Fluvial systems – meandering rivers

Rio Solimoes, Brazil synthetic aperture radar

Characteristics of meandering rivers

generally confined within one major channel

secondary channels active during floods

wide valley,
channel is a small part of entire valley

Characteristics of meandering rivers

Compared with braided river:

- low gradient
- greater sinuosity
- greater % suspended load (less bedload)
- finer-grained sediments
- more constant discharge
  (usually perennial flow)

Meanders, San Joaquin River

cohesive banks, little coarse sediment

Meanders, Sacramento River (transitional)

less cohesive banks, moderate coarse sediment

Amazon River meanders

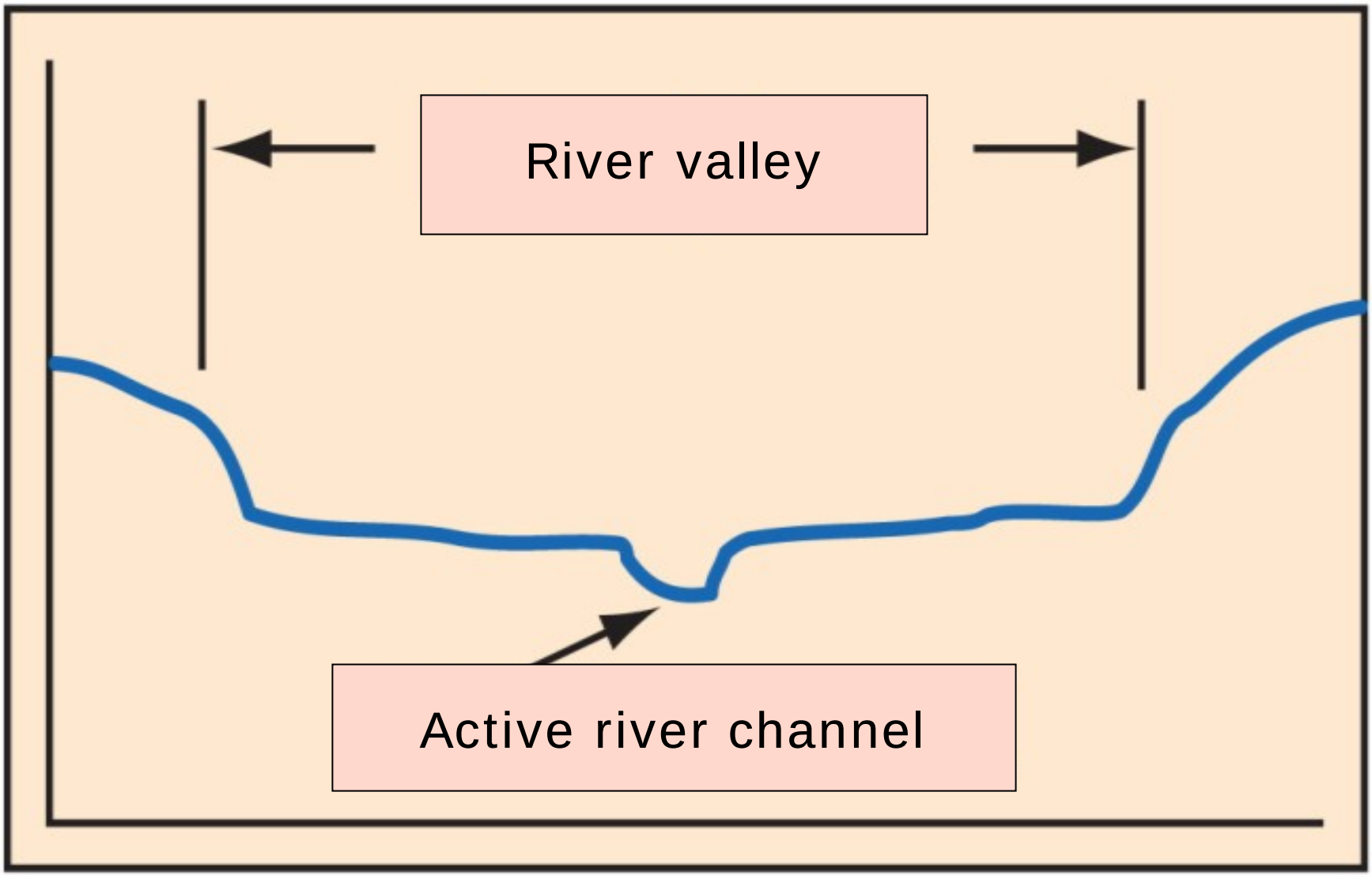
an extreme in bank stability (short-term)

