may encourage/ discourage agriculture/settlement.

d)

i) formulate study objectives/hypothesis.

a)Identifying methods of data collection/representation. Planning a schedule of activities

b) Carrying out reconnaissance survey.

c) Seeking permission from relevant authorities.

d) Identifying/collecting/sorting out relevant equipment/ tools for study.

e) Drawing a route map

f) Assembling relevant stationery

g) Reading relevant information/literature review.

h) Dividing themselves in groups

i) Hold class discussions

ii) Gives first hand information on different types of land forms.

(a)Application of knowledge gained to real life situations.

(b) Development of various skills/ application of skills learnt.

(c) Help in familiarizing with the environment.

(d) Reduces monotony and boredom in the classroom.

(e) Provides in – depth/ broader learning

(f) Enables one to appreciate landforms

(g) Enhances visual memory of landforms better than the theory.

3. Orogenesis is the process through which Fold Mountains are build.

4. folding is the process of crustal distortion which causes the rocks to bend upwards or downwards.

5. Compression boundaries – is one where plates move towards each other holding or connecting line in a fold which rock layers dip or rise from opposite directions.

6. **Limb** – layers of rock on either side of the axis while axis is the central line in a fold which rock layers dip or rise from opposite direction.

7. Foreland – is static block of land that is pushed in formation of geosyncline fold while backland is block of land where forces originate that cause sediment in the geosyncline to wrinkle.

8. Fill in the table.

Orogeny	Years (age)	Period	Mountains/features built.
Charnian	Oldest 600 million years ago	Pre- Cambrian period	-deccan plateau of India -Laurentin shield of North Americ
Caledonian	Old 440 million years ago	Silurian period	-Akwapim Hills of Ghana -Scottish highlands
Hercynian	Young 350 million years ago	Upper Carbon Ferrous Period	-Cape ranges -Appalachaian mountains -Ural mountains
Alpine	Youngest 70 million years ago	Palaocene period	-Himalayas-Asia -Rockies – USA -Anses- S. America

9. Contraction theory.

According to the after earth had formed, the surface rocks of the crust cooled faster than those in the interior. As the interior continues the cool, the surface rocks wrinkled to fit on the contracting interior leading to formation of Fold mountains.

INTERNAL LAND FORMING PROCESSES - FAULTING

1.

a)

- Fault scarp
- Tilt block
- Block/horst mountain

b)
(i) Faulting disrupts lines of transport and communication
(ii) Some features like Rift Valley form barriers which make establishment of transport and communication expensive.
(iii) Faulting cause sinking of land which leads to destruction of property such as buildings and crops.
(iv) Leads to formation of depressions which are filled with water to form lakes
(v) Unique features are formed which attracts tourists.
(vi) Faulting exposes minerals making exploitation easier.
(vii) Makes rivers to have waterfalls.

2 a)
P- Horst
Q- Rift valley
R- Escarpment

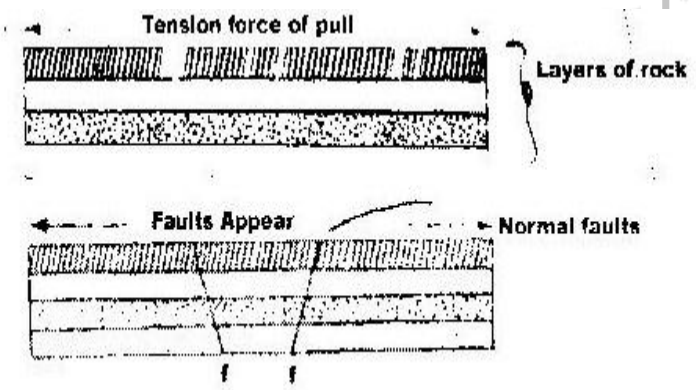
b) Normal fault is fault resulting from tension in inclined place with inclination of fault plane and direction of downthrow on same side while reversed fault is fault that results from compression forces where the one block is pushed upwards in relation to another forming up throw.

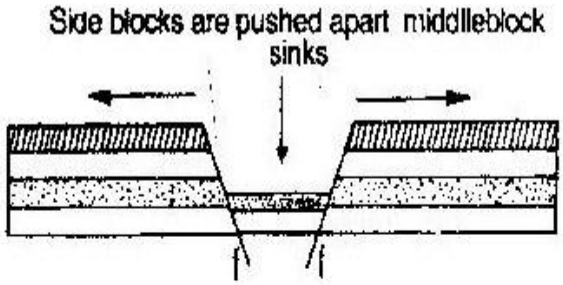
3.
a. Vertical faulting, across a river may cause waterfall/ river rejuvenation.
b. Rift faulting in an enclosed area may lead to formation of a depression which can be filled with water for form a lake.
c. Some rivers flow along fault lines/fault guided drainage
d. Uplifting of landscape which may cause reversal of direction of river flow
e. Rivers may disappear to the ground through a fault line.

