

## **GLACIATION IN EAST AFRICA**

### **Introduction**

Glaciation is a process of glacier formation and accumulation.

A glacier is a mass of ice flowing down slope or it's a nice river. In East Africa, glaciers are found on the following 3 mountains, Mt. Rwenzori, Kenya & Kilimanjaro.

The level above which there is perpetual snow cover is called a snow line.

Glaciers perform 3 major roles i.e. erosion, transportation and deposition.

### **GLACIAL LANDFORMS**

Glacial landform are categorized into two:-

Glacial erosional landforms

Glacial depositional landforms

### **GLACIAL EROSIONAL LANDFORMS**

Glacial erosional landforms are produced by 2 major processes i.e.

#### **Plucking**

This is tearing away of blocks of rocks by a glacier presence of a crack.

#### **Abrasion**

This is wearing or polishing away of rocks by a glacier.

### **Other erosional processes include the following:-**

Freeze and thaw

Basal sapping

The above processes have led to the formation of glacial erosion landforms on mountains. Rwenzori, Kenya and Kilimanjaro.

These landforms include the following;

- Corrie /arque/crom
- Arêtes
- Pyramidal peaks/horns
- Hanging valleys
- Truncated spurs
- Crag and tail
- Roche montanee

### **1. CORRIE / CIRQUE / CWM**

A corrie is a steep sided rock basin (arm-chair) formed by glacier erosion on the side of a mountain.

It is formed when water freezes into the cracks in rock and later breaking into particles.

#### **NB:**

If a corrie contains water, it is called a glacial lake or a tarn.

Examples of tarn in East Africa; Lake Teleki, Lac du speke, Lac Catherine, L.Baker, L.Speke, Tyndoll.

## **2. ARETE**

An arête is a narrow steep sided rock ridge or knife-edge like ridges separating two cirques e.g. Arete radiating eastward down to Mugusu valley.

## **3. PYRAMIDAL PEAK / HORN**

This is a pointed peak formed where 3 or more arêtes meet. It is formed by back wall recession.

## **4. U-SHAPED VALLEY**

This is a broad valley with flat bottom. Originally it was a small valley but widened by processed plucking and abrasion e.g. Mugusu, Bujuku, Teleki valley e.t.c.

## **5. HANGING VALLEY/WATERFALLS**

A hanging valley is formed when a small tributary joins a major stream of glacier. The major stream erodes its valley faster than its tributary. Thus deeper than the tributary valley.

This makes the tributary valley to remain hanging up as a hanging valley.

**NB:** The hanging valley will then pour its water into the main valley to form a water fall.

e.g. Speke glacier, joining Bujuku valley.

## **GLACIAL DEPOSITION LANDFORM**

The deposit or load carried by a glacier is known as moraine which can be;

- Lateral/side
- Dorsal (top)
- Medial (middle)
- d) Ground (bottom)

Glacial deposition landforms include the following

- Drift
- Tills
- Erratic
- Eskers
- Kames
- Out wash plain
- Kettle holes
- Moraine dammed

### **ESKERS**

It is a long winding stick sided ridge lying parallel to the direction of the ice movement e.g. river Nithi gage valley, Mobuka valley

### **KAMES**

This is an irregular undulating mounds of bedded sands and gravel deposited randomly.

### **KAME TERRACE**

A narrow flat topped like ridge of sand gravel along the valley sides e.g. Kamusoso valley on Mt. Rwenzori, Hobley valley on Mt. Kenya.

### **Erratic**

Boulders transported by moving ice for a long distance & deposited e.g. Nithi valley, Bujuku, Kamusoso valley.

### **Till plain**

This is an extensive area of mountains landscape formed when moving ice transport boulders and clay covering former hills and valleys e.g. Teleki valley, Mobuku valley.

### **Drumlins**

These are elongated hills formed when fragments of brown moraine are compressed by ice movements e.g. Teleki valley.

### **Outwash plains**

A wide gently sloping plain of gravel, sand, clay and silt e.g. Kibo and Mawenzi on Mt. Kilimanjaro and Mobuku and Bujuku valleys on Mt. Rwenzori.

