GEOMORFOLOGÍA

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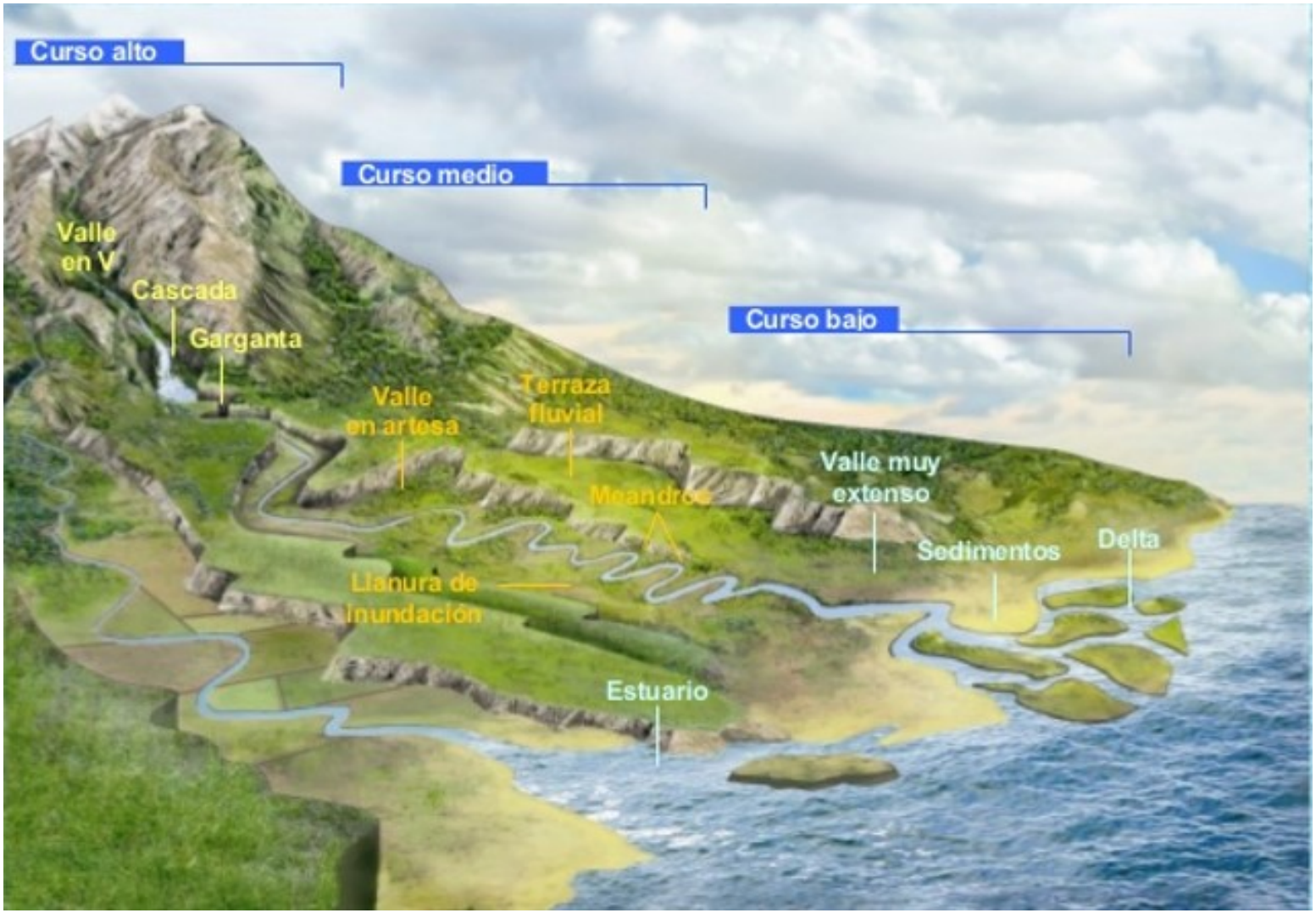
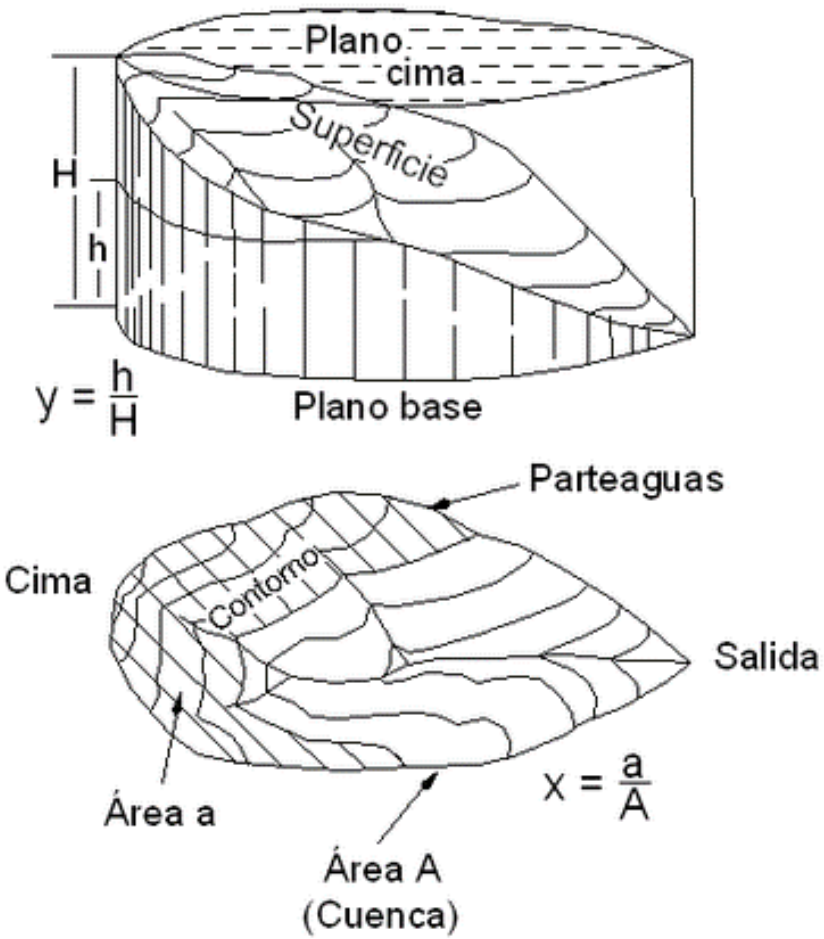
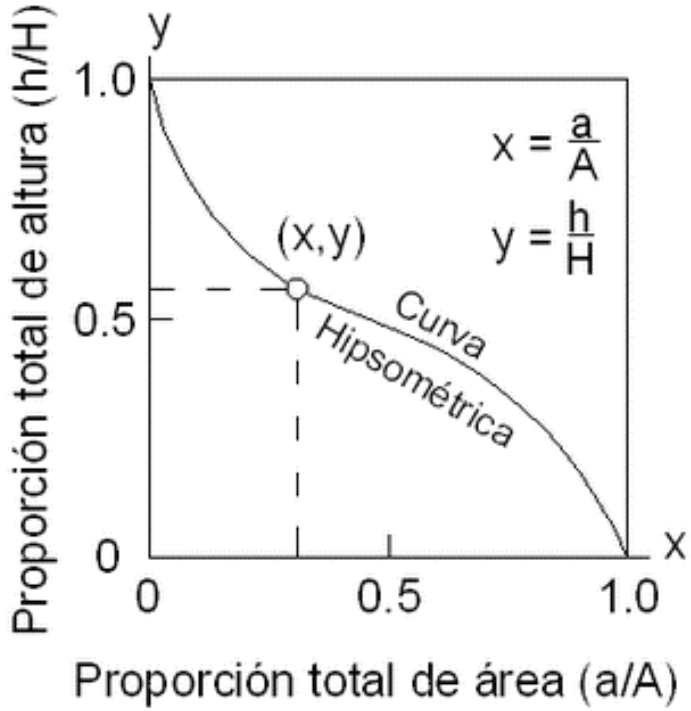
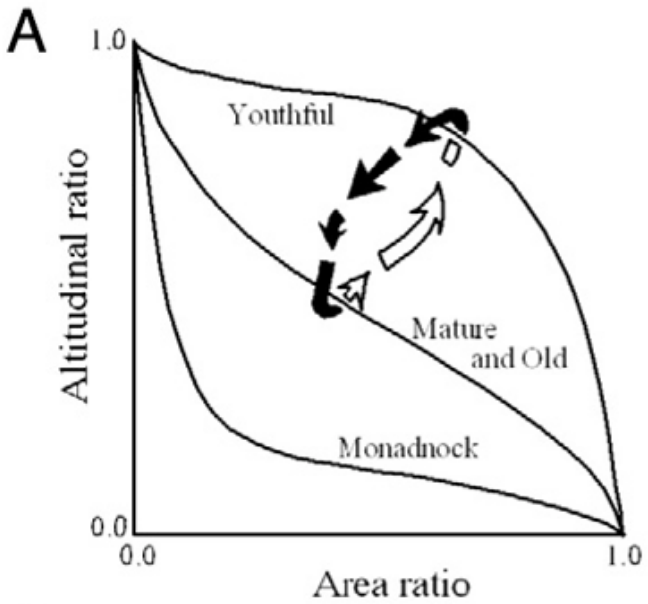
Versión:July 14, 2020

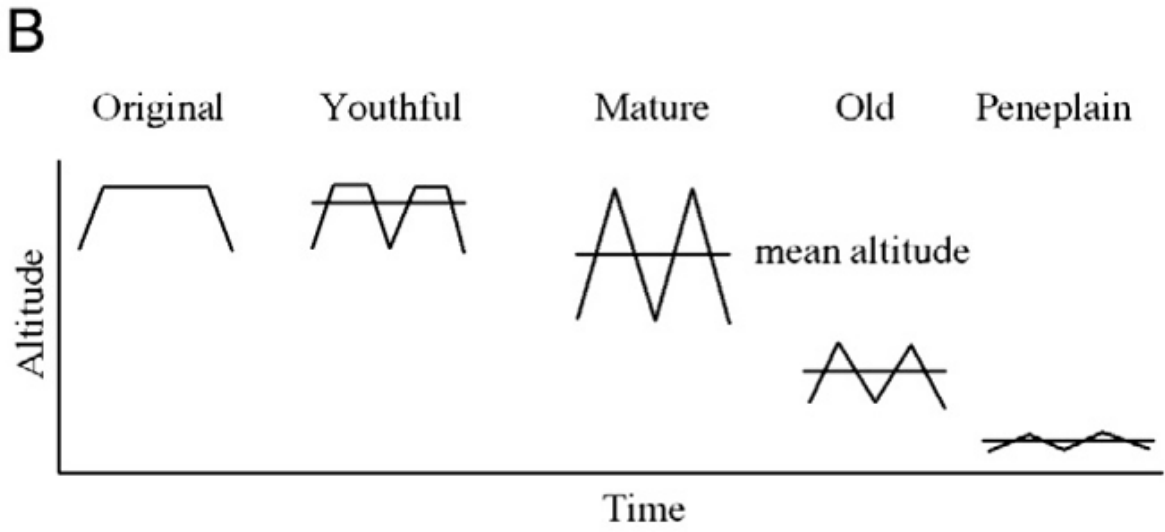
UNIVERSIDAD NACIONAL DE COLOMBIA
SEDE MEDELLÍN

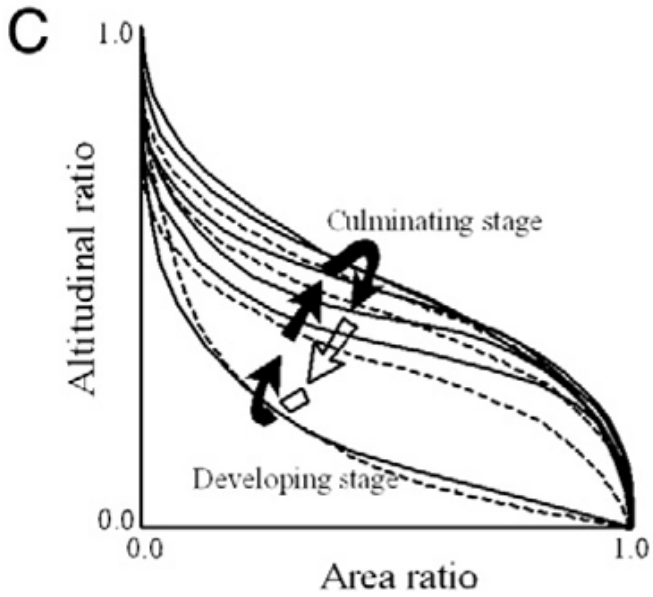

Curso alto
Curso medio
Curso bajo
Valle en V
Cascada
Garganta
Valle en artesa
Terraza fluvial
Meandros
Valle muy extenso
Sedimentos
Delta
Llanura de inundación
Estuario

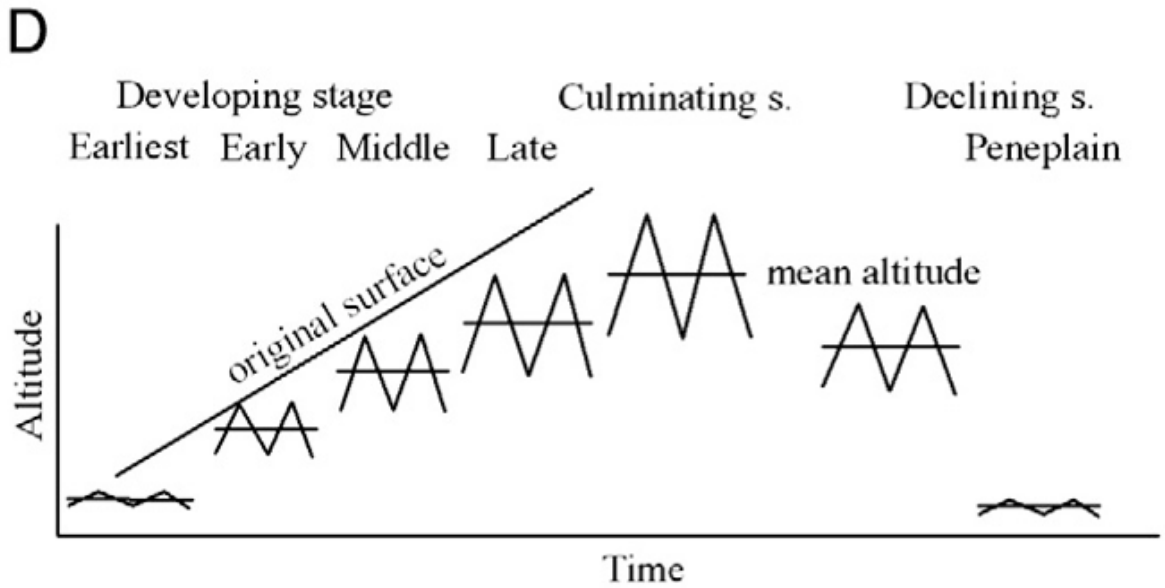

Plano
cima
Superficie
H
h
y = h/H
Plano base
Parteaguas
Cima
Contorno
Salida
X = a/A
Área a
Área A
(Cuenca)


y
1.0
0.5
0
0
0.5
1.0
x
x = a/A
y = h/H
(x,y)
Curva
Hipsométrica
Proporción total de altura (h/H)
Proporción total de área (a/A)


A
1.0
Youthful
Mature
and Old
Monadnock
Altitudinal ratio
0.0
0.0
1.0
Area ratio


B
Original
Youthful
Mature
Old
Peneplain
mean altitude
Altitude
Time


C
1.0
Culminating stage
Developing stage
Altitudinal ratio
0.0
0.0
1.0
Area ratio


D
Developing stage
Earliest
Early
Middle
Late
Culminating s.
Declining s.
Peneplain
original surface
mean altitude
Altitude
Time

