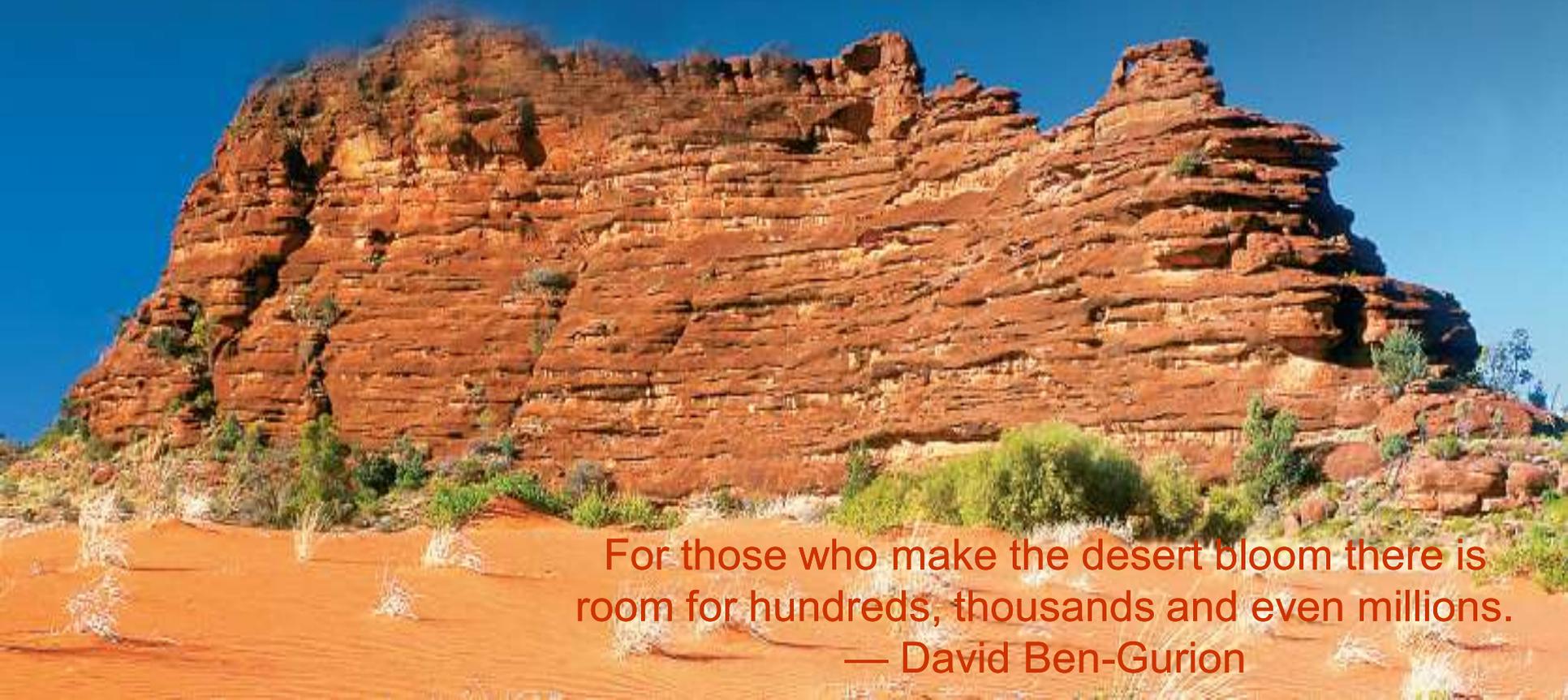


The Topography of Arid Lands



For those who make the desert bloom there is
room for hundreds, thousands and even millions.
— David Ben-Gurion



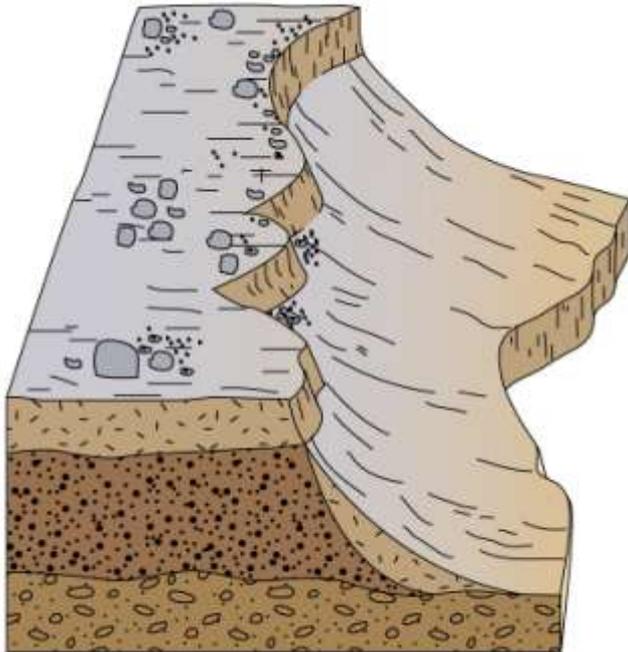
The Topography of Arid Lands

- ❖ A Specialized Environment
- ❖ Running Water in Waterless Regions
- ❖ Characteristic Desert Surfaces — Ergs, Regs and Hamadas
- ❖ The Work of the Wind
- ❖ Two Characteristic Desert Landform Assemblages in US Deserts

