S.6 GEOGRAPHY / P250/1.

DRAINAGE :

It is the discharge of water through a system of natural streams into lakes/seas/oceans.

DRAINAGE PATTERNS.

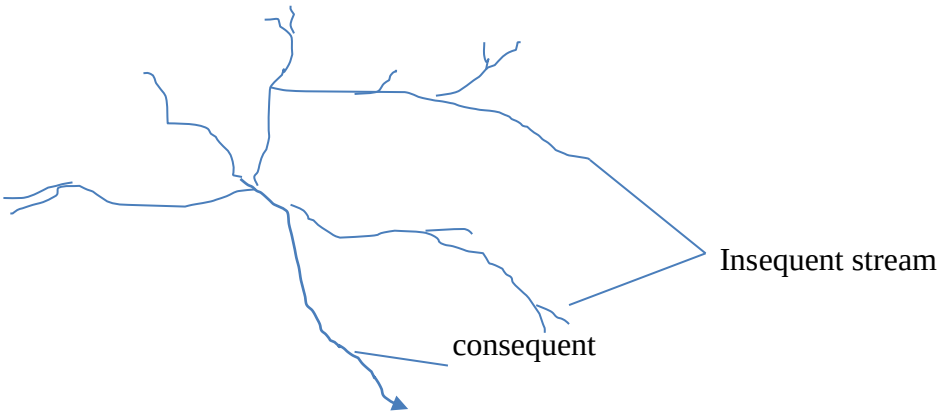
It is a lay out of plan made by rivers and their tributaries on the landscape. The various types of drainage patterns include;

1. Dendritic pattern.

   It is a tree – like pattern. Tributaries in the pattern converge on the main stream from many directions and usually join the main river at acute angles (less than 90^{o})

   - It commonly develops on crystalline cocks and gently dipping sedimentary rocks such that stream erosion is more or less uniform. Each tributary flows in a volley proportional its size or volume and maintains its direction of flow.
   - The pattern develops on gently dipping slopes where all consequent or major streams and insequent or minor streams flow in the direction of the initial slope of the area over which the pattern was established.
   - The area should be receiving reliable rainfall to maintain water in the streams to flow and complete the pattern.

   The general process of formation is that consequent streams develop headward erosion and minor streams develop in a similar manner and join the main tributaries to complete the pattern e.g River Rutagi, River Nzoia, River Ruvuma, River Nyondo, Victoria Nile etc.



2. **Radial pattern**.

   It is a drainage pattern where several streams originate from the same. Dome shaped watershed / highland and flow outwards. Rivers in the pattern are similar to spokes of the bicycle wheel.

   The main features or characteristics of the pattern include:

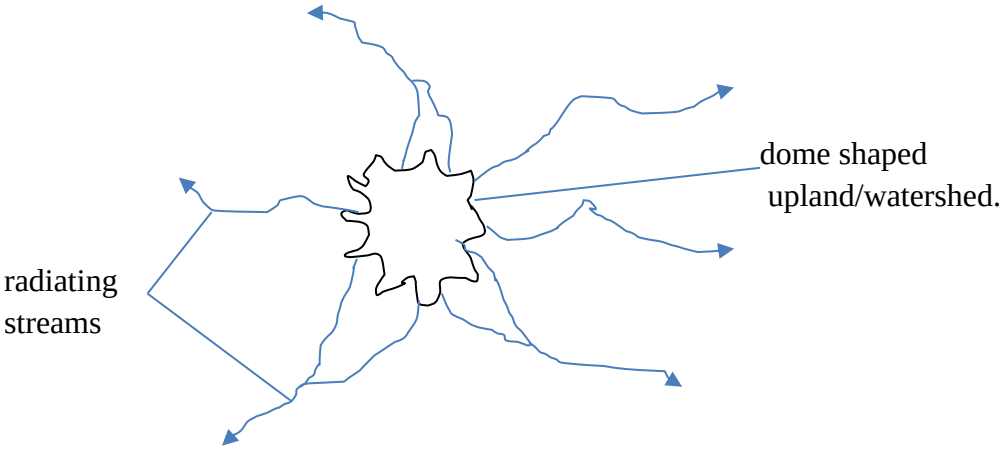
   - One source of streams
   - The source is the dome-shaped upland
   - Rivers /streams radiate in all directions.
   - Streams are long.
   - Swift flowing streams due to steep gradient

The pattern is brought about by the factors or conditions of

- Presence of a dome or cone shaped highland e.g a volcanic cone from which rivers radiate.
- The pattern is greatly controlled by very steep slopes of volcanic highland's that ensure swift flowing rivers and maintain their directions.
- The patterns develop on rocks of uniform resistance favouring uniform erosion to maintain the river's direction of flow (homogeneous /crystalline) rocks.
- There should be high precipitation in the catchment area to provide constant supply of water. This may be in form of rainfall, glaciers /snow hence rivers radiate from such places to different directions.

Examples.

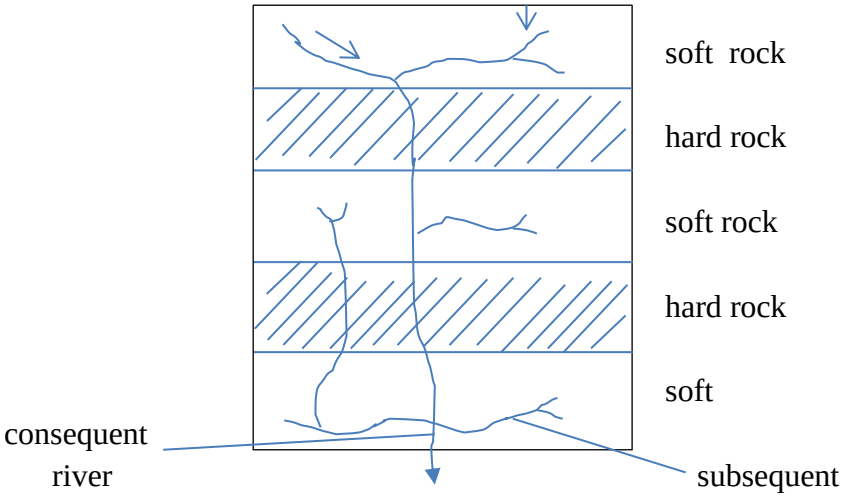
- Mt. Elgon with rivers like Sironko, Sipi, Simu, Manafwa, Koitobas etc.
- Mt. Kenya, Mt. Muhavura, Mt. Kilimanjaro, Mt. Longonot etc.



