



Cold desert

Chapter Outlines

NOTE: This is intended to help students 'organize' their understanding of each topic. It is not a comprehensive study guide for quizzes or midterms, i.e. study your text!



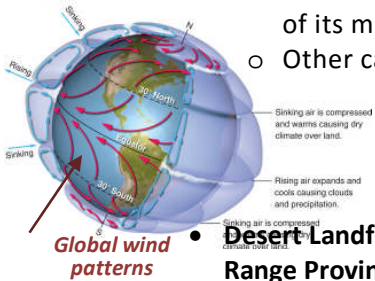
Hot desert

Deserts

Areas that receive less than 25 centimeters (10 inches) of rain annually are called **deserts**. Deserts may be hot or cold, but are always dry with sparse vegetation. Landforms tend to have angular features because the minimal rain results in minimal chemical weathering, and flash floods create steep-walled scarps and gullies. There are few plants to protect the soil from the wind, so the soil is blown away to expose the rocky surface. Even in such a dry climate, most of the landforms are carved by the rare periods of heavy rainfall that result in flash floods, erosion, and sediment deposition.

- **What causes deserts?**

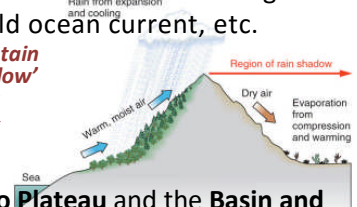
- Global atmospheric circulation has air rising and drying near the equator, and descending in the **general area of 30°** above and below the equator. This descending dry air heats adiabatically causing widespread evaporation. Most deserts are located in this general band.
- **Rain shadow deserts** are created where air is lifted over a mountain range and loses most of its moisture to precipitation, then descends and dries the area downwind of this range.
- Other causes include large distances from an ocean, or nearby cold ocean current, etc.



Global patterns of deserts



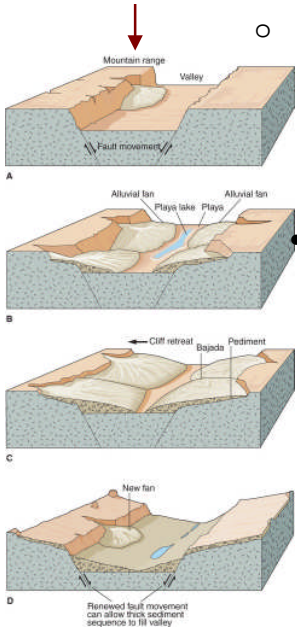
The mountain 'rain shadow' effect



- **Desert Landforms of the Southwestern United States include the Colorado Plateau and the Basin and Range Province**

- Colorado Plateau is marked by flat lying sedimentary rocks that are heavily eroded into **plateaus, mesas and buttes**
 - Hills underlain by resistant rock such as sandstone, limestone, or volcanic lava are called **plateaus**. Plateaus are edged by steep-sided scarps and gullies. As weathering and erosion cut back a plateau's slopes, remnant flat-topped towers or columns called **mesas** may be left behind. The continued erosion of a mesa results in a similar but narrower landform called a **butte**.

Desert landscape erosional features



- Basin and Range province – has rugged, linear, fault-bounded mountain ranges separated by flat occasionally-flooded valleys
 - Narrow canyons carry sediment down to valley floors during heavy rains
 - Sediment gets deposited into **alluvial fans**
 - Alluvial fans may overlap to form a **bajada**
 - Finest sediments travel to basin's center where water ponds and evaporates into **playas**

- **Desert features**

- **Alluvial fans** form at the mouth of canyons where sediment-laden ephemeral streams abruptly widen, slow, and end their flow.
- **Arroyos (also called washes)** are normally-dry washes that fill with water after a heavy rain, and sometimes have steep walls.
- **Bajada** is the feature formed when adjacent alluvial fans have become so large that they join together.
- **Ephemeral streams** flow intermittently as a result of periods of sudden rainfall followed by much longer periods of no rainfall.
- **Evaporites (salt flats)** form on flat areas call **playas** where interior drainage often ends.
- **Flash floods** result from sudden downpours. Rainwater washes across the desert surface as a result of a lack of vegetation.

