PHYSICAL GEOGRAPHY

P250/1

PAPER ONE

S.5A AND S.5 MEG 2020.

CONTINENTAL DRIFT

This refers to the large scale movement of land masses of the earth. The earth's surface is made up of continents and ocean basins. It's believed that continents have not always been fixed but have drift thru time.

Many theories have been put forward by geographers to explain origin of continent and ocean basins. Collectively, they are known as continental theories.

1. Expanding Earth Theory
2. Taylor's Theory of continent drift
3. Wager's theory of continental drift
4. The sea-floor spreading Theory
5. The plate tectonic Theory

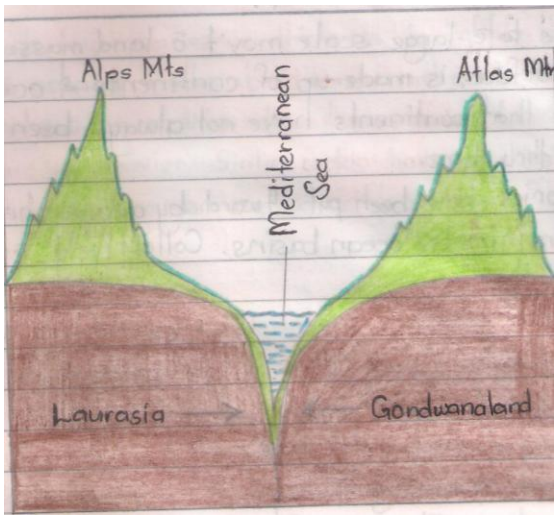
The expanding earth theory

It was of the earliest theories. It says that at first, the earth was much smaller and covered with a thin continental crust at the surface. The earth's interior began to expand and forced to crack outside. It separated into crustal blocks (continents) and the widening gap in between became oceans. It is thought that the reason why it expanded was because it was very old and its gravitational force became weaker making its materials spread outwards and expanded.

Taylor's theory of continental drift

It was put forward by FD Taylor in 1910, he described continental drift as huge landslides from the polar region to the equator.

According to him there were originally two land masses called Laurasia near the present day North Pole and the other called Gondwanaland located near the South Pole. He said that the force that caused these continents to move was the gravitational pull, which came closer to the earth and exerted great gravitational pull that caused Laurasia to move south wards and Gondwanaland to move North wards towards the equator. When the two collide, the segments in between them led to the formation of the Alps and Atlas mountains.



His theory was criticized because of the following:

i) However close the moon came to the earth, it's a small planet. It has no force strong enough to pull the huge continents from their polar locations.
ii) He failed to explain how the earlier fold mountains eg Caledonian mountains were formed before collusion of Laurasia and Gondwanaland.
iii) The cause of continental drift ought to have come from within the earth and not outside it.

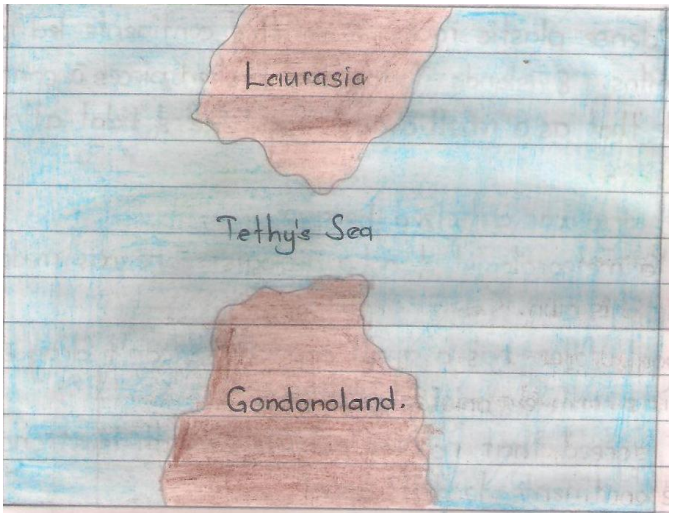
WEGNER'S THOERRY OF CONTINENETAL DRIFT

It was one of the most famous theories. It states that the present continents were formed by the breaking up of one large super continent and they afterwards moved to their present positions.

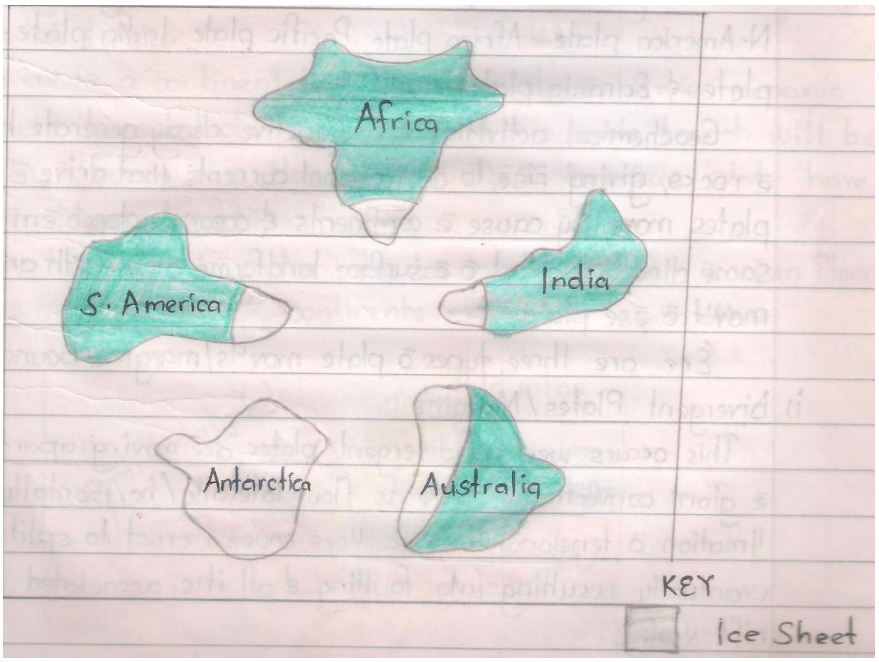
About 280 million years ago, there was a single super continent known as **PANGEA**. It was situated near the south pole and was surrounded by a large ocean known as **PANTHALASA.**

During the **mesozoic era, lateral movements** within Pangea led to the development of **numerous crocks** and it broke up into two continents; Laurasia and Gondwanaland. They were separated by a narrow sea water body known as Tethys or the Tethys sea. Laurasia lay across the equator and Gondwanaland lay near the south pole and it was covered by a large ice sheet.

Position of Laurasia and Gondwanaland



Later on, the two continents broke up to give rise to the current continents. Laurasia broke into: N. America, Asia, Europe and Greenland.
Gondwanaland broke up into Africa, S. America, New Zealand, Arabia, India, Ceylon and Madagascar. They were covered by the ice sheet as shown below.



Wegner said the continents drifted apart like solid rafts on an ocean of dense plastic rocks. The drifting continents led to the information of Fold Mountains. The islands today are broken pieces of continents. He assumed that as a result of centrifugal force the tidal attraction, they drifted.

His theory was criticized because:

i) He was meteorologist and not a geologist therefore he was meddling in a field not his own.
ii) Centrifugal force has a small capacity and cannot drag the large continents from their original positions.
iii) It was agreed that no force outside the earth is strong enough to cause the continents to drift apart.

PLATE TECTONIC THEORY

This refers to the movement of tectonic plates of the earth. It states that the earth surface is covered by a number of thin tectonic plates that can move. The plates are composed of both continental and oceanic crust. They are mobile light and therefore float on top of denser rocks of the mantle.

There are six main plates in the world and a number of small ones like N. America plate, Africa Plate, Pacific plate, India Plate, Antarctic plate and Eurasia plate.

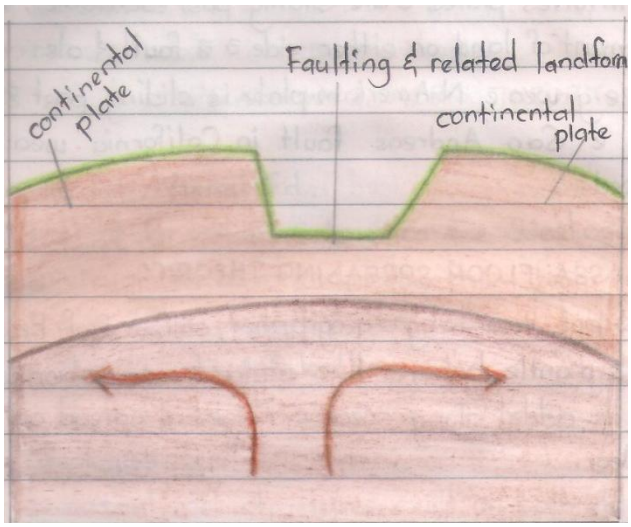
Geochemical activities and radioactive decay generate heat that melts the rocks, giving rise to convectional currents that drive the plates. When the plates move, they cause the continents and oceans on top of them to move in the same direction. Most of the surface land forms on the earth are caused by the movement of these plates.