3. **Trellised /rectangular pattern**.
   This pattern displays a rectilinear shape with tributaries joining the main stream at approximately right angles (90^o). The development of the pattern is influenced by:
   - Rock structure – It develops in areas with alternative belts of hard and soft rocks which lie at right angles to the general slope down which the principal river flows. Bands of soft rocks are eroded and hard ones remain resistant.
     Rivers follow soft rock bands to join the main channel at almost 90^o
   - Nature of the slopes /relief – Generally the pattern develops on gentle and steep sloping areas.
   - Tectonic movement eg faulting ie the pattern develops in fault scarp areas with faulted ropes rivers follow lines of weaknesses to join the principal river at almost right angles.
   - River capture: Trellis drainage pattern is as a result of river capture where parallel rivers may drain water from others which leads to abrupt change of river direction hence angularity.

- The development of the pattern is facilitated by continuous or permanent flow of a stream in an area with some reasonable rainfall to maintain the flow of rivers.

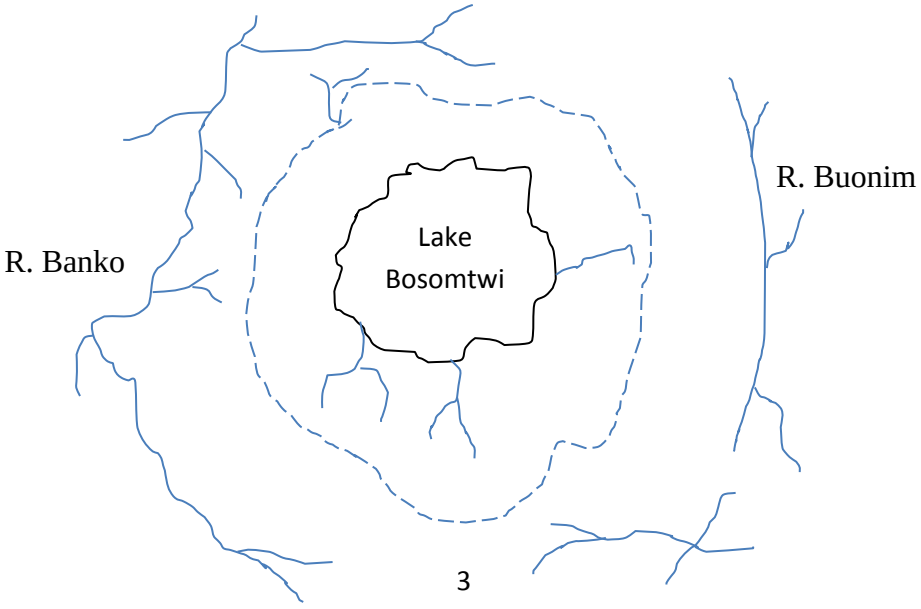
Examples: River Tiva and Galana or Athi in Kenya, River Aswa or Achwa in Northern Uganda joined by river Tochi and Pager, Mayanja Kato and Mayanja Waswa.



4. annular pattern

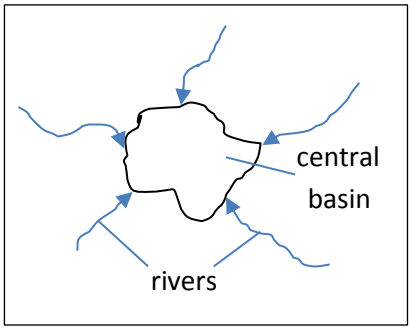
It is a type of drainage pattern where the tributaries join the main stream at sharp angles in a series of curves. The conditions for development include;

- A dissected plateau or dome with alternating hard and soft rocks or faulted zone.
- A large catchment area is essential with reliable rainfall for continuous supply of water to the flowing streams.
- The presence of a dome with a crater or basin on top around which the pattern develops.
- Rivers must be flowing sharply in a series of curves in the volcanic area. Rivers must flow in concentric curves around the dome to complete the pattern e.g around Ngorongoro in Tz, Kalongo area in Northern Uganda, around lake Bosomtw; in Ghana



5. **Centripetal pattern**.
   It is a drainage pattern in which rivers converge towards the central part or point rather than away from the centre. (It's the opposite of radial pattern) rivers usually flow down from the rims of the basin to the centre where there may be a lake basin. It thus forms an internal or inland drainage system.

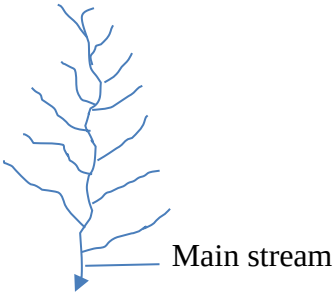
   Examples: rivers flowing into L. Victoria, L. Baringo, Turkana, Magadi, Katwe etc.



6. **Parallel /sub-parallel pattern**.
   It is a pattern in which streams and their tributaries flow parallel or almost parallel to each other. It develops in areas where bands of successive soft or weak outcrops are parallel to resistant rock out crops.

   The rivers on weak rocks flow parallel to each other to where there is a steep but elongated slope e.g a fault scarp of the rift valley e.g River Hoima and Nkusi are parallel to each other on Butiaba escarpment, River Athi and Nairobi are parallel to each other.

7. **Pinnate pattern**.
   In this pattern, tributary streams join the main channel at an angle in a way to make the pattern look like a feather e.g part of Kerio valley in a secondary rift valley in Kenya.



FACTORS INFLUENCING THE DEVELOPMENT OF DRAINAGE PATTERNS IN EAST AFRICA.

1. **RELIEF.**
   - ✓ Steep slopes on volcanic cones for example Elgon, Muhavura, A etc favour the development of radial drainage pattern. The steep slopes accelerate downward movement of water and erosion of rocks to create channels along which rivers flow.
   - ✓ Steep slopes as escarpments lead to parallel drainage pattern because rivers flow to the low lying basins without joining each other e.g on Butiaba escarpment.
   - ✓ Gently dipping slopes favour the development of dendritic pattern. Gently sloping areas encourage dendritic drainage pattern where the consequent and subsequent (minor) streams flow in the direction of the initial slope over which the pattern was established e.g Victoria Nile, Rufigi, Malagalasi in Tz.
   - ✓ Existence of hills separated by wide valleys lead to the development of trellised drainage pattern as shown by rivers Mayanja Kato and Wasswa in Mityana – Mubende areas.

2. **Nature of the rock /structure.**
   - Rocks of uniform hardness tend to lead to the development of dendritic drainage pattern because the rocks are uniformly eroded to create a variety of tributaries.
   - Jointed/faulted rocks especially on plateau landscape lead to development of trellis drainage pattern where the main stream and distributaries tend to follow rock joints or fault lines before joining at almost right angles e.g River Pager in Northern Uganda, River Tana, Athi etc
   - Alternating soft and hard rocks demarcated by joints almost at right angles to the general slope encourage trellis drainage patterns.
   - Soft and hard rocks lying side by side encourage the development of parallel drainage pattern where rivers flow by the side of each other but with limited chances of joining e.g River Nkusi and Wasswa on Butiaba escarpment.
   - Presence of steeply dipping rocks encourage the development of radical drainage pattern especially if it is on a dome shaped upland e.g on Mt. Muhavura, Mt. Kenya, Mt. Suswa etc.
   - Dome shaped rock structures with a crystalline/homogeneous nature promote the formation of radial drainage pattern.
   - Presence of impervious rock structure in a drainage basin/catchment area encourages adequate drainage causing many run-offs inform of subsequent, consequent and obsequent streams. This leads to the development of dendritic drainage pattern eg River Apwach in Karongo Northern Uganda.
   - Gently dipping homogenous or heterogenous rocks dipping towards a central basin, with rivers flowing from the rims of the catchment/basin towards a common swamp/lake encourage the development a centripetal drainage pattern eg Victoria basin, Kyoga basin etc.

