

# Continental environments

Fluvial systems

# Terrestrial Depositional Systems

- Fluvial-alluvial fan
- Glacial
- Eolian
- Lacustrine
- Playa

# Fluvial systems

- Sediments and landforms
  - Rivers
  - Streams
  - Associated gravity-flow processes
- Modern environments
  - Various climatic conditions
  - Various continental settings
    - Ranging from deserts to humid and glacial regions

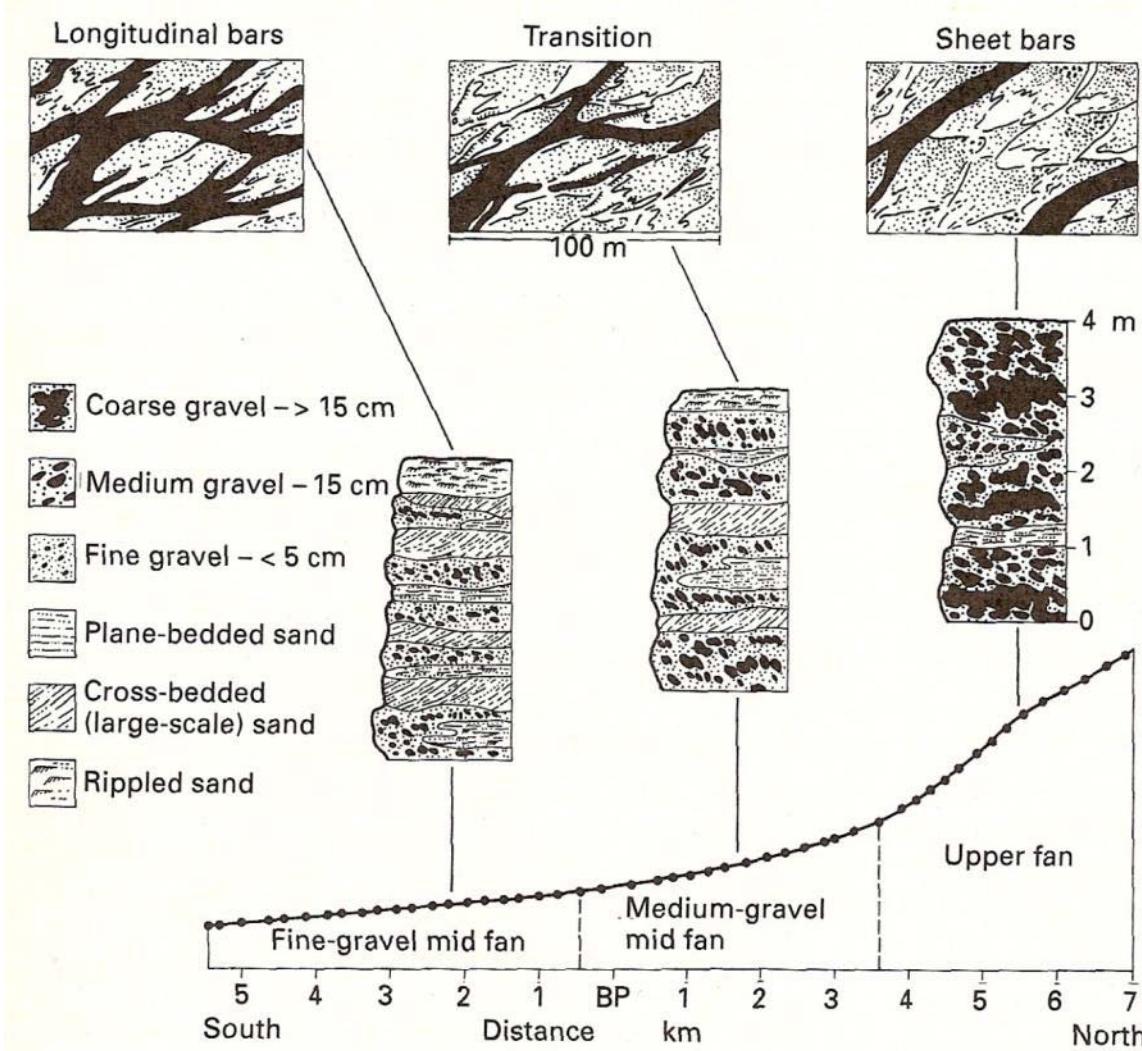
# Alluvial fans



# Alluvial fans

- Coned-shape to arcuate in plan view
- Network of branching distributary channels
- Convex-up xs-sectional profile; Concave-up long profile
- Modern alluvial fans are particularly common in areas of...
  - high relief; at the base of a mountain range
- Slope and size ...
  - Fairly steep depositional slopes
    - Greatest at the fan apex
- Abundant supply of sediment is available
- Sediments are usually ...
  - Poorly-sorted and abundant gravel-size (w muddy matrix)
  - Show downfan ↓ in grain size and bed thickness
  - Show downfan ↑ in sediment sorting