### **Moraines**

Unsorted glacial deposits made up of boulders, clay, silt & sand.

### **Kettle holes**

These are circular holes in glaciated areas formed when blocks of ice are detouched leaving behind circular depressions e.g. Mahoma kettle hole on Mt. Rwenzori.

### **Moraine dammed lakes**

Lakes formed when moraine blocks a river valley or stream.

**NB:** the lakes due to glaciations include the following:-

- Tarns
- Ribbon lakes
- Moraine dammed lake

### **REASONS WHY GLACIERS IN EAST AFRICA ARE LIMITED TO THE MOUNTAINS KILIMANJARO, RWENZORI AND KENYA.**

Glaciers however are limited in East Africa because of the following:-

Many parts of East Africa have low altitudes i.e. below 3000m above sea level.

East Africa lies astride the equator where temperatures are high for glacial accumulation.

There is influence of global warming.

Deforestation.

Influence of volcanicity i.e. vulcanicity is associated with high temperatures affecting glacial accumulation.

Large scale industrialization i.e. industries emit CO<sub>2</sub> into the atmosphere which raises temperatures affecting glacial accumulation.

The rain shadow effect especially on the lee ward side of mountains which doesn't allow the formation of glacier.

East Africa does not experience winter conditions.

### **Importance/Advantages of Glaciation in East Africa**

Promote research and scientific study.

Glacial landform such as arête, pyramidal peaks e.t.c. are tourist attraction thus source of forex.

Glacial lakes in a glaciers are sources of rivers which provide water for domestic, Industrial & Educational purposes e.g. river Mobuku on Mt. Rwenzori which provide water to Mobuku irrigation scheme.

Moraines provide fertile soils for Agriculture.

Hanging for H.E.P generation

Glaciations promote finishing in the lakes e.g. Tarns, Ribbon lakes, Moraine dammed lakes.

7. Glaciations also lead to provision of construction materials especially the boulders.
  8. U- shaped valleys provide natural route ways.
  9. Glaciations promotes sports and re-creation e.g skiing on Mt. Rwenzori.
  10. Provides employment to a number of people in East Africa.
  11. Glaciations has led to the development of infrastructure e.g. roads, holes e.t.c.
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### **Disadvantages of Glaciation**

Promotes soil erosion and land slides (Avalanches) this may lead to the destruction of property and lives.

Formation of out wash plains which contain infertile soils for Agriculture.

Leads to cold temperatures discouraging settlements on Mt. slopes.

Glaciated areas sometimes turn into many small lakes thus making the area to be a waste land.

Melting of glaciers may cause flooding of rivers which destroys lives and property.

### **RIVERS AND RIVER SYSTEMS IN EAST AFRICA**

A river is a body of water flowing over the land surface through a definite channel I a linear direction.

There are three forms of rivers:-

Permanent rivers.

Seasonal rivers.

Ephemeral rivers.

A place or point where a river begins is called a source which can be a spring, glacier, swamp, lake, e.t.c. and a place or point where it ends is called a mouth. It can be a swamp, sea, ocean, lake e.t.c.

The junction of two or more rivers is known as a confluence.

When a small river or a stream joins a major river is called a tributary. The area drained by a river and its tributaries is called a river basin or a catchment area or a drainage basin e.g. lake Victoria basin e.t.c.

An area of a higher land that separates two or more basins is called a river divide or a water shed or water parting.

The main river and all its tributaries together form a river system.

A river regime is a seasonal variation of water volumes.

This can be simple (one), double (2) or complex (many).

The materials carried by a river are known as LOAD.

A river competence is a measure of the ability of a river to carry its load.

### **NATURE OF FLOW**

The water in a river flows in two ways

#### **Laminar flow**

This is a smooth flow of a river over its base bed.

## **2. Turbulent flow**

A river flows in a circular or rough manner because of flowing over a rough bed.

### **WORKS OF THE RIVER**

A river performs three basic functions namely

1. Erosion
2. Transportation
3. Deposition

#### **River Erosion**

It involves the following processes

##### **Attrition**

A processes by which the load itself is broken down because the rock fragments are in motion and colliding with each other.