There are three types of plate movements/margins/boundaries.

i) Divergent plates/margins

This occurs were two divergent plates are moving apart. Underneath, the giant convectional currents flow laterally/horizontally leading to the formation of tensional forces. There forces that cause the crust to split and fracture eventually resulting into faulting and all its associated landforms like rift valleys.

Sometimes magma rises through the faults/cracks to from volcanic mountains we were it occurs in oceans, it results in information of mid oceanic ridges and highlands.

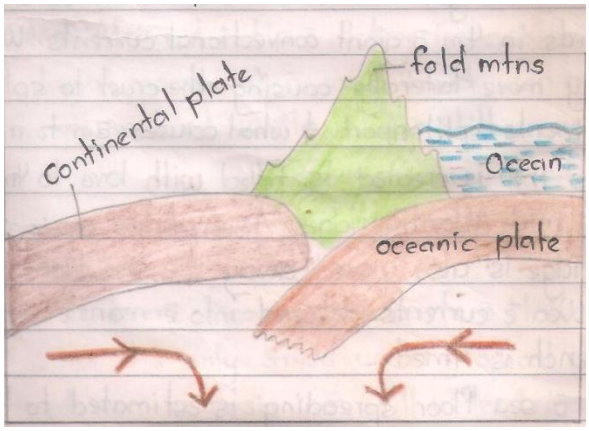


ii) Convergent plates/margins/ Plate Subduction

These occur where tectonic plates meet/converge, underneath; the convectional currents are flowing towards each other leading to compression force. When both plates are continental plates, they squeeze the segments between them to form fold mountains e.g. Himalayas mountains between India and Asia.

Where there is a continental and oceanic plate, he heavier oceanic plate will be subducted underneath and the oceanic trench will be formed in the ocean e.g Nazca plate and the S.American plate have formed the Nazca trench.

Where two oceanic plates move towards each other, the ocean floor becomes morenarrow and the continents move near each other.



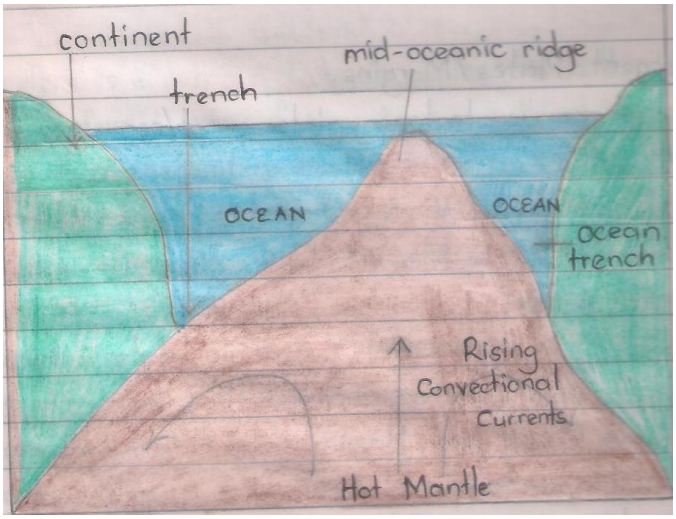
orthorth

Transform Margins/Movements

This involves plates which are sliding past each other. It leads to the displacement of land on either side of the fault and also causes severe earth quakes e.g. where the North .American plate is sliding past the pacific plate causing the San Andreas Fault in California where the rocks have been displaced.

THE SEA FLOOR SPREADING THEORY

It was put forward by a geographer called Prof. Hess. It states that the earth's mantle behaves like a giant convection current where material is added along oceanic ridges and spread out to the rest of the ocean floor.



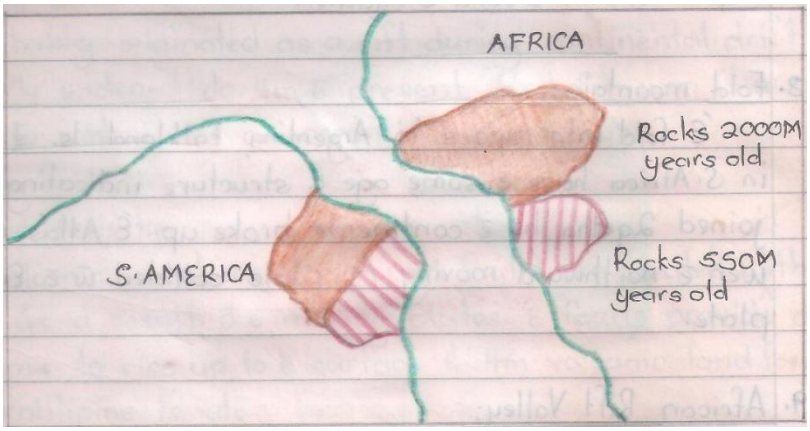
Radioactive heat generated in the core of the earth causes the material to move upwards in form of giant convectional currents. Where there is no line of weakness, they move laterally causing the crust to split thereby explaining how the continents split apart and what causes them to move to other positions.

The gap that is created is filled with lava to form a mid oceanic ridge e.g. the mid-Atlantic ridge. As the plates move away, lava along the oceanic ridge is also moved away and the sea floor appears to be spreading. Where the currents descend into the mantle (down welling) an oceanic trench is formed.

The rate of sea floor spreading is estimated to be about 6cm. in summary, this theory explains the force that caused the continents to split and move.

EVIDENCES TO SUPPORT WEGENER'S THEORY OF CONTINENTAL DRIFT

1. **The Jig-Saw Fit/Visual Fit:**
   The east coast of Brazil in South America and the west coast of Africa have a good visual fit when joined together from the surface up to a depth of 2000m. This indicates that at one time they were joined together before Gondwanaland broke up.
2. **Matching geology**
   The same geological rock structures exist on both sides of the continents e.g.Accra in West Africa and Sao Lois in Brazil.



3. **Glacial evidence**
   In Southern Africa and the tip of South .America are found thick deposits of Tillite (glacial moraine) which was formed when a large ice-sheet covered Gondwanaland while it was still around the South Pole and before it broke up.
4. **Lateritic rocks**
   Laterite has been discovered in parts of North America, Britain, German and Russia. Since it's only formed under tropical climate, it was probably formed when Laurasia was still under tropical climate around the Equator.
5. **Sedimentary basins**
   Along part of the coast of Brazil and South East Nigeria and Cameroon are found similar sedimentary rock basins which were formed before Gandwanaland broke up.

6. **Petroleum deposits**
   Studies carried out in the oil beds in Brazil and those of Angola show that they are of crustaceous origin and once formed a continuous oil bed before continental drift occurred.
7. **Salt evaporates**
   They have been discovered in the southern states of USA, Germany and Britain and can only be formed under hot and dry conditions therefore they could only have been formed while Eurasia was still under tropical climate around the equator.
8. **Fold mountain**

The fold mountain ranges in Argentina, Falkland Is. And Cape Ranges in South Africa have the same age and structure indicating that they were joined together before the continent broke up the Atlas and Alps mountains formed when the northward moving African plate collided with the European plate.

9. **African Rift Valley**

   The underground convectional currents caused the continents to break u and also in the process caused large scale reefs/cracks in the African continent.

10. **Earthquakes**

    They are still occurring today in various parts of the world e.g. in 1994, Feb.in Fortportal in Uganda, July, 1993 in Japan Afghanistan,Phillipines. They are evidence that the plates are still moving and in the process set up shock waves referred to as earthquakes.

11. **Gold deposits**

    The deposits found in Guyana, South America, appear to be a continuation of the gold deposits in Ghana indicating that they were once joined together.

12. **Coal deposits**

    The carboniferous coal deposits of Europe are a continuation of coal deposits in North America.

13. **The St. Andreas Fault**

    It's found on the coast of California and studies have shown that the rock strata has been separated and displaced along the fault and is 360km apart.

14. **The Red Sea**

    Probably originated as a rift during continental drift, gradually widen to form the present Red sea when it was filled with water. It's an ocean in the making.

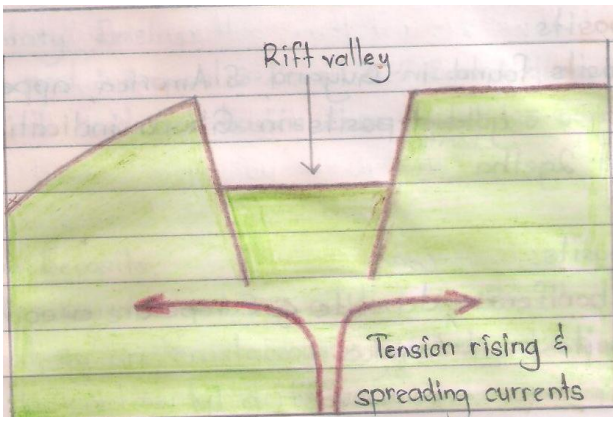
15. **Volcanic activity**

    Volcanic eruptions occur where faults are created within the crust as a result of the moving plates. The faults provide outlets for magma to rise up to the surface to form volcanic land forms e.g. in the Phillipine Is. etc.

