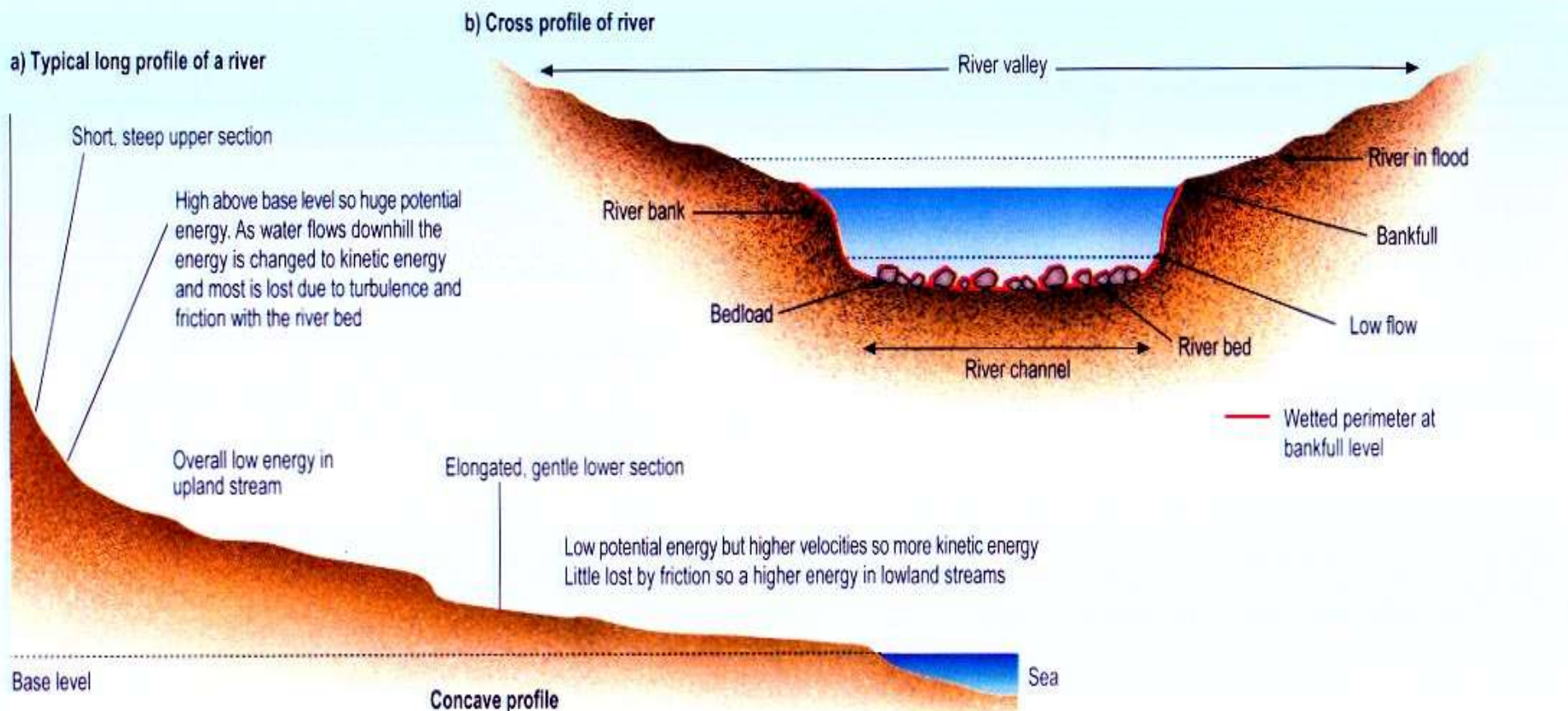


Channel Processes and Landforms

River Profiles

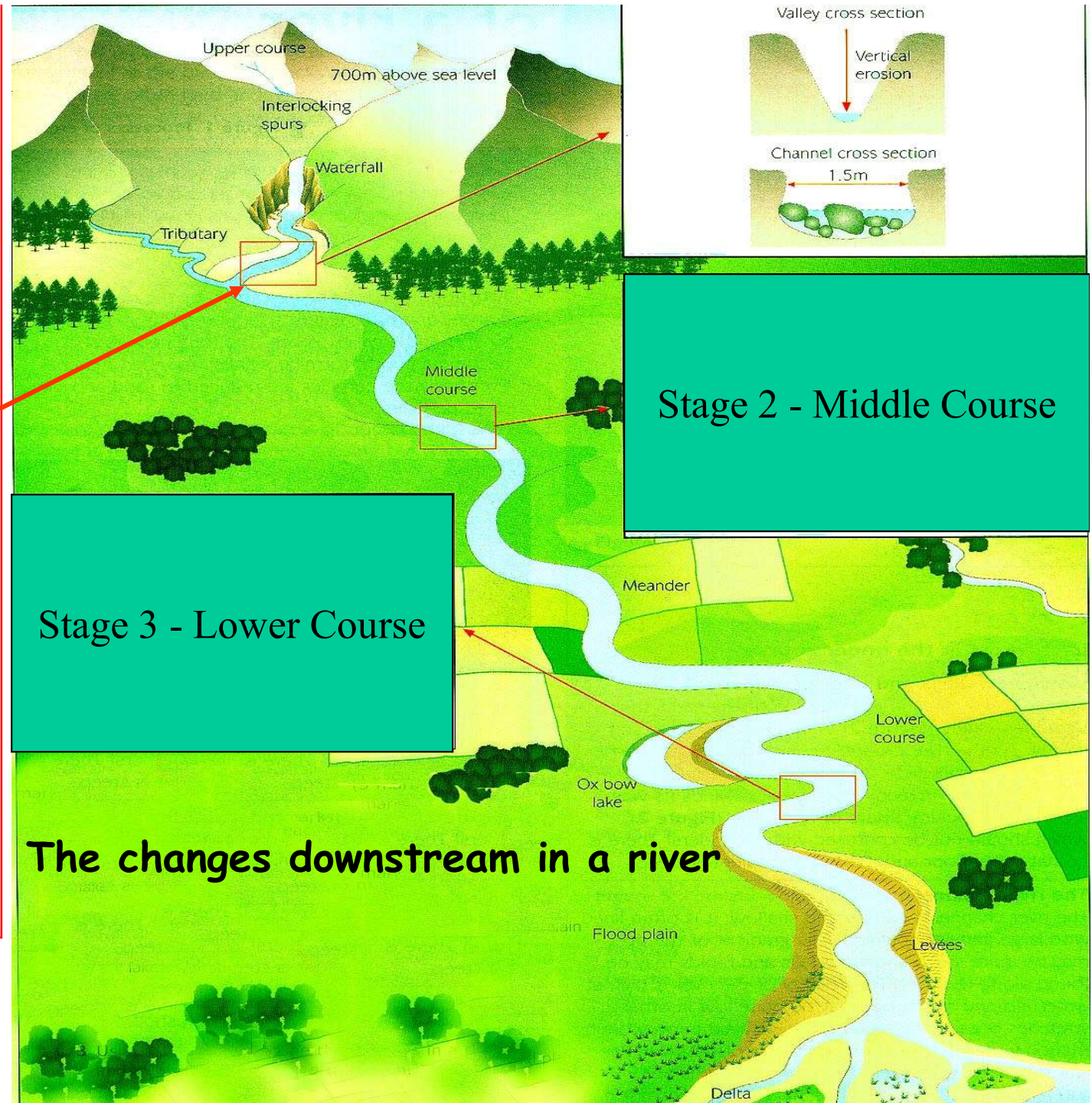
These are the key features and terminology of a river **Long Profile** - (from source to mouth), and **Cross Profile** - (from valley side to valley side.)

The cross profile changes as the river moves downstream.



UPPER COURSE

As a river flows downstream the shape of its channel changes. Many of these changes are caused by changes in the river energy. At the source the river is high above its base level (sea level). It has lots of energy and this results mostly in VERTICAL erosion to try to reach its base level. This helps to create V-shaped river valleys.