3. **Climate**.
   - ✓ Reliable rainfall received in drainage basin or catchment area is necessary to support the evolution and continued existence of a river and its tributaries which may form several patterns eg radial, trellis, dendritic etc.

4. **Tectonism.**
   - ✓ Areas affected by upwarping and down warping e.g Victoria and Kyoga basins encouraged several rivers from different directions to flow into different directions to form centripetal drainage pattern.
   - ✓ Faulting encourage the formation of pints and fault lines which later promote the formation of rectangular / rectilinear / parallel pattern.

5. **River capture system**.
   Encourages the development of drainage pattern overtime especially where a strong river captures/arrests the water of a weak neighbouring river into its own channel. This encourages the development of trellis/dendritic and barbed/hooked pattern. eg. River Tina Gallana in KY.

Questions.

- ✓ To what extent has relief influenced the development of drainage patterns in East Africa.
- ✓ (a) Distinguish between radial and dendritic drainage patterns
  (b) Examine the influence of rock structure on the development of drainage patterns in East Africa.
- ✓ To what extent has the nature of rocks influenced the development of drainage patterns in East Africa?

Map Annular

- ✓ Account for the development of the following drainage patterns;
  (a) Dendritic - Victoria Nile
  (b) Anular - Karongo area, L. Bosombtwi
  (c) Rectangular - Galana & Athi, Aswa – Tochi – Pager

- ✓ With reference to specific examples, explain the conditions which have favoured the development of the following drainage patterns in East Africa.
  (a) Dendritic
  (b) Trellised
  (c) Radial – Kyoga, Victoria

THE DEVELOPMENT OF A LONG PROFILE

The development of landscapes through the normal cycle of erosion passes through 3 stages of which William Morris Davis called the youthful, mature and senile old stages and consequently, rivers which are the main agents of the Davisian landscape development must pass through the 3 foregoing stages.
The development of the river valley/long profile mainly depends on; nature of the rock, erosive power of the river, nature of the slope and water in the catchment area of watershed.

The Davisian cycle is named after William Morris Davis who propounded the geomorphic cycle/peneplanation /erosion cycle/slope decline

He modified the cycle in 1902 that described the modification of the physical landscape as a result of natural agencies/processes (weathering, erosion, transportation and deposition) in an orderly progressive sequence

- Landforms evolve through a progressive sequence of erosional stages ie: youthful, mature and old/senile stage depending on how long or the degree of imprint of erosional processes on a particular landscape expressed in cycles but not in years.

- Slopes evolve towards level surface/peneplain that return to their point of origin. The cycle begins with uplift of the land leading to building of uplands or highlands. This can be due to earth movements or orogenic processes. The uplift has to be simple and fast or rapid enough such that it does not experience significant erosion during this phase.

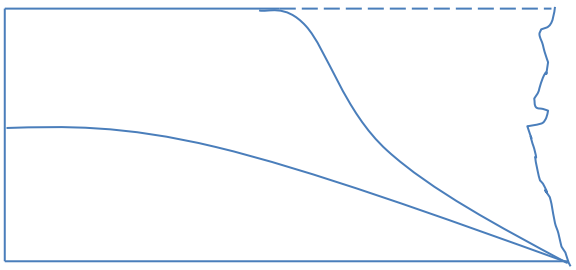
- The uplifted land would then undergo a cycle of erosion/down cutting by rivers, snow, wind etc and weathering processes help to denude the uplifted landscape.

- During the early stages, rivers in the steep slopes of the uplifted landscape quickly deepen their valleys through vertical erosion, flow at high speed etc forming v-shaped valleys. As the process continues, the relief decreases in terms of altitude; slopes and valleys begin to become more gentle, lateral erosion becomes more dominant; valleys become wider and gradually become U-shaped, the volume of water increases as tributaries join the main stream and alternating hard and soft rocks give rise to subsequent drainage patterns. The relief in this stage becomes relatively smooth and flood plains begin to develop hence the landform evolution reaches the old stage.

- Rivers in youthful and mature stages
  Deposition results into meandering of rivers as they relief becomes more gentle or flat. A lowland finally develops and Davis calls this a peneplain /level surface.

- When the peneplain stage is achieved, another uplift occurs such that the cycle starts again. He referred this as a return to a level or a point of origin. The cycle of Davis clearly points out the value of rock structure process and time in landform formation.

The steep slopes at the beginning of the process progressively decrease angle in time to give a convex upper slope and concave lower slope.



Relevance of the theory.
River profile development is in stages ie youthful, mature and old/senile. Each of the stages is related to specific landforms both erosional and depositional

- The youthful stage is associated with;
    - V-shaped valleys and steep slopes.
    - Water falls and rapids
    - Gorges.
    - Generally high/upland relief
    - Steep gradient making erosion greater than deposition
- The middle stage/mature stage is associated with;
    - Wide/open U-shaped valleys due to lateral erosion
    - River cliffs
    - Gentle gradient /slopes
    - Rounded watersheds/convex slope
    - Erosion and depositions are balanced, resulting in river.
- The old/senile is associated with:
    - Broad / - u-shaped valleys
    - Reduced gradient/slope
    - Deposition exceeding erosion
    - Levees develop
    - Deltas
    - Flood plain

Limitations.

- Not all rivers have typical geomorphic cycle as explained by Davis
- Davis cycle relates to humid temperature climate
- The study was not extended to other countries

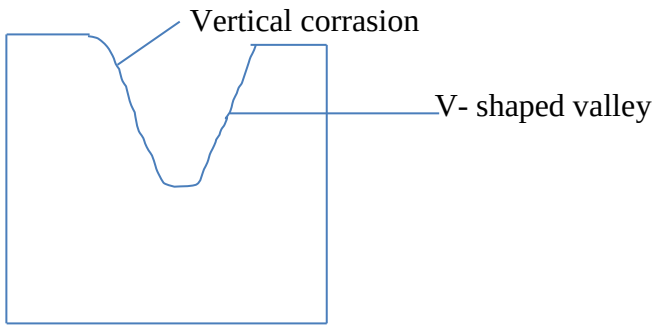
- River rejuvenation may not necessarily be as a result of uplift but due to increased water volume in the river, resulting from river capture, increased rainfall/precipitation etc.

