

Oceanography Chapter 12: COASTS

Shore - place where ocean meets land

Coast - refers to the larger zone affected by the processes that occur at this boundary.

Sea level Change

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

Classification of Coasts:

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

Erosional Coasts

- 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 12.3 / 12.4
3. Wave cut Platforms Composed of Rock!
4. Sea Stacks, natural arches

First Effect of Marine Erosion → intensity irregularity

- Then coast is smoothed through time

Drowned River Mouths – Rivers erode coast during glacial times, later during higher sea level, coast is flooded

Fig. 12.5: Chesapeake, Hudson, Sydney Harbor note: (chapter opener)

Glaciers do the eroding – Fjord or fiords – 12.6

Volcanic coasts – Fig 12.7

- Pillow lava's

Faulted Coasts – uplifted during earthquake

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

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

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

Longshore Transport

Longshore Drift - movement of sediment along the coast, driven by wave action.

Fig 12. 15

Rip Currents

- Form when a group of incoming waves pile an excess of water on the landward side of the surf zone faster than the longshore current can carry it Fig 12.16 (undertow or rip tide)

Coastal Cells

→ Input = Output Fig 12.17

Summary of Depositional Coasts – Fig 12.18

Other 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 (Fig 12.21)

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 my connect to it – sand

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

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

Glaciers also built coastlines in New England
- drumlins, moraines

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
3. 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

Estuaries

- Body of water partially surrounded by land, where fresh water from a river mixes with ocean water

Types

1. Drowned River Mouths – from last sea level rise, very common, Atlantic Coast
2. Fjords- steep glacially eroded u-shaped troughs (1000 – 1300 feet deep)
3. Bar- built Estuaries- form when a barrier island or a barrier spit is built parallel to the coast above sea level Tidal action is limited – small inlet Chincoteague, MD

4. Tectonic- constant indentations formed by faulting and local subsidence

Characteristics of Estuaries

Three factors determine the characteristics

1. Shape of the Estuary
2. Volume of river flow at the head of the estuary
3. Range of tides in the mouth

Categorizations: Fig 12.30

1. Salt Wedge Estuaries – form where a rapidly flowing large river enters the ocean in an area where tidal range is low or moderate
2. Well – Mixed Estuary