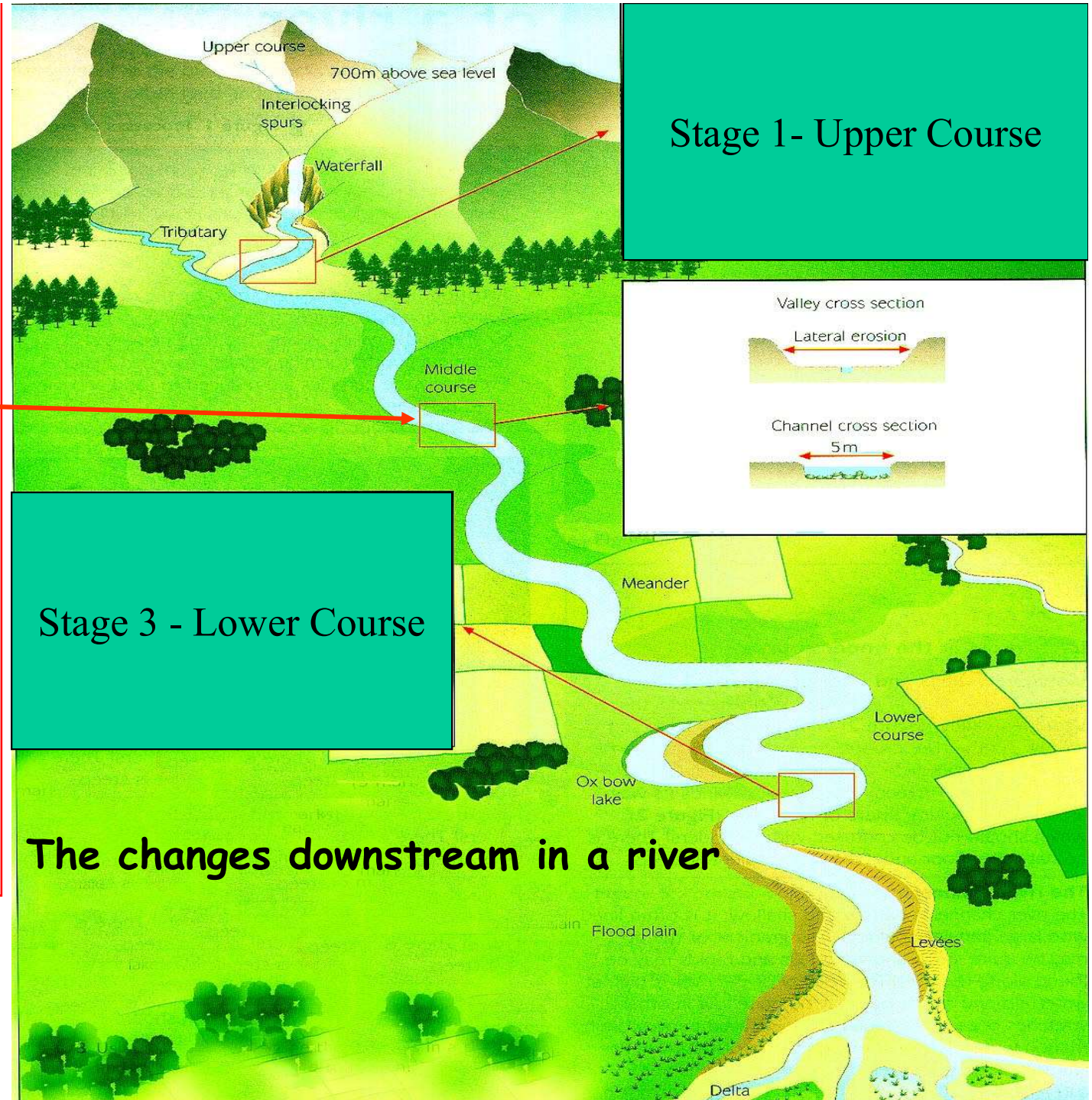
MIDDLE COURSE

As the river moves downstream it uses a lot of energy to transport the material or load it has eroded. Surplus energy is now used to erode

SIDEWAYS

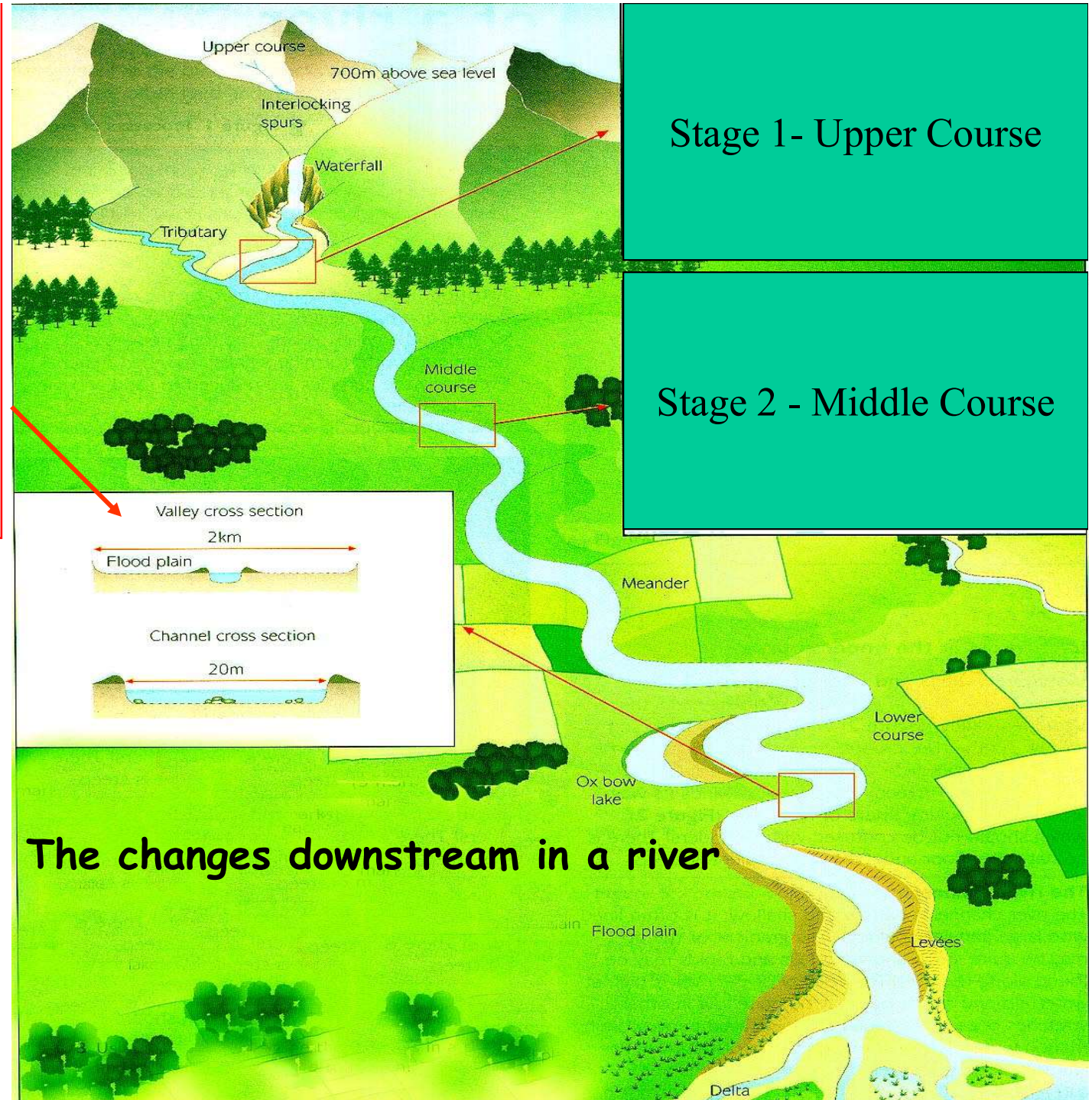
(LATERAL

EROSION) because the river is much closer to its base level, and so the river valley becomes wider and flatter.



LOWER COURSE

Close to its mouth the river is close to or at its base level. There is hardly any gradient at all. All erosion is LATERAL (Sideways) and the river meanders across a wide, flat flood plain.

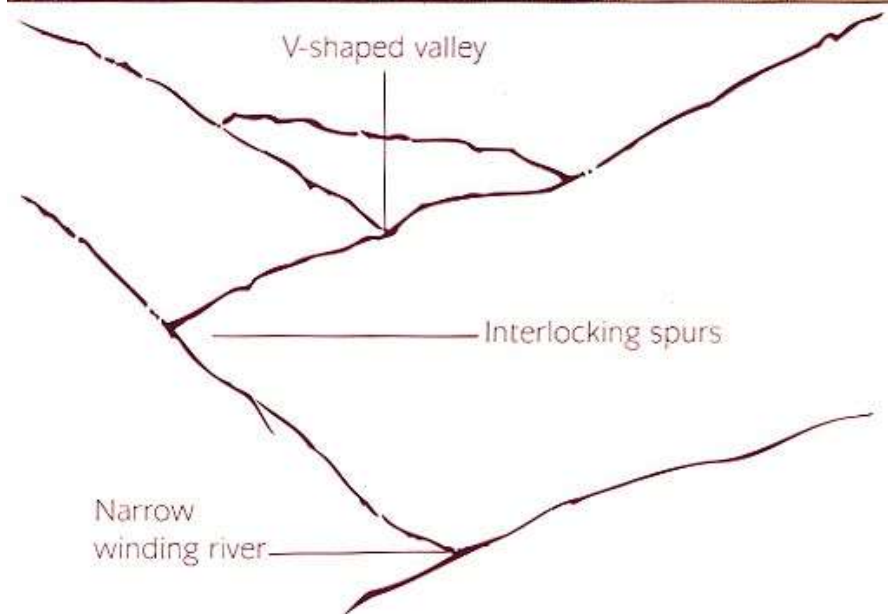


The upper river

how rivers shape land

Typical Features:

- Deep, narrow V-shaped valley
- Evidence of soil creep and rain wash of material down slope into the river
- Steep gradient = fast flowing stream
- Interlocking spurs
- Waterfalls and rapids
- Large bed load of angular boulders
- No flat valley floor
- Narrow, shallow channel
- Clear water because there is little material carried in suspension

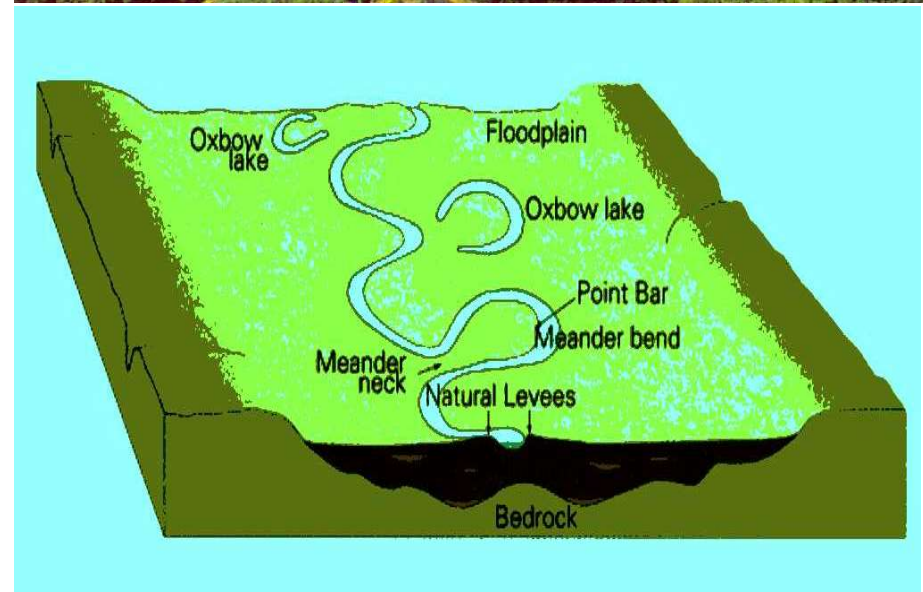


The middle river

as it flows

Typical features:

- A small flood plain
- River meanders
- River bluffs along valley side
- Point bars and river cliffs
- Ox-bow lakes
- Sideways (Lateral) erosion and downward erosion
- River terraces
- Larger discharge
- Gentle gradient



As it reaches the sea

the ending of the journey

Lower Course

Typical features:

- Flood plain - very wide & flat
- Alluvium = fertile farmland
- Very large meanders
- Little or no power to erode vertically
- Some lateral erosion
- Levees
- Deferred junctions
- Ox-bow lakes
- River terraces
- Delta
- Estuaries
- Large suspended load

Meanders on the Mississippi



Meanders

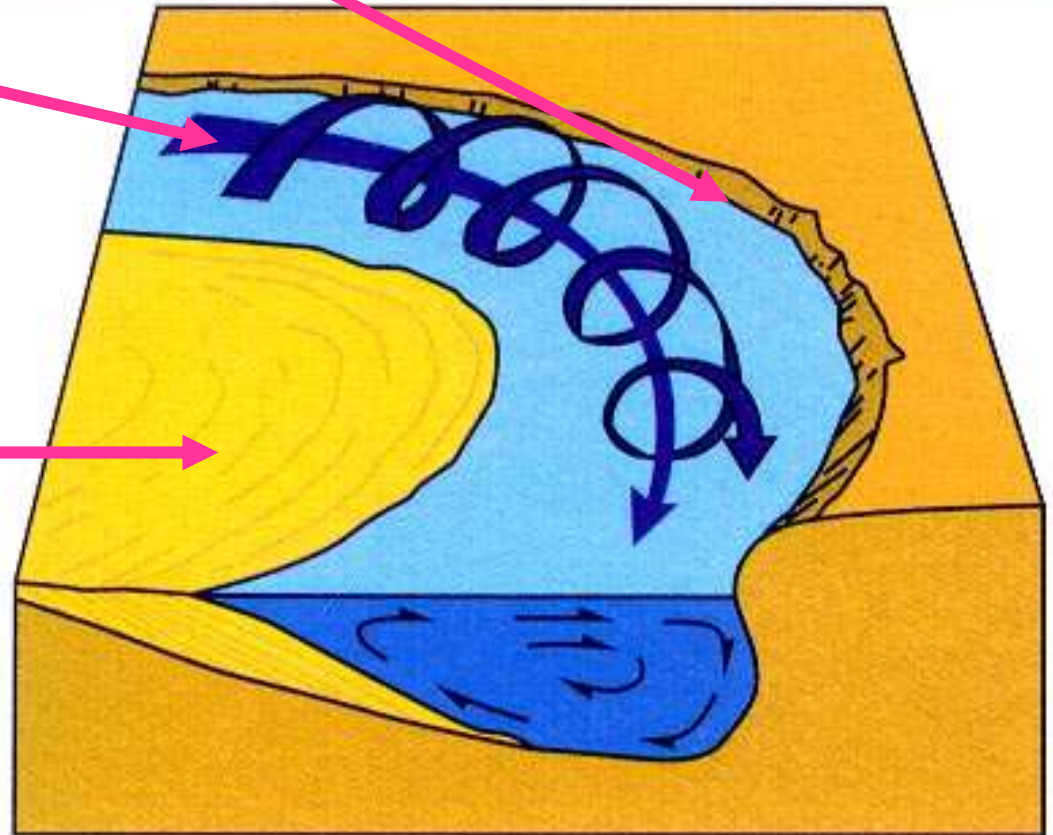


Meanders:

The corkscrew movement underwater increases the undercutting, and moves eroded material onto the point bar

On the inside of the bend the water flows much more slowly, often with slack water. This encourages deposition. Sand and pebbles are deposited creating a gentle **slip-off slope** or **point bar**.

Meanders are bends in the river's course. The water travels more quickly on the outside of the meander so the ability to erode is greater. The result is that corrasion makes deeper water and undercutting on the outside bank called a **river cliff**.

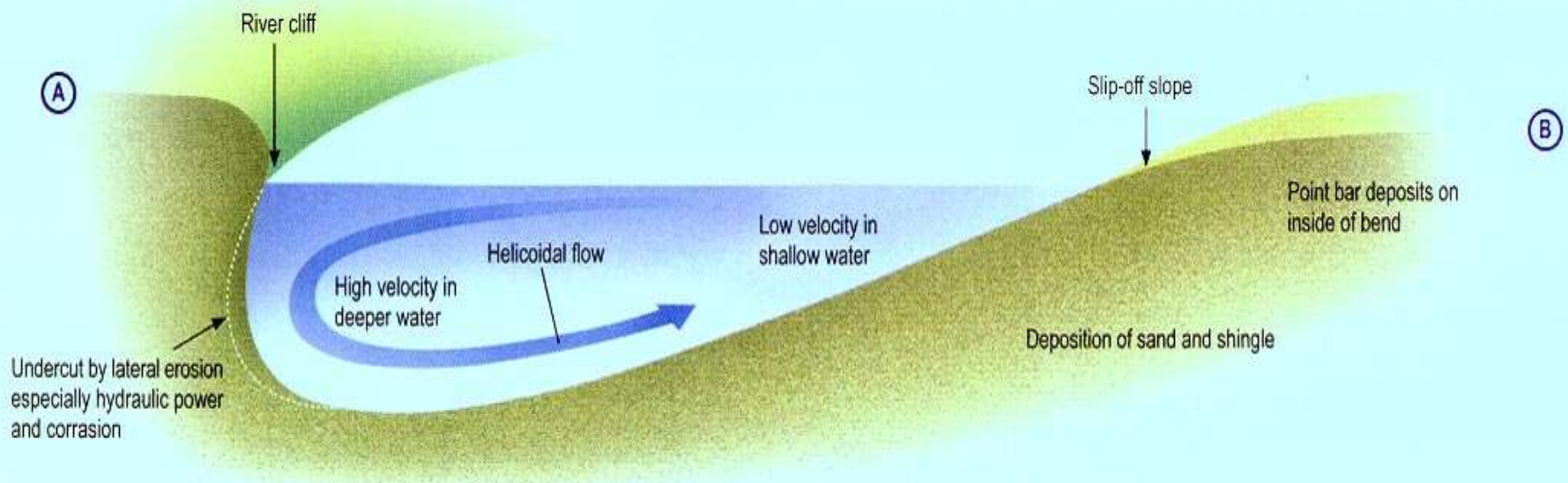


a Plan view of a meander



▼ Figure 4 Characteristics of a meander

b Cross-section through a meander along A – B



Plan view

Diagrams drawn from the 'bird's-eye' view perspective, looking vertically on to the landscape.

Cross-section

This produces a sideways view of the landscape feature(s) as if cut in half.

Key Terms:

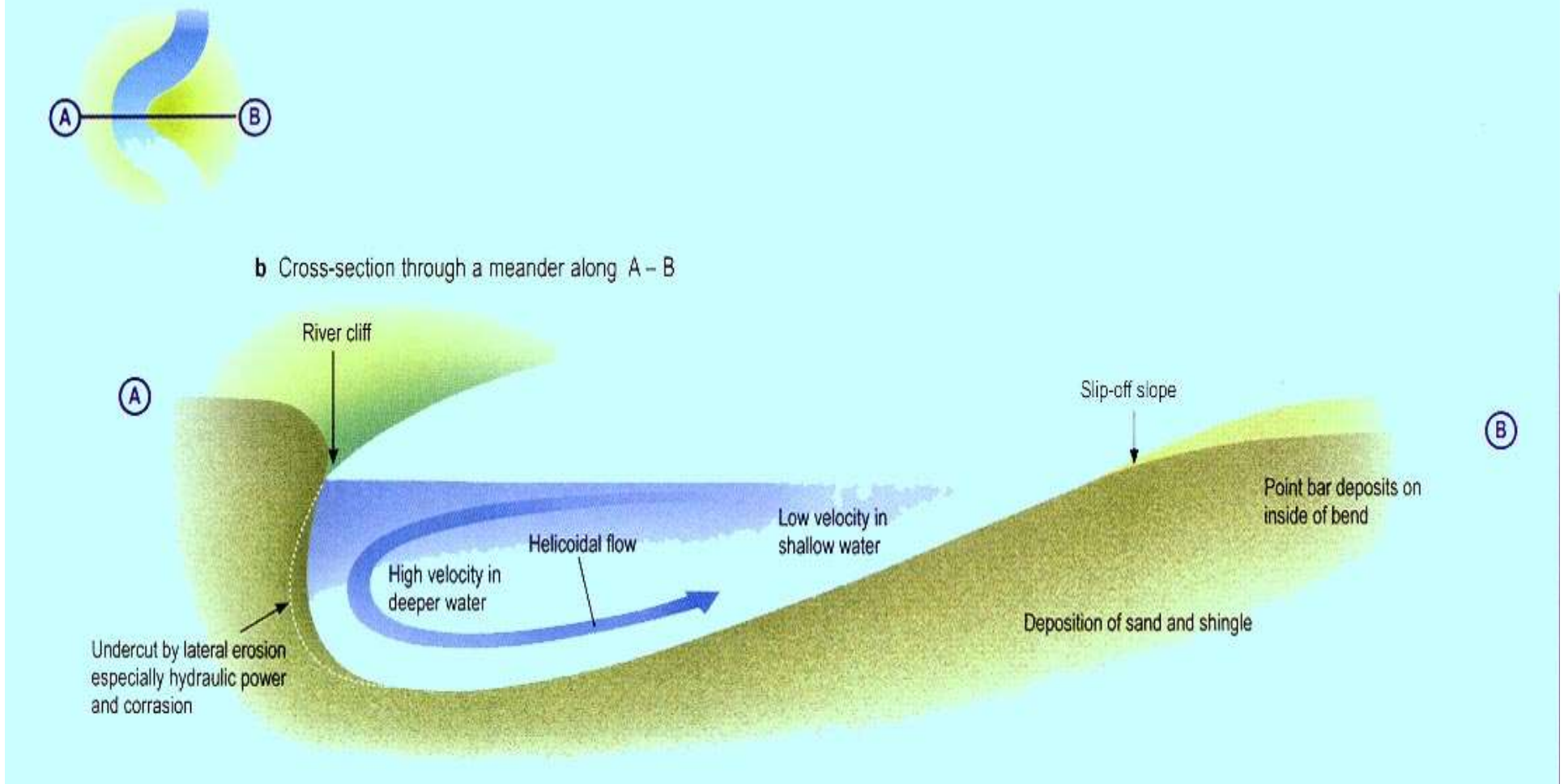
Meander = a loop in a river

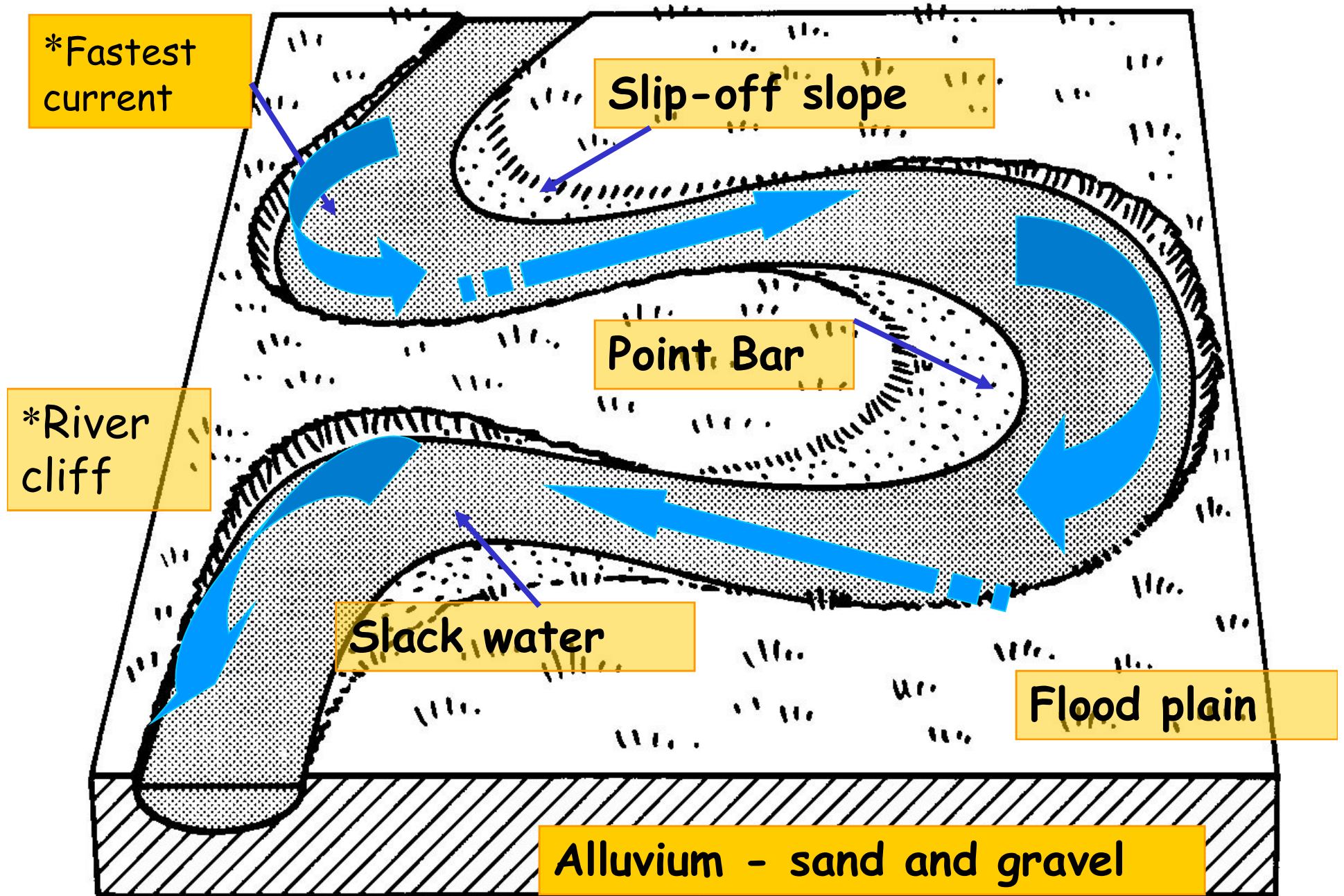
Point Bar = a deposit of sand and gravel on the inside bend of a meander.

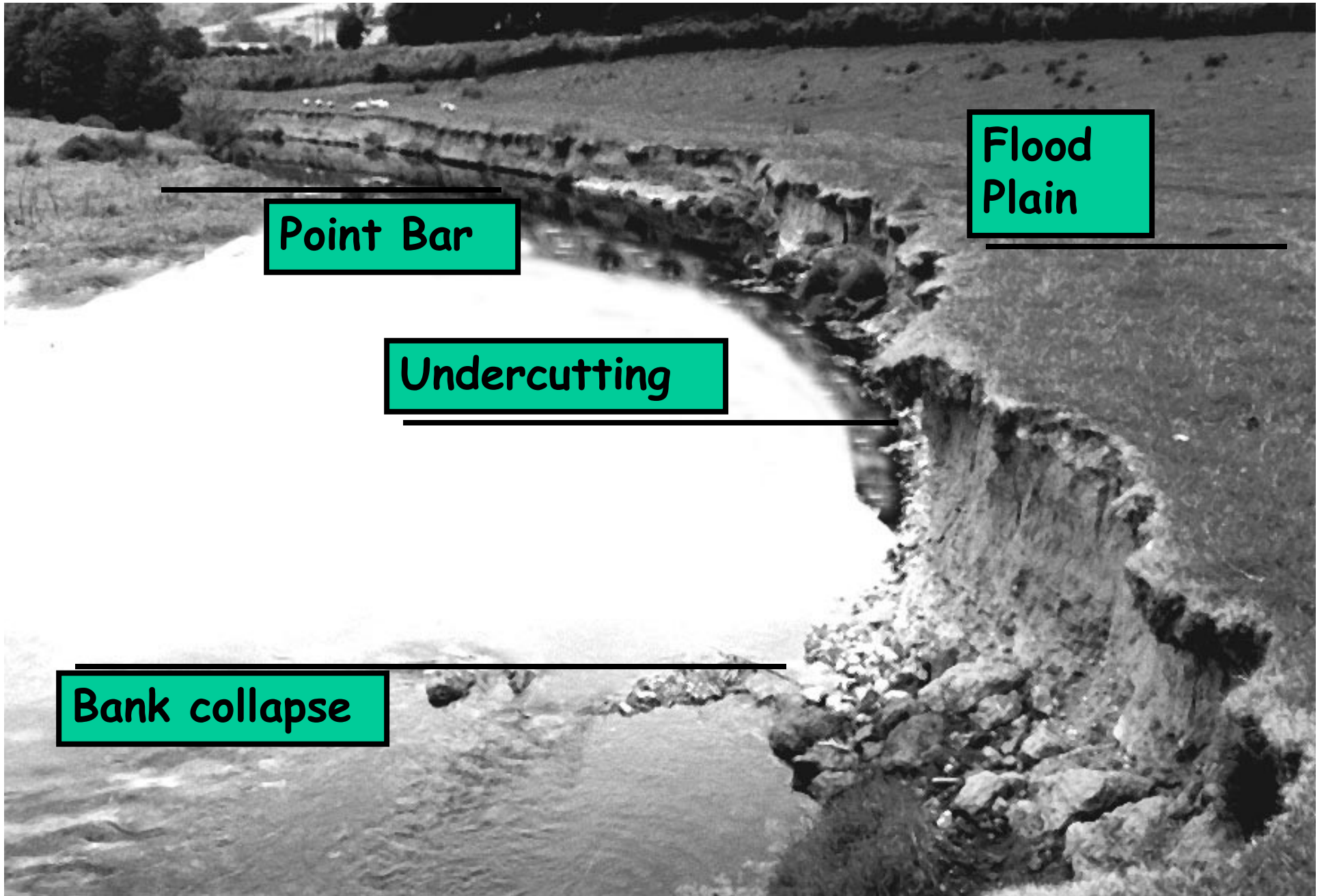
Slip-off slope = the gentle slope on the inside bend of a meander.

River cliff = a steep slope or face on the outside bend of a meander.