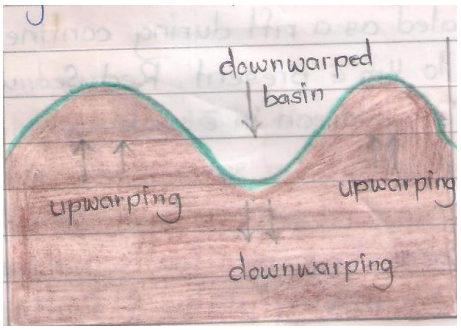
EFFECTS OF PLATE TECTONISM ON LANDFORM FORMATION IN E.A

Plate tectonism and continental drift have led to the formation of major land forms in E.A. They resulted in the formation of compressions and tensional forces which caused wide spread faulting, warping the volcanicity.

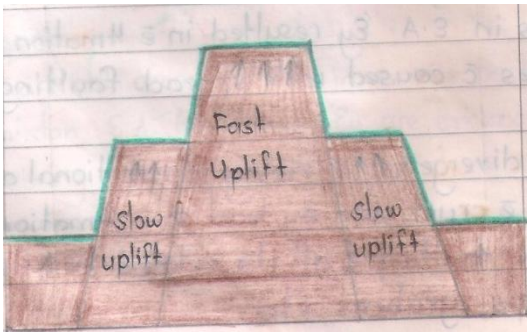
a. In areas of plate divergence, the rising convectional currents flow sideways under the crust where they lead to the formation of tensional forces. These cause faulting and all its related landforms e.g. the rift valley, scarps, grabens etc.



b. In areas of plate convergence, the convectional currents converge and sink downwards into the earth. They pull the earth downwards and therefore are responsible for the formation of down warp basins in central Uganda in the lakes Victoria and Kyoga are found where they rise to the surface up warping occurs and uplifted plateaus are formed.



c. Plate Tectonism is also important in the formation of block mountains in East Africa.As the currents rise towards the surface, they push up the crust causing it to uplift at difficult rates. The part that is uplifted at a faster rate becomes a block mountain/ horst e.g. mountain Rwenzori.



d. Plate tectonism is also responsible for the formation of volcanic land forms were faults occur as a result of the moving places. Magma rises to the surface through them to form intrusive and extrusive volcanic features orVolcanic landforms and that is why these land forms are found within or near the rift valley. Even those which are far from the rift valley eg Mt. Elgon, are located on ancient fault lines.

e. In conclusion however not all land forms in East Africa can be attributed to plate tectonism. Other processes have been responsible such as glaciations, weathering, erosion, deposition of material into rivers, lakes, lakes, oceans etc.

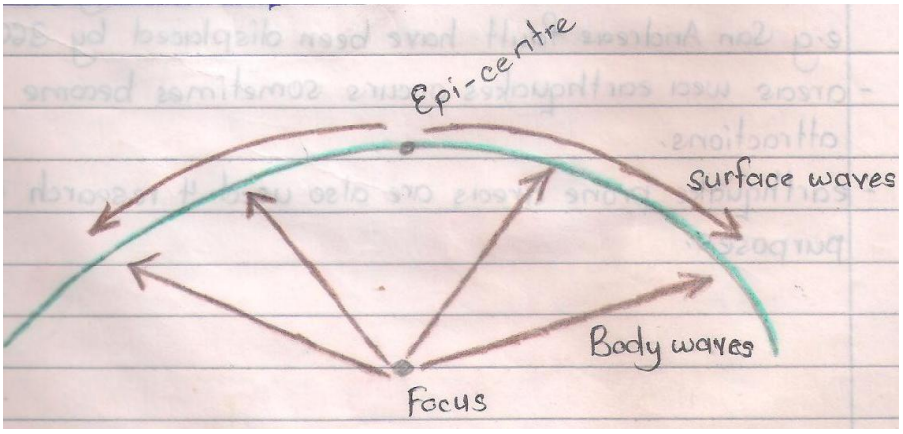
EARTHQUAKES AND PLATE TECTONISM

Earthquakes are strong and sudden vibrations in the earth's crust. They usually occur along the boundaries or margins of tectonic plates in areas with faults, along the mid oceanic ridges and volcanic islands.

Causes

1. Most earthquakes are caused when the tectonic plates collide/slide past each other along the fault e.g. North American plate is sliding past the pacific plate along San Andreas fault and causing earth quakes in California.
2. Massive movement of magma within the earth's crust can also cause earthquakes especially when volcanic eruptions occur e.gPhilippine Islands.

Nature of an Earthquake



The point within the earth's crust from which the earthquake originates is the **focus.** The point on the earth's surface above the origin is he **epicenter** and it's were the shock waves first hit the surface. As the waves travel from the focus they set up vibrations which are felt as earth quakes.

There are two types of waves:

1. **Body waves:**These are short waves which travel through the interior of the earth.
2. **Surface waves:** These are waves moving through the surface rocks.

MEASUREMENTS:

The intensity of an earth quake is measured by an instrument called a seismograph. The magnitude (size) of an earthquake is recorded on a Richter scale which ranges from 0 – 9.

Effects of earthquakes

1. The strong vibrations shake unconsolidated rack material, wet soil in areas of steep slopes move downwards leading to soil erosion and landslides.
2. They lead to destruction of life. Thousands of people die when homes are destroyed/collapse, eg in 1968 in Peru, 30,000 pple died in an earthquake and the Tooro earthquake in western Uganda in 1966 killed 150 people.
3. Destroy building structures and homes thus displacement of people. Government also spends a lot of money looking after those who remain homeless and refugees.
4. Also cause Ocean generated waves called tsunamis which destroy ships and lives along coastal areas.
5. Destroying infrastructure such as railways, roads and power lines sometimes start off with large fires that are difficult to control.
6. Can also raise/lower the rocks along the coast e.g. in 1899 the coast of Alaska was uplifted by an earthquake.
7. They also raise/lower parts of the sea floor and therefore sea level changes e.g. in 1899 in Japan, an earthquake raised Sagami bay and killed many people.
8. Displace part of the earth's crust either vertically or horizontally e.g. San Andreas fault have been displaced by 360km.
9. Areas were earthquakes occur sometimes become tourist attractions.
10. Earthquake prone areas are also used for research and study purposes.

Revision Questions

1. Describe the structure of the interior of the earth with the aid of specific diagrams
2. Discuss the continental drift theories
3. Describe Wegener's theory of continental drift
4. Describe the evidences that have been put up to support this.
5. Examine the cause and effects of earthquakes with reference to world examples
6. What is meant by plate tectonic movements?
7. Explain the effects of plate tectonic movements in Africa.
8. How does the theory of plate tectonic explain the present day distribution of continents?

VULCANICITY

Process through which gases and molten rocks are intruded into the earth's crust to form intrusive land forms or extruded onto the earth's surface to form extrusive volcanic land forms

Origin/causes of vulcanicity

The rocks beneath the earth's surface are at a very high/hot temperature e.g 15000C-50000C and pressure is also great as a result of geochemical activities and radioactive decay. This intense heat melts the rocks into a semi solid state, magma.
The molten magma then begins moving upwards through the mantle. Convectional currentsare set up within the earth and cause the magma to move upwards into the mantle.The pressure is high in the interior compared to the surface.

When there is a fault/crack in the crust, the magma finds its way to the surface where it is now referred to as lava. The lava cools and solidifies to form extrusive land forms e.g. composite volcanos and if it does not reach outside, it forms intrusive land forms e.g. batholiths.

Types of materials (lava)

1. **Acidic lava:** Has a high silica content, very viscous, cools rapidly and doesn'tflow far. It produces steep sided cones such as ash and cinder cones.
2. **Basic lava:**Has low silica content, very fluidy, produces quiet eruptions. It flows for long distances before cooling and solidifying to produce much flatter cones such as basalt domes,
3. lava plateau etc.
4. **Gaseous lava:** It produces very violent eruptions and forms features and land forms such as explosion craters like lake Katwe, some geysers etc.

   Some volcanoes can be active egNyamulangira in the Mufumbiramts and OlDonyoLengai in Tanzania. Some volcanoes are dormant or sleeping eg Mt. Longonot in Kenya and Ngorongoro in Tanzania. Others are extinct or dead such as Mt. Kenya, Elgon and Kirimanjaro.

