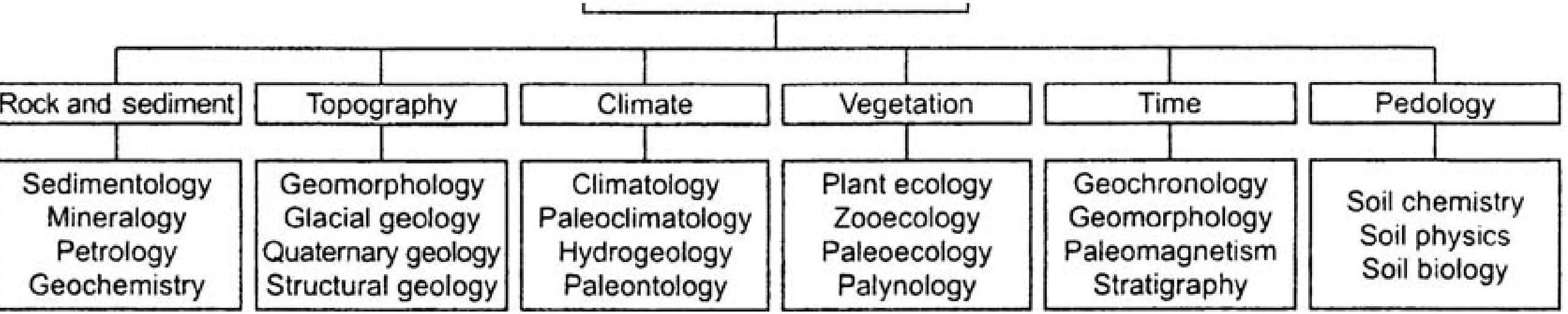
Soils and Landscapes

Geomorphology and Hydrology

Changing to Schaetzl Text.