Scroll plain

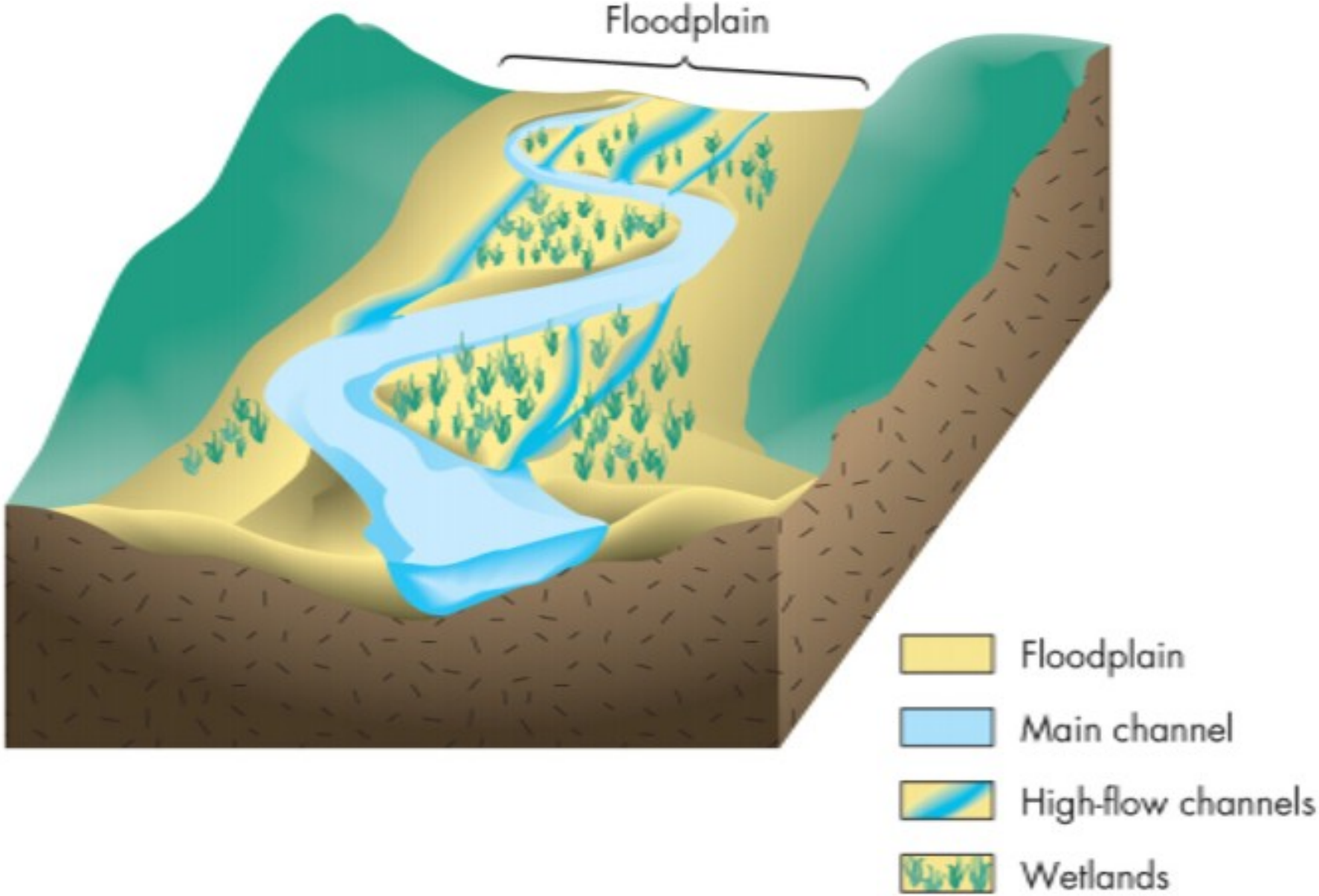
Rio Apure, Orinoco Basin

Meanders and scroll plains

Cross section of river valley & channel

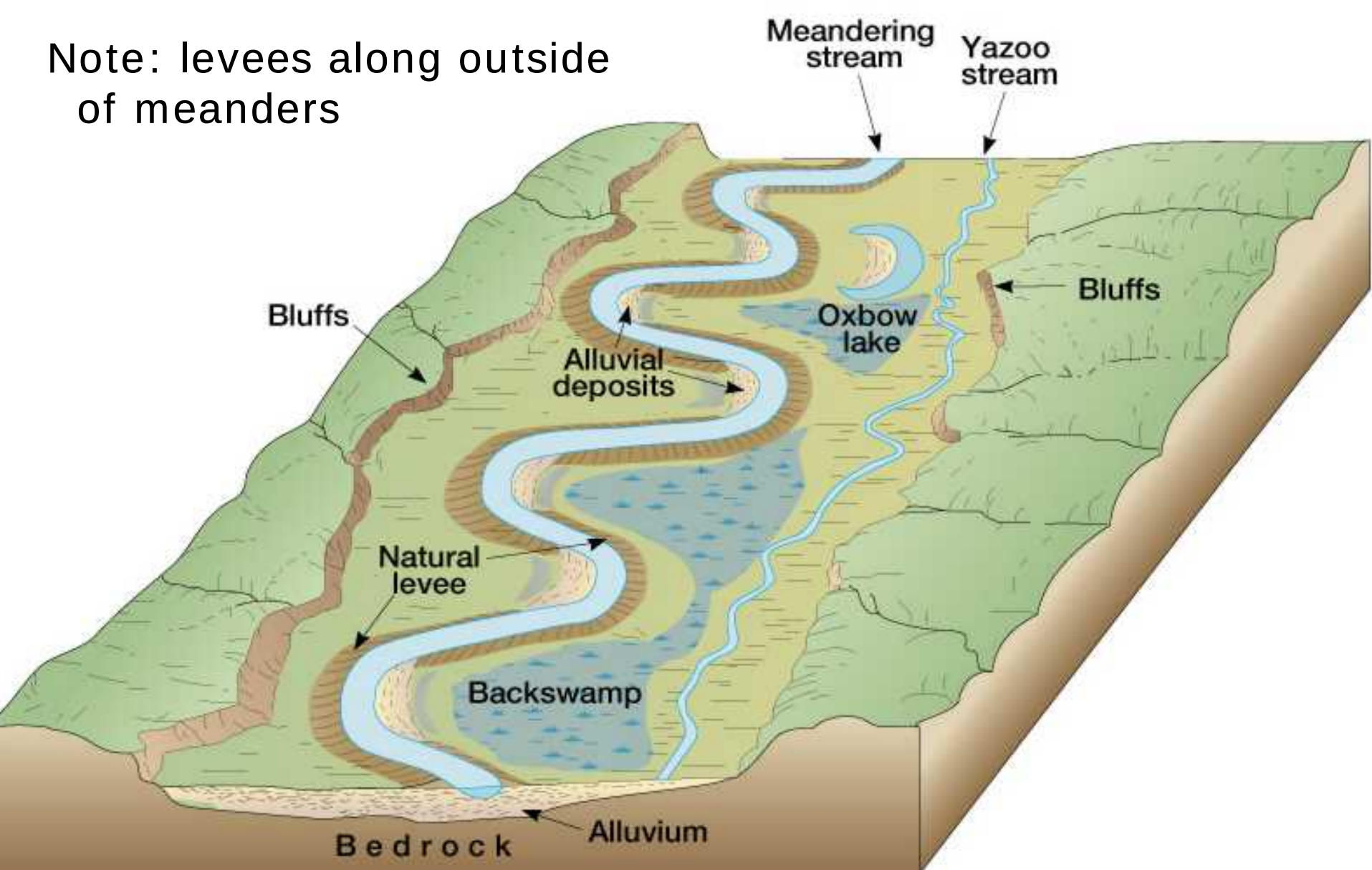


A natural river valley



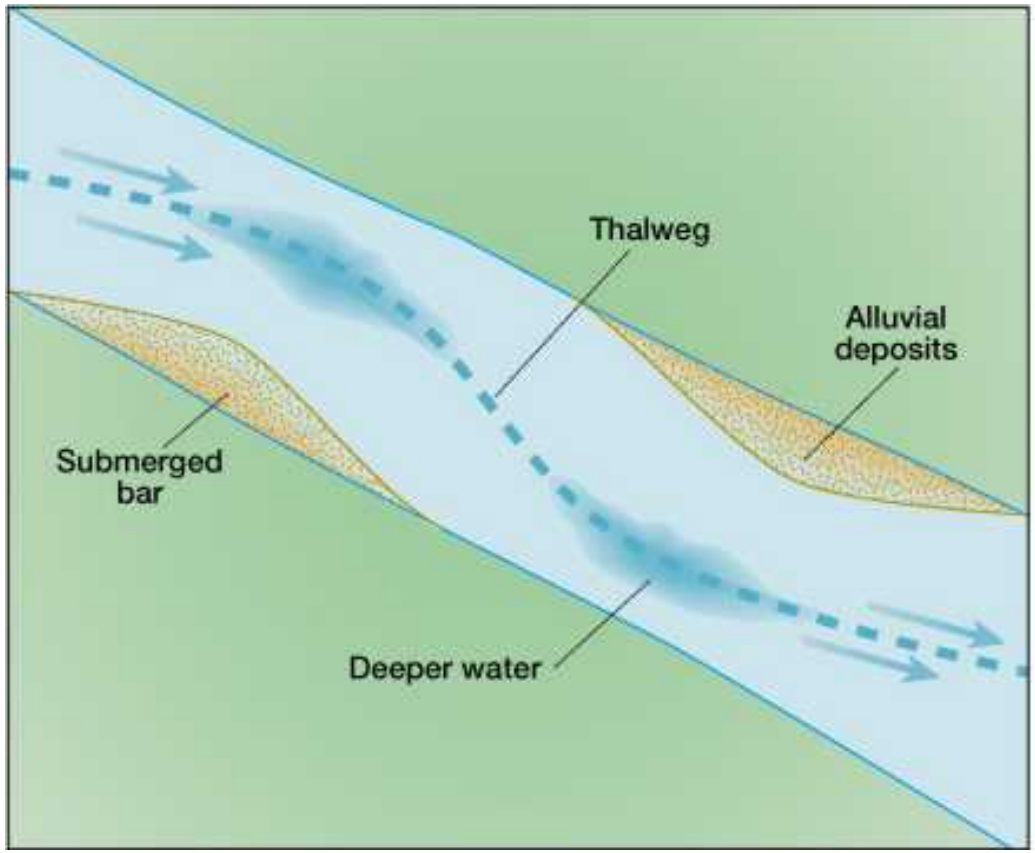
Landforms

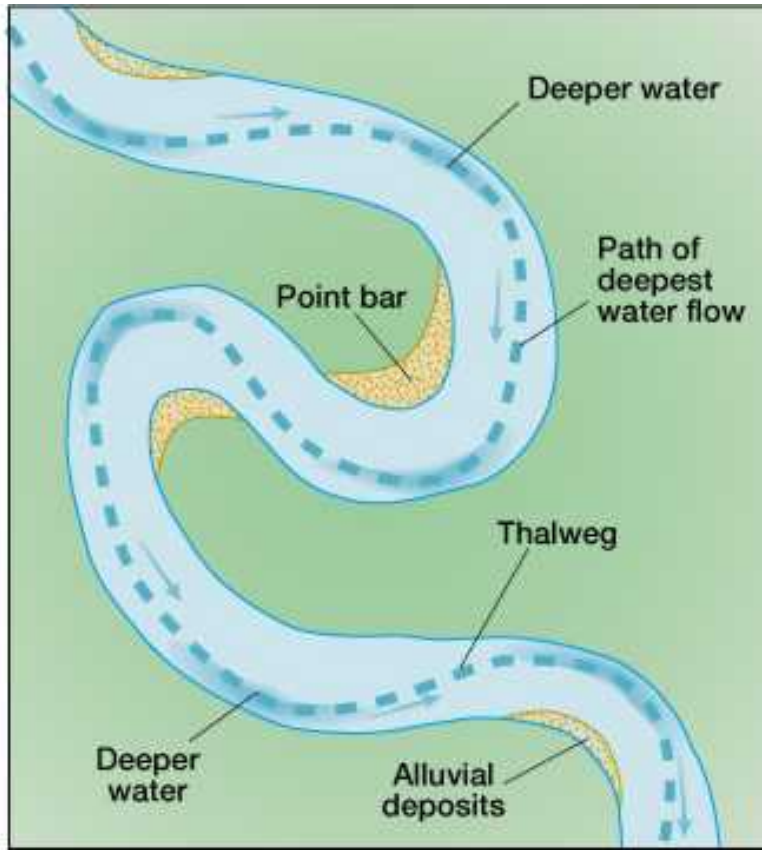
Note: levees along outside of meanders



Meandering and sinuosity

Path of highest-velocity flow