EXTRUSIVE VOLCANIC LANDFORMS

When magma is ejected to the surface, extrusive volcanic features/ land forms are formed. However, these will depend on:

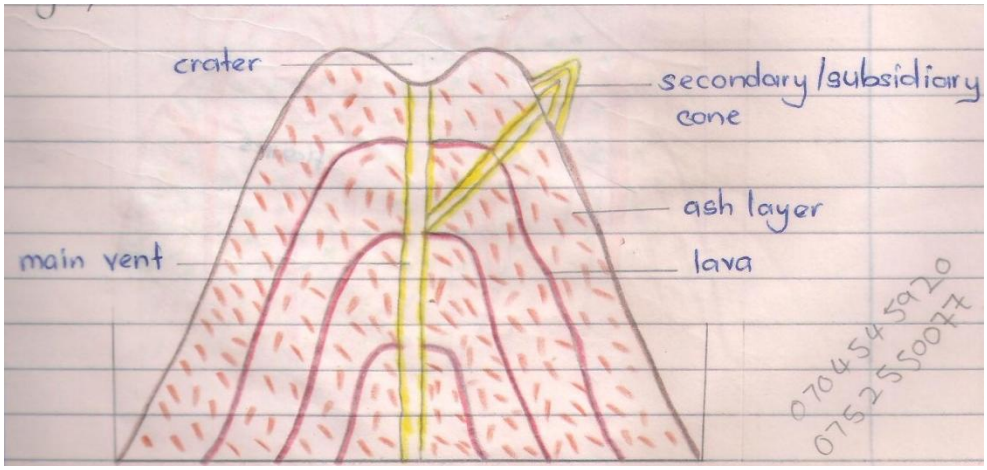
i) Nature of the eruption (quiet or violent)
ii) Type of lava(whether acidic, basic or gaseous) ejected and because of these, the landforms and features formed vary from tiny craters to high volcanic mountains like Kilimanjaro.

1. **COMPOSITE/STRATO VOLCANOES**

   Made up of alternate layers of lava and ash. It's composed of very acidic lava which causes very violent eruptions that occur over a very long period of time. Rocks in the core of the earth are in a semi solid state due to radioactive beat generated and the intense pressure, the molten rocks begin moving upwards in the mantle in form of giant convect currents.

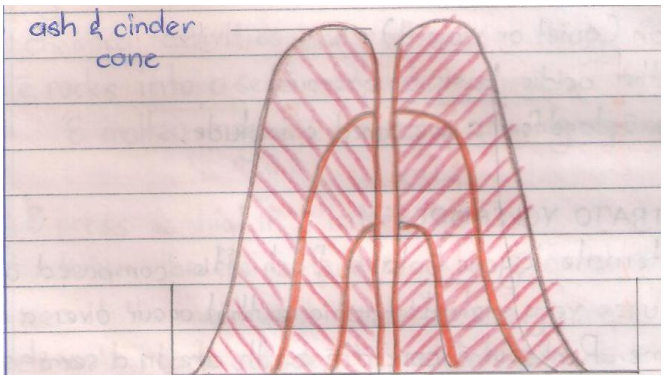
   Where there is a fault/crack, the magma reached the surface in a violent eruption leading to formation of a land from when a violent eruption occurs, the material is blown into the air and breaks into small frags of ash.

   It's afterwards covered by lava and the process is repeated until a very large mountain is formed. Sometimes the magma may find an outlet through the side of the vent to form sec/subsidiary cones e.gMufumbira ranges, Mt Kili with two subcones known as Mawenzi and Shira.



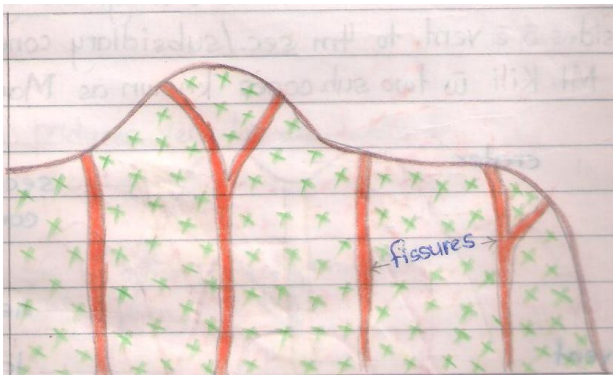
2. **ASH AND CINDER CONE**

   Formed from acidic lava which erupts with much violence to a great height such that it's broken up into very small fragments of ash and cinders. They accumulate round the rent to form a sleep sided cone of is concave shaped. He can also form small hills with 150M high/large mountains like Elgon.



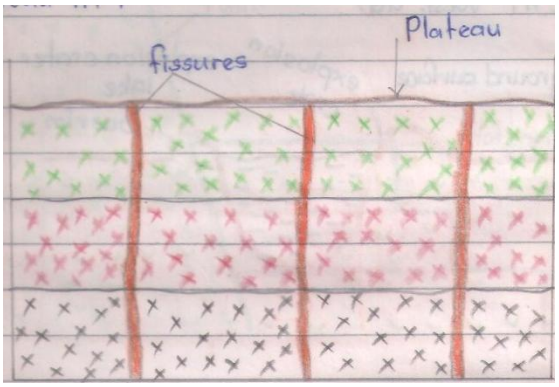
3. BASALT/ SHIELD VOLCANO

Formed from basic lava. It's very mobile and flows for long distance before solidifying. It comes out through many fissures and forms very large flat topped convex dames. Such land forms have gently sloping sides e.g. Mt. Longonot and sometimes has shallow sunken craters on top.



4. LAVA PLATEAU

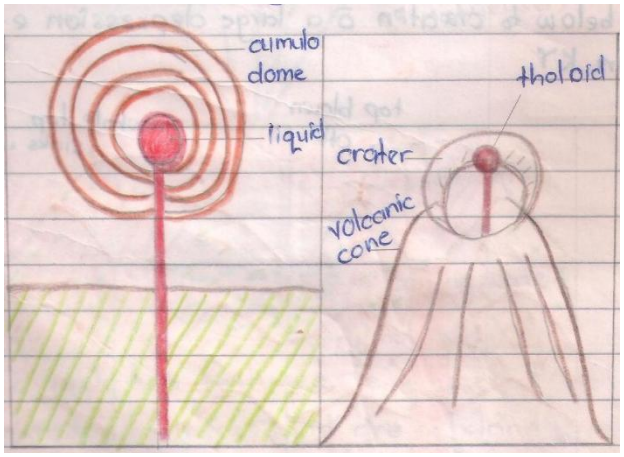
It's also formed from basic lava the flows out through many fissures extensively to cover a large area and form a flat plane as the land form. The eruption is very quiet which is built by successive layers with rep. different times of lava flows e.g. Kisoro plains in Western Uganda and Yata plateau in Kenya.



5. CUMULO DOME

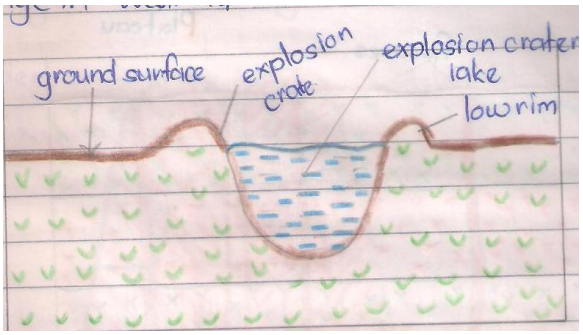
Steep sided convex dome formed from very acidic lava. It's very viscous, does not flow very far and piles up round the vent. It solidifies quickly on the outside but inside its still fluid/liquid. As more lava comes out, it pushes the solid outer layers into a dome shape which becomes more bigger and more rounded e.gNtumbi in Tanzania.

Sometimes, however, a cumulo dome is formed inside a crater where it's known as a tholoid e.g. near Rungwe in Tanzania.



6. EXPLOSION CRATER

Formed on the ground and not ontop of a volcanic cone. It occurs when an explosive gaseous eruption blows through the country rocks to create a depression surrounded by a rim. When it's filled with water, an explosion cater lake is formed e.g. L. NayamunukaKatwe, Munyanyange in West. Uganda.



7. CALDERA

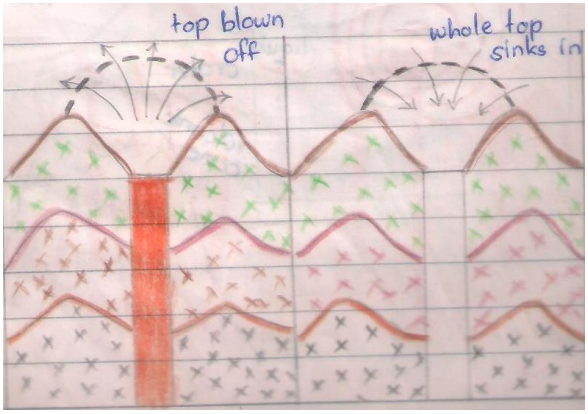
Very large depression found by either explosion/subsidence

a. An explosion Caldera

Formed when the top of an top is blown off by gaseous reaction to create a very large depression. When filled with water a caldera lake is formed.

b. A subsidence caldera

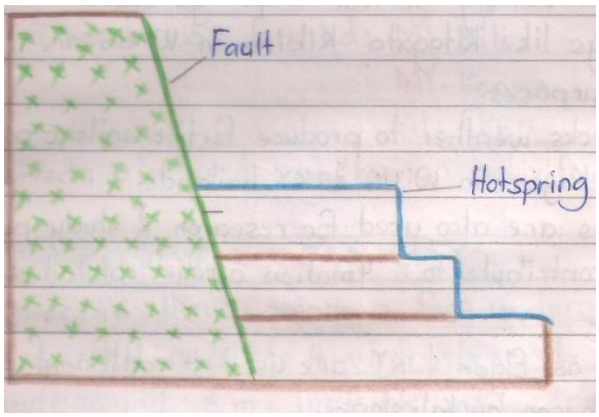
Formed when the whole top of an existing volcanic mountain sinks into the earth below to creation of a large depression e.gMenengai and Suswa in Kenya.