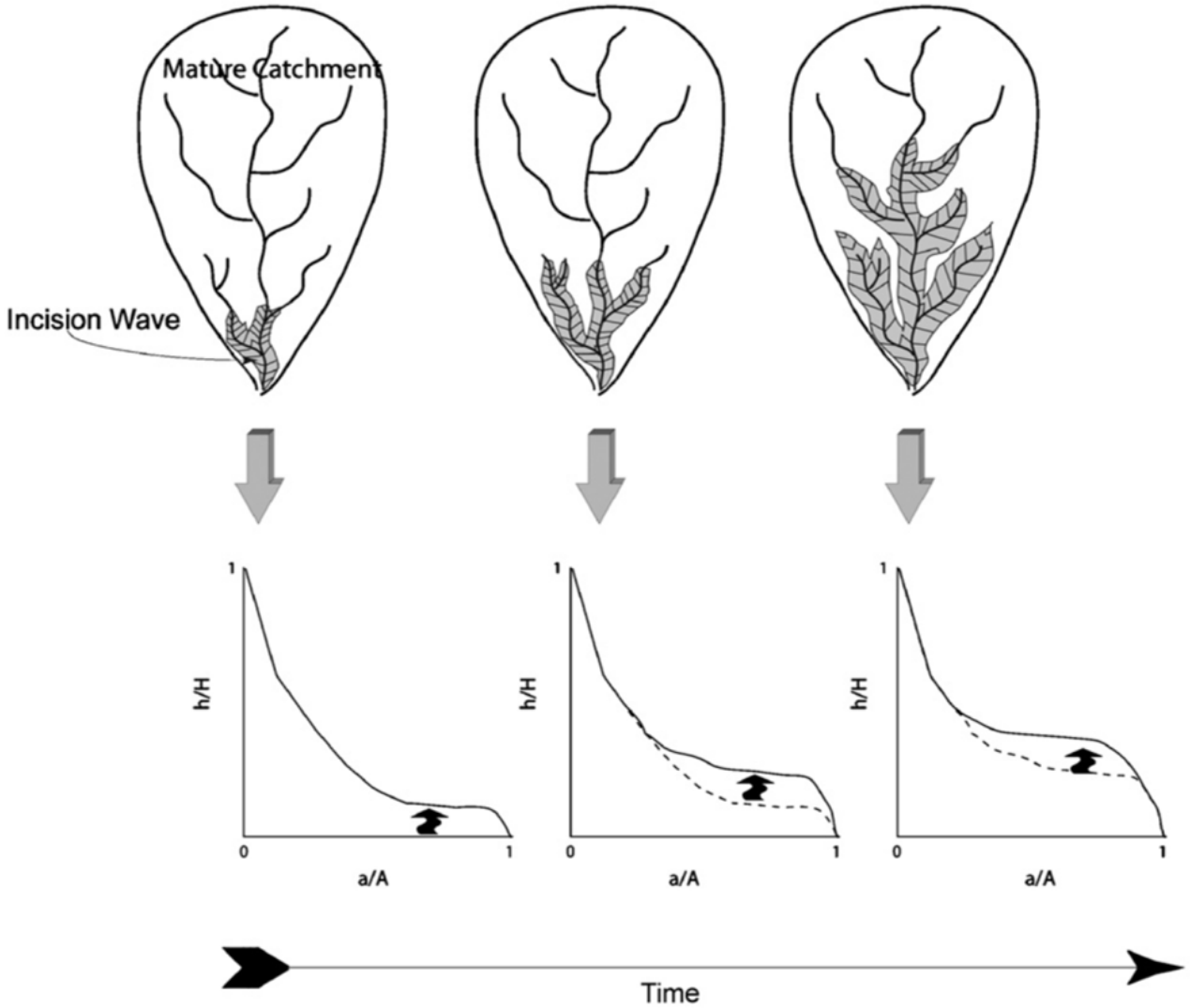
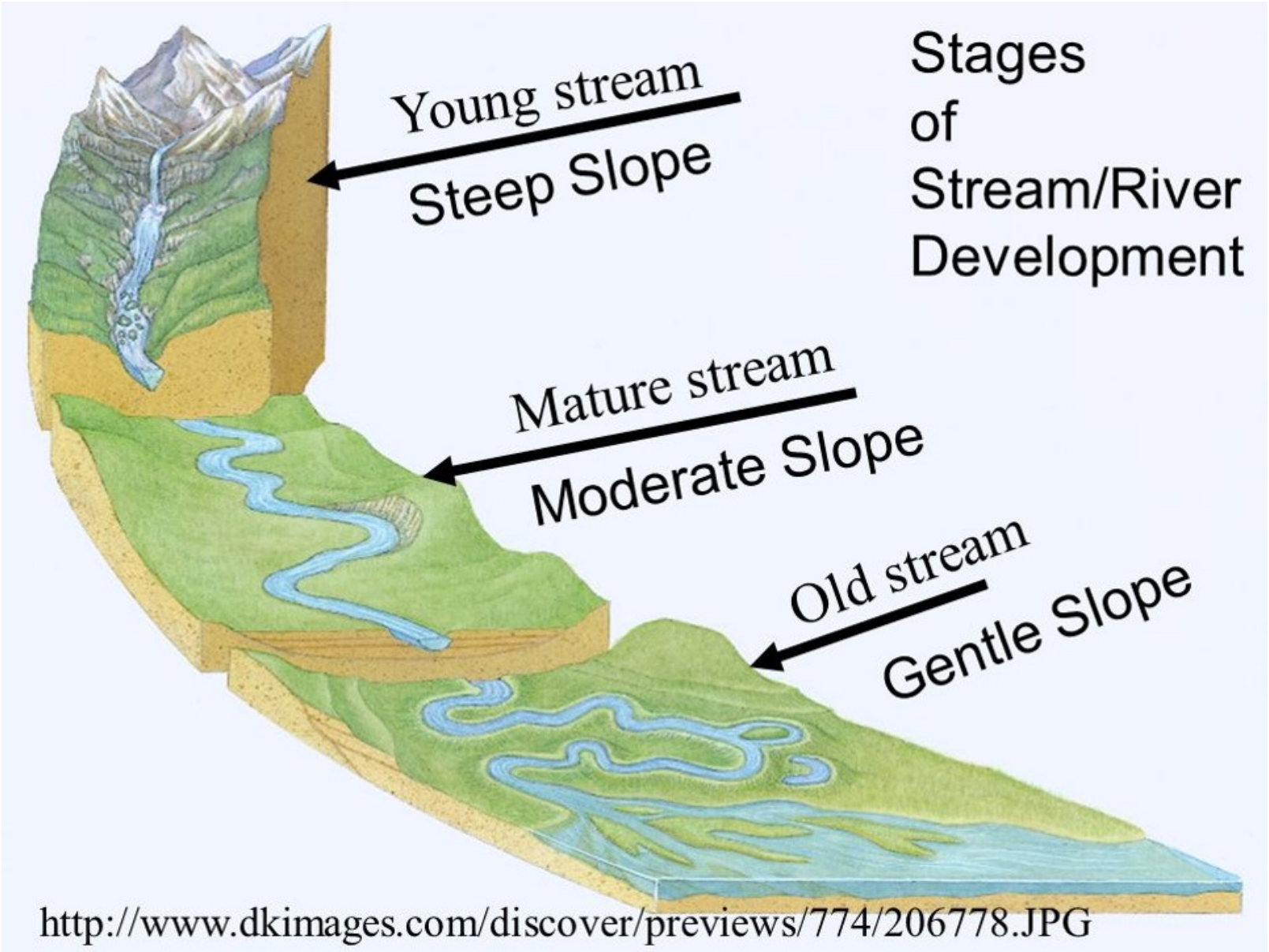
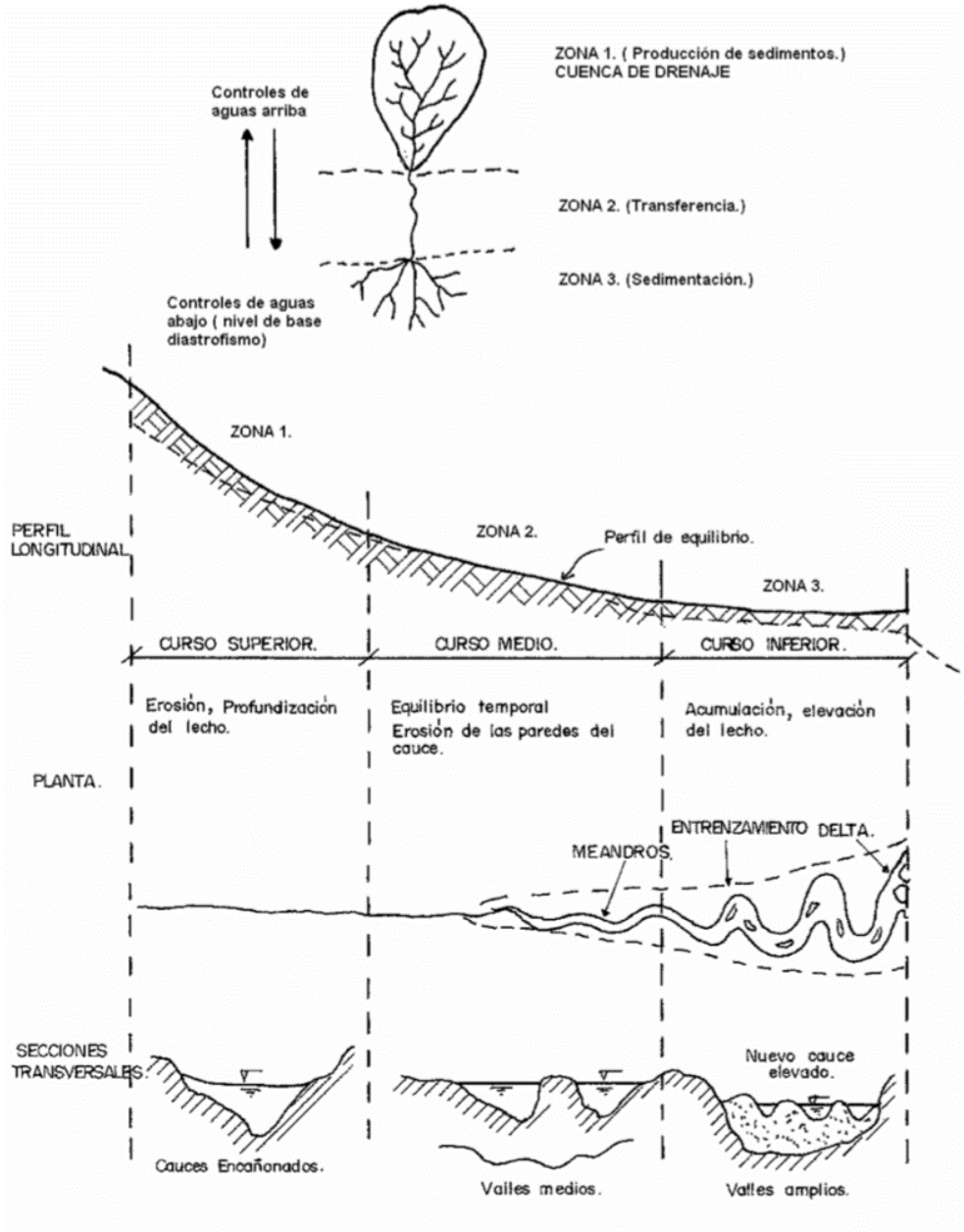
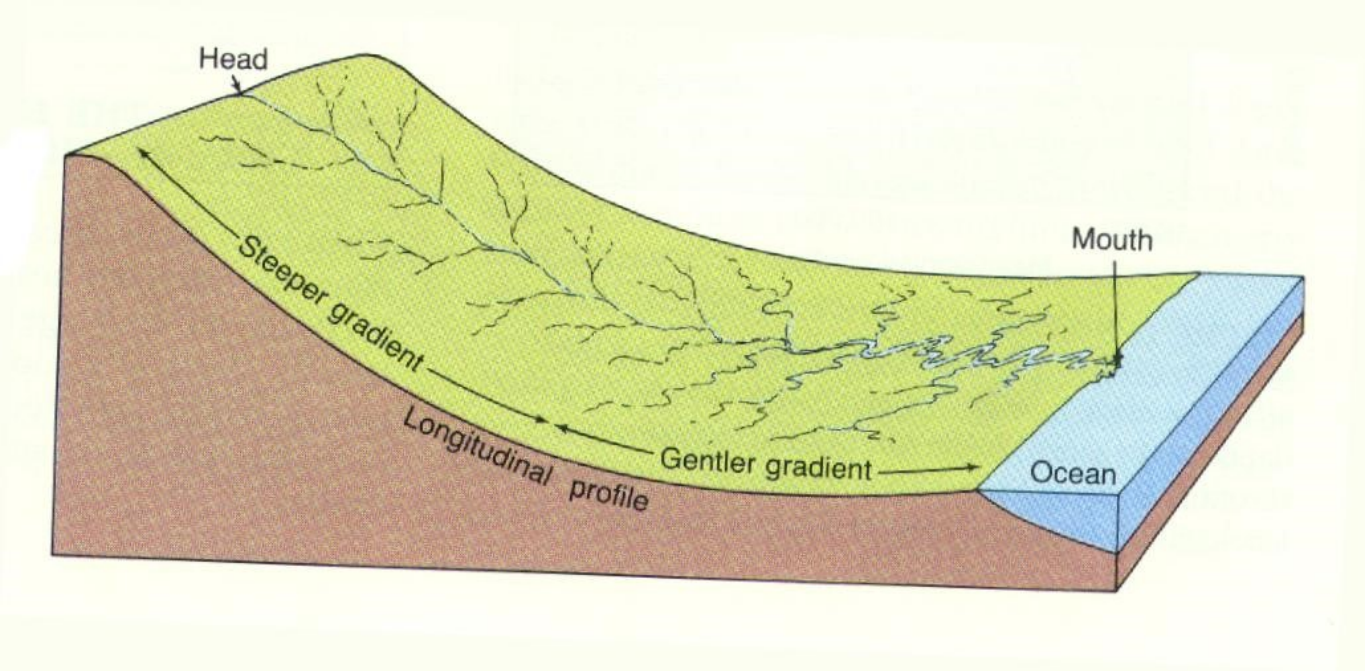
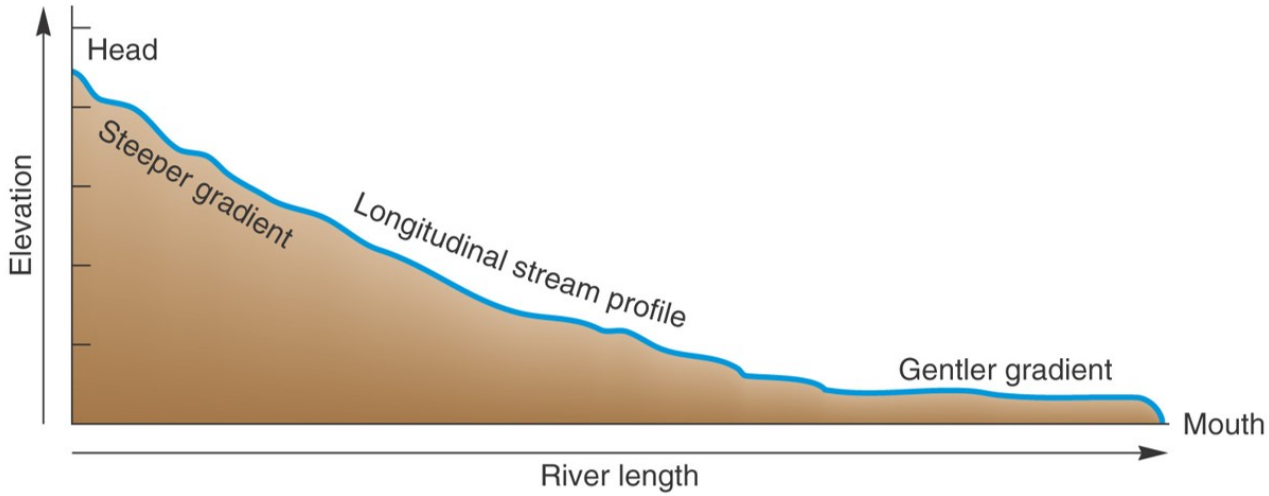


Fig. 9. Schematic drawing (not to scale) showing effect that a capture process, with a subsequent base-level lowering, will have in a mature drainage basin over time. Dashed line in hypsometric curves represents "previous" stage.

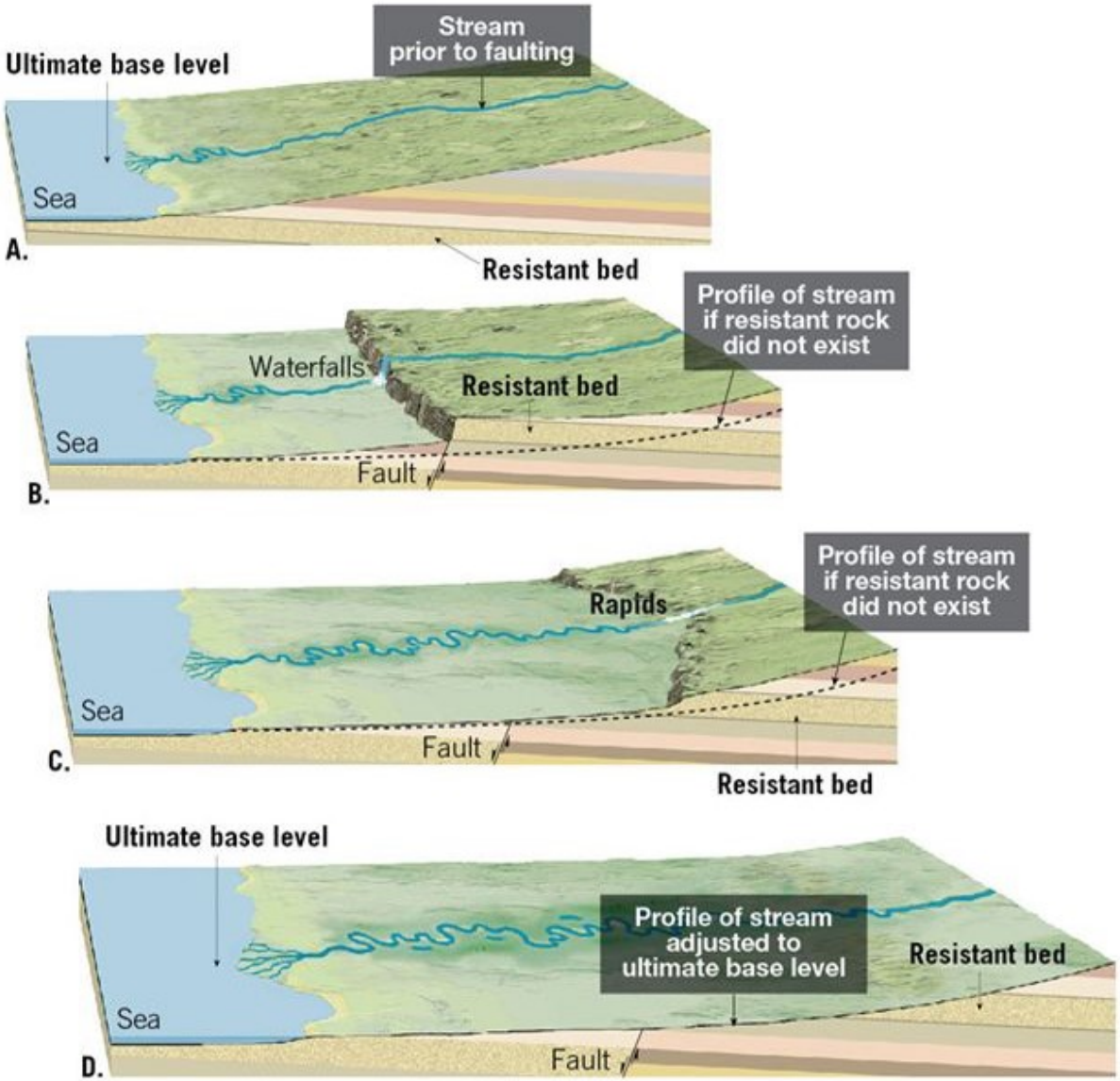

Stages
of
Stream/River
Development
Young stream
Steep Slope
Mature stream
Moderate Slope
Old stream
Gentle Slope
http://www.dkimages.com/discover/previews/774/206778.JPG


ZONA 1. (Producción de sedimentos.)
CUENCA DE DRENAJE
Controles de aguas arriba
ZONA 2. (Transferencia.)
ZONA 3. (Sedimentación.)
Controles de aguas abajo (nivel de base diastrofismo)
ZONA 1.
PERFIL LONGITUDINAL
ZONA 2.
Perfil de equilibrio.
ZONA 3.
CURSO SUPERIOR.
CURSO MEDIO.
CURSO INFERIOR.
Erosión, Profundización del lecho.
Equilibrio temporal
Erosión de las paredes del cauce.
Acumulación, elevación del lecho.
PLANTA.
ENTRENZAMIENTO DELTA.
MEANDROS.
SECCIONES TRANSVERSALES.
Nuevo cauce elevado.
Cauces Encañonados.
Valles medios.
Valles amplios.

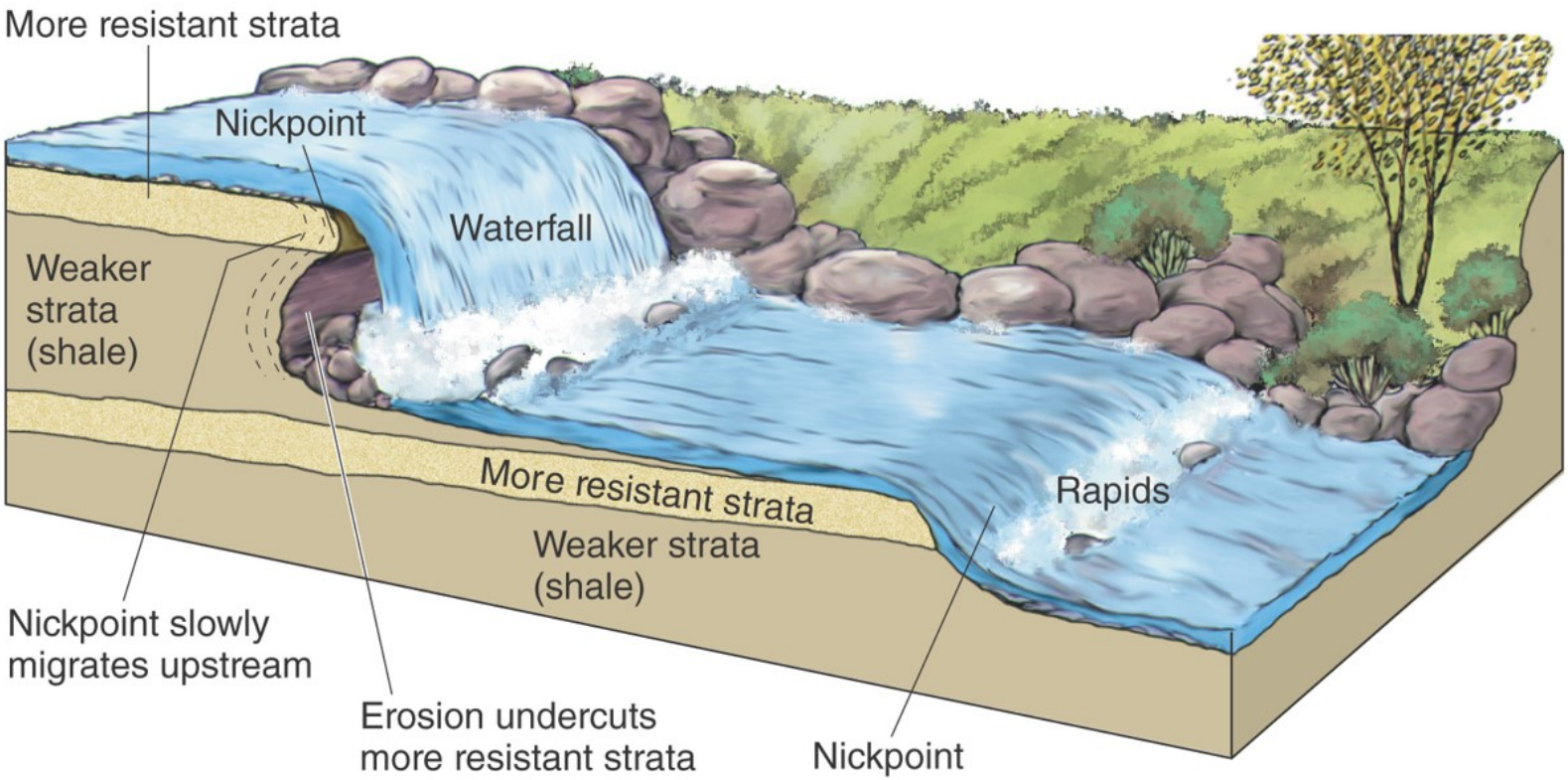

Head
Mouth
Steeper gradient
Longitudinal profile
Gentler gradient
Ocean


Head
Elevation
Steeper gradient
Longitudinal stream profile
Gentler gradient
Mouth
River length

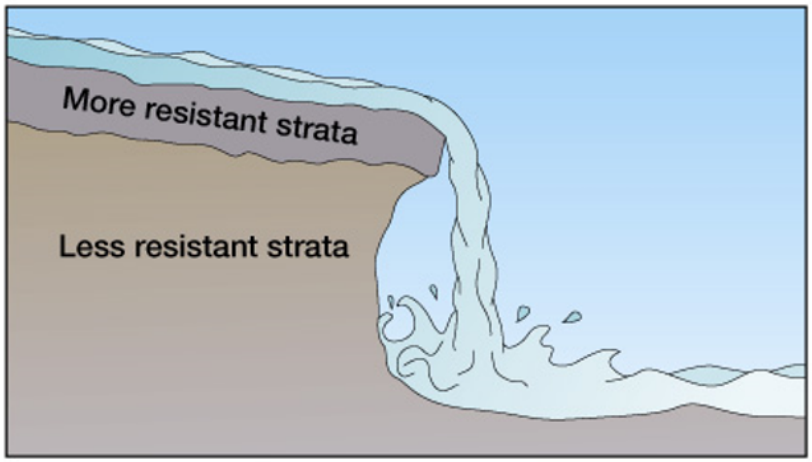
Knickpoint


Ultimate base level
Stream prior to faulting
Sea
A.
Resistant bed
Profile of stream if resistant rock did not exist
Waterfalls
Resistant bed
Sea
Fault
B.
Profile of stream if resistant rock did not exist
Rapids
Sea
Fault
C.
Resistant bed
Ultimate base level
Profile of stream adjusted to ultimate base level
Resistant bed
Sea
Fault
D.

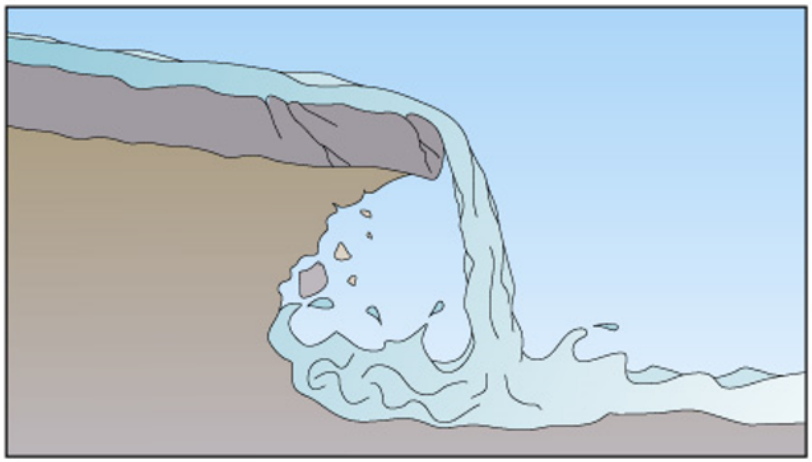
Knickpoint


More resistant strata
Nickpoint
Waterfall
Weaker strata (shale)
More resistant strata
Weaker strata (shale)
Rapids
Nickpoint slowly migrates upstream
Erosion undercuts more resistant strata
Nickpoint

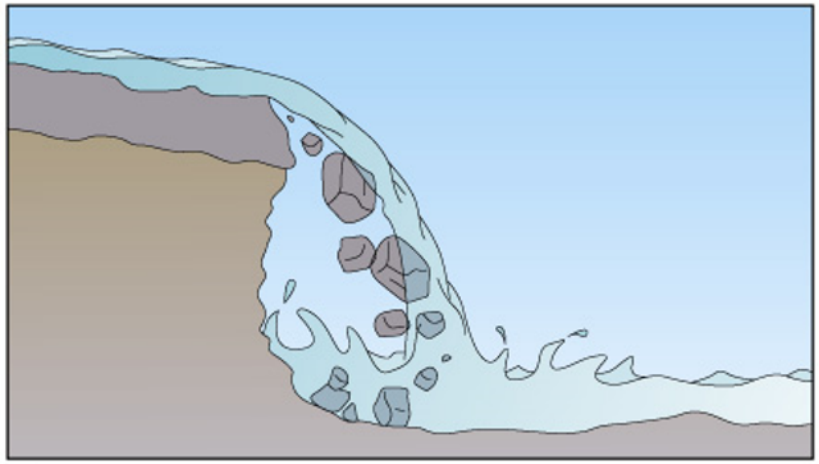
Knickpoint



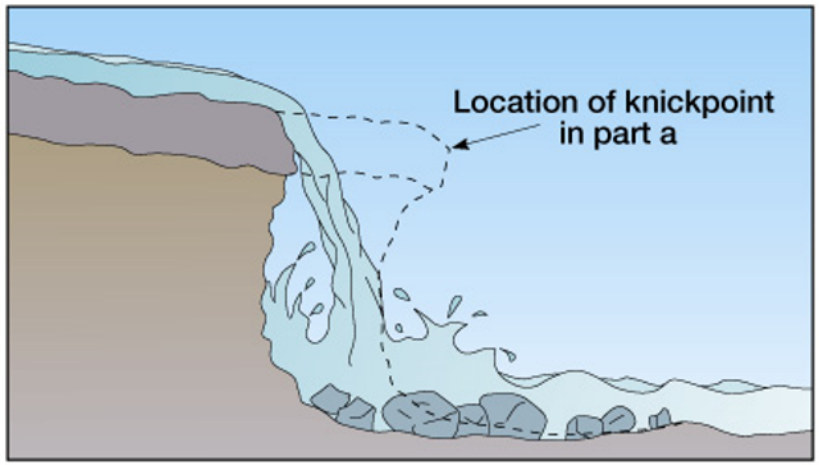
(a)



(b)



(c)



(d)