a Plan view of a meander ▼ Figure 4 Characteristics of a meander





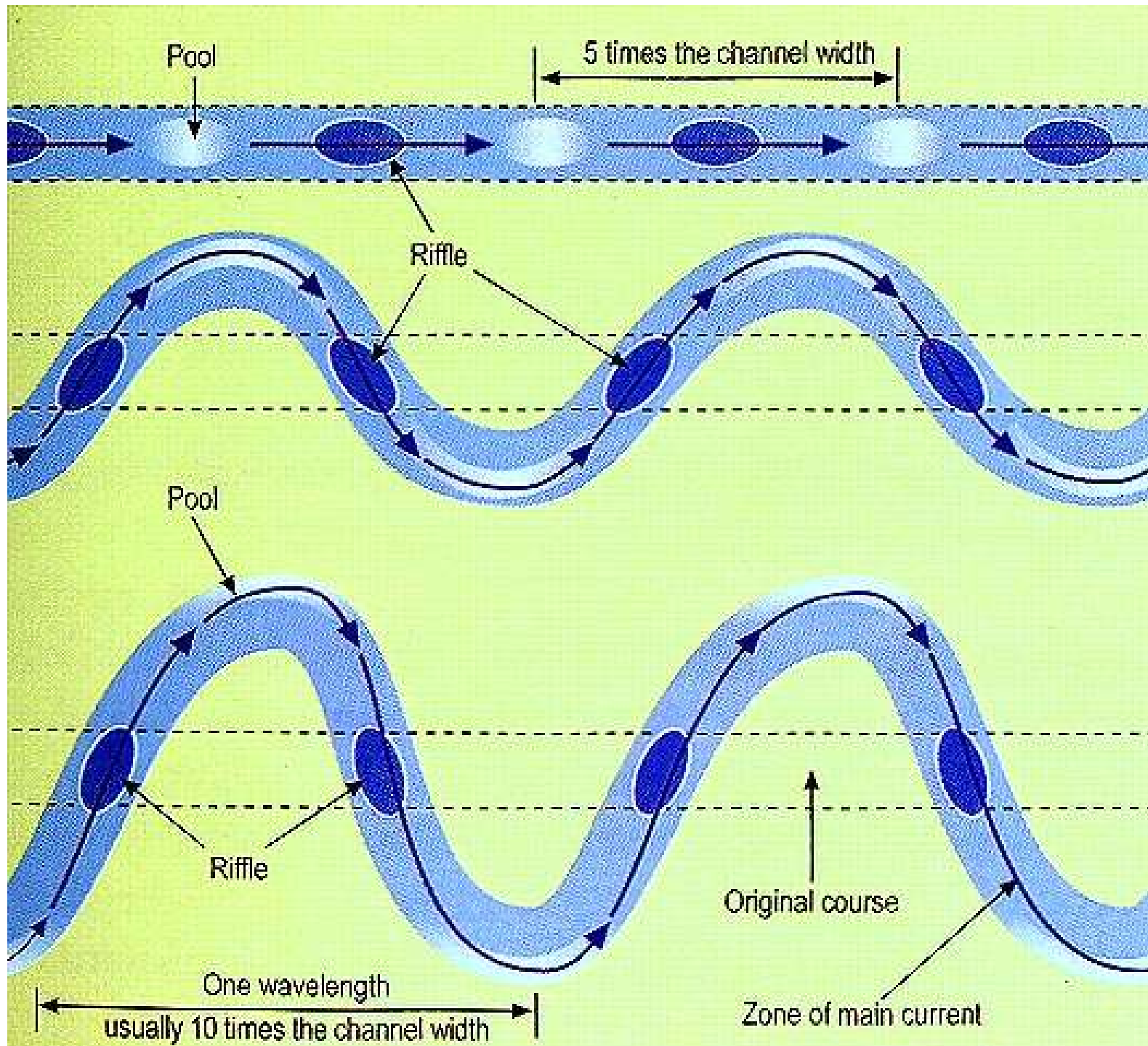


Point Bar

Flood Plain

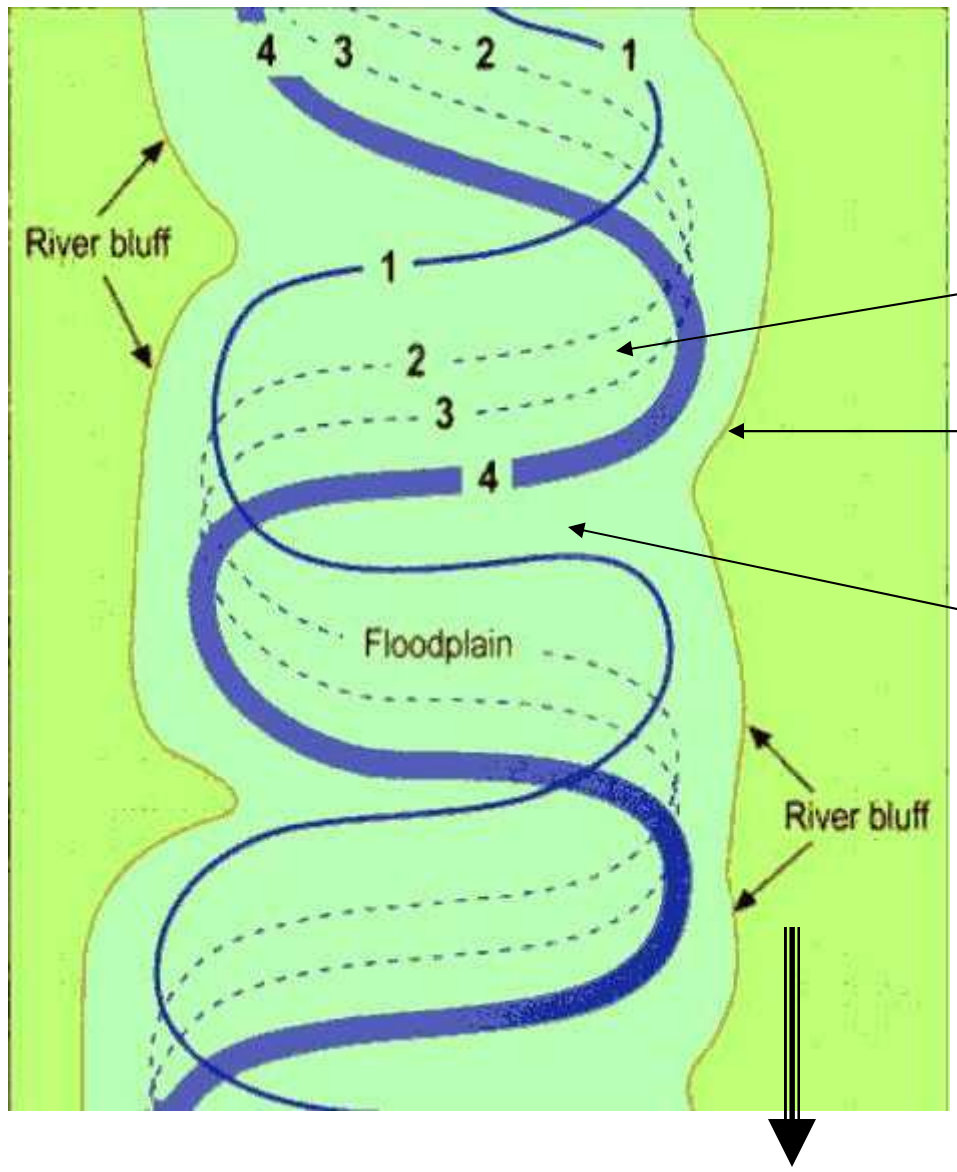
Undercutting

Bank collapse



At the meanders there are usually pools of deeper water and between the meanders are patches of shallow water called riffles.

Migrating Meanders



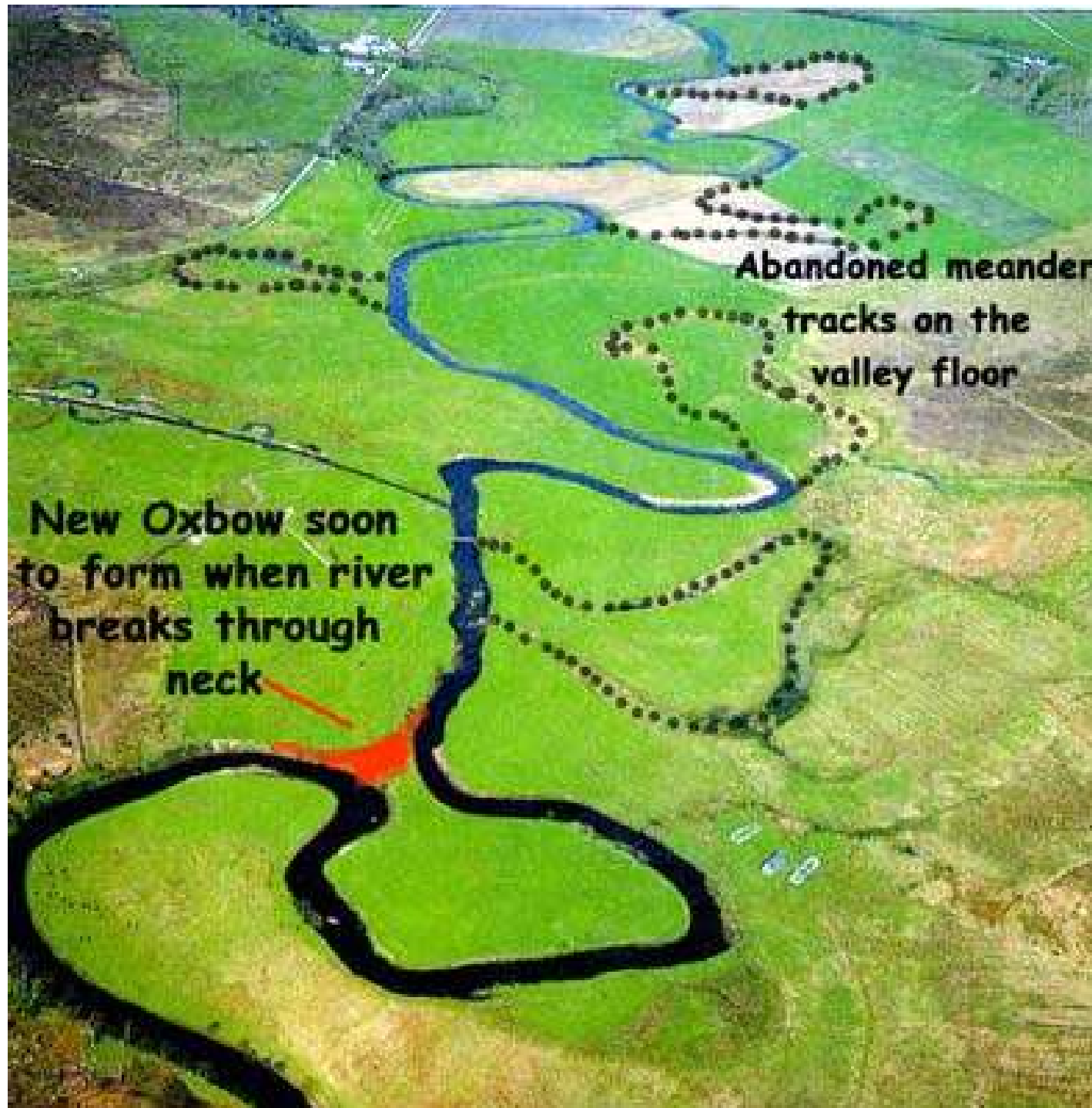
Downstream

- Meanders get wider due to erosion on the outside bend - LATERAL EROSION
- the meanders have moved or migrated downstream
- a line of river cliffs has formed along the edge of the valley floor.
- Deposition on the slip-off slopes has built up alluvium on the valley floor
- as the meanders get wider so does the valley floor or flood plain.

Click the picture to get an animation



The Meander scars are quite clear on this photo.