LANDFORMS ASSOCIATED WITH A LONG PROFILE

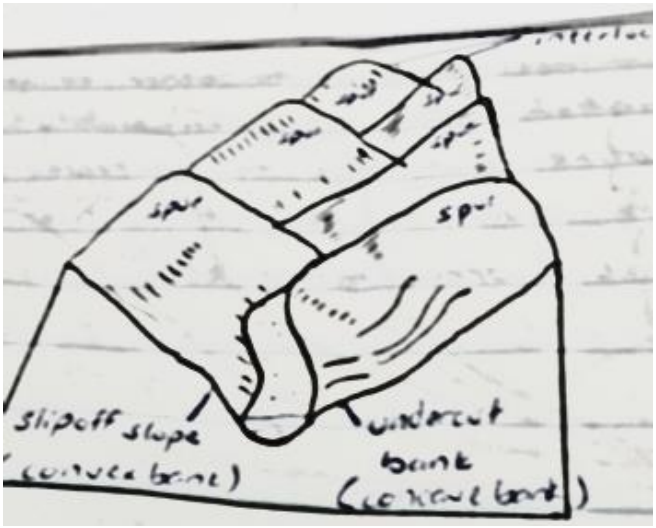
1. **Youthful stage.**

   This stage is also known as the torrent or upper valley stage. The river in this stage is flowing against a very steep gradient and is therefore very fast. Rivers in this stage are characterized by the following features;

   - Water flow is turbulent (swift flowing with a lot of swirling and eddying)
   - There is valley deepening /a narrow valley is common due to vertical erosion leading to the formation of V-shaped valleys in cross profile.



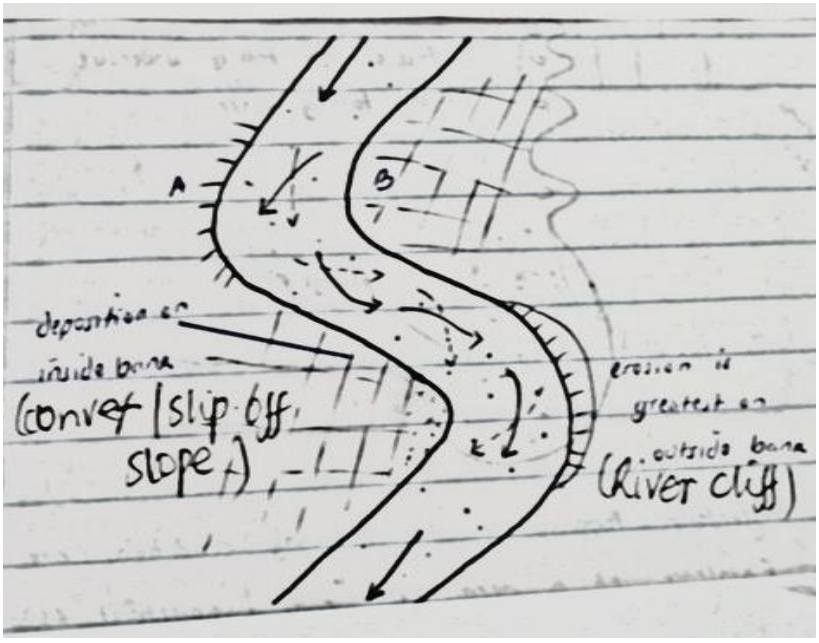
   - The floor of the river is broken by the action of pebbles which swirl against the even bed /fast flowing rivers and cut circular depressions in the river bed. The depressions gradually deepen and are called potholes
   - Interlocking spurs. They are valley edges that appear to be interlocking into each other in youthful stage. They are formed as a result of river winding eroding laterally avoiding resistant hard rocks. The river erodes more on the concave banks with softer rocks steepening them which leads to the formation of spurs that alternate on each side of the river to interlock.



River cliffs.

There are steep slopes of river meanders.

- They are formed when there is undercutting of the bank by hydraulic action of the river who creates pressure and the bank collapses leaving the river sides steep.
- On the opposite convex banks, there is no erosion and the banks form gentle, slip – off slopes, where material eroded from the river cliff may be deposited.



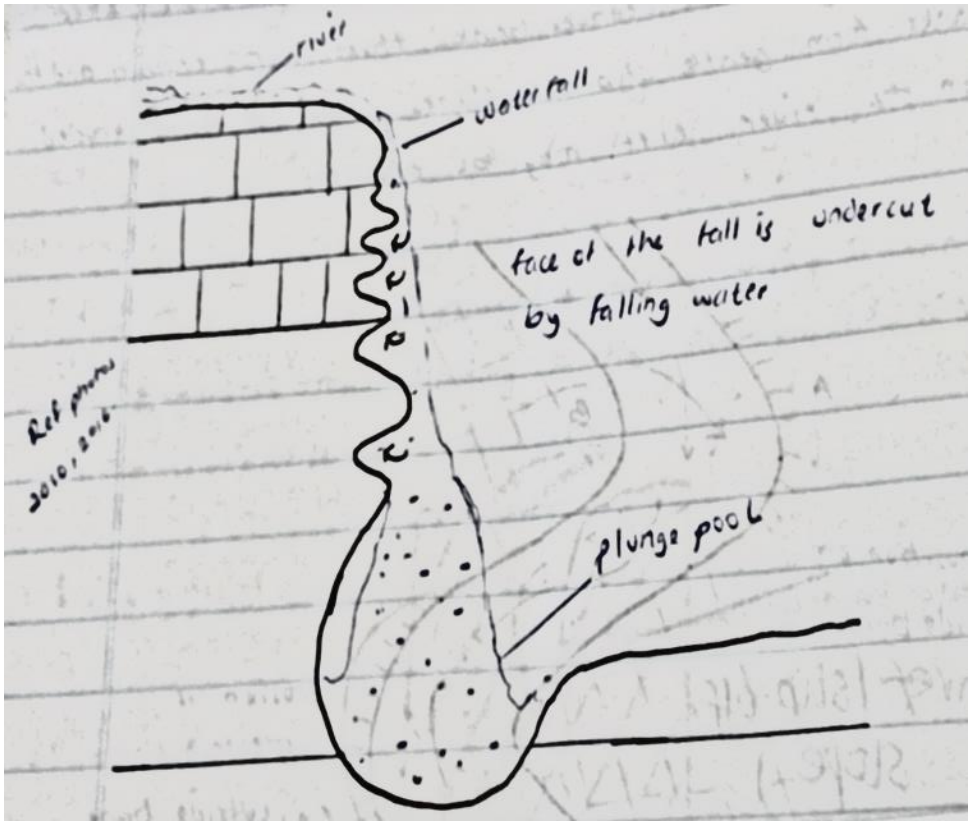
Water falls / Resistant rock outcrops.

A water fall is a sharp break in the channel bed over which the river/water falls.

They mainly occur in the upper course of the river.