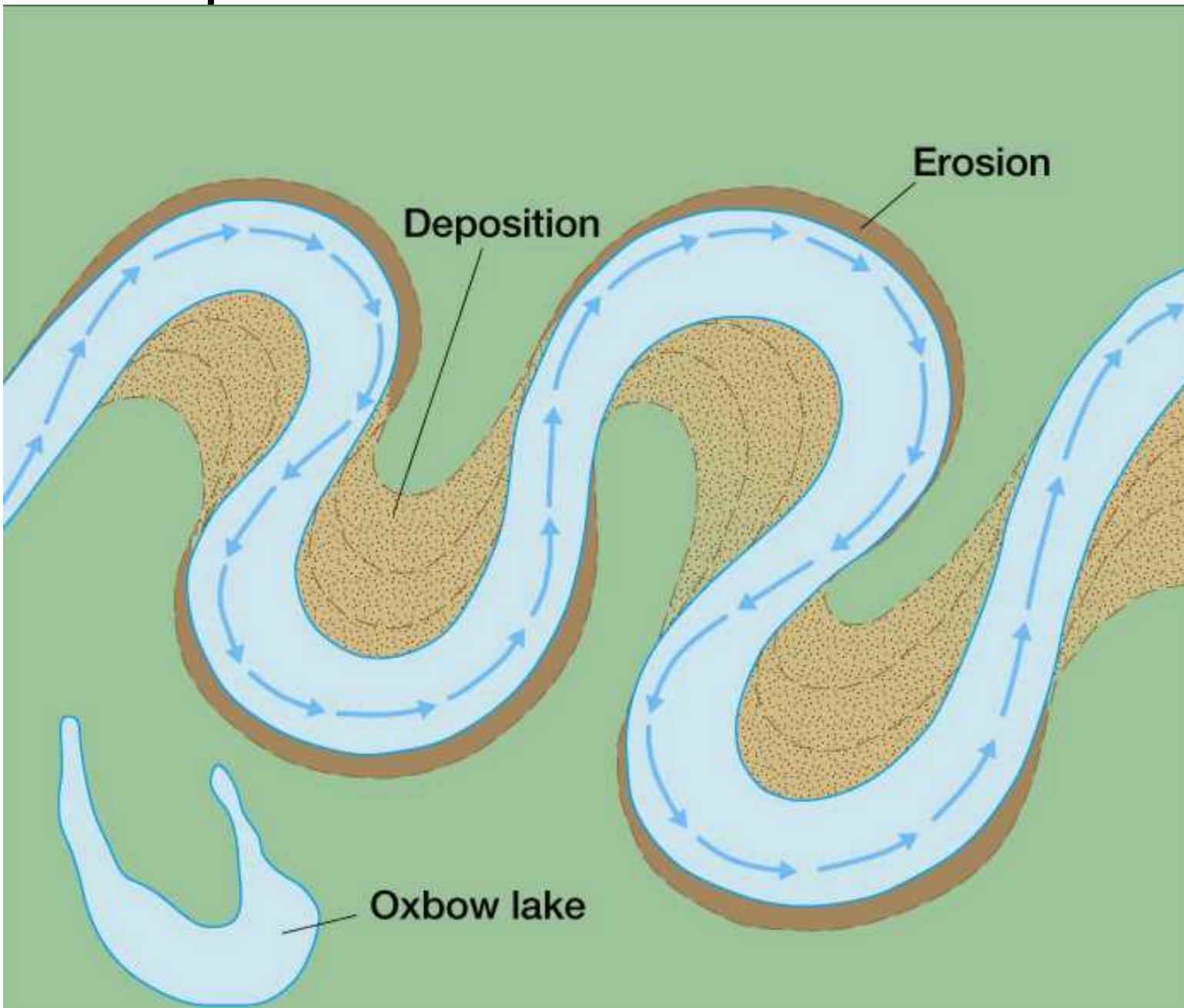


Point bars

lateral accretion of point bars

along inside of meander

Cut bank and point bar



Cut bank, Fountain Creek, New Mexico

Point bar, upstream

Fountain Creek, New Mexico

Point bar, downstream

Fountain Creek, New Mexico

Enhanced turbulence at confluence

Features of a meandering river

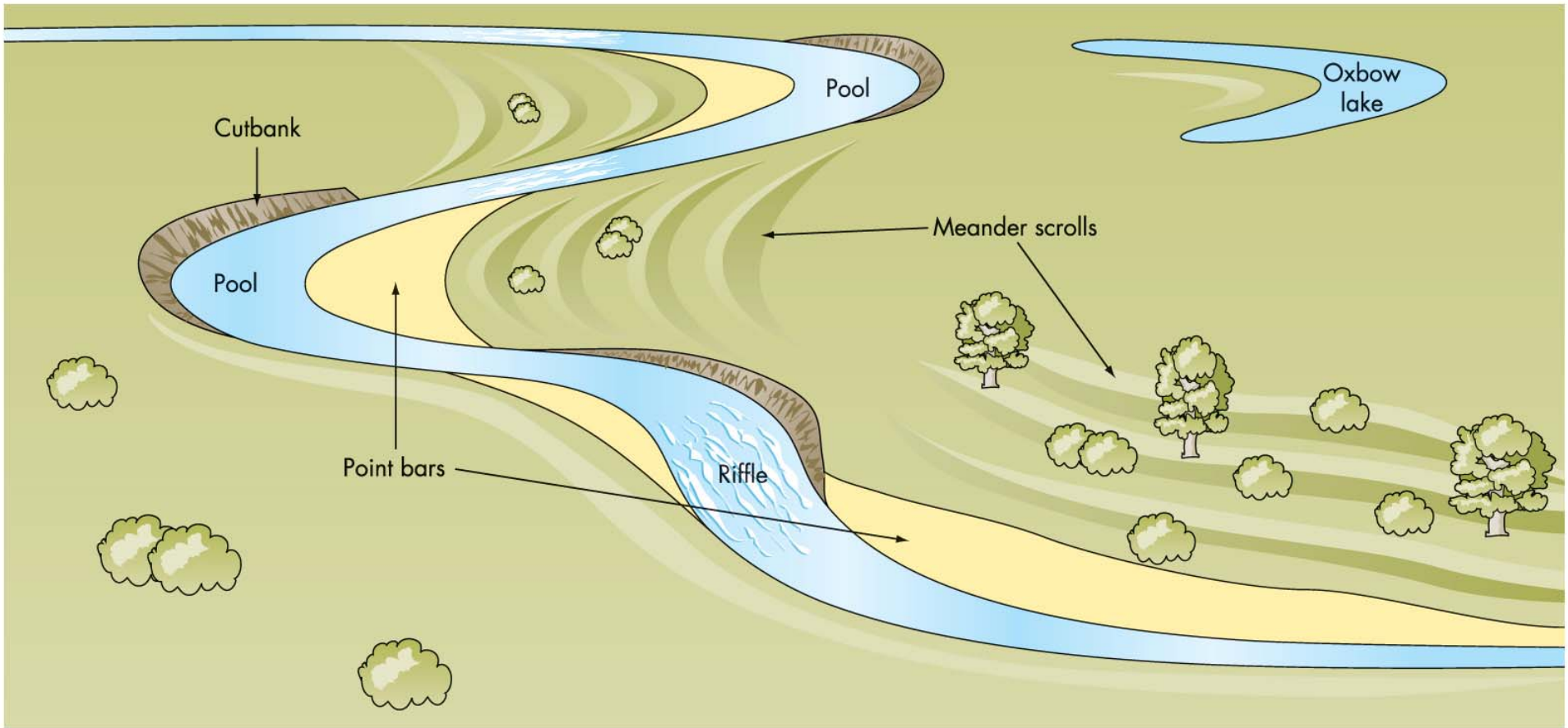
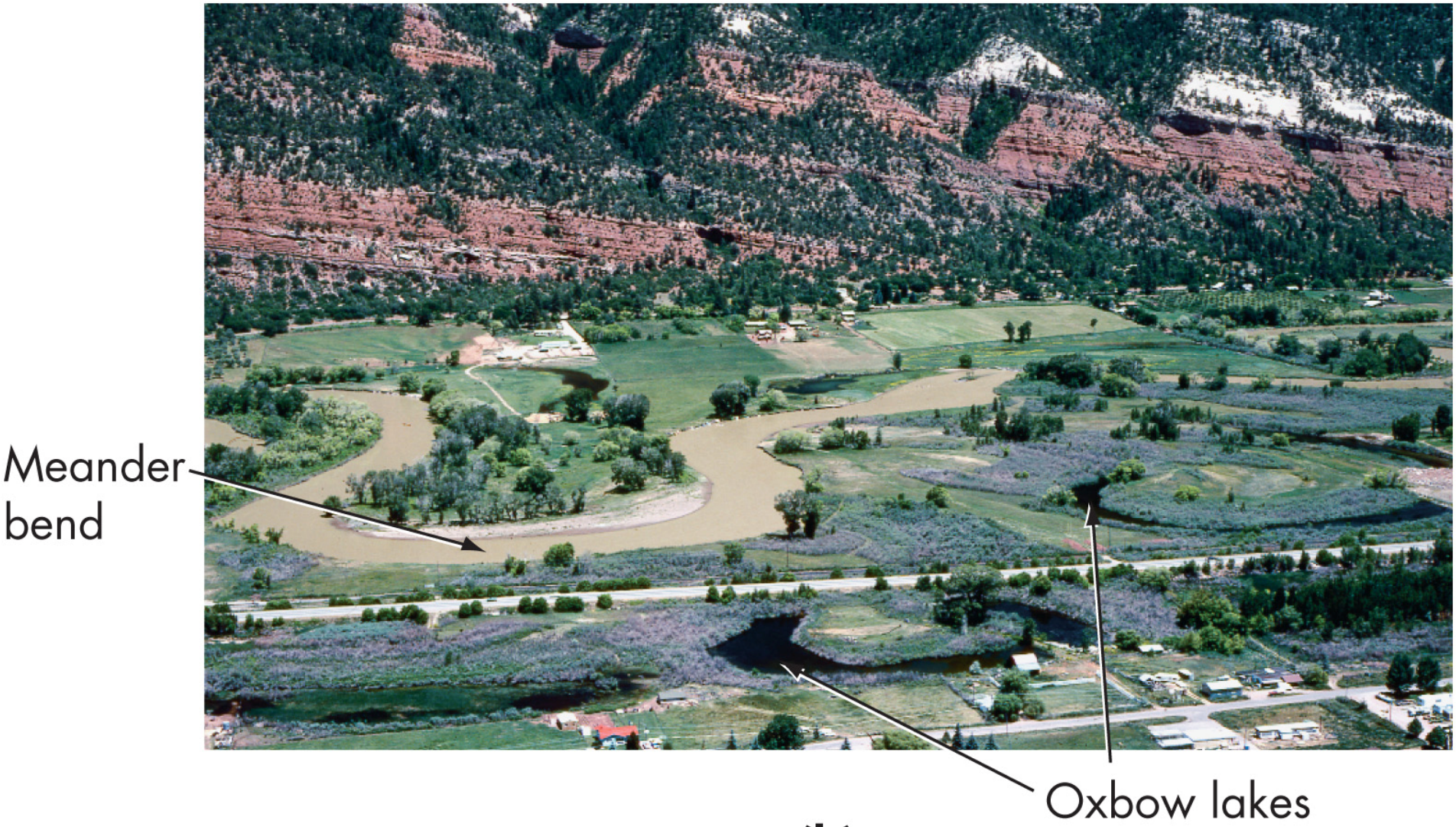