99

Scale 1: 25 000

4 centimetres on the map represent 1 kilometre on the ground

98

97

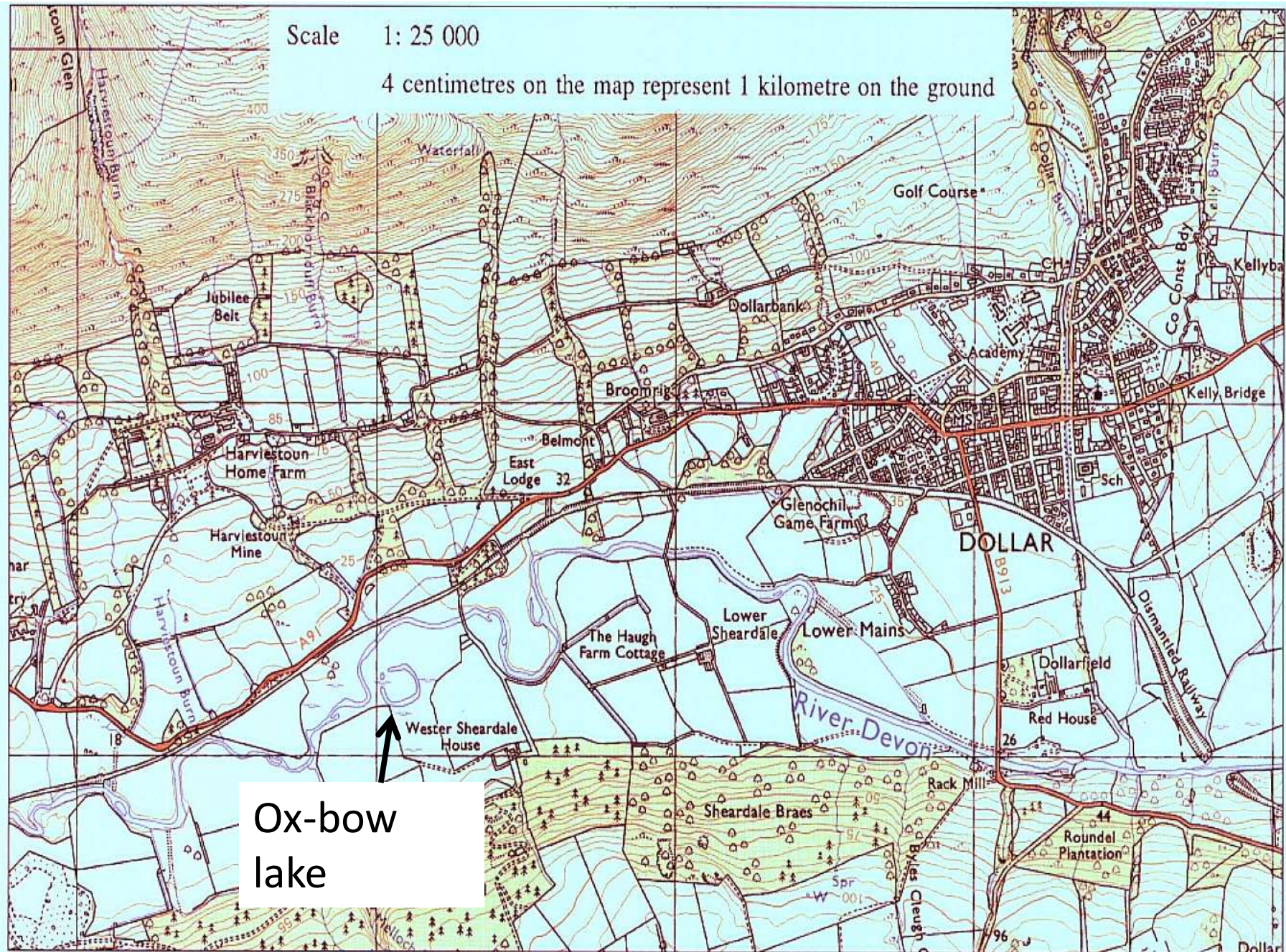
93

94

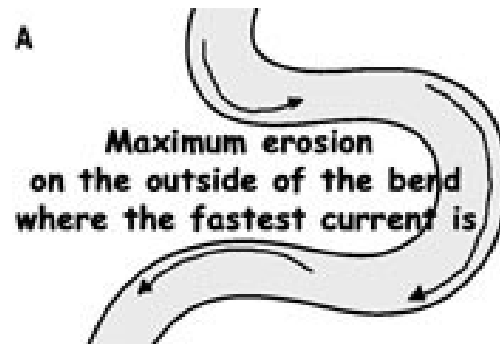
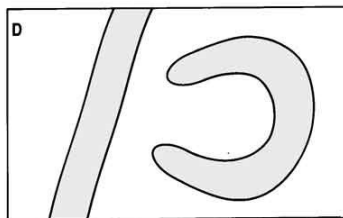
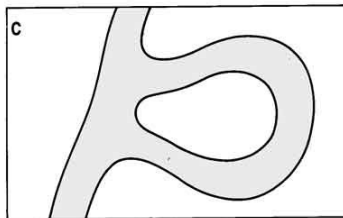
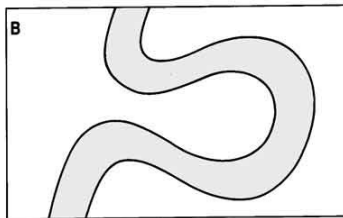
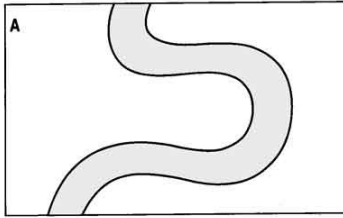
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96

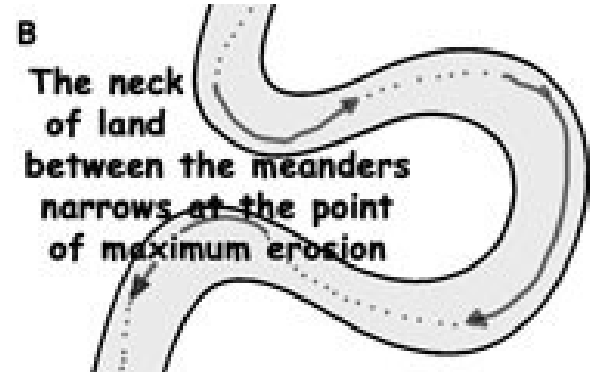
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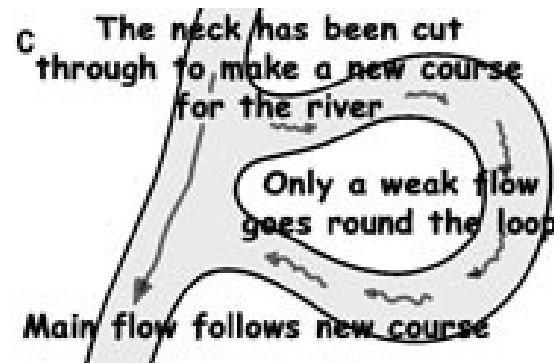
OX-BOW LAKES



Maximum erosion
on the outside of the bend
where the fastest current is



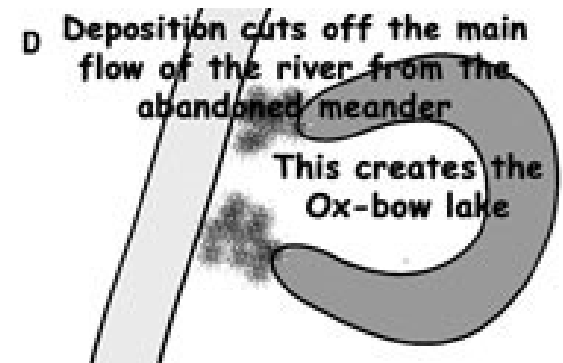
The neck
of land
between the meanders
narrows at the point
of maximum erosion



The neck has been cut
through to make a new course
for the river

Only a weak flow
goes round the loop

Main flow follows new course



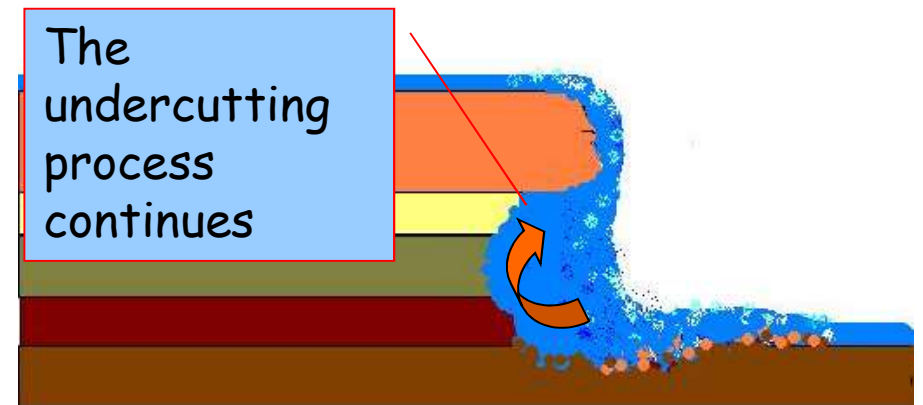
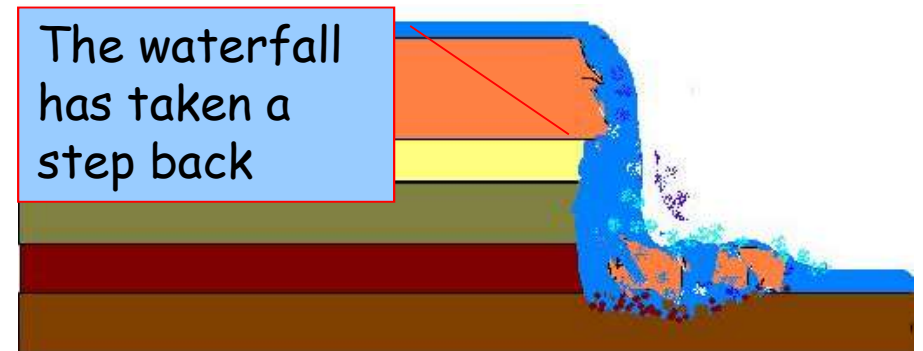
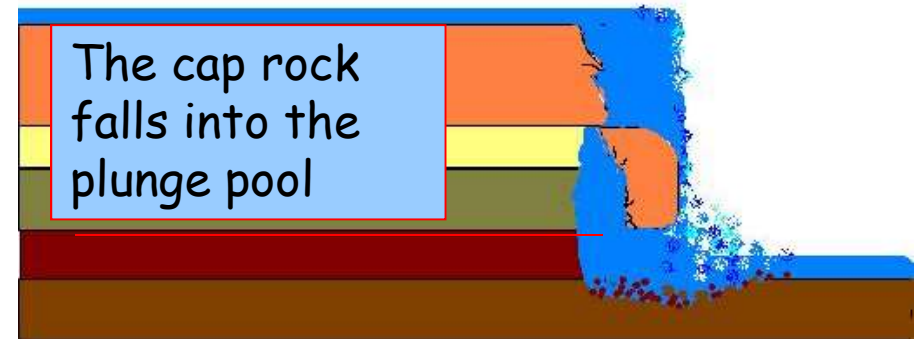
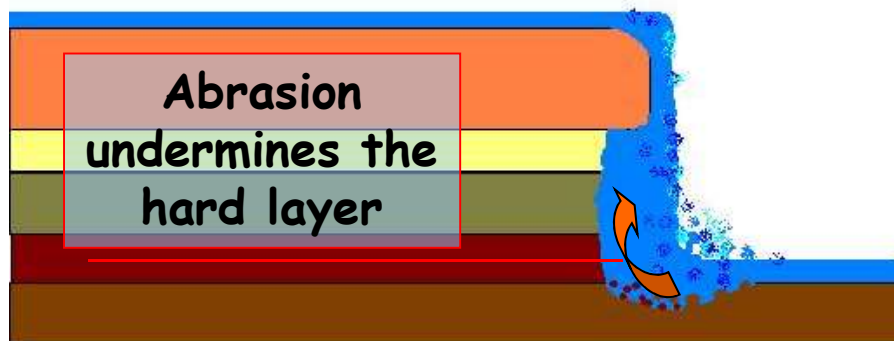
Deposition cuts off the main
flow of the river from the
abandoned meander

