University of Anbar

College of Science

Department of Applied Geology

Tectonics

Title of the lecture

The main features of oceanic floor

Ass. Prof. Dr. Abdulkhaleq A. Alhadithi

2020

The main features of oceanic floor

1. Mid – oceanic ridges: the floor beneath all major oceans includes two provinces; **abyssal plains**, the broad relatively flat regions of the ocean that lies at the depth od about 4.5 km below sea level; and **mid-oceanic ridges,** elongate submarine mountain ranges that lie only about 2-2.5 km below sea level. There are several mid – oceanic ridges in the middle of the oceans and seas, good example is Mid-Atlantic Ridge, Fig. 1.

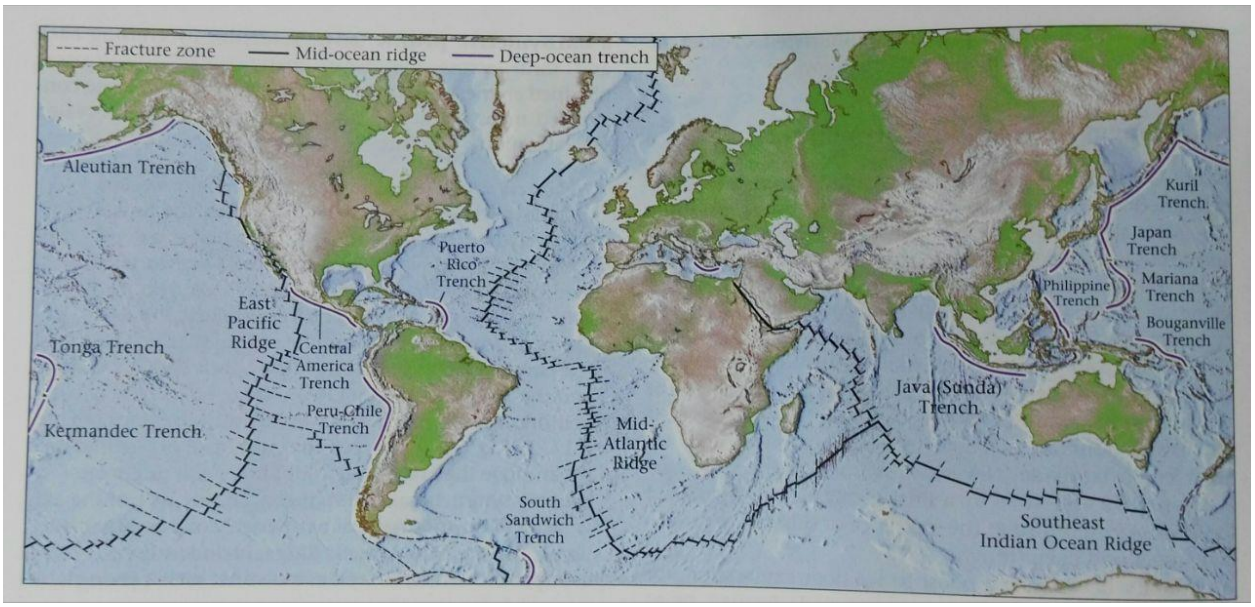

Fig. 1. The mid-oceanic ridges, fracture zones, and deep oceanic trenches

Geologists call the crest of the mid-oceanic ridges ridge axis Fig. 2. All mid oceanic ridges are roughly symmetrical- bathymetry on one side of the axis is nearly a mirror image of bathymetry on the other side.

2. Deep oceanic trenches: along much of the perimeter of the Pacific Ocean, and in a few other locations as well, the sea floor reaches to depth of 8-12 km. These deep areas define elongate troughs that are now referred to as trenches. There are volcanic arcs that border deep oceanic trenches.
3. Numerous islands poke up from oceanic floor; for example, the Hawaiian Islands lie in middle of the Pacific. In additional to island that rise above sea level, echo sounding has

detected many seamounts (isolated submarine mountains). Oceanic islands and seamounts, which began as volcanos, typically occur in chains, but in contrast to the volcanic arcs that border deep-oceanic trenches, only one island at the end of a seamount chain is actively erupted today.