# Changes along a fan

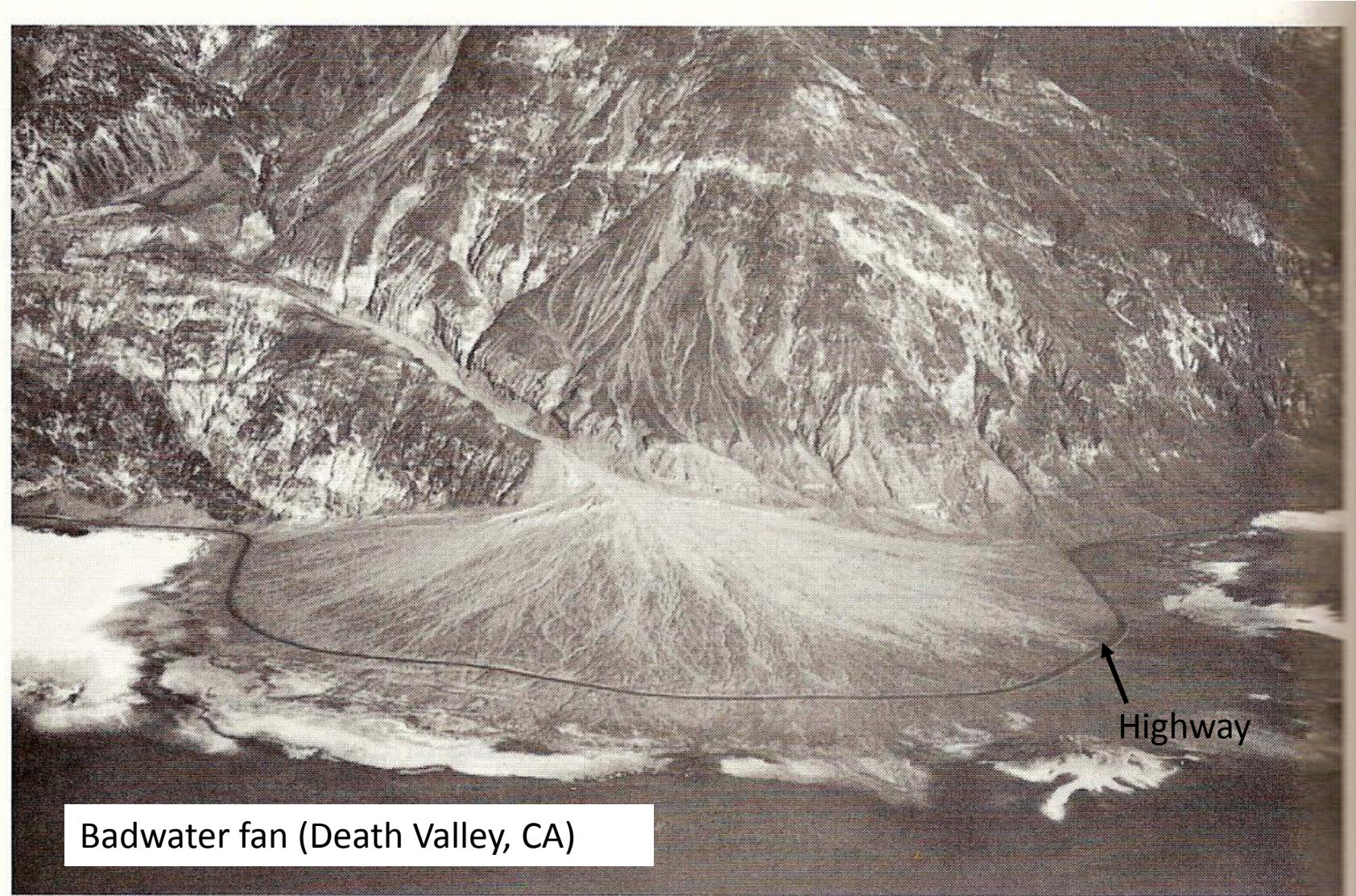


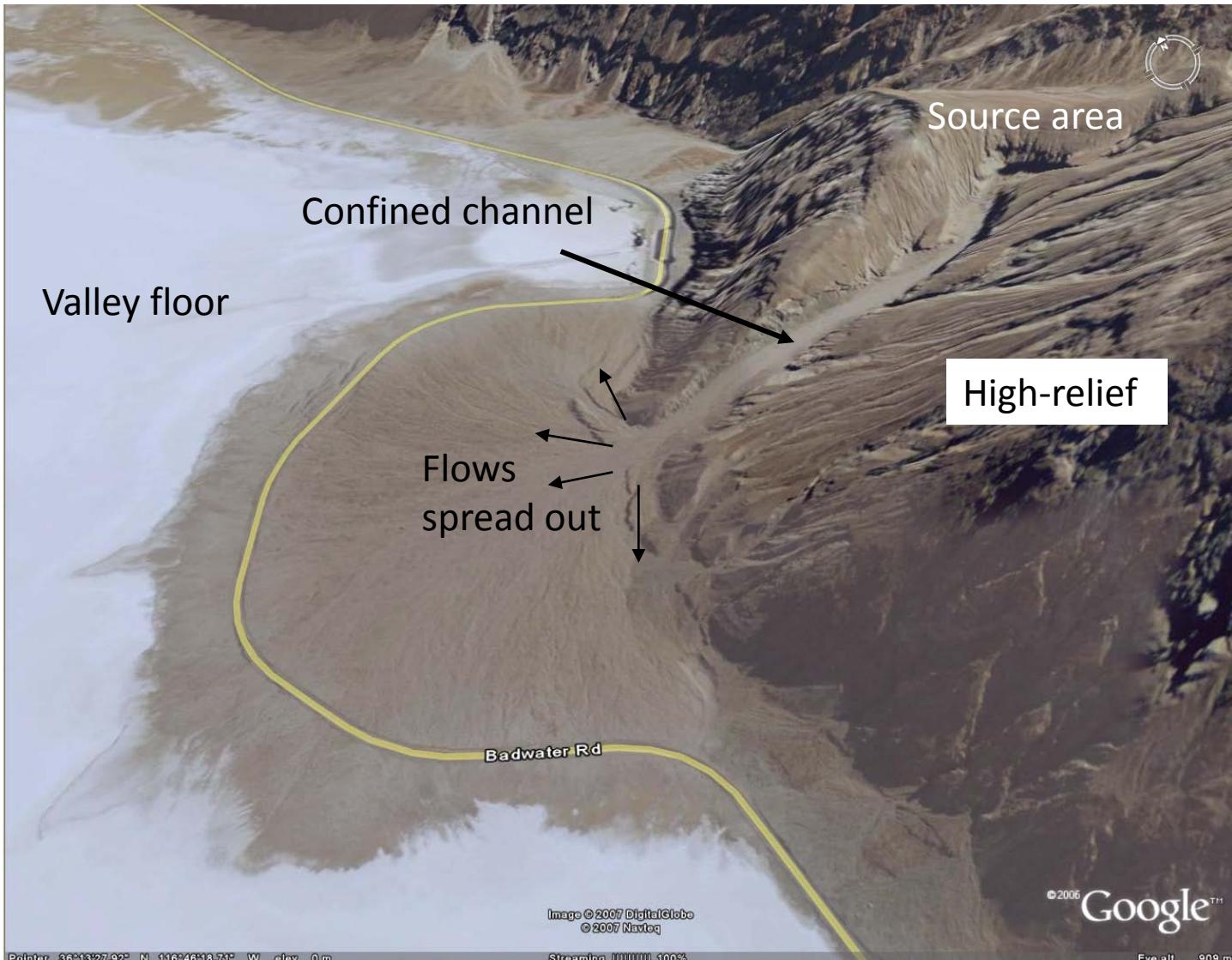
Fluvial braided outwash fan (Alaska)

