Lecture Outline Monday-Wednesday April 2-4, 2018

Questions?

Announcements:

Lecture Quiz Friday April 6

Where: Webster 16

- Type of question:
  - Multiple choice and identification of features from slides
- Length 20 questions, computer graded
- Covers material thru Chapters 13,14 and 16
  Mass Wasting, Running Water, and Groundwater

Chapter 15 – Restless Realm: Oceans and Coasts

Key Point

- Why does ocean water circulate?
- How does the topography of the ocean floor change from a continental margin to the mid-ocean ridge?
  How are the oceans mapped?
- How do ocean waves and breakers form?
- How sediments are moved along a shore line and what coastal features are formed?
- Be able to recognize both depositional and erosional coastal landforms
- What causes ocean tides?
- What causes coastal erosion? Are there any solutions to coastal erosion?

Why should we study the oceans?

- _____
- Source for food, energy
- Used for transportation
- Drives Hydrologic Cycle
- In 1990, 50% of the U.S. population lived within 75 km of a coast; and by 2025, 75% will.

Ocean Water

Composition

- Salinity is the concentration of salt in seawater (approximately _____)
- The dissolved salt content is not constant and changes with location and depth, _____
  _____-_

Temperature is stratified - varies with depth

Ocean Currents

Ocean currents move large amounts of water and heat by:

- _____ surface ocean circulation
- _____ deep-ocean circulation
  Cold salty water tends to sink
  Warm, less salty water rises

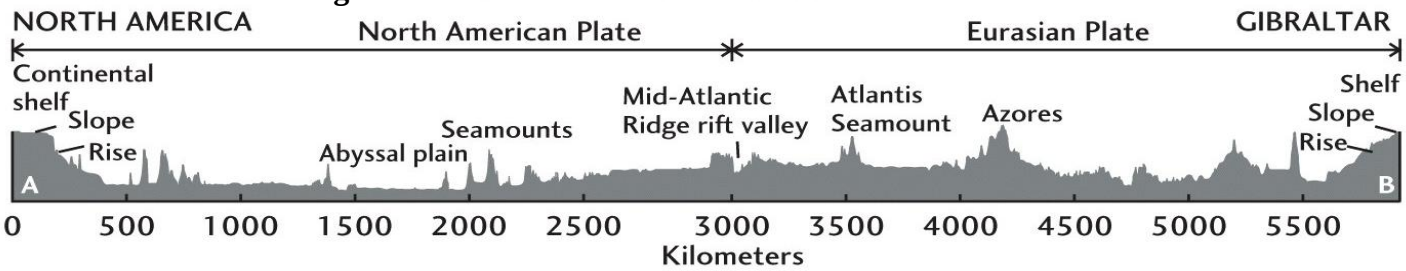
Both redistribute heat from warmer regions to cooler regions

Landscapes Beneath the Sea

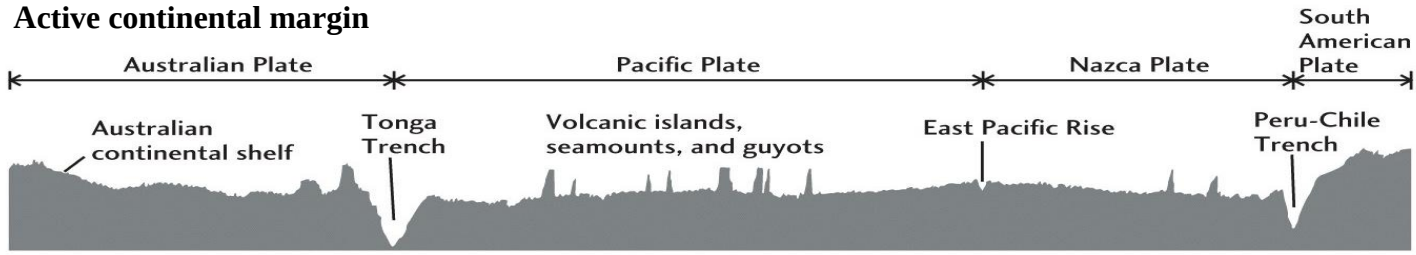
Mapping the seafloor by:

- Satellite measurements
- Echo sounding profiles
- **Side-scan sonar**
- Manned and unmanned submersibles

Passive continental margin



Active continental margin



Major Physiographic Features in the Atlantic Ocean

- continental margin
  - **continental shelf** – A broad, flat platform (~1º) extending from the shoreline to the beginning of the continental slope.
  - continental slope - A steeper (~4º) , typically mud-draped slope marking the edge of the continental shelf. **Dissected by submarine canyons and modified by turbidity currents**
  - continental rise - A gently sloping apron (~0.5-1º) of sediment formed by deposition of sands and muds at the base of the continental slope (typically at depths of 2-3 km).
- abyssal plain - This plain extends beyond the continental rise typically 4-6 km below sea level. It is the flattest surface on the earth. May include submerged volcanoes called ***seamounts*** and guyots
- mid-ocean ridge
  - abyssal hills - Linear ridges of basalt covered with a thin veneer of deep-sea sediment on the flanks of the Mid-ocean ridge.
  - central rift valley

Why map the ocean floors?

Mapping is used to locate hazards that may affect _____

_____

Hazards: seamounts/guyot, areas modified by mass wasting (underwater mudflows); areas cut by faults

Coasts - the uneasy land-sea interface

Waves are due to_____

Higher waves can be caused by:

1) Higher wind speed
2) Increased storm duration (time)
3) Longer_____

Wave characteristics

- Wave length – _____
- Wave height – vertical distance between crest and trough
- Period – time between successive waves to pass

Wave base is 1/2 wave length – there is negligible water movement due to waves below this depth

How do breakers form?

As the swell approaches the shore where the bottom shallows to less than ½ the wavelength, the _____ _____ causing it to slow

– the wave period remains the same so the wavelength decreases and the waves height increase (making the wave steeper).

- As bottom shallows further the water can no longer support itself and the waves breaks and crashes in the surf zone

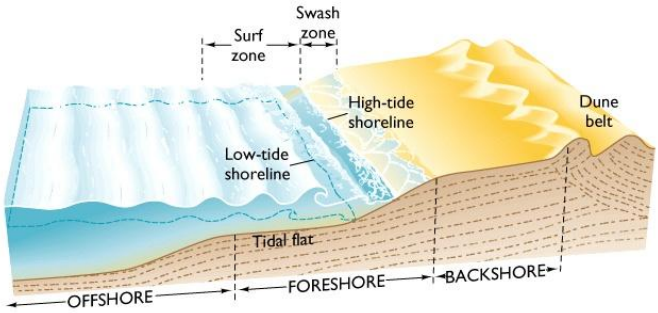
Major Parts of a Beach

Surf zone – offshore belt along which breaking waves collapse as they approach the shore

_____ - zone where water run up on the beach from a wave

Tidal flats – _____

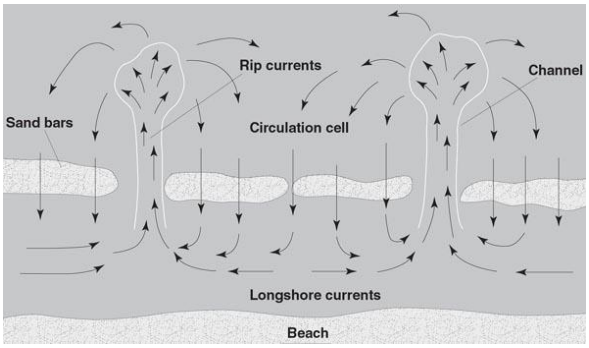
Beaches - sources of beach sediment is from rivers, cliff erosion, marine organisms; currents and waves move sediment along shore



Formation of rip currents

- rapid current draining beach area through shallow near shore bars; fast and dangerous (associated with most beach rescues)

What do you do if caught in a rip current?



