



## Bathymetry

### INTRODUCTION

The Bathymetry lesson will introduce and familiarize the student with the topography of the ocean floor and the geological processes of how it is formed.

### OBJECTIVES

By the end of this lesson, the student will be able to do the following:

1. Summarize what bathymetry is and describe the following terms in their  
  - a. relationship to bathymetry:
  - b. continental shelf
  - c. submarine canyon
  - d. mid-ocean ridge
  - e. trench
  - f. abyssal plain
  - g. island arc system
2. Describe how islands are formed
3. Illustrate a bathymetric model of the sea floor
4. Explain the geologic processes of ocean basin formation
  - a. spreading centers
5. Explain the geologic processes of ocean basin destruction
  - a. Subduction
  - b. Ring of Fire
6. Identify occupations that are related to the fields of oceanic geology and bathymetry

# Bathymetry

1. What is bathymetry?
  - a. Bathymetry refers to the study of ocean depth and the topographic relief of the ocean floor.
  - b. Some of the significant features of the ocean floor are:
    - i. Continental shelf - Most continents have an underwater extended perimeter of their coastal plain that is known as the *continental shelf*. The continental shelf generally ends at a steep slope called the shelf break. The shelf break continues into a shallower slope that ends at the sea floor. This is known as the continental slope. A continental shelf can extend anywhere from zero miles to 930 miles (Siberian shelf) out from the continent. The average length is 48 miles. The edge of the continental shelf can be anywhere from 66 to 1800 feet deep and generally average 430 feet. Continental shelves are made up of deposits of mud, sand, gravel, sedimentary rock, and crystalline rock.
    - ii. Submarine canyon - A steep V-shaped canyon cut into the continental shelf or slope.  
Mid-ocean ridge - A linear seismic mountain range that extends through all the major oceans, rising from 1 to 3 km above the deep ocean basins. Averaging 1500km in width, rift valleys are common along the central axis. A source of new oceanic crustal material.  
Trench - A long, narrow, and deep depression on the ocean floor with relatively steep sides.
    - iii. Seamount - An individual peak extending over 1000m above the ocean floor.
    - iv. Abyssal plain - Abyssal plains are those parts of the ocean that begin at the edge of the continental margin and continue into the ocean depths. These plains, which are extremely level, are the flattest places on earth and cover approximately one-half of the deep-ocean floor. Sediments, up to 5 km thick, overlie the basaltic rocks of the oceanic crust. Abyssal plains are most common in the Atlantic Ocean, and least common in the Pacific.
    - v. Island arc system - A linear arrangement of islands, many of which are volcanic, usually curved so the concave side faces a sea separating the islands from a continent. The convex sided faces the open ocean and is bounded by a deep ocean trench.
2. How islands are formed
  - a. Volcanic ocean hotspots. The second way in which islands are formed is when there are hot spots in the lithosphere. Hawaii is an example of this type of island formation.
  - b. Volcanic island arc systems. When a slab of crust is forced down into the Earth, it melts. The melted material will then rise back up into the crust, which forms a line of volcanoes. This line of volcanoes creates a chain of islands that are known as "island arcs". The Aleutian Islands of Alaska are island arcs.
  - c. Ancient reefs
3. Illustration of bathymetric model of the sea floor
  - a. Continental shelf
  - b. mid-ocean ridge
  - c. submarine canyon
  - d. abyssal plain
  - e. island arc system
4. Ocean basin formation - Ocean basins are formed at mid-ocean ridges. Sea floor spreading is the process that produces lithosphere (oceanic crust) when convective upwelling of magma along the oceanic ridges moves away at rates of from 1 to 10 cm per year. As the crust pushes out away from the Mid-ocean ridge, it causes the continents on either side of the ocean to be pushed further apart.
5. Ocean basin destruction - Ocean basins (oceanic crusts) are destroyed at subduction zones. Subduction

is the process by which one lithospheric plate descends beneath another. The surface expression of such a process may be an island arc-trench system (Marianas Islands, Mariana Trench) or a folded mountain range (Andes Mountains). Taking a look at the boundaries of the Pacific Ocean, one can notice an area of increased seismic and volcanic activity, this area around the Pacific Ocean is called the Ring of Fire and is where active subduction is taking place.

6. Have students use the internet to research occupations related to the fields of geology and bathymetry.

**USS ALLIGATOR**

**BEACH LAB**



**TIDES**

**CURRENTS**

**BATHYMETRY**

**BUOYANCY**

**LAB REPORT**

**TIDES**

1. Each group will place a stake at the edge of the tide line as soon as possible after arrival at the beach.
2. Just before leaving the beach, each group will estimate where the new tide line is and measure from that point to the first stake placed.
3. Locate the high tide line at the beach and measure from the current tide line to the high tide line.

Equipment used: \_\_\_\_\_

Measurement #1: \_\_\_\_\_

Measurement #2: \_\_\_\_\_

Be sure to use and label all your measurements in metric units.

What causes tides?

What do you call an extremely low tide? Why do they occur?

What do you call an extremely high tide? Why do they occur?

## **CURRENTS**

1. Each group will measure a 10m line parallel to the water line. Mark your distances in the sand. The groups will then split into partner/pairs to measure the flow of the current. One member will be at the 10m mark with a stop watch and the other partner will be at the zero mark with a line and bobber. As soon as the bobber hits the water, the timer should start the stop watch. As soon as the bobber passes in front of the 10m mark, the timer should stop the time and record the time.

Equipment used: \_\_\_\_\_

Time #1: \_\_\_\_\_ Distance#1 \_\_\_\_\_

Time #2: \_\_\_\_\_ Distance #2 \_\_\_\_\_

Be sure to label all your measurements in metric units.

What causes currents? Name at least 3 things.

# BATHYMETRY

Each group leader will receive a paragraph detailing one of 5 bathymetric features. The group will make a 3-D sand picture of their bathymetric feature and explain it to the other groups.

Equipment used: \_\_\_\_\_

Define each of the following:

Submarine canyon:

Continental Shelf:

Abyssal Plain:

Mid-Ocean Ridge:

Islands:

## LAB REPORT

Each person will find a quiet place to sit ALONE and think about the oceanographic factors that affected the USS *Alligator*, both before she was cut lose and after. Write a paragraph using the information learned from this lab describing what you think the factors were surrounding the loss of the USS *Alligator*.

### RESOURCES

<http://www.oceanexplorer.noaa.gov/explorations/02hudson/background/mapping/mapping.html>