Figure 5.12a



(b)

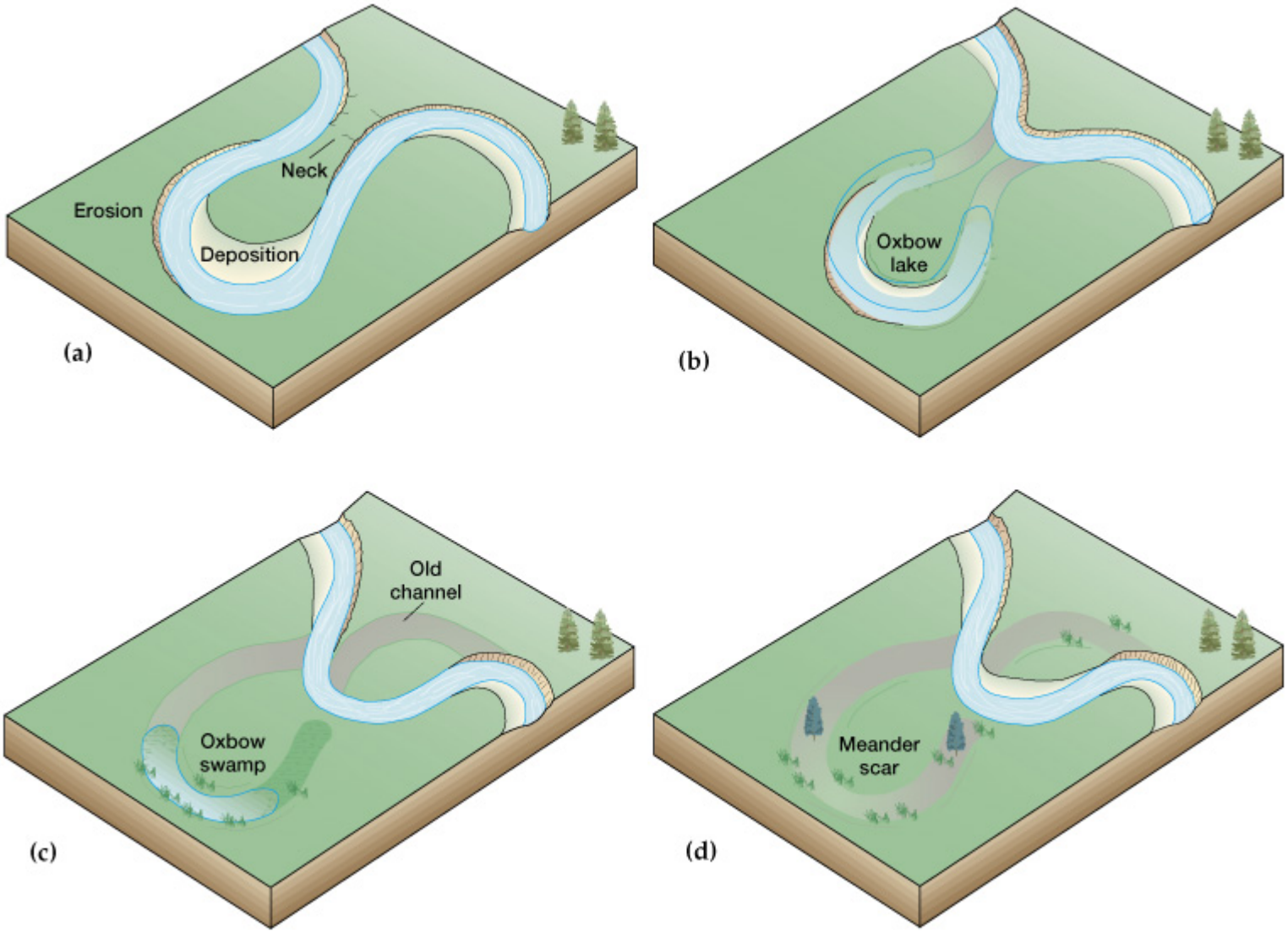
Figure 5.12b

(c)

Figure 5.12c

Meander cut-off

Forming an oxbow lake



Overbank deposition

Bankfull discharge

flood water level up to the top of the channel
maintains the primary channel
occurs once every 1-2 years

Bankfull discharge

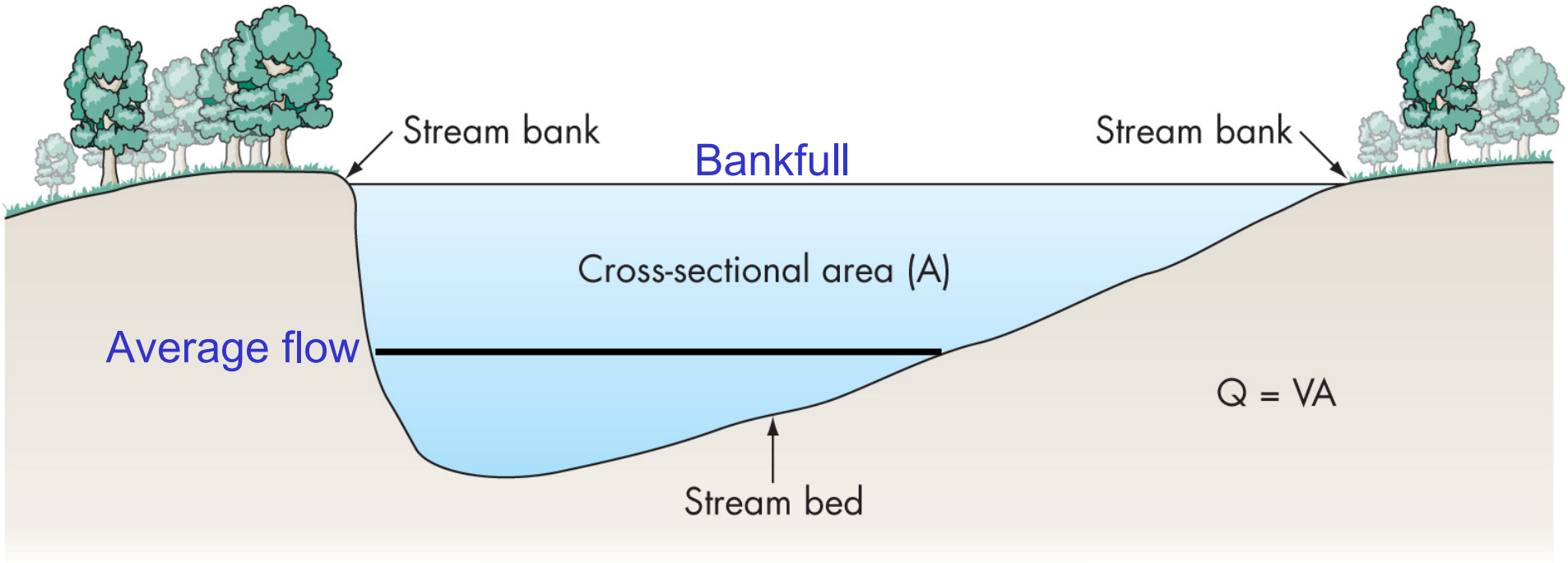


Figure 5.8

Overbank deposition

predominantly vertical accretion
(erosion is minor)

lower velocity than channel

finer-grained sediments

Main features:

Levee

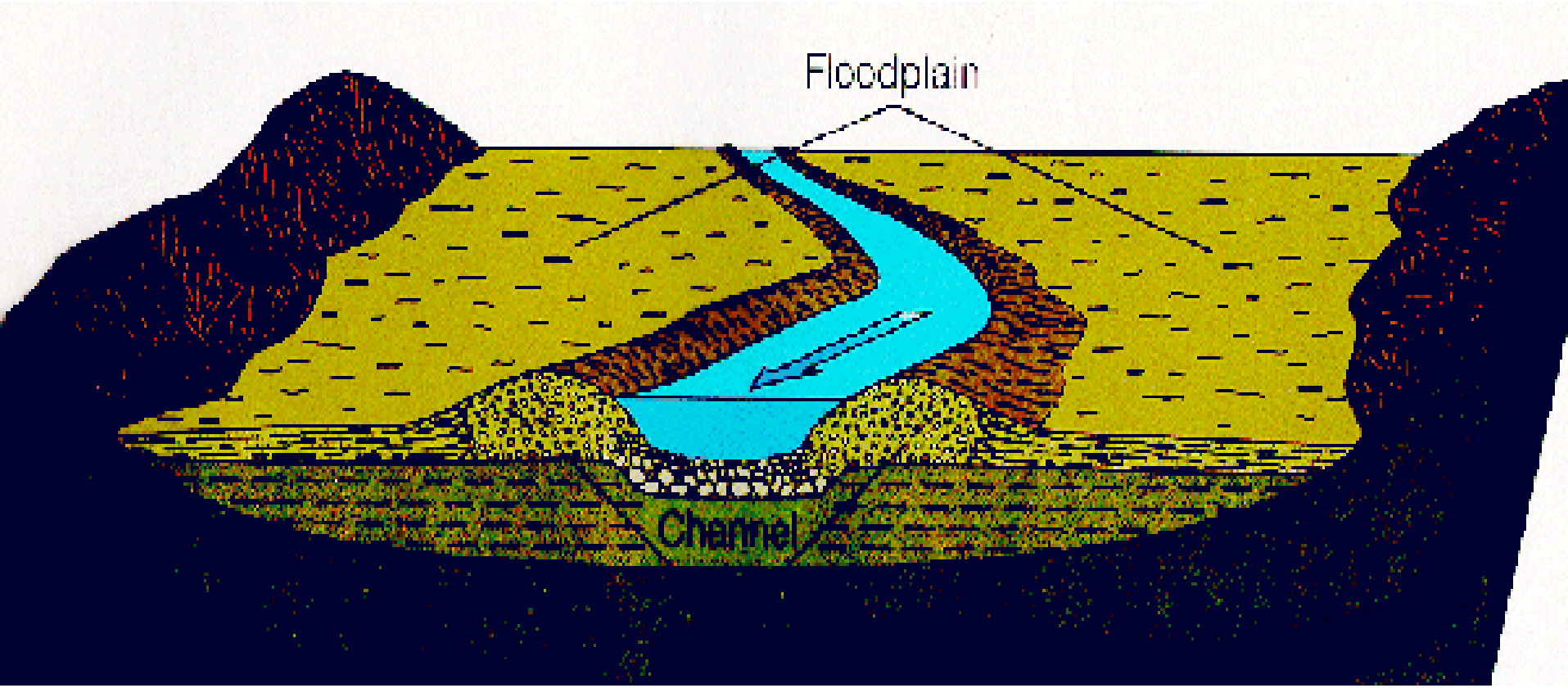
Floodplain (floodbasin)

Crevasse splay

Oxbow lake

Natural levees

rapid loss of water velocity over bank
deposition of sand and fine sand



Natural levees

mostly on outside of meander

deposition of med sand near channel,
then fine sand and coarse silt

ripple marks or laminae of fine sand / silt

Crevasse splay during flood

Note levees clearly defined

Crevasse-splay deposit (after flood)

