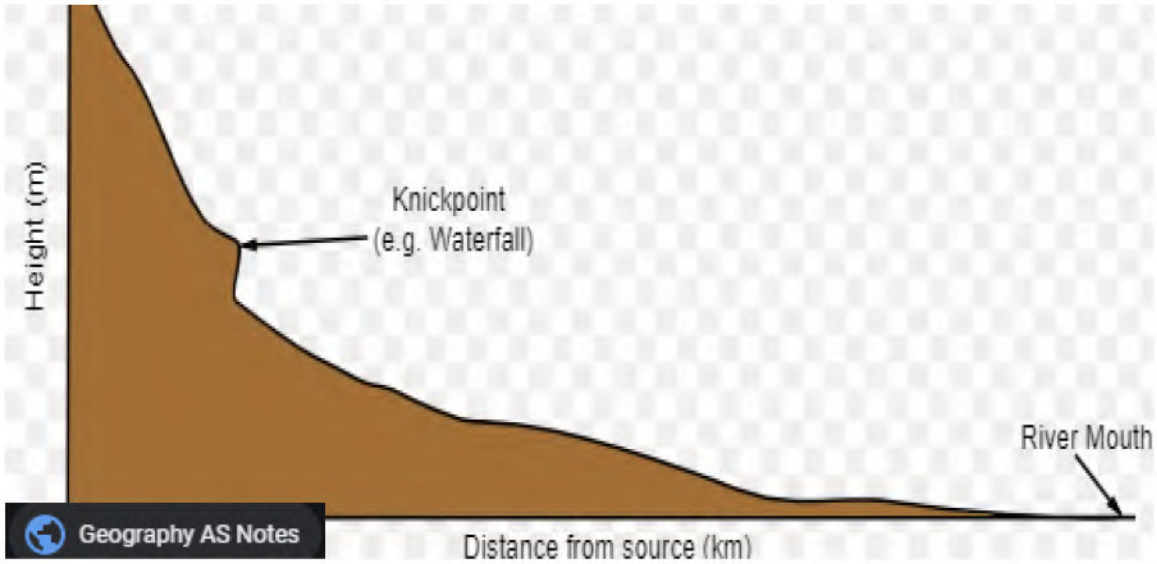
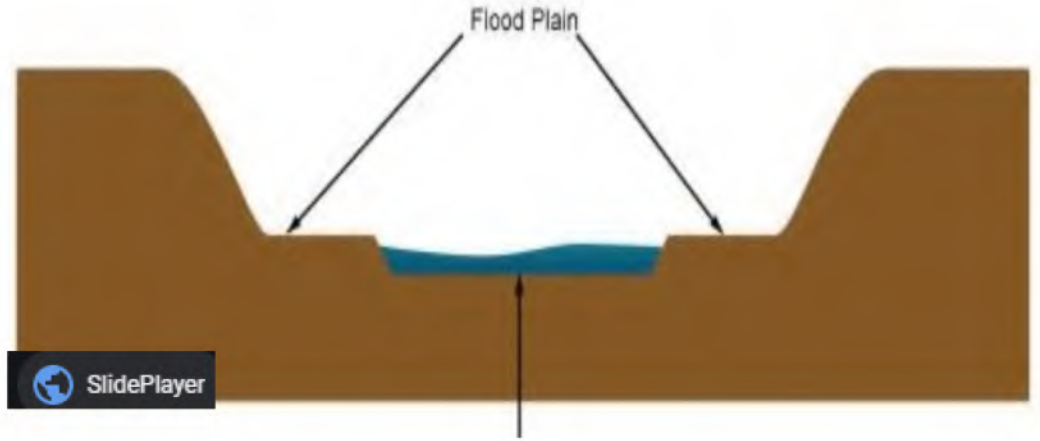
GEOMORPHOLOGY





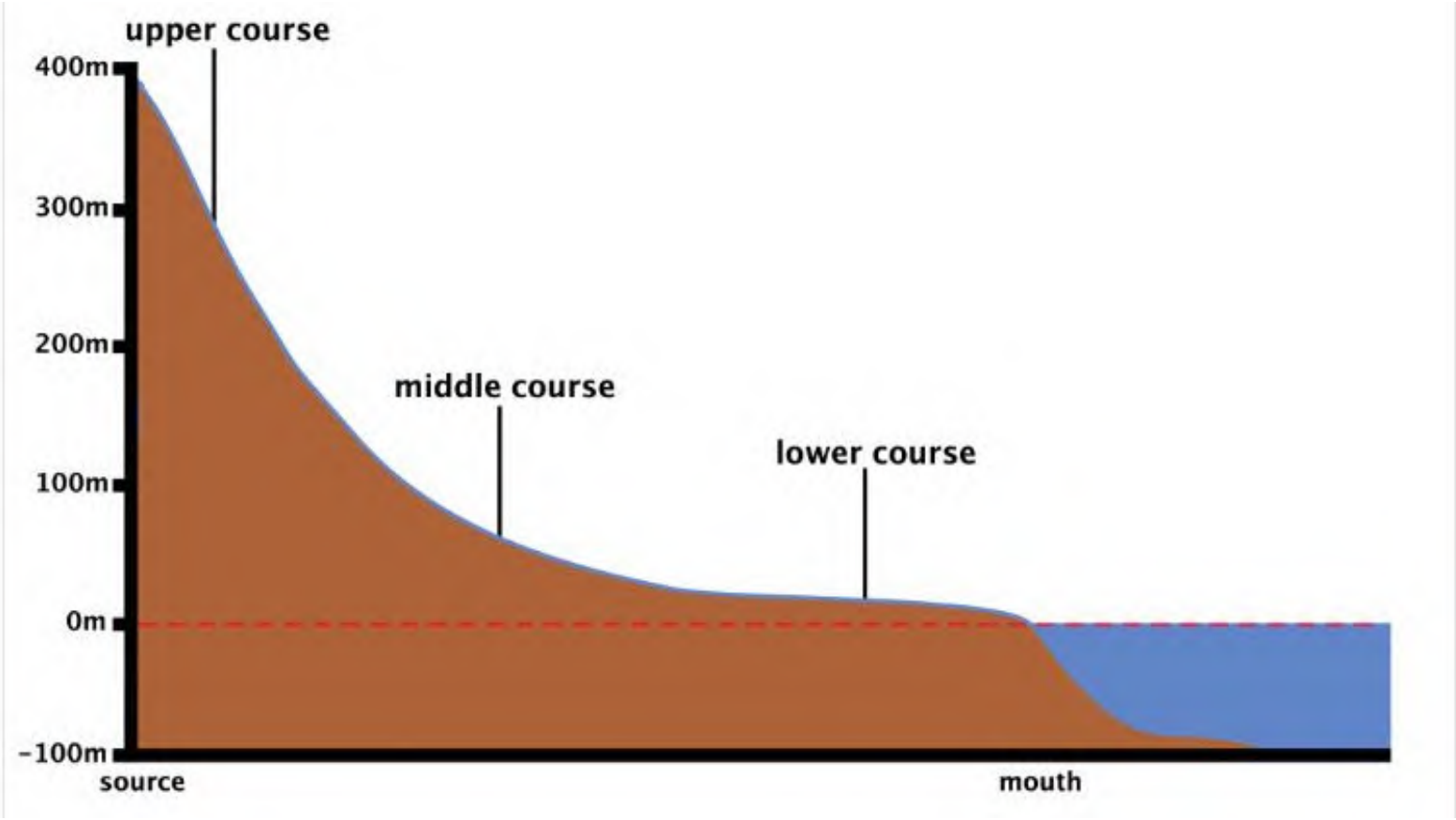
RIVER PROFILES

RAJENDRA DAVECHAND

River profiles:

- Definition, description and associated characteristics
- Cross/Transverse profile
- Longitudinal profile
- Relationship of both profiles to the stages of a river (upper, middle, lower course)

LONGITUDINAL PROFILE



Source: Internet Geography

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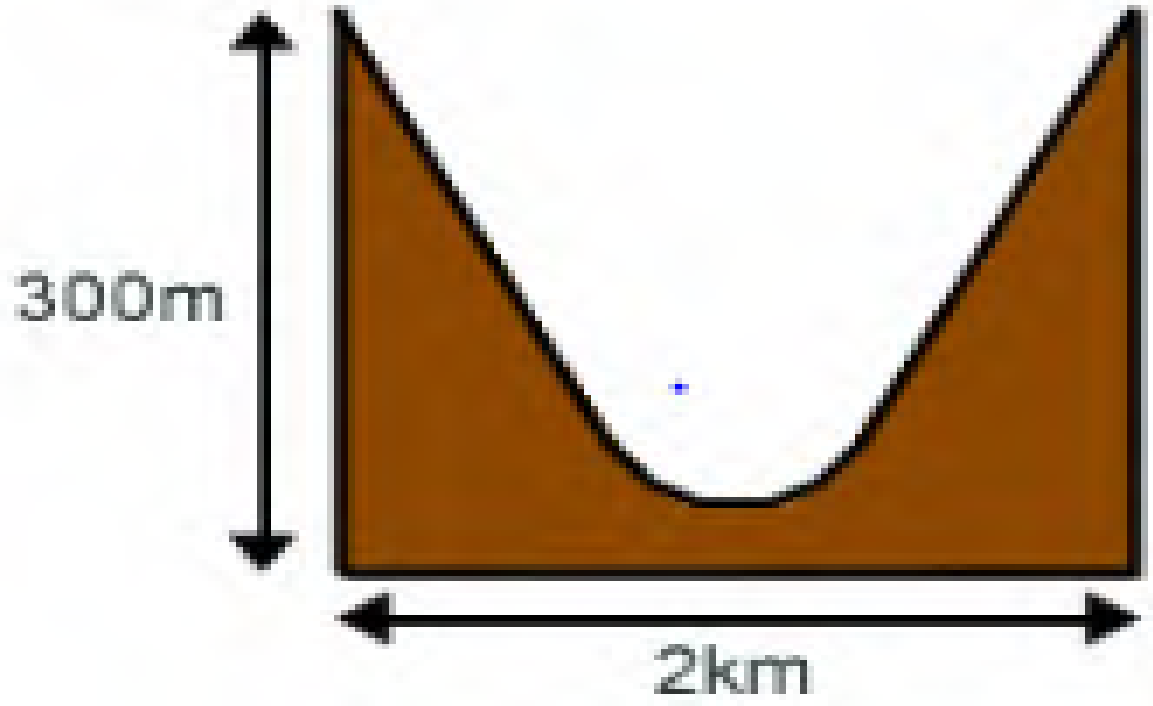
Geography with Dave

It is the side view of a river showing the path of the river from the source to the mouth

- Concave in shape
- Steep at the source and gentle at the mouth

Geography with Dave

Cross/Transverse profile



Source: Internet Geography

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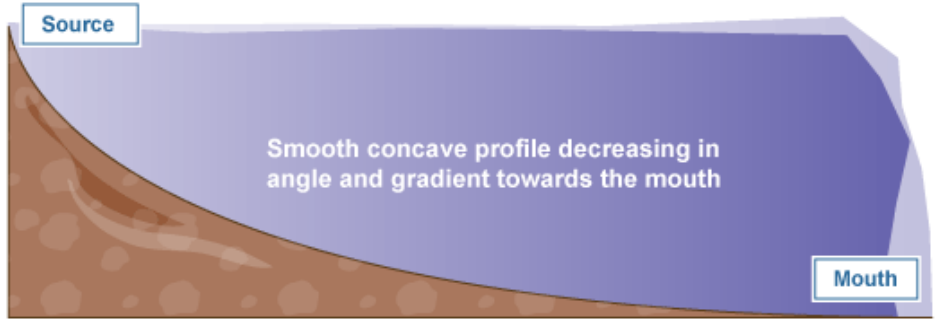
Geography with Dave

Shows the cross view of a river from bank to bank.

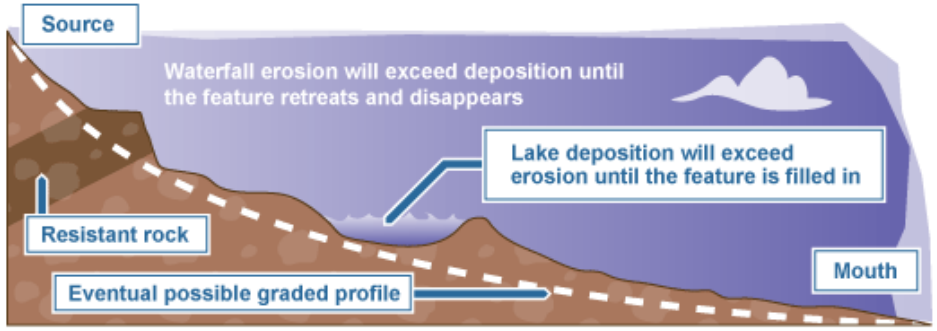
- Can view the width, height and level of water

GRADED PROFILE

Graded profile



Ungraded profile



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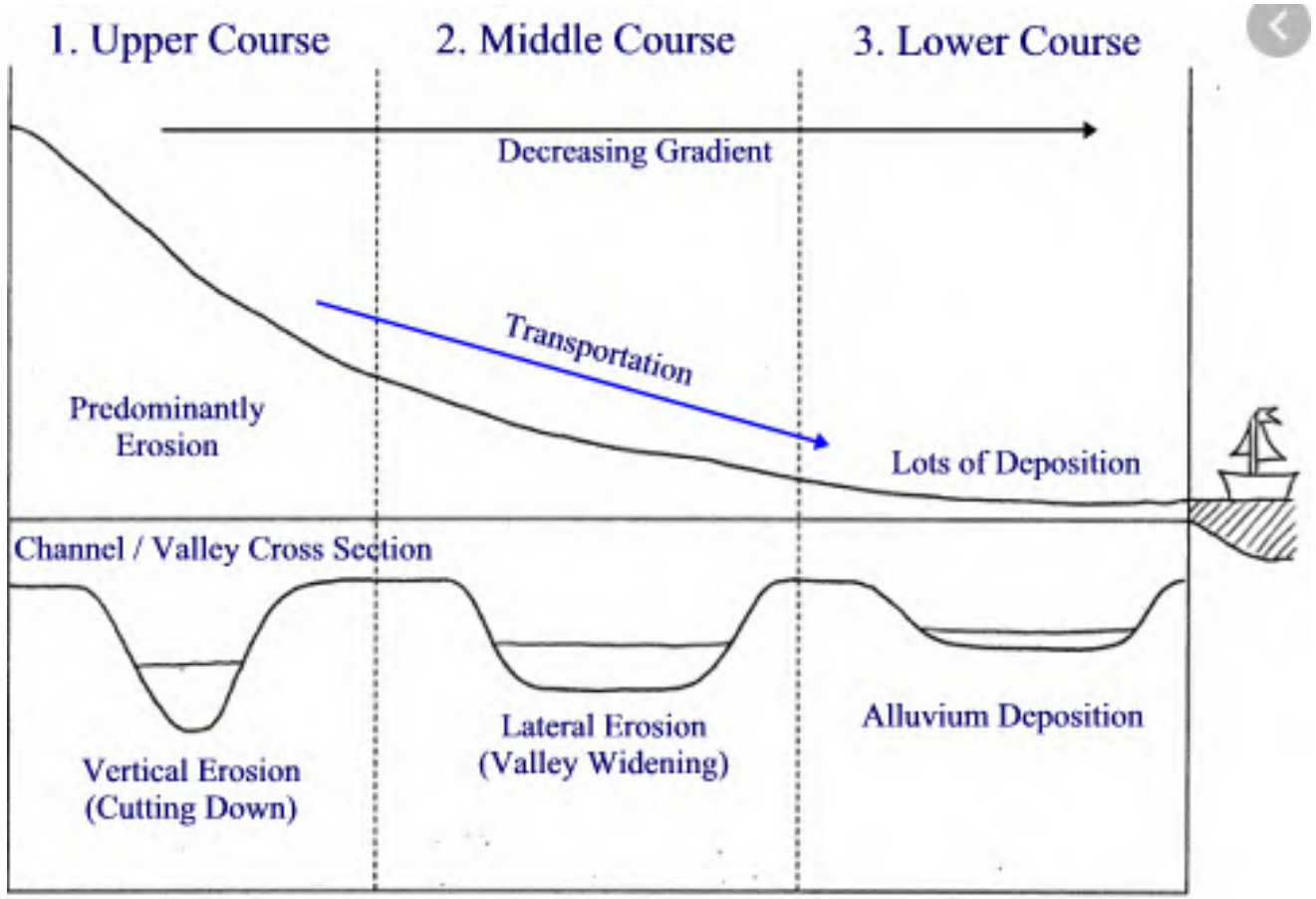
Geography with Dave