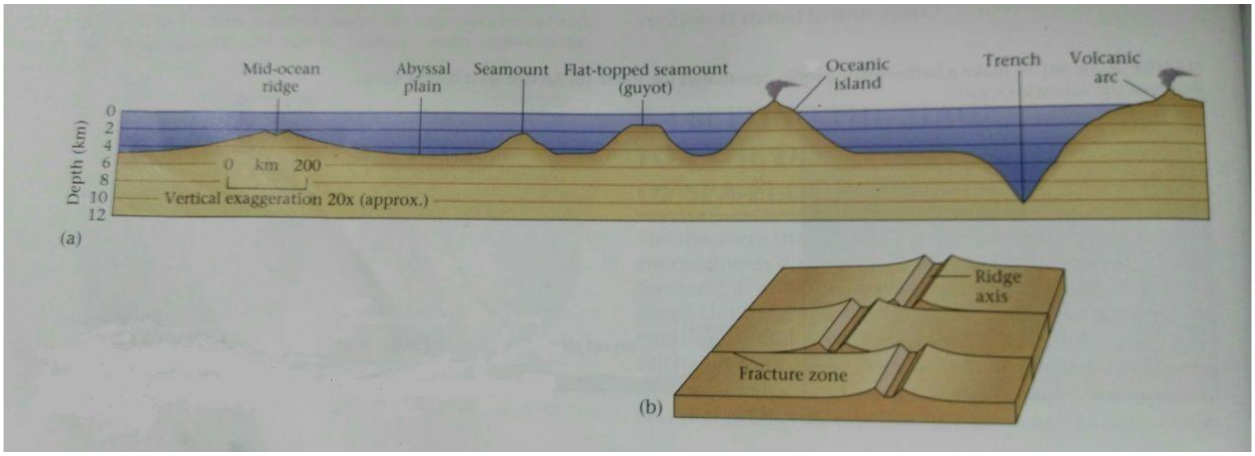

Fig. 2. (a) profile of mid-oceanic ridge, deep-oceanic trench, and seamount chain (b) fractur zone.

4. Fracture zones: surveys reveal that the ocean floor is diced up by narrow bands of vertical fractures. In each ocean, these fracture zones lie parallel to one anotheranf roughly at right angles to mid-oceanic ridges which segmenting the ridges into small pieces Fig. 2 (b).

Observations on the nature of oceanic crust

Geologists had discovered many important characteristics of the sea floor crust. These discoveries led them to realize that oceanic crust is quite different from continental crust.

1. Much of the oceanic floor is covered by a layer of sediment composed of clay and the tiny shells of dead plankton. This layer varies in thickness, no sediments coves the mid-oceanic ridge axis, while thicker sediment is found toward the margin of the ocean. But even at its thickest, the sediment layer is too thin.

2. The oceanic crust contains no granite and no metamorphic rocks (these rocks common on continents). Oceanic crust contains only basalt and gabbro. Thus, it is different in composition from continental crust.
3. Heat flow, the rate at which heat rises from the earth´s interior up through the floorof the ocean, is not the same everywhere in the oceans. More heat seems to rise beneath mid-oceanic ridges than elsewhere Fig. 3. This observation led geologists to speculate that magma might be rising into the crust just below the mid-oceanic ridge axis, because this hot molten rock could transfer heat in to the crust.

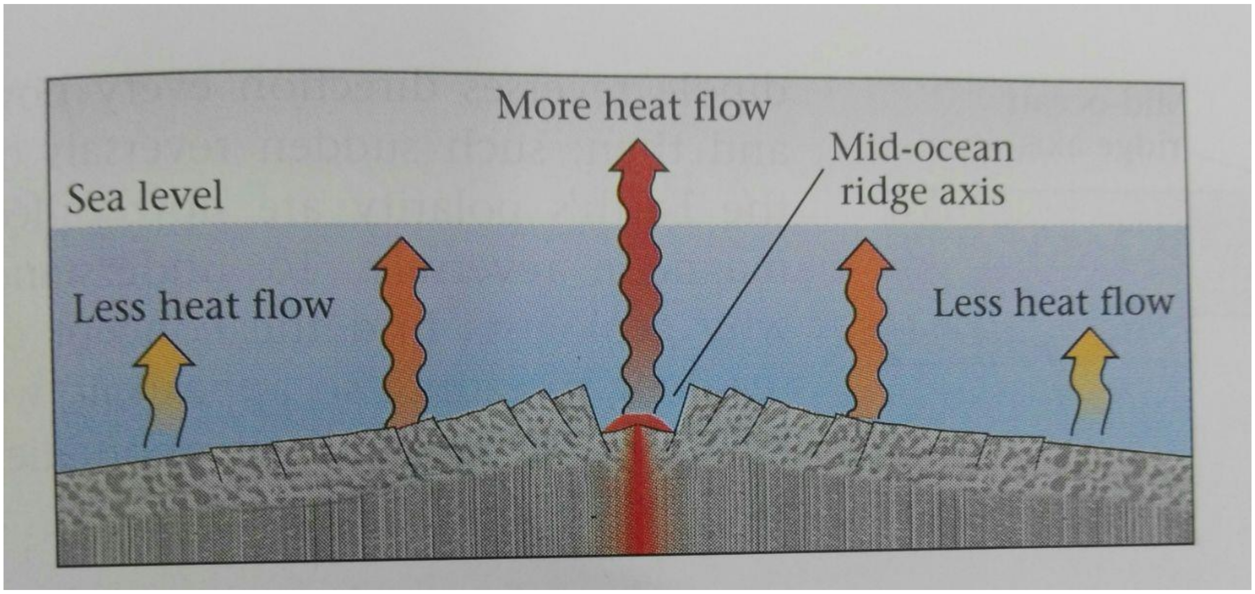

Fig. 3. In the mid-oceanic ridge, heat from the mantle flows up through the crust; heat flow decreases away from the ridge axis.

4. The distribution of earthquakes in oceanic regions shows that the earthquakes in these regions do not occur randomly, but rather define distinct belt Fig. 4. Some belts follow trenches, some mid-oceanic ridge axes, and others lie along portions of fracture zones. Since earthquakes define locations where rocks break and move, geologists realize that these bathymetric features are places where movements of the crust take place.