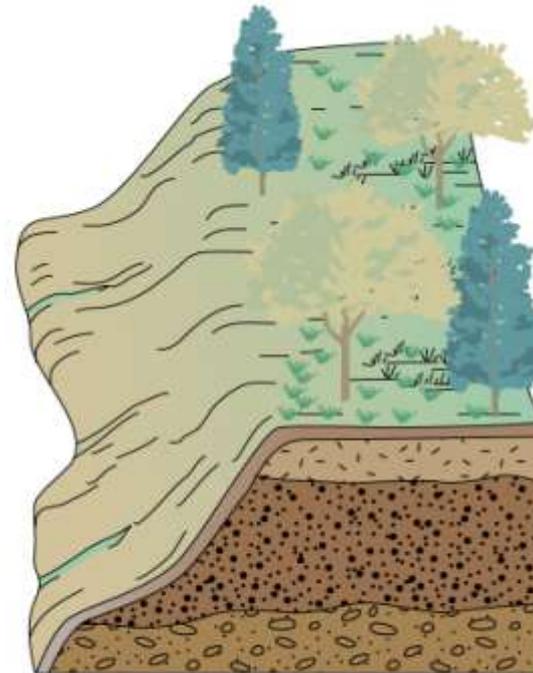


❖ A Specialized Environment

- Special Conditions in Deserts
 - Weathering
 - Soil and regolith



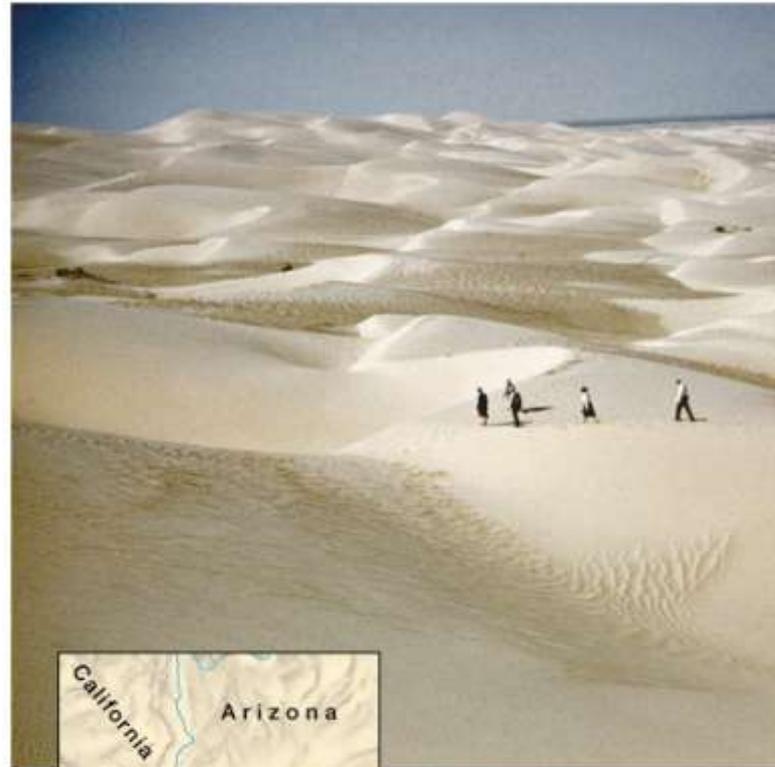
Dry climate



Moist climate



- Soil Creep
- Impermeable surface
- Sand





- Rainfall
- Fluvial deposition
- Vegetation





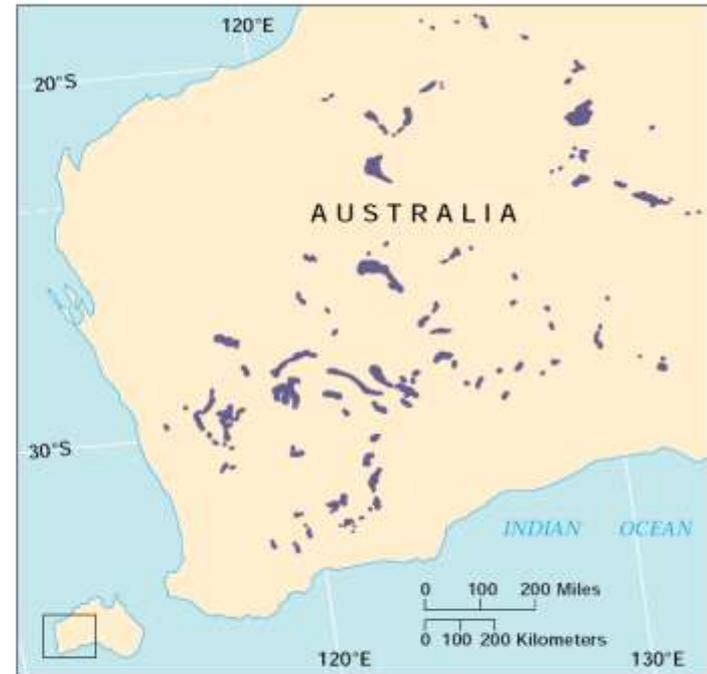
❖ Running Water in Waterless Regions

- Significance of Running Water
 - Aeolian processes less significant
 - Sparse vegetation
 - Overland flow erosion
- Surface Water in Deserts
 - Exotic Streams





- Ephemeral Streams
- Desert Lakes
 - Playas
 - Playa lakes

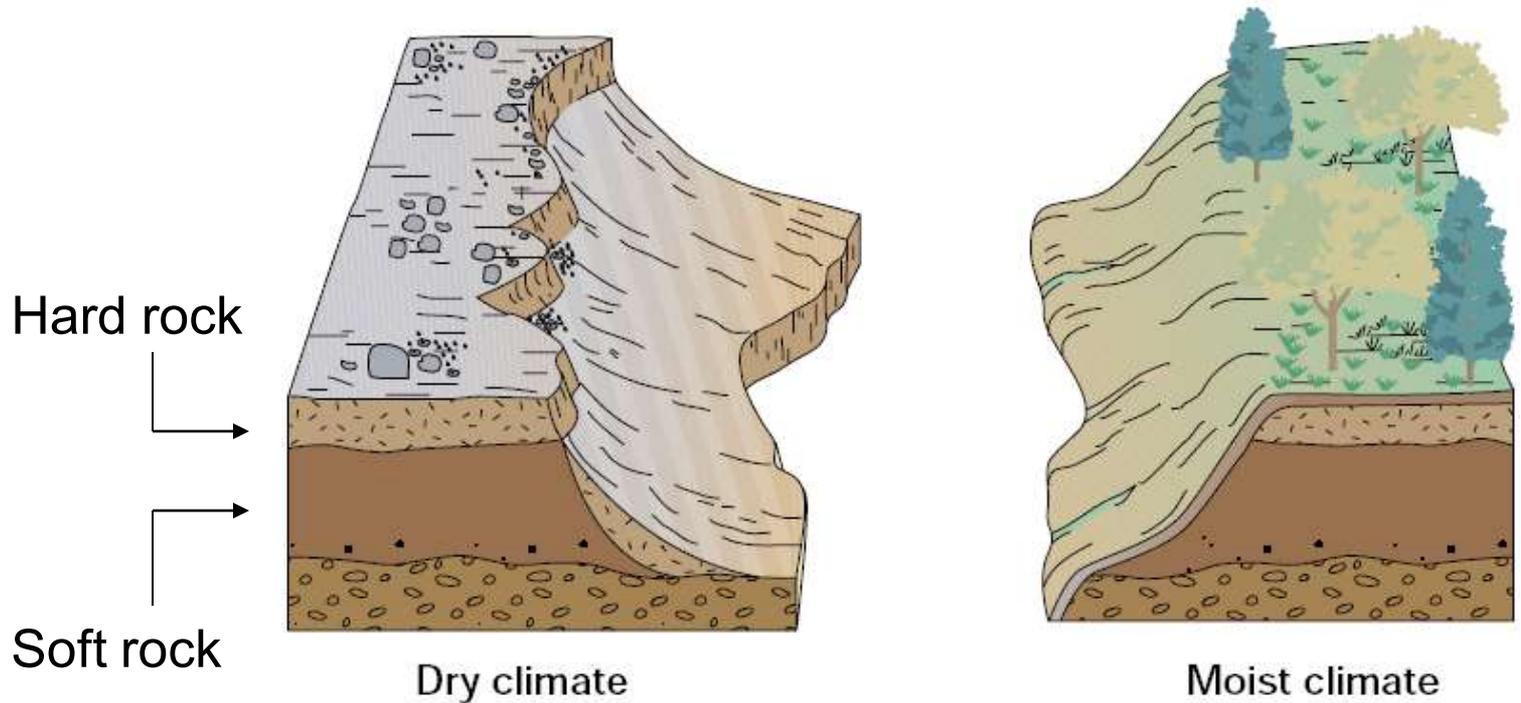




Dry lake bed (playa) in central Nevada



- Fluvial Erosion in Arid Lands
 - Differential Erosion
 - Hardness of rock layers