Graded profile

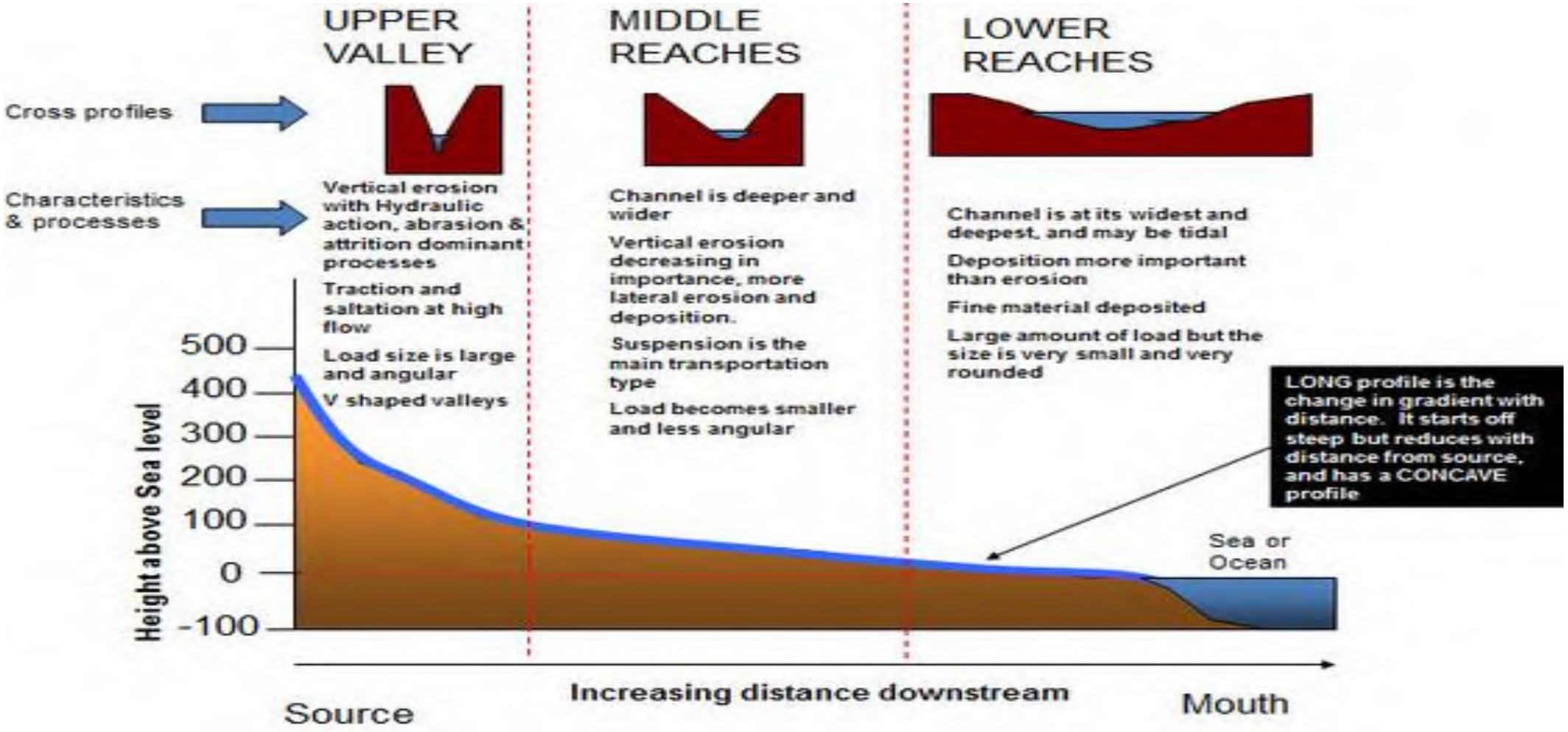
Is a smooth concave profile which is steep a the source and gentle at the mouth. It has no obstructions/knickpoints

Ungraded profile

Is a river profile that has irregularities/obstruction/temporary base levels along its path (It is not smooth)



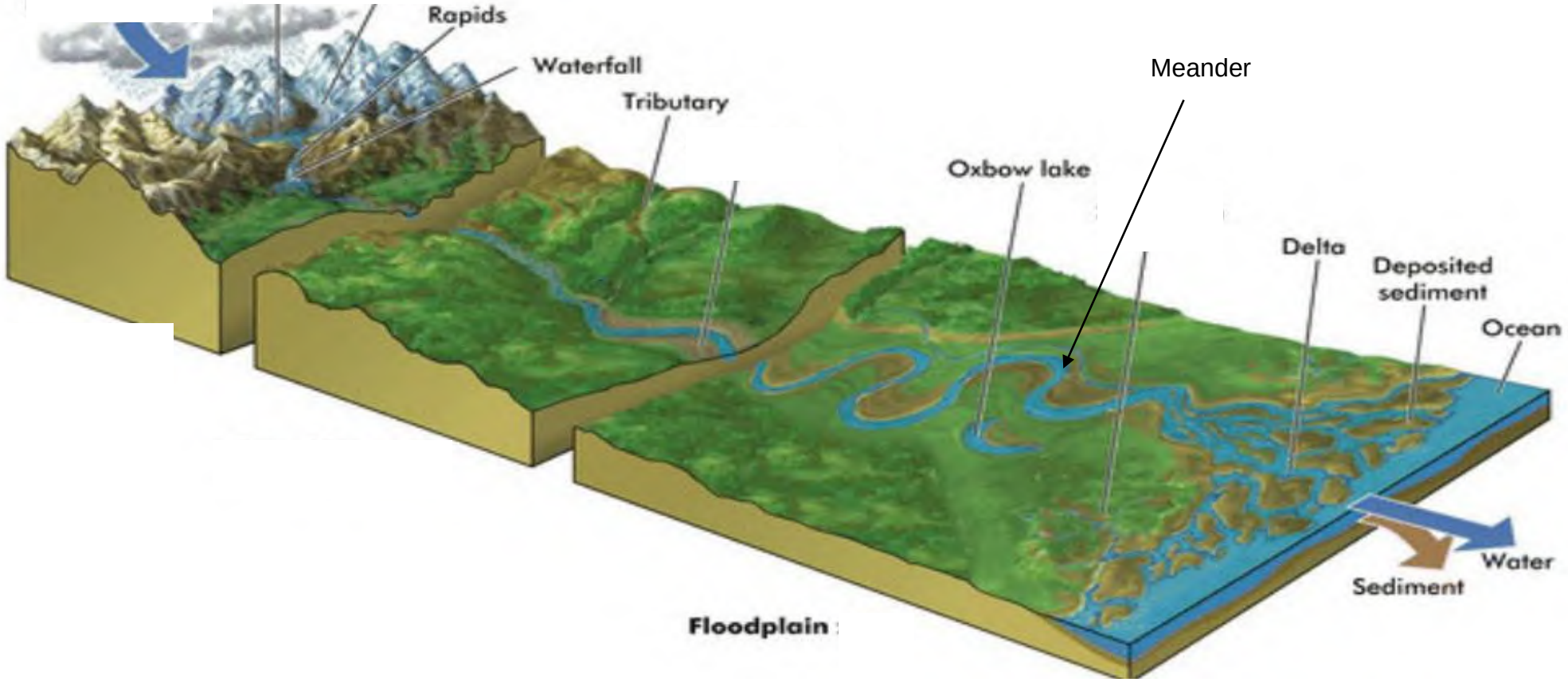
Source: Geo41.com



-Weebly

Geography with Dave

The transverse profile of the river channel changes throughout the course of the river. In the upper section the channel tends to be quite narrow, and comparatively deep. (vertical erosion dominates)
In the middle course of the river has a wider channel, which is deeper than the one in the upper reaches, and the water flows faster, as it has less material to slow it down. (lateral erosion dominates)
The lower course the channel is very wide, deep in places where the water is flowing quickest, and is smooth sided. (deposition dominates)



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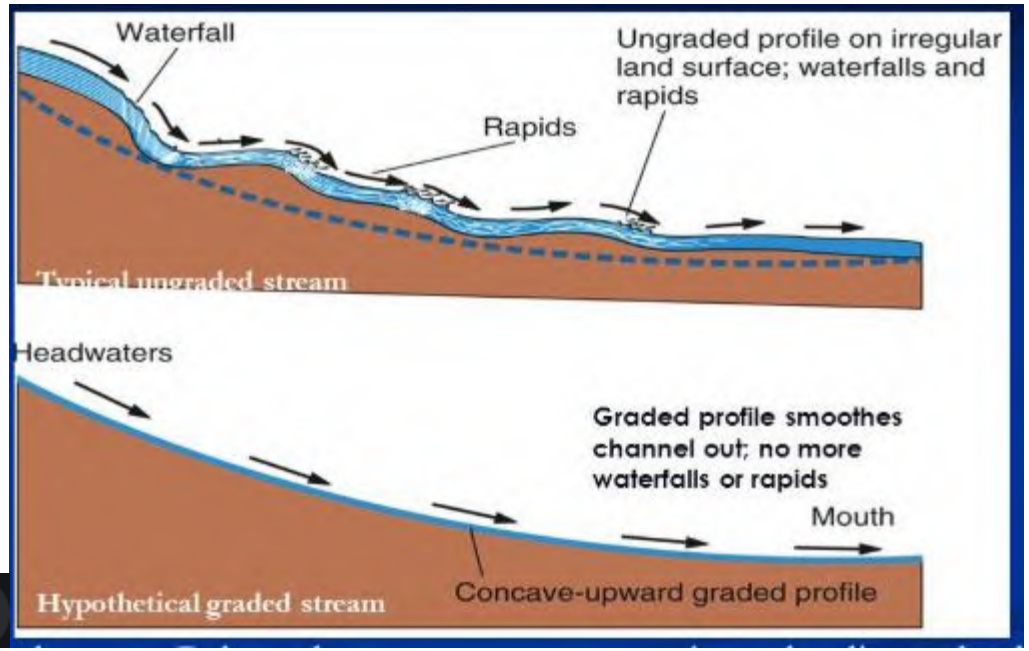
Geography with Dave

GEOMORPHOLOGY



RIVER GRADING

R. DAVECHAND

River grading:

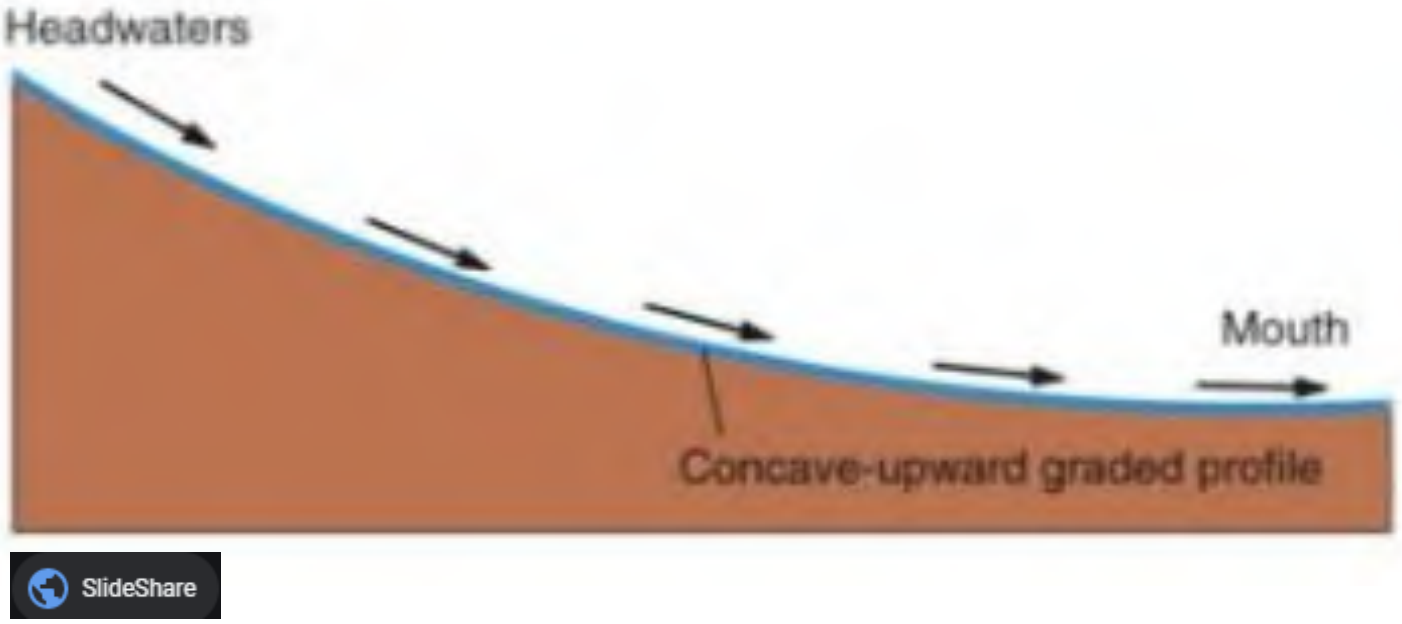
- Distinguish between graded and ungraded streams
- Base level of erosion
- Temporary base level of erosion
- Permanent base level of erosion

RIVER GRADING

Is the state of balance/equilibrium between rate of erosion and rate of deposition.

Graded river

Here the river has just enough energy to carry its load neither erosion or deposition is occurring (Results in graded profile)

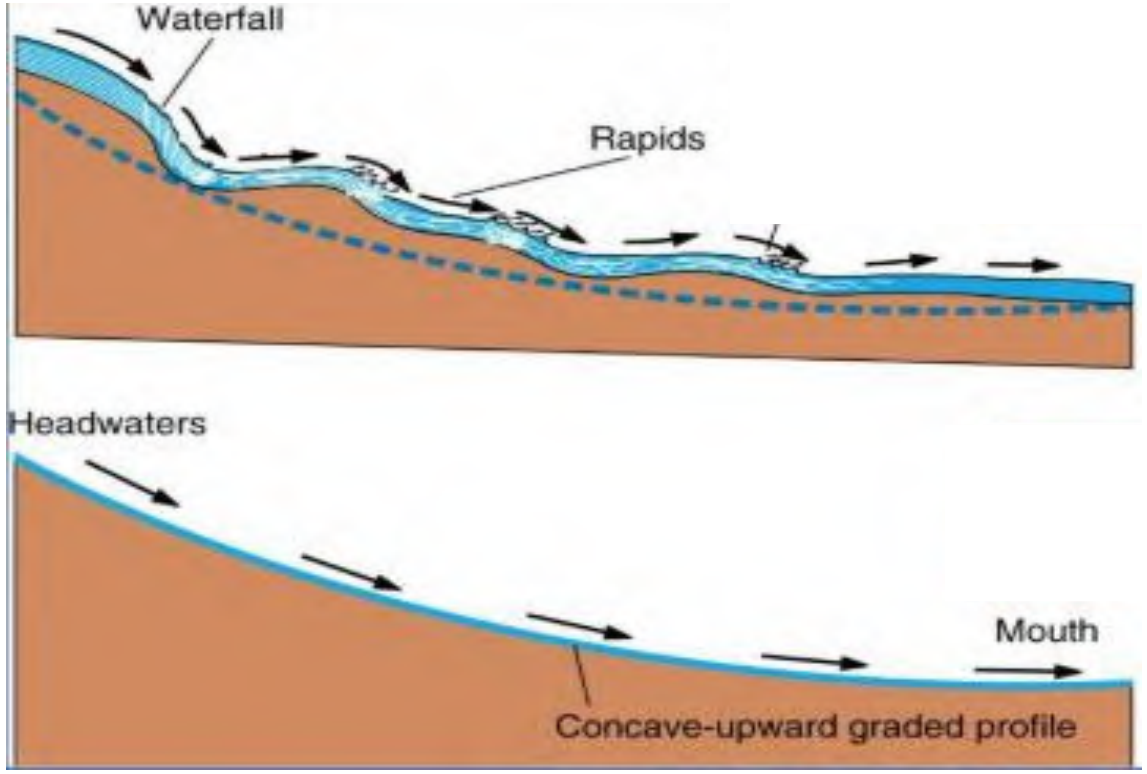


Ungraded profile

Is a river profile that has irregularities/obstruction/temporary base levels along its path (It is not smooth)

Graded profile

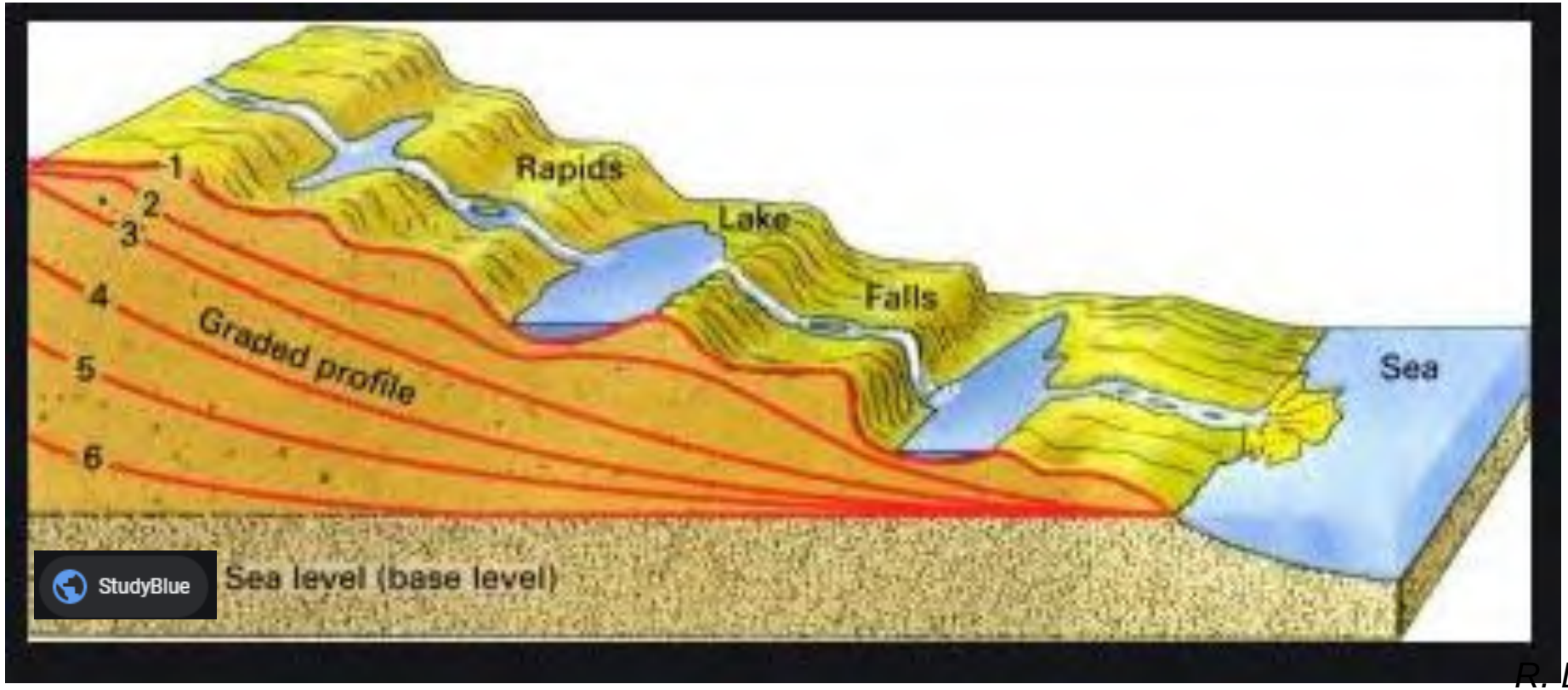
Is a smooth concave profile which is steep a the source and gentle at the mouth. It has no obstructions