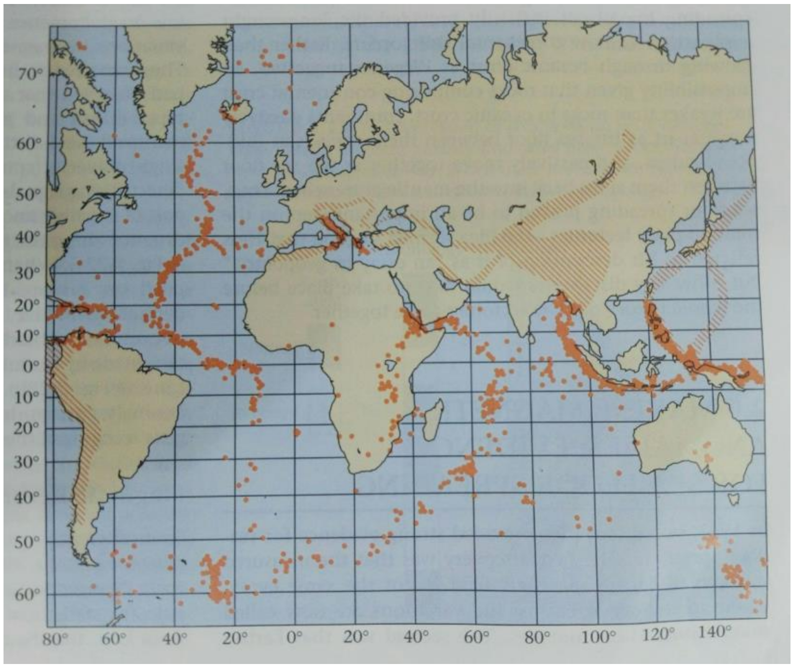

Fig. 4. Map showing the distribution of earthquakes in the oceanic basin.

Sea-floor spreading of Harry Hess

Harry Hess, after studying the observations described above, realized that the thinness of the sediment layer on the ocean floor meant that the ocean floor might be much younger than the continents, and that the progressive increase in thickness of the sediment away from mid-oceanic ridges could mean that the ridges themselves were younger than the deeper parts of the ocean floor, that mean new ocean floor must be formation at the ridges, and the ocean basin must be getting wider with time. The earthquakes with mid-oceanic ridges suggested to him that the sea floor was cracking and splitting apart at the ridge. The discovery of high heat flow along mid-oceanic ridge axes indicating the presence of molten rock beneath the ridges. In 1960, Harry Hess suggested that molten rock rose upward beneath mid-oceanic ridges and that this material solidified to create new oceanic crust. The new sea floor then moved away from the ridge, a process we now call sea-floor spreading.

Hess realized that old oceanic floor must be consumed somewhere, or the earth would have to grow. He suggested that deep-oceanic trenches might be places where the floor sank back into the mantle, and that earthquakes at trenches were evidence of this movement Fig. 5.

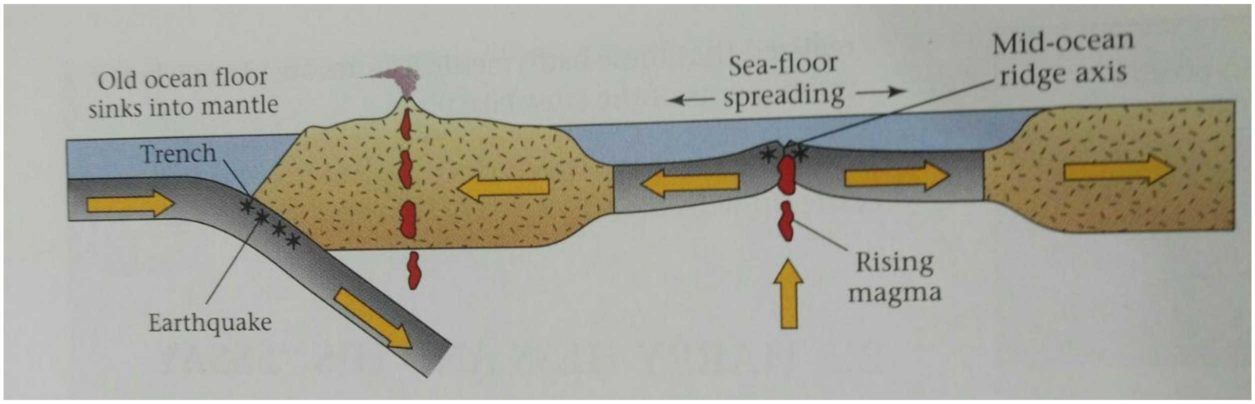

Fig. 5. Harry Hess´s basic concept of sea-floor spreading. New sea floor forms at the mid-oceanic ridge axes. As a result, the ocean grows wider. Old sea floor sinks into the mantle at a trench. Earthquakes occur at ridges and trenches.

The reference

Stephen, M., (2004) Essentials of geology, first edition, printed in United State of America, P 536.