The effects of differential erosion on the Red Cliffs near Gateway in Western Colorado

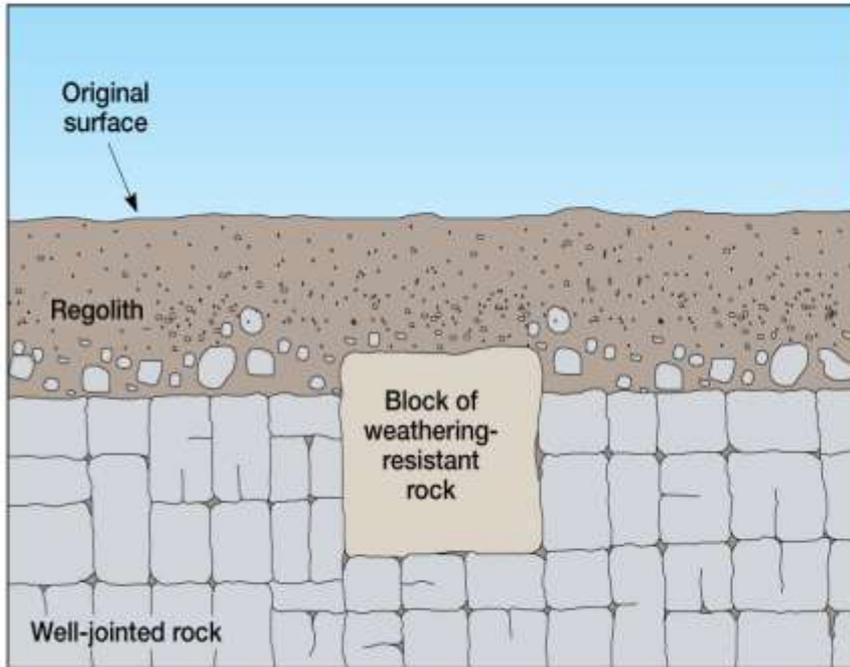


– Residual Erosional Surfaces

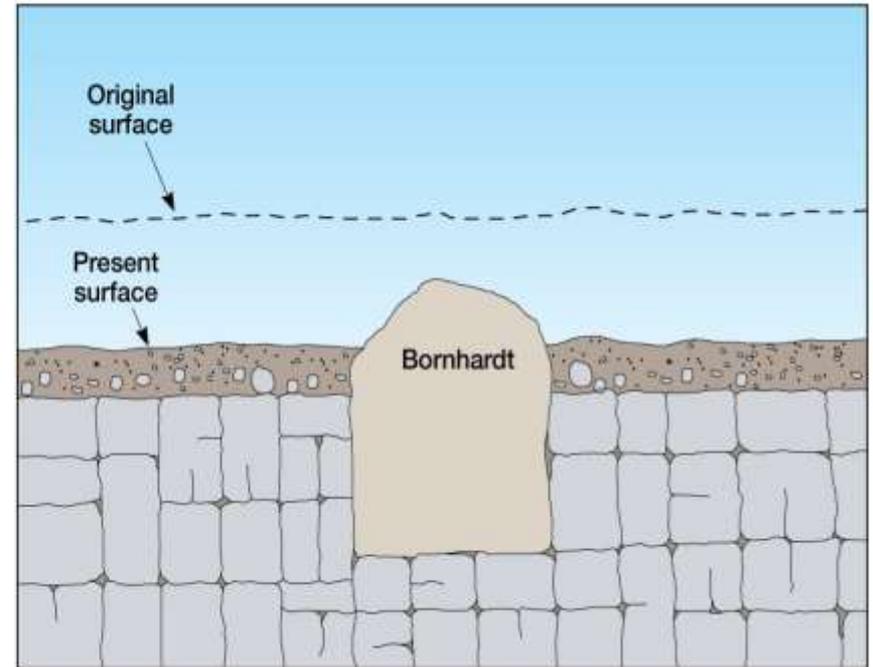
- Inselbergs (“island mountains”)
 - Bornhardts



Kata Tjuta (the Olgas) in the desert of central Australia



(a)