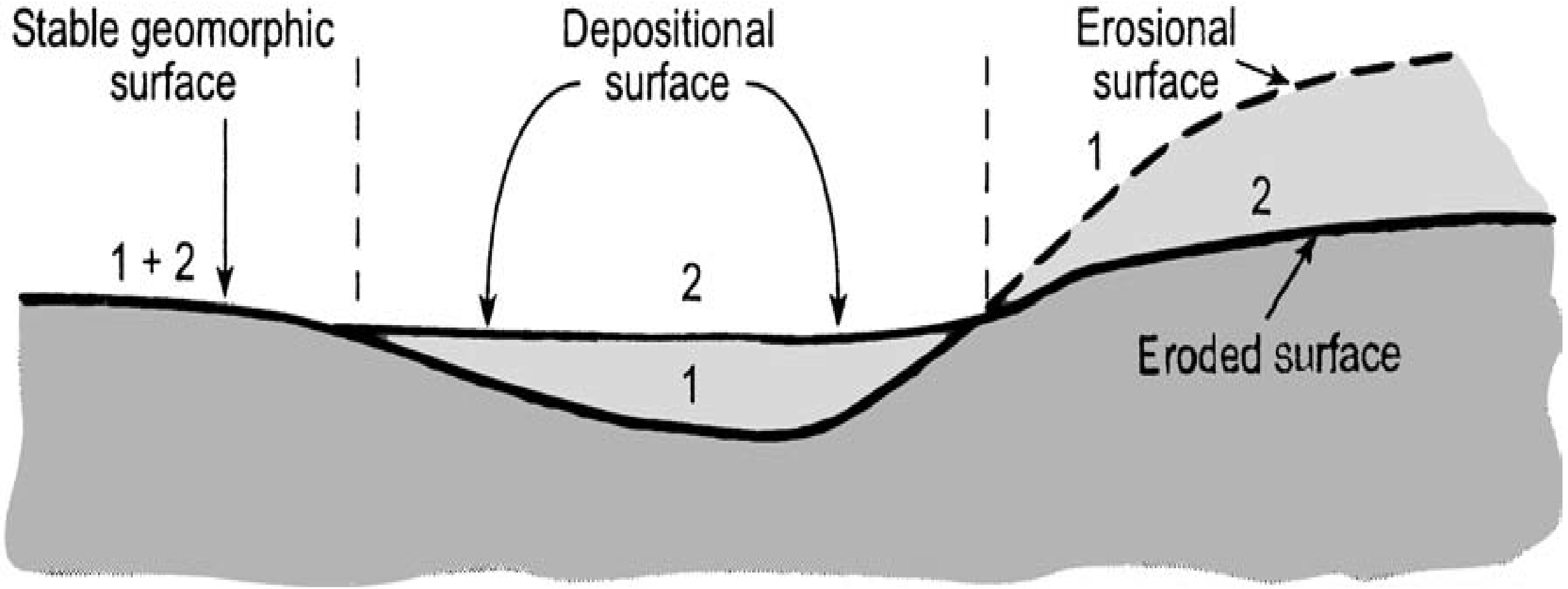
Chapter 13, 14, 15

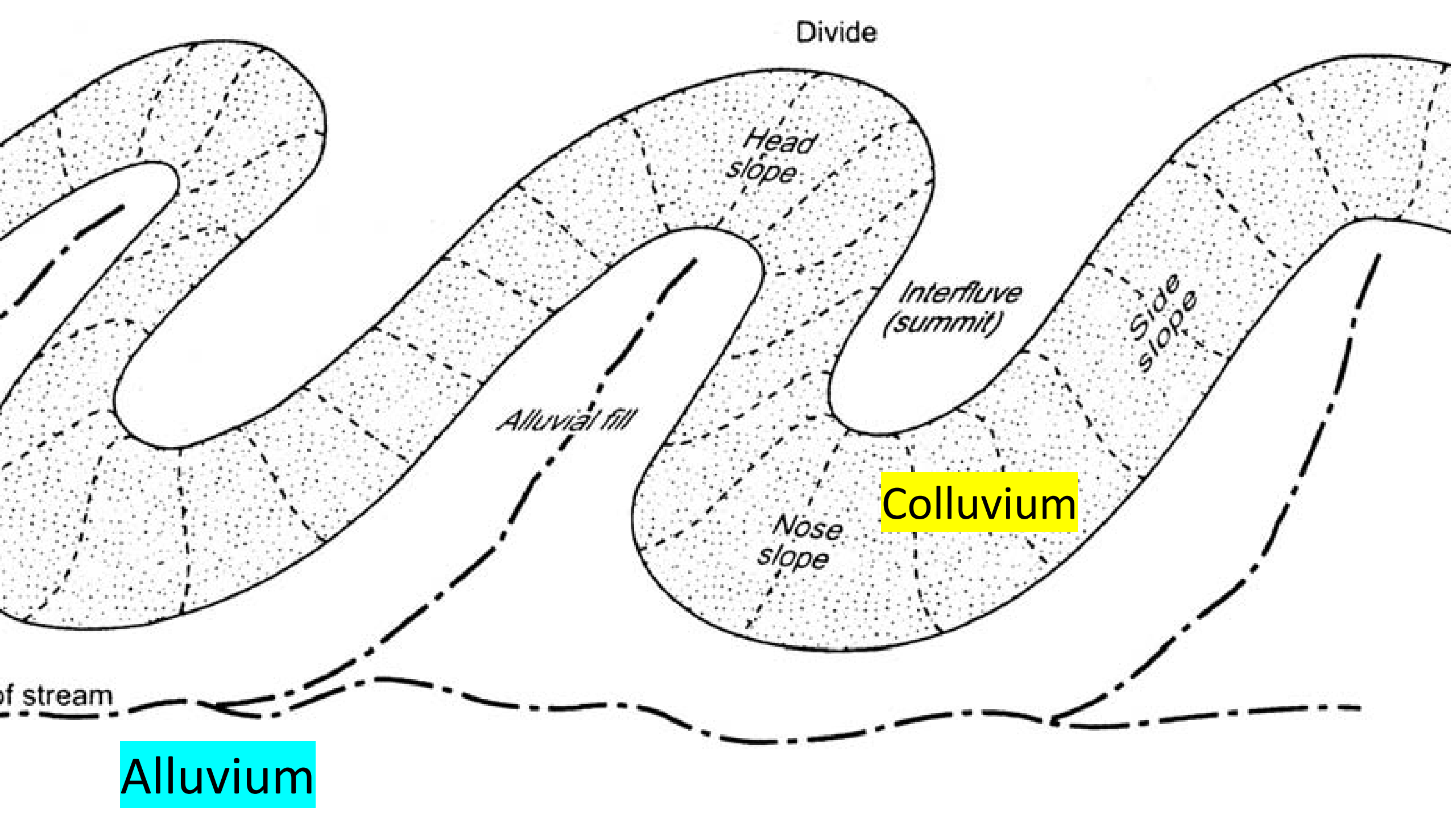
Soil Geomorphology



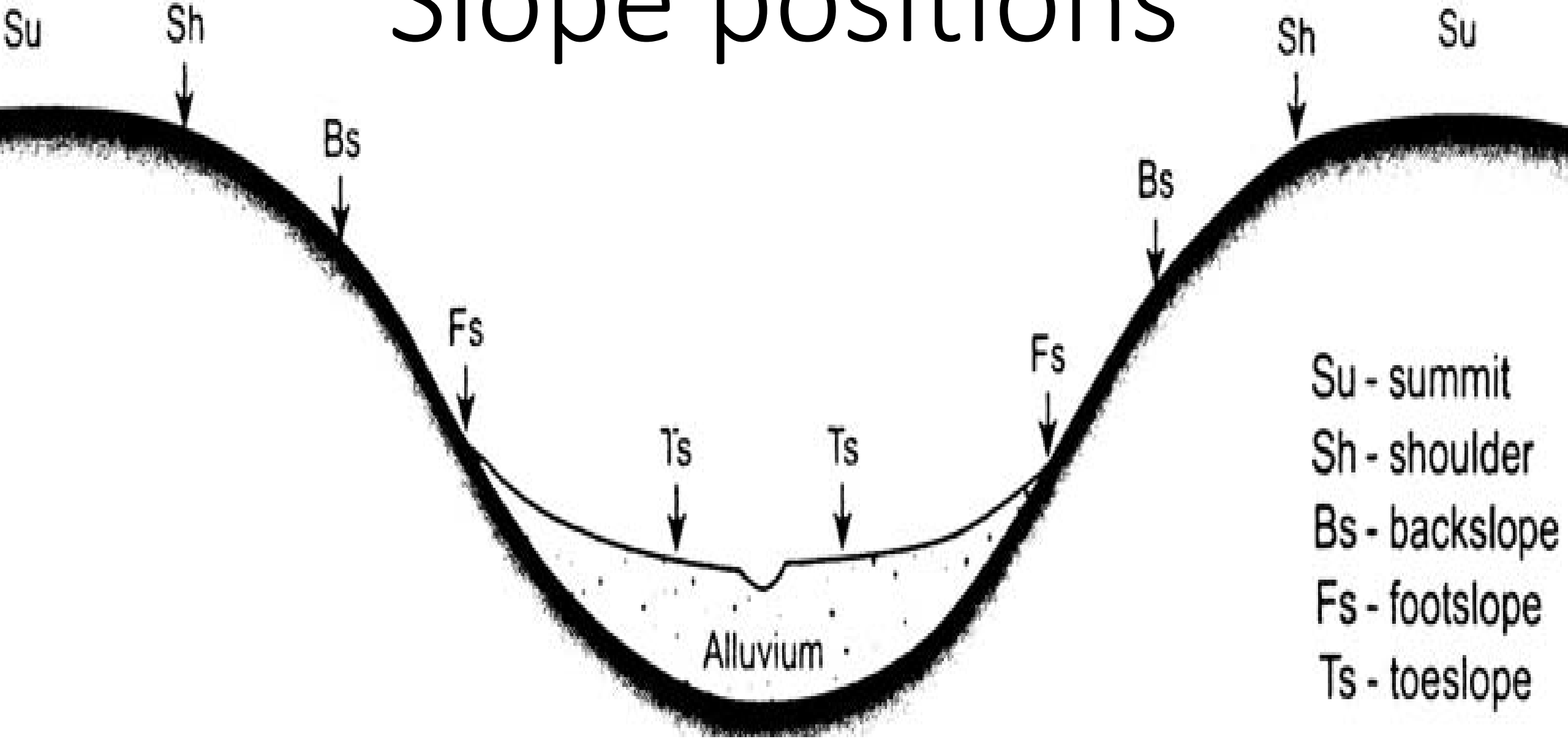
Structural Geology

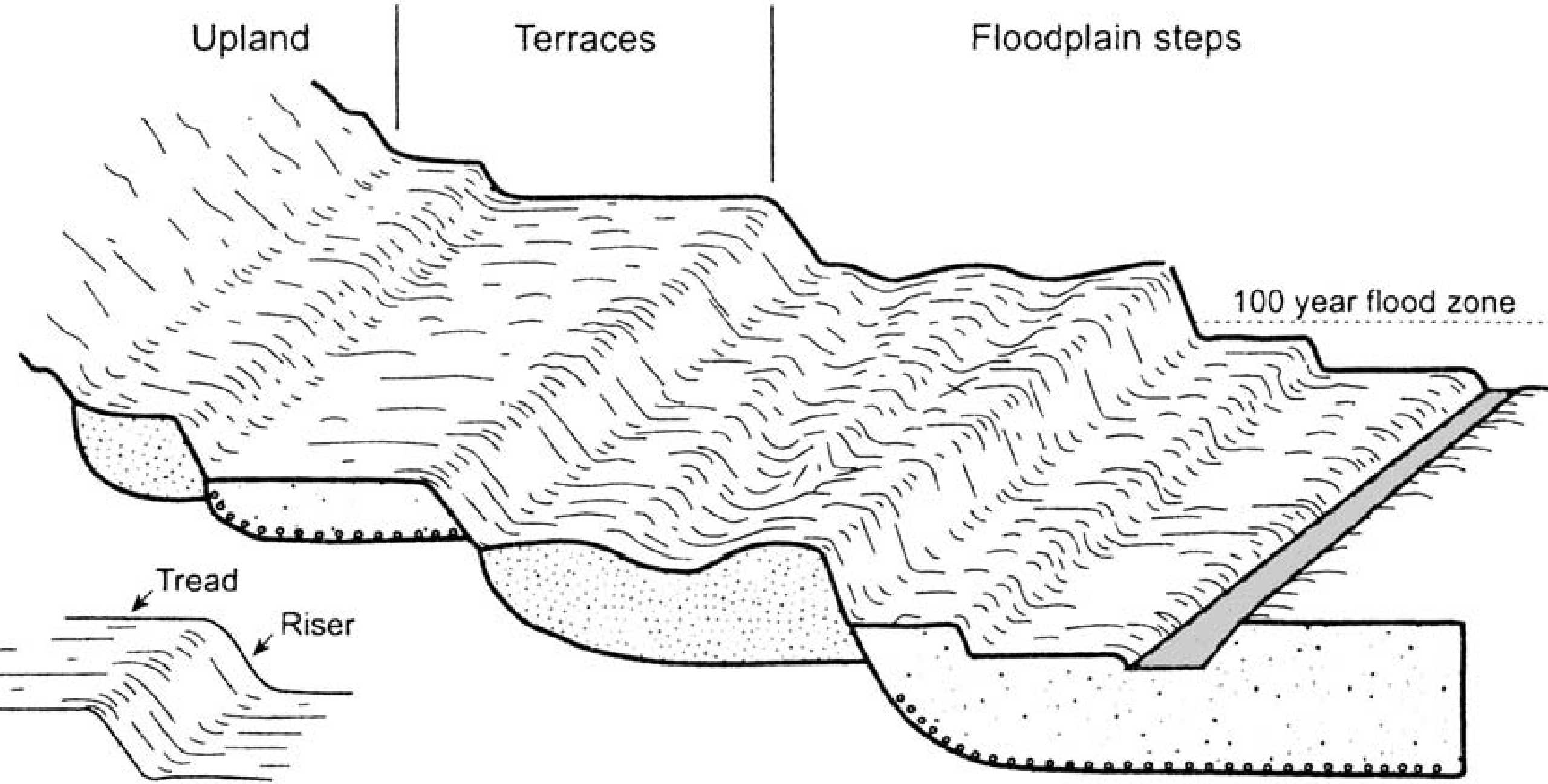
3 surface types



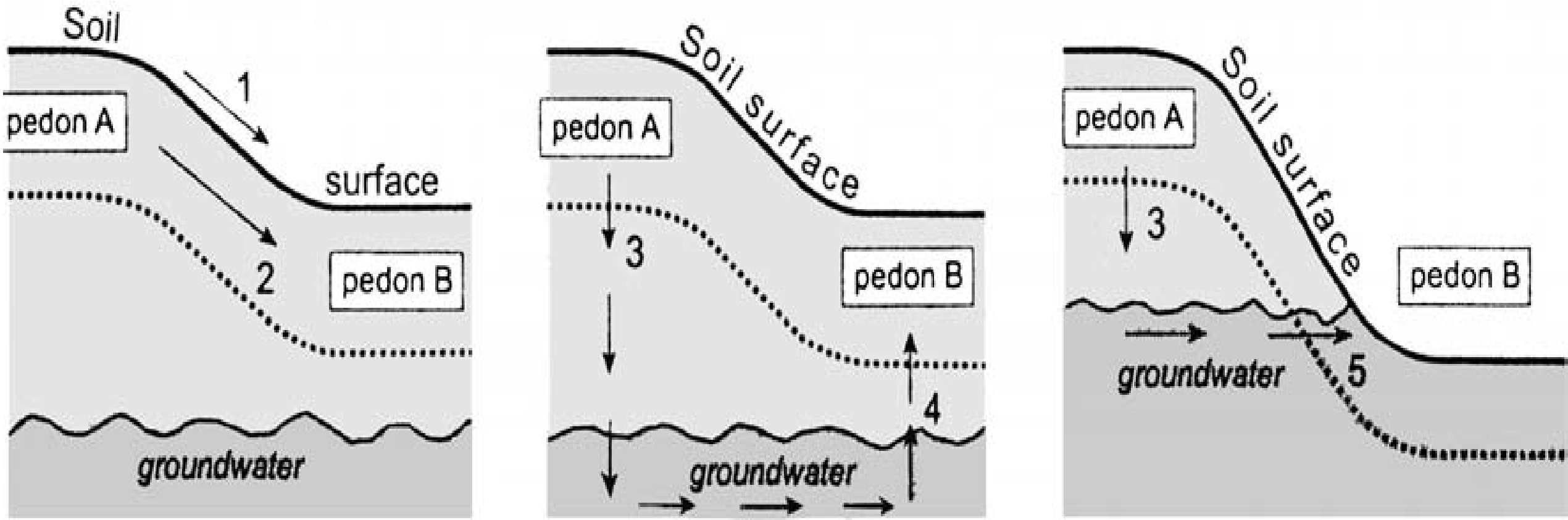

Divide
Head slope
Interfluve (summit)
Side slope
Alluvial fill
Nose slope
Colluvium
of stream
Alluvium

