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

<u>Topography of Ocean Floors</u>

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 $\rightarrow$ slope $\rightarrow$ rise

Fig 4.1
<u>Continental Shelves</u>
- 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?

Originally 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 3.7miles deeper than the abyss
- Trieste – 11,022 in (36,163 ft)

Island Arc- ocean- ocean