- They are formed when layers of safe/hard rocks are laid over each other.
- Soft rocks are quickly weathered and eroded because of steep gradient and hard rocks remain protruding in the river channel over which water drops vertically to form a water fall.
- If the surface of the rock is hard, a river flowing over the end of the hard layer will erode the soft layers below slowly, deepening its valley of a point and eroding a plunge pool, where the water falls, eg Kisizi falls, Sipi Falls, Murchison falls.

- If the river channel is not deep, but with an irregular former Bujagali Itanda (R. Nile)



Water falls from where the following conditions are met.

1. Existence of a permanent river / constant flow of water
2. Existence of a hard rock along the river channel
3. Steep gradient/relief /escarpment over which water drops.
4. Alternating hard or soft rocks are undercut at the base of the cliff by hydraulic action of falling water and swirling leading to the formation of a plunge pool.

Causes of water falls

1. An outcrop of hard rock overlying soft rock in the river bed where the resistant out-crop is horizontal or deep sub stream, the weaker underlying rock is more easily eroded which causes steep gradient and eventually a water fall eg Sipi, Sezibwa falls etc
2. Faulting across the river bed
   A fault line in the river with weak rocks downstream faulted against resistant rocks will lead to erosion of weak rocks and the formation of a fall at a fault line faulting may also cause a fall directly if a river drops over the edge of a fault, scarp eg Murchison
   - Where the river enters the sea at a cliff line a fall may develop near the mouth of the river if wave erosion cuts back the cliff face or where the sea level has fallen.
   - Where the tributary hanging valley enters a glacially of a deepened valley, a water fall forms eg water falls in Mubuku valley.
   - A lava barrier or landslide across a river may initially create a lake and a water fall is likely to form at the spili from the lake where the river drops over the edge of

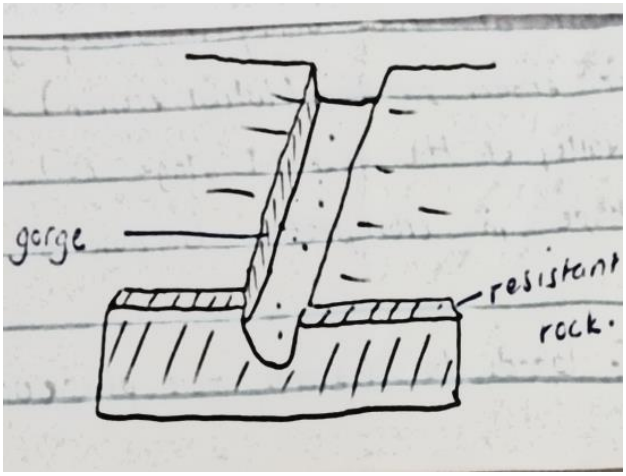
the barrier eg water from L. Bunyonyi at Muko, river draining / water draining from L. Saka in Kabarole, Lily falls in Madagascar.

- Where a river falls over a plateau edge especially when flowing from higher level of plain to a lower one, the waterfall forms eg Kisizi falls, Angrabies falls.
- Where rejuvenation of a river valley has formed a sharp knick point, a water fall is formed eg River Nyakasura water fall.

Gorges

It is a narrow and steep sided valley through which a river flows

It is formed when a river maintains its course across a belt of country that is being uplifted and the river is able to erode vertically across it. e.g Mitano gorge in Rukungiri Kanungu border through where river Birira flows.



The actual origin of any gorge is due to a number of causes ie.;

- A water fall when retreating upstream erodes the rock to form a steep sided narrow valley eg Murchison falls gorge. Batoka gorge below Victoria falls.
- A super imposed gorge forms where a river is super-imposed into a zone of hard rocks from a former covering hard rock layer eg Sabaloka gorge in Sudan.
- An antecedent gorge forms where a river cuts across a zone of rocks that are being slowly uplifted eg Great Ruaha in T.z, Mitano gorge between Kanungu & Rukungiri.
- A gorge forms when a river flows across an and or region limestone rocks, vertical erosion becomes great relative to weathering on the valley sides that become steep eg Fish river Canyon in Namibia, Kyambura gorge Manambolo gorge in Madagascar.
- Gorges also form when an overflow by a river cuts and drains a lake. This is referred to as an overflow gorge eg lower Congo gorge below Kinshasha.
- A rejuvenation gorge may form where a river cuts./incises itself into the land surface due to fall in the base level eg Lupata gorge in Mazombique

3. **Middle stage / mature stage**.

   This stage is also known as the valley stage of the river. The gradient of the river is substantially reduced and the velocity of water reduces

The stage is characterized by the following features;

- The gradient of the valley is fairly gentle
- The river erodes sideways (lateral erosion) such that the V-shaped valley of the youthful stage now becomes an open – V-shape in cross profile because of much water volume.
- The river bends to become more pronounced that the concave banks stand out as river cliffs and convex banks slope gently as slip off slopes.
  The valley slope on the outside bank is over steepened and the opposite is gentle.
- He spurs in the middle stage are removed by lateral erosion. They are remains form a line of bluff. The valley floor becomes wider hence a flood pain is formed which is a wide plain of alluvium between lines of bluffs.

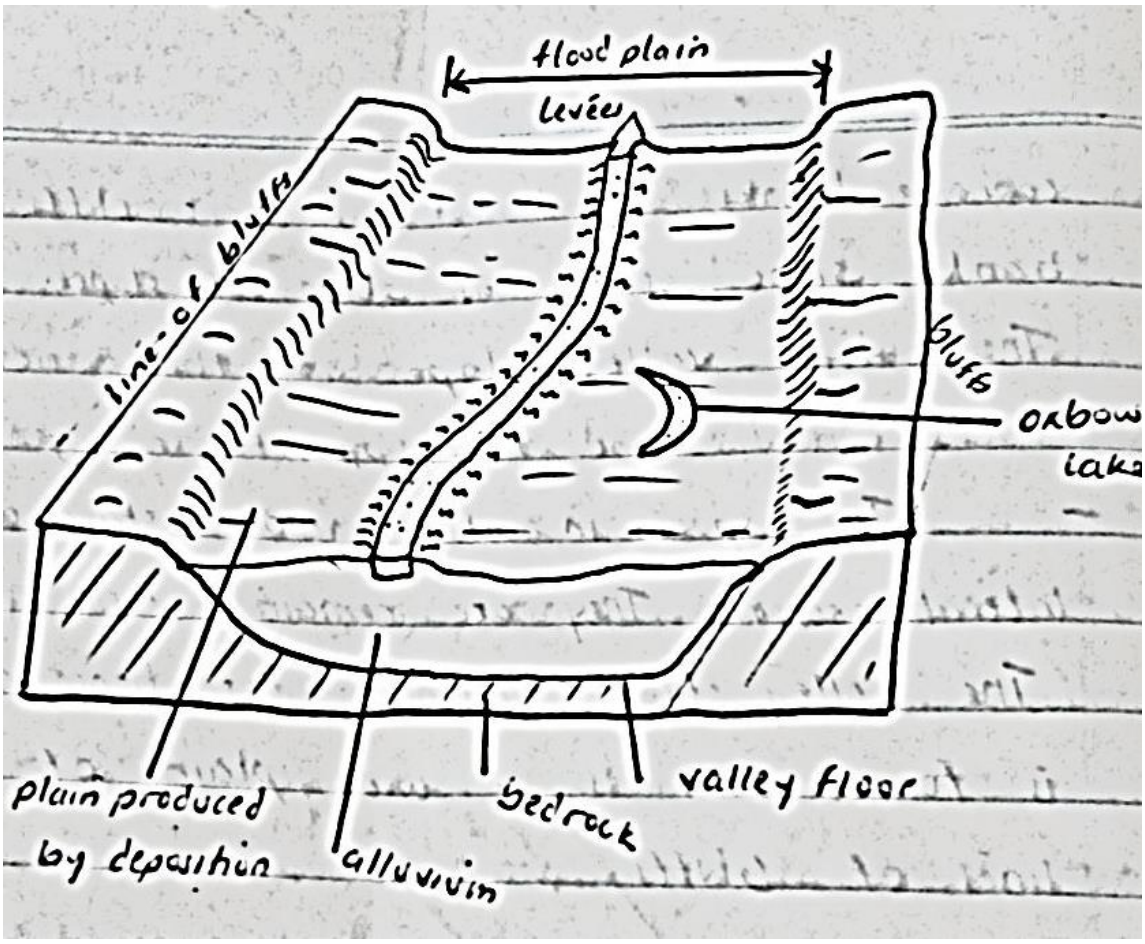
4. **Senile /old stage**.
   In this stage, the gradient of the river is reduced such that river flows very sluggishly without energy.
   The river mainly deposits and transportation involves only solution material and very tiny, light suspended load.