Slope positions



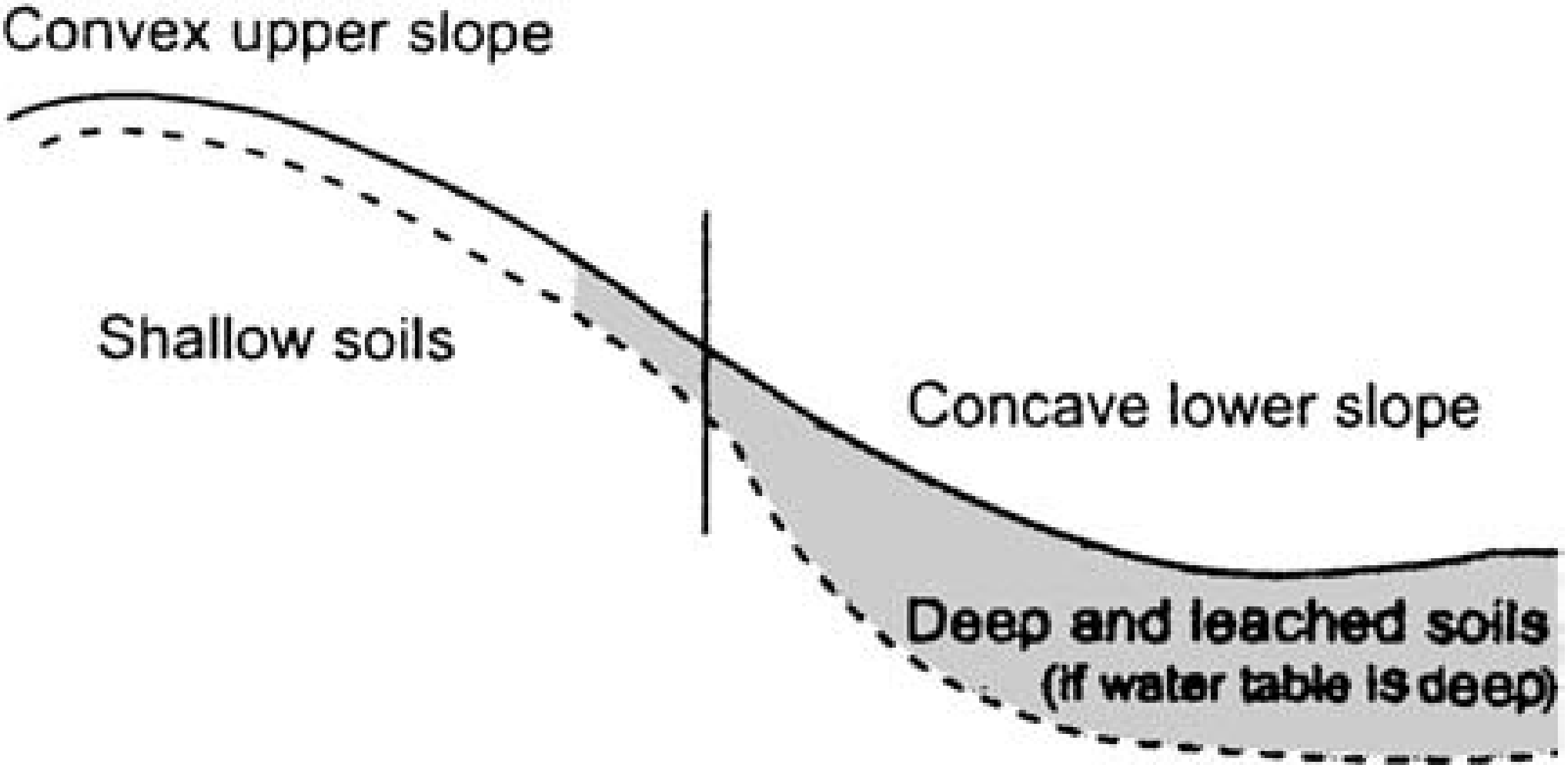

Upland
Terraces
Floodplain steps
100 year flood zone
Tread
Riser

Soil/Water flux Pathways

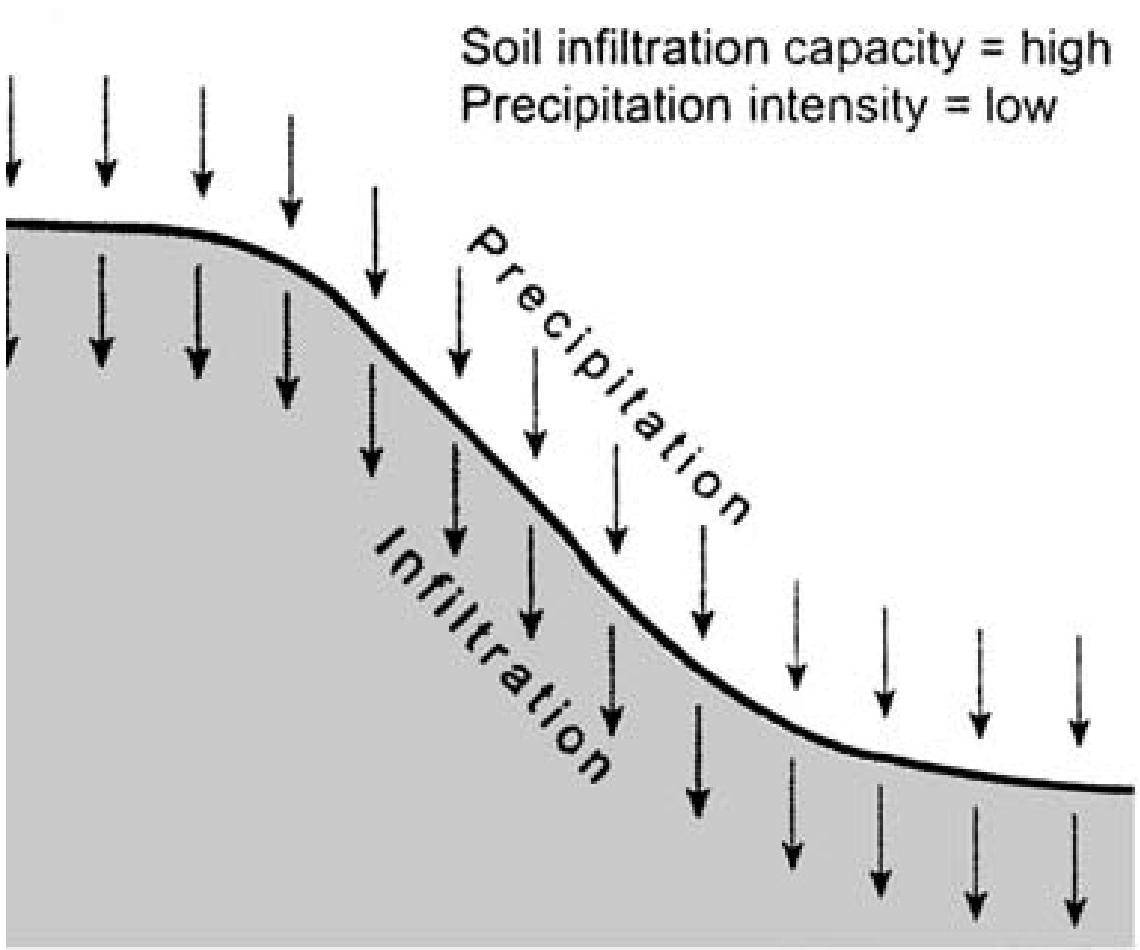


1 - Overland flow 2 - Lateral subsurface flow 3 - Vertical seepage or percolation 4 - Capillary rise 5 - Return flow

