

**Module 21**  
**Eolian System**

# Deserts and Wind Action



Photo Credit: Jon Sullivan; 2003



# Desert Vegetation



**Less than 25 cm rain per year**

Photo by David McGeary

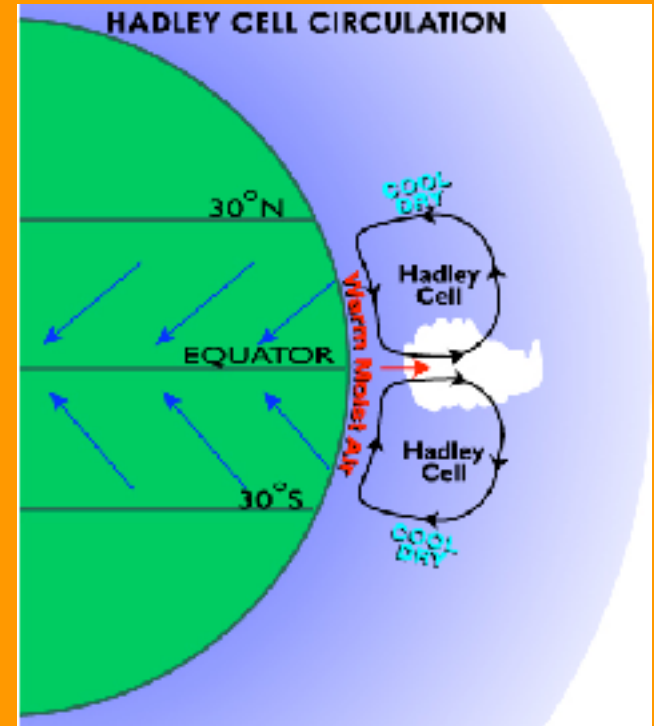
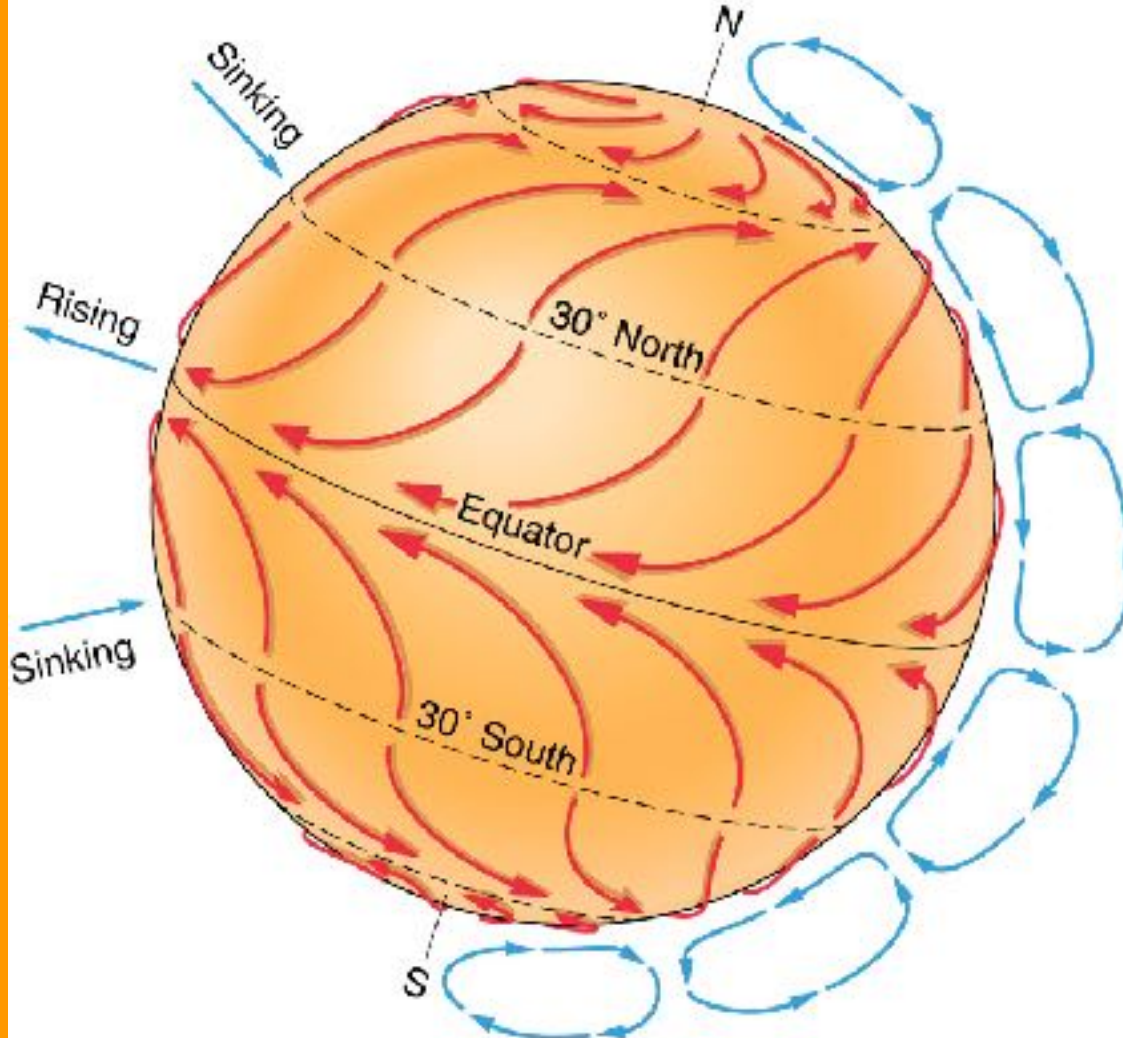
# Deserts and Winds Topics

- **Global Distribution of Deserts**
  - 10-15° latitude bands close to 30°N/S
  - Great distance from ocean
  - Rain shadows
- **Characteristics of Deserts**
  - Lack of through-flowing streams - Internal drainage
  - Flash floods
  - <25 cm of annual rainfall; few plants
- **Desert Features in the Southwestern United States**
  - Basin & Range topography