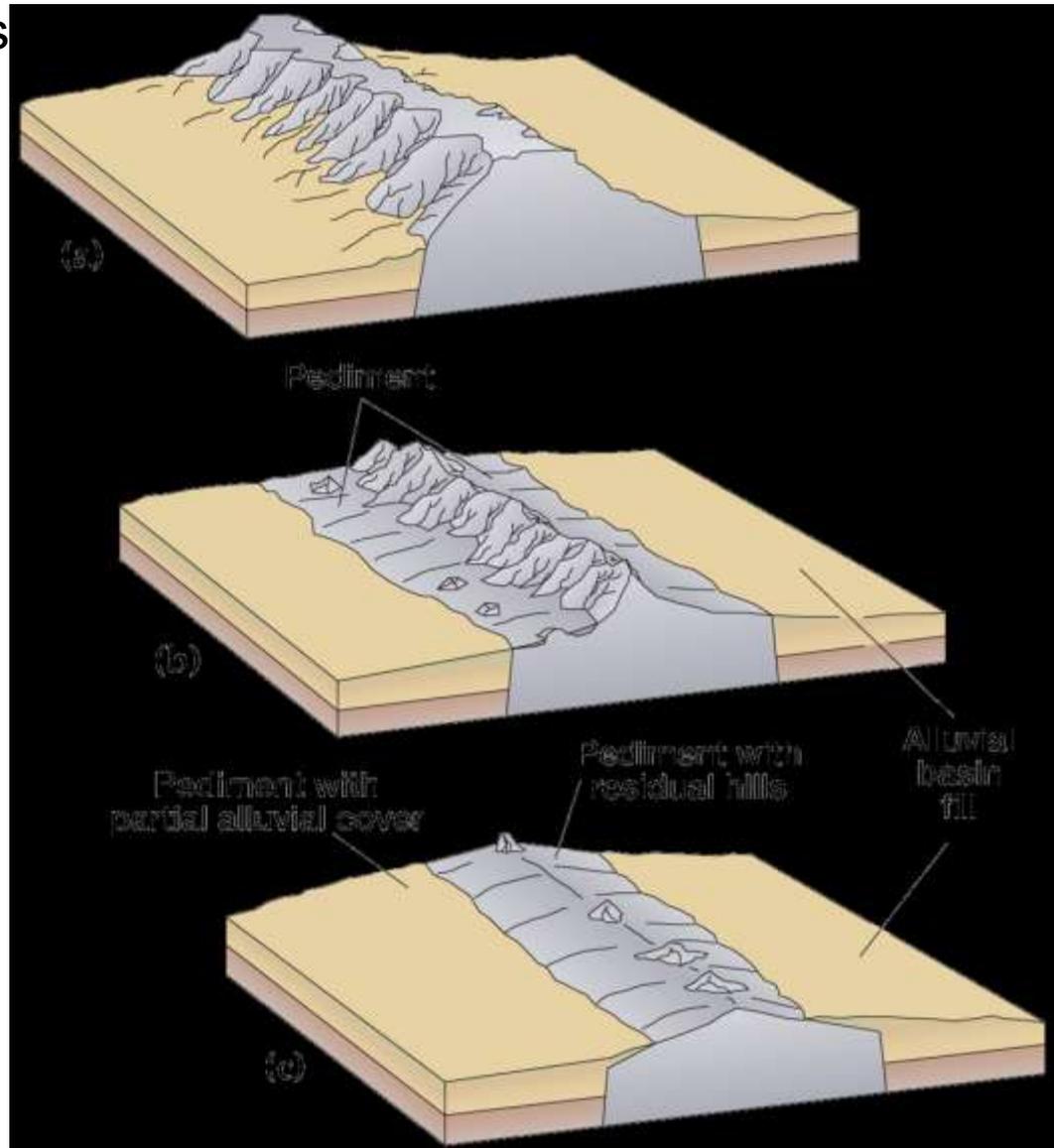


(b)

The development of a bornhardt



- Pediments





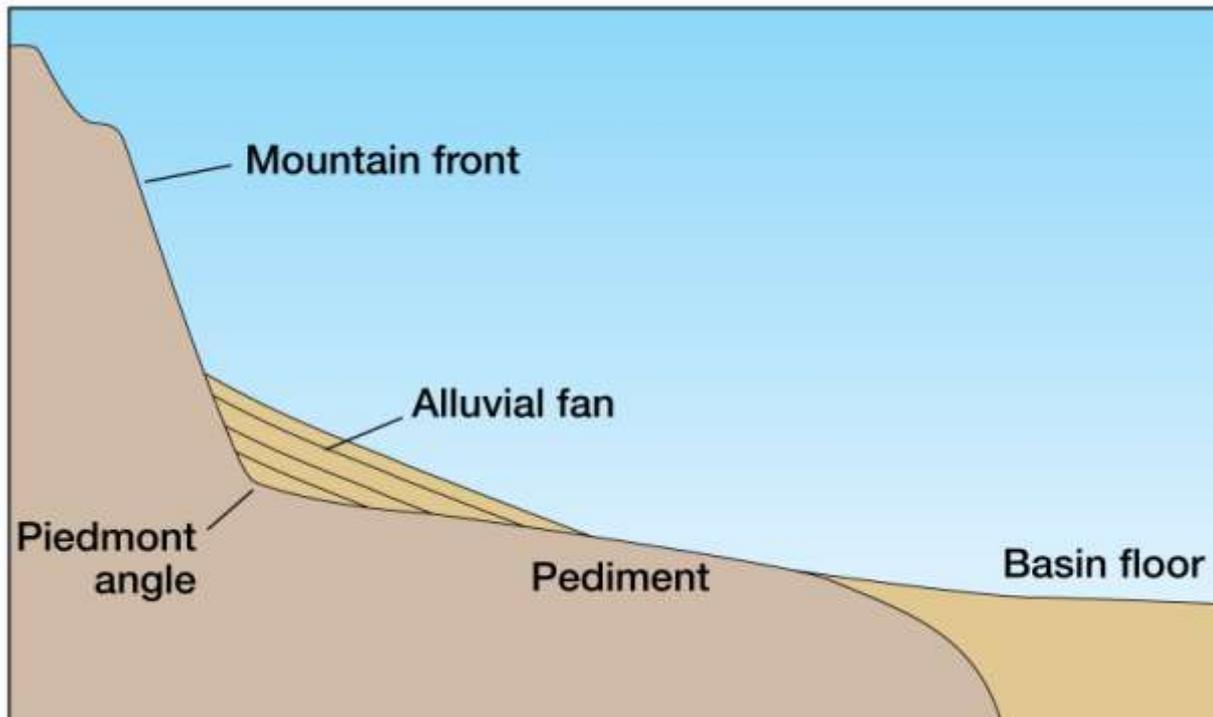
– Desert Stream Channels



Mojave Desert, near Baker, CA



- Fluvial Deposition in Arid Lands
 - Deposits in ephemeral stream channels
 - Piedmont area
 - Talus accumulations
 - Alluvial fans

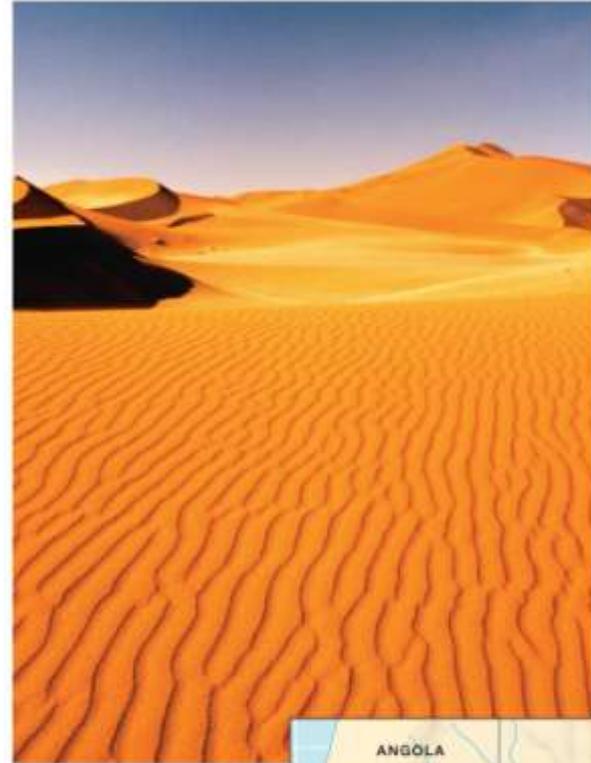


Idealized cross section of a desert piedmont zone.