Knickpoint

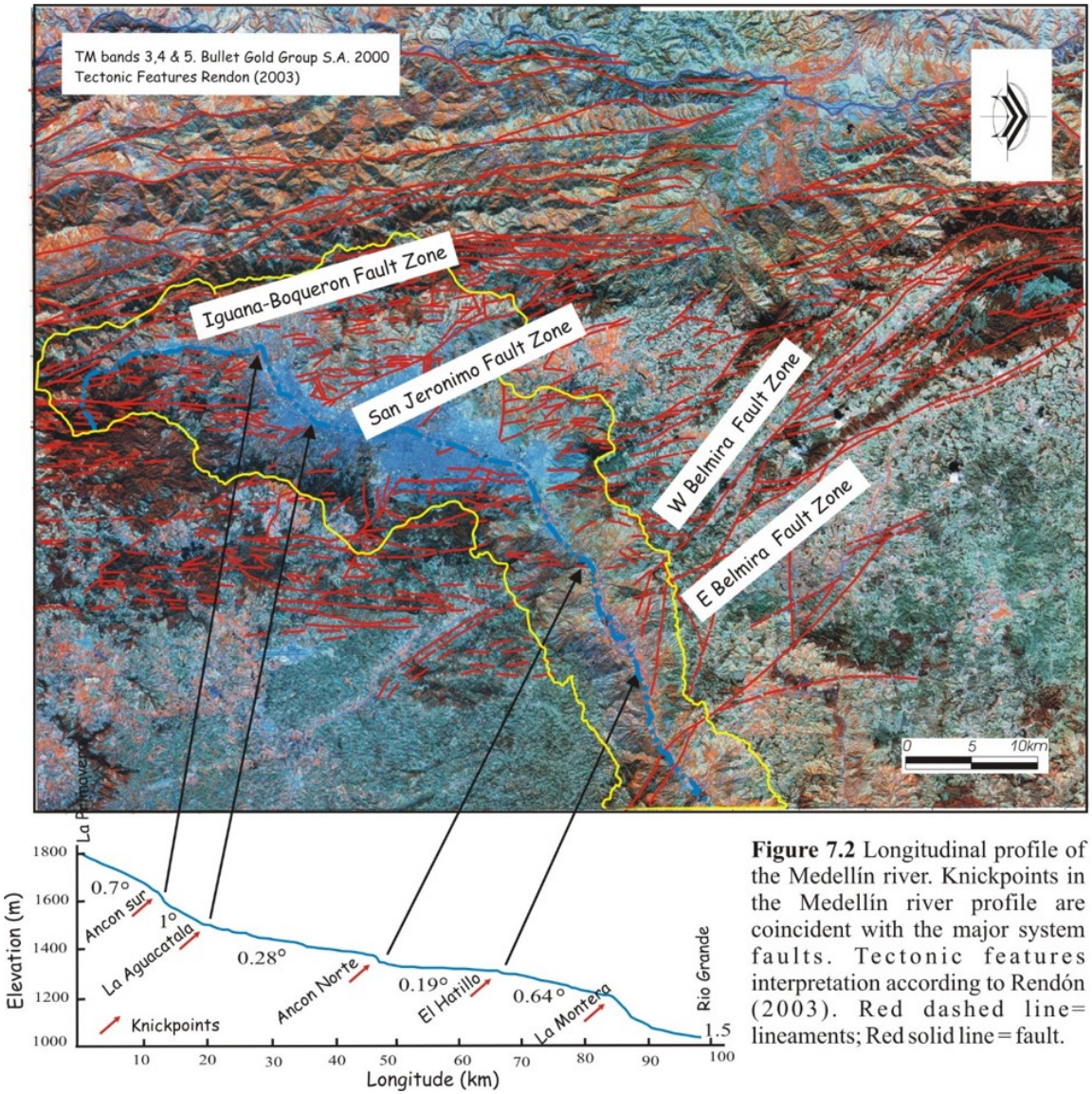
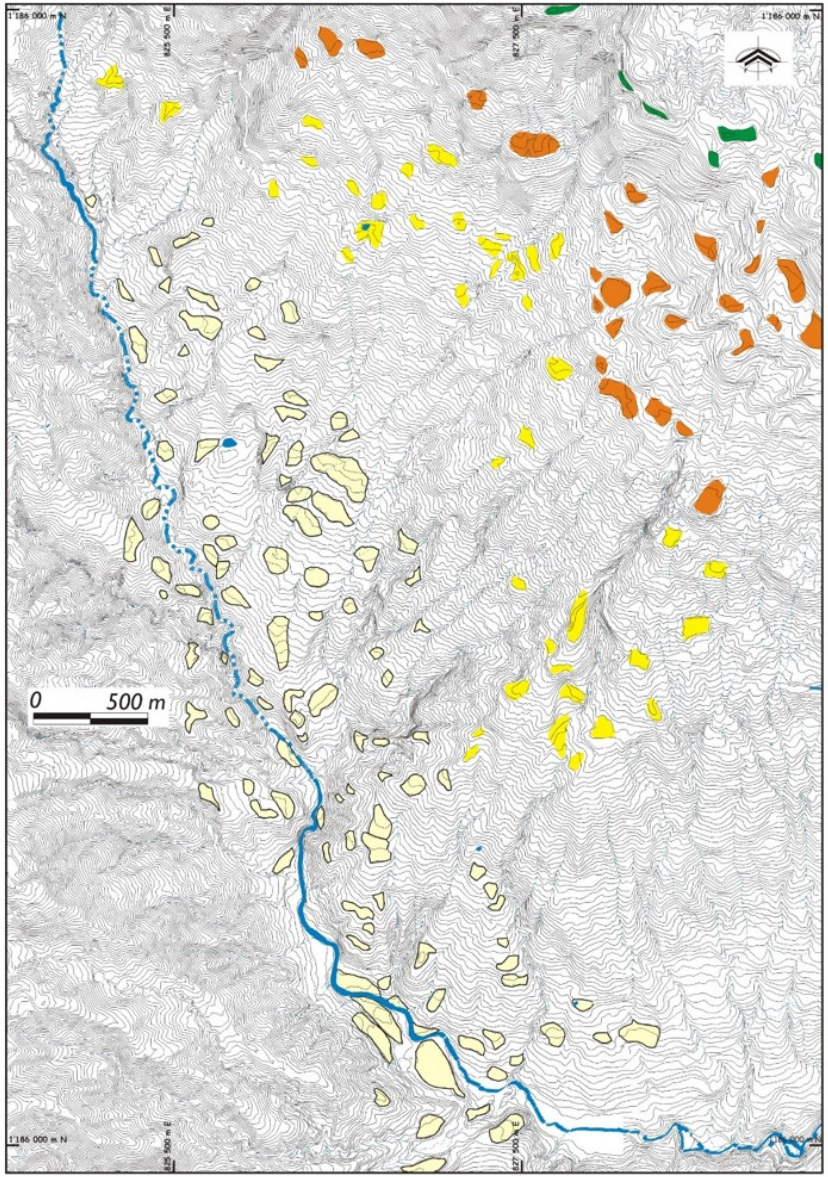
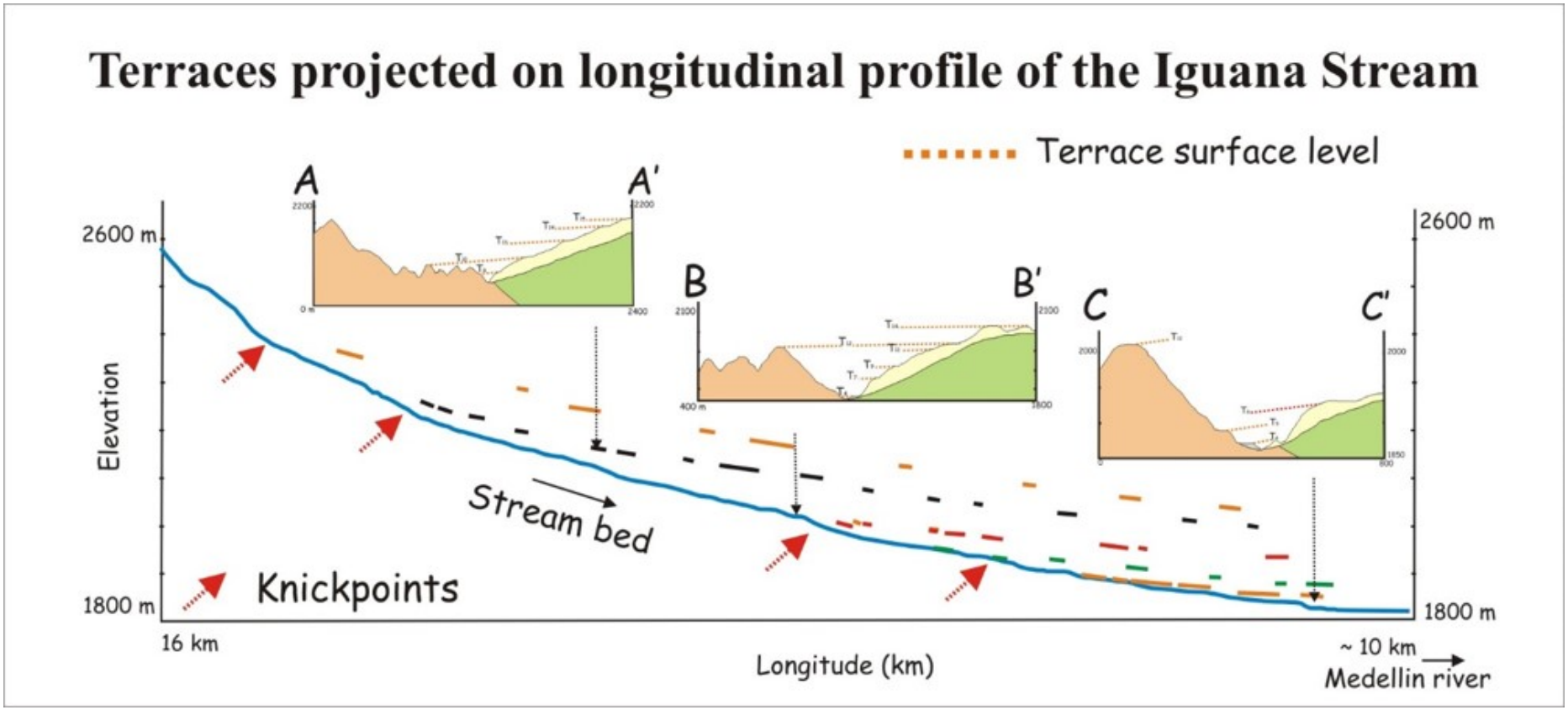


Figure 7.2 Longitudinal profile of the Medellín river. Knickpoints in the Medellín river profile are coincident with the major system faults. Tectonic features interpretation according to Rendón (2003). Red dashed line= lineaments; Red solid line = fault.

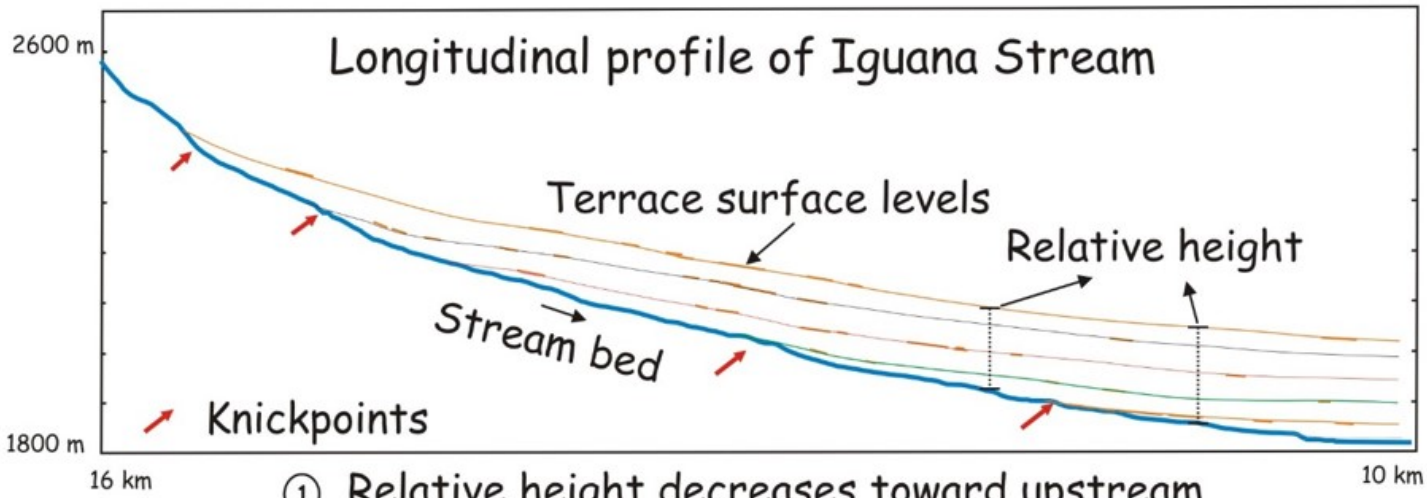
Knickpoint



Knickpoint

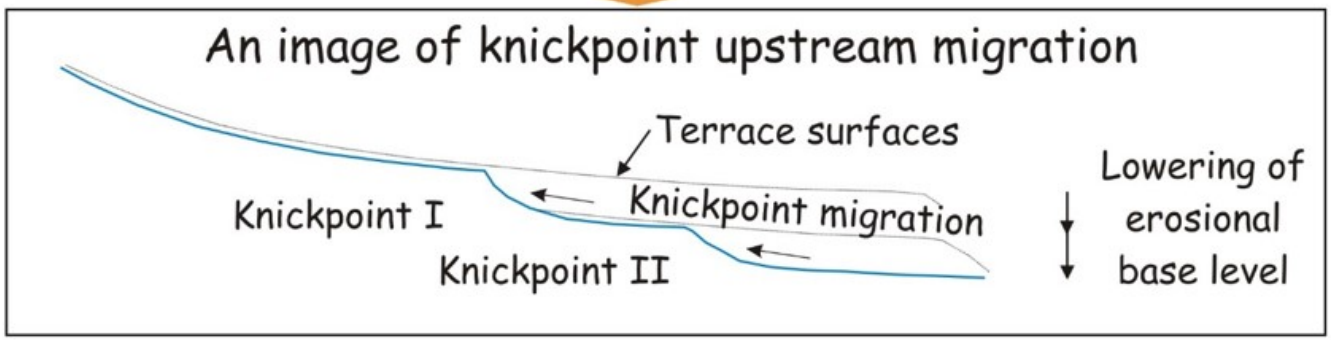

Terraces projected on longitudinal profile of the Iguana Stream
Terrace surface level
A
A'
B
B'
C
C'
2600 m
1800 m
Elevation
Stream bed
Knickpoints
16 km
Longitude (km)
~ 10 km
Medellin river

Knickpoint

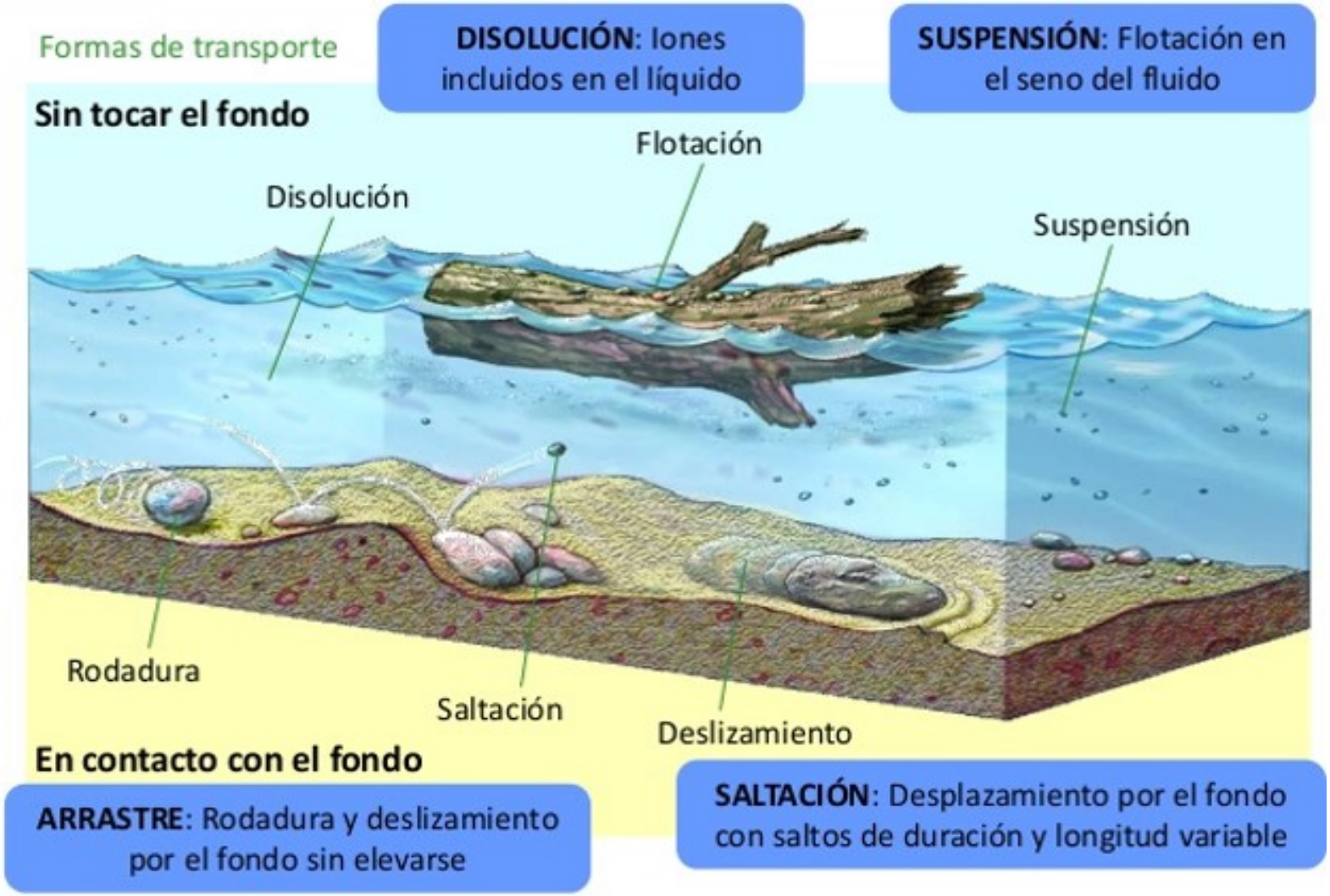


① Relative height decreases toward upstream

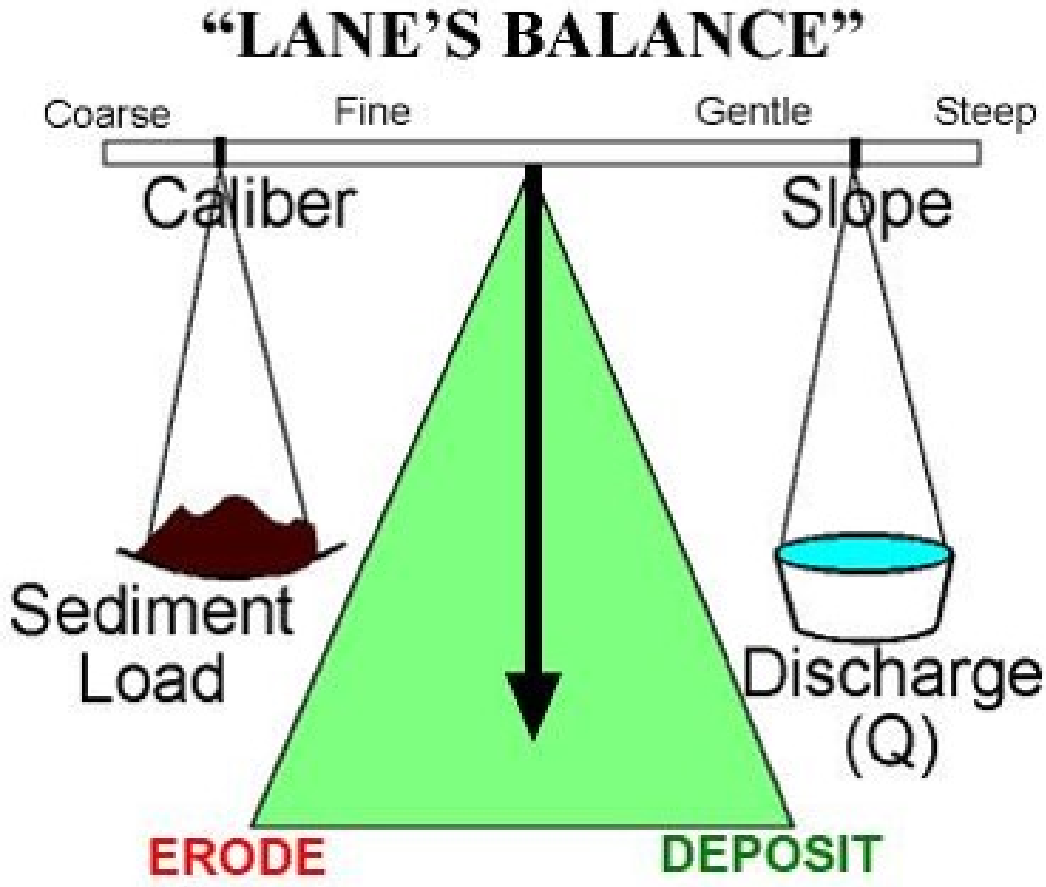
② Terrace surfaces converge to knickpoints