Geography with Dave

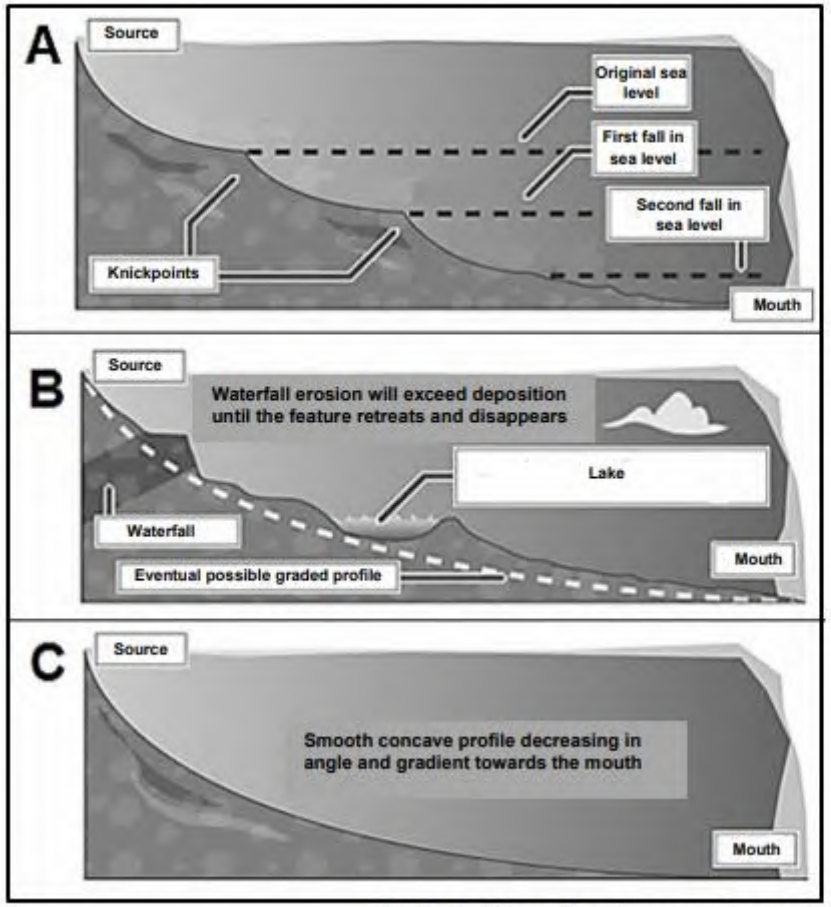
Temporary base level
Is a point along a river's course that prevents it from eroding any deeper at the moment but may be eroded through or change in time. (Results in ungraded profile)

Ultimate base level/Permanent base level
The lowest point to which a river can erode, sea level



Geography with Dave

FIGURE 1.6: RIVER GRADE AND LONGITUDINAL PROFILES OF A RIVE



[Adapted from alevelgeography.com]

1.6 Refer to FIGURE 1.6 showing river grade and the longitudinal profiles of a river.

1.6.1 Give a geographical term to describe the irregular shape of longitudinal profile **B**. (1 x 1) (1)

1.6.1 Ungraded profile (1) (1 x 1) (1)

1.6.2 Name a temporary base level evident in longitudinal profile **B**. (1 x 1) (1)

1.6.2 Lake (1)
Waterfall (1)
Knickpoint (1)
Rock outcrops (1)
[ANY ONE] (1 x 1) (1)

1.6.3 What evidence suggests that rejuvenation has taken place in longitudinal profile **A**? (1 x 2) (2)

1.6.3 A drop in the original sea level (2)
Presence of knick points/waterfalls (2)
Ungraded profile (2)
A sudden change in gradient (2)
[ANY ONE] (1 x 2) (2)

1.6.4 Describe, with reasons, the changes a river meander will undergo after rejuvenation. (2 x 2) (4)

1.6.4 **Description/Change**

The meander will become incised/entrenched (2)
The meander will develop steeper sides (2)
Will form a cut-off meander/ox bow lake (2)
[ANY ONE CHANGE]

Reason

The amount of energy of the river would increase (2)
The velocity of water flowing within the meander increases (2)
The rate of downward/vertical erosion in the meander will increase (2)
A stronger flow will result in the river cutting through the meander neck (2)
[ANY ONE REASON] (2 x 2) (4)

Geography with Dave

1.6.5 In a paragraph of approximately EIGHT lines, explain the processes that assisted the graded river in profile **C** to have a steep gradient in the upper course and a gradual gradient in the lower course. (4 x 2) (8)

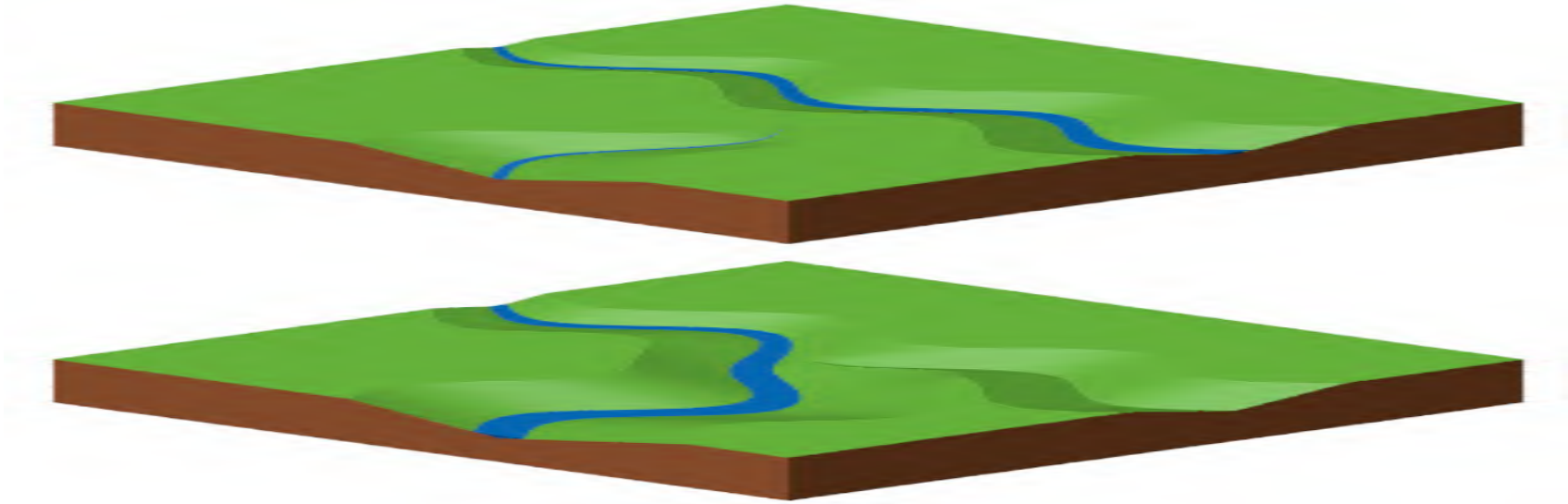
1.6.5 <u>Processes creating the steep gradient in the upper course</u>

Headward/Backward erosion of knickpoints will increase the steepness of the slope (2)
Downward erosion creates a steep gradient (2)
In the upper course water flow is mostly turbulent (2)
The stream has enough energy to carry larger particles (2)
Larger particles increase downwards erosion (2)

<u>Processes creating the gradual gradient in the lower course</u>

Lateral erosion will lead to a more gradual gradient (2)
Sediments are deposited in the lower course (2)
In the lower course water flow is laminar (2)
The carrying capacity is reduced due to the wider river channels (2)
This increases the friction on a river bed and sides and slows water flow resulting in greater deposition rates (2)
[ANY FOUR. MUST REFER TO BOTH STEEP GRADIENT AND GRADUAL GRADIENT] (4 x 2) (8)

GEOMORPHOLOGY



RIVER CAPTURE

RAJENDRA DAVECHAND

Geography with Dave

OVERVIEW

Need to know two important concepts you have done already.

Watershed is a high lying area separating two river systems/drainage basins

Headward/backward erosion is erosion at the origin of the stream channel, causing the origin to move back away from the direction of stream flow.

Here we will deal with two concepts

- River Capture
- Abstraction

The two main factors

The energy of a river

One river capturing the headwaters of another river

Factors that influence this process

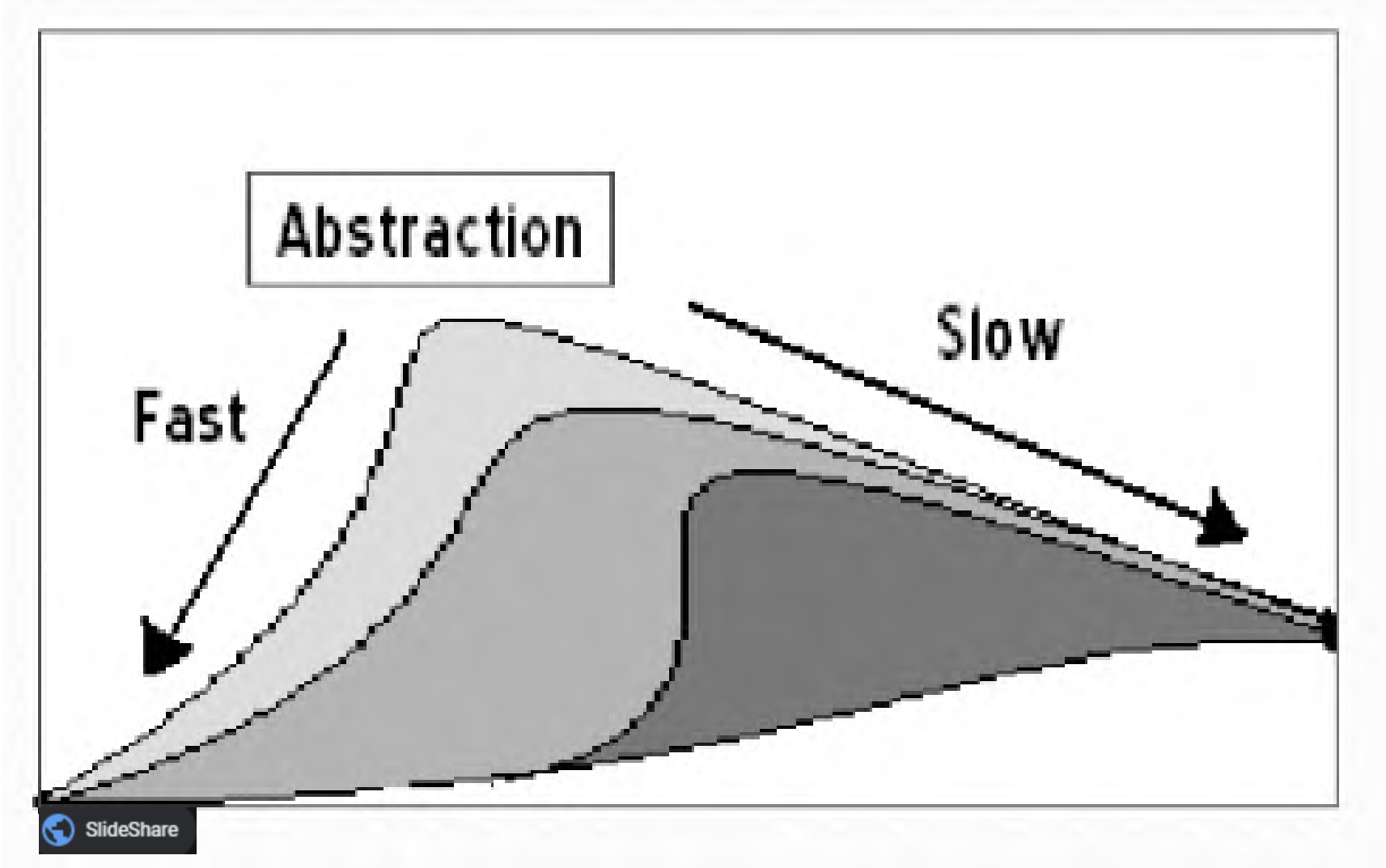
1. One river has a steeper gradient than the other river
2. One river has a less resistant underlying rock than the other river
3. One river has a greater volume of water than the other river

SOURCES USED

LinkedIn learning Geography fluvial landforms

DBE past papers

Mindset learning channel

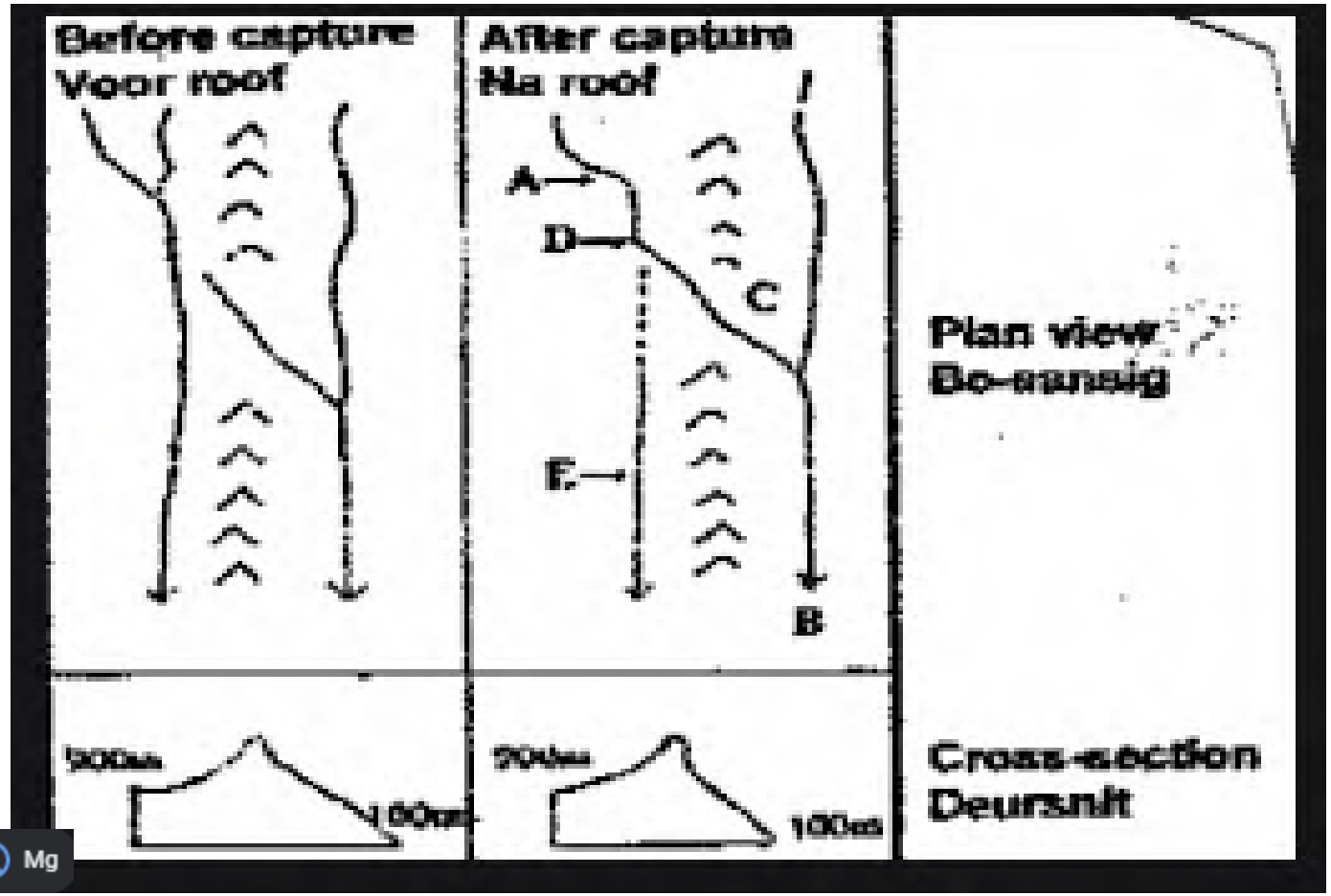


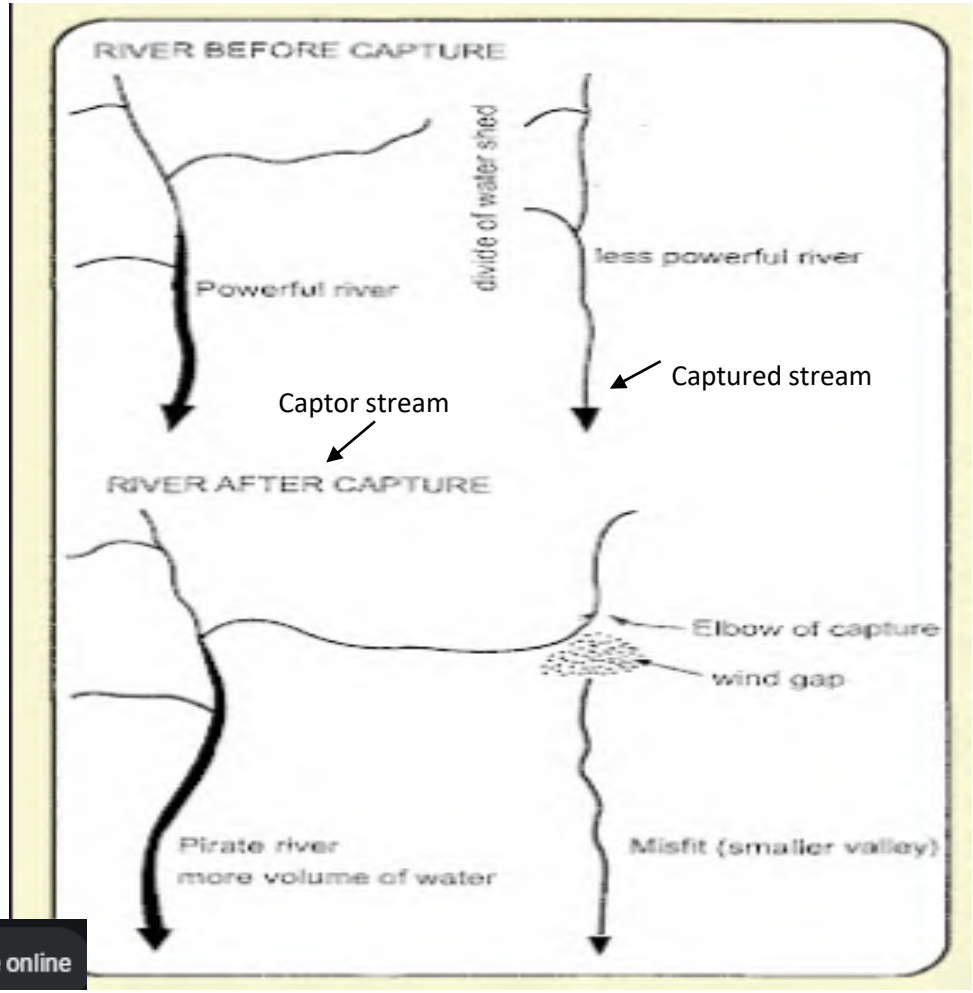
ABSTRACTION

- It occurs when streams flow on either side of a watershed. If one stream is more energetic than the other (this could be due to the three factors mentioned above) it will erode upstream and the watershed will move in the direction of the less energetic stream. This allows the more energetic stream to capture the headwaters of the less energetic stream. The size of the drainage basin of the more energetic stream increases.