##### **Corrosion /Abrasion**

This is the wearing away of the sides and bed of the river channel by the load.

##### **Solution**

Soluble minerals dissolve in water and are carried away in solution.

##### **Hydraulic Action**

This is the mechanic source of moving water which is able to remove loose materials such as gravel, sand and silt.

River erosion operates in three ways:-

Head ward erosion (lengthens the valley)

Vertical erosion (Deepens the valley)

Lateral erosion (Widens the valley)

**NB:** The lowest point to which a river can erode its bed is called Base level.

#### **River Transport**

A river transports its load in four major ways / processes.

##### **Traction**

This is the dragging /rolling of large materials on its bed e.g. pebbles.

##### **Saltation**

This is bouncing of small particles on its bed.

Suspension

This is the transportation of fine particles held in water (suspended) e.g. silt, mud e.t.c.

Solution

Small particles are dissolved in water and then transported e.g. lime stone.

### **River Deposition**

A river deposits its load when its energy to carry has greatly reduced. The materials deposited by a river are called alluvium.

### **River Profile**

A river profile is a measured slope of a river along its base bed and surface from the source to the mouth. It's a cross-section of a river from its source to the mouth.

#### **A river profile has three stages:-**

Youthful /Torrent /Source /Upper stage

Mature /Middle /Valley stage

Old /Senile / Mouth / Flood plain

### **Youthful Stage**

This is a stage where a river originates in East Africa, the following are in their youthful stages:-

Mobuku R.Nile  
at Bujagali  
R.Manafwa  
R.Sironko  
R.Nyamwamba

#### **Characteristics of the youthful stage**

The gradient is very steep.

The water speed is very fast.

Vertical erosion is dominant.

No deposition

The valley is very narrow

Small volume of water

The flow of water is turbulent (rough)

#### **The major features or landforms in this stage include the following:-**

Waterfalls, rapids, plunge pools, V-shaped valley, gorges interlocking spurs, pot holes.

### **Waterfall**

A waterfall is a mass of water falling from a higher to a lower level. Waterfalls are formed in the following ways:-

a) When a resistant rock lies across a river.

When a river falls across a fault line.

When a river falls across along the edge of a plateau.

Where a river enters a hanging valley.

When a river enters the soci at a cliff.

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Examples of waterfalls in East Africa

- Sezibwa falls
- Karuma falls
- Sipi falls
- Adamson
- Thinka falls

### **Plunge Pool**

This is a depression at the bottom of a waterfall. Plunge Pool are formed by haudralic action and abrasion.

### **Pot Holes**

These are circular depressions on the river bed. They are formed when pebbles are carried by a swirling river cut circular depression in the river bed.

### **Rapid**

A section of rough, fast flowing water in a river channel. Its formed where a waterfall has been eroded.

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### **A Gorge (Canyons/Ravine)**

This is a deep narrow valley with high vertical banks resulting from vertical erosion.

### **V-Shaped Valley**

These are formed by vertical erosion and they are pronounced in valleys with beds less resistant than those on the sides of the valley.

### **Interlocking Spurs**

Vertical erosion rapidly deepens the valley. The river twists and turns around obstacles of hard rock erosion is pronounced on the concave banks of the bends and these ultimately causes spurs (land projections) which alternate on each side of the river to interlock (Interlocking Spurs)



Interlocking spurs can be seen on the following rivers:-

Semiliki

Mobuku

Nyamugasani

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## **MATURE /MIDDLE STAGE /VALLEY STAGE**

This is the middle stage in the river profile

### **X-tics of this stage**

The gradient is more gentle

Lateral erosion is dominant

River meanders begin to form

The valley flow is wide

The speed of water is relatively slow

Deposition begins to take place

The valley has a U-shaped section

The landforms in this stage include U-shaped valleys, Meanders, River cliffs /Bluff, Slip off slopes e.t.c.

### **U-Shaped Valley**

This is an original valley which has been widened by lateral erosion.

## **2. Meander**

It's a current bend of river channel.