Deposits graded vertically and laterally

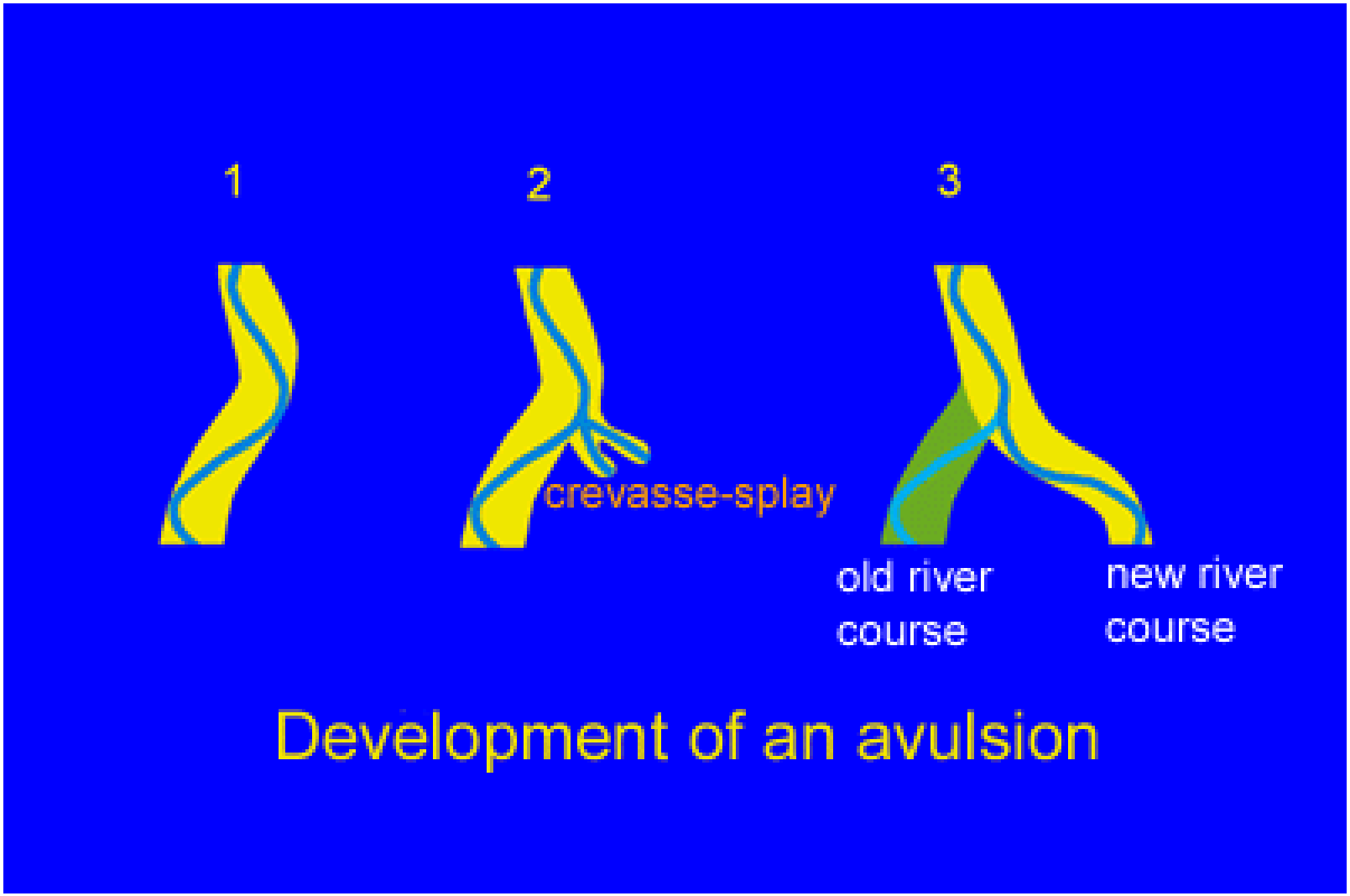
Crevasse-splay deposits

Bryants Creek, breach in man-made levee

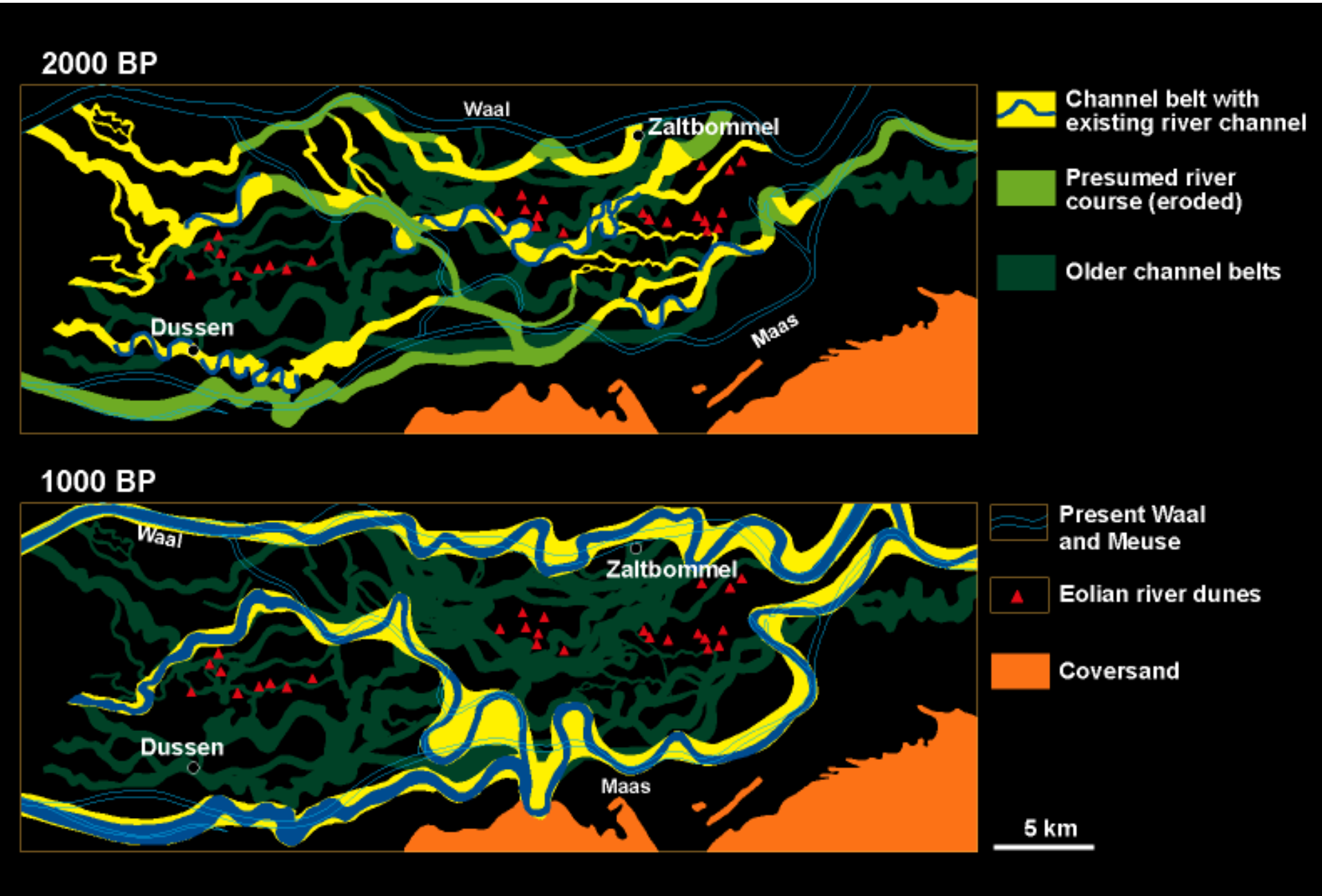
Crevasse splay – larger scale

Columbia River

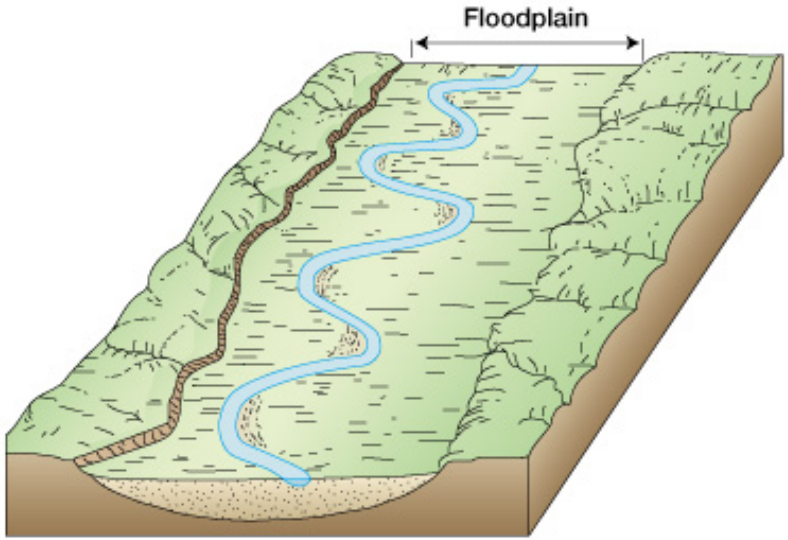
River avulsion – switching channels



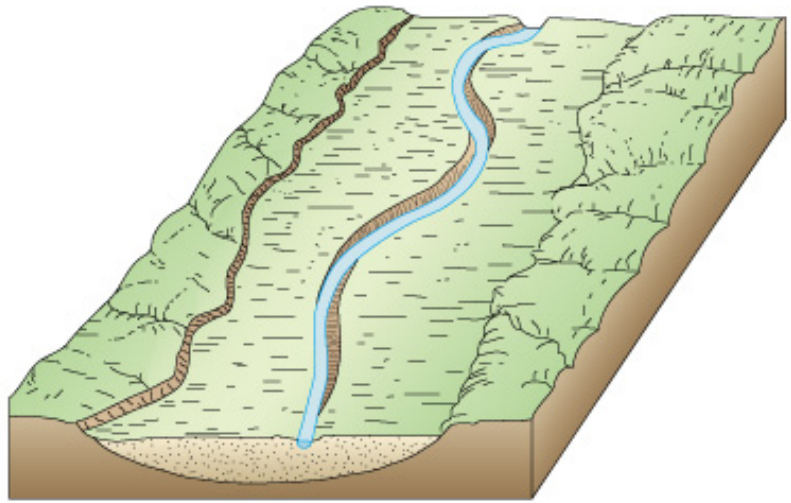
Avulsion and meander belts



