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Physical geography Chapter 3: Vulcanicity in East Africa

Volcanism, volcanism or Vulcanicity is the phenomenon of eruption of molten rock (magma) onto the surface of the Earth or a solid-surface planet or moon, where lava, pyroclastic, and volcanic gases erupt through a break in the surface called a vent.

Vulcanicity takes place when high temperature and pressure builds up into the mantle. The high temperatures is due to radioactivity, geochemical reactions and friction at plate boundary while high pressure may result from the weight of overlying rocks on the mantle, expansion of melting solid earth crust and evaporation of molten magma.

When magma pours onto the surface it loses its gases and becomes lava. Lava/magma may be acidic due to proportion of silica (above 66%) or basic due to low content of silica.

Acidic lava is viscous and largely immobile. It solidifies quickly to form steep land forms and therefore does not spread over a wide area. Basic and ultra-basic lava takes long to solidify and spreads over wide area thus forming extensive lava plains and large shield domes.

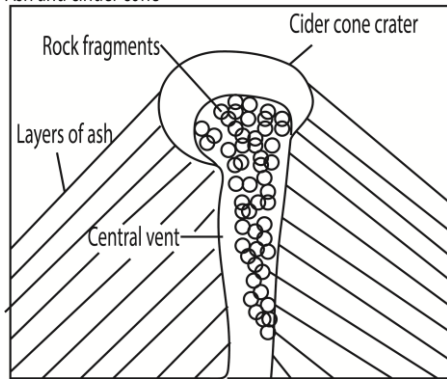
Extrusive features formed by vulcanicity include the following

These are volcanic features formed from molten material magma that has flowed out of cracks in the Earth's surface.

Ash and cinder cones

These are small steep sided cone shaped hills usually less than 200m formed by very violent eruption of many fragments of various sizes with ash being smaller than cinder. They gradually build layers of a conical hill with a bowl-shaped crater at the top.

Ash and cinder cone



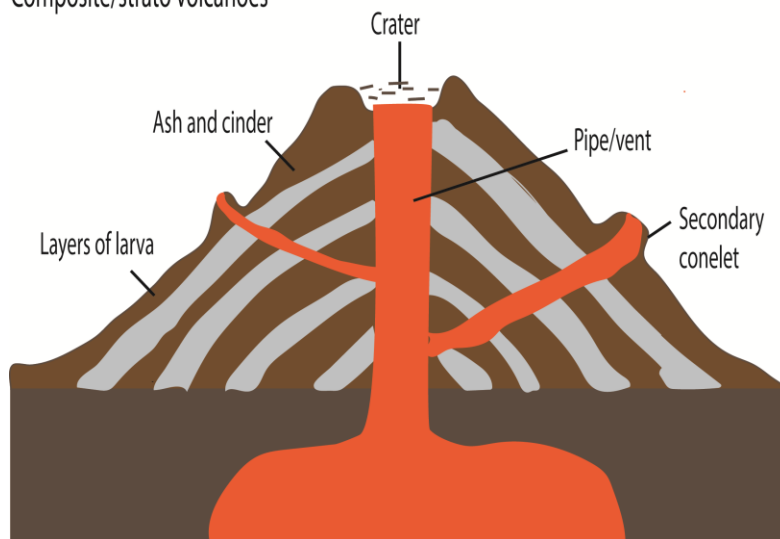
Examples in East Africa include Teleki, Likaiyu, in Kenya and Muganza, sagitwe in Uganda

Composite cones/strato volcanoes

These are usually large volcanic cones with fairly steep slopes. They are made of alternate layers of ash and lava ejected through a central vent over a long period of time. Each layer of lava over ash represents a phase of eruption.

Examples of composite cones/ strato volcanoes are Mt. Kilimanjaro, Meru, Mt Mubabura on Uganda - Rwanda border.

Composite/strato volcanoes



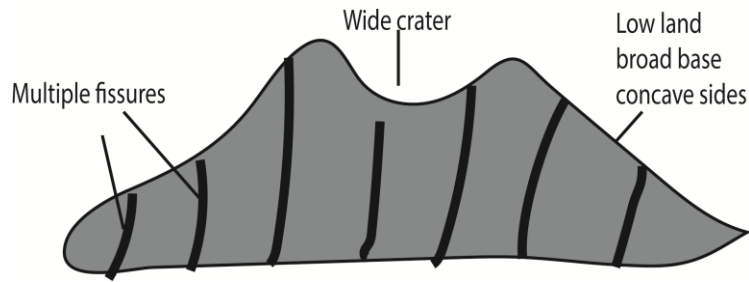
Shield volcanoes

A shield volcano is a broad volcano with sloping sides that is formed mainly out of runny lava that flows out of its central/multiple fissures.