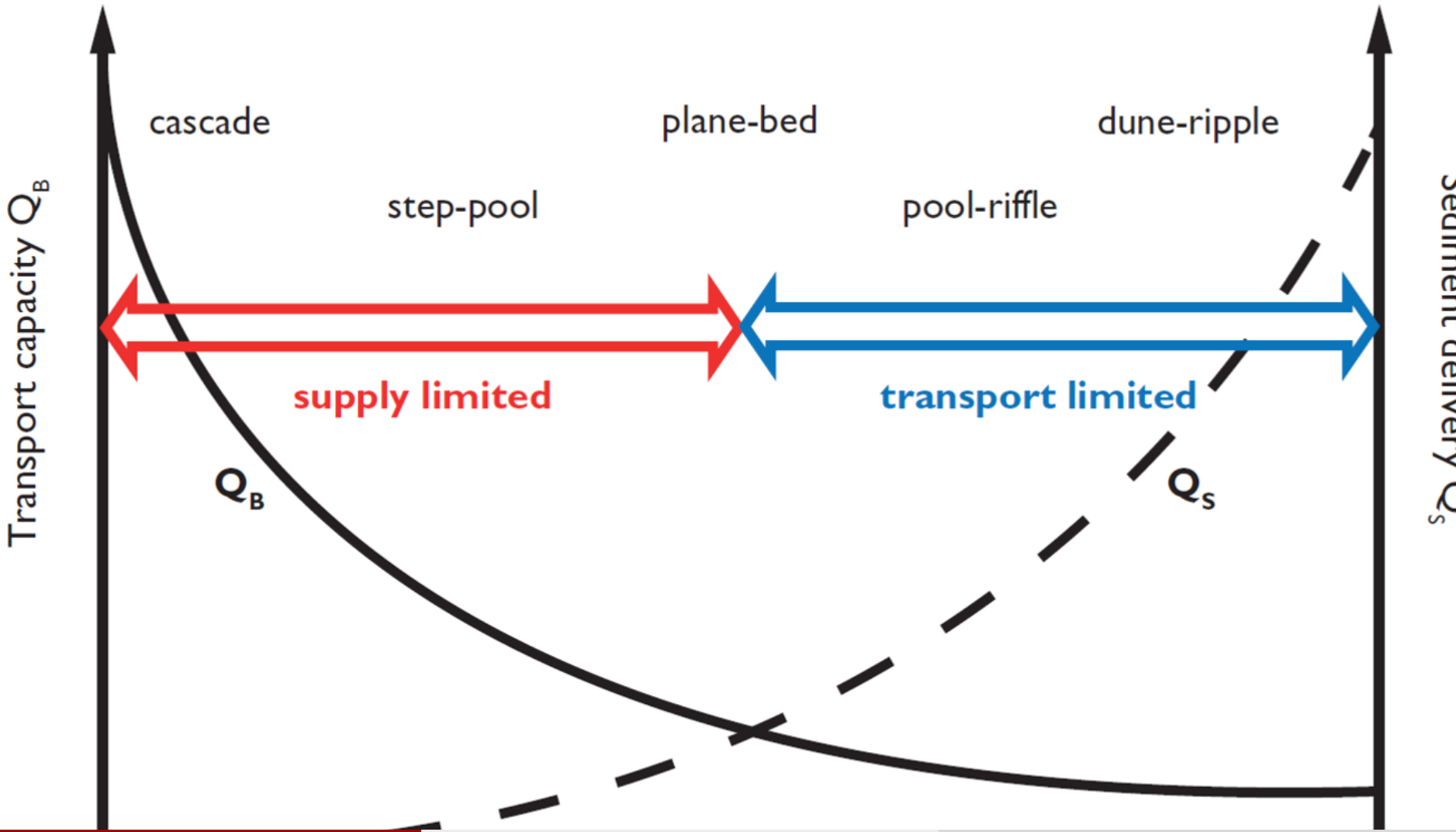
Transporte de sedimentos



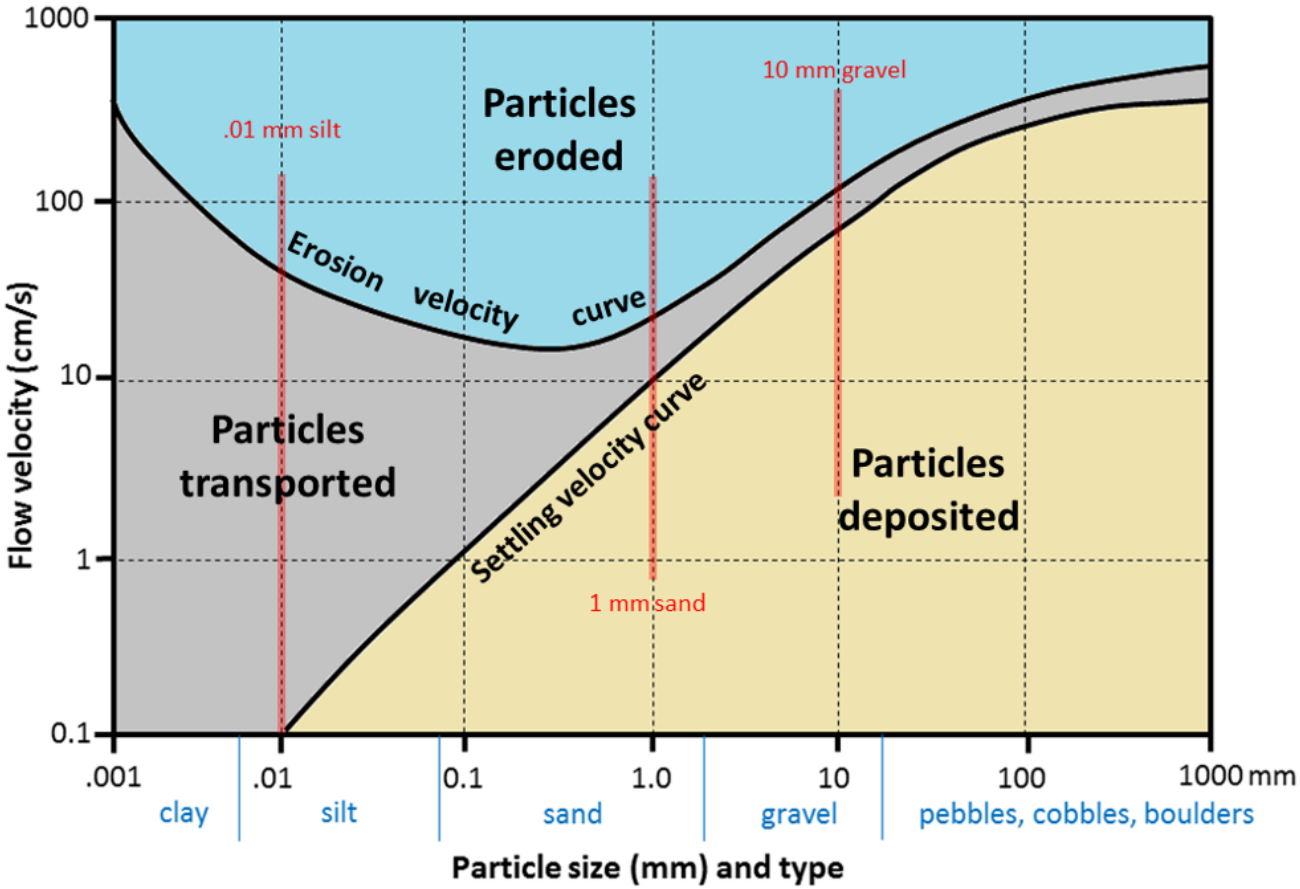
Transporte de sedimentos



Transporte de sedimentos

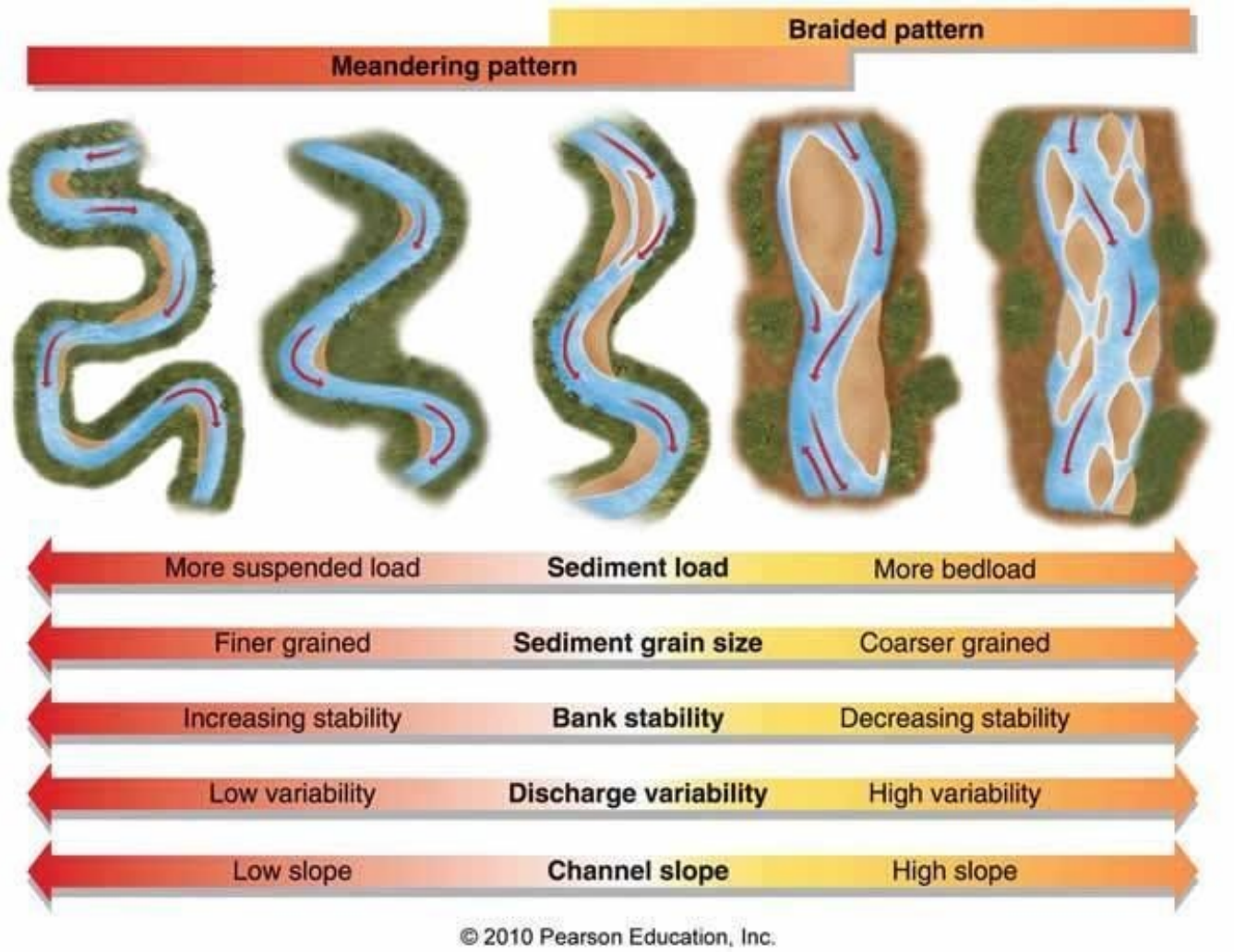


Transporte de sedimentos

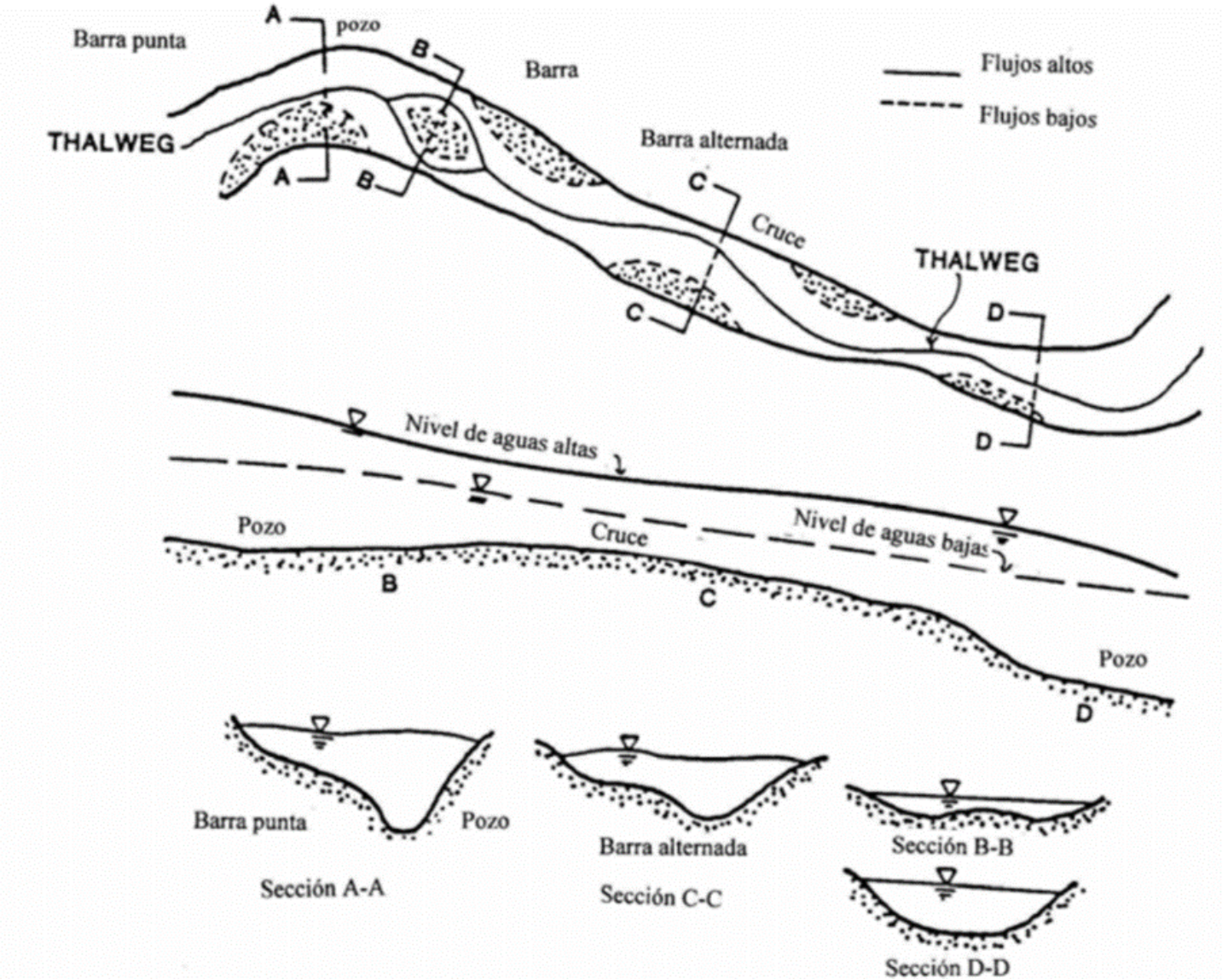


S. Earle, 2014

Cauces


Braided pattern
Meandering pattern
More suspended load
Sediment load
More bedload
Finer grained
Sediment grain size
Coarser grained
Increasing stability
Bank stability
Decreasing stability
Low variability
Discharge variability
High variability
Low slope
Channel slope
High slope
© 2010 Pearson Education, Inc.

Cauces


Barra punta
A
pozo
B
Barra
Flujos altos
Flujos bajos
THALWEG
A
B
Barra alternada
C
Cruce
THALWEG
C
D
D
Nivel de aguas altas
Pozo
Cruce
Nivel de aguas bajas
B
C
Pozo
D
Barra punta
Pozo
Sección A-A
Barra alternada
Sección C-C
Sección B-B
Sección D-D

Cauces

Cauces

Cauces

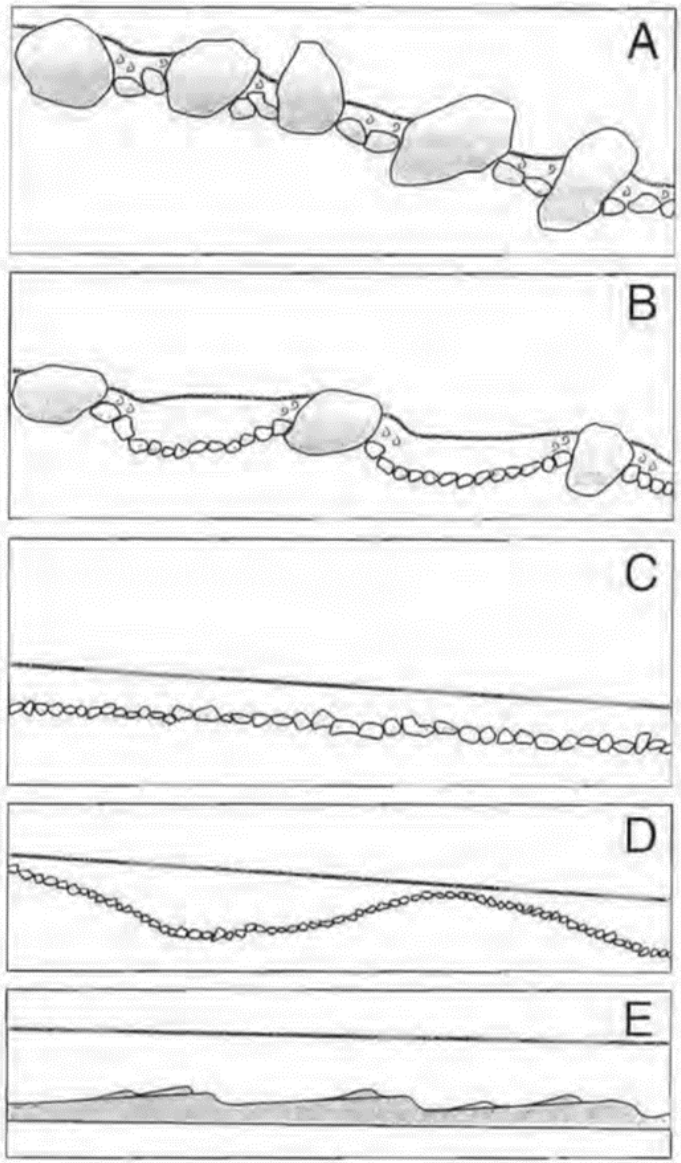


Figure 3. Schematic longitudinal profiles of alluvial channel mor-

Cauces

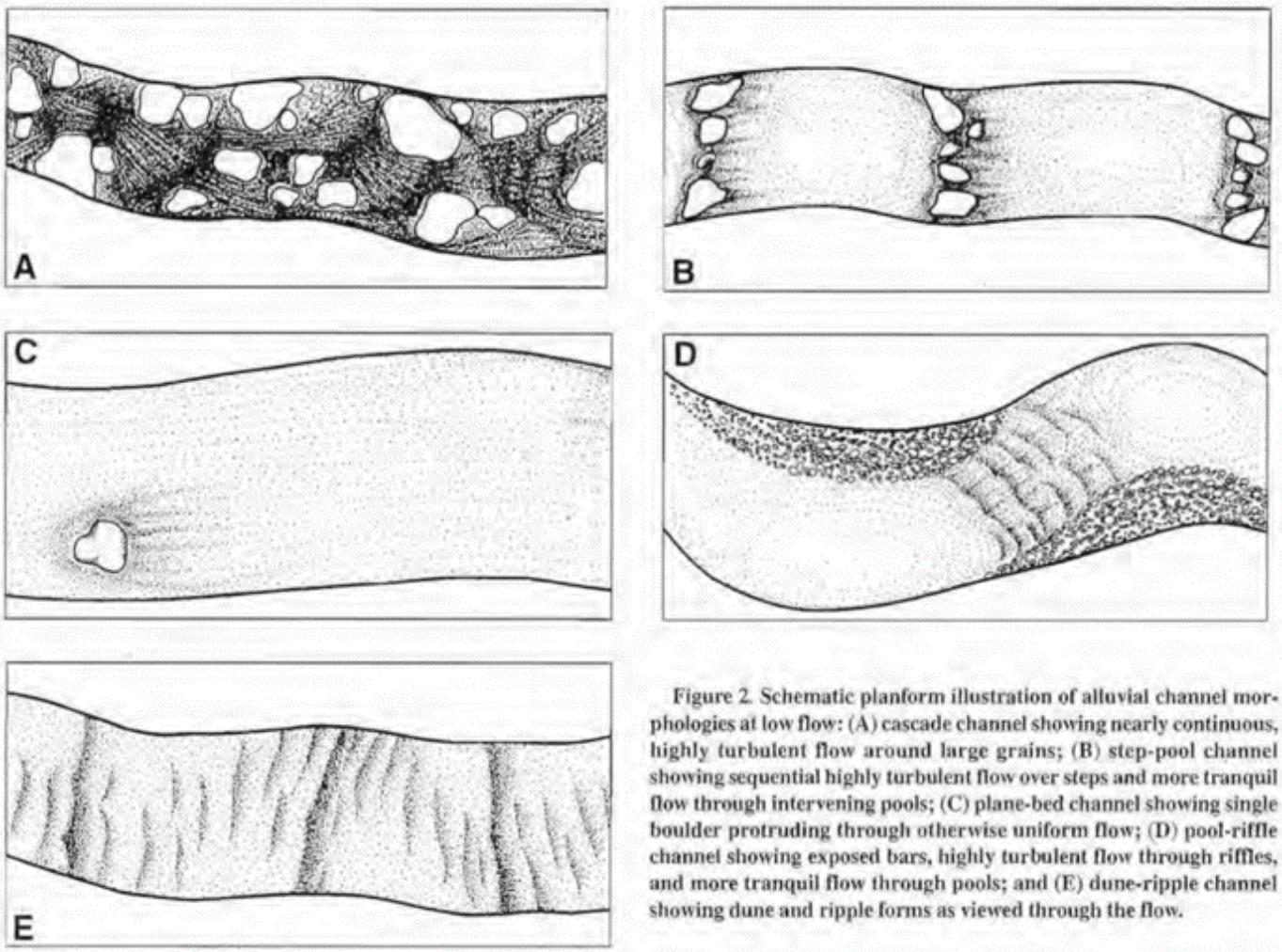
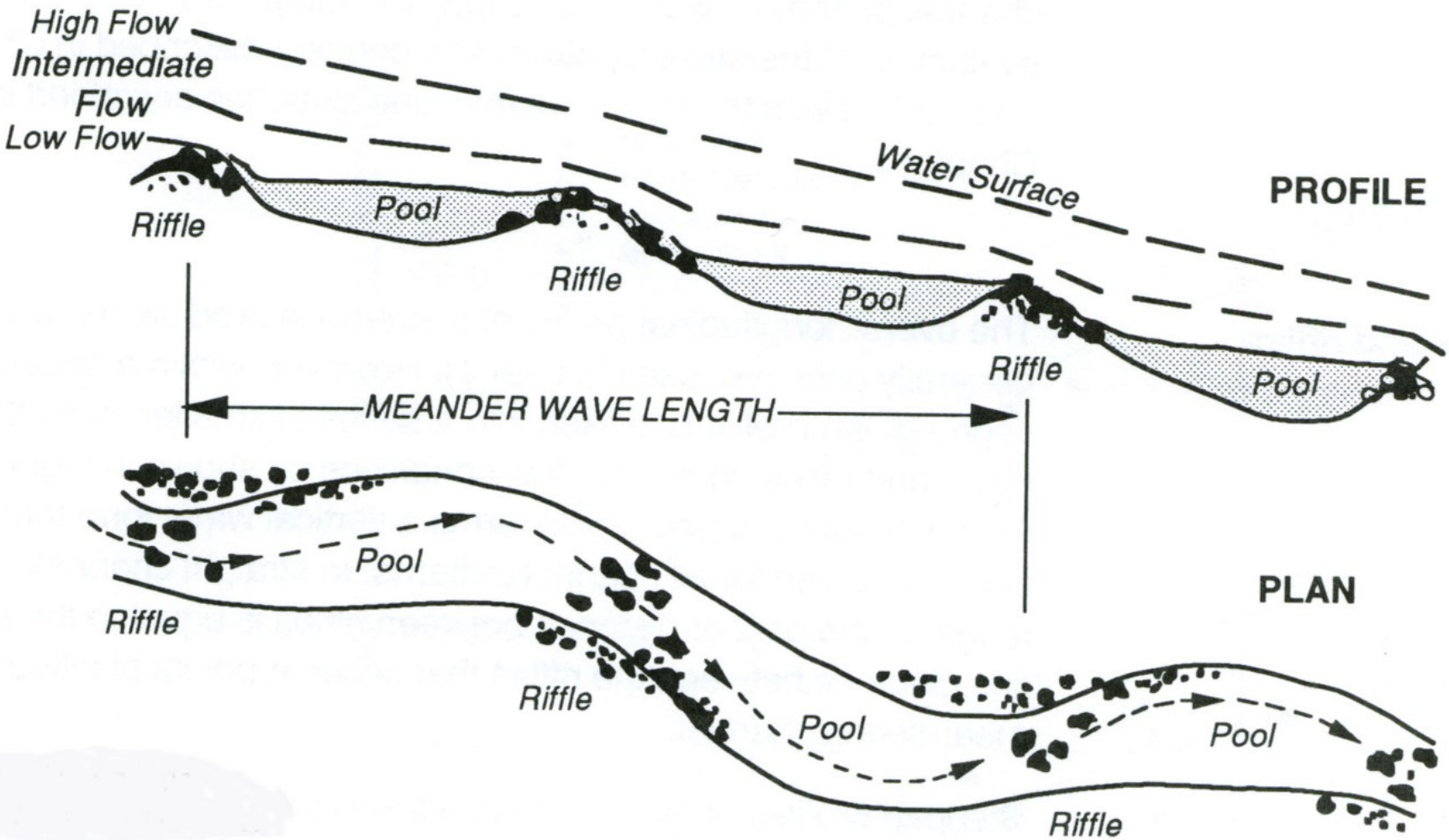
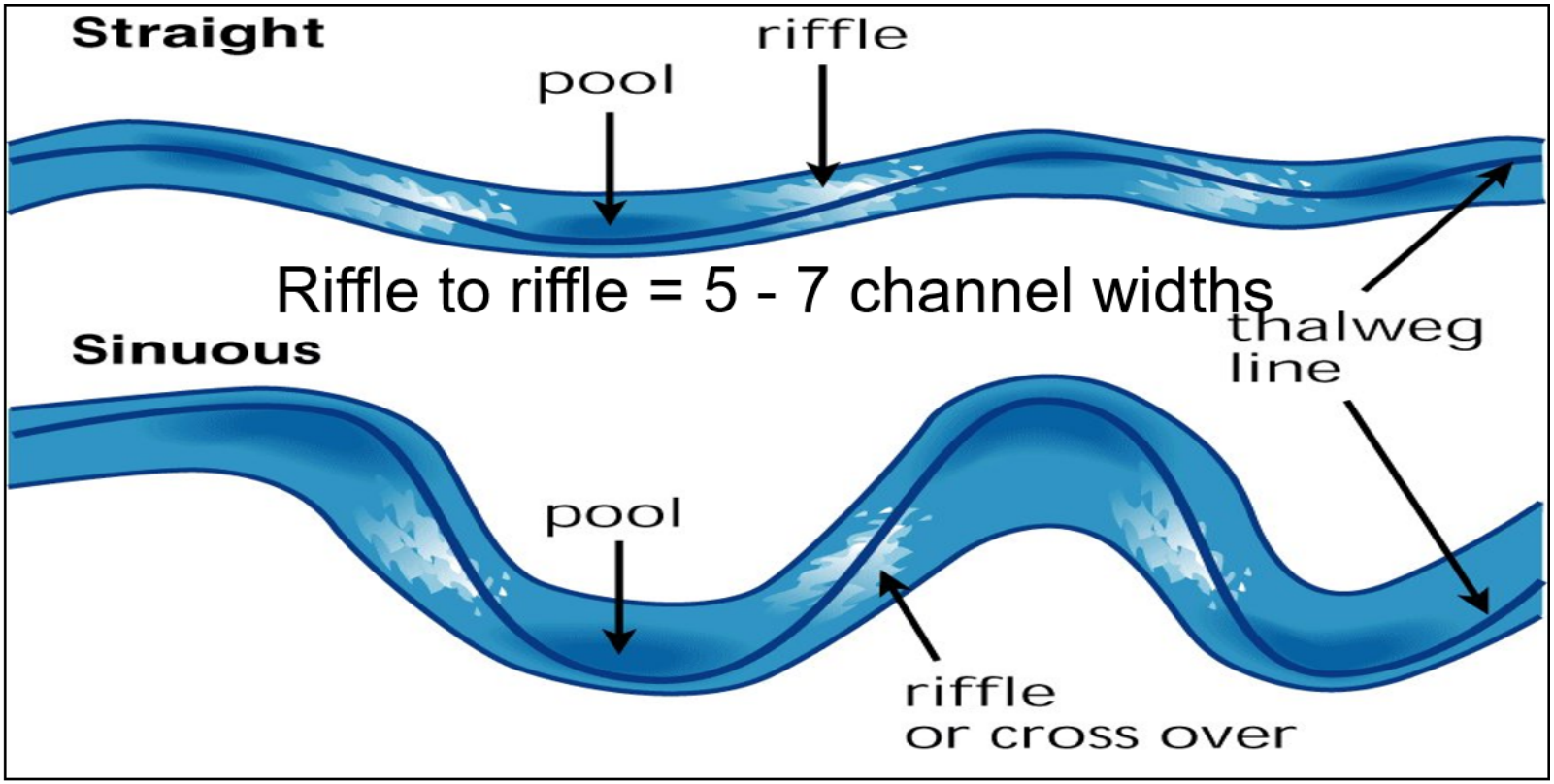