# Alluvial fans

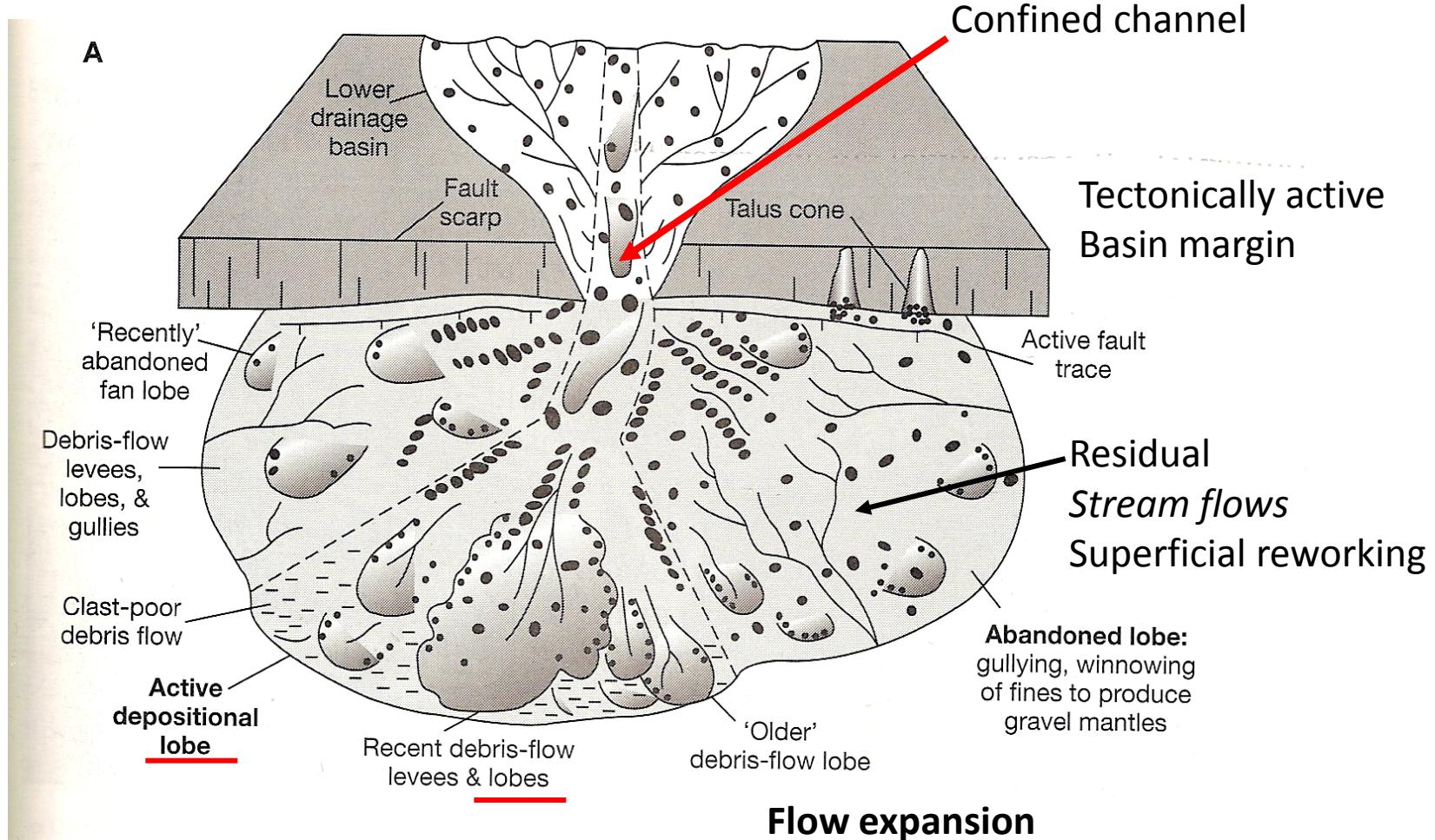
- Sparse vegetated arid, semiarid regions
  - Sediment transport...
    - Rare, irregular (catastrophic)
      - Sudden cloudburst
    - Fans may pass downslope into desert-floor env. with internal drainage (e.g. Playa lakes)
- Humid areas
  - Where rainfall is intense
  - May merge downslope with
    - alluvial or deltaic plains
    - Beaches or tidal flats
    - May even build into lakes or the ocean (fan deltas)