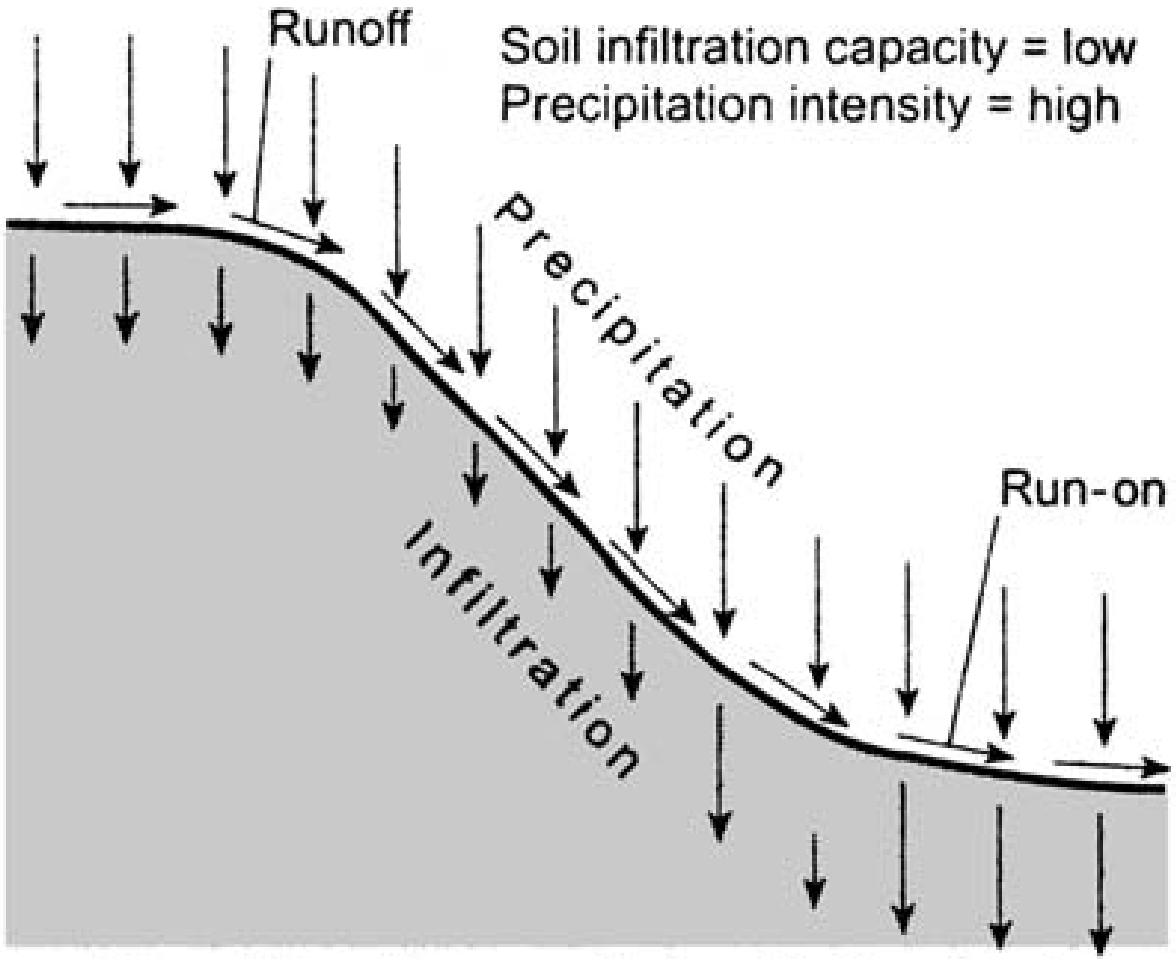
Soil Catena Relationships



Two Moisture flux/Catena Scenarios

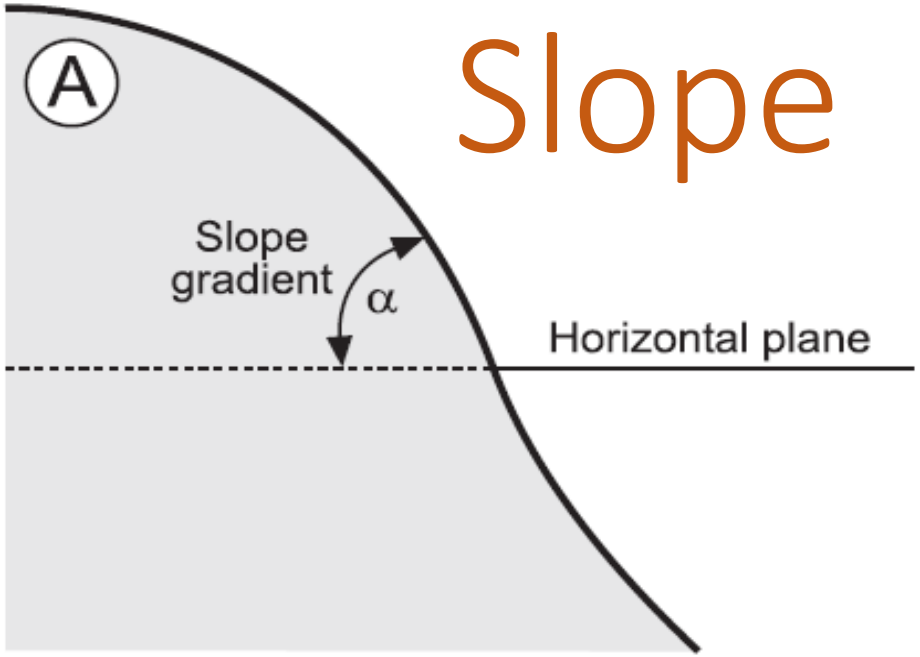


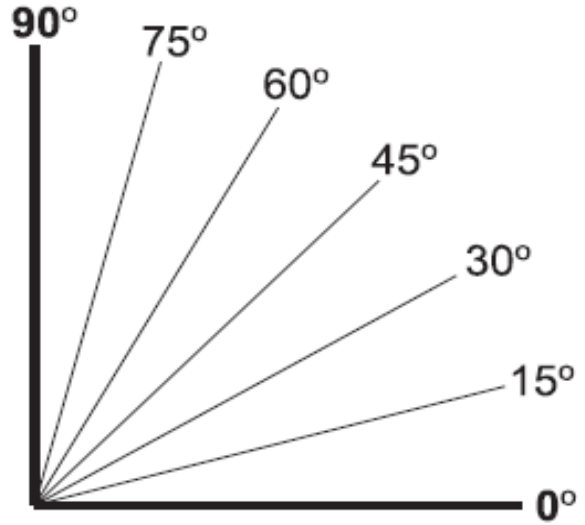
All soils equally leached



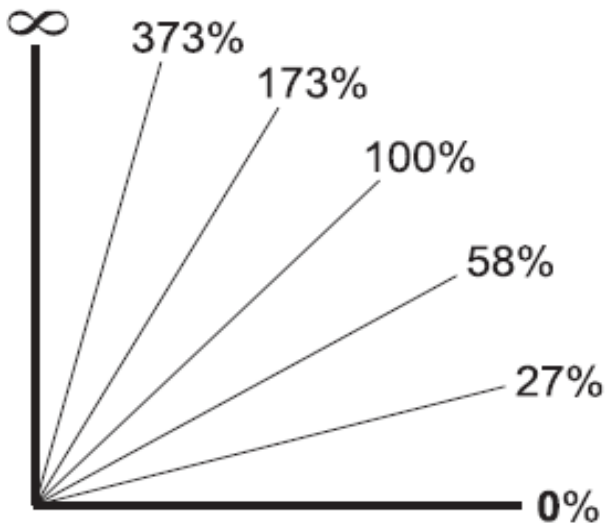
Shoulder slopes minimally leached.
Toe and footslopes excessively wet.