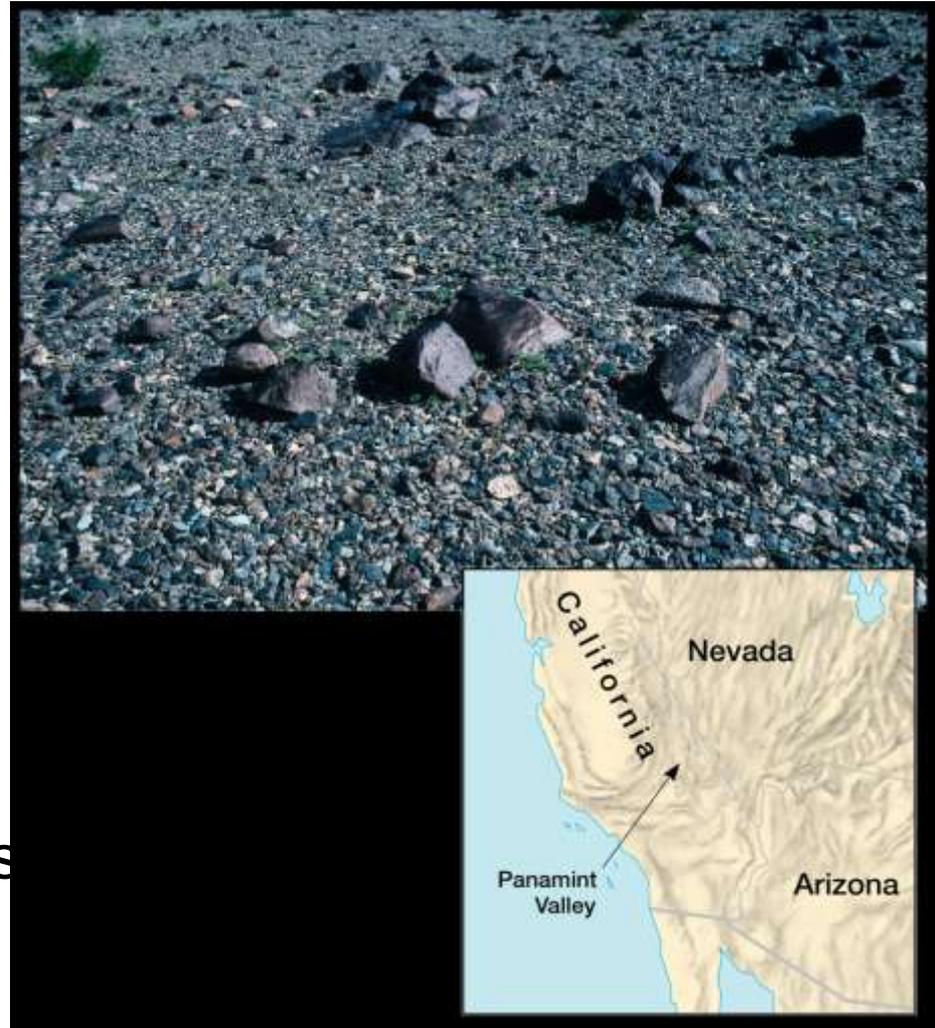
❖ **Characteristic Desert Surfaces—Ergs, Regs and Hamadas**

- Erg—A Sea of Sand
 - ‘Erg’ – Arabic for sand





- Reg—Stony Desert
 - ‘Reg’ – Arabic for “stone”
 - Desert pavement
 - Gibber plain
- Hamada—Barren Bedrock
 - ‘Hamada’ – Arabic for “rock”
 - Exposed bedrock
 - Cemented sediments





❖ The Work of Wind

- Aeolian Erosion
 - Deflation
 - Abrasion

Sand-blasted
rock or ventifact



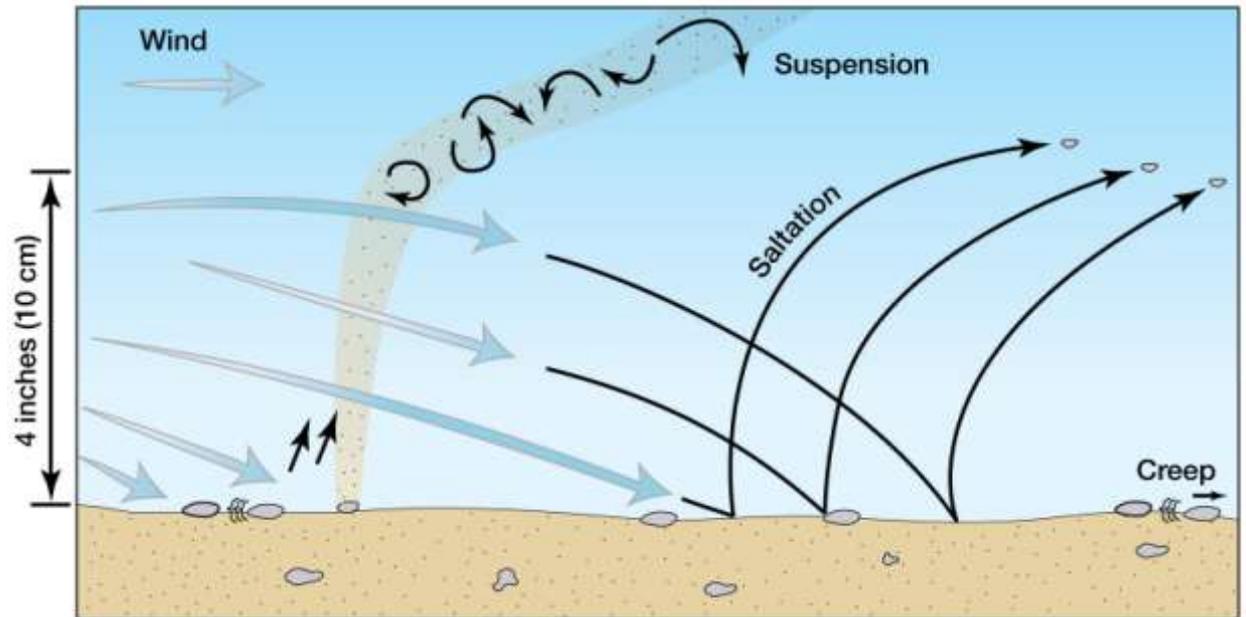
Wind deflation



- Aeolian Transportation

Animation  (Wind Transportation of Sediment)

