The Ocean

- The entire body of salt water that covers much(71%) of the earth's surface
- The major geographical divisions of this huge body of salt water

Compare the earth´s major oceans in table 8-1, p. 370.
Key words: surface area, volume, percentage, the greatest /least average depth, the shallowest
Marginal seas formed in three different ways:

- When continents came together. The Mediterranean Sea and the Black Sea are thought to have formed when two continents enclosed them.
- Some marginal seas are separated from major oceans by curved chains of islands called **island arcs,** e.g. the Caribbean Sea and the China Sea.
- Some marginal seas are thought to have formed as the result of a structural break in a land mass, e.g. the Red Sea and the Gulf of California. In the case of the Red Sea, the continental crust was not only split, but it separated. Ocean crustal rocks have been found in the area of separation.

Section 1 The Bottom of the Ocean

Sounding the ocean bottom
In 1492, when Columbus sailed across the Atlantic Ocean, a common notion was that the ocean bottom was flat and featureless. The only method known to determine the depth of the ocean water was to lower a heavy weight tied to the end of a rope into the water until it hit bottom. Then the length of line was measured. Sailors were usually interested in the position of the ocean bottom only if the water became so shallow that their ship might hit the bottom. Consequently they did not carry enough rope to reach the deep ocean bottom.
Four hundred years later, people were still using the same method. By that time, however, wire had been substituted for rope, and a power-driven winch was used to lower and raise the weight on the end of the wire. Many scientists continued to believe that the ocean bottom was mostly flat. They based their belief on the fact that the bottoms of reservoirs usually become flat because of sediments that settles out of the water.
In 1925, a more modern method of measuring the depth of the ocean was used in a detailed survey of the ocean bottom. In this method, which uses sound and is called **echo sounding,** a sharp noise called a ping travels from the ship to the ocean bottom and bounces back as an echo. The length of time it takes the ping to make the trip down and back is measured and then the distance can be calculated.
A precision depth recorder makes a continuous record of ping echoes on a moving paper. The pings are sent out continuously as the ship moves, and the paper record is a scale representation of the ocean bottom providing profiles of the topography. Thousands of these types of records have shown that the ocean bottom has an even more varied topography than does the land.
What are the words for paper record and the instrument?

Task: Say something about the history of measuring the depth of the ocean bottom.

The topography of the ocean bottom

Read Our Science Heritage on p. 375 and tell the main idea of the text in 5 minutes.

When did the expedition take place? –
What kinds of instruments were available at that time?-

Oceans basins are at a much lower level than the land, formed mainly of dense basaltic rock, whereas continental rocks are mostly granite and granite gneiss. The depth can vary greatly from one location to another, but there are several general features associated with certain earth processes. Fig. 8-6 on p.374 shows several general regions.

An area near the continents is known as the **continental margin.** It is made up of continental crustal materials and rocks. Most sediment eroded from the land is deposited in this part of the ocean.

Features: The **continental shelf**, the part nearest the land, has on the average a very gentle slope. At a depth of about 200 m the steepness increases and the **continental slope** begins. At the base of this slope is another, much gentler slope that leads down to the abyssal plain. This gently sloping area is known as the **continental rise** (úpatí, necessary to distinguish from oceanic rise – oceánský práh či hřbet !).

Erosional valleys and **canyons** cut across the margin. Some of them are deeper and wider than the Grand Canyon in Arizona! They were probably formed by rapidly flowing turbidity currents - mixtures of sediment and water, but they might also have been formed by glaciers during the last Ice Age.

Farther from shore, at a greater depth, is the deep sea floor. This area is affected by the earth processes of sedimentation and volcanism. All ocean crustal rocks are volcanic, formed by underwater eruptions of dark-colored basaltic flows.

Features: ***Seamounts*** – underwater volcanic cones that grow upward from the bottom, layer by layer, usually rising more than 1000m above the floor. Sometimes they reach the ocean surface and form islands. Virtually all islands in the ocean were formed by volcanic activity. See Fig. 8-8 on p.377. Igneous activity beneath these volcanic features causes additional bulges in the ocean crust.

Because of wave action or ocean crustal movement, volcanic islands can disappear beneath the surface of the sea. If the volcanoes have become extinct, then the wave action is able to erode the tops of the seamounts down to sea level. Sometimes the ocean crust beneath extinct volcanoes sinks, lowering the eroded seamounts well below the ocean's surface, forming flat-topped underwater mountains called **guyots.** They are found in deeper parts of the basins and can rise to nearly 1000m above the floor. *Where does the word guyot come from?*

Sporadic turbidity currents spill off the continental margins into the deep ocean. Through time, abyssal hills near continental margins can be covered with hundreds of layers of sediment. Turbidity currents can also extend for hundreds of kilometers across the bottom, leaving large flat areas called **abyssal plains** (roviny)**.** Most of them

make up the deeper parts of the major ocean basins at about 5 km depth. These plains are an example of the flat area that many scientists once thought the entire ocean bottom was like.

A very small percent of the ocean basin has long deep **trenches** that extend downward to about 11.5 km. They are usually bordered by enough volcanic activity to create island arcs. In the case of Peru-Chile Trench, the volcanic activity forms part of the Andes Mountains. The region of volcanic activity that surrounds the basin of the Pacific Ocean is called the **Ring of Fire** and is generally associated with deep sea trenches. Trenches and island arcs indicate areas of collision between separate oceanic crustal plates.

The rest of the ocean basins is made up of the world's biggest and longest mountain system, the **mid-ocean ridges.** The system is about 65 000 km long. In the Atlantic Ocean, the **Mid-Atlantic Ridge** occupies the central third of the entire basin from the Artic Ocean to about the latitude of the southern tip of Southern America. Iceland is a part of the ridge that became and island through volcanic growth. As shown in Fig.8-9 on p.380, the mid-ocean ridge passes between Africa and Antarctica and into the Indian Ocean, where it splits. One branch heads north and forms the Red Sea, the other branch extends southeast and east between Australia and Antarctica and then across the southern portion of the Pacific Ocean where the ridge is less rugged and as a result, it is called the **East Pacific Rise.** It continues under the southeastern part toward Central America where it branches. Part of it disappears near Panama and the other part disappears near Baja California. The mid-ocean ridge system is offset by hundreds of breaks in the crust – fracture zones and is extremely rugged. *Do you remember the map we already looked at last semester?* The fairly deep central **rift valley,** with high peaks near, is a site of active volcanism. Much heat from the volcanic action is absorbed by ocean water. In addition, new ocean-floor crust forms at the ridges.

Check yourself

1. *List the ocean bottom features of the continental margin and describe them.*
2. *List the features associated with the deep basins and distinguish them.*
3. *Describe the mid ocean ridge system in Fig.8-9 and see* Fig. 8-10 on p. 381 that shows two profiles of the Mid Atlantic Ridge system.
4. *What types of geologic activities affect the permanence of ocean islands?*

Resources of the ocean bottom

Task: Read the information on p.381 and make two lists:

1. Types of resources found in and on the continental margins.

See fig.8-11 and answer the question.

2. Types of resources associated with the deep ocean floor.

Are there other uses of the ocean bottom?

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What do you think the following phrases mean?

To be in a dump –

To dump sb –

Homework

Write your own definitions of all the terms in section 1.