Slope

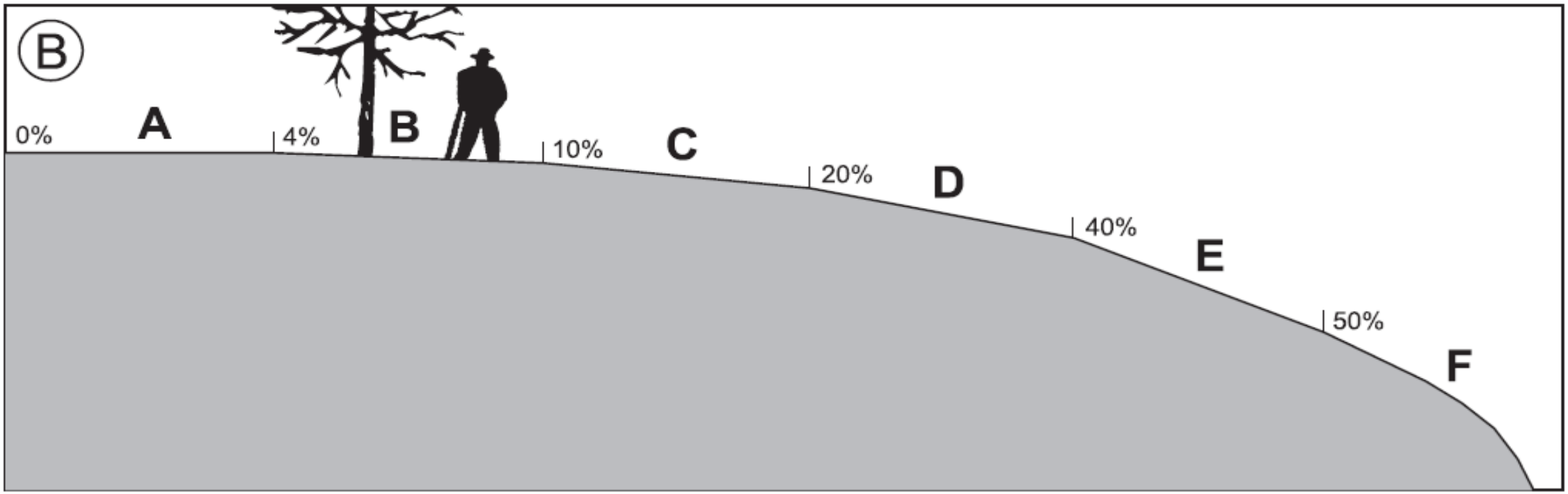




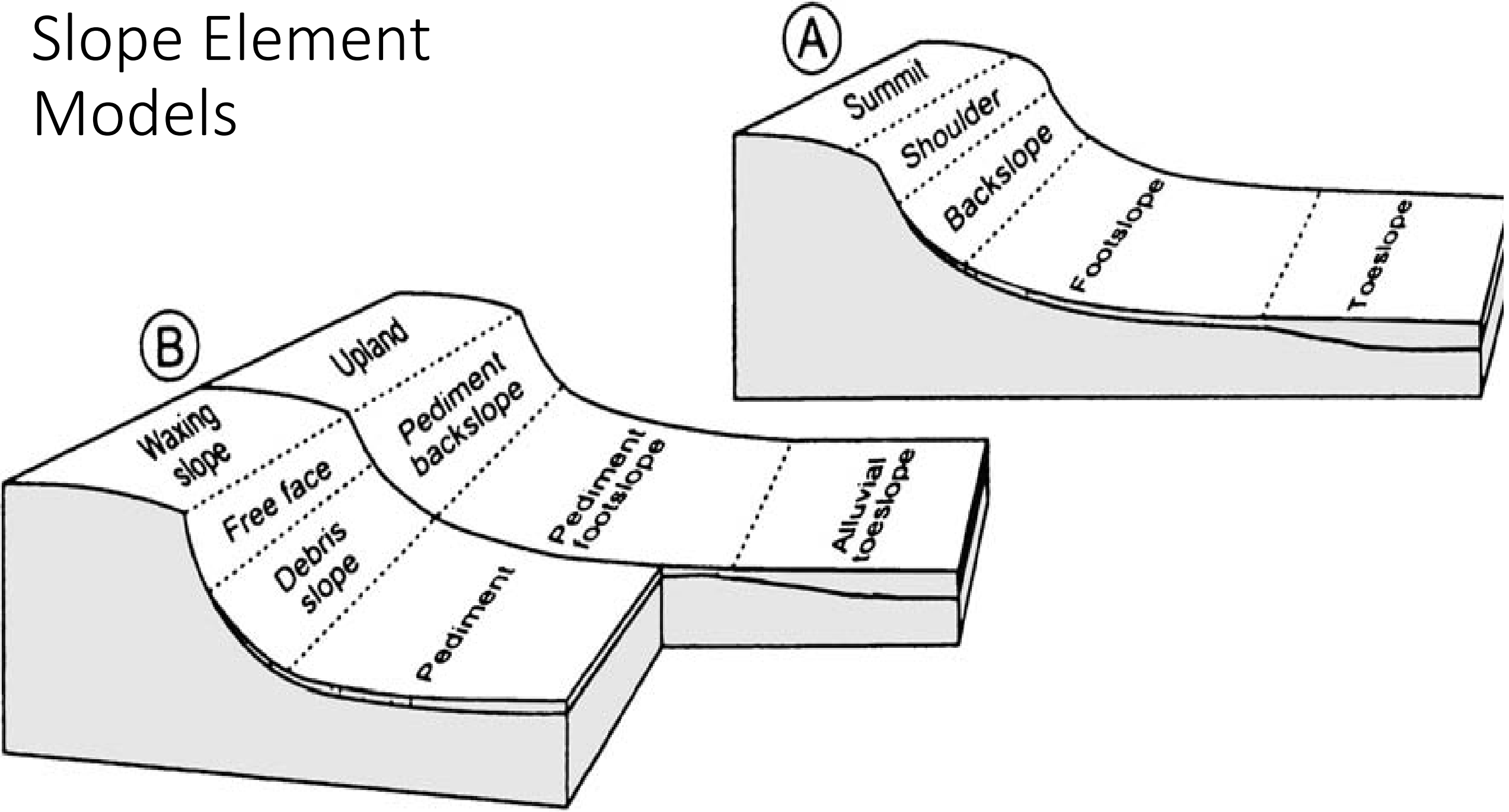
Slope expressed in degrees

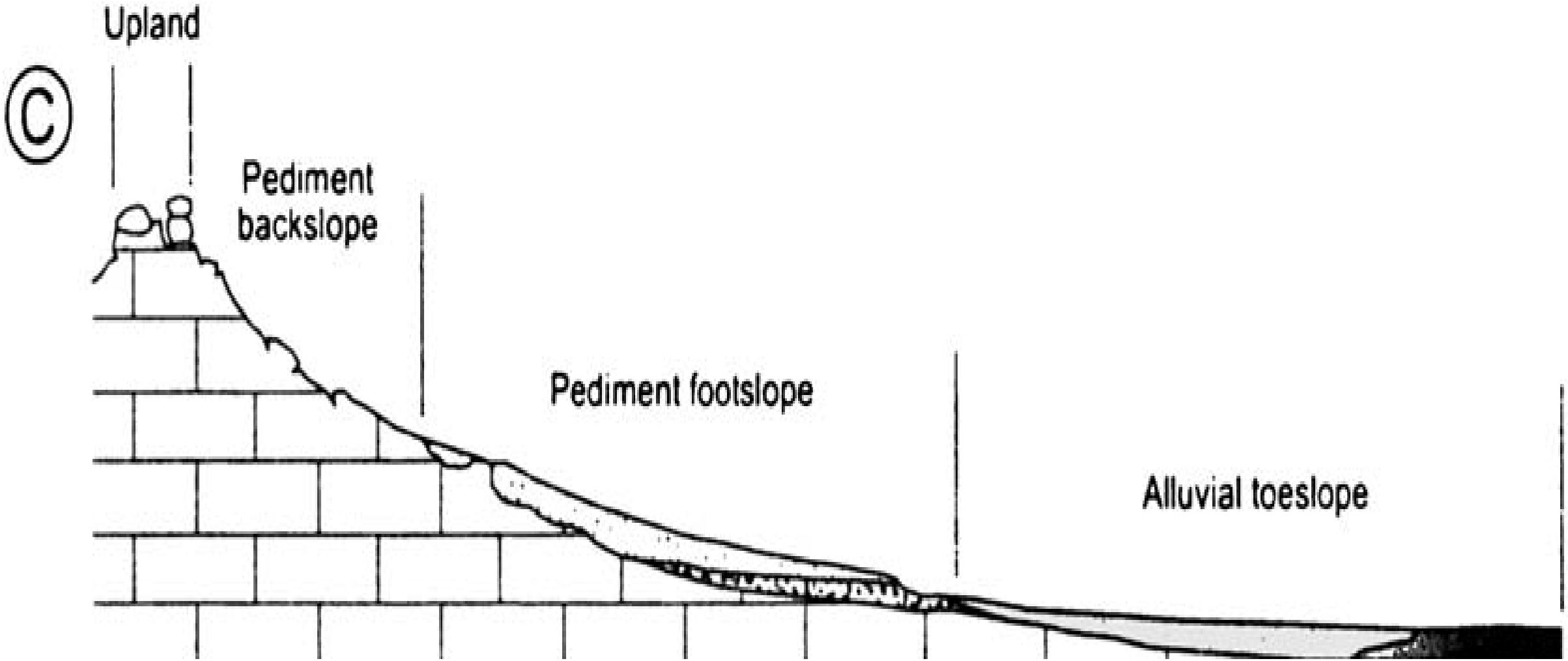


Slope expressed in percent



Slope Element Models



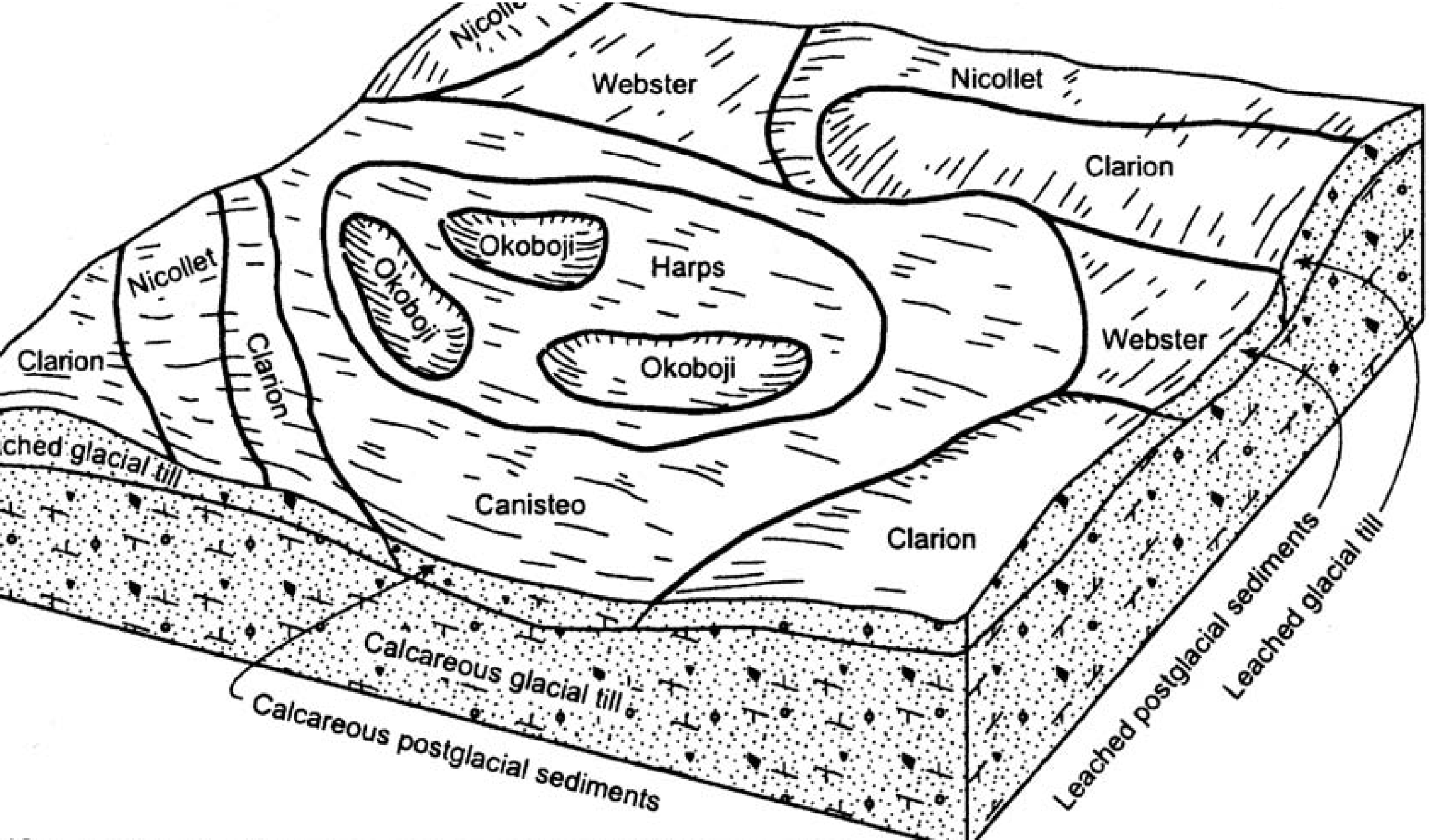

Upland
Pediment backslope
Pediment footslope
Alluvial toeslope

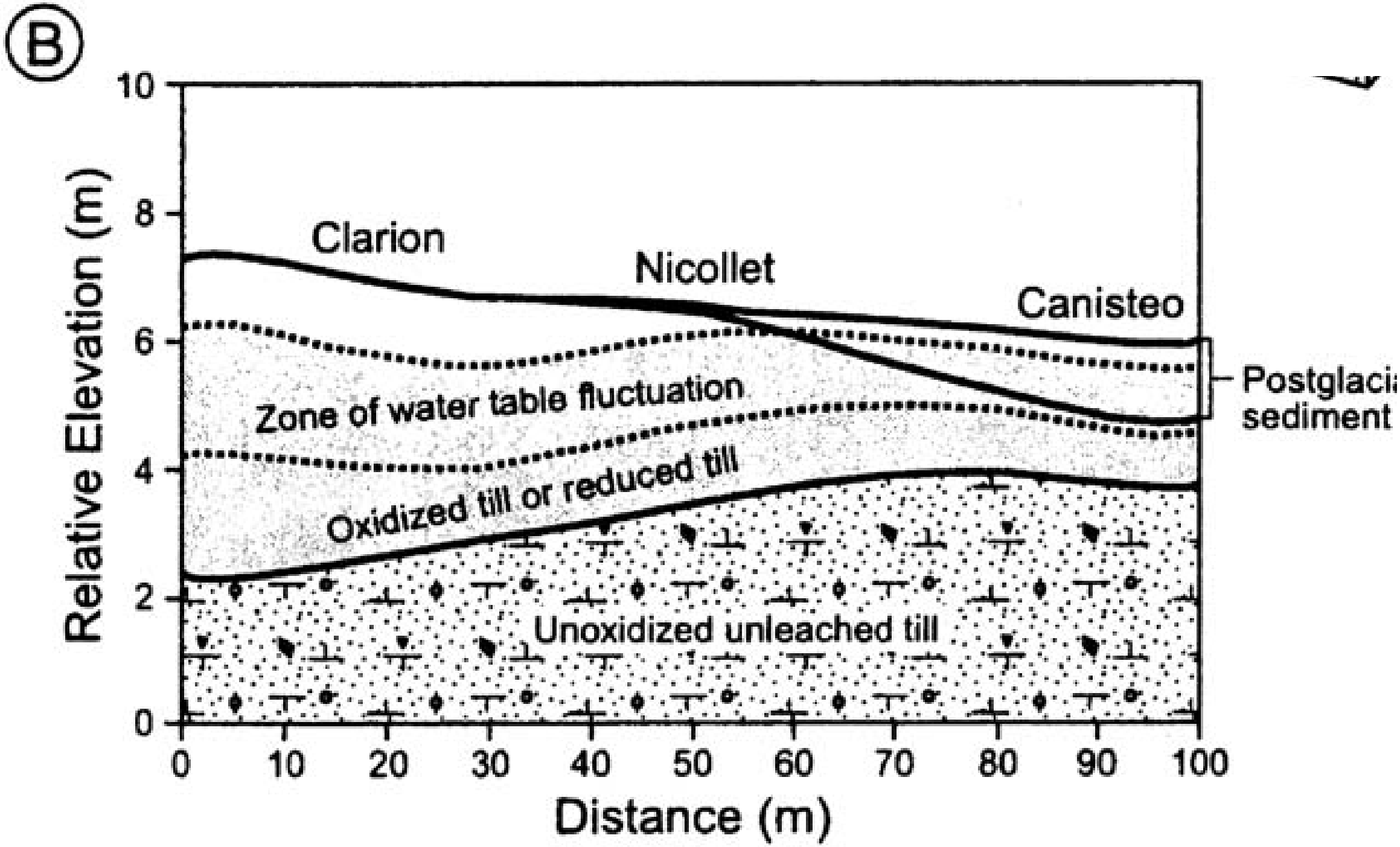
Soil aquic conditions – Saturation types