# Debris-flow dominated fan



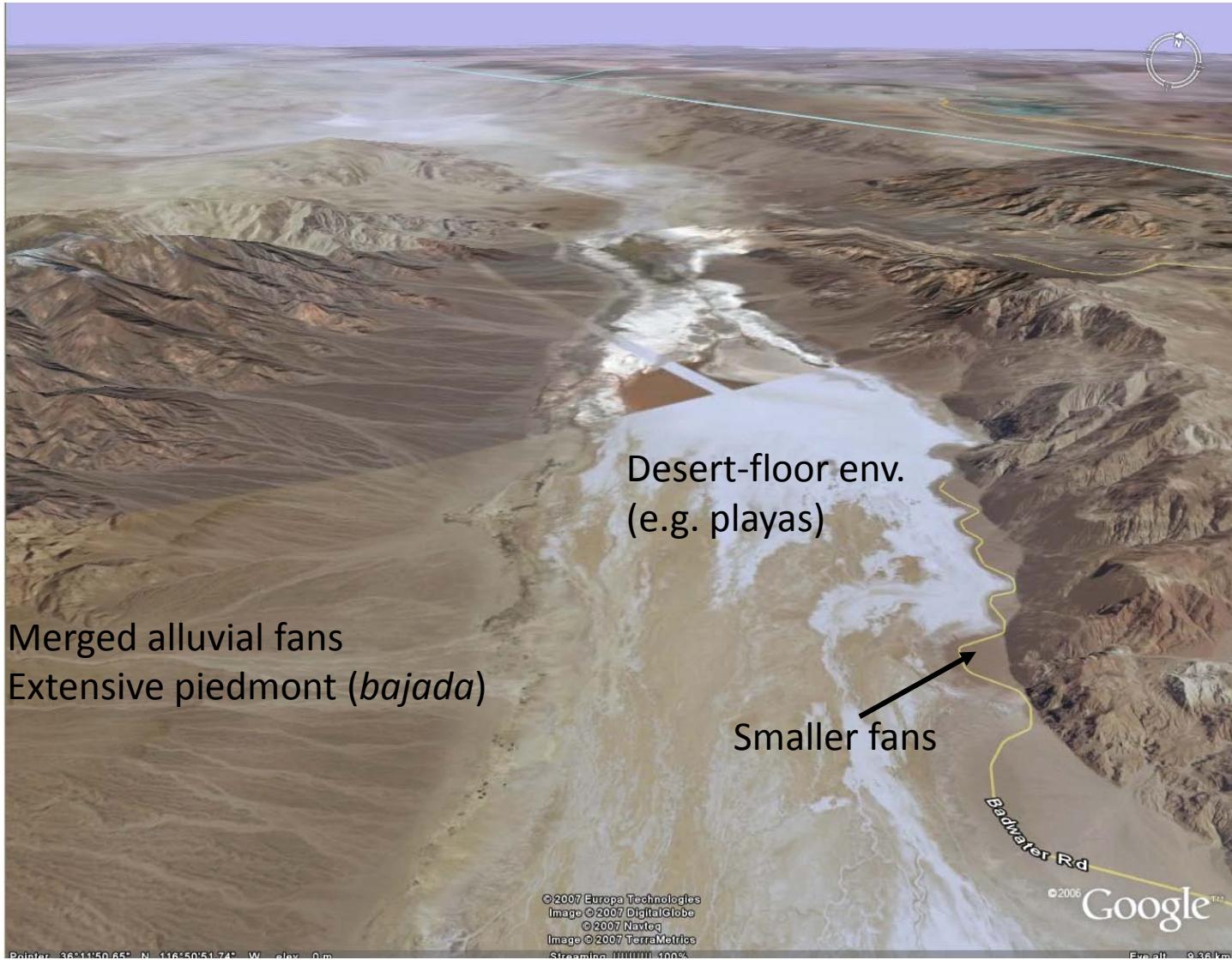


# Debris-flow-dominated fans



Typical of semi-arid/arid settings

# Death Valley fan systems





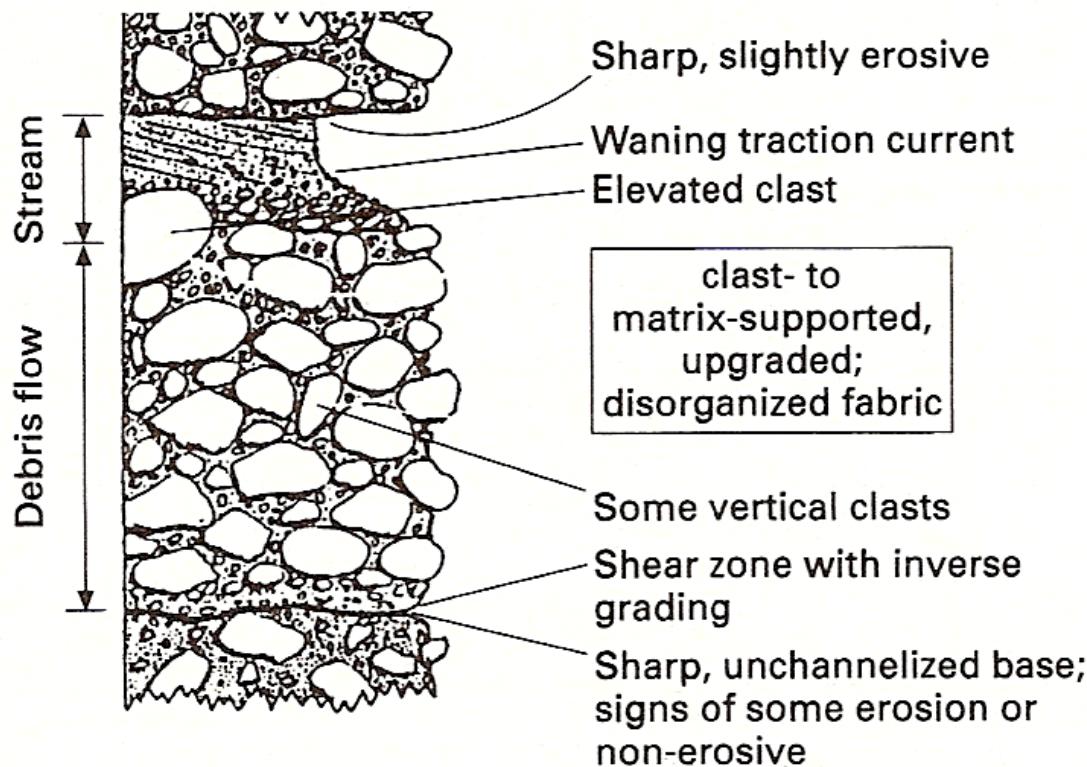
Peru, Martin Ross, 2014



