Deserts and Wind Action

Desert – any region with a low rainfall

- Less than 25 cm of rain in a year
- Desert plants have small leaves, extensive roots, are spread out (fig 18.1)
- Location is related to descending air
  (Subtropical High Pressure – Tropics of Cancer/Capricorn)
  (Figures 18.2- 18.3)

1. Some deserts are the result of rain shadow (18.4)
   (which is still High Pressure)
2. Tropic of Cancer/Capricorn (Large scale)
3. Large Scale Rain shadow and Proximity from oceans (Gobi)
4. Western coasts of continents – cold currents run along the western edges of continents
5. Poles- Like Tropic of Cancer/Capricorn – descending air

Characteristics of Deserts

1. Most deserts lack through – flowing streams
   - Exceptions – Colorado River, Nile River
2. Most deserts have internal drainage
   - Streams drain toward land-locked basins instead of the sea
   - Controlled by local base levels
3. Rainfall typically comes from violent thunderstorms
   - Results in flash floods and/or mudflows/debris flows
   - Arroyos or Dry washes – typically narrow canyons with vertical walls and flat, gravel -strewn floors (Fig 18.5 A)
4. Rocks that weather in humid climates can be very resistant in the desert.
   Ex: Lava flows, Limestone
   - Shales, silts, erode easily (Fig 18.5 B)
   - Chemical weathering is generally lower

Fluvial Landforms of the Desert

1) Arroyos or Washes (also called barrancas or wadis)
2) Badlands: highly dissected landforms or topography
3) Plateaus: regions of higher elevation but lower relief
4) Mesas and Buttes
   >Usually have a caprock
5) Pediments: erosional surface

Arid Depositional Features

1) Alluvial Fans
2) Bajadas
3) Piedmont Alluvial Plain
4) Bolsons and Playas
   a) Playa Lakes
   b) Salt Flats or Salinas

Desert Features of the SW United States

- Close to subtropical High and Rainshadow influence
- Two geologic structures- Colorado Plateau, Basin/Range (Figure 18.6)

Colorado Plateau- centers on four corners

- Mostly flat lying beds of sedimentary rocks over 1500 m (5000 ft) above sea level
- Plateaus – broad, flat – topped areas elevated above the surrounding land and bounded by mostly cliffs
  - Mesa – broad, flat- topped hill bounded by cliffs and capped with a resistant rock layer Figure 18.7
  - Butte-narrow hill of resistant rock with a flat top and very steep sides

  (most buttes form by continued erosion of mesas)
- Marked by peculiar – steep-like folds – Monoclines
- Erosion Produces: Hog back- tilted resistant layers Figure 18.8
  Cuesta- gently tilted area with one steep side and one gentle one

Note: Plateaus, Monoclines, Hog backs, and cuestas are not unique to deserts

Basin and Range Province (Fig 18.9)

- Characterized by rugged mountain ranges separated by flat valley floors
- Blocks of rock that form valleys and mountains are bounded by faults
- Lots of rainshadow
- Heavy rainfall in mountains, which erodes them and produces alluvial fans at the base of the mountain ranges (Fig 18.9-18.12)
- Playa Lakes- form on valley floors when run off water connects- typically dry up and form playas (Fig 18.13)

Bajada- broad gently sloping depositional surface formed by the coalescing of individual alluvial fans – Depositional Features

Pediment – gently sloping surface, commonly covered with a veneer of gravel, cut into the solid rock of the mountain – Erosional Feature

Inselberg (island mountain)-resistant erosional remnant

Note: Rock structure, not climate, largely controls the fact that plateaus and cliffs are found in the Colorado Plateau, while mountain ranges, broad valley alluvial fans and pediments are found in the Basin and Range Province

Features such as steep canyons, playa lakes, thin soil, and sparse vegetation, however, are typically controlled by climate

Wind Action

Important agent of erosion – Different than water

1. Can erode only fine sediments (sand, silt & clay)
2. Not confirmed to channels as running water is

- cover a vast area

Wind Works well-

1. Big T range create PGF, which drives wind
2. Wind is stronger (100 km/hr or 60 mi/hr)
3. Less vegetation means less friction, making wind and effective transport mechanism (only in dry climates)

Wind Erosion

Wind removes or erodes material by:

1) Deflation – removal of clay, silt, and sand from surface by wind

- Blowout – depression on the surface caused by deflation (pillar is left behind)
- Desert Pavement-all the fines are removed

2) Abrasion: interaction of grains

- Dust Bowl – 1930's – Fig 18.23 (Dust Storm)
- Sahara Sand- halfway around the world
- Volcanic ash - St. Helens – 1980
  - Krakatoa (1883), Tambora (1815)

Wind can pick up small particles easy (silt & clay) and they can be transported over a long distance

- Dust Bowl – 1930's – Fig 18.14
- Sahara Sand- halfway around the world
- Volcanic ash - St. Helens – 1980
  - Krakatoa (1883), Tambora (1815)

Sandblasting – rarely higher than 1 meter

- Sand moves by saltation or bouncing – sand storms (Figures 18.15 – 18.16)

Ventifacts – rocks with sand-blasted flat faces

Wind Deposition

Loess- deposit of wind blown silt and clay compose of un weathered grains of Quartz, feldspar or rocks with a calcite cement

- Very porous - 60 %
- Can stand as a vertical cliff – unlucky Chinese

US- Glacial Outwash deposited around the Mississippi River

Sand Dunes

- Mounds of loose sand heaped by the wind
- Develop in areas with strong winds that blow in the same direction

Dune Fields- Both coasts, SW, Great Lakes

- Sahara- sand seas

Mineral Composition

1. Typically Quartz
2. Quartz & Feldspar (and rock frags)

3. Gypsum – White Sands, NM

   - All dune sands are well sorted, well rounded

Can be immobilized by vegetation
   - Sand hills of Nebraska

Wind Ripples- small, low ridges of sand produced by saltation

Types of Dunes:
Shape depends on:
1. Wind velocity and direction
2. Sand supply available
3. How the vegetation cover is distributed

Types:
1. Barchan
2. Transverse
3. Parabolic
4. Longitudinal Dunes
5. Stardunes