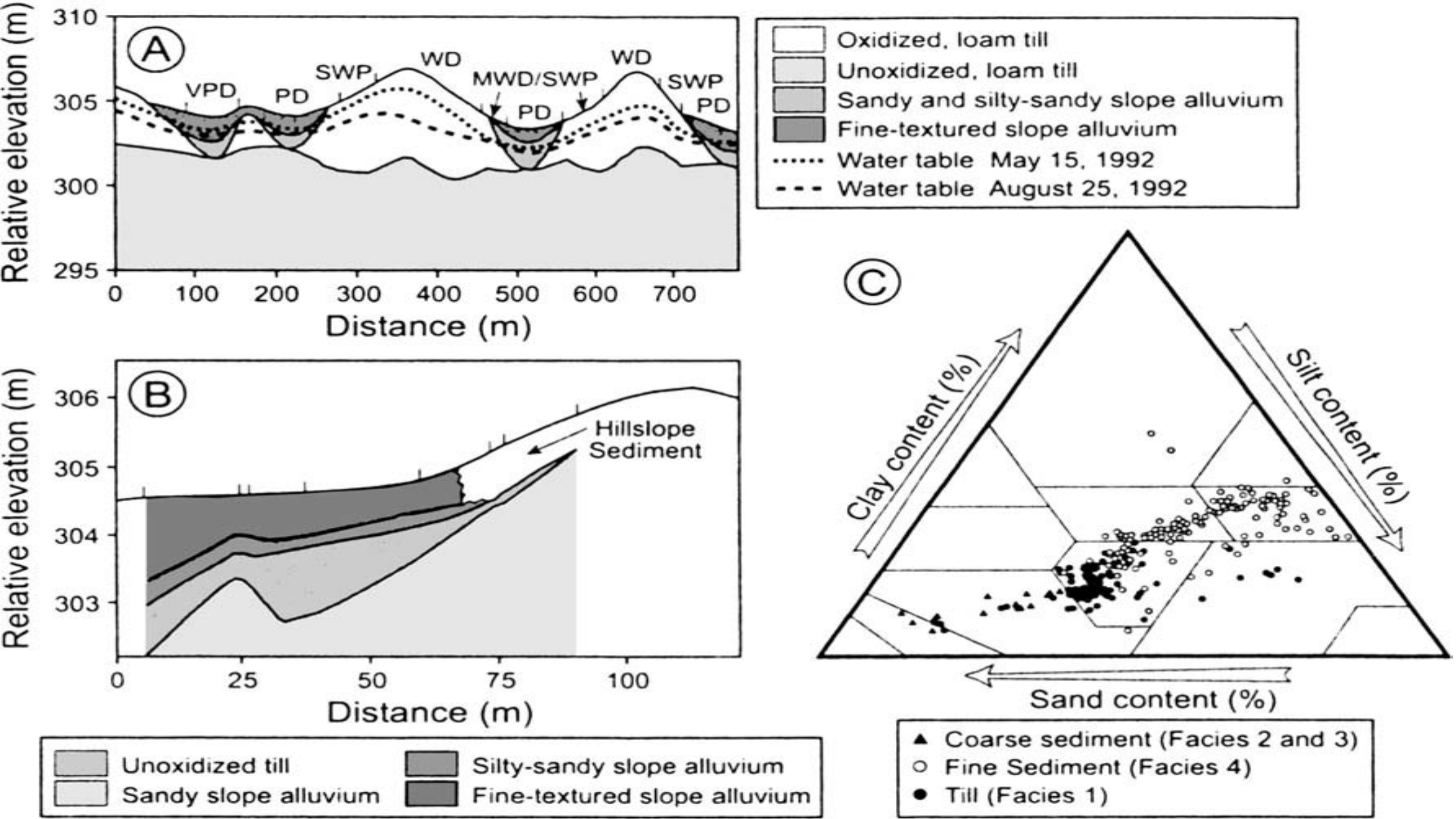
- Endosaturation
  - Saturated in all layers from the upper boundary of the water table to a depth of ≥200 cm
- Episaturation
  - Saturated in one or more layers, but it *also* has one or more *unsaturated layers* below, within 200 cm.
- Arthric saturation
  - Human-induced soils that are cultivated and irrigated, especially by flood irrigation. E.g. Cranberries

Soil Drainage Classes : Mottles

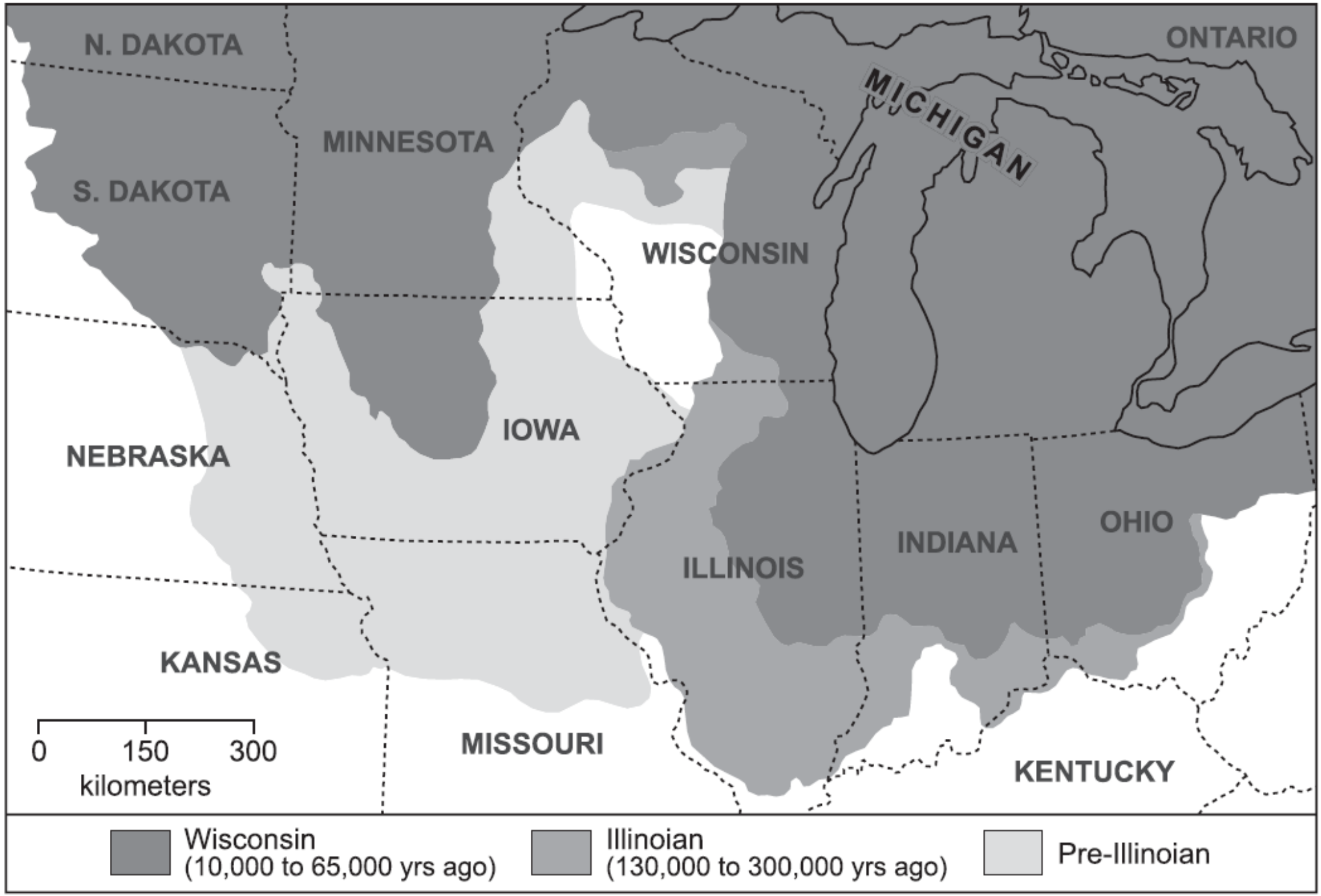
• Excessively drained	None
• Somewhat excessive	None
• Well	BC and C
• Moderately-well	B and C
• Somewhat Poorly	B and C plus gleying
• Poorly	throughout plus gleying
• Very poorly	throughout plus gleying