Lima, Peru, 2012

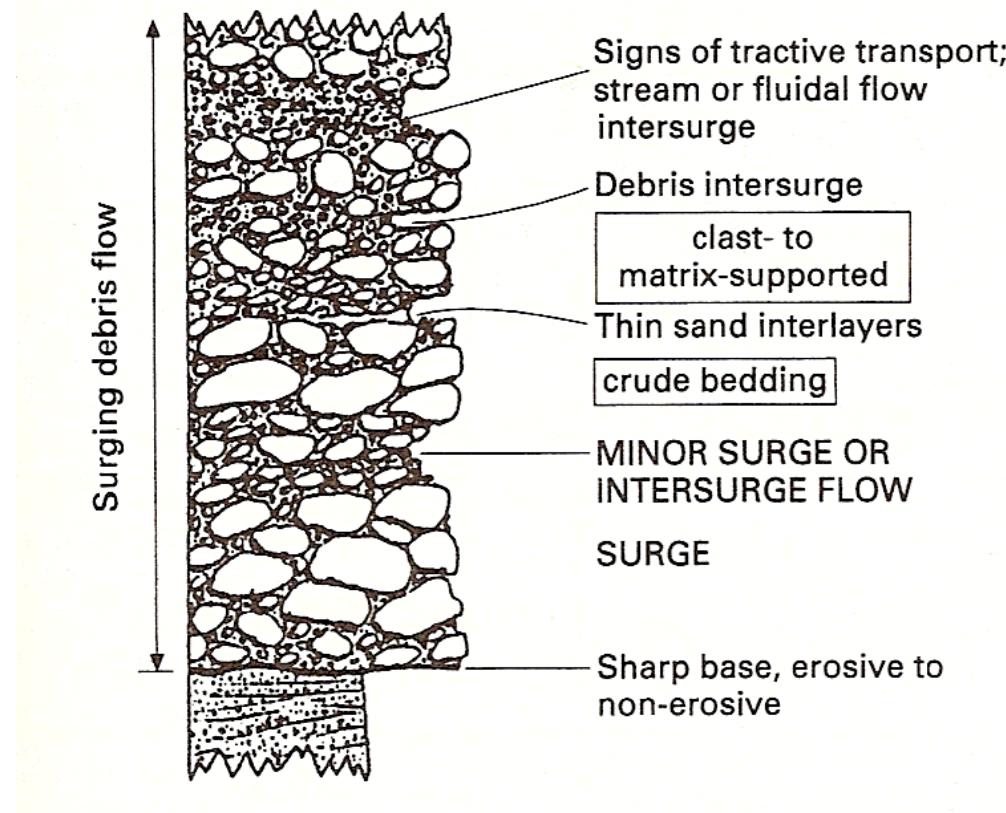
# Debris-flow alluvial fans – Typical sed. successions

Small-scale successions



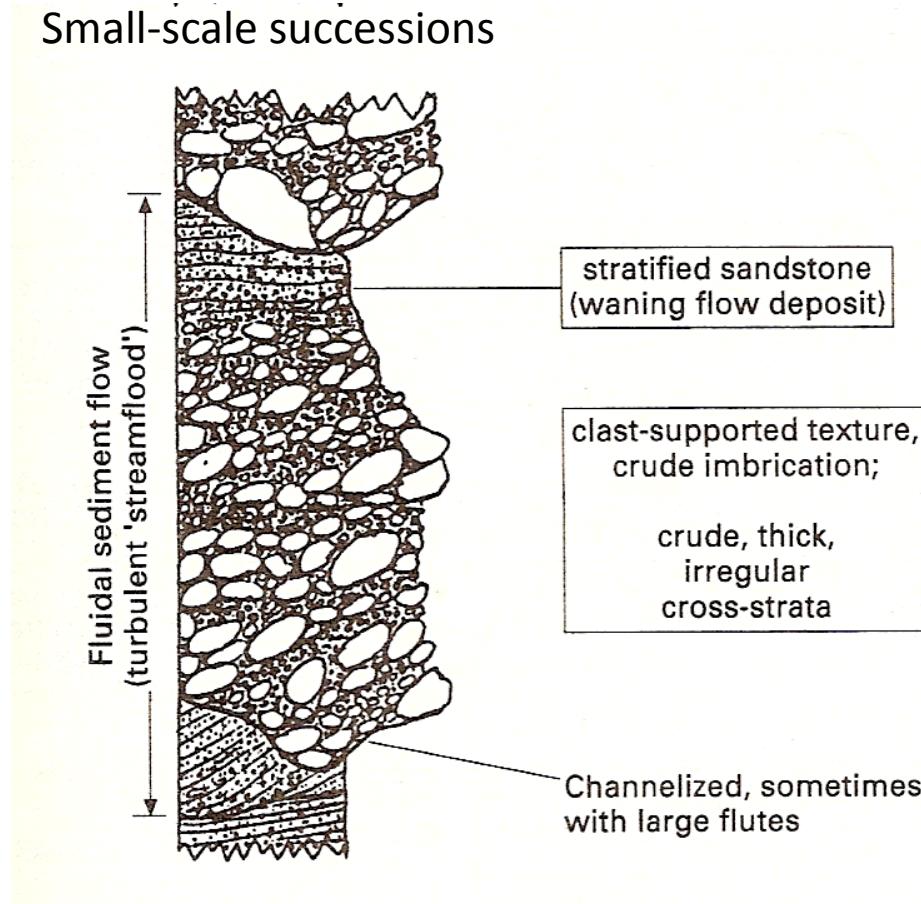
# Debris-flow alluvial fans – Typical sed. successions