RIVER CAPTURE

- Occurs when one more energetic river captures headwaters of a less energetic river.





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DESCRIPTION OF RIVER CAPTURE FEATURES

- **Captured stream**
- The part of the river that is diverted by the captor stream
- **Captor stream**
- This is the energetic stream that cuts back and intercepts the other river
- **Misfit stream**
- The river that has lost its headwaters as a result of capture
- **Elbow of capture**
- This is the point of capture where the change of flow direction occurs.
- **Windgap**
- This the area between the elbow of capture and the misfit stream where the water stops flowing and river gravels are deposited.

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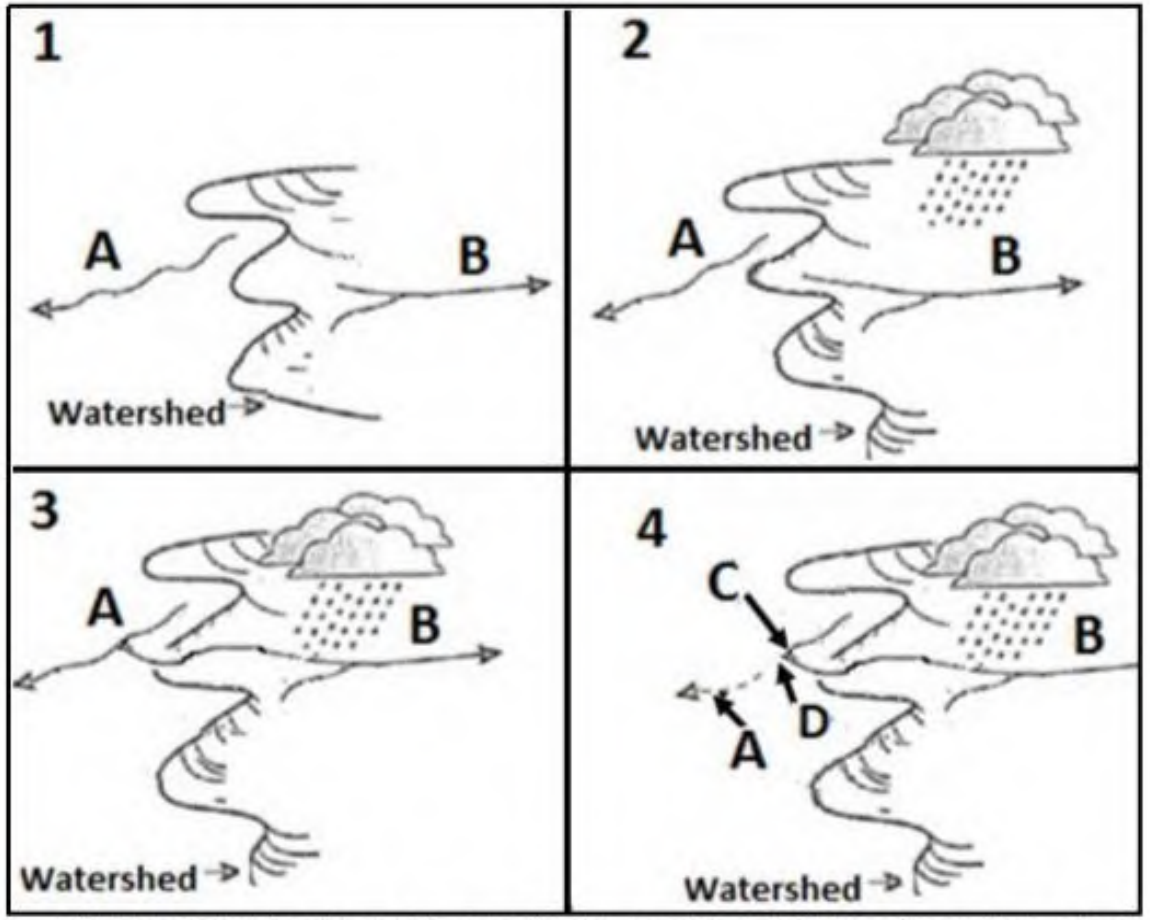
FIGURE 1.2: RIVER CAPTURE



[Adapted from https://www.bing.com/images/search=landforms+of+stream+capture]

1.2 FIGURE 1.2 shows sketches (**1** to **4**) based on river capture.

1.2.1 Refer to sketch **1**. Which one, river **A** or river **B**, is likely to be the captor stream?

1.2.2 Name the climatic factor causing river **B** in sketch **2** to erode at a faster rate.

1.2.3 What type of erosion caused the watershed to move towards river **A** in sketch **2**?

1.2.4 Refer to sketch **3**. Which one, river **A** or river **B**, is the captured stream?

1.2.5 Refer to sketch **4**. Name the feature of river capture at **C**.

1.2.6 Refer to sketch **4**. Name the feature of river capture at **D**.

1.2.7 What is the term used to describe river **A** which has been reduced in volume in sketch **4**?

1.2.8 Does river **A** or river **B** flow at a lower altitude in sketch **2**? (8 x 1) (8)

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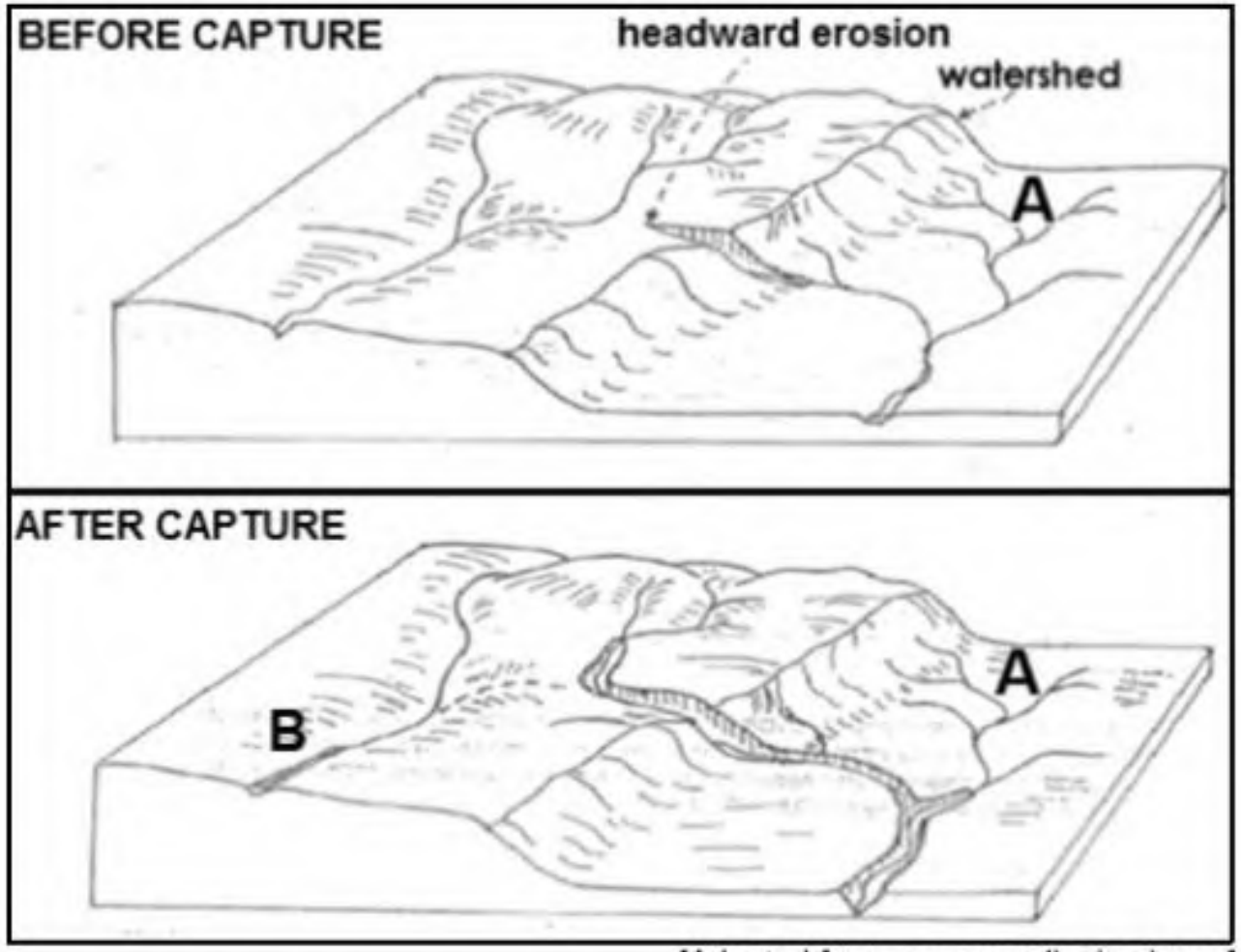
FIGURE 1.6: RIVER CAPTURE



[Adapted from ecorsesonlineiasri.com]

1.6.1 Define the term *river capture*. (1 x 1) (1)

1.6.1 When a more energetic river captures the headwaters of a less energetic river (1)

1.6.2 What evidence in sketch **A** indicates that river capture is likely to take place? (1 x 1) (1)

1.6.2 Headward erosion is taking place (1)
Tributary of river A is cutting back through watershed (1)
[ANY ONE] (1 x 1) (1)

1.6.3 Name TWO physical changes that river **A** will undergo after river capture has occurred. (2 x 1) (2)

1.6.3 Greater volume of water (1)
Erosive ability increases (1)
Drainage basin becomes larger (1)
Will be rejuvenated/more energetic/greater velocity(1)
[ANY TWO] (2 x 1) (2)

1.6.4 State TWO possible conditions that have led to river **A** being the captor stream. (2 x 2) (4)

1.6.4 River A flows at a lower level than river B (2)
River A could be flowing on softer rock (thus eroding faster) that river B (2)
River A could be in a higher rainfall area than river B (2)
Tributaries of river A flow down a steeper slope (2)
River A has a greater erosive ability (2)
Higher volume of water/higher stream order (2)
[ANY TWO] (2 x 2) (4)

1.6.5 Write a paragraph of approximately EIGHT lines to describe how the reduced volume of water will negatively impact on the farming community at **B**. (4 x 2) (8)

1.6.5 Less water for irrigation of crops (2)
Reduced yields due to the lack water (2)
Increase costs to obtain sufficient water (2)

Reduced flooding reduces natural fertilization of soil (2)
Input costs to farm increases (2)
Farming no longer economically viable (2)
Loss of jobs as farming areas decline(2)
Loss of income as farming yields decrease (2)
Poverty increases due to lack of crops to sell and access to food (2)
Rural-urban migration sets in (2)
Lack of domestic water (2)
Lack of recreational activities (2)
Poverty increases due to lack of access to food (food insecurity) (2)
[ANY FOUR] (4 x 2) (8)

GEOMORPHOLOGY

CATCHMENT AND RIVER MANAGEMENT

RAJENDRA DAVECHAND

Catchment and river management

- Importance of managing drainage basins/catchment areas
- Impact of people on drainage basins/catchment areas:
  - River pollution
  - Overgrazing
  - Deforestation
  - Human settlement
- Strategies to manage drainage basins/catchment areas

IMPORTANT CONCEPTS

A catchment is defined as the area (drainage basin) that captures rainfall which will drain into a watercourse (river system).

Drainage basin is an area drained by a river and it's tributaries.

Catchment management is balancing the use and conservation of natural resources on a whole of catchment basis.
Catchment management is achieved through the combined efforts of the community, government and non-government organisations working together towards common and sustainable targets to achieve this balance.

River Management is defined as the management of water resources of a basin as part of the natural ecosystem and in relation to their socio-economic setting. (Sustainable conservation of the river and its drainage basin).

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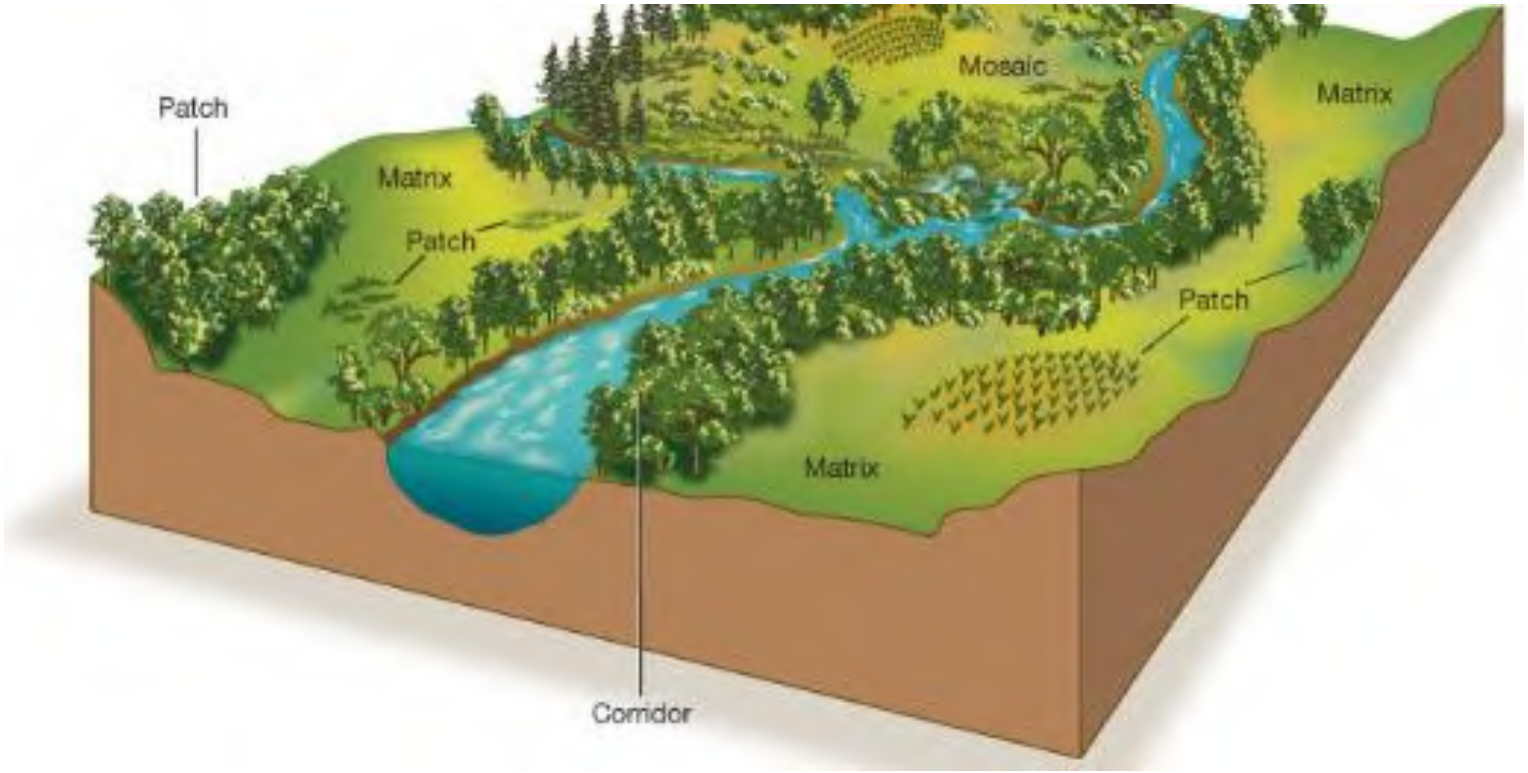
Azania

IMPORTANCE OF MANAGING DRAINAGE BASINS/CATCHMENT AREAS



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IMPORTANCE OF MANAGING DRAINAGE BASINS/CATCHMENT AREAS

- Store water and protecting for future use
- Reduce discharge and recycle harmful agricultural run-off.
- Agricultural purposes e.g. farming
- Industrial purposes e.g. use in factories cooling systems
- Flood control- control flow of water to reduce chances of flooding
- Domestic use – use by people in homes etc.
- Recreation e.g. water sport
- Hydroelectricity
- Natural vegetation
- Bird and wildlife

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RIVER POLLUTION

EOG Asia

R. Davechand 2020

iBan Plastic

ThoughtCo

River water gets polluted in various ways e.g. industrial waste, fertilizers and pesticides from agriculture, untreated sewage.

This reduces the quality of water, damages the natural environment both land and aquatic.

OVERGRAZING

Greentumble

Removes vegetation and increases run-off.