# Global Wind Systematics

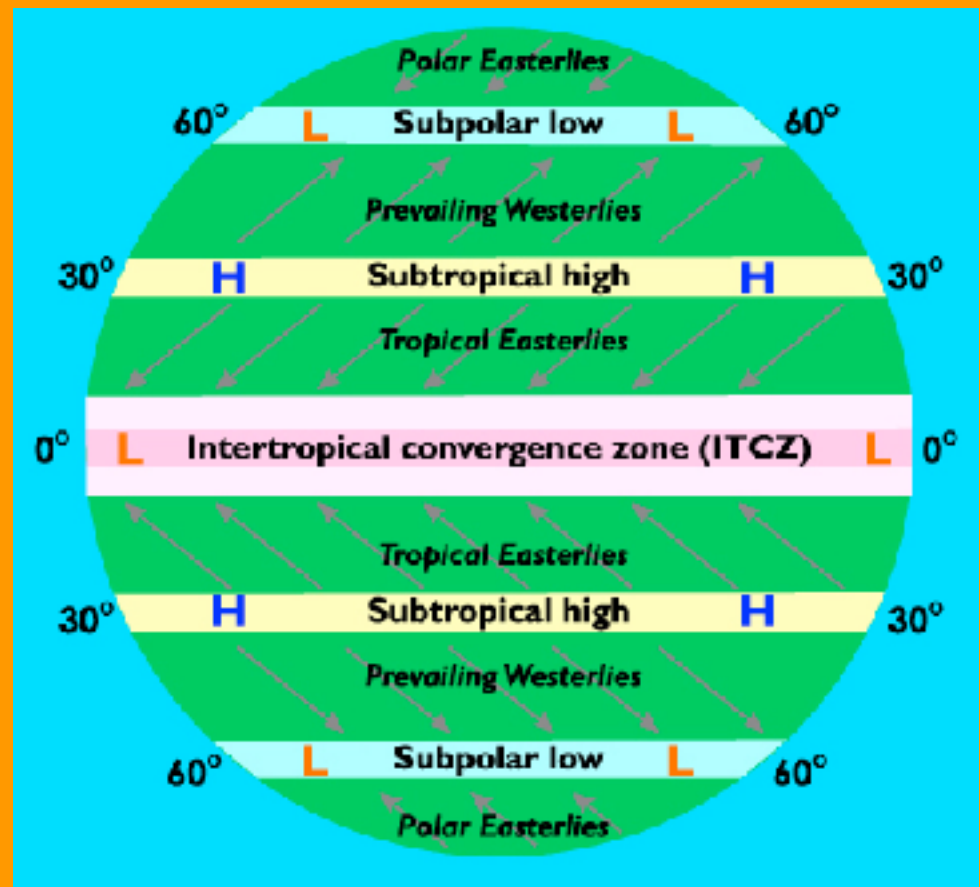
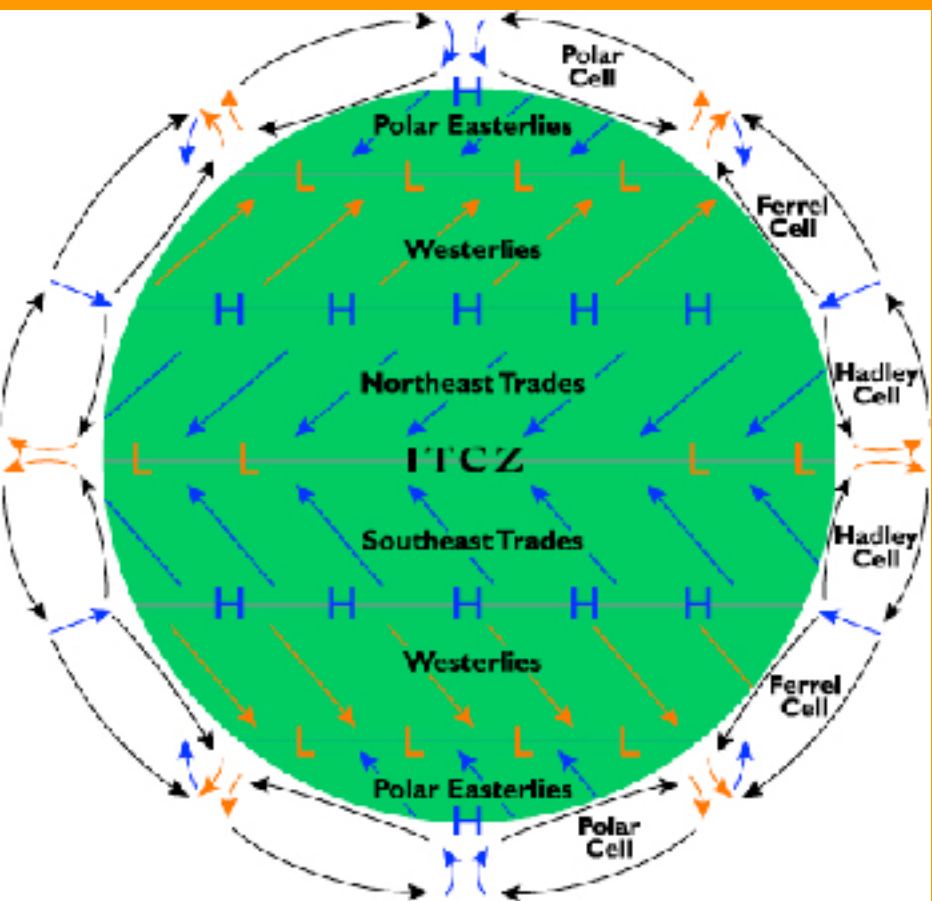
Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



## Important Controls:

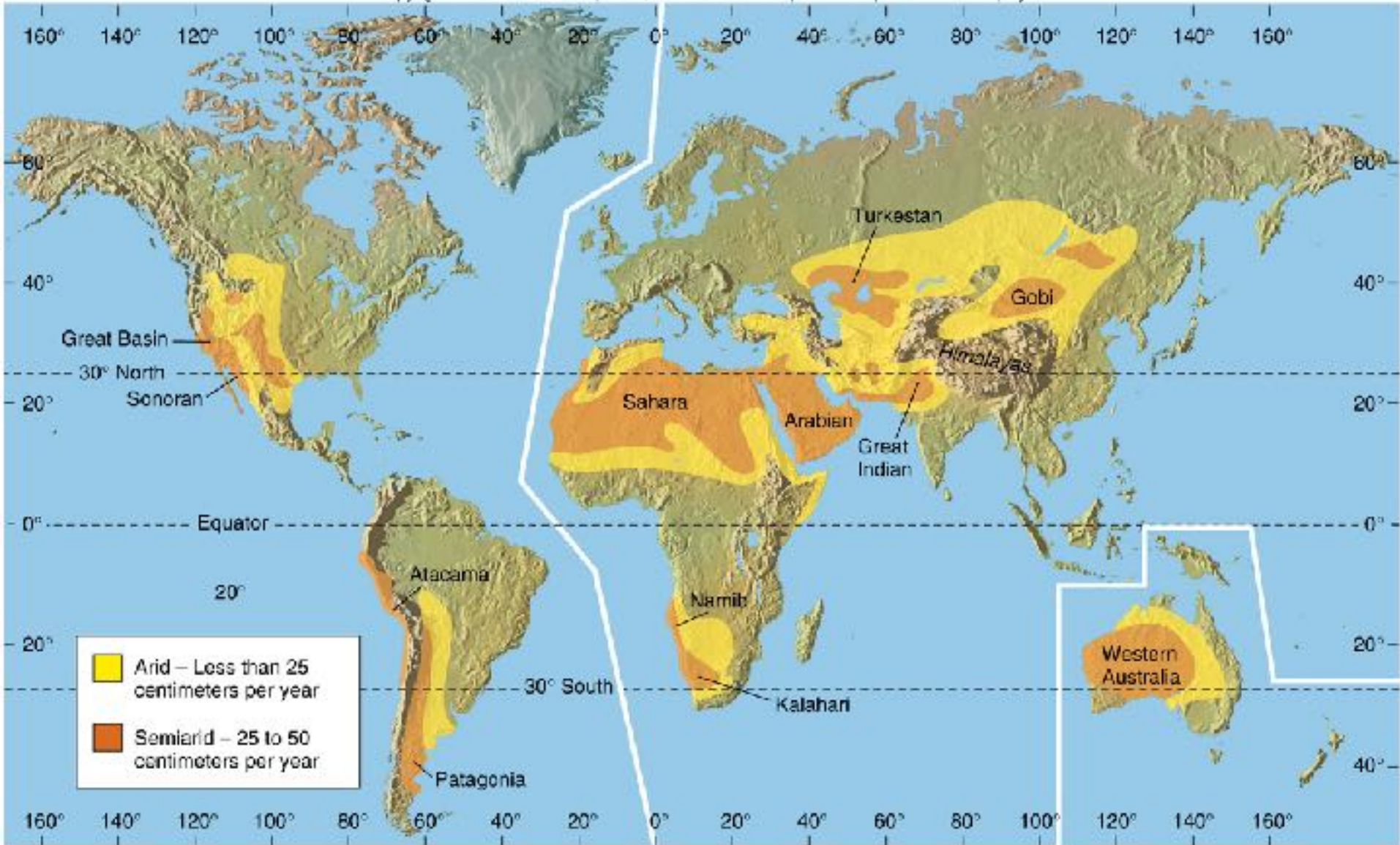
- Solar Heating
- Atmospheric Convection
- Coriolis Force (rotation)