The features that characterize this stage include:

1. (a) **Flood plain.**

It is a wide, flat lowlying plain of alluvium between bluff lines in the old stage of a river. It is produced by successive floods and deposition of sediments through down migration of meanders or during floods.

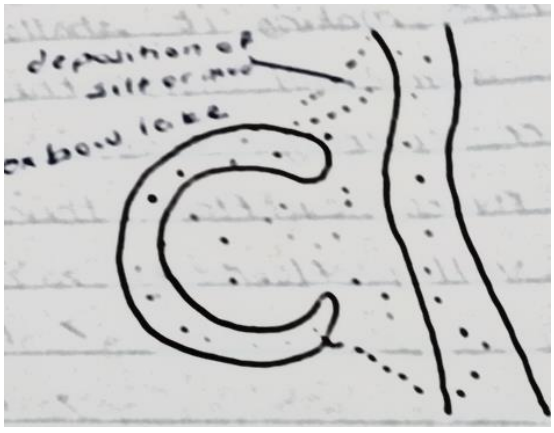
- The speed of water reduces and deposition takes place on the bed of the river making it shallow and wide
- Sediments are then spread all across the valley by both floods and river meanders covering eroded valley floor
- During floods, rivers overflow their banks and deposit silt and mud on the valley floor eg > Rwizi
  > Nyando
  > Nzoia
  > Katonga



2. **Oxbows and meander scars**.

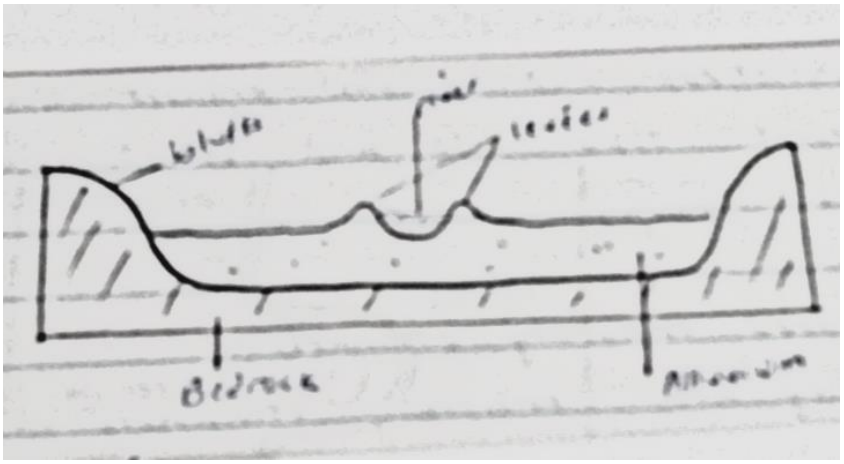
An ox-bow is a horse-shoe shaped section of a once pronounced meander.

- It occurs in the senile stage when river competence reduces
- It forms when the main current hits the outer bank (cliff) and erodes it side ways and down stream and deposition occurs on slip off slopes.
- The bends of the meander are eroded close to each of her forming a narrow neck of land known as <u>swan's neck/meander loop</u>
- During floods, the high water level cuts/ erodes straight through the neck.
- Deposition occurs at the ends of the meander enclosing water in a meander cut off forming an ex-bow lake.
- An ex-bow lake is filled with alluvium from later floods and eventually drying out a meander scar is left



3. **Levees.**

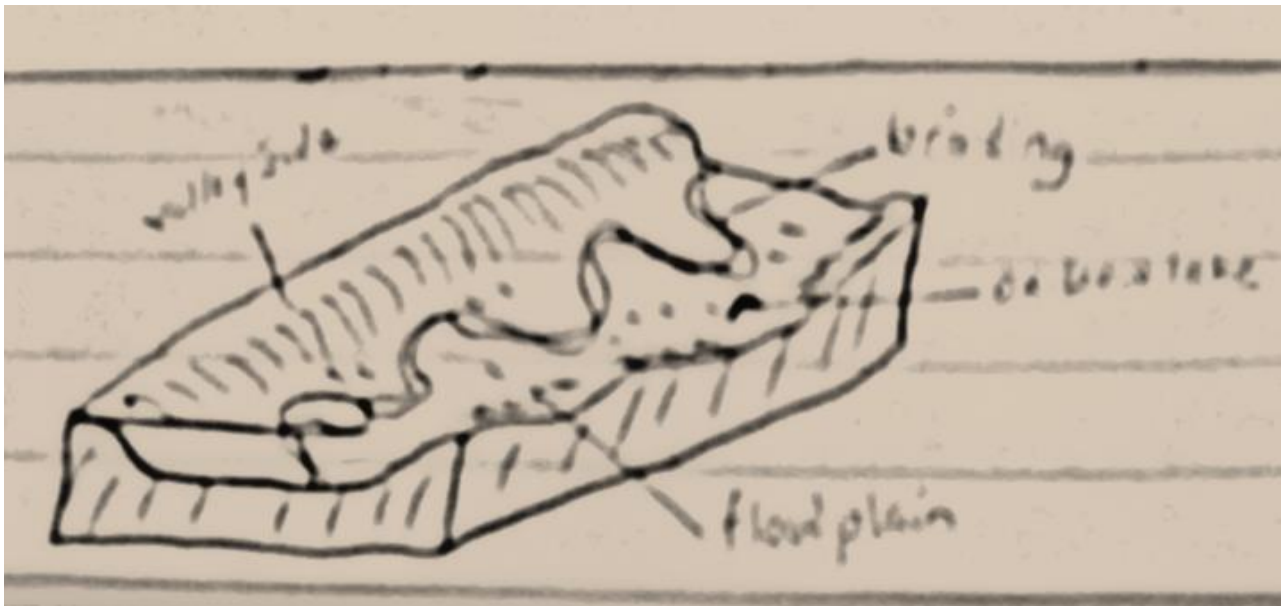
They are embarkments /raised banks on the edges of the channels. They are formed through successive flooding and deposition of sedimerits by rivers. They may be artificial or natural levees are created during floods when rivers transport and deposit their sediments beyond their banks. At the banks, much coarse sedimerits are deposited eg gravel which gradually build up into embankments higher than river banks. The river then floods between banks called levees.