Small-scale successions



# Debris-flow alluvial fans – Typical sed. successions

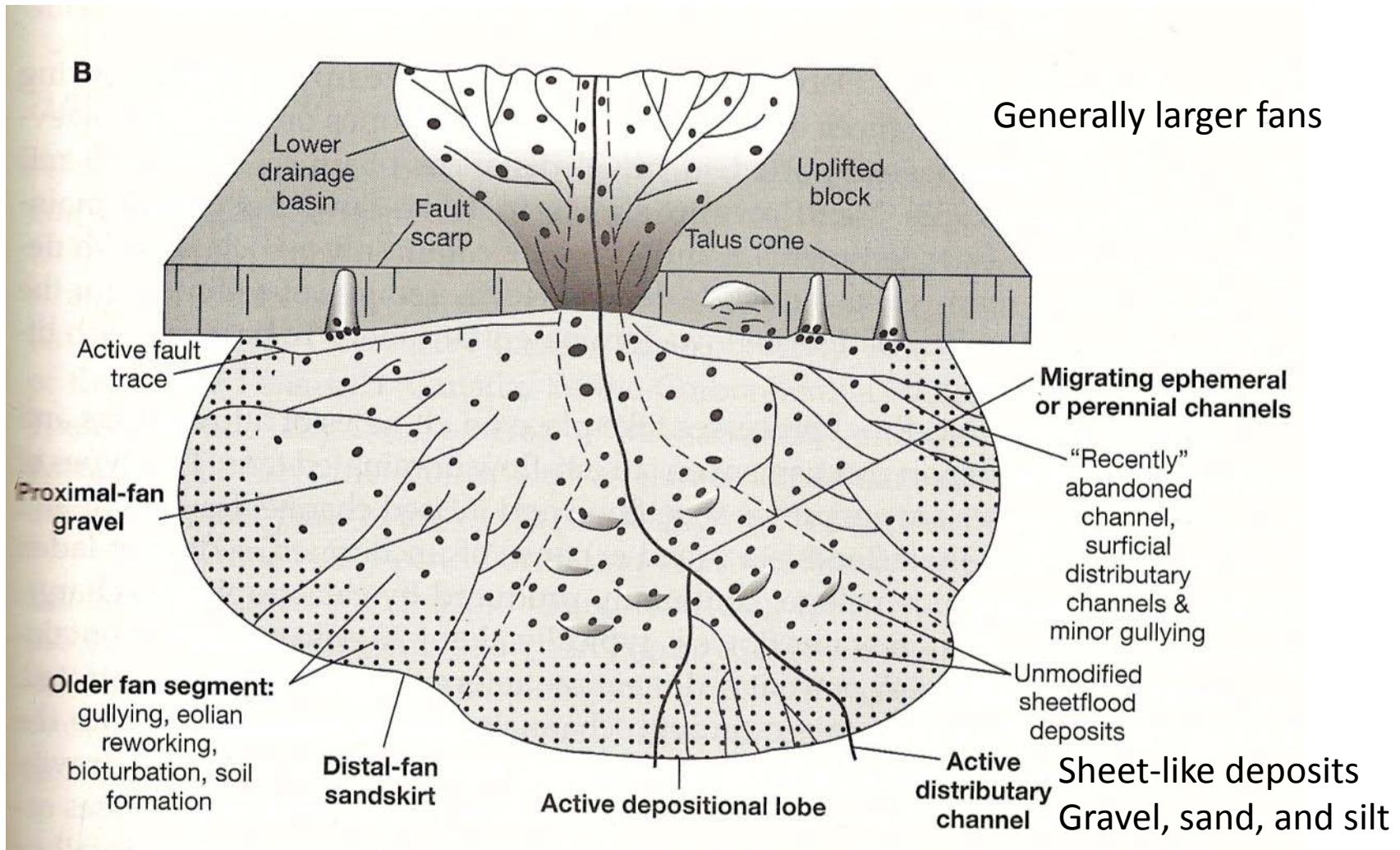
## Small-scale successions



# Conglomeratic alluvial facies

Architectural element	Bedding and sedimentary structures		Texture and fabric	Thickness (m)
Sheets of massive conglomerates	Massive imbricated clasts		Clast sizes: 5–30 cm Rounded-subrounded clasts. Low sandy matrix proportion	0.5–1.5
	Crude flat-bedding imbricated clasts			
	Convex upward tops imbricated clasts			
Units of tabular cross-stratified conglomerates	Tabular cross-stratified		Clast sizes: 3–20 cm Moderately sorted sandy matrix	0.8–1.0
Units of lateral accretion conglomerates	Lateral accretion units with sandstone drapes imbricated clasts			
	Lateral and vertical accretionary surfaces			
Channel-fill conglomerates	Massive		Clast sizes: 3–20 cm Rounded-subrounded clasts. Moderately sorted. High sandy matrix proportion	0.6–1.8
	Complex-fill stratified			
	Transverse fill cross-stratification			
	Multi-storey fill trough cross-stratification			
Units of coarse-medium sandstone	Flat or low angle cross-stratification. Rare trough cross-stratification		Coarse-medium grain size	0–5