8. HOTSPRING

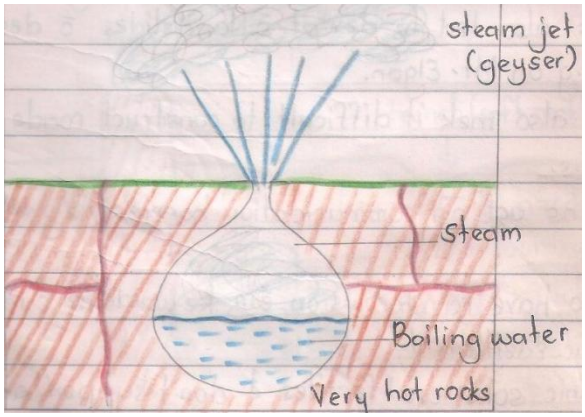
Sometimes underground water comes into contact with very hot rocks.

It's therefore heated up and may flow out continuously as a hot spring e.g. Kibiro, Kitagata, Sempaya, Amoroppi.



GEYSER

Is a steam jet which rises up in the air from underground in areas of volcanic activity. It is formed when underground water in a cavern comes into contact with hot rocks. The water reaches the boiling point and is changed into steam and when pressure builds up, it is ejected out explosively as a steam jet e.g. there is a geyser in the Longonot caldera and others are found in the rift valley areas ofNaivasha Kenya.



NOTE: The last two features ie geyser and hot spring are extrusivevolcanic features and are not landforms.

Importance of extrusive volcanic features and landforms

Positive

1. Geysers are used in production of geothermal power in the rift areas of Kenya.
2. Volcanic features are tourist attractions and East Africa earns a lot of foreign currency from them e.g. Mt. Kilimanjaro,hot springs etc.
3. The hotsprings like Kitagata, Kibiro in Western Uganda are used for curative purposes.
4. Volcanic rocks weather to produce fertile soils which can be used for agriculture e.g. Kigezi in Western Uganda and Kenya Islands
5. Volcanic features are also used for research and study purposes.
6. Volcanic mountains contribute to the formation of relief rainfall e.g. Mt. Elgon and Kili.

7. Mountains such as Elgon and Kenya are used for settlement purposes e.g. Bagisu and Chagga on Kilimanjaro slopes.
8. The Mountains also have thick forests on them which are used for lumbering purposes.
9. Volcanic mountains are sources of useful rivers e.g. R. Tana from Mt. Kenya is used for hydro Electric Power generation, navigation, irrigation etc.

Negative

1. Steep mountain slopes encourage the development of soil erosion and therefore soil conservation measures like terraces have to be employed e.g. Mt. Kenya.
2. Sleep sloes also led to development of landsides which destroyed lives, crops and animals e.g on Mt. Elgon.
3. Sleep slopes also make it difficult to construct roads and railways in the hailed areas.
4. Volcanic mountains act as communication barriers e.g. Mt. Kilimanjaro between Kenya and Tanzania.
5. The Mountains also have rain shadows on their lee ward side which receive no rain with hinders agriculture and settlement.
6. Young volcanic soils are infertile and do not support agriculture.
7. Low temperature and snow which hinder settlement.

REVISION QUESTIONS

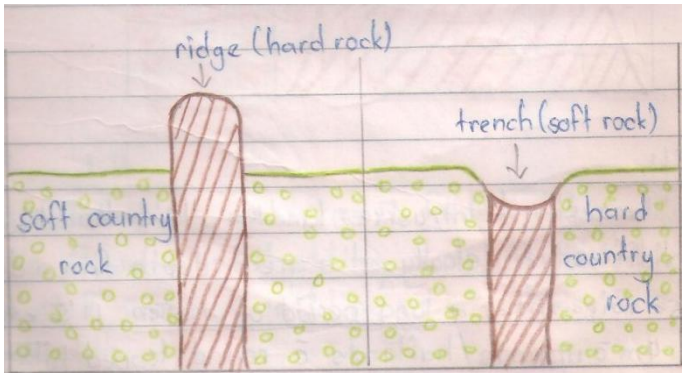
1. With the aid of specific examples, describe the influence of extrusive volcanicity in East Africa.
2. Describe the volcanic features formed by acidic lava in East Africa
3. Explain how each was formed: Mt. Kilimanjaro
   Mt. Kenya
   Mt. Elgon
4. Explain effects of mountains o man/human activities in East Africa.

INTRUSIVE VOLCANICITY

It is the process through which magma from underground solidifies within the earth's crust to form intrusive volcanic land forms. They remain underground and are invisible until exposed to the surface after long periods of erosion. Different types of land forms development depending on where and how deep the magma was before it cooled.

1. Duke

It's formed when magma solidifies vertically in fissures before reaching the surface to form a wall like land form. After a long period of erosion it's exposed on the surface either as a ridge or a trench.



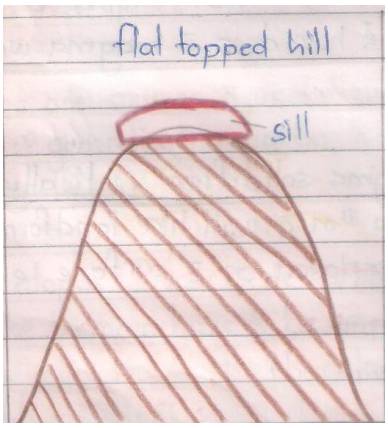
When the dyke is composed of hard resistant rocks, the surrounding soft country rock is easily eroded away and it remains upstanding as a ridge/highland. Example of ridge dykes can be found in the Sukulu hills near Tororo.

On the other hand if the dyke is composed of soft rocks as compared to the hard Country rock surrounding it. It will be eroded away to form a shallow depression/trench. When such a trench is filled with water. It's now known as an arena e.gRubanda arena in Western Uganda.

2. A sill

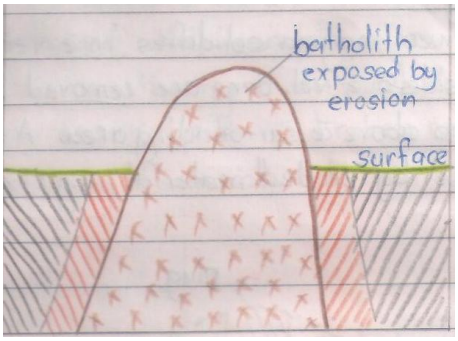
Is a thin sheet of basic magma and is formed when magma cools in horizontal layers along bedding planes of sedimentary rocks. After a long period of erosion, it's exposed on the surface in various ways.

Sometimes, if its upper side flat, erosion may expose it as a flat topped hill. The sill will protect the underlying soft rocks below it. Sometimes as an escarpment with steep slopes. When it occurs along a river, it will lead to formation of numerous rapids and falls e.gThika falls in Kenya.



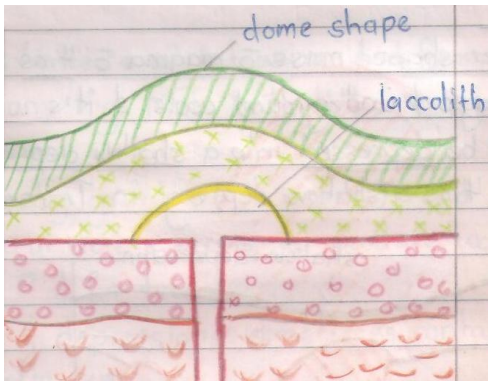
3. A batholiths

It's the largest intrusive land form. It's formed when basic magma solidifies very slowly at a great depth from a deep seated magma reservoir. After a long period of erosion it's exposed on the surface in form of uplands/highlands of round topped hills covering 100Sq.Km. sometimes the country rocks next to it are metamorphosed (changed) by the heat. Batholiths are usually composed of hard granite rocks. e.gMubende in Western Uganda andParabang in northern Uganda.



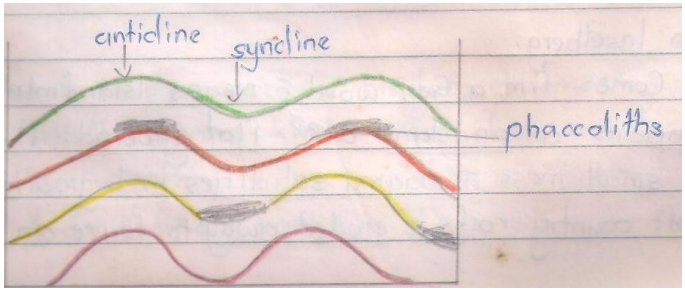
4. A laccolith

It's a dome shaped landform with a flat base. It's formed from acidic magma which fails to reach the surface. It pushes the layers with land above it to form a dome shape. Sometimes there are subsidiary laccoliths above the main one or they can be formed one ontop with another e.g. laccolith near Voi in Kenya.