# Global Wind Zones



# Global Distribution of Deserts and Rainfall

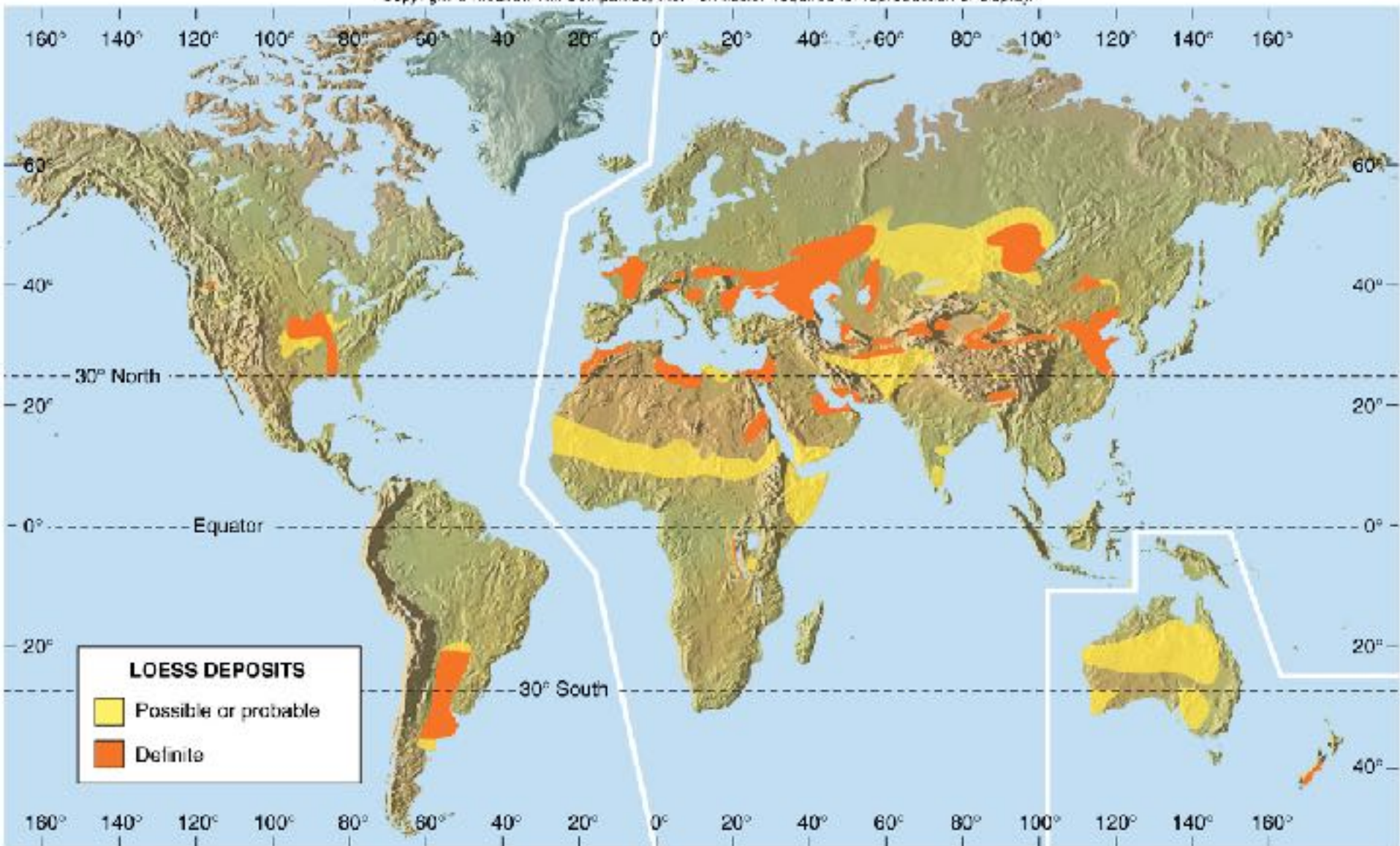
Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.





# Global Loess Deposits

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.

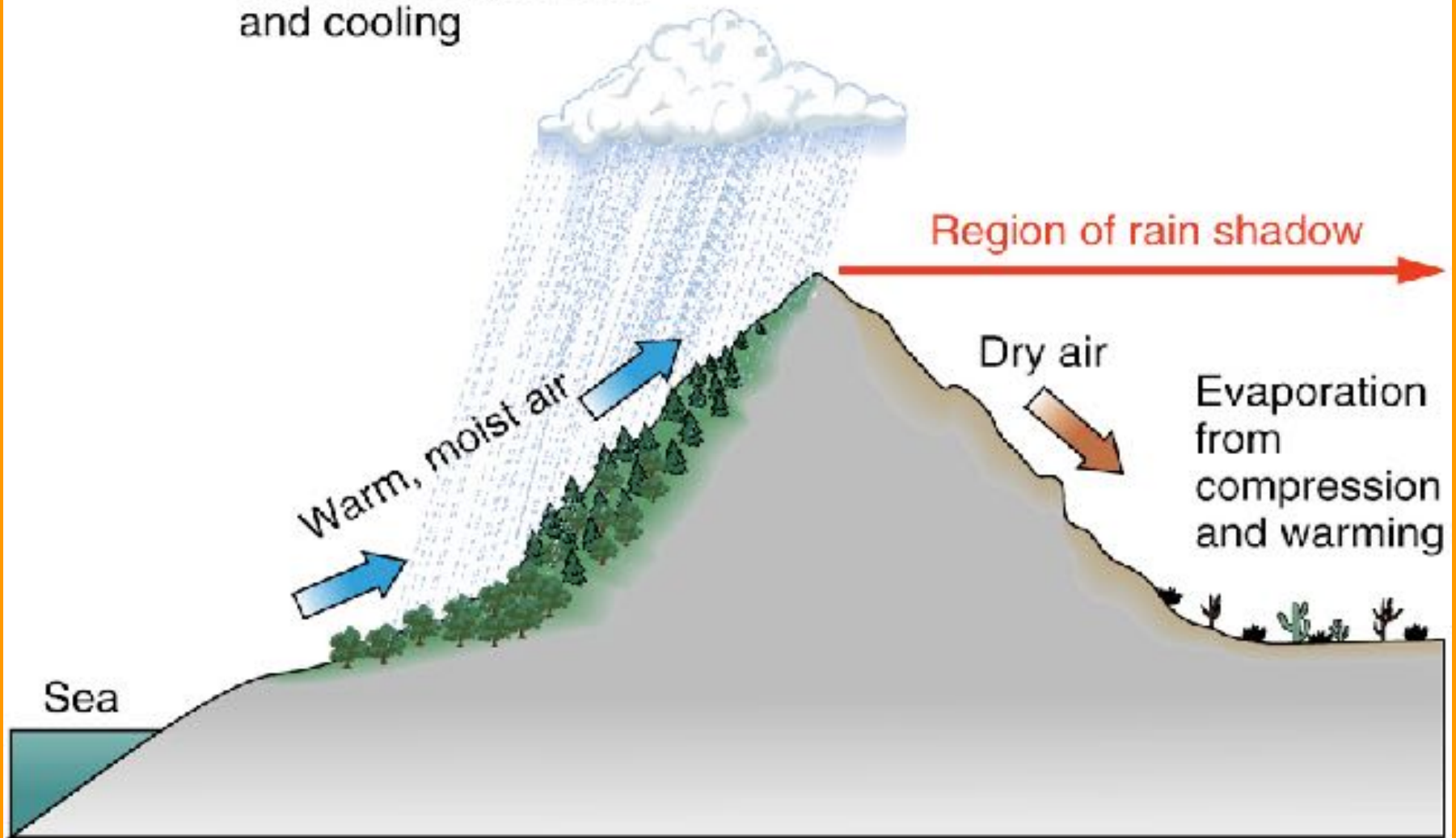




# Development of Rain Shadows

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Rain from expansion  
and cooling



# Desert Stream Channel

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.