They are built by repeated eruptions that occurred intermittently over vast periods of time (up to a million years or longer). Shield volcanoes are much wider than they are tall. Examples include

Nyamulangira volcano in Eastern DR Congo.

Shield volcanoes



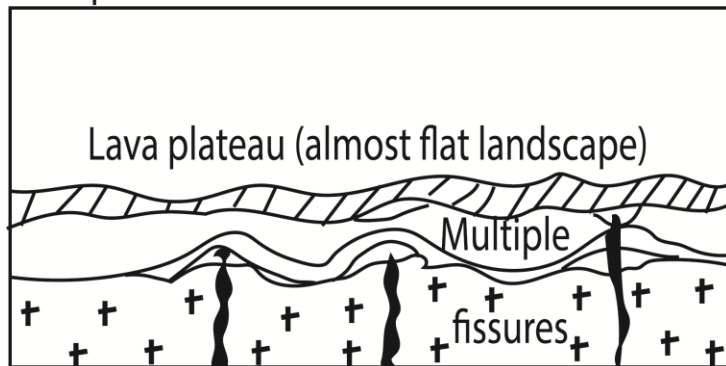
Lava plateaus

A lava plateau is upland with more or less monotonous relief and formed by different or successive layers of lava.

It's formed by a quiet eruption that basic and therefore fluid lava flows out through several fissures/cracks in the earth crust and spreads out over a long distance covering any original valleys and hills on the landscape before solidifying as a sheet of basalt. Repeated fissure eruptions lead to the building of thick and high plateau which may reach 6000feet high.

Examples include the Laikipia plateau on the eastern slopes of the Aberadare ranges in Kenya, Yatta plateau, Kisoro lava plateau, etc.

Lava plateau



Volcanic plug

Volcanic plugs are very steep sided volcanic features that stand out prominently above the ground. Volcanic plug is formed by a very explosive eruption where viscous magma is extruded out as a rigid cylindrical mass amidst clouds of hot ash and cinders

Volcanic plug

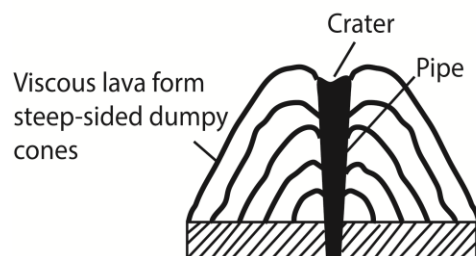
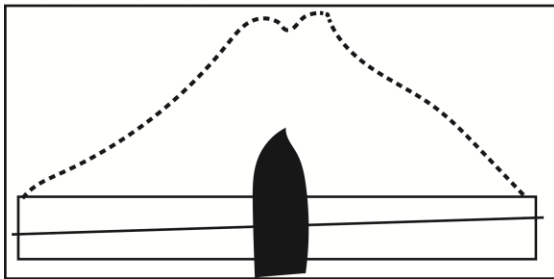


Volcanic neck

Volcanic neck was formed when lava solidified in the vent of a volcano and later exposed by the erosion of the surrounding cone.

Examples include; Mawenzi peak on Mt. Kilimanjaro, Batian and Nelion peaks on Mt Kenya, etc.

Volcanic neck



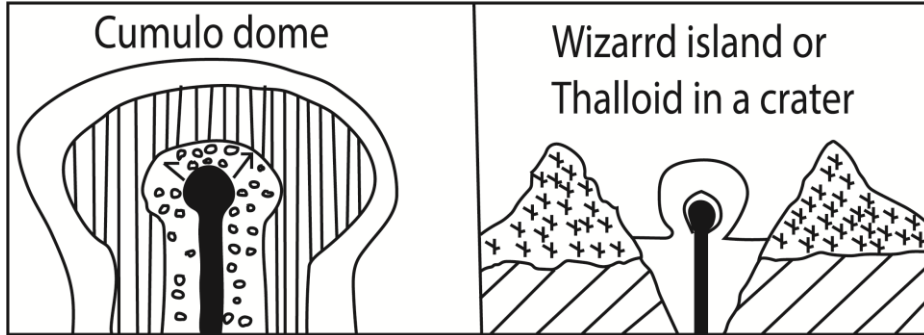
Cumulo dome

Cumulo dome is a steep-sided mound that is formed when lava reaching the Earth's surface is so viscous that it cannot flow away readily and accumulates around the vent.

When it forms into a crater, it is called a Thalloid or wizard Island.

Examples are Ntumbi cumulo dome in Tanzania, Gombe and Nakasongola domes in Uganda. In Kenya, they are found in the Tsavo National Park, Thalloids are found in a Caldera on top of Mt Rungwe in Tanzania.

Cumulo and Thalloids



Caldera

A caldera is a depression created after a volcano partially collapses after releasing the majority of its magma chamber in an explosive eruption. e.g. Ngorongoro

Caldera



Hot springs, Geysers and Fumaroles

Hot springs are springs with water at temperatures substantially higher than the air temperature of the surrounding region.