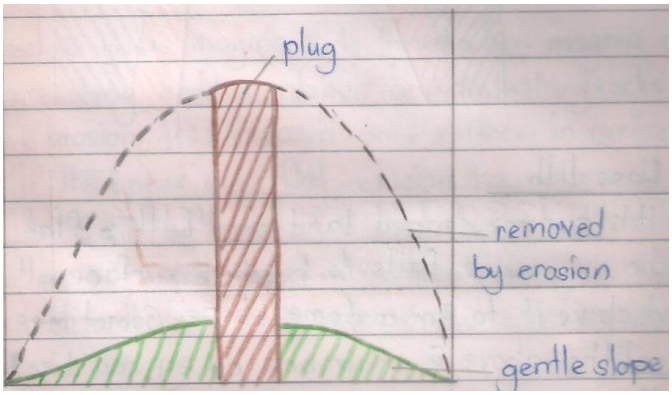
5. A Phaccolith

It's found only in areas with folded rocks. It's formed when magma flows along bedding planes of folded rocks and solidifies either at the top of an anticline o at the base of a syncline to form a phaccolith.



6. A Volcanic Plug

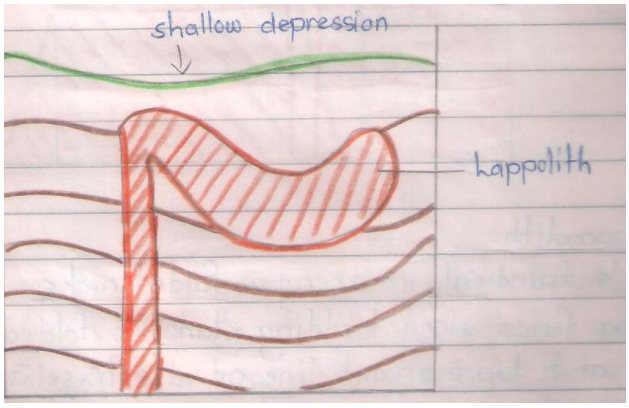
It's formed when magma solidifies in the vent of a volcanic cone. With time the side of the volcanic cone are removed by erosion to leave the plug standing up above the surrounding area. A gentle slope may be formed at the base by eroded material e.g. Tororo rock in East Uganda.



7. A Lappolith

It's a saucer shaped mass of magma which forms a shallow basin. It's formed when magma underground cools and it is weight causes the under lying rocks to be depressed into a shallow

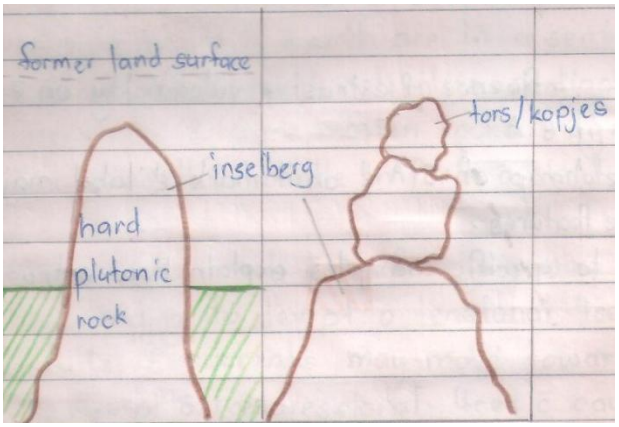
depression. The earth's surface) also forms a shallow depression e.g. in Transvaal in S.Africa.



8. An inselbelg

Comes from a German word which means Island Mountain. It's a hill which appears as an island over flat ground. It's formed when a small mass of magma solidifies underground. The surrounding soft country rocks is eroded away to leave an isolated steep hill.

It's usually composed of hard plutonic rocks. There are many examples in Mubanda, Nakasongola, Tororo and parts of Northern Uganda. Sometimes Physic wreathing of an inselberg results in formation of tors and kopjes. These are piles of broken rocks seated on the top of a formed inselberge.g Bismarck rock near Mwanza in Tanzania.



Importance/effects of intrusive land forms

1. Tourist attractions e.g. Mubende Batholiths and earn the country a lot of foreign exchange.
2. Inselbergs usually contain granite which is used for road and house constructions.
3. Where sills occur across rivers, they produce waterfalls which are used to generate Hydro Electric Power and for tourism.
4. Dyke arenas and depressions sometimes contain water which can be used for domestic purposes.
5. Volcano plugs usually contain valuable minerals e.g the mwadui volcano plug contains diamonds and Tororovolcano plug contain limestone etc.

Negative

1. Batholiths hinder construction of communication such as roads which have to go round them.
2. Batholiths also have steep slopes which hinder settlement.
3. Rocky areas with tors, kopjes hinder agriculture because of rocky nature.
4. Intrusive land forms weather to produce thin infertile soils which are usually acidic and do notfavour agriculture.
5. When sills occur across rivers, they produce waterfalls and rapids which hinder navigation etc.

REVISION QUESTIONS

1. Examine the land forms that result from intr. Volcano action in East Africa
2. Outline their importance to man
3. Describe the influence of extrusive vulcanicity on the development of relief and land forms in East Africa
4. Draw a sketch map of East Africa and on it mark and label major intrusive and extrusive features.
5. With reference to specific examples explain how extrusive features are formed.

FAULTING

Is an androgenic/tectonic process in which the earth crust is fractured leading to displacement of rocks.

A fault is a crack/break/facture in the earth's crust. It can be a normal fault caused by tension, a reversed fault caused by compression or a tear fault caused by lateral movements.

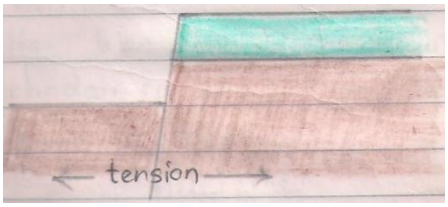
The rocks in the core of the earth are in a semi molten state as a result of geochemical activities, radioactive decay and intense pressure. The same molten rocks/magma begins moving upwards in the earth's mantle in form of giant convectional currents.

When the currents reach the surface, they may move away from each other leading to development of tensional forces which cause normal faults. The currents may move towards each other leading to development of compressional forces that are responsible for the development of land forms, formed by faulting in East Africa, such land forms include; rift valleys, escarpments, grabens, tilt blocks etc.

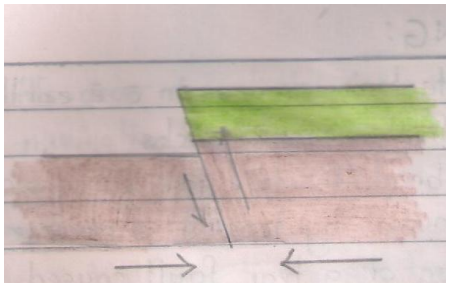
Types of faults

There are basically four types of faults

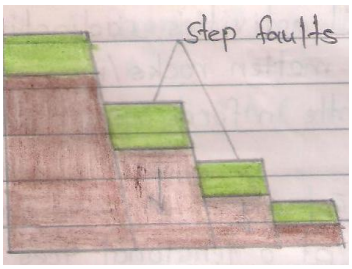
1. **Normal faults** caused by tensional forces which pull the land apart and rocks on one side of the fault slip downwards.



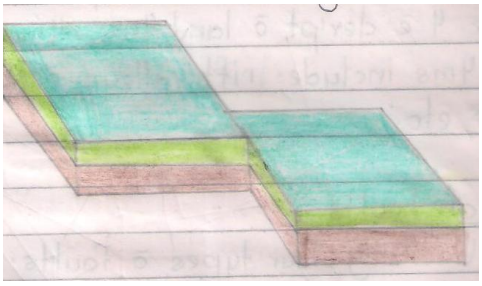
2. **Reversed faults** caused by compressional forces which push the land together and the rocks on one side of the fault move upwards over those on the other side.



3. **Step faults** which arise from **parallel faulting** and are also due to tensional forces. Each section between the faults moves downwards relative to the other.



4. **Tear faults** caused by **parallel forces** which move in opposite direction to each other. There is **horizontal displacement of rocks** but the surfaces are still at the same level. Such faults usually occur during earthquakes.



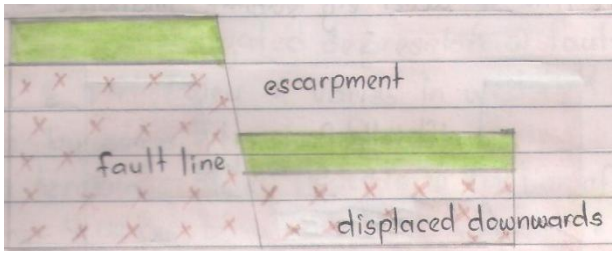
Land forms caused by faulting in East Africa

i) Escarpments
ii) Fault guided valleys
iii) Tilt blocks
iv) Grabens
v) Block mountains/horsts
vi) Rift valleys

Escarpments

Is defined as a steep slope where land falls from a high to a low level. It's formed when convectional currents underground lead to the development of tensional forces and a fault is formed. The rocks on one side of the fault are displaced downwards to form a fault scarp/escarpment.