Figure 2. Schematic planform illustration of alluvial channel morphologies at low flow: (A) cascade channel showing nearly continuous, highly turbulent flow around large grains; (B) step-pool channel showing sequential highly turbulent flow over steps and more tranquil flow through intervening pools; (C) plane-bed channel showing single boulder protruding through otherwise uniform flow; (D) pool-riffle channel showing exposed bars, highly turbulent flow through riffles, and more tranquil flow through pools; and (E) dune-ripple channel showing dune and ripple forms as viewed through the flow.

Cauces


High Flow
Intermediate Flow
Low Flow
Water Surface
PROFILE
Riffle
Pool
Riffle
Pool
Riffle
Pool
MEANDER WAVE LENGTH
Pool
PLAN
Riffle
Riffle
Pool
Pool
Riffle

Cauces

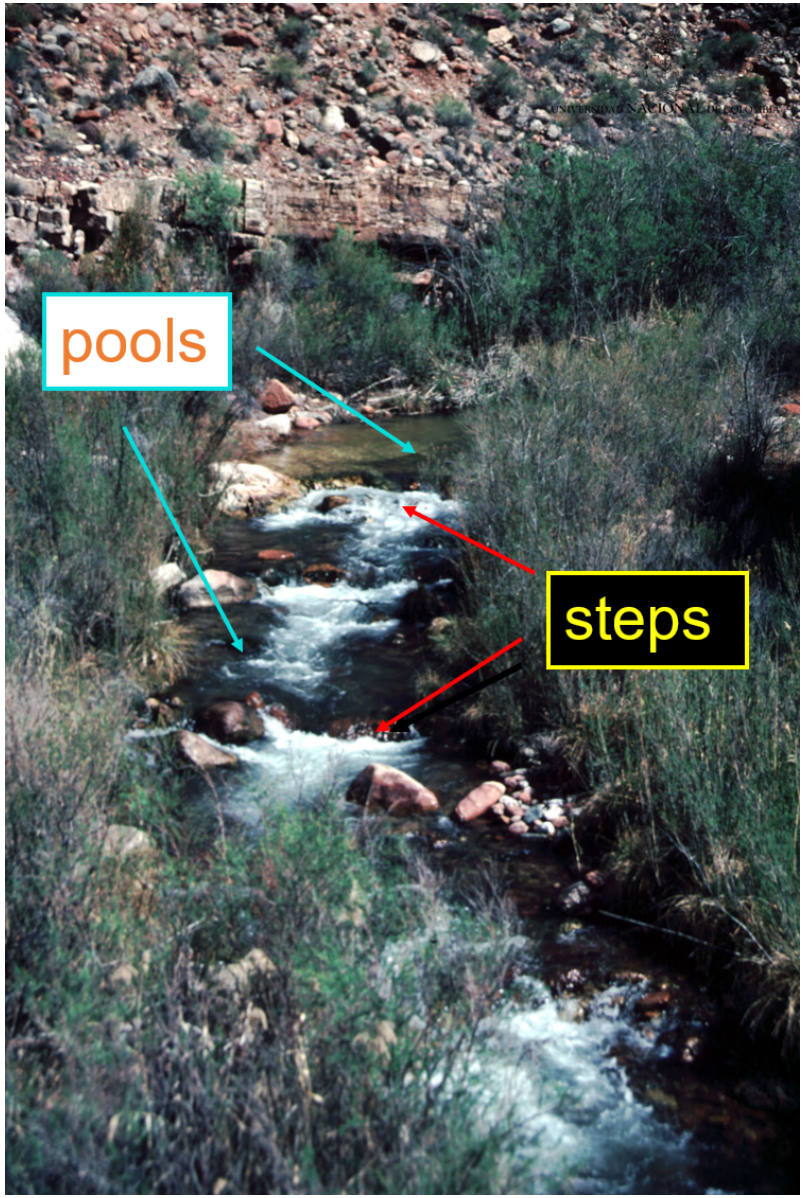

Straight
pool
riffle
Riffle to riffle = 5 - 7 channel widths
thalweg
line
Sinuous
pool
riffle
or cross over