This creates the
Ox-bow lake

Waterfalls & Rapids

- Waterfalls and rapids occur where the **long profile** of the river is steep.
- It is usually caused by an outcrop of more resistant rock called a **cap rock** overlying a softer rock. Erosion is caused by **hydraulic power** and **abrasion** in the **plunge pool** at the base of the fall.
- Undercutting of the cap rock results in periodical collapse into the plunge pool.
- The result is the waterfall moves upstream leaving a **gorge of recession** behind.
- **Key Case Study: High Force on the River Tees. 21m high**

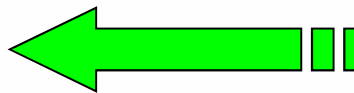
Waterfall recession



Waterfall recession animation

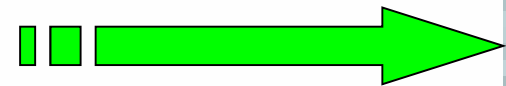
Click diagram
to
animate

Erosion moves
the waterfall up
stream



stream

Gorge of recession
is created
downstream

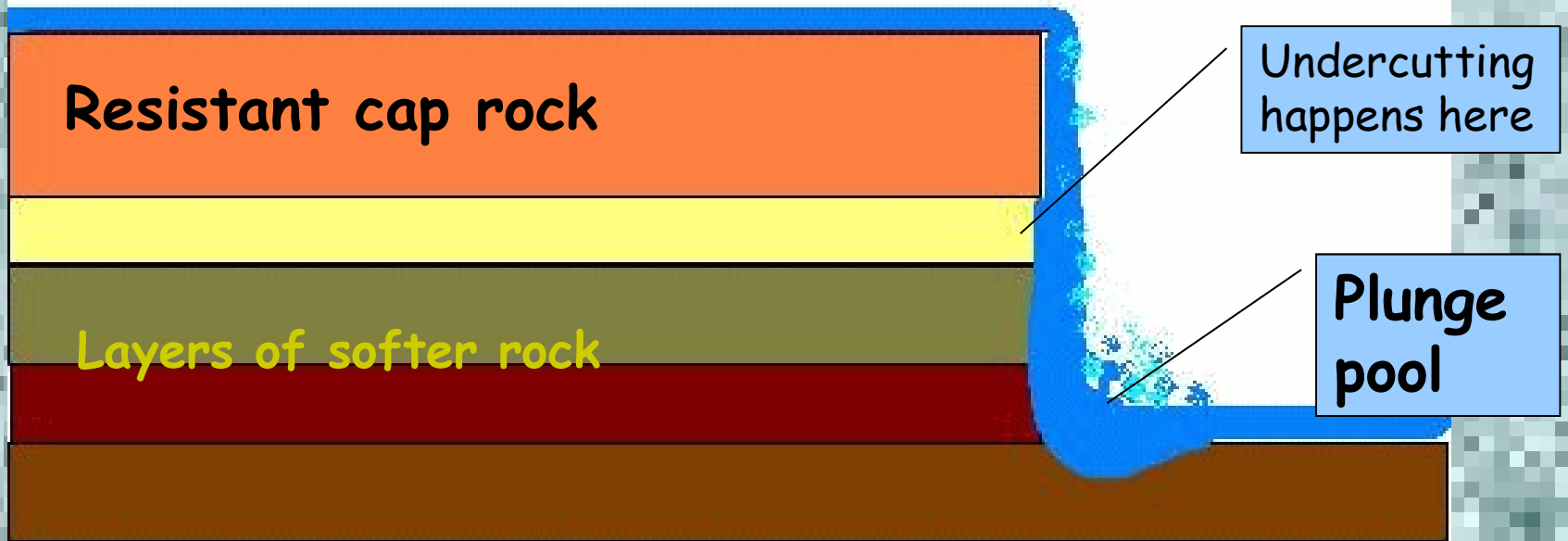


Resistant cap rock

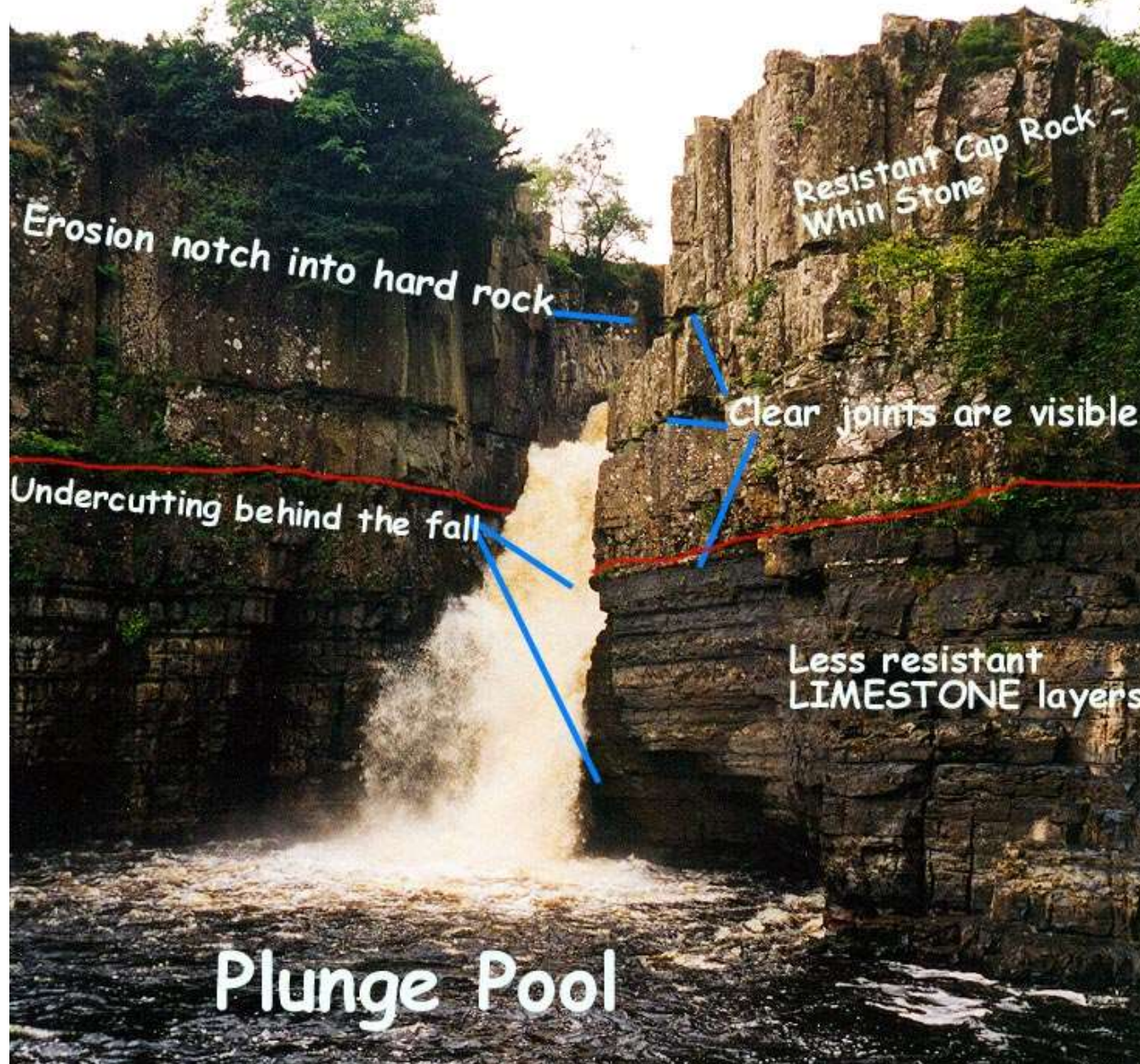
Layers of softer rock

Undercutting
happens here

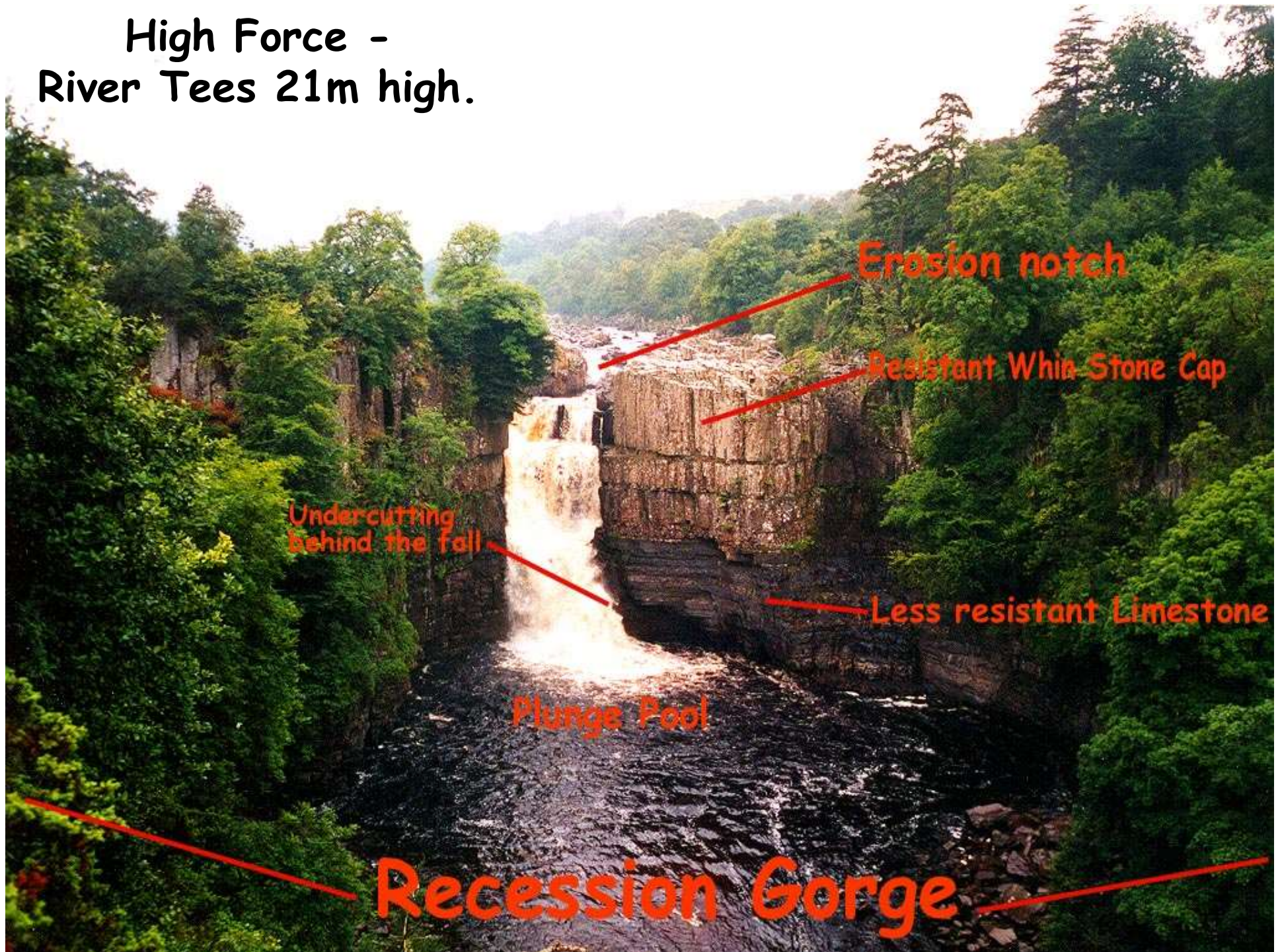
Plunge
pool



High Force - River Tees 21m high.