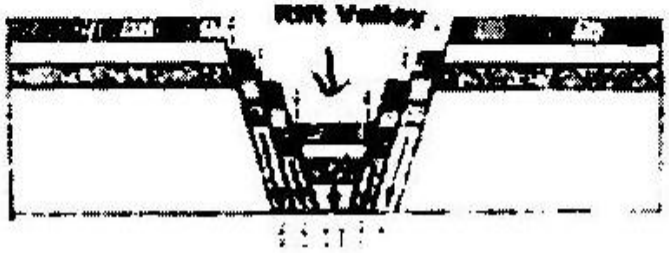
4. Pare, Usambara, Ruwenzori, Nyandarua and Mau Ranges.

5.
a. Block/ horst mountains are a source of rivers which provide water for industrial/ agriculture/domestic use.
b. Rift Valley formation has led to exposure of minerals such as diatomite, soda ash which are mined on rift valley.
c. Mountains formed are barrier to moisture carrying wind leading to orographic rainfall which favours agriculture and settlement.
d. Some Rift valley lakes are important fishing grounds/mining sites/provide water for irrigation
e. Faulted features provide beautiful scenery which promotes tourism.

6. a) Layers of rocks are subjected to tensional forces.







Two normal fault develop
Middle block subsides between two side block
Middle part form depression called rift valley enclosed by escarpment

ii) Disadvantages of direct observation of the area.
(a) It is expensive
(b) It is time consuming
(c) It is tiresome
(d) It is limited to only direct sources/primary sources of data.
(e) It only suitable to sighted people
(f) Some features may be hidden out of view.

7.

- Normal fault
- Reverse fault
- Tear fault
- Anticlinal fault
- Thrust fault

8.
i) Compression force tends to push rocks together.
ii) Lines of weakness develop and lead to formation of parallel reversed faults on the crustal rocks.
iii) Further compression thrust side blocks over middle block leaving it to form rift valley floor.

9.
a. Nyandarua Range
b. Lake Manyara escarpment.
c. Nyando escarpment

10.
i. Rift valley provides a spectacular scenery that attracts tourists earning foreign
ii. Mining of soda ash in rift valley generate export earnings
iii. Rift valley floor has fertile soils suitable for farming
iv. Rift valley lakes are suitable for fishing grounds.

INTERNAL LAND FORMING PROCESSES- VULCANICITY

1. a)
i)
X-Laccolith
Y- Batholith
Z- Dyke
ii)
- Magma is forced along horizontal lines of weakness/ bedding planes of rock strata.
- Intrusion of magma cool and solidify horizontally along bedding planes.

b)
- It has a vertical vent
- It is made up of alternating layers of ash and pyroclasts
- Conical in shape with steep sides
- May have crater on its peak or a plug
- It has side vents
- Has parasitic cones/conelets

c)
⇒ Volcanic ash and basalt on pouring provide fertile soils exploited for agriculture
⇒ Occurrence of minerals such as fluorspar in Kerio Valley and Diatomite in Shinyanga are exploited to generate foreign exchange.
⇒ Volcanic mountains act as water catchments areas from which major rivers and springs originate. The drainage features provide water for industrial and domestic use.
⇒ Geoghermic areas which owe existence due to volcanic activities are tapped to generate electricity.
⇒ Volcanic mountains form beautiful sceneries that attract tourists.

2 a)
(i) Formed when magma reaches the surface of the earth / or from lava through multiple vents/fissures.
(ii) The lava is ultrabasic / extremely fluid of low viscosity.
(iii) Lava flows over large area of distance and spread widely before cooling covering valleys and low lying hills
(iv) Lava cools slowly forming an extensive plateau.
(v) Plateau may form through a series of eruptions which results in thick layers.

b)
(i) Some volcanic features create barriers making construction of transport and communication.
(ii) The rugged nature of volcanic landscapes makes settlement and agriculture difficult
(iii) Volcanic mountains create rain shadow effect which result too aridity.
(iv) Recent volcanic lava flows have poorly developed soils which are unsuitable for agriculture.

c)

- Ash and cinder cones
- Fumaroles/solfatara
- Hot spring/geysers/stream jets
- Crater caldera
- Volcanic cones
- Lava plateau

3.

i. Hot springs/geysers/steam jets
ii. Craters/calderas/crater lakes
iii. Volcanic mountains
iv. Ash and cinder cones
v. Fumaroles/sofatara/Muffette

4. Explain four negative effects of vulcanicity in Kenya

- Some volcanic features create barriers making construction of transport and communication lines difficult.
- Rugged nature of volcanic landscape make settlement and agriculture difficult
- Volcanic eruption may produce poisonous gases which pollute environment thus posing danger to life.
- Volcanic eruption may produce poisonous gases which pollute environment thus posing danger to life.
- Volcanic mountains create rain shadow effect which result in aridity on leeward side.
- Recent volcanic lava flows have poorly developed soils which are unsuitable for agriculture.