Canales Coluviales

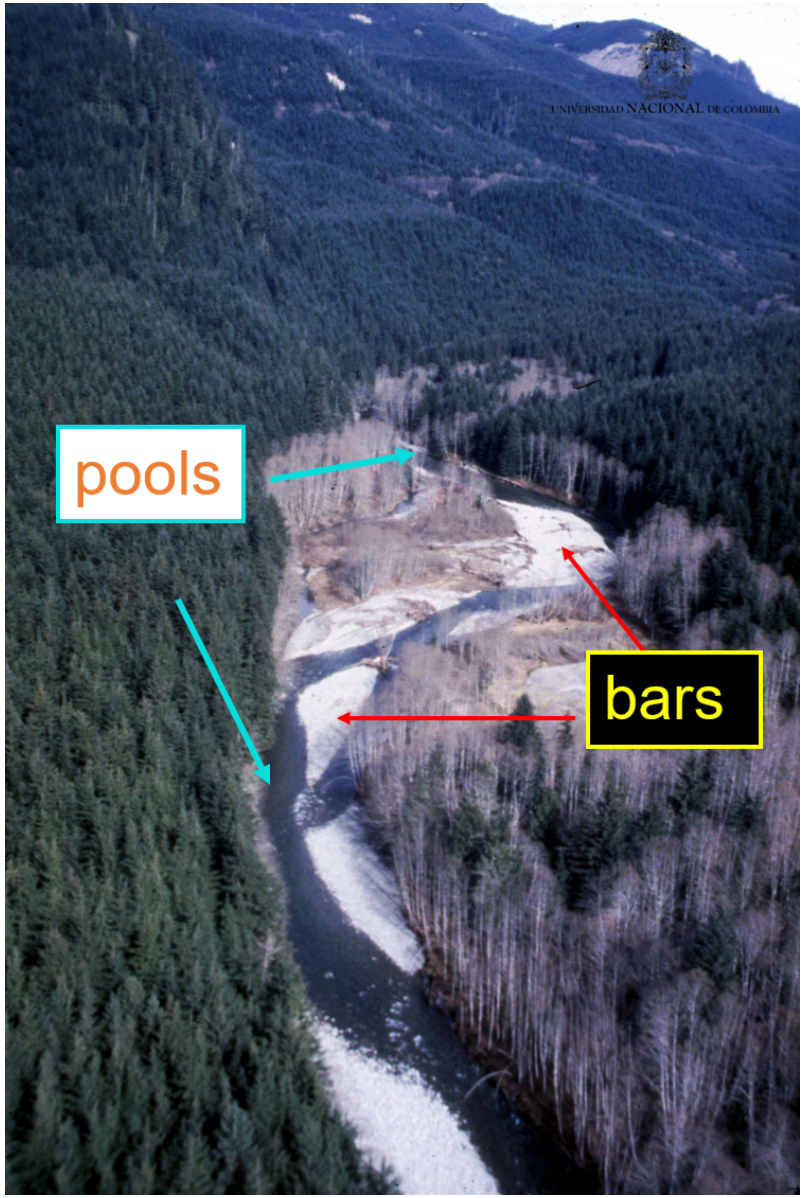
Canales en Roca

Canales en Cascada

Canales Step-Pool



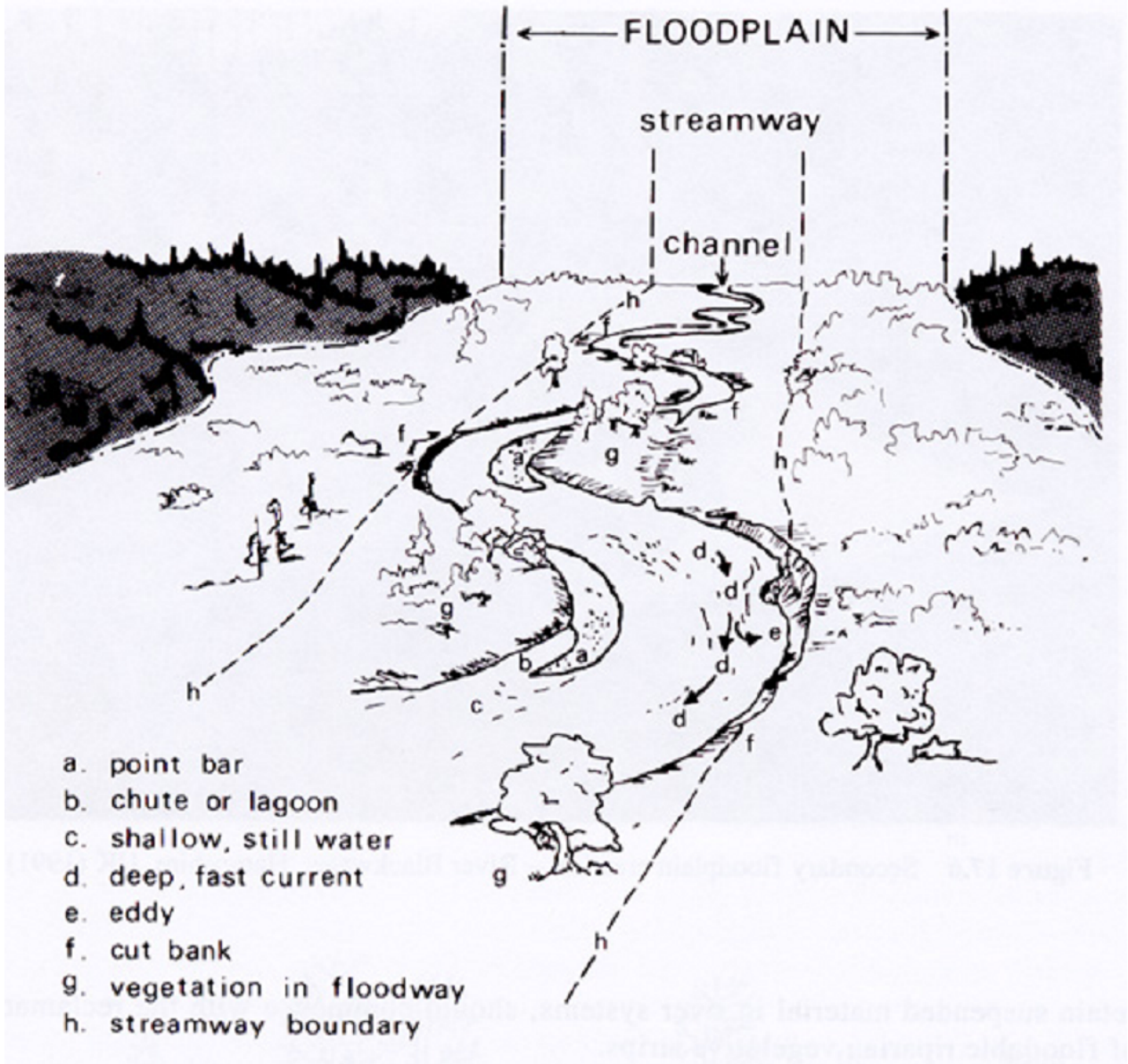
Canales Pool-Riffle



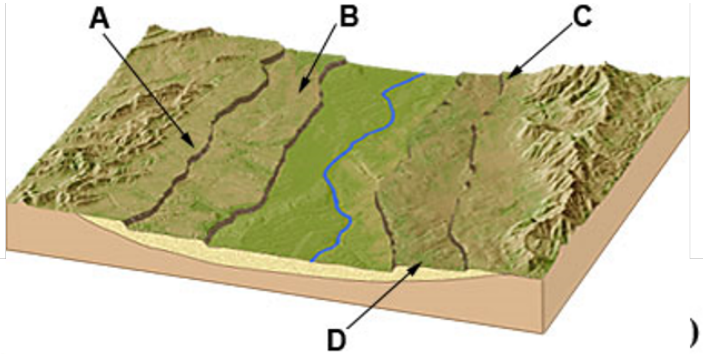
Canales Plane-Bed

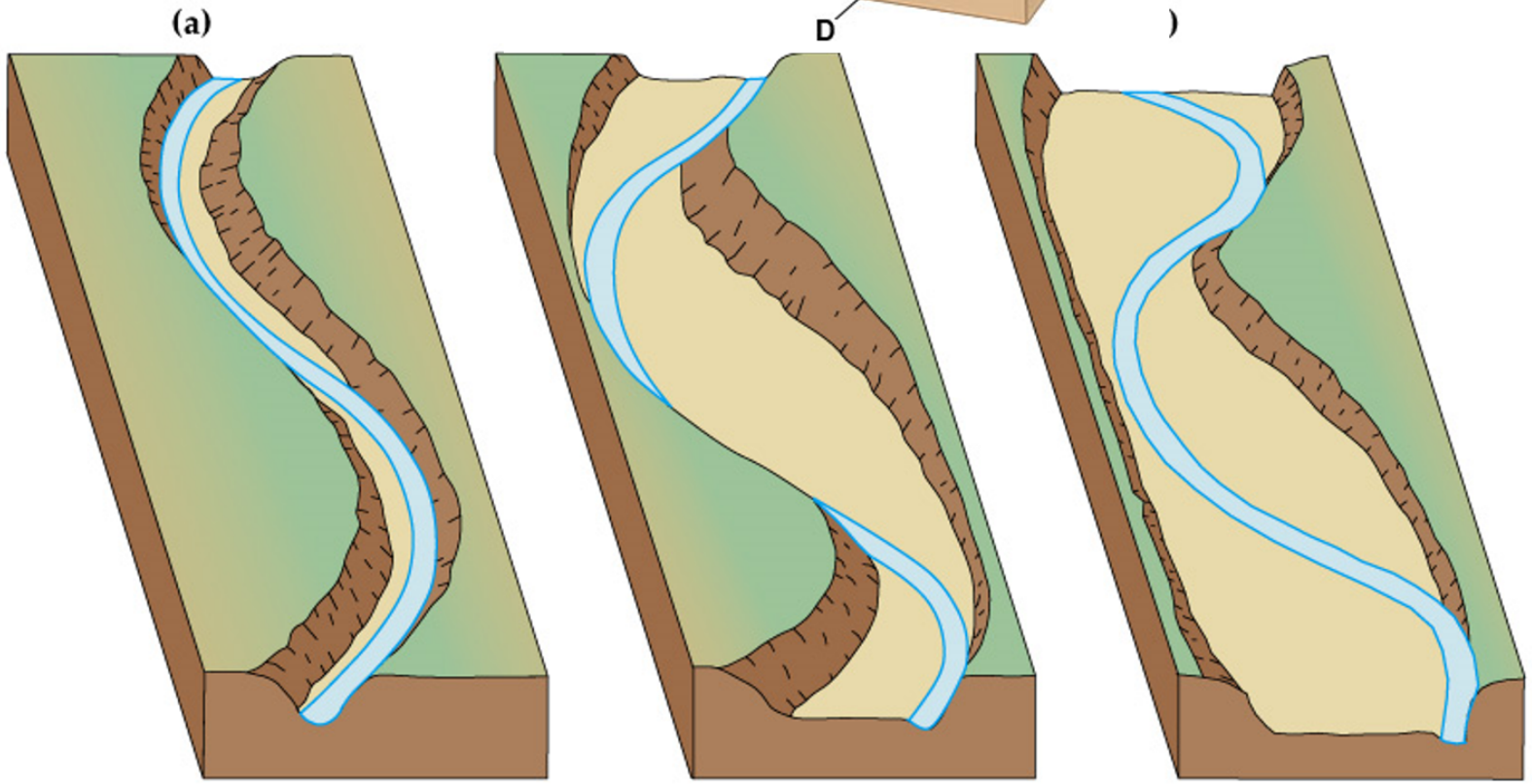
Canales Dune-Ripple

Llanuras de inundación



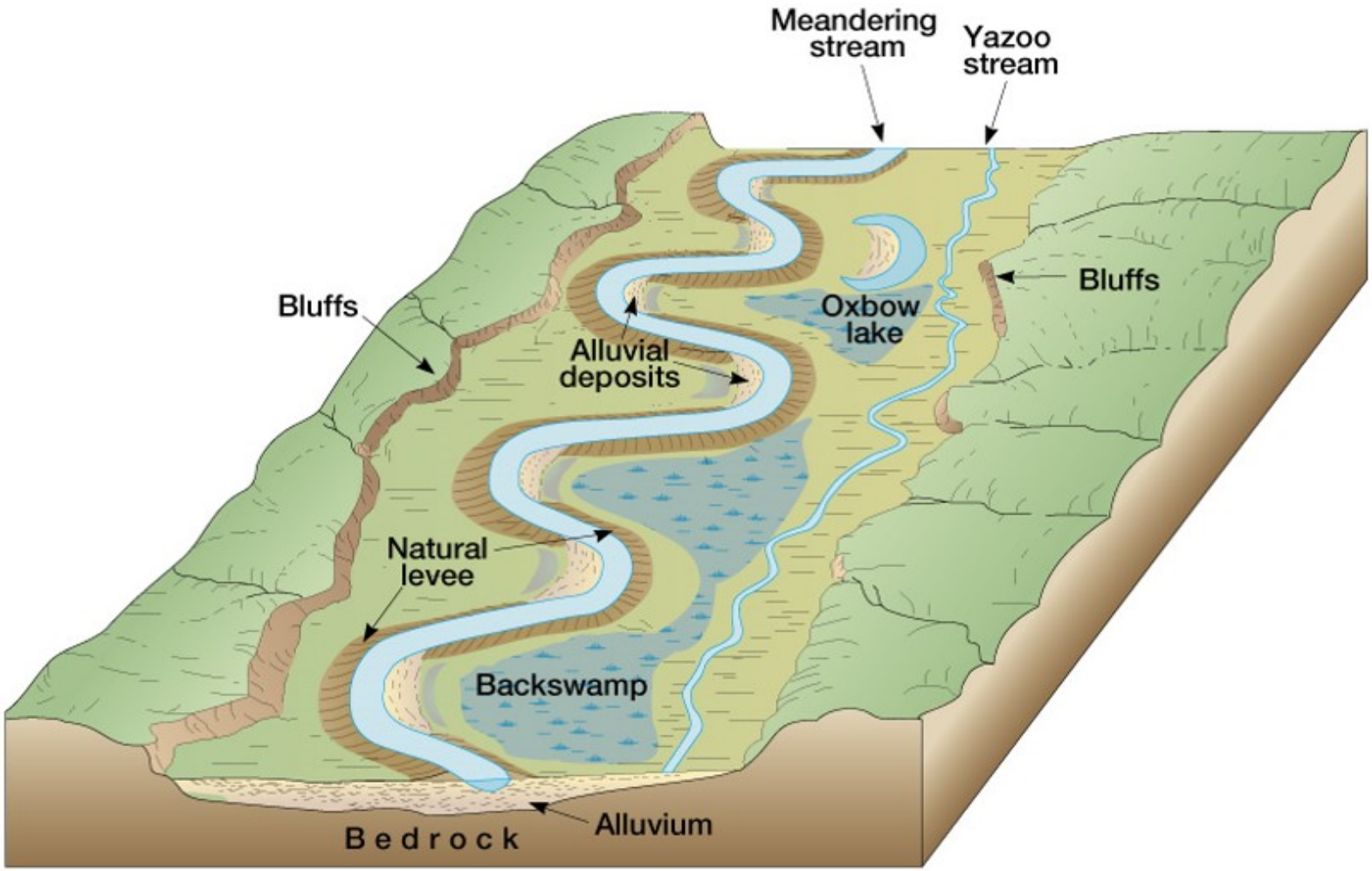
Llanuras de inundación



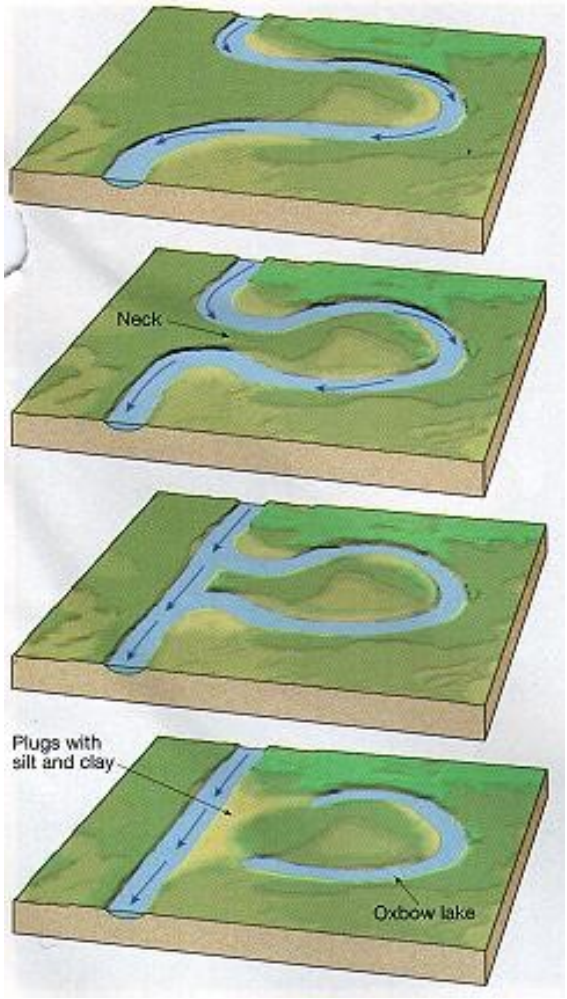


Llanuras de inundación

Llanuras de inundación

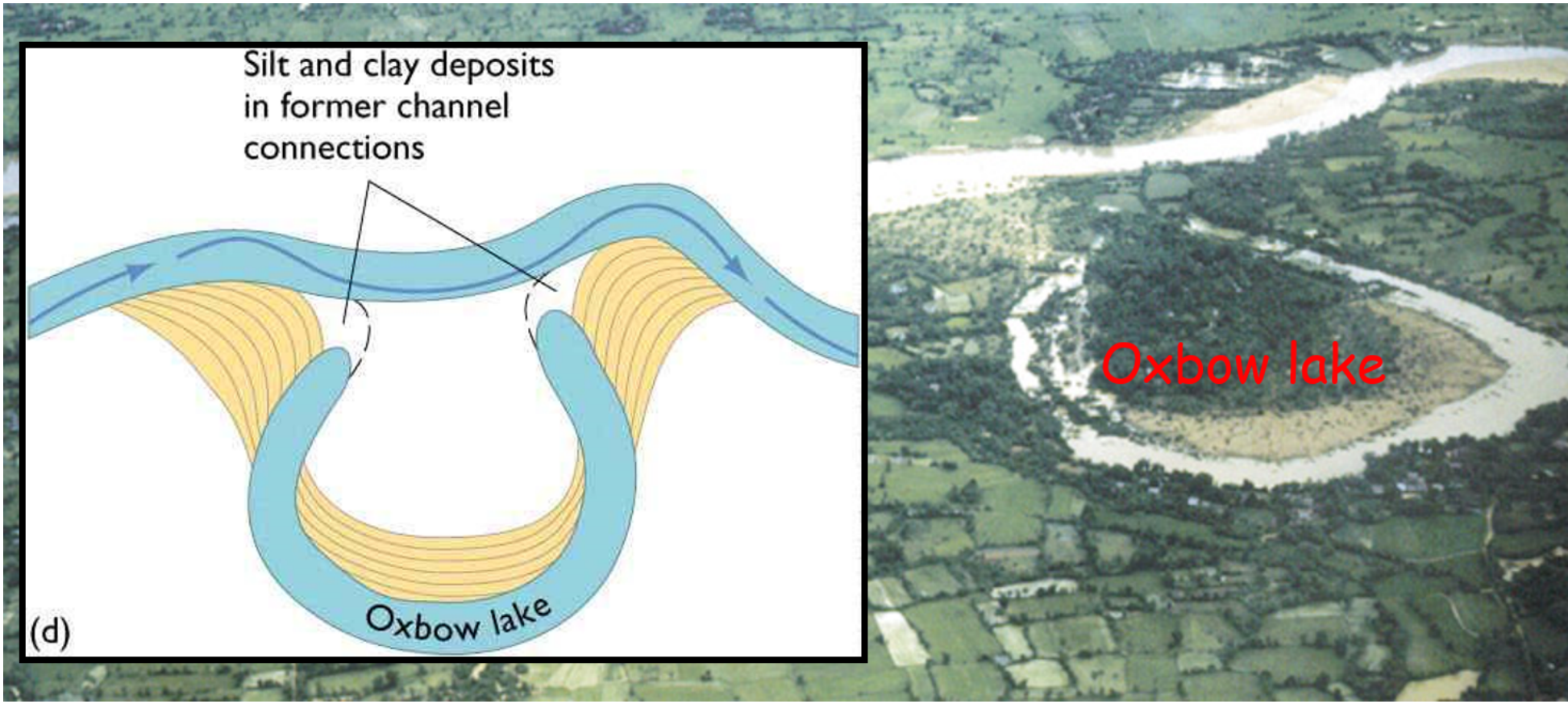


Meandros

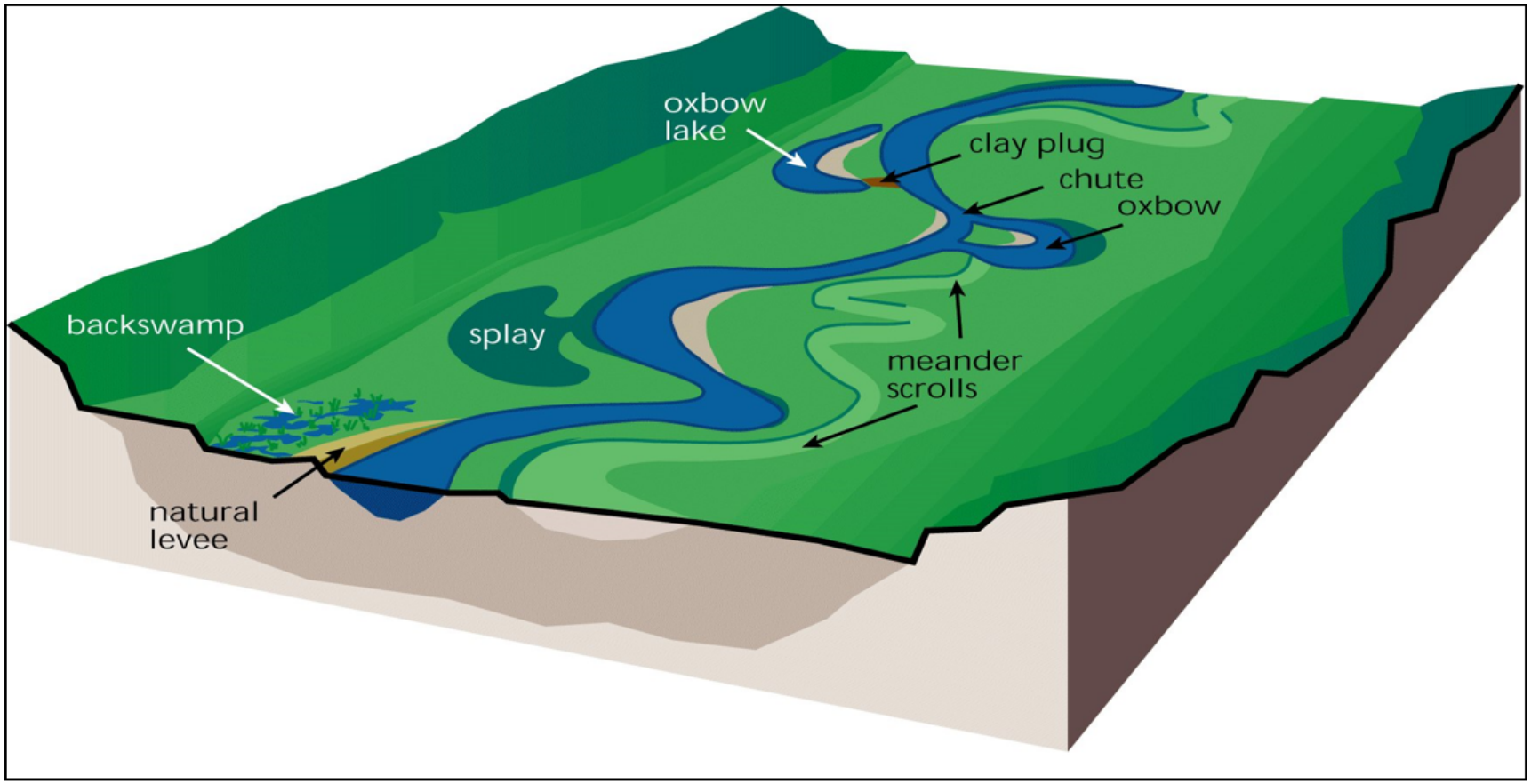


Meandros

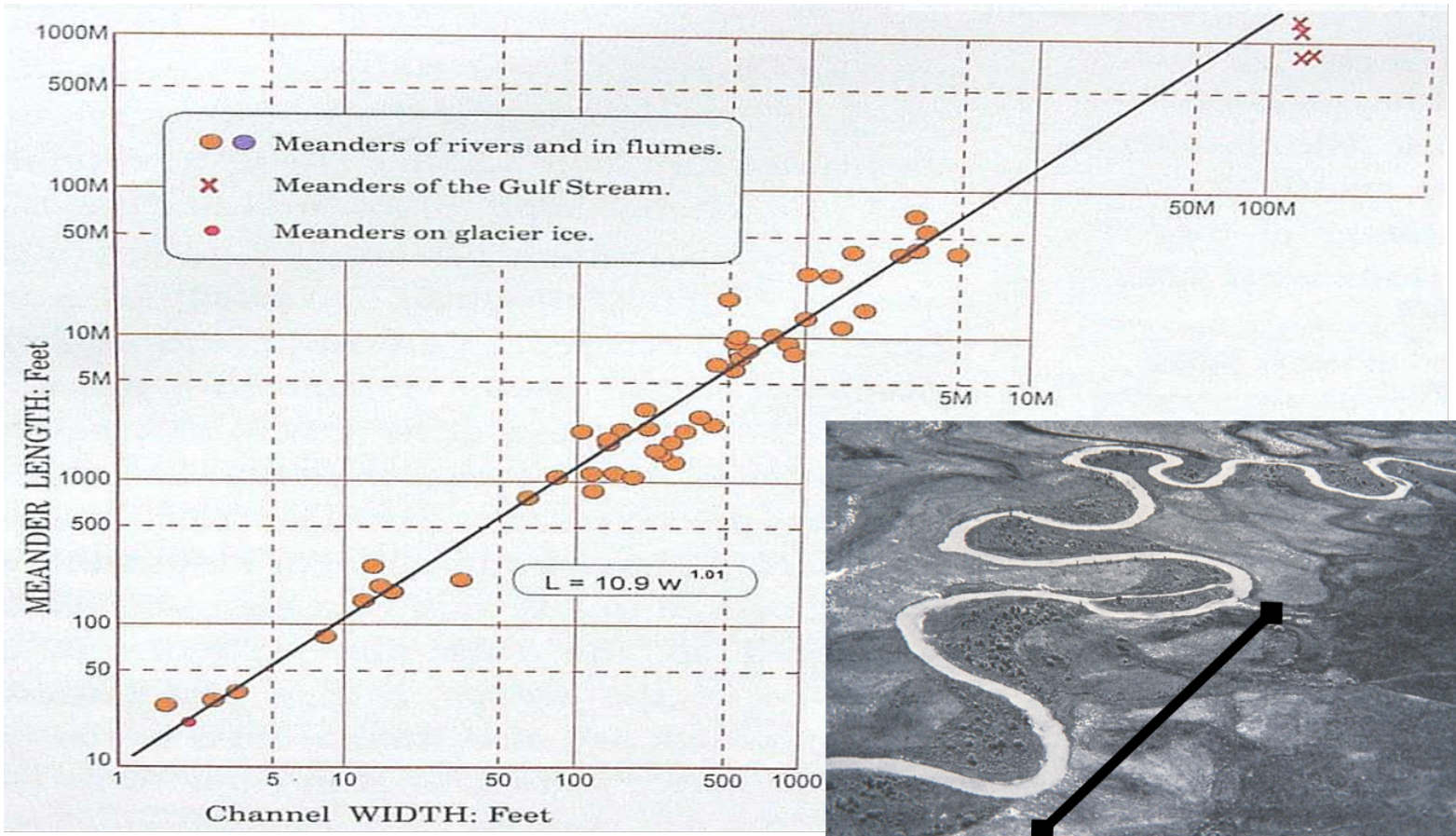
Meandros


Silt and clay deposits
in former channel
connections
Oxbow lake
(d)
Oxbow lake

Meandros

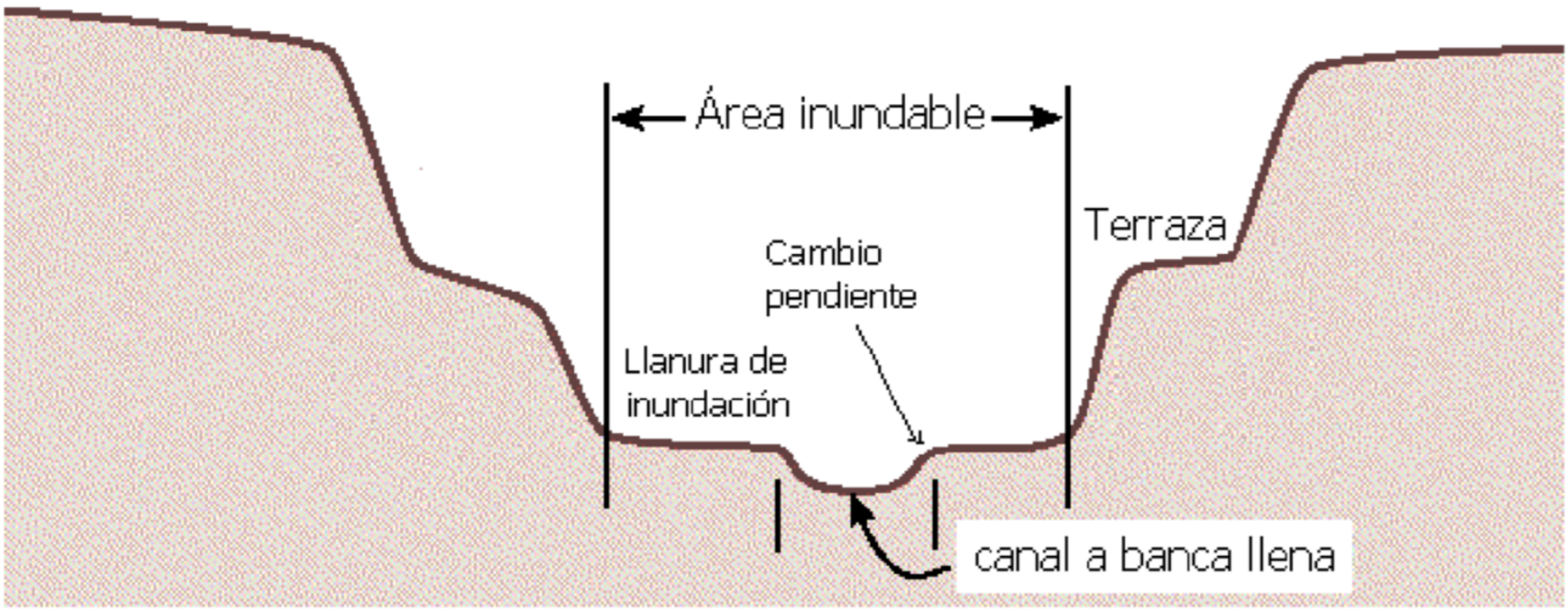

oxbow
lake
clay plug
chute
oxbow
backswamp
splay
meander
scrolls
natural
levee

Meandros



Longitud de un meandro: 10-14 ancho a banca llena

Terrazas



Adaptada de USDA

Terrazas

Clasificación de las terrazas fluviales:

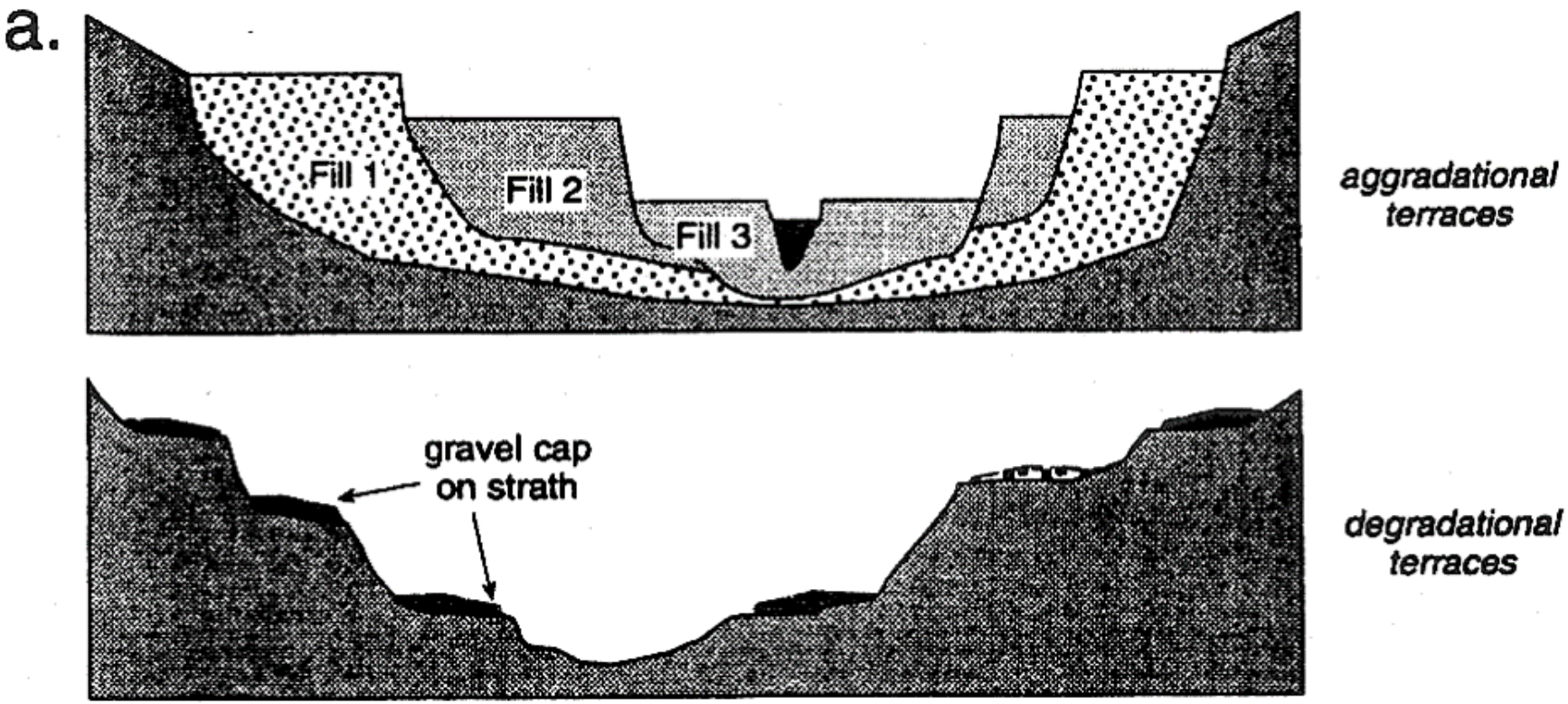
b) Según la génesis:

- Climáticas: Resultaron de una alternancia de erosión-sedimentación durante crisis climáticas del Cuaternario. Se deben a cambios climáticos y se producen en las transiciones de unas condiciones a las otras. Durante la rexistacia, cuando disminuye la temperatura y la humedad (paso de interglaciar a glaciar), disminuye la cobertura vegetal y aumenta la carga de sedimentos a los ríos y se produce aluvionamiento. Durante la biostacia, aumenta la temperatura, se pasa de glaciar a interglaciar, aumenta la humedad y aumenta la energía de los ríos, ya que disminuye la carga de sedimentos, aumentan los caudales por aumento de las precipitaciones y produce la incisión; luego aumenta la cobertura vegetal y tiende a estabilizar el sistema.
- Tectónicas (subsidentes o emergentes): Se producen por movimientos tectónicos. El tectonismo puede estar dado en el frente de contacto entre el área montana y el piedemonte transversal al escurrimiento del río (antecedente) o puede ser una falla paralela al sistema fluvial principal (consecuente). Puede elevarse la cuenca alta incrementando el poder erosivo del río y generando mayor aluvionamiento en los sectores bajos; o bien, descenso del área de aporte con disminución de la energía y aluvionamiento in situ.
- Eustáticas: cambios en el nivel de base general: mar. Al ascender el nivel del mar por interglaciación, hay aluvionamiento; al descender el nivel de mar en una glaciación, hay incisión. Glacieustáticas-Teoría inicial: Objeción: ríos endorreicos también tenían terrazas, los movimientos eustáticos solo afectan las áreas vecinas a la desembocadura.