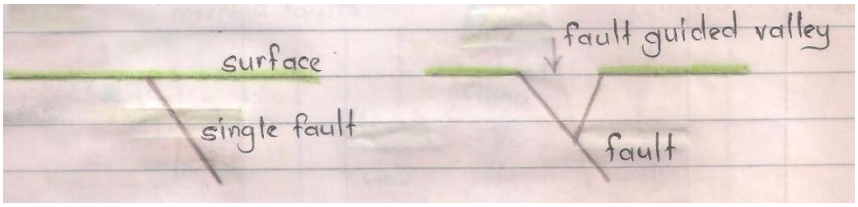
If it occurs in an area which a river, a waterfall may be formed. An example in East Africa include Butiaba, Elgeyo and Nandi escarpments.



Fault guided valley

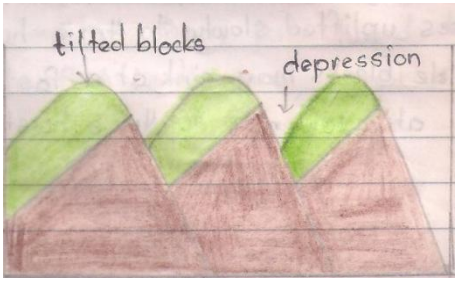
Occurs where a single fault develops in the land as a result of tension/compressional forces. The rocks along the fold are displaced and shattered/broken and are easily eroded away as a river to from a fault guided valley.

The river valley follows the orientation of a fault line e.g. R Aswa in Northern Uganda.



Tilt block

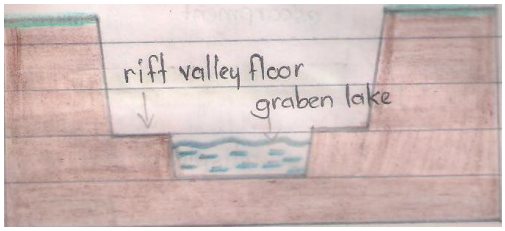
Formed when one side of a fault blocks/uplifted higher on the other side tilts. When many blocks in an area become tilted, egAbadare ranges, tilt block scenery is formed composed of angular ridges and depressions.



Graben

A narrow depression found in the rift valley. After a rift valley had been formed by either tensional/compressional forces, sec.

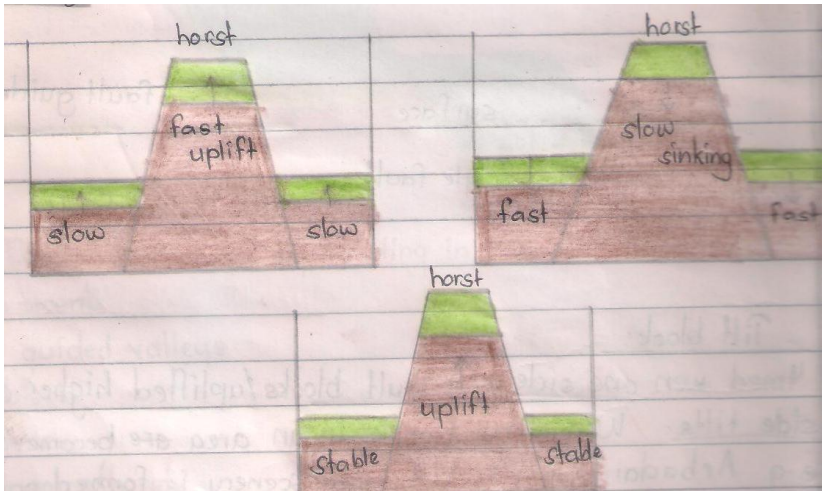
When they are filled with water e.g formation of Lake Albert.



Block Mountains

An upload bordered by fault scarp. The lead to them is divided into underground convectional currents led to development of comp. and forces which led to formation of reversed faults. The

landscape is divided into different fault blocks and a block mountain is formed by differential uplift or sinking.



The middle block may occur uplifted at a fast rate while the while she passes uplifted slowly to form the horst.

Secondly, the side blocks may sink at a fast rate while the middle to form the sources at a slow rate to form the horst.

Thirdly, the side blocks may remain stable while middle is upliftedeg, Usambara, Pare, Ulugura.

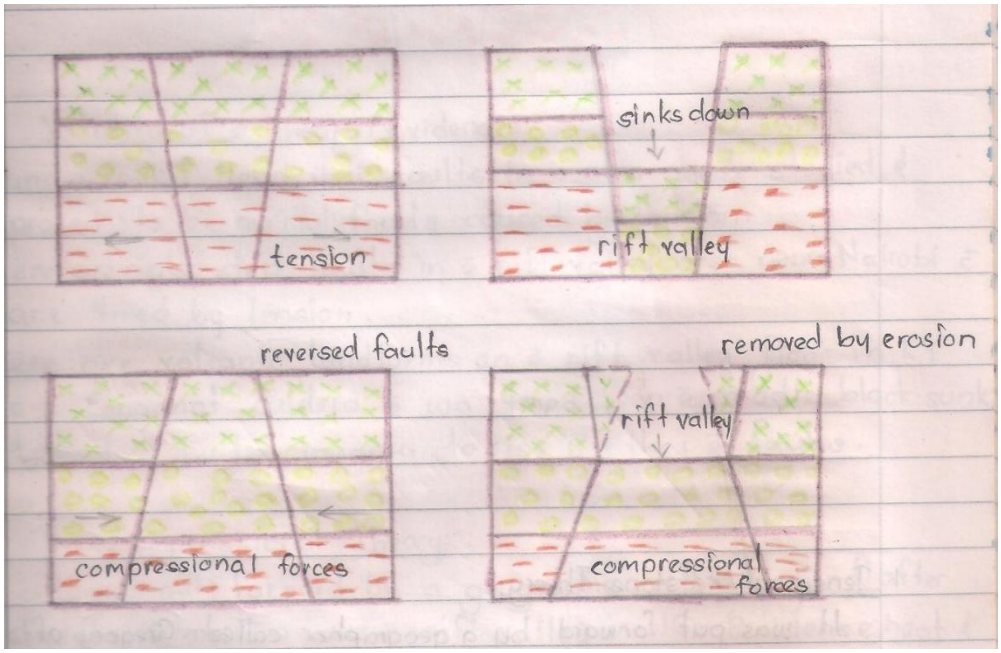
Rift valleys

Defined as an elongated depression with fault scarps on either sands. It usually has a flat or nearly flat floor and varies in width and depth. It can be formed by tensional or compressional forces.

When tensional forces pull the land apart, they lead to the formation of normal faults. The middle blocks sinks to form the floor of a Rift Valley. The side blocks remain as the escarpments or scarps.

When compressional forces push the land together, they lead to the formation of reversed faults. The side blocks override the middle block to form rift valley with sharp points which are later removed by erosion.

Diagrams showing tensional and compressional forces acting on the land.



THEORIES OF RIFT VALEY FORMATION

The East African rift valley system is in the form of inter-connected troughs in which we find most of the lakes in East Africa. It has an average width of 15km with escarpments on either side.

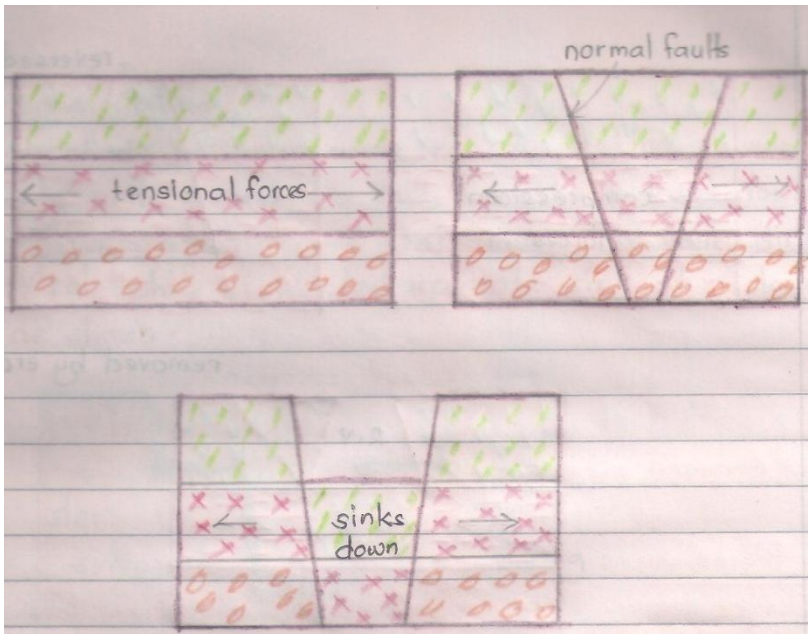
Draw a sketch map of East Africa showing the extent of the Rift Valley:

Three theories have been put toward to explain the formation of rift valley in East Africa i.e tensional, compressional and different, uplift theory.

1. **Tensional/ keystone theory**

   It was forward by a geographer called Gregory after studying the Eastern arm of the rift valley in Kenya. He defined it as a depression found between two parallel normal faults.

   The intense heat and pressure within the core of the earth cause the rising convectional currents to move apart causing tensional forces. These lead to the development of normal faults. The rock layers are pulled a par and the middle block sinks to form the floor of rift valley.