It is formed by an alternate undercutting and deposition at the concave and convex banks and the river channel respectively.

**NB:** The concave bank because of rampant erosion, a river cliff or bluff is formed while on a convex bank deposition is dominant leading to a formation of slip off slope.

Rivers with meanders in East Africa include the following:-

- R.Rwizi      - R. Mpanga      - R.Manafwa      - R.Ngaila - R.Kagera

## **OLD STAGE**

This is a stage where the river is about to reach its destination.

### **X-tics of old stage**

The gradient is more gentle or flat.

There is much deposition.

The river flows in a wide flood plain.

The river carries a load consisting of majorly silt.

The H<sub>2</sub>O is very slow and gentle.

Meanders and ox-bow lakes begin to develop.

**Rivers in this stage include the following :-**

R.Rwinzi  
R. Moroto  
R. Malaba  
R.Nyando  
R.Tana  
R.Athi

**The landforms in this stage include the following:-**

- Ox-bow lakes
  - Meander scars
  - Flood plains
  - Levees / bums
  - Graded channels
  - Deferred tributaries
- Delta

**Ox – bow lakes**

An ox-bow lake is a crescent shaped final section of once pronounced meander but now cut off from the main stream.

Ox – bow lakes are formed in the flood plains with meanders which are very sharp that only a narrow neck remains.

During flooding, the narrow neck is broken through and the river by passes the meander cutting off by deposition to form an ox-bow lake (cut off or bayous)

When an ox-bow lake is filled with alluvium, it dries out leaving behind a meander scar.

Ox – bow lakes can be seen along the following rivers; Nzoia, Rufiji, Ngoula, Kilombero e.t.c.

**Flood Plain**

This is an area of land at the sides of the river which is susceptible to the periodic erosion.

## **Levees / bums**

When a river is in the flood plain, it deposits most of its load close to the river side's forming embankments called levees/bums.

### **Braided channels**

A braided channel is a wide shallow channel in which a river divides and subdivides in a series of minor channels separated by islands of alluvium.

Braided channels can be seen on the following rivers Rufiji, Nzoia, Valo, Nyando, Sondu, Kilombero.

### **Deferred tributaries and confluence**

A deferred tributary is one which flows parallel to the main river for several kilometers before joining the river due to the levees.

The confluence at which the tributary joins the main river is called deferred confluence.

## **DELTA**

A triangular low lying swampy plain which gradually is colonized by vegetation.

The growth of a delta interferes with the flow of the river causing the river to split up into several separate channels called distributaries e.g. R. Rufiji Stages in the formation of a delta.

1. The river reaches the coast and deposits sediments.

The river is obstructed by sediments and branches into distributaries to discharge more sediments brought down.

3. The delta takes a fan shape extending sideways and seawards.

### **Conditions for Delta formation.**

A river must have a large load.

The velocity of the river must be sufficiently low to allow most of its load to be deposited in the river mouth.

The river's load must be deposited faster than it can be removed by the action of tides and currents.

### **Types of deltas**

There are 3 basic types of deltas

#### **Arcuate Delta**

This delta consists of both coarse and fine sediments and it has the shape of an inverted cone crossed by numerous distributaries e.g. Nile Delta, Niger Delta.

### **Birds' Foot Coarse**

This delta consists of very fine materials and it has a few long distributaries like the foot of a bird.

**NB:** landforms as a resultant of river action therefore can be categorized into two

#### **1. Erosional landforms**

They include the following:-

- V-Shaped valley
- Waterfalls
- Plung pools
- Rapids
- Interlocking spurs
- Cliffs or bluffs
- U – shaped valleys

Depositional landforms

e.g. Meanders, Ox-bow lakes, Meander scars, flood plain, levees or bums, deltas, alluvial fan e.t.c.

### **RIVER CAPTURE**

It is the diversion of part or whole of a river into a system of another adjacent powerful river able to erode its valley or rapidly than its neighbor.

#### **The following conditions must be in place for river capture to take place**

Two rivers should be flowing parallel to each other.

The pirate river must have more water than its neighbor.

The pirate river should flow over easily over eroded rock.