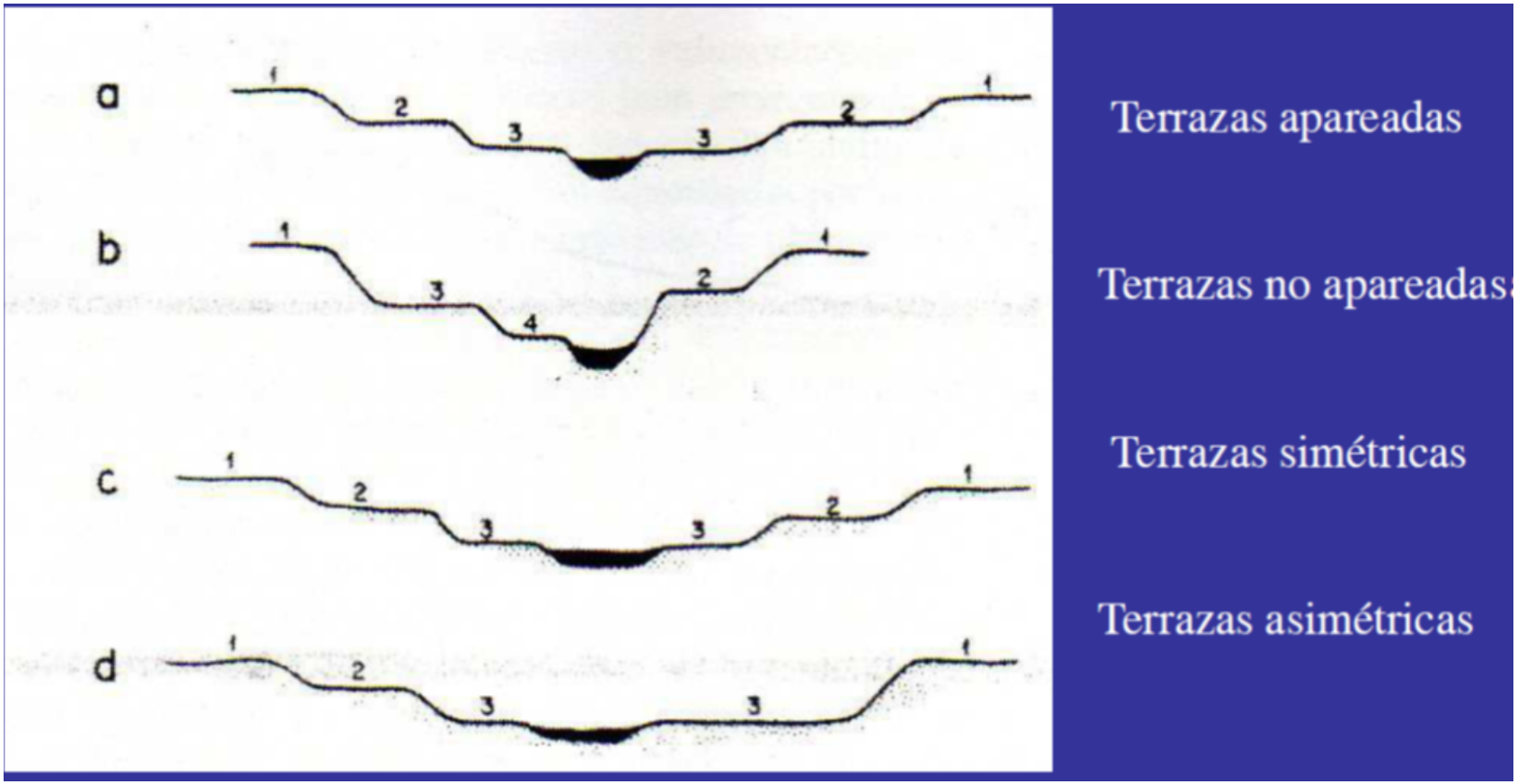
Terrazas

Tipos de terrazas de acuerdo a su ubicación en la cuenca

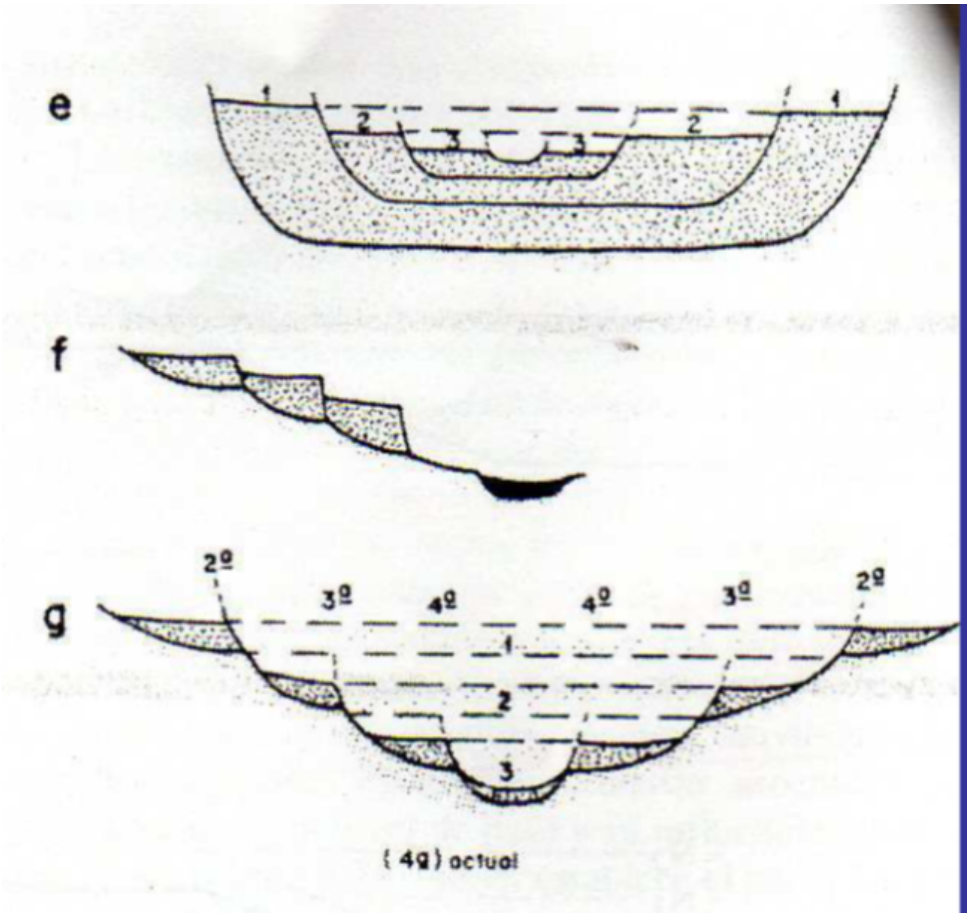
Terrazas


a.
Fill 1
Fill 2
Fill 3
aggradational terraces
gravel cap on strath
degradational terraces

Terrazas


a
b
c
d
Terrazas apareadas
Terrazas no apareadas
Terrazas simétricas
Terrazas asimétricas

Terrazas

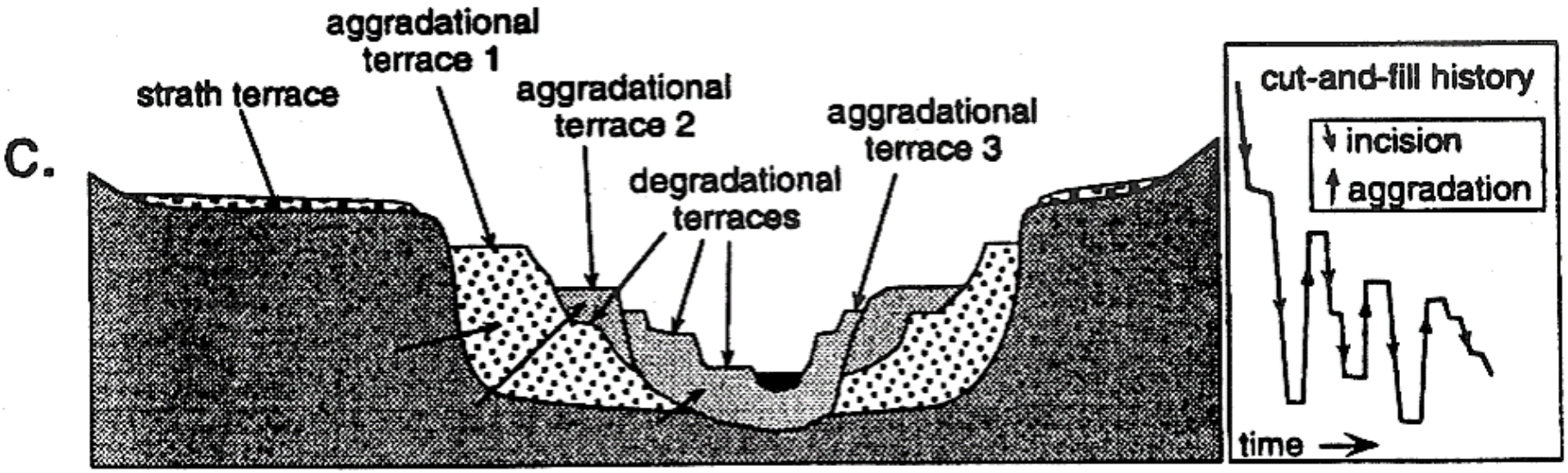


Terrazas superpuestas encajadas: No excava todo el aluvión

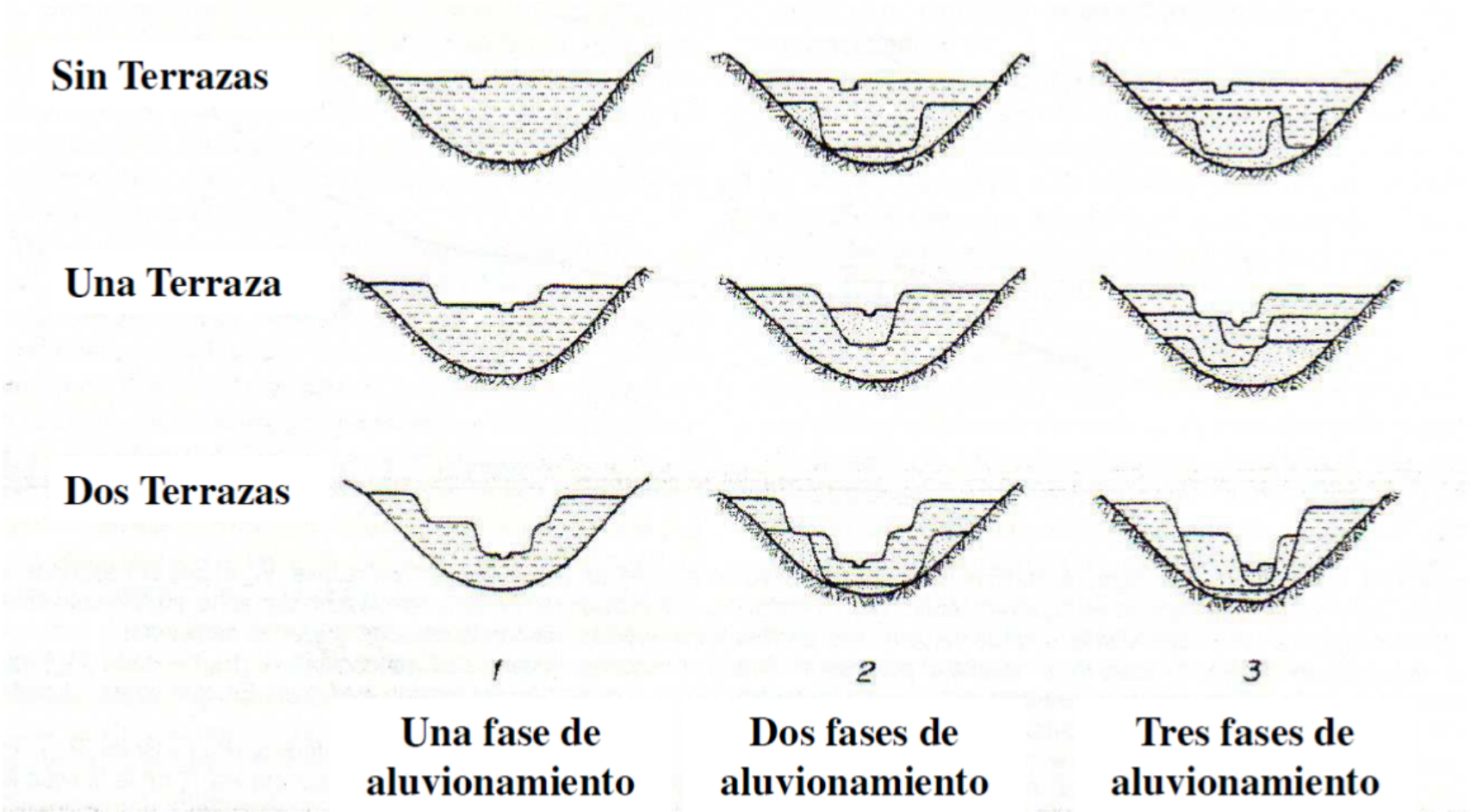
Terrazas escalonadas solapadas o yuxtapuestas: Excava todo el aluvión, pero no llega a aflorar el substrato.

Terrazas escalonadas colgadas: Excava todo el aluvión e incluso parte del substrato, haciendo aflorar.

Terrazas


C.
strath terrace
aggradational terrace 1
aggradational terrace 2
degradational terraces
aggradational terrace 3
cut-and-fill history
incision
aggradation
time

Terrazas


Sin Terrazas
Una Terraza
Dos Terrazas
1
2
3
Una fase de aluvionamiento
Dos fases de aluvionamiento
Tres fases de aluvionamiento

Terrazas erosivas

Terrazas erosivas

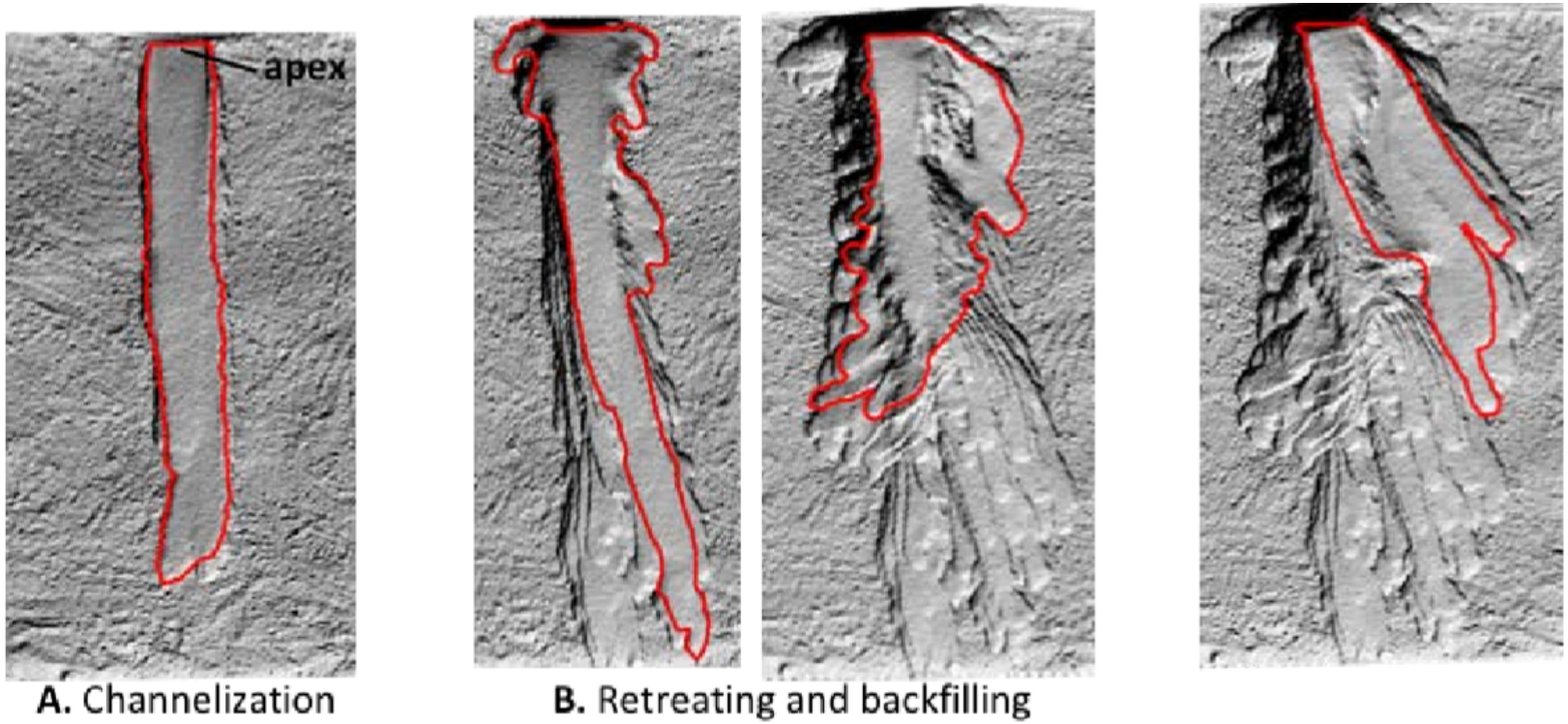
Depósitos Aluviales

Depósitos Aluviales

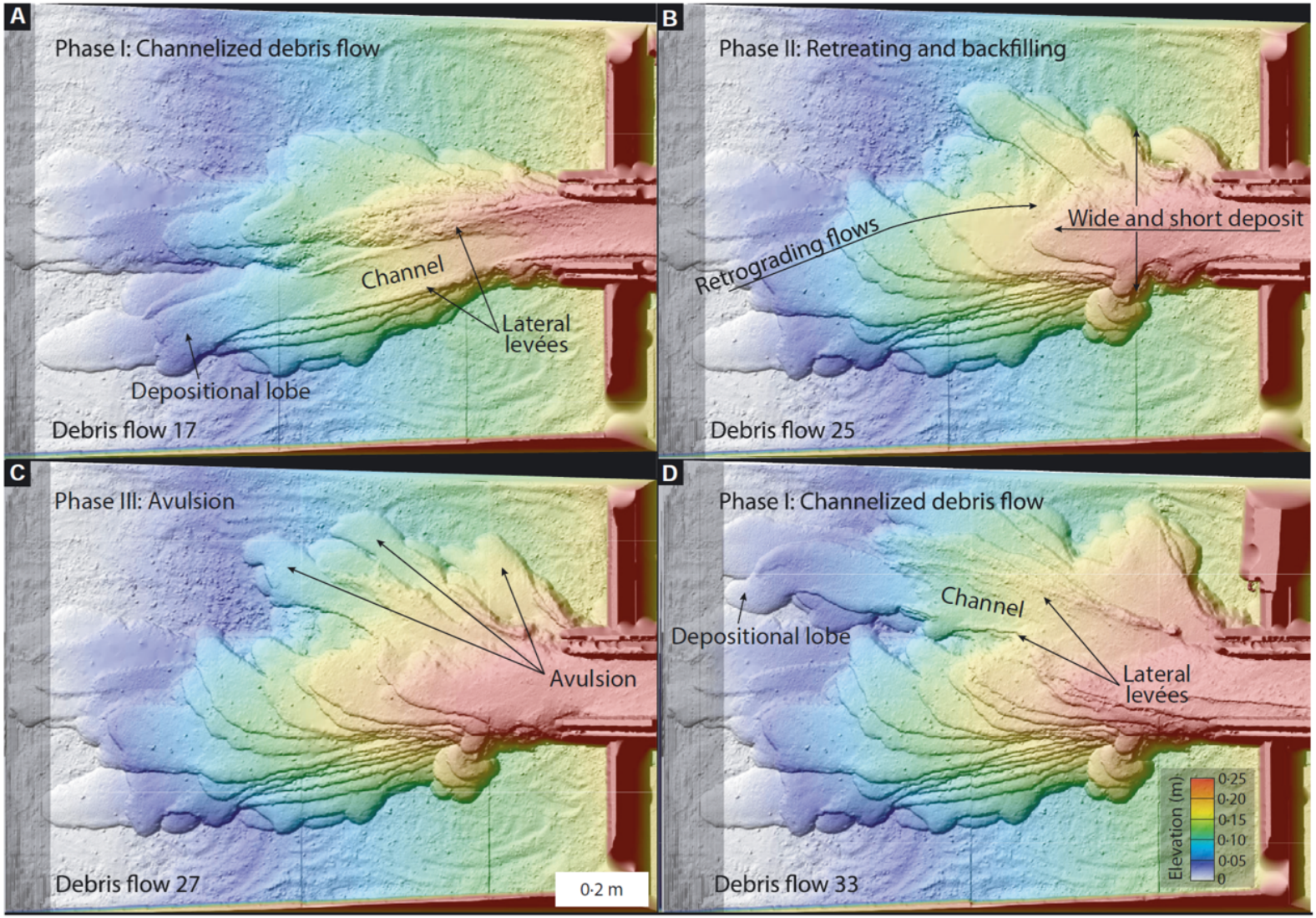
Depósitos Aluviales

Depósitos Aluviales

Abanicos

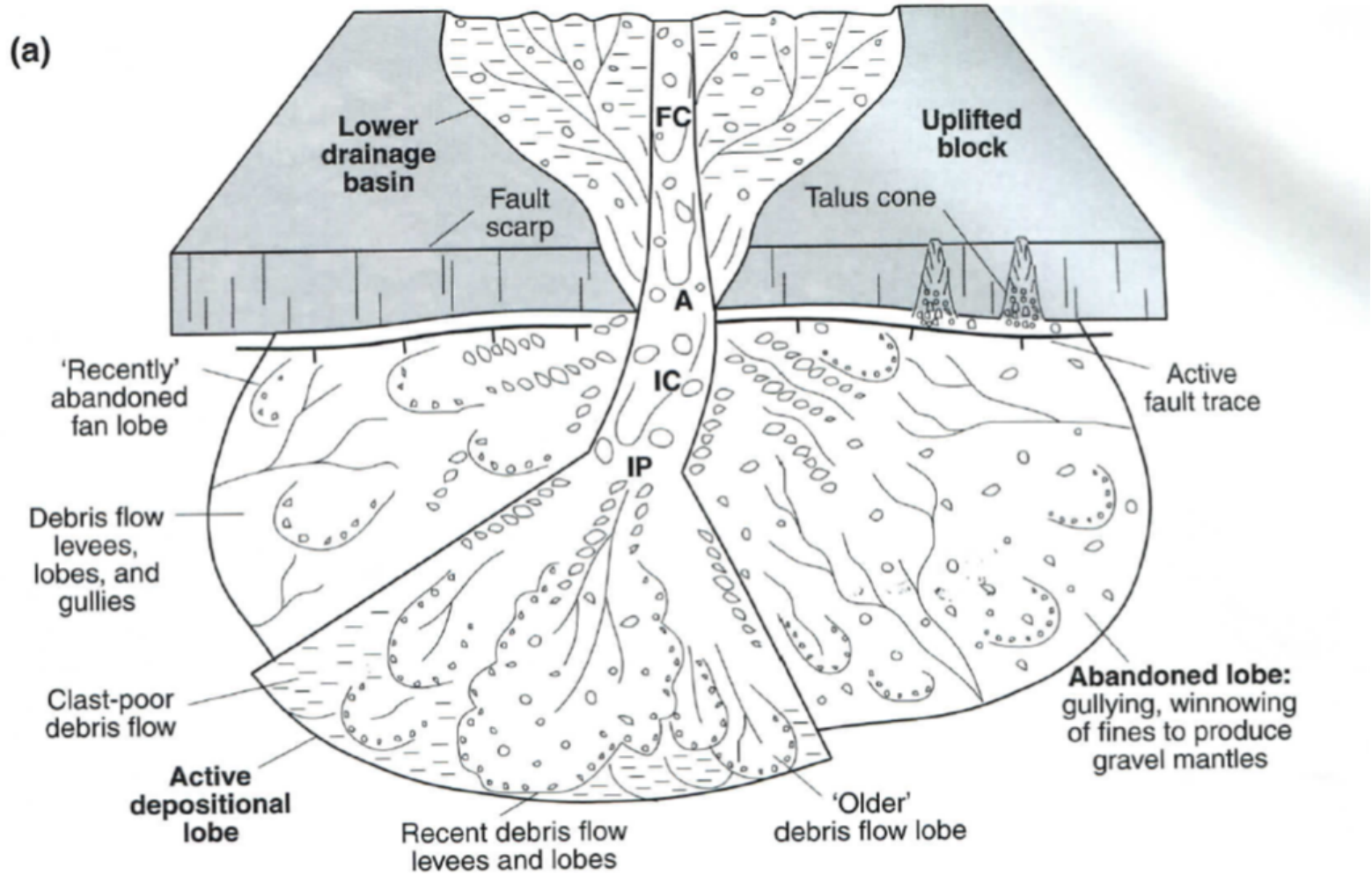

apex
A. Channelization
B. Retreating and backfilling
apex
A'
A
coarse-grained
levees
3
short
and
wide
deposit
C'
C
avulsion