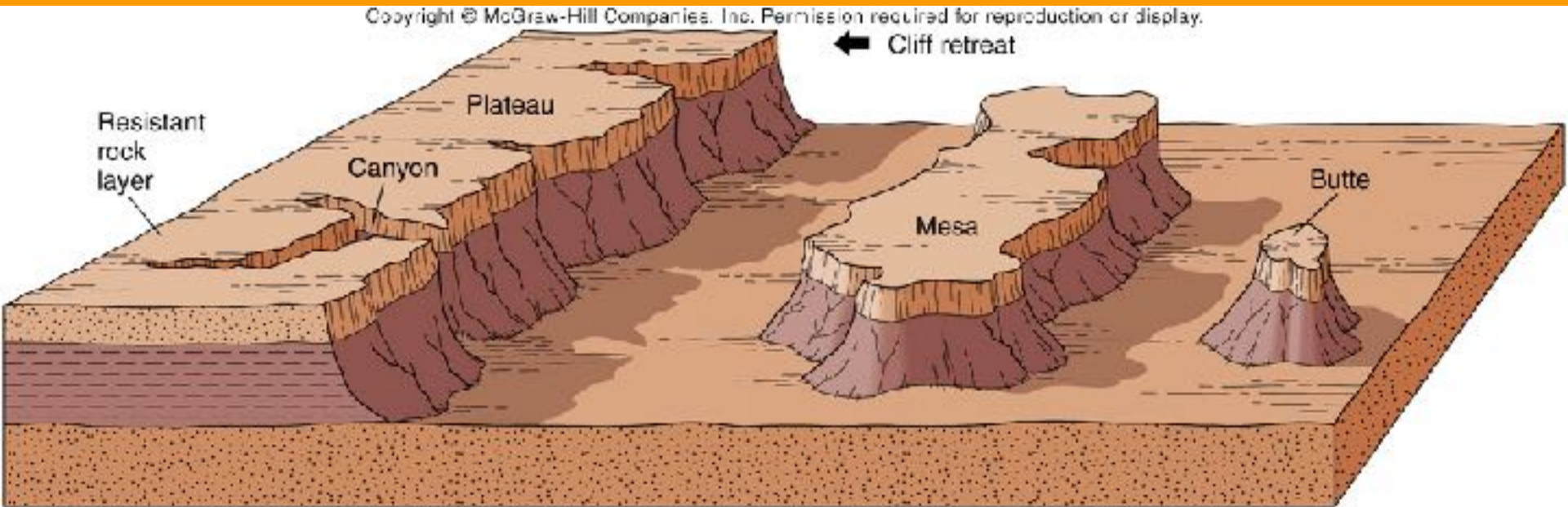


A

Photo by David McGeary



# Plateaus, Mesas, and Buttes



A

**Plateau:** Broad, flat-topped elevated areas bounded by cliffs

**Mesa:** Flat-topped hill bounded by cliffs and capped by resistant rock

**Butte:** Narrow hill with steep cliffs

# Plateaus, Mesas, and Buttes



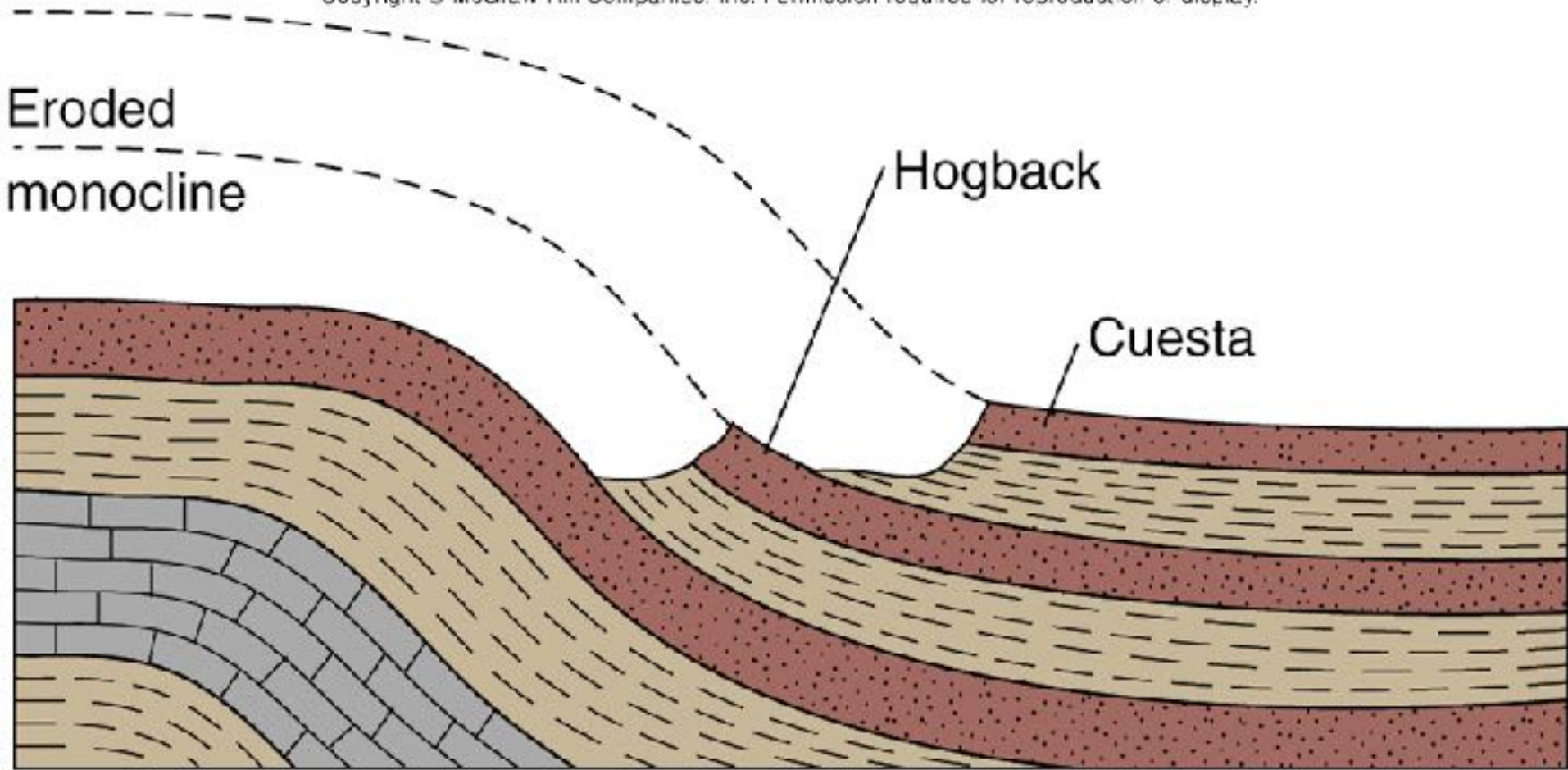
B

**Monument Valley, UT**



# Formation of Hogbacks & Cuestas

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