River capture happens when one river with a big erosive floor/power elongates its basin at the expense of a weaker one.

The powerful river erodes backwards (head ward erosion) and eventually capturing the flow of a weak river.

### **Alter Capture**

**NB:** the bend at which piracy occurs is called elbow of capture. The captured stream is called misfit or beheaded stream. The valley below the elbow of capture is called wind or dries.

### **RIVER REJUVENATION**

It is a renewed erosive activity of river.  
It may be caused by the following.

Earth movements of uplift

- Down warping
- Tilting

Lowering of the sea level.

Increase in the stream volume due to increased rainfall.

Decrease in the load that a river is carrying e.t.c.

River rejuvenation has led to a formation of new land forms in East Africa. These landforms include:-

**1. River Terrace /rejuvenation terrace**

This is a step or bench like feature formed on a side of a river after the river has renewed its erosive power or activity.

**2. Valley – in – valley**

This is a new valley created within an old valley after rejuvenation.

**3. Incised meander**

This is a curve or bend of a river that has been deeply cut vertically (Incised) after rejuvenation.

Incised meander can be of two

types **a) Entrenched meander**

**b) Ingrown meander**

**4. Knick point /Rejuvenation head**

This is a break of slope in the long profile of a river caused by renewed erosive activity. Knick points are good sites for the generation of HEP.

**DRAINAGE PATTERNS**

A drainage pattern is a plan/design/layout by a river and its tributaries. It shows how a river & its tributaries are arranged on the Earth surface.

**Trellis/Rectangular pattern**

e.g. Aswa. The tributaries joined the main stream at more or less right angles.

It develops in areas with heterogeneous rocks and faulted area.

**Dendritic drainage pattern**

It looks like a tree trunk and its branches. They develop in areas with homogenous rocks and a gentle slope.

**Radial drainage pattern**

Rivers flow from a central point (highlands) downwards in many directions e.g. R. Manafwa, R. Sipi on Mt. Elgon e.t.c.

**Parallel drainage pattern**

The rivers flow parallel to each other for a long distance. E.g. R. Mayanja and Kato.

**Centripetal drainage pattern**

River converges into a central point from all directions.

Barbed/Hooked drainage pattern

Tributaries flow in the opposite direction of the main river before joining at acute angles e.g. R. Katonga, Kagera & Rwizi.

**Angular**

Rivers join at sharp angles and arranged in series of curves around a basin.

**Braided**

Rivers divided and subdivide in series of interconnecting minor channels separated by sand banks.

**Diagrams**

1. Trellis / Rectangular pattern
2. Dendritic drainage

- |                                  |                              |
|----------------------------------|------------------------------|
| 3. Radial drainage pattern       | 4. Parallel drainage pattern |
| 5 . Centripetal drainage pattern | 6. Barbed / Hooked           |
| 7. Angular                       | 8. Braided                   |
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## **COASTLINES**

### **Definition of terms**

#### **COAST**

It is that broad area where the sea or lake comes into the contact with the land.

#### **SHORE**

This is that area near the coast lying between the higher and the lowest water levels.

#### **BEACH**

This is an accumulation of deposits (sand, shingles e.t.c.)

## **WAVES**

These are oscillations on the surface of the water body. These waves move up and down to create troughs and crests.

### **Waves are caused by the following:**

Wind duration

Catastrophic events like earthquakes

Effects of moving objects in water e.g. ships large sea animals

Wind velocity and fetch (distance travelled by waves on the water surface)

### **Waves are of two types:**

#### **Destructive waves (storms)**

These destroy the coastal lands.

#### **Constructive waves (gentle waves)**

They build on the coastal land or beaches.

**NB:** swash:- is when water runs up on the shores sweeping materials forward on the slope.

When water is exhausted the water runs back to the sea under the influence of gravity, this is called a back wash.

## **Landforms or features due to wave action**

Wave action along the coast results in the formation of two types of landforms

Wave erosional landforms

Wave depositional landforms

## **WAVE EROSIONAL LANDFORMS**

These landforms are brought about by the following process

### **1. Abrasion or corrosion**

The load in form of boulders pebbles and sand are hurled against the shore line by the waves.