- Suspension
- Saltation and Traction
 - Creep



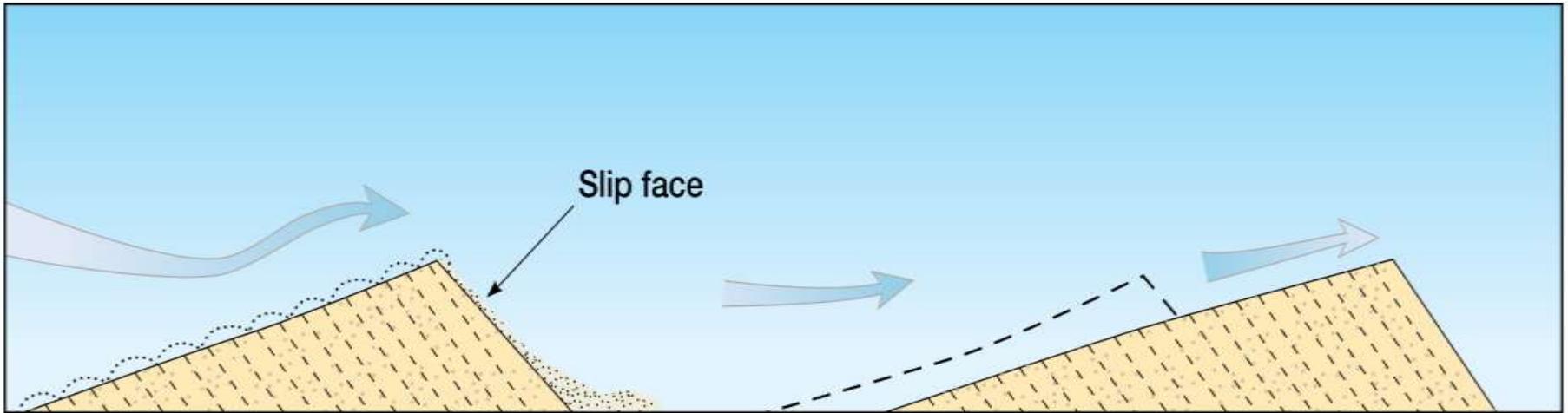


- Aeolian Deposition

Animation  (Desert Sand Dunes)

- Desert Sand Dunes

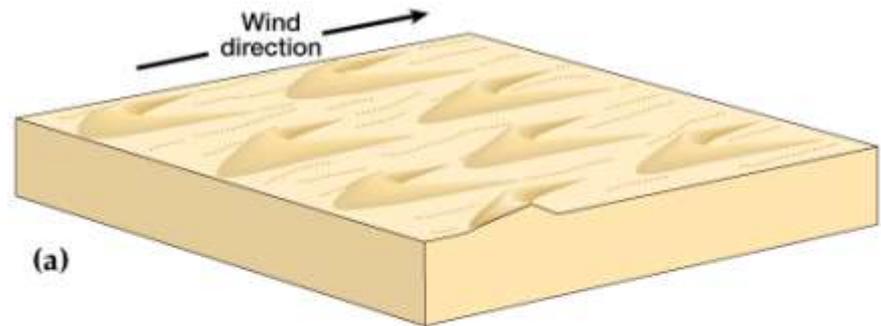
- Vegetation and Dune Stabilization



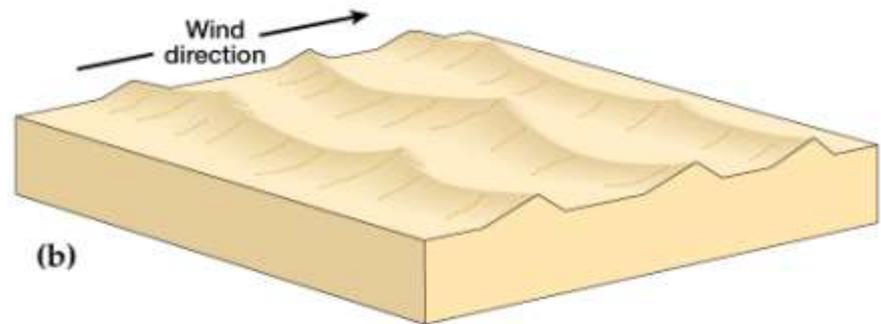


– Dune Forms (Types)

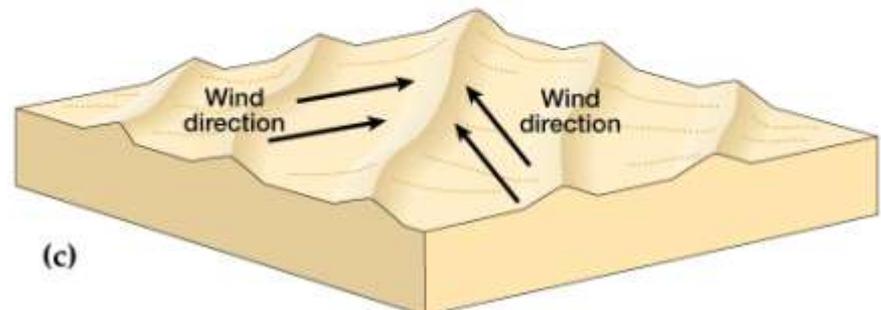
- Barchan
- Transverse
- Seif



(a)



(b)



(c)