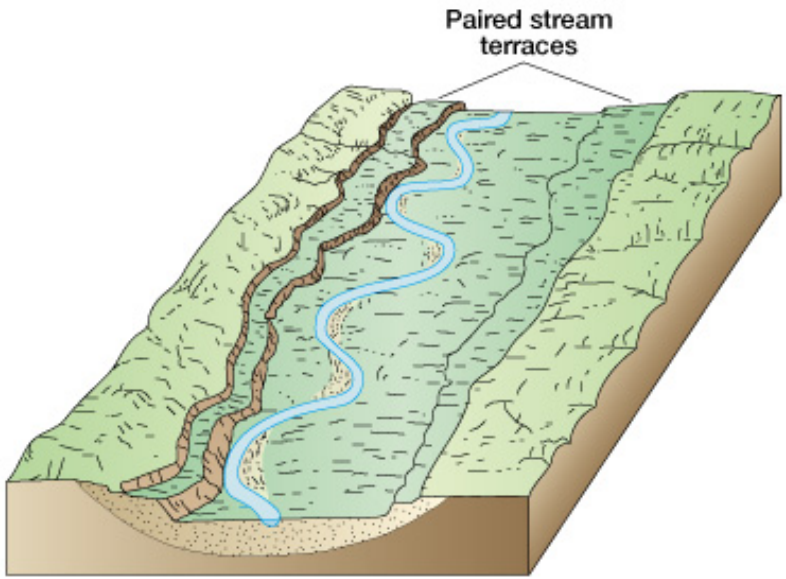
River terraces – something changed



(a) Before uplift



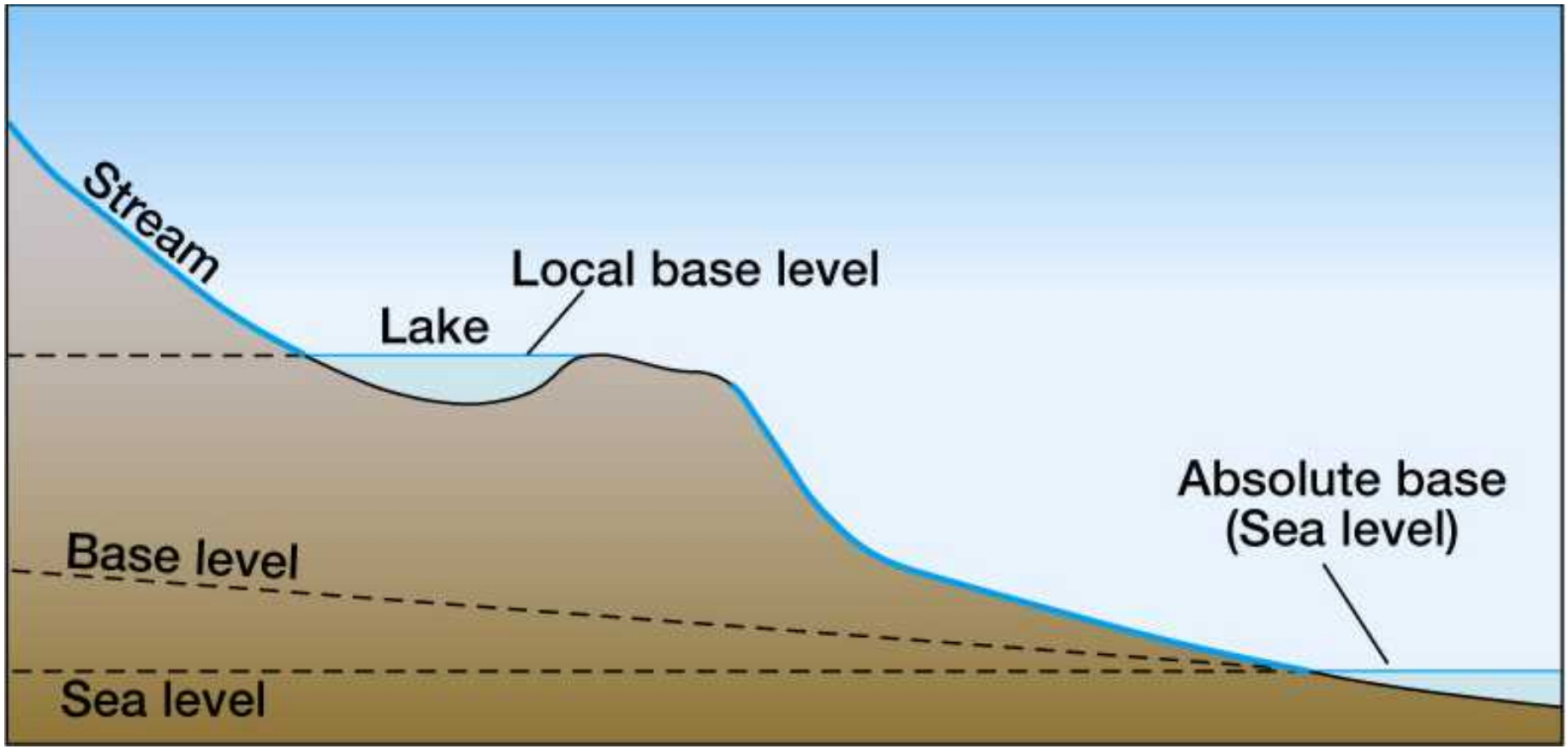
(b) Uplift

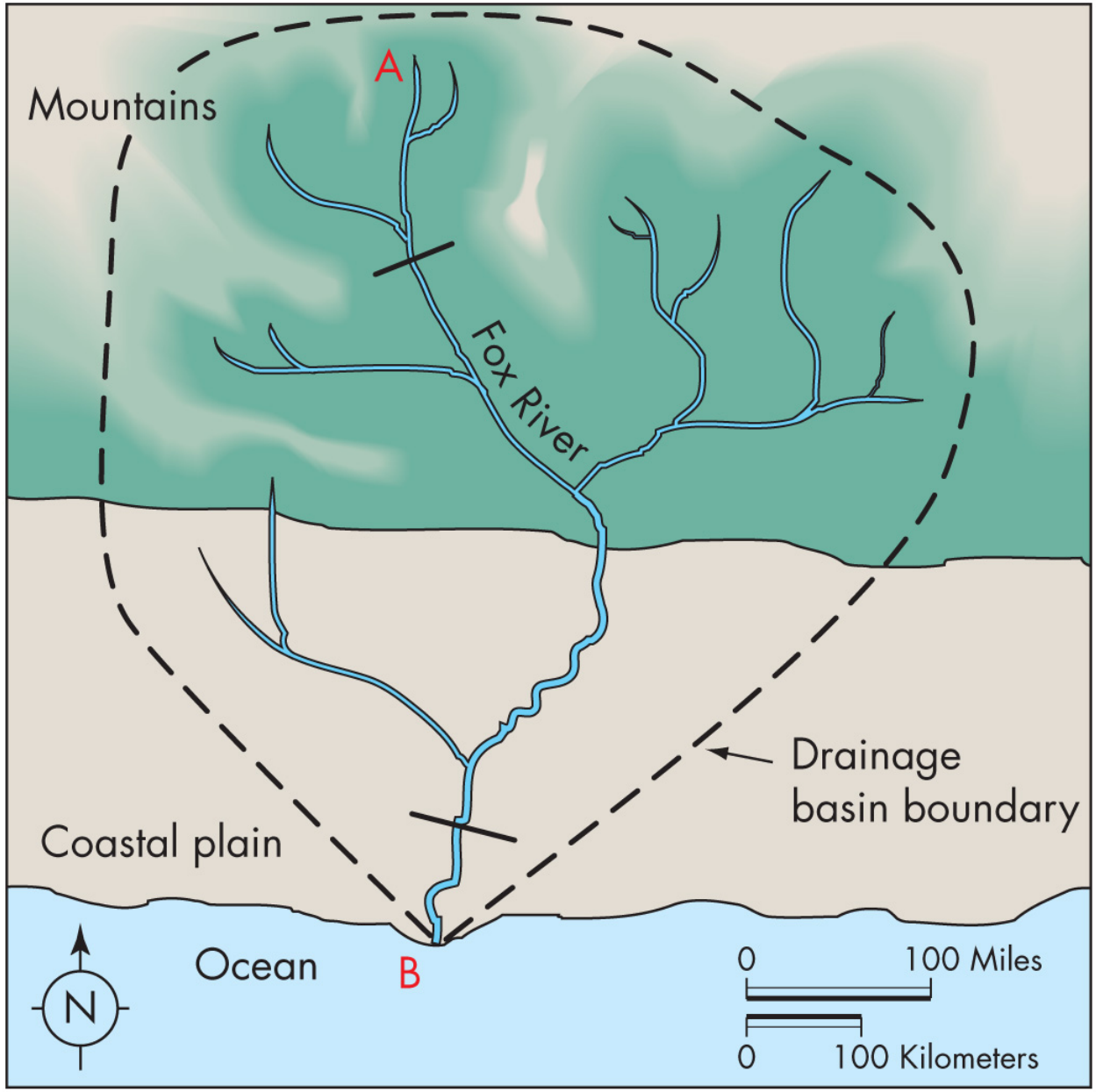


(c) After uplift

Concept of base level

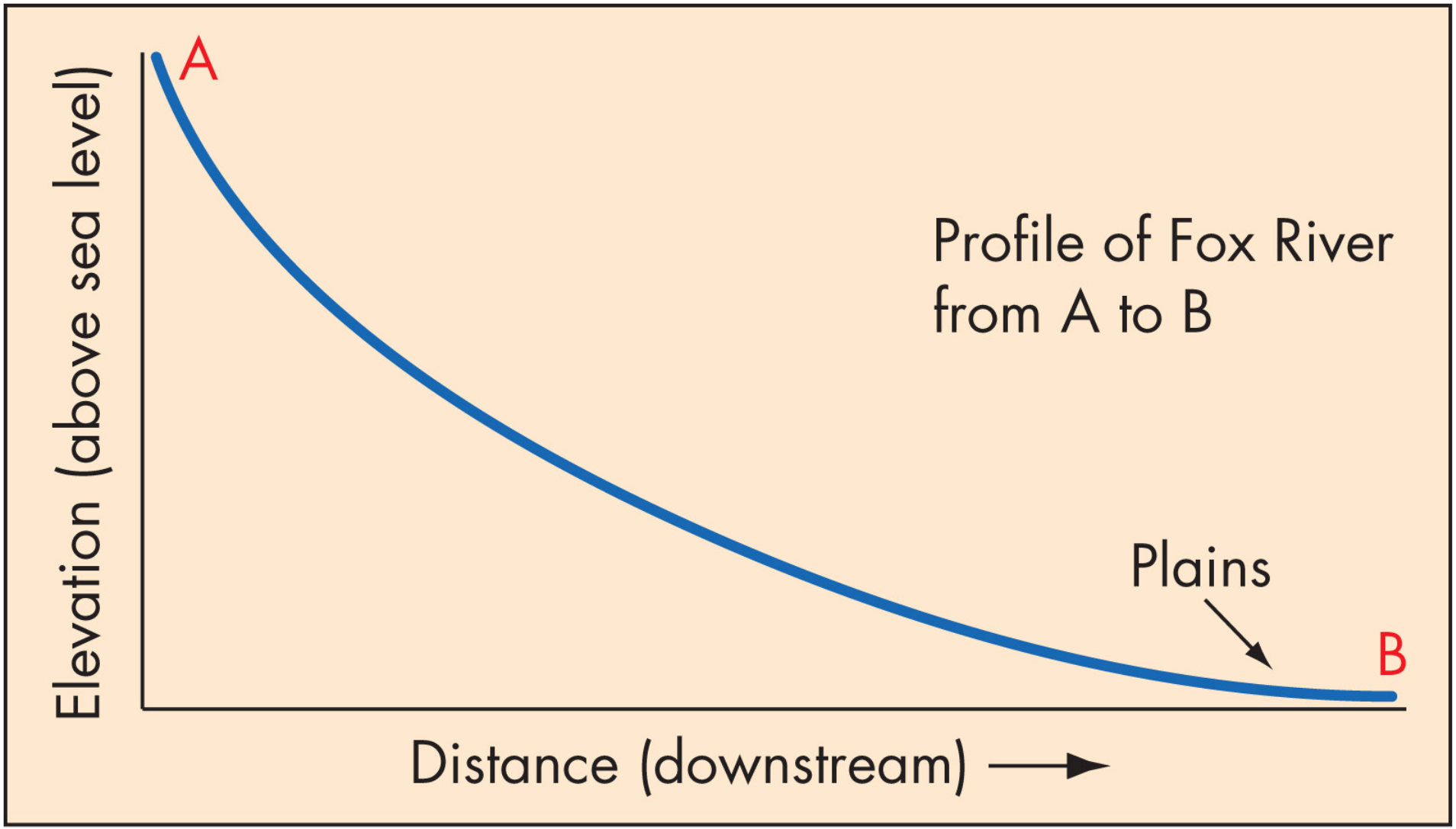
Hypothetical balance between erosion, transport, and deposition





(a) Map (plan view)