A

# Monocline - Big Horn Mtns., WY



B

Photo by Diane Carlson



# Death Valley - Basin & Range

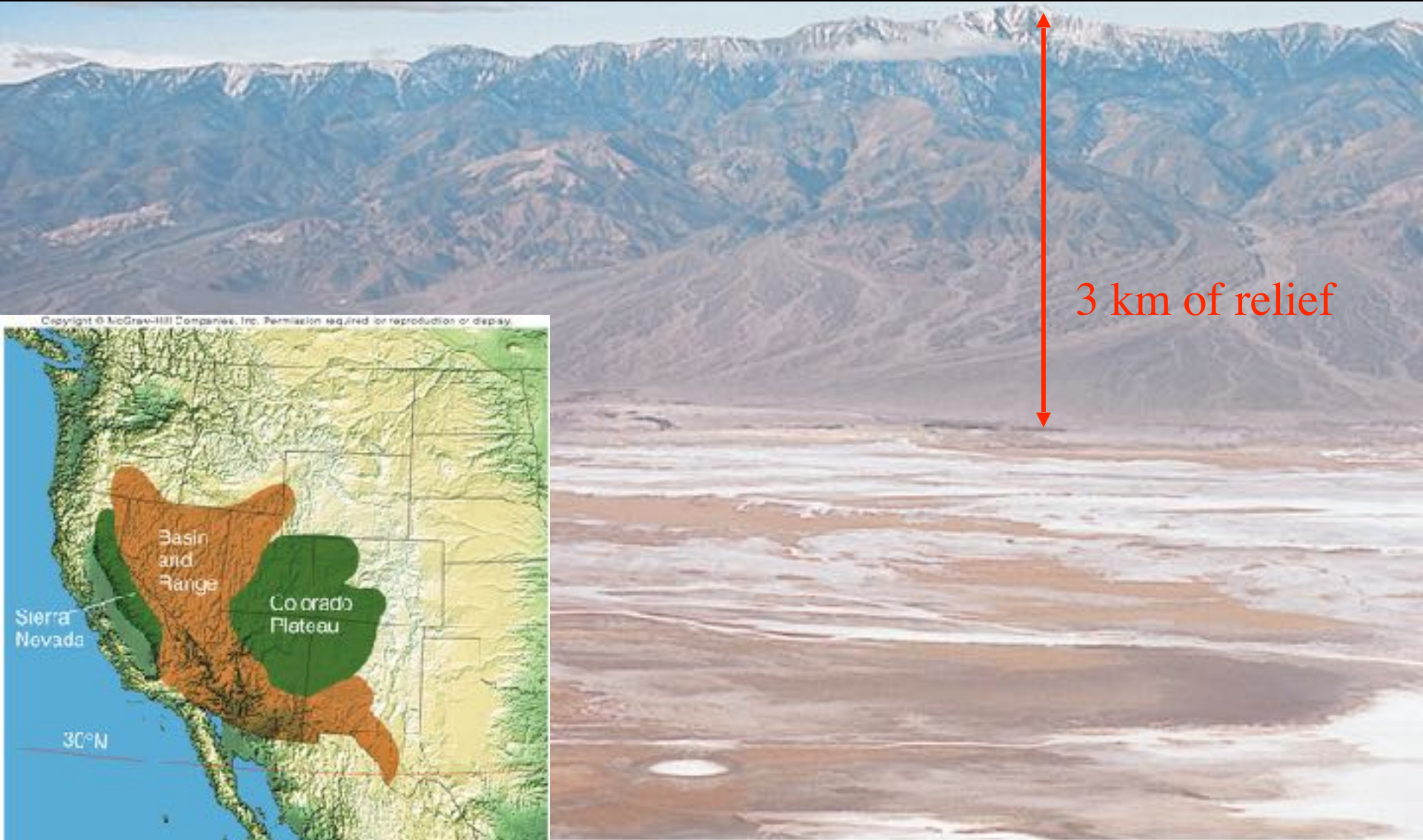
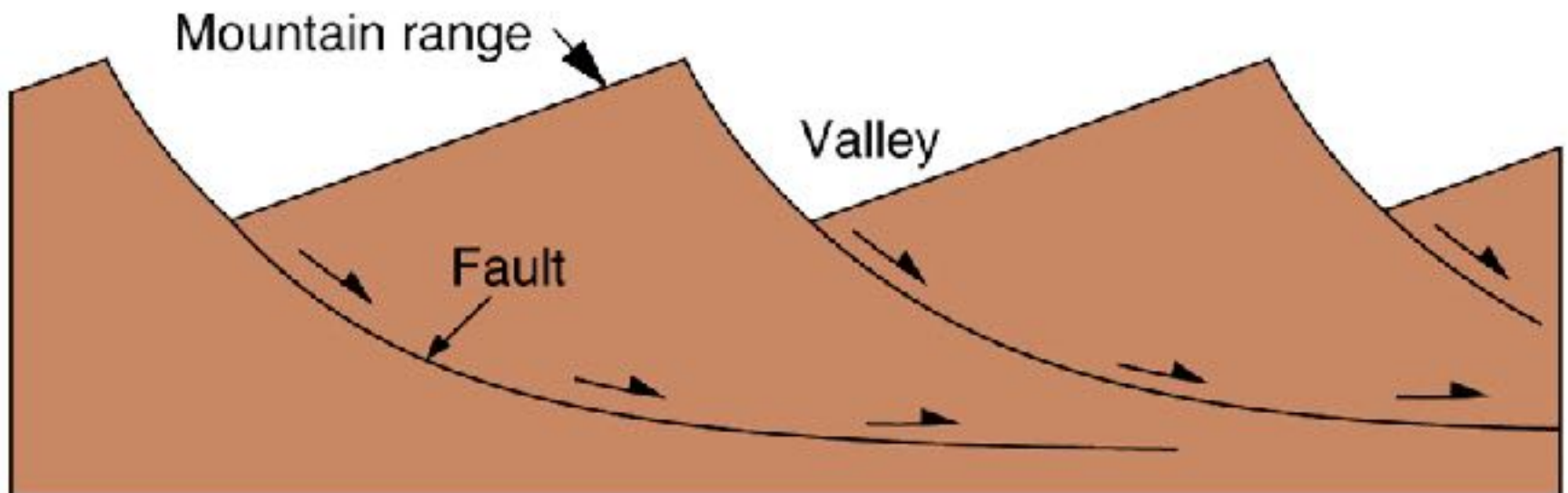
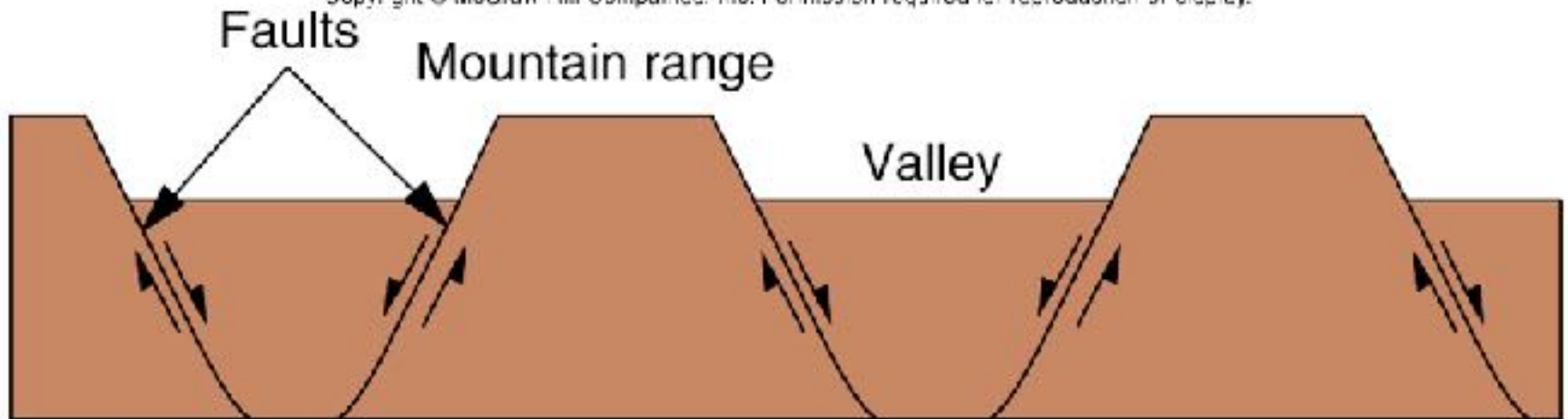


Photo by David McGeary

# Models of Graben Formation

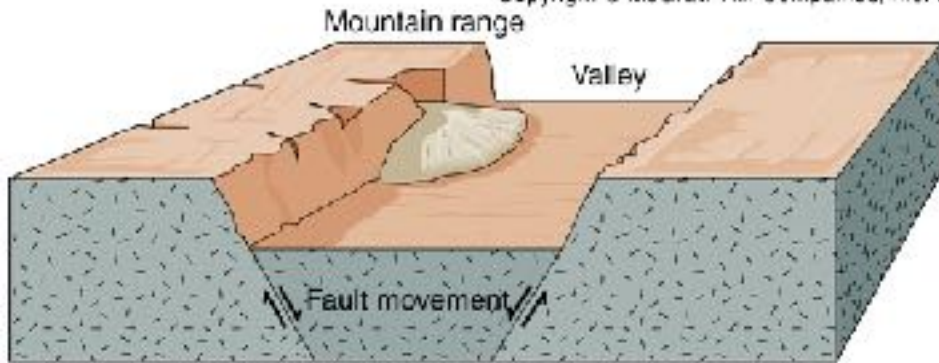
Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