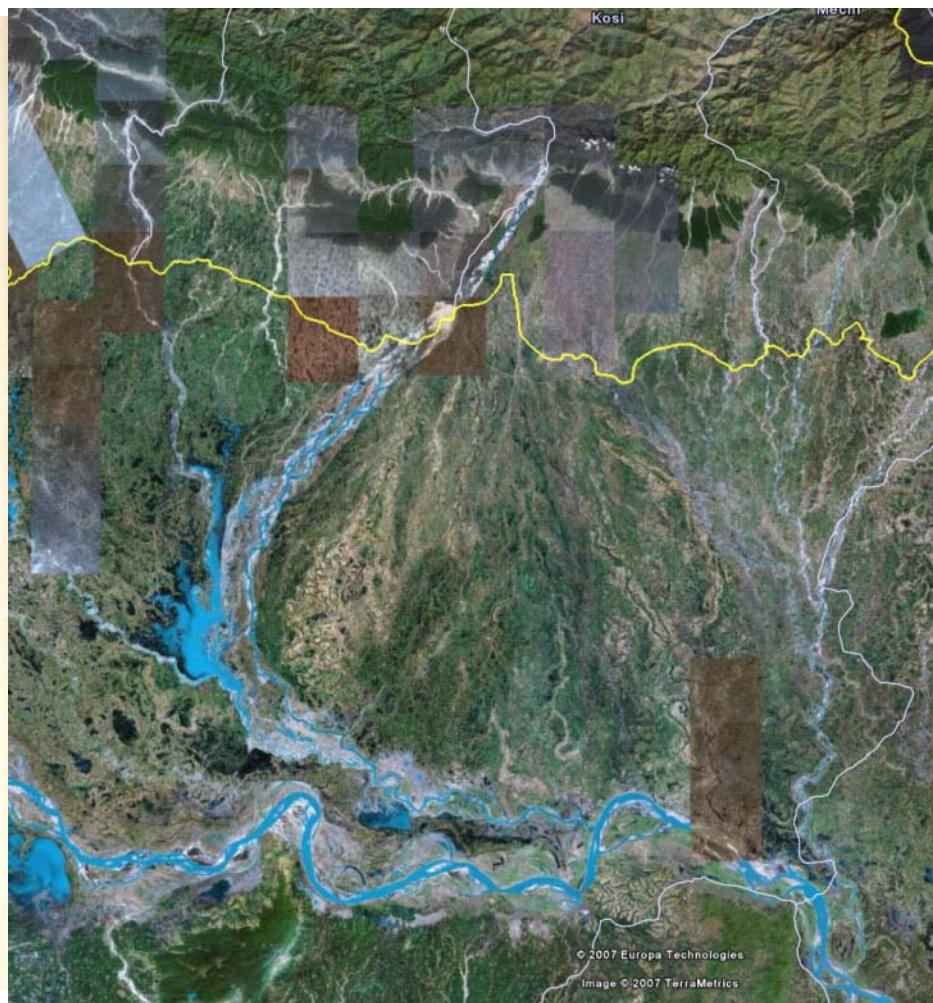
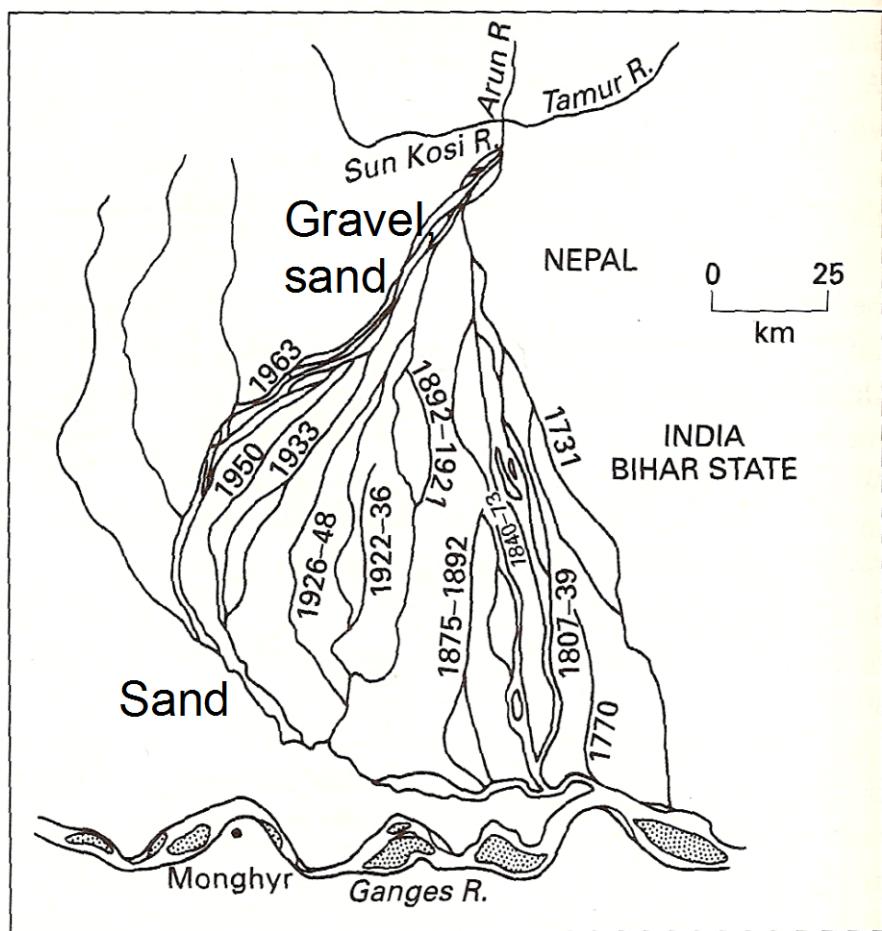
# Stream-flow dominated fans



Sheetflood: unconfined, sediment-laden (20%) runoff water moving downslope

Between about 20-45 % = hyperconcentrated flow or 'fluidal' flow (mudflow)