### **2. Hydraulic Action by the waves**

This is the wave force heating against the shore line by compressing air in areas of weakness.

### **3. Corrosion/Solution**

This is the solvent action of waves on soft rocks like limestone.

### **4. Attrition**

The load carried by the waves are broken to successive smaller particles by heating each other as they move.

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**The wave erosional landforms therefore include the following:-**

Bays /Inlets /Coves  
Headlands /Cape/Promontories  
Cliffs  
Inlets /Geos  
Stacks /Chimney /Skerries  
Arches  
Stump  
Blowhole /gloup

**Headland & Bay**

Headland is a piece of land projecting into a water body. A Bay on the other hand is an indentation of the coastal lands by water.

**Formation**

On exposed coasts, the continued action of waves on rocks of varying resistance causes the coast line to be eroded irregularly. This is pronounced where hard rocks like granite occur in alternate bands with softer rocks. The softer rocks are eroded back to form bays inlets or coves e.g. Murchison and Kibanga bays on lake Victoria. The harder resistant rock persists to form headlands or promontories or caves e.g. Kibanga headlands on L.Victoria and Watamu on the Kenyan coast.

**CLIFFS AND WAVE CUT PLATFORM**

A cliff is a steep rock face along the coast.

Cliffs are formed when waves cut a notch (small opening) on the coastal land by abrasion hydraulic action and solvent action of waves.

Repeated wave action will enlarge a notch transforming it into a steep slope called a cliff.

A wave cut platform is a bench like feature sloping sea-wards below the cliff it is formed when the cliff recedes (erode backwards) leaving behind a gentle sloping platform called wave cut platform.

Caves, Blow Holes (gloup) and a geo (Inlet)

**A cave**

A cave is a cylindrical tunnel drilled through the cliff or headland by wave erosion.

The breaking of waves compress air in areas of weakness like faults enlarging it to form a cave.

**A BLOW HOLE/GLOUP**

It is a vertical shaft above the cave.

splashing of waves against the roof of a cave may enlarge the joints when compressed air is trapped. A natural shaft is thus formed which may eventually pierce through to the surfaces. This is called a gloup or blow hole.

A Geo is a narrow sea inlet formed when the roof of the arch collapses.

### **Arches, Stacks and Stumps**

An arch is a raised bridge like feature above a passage drilled through a headland. It is formed when two caves approach one another from either sides of a headland and unite or join.

The roof of this arch may collapse leaving a piece of land detached at a sea or lake to form a stack

These stacks may be worn down by wave erosion to form a small related landform called a stump.

### **LANDFORMS DUE TO WAVE DEPOSITION**

Materials along the coast are transported by long shore drift and deposited along the coast to form wave depositional landforms. These landforms include beaches, sand bars, Spits, Cuspate foreland, Tombolos and Mud flats.

#### **A BEACH**

A beach is a coastal accumulation of sand and shingle (small rounded stones) on the shore or coast. Examples of beaches in East Africa:- Mombasa beach, Gaba beach, Lutembe beach, Lido beach, Imperial beach, Nyali beach.

#### **SAND BAR**

This is an elongated ridge of sand or shingle running roughly parallel to the coast.

#### **SPITS**

This is a low narrow ridge of pebbles or sand joined to the land at one end with the other terminating in the sea or lake e.g. Tonya spit on L.Albert, Nabugabo spit on L.Victoria.

#### **CUSPOTE FORELAND**

This is a large triangular deposit of sand and shingle projecting sea wards.

#### **TOMBOLO**

This is a spit which grows at the coast linking an island to the coast e.g. Bukakata tombolo on L.Victoria.

#### **MUD FLATS**

This is a flat form of mud composed of silt or alluvium formed along gently sloping coasts especially in bays, estuaries and delta.

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## **EUSTATISM /EUSTATIC MOVEMENTS**

Eustatism refers to changes in the sea level which may be positive involving a rise in sea level or negative involving a fall in sea level relative to the coastal land.

The changes in the sea level may be caused by the following:-

Increased plaviation (rainfall) and desiccation (drought).