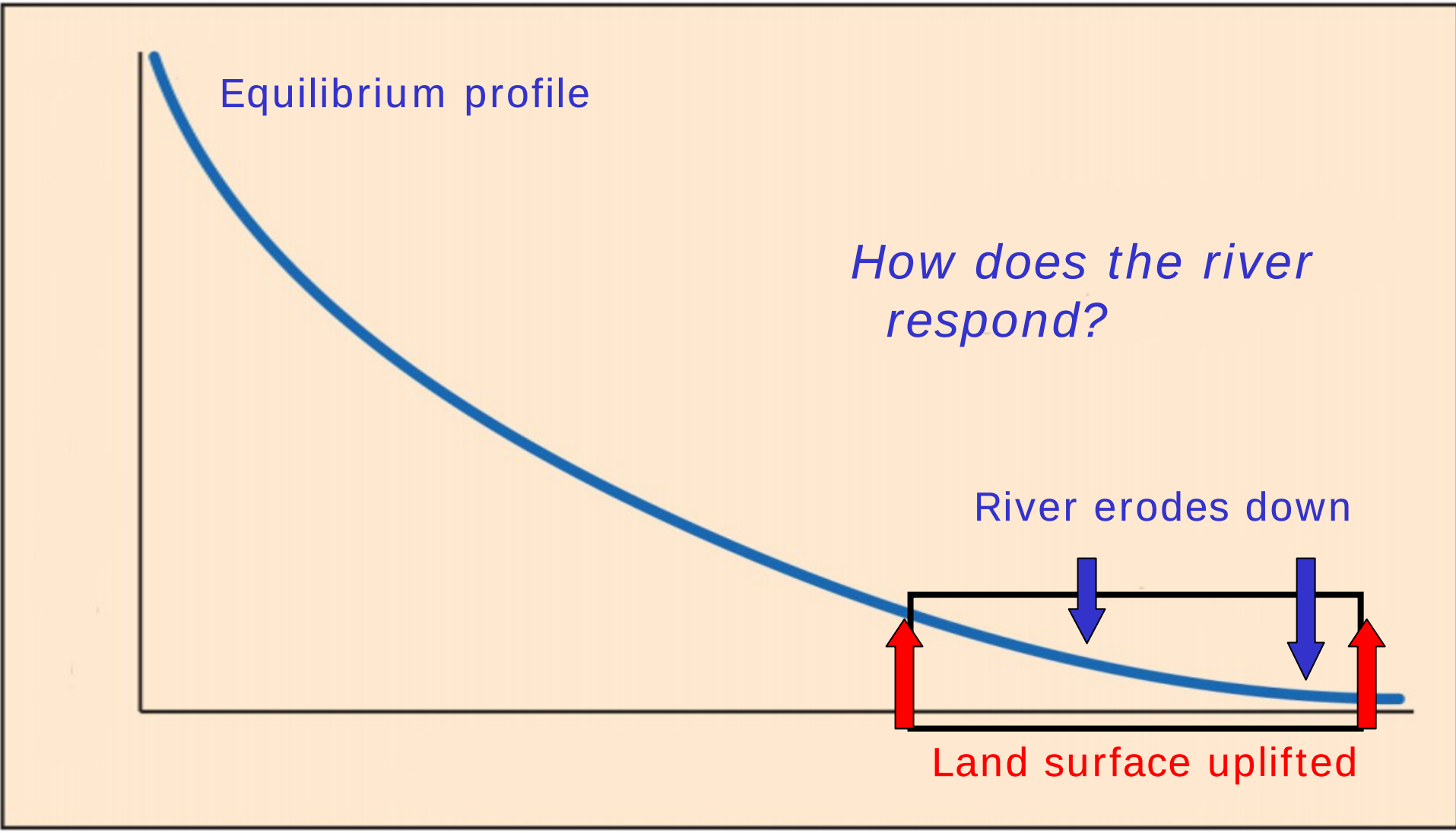
Figure 5.7b



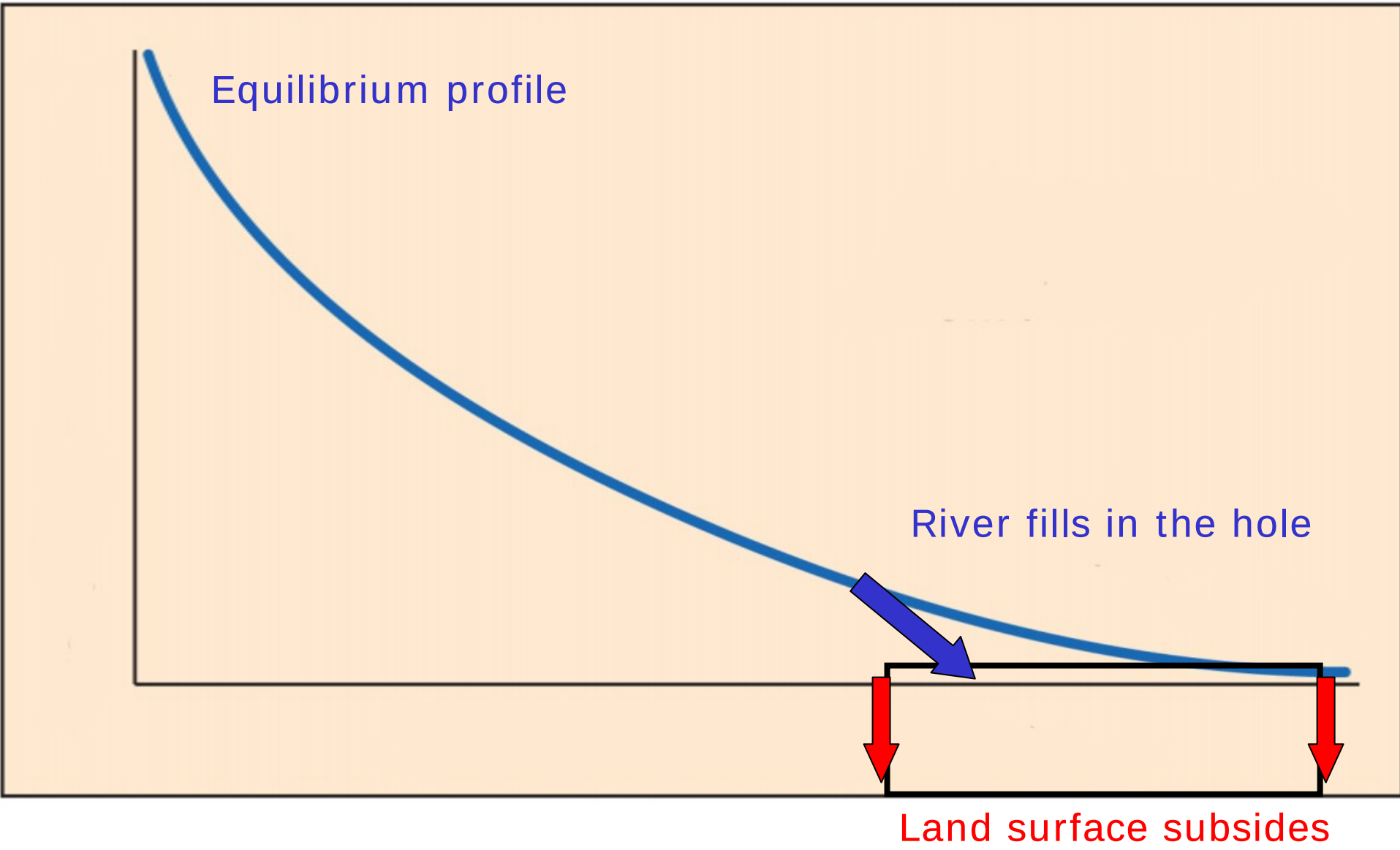
(b) Longitudinal profile

Figure 5.7b

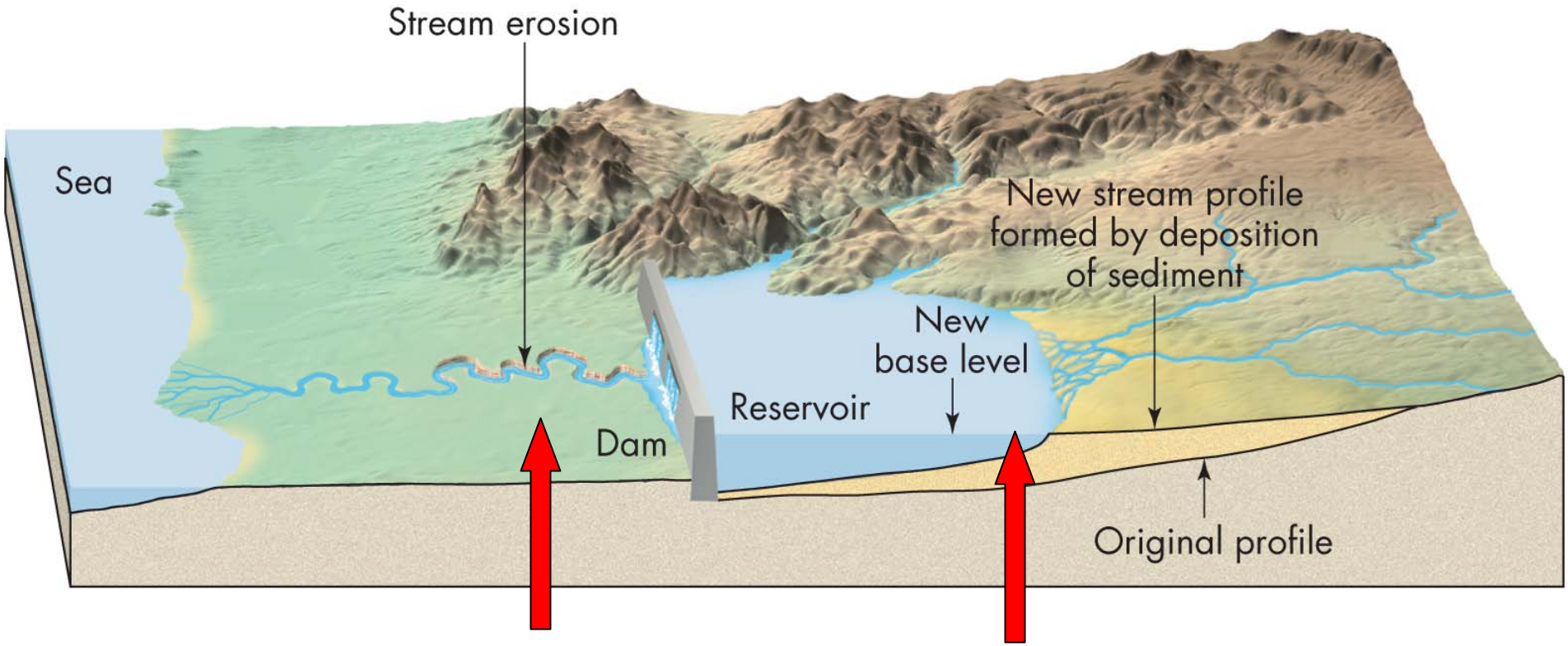
Effect of regional uplift



Effect of regional subsidence



Effects of changing base level



Downstream erosion caused by lack of sediment

Deposition of sediment in the new basin