It results in:

- Flooding
- More erosion and more soil deposited in the river system, reducing quality and quantity of water and damaging aquatic ecosystems

DEFORESTATION

Medium

Live Science

Removes vegetation and increases run-off.
It results in:
Flooding
More erosion and more soil deposited in the river system, reducing quality and quantity of water and damaging aquatic ecosystems

Other impacts by people

- Alter run-off by building dams e.g. less water below dam
- Urban development reduces infiltration
- Agricultural irrigation reduces water for natural environment
- Water projects can reduce water in areas

HUMAN SETTLEMENT

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Reduces infiltration and increases run-off.

Could result in more water and more flooding in lower region

Could result in more water usage and less water available in lower region.

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Pollute the catchment area and river
Uses a lot of water and this impact negatively on the ecology of rivers and their catchment areas
Removes vegetation and increases run-off.
It results in:
Flooding
More erosion and more soil deposited in the river system, reducing quality and quantity of water and damaging aquatic ecosystems

STRATEGIES TO MANAGE DRAINAGE BASINS/CATCHMENT AREAS

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- Improve wastewater treatment
- Maximizing wastewater re-use for irrigation and other purposes of generation
- In the dry season release stored water to keep ecosystems as natural as possible
- Remove alien vegetation
- Monitor overgrazing to reduce erosion
- Proper sewage treatment
- Educate people on the importance of catchment and river management
- Monitor and improve water purification works

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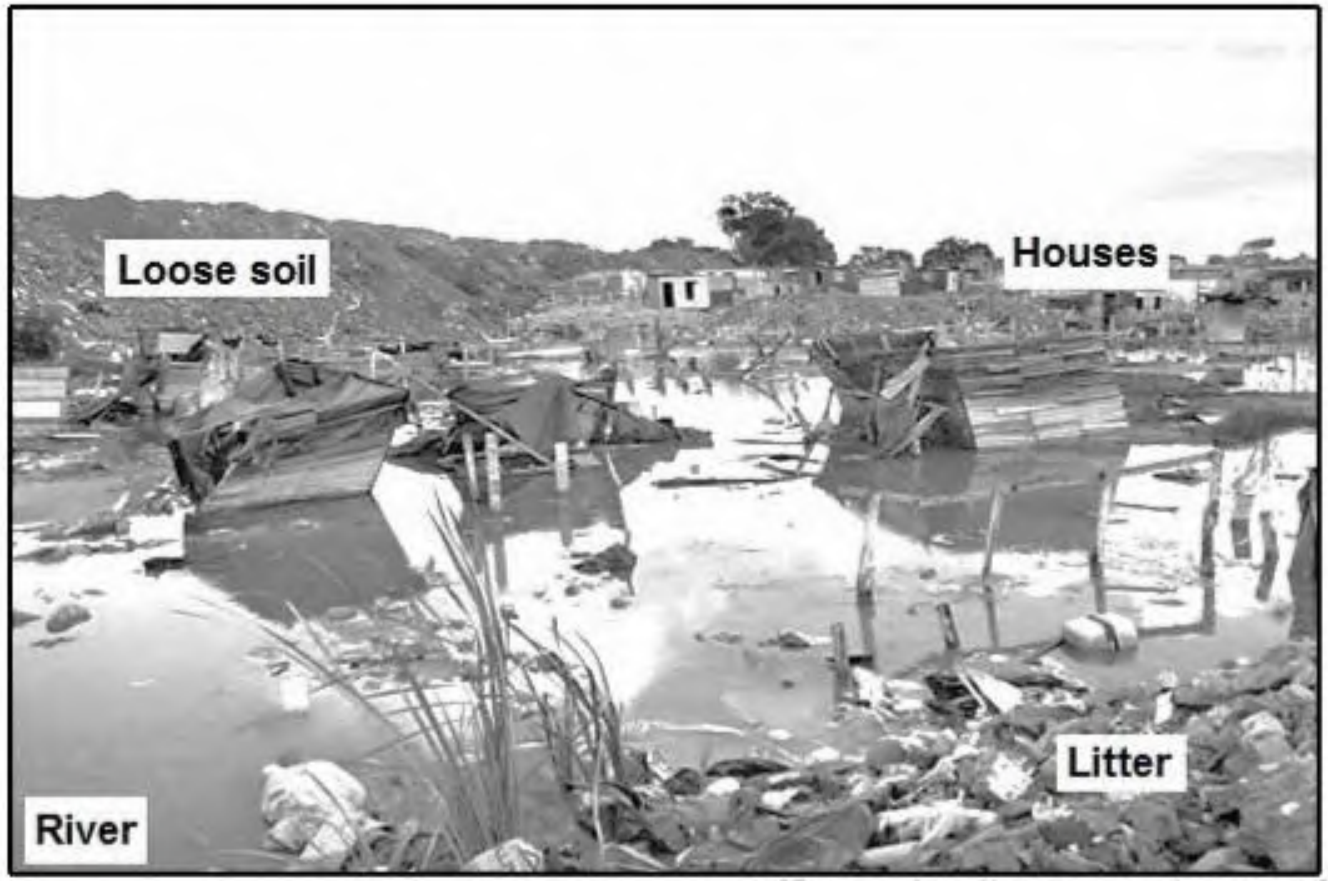
FIGURE 1.6: IMPACT OF PEOPLE ON RIVERS



[Source: http://www.groundup.org.za]

1.6 Refer to FIGURE 1.6, a photograph showing the impact of people on rivers.

1.6.1 What does the term *river management* mean? (1 x 1) (1)

1.6 1.6.1 Sustainable conservation of the river and its drainage basin (1)
[CONCEPT] (1 x 1) (1)

1.6.2 Which government department is responsible for the health and sustainable use of rivers? (1 x 1) (1)

1.6.2 The Department of Water Affairs (1) (1 x 1) (1)

1.6.3 What evidence in the photograph indicates poor river management?
(2 x 1) (2)

1.6.3 Development of informal settlement on the river bank (1)
Littering of all types of wastes in the river (1)
Removal of vegetation which results in loose soil (1)
Disposal of domestic waste as people are living on the river bank (1)
Remains of buildings in river (1)
[ANY TWO] (2 x 1) (2)

1.6.4 Recommend TWO ways in which the municipality can reduce the impact of informal settlements on rivers. (2 x 2) (4)

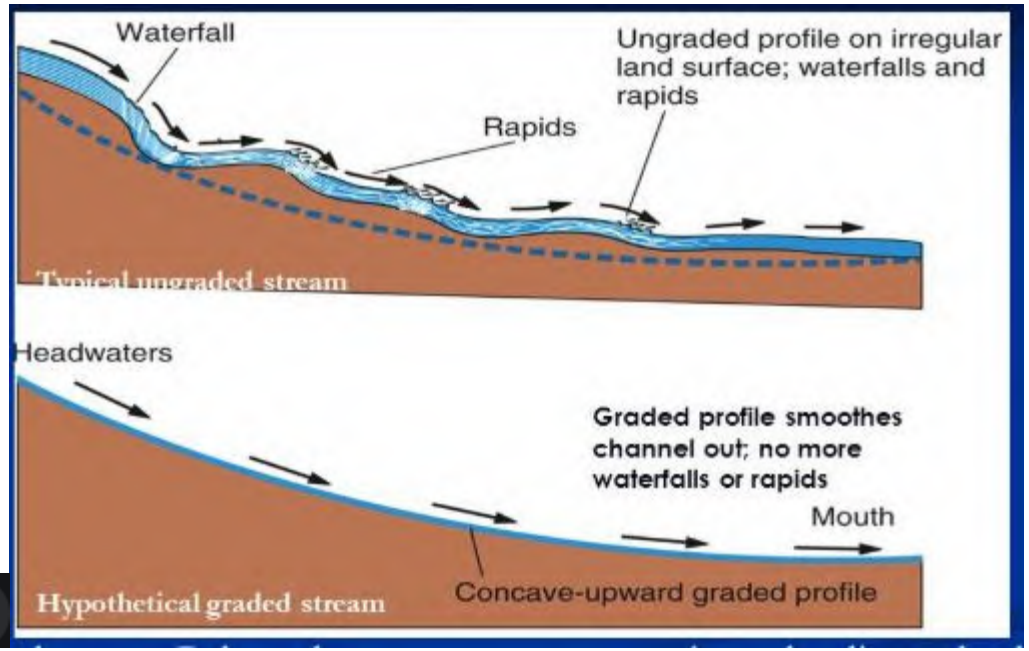
1.6.4 Move the settlement above the flood line/away from the river (2)
Educate residents about management of river resources (2)
Provision of refuse removal services (2)
Proper sanitation (2)
Running water in houses (2)
Alternative/RDP housing to relocate the people away from the river bank (2)
Vegetating the bare slopes (2)
Creating a buffer zone to prevent pollution of the river (2)
Legislation and fines (2)
[ANY TWO] (2 x 2) (4)

1.6.5 Write a paragraph of approximately EIGHT lines in which you give reasons why it is crucial (very important) to maintain the health (or quality) of rivers in South Africa. (4 x 2) (8)

1.6.5 Limited water resources in South Africa (2)
Rivers are our only source of fresh drinkable water (2)
Supply clean water that is essential for human health (2)
They are fresh water reservoirs that supply people with food e.g. fish (2)
Clean water needed for farming/irrigation (2)
Clean water needed for industrial activities (2)
Clean water for domestic purposes (2)
Ensure that the ecosystems remain healthy and in balance (2)
Maintain aesthetic appeal (2)
Essential for water recreation activities (2)
They are used for tourist attractions (2)
[ANY FOUR] (4 x 2) (8)

Geography with Dave

GEOMORPHOLOGY



RIVER GRADING

R. DAVECHAND

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RIVER GRADING

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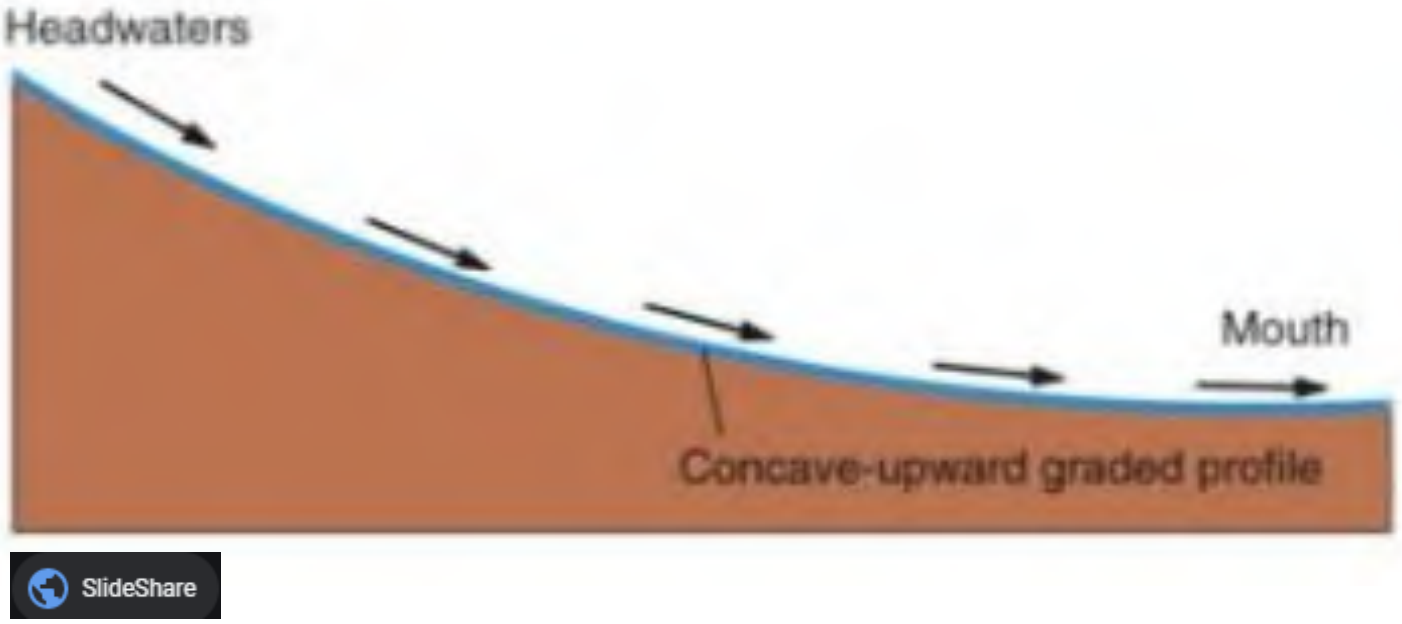

Ungraded profile

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Graded profile

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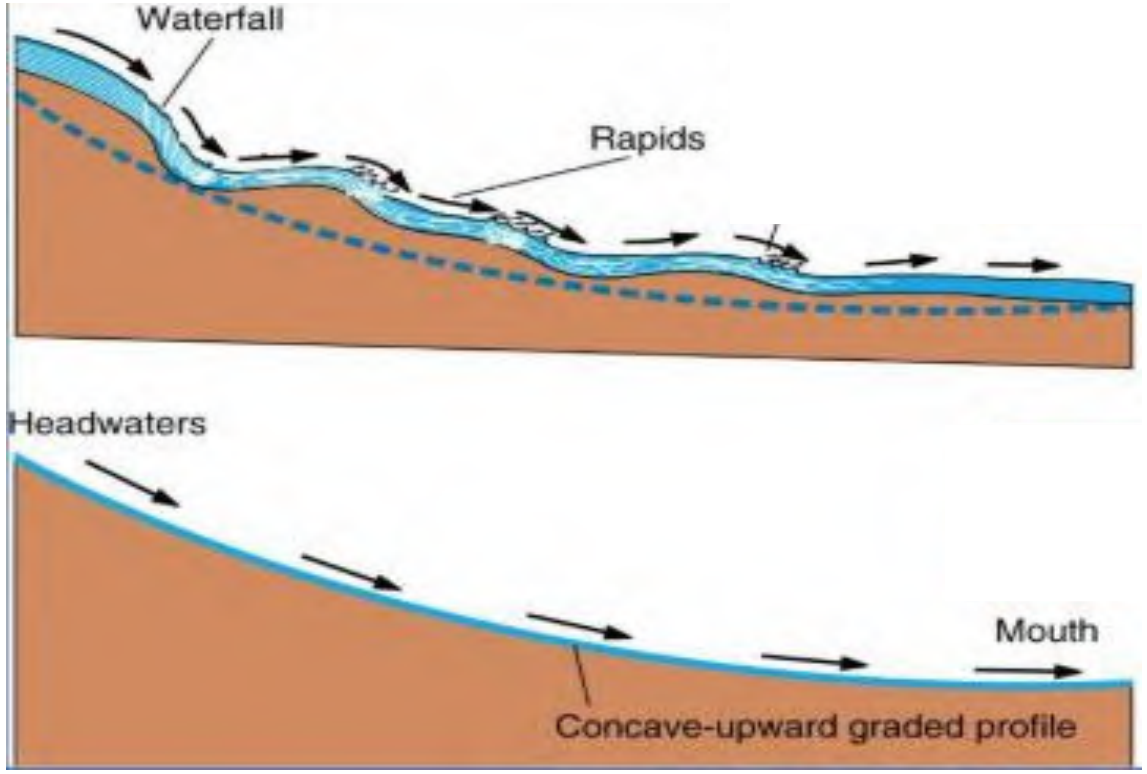

Geography with Dave

Temporary base level
Is a point along a river's course that prevents it from eroding any deeper at the moment but may be eroded through or change in time. (Results in ungraded profile)

Ultimate base level/Permanent base level
The lowest point to which a river can erode, sea level