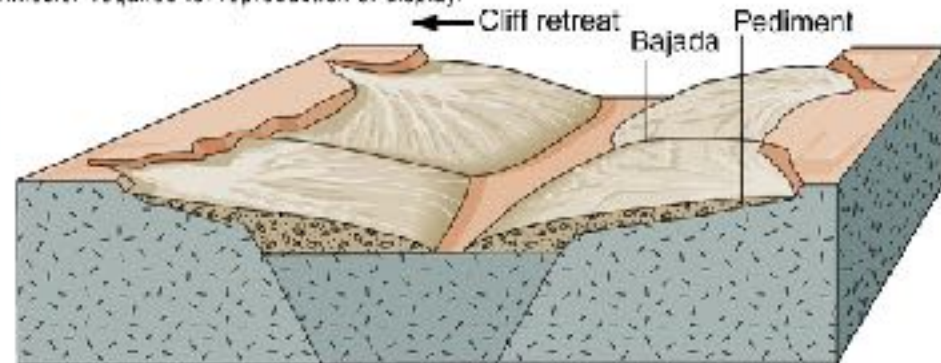


# Desert Landforms

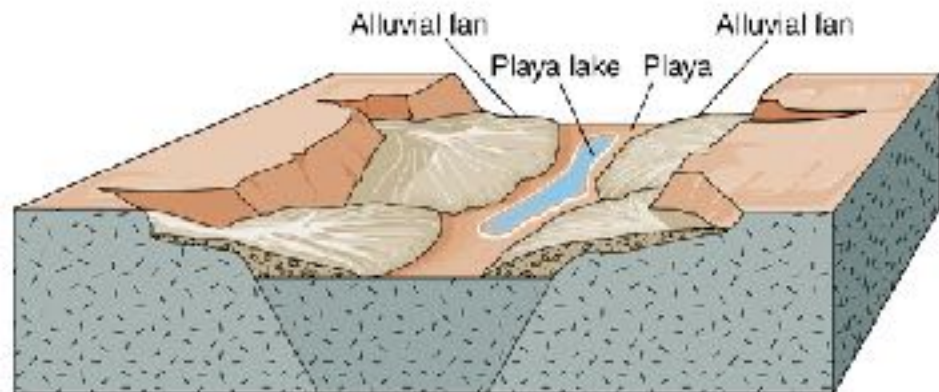
Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



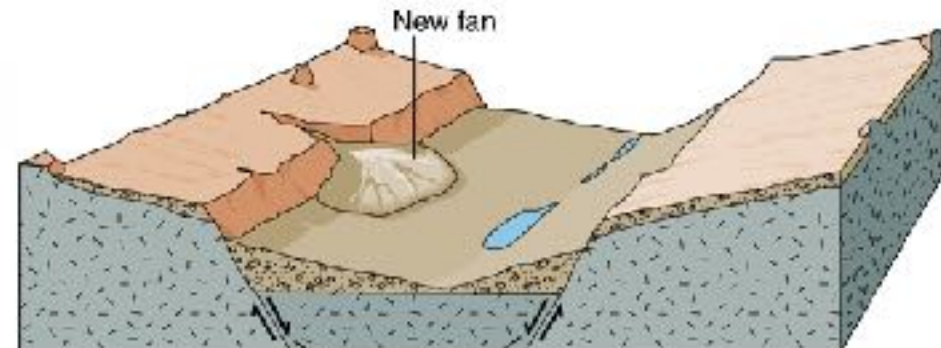
A



C



B



D

Renewed fault movement can allow thick sediment sequence to fill valley

# Wind Action

- **Wind Erosion and Transportation**
  - Dust storms and Sandstorms
  - Blowouts
  - Deflation: removal of fine particles from land surface by wind action
- **Wind Deposition**
  - Development of **loess**: deposits of wind-blown silt and clay composed of unweathered angular grains of quartz, feldspar, etc. weakly cemented by calcite. High porosity (~60%).

# Dust Storm

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



B

U.S. Department of Agriculture, Soil Conservation Service



# Effects of Wind Erosion

**PEDESTRAL ROCK**



**A**

Photo by David McGeary

# Wind Erosion and Desertification

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



B

Photo courtesy Paul Bauer



# Ventifacts

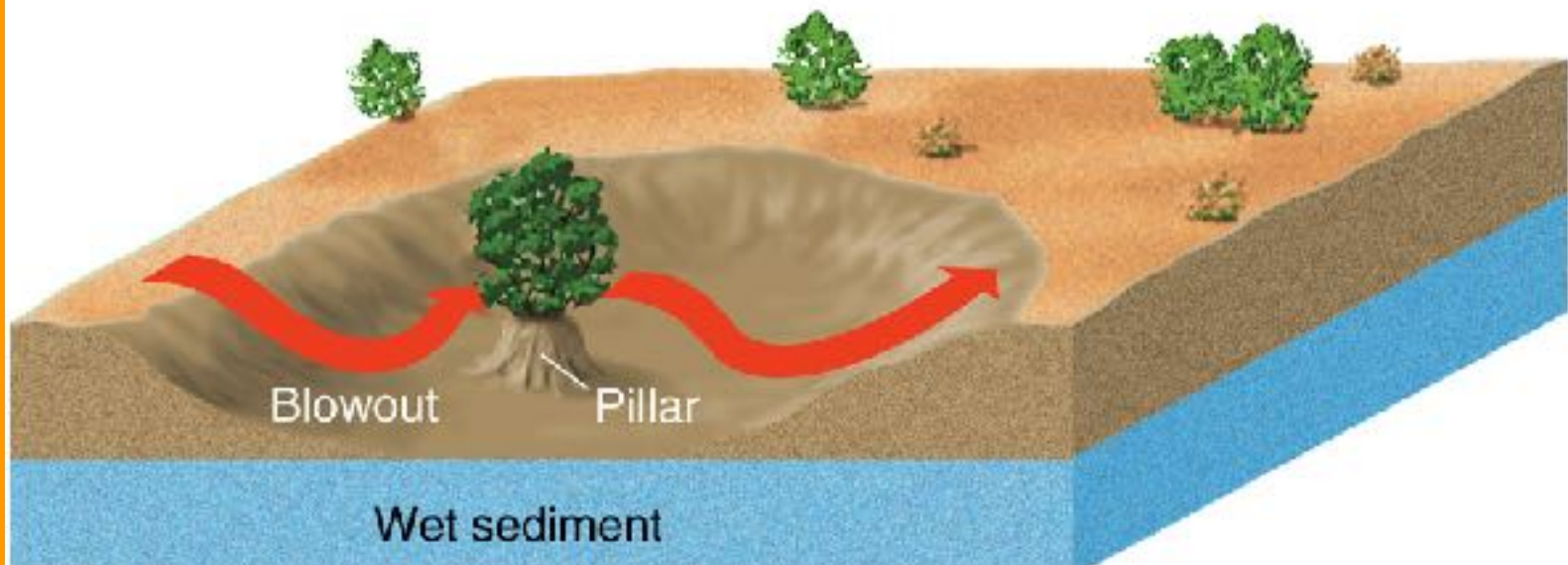
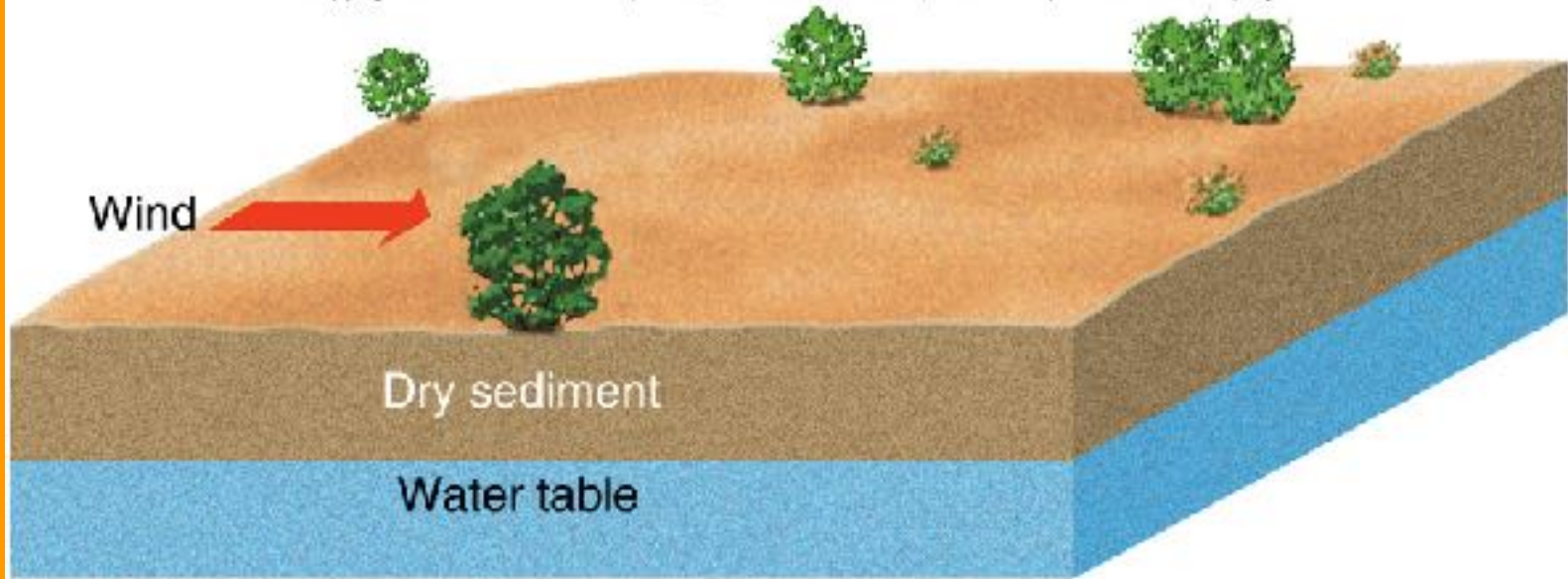