5.

- Forms from lava when magma reaches surface of each through fissures.
- Lava is ultra basic or extremely fluid or low viscosity.
- Lava cools slowly forming extensive plateau
- Plateau may further continue to form through series of eruption that follow Examples: Kaoutu, Yatta, Laikipia

6. A still is near horizontal /tabular sheet of igneous rock formed from solidified magma between bedding plane while a dyke is a sheet of intrusive rock which cut near vertical/discordantly across bedding plane.

7. Vulcanicity is the process of eruption/escaping of magma/through which gaseous,
liquid/molten and solid materials are intruded in to the earth's crust or are extruded onto the surface.

8.

- Crater lake
- Outpouring of lava forms a volcanic cone.
- The vent may be sealed when lava solidifies in it.
- This leads to building of pressure below the plug.
- This leads to explosion of cone leaving depression on top.
- Water from rain or underground source accumulates in the depression.
- Examples: L. paradise on Mt. Marsabit, crater lake in Central Island of L. Turkana, L. Sonachi on South west of Lake Naivasha, Lake Simbi Nyamia in Nyanza.

9. Formation of Mt. Kenya

i) Due to earth movements, the rocks of the crust were disturbed leading to formation of a vent.
ii) The underlying molten rock escaped through a central vent to the surface / volcanic eruption occurred
iii) There were violent eruptions which ejected acidic lava that cooled and solidified.
iv) These lava piled in layers around the vent.
v) The resultant mountain was cone shaped
vi) Over the years, eruption ceased and the volcano became extinct.
vii) Erosion set in exposing the plug and produced the jugged peaks of the mountain.

INTERNAL LAND FORMING PROCESSES - EARTHQUAKES

1. a)

- The Mercalli scale
- Rossi foren scale

b)

i) Collision of tectonic plates
ii) Energy release in the mantle
iii) Violent volcanic eruptions
iv) Nuclear explosions
v) Gravitative pressure
vi) Magma movement within the crust

2. c)

(i)

- Earthquake is sudden movements or tremors of the earth crust.

(ii)

Primary waves
Seconday waves
Rayleigh waves
Love waves

(iii)

- Rocks of the earth crust are displaced laterally.
- Earthquake causes uplift or subsidence of land.
- Earthquakes can rigger off landslides on the surface of the earth crust
- Earthquakes can lead to faulting of the crustal rocks.
- Earthquakes can lead to volcanic eruptions

3. a)

- Collision of tectonic plates
- Energy release in the mantle
- Violent volcanic eruptions
- Nuclear explosions
- Gravitative pressure
- Magma movement within the crust

b)

Effects of earthquakes in built up areas

- Loss of life (human, animal and plant)
- Disruption of transport and communication lines.
- Outbreak of fires
- Avalances and landslides may occur covering build up areas
- Tsunamis may drown coastal settlements

4.

a. Magma movement within earth crust
b. Isostatic adjustment resulting in breakage of rocks
c. Sudden explosions e.g Nuclear testing.

5.

- The strength of an earthquake is measured by its intensity and magnitude. Intensity measures how hard the earthquake hits the ground.
- Intensity is measured using Mercalli scale. Magnitude measures amount of energy given off. It is measured using Ritcher scale.

6.

a. Damage to property
b. Loss of human life
c. Can cause landslide
d. Disruption of infrastructure.
e.

7.

Seismograph is an instrument which detects and records seismic waves of earthquakes while seismogram is a graph-like record on which earthquake impulses are recorded.

8.

Intensity measures how hard earthquake hates the ground. It looks at the effects while magnitude measure amount of energy released during an earthquake.

9. i)

- Written materials/books/magazines/ newspapers.
- Maps
- Photographs/films/videos/slides (Visual aids)
- Resource persons
- Electronic media-radio, TV (Audio aids)

ii)

- Inaccessibility of the area due to massive destruction/restriction.
- Lack of informers because people may have been evacuated
- The rubble may obscure the evidence of the amount of damage.