4. **Braided channel /Braidation**.

They are extremely shallow channels in which a river divides and subdivides in a series of inter connecting several channels separated by sand bars and islands of alluvium. The sand bars and minor channels may be submerged during high floods. Braiding is most common in heavily loaded rivers flowing between banks of easily eroded material. The eroded banks widen the channel causing shallow and increased friction on the river bed which encourages further deposition.

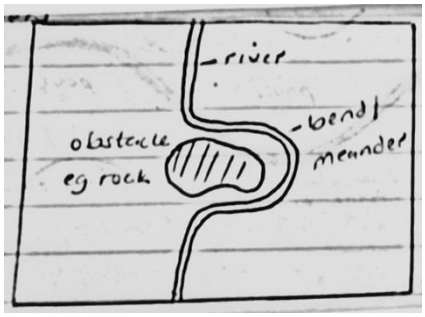
Examples of braided rivers include Mubuku, River Nile, River Rufigi, Nyamwamba, River Athi, Kilombero etc.



5. **Bluffs.**
   They are cliff – lyke features or edges of flood plains. They are termed by back-cutting of spurs (lateral erosion) to form features that stick in valleys called bluffs or bluff lines which remain when interlocking spurs have been eroded.
6. **Slip off slopes**.
   They are convex bends or gentle slopes of river meanders built up by deposition on the inner banks of meanders. They are mainly found opposite river cliffs and rivers deposit some of the carried material like silt and boulders on gently slip off slopes.
7. **Deferred tributary channels.**
   They are tributary channels in the flood plain that are forced to flow for a long distance alongside the main river before joining the main channel because of levees of alluvium deposited on the rivers confluence . When the confluence is interfered with, it is said to have its junction deterred sometimes called deterred tributary.

8. A member is a bend in course of a sluggish river with outer and inner banks eg river Nzoia Mpanga, Bwizi, Nyando, Manafwa. The origin or cause of meanders is not fully understand. Nevertheless there are some theories that try to explain the cause origin of meanders ie;

(a) **Presences of obstacles**.
It is believed that because of their sluggish movement courses, they are forced to change their cases thereby developing bends which grow into coops and meanders.



(b) **Siltation**.

Too much deposits along the river bed cause the river to be silted. This reduces the gradient of the river so much that the river is forced to wander looking for alternate steep gradient to flow to its mouth.

Through such, the river bends hence meander develop.

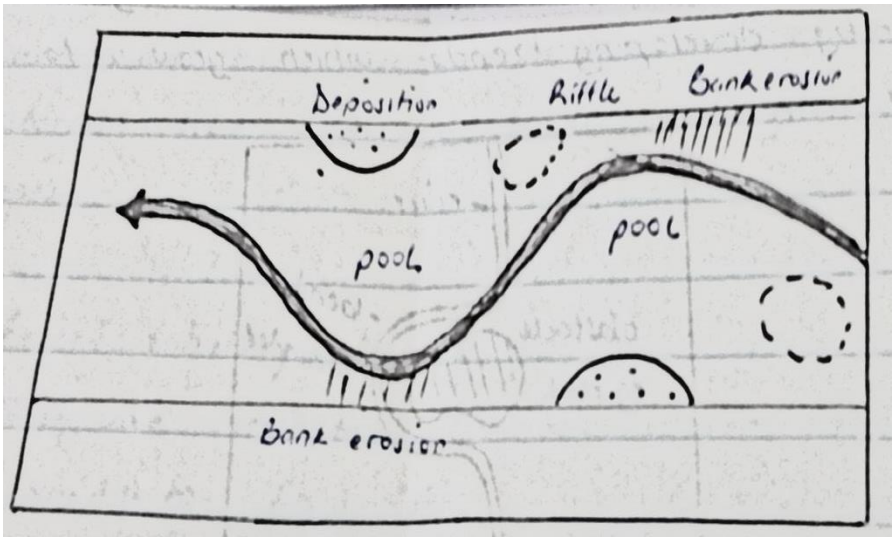
(c) **According to Arthur Holmes theory**.

When a medium passes over another, the speed is reduced because of friction. When water comes in contact with land, the speed is checked which causes meandering.

(d) The riffle and pool theory.

According to this theory, when one medium passes over another, a plane of contact between them develops a wave – like form. It has been observed that whenever a stream begins to flow along straight course, it soon modifies its course because of too much erosion in some parts and less erosion in other parts. Too much erosion creates hollow that are called pools while less erosion creates shallows of ridges known as riffles with a development of riffles & pools, the river begins to experience side to side swings ie flowing through pools and avoiding the riffles.

The flow of water moves around the river from one side to another. When water hits the bank of the stream, lateral erosion occurs and bends are started and accelerated which develop into meanders.



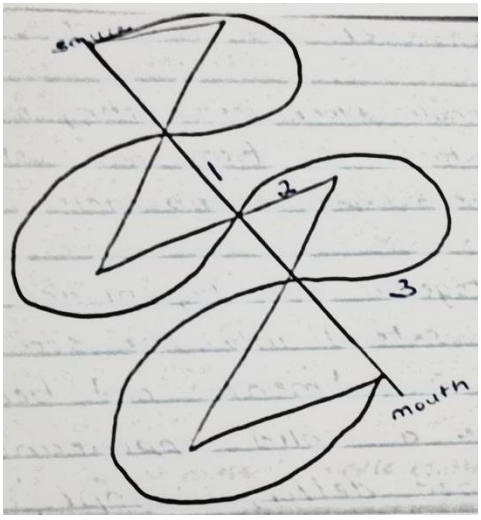
(e) Minimization of the time rate of energy expenditure.

According to Young's law, the river aims at using a very possible low rate of energy expenditure once in motion, a river has 3 alternative courses of flow from source to mouth ie

- ✓ Zig-zag flow /course
- ✓ Straight course
- ✓ Following a sinuous curve.