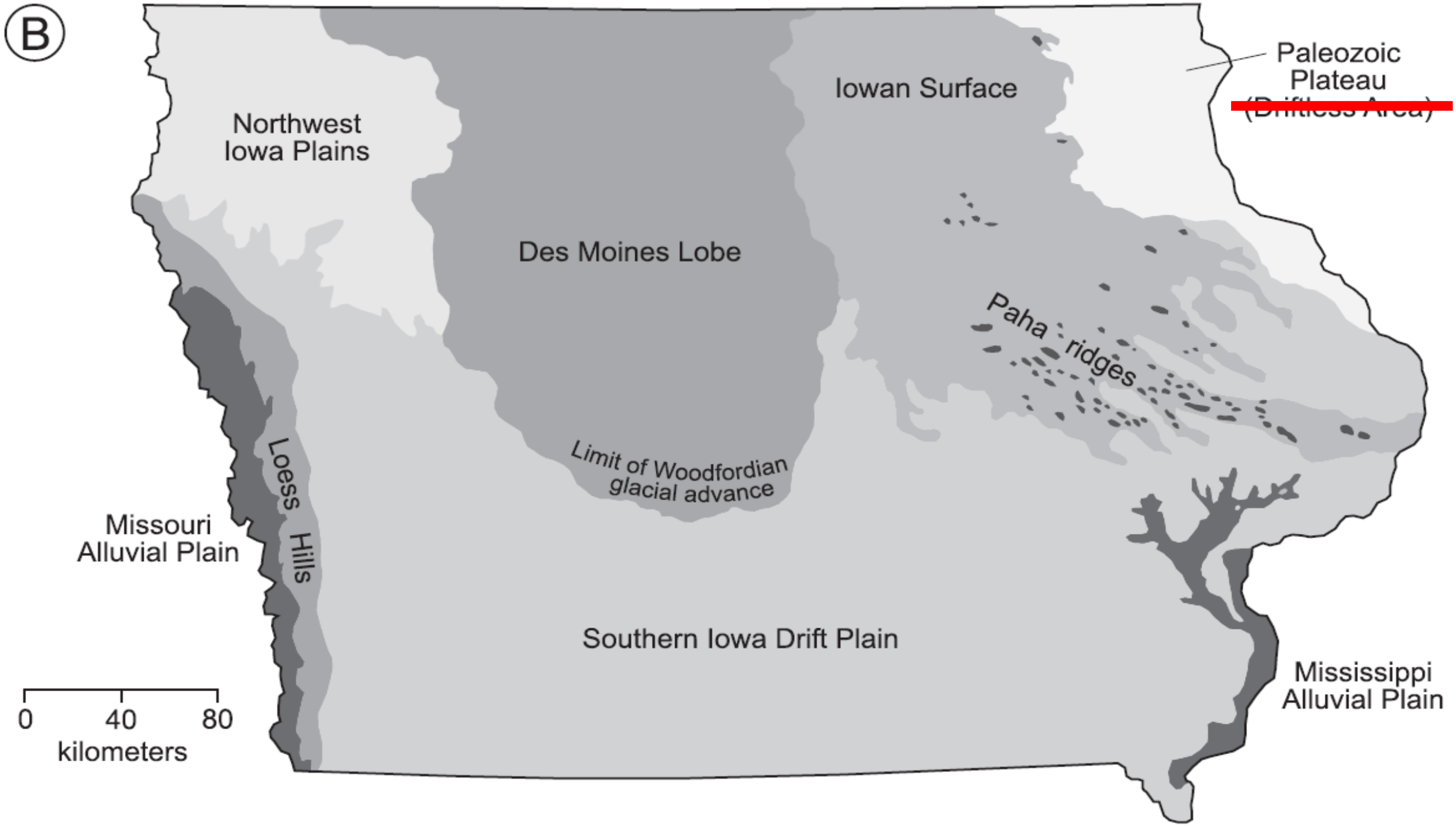

Webster
Nicollet
Clarion
Okoboji
Harps
Okoboji
Okoboji
Nicollet
Clarion
Clarion
Webster
ched glacial till
Canisteo
Clarion
Calcareous glacial till
Calcareous postglacial sediments
Leached postglacial sediments
Leached glacial till

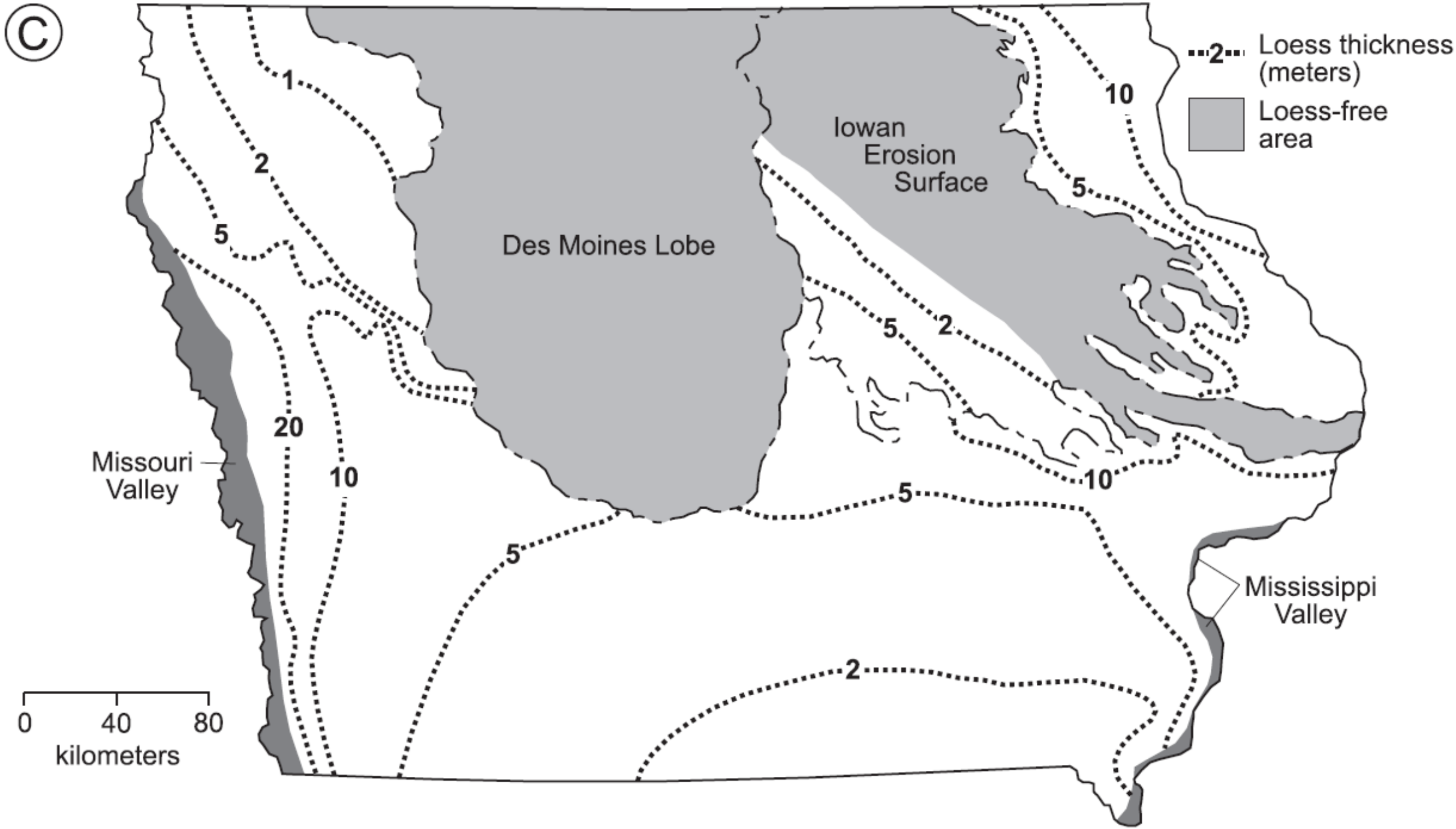

B
Relative Elevation (m)
10
8
6
4
2
0
Clarion
Nicollet
Canisteo
Zone of water table fluctuation
Oxidized till or reduced till
Unoxidized unleached till
Postglaci
sediment
0
10
20
30
40
50
60
70
80
90
100
Distance (m)


A
VPD
PD
SWP
WD
MWD/SWP
PD
WD
SWP
PD
Relative elevation (m)
310
305
300
295
0
100
200
300
400
500
600
700
Distance (m)
Oxidized, loam till
Unoxidized, loam till
Sandy and silty-sandy slope alluvium
Fine-textured slope alluvium
Water table May 15, 1992
Water table August 25, 1992
B
Hillslope Sediment
Relative elevation (m)
306
305
304
303
0
25
50
75
100
Distance (m)
C
Clay content (%)
Silt content (%)
Sand content (%)
Unoxidized till
Sandy slope alluvium
Silty-sandy slope alluvium
Fine-textured slope alluvium
Coarse sediment (Facies 2 and 3)
Fine Sediment (Facies 4)
Till (Facies 1)