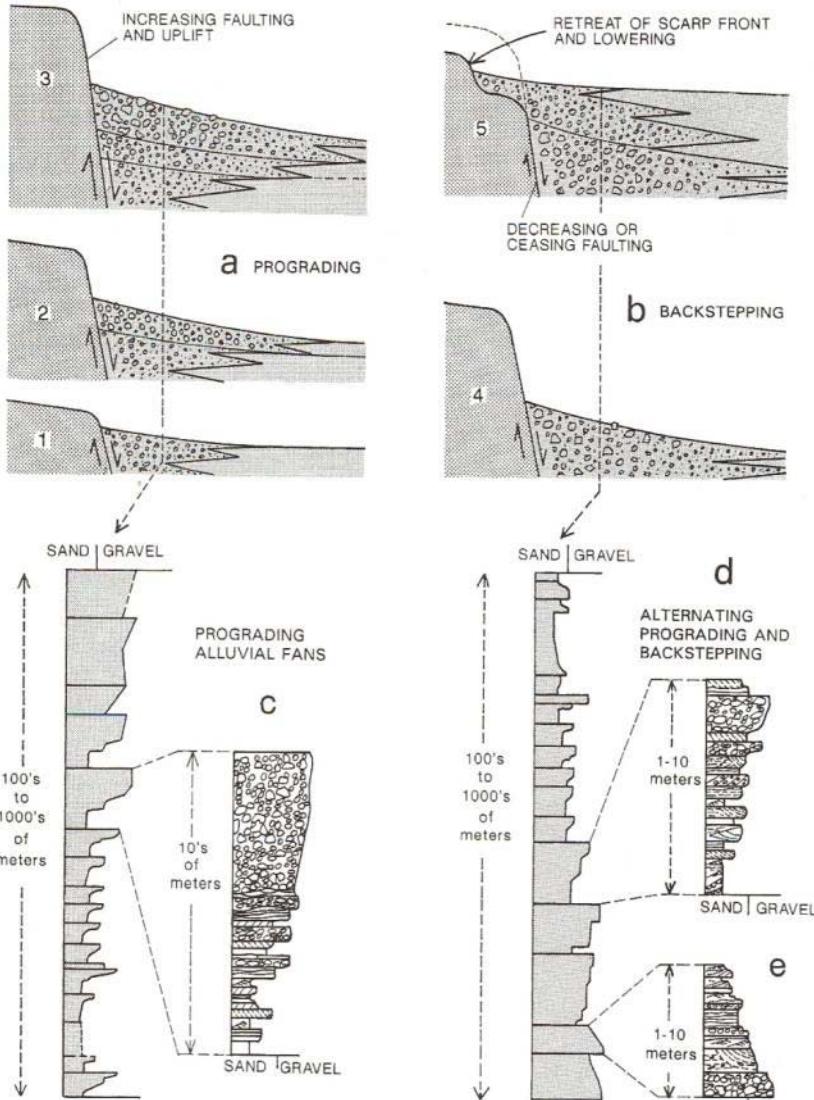
# Kosi megafan



# Alluvial fan successions

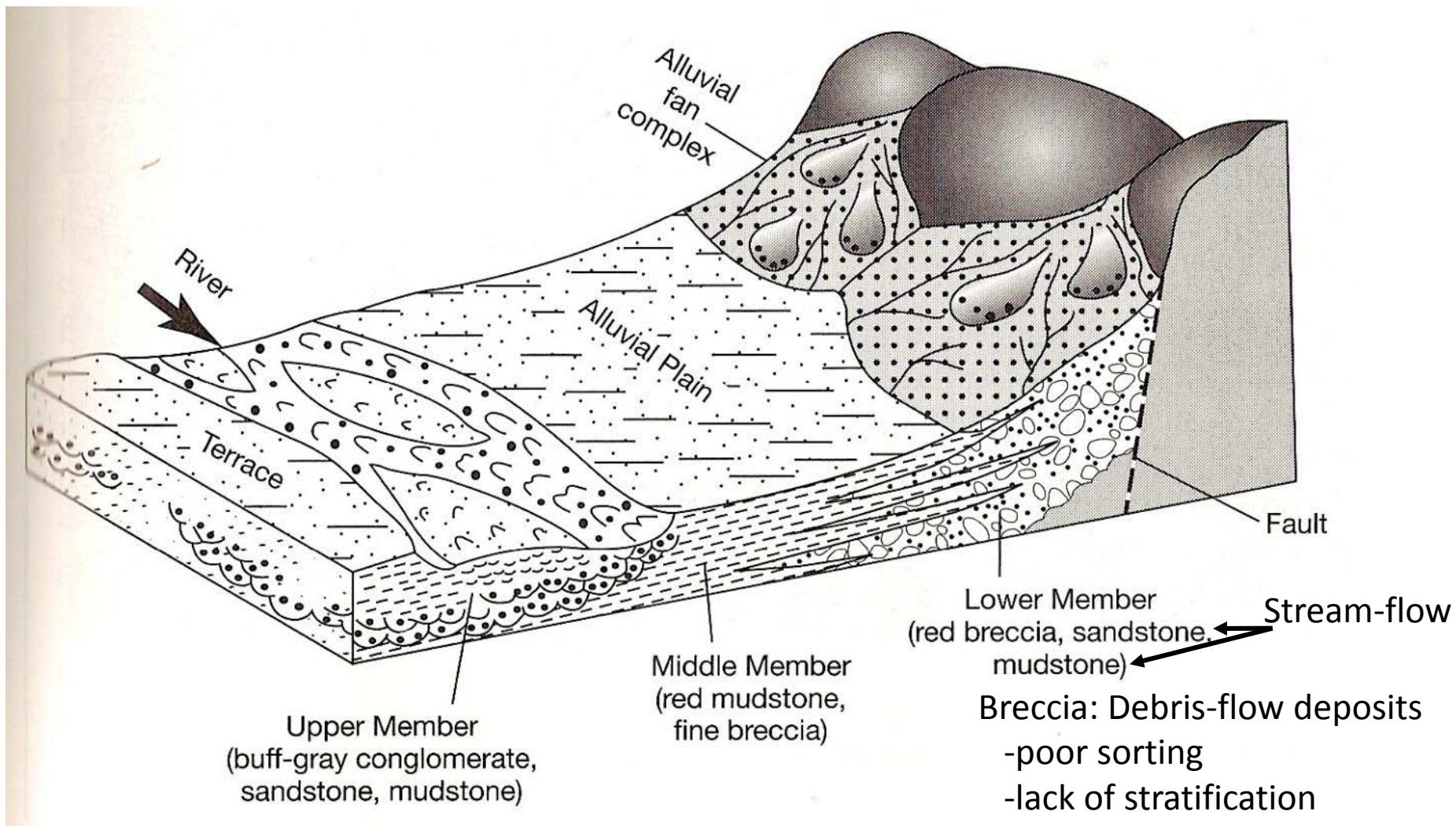
- Many beds may display no obvious vertical grain-size trends
- Others may become finer or coarser upward
- **Thickening- and coarsening-upward** successions
  - Active fan progradation
- Thinning- and fining-upward successions
  - Inactivity or fan retreat
- Successions may be  $>> 100$  m in thickness
- Grade laterally into
  - Fluvial-plain seds.
  - Eolian seds.
  - Playa-lake seds.

# Idealized vertical successions



- a) Large-scale coarsening-upward sequence due to continuous faulting and fan progradation (Stages 1-3)
- b) Large-scale fining-upward sequence caused by retreat of scarp front and lowering of relief in source area (Stages 4, 5)
- c, d) Small-scale coarsening-upward cycles due to prograding of individual fan lobes
- e) Small-scale fining-upward cycle with channelized base
  - Bar processes
  - Filling of braided channel

# Schematic depositional model



Cannes de Roche Formation (Carboniferous; Gaspé Peninsula)