The straight channel will result in maximum time rate of energy expenditure which doesn't agree with the behaviour of all streams in nature

The zig-zag channel will be long with straight sections where time rate of energy expenditure will be high. This alternative disobeys young's law.
The sinuous curve is where the river follows a lengthy channel but goes meandering for efficient utilization of energy thus the best alternative. Once a river follows such a channel, it will be meandering as shown below:



1. Straight line course
2. Zig-zag course
3. Sinuous curve/ meandering

9. Deltas.

Is a large, flat, low lying plain of river deposits laid down where a river flows into a sea or lake. Examples of rivers with deltas include: R. Rufigi as it flow into the Indian Ocean, River Omo as it flows into lake Rudolf, Victoria Nile as it joins Lake Albert, River Semliki as it enters Lake Albert, River Nile in Egypt, River Niger etc.

A number of factors greatly influence delta formation but before deltas are formed, the following conditions must be met;

1. There should be active vertical and lateral erosion in the upper course of the river to provide extensive sediments to be deposited and form deltas.
2. The coast should be sheltered preferably tideless
3. The sea adjoining or neighbouring the deltas should be shallow or else the load will disappear in deep waters.
4. There should be no large lakes in the river course to filter off the sediments.
5. There should be no strong currents running at right angles to the river mouth, washing away the sediments.

A delta is this formed through the following processes;

- A large load and because of river velocity is deposited near the river mouth.
- There is coagulation of fine material mixing with salt sea water.
- The deposited materials block the existing river channel causing new distributaries to form and with the growth of new vegetation distributaries are encouraged to form.
- Spits and bars together with lagoons are formed.
- Levees of rivers extend into the sea via distributaries
- Lagoons are fed with sediments and become swampy

- Deltas thus take a solid appearance, plants colonise the upper delta, swamps disappear leaving dry land.
- The old parts of the delta eventually become part of the flood plain

There are 3 types of deltas ie;

- **Accurate / cuspate delta**;
  It is funnel shaped and its coast forms an arc. Eg Nile Delta in Egypt, Niger Delta, Victoria Nile on L. Albert.

- **Bird's foot delta**;
  Which has built out fingers of deposited material joining the lake or see eg River Omo Howing into lake Turkana.

- **Estuarine delta;**
  Which forms within the estuary of the river. From sediments deposited in the submerged mouth of a river eg River Congo and River Gambia.

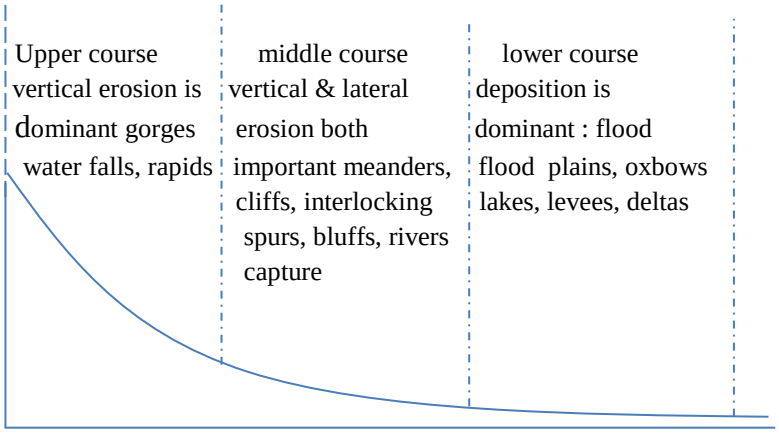
A long profile of a river.

It refers to longitudinal section of a river from its source to mouth. It is therefore the line which follows the bed or course of a river from its source to mouth.

- It usually has a concave slope or shape
- It is generally divided into 3 types of youthful, mature and old /senile stage.

The upper stage is dominated by vertical erosion, middle stage and senile stage by deposition and erosion forming a flood plain.

It describes length of the river valley which largely depends on nature of headward erosion or backward cutting of a rivers course.

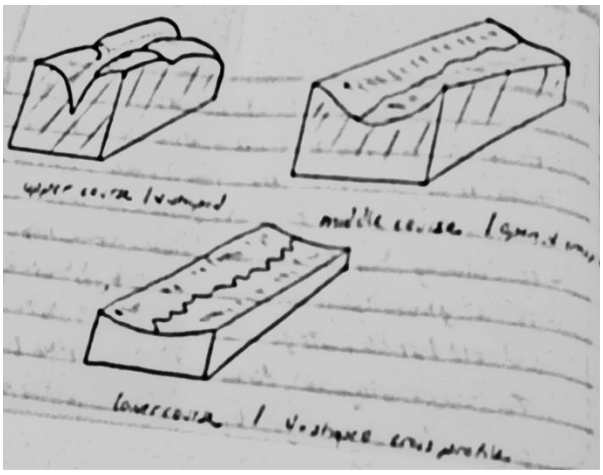


<u>A cross profile of a river</u>.

It refers to cross section of rivers channel from bank to bank. It is the width of the rivers channel together with its depth.

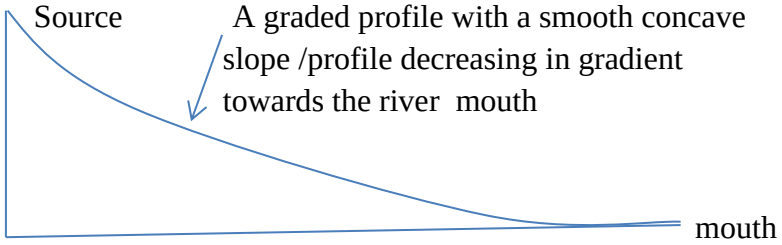
- The cross profile varies according to shape of the channel and shape of floors of the valley.
- The channel width depends on the width of lateral erosion while channel depth depends on the rate of vertical erosion.
- Hence the youthful stage has narrow / V or deep cross profile;

Nature stage has open V – shaped channels while the senile stage has wide / U-shaped shallow profile.



Graded profile

A graded profile of a river refers to a rivers activity being devoted to the attainment of a slope from the source to the mouth where erosion and deposition are balanced. The stream has just sufficient velocity to move its load hence a graded profile / slope of equilibrium



Questions.

(a) Differentiate between aggradation and degradation
(b) Explain the Davisian cycle of landform evolution.

(a) Distinguish between delta and an estuary
(b) Account for the formation of deltas in Africa.

With reference to specific examples from East Africa, explains the conditions which have led to the development of the following features a long river profile:

(a) Plunge pool
(b) Meander
(c) Flood plain.

Examine the landforms resulting from river erosion and the effects on human activities in East Africa?

Examine the relevancy of the Davisian cycle in the study of river profile development.

With ref. with specific examine the formation of feature along a long profile.

(a) Examine the processes leading to the formation of delta.

(b) Assess the importances of deltas in East Africa.