Photo by David McGeary



# Blowout and Pillar Formation

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.





# Desert Vegetation



**Less than 25 cm rain per year**

Photo by David McGeary



# Sand Pillar

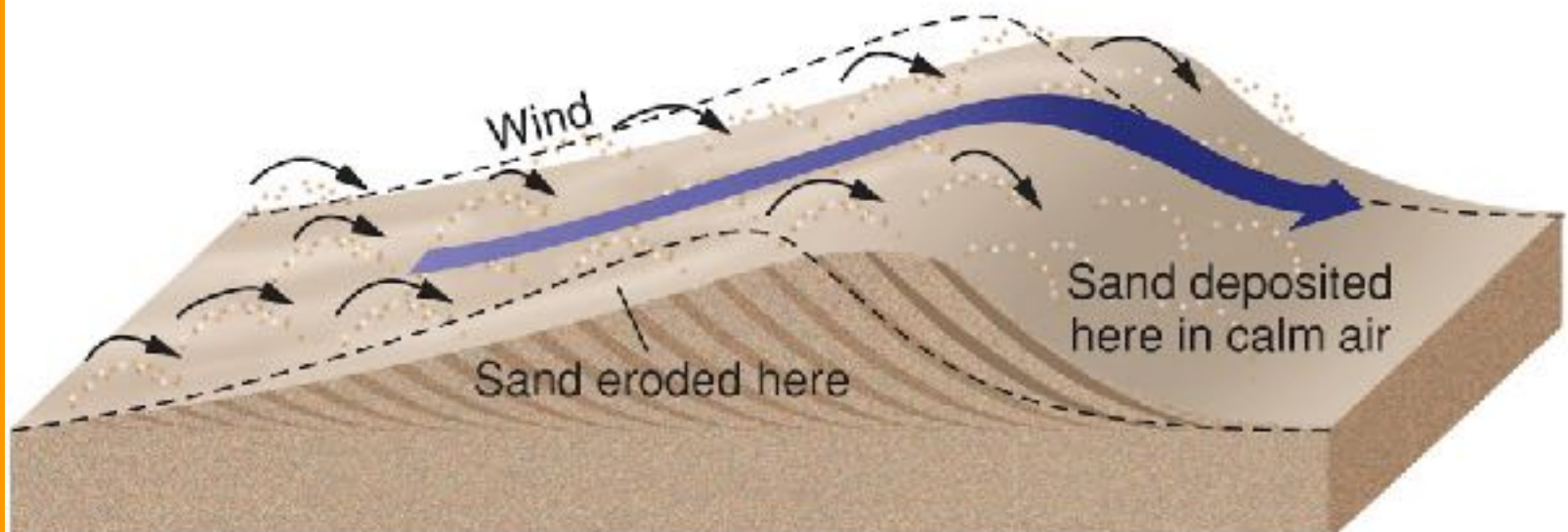
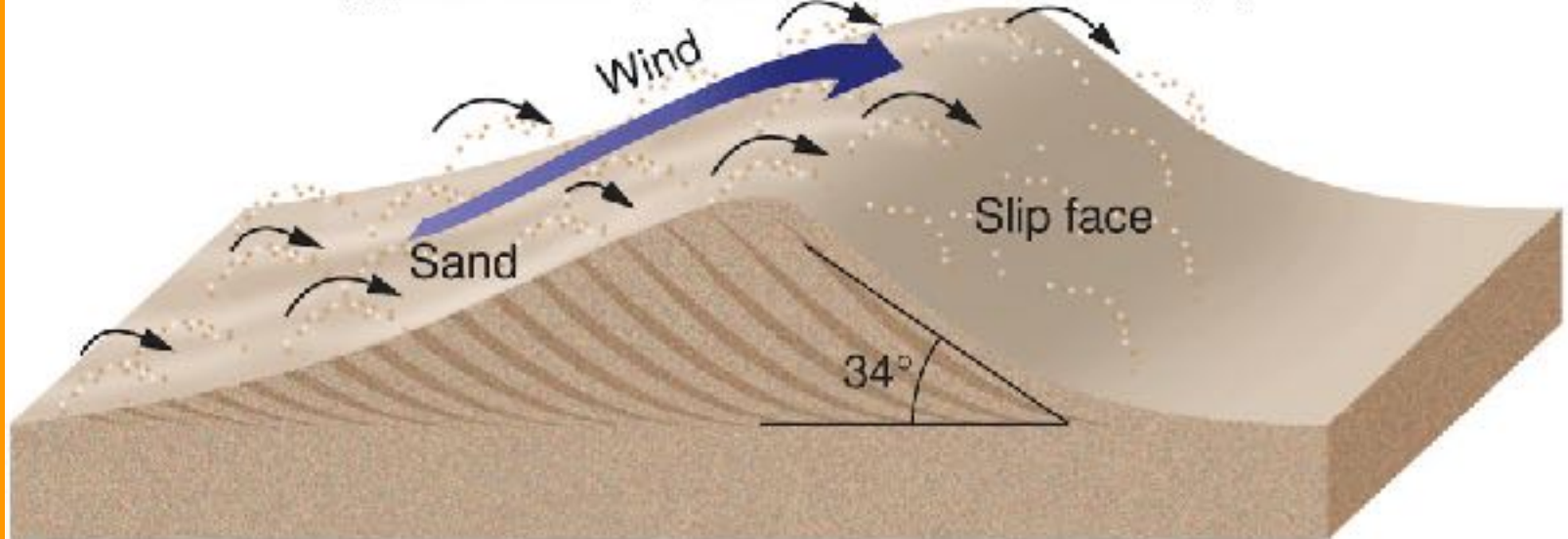