Most hot springs discharge groundwater that is heated by shallow intrusions of magma (molten rock) in volcanic areas or rocks heated by radioactivity or geochemical reaction.

Examples are found at Kitagata and Sempaya, Rwagimba, Ilimbo and Kisizi in Uganda. Majimoto in Tanzania, etc.

Geysers involve the periodical ejection of steam and hot water from the country rocks. They are formed when rain water seeps underground through small fissures and collects in an underground cavity on super-heated rock due to radioactivity. As the water is boiled up by the superheated rocks, steam and pressure powerfully pushes jets of water and steam through the thin or narrow openings. The water on top again seeps down and the same process is periodically repeated. Examples of geysers are found at Lake Bogoria in Kenya. In U.S.A the "Old faithful" geyser in the Yellow stone national park erupts regularly every after thirty minutes.

Geysers



Fumaroles are openings in the earth's surface that emit steam and volcanic gases, such as sulfur dioxide and carbon dioxide. Examples are found in the craters of Mt. Kilimanjaro, Mt. Longonot in Kenya rift valley.

Fumaroles



Intrusive volcanic features

These are volcanic features formed when magma solidify within the earth crust. They include

Batholiths

A batholith is a very large dome shaped intrusions of igneous rock that forms when magma rises into the

earth's crust, but does not erupt onto the surface.

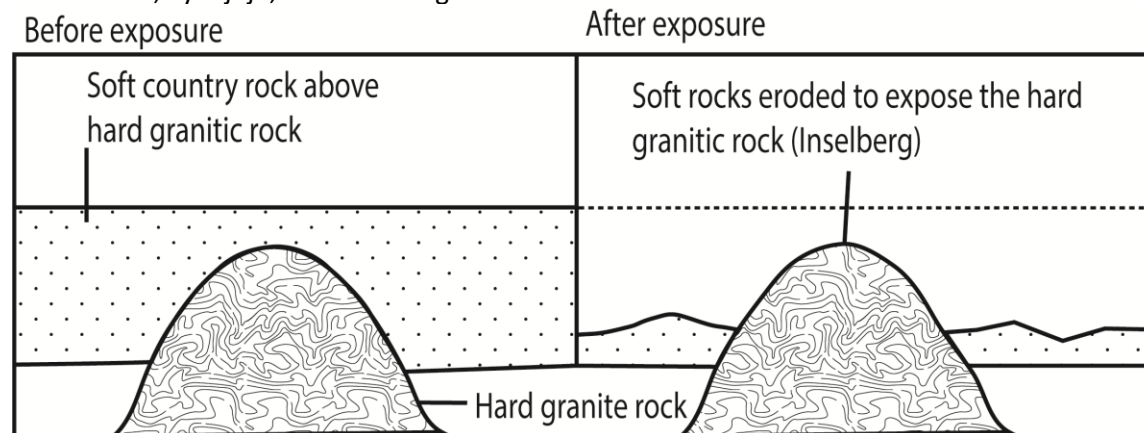
Batholiths are normally composed of hard and resistant granite rocks but may be exposed by denudation process such as erosion and weathering.

Examples of Batholiths are Mubende Batholith, Nakasongola, Luwero and Singo Batholiths. In Kumi there is Kachumbala Batholith, and Kakamaya in Kenya. In Tanzania they are found at Mwanza (Bismack rock) and Sukuma land.

Inselbergs

An inselberg is an isolated hill of hard volcanic rocks that has resisted denudation processes such as erosion and weathering.

Examples include exposed batholiths in Mubende, Singo, Parabong, Nakasongola, Labwor hills, kyenjojo, between Iringa and Mwanza in Tanzania etc.



Dykes.

- These are vertical (wall -like) or steeply inclined igneous rock structures, cutting across rock strata.
- They were formed from intrusion of magma solidifying into igneous rock structure along vertical fissures/ lines of weaknesses.
- They vary from few centimeters to hundreds of meters.
- They are always discordant cutting across the bedding planes of rock strata/ preexisting intruded rocks rock.

Dykes



Ridges

A ridge is a long, narrow, elevated geomorphologic landform, structural feature, or a combination of both separated from the surrounding terrain by steep sides, like ridges such as those in Busia, Sukulu, Isingiro, Kisumu, Rungwa complex etc.