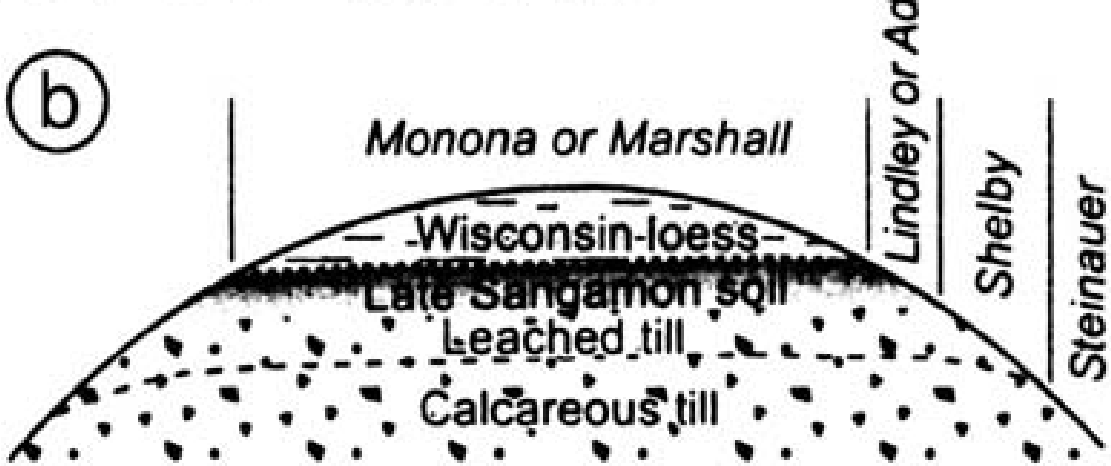
Robert Ruhe's work in Iowa

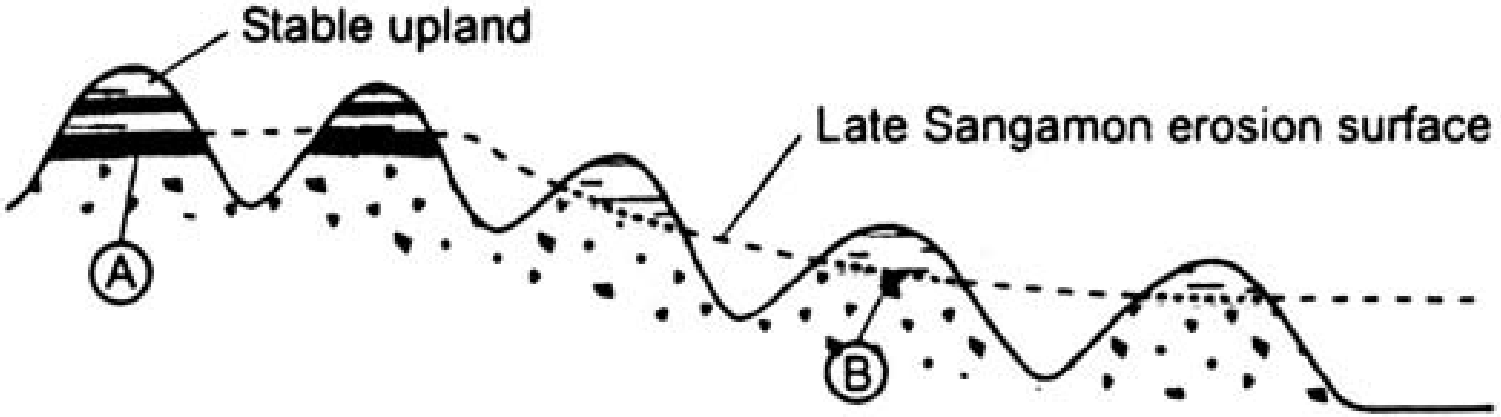



B
Northwest
Iowa Plains
Iowan Surface
Paleozoic
Plateau
(Driftless Area)
Des Moines Lobe
Paha ridges
Limit of Woodfordian
glacial advance
Loess Hills
Missouri
Alluvial Plain
Southern Iowa Drift Plain
Mississippi
Alluvial Plain
0
40
80
kilometers


C
Loess thickness (meters)
Loess-free area
Iowan Erosion Surface
Des Moines Lobe
Missouri Valley
Mississippi Valley
1
2
5
10
20
0
40
80
kilometers

Near loess source areas

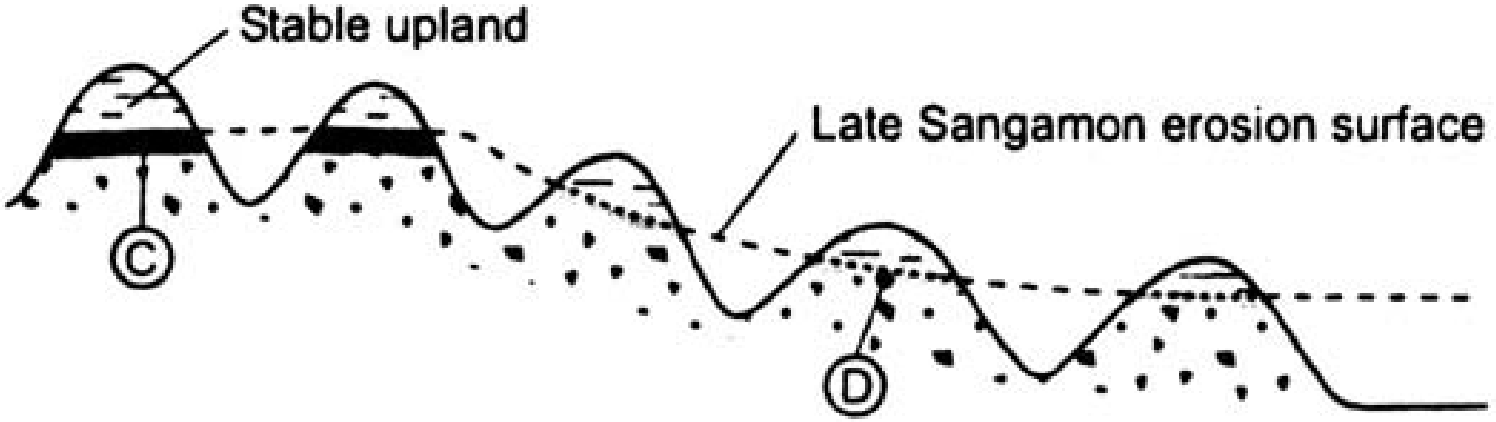




Geomorphic sequence

- Yarmouth soil formation on stable landscape
- Deposition of Loveland loess
- Sangamon soil formation on stable landscape
- Late Sangamon pedimentation and soil genesis
- Early Wisconsin dissection, loess deposition and soil genesis
- Late Wisconsin and Holocene slope beveling and soil genesis

Far from loess source areas



Geomorphic sequence

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- Early Wisconsin dissection, loess deposition and soil genesis
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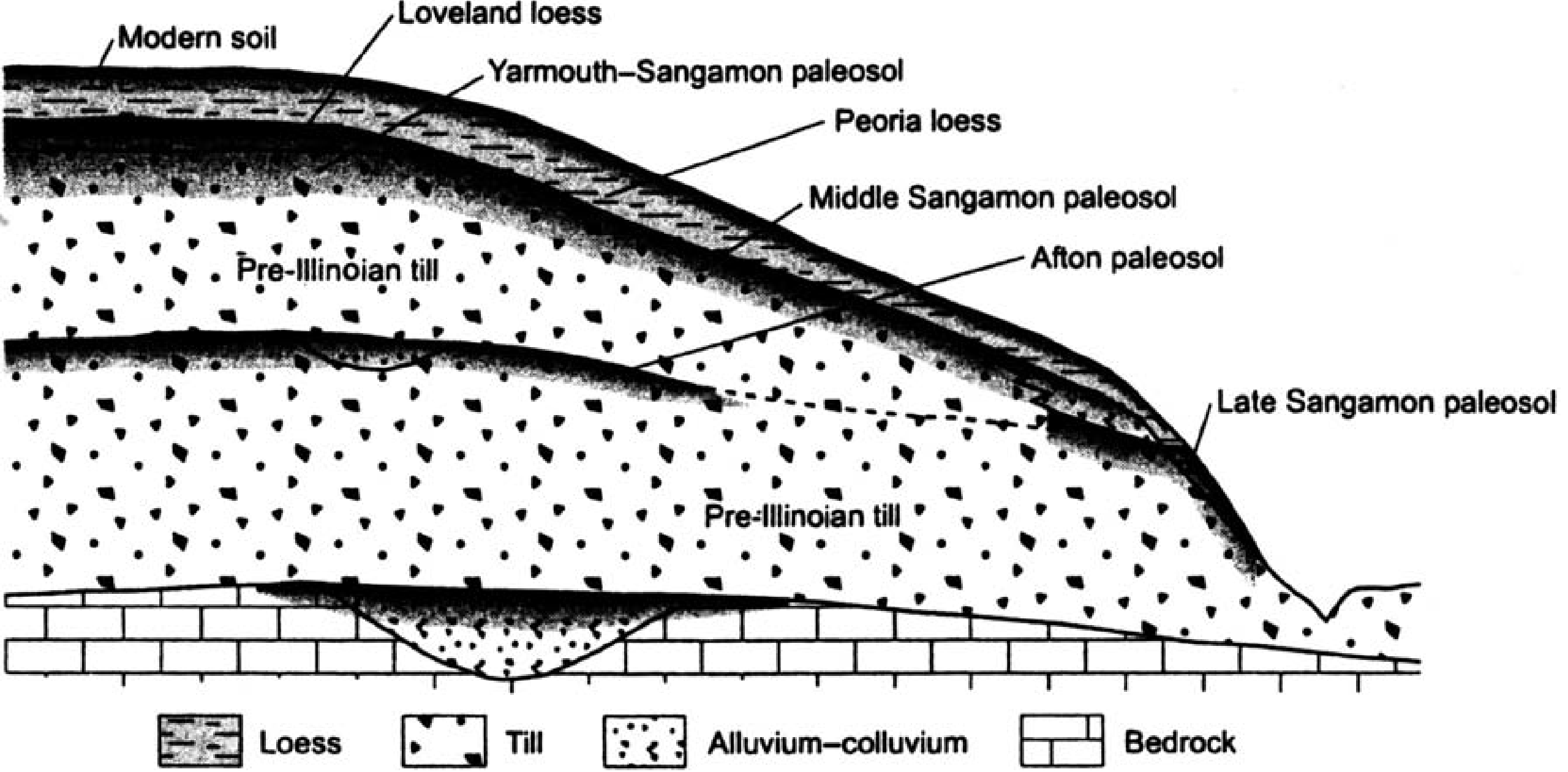
Modern soil
Loveland loess
Yarmouth–Sangamon paleosol
Peoria loess
Middle Sangamon paleosol
Afton paleosol
Late Sangamon paleosol
Pre-Illinoian till
Pre-Illinoian till
Loess
Till
Alluvium–colluvium
Bedrock