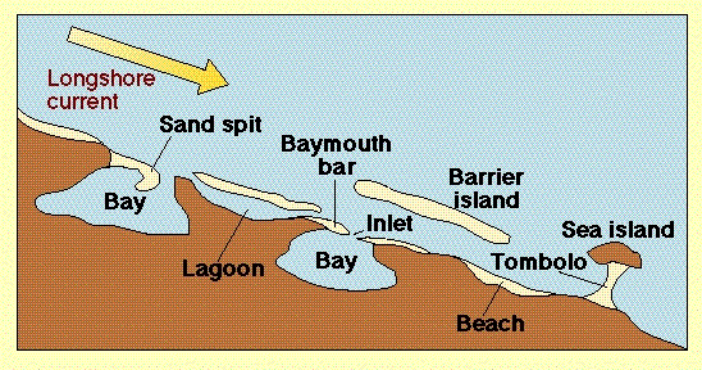
Wave refraction and Longshore drift

Far from shore the lines of swells are parallel to each other but are usually at some angel to the shoreline. As they approach the shore line wave refraction occurs.

Wave refraction occurs as waves slow down in progressively more shallow water depths allowing the wave fronts to bend and approach the shore nearly parallel.

Wave refraction moves sediment along the beach in a zigzag motion known as _____ drift.

Many coastal depositional features are formed by longshore drift. (You should be able to identify these features in a photo)



_____
Baymouth bars

_____
Barrier island

Beaches: Seasonal Changes
Summer:

- gentle waves
- add beach sand

Winter

- storm waves
- erode beach sand
-

Emergent coasts -uplifted, tectonically active coasts often rocky; rocky headlands alternate with pocket beaches formed by wave erosion

Erosion coastal features
Wave cut platforms
_____
_____
Uplifted beach terraces

Tides
Ocean tides are the result of the_____ attraction of the moon and sun on the ocean.

- causes water to bulge outward on the side nearest the moon
- On the opposite side, inertia created by Earth's rotation causes ocean water to bulge outward in the opposite direction
- 2 oceanic bulges so 2 sets of tides daily

When a location lies under a bulge, it experiences a high tide - when it passes under a depression, it feels a low tide

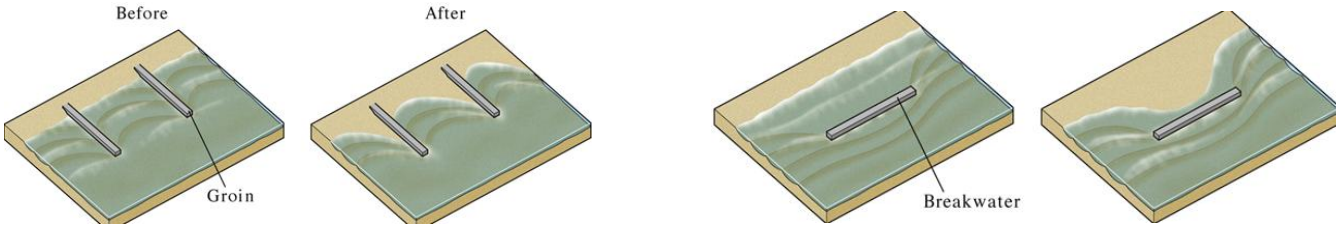
- extra low tides (Neap Tide)
- extra high tides (Spring Tide) -

The difference between high and low tide varies in different parts of the ocean.

- in Hawaii about 0.5 meter (open ocean)
- in Puget Sound about 3 meter (tides constricted by land)
- in Bay of Fundy, Canada can be more than 12 meters (restricted - wide opening to ocean the narrows)

Coastal erosion
Preventing beach erosion

- **Structural** approaches (e.g., groins, breakwater, jetties): typically cause increased erosion down-current of structure
    - _____ - catch part of the "river of sand" from longshore drift
    - _____ - reduces local wave energy so sand is deposited, not carried away
    - **Seawall** and **riprap**
    - **Sand bagging** - doesn't work



- **Non-structural** approaches (e.g., beach nourishment, land use planning): expensive, but doesn't cause erosion in new areas
    - beaches can be replenished by pumping in sand; usually it doesn't last more than a few years. Miami Beach one of the few success stories