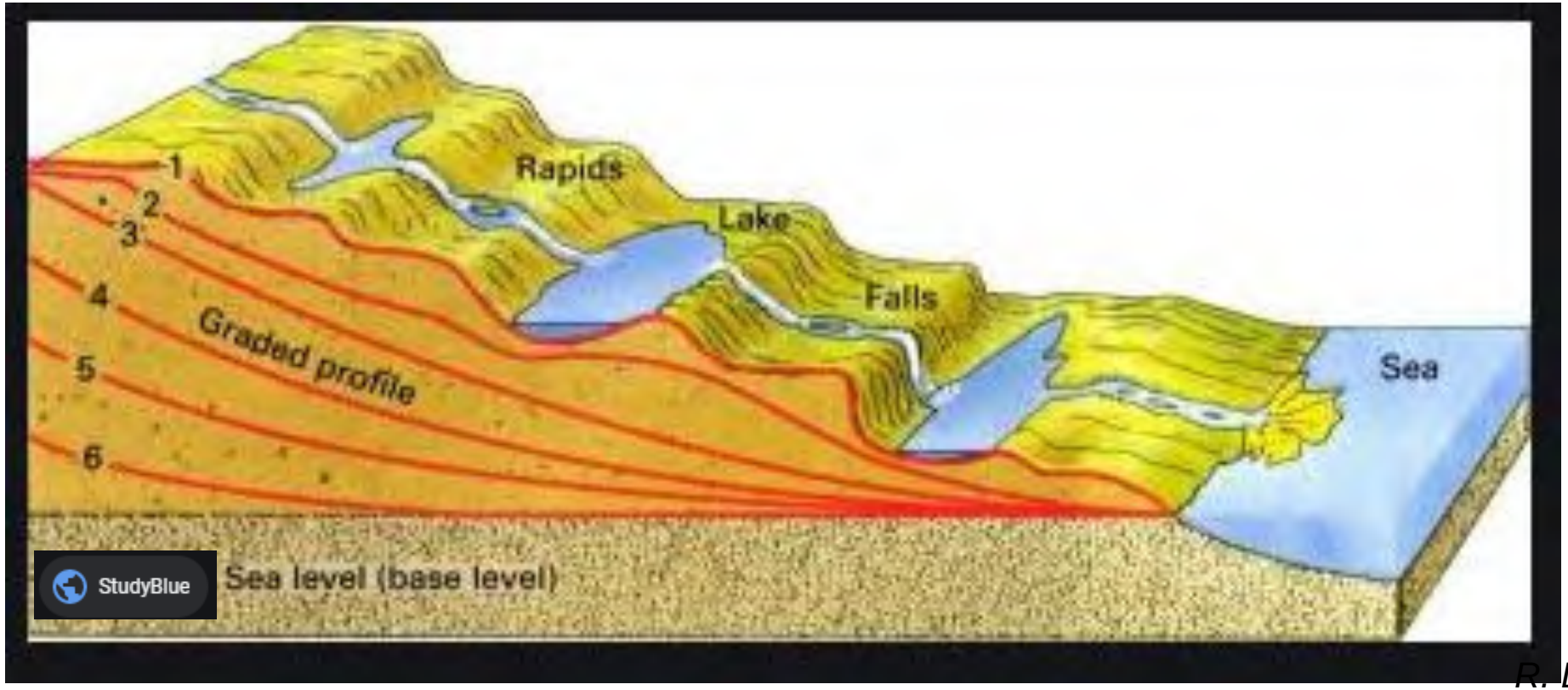

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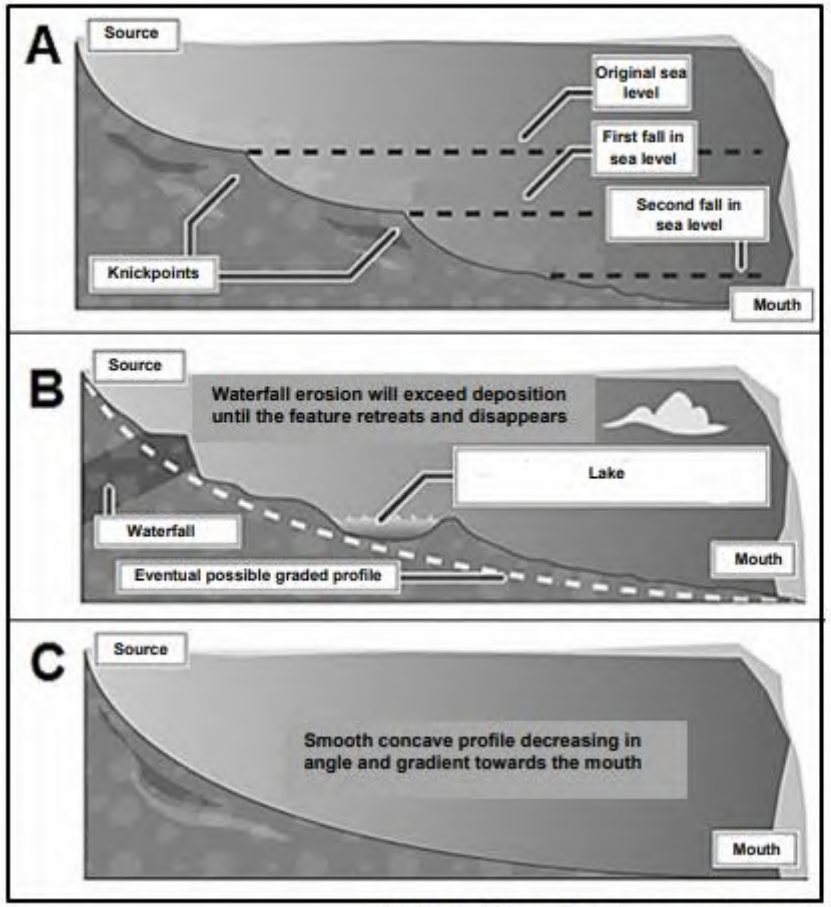
FIGURE 1.6: RIVER GRADE AND LONGITUDINAL PROFILES OF A RIVE



[Adapted from alevelgeography.com]

1.6 Refer to FIGURE 1.6 showing river grade and the longitudinal profiles of a river.

1.6.1 Give a geographical term to describe the irregular shape of longitudinal profile **B**. (1 x 1) (1)

1.6.1 Ungraded profile (1) (1 x 1) (1)

1.6.2 Name a temporary base level evident in longitudinal profile **B**. (1 x 1) (1)

1.6.2 Lake (1)
Waterfall (1)
Knickpoint (1)
Rock outcrops (1)
[ANY ONE] (1 x 1) (1)

1.6.3 What evidence suggests that rejuvenation has taken place in longitudinal profile **A**? (1 x 2) (2)

1.6.3 A drop in the original sea level (2)
Presence of knick points/waterfalls (2)
Ungraded profile (2)
A sudden change in gradient (2)
[ANY ONE] (1 x 2) (2)

1.6.4 Describe, with reasons, the changes a river meander will undergo after rejuvenation. (2 x 2) (4)

1.6.4 **Description/Change**

The meander will become incised/entrenched (2)
The meander will develop steeper sides (2)
Will form a cut-off meander/ox bow lake (2)
[ANY ONE CHANGE]

Reason

The amount of energy of the river would increase (2)
The velocity of water flowing within the meander increases (2)
The rate of downward/vertical erosion in the meander will increase (2)
A stronger flow will result in the river cutting through the meander neck (2)
[ANY ONE REASON] (2 x 2) (4)

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1.6.5 In a paragraph of approximately EIGHT lines, explain the processes that assisted the graded river in profile **C** to have a steep gradient in the upper course and a gradual gradient in the lower course. (4 x 2) (8)

1.6.5 <u>Processes creating the steep gradient in the upper course</u>

Headward/Backward erosion of knickpoints will increase the steepness of the slope (2)
Downward erosion creates a steep gradient (2)
In the upper course water flow is mostly turbulent (2)
The stream has enough energy to carry larger particles (2)
Larger particles increase downwards erosion (2)

<u>Processes creating the gradual gradient in the lower course</u>

Lateral erosion will lead to a more gradual gradient (2)
Sediments are deposited in the lower course (2)
In the lower course water flow is laminar (2)
The carrying capacity is reduced due to the wider river channels (2)
This increases the friction on a river bed and sides and slows water flow resulting in greater deposition rates (2)
[ANY FOUR. MUST REFER TO BOTH STEEP GRADIENT AND GRADUAL GRADIENT] (4 x 2) (8)

Geography with Dave

GEOMORPHOLOGY

RIVER REJUVENATION

RAJENDRA DAVECHAND

River rejuvenation:

- Reasons for rejuvenation
- Features of rejuvenation
  - Knickpoint
  - Terraces
  - Valley in a valley
  - Incised/Entrenched meanders

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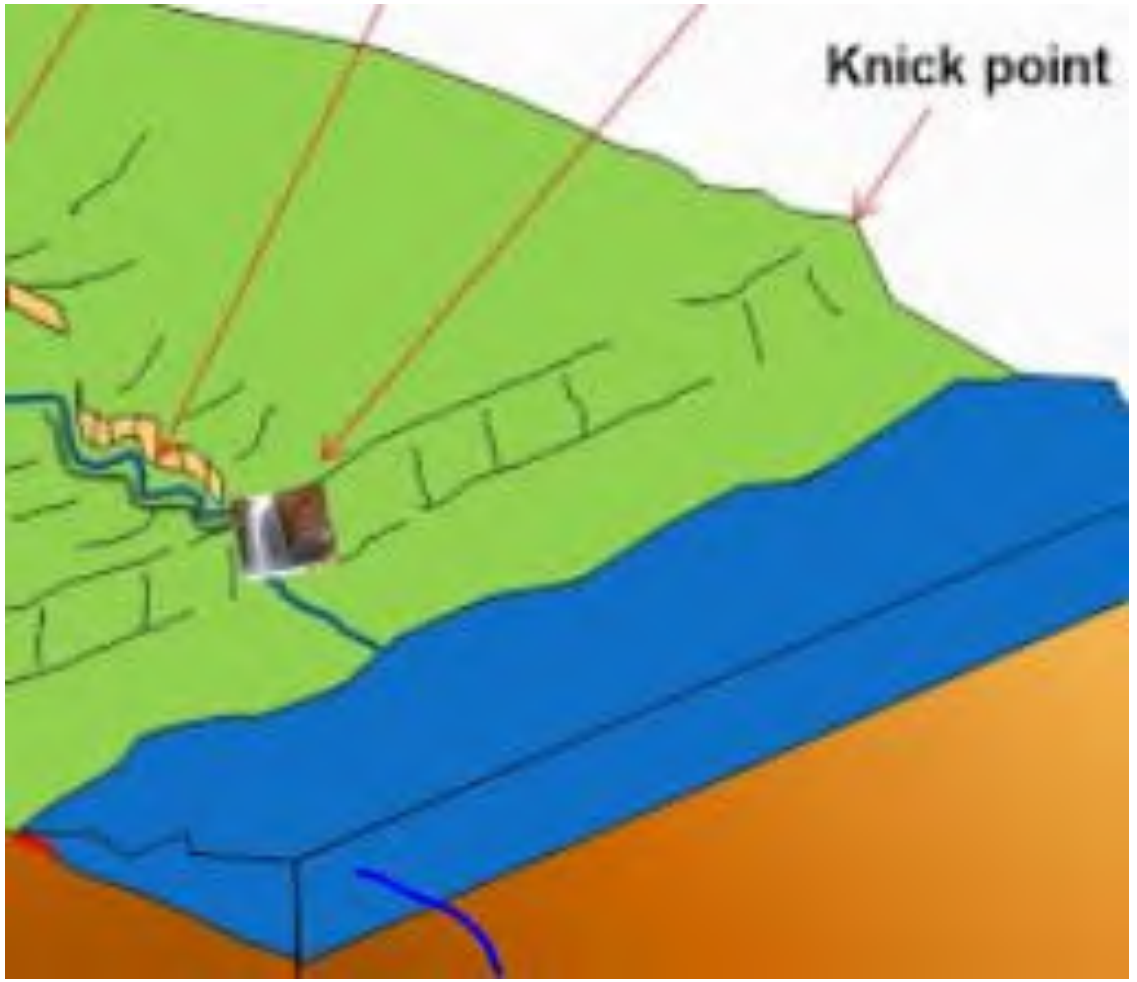
Tweets by



Cool Geography

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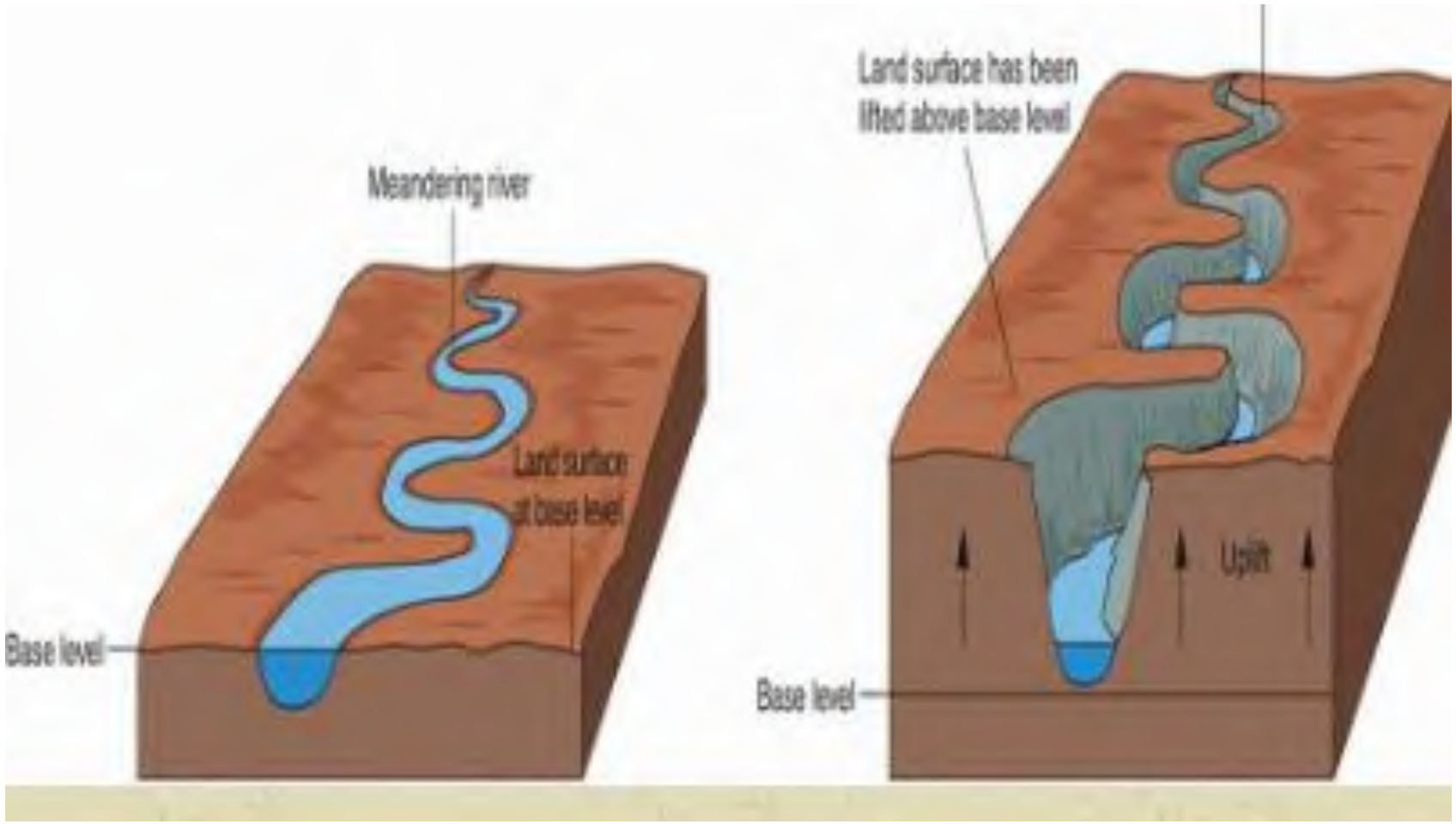
Rejuvenation

Occurs when the rivers speed and erosive power increases resulting in an increase in downward erosion (vertical erosion)



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Characteristics of a rejuvenated river include water that flows rapidly with sloping sides that create steep cuts on the valley floor.

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Reasons for rejuvenation

When the sea level is lowered
When land is uplifted e.g. due to tectonic processes
Increase in volume of water e.g. due to rainfall
River capture

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FEATURES OF REJUVENATION

Knickpoint

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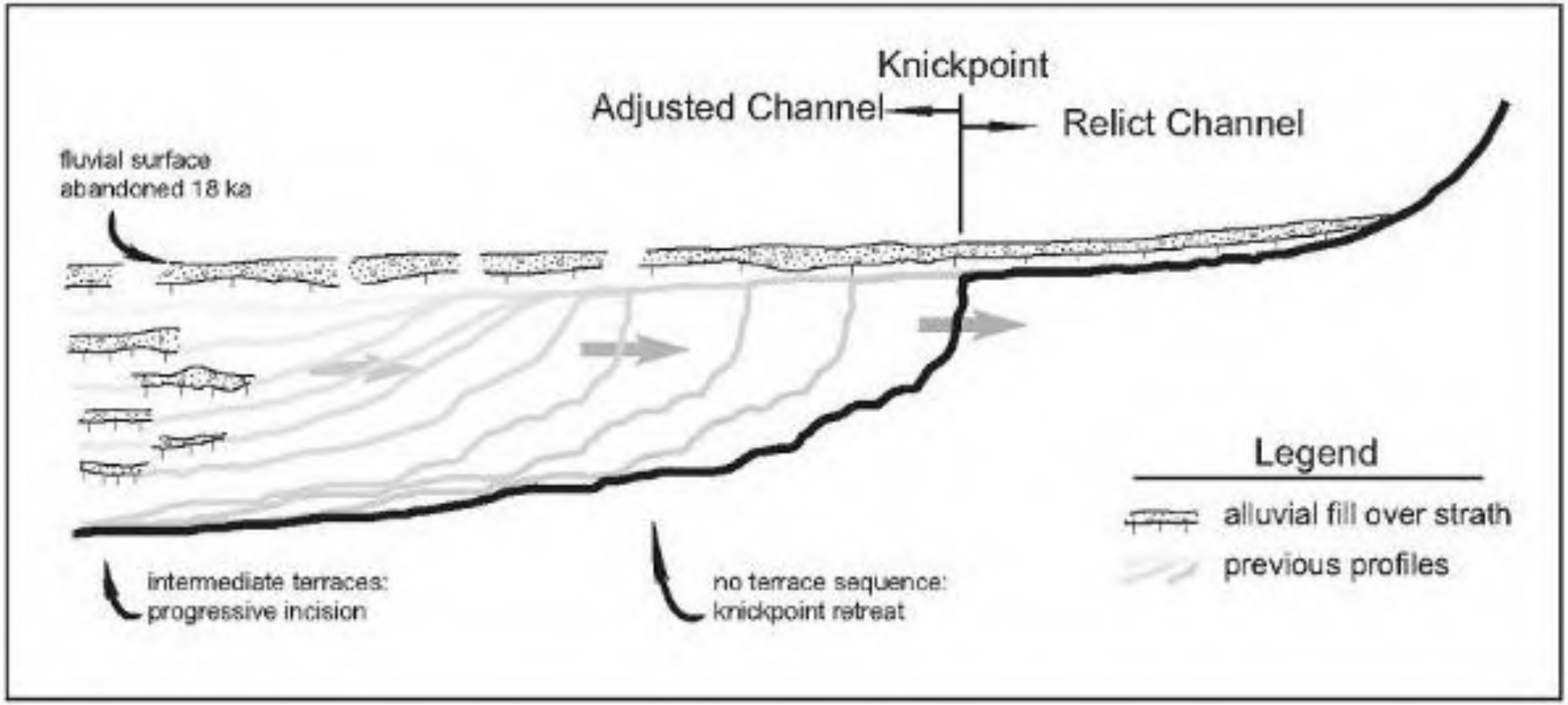

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Knickpoint is part of a river or channel where there is a sharp change in channel slope (gradient). This can result from an increase in downward (vertical erosion) due to rejuvenation.

