Waves, Beaches, and Coasts

Shore - place where ocean meets land
Coast - refers to the larger zone affected by the processes that occur at this boundary.

Waves: energy moving through water

The height of waves are controlled by:
1) Wind Speed
2) The length of time that the wind has blown
3) The Fetch

The Parts of a Wave (Draw your beautiful wave here)-Figures 14.2-14.4

Label these parts:
Wave Crest: the high point of the wave
Wave Trough: the low point of the wave
Wavelength: the horizontal distance between two wave crests (or troughs).
Wave Height: vertical distance between the crest and trough
Wave Depth: maximum depth that wave energy extends=1/2 of the wavelength
Surf: waves that break at the coast
Breakers: wave that has become so steep that the crest of the wave topples forward, moving faster than the main body of the wave.
This usually occurs at $1/20^{th}$ of the wavelength

NEAR SHORE CIRCULATION
1) Wave Refraction: the bending of waves (Figure 14.5)
2) Longshore Currents: a mass of moving water moving parallel to the shoreline.
3) Rip Currents: narrow currents that flow straight out to sea in the surf zone, returning water seaward that breaking waves have pushed ashore.
>Travel at the surface and die out with depth
>Transport lots of fine sediment

BEACHES and TYPES OF COASTS

1. Depositional Coasts: steady or growing because of their rate of sediment accumulation, or the action of living critters (like coral)
2. Erosional Coasts: New Coasts in which the dominant processes are those that remove coastal material

Depositional Coasts

- Composed of sediments rather than rock
- Can evolve from an erosional coast

Most common form – Beach

- Zone of loose particles (sediment) on the shore
- constant state of change
- Figure 14.8: seasonal beach changes

Composition of Beaches

- Ranges in size, but mostly sand
- Black Sand – Lava (Basalt)
- Cobble beaches (Greece)

Swash - water washing onto the beach
Backwash- returning water to the ocean

Finer grained beaches – gentle slope
Gravel – steeper

Beach Shape

Berm - an accumulation of sediment that runs parallel to shore and marks the normal limit of sand deposition by wave action.

- Berm Crest – highest point on the beach
  Shoreward limit of wave action during the most recent high tide
- Backshore – inland of B.C., extending to the farthest point where beach sand has been deposited
- Foreshore – seaward of the B.C. – tidal zone
- Beach Scarp - vertical wall of variable height

Longshore Trough – parallel to shore, just offshore cut by wave action, turbulent backwash and longshore currents
Produced by Longshore Transport - movement of sediment along the coast, driven by wave action. Fig 14.9

Sandbars – hidden ridges of sand offshore

- Formed associated by storms

Minor Beach Features

Ripples- caused by currents, mini dunes

Rills- small branching surface depressions that channel water back to the ocean from a saturated beach during a falling tide.

Backwash marks - form when projecting shells, pebbles, or animals interrupt the backwash

Beach Layering – stratification

Other Depositional Coast Features:
Sand Spits – form where the longshore current slows as it clears a headland and approaches a quiet bay

Baymouth Bar – forms when sand spit closes off a bay by attaching to a headland adjacent to the bay.
→ Protects bay
Inlet - natural passage cut by tides

Barrier Island – narrow, exposed sandbars that are parallel to, but separated from land. 13% coasts

Lagoon – long shallow body of seawater isolated from the ocean
- East Coast – start out as coastal dunes, then a sea level rise, and migration of the island westward

Migration – Hatteras (originally 1500 ft from ocean) - 1870
1997 - 37m (120 feet) - moved it in 1999

Barrier Islands → Atlantic City, Ocean City, Miami Palm Beach, Galveston

Sea Island – contain continental core material
- Tombolo may connect to it – sand

Erosional Coasts (Figure 14.14)
- Both land and marine erosion
- Depends upon rock type

Sandstones – weather easily
Crystalline Rocks like granite – slow

1. High Energy Coasts – large waves
   - Big fetches
   - Along eastern edges of continents: prone to hurricanes
     West Wind Drift (Southern tips of Africa, S.A.)
2. Low Energy Coasts
   - Bay protected – Gulf of Mexico

Features:
1. Sea Cliffs –slope abruptly from land into the ocean
2. Sea Caves – weaknesses in rock
   - Accessible in low tide
3. Wavecut Platforms: horizontal benches of rock formed beneath the surf zone as a coast retreats by wave erosion.
4. Sea Stacks, natural arches

First Effect of Marine Erosion → intensity irregularity
- Then coast is smoothed through time

Submergent and Emergent Coasts

Submergent or Drowned Coasts are due to the rising of sea level since glacial times.

>Drowned River Mouths (estuaries): Rivers erode coast during glacial times, later during higher sea level, coast is flooded >> Chesapeake, Hudson, Sydney Harbor

>If Glaciers do the eroding – Fjord or fiords: steep glacially eroded u-shaped troughs that meet the ocean (1000 – 1300 feet deep)

Emergent Coasts: uplifted due to tectonic action

>Can result in numerous marine terraces (or wavecut platforms)

Coasts Formed by Biological Activity

Coral Reef – linear mass of $CaCO_3$ assembled from and by multitudes of coral animals

➔ In bright lit, warm water

→ Australia's Great Barrier Reef – Figure 12.26

Coral Reef types – by Darwin – 1842

1. Fringing Reef – cling to the margin of land Hawaii

- Low rainfall on downwind side of tropical islands

2. Barrier Reef – separated by a lagoon

- Two different environments – lagoonal, oceanside

1. Atolls – ring – shaped island of coral reefs and coral debris enclosing or almost enclosing a shallow lagoon from which no land protrudes

Darwin knew subsidence – but did not know about tectonics

Mangrove Coast – trees that can grow in salt water

Deltas

- River opens into ocean - not always - need a good shelf for deposition
- Biggest one empty into stable seas/ Gulfs (Nile, Mississippi)

Combine effects of waves, tides, and river flow determine the shape of a delta

2. River dominated – strong flow of freshwater – protected from distributaries – Bird's foot of Mississippi

3. Tide Dominated – freshwater discharge is overpowered by tidal currents that mold sediments into long islands parallel to the river flow and perpendicular to the trend of the coast Ganges – Bay of Bengal Fig 12.24

3. Wave dominates – generally smallest - smooth shorelines punctuated by beaches and sand dunes

➔Has a primary exit channel

Sea level Changes

1. Eustatic Change – variations in sea level that can be measured all over the world.
2. Local Change

Eustatic Changes can be attributed to:

1. Amount of water in the world ocean varies
   - Warmer periods, volcanic periods – more ocean, higher seas
2. Volume of the ocean's container may vary
   - high rates of seafloor spreading increase sea level
   - high rates of sedimentation
3. Water itself may occupy more or less volume as its T rises or falls – warming raises sea levels (expansion)

Local Sea Level:

1. Tectonic motions and isostatic adjustment
2. Wind and currents, seiches, storm surges, and El Nino/La Nina event can force water up or down

Whether at the local level or regional, advance of the sea is referred to as Transgression, while retreat of the sea is called Regression.