Glaciations (freezing) and deglaciation (melting).

Increase in temperature will lead to a rise in sea level because H<sub>2</sub>O expands when heated from beneath.

Tectonic movements e.g. uplift of the coastal land down warping of the coastal lands. Expansion and contraction of ocean basins.

Sedimentation of materials into ocean basins.

## **LANDFORMS DUE TO SEA LEVEL CHANGES**

Sea level charges have led to the formation of two types of landforms e.g.

### a). **Submergence coasts.**

These landforms are formed when there is rise in sea level and include

e.g.

**Hord** – Narrow sea inlet (Not found in East Africa) filled with water during deglaciation.

**Ria /Creek** – This is a drowned river valley formed due to a rise in sea level e.g. Kilindini harbor, Port Tudor, (Mombasa) Mtwapa and Kilifi creeks (Dar-est-salaam)

### **Estuary**

This is a wide shallow drowned river mouth formed as a result of a Page | 55 rise in sea level e.g. R.Rufigi and R.Mwachi.

### **Dalmatian /Longitudinal coasts**

These are highlands running parallel to the coast due to a rise in sea level e.g. Islands of Pemba, Mafia and Zanzibar, Chake –Chake.

### b). **Emergence Coasts or Landforms**

these are formed when there is a fall in sea level. They led to the exposure of the formerly submerged landforms.

#### **Such landforms include:-**

Raised beach (Former beach)

Raised cliff (Former cliff)

Raised terrace (Former wave at platform)

## **CORAL REEFS**

A coral reef is a limestone rock made up of skeletons of tiny marine organisms called polyps. These skeletons contain calcium  $\text{CaCO}_3$  carbonate that when polyps die their skeletons accumulate on the continental shelf to form white coral limestone rocks.

Coral reefs occur on the East Africa coast especially at Bamburi, Mombasa.

### **Conditions or Factors for coral growth**

The ocean waters must be warm between 20-30°C.

The water must be salty.

There must be an environment of water.

The water should be shallow.

There should be presence of polyps or marine organisms.

Presences of a continental shelf on which the corals grow from.

The water should be clear, clean and oxygenated.

Absence of strong currents to interfere with coral reefs accumulation.

## **TYPES OF CORAL REEFS**

There are three types of coral reefs.

### **1. Fringing reef.**

This is a coral platform up to 1km wide, joined to the coast or separated from a shallow lagoon.

### **2. Barrier reef.**

This is a coral platform separated from the coast by a wide and deep lagoon.

### **3. An Atoll.**

This is a circular coral reef or a ring of coral surrounding a fairly deep lagoon.

## **ECONOMIC IMPORTANCE OF CORAL REEFS TO MAN IN EAST AFRICA**

Coral reefs provide man with raw materials for the manufacture of cement.

Coral reefs are tourist attractions and thus alternative sources of foreign exchange.

They protect the ports from direct wave attack e.g. port Mombasa.

Coral reefs are sources of minerals e.g. petroleum.

Lagoons within the coral reefs provide grounds for re-creation e.g. swimming and sun bathing.

The lagoons also provide water for domestic, industrial and irrigation purposes.

Coral reefs promote industrial development e.g. the Bamburi cement factory in Mombasa.

Coral reefs provide employment to many people e.g. miners, industrial workers, researchers e.t.c.

Coral reefs are sources of fertile soils for agriculture especially the growing of cloves and coconut.

They are grounds for research and scientific study.

Sources of fertilizers like SSP.

Coral reefs are platforms for port development.

Problems /Disadvantages of Coral Reefs.

1. Hinder fishing and navigation e.g. fringing and barrier,
2. The lagoons are breeding grounds for mosquitoes and snails which spread malaria and biharzia respectively.

Some coral reefs lead to the formation of poor and infertile soils which are not suitable for agriculture.

Industries related to coral reefs like the Bamburi cement factory pollute the environment.

## **DENUATION**

Denudation is the wearing down of the Earth's crust.

It involves the following processes:-

Weathering

Transport (Mass wasting and erosion)

Deposition