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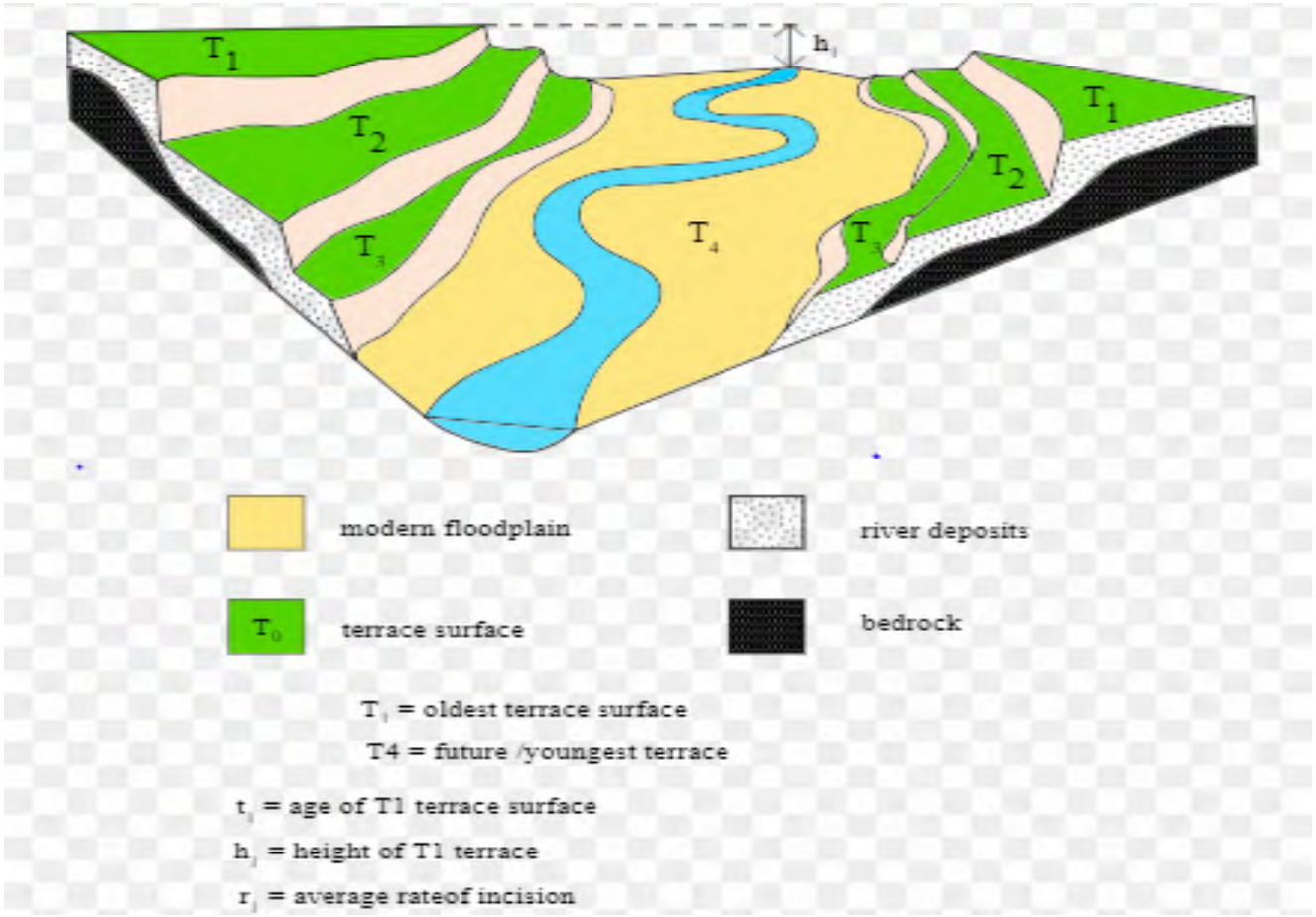
River terraces



Wikipedia

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Pinterest

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Terrace

When a river flowing on the valley floor experiences rejuvenation it cuts into the valley floor. As this process continues it creates steps at different levels known as terraces. They ae found on both sides of the river valley

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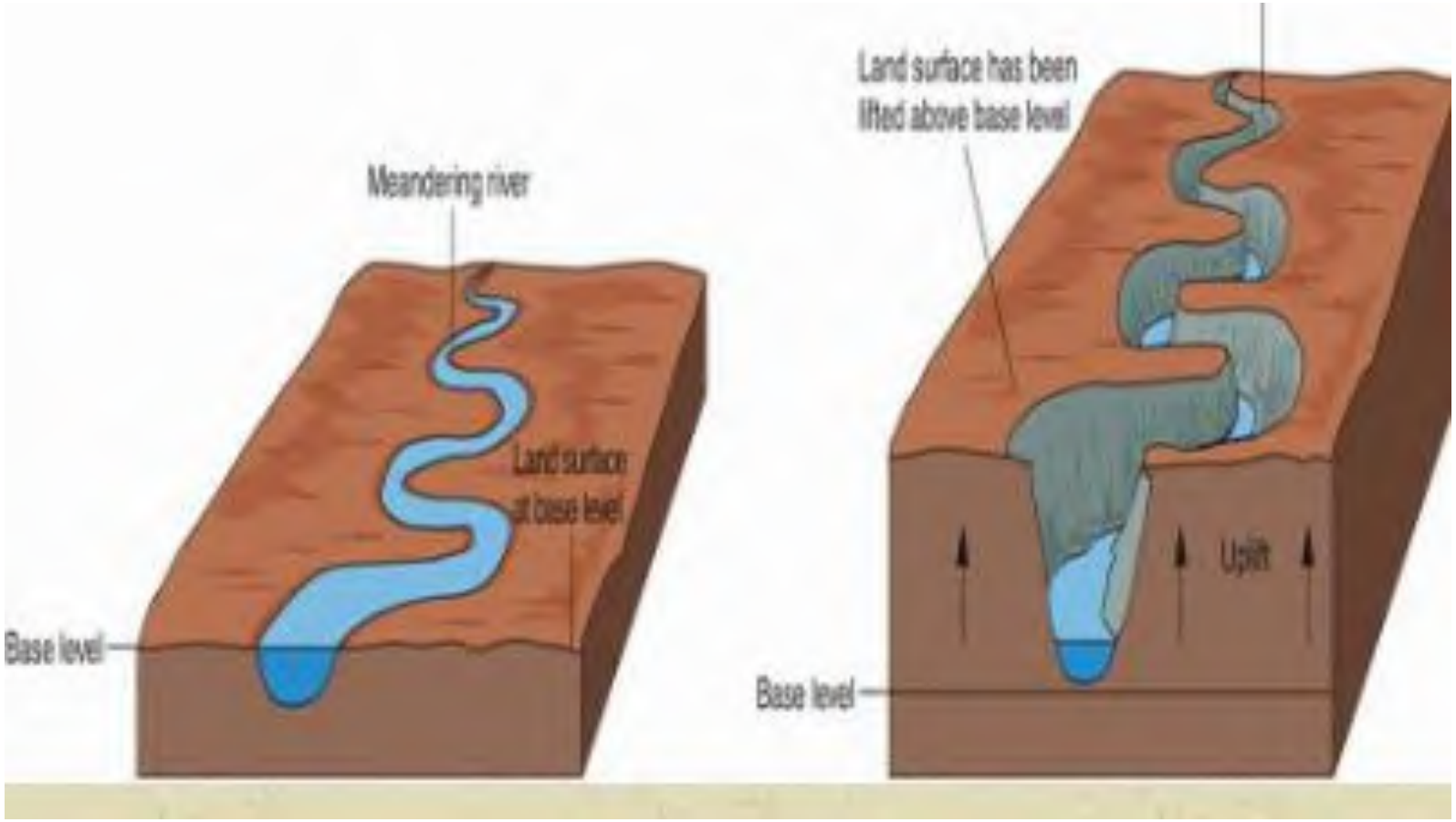
Incised/Entrenched meander



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Incised/Entrenched meander

A level Geography

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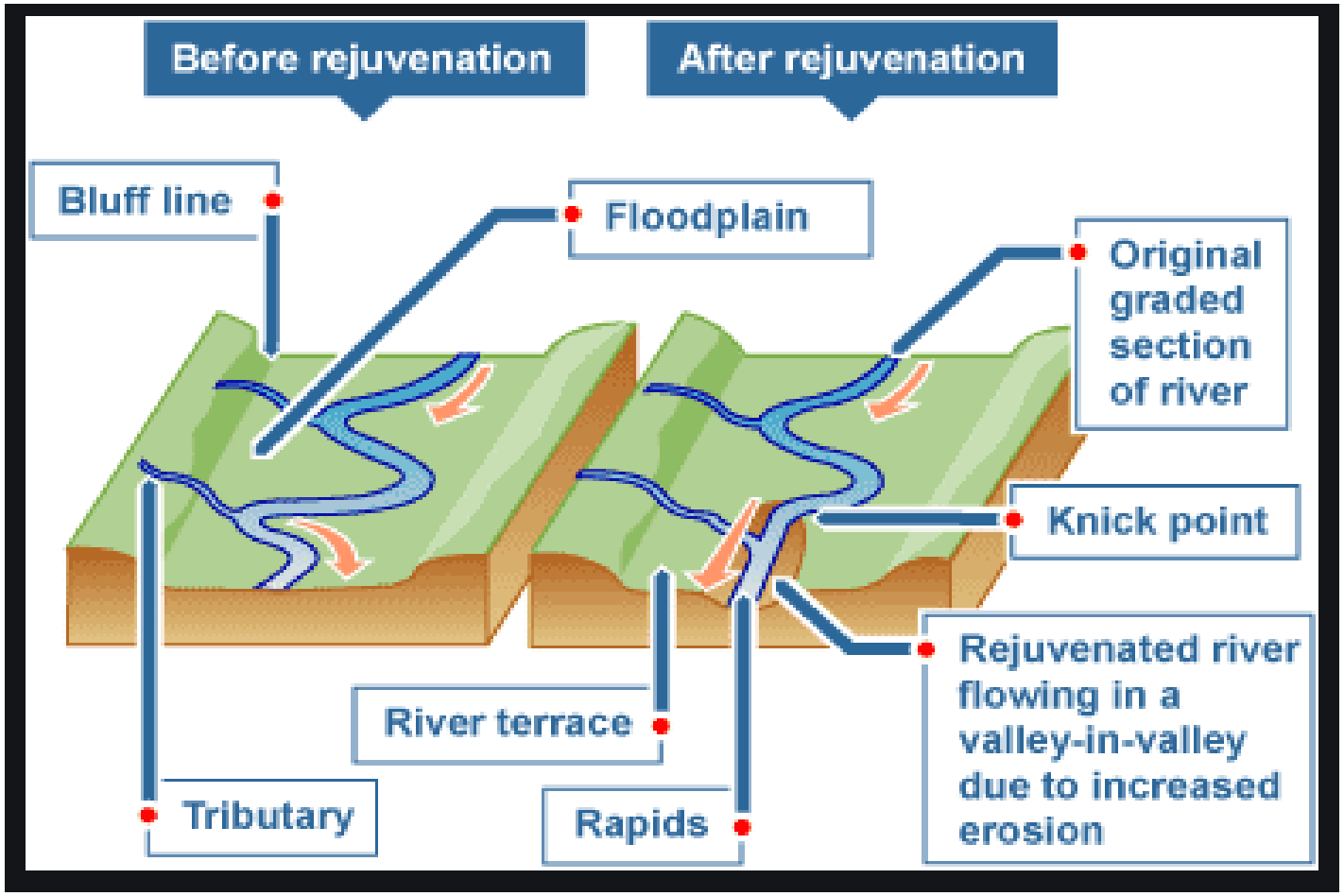
Incised/Entrenched meander

It occurs when a meandering river experiences rejuvenation resulting in more downward (vertical) erosion. This causes in deep incisions (cuts) resulting in incised meanders.

Valley in a valley



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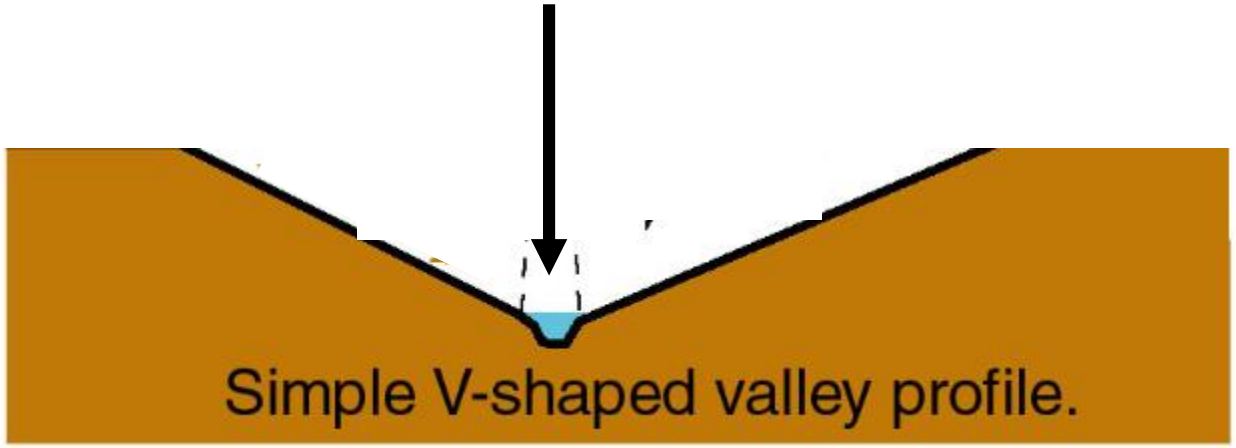
. Valley in a valley



Adapted from Geocaching

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Valley in a valley

The newly formed terrace begins to cut back and form a valley. This valley widens through lateral erosion. The process continues gradually and if rejuvenation occurs repeatedly new terraces form as well due to increase in vertical erosion. This creates a smaller valley. .

Identifying rejuvenation.

Waterfalls

Ox-bow lakes

River capture

Incised Meanders

River terraces

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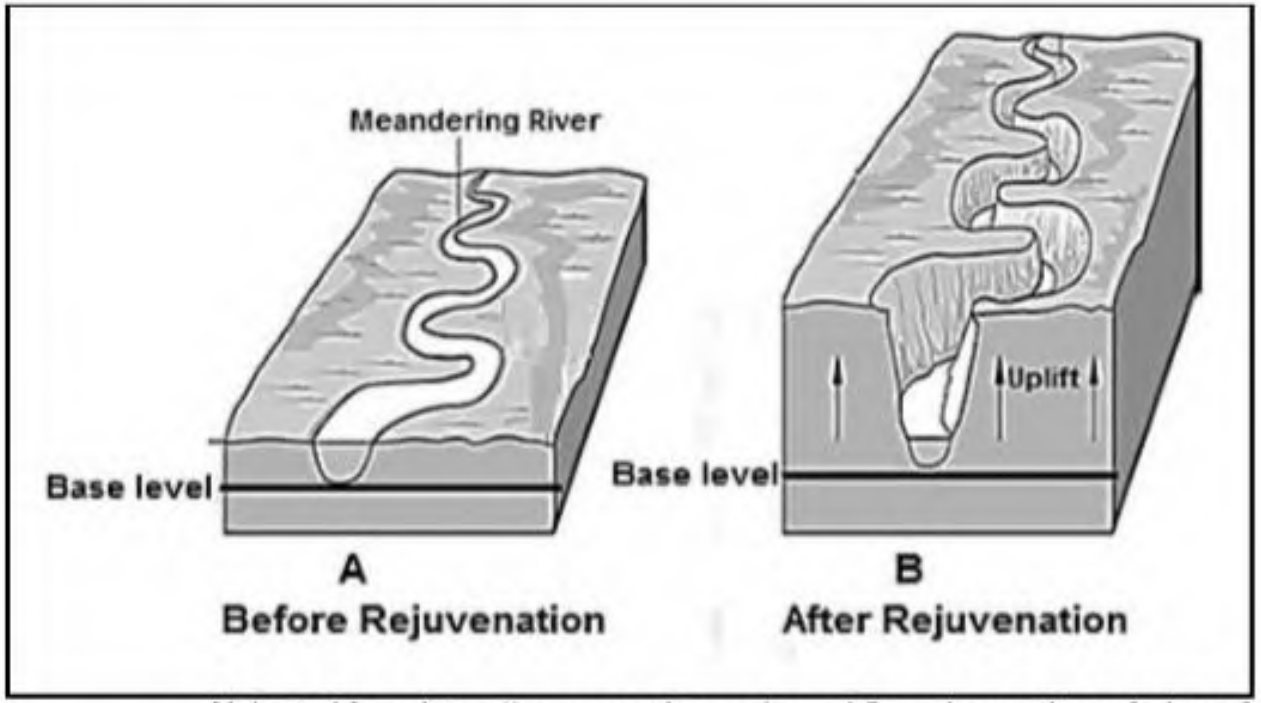
DBE PAST PAPER

FIGURE 1.6: RIVER REJUVENATION



[Adapted from https://www.google.com/search?q=rejuvenation+of+rivers:]

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1.6 FIGURE 1.6 shows river rejuvenation.