Photo by N. H. Darton, U.S. Geological Survey



# Dune Formation

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display



A

# Monument Valley Wind Ripples



Image source: George Oxford Miller

# Ripples on Dune Face

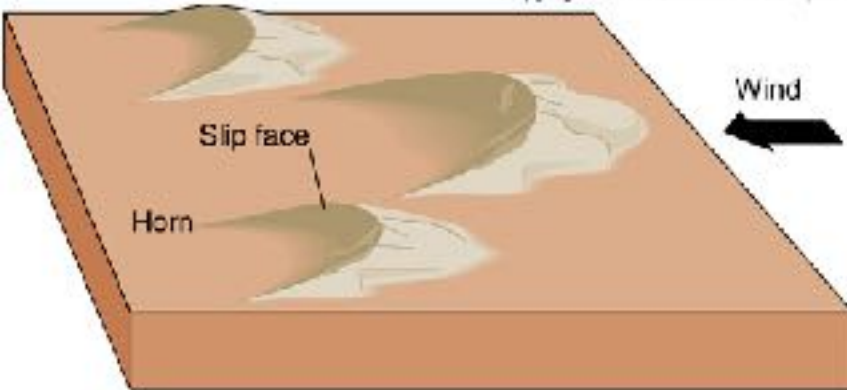


B

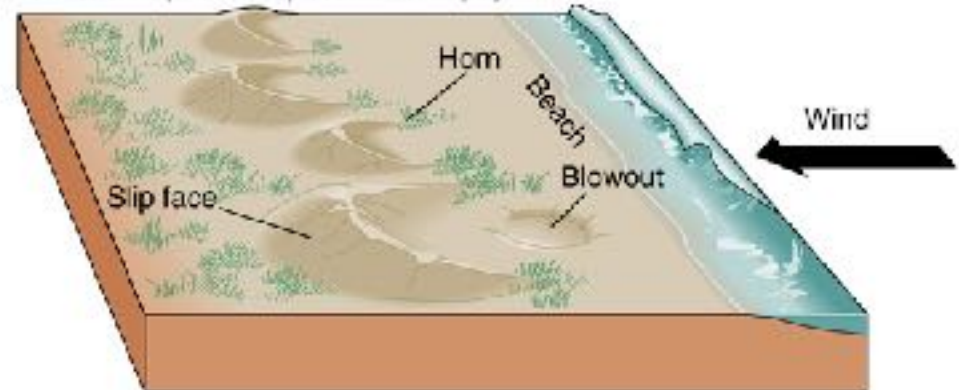


# Dune Morphology vs Wind Strength/Orientation

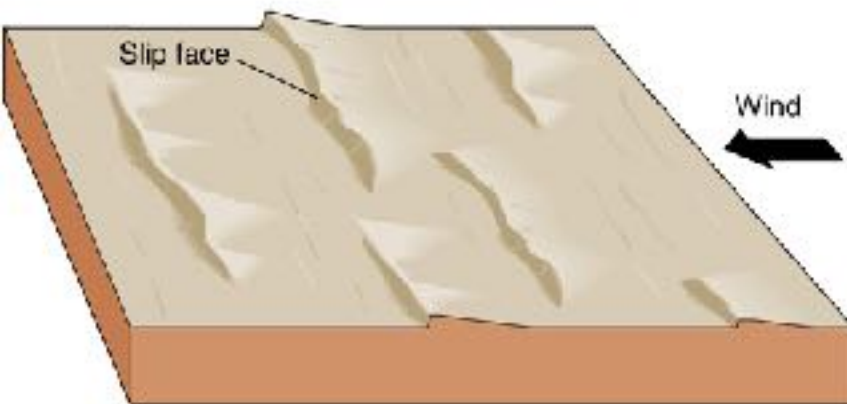
Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.



A Barchans



C Parabolic dunes



B Transverse dunes



D Longitudinal dunes (seifs)

Barchan Dunes form when there is limited sand.

Parabolic Dunes require abundant sand and strong wind!

# Barchan Dune Field - Mars

Copyright © McGraw-Hill Companies, Inc. Permission required for reproduction or display.

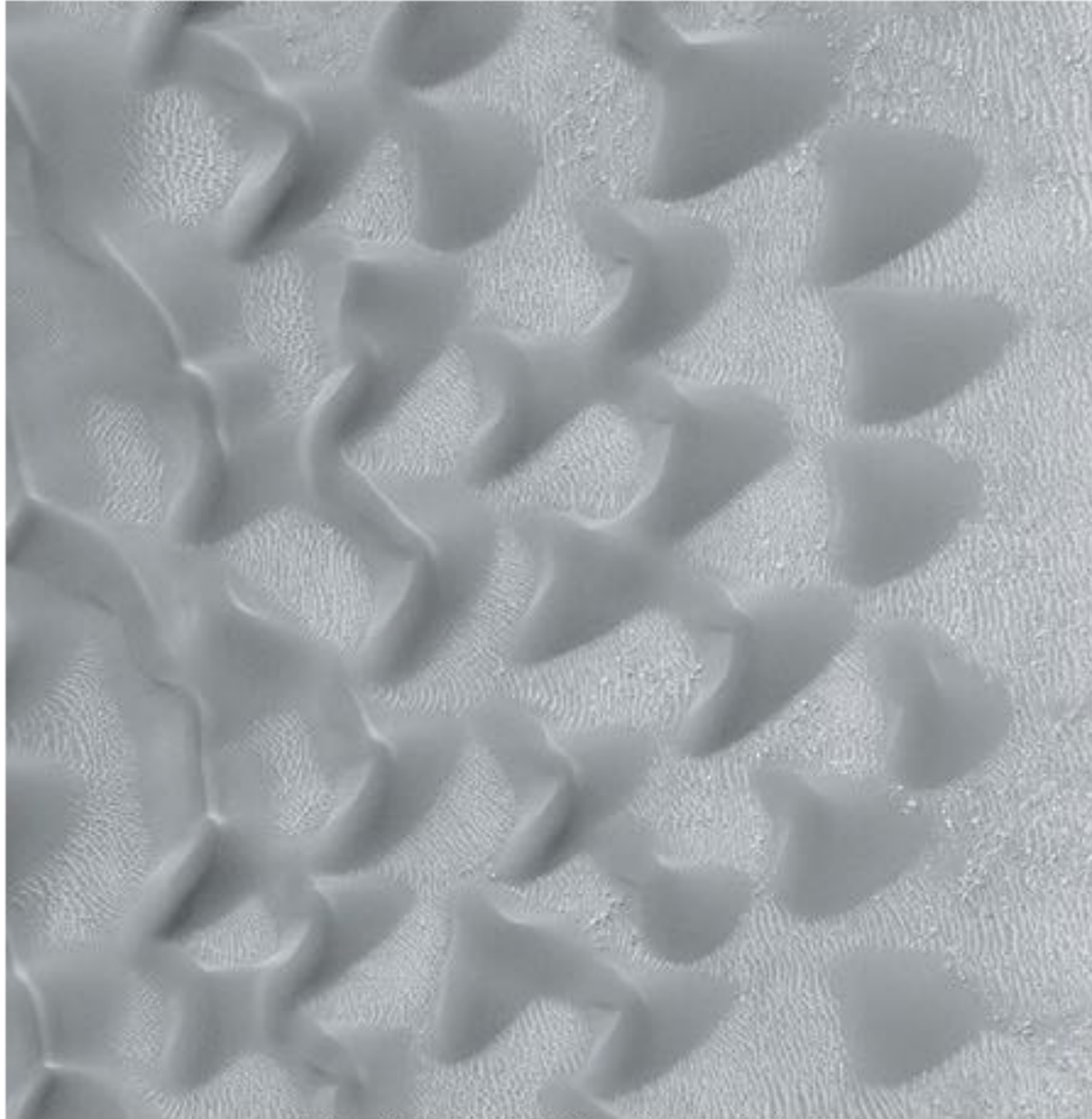


Photo by NASA/JPL/Malin Space Science Systems

# Longitudinal Dune Field - Algeria



Dunes up to 200 m high



**THANK YOU**