– Barchan in Namibia





– Seif dunes in Simpson Desert of central Australia





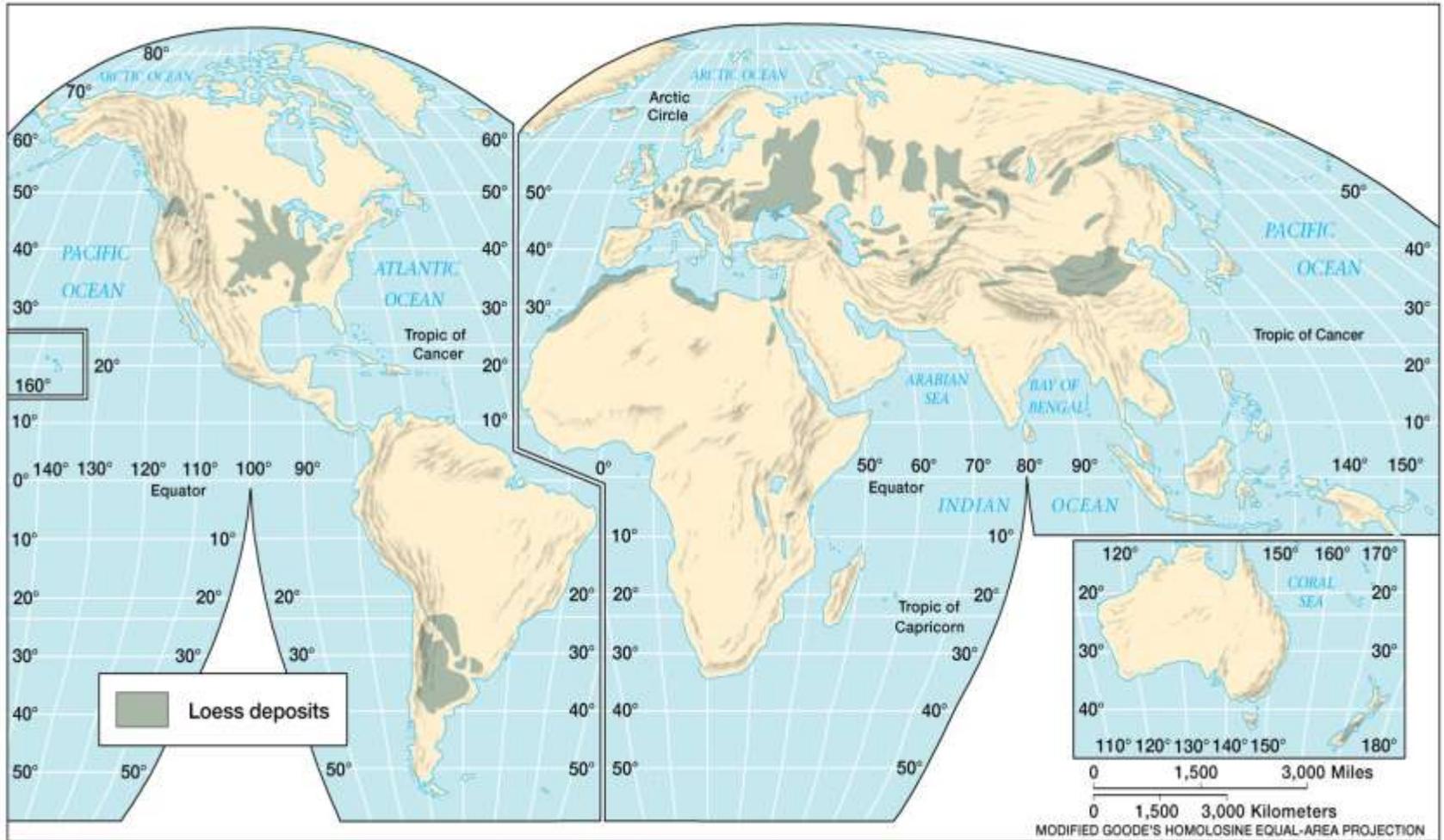
– Loess

- Another aeolian feature that can be outside of deserts
- Wind-blown silt, fine texture, no horizontal layering





- Major loess deposits of the world.