1.6.1 What type of erosion is associated with river rejuvenation? (1 x 1) (1)

1.6.1 Vertical (Accept downward) (1) (1 x 1) (1)

1.6.2 What evidence indicates that river rejuvenation has taken place? (1 x 1) (1)

1.6.2 Upliftment (1)
Entrenched/Incised meanders (1)
[ANY ONE] (1 x 1) (1)

1.6.3 Identify the force of upliftment associated with rejuvenation. (1 x 1) (1)

1.6.3 Isostatic uplift/Tectonic forces (1) (1 x 1) (1)

1.6.4	Why is rejuvenated land not suitable for human activity?	(2 x 2)	(4)

1.6.4 Steeper slopes make it unsuitable for human living (2)
Deeper gorges makes farming activity impossible (2)
Building infrastructure will be more expensive (2)
More specialised farming machinery will be needed (2)
Water will not be easily accessible for human usage (2)
Narrow floodplains reduce fertile farming land (2)
[ANY TWO] (2 x 2) (4)

1.6.5 In a paragraph of approximately EIGHT lines, explain how rejuvenation could change the fluvial features downstream of the point of rejuvenation. (4 x 2) (8)

1.6.5 A knick point will develop between the old and the new point of erosion (2)
Waterfalls develop at the knick point where there is a sharp change in gradient (2)
Vertical (accept downward) erosion results in (paired) terraces (2)
Valleys within valleys develop as a result of a new valley floor (2)
Meanders deeply erode to form entrenched or incised meanders (2)
Floodplains are narrowed (2)
[ALSO ACCEPT THE FOLLOWING]
Higher velocity may remove some braided streams (2)
Higher velocity may break through the levees (2)
Higher velocity may wash the existing deltas away (2)
Higher velocity may result in more oxbow-lakes (2)
[ANY FOUR] (4 x 2) (8)

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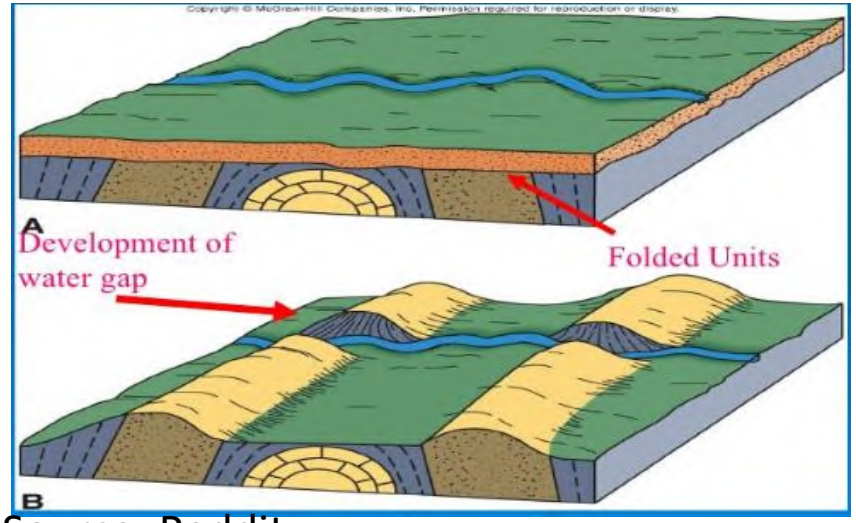
GEOMORPHOLOGY

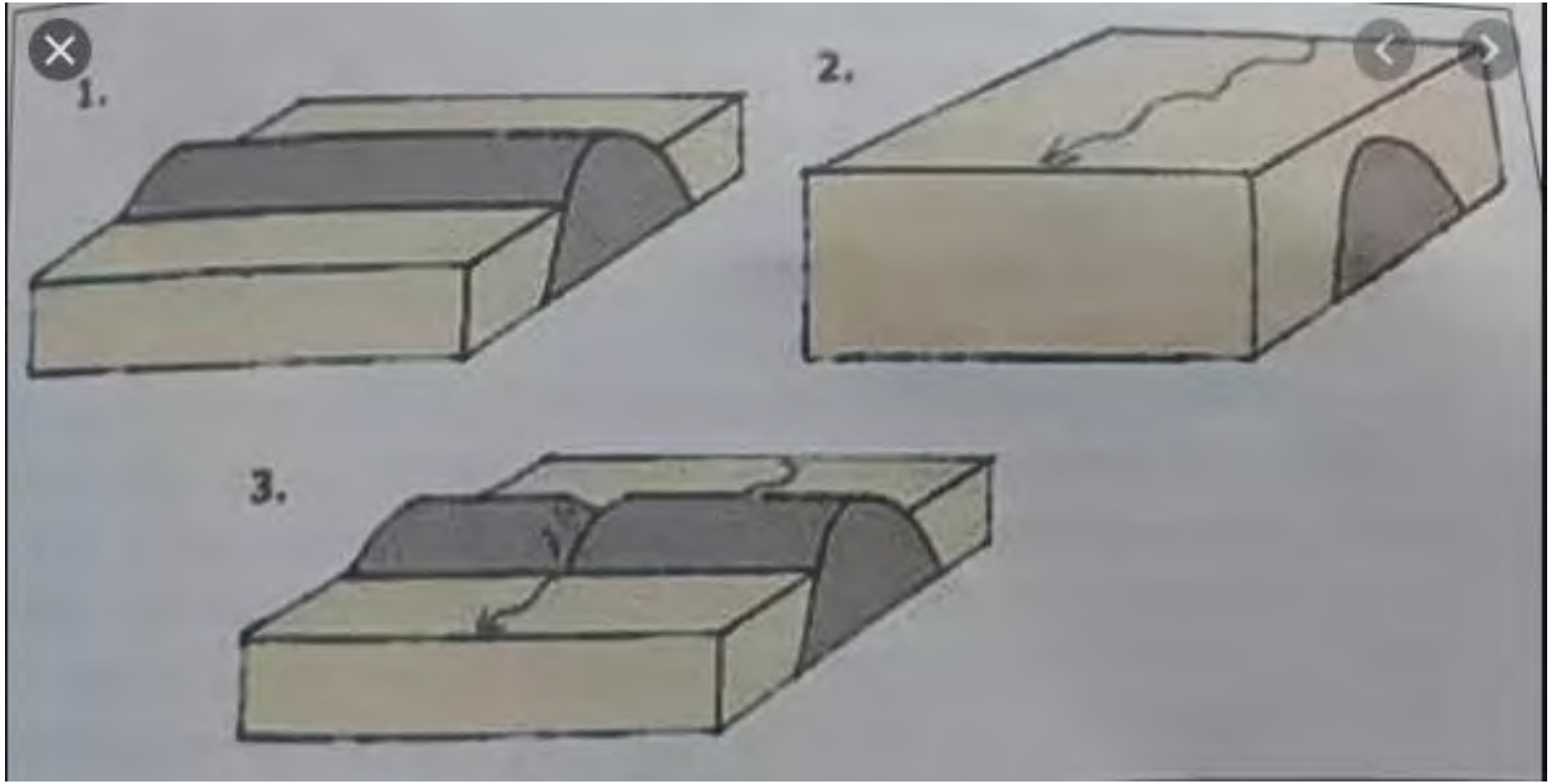


Source: Reddit

SUPERIMPOSED AND ANTECEDENT DRAINAGE

RAJENDRA DAVECHAND

SUPERIMPOSED DRAINAGE



Source: Geography Bright Career Maker

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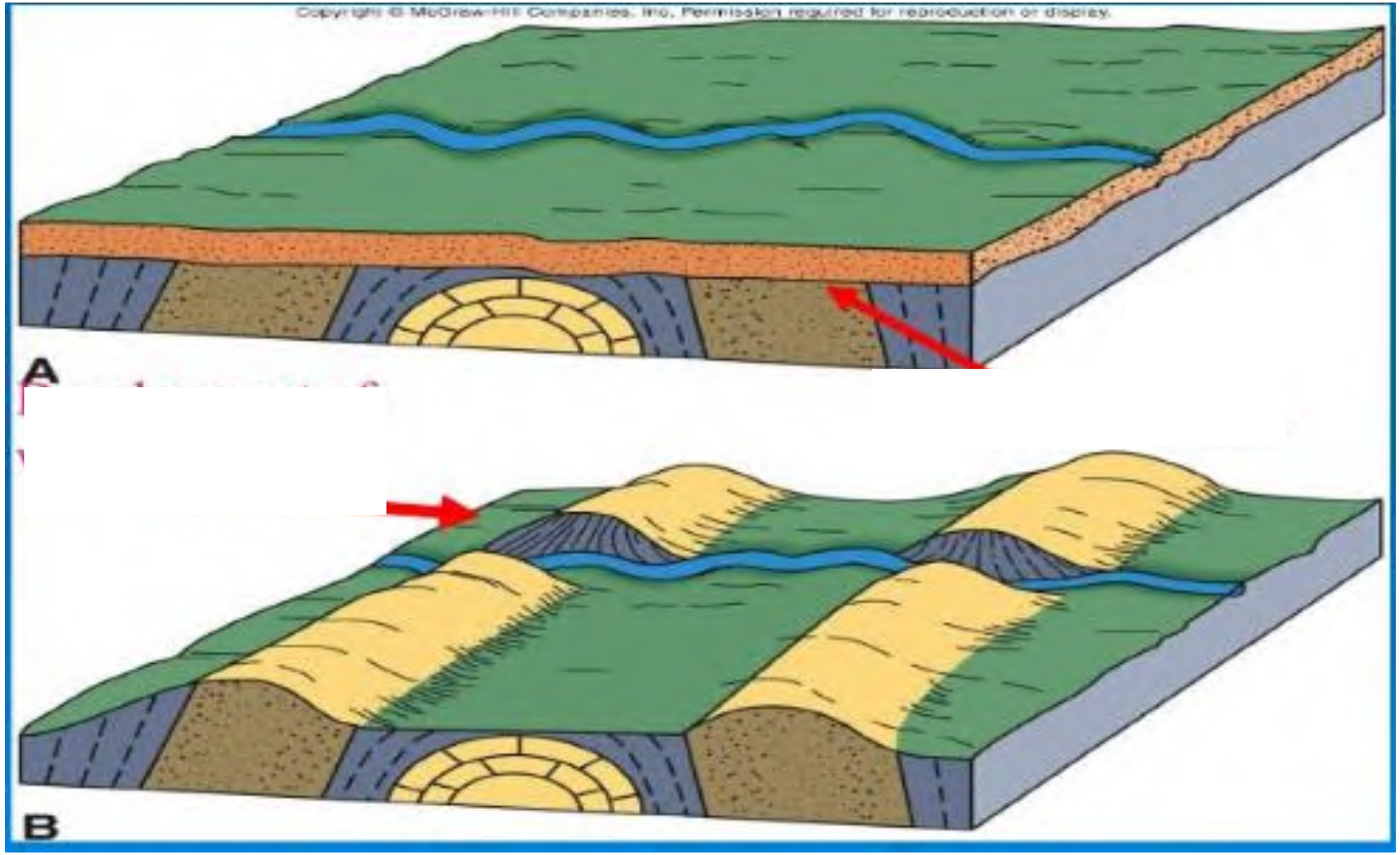

Source: Reddit

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Superimposed drainage

Here landscape develops before the river (river is younger) . The stream network displays a pattern that bears no relation to the relief of the landscape. The rivers flow in gorges cutting across higher ridges. This is called a superimposed drainage pattern because it is as if the rivers have been placed on top of the landscape. As time goes by the surface is eroded and the river may reach older underlying rocks. The river maintains its original course and is not affected by the older structures and harder rocks e.g. Vaal River

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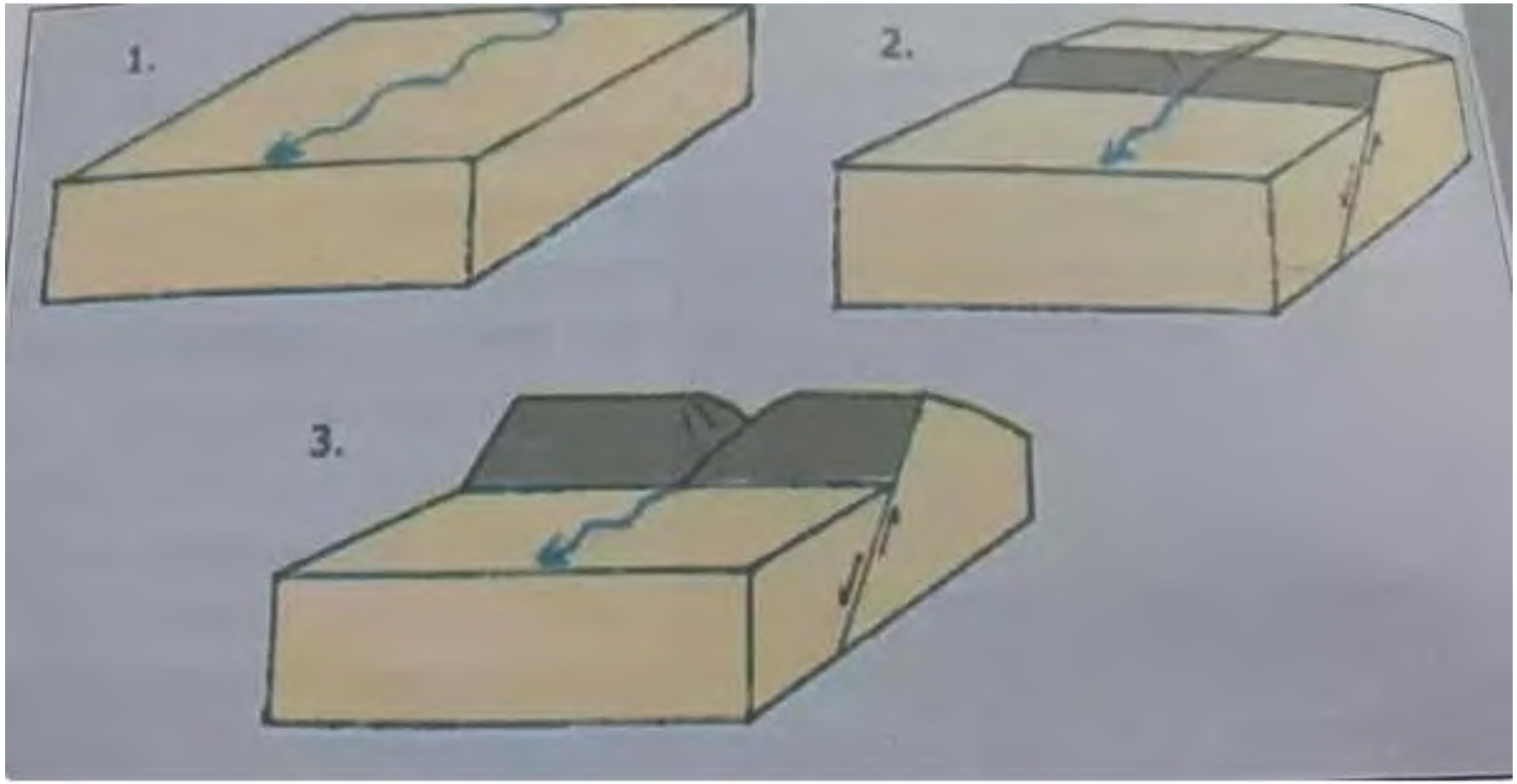
ANTECEDANT DRAINAGE



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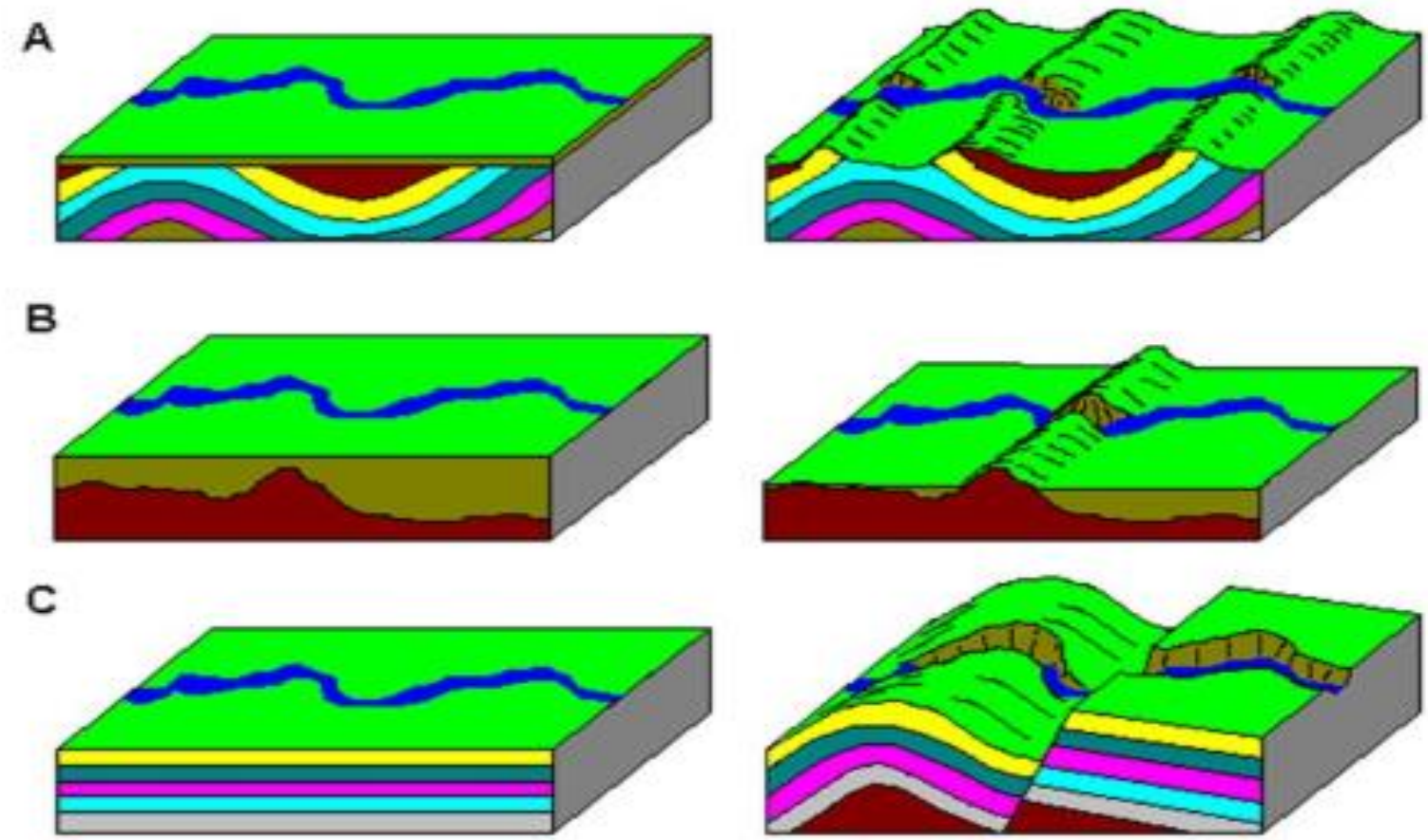

Source: SlidePlayer

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Antecedent drainage

Here the river developed its course before the high land areas formed (river is older). After the river formed, warping, folding or faulting occurred. If the rate of downcutting by the river was greater than the rate of uplift the river was able to maintain its pattern cutting a gorge through the land that has been uplifted.