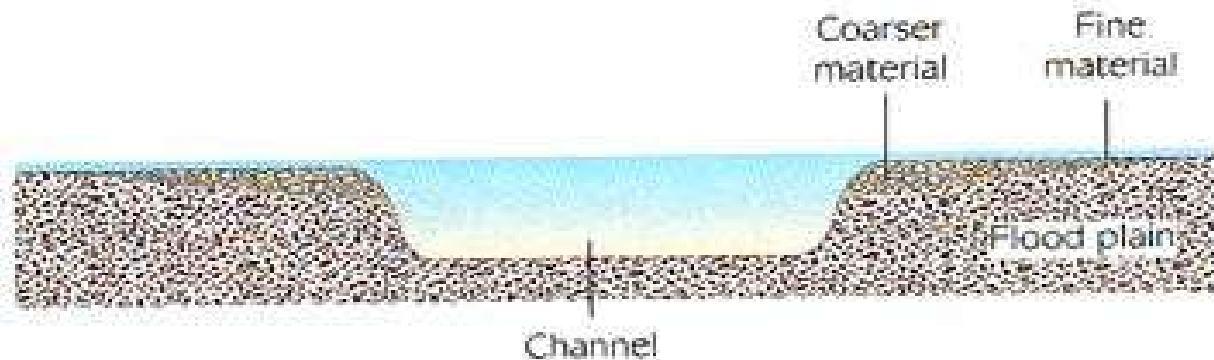
High Force -
River Tees 21m high.



River Levees

1. River in flood

As the water flow slows, energy is lost. Coarser, heavier material is deposited on the bank and finer material further away.



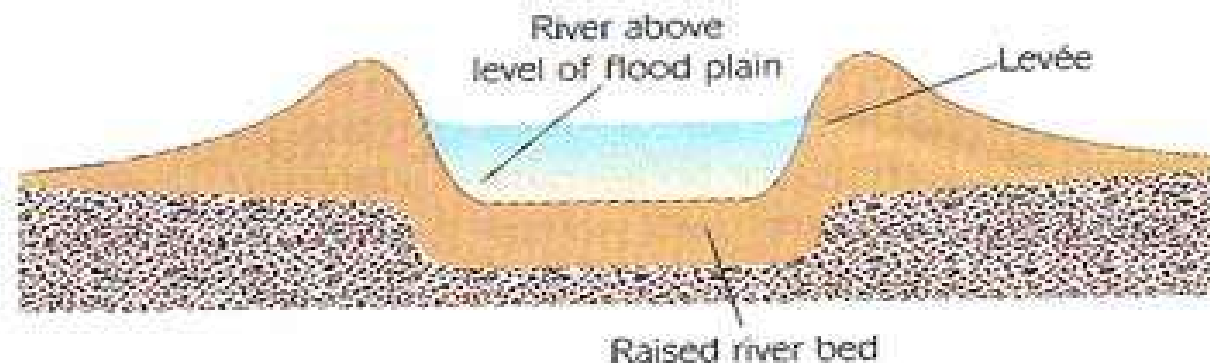
2. River at low flow

During a dry spell the river's velocity slows down and the volume falls. This causes the deposit of material on the bed.



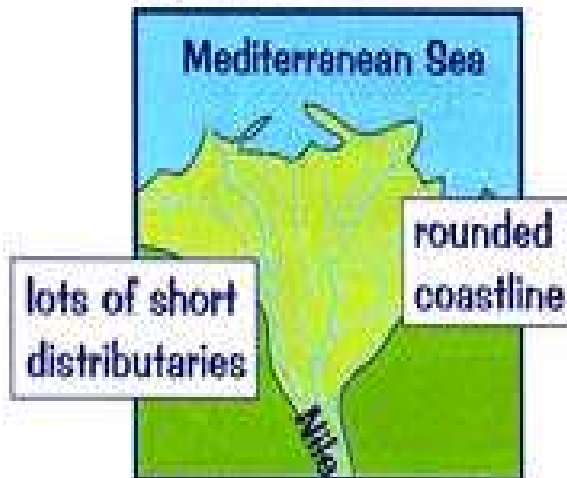
3. After repeated floods

After many floods the river banks form levées and the bed may be raised so much that the river rises above the flood plain. This can lead to more flooding.

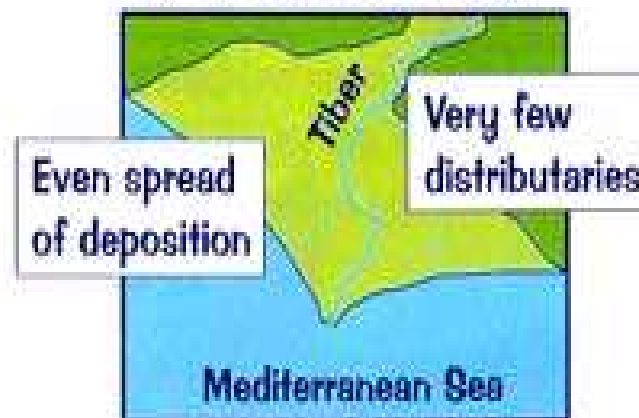


River Deltas

Arcuate (fan shaped)
eg. Nile River.



Cuspate (tooth shaped)
eg. Tiber River in Italy.

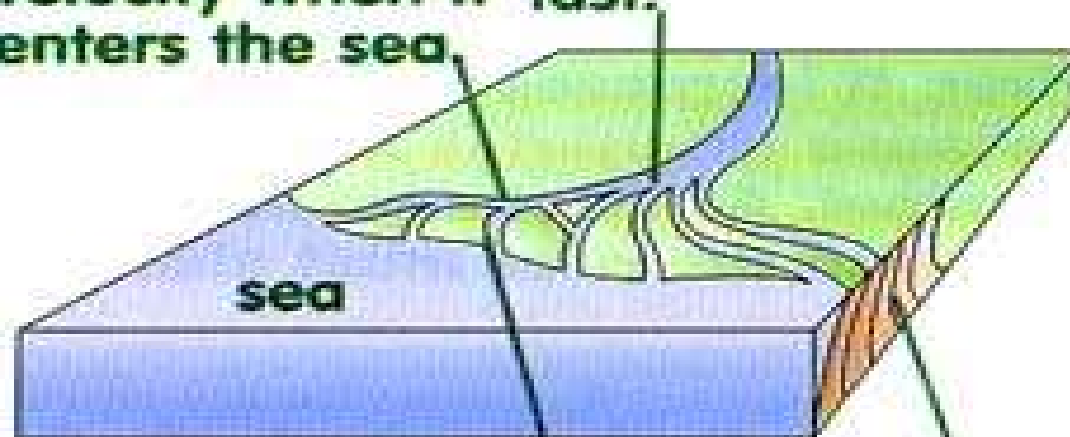


Bird's foot
eg. Mississippi River.



Deposition occurs as the river loses velocity when it enters the sea.

Heaviest material is deposited first and the lightest last.



Distributaries form as the main river channel splits into smaller channels.

Delta is built up in layers.