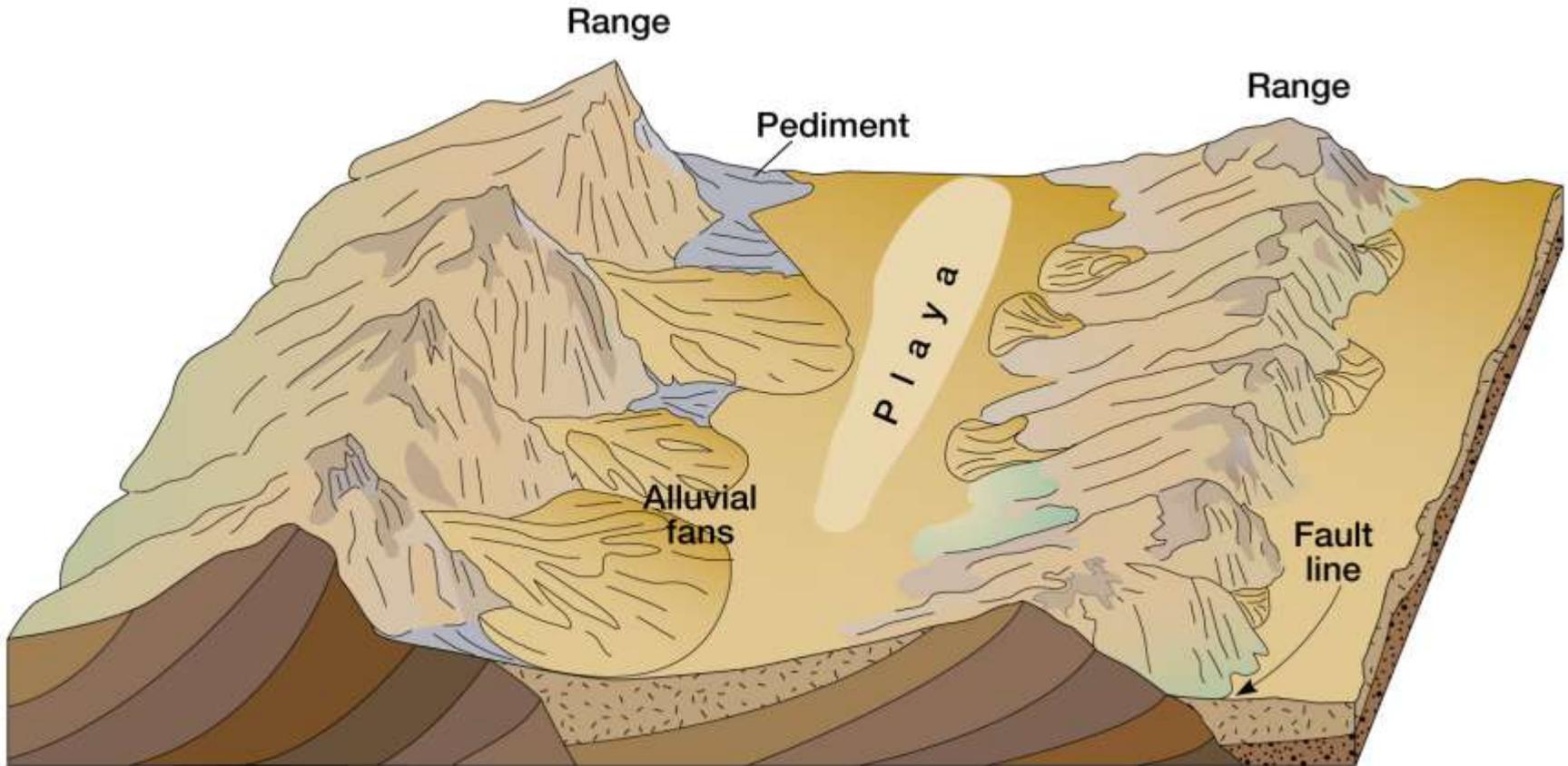


❖ Two Characteristic Desert Landform Assemblages in US Deserts





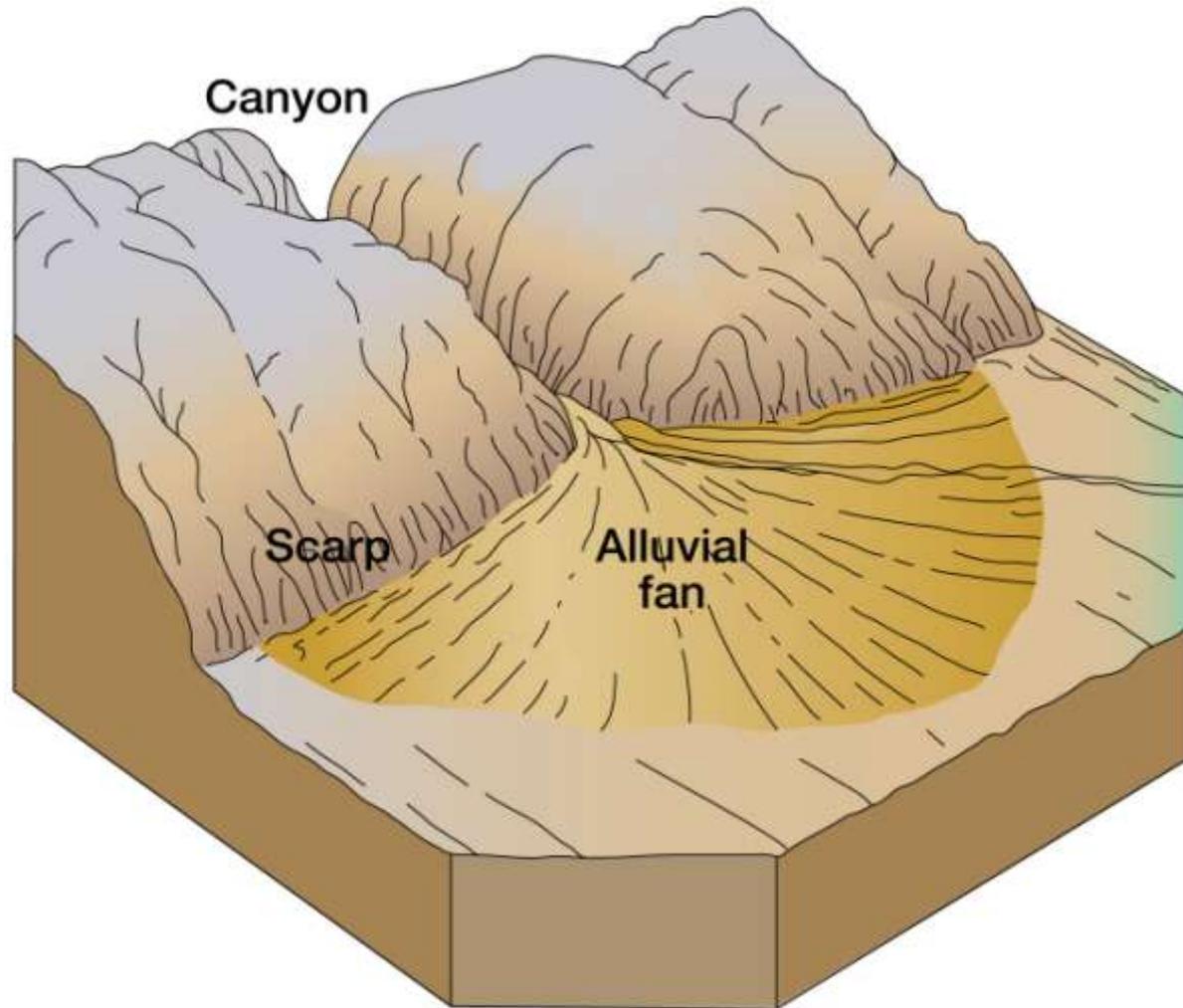
- Basin-and-Range Terrain
 - Ranges





– Piedmont Zone

- Alluvial fan





- Basin
 - Playa





– Basin

- Salt pan



Death Valley, CA



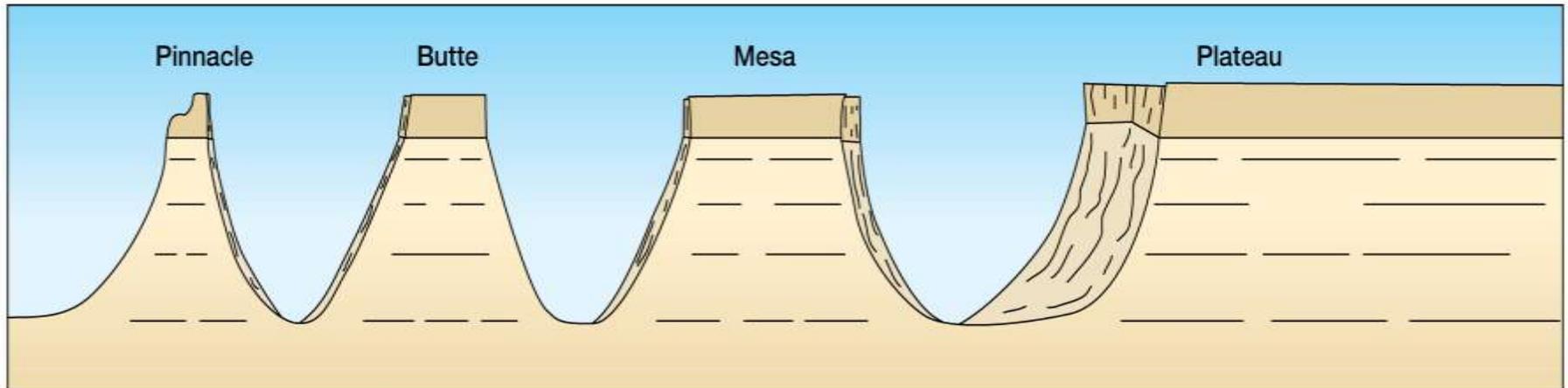
- Mesa-and-Scarp Terrain
 - Horizontal layers of rock
 - Slopes have multiple scarps
 - Differential weathering





– Residual landforms

- Flat-topped summits in horizontal sedimentary strata
- Hard cap rock





Mitten Buttes, Monument Valley, AZ



– Badlands

- Innumerable ravines and gullies
- Steep slopes





– Arches and Natural Bridges

- Minor erosional feature
- Combination of weathering and fluvial erosion





❖ Summary

- The topography of arid lands is largely a product of mechanical weathering and fluvial and aeolian processes.
- Unique desert landscapes include vast sandy areas (ergs), extensive areas with stony surfaces (regs) and barren bedrock exposures.
- Despite the scarcity of rain, fluvial processes are by far the most important agents of landform sculpting in the desert.



- Lakes in deserts are mainly playa lakes, which are temporary. Permanent lakes exist but they are rare.
- Streams are mainly of the ephemeral type, but there are a few exotic (permanent) streams.
- Desert slopes experience little chemical weathering and therefore have bare rock surfaces.
- Since mechanical weathering dominates, arid slopes have multiple scarps owing to the differential rates that hard rocks and soft rocks weather.



- Distinctive residual landforms in deserts include inselbergs, bornhardts and pediments.
- Most fluvial deposition in deserts takes place in the channels of ephemeral streams, the piedmont zone and the basin floor.
- The main depositional landforms in deserts are the playa and alluvial fan.
- Landforms created by wind are aeolian landforms.



- Sand dunes are the most prominent of all desert aeolian deposits. Common dune forms include the barchan, transverse and seif dune.
- Notable aeolian deposits that are not necessarily associated with arid regions are loess and coastal dunes.
- In dry lands of the US, two particular landform assemblages — basin-and-range and mesa-and-scarp are dominant.