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Ridge



Trenches

- When soft dykes in compression with neighboring hard rocks may be worn away forming trenches (long narrow ditch like depressions) on the surface e.g. linear trenches near Lake Turkana, in Kenya

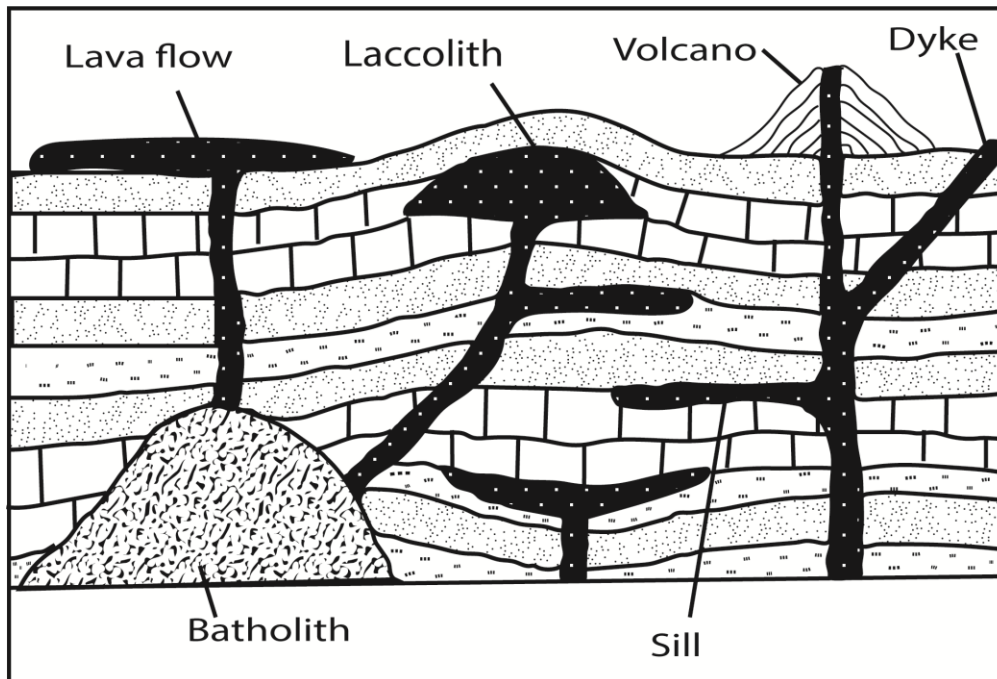
Sills

- These are horizontal sheets of igneous rock structure lying between the bedding planes.
- Formed when magma rises, spreading horizontally and solidifying between the bedding planes of rock strata.
- Vary in thickness and may extend for many km. When exposed by denudation they form flat topped hills, cliffs
- Where sills are hard compared to soft surrounding rocks, they are exposed forming flat topped hills, escarpments or cliffs as relief land forms e.g. kakinzi in Luwero, Thika district (thika falls as sills are

crossed by rivers) in Kenya etc.

Laccoliths

- These are dome shaped intrusive igneous rock structures with a flat base
- They are formed from injection of viscous magma into the layers unable to spread far, accumulating in a large mass.
- The viscous magma forced the overlying rock strata to bend upwards hence dome shaped as it solidified



Uplands

- When exposed by denudational forces, laccoliths have formed uplands when harder than the surrounding rocks e.g. Kitui, Voi areas in Kenya etc.

The importance of vulcanicity to economic development of East Africa

Vulcanicity has both positive and negative effects.

Positive effects

- Volcanic rocks weather into fertile soils for Agriculture for growth of bananas and Arabica coffee on the slopes of Mt. Elgon and Mt. Kilimanjaro.
- Minerals like diamond, limestone, salt are associated with vulcanicity e.g. Salt from L. Katwe in Uganda
- Igneous rocks are quarried into small pieces for concrete e.g. at Bukasa hill in Muyenga.

- Intrusive features such as sills when crossed by rivers form spectacular waterfalls e.g. Sezibwa and Bujagali falls in Uganda. Falls may be used to generate hydroelectricity.
- Hot springs water contains sulphur and other minerals the cure different diseases e.g. at Kitagata.
- Volcanic mountains like Mt. Kilimanjaro provide magnificent scenery that attracts tourists.
- Volcanic mountains influence formation of orographic rainfall on the windward side
- Volcanic features are homes of wild animals and plant gazzeted as game reserves for tourism and conservation

Negative effects

- Volcanic eruption leads to loss of life and properties
- Vulcanicity has produced rock deserts of lava around L. Turkana region in Kenya.
- Volcanic mountains promote arid conditions on the Leeward side.
- Landslides occur on volcanic mountains such as Elgon destroying lives and property.
- Volcanic mountains like Mt. Elgon and Kigezi highlands promote soil erosion
- Agricultural mechanization is limited in volcanic highlads
- Construction of roads and railways is very expensive in volcanic highlands and mountains.

Revision questions

1. Examine the importance of vulcanicity on land forms and drainage evolution in East Africa.
(25marks)
2. (a) Describe the effects of intrusive features on the development of relief and land forms in East Africa.
(b)Asses the importance of vulcanicity to economic development of East Africa.
3. Account for the formation of volcanoes in East Africa.