Oceanography Chapter 4

Bathymetry: discovery and study of the ocean floor.
♦ Earliest – Poseidon (85 BC) - 2km (1.25 miles) of line
♦ Sir James Clark Ross – 4893 m (16,054 ft) – 1818
♦ HMS Challenger – 1870’s – steam powered winch
  ♦ 492 bottom soundings, confirmed MOR

Echo Sounding
  Fessenden (1914)- Iceberg detector/ Echo Soundings
  ♦ used also to find subs

  Error: 1. Speed of sound waves with T,P, and Salinity
         2. Exact Location

By 1959- first ocean bottom maps

Nowadays:
1. Multi beam systems
   ♦ May have up to 121 beams

2. Satellite Altimetry
   ♦ Calculate average of ocean surface
   ♦ Reflects topography underneath

**Topography of Ocean Floors**

Continental Margin – submerged outer edge of a continent

Ocean Basin- deep seafloor beyond the continental margin

Figure 4.8 – Passive Continental Margin

Types of Margins
(Atlantic) 1. Passive Margins- diverging plates
(Pacific) 2. Active Margins

Continental Margins have
shelf → slope → rise

Fig 4.1
Continental Shelves
♦ Extension of continents
♦ Base is granite (an igneous rock)
♦ Much like the continent
♦ 7.4 % ocean area
♦ Most material of shelf is derived from eroded stuff from the continent
♦ Width of shelf is determined by plate boundaries
Shelf – Passive
♦ Short

Biggest shelves – East Coast

Passive Margin

Active Margin

Biggest shelf – Arctic Sea north of Siberia
♦ Width depends not only on tectonics but also on sedimentation rates

Florida’s Coasts
1. East – Gulf stream scours sediment away
2. West- broad shelf

Continental Shelves are greatly influenced by sea level
♦ Low level - erosion transport of sediments
♦ High level – deposition

Continental Slopes – transition between the greatly descending continental shelf and the deep – ocean floor.
♦ 4° (70 ml km, 370 ft/mi) - 25°
♦ steeper in active margins
♦ bottom is the edge of the continental slope
Shelf Break – makes the abrupt transition from continental shelf to continental slope
	♦ water depth – 140 m (460 ft)
	♦ exceptions in Antarctica/Greenland (300-400)

Submarine Canyons
	♦ Cut into shelf and slope
	♦ Some as big as Grand Canyon
	♦ How?
	Original thought that they may have formed from sea level changes and erosion, but there: 1929 Quake in New F.
	♦ Broke cables – immediately, then some others staggered

Underwater Avalanche – Turbidity Currents
(Graded Bedding)

Continental Rises
	♦ Passive Margin only
	♦ Gentle slope – 1/8 of slope
	♦ Sediment covers over basalt – from turbidity
	♦ Deep ocean currents reshape coast

Oceanic Ridges
	♦ Mountainous range of young basaltic rock
	♦ Stretching 65,000 km (40,000 miles)
	♦ Rise about 2 km off of the seafloor
	♦ Azores, Easter Island, Iceland
	♦ 22% solid surface area (24% continents)
	♦ Offset by Transform Faults

Hydro thermal Vents
	♦ Black Smokers
	♦ 350°C (660°F)
	♦ Sulfide rich
	♦ Tubeworms, clams

Abyssal (without bottom) Planes/Hills
	♦ Flat, featureless and deep
	♦ 3700 to 5500m (12k to 18k feet deep)
	♦ Sediment on top of basalt
	♦ Small extinct volcanoes – hills (see below)

Seamounts /Guyots

volcanoes  flat top volcanoes
West-central Pacific
Trench
- Arc-shaped depression where two tectonic plates meet
- Subduction Zone
- Active tectonically
- 1.9 to 3.7 miles deeper than the abyss
- Trieste – 11,022 in (36,163 ft)

Island Arc- ocean- ocean