Abanicos



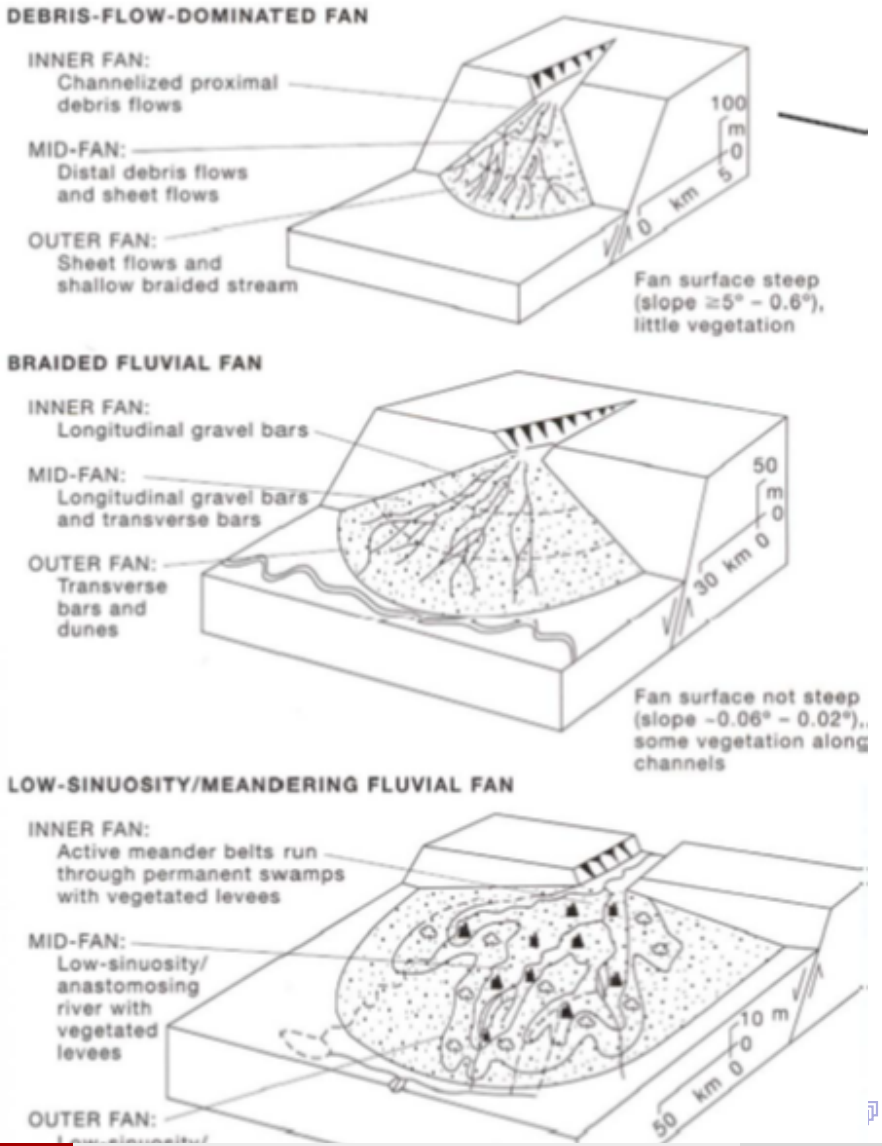
De Hass et al (2016)

Abanicos


(a)
Lower drainage basin
Fault scarp
FC
Uplifted block
Talus cone
A
IC
IP
'Recently' abandoned fan lobe
Active fault trace
Debris flow levees, lobes, and gullies
Clast-poor debris flow
Abandoned lobe: gullying, winnowing of fines to produce gravel mantles
Active depositional lobe
Recent debris flow levees and lobes
'Older' debris flow lobe

Abanicos

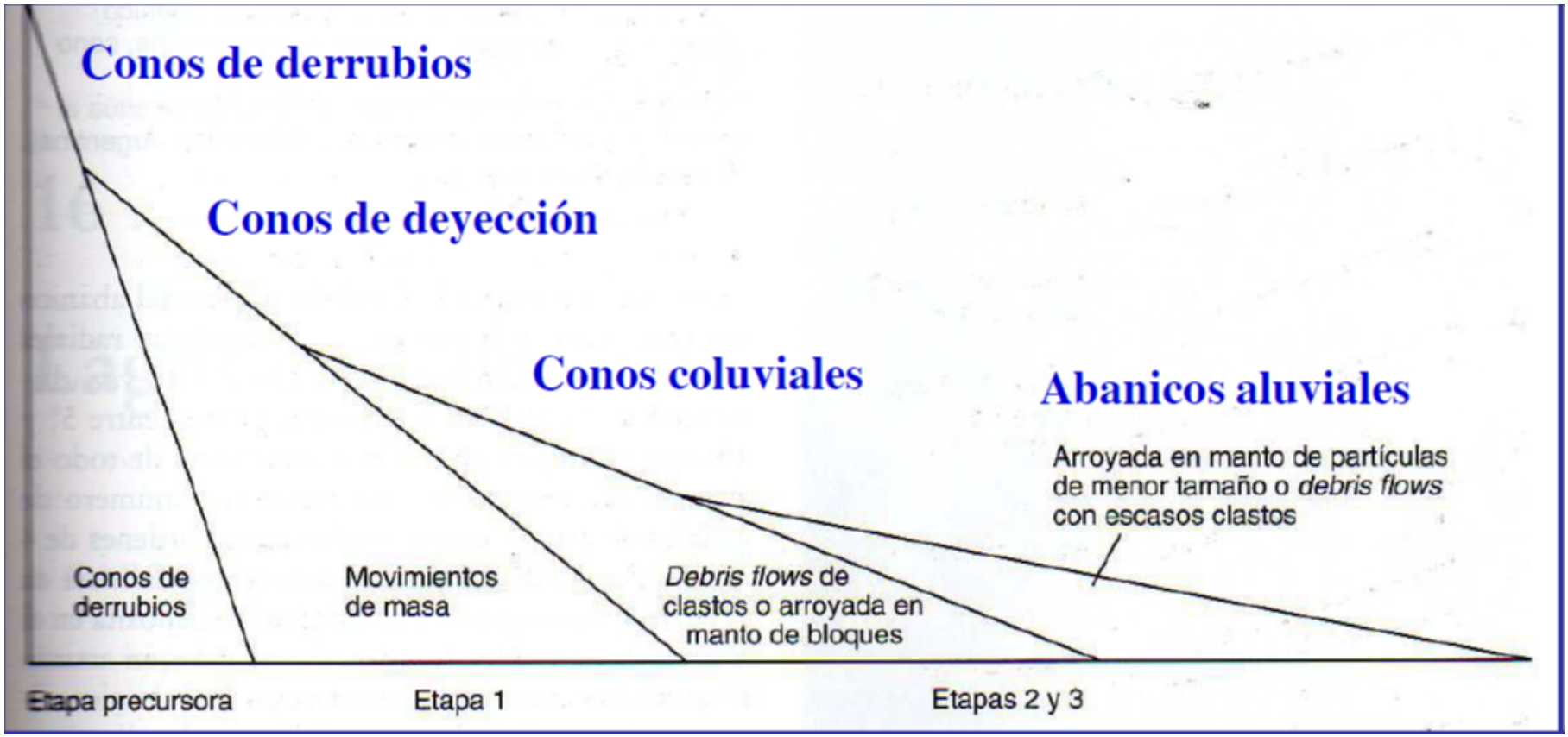
Abanicos


DEBRIS-FLOW-DOMINATED FAN
INNER FAN:
Channelized proximal debris flows
MID-FAN:
Distal debris flows and sheet flows
OUTER FAN:
Sheet flows and shallow braided stream
100 m 0
5 km 0
Fan surface steep (slope ≥5° – 0.6°), little vegetation
BRAIDED FLUVIAL FAN
INNER FAN:
Longitudinal gravel bars
MID-FAN:
Longitudinal gravel bars and transverse bars
OUTER FAN:
Transverse bars and dunes
50 m 0
30 km 0
Fan surface not steep (slope ~0.06° – 0.02°), some vegetation along channels
LOW-SINUOSITY/MEANDERING FLUVIAL FAN
INNER FAN:
Active meander belts run through permanent swamps with vegetated levees
MID-FAN:
Low-sinuosity/ anastomosing river with vegetated levees
OUTER FAN:
10 m 0
50 km 0

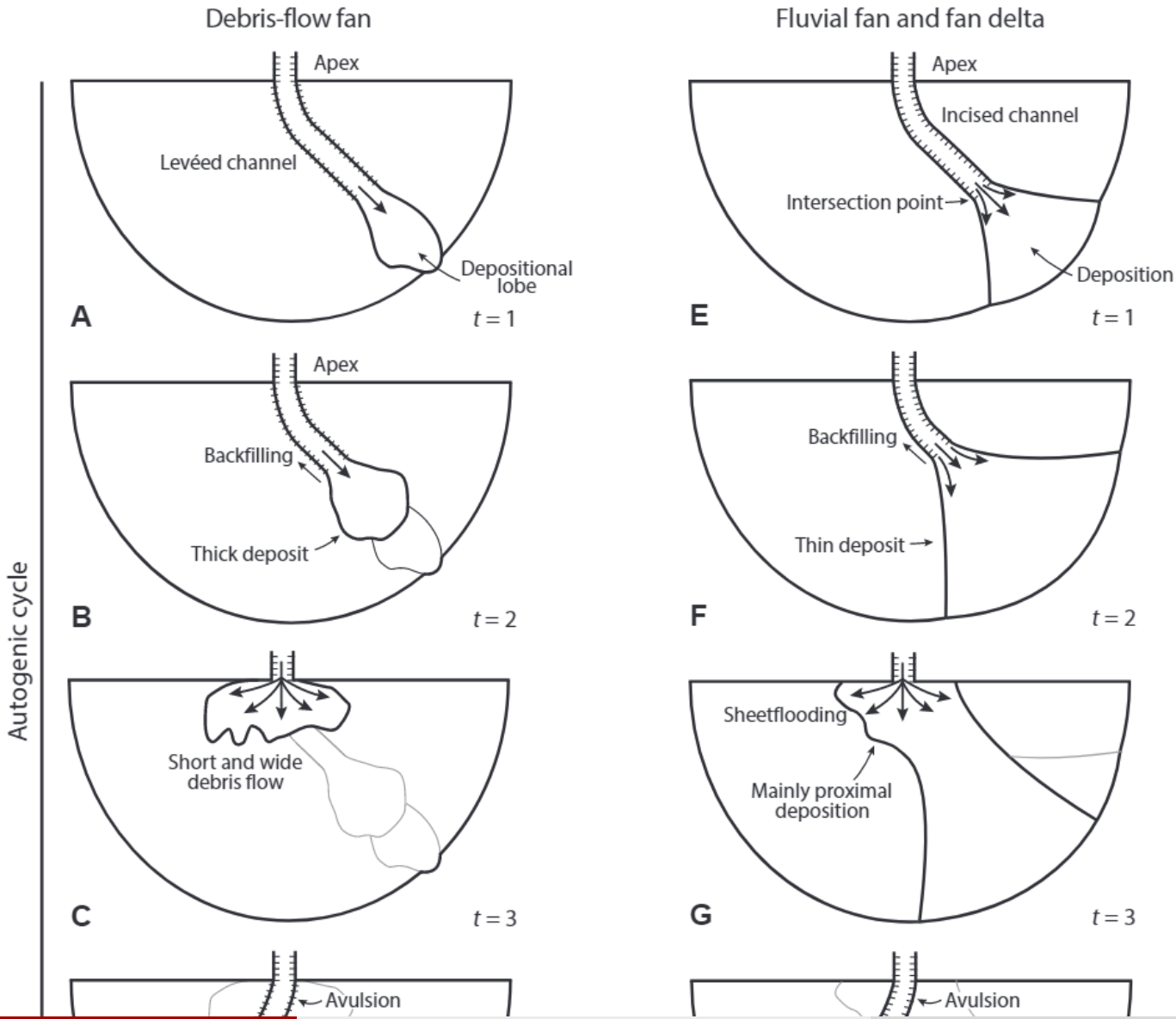
Abanicos

		Talud	Abanico coluvial	Abanico aluvial	PDFC	Sistema río colector-conoide
Ubicación respecto al frente		Ápice en la pendiente	Ápice en la pendiente y base	Ápice en la base	Pendiente	Longitudinal, en el piso del valle intermontano
Aporte		Pared de roca	Pequeñas cárcavas	Valle importante que incide el	Cursos fluviales frente montañoso	Sistemas entrelazados pequeños y efímeros
Pendiente		35° (20°)	Hasta 35° en el ápice 20° a 15° en el pie	Raramente > 10-15° en el ápice, comúnmente <1-5° en la base	2° a 3°	3° - 4°
Radio/Longitud		< 0.5 Km mayor que 1,5 Km)	< 0,5 Km (raramente	Comúnmente >10 Km (>100 Km)	4 - 6 Km	Conoide 1 a 1,5 Km Long. total > 5 Km
Litofacies		Bsl, Bsi, Bsm, Bcl	Bmm, Bcg, Asm, Bsm, Bcm, Fm, Bsi, Bsl	Bmm, Bml, Bcp, Bcm, Fm	Bcm, Bch, Bcp, SGm, SGp	Bmm, Bml, Bcm, Fm, FGm, Bcm, Bcg, Bcp
Procesos	**Caida de roca**	+ +	+ +			
	Desliz. de detritos secos	+ + + +	+ +			
	F. hiperconc.	+	+ + + +	+ +		+ + + +
	Flujos fluidos		+ +	+ +	+ + + +	+ +

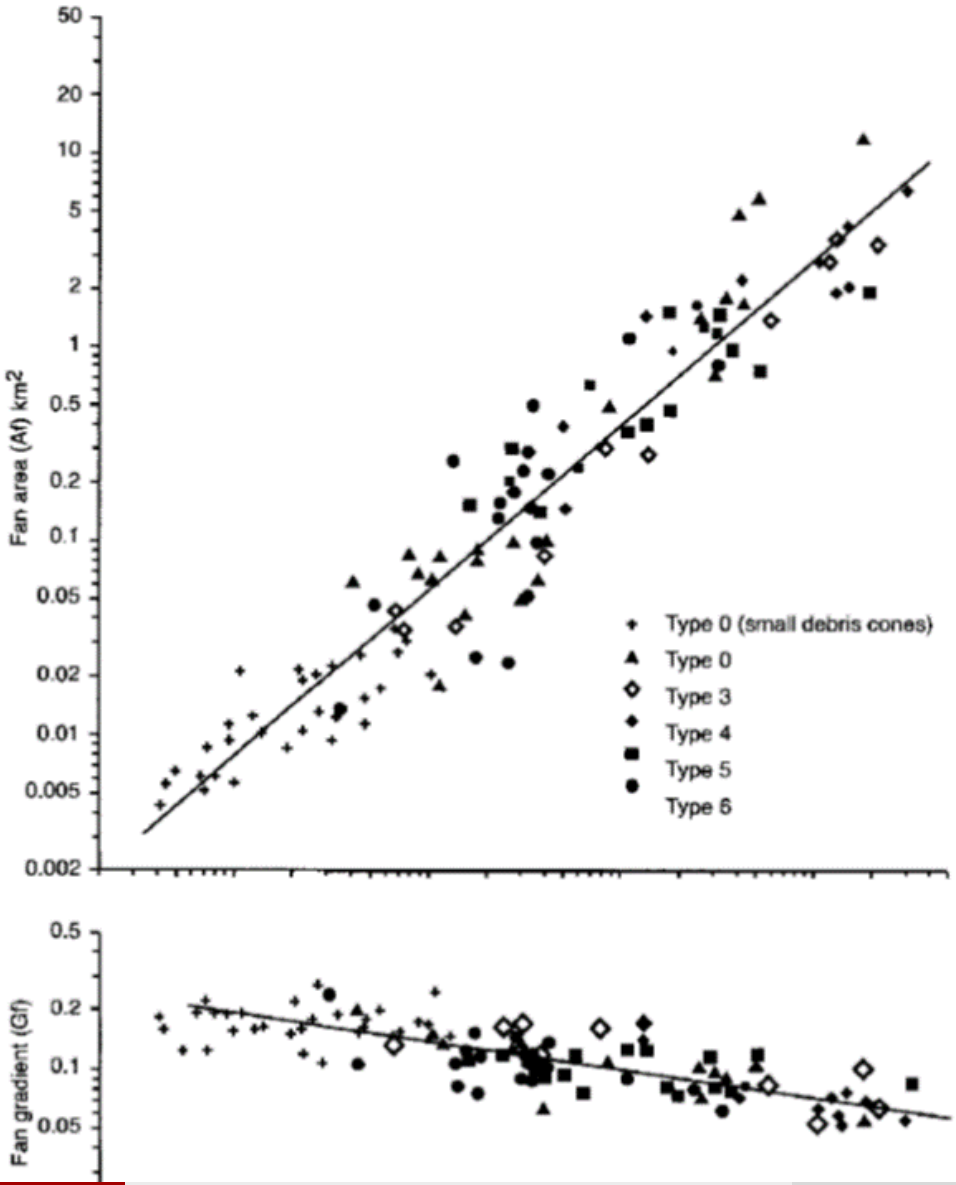
Abanicos


Conos de derrubios
Conos de deyección
Conos coluviales
Abanicos aluviales
Arroyada en manto de partículas de menor tamaño o *debris flows* con escasos clastos
Conos de derrubios
Movimientos de masa
Debris flows de clastos o arroyada en manto de bloques
Etapa precursora
Etapa 1
Etapas 2 y 3

Abanicos


Debris-flow fan
Fluvial fan and fan delta
Autogenic cycle
Apex
Levéed channel
Depositional lobe
A
t = 1
Apex
Incised channel
Intersection point
Deposition
E
t = 1
Apex
Backfilling
Thick deposit
B
t = 2
Backfilling
Thin deposit
F
t = 2
Short and wide debris flow
C
t = 3
Sheetflooding
Mainly proximal deposition
G
t = 3
Avulsion
Avulsion

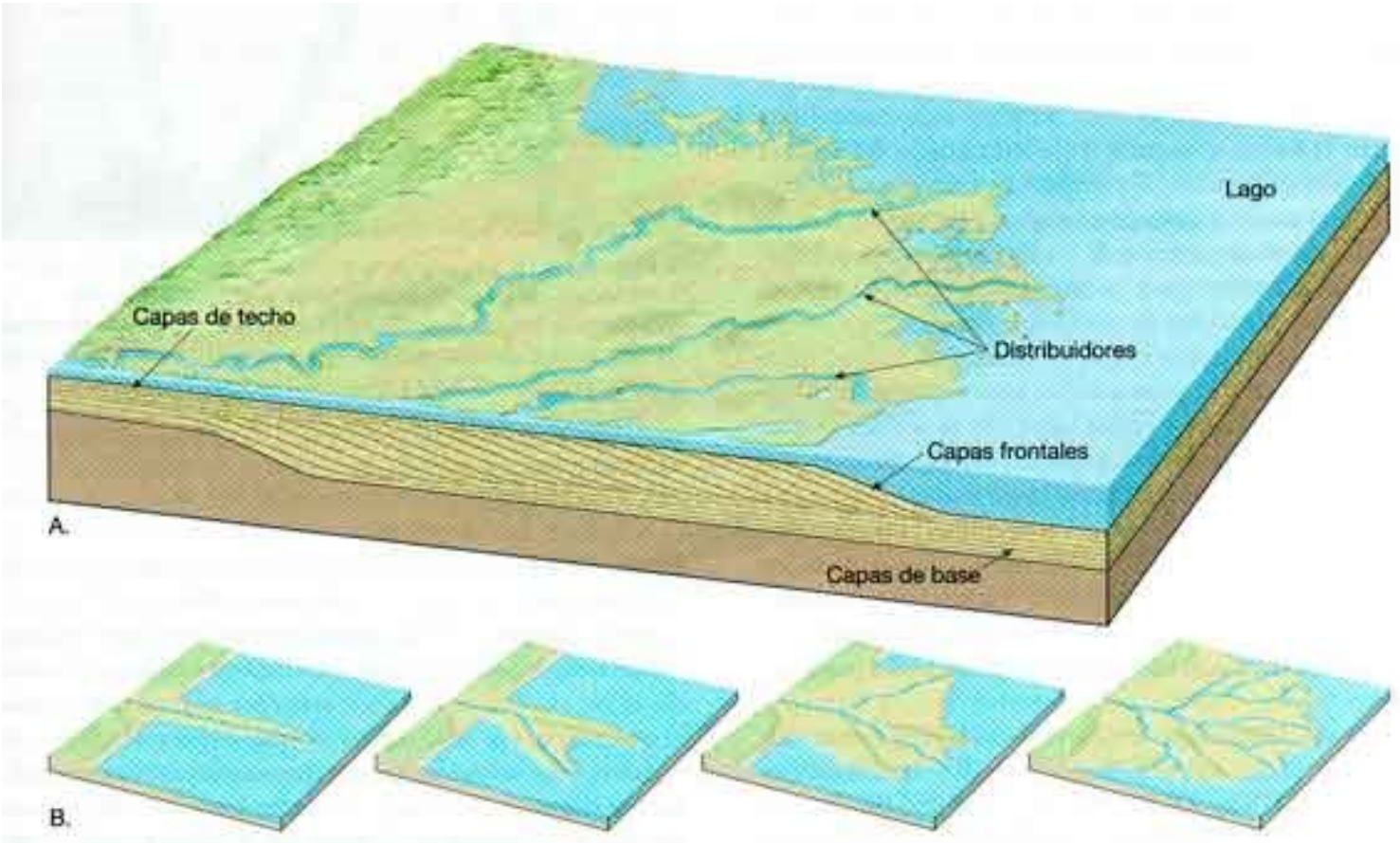
Abanicos


Fan area (Af) km²
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
Type 0 (small debris cones)
Type 0
Type 3
Type 4
Type 5
Type 6
Fan gradient (Gf)
0.5
0.2
0.1
0.05

Deltas


Image © 2010 DigitalGlobe
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Cnes/Spot Image
Image © 2010 TerraMetrics
Fechas de las imágenes: 31 de May. de 2003 - 22 de Nov. de 2005
28°29'21.74" N 34°29'18.02" E elev. 69 m
©2009 Google
Alt. ojo 7.19 km

Deltas


Lago
Capas de techo
Distribuidores
Capas frontales
A.
Capas de base
B.

Deltas

Delta del río Ebro (españa)

Estuarios