- **Interior drainage** is where streams empty into landlocked basins.
- **Inselbergs** may project abruptly through the pediment cover as rocky hills.
- **Playa lakes** are temporarily formed when ephemeral streams run onto a playa.
- **Pediment**, a low-angle erosion surface at the foot of the mountain range that is typically covered by a veneer of sediment.
- **Piedmont**, the slope from a mountain front to a playa.



Results of a flash flood in an arroyo

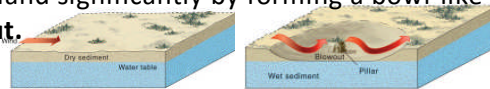
- **Effects of wind** – as a result of wide temperature variations, winds in the desert are often extreme. And, unrestricted by trees and vegetation, they can carry sediment short or long distances.

- Wind blown **bed load** consists of the heavier grains (*usually sand*) that hop and skip along the ground by **saltation**.
- **Suspended load** is the finer-grained clay and silt fraction that is actually carried long distances in the wind.
- The **velocity of wind** is a result of air pressure differences due to atmospheric heating and cooling. Desert winds are the result of temperatures differentials that commonly fluctuate from 7 degrees centigrade at night to 43°C or more during the day (45–110°F) and can travel at speeds up to 110km per hour.

- Depending on the amount of fine-grained material that is available and the speed of the wind, **dust storms** that blot out the sun can result. Particles can be carried thousands of feet upward into the atmosphere and for hundreds of kilometers laterally.

- **Ventifacts** - rocks which have flat, wind-abraded surfaces.
- **Deflation** is the removal of sediment from a land surface by wind.

- It can lower the surface of land significantly by forming a bowl-like depression called a **blowout**.



'Blowout' formation



- **Desert pavement** is a large surface of the desert floor that is covered by pebbles and stones that resemble rounded paving stones.

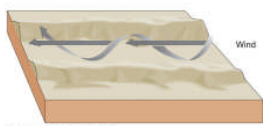
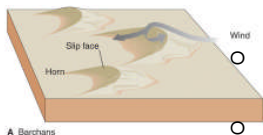
- Silt and clay deposited by wind is called **loess**. The fertile soils of the Midwestern United States include loess. The dust bowl of the 1930's was a result of wind erosion of loess.

- **Sand dunes** - Dunes (*mounds of loose sand grains piled up by the wind*) are deposited by winds in desert regions or along sandy coastlines and migrate in the direction of the wind. Types form depending on the dominant wind direction, amount of available sand, and arrangement of existing vegetation.

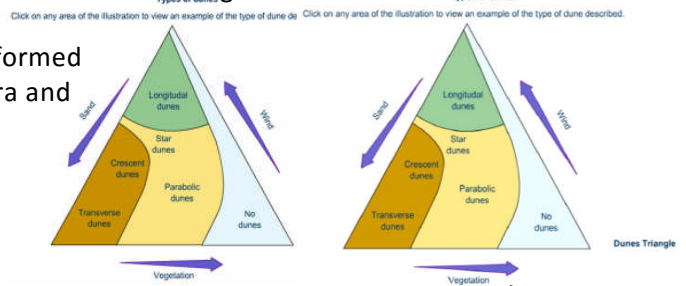
- Individual grains are commonly well-sorted and well-rounded.
- The steeper downwind slope is called the **slip face**.
- **Longitudinal dune (seif)** is a large ridge of sand that parallels the wind direction. These form in areas with large sand supply.
- **Barchan dunes (also called crescent)** are widely separated, crescent-shaped dunes that form in areas of sparse sand. The horns of a barchan dune point in the direction of the wind. These also exist on Mars.
- **Transverse dunes** are a series of long ridges that form perpendicular to the wind.
- A **parabolic dune** usually forms around a blowout in vegetated areas. The horns of a parabolic dune point into the wind.
- **Star dunes** are isolated hills of sand formed by variable winds mostly in the Sahara and Arabian Deserts.
- Small patches of dunes are common in southwestern US, but huge **sand seas** exist in the Sahara and Arabian deserts.



Sand dune migration



Sand dune types



The 'Dune Pyramid' is helpful in understanding formation of dunes

- **Desertification** is the extreme deterioration of land in arid and dry sub-humid areas due to loss of vegetation and soil moisture. Some causes can be:
 - Over-grazing in arid lands, diversion of water, change in climate...



Desertification of the Aral Sea