Validity of the theory/ evidences

i) Underground trend of the faults in the area were studied and proved to be normal faults caused by tension.

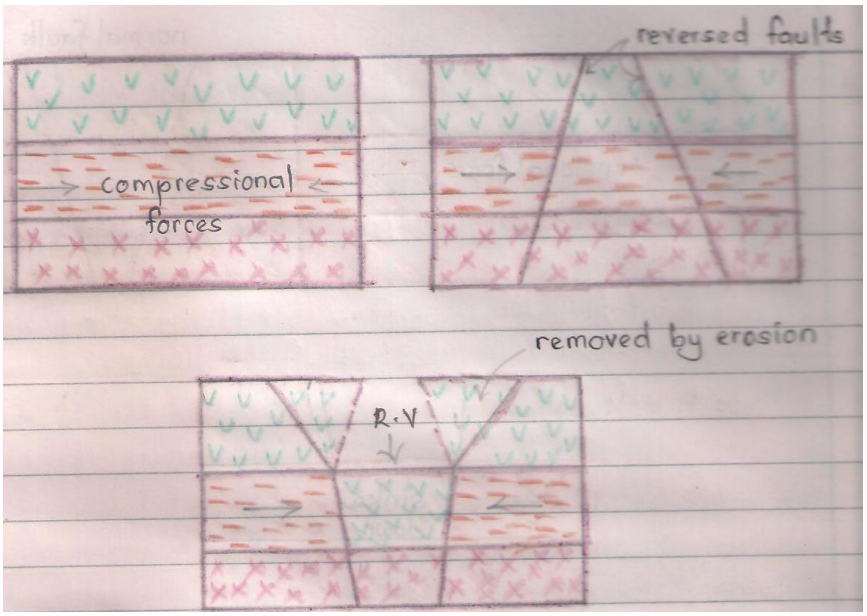
ii) There are also step faults in the rift valley area near Nairobi which are formed by tension.

iii) There are volcanic landforms on the rift valley floor in Kenya e.glongonot caldera which formed when the middle block sunk and forced the molten magma to rise up through the faults.

2. The compressional theory

It was put forward by a geographer called Wayland after studying the western arm of rift valley in Uganda. The intense heat and pressure within the core of the earth caused rising convectional currents to move towards each other causing compressional forces. These led to reversed faults.

The two side blocks were forced to over ride the central block to form a rift valley which sharp points. The sharp points were later removed by erosion to form a more open rift valley.



Evidences

i) The underground trend of faults in the area were studied and proved to be reversed faults caused by compression.

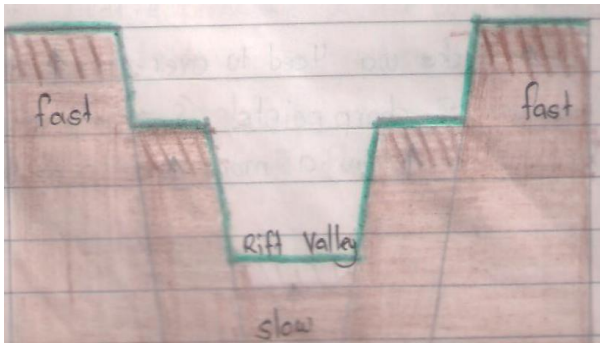
ii) Rift valley floor in Uganda also has numerous explosion craters and lava outpourings which were formed when magma passed through reversed faults.

3. The differential theory

It was put forward by a geographer called **Dixey** and can be explained in two ways.

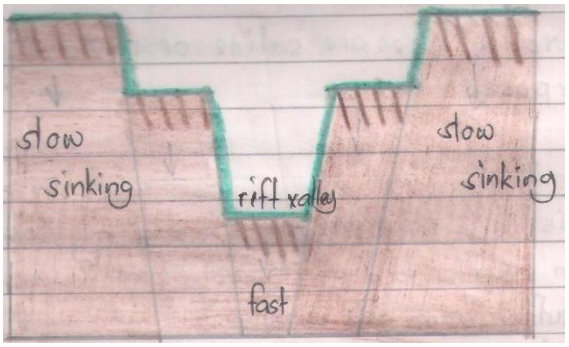
i) Differential uplift

Underneath the earth, there are rising convectional currents which uplift the blocks of land at different rates. The part that forms the rift valley is uplifted slowly while the escarpments uplift quickly.



ii) Differential sinking

Alternatively in areas where there are sinking convectional currents underground, they pull the blocks of land downwards at different rates. The part that forms the rift valley sinks at a fast rate while the sides/escarpments sink at a slower rate as shown.



Importance of faulting and related land forms in East Africa:

Rift Valley

Positive

1. Rift valley plus other land forms such as escarpments are tourist attractions and earns the East African countries foreign exchange.
2. Grasslands on rift valley floor are used for pastoralism by Masai.
3. Grasslands are also used to establish national parks for wildlife e.g Queen Elizabeth National Park in Uganda (west), Tsavo National park in Kenya etc.
4. Lakes/grabens are used for transport e.g. Lake Albert, Tangaetc
5. Fishing e.g. in Lake Turkana, Lake Tanganyika
6. Mining of soda ash e.g. L Magadi (Trona)
7. Tourism e.g. flamingos on Lake Nakuru.

Block Mountains

8. Used for settlement e.g. Bakonjo on Mt. Rwenzori
9. Fertile soils are used for agriculture e.g. Arabic coffee
10. Helps in formation of relief rainfall in surrounding areas.
11. Tourist attraction because of snow and ice at the top.
12. Mountain streams such as R. Sebwe is used for irrigation in Mobuku irrigation scheme.

Negative

1. Steep sides hinder construction of communications such as roads and railways
2. Steep slopes also favour soil erosion
3. Steep slopes are prone to landslides of destroy people and property.
4. Some parts of rift valley floor are dry and hinder settlement and agriculture e.g Lake Albert flats
5. Some of rift valley lakes are saline or salty and cannot be used for domesticpurposes.

Block Mountains

6. Lee ward side is in the rain shadow and is dry e.gKasese
7. Communication barrier between Uganda and Congo (Mt. Rwenzori)
8. Steep slopes suffer from soil erosion
9. Steep slopes also prone to land slides
10. Low temperatures at the top because of snow and ice hinder settlement and agriculture etc.

REVISION QUESTIONS

1. Describe the influence of faulting on the development of landforms in East Africa
    - Define faulting and a fault
    - Explain the underground processes all the way from the core and mantle up to development/formation of tensional and compressional forces
    - For each land form; Define
      Explain formation
      Give relevant example(s)
      Draw the diagram

    NOTE: All forces must be inside the diagrams especially for the rift valley
    - Draw a map of East Africa showing part of the Rift Valley
    - Conclude
2. Examine the theories that have been formed on rift Valley

b) Outline the importance of the rift valley to man in East Africa.

- Define faulting and a fault
- Explain the underground occurrences
- Map of the is a must
- Describe the three theories given

NOTE: All forces must be inside the diagrams

- Conclude

b) For each importance, give relative example.
   - Avoid collective term 'they' but be specific

4. Explain how the following examples and how they were formed
   - Mt Rwenzori
   - Mt Kilimanjaro

b) Explain importance of these mountains

- For each mountain describe fault
- Describe formation
- Draw a small diagram
- Conclude
- Give both positive and negative
- Each importance
- Avoid using they and be specific etc

5. Discuss the land forms formed by faulting in East Africa

b) With reference to specific examples outline the importance of faulting to man in East Africa.

6. Examine the influence of faulting on the relief and drainage of east Africa

   Intro-define faulting as an endogenic process in which the earth's crust is fractured leading to displacement of rocks. Define a fault-clearly explain the origin of faulting i.e geochemical and radioactively decay in the rocks which melt the rocks, pressure differences which cause magma to begin moving upwards where press is low. On reaching the surface, with no outlet, it moves laterally to create tensional and compressional forces.

   Influence on relief and drainage

   Discuss the features on their own followed by their influence on drainage/they can be integrated as shown below

   Formation of an escarpment/fault scarp

   Define an escarpment; steep slope where land falls from a high to a low level.

   Example: Elgeyo, Nandi; Butiaba

   Influence on drainage

11. Development of parallel drainage patterns e.g. at Butiaba escarpment all rivers flow parallel to each other from a steep area which is an escarpment.
12. Fault guided valley formed where a single fault falls into the land and the rocks beneath, shattered and a valley is formed.

13. Describe processes responsible for development of fault scarps in East Africa.

    Approach- Define fault scarp

    It is formed in 3 different ways

    1. Through tensional forces: where there are diverging convectional current they lead to formation of normal fault in landscape. Block on one side displaced downloads to form a difference in height and a fault scarp is formed. Draw diagram.
    2. Compressional forces lead to reversed faults in the land. One side is pushed upwards. This will lead to formation of fault scarps but after a long period of erosion and denudation, steepness is reduced.

    3. Fault scarp are formed thru differential movement or uplift. Write a paragraph about different uplift and another between different sinking then draw the diagrams.

    NB it is easier to explain formation of fault scarps separately rather than together with the rift valley formation which may be difficult.